

# IMPORTANT

## WARNING/CAUTION/NOTE

Please read this manual and follow its instructions carefully. To emphasize special information, the words **WARNING**, **CAUTION** and **NOTE** have special meanings. Pay special attention to the messages highlighted by these signal words.

### **WARNING:**

Indicates a potential hazard that could result in death or injury.

### **CAUTION:**

Indicates a potential hazard that could result in vehicle damage.

### **NOTE:**

Indicates special information to make maintenance easier or instructions clearer.

### **WARNING:**

This service manual is intended for authorized Suzuki dealers and qualified service technicians only. Inexperienced technicians or technicians without the proper tools and equipment may not be able to properly perform the services described in this manual.

Improper repair may result in injury to the technician and may render the vehicle unsafe for the driver and passengers.

### **WARNING:**

For vehicles equipped with a Supplemental Restraint (Air Bag) System:

- Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to “Air Bag System Components and Wiring Location View” under “General Description” in air bag system section in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and “Service Precautions” under “On-Vehicle Service” in air bag system section before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.
- If the air bag system and another vehicle system both need repair, Suzuki recommends that the air bag system be repaired first, to help avoid unintended air bag system activation.
- Do not modify the steering wheel, instrument panel or any other air bag system component (on or around air bag system components or wiring). Modifications can adversely affect air bag system performance and lead to injury.
- If the vehicle will be exposed to temperatures over 93°C (200°F) (for example, during a paint baking process), remove the air bag system components beforehand to avoid component damage or unintended activation.

The circle with a slash in this manual means “Do not do this” or “Do not let this happen”.



## Foreword

This SUPPLEMENTARY SERVICE MANUAL is a supplement to IGNIS (RM413) SERVICE MANUAL. It has been prepared exclusively for the following applicable model.

**Applicable model: IGNIS with M15 petrol engine (RM415)/IGNIS with Z13DT diesel engine (RM413D)**

It describes only different service information of the above applicable model as compared with IGNIS (RM413) SERVICE MANUAL. Therefore, whenever servicing the above applicable model, consult this supplement first. And for any section, item or description not found in this supplement, refer to the related service manuals below.

When replacing parts or servicing by disassembling, it is recommended to use SUZUKI genuine parts, tools and service materials (lubricant, sealants, etc.) as specified in each description.

All information, illustrations and specifications contained in this literature are based on the latest product information available at the time of publication approval. And used as the main subject of description is the vehicle of standard specifications among others. Therefore, note that illustrations may differ from the vehicle being actually serviced.

The right is reserved to make changes at any time without notice.

### NOTE:

“SUZUKI Dealers” means Authorized SUZUKI Service Workshop (in Europe).

### RELATED MANUAL:

Manual Name	Manual No.
IGNIS (RM413) SERVICE MANUAL	99500U86G00-01E
IGNIS (RM413D)/WAGON R+ (RB413D) SUPPLEMENTARY SERVICE MANUAL FOR Z13DT ENGINE AND M/T	99501U86G30-01E
IGNIS (RM413/RM415/RM413D) WIRING DIAGRAM MANUAL	99512U86G20-669

**MAGYAR SUZUKI CORPORATION**



# TABLE OF CONTENTS

<b>GENERAL INFORMATION</b>	
GENERAL INFORMATION	<b>0A</b>
MAINTENANCE AND LUBRICATION	<b>0B</b>
<b>HEATING AND AIR CONDITIONING</b>	
HEATER AND VENTILATION	<b>1A</b>
AIR CONDITIONING (OPTIONAL)	<b>1B</b>
<b>STEERING, SUSPENSION, WHEELS AND TIRES</b>	
Steering, Suspension, Wheels and Tires *1	<b>3</b>
Front Wheel Alignment *1	<b>3A</b>
MANUAL RACK AND PINION	<b>3B</b>
Electrical Power Steering (P/S) System *1	<b>3B1</b>
Steering Wheel and Column *1	<b>3C</b>
FRONT SUSPENSION	<b>3D</b>
REAR SUSPENSION	<b>3E</b>
WHEELS AND TIRES	<b>3F</b>
<b>DRIVE SHAFT AND PROPELLER SHAFT</b>	
FRONT DRIVE SHAFT	<b>4A</b>
Propeller Shafts *1	<b>4B</b>
<b>BRAKE SYSTEM</b>	
BRAKES	<b>5</b>
BRAKES PIPE / HOSE / MASTER CYLINDER	<b>5A</b>
FRONT BRAKE	<b>5B</b>
PARKING AND REAR BRAKE	<b>5C</b>
Antilock Brake System (ABS) *1	<b>5E</b>
<b>ENGINE</b>	
ENGINE GENERAL INFORMATION AND DIAGNOSIS (M15 ENGINE)	<b>6</b>
Engine General Information and Diagnosis (Z13DT Engine) *2	<b>6-3</b>
ENGINE MECHANICAL (M15 ENGINE)	<b>6A1</b>
Engine Mechanical (Z13DT Engine) *2	<b>6A3</b>
ENGINE COOLING (M15 ENGINE)	<b>6B</b>
Engine Cooling (Z13DT Engine) *2	<b>6B3</b>
Engine Fuel (M15 Engine) *1	<b>6C</b>
Engine Fuel (Z13DT Engine) *2	<b>6C3</b>

<b>ENGINE</b>	
ENGINE AND EMISSION CONTROL SYSTEM (M15 ENGINE)	<b>6E1</b>
Engine and Emission Control System (Z13DT Engine) *2	<b>6E3</b>
Ignition System (Electronic Ignition System) *1	<b>6F1</b>
Cranking System (M15 Engine) *1	<b>6G</b>
Cranking System (Z13DT Engine) *2	<b>6G3</b>
Charging System (M15 Engine) *1	<b>6H</b>
Charging System (Z13DT Engine) *2	<b>6H3</b>
Exhaust System (M15 Engine) *1	<b>6K</b>
Exhaust System (Z13DT Engine) *2	<b>6K3</b>
<b>TRANSMISSION, CLUTCH AND DIFFERENTIAL</b>	
MANUAL TRANSAXLE (M15 ENGINE MODEL)	<b>7A2</b>
Manual Transaxle (Z13DT Engine Model) *2	<b>7A3</b>
AUTOMATIC TRANSAXLE	<b>7B</b>
Clutch (M15 Engine Model) *1	<b>7C1</b>
Clutch (Z13DT Engine Model) *2	<b>7C3</b>
Transfer *1	<b>7D</b>
Rear Differential *1	<b>7F</b>
<b>ELECTRICAL SYSTEM</b>	
Body Electrical System *1	<b>8</b>
Wiring Diagram *1	<b>8A</b>
Lighting System *1	<b>8B</b>
Instrumentation/Driver Information (M15 Engine Model) *1	<b>8C</b>
INSTRUMENTATION/DRIVER INFORMATION (Z13DT ENGINE MODEL)	<b>8C1</b>
Windows, Mirrors, Security and Locks *1	<b>8D</b>
Immobilizer Control System (M15 Engine Model) *1	<b>8G</b>
IMMOBILIZER CONTROL SYSTEM (Z13DT ENGINE MODEL)	<b>8G3</b>
<b>BODY SERVICE</b>	<b>9</b>
<b>RESTRAINT SYSTEM</b>	
Restraint System *1	<b>10</b>
Air Bag System *1	<b>10B</b>

<b>0A</b>	<b>6E1</b>
<b>0B</b>	<b>6E3</b>
	<b>6F1</b>
<b>1A</b>	<b>6G</b>
<b>1B</b>	<b>6G3</b>
	<b>6H</b>
<b>3</b>	<b>6H3</b>
<b>3A</b>	<b>6K</b>
<b>3B</b>	<b>6K3</b>
<b>3B1</b>	
<b>3C</b>	<b>7A2</b>
<b>3D</b>	<b>7A3</b>
<b>3E</b>	<b>7B</b>
<b>3F</b>	<b>7C1</b>
	<b>7C3</b>
<b>4A</b>	<b>7D</b>
<b>4B</b>	<b>7F</b>
<b>5</b>	<b>8</b>
<b>5A</b>	<b>8A</b>
<b>5B</b>	<b>8B</b>
<b>5C</b>	<b>8C</b>
<b>5E</b>	<b>8C1</b>
	<b>8D</b>
<b>6</b>	<b>8G</b>
<b>6-3</b>	<b>8G3</b>
<b>6A1</b>	<b>9</b>
<b>6A3</b>	
<b>6B</b>	<b>10</b>
<b>6B3</b>	<b>10B</b>
<b>6C</b>	
<b>6C3</b>	

## NOTE:

- For the screen toned sections with “\*1” in the above table, refer to the same section of the Related Manual “IGNIS (RM413) SERVICE MANUAL” mentioned in FOREWORD of this manual.
- For the screen toned sections with “\*2” in the above table, refer to the same section of the Related Manual “IGNIS (RM413D)/WAGON R+ (RB413D) SUPPLEMENTARY SERVICE MANUAL FOR Z13DT ENGINE AND M/T” mentioned in FOREWORD of this manual.





SECTION 0A

GENERAL INFORMATION

NOTE:

For the items with asterisk (\*) in the “CONTENTS” below, refer to the same section of the Service Manual mentioned in “Foreword” of this manual.

CONTENTS

How to Use This Manual.....	*
Precautions .....	0A-2
Precaution for Vehicles Equipped with a Supplemental Restraint (Air Bag) System.....	*
Diagnosis.....	*
Servicing and handling .....	*
General Precautions .....	0A-2
Precaution for Wheel (with Tire) Removal .....	*
Precautions for Catalytic Converter .....	*
Precaution for Installing Mobile Communication Equipment .....	*
Precaution for CAN Communication System .....	0A-5
Precaution in Servicing Full-Time 4WD Vehicle .....	*
Precautions for Electrical Circuit Service .....	*
Electrical Circuit Inspection Procedure .....	*
Open circuit check.....	*
Continuity check.....	*
Voltage check.....	*
Short circuit check (wire harness to ground).....	*
Intermittent and Poor Connection .....	*
Identification Information.....	0A-5
Vehicle Identification Number .....	0A-5
Engine Identification Number .....	0A-6
Transmission Identification Number.....	0A-6
Warning, Caution and Information Labels ...	0A-7
Vehicle Lifting Points .....	*
When using frame contact hoist.....	*
When using floor jack.....	*
Abbreviations and Symbols May be Used in This Manual .....	0A-9
Abbreviations .....	0A-9
Symbols .....	*
Wire Color Symbols .....	*
Fastener Information .....	0A-11
Metric Fasteners Information .....	0A-11
Fastener Strength Identification .....	*
Standard Tightening Torque .....	*

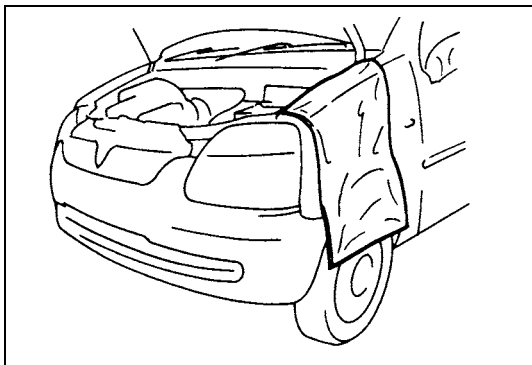
## Precautions

### General Precautions

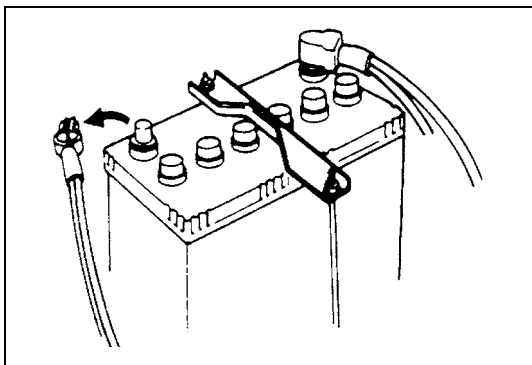
The WARNING and CAUTION below describe some general precautions that you should observe when servicing a vehicle. These general precautions apply to many of the service procedures described in this manual, and they will not necessarily be repeated with each procedure to which they apply.

#### WARNING:

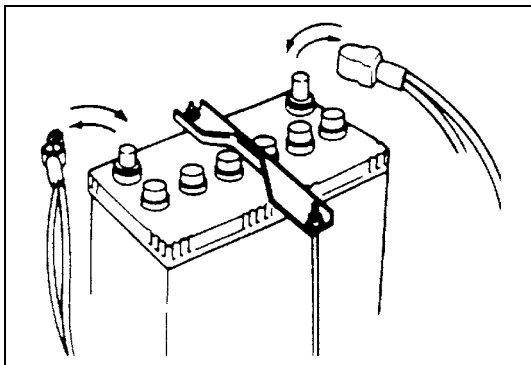
- Whenever raising a vehicle for service, be sure to follow the instructions under “Vehicle Lifting Points” in this section.
- When it is necessary to do service work with the engine running, make sure that the parking brake is set fully and the transmission is in Neutral (for manual transmission vehicles) or Park (for automatic transmission vehicles). Keep hands, hair, clothing, tools, etc. away from the fan and belts when the engine is running.
- When it is necessary to run the engine indoors, make sure that the exhaust gas is forced outdoors.
- Do not perform service work in areas where combustible materials can come in contact with a hot exhaust system. When working with toxic or flammable materials (such as gasoline and refrigerant), make sure that the area you work in is well-ventilated.
- To avoid getting burned, keep away from hot metal parts such as the radiator, exhaust manifold, tail pipe, muffler, etc.
- New and used engine oil can be hazardous. Children and pets may be harmed by swallowing new or used oil. Keep new and used oil and used engine oil filters away from children and pets. Continuous contact with used engine oil has been found to cause [skin] cancer in laboratory animals. Brief contact with used oil may irritate skin. To minimize your exposure to used engine oil, wear a long-sleeve shirt and moisture-proof gloves (such as dish washing gloves) when changing engine oil. If engine oil contacts your skin, wash thoroughly with soap and water. Launder any clothing or rags if wet with oil, recycle or properly dispose of used oil and filters.
- Make sure the bonnet is fully closed and latched before driving. If it is not, it can fly up unexpectedly during driving, obstructing your view and resulting in an accident.



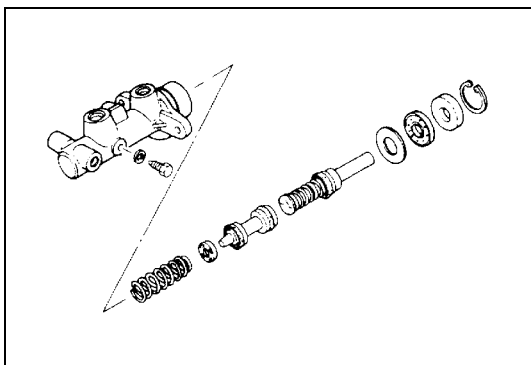
- Before starting any service work, cover fenders, seats and any other parts that are likely to get scratched or stained during servicing. Also, be aware that what you wear (e.g, buttons) may cause damage to the vehicle's finish.



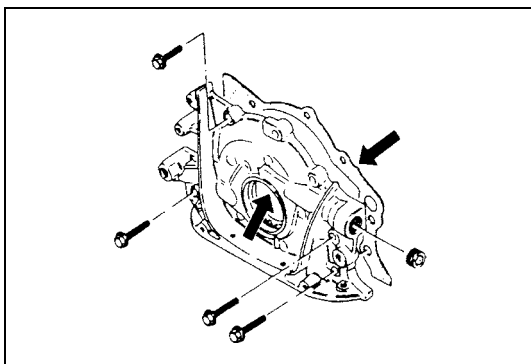
- When performing service to electrical parts that does not require use of battery power, disconnect the negative cable of the battery.
- When disconnecting the battery negative cable, record displayed contents of clock and audio system before disconnecting and reset them as before after connecting.



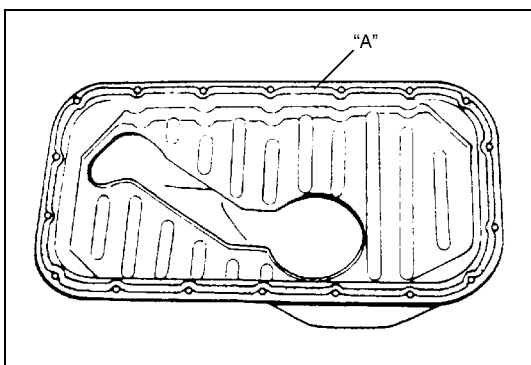
- When removing the battery, be sure to disconnect the negative cable first and then the positive cable. When reconnecting the battery, connect the positive cable first and then the negative cable, and replace the terminal cover.



- When removing parts that are to be reused, be sure to keep them arranged in an orderly manner so that they may be reinstalled in the proper order and position.

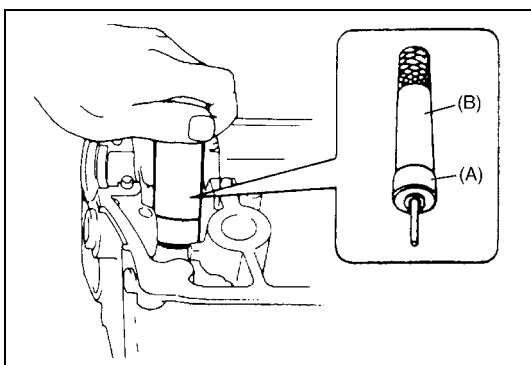


- Whenever you use oil seals, gaskets, packing, O-rings, locking washers, split pins, self-locking nuts, and certain other parts as specified, be sure to use new ones. Also, before installing new gaskets, packing, etc., be sure to remove any residual material from the mating surfaces.



- Make sure that all parts used in reassembly are perfectly clean.  
When use of a certain type of lubricant, bond or sealant is specified, be sure to use the specified type.

“A”: Sealant 99000-31250

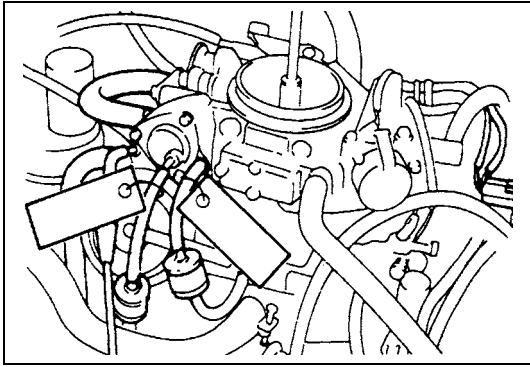


- Be sure to use special tools when instructed.

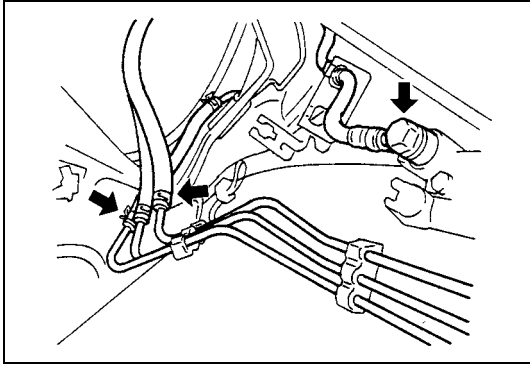
Special tool

(A): 09917-98221

(B): 09916-58210



- When disconnecting vacuum hoses, attach a tag describing the correct installation positions so that the hoses can be reinstalled correctly.

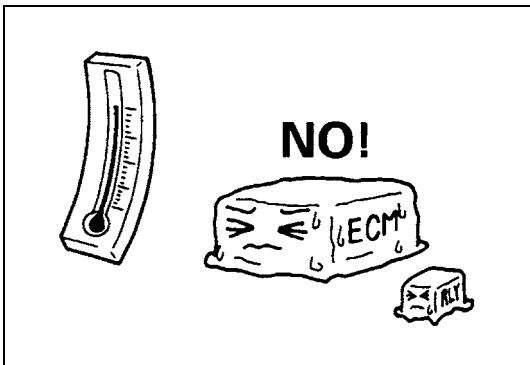


- After servicing fuel, oil, coolant, vacuum, exhaust or brake systems, check all lines related to the system for leaks.

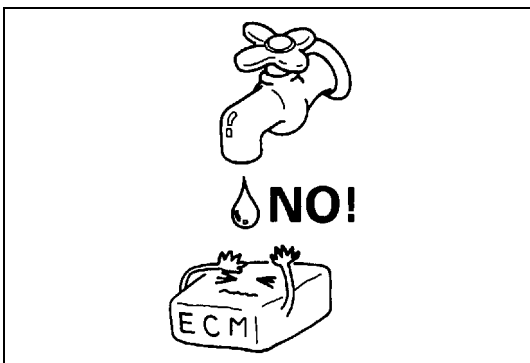
- For vehicles equipped with petrol engine, never disconnect the fuel line between the fuel pump and injector without first releasing the fuel pressure, or fuel can be sprayed out under pressure. Refer to "Fuel Pressure Relief Procedure" in section 6 for fuel pressure releasing.

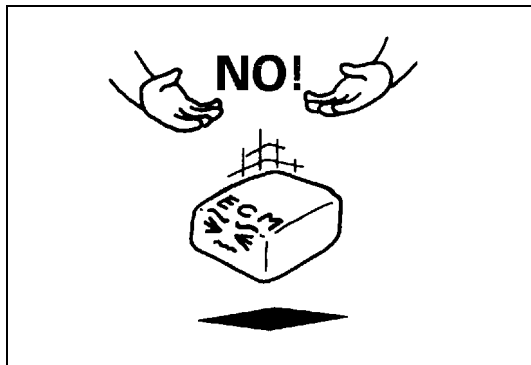
- For vehicles equipped with diesel engine, never disconnect fuel line within 60 sec. after ignition switch turned to OFF position, or fuel can be sprayed out under pressure.

- When performing a work that produces a heat exceeding 80°C (176°F) in the vicinity of the electrical parts, remove the heat sensitive electrical part(s) beforehand.



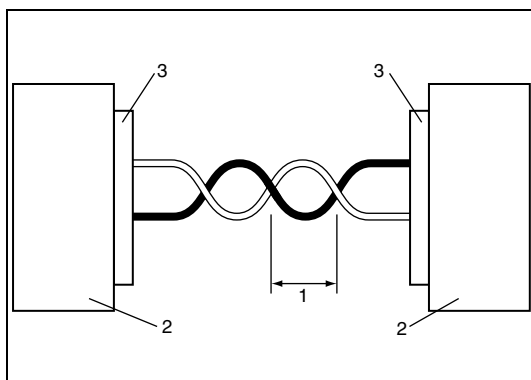
- Use care not to expose connectors and electrical parts to water which will be a cause of a trouble.





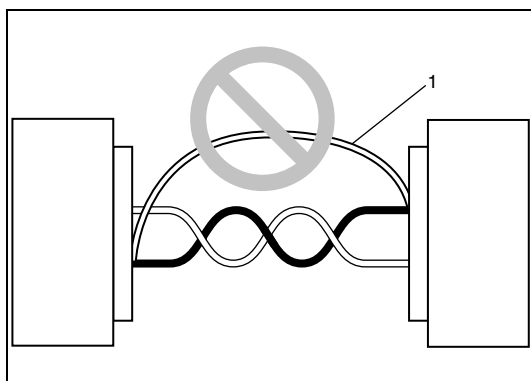
- Always be careful not to handle electrical parts (computer, relay, etc.) in a rough manner or drop them.

## Precaution for CAN Communication System



- The loose (1) in the wire harnesses twist of the CAN lines except around the connector (3) should be within 100 mm (3.9 in.) Refer to the wiring diagram for the CAN line discrimination. Excessive loosed lines may be influenced by the electric noise.

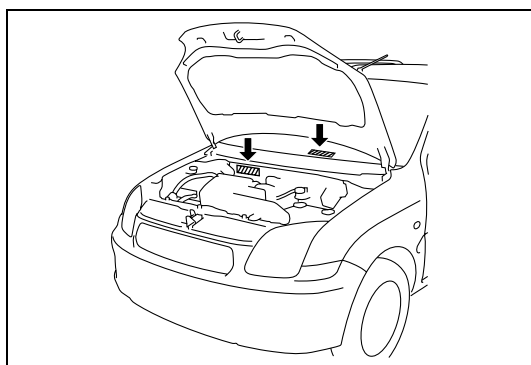
2. Controller



- Do not connect terminals of the CAN line using a bypass wire (1). Otherwise, the CAN line may be influenced by the electric noise.

