MITSUBISHI WORKSHOP MANUAL

MAGNA / VERADA

- TL/KL incl. AWD
- TJ/KJ incl. AWD
- TJ Ralliart
- TH/KH

HOME

MITSUBISHI TJ/KJ SERIES Magna / Verada Diamante WORKSHOP MANUAL

MITSUBISHI MOTORS

SEDAN / WAGON / SPORTS

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 diagnostic, disassembly, repair and installation procedures along with complete specifications and tightening references. Please read this manual carefully before proceeding, as incorrect service procedures may result in injury or death to service personnel or to the operator's of the vehicle.

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SERVICE DIVISION
TONSLEY PARK
SOUTH AUSTRALIA

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AUST. CO. No. 007 870 395

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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 in baking or drying after painting, remove the SRS components (air bag module and SRS-ECU) beforehand.

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

(4) 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

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

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

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(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 in baking or drying after painting, remove the SRS components (air bag module and SRS-ECU) beforehand.

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

(4) 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

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

Main Index
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HOW TO USE THIS MANUAL

MAINTENANCE, REPAIR AND SERVICING EXPLANATIONS

This manual provides explanations, etc. concerning procedures for the inspection, maintenance, repair and servicing of the subject model, for Australian vehicles.

ON VEHICLE SERVICE

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

INSPECTION

Items described under this heading are inspection and checking procedures to be performed by using special tools and measuring instruments and by feeling. For actual maintenance and servicing procedures, visual inspections should always be performed as well.

DEFINITION OF TERMS

STANDARD VALUE

Indicates the value used as the standard for judging the quality of a part or assembly, 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,it is provided to facilitate assembly and adjustment procedures so they can be completed more efficiently.

CAUTION

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

INDICATION OF TIGHTENING TORQUE

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.

ABBREVIATIONS

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

M/T: Indicates manual transmission, or models equipped with a manual transmission.
A/T: Indicates automatic transmission, or models equipped with an automatic transmission.
MPI: Indicates multipoint fuel injection.
S4: Indicates an engine with a single overhead camshaft and 4 valves per cylinder.

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EXPLANATION OF MANUAL CONTENTS

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

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

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Indicates the group title.

Indicates the section title.

Indicates the group number.

Indicates the page number.

POWER STEERING GEAR BOX

110000526

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. ◀A▶ ▶A◀ Connection for tie-rod end and knuckle
5. Stay (L.H.)
6. Stay (R.H.)
7. Center member assembly
8. Clamp
9. ◀B▶ Bolt
10. ◀C▶ 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.

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"

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HOW TO USE TROUBLESHOOTING/INSPECTION SERVICE POINTS

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

TROUBLESHOOTING CONTENTS

1. STANDARD FLOW OF DIAGNOSTIC TROUBLESHOOTING

The troubleshooting sections follow the basic diagnosis flow which is given below. If the diagnosis flow is different from that given below, or if additional explanation is required, the details of such differences or additions will also be listed.

Diagnosis method

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. DIAGNOSIS FUNCTION

Details which are different from those in the “Diagnosis Function” section on the next page are listed.

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4. INSPECTION CHART FOR DIAGNOSIS CODES

5. INSPECTION PROCEDURE FOR DIAGNOSIS CODES

Indicates the inspection procedures corresponding to each diagnosis code (Refer to How to Use the Inspection Procedures.)

6. INSPECTION CHART FOR TROUBLE SYMPTOMS

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

7. INSPECTION PROCEDURE FOR TROUBLE SYMPTOM

Indicates the inspection procedures corresponding to each trouble symptoms classified in the Inspection Chart for Trouble Symptoms. (Refer to How to Use the Inspection Procedures.)

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.

10. INSPECTION PROCEDURES USING AN OSCILLOSCOPE

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

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DIAGNOSIS FUNCTION

METHOD OF READING DIAGNOSIS CODES WHEN USING THE MUT-II

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

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

WHEN USING THE WARNING LAMP

1. Use the special tool to earth No.1 terminal (diagnosis control terminal) of the data link connector.
2. Turn the ignition switch on.
3. Read out a diagnosis code by observing how the warning lamp flashes.

Applicable system

System name	Warning lamp name
MPI	Engine warning lamp
A/T	Neutral position indicator lamp
ABS	ABS warning lamp
TCL	TCL warning lamp
Cruise control	Cruise warning lamp

Indications of diagnosis code by warning lamp

When the diagnosis code No.24 is output	When no diagnosis code is output

METHOD OF ERASING DIAGNOSIS CODES WHEN USING THE MUT-II

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

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

WHEN NOT USING THE MUT-II <MPI, TCL, ABS AND A/T>

1. Turn the ignition switch to OFF.
2. After disconnecting the battery cable from the battery (–) terminal for 10 seconds or more, reconnect the cable.
3. After the engine has warmed up, run it at idle for about 15 minutes.

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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.

CHECKING PROCEDURE 4

• **Indicator does not turn on or off even if control mode switch is pressed.** • **Indicator which should not be illuminated is illuminated.**	**Probable cause**
[Comment] In the above cases, the ECS switch circuit is defective or the indicator circuit is defective.	

MUT–II Service Data
17 Control mode selection switch
OK: Voltage changes between approx. 0V → approx. 2.5V → approx. 5V when the switch is operated.

OK →

NG ↓

ECU switch inspection (Refer component inspection.)

OK ↓

Measure at switch connector A-44
- Disconnect the connector, and measure at the harness side.
- Voltage between terminal 6 - earth and terminal 8 - ground
  OK: Approx. 5V

OK ↓

Check the following connector. A-44

NG → **Repair**

OK ↓

Check trouble symptom.

Replace the ECS-ECU.

1. Indicates inspection carried out using the MUT-II .
   Indicates the operation and inspection procedures.
   Indicates the OK judgement conditions.

2. Thick box lines:
   Detailed inspection procedures (methods) such as component inspection and circuit inspection are listed on a separate page, and are given here for reference.

3. Indicates voltage and resistance to be measured at a particular connector.
   (Refer to “Connector Measurement Service Points”.)
   The connector position can be located in the wiring diagram in group 54B by means of this symbol.
   Indicates operation and inspection procedures, inspection terminals and inspection conditions.
   Indicates the OK judgement conditions.

4. Inspect the contact condition at each connector terminal.
   (Refer to “Connector Inspection Service Points”.)
   The connector position can be located in the wiring diagram in group 54B by means of this symbol.
   Caution
   After carrying out connector inspection, always be sure to reconnect the connector as it was before.

5. Confirm that there are trouble symptoms. If trouble symptoms have disappeared, the connector may have been inserted incorrectly and the trouble symptom may have disappeared during inspection.
   If it seems that trouble symptoms still remain, proceed to the next stage of instructions.

6. If trouble symptoms still remain up to this stage, there is a possibility that there is an open or short circuit in the harness between the connectors, so check the harness. Alternatively, the cause may be a defective ECU, so try replacing the ECU and check if the trouble symptom disappears.

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 group 54 electrical. 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.

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CONNECTOR MEASUREMENT SERVICE POINTS

Turn the ignition switch to OFF when connecting and disconnecting the connectors, and 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, because to do 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 forced; use a special tool (the extra–thin probe in the harness set 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.

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CONNECTOR INSPECTION

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.

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.

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 or more]

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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.)

POINTS TO NOTE FOR INTERMITTENT MALFUNCTIONS

Intermittent malfunctions often occur under certain conditions, and if these conditions can be ascertained, determining the cause becomes simple. In order to ascertain the conditions under which an intermittent malfunction occurs, first ask the customer for details about the driving conditions, weather conditions, frequency of occurrence and trouble symptoms, and then try to recreate the trouble symptoms. Next, ascertain whether the reason why the trouble symptom occurred under these conditions is due to vibration, temperature or some other factor. If vibration is thought to be the cause, carry out the following checks with the connectors and components to confirm whether the trouble symptom occurs.
The objects to be checked are connectors and components which are indicated by inspection procedures or given as probable causes (which generates diagnosis codes or trouble symptoms.)

- Gently shake the connector up, down and to the left and right.
- Gently shake the wiring harness up, down and to the left and right.
- Gently rock each sensor and relay, etc. by hand.
- Gently shake the wiring harness at suspensions and other moving parts.

NOTE
If determining the cause is difficult, the flight recorder function of the MUT-II can also be used.

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VEHICLE IDENTIFICATION

VEHICLE IDENTIFICATION NUMBER (VIN)

This number is stamped on the engine bulkhead next to the compliance plate and also on the compliance plate itself. It provides information for vehicle identification purposes and should be quoted when ordering parts or in any correspondence related to the vehicle.

No.	Items	Contents
1	Geographic Area	6: Australia
2	Country within Geographic area	M: Australia
3	Manufacturer	M: Mitsubishi Motors
4	Car line	T: Magna / K: Verada
5	Series	J: Series
6	Engine / Transmission combinations	3: 3.0 litre MPI <leaded fuel> (Man)
		4: 3.0 litre MPI <leaded fuel> (Auto)
		5: 3.0 litre MPI <unleaded fuel> (Man)
		6: 3.0 litre MPI <unleaded fuel> (Auto)
		7: 3.5 litre MPI <unleaded fuel> (Man)
		8: 3.5 litre MPI <unleaded fuel> (Auto)
7	Price class	A: V6 Advance
		D: Executive
		K: Altera LS
		U: V6 Altera
		M: Executive (NZ)
		S: Sports
		W: V6 Xi (Pacific)
		W: SEi (NZ)
		Z: Super Saloon/Elite (NZ)
		H: 3.5 Ei
		X: 3.5 Xi
8	Body type	42: Sedan / 46: Wagon
9	Year	W: 1998 / X: 1999 / Y: 2000 / 1: 2001
10	Assembly Plant	T: Tonsley Park
11	Body number	000001 to 999999

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COMPLIANCE PLATE

All vehicles are manufactured to confirm to specific safety, environmental or consumer protective requirements as defined by the Australian Design Rules (ADR).

NOTE
The Compliance Plate is attached to the right hand side of the bulkhead in the engine compartment and must never be removed from the vehicle.

DATA PLATE

The Data Plate is attached to the right hand side of the bulkhead (adjacent to the compliance plate) in the engine compartment and is stamped with vehicle option codes, trim codes and a daily body sequential build number.

AUSTRALIAN DESIGN RULES

Australian Design Rules require the manufacturer of components and/or a complete vehicle to conform to specific safety, environmental or consumer protective requirements as defined by that particular rule. There is legislation that requires, amongst other things, that no modifications be made to a vehicle that would cause that vehicle not to comply with the Design Rules of that vehicle (parts replacement using approved Mitsubishi Motors Australia Limited components is permissible). Before interchanging or adding optional equipment or using non–Genuine Parts, it is recommended that advice be sought from an Authorised Mitsubishi Motors Australia Limited Dealer or from a Mitsubishi Motors Australia Limited Regional Office, because it is possible to inadvertently cause a vehicle not to comply with a Design Rule.

ENGINE MODEL NUMBER

1. The engine model number is stamped at the front side on the top edge of the cylinder block as shown in the following.

Engine model	Engine displacement
6G72	2,972cc
6G74	3,497cc

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

Engine serial number	6G72M:000000 to 999999
Engine serial number	6G74M:000000 to 999999

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OPTION CODES

DATA PLATE

The Data Plate is attached to the right hand side of the bulkhead (adjacent to the compliance plate) in the engine compartment and is stamped with vehicle option codes, trim codes and a daily body sequential build number.

Option Code:	Item
A03	Driver air bag
A05	Driver & passenger air bags
A08	Brunei tropical kit
A18	MMNZ
AD3	VR-X package - manual transmission
AD4	VR-X package - automatic transmission
AD8	Solara marketing package
B14	ABS (4)
C41	Nardi wood (A/T gear knob & steering wheel)
C43	A/T shift indicator panel
C73	Leather trim
G39	Sun roof
H50	Air conditioning - manual
J14	Roof rack rails and cross bars
J30	Cruise control
J40	Traction control
N01	L.P.G.
P31	Power windows
R34	CD stacker (in instrument panel)
V20	Metallic paint
V21	Pearlescent paint
W37	Alloy wheel 15”

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MAJOR SPECIFICATIONS

<VEHICLES FOR AUSTRALIA>

Items			Magna Executive		Magna Advance		Sports	
Vehicle dimen-sions	Overall length mm	1	4,785		4,785		4,785	
	Overall width mm	2	1,785		1,785		1,785	
	Overall height (Unladen) mm	3	1,435		1,435		1,435	
	Wheelbase mm	4	2,720		2,720		2,720	
	Track–front mm	5	1,545		1,545		1,545	
	Track–rear mm	6	1,535		1,535		1,535	
	Overhang–front mm	7	970		970		970	
	Overhang–rear mm	8	1,103		1,103		1,103	
	Minimum running ground clearance mm	9	165		165		165	
Vehicle weight kg	Kerb weight (6G72) (6G74)		Man	Auto	Man	Auto	Man	Auto
			1,425 1,445	1,445 1,468	– 1,456	– 1,478	– 1,472	– 1,506
	Gross vehicle weight rating (6G72) (6G74)		1,853 1,872	1,878 1,895	– 1,867	– 1,889	– 1,901	– 1,935
	Gross axle weight –front (6G72) (6G74)		1,009 1,018	1,036 1,045	– 1,015	– 1,042	– 1,044	– 1,085
	Gross axle weight –rear (6G72) (6G74)		844 854	842 850	– 852	– 847	– 857	– 850
Seating capacity			5					
Engine	Model No.		6G72 (SOHC) 6G74 (SOHC)		6G74 (SOHC)		6G74 (SOHC)	
	Piston displacement cm^3		2,972 3,497		3,497		3,497	
Trans-mission	Model No.		F5M51	F4A51	F5M51	F4A51	F5M51	F5A51
	Type		5 speed man	4 speed auto	5 speed man	4 speed auto	5 speed man	5 speed auto
Fuel system	Fuel supply system		Electronic control multipoint fuel injection					

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MAJOR SPECIFICATIONS

<VEHICLES FOR AUSTRALIA CONTINUED>

Items			Verada Ei	Verada Xi
Vehicle dimensions	Overall length mm	1	4,929	4,929
	Overall width mm	2	1,785	1,785
	Overall height (Unladen) mm	3	1,435	1,435
	Wheelbase mm	4	2,720	2,720
	Track–front mm	5	1,545	1,545
	Track–rear mm	6	1,536	1,536
	Overhang–front mm	7	1,018	1,018
	Overhang–rear mm	8	1,189	1,189
	Minimum running ground clearance mm	9	165	165
Vehicle weight kg	Kerb weight		Auto	Auto
			1,515	1,556
	Gross vehicle weight rating		1,940	1,964
	Gross axle weight –front		1,054	1,074
	Gross axle weight –rear		886	890
Seating capacity			5	
Engine	Model No.		6G74 (SOHC)	6G74 (SOHC)
	Piston displacement cm^3		3,497	3,497
Transmission	Model No.		F4A51	F4A51
	Type		4 speed auto	4 speed auto
Fuel system	Fuel supply system		Electronic control multipoint fuel injection	

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MAJOR SPECIFICATIONS

<VEHICLES FOR AUSTRALIA CONTINUED>

Items			Magna Executive		Magna Advance		Verada Ei
Vehicle dimen-sions	Overall length mm	1	4,812		4,812		4,878
	Overall width mm	2	1,785		1,785		1,785
	Overall height (Unladen) mm	3	1,482		1,482		1,482
	Wheelbase mm	4	2,722		2,722		2,722
	Track–front mm	5	1,545		1,545		1,545
	Track–rear mm	6	1,500		1,500		1,500
	Overhang–front mm	7	970		970		1,018
	Overhang–rear mm	8	1,103		1,103		1,138
	Minimum running ground clearance mm	9	165		165		165
Vehicle weight kg	Kerb weight (6G72) (6G74)		Man	Auto	Man	Auto	Auto
			1,505 1,506	1,530 1,531	– 1,549	– 1,566	– 1,604
	Gross vehicle weight rating (6G72) (6G74)		1,965 1,966	1,990 1,991	– 1,992	– 2,009	– 2,061
	Gross axle weight –front (6G72) (6G74)		997 998	1,022 1,023	– 1,015	– 1,028	– 1,064
	Gross axle weight –rear (6G72) (6G74)		968 967	968 967	– 977	– 981	– 997
Seating capacity			5				
Engine	Model No.		6G72(SOHC) 6G74(SOHC)		6G74 (SOHC)		6G74 (SOHC)
	Piston displacement cm^3		2,972 3,497		3,497		3,497
Trans-mission	Model No.		F5M5 1	F4A51	F5M5 1	F4A51	F4A51
	Type		5 speed	4 speed	5 speed	4 speed	4 speed
Fuel system	Fuel supply system		Electronic control multipoint fuel injection				

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MAJOR SPECIFICATIONS

<VEHICLES FOR NEW ZEALAND>

Items			Diamante Executive	Diamante Super Saloon	Diamante SEi
Vehicle dimen-sions	Overall length mm	1	4,785	4,785	4,929
	Overall width mm	2	1,785	1,785	1,785
	Overall height (Unladen) mm	3	1,435	1,435	1,435
	Wheelbase mm	4	2,720	2,720	2,720
	Track–front mm	5	1,545	1,545	1,545
	Track–rear mm	6	1,536	1,535	1,535
	Overhang–front mm	7	970	970	1,018
	Overhang–rear mm	8	1,103	1,103	1,189
	Minimum running ground clearance mm	9	165	165	165
Vehicle weight kg	Kerb weight		Auto	Auto	Auto
			1,456	1,536	1560
	Gross vehicle weight rating		1,898	1,944	1968
	Gross axle weight –front		1,030	1,060	1080
	Gross axle weight –rear		868	884	888
Seating capacity			5		
Engine	Model No.		6G72 (SOHC) 6G74 (SOHC)	6G74 (SOHC)	6G74 (SOHC)
	Piston displacement cm^3		2,972 3,497	3,497	3,497
Trans-mission	Model No.		F4A51	F4A51	F4A51
	Type		4 speed auto	4 speed auto	4 speed auto
Fuel system	Fuel supply system		Electronic control multipoint fuel injection		

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MAJOR SPECIFICATIONS

<VEHICLES FOR NEW ZEALAND CONTINUED>

Items			Diamante Executive	Diamante Elite
Vehicle dimensions	Overall length mm	1	4,812	4,812
	Overall width mm	2	1,785	1,785
	Overall height (Unladen) mm	3	1,482	1,482
	Wheelbase mm	4	2,722	2,722
	Track–front mm	5	1,545	1,545
	Track–rear mm	6	1,500	1,500
	Overhang–front mm	7	970	1,138
	Overhang–rear mm	8	1,189	1,189
	Minimum running ground clearance mm	9	165	165
Vehicle weight kg	Kerb weight		Auto	Auto
			1,512	1,530
	Gross vehicle weight rating		1,968	1,985
	Gross axle weight –front		994	1,013
	Gross axle weight –rear		974	972
Seating capacity			5	
Engine	Model No.		6G72 (SOHC) 6G74 (SOHC)	6G74 (SOHC)
	Piston displacement cm^3		2,972 3,497	3,497
Transmission	Model No.		F4A51	F4A51
	Type		4 speed auto	4 speed auto
Fuel system	Fuel supply system		Electronic control multipoint fuel injection	

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MAJOR SPECIFICATIONS

<VEHICLES FOR PACIFIC REGION & BRUNEI>

Items			Magna Altera Pacific		Magna Altera Brunei
Vehicle dimen-sions	Overall length mm	1	4,785		4,785
	Overall width mm	2	1,785		1,785
	Overall height (Unladen) mm	3	1,435		1,435
	Wheelbase mm	4	2,720		2,720
	Track–front mm	5	1,545		1,545
	Track–rear mm	6	1,536		1,536
	Overhang–front mm	7	970		970
	Overhang–rear mm	8	1,103		1,103
	Minimum running ground clearance mm	9	165		165
Vehicle weight kg	Kerb weight		Man	Auto	Auto
			1,436	1,462	1,478
	Gross vehicle weight rating		1,878	1,904	1,901
	Gross axle weight –front		1,010	1,036	1,029
	Gross axle weight –rear		868	868	872
Seating capacity			5		
Engine	Model No.		6G72 (SOHC)		6G72 (SOHC)
	Piston displacement cm^3		2,972		2,972
Trans-mission	Model No.		F5M51	F4A51	F4A51
	Type		5 speed man	4 speed auto	4 speed auto
Fuel system	Fuel supply system		Electronic control multipoint fuel injection		

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MAJOR SPECIFICATIONS

<VEHICLES FOR BRUNEI>

Items			Magna Altera
Vehicle dimensions	Overall length mm	1	4,812
	Overall width mm	2	1,785
	Overall height (Unladen) mm	3	1,482
	Wheelbase mm	4	2,722
	Track–front mm	5	1,545
	Track–rear mm	6	1,500
	Overhang–front mm	7	970
	Overhang–rear mm	8	1,138
	Minimum running ground clearance mm	9	165
Vehicle weight kg	Kerb weight		Auto
			1,522
	Gross vehicle weight rating		1,985
	Gross axle weight –front		1014
	Gross axle weight –rear		971
Seating capacity			5
Engine	Model No.		6G72 (SOHC)
	Piston displacement cm^3		2,972
Transmission	Model No.		F4A51
	Type		4 speed auto
Fuel system	Fuel supply system		Electronic control multipoint fuel injection

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HOW TO DIAGNOSE

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) Configuration 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.

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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 correctly.

INSPECTION INSTRUMENTS

In inspection, make use of the following instruments.

1. Test lights

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

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.

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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.

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2. Switch connection

This figure illustrates a complex switch. The continuity 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 magnetised to attract the iron piece, closing (ON) the contact at the tip of the iron piece. When the coil current is turned off, the iron piece is made to return to its original position 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 deenergised state means that no current is flowing through the coil and the energised state means that current is flowing through the coil.

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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 deenergised, 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 and it cannot be determine if a relay is okay or faulty by checking its state only when it is deenergised (or energised).

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 adequately 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 for shorting and check for abnormal electric parts. Only after the correction of such shorting or parts, fuse of the same capacity should be used as a replacement. Never use a fuse of larger 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 fairly long period of use and hence is less frequent than the above type. In this case, you may simply replace with a new fuse of the same capacity.

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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 as 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 that 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 voltage, with motor starting to run.

(4) The circuit illustrated here is normal but 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.

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2. SHORT-CIRCUIT CHECK

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

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3. CONTINUITY CHECK

(1) When the switch is in the OFF position, the self power test light should come on 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.

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SERVICE PRECAUTIONS

SUPPLEMENTAL RESTRAINT SYSTEM (SRS)

1. Items to follow when servicing SRS
   (1) Be sure to read GROUP 52B – Supplemental Restraint System (SRS)
   For safe operations, 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 Airbag components (SRS – ECU, air bag module and clock spring). If faulty, replace them.
   (5) Warning labels must be heeded when servicing or handling SRS components. Warning labels are located in the following locations.
   - Sun visor
   - SRS – ECU
   - Steering wheel
   - Air bag module
   - Clock spring
   - Steering gear and linkage clamp

   (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.
   Do not place anything on top.
   (7) When discarding an airbag module or disposing of a vehicle with an SRS air bag, ensure that you first activate the airbag.
   (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) If there is any possibility that the SRS airbag component parts will be subjected to heating, remove the component parts.
   - SRS - ECU, airbag module, clockspring: 93°C

   After installing the component parts, test that the SRS warning lamp lights up to confirm that the airbag system is normal.

ENGINE-A/T ECU AND BEM/IMMOBILISER SERVICE REQUIREMENTS

When replacing Engine-A/T ECU and BEM/Immobiliser ECU, related components must be replaced as follows:–

Component replacement	Additional component requirements		
	Engine-A/T ECU	BEM ECU	Ignition Keys
Engine-A/T ECU	–	Replacement required	Replacement and registration required.
Engine-A/T Reprogramming	No action required	No action required	No action required
BEM ECU	No action required	–	Re-register original keys
Ignition Key	No action required	No action required	Registration of new key and all original/other keys
RKE unit	No action required	No action required	No action required

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SERVICING THE ELECTRICAL SYSTEM

1. Note the following before proceeding with work on the electrical system.
   Note that the following must never be done:
   Unauthorised 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.

   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 battery's negative (–) terminal is connected], warm up the engine and allow it to idle for approximately ten minutes under the conditions described below, in order to stabilise the engine control conditions, and then check to be sure that idling is satisfactory.**
      Engine coolant temperature: 80–95°C
      Lights, electric fans, accessories: OFF
      Transmission: "N" or "P"
      Steering wheel: neutral (centre) 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 300 mm from any plastic parts and all opening parts (doors, luggage compartment, etc.).

MUT-II

To operate the MUT–II, refer to the "MUT-II OPERATING INSTRUCTIONS".

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

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TOWING AND HOISTING

TOWING RECOMMENDATION

FRONT TOWING PICKUP

Caution

This vehicle cannot be towed by sling-type equipment to prevent the bumper from deformation. If this vehicle is towed, use wheel lift or flat bed equipment.

The vehicle may be towed on its rear wheels for extended distances provided the parking brake is released. It is recommended that vehicles be towed using the front pickup whenever possible.

REAR TOWING PICKUP

Caution

1. **This vehicle cannot be towed by sling-type equipment. This will prevent the lower arm from deformation. If this vehicle is towed, use wheel lift of flat bed equipment.**
2. **Do not use steering column lock to secure front wheel position for towing.**
3. **Make sure the transmission is in Neutral if vehicle will be with drive wheels on the ground.**

Automatic transmission vehicle may be towed on the front wheels at speeds not to exceed 50 km/h for distances not to exceed 30 km.

Caution

If these limits cannot be met, the front wheels must be placed on a tow dolly.

TOWING WHEN KEYS ARE NOT AVAILABLE

When a locked vehicle must be towed and keys are not available, the vehicle may be lifted and towed from the front, provided the parking brake is released. If not released, the rear wheels should be placed on a tow dolly.

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SAFETY PRECAUTIONS

The following precautions should be taken when towing the vehicle.

1. DO NOT LIFT OR TOW THE VEHICLE BY ATTACHING TO OR WRAPPING AROUND THE BUMPER.
2. Any loose or protruding parts of damaged vehicle such as hoods, doors, fenders, trim, etc., should be secured or removed prior to moving the vehicle.
3. Operator should refrain from going under a vehicle while it is lifted by the towing equipment, unless the vehicle is adequately supported by safety stands.
4. Never allow passengers to ride in a towed vehicle.
5. State and local rules and regulations must be followed when towing a vehicle.

LIFTING, JACKING SUPPORT LOCATION

FLOOR JACK

Caution
Never support any point other than the specified one, or it will be deformed.

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RIGID RACK

Caution
For lifting, put rubber or similar between the side sill and rigid rack, or the side sill area will be damaged.

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 adaptors in order to support the vehicle at the proper locations.

Caution
When hoisting Magna Sports with VR-X body kit, pads must be wound down fully to go under the side air dams, then wound up fully so hoisting arms have clearance to side air dams. Hoisting pads must also be clear of the side air dams so that no weight is taken onto air dams when vehicle is lifted.

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

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TIGHTENING TORQUE

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		
Bolt nominal diameter (mm)	Pitch (mm)	Head mark “4”	Head mark “7”	Head mark “8”
M5	0.8	2.5	5	6
M6	1.0	5	9	10
M8	1.25	12	22	25
M10	1.25	24	44	52
M12	1.25	41	81	96
M14	1.5	72	137	157
M16	1.5	111	206	235
M18	1.5	167	304	343
M20	1.5	226	412	481
M22	1.5	304	559	647
M24	1.5	392	735	853

Flange bolt and nut tightening torque

Thread size		Torque Nm		
Bolt nominal diameter (mm)	Pitch (mm)	Head mark “4”	Head mark “7”	Head mark “8”
M6	1.0	5	10	12
M8	1.25	13	24	28
M10	1.25	26	49	57
M10	1.5	24	44	54
M12	1.25	46	93	103
M12	1.75	42	81	96

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HOW TO USE THIS MANUAL

MAINTENANCE, REPAIR AND SERVICING EXPLANATIONS

This manual provides explanations, etc. concerning procedures for the inspection, maintenance, repair and servicing of the subject model, for Australian vehicles.

ON VEHICLE SERVICE

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

INSPECTION

Items described under this heading are inspection and checking procedures to be performed by using special tools and measuring instruments and by feeling. For actual maintenance and servicing procedures, visual inspections should always be performed as well.

DEFINITION OF TERMS

STANDARD VALUE

Indicates the value used as the standard for judging the quality of a part or assembly, 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,it is provided to facilitate assembly and adjustment procedures so they can be completed more efficiently.

CAUTION

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

INDICATION OF TIGHTENING TORQUE

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.

ABBREVIATIONS

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

M/T: Indicates manual transmission, or models equipped with a manual transmission.
A/T: Indicates automatic transmission, or models equipped with an automatic transmission.
MPI: Indicates multipoint fuel injection.
S4: Indicates an engine with a single overhead camshaft and 4 valves per cylinder.
AWD: Indicates all wheel drive equipped vehicle.

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VEHICLE IDENTIFICATION

VEHICLE IDENTIFICATION NUMBER (VIN)

This number is stamped on the engine bulkhead next to the compliance plate and also on the compliance plate itself. It provides information for vehicle identification purposes and should be quoted when ordering parts or in any correspondence related to the vehicle.

No.	Items	Contents
1	Geographic Area	6: Australia
2	Country within Geographic area	M: Australia
3	Manufacturer	M: Mitsubishi Motors
4	Car line	T: Magna / K: Verada
5	Series	J: Series
6	Engine / Transmission combinations	9: 3.5 litre MPI <unleaded fuel> (5A/T)
7	Price class	F: Executive AWD
		X: Sports AWD
		F: Verada AWD
8	Body type	42: Sedan
9	Year	W: 1998 / X: 1999 / Y: 2000 / 1: 2001 / 2: 2002
10	Assembly Plant	T: Tonsley Park
11	Body number	000001 to 999999

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OPTION CODES

DATA PLATE

The Data Plate is attached to the right hand side of the bulkhead (adjacent to the compliance plate) in the engine compartment and is stamped with vehicle option codes, trim codes and a daily body sequential build number.

Option Code:	Item
A05	Driver & passenger air bags
A18	MMNZ
C41	Nardi wood (A/T gear knob & steering wheel)
C73	Leather trim
G39	Sun roof
J30	Cruise control
V20	Metallic paint
V21	Pearlescent paint

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MAJOR SPECIFICATIONS

<VEHICLES FOR AUSTRALIA>

Items			Magna Executive AWD		Sports AWD		Verada AWD	
Vehicle dimen-sions	Overall length mm	1	4,785		4,785		4,785	
	Overall width mm	2	1,785		1,785		1,785	
	Overall height (Unladen) mm	3	1,435		1,435		1,435	
	Wheelbase mm	4	2,720		2,720		2,720	
	Track–front mm	5	1,545		1,545		1,545	
	Track–rear mm	6	1,535		1,535		1,535	
	Overhang–front mm	7	970		970		970	
	Overhang–rear mm	8	1,103		1,103		1,103	
	Minimum running ground clearance mm	9	165		165		165	
Vehicle weight kg	Kerb weight		Man	Auto	Man	Auto	Man	Auto
			–	1,605	–	1,625	–	1,644
	Gross vehicle weight rating		–	2.032	–	2.050	–	2,073
	Gross axle weight –front (6G74)		–	1,101	–	1,108	–	1,114
	Gross axle weight –rear (6G74)		–	931	–	942	–	959
Seating capacity			5					
Engine	Model No.		6G74 (SOHC)		6G74 (SOHC)		6G74 (SOHC)	
	Piston displacement cm^3		3,497		3,497		3,497	
Trans-mission	Model No.		–	W5A51	–	W5A51	–	W5A51
	Type		–	5 speed auto	–	5 speed auto	–	5 speed auto
Fuel system	Fuel supply system		Electronic control multipoint fuel injection					

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MAJOR SPECIFICATIONS

<VEHICLES FOR NEW ZEALAND>

Items			Base AWD		Sports AWD		AWD	
Vehicle dimen-sions	Overall length mm	1	4,785		4,785		4,785	
	Overall width mm	2	1,785		1,785		1,785	
	Overall height (Unladen) mm	3	1,435		1,435		1,435	
	Wheelbase mm	4	2,720		2,720		2,720	
	Track–front mm	5	1,545		1,545		1,545	
	Track–rear mm	6	1,535		1,535		1,535	
	Overhang–front mm	7	970		970		970	
	Overhang–rear mm	8	1,103		1,103		1,103	
	Minimum running ground clearance mm	9	165		165		165	
Vehicle weight kg	Kerb weight		Man	Auto	Man	Auto	Man	Auto
			–	1,605	–	1,625	–	1,644
	Gross vehicle weight rating		–	2.032	–	2.050	–	2,073
	Gross axle weight –front (6G74)		–	1,101	–	1,108	–	1,114
	Gross axle weight –rear (6G74)		–	931	–	942	–	959
Seating capacity			5					
Engine	Model No.		6G74 (SOHC)		6G74 (SOHC)		6G74 (SOHC)	
	Piston displacement cm^3		3,497		3,497		3,497	
Trans-mission	Model No.		–	W5A51	–	W5A51	–	W5A51
	Type		–	5 speed auto	–	5 speed auto	–	5 speed auto
Fuel system	Fuel supply system		Electronic control multipoint fuel injection					

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MAJOR SPECIFICATIONS

<VEHICLES FOR PACIFIC REGION & BRUNEI>

Items			Base AWD		Sports AWD		AWD	
Vehicle dimen-sions	Overall length mm	1	4,785		4,785		4,785	
	Overall width mm	2	1,785		1,785		1,785	
	Overall height (Unladen) mm	3	1,435		1,435		1,435	
	Wheelbase mm	4	2,720		2,720		2,720	
	Track–front mm	5	1,545		1,545		1,545	
	Track–rear mm	6	1,535		1,535		1,535	
	Overhang–front mm	7	970		970		970	
	Overhang–rear mm	8	1,103		1,103		1,103	
	Minimum running ground clearance mm	9	165		165		165	
Vehicle weight kg	Kerb weight		Man	Auto	Man	Auto	Man	Auto
			–	1,605	–	1,625	–	1,644
	Gross vehicle weight rating		–	2.032	–	2.050	–	2,073
	Gross axle weight –front (6G74)		–	1,101	–	1,108	–	1,114
	Gross axle weight –rear (6G74)		–	931	–	942	–	959
Seating capacity			5					
Engine	Model No.		6G74 (SOHC)		6G74 (SOHC)		6G74 (SOHC)	
	Piston displacement cm^3		3,497		3,497		3,497	
Trans-mission	Model No.		–	W5A51	–	W5A51	–	W5A51
	Type		–	5 speed auto	–	5 speed auto	–	5 speed auto
Fuel system	Fuel supply system		Electronic control multipoint fuel injection					

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TOWING AND HOISTING

TOWING RECOMMENDATION

Towing methods	Remarks
00TJ061A	• For AWD vehicles, the basic principle is that all four wheels are to be raised before towing. • The shift lever should be in the park position and the parking brake applied.
00N0028	
00N0030	• The vehicle must not be towed by placing only the front wheels or only the rear wheels on a rolling dolly. To do so will result in deterioration of the viscous coupling and result in the viscous coupling causing the vehicle to jump forward.
00N0027	• The front and rear wheels must rotate normally. • Both running and driving systems must function normally. • The shift lever must set in the neutral position and the ignition key must be set to “ACC.”.

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Towing methods	Remarks
00N0026	● If only the front wheels or only the rear wheels are lifted for towing, the bumper will be damaged. In addition, lifting of the rear wheels causes the oil to flow forward, and may result in heat damage to the rear bushing of the transfer, therefore should not be done.
00N0029	

TOWING WHEN KEYS ARE NOT AVAILABLE

When a locked vehicle must be towed and keys are not available, the vehicle must be towed on a flat be truck or four wheel dolly system.

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SAFETY PRECAUTIONS

The following precautions should be taken when towing the vehicle.

1. DO NOT LIFT OR TOW THE VEHICLE BY ATTACHING TO OR WRAPPING AROUND THE BUMPER.
2. Any loose or protruding parts of damaged vehicle such as hoods, doors, fenders, trim, etc., should be secured or removed prior to moving the vehicle.
3. Operator should refrain from going under a vehicle while it is lifted by the towing equipment, unless the vehicle is adequately supported by safety stands.
4. Never allow passengers to ride in a towed vehicle.
5. State and local rules and regulations must be followed when towing a vehicle.

LIFTING, JACKING SUPPORT LOCATION

FLOOR JACK

Caution
Never support any point other than the specified one, or it will be deformed.

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RIGID RACK

Caution
For lifting, put rubber or similar between the side sill and rigid rack, or the side sill area will be damaged.

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 adaptors in order to support the vehicle at the proper locations.

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

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TIGHTENING TORQUE

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

Bolts	Head mark “4”		Head mark “7”		Head mark “8”	
Nuts	Head mark “4”		Head mark “6”		Head mark “6”	
Item / Nominal Size	Standard	Tightening Range	Standard	Tightening Range	Standard	Tightening Range
M5 x 0.8	2.75	2 – 3	5.20	4 – 6	5.98	5 – 7
M6 x 1.0	4.71	4 – 6	8.83	7 – 11	10.2	8 – 12
M8 x 1.25	11.2	9 – 14	20.9	17 – 26	24.2	20 – 29
M10 x 1.25	23.1	19 – 28	43.2	34 – 54	52.4	45 – 60
M12 x 1.25	42.2	33 – 49	82.1	70 – 95	95.2	85 – 110
M14 x 1.5	71.6	60 – 85	133	120 – 160	155	130 – 180
M16 x 1.5	108	90 – 130	202	180 – 240	234	200 – 270
M18 x 1.5	158	140 – 190	294	260 – 340	341	290 – 390
M20 x 1.5	221	190 – 260	412	350 – 470	478	410 – 550
M22 x 1.5	296	260 – 340	552	470 – 640	641	550 – 740
M24 x 1.5	392	340 – 450	732	630 – 840	849	730 – 980

Standard bolt tightening torque, coarse series

Bolts	Head mark “4”		Head mark “7”		Head mark “8”	
Item / Nominal Size	Standard	Tightening Range	Standard	Tightening Range	Standard	Tightening Range
M10 x 1.5	21.8	18 – 26	40.6	33 – 49	49.1	41 – 59
M12 x 1.75	38.0	31 – 46	74.1	65 – 85	86.1	75 – 100
M14 x 2	65.3	55 – 75	122	110 – 140	141	120 – 160
M16 x 2	101	90 – 120	188	160 – 220	219	190 – 260
M18 x 2.5	137	120 – 160	257	220 – 290	298	260 – 340
M20 x 2.5	196	170 – 230	367	320 – 420	426	370 – 490
M22 x 2.5	266	230 – 300	496	430 – 570	577	490 – 670
M24 x 3	339	290 – 390	634	540 – 730	736	630 – 840

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Flange bolt and nut tightening torque

Bolts	Head mark “4”		Head mark “7”		Head mark “8”	
Nuts	Head mark “4”		–		–	
Item / Nominal Size	Standard	Tightening Range	Standard	Tightening Range	Standard	Tightening Range
M6 x 1.0	5.30	4 – 6	9.81	8 – 12	11.4	9 – 14
M8 x 1.25	12.5	10 – 15	23.2	19 – 28	27.0	22 – 32
M10 x 1.25	25.4	21 – 30	47.5	39 – 58	57.5	50 – 65
M10 x 1.5	23.8	20 – 28	44.5	37 – 53	53.9	45 – 65
M12 x 1.25	46.7	38 – 54	90.9	80 – 110	106	90 – 120
M12 x 1.75	42.2	35 – 51	82.2	70 – 95	95.3	85 – 110

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OPTION CODES

DATA PLATE

The Data Plate is attached to the right hand side of the bulkhead (adjacent to the compliance plate) in the engine compartment and is stamped with vehicle option codes, trim codes and a daily body sequential build number.

Option Code:	Item	Option Code:	Item
A03	Driver air bag	D05	5 Speed A/T
A05	Driver & passenger air bags	E32	3.0 litre S4 V6
A08	Brunei tropical kit	E35	3.5 litre S4 V6
A18	MMNZ	G39	Sun roof
AA2	A/C & LPG	H50	Air conditioning
AA5	ABS & A/C	J14	Roof rack rails and cross bars
AA6	Driver SRS & A/C	J30	Cruise control
AB0	Driver SRS, ABS, A/C & Cruise Control	J40	Traction control
AB4	A/C, Cruise Control & LPG	N01	L.P.G.
AB5	A/C & Cruise Control	P31	Power windows
AB7	Driver SRS, ABS & A/C	R34	CD stacker (in instrument panel)
AC7	Dual SRS & A/C	V20	Metallic paint
AD3	VR-X package - manual transmission	V21	Pearlescent paint
AD4	VR-X package - automatic transmission	W37	Alloy wheel 15”
AD8	Solara marketing package	XM9	NZ Export pack
B14	ABS	XN0	NZ Export VR–X
C41	Nardi wood (A/T gear knob & steering wheel)	XN7	NZ Rear Garnish, Dual SRS & A/C
C73	Leather trim	X30	Brunei Export
D03	5 Speed M/T	X62	NZ Export
D04	4 Speed A/T		

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MAJOR SPECIFICATIONS

Items			Magna Executive		Magna Advance		Sports	
Vehicle dimen-sions	Overall length mm	1	4,785		4,785		4,785	
	Overall width mm	2	1,785		1,785		1,785	
	Overall height (Unladen) mm	3	1,435		1,435		1,435	
	Wheelbase mm	4	2,720		2,720		2,720	
	Track–front mm	5	1,545		1,545		1,545	
	Track–rear mm	6	1,535		1,535		1,535	
	Overhang–front mm	7	970		970		970	
	Overhang–rear mm	8	1,103		1,103		1,103	
	Minimum running ground clearance mm	9	165		165		165	
Vehicle weight kg	Kerb weight (6G72) (6G74)		Man	Auto	Man	Auto	Man	Auto
			1,436 1,456	1,461 1,479	– 1,478	– 1,500	– 1,468	– 1,505
	Gross vehicle weight rating (6G72) (6G74)		1,901 1,921	1,926 1,944	– 1,925	– 1,947	– 1,946	– 1,983
	Gross axle weight –front (6G72) (6G74)		1,049 1,058	1,076 1,085	– 1,060	– 1,087	– 1,068	– 1,111
	Gross axle weight –rear (6G72) (6G74)		852 863	850 859	– 865	– 860	– 877	– 872
Seating capacity			5					
Engine	Model No.		6G72 (SOHC) 6G74 (SOHC)		6G74 (SOHC)		6G74 (SOHC)	
	Piston displacement cm^3		2,972 3,497		3,497		3,497	
Trans-mission	Model No.		F5M51	F4A51	F5M51	F4A51	F5M51	F5A51
	Type		5 speed man	4 speed auto	5 speed man	4 speed auto	5 speed man	5 speed auto
Fuel system	Fuel supply system		Electronic control multipoint fuel injection					

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MAJOR SPECIFICATIONS

<VEHICLES FOR AUSTRALIA CONTINUED>

Items			Verada Ei	Verada Xi
Vehicle dimensions	Overall length mm	1	4,929	4,929
	Overall width mm	2	1,785	1,785
	Overall height (Unladen) mm	3	1,435	1,435
	Wheelbase mm	4	2,720	2,720
	Track–front mm	5	1,545	1,545
	Track–rear mm	6	1,536	1,536
	Overhang–front mm	7	1,018	1,018
	Overhang–rear mm	8	1,189	1,189
	Minimum running ground clearance mm	9	165	165
Vehicle weight kg	Kerb weight		Auto	Auto
			1,523	1,563
	Gross vehicle weight rating		1,948	1,972
	Gross axle weight –front		1,062	1,082
	Gross axle weight –rear		886	890
Seating capacity			5	
Engine	Model No.		6G74 (SOHC)	6G74 (SOHC)
	Piston displacement cm^3		3,497	3,497
Transmission	Model No.		F4A51	F4A51
	Type		4 speed auto	4 speed auto
Fuel system	Fuel supply system		Electronic control multipoint fuel injection	

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MAJOR SPECIFICATIONS

<VEHICLES FOR AUSTRALIA CONTINUED>

00TJ051A

00TE029A

00TE030A

Items			Magna Executive		Magna Advance		Magna Sports	Verada Ei
Vehicle dimen-sions	Overall length mm	1	4,812		4,812		4,832	4,878
	Overall width mm	2	1,785		1,785		1,785	1,785
	Overall height (Unladen) mm	3	1,482		1,482		1,523	1,482
	Wheelbase mm	4	2,722		2,722		2,722	2,722
	Track–front mm	5	1,545		1,545		1,545	1,545
	Track–rear mm	6	1,500		1,500		1,500	1,500
	Overhang–front mm	7	970		970		1,018	1,018
	Overhang–rear mm	8	1,103		1,103		1,138	1,138
	Minimum running ground clearance mm	9	165		165		168	165
Vehicle weight kg	Kerb weight (6G72) (6G74)		Man	Auto	Man	Auto	Auto	Auto
			1,516 1,517	1,541 1,542	– 1,558	– 1,575	– 1,596	– 1,611
	Gross vehicle weight rating (6G72) (6G74)		1,996 1,997	2,021 2,022	– 2,020	– 2,037	– 2,063	– 2,069
	Gross axle weight –front (6G72) (6G74)		1,031 1,032	1,056 1,057	– 1,046	– 1,059	– 1,090	– 1,072
	Gross axle weight –rear (6G72) (6G74)		965 965	965 965	– 974	– 978	– 973	– 997
Seating capacity			5					
Engine	Model No.		6G72(SOHC) 6G74(SOHC)		6G74 (SOHC)		6G74 (SOHC)	6G74 (SOHC)
	Piston displacement cm^3		2,972 3,497		3,497		3,497	3,497
Trans-mission	Model No.		F5M51	F4A51	F5M51	F4A51	F5A51	F4A51
	Type		5 speed	4 speed	5 speed	4 speed	5 speed	4 speed
Fuel system	Fuel supply system		Electronic control multipoint fuel injection					

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OPTION CODES

DATA PLATE

The Data Plate is attached to the right hand side of the bulkhead (adjacent to the compliance plate) in the engine compartment and is stamped with vehicle option codes, trim codes and a daily body sequential build number.

Option Code:	Item	Option Code:	Item
A03	Driver air bag	D05	5 Speed A/T
A05	Driver & passenger air bags	E32	3.0 litre S4 V6
A08	Brunei tropical kit	E35	3.5 litre S4 V6
A18	MMNZ	G39	Sun roof
AA2	A/C & LPG	H50	Air conditioning
AA5	ABS & A/C	J14	Roof rack rails and cross bars
AA6	Driver SRS & A/C	J30	Cruise control
AB0	Driver SRS, ABS, A/C & Cruise Control	J40	Traction control
AB4	A/C, Cruise Control & LPG	N01	L.P.G.
AB5	A/C & Cruise Control	P31	Power windows
AB7	Driver SRS, ABS & A/C	R34	CD stacker (in instrument panel)
AC7	Dual SRS & A/C	V20	Metallic paint
AD3	VR-X package - manual transmission	V21	Pearlescent paint
AD4	VR-X package - automatic transmission	W37	Alloy wheel 15”
AD8	Solara marketing package	XM9	NZ Export pack
B14	ABS	XN0	NZ Export VR–X
C41	Nardi wood (A/T gear knob & steering wheel)	XN7	NZ Rear Garnish, Dual SRS & A/C
C73	Leather trim	X30	Brunei Export
D03	5 Speed M/T	X62	NZ Export
D04	4 Speed A/T		

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VEHICLE IDENTIFICATION

VEHICLE IDENTIFICATION NUMBER (VIN)

This number is stamped on the engine bulkhead next to the compliance plate and also on the compliance plate itself. It provides information for vehicle identification purposes and should be quoted when ordering parts or in any correspondence related to the vehicle.

No.	Items	Contents
1	Geographic Area	6: Australia
2	Country within Geographic area	M: Australia
3	Manufacturer	M: Mitsubishi Motors
4	Car line	T: Magna / K: Verada
5	Series	J: Series
6	Engine / Transmission combinations	3: 3.0 litre MPI <leaded fuel> (Man)
		4: 3.0 litre MPI <leaded fuel> (Auto)
		5: 3.0 litre MPI <unleaded fuel> (Man)
		6: 3.0 litre MPI <unleaded fuel> (Auto)
		7: 3.5 litre MPI <unleaded fuel> (Man)
		8: 3.5 litre MPI <unleaded fuel> (Auto)
7	Price class	A: V6 Advance
		D: Executive
		K: Altera LS
		U: V6 Altera
		M: Executive (NZ)
		S: Sports
		W: V6 Xi (Pacific)
		W: SEi (NZ)
		Z: Super Saloon/Elite (NZ)
		H: 3.5 Ei
		X: 3.5 Xi
8	Body type	42: Sedan / 46: Wagon
9	Year	W: 1998 / X: 1999 / Y: 2000 / 1: 2001 / 2: 2002
10	Assembly Plant	T: Tonsley Park
11	Body number	000001 to 999999

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MAJOR SPECIFICATIONS

Items			Magna Executive		Magna Advance		Sports	
Vehicle dimen-sions	Overall length mm	1	4,785		4,785		4,785	
	Overall width mm	2	1,785		1,785		1,785	
	Overall height (Unladen) mm	3	1,435		1,435		1,435	
	Wheelbase mm	4	2,720		2,720		2,720	
	Track–front mm	5	1,545		1,545		1,545	
	Track–rear mm	6	1,535		1,535		1,535	
	Overhang–front mm	7	970		970		970	
	Overhang–rear mm	8	1,103		1,103		1,103	
	Minimum running ground clearance mm	9	165		165		165	
Vehicle weight kg	Kerb weight (6G72) (6G74)		Man	Auto	Man	Auto	Man	Auto
			1,443 1,467	1,475 1,486	– 1,478	– 1,497	– 1,473	– 1,512
	Gross vehicle weight rating (6G72) (6G74)		1,858 1,911	1,891 1,930	– 1,906	– 1,925	– 1,926	– 1,966
	Gross axle weight –front (6G72) (6G74)		1,016 1,040	1,040 1,065	– 1,038	– 1,058	– 1,042	– 1,090
	Gross axle weight –rear (6G72) (6G74)		842 871	851 865	– 868	– 867	– 884	– 876
Seating capacity			5					
Engine	Model No.		6G72 (SOHC) 6G74 (SOHC)		6G74 (SOHC)			
	Piston displacement cm^3		2,972 3,497		3,497			
Trans-mission	Model No.		F5M51	F4A51	F5M51	F4A51	F5M51	F5A51
	Type		5 speed man	4 speed auto	5 speed man	4 speed auto	5 speed man	5 speed auto
Fuel system	Fuel supply system		Electronic control multipoint fuel injection					

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MAJOR SPECIFICATIONS

<VEHICLES FOR AUSTRALIA CONTINUED>

Items			Verada Ei	Verada Xi	Verada GTV
Vehicle dimensions	Overall length mm	1	4,929	4,929	4,929
	Overall width mm	2	1,785	1,785	1,785
	Overall height (Unladen) mm	3	1,435	1,435	1,435
	Wheelbase mm	4	2,720	2,720	2,720
	Track–front mm	5	1,545	1,545	1,545
	Track–rear mm	6	1,536	1,536	1,536
	Overhang–front mm	7	1,018	1,018	1,018
	Overhang–rear mm	8	1,189	1,189	1,189
	Minimum running ground clearance mm	9	165	165	165
Vehicle weight kg	Kerb weight		Auto		
			1,550	1,573	1,570
	Gross vehicle weight rating		1,975	1,981	1,995
	Gross axle weight –front		1,086	1,089	1,088
	Gross axle weight –rear		889	892	907
Seating capacity			5		
Engine	Model No.		6G74 (SOHC)		
	Piston displacement cm^3		3,497		
Transmission	Model No.		F5A51		
	Type		5 speed auto		
Fuel system	Fuel supply system		Electronic control multipoint fuel injection		

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MAJOR SPECIFICATIONS

<VEHICLES FOR AUSTRALIA CONTINUED>

Items			Magna Executive		Magna Advance		Magna Sports	Verada Ei
Vehicle dimen-sions	Overall length mm	1	4,812		4,812		4,832	4,878
	Overall width mm	2	1,785		1,785		1,785	1,785
	Overall height (Unladen) mm	3	1,482		1,482		1,523	1,482
	Wheelbase mm	4	2,722		2,722		2,722	2,722
	Track–front mm	5	1,545		1,545		1,545	1,545
	Track–rear mm	6	1,500		1,500		1,500	1,500
	Overhang–front mm	7	970		970		1,018	1,018
	Overhang–rear mm	8	1,103		1,103		1,138	1,138
	Minimum running ground clearance mm	9	165		165		168	165
Vehicle weight kg	Kerb weight (6G72) (6G74)		Man	Auto	Man	Auto	Auto	Auto
			1,526 1,527	1,554 1,542	– 1,559	– 1,567	– 1,606	– 1,610
	Gross vehicle weight rating (6G72) (6G74)		1,979 1,983	2,021 2,010	– 2,007	– 2,015	– 2,049	– 2,050
	Gross axle weight –front (6G72) (6G74)		1,009 1,013	1,056 1,040	– 1,027	– 1,041	– 1,071	– 1,061
	Gross axle weight –rear (6G72) (6G74)		970 970	965 970	– 980	– 974	– 978	– 989
Seating capacity			5					
Engine	Model No.		6G72(SOHC) 6G74(SOHC)		6G74 (SOHC)		6G74 (SOHC)	6G74 (SOHC)
	Piston displacement cm^3		2,972 3,497		3,497		3,497	3,497
Trans-mission	Model No.		F5M51	F4A51	F5M51	F4A51	F5A51	
	Type		5 speed	4 speed	5 speed	4 speed	5 speed	
Fuel system	Fuel supply system		Electronic control multipoint fuel injection					

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11A ENGINE <3.0 & 3.5L> 6G72/74 SERIES

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ENGINE <3.0L & 3.5L-SOHC-24 VALVE>

GENERAL INFORMATION

Items			Specifications
Type			V-type, Over Head Camshaft
Number of cylinders			6
Bore mm			6G72 – 91.1 / 6G74 – 93.0
Stroke mm			6G72 – 76 / 6G74 – 85.8
Piston displacement cc			6G72 – 2,972 / 6G74 – 3,497
Compression ratio			9.0:1
Firing order			1-2-3-4-5-6
Valve timing	Intake valve	Opens (BTDC)	6G72 - 15° / 6G74 - 13°
		Closes (ABDC)	6G72 - 53° / 6G74 - 55°
	Exhaust valve	Opens (BBDC)	6G72 - 53° / 6G74 - 51°
		Closes (ATDC)	6G72 - 15° / 6G74 - 17°
Valve overlap			6G72 - 30° / 6G74 - 30°
Intake valve duration			6G72 - 248° / 6G74 - 248°
Exhaust valve duration			6G72 - 248° / 6G74 - 248°

SERVICE SPECIFICATIONS

Items			Standard value	Limit
Drive belt tension Nm	Alternator and A/C compressor V-ribbed type	When checked	490–686	–
		When new belt is installed	784–980	–
		When used belt is installed	539–637	–
	Power steering pump	When checked	373–569	–
		When new belt is installed	608–804	–
		When used belt is installed	422–520	–
Drive belt deflection <Reference value> mm	Alternator and A/C compressor V-ribbed type	When checked	7.9–9.7	–
		When new belt is installed	6.0–7.2	–
		When used belt is installed	8.2–9.3	–
	Power steering pump	When checked	11.0–14.2	–
		When new belt is installed	8.4–9.3	–
		When used belt is installed	11.7–13.4	–
Basic ignition timing at idle <6G72>, <6G74>			5° BTDC ± 3°	–
Actual ignition timing at curb idle		<6G72>	Approx. 15° BTDC	–
		<6G74>	Approx. 10° BTDC	–
CO contents %			0.5 or less	–
HC contents ppm			100 or less	–
Curb idle speed r/min			700±100	–

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Items		Standard value	Limit
Compression pressure (250–400 r/min) kPa		1,200	min. 890
Compression pressure difference of all cylinder kPa		–	max. 100
Intake manifold vacuum at curb idle kPa		–	min. 60
Timing belt	Amount of projection of auto tensioner rod mm (Distance between the tensioner arm and auto tensioner body)	4.8–6.0	–
Oil pressure at curb idle speed		80 kPa or more	–

SEALANT

Items	Recommended sealant
Oil pan	MD970389 / Loctite 587 Ultra blue or equivalent

SPECIAL TOOLS

Tool	Tool number and name	Supersession	Application
	MB991502 (MUT-II)	–	Checking of engine idling speed
	ROM pack	–	
	MD998781 Flywheel stopper	–	Drive plate supporting
	MD998718 Crankshaft rear oil seal installer	EMD998718	Installation of the crankshaft rear oil seal
	MB990767 End yoke holder	EMB990767	Supporting the sprocket and shaft pulley during removal and installation Use with EMD998715

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Tool	Tool number and name	Supersession	Application
	MD998715 Pulley holding pins	EMD998715	Supporting the crankshaft pulley when crankshaft bolt and pulley are removed or reinstalled. Use together with EMB990767
	MD998769 Crankshaft sprocket spacer	–	Used if the crankshaft needs to be rotated to attach the timing belt, etc.
	MB998051 Crankshaft pulley wrench	E1139	Loosening and tightening of cylinder head bolt
	MD998713 Camshaft oil seal installer	EMD998713	Camshaft oil seal installation
	MB991559 Camshaft oil seal installer	EMB991559	Press fitting the camshaft oil seal (For left bank)
	MD998767 Tension pulley socket wrench	EMD998767	Adjustment of the timing belt
	MD998717 Crankshaft front oil seal installer	EMD998717	Press-fitting of crankshaft front oil seal

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TROUBLESHOOTING

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
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	Replace 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.

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ON VEHICLE SERVICE

DRIVE BELT TENSION CHECK AND ADJUSTMENT

Check the belt tension by using a belt-tension gauge or apply 98 N 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 alternator and A/C	Tension N	490-686	784-980	539-637
	Deflection <Reference value> mm	7.9-9.7	6.0-7.2	8.2-9.3
For power steering	Tension N	373-569	608-804	422-520
	Deflection <Reference value> mm	11.0-14.2	8.4-9.3	11.7-13.4

ALTERNATOR AND 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.

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POWER STEERING OIL PUMP 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

1. Before inspection, set the vehicle to the following condition.
   - Engine coolant temperature: 80–95°C
   - Lights and all accessories: OFF
   - Transmission: Neutral (P range)
2. Turn the ignition switch to OFF.
3. Connect the MUT–II to the data link connector.
4. Install the timing light.
5. Start the engine and run at idle.
6. Using MUT–II check that the idle speed is about 700 r/min.
7. Select the MPI system Actuator Test from the MUT–II menu and scroll to item 17 – Basic Ignition Timing.
8. Press the “Y” Key and check that the basic ignition timing is the standard value.

   Standard value: 5°BTDC±3°
9. If the ignition timing value is not within the standard value range refer to GROUP 13A - Troubleshooting of MPI Components and check crank angle sensor.
10. Press the MUT–II “C” key and check that the idling ignition timing is at the correct value.

    Standard value:

    Approx. 15°BTDC <6G72>

    Approx. 10°BTDC <6G74>

    NOTE
    1. Ignition timing is variable within about±8°, even under normal operating conditions.
    2. And it is automatically further advanced by about 5° from 15°BTDC <6G72> / 10°BTDC <6G74> at higher altitudes.

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CURB IDLE SPEED CHECK

1. Before inspection, set the vehicle to the following condition.
   - Engine coolant temperature: 80–95°C
   - Lights and all accessories: OFF
   - Transmission: Neutral (P for A/T)
2. Check the basic ignition timing.

   Standard value: 5° BTDC±3°
3. After turning the ignition switch to OFF, connect the MUT–II 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 speed control (ISC) system.
7. If there is a deviation from the standard value refer to GROUP 13A – Inspection Chart Classified by Trouble Symptoms, and check the MPI components.

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IDLE MIXTURE CHECK

1. Before inspection, set the vehicle to the following condition.
   - Engine coolant temperature: 80–95°C
   - Lights and all accessories: OFF
   - Transmission: Neutral (P range)
2. Check to be sure that the basic ignition timing is at the standard value.

   Standard value: 5° BTDC±3°
3. After turning the ignition switch to OFF, connect a tachometer, or connect the MUT–II to the data link connector.
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.
   - Diagnosis 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.

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COMPRESSION PRESSURE CHECK

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
   - Lights and all accessories: OFF
   - Transmission: P range
2. Disconnect the spark plug cables.
3. Remove all of the spark plugs.

4. Disconnect the crank angle sensor connector.
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, as these heated materials will gush out from the spark plug hole, which is dangerous.**

6. Set the compression gauge 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/250–400 r/min

   Limit: min. 890 kPa/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
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 crank angle sensor connector.

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11. Reinstall the spark plugs and spark plug cables.
12. Use the MUT–II to erase the diagnosis codes, or disconnect the negative battery cable for 10 seconds or more and then re-connect it.

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

MANIFOLD VACUUM CHECK

1. Before inspection, set the vehicle to the following condition.
   - Engine coolant temperature: 80–95°C
   - Lights and all accessories: OFF
   - Transmission: Neutral P range
2. Connect a tachometer or connect the MUT–II to the data link connector.

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 gauge.
4. Start the engine and check that the idle speed is within the standard value range.
   Take a reading of the vacuum gauge.

   Limit: min. 60 kPa

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LASH ADJUSTER CHECK

If an abnormal noise (clattering noise) suspected to be caused by malfunction of the lash adjuster is produced immediately after starting the engine and does not disappear, perform the following check.

NOTE

- An abnormal noise due to malfunction of the lash adjuster is produced immediately after starting the engine and changes with engine speed, regardless of the engine load. If the abnormal noise is not produced immediately after starting the engine, or does not change with the engine speed, or it changes with the engine load, malfunction of the lash adjuster is not the cause for the abnormal noise.
- When the lash adjuster is malfunctioning, the abnormal noise is rarely eliminated by continuing the warming-up of the engine at idle speed. However, the abnormal noise may disappear only when seizure is caused by oil sludge in the engine if the oil is not maintained properly.

1. Start the engine.
2. Check if abnormal noise produced immediately after starting the engine changes with the change in the engine speed. If the abnormal noise is not produced immediately after starting the engine or it does not change with the engine speed, malfunction of the lash adjuster is not the cause for the noise. Therefore, investigate other causes. If the abnormal noise does not change with the engine speed, it is probably caused by some parts other than the engine. (In this case, the valve lash adjuster is in good condition.)
3. With the engine idling, change the engine load (shift from N to D, range for example) to make sure that there is no change in the level of abnormal noise.
   If there is a change in the level of abnormal noise, a tapping noise due to worn crankshaft bearing or connecting rod bearing is suspected. (In this case, the lash adjuster is in good condition.)
4. After the engine is warmed up, run it at idle and check for abnormal noise. If the noise is reduced or disappears, clean the lash adjuster (refer cleaning procedure) as the noise may be caused by a seized or sticking lash adjuster. If there is no change in the level of the abnormal noise, proceed to Step 5.
5. Run the engine to bleed the lash adjuster system, (Refer bleeding lash adjusters)
6. If the abnormal noise does not disappear after performing the air bleeding operation, clean the lash adjuster, (Refer cleaning procedure).

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BLEEDING THE LASH ADJUSTER SYSTEM

NOTE
- Parking the vehicle on a grade for a long time may leak oil from the lash adjuster, causing air to enter the high pressure chamber when starting the engine.
- After being parked for many hours, oil may run out from the oil passage. It takes time before oil is supplied to the lash adjuster, causing air to enter the high pressure chamber.
- In the above cases, eliminate the abnormal noise by bleeding the lash adjusters as follows:

1. Check the engine oil. Add or change oil if required.

NOTE
- If the engine oil level is low, air is sucked from the oil screen, causing air to enter the oil passage.
- If the engine oil level is higher than specification, oil may be stirred by the crankshaft causing oil to be mixed with air.
- If oil is deteriorated, air is not easily separated from the oil, increasing the quantity of air contained in the oil.

- If oil mixed with air enters the high pressure chamber inside the lash adjuster from the above causes, air in the high pressure chamber is excessively compressed while the valve is opened, resulting in abnormal noise at closing of the valve. This is the same phenomenon as when the valve clearance has become excessive. The lash adjuster can resume normal function when air that has entered the lash adjuster is removed.

2. Idle the engine for 1 to 3 minutes.

3. Repeat the operation pattern shown at left at no load to check for abnormal noise.
   (Typically the abnormal noise is eliminated after repeating the operation 10 to 30 times.
   If no change is observed in the abnormal noise after repeating the operation 30 times, it is suspected that the abnormal noise is due to some other factors.)
4. After elimination of abnormal noise, repeat the operation shown at left five more times.
5. Run the engine at idle for 1 to 3 minutes to make sure that the abnormal noise has been eliminated.
6. If abnormal noise is not eliminated, clean the lash adjuster, (Refer cleaning procedure).

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ENGINE ASSEMBLY

REMOVAL AND INSTALLATION

Pre-removal Operation
- Hood Removal (Refer to GROUP 42.)
- Air Cleaner Removal (Refer to GROUP 15.)
- Drainage of Coolant (Refer to Group 14 - Coolant replacement.)
- Radiator Removal (Refer to GROUP 14.)
- Fuel Flow Prevention (Refer to GROUP 13A – On-Vehicle Service.)
- Drainage of Power Steering Fluid (Refer to GROUP 37A – On-Vehicle Service.)
- Front Exhaust Pipe (Refer to GROUP 15.)
- Washer Tank Removal (Refer to GROUP 51.)
- Engine Cover Removal (Refer to GROUP 11B.)
- Transmission Assembly Removal (Refer to GROUPS 23A <4A/T>, 23C <5A/T>.)

Post-installation Operation
- Transmission Installation (Refer to GROUPS 23A <4A/T>, 23C <5A/T>.)
- Engine Cover Installation (Refer to Group 11B.)
- Washer Tank Installation (Refer to GROUP 51.)
- Front Exhaust Pipe Installation (Refer GROUP 15.)
- Filling with Power Steering Fluid (Refer to GROUP 37A – On-Vehicle Service.)
- Radiator Installation (Refer GROUP 14.)
- Filling with Coolant (Refer to GROUP 14 – Coolant replacement.)
- Air Cleaner Installation (Refer GROUP 15.)
- Accelerator Cable Adjustment (Refer GROUP 17.)
- Hood Installation (Refer GROUP 42.)

Removal Steps

1. Alternator connector
2. Water temperature connector
3. Water temperature gauge connector
4. Injector harness connector
5. Condenser connector
6. Distributor connector
7. ISC servo connector ◀A▶
8. TPS connector ◀B▶
9. Crank angle sensor connector
10. Drive belt (for alternator and A/C) ◀A▶ ▶B◀
11. Drive belt (for power steering) ◀C▶ ▶A◀
12. Connection of the accelerator cable
13. Connection of brake booster vacuum hose
14. Connection of fuel return hose
15. Connection of fuel high pressure hose
16. Connection of the purge hose
17. Connection of heater hose
18. A/C compressor
19. Engine mount
20. Pressure hose
21. Power steering oil pump
22. Engine assembly

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

◀B▶ ENGINE MOUNT BRACKET

1. place a garage jack against the engine oil pan through a square bar so that the weight of the engine is not placed on the engine mount bracket.
2. Remove the special tool (used during removal of the transmission assembly).
3. Hold the engine assembly with a chain block.
4. Detach the engine mount bracket.

◀C▶ ENGINE ASSEMBLY REMOVAL

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

INSTALLATION SERVICE POINTS

▶A◀ ENGINE ASSEMBLY INSTALLATION

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

▶B◀ PRESSURE HOSE

1. Apply a small amount of new engine oil to the o-ring.

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CAMSHAFT OIL SEAL

REMOVAL AND INSTALLATION

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

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 cut out in the oil seal to pry off the oil seal.

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

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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

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CRANKSHAFT OIL SEALS

FRONT OIL SEAL

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Timing Belt Removal and Installation (Refer GROUP 11B.)

Adjustment
- Engine Adjustment

Removal Steps

1. Crankshaft sprocket
2. Crank angle 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 cut out 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.

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REAR OIL SEAL
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Transmission Removal and Installation
  (Refer to GROUP 22 <M/T>, 23A <4A/T>, 23C <5A/T>.)

Removal Steps

1. Plate
2. Adaptor plate
◀A▶ ▶B◀ 3. Drive plate <A/T>, flywheel <M/T>
4. Rear plate
5. Oil seal case
◀B▶ ▶A◀ 6. Oil seal

REMOVAL SERVICE POINTS

◀A▶ DRIVE PLATE ADAPTOR PLATE REMOVAL

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

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◀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 cut out 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◀ DRIVE PLATE ADAPTOR PLATE INSTALLATION

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

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OIL PAN, LOWER

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Front Exhaust Pipe (Refer GROUP 15.)
- Draining and Filling Engine Oil (Refer GROUP 12.)

01AE011N

1. Drain plug
2. Drain plug gasket
◀A▶ ▶A◀ 3. Oil pan, lower

REMOVAL SERVICE POINT

◀A▶ OIL PAN, LOWER REMOVAL

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

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

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Flange bolt tightening sequence

View from the bottom of the lower oil pan

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 / Loctite 587 Ultra blue or equivalent

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

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OIL PAN, UPPER

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Draining and Filling with Engine Oil (Refer GROUP 12.)
- Oil pan, Lower (Refer Removal & Installation.)

Sealant: MITSUBISHI GENUINE PART NO. MD970389 / Loctite 587 ultra blue or equivalent

Removal steps

1. Drain plug
2. Drain plug gasket
3. Starter connector
4. Starter
5. Oil gauge and guide
6. O-ring
7. Oil pan, lower
8. Cover
9. Oil pan, upper

◀A▶ ▶A◀

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REMOVAL SERVICE POINT

◀A▶ OIL PAN, UPPER REMOVAL

1. Detach the bolt (1) shown at left.
2. Detach all other bolts.

3. Screw a bolt into bolt hole (A) shown (at both ends) to remove the oil pan.

   Caution
   The use of an oil pan remover (J37228) can damage the oil pan, upper (aluminium made).

INSTALLATION SERVICE POINT

▶A◀ 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 / Loctite 587 Ultra blue or equivalent

   NOTE
   The sealant should be applied in a continuous bead approximately 4 mm 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.

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INSPECTION

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

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CYLINDER HEAD GASKET

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Engine Coolant Draining and Supplying (Refer Coolant Replacement.)
- Intake Manifold Removal and Installation (Refer GROUP 15.)
- Exhaust Manifold Removal (Refer GROUP 11B.)
- Water Hose Pipe Removal (Refer GROUP 14.)
- Timing Belt Removal and Installation (Refer GROUP 11B.)

Removal steps

1. Breather hose
2. Blow-by hose
3. PCV hose
4. Spark plug cable
5. Rocker cover
6. Rocker cover gasket
7. Bracket
8. Timing belt cover (rear centre)
9. ◀A▶ ▶B◀ Cylinder head
10. ▶A◀ Cylinder head gasket

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11A Index

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.

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11B ENGINE OVERHAUL

<3.0 & 3.5L> 6G72/74 SERIES

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- REMOVAL AND INSTALLATION
- INSTALLATION SERVICE POINTS
- INSPECTION

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SPECIFICATIONS

GENERAL SPECIFICATIONS

Descriptions			Specifications
Type			60° V, SOHC (per bank)
Number of cylinders			6
Combustion chamber			Pentroof type
Total displacement cc			6G72 – 2,972 / 6G74 – 3,497
Cylinder bore mm			6G72 – 91.1 / 6G74 – 93.0
Piston stroke mm			6G72 – 76 / 6G74 – 85.8
Valve timing	Intake valve	Opens (BTDC)	6G72 – 15° / 6G74 – 13°
		Closes (ABDC)	6G72 – 53° / 6G74 – 55°
	Exhaust valve	Opens (BBDC)	6G72 – 53° / 6G74 – 51°
		Closes (ATDC)	6G72 – 15° / 6G74 – 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			CDH210
Throttle bore mm			65
Throttle position sensor			Variable resistor type
Closed throttle position switch			Movable contact type, within throttle position sensor

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SERVICE SPECIFICATIONS

Items			Standard value	Limit
Alternator				
Drive belt	Tension N	New belt	784–980	–
		Used belt	539–637	–
	Deflection mm (Reference value)	New belt	6.0–7.2	–
		Used belt	8.2–9.3	–
Fuel and emission parts				
Injector coil resistance Ω			13–16 at 20°C	–
Rocker arms and camshaft				
Camshaft	Cam height mm	Intake	37.71	37.61
		Exhaust	37.14	37.04
Camshaft	Journal diameter mm		44.93 – 44.94	–
Cylinder head and valve				
Cylinder head	Flatness of gasket surface mm		0.03	0.2
	Grinding limit of gasket surface *Includes/combined with cylinder block grinding mm		–	*0.2
	Overall height mm		120	–
Valve	Thickness of valve head (margin) mm	Intake	1.0	0.5
		Exhaust	1.2	0.7
	Stem diameter mm	Intake	6.0	–
		Exhaust	6.0	–
	Stem to guide clearance mm	Intake	0.02–0.05	0.10
		Exhaust	0.04–0.07	0.15
Valve face angle			45°–45.5°	–
Valve spring	Free height mm		51.0	50.0
	Load/installed height N/mm		267/44.2	–
	Out of squareness		2° or less	Max. 4°
Valve seat	Valve contact width mm		0.9–1.3	–
Valve guide	Inner diameter mm		6.0	–
	Outer diameter mm		11.0	–

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Items		Standard value	Limit
Front case, oil pump and oil pan			
Oil pump	Tip clearance mm	0.06–0.18	–
	Side clearance mm	0.04–0.10	–
	Body clearance mm	0.10–0.18	0.35
Piston and connecting rod			
Piston	Outer diameter mm	6G72 – 91.1 / 6G74 – 93.0	–
	Piston to cylinder clearance mm	0.02–0.04	–
Piston ring	Ring to ring groove clearance No. 1 ring mm	0.03–0.07	0.1
	Ring to ring groove clearance No. 2 ring mm	0.02–0.06	0.1
	End gap No. 1 ring mm	0.30–0.45	0.8
	End gap No. 2 ring mm	0.45–0.60	0.8
	End gap oil ring mm	6G72 – 0.20–0.60 6G74 – 0.10–0.35	1.0
Piston pin	Outer diameter mm	22.0	–
	Press-in load	6G72 – 7,350 – 17,200 N 6G74 – Finger pressure	–
	Press-in temperature	6G72 – Room Temp 6G74 – 70°C	–
Crankshaft	Oil clearance of pin mm	0.02–0.05	0.1
Connecting rod	Big end side clearance mm	0.10–0.25	0.4
Crankshaft, Flywheel and drive plate			
Crankshaft	End play mm	0.05–0.25	0.3
	Journal outer diameter mm	6G72 – 60 / 6G74 – 64	–
	Pin outer diameter mm	6G72 – 50 / 6G74 – 55	–
	Oil clearance of journal mm	0.02–0.04	0.1
Drive plate and Flywheel	Runout mm	–	0.13
Cylinder Block			
Cylinder block	Flatness of gasket surface mm	0.05	0.1
	Grinding limit of gasket surface *Includes/combined with cylinder block grinding mm	–	*0.2
	Overall height mm	210.4–210.6	–
	Cylinder bore inner diameter mm	6G72 – 91.9 / 6G74 – 93.0	–

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REWORK DIMENSIONS

Items			Standard value	Limit
Cylinder head and valve				
Cylinder head	Oversize valve guide hole (both intake and exhaust)	0.05	11.05–11.07	–
		0.25	11.25–13.32	–
		0.50	11.50–11.52	–
	Oversize intake valve seat ring hole mm	0.3	34.30–34.33	–
		0.6	34.60–34.63	–
	Oversize exhaust valve seat ring hole mm	0.3	31.80–32.83	–
		0.6	32.10–32.13	–
Crankshaft				
Crankshaft	Out of roundness and taper of journal and pin mm		0.005	–

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TORQUE SPECIFICATIONS

Items		Nm
Alternator and drive belt		
Alternator bolt		21
Tensioner pulley nut		50
Alternator bracket bolt	M8	48
	M10	23
Alternator pivot nut		44
Crankshaft bolt		180-190
Intake manifold plenum and throttle body		
Manifold differential pressure sensor bolt		4.9
Intake manifold plenum bolt and nut		18
Vacuum hose assembly bolt		9.8
Water outlet fitting bracket bolt		19
EGR pipe bolt		18
EGR pipe flare nut		59
Intake manifold plenum stay bolt	M8	18
	M10	36
EGR valve bolt		22
Bracket bolt		24
Throttle body bolt		12
Ignition system		
Spark plug		25
Distributor nut		23
Timing belt		
Crank angle sensor bolt		9
Auto tensioner bolt		24
Tensioner pulley bolt		49
Tensioner arm bolt		44
Idler pulley bolt		44
Camshaft sprocket bolt		88
Intake manifold and fuel parts		
Injector and fuel rail bolt		12
Fuel pressure regulator bolt		9
Fuel pipe bolt		9
Heat pipe bolt		18
Engine coolant temperature gauge unit		11
Engine coolant temperature sensor		30
Water outlet fitting bolt		19
Water inlet fitting bolt		19
Thermostat case bolt		19
Water (outlet) pipe bolt		14
Intake manifold nut		21

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Items		Nm
Exhaust manifold		
Oil level gauge guide bolt		14
Heat protector bolt		14
Exhaust manifold nut		29
Water pump bolt	M8	24
	M10	41
Rocker arms and camshafts		
Rocker cover bolt		3.5
Distributor adaptor bolt		23
Thrust case bolt		13
Rocker arm, rocker arm shaft bolt		31
Cylinder head and valve		
Cylinder head bolt		108
Oil pan and oil pump		
Oil pressure switch		10
Oil filter bracket bolt	M8	24
	M10	40
Drain plug		40
Oil pan (upper) bolt		6
Oil pan lower bolt		11
Cover bolt		11
Baffle plate bolt	M6	11
	M8	9
Oil screen bolt		19
Plug		45
Oil pump case bolt		14
Oil pump cover bolt		10
Piston and connecting rod		
Connecting rod cap nut		52
Crankshaft, Flywheel and drive plate		
Drive plate bolt		75
Flywheel bolt		98
Bell housing cover bolt		9
Oil seal case bolt		11
Bearing cap bolt		93
Bracket		
Bracket bolt	M8	22
	M10	41
	M12	75

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SEALANTS

Items	Specified sealant	Quantity
Engine coolant temperature sensor	Loctite 577	As required
Engine coolant temperature gauge unit	Loctite 577	As required
Oil pressure switch / gauge unit	Loctite 577	As required
Oil pump case	MD970389 / Loctite 587	As required
Oil pan	MD970389 / Loctite 587	As required
Rear main oil seal	MD970389 / Loctite 587	As required
Welsh plugs and spark plug sleeves	Loctite 262	As required
Water outlet fitting	Loctite 577	As required

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SPECIAL TOOLS

Tool	Tool number and name	Supersession	Application
	MB990767 End yoke holder	EMB990767	Holding camshaft sprocket when loosening bolt.
	MD991559 Camshaft oil seal installer adaptor	EMD991559	Installation of camshaft oil seal (Left bank) (Use with MD998713)
	MD998051 Cylinder head bolt wrench	E1139	Loosening and tightening cylinder head bolts
	MD998440 Leak-down tester	49U012005	Leak-down test of lash adjuster
	MD998441 Lash adjuster retainer	EMD998441	Bleeding of air inside adjuster
	MD998442 Air bleed wire	E9M40–1	Air bleeding of auto lash adjuster
	MD998443 Lash adjuster holder (8)	E9M40–2	Supporting lash adjuster to prevent it from falling when rocker shaft assembly is removed or installed
	MD998713 Camshaft oil seal installer	EMD998713	Installation of camshaft oil seal
	MD998717 Crankshaft front oil seal installer	EMD998717	Installation of crankshaft front oil seal

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Tool	Tool number and name	Supersession	Application
	MD998718 Crankshaft rear oil seal installer	EMD998718	Installation of crankshaft rear oil seal
	MD998715 Pulley holding pins (2)	EMD998715	Holding camshaft sprocket when loosening or torquing bolt
	MD998715 Valve spring compressor	J8062	Removal and installation of valve and related parts
	MD998767 Tension pulley wrench	EMD998767	Adjustment of timing belt tension
	MD998769 Crankshaft spacer	–	Rotation of crankshaft when installing piston and timing belt
	MD998772 Valve spring compressor	–	Compression of valve spring
	MD998774 Valve stem seal installer	EMD998774	Installation of valve stem seal
	MD998780 Piston pin setting tool	–	Removal and installation of piston pin
	MD998781 Flywheel stopper	–	Loosening and tightening crankshaft bolts

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ALTERNATOR AND DRIVE BELT

REMOVAL AND INSTALLATION

01TH035A

Removal steps

- ▶B◀ 1. Drive belt
- 2. Tensioner pulley
- ◀A▶ ▶A◀ 3. Crankshaft bolt
- 4. Washer
- 5. Crankshaft pulley
- 6. Alternator
- 7. Alternator bracket
- 8. Harness connector
- 9. Suction hose connection
- 10. Discharge hose connection
- 11. Compressor
- 12. Compressor bracket
- 13. Dip stick
- 14. O-ring
- 15. Dip stick tube
- 16. O-ring

REMOVAL SERVICE POINT

◀A▶ CRANKSHAFT BOLT LOOSENING

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

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INSTALLATION SERVICE POINT

▶A◀ CRANKSHAFT BOLT TIGHTENING

1. Using the special tool, hold the drive plate or flywheel.
2. Install the crankshaft bolt.

▶B◀ DRIVE BELT TENSION ADJUSTMENT

1. Use a belt tension gauge to check belt tension, or check deflection by applying 98 N to the shown point.

Standard value:

Alternator drive belt	Tension N
New	784 – 980
Used	539 – 637

Standard value:

Alternator drive belt	Deflection (Reference value) mm
New	6.0 – 7.2
Used	8.2 – 9.3

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INTAKE MANIFOLD PLENUM AND THROTTLE BODY

REMOVAL AND INSTALLATION

Removal steps

1. Engine cover
2. Clamp
3. Accelerator cable bracket
4. Intake plenum stay, front
5. Intake plenum stay, rear
6. EGR valve
7. EGR valve gasket
8. EGR pipe
9. EGR pipe gasket
10. Connector bracket
11. Vacuum pipe
12. Throttle body
13. Throttle body gasket
14. Intake plenum
15. Intake plenum gasket

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IGNITION SYSTEM

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
Removal and installation
- Intake manifold plenum (Refer GROUP 11B.)

Removal steps

1. Spark plug cables
2. Spark plugs
3. ▶A◀ Distributor
4. O-ring

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INSTALLATION SERVICE POINT

▶A◀ DISTRIBUTOR INSTALLATION

1. Align the mark on the distributor housing with that of the coupling and install the distributor.
2. Once the engine has been started verify that the ignition timing is correct.

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TIMING BELT

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
Removal and installation
- Crankshaft pulley (Refer Removal & Installation.)

Removal steps

1. Timing belt front upper cover, rear
2. Timing belt front upper cover, front
3. Timing belt front lower cover
4. ▶D◀ Engine support bracket
5. Crank angle sensor
6. ◀A▶ ▶C◀ Timing belt
7. ▶B◀ Automatic tensioner
8. Tensioner pulley
9. Tensioner arm
10. Shaft
11. Idler pulley
12. Idler pulley adjusting bracket
13. Adjusting bolt
14. Adjusting stud
15. Crankshaft sprocket
16. Sensing blade
17. Crankshaft spacer
18. Crankshaft key
19. ◀B▶ ▶A◀ Camshaft sprocket bolt
20. Camshaft sprocket
21. Bracket
22. Timing belt rear cover

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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.

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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 in diameter] into the set holes.
4. Remove the auto-tensioner from the vice.

▶C◀ TIMING BELT INSTALLATION

1. Move the timing mark of the crankshaft sprocket three teeth to slightly lower the piston below the top dead centre on the compression stroke of the No. 1 cylinder.

   Caution
   If the camshaft sprocket is rotated with the piston at the top dead centre on the compression stroke of the No. 1 cylinder, 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.

   Caution
   Since the camshaft sprocket readily turns because of spring action, use care to make sure that your finger is not caught.

4. Line up the timing marks of the crankshaft sprocket.
5. Install the timing belt on each sprocket in the following sequence.
   (1) Install the timing belt on the crankshaft sprocket and then on the idler pulley, while tightening it to prevent 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.

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6. Lightly press the tensioner pulley against the belt and temporarily tighten the centre bolt.
7. Check to see that the timing marks of all the sprockets are in alignment.

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

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9. Mount a special tool and torque wrench on the tensioner pulley.
10. Torque it to 4.4 Nm with the torque wrench.
11. While holding the tensioner pulley in position, tighten the centre bolt to the specified torque.

12. Remove the metal wire from the auto-tensioner.
13. Rotate the crankshaft two turns clockwise and let it stand for approx. 5 minutes. In this condition, check that the projection of the rod of the auto-tensioner is within the standard value.

    Standard value: 4.8 – 6.0 mm

14. Ensure the timing marks of the sprockets are still aligned correctly.

▶D◀ ENGINE SUPPORT BRACKET

1. Tighten bolts to specified torque in the sequence shown.

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INSPECTION

TIMING BELT

Replace belt if any of the following conditions exist.

1. Hardening of backing rubber, backing rubber is glossy, without resilience and leaves no indent when pressed with fingernail.

2. Cracks on backing rubber
3. Cracks or peeling of canvas
4. Cracks on tooth bottom
5. Cracks on side of belt

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

7. Abnormal wear on teeth
8. Tooth missing and canvas fibre exposed.

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TENSIONER PULLEY AND IDLER PULLEY

1. Turn the pulley. If pulley does not rotate smoothly, develops noise or excessive play, replace the pulley.

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

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

   Standard value: 1 mm or less.

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INTAKE MANIFOLD AND FUEL PARTS

REMOVAL AND INSTALLATION

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Removal steps

1. Engine harness
2. Injector and fuel rail
3. Insulator
- ▶H◀ 4. Fuel pressure regulator
5. O-ring
6. Insulator
- ▶G◀ 7. Injector
8. O-ring
9. Grommet
10. Fuel pipe
11. O-ring
12. Delivery pipe
- ▶F◀ 13. Intake manifold
14. Intake manifold gasket
- ▶E◀ 15. Engine coolant temperature gauge unit
- ▶D◀ 16. Engine coolant temperature sensor
17. Water hose
18. Water hose
- ▶C◀ 19. Heater inlet pipe
- ▶A◀ 20. O-ring
- ▶C◀ 21. Heater inlet pipe
- ▶A◀ 22. O-ring
23. Water outlet fitting
24. Water outlet fitting gasket
25. Water inlet fitting
- ▶B◀ 26. Thermostat
27. Thermostat housing
28. Thermostat housing gasket
- ▶A◀ 29. O-ring
30. Water pipe
- ▶A◀ 31. O-ring

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INSTALLATION SERVICE POINTS

▶A◀ O-RING AND WATER PIPE INSTALLATION

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

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

▶B◀ THERMOSTAT INSTALLATION

1. Install the thermostat in the thermostat housing with its jiggle valve located at the top position.

▶C◀ HEATER INLET AND OUTLET PIPES

1. Attach the outlet and inlet pipes in this order, one on the top of the other.

▶D◀ SEALANT APPLICATION TO ENGINE COOLANT TEMPERATURE SENSOR

Specified sealant:
Loctite 577 or equivalent

▶E◀ SEALANT APPLICATION TO ENGINE COOLANT TEMPERATURE GAUGE UNIT

Specified sealant:
Loctite 577 or equivalent

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▶F◀ INTAKE MANIFOLD INSTALLATION

1. Tighten the nuts on the right bank to 5 – 8 Nm.
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.

▶G◀ 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.

▶H◀ 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.

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EXHAUST MANIFOLD AND WATER PUMP

REMOVAL AND INSTALLATION

Removal steps

1. Oil level gauge
2. Oil level gauge guide
3. O-ring
4. Heat protector, rear
5. Exhaust manifold, rear
▶B◀ 6. Exhaust manifold gasket, rear
7. Heat protector, front
8. Engine lift bracket
9. Exhaust manifold, front
▶B◀ 10. Exhaust manifold gasket, front
▶A◀ 11. Water pump
12. Water pump gasket

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INSTALLATION SERVICE POINTS

▶A◀ O-RING AND WATER PIPE INSTALLATION

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

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

▶B◀ EXHAUST MANIFOLD GASKET INSTALLATION

1. Install gaskets with cylinder number 1, 3 and 5 embossed on their top side to the right bank and install those with cylinder number 2, 4 and 6 to the left bank.

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ROCKER ARMS AND CAMSHAFT

REMOVAL AND INSTALLATION

Lubricate all internal parts with engine oil during reassembly.

7EN0879

Removal steps

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

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REMOVAL SERVICE POINT

◀A▶ ROCKER ARM, ROCKER ARM SHAFT REMOVAL

1. Install the special tools to the rocker arm to hold the lash adjuster.
2. Loosen the camshaft bearing cap bolt. Do not remove the bolts from the cap.
3. Remove the rocker arm, shaft and bearing cap as an assembly.

NOTE
If the lash adjuster is to be re-used, it must be cleaned and checked before installation, refer Lash adjuster cleaning and checking.

INSTALLATION SERVICE POINTS

▶A◀ CAMSHAFT INSTALLATION

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

NOTE
If the lash adjuster is to be re-used, it must be cleaned and checked before installation. refer Lash adjuster cleaning and checking.

1. Fit the lash adjuster onto the rocker arm without allowing diesel fuel to spill out. Fit special tool E9M40 – 2 to prevent the lash adjuster coming free and falling to the floor.

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▶C◀ ROCKER ARM SHAFT

1. The end with the larger chamfer is at the right on the left bank and at the left on the right bank.

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

2. The side with the oil holes is on the lower side (cylinder head side).

▶D◀ ROCKER SHAFT SPRING

1. Insert the rocker shaft spring at a slant with respect to the spark plug guide and install it normal to the guide.

▶E◀ CAMSHAFT OIL SEAL INSTALLATION

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INSPECTION

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 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	37.58	37.08
Exhaust mm	36.95	36.45

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LASH ADJUSTER CLEANING AND CHECKING

Caution

- **The lash adjusters are precision-engineered mechanisms. Do not allow them to become contaminated by dirt or other foreign substances.**
- **Do not attempt to disassemble the lash adjusters.**
- **Use only fresh diesel fuel to clean the lash adjusters.**

1. Prepare three containers and approximately five litres of diesel fuel. Into each container, pour enough diesel fuel to completely cover a lash adjuster when it is standing upright. Then, perform the following steps with each lash adjuster.
2. Place the lash adjuster in container A and clean its outside surface.

   NOTE
   Use a nylon brush if deposits are hard to remove.

3. Fit special tool EMD998441 onto the lash adjuster.

   Caution
   The steel ball spring is extremely weak, so the lash adjuster's functionality may be lost if the air bleed wire is pushed in hard.
4. While gently pushing down the internal steel ball using special tool E9M40 – 1, move the plunger through five to ten strokes until it slides smoothly. In addition to eliminating stiffness in the plunger, this operation will remove dirty oil.

   NOTE
   If the plunger remains stiff or the mechanism appears otherwise abnormal, replace the lash adjuster.

5. Remove the lash adjuster from the container. Then, push down the steel ball gently and push the plunger to eliminate diesel fuel from the pressure chamber.

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6. Fit special tool EMD998441 onto the lash adjuster.

Caution
The steel ball spring is extremely weak, so the lash adjuster's functionality may be lost if the air bleed wire is pushed in hard.

7. Place the lash adjuster in container B. Then, gently push down the internal steel ball using special tool E9M40 – 1 and move the plunger through five to ten strokes until it slides smoothly. This operation will clean the lash adjuster's pressure chamber.

8. Remove the lash adjuster from the container. Then, push down the steel ball gently and push the plunger to eliminate diesel fuel from the pressure chamber.

Caution
Do not use container C for cleaning. If cleaning is performed in container C, foreign matter could enter the pressure chamber when the chamber is filled with diesel fuel.

9. Place the lash adjuster in container C. Then, gently push down the internal steel ball using special tool E9M40 – 1.

10. Stand the lash adjuster with its plunger at the top, then push the plunger downward firmly until it moves through its greatest possible stroke. Return the plunger slowly, then release the steel ball and allow the pressure chamber to fill with diesel fuel.
11. Remove special tool EMD998441.

12. Remove the lash adjuster from the container, then stand the lash adjuster with its plunger at the top. Push the plunger firmly and check that it does not move. Also, check that the lash adjuster's height matches that of a new lash adjuster.

NOTE
If lash adjuster contracts, perform the operations (9) through (12) again to fill it with diesel fuel completely. Replace the lash adjuster if it still contracts after performing these steps.

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13. Set the lash adjuster on the special tool 49U012005 (leak down tester).
14. After the plunger has moved downward slightly [0.2 to 0.5mm], measure the time taken for it to move downward by a further 1 mm.

    Standard value: 5 – 20 seconds/1mm [with diesel fuel at 15 to 20°C]

    NOTE
    Replace the lash adjuster if the time measurement is out of specification.

15. Fit special tool EMD998441 onto the lash adjuster.
16. Place the lash adjuster in container C again, then gently push down the internal steel ball using special tool E9M40 – 1.
17. Stand the lash adjuster with its plunger at the top, then push the plunger downward firmly until it moves through its greatest possible stroke. Return the plunger slowly, then release the steel ball and allow the pressure chamber to fill with diesel fuel.
18. Remove special tool EMD998441.

19. Remove the lash adjuster from the container, then stand the lash adjuster with its plunger at the top. Push the plunger firmly and check that it does not move. Also, check that the lash adjuster's height matches that of a new lash adjuster.

    NOTE
    If lash adjuster contracts, perform the operations (15) through (19) again to fill it with diesel fuel completely. Replace the lash adjuster if it still contracts after performing these steps.
20. Stand the lash adjuster upright to prevent diesel fuel spilling out. Do not allow the lash adjuster to become contaminated by dirt or other foreign matter. Fit the lash adjuster onto the engine as soon as possible.

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CYLINDER HEAD AND VALVE

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. Intake 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. Intake valve guide
18. Snap ring
19. Exhaust valve guide
20. Intake valve seat
21. Exhaust valve seat
22. Cylinder head

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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 re-use removed valve stem seals.

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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.

   Caution
   1. **Valve stem seals for intake valve and for exhaust valve are different. Be sure to install the correct ones.**
      Valve stem seal identification colour
      Intake: Silver or White
      Exhaust: Black
   2. **Do not re-use 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 colour toward the spring retainer.

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▶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 using the special tool 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.

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INSPECTION

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

   Limit: 0.2 mm

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

   Grinding limit: *0.2 mm

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

   Overall height
   120 mm

VALVE

1. If the valve stem is worn (ridge wear) or otherwise damaged, replace. Also replace the valve if the stem end (that contacts the rocker arm lash adjuster) has an indentation.

2. Check the valve face for correct contact. If incorrect, reface using a valve facer. Valve should make a uniform contact with the seat at the centre of valve face.
3. If the margin exceeds the service limit, replace the valve.

   Standard value

   <Intake>
   1.0 mm

   <Exhaust>
   1.2 mm

   Limit

   <Intake>
   0.5 mm

   <Exhaust>
   1.2 mm

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VALVE SPRINGS

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

   Standard value
   51.0 mm

   Limit
   50.0 mm

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

   Standard value: 2°

   Limit: Max. 4°

VALVE GUIDES

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

   Standard value

   <Intake>
   0.02–0.05 mm

   <Exhaust>
   0.04–0.07 mm

   Limit

   <Intake>
   0.10 mm

   <Exhaust>
   0.15 mm

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 obtain the specified seat width and angle.
3. After correction, valve and valve seat should be lapped with a lapping compound.

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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:
   See Rework Dimensions.

3. Before fitting the valve seat, either heat the cylinder head up to approximately 250°C 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 from 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 may fit to the press-fitted oversize valve guide.

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

   Valve guide hole diameter:
   See Rework Dimensions.

4. Press-fit the valve guide until it protrudes 14 mm 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; exhaust side: 50.5 mm]
   3. After installing the valve guides, insert new valves in them to check for sliding condition.

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OIL PAN AND OIL PUMP

REMOVAL AND INSTALLATION

Lubricate all internal parts with engine oil during reassembly.

7EN0893

Removal steps

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

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REMOVAL SERVICE POINT

◀A▶ OIL PAN, LOWER REMOVAL

1. Apply wood to the oil pan side and remove the oil pan lower with a plastic hammer.

   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 float and 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.

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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.

▶B◀ OIL PUMP CASE INSTALLATION

1. Remove the sealant from the cylinder block (oil pump mounting plane) and oil pump
2. Apply a 3 mm diameter bead of sealant to the oil pump case. Be sure to install the oil pan 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 / Loctite 587 Ultra blue or equivalent

▶C◀ CRANKSHAFT FRONT OIL SEAL INSTALLATION

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

NOTE
Knock the seal in until it is fully based.

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▶D◀ OIL PAN, UPPER INSTALLATION

1. Clean the gasket surfaces of the cylinder block and upper oil pan.
2. Apply a 4 mm diameter bead of sealant to the oil pump case. Be sure to install the oil pan 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.

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 / Loctite 587 Ultra blue or equivalent

▶E◀ OIL PAN, LOWER INSTALLATION

1. Clean the gasket surfaces of the upper and lower oil pans.
2. Apply a 4 mm diameter bead of sealant to the oil pump case. Be sure to install the oil pan 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 / Loctite 587 Ultra blue or equivalent

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▶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 approximately one turn [14 Nm].

▶H◀ SEALANT APPLICATION TO OIL PRESSURE SWITCH

1. Coat the threads of the switch with sealant and install the switch using the special tool.

   Specified sealant:
   Loctite 577 or equivalent

   Caution
   1. Keep the end of threaded portion clear of sealant.
   2. Avoid over tightening.

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INSPECTION

OIL PUMP

1. Check the tip clearance.
   Standard value: 0.06–0.18 mm

2. Check the side clearance.
   Standard value: 0.04–0.10 mm

3. Check the body clearance.
   Standard value: 0.10–0.18 mm
   Limit: 0.35 mm

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PISTON AND CONNECTING ROD

REMOVAL AND INSTALLATION <6G72>

Removal steps

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

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REMOVAL AND INSTALLATION <6G74>

Removal steps

1. Nut
◀A▶ ▶E◀ 2. Connecting rod cap
3. Connecting rod bearing, lower
▶D◀ 4. Piston and connecting rod assembly
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

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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▶ REMOVAL OF PISTON PIN<6G72>

The special piston pin setting tool (MD998780) consists of the parts shown at left.

1. Insert the special push rod tool from the front marked (arrow) side of the piston and attach guide “C”.
2. Set the piston and connecting rod assembly to the special tool piston pin setting base such that the front mark on the piston faces upward.
3. Remove the piston pin with a press.

   NOTE:
   After removing the piston pin, place the piston, the piston pin, and the connecting rod in order for each cylinder number.

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◀B▶ REMOVAL OF PISTON PIN<6G74>

1. Remove the snap rings.
2. Heat the piston to approximately 70°C 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<6G72>

1. Measure the dimensions of the following parts and portions.
   A: Piston pin mounting portion
   B: Distance between piston bosses
   C: Piston pin
   D: Connecting rod
2. Calculate by subtracting each measured value into the following equation.

   $$L = \frac{(A - C) - (B - D)}{2}$$

3. Insert the special push rod tool into the piston pin and attach guide A to it.
4. Combine the piston and connecting rod, matching their front marks.
5. Apply engine oil to the outer periphery of the piston pin.
6. Insert the side of the piston pin guide A attached per step (3) into the pin hole from the side of the piston containing the front mark.
7. Screw guide B into guide A until they are distance L (obtained per step (2) above) plus 3 mm apart as shown.
8. Use special tools to set the piston pin to a special tool piston base with the front mark of the piston facing up.
9. Press fit the piston pin with a press. When the load required for press fitting the piston pin is below the standard value, change the piston pin (piston assembly) or connecting rod or both.

   Standard value: 7,350 – 17,200 N

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▶A◀ PISTON PIN INSTALLATION<6G74>

1. Heat the piston to approximately 70°C and set the snap ring on one side first. Be sure to install the snap ring with the shear droop directed toward the inside.
2. With the front mark of the connecting rod and that of the piston located on the same side, insert the piston pin.
3. After insertion of the piston pin, set the other snap ring.

Caution

Apply an ample coat of engine oil to the periphery of the piston pin and the hole of the connecting rod small end.

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.

In addition, note that the piston is hot after heating.

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▶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	T
No. 2 ring	T2

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

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▶D◀ 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 centre 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).

▶E◀ 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

   Limit: 0.4 mm

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INSPECTION

CYLINDER BLOCK

1. Visually check for scratches, rust, and corrosion. Also use a flaw detecting agent for the check. If defects are evident, correct, or replace.
2. Using a straightedge and feeler gauge, check the flatness of the block top surface. Make sure that the surface is free from gasket pieces and other foreign matter.

   Standard value: 0.05 mm

   Limit: 0.1 mm
3. If distortion is excessive, correct within the allowable limit or replace.

   Grinding limit: 0.2 mm
   ***Includes/combined with cylinder head grinding.**

   Cylinder block height (when new):
   210.4–210.6 mm

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 cylindricality. 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:
   6G72 Cylinder I.D.: 91.1 mm
   6G74 Cylinder I.D.: 93.0 mm

   Concentricity: 0.01 mm

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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 O.S.	0.50
1.00 mm 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 (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:
   0.02–0.04 mm

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

PISTON

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

PISTON PIN

1. Insert the piston pin into the piston pin hole with a thumb. You should feel a slight resistance. Replace the piston pin if it can be easily inserted or there is an excessive play.
2. The piston and piston pin must be replaced as an assembly.

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.

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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
   No. 2 0.02–0.06 mm

   Limit: 0.1 mm

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
   No. 2: 0.45–0.60 mm
   Oil: 0.20–0.60 mm

   Limit:
   No. 1, No. 2: 0.8 mm
   Oil: 1.0 mm

CRANKSHAFT PIN OIL CLEARANCE (PLASTIGAUGE METHOD)

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

1. Remove oil and grease and any other foreign matters from the crankshaft pin and the bearing inner surface.
2. Install the crankshaft.
3. Cut Plastigauge 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 crushed Plastigauge at its widest section by using a scale printed on the Plastigauge bag.

   Standard value: 0.02–0.05 mm

   Limit: 0.1 mm

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CRANKSHAFT, FLYWHEEL AND DRIVE PLATE

REMOVAL AND INSTALLATION

Removal steps

1. Adaptor plate
2. Drive plate
3. Plate
4. Adaptor plate
5. Flywheel
6. Rear plate
7. ▶D◀ Oil seal case
8. ▶C◀ Crankshaft rear oil seal
9. ▶B◀ Bearing cap bolt
10. ▶B◀ Bearing cap
11. ▶A◀ Thrust bearing A <6G72>
12. ▶A◀ Thrust bearing B <6G72>
13. ▶A◀ Crankshaft bearing, lower
14. Crankshaft
15. ▶A◀ Thrust bearing B
16. ▶A◀ Thrust bearing A
17. ▶A◀ Crankshaft bearing, upper
18. Cylinder block

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▶A◀ CRANKSHAFT BEARING INSTALLATION MAIN BEARINGS

When bearing replacement is required, select and install the correct bearing by the following procedure.

1. Measure the crankshaft journal diameter and confirm its classification from the following table. In the case of a crankshaft supplied as a service part, identification colours of its journals are painted at the positions shown in the illustration.
2. The cylinder block bearing bore diameter identification marks are stamped at the position shown in the illustration from left to right, beginning at No. 1.

<6G72>

Combination of crankshaft journal diameter and cylinder block bearing bore diameter					Bearing identification colour or identification mark (for service part)
Crankshaft journal				Cylinder block bearing bore diameter identification mark	
Classification	Identification colour		O.D. mm		
	Production part	Service part			
1	None	Yellow	59.994 – 60.000	I	Pink(1)
				II	Red(2)
				III	Green(3)
2	None	None	59.988 – 59.994	I	Red(2)
				III	Green(3)
				III	Black(4)
3	None	White	59.982 – 59.988	I	Green(3)
				II	Black(4)
				III	Brown(5)

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<6G74>

Combination of crankshaft journal diameter and cylinder block bearing bore diameter					Bearing identification colour or identification mark (for service part)
Crankshaft journal				Cylinder block bearing bore diameter identification mark	
Classification	Identification colour		O.D. mm		
	Production part	Service part			
1	None	Yellow	63.994 – 64.000	I	Pink(1)
				II	Red(2)
				III	Green(3)
2	None	None	63.988 – 63.994	I	Red(2)
				III	Green(3)
				III	Black(4)
3	None	White	63.982 – 63.988	I	Green(3)
				II	Black(4)
				III	Brown(5)

3. Select the correct bearing from the above tables on the basis of the identification data confirmed at steps 1 and 2.

   Example <6G72>
   1. If the measured value of a crankshaft journal outer diameter is 59.996 mm the journal is classified as ”1” in the table.
      In case the crankshaft is also replaced by a spare part, check the identification colours of the journals painted on the new crankshaft. If the colour is yellow, for example, the journal is classified as ”1” .
   2. Next, check the cylinder block bearing bore identification mark stamped on the cylinder block. If it is ”1”, read the ”Bearing identification colour” column to find the identification colour 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.

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INSTALLATION SERVICE POINTS

▶A◀ CRANKSHAFT BEARING INSTALLATION CONNECTING ROD <6G74>

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 colour is painted at the position shown in the illustration.
2. The connecting rod identification mark is stamped at the position shown in the illustration.
3. Select a suitable bearing from the following table on the basis of the identification data confirmed under Items 1. and 2.

Items	Standard value	Limit

Crankshaft			Connecting rod			
Identification mark (colour)		Journal O.D. mm	Big end		Bearing	
Production part	Spare part		Identification mark	I.D. mm	Identification colour	Thickness mm
None	Yellow	54.994–55.000	0	58.000–58.006	Pink	1.483–1.486
			1	58.006–58.012	Red	1.486–1.489
			2	58.012–58.018	Green	1.489–1.492
None	None	54.998–54.994	0	58.000–58.006	Red	1.486–1.489
			1	58.006–58.012	Green	1.489–1.492
			2	58.012–58.018	Black	1.492–1.495
None	White	54.982–54.988	0	58.000–58.006	Green	1.489–1.492
			1	58.006–58.012	Black	1.492–1.495
			2	58.012–58.018	Brown	1.495–1.498

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▶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.

<6G72> <6G74>

7EN0524

4. Check the end plate. If it exceeds the limit value, replace the thrust bearing.

   Standard value : 0.05–0.25 mm

   Limit: 0.3 mm

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▶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 / Loctite 587 Ultra blue or equivalent

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

INSPECTION

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

   Limit: 0.1 mm

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

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CRANKSHAFT JOURNAL OIL CLEARANCE <PLASTIGAUGE METHOD>

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

1. Remove oil and grease and any other foreign matters from the crankshaft journal and bearing inner surface.
2. Install the crankshaft.
3. Cut Plastigauge 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 crushed Plastigauge at its widest section by using a scale printed on the Plastigauge package.

FLYWHEEL

1. Check the clutch disc friction surface for ridge wear, cracks and seizure.
2. If the runout of the flywheel exceeds the limit, replace the flywheel assembly.

   Limit: 0.13 mm

Caution
The flywheel mounting bolts shown must not be removed. If the bolts are removed, the flywheel will lose its original balance and could break during operation.

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12 ENGINE LUBRICATION

CONTENTS

GENERAL INFORMATION
ENGINE OILS
- Health Warning
- Recommended Precautions

LUBRICANTS
SPECIAL TOOLS
ON-VEHICLE SERVICE
- ENGINE OIL INSPECTION
- ENGINE OIL REPLACEMENT
- OIL FILTER REPLACEMENT

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GENERAL INFORMATION

The lubrication method is a fully force-fed, full flow filtration type. The oil pump is a trochoid type which is directly mounted to the crankshaft.

ENGINE OILS

Health Warning

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

Recommended Precautions

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

- Avoid prolonged and repeated contact with oils, particularly used engine oils.
- Wear protective clothing, including impervious gloves where practicable.
- Avoid contaminating clothes, particularly underpants, with oil.
- Do not put oily rags in pockets, the use of overalls without pockets will avoid this.
- Do not wear heavily soiled clothing and oil-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 improved.
- Obtain First Aid treatment immediately for open cuts and wounds.
- Wash regularly with soap and water to ensure all oil is removed, especially before meals (skin cleansers and nail brushes will help). After cleaning, the application of preparations containing lanolin to replace the natural skin oils is advised.
- Do not use petrol, kerosene, diesel fuel, gas oil, thinners or solvents for cleaning skin.
- Use barrier creams, applying them before each work period, to help the removal of oil from the skin after work.
- If skin disorders develop, obtain medical advice without delay.

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LUBRICANTS

Items	Engine oil (API classification)	Quantity (litres)
Oil filter	SJ or higher	0.3
Total quantity		4.3 <6G72>, 4.7 <6G74>

SPECIAL TOOLS

Tool	Tool number and name	Supersession	Application
	E9360 Oil filter wrench	–	Removal and installation of engine oil filter

ON-VEHICLE SERVICE

ENGINE OIL INSPECTION

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

ENGINE OIL REPLACEMENT

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

   Caution
   Use care as oil could be hot.

4. Install a new drain plug O-ring, and then tighten the drain plug to the specified torque.

   NOTE
   Tightening torque: 39 Nm

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5. Refill with specified quantity of oil.

   Specified Engine Oil (API classification): SJ or higher.

   Total quantity (Includes oil filter): 4.3L<6G72>, 4.7L<6G74>.
6. Install the engine oil filler cap.
7. Check oil level.

OIL FILTER REPLACEMENT

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

   Caution
   Use care as oil could be hot.
4. Use the Special Tool E9360 (or equivalent) to remove the engine oil filter from the underside of the vehicle.
5. Clean the filter bracket side mounting surfaces.

6. Apply a small amount of engine oil to the O-ring of the new oil filter.
7. Install the engine oil filter.

   NOTE
   Tightening torque: 14 Nm
8. Install the drain plug and refill engine oil. (Refer Engine Oil Replacement.)
9. Race the engine 2–3 times, and check to be sure there are no engine oil leaks from the installation section of the filter.

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13 FUEL

CONTENTS

MULTIPOINT FUEL INJECTION (MPI) – TJ/KJ BASE MANUAL
(effective to 31st July 2001 production)

MULTIPOINT FUEL INJECTION (MPI) – 01M/Y SPECIFICATION UPGRADE
(effective from 1st August 2001 production)

FUEL SUPPLY

TRACTION CONTROL SYSTEM (TCL) – TJ/KJ BASE MANUAL
(effective to 31st July 2001 production)

TRACTION CONTROL SYSTEM (TCL) – 01M/Y SPECIFICATION UPGRADE
(effective from 1st August 2001 production)

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- GENERAL SPECIFICATIONS
- MULTIPOINT FUEL INJECTION (MPI) SYSTEM DIAGRAM
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SERVICE SPECIFICATIONS

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SPECIAL TOOLS

TROUBLESHOOTING
- DIAGNOSIS TROUBLESHOOTING FLOW
- DIAGNOSIS FUNCTION
- FAIL-SAFE FUNCTION REFERENCE TABLE
- INSPECTION CHART FOR DIAGNOSIS
- INSPECTION CHART FOR TROUBLE SYMPTOMS
- PROBLEM SYMPTOMS TABLE (FOR YOUR INFORMATION)
- INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS
- DATA LIST REFERENCE TABLE
- ACTUATOR TEST REFERENCE TABLE
- CHECK AT THE ENGINE A/T-ECU TERMINALS

ON-VEHICLE SERVICE
- THROTTLE BODY (THROTTLE VALVE AREA) CLEANING
- CLOSED THROTTLE POSITION SWITCH AND THROTTLE POSITION SENSOR ADJUSTMENT <Vehicles without TCL>
- THROTTLE POSITION SENSOR ADJUSTMENT <Vehicles with TCL>
- CLOSED THROTTLE POSITION SWITCH AND ACCELERATOR PEDAL POSITION SENSOR ADJUSTMENT <Vehicles with TCL>
- FIXED SAS ADJUSTMENT
- BASIC IDLE SPEED ADJUSTMENT
- FUEL PRESSURE TEST
- FUEL PUMP CONNECTOR DISCONNECTION (HOW TO REDUCE PRESSURISED FUEL LINES)
- FUEL PUMP OPERATION CHECK

INSPECTION OF MPI COMPONENTS
- COMPONENT LOCATION
- MPI CONTROL RELAY AND FUEL PUMP RELAY CONTINUITY CHECK
- INTAKE AIR TEMPERATURE SENSOR CHECK

ENGINE COOLANT TEMPERATURE SENSOR CHECK

THROTTLE POSITION SENSOR CHECK

ACCELERATOR PEDAL POSITION SENSOR CHECK (Vehicles with TCL)

CLOSED THROTTLE POSITION SWITCH CHECK <Vehicles without TCL>

CLOSED THROTTLE POSITION SWITCH CHECK (Vehicles with TCL)

OXYGEN SENSOR CHECK

INJECTOR CHECK

IDLE SPEED CONTROL (ISC) SERVO (STEPPER MOTOR) CHECK

PURGE CONTROL SOLENOID VALVE CHECK

EGR CONTROL SOLENOID VALVE CHECK

VENTILATION CONTROL SOLENOID VALVE CHECK <Vehicles with TCL>

VACUUM CONTROL SOLENOID VALVE CHECK <Vehicles with TCL>

VACUUM TANK CHECK <Vehicles with TCL>

VACUUM ACTUATOR CHECK <Vehicles with TCL>

THROTTLE VALVE OPERATION CHECK <Vehicles with TCL>

NEGATIVE PRESSURE CHECK DURING TRACTION CONTROL OPERATION <Vehicles with TCL>

INJECTOR

REMOVAL SERVICE POINT

INSTALLATION SERVICE POINTS

THROTTLE BODY

REMOVAL AND INSTALLATION <Vehicles without traction control, with cruise control>

<Vehicles with traction control and cruise control>

INSTALLATION SERVICE POINT

DISASSEMBLY AND REASSEMBLY <Vehicles without traction control, with cruise control>

<Vehicles with traction control, and cruise control>

CLEANING THROTTLE BODY PARTS

REASSEMBLY SERVICE POINT

13A MULTIPOINT FUEL INJECTION (MPI) 01M/Y FROM AUG 2001

CONTENTS

TROUBLESHOOTING

- INSPECTION CHART FOR DIAGNOSIS
- INSPECTION CHART FOR TROUBLE SYMPTOMS
- PROBLEM SYMPTOMS TABLE (FOR YOUR INFORMATION)
- INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS
- DATA LIST REFERENCE TABLE
- ACTUATOR TEST REFERENCE TABLE

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MULTIPOINT FUEL INJECTION (MPI)

GENERAL INFORMATION

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

FUEL INJECTION CONTROL

The injector drive times and injector timing are controlled so that the optimum air/fuel mixture is supplied to the engine to correspond to the continually-changing engine operation conditions. A single injector is mounted at the intake port of each cylinder. Fuel is sent under pressure from the fuel tank by the fuel pump, with the pressure being regulated by the fuel pressure regulator. The fuel thus regulated is distributed to each of the injectors. Fuel injection is normally carried out once for each cylinder for every two rotations of the crankshaft. The firing order is 1-2-3-4-5-6. The Engine-ECU provides a richer air/fuel mixture by carrying out “open-loop” control when the engine is cold or operating under high load conditions in order to maintain engine performance. In addition, when the engine is warm or operating under normal conditions, the Engine-ECU controls the air/fuel mixture by using the oxygen sensor signal to carry out “closed-loop” control in order to obtain the theoretical air/fuel mixture ratio that provides the maximum cleaning performance from the three way catalyst <if equipped>.

IDLE AIR CONTROL

The idle speed is kept at the optimum speed by controlling the amount of air that bypasses the throttle valve in accordance with changes in idling conditions and engine load during idling. The Engine-ECU drives the idle air control (ISC) motor to keep the engine running at the pre-set idle target speed in accordance with the engine coolant temperature and air conditioner load. In addition, when the air conditioning switch is turned off and on while the engine is idling, the ISC motor operates to adjust the throttle valve bypass air amount in accordance with the engine load conditions in order to avoid fluctuations in the engine speed.

IGNITION TIMING CONTROL

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

SELF DIAGNOSIS FUNCTION

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

OTHER CONTROL FUNCTIONS

1. Fuel Pump Control
   Turns the fuel pump relay ON so that current is supplied to the fuel pump while the engine is cranking or running.
2. A/C Compressor Clutch Relay Control
   Turns the compressor clutch of the A/C ON and OFF.
3. Fan Relay Control
   The radiator fan and condenser fan speeds are controlled in response to the engine coolant temperature and vehicle speed.
4. Traction Control
   Engine output torque is reduced based on signals from the TCL-ECU in response to the conditions under which slipping of the driven wheels and turning of the vehicle occur.
   Furthermore, reduction of output torque is performed by closing the throttle valve and retarding the ignition timing.
5. Evaporative Emission Purge Control
   (Refer GROUP 17.)
6. EGR Control
   (Refer GROUP 17.)

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GENERAL SPECIFICATIONS

Items		Specifications
Throttle body	Throttle bore mm	65 mm
	Throttle position sensor	Variable resistor type
	Accelerator position sensor <Vehicles with TCL>	Variable resistor type
	Idle speed control servo	Stepper motor type [Stepper motor type by-pass air control system]
	Closed throttle position switch <Vehicles without TCL>	Rotary contact type, within throttle position sensor
	Closed throttle position switch <Vehicles with TCL>	Rotary contact type, within accelerator pedal position sensor
Sensors	Air flow sensor	Karman vortex type
	Barometric pressure sensor	Semiconductor type
	Intake air temperature sensor	Thermistor type
	Engine coolant temperature sensor	Thermistor type
	Oxygen sensor	Zirconia type
	Vehicle speed sensor	Hall element type
	Inhibitor switch	Contact switch type
	Camshaft position sensor	Hall element type
	Crank angle sensor	Hall element type
	Power steering pressure switch	Contact switch type
Actuators	Multipoint fuel injection control relay	Contact switch type
	Fuel pump relay	Contact switch type
	Injector type and number	Electromagnetic type, 6
	Injector identification mark	CDH210 <6G72> CDH275 <6G74>
	EGR solenoid	Duty cycle type solenoid
	Evaporative emission purge solenoid	Duty cycle type solenoid
	Evaporative emission ventilation solenoid	Duty cycle type solenoid
	Vacuum control solenoid valve <Vehicles with TCL>	Duty cycle type solenoid
	Ventilation control solenoid valve <Vehicles with TCL>	Duty cycle type solenoid
Fuel pressure regulator	Regulator pressure kPa	329

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MULTIPOINT FUEL INJECTION (MPI) SYSTEM DIAGRAM

★1 Oxygen sensor
★2 Air flow sensor
★3 Intake air temperature sensor
★4 Throttle position sensor
★5 Closed throttle position switch
★6 Camshaft position sensor
★7 Crank angle sensor
★8 Barometric pressure sensor
★9 Engine coolant temperature sensor

- Power supply
- Knock sensor
- Vehicle speed sensor
- A/C switch
- Inhibitor switch
- Power steering pressure switch
- Ignition switch-ST
- Ignition switch-IG

⇨ Engine-ECU ⇨

☆1 Injector
☆2 Idle speed control servo
☆3 Evaporative emission purge solenoid
☆4 EGR solenoid

- Fuel pump relay
- Control relay
- A/C compressor clutch relay
- Engine warning lamp
- Diagnosis output
- Ignition coil, Ignition power transistor

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MULTIPOINT FUEL INJECTION (MPI) SYSTEM DIAGRAM <WITH TCL>

★1 Oxygen sensor
★2 Air flow sensor
★3 Intake air temperature sensor
★4 Throttle position sensor
★5 Closed throttle position switch
★6 Camshaft position sensor
★7 Crank angle sensor
★8 Barometric pressure sensor
★9 Engine coolant temperature sensor

- Power supply
- Knock sensor
- Vehicle speed sensor
- A/C switch
- Inhibitor switch
- Power steering pressure switch
- Ignition switch-ST
- Ignition switch-IG

⇨ Engine-ECU ⇨

☆1 Injector
☆2 Idle speed control servo
☆3 Evaporative emission purge solenoid
☆4 EGR solenoid
☆5 Traction control vacuum solenoid
☆6 Traction control ventilation solenoid

- Fuel pump relay
- Control relay
- A/C compressor clutch relay
- Engine warning lamp
- Diagnosis output
- Ignition coil, Ignition power transistor

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SERVICE SPECIFICATIONS

Items		Standard value
Basic ignition timing		5° BTDC ± 3° at curb idle
Curb idle speed r/min		700 ± 100
Idle speed when A/C is ON r/min		900 in Neutral
Basic idle speed r/min		700 ± 50
Throttle position sensor adjusting voltage mV	Vehicles without TCL	400–1000
	Vehicles with TCL	580–690
Throttle position sensor resistance kΩ		3.5–6.5
Intake air temperature sensor resistance kΩ	20°C	2.3–3.0
	80°C	0.30–0.42
Engine coolant temperature sensor resistance kΩ	20°C	2.1–2.7
	80°C	0.26–0.36
Oxygen sensor output voltage V		0.6–1.0
Fuel pressure kPa	Vacuum hose disconnected	324–343 at curb idle
	Vacuum hose connected	Approx. 265 at curb idle
Injector coil resistance Ω		13–16 [at 20°C]
Ventilation control solenoid valve coil resistance Ω		36–44 [at 20°C]
Vacuum control solenoid valve coil resistance Ω		36–44 [at 20°C]

SEALANT

Item	Specified sealant
Engine coolant temperature sensor threaded portion	Loctite 577 or equivalent

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SPECIAL TOOLS

Tool	Tool number and name	Supersession	Application
A B C D	MB991223 A: MB991219 B: MB991220 C: MB991221 D: MB991222 Harness Set A: Test harness B: Led harness C: LED harness adaptor D: Probe	–	• Fuel gauge simple inspection Measurement of terminal voltage A: Connector pin contact pressure inspection B, C: Power circuit inspection D: Commercial tester connection
	MB991502 MUT-II	–	• Reading diagnosis codes • MPI system inspection
	ROM pack	–	
	MB991348 Test harness set	EMB991348	• Adjustment of throttle position switch, throttle position sensor • Inspection using an analyser
	MB991529 Diagnosis code check harness	–	Checking the diagnosis codes.
	MB998463 Test harness (6 pin, square)	E8M19	• Inspection of ISC servo motor • Inspection using an analyser

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Tool	Tool number and name	Supersession	Application
	MD991223 Test harness	–	● Inspection of oxygen sensor ● Inspection using an analyser
	MD998478 Test harness (3 pin, triangle)	E8M21	Inspection using an analyser
	MD998709 Adaptor hose	E14M35	Measurement of fuel pressure
	MD998742 Hose adaptor	MD998742-01	
	MD998706 Injector test set	–	Checking the spray condition of injectors
	MD991607 Injector test harness	–	
	MD998741 Injector test adaptor	–	
	MB991609 Clip	–	

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TROUBLESHOOTING

DIAGNOSIS TROUBLESHOOTING FLOW

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

Engine warning lamp
(check engine lamp)

DIAGNOSIS FUNCTION

ENGINE WARNING LAMP (CHECK ENGINE LAMP)

If an abnormality occurs in any of the following items relating to the Multipoint Fuel Injection (MPI) system, the engine warning lamp will illuminate.
If the lamp remains illuminated or if the lamp illuminates when the engine is running, check the diagnosis code output.

Engine warning lamp inspection items

Engine-ECU
Air flow sensor
Intake air temperature sensor
Throttle position sensor
Engine coolant temperature sensor
Crank angle sensor
Top dead centre sensor
Injector
Barometric pressure sensor
Ignition coil, power transistor
Immobiliser system

Caution

Engine warning lamp will come on even when ignition timing check is performed. Therefore, it is not abnormal that the lamp comes on at the time of ignition timing check.

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READING DIAGNOSIS TROUBLE CODES WHEN USING MUT–II

1. Connect the MUT-II to the diagnosis connector (16 pin), switch the ignition ON and take a reading of the diagnosis codes.
2. Repair the malfunction location while referring to the Inspection chart for diagnosis trouble codes.
3. Turn the ignition switch to OFF and then back ON again.
4. Erase the diagnosis codes using the MUT-II.
5. Check to be sure that the diagnosis code is normal.
5. Erase the diagnosis codes.

WHEN USING THE ENGINE WARNING LAMP (CHECK ENGINE LAMP)

1. Use the special tool (diagnosis code check harness) to earth terminal 1 of the diagnosis connector (16 pin).
2. Take a reading of the diagnosis code from the flashing of the engine warning lamp.
3. Repair the malfunction location while referring to the Inspection chart for diagnosis trouble codes.
4. After disconnecting the battery cable from the battery (–) terminal for 10 seconds or more, re–connect the cable.
5. After the engine has warmed up, run it at idle for about 10 minutes.

DIAGNOSIS RESULT DISPLAY METHOD WHEN USING THE ENGINE WARNING LAMP

Example of flashing when a diagnosis code is output	Flashing when normal
When diagnosis code No. 24 is output	**When no diagnosis code is output**

03X0114

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DIAGNOSIS USING DIAGNOSIS 2 MODE

1. Switch the diagnosis mode of the engine control unit to DIAGNOSIS 2 mode using the MUT-II.
2. Carry out a road test.
3. Take a reading of the diagnosis code and repair the problem location.
4. Turn the ignition switch to OFF and then back to ON again.

NOTE

By turning the ignition switch to OFF, the ENGINE-ECU will switch the diagnosis mode from DIAGNOSIS 2 mode to DIAGNOSIS 1 mode.

5. Erase the diagnosis codes.

FAIL-SAFE FUNCTION REFERENCE TABLE

When the main sensor malfunctions are detected by the diagnosis function, the vehicle is controlled by means of the pre-set control logic to maintain safe conditions for driving.

Malfunctioning item	Control contents during malfunction
Air flow sensor	1. Uses the throttle position sensor signal and engine speed signal (crank angle sensor signal) for basic injector drive time and basic ignition timing from the pre-set mapping. 2. Fixes the ISC servo in the appointed position so idle air control is not performed.
Intake air temperature sensor	Controls as if the intake air temperature is 25°C.
Throttle position sensor (TPS)	No increase in fuel injection amount during acceleration due to the unreliable throttle position sensor signal.
Engine coolant temperature sensor	Controls as if the engine coolant temperature is 80°C.
Top dead centre sensor	Injects fuel simultaneously into all cylinders. (After the ignition switch is turned to ON, No. 1 cylinder top dead centre is not detected at all.)
Barometric pressure sensor	Controls as if the barometric pressure is 101 kPa (sea level)
Communication line with transmission control module	No ignition timing retard (overall engine-transmission control) achieved when transmission speeds are changed.

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INSPECTION CHART FOR DIAGNOSIS

Code No.	Diagnosis Item
12	Air flow sensor system
13	Intake air temperature sensor system
14	Throttle position sensor system
21	Engine coolant temperature sensor system
22	Crank angle sensor system
23	Top dead centre sensor system
24	Vehicle speed sensor system
25	Barometric pressure sensor system
41	Injector system
44	Ignition coil and power transistor unit system
54	Immobiliser system
61	Communication with A/T-ECU system <A/T>

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Code No. 12 Air flow sensor system	Probable cause
Range of Check ● Engine speed is 500 rpm or more Set conditions ● Sensor output frequency is 3 Hz or less for 4 seconds.	● Malfunction of the air flow sensor ● Improper connector contact, open circuit or short-circuited harness wire ● Malfunction of the Engine-ECU

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Code No. 13 Intake air temperature sensor system	Probable cause
Range of Check ● Ignition switch: ON ● Excluding 60 seconds after the ignition is turned to ON or immediately after the engine starts. Set conditions ● Sensor output voltage is 4.6 V or more (corresponding to an intake air temperature of -45°C or less) for 4 seconds. or ● Sensor output voltage is 0.2 V or more (corresponding to an intake air temperature of -125°C or more) for 4 seconds.	● Malfunction of the intake air temperature sensor ● Improper connector contact, open circuit or short-circuited harness wire of the intake air temperature sensor circuit ● Malfunction of the Engine-ECU

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

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Code No. 21 Engine coolant temperature sensor system	Probable cause
Range of Check ● Ignition switch: ON ● Excluding 60 seconds after the ignition is turned to ON or immediately after the engine starts. Set conditions ● Sensor output voltage is 4.6 V or more (corresponding to an engine coolant temperature of -45°C or less) for 4 seconds or ● Sensor output voltage is 0.1 V or more (corresponding to an engine coolant temperature of 140°C or more) for 4 seconds.	● Malfunction of the engine coolant temperature sensor ● Improper connector contact, open circuit or short-circuited harness wire of the intake air temperature sensor circuit ● Malfunction of the Engine-ECU sensor
Range of Check ● Ignition switch: ON ● Engine speed is approx. 50 rpm or more Set conditions ● Sensor output voltage increases from 1.6 V or less (corresponding to an engine coolant temperature of -40°C or less) to 1.6 V or more (corresponding to an engine coolant temperature of -40°C or less) ● After this, the sensor output voltage is 1.6 V or more for 5 minutes.	

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

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Code No. 23 Camshaft position sensor system	Probable cause
Range of Check ● Ignition Switch: ON ● Engine speed is approx. 50 rpm or more. Set conditions ● Sensor output voltage does not change for 4 seconds (no pulse signal input).	● Malfunction of the crank angle sensor ● Improper connector contact, open circuit or short-circuited harness wire of the camshaft position sensor circuit. ● Malfunction of the Engine-ECU

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Code No. 24 Vehicle speed sensor system	Probable cause
Range of Check ● Ignition Switch: ON ● Excluding 60 seconds after the ignition switch is turned to ON or immediately after the engine starts. ● Idle position switch: OFF ● Engine speed is approx. 50 rpm or more. ● Driving under high engine load. Set conditions ● Sensor output voltage does not change for 4 seconds (no pulse signal input).	● Malfunction of the vehicle speed sensor ● Improper connector contact, open circuit or short-circuited harness wire of the vehicle speed sensor circuit. ● Malfunction of the Engine-ECU

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

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Code No. 41 Injector system	Probable cause
Range of Check ● Engine speed is approx. 50-1000 rpm ● Throttle position sensor output voltage is 1.15 Volts or less. ● Actuator test by MUT-II is not carried out. Set conditions ● Surge voltage of injector coil is not detected for 4 seconds.	● Short circuit to earth of the diagnosis control line. ● Improper connector contact, open circuit or short-circuited harness wire of the injector circuit ● Malfunction of the Engine-ECU

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Code No. 44 Ignition coil and power transistor unit system	Probable cause
Range of Check ● Engine speed is approx. 50-4000 rpm ● Engine is not cranking. Set conditions ● The ignition signal from the same coil is not input for 4 seconds. However, this excludes cases where no ignition signal is input from any coils.	● Malfunction of the ignition coil. ● Improper connector contact, open circuit or short-circuited harness wire of the ignition primary circuit ● Malfunction of the power transistor unit ● Malfunction of the Engine-ECU

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Code No. 54 Immobiliser system	Probable cause
Range of Check ● Ignition Switch: ON Set conditions ● Failure to communicate between engine ECU and immobiliser ECU.	● Confusion in ID code ● Nonmatching of ID code ● Malfunction of immobiliser ECU ● Malfunction of harness or connector ● Malfunction of the Engine-ECU

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Code No. 61 Communication with Engine-A/T-ECU System <A/T>	Probable cause
Range of Check ● For a period of 60 sec or longer immediately after completing startup ● Engine revolutions approximately 50 rpm or faster Set Conditions ● The signal from the Engine-A/T ECU requesting torque reduction has been continuously input for about 5 sec or longer	● Engine-A/T ECU fault ● Harness or connector fault

INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble symptom		Inspection procedure No.
Communication with MUT-II is impossible.	Communication with all systems is not possible.	1
	Communication with Engine-ECU only is not possible.	2
Check engine/ malfunction indicator lamp and related parts	The engine warning lamp does not illuminate right after the ignition switch is turned to the ON position.	3
	The engine warning lamp remains illuminated and never goes out.	4
Starting	Cranks, won't start	5
	Fires up and dies	6
	Hard starting	7
Idling stability (Improper idling)	Unstable idle. (Rough idle, hunting)	8
	Idle speed is high. (Improper idle speed)	9
	Idle speed is low. (Improper idle speed)	10
Idling stability (Engine stalls)	When the engine is cold, it stalls at idle (Die out)	11
	When the engine becomes hot, it stalls at idle. (Die out)	12
	The engine stalls when accelerating. (Pass out)	13
	The engine stalls when decelerating.	14

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Trouble symptom		Inspection procedure No.
Driving	Hesitation, sag or stumble	15
	Acceleration shock	16
	Deceleration shock	17
	Poor acceleration	18
	Surge	19
	Knocking	20
Dieseling (Run on)		21
Too high CO and HC concentration when idling		22

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PROBLEM SYMPTOMS TABLE (FOR YOUR INFORMATION)

Items		Symptom
Starting	Won't start	The starter is used to crank the engine, but there is no combustion within the cylinders, and the engine won't start.
	Fires up and dies	There is combustion within the cylinders, but then the engine soon stalls.
	Hard starting	Engine starts after cranking a while.
Idling stability	Hunting	Engine speed doesn't remain constant; changes at idle.
	Rough idle	Usually, a judgement can be based upon the movement of the tachometer pointer, and the vibration transmitted to the steering wheel, shift lever, body, etc. This is called rough idle.
	Incorrect idle speed	The engine doesn't idle at the usual correct speed.
	Engine stall (Die out)	The engine stalls when the foot is taken from the accelerator pedal, regardless of whether the vehicle is moving or not.
	Engine stall (Pass out)	The engine stalls when the accelerator pedal is depressed or while it is being used.
Driving	Hesitation Sag	"Hesitation" is the delay in response of the vehicle speed (engine speed) that occurs when the accelerator is depressed in order to accelerate from the speed at which the vehicle is now travelling, or a temporary drop in vehicle speed (engine speed) during such acceleration. Serious hesitation is called "sag". (Refer to Fig. 1)
	Poor acceleration	Poor acceleration is inability to obtain an acceleration corresponding to the degree of throttle opening, even though acceleration is smooth, or the inability to reach maximum speed.
	Stumble	Engine speed increase is delayed when the accelerator pedal is initially depressed for acceleration. (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 steady, light throttle cruise. Most 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 condition in which the engine continues to run after the ignition switch is turned to OFF. Also called "Dieseling".

Fig. 1

Fig. 2

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INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

INSPECTION PROCEDURE 1

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

INSPECTION PROCEDURE 2

MUT-II communication with Engine-ECU is not possible.	Probable cause
One of the following causes may be suspected. • No power supply to Engine-ECU • Defective ground circuit of Engine-ECU • Defective Engine-ECU • Improper communication line between Engine-ECU and MUT-II	• Malfunction of Engine-ECU power supply circuit • Malfunction of the Engine-ECU • Open circuit between Engine-ECU and diagnosis connector

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INSPECTION PROCEDURE 3

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

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INSPECTION PROCEDURE 4

The engine warning lamp remains illuminated.	Probable cause
In cases such as the above, the cause is probably that the Engine-ECU is detecting a problem in a sensor or actuator, or that one of these listed at right has occurred.	• Short-circuit between the check engine lamp and Engine-ECU • Malfunction of the Engine-ECU

MUT-II diagnosis codes
Are diagnosis codes output?

YES → Refer to INSPECTION CHART FOR DIAGNOSIS CODES

NO ↓

Measure at the instrument panel ECU connector C-04 <M/T>, C-04 <A/T>.
- Disconnect the connector, and measure at the harness side.
- Continuity between 14 and ground
  OK: No continuity

NG → Check the harness wire between the instrument panel ECU and Engine-ECU connector, and repair if necessary.

OK ↓

Replace the Engine-ECU. CAUTION

INSPECTION PROCEDURE 5

Cranks, won't start	Probable cause
In cases such as the above, the cause is probably that a spark plug is defective, or that the supply of fuel to the combustion chamber is defective. In addition, foreign materials (water, kerosene, etc.) may be mixed with the fuel.	• Malfunction of the ignition system • Malfunction of the fuel pump system • Malfunction of the injectors • Malfunction of the Engine-ECU • Foreign materials in fuel

Check battery positive voltage when cranking.
OK: 8 V or higher

NG → Check the battery. (Refer Battery Servicing.)

OK ↓

MUT-II: Inspection of no initial combustion. (Refer to INSPECTION PROCEDURE 36.)

OK ↓

Can any sound be heard from the injectors when cranking?

NG → Check the injector circuit (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 41.)

OK ↓

Ignition system: Inspection of no initial combustion. (Refer INSPECTION PROCEDURE 36.)

OK ↓

Check the following items.
- Check the ignition coil, spark plugs, spark plug cables.
- Check if the injectors are clogged using MUT-II Actuator Test.
- Check if foreign materials (water, alcohol, etc.) got into fuel.
- Check the compression pressure.

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INSPECTION PROCEDURE 6

Fires up and dies.	Probable cause
In such cases as the above, the cause is probably that the spark plugs are generating sparks but the sparks are weak, or the initial mixture for starting is not appropriate.	• Malfunction of the ignition system • Malfunction of the injector system • Foreign materials in fuel • Poor compression • Malfunction of the Engine-ECU

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INSPECTION PROCEDURE 7

Hard starting.	Probable cause
In cases such as the above, the cause is probably that the spark is weak and ignition is difficult, the initial mixture for starting is not appropriate, or sufficient compression pressure is not being obtained.	• Malfunction of the ignition system • Malfunction of the injector system • Inappropriate gasoline use • Poor compression

Check battery positive voltage when cranking
OK: 8 V or higher

NG → Check the battery. (Refer Battery Servicing.)

OK ↓

MUT-II: Check if incomplete combustion occurs. (Refer INSPECTION PROCEDURE 38.)

OK ↓

Can any sound be heard from the injectors when cranking?

NG → Check the injector circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 41.)

OK ↓

Check the ignition timing when cranking.
OK: 5° BTDC ±3°

NG → Check that the crank angle sensor is installed and operating correctly (Refer Troubleshooting).

OK ↓

Check the following items.
- Check the ignition coil, spark plugs, spark plug cables.
- Check if the injectors are clogged using MUT-II Actuator Test.
- Check the compression pressure.
- Check if foreign materials (water, alcohol, etc.) got into fuel.

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INSPECTION PROCEDURE 8

Unstable idle (Rough idle, hunting)	Probable cause
In cases such as the above, the cause is probably that the ignition system, air/fuel mixture, ISC servo or compression pressure is defective. Because the range of possible causes is broad, inspection is narrowed down to simple items.	• Malfunction of the ignition system • Malfunction of air-fuel ratio control system • Malfunction of the ISC system • Malfunction of the purge solenoid valve system • Poor compression • Drawing air into exhaust system • Malfunction of the EGR solenoid valve system

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INSPECTION PROCEDURE 9

Idle speed is high. (Improper idle speed)	Probable cause
In such cases as the above, the cause is probably that the intake air volume during idle is too great.	• Malfunction of the ISC servo motor system • Malfunction of the throttle body

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INSPECTION PROCEDURE 10

Idle speed is low. (Improper idle speed)	Probable cause
In cases such as the above, the cause is probably that the intake air volume during idling is too small.	• Malfunction of the ISC servo system • Malfunction of the throttle body

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INSPECTION PROCEDURE 11

When the engine is cold, it stalls at idle. (Die out)	Probable cause
In such cases as the above, the cause is probably that the air/fuel mixture is inappropriate when the engine is cold, or that the intake air volume is insufficient.	• Malfunction of the ISC servo system • Malfunction of the throttle body • Malfunction of the injector system • Malfunction of the ignition system

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INSPECTION PROCEDURE 12

When the engine is hot, it stalls at idle. (Die out)	Probable cause
In cases such as the above, the cause is probably that ignition system, air/fuel mixture, ISC servo or compression pressure is defective. In addition, if the engine suddenly stalls, the cause may also be a defective connector contact.	• Malfunction of the ignition system • Malfunction of air-fuel ratio control system • Malfunction of the ISC system • Drawing air into intake system • Improper connector contact

Were the battery terminals disconnected?
- YES → After warming-up, let the engine run at idling for 10 minutes.
- NO ↓

MUT-II diagnosis codes
Are diagnosis codes output?
- YES → Refer INSPECTION CHART FOR DIAGNOSIS CODES.
- NO ↓

Check the ISC servo for operation sound.
(Refer ISC Servo checking.)
- NG → Check the ISC servo. (Refer INSPECTION PROCEDURE 33.)
- OK ↓

Check the injector for operation sound.
- NG → Check the injector circuit . (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 41.)
- OK ↓

Does the engine stall right after the accelerator pedal is released?
- YES → Clean the throttle valve area. (Refer On Vehicle Service.) → Check & adjust the fixed SAS. (Refer On Vehicle Service.)
- NO ↓

Does the engine stall easily again?
- NO → While carrying out an intermittent simulation test (Refer How To Cope With Intermittents.), check for sudden changes in the signals shown below.
  - Crank angle sensor signal
  - Air flow sensor signal
  - Injector drive signal
  - Primary and secondary ignition signal
  - Fuel pump drive signal
  - Engine-ECU power supply voltage
- YES ↓

MUT-II: Engine stalling inspection when the engine is warm and idling (Refer INSPECTION PROCEDURE 41.)
- OK ↓

Check the ignition timing.
(Refer Ignition Timing Check.)
- NG → Check that the crank angle sensor is installed and operating correctly.
- OK ↓

Check the following items.
- Check the ignition coil, spark plugs, spark plug cables.
- Check if the injectors are clogged using MUT-II Actuator Test.
- Check the compression pressure.
- Check if foreign materials (water, alcohol, etc.) got into fuel.

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INSPECTION PROCEDURE 13

The engine stalls when accelerating. (Pass out)	Probable cause
In cases such as the above, the cause is probably misfiring due to a weak spark, or an inappropriate air/fuel mixture when the accelerator pedal is depressed.	• Drawing air into intake system • Malfunction of the ignition system

MUT-II diagnosis codes
Are diagnosis codes output?

YES → Refer INSPECTION CHART FOR DIAGNOSIS CODES.

NO ↓

Check the following items.
- Check the ignition coil, spark plugs, spark plug cables.
- Check if air was drawn into the intake system.
  - Broken intake manifold gasket or intake manifold plenum gasket
  - Broken or disconnected vacuum hose
  - Improper operation of the PCV valve
  - Broken air intake hose

INSPECTION PROCEDURE 14

The engine stalls when decelerating.	Probable cause
In cases such as the above, the cause is probably that the intake air volume is insufficient due to a defective ISC servo system.	• Malfunction of the ISC servo system

Were the battery terminals disconnected?

YES → After warming-up, let the engine run at idling for 10 minutes.

NO ↓

MUT-II diagnosis codes
Are diagnosis codes output?

YES → Refer INSPECTION CHART FOR DIAGNOSIS CODES.

NO ↓

MUT-II Data list
26 Idle position switch (Refer Item No.26.)

NG → Check the idle position switch. (Refer INSPECTION PROCEDURE 25.)

OK ↓

MUT-II Data list
14 Throttle position sensor (Refer Item No.14.)

NG → Check the throttle position sensor circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 14.)

OK ↓

MUT-II Data list
45 ISC servo position (Refer Item No.45.)
- Does the ISC servo position drop to 0–2 steps when decelerelating (engine rpm more than 1,000)?

YES → Check the vehicle speed sensor circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 24.)

NO ↓

Check the following items.
- Check the ignition coil, spark plugs, spark plug cables.
- Clean the throttle valve area.
- Check and adjust the fixed SAS.

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INSPECTION PROCEDURE 15

Hesitation, sag or stumble	Probable cause
In cases such as the above, the cause is probably that ignition system, air/fuel mixture or compression pressure is defective.	• Malfunction of the ignition system • Malfunction of air-fuel ratio control system • Malfunction of the fuel supply system • Malfunction of the EGR solenoid system • Poor compression

MUT-II diagnosis codes
Are diagnosis codes output?
- YES → Refer INSPECTION CHART FOR DIAGNOSIS CODES.
- NO ↓

Check the injectors for operation sound.
- NG → Check the injector circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 41.)
- OK ↓

Check the ignition timing.
(Refer Ignition Timing Check.)
- NG → Check that the crank angle sensor is installed and operating correctly.
- OK ↓

MUT-II: Check if hesitation, sag, stumble or poor acceleration occur. (Refer INSPECTION PROCEDURE 42.)
- OK ↓

Check the fuel pressure. (Refer Fuel Pressure Check.)
- OK ↓

Check the following items.
- Check the ignition coil, spark plugs, spark plug cables.
- Check the EGR system.
- Check the compression pressure.
- Check the fuel filter or fuel line for clogging.

INSPECTION PROCEDURE 16

Acceleration shock	Probable cause
In cases such as the above, the cause is probably that there is an ignition leak accompanying the increase in the spark plug demand voltage during acceleration.	• Malfunction of the ignition system

MUT-II diagnosis codes
Are diagnosis codes output?
- YES → Refer INSPECTION CHART FOR DIAGNOSIS CODES.
- NO ↓

Check the following items.
- Check the ignition coil, spark plugs, spark plug cables.
- Check for occurrence of ignition leak.

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INSPECTION PROCEDURE 17

Deceleration shock	Probable cause
Malfunction of the ISC system is suspected.	• Malfunction of the ISC system

MUT-II diagnosis codes
Are diagnosis codes output?
- YES → Refer INSPECTION CHART FOR DIAGNOSIS CODES.
- NO ↓

Check the ISC servo for operation sound.
(Refer ISC Servo Check.)
- NG → Check the idle control system. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 33.)
- OK ↓

MUT-II Data list
14 Throttle position sensor (Refer Item No.14.)
- NG → Check the throttle position circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 14.)
- OK ↓

MUT-II Data list
26 Closed throttle position switch (Refer Item No.26.)
- NG → Check the idle position switch. (Refer INSPECTION PROCEDURE 25.)
- OK ↓

Clean the throttle valve area. (Refer On Vehicle Service.)

INSPECTION PROCEDURE 18

Poor acceleration	Probable cause
Defective ignition system, abnormal air-fuel ratio, poor compression pressure, etc. are suspected.	• Malfunction of the ignition system • Malfunction of air-fuel ratio control system • Malfunction of the fuel supply system • Poor compression • Clogged exhaust system

MUT-II Diagnosis codes
Are diagnosis codes output?
- YES → Refer INSPECTION CHART FOR DIAGNOSIS CODES.
- NO ↓

Check the injectors for operation sound. (Refer Check procedure.)
- NG → Check the injector circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 41.)
- OK ↓

Check the ignition timing.
(Refer Ignition Timing Check.)
- NG → Check that the crank angle sensor is installed and operating correctly.
- OK ↓

MUT-II: Check if hesitation, sag, stumble or poor acceleration occur.
(Refer INSPECTION PROCEDURE 42.)
- OK ↓

Check the fuel pressure. (Refer Fuel Pressure Check.)
- OK ↓

Check the following items.
- Check the ignition coil, spark plugs, spark plug cables.
- Check the compression pressure.
- Check the fuel filter or fuel line for clogging.
- Broken air intake hose
- Clogged air cleaner
- Clogged exhaust system

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INSPECTION PROCEDURE 19

Surge	Probable cause
Defective ignition system, abnormal air-fuel ratio,etc. are suspected.	• Malfunction of the ignition system • Malfunction of air-fuel ratio control system • Malfunction of the EGR solenoid system

MUT-II Self-Diag codes
Are diagnosis codes output?
- YES → Refer INSPECTION CHART FOR DIAGNOSIS CODES.
- NO ↓

Check the injectors for operation sound, Check operation.
- NG → Check the injector circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 41.)
- OK ↓

Check the ignition timing.
(Refer Ignition Timing Check.)
- NG → Check that the crank angle sensor is installed and operaring correctly.
- OK ↓

MUT-II: Check if surge occurs. (Refer INSPECTION PROCEDURE 43.)
- OK ↓

Check the fuel pressure. (Refer Fuel pressure test.)
- OK ↓

Check the following items.
- Check the ignition coil, spark plugs, spark plug cables.
- Check the EGR system.

INSPECTION PROCEDURE 20

Knocking	Probable cause
In cases such as the above, the cause is probably that the heat value of the spark plug is inappropriate.	• Defective knock sensor • Inappropriate heat value of the spark plug

MUT-II Self-Diag codes
Are diagnosis codes output?
- YES → Refer INSPECTION CHART FOR DIAGNOSIS CODES.
- NO ↓

Check the following items.
- Spark plug heat range.
- Check if foreign materials (water, alcohol, etc.) got into fuel.

INSPECTION PROCEDURE 21

Dieseling	Probable cause
Fuel leakage from injectors is suspected.	• Fuel leakage from injectors

Check the injectors for fuel leakage.

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INSPECTION PROCEDURE 22

Too high CO and HC concentration when idling	Probable cause
Abnormal air-fuel ratio is suspected.	• Malfunction of the air-fuel ratio control system. • Deteriorated catalyst

MUT-II Self-Diag codes
Are diagnosis codes output?
- YES → Refer INSPECTION CHART FOR DIAGNOSIS CODES.
- NO ↓

Check the ignition timing.
(Refer Ignition Timing Check.)
- NG → Check that the crank angle sensor is installed and operating correctly.
- OK ↓

MUT-II Data list
21 Engine coolant temperature sensor.
(Refer Item No.21.)
- NG → Check the engine coolant temperature circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)
- OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer Item No.13.)
- NG → Check the intake air temperature circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 13.)
- OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer Item No.25.)
- NG → Check the barometric pressure circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 25.)
- OK ↓

MUT-II Data list
11 Oxygen sensor (Refer Item No.11.)
- Transmission : L range
- Driving with the throttle wide open

OK: 600–1,000 mV
- NG → Check the oxygen sensor system. (Refer INSPECTION PROCEDURE 30.)
- OK ↓

Check the fuel pressure. (Refer Fuel Pressure Test.)
- OK ↓

Check the following items.
- Check the injectors for operation sound.
- Check the injectors for fuel leakage.
- Check the ignition coil, spark plugs, spark plug cables.
- Check the compression pressure.
- Check the positive crankcase ventilation system.
- Check the evaporative emission control system.
- Check the EGR system.

↓

Check trouble symptom.
- NG ↓

Replace the three-way catalytic converter.

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INSPECTION PROCEDURE 23

Power supply system and ignition switch–IG system	Probable cause
When an ignition switch ON signal is input to the Engine-ECU, the Engine-ECU turns the MPI control relay ON. This causes battery positive voltage to be supplied to the Engine-ECU, injectors and air flow sensor.	• Malfunction of the ignition switch • Malfunction of the MPI control relay • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the Engine-ECU

Check the MPI control relay . (Refer MPI Relay check.).

NG → **Replace**

OK ↓

Measure at the MPI control relay connector B-102 <M/T>, B-102 <A/T>.
- Disconnect the connector, and measure at the harness side.
- Voltage between 3,4 and ground.
- **MUT-II ACTUATOR TEST:** Fuel pump drive
  OK: Battery positive voltage

NG → Check the harness wire between the battery and MPI control relay connector, and repair if necessary.

OK ↓

Check the Engine-ECU power supply and ground circuit. (Refer INSPECTION PROCEDURE 44.)

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INSPECTION PROCEDURE 24

Fuel pump system	Probable cause
The Engine-ECU turns the fuel pump relay ON when the engine is cranking or running, and this supplies power to drive the fuel pump.	• Malfunction of the fuel pump relay • Malfunction of the fuel pump • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the Engine-ECU

INSPECTION PROCEDURE 25

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

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INSPECTION PROCEDURE 26

Ignition switch-ST system <M/T>	Probable cause
The ignition switch-ST inputs a HIGH signal to the engine-ECU while the engine is cranking. The Engine-ECU controls the fuel injection, etc. during starting based on this input.	• Malfunction of ignition switch • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the Engine-ECU.

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INSPECTION PROCEDURE 27

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

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INSPECTION PROCEDURE 28

Power steering fluid pressure switch system	Probable cause
The presence or absence of power steering load is input to the Engine-ECU. The Engine-ECU controls the idle speed control (ISC) servo based on this input.	• Malfunction of power steering fluid pressure switch • Improper connector contact, open circuit or short circuited harness wire • Malfunction of Engine-ECU

INSPECTION PROCEDURE 29

A/C switch and A/C relay system	Probable cause
When an A/C ON signal is input to the Engine-ECU, the Engine-ECU carries out control of the ISC servo, and also operates the A/C compressor magnetic clutch.	• Malfunction of A/C control system • Malfunction of A/C switch • Improper connector contact, open circuit or short circuited harness wire • Malfunction of Engine-ECU

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INSPECTION PROCEDURE 30

Oxygen sensor system	Probable cause
• The oxygen sensor detects the oxygen content in exhaust gas, converts it to voltage and sends the voltage to the engine ECU. • The engine ECU controls the fuel injection amount to adjust the air/fuel ratio to theoretical one.	• Malfunction of the oxygen sensor • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the Engine-ECU

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INSPECTION PROCEDURE 31

Fan motor relay system (Radiator fan, A/C condenser fan)	Probable cause
The fan motor relay is controlled by the power transistor inside the Engine-ECU turning ON and OFF.	• Malfunction of fan motor relay • Malfunction of fan motor • Improper connector contact, open circuit or short circuited harness wire • Malfunction of the Engine-ECU

INSPECTION PROCEDURE 32

Ignition circuit system	Probable cause
The Engine-ECU interrupts the ignition coil primary current by turning the ignition power transistor inside the Engine-ECU ON and OFF.	• Malfunction of ignition coil • Malfunction of ignition power transistor unit • Improper connector contact, open circuit or short circuited harness wire • Malfunction of the Engine-ECU

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INSPECTION PROCEDURE 33

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

INSPECTION PROCEDURE 34

Purge control solenoid valve system	Probable cause
The purge control solenoid valve controls the purging of air from the canister located inside the intake manifold.	• Malfunction of solenoid valve • Improper connector contact, open circuit or short circuited harness wire • Malfunction of the Engine-ECU

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INSPECTION PROCEDURE 35

EGR control solenoid valve system	Probable cause
The EGR control solenoid valve is controlled by the negative pressure resulting from EGR operation leaking to port "A" of the throttle body.	• Malfunction of solenoid valve • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the Engine-ECU

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INSPECTION PROCEDURE 36

MUT-II: Inspection of no initial combustion

MUT-II Data list
16 Voltage of Engine-ECU power source
(Refer Item No.16.)

- NG → Check the power supply system. (Refer INSPECTION PROCEDURE 23.)
- OK ↓

Does the camshaft rotate at the engine cranking ? (When oil filler cap is removed.)

- NO → Check timing belt for breakage.
- YES ↓

MUT-II Self-Diag codes
Are the diagnosis codes output ?

- YES → Refer INSPECTION CHART FOR DIAGNOSIS CODES.
- NO ↓

MUT-II Data list
22 Crank angle sensor (refer Item No.22.)
OK: Cranking speed is displayed.

- NG → Check the crank angle circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 22.)
- OK ↓

MUT-II actuator test
07 Fuel pump (Refer Item No.7.)

- NG → Check the fuel pump system. (Refer INSPECTION PROCEDURE 24.)
- OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer Item No.21.)

- NG → Check the engine coolant temperature circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)

INSPECTION PROCEDURE 37

Ignition system: Inspection of no initial combustion

Does the engine tachometer display the cranking speed?
- Connect tachometer to engine.

- NG → Check the ignition circuit system (Refer INSPECTION PROCEDURE 32.)
- OK ↓

Check the ignition timing when cranking.
OK: 5° BTDC ±3°

- NG → Check for the correct installation condition of crank angle sensor.

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INSPECTION PROCEDURE 38

MUT-II: Check if incomplete combustion occurs.

MUT-II Self-Diag codes
Are diagnosis codes output ?
- YES → Refer INSPECTION CHART FOR DIAGNOSIS CODE.
- NO ↓

MUT-II actuator test
07 Fuel pump (Refer Item No.7.)
- NG → Check the fuel pump system. (Refer INSPECTION PROCEDURE 24.)
- OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer Item No.21.)
- NG → Check the engine coolant temperature circuit. (Refer INSPECTION PROCEDURES FOR DIAGNOSIS CODE 21.)
- OK ↓

MUT-II Data list
18 Ignition switch-ST (Refer Item No.18.)
- NG → Check the ignition switch-ST and inhibitor switch system <M/T>. (Refer INSPECTION PROCEDURE 26.) Check the ignition switch-ST and inhibitor switch system <A/T>. (Refer INSPECTION PROCEDURE 27.)

INSPECTION PROCEDURE 39

Check if hunting occurs.

Clean the throttle body. (Refer On Vehicle Service.)
↓
Check and adjust the fixed SAS (Refer On Vehicle Service.)
↓
Check trouble symptom.
- NG ↓

Inspect the intake of air into the air intake system
- Broken intake manifold gasket
- Broken air intake hose
- Broken vacuum hose
- Positive crankcase ventilation valve does not operate

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INSPECTION PROCEDURE 40

MUT-II: Check if idle speed is unstable.

MUT-II Data list
26 Idle position switch (Refer Item No.26.)

NG → Check the idle position switch. (Refer INSPECTION PROCEDURE 25.)

OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer Item No.13.)

NG → Check the intake air temperature circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 13.)

OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer Item No.25.)

NG → Check the barometric pressure circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 25.)

OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer Item No.21.)

NG → Check the engine coolant temperature circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)

OK ↓

MUT-II actuator test
08 Evaporative emission purge solenoid (Refer Item No.8.)

NG → Check the purge control solenoid valve circuit (Refer INSPECTION PROCEDURE 34.)

OK ↓

MUT-II Data list
11 Oxygen sensor (Refer Item No.11.)
OK: 600–1,000 mV during sudden racing

NG → Check the oxygen sensor system. (Refer INSPECTION PROCEDURE 30)

OK ↓

MUT-II Data list
11 Oxygen sensor (Refer Item No.11.)
OK: Changes between 0–400 mV and 600–1,000 mV during idling

NG → Check the fuel pressure. (Refer Fuel pressure test.)

OK →
1. Inspect the intake of air into the air intake system.
   - Broken intake manifold gasket
   - Broken vacuum hose
   - PCV valve does not operate.
   - Broken air intake hose
2. Check the injector for blockage.

OK ↓

MUT-II Data list
27 Power steering pressure switch (Refer Item No.27.)

NG → Check the power steering fluid pressure switch system. (Refer INSPECTION PROCEDURE 28.)

↓

MUT-II Data list
28 A/C switch (Refer Item No.28.)

NG → Check the A/C switch and A/C relay system. (Refer INSPECTION PROCEDURE 29.)

OK ↓

MUT-II Data list
29 Inhibitor switch (Refer Item No.29.)

NG → Check the ignition switch-ST and inhibitor switch system. (Refer INSPECTION PROCEDURE 27.)

OK ↓

MUT-II Data list
45 ISC servo position (Refer Item No.45.)

NG → Adjust the basic idle speed. (Refer On Vehicle Service.)

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INSPECTION PROCEDURE 41

MUT-II: Engine stalling inspection when the engine is warm and idling.

MUT-II Data list
26 Idle position switch (Refer Item No.26.)
- NG → Check the idle position switch. (Refer INSPECTION PROCEDURE 25.)
- OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer Item No.13.)
- NG → Check the intake air temperature circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 13.)
- OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer Item No.25.)
- NG → Check the barometric pressure circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 25.)
- OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer Item No.21.)
- NG → Check the engine coolant temperature circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)
- OK ↓

MUT-II Data list
11 Heated oxygen sensor (Refer Item No.11.)
OK: Changes between 600–1,000 mV during sudden racing
- NG → Check the oxygen sensor system. (Refer INSPECTION PROCEDURE 30)
- OK ↓

MUT-II Data list
11 Heated oxygen sensor (Refer Item No.11.)
OK: Changes between 0–400 mV and 600–1,000 mV during idling
- NG → Check the fuel pressure. (Refer Fuel Pressure Test.)
  - OK →
    1. Inspect the intake of air into the air intake system
       - Broken intake manifold gasket
       - Broken vacuum hose
       - PCV valve does not operate.
       - Broken air intake hose
    2. Check the injectors for blockage.
- OK ↓

MUT-II Data list
27 Power steering pressure switch (Refer Item No.27.)
- NG → Check the power steering fluid pressure switch circuit (Refer INSPECTION PROCEDURE 28.)
- OK ↓

MUT-II Data list
28 A/C switch (Refer Item No.28.)
- NG → Check the A/C switch and A/C compressor clutch relay system. (Refer INSPECTION PROCEDURE 29.)
- OK ↓

MUT-II Data list
29 Inhibitor switch (Refer Item No.29.)
- NG → Check the ignition switch-ST and inhibitor switch system. (Refer INSPECTION PROCEDURE 27.)
- OK ↓

MUT-II Data list
34 Air flow sensor reset signal (Refer Item No.34.)
- NG → Check the air flow sensor circuit. (Refer INSPECTION PROCEDURE 47.)
- OK ↓

MUT-II Data list
45 ISC servo position (Refer Item No.45.)
- NG → Adjust the basic idle speed. (Refer On Vehicle Service.)

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INSPECTION PROCEDURE 42

MUT-II: Check if hesitation, sag, stumble or poor acceleration occurs.

MUT-II Data list
26 Idle position switch (Refer Item No.26.)

NG → Check the idle position switch. (Refer INSPECTION PROCEDURE 25.)

OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer Item No.13.)

NG → Check the intake air temperature circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 13.)

OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer Item No.25.)

NG → Check the barometric pressure circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 25.)

OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer Item No.21.)

NG → Check the engine coolant temperature circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)

OK ↓

MUT-II Data list
14 Throttle position sensor (Refer Item No.14.)

NG → Check the throttle position circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 14.)

OK ↓

MUT-II actuator test
10 EGR solenoid (Refer Item No.10.)

NG → Check the EGR control solenoid circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 35.)

OK ↓

MUT-II Data list
11 Oxygen sensor (front) (Refer Item No.11.)
OK: Changes between 600–1,000 mV during sudden racing

NG → Check the oxygen sensor system. (Refer INSPECTION PROCEDURE 30)

OK ↓

MUT-II Data list
11 Oxygen sensor (Refer Item No.11.)
OK: Changes between 0–400 mV and 600–1,000 mV during idling

NG → Check the fuel pressure. (Refer Fuel Pressure Test.)

OK →
1. Inspect the intake of air into the air intake system
   - Broken intake manifold gasket
   - Broken vacuum hose
   - PCV valve does not operate
   - Broken air intake hose
2. Check the injectors for blockage.

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INSPECTION PROCEDURE 43

MUT-II: Check if surge occurs.

MUT-II Data list
26 Idle position switch (Refer Item No.26.)

NG → Check the idle position switch circuit. (Refer INSPECTION PROCEDURE 25.)

OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer Item No.13.)

NG → Check the intake air temperature circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 13.)

OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer Item No.25.)

NG → Check the barometric pressure circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 25.)

OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer Item No.21.)

NG → Check the engine coolant temperature circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)

OK ↓

MUT-II Data list
14 Throttle position sensor (Refer Item No.14.)

NG → Check the throttle position circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 14.)

OK ↓

MUT-II actuator test
10 EGR solenoid (Refer Item No.10.)

NG → Check the EGR solenoid valve circuit. (Refer INSPECTION PROCEDURE 35.)

OK ↓

MUT-II Data list
11 Oxygen sensor (Refer Item No.11.)
OK: Changes between 600–1,000 mV during sudden racing

NG → Check the oxygen sensor system. (Refer INSPECTION PROCEDURE 30)

OK ↓

MUT-II Data list
11 Oxygen sensor (Refer Item No.11.)
OK: Changes between 0–400 mV and 600–1,000 mV during idling

NG → Check the fuel pressure. (Refer Fuel Pressure Test.)

OK →
1. Inspect the intake of air into the air intake system
   - Broken intake manifold gasket
   - Broken vacuum hose
   - PCV valve does not operate
   - Broken air intake hose
2. Check the injector for blockage.

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INSPECTION PROCEDURE 44

Check the Engine-ECU power supply and ground circuit.

Measure at the Engine-ECU connectors
B-108, B-109, B-110, B-111 <M/T>,
B-108, B-109, B-110, B-111 <A/T>.
- Disconnect the connector and measure at the harness side

1. Voltage between 82 and ground <M/T> 98 and ground <A/T> (Ignition switch: ON)
   OK: Battery positive voltage
2. Voltage between 38 and ground <M/T> 49 and ground <A/T> (Ignition switch: ON)
   OK: Battery positive voltage
3. Voltage between 12, 25 and ground <M/T> 41, 47 and ground <A/T> (Ignition switch: ON)
   OK: Battery positive voltage
4. Continuity between 13, 26 and ground <M/T> 42,48 and ground <A/T>
   OK: Continuity
5. Voltage between 80 and ground <M/T> 66 and ground <A/T>
   OK: Battery positive voltage

1. NG → **Check the following connector.** B-43, B-77 <M/T>, B-43, B-77 <A/T>. NG → **Repair**
   OK → Check trouble symptom.
   NG → Check the harness wire between Engine-ECU and ignition switch connector. NG → **Repair**

2.,3. NG → Check the harness wire between Engine-ECU and MPI control relay connector, and repair if necessary.

4. NG → Check the harness wire between Engine-ECU and ground, and repair if necessary.

5. NG → **Check the following connector.** B-84, B-78 <M/T>, B-84, B-78 <A/T>. NG → **Repair**
   OK → Check trouble symptom.
   NG → Check the harness wire between Engine-ECU and battery, and repair if necessary.

OK → **Check the following connector.** B-108, B-109, B-110, B-111 <M/T>, B-108, B-109, B-110, B-111 <A/T> NG → **Repair**

OK → Check trouble symptoms.

NG → Replace the Engine-ECU. CAUTION

INSPECTION PROCEDURE 45

Check fuel pump circuit.

Measure at the fuel pump connector
H-01 <M/T>, H-01 <A/T>.
- Disconnect the connector and measure at the harness side.
- Continuity between 5 and ground
  OK: Continuity

NG → Check the harness wire between fuel pump and ground, and repair if necessary.

OK → **Check the following connectors.** H-09 <M/T>,H-09 <A/T> NG → **Repair**

OK → Check trouble symptom.

NG → Check the harness wire between terminal for fuel pump drive and fuel pump connector. NG → **Repair**

OK → Replace the fuel pump.

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INSPECTION PROCEDURE 46

Check the fuel pump drive control circuit.

Measure at the fuel pump relay connector
B-102 <M/T>, B-102 <A/T>.
- Disconnect the connector and measure at the harness side.
- Voltage between 3, 4 and ground (Ignition switch: ON)
  OK: Battery positive voltage

NG → **Check the following connector.** B-77, B-43 <M/T>, B-77, B-43 <A/T>. NG → **Repair**
OK → Check trouble symptom.
NG → Check the harness wire between fuel pump relay and ignition switch connector. NG → **Repair**
OK → Check the ignition switch. (Refer On Vehicle Service.)

OK ↓

Measure at the Engine-ECU connector
B-108 <M/T>, B-108 <A/T>.
- Disconnect the connector and measure at the harness side.
- Voltage between 22 <M/T> 21 <A/T> and ground (Ignition switch: ON)
  OK: Battery positive voltage

NG → **Check the following connector.** B-102 <M/T>, B-102 <A/T>. NG → **Repair**
OK → Check trouble symptom.
NG → Check the harness wire between Engine-ECU and fuel pump relay connector, and repair if necessary.

OK ↓

Check the following connector. B-108 <M/T>, B-108 <A/T>. NG → **Repair**
OK → Check trouble symptom.
NG → Replace the Engine-ECU. CAUTION

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INSPECTION PROCEDURE 47

Check air flow sensor control circuit.

INSPECTION PROCEDURE 48

Check throttle position sensor (TPS) output circuit.

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INSPECTION PROCEDURE 49

Check injector control circuit

INSPECTION PROCEDURE 50

Check ignition signal circuit.

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DATA LIST REFERENCE TABLE

Caution

1. **When shifting the select lever to D range, the brakes should be applied so that the vehicle does not move forward.**
2. **Driving tests always need another personnel.**

*1: In a new vehicle [driven approximately 500 km or less], the air flow sensor output frequency is sometimes 10% higher than the standard frequency.
*2: After performing a warm up idle from an initial engine temperature of –20°C, if the idle speed is lower than the standard value then it is assumed that the air volume limiter in the throttle body is defective (even if the ISC motor is fully open).
*3: The injector drive time represents the time when the cranking speed is at 250 rpm or below when the power supply voltage is 11 V.
*4: In a new vehicle [driven approximately 500 km or less], the injector drive time is sometimes 10% longer than the standard time.
*5: The idle position switch normally turns off when the voltage of the throttle position sensor is 50 – 100mV higher than the voltage at the idle position. If the closed throttle position switch turns back on after the throttle position sensor voltage has risen by 100mV and the throttle valve has opened, the closed throttle position switch and the throttle position sensor need to be adjusted.
*6: In a new vehicle [driven approximately 500 km or less], the step of the stepper motor is sometimes 3 steps greater than the standard value.

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.
11	Oxygen sensor	Engine: Warm (Air/fuel mixture is made leaner when decelerating, and is made richer when racing.)	When at 4,000 r/min, engine is suddenly decelerated	200 mV or less	Procedure No. 30
			When engine is suddenly raced	600–1,000 mV	
		Engine: Warm (The oxygen sensor signal is used to check the air/fuel mixture ratio, and control condition is also checked by the Engine-ECU.)	Engine is idling	400 mV or less ↔ 600–1,000 mV (Changes)	
			2,500 r/min		
12	Air flow sensor	• Engine coolant temperature: 80–95°C • Lights, electric cooling fan and all accessories: OFF • Transmission: Neutral (A/T: P range)	Engine is idling	18–44 Hz	Code No. 12
			2,500 r/min	43–83 Hz	
			Engine is raced	Frequency increases in response to racing	
13	Intake air temperature sensor	Ignition switch: ON or with engine running	When intake air temperature is –20°C	–20°C	Code No. 13
			When intake air temperature is 0°C	0°C	
			When intake air temperature is 20°C	20°C	
			When intake air temperature is 40°C	40°C	
			When intake air temperature is 80°C	80°C	

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Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.
14	Throttle position sensor	Ignition switch: ON	Set to idle position	300–1,000 mV (6–20%)	Code No. 14
			Gradually open	Increases in proportion to throttle opening angle	
			Open fully	4,500–5,500 mV (80–100%)	
16	Power supply voltage	Ignition switch: ON		Battery positive voltage	Procedure No. 23
18	Cranking signal (ignition switch-ST)	Ignition switch: ON	Engine: Stopped	OFF	Procedure No.26 <M/T> Procedure No. 27 <A/T>
			Engine: Cranking	ON	
21	Engine coolant temperature sensor	Ignition switch: ON or with engine running	When engine coolant temperature is –20°C	–20°C	Code No. 21
			When engine coolant temperature is 0°C	0°C	
			When engine coolant temperature is 20°C	20°C	
			When engine coolant temperature is 40°C	40°C	
			When engine coolant temperature is 80°C	80°C	
22	Crank angle sensor *2	● Engine: Cranking ● Tachometer: Connected	Compare the rpm of the tachometer with the one of the MUT-II.	Identical	Code No. 22
		● Engine: Idling ● Idle position switch: ON	When engine coolant temperature is –20°C	1300–1500 r/min	
			When engine coolant temperature is 0°C	1300–1500 r/min	
			When engine coolant temperature is 20°C	1300–1500 r/min	
			When engine coolant temperature is 40°C	1050–1250 r/min	
			When engine coolant temperature is 80°C	600–800 r/min	
24	Vehicle speed sensor	Drive at 40 km/h		Approx. 40 km/h	Code No. 24
25	Barometric pressure sensor	Ignition switch: ON	At altitude of 0 m	101 kPa	Code No. 25
			At altitude of 600m	95 kPa	
			At altitude of 1,200 m	88 kPa	
			At altitude of 1,800 m	81 kPa	
26	Idle position switch	Ignition switch: ON Check by operating accelerator pedal repeatedly	Throttle valve: Set to idle position	ON	Procedure No. 25
			Throttle valve: Slightly open	OFF*5	

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Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.
27	Power steering pressure switch	Engine: Idling	Steering wheel stationary	OFF	Procedure No. 28
			Steering wheel turning	ON	
28	A/C switch	Engine: Idling (When A/C switch is ON, A/C compressor should be operating.)	A/C switch: OFF	OFF	Procedure No. 29
			A/C switch: ON	ON	
29	Inhibitor switch <A/T>	Ignition switch: ON	P or N	P or N	Procedure No. 27
			D,3, 2, L or R	D,3, 2, L or R	
34	Air flow sensor reset signal	Engine: Warm	Engine is idling	ON	–
			2500 r/min	OFF	
36	Ignition timing adjustment mode.	Engine: Idling	Ignition timing adjustment terminal is earthed	ON	–
			Ignition timing adjustment terminal is disconnected from earth	OFF	
37	Volumetric efficiency	• Engine coolant temperature: 80–95°C • Lights, electric cooling fan and all accessories: OFF • Transmission: P range	Engine is idling	15–35 %	–
			2,500 r/min	15–35 %	
			When engine is suddenly raced	Volumetric efficiency increases in response to racing	
38	Crank angle sensor	• Engine cranking (reading is possible at 2000 r/min or less) • Tachometer: connected		Engine speeds displayed on the MUT-II and tachometer are identical.	–
41, 47	Injectors *3	Engine: Cranking	When engine coolant temperature is 0°C	12–18 ms	–
			When engine coolant temperature is 20°C	30–44 ms	
			When engine coolant temperature is 80°C	8–12 ms	
	Injectors *4	• Engine coolant temperature: 80–95°C • Lights, electric cooling fan and all accessories: OFF • Transmission: P range	Engine is idling	2.2–3.4 ms	
			2,500 r/min	2.0–3.2 ms	
			When engine is suddenly raced	Increases	

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Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.
44	Ignition coils and ignition power transistors	● Engine: After having warmed up ● Timing light is set. (The timing light is set in order to check actual ignition timing.)	Engine is idling	2–18 °BTDC	–
			2,500 r/min	25–45 °BTDC	
45	ISC servo (stepper motor) position *6	● Engine coolant temperature: 80 – 95°C ● Lights, electric cooling fan and all accessories: OFF ● Transmission: P range) ● Idle position switch: ON ● Engine: Idling (When A/C switch is ON, A/C compressor should be operating)	A/C switch: OFF	Increases by 2–25 steps	–
			A/C switch: OFF → ON	Increases by 10–70 steps	
			● A/C switch: OFF ● Select lever: N range → D range	Increases by 5–50 steps	
49	A/C compressor clutch relay	Engine: After having warmed up /Engine is idling	A/C switch: OFF	OFF (Compressor clutch is not operating)	Procedure No. 29
			A/C switch: ON	ON (Compressor clutch is operating	

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ACTUATOR TEST REFERENCE TABLE

Item No.	Inspection item	Drive contents	Inspection contents		Normal condition	Inspection procedure No.
01	Injectors	Cut fuel to No. 1 injector	Engine: Warm, idle (Cut the fuel supply to each injector in turn and check cylinders which don't affect idling.)		Idle speed drops equally for each injector	Code No. 41
02		Cut fuel to No. 2 injector				
03		Cut fuel to No. 3 injector				
04		Cut fuel to No. 4 injector				
05		Cut fuel to No. 5 injector				
06		Cut fuel to No. 6 injector				
07	Fuel pump	Fuel pump operates and fuel is recirculated.	• Engine: Cranking • Fuel pump: Activated Inspect according to both the above conditions.	Pinch the return hose with fingers to feel the pulse of the fuel being recirculated.	Pulse is felt.	Procedure No. 24
				Listen near the fuel tank for the sound of fuel pump operation.	Typical electric fuel pump whine.	
08	Purge control solenoid valve	Solenoid valve turns from OFF to ON.	Ignition switch: ON		Clicks when solenoid valve is driven.	Procedure No. 34
10	EGR control solenoid valve	Solenoid valve turns from OFF to ON.	Ignition switch: ON		Clicks when solenoid valve is driven.	Procedure No. 35
17	Basic ignition timing	Set to ignition timing adjustment mode	Engine: Idle Timing light is set		5°BTDC	–
20	Radiator fan (Hi) Condenser fan (Hi)	Drive the fan motors (radiator and condenser).	Ignition switch: ON A/C switch: ON		Fan motor operates at high speed.	Procedure No. 31
21	Radiator fan (Hi) Condenser fan (Low)	Drive the fan motors (radiator and condenser).	Ignition switch: ON A/C switch: ON		Fan motor operates at low speed.	Procedure No. 31
30	Basic idle speed	Set ISC servo to basic step	Engine idle speed		Stepper motor approx. 8 steps	–

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CHECK AT THE ENGINE A/T-ECU TERMINALS

TERMINAL VOLTAGE CHECK CHART

1. Connect a needle-nosed wire probe (paper clip etc.) to a voltmeter probe.
2. Insert the needle-nosed wire probe into each of the Engine A/T-ECU connector terminals from the wire side, and measure the voltage while referring to the check chart.

   NOTE
   1. Measure voltage with the Engine A/T-ECU connectors connected.
   2. You may find it convenient to pull out the Engine A/T-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, Engine A/T-ECU, or all three. Use care to prevent this!
3. If voltmeter shows any deviation from standard value, check the corresponding sensor, actuator and related electrical wiring, then repair or replace.
4. After repair or replacement, recheck with the voltmeter to confirm that the repair has corrected the problem.

Engine A/T-ECU Connector Terminal Arrangement

9FU0393

03AG079N

Terminal No.		Check item	Check condition (Engine condition)	Normal condition
M/T	A/T			
1	1	No. 1 injector	While engine is idling after having warmed up, suddenly depress the accelerator pedal slightly	From 11-14 V momentarily drops
14	9	No. 2 injector		
2	24	No. 3 injector		
15	2	No. 4 injector		
3	10	No. 5 injector		
16	25	No. 6 injector		
4	14	Stepper motor coil<A1>	Engine: Soon after the warmed up engine is started	SV ↔ 0-3V (Changes repeatedly)
17	28	Stepper motor coil<A2>		
5	15	Stepper motor coil<B1>		
18	29	Stepper motor coil<B2>		
8	20	A/C relay	• Engine: Idle speed • A/C switch: OFF → ON (A/C compressor is operating)	SV or momentarily 6V or more → 0.3 V

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Terminal No.		Check item	Check condition (Engine condition)		Normal condition
M/T	A/T				
10	11	Power transistor unit	Engine: 3000 rpm		0.3-3.0 V
12	41	Power supply	Ignition switch: ON		SV
25	47				
19	19	Volume air flow sensor reset signal	Engine: idle speed		0-1V
			Engine:3000 rpm		6-9V
20	17	Fan motor relay (High)	Radiator fan is not operating (Engine coolant temperature is 90°C or less)		SV
			Radiator fan is operating at high speed (Engine coolant temperature is 105°C or more)		0-3V
21	18	Fan motor relay (Low)	Radiator fan is not operating (Engine coolant temperature is 90°C or less)		SV
			Radiator fan is operating at low speed (Engine coolant temperature is 90-105°C)		0-3V
22	21	Fuel Pump relay	Ignition switch: ON		SV
			Engine: idle speed		0-3V
36	22	Engine warning lamp	Ignition switch: OFF → ON		0-3V → 9-13 (after several seconds have elapsed)
37	52	Power steering pressure switch	Engine: Idling after warmed up	When steering wheel is stationary	SV
				When steering wheel is turned	0-3V
38	49	Control relay (Power supply)	Ignition switch: OFF		SV
			Ignition switch: ON		0-3V
45	83	A/C switch	Engine: idle speed	Turn the A/C switch OFF	0-3V
				Turn the A/C switch ON (A/C compressor is operating)	SV
71	58	Ignition switch – ST	Engine: Cranking		8V or more
72	64	Intake air temperature sensor	Ignition switch: ON	When intake air temperature is 0°C	3.2-3.8V
				When intake air temperature is 20°C	2.3-2.9V
				When engine coolant temperature is 40°C	1.5-2.1V
				When engine coolant temperature is 80°C	0.4-1.0V
76	71	Oxygen sensor	Engine: Running at 2500 rpm after warmed up (Check using a digital type voltmeter)		0 ← → 0.8V (Changes repeatedly)
		Variable resistor	Ignition switch: ON		1-4V
80	66	Backup power supply	Ignition switch: OFF		SV
81	48	Sensor impressed voltage	Ignition switch: ON		4.5-5.5V
82	98	Ignition switch – IG	Ignition switch: ON		SV

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Terminal No.		Check item	Check condition (Engine condition)		Normal condition
M/T	A/T				
83	44	Engine coolant temperature sensor	Ignition switch: ON	When engine coolant temperature is 0°C	3.2-3.8V
				When engine coolant temperature is 20°C	2.3-2.9V
				When engine coolant temperature is 40°C	1.3-1.9V
				When engine coolant temperature is 80°C	0.3-0.9V
84	78	Throttle Position sensor	Ignition switch: ON (Check for smooth voltage increase as throttle valve is moved from idle position to wide open throttle)	Idle	0.3-1.0V
				Wide open throttle valve	4.5-5.5V
—	—	Barometric pressure sensor	Ignition switch: ON	When altitude is 0m	3.7-4.3 V
				When altitude is 1200m	3.2-3.8V
86	80	Vehicle speed sensor	• Ignition switch: ON • Move the vehicle slowly forward		0 ← → 5V (Changes repeatedly)
87	79	Idle position switch	Ignition switch: ON	Set throttle valve to idle position	0-1V
				Slightly open throttle valve	4V or more
88	56	Top dead centre sensor	Engine: Cranking		0.4-3.0V
			Engine: idle speed		0.5-2.0V
89	45	Crank angle sensor	Engine: Cranking		0.4-4.0V
			Engine: idle speed		1.5-2.5V
90	65	Volume air flow sensor	Engine: idle speed		2.2-3.2V
			Engine: 2500 rpm		
	59	Inhibitor switch <A/T>	Ignition switch: ON	Set selector lever to P or N	0-3V
				Set selector lever to D, 3, 2, L or R	8-14V

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CHECK CHART FOR RESISTANCE AND CONTINUITY BETWEEN TERMINALS

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

   NOTE
   1. When measuring resistance and checking continuity, a harness for checking contact pin pressure should be used instead of inserting a test probe.
   2. Checks do not have to be carried out in the order given in this chart.

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

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

Engine A/T-ECU Harness Side Connector Terminal Arrangement

Terminal No.		Inspection item	Normal condition (Check condition)
<M/T>	<A/T>		
1-12	1-41	No. 1 injector	13-16 kΩ (At 20°C)
14-12	9-41	No. 2 injector	
2-12	24-41	No. 3 injector	
15-12	2-41	No. 4 injector	
3-12	10-41	No. 5 injector	
16-12	25-41	No. 6 injector	
4-12	14-41	Stepper motor coil<A1>	28-33 Ω (At 20°C)
17-12	28-41	Stepper motor coil<A2>	
5-12	15-41	Stepper motor coil<B1>	
18-12	29-41	Stepper motor coil<B2>	
6-12		EGR control solenoid valve	34-44 Ω (At 20°C)
9-12		Purge control solenoid valve	34-44 Ω (At 20°C)
13-Body ground	42-Body ground	Engine-ECU ground	Continuity (0Ω)
26-Body ground	48-Body ground	Engine-ECU ground	

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Terminal No.		Inspection item	Normal condition (Check condition)
<M/T>	<A/T>		
72-92	64-57	Intake air temperature sensor	5.3-6.7 kΩ (When intake air temperature is 0°C)
			2.3-3.0 kΩ When intake air temperature is 20°C)
			1.0-1.5 kΩ (When intake air temperature is 40°C)
			0.80-0.42 kΩ (When intake air temperature is 80°C)
83-92	44-57	Engine coolant temperature sensor	5.1-6.5 kΩ (When engine coolant temperature is 0°C)
			2.1-2.7 kΩ (When engine coolant temperature is 20°C)
			0.9-1.3 kΩ (When engine coolant temperature is 40°C)
			0.26-0.36 kΩ (When engine coolant temperature is 80°C)
87-92	79-57	Idle position switch	Continuity (When throttle valve is idle position)
			No Continuity (When throttle valve is slightly open)
	59-Body earth	Inhibitor switch <A/T>	No Continuity (When select lever is at P or N)
			Continuity (When select lever is at D, 2, 1 or R)

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INSPECTION PROCEDURE USING AN ANALYSER

AIR FLOW SENSOR

Measurement Method

1. Disconnect the air flow sensor connector, and connect the special tool (test harness: EMB991348) in between. (All terminals should be connected.)
2. Connect the analyser special patterns pickup to volume air flow sensor connector terminal 3.

Alternate method (Test harness not available)

1. Connect the analyser special patterns pickup to Engine-ECU terminal 90.

Standard Wave Pattern

Observation conditions

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

Standard wave pattern

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Observation Conditions (pattern changes with engine speed changes.)

Wave Pattern Observation Points

Check to be sure that cycle time T becomes shorter and the frequency increases when the engine speed is increased.

Examples of Abnormal Wave Patterns

- Example 1

  CAUSE OF PROBLEM

  Sensor interface malfunction

  WAVE PATTERN CHARACTERISTICS

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

- Example 2

  CAUSE OF PROBLEM

  Damaged rectifier or vortex generation column

  WAVE PATTERN CHARACTERISTICS

  Unstable wave pattern with non-uniform frequency. However, when an ignition leak occurs during acceleration, the wave pattern will be distorted temporarily, even if the volume air flow sensor is normal.

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CAMSHAFT POSITION SENSOR AND CRANK ANGLE SENSOR

Measurement Method

1. Disconnect the distributor (camshaft position sensor) connector and connect the special tool (test harness: EMB991348) in between. (All terminals should be connected.)
2. Connect the analyser special patterns pickup to distributor connector terminal 5.
3. Disconnect the crank angle sensor connector and connect the special tool (test harness: E8M21) in between.
4. Connect the analyser special patterns pickup to crank angle sensor connector terminal 2.

Alternate method (Test harness not available)

1. Connect the analyser special patterns pickup to Engine A/T-ECU terminal 88. (When checking the camshaft position sensor signal wave pattern)
2. Connect the analyser special patterns pickup to Engine A/T-ECU terminal 89. (When checking the crank angle sensor signal wave pattern)

Standard Wave Pattern

Observation conditions

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

Standard wave pattern

Wave Pattern Observation Points

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

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Examples of Abnormal Wave Patterns

- Example 1

  CAUSE OF PROBLEM

  Sensor interface malfunction

  WAVE PATTERN CHARACTERISTICS

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

- Example 2

  CAUSE OF PROBLEM

  Loose timing belt
  Abnormality in sensor disk

  WAVE PATTERN CHARACTERISTICS

  Wave pattern jumps to the left or right.

INJECTOR

Measurement Method

1. Disconnect the injector intermediate connector and connect the special tool (test harness: EMB991348) in between.
2. Connect the analyser special patterns pickup to injector intermediate connector terminal 12 to analyse the No.1 cylinder,connection terminal 5 for No.2 cylinder, connection terminal 11 for No.3 cylinder, connection terminal 4 for No.4 cylinder, connection terminal 10 for No.5 cylinder, connection terminal 3 for No.6 cylinder respectively.

Alternate method (Test harness not available)

1. Connect the analyser special patterns pickup to Engine A/T-ECU terminal 1 to analyse the No.1 cylinder, connection terminal 2 to analyse the No.3 cylinder, connection terminal 3 to analyse the No.5 cylinder, connection terminal 14 to analyse the No.2 cylinder, connection terminal 15 to analyse the No.4 cylinder, and connection terminal 16 to analyse No.6 respectively.

Standard Wave Pattern

Observation conditions

Function	Special patterns
Pattern height	Variable
Variable knob	Adjust while viewing the wave pattern
Pattern selector	Display
Engine r/min	Idle

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Standard wave pattern

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 in the injector solenoid

Point B: Injector drive time

- The injector drive time will be synchronised with the MUT-II tester display.
- When the engine is suddenly raced, the drive time will be greatly extended at first, but the drive time will soon match the engine speed.

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ISC STEPPER MOTOR

Measurement Method

1. Disconnect the ISC stepper motor connector, and connect the special tool (test harness: EMB998463) in between.
2. Connect the analyser special patterns pickup to the ISC stepper motor connector terminal 1 (red clip of the special tool), terminal 3 (green clip), terminal 4 (black clip) and terminal 6 (yellow clip) respectively.

Alternate method (Test harness not available)

1. Connect the analyser special patterns pickup to Engine A/T-ECU terminals 4, 5, 17, and 18.(signal wave pattern.)

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 A/C switch to ON.
	Immediately after starting the warm engine (approx. 1 minute).

Standard wave pattern

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Wave Pattern Observation Points

Check that the standard wave pattern appears when the idle air control motor is operating.
Point A: Condition of wave pattern build-up section and maximum voltage (Refer to abnormal wave pattern.)

Contrast with standard wave pattern	Probable cause
Induced electromotive force 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 reverse electromotive force does not appear or is extremely small.	Short in coil

Examples of Abnormal Wave Patterns

- Example 1
  CAUSE OF PROBLEM

  Malfunction of motor (Motor is not operating.)

  WAVE PATTERN CHARACTERISTICS

  Induced electromotive force from the motor turning does not appear.

- Example 2

  CAUSE OF PROBLEM

  Open circuit in the line between the ISC stepper motor and Engine A/T-ECU.

  WAVE PATTERN CHARACTERISTICS

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

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IGNITION COIL AND IGNITION POWER TRANSISTOR

- Ignition coil primary signal
  Refer On Vehicle Service.
- Ignition power transistor control signal

Measurement Method

1. Disconnect the distributor (ignition power transistor) connector, and connect the special tool (test harness: EMB991348) in between. (All terminals should be connected.)
2. Connect the analyser special patterns pickup to distributor connector terminal 5.

Alternate method (Test harness not available)

1. Connect the analyser special patterns pickup to Engine A/T-ECU terminal 10.

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

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Wave Pattern Observation Points

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

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

Examples of Abnormal Wave Patterns

- Example 1
  Wave pattern during engine cranking

  CAUSE OF PROBLEM

  Open-circuit in ignition primary circuit

  WAVE PATTERN CHARACTERISTICS

  Top-right part of the build-up section cannot be seen, and voltage value is approximately 2V too low.

- Example 2
  Wave pattern during engine cranking

  CAUSE OF PROBLEM

  Malfunction in ignition power transistor

  WAVE PATTERN CHARACTERISTICS

  Power voltage results when the ignition power transistor is ON.

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ON-VEHICLE SERVICE

THROTTLE BODY (THROTTLE VALVE AREA) CLEANING

1. Start the engine and warm it up until the coolant is heated to 80°C or higher and then stop the engine.
2. Remove the air intake hose from the throttle body.

3. Plug the bypass passage inlet (arrow) of the throttle body.

   Caution
   Do not allow cleaning solvent to enter the bypass passage.
4. Spray cleaning solvent into the valve through the throttle body intake port and leave it for about 5 minutes.
5. Start the engine, race it several times and idle it for about 1 minute. If the idling speed becomes unstable (or if the engine stalls) due to the bypass passage being plugged, slightly open the throttle valve to keep the engine running.
6. If the throttle valve deposits are not removed, repeat steps 4 and 5.
7. Unplug the bypass passage inlet.
8. Attach the air intake hose.
9. Use the MUT-II to erase the diagnosis trouble code.
10. Adjust the basic idle speed. (Refer On Vehicle Service.)

    NOTE
    If the engine hunts while idling after adjustment of the basic idle speed, disconnect the (–) cable from the battery for 10 seconds or more, and then reconnect it and run the engine at idle for about 10 minutes.

CLOSED THROTTLE POSITION SWITCH AND THROTTLE POSITION SENSOR ADJUSTMENT <Vehicles without TCL>

1. Connect the MUT-II to the data link connector. When not using the MUT-II, 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.

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2. Insert a feeler gauge with a thickness of 1.4 mm between the levers shown in the illustration to a depth of no more than 3 mm

   NOTE: Inserting the feeler gauge more than 3mm will result in incorrect adjustment.

3. When using the MUT-II, turn the ignition switch ON. (Engine does not start.)

4. Loosen the throttle position sensor mounting bolt; then turn the throttle position sensor body fully counter 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 MUT-II, proceed as follows:
   (1) Connect the special tool (test harness set) between the throttle position sensor connectors which have been disconnected. (Connect all terminals taking care not to mistake the terminal No.)
   (2) Connect a digital voltmeter between the throttle position sensor terminal 1 (sensor ground) and terminal 3 (sensor output.)
   (3) Turn the ignition switch ON (but do not start the engine).

8. Check the throttle position sensor output voltage.

   Standard value: 400–1,000 mV

9. If there is a deviation from the standard value, check the throttle position sensor and the related harness.
10. Remove the feeler gauge.
11. Switch OFF the ignition switch.

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THROTTLE POSITION SENSOR ADJUSTMENT <Vehicles with TCL>

1. Connect the MUT-II to the data link connector. When not using the MUT-II, proceed as follows.
   (1) Disconnect the connector of the throttle position sensor and connect the special tool (test harness: EMB991348) in between.
   (2) Connect a digital voltmeter between terminal 3 (sensor output) and terminal 1 (sensor ground).
2. Turn the ignition switch to ON (but do not start the engine).
3. Check the throttle position sensor output voltage.

   Standard value: 580–690 mV

4. If the voltage is outside the standard value, adjust by loosening the throttle position sensor mounting bolts and turning the throttle position sensor body. After adjusting, tighten the bolts securely.
5. Turn the ignition switch to OFF.
6. If a diagnosis trouble code is output while adjusting the throttle position sensor, use the MUT-II to erase the diagnosis trouble code, or disconnect the battery negative cable from the battery terminal for 10 seconds or more, and then reconnect the cable and run the engine at idle speed for approx. 10 minutes.

CLOSED THROTTLE POSITION SWITCH AND ACCELERATOR PEDAL POSITION SENSOR ADJUSTMENT <Vehicles with TCL>

1. Connect the MUT-II to the data link connector. When not using the MUT-II, proceed as follows.
   (1) Disconnect the connector of the accelerator pedal position sensor.

   (2) Connect an ohmmeter between terminal 3 (closed throttle position switch) and terminal 4 (sensor ground) by using jumper wires.

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2. Insert a feeler gauge with a thickness of 0.85 mm between the levers shown in the illustration to a depth of no more than 3 mm

   NOTE: Inserting the feeler gauge more than 3mm will result in incorrect adjustment.
3. Turn the ignition switch to ON (but do not start the engine).

4. Loosen the accelerator pedal position sensor mounting bolt; then turn the accelerator pedal position sensor body counter clockwise as far as it will go.
5. In this condition, make sure that the closed throttle position switch is ON. (There is continuity between terminals 3 and 4.)
6. Slowly turn the accelerator pedal position sensor clockwise until the point at which the closed throttle position switch is turned OFF (continuity between terminals 1 and 2 changes to non-continuity) is found.
   Tighten the accelerator pedal position sensor installation bolt at that position.

7. When using the MUT-II, select “Traction Control System”. When not using the MUT-II, proceed as follows.
   (1) Disconnect the accelerator pedal position sensor connector and connect the special tool (test harness: EMB991348) in between.
   (2) Connect a digital voltmeter between terminal 2 (sensor output) and terminal 4 (sensor ground).
   (3) Turn the ignition switch to ON (but do not start the engine.
8. Check the accelerator pedal position sensor output voltage.

   Standard value: 400–1,000 mV
9. If the voltage is outside the standard value, check the accelerator pedal position sensor and related harnesses.
10. Remove the feeler gauge.
11. Turn the ignition switch to OFF.
12. Disconnect the MUT-II.
    When the MUT-II is not used, remove the special tool and connect the accelerator pedal position sensor.

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FIXED SAS ADJUSTMENT

NOTE
1. The fixed SAS should not be moved unnecessarily; it has been precisely adjusted by the manufacturer.
2. If the adjustment is disturbed for any reason, readjust as follows.

1. Loosen the tension of the accelerator cable sufficiently.
2. Back out the fixed SAS lock nut.
3. Turn the fixed SAS anti-clockwise until it is sufficiently backed out, and fully close the throttle valve.
4. Turn the fixed SAS clockwise until the throttle lever is touched (i.e., the point at which the throttle valve begins to open).
   From that point, turn the fixed SAS clockwise another 1-1/4 turn.
5. While holding the fixed SAS so that it doesn't move, tighten the lock nut securely.
6. Adjust the tension of the accelerator cable.
7. Adjust the basic idle speed.
8. Adjust the closed throttle position switch and the throttle position sensor <vehicles without TCL>, throttle position sensor <vehicles with TCL>, closed throttle position switch and accelerator pedal position sensor <vehicles with TCL>.

BASIC IDLE SPEED ADJUSTMENT

NOTE
1. The standard idle speed has been adjusted, by the engine speed adjusting screw, by the manufacturer, and there should usually be no need for readjustment.
2. The adjustment, if made, should be made after first confirming that the spark plugs, the injectors, the ISC servo, the compression pressure, etc., are all normal.

1. The vehicle should be set in the pre-adjustment condition before inspection and adjustment.
2. Connect the MUT-II to the data link connector (16-pin)

   NOTE
   When the MUT-II is connected, the diagnosis control terminal should be grounded.
3. Start the engine and run at idle.
4. Select item No. 30 of the **MUT-II** Actuator Test.

   NOTE
   This holds the ISC servo at the basic step to adjust the basic idle speed.
5. Check the idle speed.

   Standard value: 700 ± 100 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 or less], but no adjustment is necessary.
   2. If the engine stalls or the rpm is low even though the vehicle has been driven approximately 500 km or more, it is probable that deposits are adhered to the throttle valve, so clean it. (Refer On Vehicle Service.)

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6. If not within the standard value range, turn the engine speed adjusting screw to make the necessary adjustment.

   NOTE
   If the idling speed is higher than the standard value range even when the engine speed adjusting screw is fully closed, check whether or not there is any indication that the fixed SAS has been moved. If there is an indication that it has been moved, adjust the fixed SAS.

7. Press the clear key and release the ISC servo from the ACTUATOR TEST mode.

   NOTE
   Unless the ISC servo is released, the ACTUATOR TEST mode will continue 27 minutes.

8. Switch OFF the ignition switch.
9. Disconnect the MUT-II.
10. Start the engine again and let it run at idle speed for about 10 minutes; check that the idling condition is normal.

FUEL PRESSURE TEST

1. Release residual pressure from the fuel line to prevent fuel spray. (Refer On Vehicle Service.)
2. Disconnect the fuel high pressure hose at the fuel rail side.

   Caution
   Cover the hose connection with rags to prevent splash of fuel that could be caused by some residual pressure in the fuel pipe line.

3. Remove the union joint and bolt from the special tool (adaptor hose MD998709) and instead attach the special tool (hose adaptor MD998742) to the adaptor hose.
4. Install a fuel pressure gauge on the adaptor hose that was set up in step 3.
   Use a suitable O-ring or gasket between the fuel pressure gauge and the special tool so as to seal in order to prevent fuel leakage at this time.

5. Install the special tool, which was assembled in steps 3 and 4 between the fuel rail and the high pressure hose.

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6. Use the MUT-II to operate the fuel pump. Check the connections between the fuel pressure gauge and the special tool for leaks.
7. Start the engine and run at idle.

8. Measure fuel pressure while the engine is running at idle.

   Standard value:
   Approx. 270 kPa at curb idle

9. Disconnect and plug the vacuum hose from the fuel pressure regulator and measure fuel pressure with the hose end closed by a finger.

   Standard value:
   330–350 kPa at curb idle
10. Check to see that fuel pressure at idle does not drop even after the engine has been raced several times.
11. Racing the engine repeatedly, hold the fuel return hose lightly with fingers to feel that fuel pressure is present in the return hose.

    NOTE
    If the fuel flow rate is low, there will be no fuel pressure in the return hose.
12. If any of fuel pressure measured in steps 8 to 11 is out of specification, troubleshoot and repair according to the table below.

Symptom	Probable cause	Remedy
● Fuel pressure too low ● Fuel pressure drops after racing ● No fuel pressure in fuel return hose	Clogged fuel filter	Replace fuel filter
	Fuel leaking to return side due to poor fuel regulator valve seating or settled spring	Replace fuel pressure regulator
	Low fuel pump delivery pressure	Replace fuel pump
Fuel pressure too high	Binding valve in fuel pressure regulator	Replace fuel pressure regulator
	Clogged fuel return hose or pipe	Clean or replace hose or pipe
Same fuel pressure when vacuum hose is connected and when disconnected	Damaged vacuum hose or clogged nipple	Replace vacuum hose or clean nipple

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

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

14. Release residual pressure from the fuel pipe line. (Refer On Vehicle Service.)
15. Remove the fuel pressure gauge and special tool from the fuel rail.

    Caution
    Cover the hose connection with rags to prevent splash of fuel that could be caused by some residual pressure in the fuel pipe line.

16. Replace the O-ring at the end of the fuel high pressure hose with a new one.
17. Fit the fuel high pressure hose into the fuel rail and tighten the bolts to specified torque.

    Tightening torque: 5 Nm

18. Check for fuel leaks.
    (1) Use the MUT-II to operate the fuel pump.
    (2) Check the fuel line for leaks, repair as needed.

FUEL PUMP CONNECTOR DISCONNECTION (HOW TO REDUCE PRESSURISED FUEL LINES)

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

<SEDAN>

1. Remove the rear seat cushion. (Refer Rear seat cushion removal and installation.)
2. Remove the fuel pump/fuel gauge floor cover plate and disconnect the wiring connector at the fuel pump/gauge assembly.
3. Start the engine and let it run until it stops naturally, turn the ignition switch to OFF.
4. Re-connect the fuel pump/gauge wiring harness connector.
5. Install the rear seat cushion.

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Fuel pump connector

<WAGON>

1. Disconnect the wiring connector at the left front corner of the fuel tank.
2. Start the engine and let it run until it stops naturally, turn the ignition switch to OFF.
3. Re-connect the fuel pump/gauge wiring harness connector.

FUEL PUMP OPERATION CHECK

1. Check the operation of the fuel pump by using the MUT-II to force-drive the fuel pump.

   NOTE
   As the fuel pump is an in-tank type, the fuel pump sound is hard to hear, so remove the fuel tank filler tube cap and check from the tank inlet.

   NOTE
   Check the fuel pressure by pinching the fuel hose with the fingertips.

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INSPECTION OF MPI COMPONENTS

COMPONENT LOCATION

Name	Symbol	Name	Symbol
Accelerator pedal position sensor	F	Ignition coil and ignition power transistor <in distributor>	P
Air conditioning compressor clutch relay	J	Inhibitor switch	O
Air conditioner switch	R	Injector	L
Air flow sensor (with built-in intake air temperature sensor and barometric pressure sensor)	I	Multipoint fuel injection (MPI) relay/Fuel pump relay	U
Camshaft position sensor <in distributor>	Q	Oxygen sensor	B
Crank angle sensor	K	Power steering pressure switch	A
Data link connector	V	Purge control solenoid valve	C
EGR control solenoid valve	D	Throttle position sensor (with built-in closed throttle position switch)	E
Engine coolant temperature sensor	M	Vacuum control solenoid <Vehicles with TCL>	H
Engine A/T-ECU	T	Ventilation control solenoid valve <Vehicles with TCL>	H
Engine warning lamp (check engine lamp)	S	Vehicle speed sensor	N
Idle speed control servo	G		

NOTE
The 'Name" column is arranged in alphabetical order.

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MPI CONTROL RELAY AND FUEL PUMP RELAY CONTINUITY CHECK

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

INTAKE AIR TEMPERATURE SENSOR CHECK

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

Temperature [°C]	Resistance (kΩ)
0	5.3–6.7
20	2.3–3.0
80	0.30–0.42

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

Temperature	Resistance
Higher	Smaller

4. If resistance does not decrease as heat increases, replace the volume air flow sensor assembly.

ENGINE COOLANT TEMPERATURE SENSOR CHECK

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

1. Remove engine coolant temperature sensor from the intake manifold.

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

Temperature [°C]	Resistance (kΩ)
0	5.1–6.5
20	2.1–2.7
40	0.9–1.3
80	0.26–0.36

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

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4. Apply sealant threaded portion.

   Specified sealant:
   Loctite 577 or equivalent

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

   Sensor tightening torque: 30 Nm

6. Fasten harness connectors securely.

THROTTLE POSITION SENSOR CHECK

1. Disconnect the throttle position sensor connector.
2. Measure the resistance between the throttle position sensor side connector terminal 1 and terminal 4.

   Standard value: 3.5–6.5 kΩ

3. Measure the resistance between the throttle position sensor side connector terminal 3 and terminal 4.

Normal Condition:

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

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

NOTE: For the throttle position sensor adjustment procedure, refer to <Vehicles without TCL>, <Vehicles with TCL>.

ACCELERATOR PEDAL POSITION SENSOR CHECK (Vehicles with TCL)

1. Disconnect the accelerator pedal position sensor connector.
2. Measure the resistance between the accelerator pedal position sensor side connector terminal 1 and terminal 4.

   Standard value: 3.5–6.5 kΩ

3. Measure the resistance between the accelerator pedal position sensor side connector terminal 1 and terminal 2.

   Normal Condition:

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

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

NOTE: For the accelerator pedal position sensor adjustment procedure, refer On Vehicle Service.

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CLOSED THROTTLE POSITION SWITCH CHECK <Vehicles without TCL>

1. Disconnect the throttle position sensor connector.
2. Check the continuity between the throttle position sensor connector side terminal 1 and terminal 2.

Accelerator pedal	Continuity
Depressed	Non-conductive
Released	Conductive (0 Ω)

3. If out of specification, replace the throttle position sensor.

NOTE: After replacement, the closed throttle position switch and throttle position sensor should be adjusted. (Refer On Vehicle Service.)

CLOSED THROTTLE POSITION SWITCH CHECK (Vehicles with TCL)

1. Disconnect the accelerator pedal position sensor connector.
2. Check the continuity between the accelerator pedal position sensor connector side terminal 3 and terminal 4.

Normal Condition:

Accelerator pedal	Continuity
Depressed	Non-conductive(∞ Ω)
Released	Conductive (0 Ω)

3. If out of specification, replace the accelerator pedal position sensor.

NOTE: After replacement, the closed throttle position switch and accelerator pedal position switch should be adjusted. (Refer On Vehicle Service.)

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OXYGEN SENSOR CHECK

1. Disconnect the oxygen sensor connector and connect the special tool (test harness) to the connector on the oxygen sensor side.
2. Make sure that there is continuity [7–40 Ω at 20°C] between terminal 3 and terminal 4 on the heated oxygen sensor connector.
3. If there is no continuity, replace the heated oxygen sensor.
4. Warm up the engine until engine coolant is 80°C or higher.
5. Use the jumper wires to connect terminal 3 of the heated oxygen sensor connector to the battery (+) terminal and terminal 4 to the battery (–) terminal.

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

6. Connect a digital voltage meter between terminal 1 and terminal 2.
7. While repeatedly racing the engine, measure the heated oxygen sensor output voltage.

   Standard value:

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

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

   NOTE
   For removal and installation of the heated oxygen sensor, refer On Vehicle Service.

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INJECTOR CHECK

Measurement of Resistance between Terminals

1. Remove the injector connector.
2. Measure the resistance between terminals.

   Standard value: 13–16 Ω [at 20°C]

3. Install the injector connector

Checking operation sound

Using a stethoscope or long blade screwdriver, check the operation sound ("chi-chi-chi") of injectors during idling or during cranking
Check that as the engine speed increases, the frequency of the operating sound also increases.

Caution
Note that even if the injector you are checking is not operating, you will hear the operating sound of the other injectors.

NOTE
If no operating sound is heard from the injector that is being checked, check the injector drive circuit. If there is nothing wrong with the circuit, a defective injector or Engine A/T-ECU is suspected

IDLE SPEED CONTROL (ISC) SERVO (STEPPER MOTOR) CHECK

Use a stethoscope or long blade screwdriver to check if the sound of the idle air control motor operating can be heard immediately after the ignition switch is turned to "ON".

NOTE
If the motor operation cannot be heard, check the motor drive circuit and the idle air control motor.

CHECKING COIL RESISTANCE AND OPERATION

PURGE CONTROL SOLENOID VALVE CHECK

<Evaporative emission purge solenoid>

Refer Emission Control System.

EGR CONTROL SOLENOID VALVE CHECK

Refer Emission Control System.

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VENTILATION CONTROL SOLENOID VALVE CHECK <Vehicles with TCL>

NOTE: When disconnecting the vacuum hose, always make a mark so that it can be reconnected at original position.

1. Disconnect the vacuum hose (green stripe) from the solenoid valve.
2. Disconnect the harness connector.

3. Connect a hand vacuum pump to the nipple.
4. Check air-tightness by applying a vacuum with voltage applied directly from the battery to the solenoid valve and without applying voltage.

Normal condition:

Battery voltage	Normal condition
Applied	Vacuum maintained
Not applied	Vacuum leaks

5. Measure the resistance between the terminals of the solenoid valve.

Standard value: 36–44 Ω [at 20°C]

VACUUM CONTROL SOLENOID VALVE CHECK <Vehicles with TCL>

NOTE: When disconnecting the vacuum hose, always make a mark so that it can be reconnected at original position.

1. Disconnect the vacuum hose (blue stripe, green stripe) from the solenoid valve.
2. Disconnect the harness connector.

3. Connect a hand vacuum pump to the nipple to which the blue-striped vacuum hose was connected.
4. Check air-tightness by applying a vacuum with voltage applied directly from the battery to the solenoid valve and without applying voltage.

Battery voltage	Normal condition
Applied	Vacuum leaks
Not applied	Vacuum maintained

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5. Measure the resistance between the terminals of the solenoid valve.

   Standard value: 36–44 Ω [at 20°C]

VACUUM TANK CHECK <Vehicles with TCL>

1. Connect a hand vacuum pump to vacuum tank A nipple, apply 67 kPa of vacuum and check that the vacuum is held.
2. Connect a hand vacuum pump to vacuum tank B nipple.
3. First, close A nipple with your finger and apply 67 kPa of vacuum. Then, check that vacuum leaks immediately when you remove the finger blocking the nipple.

VACUUM ACTUATOR CHECK <Vehicles with TCL>

1. Remove the vacuum hose (green stripe) from the vacuum actuator and connect a hand vacuum pump to the vacuum actuator.
2. With the accelerator pedal depressed, check that the rod is pulled up and that vacuum is held when 27 kPa of vacuum is applied.

THROTTLE VALVE OPERATION CHECK <Vehicles with TCL>

1. Check that the throttle valve opens and closes smoothly (throttle lever moves)according to the opening and closing of the accelerator lever.
2. If the throttle valve does not open and close smoothly, there might be a deposit on the throttle valve, so clean the throttle body. (Refer On Vehicle Service.)

NEGATIVE PRESSURE CHECK DURING TRACTION CONTROL OPERATION <Vehicles with TCL>

1. Disconnect the vacuum hose (green stripe) from the vacuum actuator, connect a hand vacuum pump between the actuator nipple and the vacuum hose via a T-joint. Set the hand vacuum pump near the driver's seat so that the negative pressure check can be carried out at the driver's seat.

2. Check the negative pressure during traction control operation.
   Inspection service points are the same as for the traction control operation inspection.
   (Refer On Vehicle Service Group 13H.)

   Normal condition:

Vehicle condition	Normal negative pressure when accelerator pedal is depressed
Vehicle is lifted up	20 kPa or more
Driving on a dry, sealed road surface	No change

NOTE: The traction control system function will stop 20 seconds after the accelerator pedal has been depressed, and negative pressure will gradually drop.

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INJECTOR

REMOVAL AND INSTALLATION

Pre-removal Operation
(1) Fuel Discharge Prevention (Refer On Vehicle Service.)

Post-installation Operation
(1) Accelerator Cable Adjustment (Refer On Vehicle Service.)
(2) Fuel Leakage Inspection

Engine oil

Removal steps

1. Surge tank (Refer Group15.)
2. Injector connectors
3. Vacuum hose connection
4. Fuel return hose connection
5. ▶B◀ Fuel pressure regulator
6. ▶C◀ High-pressure fuel hose connection
7. Fuel pipe
8. ◀A▶ Fuel rail
9. Insulators
10. Insulators
11. ◀A▶ ▶A◀ Injectors
12. Grommet

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REMOVAL SERVICE POINT

◀A▶ FUEL RAIL/INJECTOR REMOVAL

Remove the fuel rail (with the injectors attached to it.)

Caution
Care must be taken, when removing the fuel rail, not to drop the injector.

INSTALLATION SERVICE POINTS

▶A◀ INJECTOR INSTALLATION

1. Apply a drop of new engine oil to the O-ring.

   Caution
   Be sure not to let engine oil in the fuel rail.

2. While turning the injector to the left and right, install it to the fuel rail.
3. Check to be sure that the injector turns smoothly.
   If it does not turn smoothly, the O-ring may be trapped, remove the injector and then re-insert it into the fuel rail and check once again.

▶B◀ FUEL PRESSURE REGULATOR INSTALLATION

1. When connecting the fuel-pressure regulator to the fuel rail, apply a drop of new engine oil to the O-ring, and then insert, being careful not to damage the O-ring.

   Caution
   Be sure not to let engine oil in the fuel rail.

2. Check to be sure that the fuel pressure regulator turns smoothly.
   If it does not turn smoothly, the O-ring may be trapped, remove the fuel pressure regulator and then re-insert it into the fuel rail and check once again.
3. Tighten the bolts to the specified torque.

   Specified tightening torque : 9 Nm

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▶C◀ HIGH-PRESSURE FUEL HOSE INSTALLATION

1. When connecting the high-pressure fuel hose to the fuel rail, apply a drop of new engine oil to the O-ring, and then insert, being careful not to damage the O-ring.

   Caution
   Be sure not to let engine oil in the fuel rail.
2. Check to be sure that the high-pressure fuel hose turns smoothly.
   If it does not turn smoothly, the O-ring may be trapped. Remove the high-pressure fuel hose and then re-insert it into the fuel rail and check once again.
3. Tighten the bolts to the specified torque.

   Specified tightening torque : 5Nm

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THROTTLE BODY

REMOVAL AND INSTALLATION
<Vehicles without traction control, with cruise control>

Pre-removal Operation
- Coolant Draining
  (Refer Engine Coolant Replacement.)

Post-installation Operation
(1) Coolant Supplying
  (Refer Engine Coolant Replacement.)
(2) Accelerator Cable Adjustment (Refer On Vehicle Service.)

Removal steps

1. Accelerator cable connection
2. Air intake hose
3. Heater hose connection
4. Vacuum hose connection
5. Throttle position sensor connector
6. Idle speed control servo connector
7. Throttle body
8. ▶A◀ Gasket

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<Vehicles with traction control and cruise control>

Pre-removal Operation
- Coolant Draining
  (Refer Engine Coolant Replacement.)

Post-installation Operation
(1) Coolant Supplying
(Refer Engine Coolant Replacement.)
(2) Accelerator Cable Adjustment (Refer On Vehicle Service.)

REMOVAL STEPS

1. Accelerator cable connection
2. Accelerator pedal position sensor connector
3. Air intake hose
4. Heater hose connection
5. Vacuum hose connection
6. Throttle position sensor connector
7. Idle speed control motor connector
8. Throttle body
9. ▶A◀ Gasket

INSTALLATION SERVICE POINT

▶A◀ GASKET INSTALLATION

Install the gasket so that the projection is where shown in the illustration.

Caution
Poor idling etc. may result if the gasket is installed incorrectly.

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DISASSEMBLY AND REASSEMBLY
<Vehicles without traction control, with cruise control>

DISASSEMBLY STEPS

▶B◀ 1. Throttle position sensor
2. Lever assembly
3. Idle air control motor
4. O-ring
5. Idle speed control body servo
6. Gasket
7. Throttle body
8. Fixed SAS
9. Cap
10. Speed adjusting screw
11. O-ring

NOTE
1. The fixed SAS is 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. (refer .On Vehicle Service.)

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<Vehicles with traction control, and cruise control>

DISASSEMBLY STEPS

▶B◀ 1. Throttle position sensor
▶A◀ 2. Accelerator pedal position sensor
3. Lever assembly
4. Idle air control motor
5. O–ring
6. Water hose
7. Idle speed control body assembly
8. Gasket
9. Throttle body
10. Fixed SAS
11. Cap
12. Speed adjusting screw
13. O–ring

NOTE
1. The fixed SAS is 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. (refer On Vehicle Service.)

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CLEANING THROTTLE BODY PARTS

1. Clean all throttle body parts.
   Do not use solvents to clean the following parts:
   - Throttle position sensor
   - Accelerator pedal position sensor
   - Idle speed control body assembly

   If these parts are immersed in solvent, their insulation will deteriorate.
   Wipe them with a cloth only.
2. Check if the vacuum port or passage is clogged. Use compressed air to clean the vacuum passage.

REASSEMBLY SERVICE POINT

▶A◀ ACCELERATOR PEDAL POSITION SENSOR(APS) INSTALLATION

1. Install the APS so that it faces as shown in the illustration, and then tighten it with the screw.
2. Connect a multimeter between terminal 1 (APS power supply) and terminal 2 (APS output) of the APS connector, and check that the resistance increases gradually as the throttle valve is opened slowly to the fully open position.

3. Check the continuity between terminal 3 (closed throttle position switch) and terminal 4 (ground) of the APS connector when the throttle valve is fully closed and fully open.

   Normal condition:

Throttle valve condition	Continuity
Fully closed	Continuity
Fully open	No continuity

   If there is no continuity when the throttle valve is fully closed, turn the APS body anti-clockwise and then check again.
4. If there is an abnormality, replace the APS.

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▶B◀ THROTTLE POSITION SENSOR (TPS) INSTALLATION

1. Install the TPS so that it faces as shown in the illustration, and then tighten it with the screw.
2. Connect a multimeter between terminal 4 (TPS power supply) and terminal 3 (TPS output) of the TPS connector, and check that the resistance increases gradually as the throttle valve is opened slowly to the fully open position.

3. For vehicles without TCL, check the continuity between terminal 2 (closed throttle position switch) and terminal 1 (ground) of the TPS connector when the throttle valve is fully closed and fully open.

   Normal condition:

Throttle valve condition	Continuity
Fully closed	Continuity
Fully open	No continuity

   If there is no continuity when the throttle valve is fully closed, turn the TPS body anti-clockwise and then check again.
4. If there is an abnormality, replace the TPS.

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IDLE SPEED CONTROL (ISC) SERVO (STEPPER MOTOR)
CHECKING THE COIL RESISTANCE

1. Disconnect the idle speed control motor connector and connect the Special Tool (test harness).
2. Measure the resistance between terminal 2 (white clip of the special tool) and either terminal 1 (red clip) or terminal 3 (blue clip) of the connector at the idle speed control servo side.

   Standard value: 28 - 33 Ω @ 20°C
3. Measure the resistance between terminal 5 (green clip of the special tool) and either terminal 6 (yellow clip) or terminal 4 (black clip) of the connector at the idle speed control servo side.

   Standard value: 28 - 33 Ω @ 20°C

OPERATIONAL CHECK

1. Remove the throttle body.
2. Remove the stepper motor.
3. Connect the special tool (test harness) to the idle speed control servo connector.
4. Connect the positive (+) terminal of a power supply (approx. 6 volts) to the white clip and the green clip.
5. With the idle speed control servo as shown in the illustration, connect the negative (–) terminal of the power supply to each clip as descibed in the following steps, and check whether or not a vibrating feeling (a feeling of very slight vibration of the stepper motor) is generated as a result of the activation of the stepper motor.
   1. Connect the negative (–) terminal of the power supply to the red and black clips.
   2. Connect the negative (–) terminal of the power supply to the blue and black clips.
   3. Connect the negative (–) terminal of the power supply to the blue and yellow clips.
   4. Connect the negative (–) terminal of the power supply to the red and yellow clips.
   5. Connect the negative (–) terminal of the power supply to the red and black clips.
   6. Repeat the tests in sequence from steps 5 to 1.
6. If, as a result of these tests, vibration is detected, the stepper motor can be considered normal.

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TROUBLESHOOTING

INSPECTION CHART FOR DIAGNOSIS

Code No.	Diagnosis Item
12	Air flow sensor system
13	Intake air temperature sensor system
14	Throttle position sensor system
21	Engine coolant temperature sensor system
22	Crank angle sensor system
23	Top dead centre sensor system
24	Vehicle speed sensor system
25	Barometric pressure sensor system
41	Injector system
44	Ignition coil and power transistor unit system
54	Immobiliser system
61	Communication with A/T-ECU system <A/T>
72	Vacum control solenoid valve system <vehicles with traction control>
73	Ventilation control solenoid valve system <vehicles with traction control>

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Code No. 12 Air flow sensor system	Probable cause
Range of Check ● Engine speed is 500 rpm or more Set conditions ● Sensor output frequency is 3 Hz or less for 4 seconds.	● Malfunction of the air flow sensor ● Improper connector contact, open circuit or short-circuited harness wire ● Malfunction of the Engine-ECU

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Code No. 13 Intake air temperature sensor system	Probable cause
Range of Check ● Ignition switch: ON ● Excluding 60 seconds after the ignition is turned to ON or immediately after the engine starts. Set conditions ● Sensor output voltage is 4.6 V or more (corresponding to an intake air temperature of -45°C or less) for 4 seconds. or ● Sensor output voltage is 0.2 V or more (corresponding to an intake air temperature of -125°C or more) for 4 seconds.	● Malfunction of the intake air temperature sensor ● Improper connector contact, open circuit or short-circuited harness wire of the intake air temperature sensor circuit ● Malfunction of the Engine-ECU

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

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Code No. 21 Engine coolant temperature sensor system	Probable cause
Range of Check ● Ignition switch: ON ● Excluding 60 seconds after the ignition is turned to ON or immediately after the engine starts. Set conditions ● Sensor output voltage is 4.6 V or more (corresponding to an engine coolant temperature of -45°C or less) for 4 seconds or ● Sensor output voltage is 0.1 V or more (corresponding to an engine coolant temperature of 140°C or more) for 4 seconds.	● Malfunction of the engine coolant temperature sensor ● Improper connector contact, open circuit or short-circuited harness wire of the intake air temperature sensor circuit ● Malfunction of the Engine-ECU sensor
Range of Check ● Ignition switch: ON ● Engine speed is approx. 50 rpm or more Set conditions ● Sensor output voltage increases from 1.6 V or less (corresponding to an engine coolant temperature of -40°C or less) to 1.6 V or more (corresponding to an engine coolant temperature of -40°C or less) ● After this, the sensor output voltage is 1.6 V or more for 5 minutes.	

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

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Code No. 23 Camshaft position sensor system	Probable cause
Range of Check ● Ignition Switch: ON ● Engine speed is approx. 50 rpm or more. Set conditions ● Sensor output voltage does not change for 4 seconds (no pulse signal input).	● Malfunction of the crank angle sensor ● Improper connector contact, open circuit or short-circuited harness wire of the camshaft position sensor circuit. ● Malfunction of the Engine-ECU

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Code No. 24 Vehicle speed sensor system	Probable cause
Range of Check ● Ignition Switch: ON ● Excluding 60 seconds after the ignition switch is turned to ON or immediately after the engine starts. ● Idle position switch: OFF ● Engine speed is approx. 50 rpm or more. ● Driving under high engine load. Set conditions ● Sensor output voltage does not change for 4 seconds (no pulse signal input).	● Malfunction of the vehicle speed sensor ● Improper connector contact, open circuit or short-circuited harness wire of the vehicle speed sensor circuit. ● Malfunction of the Engine-ECU

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

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Code No. 41 Injector system	Probable cause
Range of Check ● Engine speed is approx. 50-1000 rpm ● Throttle position sensor output voltage is 1.15 Volts or less. ● Actuator test by MUT-II is not carried out. Set conditions ● Surge voltage of injector coil is not detected for 4 seconds.	● Short circuit to earth of the diagnosis control line. ● Improper connector contact, open circuit or short-circuited harness wire of the injector circuit ● Malfunction of the Engine-ECU

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Code No. 44 Ignition coil and power transistor unit system	Probable cause
Range of Check ● Engine speed is approx. 50-4000 rpm ● Engine is not cranking. Set conditions ● The ignition signal from the same coil is not input for 4 seconds. However, this excludes cases where no ignition signal is input from any coils.	● Malfunction of the ignition coil. ● Improper connector contact, open circuit or short-circuited harness wire of the ignition primary circuit ● Malfunction of the power transistor unit ● Malfunction of the Engine-ECU

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Code No. 54 Immobiliser system	Probable cause
Range of Check ● Ignition Switch: ON Set conditions ● Failure to communicate between engine ECU and immobiliser ECU.	● Confusion in ID code ● Nonmatching of ID code ● Malfunction of immobiliser ECU ● Malfunction of harness or connector ● Malfunction of the Engine-ECU

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Code No. 61 Communication with Engine-A/T-ECU System <A/T>	Probable cause
Range of Check ● For a period of 60 sec or longer immediately after completing startup ● Engine revolutions approximately 50 rpm or faster Set Conditions ● The signal from the Engine-A/T ECU requesting torque reduction has been continuously input for about 5 sec or longer	● Engine-A/T ECU fault ● Harness or connector fault

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Code No. 72 Vacuum Control Solenoid Valve System <Vehicles with TCL>	Probable cause
Background ● The Engine-A/T ECU checks current flow in the vacuum control solenoid circuit when the solenoid is ON and OFF. **Check Area, Judgement Criteria** **Check Area** ● Ignition switch: ON. ● 60 sec or more have passed after the ignition switch was turned on or the starting sequence was completed. ● Battery voltage is 10 V or more. ● Forced actuation by means of the MUT–II is not being carried out. **Judgement Criteria** ● Solenoid coil surge voltage (system voltage +2V) is not detected when the solenoid valve is turned ON/OFF.	● Malfunction of the vacuum control solenoid valve ● Improper connector contact, open circuit or short-circuited harness wire of the vacuum control solenoid valve ● Engine-A/T ECU failed

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Code No. 73 Ventilation Control Solenoid Valve System <Vehicles with TCL>	Probable cause
Background ● The Engine-A/T ECU checks current flow in the ventilation control solenoid circuit when the solenoid is ON and OFF. **Check Area, Judgement Criteria** **Check Area** ● Ignition switch: ON. ● 60 sec or more have passed after the ignition switch was turned on or the starting sequence was completed. ● Battery voltage is 10 V or more. ● Forced actuation by means of the MUT–II is not being carried out. **Judgement Criteria** ● Solenoid coil surge voltage (system voltage +2V) is not detected when the solenoid valve is turned ON/OFF.	● Malfunction of the ventilation control solenoid valve ● Improper connector contact, open circuit or short-circuited harness wire of the ventilation control solenoid valve ● Engine-A/T ECU failed

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INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble symptom		Inspection procedure No.
Communication with MUT-II is impossible.	Communication with all systems is not possible.	1
	Communication with Engine-ECU only is not possible.	2
Check engine/ malfunction indicator lamp and related parts	The engine warning lamp does not illuminate right after the ignition switch is turned to the ON position.	3
	The engine warning lamp remains illuminated and never goes out.	4
Starting	Cranks, won't start	5
	Fires up and dies	6
	Hard starting	7
Idling stability (Improper idling)	Unstable idle. (Rough idle, hunting)	8
	Idle speed is high. (Improper idle speed)	9
	Idle speed is low. (Improper idle speed)	10
Idling stability (Engine stalls)	When the engine is cold, it stalls at idle (Die out)	11
	When the engine becomes hot, it stalls at idle. (Die out)	12
	The engine stalls when accelerating. (Pass out)	13
	The engine stalls when decelerating.	14
Driving	Hesitation, sag or stumble	15
	Acceleration shock	16
	Deceleration shock	17
	Poor acceleration	18
	Surge	19
	Knocking	20
Dieseling (Run on)		21
Too high CO and HC concentration when idling		22

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PROBLEM SYMPTOMS TABLE (FOR YOUR INFORMATION)

Items		Symptom
Starting	Won't start	The starter is used to crank the engine, but there is no combustion within the cylinders, and the engine won't start.
	Fires up and dies	There is combustion within the cylinders, but then the engine soon stalls.
	Hard starting	Engine starts after cranking a while.
Idling stability	Hunting	Engine speed doesn't remain constant; changes at idle.
	Rough idle	Usually, a judgement can be based upon the movement of the tachometer pointer, and the vibration transmitted to the steering wheel, shift lever, body, etc. This is called rough idle.
	Incorrect idle speed	The engine doesn't idle at the usual correct speed.
	Engine stall (Die out)	The engine stalls when the foot is taken from the accelerator pedal, regardless of whether the vehicle is moving or not.
	Engine stall (Pass out)	The engine stalls when the accelerator pedal is depressed or while it is being used.
Driving	Hesitation Sag	"Hesitation" is the delay in response of the vehicle speed (engine speed) that occurs when the accelerator is depressed in order to accelerate from the speed at which the vehicle is now travelling, or a temporary drop in vehicle speed (engine speed) during such acceleration. Serious hesitation is called "sag". (Refer to Fig. 1)
	Poor acceleration	Poor acceleration is inability to obtain an acceleration corresponding to the degree of throttle opening, even though acceleration is smooth, or the inability to reach maximum speed.
	Stumble	Engine speed increase is delayed when the accelerator pedal is initially depressed for acceleration. (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 steady, light throttle cruise. Most 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 condition in which the engine continues to run after the ignition switch is turned to OFF. Also called "Dieseling".

Fig. 1

Fig. 2

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INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

INSPECTION PROCEDURE 1

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

INSPECTION PROCEDURE 2

MUT-II communication with Engine-ECU is not possible.	Probable cause
One of the following causes may be suspected. • No power supply to Engine-ECU • Defective ground circuit of Engine-ECU • Defective Engine-ECU • Improper communication line between Engine-ECU and MUT-II	• Malfunction of Engine-ECU power supply circuit • Malfunction of the Engine-ECU • Open circuit between Engine-ECU and diagnosis connector

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INSPECTION PROCEDURE 3

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

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INSPECTION PROCEDURE 4

The engine warning lamp remains illuminated.	Probable cause
In cases such as the above, the cause is probably that the Engine-ECU is detecting a problem in a sensor or actuator, or that one of these listed at right has occurred.	• Short-circuit between the check engine lamp and Engine-ECU • Malfunction of the Engine-ECU

MUT-II diagnosis codes
Are diagnosis codes output?

YES → Refer to INSPECTION CHART FOR DIAGNOSIS CODES

NO ↓

Measure at the instrument panel ECU connector C-04 <M/T>, C-04 <A/T>.
- Disconnect the connector, and measure at the harness side.
- Continuity between 14 and ground
  OK: No continuity

NG → Check the harness wire between the instrument panel ECU and Engine-ECU connector, and repair if necessary.

OK ↓

Replace the Engine-ECU. CAUTION

INSPECTION PROCEDURE 5

Cranks, won't start	Probable cause
In cases such as the above, the cause is probably that a spark plug is defective, or that the supply of fuel to the combustion chamber is defective. In addition, foreign materials (water, kerosene, etc.) may be mixed with the fuel.	• Malfunction of the ignition system • Malfunction of the fuel pump system • Malfunction of the injectors • Malfunction of the Engine-ECU • Foreign materials in fuel

Check battery positive voltage when cranking.
OK: 8 V or higher

NG → Check the battery. (Refer Battery Servicing.)

OK ↓

MUT-II: Inspection of no initial combustion. (Refer to INSPECTION PROCEDURE 36.)

OK ↓

Can any sound be heard from the injectors when cranking?

NG → Check the injector circuit (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 41.)

OK ↓

Ignition system: Inspection of no initial combustion. (Refer INSPECTION PROCEDURE 36.)

OK ↓

Check the following items.
- Check the ignition coil, spark plugs, spark plug cables.
- Check if the injectors are clogged using MUT-II Actuator Test.
- Check if foreign materials (water, alcohol, etc.) got into fuel.
- Check the compression pressure.

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INSPECTION PROCEDURE 6

Fires up and dies.	Probable cause
In such cases as the above, the cause is probably that the spark plugs are generating sparks but the sparks are weak, or the initial mixture for starting is not appropriate.	• Malfunction of the ignition system • Malfunction of the injector system • Foreign materials in fuel • Poor compression • Malfunction of the Engine-ECU

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INSPECTION PROCEDURE 7

Hard starting.	Probable cause
In cases such as the above, the cause is probably that the spark is weak and ignition is difficult, the initial mixture for starting is not appropriate, or sufficient compression pressure is not being obtained.	• Malfunction of the ignition system • Malfunction of the injector system • Inappropriate gasoline use • Poor compression

Check battery positive voltage when cranking
OK: 8 V or higher

NG → Check the battery. (Refer Battery Servicing.)

OK ↓

MUT-II: Check if incomplete combustion occurs. (Refer INSPECTION PROCEDURE 38.)

OK ↓

Can any sound be heard from the injectors when cranking?

NG → Check the injector circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 41.)

OK ↓

Check the ignition timing when cranking.
OK: 5° BTDC ±3°

NG → Check that the crank angle sensor is installed and operating correctly (Refer Troubleshooting).

OK ↓

Check the following items.
- Check the ignition coil, spark plugs, spark plug cables.
- Check if the injectors are clogged using MUT-II Actuator Test.
- Check the compression pressure.
- Check if foreign materials (water, alcohol, etc.) got into fuel.

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INSPECTION PROCEDURE 8

Unstable idle (Rough idle, hunting)	Probable cause
In cases such as the above, the cause is probably that the ignition system, air/fuel mixture, ISC servo or compression pressure is defective. Because the range of possible causes is broad, inspection is narrowed down to simple items.	• Malfunction of the ignition system • Malfunction of air-fuel ratio control system • Malfunction of the ISC system • Malfunction of the purge solenoid valve system • Poor compression • Drawing air into exhaust system • Malfunction of the EGR solenoid valve system

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INSPECTION PROCEDURE 9

Idle speed is high. (Improper idle speed)	Probable cause
In such cases as the above, the cause is probably that the intake air volume during idle is too great.	• Malfunction of the ISC servo motor system • Malfunction of the throttle body

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INSPECTION PROCEDURE 10

Idle speed is low. (Improper idle speed)	Probable cause
In cases such as the above, the cause is probably that the intake air volume during idling is too small.	• Malfunction of the ISC servo system • Malfunction of the throttle body

MUT-II diagnosis codes
Are diagnosis codes output?
- YES → Refer INSPECTION CHART FOR DIAGNOSIS CODES.
- NO ↓

Check the ISC servo for operation sound. (Refer On Vehicle Service.)
- NG → Check the ISC servo system. (Refer INSPECTION PROCEDURE 33.)
- OK ↓

MUT-II Data list
26 Idle position switch (Refer Item No.26.)
- NG → Check the idle position switch system. (Refer INSPECTION PROCEDURE 25.)
- OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer Item No.21.)
- NG → Check the engine coolant temperature circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS TROUBLE CODE 21.)
- OK ↓

MUT-II Data list
29 Inhibitor switch (Refer Item No.29.)
- NG → Check the ignition switch-ST and inhibitor switch system. (Refer INSPECTION PROCEDURE 26 <M/T>, INSPECTION PROCEDURE 27 <A/T>.)
- OK ↓

Adjust the basic idle speed. (Refer On Vehicle Service.)

↓

Check trouble symptom.
- NG ↓

Clean the throttle valve area. (Refer On Vehicle Service.)

↓

Check and adjust the fixed SAS. (Refer On Vehicle Service.)

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INSPECTION PROCEDURE 11

When the engine is cold, it stalls at idle. (Die out)	Probable cause
In such cases as the above, the cause is probably that the air/fuel mixture is inappropriate when the engine is cold, or that the intake air volume is insufficient.	• Malfunction of the ISC servo system • Malfunction of the throttle body • Malfunction of the injector system • Malfunction of the ignition system

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INSPECTION PROCEDURE 12

When the engine is hot, it stalls at idle. (Die out)	Probable cause
In cases such as the above, the cause is probably that ignition system, air/fuel mixture, ISC servo or compression pressure is defective. In addition, if the engine suddenly stalls, the cause may also be a defective connector contact.	• Malfunction of the ignition system • Malfunction of air-fuel ratio control system • Malfunction of the ISC system • Drawing air into intake system • Improper connector contact

Were the battery terminals disconnected?
- YES → After warming-up, let the engine run at idling for 10 minutes.
- NO ↓

MUT-II diagnosis codes
Are diagnosis codes output?
- YES → Refer INSPECTION CHART FOR DIAGNOSIS CODES.
- NO ↓

Check the ISC servo for operation sound.
(Refer ISC Servo checking.)
- NG → Check the ISC servo. (Refer INSPECTION PROCEDURE 33.)
- OK ↓

Check the injector for operation sound.
- NG → Check the injector circuit . (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 41.)
- OK ↓

Does the engine stall right after the accelerator pedal is released?
- YES → Clean the throttle valve area. (Refer On Vehicle Service.) → Check & adjust the fixed SAS. (Refer On Vehicle Service.)
- NO ↓

Does the engine stall easily again?
- NO → While carrying out an intermittent simulation test (Refer How To Cope With Intermittents.), check for sudden changes in the signals shown below.
  - Crank angle sensor signal
  - Air flow sensor signal
  - Injector drive signal
  - Primary and secondary ignition signal
  - Fuel pump drive signal
  - Engine-ECU power supply voltage
- YES ↓

MUT-II: Engine stalling inspection when the engine is warm and idling (Refer INSPECTION PROCEDURE 41.)
- OK ↓

Check the ignition timing.
(Refer Ignition Timing Check.)
- NG → Check that the crank angle sensor is installed and operating correctly.
- OK ↓

Check the following items.
- Check the ignition coil, spark plugs, spark plug cables.
- Check if the injectors are clogged using MUT-II Actuator Test.
- Check the compression pressure.
- Check if foreign materials (water, alcohol, etc.) got into fuel.

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INSPECTION PROCEDURE 13

The engine stalls when accelerating. (Pass out)	Probable cause
In cases such as the above, the cause is probably misfiring due to a weak spark, or an inappropriate air/fuel mixture when the accelerator pedal is depressed.	• Drawing air into intake system • Malfunction of the ignition system

MUT-II diagnosis codes
Are diagnosis codes output?

YES → Refer INSPECTION CHART FOR DIAGNOSIS CODES.

NO ↓

Check the following items.
- Check the ignition coil, spark plugs, spark plug cables.
- Check if air was drawn into the intake system.
  - Broken intake manifold gasket or intake manifold plenum gasket
  - Broken or disconnected vacuum hose
  - Improper operation of the PCV valve
  - Broken air intake hose

INSPECTION PROCEDURE 14

The engine stalls when decelerating.	Probable cause
In cases such as the above, the cause is probably that the intake air volume is insufficient due to a defective ISC servo system.	• Malfunction of the ISC servo system

Were the battery terminals disconnected?

YES → After warming-up, let the engine run at idling for 10 minutes.

NO ↓

MUT-II diagnosis codes
Are diagnosis codes output?

YES → Refer INSPECTION CHART FOR DIAGNOSIS CODES.

NO ↓

MUT-II Data list
26 Idle position switch (Refer Item No.26.)

NG → Check the idle position switch. (Refer INSPECTION PROCEDURE 25.)

OK ↓

MUT-II Data list
14 Throttle position sensor (Refer Item No.14.)

NG → Check the throttle position sensor circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 14.)

OK ↓

MUT-II Data list
45 ISC servo position (Refer Item No.45.)
- Does the ISC servo position drop to 0–2 steps when decelerelating (engine rpm more than 1,000)?

YES → Check the vehicle speed sensor circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 24.)

NO ↓

Check the following items.
- Check the ignition coil, spark plugs, spark plug cables.
- Clean the throttle valve area.
- Check and adjust the fixed SAS.

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INSPECTION PROCEDURE 15

Hesitation, sag or stumble	Probable cause
In cases such as the above, the cause is probably that ignition system, air/fuel mixture or compression pressure is defective.	• Malfunction of the ignition system • Malfunction of air-fuel ratio control system • Malfunction of the fuel supply system • Malfunction of the EGR solenoid system • Poor compression

MUT-II diagnosis codes
Are diagnosis codes output?
- YES → Refer INSPECTION CHART FOR DIAGNOSIS CODES.
- NO ↓

Check the injectors for operation sound.
- NG → Check the injector circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 41.)
- OK ↓

Check the ignition timing.
(Refer Ignition Timing Check.)
- NG → Check that the crank angle sensor is installed and operating correctly.
- OK ↓

MUT-II: Check if hesitation, sag, stumble or poor acceleration occur. (Refer INSPECTION PROCEDURE 42.)
- OK ↓

Check the fuel pressure. (Refer Fuel Pressure Check.)
- OK ↓

Check the following items.
- Check the ignition coil, spark plugs, spark plug cables.
- Check the EGR system.
- Check the compression pressure.
- Check the fuel filter or fuel line for clogging.

INSPECTION PROCEDURE 16

Acceleration shock	Probable cause
In cases such as the above, the cause is probably that there is an ignition leak accompanying the increase in the spark plug demand voltage during acceleration.	• Malfunction of the ignition system

MUT-II diagnosis codes
Are diagnosis codes output?
- YES → Refer INSPECTION CHART FOR DIAGNOSIS CODES.
- NO ↓

Check the following items.
- Check the ignition coil, spark plugs, spark plug cables.
- Check for occurrence of ignition leak.

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INSPECTION PROCEDURE 17

Deceleration shock	Probable cause
Malfunction of the ISC system is suspected.	• Malfunction of the ISC system

MUT-II diagnosis codes
Are diagnosis codes output?
- YES → Refer INSPECTION CHART FOR DIAGNOSIS CODES.
- NO ↓

Check the ISC servo for operation sound.
(Refer ISC Servo Check.)
- NG → Check the idle control system. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 33.)
- OK ↓

MUT-II Data list
14 Throttle position sensor (Refer Item No.14.)
- NG → Check the throttle position circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 14.)
- OK ↓

MUT-II Data list
26 Closed throttle position switch (Refer Item No.26.)
- NG → Check the idle position switch. (Refer INSPECTION PROCEDURE 25.)
- OK ↓

Clean the throttle valve area. (Refer On Vehicle Service.)

INSPECTION PROCEDURE 18

Poor acceleration	Probable cause
Defective ignition system, abnormal air-fuel ratio, poor compression pressure, etc. are suspected.	• Malfunction of the ignition system • Malfunction of air-fuel ratio control system • Malfunction of the fuel supply system • Poor compression • Clogged exhaust system

MUT-II Diagnosis codes
Are diagnosis codes output?
- YES → Refer INSPECTION CHART FOR DIAGNOSIS CODES.
- NO ↓

Check the injectors for operation sound. (Refer Check procedure.)
- NG → Check the injector circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 41.)
- OK ↓

Check the ignition timing.
(Refer Ignition Timing Check.)
- NG → Check that the crank angle sensor is installed and operating correctly.
- OK ↓

MUT-II: Check if hesitation, sag, stumble or poor acceleration occur.
(Refer INSPECTION PROCEDURE 42.)
- OK ↓

Check the fuel pressure. (Refer Fuel Pressure Check.)
- OK ↓

Check the following items.
- Check the ignition coil, spark plugs, spark plug cables.
- Check the compression pressure.
- Check the fuel filter or fuel line for clogging.
- Broken air intake hose
- Clogged air cleaner
- Clogged exhaust system

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INSPECTION PROCEDURE 19

Surge	Probable cause
Defective ignition system, abnormal air-fuel ratio,etc. are suspected.	• Malfunction of the ignition system • Malfunction of air-fuel ratio control system • Malfunction of the EGR solenoid system

MUT-II Self-Diag codes
Are diagnosis codes output?
- YES → Refer INSPECTION CHART FOR DIAGNOSIS CODES.
- NO ↓

Check the injectors for operation sound, Check operation.
- NG → Check the injector circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 41.)
- OK ↓

Check the ignition timing.
(Refer Ignition Timing Check.)
- NG → Check that the crank angle sensor is installed and operaring correctly.
- OK ↓

MUT-II: Check if surge occurs. (Refer INSPECTION PROCEDURE 43.)
- OK ↓

Check the fuel pressure. (Refer Fuel pressure test.)
- OK ↓

Check the following items.
- Check the ignition coil, spark plugs, spark plug cables.
- Check the EGR system.

INSPECTION PROCEDURE 20

Knocking	Probable cause
In cases such as the above, the cause is probably that the heat value of the spark plug is inappropriate.	• Defective knock sensor • Inappropriate heat value of the spark plug

MUT-II Self-Diag codes
Are diagnosis codes output?
- YES → Refer INSPECTION CHART FOR DIAGNOSIS CODES.
- NO ↓

Check the following items.
- Spark plug heat range.
- Check if foreign materials (water, alcohol, etc.) got into fuel.

INSPECTION PROCEDURE 21

Dieseling	Probable cause
Fuel leakage from injectors is suspected.	• Fuel leakage from injectors

Check the injectors for fuel leakage.

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INSPECTION PROCEDURE 22

Too high CO and HC concentration when idling	Probable cause
Abnormal air-fuel ratio is suspected.	• Malfunction of the air-fuel ratio control system. • Deteriorated catalyst

MUT-II Self-Diag codes
Are diagnosis codes output?
- YES → Refer INSPECTION CHART FOR DIAGNOSIS CODES.
- NO ↓

Check the ignition timing.
(Refer Ignition Timing Check.)
- NG → Check that the crank angle sensor is installed and operating correctly.
- OK ↓

MUT-II Data list
21 Engine coolant temperature sensor.
(Refer Item No.21.)
- NG → Check the engine coolant temperature circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)
- OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer Item No.13.)
- NG → Check the intake air temperature circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 13.)
- OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer Item No.25.)
- NG → Check the barometric pressure circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 25.)
- OK ↓

MUT-II Data list
11 Oxygen sensor (Refer Item No.11.)
- Transmission : L range
- Driving with the throttle wide open

OK: 600–1,000 mV
- NG → Check the oxygen sensor system. (Refer INSPECTION PROCEDURE 30.)
- OK ↓

Check the fuel pressure. (Refer Fuel Pressure Test.)
- OK ↓

Check the following items.
- Check the injectors for operation sound.
- Check the injectors for fuel leakage.
- Check the ignition coil, spark plugs, spark plug cables.
- Check the compression pressure.
- Check the positive crankcase ventilation system.
- Check the evaporative emission control system.
- Check the EGR system.

↓

Check trouble symptom.
- NG ↓

Replace the three-way catalytic converter.

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INSPECTION PROCEDURE 23

Power supply system and ignition switch–IG system	Probable cause
When an ignition switch ON signal is input to the Engine-ECU, the Engine-ECU turns the MPI control relay ON. This causes battery positive voltage to be supplied to the Engine-ECU, injectors and air flow sensor.	• Malfunction of the ignition switch • Malfunction of the MPI control relay • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the Engine-ECU

Check the MPI control relay . (Refer MPI Relay check.).

NG → **Replace**

OK ↓

Measure at the MPI control relay connector B-102 <M/T>, B-102 <A/T>.
- Disconnect the connector, and measure at the harness side.
- Voltage between 3,4 and ground.
- **MUT-II ACTUATOR TEST:** Fuel pump drive
  OK: Battery positive voltage

NG → Check the harness wire between the battery and MPI control relay connector, and repair if necessary.

OK ↓

Check the Engine-ECU power supply and ground circuit. (Refer INSPECTION PROCEDURE 44.)

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INSPECTION PROCEDURE 24

Fuel pump system	Probable cause
The Engine-ECU turns the fuel pump relay ON when the engine is cranking or running, and this supplies power to drive the fuel pump.	• Malfunction of the fuel pump relay • Malfunction of the fuel pump • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the Engine-ECU

INSPECTION PROCEDURE 25

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

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INSPECTION PROCEDURE 26

Ignition switch-ST system <M/T>	Probable cause
The ignition switch-ST inputs a HIGH signal to the engine-ECU while the engine is cranking. The Engine-ECU controls the fuel injection, etc. during starting based on this input.	• Malfunction of ignition switch • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the Engine-ECU.

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INSPECTION PROCEDURE 27

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

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INSPECTION PROCEDURE 28

Power steering fluid pressure switch system	Probable cause
The presence or absence of power steering load is input to the Engine-ECU. The Engine-ECU controls the idle speed control (ISC) servo based on this input.	• Malfunction of power steering fluid pressure switch • Improper connector contact, open circuit or short circuited harness wire • Malfunction of Engine-ECU

INSPECTION PROCEDURE 29

A/C switch and A/C relay system	Probable cause
When an A/C ON signal is input to the Engine-ECU, the Engine-ECU carries out control of the ISC servo, and also operates the A/C compressor magnetic clutch.	• Malfunction of A/C control system • Malfunction of A/C switch • Improper connector contact, open circuit or short circuited harness wire • Malfunction of Engine-ECU

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INSPECTION PROCEDURE 30

Oxygen sensor system	Probable cause
• The oxygen sensor detects the oxygen content in exhaust gas, converts it to voltage and sends the voltage to the engine ECU. • The engine ECU controls the fuel injection amount to adjust the air/fuel ratio to theoretical one.	• Malfunction of the oxygen sensor • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the Engine-ECU

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INSPECTION PROCEDURE 31

Fan motor relay system (Radiator fan, A/C condenser fan)	Probable cause
The fan motor relay is controlled by the power transistor inside the Engine-ECU turning ON and OFF.	• Malfunction of fan motor relay • Malfunction of fan motor • Improper connector contact, open circuit or short circuited harness wire • Malfunction of the Engine-ECU

INSPECTION PROCEDURE 32

Ignition circuit system	Probable cause
The Engine-ECU interrupts the ignition coil primary current by turning the ignition power transistor inside the Engine-ECU ON and OFF.	• Malfunction of ignition coil • Malfunction of ignition power transistor unit • Improper connector contact, open circuit or short circuited harness wire • Malfunction of the Engine-ECU

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INSPECTION PROCEDURE 33

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

INSPECTION PROCEDURE 34

Purge control solenoid valve system	Probable cause
The purge control solenoid valve controls the purging of air from the canister located inside the intake manifold.	• Malfunction of solenoid valve • Improper connector contact, open circuit or short circuited harness wire • Malfunction of the Engine-ECU

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INSPECTION PROCEDURE 35

EGR control solenoid valve system	Probable cause
The EGR control solenoid valve is controlled by the negative pressure resulting from EGR operation leaking to port "A" of the throttle body.	• Malfunction of solenoid valve • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the Engine-ECU

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INSPECTION PROCEDURE 36

MUT-II: Inspection of no initial combustion

MUT-II Data list
16 Voltage of Engine-ECU power source
(Refer Item No.16.)

- NG → Check the power supply system. (Refer INSPECTION PROCEDURE 23.)
- OK ↓

Does the camshaft rotate at the engine cranking ? (When oil filler cap is removed.)

- NO → Check timing belt for breakage.
- YES ↓

MUT-II Self-Diag codes
Are the diagnosis codes output ?

- YES → Refer INSPECTION CHART FOR DIAGNOSIS CODES.
- NO ↓

MUT-II Data list
22 Crank angle sensor (refer Item No.22.)
OK: Cranking speed is displayed.

- NG → Check the crank angle circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 22.)
- OK ↓

MUT-II actuator test
07 Fuel pump (Refer Item No.7.)

- NG → Check the fuel pump system. (Refer INSPECTION PROCEDURE 24.)
- OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer Item No.21.)

- NG → Check the engine coolant temperature circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)

INSPECTION PROCEDURE 37

Ignition system: Inspection of no initial combustion

Does the engine tachometer display the cranking speed?
- Connect tachometer to engine.

- NG → Check the ignition circuit system (Refer INSPECTION PROCEDURE 32.)
- OK ↓

Check the ignition timing when cranking.
OK: 5° BTDC ±3°

- NG → Check for the correct installation condition of crank angle sensor.

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INSPECTION PROCEDURE 38

MUT-II: Check if incomplete combustion occurs.

MUT-II Self-Diag codes
Are diagnosis codes output ?
- YES → Refer INSPECTION CHART FOR DIAGNOSIS CODE.
- NO ↓

MUT-II actuator test
07 Fuel pump (Refer Item No.7.)
- NG → Check the fuel pump system. (Refer INSPECTION PROCEDURE 24.)
- OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer Item No.21.)
- NG → Check the engine coolant temperature circuit. (Refer INSPECTION PROCEDURES FOR DIAGNOSIS CODE 21.)
- OK ↓

MUT-II Data list
18 Ignition switch-ST (Refer Item No.18.)
- NG → Check the ignition switch-ST and inhibitor switch system <M/T>. (Refer INSPECTION PROCEDURE 26.) Check the ignition switch-ST and inhibitor switch system <A/T>. (Refer INSPECTION PROCEDURE 27.)

INSPECTION PROCEDURE 39

Check if hunting occurs.

Clean the throttle body. (Refer On Vehicle Service.)
↓
Check and adjust the fixed SAS (Refer On Vehicle Service.)
↓
Check trouble symptom.
- NG ↓

Inspect the intake of air into the air intake system
- Broken intake manifold gasket
- Broken air intake hose
- Broken vacuum hose
- Positive crankcase ventilation valve does not operate

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INSPECTION PROCEDURE 40

MUT-II: Check if idle speed is unstable.

MUT-II Data list
26 Idle position switch (Refer Item No.26.)
- NG → Check the idle position switch. (Refer INSPECTION PROCEDURE 25.)
- OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer Item No.13.)
- NG → Check the intake air temperature circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 13.)
- OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer Item No.25.)
- NG → Check the barometric pressure circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 25.)
- OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer Item No.21.)
- NG → Check the engine coolant temperature circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)
- OK ↓

MUT-II actuator test
08 Evaporative emission purge solenoid (Refer Item No.8.)
- NG → Check the purge control solenoid valve circuit (Refer INSPECTION PROCEDURE 34.)
- OK ↓

MUT-II Data list
11 Oxygen sensor (Refer Item No.11.)
OK: 600–1,000 mV during sudden racing
- NG → Check the oxygen sensor system. (Refer INSPECTION PROCEDURE 30)
- OK ↓

MUT-II Data list
11 Oxygen sensor (Refer Item No.11.)
OK: Changes between 0–400 mV and 600–1,000 mV during idling
- NG → Check the fuel pressure. (Refer Fuel pressure test.)
  - OK →
    1. Inspect the intake of air into the air intake system.
       - Broken intake manifold gasket
       - Broken vacuum hose
       - PCV valve does not operate.
       - Broken air intake hose
    2. Check the injector for blockage.
- OK ↓

MUT-II Data list
27 Power steering pressure switch (Refer Item No.27.)
- NG → Check the power steering fluid pressure switch system. (Refer INSPECTION PROCEDURE 28.)
- ↓

MUT-II Data list
28 A/C switch (Refer Item No.28.)
- NG → Check the A/C switch and A/C relay system. (Refer INSPECTION PROCEDURE 29.)
- OK ↓

MUT-II Data list
29 Inhibitor switch (Refer Item No.29.)
- NG → Check the ignition switch-ST and inhibitor switch system. (Refer INSPECTION PROCEDURE 27.)
- OK ↓

MUT-II Data list
45 ISC servo position (Refer Item No.45.)
- NG → Adjust the basic idle speed. (Refer On Vehicle Service.)

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INSPECTION PROCEDURE 41

MUT-II: Engine stalling inspection when the engine is warm and idling.

MUT-II Data list
26 Idle position switch (Refer Item No.26.)

NG → Check the idle position switch. (Refer INSPECTION PROCEDURE 25.)

OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer Item No.13.)

NG → Check the intake air temperature circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 13.)

OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer Item No.25.)

NG → Check the barometric pressure circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 25.)

OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer Item No.21.)

NG → Check the engine coolant temperature circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)

OK ↓

MUT-II Data list
11 Heated oxygen sensor (Refer Item No.11.)
OK: Changes between 600–1,000 mV during sudden racing

NG → Check the oxygen sensor system. (Refer INSPECTION PROCEDURE 30)

OK ↓

MUT-II Data list
11 Heated oxygen sensor (Refer Item No.11.)
OK: Changes between 0–400 mV and 600–1,000 mV during idling

NG → Check the fuel pressure. (Refer Fuel Pressure Test.)

OK →
1. Inspect the intake of air into the air intake system
   - Broken intake manifold gasket
   - Broken vacuum hose
   - PCV valve does not operate.
   - Broken air intake hose
2. Check the injectors for blockage.

OK ↓

MUT-II Data list
27 Power steering pressure switch (Refer Item No.27.)

NG → Check the power steering fluid pressure switch circuit (Refer INSPECTION PROCEDURE 28.)

OK ↓

MUT-II Data list
28 A/C switch (Refer Item No.28.)

NG → Check the A/C switch and A/C compressor clutch relay system. (Refer INSPECTION PROCEDURE 29.)

OK ↓

MUT-II Data list
29 Inhibitor switch (Refer Item No.29.)

NG → Check the ignition switch-ST and inhibitor switch system. (Refer INSPECTION PROCEDURE 27.)

OK ↓

MUT-II Data list
34 Air flow sensor reset signal (Refer Item No.34.)

NG → Check the air flow sensor circuit. (Refer INSPECTION PROCEDURE 47.)

OK ↓

MUT-II Data list
45 ISC servo position (Refer Item No.45.)

NG → Adjust the basic idle speed. (Refer On Vehicle Service.)

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INSPECTION PROCEDURE 42

MUT-II: Check if hesitation, sag, stumble or poor acceleration occurs.

MUT-II Data list
26 Idle position switch (Refer Item No.26.)

NG → Check the idle position switch. (Refer INSPECTION PROCEDURE 25.)

OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer Item No.13.)

NG → Check the intake air temperature circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 13.)

OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer Item No.25.)

NG → Check the barometric pressure circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 25.)

OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer Item No.21.)

NG → Check the engine coolant temperature circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)

OK ↓

MUT-II Data list
14 Throttle position sensor (Refer Item No.14.)

NG → Check the throttle position circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 14.)

OK ↓

MUT-II actuator test
10 EGR solenoid (Refer Item No.10.)

NG → Check the EGR control solenoid circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 35.)

OK ↓

MUT-II Data list
11 Oxygen sensor (front) (Refer Item No.11.)
OK: Changes between 600–1,000 mV during sudden racing

NG → Check the oxygen sensor system. (Refer INSPECTION PROCEDURE 30)

OK ↓

MUT-II Data list
11 Oxygen sensor (Refer Item No.11.)
OK: Changes between 0–400 mV and 600–1,000 mV during idling

NG → Check the fuel pressure. (Refer Fuel Pressure Test.)

OK →
1. Inspect the intake of air into the air intake system
   - Broken intake manifold gasket
   - Broken vacuum hose
   - PCV valve does not operate
   - Broken air intake hose
2. Check the injectors for blockage.

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INSPECTION PROCEDURE 43

MUT-II: Check if surge occurs.

MUT-II Data list
26 Idle position switch (Refer Item No.26.)

NG → Check the idle position switch circuit. (Refer INSPECTION PROCEDURE 25.)

OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer Item No.13.)

NG → Check the intake air temperature circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 13.)

OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer Item No.25.)

NG → Check the barometric pressure circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 25.)

OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer Item No.21.)

NG → Check the engine coolant temperature circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)

OK ↓

MUT-II Data list
14 Throttle position sensor (Refer Item No.14.)

NG → Check the throttle position circuit. (Refer INSPECTION PROCEDURE FOR DIAGNOSIS CODE 14.)

OK ↓

MUT-II actuator test
10 EGR solenoid (Refer Item No.10.)

NG → Check the EGR solenoid valve circuit. (Refer INSPECTION PROCEDURE 35.)

OK ↓

MUT-II Data list
11 Oxygen sensor (Refer Item No.11.)
OK: Changes between 600–1,000 mV during sudden racing

NG → Check the oxygen sensor system. (Refer INSPECTION PROCEDURE 30)

OK ↓

MUT-II Data list
11 Oxygen sensor (Refer Item No.11.)
OK: Changes between 0–400 mV and 600–1,000 mV during idling

NG → Check the fuel pressure. (Refer Fuel Pressure Test.)

OK →
1. Inspect the intake of air into the air intake system
   - Broken intake manifold gasket
   - Broken vacuum hose
   - PCV valve does not operate
   - Broken air intake hose
2. Check the injector for blockage.

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INSPECTION PROCEDURE 44

Check the Engine-ECU power supply and ground circuit.

Measure at the Engine-ECU connectors
B-108, B-109, B-110, B-111 <M/T>,
B-108, B-109, B-110, B-111 <A/T>.
- Disconnect the connector and measure at the harness side

1. Voltage between 82 and ground <M/T> 98 and ground <A/T> (Ignition switch: ON)
   OK: Battery positive voltage
2. Voltage between 38 and ground <M/T> 49 and ground <A/T> (Ignition switch: ON)
   OK: Battery positive voltage
3. Voltage between 12, 25 and ground <M/T> 41, 47 and ground <A/T> (Ignition switch: ON)
   OK: Battery positive voltage
4. Continuity between 13, 26 and ground <M/T> 42,48 and ground <A/T>
   OK: Continuity
5. Voltage between 80 and ground <M/T> 66 and ground <A/T>
   OK: Battery positive voltage

1. NG → **Check the following connector.** B-43, B-77 <M/T>, B-43, B-77 <A/T>. NG → **Repair**
   OK → Check trouble symptom.
   NG → Check the harness wire between Engine-ECU and ignition switch connector. NG → **Repair**

2.,3. NG → Check the harness wire between Engine-ECU and MPI control relay connector, and repair if necessary.

4. NG → Check the harness wire between Engine-ECU and ground, and repair if necessary.

5. NG → **Check the following connector.** B-84, B-78 <M/T>, B-84, B-78 <A/T>. NG → **Repair**
   OK → Check trouble symptom.
   NG → Check the harness wire between Engine-ECU and battery, and repair if necessary.

OK → **Check the following connector.** B-108, B-109, B-110, B-111 <M/T>, B-108, B-109, B-110, B-111 <A/T> NG → **Repair**

OK → Check trouble symptoms.

NG → Replace the Engine-ECU. CAUTION

INSPECTION PROCEDURE 45

Check fuel pump circuit.

Measure at the fuel pump connector
H-01 <M/T>, H-01 <A/T>.
- Disconnect the connector and measure at the harness side.
- Continuity between 5 and ground
  OK: Continuity

NG → Check the harness wire between fuel pump and ground, and repair if necessary.

OK → **Check the following connectors.** H-09 <M/T>,H-09 <A/T> NG → **Repair**

OK → Check trouble symptom.

NG → Check the harness wire between terminal for fuel pump drive and fuel pump connector. NG → **Repair**

OK → Replace the fuel pump. CAUTION

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INSPECTION PROCEDURE 46

Check the fuel pump drive control circuit.

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INSPECTION PROCEDURE 47

Check air flow sensor control circuit.

INSPECTION PROCEDURE 48

Check throttle position sensor (TPS) output circuit.

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INSPECTION PROCEDURE 49

Check injector control circuit

INSPECTION PROCEDURE 50

Check ignition signal circuit.

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DATA LIST REFERENCE TABLE

Caution

1. **When shifting the select lever to D range, the brakes should be applied so that the vehicle does not move forward.**
2. **Driving tests always need another personnel.**

*1: In a new vehicle [driven approximately 500 km or less], the air flow sensor output frequency is sometimes 10% higher than the standard frequency.

*2: After performing a warm up idle from an initial engine temperature of –20°C, if the idle speed is lower than the standard value then it is assumed that the air volume limiter in the throttle body is defective (even if the ISC motor is fully open).

*3: The injector drive time represents the time when the cranking speed is at 250 rpm or below when the power supply voltage is 11 V.

*4: In a new vehicle [driven approximately 500 km or less], the injector drive time is sometimes 10% longer than the standard time.

*5: The idle position switch normally turns off when the voltage of the throttle position sensor is 50 – 100mV higher than the voltage at the idle position. If the closed throttle position switch turns back on after the throttle position sensor voltage has risen by 100mV and the throttle valve has opened, the closed throttle position switch and the throttle position sensor need to be adjusted.

*6: In a new vehicle [driven approximately 500 km or less], the step of the stepper motor is sometimes 3 steps greater than the standard value.

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.
11	Oxygen sensor	Engine: Warm (Air/fuel mixture is made leaner when decelerating, and is made richer when racing.)	When at 4,000 r/min, engine is suddenly decelerated	200 mV or less	Procedure No. 30
			When engine is suddenly raced	600–1,000 mV	
		Engine: Warm (The oxygen sensor signal is used to check the air/fuel mixture ratio, and control condition is also checked by the Engine-ECU.)	Engine is idling	400 mV or less ↔ 600–1,000 mV (Changes)	
			2,500 r/min		
12	Air flow sensor	• Engine coolant temperature: 80–95°C • Lights, electric cooling fan and all accessories: OFF • Transmission: Neutral (A/T: P range)	Engine is idling	18–44 Hz	Code No. 12
			2,500 r/min	43–83 Hz	
			Engine is raced	Frequency increases in response to racing	
13t	Intake air temperature sensor	Ignition switch: ON or with engine running	When intake air temperature is –20°C	–20°C	Code No. 13
			When intake air temperature is 0°C	0°C	
			When intake air temperature is 20°C	20°C	
			When intake air temperature is 40°C	40°C	
			When intake air temperature is 80°C	80°C	

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Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.
14	Throttle position sensor	Ignition switch: ON	Set to idle position	300–1,000 mV (6–20%)	Code No. 14
			Gradually open	Increases in proportion to throttle opening angle	
			Open fully	4,500–5,500 mV (80–100%)	
16	Power supply voltage	Ignition switch: ON		Battery positive voltage	Procedure No. 23
18	Cranking signal (ignition switch-ST)	Ignition switch: ON	Engine: Stopped	OFF	Procedure No.26 <M/T> Procedure No. 27 <A/T>
			Engine: Cranking	ON	
21	Engine coolant temperature sensor	Ignition switch: ON or with engine running	When engine coolant temperature is –20°C	–20°C	Code No. 21
			When engine coolant temperature is 0°C	0°C	
			When engine coolant temperature is 20°C	20°C	
			When engine coolant temperature is 40°C	40°C	
			When engine coolant temperature is 80°C	80°C	
22	Crank angle sensor *2	• Engine: Cranking • Tachometer: Connected	Compare the rpm of the tachometer with the one of the MUT-II.	Identical	Code No. 22
		• Engine: Idling • Idle position switch: ON	When engine coolant temperature is –20°C	1300–1500 r/min	
			When engine coolant temperature is 0°C	1300–1500 r/min	
			When engine coolant temperature is 20°C	1300–1500 r/min	
			When engine coolant temperature is 40°C	1050–1250 r/min	
			When engine coolant temperature is 80°C	600–800 r/min	
24	Vehicle speed sensor	Drive at 40 km/h		Approx. 40 km/h	Code No. 24
25	Barometric pressure sensor	Ignition switch: ON	At altitude of 0 m	101 kPa	Code No. 25
			At altitude of 600m	95 kPa	
			At altitude of 1,200 m	88 kPa	
			At altitude of 1,800 m	81 kPa	
26	Idle position switch	Ignition switch: ON Check by operating accelerator pedal repeatedly	Throttle valve: Set to idle position	ON	Procedure No. 25
			Throttle valve: Slightly open	OFF*5	

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Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.
27	Power steering pressure switch	Engine: Idling	Steering wheel stationary	OFF	Procedure No. 28
			Steering wheel turning	ON	
28	A/C switch	Engine: Idling (When A/C switch is ON, A/C compressor should be operating.)	A/C switch: OFF	OFF	Procedure No. 29
			A/C switch: ON	ON	
29	Inhibitor switch <A/T>	Ignition switch: ON	P or N	P or N	Procedure No. 27
			D,3, 2, L or R	D,3, 2, L or R	
34	Air flow sensor reset signal	Engine: Warm	Engine is idling	ON	–
			2500 r/min	OFF	
36	Ignition timing adjustment mode.	Engine: Idling	Ignition timing adjustment terminal is earthed	ON	–
			Ignition timing adjustment terminal is disconnected from earth	OFF	
37	Volumetric efficiency	• Engine coolant temperature: 80–95°C • Lights, electric cooling fan and all accessories: OFF • Transmission: P range	Engine is idling	15–35 %	–
			2,500 r/min	15–35 %	
			When engine is suddenly raced	Volumetric efficiency increases in response to racing	
38	Crank angle sensor	• Engine cranking (reading is possible at 2000 r/min or less) • Tachometer: connected		Engine speeds displayed on the MUT-II and tachometer are identical.	–
41, 47	Injectors *3	Engine: Cranking	When engine coolant temperature is 0°C	12–18 ms	–
			When engine coolant temperature is 20°C	30–44 ms	
			When engine coolant temperature is 80°C	8–12 ms	
	Injectors *4	• Engine coolant temperature: 80–95°C • Lights, electric cooling fan and all accessories: OFF • Transmission: P range	Engine is idling	2.2–3.4 ms	
			2,500 r/min	2.0–3.2 ms	
			When engine is suddenly raced	Increases	

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Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.
44	Ignition coils and ignition power transistors	• Engine: After having warmed up • Timing light is set. (The timing light is set in order to check actual ignition timing.)	Engine is idling	2–18 °BTDC	–
			2,500 r/min	25–45 °BTDC	
45	ISC servo (stepper motor) position *6	• Engine coolant temperature: 80 – 95°C • Lights, electric cooling fan and all accessories: OFF • Transmission: P range) • Idle position switch: ON • Engine: Idling (When A/C switch is ON, A/C compressor should be operating)	A/C switch: OFF	Increases by 2–25 steps	–
			A/C switch: OFF → ON	Increases by 10–70 steps	
			• A/C switch: OFF • Select lever: N range → D range	Increases by 5–50 steps	
49	A/C compressor clutch relay	Engine: After having warmed up Engine is idling	A/C switch: OFF	OFF (Compressor clutch is not operating)	Procedure No. 29
			A/C switch: ON	ON (Compressor clutch is operating	

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ACTUATOR TEST REFERENCE TABLE

Item No.	Inspection item	Drive contents	Inspection contents		Normal condition	Inspection procedure No.
01	Injectors	Cut fuel to No. 1 injector	Engine: Warm, idle (Cut the fuel supply to each injector in turn and check cylinders which don't affect idling.)		Idle speed drops equally for each injector	Code No. 41
02		Cut fuel to No. 2 injector				
03		Cut fuel to No. 3 injector				
04		Cut fuel to No. 4 injector				
05		Cut fuel to No. 5 injector				
06		Cut fuel to No. 6 injector				
07	Fuel pump	Fuel pump operates and fuel is recirculated.	• Engine: Cranking • Fuel pump: Activated Inspect according to both the above conditions.	Pinch the return hose with fingers to feel the pulse of the fuel being recirculated.	Pulse is felt.	Procedure No. 24
				Listen near the fuel tank for the sound of fuel pump operation.	Typical electric fuel pump whine.	
08	Purge control solenoid valve	Solenoid valve turns from OFF to ON.	Ignition switch: ON		Clicks when solenoid valve is driven.	Procedure No. 34
10	EGR control solenoid valve	Solenoid valve turns from OFF to ON.	Ignition switch: ON		Clicks when solenoid valve is driven.	Procedure No. 35
17	Basic ignition timing	Set to ignition timing adjustment mode	Engine: Idle Timing light is set		5°BTDC	–
20	Radiator fan (Hi) Condenser fan (Hi)	Drive the fan motors (radiator and condenser).	Ignition switch: ON A/C switch: ON		Fan motor operates at high speed.	Procedure No. 31
21	Radiator fan (Hi) Condenser fan (Low)	Drive the fan motors (radiator and condenser).	Ignition switch: ON A/C switch: ON		Fan motor operates at low speed.	Procedure No. 31
30	Basic idle speed	Set ISC servo to basic step	Engine idle speed		Stepper motor approx. 8 steps	–

13F FUEL SUPPLY

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TJ/KJ BASE MANUAL
(effective to 31st July 2001 production)

TJ/KJ 01M/Y SPECIFICATION UPGRADE <AWD>
(effective from December 2002 production)

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FUEL TANK<SEDAN>
FUEL TANK<WAGON>
FUEL FILTER
REMOVAL SERVICE POINTS
INSTALLATION SERVICE POINTS

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FUEL TANK

GENERAL INFORMATION

1. A cable–type accelerator mechanism and suspended–type pedal have been adopted.
2. The fuel tank is equipped with a valve assembly (roll–over valve). It prevents fuel from leaking out of the tank if the vehicle rolls over.
3. The fuel tank is equipped with a fuel cut-off valve. It prevents fuel from leaking out of the fuel tank when the fuel filler cap is opened and when fuel is being supplied.

Items	Specifications
Fuel tank capacity (litres)	72 <sedan>, 71 <wagon>
Fuel pump type	Electrical, in-tank type

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FUEL TANK <SEDAN>

REMOVAL AND INSTALLATION

Pre-removal Operation
Reduce the Inner Pressure of Fuel Line and Hose. (Refer **On Vehicle Service**.)

Post-installation Operation
Checking for Fuel Leaks

Removal steps

1. Parking brake cable connection
2. Fuel tank
3. Vapour hose
4. Pressure hose
5. Vapour hose connection
6. Fuel pump and gauge assembly
7. Vapour hose
8. Valve assembly
9. Fuel filler cap
10. Filler hose
11. Vapour hose
12. Fuel filler neck
13. Fuel filter assembly
14. Fuel pipe

NOTE
When replacing the fuel gauge unit assembly only, it is possible to work from the service holes underneath the rear seat cushion without having to remove the fuel tank. (Refer **On Vehicle Service**.)

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FUEL TANK <WAGON>

Pre-removal Operation
Reduce the Inner Pressure of Fuel Line and Hose.
(Refer **On Vehicle Service**.)

Post-installation Operation
Checking for Fuel Leaks
Caution: Ensure that wiring loom is routed around left hand side of fuel tank. If fuel tank harness is routed over top of tank, replace harness with Part # MR925611.

Removal steps

1. Fuel pipe
2. Fuel tank
3. Vapour hose
4. Pressure hose
5. Fuel filter assembly
6. Fuel pump and gauge assembly
7. Tank band
8. Gasket
9. Fuel filler cap
10. Filler hose
11. Vapour hose
12. Fuel filler neck
13. Fuel return hose
14. Fuel cut–off valve

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FUEL CUT OFF VALVE CHECK

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.

FUEL GAUGE UNIT AND PUMP ASSEMBLY REPLACEMENT<SEDAN>

1. Remove the rear seat cushion.
   (Refer **Rear seat Removal and Installation**.)
2. Remove the cover plate.
3. Disconnect the connector from the fuel gauge unit and pump assembly, and then remove the fuel gauge unit.
4. When installing the fuel gauge unit and pump assembly, tilt the float at the end to the left and insert into the fuel tank.

   NOTE
   As there is a reservoir inside the fuel tank, if the fuel gauge unit and pump assembly is tilted to the right and inserted, the fuel gauge unit and pump assembly will touch the reservoir.
5. Align the packing positioning projections (locations indicated by arrows) with the holes in the fuel gauge unit and pump assembly.

FUEL GAUGE UNIT AND PUMP ASSEMBLY REPLACEMENT<WAGON>

1. Remove the fuel tank. (Refer **Removal and Installation**.)
2. Disconnect the connector from the fuel gauge unit and pump assembly, and then remove the fuel gauge unit.
3. When installing the fuel gauge unit and pump assembly, tilt the float at the end and insert into the fuel tank.
4. Align the packing positioning projections (locations indicated by arrows) with the holes in the fuel gauge unit and pump assembly.

FUEL GAUGE UNIT CHECK

Refer **Fuel gauge check procedure**.

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FUEL FILTER

REMOVAL AND INSTALLATION

Pre-removal Operation
Reduce the Inner Pressure of Fuel Line and Hose.
(Refer **On Vehicle Service**.)

Post-installation Operation
Checking for Fuel Leaks

<SEDAN>

<WAGON>

Removal steps

◀A▶ ▶A◀
1. Fuel pipe
2. Pressure hose
3. Fuel filter

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REMOVAL SERVICE POINTS

◀A▶ PRESSURE PIPE

1. Push the connector body gently in the direction shown in the illustration.

2. Grip the removal tabs at each side
3. Push in the direction of removal.

INSTALLATION SERVICE POINTS

▶A◀ PRESSURE PIPE

1. Push the connector over the pipe until the connector stops with a click.

2. Push the connector gently in the direction of removal to ensure that the connector is installed correctly.

13F FUEL SUPPLY <AWD>

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- REMOVAL SERVICE POINTS
- INSPECTION
- INSTALLATION SERVICE POINT

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- REMOVAL SERVICE POINTS
- INSTALLATION SERVICE POINTS

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FUEL TANK

GENERAL INFORMATION

1. A cable–type accelerator mechanism and suspended–type pedal have been adopted.
2. The fuel tank is a saddle type to allow for the drive control system. It is of plastic contruction, and located underneath the rear passenger seat floor.
3. The fuel tank is equipped with a valve assembly (roll–over valve). It prevents fuel from leaking out of the tank if the vehicle rolls over.
4. The fuel tank is equipped with a fuel cut-off valve. It prevents fuel from leaking out of the fuel tank when the fuel filler cap is opened and when fuel is being supplied.

Items	Specifications
Fuel tank capacity (litres)	70
Fuel pump type	Electrical, in-tank type

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FUEL TANK <AWD>

REMOVAL AND INSTALLATION

Pre-removal Operation
(1) Reduce the inner line and hose pressure (Refer to Group 13A)
(3) Remove Centre Exhaust Pipe (Refer to Group 15)
(4) Remove Propeller Shaft (Group 25)

Post-installation Operation
(1) Refuel Tank
(2) Check for Fuel Leakage
(4) Install Propeller Shaft (Refer to Group 25)
(3) Install Centre Exhaust Pipe (Refer to Group 15)

Removal steps

1. Parking brake cable connection
2. Protector
◀A▶ 3. Fuel tank
4. Band
5. Pressure hose
6. Return hose
7. Suction hose
8. Pipe assembly
◀B▶ ▶A◀ 9. Cap
10. Fuel gauge unit/pump assembly
11. Fuel gauge unit assembly
12. Vapour hose
13. Valve assembly
14. Fuel filler cap
15. Filler hose
16. Vapour hose
17. Fuel filler neck
18. Fuel filter assembly
19. Fuel pipe

NOTE
When replacing the fuel gauge unit assembly only, it is possible to work from the service holes underneath the rear seat cushion without having to remove the fuel tank. (Refer On Vehicle Service.)

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REMOVAL SERVICE POINTS

◀A▶ FUEL TANK

1. Disconnect the band front, and lower the front part of the band so that the fuel tank can be removed.

◀B▶ REMOVING CAP

INSPECTION

FUEL CUT OFF VALVE CHECK

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.

FUEL GAUGE UNIT AND PUMP ASSEMBLY REPLACEMENT

1. Remove the rear seat cushion.
   (Refer **Rear seat Removal and Installation**.)
2. Remove the cover plate.
3. Disconnect the connector from the fuel gauge unit and pump assembly, and then remove the fuel gauge unit.
4. When installing the fuel gauge unit and pump assembly, tilt the float at the end to the left and insert into the fuel tank.

   NOTE
   As there is a reservoir inside the fuel tank, if the fuel gauge unit and pump assembly is tilted to the right and inserted, the fuel gauge unit and pump assembly will touch the reservoir.
5. Align the packing positioning projections (locations indicated by arrows) with the holes in the fuel gauge unit and pump assembly.

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FUEL GAUGE UNIT CHECK

Refer **Fuel gauge check procedure**.

INSTALLATION SERVICE POINT

▶A◀ CAP INSTALLATION

1. Tighten the cap to the specified torque using the special tool.

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FUEL FILTER

REMOVAL AND INSTALLATION

Pre-removal Operation
Reduce the Inner Pressure of Fuel Line and Hose.
(Refer **On Vehicle Service**.)

Post-installation Operation
Checking for Fuel Leaks

Removal steps

1. Fuel pipe
◀A▶ ▶A◀ 2. Pressure hose
3. Fuel filter

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REMOVAL SERVICE POINTS

◀A▶ PRESSURE PIPE

1. Push the connector body gently in the direction shown in the illustration.

2. Grip the removal tabs at each side
3. Push in the direction of removal.

INSTALLATION SERVICE POINTS

▶A◀ PRESSURE PIPE

1. Push the connector over the pipe until the connector stops with a click.

2. Push the connector gently in the direction of removal to ensure that the connector is installed correctly.

13H TRACTION CONTROL SYSTEM (TCL)

CONTENTS

GENERAL DESCRIPTION
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- DIAGNOSTIC TROUBLESHOOTING FLOW
- DIAGNOSIS FUNCTION
- INSPECTION CHART FOR DIAGNOSIS TROUBLE CODES
- INSPECTION PROCEDURES FOR DIAGNOSIS CODES
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- CHECK AT ECU TERMINALS

ON-VEHICLE SERVICE
- INDICATOR LAMP CHECK
- TCL SYSTEM OPERATION CHECK
- STOP LAMP SWITCH CHECK
- WHEEL SPEED SENSOR CHECK
- VACUUM SOLENOID VALVE CHECK
- VENTILATION SOLENOID VALVE CHECK
- VACUUM TANK CHECK
- VACUUM ACTUATOR CHECK
- ACCELERATOR PEDAL POSITION SENSOR (APS) CHECK

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) Service or maintenance of any SRS component or SRS-related component must be performed only at an authorised MITSUBISHI dealer.
(3) MITSUBISHI dealer personnel must thoroughly review this manual, and especially its GROUP 52B – Supplemental Restraint System (SRS) before beginning any service or maintenance of any component of the SRS or any SRS-related component.

NOTE

The SRS includes the following components: SRS-ECU, SRS warning lamp, air bag module, clock spring 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 (*)

TCL SWITCH
REMOVAL AND INSTALLATION
INSPECTION
STEERING WHEEL SENSOR
REMOVAL AND INSTALLATION
REMOVAL SERVICE POINT
INSPECTION
TCL-ECU
REMOVAL AND INSTALLATION
INSPECTION

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GENERAL DESCRIPTION

The TCL system (slip control and trace control) is available as an option. This system facilitates starting, accelerating, and cornering on slippery roads such as snowy roads. In addition, this system improves driveability while cornering on normal roads and contributes to easier driving.

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SPECIAL TOOLS

Tool	Tool number and name	Supersession	Application
	MB991502 MUT-II sub assembly	–	For checking of TCL (Diagnosis code display when using the MUT-II)
	MB991529 Diagnosis code check harness	MB991529-01	For checking of TCL (Diagnosis code display when using the TCL-OFF warning lamp)

SERVICE SPECIFICATIONS

ITEM	STANDARD VALUE
Accelerator pedal position sensor resistance kΩ	3.5–6.5

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DIAGNOSIS

DIAGNOSTIC TROUBLESHOOTING FLOW

NOTE: Before carrying out trouble diagnosis, check to be sure that all of the following items are normal.

- Is the standard steering wheel being used, and has it been correctly installed to the straight-ahead position on the steering shaft?
- Are the size, specifications, air pressure, balance and wear conditions of the tyres and wheels normal?
- Is the wheel alignment normal?
- Have any other modifications been made to the engine or suspension which could conceivably have an effect on the TCL system?

DIAGNOSIS FUNCTION

DIAGNOSIS TROUBLE CODE CHECK

Connect the MUT–II to the data link connector then check diagnosis trouble codes.

CAUTION: Make certain that the ignition switch is OFF when the MUT–II is connected or disconnected.

ERASING DIAGNOSIS TROUBLE CODES

Connect the MUT–II to the data link connector then erase the diagnosis trouble codes.

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INSPECTION CHART FOR DIAGNOSIS TROUBLE CODES

CODE No.	DIAGNOSIS ITEM
11	APS circuit system
12	APS or TPS circuit system
13	TPS circuit system
23	Stop lamp switch circuit system
24	TCL switch circuit system
26	Ignition switch (IG2) circuit system
27	TCL-ECU power supply voltage circuit (engine control relay circuit) system
31	Front right wheel speed sensor circuit system
32	Front left wheel speed sensor circuit system
33	Rear right wheel speed sensor circuit system
34	Rear left wheel speed sensor circuit system
35	Rear wheel speed sensor circuit system (1)
36	Rear wheel speed sensor circuit system (2)
41	Steering wheel sensor (ST-1) circuit system (open circuit)
42	Steering wheel sensor (ST-2) circuit system (open circuit)
43	Steering wheel sensor (ST-N) circuit system (open circuit)
44	Steering wheel sensor circuit system (short circuit)
45	Steering wheel sensor (ST-N) circuit system (short circuit)
71	ECU communication circuit system
72	ECU circuit system
73	
74	Engine A/T ECU communication circuit system
76	ABS circuit system

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INSPECTION PROCEDURES FOR DIAGNOSIS CODES

Code No. 11 APS circuit system	Probable cause
This DTC is output if the APS output voltage is less than 0.2 V due to an open circuit or other malfunction in the APS circuit. The APS power supply and ground are supplied from the ECU, and the output signal is used by the Engine A/T-ECU and auto-cruise control-ECU as well as by the TCL-ECU.	• Malfunction of APS • Malfunction of TCL-ECU • Malfunction of ECU • Malfunction of harness or connector

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Code No. 12 APS or TPS circuit system	Probable cause
This DTC is output if the APS opening angle is 20° or greater than the TPS opening angle because of a short in the APS, an open circuit in the TPS or sticking of the vacuum actuator. As this detection condition can be applicable during throttle control, trouble diagnosis is invalid at this time.	• Malfunction of APS • Malfunction of TPS • Malfunction of TCL-ECU • Malfunction of ECU • Malfunction of harness or connector • Malfunction of vacuum actuator

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Code No.13 TPS circuit system	Probable cause
This DTC is output if the TPS opening angle is 20° or greater than the APS opening angle because of a short in the TPS or an open circuit in the APS. If there is an open circuit in the APS, diagnosis code No. 11 is output at the same time. Accordingly, if only DTC No. 13 is output, the cause is probably an abnormality in the TPS circuit system.	• Malfunction of APS • Malfunction of TPS • Malfunction of harness or connector • Malfunction of ECU

Code No. 23 Stop lamp switch circuit system	Probable cause
This DTC is output if the stop lamp switch remains ON for a continuous period of 15 minutes or more, or for a continuous period of 1 minute or more when driving at a speed of 10 km/h or more, because of a short circuit or defective adjustment of the stop lamp switch. This DTC No. may also occur while driving in traffic jams or if the foot is resting on the brake pedal with driving.	• Malfunction of stop lamp switch • Malfunction of harness or connector • Malfunction of TCL-ECU

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Code No. 24 TCL switch circuit system	Probable cause
This DTC is output if signals are input simultaneously from both the TCL-OFF and TCL-ON positions because of a short circuit in the TCL switch circuit.	● Malfunction of the TCL switch ● Malfunction of harness or connector ● Malfunction of TCL-ECU

Code No. 26 Ignition switch (IG2) circuit system	Probable cause
This DTC is output if the IG2 power supply is not distributed, even though the engine speed is 450 r/min or more.	● Malfunction of harness or connector ● Malfunction of TCL-ECU

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

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Code No. 31 Front right wheel speed sensor circuit system Code No. 32 Front left wheel speed sensor circuit system	Probable cause
These DTC are output if a pulse (from the front wheels) indicates that the difference between the front wheels and the rear wheels is 8 km/h or more because of an open or short circuit in a wheel speed sensor or a malfunction of sensor.	• Malfunction of front wheel speed sensor • Malfunction of harness or connector • Malfunction of TCL-ECU • Malfunction of ABS-ECU

NOTE: When these diagnosis trouble codes are output, erase the diagnosis trouble code memory after carrying out repairs, and then carry out a road test at 20 km/h or more and check to be sure that the diagnosis trouble codes are not output again.

Is the ABS warning lamp illuminated, or is an ABS diagnosis code output?
- Yes → Carry out ABS troubleshooting (Refer On Vehicle Service.)
- No ↓

Measure at ABS-ECU connector A115.
- Ignition switch: ON
- Measure at the ECU side with the connector connected.
- Voltage between terminal (20) and body ground
  OK: 4.8 – 5.2 V

- NG → Replace the TCL-ECU.
- OK ↓

Check the following connectors:
A-115, B-58, B-114

- NG → **Repair**
- OK ↓

Check trouble symptom.
- NG ↓

Check the harness connectors between the ABS-ECU and the TCL-ECU, and repair if necessary.

Code No. 33 Rear right wheel speed sensor circuit system Code No. 34 Rear left wheel speed sensor circuit system	Probable cause
These diagnosis trouble codes are output if a pulse (from the wheels on one side of rear) indicates that the difference between the left wheel and the right wheel is 8km/h or more because of an open or short circuit in a wheel speed sensor or a defective sensor.	• Malfunction of rear wheel speed sensor • Malfunction of harness or connector • Malfunction of TCL-ECU • Malfunction of ABS-ECU

NOTE: When these diagnosis trouble codes are output, erase the diagnosis code memory after carrying out repairs, and then carry out a road test at 20 km/h or more and check to be sure that the diagnosis trouble codes are not output again.

Is the ABS warning lamp illuminated, or is an ABS diagnosis code output?
- Yes → Carry out ABS troubleshooting (Refer On Vehicle Service.)
- No ↓

Measure at ABS-ECU connector A-115.
- Ignition switch : ON
- Measure at the ECU side with the connector connected.
- Voltage between terminal (20) and body ground
  OK: 4.8–5.2 V

- NG → Replace the TCL-ECU.
- OK ↓

Check the following connectors:
A-115, B-58, B-114

- NG → **Repair**
- OK ↓

Check trouble symptom.
- NG → Check the harness connectors between the ABS-ECU and the TCL-ECU, and repair if necessary.

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Code No. 35 Rear wheel speed sensor circuit system (1) Code No. 36 Rear wheel speed sensor circuit system (2)	Probable cause
DTC code No. 35 is output if the pulse signal from a rear wheel sensor is momentarily interrupted (0.02 sec.) because of a transient open circuit in a rear wheel speed sensor. DTC No. 36 is output if a rear wheel speed sensor abnormality is judged when the turning speed of both rear wheels is 0 km/h for 20 seconds or more while TCL is operating.	• Malfunction of rear wheel speed sensor • Malfunction of harness or connector • Malfunction of ABS-ECU • Malfunction of TCL-ECU

NOTE: If the front wheels only are turning while the rear wheels are stationary (wheel slip), the TCL-OFF indicator will start flashing after 20 seconds, and the system will be isolated.

NOTE: When these diagnosis trouble codes are output, erase the diagnosis trouble code memory after carrying out repairs, and then carry out a road test at 20 km/h or more and check to be sure that the diagnosis trouble codes are not output again.

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

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Code No. 44 Steering wheel sensor circuit system (short circuit)	Probable cause
This DTC is output when no steering angle signal is output because there is a short-circuit in either steering wheel sensor ST-1 or steering wheel sensor ST-2 when the speed averages output by the left and right rear wheel speed sensors are 15 km/h or more.	• Malfunction of harness or connector • Malfunction of steering wheel sensor • Malfunction of TCL-ECU

Code No. 45 Steering wheel sensor (ST-N) circuit system (short circuit)	Probable cause
This DTC is output if it is considered that there is an abnormality in the steering wheel sensor (ST-N) circuit system when the straight-ahead position is continuously detected even though the steering wheel is turned 20° or more.	• Malfunction of steering wheel sensor • Malfunction of harness or connector • Malfunction of TCL-ECU

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Code No. 71 ECU communication circuit system	Probable cause
This DTC is output if an error is detected in the communication contents because of an open or short circuit in the serial communication circuit between the TCL-ECU and the ECU, a malfunction of ECU and a defective shielding of the shield wire.	• Malfunction of harness or connector • Malfunction of TCL-ECU • Malfunction of ECU

Code No. 74 Engine A/T ECU communication circuit system	Probable cause
This DTC is output if an error is detected in the communication contents because of an open or short circuit in the serial communication circuit between the TCL-ECU and the A/T-ECU, a malfunction of ECU and a defective shielding of the shield wire.	• Malfunction of harness or connector • Malfunction of TCL-ECU • Malfunction of Engine A/T ECU

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Code No. 76 ABS circuit system	Probable cause
This diagnosis code is output if the ABS-ECU detects the system abnormality (when ABS warning lamp illumination is controlled).	• Malfunction of harness or connector • Malfunction of TCL-ECU • Malfunction of ABS-ECU

INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble symptom		Inspection procedure No.
Communication with the MUT-II is not possible.	Communication with all systems is not possible.	1
	Communication with TCL-ECU only is not possible.	2
Malfunction of TCL indicator lamp display	None of the TCL indicator lamps (TCL OFF, TCL) illuminate when the ignition switch is ON.	3
	One of the TCL indicator lamps does not illuminate when the ignition switch is ON (Another lamp does illuminate).	4
	TCL OFF indicator lamp remains illuminated even after the engine is started.	5
	TCL OFF indicator lamp flashes after the engine is started.	
	TCL remains illuminated even after the engine is started.	6
	TCL OFF indicator lamp does not illuminate even if the TCL switch is continuously pressed to the OFF side while the engine is idling.	7
Malfunction of TCL operation	TCL illuminates in the TCL operation range, but torque is not reduced.	8
Poor starting Poor acceleration	Engine output is reduced in the TCL non-operation range (TCL indicator lamp does not illuminate) and starting and acceleration performance is poor.	

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INSPECTION PROCEDURES FOR EACH TROUBLE SYMPTOM

Inspection Procedure 1

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

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Inspection Procedure 2

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

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Inspection Procedure 3

None of the TCL indicator lamps (TCL OFF, TCL) illuminate when the ignition switch is ON.	Probable cause
The main cause is an open circuit in the indicator circuit because of a burnt-out indicator lamp bulb.	• Malfunction of harness or connector • Malfunction of TCL-ECU • Malfunction of indicator lamp bulb • Assist ECU malfunction

Inspection Procedure 4

One of the TCL indicator lamps does not illuminate when the ignition switch is ON.	Probable cause
Because the TCL indicators utilise shared power supply circuits, if one of the indicator lamps is illuminated, the power supply circuit can be judged to be normal.	• Burnt-out indicator lamp bulb • Harness or connector fault • TCL-ECU fault • Assist ECU fault

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Inspection Procedure 5

• TCL OFF indicator lamp remains illuminated even after the engine is started. • TCL OFF indicator lamp flashes after the engine is started.	Probable cause
The TCL-OFF indicator is also used as a system warning indicator. If there is a system abnormality, this indicator will illuminate or flash.	• Other system related to the TCL • Malfunction of harness or connector

Inspection Procedure 6

TCL indicator lamp remains illuminated even after the engine is started.	Probable cause
The TCL indicator lamp only illuminates while the engine is running if the TCL is operating.	• Malfunction of TCL indicator power supply circuit • Malfunction of TCL-ECU • Malfunction of harness or connector

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Inspection Procedure 7

TCL OFF indicator lamp does not illuminate even if the TCL switch is continuously pressed to the OFF side while the engine is idling.	Probable cause
If the indicator lamp does not illuminate when the switch is operated, there is a malfunction in the switch, switch circuit or in the TCL-ECU.	• Malfunction of harness or connector • Malfunction of TCL switch • Malfunction of TCL-ECU

Inspection Procedure 8

• TCL illuminates in the TCL operation range, but torque is not reduced. • Engine output is reduced in the TCL non-operation range (TCL indicator lamp does not illuminate) and starting and acceleration performance is poor.	Probable cause
In cases such as the above, the electrical system is normal, and the cause is probably an abnormality in the mechanical system (vacuum actuator).	• Malfunction of vacuum solenoid valve • Malfunction of ventilation solenoid valve • Malfunction of vacuum actuator • Incorrect vacuum hose connector • Malfunction of throttle link • Malfunction of vacuum tank • Blocked air cleaner element

As the cause is probably a malfunction of the vacuum actuator system, carry out inspection of the following items in order.

- Vacuum solenoid valve operation inspection (Refer Group 13A On Vehicle Service.)
- Ventilation solenoid valve operation inspection (Refer Group 13A On Vehicle Service.)
- Disconnected or mis-connected vacuum hose inspection (Refer Group 17 On Vehicle Service.)
- Throttle link operation inspection (Refer Group 13A On Vehicle Service.)
- Vacuum tank inspection (Refer Group 13A On Vehicle Service.)
- Air cleaner element blockage inspection

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DATA LIST REFERENCE TABLE

No.	Check item	Check condition		Normal condition
11	APS	Accelerator pedal position Engine stop Selector lever position: P	Fully closed	300–1,000 mV
			Depressed	Gradually rises from the above value
			Fully open	4,500–5,500 mV
13	TPS	Accelerator pedal position Engine stop Selector lever position: P	Fully closed	300–1,000 mV
			Depressed	Gradually rises from the above value
			Fully open	4,500–5,500 mV
15	PNP	Ignition switch: ON Engine stop	Selector lever: P position	P
			Selector lever: R position	R
			Selector lever: N position	N
			Selector lever: D position	D
			Selector lever: 3 position	3
			Selector lever: 2 position	2
			Selector lever: L position	L
16	Shift position	Shift lever position: D	Driving at constant speed of 10 km/h in 1 range	1st
			Driving at constant speed of 30 km/h in 2 range	2nd
			Driving at constant speed of 50 km/h in 3 range	3rd
			Driving at constant speed of 70 km/h in 4 range	4th
21	Closed throttle position switch	Accelerator pedal position Ignition switch: ON	Depressed	OFF
			Released	ON
22	Ignition switch	Ignition switch: ON		ON
		Ignition switch: OFF		OFF
23	Stop lamp switch	Brake pedal position Ignition switch: ON	Depressed	ON
			Released	OFF
24	TCL ON switch	TCL ON switch operation Ignition switch : ON	Pressed	ON
			Released	OFF
25	TCL OFF switch	TCL OFF switch operation Ignition switch: ON	Pressed	ON
			Released	OFF

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No.	Check item	Check condition		Normal condition
27	ECU power supply voltage	Ignition switch: ON		System voltage
31	Front right wheel speed sensor	Engine running Selector lever position: D	Vehicle stopped	0 km/h
			Driving at 40 km/h	40 km/h
32	Front left wheel speed sensor	Engine running Selector lever position: D	Vehicle stopped	0 km/h
			Driving at 40 km/h	40 km/h
33	Rear right wheel speed sensor	Engine running Selector lever position: D	Vehicle stopped	0 km/h
			Driving at 40 km/h	40 km/h
34	Rear left wheel speed sensor	Engine running Selector lever position: D	Vehicle stopped	0 km/h
			Driving at 40 km/h	40 km/h
40	Engine speed	Ignition switch: ON	Engine: idling	Engine speeds displayed on the MUT-II and tachometer are identical.
44	Steering angle	Steering wheel position Ignition switch: ON	Turned 90° to the right	R 88 deg or R 92 deg
			Turned 90° to the left	L 88 deg or L 92 deg
45	Steering straight-ahead point learning	Steering wheel position Ignition switch: ON	Immediately after ignition switch is ON	OFF
			Immediately after city driving	ON
51	Slip control	TCL switch: ON Driving on low frictional resistance road	TCL indicator lamp illuminated	ON
			TCL indicator lamp switched off	OFF
52	Trace control	TCL switch: ON Driving on winding road	TCL indicator lamp illuminated	ON
			TCL indicator lamp switched off	OFF
74	Steering wheel sensor (ST-N)	Steering wheel position Engine idling	Neutral position	LOW
			Steering wheel turned 90° from neutral position	HIGH
75	Steering wheel sensor (ST-1)	Steering wheel position Ignition switch: ON	Steering wheel turned slowly to left	HIGH and LOW display alternately
76	Steering wheel sensor (ST-2)	Steering wheel position Ignition switch: ON	Steering wheel turned slowly to right	HIGH and LOW display alternately
81	Engine model	Ignition switch: ON		6G74
82	Valve type	Ignition switch: ON		SOHC
83	Aspiration type	Ignition switch: ON		N/A
84	Engine classification	Ignition switch: ON		NORMAL
85	Destination	Ignition switch: ON		OTHER

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CHECK AT ECU TERMINALS

A03X0101

Terminal No.	Check item	Measurement condition	Normal condition
1	Diagnosis control	When MUT-II is not connected	Approx. 5 V
		When MUT-II is connected	0 V
13	Ground	Ignition switch: ON	0 V
14	Diagnosis data input	When MUT-II is connected	Serial communication with MUT-II
		When MUT-II is not connected	1 V or less
15	Engine A/T-ECU data communication	Engine: Idling	Other than 0 V
16			
17	Engine A/T-ECU data communication	Engine: Idling	Other than 0 V
18			
19	APS output	Ignition switch: ON Accelerator pedal fully depressed	4.5 – 5.5 V
		Ignition switch: ON Accelerator pedal released	0.4 – 1.0 V
20	Wheel speed sensor input (rear left wheel)	Engine: Idling, Vehicle slowly moving forward	Flashes between 0 V and approx. 5 V
21	Wheel speed sensor input (front right wheel)	Engine: Idling, Vehicle slowly moving forward	Flashes between 0 V and approx. 5 V
22	Wheel speed sensor input (front left wheel)	Engine: Idling, Vehicle slowly moving forward	Flashes between 0 V and approx. 5 V
23	Wheel speed sensor input (rear right wheel)	Engine: Idling, Vehicle slowly moving forward	Flashes between 0 V and approx. 5 V
25	ECU power supply	Ignition switch: ON	Battery voltage
26	Ground	Ignition switch: ON	0 V
31	Ground	Ignition switch: ON	0 V

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Terminal No.	Check item	Measurement condition	Normal condition
32	Steering wheel sensor (ST-N) input	Engine: Idling Steering wheel in straight-ahead position	0.5 V or less
		Engine: Idling Steering wheel turned 90° from straight-ahead position	2.5 – 3.5 V
34	TCL ON switch	Ignition switch: ON TCL switch: Released	Battery voltage
35	Ignition switch IG2	Ignition switch: ON	Battery voltage
39	ECU back-up power supply	Ignition switch: OFF	Battery voltage
40	Steering wheel sensor (ST-1) input	Ignition switch: ON Steering wheel turned slowly	Flashes between 0 V and approx. 3 V
41	Steering wheel sensor (ST-2) input	Ignition switch: ON Steering wheel turned slowly.	Flashes between 0 V and approx. 3 V
42	TCL OFF switch	Ignition switch: ON TCL switch: Pressed to OFF side	0 – 2 V
		Ignition switch: ON TCL switch: Released	Battery voltage
43	Stop lamp switch input	Ignition switch: ON Brake pedal depressed	Battery voltage
		Ignition switch: ON Brake pedal released	0 – 2 V
44	ABS fail signal	During ABS fail	0 – 2 V
		When ABS is normal	Battery voltage
45	TCL-OFF indicator	Ignition switch: ON Indicator: Extinguished	Battery voltage
		Ignition switch: ON Indicator: Illuminated	0 – 2 V
46	TCL indicator	Ignition switch: ON Indicator: Illuminated	0 – 2 V
		Ignition switch: ON Indicator: Extinguished	Battery voltage

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ON-VEHICLE SERVICE

INDICATOR LAMP CHECK

Press the TCL switch and check if each TCL indicator lamp illuminates or switches off.

TCL switch mode	Inspection conditions	TCL OFF indicator (A)	TCL indicator (B)
Switch does not operate	Turn the ignition switch to the ON position.	○	○
	Start the engine.	×	×
TCL OFF mode	Engine is idling.	○	–
TCL ON mode	Drive the vehicle at 30 km/h for 2 minutes or more.	No illumination	–

NOTE
O: illuminated, X: extinguished, – : not relevant

CAUTION: If a different result is obtained when checking, refer to the Troubleshooting section for remedy.

TCL SYSTEM OPERATION CHECK

<When using the MUT-II>

1. Connect the MUT-II to the data link connector.
2. Move the selector lever to P range.
3. Start the engine.
4. Turn the TCL switch to ON.
5. Operate the MUT-II to start the actuator test (item No. 05) and fully depress the accelerator pedal at the same time. Check that the engine speed is kept down to 3,000 r/min at this time.

   CAUTION: The actuator test should only be carried out for 3 seconds.
   Because the engine speed will increase once the actuator test is stopped, the accelerator pedal should be released quickly after it has been depressed.

   NOTE: The TCL-ECU will output a “request torque: 0” signal to the engine-ECU for 3 seconds while the actuator test is being carried out, and the TCL OFF indicator will illuminate during this time.

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<When not using the MUT-II>

1. Turn the TCL switch to ON.
2. Place the front wheels onto a speedometer tester or a chassis dynamo and start the engine. (The front wheels may also be jacked up.)
3. Move the selector lever to D range.
4. Check to be sure that the engine speed is restrained when the accelerator pedal is depressed.

NOTE: If the following symptoms occur when the accelerator pedal is depressed, refer to Troubleshooting.
(1) If the TCL indicator lamp does not illuminate.
(2) If the TCL indicator lamp illuminates but the engine is not restrained.

CAUTION: Inspection should be completed within 20 seconds after the accelerator pedal was depressed. If it takes longer than 20 seconds, the TCL system function will stop and the engine speed will gradually increase.

CAUTION: Because the TCL OFF indicator will flash when the TCL system operation is stopped, the diagnosis codes should be erased if you notice that the indicator is flashing. (Refer Erasing Diagnosis Codes.)

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STOP LAMP SWITCH CHECK

Refer Group 35A On Vehicle Service.

WHEEL SPEED SENSOR CHECK

Refer Group 35B On Vehicle Service.

VACUUM SOLENOID VALVE CHECK

Refer Group 13A On Vehicle Service.

VENTILATION SOLENOID VALVE CHECK

Refer Group 13A On Vehicle Service.

VACUUM TANK CHECK

Refer Group 13A On Vehicle Service.

VACUUM ACTUATOR CHECK

Refer Group 13A On Vehicle Service.

ACCELERATOR PEDAL POSITION SENSOR (APS) CHECK

1. Disconnect the APS connector.
2. Measure the resistance between terminals (1) and (4) of the APS connector.

   Standard value: 3.5–6.5 kΩ

3. When the accelerator pedal is gradually depressed, check that the resistance between terminals (1) and (2) of the APS connector changes smoothly in proportion to the pedal opening amount.
4. If the resistance is outside the standard value, or if the resistance does not change smoothly, replace the APS. Adjust the APS after it has been replaced. (Refer On Vehicle Service.)

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TCL SWITCH

REMOVAL AND INSTALLATION

REMOVAL STEPS

1. Switch bezel
2. TCL switch

INSPECTION

TCL SWITCH CONTINUITY CHECK

SWITCH POSITION	TERMINAL No.						
	1	2	3	6	4	–	5
ON			○	○			
Neutral					○	⊖	○
OFF	○		○				

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STEERING WHEEL SENSOR

REMOVAL AND INSTALLATION

CAUTION: SRS
Before removal of air bag module and clock spring, refer to Group 52B – Service Precautions and Air Bag Module and Clock Spring.

REMOVAL STEPS

- Steering wheel and column cover (Refer Group 37A On Vehicle Service.)

◀A▶ 1. Steering wheel sensor

REMOVAL SERVICE POINT

◀A▶ STEERING WHEEL SENSOR REMOVAL

CAUTION: Do not adhere any dust or grease, etc. to the steering wheel sensor, which has a photo coupler in it.

CAUTION: Do not bend the slit plate of the column switch nor adhere any grease etc. to it.

INSPECTION

STEERING WHEEL SENSOR CHECK

Refer Data List.

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TCL-ECU

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
Floor console assembly, Centre air outlet assembly, Ashtray, Air control panel assembly and Radio/ tape player Removal and Installation (Refer Group 52A – Instrument panel.)

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Removal

1. TCL-ECU

INSPECTION

TCL-ECU CHECK

Refer Check At ECU Terminals.

13H TRACTION CONTROL SYSTEM (TCL) 01M/Y FROM AUG 2001

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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) Service or maintenance of any SRS component or SRS-related component must be performed only at an authorised MITSUBISHI dealer.

(3) MITSUBISHI dealer personnel must thoroughly review this manual, and especially its GROUP 52B – Supplemental Restraint System (SRS) before beginning any service or maintenance of any component of the SRS or any SRS-related component.

NOTE

The SRS includes the following components: SRS-ECU, SRS warning lamp, air bag module, clock spring and interconnecting wiring. Other SRS-related components (that may have to be removed/installed in connection with SRS service or maintenance) are indicated in the table of contents by an asterisk (*)

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GENERAL DESCRIPTION

The TCL system (slip control and trace control) is available as an option. This system facilitates starting, accelerating, and cornering on slippery roads such as snowy roads. In addition, this system improves driveability while cornering on normal roads and contributes to easier driving.

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INSPECTION CHART FOR DIAGNOSIS TROUBLE CODES

CODE No.	DIAGNOSIS ITEM
11	APS circuit system
12	APS or TPS circuit system
13	TPS circuit system
23	Stop lamp switch circuit system
24	TCL switch circuit system
26	Ignition switch (IG2) circuit system
27	TCL-ECU power supply voltage circuit (engine control relay circuit) system
31	Front right wheel speed sensor circuit system
32	Front left wheel speed sensor circuit system
33	Rear right wheel speed sensor circuit system
34	Rear left wheel speed sensor circuit system
35	Rear wheel speed sensor circuit system (1)
36	Rear wheel speed sensor circuit system (2)
41	Steering wheel sensor (ST-1) circuit system (open circuit)
42	Steering wheel sensor (ST-2) circuit system (open circuit)
43	Steering wheel sensor (ST-N) circuit system (open circuit)
44	Steering wheel sensor circuit system (short circuit)
45	Steering wheel sensor (ST-N) circuit system (short circuit)
71	ECU communication circuit system
72	ECU circuit system
73	ECU circuit system
74	Engine A/T ECU communication circuit system
76	ABS circuit system

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INSPECTION PROCEDURES FOR DIAGNOSIS CODES

Code No. 11 APS circuit system	Probable cause
This DTC is output if the APS output voltage is less than 0.2 V due to an open circuit or other malfunction in the APS circuit. The APS power supply and ground are supplied from the ECU, and the output signal is used by the Engine A/T-ECU and auto-cruise control-ECU as well as by the TCL-ECU.	• Malfunction of APS • Malfunction of TCL-ECU • Malfunction of ECU • Malfunction of harness or connector

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Code No. 12 APS or TPS circuit system	Probable cause
This DTC is output if the APS opening angle is 20° or greater than the TPS opening angle because of a short in the APS, an open circuit in the TPS or sticking of the vacuum actuator. As this detection condition can be applicable during throttle control, trouble diagnosis is invalid at this time.	• Malfunction of APS • Malfunction of TPS • Malfunction of TCL-ECU • Malfunction of ECU • Malfunction of harness or connector • Malfunction of vacuum actuator

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Code No.13 TPS circuit system	Probable cause
This DTC is output if the TPS opening angle is 20° or greater than the APS opening angle because of a short in the TPS or an open circuit in the APS. If there is an open circuit in the APS, diagnosis code No. 11 is output at the same time. Accordingly, if only DTC No. 13 is output, the cause is probably an abnormality in the TPS circuit system.	• Malfunction of APS • Malfunction of TPS • Malfunction of harness or connector • Malfunction of ECU

Code No. 23 Stop lamp switch circuit system	Probable cause
This DTC is output if the stop lamp switch remains ON for a continuous period of 15 minutes or more, or for a continuous period of 1 minute or more when driving at a speed of 10 km/h or more, because of a short circuit or defective adjustment of the stop lamp switch. This DTC No. may also occur while driving in traffic jams or if the foot is resting on the brake pedal with driving.	• Malfunction of stop lamp switch • Malfunction of harness or connector • Malfunction of TCL-ECU

Code No. 24 TCL switch circuit system	Probable cause
This DTC is output if signals are input simultaneously from both the TCL-OFF and TCL-ON positions because of a short circuit in the TCL switch circuit.	• Malfunction of the TCL switch • Malfunction of harness or connector • Malfunction of TCL-ECU

Code No. 26 Ignition switch (IG2) circuit system	Probable cause
This DTC is output if the IG2 power supply is not distributed, even though the engine speed is 450 r/min or more.	• Malfunction of harness or connector • Malfunction of TCL-ECU

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

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Code No. 31 Front right wheel speed sensor circuit system Code No. 32 Front left wheel speed sensor circuit system	Probable cause
These DTC are output if a pulse (from the front wheels) indicates that the difference between the front wheels and the rear wheels is 8 km/h or more because of an open or short circuit in a wheel speed sensor or a malfunction of sensor.	• Malfunction of front wheel speed sensor • Malfunction of harness or connector • Malfunction of TCL-ECU • Malfunction of ABS-ECU

NOTE: When these diagnosis trouble codes are output, erase the diagnosis trouble code memory after carrying out repairs, and then carry out a road test at 20 km/h or more and check to be sure that the diagnosis trouble codes are not output again.

Is the ABS warning lamp illuminated, or is an ABS diagnosis code output?
- Yes → Carry out ABS troubleshooting (Refer On Vehicle Service.)
- No ↓

Measure at ABS-ECU connector A115.
- Ignition switch: ON
- Measure at the ECU side with the connector connected.
- Voltage between terminal (20) and body ground
  OK: 4.8 – 5.2 V

- NG → Replace the TCL-ECU.
- OK ↓

Check the following connectors:
A-115, B-58, B-114

- NG → **Repair**
- OK ↓

Check trouble symptom.
- NG ↓

Check the harness connectors between the ABS-ECU and the TCL-ECU, and repair if necessary.

Code No. 33 Rear right wheel speed sensor circuit system Code No. 34 Rear left wheel speed sensor circuit system	Probable cause
These diagnosis trouble codes are output if a pulse (from the wheels on one side of rear) indicates that the difference between the left wheel and the right wheel is 8km/h or more because of an open or short circuit in a wheel speed sensor or a defective sensor.	• Malfunction of rear wheel speed sensor • Malfunction of harness or connector • Malfunction of TCL-ECU • Malfunction of ABS-ECU

NOTE: When these diagnosis trouble codes are output, erase the diagnosis code memory after carrying out repairs, and then carry out a road test at 20 km/h or more and check to be sure that the diagnosis trouble codes are not output again.

Is the ABS warning lamp illuminated, or is an ABS diagnosis code output?
- Yes → Carry out ABS troubleshooting (Refer On Vehicle Service.)
- No ↓

Measure at ABS-ECU connector A-115.
- Ignition switch : ON
- Measure at the ECU side with the connector connected.
- Voltage between terminal (20) and body ground
  OK: 4.8–5.2 V

- NG → Replace the TCL-ECU.
- OK ↓

Check the following connectors:
A-115, B-58, B-114

- NG → **Repair**
- OK ↓

Check trouble symptom.
- NG → Check the harness connectors between the ABS-ECU and the TCL-ECU, and repair if necessary.

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Code No. 35 Rear wheel speed sensor circuit system (1) Code No. 36 Rear wheel speed sensor circuit system (2)	Probable cause
DTC code No. 35 is output if the pulse signal from a rear wheel sensor is momentarily interrupted (0.02 sec.) because of a transient open circuit in a rear wheel speed sensor. DTC No. 36 is output if a rear wheel speed sensor abnormality is judged when the turning speed of both rear wheels is 0 km/h for 20 seconds or more while TCL is operating.	• Malfunction of rear wheel speed sensor • Malfunction of harness or connector • Malfunction of ABS-ECU • Malfunction of TCL-ECU

NOTE: If the front wheels only are turning while the rear wheels are stationary (wheel slip), the TCL-OFF indicator will start flashing after 20 seconds, and the system will be isolated.

NOTE: When these diagnosis trouble codes are output, erase the diagnosis trouble code memory after carrying out repairs, and then carry out a road test at 20 km/h or more and check to be sure that the diagnosis trouble codes are not output again.

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

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Code No. 44 Steering wheel sensor circuit system (short circuit)	Probable cause
This DTC is output when no steering angle signal is output because there is a short-circuit in either steering wheel sensor ST-1 or steering wheel sensor ST-2 when the speed averages output by the left and right rear wheel speed sensors are 15 km/h or more.	• Malfunction of harness or connector • Malfunction of steering wheel sensor • Malfunction of TCL-ECU

Code No. 45 Steering wheel sensor (ST-N) circuit system (short circuit)	Probable cause
This DTC is output if it is considered that there is an abnormality in the steering wheel sensor (ST-N) circuit system when the straight-ahead position is continuously detected even though the steering wheel is turned 20° or more.	• Malfunction of steering wheel sensor • Malfunction of harness or connector • Malfunction of TCL-ECU

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Code No. 71 ECU communication circuit system	Probable cause
This DTC is output if an error is detected in the communication contents because of an open or short circuit in the serial communication circuit between the TCL-ECU and the ECU, a malfunction of ECU and a defective shielding of the shield wire.	• Malfunction of harness or connector • Malfunction of TCL-ECU • Malfunction of ECU

Code No. 74 Engine A/T ECU communication circuit system	Probable cause
This DTC is output if an error is detected in the communication contents because of an open or short circuit in the serial communication circuit between the TCL-ECU and the A/T-ECU, a malfunction of ECU and a defective shielding of the shield wire.	• Malfunction of harness or connector • Malfunction of TCL-ECU • Malfunction of Engine A/T ECU

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Code No. 76 ABS circuit system	Probable cause
This diagnosis code is output if the ABS-ECU detects the system abnormality (when ABS warning lamp illumination is controlled).	• Malfunction of harness or connector • Malfunction of TCL-ECU • Malfunction of ABS-ECU

INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble symptom		Inspection procedure No.
Communication with the MUT-II is not possible.	Communication with all systems is not possible.	1
	Communication with TCL-ECU only is not possible.	2
Malfunction of TCL indicator lamp display	None of the TCL indicator lamps (TCL OFF, TCL) illuminate when the ignition switch is ON.	3
	One of the TCL indicator lamps does not illuminate when the ignition switch is ON (Another lamp does illuminate).	4
	TCL OFF indicator lamp remains illuminated even after the engine is started.	5
	TCL OFF indicator lamp flashes after the engine is started.	
	TCL remains illuminated even after the engine is started.	6
	TCL OFF indicator lamp does not illuminate even if the TCL switch is continuously pressed to the OFF side while the engine is idling.	7
Malfunction of TCL operation	TCL illuminates in the TCL operation range, but torque is not reduced.	8
Poor starting Poor acceleration	Engine output is reduced in the TCL non-operation range (TCL indicator lamp does not illuminate) and starting and acceleration performance is poor.	

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INSPECTION PROCEDURES FOR EACH TROUBLE SYMPTOM

Inspection Procedure 1

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

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Inspection Procedure 2

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

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Inspection Procedure 3

None of the TCL indicator lamps (TCL OFF, TCL) illuminate when the ignition switch is ON.	Probable cause
The main cause is an open circuit in the indicator circuit because of a burnt-out indicator lamp bulb.	• Malfunction of harness or connector • Malfunction of TCL-ECU • Malfunction of indicator lamp bulb

Inspection Procedure 4

One of the TCL indicator lamps does not illuminate when the ignition switch is ON.	Probable cause
Because the TCL indicators utilise shared power supply circuits, if one of the indicator lamps is illuminated, the power supply circuit can be judged to be normal.	• Burnt-out indicator lamp bulb • Harness or connector fault • TCL-ECU fault

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Inspection Procedure 5

• TCL OFF indicator lamp remains illuminated even after the engine is started. • TCL OFF indicator lamp flashes after the engine is started.	Probable cause
The TCL-OFF indicator is also used as a system warning indicator. If there is a system abnormality, this indicator will illuminate or flash.	• Other system related to the TCL • Malfunction of harness or connector

Inspection Procedure 6

TCL indicator lamp remains illuminated even after the engine is started.	Probable cause
The TCL indicator lamp only illuminates while the engine is running if the TCL is operating.	• Malfunction of TCL indicator power supply circuit • Malfunction of TCL-ECU • Malfunction of harness or connector

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Inspection Procedure 7

TCL OFF indicator lamp does not illuminate even if the TCL switch is continuously pressed to the OFF side while the engine is idling.	Probable cause
If the indicator lamp does not illuminate when the switch is operated, there is a malfunction in the switch, switch circuit or in the TCL-ECU.	• Malfunction of harness or connector • Malfunction of TCL switch • Malfunction of TCL-ECU

Inspection Procedure 8

• TCL illuminates in the TCL operation range, but torque is not reduced. • Engine output is reduced in the TCL non-operation range (TCL indicator lamp does not illuminate) and starting and acceleration performance is poor.	Probable cause
In cases such as the above, the electrical system is normal, and the cause is probably an abnormality in the mechanical system (vacuum actuator).	• Malfunction of vacuum solenoid valve • Malfunction of ventilation solenoid valve • Malfunction of vacuum actuator • Incorrect vacuum hose connector • Malfunction of throttle link • Malfunction of vacuum tank • Blocked air cleaner element

As the cause is probably a malfunction of the vacuum actuator system, carry out inspection of the following items in order.

- Vacuum solenoid valve operation inspection (Refer Group 13A On Vehicle Service.)
- Ventilation solenoid valve operation inspection (Refer Group 13A On Vehicle Service.)
- Disconnected or mis-connected vacuum hose inspection (Refer Group 17 On Vehicle Service.)
- Throttle link operation inspection (Refer Group 13A On Vehicle Service.)
- Vacuum tank inspection (Refer Group 13A On Vehicle Service.)
- Air cleaner element blockage inspection

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GENERAL INFORMATION

The cooling system is designed to keep every part of the engine at the appropriate temperature in whatever condition the engine may be operated. The cooling method is of the water-cooled, pressure forced circulation type in which the water pump pressurises coolant and circulates it throughout the engine. If the coolant temperature exceeds the prescribed temperature, the thermostat opens to circulate the coolant through the radiator as well so that the heat absorbed by the coolant may be radiated into the air.
The water pump is of the centrifugal type and is driven by the camshaft drive belt.
The radiator is the corrugated fin, down flow type and is cooled by the electrical radiator fan.

CONSTRUCTION DIAGRAM

SERVICE SPECIFICATIONS

Items		Standard value	Limit
Thermostat	Valve opening temperature of thermostat °C	88	–
	Full-opening temperature of thermostat °C	95	–
Radiator	Range of coolant antifreeze concentration %	30–50	–
Radiator cap	High pressure valve opening pressure kPa	75–105	65

LUBRICANT

Items	Specified lubricant	Quantity (litres)
Engine coolant	Mitsubishi genuine coolant	9.5

SEALANT

Items	Specified sealant	Remarks
Cylinder block drain plug	Loctite 577 or equivalent	Drying sealant

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ON-VEHICLE SERVICE

ENGINE COOLANT LEAK CHECK

1. Confirm that the coolant level is up to the filler neck. Install a radiator cap tester and apply 160 kPa pressure, and then check for leakage from the radiator hose or connections.