## Identification Information

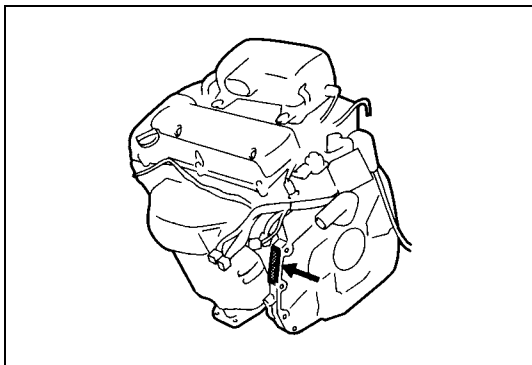
### Vehicle Identification Number



The number is punched on front dash panel in engine room and it is also on the left side of instrument panel depending on the vehicle specification.

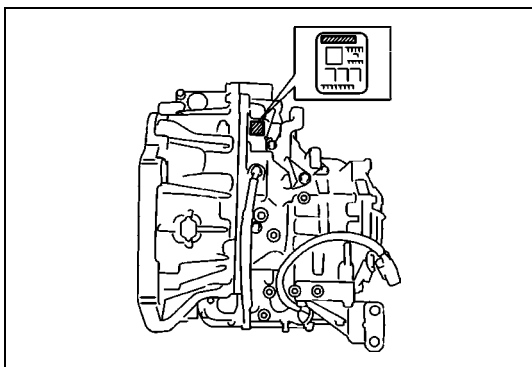
## Engine Identification Number

The number is punched on cylinder block.



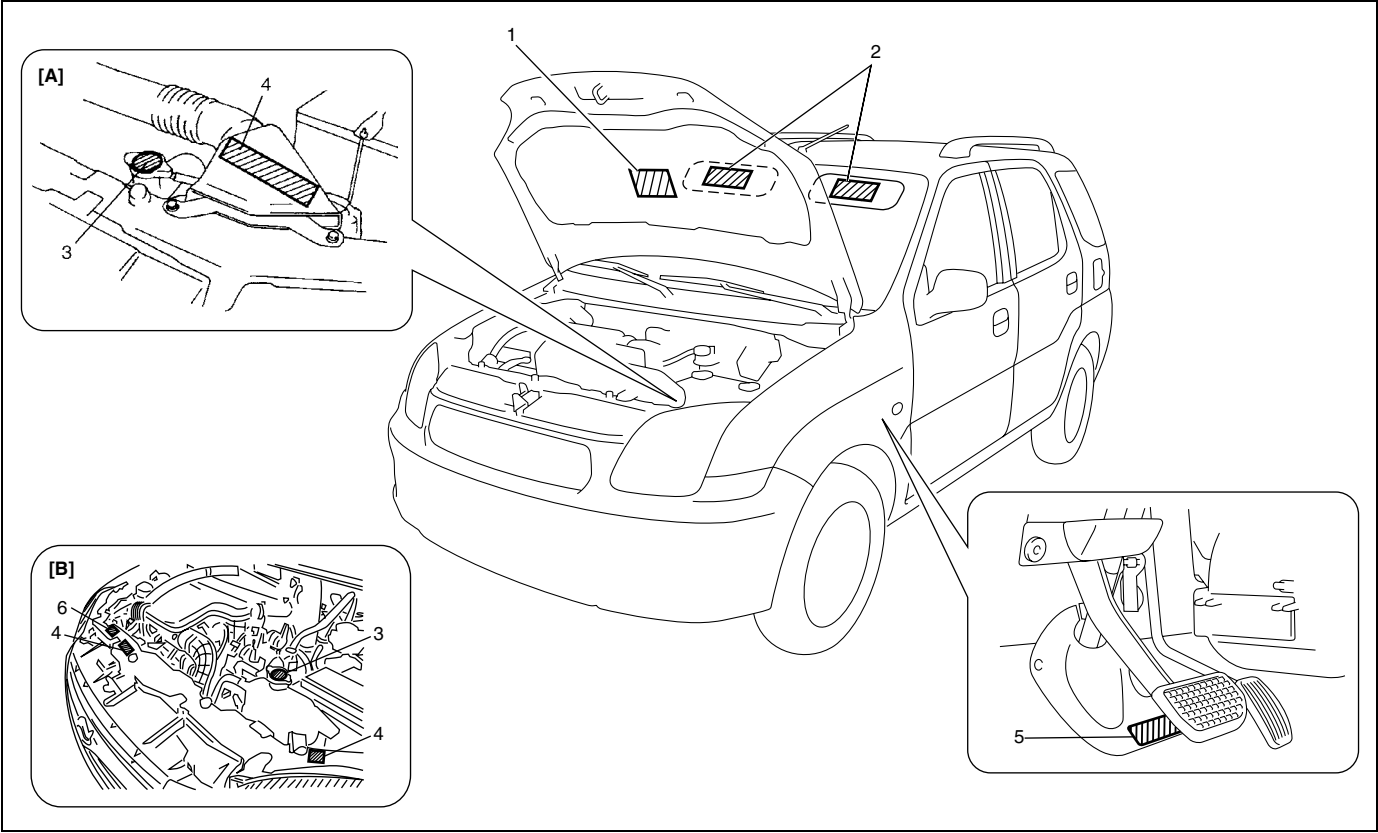
## Transmission Identification Number

The automatic transmission identification number is located on transmission case.



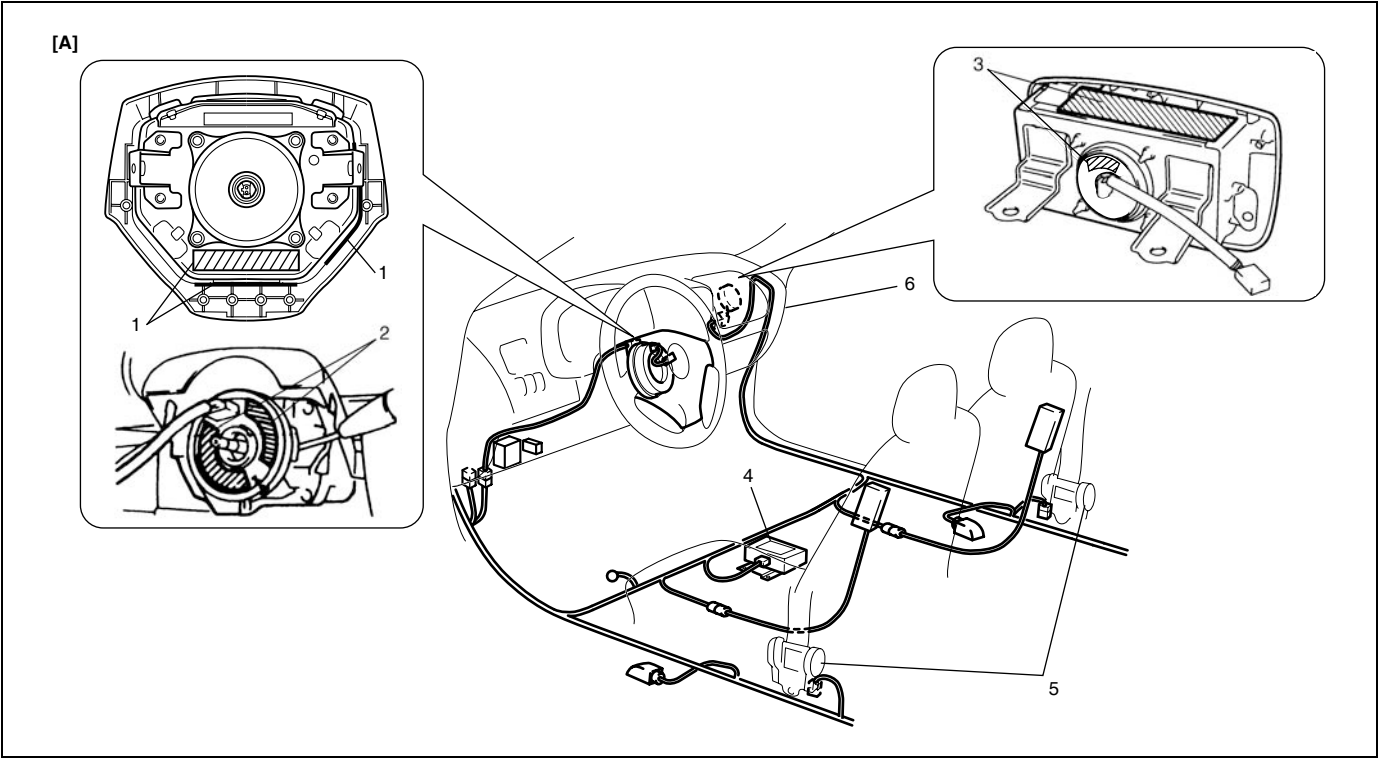
# Warning, Caution and Information Labels

The figure below shows main labels among others that are attached to vehicle component parts. When servicing and handling parts, refer to WARNING/CAUTION instructions printed on labels. If any WARNING/CAUTION label is found stained or damaged, clean or replace it as necessary.



1. Air bag label on back side of engine hood (if equipped)	5. Steering shaft joint cover label (if equipped)
2. Air bag label on sun visor (if equipped)	6. Smoke level label (Z13DT engine)
3. Radiator cap label	[A]: M15 engine model
4. Engine cooling fan label (location is different depending on vehicle specification)	[B]: Z13DT engine model





1. Air bag label on driver air bag (inflator) module	5. Pretensioner label on seat belt retractor
2. Air bag label on combination switch and contact coil assembly	6. Child seat label
3. Air bag label on passenger air bag (inflator) module	[A]: These labels are attached on vehicle equipped with air bag system only.
4. Air bag label on SDM	

# Abbreviations and Symbols May be Used in This Manual

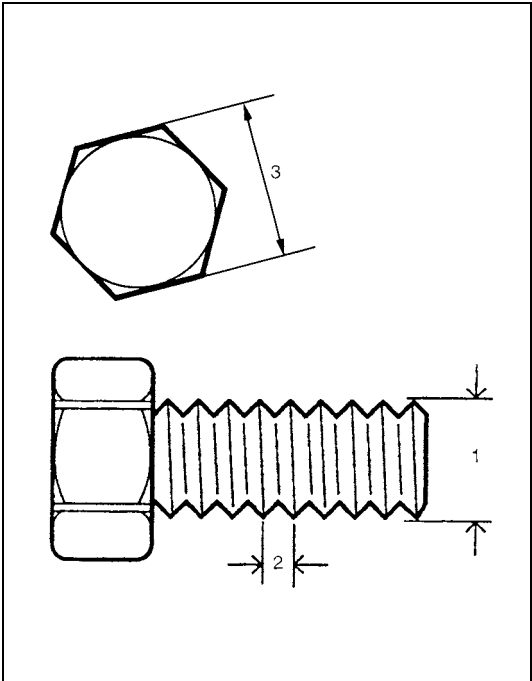
## Abbreviations

<b>A</b>	ABS	Anti-lock Brake System	<b>E</b>	EFE Heater	Early Fuel Evaporation Heater (Positive Temperature Coefficient, PTC Heater)
	ATDC	After Top Dead Center		EPS	Electronic Power Steering
	API	American Petroleum Institute		EVAP	Evaporative Emission
	ATF	Automatic Transmission Fluid		EVAP Canister	Evaporative Emission Canister (Charcoal Canister)
	ALR	Automatic Locking Retractor			
	AC	Alternating Current			
	A/T	Automatic Transmission			
	A/C	Air Conditioning			
	ABDC	After Bottom Dead Center			
	A/F	Air Fuel Mixture Ratio			
	A-ELR	Automatic-Emergency Locking Retractor			
<b>B</b>	B+	Battery Positive Voltage	<b>F</b>	4WD	4 Wheel Drive
	BTDC	Before Top Dead Center			
	BBDC	Before Bottom Dead Center			
<b>C</b>	CAN	Controller Area Network	<b>G</b>	GEN	Generator
	CKT	Circuit		GND	Ground
	CKP sensor	Crankshaft Position Sensor			
	CMP sensor	Camshaft Position Sensor			
	CO	Carbon Monoxide	<b>H</b>	HC	Hydrocarbons
	CPP switch	Clutch Pedal Position Switch (Clutch Switch, Clutch Start Switch)		HO2S	Heated Oxygen Sensor
	CPU	Central Processing Unit	<b>I</b>		
	CRS	Child Restraint System			
<b>D</b>	DC	Direct Current	<b>L</b>	IAC Valve	Idle Air Control Valve (Idle Speed Control Solenoid Valve ISC Solenoid Valve)
	DLC	Data Link Connector (Assembly Line Diag. Link, ALDL, Serial Data Link, SDL)		IAT Sensor	Intake Air Temperature Sensor (Air temperature Sensor, ATS)
				ICM	Immobilizer Control Module
	DOHC	Double Over Head Camshaft	<b>M</b>	IG	Ignition
	DOJ	Double Offset Joint		ISC Actuator	Idle Speed Control Actuator
	DRL	Daytime Running Light			
	DTC	Diagnostic Trouble Code (Diagnostic Code)	<b>N</b>	LH	Left Hand
				LSPV	Load Sensing Proportioning Valve
			<b>O</b>	MAF Sensor	Mass Air Flow Sensor (Air Flow Sensor, AFS, Air Flow Meter, AFM)
<b>E</b>	EBCM	Electronic Brake Control Module, ABS Control Module		MAP Sensor	Manifold Absolute Pressure Sensor (Pressure Sensor, PS)
	EBD	Electronic Brake Force Distribution		Max	Maximum
	ECM	Engine Control Module		MFI	Multiport Fuel Injection (Multipoint Fuel Injection)
	ECT sensor	Engine Coolant Temperature Sensor (Water Temp. Sensor, WTS)	<b>P</b>	MIN	Minimum
	EGR	Exhaust Gas Recirculation		MIL	Malfunction Indicator Lamp ("SERVICE ENGINE SOON" Light)
	EGRT sensor	EGR Temperature Sensor (Recirculated Exhaust Gas Temp. Sensor, REGTS)		M/T	Manual Transmission
			<b>O</b>	NOx	Nitrogen Oxides
				OB	On-Board Diagnostic System (Self-Diagnosis Function)
			<b>P</b>	O/D	Overdrive
				OHC	Over Head Camshaft
				O2S	Oxygen Sensor
			<b>P</b>	PNP	Park/Neutral Position
				P/S	Power Steering

<b>P</b>	PSP Switch	Power Steering Pressure Switch (P/S Pressure Switch)
	PCM	Powertrain Control Module
	PCV	Positive Crankcase Ventilation
	PPS	Pedal Position Sensor
<b>R</b>	RH	Right Hand
<b>S</b>	SAE	Society of Automotive Engineers
	SDM	Sensing and Diagnostic Module (Air bag controller, Air bag control module)
	SFI	Sequential Multiport Fuel Injection
	SOHC	Single Over Head Camshaft
	SOI	Start of Injection
<b>T</b>	TBI	Throttle Body Fuel Injection (Single-Point Fuel Injection, SPI)
	TCC	Torque Converter Clutch
	TCM	Transmission Control Module (A/T Controller, A/T Control Module)
	TP Sensor	Throttle Position Sensor
	TVV	Thermal Vacuum Valve (Thermal Vacuum Switching Valve, TVSV, Bimetal Vacuum Switching Valve, BVSV)
	TWC	Three Way Catalytic Converter (Three Way Catalyst)
	2WD	2 Wheel Drive
<b>V</b>	VIN	Vehicle Identification Number
	VSS	Vehicle Speed Sensor
	VVT	Variable Valve Timing
<b>W</b>	WU-OC	Warm Up Oxidation Catalytic Converter
	WU-TWC	Warm Up Three Way Catalytic Converter

# Fastener Information

## Metric Fasteners Information



Most of the fasteners used for this vehicle are JIS-defined and ISO-defined metric fasteners. When replacing any fasteners, it is most important that replacement fasteners be the correct diameter, thread pitch and strength.

**CAUTION:**  
Even when the nominal diameter (1) of thread is the same, the thread pitch (2) or the width across flats (3) may vary between ISO and JIS. Refer to JIS-TO-ISO Main Fasteners Comparison Table below for the difference.  
Installing a mismatched bolt or nut will cause damage to the thread.  
Before installing, check the thread pitch for correct matching and then tighten it by hand temporarily. If it is tight, recheck the thread pitch.

JIS-TO-ISO Main Fasteners Comparison Table

Nominal diameter		M6	M8	M10	M12	M14
Standard	Thread pitch	1.0	1.25	1.25	1.25	1.5
	Width across flats	10	12	14	17	19
ISO	Thread pitch	1.0	1.25	1.5	1.5	1.5
	Width across flats	10	13	16	18	21



## SECTION 0B

0B

## MAINTENANCE AND LUBRICATION

**WARNING:**

For vehicles equipped with a Supplemental Restraint (Air Bag) System:

- Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to “System Components and Wiring Location View and Connectors” under “General Description” in Section 10B in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and “Service Precautions” under “On-Vehicle Service” in Section 10B before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.
- Technical service work must be started at least 90 seconds after the ignition switch is turned to the “LOCK” position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).

**NOTE:**

For the items with asterisk (\*) in the “CONTENTS” below, refer to the same section of the Service Manual mentioned in “Foreword” of this manual.

## CONTENTS

<b>Maintenance Schedule</b> .....	<b>0B-3</b>	PCV Valve Inspection .....	*
Maintenance Schedule Under Normal		Fuel Evaporative Emission Control	
Driving Conditions .....	0B-3	System Inspection.....	*
Maintenance Recommended Under		<b>Z13DT Engine:</b>	
Severe Driving Conditions.....	0B-6	Engine Accessory Drive Belt Inspection	
<b>Maintenance Service</b> .....	<b>0B-7</b>	(Z13DT Engine) .....	0B-7
<b>M15 Engine:</b>		Water pump and generator drive	
Drive Belt Inspection .....	*	belt inspection .....	0B-7
Water pump and generator drive belt		Engine Accessory Drive Belt Replacement	
inspection .....	*	(Z13DT Engine) .....	0B-7
A/C Compressor drive belt (if equipped)		Water pump and generator drive belt	
inspection .....	*	replacement .....	0B-7
Drive Belt Replacement .....	*	Engine Oil and Oil Filter Replacement	
Water pump and generator drive belt		(Z13DT Engine) .....	0B-7
replacement.....	*	Engine Coolant Replacement	
A/C Compressor drive belt (if equipped)		(Z13DT Engine) .....	0B-9
replacement.....	*	Exhaust System Inspection	
Valve Lash (Clearance) Inspection .....	*	(Z13DT Engine) .....	0B-10
Engine Oil and Oil Filter Replacement .....	*	Air Cleaner Filter Inspection	
Engine Coolant Replacement .....	*	(Z13DT Engine) .....	0B-10
Exhaust System Inspection .....	*	Air Cleaner Filter Replacement	
Spark Plugs Replacement.....	*	(Z13DT Engine) .....	0B-10
Air Cleaner Filter Inspection .....	*	Fuel Lines and Connections Inspection	
Air Cleaner Filter Replacement .....	*	(Z13DT Engine) .....	0B-11
Fuel Lines and Connections Inspection .....	*	Fuel Filter Replacement	
Fuel Tank Inspection .....	*	(Z13DT Engine) .....	0B-11

Water Draining of Fuel Filter (Z13DT Engine).....	0B-11
Fuel Tank Inspection (Z13DT Engine) .....	0B-11
<b>M15/Z13DT Engine Models:</b>	
Brake Discs and Pads (Front) Inspection.....	*
Brake Drums and Shoes (Rear) Inspection.....	*
Brake Hoses and Pipes Inspection .....	*
Brake Fluid Replacement.....	*
Brake Lever and Cable Inspection .....	*
Clutch Inspection .....	0B-11
Tires Inspection.....	*
Wheel Discs Inspection.....	*
Wheel Bearing Inspection .....	*
Suspension System Inspection .....	*
Steering System Inspection .....	*
Drive Shaft (Axle) Boots Inspection .....	*
Propeller Shafts (4WD) Inspection.....	*
Manual Transmission Oil Inspection (M15 Engine) .....	0B-12
Manual Transmission Oil Replacement .....	0B-12

Automatic Transmission Fluid Level Inspection .....	0B-12
Automatic Transmission Fluid Replacement.....	0B-13
Automatic Transmission Fluid Cooler Hose Inspection .....	0B-13
Transfer Oil (4WD) and Rear Differential Oil (4WD) Inspection.....	*
Transfer Oil (4WD) and Rear Differential Oil (4WD) Replacement.....	*
All Latches, Hinges and Locks Inspection .....	*
Doors .....	*
Engine hood.....	*
Air Conditioning Filter (If Equipped) Inspection .....	0B-13
Air Conditioning Filter (If Equipped) Replacement.....	0B-13
<b>Final Inspection .....</b>	<b>*</b>
<b>Recommended Fluids and Lubricants.....</b>	<b>0B-14</b>

# Maintenance Schedule

## Maintenance Schedule Under Normal Driving Conditions

### NOTE:

- This interval should be judged by odometer reading or months, whichever comes first.
- This table includes service as scheduled up to 90,000 km (54,000 miles) mileage. Beyond 90,000 km (54,000 miles), carry out the same services at the same intervals respectively.

### M15 Engine Model:

Interval		Km (x 1,000)	15	30	45	60	75	90	
		Miles (x 1,000)	9	18	27	36	45	54	
		Months	12	24	36	48	60	72	
ENGINE									
Drive belt (Engine accessory drive belt)			–	–	I	–	–	R	
Valve lash (clearance)			–	I	–	I	–	I	
Engine oil and oil filter			R	R	R	R	R	R	
Engine coolant			–	–	R	–	–	R	
Exhaust system			–	I	–	I	–	I	
IGNITION SYSTEM									
*Spark plugs	When unleaded fuel is used	Vehicle with-out HO2S	Iridium plug	–	–	–	R	–	–
		Vehicle with HO2S	Iridium plug	Replace every 105,000 km (63,000 miles) or 84 months					
	When leaded fuel is used, refer to “Maintenance Recommended Under Severe Driving Conditions” in this section.								
FUEL SYSTEM									
Air cleaner filter			Paved-road	I	I	R	I	I	R
			Dusty conditions	Refer to “Maintenance Recommended Under Severe Driving Conditions” in this section.					
Fuel lines and connections			–	I	–	I	–	I	
Fuel tank			–	–	I	–	–	I	
EMISSION CONTROL SYSTEM									
*PCV valve		Vehicle without HO2S	–	–	I	–	–	I	
		Vehicle with HO2S	–	–	–	–	–	I	
*Fuel evaporative emission control system			–	–	–	–	–	I	

### NOTE:

- “R”: Replace or change
- “I”: Inspect and correct, replace or lubricate if necessary
- For Sweden, items with \* (asterisk) should be performed by odometer reading only.
- For spark plugs, replace every 50,000 km if the local law requires.
- Iridium spark plug: IFR6J11 (NGK)



**Z13DT Engine Model:**

Interval		Km (x 1,000)	15	30	45	60	75	90
		Miles (x 1,000)	9	18	27	36	45	54
		Months	12	24	36	48	60	72
ENGINE								
Engine accessory drive belt			–	I	–	I	–	I
			Replace every 150,000 km (90,000 miles) or 120 months					
Engine oil and oil filter	With a synthetic engine oil of oil grade: ACEA B3, and oil viscosity: SAE 0W-30, 0W-40, 5W-30, 5W-40		Replace every 20,000 km (12,000 miles) or 16 months					
	With engine oils other than specified synthetic engine oils		Replace every 10,000 km (6,000 miles) or 8 months					
Engine coolant			–	–	R	–	–	R
Exhaust system			–	I	–	I	–	I
FUEL SYSTEM								
Air cleaner filter			Replace every 50,000 km (30,000 miles) or 40 months					
Fuel lines and connections			–	I	–	I	–	I
Fuel filter			–	R	–	R	–	R
			Drain water every 15,000 km (90,000 miles) or 12 months					
Fuel tank			–	–	I	–	–	I

**NOTE:**

- “R”: Replace or change
- “I”: Inspect and correct, replace or lubricate if necessary
- Some maintenance items are required to be serviced at times other than the regular maintenance times shown at the top of above table. These items can be serviced at an earlier service opportunity according to customer’s maintenance convenience. Their next maintenance service should be done within the specified period.

# M15 and Z13DT Engine Models:

Interval	Km (x 1,000)	15	30	45	60	75	90
	Miles (x 1,000)	9	18	27	36	45	54
	Months	12	24	36	48	60	72
<b>BRAKE</b>							
Brake discs and pads (thickness, wear, damage)		I	I	I	I	I	I
Brake drums and shoes (wear, damage)		–	I	–	I	–	I
Brake hoses and pipes (leakage, damage, clamp)		–	I	–	I	–	I
Brake fluid		–	R	–	R	–	R
Brake lever and cable (damage, stroke, operation)		Inspect at first 15,000 km (9,000 miles only)					
<b>CHASSIS AND BODY</b>							
Clutch (travel)		–	I	–	I	–	I
Tires (wear, damage, rotation)/wheels (damage)		I	I	I	I	I	I
Suspension system (tightness, damage, rattle, breakage)		–	I	–	I	–	I
Steering system (tightness, damage, breakage, rattle)		–	I	–	I	–	I
Drive shaft (axle) boots/Propeller shafts (4WD)		–	–	I	–	–	I
Manual transmission oil	M15 engine (I: 15,000 km only)	I	–	R	–	–	R
	Z13DT engine	–	R	–	R	–	R
Automatic transmission fluid	Fluid level	–	I	–	I	–	I
	Fluid change	Replace every 165,000 km (99,000 miles)					
	Fluid hose	–	–	–	I	–	–
Transfer oil (4WD) (leakage, level)		I	–	I	–	I	–
Rear differential oil (4WD) (leakage, level) (R: 1st 15,000 km only)		R or I	–	I	–	I	–
All latches, hinges and locks		–	I	–	I	–	I
Air conditioning filter (if equipped)		–	I	R	–	I	R

## NOTE:

- “R”: Replace or change
- “I”: Inspect and correct or replace if necessary

## Maintenance Recommended Under Severe Driving Conditions

If the vehicle is usually used under the conditions corresponding to any severe condition code given below, IT IS RECOMMENDED that applicable maintenance operation be performed at the particular interval as shown in the following table.

### Severe condition code:

A: Repeated short trips

B: Driving on rough and/or muddy roads

C: Driving on dusty roads

D: Driving in extremely cold weather and/or salted roads

E: Repeated short trips in extremely cold weather

F: Leaded fuel use

G: — — — — —

H: Towing a trailer (if admitted)

Severe Condition Code	Maintenance		Maintenance Operation	Maintenance Interval
— B C D — — — —	Drive belt (Engine accessory drive belt)		I	Every 15,000 km (9,000 miles) or 12 months
			R	Every 45,000 km (27,000 miles) or 36 months
A — C D E F — H	Engine oil and oil filter	M15 engine	R	Every 5,000 km (3,000 miles) or 4 months
A — C D E — — H		Z13DT engine		Every 10,000 km (6,000 miles) or 8 months
— — C — — — — —	Air cleaner filter *1		I	Every 2,500 km (1,500 miles)
			R	Every 30,000 km (18,000 miles) or 24 months
A B C — E F — H	Spark plugs	Iridium spark plug	R	Every 30,000 km (18,000 miles) or 24 months
— B C D — — — — H	Wheel bearings		I	Every 15,000 km (9,000 miles) or 12 months
— B — D E — — H	Drive shafts and propeller shafts (4WD)		I	Every 15,000 km (9,000 miles) or 12 months
— B — — E — — H	Manual transmission, transfer (4WD) and differential oil (4WD)		R	First time only: 15,000 km (9,000 miles) or 12 months
				Second time and after: Every 30,000 km (18,000 miles) or 24 months reckoning from 0 km (0 miles) or 0 month
— B — — E — — H	Automatic transmission fluid		R	Every 30,000 km (18,000 miles) or 24 months

### NOTE:

- “I”: Inspect and correct or replace if necessary
- “R”: Replace or change
- \*1: Inspect more frequently if the vehicle is used under dusty conditions.

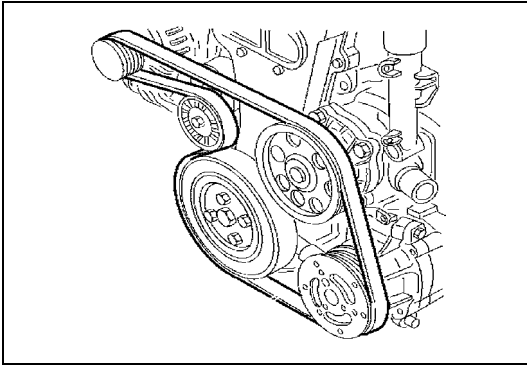
## Maintenance Service

### Engine Accessory Drive Belt Inspection (Z13DT Engine)

**WARNING:**

All inspection and replacement are to be performed with **ENGINE NOT RUNNING**.

#### Water pump and generator drive belt inspection



Inspect belt for cracks, cuts, deformation, wear, tension and cleanliness referring to “Water Pump and Generator Drive Belt Inspection” in Section 6B3. If any defect exists, replace.

### Engine Accessory Drive Belt Replacement (Z13DT Engine)

#### Water pump and generator drive belt replacement

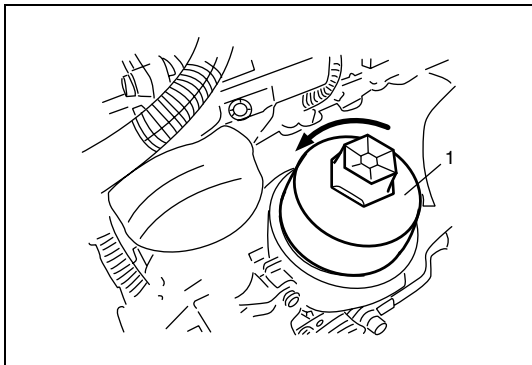
Replace belt with new one referring to “Water Pump/Generator Drive Belt Removal and Installation” in Section 6B3.

### Engine Oil and Oil Filter Replacement (Z13DT Engine)

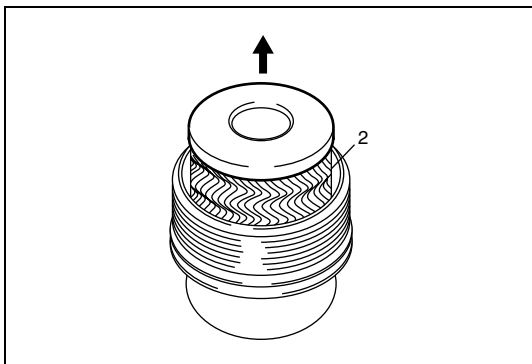
**WARNING:**

- New and used engine oil can be hazardous. Be sure to read “WARNING” in General Precaution in Section 0A and observe what is written there.
- Step 1) – 7) outlined below must be performed with **ENGINE NOT RUNNING**. For step 8), be sure to have adequate ventilation while engine is running.

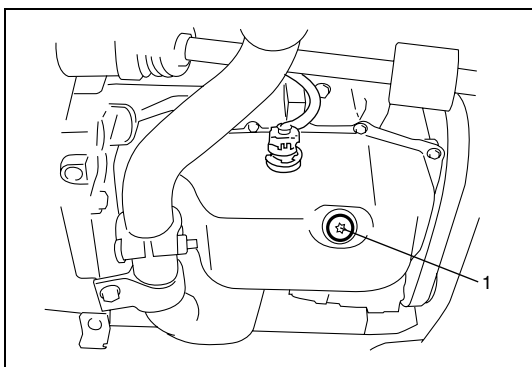
Before draining engine oil, check engine for oil leakage. If any evidence of leakage is found, make sure to correct defective part before proceeding to the following work.



- 1) Remove oil filter element.
  - a) Place oil collecting basin under filter.
  - b) Loosen and remove oil filter housing cover (1).



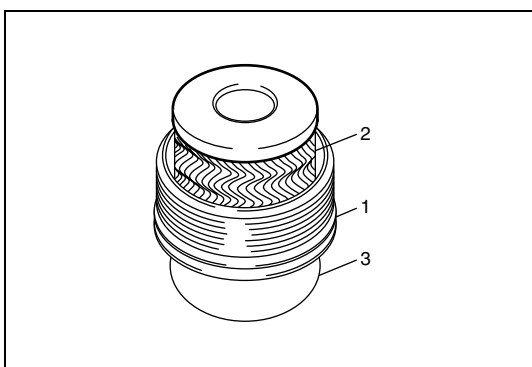
- c) Pull out oil filter element (2) from cover.



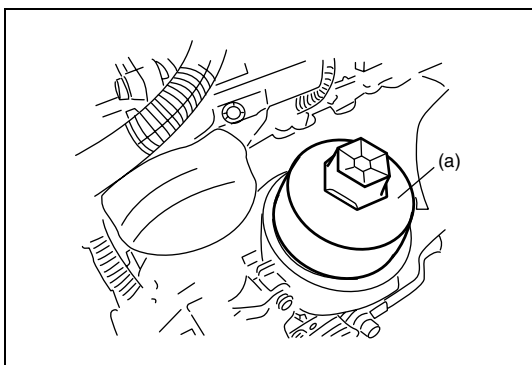
- 2) Drain engine oil by removing drain plug (1).
- 3) After draining oil, wipe drain plug clean and replace seal ring with a new one. Reinstall drain plug, and tighten it securely as specified below.

**Tightening torque**

**Engine oil drain plug (a): 20 N·m (2.0 kg-m, 14.5 lb-ft)**



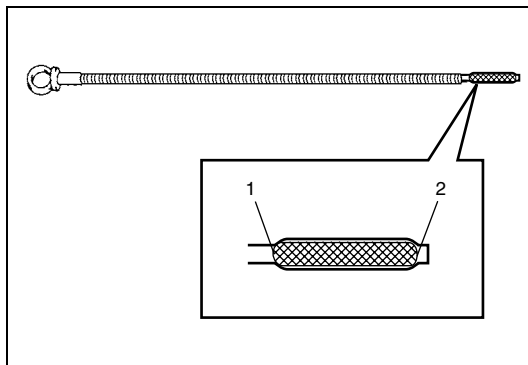
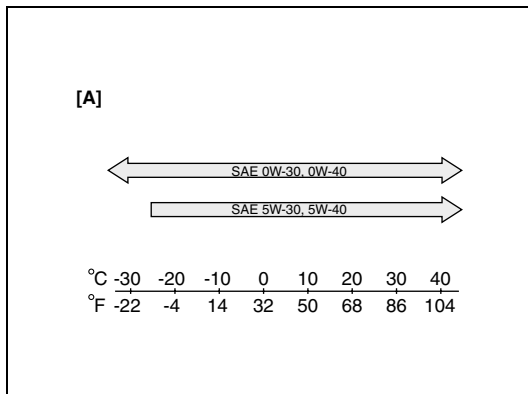
- 4) Install oil filter element.
  - a) Replace seal ring (1) of oil filter housing cover (3) with new one and apply engine oil to seal ring.
  - b) Install new oil filter element (2) to cover.



- c) Install oil filter housing cover with element.

**Tightening torque**

**Oil filter housing cover (a): 25 N·m (2.5 kg-m) 18.5 lb-ft**



- 5) Replenish oil until oil level is brought to FULL level mark on dipstick. (about 3.2 liters (5.6 Imp pt.)) The filler inlet is by the engine oil filter.  
Use specified engine oil. Select the appropriate oil viscosity according to the proper engine oil viscosity chart [A].

#### NOTE:

**Note that the amount of oil required when actually changing oil may somewhat differ from the data depending on various conditions (temperature, viscosity, etc.)**

- 6) Check oil filter and drain plug for oil leakage.
- 7) Start engine and run it for 3 minutes. Stop it and wait 5 minutes before checking oil level. Add oil, as necessary, to bring oil level to FULL level mark on dipstick.

- |                    |
|--------------------|
| 1. Full level mark |
| 2. Low level mark  |

## Engine Coolant Replacement (Z13DT Engine)

#### WARNING:

To help avoid danger of being burned, do not remove radiator cap while engine and radiator are still hot. Scalding fluid and steam can be blown out under pressure if cap is taken off too soon.

#### CAUTION:

When changing engine coolant, use mixture of 50% specified water and 50% ANTIFREEZE/ANTICORROSION COOLANT for the purpose of corrosion protection and lubrication.

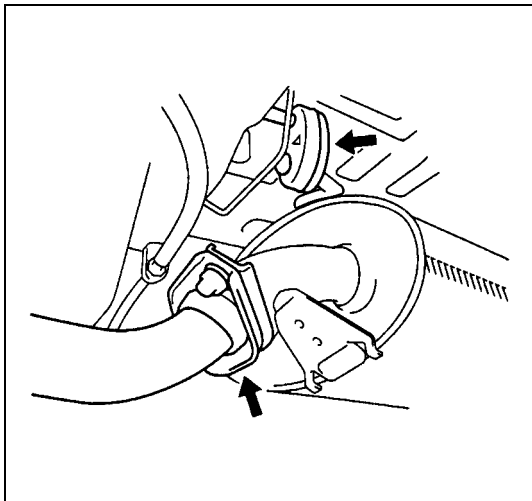
Change engine coolant with new one referring to “Cooling System Flush and Refill” in Section 6B3.

## Exhaust System Inspection (Z13DT Engine)

### WARNING:

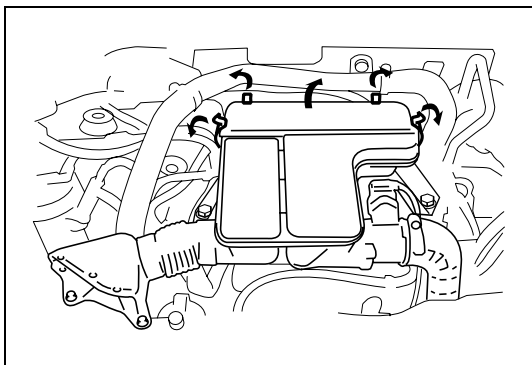
**To avoid danger of being burned, do not touch exhaust system when it is still hot. Any service on exhaust system should be performed when it is cool.**

When carrying out periodic maintenance, or the vehicle is raised for other service, check exhaust system as follows:

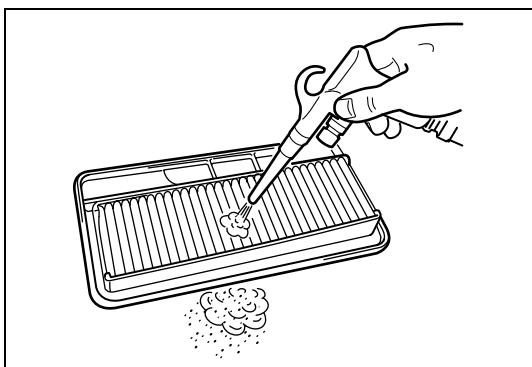


- Check rubber mountings for damage, deterioration, and out of position.
- Check exhaust system for leakage, loose connections, dents and damages.  
If bolts or nuts are loose, tighten them to specification.
- Check nearby body areas for damaged, missing, or mispositioned parts, open seams, holes, loose connections or other defects which could permit exhaust fumes to seep into the vehicle.
- Make sure that exhaust system components have enough clearance from the underbody to avoid overheating and possible damage to the floor carpet.
- Any defects should be fixed at once.

## Air Cleaner Filter Inspection (Z13DT Engine)



- 1) Remove air cleaner case clamps.
- 2) Take air cleaner filter out of case.

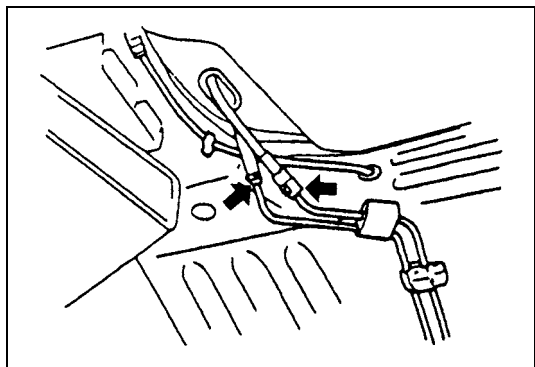


- 3) Check that filter is not excessively dirty, damaged or oily, clean filter with compressed air from air outlet side of filter.
- 4) Install air cleaner filter and clamp upper case securely.

## Air Cleaner Filter Replacement (Z13DT Engine)

Replace air cleaner filter with new one according to steps 1), 2) and 4) of inspection procedure.

## Fuel Lines and Connections Inspection (Z13DT Engine)

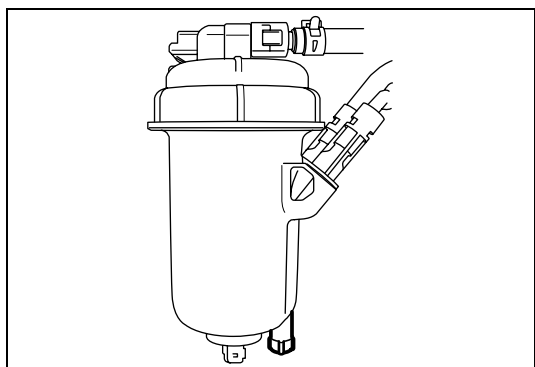


Visually inspect fuel lines and connections for evidence of fuel leakage, hose cracking and damage. Make sure all clamps are secure.

Repair leaky joints, if any.

Replace hoses that are suspected of being cracked.

## Fuel Filter Replacement (Z13DT Engine)



### **WARNING:**

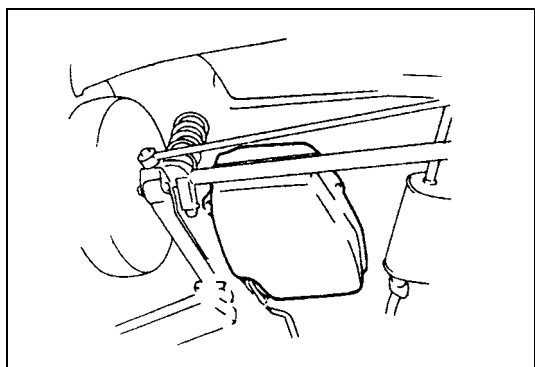
**This work must be performed in a well ventilated area and away from any open flames (such as gas hot water heaters).**

Replace fuel filter element in fuel filter assembly (1) with new one referring to “Fuel Filter” in Section 6C3.

## Water Draining of Fuel Filter (Z13DT Engine)

Bleed fuel filter of water referring to “Water Draining of Fuel Filter” in Section 6C3.

## Fuel Tank Inspection (Z13DT Engine)



Check fuel tank damage, cracks, fuel leakage, corrosion and tank bolts looseness.

If a problem is found, repair or replace.

## Clutch Inspection

For M15 engine model:

Check clutch pedal for height and free travel referring to “Clutch Pedal Height” and “Clutch Pedal Free Travel” in Section 7C. Adjust or correct if necessary.

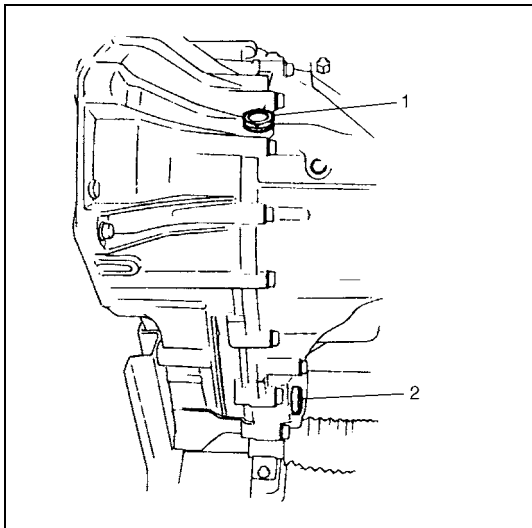
For Z13DT engine model:

Check clearance between cable nut and release shaft referring to “Clutch Cable Adjustment” in Section 7C3.

Adjust or correct if necessary.



## Manual Transmission Oil Inspection (M15 Engine)

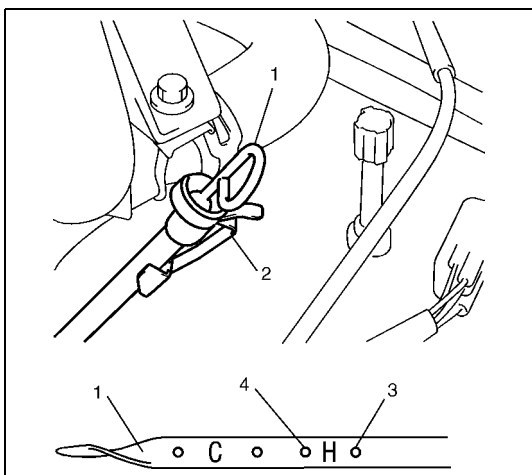


- 1) Inspect transmission case for evidence of oil leakage.  
Repair leaky point if any.
- 2) Make sure that vehicle is placed level for oil level check.
- 3) Remove oil filler/level plug (1) of transmission.
- 4) Check oil level.  
Oil level can be checked roughly by means of filler/level plug hole. That is, if oil flows out of level plug hole or if oil level is found up to hole when level plug is removed, oil is properly filled.  
If oil is found insufficient, pour specified oil up to level hole.  
For specified oil, refer to "Manual Transaxle Oil Change" in Section 7A2.
- 5) Apply sealant to filler/level plug and tighten it to specified torque.

## Manual Transmission Oil Replacement

Replace manual transmission oil referring to "Manual Transaxle Oil Change" in Section 7A2 (for M15 engine) or 7A3 (for Z13DT engine).

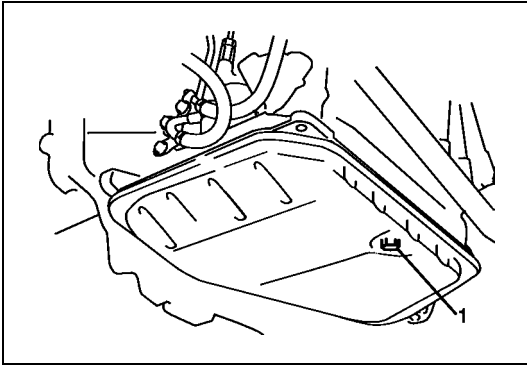
## Automatic Transmission Fluid Level Inspection



- 1) Inspect transmission case for evidence of fluid leakage.  
Repair leaky point, if any.
- 2) Make sure that vehicle is placed level for fluid level check.
- 3) Pull out dipstick and check fluid level.  
For fluid level checking procedure, refer to "Fluid level check at normal operating (hot) temperature (Hot check)" in Section 7B and be sure to perform it under specified conditions.  
If fluid level is low, replenish specified fluid.

1. Dipstick
2. Clamp
3. FULL HOT mark
4. LOW HOT mark

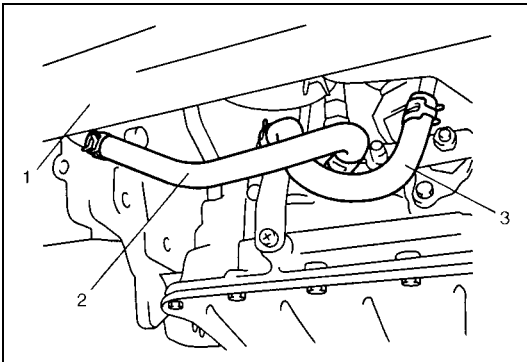
## Automatic Transmission Fluid Replacement



- 1) Inspect transmission case for evidence of fluid leakage. Repair leaky point, if any.
- 2) Make sure that vehicle is placed level for fluid level check.
- 3) Change fluid. For its procedure, refer to "Fluid change" in Section 7B.

1. Drain plug

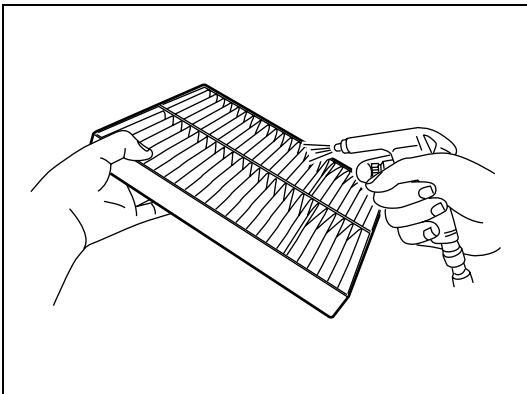
## Automatic Transmission Fluid Cooler Hose Inspection



Check automatic transaxle fluid cooler hose for fluid leakage, cracks, damage and deterioration.