   Caution
   1. **Be sure to completely clean away any moisture from the places checked.**
   2. **When the tester is taken out, be careful not to spill any coolant from it.**
   3. **Be careful, when installing and removing the tester and when testing, not to deform the filler neck of the radiator.**

2. If there is leakage, repair or replace the appropriate part.

RADIATOR CAP VALVE OPENING PRESSURE CHECK

1. Use a cap adaptor to attach the cap to the tester.
2. Increase the pressure until the indicator of the gauge stops moving.

   Limit: 65 kPa
   Standard value: 75–105 kPa

3. Replace the radiator cap if the reading does not remain at or above the limit.

   NOTE
   Be sure that the cap is clean before testing, since rust or other foreign material on the cap seal will cause an improper indication.

ENGINE COOLANT REPLACEMENT

1. Remove the heat protectors (front and rear) from the exhaust manifold.
2. Loosen the radiator drain plug, remove two drain plugs from the engine block (one for each bank) and remove the radiator cap to discharge the coolant.
3. Remove the reserve tank and discharge the coolant.
4. When the coolant has been discharged, pour water through the filler port to flush the coolant passage.

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5. Coat the threads of the engine drain plugs with the specified sealant and tighten the plugs to specification.

   Specified Sealant: Loctite 577 or equivalent.
   Tightening torque: 40 Nm

6. Fit the radiator drain plug securely.
7. Mount the reserve tank.
8. Slowly pour coolant into the radiator to the brim and also into the reserve tank to the full line.

   Specified Coolant:
   Mitsubishi Genuine Coolant

   Standard value: 30-50% (concentration range)

   Quantity: 9.5 (litres)

9. Install the radiator cap securely.
10. Start the engine and warm up until the thermostat opens.
11. Race the engine up to around 3,000 rpm several times, then stop the engine.
12. When the engine has cooled down, remove the radiator cap and add coolant up to the brim. Add coolant to the reserve tank up to the FULL line.

CONCENTRATION MEASUREMENT

The preferred method is a commercial type concentration gauge such as " Hydro – spy " coolant refractometer (special tool number J26568). Alternatively, proceed as follows.

- Using a suitable thermometer, measure coolant temperature
- Measure coolant specific gravity using a suitable hydrometer.
- Check that the specific gravity is correct for the required concentration by referring to Specification Table.
- If necessary adjust specific gravity by adding Mitsubishi Genuine Coolant (to increase specific gravity) or rain or demineralised water (to reduce specific gravity).

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Coolant temperature (°C) and specific gravity							Percentage coolant concentration	Minimum operating temperature °C
0°	10°	20°	30°	40°	50°	60°		
1.058	1.056	1.053	1.048	1.043	1.038	1.032	30%	–16°
1.067	1.064	1.061	1.056	1.050	1.045	1.039	35%	–20°
1.076	1.073	1.069	1.064	1.058	1.053	1.046	40%	–24°
1.085	1.081	1.076	1.071	1.065	1.060	1.053	45%	–30°
1.093	1.088	1.083	1.078	1.072	1.066	1.059	50%	–37°

Caution
If the concentration of the coolant is below 30%, the anti-corrosion property will be adversely affected. In addition, if the concentration is above 50%, both the anti-freezing and the engine cooling properties will decrease, affecting the engine adversely. For these reasons, be sure to maintain the concentration level within the specified range.

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THERMOSTAT

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
Engine Coolant, Draining and Supplying
(Refer Engine Coolant Replacement.)

Removal steps

◀A▶ ▶B◀ 1. Radiator lower hose connection
2. Water outlet fitting
▶A◀ 3. Thermostat

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REMOVAL SERVICE POINT

◀A▶ RADIATOR LOWER HOSE DISCONNECTION

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

INSTALLATION SERVICE POINTS

▶A◀ THERMOSTAT INSTALLATION

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

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

▶B◀ RADIATOR LOWER HOSE CONNECTION

1. Insert each hose as far as the projection of the water outlet fitting or water inlet fitting.

2. Align the mating marks on the radiator hose and hose clamp, and then connect the radiator hose.

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INSPECTION

THERMOSTAT CHECK

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

   Standard value: 88 ± 1.5°C

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

   Standard value:
   Full-opening temperature: 95°C
   Amount of valve lift: 8.5mm or more

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

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WATER PUMP

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
(1) Engine Coolant Draining and Supplying
(Refer Engine Coolant Replacement.)
(2) Timing Belt Removal and Installation
(Refer Group 11A On Vehicle Service.)

Removal steps

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

INSTALLATION SERVICE POINT

▶A◀ O-RING INSTALLATION

Insert the O-ring to the water inlet pipe, and coat the outlet circumference of the O-ring with water. By coating with water, the insertion to the water pump will become easier.

Caution

1. **Care must be taken not to permit engine oil or other greases to adhere to the O-ring.**
2. **When inserting the pipe, check to be sure that there is no sand, dirt, etc. on its inner surface.**

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WATER HOSE AND WATER PIPE

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
(1) Engine Coolant Draining and Supplying
(Refer Engine Coolant Replacement.)
(2) Air Cleaner Removal and Installation
(3) Distributor Removal and Installation
(Refer Group 16 On Vehicle Service.)

Removal steps

◀A▶ ▶B◀ 1. Radiator upper hose connection
◀A▶ ▶B◀ 2. Radiator lower hose connection
3. Water hose
4. Heater hose connection
5. Heater inlet pipe A
▶A◀ 6. O-ring
7. Heater inlet pipe B
▶A◀ 8. O-ring
9. Thermostat housing assembly
10. Gasket
11. Water inlet pipe assembly
▶A◀ 12. O-ring

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REMOVAL SERVICE POINT

◀A▶ RADIATOR UPPER HOSE/RADIATOR LOWER HOSE DISCONNECTION

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

INSTALLATION SERVICE POINTS

▶A◀ O-RING INSTALLATION

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

Caution
Care must be taken not to permit engine oil or other greases to adhere to the O-ring.

▶B◀ RADIATOR LOWER HOSE/RADIATOR UPPER HOSE CONNECTION

1. Insert each hose as far as the projection of the water outlet fitting or water inlet fitting.

2. Align the mating marks on the radiator hose and hose clamp, and then connect the radiator hose.

INSPECTION

WATER PIPE AND HOSE CHECK

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

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RADIATOR

REMOVAL AND INSTALLATION

Pre-removal Operation
Engine Coolant Draining
(Refer Engine Coolant Replacement.)

Post-installation Operation
(1) Engine Coolant Supplying and Checking
(Refer Engine Coolant Replacement.)
(2) A/T Fluid Checking and Refilling If Necessary
(Refer Checking Automatic Fluid Level.)

Radiator removal steps

1. Drain plug
2. Radiator cap
3. Overflow tube
4. Reserve tank
5. ◀A▶ ▶A◀ Radiator upper hose
6. ◀A▶ ▶A◀ Radiator lower hose
7. ◀B▶ Transmission fluid cooler hose connection
8. Transmission fluid cooler hose connection
9. Upper insulator
10. Radiator assembly
11. Lower insulator
12. Condenser fan motor assembly
13. Radiator fan motor assembly
14. Fan
15. Radiator fan motor
16. Shroud

Radiator fan motor removal steps

1. Drain plug
2. Radiator cap
5. ◀A▶ ▶A◀ Radiator upper hose
12. Condenser fan motor assembly
13. Radiator fan motor assembly
14. Fan
15. Radiator fan motor
16. Shroud

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REMOVAL SERVICE POINTS

◀A▶ RADIATOR UPPER HOSE/RADIATOR LOWER HOSE DISCONNECTION

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

◀B▶ TRANSMISSION FLUID COOLER HOSE REMOVAL

After removing the hose from the radiator, plug the hose and the radiator nipple to prevent dust or foreign particles from getting in.

INSTALLATION SERVICE POINT

▶A◀ RADIATOR LOWER HOSE/RADIATOR UPPER HOSE CONNECTION

1. Insert each hose as far as the projection of the water outlet fitting or water inlet fitting.

2. Align the mating marks on the radiator hose and hose clamp, and then connect the radiator hose.

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INSPECTION

RADIATOR FAN MOTOR CHECK

1. Check to be sure that the radiator fan rotates when battery voltage is applied between terminals.

Terminals connected to the battery				Radiator fan motor rotation
1	2	3	4	
		⊕ - - -	- - - ⊖	Low
	⊖ - - -	- - - ⊕ - - -	- - - ⊖	Medium (3.5 litre only)
⊕ - - -	- - - ⊖	⊕ - - -	- - - ⊖	High

2. Check to see that abnormal noises are not produced, while motor is turning.

RADIATOR RELAY CONTINUITY CHECK

Battery voltage	Terminal No.			
	1	3	4	5
Not supplied	○	○		
Supplied	⊕ - - -	- - - ⊖	○	○

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GENERAL INFORMATION

The intake manifold is made of an aluminium alloy, and the shape provides an increased intake inertia effect and has a good volumetric efficiency.

The exhaust pipe is divided into four parts.

SERVICE SPECIFICATIONS

Items		Standard value	Limit
Intake manifold	Distortion of the installation surface mm	0.15 or less	0.2

SPECIAL TOOL

Tool	Tool number and name	Supersession	Application
	MD998770 Oxygen sensor wrench	–	Removal/Installation of oxygen sensor <Vehicles with catalytic converter>

ON-VEHICLE SERVICE

INTAKE MANIFOLD VACUUM CHECK

Refer Group 11A On Vehicle Service.

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AIR CLEANER

REMOVAL AND INSTALLATION

Removal steps

1. Air cleaner element
2. Breather hose
3. Air flow sensor
4. Gasket
5. Air cleaner cover
6. Air intake hose assembly
7. Resonator A
8. Resonator B
9. Air intake hose
10. Air duct
11. Air cleaner body

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INTAKE MANIFOLD PLENUM

REMOVAL AND INSTALLATION

Pre-removal Operation
(1) Remove the engine cover (Refer Group 11B On Vehicle Service.)
(2) Remove the throttle body (Refer Group 13A On Vehicle Service.)
(3) Drain the power steering fluid (Refer Group 37 On Vehicle Service.)

Post-installation Operation
(1) Install the throttle body (Refer Group 13A On Vehicle Service.)
(2) Install the engine cover (Refer Group 11B On Vehicle Service.)
(3) Add power steering fluid and bleed (Refer Group 37 On Vehicle Service.)
(4) Adjust the tension of the oil pump belt (Refer Group 11A On Vehicle Service.)

Removal steps
1. Crank angle sensor connector
2. EGR valve assembly
3. Brake booster vacuum hose connection
4. EGR pipe assembly connection
5. Fuel pressure regulator vacuum hose connection
6. Oil pump belt
▶B◀ 7. Pressure hose
8. Power steering oil pump
9. Pump bracket
10. Intake manifold plenum stay, front
11. Intake manifold plenum stay, rear
12. Intake manifold plenum
▶A◀ 13. Intake manifold plenum gasket

INSPECTION

INTAKE MANIFOLD PLENUM

1. Check that the intake manifold plenum is not damaged or cracked.
2. Check that the vacuum extraction port is not clogged. If faulty, clean.
3. Using a straight edge and thickness gauge, check the mounting surface for distortion.

   Standard value: 0.15 mm or less

   Limit: 0.2 mm

INSTALLATION SERVICE POINT

▶A◀ INTAKE MANIFOLD PLENUM GASKET

Install so that the projection on the gasket is as shown in the diagram.

▶B◀ PRESSURE HOSE

Secure the notched part of the pressure hose eye joint at the position where it contacts the oil pump suction connector.

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INTAKE MANIFOLD

REMOVAL AND INSTALLATION

Pre-removal and Post-Installation Operations
- Remove or install the intake manifold plenum (Refer On Vehicle Service.)
- Fuel discharge prevention (Refer Group 13A On Vehicle Service.)

Removal steps

1. Injector connector
2. ▶C◀ Fuel high pressure hose connection
3. Return hose connection
4. Vacuum hose connection
5. ◀A▶ Injector and delivery pipe assembly
6. PCV hose connection
7. Timing belt cover(Front upper)
8. ▶B◀ Intake manifold
9. ▶A◀ Intake manifold gasket

REMOVAL SERVICE POINT

◀A▶ INJECTOR AND DELIVERY PIPE ASSEMBLY

Remove the delivery pipe with the injectors fitted to the delivery pipe.

Caution

Do not drop the injectors when removing the delivery pipe.

INSPECTION

INTAKE MANIFOLD

1. Check that the intake manifold is not damaged or cracked. If faulty, replace.
2. Check that the vacuum extraction port is not clogged. If faulty, clean.
3. Using a straight edge and thickness gauge, check the mounting surface for distortion.

   Standard value: 0.15 mm or less

   Limit: 0.2 mm

INSTALLATION SERVICE POINT

▶A◀ INTAKE MANIFOLD GASKET

Install so that the projection on the gaskets is as shown in the diagram.

▶B◀ INTAKE MANIFOLD

1. Coat the intake manifold mounting studs with engine oil.
2. Tighten the intake manifold mounting nuts in the following sequence.

Sequence	Tightening nuts	Tightening Torque Nm
1	Left bank side nuts	7
2	Right bank side nuts	20 to 23
3	Left bank side nuts	20 to 23
4	Right bank side nuts	20 to 23
5	Left bank side nuts	20 to 23

INSTALLATION SERVICE POINT

▶C◀ FUEL HIGH PRESSURE HOSE CONNECTION

1. When connecting the high-pressure fuel hose to the fuel rail, apply a drop of new engine oil to the O-ring, and then insert, being careful not to damage the O-ring.

   Caution
   Do not let engine oil in the fuel rail.

2. Check that the high-pressure fuel hose turns smoothly. If not, remove the hose and then re-insert it into the fuel rail and check again.
3. Tighten the bolts to the specified torque.

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EXHAUST MANIFOLD

REMOVAL AND INSTALLATION

Pre-removal and Post-Installation Operations
- Remove or install the front exhaust pipe (Refer On Vehicle Service.)
- Remove or install the radiator (Front bank only) (Refer Group 14 On Vehicle Service.)
- Remove or install the alternator (Front bank only) (Refer Group 16 On Vehicle Service.)

Removal Procedure for Front Bank

1. Heat protector
2. Exhaust manifold
3. Exhaust manifold gasket

Removal Procedure for Rear Bank

4. Heat protector
5. EGR pipe
6. EGR pipe gasket
7. Exhaust manifold
8. Exhaust manifold gasket

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EXHAUST PIPE AND MAIN MUFFLER

REMOVAL AND INSTALLATION

Main muffler removal steps

1. Hanger
2. Main muffler assembly
3. Hanger bracket
4. Gasket
5. Rear floor heat protector panel

Centre exhaust pipe removal steps

6. Hanger
7. Centre exhaust pipe
8. Gasket
9. Hanger bracket
10. Harness protector
11. Catalytic converter or pre-muffler
12. Gasket

Front exhaust pipe removal steps

13. Oxygen sensor
14. Hanger
15. Front exhaust pipe
16. Gasket
17. Front floor heat protector

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AIR CLEANER

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Removal steps

1. Air cleaner element
2. Breather hose
3. Air flow sensor
4. Gasket
5. Air cleaner cover
6. Resonator A
7. Air intake hose
8. Air duct
9. Air cleaner body

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EXHAUST PIPE AND MAIN MUFFLER

REMOVAL AND INSTALLATION

Main muffler removal steps

1. Hanger
2. Main muffler assembly
3. Hanger bracket
4. Gasket
5. Rear floor heat protector panel (excluding Sports & VR-X)

Centre exhaust pipe removal steps

6. Hanger
7. Centre exhaust pipe (Note:– no heat shield on Sports & VR-X)
8. Gasket
9. Hanger bracket
10. Harness protector
11. Catalytic converter or pre-muffler
12. Gasket

Front exhaust pipe removal steps

13. Oxygen sensor
14. Hanger
15. Front exhaust pipe
16. Gasket
17. Front floor heat protector

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EXHAUST PIPE AND MAIN MUFFLER

REMOVAL AND INSTALLATION

<AWD>

Caution
Support exhaust system during removal, to prevent damage to flexible front pipe section and personal injury.

Main muffler removal steps

1. Hanger
2. Main muffler assembly
3. Hanger bracket
4. Gasket
5. Rear floor heat protector panel

Centre exhaust pipe removal steps

6. Hanger
7. Centre exhaust pipe
8. Gasket
9. Hanger bracket
10. Harness protector
11. Catalytic converter or pre-muffler
12. Gasket

Front exhaust pipe removal steps

13. Oxygen sensor
14. Hanger
15. Front exhaust pipe
16. Gasket
17. Hanger bracket
18. Front floor heat protector

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- SPARK PLUG CABLE RESISTANCE CHECK
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- IGNITION SECONDARY VOLTAGE WAVE PATTERN CHECK
- IGNITION PRIMARY VOLTAGE WAVE PATTERN CHECK

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- INSPECTION

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CHARGING SYSTEM

GENERAL INFORMATION

The charging system is a system which charges the battery with the alternator output to keep the battery charged at a constant level during varying electrical load.

Operation

Rotation of the excited field coil generates AC voltage in the stator.
This alternating current is rectified through diodes to DC voltage having a waveform shown in the illustration at left.
The average output voltage fluctuates slightly with the alternator load condition.

When the ignition switch is turned on, current flows in the field coil and initial excitation of the field coil occurs.
When the stator coil begins to generate power after the engine is started, the field coil is excited by the output current of the stator coil.
The alternator output voltage rises as the field current increases and it falls as the field current decreases. When the battery voltage (alternator S terminal voltage) reaches a regulated voltage of approx. 14.4V, the field current is cut off. When the battery voltage drops below the regulated voltage, the voltage regulator regulates the output voltage to a constant level by controlling the field current.
In addition, when the field current is constant, the alternator output voltage rises as the engine speed increases.

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ALTERNATOR SPECIFICATIONS

Items	
Type	Battery voltage sensing
Rated output V/A	12/110
Voltage regulator	Electronic built-in type

SERVICE SPECIFICATIONS

Items		Standard value	Limit
Regulated voltage V (Ambient temp. at voltage	–20°C	14.2–15.4	–
Regulated voltage V (Ambient temp. at voltage regulator)	20°C	13.9–14.9	–
	60°C	13.4–14.6	–
	80°C	13.1–14.5	–
Rotor coil resistance Ω		Approx. 2.6	–
Output current		–	70% of nominal output current

SPECIAL TOOL

Tool	Tool number and name	Supersession	Application
	MB991348 Test harness set	EMB991348	Inspection of ignition primary voltage (power transistor connection)

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ON-VEHICLE SERVICE

ALTERNATOR OUTPUT LINE VOLTAGE DROP TEST

6EN0962

This test determines whether the wiring from the alternator "B" terminal to the battery (+) terminal (including the fusible link) is in a good condition or not.

1. Always be sure to check the following before the test.
   - Alternator installation
   - Alternator drive belt tension (Refer Group 11A On Vehicle Service.)
   - Fusible link
   - Abnormal noise from the alternator while the engine is running
2. Turn the ignition switch to the OFF position.
3. Disconnect the negative battery cable.
4. Disconnect the alternator output wire from the alternator "B" terminal and connect a DC test ammeter with a range of 0 – 130 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
   An inductive-type ammeter which enables measurements to be taken without disconnecting the alternator output wire is recommended. The reason for this is if a vehicle in which the voltage may have dropped due to a poor connection at the alternator "B" terminal is being inspected, and the alternator "B" terminal is loosened when the test ammeter is connected, the connection will be completed at this time and the possibility of finding problems will be reduced.
5. Connect a digital-type voltmeter between the alternator "B" terminal and the battery (+) terminal. (Connect the (+) lead of the voltmeter to the "B" terminal, and then connect the (–) lead of the voltmeter to the battery (+) cable.)

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6. Connect a tachometer.
   Refer Group 11A On Vehicle Service.)
7. Reconnect the negative battery cable.
8. Leave the hood open.
9. Start the engine.
10. With the engine running at 2500 rpm, turn the headlights and other lights on and off to adjust the alternator load so that the value displayed on the ammeter is slightly above 30 A.

    Limit value: Max. 0.3 V

    NOTE
    When the alternator 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 alternator output wire, so check the wiring between the alternator “B” terminal and the battery (+) terminal (including fusible link).
    If a terminal is not sufficiently tight or if the harness has become discoloured 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 negative battery cable.
15. Disconnect the ammeter, voltmeter and tachometer.
16. Connect the alternator output wire to the alternator “B” terminal.
17. Connect the negative battery cable.

OUTPUT CURRENT TEST

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This test determines whether alternator output current is normal.

1. Before the test, always be sure to check the following.
   - Alternator installation
   - Battery (Refer Group 54 On Vehicle Service.)

   NOTE
   The battery to be used should be slightly discharged. The load in a fully-charged battery will be insufficient and the test may not be able to be carried out correctly.
   - Alternator drive belt tension (Refer Group 11A On Vehicle Service.)
   - Fusible link
   - Abnormal noise from the alternator while the engine is running
2. Turn the ignition switch to the OFF position.
3. Disconnect the negative battery cable.
4. Disconnect the alternator output wire from the alternator "B" terminal and connect a DC test ammeter with a range of 0–130 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.)

   Caution
   Never use clips but tighten bolts and nuts to connect the line. Otherwise loose connections (e.g. using clips) will lead to a serious accident because of high current.

   NOTE
   An inductive-type ammeter which enables measurements to be taken without disconnecting the alternator output wire is recommended.
5. Connect a voltmeter with a range of 0–20 V between the alternator "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 a tachometer.
   Refer Group 11A On Vehicle Service.)
7. Connect the negative battery cable.
8. Leave the hood open.
9. Check to be sure that the reading on the voltmeter is equal to the battery voltage.

   NOTE
   If the voltage is 0 V, the cause is probably an open circuit in the wire or fusible link between the alternator "B" terminal and the battery (+) terminal.
10. After turning the light switch on and turning on the headlights, start the engine.
11. Immediately after setting the headlights to high beam and turning the heater blower switch to the high speed position, increase the engine speed to 2,500 rpm 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 Alternator Specifications.
    - Because the current from the battery will soon drop after the engine is started, the above step should be carried out as quickly as possible in order to obtain the maximum current output value.
    - The current output value will depend on the electrical load and the temperature of the alternator body.
    - If the electrical load is small while testing, the specified level of current may not be output even though the alternator is normal. In such cases, increase the electrical load by leaving the headlights turned on for some time to discharge the battery or by using the lighting system in another vehicle, and then test again.
    - The specified level of current also may not be output if the temperature of the alternator body or the ambient temperature is too high. In such cases, cool the alternator and then test again.
12. The reading on the ammeter should be above the limit value. If the reading is below the limit value and the alternator output wire is normal, remove the alternator from the engine and check the alternator.
13. Run the engine at idle speed after the test.
14. Turn the ignition switch to the OFF position.
15. Disconnect the negative battery cable.
16. Disconnect the ammeter, voltmeter and tachometer.
17. Connect the alternator output wire to the alternator "B" terminal.
18. Connect the negative battery cable.

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REGULATED VOLTAGE TEST

This test determines whether the voltage regulator is correctly controlling the alternator output voltage.

1. Always be sure to check the following before the test.
   - Alternator installation
   - Check to be sure that the battery installed in the vehicle is fully charged. (Refer Group 54 On Vehicle Service.)
   - Alternator drive belt tension (Refer Group 11A On Vehicle Service.)
   - Fusible link
   - Abnormal noise from the alternator while the engine is running
2. Turn the ignition switch to the OFF position.
3. Disconnect the negative battery cable.
4. Connect a digital-type voltmeter between the alternator "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 alternator output wire from the alternator "B" terminal.
6. Connect a DC test ammeter with a range of 0–130 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. Connect a tachometer or the MUT II. Refer Group 11A On Vehicle Service.)
8. Reconnect the negative battery cable.
9. Turn the ignition switch to the ON position and check that the reading on the voltmeter is equal to the battery voltage.

   NOTE
   If the voltage is 0 V, the cause is probably an open circuit in the wire or fusible link between the alternator "S" terminal and the battery (+) terminal.
10. Check to be sure that all 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 alternator becomes 10 A or less.
14. If the voltage reading conforms to the value in the voltage regulation table, then the voltage regulator is operating normally.
    If the voltage is outside the standard value, there is a malfunction of the voltage regulator or of the alternator.
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 or the MUT II.
19. Connect the alternator output wire to the alternator "B" terminal.
20. Connect the negative battery cable.

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VOLTAGE REGULATION TABLE

Inspection terminal	Voltage regulator ambient temperature (°C)	Standard value (V)
Terminal “S”	–20	14.2–15.4
	20	13.9–14.9
	60	13.4–14.6
	80	13.1–14.5

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WAVE PATTERN CHECK USING AN ANALYSER

MEASUREMENT METHOD

Connect the analyser special patterns pick-up to the alternator B terminal.

STANDARD WAVEFORM
Observation Conditions

FUNCTION	SPECIAL PATTERNS
PATTERN HEIGHT	VARIABLE
VARIABLE knob	Adjust while viewing the wave pattern
PATTERN SELECTOR	RASTER
Engine speed	Curb idle speed

NOTE
The voltage waveform of the alternator B terminal can undulate as shown at left. This waveform is produced when the regulator operates according to fluctuations in the alternator load (current), and is normal for the alternator.

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ABNORMAL WAVEFORM EXAMPLES

NOTE
1. The size of the waveform patterns differs largely depending on the adjustment of the variable knob on the analyser.
2. Identification of abnormal waveforms is easier when there is a large output current (regulator is not operating). (Waveforms can be observed when the headlamps are illuminated.)
3. Check the conditions of the charge light (illuminated/not illuminated). Also, carry out a total check of the charging system.

Abnormal waveforms	Problem cause
Example 1 7EL0120	• Open diode
Example 2 7EL0121	• Short in diode
Example 3 7EL0122	• Broken wire in stator coil
Example 4 7EL0123	• Short in stator coil
Example 5 NOTE: At this time, the charge light is illuminated. 7EL0124	• Open supplementary diode

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ALTERNATOR RELAY CONTINUITY CHECK

1. Remove the alternator relay from the relay box inside the engine compartment

2. Set the circuit tester to the Ω range and check that there is continuity when the (+) terminal of the tester is connected to terminal 4 of the alternator relay and the (–) terminal is connected to terminal 2.
3. Next, check that there is no continuity when the (+) terminal is connected to terminal 2 and the (–) terminal is connected to terminal 4.
4. If the continuity checks in steps 2 and 3 show a defect, replace the alternator relay.

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ALTERNATOR

REMOVAL AND INSTALLATION

Post-installation Operation
- Drive belt tension adjustment (Refer Group 11A On Vehicle Service.)

Removal steps

1. Drive belt (Alternator)
2. Alternator harness connector connection
3. Engine oil level dipstick
4. Alternator
5. Alternator bracket

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ALTERNATOR

DISASSEMBLY AND REASSEMBLY

Disassembly steps

1. Voltage regulator retaining screws
◀A▶ 2. Voltage regulator
3. Suppressor retaining nut
4. Suppressor
5. B+ terminal nut and washers
6. Through bolts
7. Slip ring end housing and stator assembly
8. Rectifier assembly retaining nuts
◀B▶ 9. Stator assembly
10. Pulley retaining nut
11. Pulley
12. Drive end bearing retaining plate screws
13. Drive end plate
14. Drive end bearing
15. Bearing retaining plate
16. Rotor
17. Slip ring end housing bearing
18. Slip ring end housing bearing cap
19. Rectifier assembly
20. Bush
21. Slip ring assembly
22. Cooling fans

DISASSEMBLY SERVICE POINTS

◀A▶ VOLTAGE REGULATOR REMOVAL

Tilt the regulator slightly from the plug connection until the regulator clears the housing then lift clear.

Caution:
Never remove regulator with B+ cable still connected as alternator rectifier will be damaged.

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◀B▶ STATOR REMOVAL

When removing stator, unsolder the stator leads soldered to main diodes on rectifier.

Caution

1. **When soldering or unsoldering, use care to make sure that heat of soldering iron in not transmitted to diodes for a long period. Finish soldering or unsoldering in as short a time as possible.**
2. **Use care that no undue force is exerted to leads of diodes.**

INSPECTION

ROTOR

1. Check rotor coil for continuity. Check to ensure that there is continuity between slip rings. If resistance is too small, it means that there is a short circuit. If there is no continuity or if there is a short circuit, replace rotor assembly.

   Resistance value: Approx. 2.6 Ω

2. Check rotor coil for grounding. Check to ensure that there is no continuity between slip ring and core. If there is continuity, replace rotor assembly.

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STATOR

1. Make continuity test on stator coil. Check to ensure that there is continuity between coil leads. If there is no continuity, replace stator assembly.

2. Check coil for grounding. Check to ensure that there is no continuity between coil and core. If there is continuity, replace stator assembly.

POWER DIODES

1. Apply the negative test probe of the diode tester or a multimeter with a diode test feature to the positive heatsink and the positive probe alternatively to A, B and C, a low resistance reading, or the forward voltage drop across the diode should be obtained. Reverse the test probes, a high resistance reading or a higher reverse voltage should be obtained.
2. Connect the positive test probe to the negative heatsink and the negative test probe alternatively to D, E and F, a low resistance of forward voltage drop across the diode should be obtained. Reverse the test probes, a high resistance reading or higher reverse voltage reading should be obtained.

BRUSHES

1. Ensure the brushes have not been worn to or beyond their wear limit,

   Brush wear limit: 3.8mm
2. Check the brush springs for burning and loss of tension due to excessive heat.

SLIP RINGS

1. Check the slip rings for excessive wear and damage.

   Minimum slip ring diameter: 26.7mm

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STARTING SYSTEM

GENERAL INFORMATION

If the ignition switch is turned to the “START” position, current flows in the coil provided inside magnetic switch, attracting the plunger. When the plunger is attracted, the lever connected to the plunger is actuated to engage the starter clutch.
Attracting the plunger will turn on the magnetic switch, allowing the B terminal and M terminal to conduct. Thus, current flows to engage the starter motor.

When the ignition switch is returned to the “ON” position after starting the engine, the starter clutch is disengaged from the ring gear.
An overrunning clutch is provided between the pinion and the armature shaft, to prevent damage to the starter.

STARTER MOTOR SPECIFICATIONS

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

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SERVICE SPECIFICATIONS

Items		Standard value	Limit
Free running	Terminal voltage V	12 ± 0.1	–
Free running characteristics	Current A	65	–
	Speed r/min	3,300 or more	–
Commutator run out mm		0.10	–
Commutator diameter mm		32.3	31.2
Undercut depth mm		0.8	–

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STARTER MOTOR

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
Air Cleaner Removal and Installation

Removal steps

1. Bolt
2. Starter motor

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MAGNETIC SWITCH PULL-IN TEST

1. Disconnect field coil wire from M-terminal of magnetic switch.
2. Connect a 12V battery between S-terminal and M-terminal.

   Caution
   This test must be performed quickly (in less than 10 seconds) to prevent coil from burning.
3. If pinion moves out, then pull-in coil is good. If it doesn't, replace magnetic switch.

MAGNETIC SWITCH HOLD-IN TEST

1. Disconnect field coil wire from M-terminal of magnetic switch.
2. Connect a 12V battery between S-terminal and body.

   Caution
   This test must be performed quickly (in less than 10 seconds) to prevent coil from burning.
3. If pinion remains out, everything is in order. If pinion moves in, hold-in circuit is open. Replace magnetic switch.

FREE RUNNING TEST

1. Place starter motor in a vice equipped with soft jaws and connect a fully-charged 12-volt battery to starter motor as follows:
2. Connect a test ammeter (130-ampere scale) and carbon pile rheostat in series between battery positive post and starter motor terminal.
3. Connect a voltmeter (15-volt scale) across starter motor.
4. Rotate carbon pile to full-resistance position.
5. Connect battery cable from battery negative post to starter motor body.
6. Adjust the rheostat until the battery 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.

   Current: Max. 110 Amps

MAGNETIC SWITCH RETURN TEST

1. Disconnect field coil wire from M-terminal of magnetic switch.
2. Connect a 12V battery between M-terminal and body.

   Caution
   This test must be performed quickly (in less than 10 seconds) to prevent coil from burning.
3. Pull pinion out and release. If pinion quickly returns to its original position, everything is in order. If it doesn't, replace magnetic switch.

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STARTER MOTOR

DISASSEMBLY AND REASSEMBLY

Disassembly steps

1. Screw
◀A▶ 2. Magnetic switch
3. Spring
4. Solenoid barrel
5. End cover screws
6. End cover
7. C clip
8. Flat washer
9. Through bolts
10. Rear housing
◀B▶ 11. Brush holder
12. Armature assembly
13. Yoke assembly
14. Rubber seal
15. Overrunning clutch, drive pinion assembly and gear set
▶B◀ 16. Front housing
◀C▶ ▶A◀ 17. Stop ring
◀C▶ ▶A◀ 18. Snap ring

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DISASSEMBLY SERVICE POINTS

◀A▶ MAGNETIC SWITCH REMOVAL

1. Disconnect the field coil wire from terminal M of the magnetic switch.

◀B▶ BRUSH HOLDER REMOVAL

1. Mark the position of the brush holder in relation to the yoke assembly.
2. Prise back the brush retaining lugs of the brushes which are connected to the yoke assembly and remove the brush plate.

◀C▶ SNAP RING AND STOP RING REMOVAL

1. Press the stop ring, by using an appropriate socket wrench, to the snap ring side.

2. After removing the snap ring (by using snap-ring pliers), remove the stop ring and the overrunning clutch.

STARTER MOTOR PART CLEANING

1. Do not immerse parts in cleaning solvent. Immersing the yoke and field assembly and/or armature will damage insulation. Wipe these parts with a cloth only.
2. Do not immerse drive unit in cleaning solvent. Overrunning clutch is pre-lubricated at the factory and solvent will wash lubrication from clutch.
3. The drive unit may be cleaned with a brush moistened with cleaning solvent and wiped dry with a cloth.

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REASSEMBLY SERVICE POINT

▶A◀ STOP RING AND SNAP RING INSTALLATION

Using a suitable pulling tool, pull the overrunning clutch stop ring over the snap ring.

▶B◀ GEAR SET HOUSING INSTALLATION

Ensure the flat of the gear set housing and the flat of the front housing are aligned together.

INSPECTION

COMMUTATOR

1. Place the armature on a pair of V-blocks, and check the deflection by using a dial gauge.

   Standard value: 0.05 mm
   Limit: 0.1 mm

2. Check the outer diameter of the commutator.

   Standard value: 32.3 mm
   Limit: 31.2 mm

3. Check the depth of the undercut between segments.

   Standard value: 0.8 mm

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BRUSH HOLDER

Check for continuity between the brush holder plate and the brush holder.
The normal condition is non-continuity.

OVERRUNNING CLUTCH

1. While holding clutch housing, rotate the pinion. Drive pinion should rotate smoothly in one direction, but should not rotate in opposite direction. If clutch does not function properly, replace overrunning clutch assembly.
2. Inspect pinion for wear or burrs. If pinion is worn or burred, replace overrunning clutch assembly. If pinion is damaged, also inspect ring gear for wear or burrs.

FRONT AND REAR BRACKET BUSHING

Inspect bushing for wear or burrs. If bushing is worn or burred, replace front bracket assembly or rear bracket assembly.

BRUSH AND SPRING REPLACEMENT

1. Brushes that are worn beyond wear limit line, or oil-soaked, should be replaced.

   Standard value: Brush minimum length 7mm

POSITIVE BRUSHES

1. Cut the old brush about 1mm away from the field coil connecting strap.
2. Tin the lead with solder, take the new brush and position it on the pre-tinned lead and solder the new brush to the lead.

NEGATIVE BRUSHES

1. Cut the old brush lead flush with the brush plate.
2. Pre-tin the remaining copper lead on the brush plate with solder.
3. Using a pair of pointed nose pliers position and solder new brushes to the brush plate.

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ARMATURE TEST

ARMATURE SHORT-CIRCUIT TEST

1. Place armature in a growler.
2. Hold a thin steel blade parallel and just above while rotating the armature slowly. A shorted armature will cause the blade to vibrate and be attracted to the core. Replace a shorted armature.

ARMATURE COIL GROUND TEST

Check the insulation between the armature coil cores and the commutator segments. They are normal if there is no continuity.

ARMATURE COIL OPEN-CIRCUIT TEST

Check for continuity between segments. The condition is normal if there is continuity.

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IGNITION SYSTEM

GENERAL INFORMATION

Interruption of the primary current flowing in the primary side of the ignition coil generates high voltage in the secondary side of the ignition coil. The high voltage thus generated is directed by the distributor to the applicable spark plug. The engine firing order is 1–2–3–4–5–6 cylinders.
On application of high voltage, the spark plug generates a spark to ignite the compressed air fuel mixture in the combustion chamber.
The Engine A/T-ECU makes and breaks the primary current of the ignition coil to regulate the ignition timing.

The Engine A/T-ECU detects the crankshaft position by the crank angle sensor mounted on the engine to provide ignition at the most appropriate timing for the engine operating condition.
When the engine is cold or operated at a high altitude, the ignition timing is slightly advanced to provide optimum performance to the operating condition.
When the automatic transmission shifts gears, ignition timing is retarded to reduce output torque and alleviate shock during shifting.

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DISTRIBUTOR SPECIFICATIONS

Items	
Type	Contact pointless with built-in ignition coil and power transistor
Advance mechanism	Electronic
Firing order	1–2–3–4–5–6

IGNITION COIL SPECIFICATION

Items	
Type	Moulded single-coil incorporated in distributor

SPARK PLUG SPECIFICATION

Items		Front bank	Rear bank
Champion	<6G72>	RC8YCC4	RC8PYP4
	<6G74>	RC10YCC4	RC10PYP4
NGK	<6G72>	BKR6E-11	PFR6J-11
	<6G74>	BKR5E-11	PFR5J-11

SERVICE SPECIFICATIONS

Items	Standard value	Limit
Primary coil resistance Ω	0.5 – 0.7	–
Secondary coil resistance kΩ	9 – 13	–
Spark plug cable resistance kΩ	Max.22	–
Spark plug gap mm	1.0–1.1	–

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ON-VEHICLE SERVICE

SPARK PLUG CABLE TEST

1. Disconnect, one at a time, each of the spark plug cables while the engine is idling to check whether the engine's running performance changes or not.

   Caution
   Wear rubber gloves while doing so.

2. If the engine performance does not change, check the resistance of the spark plug cable, and check the spark plug itself.

SPARK PLUG TEST

1. Remove the spark plug and connect to the spark plug cable.

Caution
Inhibit engine starting

2. Ground the spark plug outer electrode (body), and crank the engine.
   Check to be sure that there is an electrical discharge between the electrodes at this time.

IGNITION COIL CHECK

1. Measurement of the primary coil resistance
   Measure the resistance between connector terminal 1 and 2 of the distributor.

   Standard value: 0.5–0.7Ω

2. Measurement of secondary coil resistance
   Measure the resistance between the high-voltage terminals and connector terminals 1 or 2.

   Standard value: 9–13 kΩ

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POWER TRANSISTOR CHECK

NOTE
An analog-type ohmmeter should be used.

1. Connect the negative (–) terminal of the 1.5V power supply to terminal 4 of the power transistor; then check whether there is continuity between terminal 4 and terminal 2 when terminal 3 and the positive (+) terminal are connected and disconnected.

   NOTE
   Connect the negative (–) probe of the circuit tester to terminal 12.

Terminal 6 and (+) terminal	Terminal 5 and terminal 12
Connected	Continuity
Unconnected	No continuity

2. Replace the power transistor if there is a malfunction.

SPARK PLUG CABLE RESISTANCE CHECK

Measure the resistance of all spark plug leads.
1. Check cap and coating for cracks.
2. Measure resistance

   Limit: Max. 22 kΩ

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SPARK PLUG CHECK AND CLEANING

1. Remove the engine cover and intake manifold plenum, refer Group 11B On Vehicle Service.
2. Remove the spark plug cables.

   Caution
   When pulling off the spark plug cable from the plug always hold the cable cap, not the cable.

3. Remove the spark plugs.
4. Check for burned out electrode or damaged insulator. Check for even burning.
5. Remove carbon deposits with a plug cleaner. Remove sand from plug screw with compressed air.

   Caution
   When cleaning platinum tip spark plugs the tip may be damaged. If carbon deposits must be removed use a plug cleaner and complete cleaning within 20 seconds. Do not use a wire brush.

6. Use a plug gap gauge to check that the plug gap is within the standard value range. Replace the spark plug if the limit is exceeded.

   Standard value: 1.0–1.1 mm

   NOTE
   On conventional type plugs, if plug is outside the specified value range, adjust by bending the earth electrode.
   If the plug gap is outside the specified value range on platinum tip plugs, the plug must be replaced.
7. Clean the engine plug holes.

   Caution
   Use care not to allow foreign matter in cylinders.

8. Install the spark plugs.

CAMSHAFT POSITION SENSOR CHECK

Refer Group 13A Troubleshooting.

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IGNITION SECONDARY VOLTAGE WAVE PATTERN CHECK

MEASUREMENT METHOD

1. Clamp the spark plug cable (No. 1, No. 2, No. 3, No.4, No. 5 or No. 6) with the secondary pickup.

2. Clamp the No. 1 cylinder spark plug cable with the trigger pickup.

STANDARD WAVE PATTERN
Observation conditions

FUNCTION	SECONDARY
PATTERN HEIGHT	HIGH (or LOW)
PATTERN SELECTOR	RASTER
Engine Speed	Curb idle speed

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WAVEFORM OBSERVATION POINTS

Point A: The height, length and slope of the spark line (refer to abnormal waveform examples 1, 2, 3 and 4) show the following trends.

Spark line		Plug gap	Condition of electrode	Compression force	Concentration of air mixture	Ignition timing	Spark plug cable
Length	Long	Small	Normal	Low	Rich	Advanced	Leak
Length	Short	Large	Large wear	High	Lean	Retarded	High resistance
Height	High	Large	Large wear	High	Lean	Retarded	High Resistance
Height	Low	Small	Normal	Low	Rich	Advanced	Leak
Slope		Large	Plug is fouled	–	–	–	–

Point B: Number of vibration in reduction vibration section (Refer to abnormal waveform example 5.)

Number of vibrations	Coil and condenser
Three or more	Normal
Except above	Abnormal

Point C: Number of vibrations at beginning of dwell section (Refer to abnormal waveform example 5.)

Number of vibrations	Coil
5–6 or higher	Normal
Except above	Abnormal

Point D: Ignition voltage height (distribution per each cylinder) shows the following trends.

Ignition voltage	Plug gap	Condition of electrode	Compression force	Concentration of air mixture	Ignition timing	Spark plug cable
High	Large	Large wear	High	Lean	Retarded	High resistance
Low	Small	Normal	Low	Rich	Advanced	Leak

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ABNORMAL WAVEFORMS EXAMPLES

Abnormal waveform	Wave characteristics	Cause of problem
Example 1	Spark line is high and short.	Spark plug gap is too large.
Example 2	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	Spark line is low and long, and is sloping. However, there is almost no spark line distortion.	Spark plug gap is fouled.
Example 4	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	No waves in wave damping section	Rare short in ignition coil.

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IGNITION PRIMARY VOLTAGE WAVE PATTERN CHECK

MEASUREMENT METHOD

1. Disconnect the distributor connector and connect the special tool (test harness: EMB991348) in between. (All of the terminals should be connected.)

2. Connect the analyser primary pickup to the distributor connector terminal 2.
3. Connect the primary pickup earth terminal.
4. Clamp the spark plug cable with the trigger pickup.

   NOTE
   The wave pattern of the cylinder clamped to the trigger pickup will appear at the left edge of the screen.

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STANDARD WAVE PATTERN
Observation conditions

FUNCTION	SECONDARY
PATTERN HEIGHT	HIGH (or LOW)
PATTERN SELECTOR	RASTER
Engine Speed	Curb idle speed

Observation conditions
(Only the pattern selector shown below changes from the previous conditions)

PATTERN SELECTOR	DISPLAY

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WAVEFORM OBSERVATION POINTS

Point A: The height, length and slope of the spark line (refer to abnormal waveform examples 1, 2, 3 and 4) show the following trends.

Spark line		Plug gap	Condition of electrode	Compression force	Concentration of air mixture	Ignition timing	Spark plug cable
Length	Long	Small	Normal	Low	Rich	Advanced	Leak
Length	Short	Large	Large wear	High	Lean	Retarded	High resistance
Height	High	Large	Large wear	High	Lean	Retarded	High Resist-ance
Height	Low	Small	Normal	Low	Rich	Advanced	Leak
Slope		Large	Plug is fouled	–	–	–	–

Point B: Number of vibration in reduction vibration section (Refer to abnormal waveform example 5.)

Number of vibrations	Coil, condenser
3 or higher	Normal
Except above	Abnormal

Point C: Height of Zener voltage

Height of Zener voltage	Probable cause
High	Problem in Zener diode
Low	Abnormal resistance in primary coil circuit

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ABNORMAL WAVEFORMS EXAMPLES

Abnormal waveform	Wave characteristics	Cause of problem
Example 1 01P0210	Spark line is high and short.	Spark plug gap is too large.
Example 2 01P0211	Spark line is low and long, and is sloping. Also, the second half of the spark line is distorted. This could be a result of misfiring.	Spark plug gap is too small.
Example 3 01P0212	Spark line is low and long, and is sloping. However, there is almost no spark line distortion.	Spark plug gap is fouled.
Example 4 01P0213	Spark line is high and short.	Spark plug cable is nearly falling off. (Causing a dual ignition)
Example 5 01P0214	No waves in wave damping section	Rare short in ignition coil.

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IGNITION SYSTEM

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
Engine cover removal and installation (Refer Group 11B On Vehicle Service.)

Removal steps

▶B◀ 1. Spark plug cable
2. Spark plug
▶A◀ 3. Distributor
4. O-ring

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INSTALLATION SERVICE POINTS

▶A◀ DISTRIBUTOR INSTALLATION

1. Turn the crankshaft so that the No. 1 cylinder is at top dead centre.
2. Align the distributor housing and gear mating marks and install the distributor.

▶B◀ SPARK PLUG CABLE

Improper arrangement of spark plug cables will induce voltage between the cables, causing misfiring and developing a surge at acceleration in high-speed operation.
Therefore, be careful to arrange the spark plug cables properly paying attention to the following items.

1. Install the cables securely to avoid possible contact with metal parts.
2. Install the cables neatly, ensuring they are not too tight, loose, twisted or kinked.

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DISTRIBUTOR

DISASSEMBLY AND REASSEMBLY

Disassembly steps

1. Distributor cap
2. Breather
3. Rotor
4. Seal
5. O-ring
6. Distributor housing

INSPECTION

Check the following points; repair or replace if a problem is found.

CAP ROTOR

1. There must be no cracking in the cap.
2. There must be no damage to the cap's electrode or the rotor's electrode.
3. Clean away any dirt from the cap and rotor.

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CRANK ANGLE SENSOR

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
Timing Belt Cover Removal and Installation
(Refer Group 11B On Vehicle Service.)

Removal steps
1. Crank angle sensor

INSPECTION

CRANK ANGLE SENSOR CHECK

Refer Group 13A Troubleshooting.

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- EGR SYSTEM CHECK
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ENGINE CONTROL SYSTEM

GENERAL INFORMATION

A cable-type accelerator mechanism and a suspended-type pedal have been adopted.

SERVICE SPECIFICATIONS

Items	Standard value
Accelerator cable play mm	3–5
Engine idle speed rpm	700 ± 50

ON-VEHICLE SERVICE

ACCELERATOR CABLE CHECK AND ADJUSTMENT

1. Turn A/C and lights OFF.
   Inspect and adjust at no load.
2. Warm engine until stabilised at idle.
3. Confirm idle speed is at prescribed rpm.
4. Stop engine (ignition switch OFF).
5. Confirm there are no sharp bends in accelerator cable.
6. Check inner cable for correct slack.
7. If there is too much slack or no slack, adjust play by the following procedures.
   (1) Loosen the adjusting bolt to release the cable.
   (2) After moving the plate to the position immediately before the throttle lever starts to move, move the plate back towards the throttle body by the standard value amount only to bring the accelerator cable play to the standard value.

   Standard value: 3–5 mm

   (3) Tighten the adjusting bolts to the specified torque.

8. Adjust accelerator cable play and confirm throttle lever stopper touches the fixed SAS.

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ACCELERATOR CABLE AND PEDAL

REMOVAL AND INSTALLATION

Post-installation Operation
Adjusting the Accelerator Cable (Refer On Vehicle Service.)

07TH068A

Removal steps of accelerator cable

1. Accelerator cable connection
2. Adjusting bolts
3. ▶A◀ Accelerator cable
4. Bolt

Removal steps of accelerator pedal

5. Nut
6. Accelerator pedal bracket
7. Cotter pin
8. Washer
9. Accelerator pedal
10. Spring
11. Accelerator pedal stopper

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INSTALLATION SERVICE POINT

▶A◀ ACCELERATOR CABLE INSTALLATION

As shown in diagram, install so that the marked part is at the top of the vehicle body.

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CRUISE CONTROL SYSTEM

GENERAL INFORMATION

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

CONSTRUCTION DIAGRAM

07TH052A

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SERVICE SPECIFICATIONS

Items	Standard value
Accelerator cable play mm	3–5

SPECIAL TOOLS

Tool	Tool number and name	Supersession	Application
	MB991502 MUT-II	MB991502	• Reading diagnosis trouble code • Auto-cruise control system inspection
	ROM Pack	–	
	MB991529 Diagnosis trouble code check harness	Tool not necessary if MUT-II is available	Checking the diagnosis trouble code.

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TROUBLESHOOTING

STANDARD FLOW OF DIAGNOSIS TROUBLESHOOTING

Refer Group 00 How to use Troubleshooting/Inspection Service Points.
Note: Check that the vacuum hose is connected correctly and is not damaged, then carry out diagnosis.

DIAGNOSIS FUNCTION

METHOD OF READING DIAGNOSIS CODES

Using MUT-II.

1. Connect the MUT-II to the diagnosis connector under the instrument cover.

   Caution: Turn off the ignition before connecting or disconnecting the MUT-II.
2. With the ignition in the ON position,take a reading of the diagnosis codes.

Using an Auto-cruise Control Indicator Light.

1. Turn the ignition switch ON with the SET switch on. Then turn the RESUME switch on within 1 second.
2. Read a diagnosis code by observing the flash display pattern of the auto-cruise control indicator lamp in the combination meter.

Indication of diagnosis codes by auto-cruise control indicator lamp.

Example of Diagnosis Trouble Code 15 Output.	Example of No Diagnosis Code Output.

NOTE: Other on-board diagnosis items are also output as voltage waveforms corresponding to diagnosis code numbers.

METHOD OF ERASING DIAGNOSIS CODES

Connect MUT-II to 16 pin diagnosis connector and erase diagnosis codes.

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

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INSPECTION CHART FOR DIAGNOSIS CODES

Code No.	Diagnosis items
11	Electric vacuum pump drive system
12	Vehicle speed sensor system
14	Electric vacuum pump power supply system
15	Cruise control switch
16	Cruise control-ECU
17	Throttle position sensor system

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INSPECTION PROCEDURE FOR DIAGNOSIS CODES

Code No.11 Electric vacuum pump drive system	Probable cause
[Comment] This diagnosis code is output if the release valve, control valve and motor drive signals from the electric vacuum pump are not input to the cruise control-ECU.	• Malfunction of the electric vacuum pump • Malfunction of the stop light switch • Malfunction of the connector • Malfunction of the harness • Malfunction of the cruise control-ECU

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

Code No.14 Electric vacuum pump power supply system	Probable cause
This diagnosis code is output if the electric vacuum pump release valve, control valve and motor driving signals are not input into the cruise control ECU.	• Stop lamp switch fault • Connector fault • Harness fault • Cruise control ECU fault

Code No.15 Cruise control switch	Probable cause
[Comment] This diagnosis code is output if the cruise control RESUME switch, SET switch or CANCEL switch remains ON.	• Malfunction of the cruise control switch

Replace the cruise control switch.

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Code No.16 Cruise control-ECU	Probable cause
[Comment] This diagnosis code is output if there is an abnormality in the CANCEL hold circuit or the microprocessor monitor circuit in the cruise control-ECU.	• Malfunction of the cruise control-ECU

Replace the cruise control-ECU.

Code No.17 Throttle position sensor system	Probable cause
[Comment] This diagnosis code is output if a voltage of 1.5 V or more when the idle position switch is ON or 0.2 V or less when the idle 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 cruise control-ECU

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INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble symptom		Inspection procedure No.
Communication with MUT-II is not possible.	Communication with all systems is not possible.	1
	Communication with cruise control-ECU only is not possible.	2
Input switch inspection using the MUT-II is not possible. (However, diagnosis inspection is possible.)		3
Cruise control is not cancelled.	Even if brake pedal is depressed	4
	Even if the clutch pedal is depressed <M/T>	5
	Even if the select lever is set to N range <A/T>	6
	Even if CANCEL switch is set to ON	7
The diagnosis result displayed on the MUT-II is normal even though cruise control cannot be set.		8
Cruise control cannot be set.		9
Hunting (repeated acceleration and deceleration) occurs at the set vehicle speed.		10
Even though cruise control main switch is ON, switch indicator does not illuminate. (However, cruise control is normal.)		11
Cruise control indicator light inside combination meter does not illuminate. (However, cruise control is normal.)		13

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

INSPECTION PROCEDURE 1

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

Refer Group 13A Troubleshooting.

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INSPECTION PROCEDURE 2

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

NOTE
*1 indicates malfunction of the cruise control main switch circuit.
*2 indicates malfunction of the cruise control-ECU ground circuit.

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INSPECTION PROCEDURE 3

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

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INSPECTION PROCEDURE 4

Even if brake pedal is depressed, cruise control is not cancelled.	Probable cause
[Comment] The cause is probably a malfunction of stop light switch or a malfunction of stop light circuit.	• Malfunction of the stop light switch • Malfunction of the connector • Malfunction of the harness • Malfunction of the cruise control-ECU

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INSPECTION PROCEDURE 5

Even if clutch pedal is depressed, cruise control is not cancelled. <M/T>	Probable cause
[Comment] The cause is probably a malfunction of clutch pedal position switch or clutch circuit.	● Malfunction of the clutch pedal position switch ● Malfunction of the connector ● Malfunction of the harness ● Malfunction of the cruise control-ECU

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INSPECTION PROCEDURE 6

Even if select lever is set to N range, cruise control is not cancelled. <A/T>	Probable cause
[Comment] The cause is probably an open-circuit in the output signal circuit in N range.	• Malfunction of the connector • Malfunction of the harness • Malfunction of the cruise control-ECU

INSPECTION PROCEDURE 7

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

Replace the cruise control switch.

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INSPECTION PROCEDURE 8

The diagnostic result displayed on the MUT-II is normal even though cruise control cannot be set.	Probable cause
[Comment] Because of an open-circuit in the battery backup circuit system, the fail-safe function prevents diagnosis codes from being memorised and displayed even though cruise control is cancelled.	• Malfunction of the connector • Malfunction of the harness • Malfunction of the cruise control-ECU

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INSPECTION PROCEDURE 9

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

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INSPECTION PROCEDURE 10

Hunting (repeated acceleration and deceleration) occurs at the set vehicle speed.	Probable cause
[Comment] The cause is probably a malfunction of vehicle speed sensor or incorrect vacuum in the electric vacuum pump or actuator.	• Malfunction of the vehicle speed sensor • Malfunction of the electric vacuum pump • Malfunction of the actuator • Malfunction of the cruise control-ECU

INSPECTION PROCEDURE 11

Even though cruise control main switch is ON, switch indicator does not illuminate. (However, cruise control is normal.)	Probable cause
[Comment] Blown bulb in cruise control main switch	• Malfunction of the cruise control main switch

Replace the cruise control main switch.

INSPECTION PROCEDURE 13

Cruise control indicator inside combination meter does not illuminate. (However, cruise control is normal.)	Probable cause
[Comment] The cause is probably a malfunction of bulb or a malfunction of connector or harness.	• Malfunction of the bulb • Malfunction of the harness • Malfunction of the connector • Malfunction of the cruise control-ECU

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DATA LIST REFERENCE TABLE

For the data, which is input to the auto-cruise control-ECU the following items can be read out by using MUT-II.

HOW TO READ OUT DATA LIST

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

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

2. Turn the ignition switch to “ON” position.
3. Select “auto-cruise control” on the MUT-II menu, and then read out the data list.

Terminal No.	Check item		Check conditions		Normal condition
01	Auto-cruise control switch	MAIN	MAIN switch: ON		ON
			MAIN switch: OFF		OFF
02		SET (COAST)	MAIN switch: ON	SET switch: ON	ON
				SET switch: OFF	OFF
03		RESUME (ACCEL)		RESUME switch: ON	ON
				RESUME switch: OFF	OFF
04		CANCEL		CANCEL switch: ON	ON
				CANCEL switch: OFF	OFF
05	Stop lamp switch (for stop lamp circuit)		Brake pedal: Depressed		ON
			Brake pedal: Released		OFF
08	Accelerator switch (Idle position switch)		Accelerator pedal: Released		ON
			Accelerator pedal: Depressed		OFF
10	Vehicle speed sensor		Road test the vehicle		The speedometer and the MUT-II display the same value.
13	Throttle position sensor		Accelerator pedal: Fully depressed		300 – 1,000 mV
			Accelerator pedal: Depressed		The more deeply the pedal is depressed, the higher value the MUT-II displays.
			Accelerator pedal: Release		4,500 – 5,000 mV
14	Clutch switch <M/T>		Clutch pedal: Depressed		ON
			Brake pedal: Released		OFF
	Inhibitor switch <A/T>		Selector lever: “N” , “P” position		ON
			Selector lever: Other than “N” , “P” position		OFF
15	OD-OFF signal (OD-OFF→OD-ON signal)		Driving on level road (no OD-OFF request)		OFF
			Driving on uphill grade (OD-OFF request)		ON

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CHECK AT ECU TERMINALS

07AG059N

Terminal No.	Check item	Check conditions		Normal condition
1	Throttle position sensor input/accelerator pedal position sensor input	When the accelerator pedal is depressed fully		4.0–5.5V
		When the accelerator pedal is returned		0.5–0.7V
2	Closed throttle position switch input	When the accelerator pedal is depressed (Idle switch ON)		4.5–5.5V
		When the accelerator switch is not depressed (Idle switch OFF)		0V
3	A/T control output	No OD-OFF request		Battery voltage
		OD-OFF request		0V
4	Stop lamp switch input	When the brake pedal is depressed (Stop lamp switch ON)		Battery voltage
		When the brake pedal is not depressed (Stop lamp switch OFF)		0V
5	Pump power supply	Ignition switch ON		Battery voltage
		Main switch ON		
		Stop lamp switch OFF		
6	ECU power supply	Ignition switch ON		Battery voltage
		Main switch ON		
7	Electric vacuum pump release valve,control valve input	When decelerating with the set switch during travel at a constant speed	Release valve closed	0V
8			Control valve open	Battery voltage
7		When constant speed travel is cancelled with the cancel switch	Release valve open	Battery voltage
8			Control valve closed	Battery voltage
9	Cruise control switch input	When not operated (All switches OFF)		0V
		When Flicked down (Set switch ON)		3V
		When flicked up (Resume switch ON)		6V
		When flicked toward the driver (Cancel switch ON)		Battery voltage
10	Vehicle speed sensor input	The sensor repeatedly turns ON/OFF when the vehicle moves forwards or backwards	Sensor ON	0V
			Sensor OFF	4.5V
11	Diagnosis control input	Ignition switch ON		4.0V or greater
12	ACC power supply	When the ignition switch is on ACC		Battery voltage

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Terminal No.	Check item	Check conditions	Normal condition
13	Inhibitor switch input <A/T>	When the shift lever is other than in the N position (Inhibitor switch OFF)	Battery voltage
		When the shift lever is in the N position (Inhibitor switch ON)	0V
	Clutch pedal switch input <M/T>	When the clutch pedal is released (switch OFF)	Battery voltage
		When the clutch pedal is pressed (switch ON)	0V
14	Ground	–	–
15	Indicator lamp input (In combination meter)	On all the time	Battery voltage
16	Electric vacuum pump motor input	During constant-speed travel with Set switch (Motor stopped/ running	Battery voltage /0V
		Accelerating with Resume switch during constant-speed travel (Motor stopped/running)	Battery voltage /0V
		Decelerating with Set switch during constant-speed travel (Motor stopped)	Battery voltage
		Constant-speed travel cancelled with Cancel switch (Motor stopped)	Battery voltage

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ON-VEHICLE SERVICE

CRUISE CONTROL SYSTEM OPERATION CHECK

CRUISE CONTROL MAIN SWITCH INDICATOR LIGHT

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

CRUISE CONTROL SETTING

1. Switch ON the main switch.
2. Drive at the desired speed within the range of approximately 40–200 km/h.
3. Switch ON the SET switch.
4. Check to be sure that when the switch is released the speed is the desired constant speed.

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

SPEED-INCREASE SETTING

1. Set to the desired speed.
2. Switch ON the RESUME switch.
3. Check to be sure that acceleration continues while the switch is hold, and that when it is released the constant speed at the time when it was released becomes the driving speed.

SPEED REDUCTION SETTING

1. Set to the desired speed.
2. Switch ON the SET switch.
3. Check to be sure that deceleration continues while the switch is pressed, and that when it is released the constant speed at the time when it was released becomes the driving speed.

   NOTE
   When the vehicle speed reaches the low limit [approximately 40 km/h during deceleration, the cruise control will be cancelled.

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RETURN TO THE SET SPEED BEFORE CANCELLATION AND CRUISE CONTROL CANCELLATION

1. Set the cruise speed control.
2. When any of the following operations are performed while at constant speed during cruise control, check if normal driving is resumed and deceleration occurs.
   (1) Switch ON the CANCEL switch.
   (2) The brake pedal is depressed.
   (3) The selector lever is moved to the “N” range <A/T>.
   (4) The clutch pedal is depressed <M/T>.

3. At a vehicle speed of 40 km/h or higher, check if when the RESUME switch is switched ON, vehicle speed returns to the speed before cruise control driving was cancelled, and constant speed driving occurs.
4. When the main switch is turned to OFF while driving at constant speed, check if normal driving is resumed and deceleration occurs.

CRUISE CONTROL COMPONENT CHECK

STOP LIGHT SWITCH

Measurement conditions	For stop light circuit Terminal No.		For cruise control circuit Terminal No.	
	2	3	1	4
When brake pedal depressed.	○	○		
When brake pedal not depressed.			○	○

THROTTLE POSITION SENSOR

Refer Group 13A On Vehicle Service.

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INHIBITOR SWITCH (“N” POSITION)

Measurement conditions	Terminal No.			
	4	8	9	10
Selector lever is at ”N” position	○	○	○	○
Selector lever is not at ”N” position				

CLUTCH PEDAL SWITCH

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

CRUISE VACUUM PUMP

1. Disconnect the vacuum hose from the electric vacuum pump and connect a vacuum gauge to the vacuum pump.
2. Disconnect the electric vacuum pump connector.

3. Connect terminal (1) to the battery (+) terminal, and connect terminals (2) and (3) to the battery (–) terminal.
4. Check to be sure that the vacuum gauge shows a reading of 53 kPa (398 mm Hg)or more when terminal (4) is connected to the battery (–) terminal.

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5. In this condition, check to be sure that the vacuum gauge shows a 20 kPa (150 mm Hg) or less when terminals (2) and (3) are disconnected from the battery.

ACTUATOR

1. Disconnect the vacuum hose from the vacuum actuator and connect a hand vacuum pump to the vacuum actuator.
2. Confirm that the throttle lever operates and the vacuum is also maintained when a vacuum is present.

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CRUISE CONTROL

REMOVAL AND INSTALLATION

07AE015N

Vacuum pump removal steps

1. Vacuum hose
2. Electric vacuum pump and bracket assembly
3. Electric vacuum pump
4. Bracket

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CAUTION: SRS
Before removal of air bag module and clock spring, refer to the followings:
GROUP 52B – SRS Service Precautions.
GROUP 52B – Air Bag Module & Clock Spring.

07TH057A

03AE024N

03TE023A

07TH069A

Control switch removal steps

- Airbag module (See group 52B)

6. Control switch

Control unit removal steps

- Floor console box assembly (See group 52A)
- Centre air outlet assembly (See group 52-Instrument Panel)
- Ash tray (See group 52A-Instrument Panel)
- Air conditioner control unit and radio/ tape player

7. Cruise control ECU

Sensor removal steps

8. Throttle position sensor
9. Inhibitor switch
10. Stop lamp switch
11. Clutch pedal switch

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INSPECTION

CRUISE CONTROL SWITCH CHECK

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

Switch position	Resistance between terminals
Switch OFF	No continuity
CANCEL switch ON	Approx. 1.1 kΩ
RESUME switch ON	Approx. 331 Ω
SET switch ON	Approx. 3.1 kΩ
MAIN switch held in	0 Ω

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EMISSION CONTROL SYSTEM

GENERAL INFORMATION

The emission control system consists of the following subsystems:
- Positive crankcase ventilation system
- Evaporative emission control system
- Exhaust emission control system

Items	Name	Specification
Crankcase emission control system	Positive crankcase ventilation (PCV) valve	Variable flow type (Purpose: HC reduction)
Evaporative emission control system	Canister Purge control valve	Equipped Manifold vacuum purge (Purpose: HC reduction)
Exhaust emission control system	Air-fuel ratio control device–MPI system (vehicles with catalytic converter)	Oxygen sensor feedback type (Purpose: CO, HC, NOx reduction)
	Exhaust gas recirculation system • EGR valve • EGR control solenoid valve	Equipped Single type Duty cycle type solenoid valve (Purpose: NOx reduction)
	Catalytic converter	Monolith type (Purpose: CO, HC, NOx reduction)

EMISSION CONTROL DEVICE REFERENCE TABLE

Related parts	Crankcase emission control system	Evaporative emission control system	Air/fuel ratio control system	Catalytic converter	Exhaust gas recirculation system
PCV valve	X				
MPI system component		X	X		
EGR valve					X
EGR control solenoid valve					X
Catalytic converter				X	

SERVICE SPECIFICATIONS

Items	Specification
EGR control solenoid valve coil resistance [at 20°C] Ω	36–44

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SPECIAL TOOL

Tool	Tool number and name	Supersession	Application
	MD998770 Oxygen sensor wrench	–	Removal/Installation of heated oxygen sensor

VACUUM HOSE

VACUUM HOSE PIPING DIAGRAM

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VACUUM CIRCUIT DIAGRAM

07AE030E

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VACUUM HOSE INSTALLATION

1. When connecting the vacuum hoses, they should be securely inserted onto the nipples.
2. Connect the hoses correctly, using the VACUUM HOSE PIPING DIAGRAM as a guide.

VACUUM HOSE INSPECTION

1. Using the VACUUM HOSE PIPING DIAGRAM as a guide, check to be sure that the vacuum hoses are correctly connected.
2. Check the connection condition of the vacuum hoses, (removed, loose, etc.) and check to be sure that there are no bends or damage.

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CRANKCASE EMISSION CONTROL SYSTEM

GENERAL INFORMATION

The crankcase emission control system is a system for preventing the escape of blow-by gases from inside the crankcase into the atmosphere.
Fresh air is sent from the air cleaner into the crankcase through the breather hose to be mixed with the blow-by gases inside the crankcase.
The blow-by gas inside the crankcase is drawn into the intake manifold through the positive crankcase ventilation valve.

The positive crankcase ventilation valve is designed to lift the plunger according to the intake manifold vacuum so as to regulate the flow of blow-by gas properly.
In other words, the blow-by gas flow is regulated during low load engine operation to maintain engine stability, while the flow is increased during high load operation to improve the ventilation performance.

SYSTEM DIAGRAM

COMPONENT LOCATION

Positive crankcase ventilation valve

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POSITIVE CRANKCASE VENTILATION SYSTEM CHECK

1. Remove the ventilation hose from the positive crankcase ventilation valve.
2. Remove the positive crankcase ventilation valve from the rocker cover.
3. Reinstall the positive crankcase ventilation valve at the ventilation hose.
4. Start the engine and run at idle.

5. Place a finger at the opening of the positive crankcase ventilation valve and confirm that vacuum of the intake manifold is felt.

   NOTE
   At this moment, the plunger in the positive crankcase ventilation valve moves forward and backward.
6. If vacuum is not felt, clean the positive crankcase ventilation valve or replace it.
7. Install the positive crankcase ventilation valve.

POSITIVE CRANKCASE VENTILATION (PCV) VALVE CHECK

1. Insert a thin rod into the positive crankcase ventilation valve from the side shown in the illustration (rocker cover installation side), and move the rod back and forth to confirm that the plunger moves.
2. If the plunger does not move, there is a clogging in the positive crankcase ventilation valve. In this case, clean or replace the valve.

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EVAPORATIVE EMISSION CONTROL SYSTEM

GENERAL INFORMATION

The evaporative emission control system prevents fuel vapours generated in the fuel tank from escaping into the atmosphere.
Fuel vapours from the fuel tank flow through the fuel tank pressure control valve and vapour pipe/hose to be stored temporarily in the EVAP canister. When the vehicle is in operation, fuel vapours 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 vapour 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 stabilise the emission level.

SYSTEM DIAGRAM

COMPONENT LOCATION

Evaporative emission purge solenoid

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PURGE CONTROL SYSTEM CHECK

1. Disconnect the vacuum hose (red stripes) from the throttle body and connect it to a hand vacuum pump.
2. Plug the nipple from which the vacuum hose was removed.
3. When the engine is cold and hot, apply a vacuum while the engine is idling, and check the condition of the engine and the vacuum.

When engine is cold
[Engine coolant temperature: 40°C or less]

Vacuum	Engine status	Normal condition
400 mmHg	3,000 rpm	Vacuum is maintained

When engine is hot
[Engine coolant temperature: 80°C or higher]

Vacuum	Engine status	Normal condition
400 mmHg	Idling	Vacuum is maintained
	3,000 rpm	Vacuum will leak for approximately 3 minutes after the engine is started. After 3 minutes have elapsed, the vacuum will be maintained momentarily, after which it will again leak.*

NOTE
* The vacuum will leak continuously if the atmospheric pressure is approximately 580 mmHg or less, or the temperature of the intake air is approximately 50°C or higher.

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PURGE PORT VACUUM CHECK

1. Disconnect the vacuum hose (red stripe) from the throttle body purge 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 raises proportionately with the rise in engine speed.

   NOTE
   If there is a problem with the change in vacuum, it is possible that the throttle body purge port may be clogged and require cleaning.

EVAPORATIVE EMISSION PURGE SOLENOID CHECK

1. Remove the engine cover. Refer Group 11B.
2. Disconnect the vacuum hose (black stripe, red stripe) from the solenoid valve.

   NOTE
   Before disconnecting the vacuum hose, always make a mark so that it can be reconnected at original position.

3. Disconnect the harness connector.

4. Connect a hand vacuum pump to nipple (A) of the solenoid valve (refer to the illustration at left).
5. Check air tightness by applying a vacuum with voltage applied directly from the battery to the purge control solenoid valve and without applying voltage.

Battery voltage	Normal condition
Applied	Vacuum leaks
Not applied	Vacuum maintained

6. Measure the resistance between the terminals of the solenoid valve.

   Standard value: 36–44 Ω [at 20°C]

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VOLUME AIR FLOW SENSOR, ENGINE COOLANT TEMPERATURE SENSOR AND INTAKE AIR TEMPERATURE SENSOR CHECK

To inspect these parts, refer Group 13A On Vehicle Service of MPI Components.

AIR CONDITIONING SWITCH CHECK

To inspect the air conditioning switch, refer to GROUP 55 – Air Conditioning Switch.

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CANISTER AND TWO WAY VALVE REMOVAL AND INSTALLATION

Removal steps

1. Vapour hose
2. Purge hose connection
3. Canister
4. Breather valve and hoses (where fitted)
5. Canister bracket

INSPECTION

TWO-WAY VALVE

Refer Group 13F On Vehicle Service.

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EXHAUST GAS RECIRCULATION (EGR) SYSTEM

GENERAL INFORMATION

The exhaust gas recirculation (EGR) system lowers the nitrogen oxide (NOx) emission level. When the air/fuel mixture combustion temperature is high, a large quantity of nitrogen oxides (NOx) is generated in the combustion chamber. Therefore, this system recirculates part of emission gas from the exhaust port of the cylinder head to the combustion chamber through the intake manifold to decrease the air/fuel mixture combustion temperature, resulting in reduction of NOx.
The EGR flow rate is controlled by the EGR valve so as not to decrease the driveability.

OPERATION

When the engine coolant temperature is low, when the engine is at idle or when a wide open throttle operation is performed, the EGR valve is kept closed, achieving no EGR. In normal vehicle operation performed after warming up of the engine, the EGR valve is opened to carry out EGR.

The engine control module monitors EGR system via the manifold differential pressure sensor and turns on the check engine/malfunction indicator light to notify the driver if a failure occurs in the EGR system.

SYSTEM DIAGRAM

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COMPONENT LOCATION

EGR solenoid

EGR valve

EGR SYSTEM CHECK

1. Remove the engine cover. Refer Group 11B.
2. Disconnect the vacuum hose (green stripe) that connects to the EGR valve, and then connect a hand vacuum pump via a three-way terminal.
3. With the engine in cold and hot conditions, check the condition of vacuum when rapid racing has been performed by opening the throttle valve quickly.

When engine is cold
[Engine coolant temperature: 20°C or less]

Throttle valve	Normal vacuum condition
Open quickly	No vacuum will generate (remained as barometric pressure).

When engine is hot
[Engine coolant temperature: 80°C or higher]

Throttle valve	Normal vacuum condition
Open quickly	It will momentarily rise over 100 mmHg

4. Disconnect the three-way terminal.
5. Connect the hand vacuum pump directly to the EGR valve.
6. Check whether the engine stalls or the idling is unstable when a vacuum of 220 mmHg or higher is applied during idling.

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VACUUM CONTROL VALVE CHECK

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 disconnected vacuum hose.
3. Start the engine and run at idle.
4. Check the vacuum condition.

Engine condition	Normal vacuum condition
Idling	Approx. 170 mmHg

EGR VALVE CHECK

1. Remove the EGR valve and inspect for sticking, carbon deposits, etc. If necessary, clean with a suitable solvent so that the valve seats correctly.
2. Connect a hand vacuum pump to the EGR valve.
3. Apply 500 mmHg of vacuum, and check to be sure that the vacuum is maintained.
4. Apply a vacuum and check the passage of air by blowing through one side of the EGR passage.

Vacuum	Passage of air
40 mmHg or less	Air is not blown out
220 mmHg or more	Air is blown out

5. Use a new gasket, and tighten to the specified torque.

   Specified torque: 22 Nm

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EGR PORT VACUUM CHECK

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 raising the engine speed by racing the engine, vacuum remains fairly constant.

EGR SOLENOID CHECK

NOTE
When disconnecting the vacuum hose, always make a mark so that it can be reconnected at original position.

1. Disconnect the vacuum hose (yellow stripe, green stripe) from the solenoid valve.
2. Disconnect the harness connector.

3. Connect a hand vacuum pump to the nipple to which the green-striped vacuum hose was connected.
4. Check air tightness by applying a vacuum with voltage applied directly from the battery to the EGR control solenoid valve and without applying voltage.

Battery voltage	Normal condition
Not applied	Vacuum leaks
Applied	Vacuum maintained

5. Measure the resistance between the terminals of the solenoid valve.

   Standard value: 36–44Ω [at 20°C]

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CATALYTIC CONVERTER

GENERAL INFORMATION

The three-way catalytic converter, together with the closed loop air-fuel ratio control based on the oxygen sensor signal, oxidises carbon monoxides (CO) and hydrocarbons (HC) and reduces nitrogen oxides (NOx).

When the mixture is controlled at stoichiometric air-fuel ratio, the three-way catalytic converter provides the highest purification against the three constituents, namely, CO, HC and NOx.

REMOVAL AND INSTALLATION

Removal steps

1. Hanger
2. Main muffler assembly
3. Hanger bracket
4. Gasket
5. Rear floor heat protector panel
6. Hanger
7. Centre exhaust pipe
8. Gasket
9. Damper
10. Hanger bracket
11. Harness protector
12. Catalytic converter
13. Gasket
14. Oxygen sensor
15. Hanger
16. Front exhaust pipe
17. Gasket
18. Front floor heat protector

◀A▶

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REMOVAL SERVICE POINT

◀A▶ OXYGEN SENSOR REMOVAL

Remove the oxygen sensor with the special tool (MD998770).

INSPECTION

Inspect for damage, cracking or deterioration. 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.**

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GENERAL INFORMATION

A dry single-disc, diaphragm pull type clutch is used.
Hydraulic pressure is used for the clutch control.

Items	Specifications
Clutch operating method	Hydraulic type
Clutch disc type	Single dry disc type
Clutch disc facing diameter O.D.×I.D. mm	225×150
Clutch cover type	Diaphragm spring pull type
Clutch cover setting load N	6,300
Clutch release cylinder I.D. mm	20.5

SERVICE SPECIFICATIONS

Items	Standard value
Clutch pedal height mm	175–180
Clutch pedal clevis pin play mm	1–3
Clutch pedal free play mm	6–13
Distance between the clutch pedal and the firewall when the clutch is disengaged mm	45 or more

LUBRICANTS

Items	Specified lubricants	Quantity
Clutch fluid	Brake fluid DOT4	As required
Push rod assembly	Rubber grease	As required
Boot		
Release cylinder push rod	MITSUBISHI genuine grease Part No. 0101011	As required

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ON-VEHICLE SERVICE

CLUTCH PEDAL CHECK AND ADJUSTMENT

1. Measure the clutch pedal height and the clutch pedal clevis pin play.

   Standard value (A): 175–180 mm
   Standard value (B): 1–3 mm

2. If the height of the clutch pedal is outside the standard value, loosen the lock nut and adjust the pedal height to the standard value using the adjusting bolt (Vehicles without cruise control) or clutch pedal position switch (Vehicles with cruise control).
3. If the clutch pedal play is outside the standard value, adjust with the push rod.

   Caution
   Do not push in the master cylinder push rod at this time.

4. After completing the adjustments, confirm that the clutch pedal free play (measured at the face of the pedal pad) and the distance between the clutch pedal (the face of the pedal pad) and the firewall when the clutch is disengaged are within the standard value ranges.

   Standard value (C): 6–13 mm
   Standard value (D): 45 mm or more
5. If the clutch pedal free play and the distance between the clutch pedal and the firewall when the clutch is disengaged do not agree with the standard values, it is probably the result of either air in the hydraulic system or a faulty master cylinder or clutch. Bleed the air, or disassemble and inspect the master cylinder or clutch.

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BLEEDING

1. Top up the fluid reservoir.

   Specified brake fluid: DOT 4

   NOTE
   Always use the specified fluid that is clean and uncontaminated and has been stored in a sealed container.
2. Attach a length of transparent tubing to the bleed valve and insert the other end into a jar, partially filled with hydraulic fluid.
3. With an assistant to operate the clutch, open the bleed valve approximately half a turn, and depress the pedal. Just before the pedal reaches the end of its travel, close the bleed valve and allow the pedal to return to the rest position.
4. Repeat step 3 until the fluid hose is free of air bubbles.

   NOTE
   Ensure the reservoir fluid is replenished throughout the bleeding procedure.
5. Fill the master cylinder to the correct level.

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CLUTCH PEDAL

REMOVAL AND INSTALLATION

Post-installation Operation
Clutch Pedal Adjustment (Refer On Vehicle Service.)

08AE015E

Removal steps

1. Hood release lever
2. Lower column cover
3. Instrument under cover
4. Return spring
5. R-clip
6. Washer
7. Clevis pin
8. Nut
9. Bolt
10. Bushing
11. Clutch pedal
12. Pedal pad
13. Pedal support member

INSPECTION

- Check the pedal shaft and bushing for wear.
- Check the clutch pedal for bend or torsion.
- Check the return spring for damage or deterioration.
- Check the pedal pad for damage or wear.

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CLUTCH DISC

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Remove or install Manual Transmission

Note: The clutch release bearing must be disengaged from the clutch cover before the transmission is removed.

08TE008A

Removal procedure

1. Clutch fluid line bracket
2. Insulator
3. Washer
4. Clutch tube A
5. Clutch tube B
6. Union bolt
7. Union
8. Gasket
9. Clutch release cylinder
10. Clutch damper
11. Clutch cover
12. Clutch disc
13. Clutch release bearing
14. Release fork shaft
15. Release fork return spring
16. Release fork boot
17. Packing
18. Release fork ◀A▶ ▶A◀
19. Clutch cover bolt

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SERVICE POINTS OF REMOVAL

◀A▶ RELEASE FORK

1. Remove release fork shaft bolt
2. Remove release fork shaft and packing.
3. Remove release fork.

SERVICE POINT OF INSTALLATION

▶A◀ RELEASE FORK

1. Apply grease to the release fork shaft and transmission case in the areas shown.
2. Install release fork.
3. Install release fork packing and shaft.
4. Install release fork shaft bolt.

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INSPECTION

CLUTCH COVER ASSEMBLY

1. Check the diaphragm spring end for wear and uneven height. Replace if wear is evident or height difference exceeds the limit.

   Limit: 0.5 mm

2. Check the pressure plate surface for wear, cracks and seizure.
3. Check the strap plate rivets for looseness and replace the clutch cover assembly if loose.

CLUTCH DISC

Caution:

Do not clean the clutch disc in a cleaning fluid.

1. Check the facing for loose rivets, uneven contact, deterioration due to seizure, adhesion of oil or grease and replace the clutch disc if defective.
2. Measure the rivet sink and replace the clutch disc if it is out of specification.

   Limit: 0.5 mm

3. Check torsion spring for play and damage and replace the clutch disc if defective.
4. Combine the clutch disc with the output shaft and check the sliding condition and play in the rotating direction. If it does not slide smoothly or the play is excessive, replace the clutch disc and/or the input shaft.

CLUTCH RELEASE BEARING

Caution:

The release bearing is packed with grease. Therefore do not wash it in cleaning solvent or the like.

1. Check bearing for seizure, damage, noise or improper rotation. Also check the diaphragm spring contact surface for wear.
2. Replace bearing if its release fork contact surface is abnormally worn.
3. Replace release fork if its bearing contact surface is abnormally worn.

RELEASE FORK

1. Replace release fork if its bearing contact surface is abnormally worn.

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CLUTCH CONTROL

REMOVAL AND INSTALLATION

Pre-removal Operation
Clutch Fluid Draining

Post-installation Operation
(1) Clutch Fluid Supplying
(2) Clutch Line Bleeding (Refer On Vehicle Service.)
(3) Clutch Pedal Adjustment (Refer On Vehicle Service)

08AE017E

Clutch master cylinder removal steps

1. Air cleaner element
2. Air cleaner cover
3. Clevis pin
4. Clutch pipe connection
5. Clutch master cylinder
6. Sealer
7. Reservoir hose
8. Reservoir tank
9. Reservoir cap
10. Reservoir bracket

Clutch release cylinder removal steps

11. Clutch pipe connection
12. Clutch release cylinder

Clutch line removal steps

◀A▶ ▶A◀ 13. Clutch pipe
◀A▶ ▶A◀ 14. Clutch hose
◀A▶ ▶A◀ 15. Clutch pipe
16. Clutch hose bracket

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REMOVAL SERVICE POINT

◀A▶ CLUTCH HOSE REMOVAL

Holding the nut at the clutch hose side, loosen the flare nut of the clutch pipe.

INSTALLATION SERVICE POINT

▶A◀ CLUTCH HOSE/CLUTCH PIPE INSTALLATION

1. Temporarily tighten the clutch pipe flare nut by hand, and then tighten it to the specified torque, being careful that the clutch hose does not become twisted.
2. After tightening the clutch pipe flare nut and eye bolt, check to be sure there is no clutch fluid leakage.

INSPECTION

- Check the pedal shaft bushing for wear.
- Check the pedal arm for bend or torsion.
- Check the fluid reservoir tank, master cylinder or clutch hose for fluid leakage.
- Check the clutch hose or pipe for cracks or clogging.

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CLUTCH MASTER CYLINDER

DISASSEMBLY AND REASSEMBLY

Specified fluid:
DOT 4 Brake fluid conforming to AS1960-1983 Grade 3

08AE016E

Disassembly steps

1. Piston stopper ring
2. Damper push rod
3. Boot
4. Piston assembly
5. Nipple
6. Clutch master cylinder

Caution

1. Do not damage the master cylinder bore or piston assembly.

2. Do not disassemble the piston assembly.

INSPECTION

- Check the inside cylinder body for rust or scoring.
- Check the piston cup for wear or deformation.
- Check the piston for rust or scoring.
- Check the clutch pipe connection for clogging.

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CLUTCH RELEASE CYLINDER

DISASSEMBLY AND REASSEMBLY

Disassembly steps

1. Cap
2. Air bleeder
3. Push rod
4. Boot
5. Piston cup (A)
6. Piston (A)
7. Conical spring
8. Release cylinder

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REMOVAL SERVICE POINT

◀A▶ PISTON AND PISTON CUP

1. Remove the piston from the release cylinder using compressed air.

   CAUTION
   Cover with shop towel to prevent the piston from popping out.
   Apply compressed air slowly to prevent brake fluid from splashing.

INSTALLATION SERVICE POINT

▶A◀ PISTON AND PISTON CUP

1. After applying brake fluid to the inside wall surface of the release cylinder and all the circumferential surfaces of the piston and piston cup, insert the piston and piston cup into the cylinder.

   Specified brake fluid:
   Dot 4 conforming to AS1960–1983 Grade 3

INSPECTION

CLUTCH RELEASE CYLINDER

1. Check the inner surface of the release cylinder for rust, scratches or irregular wear.
2. Using a cylinder gauge, measure the inside diameter of the release cylinder at about three positions (the deepest, middle and brim positions). If the clearance from the outside diameter of the piston exceeds the limit, replace the release cylinder assembly as an assembly.

   Limit: 0.15mm

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22 MANUAL TRANSMISSION

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REMOVAL AND INSTALLATION

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 in baking or drying after painting, remove the SRS components (air bag module and SRS-ECU) beforehand.

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

(4) 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
Section titles with the asterisk (*) in the table of contents in each group indicate operations requiring warnings.

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LUBRICANT

Items	Specified lubricant	Quantity (litres)
Transmission oil	Hypoid gear oil SAE 75W-85W conforming to API classification GL-4	2.8

SPECIAL TOOLS

Tool	Tool number and name	Supersession	Application
	MB991113 or MB990635 Steering linkage puller	13–006	• Tie rod end ball joint and knuckle removal • Lateral lower arm ball joint and knuckle removal • Compression lower arm ball joint and knuckle removal
	MZ203827 Engine lifter	E309A	Supporting the engine assembly during removal and installation of the transmission
	MB991460 Plug	–	Preventing foreign substances from entering transmission case

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ON-VEHICLE SERVICE

TRANSMISSION OIL LEVEL CHECK

1. Remove the oil filler plug.
2. The oil level should be at the lower portion of the filler plug hole.
3. Check that the transmission oil is not noticeably dirty and that it has a suitable viscosity.
4. Tighten the filler plug to the specified torque.

   Specified torque: 32 Nm

TRANSMISSION OIL REPLACEMENT

1. Remove transmission drain plug.
2. Drain oil.
3. Tighten drain plug to specified torque.

   Specified torque: 32 Nm

4. Remove filler plug and fill with specified oil until the level reaches the lower portion of filler plug hole.

   Specified oil:
   Hypoid gear oil SAE 75W–85W conforming to API classification GL-3

   Quantity: 2.8 (litres)

5. Tighten filler plug to specified torque.

   Specified torque: 32 Nm

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TRANSMISSION CONTROL

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Air Cleaner – Removal and Installation (Refer Group 15 On Vehicle Service.)

Caution: SRS
Be careful not to subject the SRS-ECU to any shocks during removal and installation of the transmission control cable and shift lever assembly.

Transmission control cable assembly removal steps

▶B◀ 1. Shift knob
▶B◀ 2. Spacer
▶B◀ 3. Spring washer
▶B◀ 4. Nut
- Front floor console (Refer Group 52A.)

5. Select cable connection (Shift lever side)
6. Clip
7. Shift cable connection (Shift lever side)
8. R-clip
▶A◀ 9. Select cable connection (Transmission side)
▶A◀ 10. Shift cable connection (Transmission side)
▶A◀ 11. Shift cable and select cable assembly

Shift lever assembly removal steps

▶B◀ 1. Shift knob
▶B◀ 2. Spacer
▶B◀ 3. Spring washer
▶B◀ 4. Nut
- Front floor console (Refer Group 52A.)

5. Select cable connection (Shift lever side)
6. Clip
7. Shift cable connection (Shift lever side)
12. Shift lever assembly

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INSTALLATION SERVICE POINT

▶A◀ SHIFT CABLE AND SELECT CABLE ASSEMBLY/SHIFT CABLE CONNECTION/SELECT CABLE CONNECTION

1. Ensure the shift cable and select lever assembly is mounted in the vehicle with the “UP” symbol and arrow on the mounting plate pointing upward as shown in the illustration.

2. Set the transmission side shift lever and the passenger compartment side shift lever to the neutral position.
3. For the transmission side, the white and the yellow paint marks on the shift and select cable ends should face the snap rings.
4. Move the shift lever to all positions and check that the operation is smooth.

▶B◀ SPACER, SPRING WASHER, NUT AND SHIFT KNOB

1. Tighten the shift knob to specified torque.

   Specified torque:
   Loosening torque: 2.5 Nm Min.
   Tightening torque: 6.0 Nm

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SHIFT LEVER ASSEMBLY DISASSEMBLY AND REASSEMBLY

09AE004E

Disassembly steps

1. Gearshift lever assembly retaining bolts
2. Gearshift lever assembly
3. Gearshift linkage bushing
4. Gearshift cable bracket
5. Gearshift lever bracket insulator
6. Gearshift lever bracket insulator
7. Gearshift lever bracket

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TRANSMISSION ASSEMBLY

REMOVAL AND INSTALLATION

Pre-removal Operation
(1) Transmission Oil Draining (Refer On Vehicle Service.)
(2) Under Cover Removal
(3) Battery and Battery Tray Removal
(4) Air Cleaner Assembly Removal

Post-installation Operation
(1) Air Cleaner Assembly Installation
(2) Battery and Battery Tray Installation
(3) Under Cover Installation
(4) Supplying Transmission Oil (Refer On Vehicle Service.)
(5) Shift Lever Operation Check
(6) Speedometer Operation Check

Removal steps

1. Shift cable and select cable connection (Refer On Vehicle Service.)
2. Reverse lamp switch connector
3. Vehicle speed sensor connector
4. ◀A▶ Starter motor
5. ◀B▶ Clutch release cylinder connection
   - ◀C▶ Disengage clutch release bearing
6. Transmission assembly upper part coupling bolts
7. ◀D▶ Transmission mount bracket
8. ▶A◀ Transmission mount stopper
   - ◀E▶ Supporting engine assembly

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9.. Stabiliser bar connection
10. Wheel speed sensor cable connection (Vehicles with ABS)
11. Brake hose clamp
12. Tie rod end connection
13. Lower arm ball joint connection
14. Drive shaft <LH> connection
15. Drive shaft <RH> connection
16. Centre member assembly
17. Rear roll stopper
18. Rear roll stopper bracket
19. Bell housing cover
20. Transmission assembly lower part coupling bolts
21. Transmission assembly

Caution

***: Indicates parts which should be temporarily tightened, and then fully tightened with the vehicle on the ground in the unladen condition.**

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REMOVAL SERVICE POINTS

◀A▶ STARTER MOTOR

Remove the starter motor with the starter harness still connected and secure it to the inside of the engine compartment.

◀B▶ CLUTCH RELEASE CYLINDER

Remove the clutch release cylinder without disconnecting the oil line connection, and fix it to the vehicle chassis.

◀C▶ RELEASE BEARING

1. Remove the access hole covers from the top and bottom of the clutch housing.
2. Push the clutch cylinder end of the release fork so that the release bearing pushes against the diaphragm spring.

3. Insert a flat blade screwdriver in both top and bottom access holes in the clutch housing, between the release bearing and the diaphragm spring. Simultaneously turn both screwdrivers through 90° to disengage the release bearing.

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◀D▶ TRANSMISSION MOUNT BRACKET

Jack up the transmission assembly gently with a garage jack and the remove the transmission mount bracket.

◀E▶ ENGINE ASSEMBLY SUPPORTING

Set the special tool to the vehicle to support the engine assembly.

◀F▶ TIE ROD END/LOWER ARM BALL JOINT REMOVAL

Caution

1. **Loosen the nut without removing it from the ball joint and use the special tool 13–006 to disconnect the tie rod or ball joint.**
2. **Support the special tool with a cord in order to prevent it from falling off.**

◀G▶ DRIVE SHAFT REMOVAL

1. Insert a pry bar between the transmission case and the drive shaft to remove the drive shaft.

   CAUTION
   Always use a pry bar or the drive shaft joints will be damaged.

2. To prevent foreign matter from entering the transmission case, insert a suitable plug into the drive shaft openings.
3. Suspend the RH drive shaft with wire so that there are no sharp bends in any of the joints.

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INSTALLATION SERVICE POINT

▶A◀ TRANSMISSION MOUNT STOPPER INSTALLATION

Install the transmission mount stopper so that the arrow points down as shown in the illustration.

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22A MANUAL TRANSMISSION OVERHAUL

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GENERAL SPECIFICATIONS

Items	Specifications
Transmission model	F5M51–1–F5N
Gear Ratios	
1st gear	3.583
2nd gear	2.105
3rd gear	1.407
4th gear	1.031
5th gear	0.761
Reverse	3.416
Final drive	3.722

SERVICE SPECIFICATIONS

Items	Specifications
Input shaft front bearing end play	0.05–0.17 mm
Input shaft 5th gear end play	0.01–0.09 mm
Input shaft rear bearing end play	0.01–0.12 mm
Output shaft 3rd gear end play	0.01–0.09 mm
Differential case preload	0.05–0.11 mm
Differential case pinion backlash	0.025–0.15 mm
Clearance between synchroniser ring and gear	0.5 mm max.
Output shaft preload	0.13–0.18 mm
Output shaft bearing end play	0.01–0.09 mm

LUBRICANTS

Items	Specified lubricant	Quantity
Transmission oil	Hypoid gear oil SAE 75W–85W conforming to A.P.I. classification GL–4	2.8 litres
Input shaft oil seal lip	Mitsubishi genuine grease Part No. 0101011 or equivalent	as required
Selector lever shoe	Mitsubishi genuine grease Part No. 0101011 or equivalent	as required

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SEALANTS

Items	Specified sealant
Contact surface of clutch housing and transmission case	Mitsubishi genuine sealant Part No. MD997740 or equivalent.
Contact surface of control housing and transmission case	Mitsubishi genuine sealant Part No. MD997740 or equivalent.
Contact surface of under cover and transmission case	Mitsubishi genuine sealant Part No. MD997740 or equivalent.
Differential drive gear bolt	Loctite 262 or equivalent.

TORQUE SPECIFICATIONS

Items	Torque Nm
Under cover mounting bolt	6.9
Interlock plate bolt	30
Clutch housing and transmission case mounting bolt	44
Clutch release bearing retainer mounting bolt	9.8
Control housing mounting bolt	18
Shift cable bracket mounting bolt	18
Stopper bracket mounting bolt	22
Speedometer gear mounting bolt	3.9
Selector level mounting nut	11
Selector mounting bolt	18
Differential drive gear mounting bolt	132
Back–up lamp switch	32
Poppet spring	32
Roll stopper bracket mounting bolt	69
Reverse idler gear shaft mounting bolt	48

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FORM–IN–PLACE GASKET

The transmission has several areas where the form–in–place gasket (FIPG) is in use. To ensure that the gasket fully serves its purpose, it is necessary to observe some precautions when applying the gasket. Bead size, continuity and location are of paramount importance. Too thin a bead could cause leaks. Too thick a bead, on the other hand, could be squeezed out of location, causing blocking or narrowing of the fluid feed line. To eliminate the possibility of leaks from a joint, therefore, it is absolutely necessary to apply the gasket evenly without a break, while observing the correct bead size.

DISASSEMBLY

The parts assembled with the FIPG can be easily disassembled without use of a special method. In some cases, however, the sealant between the joined surfaces may have to be broken by lightly striking with a mallet or similar tool. Special care must be taken to prevent damage to aluminium surfaces.

SURFACE PREPARATION

Thoroughly remove all substances deposited on the gasket application surfaces, using a gasket scraper. Special care must be taken to prevent damage to aluminium surfaces. Check to ensure that the surfaces to which the FIPG is to be applied is flat. Make sure that there are no oils, greases and foreign substances deposited on the application surfaces. Do not forget to remove the old sealant remaining in the bolt holes.

FORM–IN–PLACE GASKET APPLICATION (FIPG)

When assembling parts with the FIPG, you must observe some precautions, but the procedure is very simple as in the case of a conventional pre–cut gasket. Applied FIPG bead should be of the specified size and without breaks. Also be sure to encircle the bolt hole circumference with a completely continuous bead. The FIPG can be wiped away unless it is hardened. While the FIPG is still moist (in less than 15 minutes), mount the parts in position. When the parts are mounted, make sure that the gasket is applied to the required area only. In addition, do not apply any oil to the sealing locations or start the engine until a sufficient amount of time (about one hour) has passed after installation is completed. The FIPG application procedure may vary on different areas. Observe the procedure described in the text when applying the FIPG.

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SNAP RINGS, SPACERS AND THRUST PLATE ADJUSTMENT

Part name	Thickness mm	Identification symbol	Part No.
Snap ring (for adjustment of input shaft front bearing end play)	1.43	Green (2)	MD746708
	1.51	White (2)	MD746709
	1.59	Yellow (2)	MD746710
Snap ring (for adjustment of input shaft rear bearing end play)	1.44	–	MD746602
	1.51	Blue	MD746603
	1.58	Brown	MD746604
Spacer (for adjustment of input shaft end play)	1.34	34	MD723600
	1.43	43	MD723603
	1.52	52	MD723606
	1.61	61	MD723609
	1.70	70	MD756760
	1.79	79	MD756763
Thrust plate (for adjustment of input shaft 5th gear end play)	3.82	0	MD748465
	3.86	2	MD748466
	3.90	3	MD748467
	3.94	5	MD748468
	3.98	6	MD748469
	4.02	7	MD748470
	4.06	8	MD748471
	4.10	9	MD748472
Snap ring (for adjustment of output shaft bearing end play)	1.36	Yellow	MD748449
	1.40	Green	MD748450
	1.44	–	MD746602
	1.48	Black	MD748451
	1.51	Blue	MD746603
	1.55	White	MD748452
	1.58	Brown	MD746604
	1.63	Orange	MD748453
	1.68	Blue	MD748454

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Part name	Thickness mm	Identification symbol	Part No.
Snap ring (for adjustment of output shaft 3rd gear end play)	2.81	–	MD746594
	2.85	Blue	MD746595
	2.89	Brown	MD746596
	2.93	Yellow	MD746597
	2.97	Green	MD746598
	3.01	Black	MD746599
	3.05	White	MD746600
	3.09	Orange	MD746601
Spacer (for adjustment of output shaft preload)	0.86	86	MD720938
	0.89	89	MD720939
	0.92	92	MD720940
	0.95	95	MD720941
	0.98	98	MD720942
	1.01	01	MD720943
	1.04	04	MD720944
	1.07	07	MD720945
	1.10	J	MD710454
	1.13	D	MD700270
	1.16	K	MD710455
	1.19	L	MD710456
	1.22	G	MD700271
	1.25	M	MD710457
	1.28	N	MD710458
	1.31	E	MD706574
	1.34	O	MD710459
	1.37	P	MD710460
	1.40	–	MD706573
	1.43	Q	MD710461
	1.46	R	MD710462

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Part name	Thickness mm	Identification symbol	Part No.
Spacer (for adjustment of differential case preload)	0.74	74	MD727660
	0.77	77	MD754476
	0.80	80	MD727661
	0.83	83	MD720937
	0.86	86	MD720938
	0.89	89	MD720939
	0.92	92	MD720940
	0.95	95	MD720941
	0.98	98	MD720942
	1.01	01	MD720943
	1.04	04	MD720944
	1.07	07	MD720945
	1.10	J	MD710454
	1.13	D	MD700270
	1.16	K	MD710455
	1.19	L	MD710456
	1.22	G	MD700271
	1.25	M	MD710457
	1.28	N	MD710458
	1.31	E	MD706574
Spacer<F5M51 with 3.0L engine only> (for adjustment of differential case pinion backlash)	0.75–0.82	–	MA180862
	0.83–0.92	–	MA180861
	0.93–1.00	–	MA180860
	1.01–1.08	–	MA180875
	1.09–1.16	–	MA180876
Spacer<F5M51 with 3.5L engine only> (for adjustment of differential case pinion backlash)	0.75–0.82	–	MD722986
	0.83–0.92	–	MD722985
	0.93–1.00	–	MD722984
	1.01–1.08	–	MD722983
	1.09–1.16	–	MD722982

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SPECIAL TOOLS

Tool	Tool number and name	Supersession	Application
	MB990926 Installer adaptor	–	To install an oil seal for the clutch housing input shaft portion
	MB990927 Installer adaptor	–	To install a sealing cap
	MB990928 Installer adaptor	–	To install the input shaft oil seal
	MB990934 Installer adaptor	–	To install a roller bearing outer race
	MB990935 Installer adaptor	–	To install a differential case taper roller bearing outer race
	MB990938 Handle	–	To be used as an installer adaptor
	MB991445 Bush remover and installer base	–	To install differential case taper roller bearing outer race
	MD998325 Differential oil seal installer	–	To install a differential oil seal
	MD998346 Bearing outer race remover	–	To remove a roller bearing outer race

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Tool	Tool number and name	Supersession	Application
	MD998364 Camshaft oil seal installer	–	To install each gear, bearing and sleeve
	MD998772 Roller bearing outer race remover	–	To remove a roller bearing outer race
	MD998801 Bearing remover	–	To install and remove each gear, bearing and sleeve
	MD998812 Installer cap	–	To be used as an installer and an installer adaptor
	MD998813 Installer 100	–	To be used as an installer cap and an installer adaptor
	MD998814 Installer 200	–	To be used as an installer cap and an installer adaptor
	MD998816 Installer adaptor (30)	–	To install input shaft front bearing
	MD998817 Installer adaptor (34)	–	Installation of the output shaft rear bearing
	MD998818 Installer adaptor (38)	–	To install input shaft rear bearing, output shaft rear bearing, reverse gear bearing and roller bearing inner race.

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Tool	Tool number and name	Supersession	Application
	MD998819 Installer adaptor (40)	–	To install 4th gear, 5th gear and 5th/reverse synchroniser hub
	MD998820 Installer adaptor (42)	–	To install reverse gear bearing sleeve
	MD998821 Installer adaptor (44)	–	To install 4th and 5th gear sleeve and 5th/reverse synchroniser
	MD998822 Installer adaptor (46)	–	To install 2nd gear sleeve and 3rd gear
	MD998823 Installer adaptor (48)	–	To install differential case taper roller bearing inner race
	MD998824 Installer adaptor (50)	–	To install 4th gear sleeve and 5th gear
	MD998825 Installer adaptor (52)	–	To install differential oil seal
	MD998917 Bearing remover	–	To install and remove each gear, bearing and sleeve
	MD999566 Claw	–	To remove differential case taper roller bearing outer race

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Tool	Tool number and name	Supersession	Application
	MD998020 Bearing outer race remover	E21M16	To remove roller bearing outer race
	MD998800 Oil seal installer	E21M14A	To install transfer cover oil seal

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TRANSMISSION

DISASSEMBLY AND REASSEMBLY

09TH011A

Disassembly steps

1. Roll stopper bracket
2. Shift cable bracket
3. Insulator washer
4. ▶J◀ Selector lever
5. ▶I◀ Speedometer gear
6. Reverse light switch
7. Gasket
8. ▶H◀ Poppet spring
9. Gasket

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DISASSEMBLY AND REASSEMBLY CONTINUED

Disassembly steps

10. Interlock plate bolt
11. Gasket
▶G◀ 12. Control housing
13. Neutral return spring
▶F◀ 14. Undercover
15. Reverse idler shaft bolt
16. Gasket
17. Reverse idler gear
▶E◀ 18. Transmission case
19. Outer race
20. Outer race
▶D◀ 21. Spacer
▶D◀ 22. Spacer
▶D◀ 23. Spacer
24. Oil guide
25. Oil guide

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DISASSEMBLY AND REASSEMBLY CONTINUED

Disassembly steps

	▶C◀	26. Spring pin
		27. 1st–2nd shift rail
		28. 1st–2nd shift fork
	▶C◀	29. Spring pin
◀A▶	▶C◀	30. Spring pin
◀B▶	▶B◀	31. 3rd–4th shift rail
◀B▶	▶B◀	32. 3rd–4th shift fork
◀B▶	▶B◀	33. 5th–reverse shift rail
◀B▶	▶B◀	34. 5th–reverse shift fork
◀C▶	▶A◀	35. Differential
◀C▶	▶A◀	36. Output shaft
◀C▶	▶A◀	37. Input shaft
		38. Clutch housing

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REMOVAL SERVICE POINTS

◀A▶ SPRING PIN

1. Shift the 5th–reverse shift fork in the direction shown before removing the spring pin.

◀B▶ 3RD–4TH SHIFT RAIL/3RD–4TH SHIFT FORK/5TH–REVERSE SHIFT RAIL/5TH–REVERSE SHIFT FORK

1. Remove each shift rail from the rail hole in the clutch housing.

◀C▶ INPUT SHAFT/OUTPUT SHAFT/DIFFERENTIAL

1. Remove the output shaft and input shaft simultaneously.
2. Remove the differential.

INSPECTION

REVERSE LIGHT SWITCH

1. Check for continuity between terminals.

Item	Continuity
Press switch	Yes
Release switch	No

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PRE–ASSEMBLY ADJUSTMENTS

SELECTION OF SPACERS FOR INPUT SHAFT END PLAY, OUTPUT SHAFT PRELOAD AND DIFFERENTIAL PRELOAD

1. Attach the differential, then the input shaft and output shaft to the clutch housing simultaneously.

2. Place solder (approx. 10mm length, 1.6mm diameter) on the input shaft bearing at the point shown.

3. Place solder (approx. 10mm length, 1.6mm diameter) on the transmission case at the point shown for the output shaft and differential bearings.
4. Install the outer race.
5. Install the transmission case and tighten the bolts to the specified torque.

6. If the solder is not crushed, carry out procedures (2–5) using lager diameter solder.

7. Measure the thickness of the crushed solder with a micrometer. Select a spacer of the thickness to attain a standard end play and preload.

   Standard values:
   Input shaft end play (0.05 – 0.17mm)
   Output shaft preload (0.13 – 0.18mm)
   Differential preload (0.05 – 0.11mm)

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INSTALLATION SERVICE POINTS

▶A◀ INPUT SHAFT/OUTPUT SHAFT/DIFFERENTIAL

1. Install the differential and then install the input and output shafts simultaneously.

▶B◀ 5TH–REVERSE SHIFT RAIL/5TH–REVERSE SHIFT FORK/5TH–REVERSE SHIFT RAIL/3RD–4TH SHIFT RAIL

1. Install the 3rd–4th shift rail and fork, as well as the 5th–reverse shift rail and fork

2. Slide each shift rail in the direction shown and then install them in the shift rail hole in the clutch housing.

▶C◀ SPRING PIN

1. Install the spring pin so that the slit faces in the direction shown.

▶D◀ SPACER

1. Install the spacer selected in “PRE–ASSEMBLY ADJUSTMENTS”.

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▶E◀ TRANSMISSION CASE

1. Apply sealant to the transmission case at the point shown by squeezing it out to a thickness of 1.5mm.

   Specified sealant:
   Mitsubishi genuine sealant Part No. MD997740 or equivalent.

   Caution
   Sealant must be squeezed out evenly, so that there are no parts where it is insufficient or excessive.

▶F◀ UNDER COVER

1. Apply sealant to the transmission case at the point shown by squeezing it out to a thickness of 1.5mm.

   Specified sealant:
   Mitsubishi genuine sealant Part No. MD997740 or equivalent.

   Caution
   Sealant must be squeezed out evenly, so that there are no parts where it is insufficient or excessive.

▶G◀ CONTROL HOUSING

1. Apply sealant to the transmission case at the point shown by squeezing it out to a thickness of 1.5mm.

   Specified sealant:
   Mitsubishi genuine sealant Part No. MD997740 or equivalent.

   Caution
   Sealant must be squeezed out evenly, so that there are no parts where it is insufficient or excessive.

▶H◀ POPPET SPRING

1. Install the poppet spring, placing the identification notch at the location shown.

▶I◀ SPEEDOMETER GEAR

1. Apply transmission oil to the O–ring of the speedometer gear.

   Specified oil:
   Hypoid gear oil SAE 75W/85W, conforming to API GL–4

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▶J◀ SELECTOR LEVER

1. Apply grease to the area of the selector lever shoe that generates friction with the control shaft.

   Specified grease:
   Mitsubishi genuine grease Part No. 0101011 or equivalent.

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INPUT SHAFT

DISASSEMBLY AND REASSEMBLY

During assembly, apply gear oil to all friction contact points

TFM0716

Disassembly steps

	▶M◀	1. Snap ring
◀A▶	▶L◀	2. Ball bearing
◀B▶	▶K◀	3. Thrust plate stopper
	▶J◀	4. Thrust plate
◀C▶	▶I◀	5. 5th gear
		6. 4th gear
		7. Needle roller bearing
◀D▶	▶H◀	8. 4th gear sleeve
		9. Synchroniser ring
	▶G◀	10. Synchroniser spring
	▶F◀	11. Synchroniser sleeve
	▶E◀	12. 3rd–4th synchroniser hub
		13. Outer synchroniser ring
	▶D◀	14. Synchroniser spring
		15. Synchroniser cone
		16. Inner synchroniser ring
		17. 3rd gear
		18. Needle roller bearing
	▶C◀	19. Snap ring
◀E▶	▶B◀	20. Ball bearing
	▶A◀	21. Oil seal
		22. Input shaft

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REMOVAL SERVICE POINTS

◀A▶ BALL BEARING

◀B▶ THRUST PLATE STOPPER

1. Remove the thrust plate stopper by using a screwdriver to raise the part of the stopper shown.

◀C▶ 5TH GEAR

◀D▶ 4TH GEAR

1. Attach the special tool to the 3rd gear and remove the 4th gear sleeve.

◀E▶ BALL BEARING

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INSPECTION

INPUT SHAFT

1. The outside diameter of the input shaft at the needle bearing installation location must be free of damage, excessive wear and seizure.
2. Check for damage to and wear of the spline.

NEEDLE BEARING

1. When turned in conjunction with the input shaft and the gear, the needle bearing must rotate smoothly and there must be no looseness or noise.
2. The cage must not be deformed.

SYNCHRONISER RING

1. The clutch gear tooth surface must not be damaged or broken.
2. The cone inside diameter must be free of damage and wear. The cone inside thread crests must not be crushed.

3. Push the synchroniser ring against the gear and check for clearance “A”. If “A” is at or below the limit value replace the synchroniser ring.

   Limit value: 0.5 mm

OUTER AND INNER SYNCHRONISER RING AND SYNCHRONISER CONE

1. The tooth flank of the clutch gear and cone surface must not be damaged or broken.

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2. Assemble the outer ring, the inner ring and the cone. Press the assembly against the gear and the clearance “A”. When “A” exceeds the limit value, replace it.

   Limit value: 0.5 mm

   Caution
   The outer ring, inner ring and cone must be replaced as a set.

SYNCHRONISER SLEEVE AND HUB

1. When the synchroniser sleeve and the synchroniser hub are combined and moved, there shall be no binding and the sliding movement must be smooth.
2. The synchroniser sleeve inner surface must not be damaged at the front and rear ends.

   Caution
   The synchroniser sleeve and synchroniser hub must be replaced as a set.

SYNCHRONISER SPRING

1. There must be no wear and tear, deformation, or breakage of the spring.

GEARS

1. The tooth surfaces of each helical gear and clutch gear must be free from damage and wear.
2. The synchroniser cone surface must not be rough, damaged or worn.
3. The gear inside diameter and front and rear surfaces must not be damaged or worn.

INSTALLATION SERVICE POINTS

▶A◀ OIL SEAL

1. Drive in the oil seal up to the dimension shown.

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▶B◀ BALL BEARING

▶C◀ SNAP RING

1. Select a snap ring that causes the input shaft front bearing end play to fall within the specified range and install it.

   Standard value: 0.01 – 0.12 mm

▶D◀ SYNCHRONISER SPRING

1. Install the synchroniser spring on the synchroniser ring at the location shown.

▶E◀ 3RD–4TH SYNCHRONISER HUB

1. Install the 3rd–4th synchroniser hub in the direction shown.

Caution
Press fit 3rd–4th synchroniser hub, making sure the synchroniser ring does not interfere with the hub.

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▶F◀ SYNCHRONISER SLEEVE

1. Install the synchroniser sleeve in the direction shown.

2. To install the sleeve, match the larger depression portion of the synchroniser hub and the larger projection portion of the synchroniser sleeve as shown.

▶G◀ SYNCHRONISER SPRING

1. Install the synchroniser spring on the synchroniser ring at the location shown.

▶H◀ 4TH GEAR SLEEVE

▶I◀ 5TH GEAR

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▶J◀ THRUST PLATE

1. Select a thrust plate that causes the input shaft 5th gear end play to fall within the specified range and install it.

   Standard value: 0.01 – 0.09 mm

▶K◀ THRUST PLATE STOPPER

1. Press in the special tool by hand so that the thrust plate stopper fits in securely and is not tilted.

▶L◀ BALL BEARING

▶M◀SNAP RING

1. Select a snap ring that causes the input shaft rear bearing end play to fall within the specified range and install it.

   Standard value: 0.01 – 0.12 mm

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OUTPUT SHAFT

DISASSEMBLY AND REASSEMBLY

During assembly, apply gear oil to all friction contact points

Disassembly steps

	▶P◀	1. Snap ring
◀A▶	▶O◀	2. Taper roller bearing
◀B▶	▶N◀	3. Reverse gear bearing sleeve
	▶N◀	4. Needle roller bearing
	▶N◀	5. Reverse gear
		6. Synchroniser ring
	▶D◀	7. Synchroniser spring
	▶F◀	8. Synchroniser sleeve
◀C▶	▶M◀	9. 5th–reverse synchroniser hub
		10. Synchroniser ring
	▶L◀	11. Synchroniser spring
		12. 5th gear
		13. Needle roller bearing
	▶K◀	14. 5th gear sleeve
	▶J◀	15. 4th gear
	▶I◀	16. Snap ring
◀D▶	▶H◀	17. 3rd gear
		18. 2nd gear
		19. Needle roller bearing
◀E▶	▶G◀	20. 2nd gear sleeve
		21. Inner synchroniser ring
		22. Synchroniser cone
		23. Outer synchroniser ring
	▶D◀	24. Synchroniser spring
	▶F◀	25. Synchroniser sleeve
	▶E◀	26. 1st–2nd synchroniser hub
		27. Outer synchroniser ring
	▶D◀	28. Synchroniser spring
		29. Inner synchroniser ring
		30. Synchroniser cone
		31. 1st gear
		32. Needle roller bearing
◀F▶	▶C◀	33. 1st gear sleeve
◀G▶	▶B◀	34. Taper roller bearing
	▶A◀	35. Oil seal
		36. Output shaft

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REMOVAL SERVICE POINTS

◀A▶ TAPER ROLLER BEARING

◀B▶ REVERSE GEAR BEARING SLEEVE

1. Attach the special tool to the reverse gear and remove the reverse gear bearing sleeve.

◀C▶ 5TH–REVERSE SYNCHRONISER HUB

1. Attach the special tool to the 4th gear and remove the 5th–reverse synchroniser hub.

◀D▶ 3RD GEAR

1. Attach the special tool to 2nd gear and remove 3rd gear.

◀E▶ 2ND GEAR SLEEVE

1. Attach the special tool to 1st gear and remove 2nd gear sleeve.

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◀F▶ 1ST GEAR SLEEVE

◀G▶ TAPER ROLLER BEARING

1. Attach the special tool to the reverse gear and remove the reverse gear bearing sleeve.

INSPECTION

OUTPUT SHAFT

1. Check for damage and wear of the spline.

NEEDLE BEARING

1. When turned in conjunction with the bearing sleeve and the gear, the needle bearing must rotate smoothly and there must be no looseness or noise.
2. The cage must not be deformed.

NEEDLE BEARING

1. The clutch gear tooth surface must not be damaged or broken.
2. The cone inside diameter must be free from damage and wear. The cone inside thread crests must not be crushed.

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3. Push the synchroniser ring against the gear and check for clearance “A”. If “A” is at or below the limit, replace the synchroniser.

   Limit value: 0.5 mm

OUTER SYNCHRONISER RING, INNER SYNCHRONISER RING AND SYNCHRONISER CONE

1. The clutch gear tooth surface and cone surface must not be damaged or broken.

2. Assemble the outer synchroniser ring, the inner synchroniser ring and the synchroniser cone, push them against the gear, and check for clearance “A”. Replace the outer ring, the inner ring and the cone when “A” is the limit value or below.

   Limit value: 0.5 mm

   Caution
   The outer synchroniser ring, the inner synchroniser ring and the synchroniser cone must be replaced as a set.

SYNCHRONISER SLEEVE HUB

1. When the synchroniser sleeve and synchroniser hub are combined and moved, there must be no binding and the sliding movement must be smooth.
2. The synchroniser sleeve inner surface must not be damaged at the front and rear ends.

   Caution
   The synchroniser sleeve and the synchroniser hub must be replaced as a set.

SYNCHRONISER SPRING

1. There must be no wear and tear, deformation or breakage of the spring.

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GEARS

1. The tooth surfaces of each helical gear and clutch gear must be free from damage and wear.
2. The synchroniser cone surface must not be rough, damaged or worn.
3. The gear inside diameter and front and rear surfaces must not be damaged or worn.

INSTALLATION SERVICE POINTS

▶A◀ OIL SEAL

1. Drive in the oil seal securely to the dimensions shown.

▶B◀ TAPER ROLLER BEARING

▶C◀ 1ST GEAR SLEEVE

▶D◀ SYNCHRONISER SPRING

1. Install the synchroniser spring on the synchroniser ring at the location shown.

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▶E◀ 1ST–2ND SYNCHRONISER HUB

1. Install the 1st–2nd synchroniser hub in the direction shown.

Caution
Press fit the 1st–2nd synchroniser hub so that the synchroniser ring does not interfere with the hub.

▶F◀ SYNCHRONISER SLEEVE

1. Install the synchroniser sleeve in the direction shown.

2. To install the sleeve, match the larger depression portion of the synchroniser hub and the larger projection portion of the synchroniser sleeve as shown.

▶G◀ 2ND GEAR SLEEVE

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▶H◀ 3RD GEAR

▶I◀ SNAP RING

1. Select a snap ring that causes the output shaft 3rd gear end play to fall within the specified range and install it.

   Standard value: 0.01 – 0.09 mm

▶J◀ 4TH GEAR

▶K◀ 5TH GEAR SLEEVE

▶L◀ SYNCHRONISER SPRING

1. Install the synchroniser spring on to the synchroniser ring at the location shown.

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▶M◀ 5TH–REVERSE SYNCHRONISER HUB

1. Install the 5th–reverse synchroniser hub in the direction shown.

Caution
Press fit the 1st–2nd speed synchroniser hub so that the synchroniser ring does not interfere with the hub.

▶N◀ REVERSE GEAR, NEEDLE ROLLER BEARING AND REVERSE GEAR BEARING SLEEVE

▶O◀ TAPER ROLLER BEARING

▶P◀ SNAP RING

1. Select a snap ring that causes the output shaft rear bearing end play to fall within the specified range and install it.

   Standard value: 0.01 – 0.09 mm

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REVERSE IDLER GEAR

DISASSEMBLY AND REASSEMBLY

During assembly, apply gear oil to all friction contact points

Removal steps

1. Snap ring
2. Thrust washer
3. Reverse idler gear
4. Needle roller bearing
5. Reverse idler gear shaft

INSPECTION

1. When turned in conjunction with the shaft and the gear, the needle bearing must rotate smoothly and there must be no looseness or noise.
2. The cage must not be deformed

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SPEEDOMETER GEAR

DISASSEMBLY AND REASSEMBLY

Removal steps

1. e–clip
2. Speedometer driven gear
3. O–ring
4. Sleeve

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SELECTOR LEVER

DISASSEMBLY AND REASSEMBLY

Disassembly steps

▶A◀ 1. Dust cover
2. Nut
3. Spring washer
4. Plain washer
5. Selector lever bush
6. Selector lever shoe
7. Selector lever
8. Selector lever bush
▶A◀ 9. Dust cover
10. Selector lever shaft

INSTALLATION SERVICE POINTS

▶A◀ DUST COVER

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CONTROL HOUSING

DISASSEMBLY AND REASSEMBLY

Disassembly steps

◀A▶ ▶C◀ 1. Lock pin
2. Interlock plate
3. Control finger
4. Pin
5. Return spring
6. Stopper plate
7. Spring pin
8. Spring pin
9. Stopper body
10. Neutral return spring
11. Spacer
12. Control shaft
▶B◀ 13. Breather
14. Control shaft boot
15. Oil seal
▶A◀ 16. Needle bearing
17. Spring washer
18. Stopper bracket
19. Control housing

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REMOVAL SERVICE POINTS

◀A▶ LOCK PIN

INSTALLATION SERVICE POINTS

▶A◀ NEEDLE BEARING

1. Press fit the needle bearing up to the dimension shown, placing the side stamped with the part No. in the direction indicated.

▶B◀ BREATHER

1. Apply sealer to the outer periphery of the insertion portion.

   Specified sealant:
   Mitsubishi genuine sealant part No. MD997740 or equivalent

2. Install the breather, placing the projecting portion in the direction shown.

▶C◀ LOCK PIN

1. Install the lock pin by striking it in the direction shown.

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CLUTCH HOUSING

DISASSEMBLY AND REASSEMBLY

TFM0831

Disassembly steps

1. Clutch release bearing retainer
2. ▶F◀ Oil seal
3. ▶E◀ Oil seal
4. ◀A▶ ▶D◀ Outer race
5. ◀B▶ ▶C◀ Outer race
6. ▶B◀ Bush
7. ▶A◀ Cover A
8. ▶A◀ Cover B
9. Clutch housing

REMOVAL SERVICE POINTS

◀A▶ OUTER RACE

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◀B▶ OUTER RACE

INSTALLATION SERVICE POINTS

▶A◀ COVER A AND COVER B

1. Ensure the covers are placed in their correct locations to avoid the cover B contacting the clutch cover. Refer to the previous page clutch housing disassembly and reassembly to establish the covers correct locations.

▶B◀ BUSH

1. Press fit the bush up to the location shown, taking care not to place the split portion of the bush over the air slot in the clutch housing.

▶C◀ OUTER RACE

1. Press fit the outer race, placing the side stamped with the part No. in the direction shown.

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▶D◀ OUTER RACE

▶E◀ OIL SEAL

1. Apply transmission oil to the lip of the oil seal.

   Specified oil:
   Hypoid gear oil SAE 75W/85W conforming to API classification GL–4

▶F◀ OIL SEAL

1. Fill the lip portion of the oil seal with grease.

   Specified grease:
   Mitsubishi genuine grease part No. 0101011 or equivalent

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TRANSMISSION CASE

DISASSEMBLY AND REASSEMBLY

Disassembly steps

▶C◀ 1. Oil seal
▶B◀ 2. Needle bearing
▶A◀ 3. Bush
4. Transmission case

INSTALLATION SERVICE POINTS

▶A◀ BUSH

1. Press fit the bush up to the location shown, taking care not to place the split potion of the bush over the air slot in the transmission case.

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▶B◀ NEEDLE BEARING

▶C◀ OIL SEAL

1. Apply transmission oil to the lip of the oil seal.

   Specified oil:

   Hypoid gear oil SAE 75W/85W conforming to API classification GL-4

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DIFFERENTIAL

DISASSEMBLY AND REASSEMBLY

During assembly, apply gear oil to all friction contact points

Disassembly steps

◀A▶ ▶C◀ 1. Differential drive gear
▶B◀ 2. Taper roller bearing
◀B▶ ▶A◀ 3. Lock pin
4. Pinion shaft
5. Pinion
6. Washer
7. Side gear
8. Spacer
9. Differential case

REMOVAL SERVICE POINTS

◀A▶ TAPER ROLLER BEARING

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◀B▶ LOCK PIN

1. Strike the lock pin to remove it from hole A.

PRE–ASSEMBLY ADJUSTMENTS

ADJUSTMENT OF PINION BACKLASH

1. After attaching the spacer to the back of the side gear, fit the side gear into the differential case.

   Caution
   When using a new slide gear, use a spacer of medium thickness (0.93 – 1.00 mm)

2. With the washer attached to the back of the pinion, engage both the side gears simultaneously and turn them into position.
3. Insert the pinion shaft.

4. Measure the backlash between the side gear and the pinion.

   Standard value: 0.025 – 0.150 mm

5. If the backlash is outside the standard range, select a spacer and re–measure the backlash.

   Caution
   Adjust so that the backlash is the same on both sides.

INSTALLATION SERVICE POINTS

▶A◀ LOCK PIN

1. Align the lock pin holes in the pinion shaft and in the differential case.
2. After confirming that the lock pin press fitting load is 1,960 N or over, press fit the lock pin from the side of the larger chamber at a load of 4,900 N or over.

   Caution
   The lock pin must be lower than the flange surface of the differential case.

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▶B◀ TAPER ROLLER BEARING

▶C◀ DIFFERENTIAL DRIVE GEAR

1. Apply sealer to the entire threaded portion.
   Specified sealant: Loctite 262 or equivalent

2. Tighten to the specified torque in the order shown.

23 AUTOMATIC TRANSMISSION

CONTENTS

23A F4A51 AUTOMATIC TRANSMISSION - TJ/KJ BASE MANUAL
(effective until 31st July 2001 production)

23A F4A51 AUTOMATIC TRANSMISSION - 01M/Y SPECIFICATION UPGRADE
(effective from 1st August 2001 production)

23B F4A51 AUTOMATIC TRANSMISSION OVERHAUL

23C F5A51 AUTOMATIC TRANSMISSION - TJ/KJ BASE MANUAL
(effective until 31st July 2001 production)

23C F5A51 AUTOMATIC TRANSMISSION - 01M/Y SPECIFICATION UPGRADE
(effective from 1st August 2001 production)

23D F5A51/W5A51 AUTOMATIC TRANSMISSION OVERHAUL

23E W5A51 AUTOMATIC TRANSMISSION <AWD>
(effective from December 2002 production)

23A AUTOMATIC TRANSMISSION

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- SELECTOR LEVER OPERATION CHECK

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 in baking or drying after painting, remove the SRS components (air bag module and SRS-ECU) beforehand.

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

(4) 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
Section titles with the asterisk (*) in the table of contents in each group indicate operations requiring warnings.

TRANSMISSION CONTROL
REMOVAL AND INSTALLATION
INSTALLATION SERVICE POINT
SELECTOR LEVER ASSEMBLY <MAGNA>
SELECTOR LEVER ASSEMBLY <VERADA>
Checking
TRANSMISSION ASSEMBLY
REMOVAL AND INSTALLATION
REMOVAL SERVICE POINTS
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SERVICE SPECIFICATIONS

Items		Standard value
Oil temperature sensor kΩ	at 0°C	16.7 – 20.5
	at 100°C	0.57 – 0.69
Resistance of damper clutch control solenoid coil [at 20°C] Ω		2.7 – 3.4
Resistance of Low-Reverse solenoid valve coil [at 20°C] Ω		2.7 – 3.4
Resistance of second solenoid valve coil [at 20°C] Ω		2.7 – 3.4
Resistance of underdrive solenoid valve coil [at 20°C] Ω		2.7 – 3.4
Resistance of overdrive solenoid valve coil [at 20°C] Ω		2.7 – 3.4
Stall speed r/min.		2,100 – 2,600

LUBRICANT

Items	Specified lubricant	Quantity (litres)
Transmission fluid	Mitsubishi ELC4–SPIII.	8.4

SPECIAL TOOLS

Tool	Tool number and name	Supersession	Application
	MB991502 MUT-II	–	Checking for diagnosis trouble codes
	MD998330 Oil pressure gauge 2,942 kPa	–	Measurement of oil pressure
	MD998332 Adaptor	–	
	MB998900 Adaptor	E21M17A	

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Tool	Tool number and name	Supersession	Application
B991113	MB991113 Steering linkage puller	13–006	Removal of the tie rod end and the lower arm
	MB991610 Oil filter wrench	–	Removal and installation of automatic transmission oil filter
Z203827	E309–A Engine lifter	–	Supporting the engine assembly during removal and installation of the transmission

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TROUBLESHOOTING

STANDARD FLOW OF DIAGNOSIS TROUBLESHOOTING

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DIAGNOSIS FUNCTION

1. N (Neutral) range light

The N range light flashes at a frequency of approximately 1 Hz (once per second) if there is an abnormality in any of the items in the table below which are related to the A/T system. Check for diagnosis trouble codes if the N range light is flashing at a frequency of approximately 1 Hz.

N range light flashing items

Input shaft speed sensor
Output shaft speed sensor
Each solenoid valve
Gear incorrect ratio

Caution

- **If the N range light is flashing at a frequency of approximately 2 Hz (two flashes per second), it means that the automatic transmission fluid temperature is too high. Stop the vehicle in a safe place and wait until the N range light switches off.**

2. Method of reading the diagnosis code

Use the MUT-II or the N range lamp to take a reading of the diagnosis codes. (Refer Group 00 - How to Use Troubleshooting/Inspection Service Points.)

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ROAD TEST

Check by the following procedures

No.	Condition	Operation	Judgement value	Check item	Code No.	Inspection procedure page if there is an abnormality
1	Ignition switch: OFF	Ignition switch (1) ON	Data list No. 54 Control Relay Voltage	A/T Control relay	54	A/T Control relay system
2	Ignition switch: ON Engine: Stopped Selector lever position: P	Selector lever position (1) P, (2) R, (3) N, (4) D, (5) 3, (6) 2, (7) L	Data list No. 61 (1) P, (2) R, (3)N, (4) D, (5) 3, (6) 2, (7) L	Inhibitor switch	27 28	Inhibitor switch system
		Accelerator pedal (1) Fully closed (2) Depressed (3) Fully open	Data list No. 11 (1) 400 – 1,000 mV (2) Gradually rises from (1) (3) 4,500 – 5,000 mV	TPS	11 12 14	TPS system
		Brake pedal (1) Depressed (2) Released	Data list No. 26 (1) ON (2) OFF	Stop light switch	26	Stop light switch system
3	Ignition switch: ST Engine: Stopped	Starting test with lever P or N range	Starting should be possible	Starting	–	Starting impossible
4	Warming up	Drive for 15 minutes or more so that the automatic transmission fluid temperature becomes 70 – 90°C.	Data list No. 15 Gradually rises to 70 – 90°C	Oil temperature sensor	15 16	Oil temperature sensor system

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No.	Condition	Operation	Judgement value	Check item	Code No.	Inspection procedure page if there is an abnormality
5	Engine: Idling Selector lever position: N	Brake pedal (Retest) (1) Depressed (2) Released	Data list No. 26 (1) ON (2) OFF	Stop light switch	26	Stop light switch system
		A/C switch (1) ON (2) OFF	Data list No. 65 (1) ON (2) OFF	Dual pressure switch	–	Dual pressure switch system
5	Engine: Idling Selector lever position: N	Accelerator pedal (1) Fully closed (2) Depressed	Data list No. 64 (1) ON (2) OFF	Idle position switch	–	Idle position switch system
			Data list No. 21 (1) 600 – 900 rpm (2) Gradually rises from (1)	Crank angle sensor	21	Crank angle sensor system
			Data list No. 57 (2) Data changes	Communication with Engine-ECU	51	Abnormal communication with Engine-ECU
5	Engine: Idling Selector lever position: N	Selector lever position (1) N → D (2) N → R	Should be no abnormal shifting shocks Time lag when shifting should be within 2 seconds	Malfunction when starting	–	Engine stalling when shifting
					–	Shocks when changing from N to D and large time lag
					–	Shocks when changing from N to R and large time lag
					–	Shocks when changing from N to D,N to R and long time lag
				Driving impossible	–	Does not move forward
					–	Does not reverse
					–	Does not move (forward or reverse)

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No.	Condition	Operation	Judgement value	Check item	Code No.	Inspection procedure page if there is an abnormality
6	Selector lever position: N (on a flat and straight road.)	Selector lever position and vehicle speed (1) Idling in L range (Vehicle stopped) (2) Driving at constant speed of 10 km/h in L position (3) Driving at constant speed of 30 km/h in 2 position (4) Accelerate to 50 km/h in 3 position, then release accelerator pedal. (5) Driving at constant speed of 50 km/h in D position (Each condition should be maintained for 10 seconds or more.)	Data list No. 63 (2) 1st, (3) 2nd, (4) 3rd, (5) 4th	Shift condition	–	–
			Data list No. 31 (2) 0 %, (3) 100 %, (4) 100 %, (5) 100 %	Low and reverse solenoid valve	31	Low and reverse solenoid valve system
			Data list No. 32 (2) 0 %, (3) 0 %, (4) 0 %, (5) 100 %	Underdrive solenoid valve	32	Underdrive solenoid valve system
			Data list No. 33 (2)100 %, (3) 0 %, (4) 100 %, (5) 0 %	Second solenoid valve	33	Second solenoid valve system

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No.	Condition	Operation	Judgement value	Check item	Code No.	Inspection procedure page if there is an abnormality
6	Selector lever position: N (on a flat and straight road.)	Selector lever position and vehicle speed (1) Idling in L range (Vehicle stopped) (2) Driving at constant speed of 10 km/h in L position (3) Driving at constant speed of 30 km/h in 2 position (4) Accelerate to 50 km/h mph) in 3 position, then release accelerator pedal. (5) Driving at constant speed of 50 km/h in D position (Each condition should be maintained for 10 seconds or more.)	Data list No. 34 (2) 100 %, (3) 100 %, (4) 0 %, (5) 0 %	Overdrive solenoid valve	34	Overdrive solenoid valve system
			Data list No. 29 (1) 0 km/h (4) 50 km/h	Vehicle speed sensor	–	Vehicle speed sensor system
			Data list No. 22 (4) 1,800 – 2,100 rpm	Input shaft speed sensor	22	Input shaft speed sensor system
			Data list No. 23 (4) 1,800 – 2,100 rpm	Output shaft speed sensor	23	Output shaft speed sensor system
7	Selector lever position: 3 (on a flat and straight road.)	Selector lever position and vehicle speed (1) Accelerate to 50 km/h in 3 position, then release accelerator pedal. (2) Driving at constant speed of 50 km/h	Data list No. 36 (1) 0% (2) Approx.70 – 90%	Damper clutch solenoid	36 52 53	Damper clutch solenoid system
			Data list No. 52 (1) Approx. 100 – 300 rpm (2) Approx. 0 – 10 rpm			

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No.	Condition	Operation	Judgement value	Check item	Code No.	Inspection procedure page if there is an abnormality
8	Use the MUT-II to stop the INVECS-II function. Selector lever position: D (on a flat and straight road.)	Monitor data list No. 11, 23, and 63 with the MUT-II. (1) Accelerate to 4th gear at a throttle position sensor output of 1.5V (accelerator opening angle of 30 %). (2) Gently decelerate to a standstill. (3) Accelerate to 4th gear at a throttle position sensor output of 2.5 V (accelerator opening angle of 50%). (4) While driving at 60 km/h in 4th gear, shift down to 3 range. (5) While driving at 40 km/h in 3rd gear, shift down to 2 range. (6) While driving at 20 km/h in 2nd gear, shift down to L range.	For (1), (2) and (3), the reading should be the same as the specified output shaft speed, and no abnormal shift shocks should occur. For (4), (5) and (6), downshifting should occur immediately after shifting.	Malfunction when shifting	–	Shift shocks and running up
				Displaced shifting points	–	All points
					–	Some points
				Does not shift	–	No diagnosis code
					22	Input shaft speed sensor system
					23	Output shaft speed sensor system

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No.	Condition	Operation	Judgement value	Check item	Code No.	Inspection procedure page if there is an abnormality
8	Use the MUT-II to stop the INVECS-II function. Selector lever position: D (on a flat and straight road.)	Monitor data list No. 11, 23, and 63 with the MUT-II. (1) Accelerate to 4th gear at a throttle position sensor output of 1.5V (accelerator opening angle of 30 %). (2) Gently decelerate to a standstill. (3) Accelerate to 4th gear at a throttle position sensor output of 2.5 V (accelerator opening angle of 50%). (4) While driving at 60 km/h in 4th gear, shift down to 3 range. (5) While driving at 40 km/h in 3rd gear, shift down to 2 range. (6) While driving at 20 km/h in 2nd gear, shift down to L range.	For (1), (2) and (3), the reading should be the same as the specified output shaft speed, and no abnormal shift shocks should occur. For (4), (5) and (6), downshifting should occur immediately after shifting.	Does not shift from 1 to 2 or 2 to 1	31	Low and reverse solenoid valve system
					33	Second solenoid valve system
					41	1st gear incorrect ratio
					42	2nd gear incorrect ratio

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No.	Condition	Operation	Judgement value	Check item	Code No.	Inspection procedure page if there is an abnormality
8	Use the MUT-II to stop the INVECS-II function. Selector lever position: D (on a flat and straight road.)	Monitor data list No. 11, 23, and 63 with the MUT-II. (1) Accelerate to 4th gear at a throttle position sensor output of 1.5V (accelerator opening angle of 30 %). (2) Gently decelerate to a standstill. (3) Accelerate to 4th gear at a throttle position sensor output of 2.5 V (accelerator opening angle of 50%). (4) While driving at 60 km/h in 4th gear, shift down to 3 range. (5) While driving at 40 km/h in 3rd gear, shift down to 2 range. (6) While driving at 20 km/h in 2nd gear, shift down to L range.	For (1), (2) and (3), the reading should be the same as the specified output shaft speed, and no abnormal shift shocks should occur. For (4), (5) and (6), downshifting should occur immediately after shifting.	Does not shift from 2 to 3 or 3 to 2	33	Second solenoid valve system
					34	Overdrive solenoid valve system
					42	2nd gear incorrect ratio
					43	3rd gear incorrect ratio

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No.	Condition	Operation	Judgement value	Check item	Code No.	Inspection procedure page if there is an abnormality
8	Use the MUT-II to stop the INVECS-II function. Selector lever position: D (on a flat and straight road.)	Monitor data list No. 11, 23, and 63 with the MUT-II. (1) Accelerate to 4th gear at a throttle position sensor output of 1.5V (accelerator opening angle of 30 %). (2) Gently decelerate to a standstill. (3) Accelerate to 4th gear at a throttle position sensor output of 2.5 V (accelerator opening angle of 50%). (4) While driving at 60 km/h in 4th gear, shift down to 3 range. (5) While driving at 40 km/h in 3rd gear, shift down to 2 range. (6) While driving at 20 km/h in 2nd gear, shift down to L range.	For (1), (2) and (3), the reading should be the same as the specified output shaft speed, and no abnormal shift shocks should occur. For (4), (5) and (6), downshifting should occur immediately after shifting.	Does not shift from 3 to 4 or 4 to 3	32	Underdrive solenoid valve system
					33	Second solenoid valve system
					43	3rd gear incorrect ratio
					44	4th gear incorrect ratio
9	Selector lever position: N (on a flat and straight road.)	Monitor data list No. 22 and No. 23 with the MUT-II. (1) Move selector lever to R range, drive at constant speed of 10 km/h.	The ratio between data list No. 22 and No. 23 should be the same as the gear ratio when reversing.	Does not shift	22	Input shaft speed sensor system
					23	Output shaft speed sensor system
					46	Reverse gear incorrect ratio

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SHIFT PATTERN

UPSHIFT PATTERN

DOWNSHIFT PATTERN

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INSPECTION CHART FOR DIAGNOSIS CODES

Code	Diagnosis item	
11	Throttle position sensor system	Short circuit
12		Open circuit
14		Sensor maladjustment
15	Oil temperature sensor system	Open circuit
16		Short circuit
21	Crank angle sensor system	Open circuit
22	Input shaft speed sensor system	Short circuit/open circuit
23	Output shaft speed sensor system	Short circuit/open circuit
26	Stop light switch system	Short circuit/open circuit
27	Inhibitor switch system	Open circuit
28		Short circuit
31	Low and reverse solenoid valve system	Short circuit/open circuit
32	Underdrive solenoid valve system	Short circuit/open circuit
33	Second solenoid valve system	Short circuit/open circuit
34	Overdrive solenoid valve system	Short circuit/open circuit
36	Damper clutch solenoid system	Short circuit/open circuit
41	1st gear incorrect ratio	
42	2nd gear incorrect ratio	
43	3rd gear incorrect ratio	
44	4th gear incorrect ratio	
46	Reverse gear incorrect ratio	
51	Abnormal communication with Engine-ECU	
52	Damper clutch solenoid system	Defective system
53		Lock-up stuck on
54	A/T Control relay system	Short circuit to ground/open circuit
56	N range light system	Short circuit to ground
71	Malfunction of A/T-ECU	

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INSPECTION PROCEDURES FOR DIAGNOSIS CODES

Code No. 11, 12, 14 Throttle position sensor system	Probable cause
If the TPS output voltage is 4.8 V or higher when the engine is idling, the output is judged to be too high and diagnosis code No. 11 is output. If the TPS output voltage is 0.2 V or lower at times other than when the engine is idling, the output is judged to be too low and diagnosis code No. 12 is output. If the TPS output voltage is 0.2 V or lower or if it is 1.2 V or higher when the engine is idling, the TPS adjustment is judged to be incorrect and diagnosis code No. 14 is output.	• Malfunction of the throttle position sensor • Malfunction of connector • Malfunction of the Engine A/T-ECU

Throttle position sensor check (Refer GROUP 13A On Vehicle Service.) — NG → **Replace**
↓ OK
Check the following connectors: A-68, B-109, B-110 — NG → **Repair**
↓ OK
Harness check
- Throttle position sensor – Engine A/T-ECU. — NG → **Repair**

↓ OK
Check the trouble symptoms. — NG → Replace the Engine A/T-ECU. CAUTION

Code No. 15, 16 Oil temperature sensor system	Probable cause
If the oil temperature sensor output voltage is 2.6 V or more even after driving for 10 minutes or more (if the oil temperature does not increase), it is judged that there is an open circuit in the oil temperature sensor and diagnosis code No. 15 is output. If the oil temperature sensor output detects the voltage which corresponds to 200°C or more for more than one second, it is judged that there is an open circuit in oil temperature sensor and diagnosis code No.16 is output.	• Malfunction of the oil temperature sensor • Malfunction of connector • Malfunction of the Engine A/T-ECU

Oil temperature sensor check (Refer On Vehicle Service.) — NG → **Replace**
↓ OK
Check the following connectors: A-87, B-111 — NG → **Repair**
↓ OK
Harness check
- Oil temperature sensor – Engine A/T-ECU. — NG → **Repair**

↓ OK
Check the trouble symptoms. — NG → Replace the Engine A/T-ECU. CAUTION

Code No. 21 Crank angle sensor system	Probable cause
If no output pulse is detected from the crank angle sensor for 5 seconds or more while driving at 25 km/h or more, it is judged that there is an open circuit in the crank angle sensor and diagnosis code No. 21 is output.	• Malfunction of the crank angle sensor • Malfunction of connector • Malfunction of the Engine A/T-ECU

Refer GROUP 13A.

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Code No. 22 Input shaft speed sensor system	Probable cause
If no output pulse is detected from the input shaft speed sensor for 1 second or more while driving in 3rd or 4th gear at a speed of 30 km/h or more, it is judged to be an open circuit or short-circuit in the input shaft speed sensor and diagnosis code No. 22 is output. If diagnosis code No. 22 is output four times, the transmission is locked into 3rd gear or 2nd gear as a fail-safe measure, and the N range light flashes at a frequency of 1 Hz.	● Malfunction of the input shaft speed sensor ● Malfunction of the underdrive clutch retainer ● Malfunction of connector ● Malfunction of the Engine A/T-ECU

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Code No. 23 Output shaft speed sensor system	Probable cause
If the output from the output shaft speed sensor is continuously 50% lower than the vehicle speed for 1 second or more while driving in 3rd or 4th gear at a speed of 30 km/h or more, it is judged to be an open circuit or short-circuit in the output shaft speed sensor and diagnosis code No. 23 is output. If diagnosis code No. 23 is output four times, the transmission is locked into 3rd gear or 2nd gear as a fail-safe measure, and the N range light flashes at a frequency of 1 Hz.	● Malfunction of the output shaft speed sensor ● Malfunction of the transfer drive gear or driven gear ● Malfunction of connector ● Malfunction of the Engine A/T-ECU

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Code No. 26 Stop light switch system	Probable cause
If the stop light switch is on for 5 minutes or more while driving, it is judged that there is a short circuit in the stop light switch and diagnosis code No. 26 is output.	• Malfunction of the stop light switch • Malfunction of connector • Malfunction of the Engine A/T-ECU

Code No.27, 28 Inhibitor switch system	Probable cause
If the A/T-ECU detects no inhibitor switch input signal for a continuous period of 30 seconds, it is judged that there is an open circuit in the inhibitor switch and diagnosis code No.27 is output. If the Engine A/T-ECU detects more than two kinds of inhibitor switch input signals for a continuous period of 30 seconds, it is judged that there is an open circuit in the inhibitor switch and diagnosis code No.28 is output.	• Malfunction of the inhibitor switch • Malfunction of the ignition switch • Malfunction of connector • Malfunction of the Engine A/T-ECU

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Code No. 31 Low and reverse solenoid valve system	Probable cause
Code No. 32 Underdrive solenoid valve system	
Code No. 33 Second solenoid valve system	
Code No. 34 Overdrive solenoid valve system	
If the resistance value for a solenoid valve is too large or too small, it is judged that there is a short-circuit or an open circuit in the solenoid valve and the respective diagnosis code is output. The transmission is locked into 3rd gear as a fail-safe measure, and the N range light flashes at a frequency of 1 Hz.	• Malfunction of solenoid valve • Malfunction of connector • Malfunction of the Engine A/T-ECU

Solenoid valve check (Refer On Vehicle Service.) — NG → **Replace**
↓ OK
Check the following connectors: A-87, B-111 — NG → **Repair**
↓ OK
Harness check
- Between solenoid valve and Engine A/T-ECU

— NG → **Repair**
↓ OK
Check the trouble symptoms. — NG → Replace the Engine A/T-ECU. CAUTION

Code No. 36, 52, 53 Damper clutch solenoid system	Probable cause
If the resistance value for the damper clutch solenoid is too large or too small, it is judged that there is a short-circuit or an open circuit in the damper clutch solenoid and diagnosis code No. 36 is output. If the drive duty rate for the damper clutch solenoid is 100 % for a continuous period of 4 seconds or more, it is judged that there is an abnormality in the damper clutch system and diagnosis code No. 52 is output. When diagnosis code No. 36 is output, the transmission is locked into 3rd gear as a fail-safe measure, and the N range light flashes at a frequency of 1 Hz. If the lock-up clutch remains engaged for a continuous period of 10 seconds when the Engine A/T-ECU is attempting to disengage the lock-up clutch, it is judged that the damper clutch is stuck on and diagnosis code No.53 is output.	• Malfunction of the damper clutch solenoid • Malfunction of connector • Malfunction of the Engine A/T-ECU

Torque converter clutch solenoid check (Refer On Vehicle Service.) — NG → **Replace**
↓ OK
Check the following connectors: A-87, B-111 — NG → **Repair**
↓ OK
Harness check
- Between damper clutch solenoid and Engine A/T-ECU

— NG → **Repair**
↓ OK
Replace the damper clutch solenoid.
↓
Check the trouble symptoms. — NG → Replace the Engine A/T-ECU. CAUTION
↓ OK
Only when code No.53 is output Refer
INSPECTION PROCEDURE 6 Engine stalling when shifting check.

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Code No. 41 1st gear incorrect ratio	Probable cause
If the output from the output shaft speed sensor multiplied by the 1st gear ratio is not the same as the output from the input shaft speed sensor after shifting to 1st gear has been completed, diagnosis code No. 41 is output. If diagnosis code No. 41 is output four times, the transmission is locked into 3rd gear as a fail-safe measure, and the N range light flashes at a frequency of 1 Hz.	• Malfunction of the input shaft speed sensor • Malfunction of the output shaft speed sensor • Malfunction of the underdrive clutch retainer • Malfunction of the transfer drive gear or driven gear • Malfunction of the low and reverse brake system • Malfunction of the underdrive clutch system • Noise generated

MUT-II Self Diagnosis Check
Is the diagnosis code No. 22 output?

- Yes → Code No. 22 Check Input shaft speed sensor system.
- No ↓

MUT-II Self Diagnosis Check
Is the diagnosis code No. 23 output?

- Yes → Code No. 23 Check Output shaft speed sensor system.
- No ↓

Measure output waveform from the input shaft speed sensor. (using an oscilloscope)
- Connect the connector B-109 and B-111 and measure voltage between 57 and 103 at the Engine A/T-ECU.
- Engine: 2,000 r/min [approx. 50 km/h]
- Selector lever position: 3
  (Voltage)
  OK: A waveform such as the one shown in (Inspection Procedure Using an Oscilloscope) is output (flashing between 0 ←→ 5V) and there is no noise appearing in the waveform.

- NG →
  - Replace the input shaft speed sensor.
  - ↓ Check the trouble symptoms.
  - NG ↓ A/T overhaul
    - Replace the underdrive clutch retainer.
  - ↓ Check the trouble symptoms.
  - NG ↓ Eliminate the cause of the noise.
- OK ↓

Measure output waveform from the output shaft speed sensor. (using an oscilloscope)
- Connect the connector B-109 and B-111 and measure voltage between 57 and 104 at the Engine A/T-ECU.
- Engine: 2,000 r/min [approx. 50 km/h]
- Selector lever position: 3
  (Voltage)
  OK: A waveform such as the one shown in (Inspection Procedure Using an Oscilloscope) is output (flashing between 0 ←→ 5V) and there is no noise appearing in the waveform.

- NG →
  - Replace the output shaft speed sensor.
  - ↓ Check the trouble symptoms.
  - NG ↓ A/T overhaul
    - Replace the transfer drive gear and driven gear.
  - ↓ Check the trouble symptoms.
  - NG ↓ Eliminate the cause of the noise.
- OK ↓

A/T overhaul ★
- Replace the underdrive clutch. (No.42, No.43 or no diagnosis code is output.)
- Replace the low and reverse clutch. (No.46 or no diagnosis code is output.)

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Code No. 42 2nd gear incorrect ratio	Probable cause
If the output from the output shaft speed sensor multiplied by the 2nd gear ratio is not the same as the output from the input shaft speed sensor after shifting to 2nd gear has been completed, diagnosis code No. 42 is output. If diagnosis code No. 42 is output four times, the transmission is locked into 3rd gear as a fail-safe measure, and the N range light flashes at a frequency of 1 Hz.	• Malfunction of the input shaft speed sensor • Malfunction of the output shaft speed sensor • Malfunction of the underdrive clutch retainer • Malfunction of the transfer drive gear or driven gear • Malfunction of the second brake system • Malfunction of the underdrive clutch system • Noise generated

MUT-II Self Diagnosis
Is the diagnosis code No. 22 output?

Yes → Code No. 22 Check Input shaft speed sensor system.

No ↓

MUT-II Self Diagnosis
Is the diagnosis code No. 23 output?

Yes → Code No. 23 Check Output shaft speed sensor system.

No ↓

Measure output waveform from the input shaft speed sensor. (using an oscilloscope)
- Connect the connector B-109 and B-111 and measure voltage between 57 and 103 at the Engine A/T-ECU.
- Engine: 2,000 r/min [approx. 50 km/h]
- Selector lever position: 3

(Voltage)
OK: A waveform such as the one shown in (Inspection Procedure Using an Oscilloscope) is output (flashing between 0 ←→ 5V) and there is no noise appearing in the waveform.

NG →
- Replace the input shaft speed sensor.
- ↓ Check the trouble symptoms.
- NG ↓ A/T overhaul
  - Replace the underdrive clutch retainer.
- ↓ Check the trouble symptoms.
- NG ↓ Eliminate the cause of the noise.

OK ↓

Measure output waveform from the output shaft speed sensor. (using an oscilloscope)
- Connect the connector B-109 and B-111 and measure voltage between 57 and 103 at the Engine A/T-ECU.
- Engine: 2,000 r/min [approx. 50 km/h]
- Selector lever position: 3

(Voltage)
OK: A waveform such as the one shown in (Inspection Procedure Using an Oscilloscope) is output (flashing between 0 ←→ 5V) and there is no noise appearing in the waveform.

NG →
- Replace the output shaft speed sensor.
- ↓ Check the trouble symptoms.
- NG ↓ A/T overhaul
  - Replace the transfer drive gear and driven gear.
- ↓ Check the trouble symptoms.
- NG ↓ Eliminate the cause of the noise.

OK ↓

A/T overhaul ★
- Replace the underdrive clutch. (No.41, No.43 or no diagnosis code is output.)
- Replace the second clutch. (No.44 or no diagnosis code is output.)

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Code No. 43 3rd gear incorrect ratio	Probable cause
If the output from the output shaft speed sensor multiplied by the 3rd gear ratio is not the same as the output from the input shaft speed sensor after shifting to 3rd gear has been completed, diagnosis code No. 43 is output. If diagnosis code No. 43 is output four times, the transmission is locked into 3rd gear as a fail-safe measure, and the N range light flashes at a frequency of 1 Hz.	• Malfunction of the input shaft speed sensor • Malfunction of the output shaft speed sensor • Malfunction of the underdrive clutch retainer • Malfunction of the transfer drive gear or driven gear • Malfunction of the underdrive clutch system • Malfunction of the overdrive clutch system • Noise generated

MUT-II Self Diagnosis
Is the diagnosis code No. 22 output?

Yes → Code No. 22 Check Input shaft speed sensor system.

No ↓

MUT-II Self Diagnosis
Is the diagnosis code No. 23 output?

Yes → Code No. 23 Check Output shaft speed sensor system.

No ↓

Measure output waveform from the input shaft speed sensor. (using an oscilloscope)
- Connect the connector B-109 and B-111 and measure voltage between 57 and 103 at the Engine A/T-ECU.
- Engine: 2,000 r/min [approx. 50 km/h]
- Selector lever position: 3

(Voltage)
OK: A waveform such as the one shown in (Inspection Procedure Using an Oscilloscope) is output (flashing between 0 ←→ 5V) and there is no noise appearing in the waveform.

NG →
- Replace the input shaft speed sensor.
- Check the trouble symptoms.
- NG → A/T overhaul
  - Replace the underdrive clutch retainer.
- Check the trouble symptoms.
- NG → Eliminate the cause of the noise.

OK ↓

Measure output waveform from the output shaft speed sensor. (using an oscilloscope)
- Connect the connector B-109 and B-111 and measure voltage between 57 and 103 at the Engine A/T-ECU.
- Engine: 2,000 r/min [approx. 50 km/h]
- Selector lever position: 3

(Voltage)
OK: A waveform such as the one shown in (Inspection Procedure Using an Oscilloscope) is output (flashing between 0 ←→ 5V) and there is no noise appearing in the waveform.

NG →
- Replace the output shaft speed sensor.
- Check the trouble symptoms.
- NG → A/T overhaul
  - Replace the transfer drive gear and driven gear.
- Check the trouble symptoms.
- NG → Eliminate the cause of the noise.

OK ↓

A/T overhaul
- Replace the underdrive clutch. (No.41, No.42 or no diagnosis code is output.)
- Replace the overdrive clutch. (No.44 or no diagnosis code is output.)

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Code No. 44 4th gear incorrect ratio	Probable cause
If the output from the output shaft speed sensor multiplied by the 4th gear ratio is not the same as the output from the input shaft speed sensor after shifting to 4th gear has been completed, diagnosis code No. 44 is output. If diagnosis code No. 44 is output four times, the transmission is locked into 3rd gear as a fail-safe measure, and the N range light flashes at a frequency of 1 Hz.	• Malfunction of the input shaft speed sensor • Malfunction of the output shaft speed sensor • Malfunction of the underdrive clutch retainer • Malfunction of the transfer drive gear or driven gear • Malfunction of the second brake system • Malfunction of the overdrive clutch system • Noise generated

MUT-II Self Diagnosis
Is the diagnosis code No. 22 output?

Yes → Code No. 22 Check Input shaft speed sensor system.

No ↓

MUT-II Self Diagnosis
Is the diagnosis code No. 23 output?

Yes → Code No. 23 Check Output shaft speed sensor system.

No ↓

Measure output waveform from the input shaft speed sensor. (using an oscilloscope)
- Connect the connector B-109 and B-111 and measure voltage between 57 and 103 at the Engine A/T-ECU.
- Engine: 2,000 r/min [approx. 50 km/h]
- Selector lever position: 3

(Voltage)
OK: A waveform such as the one shown in (Inspection Procedure Using an Oscilloscope) is output (flashing between 0 ←→ 5V) and there is no noise appearing in the waveform.

NG →
- Replace the input shaft speed sensor.
- Check the trouble symptoms.
- NG → A/T overhaul
  - Replace the underdrive clutch retainer.
- Check the trouble symptoms.
- NG → Eliminate the cause of the noise.

OK ↓

Measure output waveform from the output shaft speed sensor. (using an oscilloscope)
- Connect the connector B-109 and B-111 and measure voltage between 57 and 104 at the Engine A/T-ECU.
- Engine: 2,000 r/min [approx. 50 km/h]
- Selector lever position: 3

(Voltage)
OK: A waveform such as the one shown in (Inspection Procedure Using an Oscilloscope) is output (flashing between 0 ←→ 5V) and there is no noise appearing in the waveform.

NG →
- Replace the output shaft speed sensor.
- Check the trouble symptoms.
- NG → A/T overhaul
  - Replace the transfer drive gear and driven gear.
- Check the trouble symptoms.
- NG → Eliminate the cause of the noise.

OK ↓

A/T overhaul
- Replace the second brake. (No.42 or no diagnosis code is output.)
- Replace the overdrive clutch. (No.43 or no diagnosis code is output.)

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Code No. 46 Reverse gear incorrect ratio	Probable cause
If the output from the output shaft speed sensor multiplied by the reverse gear ratio is not the same as the output from the input shaft speed sensor after shifting to reverse gear has been completed, diagnosis code No. 46 is output. If diagnosis code No. 46 is output four times, the transmission is locked into 3rd gear as a fail-safe measure, and the N range light flashes at a frequency of 1 Hz.	• Malfunction of the input shaft speed sensor • Malfunction of the output shaft speed sensor • Malfunction of the underdrive clutch retainer • Malfunction of the transfer drive gear or driven gear • Malfunction of the low and reverse brake system • Malfunction of the reverse clutch system • Noise generated

MUT-II Self Diagnosis
Is the diagnosis code No. 22 output?

Yes → Code No. 22 Check Input shaft speed sensor system.

No ↓

MUT-II Self Diagnosis
Is the diagnosis code No. 23 output?

Yes → Code No. 23 Check Output shaft speed sensor system.

No ↓

Measure output waveform from the input shaft speed sensor. (using an oscilloscope)
- Connect the connector B-109 and B-111 and measure voltage between 57 and 103 at the Engine A/T-ECU.
- Engine: 2,000 r/min [approx. 50 km/h]
- Selector lever position: 3

(Voltage)
OK: A waveform such as the one shown in (Inspection Procedure Using an Oscilloscope) is output (flashing between 0 ←→ 5V) and there is no noise appearing in the waveform.

NG →
- Replace the input shaft speed sensor.
- Check the trouble symptoms.
- NG →
- A/T overhaul
  - Replace the underdrive clutch retainer.
- Check the trouble symptoms.
- NG →
- Eliminate the cause of the noise.

OK ↓

Measure output waveform from the output shaft speed sensor. (using an oscilloscope)
- Connect the connector B-109 and B-111 and measure voltage between 57 and 104 at the Engine A/T-ECU.
- Engine: 2,000 r/min [approx. 50 km/h]
- Selector lever position: 3

(Voltage)
OK: A waveform such as the one shown in (Inspection Procedure Using an Oscilloscope) is output (flashing between 0 ←→ 5V) and there is no noise appearing in the waveform.

NG →
- Replace the output shaft speed sensor.
- Check the trouble symptoms.
- NG →
- A/T overhaul
  - Replace the transfer drive gear and driven gear.
- Check the trouble symptoms.
- NG →
- Eliminate the cause of the noise.

OK ↓

A/T overhaul
- Replace the low and reverse brake. (No.41 or no diagnosis code is output.)
- Replace the reverse clutch. (No diagnosis code is output.)