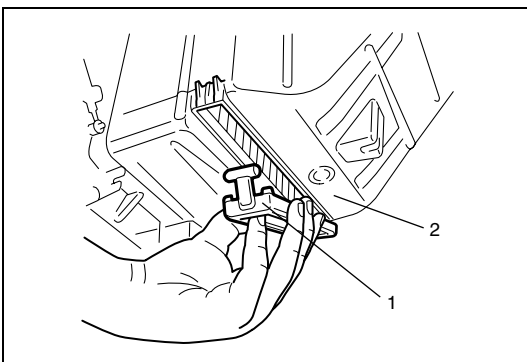
Replace hose and/or clamp if any faulty condition is found.

## Air Conditioning Filter (If Equipped) Inspection



- 1) Remove the air conditioning filter from the cooling unit referring to "Air Conditioning Filter (If Equipped) Replacement" in this section.
- 2) Check for dirt and dust. If the air conditioning filter is excessively dirty, replace the air conditioning filter with the new one. If not, go to the next step.
- 3) Blow compressed air on the air outlet side of the air conditioning filter for removing dust.
- 4) Install the air conditioning filter into the cooling unit by reversing the removal procedure.

## Air Conditioning Filter (If Equipped) Replacement



- 1) Remove the air conditioning filter door (1) from the cooling unit (2).
- 2) Remove the air conditioning filter from the cooling unit.
- 3) Install the new air conditioning filter into the cooling unit.
- 4) Install the air conditioning filter door onto the cooling unit.

## Recommended Fluids and Lubricants

Engine oil (M15 engine)	SG, SH, SJ or SL grade (Refer to “Engine Oil and Oil Filter Replacement (Z13DT Engine)” for M15 engine in this section for engine oil viscosity.)
Engine oil (Z13DT engine)	Refer to “Engine Oil and Oil Filter Replacement (Z13DT Engine)” in this section for engine oil grade and viscosity.
Engine coolant (Ethylene glycol base coolant)	“Antifreeze/Anticorrosion coolant”
Brake fluid	DOT 4 or SAE J1704
Manual transmission oil	Refer to “Manual Transaxle Oil Change” in Section 7A2 or 7A3.
Transfer oil (4WD)	Refer to “Transfer Oil Change” in Section 7D.
Differential oil (4WD)	Refer to “Rear Differential Oil Change” in Section 7F.
Automatic transmission fluid	An equivalent of DEXRON® – III
Door hinges	Engine oil or water resistance chassis grease
Hood latch assembly	Engine oil or water resistance chassis grease
Key lock cylinder	Spray lubricant

## SECTION 1A

## HEATER AND VENTILATION

1A

**WARNING:**

For vehicles equipped with Supplement Restraint (Air Bag) System:

- Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to “Air Bag System Components and Wiring Location View” under “General Description” in air bag system section in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and “Service Precautions” under “On-Vehicle Service” in air bag system section before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either or these two conditions may result in severe injury.
- Technical service work must be started at least 90 seconds after the ignition switch is turned to the “LOCK” position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).

**NOTE:**

For the items with asterisk (\*) in the “CONTENTS” below, refer to the same section of the Service Manual mentioned in the “Foreword” of this manual.

## CONTENTS

<b>General Description .....</b>	<b>1A-2</b>	Supplementary Heater Removal and Installation (if equipped) (Z13DT Engine) .....	1A-11
Heater and Ventilation Construction .....	1A-2	Supplementary Heater Inspection (if equipped) (Z13DT Engine) .....	1A-11
Heater and Ventilation Wiring Circuit Diagram.....	1A-3	Supplementary Heater Controller Removal and Installation (if equipped) (Z13DT Engine) .....	1A-11
On-Board Diagnostic System Description (Z13DT Engine Model) .....	1A-4	Supplementary Heater Relay Inspection (if equipped) (Z13DT Engine) .....	1A-11
<b>Diagnosis .....</b>	<b>1A-5</b>	Heater Control Lever Assembly Components.....	*
Heater and Ventilation System Symptom Diagnosis .....	1A-5	Heater Control Lever Assembly Removal and Installation.....	*
Diagnostic Trouble Code (DTC) Check (Z13DT Engine Model) .....	1A-6	Blower Speed Selector Inspection .....	*
Diagnostic Trouble Code (DTC) Table (Z13DT Engine Model) .....	1A-7	Rear Defogger Switch Inspection .....	*
<b>On-Vehicle Service .....</b>	<b>1A-9</b>	Air Inlet Box Components .....	1A-12
Heater Unit Components.....	1A-9	Air Inlet Box Removal and Installation .....	*
Heater Unit Removal and Installation.....	1A-10	Center Ventilation Louver Removal and Installation .....	*
Blower Motor Removal and Installation.....	*	Side Ventilation Louver Removal and Installation.....	*
Blower Motor Inspection.....	*		
Blower Motor Resistor Removal and Installation .....	*		
Blower Motor Resistor Inspection .....	*		

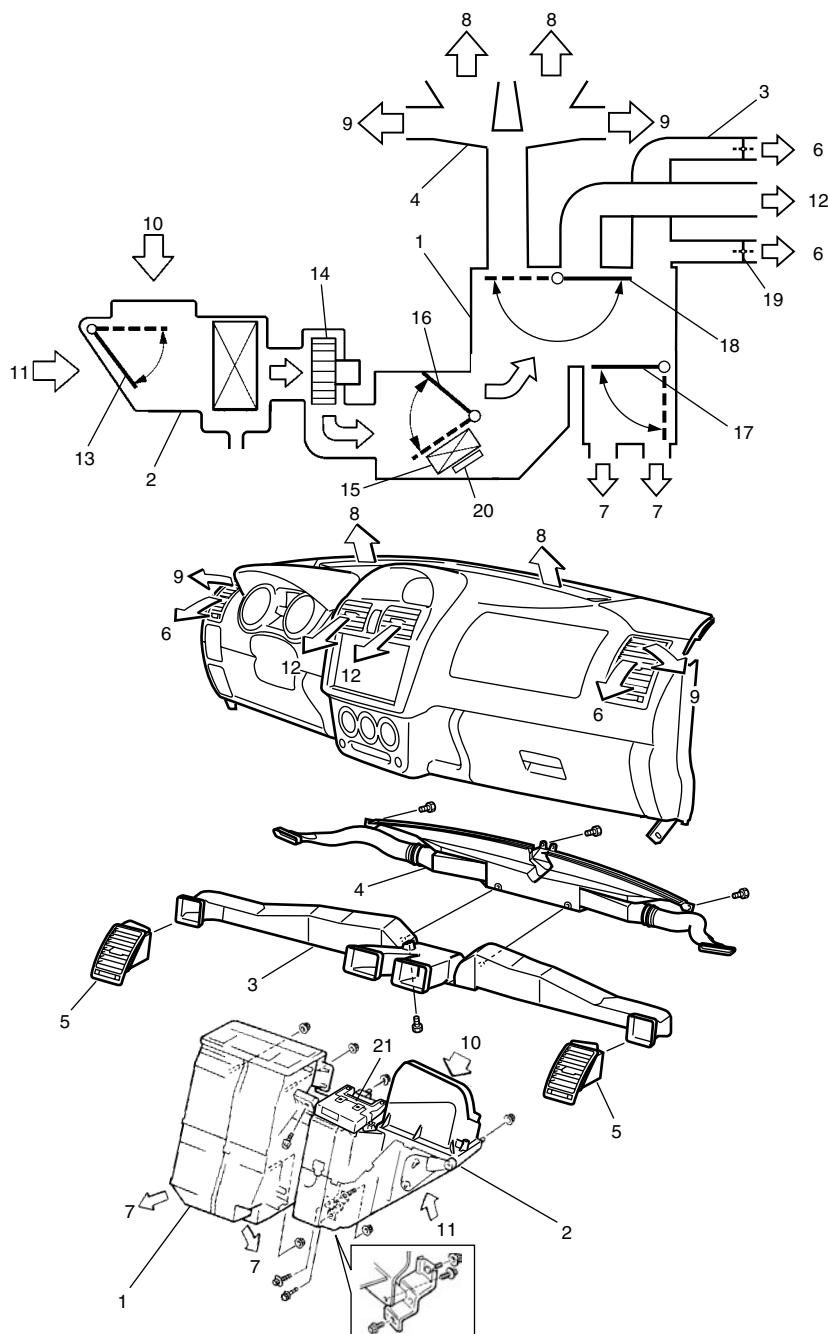
## General Description

### Heater and Ventilation Construction

#### NOTE:

For M15 engine model, refer to the same section of the Service Manual mentioned in the “Foreword” of this service manual.

#### For Z13DT Engine Model



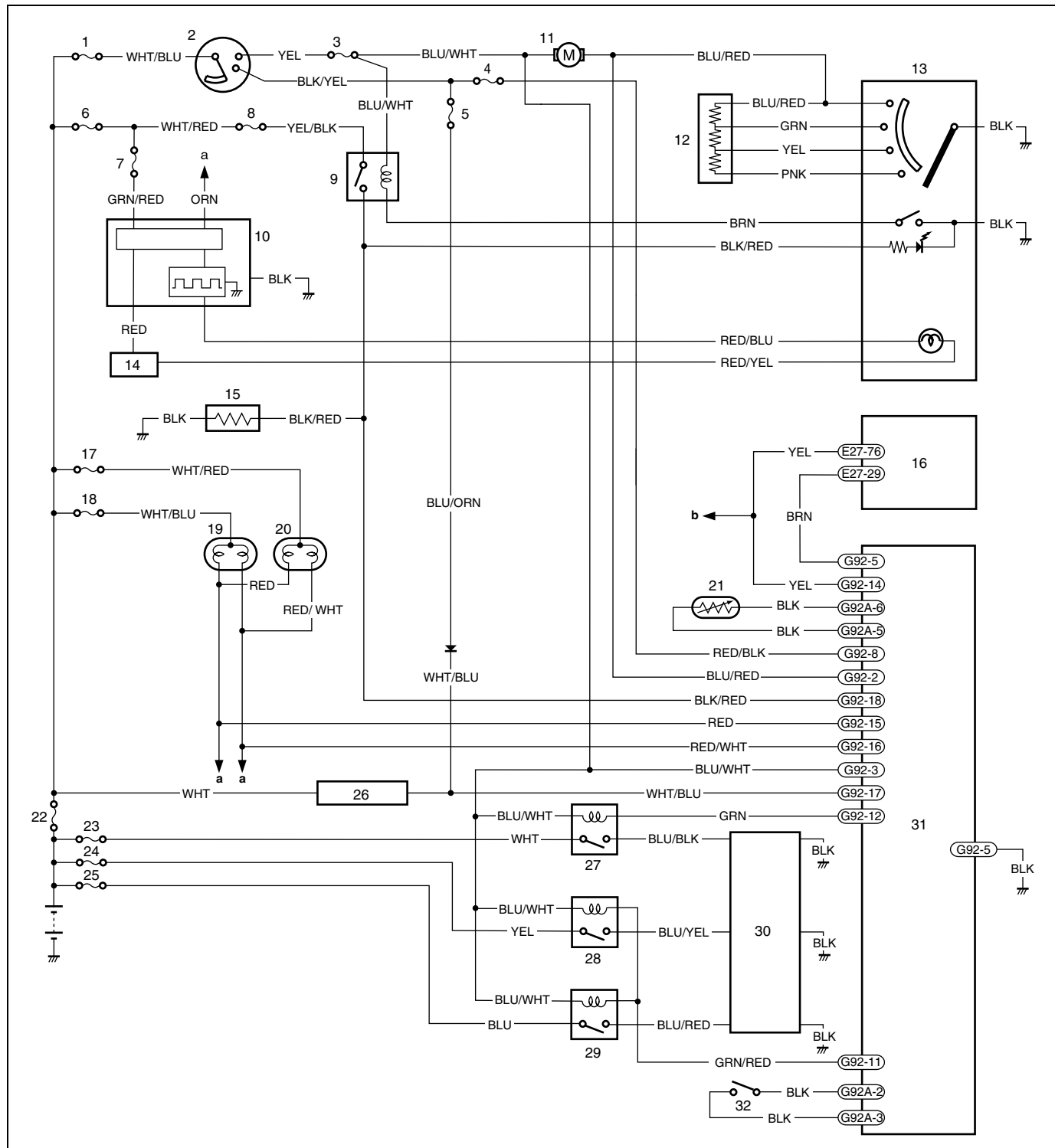
1. Heater unit	7. Foot air	13. Air inlet select door	19. Side ventilation control door
2. Air inlet box	8. Front defroster air	14. Blower motor	20. Supplementary heater (if equipped)
3. Ventilator duct	9. Side defroster air	15. Heater core	21. Supplementary heater controller (if equipped)
4. Defroster nozzle	10. Fresh air	16. Temperature control door	
5. Ventilator outlet	11. Recirculation air	17. Foot air control door	
6. Side ventilation air	12. Center ventilation air	18. Ventilation defroster air control door	

# Heater and Ventilation Wiring Circuit Diagram

## NOTE:

For M15 engine model, refer to the same section of the Service Manual mentioned in the “Foreword” of this service manual.

## For Z13DT Engine Model



1. "IGNITION SWITCH" fuse	10. Lighting controller	19. Left headlight	28. Supplementary heater rarely 2
2. Ignition switch	11. Blower motor	20. Right headlight	29. Supplementary heater rarely 3
3. "HEATER" fuse	12. Blower motor resistor	21. Water temperature sensor	30. Supplementary heater
4. "TURN. BACK" fuse	13. Heater control panel	22. Main fuse	31. Supplementary heater controller
5. "METER" fuse	14. Junction connector	23. Supplementary heater fuse 1	a. To lighting switch
6. "CIRCUIT FUSE BOX" fuse	15. Rear defogger	24. Supplementary heater fuse 2	b. To fuel heating relay
7. "REAR FOG" fuse	16. ECM	25. Supplementary heater fuse 3	
8. "REAR DEFG" fuse	17. "HEAD LIGHT (R)" fuse	26. Generator	
9. Rear defogger relay	18. "HEAD LIGHT (L)" fuse	27. Supplementary heater rarely 1	

## On-Board Diagnostic System Description (Z13DT Engine Model)

### NOTE:

- The on-board diagnostic system is available only for Z13DT engine model with the supplementary heater system.
- The SUZUKI scan tool cannot be used.

For Z13DT Engine Model with the supplementary heater system, the on-board diagnostic system is available. The supplementary heater controller detects malfunctions related to the supplementary heater system. When the controller detects some malfunction, the diagnostic information as diagnostic trouble code (DTC) is stored in the memory of the controller. By performing the DTC check procedure, the diagnostic information can be known. For the procedure, refer to "Diagnostic Trouble Code (DTC) Check (Z13DT Engine Model)" and "Diagnostic Trouble Code (DTC) Table (Z13DT Engine Model)" in this section.

## Diagnosis

### Heater and Ventilation System Symptom Diagnosis

**NOTE:**

For M15 engine model, refer to the same section of the Service Manual mentioned in the “Foreword” of this service manual.

**For Z13DT Engine Model**

Condition	Possible Cause	Correction
<b>Blower motor dose not work even when its switch is at operating position.</b>	Fuse blown	Check “HEATER” fuse and main heater fuse, and then check for short circuit to ground.
	Blower motor resistor faulty	Check blower motor resistor.
	Blower speed selector faulty	Check blower speed selector.
	Blower motor faulty	Replace blower motor.
	Wiring or grounding faulty	Repair as necessary.
<b>Blower speed selector dose not work when its switch is at maximum airflow position.</b>	Blower speed selector faulty	Check blower speed selector.
	Wiring or grounding faulty	Check wiring and grounding, and then repair as necessary.
<b>Incorrect temperature output.</b>	Control cables broken or binding	Check control cables.
	Temperature control lever faulty	Check temperature control lever.
	Position of control cable clamp is faulty	Check position and adjust it as necessary.
	Temperature control door assembly broken	Repair temperature control door assembly.
	Air ducts clogged	Repair air ducts.
	Heater core leaking or clogged	Replace heater core.
	Heater hoses leaking or clogged	Replace heater hoses.
	Thermostat faulty	Replace thermostat case assembly referring to Section 6B3.
	Fuse blown	Check supplementary heater fuses.
	Supplementary heater faulty	Check supplementary heater (if equipped).
	Supplementary heater controller faulty	Check supplementary heater controller (if equipped).
	Supplementary heater relay faulty	Check supplementary heater relay (if equipped).
	Water temperature sensor faulty	Check water temperature sensor (if equipped).
	Full hot switch faulty	Check full hot switch (if equipped).
<b>When mode control lever is changed, air outlet port dose not change or lever position disagree with air outlet port.</b>	Control cable broken or binding	Check control cable.
	Airflow control lever faulty	Check airflow control lever.
	Position of control cable clamp is faulty	Check position and adjust it as necessary.
	Control doors broken	Repair control doors.
	Air ducts leaking or clogged	Repair air ducts.

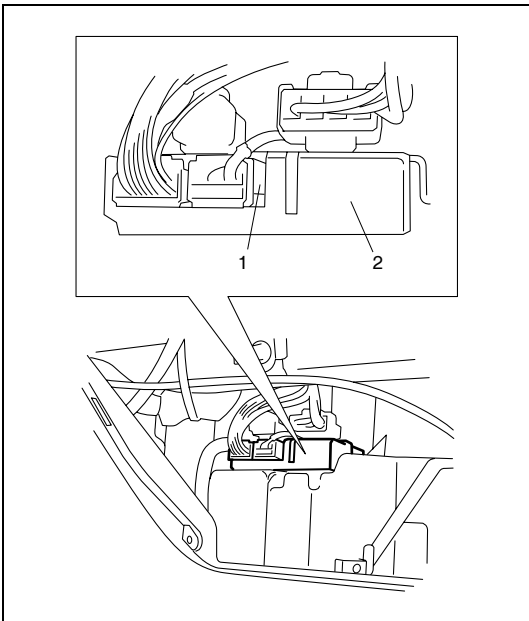


## Diagnostic Trouble Code (DTC) Check (Z13DT Engine Model)

### NOTE:

- This checking procedure is available only for Z13DT engine model with the supplementary heater system.
- If more than two DTCs are detected, only DTC, which has the highest priority, is indicated. After the DTC is trouble-shot, DTC, which has the next priority, is indicated.
- The following procedure has to be performed two times. For the first time, the headlight has to be set at LOW position in the Step 7 below. For the second time, the headlight has to be set at HIGH position in the same step. Otherwise, it cannot be judged whether the DTC No.111 and 112 are detected or not.
- Be sure that the rear defogger switch is set at the ON position in the Step 4. Otherwise, the DTC No.101 is indicated even if the system is normal.

- 1) Remove the glove box from the instrument panel.
- 2) Set the blower speed selector at the OFF position.
- 3) Set the temperature selector at the MAX hot position.
- 4) Set the rear defogger switch at the ON position.
- 5) Turn the headlight ON.
- 6) Set the headlight at the LOW position (or HIGH position).
- 7) Start the engine.
- 8) Refer to "Diagnostic Trouble Code (DTC) Table (Z13DT Engine Model)" in this section, and see what DTC is detected by reading the flashing pattern of the LED (1) in the supplementary heater controller (2).



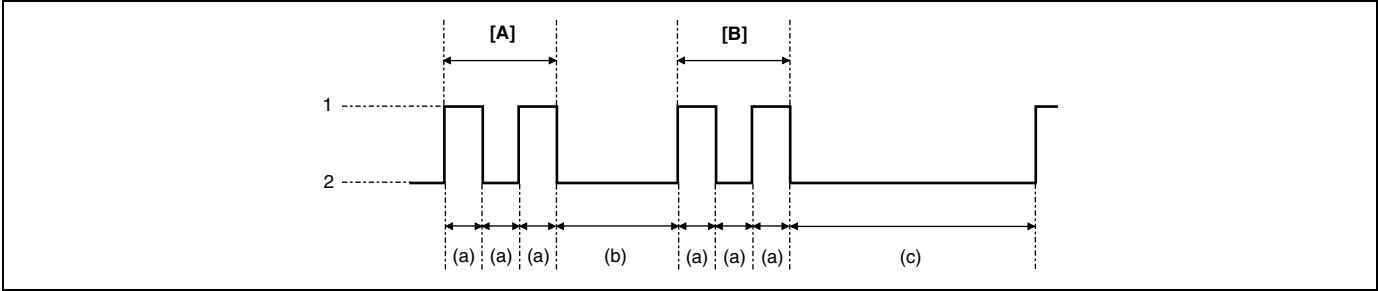
## Diagnostic Trouble Code (DTC) Table (Z13DT Engine Model)

### NOTE:

- This table is available only for Z13DT engine model with the supplementary heater system.
- Refer to “A/C System Wiring Circuit Diagram” in this section for details of system components, wire colors, and terminal numbers of supplementary heater controller.
- In case that DTC 2-1, 2-2, 3-1, 3-2, 4-3, 7-1, and/or 8-1 are detected, the supplementary heater is not activated by the supplementary heater controller.

DTC	LED flashing pattern		Priority	Possible cause
	First figure	Second figure		
–	Lighted ON		1	Normal
–	Lighted OFF		2	<ul style="list-style-type: none"> <li>• “RED/BLK” wire at “G92-8” terminal open</li> <li>• “BLK” wire at “G92-10” terminal open</li> <li>• “TURN. BACK” fuse faulty</li> </ul>
1-2	1	2	3	<ul style="list-style-type: none"> <li>• “WHT/BLU” wire at “G92-17” terminal open</li> <li>• Alternator not generated</li> </ul>
2-1	2	1	4	<ul style="list-style-type: none"> <li>• “BRN” wire at “G92-5” terminal open</li> </ul>
2-2	2	2	5	<ul style="list-style-type: none"> <li>• “BRN” wire at “G92-5” terminal short</li> </ul>
3-1	3	1	6	<ul style="list-style-type: none"> <li>• “BLK” wire at “G92A-5” terminal open</li> <li>• “BLK” wire at “G92A-6” terminal open</li> </ul>
3-2	3	2	7	<ul style="list-style-type: none"> <li>• “BLK” wire at “G92A-5” terminal short</li> <li>• “BLK” wire at “G92A-6” terminal short</li> </ul>
4-3	4	3	8	<ul style="list-style-type: none"> <li>• “BLU/WHT” wire at “G92-3” terminal open</li> <li>• “BLU/WHT” wire at “G92-3” terminal short</li> <li>• “HEATER” fuse faulty</li> </ul>
5-3	5	3	9	<ul style="list-style-type: none"> <li>• “BLU/RED” wire at “G92-2” terminal open</li> <li>• “BLU/RED” wire at “G92-2” terminal short</li> </ul>
6-1	6	1	10	<ul style="list-style-type: none"> <li>• “BLK” wire at “G92A-2” terminal open</li> <li>• “BLK” wire at “G92A-3” terminal open</li> </ul>
7-1	7	1	11	<ul style="list-style-type: none"> <li>• “GRN” wire at “G92-12” terminal open</li> <li>• “GRN” wire at “G92-12” terminal short</li> <li>• Supplementary heater relay 1 faulty</li> <li>• “HEATER” fuse faulty</li> </ul>
8-1	8	1	12	<ul style="list-style-type: none"> <li>• “GRN/RED” wire at “G92-11” terminal open</li> <li>• “GRN/RED” wire at “G92-11” terminal short</li> <li>• Supplementary heater relay 2 and 3 faulty</li> <li>• “HEATER” fuse faulty</li> </ul>
10-1	10	1	13	<ul style="list-style-type: none"> <li>• “BLK/RED” wire at “G92-18” terminal open</li> <li>• “BLK/RED” wire at “G92-18” terminal short</li> <li>• Rear defogger relay faulty</li> <li>• “REAR DEFG” fuse faulty</li> </ul>
11-1	11	1	14	<ul style="list-style-type: none"> <li>• “RED/WHT” wire at “G92-16” terminal open</li> <li>• “RED/WHT” wire at “G92-16” terminal short</li> <li>• Headlight bulbs faulty</li> <li>• “HEAD LIGHT” fuses faulty</li> </ul>
11-2	11	2	15	<ul style="list-style-type: none"> <li>• “RED” wire at “G92-15” terminal open</li> <li>• “RED” wire at “G92-15” terminal short</li> <li>• Headlight bulbs faulty</li> <li>• “HEAD LIGHT” fuses faulty</li> </ul>

Example (DTC No.2-2) of LED Flashing Pattern



[A]: First figure	1. LED ON	(a). 0.3 seconds	(c). 2.0 seconds
[B]: Second figure	2. LED OFF	(b). 1.0 seconds	

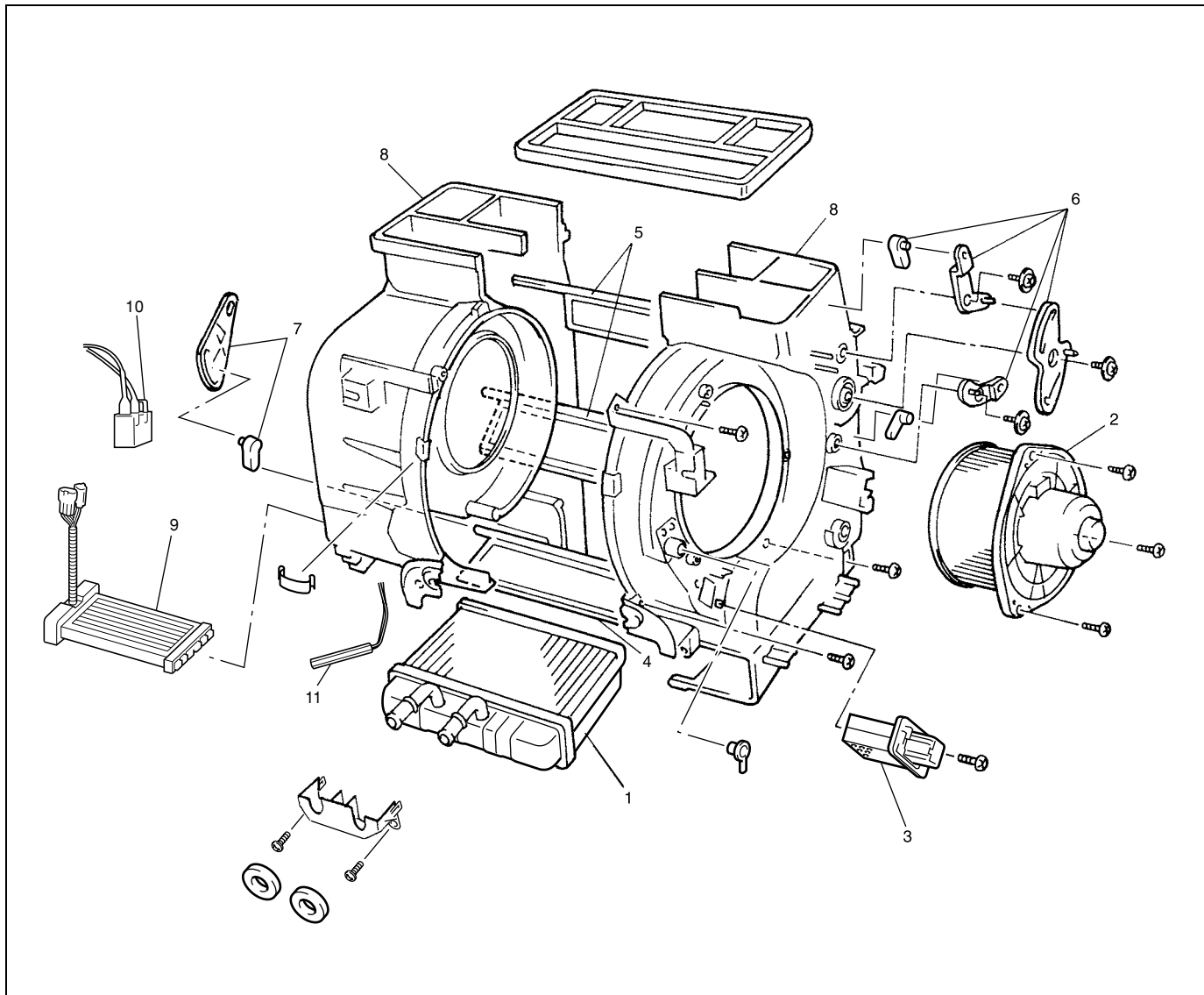
## On-Vehicle Service

### Heater Unit Components

**NOTE:**

For M15 engine model, refer to the same section of the Service Manual mentioned in the “Foreword” of this service manual.

**For Z13DT Engine Model**



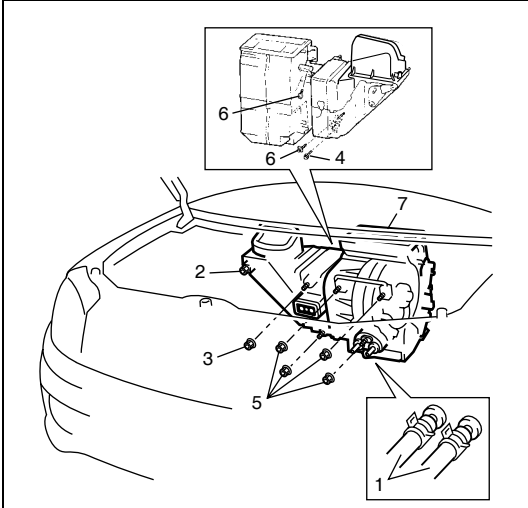
1. Heater core	4. Temperature control door assembly	7. Temperature control lever	10. Full hot switch (if equipped)
2. Blower motor assembly	5. Air flow control door assembly	8. Heater case	11. Water temperature sensor (if equipped)
3. Blower motor resistor	6. Air flow control lever	9. Supplementary heater (if equipped)	

## Heater Unit Removal and Installation

### Removal

#### For Z13DT Engine Model

- 1) Disconnect negative (–) cable at battery.
- 2) If equipped with air bag system, disable air bag system referring to “Disabling Air Bag System” in Section 10B.
- 3) Drain engine coolant, and then disconnect heater hoses (1) from heater unit.
- 4) Remove instrument panel referring to “Instrument Panel Removal and Installation” in Section 9.
- 5) Remove 20-pin connector from supplementary heater controller and two connectors located on supplementary heater controller.
- 6) Loosen air inlet box (cooling unit) mounting nut (2) and mounting nut (3).
- 7) Remove bolts (4), nuts (5) and screws (6).
- 8) Remove heater unit (7).



#### For M15 Engine model

#### NOTE:

For M15 engine model, refer to the same section of the Service Manual mentioned in the “Foreword” of this service manual.

### Installation

#### For Z13DT Engine Model

Reverse removal procedure to install heater unit noting the following instructions.

- When installing each part, be careful not to catch any cable or wiring harness.
- Adjust control cables by referring to “Heater Control Lever Assembly Removal and Installation” in this section.
- Fill engine coolant to radiator.
- If equipped with air bag system, enable air bag system referring to “Enabling Air Bag System” in Section 10B.

#### For M15 Engine model

#### NOTE:

For M15 engine model, refer to the same section of the Service Manual mentioned in the “Foreword” of this service manual.

## Supplementary Heater Removal and Installation (if equipped) (Z13DT Engine)

### Removal

- 1) Remove heater unit referring to “Heater Unit Removal and Installation” in this section.
- 2) Remove supplementary heater cover and supplementary heater referring to “Heater Unit Components” in this section.

### Installation

- 1) Install supplementary heater and supplementary heater cover referring to “Heater Unit Components” in this section.
- 2) Install heater unit referring to “Heater Unit Removal and Installation” in this section.

## Supplementary Heater Inspection (if equipped) (Z13DT Engine)

- Check if there is continuity between supplementary heater terminals. If there is no continuity, replace supplementary heater.
- Check supplementary heater for crack or any other damage. Replace if needed.

## Supplementary Heater Controller Removal and Installation (if equipped) (Z13DT Engine)

### Removal

- 1) Remove air inlet box referring to “Air Inlet Box Removal and Installation” in this section.
- 2) Remove supplementary heater controller referring to “Air Inlet Box Components” in this section.

### Installation

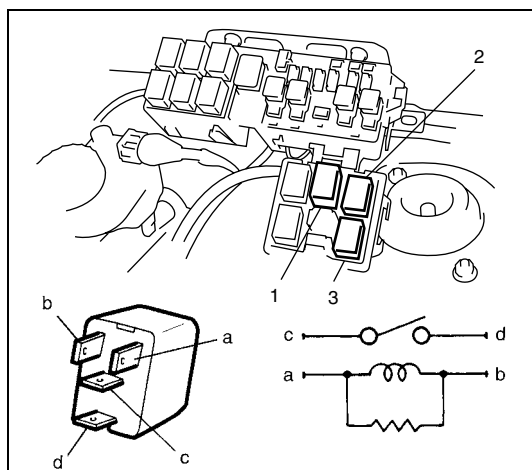
Reverse removal procedure for installation.

## Supplementary Heater Relay Inspection (if equipped) (Z13DT Engine)

- 1) Disconnect negative (–) cable at battery.
- 2) Remove supplementary heater relay (No.1, No.2 and No.3) from supplementary fuse box (No.1).

1.	Supplementary heater relay No.1
2.	Supplementary heater relay No.2
3.	Supplementary heater relay No.3

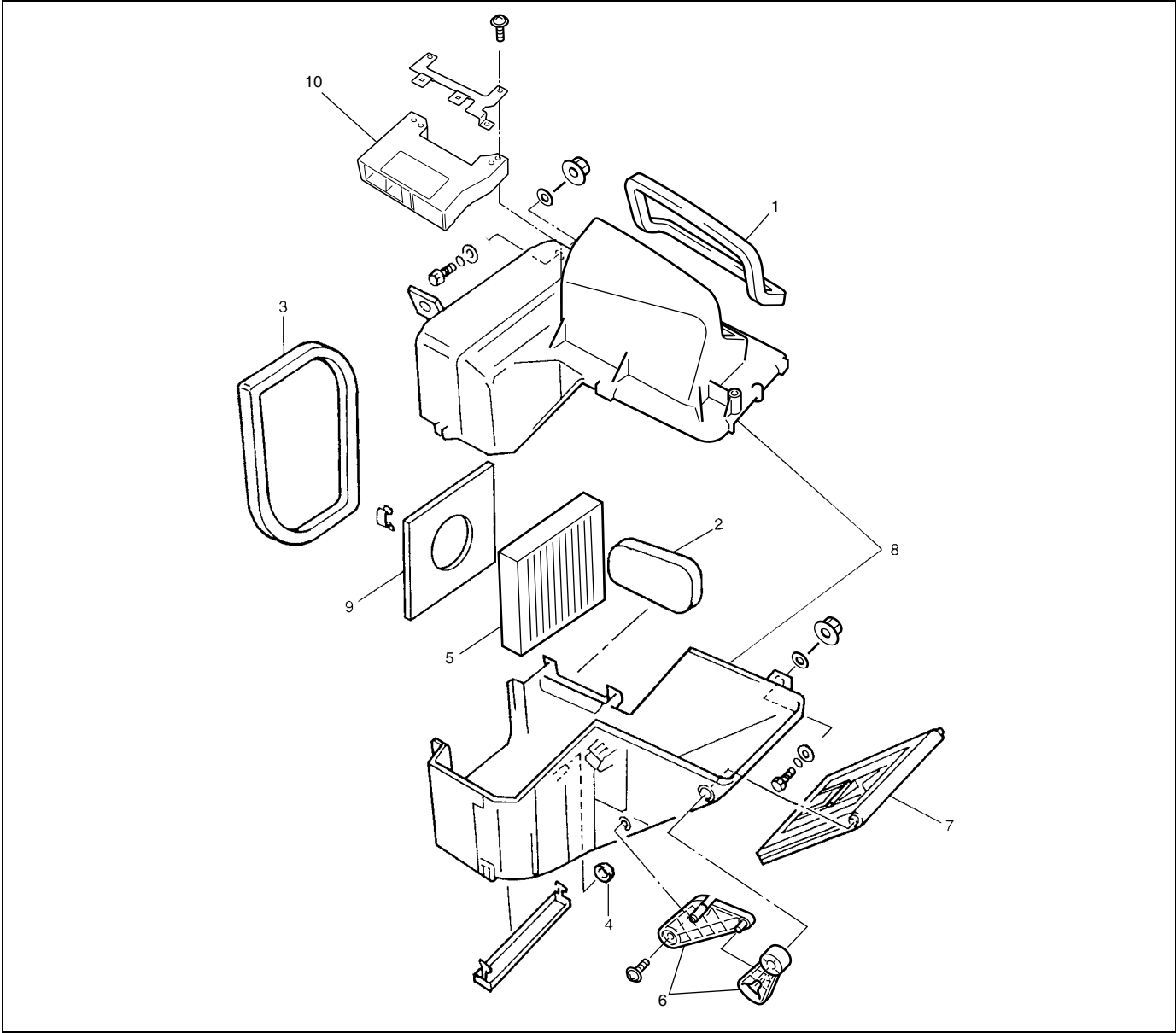
- 3) Check if there is no continuity between terminal “c” and “d”. If there is continuity, replace relay.
- 4) Check if there is continuity between terminal “c” and “d” when a 12 V battery is connected to terminals “a” and “b”. If there is no continuity, replace relay.



# Air Inlet Box Components

**NOTE:**  
For M15 engine model, refer to the same section of the Service Manual mentioned in the “Foreword” of this service manual.

For Z13DT Engine Model



1. Air inlet box	4. Grommet	7. Air inlet door	10. Supplementary heater controller (if equipped)
2. Dash packing	5. Air filter (if equipped)	8. Air inlet box	
3. Packing	6. Door link	9. Air resistance board	

## SECTION 1B

## AIR CONDITIONING (OPTIONAL)

1B

**WARNING:**

For vehicles equipped with Supplemental Restraint (Air Bag) System:

- Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to “Air Bag System Components and Wiring Location View” under “General Description” in air bag system section in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and “Service Precautions” under “On-Vehicle Service” in air bag system section before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.
- Technical service work must be started at least 90 seconds after the ignition switch is turned to the “LOCK” position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).

**CAUTION:**

The air conditioning system of this vehicle uses refrigerant HFC-134a (R-134a).

None of refrigerant, compressor oil and component parts is interchangeable between two types of A/C: one using refrigerant CFC-12 (R-12) and the other using refrigerant HFC-134a (R-134a).

Be sure to check which refrigerant is used before any service work including inspection and maintenance. For identification between these two types, refer to “Refrigerant Type Construction” in this section.

When replenishing or changing refrigerant and compressor oil and when replacing parts, make sure that the material or the part to be used is appropriate to the A/C installed in the vehicle being serviced. Use of incorrect one will result in leakage of refrigerant, damage in parts or other faulty condition.

**NOTE:**

For the items with asterisk (\*) in the “CONTENTS” below, refer to the same section of the Service Manual mentioned in the “Foreword” of this manual.

## CONTENTS

<b>General Description .....</b>	<b>1B-3</b>	Abnormal noise from crankshaft pulley .....	*
Refrigerant Type Construction .....	*	Abnormal noise from tension pulley .....	*
Air Conditioning System Description .....	*	Abnormal noise from A/C evaporator .....	*
Major Components of A/C System .....	1B-3	Abnormal noise from blower motor .....	*
A/C System Wiring Circuit Diagram .....	1B-4	A/C System Performance Inspection .....	*
<b>Diagnosis .....</b>	<b>1B-6</b>	Performance diagnosis table .....	*
A/C System Symptom Diagnosis .....	1B-6	<b>On-Vehicle Service .....</b>	<b>1B-8</b>
Abnormal Noise Diagnosis of A/C System .....	*	Operation Procedure for Refrigerant	
Abnormal noise from compressor .....	*	Charge .....	1B-8
Abnormal noise from magnetic clutch .....	*	Recovery .....	*
Abnormal noise from tubing .....	*	Replenishing compressor oil .....	1B-9
Abnormal noise from condenser		When replacing other part .....	*
assembly .....	*	Evacuation of A/C system .....	*



A/C system check for pressure leaks .....	*	Expansion Valve Removal and Installation.....	*
Charge .....	*	Pressure Sensor Inspection (Z13DT Engine) .....	1B-15
Removing manifold gauge set.....	*	Pressure Sensor Removal and Installation (Z13DT Engine) .....	1B-16
Leak test.....	*	A/C Switch Inspection.....	*
Precautions on Servicing A/C System .....	*	A/C Relay Inspection (Z13DT Engine).....	1B-16
Refrigerant line .....	*	Compressor Relay Inspection.....	*
Handling refrigerant HFC-134a (R-134a) .....	*	Compressor Assembly Removal and Installation.....	1B-17
Refrigerant recovery.....	*	Compressor Drive Belt Inspection and Adjustment.....	1B-18
Refrigerant charge .....	*	Compressor Drive Belt Replacement .....	1B-18
Procedure After ECM Replacement (Z13DT Engine Model).....	1B-9	Magnet Clutch Inspection .....	1B-18
Condenser Assembly On-Vehicle Inspection.....	*	Relief Valve Inspection .....	1B-19
Condenser Assembly Removal and Installation.....	1B-10	<b>Specifications .....</b>	<b>1B-19</b>
Receiver / Dryer Removal and Installation.....	1B-11	Tightening Torque Specifications .....	1B-19
Cooling Unit (Evaporator) Components .....	1B-13	<b>Special Tools and Equipment.....</b>	<b>1B-20</b>
Cooling Unit (Evaporator) Removal and Installation.....	1B-14	Required Service Material .....	1B-20
Cooling Unit (Evaporator) Inspection .....	*	Special Tool .....	1B-20
Expansion Valve Inspection .....	*		

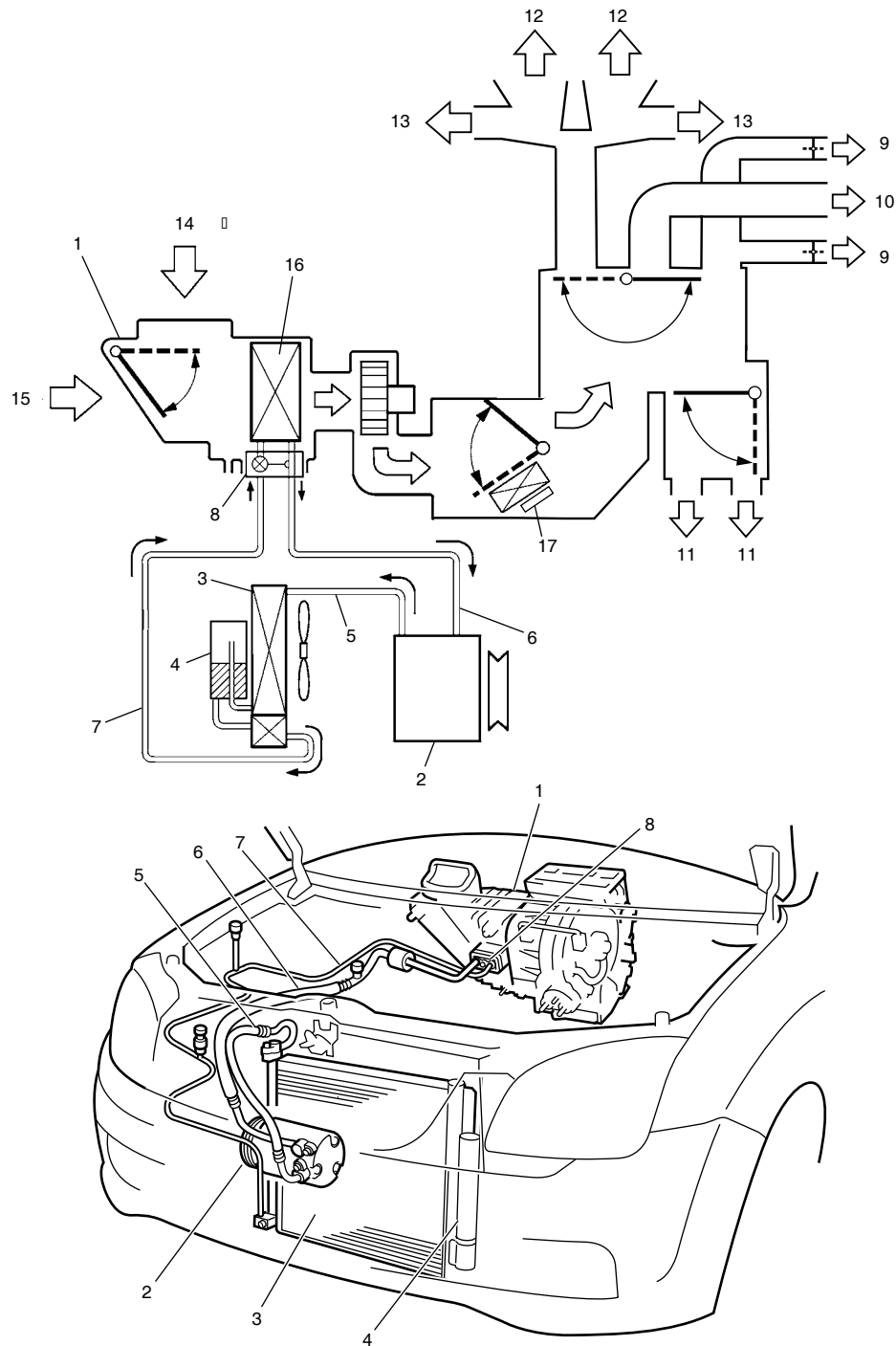
## General Description

### Major Components of A/C System

#### NOTE:

For M15 engine model, refer to the same section of the Service Manual mentioned in the “Foreword” of this service manual.