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Code No. 51 Abnormal communication with Engine A/T-ECU	Probable cause
If normal communication is not possible for a continuous period of 1 second or more when the battery voltage is 10 V or more and the engine speed is 450 r/min or more, diagnosis code No. 51 is output. Diagnosis code No. 51 is also output if the data being received is abnormal for a continuous period of 4 seconds under the same conditions.	• Malfunction of the Engine A/T-ECU

Replace the Engine A/T-ECU. CAUTION

Code No. 54 A/T Control relay system	Probable cause
If the control relay voltage is less than 7 V after the ignition switch has been turned to ON, it is judged that there is an open circuit or a short-circuit in the A/T control relay earth and diagnosis code No. 54 is output. The transmission is locked into 3rd gear as a fail-safe measure, and the N range light flashes at a frequency of 1 Hz.	• Malfunction of the A/T control relay • Malfunction of connector • Malfunction of the Engine A/T-ECU

Check the A/T control relay. (Refer On Vehicle Service.)
- NG → **Replace**
- OK ↓

Check the following connectors: A-28, B-59, B-110
- NG → **Repair**
- OK ↓

Harness check
- Between control relay and body ground
- Between control relay and battery
- Between control relay and Engine A/T-ECU

- NG → **Repair**
- OK ↓

Check the trouble symptoms.
- NG → Replace the Engine A/T-ECU. CAUTION

Code No. 56 N range light system	Probable cause
If the N range signal is off after an N range light illumination instruction (ON instruction) has been given, it is judged that there is a short-circuit in the N range light earth and diagnosis code No. 56 is output.	• Malfunction of connector • Malfunction of the Engine A/T-ECU

Check the following connectors: A-89, B-111<MAGNA>, A-89, B-111 <VERADA>
- NG → **Repair**
- OK ↓

Harness check
- Inhibitor switch – Engine A/T-ECU

- NG → **Repair**
- OK ↓

Check the trouble symptoms.
- NG → Replace the Engine A/T-ECU. CAUTION

Code No. 71 Malfunction of Engine A/T-ECU	Probable cause
There is an abnormality in the Engine A/T-ECU. The transmission is locked into 3rd gear as a fail-safe measure.	• Malfunction of the Engine A/T-ECU

Replace the Engine-A/T-ECU. CAUTION

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INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble symptom		Inspection procedure No.
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	Does not move (forward or reverse)	5
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	Shocks when changing from N to R and long time lag	8
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INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

INSPECTION PROCEDURE 1

Communication with the MUT-II is not possible	Probable cause
If communication with the MUT-II is not possible, the cause is probably a defective diagnosis line or the Engine A/T-ECU is not functioning.	• Malfunction of diagnosis line • Malfunction of connector • Malfunction of the Engine A/T-ECU

INSPECTION PROCEDURE 2

Starting impossible	Probable cause
Starting is not possible when the selector lever is in P or N range. In such cases, the cause is probably a defective engine system, torque converter or oil pump or seized oil pump.	• Malfunction of the engine system • Malfunction of the torque converter • Malfunction of the oil pump

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INSPECTION PROCEDURE 3

Does not move (forward)	Probable cause
If the vehicle does not move forward when the selector lever is shifted from N to D, 3, 2 or L range while the engine is idling, the cause is probably abnormal line pressure or a malfunction of the underdrive clutch or valve body.	• Abnormal line pressure • Malfunction of the underdrive solenoid valve • Malfunction of the underdrive clutch • Malfunction of the valve body

INSPECTION PROCEDURE 4

Does not reverse	Probable cause
If the vehicle does not reverse when the selector lever is shifted from N to R range while the engine is idling, the cause is probably abnormal pressure in the reverse clutch or low and reverse brake or a malfunction of the reverse clutch, low and reverse brake or valve body.	• Abnormal reverse clutch pressure • Abnormal low and reverse brake pressure • Malfunction of the low and reverse solenoid valve • Malfunction of the reverse clutch • Malfunction of the low and reverse brake • Malfunction of the valve body

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INSPECTION PROCEDURE 5

Does not move (forward or reverse)	Probable cause
If the vehicle does not move forward or reverse when the selector lever is shifted to any position while the engine is idling, the cause is probably abnormal line pressure, or a malfunction of the power train, oil pump or valve body.	• Abnormal line pressure • Malfunction of power train • Malfunction of the oil pump • Malfunction of the valve body

Check Hydraulic pressure
- Measure the hydraulic pressure for each element when moving forward and back.
  Standard Value: Refer Specifications.

OK → Power train check
- Disassemble the transmission, check the condition of the planetary carrier, output shaft and differential, etc.

NG ↓

Replace the oil pump assembly.
(The oil pump cannot be disassembled.)

NG → Valve body disassembly, cleaning and reassembly
- Pay particular attention to loosening of bolts, and to damage and slippage of O-rings, valves and valve bodies.
- If the damage cannot be repaired, replace the valve body assembly.

INSPECTION PROCEDURE 6

Engine stalling when shifting	Probable cause
If the engine stalls when the selector lever is shifted from N to D or R range while the engine is idling, the cause is probably a malfunction of the engine system, damper clutch control solenoid, valve body or torque converter (damper clutch malfunction).	• Malfunction of the engine system • Malfunction of the damper clutch control solenoid • Malfunction of the valve body • Malfunction of the torque converter (Malfunction of the damper clutch)

Engine system check
- Check the control system, ignition system, fuel system and main system.

NG → **Repair, replace**

OK ↓

Replace the damper clutch control solenoid.

↓

Valve body disassembly, cleaning and reassembly
- Pay particular attention to loosening of bolts, and to damage and slippage of O-rings, valves and valve bodies.
- If the damage cannot be repaired, replace the valve body assembly.

NG → Replace the torque converter.

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INSPECTION PROCEDURE 7

Shocks when changing from N to D and large time lag	Probable cause
If abnormal shocks or a time lag of 2 seconds or more occur when the selector lever is shifted from N to D range while the engine is idling, the cause is probably abnormal underdrive clutch pressure or a malfunction of the underdrive clutch, valve body or idle position switch.	• Abnormal underdrive clutch pressure • Malfunction of the underdrive solenoid valve • Malfunction of the underdrive clutch • Malfunction of the valve body • Malfunction of the idle position switch

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INSPECTION PROCEDURE 8

Shocks when changing from N to R and large time lag	Probable cause
If abnormal shocks or a time lag of 2 seconds or more occurs when the selector lever is shifted from N to R range while the engine is idling, the cause is probably abnormal reverse clutch pressure or low and reverse brake pressure, or a malfunction of the reverse clutch, low and reverse brake, valve body or idle position switch.	• Abnormal reverse clutch pressure • Abnormal low and reverse brake pressure • Malfunction of the low and reverse solenoid valve • Malfunction of the reverse clutch • Malfunction of the low and reverse brake • Malfunction of the valve body • Malfunction of the idle position switch

INSPECTION PROCEDURE 9

Shocks when changing from N to D, N to R and large time lag	Probable cause
If abnormal shocks or a time lag of 2 seconds or more occur when the selector lever is shifted from N to D range and from N to R range while the engine is idling, the cause is probably abnormal line pressure or a malfunction of the oil pump or valve body.	• Abnormal line pressure • Malfunction of the oil pump • Malfunction of the valve body

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INSPECTION PROCEDURE 10

Shocks and running up	Probable cause
If shocks occur when driving due to upshifting or downshifting and the transmission speed becomes higher than the engine speed, the cause is probably abnormal line pressure or a malfunction of a solenoid valve, oil pump, valve body or of a brake or clutch.	• Abnormal line pressure • Malfunction of each solenoid valve • Malfunction of the oil pump • Malfunction of the valve body • Malfunction of each brake or each clutch

MUT-II Actuator Test
- No. 1 Low and reverse solenoid valve
- No. 2 Underdrive solenoid valve
- No. 3 Second solenoid valve
- No. 4 Overdrive solenoid valve

OK: Sound of operation can be heard.

NG → Replace the solenoid valve.

OK ↓

Adjust the line pressure. (Refer On Vehicle Service.)

NG → Replace the oil pump assembly. (The oil pump cannot be disassembled.)

NG ↓

Valve body disassembly, cleaning and reassembly
- Pay particular attention to loosening of bolts, and to damage and slippage of O-rings, valves and valve bodies.
- If the damage cannot be repaired, replace the valve body assembly.

OK ↓

Clutch and brake check ★
- Check for burning of the facing, defective piston seal rings and interference at the retainer.

INSPECTION PROCEDURE 11

All points (Displaced shifting points)	Probable cause
If all shift points are displaced while driving, the cause is probably a malfunction of the output shaft speed sensor, TPS or of a solenoid valve.	• Malfunction of the output shaft speed sensor • Malfunction of the throttle position sensor • Malfunction of each solenoid valve • Abnormal line pressure • Malfunction of the valve body • Malfunction of the Engine A/T-ECU

MUT-II Data list
- No. 23 Output shaft speed sensor

OK: Increases in proportion to vehicle speed.

NG → Code No. 23 – Check Output shaft speed sensor system

OK ↓

MUT-II Data list
- No. 11 TPS

OK: Increases in proportion to accelerator pedal opening angle

NG → Code No. 11, 12, 14 Check TPS system

OK ↓

MUT-II Data list
- No. 31 Low and reverse solenoid valve duty %
- No. 32 Underdrive solenoid valve duty %
- No. 33 Second solenoid valve duty %
- No. 34 Overdrive solenoid valve duty %

OK: Refer to the table below.

NG → Replace the solenoid valve.

NG ↓

Replace the Engine A/T-ECU. CAUTION

OK ↓

Adjust the line pressure. (Refer On Vehicle Service.)

NG → Valve body disassembly, cleaning and reassembly ★
- Pay particular attention to loosening of bolts, and to damage and slippage of O-rings, valves and valve bodies.
- If the damage cannot be repaired, replace the valve body assembly.

	No. 31	No. 32	No. 33	No. 34
Driving at constant speed in 1st gear	0 %	0 %	100 %	100 %
Driving at constant speed in 2nd gear	100 %	0 %	0 %	100 %
Driving at constant speed in 3rd gear	100 %	0 %	100 %	0 %
Driving at constant speed in 4th gear	100 %	100 %	0 %	0 %

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INSPECTION PROCEDURE 12

Some points (Displaced shifting points)	Probable cause
If some of the shift points are displaced while driving, the cause is probably a malfunction of the valve body, or it is related to control and is not an abnormality.	• Malfunction of the valve body

INSPECTION PROCEDURE 13

No diagnosis codes (Does not shift)	Probable cause
If shifting does not occur while driving and no diagnosis codes are output, the cause is probably a malfunction of the Inhibitor switch, or Engine A/T-ECU.	• Malfunction of the Inhibitor switch • Malfunction of the Engine A/T-ECU

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INSPECTION PROCEDURE 14

Poor acceleration	Probable cause
If acceleration is poor even if downshifting occurs while driving, the cause is probably a malfunction of the engine system or of a brake or clutch.	• Malfunction of the engine system • Malfunction of the brake or clutch

Engine system check
- Check the control system, ignition system, fuel system and main system.

NG → **Replace, repair**

OK ↓

Brake or clutch check
- Check for burning of the facing, defective piston seal rings and interference at the retainer.

INSPECTION PROCEDURE 15

Vibration	Probable cause
If vibration occurs when driving at constant speed or when accelerating in top range, the cause is probably abnormal damper clutch pressure or a malfunction of the engine system, damper clutch solenoid, torque converter or valve body.	• Abnormal damper clutch pressure • Malfunction of the engine system • Malfunction of the damper clutch solenoid • Malfunction of the torque converter • Malfunction of the valve body

MUT-II Actuator Test
- No. 6 Damper clutch solenoid
  OK: Sound of operation can be heard.

NG → Replace the damper clutch solenoid valve.

OK ↓

Does the problem occur even when the oil temperature sensor connector is disconnected?

Yes → Engine system check
- Check the control system, ignition system, fuel system and main system.

No ↓

Check Hydraulic pressure
- Measure the damper clutch pressure.
  Standard Value: Refer Specifications

NG → Valve body disassembly, cleaning and reassembly
- Pay particular attention to loosening of bolts, and to damage and slippage of O-rings, valves and valve bodies.
- If the damage cannot be repaired, replace the valve body assembly.

OK ↓

Replace the torque converter assembly.

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INSPECTION PROCEDURE 16

Idle position switch system	Probable cause
The cause is probably a defective idle position switch circuit or a defective Engine A/T-ECU circuit.	• Malfunction of the idle position switch • Malfunction of connector • Malfunction of the Engine A/T-ECU

INSPECTION PROCEDURE 17

Dual pressure switch system	Probable cause
The cause is probably a defective dual pressure switch circuit or a defective Engine A/T-ECU.	• Malfunction of the dual pressure switch • Malfunction of connector • Malfunction of A/C system • Malfunction of the Engine A/T-ECU

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INSPECTION PROCEDURE 18

Vehicle speed sensor system	Probable cause
A malfunction may exist in the speed sensor circuit or the Engine A/T-ECU.	• Malfunction of the vehicle speed sensor • Malfunction of the connector • Malfunction of the Engine A/T-ECU

INSPECTION PROCEDURE 19

Cruise control -ECU signal system	Probable cause
A malfunction may exist in the cruise control signal line circuit or the Engine A/T-ECU.	• Malfunction of connector • Malfunction of the Engine A/T-ECU • Malfunction of the cruise control ECU

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SERVICE DATA REFERENCE TABLE

Item No.	Check item	Check requirement		Normal value
11	Throttle position sensor	Engine: Stopped Selector lever position: P	Accelerator pedal: Fully closed	400 – 1,000 mV
			Accelerator pedal: Depressed	Gradually rises from the above value
			Accelerator pedal: Fully open	4,500 – 5,000 mV
15	Oil temperature sensor	Warming up	Drive for 15 minutes or more so that the automatic transmission fluid temperature becomes 70 – 90 °C.	Gradually rises to 70 – 90 °C
21	Crank angle sensor	Engine: Idling Selector lever position: P	Accelerator pedal: Fully closed	600 – 900 rpm
			Accelerator pedal: Depressed	Gradually rises from the above value
22	Input shaft speed sensor	Selector lever position: 3	Driving at constant speed of 50 km/h gear	1,800 – 2,100 rpm
23	Output shaft speed sensor	Selector lever position: 3	Driving at constant speed of 50 km/h in 3rd gear	1,800 – 2,100 rpm
26	Stop light switch	Ignition switch: ON Engine: Stopped	Brake pedal: Depressed	ON
			Brake pedal: Released	OFF
29	Vehicle speed sensor	Selector lever position: 3	Idling with 1st gear (Vehicle stopped)	0 km/h
			Driving at constant speed of 50 km/h in 3rd gear	50 km/h
31	Low and reverse solenoid valve duty %	Selector lever position: L, 2, 3, D	Driving at constant speed of 10 km/h in 1st gear	No. 31: 0 %, No. 32: 0 %, No. 33: 100 %, No. 34: 100%
32	Underdrive solenoid valve duty %		Driving at constant speed of 30 km/h in 2nd gear	No. 31: 100 %, No. 32: 0 %, No. 33: 0 %, No. 34: 100%
33	Second solenoid valve duty %		Driving at constant speed of 50 km/h in 3rd gear	No. 31: 100 %, No. 32: 0 %, No. 33: 100 %, No. 34: 0%
34	Overdrive solenoid valve duty %		Driving at constant speed of 50 km/h in 4th gear	No. 31: 100 %, No. 32: 100 %, No. 33: 0 %, No. 34: 0%

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Item No.	Check item	Check requirement		Normal value
36	Damper clutch solenoid duty %	Selector lever position: 3	Accelerate to 50 km/h in 3 position, then release accelerator pedal*	0 %
			Driving at constant speed of 50 km/h in 3rd gear	Approx. 70 – 90 %
52	Amount of damper clutch slippage	Selector lever position: 3	Accelerate to 50 km/h in 3 position, then release accelerator pedal*	Approx. 100 – 300 rpm*
			Driving at constant speed of 50 km/h in 3rd gear	Approx. 0 – 10 rpm
54	A/T control relay output voltage		Ignition switch: OFF → ON	0 mV → Battery voltage (mV)
57	Engine volumetric efficiency	Selector lever position: N	Accelerator pedal fully closed → depressed	Data changes
61	Inhibitor switch	Ignition switch: ON Engine: Stopped	Selector lever position: P	P
			Selector lever position: R	R
			Selector lever position: N	N
			Selector lever position: D	D
			Selector lever position: 3	3
			Selector lever position: 2	2
			Selector lever position: L	L
63	Shift position	Selector lever position: L, 2, 3, D	Driving at constant speed of 10 km/h in 1st gear	1st
			Driving at constant speed of 30 km/h in 2nd gear	2nd
			Driving at constant speed of 50 km/h in 3rd gear	3rd
			Driving at constant speed of 50 km/h in 4th gear	4th

Item No.	Check item	Check requirement		Normal value
64	Idle position switch	Engine: Idling Selector lever position: N	Accelerator pedal: Fully closed	ON
			Accelerator pedal: Depressed	OFF
65	Dual pressure switch	Engine: Idling Selector lever position: N	A/C switch: ON	ON
			A/C switch: OFF	OFF
66	Cruise control ECU signal	While cruise control operating	Plain road	OFF
			Sloping road	ON

NOTE
*: The damper clutch is released when the accelerator is fully closed (Idle position switch: ON).

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ACTUATOR TEST JUDGEMENT VALUE

Item No.	Check item	Test content	Check requirement	Normal value
1	Low reverse solenoid valve	Drive the solenoid valve specified by the MUT-II at 50 % duty for 5 seconds. No other solenoid valve should be energised.	Ignition switch: ON Selector lever position: P Engine: 0 r/min Vehicle speed: 0 km/h (Vehicle stopped) Throttle opening voltage: Less than 1 V Idle position switch: ON While fail-safe function is not in operation.	The operation sound should be audible when the solenoid valve is driven.
2	Underdrive solenoid valve			
3	Second solenoid valve			
4	Overdrive solenoid valve			
6	Damper clutch solenoid			
12	A/T control relay	Control relay is OFF for 3 seconds.		Data list No. 54 (1) During test: 0 mV (2) Normal: Battery voltage [mV]

INVECS-II CANCEL COMMAND

Item No.	Item	Content	Remarks
14	INVECS-II	Stop the INVECS-II control and change gears according to the standard shift pattern.	Use this function when carrying out procedure 8 in the road tests.

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CHECK AT ENGINE A/T-ECU TERMINALS

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Terminal No.	Check item	Check requirement	Standard value
50	A/T control relay	Ignition switch: Off	0 V
		Ignition switch: On	Battery voltage
57	Sensor ground	Always	0 V
75	Cruise control unit	OD-OFF command not executed	Battery voltage
		OD-OFF command executed	0 V
76	Ground	Always	0 V
77	Power supply	Ignition switch: OFF	0 V
		Ignition switch: ON	Battery voltage
88	Ground	Always	0 V
89	Power supply	Ignition switch: OFF	0 V
		Ignition switch: ON	Battery voltage
97	Ground	Always	0 V
101	Inhibitor switch: P	Selector lever position: P	Battery voltage
		Selector lever position: Other than above	0 V
102	Inhibitor switch: D	Selector lever position: D	Battery voltage
		Selector lever position: Other than above	0 V
103	Input shaft speed sensor	Measure from terminal No. 104 to 57 with an oscilloscope. Engine: 2,000 rpm Selector lever position: D (3rd)	See procedures for checking with an oscilloscope (Page 23–44).
104	Output shaft speed sensor	Measure from terminal No. 104 to 57 with an oscilloscope. Engine: 2,000 rpm Selector lever position: D (3rd)	
106	2nd solenoid valve	Selector lever position: D (2nd)	Battery voltage
		Selector lever position: D (1st)	Approx. 7 – 9 V
107	DCC solenoid valve	Selector lever position: D (1st)	Battery voltage
		Selector lever position: D (3rd-60km/h)	Approx. 7 – 9 V
108	Inhibitor switch: R	Selector lever position: R	Battery voltage
		Selector lever position: Other than above	0 V

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Terminal No.	Check item	Check requirement	Standard value
120	UD solenoid valve	Selector lever position: (1st)	Battery voltage
		Selector lever position: R	Approx. 7 – 9 V
121	Inhibitor switch: N	Selector lever position: N	Battery voltage
		Selector lever position: Other than above	0 V
123	Stop lamp switch	Brake pedal: Depressed	Battery voltage
		Brake pedal: Released	0 V
124	Oil temperature sensor	ATF temperature: 25°C	3.8 – 4.0 V
		ATF temperature: 80°C	2.3 – 2.5 V
129	LR solenoid valve	Selector lever position: D (1st)	Battery voltage
		Selector lever position: D (2nd)	Approx. 7 – 9 V
130	OD solenoid valve	Selector lever position: D (3rd)	Battery voltage
		Selector lever position: D (1st)	Approx. 7 – 9 V

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OSCILLOSCOPE INSPECTION PROCEDURE

Check item	Check requirement		Normal condition (Waveform sample)
Crank angle sensor	Selector lever position: N	Idling (Vehicle stopped)	Waveform A
Input shaft speed sensor	Selector lever position: 3	Driving at constant speed of 50 km/h in 3rd gear (Engine: 1,800 – 2,100 r/min)	Waveform B
Output shaft speed sensor			
Vehicle speed sensor			
Low reverse solenoid valve	Ignition switch: ON Selector lever position: P Engine: 0 r/min Vehicle speed: 0 km/h (Vehicle stopped) Throttle (Accelerator) opening angle: Less than 1 V Closed throttle position switch: ON	Force drive each solenoid valve (Actuator test)	Waveform C
Underdrive solenoid valve			
Second solenoid valve			
Overdrive solenoid valve			
Damper clutch control solenoid			

Waveform sample

Waveform A

Waveform B

Waveform C

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ON-VEHICLE SERVICE

AUTOMATIC TRANSMISSION FLUID CHECK

1. Drive until the fluid temperature reaches the operating temperature 70–80°C.
2. Place vehicle on level floor.
3. Move selector lever sequentially to every position to fill torque converter and hydraulic circuit with fluid, then place lever in “N” Neutral position. This operation is necessary to be sure that fluid level check is accurate.
4. Before removing the oil level gauge, wipe all dirt from area around the oil level gauge. Then take out the oil level gauge and check the condition of the fluid.
   Further investigation of the transmission is necessary if,
   - the fluid smells burnt.
   - the fluid colour is brown or black.
   - metal particles can be seen or felt on the dipstick.
5. Check to see if fluid level is in “HOT” range on oil level gauge. If fluid level is low, add ATF until level reaches “HOT” range.

   NOTE
   Low fluid level can cause a variety of conditions because it allows the pump to take in air along with fluid. Air trapped in the hydraulic circuit forms bubbles which make the fluid spongy.

   Therefore, pressures will be erratic.
   Improper filling can also raise fluid level too high. When the transmission has too much fluid, gears churn up foam and cause the same conditions which occur with low fluid level, resulting in accelerated deterioration of ATF. In either case, air bubbles can cause overheating, fluid oxidation, which can interfere with normal valve, clutch, and servo operation. Foaming can also result in fluid escaping from the transmission vent where it may be mistaken for a leak.
6. Be sure to examine the fluid on the oil level gauge closely.

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AUTOMATIC TRANSMISSION FLUID REPLACEMENT

With the ATF at normal operating temperature, replace the ATF using the following procedure.

1. Remove the right hand hose connecting the transmission oil cooler pipe to the oil cooler (built in to the bottom of the radiator).
2. Connect a suitable length of hose from the radiator cooler pipe to an oil drain receptacle, large enough to hold the quantity of discharged fluid.
3. Start the engine and discharge the ATF.
   Operating conditions: “N” Neutral gear and idling.

Caution
Start the engine and then stop it within one minute. If the ATF is discharged before the one minute elapses, stop the engine at that time.

Amount of ATF discharged: Approximately 4.5 (litres)

4. Remove the drain plug at the bottom of the transmission case and discharge the ATF.

   Amount of ATF discharged: Approximately 1.0 (litre)
5. Install the drain plug and gasket, applying the specified amount of torque.

   Tightening torque: 32 Nm
6. Fill with new ATF through the oil filler tube.

   Amount of ATF added: Approximately 5.5 (litres)

   NOTE
   Stop pouring if the entire amount of new ATF cannot be added. (Do not exceed “COLD” level)
7. Repeat the procedure in step (3) and discharge approximately 3.0 litres of ATF.

   NOTE
   Check the ATF discharged in step (8) for contamination. If it is contaminated, repeat steps (7) and (8).
8. Add the new ATF through the oil filler tube.

   Amount of ATF added: Approximately 3.0 (litres)
9. Attach and secure the hose that was disconnected in step (1) and securely insert the oil level gauge.
10. Start the engine and let it idle for one or two minutes.
11. Move the selector lever through all gear positions, ending in Neutral position.

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12. Make sure the ATF reaches the “COLD” mark on the oil level gauge. If there is not enough ATF, add more.
13. Drive the car until the ATF temperature reaches normal 70–80°C and recheck the ATF level. The ATF must be within the “HOT” range.

    NOTE
    The “COLD” level is for reference only and the “HOT” level serves as the standard.
14. Securely insert the oil level gauge into the filler tube.

THROTTLE POSITION SENSOR ADJUSTMENT

Refer GROUP 13A On Vehicle Service

INHIBITOR SWITCH CONTINUITY CHECK

Items	Terminal No.									
	1	2	3	4	5	6	7	8	9	10
P			○					○	○	○
R							○	○		
N				○				○	○	○
D	○							○		
3					○			○		
2		○						○		
L						○		○		

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INHIBITOR SWITCH AND CONTROL CABLE ADJUSTMENT

1. Set the selector lever to the “N” position.
2. Loosen the control cable to manual control lever coupling nut to free the cable and lever.
3. Set the manual control lever to the neutral position.

4. Loosen the inhibitor switch body mounting bolts and turn the inhibitor switch body so the hole in the end of the manual control lever and the hole (cross section A-A in the figure on the left) in the flange of the inhibitor switch body flange are aligned.
5. Tighten the inhibitor switch body mounting bolts to the specified torque. Be careful at this time that the position of the switch body is not changed.

6. Gently pull the transmission control cable in the direction of the arrow, and then tighten the adjusting nut.
7. Check that the selector lever is in the “N” position.
8. Check that each range on the transmission side operates and functions correctly for each position of the selector lever.

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A/T CONTROL COMPONENT LOCATION

Name	Symbol	Name	Symbol
A/T control relay	I	Oil temperature sensor	D
Crank angle sensor	F	Output shaft speed sensor	C
Diagnosis connector	J	Shift indicator light	G
Dual pressure switch	B	Solenoid valve	D
Engine-A/T-ECU	H	Stop light switch	K
Inhibitor switch	E	Throttle position sensor (with built-in idle position switch)	A
Input shaft speed sensor	C	Vehicle speed sensor	C

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A/T CONTROL COMPONENT CHECK

1. CRANK ANGLE SENSOR CHECK

Refer GROUP 13A On Vehicle Service

2. THROTTLE POSITION SENSOR CHECK

Refer GROUP 13A On Vehicle Service

3. OIL TEMPERATURE SENSOR CHECK

1. Remove the oil temperature sensor.
2. Measure the resistance between terminals No.1 and No.2 of the oil temperature sensor connector.

   Standard value:

Oil temperature [°C]	Resistance (kΩ)
0	1.67 – 20.5
100	0.57 – 0.69

3. Replace the sensor if not within the standard value.

4. INHIBITOR SWITCH CHECK

Refer On Vehicle Service

5. STOP LIGHT SWITCH CHECK

Refer GROUP 35 On Vehicle Service

6. VEHICLE SPEED SENSOR CHECK

Refer GROUP 54 On Vehicle Service

7. DUAL PRESSURE SWITCH CHECK

Refer GROUP 55 On Vehicle Service

8. IDLE POSITION SWITCH CHECK

Refer GROUP 13A On Vehicle Service

9. A/T CONTROL RELAY CHECK

1. Remove the A/T control relay.
2. Use jumper wires to connect the A/T control relay terminal (2) to the battery (–) terminal and terminal (4) to the battery (+) terminal.
3. Check the continuity between the terminal (1) and the terminal (3) of the A/T control relay when the jumper wires are connected to and disconnected from the battery.

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Jumper wire	Continuity between terminals No.1 and No.3
Connected	Continuity
Disconnected	No continuity

4. If there is a problem, replace the A/T control relay.

10. SOLENOID VALVE CHECK

1. Remove the valve body cover.
2. Disconnect the connectors of each solenoid valve.

3. Measure the resistance between terminals 1 and 2 of each solenoid valve.

Standard value:

Name	Resistance
Damper clutch solenoid	2.7 – 3.4 Ω (at 20°C)
Low and reverse solenoid valve	
Second solenoid valve	
Underdrive solenoid valve	
Overdrive solenoid valve	

4. If the resistance is not within the standard value, replace the solenoid valve.

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TORQUE CONVERTER STALL TEST

This test measures the maximum engine speed when the selector lever is at the D or R position and the torque converter stalls to test the operation of the torque converter, starter motor and one-way clutch operation and the holding performance of the clutches and brakes in the transmission.

Caution
Do not let anybody stand in front of or behind the vehicle while this test is being carried out.

1. Check the automatic transmission fluid level and temperature and the engine coolant temperature.
   - Fluid level: At the HOT mark on the oil level gauge
   - Fluid temperature: 80 – 100°C
   - Engine coolant temperature: 80 – 100°C
2. Chock both rear wheels.
3. Pull the parking brake lever on, with the brake pedal fully depressed.
4. Start the engine.
5. Move the selector lever to the D position, fully depress the accelerator pedal and take a reading of the maximum engine speed at this time.

   Caution
   1. **The throttle should not be left fully open for any more than eight seconds.**
   2. **If carrying out the stall test two or more times, move the selector lever to the N position and run the engine at 1,000 r/min to let the automatic transmission fluid cool down before carrying out subsequent tests.**

   Standard value:

   Stall speed: 2,100 – 2,600 r/min

6. Move the selector lever to the R position and carry out the same test again.

   Standard value:

   Stall speed: 2,100 – 2,600 r/min

TORQUE CONVERTER STALL TEST JUDGEMENT RESULTS

a. Stall speed is too high in both D and R ranges
   - Low line pressure
   - Low & reverse brake slippage

b. Stall speed is too high in D range only
   - Underdrive clutch slippage

c. Stall speed is too high in R range only
   - Reverse clutch slippage

d. Stall speed too low in both D and R ranges
   - Malfunction of torque converter
   - Insufficient engine output

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HYDRAULIC PRESSURE TEST

1. Warm up the engine until the automatic transmission fluid temperature is 80–100°C.
2. Jack up the vehicle so that the wheels are free to turn.
3. Connect the special tools (2,942 kPa) oil pressure gauge [MD998330] and joints [MD998332, E21M17A]) to each pressure discharge port.
4. Measure the hydraulic pressure at each port under the conditions given in the standard hydraulic pressure table, and check that the measured values are within the standard value ranges.
5. If a value is outside the standard range, correct the problem while referring to the hydraulic pressure test diagnosis table.

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STANDARD HYDRAULIC PRESSURE TEST

Measurement condition			Standard hydraulic pressure kPa					
Selector lever position	Shift position	Engine speed (r/min)	Underdrive clutch pressure	Reverse clutch pressure	Over-drive clutch pressure	Low and reverse brake pressure	Second brake pressure	Torque converter pressure
P	–	2,500	–	–	–	260 – 340	–	260 – 340
R	Reverse	2,500	–	1,270 – 1,770	–	1,270 – 1,770	–	500 – 700
N	2,500	–	–	–	–	260 – 340	–	260 – 340
D	1st gear	2,500	1,010 – 1,050	–	–	1,010 – 1,050	–	500 – 700
	2nd gear	2,500	1,010 – 1,050	–	–	–	1,010 – 1,050	500 – 700
	3rd gear	2,500	780 – 880	–	780 – 880	–	–	450 – 650
	4th gear	2,500	–	–	780 – 880	–	780 – 880	450 – 650

HYDRAULIC PRESSURE TEST DIAGNOSIS TABLE

Trouble symptom	Probable cause
All hydraulic pressures are high.	Incorrectly adjusted line pressure
	Malfunction of the regulator valve
All hydraulic pressures are low.	Incorrectly adjusted line pressure
	Malfunction of the oil pump
	Clogged internal oil filter
	Clogged oil cooler
	Malfunction of the regulator valve
	Malfunction of the relief valve
	Incorrect valve body installation
Hydraulic pressure is abnormal in “R” range only.	Malfunction of the regulator valve
	Clogged orifice
	Incorrect valve body installation
Hydraulic pressure is abnormal in “3” or “4” range only.	Malfunction of the overdrive solenoid valve
	Malfunction of the overdrive pressure control valve
	Malfunction of the regulator valve
	Malfunction of the switch valve
	Clogged orifice
	Incorrect valve body installation

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Trouble symptom	Probable cause
Only underdrive hydraulic pressure is abnormal.	Malfunction of the oil seal K
	Malfunction of the oil seal L
	Malfunction of the oil seal M
	Malfunction of the underdrive solenoid valve
	Malfunction of the underdrive pressure control valve
	Malfunction of check ball
	Clogged orifice
	Incorrect valve body installation
Only reverse clutch hydraulic pressure is abnormal.	Malfunction of the oil seal A
	Malfunction of the oil seal B
	Malfunction of the oil seal C
	Clogged orifice
	Incorrect valve body installation
Only overdrive hydraulic pressure is abnormal.	Malfunction of the oil seal D
	Malfunction of the oil seal E
	Malfunction of the oil seal F
	Malfunction of the overdrive solenoid valve
	Malfunction of the overdrive pressure control valve
	Malfunction of check ball
	Clogged orifice
	Incorrect valve body installation
Only low and reverse hydraulic pressure is abnormal.	Malfunction of the oil seal I
	Malfunction of the oil seal J
	Malfunction of the low and reverse solenoid valve
	Malfunction of the low and reverse pressure control valve
	Malfunction of the switch valve
	Malfunction of the fail safe valve A
	Malfunction of check ball
	Clogged orifice
	Incorrect valve body installation

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Trouble symptom	Probable cause
Only second hydraulic pressure is abnormal.	Malfunction of the oil seal G
	Malfunction of the oil seal H
	Malfunction of the oil seal O
	Malfunction of the second solenoid valve
	Malfunction of the second pressure control valve
	Malfunction of the fail safe valve B
	Clogged orifice
	Incorrect valve body installation
Only torque converter pressure is abnormal.	Clogged oil cooler
	Malfunction of the oil seal N
	Malfunction of the damper clutch solenoid
	Malfunction of the damper clutch control valve
	Malfunction of the torque converter pressure control valve
	Clogged orifice
	Incorrect valve body installation
Pressure applied to element which should not receive pressure.	Incorrect transmission control cable adjustment
	Malfunction of the manual valve
	Malfunction of check ball
	Incorrect valve body installation

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OIL SEAL LAYOUT

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HYDRAULIC CIRCUIT

PARKING AND NEUTRAL

1. Reverse clutch
2. Low-reverse brake
3. Second brake
4. Underdrive clutch
5. Overdrive clutch
6. Accumulator
7. Check ball
8. Torque converter clutch
9. Fail safe valve A
10. Fail safe valve B
11. Torque converter clutch control valve
12. Switch valve
13. Automatic transmission fluid cooler
14. Lubrication
15. Low-reverse pressure control valve
16. Second pressure control valve
17. Underdrive pressure control valve
18. Overdrive pressure control valve
19. Torque converter clutch solenoid
20. Low-reverse solenoid valve
21. Second solenoid valve
22. Underdrive solenoid valve
23. Overdrive solenoid valve
24. Torque converter pressure control valve
25. Regulator valve
26. Manual valve
27. Oil filter
28. Oil pump
29. Oil strainer
30. Oil filter (Built-in type)
31. Relief valve
32. Oil pan

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LINE PRESSURE ADJUSTMENT

1. Discharge the automatic transmission fluid, and then remove the valve body cover.
2. Turn the adjusting screw shown in the illustration to adjust the underdrive pressure in “D” range 1st or 2nd gear to the standard value.

   NOTE
   When adjusting the underdrive pressure, adjust to the middle of the standard value range.

   Standard value: 1,010 – 1,050 kPa

   Change in pressure for each turn of the adjusting screw: 35 kPa
3. Install the valve body cover, and pour in the standard volume of automatic transmission fluid.
4. Carry out a hydraulic pressure test. Readjust the line pressure if necessary.

SELECTOR LEVER OPERATION CHECK

1. Shift selector lever to each range and check that lever moves smoothly and clicks into position. Check that position indicator is correct.
2. Check to be sure the selector lever can be shifted to each position (by button operation as shown in the illustration).
3. Start the engine and check if the vehicle moves forward when the selector lever is shifted from N to D, and moves backward when shifted to R.
4. When the shift lever malfunctions, adjust control cable and selector lever sleeve. Check for worn shift lever assembly sliding parts.

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TRANSMISSION CONTROL

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
(1) Air Cleaner Assembly Removal and Installation
(2) Front Floor Console Removal and Installation (Refer GROUP 52A.)

Caution: SRS
Be careful not to subject the SRS-ECU to any shocks during removal and installation of the transmission control cable and selector lever assembly.

10AE013E

10AE014E

Transmission control cable assembly removal steps

1. Foot rest
2. Floor carpet front reinforcements (LH and RH)
3. Harness protector
4. Engine-A/T-ECU and A/T control relay
5. ▶A◀ Nut
6. Connection of the transmission control cable
7. Transmission control cable assembly

Selector lever assembly removal steps

7. Transmission control cable assembly
8. Harness connector
9. Selector lever assembly

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INSTALLATION SERVICE POINT

▶A◀ NUT INSTALLATION

1. Put the selector lever in the “N” position.
2. Loosen the adjusting nut, gently pull the transmission control cable in the direction of the arrow and tighten the nut.

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SELECTOR LEVER ASSEMBLY <MAGNA>

DISASSEMBLY AND REASSEMBLY

Disassembly steps

1. Push button
2. Spring
3. Cap
4. Shift knob
5. Indicator panel assembly
6. Position indicator light assembly
7. Bolt
8. Parking Brake cable bracket
9. Pipe
10. Level assembly
11. Clevis pin
12. Cam spring
13. Lock cam
14. Stopper
15. Bracket assembly

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SELECTOR LEVER ASSEMBLY <VERADA>

DISASSEMBLY AND REASSEMBLY

Disassembly steps

1. Push button
2. Spring
3. Cap
4. Shift Knob
5. Indicator panel assembly
6. Manual control switch assembly
7. Bush
8. Return spring
9. Pipe
10. Bracket
11. Lever
12. Shift bush
13. Pipe
14. Select lever
15. Spring
16. Manual lever
17. Shift bush
18. Pipe
19. Cable lever
20. Shift bush
21. Pipe
26. Guard block
27. Stopper
28. Compression spring
29. Ball
30. Ball stopper
31. Spring
33. Bracket assembly

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Checking

MANUAL CONTROL SWITCH ASSEMBLY CIRCUIT CHECK.

Switch Position		Terminal No.					
		1	3	4	5	7	8
(UP) Shift Switch	ON		○			○	
	OFF						
(DOWN) Shift Switch	ON		○				○
	OFF						
Select Switch	AUTO	○			○		
	SPORT	○		○			

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TRANSMISSION ASSEMBLY

REMOVAL AND INSTALLATION

Pre-removal Operation
(1) Transmission Fluid Draining
(Refer Fluid Replacement.)
(2) Under Cover Removal
(3) Battery and Battery Tray Removal
(4) Air Cleaner Assembly Removal

Post-installation Operation
(1) Air Cleaner Assembly Installation
(2) Battery and Battery Tray Installation
(3) Under Cover Installation
(4) Transmission Fluid Supplying
(Refer Fluid Replacement.)
(5) Selector Lever Operation Check
(6) Speedometer Operation Check

Removal steps

1. Transmission control cable connection
2. Transmission oil cooler hoses connection
3. Inhibitor switch connector
4. A/T control solenoid valve connector
5. Input shaft speed sensor connector
6. Output shaft speed sensor connector
7. Vehicle speed sensor connector
8. Split pin

◀A▶

9. Connection of the tie rod end
10. Drive shaft nut
11. Connection for the lower arm ball joint

◀B▶

12. Drive shaft and inner shaft assembly (RH) and the drive shaft (LH)

Caution
Mounting locations marked by * should be provisionally tightened, and then fully tightened when the body is supporting the full weight of the engine.

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Lifting up of the vehicle

13. Starter motor
14. Centre member assembly
15. Rear roll stopper bracket
16. Transmission upper portion fixing bolt
17. ◀C▶ Transmission mounting bracket
18. ▶B◀ Transmission mount stopper
    - ◀D▶ Support the engine and transmission assembly
19. Bell housing cover
20. ◀E▶ Drive plate attaching bolt
21. ◀E▶ Transmission lower portion fixing bolt
22. ◀E▶ ▶A◀ Transmission assembly

Caution

Mounting locations marked by * should be provisionally tightened, and then fully tightened when the body is supporting the full weight of the engine.

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REMOVAL SERVICE POINTS

◀A▶ TIE ROD END/LOWER ARM BALL JOINT DISCONNECTION

Caution

1. **Before using the special tool, loosen the tie-rod end mounting nut. Only loosen the nut; do not remove it from the ball joint.**
2. **Support the special tool with a cord, etc. to prevent it from coming off.**

◀B▶ DRIVE SHAFT <L.H.>/DRIVE SHAFT <R.H.> DISCONNECTION

1. Insert a pry bar between the transmission case and the drive shaft as shown to remove the drive shaft.

   NOTE
   Do not remove the hub and knuckle from the drive shaft.

   Caution
   Always use a pry bar, or the ball joint will be damaged.

2. Lightly strike the centre bearing with a plastic hammer or similar object and pull out the inner shaft (RH) from the transmission.
3. Suspend the removed drive shaft with a wire so that there are no sharp bends in any of the joints.
4. Use a shop towel to cover the transmission case to prevent foreign material from entering it.

◀C▶ TRANSMISSION MOUNT BRACKET REMOVAL

Jack up the transmission assembly gently with a garage jack, and then remove the transmission mounting.

◀D▶ ENGINE ASSEMBLY SUPPORTING

Set the special tool to the vehicle to support the engine assembly.

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◀E▶ DRIVE PLATE BOLTS/TRANSMISSION ASSEMBLY LOWER PART COUPLING BOLTS/TRANSMISSION ASSEMBLY REMOVAL

1. Support the transmission assembly by using a transmission jack.
2. Remove the drive plate bolts while turning the crank shaft.
3. Press in the torque converter to the transmission side so that the torque converter does not remain on the engine side.
4. Remove the transmission assembly lower bolts and lower the transmission assembly.

INSTALLATION SERVICE POINTS

▶A◀ TRANSMISSION ASSEMBLY INSTALLATION

After securely inserting the torque converter into the transmission side so that the shown dimension is approx. 12.2 mm, install the transmission assembly to the engine.

▶B◀ TRANSMISSION MOUNT STOPPER INSTALLATION

Install the transmission mount stopper so that the arrow mark points as shown in the illustration.

23A AUTOMATIC TRANSMISSION 01M/Y FROM AUG 2001

CONTENTS

LUBRICANT

TROUBLESHOOTING

- INSPECTION CHART FOR DIAGNOSIS CODES
- INSPECTION PROCEDURES FOR DIAGNOSIS CODES
- INSPECTION CHART FOR TROUBLE SYMPTOMS
- INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

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 in baking or drying after painting, remove the SRS components (air bag module and SRS-ECU) beforehand.

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

(4) 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

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

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LUBRICANT

Items	Specified lubricant	Quantity (litres)
Transmission fluid	Mitsubishi ELC4–SPIII.	8.4

TROUBLESHOOTING

INSPECTION CHART FOR DIAGNOSIS CODES

Code	Diagnosis item	
11	Throttle position sensor system	Short circuit
12		Open circuit
14		Sensor maladjustment
15	Oil temperature sensor system	Open circuit
16		Short circuit
21	Crank angle sensor system	Open circuit
22	Input shaft speed sensor system	Short circuit/open circuit
23	Output shaft speed sensor system	Short circuit/open circuit
26	Stop light switch system	Short circuit/open circuit
27	Inhibitor switch system	Open circuit
28		Short circuit
31	Low and reverse solenoid valve system	Short circuit/open circuit
32	Underdrive solenoid valve system	Short circuit/open circuit
33	Second solenoid valve system	Short circuit/open circuit
34	Overdrive solenoid valve system	Short circuit/open circuit
36	Damper clutch solenoid system	Short circuit/open circuit
41	1st gear incorrect ratio	
42	2nd gear incorrect ratio	
43	3rd gear incorrect ratio	
44	4th gear incorrect ratio	
46	Reverse gear incorrect ratio	
51	Abnormal communication with Engine-ECU	

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Code	Diagnosis item	
52	Damper clutch solenoid system	Defective system
53		Lock-up stuck on
54	A/T Control relay system	Short circuit to ground/open circuit
56	N range light system	Short circuit to ground
71	Malfunction of A/T-ECU	

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INSPECTION PROCEDURES FOR DIAGNOSIS CODES

Code No. 11, 12, 14 Throttle position sensor system	Probable cause
If the TPS output voltage is 4.8 V or higher when the engine is idling, the output is judged to be too high and diagnosis code No. 11 is output. If the TPS output voltage is 0.2 V or lower at times other than when the engine is idling, the output is judged to be too low and diagnosis code No. 12 is output. If the TPS output voltage is 0.2 V or lower or if it is 1.2 V or higher when the engine is idling, the TPS adjustment is judged to be incorrect and diagnosis code No. 14 is output.	• Malfunction of the throttle position sensor • Malfunction of connector • Malfunction of the Engine A/T-ECU

Throttle position sensor check (Refer GROUP 13A On Vehicle Service.) — NG → **Replace**
↓ OK
Check the following connectors: A-68, B-109, B-110<Magna>, A-68, B-109, B-110 <Verada> — NG → **Repair**
↓ OK
Harness check
- Throttle position sensor to Engine A/T-ECU. — NG → **Repair**

↓ OK
Check the trouble symptoms. — NG → Replace the Engine A/T-ECU. CAUTION

Code No. 15, 16 Oil temperature sensor system	Probable cause
If the oil temperature sensor output voltage is 2.6 V or more even after driving for 10 minutes or more (if the oil temperature does not increase), it is judged that there is an open circuit in the oil temperature sensor and diagnosis code No. 15 is output. If the oil temperature sensor output detects the voltage which corresponds to 200°C or more for more than one second, it is judged that there is an open circuit in oil temperature sensor and diagnosis code No.16 is output.	• Malfunction of the oil temperature sensor • Malfunction of connector • Malfunction of the Engine A/T-ECU

Oil temperature sensor check (Refer On Vehicle Service.) — NG → **Replace**
↓ OK
Check the following connectors: A-87, B-111<Magna> A-87, B-111 <Verada> — NG → **Repair**
↓ OK
Harness check
- Oil temperature sensor to Engine A/T-ECU. — NG → **Repair**

↓ OK
Check the trouble symptoms. — NG → Replace the Engine A/T-ECU. CAUTION

Code No. 21 Crank angle sensor system	Probable cause
If no output pulse is detected from the crank angle sensor for 5 seconds or more while driving at 25 km/h or more, it is judged that there is an open circuit in the crank angle sensor and diagnosis code No. 21 is output.	• Malfunction of the crank angle sensor • Malfunction of connector • Malfunction of the Engine A/T-ECU

Refer GROUP 13A.

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Code No. 22 Input shaft speed sensor system	Probable cause
If no output pulse is detected from the input shaft speed sensor for 1 second or more while driving in 3rd or 4th gear at a speed of 30 km/h or more, it is judged to be an open circuit or short-circuit in the input shaft speed sensor and diagnosis code No. 22 is output. If diagnosis code No. 22 is output four times, the transmission is locked into 3rd gear or 2nd gear as a fail-safe measure, and the N range light flashes at a frequency of 1 Hz.	● Malfunction of the input shaft speed sensor ● Malfunction of the underdrive clutch retainer ● Malfunction of connector ● Malfunction of the Engine A/T-ECU

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Code No. 23 Output shaft speed sensor system	Probable cause
If the output from the output shaft speed sensor is continuously 50% lower than the vehicle speed for 1 second or more while driving in 3rd or 4th gear at a speed of 30 km/h or more, it is judged to be an open circuit or short-circuit in the output shaft speed sensor and diagnosis code No. 23 is output. If diagnosis code No. 23 is output four times, the transmission is locked into 3rd gear or 2nd gear as a fail-safe measure, and the N range light flashes at a frequency of 1 Hz.	● Malfunction of the output shaft speed sensor ● Malfunction of the transfer drive gear or driven gear ● Malfunction of connector ● Malfunction of the Engine A/T-ECU

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Code No. 26 Stop light switch system	Probable cause
If the stop light switch is on for 5 minutes or more while driving, it is judged that there is a short circuit in the stop light switch and diagnosis code No. 26 is output.	• Malfunction of the stop light switch • Malfunction of connector • Malfunction of the Engine A/T-ECU

Code No.27, 28 Inhibitor switch system	Probable cause
If the A/T-ECU detects no inhibitor switch input signal for a continuous period of 30 seconds, it is judged that there is an open circuit in the inhibitor switch and diagnosis code No.27 is output. If the Engine A/T-ECU detects more than two kinds of inhibitor switch input signals for a continuous period of 30 seconds, it is judged that there is an open circuit in the inhibitor switch and diagnosis code No.28 is output.	• Malfunction of the inhibitor switch • Malfunction of the ignition switch • Malfunction of connector • Malfunction of the Engine A/T-ECU

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Code No. 31 Low and reverse solenoid valve system	Probable cause
Code No. 32 Underdrive solenoid valve system	
Code No. 33 Second solenoid valve system	
Code No. 34 Overdrive solenoid valve system	
If the resistance value for a solenoid valve is too large or too small, it is judged that there is a short-circuit or an open circuit in the solenoid valve and the respective diagnosis code is output. The transmission is locked into 3rd gear as a fail-safe measure, and the N range light flashes at a frequency of 1 Hz.	• Malfunction of solenoid valve • Malfunction of connector • Malfunction of the Engine A/T-ECU

Solenoid valve check (Refer On Vehicle Service.) — NG → **Replace**

OK ↓

Check the following connectors: A-87, B-111<Magna>, A-87, B-111 <Verada>. — NG → **Repair**

OK ↓

Harness check
- Between solenoid valve and Engine A/T-ECU — NG → **Repair**

OK ↓

Check the trouble symptoms. — NG → Replace the Engine A/T-ECU. CAUTION

Code No. 36, 52, 53 Damper clutch solenoid system	Probable cause
If the resistance value for the damper clutch solenoid is too large or too small, it is judged that there is a short-circuit or an open circuit in the damper clutch solenoid and diagnosis code No. 36 is output. If the drive duty rate for the damper clutch solenoid is 100 % for a continuous period of 4 seconds or more, it is judged that there is an abnormality in the damper clutch system and diagnosis code No. 52 is output. When diagnosis code No. 36 is output, the transmission is locked into 3rd gear as a fail-safe measure, and the N range light flashes at a frequency of 1 Hz. If the lock-up clutch remains engaged for a continuous period of 10 seconds when the Engine A/T-ECU is attempting to disengage the lock-up clutch, it is judged that the damper clutch is stuck on and diagnosis code No.53 is output.	• Malfunction of the damper clutch solenoid • Malfunction of connector • Malfunction of the Engine A/T-ECU

Torque converter clutch solenoid check (Refer On Vehicle Service.) — NG → **Replace**

OK ↓

Check the following connectors: A-87, B-111<Magna>, A-87, B-111 <Verada>. — NG → **Repair**

OK ↓

Harness check
- Between damper clutch solenoid and Engine A/T-ECU — NG → **Repair**

OK ↓

Replace the damper clutch solenoid.

↓

Check the trouble symptoms. — NG → Replace the Engine A/T-ECU. CAUTION

OK ↓

Only when code No.53 is output Refer INSPECTION PROCEDURE 6 Engine stalling when shifting check.

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Code No. 41 1st gear incorrect ratio	Probable cause
If the output from the output shaft speed sensor multiplied by the 1st gear ratio is not the same as the output from the input shaft speed sensor after shifting to 1st gear has been completed, diagnosis code No. 41 is output. If diagnosis code No. 41 is output four times, the transmission is locked into 3rd gear as a fail-safe measure, and the N range light flashes at a frequency of 1 Hz.	• Malfunction of the input shaft speed sensor • Malfunction of the output shaft speed sensor • Malfunction of the underdrive clutch retainer • Malfunction of the transfer drive gear or driven gear • Malfunction of the low and reverse brake system • Malfunction of the underdrive clutch system • Noise generated

MUT-II Self Diagnosis Check
Is the diagnosis code No. 22 output?

Yes → Code No. 22 Check Input shaft speed sensor system.

No ↓

MUT-II Self Diagnosis Check
Is the diagnosis code No. 23 output?

Yes → Code No. 23 Check Output shaft speed sensor system.

No ↓

Measure output waveform from the input shaft speed sensor. (using an oscilloscope)
- Connect the connector B-109 and B-111<Magna>, B-109 and B-111 <Verada> and measure voltage between 57 and 103 at the Engine A/T-ECU.
- Engine: 2,000 r/min [approx. 50 km/h]
- Selector lever position: 3

(Voltage)
OK: A waveform such as the one shown in (Inspection Procedure Using an Oscilloscope) is output (flashing between 0 ←→ 5V) and there is no noise appearing in the waveform.

NG →
- Replace the input shaft speed sensor.
- ↓ Check the trouble symptoms.
- NG ↓ A/T overhaul
  - Replace the underdrive clutch retainer.
- ↓ Check the trouble symptoms.
- NG ↓ Eliminate the cause of the noise.

OK ↓

Measure output waveform from the output shaft speed sensor. (using an oscilloscope)
- Connect the connector B-109 and B-111<Magna>, B-109 and B-111 <Verada> and measure voltage between 57 and 104 at the Engine A/T-ECU.
- Engine: 2,000 r/min [approx. 50 km/h]
- Selector lever position: 3

(Voltage)
OK: A waveform such as the one shown in (Inspection Procedure Using an Oscilloscope) is output (flashing between 0 ←→ 5V) and there is no noise appearing in the waveform.

NG →
- Replace the output shaft speed sensor.
- ↓ Check the trouble symptoms.
- NG ↓ A/T overhaul
  - Replace the transfer drive gear and driven gear.
- ↓ Check the trouble symptoms.
- NG ↓ Eliminate the cause of the noise.

OK ↓

A/T overhaul ★
- Replace the underdrive clutch. (No.42, No.43 or no diagnosis code is output.)
- Replace the low and reverse clutch. (No.46 or no diagnosis code is output.)

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Code No. 42 2nd gear incorrect ratio	Probable cause
If the output from the output shaft speed sensor multiplied by the 2nd gear ratio is not the same as the output from the input shaft speed sensor after shifting to 2nd gear has been completed, diagnosis code No. 42 is output. If diagnosis code No. 42 is output four times, the transmission is locked into 3rd gear as a fail-safe measure, and the N range light flashes at a frequency of 1 Hz.	• Malfunction of the input shaft speed sensor • Malfunction of the output shaft speed sensor • Malfunction of the underdrive clutch retainer • Malfunction of the transfer drive gear or driven gear • Malfunction of the second brake system • Malfunction of the underdrive clutch system • Noise generated

MUT-II Self Diagnosis
Is the diagnosis code No. 22 output?

Yes → Code No. 22 Check Input shaft speed sensor system.

No ↓

MUT-II Self Diagnosis
Is the diagnosis code No. 23 output?

Yes → Code No. 23 Check Output shaft speed sensor system.

No ↓

Measure output waveform from the input shaft speed sensor. (using an oscilloscope)
- Connect the connector B-109 and B-111<Magna>, B-109 and B-111 <Verada> and measure voltage between 57 and 103 at the Engine A/T-ECU.
- Engine: 2,000 r/min [approx. 50 km/h]
- Selector lever position: 3

(Voltage)
OK: A waveform such as the one shown in (Inspection Procedure Using an Oscilloscope) is output (flashing between 0 ←→ 5V) and there is no noise appearing in the waveform.

NG →
- Replace the input shaft speed sensor.
- ↓ Check the trouble symptoms.
- NG ↓ A/T overhaul
  - Replace the underdrive clutch retainer.
- ↓ Check the trouble symptoms.
- NG ↓ Eliminate the cause of the noise.

OK ↓

Measure output waveform from the output shaft speed sensor. (using an oscilloscope)
- Connect the connector B-109 and B-111<Magna>, B-109 and B-111 <Verada> and measure voltage between 57 and 103 at the Engine A/T-ECU.
- Engine: 2,000 r/min [approx. 50 km/h]
- Selector lever position: 3

(Voltage)
OK: A waveform such as the one shown in (Inspection Procedure Using an Oscilloscope) is output (flashing between 0 ←→ 5V) and there is no noise appearing in the waveform.

NG →
- Replace the output shaft speed sensor.
- ↓ Check the trouble symptoms.
- NG ↓ A/T overhaul
  - Replace the transfer drive gear and driven gear.
- ↓ Check the trouble symptoms.
- NG ↓ Eliminate the cause of the noise.

OK ↓

A/T overhaul ★
- Replace the underdrive clutch. (No.41, No.43 or no diagnosis code is output.)
- Replace the second clutch. (No.44 or no diagnosis code is output.)

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Code No. 43 3rd gear incorrect ratio	Probable cause
If the output from the output shaft speed sensor multiplied by the 3rd gear ratio is not the same as the output from the input shaft speed sensor after shifting to 3rd gear has been completed, diagnosis code No. 43 is output. If diagnosis code No. 43 is output four times, the transmission is locked into 3rd gear as a fail-safe measure, and the N range light flashes at a frequency of 1 Hz.	• Malfunction of the input shaft speed sensor • Malfunction of the output shaft speed sensor • Malfunction of the underdrive clutch retainer • Malfunction of the transfer drive gear or driven gear • Malfunction of the underdrive clutch system • Malfunction of the overdrive clutch system • Noise generated

MUT-II Self Diagnosis
Is the diagnosis code No. 22 output?

Yes → Code No. 22 Check Input shaft speed sensor system.

No ↓

MUT-II Self Diagnosis
Is the diagnosis code No. 23 output?

Yes → Code No. 23 Check Output shaft speed sensor system.

No ↓

Measure output waveform from the input shaft speed sensor. (using an oscilloscope)
- Connect the connector B-109 and B-111<Magna>, B-109 and B-111 <Verada> and measure voltage between 57 and 103 at the Engine A/T-ECU.
- Engine: 2,000 r/min [approx. 50 km/h]
- Selector lever position: 3

(Voltage)
OK: A waveform such as the one shown in (Inspection Procedure Using an Oscilloscope) is output (flashing between 0 ←→ 5V) and there is no noise appearing in the waveform.

NG →
- Replace the input shaft speed sensor.
- Check the trouble symptoms.
- NG ↓
- A/T overhaul
  - Replace the underdrive clutch retainer.
- Check the trouble symptoms.
- NG ↓
- Eliminate the cause of the noise.

OK ↓

Measure output waveform from the output shaft speed sensor. (using an oscilloscope)
- Connect the connector B-109 and B-111<Magna>, B-109 and B-111 <Verada> and measure voltage between 57 and 103 at the Engine A/T-ECU.
- Engine: 2,000 r/min [approx. 50 km/h]
- Selector lever position: 3

(Voltage)
OK: A waveform such as the one shown in (Inspection Procedure Using an Oscilloscope) is output (flashing between 0 ←→ 5V) and there is no noise appearing in the waveform.

NG →
- Replace the output shaft speed sensor.
- Check the trouble symptoms.
- NG ↓
- A/T overhaul
  - Replace the transfer drive gear and driven gear.
- Check the trouble symptoms.
- NG ↓
- Eliminate the cause of the noise.

OK ↓

A/T overhaul
- Replace the underdrive clutch. (No.41, No.42 or no diagnosis code is output.)
- Replace the overdrive clutch. (No.44 or no diagnosis code is output.)

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Code No. 44 4th gear incorrect ratio	Probable cause
If the output from the output shaft speed sensor multiplied by the 4th gear ratio is not the same as the output from the input shaft speed sensor after shifting to 4th gear has been completed, diagnosis code No. 44 is output. If diagnosis code No. 44 is output four times, the transmission is locked into 3rd gear as a fail-safe measure, and the N range light flashes at a frequency of 1 Hz.	• Malfunction of the input shaft speed sensor • Malfunction of the output shaft speed sensor • Malfunction of the underdrive clutch retainer • Malfunction of the transfer drive gear or driven gear • Malfunction of the second brake system • Malfunction of the overdrive clutch system • Noise generated

MUT-II Self Diagnosis
Is the diagnosis code No. 22 output?

Yes → Code No. 22 Check Input shaft speed sensor system.

No ↓

MUT-II Self Diagnosis
Is the diagnosis code No. 23 output?

Yes → Code No. 23 Check Output shaft speed sensor system.

No ↓

Measure output waveform from the input shaft speed sensor. (using an oscilloscope)
- Connect the connector B-109 and B-111<Magna>, B-109 and B-111 <Verada> and measure voltage between 57 and 103 at the Engine A/T-ECU.
- Engine: 2,000 r/min [approx. 50 km/h]
- Selector lever position: 3

(Voltage)
OK: A waveform such as the one shown in (Inspection Procedure Using an Oscilloscope) is output (flashing between 0 ←→ 5V) and there is no noise appearing in the waveform.

NG →
- Replace the input shaft speed sensor.
- Check the trouble symptoms.
- NG ↓ A/T overhaul
  - Replace the underdrive clutch retainer.
- Check the trouble symptoms.
- NG ↓ Eliminate the cause of the noise.

OK ↓

Measure output waveform from the output shaft speed sensor. (using an oscilloscope)
- Connect the connector B-109 and B-111<Magna>, B-109 and B-111 <Verada> and measure voltage between 57 and 104 at the Engine A/T-ECU.
- Engine: 2,000 r/min [approx. 50 km/h]
- Selector lever position: 3

(Voltage)
OK: A waveform such as the one shown in (Inspection Procedure Using an Oscilloscope) is output (flashing between 0 ←→ 5V) and there is no noise appearing in the waveform.

NG →
- Replace the output shaft speed sensor.
- Check the trouble symptoms.
- NG ↓ A/T overhaul
  - Replace the transfer drive gear and driven gear.
- Check the trouble symptoms.
- NG ↓ Eliminate the cause of the noise.

OK ↓

A/T overhaul
- Replace the second brake. (No.42 or no diagnosis code is output.)
- Replace the overdrive clutch. (No.43 or no diagnosis code is output.)

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Code No. 46 Reverse gear incorrect ratio	Probable cause
If the output from the output shaft speed sensor multiplied by the reverse gear ratio is not the same as the output from the input shaft speed sensor after shifting to reverse gear has been completed, diagnosis code No. 46 is output. If diagnosis code No. 46 is output four times, the transmission is locked into 3rd gear as a fail-safe measure, and the N range light flashes at a frequency of 1 Hz.	• Malfunction of the input shaft speed sensor • Malfunction of the output shaft speed sensor • Malfunction of the underdrive clutch retainer • Malfunction of the transfer drive gear or driven gear • Malfunction of the low and reverse brake system • Malfunction of the reverse clutch system • Noise generated

MUT-II Self Diagnosis
Is the diagnosis code No. 22 output?

Yes → Code No. 22 Check Input shaft speed sensor system.

No ↓

MUT-II Self Diagnosis
Is the diagnosis code No. 23 output?

Yes → Code No. 23 Check Output shaft speed sensor system.

No ↓

Measure output waveform from the input shaft speed sensor. (using an oscilloscope)
- Connect the connector B-109 and B-111<Magna>, B-109 and B-111 <Verada> and measure voltage between 57 and 103 at the Engine A/T-ECU.
- Engine: 2,000 r/min [approx. 50 km/h]
- Selector lever position: 3

(Voltage)
OK: A waveform such as the one shown in (Inspection Procedure Using an Oscilloscope) is output (flashing between 0 ←→ 5V) and there is no noise appearing in the waveform.

NG →
- Replace the input shaft speed sensor.
- Check the trouble symptoms.
- NG → A/T overhaul
  - Replace the underdrive clutch retainer.
- Check the trouble symptoms.
- NG → Eliminate the cause of the noise.

OK ↓

Measure output waveform from the output shaft speed sensor. (using an oscilloscope)
- Connect the connector B-109 and B-111 <Magna>, B-109 and B-111 <Verada> and measure voltage between 57 and 104 at the Engine A/T-ECU.
- Engine: 2,000 r/min [approx. 50 km/h]
- Selector lever position: 3

(Voltage)
OK: A waveform such as the one shown in (Inspection Procedure Using an Oscilloscope) is output (flashing between 0 ←→ 5V) and there is no noise appearing in the waveform.

NG →
- Replace the output shaft speed sensor.
- Check the trouble symptoms.
- NG → A/T overhaul
  - Replace the transfer drive gear and driven gear.
- Check the trouble symptoms.
- NG → Eliminate the cause of the noise.

OK ↓

A/T overhaul
- Replace the low and reverse brake. (No.41 or no diagnosis code is output.)
- Replace the reverse clutch. (No diagnosis code is output.)

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Code No. 51 Abnormal communication with Engine A/T-ECU	Probable cause
If normal communication is not possible for a continuous period of 1 second or more when the battery voltage is 10 V or more and the engine speed is 450 r/min or more, diagnosis code No. 51 is output. Diagnosis code No. 51 is also output if the data being received is abnormal for a continuous period of 4 seconds under the same conditions.	• Malfunction of the Engine A/T-ECU

Replace the Engine A/T-ECU. CAUTION

Code No. 54 A/T Control relay system	Probable cause
If the control relay voltage is less than 7 V after the ignition switch has been turned to ON, it is judged that there is an open circuit or a short-circuit in the A/T control relay earth and diagnosis code No. 54 is output. The transmission is locked into 3rd gear as a fail-safe measure, and the N range light flashes at a frequency of 1 Hz.	• Malfunction of the A/T control relay • Malfunction of connector • Malfunction of the Engine A/T-ECU

Code No. 56 N range light system	Probable cause
If the N range signal is off after an N range light illumination instruction (ON instruction) has been given, it is judged that there is a short-circuit in the N range light earth and diagnosis code No. 56 is output.	• Malfunction of connector • Malfunction of the Engine A/T-ECU

Code No. 71 Malfunction of Engine A/T-ECU	Probable cause
There is an abnormality in the Engine A/T-ECU. The transmission is locked into 3rd gear as a fail-safe measure.	• Malfunction of the Engine A/T-ECU

Replace the Engine-A/T-ECU. CAUTION

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INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble symptom		Inspection procedure No.
Communication with the MUT-II is not possible		1
Driving impossible	Starting impossible	2
	Does not move forward	3
	Does not reverse	4
	Does not move (forward or reverse)	5
Malfunction when starting	Engine stalling when shifting	6
	Shocks when changing from N to D and long time lag	7
	Shocks when changing from N to R and long time lag	8
	Shocks when changing from N to D, N to R and long time lag	9
Malfunction when shifting	Shocks and running up	10
Displaced shifting points	All points	11
	Some points	12
Does not shift	No diagnosis codes	13
Malfunction while driving	Poor acceleration	14
	Vibration	15
Idle position switch system		16
Dual pressure switch system		17
Vehicle speed sensor system		18
Cruise control -ECU signal system		19

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INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

INSPECTION PROCEDURE 1

Communication with the MUT-II is not possible	Probable cause
If communication with the MUT-II is not possible, the cause is probably a defective diagnosis line or the Engine A/T-ECU is not functioning.	• Malfunction of diagnosis line • Malfunction of connector • Malfunction of the Engine A/T-ECU

INSPECTION PROCEDURE 2

Starting impossible	Probable cause
Starting is not possible when the selector lever is in P or N range. In such cases, the cause is probably a defective engine system, torque converter or oil pump or seized oil pump.	• Malfunction of the engine system • Malfunction of the torque converter • Malfunction of the oil pump

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INSPECTION PROCEDURE 3

Does not move (forward)	Probable cause
If the vehicle does not move forward when the selector lever is shifted from N to D, 3, 2 or L range while the engine is idling, the cause is probably abnormal line pressure or a malfunction of the underdrive clutch or valve body.	• Abnormal line pressure • Malfunction of the underdrive solenoid valve • Malfunction of the underdrive clutch • Malfunction of the valve body

INSPECTION PROCEDURE 4

Does not reverse	Probable cause
If the vehicle does not reverse when the selector lever is shifted from N to R range while the engine is idling, the cause is probably abnormal pressure in the reverse clutch or low and reverse brake or a malfunction of the reverse clutch, low and reverse brake or valve body.	• Abnormal reverse clutch pressure • Abnormal low and reverse brake pressure • Malfunction of the low and reverse solenoid valve • Malfunction of the reverse clutch • Malfunction of the low and reverse brake • Malfunction of the valve body

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INSPECTION PROCEDURE 5

Does not move (forward or reverse)	Probable cause
If the vehicle does not move forward or reverse when the selector lever is shifted to any position while the engine is idling, the cause is probably abnormal line pressure, or a malfunction of the power train, oil pump or valve body.	• Abnormal line pressure • Malfunction of power train • Malfunction of the oil pump • Malfunction of the valve body

Check Hydraulic pressure
- Measure the hydraulic pressure for each element when moving forward and back.
  Standard Value: Refer Specifications.

OK → Power train check
- Disassemble the transmission, check the condition of the planetary carrier, output shaft and differential, etc.

NG ↓

Replace the oil pump assembly.
(The oil pump cannot be disassembled.)

NG → Valve body disassembly, cleaning and reassembly
- Pay particular attention to loosening of bolts, and to damage and slippage of O-rings, valves and valve bodies.
- If the damage cannot be repaired, replace the valve body assembly.

INSPECTION PROCEDURE 6

Engine stalling when shifting	Probable cause
If the engine stalls when the selector lever is shifted from N to D or R range while the engine is idling, the cause is probably a malfunction of the engine system, damper clutch control solenoid, valve body or torque converter (damper clutch malfunction).	• Malfunction of the engine system • Malfunction of the damper clutch control solenoid • Malfunction of the valve body • Malfunction of the torque converter (Malfunction of the damper clutch)

Engine system check
- Check the control system, ignition system, fuel system and main system.

NG → **Repair, replace**

OK ↓

Replace the damper clutch control solenoid.

↓

Valve body disassembly, cleaning and reassembly
- Pay particular attention to loosening of bolts, and to damage and slippage of O-rings, valves and valve bodies.
- If the damage cannot be repaired, replace the valve body assembly.

NG → Replace the torque converter.

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INSPECTION PROCEDURE 7

Shocks when changing from N to D and large time lag	Probable cause
If abnormal shocks or a time lag of 2 seconds or more occur when the selector lever is shifted from N to D range while the engine is idling, the cause is probably abnormal underdrive clutch pressure or a malfunction of the underdrive clutch, valve body or idle position switch.	• Abnormal underdrive clutch pressure • Malfunction of the underdrive solenoid valve • Malfunction of the underdrive clutch • Malfunction of the valve body • Malfunction of the idle position switch

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INSPECTION PROCEDURE 8

Shocks when changing from N to R and large time lag	Probable cause
If abnormal shocks or a time lag of 2 seconds or more occurs when the selector lever is shifted from N to R range while the engine is idling, the cause is probably abnormal reverse clutch pressure or low and reverse brake pressure, or a malfunction of the reverse clutch, low and reverse brake, valve body or idle position switch.	• Abnormal reverse clutch pressure • Abnormal low and reverse brake pressure • Malfunction of the low and reverse solenoid valve • Malfunction of the reverse clutch • Malfunction of the low and reverse brake • Malfunction of the valve body • Malfunction of the idle position switch

INSPECTION PROCEDURE 9

Shocks when changing from N to D, N to R and large time lag	Probable cause
If abnormal shocks or a time lag of 2 seconds or more occur when the selector lever is shifted from N to D range and from N to R range while the engine is idling, the cause is probably abnormal line pressure or a malfunction of the oil pump or valve body.	• Abnormal line pressure • Malfunction of the oil pump • Malfunction of the valve body

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INSPECTION PROCEDURE 10

Shocks and running up	Probable cause
If shocks occur when driving due to upshifting or downshifting and the transmission speed becomes higher than the engine speed, the cause is probably abnormal line pressure or a malfunction of a solenoid valve, oil pump, valve body or of a brake or clutch.	• Abnormal line pressure • Malfunction of each solenoid valve • Malfunction of the oil pump • Malfunction of the valve body • Malfunction of each brake or each clutch

MUT-II Actuator Test
- No. 1 Low and reverse solenoid valve
- No. 2 Underdrive solenoid valve
- No. 3 Second solenoid valve
- No. 4 Overdrive solenoid valve

OK: Sound of operation can be heard.

NG → Replace the solenoid valve.

OK ↓

Adjust the line pressure. (Refer On Vehicle Service.)

NG → Replace the oil pump assembly. (The oil pump cannot be disassembled.)

NG ↓

Valve body disassembly, cleaning and reassembly
- Pay particular attention to loosening of bolts, and to damage and slippage of O-rings, valves and valve bodies.
- If the damage cannot be repaired, replace the valve body assembly.

OK ↓

Clutch and brake check ★
- Check for burning of the facing, defective piston seal rings and interference at the retainer.

INSPECTION PROCEDURE 11

All points (Displaced shifting points)	Probable cause
If all shift points are displaced while driving, the cause is probably a malfunction of the output shaft speed sensor, TPS or of a solenoid valve.	• Malfunction of the output shaft speed sensor • Malfunction of the throttle position sensor • Malfunction of each solenoid valve • Abnormal line pressure • Malfunction of the valve body • Malfunction of the Engine A/T-ECU

MUT-II Data list
- No. 23 Output shaft speed sensor

OK: Increases in proportion to vehicle speed.

NG → Code No. 23 – Check Output shaft speed sensor system

OK ↓

MUT-II Data list
- No. 11 TPS

OK: Increases in proportion to accelerator pedal opening angle

NG → Code No. 11, 12, 14 Check TPS system

OK ↓

MUT-II Data list
- No. 31 Low and reverse solenoid valve duty %
- No. 32 Underdrive solenoid valve duty %
- No. 33 Second solenoid valve duty %
- No. 34 Overdrive solenoid valve duty %

OK: Refer to the table below.

NG → Replace the solenoid valve.

NG ↓

Replace the Engine A/T-ECU. CAUTION

OK ↓

Adjust the line pressure. (Refer On Vehicle Service.)

NG → Valve body disassembly, cleaning and reassembly ★
- Pay particular attention to loosening of bolts, and to damage and slippage of O-rings, valves and valve bodies.
- If the damage cannot be repaired, replace the valve body assembly.

	No. 31	No. 32	No. 33	No. 34
Driving at constant speed in 1st gear	0 %	0 %	100 %	100 %
Driving at constant speed in 2nd gear	100 %	0 %	0 %	100 %
Driving at constant speed in 3rd gear	100 %	0 %	100 %	0 %
Driving at constant speed in 4th gear	100 %	100 %	0 %	0 %

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INSPECTION PROCEDURE 12

Some points (Displaced shifting points)	Probable cause
If some of the shift points are displaced while driving, the cause is probably a malfunction of the valve body, or it is related to control and is not an abnormality.	• Malfunction of the valve body

INSPECTION PROCEDURE 13

No diagnosis codes (Does not shift)	Probable cause
If shifting does not occur while driving and no diagnosis codes are output, the cause is probably a malfunction of the Inhibitor switch, or Engine A/T-ECU.	• Malfunction of the Inhibitor switch • Malfunction of the Engine A/T-ECU

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INSPECTION PROCEDURE 14

Poor acceleration	Probable cause
If acceleration is poor even if downshifting occurs while driving, the cause is probably a malfunction of the engine system or of a brake or clutch.	• Malfunction of the engine system • Malfunction of the brake or clutch

Engine system check
- Check the control system, ignition system, fuel system and main system.

NG → **Replace, repair**

OK ↓

Brake or clutch check
- Check for burning of the facing, defective piston seal rings and interference at the retainer.

INSPECTION PROCEDURE 15

Vibration	Probable cause
If vibration occurs when driving at constant speed or when accelerating in top range, the cause is probably abnormal damper clutch pressure or a malfunction of the engine system, damper clutch solenoid, torque converter or valve body.	• Abnormal damper clutch pressure • Malfunction of the engine system • Malfunction of the damper clutch solenoid • Malfunction of the torque converter • Malfunction of the valve body

MUT-II Actuator Test
- No. 6 Damper clutch solenoid
  OK: Sound of operation can be heard.

NG → Replace the damper clutch solenoid valve.

OK ↓

Does the problem occur even when the oil temperature sensor connector is disconnected?

Yes → Engine system check
- Check the control system, ignition system, fuel system and main system.

No ↓

Check Hydraulic pressure
- Measure the damper clutch pressure.
  Standard Value: Refer Specifications

NG → Valve body disassembly, cleaning and reassembly
- Pay particular attention to loosening of bolts, and to damage and slippage of O-rings, valves and valve bodies.
- If the damage cannot be repaired, replace the valve body assembly.

OK ↓

Replace the torque converter assembly.

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INSPECTION PROCEDURE 16

Idle position switch system	Probable cause
The cause is probably a defective idle position switch circuit or a defective Engine A/T-ECU circuit.	• Malfunction of the idle position switch • Malfunction of connector • Malfunction of the Engine A/T-ECU

INSPECTION PROCEDURE 17

Dual pressure switch system	Probable cause
The cause is probably a defective dual pressure switch circuit or a defective Engine A/T-ECU.	• Malfunction of the dual pressure switch • Malfunction of connector • Malfunction of A/C system • Malfunction of the Engine A/T-ECU

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INSPECTION PROCEDURE 18

Vehicle speed sensor system	Probable cause
A malfunction may exist in the speed sensor circuit or the Engine A/T-ECU.	• Malfunction of the vehicle speed sensor • Malfunction of the connector • Malfunction of the Engine A/T-ECU

INSPECTION PROCEDURE 19

Cruise control -ECU signal system	Probable cause
A malfunction may exist in the cruise control signal line circuit or the Engine A/T-ECU.	• Malfunction of connector • Malfunction of the Engine A/T-ECU • Malfunction of the cruise control ECU

23B AUTOMATIC TRANSMISSION OVERHAUL

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GENERAL INFORMATION

1. The combination of highest-precision electronic and mechanical technology heralds a new era in automatic transmission performance.
2. The gear shifting clutches use a hydraulic balancing mechanism to enable gear shifting at extra-high engine speeds.
3. The number of shafts has been decreased to two and increased use has been made of metal plates which all contributes to reduce the weight.
4. Increased meshing ratios and improved rigidity of the gear supports and casing result in less noise.
5. In addition, adoption of a newly-developed automatic transmission fluid (ATF) increases the service life of the fluid.
6. The number of oil cooler feed tubes is increased to two.

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SECTIONAL VIEW

<F4A51>

1. Reverse clutch
2. Planetary carrier assembly
3. Second brake
4. Low-reverse brake
5. Output planetary carrier
6. One-way clutch
7. Transmission case
8. Transfer drive gear
9. Underdrive clutch
10. Torque converter
11. Torque converter clutch
12. Input shaft
13. Oil pump
14. Converter housing
15. Differential
16. Transfer driven gear
17. Output shaft
18. Rear cover
19. Overdrive clutch

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HYDRAULIC CIRCUIT

1. Reverse clutch
2. Low-reverse brake
3. Second brake
4. Underdrive clutch
5. Overdrive clutch
6. Low-reverse accumulator
7. Second accumulator
8. Underdrive accumulator
9. Overdrive accumulator
10. Torque converter clutch
11. Fail-safe valve A
12. Fail-safe valve B
13. Torque converter clutch control valve
14. Switching valve
15. Low-reverse pressure control valve
16. Second pressure control valve
17. Underdrive pressure control valve
18. Overdrive pressure control valve
19. Torque converter clutch control solenoid valve
20. Low-reverse solenoid valve
21. Second solenoid valve
22. Underdrive solenoid valve
23. Overdrive solenoid valve
24. Torque converter pressure control valve
25. Regulator valve
26. Manual valve
27. Oil filter
28. Oil filter
29. Oil pan
30. Oil pump
31. Relief valve
32. Oil strainer

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SPECIFICATIONS

GENERAL SPECIFICATIONS

Items		Specifications	
Model		F4A51-2-EZB<6G72>, F4A51-2-BZB<6G74>	
Type		Electronically controlled 4-speed full-automatic	
Torque converter	Type	3-element with torque converter clutch	
	Engine stall speed	2100 – 2600 r/min.	
	Stall torque ratio	2.0	
Gear ratio		6G72	6G74
	1st	2.849	3.036
	2nd	1.499	1.597
	3rd	1.002	1.068
	4th	0.733	0.781
	Reverse	2.726	2.906
Final gear ratio		3.735	3.274

SERVICE SPECIFICATIONS

Items	Standard value
Output shaft preload mm	0.01 – 0.09
Brake reaction plate end play mm	0 – 0.16
Low-reverse brake end play mm	1.65 – 2.11
Second brake end play mm	1.09 – 1.55
Underdrive sun gear end play mm	0.25 – 0.45
Input shaft end play mm	0.70 – 1.45
Differential case preload mm	0.045 – 0.105
Underdrive clutch end play mm	1.60 – 1.80
Reverse and overdrive clutch return spring end play mm	0 – 0.09
Overdrive clutch end play mm	1.6 – 1.8
Reverse clutch end play mm	1.5 – 1.6
Backlash between differential side gear and pinion mm	0.025 – 0.150

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VALVE BODY SPRING IDENTIFICATION TABLE

Spring	Wire diameter mm	Outside diameter mm	Free length mm	Number of loops
Regulator valve spring	1.8	15.7	86.7	24
Underdrive pressure control valve spring	0.7	7.6	37.7	25
Overdrive pressure control valve spring	0.7	7.6	37.7	25
Low-reverse pressure control valve spring	0.7	7.6	37.7	25
Second pressure control valve spring	0.7	7.6	37.7	25
Torque converter spring	1.6	11.2	34.4	12.5
Torque converter clutch control valve spring	0.7	5.9	28.1	19
Fail-safe valve A spring	0.7	8.9	21.9	9.5
Damping valve spring	1.0	7.7	35.8	17
Line relief valve spring	1.0	7.0	17.3	10
Orifice check ball spring	0.5	4.5	17.2	15

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SNAP RING, SPACER, THRUST WASHER, THRUST RACE AND PRESSURE PLATE FOR ADJUSTMENT

Thrust washer (For adjustment of input shaft end play)

Thickness mm	Identification symbol	Part No.	Thickness mm	Identification symbol	Part No.
1.8	18	MD754509	2.4	24	MD753793
2.0	20	MD754508	2.6	26	MD753794
2.2	22	MD754507	2.8	28	MD753795

Snap ring (For adjustment of underdrive clutch and overdrive clutch end plays)

Thickness mm	Identification symbol	Part No.	Thickness mm	Identification symbol	Part No.
1.6	None	MD759660	2.4	Brown	MD750845
1.7	Blue	MD759661	2.5	None	MD750846
1.8	Brown	MD759662	2.6	Blue	MD750847
1.9	None	MD758892	2.7	Brown	MD750848
2.0	Blue	MD750841	2.8	None	MD750849
2.1	Brown	MD750842	2.9	Blue	MD750850
2.2	None	MD750843	3.0	Brown	MD750851
2.3	Blue	MD750844			

Snap ring (For adjustment of low-reverse brake and second brake reaction plates end plays)

Thickness mm	Identification symbol	Part No.	Thickness mm	Identification symbol	Part No.
2.2	Blue	MD756784	2.4	None	MD758552
2.3	Brown	MD756785	2.5	Blue	MD758553

Pressure plate (For adjustment of low-reverse brake end play)

Thickness mm	Identification symbol	Part No.	Thickness mm	Identification symbol	Part No.
1.6	F	MD759568	2.4	B	MD759428
1.8	E	MD759425	2.6	A	MD759429
2.0	D	MD759426	2.8	0	MD759430
2.2	C	MD759427	3.0	1	MD759431

Pressure plate (For adjustment of second brake end play)

Thickness mm	Identification symbol	Part No.	Thickness mm	Identification symbol	Part No.
1.8	E	MD759425	2.4	B	MD759428
2.0	D	MD759426	2.6	A	MD759429
2.2	C	MD759427	2.8	0	MD759430

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Snap ring (For adjustment of reverse clutch end play)

Thickness mm	Identification symbol	Part No.	Thickness mm	Identification symbol	Part No.
1.6	None	MD761088	2.3	Blue	MD756693
1.7	Blue	MD761089	2.4	Brown	MD756694
1.8	Brown	MD761090	2.5	None	MD756695
1.9	None	MD758947	2.6	Blue	MD756696
2.0	Blue	MD756690	2.7	Brown	MD756697
2.1	Brown	MD756691	2.8	None	MD756698
2.2	None	MD756692			

Snap ring (For adjustment of reverse clutch and overdrive clutch spring retainers end plays)

Thickness mm	Identification symbol	Part No.	Thickness mm	Identification symbol	Part No.
1.48	Brown	MD755600	1.58	Blue	MD755602
1.53	None	MD755601	1.63	Brown	MD755603

Thrust race (For adjustment of underdrive sun gear end play)

Thickness mm	Identification symbol	Part No.	Thickness mm	Identification symbol	Part No.
1.6	–	MD707267	2.2	–	MD723065
1.7	–	MD759681	2.3	–	MD754796
1.8	–	MD723064	2.4	–	MD724358
1.9	–	MD754794	2.5	–	MD754797
2.0	–	MD707268	2.6	–	MD754798
2.1	–	MD754795			

Spacer (For adjustment of output shaft preload)

Thickness mm	Identification symbol	Part No.	Thickness mm	Identification symbol	Part No.
1.88	88	MD756579	2.36	36	MD756591
1.92	92	MD756580	2.40	40	MD756592
1.96	96	MD756581	2.44	44	MD756593
2.00	00	MD756582	2.48	48	MD756594
2.04	04	MD756583	2.52	52	MD756595
2.08	08	MD756584	2.56	56	MD756596
2.12	12	MD756585	2.60	60	MD756597
2.16	16	MD756586	2.64	64	MD756598
2.20	20	MD756587	2.68	68	MD756599
2.24	24	MD756588	2.72	72	MD760685
2.28	28	MD756589	2.76	76	MD760686
2.32	32	MD756590			

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Spacer (For adjustment of differential case preload)

Thickness mm	Identification symbol	Part No.	Thickness mm	Identification symbol	Part No.
0.71	71	MD754475	1.07	07	MD720945
0.74	74	MD727660	1.10	J	MD710454
0.77	77	MD754476	1.13	D	MD700270
0.80	80	MD727661	1.16	K	MD710455
0.83	83	MD720937	1.19	L	MD710456
0.86	86	MD720938	1.22	G	MD700271
0.89	89	MD720939	1.25	M	MD710457
0.92	92	MD720940	1.28	N	MD710458
0.95	95	MD720941	1.31	E	MD706574
0.98	98	MD720942	1.34	O	MD710459
1.01	01	MD720943	1.37	P	MD710460
1.04	04	MD720944			

Spacer (For adjustment of backlash between differential side gear and pinion)

Thickness mm	Identification symbol	Part No.	Thickness mm	Identification symbol	Part No.
0.75 – 0.82	–	MD722986	1.01 – 1.08	–	MD722982
0.83 – 0.92	–	MD722985	1.09 – 1.16	–	
0.93 – 1.00	–	MD722984			MD722983

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TORQUE SPECIFICATIONS

Items		Nm
Transmission	Roll stopper bracket	69
	Wiring harness bracket	23
	Control cable bracket	23
	Eye bolt	30
	Oil cooler feed tube	9.8
	Oil filter	12
	Input shaft speed sensor	11
	Output shaft speed sensor	11
	Manual control lever	22
	Park/neutral position switch (PNP switch)	11
	Speedometer gear	4.9
	Valve body cover	11
	Valve body mounting bolt	11
	Fluid temperature sensor	11
	Manual control shaft detent	5.9
	Rear cover	23
	Torque converter housing	47
	Oil pump	23
	Transfer drive gear	34
	Output shaft lock nut	167
	Output shaft bearing retainer	23
Components	Differential drive gear	132
	Valve body	11
	Solenoid valve support	5.9
	Plate	5.9

SEALANTS

Items	Specified sealant
Rear cover	Mitsubishi genuine sealant Part No. MD974421 or equivalent
Torque converter housing	Mitsubishi genuine sealant Part No. MD974421 or equivalent
Valve body cover	Mitsubishi genuine sealant Part No. MD974421 or equivalent

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SPECIAL TOOLS

Tool	Tool number and name	Supersession	Application
	MB990607 Torque wrench socket	E19M50–6	Removal and installation of output shaft lock nut
	MB990930 Installer adaptor	–	Installation of output shaft bearing outer race
	MB990931 Installer adaptor	–	Installation of cap
	MB990936 Installer adaptor	–	Installation of differential taper roller bearing outer race
	MB990937 Installer adaptor	–	Installation of output shaft taper roller bearing outer race
	MB990938 Handle	–	• Installation of input shaft rear bearing • Use with installer adaptor
	MB991625 Special socket (41)	–	Removal and installation of output shaft lock nut
	MB991629 Spring compressor	EMB991629	Measurement of underdrive clutch and overdrive clutch end plays

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Tool	Tool number and name	Supersession	Application
	MB991632 Clearance dummy plate	–	Measurement of low-reverse brake and second brake end play
	MD998333 Oil pump remover	–	Removal of oil pump
	MD998334 Oil seal installer	E9055 (17-010A)	Installation of oil pump oil seal
	MD998338 Spring compressor	EMD998338	Removal and installation of low-reverse brake snap ring
	MD998348 Bearing and gear puller	E21M16D	Removal of transfer drive gear bearing
	MD998350 Bearing installer	E7513A	Installation of output shaft
	MD998412 Guide	–	Installation of oil pump and transfer drive gear
	MD998800 Oil seal installer	E21M14A	Installation of drive shaft oil seal
	MD998801 Bearing remover	–	Removal of each bearing

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Tool	Tool number and name	Supersession	Application
	MD998812 Installer cap	–	Use with installer and installer adaptor
	MD998813 Installer – 100	–	Use with installer cap and installer adaptor
	MD998814 Installer – 200	–	Use with installer cap and installer adaptor
	MD998824 Installer adaptor (50)	–	• Installation of transfer drive gear • Installation of output shaft taper roller bearing
	MD998827 Installer adaptor	–	Installation of output shaft taper roller bearing
	MD998907 Spring compressor	E21M43	Removal and installation of underdrive clutch snap ring
	MD998913 Dial gauge extension	E21M44	Measurement of low-reverse brake and second brake end plays
	MD998917 Bearing remover	–	Removal of output shaft taper roller bearing
	MD998924 Spring compressor retainer	–	• Removal and installation of low-reverse brake snap ring • Measurement of underdrive clutch and overdrive clutch end plays

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Tool	Tool number and name	Supersession	Application
	MD999590 Spring compressor	EMD999590	Removal and installation of overdrive clutch snap ring

FORM–IN–PLACE GASKET

The transmission has several areas where the form–in–place gasket (FIPG) is in use. To ensure that the gasket fully serves its purpose, it is necessary to observe some precautions when applying the gasket. Bead size, continuity and location are of paramount importance. Too thin a bead could cause leaks. Too thick a bead, on the other hand, could be squeezed out of location, causing blocking or narrowing of the fluid feed line. To eliminate the possibility of leaks from a joint, therefore, it is absolutely necessary to apply the gasket evenly without a break, while observing the correct bead size.

DISASSEMBLY

The parts assembled with the FIPG can be easily disassembled without use of a special method. In some cases, however, the sealant between the joined surfaces may have to be broken by lightly striking with a mallet or similar tool. A flat and thin gasket scraper may be lightly hammered in between the joined surfaces. In this case, however, care must be taken to prevent damage to the joined surfaces.

SURFACE PREPARATION

Thoroughly remove all substances deposited on the gasket application surfaces, using a gasket scraper or wire brush. Check to ensure that the surfaces to which the FIPG is to be applied is flat. Make sure that there are no oils, greases and foreign substances deposited on the application surfaces. Do not forget to remove the old sealant remaining in the bolt holes.

FORM–IN–PLACE GASKET APPLICATION (FIPG)

When assembling parts with the FIPG, you must observe some precautions, but the procedure is very simple as in the case of a conventional pre–cut gasket. Applied FIPG bead should be of the specified size and without breaks. Also be sure to encircle the bolt hole circumference with a completely continuous bead. The FIPG can be wiped away unless it is hardened. While the FIPG is still moist (in less than 15 minutes), mount the parts in position. When the parts are mounted, make sure that the gasket is applied to the required area only. In addition, do not apply any oil to the sealing locations or start the engine until a sufficient amount of time (about one hour) has passed after installation is completed. The FIPG application procedure may vary on different areas. Observe the procedure described in the text when applying the FIPG.

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TRANSMISSION

DISASSEMBLY AND REASSEMBLY

Lubricate all internal parts with automatic transmission fluid during reassembly.

1. Torque converter
2. Roll stopper bracket
3. Harness bracket
4. Control cable support bracket
5. Oil level gauge
6. Input shaft speed sensor
7. Output shaft speed sensor
8. Manual control lever
9. Park/neutral position switch
10. Speedometer gear
11. Valve body cover
12. Manual control shaft detent

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13. Fluid temperature sensor
14. Valve body
15. Steel ball
16. Gasket
17. Snap ring
18. Solenoid valve harness
19. Strainer
20. Second brake retainer oil seal
21. Accumulator piston
22. Accumulator spring
23. Accumulator spring
24. Manual control lever shaft roller
25. Manual control lever shaft
26. Parking pawl rod

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Lubricate all internal parts with automatic transmission fluid during reassembly.

27. Torque converter housing
28. Differential
29. Oil filter
30. Oil pump
31. Gasket
32. Thrust washer #1
33. Underdrive clutch and input shaft
34. Thrust bearing #2
35. Underdrive clutch hub
36. Outer race
37. Spacer

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No. of Brake Discs and Plates

Brake	Brake Disc	Brake Plate
Low-reverse brake	6	5
Second brake	4	3

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38. Rear cover
39. Thrust race #8
40. Seal ring
41. Input shaft rear bearing
42. Thrust bearing #7
43. Reverse and overdrive clutch
44. Thrust bearing #6
45. Overdrive clutch hub
46. Thrust bearing #5
47. Planetary reverse sun gear
48. Snap ring
49. Second brake piston
50. Return spring
51. Pressure plate
52. Second brake disc
53. Second brake plate
54. Overdrive planetary carrier
55. Snap ring
56. Reaction plate
57. Snap ring
58. Low-reverse brake disc
59. Low-reverse brake plate
60. Pressure plate
61. Wave spring
62. Parking pawl shaft
63. Spacer
64. Parking pawl spring
65. Parking roller support shaft
66. Parking pawl
67. Parking roller support
68. Snap ring
69. One-way clutch inner race
70. O-ring
71. Spring retainer
72. Return spring
73. Low-reverse brake piston
74. Transfer drive gear
75. Cap
76. Lock nut
77. Output shaft
78. Taper roller bearing
79. Collar
80. Outer race
81. Spacer
82. Snap ring
83. Outer race
84. Transmission case

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DISASSEMBLY

Caution

1. **Because the automatic transmission is manufactured from high-precision parts, sufficient care must be taken not to scratch or damage these parts during disassembly and reassembly.**
2. **The working area should be covered with a rubber mat to keep it clean at all times.**
3. **Do not wear any cloth gloves and do not use any rags during disassembly. Use nylon cloth if you need to use something.**
4. **Parts which have been disassembled should all be cleaned. Metal parts can be cleaned with normal detergent, but they should be dried completely using compressed air.**
5. **Clutch discs, plastic thrust plates and rubber parts should be cleaned with automatic transmission fluid (ATF) so that they do not become dirty.**
6. **If the transmission body has been damaged, disassemble and clean the cooler system also.**

1. Remove the torque converter.
2. Use the dial gauge to measure the input shaft end play.
3. Remove each bracket.
4. Remove the oil level gauge.
5. Remove the eye bolt, gasket and the oil cooler feed tube.
6. Remove the oil filter and oil filter gasket.

7. Remove the input shaft speed sensor and output shaft speed sensor.

8. Remove the manual control lever, and then remove the park/neutral position switch.

   Caution
   Make sure that the manual control lever installation nut is removed before removing the valve body.

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9. Remove the speedometer gear.

10. Remove the valve body cover.

11. Remove the manual control shaft detent.

12. Disconnect the harness connectors of the valve body.

13. Remove the valve body mounting bolts (28 pieces).
14. Remove the fluid temperature sensor.

Caution
Make sure that the manual control lever and the park/neutral position switch are removed.

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15. Remove the valve body, gasket and the steel balls (2 pieces).

    Caution
    Do not lose the steel balls (2 pieces).

16. Remove the snap ring, and then remove the solenoid valve harness.

17. Remove the strainer and the second brake retainer oil seal.

18. Remove each accumulator piston and spring.

No.	Name
1	For low-reverse brake
2	For underdrive clutch
3	For second brake
4	For overdrive clutch

19. Remove the manual control lever shaft roller.
20. Remove the manual control lever shaft and the parking pawl rod.

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21. Remove the torque converter housing mounting bolts (18 pieces), and then remove the torque converter housing.

22. Remove the O-rings (2 pieces).

23. Remove the differential.

24. Remove the oil filter.

25. Remove the oil pump mounting bolts (6 pieces).
26. Install the special tool (MD998333) in the hole A.

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27. Screw the special tool to remove the oil pump.
28. Remove the oil pump gasket.

29. Remove thrust washer #1.

30. Hold the input shaft, and then remove the underdrive clutch.

31. Remove thrust bearing #2.

32. Remove the underdrive clutch hub.

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33. Remove the rear cover.
34. Remove the thrust race #8.
35. Remove the seal rings (4 pieces).
36. Remove the input shaft rear bearing.

37. Remove the O-rings (3 pieces).

38. Remove the reverse and overdrive clutch and the thrust bearing #7.

39. Remove the overdrive clutch hub and the thrust bearing #6.

40. Remove thrust bearing #5.

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41. Remove the planetary reverse sun gear.

42. Remove the snap ring.

43. Remove the second brake piston and the return spring.

44. Remove the pressure plate, brake discs and brake plates.

45. Remove the planetary carrier assembly.

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46. Remove the snap ring.

47. Remove the reaction plate and the brake disc.

48. Remove the snap ring.

49. Remove the brake plates, brake discs and pressure plate.

50. Remove the wave spring.

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51. Remove the parking pawl shaft, and then remove the spacer and spring.

52. Remove the two parking roller support shafts, and then remove the parking pawl case and parking roller support.

53. Use the special tool to remove the snap ring.
54. Remove the one-way clutch inner race and O-ring, spring retainer, return spring and the low-reverse brake piston.

55. Remove the transfer drive gear mounting bolts (8 pieces).

56. Remove the transfer drive gear.

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57. Remove the cap.

58. Straighten the locking tab of the output shaft lock nut.

59. Use the special tool to remove the output shaft lock nut.

    Caution
    The lock has left-handed threads.

60. Remove the bearing retainer mounting bolt.

61. Tap on the rear of the output shaft to remove the output shaft, taper roller bearing and the collar.

62. Remove the spacer and the outer race.
63. Remove the snap ring.

64. Remove the differential bearing outer race and spacer from the torque converter housing.
65. Remove the differential bearing outer race from the transmission case.

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REASSEMBLY

Caution

1. **Never reuse the gasket, O-ring, oil seal, etc. Always replace with a new one when reassembling.**
2. **Never use grease other than blue petrolatum jelly and white Vaseline.**
3. **Apply ATF to friction components, rotating parts, and sliding parts before installation. Immerse a new clutch disc or brake disc in ATF for at least two hours before assembling them.**
4. **Never apply sealant or adhesive to gaskets.**
5. **When replacing a bushing, replace the assembly which it belongs to.**
6. **Never use any cloth gloves or any rags during reassembly. Use nylon cloth or paper towels if you need to use something.**
7. **Change the oil in the cooler system.**

1. Use the special tools to tap the differential bearing outer race in the transmission case.

2. Use the special tools to tap the output shaft bearing outer race in the transmission case.
3. Install the used spacer and snap ring.

4. Install the transfer gear, low-reverse brake piston, return spring, and spring retainer, one-way clutch and O-ring.
5. Use the special tools to install the snap ring.

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6. Install the wave spring.

7. Replace the pressure plate of the low-reverse brake with the special tool, and then install the (6) brake discs, (5) brake plates and snap ring as shown in the figure.

8. Install the reaction plate and the used snap ring.
9. Move the special tool to measure the end play, and then replace the snap ring installed in step (8) to adjust the end play to standard value.

   Standard value: 0 – 0.16 mm

10. Replace the pressure plate of the second brake with the special tool, and then install the brake disc and brake plate as shown in the figure.
11. Install the return spring, second brake piston and snap ring.

12. Move the special tool (MB991632) to measure the end play.

    Standard value:
    1.09 – 1.55 mm

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Remove the special tool. Use the following formula to determine the proper thickness range for the pressure plate. Install the correct size pressure plate based on your calculations.

Reference: Pressure Plate Thickness

A=Special tool end play measurement determined earlier in this step.
Metric values: [(A+2.0 mm) – 1.55 mm] to [(A+2.0 mm) – 1.09 mm]

13. Turn the transmission over.

14. Install the special tool (E21M44) in a dial gauge, and then move the special tool (MB991632) to measure the axial play.

Standard value:
1.65 – 2.11 mm

Reference: Pressure Plate Thickness

A=Special tool end play measurement determined earlier in this step.
Metric values: [(A+2.0 mm) – 2.11 mm] to [(A+2.0 mm) – 1.65 mm]

15. Remove the parts installed from steps (6) to (14).

16. Tighten the mounting bolts of the output shaft bearing retainer to the specified torque.

Standard value: 23 Nm

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17. Install the output shaft in the transmission case, and then use the special tool to install the collar and taper roller bearing in the output shaft.

18. Apply ATF to a new lock nut, and use the special tool to tighten the lock nut to the specified torque. Then turn back one turn, and tighten to the specified torque again.

    Standard value: 167 Nm

    Caution
    The lock nut has left-handed threads.

19. Move the output shaft to measure operating amount (A), and then replace the spacer installed in step (3) with a new one which thickness is within the following value.

    A=Operating amount
    B=Thickness of the old spacer
    Metric values: [A+B+0.015 mm] to [A+B+0.075 mm]

20. Prevent the lock nut from turning by staking it in two places.

21. Install the cap as shown in the figure.

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22. Use the special tool to install the transfer drive gear.

23. Tighten the eight mounting bolts of the transfer drive gear to the specified torque.

    Standard value: 34 Nm

24. Install the parking pawl, spacer, and spring. Then install the parking pawl shaft.

25. Install the parking roller support, and then the two parking roller support shafts.

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IDENTIFICATION OF THRUST BEARINGS, THRUST RACES, AND THRUST WASHERS

mm

Symbol	O.D.	I.D.	Thickness	Part number
#1	59	47	1.8	MD754509
#1	59	47	2.0	MD754508
#1	59	47	2.2	MD754507
#1	59	47	2.4	MD753793
#1	59	47	2.6	MD753794
#1	59	47	2.8	MD753795
#2	49	36	3.6	MD756846
#3	49	36	3.6	MD756846

Symbol	O.D.	I.D.	Thickness	Part number
#4	55.4	38.5	3.3	MD757847
#5	57	38.5	4.1	MD756846
#6	57	38.5	4.1	MD756846
#7	59	37	2.8	MD754595
#8	48.9	37	1.6	MD707267
#8	48.9	37	1.7	MD759681

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Symbol	O.D.	I.D.	Thickness	Part number
#8	48.9	37	1.8	MD723064
#8	48.9	37	1.9	MD754794
#8	48.9	37	2.0	MD707268
#8	48.9	37	2.1	MD754795
#8	48.9	37	2.2	MD723065
#8	48.9	37	2.3	MD754796
#8	48.9	37	2.4	MD724358
#8	48.9	37	2.5	MD754797
#8	48.9	37	2.6	MD754798

26. Install the planetary carrier assembly.

27. Install the planetary reverse sun gear.

28. Install the wave spring.

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29. Install the pressure plate, brake disc, and brake plate.

30. Install the snap ring.

31. Install the reaction plate.

32. Install the snap ring.

33. Install the brake disc, brake plate, and pressure plate.

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34. Install the return spring and second brake piston.

35. Install the snap ring.

36. Install thrust bearing #5.

Caution
Be sure to install the thrust bearing in the correct direction.

37. Install the overdrive clutch hub and thrust bearing #6 to the reverse and overdrive clutch.

Caution
Be careful about the installation direction of the thrust bearing.

38. Install the reverse and overdrive clutch, and thrust bearing #7.

Caution
Be careful about the installation direction of the thrust bearing.

39. Install the three O-rings.

40. Install the input shaft bearing.
41. Install the four seal rings.

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Caution
There are two types of seal rings, with and without identification colour. Be sure to install them to their correct positions.

42. Install used thrust race #8, and then the rear cover.
43. Measure end play of the underdrive sun gear. Replace the thrust race installed in step (44) to adjust the play to the standard value. Refer to the Specification chart for the appropriate parts number.

    Standard value: 0.25 – 0.45 mm

    NOTE
    Installing the underdrive clutch hub makes it easy to measure the end play of the underdrive sun gear.

44. Squeeze out the liquid gasket and apply it to the shown points of the rear cover.

    Liquid gasket:
    MITSUBISHI genuine sealant Part No. MD974421 or equivalent

    NOTE
    1. Be sure to install the case quickly while the sealant is wet (with 15 minutes).
    2. After installation, keep the sealed area away from the oil for approx. 1 hour.

45. Install the rear cover, and tighten its mounting bolts to the specified torque.

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46. Install the underdrive clutch hub.

47. Install thrust bearing #2.

    Caution
    Be sure to install the thrust bearing in the correct direction.

48. Hold the input shaft, and install the underdrive clutch.

49. Install the used thrust washer #1.

50. Use the special tool to install a new oil pump gasket and oil pump.

    Caution
    Never reuse the old gasket.

51. Tighten the oil pump mounting bolts to the specified torque.

    Standard value: 23 Nm

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52. Measure end play of the input shaft. Replace the thrust washer installed in step (51) to adjust the play to the standard value. Refer to the Specification chart on for the appropriate parts number.

    Standard value: 0.70 – 1.45 mm

53. Install the oil filter.

54. Install the differential.

55. Place a solder (approx. 10 mm in length, 3 mm in diameter) on the torque converter housing as shown in the figure.

56. Install the torque converter housing to the transmission case without applying sealant. Tighten its mounting bolts to the specified torque.

    Standard value: 47 Nm

57. Loosen the bolts, and remove the solder.

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58. Use a micrometer to measure the thickness of the pressed solder. Select a spacer which thickness is within the following value. Refer to the Spacer chart for the appropriate parts number.

    [T + 0.045 mm] to [T + 0.105 mm]

59. Install the spacer selected in the above step.

60. Assemble the spacer selected in step (60) to the torque converter housing. Use the special tool to press in the outer race.

61. Squeeze out the liquid gasket and apply it to the shown area of torque converter housing.

    Liquid gasket:
    MITSUBISHI genuine sealant Part No. MD974421 or equivalent

    NOTE
    1. Be sure to install the case quickly while the sealant is wet (with 15 minutes).
    2. After installation, keep the sealed area away from the oil for approx. 1 hour.

62. Install the two O-rings.

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63. Install the torque converter, and then tighten its 18 mounting bolts to the specified torque.

    Standard value: 47 Nm

64. Install the manual control lever shaft and parking pawl rod.
65. Install the manual control lever shaft roller.

66. Install the accumulator pistons, new seal rings, and springs.

    NOTE
    The accumulator springs are identified as shown in the figure.

No.	Name
1	For low-reverse brake
2	For underdrive clutch
3	For second brake
4	For overdrive clutch

67. Install the strainer and second brake retainer oil seal.

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68. Install the solenoid valve harness, and then secure the snap ring to the connector groove.

69. Install the valve body, gasket, and two steel balls.

70. Install the fluid temperature sensor.
71. Install the 28 valve body mounting bolts.

72. Connect the valve body connectors.

No.	Parts to be connected	Cable colour	Connector housing colour
1	Underdrive solenoid valve	White, red, red	Black
2	Overdrive solenoid valve	Orange, red	Black
3	Low-reverse solenoid valve	Brown, yellow	Milky white
4	Second solenoid valve	Green, red, red	Milky white
5	Damper clutch control solenoid valve	Blue, yellow, yellow	Black
6	Fluid temperature sensor	Black, red	Black

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73. Install the manual control shaft detent.

74. Apply the liquid gasket to the valve body cover.

    Liquid gasket:
    MITSUBISHI genuine sealant Part No. MD974421 or equivalent

    NOTE
    1. Be sure to install the case quickly while the sealant is wet (with 15 minutes).
    2. After installation, keep the sealed area away from the oil for approx. 1 hour.

75. Install the valve body cover, and then tighten its mounting bolts to the specified torque.

    Standard value: 11 Nm

76. Install the speedometer gear.

77. Install the park/neutral position switch and manual control lever.

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78. Install the input shaft speed sensor and output shaft speed sensor.
79. Install the eye bolt, a new gasket, and the oil cooler feed tube.
80. Install the oil dipstick.
81. Install the brackets.

82. Install the torque converter, and secure it so that the shown dimension (A) meets the reference value.

    Reference value: approx. 9.4 mm

    Caution
    Apply ATF to the oil pump drive hub before installing the torque converter. Be careful not to damage the oil seal lip when installing the torque converter.

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OIL PUMP

DISASSEMBLY AND REASSEMBLY

Lubricate all internal parts with automatic transmission fluid during reassembly.

Disassembly steps

1. ▶C◀ O-ring
2. ▶B◀ Seal ring
3. ▶B◀ Seal ring
4. ▶A◀ Oil seal
5. Oil pump assembly

DISASSEMBLY SERVICE POINTS

▶A◀ OIL SEAL INSTALLATION

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▶B◀ SEAL RING INSTALLATION

Caution
There are two types of seal rings, with and without identification colour. Be sure to install them to their correct positions.

▶C◀ O-RING INSTALLATION

Install a new O-ring to the outer groove of the oil pump, and apply ATF, blue petrolatum jelly or white Vaseline to the outer inside diameter of the O-ring.

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UNDERDRIVE CLUTCH AND INPUT SHAFT

DISASSEMBLY AND REASSEMBLY

Lubricate all internal parts with automatic transmission fluid during reassembly.

Number of clutch discs and plates

Clutch disc	Clutch plate	Clutch reaction plate
4	4	1

Disassembly steps

1. Snap ring
2. Input shaft
3. Seal ring
4. ▶D◀ Snap ring
5. ▶C◀ Clutch reaction plate
6. ▶C◀ Clutch disc
7. ▶C◀ Clutch plate
8. ◀A▶ ▶B◀ Snap ring
9. Spring retainer
10. ▶A◀ D-ring
11. Return spring
12. Underdrive clutch piston
13. ▶A◀ D-ring
14. ▶A◀ D-ring
15. Underdrive clutch retainer

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DISASSEMBLY SERVICE POINT

◀A▶ SNAP RING REMOVAL

REASSEMBLY SERVICE POINTS

▶A◀ D-RING INSTALLATION

Apply ATF, blue petrolatum jelly or white Vaseline to the D-ring, and install it carefully.

▶B◀ SNAP RING INSTALLATION

▶C◀ CLUTCH PLATE/CLUTCH DISC/CLUTCH REACTION PLATE INSTALLATION

1. Align the space between the teeth (part A) of the clutch plate, clutch disc and clutch reaction plate to the outer circumference hole (part B) of the underdrive clutch retainer.

   Caution
   Immerse the clutch disc in ATF before assembling it.

2. Install the clutch reaction plate in the shown direction.

   Number of clutch discs and plates

Clutch disc	Clutch plate	Clutch reaction plate
4	4	1

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▶D◀ SNAP RING INSTALLATION

Check that the clearance between the snap ring and the clutch reaction plate is within the standard value.

Standard value:
1.65 – 1.85 mm

When measuring the clearance, use the special tool to press the clutch reaction plate evenly. If not within the standard value, select a snap ring to adjust.

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REVERSE AND OVERDRIVE CLUTCH

DISASSEMBLY AND REASSEMBLY

Lubricate all internal parts with automatic transmission fluid during reassembly.

Number of clutch discs and plates

Clutch disc	Clutch plate	Clutch reaction plate
4	4	1

Disassembly steps

- ▶G◀ 1. Snap ring
- ▶F◀ 2. Clutch reaction plate
- ▶F◀ 3. Clutch disc
- ▶F◀ 4. Clutch plate
- ▶E◀ 5. Snap ring
- ▶D◀ 6. Clutch reaction plate
- ▶D◀ 7. Clutch disc
- ▶D◀ 8. Clutch plate
- ◀A▶ ▶C◀ 9. Snap ring
- 10. Spring retainer
- ▶A◀ 11. D-ring
- 12. Return spring
- 13. Overdrive clutch piston
- ▶A◀ 14. D-ring
- ▶B◀ 15. Reverse clutch piston
- ▶A◀ 16. D-ring
- 17. Reverse clutch retainer
- ▶A◀ 18. D-ring
- ▶A◀ 19. D-ring

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DISASSEMBLY SERVICE POINT

◀A▶ SNAP RING REMOVAL

REASSEMBLY SERVICE POINTS

▶A◀ D-RING INSTALLATION

Apply ATF, blue petroleum jelly or white Vaseline to D-ring, and install carefully.

▶B◀ REVERSE CLUTCH PISTON INSTALLATION

Align the outer circumference holes (parts A and B) of the reverse clutch piston and the reverse clutch retainer to assemble them.

▶C◀ SNAP RING INSTALLATION

1. Use the special tool to install the snap ring.

2. Check that the clearance between the snap ring and the return spring retainer is within the standard value. When measuring the clearance, press the return spring retainer by the weight of 49 N evenly. If not within the standard value, select a snap ring to adjust.

   Standard value: 0 – 0.09 mm

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▶D◀ CLUTCH PLATE/CLUTCH DISC/CLUTCH REACTION PLATE INSTALLATION

Install the clutch reaction plate in the shown direction.

Caution
Immerse the clutch disc in ATF before assembling the clutch disc.

Number of clutch discs and plates

Clutch disc	Clutch plate	Clutch reaction plate
4	4	1

▶E◀ SNAP RING INSTALLATION

Check that the clearance between the snap ring and the clutch reaction plate is within the standard value. When measuring the clearance, use the special tool to press the clutch reaction plate evenly. If not within the standard value, select a snap ring to adjust.

Standard value:
1.6 – 1.8 mm

▶F◀ CLUTCH PLATE/CLUTCH DISC/CLUTCH REACTION PLATE INSTALLATION

1. Align the space between the teeth (part A) of the clutch plate, clutch disc and clutch reaction plate to the outer circumference hole (part B) of the reverse clutch retainer.

   Caution
   Immerse the clutch disc in ATF.

2. Install the clutch reaction plate in the shown direction.

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▶G◀ SNAP RING INSTALLATION

Check that the clearance between the snap ring and the clutch reaction plate is within the standard value. When measuring the clearance, press the clutch reaction plate by the weight of 49 N evenly. If not within the standard value, select a snap ring to adjust.

Standard value: 1.5 – 1.6 mm

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PLANETARY CARRIER ASSEMBLY

DISASSEMBLY AND REASSEMBLY

Lubricate all internal parts with automatic transmission fluid during reassembly.

Disassembly steps

1. Stopper plate
2. ▶B◀ One-way clutch
3. Snap ring
4. Output planetary carrier
5. ▶A◀ Thrust bearing #3
6. Under drive sun gear
7. ▶A◀ Thrust bearing #4
8. Snap ring
9. Over drive planetary carrier
10. Over drive annulus gear

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REASSEMBLY SERVICE POINTS

▶A◀ THRUST BEARINGS #3 & #4 INSTALLATION

1. Install thrust bearing #3 and #4 in the position shown in the diagram.

   Reference:
   Install thrust bearings in the correct direction.

▶B◀ ONE WAY CLUTCH INSTALLATION

1. Insert one way clutch into over drive annulus gear as the arrow points to output planetary carrier side.

   Caution:
   Install one way clutch in the correct direction.

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LOW-REVERSE BRAKE

DISASSEMBLY AND REASSEMBLY

Lubricate all internal parts with automatic transmission fluid during reassembly.

TFA1373

Disassembly steps

▶A◀ 1. D-ring
▶A◀ 2. D-ring
3. Low-reverse brake piston

REASSEMBLY SERVICE POINT

▶A◀ D-RING INSTALLATION

Apply ATF, blue petrolatum jelly or white Vaseline to D-ring, and install carefully.

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SECOND BRAKE

DISASSEMBLY AND REASSEMBLY

Lubricate all internal parts with automatic transmission fluid during reassembly.

TFA1374

Disassembly steps

▶A◀ 1. Second brake retainer
2. D-ring
3. Second brake piston
▶A◀ 4. D-ring

REASSEMBLY SERVICE POINT

▶A◀ D-RING INSTALLATION

Apply ATF, blue petrolatum jelly or white Vaseline to D-ring, and install carefully.

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OUTPUT SHAFT

DISASSEMBLY AND REASSEMBLY

Lubricate all internal parts with automatic transmission fluid during reassembly.

TFA1375

Disassembly steps

◀A▶ ▶C◀ 1. Transfer driven gear
2. Bearing retainer
▶B◀ 3. Outer race
◀B▶ ▶A◀ 4. Taper roller bearing
5. Output shaft

DISASSEMBLY SERVICE POINTS

◀A▶ TRANSFER DRIVEN GEAR REMOVAL

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◀B▶ TAPER ROLLER BEARING REMOVAL

REASSEMBLY SERVICE POINTS

▶A◀ TAPER ROLLER BEARING INSTALLATION

▶B◀ OUTER RACE INSTALLATION

▶C◀ TRANSFER DRIVEN GEAR INSTALLATION

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DIFFERENTIAL

DISASSEMBLY AND REASSEMBLY

Lubricate all internal parts with automatic transmission fluid during reassembly.

Disassembly steps

◀A▶ ▶D◀ 1. Differential drive gear
▶C◀ 2. Taper roller bearings
▶B◀ 3. Lock pin
▶A◀ 4. Pinion shaft
▶A◀ 5. Pinions
▶A◀ 6. Washers
▶A◀ 7. Side gears
▶A◀ 8. Spacers
9. Differential case

DISASSEMBLY SERVICE POINTS

◀A▶ TAPER ROLLER BEARING REMOVAL

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REASSEMBLY SERVICE POINTS

▶A◀ SPACER, SIDE GEAR, WASHER, PINION, PINION SHAFT INSTALLATION

1. Install the spacers to the back side of the side gears, and then assemble the side gears into the differential case.

   NOTE
   Select the medium size spacer [0.93 – 1.00 mm] when assembling a new side gear.

2. Attach the washers to the back side of the pinions, engage the pinions simultaneously to the side gears, and settle the gears by turning.

3. Insert the pinion shaft.

4. Measure the backlash between the side gears and pinions.

   Standard value:
   0.025 – 0.150 mm

5. If not within the standard value, change a spacer and measure the backlash again.

   NOTE
   Adjust so that both backlashes are equal.

▶B◀ LOCK PIN INSTALLATION

1. Install the chamfered side of the lock pin first.

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▶C◀ TAPER ROLLER BEARING INSTALLATION

▶D◀ DIFFERENTIAL DRIVE GEAR INSTALLATION

Apply ATF to the bolt, tighten the bolts to the specified torque in the shown sequence.

Standard value: 132 Nm

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VALVE BODY

DISASSEMBLY AND REASSEMBLY

Lubricate all internal parts with automatic transmission fluid during reassembly.

Disassembly steps

1. Solenoid valve support
2. ◀A▶ ▶C◀ Underdrive solenoid valve
3. ◀A▶ ▶C◀ Second solenoid valve
4. ◀A▶ ▶C◀ Torque converter clutch control solenoid valve
5. ◀A▶ ▶C◀ Overdrive solenoid valve
6. ◀A▶ ▶C◀ Low-reverse solenoid valve
7. Manual valve
8. Cover
9. Plate
10. Outside valve body assembly
11. ▶B◀ Steel ball (orifice check ball)
12. ▶B◀ Spring
13. Plate
14. ▶A◀ Damping valve
15. ▶A◀ Damping valve spring
16. ▶A◀ Steel ball (line relief)
17. ▶A◀ Spring
18. ▶A◀ Steel ball (orifice check ball)
19. ▶A◀ Spring
20. Inside valve body assembly

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Lubricate all internal parts with automatic transmission fluid during reassembly.

TFA1589

21. Roller
22. Torque converter clutch control valve sleeve
23. Torque converter clutch control valve
24. Torque converter clutch control valve spring
25. Plate
26. Screw
27. Regulator valve spring
28. Regulator valve
29. Plate
30. Fail-safe valve A sleeve
31. Fail-safe valve A2
32. Fail-safe valve A spring
33. Fail-safe valve A1
34. Plate
35. Plug
36. Torque converter valve
37. Torque converter valve spring
38. Plate
39. Fail-safe valve B sleeve
40. Fail-safe valve B
41. Inside valve body

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Lubricate all internal parts with automatic transmission fluid during reassembly.

TFA1590

42. Roller
43. Overdrive pressure control valve sleeve
44. Overdrive pressure control valve
45. Overdrive pressure control valve spring
46. Roller
47. Low-reverse pressure control valve sleeve
48. Low-reverse pressure control valve
49. Low-reverse pressure control valve spring
50. Plate
51. Plug
52. Switching valve
53. Roller
54. Underdrive pressure control valve sleeve
55. Underdrive pressure control valve
56. Underdrive pressure control valve spring
57. Roller
58. Second pressure control valve sleeve
59. Second pressure control valve
60. Second pressure control valve spring
61. Outside valve body

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DISASSEMBLY SERVICE POINT

◀A▶ SOLENOID VALVES REMOVAL

NOTE
1. Before removing the solenoid valves, identify each solenoid valve with white paint or similar to facilitate reassembly.
2. Store each solenoid valve separately, according to its location, to avoid incorrect reassembly.

REASSEMBLY SERVICE POINTS

▶A◀ SPRING/STEEL BALL/DAMPING VALVE/DAMPING VALVE SPRING INSTALLATION

▶B◀ SPRING/STEEL BALL INSTALLATION

▶C◀ SOLENOID VALVES INSTALLATION

1. Apply ATF, blue petroleum jelly or white Vaseline to O-ring, and install carefully.
2. Install the solenoid valves by referring to the marks made during disassembly.

No.	Name
1	Underdrive solenoid valve
2	Second solenoid valve
3	Torque converter clutch control solenoid valve
4	Overdrive solenoid valve
5	Low–reverse solenoid valve

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SPEEDOMETER GEAR

DISASSEMBLY AND REASSEMBLY

Disassembly steps

1. E-clip
2. Speedometer driven gear
3. ▶A◀ O-ring
4. Sleeve

REASSEMBLY SERVICE POINT

▶A◀ OIL SEAL INSTALLATION

Insert the oil seal in the position and direction shown in the figure.

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DRIVE SHAFT OIL SEAL

DISASSEMBLY AND REASSEMBLY

Lubricate all internal parts with automatic transmission fluid during reassembly.

Disassembly steps

1. ▶A◀ Oil seal
2. Torque converter housing
3. ▶B◀ Oil seal
4. Transmission case

REASSEMBLY SERVICE POINT

▶A◀ OIL SEAL INSTALLATION

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▶B◀ OIL SEAL INSTALLATION

23C AUTOMATIC TRANSMISSION F5A51

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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 in baking or drying after painting, remove the SRS components (air bag module and SRS-ECU) beforehand.

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

(4) 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
Section titles with the asterisk (*) in the table of contents in each group indicate operations requiring warnings.

ON-VEHICLE SERVICE

AUTOMATIC TRANSMISSION FLUID CHECK

AUTOMATIC TRANSMISSION FLUID REPLACEMENT

THROTTLE POSITION SENSOR ADJUSTMENT / ACCELERATOR PEDAL POSITION SENSOR

INHIBITOR SWITCH CONTINUITY CHECK

INHIBITOR SWITCH AND CONTROL CABLE ADJUSTMENT

A/T CONTROL COMPONENT LOCATION

A/T CONTROL COMPONENT CHECK

TORQUE CONVERTER STALL TEST

HYDRAULIC PRESSURE TEST

HYDRAULIC CIRCUIT

LINE PRESSURE ADJUSTMENT

SELECTOR LEVER OPERATION CHECK

TRANSMISSION CONTROL

REMOVAL AND INSTALLATION

INSTALLATION SERVICE POINT

SELECTOR LEVER ASSEMBLY

CHECKING MANUAL CONTROL SWITCH ASSEMBLY CIRCUIT.

TRANSMISSION ASSEMBLY

REMOVAL AND INSTALLATION

REMOVAL SERVICE POINTS

INSTALLATION SERVICE POINTS

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SERVICE SPECIFICATIONS

Items		Standard value
Oil temperature sensor kΩ	at 0°C	16.7 – 20.5
	at 100°C	0.57 – 0.69
Input shaft speed sensor resistance [at 20°C] Ω		330-390
Output shaft speed sensor resistance [at 20°C] Ω		330-390
Resistance of damper clutch control solenoid coil [at 20°C] Ω		2.7 – 3.4
Resistance of Low-Reverse solenoid valve coil [at 20°C] Ω		2.7 – 3.4
Resistance of second solenoid valve coil [at 20°C] Ω		2.7 – 3.4
Resistance of underdrive solenoid valve coil [at 20°C] Ω		2.7 – 3.4
Resistance of overdrive solenoid valve coil [at 20°C] Ω		2.7 – 3.4
Resistance of reduction solenoid valve coil [at 20°C] Ω		2.7 – 3.4
Stall speed r/min.		2,100 – 2,600

LUBRICANT

Items	Specified lubricant	Quantity (litres)
Transmission fluid	Mitsubishi ELC4–SP III.	8.4

SPECIAL TOOLS

Tool	Tool number and name	Supersession	Application
	MB991502 MUT-II	–	Checking for diagnosis trouble codes
	MD998330 Oil pressure gauge 2,942 kPa	–	Measurement of oil pressure
	MD998332 Adaptor	–	
	MB998900 Adaptor	E21M17A	

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Tool	Tool number and name	Supersession	Application
B991113	MB991113 Steering linkage puller	13–006	Removal of the tie rod end and the lower arm
Z203827	E309–A Engine lifter	–	Supporting the engine assembly during removal and installation of the transmission
	E16M1 Electrical test terminals	–	Checking for diagnosis trouble codes

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TROUBLESHOOTING

STANDARD FLOW OF DIAGNOSIS TROUBLESHOOTING

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DIAGNOSIS FUNCTION

1. N (Neutral) range light

The N range light flashes at a frequency of approximately 1 Hz (once per second) if there is an abnormality in any of the items in the table below which are related to the A/T system. Check for diagnosis trouble codes if the N range light is flashing at a frequency of approximately 1 Hz.

N range light flashing items

A/T control relay system
Input shaft speed sensor
Output shaft speed sensor
Each solenoid valve
Cycle miss in each shift change

Caution

- **If the N range light is flashing at a frequency of approximately 2 Hz (two flashes per second), it means that the automatic transmission fluid temperature is too high. Stop the vehicle in a safe place and with the engine idling and N selected, wait until the N range light stops flashing.**

2. Method of reading the diagnosis code

Use the MUT-II or the N range lamp to take a reading of the diagnosis codes. (Refer to Group 00.)

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ROAD TEST

Check by the following procedures

No.	Condition	Operation	Judgement value	Check item	Code No.	Inspection procedure page if there is an abnormality
1	Ignition switch: OFF	Ignition switch (1) ON	Data list No. 54 Control Relay Voltage	A/T Control relay	54 55	A/T Control relay system
2	Ignition switch: ON Engine: Stopped Selector lever position: P	Selector lever position (1) P, (2) R, (3) N, (4) D,	Data list No. 61 (1) P, (2) R, (3)N, (4) D	Inhibitor switch	–	Inhibitor switch system
		Selector lever position (1) D (1st speed) (2) Select sports mode (1st gear) (3) Upshift and hold lever (2nd gear) (4) Downshift and hold lever (1st gear)	Data list (1) OFF OFF ON (2) ON OFF ON (3) ON ON OFF (4) ON OFF ON Shift indicator lamp (1) D and 1 lit (2) Only 1 lit (3) Only 2 lit (4) Only 1 lit	Select switch Upshift switch Downshift switch	–	Sports mode switch system
		Accelerator pedal (1) Fully closed (2) Depressed (3) Fully open	Data list No. 11 (1) 400 – 1,000 mV (2) Gradually rises from (1) (3) 4,500 – 5,000 mV	TPS	11 12 14	TPS system
		Brake pedal (1) Depressed (2) Released	Data list No. 26 (1) ON (2) OFF	Stop light switch	26	Stop light switch system
3	Ignition switch: START Engine: Stopped	Starting test with lever P or N range	Starting should be possible	Starting	–	Starting impossible
4	Warming up	Drive for 15 minutes or more so that the automatic transmission fluid temperature becomes 70 – 90°C.	Data list No. 15 Gradually rises to 70 – 90°C	Oil temperature sensor	15	Oil temperature sensor system

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No.	Condition	Operation	Judgement value	Check item	Code No.	Inspection procedure page if there is an abnormality
5	Engine: Idling Selector lever position: N	Brake pedal (Retest) (1) Depressed (2) Released	Data list No. 26 (1) ON (2) OFF	Stop light switch	26	Stop light switch system
		A/C switch (1) ON (2) OFF	Data list No. 65 (1) ON (2) OFF	Dual pressure switch	–	Dual pressure switch system
		Accelerator pedal (1) Fully closed (2) Depressed	Data list No. 64 (1) ON (2) OFF	Idle position switch	–	Idle position switch system
			Data list No. 21 (1) 800 – 900 rpm (2) Gradually rises from (1)	Crank angle sensor	21	Crank angle sensor system
			Data list No. 57 (2) Data changes	Communication with Engine-ECU	51	Abnormal communication with Engine-ECU
		Selector lever position (1) N → D (2) N → R	Should be no abnormal shifting shocks Time lag when shifting should be within 2 seconds	Malfunction when starting	–	Engine stalling when shifting
					–	Shocks when changing from N to D and large time lag
					–	Shocks when changing from N to R and large time lag
				Driving impossible	–	Does not move forward
					–	Does not reverse
					–	Does not move (forward or reverse)

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No.	Condition	Operation	Judgement value	Check item	Code No.	Inspection procedure page if there is an abnormality
6	Selector lever position: Sports mode	(1) Idling in L range (Vehicle stopped) (2) Driving at constant speed of 10 km/h in L position. (3) Driving at constant speed of 30 km/h in 2 position. (4) Driving at constant speed of 50 km/h in 3 position. (5) Driving at constant speed of 70 km/h in 3 position (6) Driving at constant speed of 70 km/h in D position (Each condition should be maintained for 10 seconds or more.)	Data list No. 63 (2) 1st, (3) 2nd, (4) 3rd, (6) 4th	Shift condition	–	–
			Data list No. 31 (2) 100 %, (3) 100 %, (4) 100 %, (6) 100 %	Low and reverse solenoid valve	31	Low and reverse solenoid valve system
			Data list No. 32 (2) 0 %, (3) 0 %, (4) 0 %, (6) 100 %	Underdrive solenoid valve	32	Underdrive solenoid valve system
			Data list No. 33 (2)100 %, (3) 0 %, (4) 0 %, (6) 0 %	Second solenoid valve	33	Second solenoid valve system
			Data list No. 34 (2)100 %, (3) 100 %, (4) 0 %, (6) 0 %	Overdrive solenoid valve	34	Overdrive solenoid valve system
			Data list No. 29 (1) 0km/h (4 50km/h	Vehicle speed sensor	–	Vehicle speed sensor system
			Data list No. 22 1600 ~ 1900 rpm	Input shaft speed sensor	22	Input shaft speed sensor system
			Data list No. 23 1600 ~ 1900 rpm	Output shaft speed sensor	23	Output shaft speed sensor system
			Data list No. 36 (3) 0 %, (5) Approx. 70 %-90%	Damper clutch control solenoid valve	36 52	DCC solenoid valve system
			Data list No. 52 (3) Approx. 100-300 rpm (5) Approx. 0-10 rpm			

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No.	Condition	Operation	Judgement value	Check item	Code No.	Inspection procedure page if there is an abnormality
7	Selector lever position: Sports mode	(1) Idling in L range (Vehicle stopped) (2) Driving at constant speed of 10 km/h in L position. (3) Driving at constant speed of 30 km/h in 2 position. (4) Driving at constant speed of 50 km/h in 3 position. (5) Driving at constant speed of 70 km/h in 3 position (6) Driving at constant speed of 70 km/h in D position (Each condition should be maintained for 10 seconds or more.)	Data list No. 63 (2) 1st, (3) 2nd, (4) 3rd, (6) 4th	Shift conditions	–	–
			Data list No. 31 (2) 100 %, (3) 100 %, (4) 100 %, (6) 100 %	Low and reverse solenoid valve	31	Low and reverse solenoid valve system
			Data list No. 32 (2) 0 %, (3) 0 %, (4) 0 %, (6) 100 %	Underdrive solenoid valve	32	Underdrive solenoid valve system
			Data list No. 33 (2)100 %, (3) 0 %, (4) 0 %, (6) 0 %	Second solenoid valve	33	Second solenoid valve system
			Data list No. 34 (2)100 %, (3) 100 %, (4) 0 %, (6) 0 %	Overdrive solenoid valve	34	Overdrive solenoid valve system
			Data list No. 35 (2)0 %, (3) 0 %, (4) 100 %, (6) 100 %	Reduction solenoid valve	35	Red solenoid valve system
			Data list No. 29 (1) 0km/h (4) 50km/h	Vehicle speed sensor	–	Vehicle speed sensor system
			Data list No. 22 1600 ~ 1900 rpm	Input shaft speed sensor	22	Input shaft speed sensor system
			Data list No. 23 1600 ~ 1900 rpm	Output shaft speed sensor	23	Output shaft speed sensor system
			Data list No. 36 (3) 0 %, (5) Approx. 70 %-90%	Damper clutch control solenoid valve	36 52	DCC solenoid valve system
			Data list No. 52 (3) Approx. 100-300 rpm (5) Approx. 0-10 rpm			

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No.	Condition	Operation	Judgement value	Check item	Code No.	Inspection procedure page if there is an abnormality
8	Use the MUT-II to stop the INVECS-II function. Selector lever position: D (on a flat and straight road.)	Monitor data list No. 11, 23, and 63 with the MUT-II. (1) Accelerate to 5th gear at TPS output of 1.5V (accelerator opening angle of 30 %). (2) Gently decelerate to a standstill. (3) Accelerate to 5th gear at TPS output of 2.5 V (accelerator opening angle of 50%). (4) While driving at 60 km/h in 5th gear, select sports mode and shift down to 4th. range. (5) While driving at 40 km/h in 4th gear, shift down to 3rd. (6) While driving at 30 km/h in 3rd gear, shift down to 2nd. (7) While driving at 20 km/h in 2nd gear, shift down to 1st.	For (1), (2) and (3), the reading should be the same as the specified output shaft speed, and no abnormal shift shocks should occur. For (4), (5) and (6), downshifting should occur immediately after shifting.	Malfunction when shifting	–	Shift shocks and running up
				Displaced shifting points	–	All points
					–	Some points
				Does not shift	–	No diagnosis code
					22	Input shaft speed sensor system
					23	Output shaft speed sensor system
				Does not shift from 1 to 2 or 2 to 1	31	Low and reverse solenoid valve system
					33	Second solenoid valve system
					41	1st gear incorrect ratio
					42	2nd gear incorrect ratio
				Does not shift from 2 to 3 or 3 to 2	33	Second solenoid valve system
					34	Overdrive solenoid valve system
					42	2nd gear incorrect ratio
					43	3rd gear incorrect ratio
				Does not shift from 3 to 4 or 4 to 3	31	Low and reverse solenoid valve system
					35	Red solenoid valve system
					43	3rd gear incorrect ratio

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No.	Condition	Operation	Judgement value	Check item	Code No.	Inspection procedure page if there is an abnormality
8	Use the MUT-II to stop the INVECS-II function. Selector lever position: D (on a flat and straight road.)	Monitor data list No. 11, 23, and 63 with the MUT-II. (1) Accelerate to 5th gear at TPS output of 1.5V (accelerator opening angle of 30 %). (2) Gently decelerate to a standstill. (3) Accelerate to 5th gear at TPS output of 2.5 V (accelerator opening angle of 50%). (4) While driving at 60 km/h in 5th gear, select sports mode and shift down to 4th. range. (5) While driving at 40 km/h in 4th gear, shift down to 3rd. (6) While driving at 30 km/h in 3rd gear, shift down to 2nd. (7) While driving at 20 km/h in 2nd gear, shift down to 1st.	For (1), (2) and (3), the reading should be the same as the specified output shaft speed, and no abnormal shift shocks should occur. For (4), (5) and (6), downshifting should occur immediately after shifting.	Does not shift from 3 to 4 or 4 to 3	44	4th gear incorrect ratio
				Does not shift from 4 to 5 or 5 to 4	32	Underdrive solenoid valve system
					33	Second solenoid valve system
					44	4th gear incorrect ratio
					45	5th gear incorrect ratio
9	Selector lever position: N (on a flat and straight road.)	Monitor data list No. 22 and No. 23 with the MUT-II. (1) Move selector lever to R range, drive at constant speed of 10 km/h.	The ratio between data list No. 22 and No. 23 should be the same as the gear ratio when reversing.	Does not shift	22	Input shaft speed sensor system
					23	Output shaft speed sensor system
					46	Reverse gear incorrect ratio

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SHIFT PATTERN

UPSHIFT PATTERN

Bold Line: Standard shift pattern

DOWNSHIFT PATTERN

Bold Line: Standard shift pattern

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INSPECTION CHART FOR DIAGNOSIS CODES

Code	Diagnosis item	
11	Throttle position sensor system	Short circuit
12		Open circuit
14		Sensor maladjustment
15	Oil temperature sensor system	Open circuit
21	Crank angle sensor system	Open circuit
22	Input shaft speed sensor system	Short circuit/open circuit
23	Output shaft speed sensor system	Short circuit/open circuit
26	Stop light switch system	Short circuit/open circuit
31	Low and reverse solenoid valve system	Short circuit/open circuit
32	Underdrive solenoid valve system	Short circuit/open circuit
33	Second solenoid valve system	Short circuit/open circuit
34	Overdrive solenoid valve system	Short circuit/open circuit
35	RED solenoid valve system	Short circuit/open circuit
36	DCC solenoid valve system	Short circuit/open circuit
41	1st gear incorrect ratio	
42	2nd gear incorrect ratio	
43	3rd gear incorrect ratio	
44	4th gear incorrect ratio	
45	5th gear incorrect ratio	
46	Reverse gear incorrect ratio	
51	Abnormal communication with Engine-ECU / TCL ECU	
52	Damper clutch solenoid system	Defective system
54	A/T Control relay system	Short circuit to ground/open circuit
55		Contact point melted
56	N range light system	Short circuit to ground
71	Malfunction of A/T-ECU	

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INSPECTION PROCEDURES FOR DIAGNOSIS CODES

Code No. 11, 12, 14 Throttle position sensor system	Probable cause
If the TPS output voltage is 4.8 V or higher when the engine is idling, the output is judged to be too high and diagnosis code No. 11 is output. If the TPS output voltage is 0.2 V or lower at times other than when the engine is idling, the output is judged to be too low and diagnosis code No. 12 is output. If the TPS output voltage is 0.2 V or lower or if it is 1.2 V or higher when the engine is idling, the TPS adjustment is judged to be incorrect and diagnosis code No. 14 is output.	• Malfunction of the throttle position sensor • Malfunction of connector • Malfunction of the Engine A/T-ECU

Throttle position sensor check (Refer GROUP 13A On Vehicle Service.)
- NG → **Replace**
- OK ↓

Check the following connectors: A-68, B-109, B-110
- NG → **Repair**
- OK ↓

Harness check
- Throttle position sensor – Engine A/T-ECU.
- NG → **Repair**
- OK ↓

Check the trouble symptoms.
- NG → Replace the Engine A/T-ECU. CAUTION

Code No. 15, Oil temperature sensor system	Probable cause
If the oil temperature sensor output voltage is 2.6 V or more even after driving for 10 minutes or more (if the oil temperature does not increase), it is judged that there is an open circuit in the oil temperature sensor and diagnosis code No. 15 is output to indicate that the oil temperature sensor is disconnected.	• Malfunction of the oil temperature sensor • Malfunction of connector • Malfunction of the Engine A/T-ECU

Oil temperature sensor check (Refer On Vehicle Service
- NG → **Replace**
- OK ↓

Check the following connectors: A-87, B-111
- NG → **Repair**
- OK ↓

Harness check
- Oil temperature sensor – Engine A/T-ECU.
- NG → **Repair**
- OK ↓

Check the trouble symptoms.
- NG → Replace the Engine A/T-ECU. CAUTION

Code No. 21 Crank angle sensor system	Probable cause
If no output pulse is detected from the crank angle sensor for 5 seconds or more while driving at 40 km/h or more, it is judged that there is an open circuit in the crank angle sensor and diagnosis code No. 21 is output.	• Malfunction of the crank angle sensor • Malfunction of connector • Malfunction of the Engine A/T-ECU

Refer GROUP 13A On Vehicle Service

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Code No. 22 Input shaft speed sensor system	Probable cause
If no output pulse is detected from the input shaft speed sensor for 1 second or more while driving in 3rd or 4th gear at a speed of 45 km/h or more, it is judged to be an open circuit or short-circuit in the input shaft speed sensor and diagnosis code No. 22 is output. If diagnosis code No. 22 is output four times, the transmission is locked into 3rd gear or 2nd gear as a fail-safe measure, and the N range light flashes at a frequency of 1 Hz.	● Malfunction of the input shaft speed sensor ● Malfunction of the underdrive clutch retainer ● Malfunction of connector ● Malfunction of the Engine A/T-ECU

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Code No. 23 Output shaft speed sensor system	Probable cause
If the output from the output shaft speed sensor is continuously 30% lower than the vehicle speed for 1 second or more while driving in 3rd or 4th gear at a speed of 45 km/h or more, it is judged to be an open circuit or short-circuit in the output shaft speed sensor and diagnosis code No. 23 is output. If diagnosis code No. 23 is output four times, the transmission is locked into 3rd gear or 2nd gear as a fail-safe measure, and the N range light flashes at a frequency of 1 Hz.	● Malfunction of the output shaft speed sensor ● Malfunction of the direct planetary carrier ● Malfunction of connector ● Malfunction of the Engine A/T-ECU

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Code No. 26 Stop light switch system	Probable cause
If the stop light switch is on for 5 minutes or more while driving, it is judged that there is a short circuit in the stop light switch and diagnosis code No. 26 is output.	• Malfunction of the stop light switch • Malfunction of connector • Malfunction of the Engine A/T-ECU

Stop light switch check (Refer GROUP 35 On Vehicle Service.) — NG → **Replace**
↓ OK
Check the following connectors: B-18, B-41, B-111 — NG → **Repair**
↓ OK
Harness check
- Between stop light switch and Engine A/T-ECU — NG → **Repair**

↓ OK
Check the trouble symptoms. — NG → Replace the Engine A/T-ECU. CAUTION

Code No. 31 Low and reverse solenoid valve system	Probable cause
Code No. 32 Underdrive solenoid valve system	
Code No. 33 Second solenoid valve system	
Code No. 34 Overdrive solenoid valve system	
Code No. 35 RED solenoid valve system	
If the resistance value for a solenoid valve is too large or too small, it is judged that there is a short-circuit or an open circuit in the solenoid valve and the respective diagnosis code is output. The transmission is locked into 3rd gear as a fail-safe measure, and the N range light flashes at a frequency of 1 Hz.	• Malfunction of solenoid valve • Malfunction of connector • Malfunction of the Engine A/T-ECU

Solenoid valve check (Refer On Vehicle Service.) — NG → **Replace**
↓ OK
Check the following connectors: A-87, B-111 — NG → **Repair**
↓ OK
Harness check
- Between solenoid valve and Engine A/T-ECU — NG → **Repair**

↓ OK
Check the trouble symptoms. — NG → Replace the Engine A/T-ECU. CAUTION

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Code No. 36, 52, DCC solenoid valve system	Probable cause
If the DCC solenoid valve resistance value is too large or too small, it is judged that there is a short-circuit or an open circuit in the damper clutch solenoid and diagnosis code No. 36 is output. If the drive duty rate for the DCC solenoid valve is 100 % for a continuous period of 4 seconds or more, it is judged that there is an abnormality in the damper clutch system and diagnosis code No. 52 is output. When diagnosis code No. 36 is output, the transmission is locked into 3rd gear as a fail-safe measure, and the N range light flashes at a frequency of 1 Hz.	● Malfunction of the DCC solenoid valve ● Malfunction of connector ● Malfunction of the Engine A/T-ECU

DCC solenoid valve check (Refer On Vehicle Service.) — NG → **Replace**

↓ OK

Check the following connectors: A-87, B-111 — NG → **Repair**

↓ OK

Harness check
● Between applicable solenoid and Engine A/T-ECU — NG → **Repair**

↓ OK

Replace the DCC solenoid valve.

↓

Check the trouble symptoms. — NG → Replace the Engine A/T-ECU. CAUTION

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Code No. 41 1st gear incorrect ratio	Probable cause
If the output from the output shaft speed sensor multiplied by the 1st gear ratio is not the same as the output from the input shaft speed sensor after shifting to 1st gear has been completed, diagnosis code No. 41 is output. If diagnosis code No. 41 is output four times, the transmission is locked into 3rd gear as a fail-safe measure, and the N range light flashes at a frequency of 1 Hz.	• Malfunction of the input shaft speed sensor • Malfunction of the output shaft speed sensor • Malfunction of the underdrive clutch retainer • Malfunction of the low and reverse brake system • Malfunction of the underdrive clutch system • Malfunction of the RED brake system • Noise generated

MUT-II Self Diagnosis
Is the diagnosis code No. 22 output?

Yes → Code No. 22 Check Input shaft speed sensor system.

No ↓

MUT-II Self Diagnosis
Is the diagnosis code No. 23 output?

Yes → Code No. 23 Check Output shaft speed sensor system.

No ↓

Measure output waveform from the input shaft speed sensor. (using an oscilloscope)
- Connect the connector B-109 and B-111 and measure voltage between 57 and 103 at the Engine A/T-ECU.
- Engine: 2,000 r/min [approx. 50 km/h]
- Selector lever position: 3
  (Voltage)
  OK: A waveform such as the one shown in (Inspection Procedure Using an Oscilloscope) is output (flashing 1.0V or higher) and there is no noise appearing in the waveform.

NG →
- Replace the input shaft speed sensor.
- ↓ Check the trouble symptoms.
- NG ↓ A/T overhaul
  - Replace the underdrive clutch retainer.
- ↓ Check the trouble symptoms.
- NG ↓ Eliminate the cause of the noise.

OK ↓

Measure output waveform from the output shaft speed sensor. (using an oscilloscope)
- Connect the connector B-109 and B-111 and measure voltage between 57 and 103 at the Engine A/T-ECU.
- Engine: 2,000 r/min [approx. 50 km/h]
- Selector lever position: 3
  (Voltage)
  OK: A waveform such as the one shown in (Inspection procedure for using oscilloscope) is output (flashing 1.0V or higher) and there is no noise appearing in the waveform.

NG →
- Replace the output shaft speed sensor.
- ↓ Check the trouble symptoms.
- NG ↓ A/T overhaul
  - Replace the transfer drive gear and driven gear.
- ↓ Check the trouble symptoms.
- NG ↓ Eliminate the cause of the noise.

OK ↓

A/T overhaul ★
- Replace the underdrive clutch. (No.41, No.43 or no diagnosis code is output.)
- Replace the second clutch. (No.44 or no diagnosis code is output.)
- Check RED brake system.

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Code No. 42 2nd gear incorrect ratio	Probable cause
If the output from the output shaft speed sensor multiplied by the 2nd gear ratio is not the same as the output from the input shaft speed sensor after shifting to 2nd gear has been completed, diagnosis code No. 42 is output. If diagnosis code No. 42 is output four times, the transmission is locked into 3rd gear as a fail-safe measure, and the N range light flashes at a frequency of 1 Hz.	• Malfunction of the input shaft speed sensor • Malfunction of the output shaft speed sensor • Malfunction of the underdrive clutch retainer • Malfunction of the second brake system • Malfunction of the underdrive clutch system • Malfunction of the RED brake system • Noise generated

MUT-II Self Diagnosis
Is the diagnosis code No. 22 output?

Yes → Code No. 22 Check Input shaft speed sensor system.

No ↓

MUT-II Self Diagnosis
Is the diagnosis code No. 23 output?

Yes → Code No. 23 Check Output shaft speed sensor system.

No ↓

Measure output waveform from the input shaft speed sensor. (using an oscilloscope)
- Connect the connector B-109 and B-111 and measure voltage between 57 and 103 at the Engine A/T-ECU.
- Engine: 2,000 r/min [approx. 50 km/h]
- Selector lever position: 3
  (Voltage)
  OK: A waveform such as the one shown in (Inspection Procedure Using an Oscilloscope) is output (flashing 1.0V or higher) and there is no noise appearing in the waveform.

NG →
- Replace the input shaft speed sensor.
- ↓ Check the trouble symptoms.
- NG ↓ A/T overhaul
  - Replace the underdrive clutch retainer.
- ↓ Check the trouble symptoms.
- NG ↓ Eliminate the cause of the noise.

OK ↓

Measure output waveform from the output shaft speed sensor. (using an oscilloscope)
- Connect the connector B-109 and B-111 and measure voltage between 57 and 103 at the Engine A/T-ECU.
- Engine: 2,000 r/min [approx. 50 km/h]
- Selector lever position: 3
  (Voltage)
  OK: A waveform such as the one shown in (Inspection procedure for using oscilloscope) is output (flashing 1.0V or higher) and there is no noise appearing in the waveform.

NG →
- Replace the output shaft speed sensor.
- ↓ Check the trouble symptoms.
- NG ↓ A/T overhaul
  - Replace the transfer drive gear and driven gear.
- ↓ Check the trouble symptoms.
- NG ↓ Eliminate the cause of the noise.

OK ↓

A/T overhaul ★
- Replace the underdrive clutch. (No.41, No.43 or no diagnosis code is output.)
- Replace the second clutch. (No.44 or no diagnosis code is output.)
- Check RED brake system.

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Code No. 43 3rd gear incorrect ratio	Probable cause
If the output from the output shaft speed sensor multiplied by the 3rd gear ratio is not the same as the output from the input shaft speed sensor after shifting to 3rd gear has been completed, diagnosis code No. 43 is output. If diagnosis code No. 43 is output four times, the transmission is locked into 3rd gear as a fail-safe measure, and the N range light flashes at a frequency of 1 Hz.	• Malfunction of the input shaft speed sensor • Malfunction of the output shaft speed sensor • Malfunction of the underdrive clutch retainer • Malfunction of the underdrive clutch system • Malfunction of the overdrive clutch system • Malfunction of the RED brake system • Noise generated

MUT-II Self Diagnosis
Is the diagnosis code No. 22 output?

Yes → Code No. 22 Check Input shaft speed sensor system.

No ↓

MUT-II Self Diagnosis
Is the diagnosis code No. 23 output?

Yes → Code No. 23 Check Output shaft speed sensor system.

No ↓

Measure output waveform from the input shaft speed sensor. (using an oscilloscope)
- Connect the connector B-109 and B-111 and measure voltage between 57 and 103 at the Engine A/T-ECU.
- Engine: 2,000 r/min [approx. 50 km/h]
- Selector lever position: 3
  (Voltage)
  OK: A waveform such as the one shown in (Inspection Procedure Using an Oscilloscope) is output (flashing 1.0V or higher) and there is no noise appearing in the waveform.

NG →
- Replace the input shaft speed sensor.
- ↓ Check the trouble symptoms.
- NG ↓ A/T overhaul
  - Replace the underdrive clutch retainer.
- ↓ Check the trouble symptoms.
- NG ↓ Eliminate the cause of the noise.

OK ↓

Measure output waveform from the output shaft speed sensor. (using an oscilloscope)
- Connect the connector B-109 and B-111 and measure voltage between 57 and 103 at the Engine A/T-ECU.
- Engine: 2,000 r/min [approx. 50 km/h]
- Selector lever position: 3
  (Voltage)
  OK: A waveform such as the one shown in (Inspection Procedure Using an Oscilloscope) is output (flashing 1.0V or higher) and there is no noise appearing in the waveform.

NG →
- Replace the output shaft speed sensor.
- ↓ Check the trouble symptoms.
- NG ↓ A/T overhaul
  - Replace the transfer drive gear and driven gear.
- ↓ Check the trouble symptoms.
- NG ↓ Eliminate the cause of the noise.

OK ↓

A/T overhaul
- Replace the underdrive clutch. (No.41, No.42 or no diagnosis code is output.)
- Replace the overdrive clutch. (No.44 or no diagnosis code is output.)
- Check RED brake system.

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Code No. 44 4th gear incorrect ratio	Probable cause
If the output from the output shaft speed sensor multiplied by the 4th gear ratio is not the same as the output from the input shaft speed sensor after shifting to 4th gear has been completed, diagnosis code No. 44 is output. If diagnosis code No. 44 is output four times, the transmission is locked into 3rd gear as a fail-safe measure, and the N range light flashes at a frequency of 1 Hz.	• Malfunction of the input shaft speed sensor • Malfunction of the output shaft speed sensor • Malfunction of the underdrive clutch retainer • Malfunction of the DIR clutch system • Noise generated

MUT-II Self Diagnosis
Is the diagnosis code No. 22 output?

Yes → Code No. 22 Check Input shaft speed sensor system.

No ↓

MUT-II Self Diagnosis
Is the diagnosis code No. 23 output?

Yes → Code No. 23 Check Output shaft speed sensor system.

No ↓

Measure output waveform from the input shaft speed sensor. (using an oscilloscope)
- Connect the connector B-109 and B-111 and measure voltage between 57 and 103 at the Engine A/T-ECU.
- Engine: 2,000 r/min [approx. 50 km/h]
- Selector lever position: 3

(Voltage)
OK: A waveform such as the one shown in (Inspection Procedure Using an Oscilloscope) is output (flashing 1.0V or higher) and there is no noise appearing in the waveform.

NG →
Replace the input shaft speed sensor.
↓
Check the trouble symptoms.
NG ↓
A/T overhaul
- Replace the underdrive clutch retainer.

↓
Check the trouble symptoms.
NG ↓
Eliminate the cause of the noise.

OK ↓

Measure output waveform from the output shaft speed sensor. (using an oscilloscope)
- Connect the connector B-109 and B-111 and measure voltage between 57 and 104 at the Engine A/T-ECU.
- Engine: 2,000 r/min [approx. 50 km/h]
- Selector lever position: 3

(Voltage)
OK: A waveform such as the one shown in (Inspection Procedure Using an Oscilloscope) is output (flashing 1.0V or higher) and there is no noise appearing in the waveform.

NG →
Replace the output shaft speed sensor.
↓
Check the trouble symptoms.
NG ↓
A/T overhaul
- Replace the transfer drive gear and driven gear.

↓
Check the trouble symptoms.
NG ↓
Eliminate the cause of the noise.

OK ↓

A/T overhaul
- Check underdrive clutch system.
- Replace the overdrive clutch. (No.43 or no diagnosis code is output.)
- Check DIR clutch system.

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Code No. 45 5th gear incorrect ratio	Probable cause
If the output from the output shaft speed sensor multiplied by the 5th gear ratio is not the same as the output from the input shaft speed sensor after shifting to 5th gear has been completed, diagnosis code No. 45 is output. If diagnosis code No. 45 is output four times, the transmission is locked into 3rd gear as a fail-safe measure, and the N range light flashes at a frequency of 1 Hz.	• Malfunction of the input shaft speed sensor • Malfunction of the output shaft speed sensor • Malfunction of the underdrive clutch retainer • Malfunction of the direct planetary carrier • Malfunction of the 2nd brake system • Malfunction of the overdrive clutch system • Malfunction of the DIR clutch system • Noise generated

MUT-II Self Diagnosis
Is the diagnosis code No. 22 output?

Yes → Code No. 22 Check Input shaft speed sensor system.

No ↓

MUT-II Self Diagnosis
Is the diagnosis code No. 23 output?

Yes → Code No. 23 Check Output shaft speed sensor system.

No ↓

Measure output waveform from the input shaft speed sensor. (using an oscilloscope)
- Connect the connector B-109 and B-111 and measure voltage between 57 and 103 at the Engine A/T-ECU.
- Engine: 2,000 r/min [approx. 50 km/h]
- Selector lever position: 3
(Voltage)
OK: A waveform such as the one shown in (Inspection Procedure Using an Oscilloscope) is output (flashing 1.0V or higher) and there is no noise appearing in the waveform.

NG →
- Replace the input shaft speed sensor.
- ↓ Check the trouble symptoms.
- NG ↓ A/T overhaul
  - Replace the underdrive clutch retainer.
- ↓ Check the trouble symptoms.
- NG ↓ Eliminate the cause of the noise.

OK ↓

Measure output waveform from the output shaft speed sensor. (using an oscilloscope)
- Connect the connector B-109 and B-111 and measure voltage between 57 and 104 at the Engine A/T-ECU.
- Engine: 2,000 r/min [approx. 50 km/h]
- Selector lever position: 3
(Voltage)
OK: A waveform such as the one shown in (Inspection Procedure Using an Oscilloscope) is output (flashing 1.0V or higher) and there is no noise appearing in the waveform.

NG →
- Replace the output shaft speed sensor.
- ↓ Check the trouble symptoms.
- NG ↓ A/T overhaul
  - Replace the transfer drive gear and driven gear.
- ↓ Check the trouble symptoms.
- NG ↓ Eliminate the cause of the noise.

OK ↓

A/T overhaul
- Check the 2nd brake system.
- Check the overdrive clutch system.
- Check the DIR clutch system.

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Code No. 46 Reverse gear incorrect ratio	Probable cause
If the output from the output shaft speed sensor multiplied by the reverse gear ratio is not the same as the output from the input shaft speed sensor after shifting to reverse gear has been completed, diagnosis code No. 46 is output. If diagnosis code No. 46 is output four times, the transmission is locked into 3rd gear as a fail-safe measure, and the N range light flashes at a frequency of 1 Hz.	• Malfunction of the input shaft speed sensor • Malfunction of the output shaft speed sensor • Malfunction of the planetary carrier • Malfunction of the RED clutch system • Malfunction of the low and reverse brake system • Malfunction of the reverse clutch system • Noise generated

MUT-II Self Diagnosis
Is the diagnosis code No. 22 output?

Yes → Code No. 22 Check Input shaft speed sensor system.

No ↓

MUT-II Self Diagnosis
Is the diagnosis code No. 23 output?

Yes → Code No. 23 Check Output shaft speed sensor system.

No ↓

Measure output waveform from the input shaft speed sensor. (using an oscilloscope)
- Connect the connector B-109 and B-111 and measure voltage between 57 and 103 at the Engine A/T-ECU.
- Engine: 2,000 r/min [approx. 50 km/h]
- Selector lever position: 3
  (Voltage)
  OK: A waveform such as the one shown in (Inspection Procedure Using an Oscilloscope) is output (flashing 1.0V or higher) and there is no noise appearing in the waveform.

NG →
- Replace the input shaft speed sensor.
- Check the trouble symptoms.
- NG ↓
- A/T overhaul
  - Replace the underdrive clutch retainer.
- Check the trouble symptoms.
- NG ↓
- Eliminate the cause of the noise.

OK ↓

Measure output waveform from the output shaft speed sensor. (using an oscilloscope)
- Connect the connector B-109 and B-111 and measure voltage between 57 and 104 at the Engine A/T-ECU.
- Engine: 2,000 r/min [approx. 50 km/h]
- Selector lever position: 3
  (Voltage)
  OK: A waveform such as the one shown in (Inspection Procedure Using an Oscilloscope) is output (flashing 1.0V or higher) and there is no noise appearing in the waveform.

NG →
- Replace the output shaft speed sensor.
- Check the trouble symptoms.
- NG ↓
- A/T overhaul
  - Replace the transfer drive gear and driven gear.
- Check the trouble symptoms.
- NG ↓
- Eliminate the cause of the noise.

OK ↓

A/T overhaul
- Replace the low and reverse brake. (No.41 or no diagnosis code is output.)
- Replace the reverse clutch. (No diagnosis code is output.)
- Check the DIR clutch system.

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Code No. 51 Abnormal communication with Engine A/T-ECU	Probable cause
If normal communication is not possible for a continuous period of 1 second or more when the battery voltage is 10 V or more and the engine speed is 450 r/min or more, diagnosis code No. 51 is output. Diagnosis code No. 51 is also output if the data being received is abnormal for a continuous period of 4 seconds under the same conditions.	• Malfunction of the Engine A/T-ECU • Faulty connector

Code No. 54 and 55 A/T Control relay system	Probable cause
If the control relay voltage is less than 7 V after the ignition switch has been turned to ON, it is judged that there is an open circuit or a short-circuit in the A/T control relay earth and diagnosis code No. 54 is output. After the ignition switch is turned on, if the A/T voltage is 5 V or higher before the A/T ECU sends instructions for the relay to be turned on, Code 55 will be output to indicate a malfunction of the A/T control relay. The transmission is locked into 3rd gear as a fail-safe measure, and the N range light flashes at a frequency of 1 Hz.	• Malfunction of the A/T control relay • Malfunction of connector • Malfunction of the Engine A/T-ECU

Code No. 56 N range light system	Probable cause
If the N range signal is off after an N range light illumination instruction (ON instruction) has been given, it is judged that there is a short-circuit in the N range light earth and diagnosis code No. 56 is output.	• Malfunction of connector • Malfunction of the Engine A/T-ECU

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Code No. 71 Malfunction of Engine A/T-ECU	Probable cause
There is an abnormality in the Engine A/T-ECU. The transmission is locked into 3rd gear as a fail-safe measure.	• Malfunction of the Engine A/T-ECU

Replace the Engine-A/T-ECU. CAUTION

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INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble symptom		Inspection procedure No.
Communication with the MUT-II is not possible		1
Driving impossible	Starting impossible	2
	Does not move forward	3
	Does not reverse	4
	Does not move (forward or reverse)	5
Malfunction when starting	Engine stalling when shifting	6
	Shocks when changing from N to D and long time lag	7
	Shocks when changing from N to R and long time lag	8
	Shocks when changing from N to D, N to R and long time lag	9
Malfunction when shifting	Shocks and running up	10
Displaced shifting points	All points	11
	Some points	12
Does not shift	No diagnosis codes	13
Malfunction while driving	Poor acceleration	14
	Vibration	15
Inhibitor switch system		16
Sports mode switch system		17
Idle position switch system		18
Dual pressure switch system		19
Vehicle speed sensor system		20
Cruise control -ECU signal system		21

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INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

INSPECTION PROCEDURE 1

Communication with the MUT-II is not possible	Probable cause
If communication with the MUT-II is not possible, the cause is probably a defective diagnosis line or the Engine A/T-ECU is not functioning.	• Malfunction of diagnosis line • Malfunction of connector • Malfunction of the Engine A/T-ECU

INSPECTION PROCEDURE 2

Starting impossible	Probable cause
Starting is not possible when the selector lever is in P or N range. In such cases, the cause is probably a defective engine system, torque converter or oil pump or seized oil pump.	• Malfunction of the engine system • Malfunction of the torque converter • Malfunction of the oil pump

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INSPECTION PROCEDURE 3

Does not move (forward)	Probable cause
If the vehicle does not move forward when the selector lever is shifted from N to D, 3, 2 or L range, sports mode 1st or 2nd while the engine is idling, the cause is probably abnormal line pressure or a malfunction of the underdrive clutch or valve body.	• Abnormal line pressure • Malfunction of the underdrive solenoid valve • Malfunction of the underdrive clutch • Malfunction of the valve body

INSPECTION PROCEDURE 4

Does not reverse	Probable cause
If the vehicle does not reverse when the selector lever is shifted from N to R range while the engine is idling, the cause is probably abnormal pressure in the reverse clutch or low and reverse brake or a malfunction of the reverse clutch, low and reverse brake or valve body.	• Abnormal reverse clutch pressure • Abnormal low and reverse brake pressure • Malfunction of the low and reverse solenoid valve • Malfunction of the reverse clutch • Malfunction of the low and reverse brake • Malfunction of the valve body

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INSPECTION PROCEDURE 5

Does not move (forward or reverse)	Probable cause
If the vehicle does not move forward or reverse when the selector lever is shifted to any position while the engine is idling, the cause is probably abnormal line pressure, or a malfunction of the power train, oil pump or valve body.	• Abnormal line pressure • Malfunction of power train • Malfunction of the oil pump • Malfunction of the valve body

Check Hydraulic pressure
- Measure the hydraulic pressure for each element when moving forward and back.
  Standard Value: Refer Specifications

OK → Power train check
- Disassemble the transmission, check the condition of the planetary carrier, output shaft and differential, etc.

NG ↓

Replace the oil pump assembly.
(The oil pump cannot be disassembled.)

NG → Valve body disassembly, cleaning and reassembly
- Pay particular attention to loosening of bolts, and to damage and slippage of O-rings, valves and valve bodies.
- If the damage cannot be repaired, replace the valve body assembly.

INSPECTION PROCEDURE 6

Engine stalling when shifting	Probable cause
If the engine stalls when the selector lever is shifted from N to D or R range while the engine is idling, the cause is probably a malfunction of the engine system, damper clutch control solenoid, valve body or torque converter (damper clutch malfunction).	• Malfunction of the engine system • Malfunction of the damper clutch control solenoid • Malfunction of the valve body • Malfunction of the torque converter (Malfunction of the damper clutch)

Engine system check
- Check the control system, ignition system, fuel system and main system.

NG → **Repair, replace**

OK ↓

Replace the damper clutch control solenoid.

↓

Valve body disassembly, cleaning and reassembly
- Pay particular attention to loosening of bolts, and to damage and slippage of O-rings, valves and valve bodies.
- If the damage cannot be repaired, replace the valve body assembly.

NG → Replace the torque converter.

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INSPECTION PROCEDURE 7

Shocks when changing from N to D and large time lag	Probable cause
If abnormal shocks or a time lag of 2 seconds or more occur when the selector lever is shifted from N to D range while the engine is idling, the cause is probably abnormal underdrive clutch pressure or a malfunction of the underdrive clutch, valve body or idle position switch.	• Abnormal underdrive clutch pressure • Malfunction of the underdrive solenoid valve • Malfunction of the underdrive clutch • Malfunction of the valve body • Malfunction of the idle position switch

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INSPECTION PROCEDURE 8

Shocks when changing from N to R and large time lag	Probable cause
If abnormal shocks or a time lag of 2 seconds or more occurs when the selector lever is shifted from N to R range while the engine is idling, the cause is probably abnormal reverse clutch pressure or low and reverse brake pressure, or a malfunction of the reverse clutch, low and reverse brake, valve body or idle position switch.	• Abnormal reverse clutch pressure • Abnormal low and reverse brake pressure • Malfunction of the low and reverse solenoid valve • Malfunction of the reverse clutch • Malfunction of the low and reverse brake • Malfunction of the valve body • Malfunction of the idle position switch

INSPECTION PROCEDURE 9

Shocks when changing from N to D, N to R and large time lag	Probable cause
If abnormal shocks or a time lag of 2 seconds or more occur when the selector lever is shifted from N to D range and from N to R range while the engine is idling, the cause is probably abnormal line pressure or a malfunction of the oil pump or valve body.	• Abnormal line pressure • Malfunction of the oil pump • Malfunction of the valve body

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INSPECTION PROCEDURE 10

Shocks and running up	Probable cause
If shocks occur when driving due to upshifting or downshifting and the transmission speed becomes higher than the engine speed, the cause is probably abnormal line pressure or a malfunction of a solenoid valve, oil pump, valve body or of a brake or clutch.	• Abnormal line pressure • Malfunction of each solenoid valve • Malfunction of the oil pump • Malfunction of the valve body • Malfunction of each brake or each clutch

MUT-II Actuator Test
- No. 1 Low and reverse solenoid valve
- No. 2 Underdrive solenoid valve
- No. 3 Second solenoid valve
- No. 4 Overdrive solenoid valve
- No. 5 RED solenoid valve

OK: Sound of operation can be heard.

NG → Replace the solenoid valve.

OK ↓

Adjust the line pressure.

NG → Replace the oil pump assembly. (The oil pump cannot be disassembled.)

NG ↓

Valve body disassembly, cleaning and reassembly
- Pay particular attention to loosening of bolts, and to damage and slippage of O-rings, valves and valve bodies.
- If the damage cannot be repaired, replace the valve body assembly.

OK ↓

Clutch and brake check ★
- Check for burning of the facing, defective piston seal rings and interference at the retainer.

INSPECTION PROCEDURE 11

All points (Displaced shifting points)	Probable cause
If all shift points are displaced while driving, the cause is probably a malfunction of the output shaft speed sensor, TPS or of a solenoid valve.	• Malfunction of the output shaft speed sensor • Malfunction of the throttle position sensor • Malfunction of each solenoid valve • Abnormal line pressure • Malfunction of the valve body • Malfunction of the Engine A/T-ECU

MUT-II Data list
- No. 23 Output shaft speed sensor

OK: Increases in proportion to vehicle speed.

NG → Code No. 23 – Check Output shaft speed sensor system.

OK ↓

MUT-II Data list
- No. 11 TPS

OK: Increases in proportion to accelerator pedal opening angle

NG → Code No. 11, 12, 14 Check TPS system.

OK ↓

MUT-II Data list
- No. 31 Low and reverse solenoid valve duty %
- No. 32 Underdrive solenoid valve duty %
- No. 33 Second solenoid valve duty %
- No. 34 Overdrive solenoid valve duty %
- No. 35 RED solenoid valve duty %

OK: Refer to the table on next page.

NG → Replace the solenoid valve.

NG ↓

Replace the Engine A/T-ECU. CAUTION

OK ↓

Adjust the line pressure. (Refer On Vehicle Service.)

NG → Valve body disassembly, cleaning and reassembly ★
- Pay particular attention to loosening of bolts, and to damage and slippage of O-rings, valves and valve bodies.
- If the damage cannot be repaired, replace the valve body assembly.

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	No. 31	No. 32	No. 33	No. 34	No. 35
Driving at constant speed in 1st gear	100 %	0 %	100 %	100 %	0 %
Driving at constant speed in 2nd gear	100 %	0 %	0 %	100 %	0 %
Driving at constant speed in 3rd gear	100 %	0 %	100 %	0 %	0 %
Driving at constant speed in 4th gear	0 %	0 %	100 %	0 %	100 %
Driving at constant speed in 5th gear	0 %	100 %	0 %	0 %	100 %

INSPECTION PROCEDURE 12

Some points (Displaced shifting points)	Probable cause
If some of the shift points are displaced while driving, the cause is probably a malfunction of the valve body, or it is related to control and is not an abnormality.	• Malfunction of the valve body

INSPECTION PROCEDURE 13

No diagnosis codes (Does not shift)	Probable cause
If shifting does not occur while driving and no diagnosis codes are output, the cause is probably a malfunction of the Inhibitor switch, or Engine A/T-ECU.	• Malfunction of the Inhibitor switch • Malfunction of the Engine A/T-ECU

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INSPECTION PROCEDURE 14

Poor acceleration	Probable cause
If acceleration is poor even if downshifting occurs while driving, the cause is probably a malfunction of the engine system or of a brake or clutch.	• Malfunction of the engine system • Malfunction of the brake or clutch

Engine system check
- Check the control system, ignition system, fuel system and main system.

NG → **Replace, repair**

OK ↓

Brake or clutch check
- Check for burning of the facing, defective piston seal rings and interference at the retainer.

INSPECTION PROCEDURE 15

Vibration	Probable cause
If vibration occurs when driving at constant speed or when accelerating in top range, the cause is probably abnormal damper clutch pressure or a malfunction of the engine system, damper clutch solenoid, torque converter or valve body.	• Abnormal damper clutch pressure • Malfunction of the engine system • Malfunction of the damper clutch solenoid • Malfunction of the torque converter • Malfunction of the valve body

MUT-II Actuator Test
- No. 6 Damper clutch solenoid
  OK: Sound of operation can be heard.

NG → Replace the damper clutch solenoid valve.

OK ↓

Does the problem occur even when the oil temperature sensor connector is disconnected?

Yes → Engine system check
- Check the control system, ignition system, fuel system and main system.

No ↓

Check Hydraulic pressure
- Measure the damper clutch pressure.
  Standard Value: Refer Specifications

NG → Valve body disassembly, cleaning and reassembly
- Pay particular attention to loosening of bolts, and to damage and slippage of O-rings, valves and valve bodies.
- If the damage cannot be repaired, replace the valve body assembly.

OK ↓

Replace the torque converter assembly.

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INSPECTION PROCEDURE 16

Inhibitor switch system	Probable cause
There may be defects with the inhibitor switch circuit or the ignition switch circuit.	• Malfunction of the inhibitor switch • Malfunction of connector • Malfunction of the ignition switch • Malfunction of the Engine A/T-ECU

INSPECTION PROCEDURE 17

Sports mode switch system	Probable cause
A malfunction may exist with the inhibitor switch circuit, the sports mode switch circuit or the Engine–A/T ECU.	• Malfunction of inhibitor switch • Malfunction of the Engine A/T-ECU • Malfunction of the sports mode select switch • Malfunction of the sports mode upshift select switch • Malfunction of the sports mode downshift select switch

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INSPECTION PROCEDURE 18

Idle switch circuit system	Probable cause
There may be a malfunction of the inhibitor switch circuit or the ignition switch circuit.	• Malfunction of the idle switch • Malfunction of connector • Malfunction of the Engine A/T-ECU

INSPECTION PROCEDURE 19

Dual pressure switch system	Probable cause
The cause is probably a defective dual pressure switch circuit or a defective Engine A/T-ECU.	• Malfunction of the dual pressure switch • Malfunction of connector • Malfunction of A/C system • Malfunction of the Engine A/T-ECU

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INSPECTION PROCEDURE 20

Vehicle speed sensor system	Probable cause
A malfunction may exist in the speed sensor circuit or the Engine A/T-ECU.	• Malfunction of the vehicle speed sensor • Malfunction of the connector • Malfunction of the Engine A/T-ECU

INSPECTION PROCEDURE 21

Cruise control -ECU signal system	Probable cause
A malfunction may exist in the cruise control signal line circuit or the Engine A/T-ECU.	• Malfunction of connector • Malfunction of the Engine A/T-ECU • Malfunction of the cruise control ECU

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SERVICE DATA REFERENCE TABLE

Item No.	Check item	Check requirement		Normal value
11	Throttle position sensor	Engine: Stopped Selector lever position: P	Accelerator pedal: Fully closed	400 – 1,000 mV
			Accelerator pedal: Depressed	Gradually rises from the above value
			Accelerator pedal: Fully open	4,500 – 5,000 mV
15	Oil temperature sensor	Warming up	Drive for 15 minutes or more so that the automatic transmission fluid temperature becomes 70 – 90 °C.	Gradually rises to 70 – 90 °C
21	Crank angle sensor	Engine: Idling Selector lever position: P	Accelerator pedal: Fully closed	800 – 900 rpm
			Accelerator pedal: Depressed	Gradually rises from the above value
22	Input shaft speed sensor	Selector lever position: Sports mode	Driving at constant speed of 50 km/h in 4th gear	1,100 – 1,400 rpm
23	Output shaft speed sensor	Selector lever position: 3	Driving at constant speed of 50 km/h in 3rd gear	1,100 – 1,400 rpm
26	Stop light switch	Ignition switch: ON Engine: Stopped	Brake pedal: Depressed	ON
			Brake pedal: Released	OFF
29	Vehicle speed sensor	Shift range: Speed	Idling with 1st gear (Vehicle stopped)	0 km/h
			Driving at constant speed of 50 km/h in 3rd gear	50 km/h
31	Low and reverse solenoid valve duty %	Shift range: Speed	Driving at constant speed of 10 km/h in 1st gear	No. 31: 100 %, No. 32: 0 %, No. 33: 100 %, No. 34: 100%, No. 35: 0%
32	Underdrive solenoid valve duty %		Driving at constant speed of 30 km/h in 2nd gear	No. 31: 100 %, No. 32: 0 %, No. 33: 0 %, No. 34: 100%, No. 35: 0%
33	Second solenoid valve duty %		Driving at constant speed of 50 km/h in 3rd gear	No. 31: 100 %, No. 32: 0 %, No. 33: 100 %, No. 34: 0%, No. 35: 0%
34	Overdrive solenoid valve duty %		Driving at constant speed of 50 km/h in 4th gear	No. 31: 0 %, No. 32: 0 %, No. 33: 100 %, No. 34: 0%, No. 35: 100%
35	RED solenoid valve duty %		Driving at constant speed of 50 km/h in 5th gear	No. 31: 0 %, No. 32: 100 %, No. 33: 0 %, No. 34: 0%, No. 35: 100%

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Item No.	Check item	Check requirement		Normal value
36	Damper clutch solenoid duty %	Shift range: Speed	Accelerate to 50 km/h in 3 position, then release accelerator pedal*	0 %
			Driving at constant speed of 50 km/h in 3rd gear	Approx. 70 – 90 %
52	Amount of damper clutch slippage	Shift range: Speed	Driving at constant speed of 50 km/h in 3rd gear	Approx. 100 – 300 rpm*
			Driving at constant speed of 70 km/h in 4th gear	Approx. 0 – 10 rpm
54	A/T control relay output voltage		Ignition switch: OFF → ON	0 mV → Battery voltage (mV)
57	Engine volumetric efficiency	Selector lever position: N	Accelerator pedal fully closed → depressed	Data changes
58	Engine intake manifold vacuum	Selector lever position: N	Accelerator pedal fully closed → depressed	Data changes
61	Inhibitor switch	Ignition switch: ON Engine: Stopped	Selector lever position: P	P
			Selector lever position: R	R
			Selector lever position: N	N
			Selector lever position: D	D
63	Shift position	Selector lever position: Sports mode	Driving at constant speed of 10 km/h in 1st gear	1st
			Driving at constant speed of 30 km/h in 2nd gear	2nd
			Driving at constant speed of 50 km/h in 3rd gear	3rd
			Driving at constant speed of 70 km/h in 4th gear	4th
			Driving at constant speed of 70 km/h in 5th gear	5th
64	Idle position switch	Engine: Idling Selector lever position: N	Accelerator pedal: Fully closed	ON
			Accelerator pedal: Depressed	OFF

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Item No.	Check item	Check requirement		Normal value
65	Dual pressure switch	Engine: Idling Selector lever position: N	A/C switch: ON	ON
			A/C switch: OFF	OFF
66	Cruise control ECU signal	While cruise control operating	Plain road	OFF
			Sloping road	ON
67	Sports mode select switch	Ignition switch: ON Engine: Stopped	Selector lever: D position	No. 67: OFF, No. 68: OFF, No. 69: OFF
68	Sports mode upshift switch		Selector lever operation: Select to sports mode	No. 67: ON, No. 68: OFF, No. 69: OFF
69	Sports mode downshift switch		Selector lever operation: Upshift and hold lever	No. 67: ON, No. 68: OFF, No. 69: OFF
			Selector lever operation: Downshift and hold lever	No. 67: ON, No. 68: OFF, No. 69: OFF

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ACTUATOR TEST JUDGEMENT VALUE

Item No.	Check item	Test content	Check requirement	Normal value
1	Low reverse solenoid valve	Drive the solenoid valve specified by the MUT-II at 50 % duty for 5 seconds. No other solenoid valve should be energised.	Ignition switch: ON Selector lever position: P Engine: 0 r/min Vehicle speed: 0 km/h (Vehicle stopped) Throttle opening voltage: Less than 1 V Idle position switch: ON While fail-safe function is not in operation.	The operation sound should be audible when the solenoid valve is driven.
2	Underdrive solenoid valve			
3	Second solenoid valve			
4	Overdrive solenoid valve			
5	RED solenoid valve			
6	Damper clutch solenoid			
7	1st speed shift indicator lamp	The indicator lamp for the gear specified by MUT-II is lit for 3 seconds		The shift indicator lamp must be lit.
8	2nd speed shift indicator lamp			
9	3rd speed shift indicator lamp			
10	4th speed shift indicator lamp			
11	5th speed shift indicator lamp			
12	A/T control relay	Control relay is OFF for 3 seconds.		Data list No. 54 (1) During test: 0 mV (2) Normal: Battery voltage [mV]

INVECS-II CANCEL COMMAND

Item No.	Item	Content	Remarks
14	INVECS-II	Stop the INVECS-II control and change gears according to the standard shift pattern.	Use this function when carrying out procedure 7 in the road tests.

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CHECK AT ENGINE A/T-ECU TERMINALS

Terminal No.	Check item	Check requirement	Standard value
50	A/T control relay	Ignition switch: Off	0 V
		Ignition switch: On	Battery voltage
57	Sensor ground	Always	0 V
75	Cruise control unit	OD-OFF command not executed	Battery voltage
		OD-OFF command executed	0 V
76	Ground	Always	0 V
77	Power supply – solenoid valve	Ignition switch: OFF	0 V
		Ignition switch: ON	Battery voltage
86	Input of communication with the TCL-ECU	Engine: Operation at idle Selector lever position: D	Other than 0 V
87	Output of communication with the TCL-ECU	Engine: Operation at idle Selector lever position: D	Other than 0 V
88	Ground	Always	0 V
89	Power supply – solenoid valve	Ignition switch: OFF	0 V
		Ignition switch: ON	Battery voltage
97	Ground	Always	0 V
101	Inhibitor switch: P	Selector lever position: P	Battery voltage
		Selector lever position: Other than above	0 V
102	Inhibitor switch: D	Selector lever position: D	Battery voltage
		Selector lever position: Other than above	0 V
103	Input shaft speed sensor	Measure from terminal No. 103 to 111 with an oscilloscope. Engine: 2,000 rpm Selector lever position: D (3rd)	See procedures for checking with an oscilloscope.
104	Output shaft speed sensor	Measure from terminal No. 104 to 112 with an oscilloscope. Engine: 2,000 rpm Selector lever position: D (3rd)	
106	2nd solenoid valve	Selector lever position: D (2nd)	Battery voltage
		Selector lever position: D (1st)	Approx. 7 – 9 V

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Terminal No.	Check item	Check requirement	Standard value
107	DCC solenoid valve	Selector lever position: D (1st)	Battery voltage
		Selector lever position: D (3rd-60km/h)	Approx. 7 – 9 V
108	Inhibitor switch: R	Selector lever position: R	Battery voltage
		Selector lever position: Other than above	0 V
109	Select switch	Selector lever position: Sports mode	Battery voltage
		Selector lever position: Other than above	0 V
110	Downshift switch	Selector lever position: While downshifting in sports mode	Battery voltage
		Selector lever position: Other than above	0 V
111	Input shaft speed sensor	Measure from terminal No. 103 to 111 with an oscilloscope, Engine: 2,000 rpm Selector lever position: D (3rd)	See procedures for checking with an oscilloscope.
112	Output shaft speed sensor	Measure from terminal No. 104 to 112 with an oscilloscope, Engine: 2,000 rpm Selector lever position: D (3rd)	
119	RED solenoid	Selector lever position: D (1st)	Battery voltage
		Selector lever position: D (5th)	Approx. 7 – 9 V
120	UD solenoid valve	Selector lever position: (1st)	Battery voltage
		Selector lever position: R	Approx. 7 – 9 V
121	Inhibitor switch: N	Selector lever position: N	Battery voltage
		Selector lever position: Other than above	0 V
122	Upshift switch	Selector lever position: While upshifting in sports mode	Battery voltage
		Selector lever position: Other than above	0 V
123	Stop lamp switch	Brake pedal: Depressed	Battery voltage
		Brake pedal: Released	0 V
124	Oil temperature sensor	ATF temperature: 25°C	3.8 – 4.0 V
		ATF temperature: 80°C	2.3 – 2.5 V
129	LR solenoid valve	Selector lever position: D (1st)	Battery voltage
		Selector lever position: D (2nd)	Approx. 7 – 9 V
130	OD solenoid valve	Selector lever position: D (3rd)	Battery voltage
		Selector lever position: D (1st)	Approx. 7 – 9 V

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OSCILLOSCOPE INSPECTION PROCEDURE

Check item	Check requirement		Normal condition (Waveform sample)
Crank angle sensor	Selector lever position: N	Idling (Vehicle stopped)	Waveform A
Input shaft speed sensor	Selector lever position: Sports mode	Driving at constant speed of 50 km/h in 3rd gear (Engine: 1,900 – 2,100 r/min)	Waveform B
Output shaft speed sensor			Waveform C
Vehicle speed sensor			Waveform D
Low reverse solenoid valve	Ignition switch: ON Selector lever position: P Engine: 0 r/min Vehicle speed: 0 km/h (Vehicle stopped) Throttle (Accelerator) opening angle: Less than 1 V Closed throttle position switch: ON	Force drive each solenoid valve (Actuator test)	Waveform E
Underdrive solenoid valve			
Second solenoid valve			
Overdrive solenoid valve			
RED control solenoid			
Damper clutch control solenoid			

Waveform sample

Waveform A

Waveform B

Waveform C

Waveform D

Waveform E

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ON-VEHICLE SERVICE

AUTOMATIC TRANSMISSION FLUID CHECK

1. Drive until the fluid temperature reaches the operating temperature 70–80°C.
2. Place vehicle on level floor.
3. Move selector lever sequentially to every position to fill torque converter and hydraulic circuit with fluid, then place lever in “N” Neutral position. This operation is necessary to be sure that fluid level check is accurate.
4. Before removing the oil level gauge, wipe all dirt from area around the oil level gauge. Then take out the oil level gauge and check the condition of the fluid.
   Further investigation of the transmission is necessary if,
   - the fluid smells burnt.
   - the fluid colour is brown or black.
   - metal particles can be seen or felt on the dipstick.
5. Check to see if fluid level is in “HOT” range on oil level gauge. If fluid level is low, add ATF until level reaches “HOT” range.

   NOTE
   Low fluid level can cause a variety of conditions because it allows the pump to take in air along with fluid. Air trapped in the hydraulic circuit forms bubbles which make the fluid spongy.

   Therefore, pressures will be erratic.
   Improper filling can also raise fluid level too high. When the transmission has too much fluid, gears churn up foam and cause the same conditions which occur with low fluid level, resulting in accelerated deterioration of ATF. In either case, air bubbles can cause overheating, fluid oxidation, which can interfere with normal valve, clutch, and servo operation. Foaming can also result in fluid escaping from the transmission vent where it may be mistaken for a leak.
6. Be sure to examine the fluid on the oil level gauge closely.

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AUTOMATIC TRANSMISSION FLUID REPLACEMENT

With the ATF at normal operating temperature, replace the ATF using the following procedure.

1. Remove the right hand hose connecting the transmission oil cooler pipe to the oil cooler (built in to the bottom of the radiator).
2. Connect a suitable length of hose from the radiator cooler pipe to an oil drain receptacle, large enough to hold the quantity of discharged fluid.
3. Start the engine and discharge the ATF.
   Operating conditions: “N” Neutral gear and idling.

Caution
Start the engine and then stop it within one minute. If the ATF is discharged before the one minute elapses, stop the engine at that time.

Amount of ATF discharged: Approximately 4.5 (litres)

4. Remove the drain plug at the bottom of the transmission case and discharge the ATF.

   Amount of ATF discharged: Approximately 1.0 (litre)
5. Install the drain plug and gasket, applying the specified amount of torque.

   Tightening torque: 32 Nm
6. Fill with new ATF through the oil filler tube.

   Amount of ATF added: Approximately 5.5 (litres)

   NOTE
   Stop pouring if the entire amount of new ATF cannot be added. (Do not exceed “COLD” level)
7. Repeat the procedure in step (3) and discharge approximately 3.0 litres of ATF.

   NOTE
   Check the ATF discharged in step (8) for contamination. If it is contaminated, repeat steps (7) and (8).
8. Add the new ATF through the oil filler tube.

   Amount of ATF added: Approximately 3.0 (litres)
9. Attach and secure the hose that was disconnected in step (1) and securely insert the oil level gauge.
10. Start the engine and let it idle for one or two minutes.
11. Move the selector lever through all gear positions, ending in Neutral position.

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12. Make sure the ATF reaches the “COLD” mark on the oil level gauge. If there is not enough ATF, add more.
13. Drive the car until the ATF temperature reaches normal 70–80°C and recheck the ATF level. The ATF must be within the “HOT” range.

    NOTE
    The “COLD” level is for reference only and the “HOT” level serves as the standard.
14. Securely insert the oil level gauge into the filler tube.

THROTTLE POSITION SENSOR ADJUSTMENT / ACCELERATOR PEDAL POSITION SENSOR

Refer GROUP 13A On Vehicle Service.

INHIBITOR SWITCH CONTINUITY CHECK

Items	Terminal No.									
	1	2	3	4	5	6	7	8	9	10
P 5 A/T			○					○	○	○
R 5 A/T							○	○		
N 5 A/T				○				○	○	○
D 5 A/T	○							○		

NOTE:

5 A/T seven positions are available for the inhibitor switch but only the four shown above are used.

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INHIBITOR SWITCH AND CONTROL CABLE ADJUSTMENT

1. Set the selector lever to the “N” position.
2. Loosen the control cable to manual control lever coupling nut to free the cable and lever.
3. Set the manual control lever to the neutral position.

4. Loosen the inhibitor switch body mounting bolts and turn the inhibitor switch body so the hole in the end of the manual control lever and the hole (cross section A-A in the figure on the left) in the flange of the inhibitor switch body flange are aligned.
5. Tighten the inhibitor switch body mounting bolts to the specified torque. Be careful at this time that the position of the switch body is not changed.

6. Gently pull the transmission control cable in the direction of the arrow, and then tighten the adjusting nut.
7. Check that the selector lever is in the “N” position.
8. Check that each range on the transmission side operates and functions correctly for each position of the selector lever.

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A/T CONTROL COMPONENT LOCATION

Name	Symbol	Name	Symbol
A/T control relay	I	Oil temperature sensor	D
Crank angle sensor	F	Output shaft speed sensor	C
Diagnosis connector	J	Shift indicator light	G
Dual pressure switch	B	Solenoid valve	D
Engine-A/T-ECU	H	Stop light switch	K
Inhibitor switch	E	Throttle position sensor (with built-in idle position switch)	A
Input shaft speed sensor	C	Vehicle speed sensor	C
Accelerator pedal position sensor (APS)	A	Upshift switch	L
Idle switch	A	Downshift switch	L
TCL–ECU	M	Select switch	L

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A/T CONTROL COMPONENT CHECK

1. CRANK ANGLE SENSOR CHECK

Refer GROUP 13A – Troubleshooting.

2. THROTTLE POSITION SENSOR CHECK

Refer GROUP 13A – On–vehicle Service.

3. ACCELERATOR PEDAL POSITION SENSOR (APS) CHECK

Refer GROUP 13H – On-vehicle Service.

4. OIL TEMPERATURE SENSOR CHECK

1. Remove the oil temperature sensor.
2. Measure the resistance between terminals No.1 and No.2 of the oil temperature sensor connector.

Standard value:

Oil temperature [°C]	Resistance (kΩ)
0	1.67 – 20.5
100	0.57 – 0.69

3. Replace the sensor if not within the standard value.

5. INHIBITOR SWITCH CHECK

Refer On Vehicle Service.

6. STOP LIGHT SWITCH CHECK

Refer GROUP 35 – Brake Pedal.

7. VEHICLE SPEED SENSOR CHECK

Refer GROUP 54 – On-vehicle Service.

8. DUAL PRESSURE SWITCH CHECK

Refer GROUP 55 – On-vehicle Service.

9. IDLE POSITION SWITCH CHECK

Refer GROUP 13A – On-vehicle Service.

10. SELECT SWITCH CHECK

Refer On Vehicle Service.

11. UPSHIFT SWITCH CHECK

Refer On Vehicle Service.

12. DOWNSHIFT SWITCH CHECK

Refer On Vehicle Service.

13. A/T CONTROL RELAY CHECK

1. Remove the A/T control relay.
2. Use jumper wires to connect the A/T control relay terminal (2) to the battery (–) terminal and terminal (4) to the battery (+) terminal.
3. Check the continuity between the terminal (1) and the terminal (3) of the A/T control relay when the jumper wires are connected to and disconnected from the battery.

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Jumper wire	Continuity between terminals No.1 and No.3
Connected	Continuity
Disconnected	No continuity

4. If there is a problem, replace the A/T control relay.

10. SOLENOID VALVE CHECK

1. Remove the valve body cover.
2. Disconnect the connectors of each solenoid valve.

3. Measure the resistance between terminals 1 and 2 of each solenoid valve.

Standard value:

Name	Resistance
Damper clutch solenoid	2.7 – 3.4 Ω (at 20°C)
Low and reverse solenoid valve	
Second solenoid valve	
Underdrive solenoid valve	
Overdrive solenoid valve	
Reduction solenoid valve	

4. If the resistance is not within the standard value, replace the solenoid valve.

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TORQUE CONVERTER STALL TEST

This test measures the maximum engine speed when the selector lever is at the D or R position and the torque converter stalls to test the operation of the torque converter, starter motor and one-way clutch operation and the holding performance of the clutches and brakes in the transmission.

Caution
Do not let anybody stand in front of or behind the vehicle while this test is being carried out.

1. Check the automatic transmission fluid level and temperature and the engine coolant temperature.
   - Fluid level: At the HOT mark on the oil level gauge
   - Fluid temperature: 70 – 80°C
   - Engine coolant temperature: 80 – 100°C
2. Chock both rear wheels.
3. Pull the parking brake lever on, with the brake pedal fully depressed.
4. Start the engine.
5. Move the selector lever to the D position, fully depress the accelerator pedal and take a reading of the maximum engine speed at this time.

   Caution
   1. **The throttle should not be left fully open for any more than eight seconds.**
   2. **If carrying out the stall test two or more times, move the selector lever to the N position and run the engine at 1,000 r/min to let the automatic transmission fluid cool down before carrying out subsequent tests.**

   Standard value:

   Stall speed: 2,100 – 2,600 r/min

6. Move the selector lever to the R position and carry out the same test again.

   Standard value:

   Stall speed: 2,100 – 2,600 r/min

TORQUE CONVERTER STALL TEST JUDGEMENT RESULTS

a. Stall speed is too high in both D and R ranges
   - Low line pressure
   - Low & reverse brake slippage

b. Stall speed is too high in D range only
   - Underdrive clutch slippage

c. Stall speed is too high in R range only
   - Reverse clutch slippage

d. Stall speed too low in both D and R ranges
   - Malfunction of torque converter
   - Insufficient engine output

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HYDRAULIC PRESSURE TEST

1. Warm up the engine until the automatic transmission fluid temperature is 80–100°C.
2. Jack up the vehicle so that the wheels are free to turn.
3. Connect the special tools (2,942 kPa) oil pressure gauge [MD998330] and joints [MD998332, E21M17A]) to each pressure discharge port.
4. Measure the hydraulic pressure at each port under the conditions given in the standard hydraulic pressure table, and check that the measured values are within the standard value ranges.
5. If a value is outside the standard range, correct the problem while referring to the hydraulic pressure test diagnosis table.

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STANDARD HYDRAULIC PRESSURE TEST

Measurement condition			Standard hydraulic pressure kPa							
Selector lever position	Shift position	Engine speed (r/min)	Under-drive clutch pressure	Reverse clutch pressure	Over-drive clutch pressure	Direct clutch pressure	Low and reverse brake pressure	Second brake pressure	Reduction brake pressure	Torque converter pressure
P	–	2,500	–	–	–	–	1,010 - 1,050	–	1,010 - 1,050	500-700
R	Reverse	2,500	–	1,270 – 1,770	–	–	1,270 – 1,770	–	1,010 - 1,050	500-700
N	–	2,500	–	–	–	–	1,010 - 1,050	–	1,010 - 1,050	500-700
D	1st gear	2,500	1,010 - 1,050	–	–	–	1,010 - 1,050	–	1,010 - 1,050	500-700
	2nd gear	2,500	1,010 - 1,050	–	–	–	–	1,010 - 1,050	1,010 - 1,050	500-700
	3rd gear	2,500	–	–	784-882	–	–	784-882	784-882	450-650
	4th gear	2,500	–	–	784-882	784-882	–	784-882		450-650
	5th gear	2,500	784-882	–	784-882	784-882	–	–		450-650

HYDRAULIC PRESSURE TEST DIAGNOSIS TABLE

Trouble symptom	Probable cause
All hydraulic pressures are high.	Malfunction of the regulator valve
All hydraulic pressures are low.	Incorrectly adjusted line pressure
	Clogged internal oil filter
	Malfunction of the oil pump
	Clogged oil cooler
	Malfunction of the regulator valve
	Malfunction of the relief valve
	Incorrect valve body installation
Hydraulic pressure is abnormal in “R” range only.	Malfunction of the regulator valve
Hydraulic pressure is abnormal in “3” or “4” range only.	Malfunction of the regulator valve
	Malfunction of the switch valve

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Trouble symptom	Probable cause
Only underdrive hydraulic pressure is abnormal.	Malfunction of the oil seal K
	Malfunction of the oil seal L
	Malfunction of the oil seal M
	Malfunction of the underdrive solenoid valve
	Malfunction of the underdrive pressure control valve
	Malfunction of check ball
	Clogged orifice
	Incorrect valve body installation
Only reverse clutch hydraulic pressure is abnormal.	Malfunction of the oil seal A
	Malfunction of the oil seal B
	Malfunction of the oil seal C
	Malfunction of check ball
	Clogged orifice
	Incorrect valve body installation
Only overdrive hydraulic pressure is abnormal.	Malfunction of the oil seal D
	Malfunction of the oil seal E
	Malfunction of the oil seal F
	Malfunction of check ball
	Malfunction of the overdrive solenoid valve
	Malfunction of the overdrive pressure control valve
	Clogged orifice
	Incorrect valve body installation
Only direct clutch hydraulic pressure is abnormal.	Malfunction of the oil seal P
	Malfunction of the oil seal Q
	Malfunction of the oil seal R
	Malfunction of the low and reverse solenoid valve (Common use with direct clutch)
	Malfunction of the low and reverse pressure control valve
	Malfunction of the switch valve
	Malfunction of the fail safe valve C
	Clogged orifice
	Incorrect valve body installation
Only RED hydraulic pressure is abnormal.	Malfunction of the oil seal S
	Malfunction of the oil seal T
	Malfunction of the reduction solenoid valve
	Malfunction of the reduction pressure control valve
	Clogged orifice
	Incorrect valve body installation

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Trouble symptom	Probable cause
Only torque converter pressure is abnormal.	Clogged oil cooler
	Malfunction of the oil seal N
	Malfunction of the damper clutch solenoid valve
	Malfunction of the damper clutch control valve
	Malfunction of the torque converter pressure control valve
	Clogged orifice
	Incorrect valve body installation
Pressure applied to element which should not receive pressure.	Incorrect transmission control cable adjustment
	Malfunction of the manual valve
	Malfunction of check ball
	Incorrect valve body installation
Only second hydraulic pressure is abnormal.	Malfunction of the oil seal G
	Malfunction of the oil seal H
	Malfunction of the oil seal O
	Malfunction of the second solenoid valve
	Malfunction of the second pressure control valve
	Malfunction of the fail safe valve B
	Clogged orifice
	Incorrect valve body installation
Only low and reverse hydraulic pressure is abnormal.	Malfunction of the oil seal I
	Malfunction of the oil seal J
	Malfunction of the low and reverse solenoid valve (Common use with direct clutch)
	Malfunction of the low and reverse pressure control valve
	Malfunction of the switch valve
	Malfunction of the fail safe valve A
	Clogged orifice
	Incorrect valve body installation

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OIL SEAL LAYOUT

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HYDRAULIC CIRCUIT

PARKING AND NEUTRAL

1. Reverse clutch
2. Low-reverse brake
3. Second brake
4. Underdrive clutch
5. Overdrive clutch
6. RED clutch
7. DIR clutch
8. Torque converter clutch
9. Fail safe valve A
10. Fail safe valve B
11. Fail safe valve C
12. Switch valve
13. Automatic transmission fluid cooler
14. Torque converter clutch control valve
15. Low-reverse pressure control valve
16. Second pressure control valve
17. Underdrive pressure control valve
18. Overdrive pressure control valve
19. RED pressure control valve
20. Torque converter clutch solenoid
21. Low reverse solenoid valve
22. Second solenoid valve
23. Underdrive solenoid valve
24. Overdrive solenoid valve
25. RED solenoid valve
26. Torque converter pressure control valve
27. Regulator valve
28. Manual valve
29. Oil strainer
30. Oil filter
31. Oil pump
32. Oil filter (Built-in type)
33. Relief valve
34. Oil pan

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LINE PRESSURE ADJUSTMENT

1. Discharge the automatic transmission fluid, and then remove the valve body cover.
2. Turn the adjusting screw shown in the illustration to adjust the underdrive pressure in “D” range 1st or 2nd gear to the standard value.

   NOTE
   When adjusting the underdrive pressure, adjust to the middle of the standard value range.

   Standard value: 1,010 – 1,050 kPa

   Change in pressure for each turn of the adjusting screw: 35 kPa
3. Install the valve body cover, and pour in the standard volume of automatic transmission fluid.
4. Carry out a hydraulic pressure test. Readjust the line pressure if necessary.

SELECTOR LEVER OPERATION CHECK

1. Shift selector lever to each range and check that lever moves smoothly and clicks into position. Check that position indicator is correct.
2. Check to be sure the selector lever can be shifted to each position (by button operation as shown in the illustration).
3. Start the engine and check if the vehicle moves forward when the selector lever is shifted from N to D, and moves backward when shifted to R.
4. When the shift lever malfunctions, adjust control cable and selector lever sleeve. Check for worn shift lever assembly sliding parts.

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TRANSMISSION CONTROL

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
(1) Air Cleaner Assembly Removal and Installation
(2) Front Floor Console Removal and Installation (Refer GROUP 52A)

Caution: SRS
Be careful not to subject the SRS-ECU to any shocks during removal and installation of the transmission control cable and selector lever assembly.

10AE013E

10AE014E
10TJ052A

Transmission control cable assembly removal steps

1. Foot rest
2. Floor carpet front reinforcements (LH and RH)
3. Harness protector
4. Engine-A/T-ECU and A/T control relay
5. ▶A◀ Nut
6. Connection of the transmission control cable
7. Transmission control cable assembly

Selector lever assembly removal steps

7. Transmission control cable assembly
8. Harness connector
9. Selector lever assembly

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INSTALLATION SERVICE POINT

▶A◀ NUT INSTALLATION

1. Put the selector lever in the “N” position.
2. Loosen the adjusting nut, gently pull the transmission control cable in the direction of the arrow and tighten the nut.

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SELECTOR LEVER ASSEMBLY

DISASSEMBLY AND REASSEMBLY

Disassembly steps

1. Push button
2. Spring
3. Cap
4. Shift Knob
5. Indicator panel assembly
6. Manual control switch assembly
7. Bush
8. Return spring
9. Pipe
10. Bracket
11. Lever
12. Shift bush
13. Pipe
14. Select lever
15. Spring
16. Manual lever
17. Shift bush
18. Pipe
19. Cable lever
20. Shift bush
21. Pipe
26. Guard block
27. Stopper
28. Compression spring
29. Ball
30. Ball stopper
31. Spring
33. Bracket assembly

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CHECKING MANUAL CONTROL SWITCH ASSEMBLY CIRCUIT.

Switch Position		Terminal No.					
		1	3	4	5	7	8
(UP) Shift Switch	ON		○	—	—	○	
	OFF						
(DOWN) Shift Switch	ON		○	—	—	—	○
	OFF						
Select Switch	AUTO	○	—	—	○		
	SPORT	○	—	○			

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TRANSMISSION ASSEMBLY

REMOVAL AND INSTALLATION

Pre-removal Operation
(1) Transmission Fluid Draining
(Refer Fluid Replacement.)
(2) Under Cover Removal
(3) Battery and Battery Tray Removal
(4) Air Cleaner Assembly Removal

Post-installation Operation
(1) Air Cleaner Assembly Installation
(2) Battery and Battery Tray Installation
(3) Under Cover Installation
(4) Transmission Fluid Supplying
(Refer Fluid Replacement.)
(5) Selector Lever Operation Check
(6) Speedometer Operation Check

Removal steps

1. Transmission control cable connection
2. Transmission oil cooler hoses connection
3. Inhibitor switch connector
4. A/T control solenoid valve connector
5. Input shaft speed sensor connector
6. Output shaft speed sensor connector
7. Vehicle speed sensor connector
8. Split pin

◀A▶
9. Connection of the tie rod end
10. Drive shaft nut
11. Connection for the lower arm ball joint

◀B▶
12. Drive shaft and inner shaft assembly (RH) and the drive shaft (LH)

Caution
Mounting locations marked by * should be provisionally tightened, and then fully tightened when the body is supporting the full weight of the engine.

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Lifting up of the vehicle

13. Starter motor
14. Centre member assembly
15. Rear roll stopper bracket
16. Transmission upper portion fixing bolt
17. ◀C▶ Transmission mounting bracket
18. ▶B◀ Transmission mount stopper
    - ◀D▶ Support the engine and transmission assembly
19. Bell housing cover
20. ◀E▶ Drive plate attaching bolt
21. ◀E▶ Transmission lower portion fixing bolt
22. ◀E▶ ▶A◀ Transmission assembly

Caution

Mounting locations marked by * should be provisionally tightened, and then fully tightened when the body is supporting the full weight of the engine.

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REMOVAL SERVICE POINTS

◀A▶ TIE ROD END/LOWER ARM BALL JOINT DISCONNECTION

Caution

1. **Before using the special tool, loosen the tie-rod end mounting nut. Only loosen the nut; do not remove it from the ball joint.**
2. **Support the special tool with a cord, etc. to prevent it from coming off.**

◀B▶ DRIVE SHAFT <L.H.>/DRIVE SHAFT <R.H.> DISCONNECTION

1. Insert a pry bar between the transmission case and the drive shaft as shown to remove the drive shaft.

   NOTE
   Do not remove the hub and knuckle from the drive shaft.

   Caution
   Always use a pry bar, or the ball joint will be damaged.

2. Lightly strike the centre bearing with a plastic hammer or similar object and pull out the inner shaft (RH) from the transmission.
3. Suspend the removed drive shaft with a wire so that there are no sharp bends in any of the joints.
4. Use a shop towel to cover the transmission case to prevent foreign material from entering it.

◀C▶ TRANSMISSION MOUNT BRACKET REMOVAL

Jack up the transmission assembly gently with a garage jack, and then remove the transmission mounting.

◀D▶ ENGINE ASSEMBLY SUPPORTING

Set the special tool to the vehicle to support the engine assembly.

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◀E▶ DRIVE PLATE BOLTS/TRANSMISSION ASSEMBLY LOWER PART COUPLING BOLTS/TRANSMISSION ASSEMBLY REMOVAL

1. Support the transmission assembly by using a transmission jack.
2. Remove the drive plate bolts while turning the crank shaft.
3. Press in the torque converter to the transmission side so that the torque converter does not remain on the engine side.
4. Remove the transmission assembly lower bolts and lower the transmission assembly.

INSTALLATION SERVICE POINTS

▶A◀ TRANSMISSION ASSEMBLY INSTALLATION

After securely inserting the torque converter into the transmission side so that the shown dimension is approx. 12.2 mm, install the transmission assembly to the engine.

▶B◀ TRANSMISSION MOUNT STOPPER INSTALLATION

Install the transmission mount stopper so that the arrow mark points as shown in the illustration.

23C AUTOMATIC TRANSMISSION F5A51 01M/Y FROM AUG 2001

CONTENTS

LUBRICANT

TROUBLESHOOTING

- INSPECTION CHART FOR DIAGNOSIS CODES
- INSPECTION PROCEDURES FOR DIAGNOSIS CODES
- INSPECTION CHART FOR TROUBLE SYMPTOMS
- INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

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 in baking or drying after painting, remove the SRS components (air bag module and SRS-ECU) beforehand.

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

(4) 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

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

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LUBRICANT

Items	Specified lubricant	Quantity (litres)
Transmission fluid	Mitsubishi ELC4–SP III	8.4

TROUBLESHOOTING

INSPECTION CHART FOR DIAGNOSIS CODES

Code	Diagnosis item	
11	Throttle position sensor system	Short circuit
12		Open circuit
14		Sensor maladjustment
15	Oil temperature sensor system	Open circuit
21	Crank angle sensor system	Open circuit
22	Input shaft speed sensor system	Short circuit/open circuit
23	Output shaft speed sensor system	Short circuit/open circuit
26	Stop light switch system	Short circuit/open circuit
31	Low and reverse solenoid valve system	Short circuit/open circuit
32	Underdrive solenoid valve system	Short circuit/open circuit
33	Second solenoid valve system	Short circuit/open circuit
34	Overdrive solenoid valve system	Short circuit/open circuit
35	RED solenoid valve system	Short circuit/open circuit
36	DCC solenoid valve system	Short circuit/open circuit
41	1st gear incorrect ratio	
42	2nd gear incorrect ratio	
43	3rd gear incorrect ratio	
44	4th gear incorrect ratio	
45	5th gear incorrect ratio	
46	Reverse gear incorrect ratio	
51	Abnormal communication with Engine-ECU / TCL ECU	
52	Damper clutch solenoid system	Defective system

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Code	Diagnosis item	
54	A/T Control relay system	Short circuit to ground/open circuit
55		Contact point melted
56	N range light system	Short circuit to ground
71	Malfunction of A/T-ECU	

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INSPECTION PROCEDURES FOR DIAGNOSIS CODES

Code No. 11, 12, 14 Throttle position sensor system	Probable cause
If the TPS output voltage is 4.8 V or higher when the engine is idling, the output is judged to be too high and diagnosis code No. 11 is output. If the TPS output voltage is 0.2 V or lower at times other than when the engine is idling, the output is judged to be too low and diagnosis code No. 12 is output. If the TPS output voltage is 0.2 V or lower or if it is 1.2 V or higher when the engine is idling, the TPS adjustment is judged to be incorrect and diagnosis code No. 14 is output.	• Malfunction of the throttle position sensor • Malfunction of connector • Malfunction of the Engine A/T-ECU

Throttle position sensor check (Refer GROUP 13A On Vehicle Service.) — NG → **Replace**
↓ OK
Check the following connectors: A-68, B-109, B-110 — NG → **Repair**
↓ OK
Harness check
- Throttle position sensor – Engine A/T-ECU.

— NG → **Repair**
↓ OK
Check the trouble symptoms. — NG → Replace the Engine A/T-ECU. CAUTION

Code No. 15, Oil temperature sensor system	Probable cause
If the oil temperature sensor output voltage is 2.6 V or more even after driving for 10 minutes or more (if the oil temperature does not increase), it is judged that there is an open circuit in the oil temperature sensor and diagnosis code No. 15 is output to indicate that the oil temperature sensor is disconnected.	• Malfunction of the oil temperature sensor • Malfunction of connector • Malfunction of the Engine A/T-ECU

Oil temperature sensor check (Refer On Vehicle Service — NG → **Replace**
↓ OK
Check the following connectors: A-87, B-111 — NG → **Repair**
↓ OK
Harness check
- Oil temperature sensor – Engine A/T-ECU.

— NG → **Repair**
↓ OK
Check the trouble symptoms. — NG → Replace the Engine A/T-ECU. CAUTION

Code No. 21 Crank angle sensor system	Probable cause
If no output pulse is detected from the crank angle sensor for 5 seconds or more while driving at 40 km/h or more, it is judged that there is an open circuit in the crank angle sensor and diagnosis code No. 21 is output.	• Malfunction of the crank angle sensor • Malfunction of connector • Malfunction of the Engine A/T-ECU

Refer GROUP 13A On Vehicle Service

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Code No. 22 Input shaft speed sensor system	Probable cause
If no output pulse is detected from the input shaft speed sensor for 1 second or more while driving in 3rd or 4th gear at a speed of 45 km/h or more, it is judged to be an open circuit or short-circuit in the input shaft speed sensor and diagnosis code No. 22 is output. If diagnosis code No. 22 is output four times, the transmission is locked into 3rd gear or 2nd gear as a fail-safe measure, and the N range light flashes at a frequency of 1 Hz.	• Malfunction of the input shaft speed sensor • Malfunction of the underdrive clutch retainer • Malfunction of connector • Malfunction of the Engine A/T-ECU

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Code No. 23 Output shaft speed sensor system	Probable cause
If the output from the output shaft speed sensor is continuously 30% lower than the vehicle speed for 1 second or more while driving in 3rd or 4th gear at a speed of 45 km/h or more, it is judged to be an open circuit or short-circuit in the output shaft speed sensor and diagnosis code No. 23 is output. If diagnosis code No. 23 is output four times, the transmission is locked into 3rd gear or 2nd gear as a fail-safe measure, and the N range light flashes at a frequency of 1 Hz.	● Malfunction of the output shaft speed sensor ● Malfunction of the direct planetary carrier ● Malfunction of connector ● Malfunction of the Engine A/T-ECU

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Code No. 26 Stop light switch system	Probable cause
If the stop light switch is on for 5 minutes or more while driving, it is judged that there is a short circuit in the stop light switch and diagnosis code No. 26 is output.	• Malfunction of the stop light switch • Malfunction of connector • Malfunction of the Engine A/T-ECU

Stop light switch check (Refer GROUP 35 On Vehicle Service.) — NG → **Replace**
↓ OK
Check the following connectors: B-18, B-41, B-111 — NG → **Repair**
↓ OK
Harness check
- Between stop light switch and Engine A/T-ECU — NG → **Repair**

↓ OK
Check the trouble symptoms. — NG → Replace the Engine A/T-ECU. CAUTION

Code No. 31 Low and reverse solenoid valve system	Probable cause
Code No. 32 Underdrive solenoid valve system	
Code No. 33 Second solenoid valve system	
Code No. 34 Overdrive solenoid valve system	
Code No. 35 RED solenoid valve system	
If the resistance value for a solenoid valve is too large or too small, it is judged that there is a short-circuit or an open circuit in the solenoid valve and the respective diagnosis code is output. The transmission is locked into 3rd gear as a fail-safe measure, and the N range light flashes at a frequency of 1 Hz.	• Malfunction of solenoid valve • Malfunction of connector • Malfunction of the Engine A/T-ECU

Solenoid valve check (Refer On Vehicle Service.) — NG → **Replace**
↓ OK
Check the following connectors: A-87, B-111 — NG → **Repair**
↓ OK
Harness check
- Between solenoid valve and Engine A/T-ECU — NG → **Repair**

↓ OK
Check the trouble symptoms. — NG → Replace the Engine A/T-ECU. CAUTION

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Code No. 36, 52, DCC solenoid valve system	Probable cause
If the DCC solenoid valve resistance value is too large or too small, it is judged that there is a short-circuit or an open circuit in the damper clutch solenoid and diagnosis code No. 36 is output. If the drive duty rate for the DCC solenoid valve is 100 % for a continuous period of 4 seconds or more, it is judged that there is an abnormality in the damper clutch system and diagnosis code No. 52 is output. When diagnosis code No. 36 is output, the transmission is locked into 3rd gear as a fail-safe measure, and the N range light flashes at a frequency of 1 Hz.	● Malfunction of the DCC solenoid valve ● Malfunction of connector ● Malfunction of the Engine A/T-ECU

DCC solenoid valve check (Refer On Vehicle Service.) — NG → **Replace**

↓ OK

Check the following connectors: A-87, B-111 — NG → **Repair**

↓ OK

Harness check
● Between applicable solenoid and Engine A/T-ECU — NG → **Repair**

↓ OK

Replace the DCC solenoid valve.

↓

Check the trouble symptoms. — NG → Replace the Engine A/T-ECU. CAUTION

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Code No. 41 1st gear incorrect ratio	Probable cause
If the output from the output shaft speed sensor multiplied by the 1st gear ratio is not the same as the output from the input shaft speed sensor after shifting to 1st gear has been completed, diagnosis code No. 41 is output. If diagnosis code No. 41 is output four times, the transmission is locked into 3rd gear as a fail-safe measure, and the N range light flashes at a frequency of 1 Hz.	• Malfunction of the input shaft speed sensor • Malfunction of the output shaft speed sensor • Malfunction of the underdrive clutch retainer • Malfunction of the low and reverse brake system • Malfunction of the underdrive clutch system • Malfunction of the RED brake system • Noise generated

MUT-II Self Diagnosis
Is the diagnosis code No. 22 output?

Yes → Code No. 22 Check Input shaft speed sensor system.

No ↓

MUT-II Self Diagnosis
Is the diagnosis code No. 23 output?

Yes → Code No. 23 Check Output shaft speed sensor system.

No ↓

Measure output waveform from the input shaft speed sensor. (using an oscilloscope)
- Connect the connector B-109 and B-111 and measure voltage between 57 and 103 at the Engine A/T-ECU.
- Engine: 2,000 r/min [approx. 50 km/h]
- Selector lever position: 3
  (Voltage)
  OK: A waveform such as the one shown in (Inspection Procedure Using an Oscilloscope) is output (flashing 1.0V or higher) and there is no noise appearing in the waveform.

NG →
- Replace the input shaft speed sensor.
- ↓ Check the trouble symptoms.
- NG ↓ A/T overhaul
  - Replace the underdrive clutch retainer.
- ↓ Check the trouble symptoms.
- NG ↓ Eliminate the cause of the noise.

OK ↓

Measure output waveform from the output shaft speed sensor. (using an oscilloscope)
- Connect the connector B-109 and B-111 and measure voltage between 57 and 103 at the Engine A/T-ECU.
- Engine: 2,000 r/min [approx. 50 km/h]
- Selector lever position: 3
  (Voltage)
  OK: A waveform such as the one shown in (Inspection procedure for using oscilloscope) is output (flashing 1.0V or higher) and there is no noise appearing in the waveform.

NG →
- Replace the output shaft speed sensor.
- ↓ Check the trouble symptoms.
- NG ↓ A/T overhaul
  - Replace the transfer drive gear and driven gear.
- ↓ Check the trouble symptoms.
- NG ↓ Eliminate the cause of the noise.

OK ↓

A/T overhaul ★
- Replace the underdrive clutch. (No.41, No.43 or no diagnosis code is output.)
- Replace the second clutch. (No.44 or no diagnosis code is output.)
- Check RED brake system.

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Code No. 42 2nd gear incorrect ratio	Probable cause
If the output from the output shaft speed sensor multiplied by the 2nd gear ratio is not the same as the output from the input shaft speed sensor after shifting to 2nd gear has been completed, diagnosis code No. 42 is output. If diagnosis code No. 42 is output four times, the transmission is locked into 3rd gear as a fail-safe measure, and the N range light flashes at a frequency of 1 Hz.	• Malfunction of the input shaft speed sensor • Malfunction of the output shaft speed sensor • Malfunction of the underdrive clutch retainer • Malfunction of the second brake system • Malfunction of the underdrive clutch system • Malfunction of the RED brake system • Noise generated

MUT-II Self Diagnosis
Is the diagnosis code No. 22 output?

Yes → Code No. 22 Check Input shaft speed sensor system.

No ↓

MUT-II Self Diagnosis
Is the diagnosis code No. 23 output?

Yes → Code No. 23 Check Output shaft speed sensor system.

No ↓

Measure output waveform from the input shaft speed sensor. (using an oscilloscope)
- Connect the connector B-109 and B-111 and measure voltage between 57 and 103 at the Engine A/T-ECU.
- Engine: 2,000 r/min [approx. 50 km/h]
- Selector lever position: 3
  (Voltage)
  OK: A waveform such as the one shown in (Inspection Procedure Using an Oscilloscope) is output (flashing 1.0V or higher) and there is no noise appearing in the waveform.

NG →
- Replace the input shaft speed sensor.
- Check the trouble symptoms.
- NG →
- A/T overhaul
  - Replace the underdrive clutch retainer.
- Check the trouble symptoms.
- NG →
- Eliminate the cause of the noise.

OK ↓

Measure output waveform from the output shaft speed sensor. (using an oscilloscope)
- Connect the connector B-109 and B-111 and measure voltage between 57 and 103 at the Engine A/T-ECU.
- Engine: 2,000 r/min [approx. 50 km/h]
- Selector lever position: 3
  (Voltage)
  OK: A waveform such as the one shown in (Inspection procedure for using oscilloscope) is output (flashing 1.0V or higher) and there is no noise appearing in the waveform.

NG →
- Replace the output shaft speed sensor.
- Check the trouble symptoms.
- NG →
- A/T overhaul
  - Replace the transfer drive gear and driven gear.
- Check the trouble symptoms.
- NG →
- Eliminate the cause of the noise.

OK ↓

A/T overhaul ★
- Replace the underdrive clutch. (No.41, No.43 or no diagnosis code is output.)
- Replace the second clutch. (No.44 or no diagnosis code is output.)
- Check RED brake system.

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Code No. 43 3rd gear incorrect ratio	Probable cause
If the output from the output shaft speed sensor multiplied by the 3rd gear ratio is not the same as the output from the input shaft speed sensor after shifting to 3rd gear has been completed, diagnosis code No. 43 is output. If diagnosis code No. 43 is output four times, the transmission is locked into 3rd gear as a fail-safe measure, and the N range light flashes at a frequency of 1 Hz.	• Malfunction of the input shaft speed sensor • Malfunction of the output shaft speed sensor • Malfunction of the underdrive clutch retainer • Malfunction of the underdrive clutch system • Malfunction of the overdrive clutch system • Malfunction of the RED brake system • Noise generated

MUT-II Self Diagnosis
Is the diagnosis code No. 22 output?

Yes → Code No. 22 Check Input shaft speed sensor system.

No ↓

MUT-II Self Diagnosis
Is the diagnosis code No. 23 output?

Yes → Code No. 23 Check Output shaft speed sensor system.

No ↓

Measure output waveform from the input shaft speed sensor. (using an oscilloscope)
- Connect the connector B-109 and B-111 and measure voltage between 57 and 103 at the Engine A/T-ECU.
- Engine: 2,000 r/min [approx. 50 km/h]
- Selector lever position: 3
  (Voltage)
  OK: A waveform such as the one shown in (Inspection Procedure Using an Oscilloscope) is output (flashing 1.0V or higher) and there is no noise appearing in the waveform.

NG →
- Replace the input shaft speed sensor.
- ↓ Check the trouble symptoms.
- NG ↓ A/T overhaul
  - Replace the underdrive clutch retainer.
- ↓ Check the trouble symptoms.
- NG ↓ Eliminate the cause of the noise.

OK ↓

Measure output waveform from the output shaft speed sensor. (using an oscilloscope)
- Connect the connector B-109 and B-111 and measure voltage between 57 and 103 at the Engine A/T-ECU.
- Engine: 2,000 r/min [approx. 50 km/h]
- Selector lever position: 3
  (Voltage)
  OK: A waveform such as the one shown in (Inspection Procedure Using an Oscilloscope) is output (flashing 1.0V or higher) and there is no noise appearing in the waveform.

NG →
- Replace the output shaft speed sensor.
- ↓ Check the trouble symptoms.
- NG ↓ A/T overhaul
  - Replace the transfer drive gear and driven gear.
- ↓ Check the trouble symptoms.
- NG ↓ Eliminate the cause of the noise.

OK ↓

A/T overhaul
- Replace the underdrive clutch. (No.41, No.42 or no diagnosis code is output.)
- Replace the overdrive clutch. (No.44 or no diagnosis code is output.)
- Check RED brake system.

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Code No. 44 4th gear incorrect ratio	Probable cause
If the output from the output shaft speed sensor multiplied by the 4th gear ratio is not the same as the output from the input shaft speed sensor after shifting to 4th gear has been completed, diagnosis code No. 44 is output. If diagnosis code No. 44 is output four times, the transmission is locked into 3rd gear as a fail-safe measure, and the N range light flashes at a frequency of 1 Hz.	• Malfunction of the input shaft speed sensor • Malfunction of the output shaft speed sensor • Malfunction of the underdrive clutch retainer • Malfunction of the DIR clutch system • Noise generated

MUT-II Self Diagnosis
Is the diagnosis code No. 22 output?

Yes → Code No. 22 Check Input shaft speed sensor system.

No ↓

MUT-II Self Diagnosis
Is the diagnosis code No. 23 output?

Yes → Code No. 23 Check Output shaft speed sensor system.

No ↓

Measure output waveform from the input shaft speed sensor. (using an oscilloscope)
- Connect the connector B-109 and B-111 and measure voltage between 57 and 103 at the Engine A/T-ECU.
- Engine: 2,000 r/min [approx. 50 km/h]
- Selector lever position: 3

(Voltage)
OK: A waveform such as the one shown in (Inspection Procedure Using an Oscilloscope) is output (flashing 1.0V or higher) and there is no noise appearing in the waveform.

NG →
- Replace the input shaft speed sensor.
- ↓ Check the trouble symptoms.
- NG ↓ A/T overhaul
  - Replace the underdrive clutch retainer.
- ↓ Check the trouble symptoms.
- NG ↓ Eliminate the cause of the noise.

OK ↓

Measure output waveform from the output shaft speed sensor. (using an oscilloscope)
- Connect the connector B-109 and B-111 and measure voltage between 57 and 104 at the Engine A/T-ECU.
- Engine: 2,000 r/min [approx. 50 km/h]
- Selector lever position: 3

(Voltage)
OK: A waveform such as the one shown in (Inspection Procedure Using an Oscilloscope) is output (flashing 1.0V or higher) and there is no noise appearing in the waveform.

NG →
- Replace the output shaft speed sensor.
- ↓ Check the trouble symptoms.
- NG ↓ A/T overhaul
  - Replace the transfer drive gear and driven gear.
- ↓ Check the trouble symptoms.
- NG ↓ Eliminate the cause of the noise.

OK ↓

A/T overhaul
- Check underdrive clutch system.
- Replace the overdrive clutch. (No.43 or no diagnosis code is output.)
- Check DIR clutch system.

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Code No. 45 5th gear incorrect ratio	Probable cause
If the output from the output shaft speed sensor multiplied by the 5th gear ratio is not the same as the output from the input shaft speed sensor after shifting to 5th gear has been completed, diagnosis code No. 45 is output. If diagnosis code No. 45 is output four times, the transmission is locked into 3rd gear as a fail-safe measure, and the N range light flashes at a frequency of 1 Hz.	• Malfunction of the input shaft speed sensor • Malfunction of the output shaft speed sensor • Malfunction of the underdrive clutch retainer • Malfunction of the direct planetary carrier • Malfunction of the 2nd brake system • Malfunction of the overdrive clutch system • Malfunction of the DIR clutch system • Noise generated

MUT-II Self Diagnosis
Is the diagnosis code No. 22 output?

Yes → Code No. 22 Check Input shaft speed sensor system.

No ↓

MUT-II Self Diagnosis
Is the diagnosis code No. 23 output?

Yes → Code No. 23 Check Output shaft speed sensor system.

No ↓

Measure output waveform from the input shaft speed sensor. (using an oscilloscope)
- Connect the connector B-109 and B-111 and measure voltage between 57 and 103 at the Engine A/T-ECU.
- Engine: 2,000 r/min [approx. 50 km/h]
- Selector lever position: 3
(Voltage)
OK: A waveform such as the one shown in (Inspection Procedure Using an Oscilloscope) is output (flashing 1.0V or higher) and there is no noise appearing in the waveform.

NG →
- Replace the input shaft speed sensor.
- ↓ Check the trouble symptoms.
- NG ↓ A/T overhaul
  - Replace the underdrive clutch retainer.
- ↓ Check the trouble symptoms.
- NG ↓ Eliminate the cause of the noise.

OK ↓

Measure output waveform from the output shaft speed sensor. (using an oscilloscope)
- Connect the connector B-109 and B-111 and measure voltage between 57 and 104 at the Engine A/T-ECU.
- Engine: 2,000 r/min [approx. 50 km/h]
- Selector lever position: 3
(Voltage)
OK: A waveform such as the one shown in (Inspection Procedure Using an Oscilloscope) is output (flashing 1.0V or higher) and there is no noise appearing in the waveform.

NG →
- Replace the output shaft speed sensor.
- ↓ Check the trouble symptoms.
- NG ↓ A/T overhaul
  - Replace the transfer drive gear and driven gear.
- ↓ Check the trouble symptoms.
- NG ↓ Eliminate the cause of the noise.

OK ↓

A/T overhaul
- Check the 2nd brake system.
- Check the overdrive clutch system.
- Check the DIR clutch system.

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Code No. 46 Reverse gear incorrect ratio	Probable cause
If the output from the output shaft speed sensor multiplied by the reverse gear ratio is not the same as the output from the input shaft speed sensor after shifting to reverse gear has been completed, diagnosis code No. 46 is output. If diagnosis code No. 46 is output four times, the transmission is locked into 3rd gear as a fail-safe measure, and the N range light flashes at a frequency of 1 Hz.	• Malfunction of the input shaft speed sensor • Malfunction of the output shaft speed sensor • Malfunction of the planetary carrier • Malfunction of the RED clutch system • Malfunction of the low and reverse brake system • Malfunction of the reverse clutch system • Noise generated

MUT-II Self Diagnosis
Is the diagnosis code No. 22 output?

Yes → Code No. 22 Check Input shaft speed sensor system.

No ↓

MUT-II Self Diagnosis
Is the diagnosis code No. 23 output?

Yes → Code No. 23 Check Output shaft speed sensor system.

No ↓

Measure output waveform from the input shaft speed sensor. (using an oscilloscope)
- Connect the connector B-109 and B-111 and measure voltage between 57 and 103 at the Engine A/T-ECU.
- Engine: 2,000 r/min [approx. 50 km/h]
- Selector lever position: 3
  (Voltage)
  OK: A waveform such as the one shown in (Inspection Procedure Using an Oscilloscope) is output (flashing 1.0V or higher) and there is no noise appearing in the waveform.

NG →
- Replace the input shaft speed sensor.
- ↓ Check the trouble symptoms.
- NG ↓ A/T overhaul
  - Replace the underdrive clutch retainer.
- ↓ Check the trouble symptoms.
- NG ↓ Eliminate the cause of the noise.

OK ↓

Measure output waveform from the output shaft speed sensor. (using an oscilloscope)
- Connect the connector B-109 and B-111 and measure voltage between 57 and 104 at the Engine A/T-ECU.
- Engine: 2,000 r/min [approx. 50 km/h]
- Selector lever position: 3
  (Voltage)
  OK: A waveform such as the one shown in (Inspection Procedure Using an Oscilloscope) is output (flashing 1.0V or higher) and there is no noise appearing in the waveform.

NG →
- Replace the output shaft speed sensor.
- ↓ Check the trouble symptoms.
- NG ↓ A/T overhaul
  - Replace the transfer drive gear and driven gear.
- ↓ Check the trouble symptoms.
- NG ↓ Eliminate the cause of the noise.

OK ↓

A/T overhaul
- Replace the low and reverse brake. (No.41 or no diagnosis code is output.)
- Replace the reverse clutch. (No diagnosis code is output.)
- Check the DIR clutch system.

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Code No. 51 Abnormal communication with Engine A/T-ECU	Probable cause
If normal communication is not possible for a continuous period of 1 second or more when the battery voltage is 10 V or more and the engine speed is 450 r/min or more, diagnosis code No. 51 is output. Diagnosis code No. 51 is also output if the data being received is abnormal for a continuous period of 4 seconds under the same conditions.	• Malfunction of the Engine A/T-ECU • Faulty connector

Code No. 54 and 55 A/T Control relay system	Probable cause
If the control relay voltage is less than 7 V after the ignition switch has been turned to ON, it is judged that there is an open circuit or a short-circuit in the A/T control relay earth and diagnosis code No. 54 is output. After the ignition switch is turned on, if the A/T voltage is 5 V or higher before the A/T ECU sends instructions for the relay to be turned on, Code 55 will be output to indicate a malfunction of the A/T control relay. The transmission is locked into 3rd gear as a fail-safe measure, and the N range light flashes at a frequency of 1 Hz.	• Malfunction of the A/T control relay • Malfunction of connector • Malfunction of the Engine A/T-ECU

Code No. 56 N range light system	Probable cause
If the N range signal is off after an N range light illumination instruction (ON instruction) has been given, it is judged that there is a short-circuit in the N range light earth and diagnosis code No. 56 is output.	• Malfunction of connector • Malfunction of the Engine A/T-ECU

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Code No. 71 Malfunction of Engine A/T-ECU	Probable cause
There is an abnormality in the Engine A/T-ECU. The transmission is locked into 3rd gear as a fail-safe measure.	• Malfunction of the Engine A/T-ECU

Replace the Engine-A/T-ECU. CAUTION

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INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble symptom		Inspection procedure No.
Communication with the MUT-II is not possible		1
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INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

INSPECTION PROCEDURE 1

Communication with the MUT-II is not possible	Probable cause
If communication with the MUT-II is not possible, the cause is probably a defective diagnosis line or the Engine A/T-ECU is not functioning.	• Malfunction of diagnosis line • Malfunction of connector • Malfunction of the Engine A/T-ECU

INSPECTION PROCEDURE 2

Starting impossible	Probable cause
Starting is not possible when the selector lever is in P or N range. In such cases, the cause is probably a defective engine system, torque converter or oil pump or seized oil pump.	• Malfunction of the engine system • Malfunction of the torque converter • Malfunction of the oil pump

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INSPECTION PROCEDURE 3

Does not move (forward)	Probable cause
If the vehicle does not move forward when the selector lever is shifted from N to D, 3, 2 or L range, sports mode 1st or 2nd while the engine is idling, the cause is probably abnormal line pressure or a malfunction of the underdrive clutch or valve body.	• Abnormal line pressure • Malfunction of the underdrive solenoid valve • Malfunction of the underdrive clutch • Malfunction of the valve body

INSPECTION PROCEDURE 4

Does not reverse	Probable cause
If the vehicle does not reverse when the selector lever is shifted from N to R range while the engine is idling, the cause is probably abnormal pressure in the reverse clutch or low and reverse brake or a malfunction of the reverse clutch, low and reverse brake or valve body.	• Abnormal reverse clutch pressure • Abnormal low and reverse brake pressure • Malfunction of the low and reverse solenoid valve • Malfunction of the reverse clutch • Malfunction of the low and reverse brake • Malfunction of the valve body

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INSPECTION PROCEDURE 5

Does not move (forward or reverse)	Probable cause
If the vehicle does not move forward or reverse when the selector lever is shifted to any position while the engine is idling, the cause is probably abnormal line pressure, or a malfunction of the power train, oil pump or valve body.	• Abnormal line pressure • Malfunction of power train • Malfunction of the oil pump • Malfunction of the valve body

Check Hydraulic pressure
- Measure the hydraulic pressure for each element when moving forward and back.
  Standard Value: Refer Specifications

OK → Power train check
- Disassemble the transmission, check the condition of the planetary carrier, output shaft and differential, etc.

NG ↓

Replace the oil pump assembly.
(The oil pump cannot be disassembled.)

NG → Valve body disassembly, cleaning and reassembly
- Pay particular attention to loosening of bolts, and to damage and slippage of O-rings, valves and valve bodies.
- If the damage cannot be repaired, replace the valve body assembly.

INSPECTION PROCEDURE 6

Engine stalling when shifting	Probable cause
If the engine stalls when the selector lever is shifted from N to D or R range while the engine is idling, the cause is probably a malfunction of the engine system, damper clutch control solenoid, valve body or torque converter (damper clutch malfunction).	• Malfunction of the engine system • Malfunction of the damper clutch control solenoid • Malfunction of the valve body • Malfunction of the torque converter (Malfunction of the damper clutch)

Engine system check
- Check the control system, ignition system, fuel system and main system.

NG → **Repair, replace**

OK ↓

Replace the damper clutch control solenoid.

↓

Valve body disassembly, cleaning and reassembly
- Pay particular attention to loosening of bolts, and to damage and slippage of O-rings, valves and valve bodies.
- If the damage cannot be repaired, replace the valve body assembly.

NG → Replace the torque converter.

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INSPECTION PROCEDURE 7

Shocks when changing from N to D and large time lag	Probable cause
If abnormal shocks or a time lag of 2 seconds or more occur when the selector lever is shifted from N to D range while the engine is idling, the cause is probably abnormal underdrive clutch pressure or a malfunction of the underdrive clutch, valve body or idle position switch.	• Abnormal underdrive clutch pressure • Malfunction of the underdrive solenoid valve • Malfunction of the underdrive clutch • Malfunction of the valve body • Malfunction of the idle position switch

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INSPECTION PROCEDURE 8

Shocks when changing from N to R and large time lag	Probable cause
If abnormal shocks or a time lag of 2 seconds or more occurs when the selector lever is shifted from N to R range while the engine is idling, the cause is probably abnormal reverse clutch pressure or low and reverse brake pressure, or a malfunction of the reverse clutch, low and reverse brake, valve body or idle position switch.	• Abnormal reverse clutch pressure • Abnormal low and reverse brake pressure • Malfunction of the low and reverse solenoid valve • Malfunction of the reverse clutch • Malfunction of the low and reverse brake • Malfunction of the valve body • Malfunction of the idle position switch

INSPECTION PROCEDURE 9

Shocks when changing from N to D, N to R and large time lag	Probable cause
If abnormal shocks or a time lag of 2 seconds or more occur when the selector lever is shifted from N to D range and from N to R range while the engine is idling, the cause is probably abnormal line pressure or a malfunction of the oil pump or valve body.	• Abnormal line pressure • Malfunction of the oil pump • Malfunction of the valve body

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INSPECTION PROCEDURE 10

Shocks and running up	Probable cause
If shocks occur when driving due to upshifting or downshifting and the transmission speed becomes higher than the engine speed, the cause is probably abnormal line pressure or a malfunction of a solenoid valve, oil pump, valve body or of a brake or clutch.	• Abnormal line pressure • Malfunction of each solenoid valve • Malfunction of the oil pump • Malfunction of the valve body • Malfunction of each brake or each clutch

MUT-II Actuator Test
- No. 1 Low and reverse solenoid valve
- No. 2 Underdrive solenoid valve
- No. 3 Second solenoid valve
- No. 4 Overdrive solenoid valve
- No. 5 RED solenoid valve

OK: Sound of operation can be heard.

NG → Replace the solenoid valve.

OK ↓

Adjust the line pressure.

NG → Replace the oil pump assembly. (The oil pump cannot be disassembled.)

NG ↓

Valve body disassembly, cleaning and reassembly
- Pay particular attention to loosening of bolts, and to damage and slippage of O-rings, valves and valve bodies.
- If the damage cannot be repaired, replace the valve body assembly.

OK ↓

Clutch and brake check ★
- Check for burning of the facing, defective piston seal rings and interference at the retainer.

INSPECTION PROCEDURE 11

All points (Displaced shifting points)	Probable cause
If all shift points are displaced while driving, the cause is probably a malfunction of the output shaft speed sensor, TPS or of a solenoid valve.	• Malfunction of the output shaft speed sensor • Malfunction of the throttle position sensor • Malfunction of each solenoid valve • Abnormal line pressure • Malfunction of the valve body • Malfunction of the Engine A/T-ECU

MUT-II Data list
- No. 23 Output shaft speed sensor

OK: Increases in proportion to vehicle speed.

NG → Code No. 23 – Check Output shaft speed sensor system.

OK ↓

MUT-II Data list
- No. 11 TPS

OK: Increases in proportion to accelerator pedal opening angle

NG → Code No. 11, 12, 14 Check TPS system.

OK ↓

MUT-II Data list
- No. 31 Low and reverse solenoid valve duty %
- No. 32 Underdrive solenoid valve duty %
- No. 33 Second solenoid valve duty %
- No. 34 Overdrive solenoid valve duty %
- No. 35 RED solenoid valve duty %

OK: Refer to the table on next page.

NG → Replace the solenoid valve.

NG ↓

Replace the Engine A/T-ECU. CAUTION

OK ↓

Adjust the line pressure. (Refer On Vehicle Service.)

NG → Valve body disassembly, cleaning and reassembly ★
- Pay particular attention to loosening of bolts, and to damage and slippage of O-rings, valves and valve bodies.
- If the damage cannot be repaired, replace the valve body assembly.

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	No. 31	No. 32	No. 33	No. 34	No. 35
Driving at constant speed in 1st gear	100 %	0 %	100 %	100 %	0 %
Driving at constant speed in 2nd gear	100 %	0 %	0 %	100 %	0 %
Driving at constant speed in 3rd gear	100 %	0 %	100 %	0 %	0 %
Driving at constant speed in 4th gear	0 %	0 %	100 %	0 %	100 %
Driving at constant speed in 5th gear	0 %	100 %	0 %	0 %	100 %

INSPECTION PROCEDURE 12

Some points (Displaced shifting points)	Probable cause
If some of the shift points are displaced while driving, the cause is probably a malfunction of the valve body, or it is related to control and is not an abnormality.	• Malfunction of the valve body

INSPECTION PROCEDURE 13

No diagnosis codes (Does not shift)	Probable cause
If shifting does not occur while driving and no diagnosis codes are output, the cause is probably a malfunction of the Inhibitor switch, or Engine A/T-ECU.	• Malfunction of the Inhibitor switch • Malfunction of the Engine A/T-ECU

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INSPECTION PROCEDURE 14

Poor acceleration	Probable cause
If acceleration is poor even if downshifting occurs while driving, the cause is probably a malfunction of the engine system or of a brake or clutch.	• Malfunction of the engine system • Malfunction of the brake or clutch

Engine system check
- Check the control system, ignition system, fuel system and main system.

NG → **Replace, repair**

OK ↓

Brake or clutch check
- Check for burning of the facing, defective piston seal rings and interference at the retainer.

INSPECTION PROCEDURE 15

Vibration	Probable cause
If vibration occurs when driving at constant speed or when accelerating in top range, the cause is probably abnormal damper clutch pressure or a malfunction of the engine system, damper clutch solenoid, torque converter or valve body.	• Abnormal damper clutch pressure • Malfunction of the engine system • Malfunction of the damper clutch solenoid • Malfunction of the torque converter • Malfunction of the valve body

MUT-II Actuator Test
- No. 6 Damper clutch solenoid
  OK: Sound of operation can be heard.

NG → Replace the damper clutch solenoid valve.

OK ↓

Does the problem occur even when the oil temperature sensor connector is disconnected?

Yes → Engine system check
- Check the control system, ignition system, fuel system and main system.

No ↓

Check Hydraulic pressure
- Measure the damper clutch pressure.
  Standard Value: Refer Specifications

NG → Valve body disassembly, cleaning and reassembly
- Pay particular attention to loosening of bolts, and to damage and slippage of O-rings, valves and valve bodies.
- If the damage cannot be repaired, replace the valve body assembly.

OK ↓

Replace the torque converter assembly.

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INSPECTION PROCEDURE 16

Inhibitor switch system	Probable cause
There may be defects with the inhibitor switch circuit or the ignition switch circuit.	• Malfunction of the inhibitor switch • Malfunction of connector • Malfunction of the ignition switch • Malfunction of the Engine A/T-ECU

INSPECTION PROCEDURE 17

Sports mode switch system	Probable cause
A malfunction may exist with the inhibitor switch circuit, the sports mode switch circuit or the Engine–A/T ECU.	• Malfunction of inhibitor switch • Malfunction of the Engine A/T-ECU • Malfunction of the sports mode select switch • Malfunction of the sports mode upshift select switch • Malfunction of the sports mode downshift select switch

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INSPECTION PROCEDURE 18

Idle switch circuit system	Probable cause
There may be a malfunction of the inhibitor switch circuit or the ignition switch circuit.	• Malfunction of the idle switch • Malfunction of connector • Malfunction of the Engine A/T-ECU

INSPECTION PROCEDURE 19

Dual pressure switch system	Probable cause
The cause is probably a defective dual pressure switch circuit or a defective Engine A/T-ECU.	• Malfunction of the dual pressure switch • Malfunction of connector • Malfunction of A/C system • Malfunction of the Engine A/T-ECU

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INSPECTION PROCEDURE 20

Vehicle speed sensor system	Probable cause
A malfunction may exist in the speed sensor circuit or the Engine A/T-ECU.	• Malfunction of the vehicle speed sensor • Malfunction of the connector • Malfunction of the Engine A/T-ECU

INSPECTION PROCEDURE 21

Cruise control -ECU signal system	Probable cause
A malfunction may exist in the cruise control signal line circuit or the Engine A/T-ECU.	• Malfunction of connector • Malfunction of the Engine A/T-ECU • Malfunction of the cruise control ECU

23D AUTOMATIC TRANSMISSION OVERHAUL

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- DISASSEMBLY AND REASSEMBLY
- DISASSEMBLY
- REASSEMBLY

OIL PUMP
- DISASSEMBLY AND REASSEMBLY
- REASSEMBLY SERVICE POINTS

UNDERDRIVE CLUTCH AND INPUT SHAFT
- DISASSEMBLY AND REASSEMBLY
- DISASSEMBLY SERVICE POINT
- REASSEMBLY SERVICE POINTS

REVERSE AND OVERDRIVE CLUTCH
- DISASSEMBLY AND REASSEMBLY
- DISASSEMBLY SERVICE POINT
- REASSEMBLY SERVICE POINTS

DIRECT CLUTCH
- DISASSEMBLY AND REASSEMBLY
- DISASSEMBLY SERVICE POINT
- REASSEMBLY SERVICE POINTS

PLANETARY CARRIER ASSEMBLY
- DISASSEMBLY AND REASSEMBLY
- REASSEMBLY SERVICE POINTS

LOW-REVERSE BRAKE
- DISASSEMBLY AND REASSEMBLY
- REASSEMBLY SERVICE POINT

SECOND BRAKE
- DISASSEMBLY AND REASSEMBLY
- REASSEMBLY SERVICE POINT

DIRECT PLANETARY CARRIER
- DISASSEMBLY AND REASSEMBLY
- DISASSEMBLY SERVICE POINTS
- ASSEMBLY SERVICE POINTS

DIFFERENTIAL
- DISASSEMBLY AND REASSEMBLY
- DISASSEMBLY SERVICE POINTS
- REASSEMBLY SERVICE POINTS

VALVE BODY
- DISASSEMBLY AND REASSEMBLY
- DISASSEMBLY SERVICE POINT
- REASSEMBLY SERVICE POINTS

REDUCTION BRAKE PISTON
- DISASSEMBLY AND REASSEMBLY

SPEEDOMETER GEAR
- DISASSEMBLY AND REASSEMBLY

DRIVE SHAFT OIL SEAL
- DISASSEMBLY AND REASSEMBLY
- REASSEMBLY SERVICE POINT

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GENERAL INFORMATION

1. The combination of highest-precision electronic and mechanical technology heralds a new era in automatic transmission performance.
2. The gear shifting clutches use a hydraulic balancing mechanism to enable gear shifting at extra-high engine speeds.
3. The number of shafts has been decreased to two and increased use has been made of metal plates which all contributes to reduce the weight.
4. Increased meshing ratios and improved rigidity of the gear supports and casing result in less noise.
5. In addition, adoption of a newly-developed automatic transmission fluid (ATF) increases the service life of the fluid.
6. The number of oil cooler feed tubes is increased to two.

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SECTIONAL VIEW

<F5A51>

1. Over drive clutch
2. Reverse clutch
3. Overdrive planetary carrier
4. Output planetary carrier
5. Second brake
6. Low-reverse brake
7. One-way clutch
8. Transfer drive gear
9. Transmission case
10. Underdrive clutch
11. Oil pump
12. Converter housing
13. Torque converter clutch
14. Torque converter
15. Input shaft
16. Differential
17. Rear cover
18. One-way clutch
19. Direct clutch
20. Reduction brake band
21. Direct planetary carrier
22. Transfer driven gear
23. Output gear
24. Differential drive gear

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HYDRAULIC CIRCUIT

1. Reverse clutch
2. Low-reverse brake
3. Second brake
4. Underdrive clutch
5. Overdrive clutch
6. Reduction brake
7. Direct clutch
8. Torque converter clutch
9. Accumulator
10. Fail safe valve A
11. Fail safe valve B
12. Fail safe valve C
13. Torque converter clutch control valve
14. Switch valve
15. Cooler
16. Low reverse pressure control valve
17. Second pressure control valve
18. Under drive pressure control valve
19. Over drive pressure control valve
20. Reduction pressure control valve
21. Torque converter clutch control valve
22. Low reverse solenoid valve
23. Second solenoid valve
24. Under drive solenoid valve
25. Over drive solenoid valve
26. Reduction solenoid valve
27. Torque converter pressure control valve
28. Regulator valve
29. Manual valve
30. Oil pump
31. Oil strainer
32. Oil filter
33. Oil pan
34. Relief valve

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SPECIFICATIONS

GENERAL SPECIFICATIONS

Items		Specifications
Model		F5A51-2-EZB
Type		Electronically controlled 5-speed full-automatic
Torque converter	Type	3-element with torque converter clutch
	Engine stall speed	2100 – 2600 r/min.
Gear ratio	1st	3.789
	2nd	2.057
	3rd	1.421
	4th	1.000
	5th	0.731
Gear ratio	Reverse	3.865
Final gear ratio		3.684

SERVICE SPECIFICATIONS

Items	Standard value
Output shaft preload mm	0.01 – 0.09
Brake reaction plate end play mm	0 – 0.16
Low-reverse brake end play mm	1.65 – 2.11
Second brake end play mm	1.09 – 1.55
Underdrive sun gear end play mm	0.25 – 0.45
Input shaft end play mm	0.70 – 1.45
Differential case preload mm	0.045 – 0.105
Underdrive clutch end play mm	1.60 – 1.80
Reverse and overdrive clutch return spring end play mm	0 – 0.09
Overdrive clutch end play mm	1.6 – 1.8
Reverse clutch end play mm	1.5 – 1.7
Backlash between differential side gear and pinion mm	0.025 – 0.150
Direct clutch end play mm	1.0 – 1.2

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VALVE BODY SPRING IDENTIFICATION TABLE

Spring	Wire diameter mm	Outside diameter mm	Free length mm	Number of loops
Regulator valve spring	1.8	15.7	86.7	24
Underdrive pressure control valve spring	0.7	7.6	37.7	25
Overdrive pressure control valve spring	0.7	7.6	37.7	25
Low-reverse pressure control valve spring	0.7	7.6	37.7	25
Second pressure control valve spring	0.7	7.6	37.7	25
Reduction pressure control valve spring	0.7	7.6	37.7	25
Torque converter valve spring	1.6	11.2	34.4	12.5
Torque converter clutch control valve spring	0.7	5.9	28.1	19
Fail-safe valve A spring	0.7	8.9	21.9	9.5
Damping valve spring	1.0	7.7	35.8	17
Line relief valve spring	1.0	7.0	17.3	10
Orifice check ball spring	0.5	4.5	15.4	15

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SNAP RING, SPACER, THRUST WASHER, THRUST RACE AND PRESSURE PLATE FOR ADJUSTMENT

Thrust washer (For adjustment of input shaft end play)

Thickness mm	Identification symbol	Part No.	Thickness mm	Identification symbol	Part No.
1.8	18	MD754509	2.4	24	MD753793
2.0	20	MD754508	2.6	26	MD753794
2.2	22	MD754507	2.8	28	MD753795

Snap ring (For adjustment of underdrive clutch and overdrive clutch end play)

Thickness mm	Identification symbol	Part No.	Thickness mm	Identification symbol	Part No.
1.6	Brown	MD759660	2.4	Blue	MD750845
1.7	None	MD759661	2.5	Brown	MD750846
1.8	Blue	MD759662	2.6	None	MD750847
1.9	Brown	MD758892	2.7	Blue	MD750848
2.0	None	MD750841	2.8	Brown	MD750849
2.1	Blue	MD750842	2.9	None	MD750850
2.2	Brown	MD750843	3.0	Blue	MD750851
2.3	None	MD750844			

Snap ring (For adjustment of low-reverse brake and second brake reaction plate end play)

Thickness mm	Identification symbol	Part No.	Thickness mm	Identification symbol	Part No.
2.2	None	MD756784	2.4	Brown	MD758552
2.3	Blue	MD756785	2.5	None	MD758553

Pressure plate (For adjustment of low-reverse brake end play)

Thickness mm	Identification symbol	Part No.	Thickness mm	Identification symbol	Part No.
1.6	F	MD759568	2.4	B	MD759428
1.8	E	MD759425	2.6	A	MD759429
2.0	D	MD759426	2.8	0	MD759430
2.2	C	MD759427	3.0	1	MD759431

Pressure plate (For adjustment of second brake end play)

Thickness mm	Identification symbol	Part No.	Thickness mm	Identification symbol	Part No.
1.6	F	MD759568	2.4	B	MD759428
1.8	E	MD759425	2.6	A	MD759429
2.0	D	MD759426	2.8	0	MD759430
2.2	C	MD759427	3.0	1	MD759431

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Snap ring (For adjustment of reverse clutch end play)

Thickness mm	Identification symbol	Part No.	Thickness mm	Identification symbol	Part No.
1.9	None	MD758947	2.4	Blue	MD756694
2.0	None	MD756690	2.5	Brown	MD756695
2.1	Blue	MD756691	2.6	None	MD756696
2.2	Brown	MD756692	2.7	Blue	MD756697
2.3	None	MD756693	2.8	Brown	MD756698

Snap ring (For adjustment of reverse clutch and overdrive clutch spring retainers end play)

Thickness mm	Identification symbol	Part No.	Thickness mm	Identification symbol	Part No.
1.48	Brown	MD755600	1.58	Blue	MD755602
1.53	None	MD755601	1.63	Brown	MD755603

Thrust race (For adjustment of underdrive sun gear end play)

Thickness mm	Identification symbol	Part No.	Thickness mm	Identification symbol	Part No.
1.6	–	MD707267	2.2	–	MD723065
1.7	–	MD759681	2.3	–	MD754796
1.8	–	MD723064	2.4	–	MD724358
1.9	–	MD754794	2.5	–	MD754797
2.0	–	MD707268	2.6	–	MD754798
2.1	–	MD754795			

Snap ring (For adjustment of direct clutch end play)

Thickness mm	Identification symbol	Part No.	Thickness mm	Identification symbol	Part No.
1.9	Brown	MD758946	2.5	Brown	MD753402
2.0	None	MD753397	2.6	None	MD753403
2.1	Blue	MD753398	2.7	Blue	MD753404
2.2	Brown	MD753399	2.8	Brown	MD753405
2.3	None	MD753400	2.9	None	MD753406
2.4	Blue	MD753401	3.0	Blue	MD753407

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Spacer (For adjustment of differential case preload)

Thickness mm	Identification symbol	Part No.	Thickness mm	Identification symbol	Part No.
0.83	83	MD756948	1.10	10	MD756957
0.86	86	MD756949	1.13	13	MD756958
0.89	89	MD756950	1.16	16	MD756959
0.92	92	MD756951	1.19	19	MD756960
0.95	95	MD756952	1.22	22	MD756961
0.98	98	MD756953	1.25	25	MD756962
1.01	01	MD756954	1.28	28	MD756963
1.04	04	MD756955	1.31	31	MD756964
1.07	07	MD756956	1.34	34	MD756965

Spacer (For adjustment of backlash between differential side gear and pinion)

Thickness mm	Identification symbol	Part No.	Thickness mm	Identification symbol	Part No.
0.56 – 0.64	–	MD757996	0.86 – 0.94	–	MD757999
0.66 – 0.74	–	MD757997	0.96 – 1.04	–	MD758000
0.76 – 0.84	–	MD757998	1.06 – 1.14	–	MD758001

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TORQUE SPECIFICATIONS

Items		Nm
Transmission	Roll stopper bracket	59 – 79
	Wiring harness bracket	20 – 26
	Control cable bracket	20 – 26
	Eye bolt	27 – 33
	Oil cooler feed tube	10 – 12
	Oil filter	11 – 13
	Input shaft speed sensor	10 – 12
	Output shaft speed sensor	10 – 12
	Manual control lever	19 – 25
	Park/neutral position switch (Inhibitor switch)	10 – 12
	Speedometer gear	3.9 – 5.9
	Valve body cover	10 – 12
	Valve body mounting bolt	10 – 12
	Fluid temperature sensor	10 – 12
	Manual control shaft detent	4.9 – 6.9
	Rear cover	20 – 26
	Torque converter housing	41 – 53
	Oil pump	20 – 26
	Transfer drive gear	32 – 36
	Output shaft lock nut	157 – 177
	Output shaft bearing retainer	20 – 26
	Oil filler plug	30 – 34
	Oil drain plug	30 – 34
Components	Differential drive gear	127 – 137
	Valve body	10 – 12
	Solenoid valve support	5 – 7
	Direct planetary carrier lock nut	157 – 177
	Anchor plug	83 – 113

SEALANTS

Items	Specified sealant
Rear cover	Mitsubishi genuine sealant Part No. MD974421 or equivalent
Torque converter housing	Mitsubishi genuine sealant Part No. MD974421 or equivalent
Valve body cover	Mitsubishi genuine sealant Part No. MD974421 or equivalent

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SPECIAL TOOLS

Tool	Tool number and name	Supersession	Application
	MD998333 Oil pump remover.	–	Removal of oil pump.
	MB991629 Spring compressor.	EMB991629.	Measurement of underdrive clutch and overdrive clutch end plays.
	MD998924 Spring compressor retainer.		Removal and installation of low-reverse brake snap ring. Measurement of underdrive clutch and overdrive clutch end plays.
	MB990936 Installer adaptor.	–	Installation of differential taper roller bearing outer race.
	MB990938 Handle.	–	Installation of input shaft rear bearing. Use with installer adaptor.
	MB991632 Clearance dummy plate.	–	Measurement of low-reverse brake and second brake end play.
	MD998412 Guide.	–	Installation of oil pump and transfer drive gear.
	MD998334 Oil seal installer.	E9055 (17-010A).	Installation of oil pump oil seal.

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Tool	Tool number and name	Supersession	Application
	MD998800 Oil seal installer.	E21M14A.	Installation of drive shaft oil seal.
	MD998801 Bearing remover.	–	Removal of diff bearings.
	MD998913 Dial gauge extension.	E21M44.	Measurement of low-reverse brake and second brake end plays.
	MD998917 Bearing remover.	–	Removal of direct planetary carrier taper roller bearing.
	MD999590 Spring compressor.	EMD999590.	Removal and installation of overdrive clutch snap ring.
	MD998907 Spring compressor.	E21M43.	Removal and installation of underdrive clutch snap ring.
	MB991630 Spring compressor.	–	Removal and installation of direct clutch snap ring.
	MD998834 Torque wrench adaptor.	–	Removal and installation of direct planetary carrier lock nut.
	MD998823 Installer adaptor (48).	–	Install differential bearings.

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Tool	Tool number and name	Supersession	Application
	MD998812 Installer cap.	–	Use with installer and installer adaptor.
	MD998813 Installer – (100).	–	Use with installer cap and installer adaptor.
	MD998824 Installer adaptor (50)	–	Installation of transfer drive gear.
	MB991633 Reduction brake wrench set.	–	Removal, installation and adjustment of reduction brake piston.

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FORM–IN–PLACE GASKET

The transmission has several areas where the form–in–place gasket (FIPG) is in use. To ensure that the gasket fully serves its purpose, it is necessary to observe some precautions when applying the gasket. Bead size, continuity and location are of paramount importance. Too thin a bead could cause leaks. Too thick a bead, on the other hand, could be squeezed out of location, causing blocking or narrowing of the fluid feed line. To eliminate the possibility of leaks from a joint, therefore, it is absolutely necessary to apply the gasket evenly without a break, while observing the correct bead size.

DISASSEMBLY

The parts assembled with the FIPG can be easily disassembled without use of a special method. In some cases, however, the sealant between the joined surfaces may have to be broken by lightly striking with a mallet or similar tool. A flat and thin gasket scraper may be lightly hammered in between the joined surfaces. In this case, however, care must be taken to prevent damage to the joined surfaces.

SURFACE PREPARATION

Thoroughly remove all substances deposited on the gasket application surfaces, using a gasket scraper or wire brush. Check to ensure that the surfaces to which the FIPG is to be applied is flat. Make sure that there are no oils, greases and foreign substances deposited on the application surfaces. Do not forget to remove the old sealant remaining in the bolt holes.

FORM–IN–PLACE GASKET APPLICATION (FIPG)

When assembling parts with the FIPG, you must observe some precautions, but the procedure is very simple as in the case of a conventional pre–cut gasket. Applied FIPG bead should be of the specified size and without breaks. Also be sure to encircle the bolt hole circumference with a completely continuous bead. The FIPG can be wiped away unless it is hardened. While the FIPG is still moist (in less than 15 minutes), mount the parts in position. When the parts are mounted, make sure that the gasket is applied to the required area only. In addition, do not apply any oil to the sealing locations or start the engine until a sufficient amount of time (about one hour) has passed after installation is completed. The FIPG application procedure may vary on different areas. Observe the procedure described in the text when applying the FIPG.

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TRANSMISSION

DISASSEMBLY AND REASSEMBLY

Lubricate all internal parts with automatic transmission fluid during reassembly.

1. Torque converter
2. Roll stopper bracket
3. Harness bracket
4. Control cable support bracket
5. Oil level gauge
6. Eye bolts
7. Cooler pipes
8. Input shaft speed sensor
9. Output shaft speed sensor
10. Manual control lever
11. Park/neutral position switch
12. Speedometer gear
13. Valve body cover
14. Manual control shaft detent

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Lubricate all internal parts with automatic transmission fluid during reassembly.

15. Fluid temperature sensor
16. Valve body
17. Steel ball
18. Gasket
19. Snap ring
20. Solenoid valve harness
21. Strainer
22. Second brake retainer oil seal
23. Accumulator piston
24. Accumulator spring
25. Accumulator spring
26. Snap ring
27. Accumulator cover
28. Accumulator spring
29. Accumulator piston
30. Manual control lever shaft pin
31. Manual control lever shaft
32. Parking pawl rod

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33. Torque converter housing
34. Differential
35. Oil filter
36. Oil pump
37. Gasket
38. Pipe
39. Thrust washer #1
40. Under drive clutch & input shaft
41. Thrust bearing #2
42. Under drive clutch hub
43. Snap ring
44. Reduction brake piston cover
45. Snap ring
46. Reduction brake piston
47. Reduction brake spring
48. Parking pawl shaft
49. Parking pawl shaft spring
50. Parking roller support shaft
51. Parking pawl
52. Parking roller support
53. Direct planetary carrier
54. Anchor plug
55. Direct clutch
56. Reduction brake band
57. Thrust bearing #11
58. Thrust race #12
59. Rear cover
60. Thrust race #8
61. Seal ring
62. Input shaft rear bearing
63. Accumulator piston
64. Accumulator spring
65. Thrust bearing #7
66. Reverse & overdrive clutch
67. Thrust bearing #6
68. Overdrive clutch hub
69. Thrust bearing #5
70. Planetary reverse sun gear

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No. of Brake Discs and Plates

Brake	Brake Disc	Brake Plate
Low-reverse brake	6	5
Second brake	4	3

Lubricate all internal parts with automatic transmission fluid during reassembly.

71. Snap ring
72. Second brake piston
73. Return spring
74. Pressure plate
75. Second brake disc
76. Second brake plate
77. Planetary carrier assembly
78. Snap Ring
79. Reaction plate
80. Snap ring
81. Low reverse brake disc
82. Low reverse brake plate
83. Pressure plate
84. Wave spring
85. Snap ring
86. One way clutch inner race
87. O-ring
88. Spring retainer
89. Return spring
90. Low reverse brake piston
91. Transfer drive gear
92. Snap ring
93. One way clutch
94. Seal ring
95. Needle bearing
96. Outer race
97. Spacer
98. Outer race
99. Transmission case

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DISASSEMBLY

Caution

1. **Because the automatic transmission is manufactured from high-precision parts, sufficient care must be taken not to scratch or damage these parts during disassembly and reassembly.**
2. **The working area should be covered with a rubber mat to keep it clean at all times.**
3. **Do not wear any cloth gloves and do not use any rags during disassembly. Use nylon cloth if you need to use something.**
4. **Parts which have been disassembled should all be cleaned. Metal parts can be cleaned with normal detergent, but they should be dried completely using compressed air.**
5. **Clutch discs, plastic thrust plates and rubber parts should be cleaned with automatic transmission fluid (ATF) and keep them out of dust.**
6. **If the transmission body has been damaged, disassemble, flush and clean the cooler system also.**

1. Remove the torque converter.
2. Use the dial gauge to measure the input shaft end play.
3. Remove each bracket.
4. Remove the oil level gauge.
5. Remove the eye bolt, gasket and the oil cooler feed tubes.

6. Remove the input shaft speed sensor and output shaft speed sensor.

7. Remove the manual control lever, and then remove the park/neutral position switch.

   Caution
   Make sure that the manual control lever installation nut is removed before removing the valve body.

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8. Remove the speedometer gear.

9. Remove the valve body cover.

10. Remove the manual control shaft detent.

11. Disconnect the harness connectors of the valve body.

12. Remove the valve body mounting bolts (28 of).
13. Remove the fluid temperature sensor.

Caution
Make sure that the manual control lever and the park/neutral position switch are removed.

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14. Remove the valve body, gasket and the steel balls (2 pieces).

    Caution
    Do not lose the steel balls (2 pieces).

15. Remove the snap ring, and then remove the solenoid valve harness.

16. Remove the strainer and the second brake retainer oil seal.

17. Remove each accumulator piston and spring.

No.	Name
1	For low-reverse brake
2	For underdrive clutch
3	For second brake
4	For overdrive clutch

Note: Label each accumulator piston and spring so that they can be reinstalled correctly.

18. Remove snap ring, reduction brake accumulator cover, spring and piston.

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19. Remove the manual control lever shaft roller.
20. Remove the manual control lever shaft and the parking pawl rod.

21. Remove the torque converter housing mounting bolts (20 pieces), and then remove the torque converter housing.

22. Remove the O-rings (2 pieces).

23. Remove the differential.

24. Remove the oil filter.

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25. Remove the oil pump pipe bolts and mounting bolts.
26. Install the special tools (MD998333) in the holes A.

27. Screw the special tool to remove the oil pump and pipe.
28. Remove the oil pump gasket and remove the pipe from the oil pump.

29. Remove thrust washer #1.

30. Hold the input shaft, and then remove the underdrive clutch.

31. Remove thrust bearing #2.

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32. Remove the underdrive clutch hub.

33. Remove snap ring and the reduction brake piston cover.
34. Remove snap ring and then the reduction brake piston and snap ring.

35. Remove the parking pawl shaft and spring.

36. Pull out parking pawl roller support shafts out and remove the parking pawl and parking roller support.

37. Remove direct planetary carrier assembly.

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38. Remove anchor plug and o-ring.

39. Remove direct clutch.

40. Remove reduction brake band.

41. Remove thrust bearing #11 and thrust race #12.

42. Remove the rear cover.
43. Remove the thrust race #8.
44. Remove the seal rings (4 pieces).
45. Remove the input shaft rear bearing.

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46. Remove the O-rings.

47. Remove o-ring and then direct clutch accumulator piston and spring.

48. Remove the reverse and overdrive clutch and the thrust bearing #7.

49. Remove the overdrive clutch hub and the thrust bearing #6.

50. Remove thrust bearing #5.

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51. Remove the planetary reverse sun gear.

52. Remove the snap ring.

53. Remove the second brake piston and the return spring.

54. Remove the pressure plate, brake discs and brake plates.

55. Remove the planetary carrier assembly.

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56. Remove the snap ring.

57. Remove the reaction plate and brake disc.

58. Remove the snap ring.

59. Remove brake plates,brake discs and pressure plate.

60. Remove wave spring.

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61. Remove the snap ring using special tools.
62. Remove one way clutch race, o-ring, spring retainer, return spring and low reverse brake piston.

63. Remove the transfer drive gear fixing bolts.
64. After removing the transfer drive gear fixing bolts, turn gear 1/8 of turn and remove remaining bolts.

65. Remove the transfer drive gear.

66. Remove snap ring.

67. Remove one way clutch.
68. Remove seal rings.
69. Remove needle bearing.
70. Remove differential bearing outer race and spacer from converter housing.
71. Remove differential bearing outer race from transmission case.

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REASSEMBLY

Caution

1. **Never reuse the gasket, O-ring, oil seal, etc. Always replace with new ones when reassembling.**
2. **Never use grease other than blue or white petrolatum jelly.**
3. **Apply ATF to friction components, rotating parts, and sliding parts before installation. Immerse a new clutch disc or brake disc in ATF for at least two hours before assembling them.**
4. **Never apply sealant or adhesive to gaskets.**
5. **When replacing a bushing, replace the assembly which it belongs to.**
6. **Never use any cloth gloves or any rags during reassembly. Use nylon cloth or paper towels if you need to use something.**
7. **Change the oil in the cooler system.**

1. Install transfer drive gear using special tool.

2. Tighten transfer drive gear fixing bolts (8 of) to specified torque.

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3. Install low-reverse brake piston, return spring and spring retainer.
4. Install new o-ring into the groove of the one way clutch inner race.
5. Check the position of identification notch of the one way clutch inner race and install one way clutch inner race onto the transfer drive gear bearing as the notch comes on A-A line.

6. Install snap ring using special tools.

7. Install wave spring onto low-reverse brake piston.

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8. Install brake discs for low-reverse brake, brake plates and snap ring as shown in diagram.

   Note: Do Not Install Pressure Plate.

   Reference: Number of Brake Discs and Plates

Item	Quantity
Brake Discs	6
Brake Plates	5

9. Install the special tool on brake disc.
10. Install original reaction plate and snap ring.
11. Move the special tool and measure end play of reaction plate. Select the snap ring which was installed in 10. as it becomes the standard value and reassemble it.

    Standard Value: 0 – 0.16 mm.
12. Install brake disc and brake plate for second brake.

    Note: Do Not Install Pressure Plate.

    Reference: Number of Brake Discs and Plates

Item	Quantity
Brake Discs	4
Brake Plates	3

13. Install the special tool.
14. Install return spring, second brake piston and snap ring.
15. Move the special tool and measure the amount of its end play. Select a pressure plate, which has the thickness for the specified amount, from the table below.

    Reference: Standard value of end play for second brake 1.09 – 1.55 mm.

    Pressure plate (second brake)

Amount of end play in mm.	Thickness mm.	Identification Code	Part Number
1.1 – 1.3	1.8	E	MD749425
1.3 – 1.5	2.0	D	MD749426
1.5 – 1.7	2.2	C	MD749427
1.7 – 1.9	2.4	B	MD749428
1.9 – 2.1	2.6	A	MD749429
2.1 – 2.3	2.8	0	MD749430

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16. Turn the transmission over.
17. Install the special tool (MD998913) on dial gauge, move the special tool (MB991631 or MB991632) and measure the amount of its movement. Select a pressure plate, which has the thickness for the measured amount, from the table shown below.

    Reference: Standard value of end play of low-reverse brake 1.65 – 2.11 mm.

    Pressure plate (low-reverse brake)

Amount of end play in mm.	Thickness mm.	Identification Code	Part Number
1.0 – 1.2	1.6	F	MD759568
1.2 – 1.4	1.8	E	MD759425
1.4 – 1.6	2.0	D	MD759426
1.6 – 1.8	2.2	C	MD759427
1.8 – 2.0	2.4	B	MD759428
2.0 – 2.2	2.6	A	MD759429
2.2 – 2.4	2.8	0	MD759430
2.4 – 2.6	3.0	1	MD759431

18. Remove the parts which were installed in 7.–17.

19. Install needle bearing as shown on the figure.
20. Install the seal rings (2 of).

21. Install one way clutch with the identification mark up.

22. Install the snap ring.

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IDENTIFICATION OF THRUST BEARINGS, THRUST RACES, AND THRUST WASHERS (All Units in mm.)

Symbol	O.D.	I.D.	Thickness	Part number
#1	59	47	1.8	MD754509
			2.0	MD754508
			2.2	MD754507
			2.4	MD753793
			2.6	MD753794
			2.8	MD753795
#2	49	34	3.6	MD756846

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Symbol	O.D.	I.D.	Thickness	Part number
#3	57	38.5	4.12	MD758556
#4	55.4	38.5	3.3	MD761683
#5	57	38.5	4.12	MD758556
#6	57	38.5	4.12	MD758556
#7	59	37	2.8	MD754595
#8	48.9	37	1.6	MD707267
			1.7	MD759681
			1.8	MD723064
			1.9	MD754794
			2.0	MD707268
			2.1	MD754795
			2.2	MD723065
			2.3	MD754796
			2.4	MD724358
			2.5	MD754797
			2.6	MD754798
#9	78.5	60	2.5	MD753250
#10	54.6	43	3	MD753457
#11	58	40.7	4.2	MD762868
#12	80	60	2.5	MD753251

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23. Install overdrive planetary carrier.
24. Install planetary carrier assembly.

25. Install planetary reverse sun gear.

26. Install wave spring on low reverse brake piston.

27. Install the pressure plate that was selected in 17. Then install brake discs and brake plates.

Reference: Number of Brake Discs and Plates

Item	Quantity
Brake Discs	6
Brake Plates	5
Pressure Plates	1

28. Install the snap ring.

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29. Install the reaction plate.

30. Install the snap ring that was selected in 11.

31. Install the brake discs, brake plates and pressure plate that was selected in 15.

Reference: Number of Brake Discs and Plates

Item	Quantity
Brake Discs	4
Brake Plates	3
Pressure Plates	1

32. Install the return spring and second brake piston.

33. Install the snap ring.

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34. Install thrust bearing #5.

    Caution:
    Install the thrust bearing in the correct direction.

35. Install over drive clutch hub and thrust bearing #6 on reverse & over drive clutch.

    Caution:
    Install the thrust bearing in the correct direction.

36. Install reverse, over drive clutch and thrust bearing #7.

    Caution:
    Install the thrust bearing in the correct direction.

37. Install the input shaft bearing into the rear cover using special tool.
38. Install seal rings (4 of).

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39. Use the following procedure to measure the under drive sun gear end play for the correct selection of thrust race #8.
(a) Install the thinnest thrust race #8 (thickness: 1.6mm, part number MD707267) on thrust bearing #7.
(b) Install rear cover on transmission and tighten bolts to specified torque.
(c) Turn transmission over and put the torque converter housing fixing side up.
(d) Install under drive clutch hub on under drive sun gear.
(e) Measure the end play of under drive sun gear and record the measured value.

Reference:
Standard Value: 0.25 – 0.45 mm.

(f) After the measurement, remove the parts which were installed in the procedure (a) – (d).

40. Install the direct clutch accumulator spring, piston and then o-ring.

41. Install the O-rings (6 of).
42. Select the thrust race which has the correct thickness for the measured value which was recorded in 39. and install it onto thrust bearing #7.

Measured Amount mm.	Thickness mm.	Part Number
0.3 – 0.4	1.6	MD707267
0.4 – 0.5	1.7	MD759681
0.5 – 0.6	1.8	MD723064
0.6 – 0.7	1.9	MD754794
0.7 – 0.8	2.0	MD707268
0.8 – 0.9	2.1	MD754795
0.9 – 1.0	2.2	MD723065
1.0 – 1.1	2.3	MD754796
1.1 – 1.2	2.4	MD724358
1.2 – 1.3	2.5	MD754797
1.3 – 1.4	2.6	MD754798

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43. Squeeze out liquid gasket of 1.6mm. thickness and apply it to the places on rear cover as shown in diagram.

Reference:
Use Mitsubishi genuine sealant part # MD974421 or Equivalent.

44. Install the rear cover and tighten the bolts to the specified torque.

45. Install thrust race #12 and thrust bearing #11.

Note:
Install thrust bearing in the correct direction.

46. Tighten anchor plug and new o-ring temporarily and install reduction brake band and direct clutch at the same time.

47. Check that the direct clutch only turns in the direction shown in the diagram.

Note:
Reinstall one way clutch if it turns in opposite direction to direction shown in diagram.

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48. Tighten anchor plug to specified torque.

49. Install direct planetary carrier assembly.

50. Install spring and reduction brake piston in transmission case and then the snap ring.

51. Adjust reduction brake piston using the following procedure.
(a) Remove nut from reduction brake piston.
(b) Install the special tool (MB991633 stopper) in order to stop the reduction piston rotating.
(c) Using special tool (MB991633 socket) tighten and back off the adjusting rod to 10Nm twice. Tighten the adjusting rod to 5Nm and then back off the adjusting rod between 5 1/2 – 5 3/4 turns.
(d) Install the nut on the adjusting rod without changing the rod position and tighten the nut using special tool to 19 ± 3 Nm.

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52. Install the reduction brake piston cover and snap ring.

53. Install the parking pawl, spring and parking pawl shaft.

54. Install parking roller support and then parking roller support shafts (2 of).

55. Install the under drive clutch hub.

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56. Install thrust bearing #2.

    Note:
    Install thrust bearing in the correct direction.

57. Hold input shaft and install under drive clutch.

58. Install thrust washer #1 (thickness: 1.8mm, part number MD754509) for the thinnest input shaft end play on under drive clutch retainer.

59. Install oil pipe on oil pump.

60. Install new oil pump gasket and oil pump using special tools. Install the pipe at the same time.

    Note:
    Do not reuse a gasket even if it has been tightened only once.

61. Tighten oil pump fixing bolts and pipe fixing bolt to the specified torque.

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62. Measure the end play of the input shaft. Select thrust washer #1, which has the thickness to obtain the standard value, from the table on page 23D-36 and replace the thrust washer assembled in 58.

    Reference:
    Standard value: 0.70 – 1.45 mm.

63. Install oil filter.

64. Install the differential bearing outer race into the transmission case using special tools.

65. Install differential.

66. Install a piece of solder (approx. 10mm in length and 3mm in diameter) on the torque converter housing in the positions shown.

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67. Install outer race using special tools.

68. Install the converter housing onto transmission without applying liquid gasket and tighten to the specified torque.
69. Loosen the bolts, remove converter housing and then take out the solder.

70. Measure the thickness of the crushed solder using a micrometer.
71. Select a spacer, from spacer selection table, which is the measured thickness value plus the standard value of preload.

    Reference:
    Standard value: 0.045 – 0.105 mm preload.

72. Install the spacer selected in 70. into converter housing and tap into place using special tools.

73. Squeeze out liquid gasket of 1.6mm. thickness and apply it to the places on rear cover as shown in diagram.

    Reference:
    Use Mitsubishi genuine sealant part # MD974421 or Equivalent.

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74. Install the converter housing and tighten the fixing bolts to the specified torque.

75. Install the manual control lever shaft and parking pawl rod.
76. Install the manual control lever shaft pin.

77. Install the reduction brake accumulator piston, spring, accumulator cover and snap ring.

78. Install a new seal ring on each accumulator piston.

Reference:
Pistons and seal rings are common parts.

79. Check the identification of the accumulator springs and insert them into each hole of transmission case.

Reference:
The identification of the accumulator springs are as in the following table and diagrams:

Name	Code	Identification Ink - Blue
Low-reverse brake	1	None
Under drive clutch	2	Half applied
Second brake	3	Fully applied
Over drive clutch	4	None

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80. Install the strainer and second brake retainer oil seal as shown in the diagram.

81. Install a new o-ring onto the groove of the solenoid valve harness connector.
82. Insert solenoid valve harness connector in to the hole from the inside of the transmission case as it faces the direction shown in the diagram. Then securely install the snap ring onto the connector groove.

83. Install the steel balls into each of 2 holes on the top of valve body (outside valve body).
84. Install valve body and gasket. Check that manual valve pin is in the detent plate groove of the manual control lever shaft.

85. Install oil temperature sensor.
86. Install valve body fixing bolts and tighten to the specified torque.
87. Connect connector to valve body.

Code	Fixing Position	Colour of Wire	Colour of Connector
1	Under drive solenoid valve	white,red, red	Black
2	Over drive solenoid valve	orange, red	Black
3	Low reverse solenoid valve	brown, yellow	Cream
4	Second solenoid valve	green,red, red	Cream
5	Damper clutch solenoid valve	blue, blue,yellow	Black
6	Reduction solenoid valve	orange,yel-low,yellow	Black
7	Oil temperature sensor	black, red	Black

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88. Install the manual control shaft detent.

89. Apply liquid gasket to the valve body cover as shown in the diagram.

Reference:
Use Mitsubishi genuine sealant part # MD974421 or equivalent.

90.. Install the valve body cover and tighten the fixing bolt to the specified torque.

91. Install speedometer gear.

92. Install the inhibitor switch and the manual control lever.

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93. Install the input shaft speed sensor and output shaft speed sensor.

94. Install the eye bolt, a new gasket, and the oil cooler feed tube.
95. Install the oil dipstick.
96. Install the brackets.
97.. Install the torque converter, and secure it so that the shown dimension (A) meets the reference value.

Reference:
Standard value: approx. 9.4 mm

Caution
Apply ATF to the oil pump drive hub before installing the torque converter. Be careful not to damage the oil seal lip when installing the torque converter.

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OIL PUMP

DISASSEMBLY AND REASSEMBLY

Lubricate all internal parts with automatic transmission fluid during reassembly.

Disassembly steps

1. O-ring
2. Seal ring
3. ▶A◀ Oil seal
4. Oil pump assembly

REASSEMBLY SERVICE POINTS

▶A◀ OIL SEAL INSTALLATION

1. Install oil seal using special tool.

▶B◀ O-RING INSTALLATION

2. Install new o-ring to the outside groove of the oil pump, apply ATF, blue or white petroleum jelly to the outside surface of the o-ring.

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UNDERDRIVE CLUTCH AND INPUT SHAFT

DISASSEMBLY AND REASSEMBLY

Lubricate all internal parts with automatic transmission fluid during reassembly.

Number of clutch discs and plates

Clutch disc	Clutch plate	Clutch reaction plate
4	4	1

Disassembly steps

1. Snap ring
2. Input shaft
3. Seal ring
4. ▶D◀ Snap ring
5. ▶C◀ Clutch reaction plate
6. ▶C◀ Clutch disc
7. ▶C◀ Clutch plate
8. ◀A▶ ▶B◀ Snap ring
9. Spring retainer
10. ▶A◀ D-ring
11. Return spring
12. Underdrive clutch piston
13. ▶A◀ D-ring
14. ▶A◀ D-ring
15. Underdrive clutch retainer

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DISASSEMBLY SERVICE POINT

◀A▶ SNAP RING REMOVAL

1. Remove snap ring using special tools.

REASSEMBLY SERVICE POINTS

▶A◀ D-RING INSTALLATION

1. Apply ATF, blue petrolatum jelly or white Vaseline to the D-ring, and install it carefully.

▶B◀ SNAP RING INSTALLATION

1. Install snap ring using special tools.

▶C◀ CLUTCH PLATE/CLUTCH DISC/CLUTCH REACTION PLATE INSTALLATION

1. Wave type clutch discs are used. Put two clutch discs together and gradually slide them around, if there is a gap visible between them, they are wave type clutch discs.

   Caution:
   Immerse the clutch disc in ATF before assembling it.

2. Align the spaces between the teeth (part A) of clutch plate, clutch discs and clutch reaction plate to the outer circumference hole (part B) of the under drive clutch retainer and assemble.

3. Install clutch reaction plate in the direction shown in diagram.

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▶D◀ SNAP RING INSTALLATION

1. Install snap ring
2. When measuring the clearance, use the special tool to press the clutch reaction plate evenly.
3. Check that the clearance between the snap ring and the clutch reaction plate is within the standard value. If not within the standard value, select a snap ring to adjust.

Standard value:
1.7 ± 0.1 mm

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REVERSE AND OVERDRIVE CLUTCH

DISASSEMBLY AND REASSEMBLY

Lubricate all internal parts with automatic transmission fluid during reassembly.

Number of over drive clutch discs and plates

Clutch disc	Clutch plate	Clutch reaction plate
4	3	1

Disassembly steps

- ▶G◀ 1. Snap ring
- ▶F◀ 2. Clutch reaction plate
- ▶F◀ 3. Clutch disc
- ▶F◀ 4. Clutch plate
- ▶E◀ 5. Snap ring
- ▶D◀ 6. Clutch reaction plate
- ▶D◀ 7. Clutch disc
- ▶D◀ 8. Clutch plate
- ▶D◀ 9. Clutch pressure plate
- ◀A▶ ▶C◀ 10. Snap ring
- 11. Spring retainer
- ▶A◀ 12. D-ring
- 13. D-ring
- 14. Overdrive clutch piston
- ▶A◀ 15. D-ring
- ▶B◀ 16. Reverse clutch piston
- ▶A◀ 17. D-ring
- 18. Reverse clutch retainer
- ▶A◀ 19. D-ring
- ▶A◀ 20. D-ring

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DISASSEMBLY SERVICE POINT

◀A▶ SNAP RING REMOVAL

1. Remove snap ring using special tools.

REASSEMBLY SERVICE POINTS

▶A◀ D-RING INSTALLATION

1. Apply ATF, blue petroleum jelly or white Vaseline to D-ring, and install carefully.

▶B◀ REVERSE CLUTCH PISTON INSTALLATION

1. Align the outer circumference holes (parts A and B) of the reverse clutch piston and the reverse clutch retainer to assemble them.

▶C◀ SNAP RING INSTALLATION

1. Use the special tool to install the snap ring.

2. Push evenly on circumference of return spring retainer firmly (49N {5kgf}).
3. Check that the clearance between the snap ring and the return spring retainer is within the standard value. If not within the standard value, select a snap ring to adjust to standard value.

   Reference:
   Standard value: 0 – 0.09 mm

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▶D◀ CLUTCH PLATE/CLUTCH DISC/CLUTCH REACTION PLATE INSTALLATION

1. Wave type clutch discs are used. Put two clutch discs together and gradually slide them around, if there is a gap visible between them, they are wave type clutch discs.

2. Align the spaces between the teeth (part A) of clutch pressure plate, clutch plate, clutch disc, and clutch reaction plate to the outer circumference hole (part B) of reverse clutch piston and assemble.

Caution
Immerse the clutch disc in ATF before assembling the clutch disc.

3. Install the clutch reaction plate in the direction shown in the diagram.

▶E◀ SNAP RING INSTALLATION

1. Install snap ring.
2. When measuring the clearance, use the special tool to press the clutch reaction plate evenly. Check that the clearance between the snap ring and the clutch reaction plate is within the standard value. If not within the standard value, select a snap ring to adjust.

Reference:
Standard value: 1.7 ± 0.1 mm

▶F◀ CLUTCH PLATE/CLUTCH DISC/CLUTCH REACTION PLATE INSTALLATION

1. Wave type clutch discs are used. Put two clutch discs together and gradually slide them around, if there is a gap visible between them, they are wave type clutch discs.

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2☞ Align the space between the teeth (part A) of the clutch pressure plate, clutch plate, clutch disc and clutch reaction plate to the outer circumference hole (part B) of the reverse clutch piston and assemble.

Caution
Immerse the clutch disc in ATF before assembling the clutch disc.

3. Install the clutch reaction plate in the shown direction.

▶G◀SNAP RING INSTALLATION

1. Install snap ring.
2. When measuring the clearance, press the clutch reaction plate by the weight of 1471 ± 50N (150 ± 5kgf) evenly. Check that the clearance between the snap ring and the clutch reaction plate is within the standard value. If not within the standard value, select a snap ring to adjust to standard value.

Reference:
Standard value: 1.6 ± 0.1mm

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DIRECT CLUTCH

DISASSEMBLY AND REASSEMBLY

Lubricate all internal parts with automatic transmission fluid during reassembly.

Disassembly steps

- ▶D◀ 1. Snap ring
- ▶C◀ 2. Clutch reaction plate
- ▶C◀ 3. Clutch disc
- ▶C◀ 4. Clutch plate
- ◀A▶ ▶B◀ 5. Snap ring
- 6. Spring retainer
- ▶A◀ 7. D-ring
- 8. Return spring
- 9. Direct clutch piston
- ▶A◀ 10. D-ring
- ▶A◀ 11. D-ring
- 12. Direct clutch retainer

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DISASSEMBLY SERVICE POINT

◀A▶ SNAP RING REMOVAL

1. Remove snap ring using special tools.

REASSEMBLY SERVICE POINTS

▶A◀ D-RING INSTALLATION

1. Apply ATF, blue petroleum jelly or white Vaseline to D-ring, and install carefully.

▶B◀ SNAP RING INSTALLATION

1. Use the special tools to install the snap ring.

▶C◀ CLUTCH PLATE, CLUTCH DISC AND CLUTCH REACTION PLATE INSTALLATION

1. Align the spaces between the teeth (part A) of clutch plate, clutch disc and clutch reaction plate to the outer circumference hole (part B) of direct clutch retainer and assemble.

Caution
Immerse the clutch disc in ATF before assembling the clutch disc.

2. Install the clutch reaction plate in the direction shown in the diagram.

▶D◀ SNAP RING INSTALLATION

1. Install snap ring.
2. When measuring the clearance, press the return spring retainer by the weight of 49 N (5kgf) evenly. Check that the clearance between the snap ring and the return spring retainer is within the standard value. If not within the standard value, select a snap ring to adjust.

   Reference:
   Standard value: 1.1 ± 0.1 mm

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PLANETARY CARRIER ASSEMBLY

DISASSEMBLY AND REASSEMBLY

Lubricate all internal parts with automatic transmission fluid during reassembly.

Disassembly steps

1. Stopper plate
2. ▶B◀ One-way clutch
3. Snap ring
4. Output planetary carrier
5. ▶A◀ Thrust bearing #3
6. Under drive sun gear
7. ▶A◀ Thrust bearing #4
8. Snap ring
9. Over drive planetary carrier
10. Over drive annulus gear

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REASSEMBLY SERVICE POINTS

▶A◀ THRUST BEARINGS #3 & #4 INSTALLATION

1. Install thrust bearing #3 and #4 in the position shown in the diagram.

   Reference:
   Install thrust bearings in the correct direction.

▶B◀ ONE WAY CLUTCH INSTALLATION

1. Insert one way clutch into over drive annulus gear as the arrow points to output planetary carrier side.

   Caution:
   Install one way clutch in the correct direction.

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LOW-REVERSE BRAKE

DISASSEMBLY AND REASSEMBLY

Lubricate all internal parts with automatic transmission fluid during reassembly.

TFA2214

Disassembly steps

▶A◀ 1. D-ring
▶A◀ 2. D-ring
3. Low-reverse brake piston

REASSEMBLY SERVICE POINT

▶A◀ D-RING INSTALLATION

Apply ATF, blue petrolatum jelly or white petrolatum jelly to D-ring, and install carefully.

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SECOND BRAKE

DISASSEMBLY AND REASSEMBLY

Lubricate all internal parts with automatic transmission fluid during reassembly.

TFA2215

Disassembly steps

1. Second brake retainer
2. ▶A◀ D-ring
3. Second brake piston
4. ▶A◀ D-ring

REASSEMBLY SERVICE POINT

▶A◀ D-RING INSTALLATION

Apply ATF, blue petrolatum jelly or white Vaseline to D-ring, and install carefully.

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DIRECT PLANETARY CARRIER

DISASSEMBLY AND REASSEMBLY

Lubricate all internal parts with automatic transmission fluid during reassembly.

Disassembly steps

◀A▶ ▶D◀ 1. Lock nut
2. Roller bearing
3. Thrust bearing #9
4. Thrust race #10
◀B▶ ▶C◀ 5. Output gear
◀B▶ ▶C◀ 6. Parking gear
◀C▶ ▶B◀ 7. Taper roller bearing
8. Transfer driven & direct annulus gear
◀D▶ ▶A◀ 9. Taper roller bearing
10. Direct planetary carrier

DISASSEMBLY SERVICE POINTS

◀A▶ LOCK NUT REMOVAL

1. Remove stake from lock nut.

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2. Remove lock nut using special tool.

◀B▶ OUTPUT GEAR / PARKING GEAR REMOVAL

1. Remove output gear and parking gear using special tools.

◀C▶ TAPER ROLLER BEARING / TRANSFER DRIVEN GEAR REMOVAL

1. Support transfer driven gear as shown in diagram.
2. Push directly on planetary carrier shaft and pull taper roller bearing and transfer driven gear off.

◀D▶ TAPER ROLLER BEARING REMOVAL

1. Remove taper roller bearing using special tools.

ASSEMBLY SERVICE POINTS

▶A◀ TAPER ROLLER BEARING INSTALLATION

1. Install taper roller bearing using special tools.

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▶B◀ TAPER ROLLER BEARING INSTALLATION

1. Install transfer driven gear and taper roller bearing using special tools.

▶C◀ OUTPUT GEAR / PARKING GEAR INSTALLATION

1. Install output gear and parking gear using special tools.

▶D◀ LOCK NUT INSTALLATION

1. Apply ATF to new lock nut and tighten it to the specified torque. Then loosen it one turn and tighten it again to the specified torque.

2. Stake the new lock nut in two places to prevent it from turning.

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DIFFERENTIAL

DISASSEMBLY AND REASSEMBLY

Lubricate all internal parts with automatic transmission fluid during reassembly.

Disassembly steps

◀A▶ ▶D◀ 1. Differential drive gear
▶C◀ 2. Taper roller bearings
▶B◀ 3. Lock pin
▶A◀ 4. Pinion shaft
▶A◀ 5. Pinions
▶A◀ 6. Washers
▶A◀ 7. Side gears
▶A◀ 8. Spacers
9. Differential case

DISASSEMBLY SERVICE POINTS

◀A▶ TAPER ROLLER BEARING REMOVAL

1. Remove taper roller bearing using special tools.

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REASSEMBLY SERVICE POINTS

▶A◀ SPACER, SIDE GEAR, WASHER, PINION, PINION SHAFT INSTALLATION

1. Install the spacers to the back side of the side gears, and then assemble the side gears into the differential case.

   NOTE
   Select the medium size spacer [0.93 – 1.00 mm] when assembling a new side gear.

2. Attach the washers to the back side of the pinions, engage the pinions simultaneously to the side gears, and settle the gears to the specified position by turning.

3. Insert the pinion shaft.

4. Measure the backlash between the side gears and pinions.

   Standard value:
   0.025 – 0.150 mm

5. If not within the standard value, change a spacer and measure the backlash again.

   NOTE
   Adjust so that both backlashes are equal.

▶B◀ LOCK PIN INSTALLATION

1. Install the chamfered side of the lock pin first, as per diagram.

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▶C◀ TAPER ROLLER BEARING INSTALLATION

1. Install the taper roller bearings using special tools.

▶D◀ DIFFERENTIAL DRIVE GEAR INSTALLATION

1. Apply ATF to the bolts and tighten to the specified torque in the sequence shown in the diagram.

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VALVE BODY

DISASSEMBLY AND REASSEMBLY

Disassembly steps

1. Solenoid valve support
2. ◀A▶ ▶C◀ Underdrive solenoid valve
3. ◀A▶ ▶C◀ Second solenoid valve
4. ◀A▶ ▶C◀ Torque converter clutch control solenoid valve
5. ◀A▶ ▶C◀ Overdrive solenoid valve
6. ◀A▶ ▶C◀ Low-reverse solenoid valve
7. ◀A▶ ▶C◀ Reduction solenoid valve
8. Manual valve
9. Cover
10. Plate
11. Outside valve body assembly
12. ▶B◀ Steel ball (orifice check ball)
13. ▶B◀ Spring
14. Plate
15. ▶A◀ Damping valve
16. ▶A◀ Damping valve spring
17. ▶A◀ Steel ball (line relief)
18. ▶A◀ Spring
19. ▶A◀ Steel ball (orifice check ball)
20. ▶A◀ Spring
21. Inside valve body assembly

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22. Roller
23. Damper clutch control valve sleeve
24. Damper clutch control valve
25. Damper clutch control valve spring
26. Plate
27. Screw
28. Regulator valve spring
29. Regulator valve
30. Plate
31. Fail-safe valve A sleeve
32. Fail-safe valve A2
33. Fail-safe valve A spring
34. Fail-safe valve A1
35. Plate
36. Plug
37. Torque converter valve
38. Torque converter valve spring
39. Plate
40. Fail-safe valve B sleeve
41. Fail-safe valve B
42. Inside valve body
43. Roller
44. Overdrive pressure control valve sleeve
45. Overdrive pressure control valve
46. Overdrive pressure control valve spring
47. Roller
48. Low–reverse pressure control valve sleeve
49. Low–reverse pressure control valve
50. Low–reverse pressure control valve spring
51. Roller
52. Reduction pressure control valve sleeve
53. Reduction pressure control valve
54. Reduction pressure control valve spring
55. Plate
56. Plug
57. Switch valve
58. Roller
59. Underdrive pressure control valve sleeve
60. Underdrive pressure control valve
61. Underdrive pressure control valve spring
62. Roller
63. Second pressure control valve sleeve
64. Second pressure control valve
65. Second pressure control valve spring
66. Plate
67. Fail-safe valve C sleeve
68. Fail-safe valve C
69. Outside valve body

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DISASSEMBLY SERVICE POINT

◀A▶ SOLENOID VALVE REMOVAL

NOTE
1. Before removing the solenoid valves, identify each solenoid valve with white paint or similar to facilitate reassembly.
2. Store each solenoid valve separately, according to its location, to avoid incorrect reassembly.

REASSEMBLY SERVICE POINTS

▶A◀ SPRING/STEEL BALL/DAMPING VALVE/DAMPING VALVE SPRING INSTALLATION

1. Install steel balls, springs and damping valve in the positions shown in the diagram.

▶B◀ SPRING/STEEL BALL INSTALLATION

1. Install spring and steel balls in the positions shown in the diagram.

▶C◀ SOLENOID VALVE INSTALLATION

1. Install the solenoid valves by referring to the marks made during disassembly.

No.	Name
1	Underdrive solenoid valve
2	Second solenoid valve
3	Damper clutch control solenoid valve
4	Overdrive solenoid valve
5	Low–reverse solenoid valve
6	Reduction solenoid valve

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REDUCTION BRAKE PISTON

DISASSEMBLY AND REASSEMBLY

Lubricate all internal parts with automatic transmission fluid during reassembly.

TFA1730

Disassembly steps

1. Nut
2. Adjusting rod
3. Reduction brake piston
4. Seal ring

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SPEEDOMETER GEAR

DISASSEMBLY AND REASSEMBLY

Disassembly steps

1. E-clip
2. Speedometer driven gear
3. O-ring
4. Sleeve

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DRIVE SHAFT OIL SEAL

DISASSEMBLY AND REASSEMBLY

Lubricate all internal parts with automatic transmission fluid during reassembly.

TFA1731

Disassembly steps

▶A◀ 1. Oil seal
2. Torque converter housing
▶B◀ 3. Oil seal
4. Transmission case

REASSEMBLY SERVICE POINT

▶A◀ OIL SEAL INSTALLATION

1. Install oil seal using special tool.

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▶B◀ OIL SEAL INSTALLATION

1. Install oil seal using special tool.

23E AUTOMATIC TRANSMISSION W5A51 <AWD>

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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 in baking or drying after painting, remove the SRS components (air bag module and SRS-ECU) beforehand.

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

(4) 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
Section titles with the asterisk (*) in the table of contents in each group indicate operations requiring warnings.

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GENERAL SPECIFICATIONS

Items		Specifications
Model		W5A51-1-E1DD
Type		Electronically controlled 5-speed full-automatic
Torque converter	Type	3-element with torque converter clutch
	Engine stall speed	2100 – 2600 r/min.
Gear ratio	1st	3.789
	2nd	2.057
	3rd	1.421
	4th	1.000
	5th	0.731
	Reverse	3.865
Final gear ratio		3.684
Transfer		0.301
Centre differential		3.684

SERVICE SPECIFICATIONS

Items		Standard value
Oil temperature sensor kΩ	at 0°C	16.7 – 20.5
	at 100°C	0.57 – 0.69
Input shaft speed sensor resistance [at 20°C] Ω		330-390
Output shaft speed sensor resistance [at 20°C] Ω		330-390
Resistance of damper clutch control solenoid coil [at 20°C] Ω		2.7 – 3.4
Resistance of Low-Reverse solenoid valve coil [at 20°C] Ω		2.7 – 3.4
Resistance of second solenoid valve coil [at 20°C] Ω		2.7 – 3.4
Resistance of underdrive solenoid valve coil [at 20°C] Ω		2.7 – 3.4
Resistance of overdrive solenoid valve coil [at 20°C] Ω		2.7 – 3.4
Resistance of reduction solenoid valve coil [at 20°C] Ω		2.7 – 3.4
Stall speed r/min.		2,100 – 2,600

LUBRICANT

Items	Specified lubricant	Quantity (litres)
Transmission fluid	Mitsubishi ELC4–SP III.	8.8
Transfer case	Hypoid gear oil API classification GL–5 SAE 90	0.62

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SPECIAL TOOLS

Tool	Tool number and name	Supersession	Application
B991502	MB991502 MUT-II	–	Checking for diagnosis trouble codes
B991113	MB991113 Steering linkage puller	13–006	Removal of the tie rod end and the lower arm
Z203827	E309–A Engine lifter	–	Supporting the engine assembly during removal and installation of the transmission

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ON-VEHICLE SERVICE

AUTOMATIC TRANSMISSION FLUID CHECK

1. Drive until the fluid temperature reaches the operating temperature 70–80°C.
2. Place vehicle on level floor.
3. Move selector lever sequentially to every position to fill torque converter and hydraulic circuit with fluid, then place lever in “N” Neutral position. This operation is necessary to be sure that fluid level check is accurate.
4. Before removing the oil level gauge, wipe all dirt from area around the oil level gauge. Then take out the oil level gauge and check the condition of the fluid.
   Further investigation of the transmission is necessary if,
   - the fluid smells burnt.
   - the fluid colour is brown or black.
   - metal particles can be seen or felt on the dipstick.
5. Check to see if fluid level is in “HOT” range on oil level gauge. If fluid level is low, add ATF until level reaches “HOT” range.

   NOTE
   Low fluid level can cause a variety of conditions because it allows the pump to take in air along with fluid. Air trapped in the hydraulic circuit forms bubbles which make the fluid spongy.

   Therefore, pressures will be erratic.
   Improper filling can also raise fluid level too high. When the transmission has too much fluid, gears churn up foam and cause the same conditions which occur with low fluid level, resulting in accelerated deterioration of ATF. In either case, air bubbles can cause overheating, fluid oxidation, which can interfere with normal valve, clutch, and servo operation. Foaming can also result in fluid escaping from the transmission vent where it may be mistaken for a leak.
6. Be sure to examine the fluid on the oil level gauge closely.

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AUTOMATIC TRANSMISSION FLUID REPLACEMENT

With the ATF at normal operating temperature, replace the ATF using the following procedure.

1. Remove the right hand hose connecting the transmission oil cooler pipe to the oil cooler (built in to the bottom of the radiator).
2. Connect a suitable length of hose from the radiator cooler pipe to an oil drain receptacle, large enough to hold the quantity of discharged fluid.
3. Start the engine and discharge the ATF.
   Operating conditions: “N” Neutral gear and idling.

Caution
Start the engine and then stop it within one minute. If the ATF is discharged before the one minute elapses, stop the engine at that time.

Amount of ATF discharged: Approximately 4.5 (litres)

4. Remove the drain plug at the bottom of the transmission case and discharge the ATF.

   Amount of ATF discharged: Approximately 1.0 (litre)
5. Install the drain plug and gasket, and tighten to the specified torque.

   Tightening torque: 32 Nm
6. Fill with new ATF through the oil filler tube.

   Amount of ATF added: Approximately 5.5 (litres)

   NOTE
   Stop pouring if the entire amount of new ATF cannot be added. (Do not exceed “COLD” level)
7. Repeat the procedure in step (3) and discharge approximately 3.0 litres of ATF.

   NOTE
   Check the ATF discharged in step (8) for contamination. If it is contaminated, repeat steps (7) and (8).
8. Add the new ATF through the oil filler tube.

   Amount of ATF added: Approximately 3.0 (litres)
9. Attach and secure the hose that was disconnected in step (1) and securely insert the oil level gauge.
10. Start the engine and let it idle for one or two minutes.
11. Move the selector lever through all gear positions, ending in Neutral position.

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12. Make sure the ATF reaches the “COLD” mark on the oil level gauge. If there is not enough ATF, add more.
13. Drive the car until the ATF temperature reaches normal 70–80°C and recheck the ATF level. The ATF must be within the “HOT” range.

    NOTE
    The “COLD” level is for reference only and the “HOT” level serves as the standard.
14. Securely insert the oil level gauge into the filler tube.

TRANSFER CASE OIL CHECK

1. Remove the oil filler plug
2. Check whether oil is up to the lowest edge of the filler plug hole.
3. Check oil is not extremely dirty and has suitable viscosity.
4. Fit the oil filler plug and tighten to the specified torque.

   Tightening torque: 32 Nm

TRANSFER CASE OIL REPLACEMENT

1. Remove the oil drain plug and drain the oil.
2. Fit the oil drain plug and tighten to the specified torque.

   Tightening torque: 32 Nm
3. Remove the oil filler plug and fill the transfer case up to the lower edge of the filler plug.

SELECTOR LEVER OPERATION CHECK

1. Shift the selector lever to each range and check that the lever moves smoothly and clicks into position. Check that the position indicator is correct.
2. Check to be sure the selector lever can be shifted to each position (by button operation as shown in the illustration).
3. Start the engine and check if the vehicle moves forward when the selector lever is shifted from N to D, and moves backward when shifted to R.
4. When the shift lever malfunctions, adjust control cable and selector lever sleeve. Check for worn shift lever assembly sliding parts.

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KEY INTERLOCK STRUCTURE CHECK

Order of check	Check conditions		Checking details (normal conditions)
1	Full brake pedal stroke	Ignition key position: “LOCK”	The push button of the selector lever cannot be pushed. The lever cannot be operated from “P” position to another position.
2		Ignition key position: “ACC”	After pushing the push button of the selector lever, the lever can be operated from “P” position to another position.
3	No brake pedal stroke	Selector lever: Other than “P”	The ignition key does not turn to “LOCK” position.
4		Selector lever: “P”	The ignition key turns to “LOCK” position smoothly.

Adjust the key interlock cable as follows when the operations mentioned above do not work.
1. Remove the floor console. (Refer to Group 52A)
2. Position the selector lever at “P”.
3. Position the ignition key at “LOCK”.
4. Loosen the nut at the key interlock cable.
5. Tighten the nut while pushing the cable connection part of the lockcam towards the arrow A direction lightly.
6. Install the floor console.

SHIFT LOCK STRUCTURE CHECK

Order of check	Check conditions		Checking details (normal conditions)
1	No brake pedal stroke	Ignition key position: “ACC”	The push button of the selector lever cannot be pushed. The lever cannot be operated from “P” position to another position.
2	Full brake pedal stroke		After pushing the push button of the selector lever, the lever can be operated from “P” position to another position smoothly.
3	No brake pedal stroke		After pushing the button of the selector lever, the lever can be operated from “R” position to “P” position smoothly.

Adjust the key interlock cable as follows when the operations mentioned above do not work.
1. Remove the floor console. (Refer to Group 52A)
2. Position the selector lever at “P”.
3. Loosen the nut at the shift lock cable.
4. Tighten the nut at the position where the tip of the shift lock cable is above the red marking part of the lockcam.
5. Install the floor console.

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TRANSMISSION CONTROL

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
(1) Air Cleaner Assembly Removal and Installation
(2) Front Floor Console Removal and Installation (Refer GROUP 52A)

Caution: SRS
Be careful not to subject the SRS-ECU to any shocks during removal and installation of the transmission control cable, key interlock cable, shift interlock cable and selector lever assembly.

10AE013E

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Transmission control cable assembly removal steps

1. Foot rest
2. Floor carpet front reinforcements (LH and RH)
3. Harness protector
4. Engine-A/T-ECU and A/T control relay
5. ▶A◀ Nut
6. Connection of the transmission control cable
7. Transmission control cable assembly

Selector lever assembly removal steps

6. Connection of transmission control cable assembly
8. Connection of key interlock cable
9. Connection of shift lock cable
10. Harness connector
11. Selector lever assembly

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INSTALLATION SERVICE POINT

▶A◀ NUT INSTALLATION

1. Put the selector lever in the “N” position.
2. Loosen the adjusting nut, gently pull the transmission control cable in the direction of the arrow and tighten the nut.

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SELECTOR LEVER ASSEMBLY

DISASSEMBLY AND REASSEMBLY

Disassembly steps

1. Push button
2. Spring
3. Cap
4. Shift Knob
5. Indicator panel assembly
6. Manual control switch assembly
7. Bush
8. Return spring
9. Pipe
10. Bracket
11. Lever
12. Shift bush
13. Pipe
14. Select lever
15. Spring
16. Manual lever
17. Shift bush
18. Pipe
19. Cable lever
20. Shift bush
21. Pipe
22. Detent spring assembly
23. Lockcam A
24. Lockcam B
25. Clevis pin
26. Guard block
27. Stopper
28. Compression spring
29. Ball
30. Ball stopper
31. Spring
32. Cable bracket
33. Bracket assembly

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CHECKING MANUAL CONTROL SWITCH ASSEMBLY CIRCUIT.

Switch Position		Terminal No.					
		1	3	4	5	7	8
(UP) Shift Switch	ON		○	—	—	○	
	OFF						
(DOWN) Shift Switch	ON		○	—	—	—	○
	OFF						
Select Switch	AUTO	○	—	—	○		
	SPORT	○	—	○			

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TRANSMISSION SHIFT LOCK

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
(1) Front Floor Console Removal and Installation (Refer GROUP 52A)
(2) Instrument Panel Lower Cover Assembly Removal and Installation (Refer GROUP 52A)

Caution: SRS
Be careful not to subject the SRS-ECU to any shocks during removal and installation of the transmission control cable, key interlock cable, shift interlock cable and selector lever assembly.

Key interlock cable removal steps

▶C◀ 1. Connection of key interlock cable (selector lever side)
2. Cover
▶B◀ 3. Connection of key interlock cable (steering lock cylinder side)
4. Key interlock cable

Shift lock cable removal steps

▶A◀ 5. Shiftlock cable (selector lever side)
6. Shiftlock cable (brake pedal side)
7. Shiftlock cable

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TRANSMISSION SHIFT LOCK

◀A▶ INSTALLATION OF SHIFT LOCK CABLE (SELECTOR LEVER SIDE)

1. Position selector lever at “P”.
2. Fix shift lock cable at the position where the tip of the shift lock cable is above the red marking part of the lockcam.

◀B▶ INSTALLATION OF KEY INTERLOCK CABLE (STEERING LOCK CYLINDER SIDE)

Position the ignition key at “LOCK”, and install the key interlock cable.

◀C▶ INSTALLATION OF KEY INTERLOCK CABLE

1. Install the key interlock cable to the lockcam.
2. Install the spring and washer of the key interlock cable.
3. Fix the key interlock cable by tightening the nut while pushing the lockcam cable connection part to A direction.

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TRANSMISSION ASSEMBLY

REMOVAL AND INSTALLATION

Pre-removal Operation
(1) Transmission Fluid Draining
(Refer Fluid Replacement.)
(2) Under Cover Removal
(3) Battery and Battery Tray Removal
(4) Air Cleaner Assembly Removal

Post-installation Operation
(1) Air Cleaner Assembly Installation
(2) Battery and Battery Tray Installation
(3) Under Cover Installation
(4) Transmission Fluid Supplying
(Refer Fluid Replacement.)
(5) Selector Lever Operation Check
(6) Speedometer Operation Check

Removal steps

1. Transmission control cable connection
2. Transmission oil cooler hoses connection
3. Inhibitor switch connector
4. A/T control solenoid valve connector
5. Input shaft speed sensor connector
6. Output shaft speed sensor connector
7. Vehicle speed sensor connector
8. Split pin
9. Connection of the tie rod end
10. Drive shaft nut
11. Connection for the lower arm ball joint
12. Drive shaft and inner shaft assembly (RH) and the drive shaft (LH)
13. Output shaft

◀A▶

◀B▶

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Lifting up of the vehicle

14. Starter motor
15. Centre member assembly
16. Rear roll stopper bracket
17. Transmission upper portion fixing bolt
◀C▶ 18. Transmission mounting bracket
▶B◀ 19. Transmission mount stopper
◀D▶ ● Support the engine and transmission assembly
20. Bell housing cover
◀E▶ 21. Drive plate attaching bolt
◀E▶ 22. Transmission lower portion fixing bolt
◀E▶ ▶A◀ 23. Transmission assembly

Caution
Mounting locations marked by * should be provisionally tightened, and then fully tightened when the body is supporting the full weight of the engine.

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REMOVAL SERVICE POINTS

◀A▶ DRIVE SHAFT DISCONNECTION

1. The RH inner drive shaft joint boot is made of silicone rubber for improved heat resistance due to the close proximity to the exhaust pipe. This material is more susceptible to damage than the conventional rubber boot material. Therefore, care should be taken not to over extend or bend the joint when handling as internal components of the joint can pinch/split the inside of the boot.

2. Insert a pry bar between the transmission case and the drive shaft as shown to remove the drive shaft.

   NOTE
   Do not remove the hub and knuckle from the drive shaft.

   Caution
   Always use a pry bar, or the ball joint will be damaged.

◀B▶ OUTPUT SHAFT REMOVAL

1. Remove the out put shaft using the special tools, MB991612, MB990211.
2. Cover the transmission case using the special tool to prevent foreign material entering the transmission.
3. Suspend the removed drive shaft with a wire so that there are no sharp bends in any of the joints.

◀C▶ TRANSMISSION MOUNT BRACKET REMOVAL

Jack up the transmission assembly gently with a garage jack, and then remove the transmission mounting.

◀D▶ ENGINE ASSEMBLY SUPPORTING

Set the special tool to the vehicle to support the engine assembly.

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◀E▶ DRIVE PLATE BOLTS/TRANSMISSION ASSEMBLY LOWER PART COUPLING BOLTS/TRANSMISSION ASSEMBLY REMOVAL

1. Support the transmission assembly by using a transmission jack.
2. Remove the drive plate bolts while turning the crank shaft.
3. Press in the torque converter to the transmission side so that the torque converter does not remain on the engine side.
4. Remove the transmission assembly lower bolts and lower the transmission assembly.

INSTALLATION SERVICE POINTS

▶A◀ TRANSMISSION ASSEMBLY INSTALLATION

After securely inserting the torque converter into the transmission side so that the shown dimension is approx. 12.2 mm, install the transmission assembly to the engine.

▶B◀ TRANSMISSION MOUNT STOPPER INSTALLATION

Install the transmission mount stopper so that the arrow mark points as shown in the illustration.

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TRANSFER ASSEMBLY

REMOVAL AND INSTALLATION

Pre-removal and Post installation Operations
(1) Transmission Fluid Sampling and Supplying (Refer Fluid Replacement.)
(2) Transfer Oil Sampling and Supplying
(3) Front Exhaust Pipe Removal and Installation (Refer to GROUP 15)

Gear oil:
Mitsubishi pure dia–queen super hypoid gear oil (GL – 5).

Removal steps

- Drive shaft (Refer GROUP 23)
1. Front propeller shaft (Refer to GROUP 25)

◀A▶

2. Transfer assembly

REMOVAL SERVICE POINTS

◀A▶ REMOVAL OF TRANSFER ASSEMBLY

Caution

1. **Take care not to damage the oil seal lip part of the transfer.**
2. **Cover transfer with special tool to prevent oil flowing out and the entry of foreign material.**

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GENERAL INFORMATION

Because the viscous coupling unit (VCU) of the centre differential and the front differential are placed in the transfer case, a larger case has been employed. The case is made of aluminium die cast to lower its weight and has a minimum number of ribs placed in optimum places to reduce weight and increase rigidity.

CONSTRUCTION DIAGRAM

POWER TRAIN

FRONT DIFFERENTIAL

A bevel type differential is used in the W5A51 transmission.

CENTRE DIFFERENTIAL

The location of the centre differential for AWD vehicles is the same as that of the front differential for 2WD vehicles.

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VISCOUS COUPLING UNIT (VCU)

A viscous coupling unit (VCU) is installed at the rear of the front differential in order to limit the slip of the centre differential.

25 PROPELLER SHAFT <AWD>

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- LUBRICANTS
- ADHESIVES
- SPECIAL TOOLS

PROPELLER SHAFT
- REMOVAL AND INSTALLATION
- REMOVAL SERVICE POINTS
- INSPECTION
- INSTALLATION SERVICE POINT

PROPELLER SHAFT
- REMOVAL AND INSTALLATION
- LUBRICATION AND ADHESIVE POINTS
- DISASSEMBLY SERVICE POINTS
- REASSEMBLY SERVICE POINTS

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SERVICE SPECIFICATIONS

ITEM

Item	Limit
Runout of propeller shaft (front, centre, rear)	Max. 0.6mm

LUBRICANTS

Item	Brand	Volume
Sleeve yoke of front propeller shaft	Mitsubishi pure diaqueen super hypoid gear oil (GL–5)	As required
DOJ Assembly	Repair kit grease (NTN LJ grease)	105 – 115g
LJ Assembly	Repair kit grease (NTN LJ grease)	45 – 55g

ADHESIVES

Application	Brand
Rubber packing for DOJ Assembly, LJ Assembly	Three–bond 1741 or equivalent

SPECIAL TOOLS

Tool	Tool number and name	Supersession	Application
	MB991193 Plug	–	Prevent entry of foreign objects into transmission and transfer
	MB998801 Bearing remover	–	Removal of centre bearing assembly

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PROPELLER SHAFT

REMOVAL AND INSTALLATION

Gear oil:
Mitsubishi pure dia–queen super hypoid gear oil (GL – 5).

Removal steps

1. Insulator
2. Spacer
3. Propeller shaft assembly ◀A▶ ▶A◀
4. Spacer ◀B▶

REMOVAL SERVICE POINTS

◀A▶ PROPELLER SHAFT ASSEMBLY REMOVAL

1. Make mating marks on the differential companion flange and LJ assembly, and remove the propeller shaft assembly.

   Caution
   Be careful not to bend the joint portion when removing the propeller shaft because this will damage the joint boot.

2. Insert a rag to avoid boot damage, and remove the propeller shaft in a straight and level manner.

3. Cover the transfer case using the special tool to prevent entry of foreign objects.

◀B▶ SPACER REMOVAL

1. Number of spacers may be different depending on where to install (front or rear). Record the number of spacers when they are removed to ensure correct installation.

INSPECTION

RUN OUT OF PROPELLER SHAFT

Inspect the run out of front, centre and rear shafts.

Limit: Max 0.6 mm

INSTALLATION SERVICE POINT

▶A◀ PROPELLER SHAFT ASSEMBLY INSTALLATION

1. Align the mating marks and fit propeller shaft to companion flange.

Caution

1. **Try not to damage the oil seal lip of transfer case.**
2. **If installation bolts and nuts have oil or grease on the threads, remove it before installation to avoid loosening.**

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PROPELLER SHAFT

REMOVAL AND INSTALLATION

Removal steps

◀A▶ 1. Front propeller shaft
▶E◀ 2. Self locking nut
◀B▶ ▶E◀ 3. Companion flange
◀C▶ ▶E◀ 4. Centre bearing assembly
◀D▶ 5. Bolt
▶E◀ 6. Self locking nut
◀B▶ ▶E◀ 7. Companion flange
◀C▶ ▶E◀ 8. Centre bearing flange
9. Centre propeller shaft
10. Snap ring
▶C◀ 11. Boot band
◀E▶ ▶D◀ 12. DOJ assembly
13. Rubber packing
◀F▶ ▶A◀ 14. DOJ boot
15. Washer
16. Plate
◀G▶ 17. Snap ring
▶C◀ 18. Boot band
◀H▶ ▶B◀ 19. LJ assembly
20. Rubber packing
◀F▶ ▶A◀ 21. LJ boot
22. Washer
23. Rear propeller shaft

LUBRICATION AND ADHESIVE POINTS

10X0040	10N0009
Repair kit grease **DOJ assembly: 105 – 115g** **LJ assembly: 45 – 55g**	**Adhesives** **Three–bond 1741 or equivalent**

DISASSEMBLY SERVICE POINTS

◀A▶ FRONT PROPELLER SHAFT ASSEMBLY REMOVAL

1. Make mating marks on the flange yoke of the front propeller shaft and companion flange, and remove the front propeller shaft assembly.

◀B▶ COMPANION FLANGE REMOVAL

1. Make mating marks on the companion flange and centre propeller shaft, and remove the companion flange.

◀C▶ CENTRE BEARING ASSEMBLY REMOVAL

◀D▶ BOLT REMOVAL

1. Make mating marks on the rear propeller shaft, DOJ assembly, and companion flange, and remove the bolts.

◀E▶ DOJ ASSEMBLY REMOVAL

1. Remove DOJ boot from DOJ assembly.

2. Make mating marks on the outer race, cage and inner race, and remove the circlip, outer race and balls.

   NOTE
   Note the positions of the balls so they can be reinstalled in their original positions.

3. Remove the inner race and cage from the propeller shaft assembly by using a puller.
4. Wipe off the grease and wash the outer race, inner race, cage and balls.

◀F▶ DOJ BOOT AND LJ BOOT REMOVAL

1. When reusing the DOJ boot or LJ boot, wrap tape around the spline of the propeller shaft, and then remove the boot.

◀G▶ SNAP RING REMOVAL

1. Make mating marks on the rear propeller shaft and LJ assembly, and remove the snap ring.

◀H▶ LJ ASSEMBLY REMOVAL

1. Remove the LJ boot from the LJ assembly.

2. Make mating marks on the outer race, cage and inner race, and remove the outer race and balls.

   NOTE
   Note the positions of the balls so they can be reinstalled in their original positions.

3. Remove the inner race and cage from the propeller shaft assembly by using a puller.
4. Wipe off the grease and wash the outer race, inner race, cage and balls.

REASSEMBLY SERVICE POINTS

▶A◀ LJ BOOT AND DOJ BOOT INSTALLATION

1. Set the boot band.
2. Wrap tape around the spline of the rear propeller shaft, and install the LJ boot or DOJ boot.

▶B◀ LJ ASSEMBLY INSTALLATION

1. Apply the specified grease to the ball grooves of the inner and outer races.

   Repair kit grease: NTN LJ grease

2. Align the marks on the inner race and cage, and install 2 balls in the same positions diagonally as before disassembly.
3. Align the marks on the inner race, cage and outer race to put them together.

   NOTE
   Confirm that the notched face on the inner race, the level–differed face for packing on outer race and chamfered face of cage are on the same surface, and that the positions of the outer race and inner race are as indicated in the diagram.
4. Put the rest of the balls into the cage in the same positions as before disassembly.
5. Confirm that the outer race and inner race work smoothly.

6. Apply the specified grease evenly to LJ assembly.

   Repair kit grease:
   NTN LJ grease: Specified amount: 45 – 55g
7. Apply a small amount of the specified adhesive in the locations pointed by arrows in the diagram on the grooved face for packing of the LJ assembly to fix the rubber packing.

   Specified adhesive: Three–bond 1741 or equivalent.

8. Fit LJ assembly with the grooved surface for packing facing the LJ boot.
9. Align the marks on the LJ assembly and rear propeller shaft, put LJ assembly into the rear propeller shaft using a socket wrench.

10. Fit LJ boot to LJ assembly using the bolts to align the holes.
11. Fix the rubber packing of the plate side to the plate as instructed in step 7.