#### For Z13DT Engine Model



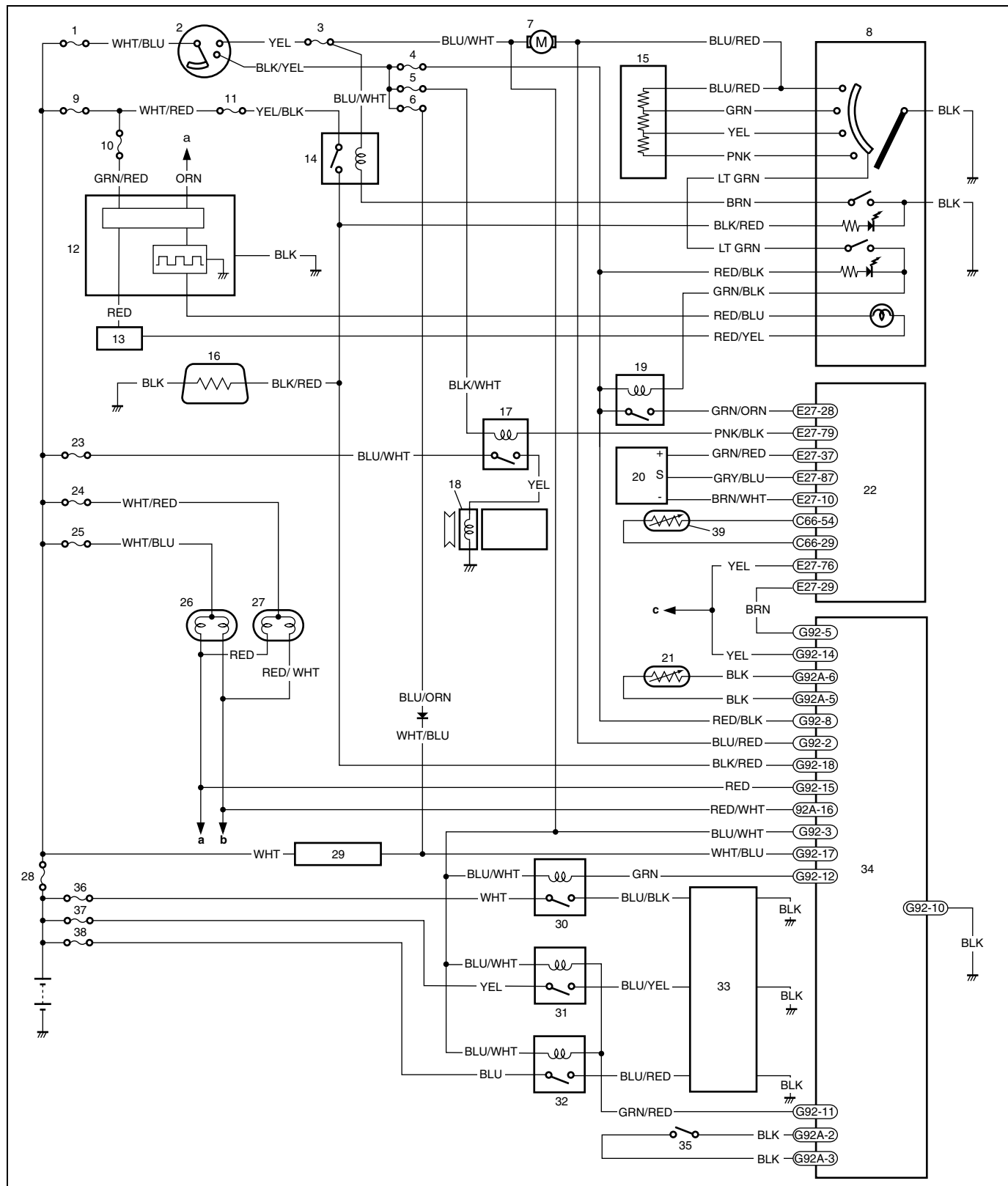
1. Cooling unit	5. Discharge hose	9. Side ventilation air	13. Side defroster air	17. Supplementary heater (if equipped)
2. Compressor	6. Suction hose	10. Center ventilation air	14. Fresh air	
3. Condenser assembly	7. Liquid pipe	11. Foot air	15. Recirculation air	
4. Receiver / dryer	8. Expansion valve	12. Front defroster air	16. Evaporator	

# A/C System Wiring Circuit Diagram

## NOTE:

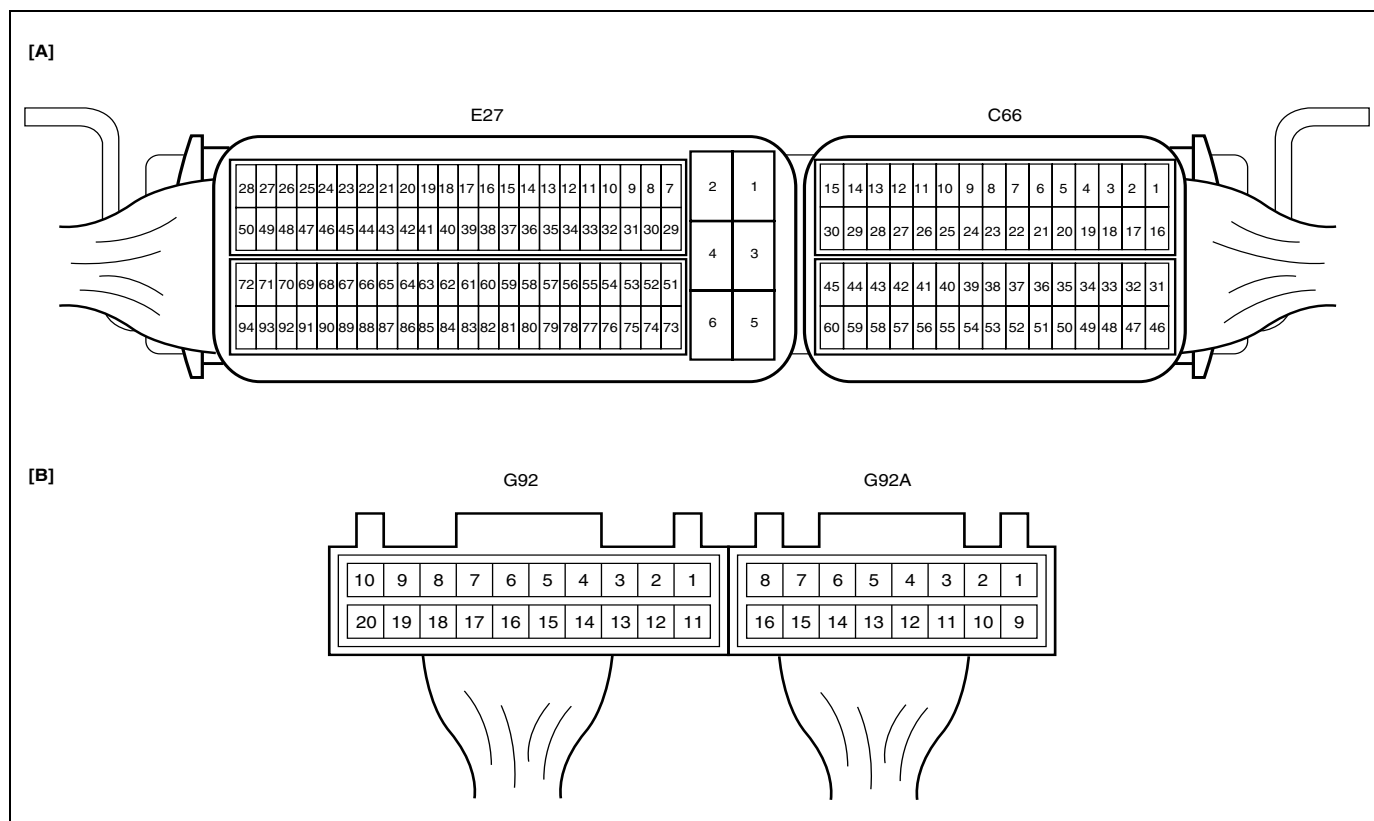
For M15 engine model, refer to the same section of the Service Manual mentioned in the “Foreword” of this service manual.

## For Z13DT Engine Model



1. "IGNITION SWITCH" fuse	12. Lighting controller	23. "COMPRESSOR RELAY" fuse	34. Supplementary heater controller
2. Ignition switch	13. Junction connector	24. "HEAD LIGHT (R)" fuse	35. Full hot switch
3. "HEATER" fuse	14. Rear defogger relay	25. "HEAD LIGHT (L)" fuse	36. Supplementary heater fuse 1
4. "TURN. BACK" fuse	15. Blower motor resistor	26. Left head light	37. Supplementary heater fuse 2
5. "IG" fuse	16. Rear defogger	27. Right head light	38. Supplementary heater fuse 3
6. "METER" fuse	17. Compressor relay	28. Main fuse	39. ETC sensor
7. Blower motor	18. Magnet clutch	29. Generator	a: To lightening switch
8. Heater control panel	19. A/C relay	30. Supplementary heater relay 1	b: To lightening switch
9. "CIRCUIT FUSE BOX" fuse	20. Pressure sensor	31. Supplementary heater relay 2	c: To fuel heating relay
10. "REAR FOG" fuse	21. Water temperature sensor	32. Supplementary heater relay 3	
11. "REAR DEFG" fuse	22. ECM	33. Supplementary heater	

## ECM and Supplementary Heater Controller Terminal Arrangements



[A]: ECM coupler

[B]: Supplementary heater controller coupler

## Diagnosis

### A/C System Symptom Diagnosis

**NOTE:**

For M15 engine model, refer to the same section of the Service Manual mentioned in the “Foreword” of this service manual.

**For Z13DT Engine Model**

Condition	Possible Cause	Correction
<b>No cool air comes out (A/C system does not operate)</b>	No refrigerant	Perform recovery, evacuation and charge.
	Fuse blown	Check related fuses, and check short circuit to ground.
	A/C switch faulty	Check A/C switch.
	Blower speed selector faulty	Check blower speed selector referring to “Blower Speed Selector Inspection” in Section 1A.
	Pressure sensor faulty	Check pressure sensor.
	Wiring or grounding faulty	Repair as necessary.
	ECT sensor faulty	Check ECT sensor referring to Section 6E3.
	ECM and/or its circuit faulty	Check ECM and its circuit referring to Section 6E3.
	Magnet clutch faulty	Check magnet clutch.
	Belt loosened or broken	Adjust or replace belt.
	Compressor faulty	Check compressor.
	Compressor relay faulty	Check compressor relay.
<b>No cool air comes out (A/C condenser cooling fan motor does not operate)</b>	Fuse blown	Check related fuses, and check for short circuit to ground.
	Wiring or grounding faulty	Repair as necessary.
	Radiator cooling fan motor relay faulty	Check radiator cooling fan motor relay.
	Radiator cooling fan motor faulty	Check radiator cooling fan motor.
<b>No cool air comes out (Blower motor does not operate)</b>	ECM and/or its circuit faulty	Check ECM and its circuit referring to Section 6E3.
	Fuse blown	Check related fuses, and check for short circuit to ground.
	Blower motor resistor faulty	Check blower motor resistor referring to “Blower Motor Resistor Inspection” in Section 1A.
	Blower speed selector faulty	Check blower speed selector referring to “Blower Speed Selector Inspection” in Section 1A.
	Wiring or grounding faulty	Repair as necessary.
	Blower motor faulty	Check blower motor referring to “Blower Motor Inspection” in Section 1A.

Condition	Possible Cause	Correction
<b>Cool air does not come out or insufficient cooling (A/C system normal operation)</b>	Insufficient or excessive charge of refrigerant	Check charge of refrigerant and system for leaks.
	Condenser clogged	Check condenser.
	A/C evaporator clogged or frosted	Check A/C evaporator and A/C evaporator temperature sensor.
	Expansion valve faulty	Check expansion valve.
	Desiccant clogged	Check receiver / dryer
	Belt loosened or broken	Adjust or replace belt.
	Magnetic clutch faulty	Check magnetic clutch.
	Compressor faulty	Check compressor.
	Air in A/C system	Replace desiccant, and perform evacuation and charge.
	Air leaking from heater and cooling unit or air duct	Repair as necessary.
	Heater and ventilation system faulty	Check air inlet box (cooling unit), heater control assembly and heater unit.
	Blower motor faulty	Check blower motor referring to "Blower Motor Inspection" in Section 1A.
	Excessive compressor oil existing in A/C system	Pull out excess compressor oil in A/C system circuit, and check compressor.
<b>Cool air does not come out only intermittently</b>	Wiring connection faulty	Repair as necessary.
	Expansion valve faulty	Check expansion valve.
	Excessive moisture in A/C system	Replace receiver / dryer, and perform evacuation and charge.
	Magnetic clutch faulty	Check magnetic clutch.
	Excessive charge of refrigerant	Check charge of refrigerant.
<b>Cool air comes out only at high speed</b>	Condenser clogged	Check condenser.
	Insufficient charge of refrigerant	Check for charge of refrigerant.
	Air in A/C system	Replace receiver / dryer, and perform evacuation and charge.
	Belt loosened or broken	Adjust or replace belt.
	Compressor faulty	Check compressor.
	Radiator cooling fan motor faulty	Check radiator cooling fan motor.
	Radiator cooling fan motor relay faulty	Check radiator cooling fan motor relay.
	Radiator cooling fan blade faulty	Check radiator cooling fan blade.
<b>Cool air does not come out only at high speed</b>	Excessive charge of refrigerant	Check for charge of refrigerant.
	A/C evaporator frosted	Check A/C evaporator and A/C evaporator temperature sensor.
<b>Insufficient airflow of cooled air</b>	A/C evaporator clogged or frosted	Check A/C evaporator and A/C evaporator temperature sensor.
	Air leaking from cooling unit or air duct	Repair as necessary.
	Blower motor faulty	Check blower motor referring to "Blower Motor Inspection" in Section 1A.
	Wiring or grounding faulty	Repair as necessary.

## On-Vehicle Service

### Operation Procedure for Refrigerant Charge

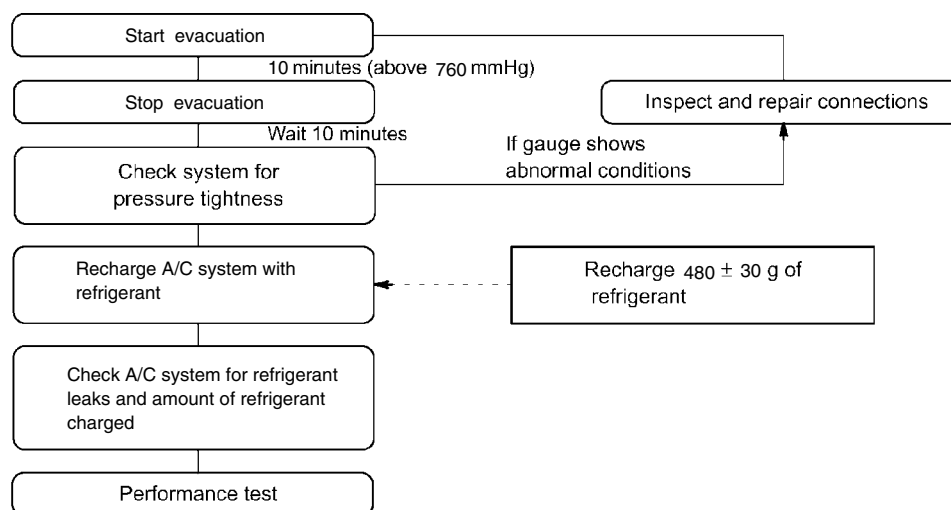
#### NOTE:

For M15 engine model, refer to the same section of the Service Manual mentioned in the “Foreword” of this service manual.

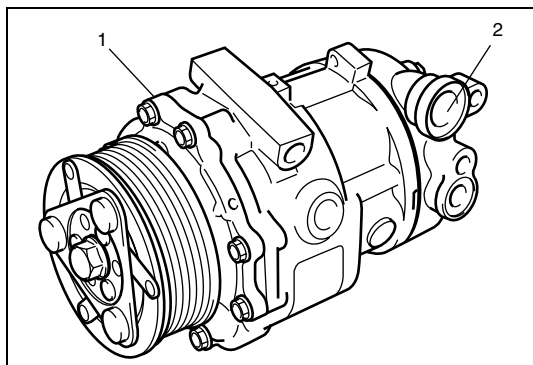
#### For Z13DT Engine Model

#### WARNING:

- Your eyes should not be exposed to refrigerant (liquid).  
Any liquid HFC-134a (R-134a) escaping by accident shows a temperature as low as approximately  $-6^{\circ}\text{C}$  ( $21^{\circ}\text{F}$ ) below freezing point. Should liquid HFC-134a (R-134a) get into your eyes, it may cause a serious injury. To protect your eyes against such accident, it is necessary to always wear goggles. Should it occur that HFC-134a (R-134a) strikes your eyes, consult a doctor immediately.
  - Do not use your hand to rub the affected eye(s). Instead, use quantities of fresh cold water to splash it over the affected area to gradually raise temperature of such area above freezing point.
  - Obtain proper treatment as soon as possible from a doctor or eye specialist.
- Should the HFC-134a (R-134a) liquid come into contact with your skin, the affected area should be treated in the same manner as when skin is frostbitten or frozen.
- Refrigerant must not be handled near where welding or steam cleaning is performed.
- Refrigerant should be kept at a cold and dark place. It should never be stored where a high temperature is anticipated, e.g. where exposed to direct sun light, close to fire or inside vehicle (including trunk room).
- Avoid breathing fumes produced when HFC-134a (R-134a) is burned. Such fumes may be hazardous to health.



## Replenishing compressor oil



### NOTE:

For M15 engine model, refer to the same section of the Service Manual mentioned in the “Foreword” of this service manual.

### For Z13DT Engine Model

It is necessary to replenish specified amount of compressor oil to compressor (1) from compressor suction side hole (2) before evacuating and charging refrigerant.

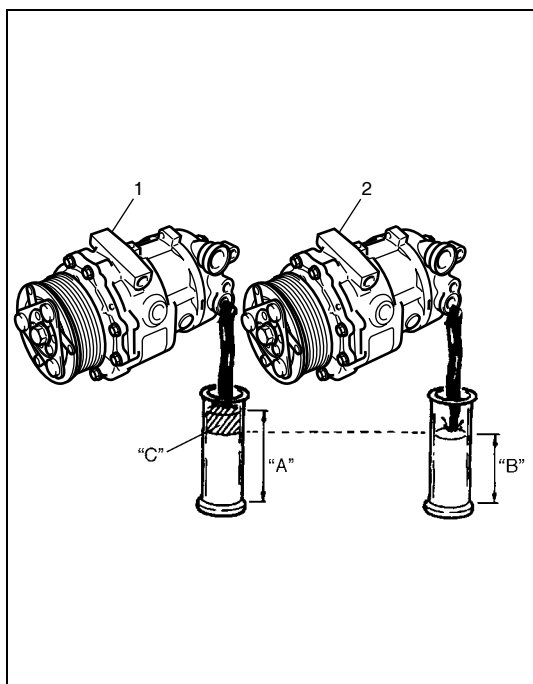
### When Charging Refrigerant Only

When evacuating and charging refrigerant without replacing any component part, replenish the same amount of measured oil when recovering refrigerant (if not measured, replenish 30 cc oil).

### When Replacing Compressor

#### CAUTION:

Be sure to use P/N: 99000-990C5-00A compressor oil or an equivalent compressor oil.



Compressor oil is sealed in each new compressor by the amount required for A/C system. Therefore, when using a new compressor for replacement, drain oil from it by the amount calculated as follows.

$$“C” = “A” - “B”$$

“C”: Amount of oil to be drained

“A”: Amount of oil sealed in a new compressor

“B”: Amount of oil remaining in removed compressor

### NOTE:

Compressor assembly supplied from factory is filled up with the following amount of oil.

Oil amount in compressor

100 cm<sup>3</sup> (100 cc, 6.1 in<sup>3</sup>)

1.	New compressor
2.	Removed compressor

## Procedure After ECM Replacement (Z13DT Engine Model)

Refer to “Procedure after ECM replacement” under “ECM Registration” in Section 6E3.



## Condenser Assembly Removal and Installation

**CAUTION:**

Be careful not to damage condenser fins. If condenser fin is bent, straighten it by using flat head screwdriver or pair of pliers.

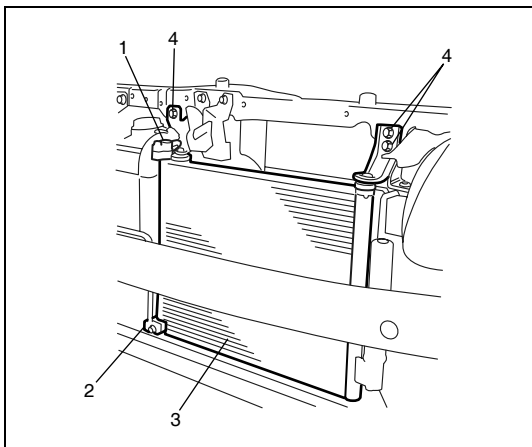
**Removal****For Z13DT Engine Model**

- 1) Disconnect negative (–) cable at battery.
- 2) Recover refrigerant from A/C system by referring to “Recovery” in this section.

**NOTE:**

The amount of removed compressor oil must be measured for replenishing compressor oil.

- 3) Remove front bumper referring to “Front Bumper and Rear Bumper” in Section 9.
- 4) Disconnect discharge hose (1) and liquid pipe (2) from condenser assembly (3).
- 5) Remove condenser bracket bolts (4).
- 6) Remove condenser assembly (3).

**For M15 Engine Model****NOTE:**

For M15 engine model, refer to the same section of the Service Manual mentioned in the “Foreword” of this service manual.

**Installation****For Z13DT Engine Model**

Reverse removal procedure to install condenser noting the following instructions.

- Replenish specified amount of compressor oil to compressor suction side by referring to “Replenishing compressor oil” in this section.
- Evacuate and charge refrigerant by referring to “Evacuation of A/C System” and “Charge” in this section.

## For M15 Engine Model

### NOTE:

For M15 engine model, refer to the same section of the Service Manual mentioned in the “Foreword” of this service manual.

## Receiver / Dryer Removal and Installation

### Removal

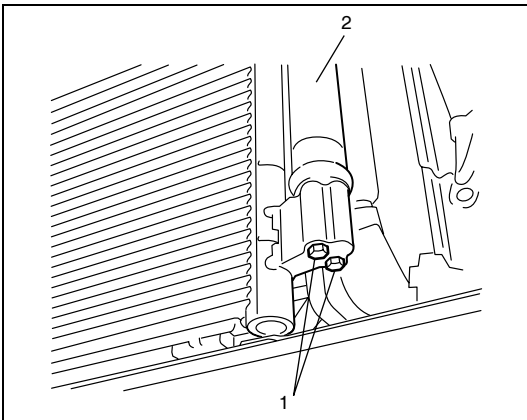
#### For Z13DT Engine Model

- 1) Remove refrigerant from A/C system by referring to “Recovery” in this section.

### NOTE:

The amount of removed compressor oil must be measured for replenishing compressor oil.

- 2) Remove front bumper referring to “Front Bumper and Rear Bumper” in Section 9.
- 3) Loosen receiver / dryer attachment bolts (1).
- 4) Remove receiver / dryer (2).



#### For M15 Engine Model

### NOTE:

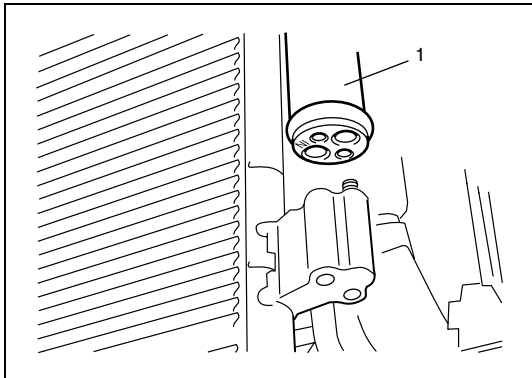
For M15 engine model, refer to the same section of the Service Manual mentioned in the “Foreword” of this service manual.

## Installation

### For Z13DT Engine Model

Reverse removal procedure to install receiver / dryer noting the following instructions.

- Replenish specified amount of compressor oil to compressor suction side by referring to “Replenishing compressor oil” (Z13DT Engine) in this section.
- Be sure to install receiver / dryer (1) to proper direction as shown.
- Evacuate and charge refrigerant by referring to “Evacuation of A/C System” and “Charge” in this section.



### For M15 Engine Model

#### NOTE:

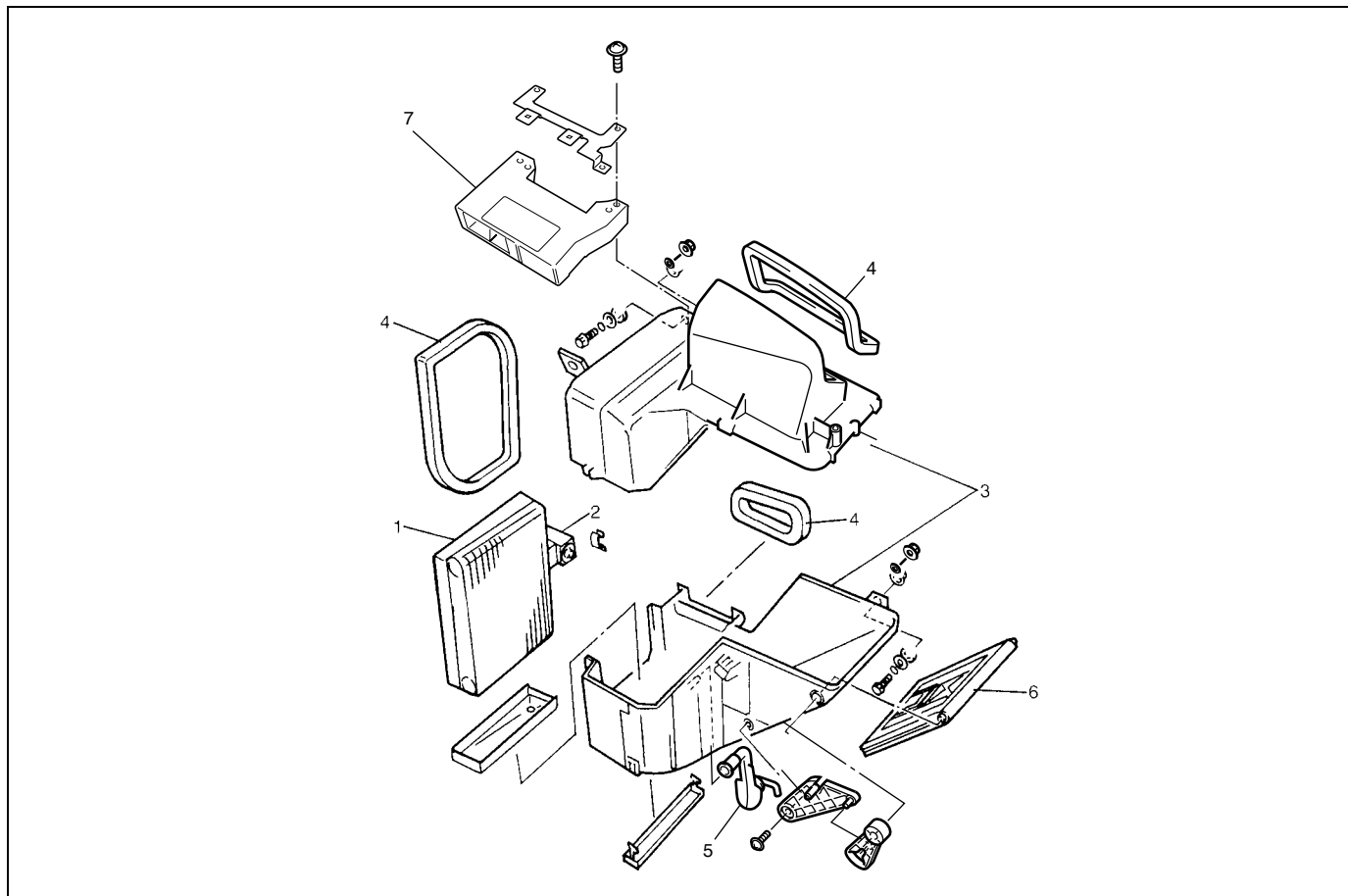
For M15 engine model, refer to the same section of the Service Manual mentioned in the “Foreword” of this service manual.