▶C◀ BOOT BAND INSTALLATION

Caution

1. **Clamp the boot by holding down the lever at a position nearly opposite to the vent groove provided.**
2. **Be sure to remove grease, if present, from around the vent groove. Grease obstructs the ventilation air passage.**

▶D◀ DOJ ASSEMBLY INSTALLATION

1. Apply the specified grease thinly to the outer and inner races on the locus where the balls move.

   Repair kit grease: NTN LJ grease
2. Align the mating marks, fit the outer race, cage, balls and inner race together.
3. Fit circlips.
4. Apply the specified grease evenly to DOJ assembly.

   Repair kit grease:
   NTN LJ grease: Specified amount: 105 – 115g

5. Apply a small amount of the specified adhesive in the locations pointed by arrows in the diagram on the grooved face for packing of the DOJ assembly to fix the rubber packing.

   Specified adhesive: Three–bond 1741 or equivalent.

6. When fitting the LJ assembly, the grooved surface for packing faces the LJ boot.
7. Align the marks on the DOJ assembly and rear propeller shaft, put LJ assembly into the rear propeller shaft using a socket wrench.

8. Fit DOJ boot to DOJ assembly with bolts through the bolt holes of the DOJ boot and DOJ assembly.
9. Glue the rubber packing to the companion flange as instructed in step 5.

▶E◀ INSTALLATION OF CENTRE BEARING ASSEMBLIES, COMPANION FLANGE AND SELF LOCKING NUTS

1. Fit the centre bearing assembly to the centre propeller shaft as shown in the diagram.
2. Align the mating marks of the companion flange and centre propeller shaft.
3. Tightening the self locking nut, press fit the centre bearing assembly with the companion flange.

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26 FRONT AXLE

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TJ/KJ BASE MANUAL
(effective to 31st July 2001 production)

TJ/KJ 01M/Y SPECIFICATION UPGRADE <AWD>
(effective from December 2002 production)

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GENERAL INFORMATION

The front axle consists of a knuckle, front hub, double-row angular contact ball bearing and drive shaft. The bearing is press-fitted to the hub and the hub and bearing assembly is press fitted in the knuckle to support the drive shaft. The drive shaft has a tripod joint (T.J.) on the transmission side and a birfield joint (B.J.) on the wheel side.

CONSTRUCTION DIAGRAM

SERVICE SPECIFICATIONS

Items		Standard value	Limit
Setting of the T.J. boot length mm		75±3	
Hub axial play mm		–	0.05
Wheel bearing breakaway torque Nm		–	1.8 or less
Opening dimension of the special tool (MB991561) mm	When the B.J boot band (small) is crimped	2.9	–
	When the B.J. boot band (big) is crimped	3.2	–
Crimped width of the B.J. boot band mm		2.4 – 2.8	–
Clearance between the B.J. boot (larger diameter side) and the stepped phase of the B.J. housing mm		0.1 – 1.55	–

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LUBRICANTS

Items	Quantity g	Specified lubricant
T.J. boot grease	145	Repair kit grease
B.J. boot grease	160	Repair kit grease

SPECIAL TOOLS

Tool	Tool number and name	Supersession	Application
	MB990767 End yoke holder	EMB990767	Hub fixing
	MB991113 or MB990635 Steering linkage puller	13–006	Tie rod end and lower arm ball joint removal
	MB990241 Axle shaft puller	–	Drive shaft removal
	MB990998 Front hub remover and installer	E2M45A	• Wheel bearing provisional holding • Hub axial play measurement • Rotational starting torque measurement
	MB990685 Torque wrench		Wheel bearing starting torque measurement
	MB990326 Preload wrench	EMB990326	Wheel bearing starting torque measurement
	MB990810 Bearing puller	E2M49	Removal of the wheel bearing inner race

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Tool	Tool number and name	Supersession	Application
	MB991172 Adaptor	–	Press-fitting
	MB991248 Inner shaft remover	–	Pressing-out
	MB991056 Knuckle arm bridge	E320	Removal of the hub
	MB990955 Oil seal installer	–	Press-fitting the oil seal
	MB990947 Lower arm bushing arbor	E17M15/16	Press-fitting the oil seal
	MB990890 Rear suspension bushing base	EMB990890	Press-fitting the wheel bearing
	MB990883 Rear suspension arbor	EMB990883	Press-fitting the wheel bearing
	MB991561 Boot band clipping tool	–	Resin boot band installation

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MB990925

Installer adaptor

Bar (snap–in type)

A11W0113

Type	Tool number	O.D. mm	Type	Tool number	O.D. mm
A	MB990926	39	A	MB990933	63.5
	MB990927	45		MB990934	67.5
	MB990928	49.5		MB990935	71.5
	MB990929	51		MB990936	75.5
	MB990930	54		MB990937	79
	MB990931	57	B	MB990938	–
	MB990932	61	C	MB990939	–

ON-VEHICLE SERVICE

HUB AXIAL PLAY CHECK

1. Remove the disc brake calliper and suspend it with a wire.
2. Remove the brake disc from the front hub.
3. Attach a dial gauge as shown in the illustration, and then measure the axial play while moving the hub in the axial direction.

   Limit: 0.01 mm
4. If end play exceeds the limit, check that the driveshaft nut is tightened to specified torque, if correctly tensioned, replace the front hub bearing assembly.

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HUB BOLT REPLACEMENT

1. Remove the calliper assembly and secure it with wire so that it does not fall.
2. Remove the brake disc.
3. Use the special tools to remove the hub bolts.

   Caution
   The special tool should be suspended by a cord to prevent it from coming off.

4. Align the splines on the hub bolt with the splines in the hub and use the wheel nuts to securely install the new hub bolts.

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FRONT HUB AND KNUCKLE ASSEMBLY

REMOVAL AND INSTALLATION

Removal steps

1. Front speed sensor <Vehicles with ABS>
2. Split pin
3. ◀A▶ ▶A◀ Drive shaft nut
4. ◀B▶ Calliper assembly
5. Brake disc
6. ◀C▶ Connection for lower arm ball joint
7. Split pin
8. ◀C▶ Connection for tie rod end
9. Drive shaft
10. Front strut mounting bolt
11. Hub and knuckle

REMOVAL SERVICE POINTS

◀A▶ DRIVE SHAFT NUT REMOVAL

◀B▶ CALLIPER ASSEMBLY REMOVAL

Secure the calliper assembly with wire to avoid placing load on the brake hose.

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◀C▶ DISCONNECTION OF LOWER ARM BALL JOINT/ TIE ROD END

Caution

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

INSTALLATION SERVICE POINT

▶A◀ DRIVE SHAFT NUT INSTALLATION

1. Be sure to install the drive shaft washer in the specified direction.

2. Using the special tool, tighten the drive shaft nut to the lower end of the specified torque range.

   Caution
   There should be no load on the wheel bearings when the drive shaft nut is tightened.

3. If the position of the cotter pin holes does not match, tighten the nut up to a maximum of 255 Nm.
4. Install the cotter pin in the first matching holes and bend it securely.

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DISASSEMBLY AND REASSEMBLY

Disassembly Procedure

▶D◀ ▶C◀ 1. Oil seal (Drive shaft side)
- Adjustment of the wheel bearing starting torque

▶C◀ ◀A▶ ▶C◀ 2. Hub
- Adjustment of the hub end play

3. Dust shield
▶B◀ 4. Oil seal
5. Snap ring
◀B▶ ▶A◀ 6. Wheel bearing
7. Knuckle

SERVICE POINTS OF DISASSEMBLY

◀A▶ REMOVAL OF HUB FROM KNUCKLE

1. Attach the special tools to the knuckle and hub.
2. Secure the knuckle in a vice.
3. Tighten the nut of the special tool to remove the hub from the knuckle.

Caution

1. **Always use the special tool to remove the hub.**
2. **Never strike the hub or knuckle with a hammer to separate them as the bearing will be damaged.**

◀B▶ WHEEL BEARING

1. Crush the oil seal in two places so that the tabs of the special tool can be engaged on the wheel bearing inner race.

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2. Remove the wheel bearing inner race from the front hub by using the special tool, as shown in the illustration.

3. Drive the wheel bearing out with a press, using a 61 mm installer adaptor.

INSPECTION

- Check the front hub and brake disc mounting surfaces for fretting and contamination.
- Check the knuckle inner surface for galling or cracks.
- Check for a defective bearing.

SERVICE POINTS OF REASSEMBLY

▶A◀ WHEEL BEARING

1. Fill the wheel bearing with multipurpose grease.
2. Apply a thin coating of multipurpose grease to the knuckle and bearing contact surfaces.
3. Press-in the bearing using the special tools.

▶B◀ OIL SEAL (HUB SIDE)

1. Drive the oil seal (hub side) into the knuckle by using the special tools until it is flush with the knuckle end surface.
2. Apply multipurpose grease to the lip of the oil seal and to the surfaces of the oil seal which contact the front hub.

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▶C◀ INSTALLING HUB (ON TO KNUCKLE)

1. Use the special tool to mount the hub on to the knuckle.
2. Torque the nut of the special tool to 196-255 Nm.
3. Rotate the hub in order to seat the bearing.
4. Leave the special tool in place and take the measurements described under “Inspection”.

▶D◀ OIL SEAL (DRIVE SHAFT SIDE)

1. Drive the oil seal (drive shaft side) into the knuckle until it contacts the snap ring.
2. Apply multipurpose grease to the lip of the oil seal.

INSPECTION

WHEEL BEARING BREAKAWAY TORQUE CHECK

1. Tighten the special tool to the front hub assembly to the specified torque 196–255 Nm.
2. Use the special tool to measure the hub rotation starting torque.

   Limit: 1.8 Nm or less
3. The hub rotation breakaway torque should be within the limit value range, and there should be no tight spots or feeling of roughness.

WHEEL BEARING AXIAL PLAY CHECK

1. Tighten the special tool to the front hub assembly to the specified torque 196–255 Nm.
2. Measure the play in the wheel bearing axial direction.

   Limit: 0.01 mm
3. If the limit value of wheel bearing axial play cannot be obtained, replace the front hub assembly.

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DRIVE SHAFT

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Remove the transmission under cover.
- Drain and replenish the transmission fluid.

Removal steps

1. Drive shaft cotter pin
◀A▶ ▶A◀ 2. Drive shaft nut
3. Lower arm ball joint retaining nut
◀B▶ 4. Connection for lower arm ball joint
5. Tie rod end cotter pin
6. Tie rod end retaining nut
◀C▶ 7. Connection for tie rod end
8. Centre bearing bracket bolts
◀D▶ 9. Drive shaft and inner shaft assembly (RH)
◀D▶ 10. Drive shaft (LH)
11. Circlip

Caution
***: Indicates parts which should be temporarily tightened, and then fully tightened with the vehicle on the ground in the unladen condition.**

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REMOVAL SERVICE POINTS

◀A▶ DRIVE SHAFT NUT REMOVAL

Caution
Do not apply the vehicle weight to the wheel bearing while loosening the drive shaft nut.

◀B▶ DISCONNECTION OF LOWER ARM BALL JOINT

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.**

1. Disconnect the ball joint by using the special tool.

◀C▶ TIE ROD END REMOVAL

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

◀D▶ DRIVE SHAFT AND INNER SHAFT (RH) AND DRIVESHAFT (LH) REMOVAL

1. Use the special tools to push out the drive shaft from the hub.

2. Tap the centre bearing bracket with a hammer, to remove the drive shaft and inner shaft (RH) from the transmission.

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3. Insert a pry bar between the transmission case and the drive shaft, and then pry the drive shaft from the transmission.

Caution
1. Do not pull on the drive shaft; doing so will damage the T.J.; be sure to use the pry bar.
2. Do not insert the pry bar so deep as to damage the oil seal.

4. Use a suitable plug to prevent the entry of foreign objects into the transmission.

Caution
Do not apply the full load of the vehicle onto the wheel bearings when the drive shaft has been removed. If you need to apply a load to the bearings in order to move the vehicle, for instance, use the special tool to provisional secure the bearings.

INSTALLATION SERVICE POINT

▶A◀ DRIVE SHAFT NUT INSTALLATION

1. Be sure to install the drive shaft washer in the specified direction.

2. Using the special tool, tighten the drive shaft nut to the lower end of the specified torque range.

Caution
There should be no load on the wheel bearings when the drive shaft nut is tightened.

3. If the position of the cotter pin holes does not match, tighten the nut to a maximum of 255 Nm.
4. Install the cotter pin in the first matching holes and bend it securely.

INSPECTION

- Check the drive shaft boot for damage or deterioration.
- Check the ball joints for wear or operating condition.
- Check the spline part for wear or damage.

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DISASSEMBLY AND REASSEMBLY

Disassembly steps

	▶G◀	1. Boot band (large)
	▶G◀	2. Boot band (small)
◀A▶	▶F◀	3. T.J. case (RH)
◀A▶	▶B◀	4. T.J. case (LH)
		5. Seal plate
◀C▶	▶E◀	6. Inner shaft
		7. Bracket assembly
	▶D◀	8. Dust seal outer
	▶D◀	9. Dust seal inner
◀D▶	▶C◀	10. Centre bearing
	▶C◀	11. Centre bearing bracket
◀B▶	▶C◀	12. Circlip
◀B▶		13. Snap ring
◀A▶	▶B◀	14. Spider assembly
	▶A◀	15. T.J. boot
◀E▶		16. B.J. assembly
		17. B.J. boot band (small)
		18. B.J. boot band
		19. B.J. boot

Caution
Do not disassemble the B.J. assembly or remove the boot bands unless boot replacement is required.

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LUBRICANT POINTS

Grease: Multipurpose grease
Amounts to be used:
7-10g (dust seal inner)
4-6g (dust seal outer)

Grease: Repair kit grease
Amount to be used: 145g

Caution: Since special grease is used for the joint, do not mix old and new greases or differing types of grease.

Grease: repair kit grease

Grease: repair kit grease
Amount to be used: 160g

Caution: Since special grease is used for the joint, do not mix old and new greases or differing types of grease.

DISASSEMBLY SERVICE POINTS

◀A▶ T.J. CASE REMOVAL

Remove the T.J. case from the B.J. assembly, and wipe off the grease inside the T.J. case.

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◀B▶ SNAP RING/SPIDER ASSEMBLY REMOVAL

1. Remove the snap ring from the drive shaft with the special tool.
2. Take out the spider assembly from the drive shaft.
3. Clean the spider assembly.

Caution
1. Do not disassemble the spider assembly.
2. Use care in handling so as not to damage the drive shaft.

◀C▶ INNER SHAFT

1. Using the special tool, secure the T.J. case.
2. Push the seal plate with a bar (Diam 20mm),and press out the inner shaft assembly together with the seal plate.

3. Using the special tool, remove the inner shaft from the centre bearing bracket.

◀D▶ CENTRE BEARING

◀E▶ T.J. BOOT REMOVAL

1. Wipe the grease off of the spline portion.
2. Remove the T.J. boot.

NOTE
If the boot is to be reused, wrap vinyl tape around the drive shaft spline so that the boot is not damaged when it is removed.

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REASSEMBLY SERVICE POINTS

▶A◀ T.J. BOOT INSTALLATION

Wrap vinyl tape around the spline part on the drive shaft, and then install the T.J. boot band (small) and T.J. boot.

▶B◀ SPIDER ASSEMBLY/T.J. CASE INSTALLATION (LH)

1. Apply the specified grease furnished in the repair kit to the spider assembly between the spider axle and the roller.

   Specified grease: Repair kit grease

   Caution
   1. The drive shaft joint uses special grease. Do not mix old and new or different types of grease.
   2. If the spider assembly has been cleaned, take special care to apply the specified grease.

2. Install the spider assembly to the shaft from the direction of the spline bevelled section.
3. After applying the specified grease to the T.J. case, insert the drive shaft and apply grease one more time.

   Specified grease:
   Repair kit grease 145g

   NOTE
   When using the repair kit grease, use the whole amount, aiming at filling the inside of the joint and the inside of the boot with about half each.

   Caution
   The drive shaft joint uses special grease. Do not mix old and new or different types of grease.

▶C◀ CENTRE BEARING

1. Using a 61mm installer, press in the centre bearing.

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▶D◀ DUST SEAL INNER/DUST SEAL OUTER

1. Fill the back surfaces of each dust seal with multipurpose grease.

Amount to be used:

7-10g (dust seal inner)

4-6g (dust seal outer)

2. Using a 61mm installer, drive in the oil seal until it is flat against the end face of the centre bearing bracket.

3. Coat the lip parts of each dust seal with multipurpose grease.

   NOTE
   Coat so that grease does not adhere to the outside of the lip.

▶E◀INNER SHAFT/CENTRE BEARING ASSEMBLY

▶F◀INNER SHAFT ASSEMBLY/T.J. CASE (RH) ASSEMBLY

1. Coat the spline part of the inner shaft with multipurpose grease and force the inner shaft assembly into the T.J. case.
2. Using the special tool, force the seal plate into the T.J. case.

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3. Fill the T.J. case with the specified grease, then insert the drive shaft, and once again fill with the specified grease.

   Specified grease: Repair kit grease
   Amount to be used: 145g

   NOTE
   When using the repair kit grease, use the whole amount, aiming at filling the inside of the joint and the inside of the boot with about half each.

   Caution
   The drive shaft joint uses special grease. Do not mix old and new or different types of grease.

▶G◀T.J. BOOT BAND (SMALL)/T.J. BOOT BAND (LARGE) INSTALLATION

Set the T.J. boot bands at the specified distance in order to adjust the amount of air inside the T.J. boot, and then tighten the T.J. boot bands securely.

Standard value (A): 75±3 mm

INSPECTION

- Check the drive shaft for damage, bending or corrosion.
- Check the drive shaft spline part for wear or damage.
- Check the spider assembly for roller rotation, wear or corrosion.
- Check the groove inside T.J. case for wear of corrosion.
- Check the boots for deterioration, damage or cracking.

B.J. BOOT (RUBBER BOOT) REPLACEMENT

1. Remove the B.J. boot bands (large and small).

   NOTE
   The B.J. boot bands cannot be re-used.

2. Remove the B.J. boot.

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3. Install the B.J. boot with the part with the smallest diameter in a position such that the shaft groove can be seen.

4. Turn the adjusting bolt on the special tool so that the size of the opening (W) is at the standard value.

Standard value (W): 2.9 mm

<If it is larger than 2.9 mm>
Tighten the adjusting bolt.

<If it is smaller than 2.9 mm>
Loosen the adjusting bolt.

NOTE
1. The value of W will change by approximately 0.7 mm for each turn of the adjusting bolt.
2. The adjusting bolt should not be turned more than once.

5. Place the B.J. boot band (small) against the projection at the edge of the boot, and then secure it so that there is a clearance left as shown by (A) in the illustration.

6. Use the special tool to crimp the B.J. boot band (small).

Caution
1. **Secure the drive shaft in an upright position and clamp the part of the B.J. boot band to be crimped securely in the jaws of the special tool.**
2. **Crimp the B.J. boot band until the special tool touches the stopper.**

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7. Check that the crimping amount (B) of the B.J. boot band is at the standard value.

Standard value (B): 2.4 mm – 2.8mm

<If the crimping amount is larger than 2.8 mm>
Readjust the value of (W) in step (4) according to the following formula, and then repeat the operation in step (6).
W = 5.5 mm – B
EXAMPLE: If B = 2.9 mm,then W = 2.6 mm

<If the crimping amount is smaller than 2.4 mm>
Remove the B.J. boot band, readjust the value of (W) in step (4) according to the following formula, and then repeat the operations in steps (5) and (6) using a new B.J. boot band.
W = 5.5 mm – B
Example: If B = 2.3 mm, then W = 3.2 mm.

8. Check that the B.J. boot band in not sticking out past the place where it had been installed.
If the B.J. boot band is sticking out, remove it and then repeat the operations in step (5) to (7) using a new boot band.

9. Fill the inside of the B.J. boot with the specified grease.

Specified grease: Repair kit grease
Amount to be used: 145g

10. Install the B.J. boot band (large) so that there is the clearance (C) between it and the B.J. housing is at the standard value.

Standard value (C): 0.1 – 1.55 mm

11. Follow the same procedure as in step (4) to adjust the size of the opening (W) on the special tool so that it is at the standard value.

Standard value (W): 3.2 mm

12. Place the B.J. boot band (large) against the projection at the edge of the boot, and then secure it so that there is a clearance left as shown by (D) in the illustration.
13. Use the special tool to crimp the B.J. boot band (large) in the same way as in step (6).

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14. Check that the crimping amount (E) of the B.J. boot band is at the standard value.

Standard value (E): 2.4 – 2.8 mm

<If the crimping amount is larger than 2.8 mm>
Readjust the value of (W) in step (4) according to the following formula, and then repeat the operation in step (13).
W = 5.8 mm – E
Example: If E = 2.9 mm, then W = 2.9 mm

<If the crimping amount is smaller than 2.4 mm>
Remove the B.J. boot band, readjust the value of (W) in step (11) according to the following formula, and then repeat the operations in steps (12) and (13) using a new B.J. boot band.
W = 5.8 mm – E
Example: If E = 2.3 mm, then W = 3.5 mm

15. Check that the B.J. boot is not sticking out past the place where it has been installed.
If the B.J. boot band is sticking out, remove it and then repeat operations in steps (12) to (14) using a new B.J. boot band.

26B FRONT AXLE <AWD>

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GENERAL INFORMATION

The front axle consists of a knuckle, front hub, double-row angular contact ball bearing and drive shaft. The bearing is press-fitted to the hub and the hub and bearing assembly is press fitted in the knuckle to support the drive shaft. The drive shaft has a tripod joint (T.J.) on the transmission side and a birfield joint (B.J.) on the wheel side.

CONSTRUCTION DIAGRAM

SERVICE SPECIFICATIONS

Items		Standard value	Limit
Setting of the T.J. boot length mm		75±3	
Hub axial play mm		–	0.05
Wheel bearing breakaway torque Nm		–	1.8 or less
Opening dimension of the special tool (MB991561) mm	When the B.J boot band (small) is crimped	2.9	–
	When the B.J. boot band (big) is crimped	3.2	–
Crimped width of the B.J. boot band mm		2.4 – 2.8	–
Clearance between the B.J. boot (larger diameter side) and the stepped phase of the B.J. housing mm		0.1 – 1.55	–

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LUBRICANTS

Items	Quantity g	Specified lubricant
T.J. boot grease	145	Repair kit grease
B.J. boot grease	160	Repair kit grease

SPECIAL TOOLS

Tool	Tool number and name	Supersession	Application
	MB990767 End yoke holder	EMB990767	Hub fixing
	MB991113 or MB990635 Steering linkage puller	13–006	Tie rod end and lower arm ball joint removal
	MB990241 Axle shaft puller	–	Drive shaft removal
	MB990998 Front hub remover and installer	E2M45A	• Wheel bearing provisional holding • Hub axial play measurement • Rotational starting torque measurement
	MB990685 Torque wrench		Wheel bearing starting torque measurement
	MB990326 Preload wrench	EMB990326	Wheel bearing starting torque measurement
	MB990810 Bearing puller	E2M49	Removal of the wheel bearing inner race

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Tool	Tool number and name	Supersession	Application
	MB991172 Adaptor	–	Press-fitting
	MB991248 Inner shaft remover	–	Pressing-out
	MB991056 Knuckle arm bridge	E320	Removal of the hub
	MB990955 Oil seal installer	–	Press-fitting the oil seal
	MB990947 Lower arm bushing arbor	E17M15/16	Press-fitting the oil seal
	MB990890 Rear suspension bushing base	EMB990890	Press-fitting the wheel bearing
	MB990883 Rear suspension arbor	EMB990883	Press-fitting the wheel bearing
	MB991561 Boot band clipping tool	–	Resin boot band installation

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MB990925

Installer adaptor

Bar (snap–in type)

A11W0113

Type	Tool number	O.D. mm	Type	Tool number	O.D. mm
A	MB990926	39	A	MB990933	63.5
	MB990927	45		MB990934	67.5
	MB990928	49.5		MB990935	71.5
	MB990929	51		MB990936	75.5
	MB990930	54		MB990937	79
	MB990931	57	B	MB990938	–
	MB990932	61	C	MB990939	–

ON-VEHICLE SERVICE

HUB AXIAL PLAY CHECK

1. Remove the calliper assembly and secure it with wire so that it does not fall.
2. Remove the brake disc from the front hub.
3. Attach a dial gauge as shown in the illustration, and then measure the axial play while moving the hub in the axial direction.

   Limit: 0.01 mm
4. If end play exceeds the limit, check that the drive shaft nut is tightened to specified torque, if correctly tensioned, replace the front hub bearing assembly.

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HUB BOLT REPLACEMENT

1. Remove the calliper assembly and secure it with wire so that it does not fall.
2. Remove the brake disc.
3. Use the special tools to remove the hub bolts.

   Caution
   The special tool should be suspended by a cord to prevent it from coming off.

4. Align the splines on the hub bolt with the splines in the hub and use the wheel nuts to securely install the new hub bolts.

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FRONT HUB AND KNUCKLE ASSEMBLY

REMOVAL AND INSTALLATION

Removal steps

1. Front speed sensor <Vehicles with ABS>
2. Split pin
3. ◀A▶ ▶A◀ Drive shaft nut
4. ◀B▶ Calliper assembly
5. Brake disc
6. ◀C▶ Connection for lower arm ball joint
7. Split pin
8. ◀C▶ Connection for tie rod end
9. Drive shaft
10. Front strut mounting bolt
11. Hub and knuckle

REMOVAL SERVICE POINTS

◀A▶ DRIVE SHAFT NUT REMOVAL

◀B▶ CALLIPER ASSEMBLY REMOVAL

Secure the calliper assembly with wire to avoid placing load on the brake hose.

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◀C▶ DISCONNECTION OF LOWER ARM BALL JOINT/ TIE ROD END

Caution

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

INSTALLATION SERVICE POINT

▶A◀ DRIVE SHAFT NUT INSTALLATION

1. Be sure to install the drive shaft washer in the specified direction.

2. Using the special tool, tighten the drive shaft nut to the lower end of the specified torque range.

   Caution
   There should be no load on the wheel bearings when the drive shaft nut is tightened.

3. If the position of the cotter pin holes does not match, tighten the nut up to a maximum of 255 Nm.
4. Install the cotter pin in the first matching holes and bend it securely.

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DISASSEMBLY AND REASSEMBLY

Disassembly Procedure

▶D◀ ▶C◀ 1. Oil seal (Drive shaft side)
- Adjustment of the wheel bearing starting torque

▶C◀ ◀A▶ ▶C◀ 2. Hub
- Adjustment of the hub end play

3. Dust shield
▶B◀ 4. Oil seal
5. Snap ring
◀B▶ ▶A◀ 6. Wheel bearing
7. Knuckle

SERVICE POINTS OF DISASSEMBLY

◀A▶ REMOVAL OF HUB FROM KNUCKLE

1. Attach the special tools to the knuckle and hub.
2. Secure the knuckle in a vice.
3. Tighten the nut of the special tool to remove the hub from the knuckle.

Caution

1. **Always use the special tool to remove the hub.**
2. **Never strike the hub or knuckle with a hammer to separate them as the bearing will be damaged.**

◀B▶ WHEEL BEARING

1. Crush the oil seal in two places so that the tabs of the special tool can be engaged on the wheel bearing inner race.

2. Remove the wheel bearing inner race from the front hub by using the special tool, as shown in the illustration.

3. Drive the wheel bearing out with a press, using a 61 mm installer adaptor.

INSPECTION

- Check the front hub and brake disc mounting surfaces for fretting and contamination.
- Check the knuckle inner surface for galling or cracks.
- Check for a defective bearing.

SERVICE POINTS OF REASSEMBLY

▶A◀ WHEEL BEARING

1. Fill the wheel bearing with multipurpose grease.
2. Apply a thin coating of multipurpose grease to the knuckle and bearing contact surfaces.
3. Press-in the bearing using the special tools.

▶B◀ OIL SEAL (HUB SIDE)

1. Drive the oil seal (hub side) into the knuckle by using the special tools until it is flush with the knuckle end surface.
2. Apply multipurpose grease to the lip of the oil seal and to the surfaces of the oil seal which contact the front hub.

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▶C◀ INSTALLING HUB (ON TO KNUCKLE)

1. Use the special tool to mount the hub on to the knuckle.
2. Torque the nut of the special tool to 196-255 Nm.
3. Rotate the hub in order to seat the bearing.
4. Leave the special tool in place and take the measurements described under “Inspection”.

▶D◀ OIL SEAL (DRIVE SHAFT SIDE)

1. Drive the oil seal (drive shaft side) into the knuckle until it contacts the snap ring.
2. Apply multipurpose grease to the lip of the oil seal.

INSPECTION

WHEEL BEARING BREAKAWAY TORQUE CHECK

1. Tighten the special tool to the front hub assembly to the specified torque 196–255 Nm.
2. Use the special tool to measure the hub rotation starting torque.

   Limit: 1.8 Nm or less
3. The hub rotation breakaway torque should be within the limit value range, and there should be no tight spots or feeling of roughness.

WHEEL BEARING AXIAL PLAY CHECK

1. Tighten the special tool to the front hub assembly to the specified torque 196–255 Nm.
2. Measure the play in the wheel bearing axial direction.

   Limit: 0.01 mm
3. If the limit value of wheel bearing axial play cannot be obtained, replace the front hub assembly.

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DRIVE SHAFT

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Remove the transmission under cover.
- Drain and replenish the transmission fluid.

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Removal steps

◀A▶ ▶A◀ 1. Drive shaft nut
◀B▶ 2. Lower arm ball joint retaining nut
3. Split pin
◀C▶ 4. Connection for tie rod end
◀D▶ 5. Drive shaft (LH)
◀E▶ 6. Output shaft
7. Drive shaft (RH)

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REMOVAL SERVICE POINTS

◀A▶ DRIVE SHAFT NUT REMOVAL

Caution
Do not apply the vehicle weight to the wheel bearing while loosening the drive shaft nut.

1. Push out the drive shaft from the hub using the special tool.

◀B▶ DISCONNECTION OF LOWER ARM BALL JOINT

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.**

1. Disconnect the ball joint by using the special tool.

◀C▶ TIE ROD END REMOVAL

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

◀D▶ DRIVE SHAFT REMOVAL

1. Use the special tools to push out the drive shaft from the hub.

Caution
The RH inner drive shaft joint boot is made of silicone rubber for improved heat resistance due to the close proximity to the exhaust pipe. This material is more susceptible to damage than the conventional rubber boot material. Therefore, care should be taken not to over extend or bend the joint when handling as internal components of the joint can pinch/split the inside of the boot.

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2. Use a lever on the projection of the TJ joint to remove the drive shaft from the transmission.

Caution
Always use a lever to remove the drive shaft as pulling the drive shaft can damage the BJ joint.

◀E▶ OUTPUT SHAFT

1. Use the special tool (MB991612, MB990211) to remove the output shaft.

2. Use the special tool to cover the transmission case to prevent entry of foreign material.

INSTALLATION SERVICE POINT

▶A◀ DRIVE SHAFT NUT INSTALLATION

1. Be sure to install the drive shaft washer in the specified direction.

2. Using the special tool, tighten the drive shaft nut to the lower end of the specified torque range.

Caution
There should be no load on the wheel bearings when the drive shaft nut is tightened.

3. If the position of the cotter pin holes does not match, tighten the nut to a maximum of 255 Nm.
4. Install the cotter pin in the first matching holes and bend it securely.

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INSPECTION

- Check the drive shaft boot for damage or deterioration.
- Check the ball joints for wear or operating condition.
- Check the spline part for wear or damage.

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DISASSEMBLY AND REASSEMBLY

T.J. boot repair kit	**T.J. repair kit**	**Output shaft repair kit**	**B.J. boot repair kit**

Disassembly steps

- ▶A◀ 1. TJ boot band
- ▶A◀ 2. Boot band (small)
- ◀A▶ 3. T.J. case
- 4. Seal plate
- ◀B▶ ▶B◀ 5. Snap ring
- ◀B▶ ▶B◀ 6. Spider assembly
- ◀C▶ ▶C◀ 7. TJ boot
- 8. BJ assembly
- 9. BJ boot band (small)
- 10. BJ boot band
- 12. Circlip
- 13. Output shaft

Caution
Do not disassemble the B.J. assembly or remove the boot bands unless boot replacement is required.

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LUBRICANT POINTS

Grease: Repair kit grease
Amount to be used: 115 ± 10g

Caution: Since special grease is used for the joint, do not mix old and new grease or differing types of grease.

Grease: Repair kit grease
Amount to be used: 110 ± 10g

Caution: Since special grease is used for the joint, do not mix old and new grease or differing types of grease.

Grease: repair kit grease

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DISASSEMBLY SERVICE POINTS

◀A▶ T.J. CASE REMOVAL

Remove the T.J. case from the B.J. assembly, and wipe off the grease inside the T.J. case.

◀B▶ SNAP RING/SPIDER ASSEMBLY REMOVAL

1. Remove the snap ring from the drive shaft with the special tool.
2. Take out the spider assembly from the drive shaft.
3. Clean the spider assembly.

Caution
1. Do not disassemble the spider assembly.
2. Use care in handling so as not to damage the drive shaft.

◀C▶ T.J. BOOT REMOVAL

1. Wipe off the grease from the spline portion.
2. Remove the T.J. boot.

NOTE
If the boot is to be reused, wrap vinyl tape around the drive shaft spline so that the boot is not damaged when it is removed.

REASSEMBLY SERVICE POINTS

▶A◀ T.J. BOOT INSTALLATION

Wrap vinyl tape around the spline part on the drive shaft, then install the T.J. boot band (small) and T.J. boot.

▶B◀ SPIDER ASSEMBLY/T.J. CASE INSTALLATION (RH)

1. Apply the specified grease furnished in the repair kit to the spider assembly between the spider axle and the roller.

Specified grease: Repair kit grease

Caution
1. The drive shaft joint uses special grease. Do not mix old and new or different types of grease.

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2. **If the spider assembly has been cleaned, take special care to apply the specified grease.**
2. Install the spider assembly to the shaft from the direction of the spline bevelled section.
3. After applying the specified grease to the T.J. case, insert the drive shaft and apply grease one more time.

   Specified grease:
   Repair kit grease 145g

   NOTE
   When using the repair kit grease, use the whole amount, aiming at filling the inside of the joint and the inside of the boot with about half each.

   Caution
   The drive shaft joint uses special grease. Do not mix old and new or different types of grease.

▶C◀ T.J. BOOT BAND (SMALL)/T.J. BOOT BAND (LARGE) INSTALLATION

Set the T.J. boot bands at the specified distance in order to adjust the amount of air inside the T.J. boot, and then tighten the T.J. boot bands securely.

Standard value (A): 80 mm

INSPECTION

- Check the drive shaft for damage, bending or corrosion.
- Check the drive shaft spline part for wear or damage.
- Check the spider assembly for roller rotation, wear or corrosion.
- Check the groove inside T.J. case for wear or corrosion.
- Check the boots for deterioration, damage or cracking.

B.J. BOOT (RUBBER BOOT) REPLACEMENT

1. Remove the B.J. boot bands (large and small).

   NOTE
   The B.J. boot bands cannot be re-used.
2. Remove the B.J. boot.

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3. Install the B.J. boot with the part with the smallest diameter in a position such that the shaft groove can be seen.

4. Turn the adjusting bolt on the special tool so that the size of the opening (W) is at the standard value.

Standard value (W): 2.9 mm

<If it is larger than 2.9 mm>
Tighten the adjusting bolt.

<If it is smaller than 2.9 mm>
Loosen the adjusting bolt.

NOTE
1. The value of W will change by approximately 0.7 mm for each turn of the adjusting bolt.
2. The adjusting bolt should not be turned more than once.

5. Place the B.J. boot band (small) against the projection at the edge of the boot, and then secure it so that there is a clearance left as shown by (A) in the illustration.

6. Use the special tool to crimp the B.J. boot band (small).

Caution
1. **Secure the drive shaft in an upright position and clamp the part of the B.J. boot band to be crimped securely in the jaws of the special tool.**
2. **Crimp the B.J. boot band until the special tool touches the stopper.**

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7. Check that the crimping amount (B) of the B.J. boot band is at the standard value.

Standard value (B): 2.4 mm – 2.8mm

<If the crimping amount is larger than 2.8 mm>
Readjust the value of (W) in step (4) according to the following formula, and then repeat the operation in step (6).
W = 5.5 mm – B
EXAMPLE: If B = 2.9 mm,then W = 2.6 mm

<If the crimping amount is smaller than 2.4 mm>
Remove the B.J. boot band, readjust the value of (W) in step (4) according to the following formula, and then repeat the operations in steps (5) and (6) using a new B.J. boot band.
W = 5.5 mm – B
Example: If B = 2.3 mm, then W = 3.2 mm.

8. Check that the B.J. boot band in not sticking out past the place where it had been installed.
If the B.J. boot band is sticking out, remove it and then repeat the operations in step (5) to (7) using a new boot band.

9. Fill the inside of the B.J. boot with the specified grease.

Specified grease: Repair kit grease
Amount to be used: 145g

10. Install the B.J. boot band (large) so that there is the clearance (C) between it and the B.J. housing is at the standard value.

Standard value (C): 0.1 – 1.55 mm

11. Follow the same procedure as in step (4) to adjust the size of the opening (W) on the special tool so that it is at the standard value.

Standard value (W): 3.2 mm

12. Place the B.J. boot band (large) against the projection at the edge of the boot, and then secure it so that there is a clearance left as shown by (D) in the illustration.
13. Use the special tool to crimp the B.J. boot band (large) in the same way as in step (6).

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14. Check that the crimping amount (E) of the B.J. boot band is at the standard value.

Standard value (E): 2.4 – 2.8 mm

<If the crimping amount is larger than 2.8 mm>
Readjust the value of (W) in step (4) according to the following formula, and then repeat the operation in step (13).
W = 5.8 mm – E
Example: If E = 2.9 mm, then W = 2.9 mm

<If the crimping amount is smaller than 2.4 mm>
Remove the B.J. boot band, readjust the value of (W) in step (11) according to the following formula, and then repeat the operations in steps (12) and (13) using a new B.J. boot band.
W = 5.8 mm – E
Example: If E = 2.3 mm, then W = 3.5 mm

15. Check that the B.J. boot is not sticking out past the place where it has been installed.
If the B.J. boot band is sticking out, remove it and then repeat operations in steps (12) to (14) using a new B.J. boot band.

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27 REAR AXLE

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GENERAL INFORMATION

The rear axle consists of a knuckle, rear hub, unit bearing and axle shaft. The unit bearing is press-fitted to the rear axle shaft and bolted to the knuckle. The unit bearing utilises the double row angular contact ball bearing type. For ABS operation, a rotor is located on the rear axle shaft, and a speed sensor is located on the knuckle to detect vehicle speed.

SECTIONAL VIEW

SERVICE SPECIFICATIONS

Items	Limit
Wheel bearing axial play mm	0.05
Wheel bearing rotary-sliding resistance N	18 or less

SPECIAL TOOLS

Tool	Tool number and name	Supersession	Application
	MB991113 or MB990635 Steering linkage puller	13–006	Toe control arm ball joint and knuckle removal
	MB991248 Inner shaft remover	–	ABS rotor removal

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ON-VEHICLE SERVICE

HUB AXIAL PLAY CHECK

1. Remove the calliper assembly and the brake disc.
2. Check the hub axial play
   Place a dial gauge against the hub surface; then move the hub in the axial direction and check whether or not there is axial play.

   Limit: 0.05 mm
3. If the play exceeds the limit value, replace the rear hub assembly.

REAR HUB ROTARY-SLIDING RESISTANCE CHECK

1. Remove the calliper assembly and the brake disc.
2. After turning the hub a few times to seat the bearing, wind a cord around the hub bolt and turn the hub by pulling at a 90° angle with a spring balance. Measure to determine whether or not the rotary-sliding resistance of the rear hub is at the limit value.

   Limit: 18 N or less
3. If the rotary-sliding resistance exceeds the limit value, replace the rear hub assembly.

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HUB BOLT REPLACEMENT

1. Remove the calliper assembly and support it with wire so that it does not fall.
2. Remove the brake disc.
3. Remove the parking brake shoe and lining assembly.

4. Pull the hub bolt out using the special tool.

   Caution
   The special tool should be suspended by a cord to prevent it from coming off.

5. Use the wheel nuts to securely install the new hub bolts, ensuring they are seated correctly.

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REAR HUB ASSEMBLY

REMOVAL AND INSTALLATION

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Removal steps

1. Rear speed sensor (Refer Group 35B Wheel speed sensor.)
◀A▶ 2. Calliper assembly
3. Brake disc
4. Rear hub assembly
◀B▶ ▶A◀ 5. Rotor

Caution
The rear hub assembly should not be disassembled.

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REMOVAL SERVICE POINTS

◀A▶ CALLIPER ASSEMBLY REMOVAL

Remove the calliper assembly and suspend it with wire to an adjacent part to ensure no load is placed on the brake hose.

◀B▶ ROTOR REMOVAL

INSTALLATION SERVICE POINT

▶A◀ ROTOR INSTALLATION

INSPECTION

- Check the oil seal for crack or damage.
- Check the rear rotor for chipped teeth.

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REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
(1) Rear Speed sensor Removal and Installation (Refer GROUP 35B Wheel speed sensor.)
(2) Rear Hub Assembly Removal and Installation

Removal steps

1. Connection for trailing arm
2. Connection for lower arm
3. Connection for toe control arm
4. Connection for shock absorber
5. Connection for upper arm
6. Knuckle

◀A▶

Caution

***: Indicates parts which should be temporarily tightened, and then fully tightened with the vehicle on the ground in the unladen condition.**

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REMOVAL SERVICE POINT

◀A▶ TOE CONTROL ARM REMOVAL

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.**

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GENERAL INFORMATION

The rear axle consists of a knuckle, rear hub, unit bearing and axle shaft. The unit bearing is press-fitted to the rear axle shaft and bolted to the knuckle. The unit bearing utilises the double row angular contact ball bearing type. For ABS operation, a rotor is located on the rear axle shaft, and a speed sensor is located on the knuckle to detect vehicle speed.

SECTIONAL VIEW

SERVICE SPECIFICATIONS

Items	Limit
Wheel bearing axial play mm	0.05
Wheel bearing rotary-sliding resistance N	18 or less

SPECIAL TOOLS

Tool	Tool number and name	Supersession	Application
	MB991113 or MB990635 Steering linkage puller	13–006	Toe control arm ball joint and knuckle removal
	MB991248 Inner shaft remover	–	ABS rotor removal

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ON-VEHICLE SERVICE

HUB AXIAL PLAY CHECK

1. Remove the calliper assembly and the brake disc.
2. Check the hub axial play
   Place a dial gauge against the hub surface; then move the hub in the axial direction and check whether or not there is axial play.

   Limit: 0.05 mm
3. If the play exceeds the limit value, replace the rear hub assembly.

REAR HUB ROTARY-SLIDING RESISTANCE CHECK

1. Remove the calliper assembly and the brake disc.
2. After turning the hub a few times to seat the bearing, wind a cord around the hub bolt and turn the hub by pulling at a 90° angle with a spring balance. Measure to determine whether or not the rotary-sliding resistance of the rear hub is at the limit value.

   Limit: 18 N or less
3. If the rotary-sliding resistance exceeds the limit value, replace the rear hub assembly.

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HUB BOLT REPLACEMENT

1. Remove the calliper assembly and support it with wire so that it does not fall.
2. Remove the brake disc.
3. Remove the parking brake shoe and lining assembly.

4. Pull the hub bolt out using the special tool.

   Caution
   The special tool should be suspended by a cord to prevent it from coming off.

5. Use the wheel nuts to securely install the new hub bolts, ensuring they are seated correctly.

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REAR HUB ASSEMBLY

REMOVAL AND INSTALLATION

Removal steps

1. Rear speed sensor (Refer GROUP 35B .)
◀A▶ 2. Caliper assembly
3. Brake disc
4. Dust cap
5. Nut
6. Washer
7. Rear hub assembly
◀B▶ ▶A◀ 8. Rotor <Vehicles with ABS>
9. Rear hub

Caution
The rear hub assembly should not be disassembled.

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REMOVAL SERVICE POINTS

◀A▶ CALIPER ASSEMBLY REMOVAL

1. Remove the calliper assembly and suspend it with wire to an adjacent part to ensure no load is placed on the brake hose.

◀B▶ ROTOR REMOVAL

1. Clamp special tool (MB991248) around the rotor.
2. Place the rear hub in the press as shown in the illustration and apply force with the press onto the base of the hub to remove the rotor.

INSPECTION

- Check the oil seal for crack or damage.
- Check the rear rotor for chipped teeth.

INSTALLATION SERVICE POINT

▶A◀ ROTOR INSTALLATION

1. Place the rear hub in a press as shown in the illustration.
2. Use an appropriate section of pipe with a larger inside diameter than that of the rear hub and drive the rotor onto the hub until it is seated correctly.

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REAR AXLE AWD

SERVICE SPECIFICATIONS

Items			Standard value	Limit
Rear axle total backlash mm			–	5
Wheel bearing axial play mm			–	0.05
Rear wheel bearing turning starting torque Nm			1.0	–
TJ boot assembly dimension mm			0.11 – 0.16	–
Differential gear backlash (VCU LSD) mm			0.03 – 0.09	0.2
Drive pinion turning torque	Without seal	When replacing with new part (with rust prevention oil)	0.9 – 1.2	–
		New or re–used (oil applied)	0.4 – 0.5	–
	With oil seal	Replacing with new part (with rust prevention oil)	1.0 – 1.3	–
		New or re–used (oil applied)	0.5 – 0.6	–
Rear differential ratio			3.312	

LUBRICANTS

Item	Brand	Volume
Gear oil VCU LSD	Hypoid gear oil API classification GL–5 or higher. Above 10°C SAE 90W. Below 10°C SAE 80W.	0.55 litres
BJ Joint	Repair kit grease (NTN LJ grease)	85g
TJ Joint	Repair kit grease (NTN LJ grease)	105g

SEALANT AND ADHESIVES

Application	Brand
Bent plug	Three bond 1104 semi dry sealant
Differential cover assembly	
Drive gear and differential case	

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SPECIAL TOOLS

Tool	Tool number and name	Supersession	Application
	MB991115 Oil seal installer		Press fitting of differential side oil seal Use together with MB990938
	MB990767 End yoke holder		Hub fixing
	MB991354 Puller body		Removal of drive shaft Removal of rear hub assembly
	MB 990241 Rear axle shaft puller A: MB990242 Puller shaft B: MB990244 Puller bar		
	MB990998 Front hub remover and installer		Measurement of hub turning starting torque Temporary fix of wheel alignment
	MB990326 Pre–load socket		Measurement of hub turning starting torque Measurement of drive pinion pre–load
	MB990560 Bearing remover		Rotor removal, press fitting
	MB991406, MB991113 , or MB990635 Steering linkage puller	13–006	Toe control arm ball joint and knuckle removal

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Tool	Tool number and name	Supersession	Application
	MB991460 Plug	–	Prevention of differential oil from running out and the entry of foreign material
	MB990909 Working base		Differential carrier assembly disassembly and reassembly
	MB991116 Working base adaptor		
	MB990925 Bearing and oil seal installer set		Removal and press fitting of oil seal and bearing outer race Differential final gear tooth contact
	MB990810 Bearing puller		Removal of side bearing inner race Removal of companion flange
	MB990850 End yoke holder		Removal and fitting of companion flange
	MB990339 Bearing puller		Removal of drive pinion rear bearing inner race
	MB990374 Pinion bearing removal		

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Tool	Tool number and name	Supersession	Application
	MB990835 Drive pinion setting gauge set		Measurement of drive pinion height
	MB990728 Bearing installer		Press fitting of drive pinion rear bearing inner race Press fitting of side bearing inner race
	MB990031 or MB990699 Oil seal installer		Press fitting of drive pinion oil seal
	MB991357 Side gear holding tool		Inspection for differential gear backlash

ON-VEHICLE SERVICE

REAR AXIAL TOTAL BACKLASH CHECK

If the drive system booms or the vehicle vibrates, measure the rear axle total backlash by the following procedure. Then judge if the differential carrier assembly removal is necessary from the result.

1. Place the shift lever in the neutral position and apply the park brake.
2. Turn the propeller shaft clockwise as far as it goes. Make mating marks on the dust cover of the companion flange and the gear carrier.
3. Turn the propeller shaft counterclockwise as far as it goes, and measure the distance between the mating marks.

   Limit: 5 mm

3. If the backlash exceeds the limit value, remove the differential carrier assembly and check the following points.
   1. Final drive gear backlash
   2. Differential gear backlash

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GEAR OIL LEVEL CHECK

If the gear oil level is not within the upper and lower limits, add the specified gear oil to the upper limit level, (the bottom of the plug hole).

Specified gear oil: Hypoid gear oil API classification GL–5 or higher. Above 10°C SAE 90W. Below 10°C SAE 80W

Amount used: 0.55l

WHEEL BEARING CHECK FOR FREE PLAY IN AXIAL DIRECTION

1. Remove the caliper assembly and brake disc.
2. Fit dial gauge as shown in diagram and move the rear hub in the axial direction to measure the free play.

   Limit: 0.05 mm
3. If the free play exceeds the limit, replace the rear hub assembly.

VCU LSD CHECK

1. Place the shift lever in the neutral position, and chock front wheels.
2. Release the parking brake.
3. Jack up the rear wheels, and apply rigid rack to the specified place.
4. Separate the joint on the differential carrier and propeller shaft.
5. Confirm that if one wheel is turned slowly (approx. 29 Nm of turning torque) the other wheel turns in the same direction.
6. If the other wheel turns in the opposite direction replace the VCU.

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DIFFERENTIAL CARRIER OIL SEAL REPLACEMENT

1. Remove the drive shaft.
2. Remove the differential carrier oil seal.
3. Use the special tools to drive a new oil seal to the side face of the differential carrier.
4. Apply multi–purpose grease to the seal lip and drive shaft oil seating area.
5. Install a new drive shaft circlip, and install the drive shaft to the differential carrier.
6. Check wheel alignment. (Refer to Group 34 – On–vehicle Service).

HUB BOLT REPLACEMENT

Refer to Group 27

REAR HUB ASSEMBLY

REMOVAL AND INSTALLATION

Removal steps

1. Rear speed sensor (Refer Group 35B Wheel speed sensor.)
2. ◀A▶ Calliper assembly
3. Brake disc
4. Shoe and lining Refer to Group 36 – Parking Brake
5. Clip
6. Connection of parking brake cable
7. ◀B▶ ◀C▶ ▶A◀ Drive shaft nut
8. Rear hub nut
9. Dust shield

REMOVAL SERVICE POINTS

◀A▶ CALLIPER ASSEMBLY REMOVAL

Remove the calliper assembly and suspend it with wire to an adjacent part to ensure no load is placed on the brake hose.

◀B▶ DRIVE SHAFT NUT REMOVAL

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◀C▶ REAR HUB ASSEMBLY REMOVAL

INSPECTION

REAR WHEEL BEARING TURN STARTING TORQUE CHECK

1. Use the special tool (MB990998) to tighten to the specified torque.
2. Use the special tool (MB990326) to measure the turn starting torque of the rear wheel bearing.

   Limit: 1.0 Nm
3. Turn starting torque should be within the specified limit, and it should not be notchy or crunchy when the hub is turning.

INSTALLATION SERVICE POINT

▶A◀ DRIVE SHAFT NUT INSTALLATION

1. Assemble the drive shaft washer in the direction shown in the illustration.
2. Use the special tools as used for the removal to tighten the drive shaft nut to the specified torque.

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KNUCKLE

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
(1) Rear Speed sensor Removal and Installation (Refer GROUP 35B Wheel speed sensor.)
(2) Rear Hub Assembly Removal and Installation

Removal steps

1. Connection for trailing arm
2. Connection for lower arm
3. Connection for toe control arm
4. Connection for shock absorber
5. Connection for upper arm
6. Knuckle

◀A▶

Caution
***: Indicates parts which should be temporarily tightened, and then fully tightened with the vehicle on the ground in the unladen condition.**

REMOVAL SERVICE POINT

◀A▶ TOE CONTROL ARM REMOVAL

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.**

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DRIVE SHAFT

REMOVAL AND INSTALLATION

Removal steps

1. Rear speed sensor (Refer to Group 35B)
2. Caliper assembly
3. Brake disc
4. Shoe and lining assembly (Refer to Group 36)
5. Clip
6. Parking brake cable
7. Connection for shock absorber
8. Connection for trailing arm

◀A▶

9. Connection for lower arm
10. Connection for toe control arm
11. Drive shaft nut
12. Washer
13. Drive shaft
14. Circlip

Caution

***: Indicates parts which should be temporarily tightened, and then fully tightened with the vehicle on the ground in the unladen condition.**

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REMOVAL SERVICE POINTS

◀A▶ DRIVE SHAFT NUT REMOVAL

◀B▶ DRIVE SHAFT REMOVAL

1. Push the knuckle bottom toward the outer side of the vehicle and separate the drive shaft from the differential carrier using a lever.

2. Use the special tool to remove the drive shaft from the rear hub.

INSTALLATION SERVICE POINTS

▶A◀ DRIVE SHAFT INSTALLATION

Caution

1. **Be careful that the spline part of the drive shaft does not damage the oil seal of the differential carrier.**
2. **Ensure the drive shaft with the double splines is installed into the right hand side of the differential.**

NOTE
Identify the drive shaft for the right and left by the colour of the TJ boot band (Small).

Left drive shaft	Right drive shaft
Yellowish green	Brown

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▶B◀ DRIVE SHAFT NUT INSTALLATION

1. Assemble the drive shaft washer in the direction shown in the illustration.
2. Use the special tools as used for the removal to tighten the drive shaft nut to the specified torque.

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DRIVE SHAFT

DISASSEMBLY AND REASSEMBLY

BJ Repair Kit

TJ Repair Kit

BJ Boot Repair Kit

TJ Boot Repair Kit

Removal steps

- ▶C◀ 1. TJ boot band
- ▶C◀ 2. Boot band (small)
- ◀A▶ ▶B◀ 3. TJ case
- 4. Snap ring
- ◀A▶ ▶B◀ 5. Spider assembly
- ◀B▶ ▶A◀ 6. TJ boot
- 7. BJ boot band
- 8. Boot band (small)
- ◀B▶ ▶A◀ 9. BJ boot
- 10. BJ assembly
- 11. Circlip

Caution

Be aware that right and left TJ cases are different.

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DRIVE SHAFT

LUBRICATION POINTS

Grease: Repair kit grease
Amount used: 105g
Caution:
The joint uses special grease. Do not mix old and new or different types of grease.

Grease: Repair kit grease
Amount used: 85g
Caution:
The joint uses special grease. Do not mix old and new or different types of grease.

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DISASSEMBLY SERVICE POINTS

◀A▶ TJ CASE/SPIDER ASSEMBLY REMOVAL

1. Wipe off grease from the inside of the TJ case and spider assembly.
2. If there is water or foreign material in the wiped grease, be sure to clean the spider assembly.

Caution
Do not disassemble the spider assembly.

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◀B▶ JT BOOT/BJ BOOT REMOVAL

1. Wipe off the grease from the shaft spline.
2. If the TJ boot and the BJ boot are re–used, wrap tape around the shaft spline so that they are not damaged when removed.

ASSEMBLY SERVICE POINTS

▶A◀ BJ BOOT/TJ BOOT INSTALLATION

1. Wrap tape around the shaft spline, then install the BJ boot followed by the TJ boot.
2. Fill the BJ and BJ boot with the specified grease.

   Specified grease:

   Repair kit grease: Amount used 85g

   NOTE
   When using the repair kit grease, use the whole amount, aiming at filling the inside of the joint and the inside of the boot with about half each.

Caution

1. **In order to control the amount of air in the BJ boot as specified, the bending angle of the drive shaft should be 0°.**
2. **BJ boot band and TJ boot band should be identified by the identification number marked on the lever.**

Item	Identification number
BJ boot band	20–113#BJ87L
TJ boot band	20–125#BJ87
BJ, TJ boot band (small)	20–146#BJ87

▶B◀ SPIDER ASSEMBLY/TJ CASE INSTALLATION

1. Apply the specified grease sufficiently between the spider axle and the roller.

   Specified grease:

   Repair kit grease

Caution

1. **The drive shaft joint uses special grease. Do not mix old and new or different types of grease.**
2. **If the spider assembly has been cleaned, take special care to apply the specified grease.**

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2. Fit the spider assembly to the shaft on the chamfered side of spline.
3. After applying the specified grease to the TJ case, insert the drive shaft and apply grease once more.

Specified grease:

Repair kit grease: Amount 105g

NOTE
When using the repair kit grease, use the whole amount, aiming at filling the inside of the joint and the inside of the boot with about half each.

Caution
The drive shaft joint uses special grease. Do not mix old and new or different types of grease.

▶C◀ BOOT BAND (SMALL)/TJ BOOT BAND INSTALLATION

Set the boot bands at the specified distance in order to adjust the amount of air inside the TJ. boot, and then tighten the TJ. boot bands securely.

Standard value (A): 85mm

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DIFFERENTIAL CARRIER

REMOVAL AND INSTALLATION

Post-installation Operation
- Adjustment of Parking Brake (Refer Group 36.)

Removal steps

1. Rear speed sensor (Refer to Group 35B)
2. Caliper assembly
3. Brake disc
4. Shoe and lining assembly (Refer to Group 36)
5. Clip
6. Parking brake cable
7. Connection for shock absorber
8. Connection for trailing arm

◀A▶

9. Connection for lower arm
10. Connection for toe control arm
11. Connection for propeller shaft
12. Connection for drive shaft
13. Differential carrier
14. Differential mount bracket

Caution

***: Indicates parts which should be temporarily tightened, and then fully tightened with the vehicle on the ground in the unladen condition.**

REMOVAL SERVICE POINTS

◀A▶ PROPELLER SHAFT REMOVAL

1. Make mating marks on the differential companion flange yoke, and disconnect the differential carrier assembly and propeller shaft.
2. Suspend the removed propeller shaft from the body with a wire to prevent bending.

Caution

If propeller shaft bends sharply, cross groove universal joint can be damaged.

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◀B▶ DRIVE SHAFT REMOVAL

1. Push the knuckle bottom toward the outer side of the vehicle and separate the drive shaft from the differential carrier using a lever.
2. Suspend the drive shaft with wire, so the joint is not damaged.

3. Use the special tool to cover the differential to prevent the entry of foreign material.

◀C▶ DIFFERENTIAL CARRIER REMOVAL

Supporting the bottom of the differential carrier with a jack, remove the bolt from the joint with rear crossmember, and remove the differential carrier.

INSTALLATION SERVICE POINTS

▶A◀ DRIVE SHAFT INSTALLATION

Caution
Do not damage the oil seal of the differential carrier

INSPECTION BEFORE DISASSEMBLY

Remove the cover, fix the special tool to the vise, and install the differential carrier assembly to check the following items.

FINAL DRIVE GEAR BACKLASH

Check the final drive gear for backlash in the following procedure.

1. Setting a dial gauge on the side face of the drive gear tooth with the drive pinion.

   NOTE
   Measure the backlash on 4 or more points on the circumference of the drive gear.

   Standard value: 0.11 – 0.16mm

2. If the backlash is not within the standard value, adjust it by the side bearing spacer.

   NOTE
   After the adjustment, inspect the final drive gear tooth contact.

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DRIVE GEAR BACK RUNOUT

Check the drive gear for runout by the following procedure.

1. With a dial gauge on the back of the drive gear, turn the drive gear and measure runout.

   Limit: 0.05mm
2. If runout exceeds the limit value, check if there is foreign material between the back of the drive gear and the differential case or the installation bolts of the drive gear are loose.
3. If the results in step 2 are normal, reposition the drive gear and the differential case and measure it again.

   NOTE
   If adjustment is impossible, replace the differential case, or the drive gear and pinion as a set.

DIFFERENTIAL GEAR BACKLASH

Check the differential gear for backlash by the following procedure.

1. Insert a wedge (made of wood) between the side gear and the pinion shaft to lock one of the side gears, and measure the backlash with a dial gauge on the pinion gear.

   NOTE
   Measure the backlash of 2 pinion gears.

   Standard value: 0 – 0.076mm

   Limit: 0.2mm
2. If the backlash exceeds the limit, adjust it by the side gear spacer.

   NOTE
   If the adjustment is not possible, replace the side gear and pinion gear as a set.

FINAL DRIVE GEAR TOOTH CONTACT

Check final drive gear tooth contact by the following procedure.

1. Apply a thin, uniform coat of machine blue, to both sides, of the drive gear teeth.
2. Insert the special tool between the gear carrier and the side face of the drive gear fitting part of the differential case. Rotate the companion flange by hand, once in the normal direction and once in the reverse direction, while applying a load to the drive gear so that a turning torque of approximately 2.5 – 3.0Nm is applied to the drive pinion.

   Caution
   Do not rotate the drive gear repeatedly, as the tooth contact pattern will look unclear.
3. Check the tooth contact condition of the final drive gear.

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Standard tooth contact pattern	Problem	Solution
1 Narrow tooth side 2 Drive-side tooth surface (the side applying power during forward movement) 3 Wide tooth side 4 Coast-side tooth surface (the side applying power during reverse movement) 	Tooth contact pattern resulting from excessive pinion height The drive pinion is positioned too far from the centre of the drive gear.	 Increase the thickness of the drive pinion rear shim, and position the drive pinion closer to the centre of the drive gear. Also, for backlash adjustment, position the drive gear farther from the drive pinion.
	Tooth contact pattern resulting from insufficient pinion height The drive pinion is positioned too close to the centre of the drive gear.	 Decrease the thickness of the drive pinion rear shim, and position the drive pinion farther from the centre of the drive gear. Also, for backlash adjustment, position the drive gear closer to the drive pinion.

NOTE
Checking the tooth contact pattern is the way to confirm that the adjustments of the pinion height and backlash have been done properly. Continue to adjust the pinion height and backlash until the tooth contact pattern resembles the standard pattern.

If, even after adjustments have been made, the correct tooth contact pattern cannot be obtained, it means that the drive gear and the drive pinion have become worn beyond the allowable limit. Replace the gear set.

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DIFFERENTIAL

DISASSEMBLY

Disassembly steps

1. Differential cover assembly
2. Bent plug
3. Bearing cap
4. ◀A▶ Differential case assembly
5. Side bearing spacer
6. Side bearing outer race
7. ◀B▶ Side bearing inner race
8. ◀C▶ Drive gear
9. LSD case assembly
10. ◀D▶ Self–locking nut
11. Washer
12. ◀E▶ Drive pinion assembly
13. Companion flange
14. Drive pinion front shim (for adjusting drive pinion turning torque)
15. Drive pinion spacer
16. ◀F▶ Drive pinion rear bearing inner race
17. Drive pinion rear shim (for adjusting drive pinion height)
18. Drive pinion
19. ◀G▶ Oil seal
20. ◀G▶ Drive pinion front bearing inner race
21. ◀G▶ Drive pinion front bearing outer race
22. ◀G▶ Drive pinion rear bearing outer race
23. Oil seal
24. Gear carrier

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DISASSEMBLY SERVICE POINTS

◀A▶ DIFFERENTIAL CASE ASSEMBLY REMOVAL

Caution
Remove the differential case assembly slowly, and be careful not to drop the side bearing outer race.

NOTE
Keep the right and left side bearing shims and side bearing outer races separate to avoid confusion during assembly.

◀B▶ SIDE BEARING INNER RACE REMOVAL

Use the special tool to remove side bearing inner race.

NOTE
Hitch the claws of the special tool on the 2 notches of the side bearing inner race on the differential case side.

◀C▶ DRIVE GEAR REMOVAL

1. Make mating marks on the drive gear and the differential case.
2. Loosen the bolts in the drive gear in a diagonal sequence to remove the drive gear.

◀D▶ SELF LOCKING NUT REMOVAL

◀E▶ DRIVE PINION ASSEMBLY REMOVAL

1. Make mating marks on the drive pinion and the companion flange for reassembly.

   Caution
   Do not make mating marks on the contact surface of the companion flange and propeller shaft.
2. Use the special tool to remove the companion flange.

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◀F▶ DRIVE PINION REAR BEARING INNER RACE REMOVAL

Use special tools to pull out the front bearing inner race.

◀G▶ OIL SEAL/DRIVE DRIVE PINION FRONT BEARING INNER RACE, DRIVE PINION FRONT BEARING OUTER RACE, AND DRIVE PINION REAR BEARING OUTER RACE REMOVAL

Use the special tool to remove drive pinion front bearing outer race.

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DIFFERENTIAL

REASSEMBLY

Final drive gear set

Disassembly steps

1. Gear carrier
▶A◀ 2. Oil seal
▶B◀ 3. Drive pinion rear bearing outer race
▶B◀ 4. Drive pinion front bearing outer race
▶C◀ ● Adjustment of drive pinion height
5. Drive pinion
6. Drive pinion rear shim (for adjusting drive pinion)
7. Drive pinion rear bearing inner race
8. Drive pinion spacer
▶D◀ ● Adjustment of drive pinion turning torque
9. Drive pinion front shim (for adjusting drive pinion turning torque)
10. Drive pinion assembly
11. Drive pinion front bearing inner race
12. Oil seal
13. Companion flange
14. Washer
15. Self–locking nut
16. LSD case assembly
▶E◀ 17. Drive gear
▶F◀ 18. Side bearing inner race
19. Side bearing outer race
▶G◀ ● Adjustment of final gear backlash
20. Side bearing spacer
21. Differential case assembly
22. Bearing cap
23. Bent plug
24. Differential cover assembly

Caution
Tightening torque marked with * is that with oil coated.

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LUBRICATION AND ADHESIVE POINTS

REASSEMBLY SERVICE POINTS

▶A◀ OIL SEAL FITTING

1. Use the special tools to press–fit the oil seal to the side face of the differential carrier.
2. Apply a thin amount of multi purpose grease to the oil seal lip.

▶B◀ DRIVE PINION REAR BEARING OUTER RACE, DRIVE PINION FRONT BEARING OUTER RACE FITTING

Caution
Do not lean outer race to press–fit

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▶C◀ DRIVE PINION HEIGHT ADJUSTMENT

Adjust the drive pinion height by the following procedures:

1. Apply multipurpose grease to the washer of the special tool.
2. Install the special tool and drive pinion front and rear bearing inner races to the gear carrier in the sequence shown in the illustration.

3. Tighten the nut of the special tool a little at a time while measuring the turning torque of the drive pinion. Then confirm the turning torque (without the oil seal) is at the standard value.

Standard value:

Bearing type	Turning torque
New	0.4 – 0.5 N·m

4. Clean the side bearing hub.
5. Place the special tool between the side bearing hub of the gear carrier, and position the notch as shown in the illustration. Then tighten side bearing mounting bolt.
6. Use a thickness gauge to measure the clearance (A) between the special tools.

7. Remove special tools (MB990836).
8. Use a micrometer to measure the shown dimensions (B, C) of special tools.

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9. Install the bearing cap, and then use a cylinder gauge to measure inside diameter (D) of the bearing cap.
10. Calculate thickness (F) of the required drive pinion rear shim twice by the following formula. Select a shim which most closely matches this thickness.
    F = A + B + C – 1/2D – 86.00 mm

11. Fit the selected drive pinion rear shim(s) to the drive pinion, and press-fit the drive pinion rear bearing inner race by using the special tool.

▶D◀ DRIVE PINION TURNING TORQUE ADJUSTMENT /OIL SEAL INSTALLATION

1. Insert the drive pinion into the gear carrier, and then install the following parts in sequence from the carrier rear side. Drive pinion spacer, drive pinion front shim and drive pinion front bearing inner race, companion flange.

   NOTE
   Do not install the oil seal.
2. Tighten the companion flange to the specified torque by using special tool.

3. Measure the drive pinion turning torque (without the oil seal).

   Standard value:

Bearing division	Turning torque
New	0.9 – 1.2 N·m

4. If the drive pinion turning torque is not within the standard value, adjust the turning torque by replacing the drive pinion front shim(s).

   NOTE
   When selecting the drive pinion front shims, if the number of shims is large, reduce the number of shims to a minimum by selecting the drive pinion spacers.

5. Remove the companion flange and drive pinion again. Then insert the drive pinion front bearing inner race into the gear carrier. Use the special tool to press-fit the oil seal.
6. Apply multi–purpose grease to the working face and washer of the companion flange.

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7. Install the drive pinion assembly and companion flange with mating marks properly aligned. Tighten the companion flange self-locking nut to the specified torque using the special tool.
8. Measure the drive pinion turning torque (with oil seal) to verify that the drive pinion turning torque complies with the standard value.

Standard value:

Bearing division	Companion flange lubrication	Turning torque
New	None (With anti-rust agent)	1.0 – 1.3 N·m
	Gear oil applied	0.5 – 0.6 N·m

9. If the turning torque is not within the standard value, check the tightening torque of the companion flange self-locking nut, and the installation of the oil seal.

▶E◀ DRIVE GEAR INSTALLATION

1. Clean the drive gear attaching bolts.
2. Remove the adhesive adhered to the threaded holes of the drive gear by turning the special tool (tap M10 x 1.25), and then clean the threaded holes by applying compressed air.
3. Apply the specified adhesive to the threaded holes of the drive gear.

   Specified adhesive:
   3M Stud Locking 4170 or equivalent

4. Install the drive gear onto the differential case with the mating marks properly aligned. Tighten the bolts to the specified torque in a diagonal sequence.

   Tightening torque: 78 – 88 N·m

▶F◀ SIDE BEARING INNER RACE INSTALLATION

Use the special tool to press-fit the side bearing inner races into the differential case.

▶G◀ BEARING CAP INSTALLATION/FINAL DRIVE GEAR BACKLASH ADJUSTMENT

Adjust drive gear backlash as follows:

1. Assemble the differential case with the side bearing outer race to the gear carrier.
2. Press the differential case to one side to measure the clearance of the side bearing outer race and the gear carrier.

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3. Remove the differential case, and measure the thickness of the installed side bearing spacer on one side. The measured value + 1/2 of clearance + 0.05mm pre–load should be the thickness of the side bearing spacer to choose. Select two bearing spacers.

4. Install the side bearing spacer chosen above into the differential carrier with the side bearing outer race as shown in the diagram.

5. Use the special tool to drive the side bearing outer race.

6. Align the mating marks on the gear carrier and bearing cap and install the bearing cap.

7. Use a dial gauge, touching the side of the drive gear teeth to check if the backlash is the standard value by fixing the drive pinion and moving the drive gear.

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8. If the backlash is not within the standard value, move the side bearing spacer as shown in the illustration to adjust the backlash.

   NOTE
   The increment of side bearing spacer must be coincided with the decreased amount.

9. Inspect the tooth condition at the final drive gear and make an adjustment if required. (Refer to GROUP 27 – Pre-removal Inspection.)

10. Measure the drive gear runout.

    Limit: 0.05 mm

11. When drive gear runout exceeds the limit, remove the differential case and then the drive gears, moving them to different positions and reinstall them.

    NOTE:
    If adjustment is not possible, replace the differential case or drive gear and drive pinion as a set.

LSD CASE ASSEMBLY

INSPECTION BEFORE DISASSEMBLY

DIFFERENTIAL GEAR BACKLASH CHECK

1. Fix the LSD case assembly to a vise with the differential side gear (RH) up.

   Caution
   Do not tighten the LSD case assembly too much

2. Insert 2 thickness gauges of 0.03mm in thickness, in diagonal positions between the differential case B and the thrust washer (RH).

   Caution
   Do not insert the thickness gauge at the oil groove of the differential case B.

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3. Insert the special tool into the spline part of the differential side gear (RH), and make sure that the side gear (RH) rotates.
4. Replace with the thickness gauge of 0.09mm.
5. Insert the special tool into the spline part of the differential side gear (RH), and make sure the side gear (RH) does not rotate.

   Differential gear backlash
   Standard value (Clearance from side gear on the thrust side): 0.03 – 0.09mm
6. If the clearance is beyond the standard value, remove the differential case A, and adjust it by the thickness of thrust washer (LH).

Thrust washer thickness	
LH	RH (Reference)
0.8	0.8
0.9	
1.0	
1.1	
1.15	
1.2	
1.25	
1.3	
1.35	
1.4	
1.5	

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DISASSEMBLY AND REASSEMBLY

Disassembly steps

- Pre–disassembly inspection (Refer to Group 27)

1. Screw
2. ▶A◀ Differential case A
3. ◀A▶ ▶C◀ Thrust washer (LH)
4. ▶B◀ VCU (differential side gear)
5. Pinion mate washer
6. ▶B◀ Differential pinion mate
7. Differential pinion shaft
8. Differential side gear
9. ◀A▶ Thrust washer (RH)
10. ▶A◀ Differential case B

DISASSEMBLY SERVICE POINT

◀A▶ THRUST WASHER (LH)/THRUST WASHER (RH) REMOVAL

Thrust washer thickness is different between LH and RH.

REASSEMBLY SERVICE POINTS

▶A◀ DIFFERENTIAL CASE B/DIFFERENTIAL CASE A INSTALLATION

Align the mating marks on the differential case B and A, and assemble the case.

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▶B◀ DIFFERENTIAL PINION MATE/PINION MATE WASHER INSTALLATION

Install the washer into the differential pinion shaft in the direction shown in the diagram, then install them into the differential case B.

▶C◀ THRUST WASHER (LH) INSTALLATION

When replacing the differential side gear and pinion mate gear, choose thrust washer (LH) by the following procedure.

1. Clean the differential side gear and the pinion mate gear with solvent to remove grease.
2. Install the thrust washers, which have been used, with RH and LH in the correct positions into the differential case A and B as well as gears, VCU, pinion mate washers and pinion shaft, and tighten temporarily with screws.
3. Check the differential gear for backlash. Choose thrust washer (LH) to control the backlash to the standard value. (Refer to Group 27)

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31 WHEEL AND TYRE

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- WHEEL RUNOUT CHECK

WHEEL AND TYRE
- WHEEL AND TYRE REMOVAL AND INSTALLATION

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GENERAL INFORMATION

Both steel type and aluminium type wheels have been adopted. The type of wheel used depends on the vehicle model.

Wheels	Country	Vehicle	Steel	Aluminium
	Australia and Brunei	Magna V6	15×6.0J(ISO)	15×6.0J(ISO) option
		Advance	15×6.0J(ISO)	15×6.0J(ISO) option
		Verada		16×6.0J(ISO)
		Sports		16×7.0J(ISO)
		VR–X		17x7.0J(ISO)
		AWD		16 x 6.0J(ISO)
	New Zealand	Magna V6	15×6.0J(ISO)	
		Super Saloon		15×6.0J(ISO)
		SEi		16×6.0J(ISO)
		AWD		16x 6.0J(ISO)
	Pacific regions	Magna V6	15×6.0J(ISO)	15×6.0J(ISO) option
		AWD		16x 6.0J(ISO)

Tyres	Type	Size	Steel	Aluminium
	Radial	15”	P205/65R15 95H	P205/65R15 95H
	Radial	16”		215/60R16 95H
	Radial	17”		225/50R17

SERVICE SPECIFICATIONS

Items			Limit
Wheel runout mm	Average radial runout	Steel wheel	0.5 or less
		Aluminium wheel	0.3 or less
	Lateral runout	Steel wheel	1.0 or less
		Aluminium wheel	0.3 or less
Tyre runout mm	Radial runout		1.0 or less
	Lateral runout		1.3 or less
Tyre and Wheel runout mm	Radial runout	Steel wheel	1.5 or less
		Aluminium wheel	1.3 or less
	Lateral runout	Steel wheel	2.5 or less
		Aluminium wheel	1.7 or less
Tread depth of tyre mm			1.6
Maximum imbalance		Steel – 120grams	Aluminium – 120 grams

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NOTE: Tyre pressure and rim combinations are covered by Australian Design Rules. Approved combinations for each vehicle are listed on the tyre placard. Any deviation from these specifications, requires approval by State Registration Authorities prior to installation or the vehicle may subsequently be refused registration.

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TROUBLESHOOTING

Symptom		Probable cause		Remedy
Rapid wear at shoulders	11X0109	Under-inflation or lack of rotation	11X0116	Adjust the tyre pressure.
Rapid wear at centre	11X0110	Over-inflation or lack of rotation	11X0117	Adjust the tyre pressure.
Cracked treads	11X0111	Under-inflation		Adjust the tyre pressure.
Wear on one side	11X0112	Excessive camber	11X0118	Inspect the camber.
Feathered edge	11X0113	Incorrect toe-in	11X0119	Adjust the toe-in.
Bald spots	11X0114	Unbalanced wheel	11X0120	Adjust the imbalanced wheels.
Scalloped wear	11X0115	Lack of rotation of tyres or worn or out-of-alignment suspension		Rotate the tyres, inspect the front suspension alignment.

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ON-VEHICLE SERVICE

TYRE INFLATION PRESSURE CHECK

NOTE
Refer to the tyre placard located at the base of the right hand 'B' pillar.

TYRE WEAR CHECK

Measure the tread depth of tyres.

Limit: 1.6 mm

If the remaining tread depth is less than the limit, replace the tyre.

NOTE
When the tread depth of tyres is reduced to 1.6 mm or less, wear indicators will appear.

TYRE ROTATION

Slightly accelerated tyre wear may be experienced on the front wheels of 2WD vehicles. Tyre wear can be minimised on both 2WD and AWD vehicles, with accurate front and rear wheel alignment, correct tyre inflation pressures and careful driving habits. However if it is deemed necessary to rotate the tyres use the sequence shown in the illustration.

WHEEL RUNOUT CHECK

Jack up the vehicle so that the wheels are clear of the floor. While slowly turning the wheel, measure wheel runout with a dial indicator.

Limit:

Radial runout.
Steel wheel; 0.5mm
Aluminium wheel; 0.3mm

Lateral runout.
Steel wheel; 1.0mm
Aluminium wheel; 0.3mm

If wheel runout exceeds the limit, replace the wheel.

WHEEL AND TYRE

WHEEL AND TYRE REMOVAL AND INSTALLATION

Tighten the wheel nut to the specified torque.

Tightening torque: 90–110 Nm

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TJ/KJ BASE MANUAL
(effective to 31st July 2001 production)

TJ/KJ 01M/Y SPECIFICATION UPGRADE <AWD>
(effective from December 2002 production)

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SPECIAL TOOLS

Tool	Tool number and name	Supersession	Application
	MZ203827 Engine lifter	E309A	To support the engine assembly during removal and installation of the centre member
	MB991113 or MB990635 Steering linkage puller	13–006	Disconnecting the tie rod end from the knuckle

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ENGINE MOUNTING

REMOVAL AND INSTALLATION

Pre-removal Operation
- Raise the engine and transmission assembly to a position where the weight is removed from the insulator
- Remove the washer fluid tank

Post-installation Operation
- Lower the engine and transmission assembly to their original position
- Replace the washer fluid tank

Removal steps

1. Mounting bolt for engine mount insulator
2. Engine mount bracket
3. ▶A◀ Engine mount stopper
4. Dynamic damper

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INSTALLATION SERVICE POINT

▶A◀ ENGINE MOUNT STOPPER

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

INSPECTION

- Check each insulator for cracks or damage.
- Check each bracket for deformations or damage.

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TRANSMISSION MOUNTING

REMOVAL AND INSTALLATION

Pre-removal Operation
- Remove the air cleaner assembly, refer Group 15
- Remove the battery and battery tray
- Remove the front roll stopper, refer on vehicle service
- Remove the washer, transmission and rear roll stopper coupling bolt, refer on vehcile service
- Remove the rear roll stopper bracket, refer on vehicle service

Post-installation Operation
- Replace the rear roll stopper bracket, refer on vehicle service
- Replace the transmission and rear rear roll stopper coupling bolt, refer on vehcile service
- Replace the front roll stopper, refer on vehicle service
- Replace the battery and battery tray
- Replace the air cleaner assembly,refer Group 15

<Automatic Transmission>

<Manual Transmission>

Removal steps

◀A▶ 1. Transmission mount bracket
▶A◀ 2. Transmission mount stopper

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REMOVAL SERVICE POINT

◀A▶ TRANSMISSION MOUNT BRACKET

1. Fit the special tool to the vehicle and support the engine and transmission assembly.
2. Remove the bolts and nuts from the transmission mount bracket.
3. Slightly lower the engine and transmission (while still supporting) and remove the transmission mount bracket.

INSPECTION

- Check each insulator for cracks or damage.
- Check each bracket for deformation or damage.

INSTALLATION SERVICE POINT

▶A◀ TRANSMISSION MOUNT STOPPER

Fit the transmission mount stopper so that the arrow points in the direction shown in the diagram.

INSPECTION

- Check each insulator for cracks or damage.
- Check each bracket for deformations or damage.

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ENGINE ROLL STOPPER, CENTRE MEMBER

REMOVAL AND INSTALLATION

Front roll stopper & Centre Member
Removal steps

1. Coupling bolt for transmission and front roll stopper
2. Mounting bolt for centre member
3. Stopper
4. Centre member
5. Front roll stopper
6. Collar
7. Bush (lower)
8. Bush (upper)

Rear roll stopper
Removal steps

9. Coupling bolt between transmission and rear roll stopper
10. Rear roll stopper

Caution

***: Indicates parts which should be temporarily tightened, and then fully tightened with the vehicle on the ground in the unladen condition.**

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CROSSMEMBER

REMOVAL AND INSTALLATION

Pre-removal Operation
- Drain the power steering fluid, refer Group 37A
- Remove the centre member, refer on vehicle service
- Disconnect the front exhaust pipe, refer Group 15
- Remove the front stabiliser bar, refer Group 33
- Remove the rear roll stopper, refer on vehicle service

Post-installation Operation
- Install the rear roll stopper, refer on vehicle service
- Install the front stabiliser bar, refer Group 33
- Reconnect the front exhaust pipe, refer Group 15
- Install the centre member, refer on vehicle service
- Replenish the power steering fluid, refer Group 37A

CAUTION: SRS
For vehicles with SRS, before removal of steering rack, ensure you refer to Group 52B – SRS Airbag. In addition, place the front wheels in a straight ahead position and remove the ignition key. If you fail to observe this caution, the SRS clockspring may be damaged and could render the SRS system inoperative and could result in serious injury to the driver in the event of an accident.

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Removal steps for crossmember

1. Self locking nut
2. Lower control arm mounting bolt and nut
3. Lower control arm mounting bolts
4. Lower control arm
5. Coupling bolt for steering gear and joint
6. Split pin
7. Tie rod end coupling bolt
8. Crossmember mounting bolt and nut
9. Lower stopper
- Steering gear and linkage (refer Group 37A)
10. Crossmember
11. Stopper B

Caution

*** : Indicates parts which should be temporarily tightened, and then fully tightened with the vehicle on the ground in the unladen condition.**

◀A▶
◀B▶

Caution

Under no circumstances is the front crossmember on this vehicle to be repaired. If it is found to be faulty it must be replaced with a new part.

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REMOVAL SERVICE POINTS

◀A▶ DISCONNECTING THE TIE ROD END AND KNUCKLE

Caution
1. Using the special tool, loosen the tie rod end mounting nut but do not remove it until the ball joint has been dislodged.
2. Be sure to tie the cord attached to the special tool to a nearby part to prevent the tool from falling.

◀B▶ DISCONNECTING THE CROSSMEMBER MOUNTING BOLT AND NUT

1. Support the crossmember with a transmission jack and remove the bolt and nut.

32 POWER PLANT MOUNT <AWD>

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SPECIAL TOOLS

Tool	Tool number and name	Supersession	Application
	MZ203827 Engine lifter	E309A	To support the engine assembly during removal and installation of the centre member
	MB991113 or MB990635 Steering linkage puller	13–006	Disconnecting the tie rod end from the knuckle

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ENGINE MOUNTING

REMOVAL AND INSTALLATION

Pre-removal Operation
- Raise the engine and transmission assembly to a position where the weight is removed from the insulator
- Remove the washer fluid tank

Post-installation Operation
- Lower the engine and transmission assembly to their original position
- Replace the washer fluid tank

Removal steps

1. Mounting bolt for engine mount insulator
2. Engine mount bracket
3. ▶A◀ Engine mount stopper
4. Dynamic damper

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INSTALLATION SERVICE POINT

▶A◀ ENGINE MOUNT STOPPER

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

INSPECTION

- Check each insulator for cracks or damage.
- Check each bracket for deformations or damage.

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TRANSMISSION MOUNTING

REMOVAL AND INSTALLATION

Pre-removal Operation
- Remove the air cleaner assembly, refer Group 15
- Remove the battery and battery tray
- Remove the front roll stopper, refer on vehicle service
- Remove the washer, transmission and rear roll stopper coupling bolt, refer on vehcile service
- Remove the rear roll stopper bracket, refer on vehicle service

Post-installation Operation
- Replace the rear roll stopper bracket, refer on vehicle service
- Replace the transmission and rear rear roll stopper coupling bolt, refer on vehcile service
- Replace the front roll stopper, refer on vehicle service
- Replace the battery and battery tray
- Replace the air cleaner assembly,refer Group 15

<Automatic Transmission>

<Manual Transmission>

Removal steps

◀A▶ 1. Transmission mount bracket
▶A◀ 2. Transmission mount stopper

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REMOVAL SERVICE POINT

◀A▶ TRANSMISSION MOUNT BRACKET

1. Fit the special tool to the vehicle and support the engine and transmission assembly.
2. Remove the bolts and nuts from the transmission mount bracket.
3. Slightly lower the engine and transmission (while still supporting) and remove the transmission mount bracket.

INSPECTION

- Check each insulator for cracks or damage.
- Check each bracket for deformation or damage.

INSTALLATION SERVICE POINT

▶A◀ TRANSMISSION MOUNT STOPPER

Fit the transmission mount stopper so that the arrow points in the direction shown in the diagram.

INSPECTION

- Check each insulator for cracks or damage.
- Check each bracket for deformations or damage.

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ENGINE ROLL STOPPER, CENTRE MEMBER

REMOVAL AND INSTALLATION

Front roll stopper & Centre Member
Removal steps

1. Coupling bolt for transmission and front roll stopper
2. Mounting bolt for centre member
3. Stopper
4. Centre member
5. Front roll stopper
6. Collar
7. Bush (lower)
8. Bush (upper)

Rear roll stopper
Removal steps

9. Coupling bolt between transmission and rear roll stopper
10. Rear roll stopper

Caution

***: Indicates parts which should be temporarily tightened, and then fully tightened with the vehicle on the ground in the unladen condition.**

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CROSSMEMBER

REMOVAL AND INSTALLATION

Pre-removal Operation
- Drain the power steering fluid, refer Group 37A
- Remove the centre member, refer on vehicle service
- Disconnect the front exhaust pipe, refer Group 15
- Remove propeller shaft, refer Group 25
- Remove front drive shafts, refer Group 23E
- Remove transfer case, refer Group 23E
- Remove the front stabiliser bar, refer Group 33
- Remove the rear roll stopper, refer on vehicle service

CAUTION: SRS
For vehicles with SRS, before removal of steering rack, ensure you refer to Group 52B – SRS Airbag. In addition, place the front wheels in a straight ahead position and remove the ignition key. If you fail to observe this caution, the SRS clockspring may be damaged and could render the SRS system inoperative and could result in serious injury to the driver in the event of an accident.

Post-installation Operation
- Install the rear roll stopper, refer on vehicle service
- Install the front stabiliser bar, refer Group 33
- Install transfer case, refer Group 23E
- Install front drive shafts, refer Group 23E
- Install propeller shaft, refer Group 25
- Reconnect the front exhaust pipe, refer Group 15
- Install the centre member, refer on vehicle service
- Replenish the power steering fluid, refer Group 37A

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Removal steps for crossmember

1. Self locking nut
2. Lower control arm mounting bolt and nut
3. Lower control arm mounting bolts
4. Lower control arm
5. Coupling bolt for steering gear and joint
6. Split pin
7. Tie rod end coupling bolt
8. Crossmember mounting bolt and nut
9. Lower stopper
- Steering gear and linkage (refer Group 37A)
10. Crossmember
11. Stopper B

Caution

*** : Indicates parts which should be temporarily tightened, and then fully tightened with the vehicle on the ground in the unladen condition.**

◀A▶
◀B▶

Caution

Under no circumstances is the front crossmember on this vehicle to be repaired. If it is found to be faulty it must be replaced with a new part.

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REMOVAL SERVICE POINTS

◀A▶ DISCONNECTING THE TIE ROD END AND KNUCKLE

Caution
1. Using the special tool, loosen the tie rod end mounting nut but do not remove it until the ball joint has been dislodged.
2. Be sure to tie the cord attached to the special tool to a nearby part to prevent the tool from falling.

◀B▶ DISCONNECTING THE CROSSMEMBER MOUNTING BOLT AND NUT

1. Support the crossmember with a transmission jack and remove the bolt and nut.

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33 FRONT SUSPENSION

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GENERAL INFORMATION

The front suspension is McPherson strut type with coil springs and compression rod. Anti-dive geometry ensures excellent driving stability whilst negative offset geometry provides good braking stability. The offset coil spring ensures optimum riding comfort.

COIL SPRINGS

NOTE:
Worn springs are only to be fitted in pairs, according to the colour code.

SHOCK ABSORBER

Type Hydraulic,	cylindrical double–acting type
Max. length	503.5 mm
Min. length	361 mm
Stroke	142.5 mm
Expansion N	980 mm
Contraction N	640 mm

CONSTRUCTION DIAGRAM

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SERVICE SPECIFICATIONS

Items		Specifications
Toe-in mm		0±3
Steering angle	Inner wheel	39°00'±2°
	Outer wheel	30°30'
Camber		0°00'±30' <Left/right deviation within 30'>
Caster		3°00'±30' <Left/right deviation within 30'>
Lower arm ball joint starting torque Nm		10.0–22.0
Stabiliser link ball joint breakaway torque Nm		1.7–3.2

SPECIAL TOOLS

Tool	Tool number and name	Supersession	Application
	MB991004 Wheel alignment gauge attachment	–	Wheel alignment measurement
	MB991176 Spring seat holder	–	Strut disassembly and assembly
	MB991237 Spring compressor body MB991238 Arm set	– –	Front coil spring compression
	MB991113 or MB991217 Steering linkage puller	13–006	Lower arm ball joint removal
	MB990326 Preload socket	EMB990326	Lower arm ball joint rotation starting torque measurement
	MB990800 Ball joint remover and installer	E2M15–2	Dust cover installation

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ON-VEHICLE SERVICE

FRONT WHEEL ALIGNMENT CHECK AND ADJUSTMENT

Measure wheel alignment with alignment equipment on a level surface.
The front suspension, steering system, and wheels should be serviced to normal condition prior to measurement of wheel alignment.

TOE-IN

Standard value: 0 ± 3 mm

NOTE
1. If the toe-in is not within the standard value, adjust the toe-in by undoing the clips and turning the left and right tie rod turnbuckles by the same amount (in opposite directions).
2. The toe will move out as the left turnbuckle is turned toward the front of the vehicle and the right turnbuckle is turned toward the rear of the vehicle.

STEERING ANGLE

Standard value:
Inner wheel 39°00' ± 2°
Outer wheel 30°30'

CAMBER AND CASTER

Standard value:
Camber 0°00' ± 30' (Left/right deviation within 30')
Caster 3°00' ± 0°30' (Left/right deviation within 30')

NOTE
1. Camber and caster are preset at the factory and cannot be adjusted.
2. If camber is not within the standard value, check and replace bent or damaged parts.
3. For vehicles with aluminium type wheels, attach the camber/caster/kingpin gauge to the drive shaft by using the special tool. Tighten the special tool to the same torque [196–255 Nm] as the drive shaft nut.

   Caution
   Never subject the wheel bearings to the vehicle load when the drive shaft nuts are loosened.

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STRUT ASSEMBLY

REMOVAL AND INSTALLATION

Post-installation Operation
- Front Wheel Alignment Adjustment (Refer On vehicle service.)

12TE006A

Removal steps
1. Brake hose
2. Front speed sensor wiring clamp <Vehicles with ABS>
3. ▶A◀ Strut lower mounting bolt
4. Strut upper mounting nuts
5. Strut assembly

REMOVAL SERVICE POINT

▶A◀ BOLT REMOVAL

1. Suspend the lower arm from the vehicle with wire.
2. Remove the strut and knuckle connection.

INSPECTION

- Check for oil leaks from the strut assembly.
- Check the strut assembly shock absorber for damage or deformation.

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STRUT ASSEMBLY

DISASSEMBLY AND REASSEMBLY

Post-installation Operation
- Front Wheel Alignment Adjustment (Refer On vehicle service.)

NOTE:
Worn springs and struts should always be replaced as pairs

Disassembly steps

1. Dust cover
2. ◀A▶ ▶A◀ Self locking nut
3. Strut insulator
4. Upper spring seat
5. Upper spring pad
6. Bump rubber
7. Dust cover
8. Coil spring
9. Lower spring pad
10. Strut assembly

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DISASSEMBLY SERVICE POINTS

◀A▶ SELF-LOCKING NUT REMOVAL

1. Whilst holding the spring upper seat with the special tool loosen the self-locking nut.

   Caution
   The self-locking nut should be loosened only, not removed, and should never be loosened using an air tool.

2. Using the special tools, compress the coil spring, and then remove the self-locking nut.

NOTE
1. Extend the special tool to the maximum length to which it is able to be fitted to the spring.
2. Ensure that the special tool is installed evenly.

Caution
Never use an air tool to tighten the special tool.

REASSEMBLY SERVICE POINTS

▶A◀ SELF-LOCKING NUT INSTALLATION

1. Line up the holes in the strut assembly spring lower seat with the holes in the spring upper seat.

   NOTE
   Aligning of the holes in the strut assembly can be easily achieved by using a steel bar 10mm x 300mm.

2. With the coil spring held compressed by the special tools (MB991237 and MB991238), temporally tighten the self-locking nut.
3. Correctly align both ends of the coil spring with grooves in the spring seat, and then loosen the special tools MB991237 and MB991238.
4. Using the special tool, tighten the strut insulator to the specified torque [60–70 Nm].

   NOTE
   Do not use an air tool to tighten the strut insulator.

5. Apply multi-purpose grease to the bearing part of the strut insulator, and install the insulator cap.

   Caution
   When applying the grease, take care that grease does not come into contact with the insulator's rubber components as this will cause the rubber to deteriorate.

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LOWER ARM

REMOVAL AND INSTALLATION

Removal steps

1. Stabiliser link mounting nuts
2. Stabiliser link
3. Self-locking nut
4. Lower arm mounting nut and bolt
5. Bolts
6. Lower arm assembly
7. Ball joint dust cover
8. Self-locking nut
9. Clamp

◀A▶

▶A◀

Caution

***: Indicates parts which should be temporarily tightened, and then fully tightened with the vehicle on the ground in the unladen condition.**

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REMOVAL SERVICE POINTS

◀A▶ DISCONNECTION OF LOWER ARM BALL JOINT AND KNUCKLE

Caution

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

INSTALLATION SERVICE POINTS

▶A◀ SELF-LOCKING NUT INSTALLATION

1. After positioning the clamp at the angle indicated, install the self-locking nut.

INSPECTION

- Check the bushings for wear and deterioration.
- Check the lower arm for bends or damage.
- Check the ball joint dust cover for cracks.
- Check all bolts for condition and straightness.
- Check clamp for deterioration or damage.

BALL JOINT STARTING TORQUE CHECK

Standard value: 10.0–22.0 Nm

BALL JOINT DUST COVER REPLACEMENT

1. Remove the dust cover.
2. Apply multipurpose grease to the lip and inside of the dust cover.

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3. Using the special tool, drive in the dust cover to the position shown in the illustration.

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STABILISER BAR

REMOVAL AND INSTALLATION

Pre-removal Operations
- Removal of front exhaust pipe (Refer Group 15.)
- Removal of lower arm (Refer On vehicle service.)

12TE003A
12TE009A

Removal steps

1. Stabiliser link mounting nut
2. Stabiliser link
3. ▶A◀ Stabiliser bar bracket
4. Bushing
5. Stabiliser bar

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INSTALLATION SERVICE POINT

▶A◀ STABILISER BAR BRACKET INSTALLATION

Position the stabiliser bar so that the marking on the stabiliser bar and the edge of the bracket becomes the reference value, and then tighten the stabiliser bar bracket mounting bolt.

Reference value: Approx. 10 mm

INSPECTION

- Check the bushings for wear and deterioration.
- Check the stabiliser bar for deterioration or damage.
- Check the stabiliser link ball joint dust cover for cracks.
- Check all bolts for condition and straightness.

STABILISER LINK BALL JOINT STARTING TORQUE CHECK

Standard value: 1.7–3.2 Nm

BALL JOINT DUST COVER REPLACEMENT

1. Remove the clip ring and the dust cover.

2. Apply multipurpose grease to the lip and inside of the dust cover.

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3. Use vinyl tape on the stabiliser link threads as shown in the illustration, and then install the dust cover to the stabiliser link.
4. Secure the dust cover by the clip ring.

   NOTE
   When installing the clip ring, align the ends at a 90° angle from the axis of the stabiliser link.

34 REAR SUSPENSION

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GENERAL INFORMATION

A multi-link type of suspension has been adopted for the rear suspension. The layout of each arm and the rigidity balance of each bushing have been rationalised to provide both excellent steering stability and riding comfort.

COIL SPRING

NOTE:
Worn springs are only to be fitted in pairs, according to the colour code.

SHOCK ABSORBER

Stroke	182 mm

CONSTRUCTION DIAGRAM

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SERVICE SPECIFICATIONS

Items	Standard value
Toe-in mm	3 ± 3
Toe angle (per wheel)	16’ ± 16’
Camber – 205/65R15 Tyre – 215/60R16 Tyre	– 40′ ± 30′ – 50′ ± 30′
Toe control arm ball joint breakaway torque Nm	0.1–2.65

SPECIAL TOOLS

Tool	Number	Name	Use
	MB991004 Wheel alignment gauge attachment	–	Wheel alignment measurement
	MB991237 Spring compressor body MB991239 Arm set	– –	Coil spring removal and installation
	MB991113 or MB991217 Steering linkage puller	13–006	Ball joint disconnection
	MB990326 Preload socket	EMB990326	Ball joint rotating torque check
	MB990800 Ball joint remover and installer	E2M15–2	Dust cover installation

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ON-VEHICLE SERVICE

REAR WHEEL ALIGNMENT CHECK AND ADJUSTMENT

Measure the wheel alignment with the vehicle parked on level ground.
The rear suspension and wheels should be serviced to the normal condition prior to measurement of wheel alignment.

TOE-IN

Standard value: 3 ± 3 mm

Adjustment is carried out by turning the toe control arm mounting bolt to the left or right by equal amounts.

L.H.: Turning clockwise toe-out direction

R.H.: Turning clockwise toe-in direction

One Scale mark is equivalent to a change of about 1.7mm.

Caution:
- **Adjustments are to be made within the range of ± 90° from the position indicated in the diagram.**

CAMBER

Standard value:
With 205/65R15 Tyres – 40′± 30′
With 215/60R16 Tyres – 50′± 30′

NOTE
1. Camber is preset at the factory and cannot be adjusted.
2. If camber is not within the standard value, check and replace bent or damaged parts.

3. For vehicles with aluminium type wheels, attach the camber/caster/kingpin gauge by using the special tool. Tighten the special tool to the same torque [196–255 Nm] as the drive shaft nut.

   Caution
   Never subject the wheel bearings to the full vehicle load when the flange nuts are loosened.

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REAR SUSPENSION ASSEMBLY

REMOVAL AND INSTALLATION

Pre-removal Operation
- Rear Seat Removal (Refer Group 52A.)
- Centre Exhaust Pipe Removal (Refer Group 15.)

Post-installation Operation
- Centre Exhaust Pipe Installation (Refer Group 15.)
- Rear Seat Installation (Refer Group 52A.)
- Parking Brake Lever Stroke Check (Refer Group 36.)
- Wheel Alignment Check and Adjustment (Refer On vehicle service.)

Removal steps
1. Shock absorber mounting nuts
2. Brake calliper assembly
3. Brake disc
4. Parking brake cable end (Refer Group 36.)
5. Rear speed sensor connector
6. Upper arm bracket mounting bolt
7. Grommet

◀A▶

8. Trailing arm mounting bolt
9. Crossmember mounting self-locking nuts
10. Rear suspension assembly

Caution
*** Indicates parts which should be temporarily tightened, and then full tightened with the vehicles on the ground in the unladen condition.**

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REMOVAL SERVICE POINT

◀A▶ CROSSMEMBER MOUNTING SELF-LOCKING NUT REMOVAL

After supporting the crossmember with a garage jack or transmission jack respectively, remove the crossmember mounting nuts.

INSPECTION

- Check crossmember for cracks or other damage.

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UPPER ARM ASSEMBLY

REMOVAL AND INSTALLATION

Post-installation Operation
- Wheel Alignment Check and Adjustment (Refer On vehicle service.)

17TE007A

Removal steps
1. Upper arm and knuckle connecting bolt and nut
2. Upper arm assembly mounting bolts
3. Upper arm assembly
4. Upper arm bracket

▶A◀

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INSTALLATION SERVICE POINT

▶A◀ UPPER ARM BRACKET INSTALLATION

Tighten the upper arm bracket installation nut and bolt so that the dimension shown in the illustration is at the standard value.

Standard value: 37.2 ± 2 mm

NOTE
If the upper arm bracket is installed with the former-mentioned standard value, the reference dimension is determined as follows;

A: 213.5 mm
B: 269.2 mm

INSPECTION

- Check the bushings for wear and deterioration.
- Check the upper arm for bends or damage.
- Check all bolts for condition and straightness.

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TRAILING ARM ASSEMBLY

REMOVAL AND INSTALLATION

Post-installation Operation
- Wheel Alignment Check and Adjustment (Refer On vehicle service.)

Removal steps
1. Connection for knuckle and trailing arm assembly
2. Grommet
3. Trailing arm assembly mounting bolt
4. Stopper
5. Trailing arm assembly

Caution
*** Indicates parts which should be temporarily tightened, and then fully tightened with the vehicles on the ground in the unladen condition.**

INSPECTION

- Check the bushings for wear and deterioration.
- Check the trailing arm for bends or damage.

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LOWER ARM AND TOE CONTROL ARM ASSEMBLIES

REMOVAL AND INSTALLATION

Post-installation Operation
- Wheel Alignment Check and Adjustment (Refer On vehicle service.)

Lower arm assembly removal steps

1. Lower arm assembly and knuckle connection
2. Lower arm assembly mounting bolt
3. Lower arm assembly

Toe control arm assembly removal steps

◀A▶ 4. Connection for toe control arm ball joint joint and knuckle

◀B▶ 5. Toe control arm assembly mounting bolt

6. Toe control arm assembly

Caution

*** Indicates parts which should be temporarily tightened, and then fully tightened with the vehicle on the ground in the unladen condition.**

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REMOVAL SERVICE POINTS

◀A▶ DISCONNECTION OF TOE CONTROL ARM BALL JOINT AND KNUCKLE

Caution

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

◀B▶ TOE CONTROL ARM ASSEMBLY MOUNTING BOLT REMOVAL

Make mating marks on the toe control arm and eccentric cam bolt before removing the bolt.

INSPECTION

- Check the bushings for wear and deterioration.
- Check the lower arm or toe control arm for bends or damage.
- Check the ball joint dust cover for cracks.
- Check all bolts for condition and straightness.

BALL JOINT BREAKAWAY TORQUE CHECK

Standard value: 0.1–2.65 Nm

BALL JOINT DUST COVER REPLACEMENT

1. Remove the dust cover.
2. Apply multipurpose grease to the lip and inside of the dust cover.
3. Drive in the dust cover with special tool until it is fully seated.

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SHOCK ABSORBER ASSEMBLY

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Rear Seat Removal and Installation (Refer Group 52A.)

Removal steps
1. Flange nut
2. Bolt
3. Shock absorber

INSPECTION

- Check the rubber parts for cracks and wear.
- Check the shock absorber for malfunctions, oil leakage or abnormal noise.

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DISASSEMBLY AND REASSEMBLY

A12X0083

Disassembly steps

1. Cap
◀A▶ ▶C◀ 2. Self-locking nut
3. Washer
4. Upper bushing A
▶B◀ 5. Bracket
6. Spring pad
7. Upper bushing B
8. Collar
9. Cup
10. Dust cover
11. Bump rubber
▶A◀ 12. Coil spring
13. Shock absorber assembly

DISASSEMBLY SERVICE POINT

◀A▶ SELF LOCKING NUT REMOVAL

1. Compress the coil spring using the special tools.

   NOTE
   Install the special tools evenly, and so that the maximum length will be attained within the installation range.

   Caution
   An air tool should not be used for the tightening of the special tool bolt.

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2. While holding the piston rod, remove the self-locking nut.

   Caution
   An air tool should not be used for the removal of the special tool bolt.

REASSEMBLY SERVICE POINTS

▶A◀ COIL SPRING INSTALLATION

1. Use the special tools (MB991237 and MB991239) to compress the coil spring and install it to the shock absorber seat.
2. Align the edge of the coil spring to the stepped part of the shock absorber spring seat.

   Caution
   An air tool should not be used for the tightening of the special tool bolt.

▶B◀ BRACKET INSTALLATION

Install the bracket as shown in the illustration.

▶C◀ SELF-LOCKING NUT INSTALLATION

1. Temporarily tighten the self-locking nut.
2. Remove the special tools (MB991237, MB991239), and tighten the self-locking nut to the specified torque.

   Caution
   Do not use an air tool.

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STABILIZER BAR

REMOVAL AND INSTALLATION

17AE010N
17AE011N

DISASSEMBLY STEPS

1. Stabilizer link mounting nuts
2. Stabilizer link
3. ▶A◀ Stabilizer bar brackets
4. ▶A◀ bushing
5. ▶A◀ Stabilizer

INSTALLATION SERVICE POINTS

▶A◀ STABILIZER BAR/BUSHING/STABILIZER BAR BRACKET INSTALLATION

INSPECTION

- Check the bushings for wear and deterioration.
- Check the stabilizer bar for deterioration or damage.
- Check the stabilizer link ball joint dust cover for cracks.
- Check all bolts for condition and straightness.

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STABILIZER LINK BALL JOINT BREAKAWAY TORQUE CHECK

Standard Value: 0.5–1.5 Nm

BALL JOINT DUST COVER REPLACEMENT

1. Remove the clip ring and the dust cover.

2. Apply multi-purpose grease to the lip and inside of the dust cover.

3. Use vinyl tape to tape the stabilizer link where shown in the illustration, and then install the dust cover to the stabilizer link.
4. Secure the dust cover with the clip ring.

   NOTE: When installing the clip ring, align it so that its ends are located at a 90° angle from the axis of the stabilizer link.

34A REAR SUSPENSION <WAGON>

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REAR SUSPENSION ASSEMBLY
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GENERAL INFORMATION

The rear suspension uses a rigid axle retained by upper and lower control arms. Lateral location of the axle is maintained by the lateral rod.
Coil springs are mounted between the axle and the body. Monorate springs are used to ensure good ride and handling characteristics, for all load carrying requirements.

COIL SPRING

NOTE:
Worn springs are only to be fitted in pairs, according to the colour code.

SHOCK ABSORBER

Stroke	184 mm

CONSTRUCTION DIAGRAM

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SERVICE SPECIFICATIONS

Items	Standard value
Toe-in mm	3 ± 3
Camber Maximum difference per side	– 40′ ± 30′ 30’

SPECIAL TOOLS

Tool	Tool number and name	Supersession	Application
	E17M15 Bush remover and installer kit	–	Removing and installing rear suspension bushes.
	E17M17–1 Receiver adaptor	–	Removal and installation of lateral rod bushes.

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ON-VEHICLE SERVICE

LOWER CONTROL ARM BUSH REPLACEMENT

1. Use special tool kit E17M15 to remove the front and rear bushes.

2. Use tool kit E17M15 to install the new front bush into the chamfered end of the bush hole in the control arm ensuring the large cut out in the bush faces the rear of the vehicle. When installed ensure that the bush projects equally past either side of the arm.

3. Use tool kit E17M15 to install the new rear bush, tool E17M15–14 should be used to guide and compress the new bush during installation. Lubricate the bush, sleeve and bush hole with soapy solution prior to installation.

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4. When installed ensure that the bush projects equally past either side of the arm.

LATERAL ROD BUSH REPLACEMENT

1. Using special tools E17M15–16,E17M15–19 and E17M17–1 to press out the lateral rod bush and then press fit the new bush, ensuring that the projection is equal on both sides.

UPPER CONTROL ARM BUSH REPLACEMENT

1. Remove the bushes with the aid of special tools E17M15–11, E17M15–20, E17M15–21 and W17M15–12. Install the bushes with the same tools as above with the addition of special tool E17M15–15.

2. When installed ensure that the bush projects equally past either side of the arm.

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REAR SUSPENSION ASSEMBLY

REMOVAL AND INSTALLATION

Pre-removal Operation
- Rear wheel sensor <Vehicle with ABS> (Refer Group 35B.)

Post-installation Operation
- Rear wheel speed sensor <Vehicles with ABS> (Refer Group 35B.)
- Parking brake lever stroke adjustment (refer Group 36.)

Removal steps
1. Brake calliper assembly
2. Brake disc
3. Hub
4. ◀A▶ Parking brake cable end
5. Splash shield and park brake assembly
6. ◀B▶ Lateral rod
7. ◀B▶ ▶B◀ Upper control arms
8. ◀B▶ Rear shock absorbers
9. ◀C▶ ▶A◀ Springs
10. Sway bar
11. Lower control arms
12. Axle assembly

Caution
*** Indicates parts which should be temporarily tightened, and then fully tightened with the vehicles on the ground in the unladen condition.**

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REMOVAL SERVICE POINTS

◀A▶ PARK BRAKE CABLE END

1. Loosen the park brake cable adjusting nut all the way to the cable rod as shown in the illustration.

2. Push the cable towards the rear of the vehicle to release the park brake cable end from the actuator lever.

◀B▶ LATERAL ROD / UPPER CONTROL ARMS / REAR SHOCK ABSORBERS

1. Support the rear axle on a jack, raised sufficiently to relieve tension on the lateral rod, control arms and shock absorbers, then remove the components.

◀C▶ REAR SPRINGS

1. After removing the shock absorbers use caution lowering the rear axle and remove the springs.

INSPECTION

CONTROL ARMS

- Check the upper and lower control arms for bends, cracks and damage.
- Check each bush for deterioration, cracks and spalling.

  NOTE:
  The control arm bushings should not be removed unless they are worn or damaged and if removed they must be replaced with new ones.

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COIL SPRINGS

- Check springs for bends, cracks and deterioration.
- Check the spring pad and axle bumper rubber for cracks and damage.

SHOCK ABSORBERS

- Manually move the absorber assembly throughout its full stroke. The absorber assembly must move smoothly, with uniform resistance.
- Check bushings for deterioration and cracks.
- Check for leaks.

LATERAL ROD

- Check for bends, cracks or damage.
- Check bushings for damage, wear or distortion.

REAR AXLE

- Check for distortion, bends, cracks and damage.

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REASSEMBLY SERVICE POINTS

▶A◀ UPPER CONTROL ARMS

1. When installing the upper control arms ensure that the attaching bolts are positioned in the direction as shown in the installation diagram. Torque all upper control arm attaching bolts to 230 Nm.

▶B◀ REAR SPRINGS

1. Install the springs with the small end to the top and ensure the step in the pad aligns with the end of the spring.

34B REAR SUSPENSION <AWD>

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GENERAL INFORMATION

A multi-link type of suspension has been adopted for the rear suspension. The layout of each arm and the rigidity balance of each bushing have been rationalised to provide both excellent steering stability and riding comfort.

COIL SPRING

NOTE:
Worn springs are only to be fitted in pairs, according to the colour code.

SHOCK ABSORBER

Stroke	182 mm

CONSTRUCTION DIAGRAM

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SERVICE SPECIFICATIONS

Items	Standard value
Toe-in mm	3 ± 3
Toe angle (per wheel)	16’ ± 16’
Camber – 215/60R16 Tyre	– 50′ ± 30′
Toe control arm ball joint breakaway torque Nm	0.1–2.65

SPECIAL TOOLS

Tool	Number	Name	Use
	MB991004 Wheel alignment gauge attachment	–	Wheel alignment measurement
	MB991237 Spring compressor body MB991239 Arm set	– –	Coil spring removal and installation
	MB991113 or MB991217 Steering linkage puller	13–006	Ball joint disconnection
	MB990326 Preload socket	EMB990326	Ball joint rotating torque check
	MB990800 Ball joint remover and installer	E2M15–2	Dust cover installation

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ON-VEHICLE SERVICE

REAR WHEEL ALIGNMENT CHECK AND ADJUSTMENT

Measure the wheel alignment with the vehicle parked on level ground.
The rear suspension and wheels should be serviced to the normal condition prior to measurement of wheel alignment.

TOE-IN

Standard value: 3 ± 3 mm

Adjustment is carried out by turning the toe control arm mounting bolt to the left or right by equal amounts.

L.H.: Turning clockwise toe-out direction

R.H.: Turning clockwise toe-in direction

One Scale mark is equivalent to a change of about 1.7mm.

Caution:
- **Adjustments are to be made within the range of ± 90° from the position indicated in the diagram.**

CAMBER

Standard value:
With 215/60R16 Tyres – 50′± 30′

NOTE
1. Camber is preset at the factory and cannot be adjusted.
2. If camber is not within the standard value, check and replace bent or damaged parts.

3. For vehicles with aluminium type wheels, attach the camber/caster/kingpin gauge by using the special tool. Tighten the special tool to the same torque [196–255 Nm] as the drive shaft nut.

   Caution
   Never subject the wheel bearings to the full vehicle load when the flange nuts are loosened.

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REAR SUSPENSION ASSEMBLY

REMOVAL AND INSTALLATION

Pre-removal Operation
- Rear Seat Removal (Refer Group 52A.)
- Rear Shelf Trim Removal (Refer Group 52A.)
- Centre Exhaust Pipe Removal (Refer Group 15.)

Post-installation Operation
- Centre Exhaust Pipe Installation (Refer Group 15.)
- Rear Seat Installation (Refer Group 52A.)
- Rear Shelf Trim Installation (Refer Group 52A.)
- Parking Brake Lever Stroke Check (Refer Group 36.)
- Wheel Alignment Check and Adjustment (Refer On vehicle service.)

Removal steps
1. Cap
2. Shock absorber mounting nuts
3. Brake calliper assembly
4. Rear speed sensor
5. Rear brake disc
6. Parking brake cable end (Refer Group 36.)
◀A▶ ▶A◀ 7. Propeller shaft connection
8. Upper arm bracket mounting bolt
9. Grommet
10. Trailing arm mounting bolt
◀B▶ 11. Crossmember mounting self-locking nuts
12. Rear suspension assembly

Caution
*** Indicates parts which should be temporarily tightened, and then full tightened with the vehicles on the ground in the unladen condition.**

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REMOVAL SERVICE POINT

◀A▶ PROPELLER SHAFT REMOVAL

1. Make mating marks on the companion flange of the differential carrier and the flange yoke of the propeller shaft.
2. Remove the fitting bolts and nuts of the differential carrier and propeller shaft.

◀B▶ CROSSMEMBER MOUNTING SELF-LOCKING NUT REMOVAL

After supporting the crossmember with a garage jack or transmission jack respectively, remove the crossmember mounting nuts.

INSPECTION

- Check crossmember for cracks or other damage.

INSTALLATION SERVICE POINT

▶A◀ PROPELLER SHAFT

Align the mating marks on the differential carrier and the propeller shaft to install.

Caution
Remove oil, grease, etc. from the threads of the nuts and bolts to prevent from damage and loosening.

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UPPER ARM ASSEMBLY

REMOVAL AND INSTALLATION

Post-installation Operation
- Wheel Alignment Check and Adjustment (Refer On vehicle service.)

17TE007A

Removal steps
1. Upper arm and knuckle connecting bolt and nut
2. Upper arm assembly mounting bolts
3. Upper arm assembly
4. Upper arm bracket

▶A◀

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INSTALLATION SERVICE POINT

▶A◀ UPPER ARM BRACKET INSTALLATION

Tighten the upper arm bracket installation nut and bolt so that the dimension shown in the illustration is at the standard value.

Standard value: 37.2 ± 2 mm

NOTE
If the upper arm bracket is installed with the former-mentioned standard value, the reference dimension is determined as follows;

A: 213.5 mm
B: 269.2 mm

INSPECTION

- Check the bushings for wear and deterioration.
- Check the upper arm for bends or damage.
- Check all bolts for condition and straightness.

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TRAILING ARM ASSEMBLY

REMOVAL AND INSTALLATION

Post-installation Operation
- Wheel Alignment Check and Adjustment (Refer On vehicle service.)

Removal steps
1. Connection for knuckle and trailing arm assembly
2. Grommet
3. Trailing arm assembly mounting bolt
4. Stopper
5. Trailing arm assembly

Caution
*** Indicates parts which should be temporarily tightened, and then fully tightened with the vehicles on the ground in the unladen condition.**

INSPECTION

- Check the bushings for wear and deterioration.
- Check the trailing arm for bends or damage.

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LOWER ARM AND TOE CONTROL ARM ASSEMBLIES

REMOVAL AND INSTALLATION

Post-installation Operation
- Wheel Alignment Check and Adjustment (Refer On vehicle service.)

Lower arm assembly removal steps

1. Lower arm assembly and knuckle connection
2. Lower arm assembly mounting bolt
3. Lower arm assembly

Toe control arm assembly removal steps

◀A▶ 4. Connection for toe control arm ball joint joint and knuckle

◀B▶ 5. Toe control arm assembly mounting bolt

6. Toe control arm assembly

Caution

*** Indicates parts which should be temporarily tightened, and then fully tightened with the vehicle on the ground in the unladen condition.**

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REMOVAL SERVICE POINTS

◀A▶ DISCONNECTION OF TOE CONTROL ARM BALL JOINT AND KNUCKLE

Caution

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

◀B▶ TOE CONTROL ARM ASSEMBLY MOUNTING BOLT REMOVAL

Make mating marks on the toe control arm and eccentric cam bolt before removing the bolt.

INSPECTION

- Check the bushings for wear and deterioration.
- Check the lower arm or toe control arm for bends or damage.
- Check the ball joint dust cover for cracks.
- Check all bolts for condition and straightness.

BALL JOINT BREAKAWAY TORQUE CHECK

Standard value: 0.1–2.65 Nm

BALL JOINT DUST COVER REPLACEMENT

1. Remove the dust cover.
2. Apply multipurpose grease to the lip and inside of the dust cover.
3. Drive in the dust cover with the special tool until it is fully seated.

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SHOCK ABSORBER ASSEMBLY

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Rear Seat Removal and Installation (Refer Group 52A.)

Removal steps
1. Flange nut
2. Bolt
3. Shock absorber

INSPECTION

- Check the rubber parts for cracks and wear.
- Check the shock absorber for malfunctions, oil leakage or abnormal noise.

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DISASSEMBLY AND REASSEMBLY

A12X0083

Disassembly steps

1. Cap
◀A▶ ▶C◀ 2. Self-locking nut
3. Washer
4. Upper bushing A
▶B◀ 5. Bracket
6. Spring pad
7. Upper bushing B
8. Collar
9. Cup
10. Dust cover
11. Bump rubber
▶A◀ 12. Coil spring
13. Shock absorber assembly

DISASSEMBLY SERVICE POINT

◀A▶ SELF LOCKING NUT REMOVAL

1. Compress the coil spring using the special tools.

   NOTE
   Install the special tools evenly, and so that the maximum length will be attained within the installation range.

   Caution
   An air tool should not be used for the tightening of the special tool bolt.

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2. While holding the piston rod, remove the self-locking nut.

REASSEMBLY SERVICE POINTS

▶A◀ COIL SPRING INSTALLATION

1. Use the special tools (MB991237 and MB991239) to compress the coil spring and install it to the shock absorber seat.
2. Align the edge of the coil spring to the stepped part of the shock absorber spring seat.

Caution
An air tool should not be used for the tightening of the special tool bolt.

▶B◀ BRACKET INSTALLATION

Install the bracket as shown in the illustration.

▶C◀ SELF-LOCKING NUT INSTALLATION

1. Temporarily tighten the self-locking nut.
2. Remove the special tools (MB991237, MB991239), and tighten the self-locking nut to the specified torque.

Caution
Do not use an air tool.

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STABILIZER BAR

REMOVAL AND INSTALLATION

17AE010N
17AE011N

DISASSEMBLY STEPS

1. Stabilizer link mounting nuts
2. Stabilizer link
3. ▶A◀ Stabilizer bar brackets
4. ▶A◀ bushing
5. ▶A◀ Stabilizer

INSTALLATION SERVICE POINTS

▶A◀ STABILIZER BAR/BUSHING/STABILIZER BAR BRACKET INSTALLATION

INSPECTION

- Check the bushings for wear and deterioration.
- Check the stabilizer bar for deterioration or damage.
- Check the stabilizer link ball joint dust cover for cracks.
- Check all bolts for condition and straightness.

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STABILIZER LINK BALL JOINT BREAKAWAY TORQUE CHECK

Standard Value: 0.5–1.5 Nm

BALL JOINT DUST COVER REPLACEMENT

1. Remove the clip ring and the dust cover.

2. Apply multi-purpose grease to the lip and inside of the dust cover.

3. Use vinyl tape to tape the stabilizer link where shown in the illustration, and then install the dust cover to the stabilizer link.
4. Secure the dust cover with the clip ring.

   NOTE: When installing the clip ring, align it so that its ends are located at a 90° angle from the axis of the stabilizer link.

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35B ANTI-LOCK BRAKING SYSTEM (ABS)

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GENERAL INFORMATION

The brake system has high reliability and durability which maintains excellent braking performance. The main features are as follows.

- A dual type master cylinder is equipped on all models.
- A tandem type brake booster has been adopted.
- Floating caliper, single piston, ventilated disc brakes have been adopted as the front brakes.
- Each rear disc brake is equipped with floating caliper, single piston and solid disc.

CONSTRUCTION DIAGRAM

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GENERAL SPECIFICATIONS

Items		
Master cylinder	I.D. mm	25.4
Brake booster	Effective dia. of power cylinder mm	203 /230
	Boosting ratio	6.5 :1
Proportioning valve	Decompression ratio	0.25
Front brakes	Disc effective dia. mm	276
	Disc thickness, mm	24
	Pad thickness, mm	7.9
	Wheel cylinder I.D. mm	60.52
Rear disc brakes	Disc effective dia. mm	258
	Disc thickness, mm	10.4 ± 1
	Pad thickness, mm	8.8
	Wheel cylinder I.D. mm	38.2

SERVICE SPECIFICATIONS

Items		Standard value	Limit
Brake pedal height mm		168–173	–
Brake pedal free play mm		3–8	–
Brake pedal to floorboard clearance mm		85 or more	–
Output pressure of proportioning valve MPa	Split point	2.2–2.7	–
	Output fluid pressure	3.4–3.9	–
Left/right proportioning valve output pressure difference MPa		–	0.4
Front disc brake pad thickness mm		7.9	1.0
Front disc brake drag force (tangential force of wheel mounting bolts) N		69 or less	–
Front brake disc thickness mm		24	22.4
Front brake disc run-out mm		–	0.05
Front hub end play mm		–	0.05
Rear disc brake pad thickness mm		8.8	1.0
Rear disc brake drag force (tangential force of wheel mounting bolts) N		69 or less	–
Rear brake disc thickness mm		10.4	8.4
Rear brake disc run-out mm		–	0.05

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LUBRICANTS

Items	Specified lubricant
Brake fluid	DOT4
Brake piston seal	Repair kit grease (orange)
Slide pin boot and slide pin bush inner surfaces	
Brake piston boot inner surfaces	
Lock pin boot inner surfaces	
Guide pin boot inner surfaces	
Pad assembly and shim contact surface	
Piston boot mounting grooves	
Piston cup surface	

SEALANT

Items	Specified sealant	Remarks
Thread part fitting	3M ATD Part No. 8661 or equivalent	Semi-drying sealant
Vacuum switch		

SPECIAL TOOLS

Tool	Tool number and name	Supersession	Application
	MB990964 MB990520 MB990619 Brake tool set	–	Compressing front disc brake piston Installation of drum brake wheel cylinder piston cup
	E2M45A Front hub remover and installer	–	Removal and installation of front hub

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ON-VEHICLE SERVICE

BRAKE PEDAL HEIGHT CHECK

1. Measure the brake pedal height as illustrated.

NOTE: Brake pedal height is non-adjustable.

NOTE: Ensure stop light switch is adjusted correctly before measuring brake pedal height.

Standard value (A): 163–173 mm

2. With the engine stopped, press the brake pedal two or three times. After eliminating the vacuum in the power brake booster, press the pedal down by hand, and confirm that the amount of movement before feeling resistance (the free play) is within the standard value range.

   Standard value (B): 3–8 mm

   If the free play exceeds the standard value, it is probably due to excessive play between the clevis pin and brake pedal arm.
   Check for excessive clearance and replace faulty parts as required.

3. Depress the brake pedal with approximately 196 N (45 lbs.) of force, and measure the clearance between the brake pedal and the floorboard. Calculate the difference between the brake pedal height and the depressed height.

   Standard value (C): 65 mm or less

   If the clearance is more than the standard value, check for air trapped in the brake line.
   Adjust and replace defective parts as required.

STOP LIGHT SWITCH ADJUSTMENT

(1) Turn the stop light switch anticlockwise 1/8 turn to release the switch.
(2) Push the switch through the retaining clip until the switch plunger body just contacts the brake pedal stopper.
(3) Turn switch 1/8 turn clockwise to securely lock the switch.
(4) Check to be sure that the stop light is not illuminated with the brake pedal released.

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STOP LIGHT SWITCH CHECK

Connect a circuit tester to stop light switch terminals “a” and “b” and check whether or not there is continuity when the plunger of the stop light switch is pushed in and when it is released.
The stop light switch is in good condition if there is no continuity when the plunger is pushed in to a depth of within 4 mm from the outer case edge surface, and if there is continuity when it is released.

BRAKE BOOSTER OPERATING TEST

For simple checking of the brake booster operation, carry out the following tests:

1. Run the engine for one or two minutes, and then turn the engine off.
   If the pedal depresses fully the first time but gradually becomes higher when depressed succeeding times, the booster is operating properly. If the pedal height remains unchanged, the booster is defective.

2. With the engine stopped, step on the brake pedal several times.
   Then step on the brake pedal and start the engine.
   If the pedal moves downward slightly, the booster is in good condition. If there is no change, the booster is defective.

3. With the engine running, step on the brake pedal and then stop the engine.
   Hold the pedal depressed for 30 seconds. If the pedal height does not change, the booster is in good condition. If the pedal rises, the booster is defective.
   Brake booster performance is satisfactory if it passes all three operating tests.
   If the brake booster does not pass all three tests, there may be a fault in the check valve, vacuum hose or in the booster itself.

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CHECK VALVE OPERATION CHECK

1. Remove the vacuum hose.
2. Remove the check valve.
3. Check the operation of the check valve by using a vacuum pump.

Vacuum pump connection	Accept/reject criteria
Connection at the brake booster side (A)	A negative pressure (vacuum) is created and held.
Connection at the intake manifold side (B)	A negative pressure (vacuum) is not created.

Caution
If the check valve is defective, replace it as an assembly, never attempt to disassemble it.

PROPORTIONING VALVE FUNCTION TEST

1. Connect two pressure gauges, one each to the input side and output side of the proportioning valve, as shown.
2. Air bleed the brake line and the pressure gauge.
3. While gradually depressing the brake pedal, make the following measurements and check to be sure that the measured values are within the allowable range.

(1) Output pressure begins to drop relative to input pressure (split point).

Standard value:
Sedan 1.72 – 2.7 MPa
Wagon 3.68 – 4.67

(2) <SEDAN> Output fluid pressure when input fluid pressure is 7.0 MPa.

Standard value: 2.9–3.5 MPa
<WAGON> Output fluid pressure when input fluid pressure is 9.0 MPa.

Standard value: 4.8–5.45 MPa

(3) Output pressure difference between left and right brake lines

Limit: 0.4 MPa

4. If the measured pressures are not within allowable ranges, replace the proportioning valve.

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BRAKE FLUID LEVEL SENSOR CHECK

The brake fluid level sensor is in good condition if there is no continuity when the float surface is above “MIN” or “A” and if there is continuity when the float surface is below “MIN” or “A”.

BLEEDING

Caution

Use the specified brake fluid. Don’t use a mixture of the specified brake fluid and another non-specified fluid.

Specified brake fluid: DOT4

MASTER CYLINDER BLEEDING

The master cylinder has no check valve, so if bleeding is carried out by the following procedure, bleeding of air from the brake line will become easier.

(1) Fill the reserve tank with brake fluid.
(2) Keep the brake pedal depressed.
(3) Have another person cover the master cylinder outlet with a finger.
(4) With the outlet still closed, release the brake pedal.
(5) Repeat steps 2.–4. three or four times to fill the inside of the master cylinder with brake fluid.

BRAKE LINE BLEEDING

Start the engine and bleed the air in the sequence shown in the figure.

FRONT DISC BRAKE PAD CHECK AND REPLACEMENT

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FRONT DISC BRAKE PAD INSPECTION

1. Check brake pad thickness through caliper body check port.

   Standard value: 7.9 mm
   Limit: 1.0 mm

   Caution
   1. When the limit is exceeded, the brake pads on both the left and right wheels must be replaced as a set.
   2. If there is a significant difference in the thicknesses of the pads on the left and right sides, check the sliding condition of the piston, lock pin and guide pin.

2. Remove guide lower pin locking bolt. Lift caliper assembly upwards and support it with wires.

   Caution
   Do not wipe off the special grease that is on the guide pin or allow it to contaminate the bolt thread.

3. Remove the following parts from caliper support.
   1. Pad assembly
   2. Pad assembly
   3. Outer shim (stainless)
   4. Inner shim (coated with rubber)
   5. Outer shim (stainless)
   6. Inner shim (coated with rubber)

   NOTE
   Shims must be cleaned and inspected for serviceability, if found to be unserviceable new shims must be fitted.

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4. Take out the drive shaft.
   (Refer Group 26.)
5. Set the special tool to the front hub assembly as shown in the illustration.

6. Measure hub torque (A) with pads removed to measure brake drag torque. Torque value will be used later to calculate brake drag force with the pads installed.

   NOTE
   Tighten the nuts in order to secure the disc to the hub.
7. Fit the pad clip and pads to the caliper support.

8. Clean piston and push into cylinder (caliper) with special tool.
9. Be careful that the piston boot does not catch and tear as the caliper assembly is swung into position. Replace guide pin locking bolt and torque dry to the specified torque.

10. Check brake drag torque as follows.
    (1) Start engine and hold brake pedal down for 5 seconds. [Pedal depression force: approx. 196 N]
    (2) Stop engine.
    (3) Turn brake disc forward 10 times.
    (4) Check hub torque (B) with spring scale.
    (5) Calculate the drag torque of the disc brake [difference between hub torque (B) and hub torque (A)].

    Standard value:
    69 N [4 Nm] or less
11. If the difference between brake drag torque and hub torque exceeds the standard value, disassemble piston and clean the piston. Check for corrosion or worn piston seal, and check the sliding condition of the lock pin and guide pin.
12. Reinstall the drive shaft.
    (Refer Group 26.)

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DISC BRAKE ROTOR CHECK

Caution

To maintain safe braking performance, the disc brake rotors must be kept within allowable service specifications.

Before re-finishing or re-processing the brake disc surface, the following conditions should be checked.

Inspection items	Remarks
Scratches, rust, saturated lining materials and wear	● If the vehicle is not driven for a certain period, the sections of the discs that are not in contact with lining will become rusty, causing noise and shuddering. ● If grooves resulting from excessive disc wear and scratches are not removed prior to installing a new pad assembly, there will momentarily be inappropriate contact between the disc and the lining (pad).
Run-out or drift	Excessive run-out or drift of the discs will increase the pedal depression resistance due to piston knock-back.
Change in thickness (parallelism)	If the thickness of the disc changes, this will cause pedal pulsation, shuddering and surging.
Inset or warping (flatness)	Overheating and improper handling while servicing will cause inset or warping.

FRONT BRAKE DISC RUN-OUT CHECK

1. Remove the caliper support bolts, then raise the caliper assembly upward and secure by using wire.
2. Inspect the disc surface for grooves, cracks, and rust. Clean the disc thoroughly and remove all rust.

3. Place a dial gauge approximately 5 mm from the outer circumference of the brake disc, and measure the runout of the disc.

   Limit: 0.05 mm

   NOTE
   Tighten the nuts in order to secure the disc to the hub.

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FRONT BRAKE DISC RUN-OUT CORRECTION

1. If the run-out of the brake disc is equivalent to or exceeds the limit specification, change the phase of the disc and hub, and then measure the run-out again.
   (1) Before removing the brake disc, chalk both sides of the wheel stud on the side at which run-out is greatest.

   (2) Remove the brake disc, and then place a dial gauge as shown in the illustration; then move the hub in the axial direction and measure the play.

   Limit: 0.01 mm

   If the play is equivalent to or exceeds the limit, disassemble the hub knuckle and check each part.

   (3) If the play does not exceed the limit specification, install the brake disc at a position 180° away from the chalk mark, and then check the run-out of the brake disc once again.
2. If the run-out cannot be corrected by changing the phase of the brake disc, replace the brake disc or turn the rotor with a high quality on the car type brake lathe. Be sure to follow the exact brake lathe manufacturer instructions. Rotors turned on the vehicle will often have a lower run-out than a new brake disc.

FRONT BRAKE DISC THICKNESS CHECK

1. Using a micrometer, measure disc thickness at eight positions, approximately 45° apart and 10 mm in from the outer edge of the disc.

   Brake disc thickness
   Standard value: 24 mm
   Limit: 22.4 mm

   Thickness variation (at least 8 positions)
   The difference between any thickness measurements should not be more than 0.015 mm.
2. If the disc is beyond the limits for thickness, remove it and install a new one. If thickness variation exceeds the specification, replace the brake disc or turn the rotor with a high quality on the car type brake lathe. Be sure to follow the exact brake lathe manufacturer instructions.

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REAR DISC BRAKE PAD CHECK AND REPLACEMENT

1. Check brake pad thickness through caliper body check port.

   Standard value: 8.8 mm
   Limit: 1.0 mm

Caution
1. When the limit is exceeded, the brake pads on both the left and right wheels must be replaced as a set.
2. If there is a significant difference in the thicknesses of the pads on the left and right sides, check the sliding condition of the piston, lock pin sleeve and guide pin sleeve.

2. Remove the lower guide pin caliper bolt. Lift caliper assembly and retain with wire.

   Caution
   Do not wipe off the special grease that is on the guide pin or allow it to contaminate the bolt thread.

3. Remove the brake pads parts from the caliper support.

4. Measure hub torque (A) with pads removed to measure brake drag torque. Torque value (A) will be used later to calculate brake drag force with the pads installed.

   NOTE
   To secure the disc to the hub, tighten the nuts.

5. Clean the piston; then use the special tool to push the piston into the cylinder (caliper).
6. Be careful that the piston boot does not catch and tear as the caliper assembly is swung back into position. Replace guide pin locking bolt and torque dry to specified torque.

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7. Check brake drag torque as follows.
   (1) Start engine and hold brake pedal down for 5 seconds. [Pedal depression force: approx. 196 N]
   (2) Stop engine.
   (3) Turn brake disc forward 10 times.
   (4) Check brake hub torque (B) with spring scale.
   (5) Calculate the drag torque of the disc brake [difference between hub torque (B) and hub torque (A)].

   Standard value: 69 N [4 Nm] or less

8. If the difference between brake drag torque and hub torque exceeds the standard value, disassemble piston and clean piston. Check for corrosion or worn piston seal, and check the sliding condition of the lock pin and guide pin.

REAR BRAKE DISC THICKNESS CHECK

1. Remove dirt and rust from brake disc surface.
2. Measure disc thickness at 4 locations or more.

   Standard value: 10.4 mm
   Limit: 8.4 mm

   Replace the discs and pad assembly for both sides left and right of the vehicle if they are worn beyond the specified limit.

REAR BRAKE DISC RUN-OUT CHECK

1. Remove the caliper support, raise the caliper assembly, and secure it by using a wire, etc.
2. Place a dial gauge approximately 5 mm from the outer circumference of the brake disc, and measure the run-out of the disc.

   Limit: 0.05 mm

   NOTE
   To secure the disc to the hub, tighten the nuts.

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REAR BRAKE DISC RUN-OUT CORRECTION

1. If the run-out of the brake disc is equivalent to or exceeds the limit specification, change the phase of the disc and hub, and then measure the run-out again.

   NOTE
   The procedures for checking and changing the rear disc phase are the same as those for the front brake discs.

2. If the problem cannot be corrected by changing the phase of the brake disc, replace the disc or turn rotor using an on the car type brake lathe. Be sure to follow the exact brake lathe manufacturer instructions. Rotors turned on the vehicle will often have a lower run-out than a new brake disc.

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BRAKE PEDAL

REMOVAL AND INSTALLATION

Pre-removal Operation
- Instrument panel lower cover removal (Refer Group 52A.)
- Steering column assembly removal (Refer Group 37A.)

Post-installation Operation
- Adjust the brake pedal (Refer On vehicle service.)
- Fit the steering column assembly (Refer Group 37A.)
- Fit the lower cover of the instrument panel (Refer Group 52A.)

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Removal steps

1. Harness connector
2. Brake pedal return spring
3. R clip
4. Washer
5. Booster attaching pin
6. Stop lamp switch retainer
7. Stop lamp switch
8. Pedal support member
9. Brake pedal shaft bolt
10. Bushing
11. Spacer
12. Brake pedal
13. Pedal pad
14. Stopper

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MASTER CYLINDER AND BRAKE BOOSTER

REMOVAL AND INSTALLATION

Pre-removal Operation
- Brake Fluid Draining

Post-installation Operation
- Brake Fluid Supplying
- Brake Line Bleeding (Refer On vehicle service.)
- Brake Pedal Adjustment (Refer On vehicle service.)

Master cylinder removal steps

1. Master cylinder

Brake booster removal steps

1. Master cylinder
2. Vacuum hose
   (With built-in check valve)
3. Brake pedal
4. Washer
5. R-clip
6. Brake booster
7. Sealer

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Grease points

INSTALLATION SERVICE POINTS

BRAKE BOOSTER PUSH ROD ADJUSTMENT

NOTE:
This adjustment is factory set and should not be altered. However, if the adjustment has been disturbed the following checks and adjustments can be applied.

1. The servo must be stroked at least twice with the master cylinder in place and the engine running then allowed to return freely and stabilised for a minimum of 10 seconds prior to setting.

CAUTION:
After removing the master cylinder from the brake booster, care must be taken not to disturb the pushrod and not to depress the brake pedal. Failure to observe this caution may result in the brake booster re–action disc becoming dislodged inside the brake booster.

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2. Remove master cylinder.

3. Using a block gauge and vernier caliper, set the vernier at 9.3mm plus the thickness value of the block gauge.

Standard Value: 9.2 – 9.4 mm

4. Check the position of the push rod with the vernier set at the calculated dimension.

NOTE:
1. The measurement is to be taken on the radial face of the push rod 2.15mm from the centre.
2. Setting procedure must be carried out with 68kpa ± 5kpa of vacuum applied to the servo.

5. Adjust only if necessary by turning the pushrod screw to achieve the desired length.

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MASTER CYLINDER
DISASSEMBLY AND REASSEMBLY

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15AE058N

Disassembly steps

1. Reservoir cap assembly
2. Diaphragm
3. Brake fluid level sensor
4. Reservoir bolt
5. Reservoir
6. Reservoir seals
7. ◀A▶ ▶A◀ Piston stopper pin (ABS Vehicles)
8. ◀B▶ Piston stopper bolt (Non ABS Vehicles)
9. Gasket (Non ABS Vehicles)
10. Primary piston assembly
11. Secondary piston assembly
12. Master cylinder body

Caution
Do not disassemble the primary and secondary piston assemblies.

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DISASSEMBLY SERVICE POINT

◀A▶ PISTON STOPPER PIN REMOVAL <WITH ABS>

Remove the piston stopper pin, while depressing the piston.

◀B▶ PISTON STOPPER BOLT REMOVAL <WITHOUT ABS>

Remove the piston stopper bolt while depressing the piston.

INSPECTION

- Check the inner surface of master cylinder body for rust or pitting.
- Check the primary and secondary pistons for rust, scoring, wear or damage.
- Check the diaphragm for cracks and wear.

REASSEMBLY SERVICE POINT

▶A◀ PISTON STOPPER PIN <WITH ABS>

1. Align the relief in the secondary piston with the piston stopper pin locating hole and push the piston into the bore.

2. Push the primary piston into the bore and then while depressing the primary piston drop the piston stopper pin through the locating hole into the secondary piston relief.

   NOTE
   Ensure the pin goes all the way through the secondary piston and locates in the bottom of the master cylinder bore.

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FRONT DISC BRAKE

REMOVAL AND INSTALLATION

Pre-removal Operation
- Brake Fluid Draining

Post-installation Operation
- Brake Fluid Supplying
- Brake Line Bleeding (Refer On vehicle service.)

Removal steps

1. Connection for the brake hose
2. Gasket
3. ▶A◀ Front brake assembly
4. Brake disc

INSTALLATION SERVICE POINTS

▶A◀ FRONT BRAKE ASSEMBLY INSTALLATION

Install the front brake assembly and measure the disc brake drag torque. (Refer On vehicle service.)

INSPECTION

Check the brake disc for damage.

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DISASSEMBLY AND REASSEMBLY

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Brake caliper kit	Pad kit	Seal and boot kit

caliper Disassembly steps

1. Guide pin locking bolts
2. Guide pins
3. Boot
4. caliper support (pad, shims)
5. Piston boot ◀A▶
6. Piston ◀A▶
7. Piston seal ◀B▶
8. caliper body

Pad Disassembly steps

1. Guide pin locking bolts
2. Guide pins
3. Boot
4. caliper support (pad, shims)
9. Pad assembly
10. Pad assembly
11. Outer shim (stainless)
12. Inner shim (coated with rubber)
13. Outer shim (stainless)
14. Inner shim (coated with rubber)

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LUBRICATION POINTS

Caution
The piston seal inside the seal and boot kit is coated with special grease. Do not wipe this grease off.

Brake fluid: DOT4

Grease: Repair kit grease (orange)

Grease: Repair kit grease (orange)

Grease: Repair kit grease (orange)

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DISASSEMBLY SERVICE POINTS

When disassembling the disc brakes, disassemble both sides (left and right) as a set.

◀A▶ PISTON BOOT/PISTON REMOVAL

Protect caliper body with cloth. Blow compressed air through brake hose to remove piston boot and piston.

Caution
Blow compressed air gently.

◀B▶ PISTON SEAL REMOVAL

1. Remove piston seal with finger tip.

   Caution
   Do not use a flat-tipped screwdriver or other tool to prevent damage to inner cylinder.

2. Clean piston surface and inner cylinder with alcohol, or specified brake fluid.

   Specified brake fluid: DOT4

INSPECTION

- Check cylinder for wear, damage or rust.
- Check piston surface for wear, damage or rust.
- Check caliper body or sleeve for wear.
- Check pad for damage or adhesion of grease, check backing metal for damage.

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PAD WEAR CHECK

Measure thickness at the thinnest and worn area of the pad. Replace pad assembly when pad thickness is less than the limit value.

Standard value: 7.9 mm
Limit value: 1.0 mm

Caution

1. **When the limit is exceeded, the brake pads on both the left and right wheels must be replaced as a set.**
2. **If there is a significant difference in the thicknesses of the pads on the left and right sides, check the sliding condition of the piston and guide pin.**

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REAR DISC BRAKE

REMOVAL AND INSTALLATION

Pre-removal Operation
- Loosening Parking Brake Cable Adjusting Nut.
- Brake Fluid Draining

Post-installation Operation
- Brake Fluid Filling and Air Bleeding (Refer On vehicle service.)
- Parking Brake Lever Stroke Adjustment (Refer Group 36.)

Removal steps

1. Connection for the brake hose
2. Gasket
3. ▶A◀ Rear brake assembly
4. Brake disc

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INSTALLATION SERVICE POINT

▶A◀ REAR BRAKE ASSEMBLY INSTALLATION

Install the rear brake assembly and measure the disc brake drag torque. (Refer On vehicle service.)

INSPECTION

- Check the brake disc for damage.
- Check the brake disc for thickness.
- Check the brake disc for run-out.

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DISASSEMBLY AND REASSEMBLY

15AE062N

Caliper assembly disassembly steps

1. Guide pin locking bolts
2. Guide pin
3. Boot
4. Calliper support (pads)
5. Piston boot
6. Piston
7. Piston seal
8. caliper body

Pad assembly disassembly steps

1. Locking bolts
2. Guide pin
3. Boot
4. caliper support (pads)
9. Pad and wear indicator assembly
10. Pad assembly

A
A
B

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35 BASE

Lubrication Points

Caution
The piston seal inside the seal and boot kit is coated with special grease. Do not wipe this grease off.

Brake fluid: DOT4

Grease: Repair kit grease (orange)

Grease: Repair kit grease

DISASSEMBLY SERVICE POINTS

When disassembling the disc brakes, disassemble both sides (left and right) as a set.

◀A▶ PISTON BOOT/PISTON REMOVAL

Protect caliper body with cloth. Blow compressed air through brake hose to remove piston boot and piston.

Caution
Blow compressed air gently.

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◀B▶ PISTON SEAL REMOVAL

1. Remove piston seal with finger tip.

   Caution
   Do not use a flat-tipped screwdriver or other tool to prevent damage to inner cylinder.

2. Clean piston surface and inner cylinder with approved brake cleaning fluid, alcohol or specified brake fluid.

   Specified brake fluid: DOT4

INSPECTION

- Check cylinder for wear, damage or rust.
- Check piston surface for wear, damage or rust.
- Check caliper body or sleeve for wear.
- Check pad for damage or adhesion of grease, check backing metal for damage.

PAD WEAR CHECK

Measure thickness at the thinnest and worn area of the pad. Replace pad assembly when pad thickness is less than the limit value.

Standard value: 8.8 mm
Limit value: 1.0 mm

Caution

1. **When the limit is exceeded, the brake pads on both the left and right wheels must be replaced as a set.**
2. **If there is a significant difference in the thicknesses of the pads on the left and right sides, check the sliding condition of the piston, lock pin and guide pin.**

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PROPORTIONING VALVE <VEHICLES WITHOUT ABS>

REMOVAL AND INSTALLATION

Pre-removal Operation
- Brake Fluid Draining
- Air Intake Hose Removal

Post-installation Operation
- Brake Fluid Supplying
- Brake Line Bleeding (Refer On vehicle service.)
- Air Intake Hose Installation

Flared brake line nuts

15TE032A
15AE065N

Removal steps

▶A◀ 1. Connection for the brake pipe
2. Proportioning valve

INSTALLATION SERVICE POINT

▶A◀ BRAKE PIPE CONNECTION

Connect the pipes to the hydraulic unit as shown in the illustration.

1. Proportioning valve – Rear brake (L.H.)
2. Proportioning valve – Rear brake (R.H.)
3. Proportioning valve – Front brake (R.H.)
4. Proportioning valve – Front brake (L.H.)
5. Master cylinder (for right front and left rear)
6. Master cylinder (for left front and right rear)

35 BRAKES <AWD>

CONTENTS

GENERAL SPECIFICATIONS
SERVICE SPECIFICATIONS
FRONT DISC BRAKE
- REMOVAL AND INSTALLATION
- INSTALLATION SERVICE POINTS
- INSPECTION
- DISASSEMBLY AND REASSEMBLY
- LUBRICATION POINTS
- DISASSEMBLY SERVICE POINTS
- REASSEMBLY SERVICE POINT
- INSPECTION
- REAR DISC BRAKE PAD CHECK AND REPLACEMENT
- REAR BRAKE DISC THICKNESS CHECK
- REAR BRAKE DISC RUN-OUT CHECK
- REAR BRAKE DISC RUN-OUT CORRECTION

REAR DISC BRAKE
- REMOVAL AND INSTALLATION
- DISASSEMBLY AND REASSEMBLY
- LUBRICATION POINTS

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GENERAL SPECIFICATIONS

Items		
Master cylinder	I.D. mm	25.4
Brake booster	Effective diameter of power cylinder, mm	203 /230
	Boosting ratio	6.5 :1
Front brakes	Disc outer diameter, mm	294
	Disc thickness, mm	24
	Pad thickness, mm	10
	Caliper piston diameter, mm	2 x 42.9
Rear disc brakes	Disc outer diameter mm	284
	Disc thickness, mm	20
	Pad thickness, mm	10
	Caliper piston diameter, mm	38.1

SERVICE SPECIFICATIONS

Items	Standard value	Limit
Brake pedal height mm	168–173	–
Brake pedal free play mm	3–8	–
Brake pedal to floorboard clearance mm	85 or more	–
Front disc brake pad thickness mm	10	2.0
Front disc brake drag force (tangential force of wheel mounting bolts) N	69 or less	–
Front brake disc thickness mm	24	22.4
Front brake disc run-out mm	–	0.05
Front hub end play mm	–	0.05
Rear disc brake pad thickness mm	10	1.0
Rear disc brake drag force (tangential force of wheel mounting bolts) N	69 or less	–
Rear brake disc thickness mm	20	18.4
Rear brake disc run-out mm	–	0.05

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FRONT DISC BRAKE

REMOVAL AND INSTALLATION

Pre-removal Operation
- Brake Fluid Draining

Post-installation Operation
- Brake Fluid Supplying
- Brake Line Bleeding

REMOVAL STEPS

1. Brake hose connector bolt
2. Gasket
3. ▶A◀ Front brake assembly
4. Brake disc

INSTALLATION SERVICE POINTS

▶A◀ FRONT BRAKE ASSEMBLY INSTALLATION

Install the front brake assembly and measure the disc brake drag torque.

INSPECTION

Check the brake disc for damage.

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DISASSEMBLY AND REASSEMBLY

Brake caliper kit	Pad kit	Seal and boot kit

15AE059N

DISASSEMBLY STEPS

▶A◀ 1. Guide pin
▶A◀ 2. Lock pin
3. Bushing
4. Caliper support (pad, clip, shim)
5. Pin boot
6. Boot ring
◀A▶ 7. Piston boot
◀A▶ 8. Piston
◀B▶ 9. Piston seal
10. Caliper body
11. Pad and wear indicator assembly
12. Pad assembly
13. Outer shim
14. Clip

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LUBRICATION POINTS

Caution
The piston seal inside the seal and boot kit is coated with special grease. Do not wipe this grease off.

Brake fluid: DOT4

Grease: Repair kit grease (orange)

Grease: Repair kit grease (orange)

14N0286
15AE060N

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DISASSEMBLY SERVICE POINTS

When disassembling the disc brakes, disassemble both sides (left and right) as a set.

◀A▶ PISTON BOOT/PISTON REMOVAL

Protect caliper body with cloth. Blow compressed air through brake hose to remove piston boot and piston.

CAUTION: Blow compressed air gently.

◀B▶ PISTON SEAL REMOVAL

1. Remove piston seal with finger tip.

CAUTION: Do not use a flat-tipped screwdriver or other tool to prevent damage to inner cylinder.

2. Clean piston surface and inner cylinder with alcohol, or specified brake fluid.

   Specified brake fluid: DOT4

REASSEMBLY SERVICE POINT

▶A◀ LOCK PIN/GUIDE PIN INSTALLATION

Install the guide pin and lock pin as illustrated so that each head mark of the guide pin and the lock pin matches the indication mark located on the caliper body.

INSPECTION

- Check cylinder for wear, damage or rust.
- Check piston surface for wear, damage or rust.
- Check caliper body or sleeve for wear.
- Check pad for damage or adhesion of grease, check backing metal for damage.

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PAD WEAR CHECK

Measure the thickness at the most worn area of the pad. Replace pad assembly when pad thickness is less than the limit value.

Standard value: 10 mm
Limit value: 2.0 mm

CAUTION: When the limit is exceeded, the brake pads on both the left and right wheels must be replaced as a set.

CAUTION: If there is a significant difference in the thickness of the pads on the left and right sides, check the sliding condition of the piston, lock pin and guide pin.

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REAR DISC BRAKE PAD CHECK AND REPLACEMENT

1. Check brake pad thickness through caliper body check port.

   Standard value: 10 mm
   Limit: 1.0 mm

Caution
1. When the limit is exceeded, the brake pads on both the left and right wheels must be replaced as a set.
2. If there is a significant difference in the thicknesses of the pads on the left and right sides, check the sliding condition of the piston, lock pin sleeve and guide pin sleeve.

2. Remove the lower guide pin caliper bolt. Lift caliper assembly and retain with wire.

   Caution
   Do not wipe off the special grease that is on the guide pin or allow it to contaminate the bolt thread.

3. Remove the brake pads parts from the caliper support.

4. Measure hub torque (A) with pads removed to measure brake drag torque. Torque value (A) will be used later to calculate brake drag force with the pads installed.

   NOTE
   To secure the disc to the hub, tighten the nuts.

5. Clean the piston; then use the special tool to push the piston into the cylinder (caliper).
6. Be careful that the piston boot does not catch and tear as the caliper assembly is swung back into position. Replace guide pin locking bolt and torque dry to specified torque.

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7. Check brake drag torque as follows.
   (1) Start engine and hold brake pedal down for 5 seconds. [Pedal depression force: approx. 196 N]
   (2) Stop engine.
   (3) Turn brake disc forward 10 times.
   (4) Check brake hub torque (B) with spring scale.
   (5) Calculate the drag torque of the disc brake [difference between hub torque (B) and hub torque (A)].

   Standard value: 69 N [4 Nm] or less

8. If the difference between brake drag torque and hub torque exceeds the standard value, disassemble piston and clean piston. Check for corrosion or worn piston seal, and check the sliding condition of the lock pin and guide pin.

REAR BRAKE DISC THICKNESS CHECK

1. Remove dirt and rust from brake disc surface.
2. Measure disc thickness at 4 locations or more.

   Standard value: 20 mm
   Limit: 18.4 mm

   Replace the discs and pad assembly for both sides left and right of the vehicle if they are worn beyond the specified limit.

REAR BRAKE DISC RUN-OUT CHECK

1. Remove the caliper support, raise the caliper assembly, and secure it by using a wire, etc.
2. Place a dial gauge approximately 5 mm from the outer circumference of the brake disc, and measure the run-out of the disc.

   Limit: 0.05 mm

   NOTE
   To secure the disc to the hub, tighten the nuts.

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REAR BRAKE DISC RUN-OUT CORRECTION

1. If the run-out of the brake disc is equivalent to or exceeds the limit specification, change the phase of the disc and hub, and then measure the run-out again.

   NOTE
   The procedures for checking and changing the rear disc phase are the same as those for the front brake discs.

2. If the problem cannot be corrected by changing the phase of the brake disc, replace the disc or turn rotor using an on the car type brake lathe. Be sure to follow the exact brake lathe manufacturer instructions. Rotors turned on the vehicle will often have a lower run-out than a new brake disc.

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REAR DISC BRAKE

REMOVAL AND INSTALLATION

Pre-removal Operation
- Loosening Parking Brake Cable Adjusting Nut.
- Brake Fluid Draining

Post-installation Operation
- Brake Fluid Filling and Air Bleeding
- Parking Brake Lever Stroke Adjustment

15TJ163A

Removal steps

1. Connection for the brake hose
2. Gasket
3. Rear brake assembly
4. Brake disc

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DISASSEMBLY AND REASSEMBLY

Brake caliper kit	**Pad repair kit**	**Seal and boots repair kit**

15TJ164A

Caliper assembly disassembly steps

1. Guide pin
2. Lock pin
3. Bushing
4. Caliper support (pads)
5. Boot
6. Boot ring
7. Piston boot
8. Piston
9. Piston seal
10. Caliper body

Pad assembly disassembly steps

1. Guide pin
2. Lock pin
3. Bushing
4. Caliper support (pads, clip, shim)
11. Pad and wear indicator assembly
12. Pad assembly
13. Outer shim
14. Clip

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LUBRICATION POINTS

Caution
The piston seal inside the seal and boot kit is coated with special grease. Do not wipe this grease off.

Brake fluid: DOT4

Grease: Repair kit grease (orange)

Grease: Repair kit grease (orange)

Grease: Repair kit grease (orange)

35B ANTI-LOCK BRAKING SYSTEM (ABS)

CONTENTS

GENERAL INFORMATION
- CONSTRUCTION DIAGRAM

SERVICE SPECIFICATIONS

SEALANT

SPECIAL TOOLS

TROUBLESHOOTING
- DIAGNOSIS FUNCTION
- ERASING DIAGNOSIS CODES
- INSPECTION CHART FOR DIAGNOSIS CODES
- ABS WARNING LIGHT INSPECTION
- ACTUATOR TEST REFERENCE TABLE
- CHECK AT THE ABS-ECU

ON-VEHICLE SERVICE
- BLEEDING
- ABS OPERATION CHECK

MASTER CYLINDER AND BRAKE BOOSTER

HYDRAULIC UNIT
- INSTALLATION SERVICE POINT

WHEEL SPEED SENSOR

Refer to GROUP 35 for the following items.

BRAKE PEDAL
FRONT DISC BRAKE
LUBRICANTS
ON–VEHICLE SERVICE
Brake Booster Operating Test
Brake Fluid Level Sensor Check
Check Valve Operation Check
Front Brake Disc Run-out Check
Front Brake Disc Run-out Correction
Front Brake Disc Thickness Check
Front Disc Brake Pad Check and Replacement
Front Disc Brake Rotor Inspection
Proportioning Valve Function Test
Rear Brake Disc Run-out Check
Rear Brake Disc Run-out Correction
Rear Brake Disc Thickness Check
Rear Disc Brake Pad Check and Replacement
REAR DISC BRAKE

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GENERAL INFORMATION

The ABS consists of wheel speed sensors, brake pedal switch, integral hydraulic unit and ABS-ECU. If a problem occurs in the system, the malfunctioning system can be identified by means of the diagnosis function. The diagnosis codes recorded in the memory will not be erased even if the ignition switch is turned to OFF. In addition, reading of diagnosis codes, service data and actuator testing are possible using the MUT-II. Electronic Brake-Force Distribution (EBD) uses the ABS Hydraulic Unit to control rear brake pressures, hence deleting the need for a proportioning valve.

Items	Specifications
Speed sensor	Magnet coil type
Front rotor teeth	48
Rear rotor teeth	48

CONSTRUCTION DIAGRAM

1. Stop lamp switch
2. Data link connector
3. ABS warning light
4. Rotor
5. Wheel speed sensor
6. ABS-ECU/Hydraulic unit

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SERVICE SPECIFICATIONS

Items	Standard value
Speed sensor's internal resistance kΩ	1.4 – 1.8
Clearance between the wheel speed sensor mounting surface and the toothed rotor mm.	28.2–28.5

SEALANT

Items	Specified sealant	Remarks
Thread part fitting	Loctite 577	Semi-drying sealant
Vacuum switch		

SPECIAL TOOLS

Tool	Tool number and name	Supersession	Application
	MB991502 MUT-II	–	For checking ABS
	ROM pack	–	

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TROUBLESHOOTING

STANDARD FLOW OF DIAGNOSIS TROUBLESHOOTING

Refer Group 00.

NOTES WITH REGARD TO DIAGNOSIS

The conditions listed in the following table are considered normal.

Condition	Explanation of condition
System check sound	When starting the engine, a thudding sound can sometimes be heard coming from inside the engine compartment, but this is because the system operation check is being performed. This is considered normal.
ABS operation sound	1. Sound of the motor inside the ABS hydraulic unit operating (whine) 2. Sound is generated along with vibration of the brake pedal. (scraping) 3. When ABS operates, sound is generated from the vehicle chassis due to repeated brake application and release. (Thump: suspension; squeak: tyres)
ABS operation (Long braking distance)	For road surfaces such as snow-covered roads and gravel roads, the braking distance for vehicles with ABS can sometimes be longer than that for other vehicles. Accordingly, advise the customer to drive safely on such roads by lowering the vehicle speed and not being overconfident.

Diagnosis detection condition depends on the diagnosis code.
When checking to see if the trouble symptom reoccurs after the diagnosis code has been erased, check the detection conditions column in the inspection chart for diagnosis codes (refer on vehicle service) and the memorise conditions recorded in the “Comments” column of the inspection procedure chart for diagnosis codes in order to carry out testing under driving conditions which satisfy each of the given conditions.

DIAGNOSIS FUNCTION

DIAGNOSIS CODES CHECK

Read the diagnosis codes by the MUT-II or ABS warning lamp. (Refer Group 00.)

ERASING DIAGNOSIS CODES

WITH MUT-II

Read the diagnosis codes by the MUT-II or ABS warning lamp. (Refer Group 00.)

WITHOUT MUT-II

1. Press on the brake pedal so that the brake pedal switch is on.
2. Switch the ignition ON.
3. Wait until the ABS warning lamp goes out, then release the brake pedal.
4. “Toggle” the brake pedal so that the ABS–ECU receives a brake pedal switch on signal 9 times in 20 seconds.
5. The warning lamp will illuminate for 1 second to confirm code erasure.

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INSPECTION CHART FOR DIAGNOSIS CODES

Inspect according to the inspection chart that is appropriate for the diagnosis code.

Diagnosis code no.	Inspection item		Detection conditions
11	Front right wheel speed sensor	Open circuit	B, C
12	Front left wheel speed sensor		
13	Rear right wheel speed sensor		
14	Rear left wheel speed sensor		
15	Wheel speed sensor output signal abnormal		A, B
16	Power supply system		A, B, C
21	Front right wheel speed sensor	Short circuit	B, C
22	Front left wheel speed sensor		
23	Rear right wheel speed sensor		
24	Rear left wheel speed sensor		
38	Stop light switch system		B, C
41	Front right solenoid valve (inlet)		B, C
42	Front left solenoid valve (inlet)		
43	Rear right solenoid valve (inlet)		
44	Rear left solenoid valve (inlet)		
45	Front right solenoid valve (outlet)		B, C
46	Front left solenoid valve (outlet)		
47	Rear right solenoid valve (outlet)		
48	Rear left solenoid valve (outlet)		
51	Valve relay		A, B, C
53	Motor relay		B
63	ABS–ECU		A, B, C

Detection conditions

A: During system check immediately after starting
B: While ABS control is not operating while driving
C: While ABS control is operating

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INSPECTION PROCEDURE FOR DIAGNOSIS CODES

Code No. 11, 12, 13, 14 Wheel speed sensor open circuit	Probable cause
[Comment] These codes are displayed when the sensor with the open circuit can be distinguished.	• Malfunction of wheel speed sensor (Open circuit) • Malfunction of wiring harness or connector • Malfunction of ABS-ECU

Code No. 15 Wheel speed sensor (Abnormal output signal)	Probable cause
[Comment] A wheel speed sensor outputs an abnormal signal (other than an open or short circuit)	• Improper installation of wheel speed sensor • Malfunction of wheel speed sensor • Damaged rotor • Wheel bearing worn or loose • Malfunction of wiring harness or connector • Malfunction of ABS–ECU

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Code No. 16 Power supply system	Probable cause
[Comment] This diagnosis code is output when the ABS-ECU power voltage is outside the standard value. Furthermore, if the voltage returns to normal, this diagnosis code will not be output.	• Malfunction of wiring harness or connector. • Malfunction of battery or alternator • Malfunction of ABS-ECU

Caution
If the battery voltage drops during inspection, this code will be output as a current problem, and correct diagnosis of the problem cannot be made.
Before carrying out the following inspection, check the battery condition, and recharge it if necessary.

Code No. 21, 22, 23, 24 Wheel speed sensor short circuit	Probable cause
[Comment] These codes are displayed when the sensor with the short circuited can be distinguished.	• Malfunction of wheel speed sensor • Malfunction of wiring harness • Malfunction of ABS-ECU

NOTE
Short circuit is not detected when IG power voltage drops.

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Code No. 38 Stop light switch system	Probable cause
[Comment] This diagnosis code is output if it is judged to be a short circuit when the stop light switch is ON for a continuous period of 15 minutes or more.	• Malfunction of wiring harness or connector • Malfunction of stop light switch • Malfunction of ABS-ECU

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Code No. 41, 42, 43, 44 Solenoid valve (inlet)	Probable cause
[Comment] The ABS-ECU normally monitors the solenoid valve drive circuit. and determines if there is an open circuit or short circuit in the solenoid coil or in the harness, i.e. no current flows in the solenoid even though the ABS–ECU turns it on, and vice versa.	• Malfunction of wiring harness • Malfunction of hydraulic unit • Malfunction of ABS-ECU

Refer to Troubleshooting procedure for DTC No.16.

Code No. 45, 46, 47, 48 Solenoid valve (outlet)	Probable cause
[Comment] The ABS-ECU normally monitors the solenoid valve drive circuit. and determines if there is an open circuit or short circuit in the solenoid coil or in the harness, i.e. no current flows in the solenoid even though the ABS–ECU turns it on, and vice versa.	• Malfunction of wiring harness • Malfunction of hydraulic unit • Malfunction of ABS-ECU

Refer to Troubleshooting procedure for DTC No.16.

Code No. 51 Valve relay	Probable cause
[Comment] When the ignition switch is turned to ON, the ABS–ECU switches the valve relay off and on during the initial check to check if the valve relay is operating normally.	• Malfunction of ABS valve relay • Malfunction of wiring harness or connector • Malfunction of ABS-ECU • Malfunction of hydraulic unit

Refer to Troubleshooting procedure for DTC No.16.

Code No. 53 Motor relay, motor	Probable cause
[Comment] The code is output at the following times: • When the motor relay is on but no signal is input to the motor monitor line (motor is not operating etc.). • When the motor relay is off but a signal is input to the motor monitor line (motor continues operating etc.).	• Malfunction of ABS motor relay • Malfunction of wiring harness or connector • Malfunction of hydraulic unit • Malfunction of ABS-ECU

Refer to Troubleshooting procedure for DTC No.16.

Code No. 63 ABS-ECU	Probable cause
[Comment] The code is output at the following times: • During diagnosis output test or flash code output test.	• Malfunction of wiring harness or connector • Malfunction of ABS-ECU

Refer to Troubleshooting procedure for DTC No.16.

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15TH143A

14X0159

15TH144A

ABS WARNING LIGHT INSPECTION

Check that the ABS warning light illuminates as follows.

1. When the ignition key is turned to “ON”, the ABS warning light illuminates for approximately 3 seconds and then switches off.
2. When the ignition key is turned to “START”, the ABS warning light remains illuminated.
3. When the ignition key is turned from “START” back to “ON”, the ABS warning light illuminates for approximately 3 seconds and then switches off.
4. If the illumination is other than the above, check the diagnosis trouble codes.

INSPECTION CHART FOR TROUBLE SYMPTOMS

Get an understanding of the trouble symptoms and check according to the inspection procedure chart.

Trouble symptom		Inspection procedure No.
Communication with MUT-II is not possible.	Communication with all systems is not possible.	1
	Communication with ABS only is not possible.	2
When the ignition key is turned to “ON” (engine stopped), the ABS warning light does not illuminate.		3
After the engine starts, the light remains illuminated.		4
After the engine started, the ABS warning light and the Brake warning light remains illuminated.		5
Faulty ABS operation	Unequal braking power on both sides	6
	Insufficient braking power	
	ABS operates under normal braking conditions	
	ABS operates before vehicle stops under normal braking conditions	
	Large brake pedal vibration when ABS operates	
	Large brake pedal vibration (Caution 2.)	Caution 2

Caution

1. **If steering movements are made when driving at high speed, or when driving on road surfaces with low frictional resistance, or when passing over bumps, the ABS may operate even though sudden braking is not being applied. Because of this, when getting information from the customer, check if the problem occurred while driving under such conditions as these.**
2. **During ABS operation, changes in the feeling of the brake pedal (vibration may occur or pedal may not be able to be depressed). Such changes are due to intermittent changes in hydraulic pressure inside the brake line to prevent the wheels from locking, and is considered normal.**

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INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

INSPECTION PROCEDURE 1

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

Refer Group 13A.

INSPECTION PROCEDURE 2

Communication with MUT-II is not possible. (Communication with ABS only is not possible.)	Probable cause
[Comment] When communication with the MUT-II is not possible, the cause is probably an open circuit in the ABS-ECU power circuit or an open circuit in the diagnostic output circuit.	• Blown fuse • Malfunction of wiring harness or connector • Malfunction of ABS power relay • Malfunction of ABS-ECU

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INSPECTION PROCEDURE 3

When ignition key is turned to "ON" (engine stopped), ABS warning light does not illuminate	Probable cause
[Comment] The cause may be an open circuit in the lamp power supply circuit, a blown light bulb, an open circuit in both the circuit between the ABS warning light and the ABS-ECU.	• Blown fuse • Burnt out ABS warning light bulb • Malfunction of wiring harness or connector

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INSPECTION PROCEDURE 4

Even after the engine is started, the ABS warning light remains illuminated.	Probable cause
[Comment] The cause may be a short circuit in the ABS warning light illumination circuit or an incorrectly secured connector at the ABS-ECU.	• Combination meter fault • ABS-ECU fault • Harness fault (short)

This breakdown phenomenon is restricted to circumstances where communication with the MUT-II is possible (ABS-ECU power supply normal), and when the diagnosis code is normal.

INSPECTION PROCEDURE 5

Even after the engine is started, the ABS warning light and the Brake warning light remains illuminated.	Probable cause
[Comment] The cause may be an ABS/EBD system fault or an ABS combined with a brake system fault.	• ABS-ECU fault • Valve relay interruption • Solenoid valve actuation fault • Brake failure • Parkbrake switch failure • Harness fault (short)

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INSPECTION PROCEDURE 6

Brake operation is abnormal	Probable cause
[Comment] This varies depending on the driving conditions and the road surface conditions, so problem diagnosis is difficult. However, if a normal diagnosis code is displayed, carry out the following inspection.	• Improper installation of wheel speed sensor • Incorrect sensor harness contact • Malfunction of wheel speed sensor • Malfunction of rotor • Malfunction of wheel bearing • Malfunction of hydraulic unit • Malfunction of ABS-ECU

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DATA LIST REFERENCE TABLE

With the MUT-II, check the data list for the items listed.

Item No.	Check point	Check condition	Normal condition
11	Front right wheel speed sensor	Check by actually operating vehicle.	Speedometer indication and MUT-II indication are the same.
12	Front left wheel speed sensor		
13	Rear right wheel speed sensor		
14	Rear left wheel speed sensor		
16	Battery positive voltage	IG power voltage and valve monitor voltage	9–16 V
33	Stop lamp switch	Depress brake pedal.	ON
		Release brake pedal.	OFF

ACTUATOR TEST REFERENCE TABLE

The MUT-II activates the following actuators for testing.
NOTE
1. If the ABS-ECU is not functional, actuator testing cannot be carried out.
2. Actuator testing is only possible when the vehicle is stationary. If the vehicle speed during actuator testing exceeds 10 km/h, forced actuation will be cancelled.
3. During the actuator test, the ABS warning lamp will illuminate and the anti-skid control will be cancelled.

NOTE
A: Hydraulic pressure increase
B: Hydraulic pressure holds
C: Hydraulic pressure decrease

ACTUATOR TEST SPECIFICATIONS

No.	Item	
01	Solenoid valve for front-left wheel	Solenoid valves and pump motors in the hydraulic unit (simple inspection mode)
02	Solenoid valve for front-right wheel	
03	Solenoid valve for rear-left wheel	
04	Solenoid valve for rear-right wheel	

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CHECK AT THE ABS-ECU

TERMINAL VOLTAGE CHECK CHART

1. Turn the ignition switch to OFF.
2. Disconnect the ABS-ECU connector.
3. Measure the voltage at the terminals of the ABS-ECU harness-side connector while referring to the check chart.

   NOTE
   1. When measuring voltage, a harness for checking contact pin pressure should be used instead of inserting a test probe.
   2. Checks do not have to be carried out in the order given in this chart.

   Caution

   Short-circuiting the positive (+) probe between a connector terminal and ground could damage the vehicle wiring, the sensor, ABS-ECU, or all three. Use care to prevent this!
4. If voltmeter shows any deviation from standard value, check the corresponding sensor, actuator and related electrical wiring, then repair or replace.
5. After repair or replacement, recheck with the voltmeter to confirm that the repair has corrected the problem.

15AG113N

Terminal No.	Name of circuit	Check requirements		Normal condition
14	Stop light switch (Input)	Ignition switch: ON (Stop light switch ON)		Battery positive voltage
		Ignition switch: ON (Stop light switch OFF)		1.0 V or less
17, 18	Memory power supply	At all times		Battery positive voltage
15	ECU power supply	Ignition switch: ON		Battery positive voltage
20	ABS warning light (Output)	Ignition switch: ON	When light is switched off	Battery positive voltage
			When light is illuminated	0–2 V
21	Brake warning light (EBD) (Output)	Ignition switch: ON	When light is switched off	Battery positive voltage
			When light is illuminated	0–2 V

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TERMINAL RESISTANCE AND CONTINUITY CHECKS

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

   NOTE
   1. When measuring resistance and checking continuity, a harness for checking contact pin pressure should be used instead of inserting a test probe.
   2. Checks do not have to be carried out in the order given in this chart.

   Caution

   If resistance or continuity checks are performed on the wrong terminals, damage to the vehicle wiring, sensors, ABS-ECU, and/or ohmmeter may occur. Use care to prevent this!
4. If ohmmeter shows any deviation from the normal condition, 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 or replacement has corrected the problem.

15AG113N

Terminal No.	Name of circuit	Check requirements	Terminal voltage
1–2	Rear right wheel speed sensor	Ignition switch: OFF	1.4–1.8 kΩ
6–7	Front left wheel speed sensor	Ignition switch: OFF	1.4–1.8 kΩ
16–ground	ABS-ECU ground	—	Continuity
19–ground	ABS-ECU ground	—	Continuity
8–9	Rear left wheel speed sensor	Ignition switch: OFF	1.4–1.8 kΩ
4–5	Front right wheel speed sensor	Ignition switch: OFF	1.4–1.8 kΩ

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ON-VEHICLE SERVICE

BLEEDING

Caution
Use the specified brake fluid. Avoid using a mixture of the specified brake fluid and other fluid.

Specified brake fluid: DOT4

MASTER CYLINDER BLEEDING

Refer Group 35 - On vehicle service.

BRAKE LINE BLEEDING

Start the engine and bleed the air in the sequence shown in the figure.

Caution
For vehicles with ABS, be sure to filter/strain the brake fluid being added to the master cylinder reservoir tank. Debris may damage the Hydraulic Unit.

ABS OPERATION CHECK

WHEEL SPEED SENSOR OUTPUT VOLTAGE CHECK

1. Lift up the vehicle and release the parking brake.
2. Disconnect the ABS-ECU harness connector and measure from the harness side connector.

   Caution
   Use a special tool (inspection harness for connector pin contact pressure) to measure the output voltage at the harness side connector to prevent damaging the connector terminals.

3. Rotate the wheel to be measured at approximately 1/2–1 rotation per second, and check the output voltage using a circuit tester or an oscilloscope.

Wheel speed sensor	Front left	Front right	Rear left	Rear right
Terminal No.	6	4	8	1
	7	5	9	2

Output voltage
When measuring with a circuit tester:
50 mV or more
When measuring with an oscilloscope:
20 mV p-p or more

4. If the output voltage is lower than the above values, the reason could be as follow:
   - Faulty wheel speed sensor – replace the wheel speed sensor.

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Inspecting Wave Forms With An Oscilloscope

Use the following method to observe the output voltage wave form from each wheel sensor with an oscilloscope:-

- Start the engine, and rotate the front wheels by engaging D range. Turn the rear wheels manually so that they rotate at a constant speed.

NOTE

1. Check the connection of the sensor harness and connector before using the oscilloscope.
2. The wave form measurements can also be taken while the vehicle is actually moving.
3. The output voltage will be low when the wheel speed is low, and similarly it will be higher as the wheel speed increases.

Points In Waveform Measurement

Symptom	Probable causes	Remedy
Too small or zero waveform amplitude	Faulty wheel speed sensor	Replace sensor
Waveform amplitude fluctuates excessively (this is no problem if the minimum amplitude is 100 mV or more)	Axle hub eccentric or with large runout	Replace hub
Noisy or disturbed waveform	Open circuit in sensor	Replace sensor
	Open circuit in harness	Correct harness
	Incorrectly mounted wheel speed sensor	Mount correctly
	Rotor with missing or damaged teeth	Replace rotor

NOTE
The wheel speed sensor cable moves following motion of the front or rear suspension. Therefore, it is likely that it has an open circuit only when driving on rough roads and it functions normally on ordinary roads. It is, therefore, recommended to observe sensor output voltage waveform also under special conditions, such as rough road driving.

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HYDRAULIC UNIT (HU) INSPECTION

Caution

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

1. Jack up the vehicle and support the vehicle with rigid racks placed at the specified jack-up points or place the wheels which are checked on the rollers of the braking force tester.

   Caution
   1. **The roller of the braking force tester and the tyre should be dry during testing.**
   2. **When testing the front brakes, apply the parking brake, and when testing the rear brakes, stop the front wheels by chocking them.**

2. Release the parking brake, and feel the drag force (drag torque) on each road wheel.
   When using the braking force tester, take a reading of the brake drag force.
3. Turn the ignition key to the OFF position and set the MUT-II as shown in the diagram.
4. After checking that the selector lever is in neutral, start the engine.

   NOTE
   1. At this time, the ABS system will switch to the MUT-II mode and the ABS warning light will illuminate.
   2. When the ABS has been interrupted by the fail-safe function, the MUT-II actuator testing cannot be used.

5. Use the MUT-II to force-drive the actuator.
6. Turn the wheel by hand and check the change in braking force when the brake pedal is depressed.
   When using the braking force tester, depress the brake pedal until the braking force is at the following values, and check to be sure that the braking force changes to the brake drag force inspected in step 2 when the actuator is force-driven.

N

Front wheel	785–981
Rear wheel	294–490

The result should be as shown in the following diagram.

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7. If the result of inspection is abnormal, correct according to the “Diagnosis Table.”

Diagnosis Table

No.	Operation	Judgement-Normal	Judgement-Abnormal	Probable cause	Remedy
01	(1) Depress brake pedal to lock wheel. (2) Using the MUT-II, select the wheel to be checked and force the actuator to operate. (3) Turn the selected wheel manually to check the change of brake force.	Brake force released for 3 seconds after locking.	Wheel does not lock when brake pedal is depressed.	Clogged brake line other than HU	Check and clean brake line
02				Clogged hydraulic circuit in HU	Replace HU assembly
03			Brake force is not released	Incorrect HU brake tube connection	Connect correctly
04				HU solenoid valve not functioning correctly	Replace HU assembly

8. After inspection, disconnect the MUT-II immediately after turning the ignition switch to OFF.

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REMEDY FOR A FLAT BATTERY

When booster cables are used to start the engine when the battery is completely discharged and then the vehicle is immediately driven without waiting for the battery to recharge itself to some extent, the engine may misfire or stall, making driving difficult.

This happens because ABS consumes a great amount of current for its self-check function. The remedy is to either allow the battery to recharge sufficiently, or to remove the fusible link for ABS circuit, thus disabling the anti-lock brake system.

The ABS warning light will illuminate when the fusible link (for ABS) is removed.

After the battery has sufficiently charged, install the fusible link (for ABS) and restart the engine; then check to be sure the ABS warning light is not illuminated.

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MASTER CYLINDER AND BRAKE BOOSTER

REMOVAL AND INSTALLATION

(Refer Group 35 - Master Cylinder)

MASTER CYLINDER

DISASSEMBLY AND REASSEMBLY

15AE079N

Disassembly steps

1. Reservoir cap assembly
2. Diaphragm
3. Brake fluid level sensor
4. Reservoir bolt
5. Reservoir

◀A▶

6. Reservoir seals
7. Piston stopper pin
8. Primary piston assembly
9. Secondary piston assembly
10. Master cylinder body

Caution
Do not disassemble the primary and secondary piston assemblies.

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DISASSEMBLY SERVICE POINTS

◀A▶ PISTON STOPPER PIN DISASSEMBLY

Remove the piston stopper pin, while depressing the piston.

INSPECTION

- Check the inner surface of master cylinder body for corrosion or pitting.
- Check the primary and secondary pistons for corrosion, scoring, damage or wear.
- Check the diaphragm for cracks and wear.

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HYDRAULIC UNIT

REMOVAL AND INSTALLATION

Pre-removal Operation
- Brake Fluid Draining
- Air Intake Hose Removal

Post-installation Operation
- Installation of the Air Intake Hose Removal
- Brake Fluid Supplying
- Brake Line Bleeding (Refer On vehicle service.)
- Hydraulic Unit Checking (Refer On vehicle service.)

Flared brake line nuts

Removal steps

▶A◀ 1. Connection for brake pipe
2. Connection for harness connector
◀A▶ 3. Hydraulic unit
4. Hydraulic unit bracket

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REMOVAL SERVICE POINT

◀A▶ HYDRAULIC UNIT REMOVAL

Caution

1. **The hydraulic unit is heavy, and so care should be taken when removing it.**
2. **The hydraulic unit is not to be disassembled; its nuts and bolts must not be loosened.**
3. **The hydraulic unit must not be dropped or otherwise subjected to impact shocks.**
4. **The hydraulic unit must not be turned upside down or laid on its side.**

INSTALLATION SERVICE POINT

▶A◀ BRAKE PIPE CONNECTION

Connect the pipes to the hydraulic unit as shown in the illustration.

1. To the rear brake (LH)
2. To the rear brake (RH)
3. From the master cylinder (primary)
4. From the master cylinder (secondary)
5. To the front brake (LH)
6. To the front brake (RH)

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WHEEL SPEED SENSOR

REMOVAL AND INSTALLATION

Post-installation Operation
- Wheel Speed Sensor Output Voltage Checking (Refer On vehicle service.)

Front speed sensor removal steps

1. Front speed sensor
2. Front rotor (Refer Group 26 -Driveshaft.)

Rear speed sensor removal<Sedan>

3. Rear rotor (Refer Group 27 - Rear Axle hub.)
4. Rear speed sensor

Rear speed sensor removal <Wagon>

3. Rear rotor (Refer Group 27A - Rear Axle hub.)
4. Rear speed sensor
5. Hub

NOTE
The front rotor is integrated with the drive shaft and is not disassembled.

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INSPECTION

SPEED SENSOR

1. Check whether any metallic foreign material has adhered to the parts shown in the illustration at the speed sensor tip, and if so, remove it.

   NOTE
   The section shown in the illustration can become magnetised because of the magnet built into the speed sensor, with the result that foreign metallic material is attached to it.

2. Measure the resistance between the speed sensor terminals.

   Standard value: 1.4–1.8 kΩ

   If the internal resistance of the speed sensor is not within the standard value, replace with a new speed sensor.

3. Check the speed sensor cable for breakage, damage or disconnection; replace with a new one if a problem is found.

   NOTE
   When checking for cable damage, remove the cable clamp part from the body and then bend and pull the cable near the clamp to check whether or not an intermittent contact results. Check the connector connection and the terminal insertion.

SPEED SENSOR INSULATION INSPECTION

1. Remove all connections from the speed sensor, and then measure the resistance between terminals (1) and (2) and the body of the speed sensor.

   Standard value: 100 kΩ or more

2. If the speed sensor insulation resistance is outside the standard value range, replace with a new speed sensor.

TOOTHED ROTOR

Check whether rotor teeth are broken or deformed, and, if so, replace the rotor.

35B ANTI-LOCK BRAKING SYSTEM (ABS) <AWD>

CONTENTS

GENERAL INFORMATION
- CONSTRUCTION DIAGRAM

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TROUBLESHOOTING
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MASTER CYLINDER AND BRAKE BOOSTER

HYDRAULIC UNIT
- REMOVAL SERVICE POINT
- INSTALLATION SERVICE POINT

WHEEL SPEED SENSOR

G SENSOR
- INSPECTION

Refer to GROUP 35 for the following items.

BRAKE PEDAL
FRONT DISC BRAKE
LUBRICANTS
ON–VEHICLE SERVICE
Brake Booster Operating Test
Brake Fluid Level Sensor Check
Check Valve Operation Check
Front Brake Disc Run-out Check
Front Brake Disc Run-out Correction
Front Brake Disc Thickness Check
Front Disc Brake Pad Check and Replacement
Front Disc Brake Rotor Inspection
Proportioning Valve Function Test
Rear Brake Disc Run-out Check
Rear Brake Disc Run-out Correction
Rear Brake Disc Thickness Check
Rear Disc Brake Pad Check and Replacement
REAR DISC BRAKE

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GENERAL INFORMATION

The ABS consists of wheel speed sensors, brake pedal switch, G sensor, integral hydraulic unit and ABS-ECU. If a problem occurs in the system, the malfunctioning system can be identified by means of the diagnosis function. The diagnosis codes recorded in the memory will not be erased even if the ignition switch is turned to OFF. In addition, reading of diagnosis codes, service data and actuator testing are possible using the MUT-II. Electronic Brake-Force Distribution (EBD) uses the ABS Hydraulic Unit to control rear brake pressures, hence deleting the need for a proportioning valve.

Items	Specifications
Speed sensor	Magnet coil type
Front rotor teeth	48
Rear rotor teeth	48

CONSTRUCTION DIAGRAM

1. Stop lamp switch
2. Data link connector
3. ABS warning light
4. Rotor
5. Wheel speed sensor
6. G sensor
7. ABS-ECU/Hydraulic unit

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SERVICE SPECIFICATIONS

Items	Standard value
Speed sensor's internal resistance kΩ	1.4 – 1.8
Clearance between the wheel speed sensor mounting surface and the toothed rotor mm.	28.2–28.5

SEALANT

Items	Specified sealant	Remarks
Thread part fitting	Loctite 577	Semi-drying sealant
Vacuum switch		

SPECIAL TOOLS

Tool	Tool number and name	Supersession	Application
	MB991502 MUT-II	–	For checking ABS
	ROM pack	–	

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TROUBLESHOOTING

STANDARD FLOW OF DIAGNOSIS TROUBLESHOOTING

Refer Group 00.

NOTES WITH REGARD TO DIAGNOSIS

The conditions listed in the following table are considered normal.

Condition	Explanation of condition
System check sound	When starting the engine, a thudding sound can sometimes be heard coming from inside the engine compartment, this is because the system operation check is being performed. This is considered normal.
ABS operation sound	1. Sound of the motor inside the ABS hydraulic unit operating (whine) 2. Sound is generated along with vibration of the brake pedal. (scraping) 3. When ABS operates, sound is generated from the vehicle chassis due to repeated brake application and release. (Thump: suspension; squeak: tyres)
ABS operation (Long braking distance)	For road surfaces such as snow-covered roads and gravel roads, the braking distance for vehicles with ABS can sometimes be longer than that for other vehicles. Accordingly, advise the customer to drive safely on such roads by lowering the vehicle speed and not being overconfident.

Diagnosis detection condition depends on the diagnosis code.
When checking to see if the trouble symptom reoccurs after the diagnosis code has been erased, check the detection conditions column in the inspection chart for diagnosis codes (refer on vehicle service) and the memorise conditions recorded in the “Comments” column of the inspection procedure chart for diagnosis codes in order to carry out testing under driving conditions which satisfy each of the given conditions.

DIAGNOSIS FUNCTION

DIAGNOSIS CODES CHECK

Read the diagnosis codes by the MUT-II or ABS warning lamp. (Refer Group 00.)

ERASING DIAGNOSIS CODES

WITH MUT-II

Read the diagnosis codes by the MUT-II or ABS warning lamp. (Refer Group 00.)

WITHOUT MUT-II

1. Press on the brake pedal so that the brake pedal switch is on.
2. Switch the ignition ON.
3. Wait until the ABS warning lamp goes out, then release the brake pedal.
4. “Toggle” the brake pedal so that the ABS–ECU receives a brake pedal switch on signal 9 times in 20 seconds.
5. The warning lamp will illuminate for 1 second to confirm code erasure.

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INSPECTION CHART FOR DIAGNOSIS CODES

Inspect according to the inspection chart that is appropriate for the diagnosis code.

Diagnosis code no.	Inspection item		Detection conditions
11	Front right wheel speed sensor	Open circuit	B, C
12	Front left wheel speed sensor		
13	Rear right wheel speed sensor		
14	Rear left wheel speed sensor		
15	Wheel speed sensor output signal abnormal		A, B
16	Power supply system		A, B, C
21	Front right wheel speed sensor	Short circuit	B, C
22	Front left wheel speed sensor		
23	Rear right wheel speed sensor		
24	Rear left wheel speed sensor		
32	G Sensor		A, B, C
38	Stop light switch system		B, C
41	Front right solenoid valve (inlet)		B, C
42	Front left solenoid valve (inlet)		
43	Rear right solenoid valve (inlet)		
44	Rear left solenoid valve (inlet)		
45	Front right solenoid valve (outlet)		B, C
46	Front left solenoid valve (outlet)		
47	Rear right solenoid valve (outlet)		
48	Rear left solenoid valve (outlet)		
51	Valve relay		A, B, C
53	Motor relay		B
63	ABS–ECU		A, B, C

Detection conditions

A: During system check immediately after starting
B: While ABS control is not operating while driving
C: While ABS control is operating

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INSPECTION PROCEDURE FOR DIAGNOSIS CODES

Code No. 11, 12, 13, 14 Wheel speed sensor open circuit	Probable cause
[Comment] These codes are displayed when the sensor with the open circuit can be distinguished.	• Malfunction of wheel speed sensor (Open circuit) • Malfunction of wiring harness or connector • Malfunction of ABS-ECU

Code No. 15 Wheel speed sensor (Abnormal output signal)	Probable cause
[Comment] A wheel speed sensor outputs an abnormal signal (other than an open or short circuit)	• Improper installation of wheel speed sensor • Malfunction of wheel speed sensor • Damaged rotor • Wheel bearing worn or loose • Malfunction of wiring harness or connector • Malfunction of ABS–ECU

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Code No. 16 Power supply system	Probable cause
[Comment] This diagnosis code is output when the ABS-ECU power voltage is outside the standard value. Furthermore, if the voltage returns to normal, this diagnosis code will not be output.	● Malfunction of wiring harness or connector. ● Malfunction of battery or alternator ● Malfunction of ABS-ECU

Caution
If the battery voltage drops during inspection, this code will be output as a current problem, and correct diagnosis of the problem cannot be made.
Before carrying out the following inspection, check the battery condition, and recharge it if necessary.

Code No. 21, 22, 23, 24 Wheel speed sensor short circuit	Probable cause
[Comment] These codes are displayed when the sensor with the short circuited can be distinguished.	● Malfunction of wheel speed sensor ● Malfunction of wiring harness ● Malfunction of ABS-ECU

NOTE
Short circuit is not detected when IG power voltage drops.

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Code No. 32 G Sensor	Probable cause
[Comment] This diagnosis code is output in the following cases: ● When the G sensor output is lower than 0.5V or higher than 4.5V (Open circuit of short circuit in G sensor circuit) ● When there is no variation in the G sensor output voltage (G sensor output seized)	● Malfunction of the G sensor ● Malfunction of harness or connector ● Malfunction of ABS-ECU

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Code No. 38 Stop light switch system	Probable cause
[Comment] This diagnosis code is output if it is judged to be a short circuit when the stop light switch is ON for a continuous period of 15 minutes or more.	● Malfunction of wiring harness or connector ● Malfunction of stop light switch ● Malfunction of ABS-ECU

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Code No. 41, 42, 43, 44 Solenoid valve (inlet)	Probable cause
[Comment] The ABS-ECU normally monitors the solenoid valve drive circuit. and determines if there is an open circuit or short circuit in the solenoid coil or in the harness, i.e. no current flows in the solenoid even though the ABS–ECU turns it on, and vice versa.	• Malfunction of wiring harness • Malfunction of hydraulic unit • Malfunction of ABS-ECU

Refer to Troubleshooting procedure for DTC No.16.

Code No. 45, 46, 47, 48 Solenoid valve (outlet)	Probable cause
[Comment] The ABS-ECU normally monitors the solenoid valve drive circuit. and determines if there is an open circuit or short circuit in the solenoid coil or in the harness, i.e. no current flows in the solenoid even though the ABS–ECU turns it on, and vice versa.	• Malfunction of wiring harness • Malfunction of hydraulic unit • Malfunction of ABS-ECU

Refer to Troubleshooting procedure for DTC No.16.

Code No. 51 Valve relay	Probable cause
[Comment] When the ignition switch is turned to ON, the ABS–ECU switches the valve relay off and on during the initial check to check if the valve relay is operating normally.	• Malfunction of ABS valve relay • Malfunction of wiring harness or connector • Malfunction of ABS-ECU • Malfunction of hydraulic unit

Refer to Troubleshooting procedure for DTC No.16.

Code No. 53 Motor relay, motor	Probable cause
[Comment] The code is output at the following times: • When the motor relay is on but no signal is input to the motor monitor line (motor is not operating etc.). • When the motor relay is off but a signal is input to the motor monitor line (motor continues operating etc.).	• Malfunction of ABS motor relay • Malfunction of wiring harness or connector • Malfunction of hydraulic unit • Malfunction of ABS-ECU

Refer to Troubleshooting procedure for DTC No.16.

Code No. 63 ABS-ECU	Probable cause
[Comment] The code is output at the following times: • During diagnosis output test or flash code output test.	• Malfunction of wiring harness or connector • Malfunction of ABS-ECU

Refer to Troubleshooting procedure for DTC No.16.

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ABS WARNING LIGHT INSPECTION

Check that the ABS warning light illuminates as follows.

1. When the ignition key is turned to “ON”, the ABS warning light illuminates for approximately 3 seconds and then switches off.
2. When the ignition key is turned to “START”, the ABS warning light remains illuminated.
3. When the ignition key is turned from “START” back to “ON”, the ABS warning light illuminates for approximately 3 seconds and then switches off.
4. If the illumination is other than the above, check the diagnosis trouble codes.

INSPECTION CHART FOR TROUBLE SYMPTOMS

Get an understanding of the trouble symptoms and check according to the inspection procedure chart.

Trouble symptom		Inspection procedure No.
Communication with MUT-II is not possible.	Communication with all systems is not possible.	1
	Communication with ABS only is not possible.	2
When the ignition key is turned to “ON” (engine stopped), the ABS warning light does not illuminate.		3
After the engine starts, the light remains illuminated.		4
After the engine started, the ABS warning light and the Brake warning light remains illuminated.		5
Faulty ABS operation	Unequal braking power on both sides	6
	Insufficient braking power	
	ABS operates under normal braking conditions	
	ABS operates before vehicle stops under normal braking conditions	
	Large brake pedal vibration when ABS operates	
	Large brake pedal vibration (Caution 2.)	Caution 2

Caution

1. **If steering movements are made when driving at high speed, or when driving on road surfaces with low frictional resistance, or when passing over bumps, the ABS may operate even though sudden braking is not being applied. Because of this, when getting information from the customer, check if the problem occurred while driving under such conditions as these.**
2. **During ABS operation, changes in the feeling of the brake pedal (vibration may occur or pedal may not be able to be depressed). Such changes are due to intermittent changes in hydraulic pressure inside the brake line to prevent the wheels from locking, and is considered normal.**

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INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

INSPECTION PROCEDURE 1

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

Refer Group 13A.

INSPECTION PROCEDURE 2

Communication with MUT-II is not possible. (Communication with ABS only is not possible.)	Probable cause
[Comment] When communication with the MUT-II is not possible, the cause is probably an open circuit in the ABS-ECU power circuit or an open circuit in the diagnostic output circuit.	• Blown fuse • Malfunction of wiring harness or connector • Malfunction of ABS power relay • Malfunction of ABS-ECU

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INSPECTION PROCEDURE 3

When ignition key is turned to "ON" (engine stopped), ABS warning light does not illuminate	Probable cause
[Comment] The cause may be an open circuit in the lamp power supply circuit, a blown light bulb, an open circuit in both the circuit between the ABS warning light and the ABS-ECU.	• Blown fuse • Burnt out ABS warning light bulb • Malfunction of wiring harness or connector

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INSPECTION PROCEDURE 4

Even after the engine is started, the ABS warning light remains illuminated.	Probable cause
[Comment] The cause may be a short circuit in the ABS warning light illumination circuit or an incorrectly secured connector at the ABS-ECU.	• Combination meter fault • ABS-ECU fault • Harness fault (short)

This breakdown phenomenon is restricted to circumstances where communication with the MUT-II is possible (ABS-ECU power supply normal), and when the diagnosis code is normal.

INSPECTION PROCEDURE 5

Even after the engine is started, the ABS warning light and the Brake warning light remains illuminated.	Probable cause
[Comment] The cause may be an ABS/EBD system fault or an ABS combined with a brake system fault.	• ABS-ECU fault • Valve relay interruption • Solenoid valve actuation fault • Brake failure • Parkbrake switch failure • Harness fault (short)

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INSPECTION PROCEDURE 6

Brake operation is abnormal	Probable cause
[Comment] This varies depending on the driving conditions and the road surface conditions, so problem diagnosis is difficult. However, if a normal diagnosis code is displayed, carry out the following inspection.	• Improper installation of wheel speed sensor • Incorrect sensor harness contact • Malfunction of wheel speed sensor • Malfunction of rotor • Malfunction of wheel bearing • Malfunction of hydraulic unit • Malfunction of ABS-ECU

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DATA LIST REFERENCE TABLE

With the MUT-II, check the data list for the items listed.

Item No.	Check point	Check condition	Normal condition
11	Front right wheel speed sensor	Check by actually operating vehicle.	Speedometer indication and MUT-II indication are the same.
12	Front left wheel speed sensor		
13	Rear right wheel speed sensor		
14	Rear left wheel speed sensor		
16	Battery positive voltage	IG power voltage and valve monitor voltage	9–16 V
33	Stop lamp switch	Depress brake pedal.	ON
		Release brake pedal.	OFF

ACTUATOR TEST REFERENCE TABLE

The MUT-II activates the following actuators for testing.
NOTE
1. If the ABS-ECU is not functional, actuator testing cannot be carried out.
2. Actuator testing is only possible when the vehicle is stationary. If the vehicle speed during actuator testing exceeds 10 km/h, forced actuation will be cancelled.
3. During the actuator test, the ABS warning lamp will illuminate and the anti-skid control will be cancelled.

NOTE
A: Hydraulic pressure increase
B: Hydraulic pressure holds
C: Hydraulic pressure decrease

ACTUATOR TEST SPECIFICATIONS

No.	Item	
01	Solenoid valve for front-left wheel	Solenoid valves and pump motors in the hydraulic unit (simple inspection mode)
02	Solenoid valve for front-right wheel	
03	Solenoid valve for rear-left wheel	
04	Solenoid valve for rear-right wheel	

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CHECK AT THE ABS-ECU

TERMINAL VOLTAGE CHECK CHART

1. Turn the ignition switch to OFF.
2. Disconnect the ABS-ECU connector.
3. Measure the voltage at the terminals of the ABS-ECU harness-side connector while referring to the check chart.

   NOTE
   1. When measuring voltage, a harness for checking contact pin pressure should be used instead of inserting a test probe.
   2. Checks do not have to be carried out in the order given in this chart.

   Caution

   Short-circuiting the positive (+) probe between a connector terminal and ground could damage the vehicle wiring, the sensor, ABS-ECU, or all three. Use care to prevent this!
4. If voltmeter shows any deviation from standard value, check the corresponding sensor, actuator and related electrical wiring, then repair or replace.
5. After repair or replacement, recheck with the voltmeter to confirm that the repair has corrected the problem.

15AG113N

Terminal No.	Name of circuit	Check requirements		Normal condition
14	Stop light switch (Input)	Ignition switch: ON (Stop light switch ON)		Battery positive voltage
		Ignition switch: ON (Stop light switch OFF)		1.0 V or less
17, 18	Memory power supply	At all times		Battery positive voltage
15	ECU power supply	Ignition switch: ON		Battery positive voltage
20	ABS warning light (Output)	Ignition switch: ON	When light is switched off	Battery positive voltage
			When light is illuminated	0–2 V
21	Brake warning light (EBD) (Output)	Ignition switch: ON	When light is switched off	Battery positive voltage
			When light is illuminated	0–2 V

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TERMINAL RESISTANCE AND CONTINUITY CHECKS

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

   NOTE
   1. When measuring resistance and checking continuity, a harness for checking contact pin pressure should be used instead of inserting a test probe.
   2. Checks do not have to be carried out in the order given in this chart.

   Caution

   If resistance or continuity checks are performed on the wrong terminals, damage to the vehicle wiring, sensors, ABS-ECU, and/or ohmmeter may occur. Use care to prevent this!
4. If ohmmeter shows any deviation from the normal condition, 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 or replacement has corrected the problem.

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Terminal No.	Name of circuit	Check requirements	Terminal voltage
1–2	Rear right wheel speed sensor	Ignition switch: OFF	1.4–1.8 kΩ
6–7	Front left wheel speed sensor	Ignition switch: OFF	1.4–1.8 kΩ
16–ground	ABS-ECU ground	—	Continuity
19–ground	ABS-ECU ground	—	Continuity
8–9	Rear left wheel speed sensor	Ignition switch: OFF	1.4–1.8 kΩ
4–5	Front right wheel speed sensor	Ignition switch: OFF	1.4–1.8 kΩ

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ON-VEHICLE SERVICE

BLEEDING

Caution
Use the specified brake fluid. Avoid using a mixture of the specified brake fluid and other fluid.

Specified brake fluid: DOT4

MASTER CYLINDER BLEEDING

Refer Group 35 - On vehicle service.

BRAKE LINE BLEEDING

Start the engine and bleed the air in the sequence shown in the figure.

Caution
For vehicles with ABS, be sure to filter/strain the brake fluid being added to the master cylinder reservoir tank. Debris may damage the Hydraulic Unit.

ABS OPERATION CHECK

WHEEL SPEED SENSOR OUTPUT VOLTAGE CHECK

1. Lift up the vehicle and release the parking brake.
2. Disconnect the ABS-ECU harness connector and measure from the harness side connector.

   Caution
   Use a special tool (inspection harness for connector pin contact pressure) to measure the output voltage at the harness side connector to prevent damaging the connector terminals.

3. Rotate the wheel to be measured at approximately 1/2–1 rotation per second, and check the output voltage using a circuit tester or an oscilloscope.

Wheel speed sensor	Front left	Front right	Rear left	Rear right
Terminal No.	6	4	8	1
	7	5	9	2

Output voltage
When measuring with a circuit tester:
50 mV or more
When measuring with an oscilloscope:
20 mV p-p or more

4. If the output voltage is lower than the above values, the reason could be as follow:
   - Faulty wheel speed sensor – replace the wheel speed sensor.

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Inspecting Wave Forms With An Oscilloscope

Use the following method to observe the output voltage wave form from each wheel sensor with an oscilloscope:-

- Start the engine, and rotate the front wheels by engaging D range. Turn the rear wheels manually so that they rotate at a constant speed.

NOTE

1. Check the connection of the sensor harness and connector before using the oscilloscope.
2. The wave form measurements can also be taken while the vehicle is actually moving.
3. The output voltage will be low when the wheel speed is low, and similarly it will be higher as the wheel speed increases.

Points In Waveform Measurement

Symptom	Probable causes	Remedy
Too small or zero waveform amplitude	Faulty wheel speed sensor	Replace sensor
Waveform amplitude fluctuates excessively (this is no problem if the minimum amplitude is 100 mV or more)	Axle hub eccentric or with large runout	Replace hub
Noisy or disturbed waveform	Open circuit in sensor	Replace sensor
	Open circuit in harness	Correct harness
	Incorrectly mounted wheel speed sensor	Mount correctly
	Rotor with missing or damaged teeth	Replace rotor

NOTE
The wheel speed sensor cable moves following motion of the front or rear suspension. Therefore, it is likely that it has an open circuit only when driving on rough roads and it functions normally on ordinary roads. It is, therefore, recommended to observe sensor output voltage waveform also under special conditions, such as rough road driving.

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HYDRAULIC UNIT (HU) INSPECTION

Caution

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

1. Jack up the vehicle and support the vehicle with rigid racks placed at the specified jack-up points or place the wheels which are checked on the rollers of the braking force tester.

   Caution
   1. **The roller of the braking force tester and the tyre should be dry during testing.**
   2. **When testing the front brakes, apply the parking brake, and when testing the rear brakes, stop the front wheels by chocking them.**

2. Release the parking brake, and feel the drag force (drag torque) on each road wheel.
   When using the braking force tester, take a reading of the brake drag force.
3. Turn the ignition key to the OFF position and set the MUT-II as shown in the diagram.
4. After checking that the selector lever is in neutral, start the engine.

   NOTE
   1. At this time, the ABS system will switch to the MUT-II mode and the ABS warning light will illuminate.
   2. When the ABS has been interrupted by the fail-safe function, the MUT-II actuator testing cannot be used.

5. Use the MUT-II to force-drive the actuator.
6. Turn the wheel by hand and check the change in braking force when the brake pedal is depressed.
   When using the braking force tester, depress the brake pedal until the braking force is at the following values, and check to be sure that the braking force changes to the brake drag force inspected in step 2 when the actuator is force-driven.

N

Front wheel	785–981
Rear wheel	294–490

The result should be as shown in the following diagram.

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7. If the result of inspection is abnormal, correct according to the “Diagnosis Table.”

Diagnosis Table

No.	Operation	Judgement-Normal	Judgement-Abnormal	Probable cause	Remedy
01	(1) Depress brake pedal to lock wheel. (2) Using the MUT-II, select the wheel to be checked and force the actuator to operate. (3) Turn the selected wheel manually to check the change of brake force.	Brake force released for 3 seconds after locking.	Wheel does not lock when brake pedal is depressed.	Clogged brake line other than HU	Check and clean brake line
02				Clogged hydraulic circuit in HU	Replace HU assembly
03			Brake force is not released	Incorrect HU brake tube connection	Connect correctly
04				HU solenoid valve not functioning correctly	Replace HU assembly

8. After inspection, disconnect the MUT-II immediately after turning the ignition switch to OFF.

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REMEDY FOR A FLAT BATTERY

When booster cables are used to start the engine when the battery is completely discharged and then the vehicle is immediately driven without waiting for the battery to recharge itself to some extent, the engine may misfire or stall, making driving difficult.

This happens because ABS consumes a great amount of current for its self-check function. The remedy is to either allow the battery to recharge sufficiently, or to remove the fusible link for ABS circuit, thus disabling the anti-lock brake system.

The ABS warning light will illuminate when the fusible link (for ABS) is removed.

After the battery has sufficiently charged, install the fusible link (for ABS) and restart the engine; then check to be sure the ABS warning light is not illuminated.

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MASTER CYLINDER AND BRAKE BOOSTER

REMOVAL AND INSTALLATION

(Refer Group 35 - Master Cylinder)

MASTER CYLINDER

DISASSEMBLY AND REASSEMBLY

15AE079N

Disassembly steps

1. Reservoir cap assembly
2. Diaphragm
3. Brake fluid level sensor
4. Reservoir bolt
5. Reservoir

◀A▶

6. Reservoir seals
7. Piston stopper pin
8. Primary piston assembly
9. Secondary piston assembly
10. Master cylinder body

Caution
Do not disassemble the primary and secondary piston assemblies.

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DISASSEMBLY SERVICE POINTS

◀A▶ PISTON STOPPER PIN DISASSEMBLY

Remove the piston stopper pin, while depressing the piston.

INSPECTION

- Check the inner surface of master cylinder body for corrosion or pitting.
- Check the primary and secondary pistons for corrosion, scoring, damage or wear.
- Check the diaphragm for cracks and wear.

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HYDRAULIC UNIT

REMOVAL AND INSTALLATION

Pre-removal Operation
- Brake Fluid Draining
- Air Intake Hose Removal

Post-installation Operation
- Installation of the Air Intake Hose Removal
- Brake Fluid Supplying
- Brake Line Bleeding (Refer On vehicle service.)
- Hydraulic Unit Checking (Refer On vehicle service.)

Flared brake line nuts

Removal steps

▶A◀ 1. Connection for brake pipe
2. Connection for harness connector
◀A▶ 3. Hydraulic unit
4. Hydraulic unit bracket

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REMOVAL SERVICE POINT

◀A▶ HYDRAULIC UNIT REMOVAL

Caution

1. **The hydraulic unit is heavy, and so care should be taken when removing it.**
2. **The hydraulic unit is not to be disassembled; its nuts and bolts must not be loosened.**
3. **The hydraulic unit must not be dropped or otherwise subjected to impact shocks.**
4. **The hydraulic unit must not be turned upside down or laid on its side.**

INSTALLATION SERVICE POINT

▶A◀ BRAKE PIPE CONNECTION

Connect the pipes to the hydraulic unit as shown in the illustration.

1. To the rear brake (LH)
2. To the rear brake (RH)
3. From the master cylinder (primary)
4. From the master cylinder (secondary)
5. To the front brake (LH)
6. To the front brake (RH)

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WHEEL SPEED SENSOR

REMOVAL AND INSTALLATION

Post-installation Operation
- Wheel Speed Sensor Output Voltage Checking (Refer On vehicle service.)

Front speed sensor removal steps

1. Front speed sensor
2. Front rotor (Refer Group 26 -Driveshaft.)

Rear speed sensor removal

3. Rear rotor (Refer Group 27B - Driveshaft.)
4. Rear speed sensor

NOTE
The front and rear rotors are integrated with the drive shaft and are not disassembled.

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INSPECTION

SPEED SENSOR

1. Check whether any metallic foreign material has adhered to the parts shown in the illustration at the speed sensor tip, and if so, remove it.

   NOTE
   The section shown in the illustration can become magnetised because of the magnet built into the speed sensor, with the result that foreign metallic material is attached to it.

2. Measure the resistance between the speed sensor terminals.

   Standard value: 1.4–1.8 kΩ

   If the internal resistance of the speed sensor is not within the standard value, replace with a new speed sensor.

3. Check the speed sensor cable for breakage, damage or disconnection; replace with a new one if a problem is found.

   NOTE
   When checking for cable damage, remove the cable clamp part from the body and then bend and pull the cable near the clamp to check whether or not an intermittent contact results. Check the connector connection and the terminal insertion.

SPEED SENSOR INSULATION INSPECTION

1. Remove all connections from the speed sensor, and then measure the resistance between terminals (1) and (2) and the body of the speed sensor.

   Standard value: 100 kΩ or more

2. If the speed sensor insulation resistance is outside the standard value range, replace with a new speed sensor.

TOOTHED ROTOR

Check whether rotor teeth are broken or deformed, and, if so, replace the rotor.

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G SENSOR

REMOVAL AND INSTALLATION

Caution
Do not drop the G sensor or subject it to any shocks

Pre–removal Operation
- Floor Console
  (Refer Group 52A.)

INSPECTION

G SENSOR

1. Connect the special tool between the G sensor harness side connector B–129 and the G sensor.
2. With the ignition ON, check voltage between terminal 1 and terminal 2 when the G sensor is placed on a level surface.

   Standard value: 2.3V – 2.7V

3. With the ignition ON, check voltage between terminal 1 and terminal 2 when the G sensor is placed so that the label is facing straight up.

   Standard value: 3.3V – 3.7V
4. If the voltage deviates from the standard value, make ensure there is nothing wrong with the power supply wire and earth wire and then replace the G sensor.

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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 in baking or drying after painting, remove the SRS components (air bag module and SRS-ECU) beforehand.

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

(4) 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

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

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GENERAL INFORMATION

The parking brake is of a mechanical rear-wheel brake construction employing a drum in disc-type parking brake mechanism.

The operation method utilises a parking brake lever which is in an offset position at the driver's side.

CONSTRUCTION DIAGRAM

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SERVICE SPECIFICATIONS

Item	Standard value	Limit
Parking brake lever stroke	3-5 notches	-
Brake lining thickness mm	2.8	1.0
Brake drum inside diameter mm	168	169

LUBRICANTS

Items	Specified lubricants
Shoe and lining assembly and adjuster contact surfaces	Brake grease SAE J310, NLGI No. 1
Adjuster	

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ON-VEHICLE SERVICE

PARKING BRAKE LEVER STROKE CHECK

1. Pull the parking brake lever with a force of approx. 200 N and count the number of notches.

   Caution
   The 200 N force of the parking brake lever must be strictly observed.

   Standard value: 3-5 notches

2. If the parking brake lever stroke is not the standard value, adjust as described below.
   (1) Remove the inner compartment of the floor console.
   (2) Loosen the parking brake cable adjusting nut to the end of the cable rod, to allow slack in the cables.

   (3) Jack up the rear of the vehicle and support on jack stands and remove the rear wheels.
   (4) Temporarily install the wheel nuts so that the back of the nuts contact the brake disc and hold the disc in position.
   (5) Remove the brake shoe adjustment hole plug, and insert a flat blade screwdriver to turn the adjuster wheel (to expand the shoe) sufficiently to prevent the disc rotating.
   (6) Rotate the adjuster wheel 5 notches in the reverse direction to allow the disc to rotate freely. Carry out this operation on both sides.
   (7) Remove the temporarily installed wheel nuts and install the rear wheels.
   (8) Tighten the parking brake cable adjusting nut inside the vehicle to achieve a 3-5 notch stroke of the parking brake lever at the specified lever force.

   Caution
   If the number of brake lever notches engaged is less than the standard value, the cable has been over adjusted. Be sure to adjust it to within the standard value.

   (9) After completing the adjustment, check to be sure that there is no play between the adjusting nut and the pin. Also check that the adjusting nut is securely held by the nut holder.
   (10) With the parking brake lever in the released position, turn the rear wheels to confirm that the rear brakes are not dragging.
   (11) Remove the jack stands and lower the vehicle to the floor. Retorque the wheel nuts to the specified torque.

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LINING RUNNING-IN

The parking brakes must always be run – in using the following procedure when the parking brake linings or brake disc rotors have been replaced; if the brake drum has been machined or when parking brake performance is insufficient.

1. Adjust the parking brake stroke to the specified value.
2. Hook a spring scale onto the centre of the parking brake lever grip and pull it with a force of 50 N in a direction perpendicular to the handle.
3. Drive the vehicle in a forward direction at a constant speed of 30 km/h for 50 m.
4. Release the parking brake and let the brakes cool for 5 to 10 minutes.
5. Repeat the procedure in steps (2) to (4) 4-5 times.
6. Repeat step (2) and drive the vehicle at 5 km/h in the reverse direction for 50 m.
7. Repeat this operation twice, allowing the brakes to cool for 5 to 10 minutes between each operation.

8. Confirm the parking brake is working correctly by parking the vehicle in a large open area (at least 10 m from any obstacles) and apply the parking brake lever with a force of 400 N. It should be possible to stall the engine in both the forward and reverse directions in low gear without the vehicle moving.

Caution

1. **Care must be exercised when undertaking this test. The driver must be ready to apply the footbrake in case of emergency.**
2. **The above test should only be conducted once in the forward and once in the reverse direction.**
3. **The vehicle transmission should never be stalled for more than 3 seconds, as damage to the transmission may result.**

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REPLACING DUST BOOT

1. Remove the backing plate, refer On vehicle service.
2. Drill out the rivet of the dust boot retaining bracket.
3. Remove the old dust boot.

4. Install the new dust boot onto the backing plate.
5. Place the dust boot retaining bracket onto the backing plate.
6. Re-rivet the dust boot retaining bracket onto the backing plate.

PARKING BRAKE SWITCH CHECK

1. Disconnect the connector of the parking brake switch and connect an ohmmeter between the parking brake switch and the installation bolt.
2. The parking brake switch is serviceable if there is continuity when the parking brake lever is raised and if there is no continuity when it is returned.

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PARKING BRAKE LEVER

REMOVAL AND INSTALLATION

Pre-removal Operation
Floor Console Removal
(Refer On vehicle service.)

CAUTION: SRS
1. **When removing and installing the floor console, do not let it bump against the SRS-ECU or other components.**
2. **Before removal of SRS-ECU , refer Group 52B - SRS-ECU.**

Post-installation Operation
- Parking Brake Lever Stroke Adjustment
  (Refer On vehicle service.)
- Floor Console Installation
  (Refer On vehicle service.)

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Removal steps

1. Adjusting nut
2. Parking brake stay
3. Bushing
4. Parking brake switch
5. Parking brake lever

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PARKING BRAKE CABLE

REMOVAL AND INSTALLATION

Pre-removal Operation
- Floor Console Removal (Refer On vehicle service.)

CAUTION: SRS
1. **When removing and installing the floor console, do not let it bump against the SRS-ECU or other components.**
2. **Before removal of SRS-ECU , refer Group 52B - SRS-ECU.**

Post-installation Operation
- Parking Brake Lever Stroke Adjustment (Refer On vehicle service.)
- Floor Console Installation (Refer On vehicle service.)

<SEDAN>

<WAGON>

Removal steps

◀A▶
◀B▶

1. Park brake cable trunnion
2. Park brake cable actuator lever eyelet
3. Interior park brake cable retaining clamp bolts
4. Interior park brake cable retaining clamp
5. Exterior park brake cable clamp bolts
6. Grommets
7. Cables
8. Retaining clip

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REMOVAL SERVICE POINTS

◀A▶ PARK BRAKE CABLE TRUNNION

1. Loosen the park brake cable adjusting nut to the end of the cable rod as shown in the illustration.

2. Unclip the park brake cable trunnions from the equaliser and remove the cable from the body retainers.

◀B▶ PARK BRAKE CABLE ACTUATOR LEVER EYELET

1. Push the cable towards the rear of the vehicle to release the park brake cable eyelet from the actuator lever.

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PARKING BRAKE

REMOVAL AND INSTALLATION

Post-installation Operation
- Parking Brake Lever Stroke Check
  (Refer On vehicle service.)

<SEDAN>

Brake grease: SAE J310, NLGI No. 1

Removal steps

1. Calliper attaching bolts
2. ◀A▶ Calliper
3. ◀B▶ Disc
4. ◀C▶ ▶C◀ Speed sensor <Vehicles with ABS>
5. Hub retaining bolts
6. ◀C▶ ▶C◀ Hub
7. Shoe hold down spring screw
8. Shoe hold down spring
9. Shoe
10. Splash shield
11. Parking brake cable to lever connection
12. Backing plate
13. Adjuster star wheel
14. ▶B◀ Tappet
15. ▶B◀ Pushrod
16. ◀D▶ ▶A◀ Lever

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PARKING BRAKE

REMOVAL AND INSTALLATION

Post-installation Operation
- Parking Brake Lever Stroke Check
  (Refer On vehicle service.)

<WAGON>

Brake grease: SAE J310, NLGI No. 1

Removal steps

1. Calliper attaching bolts
◀A▶ 2. Calliper
◀B▶ 3. Disc
◀C▶ ▶C◀ 4. Speed sensor <Vehicles with ABS>
5. Dust cap
6. Nut
7. Washer
◀C▶ ▶C◀ 8. Hub
9. Shoe hold down spring screw
10. Shoe hold down spring
11. Shoe
12. Splash shield retaining bolts
13. Splash shield
14. Retaining clip
15. Parking brake cable to lever connection
16. Backing plate
17. Adjuster star wheel
▶B◀ 18. Tappet
▶B◀ 19. Pushrod
◀D▶ ▶A◀ 20. Lever

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REMOVAL SERVICE POINTS

◀A▶ CALLIPER

1. Support the removed calliper with wire to a nearby part to avoid placing stress on the flexible brake hose.

◀B▶ BRAKE DISC

1. If removal of the brake disc is difficult, release the shoe adjuster star wheel to a point where the brake disc is able to be removed by rotating the disc and pulling gently.

Caution
If excessive force is applied to the brake disc, the shoe hold down clip will be damaged.

◀C▶ HUB/SPEED SENSOR

1. Ensure no damage is caused to the ABS rotor or speed sensor by striking them against each other or other components.

◀D▶ LEVER

NOTE
Care must be taken when pulling the lever through the boot as damage may result.

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INSTALLATION SERVICE POINTS

▶A◀ LEVER

1. When inserting the lever through the boot, take care not to damage the boot.

▶B◀ PUSHROD/TAPPET

1. Pack the inside of the tappet with grease to hold the pushrod during assembly.

▶C◀ HUB/SPEED SENSOR

1. Ensure no damage is caused to the ABS rotor or speed sensor by striking them against each other or other components.

INSPECTION

- Clean the backing plate, boot and actuation components.

Caution

1. **Do not clean the shoe, only brush off the brake dust.**
2. **Only use soap and water to wash the boot as solvents may damage the rubber.**

- Measure the brake lining thickness in at least three locations on each side of the shoe. Replace the shoe if less than the limit value of lining exists or if the lining is worn unevenly.

  Standard value: 2.8mm

  Limit (maximum): 1.5mm

- Using an inside micrometer measure the brake disc inner diameter in two or more locations. Replace the rotor if the inside diameter exceeds the limit value.

  Standard value: 168mm

  Limit (maximum): 169mm
- Inspect the actuation components for wear or cracking.
- Check the shoe for cracks.

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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 in baking or drying after painting, remove the SRS components (air bag module and SRS-ECU) beforehand.

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

(4) 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
Section titles with the asterisk (*) in the table of contents in each group indicate operations requiring warnings.

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GENERAL INFORMATION

The parking brake is of a mechanical rear-wheel brake construction employing a drum in disc-type parking brake mechanism.

The operation method utilises a parking brake lever which is in an offset position at the driver's side.

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SERVICE SPECIFICATIONS

Item	Standard value	Limit
Parking brake lever stroke	3-5 notches	-
Brake lining thickness mm	2.8	1.0
Brake drum inside diameter mm	168	169

LUBRICANTS

Items	Specified lubricants
Shoe and lining assembly and adjuster contact surfaces	Brake grease SAE J310, NLGI No. 1
Adjuster	

SPECIAL TOOLS

Tool	Tool number and name	Supersession	Application
	MB990767 End yoke holder		Hub fixing
	MB991406, MB991113 , or MB990635 Steering linkage puller	13–006	Toe control arm ball joint and knuckle removal
	MB 990241 Rear axle shaft puller A: MB990242 Puller shaft B: MB990244 Puller bar		Removal of drive shaft Removal of rear hub assembly
	MB991354 Puller body		

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ON-VEHICLE SERVICE

PARKING BRAKE LEVER STROKE CHECK

1. Pull the parking brake lever with a force of approx. 196 N and count the number of notches.

   Caution
   The 196 N force of the parking brake lever must be strictly observed.

   Standard value: 3-5 notches at 196 N.

2. If the parking brake lever stroke is not the standard value, adjust as described below.
   (1) Remove the inner compartment of the floor console.
   (2) Loosen the parking brake cable adjusting nut to the end of the cable rod, to allow slack in the cables.

   (3) Jack up the rear of the vehicle and support on jack stands and remove the rear wheels.
   (4) Temporarily install the wheel nuts so that the back of the nuts contact the brake disc and hold the disc in position.
   (5) Remove the brake shoe adjustment hole plug, and insert a flat blade screwdriver to turn the adjuster wheel (to expand the shoe) sufficiently to prevent the disc rotating.
   (6) Rotate the adjuster wheel 5 notches in the reverse direction to allow the disc to rotate freely. Carry out this operation on both sides.
   (7) Remove the temporarily installed wheel nuts and install the rear wheels.
   (8) Tighten the parking brake cable adjusting nut inside the vehicle to achieve a 3-5 notch stroke of the parking brake lever at the specified lever force.

   Caution
   If the number of brake lever notches engaged is less than the standard value, the cable has been over adjusted. Be sure to adjust it to within the standard value.

   (9) After completing the adjustment, check to be sure that there is no play between the adjusting nut and the pin. Also check that the adjusting nut is securely held by the nut holder.
   (10) With the parking brake lever in the released position, turn the rear wheels to confirm that the rear brakes are not dragging.
   (11) Remove the jack stands and lower the vehicle to the floor. Retorque the wheel nuts to the specified torque.

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LINING RUNNING-IN

The parking brakes must always be run–in using the following procedure when the parking brake linings or brake disc rotors have been replaced, if the brake drum has been machined or when parking brake performance is insufficient.

1. Adjust the parking brake stroke to the specified value.
2. Apply the parking brake at 5 clicks, (approx 250N), and dive the vehicle at 20 km/h for 90 metres.
3. Release the parking brake and drive the vehicle at normal speed for 1.5 kilometres.
4. Repeat the procedure in step 2, with the vehicle only travelling 50 metres.

   Caution
   Care must be exercised when undertaking this test. The driver must be ready to apply the footbrake in case of emergency.

5. Confirm the parking brake is working correctly and is adjusted within specification.

   Standard value: 3-5 notches at 196 N.

PARKING BRAKE SWITCH CHECK

1. Disconnect the connector of the parking brake switch and connect an ohmmeter between the parking brake switch and the installation bolt.
2. The parking brake switch is serviceable if there is continuity when the parking brake lever is raised and if there is no continuity when it is returned.

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PARKING BRAKE LEVER

REMOVAL AND INSTALLATION

Pre-removal Operation
Floor Console Removal
(Refer On vehicle service.)

CAUTION: SRS
1. **When removing and installing the floor console, do not let it bump against the SRS-ECU or other components.**
2. **Before removal of SRS-ECU , refer Group 52B - SRS-ECU.**

Post-installation Operation
- Parking Brake Lever Stroke Adjustment
  (Refer On vehicle service.)
- Floor Console Installation
  (Refer On vehicle service.)

14AE015N

Removal steps

1. Adjusting nut
2. Parking brake stay
3. Bushing
4. Parking brake switch
5. Parking brake lever

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PARKING BRAKE CABLE

REMOVAL AND INSTALLATION

Pre-removal Operation
- Floor Console Removal (Refer On vehicle service.)

CAUTION: SRS
1. **When removing and installing the floor console, do not let it bump against the SRS-ECU or other components.**
2. **Before removal of SRS-ECU , refer Group 52B - SRS-ECU.**

Post-installation Operation
- Parking Brake Lever Stroke Adjustment (Refer On vehicle service.)
- Floor Console Installation (Refer On vehicle service.)

Brake grease: SAE J310, NLGI No. 1

Removal steps
- Rear seat cushion (Refer GROUP 52A)

◀A▶ 1. Park brake cable trunnion
◀B▶ 2. Rear brake caliper
3. Rear brake disc
▶B◀ 4. Shoe to anchor spring
5. Adjusting wheel spring
▶A◀ 6. Adjuster
7. Strut
8. Strut return spring
◀C▶ 9. Shoe hold down cup
10. Shoe hold down spring
11. Shoe hold down pin
12. Shoe and lining assembly
13. Clip
14. Rear park brake cable

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REMOVAL SERVICE POINTS

◀A▶ PARK BRAKE CABLE TRUNNION

1. Loosen the park brake cable adjusting nut to the end of the cable rod as shown in the illustration.

2. Unclip the park brake cable trunnions from the equaliser and remove the cable from the body retainers.

◀B▶ REAR BRAKE CALIPER ASSEMBLY

1. Remove the rear brake caliper and support it with wire to prevent stain on the brake hose.

   NOTE
   Loosen the locknut before removing the rear brake caliper assembly in the case of removing the drive shaft.

◀C▶ SHOE HOLD DOWN CUP

1. Expand the shoe and lining assembly and remove the shoe hold down cup.

INSTALLATION SERVICE POINTS

▶A◀ ADJUSTER

1. Install the left side shoe adjusting bolt to the vehicle forward, and the right side to the vehicle rearward.

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▶B◀ SHOE TO ANCHOR SPRING

1. Install the shoe to anchor spring as shown in the diagram.

Caution
Each shoe to anchor spring has a different load. The rear spring has been painted in an identification colour to prevent incorrect assembly.

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PARKING BRAKE

REMOVAL AND INSTALLATION

Post-installation Operation
- Parking Brake Lever Stroke Check (Refer On vehicle service.)

Brake grease: SAE J310, NLGI No. 1

Removal steps

1. Rear caliper assembly
2. Rear brake disc
3. Shoe to anchor spring
4. Adjusting wheel spring
5. Adjuster
6. Strut
7. Strut return spring
8. Shoe hold down cup
9. Shoe hold down spring
10. Shoe hold down pin
11. Shoe and lining assembly
12. Clip
13. Park brake cable
14. Split pin
15. Drive shaft nut ◀A▶ ▶B◀
16. Connection of shock absorber
17. Connection of trailing arm
18. connection of lower arm
19. connection of toe control arm ◀B▶
20. Drive shaft ◀C▶ ▶A◀
21. Rear hub assembly
22. Backing plate

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REMOVAL SERVICE POINTS

◀A▶ DRIVE SHAFT NUT

◀B▶ TOE CONTROL ARM

Caution

1. **Loosen the nut from the ball joint.**
2. **Attach the special tool with a string to prevent it from falling.**

◀C▶ DRIVE SHAFT

1. Push the lower part of the knuckle to the outside of the vehicle. Using a tyre lever, separate the drive shaft from the differential carrier.

2. Remove the drive shaft from the hub using the special tools.

INSPECTION

BRAKE LINING/BRAKE DRUM WEAR

1. Measure the thickness of the brake linings at the most worn area.

   Standard value: 2.8mm

   Limit: 1.0mm
2. If the thickness of the brake lining is worn more than the limit value, replace the left and right shoe and lining assembly and the same time.

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3. Measure the internal brake discs at more than two places.

   Standard value: 168mm

   Limit: 169mm
4. Replace the brake disc if its internal measurement is worn beyond the limit value.

INSTALLATION SERVICE POINTS

▶A◀ DRIVE SHAFT INSTALLATION

Caution

1. **Be careful that the spline part of the drive shaft does not damage the oil seal of the differential carrier.**
2. **Ensure the drive shaft with the double splines is installed into the right hand side of the differential.**

   NOTE
   Identify the drive shaft for the right and left by the colour of the TJ boot band (Small).

Left drive shaft	Right drive shaft
Yellowish green	Brown

▶B◀ DRIVE SHAFT NUT INSTALLATION

1. Assemble the drive shaft washer in the direction shown in the illustration.
2. Use the special tools as used for the removal to tighten the drive shaft nut to the specified torque.

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RACK AND PINION
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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 in baking or drying after painting, remove the SRS components (air bag module and SRS-ECU) beforehand.

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

(4) 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
Section titles with the asterisk (*) in the table of contents in each group indicate operations requiring warnings.

POWER STEERING OIL PUMP
REMOVAL AND INSTALLATION
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GENERAL INFORMATION

Power steering has been adopted in all models. The power steering is responsive to engine speed. The main features are as follows.
Four-spoke steering wheel has been adopted. In addition, a driver SRS airbag is provided as a standard in all vehicles.

The steering column in all vehicles has a shock absorber mechanism and a tilt steering mechanism. A vane-type oil pump with a fluid flow control system included has been adopted.
The steering gear and linkage is an integral rack and pinion type.

Items		Specifications
Gear box	Steering gear type	Rack and pinion
Oil pump	Oil pump type	Vane type
	Displacement cm^3/rev.	9.6
	Relief set pressure MPa	8.8

SERVICE SPECIFICATIONS

Items		Standard value	Limit
Steering wheel free play mm	with engine stopped	0–10	–
	with engine running	–	30
Steering angle	Inner wheel	37°30' ± 2°	–
	Outer wheel	30°0'	–
Tie rod end ball joint starting torque Nm		0.5–2.5	–
Stationary steering effort N		27 or less	–
Fluctuation allowance N		5.9 or less	–
Oil pump pressure MPa	Oil pump relief pressure	8.8	–
	Pressure under no-load conditions	0.8–1.0	–
	Steering gear holding hydraulic pressure	8.8	–
Power steering pressure switch operating pressure MPa	ON → OFF	3.4–4.4	–
	OFF → ON	1.8–2.4	–
Total pinion preload Nm		0.8–1.6	–
Tie-rod joint swing resistance N		6–20	–
Tie-rod joint swing torque Nm		2–5	–
Oil pump pulley assembly backlash mm		–	0.1

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LUBRICANTS

Items		Specified lubricants	Quantity
Power steering gearbox	Bearing	Automatic transmission fluid DEXRON II ATF	As required
	O-ring		
	Oil seal		
	Special tool (E37M1–6)		
	Pinion and valve assembly seal ring part		
	Bellows	Silicone grease	As required
Oil pump	Power steering fluid	Automatic transmission fluid DEXRON II ATF	0.9 dm^3
	Flow control valve	Automatic transmission fluid DEXRON II ATF	As required
	Friction surface of rotor, vane, cam ring and pump cover		
	O-ring		

SEALANT

Items		Specified sealant and adhesive	Remarks
Power steering gearbox	End plug screw	Loctite 577	Semi-drying sealants
	Power steering rack support cover screw		
	Dust cover lip for tie rod end ball joint		

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SPECIAL TOOLS

Tool	Tool number and name	Supersession	Application
	MB991113 or MB990635 Steering linkage Puller	13–006	Tie-rod end disconnection
	EMB990326 Preload socket	MB990326	Tie rod end ball joint starting torque check
	MB990662 Oil pressure gauge assembly	E9254A	Oil pump pressure test
	MB990993 or MB991217 Power steering oil pressure gauge adaptor (pump side)	–	Oil pump pressure test
	MB990994 Power steering oil pressure gauge adaptor (hose side)	–	
	MB990803 Steering wheel puller	7245	Steering wheel removal
	MB991006 Preload socket	EMB991006	Pinion shaft preload measurement
	E37M2–2 Torque wrench socket	–	Rack support adjustment Rack support cover removal
	MB990925 Bearing and oil seal installer set	27794	Bearing and oil seal installation

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Tool	Tool number and name	Supersession	Application
	MB991197 Rack oil seal installer bar (long type)	–	Oil seal installation
	E37M1–2 Oil seal installer	–	Oil seal installation
	E37M1–6 Rack installer	–	Rack installation
	E37M2–1 Pinion gear seal compressor	–	Seal ring installation
	E37M2–3 Rack bush remover and installer	–	To remove the rack bush circlip
	E37M50–3 Oil seal & bearing installer	–	Oil seal and bearing installation
	E8802-6 Tie rod torque wrench adaptor	–	To remove and replace tie rod on rack
	MB990776 Tie rod end seal installer	E2M44	Dust cover installation
	M16X1.5 tap	–	To re-tap the rack end thread

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ON-VEHICLE SERVICE

STEERING WHEEL FREE PLAY CHECK

1. With engine running (hydraulic operation), set front wheels straight ahead.
2. Measure the play on steering wheel circumference before wheels start to move when slightly moving steering wheel in both directions.

   Limit: 30 mm

3. When play exceeds the limit, check for play on steering shaft connection and steering linkage. Correct or replace.
4. If the free play still exceeds the limit value, set steering wheel straight ahead with engine stopped.
   Load 5 N towards steering wheel circumference and check play.

   Standard value (steering wheel play with engine stopped): 0–10 mm or less

   If the play exceeds the standard value, remove steering gear box and check total pinion torque.

STEERING ANGLE CHECK

1. Locate front wheels on turning radius gauge and measure steering angle.

   Standard value:
   Inside wheel: 37°00' ± 2°
   Outside wheel: 30°00'

2. When the angle is not within the standard value, the toe is probably incorrect. Adjust toe (Refer Group 33A.) and recheck steering angle.

TIE ROD END BALL JOINT STARTING TORQUE CHECK

1. Disconnect tie rod and knuckle with special tool.

   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 until the tie rod end is separated from the knuckle.

2. Move ball joint stud several times and install nut on stud. Measure ball joint starting torque with special tools.

   Standard value: 0.5–2.5 Nm

3. When the starting torque exceeds the standard value, replace tie rod end.
4. When the starting torque is less than the standard value, check ball joint for excessive end play or binding. If these checks are satisfactory, the joint is still serviceable.

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STATIONARY STEERING EFFORT CHECK

1. With the vehicle stopped on a flat, paved surface, turn the steering wheel to the straight ahead position.
2. Start the engine and set it to 1,000 ± 100 rpm.

   Caution
   After checking, reset the idle speed to the specified idling rpm.

3. Attach a spring balance to the outer circumference of the steering wheel and measure the steering force required to turn the steering wheel from the straight ahead position to the left and right (within a range of 1.5 turns). Also check to be sure that there is no significant fluctuation of the required steering force.

   Standard value:
   Steering effort: 27 N or less
   Fluctuation allowance: 5.9 N or less

4. If the measured force exceeds the standard value, refer to the troubleshooting and make the checks and adjustments described there.

CHECKING STEERING WHEEL RETURN TO CENTRE

To perform this test, conduct a road test and check as follows.

1. Make both gradual and sudden turns and check the steering "feeling" to be sure that there is no difference in the steering force required and the wheel return between left and right turns.
2. At a speed of 20–30 km/h, turn the steering wheel 90°, and release the steering wheel after 1 or 2 seconds. If the steering wheel then returns 70° or more, the return can be judged to the satisfactory.

   NOTE
   There will be a momentary feeling or "heaviness" when the wheel is turned quickly, but this is not abnormal. (This is because the oil pump discharge amount is reduced during idling.)

FLUID LEVEL CHECK

1. Park the vehicle on a flat, level surface, start the engine, and then turn the steering wheel several times to raise the temperature of the fluid to approximately 50–60°C.
2. With the engine running, turn the wheel all the way to the left and right several times.
3. Check the fluid in the oil reservoir for foaming or milkiness.
4. Check the difference of the fluid level when the engine is stopped, and while it is running. If the fluid level changes considerably, air bleeding should be done.

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FLUID REPLACEMENT

1. Raise the front wheels on a jack, and then support them with rigid racks.
2. Disconnect the return hose connection.
3. Connect a vinyl hose to the return hose, and drain the oil into a container.
4. Disconnect the connector from the crank angle sensor and then while operating the starter motor intermittently, turn the steering wheel all the way to the left and right several times to drain all of the fluid.
5. Connect the return hoses securely, and then secure it with the clip.
6. Fill the oil reservoir with the specified fluid up to the lower position of the filter, and then bleed the air.

   Specified fluid:
   Automatic transmission fluid DEXRON II ATF

   Caution:
   Do not use ELC–SP2
7. Erase the diagnosis code (generated by step 4) from the MPI system.

BLEEDING

1. Jack up the front wheels and support them by using a rigid rack.
2. Manually turn the oil pump pulley a few times.
3. Turn the steering wheel all the way to the left and to the right five or six time.
4. Disconnect the connector from the crank angle sensor and then, while operating the starting motor intermittently, turn the steering wheel all the way to the left and right five or six times (for 15 to 20 seconds).

   Caution
   1. **During air bleeding, replenish the fluid supply so that the level never falls below the lower position of the filter.**
   2. **If air bleeding is done while engine is running, the air will be broken up and absorbed into the fluid; be sure to do the bleeding only while cranking.**
5. Connect the crank angle sensor connector and then start the engine (idling).
6. Turn the steering wheel to the left and right until there are no air bubbles in the oil reservoir.
7. Confirm that the fluid is not milky, and that the level is up to the specified position on the level gauge.
8. Confirm that there is very little change in the fluid level when the steering wheel is turned left and right.

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9. Check whether or not the change in the fluid level is within 5 mm when the engine is stopped and when it is running.

Caution
1. **If the change of the fluid level is 5 mm or more, the air has not been completely bled from the system, and thus must be bled completely.**
2. **If the fluid level rises suddenly after the engine is stopped, the air has not been completely bled.**
3. **If air bleeding is not complete, there will be abnormal noises from the pump and the flow-control valve, and this condition could cause a lessening of the life of the pump, etc.**

OIL PUMP PRESSURE TEST

CHECKING THE OIL PUMP RELIEF PRESSURE

1. Disconnect the pressure hose from the oil pump, and then connect the special tools.
2. Bleed the air, and then turn the steering wheel several times while the vehicle is not moving so that the temperature of the fluid rises to approximately 50–60°C.
3. Start the engine and idle it at 1,000 ± 100 rpm.
4. Fully close the shut-off valve of the pressure gauge and measure the oil pump relief pressure to confirm that it is within the standard value range.

   Standard value: 8.3–8.8 MPa

   Caution
   Pressure gauge shut off valve must not remain closed for more than 10 seconds.
5. If it is not within the standard value, overhaul the oil pump.
6. Remove the special tools and then tighten the pressure hose to the specified torque.
7. Bleed the system.

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CHECKING THE PRESSURE UNDER NO-LOAD CONDITIONS

1. Disconnect the pressure hose from the oil pump, and then connect the special tools.
2. Bleed the air, and then turn the steering wheel several times while the vehicle is not moving so that the temperature of the fluid rises to approximately 50–60°C.
3. Start the engine and idle it at 1,000 ± 100 rpm.
4. Check whether or not the hydraulic pressure is the standard value when no-load conditions are created by fully opening the shut-off valve of the pressure gauge.

   Standard value: 0.8–1.0 MPa
5. If it is not within the standard value, the probable cause is a malfunction of the oil line or steering gear box, so check these parts and repair as necessary.
6. Remove the special tools, and then tighten the pressure hose to the specified torque.
7. Bleed the system.

CHECKING THE STEERING GEAR HOLDING HYDRAULIC PRESSURE

1. Disconnect the pressure hose from the oil pump, and then connect the special tools.
2. Bleed the air, and then turn the steering wheel several times while the vehicle is not moving so that the temperature of the fluid rises to approximately 50–60°C.
3. Start the engine and idle it at 1,000 ± 100 rpm.
4. Fully close and fully open the shut-off valve of the pressure gauge.
5. Turn the steering wheel all the way to the left or right; then check whether or not the holding hydraulic pressure is the standard value.

   Standard value: 8.8 MPa
6. When not within the standard value, overhaul the steering gear box.
   Remeasure fluid pressure.
7. Remove the special tools, and the tighten the pressure hose to the specified torque.
8. Bleed the system.

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POWER STEERING PRESSURE SWITCH CHECK

1. Disconnect the pressure hose from the oil pump, and then connect the special tools.
2. Bleed the air, and then turn the steering wheel several times while the vehicle is not moving so that the temperature of the fluid rises to approximately 50–60°C.
3. The engine should be idling.
4. Disconnect the connection of the connector for the pressure switch, and place an ohmmeter in position.
5. Gradually close the shut-off valve of the pressure gauge and increase the hydraulic pressure then check whether or not the hydraulic pressure that activates the switch is the standard value.

   Standard value: 3.4–4.4 MPa

6. Gradually open the shut-off valve and reduce the hydraulic pressure; then check whether or not the hydraulic pressure that deactivates the switch is the standard value.

   Standard value: 1.8–2.4 MPa

7. Remove the special tools, and then tighten the pressure hose to the specified torque.
8. Bleed the system.

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STEERING WHEEL AND SHAFT

REMOVAL AND INSTALLATION

CAUTION: SRS
Before removal of air bag module, refer to:
Group 52B - SRS Service Precautions
Group 52B - Air bag module and clock spring

Post-installation Operation
- Checking Steering Wheel Position with Wheels Straight Ahead

Removal steps

1. Horn pad assembly <Non – SRS vehicles>
2. Air bag module <SRS vehicles> (Refer Group 52B.)
3. Steering wheel retaining nut
4. Spring washer
5. Flat washer
6. Steering wheel
7. Cruise control switch
8. Remote control switch
9. Hood release handle
10. Instrument panel lower cover
11. Key cylinder panel
12. Lower column cover
13. Upper column cover
14. Column switch assembly
15. Clock spring and column switch assembly (Refer Group 52B.)
16. Retainer mounting bolt
17. Steering column assembly

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REMOVAL SERVICE POINT

◀A▶ STEERING WHEEL REMOVAL

DISASSEMBLY AND REASSEMBLY

Disassembly steps

◀A▶ ▶A◀ 1. Special bolt
▶A◀ 2. Steering handle lock
3. Steering column assembly
4. Cover assembly
5. Steering joint assembly

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DISASSEMBLY SERVICE POINTS

◀A▶ SPECIAL BOLT

1. Drill a hole in the special bolt to a depth to enable a suitable size stud extractor to stand up.
2. Using the stud extractor, remove the special bolt.

REASSEMBLY SERVICE POINTS

▶A◀ STEERING LOCK CYLINDER/STEERING LOCK BRACKET/SPECIAL BOLT INSTALLATION

1. When installing the steering lock and steering lock bracket to the column tube, temporarily install the steering lock in alignment with the column boss.
2. After checking that the lock works properly, tighten the special bolts until the head twists off.

Caution
The steering lock bracket and bolts must be replaced with new ones when the steering lock is installed.

INSPECTION

- Check the steering shaft for play and rough movement.
- Check the joints for play, damage, or rough movement.
- Check the joint bearing for wear and damage.
- Check the dust shield for damage.

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RACK AND PINION

REMOVAL AND INSTALLATION

Pre-removal Operation
- Power Steering Fluid Draining (Refer On vehicle service.)
- Disconnect the centre member (Refer Group 32.)
- Disconnect the front exhaust pipe (Refer Group 15.)

CAUTION: SRS
For vehicles with SRS, before removal of steering gear box, refer Group 52B – General Information, centre front wheels and remove ignition key. Failure to do so may damage the SRS clock spring and render the SRS system inoperative, risking serious driver injury.

Post-installation Operation
- Fit the front exhaust pipe (Refer Group 15.)
- Fit the centre member (Refer Group 32.)
- Power Steering Fluid Supplying (Refer On vehicle service.)
- Power Steering Fluid Line Bleeding (Refer On vehicle service.)
- Steering Wheel Position with Wheels Straight Ahead Checking
- Front Wheel Alignment Adjustment (Refer Group 33A.)

Removal steps

1. Joint assembly and gear box connecting bolt
2. Cotter pin
3. Connection for tie-rod end and knuckle
4. Pressure pipe
5. Return pipe
6. Clamp
7. Steering gear and linkage

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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 until the tie rod end is separated from the knuckle.**

◀B▶ GEAR BOX ASSEMBLY REMOVAL

Caution
Be careful not to damage the bellows and the tie-rod end dust cover when removing the gear box assembly.

INSPECTION

- Check the rubber parts for cracks and breakage.

GEAR BOX TOTAL PINION TORQUE

Using the special tools, rotate the pinion gear at the rate of one rotation in approximately 4 to 6 seconds to check the total pinion torque.

Standard value: 0.8–1.6 Nm
Torque variation: 0.5 Nm

NOTE
When measuring, remove the bellows from the rack housing. Measure the pinion torque through the whole stroke of the rack.
If the measured value is not within the standard range, first adjust the rack support cover, and then check the total pinion starting torque again.
If the total pinion starting torque cannot be adjusted to within the standard range by adjusting the rack support cover, check the rack support cover, rack support spring, rack support and replace any parts necessary.

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CHECK THE TIE ROD FOR SWING RESISTANCE

1. Give 10 hard swings to the tie rod.
2. Measure the tie rod swing resistance with a spring balance.

   Standard value: 6–20 N

3. If the measured value exceeds the standard value, replace tie rod assembly.
4. Even if the measured value is below the standard value, the tie rod which swings smoothly without excessive play may be used.

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DISASSEMBLY AND REASSEMBLY

Disassembly steps

1. Feed tube
2. ▶J◀ Lock nut
3. ▶J◀ Tie rod end
4. ▶I◀ Dust cover
5. Clip
6. Band
7. Bellows
   - ▶H◀ Total pinion rotation torque adjustment
8. ◀A▶ ▶G◀ Tie rod
9. Lock nut
10. ◀B▶ Rack support cover
11. Spring
12. Rack support
13. ◀C▶ Pinion and valve assembly
14. ◀D▶ ▶F◀ Seal ring
15. ◀E▶ ▶E◀ Valve housing
16. ◀E▶ ▶E◀ Upper oil seal
17. Upper bearing
18. ◀F▶ ▶D◀ Retaining wire
19. ◀G▶ ▶C◀ Rack bush
20. ◀G▶ ▶C◀ Outer oil seal
21. ◀G▶ ▶B◀ Rack assembly
22. ◀H▶ ▶A◀ Inner oil seal
23. Rack housing
24. Rack housing mount bush

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LUBRICATION AND SEALING POINTS

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37A BASE

SERVICE POINTS OF DISASSEMBLY

◀A▶ TIE ROD REMOVAL

◀B▶ RACK SUPPORT COVER

1. Scribe a mark across the surface of the rack support cover and the rack housing.
2. Remove the lock nut.
3. Remove the rack support cover.

◀C▶PINION AND VALVE ASSEMBLY

1. Using a plastic hammer, gently tap the pinion to remove it.

◀D▶ SEAL RING

1. Cut the seal ring and remove it from the pinion and valve assembly and the rack.

   NOTE
   Take care not to scratch the pinion and valve assembly, or the rack assembly when cutting the seal ring.

◀E▶ UPPER BEARING/UPPER OIL SEAL

1. Using an appropriate socket, remove the oil seal and the ball bearing from the valve housing simultaneously.

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◀F▶ RETAINING WIRE

1. Turn the rack stopper in the direction of least resistance until the wire end emerges from the cylinder slot.
2. Locate the end of the wire, lift with a suitable screwdriver, turn the rack bushing to remove the wire.

◀G▶ RACK BUSH/RACK ASSEMBLY/OUTER OIL SEAL

1. Pull out the rack slowly and remove the rack bush and the outer oil seal at the same time from the steel tube end.

◀H▶ OIL SEAL

1. Use a pipe, [outside diameter 30mm] or similar tool to remove the oil seal and back up washer.

REASSEMBLY SERVICE POINTS

▶A◀ OIL SEAL

1. Apply a coating of the specified fluid to the inside and outside of the oil seal.
2. Place the inner oil seal on the seal installer.
3. Slowly insert the installer into the gear housing from the gear steel tube end.

   NOTE
   Ensure installer is aligned with gear steel tube during insertion to prevent damage and distortion to the seal.

▶B◀ RACK ASSEMBLY

1. Re-tap the tie rod threads using a M16x1.5 tap.
2. Apply a coating of multipurpose grease to the rack teeth face.

   NOTE
   Do not block the vent hole in the rack with grease.

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3. Cover the rack assembly teeth side using a special tool.
4. Apply specified fluid to the outside of the special tool and the piston seal ring.

   Fluid: DEXRON II

5. Slowly insert the rack covered with the special tool from the power cylinder end of the gear housing.

   NOTE
   When inserting the rack, ensure the oil seal retaining ring does not pop out by keeping the centre of the oil seal aligned with the front end of the special tool.

6. Remove the special tool.

▶C◀ RACK BUSH AND OUTER OIL SEAL

1. Apply the specified fluid to both sides of the outer oil seal.

   Fluid: DEXRON II

   Caution
   Do not allow oil seal retainer spring to slip out.

2. Wrap the end of the rack in plastic tape and insert the outer oil seal and rack bush into the rack.

▶D◀ RETAINING WIRE

1. Align the rack stopper marking with the cylinder slot. Insert the circlip into the cylinder slot and then into the rack stopper hole and turn the rack stopper in a clockwise direction until the circlip is fully in place.

▶E◀ UPPER OIL SEAL/UPPER BEARING

1. Apply a thin film of the designated fluid to the inside of the seal.
2. Place the upper bearing, then the seal onto the special tool.
3. Lightly press the upper seal and upper bearing into the valve housing.

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▶F◀ SEAL RING

1. As the seal rings will be stretched after assembly onto the pinion shaft use the special tool to compress the seal rings so that they will be well seated into the grooves and be able to be easily installed without causing any damage to them.

▶G◀ TIE ROD ASSEMBLY

NOTE
Tie rods must be replaced as the thread would have been damaged during removal.

1. Install the new tie rod to the rack assembly after the pinion assembly has been installed. Tighten the tie rod using special tool E8802-6 and a torque as follows:

Torque Wrench Effective Length (mm)	Torque Setting (Nm)
300	62
350	64
400	67

NOTE
Ensure the torque wrench is kept in the same plane as the special tool; as shown in the illustration. Any variation to this will alter the torque setting.

2. Stake the key slot section of the rack assembly end to the recessed area behind the thread of the tie rod.

▶H◀ ADJUSTING THE TOTAL PINION TORQUE

1. Use the special tool to tighten the rack support cover to 15 Nm.
2. Reverse rotate the rack support cover by about 30°.

3. Use the special tool to rotate the pinion shaft at the rate of one rotation in approximately 4 to 6 seconds and inspect if rotation torque and torque fluctuations during rotation are standard values.

   Standard value: 0.8 – 1.6 Nm

   Torque variation: 0.5 Nm or less

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4. If the rotation torque or torque fluctuation is outside the standard value, adjust by reverse rotating the rack support cover to within a range of 0 – 30°.
5. After adjusting, lock rack support cover with lock nut.

   NOTE
   1. **When adjusting, keep to the upper limits of the designated values.**
   2. **When operating the rack in the axial direction,ensure there is no roughness or snagging.**
   3. **Measure the torque at all points.**
   4. **If it is impossible to adjust the rack support cover to the standard values while within the regulated reverse rotation angle, carry out an inspection of the rack support cover and replace if necessary.**

▶I◀ DUST COVER

▶J◀ TIE ROD END INSTALLATION

1. Temporarily tighten the tie-rod to the measurements shown in the illustration using a screw lock nut.

   NOTE
   Final tightening of the lock nut is carried out when the steering gear and linkage are attached to the chassis (after toe-in adjustment).

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POWER STEERING OIL PUMP

REMOVAL AND INSTALLATION

Pre-removal Operation
- Power Steering Fluid Draining (Refer On vehicle service.)

Post-installation Operation
- Power Steering Fluid Supplying (Refer On vehicle service.)
- Drive-belt Tension Adjusting (Refer Group 11A.)
- Power Steering Fluid Line Bleeding (Refer On vehicle service.)
- Oil Pump Pressure Check (Refer On vehicle service.)

Removal steps
1. Drive-belt
2. Suction hose
3. ▶A◀ Pressure hose
4. Pressure switch connector
5. Power steering pump bracket stay
6. Oil pump

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37A BASE

INSTALLATION SERVICE POINT

▶A◀ PRESSURE HOSE INSTALLATION

Connect the pressure hose so that its notched part contacts the suction connector.

INSPECTION

- Check the drive-belt for cracks
- Check the pulley assembly for uneven rotation.

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DISASSEMBLY AND REASSEMBLY

Oil pump pulley and shaft kit	Oil pump seal kit	Oil pump cartridge kit

13AE016N

Disassembly steps

1. Pump cover
2. O-ring
3. Snap ring
4. Oil pump cartridge
5. Side plate
6. ▶A◀ O-ring
7. Connector
8. ▶A◀ O-ring
9. Flow control valve
10. Flow control spring
11. Terminal assembly
12. ▶A◀ O-ring
13. Plunger spring
14. Plunger
15. Piston rod
16. Suction connector
17. ▶A◀ O-ring
18. Pulley and shaft
19. Shaft oil seal
20. Oil pump

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REASSEMBLY SERVICE POINTS

▶A◀ O-RINGS INSTALLATION

No.	I.D.×Width mm
1	11×1.9
2	13×1.9
3	17.8×2.4
4	13.5×1.5
5	3.8×1.9
6	16.8×2.4
7	17.8×2.4
8	47.2×2.4

INSPECTION

- Check the flow control valve for clogging.
- Check the pulley assembly for wear or damage.
- Check the groove of rotor and vane for “stepped” wear.
- Check the contact surface of cam ring and vanes for “stepped” wear.
- Check the vanes for damage.

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POWER STEERING HOSES

REMOVAL AND INSTALLATION

Pre-removal Operation
- Power Steering Fluid Draining (Refer On vehicle service.)
- Front Bumper Removal (Refer Group 51.)

Post-installation Operation
- Front Bumper Installation (Refer Group 51.)
- Power Steering Fluid Supplying (Refer On vehicle service.)
- Power Steering Fluid Line Bleeding (Refer On vehicle service.)

▶A◀
1. Pressure hose
2. Pressure tube
3. Return tube
4. Return hose
5. Cooler tube
6. Hose
7. O-ring
8. Oil reservoir
9. Suction hose

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37A BASE

INSTALLATION SERVICE POINT

▶A◀ PRESSURE HOSE INSTALLATION

1. Connect the pressure hose so that its slot section contacts the oil pump's guide bracket.

2. When the pressure hose is installed, align the white line on the pressure hose with the white line on the pressure tube so that together they form a straight line.

37A STEERING <AWD>

CONTENTS

RACK AND PINION

REMOVAL AND INSTALLATION

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 in baking or drying after painting, remove the SRS components (air bag module and SRS-ECU) beforehand.

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

(4) 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

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

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RACK AND PINION

REMOVAL AND INSTALLATION

Pre-removal Operation
- Power Steering Fluid Draining (Refer On vehicle service.)
- Disconnect the centre member (Refer Group 32.)
- Disconnect the front exhaust pipe (Refer Group 15.)
- Remove the lower RH strut mounting bolts (Refer Group 33)
- Remove the rear roll stopper (Refer Group 32)
- Loosen the LH side crossmember mounting nuts and bolts (Refer Group 32)
- Remove the RH side crossmember mounting nuts and bolts to allow steering rack to slide out (Refer Group 32)

CAUTION: SRS
For vehicles with SRS, before removal of steering gear box, refer Group 52B – General Information, centre front wheels and remove ignition key. Failure to do so may damage the SRS clock spring and render the SRS system inoperative, risking serious driver injury.

Post-installation Operation
- Install the RH side crossmember mounting nuts and bolts (Refer Group 32)
- Tighten the LH side crossmember mounting nuts and bolts (Refer Group 32)
- Install the lower RH strut mounting bolts (Refer Group 33)
- Install the rear roll stopper (Refer Group 32)
- Fit the front exhaust pipe (Refer Group 15.)
- Fit the centre member (Refer Group 32.)
- Power Steering Fluid Supplying (Refer On vehicle service.)
- Power Steering Fluid Line Bleeding (Refer On vehicle service.)
- Steering Wheel Position with Wheels Straight Ahead Checking
- Front Wheel Alignment Adjustment (Refer Group 33A.)

Removal steps

1. Joint assembly and gear box connecting bolt
2. Cotter pin
3. Connection for tie-rod end and knuckle
4. Pressure pipe
5. Return pipe
6. Clamp
7. Steering gear and linkage

◀A▶ ◀B▶

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SPECIAL TOOLS

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- REMOVAL AND INSTALLATION
- INSTALLATION SERVICE POINTS

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- REMOVAL SERVICE POINTS
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- REMOVAL AND INSTALLATION
- REMOVAL SERVICE POINTS
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- REMOVAL AND INSTALLATION

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WINDOW GLASS

- GENERAL

WINDSHIELD

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- REMOVAL SERVICE POINTS
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REAR WINDOW GLASS

- REMOVAL AND INSTALLATION
- INSTALLATION SERVICE POINTS

TAILGATE WINDOW GLASS

- REMOVAL AND INSTALLATION
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- INSTALLATION SERVICE POINTS
- INSPECTION

DOOR TRIM AND WATERPROOF FILM

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- REMOVAL AND INSTALLATION
- INSTALLATION SERVICE POINTS
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- DOOR FIT ADJUSTMENT
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- INSPECTION

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- INSIDE HANDLE PLAY ADJUSTMENT
- OUTSIDE HANDLE PLAY CHECK

DOOR BELT LINE MOULDING AND DOOR OPENING WEATHERSTRIP
- REMOVAL AND INSTALLATION
- REMOVAL SERVICE POINTS
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SUNROOF

SERVICE SPECIFICATIONS

TROUBLESHOOTING
- CHECKING THE SUNROOF ECU TERMINALS

ON-VEHICLE SERVICE
- WATER TEST
- SUNROOF FIT ADJUSTMENT

SUNROOF
- REMOVAL AND INSTALLATION
- REMOVAL SERVICE POINTS
- INSTALLATION SERVICE POINTS
- INSPECTION
- DISASSEMBLY AND REASSEMBLY

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SPECIAL TOOLS

Tool	Tool number and name	Supersession	Application
	MB991244 Torsion bar remover and installer	–	Removal and installation of trunk lid torsion bar
	E42M4 Door glass adjusting kit	–	Adjusting door glass
	MB991502 MUTT-II sub assembly	–	Registering the radio wave key-less entry transmitter
	MB990480 Glass holder	–	Removal and installation of window glass
	MB990784 Ornament remover	E23M6	Removal of the door trims
	MB991529 Diagnosis code check harness	MB991529-01	For checking of fault codes

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HOOD

REMOVAL AND INSTALLATION

Adjustment of hood step and hood striker linkage

Adjustment of clearance around hood and height

20TJ070A

▶A◀ 1. Bumper
2. Hood weatherstrip
3. Hood weatherstrip
4. Hood silencer
5. Lock release handle

Hood lock release cable removal steps

- Splash shield (Refer On vehicle service.)

6. Hood lock release cable

Hood latch removal steps

- Radiator grille (Refer Group 51.)

7. Hood latch

Hood and hinges removal steps

8. Washer tube connection
9. Hood gas spring
10. Hood
11. Hood hinge

Caution:

1. **Do not disassemble or dispose of the hood gas spring in a fire.**
2. **Before disposing of the hood gas spring, refer to gas spring disposal.**

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INSTALLATION SERVICE POINTS

▶A◀ BUMPER INSTALLATION

Install the bumper as shown in the diagram.

HOOD GAS SPRING DISPOSAL

Caution

The gas springs are under pressure and must be vented in accordance with the following instructions before being discarded.

1. The pressure tube must be clamped between two V–blocks without being deformed. Dimension “X” as shown in the illustration must be at least 25 mm and left unobstructed by V–blocks.
2. Suitable safety measures must be taken before performing the above venting operations. Full face visor, leather gloves and protective clothings must be worn by the person performing the venting operations. Any persons in close vicinity of the area must also observe these safety measures.
3. To vent the pressure tube, drill a 3 mm diameter hole 20 mm from the bottom cover as shown in the illustration.
4. The cylinder is correctly vented when the piston rod can be moved in and out without the use of force.
5. The gas springs are partially filled with oil. Be sure to comply with the laws of your state regarding the disposal of oil.

NOTE:
If correct disposal in accordance with these instructions is not possible, please return the gas springs to your authorised Mitsubishi Dealer. This procedure also applies for the disposal of tailgate gas springs.

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TRUNK LID

REMOVAL AND INSTALLATION

Adjusting the trunk lid

18TH097A

Trunk lid release cable and lid lock release handle (wire-type opener) removal steps

- Front seat (driver side) (Refer Group 52A.)
- Rear seat (Refer Group 52A.)
- Front scuff plate (LH) (Refer Group 52A)
- Centre pillar lower trim A (LH) (Refer Group 52A.)
- Rear scuff plate (LH) (Refer Group 52A.)
- Trunk rear trim cover (Refer Group 52A.)
- Trunk rear centre trim (Refer Group 52A.)
- Trunk rear side trim (LH) (Refer Group 52A.)
- Trunk side trim (LH) (Refer Group 52A)

1. Lid lock release handle
2. ▶A◀ Trunk lid weather strip

Electric trunk lid release cable removal steps

- Trunk rear side trim (LH) (Refer Group 52A.)
- Trunk lid trim (Refer Group 52A.)

3. Trunk lid opener.
4. Trunk lid and fuel filler door opener actuator.

Trunk lid striker removal steps

- Trunk rear trim cover (Refer Group 52A.)

5. Trunk lid release cable

Trunk lid removal steps

- Trunk lid trim (Refer Group 52A.)
- Rear lid harness connection

6. Trunk lid striker
7. Trunk lid release cable connection
8. ◀A▶ ▶C◀ Trunk lid torsion bar
9. Trunk lid panel assembly
10. Licence plate lamp
11. Rear lid lamp
12. Rear panel upper garnish
13. Rear panel lower garnish
14. Trunk lid lock cylinder
15. Bumper

Trunk lid latch removal steps

- Trunk lid trim (Refer Group 52A.)

16. ▶B◀ Bumper

Trunk lid weatherstrip removal

17. Trunk lid latch assembly

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REMOVAL SERVICE POINTS

◀A▶ TRUNK LID TORSION BAR REMOVAL

1. Disconnect the body harness and the harness connector of the rear shelf lower panel.
2. Attach the special tool to the link side of the torsion bar as shown in the figure, and push downwards to remove the torsion bar from the link.

   NOTE
   When removing the torsion bars, the left and right torsion bars cross at the centre, so the bar that is towards you at the crossed section should be removed first.

   Caution
   Be sure to attach the special tool properly, as the body or parts could be damaged when the torsion is removed from the special tool.

INSTALLATION SERVICE POINTS

▶A◀ TRUNK LID WEATHERSTRIP INSTALLATION

Install the trunk lid weatherstrip so that the marked part is at the position shown in the illustration.

▶B◀ BUMPER INSTALLATION

Install the bumper as shown in the figure.

▶C◀ TRUNK LID TORSION BAR INSTALLATION

1. Insert the end of the torsion bar through the link side mounting hole.
2. Attach the special tool as described previously. Refer to – Trunk Lid Torsion Bar Removal.

   Caution
   Be sure to attach the special tool properly, as the body or parts could be damaged when the torsion bar is removed from the special tool.

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INSPECTION

TRUNK LID LATCH SWITCH CONTINUITY CHECK

Switch position	Terminal Number	
	1	Body Ground
ON (Latch open)	○	○
OFF (Latch shut)		

TRUNK LID AND FUEL FILLER DOOR OPENER ACTUATOR

1. Connect a battery directly to the actuator terminals and check that the motor rotates smoothly.
2. Check that the motor rotates in the reverse direction when the polarity of the battery is reversed.

TRUNK LID AND FUEL FILLER DOOR OPENER SWITCH CONTINUITY CHECK

Switch position	Terminal Number	
	1	2
OFF	○	○
ON		

NOTE
See the Fuel Filler Door section for section for instructions on checking the fuel filler door side.

TRUNK LID AND FUEL FILLER DOOR OPENER RELAY CONTINUITY CHECK

Battery Voltage	Terminal Numbers					
	1	2	3	4	5	7
Continuity no voltage	○		○		○	
Continuity with voltage	○	○		⊖	⊖	⊕

NOTE
See the Fuel Filler Door section for section for instructions on checking the fuel filler door side.

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TAILGATE

REMOVAL AND INSTALLATION

Removal Procedure

1. Damper
2. Bumper
3. High mount stop lamp cover
4. Tailgate side trim
5. High mount stop lamp
6. Grab handle
7. Tailgate trim
8. Speaker
9. Waterproof film
10. Wiper arm cover
11. Wiper arm assembly
12. Wiper motor
13. Tailgate lock actuator
14. Rod
15. Tailgate latch assembly
16. Rod
17. Rear garnish panel
18. Tailgate air deflector

● . Rear window glass (Refer On vehicle service.)

◀A▶

▶A◀

19. Tailgate handle
20. Tailgate lock cylinder
21. Harness
22. Harness and rear washer tube
23. Washer nozzle
24. Harness grommet
25. Weatherstrip
26. Tailgate scuff plate
27. Tailgate striker
28. Tailgate gas spring
29. Tailgate assembly
30. Tailgate hinge

Caution:

1. **Do not disassemble or dispose of the tailgate gas spring in a fire.**
2. **Before disposing of the tailgate gas spring, refer to tailgate gas spring disposal.**

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REMOVAL SERVICE POINTS

◀A▶ TAILGATE GAS SPRING

Caution
Before removing the gas springs, ensure the tailgate is well supported in the open position. Failure to observe this may cause serious personal injury.

1. Gently lever the metal clips at each end of the gas spring as shown in the illustration, to remove the gas spring.

INSTALLATION SERVICE POINTS

▶A◀ TAILGATE

1. Adjust the clearance around the tailgate by adjusting the hinges on both sides as shown in the illustration.

2. Apply multi–purpose grease in the areas shown in the illustration.

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TAILGATE GAS SPRING DISPOSAL

Caution
The gas springs are under pressure and must be vented in accordance with the following instructions before being discarded.

1. The pressure tube must be clamped between two V–blocks without being deformed. Dimension “X” as shown in the illustration must be at least 25 mm and left unobstructed by V–blocks.
2. Suitable safety measures must be taken before performing the above venting operations. Full face visor, leather gloves and protective clothings must be worn by the person performing the venting operations. Any persons in close vicinity of the area must also observe these safety measures.
3. To vent the pressure tube, drill a 3 mm diameter hole 20 mm from the bottom cover as shown in the illustration.
4. The cylinder is correctly vented when the piston rod can be moved in and out without the use of force.
5. The gas springs are partially filled with oil. Be sure to comply with the laws of your state regarding the disposal of oil.

NOTE:
If correct disposal in accordance with these instructions is not possible, please return the gas springs to your authorised Mitsubishi Dealer. This procedure also applies for the disposal of hood gas springs.

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FENDER

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Front Bumper Removal and Installation (Refer Group 51.)
- Front Side Air Dam Removal and Installation (Refer Group 51.)

18P0087

18P0077

Sealant:
3M ATD Part No. 8625 or equivalent

18P0078

Sealant:
3M ATD Part No. 8625 or equivalent

18AE013N

Removal steps

1. Splash shield
2. Fender

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FUEL FILLER DOOR

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Front Seat (driver's side) Removal and Installation (Refer Group 52A.)
  Rear Seat Removal and Installation (Refer Group 52A.)
- Centre Pillar Lower Trim (driver's side), Front Scuff Plate (driver's side), Rear Scuff Plate (driver's side), Trunk Side Trim, Rear End Trim Cover, Trunk Rear Trim Removal and Installation (Refer Group 52A.)

Adjustment of step and clearance around fuel filler door

18TH105A

Removal steps
<Wire type opener>

1. Fuel filler door panel
2. Fuel filler door hook
3. Lid lock release handle
4. Fuel filler door lock release cable

Electric Removal steps
<Electric opener>

1. Fuel filler door panel
2. Fuel filler door hook
5. Trunk and fuel filler door opener switch
6. Trunk and fuel filler door opener actuator
7. Fuel filler door lock release cable
8. Emergency lever

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INSPECTION

TRUNK LID AND FUEL FILLER DOOR OPENER SWITCH CONTINUITY CHECK

Switch position	Terminal Numbers	
	2	3
OFF		
ON	○——	——○

NOTE
See the Trunk Lid section for instructions on checking the trunk lid side.

TRUNK LID AND FUEL FILLER DOOR OPENER RELAY CONTINUITY CHECK

Battery Voltage	Terminal Numbers					
	1	2	3	5	7	8
Continuity no voltage	○——		——○	——○		
Continuity with voltage		○——	——○		⊕—	—⊖

NOTE
See the Trunk Lid section for instructions on checking the trunk lid side.

TRUNK LID AND FUEL FILLER DOOR OPENER ACTUATOR CHECK

See On vehicle service.

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WINDSHIELD AND WINDOW GLASS

WINDOW GLASS

GENERAL

The windshield and rear window glass are attached by an urethane-base adhesive to the window frame. This adhesive not only provides improved glass holding and sealing, but also permits use of body openings having a greater structural strength.

ITEMS NEEDED

Name	Remarks
Adhesive	Betaseal – 58702
Primer Body Glass	 Betaseal – 43432 Betaseal – 43520A
Spacers	Available as service part
Anti-rust solvent (or Tectyl 506T – Valvoline Oil Company)	For rust prevention
Isopropyl alcohol	For grease removal from bonded surface
Steel piano wire	Dia. x length – 0.6mm x 1mm For cutting adhesive
Adhesive gun	For pressing-out adhesive

HANDLING OF AUTO WINDOW SEALER

Keep the sealant in a cool place, not exposed to the direct rays of the sun. Do not place any heavy article on the sealant nor press it, otherwise it will become deformed. Avoid storing the sealant for more than 6 months, because it will lose its sealing effect.

BODY PINCH-WELD FLANGE SERVICING

Before servicing the body pinch-weld flange, remove old adhesive completely. If the flange requires painting, bake it after painting is completed.

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WORKING PROCESS

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WINDSHIELD

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
Removal and Installation
- Front Deck Garnish (Refer Group 51.)
- Front Pillar Trim (Refer Group 52A.)
- Headlining (Refer Group 52A.)

Specified primer: Body–Betaseal 43532 – Glass–Betaseal 43520A
Specified adhesive: Betaseal 58702 or equivalent

18AE015N

Removal steps

1. Windshield side moulding
2. ▶A◀ Windshield upper moulding
3. ◀A▶ ▶A◀ Windshield
4. ▶A◀ Windshield moulding fastener
5. ▶A◀ Windshield moulding clip
6. ▶A◀ Window spacer
7. Windshield spacer

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REMOVAL SERVICE POINTS

◀A▶ WINDSHIELD GLASS REMOVAL

1. In order to protect the body (paint surface), apply cloth tape to all body areas around the installed windshield glass.
2. Remove the windshield side and upper mouldings.

3. Using a sharp-point drill, make hole in the windshield glass adhesive.
4. Pass the piano wire from the inside of the vehicle through the hole.
5. Pull the piano wire alternately from the inside and outside along the windshield glass to cut the adhesive.

   Caution
   Do not let the piano wire touch the edge of the windshield glass.
6. If the glass is to be reused make mating marks on the windshield glass and body.

7. Use the special tool to remove the windshield glass.

8. Use a knife to cut away the remaining adhesive so that the thickness is within 2 mm around the entire circumference of the body flange.
9. Finish the flange surfaces so that they are smooth.

   Caution
   1. **Be careful not to remove more adhesive than is necessary.**
   2. **Be careful also not damage the paintwork on the body surface with the knife. If the paintwork is damaged, repair the damaged area with repair paint or anti-rust agent.**
10. When reusing the glass, remove the adhesive still adhering to the glass, and clean with isopropyl alcohol.
11. Clean the body side in the same way.

    Caution
    Let the cleaned places stand for 3 minutes or more, and carry out the next procedures after they have dried. Also, do not touch any surface that has been cleaned.

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INSTALLATION SERVICE POINTS

▶A◀ WINDOW SPACER/WINDSHIELD MOULDING CLIP/WINDSHIELD MOULDING FASTENER

1. When replacing a windshield, temporarily fit the windshield to the body and make matchmarks on the body and windshield.
2. Degrease the inner perimeter of the windshield and the flange on the body side with iso–propanol (IPA).
3. Soak a sponge in primer, and apply uniformly to the specified locations on the entire perimeter of the windshield and the body.
4. Allow to dry for 3-30 min after applying primer.

   Specified primer:
   Body – Betaseal 43532 / Glass – Betaseal 43520A or equivalent.

   Caution
   1. **The primer strengthens the adhesive strength, so be sure to apply it evenly around the entire circumference. But, a too thick application will cause lowering of the adhesive strength.**
   2. **Do not touch the coated surface.**

5. If there are any bends or lifts on the inside of the windshield, install the window spacers so that the clearance on the right and left are uniform.
6. Match the edge of the windshield moulding fastener to the notch on the body and bond.
7. Fit the windshield moulding clip into the clip stud.

   Caution
   If heat is applied with an infra-red lamp to shorten the setting time, keep the surface temperature of the adhesive below 60°C.

8. Fill a sealant gun with adhesive within 30 min of applying primer, and apply uniformly to the entire perimeter of the windshield.

Note:
Cutting a V-shape in the tip of the sealant gun nozzle will facilitate application.

9. After applying the adhesive, match up marks on the glass and the body.
10. After removing any adhesive that is sticking out or adhering to the body or glass with a spatula, etc., clean off with isopropyl alcohol.
11. After completion of this operation (after installing the glass), place it somewhere where it will not be disturbed, until the adhesive sets.
12. After attaching the windshield glass to the body, let it stand for 30 minutes or more, and then test for water leakage.

    Caution
    1. **If moving the vehicle, it should be done gently.**
    2. **When testing for water leakage, do not pinch the end of the hose to spray the water.**

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REAR WINDOW GLASS

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
Removal and Installation
- Trunk Lid (Refer On vehicle service.)
- Rear shelf trim (Refer Group 52A.)
- Rear Pillar Trim (Refer Group 52A.)
- Headlining (Refer Group 52A.)

Specified primer: Body–Betaseal 43532 – Glass–Betaseal 43520A
Specified adhesive: Betaseal 58702 or equivalent

Removal steps
1. Harness connector
2. ▶A◀ Window spacer
3. ◀A▶ ▶A◀ Rear window glass
4. Urethane moulding

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◀A▶ REAR WINDOW GLASS REMOVAL

Remove the window glass by the same procedure as for the windshield. (Refer On vehicle service.)

NOTE: If the window molding is damaged in any way the window must be replaced.

INSTALLATION SERVICE POINTS

▶A◀ WINDOW SPACER/REAR WINDOW GLASS INSTALLATION

1. When installing the rear window glass, temporarily fit the window to the body and make matchmarks on the body and window glass.
2. Degrease the inner perimeter of the rear window glass and the flange on the body side with iso–propanol (IPA).
3. Soak a sponge in primer, and apply uniformly to the specified locations on the entire perimeter of the window and the body.
4. Allow to dry for 3-30 min after applying primer.

   Specified primer:
   Body – Betaseal 43532 / Glass – Betaseal 43520A or equivalent.

   Caution
   1. The primer strengthens the adhesive strength, so be sure to apply it evenly around the entire circumference. But, a too thick application will cause lowering of the adhesive strength.
   2. Do not touch the coated surface.

5. If there are any bends or lifts on the inside of the window glass, install the window spacers so that the clearance on the right and left are uniform.

   Caution
   If heat is applied with an infra-red lamp to shorten the setting time, keep the surface temperature of the adhesive below 60°C.

6. Fill a sealant gun with adhesive within 30 min of applying primer, and apply uniformly to the entire perimeter of the windshield.

Note:
Cutting a V-shape in the tip of the sealant gun nozzle will facilitate application.

7. After applying the adhesive, match up marks on the glass and the body.

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8. After removing any adhesive that is sticking out or adhering to the body or glass with a spatula, etc., clean off with isopropyl alcohol.
9. After completion of this operation (after installing the glass), place it somewhere where it will not be disturbed, until the adhesive sets.
10. After attaching the rear window glass to the body, let it stand for 30 minutes or more, and then test for water leakage.

Caution

1. **If moving the vehicle, it should be done gently.**
2. **When testing for water leakage, do not pinch the end of the hose to spray the water.**

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TAILGATE WINDOW GLASS

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
Removal and Installation
- Tailgate deflector (Refer On vehicle service.)
- High mount stop lamp cover, tailgate side trim and tailgate lower trim (Refer Group 52A.)
- High mount stop lamp (Refer Group 52A.)
- Rear wiper (Refer Group 51.)

Removal steps

◀A▶ ▶A◀ 1. Rear defogger terminals
2. Tailgate window glass
▶A◀ 3. Tailgate window glass moulding

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REMOVAL SERVICE POINTS

◀A▶ TAILGATE WINDOW GLASS

1. In order to protect the tailgate (paint surface) apply cloth tape to the areas surrounding the installed tailgate window glass.
2. Using a sharp–point drill, make a hole in the tailgate window glass adhesive.
3. Pass piano wire from the inside of the vehicle through the hole.

4. Wrap the wire around a suitable blunt ended tool handle and with the aid of an assistant pull the piano wire alternately from the inside and outside of the vehicle, and steadily move around the tailgate glass to cut the adhesive.

Caution

1. **The use of safety glasses and heavy duty gloves is recommended to prevent injury in case of wire breakage.**
2. **Do not let the piano wire touch the edge of the tailgate window glass.**

5. Use the special tool to assist with the removal of the tailgate window glass.

6. Use a knife to cut away the remaining adhesive so that thickness is within 2 mm around the entire circumference of the body flange.
7. Finish the flange surfaces so that they are smooth.

Caution

1. **Be careful not to remove more adhesive than is necessary.**
2. **Care must be taken to avoid damage to the paintwork on the body surface with the knife. If the paintwork is damaged, repair the damaged area with repair paint or an anti–rust agent.**

8. Clean the body flange and any remaining adhesive with alcohol.
9. If the glass is to be reused, remove as much of the old adhesive and dam as possible with a knife, taking care not to damage the glass surface and clean with alcohol.

Caution

1. **Let the cleaned areas stand for at least 3 minutes before carrying out the next procedure, to allow for drying.**
2. **Do not touch any surface that has been cleaned.**

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INSTALLATION SERVICE POINTS

▶A◀ TAILGATE WINDOW GLASS/TAILGATE WINDOW GLASS MOULDING

1. Position the foam strip adhesive dam material onto the glass as shown in the illustration.
2. Apply the new moulding onto the glass edge as shown in the illustration with the joint at the bottom centre between the marks in the ceramic black out. Use approximately 50 mm of double sided tape 6 mm wide on the glass edge, at joint only to assist with assembly.
3. Apply both the body and glass primers to the areas shown in the illustrations.

Caution

1. **The primer strengthens the adhesive strength so ensure that it is applied evenly around the entire perimeter of the glass. Too thick an application will lower the adhesive strength.**
2. **Do not touch the coated surface. If this occurs re–apply the primer to that area.**

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4. After applying the primer allow it to dry for 10 to 15 minutes.
5. Approximately 10–15 minutes after applying the primer, apply an even bead of adhesive around the periphery of the glass between the moulding and the dam as shown in the illustration .

Specified sealant:
Betaseal 58702 or equivalent.

NOTE
Cut the nozzle tip of the sealant tube into a V shape to facilitate adhesive application.

6. Remove the backing paper from the dam material.
7. With the adhesive applied, carefully locate the tailgate glass in position and lightly press the glass evenly so that it adheres completely.
8. After removing any excess adhesive that is sticking out or adhering to the body or glass using a spatula etc., clean off with alcohol. After the installation of the tailgate glass leave the vehicle standing until the adhesive sets.
9. After the vehicle has been left standing for 30 minutes or more the glass can be tested for water leakage.
10. Any leaks can be remedied by applying a bead of sealant from the inside opening around the perimeter, between the dam and body flange. (Do not disturb the moulding).

CAUTION

1. **When testing for water leakage do not pinch the end of the hose to spray the water.**
2. **Due to the curing time required for polyurethane sealant, do not drive the vehicle with the door window glass down for at least 2 days or the tailgate glass may dislodge.**

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REAR QUARTER WINDOW GLASS

REMOVAL AND INSTALLATION

Removal steps

1. Quarter window rear moulding
2. Quarter window beltline moulding
3. Quarter window
4. Quarter window dripgutter moulding

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DOOR ASSEMBLY

REMOVAL AND INSTALLATION

Door Post-installation Operation
- Door Adjustment (Refer On vehicle service.)

Door assembly removal steps

1. Harness connector
2. Door check cover
3. Bolt
4. Door assembly
5. ▶B◀ Door upper hinge
6. ▶B◀ Door lower hinge

Door check removal steps

- Door trim and waterproof film (Refer On vehicle service.)
2. Door check cover
7. ▶A◀ Door check

Striker removal steps

8. Striker
9. Striker shim

Door switch removal steps

10. Door switch cap
11. Door switch

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INSTALLATION SERVICE POINTS

▶A◀ DOOR CHECK INSTALLATION

Install the door check so that the identification mark faces upwards.

Applicable location		Identification mark
RH	Front door	1R
	Rear door	2R
LH	Front door	1L
	Rear door	2L

▶B◀ DOOR LOWER HINGE/ DOOR UPPER HINGE INSTALLATION

The door hinges differ according to where they are used, so check the identification mark before installation.

Applicable location		Identification mark
Front left door	Upper hinge	V
	Lower hinge	U
Front right door	Upper hinge	U
	Lower hinge	V
Rear left door	Upper hinge	1
	Lower hinge	02
Rear right door	Upper hinge	2
	Lower hinge	P2

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INSPECTION

DOOR SWITCH CONTINUITY CHECK

Driver's door switch and passenger's door switch

Switch position	1	2	3
Open (ON)	○———	———○———	———○
Depressed (OFF)			

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DOOR TRIM AND WATERPROOF FILM

REMOVAL AND INSTALLATION
POWER WINDOWS

♦ **Symbol indicates plastic clip location**

Sealant: 3M ATD Part No. 8625 or equivalent

Sealant: 3M ATD Part No. 8625 or equivalent

18TH099A

Removal steps

1. Inside handle cover
2. Harness connector
3. Harness
4. Inner delta cover or tweeter cover
5. Cap
6. Door trim
7. Driver side door module or power window sub-switch
8. Pull handle bracket
9. Door inside handle
10. Speaker
11. Speaker cover
12. Waterproof film

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DOOR TRIM AND WATERPROOF FILM

REMOVAL AND INSTALLATION
MANUAL WINDOWS

♦ Symbol indicates plastic clip location

Sealant: 3M ATD Part No. 8625 or equivalent

Sealant: 3M ATD Part No. 8625 or equivalent

18TH100A

Removal steps

1. Inside handle cover
2. Inner delta cover
3. Cap
4. ◀A▶ ▶A◀ Window winder handle
5. ◀B▶ Door trim
6. Pull handle bracket
7. Door inside handle
8. Speaker
9. Speaker cover
10. Waterproof film

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REMOVAL SERVICE POINTS

◀A▶ WINDOW WINDER HANDLE

1. Remove the clip by using a rag, and then remove the regulator handle

◀B▶ DOOR TRIM

1. After removing the trim mounting screws and clips, push up the trim to remove it from the door window inner weather–strip clips.

INSTALLATION SERVICE POINTS

▶A◀ WINDOW WINDER HANDLE

1. Install the escutcheon and the clip to the regulator handle.
2. Fully close the front door glass, and install the regulator handle so that it faces as shown in the illustration.

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DOOR GLASS AND REGULATOR

REMOVAL AND INSTALLATION

POWER WINDOWS

Pre-removal Operation
- Door Trim and Waterproof Film Removal (Refer On vehicle service.)
- Door Belt Line Moulding, Removal (Refer On vehicle service.)

Post-installation Operation
- Door Window Glass Adjustment (Refer On vehicle service.)
- Door Trim and Waterproof Film Installation (Refer On vehicle service.)
- Door Belt Line Moulding, Installation (Refer On vehicle service.)

Front door

Rear door

Front window regulator assembly removal steps

1. Up stop
2. ▶A◀ Inner stabiliser A (left front door)
   Inner stabiliser B (right front door)
3. Outer delta cover
4. Delta sash assembly
5. Door window glass
6. Window regulator assembly
7. Power window motor

Rear window regulator assembly removal steps

1. Up stop
2. ▶A◀ Inner stabiliser A (right rear door)
   Inner stabiliser B (left rear door)
5. Door window glass
6. Window regulator assembly
7. Power window motor
8. Rear glass guide track
9. Front glass guide track

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DOOR GLASS AND REGULATOR

REMOVAL AND INSTALLATION

MANUAL WINDOWS

Pre-removal Operation
- Door Trim and Waterproof Film Removal (Refer On vehicle service.)
- Door Belt Line Moulding, Removal (Refer On vehicle service.)

Post-installation Operation
- Door Window Glass Adjustment (Refer On vehicle service.)
- Door Trim and Waterproof Film Installation (Refer On vehicle service.)
- Door Belt Line Moulding, Installation (Refer On vehicle service.)

Front window regulator assembly removal steps

1. Up stop
2. ▶A◀ Inner stabiliser A (left front door)
   Inner stabiliser B (right front door)
3. Outer delta cover
4. Delta sash assembly
5. Door window glass
6. Window regulator assembly

Rear window regulator assembly removal steps

1. Up stop
2. ▶A◀ Inner stabiliser A (right rear door)
   Inner stabiliser B (left rear door)
5. Door window glass
6. Window regulator assembly
7. Rear glass guide track
8. Front glass guide track

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INSTALLATION SERVICE POINTS

▶A◀ INNER STABILISER A AND INNER STABILISER B INSTALLATION

1. Confirm the difference between inner stabilisers A and B using the identification marks.

Applicable location		Identifying Colour
Inner stabiliser A	Left door front Right door rear	Yellow
Inner stabiliser B	Right door front Left door rear	Gray

2. Install each inner stabiliser so the arrow symbol points upwards.

INSPECTION

POWER WINDOW MOTOR

1. Check if the slider moves smoothly when the battery is directly connected to the motor terminals.
2. Check if the slider moves in the opposite direction when the battery is connected with the polarities reversed.

POWER WINDOW SWITCH CONTINUITY CHECK

Main switch (Driver side door module)

Sub Switch

Terminal Number	Switch position				
	Up	OFF			Down
		Not Live	Live		
2		○		⊖	
4		○			○
5		○	⊖		
6	○				○
7	○	○	⊕	⊕	○
9			○		
10			○	○	

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CONTINUITY OF THE POWER WINDOW RELAY

Battery Voltage	Terminal No.			
	1	3	4	5
When not live	○———	———○		
When live	⊖- - - -	- - -⊕	○———	———○

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ON-VEHICLE SERVICE

DOOR FIT ADJUSTMENT

1. Use the special tool to loosen the hinge mounting bolts on the body side, and then adjust the clearance around the door so that it is uniform on all sides.
2. When there is a stepped section in the door and body, use the special tool to loosen the door hinge mounting bolt on the door side and adjust the door fit.

   Caution
   Attach protection tape to the fender edges where the hinge is installed.
3. If the door opening or closing is stiff, adjust the engagement of the striker and the door latch using the shim, while moving the striker up and down, or left and right.

DOOR GLASS ADJUSTMENT

CHECKING THE DOOR WINDOW GLASS SETTINGS

FRONT

1. Place masking tape on the edge of the door glass in the positions as shown in the illustration.
2. Mark the tape from the catch lip as in cross sections A-A and B-B and measure from the edge of the door glass to the mark on the tape with the door open. This will give dimensions “D” and “E” (glass intrusion).

   Standard value:
   (D) 2.4 ± 1.0 mm (0.09 ± 0.039 in.)
   (E) 3.4 ± 1.0 mm (0.13 ± 0.039 in.)
3. Mark the tape on the “B” pillar 100 mm from the glass catch at the top and 100 mm from the bottom. Measure from “B” pillar to the edge of the glass in both positions. This will give cross section C-C Measurement “F” (glass margin).

   Standard value: 12.7 ± 1.0 mm (0.5 ± 0.039 in.) (parallel within 1.5 mm [0.059 in.])
4. With the glass fully raised, close the door until the rear corner of the door glass just contacts the door seal and measure the distance between the rear edge of the opened door panel and the adjacent panel (rear door) at the widest point of door (soft touch).

   Standard value: 20 – 25 mm (0.78 – 0.98 in.) if weatherstrip is new.

   Standard value: 15 – 20 mm (0.59 – 0.78 in.) if weatherstrip fitted for more than 7 days

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5. Remove the belt line moulding and check the door glass stabilizer setting using a suitable gauge, while maintaining an inboard preload condition on the top of the glass of 2kg (4.4 lbs.) force (or sufficient force to ensure that the stabilizer block fibres are being compressed).

   Standard value: 11.0 ± 0.5 mm (0.43 ± 0.020 in.)

6. Check the top delta setting position between the delta hard surface and top edge of the glass.

   Standard value: 0 ± 0.5 mm (0.020 in.)

   Ensure the top of the delta and the surface of the glass are aligned.

   Standard value: 0 ± 1 mm (0.039 in.)

   NOTE: If all dimensions are in specification the customer concern is probably caused by a condition other than door glass settings.

REAR

1. Place masking tape on the edge of the door glass in the positions as shown in the illustration.
2. Mark the tape from the catch lip on the top front piece of tape at cross section J-J.
   Measure from the edge of the door glass to mark on the tape. This gives dimension “N” (glass intrusion).
3. Mark the tape on the “B” pillar 100 mm up and 100 mm down from the glass catch. Measure from the rib on the “B” pillar weather strip to the edge of the glass in both positions. This will give cross section I-I dimension “M” (glass margin).
4. Measure the distance between the rear edge of the glass and the “C” pillar moulding at cross section K-K. This will give dimension “P”.

   Standard value:
   (M) 12.7 ± 1.0 mm (0.5 ± 0.039 in.) (parallel within 1.5 mm [0.059 in.])
   (N) 3.4 ± 1.0 mm (0.13 ± 0.039 in.)
   (P) 4.2 ± 1.0 mm (0.17 ± 0.039 in.)

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5. With the glass fully raised, close the door until the rear corner of the door glass just contacts the door seal and measure the distance between the rear edge of the opened door panel and the adjacent panel (rear fender) at the widest point (soft touch).

   Standard value: 20 – 25 mm (0.78 – 0.98 in.) if weatherstrip is new.

   Standard value: 15 – 20 mm (0.59 – 0.78 in.) if weatherstrip fitted for more than 7 days

6. Remove the belt line moulding and check the door glass stabilizer setting using a suitable gauge, while maintaining an inboard preload condition on the top of the glass of 2kg (4.4 lbs.) force (or sufficient force to ensure that the stabilizer block fibres are being compressed).

   Standard value:
   Front stabilizer 11.0 ± 0.5 mm (0.43 ± 0.197 in.)
   Rear stabilizer 13 ± 0.5 mm (0.51 ± 0.197 in.)

   NOTE: If all dimensions are in specification, the customer concern is probably caused by a condition other than door glass settings.

DOOR GLASS ADJUSTMENTS

NOTE: Do not attempt door glass adjustment unless glass settings have been confirmed as being incorrect.

FRONT DOOR

1. Wind the glass fully up.
2. Remove the door trim, waterproof film (refer on vehicle service) and belt line moulding.
3. Loosen the two top regulator attaching nuts.

4 Check and adjust the door glass stabilizer settings ensuring the adjusting screw is held while tightening the lock nut. Tighten the regulator attaching nuts and then re-install the belt line moulding.
5. Loosen the mounting bolts and nuts for up stops, delta sash, carrier plate, and regulator (bottom).

   NOTE: Mark the position of all bolts and nuts before loosening so that they can be returned to the original position if necessary.

6. With the window up, close door carefully.
7. Hold the door glass with both hands, (one hand through the rear window) push the glass towards the glass catch to achieve the glass position specification in the glass catch (glass intrusion) and the “B” pillar glass margin.

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8. If the specification is achieved, keep the door closed and from the inside of the vehicle push the up stops to the glass stops and tighten. Tighten the carrier plate bolts, open the door and tighten the regulator bottom bolts.
9. Check soft touch and if necessary adjust the lower regulator mounting studs and retighten.

10. Recheck the glass intrusion, “soft touch” and glass margin. Alter glass intrusion by moving the up stops. Alter “soft touch” by adjusting the lower regulator mounting studs.

CAUTION: Always turn each adjustment stud the same amount and ensure that the amount of stud protrusion is equal at stabilizers and lower track attachments.

If margin is incorrect, repeat steps 5-10.

11. With the glass fully raised, press the delta onto the glass so that the delta setting is the standard value.
12. Confirm that door can be closed without glass hitting catch.
13. Install the waterproof film and door trim.
14. Perform a leak test to confirm that water does not leak into the interior.

REAR DOOR

1. Remove the door trim, waterproof film, and belt line moulding.
2. Fully raise the door glass and check the door glass stabilizer settings using a suitable gauge. If adjustment is required, loosen top studs on guide tracks, adjust the settings and retighten studs. Reinstall belt line mouldings.

3. Loosen the upper mounting studs and nuts for the front glass guide track, rear glass guide track, up stops and equalizer arm bracket.
4. Move the door glass backwards and forwards by moving the rear glass guide track and at the same time tilt the glass by moving the equalizer arm bracket to set the glass margin, “C” pillar gap and door glass intrusion then tighten the equalizer arm bracket and guide track upper studs.

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5. Hold the up stops against the regulator lift arm and tighten.
6. Verify the “soft touch” setting and if necessary adjust by turning the glass track upper studs.

CAUTION: Always turn each adjustment stud the same amount and ensure that the amount of stud protrusion is equal at stabilizers and upper track attachments.

7. Lower and raise the door glass and verify that all dimensions are correct.
   Alter glass intrusion by moving the up stops.
   Alter “soft touch” by adjusting the guide track upper studs.
   If glass margin is incorrect repeat steps 3-7.
8. Install the waterproof film and door trim.
9. Perform a leak test to confirm that water does not leak into the interior.

CIRCUIT BREAKER (INCORPORATED IN THE POWER WINDOW MOTOR) INSPECTION

1. Lift the UP switch to fully close the window glass, and continue to lift the switch for 40 seconds.
2. At the moment that the UP switch is released, press the DOWN switch. The circuit breaker can be considered good if at this time the door window glass begins to open within 60 seconds.

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DOOR HANDLE AND LATCH

REMOVAL AND INSTALLATION

Pre-removal Operation
- Door Trim Removal

Post-installation Operation
- Inside Handle Play Adjustment.
- Door Trim Installation

18AE030N

Front door inside handle removal steps

1. Front door inside handle

Front door outside handle and door latch assembly removal steps

1. Front door inside handle
- Waterproof film (Removal.)
2. Harness connector
3. Door lock key cylinder
4. Front door latch assembly
5. Front door outside handle

Rear door inside handle removal steps

6. Rear door inside handle

Rear door outside handle and door latch assembly removal steps

6. Rear door inside handle
- Waterproof film (Removal.)
7. Rear door lock actuator
8. Rear door latch assembly
9. Rear door outside handle

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INSPECTION

FRONT DOOR LOCK ACTUATOR CHECK

<L.H.>

1. After setting the rod to the LOCK position, apply battery voltage to terminal 3 and check if the rod moves as far as the UNLOCK position when terminal 4 is grounded.
2. After setting the rod to the UNLOCK position and applying battery voltage to terminal 4, check if the rod moves as far as the LOCK position when terminal 3 is grounded.
3. When the rod is set to the UNLOCK position, check if there is continuity between terminal 1 and terminal 2, and when the rod is set to the LOCK position, check that there is no continuity.

<R.H.>

1. After setting the rod to the LOCK position, apply battery voltage to terminal 4 and check if the rod moves as far as the UNLOCK position when terminal 3 is grounded.
2. After setting the rod to the UNLOCK position and applying battery voltage to terminal 3, check if the rod moves as far as the LOCK position when terminal 4 is grounded.
3. When the rod is set to the UNLOCK position. check if there is continuity between terminal 2 and terminal 1, and when the rod is set to the LOCK position, check that there is no continuity.

REAR DOOR LOCK ACTUATOR CHECK

<L.H.>

1. After setting the rod to the LOCK position, apply battery voltage to terminal 1 and check if the rod moves to the UNLOCK position when terminal 3 is grounded.
2. After setting the rod to the UNLOCK position and applying battery voltage to terminal 3, check if the rod moves to the LOCK position when terminal 1 is grounded.

<R.H.>

1. After setting the rod to the LOCK position and applying battery voltage to terminal 3, check if the rod moves to the UNLOCK position when terminal 1 grounded.
2. After setting the rod to the UNLOCK position and applying battery voltage to terminal 1, check if the rod moves to the LOCK position when terminal 3 is grounded.

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DOOR LOCK KEY CYLINDER SWITCH CONTINUITY CHECK

Switch position	Terminal No.		
	1	2	3
LOCK	○	○	
Neutral (OFF)			
UNLOCK		○	○

ON-VEHICLE SERVICE

INSIDE HANDLE PLAY ADJUSTMENT

1. Remove the door trim and waterproof film.
2. Move the door inside handle installation position back and forth to adjust so that the inside handle play allowance agrees with the standard value.

   Standard value (A):
   Front; 2.1 – 10.8 mm
   Rear; 4.1 – 12.7 mm

OUTSIDE HANDLE PLAY CHECK

If the door outside handle play does not conform to the standard value, check the door outside handle or door latch assembly, and replace if necessary.

Standard value (A):
Front; 1.7 – 6.0 mm
Rear; 1.9 – 5.8 mm

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DOOR BELT LINE MOULDING AND DOOR OPENING WEATHERSTRIP

REMOVAL AND INSTALLATION

Door outer opening weatherstrip removal steps

- Door trim (Refer On vehicle service.)

◀A▶ ▶A◀ 1. Door outer opening weatherstrip

Beltline moulding removal steps

1. Door outer opening weatherstrip
2. Beltline moulding

Dripline weatherstrip removal steps

3. Dripline weatherstrip
4. Centre pillar holder
5. Door weatherstrip holder

REMOVAL SERVICE POINTS

◀A▶ DOOR OUTER OPENING WEATHERSTRIP REMOVAL

Make a tool as shown in the illustration to remove the door opening weatherstrip.

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INSTALLATION SERVICE POINTS

▶A◀ DOOR OUTER OPENING WEATHERSTRIP INSTALLATION

The clip colour identifies the left and right weatherstrips, so be sure to use the colours so as to install correctly.

Applicable side	Identification colour
Left door	White
Right door	Yellow

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SUNROOF

SERVICE SPECIFICATIONS

Items	Specifications
Roof lid operating current A	9 or less (at 20°C)
Slipping force of sunroof motor clutch N	47-62

TROUBLESHOOTING

INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble symptom	Inspection procedure no.
Sunroof does not operate with ignition ON	1
When the sunroof is closing, the motor does not reverse when a load of 140N or more is applied.	2
The timer does not operate for 30 seconds after the ignition is switched off (power window timer operates normally)	3

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

INSPECTION PROCEDURE 1

The sunroof does not operate with the ignition switch ON	Probable cause
Possible causes include faults in the sunroof switch, sunroof motor or sunroof ECU power supply circuit, or ground circuit.	• Sunroof switch fault • Sunroof motor fault • Harness or connector fault • Sunroof ECU fault

Continued next page:

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INSPECTION PROCEDURE 2

The motor does not reverse when a load of at least 140N (14.3kgf) is applied to the sunroof when closing	Probable cause
The sunroof ECU monitors the load status from the current flowing in the motor, and if the load exceeds a preset level, reverses the motor to prevent fingers etc. being trapped. If the motor doesn't reverse when the load is excessive, the cause is probably a fault in the sunroof ECU.	• Sunroof ECU fault

Replace sunroof ECU

INSPECTION PROCEDURE 3

The timer does not operate for 30 sec after the ignition switch is turned OFF (However, the power window is timer-operable)	Probable cause
The sunroof ECU has a timer function for the 30 sec after the ignition switch is turned OFF. In addition, power is supplied from the power window relay while the timer is operating. If the timer does not operate therefore, possible causes include a sunroof ECU fault or a fault in the connector harness between the power window relay and the sunroof ECU.	• Harness or connector fault • Sunroof ECU fault

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CHECKING THE SUNROOF ECU TERMINALS

18PO142

Terminal	Check Item	Conditions		Terminal Voltage
1	Door switch input	Driver side door switch	ON	0V
			OFF	Battery positive voltage
2	Sunroof switch (up) input	Sunroof switch (up)	ON	0V
			OFF	Battery positive voltage
3	Sunroof switch (close, down) input	Sunroof switch (close, down)	ON	0V
			OFF	Battery positive voltage
4	Sunroof switch (open) input	Sunroof switch (open)	ON	0V
			OFF	Battery positive voltage
5	ECU power supply	Ignition switch: ON		Battery positive voltage
6	Motor output (when opening)	During sunroof opening, down operations		Battery positive voltage
		Other than the above		0V
7	Timer operation power supply	Power window relay: Power window relay: ON		Battery positive voltage
8	Motor output (when closing)	During sunroof closing and up operations		Battery positive voltage
		Other than the above		0V
9	Limit switch 3 input	When sunroof tilting up and fully open		0V
		Other than the above		Battery positive voltage
10	Limit switch 1 input	When sunroof tilting up		Battery positive voltage
		When sunroof is fully closed and fully open		0V
		When sunroof is sliding to close		0V→Battery positive voltage→0V
12	Limit switch 2 input	When sunroof tilting up, fully closed		Battery positive voltage
		Other than the above		0V
13, 18	Ground	At all times		0V

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ON-VEHICLE SERVICE

WATER TEST

1. Close roof lid tightly.
2. Hold hose upward and adjust water fountain to about 50 cm high.

3. Pour water over the roof from about 30 cm above roof for more than 5 minutes.
4. While pouring water, check for leak around roof lid.
5. In the event of leakage, check drain pipe, weatherstrip contact and others.

SUNROOF FIT ADJUSTMENT

FORWARD, BACKWARD AND SIDEWAYS ADJUSTMENT OF THE SUNROOF GLASS

1. Fully close the roof lid glass.
2. Fully open the sun shade.
3. Remove the decoration cover.

4. Loosen the 6 roof lid glass mounting nuts and adjust the glass forward, backward or sideways.

   NOTE
   If the adjustment cannot be made by loosening the mounting nuts, the roof lid glass or the motor have not been fully closed, so they should be adjusted to the fully closed positions.

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HEIGHT ADJUSTMENT OF THE ROOF LID GLASS AND THE ROOF

1. Fully close the roof lid glass.
2. Fully open the sun shade.
3. Remove the decoration cover.

4. Loosen the four guide (A) assembly mounting screws and move the roof lid glass assembly along the grooves in the guide (A) assembly.
5. After adjustment, confirm that the sunroof operates smoothly.

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SUNROOF

REMOVAL AND INSTALLATION

Post-installation Operation
- Sunroof Fit Adjustment (Refer On vehicle service.)
- Water Test (Refer On vehicle service.)

NOTE
⇦: Indicates the clip positions

Roof lid glass removal steps

◀A▶
1. Side decoration cover
2. Front decoration cover
3. Roof lid glass assembly

Deflector removal steps

4. Deflector link assembly
5. Deflector

Sunroof motor and sunroof control unit removal steps

6. Sunroof switch cover
7. Sunroof switch
8. Headlining (Refer Group 52A.)
10. Sunroof ECU
11. Headlining bracket
◀C▶ 12. Sunroof motor

Sunroof assembly removal steps

6. Sunroof switch cover
7. Sunroof switch
8. Headlining (Refer Group 52A.)
9. Drain hose connection
13. Sunroof switch bracket
15. Set bracket
16. Sunroof assembly

Drain hose removal steps

- Splash shield <Front drain hose> (Refer On vehicle service.)
- Trunk side trim <Rear drain hose> (Refer Group 52A.)

6. Sunroof switch cover
7. Sunroof switch cover
8. Headlining (Refer Group 52A.)
◀B▶ ▶A◀ 9. Drain hose

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REMOVAL SERVICE POINTS

◀A▶ SIDE DECORATION COVER/FRONT DECORATION COVER/REAR DECORATION COVER REMOVAL

There are clips in the positions shown in the illustration, so be careful of them while pushing the decoration cover downwards with your hand to remove it.

◀B▶ SUNROOF MOTOR REMOVAL

Caution
When removing the sunroof motor, always be sure to fully close the roof lid glass.
If the roof lid glass and the sunroof motor are not both in the fully-closed positions, the sunroof will not operate properly.

◀C▶ DRAIN HOSE REMOVAL

Remove the grommet. Tie a cord to the end of the drain hose, wind tape around it so that there is no unevenness, and pull the drain hose out into the wheel house.

INSTALLATION SERVICE POINTS

▶A◀ DRAIN HOSE INSTALLATION

1. Tie the cord that was used during removal to the end of the drain hose, and wind tape around it so that there is no unevenness.
2. Pull the cord to pull through the drain hose

3. Make the protrusion from the drain hose grommet as shown in the illustration.

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INSPECTION

ROOF LID GLASS OPERATING CURRENT CHECK

1. Remove the sunroof fuse, and connect a circuit tester as illustrated.
2. Turn the sunroof switch ON, and measure the current at an intermediate point, excluding the following times: start-up, fully closed, fully open, fully tilted up.

   Standard value: 9A or below (at 20°C)

3. If the roof lid glass operating current exceeds specification check for the following.
   1. The fitting of the sunroof assembly, any deformation or entrapped foreign objects
   2. Sticking of the drive cable
   3. Tilted roof lid glass

SLIDING FORCE OF SUNROOF MOTOR'S CLUTCH CHECK

Inspect the sliding force of the clutch by the following procedure.

1. Place the sunroof wrench from the on-board tools into the hexagonal socket of the sunroof motor drive shaft, and set a spring scale in a position 100 mm from the drive shaft.
2. Connect the battery to sunroof motor connector terminals 1 and 2 to rotate the sunroof motor.
3. Measure the spring scale reading when the rotating force of the sunroof motor equals the spring force of the spring scale.

   Standard value: 47–62 N

   Caution
   1. **The spring scale should be kept a right angle to the sunroof wrench.**
   2. **If a wrench other than that in the on-board tools is used, the value for the clutch sliding force will be different, so only the on-board tool should be used.**
4. If the clutch sliding force is outside the standard value, replace the motor.

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SUNROOF MOTOR OPERATION CHECK

Check the direction of rotation of the drive gear when the battery is connected to the connector.

Terminal 1	Terminal 2	Drive gear rotation direction
–	+	Right
+	–	Left

LIMIT SWITCH CONTINUITY CHECK

1. Remove the limit switch from the sunroof motor; then operate the limit switch and check for continuity between the terminals.

Switch		Terminal No.			
		3	5	6	7
Limit switch 1	ON	○	○		
	OFF				
Limit switch 2	ON	○		○	
	OFF				
Limit switch 3	ON	○			○
	OFF				

2. When installing the limit switch, check the wire colours for the limit switches, and install so that the position and direction are as shown in the illustration.

SUNROOF SWITCH CONTINUITY CHECK

Switch Position	Terminal No.			
	4	5	6	7
Open		○	○	
OFF				
Up	○	○		
Close, Down		○		○

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DISASSEMBLY AND REASSEMBLY

Sealant:
3M ATD Part No. 8531 or 3M ATD Part No.8646, or equivalent

18AE032N

Deflector removal steps

1. Side decoration cover
2. Front decoration cover
3. Roof lid glass assembly
4. Sunroof ECU
5. Head lining bracket
6. Sunroof motor
7. Deflector link assembly
8. Deflector assembly
9. Drip rail assembly
10. Sun shade assembly
11. Sun shade slider assembly
12. Cushion (B) assembly
13. Decoration link
14. Guide (A) assembly
15. Slider sub-assembly
16. Cable assembly
17. Drive unit assembly
18. Rail cover assembly
19. Frame assembly

51 EXTERIOR

CONTENTS

SERVICE SPECIFICATION

SEALANT AND ADHESIVE

SPECIAL TOOLS

FRONT BUMPER <MAGNA>

- REMOVAL AND INSTALLATION
- DISASSEMBLY AND REASSEMBLY

FRONT BUMPER <VERADA>

- REMOVAL AND INSTALLATION
- DISASSEMBLY AND REASSEMBLY

REAR BUMPER <MAGNA SEDAN>

- REMOVAL AND INSTALLATION

REAR BUMPER <VERADA SEDAN>

- REMOVAL AND INSTALLATION

REAR BUMPER <WAGON>

- REMOVAL AND INSTALLATION

GRILLES AND GARNISHES

- REMOVAL AND INSTALLATION
- REMOVAL SERVICE POINT

MOULDINGS

- REMOVAL AND INSTALLATION

AERO PARTS

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WINDSHIELD WIPER AND WASHER

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DOOR MIRROR

- REMOVAL AND INSTALLATION
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ROOF RACK

- REMOVAL AND INSTALLATION

VR-X BODY KIT FRONT AND SIDE

- REMOVAL AND INSTALLATION

VR-X BODY KIT REAR

- REMOVAL AND INSTALLATION
- INSTALLATION SERVICE POINT

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 in baking or drying after painting, remove the SRS components (air bag module and SRS-ECU) beforehand.

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

(4) 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

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

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SERVICE SPECIFICATION

Item	Standard value
Windshield wiper blade installation position mm	10–25

SEALANT AND ADHESIVE

Items	Specified sealant and adhesive
Side sill splash protector	3M ATD Part No. 5357 or equivalent
Side protector moulding	3M ATD Part No. 4213 or equivalent
Side air dam	3M ATD Part No. 5356 or equivalent

SPECIAL TOOLS

Tool	Tool number and name	Supersession	Application
	MB990784 Ornament remover	E23M6	Removal of door mirror control switch
	MB990449 Window moulding remover	–	Removal of roof drip moulding, etc.

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FRONT BUMPER <MAGNA>

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
1. Undercover panel Removal and Installation
2. Splash shield Removal and Installation
3. Radiator grille Removal and Installation (Refer to On vehicle service.)

Removal steps
1. Under grille
2. Fog light or fog light cover
3. Bumper assembly

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DISASSEMBLY AND REASSEMBLY

Disassembly steps

1. Upper side plate
2. Rear side plate
3. Lower reinforcement
4. Reinforcement extension
5. Bumper reinforcement
6. Upper plate
7. Upper support
8. Bumper face

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FRONT BUMPER <VERADA>

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
1. Undercover panel Removal and Installation
2. Splash shield Removal and Installation
3. Radiator grille Removal and Installation (Refer to On vehicle service.)

Removal steps
1. Fog lamp
2. Front turn signal lamp
3. Front Bumper assembly

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DISASSEMBLY AND REASSEMBLY

Disassembly steps

1. Upper side plate
2. Rear side plate
3. Fog light bracket
4. Fog light support
5. Bumper reinforcement
6. Bumper core
7. Upper plate
8. Upper support
9. Bumper face

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REAR BUMPER <MAGNA SEDAN>

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
1. Trunk rear trim cover, trunk rear centre trim and trunk rear side trim Removal and Installation (Refer Group 52A.)
2. Splash shield Removal and Installation

Removal steps
1. Nut
2. Bolt
3. Screw
4. Clip
5. Bumper face assembly
6. Side reinforcement
7. Side support
8. Upper centre plate
9. Upper support
10. Bumper face
11. Main muffler hanger connection
12. Bumper reinforcement

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REAR BUMPER <VERADA SEDAN>

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
1. Trunk rear trim cover, trunk rear centre trim and trunk rear side trim Removal and Installation (Refer Group 52A.)
2. Splash shield Removal and Installation

Removal steps
1. Nut
2. Bolt
3. Screw
4. Clip
5. Bumper face assembly
6. Side reinforcement
7. Side support
8. Upper centre plate
9. Upper support
10. Bumper face
11. Main muffler hanger connection
12. Bumper reinforcement
13. Bumper core
14. Reflector

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REAR BUMPER <WAGON>

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
1. Cargo compartment lower side B trim (Refer Group 52A.)
2. Splash shield Removal and Installation

Removal steps
1. Nut
2. Bolt
3. Cargo floor board
4. Grommet
5. Bumper retaining bolts
6. Splash shield
7. Bumper bracket
8. Screw
9. Bumper face assembly
10. Side reinforcement
11. Side support
12. Bumper face retaining bolts
13. Bumper reinforcement
14. Upper centre plate
15. Upper support
16. Bumper face

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GRILLES AND GARNISHES

REMOVAL AND INSTALLATION

Radiator grille removal

◀A▶ 1. Radiator grille

Air inlet grille removal steps

2. Wiper arm assembly
3. Front deck garnish (RH)
4. Front deck garnish (LH)
5. Air intake garnish

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REMOVAL SERVICE POINT

◀A▶ RADIATOR GRILLE REMOVAL

While gently pulling the radiator grille towards you, use a flat-bladed screwdriver to push the clip catches in the direction indicated by the arrows.

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MOULDINGS

REMOVAL AND INSTALLATION

Adhesive tape:	
• Side sill splash protector:	**3M Part No. 5356 or equivalent 8 mm wide and 1.5 mm thick**
• Side protector moulding:	**3M Part No. 4213 or equivalent 5 mm wide and 0.8 mm thick**
Primer:	**3M Part No. K500 or equivalent polypropylene primer**

◀A▶ ▶A◀ 1. Side protector moulding
◀A▶ ▶A◀ 2. Side sill splash protector

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REMOVAL SERVICE POINTS

◀A▶ SIDE PROTECTOR MOULDING AND SIDE SILL SPLASH PROTECTOR REMOVAL

1. Apply masking tape along the outside edges(s) of the moulding.

2. Insert fishing line [ø0.8 mm] in between the body and the moulding, and pull both ends alternately to cut the adhesive section and remove the moulding.

   Caution
   1. **If the moulding is to be reused, pull the fishing line along the edge of the body so as not to damage the edge of the moulding.**
   2. **If the adhesive is difficult to remove, heat it to 40°C.**

3. Pull the section of the side protector moulding with the positioning bosses towards you to remove the bosses from the mounting holes.

4. Scrape off the double-sided adhesive tape with a resin spatula.
5. Pull off the masking tape.
6. Scrape off a small amount of the adhesive with a cutter knife.

7. Wipe the body surface clean with a rag moistened with isopropyl alcohol.

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INSTALLATION SERVICE POINTS

▶A◀ SIDE PROTECTOR MOULDING AND SIDE SILL SPLASH PROTECTOR INSTALLATION

Affixing double-sided tape to the mouldings (when re-using mouldings)

1. Scrape off the double-sided adhesive tape with a resin spatula or gasket scraper.

2. Wipe the moulding adhesion surface clean with a rag moistened with isopropyl alcohol.
3. Apply the specified primer to the area where the double-sided tape is to be attached and allow to dry thoroughly.

   Specified primer: 3M Part No. K500 (or equivalent polypropylene primer)

4. Heat the adhesive surface of the double-sided tape on the side protector moulding to about 40–60°C.
5. Affix the specified double-sided adhesive tape to the moulding.

   Specified adhesive tape:

   Side protector moulding:
   3M ATD Part No. 5357 or equivalent
   8 mm wide and 1.2 mm thick

   Side sill splash protector
   3M ATD Part No. 4213 or equivalent
   5 mm wide and 0.8 mm thick

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MOULDING INSTALLATION

1. Tear off the double-sided tape backing paper.

   NOTE
   If you attach adhesive tape to the edge of the backing paper, it will be easy to tear off.

2. Install the side protector moulding so that the positioning bosses match the body holes.

   NOTE
   If the double-sided adhesive tape is difficult to affix during winter, etc., warm the bonding surfaces of the body and the side protector moulding to about 40–60°C before affixing the tape.

3. Firmly press in the side protector moulding.

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AERO PARTS

REMOVAL AND INSTALLATION

Adhesive tape:	**3M ATD Part No. 5356 or equivalent 4.0 mm wide and 1.6 mm thick**
Primer:	**3M Part No. K500 or equivalent polypropylene primer**

20AE009N

Removal steps

◀A▶ ▶A◀ 1. Front side air dam
◀A▶ ▶A◀ 2. Rear side air dam
◀A▶ ▶A◀ 3. Lower side air dam

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REMOVAL SERVICE POINTS

◀A▶ FRONT SIDE AIR DAM/LOWER SIDE AIR DAM/REAR SIDE AIR DAM REMOVAL

Remove by following the procedure described for the side protector moulding and side sill splash protector. Refer On vehicle service.

INSTALLATION SERVICE POINTS

▶A◀ FRONT SIDE AIR DAM/LOWER SIDE AIR DAM/REAR SIDE AIR DAM INSTALLATION

Install by following the procedure described for the side protector moulding and side sill splash protector. Refer On vehicle service.

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WINDSHIELD WIPER AND WASHER

REMOVAL AND INSTALLATION

18P0141

Wiper motor and linkage removal steps

▶A◀ 1. Wiper arm and blade assembly
2. Front deck garnish (LH)
3. Front deck garnish (RH)
4. Wiper motor and linkage

Washer nozzle removal steps

5. Washer hose
9. Washer nozzle

Washer tank removal steps

5. Washer hose
6. Washer tank
7. Washer motor
8. Rear washer motor <Wagon>
9. Washer nozzle

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REAR WIPER AND WASHER

REMOVAL AND INSTALLATION

Removal steps

1. High mount stop lamp cover
2. Tailgate side trim
3. Grab handle
4. Tailgate trim
5. Wiper arm cover
6. ▶A◀ Wiper arm assembly
7. Grommet
8. Wiper motor

Operation inspection

INSPECTION

REAR WIPER MOTOR OPERATION

1. Connect the battery to the wiper motor as illustrated, and check the operation of the wiper motor.

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STOP POSITION OF THE WIPER MOTOR

1. Connect the battery to the wiper motor as illustrated under the operation inspection and after running the wiper motor, disconnect the battery to stop the wiper motor.
2. Connect the battery and terminals as illustrated in stop position inspection, run the wiper motor and confirm that the motor stops at the automatic stop position.

REAR WASHER MOTOR

1. When checking the washer motor, check with water added to the washer tank, with the tank still installed.
2. Confirm that the water is pumped at an adequate pressure when the battery is connected as illustrated.

INSTALLATION SERVICE POINTS

▶A◀ WIPER ARM AND BLADE ASSEMBLY

1. Set the wiper arm and blade assembly position to the specification as shown in the illustrations.
   Caution:
   Ensure that the wiper arm is installed on the correct side. The park position will depend on the type of rear wiper motor assembly fitted to the vehicle.

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CAUTION: SRS
Before removal of air bag module and clock spring, refer to the following:
Group 52B – SRS Service Precautions, Air Bag Module and Clock Spring.

Column switch removal steps

- Horn pad (Refer Group 37A.)
- Air bag module (Refer Group 52B.)
- Steering wheel (Refer Group 37A.)

11. Column cover lower
12. Column cover upper
13. Column switch assembly (with built-in wiper and washer switch)

- Clock spring* (Refer Group 52B.)

NOTE
Parts marked with * should not be removed from the column switch except when removal is absolutely necessary.

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INSTALLATION SERVICE POINT

▶A◀ WIPER ARM AND BLADE ASSEMBLY INSTALLATION

1. The movements of the left and right wiper arms are different, so check the identification marks.
2. Install the wiper blade in the specified position (standard value) as shown in the illustration.

   Standard value (A): 20–35 mm

   Standard value (B): 65–80 mm

INSPECTION

WIPER MOTOR CHECK

Check the wiper motor after disconnecting the wiring harness connector, and with the wiper motor installed.

Wiper Motor Low Speed and High Speed Operation

Connect a battery to the wiper motor as shown in the illustration and inspect motor operation at low speed and high speed.

Wiper Motor Stop Position Operation

1. Run the wiper motor at low speed, disconnect the battery, and stop the motor.
2. Reconnect the battery as shown in the illustration, and confirm that after the motor starts turning at low speed, it stops at the automatic stop position.

COLUMN SWITCH CHECK

Wiper and Washer Switch Continuity check

Switch position		Terminal Numbers				
		8	9	10	11	12
Wiper switch	OFF			○	○	
	INT			○	○	
	LO	○		○		
	HI	○	○			
Washer switch ON		○				○

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WASHER MOTOR CHECK

1. With the washer motor installed to the washer tank, fill the washer tank with water.
2. When the battery is connected as shown in the figure, check that the water squirts out strongly.

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DOOR MIRROR

REMOVAL AND INSTALLATION

Door mirror removal steps

1. Door mirror assembly

◀A▶

2. Mirror glass

REMOVAL SERVICE POINT

◀A▶ MIRROR GLASS REMOVAL

Turn the mirror by hand so that it faces upwards, insert the (–) driver wound with masking tape into the notched section, and lever out to release the mirror from the bottom catches. Remove the mirror from the upper catches by pulling downwards.

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INSPECTION

REMOTE CONTROL MIRROR ASSEMBLY CHECK

Check to be sure that the mirror moves as described in the table when each terminal is connected to the battery.

Direction of operation	Terminal No.		
	3	4	5
UP	⊖ - ⊕		
DOWN	⊕ - ⊖		
LEFT	⊕ -	- ⊖	
RIGHT	⊖ -	- ⊕	

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ROOF RACK

REMOVAL AND INSTALLATION

Removal steps

◀A▶ ▶B◀ 1. Stanchion cover
2. Retaining bolts

▶A◀ 3. Roof rail and stanchion assembly
4. Gasket

REMOVAL SERVICE POINT

◀A▶ STANCHION COVER

1. Insert a nylon stick between the stanchion cover and roof rail and prise the stanchion cover off.

INSTALLATION SERVICE POINT

▶A◀ ROOF RAIL AND STANCHION ASSEMBLY

1. Insert the front bolt of the rear stanchion first to locate the assembly.
2. Insert the remaining bolts and tighten to the specified torque.