## Cooling Unit (Evaporator) Components

### NOTE:

For M15 engine model, refer to the same section of the Service Manual mentioned in the “Foreword” of this service manual.

### For Z13DT Engine Model



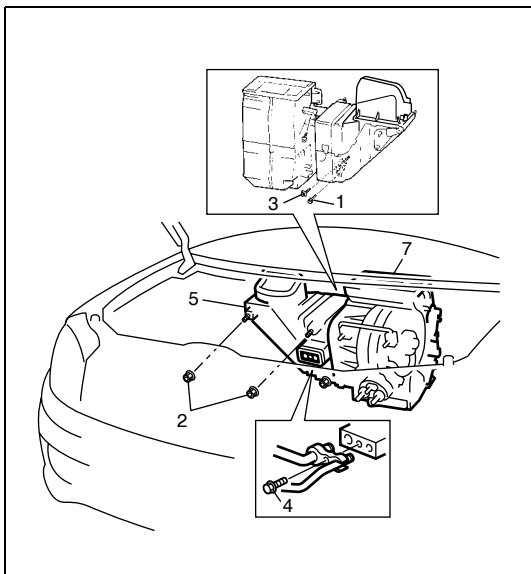
1. Evaporator	3. Evaporator case	5. Drain hose	7. Supplementary heater controller (if equipped)
2. Expansion valve	4. Packing	6. Air inlet door	

## Cooling Unit (Evaporator) Removal and Installation

### Removal

#### For Z13DT Engine Model

- 1) Disconnect negative (–) cable at battery.
- 2) If equipped with air bag system, disable air bag system referring to “Disabling Air Bag System” in Section 10B.
- 3) Recover refrigerant from refrigeration system by using recovery and recycling equipment referring to “Operation Procedure for Refrigerant Charge” in this section.
- 4) Remove heater control cable and main harness clamp.
- 5) Remove 20-pin connector from supplementary heater controller and two connectors located on supplementary heater controller.
- 6) Loosen suction hose and liquid pipe bolt (4).
- 7) Loosen cooling unit bolt (1), nut (2) and screw (3) as shown in figure.
- 8) Remove cooling unit (5).



#### For M15 Engine Model

#### NOTE:

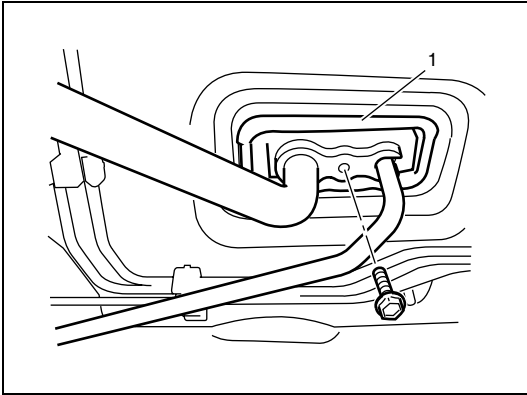
For M15 engine model, refer to the same section of the Service Manual mentioned in the “Foreword” of this service manual.

## Installation

### For Z13DT Engine Model

Reverse removal sequence to install cooling unit, noting the following points.

- If cooling unit or evaporator is replaced, pour 25 cc of refrigerating oil to compressor suction-side.
- Install uniformly the padding (1) to installation hole.
- Evacuate and charge system according to previously described procedure.
- Adjust heater control cable, referring to "Heater Control Lever Assembly Removal and Installation" in Section 1A.
- Enable air bag system, if equipped.



### For M15 Engine Model

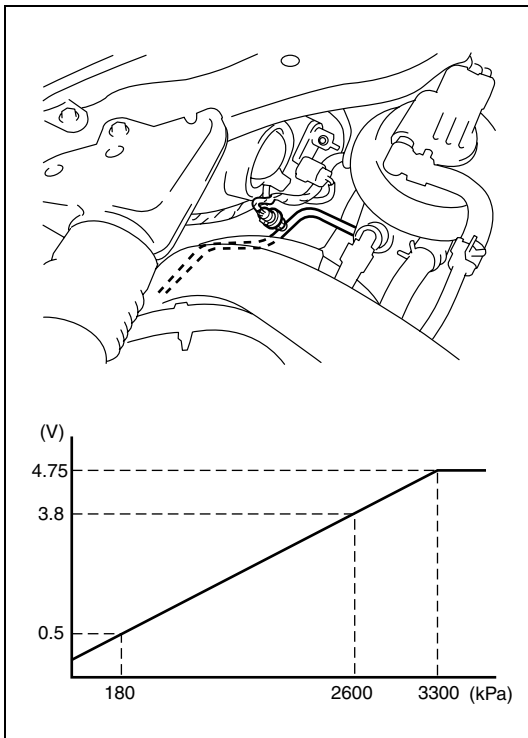
#### NOTE:

For M15 engine model, refer to the same section of the Service Manual mentioned in the "Foreword" of this service manual.

## Pressure Sensor Inspection (Z13DT Engine)

- 1) Connect manifold gauge to A/C system and operate A/C system.
- 2) Check output voltage for pressure sensor (1) between GRY/BLU and BRN/WHT, and then compare measured voltage with specified voltage in graph.

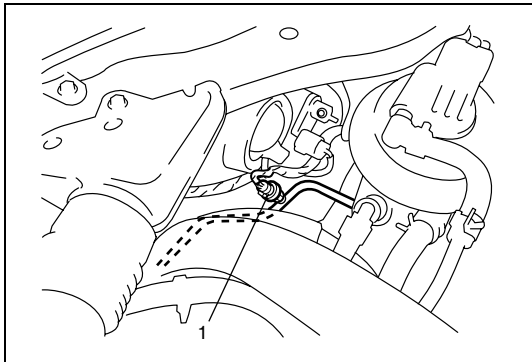
If it does not show such characteristic as shown in graph, replace pressure sensor.



## Pressure Sensor Removal and Installation (Z13DT Engine)

### Removal

- 1) Recover refrigerant from refrigeration system by using recovery and recycling equipment referring to "Operation Procedure for Refrigerant Charge" in this section.
- 2) Disconnect negative (–) cable at battery.
- 3) Remove pressure sensor (1).



### Installation

Reverse removal procedure for installation, noting the following points.

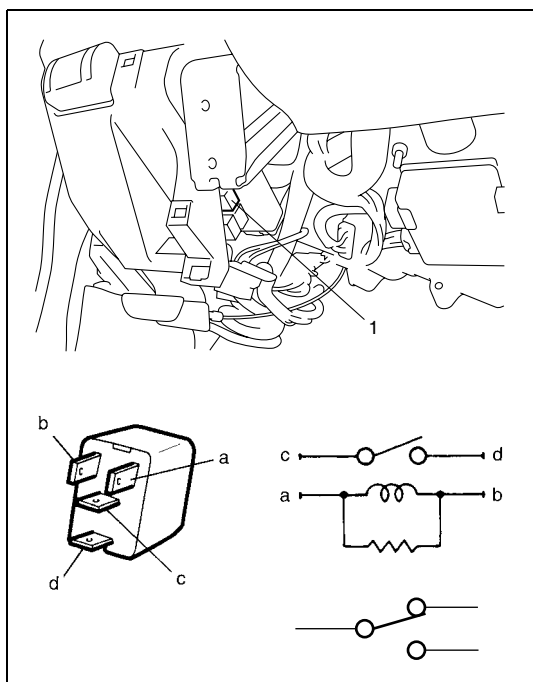
- Apply compressor oil to dual pressure switch O-ring.
- Evacuate and charge system according to previously described procedure.

### Tightening torque

**Pressure sensor:** 11 N·m (1.1 kg-m, 8.0 lb-ft)

## A/C Relay Inspection (Z13DT Engine)

- 1) Disconnect negative (–) cable at battery.
- 2) Remove steering column hole cover.
- 3) Remove A/C relay (1).
- 4) Check that there is no continuity between terminal "c" and "d". If there is continuity, replace relay.
- 5) Connect battery positive (+) terminal to terminal "b" of relay. Connect battery negative (–) terminal to terminal "a" of relay. Check for continuity between terminal "c" and "d". If there is no continuity when relay is connected to the battery, replace relay.

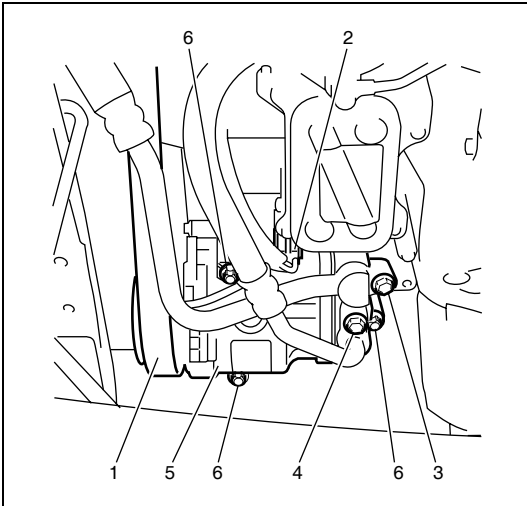


## Compressor Assembly Removal and Installation

### Removal

#### For Z13DT Engine Model

- 1) Run engine at idle speed with air conditioning ON for 10 minutes. After that stop the engine.
- 2) Disconnect negative (–) cable at battery.
- 3) Remove front bumper by referring to “Front Bumper and Rear Bumper” in Section 9.
- 4) Remove belt (1).
- 5) Disconnect magnet clutch lead wire coupler (2).
- 6) Disconnect suction pipe (3) and discharge hose (4) from compressor (5).



#### NOTE:

**Cap open fittings immediately to keep moisture out of system.**

- 7) Remove compressor mounting bolts (6), and then remove compressor (5) from its bracket.

#### For M15 Engine Model

#### NOTE:

**For M15 engine model, refer to the same section of the Service Manual mentioned in the “Foreword” of this service manual.**

### Installation

#### For Z13DT Engine Model

Reverse removal procedure to install compressor noting the following instructions.

- If compressor is replaced, pour new compressor oil by referring to “Replenishing compressor oil” in this section.
- Evacuate and charge system by referring to “Recovery” in this section.
- Adjust drive belt tension by referring to “Compressor Drive Belt Inspection and Adjustment” in this section.

#### For M15 Engine Model

#### NOTE:

**For M15 engine model, refer to the same section of the Service Manual mentioned in the “Foreword” of this service manual.**



## Compressor Drive Belt Inspection and Adjustment

### Inspection

#### For Z13DT Engine Model

Refer to “Water Pump/Generator Drive Belt Tension Inspection” in Section 6B3.

#### For M15 Engine Model

#### NOTE:

For M15 engine model, refer to the same section of the Service Manual mentioned in the “Foreword” of this service manual.

## Compressor Drive Belt Replacement

### Replacement

#### For Z13DT Engine Model

Refer to “Water Pump/Generator Drive Belt Tension Inspection” in Section 6B3.

#### For M15 Engine Model

#### NOTE:

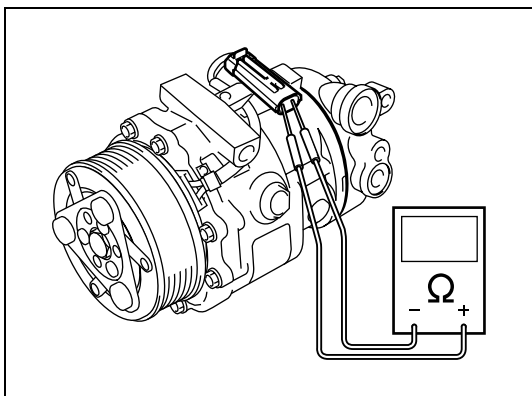
For M15 engine model, refer to the same section of the Service Manual mentioned in the “Foreword” of this service manual.

## Magnet Clutch Inspection

### For Z13DT Engine Model

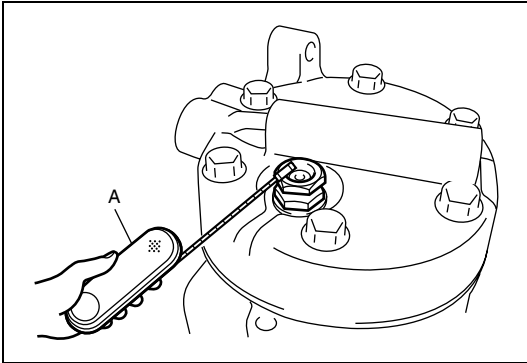
- Check armature plate and magnet clutch pulley for wear and oil soaked conditions respectively.
- Check magnet clutch pulley bearing for noise, wear and grease leakage.
- Measure magnet clutch coil for resistance at 20 °C (68 °F).  
If the measured resistance does not remain within above tolerance, replace compressor assembly.

**Standard Resistance: approximately 3.7  $\Omega$**



**For M15 Engine Model****NOTE:**

For M15 engine model, refer to the same section of the Service Manual mentioned in the “Foreword” of this service manual.

**Relief Valve Inspection****For Z13DT Engine Model**

By using special tool, check if there is refrigerant leakage.  
If there is refrigerant leakage, replace the compressor assembly.

**Special tool**

(A): 09990-86011

**For M15 Engine Model****NOTE:**

For M15 engine model, refer to the same section of the Service Manual mentioned in the “Foreword” of this service manual.

**Specifications****Tightening Torque Specifications****For M15 Engine Model****NOTE:**

For M15 engine model, refer to the same section of the Service Manual mentioned in the “Foreword” of this service manual.

**For Z13DT Engine Model**

Fastening part		Tightening torque		
		N•m	kg-m	lb-ft
Refrigerant line	8 mm pipe	13	1.3	9.5
	12 mm pipe	23	2.3	17.0
	14.5 mm pipe	33	3.3	24.0
Pressure sensor		11	1.1	8.0

## Special Tools and Equipment

### Required Service Material

#### For M15 Engine Model

**NOTE:**

For M15 engine model, refer to the same section of the Service Manual mentioned in the “Foreword” of this service manual.

#### For Z13DT Engine Model

Material	Recommended SUZUKI product (Part Number)	Use
Compressor oil (refrigerant oil)	COMPRESSOR OIL P/No.: 99000-990C5-00A	<ul style="list-style-type: none"><li>• O-ring</li><li>• Each component</li></ul>

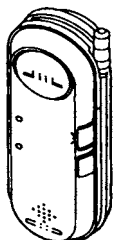
## Special Tool

#### For M15 Engine Model

**NOTE:**

For M15 engine model, refer to the same section of the Service Manual mentioned in the “Foreword” of this service manual.

#### For Z13DT Engine Model



09990-86011

Gas leak detector

SECTION 3B

MANUAL RACK AND PINION

WARNING:

For vehicles equipped with Supplemental Restraint (Air Bag) System:

- Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to “Air Bag System Components and Wiring Location View” under “General Description” in air bag system section in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and “Service Precautions” under “On-Vehicle Service” in air bag system section before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.
- Technical service work must be started at least 90 seconds after the ignition switch is turned to the “LOCK” position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).

NOTE:

- All steering gear fasteners are important attaching parts in that they could affect the performance of vital parts and systems, and/or could result in major repair expense. They must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of these parts.
- For the items with asterisk (\*) in the “CONTENTS” below, refer to the same section of the Service Manual mentioned in “Foreword” of this manual.

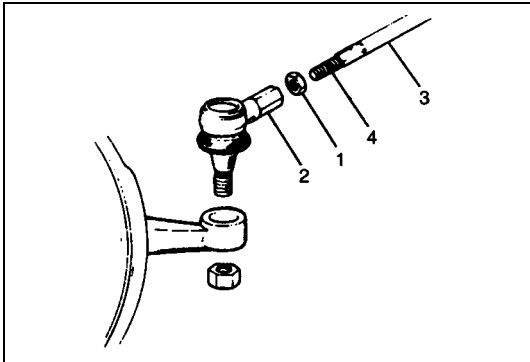
CONTENTS

<b>General Description</b> ..... *	<b>Unit Repair</b> ..... *
Rack and Pinion Steering Construction ..... *	Rack Boot / Tie Rod Removal and
<b>Diagnosis</b> ..... *	Installation..... *
Diagnosis Table ..... *	Steering Rack Plunger Removal and
Steering Wheel Check ..... *	Installation..... *
Steering Rack Boot Check ..... *	Steering Rack Plunger Inspection..... *
Tie Rod End Boot Check..... *	Steering Pinion Removal and Installation ..... *
Steering Shaft Joint Check..... *	Steering Pinion Inspection ..... *
Tie Rod End Check ..... *	Steering Rack Removal and Installation ..... *
<b>On-Vehicle Service</b> .....3B-2	Steering Rack Inspection ..... *
Rack and Pinion Assembly Components ..... *	Pinion Bearing Removal and Installation ..... *
Tie Rod End Removal and Installation..... 3B-2	<b>Tightening Torque Specifications</b> ..... 3B-7
Steering Gear Case Removal and	<b>Required Service Material</b> ..... *
Installation (for Gasoline Engine Model) ..... *	<b>Special Tool</b> ..... *
Steering Gear Case Removal and	
Installation (for Diesel Engine Model) ..... 3B-2	

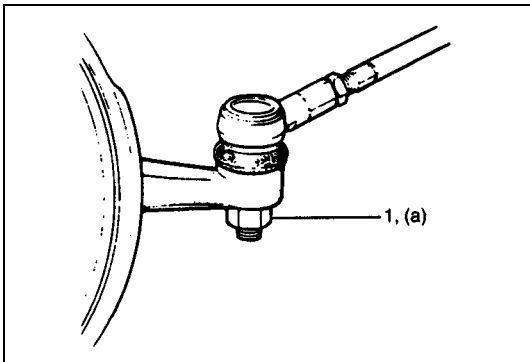
## On-Vehicle Service

### Tie Rod End Removal and Installation

#### Installation



- 1) Install tie rod end lock nut (1) and tie rod end (2) to tie rod (3). Align lock nut with mark (4) on tie rod thread.

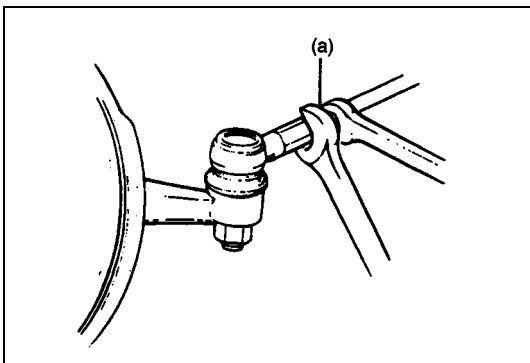


- 2) Connect tie rod end to knuckle. Tighten new tie rod end nut (1) to specified torque.

#### Tightening torque

**Tie rod end nut (a): 40 N·m (4.0 kg-m, 29.0 lb-ft)**

- 3) Inspect for proper toe (Refer to "Front End Alignment").



- 4) After confirming proper toe, tighten tie rod end lock nut to specified torque.

#### Tightening torque

**Tie rod end lock nut (a): 45 N·m (4.5 kg-m, 32.5 lb-ft)**

- 5) Tighten wheel bolts to specified torque and lower hoist.

#### Tightening torque

**Wheel bolt: 95 N·m (9.5 kg-m, 69.0 lb-ft)**

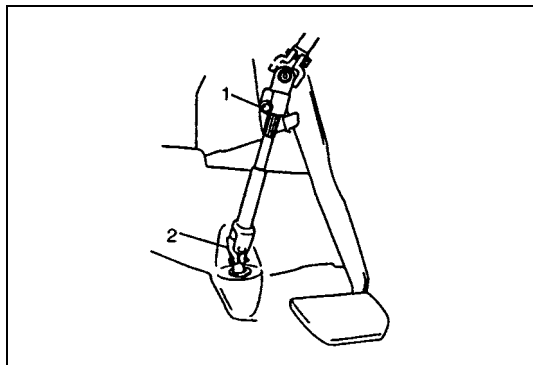
### Steering Gear Case Removal and Installation (for Diesel Engine Model)

#### Removal

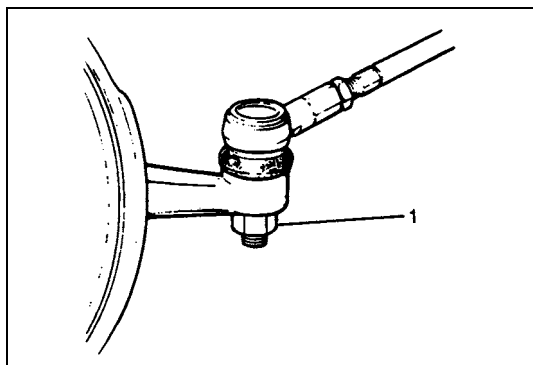
##### CAUTION:

Be sure to set front wheels in straight direction and remove ignition key from key cylinder before these steps, otherwise contact coil of air bag system may get damaged.

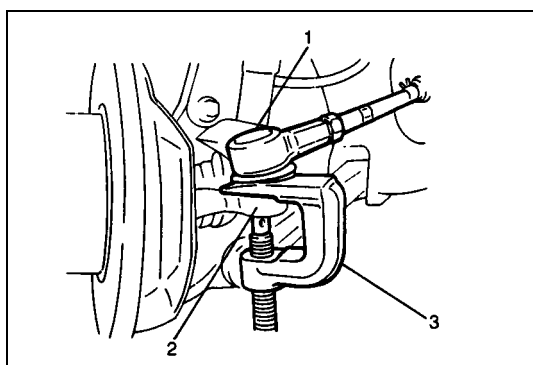
- 1) Slide driver's seat as far back as possible.



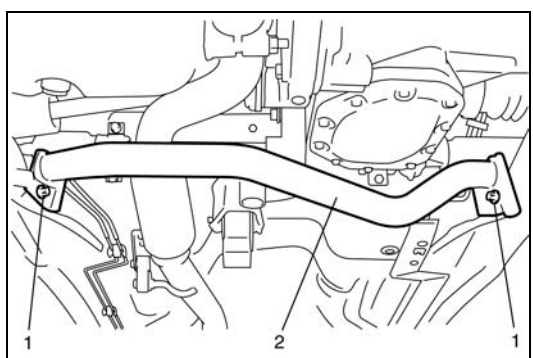
- 2) For ease of installation, loosen steering shaft upper joint bolt (1) but don't remove.
- 3) Remove steering shaft lower joint bolt (2).
- 4) Disconnect lower joint from pinion.
- 5) Hoist vehicle and remove both wheels referring to "Wheel Removal and Installation" in Section 3F.