▶B◀ STANCHION COVER

1. Align the two retaining clips of the stanchion cover and slide the cover onto the stanchion.

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VR-X BODY KIT FRONT AND SIDE

REMOVAL AND INSTALLATION

Note:
- Front bumper must be removed to enable front air dam removal (Refer on vehicle service.)
- Side air dam service points (Refer on vehicle service.)

1. Wheel arch flare front
2. Wheel arch flare rear
3. Side air dam - front
4. Side air dam - rear
5. LH air dam
6. RH air dam
7. Fog lamp cover

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VR-X BODY KIT REAR

REMOVAL AND INSTALLATION

▶A◀ 1. Clips
1. Rear air dam
3. Side air dams
4. Spoiler

INSTALLATION SERVICE POINT

▶A◀ AIR DAM CLIP FITMENT

While holding air dam against bumper, install clip horizontally and push firmly to base (19 places on rear and side air dams).

52A INTERIOR

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- REMOVAL SERVICE POINTS
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- REMOVAL AND INSTALLATION
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REAR SEAT BELT<SEDAN>

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- REMOVAL AND INSTALLATION

REAR CENTRE SEAT BELT<WAGON>

- REMOVAL AND INSTALLATION
- REMOVAL SERVICE POINTS
- INSTALLATION SERVICE POINTS

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 in baking or drying after painting, remove the SRS components (air bag module and SRS-ECU) beforehand.

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

(4) 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
Section titles with the asterisk (*) in the table of contents in each group indicate operations requiring warnings.

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SPECIAL TOOLS

Tool	Tool number and name	Supersession	Application
	MB990784 Ornament remover	E23M6	Removal of switch, trim, etc.
	MB991502 (MUT-II)	–	diagnosis testing
	ROM pack	–	diagnosis testing
	MB991529 diagnosis check harness	–	diagnosis testing
	E52M2 Centre vent remover	–	Removal of centre vent

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INSTRUMENT PANEL

REMOVAL AND INSTALLATION

For installation of the instrument panel, the bolts and screws described below are used. They are indicated by symbols in the illustration.

Name	Symbol	Size mm (D × L)	Colour	Shape
Tapping screw	A	4×12	–	
	B	5×10	–	
	C	5×12	–	
	D	5×16	–	
	E	5×12	–	
	F	5×16	Black	
	G	5×20	Black	
	H	5×12	–	
	I	5×6	Black	
Screw with washer	J	4×12	–	
	K	5×16	–	
Bolt with washer	L	6×16	–	
	M	6×16	–	
	N	6×12	–	
	O	6×16	–	
	P	8×20	–	

D = Thread diameter
L = Effective thread length

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Pre-removal and Post-installation Operation
- Floor Console Assembly Removal and Installation (Refer On vehicle service.).
- Front Pillar Trim Removal and Installation (Refer On vehicle service.).

CAUTION: SRS Airbag
(1)When removing and installing the floor console, do not let it bump against the SRS–ECU.
(2)For the passenger side air bag module removal/installation, always observe the service procedures of GROUP 52B – Air Bag Modules and Clock Spring.

NOTE
(1)⇦: metal clip position
(2)⬅: plastic clip position

19TH064A

Removal steps
1. Column cover
2. Hood lock release handle
3. Instrument panel lower cover assembly (RH)
4. Key cylinder panel
5. Antenna ring
6. Meter bezel
7. Combination meter
◀A▶ ▶A◀ 8. Centre air outlet assembly
9. Ashtray
10. Audio unit <Non-auto air vehicles>
11. Air control panel assembly & audio unit <Auto air vehicles>
12. Undercover assembly
13. Glovebox assembly
14. Glovebox outer case
15. Passenger side airbag module / upper glove box
16. Console side cover assembly
17. Floor carpet rear reinforcement
18. Harness connector
19. Plug
20. Instrument panel
21. Steering column mounting bolt

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REMOVAL SERVICE POINTS

◀A▶ CENTRE AIR OUTLET ASSEMBLY REMOVAL

1. Turn the cool air bypass lever of the air outlet centre panel assembly fully upward.

2. Disconnect the bypass lever cable at the heater unit end.

   NOTE
   Ensure that you disconnect the correct cable.

3. With the notch on special tool E52M2 facing outward, insert one removal tool at the bottom corner on each side of the vent assembly.

4. Without levering against the vent assembly vane, apply outward force on the tip of the tool and push the tool forward until the indicator mark on the tool is aligned with the outer face of the vent assembly.
   At this point, the notch in the tool should engage on the rear edge of the vent assembly.
5. While maintaining slight outward pressure on the tip of the tool (to maintain engagement with the vent assembly), apply pulling force to the tool inserted in the right hand side until the retaining clip disengages.
6. Repeat step 5 on the left hand side to remove the vent assembly.

   NOTE
   A strong, steady pulling force is required to disengage the clips. If the clips do not disengage, increase pulling force. Do not jerk the tool as this may result in the tool dislodging and / or clip post breakage.

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INSTALLATION SERVICE POINTS

▶A◀ CENTRE AIR OUTLET ASSEMBLY INSTALLATION

1. Turn the cool air bypass lever of the air outlet centre panel assembly fully upward.
2. Feed the bypass air cable through to the RH side of the outlet duct and below the cross brace.
3. Clip the vent assembly into place.
4. With the air bypass lever on the heater unit in the upward position, attach the cable and clip into place.
5. Check the operation of the cold air bypass and air flow dials.

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DISASSEMBLY AND REASSEMBLY

NOTE
⇦ : metal clip position

Disassembly steps

- Heater ducts (See Group 55)

1. Side air outlet assembly
2. Centre display
3. Glovebox frame
4. Instrument panel centre support panel
5. Photo sensor
6. Defroster garnish
7. Centre display bracket
8. Instrument panel side support panel
9. Instrument panel wiring harness
10. Instrument panel lower bracket
11. Floor carpet front reinforcement
12. Centre stay assembly
13. Connector mounting bracket
14. Centre console bracket

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FLOOR CONSOLE

REMOVAL AND INSTALLATION

CAUTION: SRS
When removing and installing the floor console assembly, do not let it bump against the SRS–ECU or other components.

19AE008N

NOTE
(1) ⇦ : metal clip position
(2) ⬅ : plastic clip position

Removal steps

1. Cup holder assembly
2. Coin box assembly
3. Floor console panel
4. Console side cover assembly
5. Floor console box
6. Console bracket A
7. Console bracket B

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52A Index

TRIMS<SEDAN>

REMOVAL AND INSTALLATION

NOTE
(1) ⇦ : metal clip position
(2) ⬅ : plastic clip position

19AE010N

Removal steps

1. Front scuff plate
2. Rear scuff plate
3. Cowl side trim
4. Centre pillar lower trim B
5. Centre pillar lower trim A
6. Sash guide
7. Centre pillar upper trim
8. Front door opening trim
9. Rear door opening trim
10. Front pillar trim
- Rear seat assembly (Refer Remove & Install.)
11. Rear seatbelt anchor plate
12. Rear pillar trim
13. Speaker garnish
14. Rear shelf trim

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TRIMS<SEDAN>

REMOVAL AND INSTALLATION

NOTE
⬅ : plastic clip position

Removal steps

15. Trunk rear trim cover
16. Trunk rear centre trim
17. Trunk rear side trim
18. Trunk rear side trim
19. Trunk side trim
20. Trunk front trim
21. Trunk lid trim

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TRIMS<WAGON>

REMOVAL AND INSTALLATION

NOTE
(1) ⇦ : metal clip position
(2) ⬅ : plastic clip position

19KE049J

Removal steps

1. Front scuff plate
2. Rear scuff plate
3. Cowl side trim
4. Centre pillar lower trim B
5. Centre pillar lower trim A
6. Centre pillar upper trim
7. Front door opening trim
8. Rear door opening trim
9. Front pillar trim
10. Cargo compartment lower side trim B
11. Cargo compartment upper side trim A
12. Cargo compartment upper side trim B
13. Rear headlining trim panel
14. High mount stop lamp cover
15. Tailgate side trim
16. Grab handle
17. Tailgate lower trim
18. Tailgate sill scuff plate

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HEADLINING AND INSIDE REAR VIEW MIRROR<SEDAN>

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Door opening trim, Front Pillar Trim, Centre Pillar Upper Trim and Rear Pillar Trim, Refer Removal and Installation.

<Vehicles without sunroof>

<Vehicles with sunroof>

NOTE
⬅ : plastic clip position

19AG055N

◀A▶ **Inside rear view mirror removal**
1. Inside rear view mirror

Headlining removal steps
2. Sunvisor assembly

◀B▶
3. Sunvisor holder
4. Room light assembly
5. Sunroof switch cover
6. Assist grip

◀C▶
7. Headlining

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HEADLINING AND INSIDE REAR VIEW MIRROR<WAGON>

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Door opening trim, Front Pillar Trim, Centre Pillar Upper Trim, Cargo compartment lower side trim B, Cargo compartment upper side trim A and Rear headlining trim panel. Refer Trim Removal and Installation.

NOTE
⬅ : plastic clip position

Inside rear view mirror removal

◀A▶ 1. Inside rear view mirror

Headlining removal steps

2. Sunvisor assembly
3. Sunvisor holder

◀B▶ 4. Room light assembly<Altera & Verada>

◀B▶ 5. Room light assembly<Magna>

6. Assist grip
7. Luggage compartment light
8. Child restraint anchorage
9. Headlining

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REMOVAL SERVICE POINTS

◀A▶ INSIDE REAR VIEW MIRROR REMOVAL

Insert a narrow flat-tip screwdriver between the retaining spring and the button at the bottom section of the rear view mirror bracket, keep the spring pushed in and remove the rear view mirror in the direction of the arrow in the illustration.

NOTE
1. While the spring is pushed in, connection between the spring and the pawl of the button is released.

◀B▶ ROOM LIGHT ASSEMBLY REMOVAL

1. Insert a screwdriver into the notch of the room light lens and pry gently to remove it.
2. Remove the mounting screws and pull the room light assembly downwards to remove it.

◀C▶ HEADLINING REMOVAL

While bending the headlining slightly, pull it through the front door opening to the outside of the vehicle.

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FRONT SEAT

REMOVAL AND INSTALLATION

Head rest removal

1. Head rest

Front seat assembly removal steps

2. Harness connector – power seat
3. Harness connector – seat belt
4. Seat anchor cover
5. Front seat assembly

NOTE

1. After provisionally tightening the seat assembly mounting nuts and bolts in every installation location, fully tighten them to the specified torque.
2. When installing a manual seat assembly, tighten after firmly locking the seat adjuster

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REMOVAL AND INSTALLATION

If removal of the seat mounting nut and bolt is impossible when there is a malfunction in the slide motor or the slide switch and the seat cannot slide, remove and install the front seat assembly by the following procedure.

1. Remove the bolts below the seat cushion as shown in the illustration.

2. Insert a flat-tipped screwdriver in between the lower rail and the nut housing, and detach the nut housing from the lower rail hole and turn it.
3. Slide the seat, and remove the seat mounting nuts and bolts.

4. When reusing the power height adjuster assembly, apply specified adhesive to the mounting bolt, and tighten to the specified torque.

   Specified adhesive: 3M Stud Locking Part No.4170 or equivalent

   Caution
   1. **Match to the left and right nut housing positions.**
   2. **Install so that the screw and nut housing plate do not cause interference.**

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DISASSEMBLY AND REASSEMBLY

<Manual seat>

Disassembly steps

1. Clip
2. Height adjustment knob <driver side>
3. Slide adjustment knob
4. Reclining adjustment knob
5. Front seat side shield cover
7. Front seat hinge cover
8. Inner seat belt
9. Hog ring

◀A▶

10. Seat cushion assembly
15. Lumbar support lever <driver side>
16. Front back panel assembly
17. Head rest guide
18. Seat back assembly
20. Pull wire
21. Seat adjuster assembly
22. Reclining adjuster inner cover

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<Power seat>

Disassembly steps

5. Front seat side shield cover
6. Reclining adjuster cover
8. Inner seat belt
9. Hog ring
10. Seat cushion assembly
11. Power seat reclining lever
12. Power seat adjuster lever

◀A▶

13. Garnish
14. Power seat switch
16. Front back panel assembly
17. Head rest guide
18. Seat back assembly
21. Seat adjuster assembly
22. Reclining adjuster inner cover

DISASSEMBLY SERVICE POINT

◀A▶ FRONT-BACK PANEL ASSEMBLY REMOVAL

Lift the front-back panel assembly upwards, and pull the lower portion towards you to remove.

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INSPECTION

POWER SEAT SWITCH CONTINUITY CHECK

Terminal Number			Terminal No. 1	2	3	4	5	6	7	8	9	10	11	12	13	14
Reclining switch	Front (Rear)	A			○	○									○	○
						○										○
	Rear (Front)	B			○										○	
									○	○					○	○
Slide switch	Front (Rear)	C							○	○					○	○
				○												○
	Rear (Front)	D	○									○				
			○													○
				○								○				
Front height switch (Rear height switch)	Up	E					○									○
								○					○			
	Down	F						○								○
							○							○		
Rear height switch (Front height switch)	Up	G														
	Down	H														

POWER SEAT MOTOR CHECK

Check the operation of each motor using the following procedure.

1. Disconnect the connector for each motor.
2. Check that each motor runs smoothly when the battery is directly connected to the motor terminals, and that each adjustment mechanism operates in the directions in the table below.
3. If there is a problem, replace the power seat adjuster assembly.

Motor Name	Operating Direction	Terminal No. 1	Terminal No. 2	Stop Position
Front height	Down	⊕	⊖	Stops at limit switch OFF
	Up	⊖	⊕	
Rear height	Down	⊕	⊖	
	Up	⊖	⊕	
Slide	Down	⊕	⊖	Stops at operating range limit
	Up	⊖	⊕	
Reclining	Down	⊕	⊖	
	Up	⊖	⊕	

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LIMIT SWITCH CONTINUITY CHECK

1. Disconnect the limit switch connector and connect a circuit tester to the terminals.
2. Operate the switch and check that there is continuity between the terminals.
3. If there is a problem, replace the power seat adjuster assembly.

Switch Name	Switch position	Terminal No.		
		1	2	3
Front height limit switch	Up	○	○	
	Down	○		○
Rear height limit switch	Up	○	○	
	Down	○		○
All limit switches	Middle (ON)	○	○	○

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REAR SEAT<SEDAN>

REMOVAL AND INSTALLATION

NOTE
⬅ : Indicates hook location

Seat cushion removal

1. Seat cushion

Rear seat back removal

2. Rear seat back assembly
3. Armrest
4. Headrest <Verada only>

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REAR SEAT<WAGON>

REMOVAL AND INSTALLATION

NOTE
⬅ : Indicates hook location

Seat removal

1. Headrest <Verada only>
2. Seat cushion
3. Rear seat back assembly
4. Arm rest

Caution
When removing.. the seat back the shoulder bolts marked with a ★ are not to be removed as the seat back assembly mounting brackets have provisions to enable the seat back to be lifted from under these bolts.
If these bolts must be removed to perform a body repair etc. they must be installed with Loctite and torqued to 15 to 20 Nm.

Caution
The seat back assembly left hand mounting bracket, is pre–tensioned by an assist spring therefore the seat back must be kept in an upright or vertical position (as shown) when being removed or installed. Failure to observe the correct procedure may result in a disabling injury.

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FRONT SEAT BELT

REMOVAL AND INSTALLATION

19P0063

Outer seat belt removal steps

- Front scuff plate and rear scuff plate (Refer on vehicle service.).
- Centre pillar lower trim (Refer on vehicle service.).

1. Sash guide cover
2. Sash guide
3. Outer seat belt
4. Centre pillar upper trim (Refer on vehicle service.).
5. Adjustable seat belt anchor

Inner seat belt removal steps

- Front seat assembly (Refer On vehicle service.).

6. Front seat belt hinge cover
7. Inner seat belt

INSPECTION

SEAT BELT

1. Confirm that label A is not exposed outside the seat belt sleeve. If exposed, replace the seat belt.

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REAR SEAT BELT<SEDAN>

REMOVAL AND INSTALLATION

Removal steps

- Rear seat cushion
  (Refer On vehicle service.).
1. Inner seat belt
   (centre seat belt)
2. Inner seat belt
   (outer seat belt)
- Rear seat back assembly
  (Refer On vehicle service).
- Rear shelf trim
  (Refer On vehicle service).
3. Rear pillar trim
   (Refer On vehicle service).
4. Outer seat belt
5. Centre seat belt

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REAR SEAT BELT<WAGON>

REMOVAL AND INSTALLATION

Removal steps

- Rear seat cushion (Refer On vehicle service.).
1. Inner seat belt
2. Cargo compartment upper side trim A & B (Refer On vehicle service)
- Rear seat back assembly (Refer On vehicle service).
3. Bracket
4. Outer seat belt

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REAR CENTRE SEAT BELT<WAGON>

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Cargo compartment lower side trim (Refer On vehicle service.)

Removal steps

1. Inner seat belt (for centre seat)
2. Rear seat back mat assembly
3. Anchor cover panel
◀A▶ ▶A◀ 4. Trim guide
5. Centre seat belt

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REMOVAL SERVICE POINTS

◀A▶ TRIM GUIDE

1. Pull the front of the trim guide upwards as shown in the illustration to remove it.

INSTALLATION SERVICE POINTS

▶A◀ TRIM GUIDE

1. Locate the rear of the trim guide into the seat back then push down on the front section to lock the trim guide into the seat back.

▶B◀ REAR SEAT BACK MAT ASSEMBLY

1. Ensure the cut outs in the rear seat back mat assembly align and are fitted into the slots of the rear seat before installing the rear seat back assembly.

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52B SUPPLEMENTAL RESTRAINT SYSTEM (SRS)

CONTENTS

GENERAL INFORMATION
- CONSTRUCTION DIAGRAM
- WARNING/CAUTION LABELS

SRS SERVICE PRECAUTIONS

SPECIAL TOOLS

TEST EQUIPMENT

TROUBLESHOOTING
- STANDARD FLOW OF DIAGNOSIS TROUBLESHOOTING
- DIAGNOSIS FUNCTION
- INSPECTION CHART FOR DIAGNOSIS TROUBLE CODES
- INSPECTION PROCEDURE CLASSIFIED BY DIAGNOSIS CODE
- SRS WARNING LIGHT CHECK
- INSPECTION CHART FOR TROUBLE SYMPTOMS
- INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

SRS MAINTENANCE
- SRS COMPONENT VISUAL CHECK

POST-COLLISION DIAGNOSIS
- SRS-ECU MEMORY CHECK
- REPAIR PROCEDURE

INDIVIDUAL COMPONENT SERVICE

SRS AIR BAG CONTROL UNIT (SRS-ECU)
- REMOVAL AND INSTALLATION
- REMOVAL SERVICE POINT
- INSTALLATION SERVICE POINTS
- INSPECTION

AIR BAG MODULES AND CLOCK SPRING
- REMOVAL AND INSTALLATION
- REMOVAL SERVICE POINTS
- INSTALLATION SERVICE POINTS
- INSPECTION

AIR BAG MODULE DISPOSAL PROCEDURES
- UNDEPLOYED AIR BAG MODULE DISPOSAL
- DEPLOYED AIR BAG MODULE DISPOSAL

CAUTION

- **Carefully read and observe the information in the SRS SERVICE PRECAUTIONS prior to any service.**
- **For information concerning troubleshooting or maintenance, always observe the procedures in the Troubleshooting or the SRS Maintenance sections, respectively.**
- **If any SRS components are removed or replaced in connection with any service procedures, be sure to follow the procedures in the INDIVIDUAL COMPONENT SERVICE section for the components involved.**
- **If you have any questions about the SRS, please contact your local distributor.**

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GENERAL INFORMATION

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

The SRS Airbag consists of two air bag modules, SRS air bag control unit (SRS-ECU), SRS warning light, and clock spring. The driver's air bag is located in the centre of the steering wheel and the passenger's airbag above the glove box. Each air bag is made up of a folded air bag and an inflator unit. The control unit under the floor console monitors the system and has a safing G sensor and an analog G sensor. The warning light on the instrument panel indicates the operational status of the SRS. The clock spring is installed in the steering column.

Only authorised service personnel should do work on or around the SRS components. Those service personnel should read this manual carefully before starting any such work.

Caution

Extreme care must be used when servicing the SRS or performing repairs on components mounted near SRS components to avoid injury to the service personnel (by inadvertent deployment of the air bags) or the driver (by rendering the SRS inoperative).

SRS warning light

24TH026A

SRS WARNING LIGHT FUNCTION

The SRS-ECU monitors the SRS Airbag system and stores data concerning any detected faults in the system. When the ignition key is in "ON" or "START" position, the SRS warning light should illuminate for about 7 seconds and then turn off and remain extinguished for at least 5 seconds. That indicates that the SRS system is in operational order. If the SRS warning light does any of the following, immediate inspection by an authorised dealer is needed.

(1) The SRS warning light does not illuminate as described above.
(2) The SRS warning light stays on for more than 7 seconds.
(3) The SRS warning light illuminates while driving.

If a vehicle's SRS warning light is in any of these three conditions when brought in for inspection, the SRS system must be inspected, diagnosed and serviced in accordance with this manual.

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CONSTRUCTION DIAGRAM

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WARNING/CAUTION LABELS

A number of caution labels related to the SRS are found in the vehicle, as shown in the following illustration. Follow label instructions when servicing SRS. If labels are dirty or damaged, replace them.

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52B Index

SRS SERVICE PRECAUTIONS

1. In order to avoid injury to yourself or others from accidental deployment of the air bag during servicing, read and carefully follow all the precautions and procedures described in this manual.
2. Do not use any electrical test equipment on or near SRS Airbag components, except those specified in special tools.
3. **Never Attempt to Repair the Following Components:**
   - SRS air bag control unit (SRS-ECU)
   - Clock Spring
   - Air Bag Module

   If any of these components are diagnosed as faulty, they should only be replaced, in accordance with the INDIVIDUAL COMPONENT SERVICE PROCEDURE in this manual.

4. **After disconnecting the battery cable, wait 60 seconds or more before proceeding with the following work. The SRS system is designed to retain enough voltage to deploy the air bag for a short time even after the battery has been disconnected, so serious injury may result from unintended air bag deployment if work is done on the SRS system immediately after the battery cables are disconnected.**

5. Do not attempt to repair the wiring harness connectors of the SRS airbag. If any of the connectors are diagnosed as faulty, replace the wiring harness. If the wires are diagnosed as faulty, replace or repair the wiring harness according to the following table.

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52B Index

SRS-ECU terminal No.	Destination of harness	Corrective action
1 to 6	–	–
7	Body wiring harness → Ground	Correct or replace each wiring harness.
8	Body wiring harness → SRS warning light	
9	Body wiring harness → Air bag module (Front passenger's side)	
10		
11	Body wiring harness → Clock spring → Air bag module (Driver's side)	Correct or replace each wiring harness. Replace clock spring.
12		
13	Body wiring harness → Junction block (fuse No.4)	Correct or replace each wiring harness.
14	Body wiring harness → BEM (crash detector)	
15	Body wiring harness → Ground	
16	Body wiring harness → Junction block (fuse No.13)	
17 to 19	–	–
20	Body wiring harness → Diagnosis connector	Correct or replace body wiring harness.

6. **SRS components should not be subjected to heat over 93°C, so remove the SRS-ECU, air bag module and clock spring before drying or baking the vehicle after painting.**
7. **Whenever you finish servicing the SRS airbag, check warning light operation to make sure that the system functions properly.**
8. **Make certain that the ignition switch is OFF when the MUT-II is connected or disconnected.**

   WARNING
   AS SERIOUS INJURY CAN RESULT FROM UNINTENDED DEPLOYMENT OF THE AIRBAGS, USE ONLY THE PROCEDURES AND EQUIPMENT SPECIFIED IN THIS MANUAL.
9. **If checks are carried out using the SRS-ECU harness connector, observe the following procedures:**
   Insert a small probe (MB991222) into the connector from the harness (rear) side, and connect the tester to this probe. If any tool other than a small probe is used, damage to the harness and other components will result. Never insert the probe directly to the terminals from the front of the connector. The terminals are plated to increase their conductivity, so that if they are touched directly by the probe, the plating may break, which will cause drops in reliability.

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SPECIAL TOOLS

Tool	Tool number and name	Supersession	Application
B991502	MB991502 MUT-II	–	• Reading diagnosis trouble codes • Erasing diagnosis trouble codes • Reading trouble period • Reading erase times
	MB991613 SRS check harness	–	Checking the SRS electrical circuitry with a digital multi-meter
B990803	7245 Steering wheel puller	–	Removal of steering wheel
B686560	MB686560 SRS air bag adaptor harness A	–	• Deployment of air bag module inside the vehicle • Deployment of air bag module (front passengers side) outside the vehicle
B628919	MR203491 or MB628919 SRS air bag adaptor harness B	–	Deployment of air bag module (driver's side) outside the vehicle
MB991222	MB991222 Probe (part of harness set MB991223)	–	Checking the SRS electrical circuitry with a digital multi-meter

TEST EQUIPMENT

Tool	Name	Use
13R0746	Digital multi-meter Use a multi-meter for which the maximum test current is 2 mA or less at the minimum range of resistance measurement	Checking the SRS electrical circuitry with SRS check harness

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TROUBLESHOOTING

STANDARD FLOW OF DIAGNOSIS TROUBLESHOOTING

Refer Group 00.

DIAGNOSIS FUNCTION

DIAGNOSIS CODES CHECK

Connect the MUT-II to the diagnosis connector (16-pin) under the instrument under cover, then check diagnosis codes.
(Refer Group 00.)

ERASING DIAGNOSIS CODES

(Refer Group 00.)

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INSPECTION CHART FOR DIAGNOSIS TROUBLE CODES

Inspect according to the inspection chart that is appropriate for the diagnosis code.

Code No.	Diagnosis item	
14	Analog G-sensor system in the SRS-ECU	
15,16	Safing G-sensor system in the SRS-ECU	
21, 22, 61, 62*	Driver's air bag module (squib) system	
24, 25, 64, 65*	Front passenger's air bag module (squib) system	
31, 32	SRS-ECU DC-DC converter system	
34*	Connector lock system	
35	SRS-ECU (deployed air bag) system	
41*	IG_1 (A) power circuit system (fuse No.13)	
42*	IG_1 (B) power circuit system (fuse No.4)	
43	SRS warning light drive circuit system	Light does not illuminate.
		Light does not switch off.
44*	SRS warning light drive circuit system	
45	Internal circuit system of non-volatile memory (EEPROM) inside SRS-ECU	
51, 52	Driver's air bag module (squib) system	
54, 55	Front passenger's air bag module (squib) system	

NOTE
(1) *: If the vehicle condition returns to normal, the diagnosis code will be automatically erased, and the SRS warning light will return to normal.
(2) If the vehicle has a discharged battery it will store the diagnosis codes 41 or 42. When these diagnosis codes are displayed, check the battery.

INSPECTION PROCEDURE CLASSIFIED BY DIAGNOSIS CODE

Code No.14 Analog G-sensor system in the SRS-ECU	Probable cause
The SRS-ECU monitors the output of the analog G-sensor inside the SRS-ECU. It outputs this code when any of the following are detected. ● When the analog G-sensor is not operating ● When the characteristics of the analog G-sensor are abnormal ● When the output from the analog G-sensor is abnormal	● Malfunction of SRS-ECU

Replace the SRS-ECU.

Code No.15 or 16 Safing G-sensor system in the SRS-ECU	Probable cause
This code is output if there is a short or open circuit inside the SRS-ECU between the terminals of the safing G-sensor. The trouble causes for each diagnosis code No. are as follows.	● Malfunction of SRS-ECU

Code No.	Trouble symptom
15	Short circuit in the safing G-sensor
16	Open circuit in the safing G-sensor

Replace the SRS-ECU.

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Code No.21, 22, 61 or 62 Driver's side air bag module (squib) system	Probable cause
These diagnosis trouble codes are output if there is abnormal resistance between the input terminals of the driver's air bag module (squib) inside the SRS-ECU. The trouble causes for each diagnosis trouble code No. are as follows. However, as for code Nos.21 and 22, if the vehicle's condition returns to normal, SRS warning lamp will go out. (diagnosis code will remained stored)	• Malfunction of clock spring • Partially open as clock spring is not in neutral position • Malfunction of wiring harnesses or connectors • Malfunction of driver's side air bag module (squib) • Malfunction of SRS-ECU

Code No.	Trouble symptom
21	• Short in driver's air bag module (squib) or harness short • Short in clock spring • Poor connector contact *
22	• Open circuit in driver's side air bag module (squib) or open harness • Open circuit in clock spring • Disconnected driver's air bag module (squib) connector • Partially open as clock spring is not in neutral position • Malfunction of connector contact
61	• Short in driver's air bag module (squib) harness leading to the power supply
62	• Short in driver's air bag module (squib) harness leading to the ground

Note:

***: The shorting bars, which short positive (+) and negative (–) wires to prevent the air bags from accidental deployment during the disconnection of the connector, are set in the squib circuit connectors. In a defective connector, the short-bar may be still working even after the connection of the squib.**

MUT-II Self-Diag code
- Disconnect clock spring connector B-32.
- Connect SRS check harness connector (1).
- Erase diagnosis code memory.
  Are code Nos.21, 22, 61 or 62 output?

Yes → **Check the following connectors:** B-45 → NG → **Repair**
OK → Check trouble symptoms.
NG → Check the harness wire between the SRS-ECU and clock spring. → NG → **Repair**
OK → Replace the SRS-ECU.

No → Check the clock spring. → NG → **Repair**
OK → Replace the driver's side air bag module.

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Code No.24, 25, 64 or 65 Front passenger's side air bag module (squib) system	Probable cause
These diagnosis codes are output if there is abnormal resistance between the input terminals of the front passenger's air bag module (squib) inside the SRS-ECU. The trouble causes for each diagnosis code No. are as follows. However, as for code Nos.24 and 25, if the vehicle's condition returns to normal, SRS warning light will go out. (diagnosis code will remain stored)	• Malfunction of wiring harness or connector • Malfunction of front passenger's air bag module (squib) • Malfunction of SRS-ECU

Code No.	Trouble symptom
24	• Short in passenger's air bag module (squib) or harness short • Poor connector contact *
25	• Open circuit in passenger's air bag module (squib) or open harness • Poor connector contact
64	• Short in passenger's air bag module (squib) harness leading to the power supply
65	• Short in passenger's air bag module (squib) harness leading to the ground

Note:

***: The shorting bars, which short positive (+) and negative (–) wires to prevent the air bags from accidental deployment during the disconnection of the connector, are set in the squib circuit connectors. In a defective connector, the short-bar may be still working even after the connection of the squib.**

Code No.31 or 32 SRS-ECU DC-DC converter system	Probable cause
These diagnosis codes are output if the voltage at the SRS-ECU converter terminal is higher (No.31) or lower (No.32) than the specified value for 5 seconds or more. However, if the diagnosis code Nos. 41 and 42 are being output due to a drop in battery voltage, code No. 32 will not be detected.	• Malfunction of SRS-ECU

Replace the SRS-ECU.

Code No.34 Connector lock system	Probable cause
This diagnosis code is output when the SRS-ECU detects that the SRS-ECU connector is improperly connected. However, if the vehicle condition returns to normal, diagnosis code No.34 will be automatically erased, and the SRS warning light will go out.	• Malfunction of connector • Malfunction of SRS-ECU

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Code No.35 SRS-ECU (deployed air bag) system	Probable cause
This diagnosis code is output after the air bag deploys. If this code is output before the air bag has deployed, the cause is probably a malfunction inside the SRS-ECU.	• Malfunction of SRS-ECU

Replace the SRS-ECU.

Code No.41 IG_1 (A) power circuit system	Probable cause
This diagnosis code is output if the voltage between the IG_1 terminal (SRS-ECU terminal 16) and ground is lower than the specified value for a continuous period of 5 seconds or more. However, if the vehicle condition returns to normal, diagnosis code No.41 will be automatically erased, and the SRS warning light will switch off. If codes Nos.41 and 42 are displayed together, check the battery first as vehicle may have discharged battery.	• Malfunction of wiring harnesses or connectors • Malfunction of SRS-ECU

Measure at SRS-ECU connector B-45.
- Disconnect SRS-ECU connector B-45 and measure at the harness side.
- Connect the negative (–) battery terminal.
- Ignition switch: ON
- Voltage between terminal 16 and body earth (OK if 9 volt or more).

NG → **Check the following connectors:** B-76, B-45, B-77

NG → **Repair**

OK → Check trouble symptoms.

NG → Check the harness wire between the SRS-ECU and ignition switch IG_1, and repair if necessary.

OK → Replace the SRS-ECU.

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Code No.42 IG_1 (B) power circuit system	Probable cause
This diagnosis code is output if the voltage between the IG_1 terminal (SRS-ECU terminal 13) and ground is lower than the specified value for a continuous period of 5 seconds or more. However, if the vehicle condition returns to normal, diagnosis code No.42 will be automatically erased, and the SRS warning light will switch off.. If codes Nos.41 and 42 are displayed together, check the battery first as vehicle may have discharged battery.	● Malfunction of wiring harnesses or connectors ● Malfunction of SRS-ECU

Measure at SRS-ECU connector B-45.
- Disconnect SRS-ECU connector B-45 and measure at the harness side.
- Connect the negative (–) battery terminal.
- Ignition switch: ON
- Voltage between terminal 13 and body earth (OK if 9 volt or more).

NG → **Check the following connectors:** B-76, B-45, B-77

NG → **Repair**

OK → Check trouble symptoms.

NG → Check the harness wire between the SRS-ECU and ignition switch IG_1, and repair if necessary.

OK → Replace the SRS-ECU.

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Code No.43 SRS warning light drive circuit system (Light does not illuminate.)	Probable cause
This diagnosis code is output when an open circuit occurs for a continuous period of 5 seconds while the SRS-ECU is monitoring the SRS warning light and the light is OFF (transistor OFF). However, if this code is output due to an open circuit, if the vehicle condition returns to normal, this diagnosis code No.43 will be automatically erased, and the SRS warning light will return to normal.	• Malfunction of wiring harness or connector • Blown bulb • Malfunction of SRS-ECU • Malfunction of combination meter

Code No.43 SRS warning light drive circuit system (Light does not switch off.)	Probable cause
This diagnosis code is output when a short to ground occurs in the harness between the SRS warning light and the SRS-ECU. However, the vehicle condition returns to normal condition, this code will be automatically erased, and SRS warning lamp will go out.	• Malfunction of wiring harness or connector • Malfunction of SRS-ECU • Malfunction of combination meter

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Code No.44 SRS warning light drive circuit system	Probable cause
This diagnosis code is output when a short occurs in the light drive circuit or a malfunction of the output transistor inside the SRS-ECU is detected while the SRS-ECU is monitoring the SRS warning light drive circuit. However, if the vehicle conditions return to normal, the diagnosis code No. 44 will be automatically erased, and the SRS warning light will go out.	• Malfunction of wiring harnesses or connectors • Malfunction of SRS-ECU

Check the SRS warning light drive circuit system. —OK→ Replace the SRS-ECU.

Code No.45 SRS-ECU non-volatile memory (EEPROM) and A/D converter system	Probable cause
This diagnosis code is output if there is a malfunction in the SRS-ECU non-volatile memory (EEPROM).	• Malfunction of SRS-ECU

Replace the SRS-ECU.

Code No.51 or 52 Driver's air bag module (squib ignition drive circuit) system	Probable cause
This diagnosis code is output if a short circuit (No.51) or an open circuit (No.52) is detected in the circuit for the driver's squib.	• Malfunction of SRS-ECU

Replace the SRS-ECU.

Code No.54 or 55 Front passenger's air bag module (squib ignition drive circuit) system	Probable cause
This diagnosis code is output if a short circuit (No.54) or an open circuit (No.55) is detected in the circuit for the passenger's squib.	• Malfunction of SRS-ECU

Replace the SRS-ECU.

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SRS warning light

SRS WARNING LIGHT CHECK

1. Check to be sure that the SRS warning light illuminates when the ignition switch is in the ON position.
2. Check to be sure that it illuminates for approximately 7 seconds and then switch off and remain extinguished for at least 5 seconds.
3. If the above is not the case, inspect for diagnosis codes.

INSPECTION CHART FOR TROUBLE SYMPTOMS

Get an understanding of the trouble symptoms and check according to the inspection procedure chart.

Trouble symptom		Inspection procedure No.
Communication with MUT-II is not possible.	Communication with all systems is not possible.	1
	Communication is not possible with SRS only.	2
When the ignition key is turned to “ON” (engine stopped), the SRS warning light does not illuminate.		Refer to diagnosis code No.43.
After the ignition switch is turned to ON, the SRS warning light is still on after approximately 7 seconds have passed.		Refer to diagnosis code No.43 or No.44.

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

Inspection Procedure 1

Communication with MUT-II is not possible. (Communication with all systems is not possible.)	Probable cause
The cause is probably in the power supply system (including ground circuit) of the diagnosis line.	• Malfunction of wiring harnesses or connectors

Refer Group 13A.

Inspection Procedure 2

Communication with MUT-II is not possible. (Communication is not possible with SRS only.)	Probable cause
If communication is not possible only with the SRS, the cause is probably an open circuit in the diagnosis output circuit of the SRS or in the power circuit (including ground circuit).	• Malfunction of wiring harnesses or connectors • Malfunction of SRS-ECU

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SRS MAINTENANCE

The SRS must be inspected by an authorised dealer up to 10 years after the date of vehicle registration.

SRS COMPONENT VISUAL CHECK

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

Caution

Wait at least 60 seconds after disconnecting the battery cable before doing any further work. (Refer SRS service precautions.)

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SRS CONTROL UNIT (SRS-ECU)

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

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

2. Check connector for damage, and terminals for deformation or rust.
   Replace SRS-ECU if it fails visual check. (Refer ECU removal & Installation.)

AIR BAG MODULES,STEERING WHEEL AND CLOCK SPRING

1. Remove the air bag modules, steering wheel and clock spring. (Refer On vehicle service precautions.)

   Caution
   The removed air bag module should be stored in a clean, dry place with the pad cover face up.

2. Check pad cover for dents, cracks or deformities.

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3. Check connector for damage, terminals for deformities, and harness for binding.
4. Check air bag inflator case for dents, cracks or deformities.
5. Check harness (built into steering wheel) and connectors for damage and terminals for deformities.

6. Check clock spring connectors and protective tube for damage, and terminals for deformation.
7. Visually check the clock spring case for damage.
8. Align the mating marks of the clock spring and after turning the vehicles wheels to the straight ahead position, install the clock spring to the column switch..

Mating Mark Alignment

Turn the clock spring clockwise fully, and then turn it back approx. 3 4/5 turns counterclockwise to align the mating marks.

Caution
If the clock spring's mating marks are 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 the air bag module.
10. Check the steering wheel for noise, binds or difficult operation.
11. Check the steering wheel for excessive free play.
    REPLACE ANY VISUALLY INSPECTED PART IF IT FAILS THAT INSPECTION. (Refer Component service.)

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

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BODY WIRING HARNESS

1. Check connectors for poor connection.
2. Check harnesses for binding, connectors for damage, and terminals for deformation.
   REPLACE ANY CONNECTORS OR HARNESS THAT FAIL THE VISUAL INSPECTION.
   (Refer 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.

POST-INSTALLATION INSPECTION

Reconnect the negative battery terminal. Turn the ignition key to the "ON" position. Does the SRS warning light illuminate for about 7 seconds, turn off and then remain extinguished for at least 5 seconds? If yes, SRS system is functioning properly. If not, refer to Troubleshooting.

POST-COLLISION DIAGNOSIS

To inspect and service the SRS after a collision (whether or not the air bags have deployed),perform the following steps.

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SRS-ECU MEMORY CHECK

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

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

2. Read (and write down) all displayed diagnosis codes. (Refer Inspection chart for diagnosis trouble codes.)

   NOTE
   If the battery power supply has been disconnected or disrupted by the collision, the MUT-II cannot communicate with the SRS-ECU. Check the battery then inspect and, if necessary, repair the body wiring harnesses before proceeding further.

3. Read the data list (fault duration and how many times memories are erased) using the MUT-II.

Data list

No	Service Data Item	Applicability
92	Number indicating how often the memory is cleared	Maximum time to be stored: 250
93	How long a problem has lasted (How long it takes from the occurrence of the problem till the first air bag squib igniting signal)	Maximum time to be stored: 99999 minutes (approximately 7 days)
94	How long a problem has lasted (How long it takes from the first air bag squib igniting signal till now)	

4. Erase the diagnosis codes and after waiting 5 seconds or more read (and write down) all displayed diagnosis codes. (Refer Inspection chart for diagnosis trouble codes.)

REPAIR PROCEDURE

WHEN AIR BAG DEPLOYS IN A COLLISION.

1. Replace the following parts with new ones.
   - SRS-ECU (Refer On vehicle service.)
   - Air bag modules (Refer On vehicle service.)
2. Check the following parts and replace if there are any malfunctions.
   - Clock spring (Refer On vehicle service.)
   - Steering wheel, steering column and intermediate joint
     (1) Check wiring harness (built into steering wheel) and connectors for damage, and terminals for deformation.
     (2) Install air bag module to check fit or alignment with steering wheel.
     (3) Check steering wheel for noise, binding or difficult operation and excessive free play.
3. Check harnesses for binding, connectors for damage, poor connections, and terminals for deformation. (Refer SRS Service Precautions.)

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WHEN AIR BAG DOES NOT DEPLOY IN LOW-SPEED COLLISION.

Check the SRS components. If the SRS components are showing any visible damage such as dents, cracks, or deformation, replace them with new ones. Concerning parts removed for inspection, replacement with new parts and cautionary points for working, refer to appropriate INDIVIDUAL COMPONENT SERVICE.

SRS-ECU

1. Check SRS-ECU case and brackets for dents, cracks or deformation.
2. Check connector for damage, and terminals for deformation.
3. Check the SRS-ECU and bracket for installation condition.

Air bag modules

1. Check pad cover for dents, cracks or deformation.
2. Check connector for damage, terminals deformities, and harness for binds.
3. Check air bag inflator case for dents, cracks or deformities.
4. Check air bag modules for fit and proper installation.

Clock spring

1. Check clock spring connectors and protective tube for damage, and terminals for deformation.
2. Visually check the case for damage.

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Steering wheel, steering column and intermediate joint

1. Check wiring harness (built into steering wheel) and connectors for damage, and terminals for deformation.
2. Install air bag module to check fit or alignment with steering wheel.
3. Check steering wheel for noise, binding or difficult operation and excessive free play.

Harness connector (body wiring harness)

Check harnesses for binding, connectors for damage, poor connection, and terminals for deformation. (Refer SRS Service Precautions.)

INDIVIDUAL COMPONENT SERVICE

If the SRS components are to be removed or replaced as a result of maintenance, troubleshooting, etc., follow each procedure. (SRS Air Bag Control Unit, Air Bag Modules and Clock Spring.)

Caution

1. **SRS components should not be subjected to heat over 93°C, so remove the SRS-ECU, air bag modules and clock spring before drying or baking the vehicle after painting. Recheck SRS airbag system after re-installing components. (Refer to Group 00.)**
2. **If the SRS components are removed for the purpose of check, sheet metal repair, painting, etc., they should be stored in a clean, dry place until they are reinstalled.**

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SRS AIR BAG CONTROL UNIT (SRS-ECU)

Caution

1. **Disconnect the negative (–) battery terminal and wait for 60 seconds or more before starting work. Also, the disconnected battery terminal should be insulated with tape.**
2. **Never attempt to disassemble or repair the SRS-ECU. If faulty, replace it.**
3. **Do not drop or subject the SRS-ECU to impact or vibration. If denting, cracking, deformation, or rust are discovered in the SRS-ECU, replace it with a new SRS-ECU. Discard the old one.**
4. **After deployment of an air bag, replace the SRS-ECU with a new one.**
5. **Never use an ohmmeter on or near the SRS-ECU, and use only the special test equipment.**

REMOVAL AND INSTALLATION

Pre-removal Operation
- Turn the ignition key to the “LOCK” position.

Removal steps

- ▶B◀ Post-installation inspection
- ◀A▶ 1. Negative (–) battery cable connection
2. Footrest
3. Console side cover (LH and RH)
4. Floor carpet reinforcement (LH and RH)
5. Harness protector
6. Engine-A/T-ECU and A/T control relay
- ▶A◀ 7. SRS-ECU

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REMOVAL SERVICE POINT

◀A▶ NEGATIVE (–) BATTERY CABLE DISCONNECTION

Disconnect the negative battery cable from the battery and tape the terminal.

Caution
Wait at least 60 seconds after disconnecting the battery cable before doing any further work. (Refer SRS-Service Precautions.)

INSTALLATION SERVICE POINTS

▶A◀ SRS-ECU INSTALLATION

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

▶B◀ POST-INSTALLATION INSPECTION

1. Turn the ignition key to the "ON" position.
2. Does the "SRS" warning light illuminate for about 7 seconds, and then remain off for at least 5 seconds after turning off?
3. If yes, SRS system is functioning properly.
   If no, consult Troubleshooting.

INSPECTION

- Check the SRS-ECU and brackets for dents, cracks or deformation.
- Check connector for damage, and terminals for deformation.

  Caution
  If a dent, crack, deformation or rust is discovered, replace the SRS-ECU with a new one.

  NOTE
  For checking of the SRS-ECU other than described above, refer Troubleshooting.

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AIR BAG MODULES AND CLOCK SPRING

Caution

1. **Disconnect the negative (–) battery terminal and wait for 60 seconds or more before starting work. Also, the disconnected battery terminal should be insulated with tape.**
2. **Never attempt to disassemble or repair the air bag modules or clock spring.**
   If faulty, replace the component.
3. **Do not drop the air bag modules or clock spring or allow contact with water, grease or oil.**
   Replace the component if a dent, crack, deformation or rust is detected.
4. **The air bag modules should be stored on a flat surface and placed so that the pad surface is facing upward.**
   Do not place anything on top of it.
5. **Do not expose the air bag modules to temperatures over 93°C.**
6. **After deployment of an air bag, replace the air bag with a new one.**
7. **Wear gloves and safety glasses when handling air bags that have already deployed.**
8. **An undeployed air bag module should only be disposed of in accordance with the Undeployed air bag disposal procedures.**

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REMOVAL AND INSTALLATION

<Air bag module (driver's side), clock spring>

Pre-removal Operation
- After setting the steering wheel and the front wheels to the straight ahead position, remove the ignition key.

Air bag module removal steps

	▶D◀	● Post-installation inspection
◀A▶		1. Negative (–) battery cable connection
◀B▶		2. Air bag module
	▶A◀	● Pre-installation inspection

Clock spring removal steps

	▶D◀	● Post-installation inspection
◀A▶		1. Negative (–) battery cable connection
◀B▶		2. Air bag module
◀C▶	▶C◀	3. Steering wheel
		4. Instrument lower panel
		5. Column cover lower
◀D▶	▶B◀	6. Clock spring
	▶A◀	● Pre-installation inspection

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<Air bag module (front passenger's side)>

19P0040

Air bag module removal steps

▶D◀ ● Post-installation inspection
◀A▶ 1. Negative (–) battery cable connection
2. Undercover
3. Glove box assembly
4. Glove box case
◀E▶ 5. Air bag module
▶A◀ ● Pre-installation inspection

REMOVAL SERVICE POINTS

◀A▶ NEGATIVE (–) BATTERY CABLE DISCONNECTION

Disconnect the negative battery cable from the battery and tape the terminal.

Caution

Wait at least 60 seconds after disconnecting the battery cable before doing any further work. (Refer SRS - Service precautions.)

◀B▶ AIR BAG MODULE REMOVAL (DRIVER'S SIDE)

When disconnecting the connector of the clock spring from the air bag module, press the air bag's lock toward the outer side to spread it open. Use a flat-tipped screwdriver, prying gently as shown in the figure at the left, to remove the connector.

Caution

1. **When disconnecting the air bag module-clock spring connector, take care not to apply excessive force to it.**
2. **The removed air bag module should be stored in a clean, dry place with the pad cover face up.**

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◀C▶ STEERING WHEEL REMOVAL

Caution
Do not hammer on the steering wheel. Doing so may damage the collapsible column mechanism.

◀D▶ CLOCK SPRING REMOVAL

Caution
The removed clock spring should be stored in a clean, dry place.

◀E▶ AIR BAG MODULE REMOVAL (FRONT PASSENGER'S SIDE)

Caution
The removed air bag module should be stored in a clean, dry place with the pad cover face up.

INSTALLATION SERVICE POINTS

▶A◀ PRE-INSTALLATION INSPECTION

1. When installing the new air bag modules and clock spring, refer to INSPECTION.

   Caution
   Dispose of air bag modules only according to the specified procedure.

2. Connect the battery (–) terminal.
3. Connect the MUT-II to the diagnosis connector.

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

4. Turn the ignition key to the "ON" position.
5. Conduct diagnosis test using the MUT-II to ensure entire SRS operates properly.
6. Turn the ignition key to the "LOCK" position, disconnect the negative battery cable and tape the terminal.

   Caution
   Wait at least 60 seconds after disconnecting the battery cable before doing any further work.

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▶B◀ CLOCK SPRING INSTALLATION

Align the mating marks of the clock spring and, after turning the front wheels to the straightahead position, install the clock spring to the column switch.

Mating Mark Alignment

Turn the clock spring clockwise fully, and then turn it back approx. 3 4/5 turns counterclockwise to align the mating marks.

Caution
If the clock spring's mating marks are not properly aligned, the steering wheel may not rotate completely 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.

▶C◀ STEERING WHEEL INSTALLATION

1. Before installing the steering wheel, be sure to first turn the vehicle's front wheels to the straight-ahead position and align the mating marks of the clock spring.

   Caution
   Be sure when installing the steering wheel, that the harness of the clock spring does not become caught or tangled.

2. After securing the steering wheel, turn the steering wheel all the way in both directions to confirm that steering wheel rotation is normal.

▶D◀ POST-INSTALLATION INSPECTION

1. Turn the ignition key to the "ON" position.
2. Does the "SRS" warning light illuminate for about 7 seconds, and then remain off for at least 5 seconds after turning off?
3. If yes, SRS system is functioning properly.
   If no, consult Troubleshooting.

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INSPECTION

AIR BAG MODULE CHECK

If any improper part is found during the following inspection, replace the air bag module with a new one.
Dispose the old one according to the specified procedure.

Caution
Never attempt to measure the circuit resistance of the air bag modules (squib) even if you are using the specified tester. If the circuit resistance is measured with a tester, accidental air bag deployment will result in serious personal injury.

1. Check pad cover for dents, cracks or deformation.
2. Check connectors for damage, terminals for deformation, and harness for binds.
3. Check air bag inflator case for dents, cracks or deformation.
4. Install the air bag module to steering wheel or dash to check fit or alignment.

Caution
If dents, cracks, deformation, or rust are discovered in the air bag module, replace it with a new one.
Dispose of the old one according to the specified procedure.

CLOCK SPRING CHECK

If, as result of following checks, even one abnormal point is discovered, replace the clock spring with a new one.

1. Check connectors and protective tube for damage, and terminals for deformation.
2. Visually check the case for damage.

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3. Check for continuity between the No.1 connector of the clock spring and connectors No.2, 3 and 4

   NOTE:
   Connector No.1 terminal 4 and connector No.3 are provided only on vehicles equipped with audio system remote control.

Connector No.	1				2	3		4	
Terminal No.	1	2	3	4	1	1	2	1	2
Continuity between terminals	○								○
		○				○			
		○						○	
			○		○				
				○			○		

4. Align the paint mark of the SRS check harness connector No.4 with the notch in clock spring connector No.6 (arrow in the illustration) to connect the connectors Nos.6 and 4.
5. Connect SRS check harness connector No.1 with clock spring connector No.5.
6. Check continuity between terminals 22 and 25 and between terminals 23 and 24 of the SRS check harness connector No.5.

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AIR BAG MODULE DISPOSAL PROCEDURES

Before disposing of an air bag or a vehicle which is equipped with it, follow the procedures below to deploy the air bag (s).

UNDEPLOYED AIR BAG MODULE DISPOSAL

Caution

1. **If the vehicle is to be scrapped or otherwise disposed of, deploy the air bags inside the vehicle. If the vehicle will continue to be used and only the air bag modules are to be disposed of, deploy the air bags outside the vehicle.**
2. **Since a large amount of smoke is produced when the air bag is deployed, avoid residential areas whenever possible.**
3. **Since there is loud noise when the air bags are deployed, avoid residential areas whenever possible. If anyone is nearby, give warning of the impending noise.**
4. **Suitable ear protection should be worn by personnel performing these procedures or by people in the immediate area.**

DEPLOYMENT INSIDE THE VEHICLE

(when disposing of a vehicle)

1. Open all windows and doors of the vehicle. Move the vehicle to an isolated spot.
2. Disconnect the negative (–) and positive (+) battery cables from the battery terminals, and then remove the battery from the vehicle.

   Caution
   Wait at least 60 seconds after disconnecting the battery cables before doing any further work.
   (Refer to SRS - Service precautions.)

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3. To deploy the air bag module (driver's side):
   (1) Remove the steering column cover lower.
   (2) Remove the connection between the clock spring 2-pin connector (red) and the body wiring harness connector.

   NOTE
   If the clock spring connector is disconnected from the body wiring harness, both electrodes of the clock spring connector will be automatically shorted to prevent unintended deployment of the air bag due to static electricity, etc.

4. To deploy the air bag module (front passenger's side):
   (1) Remove the glove box. (Refer Removal & Installation.)
   (2) Remove the connection between the air bag module (front passenger's side) connector (red 2-pin) and the body wiring harness connector.

5. Connect two wires, each six metres or longer, to the two leads of SRS air bag adaptor harness A and cover the connections with insulation tape. The other ends of the two wires should be connected to each other (short-circuited), to prevent sudden unexpected deployment of the air bag.

6. Connect the clock spring or air bag module (front passenger's side) 2-pin connector (red) to SRS air bag adaptor harness A and pass the deployment wires out of the vehicle.

7. At a location as far away from the vehicle as possible, disconnect the two connected wires from each other, and connect them to the two terminals of the battery (which has been removed from the vehicle) to deploy the air bag.

   Caution
   1. Before deploying the air bag in this manner, first check to be sure that there is no one in or near the vehicle. Wear safety glasses.

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2. **The inflator will be quite hot immediately following the deployment, so wait at least 30 minutes to allow it to cool before attempting to handle it. Although not poisonous, do not inhale gas from air bag deployment. See Deployed Air Bag Module Disposal Procedures for post-deployment handling instructions.**
3. **If the air bag module fails to deploy when the procedures above are followed, do not go near the module. Contact your local Distributor**

8. After deployment, dispose of the air bag module according to the Deployed Air Bag Module Disposal Procedures.

DEPLOYMENT OUTSIDE THE VEHICLE

Caution

1. **This should be carried out in a wide, flat area at least 6 metres away from obstacles and other people.**
2. **Do not perform deployment outside, if a strong wind is blowing, and if there is even a slight breeze, the air bag module should be placed and deployed downwind from the battery.**

1. Disconnect the negative (–) and positive (+) battery cables from the battery terminals, and then remove the battery from the vehicle.

   Caution
   Wait at least 60 seconds after disconnecting the battery cables before doing any further work. (Refer SRS - Service precautions.)

2. Remove the air bag module from the vehicle. (Refer Removal and installation.)

   Caution
   The air bag module should be stored on a flat surface and placed so that the pad cover face up. Do not place anything on top of it.

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3. Connect two wires, each six metres or longer, to the two leads of SRS air bag adaptor harness B <driver's side> or SRS air bag adaptor harness A <front passenger's side>, and cover the connections with insulation tape. The other ends of the two wires should be connected to each other (short-circuited), to prevent sudden unexpected deployment of the air bag module.

4. Set the air bag modules as follows:

<Air bag module (driver's side)>

(1) Take the SRS air bag adaptor harness B that is connected to the wires, pass it beneath an old tyre and wheel assembly, and connect it to the air bag module.

(2) Pass thick wire through the air bag module mounting hole, and then secure the air bag module to an old tyre with a wheel in it so that the pad on the module is facing upwards.

Caution
Leave some space below the wheel for the adaptor harness. If there is no space, the reaction when the air bag deploys could damage the adaptor harness.

(3) Place three old tyres with no wheels on top of the tyre secured to the air bag module, and secure all tyres with ropes (4 locations).

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<Air bag module (front passenger's side)>

(1) Connect the deployment wires to the SRS air bag adaptor harness A, pass it beneath the tyre and wheel assembly, and connect it to the air bag module.

(2) Pass thick wires into the hole of the air bag module bracket, and secure it to the wheel of an old tyre and wheel (4 locations), with the air bag facing upwards.

Caution

1. **Leave some space below the wheel for the deployment wires.**
   If there is no space, the reaction of the air bag deployment could result in damage of the adaptor harness.
2. **While deployment takes place, do not have the connector of the SRS air bag adaptor harness A inserted between the tyres.**

(3) Place four old tyres without wheels on top of the tyre secured to the air bag module, and secure all tyres with ropes (4 locations).

5. At a location as far away from the air bag module as possible, and from a shielded position, disconnect the two connected wires from each other, and connect them to the two terminals of the battery (which has been removed from the vehicle) to deploy the air bag.

Caution

1. **Before deployment, check carefully to be sure that no one is nearby.**
2. **The inflator will be quite hot immediately following the deployment, so wait at least 30 minutes to allow it to cool before attempting to handle it. Although not poisonous, do not inhale gas from air bag deployment. See Deployed Air Bag Module Disposal Procedures for post-deployment handling instructions.**
3. **If the air bag fails to deploy when the procedures above are followed, do not go near the module. Contact your local Distributor.**

6. After deployment, dispose of the air bag module according to the Deployed Air Bag Module Disposal Procedures.

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DEPLOYED AIR BAG MODULE DISPOSAL

After deployment, the air bag module should be disposed of in the same manner as any other scrap parts, adhering to local laws and/or legislation that may be in force except that the following points should be carefully noted during disposal.

1. The inflator will be quite hot immediately following deployment, so wait at least 30 minutes to allow it cool before attempting to handle it.
2. Do not put water or oil on the air bag after deployment.
3. There may be, adhered to the deployed air bag module, material that could irritate the eye and/or skin, so wear gloves and safety glasses when handling a deployed air bag module.

   Caution
   If after following these precautions, any material does get into the eyes or on the skin, immediately rinse the affected area with a large amount of clean water. If any irritation develops, seek medical attention.

4. Tightly seal the air bag module in a strong vinyl bag for disposal.
5. Be sure to always wash your hands after completing this operation.

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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 baking or drying after painting, remove the SRS components (air bag module and SRS-ECU) beforehand.

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

(4) 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
Section titles with the asterisk (*) in the table of contents in each group indicate operations requiring warnings.

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HOW TO READ CONFIGURATION DIAGRAMS

The wiring harness diagrams clearly show the connector locations and harness routings at each site on actual vehicles.

Denotes connector No.
The same connector No. is used throughout the circuit diagrams to facilitate connector location searches.
The first alphabetical symbol indicates the location site of the connector to parts in clockwise order on the diagram.
In addition, the number of connector wires and the connector colour (except milk white)* are shown for ease of retrieval.

Example: A-77 (5-B)

- Connector colour (milk white if no colour is indicated)
- Number of connector wires
- Number specific to connector (serial number)
- Connector location site symbol
  - A : Engine compartment
  - B : Dash panel
  - C : Instrument panel
  - D : Floor and roof
  - E : Seat
  - F : Door
  - G : Trunk room
  - H : Rear floor lower section

*: Typical connector colours
- B : Black
- Y : Yellow
- L : Blue
- G : Green
- R : Red
- BR : Brown
- V : Violet
- O : Orange
- GR : Gray

Denotes a section covered by a corrugated tube.

Denotes ground point.
Same ground number is used throughout circuit diagrams to facilitate search of ground point. Refer to Group 54A for details of ground points.

Indicates the device to which the connector is to be connected.

A-77	Valve relay <ABS>
A-57	Power steering oil pressure switch
A-58	Crank angle sensor
A-60	Connection of control harness and power steering harness
A-63	Knock sensor
A-67	Condenser
A-68	Throttle position sensor
A-70	Idle speed control servo
A-72	Air flow sensor
A-75	Checking connector (for adjusting ignition timing, checking fuel pump)
A-76	Hydraulic unit <ABS>
A-82	Distributor assembly
A-84	Connection of control harness and battery harness
A-85	Output shaft speed sensor
A-86	Input shaft speed sensor

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HOW TO READ CIRCUIT DIAGRAMS

The circuit of each system from the fuse (or fusible link) to ground is shown. The power supply is shown at the top and the ground at the bottom to facilitate understanding of how the current flows.

Indicates connector No. The same No. as in the wiring harness diagram is used. Connector numbers enclosed by frame are indicated with the connector symbols at the lower part of the page.

Indicates the circuit name to be connected. The arrow indicates the current flow direction.

Indicates power take out.

Indicates the circuit name to be connected. The arrow indicates the current flow direction.

Indicates the power supply in the control unit. If no voltage is displayed, this indicates battery positive voltage.

An “X” at the end of a connector No. indicates that the connector is connected to a centralised junction that is shown in the section “Centralised Junction”.

Indicates the operating conditions of the engine coolant switch, etc.

Indicates that the diagram continues at A in the same circuit.

Indicates the connector symbol. Connectors in the circuit diagram are indicated in numerical order.

Indicates shield wire.

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Indicates input/output to/from control unit (current flow direction).

A broken line indicates that these connectors are the same intermediate connectors.

Indicates that the diagram comes from (A) in the same circuit.

Indicates terminal No.

In case two or more connectors are connected to the same device, markings indicating the same connector are connected by a broken line.

Indicates current flow downward or upward as controlled by the control unit.

Indicates harness junction where wire diameter or colour changes.

Indicates intersections at which the lead wires are not connected.

Indicates intersections at which the lead wires are connected.

Indicates vehicle body ground point. (Same No. as that of ground point in GROUNDING LOCATION).

HF00M00A

Indicates that the terminal is a spare one if the device (sensor in this case) is not provided.

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MARKINGS FOR CONNECTOR EARTHING

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Item	NO.	Connector/Earthing	Symbol	Contents
Connector marking	1	Male WH–1	WH–3	Double connector contour lines indicate male connector terminals and single contour lines indicates female terminals as illustrated here.
	–	Female WH–2	WH–4	
Connector symbol marking	2	Device 16A0333 Intermediate connector	WH–1	The symbol indicates the connector as viewed from the illustrated direction. At the connection with a device, the connector symbol on the device side is shown, and for an intermediate connector, the male connector symbol is shown. For the diagnosis connector, its contents differ from the previous description. Refer to MUT-II operation instruction in detail.
Connector connection marking	3	Direct connection type 16X0700	WH–5	A connection between a device and connector on the harness side is either by direct insertion in the device (direct connection type) or by connection with a harness connector furnished on the device side (harness connection type). The two types are indicated as illustrated.
	4	Harness connection type 16A0334	WH–6	
	5	Intermediate connector 16A0339	WH–7	

Item	NO.	Connector/Earthing	Symbol	Contents
Ground markings	6	Body ground	WH–8	Ground is either by body ground, device ground or control unit interior ground. These are indicated as illustrated.
	7	Device ground	WH–9	
	8	Ground in control unit	WH–10	

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WIRE COLOUR CODES

Wire colours are identified by the following colour codes.

Code	Wire colour	Code	Wire colour
B	Black	P	Pink
BR	Brown	R	Red
G	Green	SB	Sky blue
GR	Gray	V	Violet
L	Blue	W	White
LG	Light green	Y	Yellow
O	Orange	–	–

If a cable has two colours, the first of the two colour code characters indicates the basic colour (colour of the cable casing) and the second indicates the marking colour.

No.	Meaning
1	<F>: Flexible wire
	<T>: Twisted wire
2	Wire size (mm^2)
3	Basic colour (colour of the cable casing)
4	Marking colour

NOTE
*: No code indicates 0.5 mm^2.
Cable colour code in parentheses indicates 0.3 mm^2.

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ABBREVIATION SYMBOLS

The abbreviation symbols used in wiring diagrams are defined below.

1. Abbreviation symbols used for wiring harness

Abbreviation symbol	Meaning	Abbreviation symbol	Meaning
ABS	Antilock braking system	ELC-4A/T	Electronic controlled 4-speed automatic transmission
A/C	Air conditioner	BEM	Body Electronics Module
A/T	Automatic transmission	MPI	Multi-point injection
EGR	Exhaust gas recirculation	M/T	Manual transmission
		SRS	Supplemental restraint system

2. Abbreviation symbols for combination meters

Abbreviation symbol	Meaning	Abbreviation symbol	Meaning
ABS	Antilock braking system warning lamp	OIL	Oil pressure warning lamp
BEAM	High beam indicator lamp	SEAT BELT	Seat belt warning lamp
BRAKE	Brake warning lamp	SPEED	Speedometer
CHECK ENGINE	Check engine warning lamp	SRS	Supplemental restraint system warning lamp
CHG	Charging warning lamp	TACHO	Tachometer
DOOR	Door-ajar warning lamp	T/GA	Engine coolant temperature gauge
F/GA	Fuel gauge	TURN (LH)	Turn signal indicator lamp (L.H.)
FUEL	Low fuel warning lamp	TURN (RH)	Turn signal indicator lamp (R.H.)

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3. Abbreviation symbols used for switches and relays

Names of switches and relays	Abbre-viation symbols	Operation	Name of switches and relays	Abbre-viation symbols	Operation
Ignition switch	ACC	When turned to the ACC (ACCESSORY) or ON position, the power circuit will start	Blower switch	LO	Blower operates at low speed
				ML	Blower operates at medium low speed
	IG1	Even when at the ST (START) position, the power circuit will start		MH	Blower operates at medium high speed
				HI	Blower operates at high speed
	IG2	When at the ST (START) position, the power circuit will not start functioning	Wind-shield wiper switch	LO	Wipers operate at low speed
				HI	Wipers operate at high speed
Dimmer passing switch	LO	Low beams ON		INT	Wipers operate intermittently
	HI	High beams ON	Variable intermit-tent wiper control switch	SLOW	Pause time for intermittent operation lengthen
Lighting switch	TAIL	Position, tail, licence plate and instrument panel lamps ON		FAST	Pause time for intermittent operation shorten
	HEAD	Headlamps ON	Rear wiper switch	LO	Wiper operates at low speed
Room lamp switch	DOOR	Room lamp ON when a door is open		INT	Wiper operates intermittently
Turn sig-nal switch	LH	L.H. turn signal lamps ON	Remote control mirror switch	LH	L.H. mirror operates
	RH	R.H. turn signal lamps ON		RH	R.H. mirror operates
Power window switch	UP	Window closes	Sunroof switch	OPEN	Sunroof slides to open
	DOWN	Window opens		CLOSE	Sunroof slides to close
Door lock actuator	LOCK	Door lock		UP	Sunroof tilted up
	UN-LOCK	Door unlock		DOWN	Sunroof tilted down
Door lock key cylin-der switch	LOCK	Door lock	Others	ON	Switched on
	UN-LOCK	Door unlock		OFF	Switched off

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4. Other Abbreviation symbols

Abbreviation symbol	Meaning	Abbreviation symbol	Meaning
ECU	Electronic control unit	LH	Left hand
GND	Ground	LHD	L.H. drive vehicles
ILL	Illumination lamp	RH	Right hand
IND	Indicator lamp	RHD	R.H. drive vehicles
J/B	Junction block	ROOM	Room lamp
J/C	Joint connector	STOP	Stop lamp

SPECIAL TOOLS

Tool	Tool number and name	Supersession	Application
	MB991502 MUT-II	–	Diagnosis checking
	ROM pack	–	
	MB991529 Diagnosis code check harness	–	Diagnosis checking

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BATTERY

ON-VEHICLE SERVICE

FLUID LEVEL AND SPECIFIC GRAVITY CHECK

1. Check the battery electrolyte level at regular intervals. Maintain the electrolyte at a level approximately 6 mm above the plate using mineral free water.
2. Use a hydrometer and thermometer to check the specific gravity of the battery fluid.

   Standard value: 1.220-1.290 [20°C]
   The specific gravity of the battery fluid varies with the temperature, so use the following formula to calculate the specific gravity for 20°C. Use the calculated value to determine whether or not the specific gravity is satisfactory.

   D20=Dt+0.0007 (t-20)

   D20: Specific gravity of the battery fluid calculated for 20°C.

   Dt: Actually measured specific gravity

   t: Actually measured temperature

BATTERY INSPECTION

Make sure ignition switch is in OFF position and all battery feed accessories are OFF.

1. Disconnect ground cable from battery before disconnecting (+) cable.
2. Remove battery from vehicle.

   Caution
   Care should be taken in the event battery case is cracked or leaking to protect hands from the electrolyte. A suitable pair of rubber gloves (not the household type) should be worn when removing battery by hand.

3. Inspect battery carrier for damage caused by loss of acid from battery. If acid damage is present, it will be necessary to clean area with a solution of clean warm water and baking soda. Scrub area with a stiff bristle brush and wipe off with a cloth moistened with ammonia or baking soda in water.
4. Clean top of battery with same solutions as described in step 3
5. Inspect battery case and cover for cracks. If cracks are present, battery must be replaced.
6. Clean the battery post with a suitable battery post cleaning tool.
7. Clean the inside surfaces of the terminal clamps with a suitable battery terminal cleaning tool. Replace damaged or frayed cables and broken terminal clamps.
8. Install the battery in vehicle.
9. Connect (+) and (–) cables to battery in the order of mention.
10. Tighten the clamp nut securely.

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BATTERY CHARGING

Caution

When batteries are being charged, an explosive gas forms beneath the cover of each cell. Do not smoke near batteries on charge or which have recently been charged. Do not break live circuits at the terminals of the batteries on charge. A spark will occur where the live circuit is broken.

Keep all open flames away from the battery.

Battery electrolyte temperature may temporarily be allowed to rise to 55°C. Increase of electrolyte temperature above 55°C is harmful to the battery, causing deformation of battery cell, decrease in life of battery, etc.

CHARGE RATE

If the battery specific gravity is below 1,220, the battery should be charged as outlined below.

When the battery fluid specific gravity reaches 1.250–1,290 and the constant is maintained for more than an hour, charging should be stopped.

NOTE

If the battery is overcharged, the battery should be replaced; do not overcharge.

Charge Rate Chart

Battery	
Slow charging	5 amps 15 hrs.
Fast charging	20 amps 3.75 hrs.

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IGNITION SWITCH

REMOVAL AND INSTALLATION

16TE017A

Steering lock cylinder and ignition switch removal steps

- Instrument lower cover (driver) (See Group 52A - Instrument Panel).

1. Key cylinder panel
2. Antenna and Keyhole lighting ring
3. Steering lock cylinder
4. Ignition switch
5. Key reminder switch

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REMOVAL SERVICE POINT

◀A▶ STEERING LOCK CYLINDER REMOVAL

1. Insert the key in the steering lock cylinder and turn it to the “ACC” position.
2. Using a cross-tip (+) screwdriver (small) or a similar tool, push the lock pin of the steering lock cylinder inward and then pull the steering lock cylinder toward you.

INSPECTION

IGNITION SWITCH CONTINUITY CHECK

1. Remove the instrument under cover. (Refer Group 52A).
2. Disconnect the wiring connector from the ignition switch and connect an ohmmeter to the switch side connector.
3. Operate the ignition switch and check the continuity.

Ignition key position	Terminal No.					
	1	2	3	4	5	6
LOCK						
ACC	○					○
ON	○	○		○		○
START	○	○	○		○	

KEY REMINDER SWITCH, KEY HOLE ILLUMINATION LIGHT CONTINUITY CHECK

1. Remove the instrument undercover (Refer Group 52A.).
2. Disconnect the wiring connector from the key reminder switch and connect an ohmmeter to the switch side connector.
3. Check the continuity when the ignition key is pulled out of and inserted into the steering lock cylinder.

Ignition key	Terminal No.	
	Key reminder switch	
	2	5
Removed	○	○
Inserted		

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BODY ELECTRONICS MODULE (BEM)

SPECIAL TOOLS

Tool	Tool number and name	Supersession	Application
	MB991502 MUT-II	–	Diagnosis checking
	ROM pack	–	

TROUBLESHOOTING

STANDARD FLOW OF DIAGNOSIS TROUBLESHOOTING

Refer to Group 00.

DIAGNOSIS FUNCTION

DIAGNOSIS CODES CHECK

Read a diagnosis code by the MUT-II for immobiliser functions and the high beam indicator lamp for BEM functions. (Refer to Group 00.).

ERASING DIAGNOSIS CODES

Refer to Group 00.

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BASIC TEST MODE (BTM) PROCEDURE

1. Open drivers door.
2. Connect MUT-II to diagnosis connector (16 pin).
3. Flash high beam headlamps.

   NOTE: Interior lamp will switch off (only if switched on). This indicates that the BTM has been activated.

4. Check security lamp for Flash Codes.

   NOTE: Any flash codes in memory will be displayed. Refer to flash code table.

5. Check BEM outputs.

   NOTE: Outputs are activated in sequence for 0.5 seconds by flashing the high beam. Refer to the output checklist.

6. Check BEM inputs.

   NOTE: Inputs are activated by changing their state. Refer to the input checklist.

7. Disconnect MUT-II.

   NOTE: BTM has been completed. The interior lamp will switch on indicating BTM is no longer active.

FLASH CODE REFERENCE TABLE

Codes	Circuits	Codes	Circuits
2 flashes	Alarm trigger memory is clear	6 flashes	Right front snib
3 flashes	Door ajar	7 flashes	Left front snib
4 flashes	Trunk	8 flashes	Right rear snib
5 flashes	Hood	9 flashes	Left rear snib

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OUTPUT TEST CHECKLIST

Sequence	BEM function	Result
1	Room lamp	Switches ON
2	Ignition key lamp	Switches ON
3	Security lamp	Switches ON
4*	Seat belt warning lamp	Switches ON
5	Hazard lamps	Switch ON
6	Headlamps	Switch ON
7**	Trunk release relay / trunk unlock motor	Boot opens
8***	Rear demister	Switches ON
9****	Power window / Sunroof supply	Open / close
10	Horn	Sounds
11	Lock all doors relay	All doors lock
12	Unlock drivers door relay	Drivers door unlocks
13	Unlock passengers door relay	Passengers doors unlock

NOTE:
* Insert key before step 4 and turn ON. Remove after completion of step 4.
** Sedan only.
*** Press demister switch when buzzer sounds. (Applies to models without climate control).
**** Press power windows / sunroof switches when buzzer sounds.

INPUT TEST CHECKLIST

Number	Input description	Activation method
1	Key in ignition	Insert ignition key
2	Accessories	Turn key to accessories position
3	Ignition	Turn key to run position
4	Parking light	Turn parking lamps ON/OFF
5	High beam	Flash high beam lights
6	Rear demister	Turn demister ON/OFF
7	Door switches x 4 (all doors individually)	Press and release
8	Door locks x 4 4 (all doors individually)	Lock/unlock
9	Hood switch	Press and release
10	RH door key cylinder switch	Rotate/release (both directions)
11	LH door key cylinder switch	Rotate/release (both directions)
12	Boot / tailgate key cylinder switch	Rotate/release

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INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble symptom	Inspection procedure No.
Power windows and sunroof will not operate.	1
Seat belt warning won't go off.	2
Vehicle will not respond to remote key.	3
Poor remote key range (all keys)	4
No panic function.	5
No audible warning.	6
Lock over-use function inoperative.	7
Engine will not start.	8
Ignition key slot not illuminated (except executive models).	9
No illuminated entry or fade.	10
Headlamps on at all times.	11
No headlamp delay function.	12
No headlamp reminder function.	13
No hazard flash acknowledgment.	14
Door ajar warning sounds with all doors closed.	15
Doors unlock intermittently.	16
Rear demister does not function.	17
Trunk will not release with remote key.	18
Alarm sounds if trunk is opened with the mechanical key.	19
Doors unlock and interior lamps remain on.	20
Interior lamp will not go out.	21
Battery goes flat	22
Able to lock car with key in ignition.	23

INSPECTION PROCEDURE 1

Power windows and sunroof do not operate	Probable cause
BEM supplies power to relay to operate windows and sunroof.	• Malfunction of window relay. • Malfunction of the BEM ECU.

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INSPECTION PROCEDURE 2

Seat belt warning won't go off	Probable cause
BEM power supply to relay interrupted to operate windows and sunroof.	• Short in circuit. • Malfunction of the BEM ECU.

INSPECTION PROCEDURE 3

Vehicle will not respond to remote key	Probable cause
Signal from remote key not reaching or is different to BEM signal.	• Malfunction of the BEM ECU. • Bad earth • Keys require reteaching

INSPECTION PROCEDURE 4

Poor remote key range. (all keys)	Probable cause
Battery condition may be down.	• Malfunction of the BEM ECU. • Metallic window tint.

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INSPECTION PROCEDURE 5

No panic function	Probable cause
Remote key may be out of range.	• Malfunction of the BEM ECU. • Remote key battery voltage. • Faulty ignition switch.

INSPECTION PROCEDURE 6

No audible warning	Probable cause
Horn relay may be defective.	• Horn relay • Malfunction of the BEM ECU.

INSPECTION PROCEDURE 7

Lock over-use function inoperative	Probable cause
BEM malfunction.	• Malfunction of the BEM ECU.

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INSPECTION PROCEDURE 8

Engine will not start.	Probable cause
Key may need reteaching.	• Malfunction of the BEM ECU. • Faulty ignition switch.

Ensure the ignition key is not faulty and is validated. — NO → Replace key or validate key.

↓ OK

Check for O/C Antenna with key in ignition.

↓ OK

No communication, Check pin No. 4.

↓ OK

Connect MUT-II to locate fault.

↓

From indicated fault repair as necessary.

INSPECTION PROCEDURE 9

Ignition key slot not illuminated (except executive models)	Probable cause
Light ring wiring or connector may be faulty.	• Malfunction of the BEM ECU. • Blown globe. • Faulty Door switch.

Is ignition turned ON. — YES → Turn ignition OFF and retest.

↓ NO

Check for blown globe. — NG → **Replace**

↓ OK

Test drivers door switch input pin No. 32 using an oscilloscope. Lamp should go OFF and ON when switch is opened and closed. — NG → Test wiring for open circuits.

↓ OK

Test output voltage on pin No. 20 door opened and then closed. Voltage should be at 12V then go to zero after timed period. — NG → Replace BEM ECU. CAUTION

↓ YES

Check wiring to light ring.

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INSPECTION PROCEDURE 10

No illuminated entry or fade.	Probable cause
Light ring wiring or connector may be faulty.	• Malfunction of the BEM ECU. • Blown globe. • Faulty Door switch.

INSPECTION PROCEDURE 11

Headlamps on at all times.	Probable cause
Relay may be faulty.	• Malfunction of headlamp switch. • Short circuit.

INSPECTION PROCEDURE 12

No headlamp delay function.	Probable cause
Possible faulty high beam switch.	• Malfunction of the BEM ECU. • Open circuit. • Faulty high beam switch.

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INSPECTION PROCEDURE 13

No headlamp reminder function.	Probable cause
Parklamp switch may be faulty.	• Malfunction of the BEM ECU. • Ignition switch

INSPECTION PROCEDURE 14

No hazard flash acknowledgment	Probable cause
Possible fault in wiring.	• Malfunction of the BEM ECU. • Blown fuse.

INSPECTION PROCEDURE 15

Door ajar warning sounds with all doors closed	Probable cause
Possible door switch malfunction.	• Malfunction of door switch. • Door switch adjustment.

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INSPECTION PROCEDURE 16

Doors unlock intermittently	Probable cause
Door snib switch may be faulty.	• Malfunction of the BEM ECU. • Faulty door snib switch

INSPECTION PROCEDURE 17

Rear demister does not function.	Probable cause
Demister element may be faulty.	• Malfunction of the BEM ECU. • Faulty demister switch. • Faulty demister relay.

INSPECTION PROCEDURE 18

Trunk lid will not release with remote key.	Probable cause
Faulty trunk lid release motor.	• Malfunction of the BEM ECU. • Faulty trunk lid release relay. • Faulty trunk lid motor.

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INSPECTION PROCEDURE 19

Alarm sounds if trunk lid is opened with the mechanical key.	Probable cause
Faulty trunk lid release motor.	• Malfunction of the BEM ECU. • Faulty trunk lid release relay. • Faulty trunk lid motor.

INSPECTION PROCEDURE 20

Doors unlock and interior lamps remain on.	Probable cause
Crash sensor may be faulty.	• Malfunction of the BEM ECU. • Faulty crash sensor. • Fault in wiring.

INSPECTION PROCEDURE 21

Interior lamp does not go out.	Probable cause
BEM has recieved a door unlock command from the crash sensor.	• Malfunction of the BEM ECU. • Faulty crash sensor. • Fault in wiring.

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INSPECTION PROCEDURE 22

Battery goes flat.	Probable cause
Faulty battery saver function or crash sensor.	• Malfunction of the BEM ECU. • Faulty crash sensor. • Faulty wiring.

INSPECTION PROCEDURE 23

Able to lock car with key in ignition.	Probable cause
Possible faulty key remind switch.	• Malfunction of the BEM ECU. • Faulty key in lock switch. • Fault in wiring.

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IMMOBILISER

DIAGNOSIS FUNCTION

DIAGNOSIS CODES

1. Insert MUT-II into diagnosis connector (16 pin).

   NOTE: MUT-II will display the opening menu.
2. Select option 1 (system check & adjusting).

   NOTE: MUT-II will display a new menu.
3. Select option (Immobiliser).

   NOTE: MUT-II will display a new menu.
4. Select option 1 (self diagnosis code).
5. This option will perform a system check and display a fault code, if present. Refer to Inspection chart for diagnosis trouble codes.

INSPECTION CHART FOR IMMOBILISER SYSTEM DIAGNOSIS CODES

Diagnosis code	Inspection items
11	There is a communication problem.
12	The Engine ECU / BEM / transponder codes do not match or are not registered.

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INSPECTION PROCEDURE FOR DIAGNOSIS CODES

Code No. 11 Transponder communication system	Probable cause
Indicates there is a communication problem.	• Malfunction of the ignition key ring antenna. • Malfunction of the harness or connectors. • Malfunction of the BEM ECU. • Malfunction of the engine ECU. • Malfunction of the transponder.

Code No. 12 EMS/BEM/Transponder codes do not match.	Probable cause
The EMS/BEM/Transponder codes do not match.	• System has not been taught. • Mismatched parts fitted to vehicle.

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BEM PINOUT REFERENCE TABLE

Pin No.	Circuit	Active state	Inactive state
1	Unlock passengers doors	13.3-13.9V	0.1V
2	Boot unlock	13.9V	0.0V
3	Accessory feed	14.0V	0.0V
4	Data to Engine ECU	Data stream	
5	–	–	–
6	Cabin illumination	0.1V	13.9V
7	Right hand indicator	13.9V	0.0V
8	Battery feed	14.0V	0.0V
9	Door locking supply	14.0V	0.0V
10	Ignition feed	14.0V	0.0V
11	Drivers door lock	13.9V	0.1V
12	Door locking ground	0.0V	N/A
13	Left hand indicator	13.9V	0.0V
14	Indicator / boot motor supply	14.0V	0.0V
15	System ground	0.0V	Continuity to ground
16	Lock all doors	13.1-13.9V	0.1V
17	–	–	–
18	Antenna 1	60Vp-p ± 6Vp-p	0.2Vp-p (CRO)
19	Headlamp relays (LOW)	0.1-0.6V	13.9V
20	Key slot illumination	0.1-0.6V	13.9V
21	Diagnosis	–	–
22	Seat belt warning	0.1-0.6V	13.9V Ignition ON
23	–	–	–
24	Antenna 2	60Vp-p ± 6Vp-p	0.2Vp-p (CRO)
25	Rear demist relay	0.1-0.6V	13.9V
26	Security lamp	0.1-0.6V	13.9V
27	Horn relay	0.1-0.6V	13.9V
28	Window / Sunroof relay	0.1-0.6V	13.9V

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Pin No.	Circuit	Active state	Inactive state
29	Front door cylinder lock	0.0V	Vbat @ 20HZ
30	Left hand cylinder unlock	0.0V	Vbat @ 20HZ
31	Trunk lid cylinder	0.0V	Vbat @ 20HZ
32	Door ajar	0.0V	Vbat @ 20HZ
33	Parking light	0.0V	14.0V
34	Rear demist switch	0.0V	Vbat @ 20HZ
35	Right hand front door snib	0.0V	Vbat @ 20HZ
36	–	–	–
37	Crash sensor	0.0V	4.2V
38	RF probe (Bosch only)	–	–
39	Left hand rear door snib	0.0V	Vbat @ 20HZ
40	Left hand front door snib	0.0V	Vbat @ 20HZ
41	Right hand door cylinder unlock	0.0V	Vbat @ 20HZ
42	Front right hand door	0.0V	Vbat @ 20HZ
43	High beam	0.0V	O/C
44	Key in ignition	O/C key in	0V key out
45	Right hand rear door snib	0.0V	Vbat @ 20HZ
46	Hood	0.0V	Vbat @ 20HZ
47	DTC line (MUT-II)	0V	O/C
48	Trunk light	0.0V	14.0V

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ON-VEHICLE SERVICE

IMMOBILISER TEACHING OPTIONS

1. Insert MUT-II into diagnosis connector (16 pin).

   NOTE: MUT-II will display the opening menu.
2. Select option 1 (system check & adjusting).

   NOTE: MUT-II will display a new menu.
3. Select option (Immobiliser).

   NOTE: MUT-II will display a new menu.
4. Select option 3 (Special Func).
5. Select required option.

NOTE:

MUT-II will notify the user if components have been previously taught.

Keys must be new or previously matched to the Engine /Trans ECU.

MUT-II IMMOBILISER MENU

Insert MUT-II into the diagnosis connector. (MUT-II will display the opening menu).

↓

Select option '1. System check & adjusting. (The MUT-II will display a new menu).

↓

Select option 'Immobiliser' (The MUT-II will display a new menu).

↓

Select option '3. Special Func' (This option will display the menu with all the immobiliser options).

↓

The special function menu will appear as follows:
1. Key ID registr
2. Password Set

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CRASH DETECT SENSOR - NON SRS

REMOVAL AND INSTALLATION

Note:
- Crash detect sensor on SRS vehicles is part of the SRS ECU (refer Group 52B).

1. Nut
▶A◀ 2. Crash detect sensor

INSTALLATION SERVICE POINT

▶A◀CRASH DETECT SENSOR.

Caution: Ensure that the direction arrow on sensor faces the front.

CRASH DETECT SENSOR TESTING

1. Check resistance between pins 1 & 3 is standard value.

   Standard value: 2.2kΩ ± 22Ω.

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RF TRANSMITTER

BATTERY TESTING

1. Using a digital voltmeter measure the battery voltage.

   Battery: Lithium battery CR2032

   Standard value: 3.0–3.2 Volts

   Limit: 2.5 Volts
2. If the battery voltage reaches 2.5 volts or lower at room temperature, it should be replaced.

BATTERY REPLACEMENT

1. Insert a flat blade screwdriver (cloth covered) at the top of the transmitter (as shown in the diagram) and twist, to open the case.

   Caution:
   Be careful not to damage the silicon pad. The silicon pad creates the water proof seal, any damage to the pad will break the seal.

   NOTE:
   Latex gloves should be worn while performing this procedure to ensure no contaminants contact the circuit board or battery.

   Replacement battery: Lithium battery CR2032

   NOTE:
   Unpack the new battery before removing the old one. The reason for this is the internal capacitor will hold the rolling code for up to 15 seconds. If more than 15 seconds elapses before the battery is replaced, resynchronisation is required.

2. Push the battery in against the spring pressure, then up at the same time. (as shown in the diagram) This will release the discharged battery from the retaining clips and allow removal from the circuit board.

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3. Insert a new battery with the positive (+) side up. Push the battery in against the spring pressure, then down at the same time (as shown in the diagram).

4. Ensure the silicon pad is not puckered.
5. Push the case back together with finger pressure only.
6. Check that each switch operates it's corresponding function on the vehicle.
7. If resynchronisation is required.
   1. Turn the ignition ON
   2. Immediately press any remote key button
   3. When resynchronisation has been acknowledged the buzzer in the instrument panel will sound.

PROGRAMMING RF TRANSMITTERS

Have all transmitters that are to be programmed together in the vehicle.

NOTE: Once teach mode has been entered all previous codes will be erased.

1. To invoke teaching mode for the RF transmitters, turn the ignition between ACC and IGN 3 times within 5 seconds and leave at the IGN position.
2. The hazard lamps will flash once if entry is successful.
3. Within 5 seconds of this acknowledgment, press any button on the first remote key.
4. The hazard lamps will flash once to indicate acceptance.
5. Within 5 seconds press any button on the next key to be taught, this process may be repeated for up to 4 keys.
6. Teaching mode will be terminated by any of the following events.
   1. The ignition is turned off.
   2. More than 5 seconds have elapsed since the last valid key code.
   3. Four keys have been taught to the BEM.
   4. No correct data has been received in 10 seconds.

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SPEEDOMETER CHECK

1. Adjust the pressure of the tyres to the specified value.
2. Position the vehicle on a speedometer tester drum.
3. Make sure the parking brake has been applied.

4. Attach metal fittings to the tow hook and the tie-down hook to prevent the front wheels from slipping sideways. Attach both ends to the anchor plate.
5. Securely anchor one end of the chain or a wire and attach the other end to the rear tow hook to prevent the car from jumping forward
6. Take all other necessary precautions.
7. Check if the speedometer indication range is within the standard values.

Caution
Do not increase/decrease speed rapidly while testing.

Standard values:

Vehicle Speed km/h	**60**	**100**
Allowable Indication range km/h	**54.7 – 63.2**	**91.9 – 103.9**

Limit: Pointer oscillation
(running speed over 35km/h) ± 3km/h

TACHOMETER CHECK

1. Compare the readings of the engine speedometer and the tachometer at every engine speed, and check if the variations are within the standard values.

NOTE
For tachometer inspection, use of a fluxmeter-type engine speedometer is recommended. (Because a fluxmeter only needs to be clipped to the high tension cable.)

Standard value:

Engine speed rpm	**700**	**2,000**	**4,000**	**6,000**
Indicated variation rpm	**±100**	**±175**	**±300**	**±400**

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FUEL GAUGE SIMPLE CHECK

Disconnect the fuel gauge unit connector. (Refer Group 13F.)

↓

Connect a test light to the harness side connector.

↓

Turn the ignition switch to ON.

↓

Check the condition of the test light and the gauge.

1. Test light is illuminated (Gauge needle is not moving) → Replace the fuel gauge.
2. Test light is illuminated (Gauge needle is moving) → Replace the fuel gauge sender unit.
3. Test light is not illuminated (Gauge needle is not moving) → Repair the harness.

FUEL GAUGE UNIT CHECK

To check, remove fuel gauge unit from fuel tank. (Refer Group 13F..)

FUEL GAUGE UNIT FLOAT HEIGHT

Move float and measure the height A at point F (highest) and B at point E (lowest) with float arm touching stopper.

Standard value:

<Sedan>
A: 0±3mm
B: 144±3mm
<Wagon>
A: 193±3mm
B: 12±3mm

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FUEL GAUGE UNIT RESISTANCE

1. Check that resistance value between the fuel gauge terminal and ground terminal is at standard value when fuel gauge unit float is at point F (highest) and point E (lowest).

   Standard value:
   <Sedan>
   POINT F: 4±1 Ω
   POINT E: 107±1 Ω
   <Wagon>
   POINT F: 3±1 Ω
   POINT E: 107±1 Ω

2. Check that resistance value changes smoothly when float moves slowly between point F (highest) and point E (lowest.)

THERMISTOR

1. Connect fuel gauge unit to battery via test light (12V–3.4W). Immerse in water.
2. Condition good if light goes off when thermistor is in water and lights when it is removed from water.

   Caution
   After completing this test, wipe the unit dry and install it in the fuel tank.

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ENGINE COOLANT TEMPERATURE GAUGE SIMPLE CHECK

Remove the engine coolant gauge unit connector.

↓

Connect a test light (12V–3.4W) between the harness side connector and the ground.

↓

Turn the ignition switch ON.

↓

Check the condition of the test light and the gauge.

1. Test light is illuminated (Gauge needle is not moving) → Replace the engine coolant temperature gauge.
2. Test light is illuminated (Gauge needle is moving) → Replace the engine coolant temperature gauge unit.
3. Test light is not illuminated (Gauge needle is not moving) → Repair the harness.

ENGINE COOLANT TEMPERATURE GAUGE UNIT CHECK

1. Drain the engine coolant.
   (Refer Group 14.)
2. Remove the engine coolant temperature gauge unit.
3. Immerse the unit in 70°C water to measure the resistance.

   Standard value: 104±13.5 Ω

4. After checking, apply the specified adhesive around the thread of engine coolant temperature gauge unit.

   Specified sealant:
   Loctite 577

5. Add engine coolant.
   (Refer Group 14.)

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COMBINATION METERS

REMOVAL AND INSTALLATION

1. Vehicle speed sensor
2. Meter bezel
3. Combination meter

Vehicle speed sensor removal steps

- Air cleaner assembly (Refer Group 15.)

1. Vehicle speed sensor

Combination meter removal steps

2. Meter bezel
3. Combination meter

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INSPECTION

VEHICLE SPEED SENSOR CHECK

1. Remove the vehicle speed sensor and connect a 3–10 kΩ resistance as shown in the illustration at left.
2. Turn the shaft of the vehicle speed sensor and check to be sure that there is voltage between terminals 2 – 3. (1 turn = 4 pulses)

FUEL GAUGE CHECK

1. Remove the power supply tightening screw.
2. Use a circuit tester to measure the resistance value between the terminals.

Caution
When inserting the test probe into the power supply terminal, be careful not to touch the printed board.

Standard value:
<Standard Meter>
Power supply–Earth: 56.3 Ω
Power supply–Fuel gauge: 106 Ω
Fuel gauge–Earth: 150.3 Ω
<Hi Contrast Meter>
SIN ⊕ -SIN ⊖ 151.8 Ω
COS ⊕ -COS ⊖ 164.2 Ω

ENGINE COOLANT TEMPERATURE GAUGE CHECK

1. Remove the power supply attaching screw.
2. Use a circuit tester to measure the resistance value between the terminals.

Caution
When inserting the test probe into the power supply terminal, be careful not to touch the printed board.

Standard values:
<Standard Meter/Hi Contrast Meter>
Power supply–Water temperature gauge:
54 Ω/59 Ω
Power supply–Earth: 176.5 Ω
Water temperature gauge–Earth: 230.5 Ω/230.5 Ω

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CENTRE MESSAGE DISPLAY

SERVICE SPECIFICATIONS

Item	Units	Resolution	Minimum	Maximum
Clock	hh/mm	minutes	–	–
Range	km	10	50	990
Fuel total	litres	0.1	0.1	199.9
		1	200	600
Average Fuel	ℓ/100 km	0.1	0.1	99.9
Instant Fuel	ℓ/100 km	0.1	0.1	99.9
Time travelled	hh/mm	minutes	0:00	19:59
Total (distance)	km	1	0	1999
Average speed	km/h	0.1	0	199
		1	200	240
Set speed (Speed alarm)	km/h	5	20	195

SPECIAL TOOLS

Tool	Number	Name	Use
	MB991502	MUT-II	Diagnosis checking
		ROM pack	
	MB991529	Diagnosis code check harness	Diagnosis checking (when using a voltmeter)

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PRELIMINARY TROUBLE SYMPTOM CHECKS <MAGNA AND SPORTS>

Symptom	Input wire	Symptom/ Connector pin
Display background illuminates, but no white segments are visible	Battery	1
Display does not autoscroll when ignition ON, Oil and Charge lamps do not illuminate during ignition ON check	Ignition	2
Display illumination does not turn on, but warning jewels illuminate during ignition ON check (refer symptom 4, 16)	Accessory	3
Display illumination does not work with headlights OFF, but works with headlights ON, dimmed mode (refer symptom 3, 16)	Illumination +	4
Instant fuel / Average fuel consumption data is abnormally small	Injector Ignition +	5
Fuel gauge reads ≤ “EMPTY” continuously, Range to empty displays “---” flashing. Confirm by resetting Trip computer by IOD and after 5 min, Range displays flashing “---” (refer symptom 12)	Fuel sender in	6
Instant fuel consumption reads “--.-”ℓ/100 km when driving	Speed	7
Instant fuel consumption reads “0.1”ℓ/100 km when driving	Injector	8
Display background illuminates, but no white segments are visible	Power GND	9
Display background illuminates, but no white segments are visible	Signal GND	10
Charge lamp does not illuminate during ignition ON check	Charge	11
Range displays flashing “---”. Confirm by resetting Trip computer by IOD and after 3 minutes 40 seconds, Range displays flashing “---” (refer symptom 6)	Low fuel	12
Engine oil lamp does not illuminate during ignition ON check	Engine oil	13
–	–	14
Speed alarm cannot be adjusted down	Down	15
Display illumination does not work with headlights ON, but works with headlights OFF, daytime brightness (refer symptom 4, 16)	Illumination –	16
Fuel gauge reads ≤ ’EMPTY’ continuously (Standard combination meter only)	Fuel gauge (out)	17
Speed lamp does not illuminate when vehicle speed exceeds set speed	Alarm lamp	18
Speed alarm cannot be adjusted up	Up	19
Vehicle or Engine type cannot be set	Mode	20

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PRELIMINARY TROUBLE SYMPTOM CHECKS <VERADA>

Symptom	Input wire	Symptom/ Connector pin
Display background illuminates, but no white segments are visible	Battery	1
Display does not autoscroll when ignition ON, Oil and Charge lamps do not illuminate during ignition ON check	Ignition	2
Display illumination does not turn on, but warning jewels illuminate during ignition ON check (refer symptom 4, 16)	Accessory	3
Display illumination does not work with headlights OFF, but works with headlights ON, dimmed mode (refer symptom 3, 16)	Illumination +	4
Instant fuel / Average fuel consumption data is abnormally small	Injector Ignition +	5
Range to empty displays “---” flashing. Confirm by resetting Trip computer by IOD and after 5 min, Range displays flashing “---” (refer symptom 12)	Fuel sender in	6
Instant fuel consumption reads “--.-”ℓ/100 km when driving	Speed	7
Instant fuel consumption reads “0.1”ℓ/100 km when driving	Injector	8
Display background illuminates, but no white segments are visible	Power GND	9
Display background illuminates, but no white segments are visible	Signal GND	10
Charge lamp does not illuminate during ignition ON check	Charge	11
Range displays flashing “---”. Confirm by resetting Trip computer by IOD and after 3 minutes 40 seconds, Range displays flashing “---” (refer symptom 6)	Low fuel	12
Engine oil lamp does not illuminate during ignition ON check	Engine oil	13
–	–	14
Speed alarm cannot be adjusted down	Down	15
Display illumination does not work with headlights ON, but works with headlights OFF, daytime brightness (refer symptom 4, 16)	Illumination –	16
–	–	17
Speed lamp does not illuminate when vehicle speed exceeds set speed	Alarm lamp	18
Speed alarm cannot be adjusted up	Up	19
Vehicle or Engine type cannot be set	Mode	20

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INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble symptom	Inspection procedure No.
Centre display backlight does not illuminate when ignition switch is in ACC. or Ignition position. (Warning lights operate normally during Ignition ON check)	1
Centre display backlight illuminates but no white segments are visible. (trip data display)	2
Centre display backlight does not illuminate when ignition switch is in ACC. or Ignition position and headlights ON. (works with headlamps off)	3
Centre display backlight does not illuminate when ignition switch is in ACC. or Ignition position and headlights OFF. (works with headlamps ON – dimmed mode)	4
Centre display resets to 1:00AM when ignition switch is turned to lock position.	5
Clock time cannot be adjusted with ACC. and/or Ignition ON.	6
Range to empty always displays flashing “---” km.	7
Range to empty does not detect refuels.	8
Total fuel used does not operate. (increase)	9
Total fuel used displays abnormally low/high value.	10
Average fuel always displays “--.-” ℓ/100 km.	11
Average fuel always displays “0.1” ℓ/100 km.	12
Average fuel displays abnormally low result.	13
Instant fuel always displays “--.-” ℓ/100 km.	14
Instant fuel always displays “0.1” ℓ/100 km.	15
Instant fuel displays abnormally low/high result.	16
Total distance travelled does not operate. (increase)	17
Average speed always displays “--.-” km/h	18
Speed alarm warning “Beeps” do not trigger when set speed is exceeded.	19
Centre display speed alarm set speed cannot be adjusted and/or turned off and/or operating mode cannot be changed.	20

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INSPECTION PROCEDURE 1

Centre Display backlight does not illuminate when ignition switch is in ACC. or Ignition position (warning lights operate normally during Ignition ON check)	Probable cause
The Centre Display power or ground circuits may be defective.	• Harness or Connector defective • Centre Display malfunction

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INSPECTION PROCEDURE 2

Centre Display backlight illuminates but no white segments are visible (trip data display)	Probable cause
The Centre Display power or ground circuits may be defective.	• Harness or Connector defective • Centre Display malfunction

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INSPECTION PROCEDURE 3

Centre Display backlight does not illuminate when ignition switch is in ACC. or ignition position and headlamps ON (works head-lights OFF)	Probable cause
The Centre Display power or ground circuits may be defective.	• Harness or Connector defective • Centre Display malfunction

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INSPECTION PROCEDURE 4

Centre Display backlight does not illuminate when ignition switch is in ACC. or ignition position and headlamps OFF (works head-lights ON – dimmed mode)	Probable cause
The Centre Display power or ground circuits may be defective.	• Harness or Connector defective • Centre Display malfunction

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INSPECTION PROCEDURE 5

Clock display resets to 1:00 AM when ignition switch is turned to LOCK position.	Probable cause
The Centre Display power or ground circuits may be defective.	• Harness or Connector defective • Centre Display malfunction

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INSPECTION PROCEDURE 6

Clock time cannot be adjusted with ACC. and or ignition ON.	Probable cause
The Centre Display switch input circuits may be defective.	• Harness or Connector defective • Switch assembly defective • Centre Display malfunction

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INSPECTION PROCEDURE 7

Range to empty always displays flashing "---" km (even when fuel tank is full)	Probable cause
The Centre Display fuel sender circuit may be defective.	• Harness or Connector defective • Injector input missing • Fuel sender assembly faulty • Centre Display malfunction

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INSPECTION PROCEDURE 8

Range to empty does not detect refuels (even when > 17 litres)	Probable cause
The Centre Display fuel sender circuit may be defective.	• Harness or Connector defective • Fuel sender assembly faulty • Centre Display malfunction

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INSPECTION PROCEDURE 9

Total fuel used does not operate (increase)	Probable cause
The Centre Display power or ground circuits may be defective.	• Harness or Connector defective • Injector assembly faulty • Centre Display malfunction

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INSPECTION PROCEDURE 10

Total fuel used displays abnormally low/high value	Probable cause
The Centre Display power or ground circuits may be defective.	• Harness or Connector defective • Centre Display malfunction

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INSPECTION PROCEDURE 11

Average fuel always displays "---" ℓ/100 km	Probable cause
The Centre Display speed signal input circuit may be defective.	• Harness or Connector defective • Speed sensor defective • Centre Display malfunction

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INSPECTION PROCEDURE 12

Average fuel always displays “0.1” ℓ/100 km	Probable cause
The Centre Display injector circuit input circuit may be defective.	• Harness or Connector defective • Injector assembly faulty • Centre Display malfunction

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INSPECTION PROCEDURE 13

Average fuel displays abnormally low/high value	Probable cause
The Centre Display injector ignition circuit may be defective.	• Harness or Connector defective • Centre Display malfunction

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INSPECTION PROCEDURE 14

Instant fuel always displays "--.-" ℓ/100 km	Probable cause
The Centre Display speed signal input circuit may be defective.	• Harness or Connector defective • Speed sensor defective • Centre Display malfunction

Check at Centre Display connector C-02
- Disconnect connector and measure at the harness side (Simulate a SPEED signal using MUT II. eg. using Cruise Control system.)

1. Signal between SPEED input terminal (7) and ground
   OK: Correct SPEED signal present

OK → Replace the Centre Display

NG → **Check connectors** C-02, C-09, B-41

NG → **Repair**

OK → Check trouble symptom

NG → Check and repair harness between engine ECU injector output pin (14) (Manual Trans) / pin (9) (Auto Trans) and Centre Display.

NG → **Repair**

OK → Check trouble symptom

NG → Check the speed sensor

OK → Check trouble symptom

NG → Replace the Centre Display

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INSPECTION PROCEDURE 15

Instant fuel always displays “0.1” ℓ/100 km	Probable cause
The Centre Display injector circuit input circuit may be defective.	• Harness or Connector defective • Injector assembly faulty • Centre Display malfunction

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INSPECTION PROCEDURE 16

Instant fuel displays abnormally low/high result	Probable cause
The Centre Display injector ignition circuit may be defective.	• Harness or Connector defective • Centre Display malfunction

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INSPECTION PROCEDURE 17

Total distance travelled does not operate (increase)	Probable cause
The Centre Display Speed signal input circuit may be defective.	• Harness or Connector defective • Speed sender defective • Centre Display malfunction

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INSPECTION PROCEDURE 18

Average speed always displays "--.-" km/h	Probable cause
The Centre Display Speed signal input circuit may be defective.	• Harness or Connector defective • Speed sender defective • Centre Display malfunction

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INSPECTION PROCEDURE 19

Speed Alarm warning "BEEPS" do not trigger when set speed is exceeded	Probable cause
The Centre Display Speed signal input circuit may be defective.	• Harness or Connector defective • Speed sender defective • Centre Display malfunction

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INSPECTION PROCEDURE 20

Centre Display Speed Alarm set speed cannot be adjusted and/or turned off and/or operating mode cannot be changed	Probable cause
The Centre Display switch input circuits may be defective.	• Harness or Connector defective • Switch assembly defective • Centre Display malfunction

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CENTRE MESSAGE DISPLAY

REMOVAL AND INSTALLATION

1. Centre Message Display
2. Meter bezel
3. Clock switch / Speed alarm switch

Centre Message Display removal steps

- Centre Air Outlet Assembly. (Refer Group 52A.)

1. Centre Message Display
2. Meter bezel
3. Clock switch / Speed alarm switch

INSPECTION

SPEED ALARM / CLOCK SWITCH CONTINUITY CHECK

Switch	Terminal No.							
	1	2	3	4	5	6	7	8
MODE	○	—	—	○				
UP △				○	○			
Down ▽				○	—	○		
Light		○	—	—	○	—	○	

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CENTRE DISPLAY SETTING PROCEDURE

The Trip computer is coded to the vehicle and must be recoded if the power is removed from the unit, ie. the battery is disconnected or the unit is removed from the vehicle.

1. Ensure the unit is fitted correctly and the battery is connected.
2. Turn the ignition switch to the “ACC” or “ON” position.

3. The vehicle code screen will appear, displaying an “S” for sedan. If the vehicle is a sedan, press and hold the MODE button for more than 2 seconds to set for sedan. For a wagon, press the MODE button for less than 2 seconds and the display will change to a “W”. Press the MODE button for more than 2 seconds to set for wagon.

4. When the vehicle code is selected, the unit will beep and commence flashing the engine code “3.5 litres”. If the vehicle engine type is 3.5 litre, press and hold MODE button for more than 2 seconds to set for a 3.5 litre engine. For a 3.0 litre engine type, press the MODE button for less than 2 seconds and the display will change to “3.0 litres”. Press the MODE button for more than 2 seconds to set for a 3.0 litre engine.
5. When the engine code is selected, the unit will beep and the unit is programmed.

   NOTE
   Range to empty will display “---” for the first continuous 5 minutes with the ignition on.
6. The “set” code can be checked by holding the MODE button and turning the key to “ACC”.
7. If a code is incorrect, lift the IOD connector or disconnect the battery and repeat the above procedure.

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EXTERIOR LAMPS

HEADLAMPS

ON-VEHICLE SERVICE

HEADLAMP AIMING

PRE-AIMING INSTRUCTIONS

1. Inspect for badly rusted or faulty headlamp assemblies.
2. These conditions must be corrected before a satisfactory adjustment can be made.
3. Place vehicle on a level floor.
4. Bounce front suspension through three (3) oscillations by applying body weight to hood or bumper.
5. Inspect tyre inflation.
6. Rock vehicle sideways to allow vehicle to assume its normal position.
7. If fuel is not full, place a weight in trunk of vehicle to simulate weight of a full tank [0.72kg per litre]
8. There should be no other load in the vehicle other than driver or substituted weight of approximately 55 kg placed in driver's position.
   Thoroughly clean headlamp lenses.

NOTE:
Magna headlamps do not have a separate adjuster for high beam, this is done automatically when the low beam is adjusted. The low beam must be set first then the high beam checked to ensure it is in it's correct position. If the high beam is out of position check that both the low and high beam bulbs are seated correctly and in good condition. If the high beam cannot be rectified the problem is internal within the lamp assembly and it must be replaced as a unit.

HIGH BEAM ADJUSTMENT <VERADA ONLY>

1. Calculate the centre of both the high and low beam lights as shown in the illustration and mark with a marking pen or similar.

2. Set the beam so that the centre of the tester focusing lens meets the light centre with a distance of 3 m in between.

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3. Turn the adjusting screw until the deviation of the main optical axis falls within the standard values.

Standard Values

Vertical direction	22 mm downward from horizontal line H
Transverse direction	Left headlamp parallel to advancing direction
	Right headlamp 13 mm to left of vertical line V

NOTE
1. Remove the connector and adjust an unadjusted lamp while it is not lit. Be sure not to deviate the optical axis when connecting the connector. When you must cover the lens surface with a shade, the lamp must not be lit for more than three minutes.
2. Do not mask the outer lens surface with tape, etc.

LOW BEAM ADJUSTMENTS

1. Prepare an adjustment screen as shown.

NOTE
Use thick white paper for the adjustment screen.

2. Draw in the line that divides the light and shade.

3. Set the tester and the light in such a way that the centre of the tester focusing lens meets the light centre with a distance of 3 m in between.

NOTE
<VERADA ONLY> refer to step 1 of the high beam adjustment procedure to calculate the light centre.

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4. Match the centre hole of the adjustment screen to the centre of the tester focusing lens and attach the screen with tape.

5. Turn the adjusting screw until the deviation of the high illumination zone on the adjustment screen is within the standard values (dividing line between light and shade).

Standard Values

Vertical	22 mm downward from horizontal line H
Transverse	Point at which 15° start up portion intersects perpendicular line V

NOTE
1. Remove the connector and adjust an unadjusted lamp while it is not lit. Be sure not to deviate the optical axis when connecting the connector. When you must cover the lens surface with a shade, the lamp must not be lit for more than three minutes.
2. Do not mask the outer lens surface with tape, etc.

LUMINOUS INTENSITY MEASUREMENT

Measure the luminous intensity of headlamps with a photometer in accordance with the instruction manual prepared by the manufacturer of the photometer and make sure that the luminous intensity is within the following limit.

Limit:
over 12,000 CD per light

NOTES
1. When measuring the luminous intensity of headlamp, keep the engine at 2,000 rpm and have the battery charged.
2. If there are specific regulations for luminous intensity of headlamps in the region where the vehicle is operated, make sure that the intensity conforms to the requirements of such regulations.

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HEADLAMP, POSITION LAMP ASSEMBLY AND FRONT TURN SIGNAL LAMP ASSEMBLY

REMOVAL AND INSTALLATION

CAUTION: SRS
Before removal of air bag module and clock spring, refer to the followings:
Group 52B – SRS Service Precautions
Group 52B – Air Bag Module and Clock Spring

Pre-removal and Post-installation Operation
- Removal and Installation of Battery (When replacing only left side headlamp)
- Radiator Grille Removal and Installation

16TE014A

Headlamp, position lamp and front turn signal lamp removal steps

◀A▶ 1. Front turn signal lamp assembly
2. Headlamp assembly

Removal and installation of column switch assembly

REMOVAL SERVICE POINT

◀A▶ FRONT TURN SIGNAL LAMP ASSEMBLY

1. Remove the lamp locking spring.
2. Pull the lamp assembly forward and out.

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INSPECTION

Refer Group 51 – Windshield Wiper and Washer for removal and installation of the column switch.

Caution
Before removal of air bag module and clock spring, refer to the followings:
Group 52B – SRS Service Precautions
Group 52B – Air Bag Module and Clock Spring

COLUMN SWITCH CONTINUITY CHECK <Lighting Switch and Dimmer/Passing Switch>

Switch position			Connector (A) terminal No.				Connector (B) terminal No.				
			2	5	8	9	1	2	3	4	6
OFF											
Lighting Switch	Position taillamp			○	○						
	Headlamp		○	○	○						
Dimmer Switch	Low-beam								○	○	
	High-beam									○	○
	PASSING	At low beam					○	○	○	○	○
		At high beam					○	○		○	○

COLUMN SWITCH CONTINUITY CHECK <Turn-signal light switch>

Switch position		Connector (C) terminal No.		
		5	7	8
Turn signal lamp switch	LH	○		○
	OFF			
	RH		○	○

HAZARD LIGHT SWITCH CONTINUITY CHECK

Refer On vehicle service.

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HEADLAMP RELAY CONTINUITY CHECK

Battery voltage	Terminal No.			
	1	3	4	5
Power is not supplied	○	○		
Power is supplied	⊕	⊖	○	○

HEADLAMP BULB REPLACEMENT

<VERADA>

1. Remove the sealing cover by turning it counterclockwise.

2. Detach the bulb fitting spring, and then remove the bulb.

   Caution
   Do not touch the surface of the bulb with hands or dirty gloves. If the surface does become dirty, clean it with alcohol or thinners, and let it dry thoroughly before installing.

3. Install the sealing cover securely after the bulb replacement.
   If the sealing cover is not securely installed, the lens will be out of focus, or water will get inside the lamp unit, so the cover should be securely installed.

<MAGNA>

1. Remove the sealing cover.

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2. Unhook the spring securing the bulb.
3. Turn the bulb to the left and pull the bulb out.

POSITION LAMP BULB REPLACEMENT

<VERADA>

1. Disconnect the connector and remove the sealing cover of the headlamp low beam.
2. Lift the spring and pull out the position lamp bulb.

<MAGNA>

1. Pullout the lower bulb socket and pull the bulb from the socket.

TURN SIGNAL LAMP BULB REPLACEMENT

1. Remove the lamp locking spring.
2. Pull the lamp assembly forward and out.
3. Uncouple the connector.
4. Remove the bulb socket by turning anti–clockwise and pull the bulb out.

NOTE

Incorrectly attaching the bulb socket may result in a cloudy lens or may allow water to enter into the lamp unit so ensure the cover is attached correctly.

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SIDE TURN SIGNAL LAMP

REMOVAL AND INSTALLATION

Removal Procedure

◀A▶ 1. Side turn signal lamp
2. Bulb socket
3. Bulb
4. Packing

NOTE:
See Group 37A - Steering Wheel and Shaft, for removal and installation of the column switch assembly (lighting switch).

REMOVAL SERVICE POINT

◀A▶ **SIDE TURN SIGNAL LAMP**

1. With a flat-bladed screwdriver, remove the lock from the fender panel and take out the side turn signal lamp.

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FOG LAMP

FOG LAMP AIMING

1. Inspect for badly rusted or faulty fog lamp.
2. These conditions must be corrected before a satisfactory adjustment can be made.
3. Place vehicle on a level floor.
4. Bounce front suspension through three (3) oscillations by applying body weight to hood or bumper.
5. Inspect tyre inflation.
6. Rock vehicle sideways to allow vehicle to assume its normal position.
7. If fuel tank is not full, place a weight in trunk of vehicle to simulate weight of a full tank [0.72kg per litre].
8. There should be no other load in the vehicle other than driver or substituted weight of approximately 55 kg placed in driver's position.
   Thoroughly clean fog lamp lenses.

9. Measure the centre of the fog lamps as shown in the illustration.

10. Set the distance between the screen and the centre of the fog lamps as shown in the illustration.

11. Check if the beam shining onto the screen is at the standard value.

    Standard value:
    (Vertical direction)
    47mm below horizontal (H)
    (Horizontal direction)
    35mm to left of vertical line (V)

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NOTE
The horizontal direction is non-adjustable. If the deviation of the lamp beam axis exceeds the standard value, check to be sure that the mounting location or some other point is not defective.

FOG LAMP

REMOVAL AND INSTALLATION

Fog lamp switch removal steps
Column switch (Refer Group 51.)

Fog lamp removal steps
1. Under grille
2. Fog lamp
3. Sealing cover ▶A◀
4. Bulb ◀A▶

REMOVAL SERVICE POINT

◀A▶ BULB REMOVAL

1. Remove the bulb socket cap.
2. Remove the bulb attachment spring and pull out the bulb.

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Caution
Do not touch the surface of the bulb with hands or dirty gloves. If the surface does become dirty, clean it with alcohol or thinner, and let it dry thoroughly before installing.

INSTALLATION SERVICE POINT

▶A◀ SEALING COVER INSTALLATION

Install the sealing cover securely.

Caution
If the sealing cover is not securely installed, the lens will be out of focus, or water will get inside the lamp unit, so the sealing cover should be securely installed.

INSPECTION

FOG LAMP SWITCH CONTINUITY CHECK

Switch position		Terminal No. 3	Terminal No. 7
Fog lamp switch	OFF		
	ON	○	○

FOG LAMP RELAY CONTINUITY CHECK

Battery voltage	Terminal No. 1	Terminal No. 3	Terminal No. 4	Terminal No. 5
Power is not supplied	○	○		
Power is supplied	⊕	⊖	○	○

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REAR COMBINATION LAMP AND REAR LID LAMP

REMOVAL AND INSTALLATION

<SEDAN>

Rear combination lamp removal steps

- Trunk rear side trim (Refer Group 52A)

1. Rear combination lamp
2. Socket holder/bulb assembly

Rear lid lamp removal steps

- Trunk rear trim (Refer Group 52A.)

3. Rear lid lamp
4. Socket assembly
5. Bulb

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<WAGON>

Pre-removal and Post-installation operation
- Cargo compartment lower side trim.

Rear combination lamp removal steps

1. Connector
2. Rear combination lamp
3. Socket assembly
4. Bulb

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TAILLAMP RELAY CONTINUITY CHECK

Battery voltage	Terminal No.			
	1	3	4	5
Power is not supplied	○	○		
Power is supplied	⊕	⊖	○	○

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HIGH MOUNTED STOP LAMP

REMOVAL AND INSTALLATION

<SEDAN>

REMOVAL

1. Insert a clean flat blade screwdriver at the triangle marker position at one side of the lamp as shown in the illustration.
2. Push the screwdriver in until the retainer clip releases from the glass mounting clip and move the lamp toward the rear. Repeat this step at the other side of the lamp.
3. Disconnect the wiring connector and remove the lamp.

INSTALLATION

1. Connect the wiring connector and slide the lamp onto the glass mounting clip until the retaining clips lock on the glass mounting clips positively.

<WAGON>

Removal steps

1. Plug
2. High mount stop lamp cover
3. Connector
4. High mount stop lamp
5. Bulb and socket assembly

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RHEOSTAT

REMOVAL AND INSTALLATION

16TH181A

Removal steps

1. Meter bezel
2. Rheostat

16P0263

INSPECTION

1. Connect a battery and test lamp (40W) as shown in the illustration.
2. Operate the rheostat, and if the brightness changes smoothly without switching off, then the rheostat function is normal.

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HAZARD WARNING LAMP SWITCH

REMOVAL AND INSTALLATION

Removal steps

- Floor console assembly (Refer Group 52A.)
- Centre air outlet assembly (Refer Group 52A.)
- Ashtray (Refer On vehcile service)

1. Air conditioner control panel assembly
2. Hazard light switch

INSPECTION

HAZARD WARNING LAMP SWITCH CONTINUITY CHECK

Switch position	Terminal No.										
	1	2	3	4	5	6	7	8	9		10
OFF					○	——	○		○	ILL	○
ON	○	○	○	○	○	○			○	ILL	○

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HORN

INSPECTION

HORN RELAY CONTINUITY CHECK

Battery voltage	Terminal No.			
	1	3	4	5
Power is not supplied	○	○		
Power is supplied	⊕	⊖	○	○

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CIGARETTE LIGHTER

REMOVAL AND INSTALLATION

Pre-removal and Post-installation procedures
- Floor Console Assembly Removal and Installation (Refer Group 52A.)

Removal steps

1. Ashtray
2. Plug
3. Ashtray cover
4. Protector
5. Socket assembly
6. Socket case
7. Socket washer

INSPECTION

- Take out the plug, and check for a worn edge on the element spot connection, and for shreds of tobacco or other material on the element.
- Using a ohmmeter, check the continuity of the element.

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ACCESSORY SOCKET <VERADA>

REMOVAL AND INSTALLATION

Removal steps

1. Coin tray assembly
2. Socket
3. Socket assembly

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RADIO, TAPE PLAYER AND CD PLAYER

QUICK-REFERENCE TROUBLESHOOTING CHART

Items	Problem symptom and reference.	Relevant chart
Noise	Noise appears at certain places when travelling (AM).	A–1
	Noise appears at certain places when travelling (FM).	A–2
	Mixed with noise, only at night (AM).	A–3
	Broadcasts can be heard but both AM and FM have a lot of noise	A–4
	There is more noise either on AM or on FM.	A–5
	There is noise when starting the engine.	A–6
	Some noise appears when there is vibration or shocks during travelling	A–7
	Noise sometimes appears on FM during travelling.	A–8
	Ever-present noise.	A–9
Radio	When switch is set to ON, no power is available.	B–1
	No sound from one speaker.	B–2
	There is noise but no reception for both AM and FM or no sound from AM, or no sound from FM.	B–3
	Insufficient sensitivity.	B–4
	Distortion on AM or on both AM and FM.	B–5
	Distortion on FM only.	B–6
	Too few automatic select stations.	B–7
	Insufficient memory (preset stations are erased).	B–8
Tape player	Cassette tape will not insert.	C–1
	No sound.	C–2
	No sound from one channel.	C–3
	Sound quality is poor, or sound is weak.	C–4
	Cassette tape will not eject.	C–5
	Uneven revolution. Tape speed is fast or slow.	C–6
	Faulty auto reverse.	C–7
	Tape gets caught in mechanism.	C–8
	Automatic search does not work	C–9

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Items	Problem symptom	Relevant chart
CD player	CD will not be accepted.	D–1
	No sound.	D–2
	CD sound skips.	D–3
	Sound quality is poor.	D–4
	CD will not be ejected.	D–5
	No sound from one channel.	D–6
Motor antenna	Motor antenna won't extend or retract.	E–1
	Motor antenna extends and retracts but does not receive.	E–2

CHART

A. NOISE

A–1	Noise appears at certain places when travelling (AM).

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A–2	Noise appears at certain places when travelling (FM).

Do the following measures eliminate the noise?
- Change to a different station with a strong signal to boost resistance to interference.
- Suppress high tones to reduce noise.
- Extend antenna completely.

Yes → OK

No ↓

If there is more noise than other radios, find out the noise conditions and the name and frequency of the receiving stations from the user, and consult with the service centre.

NOTE
About FM waves:
FM waves have the same properties as light, and can be deflected and blocked. Wave reception is not possible in the shadow of obstructions such as buildings or mountains.

1. The signal becomes weak as the distance from the station's transmission antenna increases. Although this may vary according to the signal strength of the transmitting station and intervening geographical formation or buildings, the area of good reception is approx. 20–25 km for stereo reception, and 30–40 km for monaural reception.
2. The signal becomes weak when an area of shadow from the transmitting antenna (places where there are obstructions such as mountains or buildings between the antenna and the car), and noise will appear. <This is called first fading, and gives a steady buzzing noise.>
3. If a direct signal hits the antenna at the same time as a signal reflected by obstructions such as mountains or buildings, interference of the two signals will generate noise. During travelling, noise will appear each time the vehicle's antenna passes through this kind of obstructed area. The strength and interval of the noise varies according to the signal strength and the conditions of deflection. <This is called multipath noise, and is a repetitious buzzing.>
4. Since FM stereo transmission and reception has a weaker field than monaural, it is often accompanied by a hissing noise.

FM Broadcast Good Reception Areas

16A0663

FM Signal Characteristics and Signal Interference

16A0664

00000295

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A–3	Mixed with noise, only at night (AM).

The following factors can be considered as possible causes of noise appearing at night.

1. Factors due to signal conditions: Due to the fact that long-distance signals are more easily received at night, even stations that are received without problem during the day may experience interference in a general worsening of reception conditions. The weaker a station is the more susceptible it is to interference, and a change to a different station or the appearance of a beating sound* may occur.
   Beat sound*: Two signals close in frequency interfere with each other, creating a repetitious high-pitched sound. This sound is generated not only by sound signals but by electrical waves as well.
2. Factors due to vehicle noise: Alternator noise may be a cause.

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A–4	Broadcasts can be heard but both AM and FM have a lot of noise.

NOTE
About noise encountered during FM reception only. Due to differences in FM and AM systems, FM is not as susceptible as AM to interference from engines, power lines, lightning, etc. On the other hand, there are cases due to the characteristics of FM waves of noise or distortion generated by typical noise interference (first fading and multi-path).

<Noise (hissing) occurs in weak signal areas such as mountainous regions, but this is not due to a problem with the radio.>

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A–5	There is more noise either on AM or on FM.

1. There is much noise only on AM
   Due to differences in AM and FM systems, AM is more susceptible to noise interference.

2. There is much noise only on FM
   Due to differences in FM and AM systems, FM is not as susceptible as AM to interference from engines, power lines, lightning, etc. On the other hand, there are cases due to the characteristics of FM waves of noise or distortion generated by typical noise interference (first fading and multipath). <Noise (hissing) occurs in weak signal areas such as mountainous regions, but this is not due to a problem with the radio.>

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A–6	There is noise when starting the engine.

Noise type Sounds are in parentheses ( ).	Conditions	Cause	Inspection or replacement (Noise-preventive part)	
AM, FM: Ignition noise (Popping, Snapping, Cracking, Buzzing)	• Increasing the engine speed causing the popping sound to speed up, and volume decreases. • Disappears when the ignition switch is turned to ACC.	• Mainly due to the spark plugs. • Due to the engine noise.	Ground cable	Check or replace the ground cable.
			Noise capacitor	Check or replace the noise capacitor.
Other electrical components	–	Noise may appear as electrical components become older.	Repair or replace electrical components.	
Static electricity (Cracking, Crinkling)	• Disappears when the vehicle is completely stopped. • Severe when the clutch is engaged.	Occurs when parts or wiring move for some reason and contact metal parts of the body.	Return parts or wiring to their proper position.	
	• Various noises are produced depending on the body part of the vehicle.	Due to detachment from the body of the front hood, bumpers, exhaust pipe and muffler, suspension, etc.	Ground parts by bonding. Cases where the problem is not eliminated by a single response to one area are common, due to several body parts being imperfectly grounded.	

Caution

1. **Connecting a high tension cable to the noise filter may destroy the noise filter and should never be done.**
2. **Check that there is no external noise. Since failure due this may result in misdiagnosis due to inability to identify the noise source, this operation must be performed.**
3. **Noise prevention should be performed by suppressing strong sources of noise step by step.**

NOTE

1. Capacitor
   The capacitor does not pass D.C. current, but as the number of waves increases when it passes A.C. current, impedance (resistance against A.C.) decreases, and current flow is facilitated. A noise suppressing condenser which takes advantage of this property is inserted between the power line for the noise source and the ground. This suppresses noise by grounding the noise component (A.C. or pulse signal) to the body of the vehicle.
2. Coil
   The coil passes D.C. current, but impedance rises as the number of waves increases relative to the A.C. current. A noise suppressing coil which takes advantage of this property is inserted into the power line for the noise source, and works by preventing the noise component from flowing or radiating out of the line.

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A–7	Some noise appears when there is vibration or shocks during travelling.

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A–8	Noise sometimes appears on FM during travelling.

* About multipath noise and fading noise
Because the frequency of FM waves is extremely high, it is highly susceptible to effects from geological formations and buildings. These effects disrupt the broadcast signal and obstruct reception in several ways.

- Multipath noise
  This describes the echo that occurs when the broadcast signal is reflected by a large obstruction and enters the receiver with a slight time delay relative to the direct signal (repetitious buzzing).
- Fading noise
  This is a buzzing noise that occurs when the broadcast beam is disrupted by obstructing objects and the signal strength fluctuates intricately within a narrow range.

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A–9	Ever-present noise.

Noise is often created by the following factors, and often the radio is OK when it is checked individually.

- Travelling conditions of the vehicle
- Terrain of area travelled through
- Surrounding buildings
- Signal conditions
- Time period

For this reason, if there are still problems with noise even after the measures described in steps A-1 to A-8 have been taken, get information on the factors listed above as well as determining whether the problem occurs with AM or FM, the station names, frequencies, etc., and contact a service centre.

B. RADIO

B–1	No power is supplied when the switch is set to ON.

B–2	No sound from one speaker.

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B–3	There is noise but no reception for both AM and FM or no sound from AM, or no sound from FM.

B–4	Insufficient sensitivity.

* About multipath noise and fading noise
Because the frequency of FM waves is extremely high, it is highly susceptible to effects from geological formations and buildings. These effects disrupt the broadcast signal and obstruct reception in several ways.

- Multipath noise
  This describes the echo that occurs when the broadcast signal is reflected by a large obstruction and enters the receiver with a slight time delay relative to the direct signal (repetitious buzzing).
- Fading noise
  This is a buzzing noise that occurs when the broadcast beam is disrupted by obstructing objects and the signal strength fluctuates intricately within a narrow range.

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B–5 Distortion on AM or on both AM and FM.

B–6 Distortion on FM only

B–7 Too few automatic select stations.

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B–8	Insufficient memory (preset stations are erased).

C. TAPE PLAYER

C–1	Cassette tape will not insert.

*1
Attempting to force a foreign object (e.g., a coin or clip, etc.) out of the tape player may damage the mechanism. The player should be taken to a service dealer for repair.

*2
Ensure that the tape label is not loose, that the tape itself is not deformed and that the tape is tightly wound. Also, tape of C-120 or greater length often get caught in the mechanism and should not be used.

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C–2	No sound (even after a tape has been inserted).

C–3	No sound from one speaker.

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C–4	Sound quality is poor, or sound is weak.

C–5	Cassette tape will not eject.

The problems covered here are all the result of the use of a bad tape (deformed or not properly tightened) or of a malfunction of the tape player itself. Malfunctions involving the tape becoming caught in the mechanism and ruining the case are also possible, and attempting to force the tape out of the player can cause damage to the mechanism. The player should be taken to a service dealer for repair.

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C–6 Uneven revolution. Tape speed is fast or slow.

- Does the player play OK if the tape*1 is changed?
  - Yes → OK
  - No ↓
- Are there any foreign objects *2 inside the tape player?
  - Yes → Remove foreign object(s)
  - No ↓
- Is the head or capstan roller dirty? (Refer to Fig. 1)
  - Yes → Clean.
  - No ↓
- Repair or replace tape player.

Fig. 1

*1
Ensure that the tape label is not loose, that the tape itself is not deformed and that the tape is tightly wound. Also, tape of C-120 or greater length often get caught in the mechanism and should not be used.

*2
Attempting to force a foreign object (e.g., a coin or clip, etc.) out of the tape player may damage the mechanism. The player should be taken to a service dealer for repair.

C–7 Faulty auto reverse.

- Does the player play OK if the tape* is changed?
  - Yes → OK
  - No ↓

*:
- Ensure that the tape label is not loose, that the tape itself is not deformed and that the tape is tightly wound.
- Tapes of C-120 or greater length often get caught in the mechanism and should not be used.

- Does the problem only occur while the vehicle is being driven?
  - No → Repair or replace tape player.
  - Yes ↓
- Is the tape player properly installed to the vehicle?
  - No → Ensure tape player installation.
  - Yes ↓
- Repair or replace tape player.

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C–8 Tape gets caught in mechanism*1.

*1
When the tape is caught in the mechanism, the case may not eject. When this occurs, do not try to force the tape out as this may damage the tape player mechanism. Take the cassette to a service dealer for repair.

Does the player play OK if the tape*2 is changed?
- Yes → Tape used is bad.
- No ↓ Repair or replace tape player.

*2
Ensure that the tape label is not loose, that the tape itself is not deformed and that the tape is tightly wound. Also, tapes of C-120 or greater length often get caught in the mechanism and should not be used.

C–9 Automatic search does not work

Does the MSS (automatic search) button*1 depress properly?
- No → Button improperly operated.
- Yes ↓

Does the player play OK if the tape*2 is changed?
- Yes → Tape used is bad.
- No ↓ Repair or replace the tape player.

*1
- When the time between songs on a tape is less than three seconds, or when there is a three second period in the middle of a song in which the volume level is extremely low, the automatic search function may not work properly.

*2
- Ensure that the tape label is not loose, that the tape itself is not deformed and that the tape is tightly wound. Also, tapes of C-120 or greater length often get caught in the mechanism and should not be used.

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D. CD PLAYER

D-1	CD will not be accepted.

*1 If the CD is already loaded, doesn’t the shutter open to allow insertion when another CD is inserted?

*2 If the key switch is not at ACC or ON, the CD stops at depth of 15 mm below the panel surface even when it is inserted, and it will be rejected when pushed farther?

*3 Even though the CD is loaded, E (error) is sometimes displayed with the CD rejected because of vibration/shock or dew on the CD face or optical lens.

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D–2 No sound.

(The combined radio cassette must operate properly.)

D-3 CD sound skips.

1. Sound sometimes skips during parking.

2. Sound sometimes skips during driving.
(Stop vehicle, and check it.)
(Check it by using a CD which is free of scratch, dirt or other abnormality.)

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D–4 Sound quality is poor

D-5 CD will not be ejected.

D-6 No sound from one speaker.

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E. MOTOR ANTENNA

E–1	Motor antenna won't extend or retract.

Clean and polish the surface of the antenna rod.

- Is the radio power switch ON? — No → Switch it ON.
  - Yes ↓
- Is battery positive voltage emitted to the radio's motor antenna terminal? — No → Repair or replace the radio.
  - Yes ↓
- Is the antenna bent? — Yes → Repair the bend, or replace the antenna pole.
  - No ↓
- Is the motor antenna-ECU OK? — No → Replace the motor antenna-ECU
  - Yes ↓
- Is the motor OK? — No → Replace the motor antenna.
  - Yes ↓
- Repair the harness.

E–2	Motor antenna extends and retracts but does not receive signals.

- Is the antenna itself OK? (Refer to Fig. 1) — No → Repair or replace it.
  - Yes ↓
- Is operation normal when a new antenna assembly is directly installed to the radio? — No → Refer to "Radio troubleshooting".
  - Yes ↓
- Replace the feeder cable.

Fig. 1

Ohmmeter measurement locations	Result
Circuits from F to A, B, C, D and E	Continuity
Circuit between G and H	Continuity
Circuits from H to A, B, C, D and E	No continuity

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RADIO WITH TAPE PLAYER AND CD PLAYER

REMOVAL AND INSTALLATION

Type 1

Type 2

Removal steps

- Floor console assembly (Refer Group 52A.)
- Centre air outlet assembly (Refer Group 52A.)
- Ashtray (Refer On vehicle service.)

1. Air conditioner control panel assembly
2. Radio bracket
3. Radio and cassette player (Type 1) Radio / cassette and CD (Type 2)

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SPEAKERS

REMOVAL AND INSTALLATION

<Door speaker>

16P0279

Door speaker removal steps

1. Door trim (Refer to Group 42.)
2. Speaker mesh
3. Speaker cover
4. Speaker
5. Speaker base

<Rear speaker>

16TE002A

Rear speaker removal steps

1. Speaker mesh
2. Speaker
   - Rear seat cushion (Refer Group 52A.)
3. Rear shelf trim (Refer Group 52A.)

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<Instrument panel speaker>

Instrument Panel speaker removal steps

1. Speaker
2. Connector

<Tailgate speakers>

Tailgate speaker removal steps

1. High mount stop lamp cover
2. Tailgate side trim
3. Grab handle
4. Tailgate lower trim
5. Speaker mesh
6. Speaker

REMOVAL SERVICE POINTS

◀A▶ SPEAKER

1. Insert a nylon stick between the instrument panel and the speaker and prise the speaker out taking extra care not to damage the instrument panel.

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ANTENNA

REMOVAL AND INSTALLATION

<SEDAN>

<Manual antenna>

<Motorised antenna>

- Front scuff plate (LH) (Refer Group 52A.)
- Rear scuff plate (LH) (Refer Group 52A.)
- Rear seat assembly (Refer Group 52A.)
- Rear pillar trim (LH) (Refer Group 52A.)
- Trunk side trim (LH) (Refer Group 52A.)

1. Ring nut
2. Base
3. Antenna pole
4. Antenna bracket
5. Antenna assembly
6. Antenna feeder cable

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<WAGON>

<Manual antenna>

<Motorised antenna>

- Front scuff plate (LH) (Refer Group 52A.)
- Rear scuff plate (LH) (Refer Group 52A.)
- Cargo compartment lower side trim (LH) (Refer Group 52A.)
- Rear seat (Refer Group 52A.)

1. Ring nut
2. Base
3. Antenna pole
4. Antenna bracket
5. Antenna assembly
6. Antenna feeder cable

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INSPECTION

ANTENNA MOTOR

1. Connect the circuits shown as solid lines.
2. Check that when circuits shown as broken lines are connected, the antenna rises.
3. Verify that when the circuits shown as broken lines are disconnected and the circuits shown as dotted lines are connected, the antenna descends to the intermediate position.
4. Verify that when the circuits shown as dotted lines are disconnected, the antenna descends all the way.

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ANTENNA POLE REPLACEMENT

1. Remove the ring nut.

2. After turning the ignition switch to ACC or ON, turn the radio switch to ON to raise the antenna pole, and remove it, together with the rack cable.

3. Draw out the antenna pole to the maximum extension.

   NOTE
   If there is a bend in the motor end of the rack cable, remove the bend.

4. Insert the rack cable into the motor assembly with the rack cable teeth facing the trunk room side.

5. Turn the rack cable teeth towards the rear of the vehicle (right 90°) so that the rack cable meshes with the motor gear.
6. If the rack cable pulls out with no resistance when it is lightly pulled, then the cable is not meshed with the motor gear, so check that there are no bends in the end of the rack cable, and then repeat steps (4) and (5) above.
7. Set the antenna pole vertically and turn the radio switch OFF to wind up the rack cable. Insert the antenna to the motor antenna side to align it with the wound-up rack cable.
8. After tightening the ring nut, check the movement of the antenna by turning the radio switch ON and OFF.

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REAR WINDOW DEFOGGER

ON-VEHICLE SERVICE

PRINTED-HEATER LINE CHECK

1. Run engine at 2,000 rpm. Check heater element with battery at full charge.
2. Turn ON rear window defogger switch. Measure heater element voltage with voltmeter at rear window glass centre A.
   Condition good if about 6V.
3. If battery positive voltage is indicated at A, there is a break in the negative terminals from A.
   Move test bar slowly to negative terminal to detect where voltage changes suddenly (0V).
4. If 0V is indicated at A, there is a break in the positive terminals from A. Defect where the voltage changes suddenly (battery positive voltage) with the same method described.

DEFOGGER RELAY CONTINUITY CHECK

Battery voltage	Terminal No.			
	1	3	4	5
Power is not supplied	○	○		
Power is supplied	⊕ - - -	- - - ⊖	○	○

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STEERING REMOTE CONTROL AND SLIP RING

REMOVAL AND INSTALLATION

CAUTION: SRS
Before removal of air bag module and clock spring, refer to the followings:
GROUP 52B – SRS Service Precautions
GROUP 52B – Air Bag Module and Clock Spring

1. Horn pad / Airbag module (refer group 52B.)
2. Steering wheel remote control
3. Steering wheel (refer group 37A.)
4. Lower column cover
5. Upper column cover
6. Slip ring

INSPECTION

SLIP RING CONTINUITY

Switch position	Terminal No.									
	Connector A					Connector B				
Terminal in use	1	2	3	4	5	1	2	3	6	7
ACC power supply		○				○				
Ground					○					○
Cruise control				○					○	
Steering remote control			○					○		
Horn	○					○				

NOTE
Verify that when the steering wheel is turned there is continuity.

CLOCK SPRING <SRS VEHICLES>

Refer Group 52B.

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BODY ELECTRONICS MODULE (BEM)

TROUBLESHOOTING

INSPECTION CHART FOR TROUBLE SYMPTOMS

INSPECTION PROCEDURES FOR TROUBLE SYMPTOMS

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 baking or drying after painting, remove the SRS components (air bag module and SRS-ECU) beforehand.

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

(4) 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

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

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BODY ELECTRONICS MODULE (BEM)

TROUBLESHOOTING

INSPECTION CHART FOR TROUBLE SYMPTOMS

★ :Refer to TJ/KJ Base Manual.

Trouble symptom	Inspection procedure No.
Power windows and sunroof will not operate.	1
Seat belt warning won't go off.	2 ★
Vehicle will not respond to remote key.	3
Poor remote key range (all keys)	4 ★
No panic function.	5
No audible warning.	6
Lock over-use function inoperative.	7★
Engine will not start.	8★
Ignition key slot not illuminated (except executive models).	9★
No illuminated entry or fade.	10 ★
Headlamps on at all times.	11 ★
No headlamp delay function.	12 ★
No headlamp reminder function.	13 ★
No hazard flash acknowledgment.	14
Door ajar warning sounds with all doors closed.	15
Doors unlock intermittently.	16
Rear demister does not function.	17 ★
Trunk will not release with remote key.	18
Alarm sounds if trunk is opened with the mechanical key.	19
Doors unlock and interior lamps remain on.	20 ★
Interior lamp will not go out.	21 ★
Battery goes flat	22 ★
Able to lock car with key in ignition.	23

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INSPECTION PROCEDURE 1

Power windows and sunroof do not operate	Probable cause
BEM supplies power to relay to operate windows and sunroof.	• Malfunction of window relay. • Malfunction of the BEM ECU.

INSPECTION PROCEDURE 3

Vehicle will not respond to remote key	Probable cause
Signal from remote key not reaching or is different to BEM signal.	• Malfunction of the BEM ECU. • Bad earth • Keys require reteaching

INSPECTION PROCEDURE 5

No panic function	Probable cause
Remote key may be out of range.	• Malfunction of the BEM ECU. • Remote key battery voltage. • Faulty ignition switch.

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INSPECTION PROCEDURE 6

No audible warning	Probable cause
Horn relay may be defective.	• Horn relay • Malfunction of the BEM ECU.

Test pin No. 27 for pulsed 12 volts.
- NO → Replace BEM ECU. CAUTION
- OK ↓ Check horn relay and fuse wiring.

INSPECTION PROCEDURE 14

No hazard flash acknowledgment	Probable cause
Possible fault in wiring.	• Malfunction of the BEM ECU. • Blown fuse.

Test for 12V on pin No.14.
- NG → Check indicator / boot motor fuse.
- OK ↓ Operate remote key and test for output on pins No. 7 & 13.
- OK ↓ Is pulsed 12 Volts present.
  - NG → Replace BEM ECU. CAUTION
  - OK ↓ Test wiring between BEM and flasher circuit.

INSPECTION PROCEDURE 15

Door ajar warning sounds with all doors closed	Probable cause
Possible door switch malfunction.	• Malfunction of door switch. • Door switch adjustment.

Test pin No. 42 for short circuits to ground with the door closed.
- OK ↓ Test door switches for internal short circuits.
- OK ↓ Check door switch adjustment.

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INSPECTION PROCEDURE 16

Doors unlock intermittently	Probable cause
Door snib switch may be faulty.	• Malfunction of the BEM ECU. • Faulty door snib switch

INSPECTION PROCEDURE 18

Trunk lid will not release with remote key.	Probable cause
Faulty trunk lid release motor.	• Malfunction of the BEM ECU. • Faulty trunk lid release relay. • Faulty trunk lid motor.

INSPECTION PROCEDURE 19

Alarm sounds if trunk lid is opened with the mechanical key.	Probable cause
Faulty trunk lid release motor.	• Malfunction of the BEM ECU. • Faulty trunk lid release relay. • Faulty trunk lid motor.

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INSPECTION PROCEDURE 23

Able to lock car with key in ignition.	Probable cause
Possible faulty key remind switch.	• Malfunction of the BEM ECU. • Faulty key in lock switch. • Fault in wiring.

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COMBINATION METER
- FUEL GAUGE TEST
- LOW FUEL WARNING LAMP
- ENGINE COOLANT TEMPERATURE GAUGE TEST

TRIP COMPUTER
- SERVICE SPECIFICATIONS
- PRELIMINARY TROUBLE SYMPTOM CHECKS
- INSPECTION CHART FOR TROUBLE SYMPTOMS
- TRIP COMPUTER SETTING PROCEDURE

ANTENNA
- INSPECTION

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 baking or drying after painting, remove the SRS components (air bag module and SRS-ECU) beforehand.

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(4) 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
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COMBINATION METER

FUEL GAUGE TEST

1. Remove the fuel gauge unit connector.
2. Dis–connect the battery.
3. Connect a resistor between the fuel gauge and earth terminals (pin 2 & 3). Select the resistor from the following chart for the desired gauge reading:-

Fuel Gauge Position or Reading	Resistor Value Required
Full	10 ohm
Half full	55 ohm
Empty	100 ohm

4. Re–connect the battery. Turn on the ignition switch and check gauge reading.
5. To check another fuel gauge reading or position, repeat steps 2 to 4. When fuel gauge check is completed, dis–connect the battery, re–connect the fuel gauge unit connector and then re–connect the battery.

Note:
The fuel gauge is a microcontroller driven analogue gauge. The memory must be cleared by dis–connecting the battery during and after each test.

Note:
If the fuel gauge reading displayed differs from the standard value, check all wiring and connections for the combination meter before replacing the meter assembly.

LOW FUEL WARNING LAMP

Note:
The low fuel warning lamp is operated by the internal microcontroller within the combination meter.

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ENGINE COOLANT TEMPERATURE GAUGE TEST

1. Remove the engine coolant temperature gauge unit connector.
2. Dis–connect the battery.
3. Connect a resistor between the harness side connector and earth. Select the resistor from the following chart for the desired gauge reading:-

Temperature Gauge Position or Reading	Resistor Value Required
Hot	20 ohm
Half	45 ohm
Cold	203 ohm

4. Re–connect the battery. Turn on the ignition switch and check gauge reading.
5. To check another temperature gauge reading or position, repeat steps 2 to 4. When temperature gauge check is completed, dis–connect the battery, re–connect the temperature gauge unit connector and then re–connect the battery.

Note:
The temperature gauge is a microcontroller driven analogue gauge. The memory must be cleared by dis–connecting the battery during and after each test.

Note:
If the temperature gauge reading displayed differs from the standard value, check all wiring and connections for the combination meter before replacing the meter assembly.

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TRIP COMPUTER

SERVICE SPECIFICATIONS

Item	Units	Resolution	Minimum	Maximum
Range	km	10	50	1000
Fuel total	litres	0.1	0.1	199.9
		1	200	2500
Average Fuel	ℓ/100 km	0.1	0.1	99.9
Instant Fuel	ℓ/100 km	0.1	0.1	199.9
Time travelled	hh/mm	minutes	0:00	199:59
Total (distance)	km	1	0	9999
Average speed	km/h	0.1	0	199.9
Set speed (Speed alarm)	km/h	5	20	195

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PRELIMINARY TROUBLE SYMPTOM CHECKS

Symptom	Input wire	Symptom/ Connector pin
Fuel gauge reads “EMPTY” continuously. Range to empty displays “——”.	Fuel gauge sender unit	1
Engine coolant temperature gauge displays “C” continuously.	Engine Coolant Temperature unit	2
Display illumination does not dim with rheostat.	Rheostat	3
–	–	4
–	–	5
–	–	6
–	–	7
–	–	8
–	–	9
Tachometer displays “0rpm” continuously.	Distributor	10
Meters do not illuminate or function.	Battery (IOD)	11
Meters do not illuminate or function.	Battery (IOD) High contrast only	12
Gauges & trip computer do not function.	Ignition switch	13
–	–	14
Meters do not illuminate.	Taillamp relay High contrast only	15
–	–	16
Instant / average fuel consumption is abnormally small.	No.2 Injector	17
Speedometer and speed alarm do not function.	Vehicle speed sensor	18
Meters and Trip computer do not function.	Earth	19
Meters and Trip computer do not function.	Earth	20

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INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble symptom	Inspection procedure No.
Range to empty always displays flashing “---” km.	7
Range to empty does not detect refuels.	8
Total fuel used does not operate. (increase)	9
Total fuel used displays abnormally low/high value.	10
Average fuel always displays “--.-” ℓ/100 km.	11
Average fuel always displays “0.1” ℓ/100 km.	12
Average fuel displays abnormally low/high value.	13
Instant fuel always displays “--.-” ℓ/100 km.	14
Instant fuel always displays “0.1” ℓ/100 km.	15
Instant fuel displays abnormally low/high result.	16
Total distance travelled does not operate (increase).	17
Average speed always displays “--.-” km/h	18
Speed alarm warning “Beeps” do not trigger when set speed is exceeded.	19
Speed alarm set speed cannot be adjusted and/or turned off and/or operating mode cannot be changed.	20

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INSPECTION PROCEDURE 7

Range to empty always displays flashing "---" km (even when fuel tank is full)	Probable cause
The Trip Meter Display fuel sender circuit may be defective.	• Harness or Connector defective • Fuel sender assembly faulty • Trip Computer malfunction

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INSPECTION PROCEDURE 8

Range to empty does not detect refuels (even when > 7 litres)	Probable cause
The Trip Computer fuel sender circuit may be defective.	• Harness or Connector defective • Fuel sender assembly faulty • Trip Meter malfunction

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INSPECTION PROCEDURE 9

Total fuel used does not operate (increase)	Probable cause
The Trip Computer power or ground circuits may be defective.	• Harness or Connector defective • Injector assembly faulty • Trip Computer malfunction

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INSPECTION PROCEDURE 10

Total fuel used displays abnormally low/high value	Probable cause
The Trip Computer power or ground circuits may be defective.	• Harness or Connector defective • Trip Computer malfunction

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INSPECTION PROCEDURE 11

Average fuel always displays "---" ℓ/100 km	Probable cause
The Trip Computer speed signal input circuit may be defective.	• Harness or Connector defective • Speed sensor defective • Trip Computer malfunction

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INSPECTION PROCEDURE 12

Average fuel always displays “0.1” ℓ/100 km	Probable cause
The Trip Computer injector input circuit may be defective.	• Harness or Connector defective • Injector assembly faulty • Trip Computer malfunction

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INSPECTION PROCEDURE 13

Average fuel displays abnormally low/high value	Probable cause
The Trip Computer injector ignition circuit may be defective.	• Harness or Connector defective • Trip Computer malfunction

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INSPECTION PROCEDURE 14

Instant fuel always displays "--.-" ℓ/100 km	Probable cause
The Trip Computer speed signal input circuit may be defective.	• Harness or Connector defective • Speed sensor defective • Trip Computer malfunction

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INSPECTION PROCEDURE 15

Instant fuel always displays “0.1” ℓ/100 km	Probable cause
The Trip Computer injector input circuit may be defective.	• Harness or Connector defective • Injector assembly faulty • Trip Computer malfunction

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INSPECTION PROCEDURE 16

Instant fuel displays abnormally low/high result	Probable cause
The Trip Computer injector ignition circuit may be defective.	• Harness or Connector defective • Trip Computer malfunction

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INSPECTION PROCEDURE 17

Total distance travelled does not operate (increase)	Probable cause
The Trip Computer Speed signal input circuit may be defective.	• Harness or Connector defective • Speed sender defective • Trip Computer malfunction

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INSPECTION PROCEDURE 18

Average speed always displays “--.-” km/h	Probable cause
The Trip Computer Speed signal input circuit may be defective.	• Harness or Connector defective • Speed sender defective • Trip Computer malfunction

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INSPECTION PROCEDURE 19

Speed Alarm warning "BEEPS" do not trigger when set speed is exceeded	Probable cause
The Trip Computer Speed signal input circuit may be defective.	• Harness or Connector defective • Speed sender defective • Trip Computer malfunction

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INSPECTION PROCEDURE 20

Speed Alarm set speed cannot be adjusted and/or turned off and/ or operating mode cannot be changed	Probable cause
The Trip Computer switch input circuits may be defective.	• Harness or Connector defective • Switch assembly defective • Trip Computer malfunction

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TRIP COMPUTER SETTING PROCEDURE

The Trip computer is coded to the vehicle and must be recoded if the power is removed from the unit, ie. the battery is disconnected or the unit is removed from the vehicle.

1. Ensure the unit is fitted correctly and the battery is connected.
2. Turn the ignition switch to the “ACC” or “ON” position.
3. The vehicle code screen will appear, displaying an “S” for sedan. If the vehicle is a sedan, press and hold the MODE button for more than 2 seconds to set for sedan. For a wagon, press the MODE button for less than 2 seconds and the display will change to a “W”. Press the MODE button for more than 2 seconds to set for wagon.
4. When the vehicle code is selected, the unit will beep and commence flashing the engine code “3.5 litres”. If the vehicle engine type is 3.5 litre, press and hold MODE button for more than 2 seconds to set for a 3.5 litre engine. For a 3.0 litre engine type, press the MODE button for less than 2 seconds and the display will change to “3.0 litres”. Press the MODE button for more than 2 seconds to set for a 3.0 litre engine.
5. When the engine code is selected, the unit will beep and the unit is programmed.

   NOTE
   Range to empty will display “---” for the first continuous 5 minutes with the ignition on.
6. The “set” code can be checked by holding the MODE button and turning the key to “ACC”.

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ANTENNA

INSPECTION

ANTENNA MOTOR

1. To test the antenna, connect the antenna motor connector (G-44) to a battery (as per illustration), terminal/pin 1 to battery positive (12 volt) and terminal/pin 3 to battery negative.
2. Connect terminal /pin 2 to battery positive. Verify that the antenna rises to the full position.
3. Dis-connect the battery positive wire from terminal/pin 2 and verify that the antenna descends all the way to the fully down position.

54 CHASSIS ELECTRICAL <AWD>

CONTENTS

HOW TO READ CONFIGURATION DIAGRAMS

HOW TO READ CIRCUIT DIAGRAMS

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WIRE COLOUR CODES

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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 baking or drying after painting, remove the SRS components (air bag module and SRS-ECU) beforehand.

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

(4) 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

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

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HOW TO READ CONFIGURATION DIAGRAMS

The wiring harness diagrams clearly show the connector locations and harness routings at each site on actual vehicles.

Denotes connector No.
The same connector No. is used throughout the circuit diagrams to facilitate connector location searches.
The first alphabetical symbol indicates the location site of the connector to parts in clockwise order on the diagram.
In addition, the number of connector wires and the connector colour (except milk white)* are shown for ease of retrieval.

Example: A-77 (5-B)

- Connector colour (milk white if no colour is indicated)
- Number of connector wires
- Number specific to connector (serial number)
- Connector location site symbol
  - A : Engine compartment
  - B : Dash panel
  - C : Instrument panel
  - D : Floor and roof
  - E : Seat
  - F : Door
  - G : Trunk room
  - H : Rear floor lower section

*: Typical connector colours

B	:	Black
Y	:	Yellow
L	:	Blue
G	:	Green
R	:	Red
BR	:	Brown
V	:	Violet
O	:	Orange
GR	:	Gray

Denotes a section covered by a corrugated tube.

Denotes ground point.
Same ground number is used throughout circuit diagrams to facilitate search of ground point. Refer to Group 54A for details of ground points.

Indicates the device to which the connector is to be connected.

A-77	Valve relay <ABS>	A-72	Air flow sensor
A-57	Power steering oil pressure switch	A-75	Checking connector (for adjusting ignition timing, checking fuel pump)
A-58	Crank angle sensor	A-76	Hydraulic unit <ABS>
A-60	Connection of control harness and power steering harness	A-82	Distributor assembly
A-63	Knock sensor	A-84	Connection of control harness and battery harness
A-67	Condenser	A-85	Output shaft speed sensor
A-68	Throttle position sensor	A-86	Input shaft speed sensor
A-70	Idle speed control servo		

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HOW TO READ CIRCUIT DIAGRAMS

The circuit of each system from the fuse (or fusible link) to ground is shown. The power supply is shown at the top and the ground at the bottom to facilitate understanding of how the current flows.

Indicates connector No. The same No. as in the wiring harness diagram is used. Connector numbers enclosed by frame are indicated with the connector symbols at the lower part of the page.

Indicates the circuit name to be connected. The arrow indicates the current flow direction.

Indicates power take out.

Indicates the circuit name to be connected. The arrow indicates the current flow direction.

Indicates the power supply in the control unit. If no voltage is displayed, this indicates battery positive voltage.

An “X” at the end of a connector No. indicates that the connector is connected to a centralised junction that is shown in the section “Centralised Junction”.

Indicates the operating conditions of the engine coolant switch, etc.

Indicates that the diagram continues at A in the same circuit.

Indicates the connector symbol. Connectors in the circuit diagram are indicated in numerical order.

Indicates shield wire.

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Indicates input/output to/from control unit (current flow direction).

Input Output Input/ output

A broken line indicates that these connectors are the same intermediate connectors.

Indicates that the diagram comes from (A) in the same circuit.

Indicates terminal No.

In case two or more connectors are connected to the same device, markings indicating the same connector are connected by a broken line.

Indicates current flow downward or upward as controlled by the control unit.

Indicates harness junction where wire diameter or colour changes.

Indicates intersections at which the lead wires are not connected.

Indicates intersections at which the lead wires are connected.

Indicates vehicle body ground point. (Same No. as that of ground point in GROUNDING LOCATION).

Indicates that the terminal is a spare one if the device (sensor in this case) is not provided.

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MARKINGS FOR CONNECTOR EARTHING

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Item	NO.	Connector/Earthing	Symbol	Contents
Connector marking	1	Male WH–1	WH–3	Double connector contour lines indicate male connector terminals and single contour lines indicates female terminals as illustrated here.
	–	Female WH–2	WH–4	
Connector symbol marking	2	Device 16A0333 Intermediate connector	WH–1	The symbol indicates the connector as viewed from the illustrated direction. At the connection with a device, the connector symbol on the device side is shown, and for an intermediate connector, the male connector symbol is shown. For the diagnosis connector, its contents differ from the previous description. Refer to MUT-II operation instruction in detail.
Connector connection marking	3	Direct connection type 16X0700	WH–5	A connection between a device and connector on the harness side is either by direct insertion in the device (direct connection type) or by connection with a harness connector furnished on the device side (harness connection type). The two types are indicated as illustrated.
	4	Harness connection type 16A0334	WH–6	
	5	Intermediate connector 16A0339	WH–7	

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Item	NO.	Connector/Earthing	Symbol	Contents
Ground markings	6	Body ground	WH–8	Ground is either by body ground, device ground or control unit interior ground. These are indicated as illustrated.
	7	Device ground	WH–9	
	8	Ground in control unit	WH–10	

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WIRE COLOUR CODES

Wire colours are identified by the following colour codes.

Code	Wire colour	Code	Wire colour
B	Black	P	Pink
BR	Brown	R	Red
G	Green	SB	Sky blue
GR	Gray	V	Violet
L	Blue	W	White
LG	Light green	Y	Yellow
O	Orange	–	–

If a cable has two colours, the first of the two colour code characters indicates the basic colour (colour of the cable casing) and the second indicates the marking colour.

No.	Meaning
1	<F>: Flexible wire
	<T>: Twisted wire
2	Wire size (mm^2)
3	Basic colour (colour of the cable casing)
4	Marking colour

NOTE
*: No code indicates 0.5 mm^2.
Cable colour code in parentheses indicates 0.3 mm^2.

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FUEL GAUGE CHECK

Disconnect the fuel gauge unit connector. (Refer Group 13F.)

↓

Connect a test lamp (12V–3.4W) to the harness side connector.

↓

Test lamp lights up when the ignition switch is ON.

- NG → Harness to be repaired.
- OK → Pointer of fuel gauge moves.
  - NG → Replace the fuel gauge.
  - OK → Replace the fuel gauge unit.

INSPECTION

Remove fuel gauge unit from fuel tank. (Refer Group 13F..)

FUEL GAUGE UNIT RESISTANCE

1. Check that resistance value between the fuel gauge terminal and earth terminal is at the standard value when fuel gauge unit float is at point F (highest) and point E (lowest).

	Main	Sub
F position	2 ± 1 Ω	2 ± 1 Ω
E position	55 ± 1 Ω	32 ± 1 Ω

2. Check that resistance value changes smoothly when float moves slowly between point F (highest) and point E (lowest.)

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FUEL GAUGE UNIT FLOAT HEIGHT

Move float and measure the height A at point F (highest) and B at point E (lowest) with float arm touching stopper.

	Main	Sub
A position	115 ± 3 mm	104.6 ± 3 mm
B position	126.1 ± 3 mm	244.9 ± 3 mm

NOTE:
The fuel gauge is a microcontroller driven analogue gauge. The memory must be cleared by dis–connecting the battery during and after each test.

NOTE:
If the fuel gauge reading displayed differs from the standard value, check all wiring and connections for the combination meter before replacing the meter assembly.

LOW FUEL WARNING LAMP

NOTE:
The low fuel warning lamp is operated by the internal microcontroller within the combination meter.