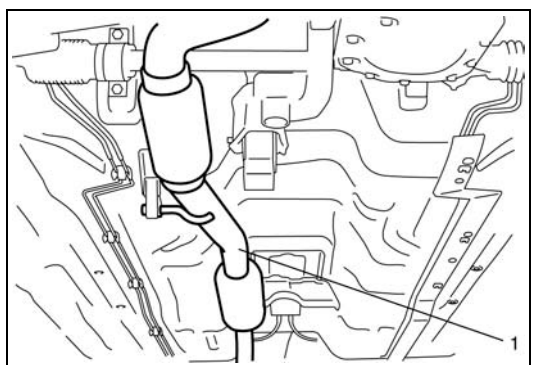
- 6) Remove tie rod end nuts (1) from both steering knuckles.



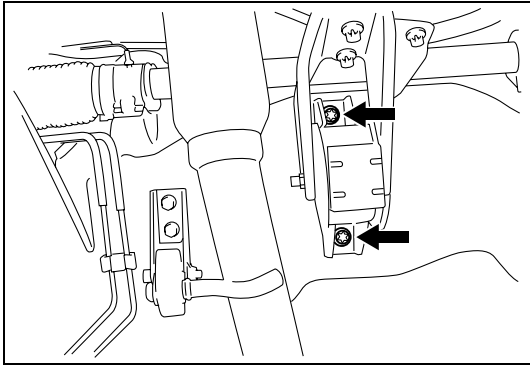
- 7) Disconnect both tie rod ends (1) from knuckles (2), using puller (3).



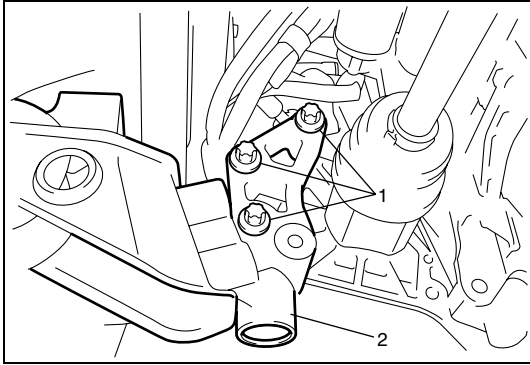
- 8) Remove lower member mounting bolts (1) and lower member (2).



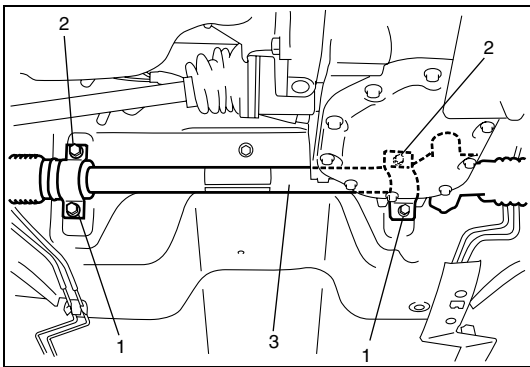
- 9) Remove exhaust pipe (1) referring to "Exhaust Pipe".



- 10) Support engine with transmission by transmission jack and then remove engine rear mount bracket from floor panel.



- 11) Remove engine mount bracket bolts (1) and engine rear mount bracket (2).



- 12) Remove steering gear case mounting bolts (1), nuts (2) and gear case brackets, then remove gear case (3).

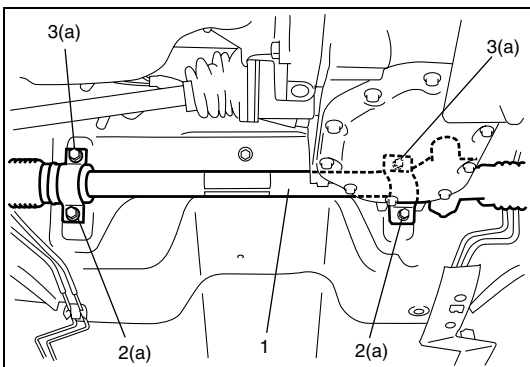
## Installation

- 1) Apply grease to inside of pinion packing and install pinion packing onto pinion. Mount steering gear case (1) to body and tighten gear case mounting bolts (2) and nuts (3) to specified torque.

### Tightening torque

#### Steering gear case mounting bolt and nut

(a): 25N·m (2.5 kg-m, 18.0 lb-ft)





- 2) Remount the engine with transmission and tighten each bolt to specified torque.

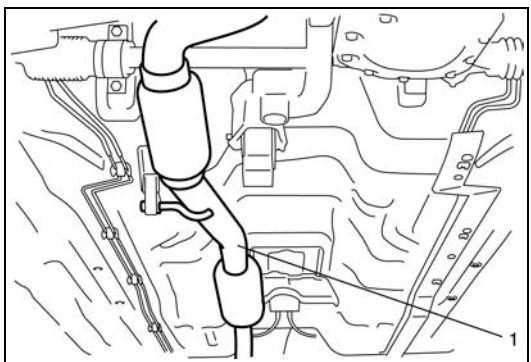
**Tightening torque**

**Engine rear mount bracket bolt**

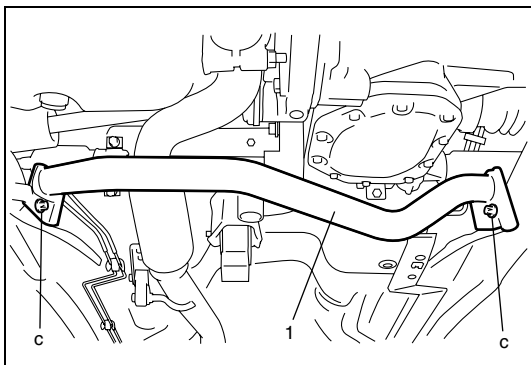
**(a): 85 N·m (8.5 kg-m, 61.5 lb-ft)**

**Engine rear mounting bolt**

**(b): 55N·m (5.5 kg-m, 40.0 lb-ft)**



- 3) Install exhaust pipe (1) referring to "Exhaust Pipe".



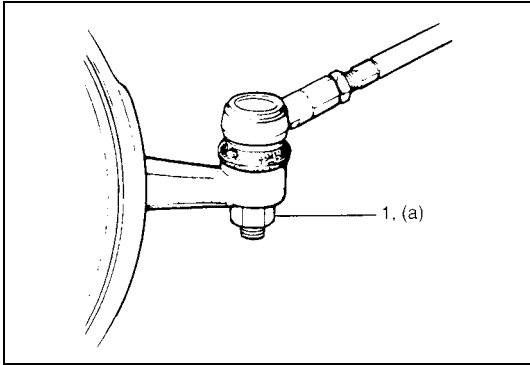
- 4) Install control arm cross member (1).

**Tightening torque**

**Control arm cross member (c): 60 N·m (6.0 kg-m, 43.5 lb-ft)**

- 5) Remove transmission jack.



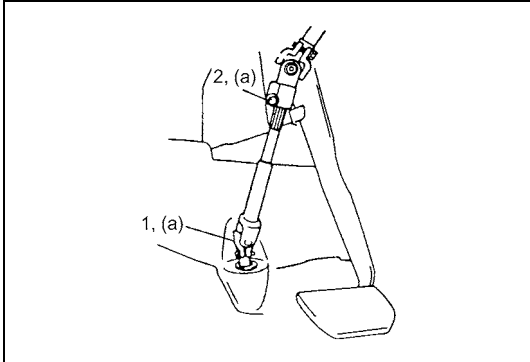


- 6) Install tie rod ends to knuckles (right & left). Tighten each new tie rod end nut (1) to specified torque.

**Tightening torque**

**Tie rod end nut (a): 40 N·m (4.0 kg-m, 29.0 lb-ft)**

- 7) Be sure that steering wheel and brake discs (right & left) are all straight-ahead position and then insert steering lower joint into steering pinion shaft.



- 8) Tighten steering shaft joint bolts (1) and (2) to specified torque (Lower side first and then upper side).

**Tightening torque**

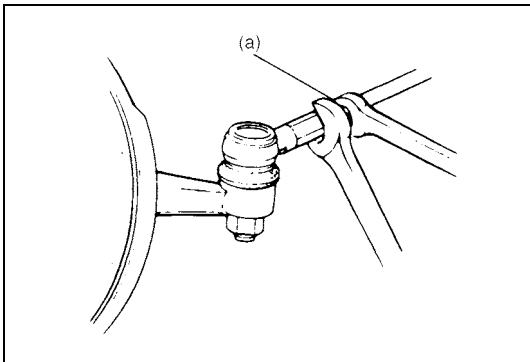
**Steering shaft joint bolt (a): 28 N·m (2.8 kg-m, 20.5 lb-ft)**

- 9) Install both wheels and tighten wheel bolts to specified torque.

**Tightening torque**

**Wheel bolt: 95 N·m (9.5 kg-m, 69.0 lb-ft)**

- 10) Lower hoist.  
11) Check toe setting. Adjust as required (refer to "Front Wheel Alignment" in Section 3A).



- 12) Tighten both tie rod end lock nuts to specified torque.

**Tightening torque**

**Tie rod end lock nut (a): 45 N·m (4.5 kg-m, 32.5 lb-ft)**

## Tightening Torque Specifications

Fastening part	Tightening torque		
	N•m	kg-m	lb-ft
Steering gear case mounting bolt and nut	25	2.5	18.0
Engine rear mount bracket bolt	85	8.5	61.5
Engine rear mounting bolt	55	5.5	40.0
Control arm cross member	60	6.0	43.5
Tie rod end nut	40	4.0	29.0
Steering shaft joint bolt	28	2.8	20.5
Wheel bolt	95	9.5	69.0
Tie rod end lock nut	45	4.5	32.5



## SECTION 3D

# FRONT SUSPENSION

### NOTE:

- All front suspension fasteners are an important attaching part in that it could affect the performance of vital parts and systems, and/or could result in major repair expense. They must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.
- Never attempt to heat, quench or straighten any front suspension part. Replace it with a new part or damage to the part may result.
- For the items with asterisk (\*) in the "CONTENTS" below, refer to the same section of the Service Manual mentioned in "Foreword" of this manual.

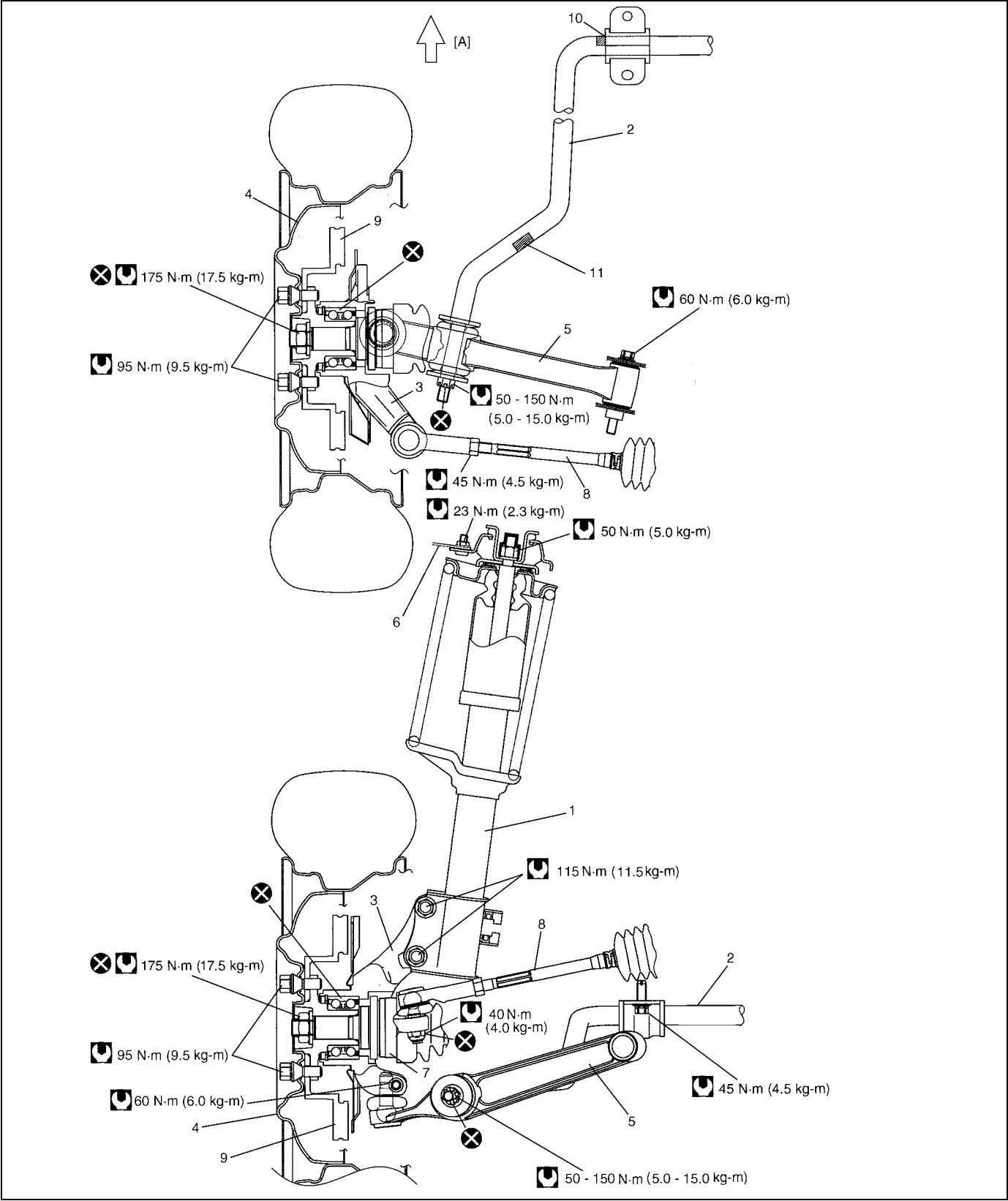
3D

## CONTENTS

<b>General Description .....</b>	<b>3D-2</b>	Stabilizer Bar and Bushings Component .....	*
Front Suspension Construction .....	3D-2	Stabilizer Bar and Bushings Removal	
<b>Diagnosis .....</b>	<b>3D-3</b>	and Installation .....	3D-4
Diagnosis Table .....	*	Wheel Hub and Steering Knuckle	
Stabilizer Bar and Bushing Check .....	*	Component .....	*
Strut Assembly Check .....	*	Wheel Hub and Steering Knuckle	
Suspension Control Arm / Steering		Removal and Installation .....	3D-5
Knuckle Check .....	*	Wheel Hub and Steering Knuckle	
Suspension Control Arm Joint Check .....	*	Disassembly and Assembly .....	*
Front Suspension Fasteners Check .....	*	Suspension Control Arm / Bushing	
Wheel Disc, Nut and Bearing Check .....	3D-3	Removal and Installation .....	*
<b>On-Vehicle Service .....</b>	<b>3D-4</b>	Suspension Control Arm / Bushing	
Strut Assembly Component .....	*	Disassembly and Assembly .....	*
Strut Assembly Removal and Installation .....	3D-4	<b>Tightening Torque Specifications .....</b>	<b>3D-7</b>
Strut Assembly Disassembly and		<b>Required Service Material .....</b>	*
Assembly .....	*	<b>Special Tool .....</b>	*

General Description

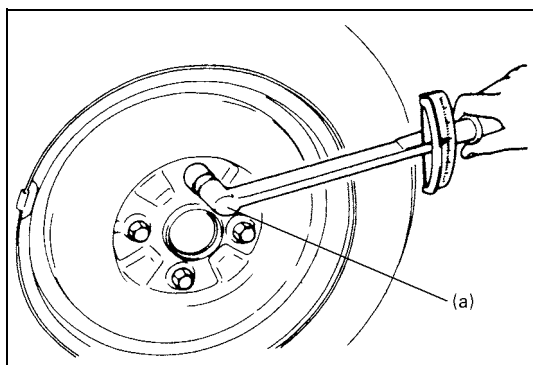
Front Suspension Construction



1. Strut assembly	4. Wheel	7. Drive shaft	10. Paint mark	Tightening torque
2. Stabilizer bar	5. Suspension control arm	8. Tie rod	11. Paint mark (only RH side)	Do not reuse.
3. Steering knuckle	6. Vehicle body	9. Brake disc	[A] : Forward	

## Diagnosis

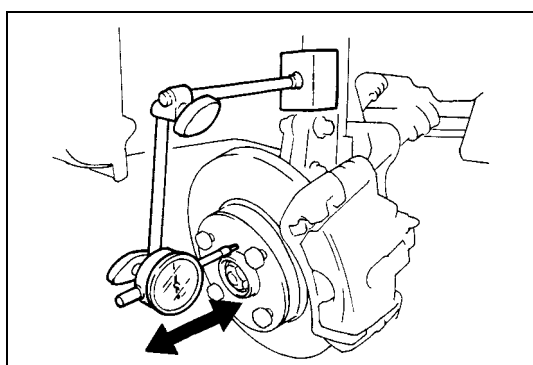
### Wheel Disc, Nut and Bearing Check



- Inspect each wheel disc for dents, distortion and cracks. A disc in badly damaged condition must be replaced.
- Check wheel bolts for tightness and, as necessary, retighten them to specification.

#### Tightening torque

**Wheel bolt (a): 95 N·m (9.5 kg-m, 69.0 lb-ft)**

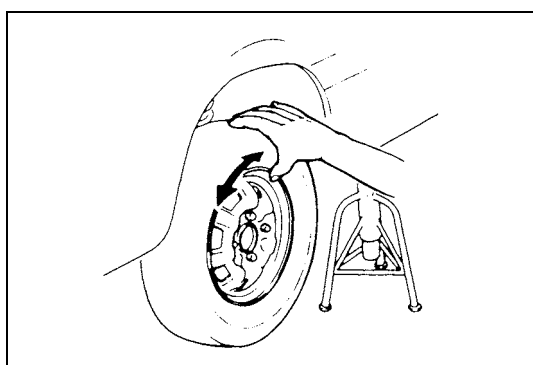


- Check wheel bearing for wear.
  - a) Remove wheel, referring to “Wheel Removal and Installation” in Section 3F.
  - b) Fix brake disc tightening wheel bolts.
  - c) Set a dial gauge.
  - d) Check wheel bearing for thrust play.
 

When measurement exceeds limit, replace bearing.

#### Thrust play limit:

**0.1 mm (0.004 in.)**



- By rotating wheel actually, check wheel bearing for noise and smooth rotation.
 

If defective, replace bearing.

## On-Vehicle Service

### Strut Assembly Removal and Installation

#### Installation

Install strut assembly by reversing removal procedure, noting the following instructions.

- Insert bolts in such direction as shown in figure.
- Tighten all fasteners to specified torque.

#### Tightening torque

**Strut bracket nut (a): 115 N·m (11.5 kg-m, 83.0 lb-ft)**

**Strut support nut (b): 23 N·m (2.3 kg-m, 17.0 lb-ft)**

**Strut nut (c): 50 N·m (5.0 kg-m, 36.5 lb-ft)**

#### CAUTION:

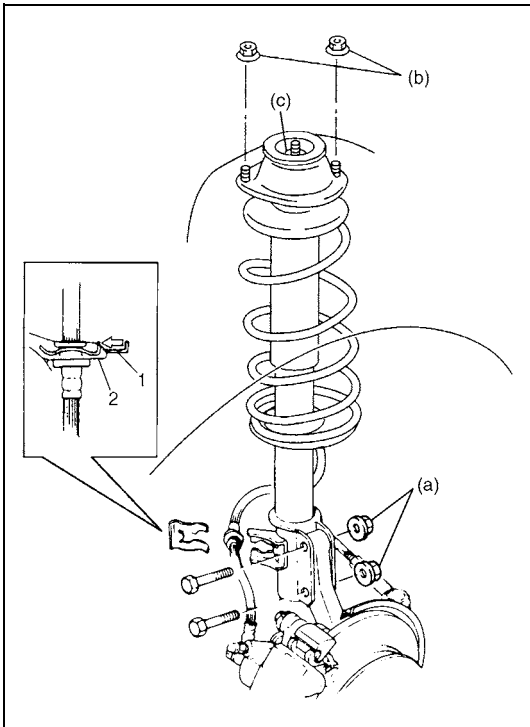
- Don't twist brake hose when installing it.
- Install E-ring (1) as far as it fits to bracket (2) as shown in figure.

- Tighten wheel bolts to specified torque.

#### Tightening torque

**Wheel bolt: 95 N·m (9.5 kg-m, 69.0 lb-ft)**

- After installation, confirm front wheel alignment referring to "Preliminary Checks Prior to Adjusting Front Wheel Alignment" in Section 3A.

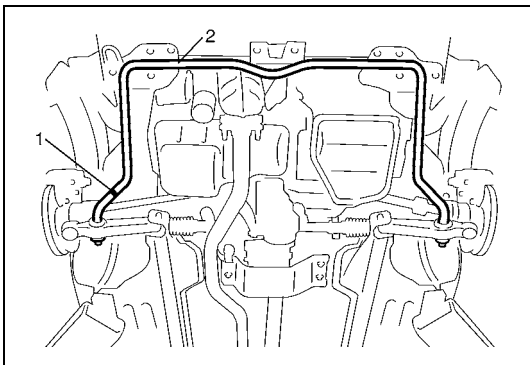


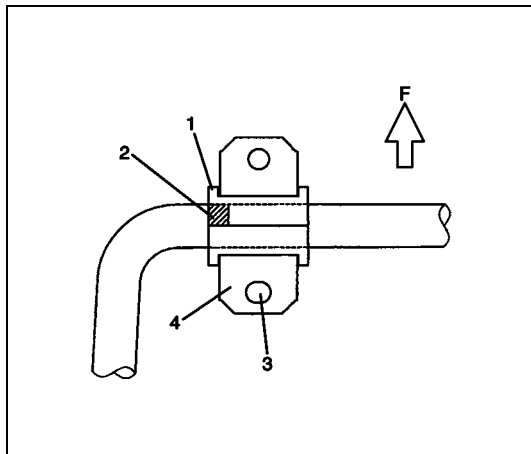
### Stabilizer Bar and Bushings Removal and Installation

#### Installation

For installation, reverse removal procedure, noting the following instructions.

- Install stabilizer bar (2) so that paint mark (1) on it comes to the right side of vehicle.





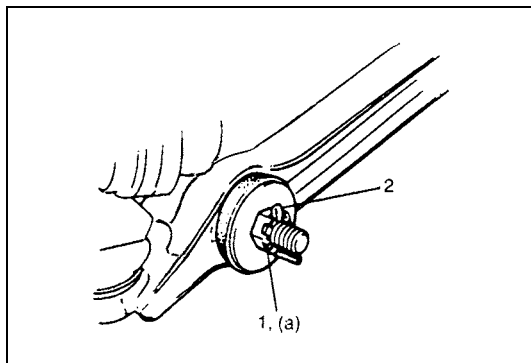
- Align the outside edge (1) of mount bushing with the outside edge (2) of paint mark as shown in figure.
- Install mount brackets (4) so that its oblong hole side (3) comes to the rear.

F: Forward

- Tighten stabilizer bar mounting bracket bolts to specified torque.

#### Tightening torque

**Stabilizer bar mounting bracket bolt:**  
45 N·m (4.5 kg-m, 32.5 lb-ft)



- Tighten stabilizer bar nuts (1) to specified torque.

#### Tightening torque

**Stabilizer bar nut**  
(a): 50 – 150 N·m (5.0 – 15.0 kg-m, 36.5 – 108.0 lb-ft)

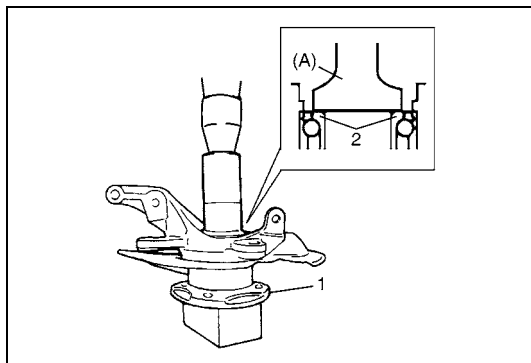
- Install new split pins (2) as shown.
- Tighten wheel bolts to specified torque.

#### Tightening torque

**Wheel bolt:** 95 N·m (9.5 kg-m, 69.0 lb-ft)

## Wheel Hub and Steering Knuckle Removal and Installation

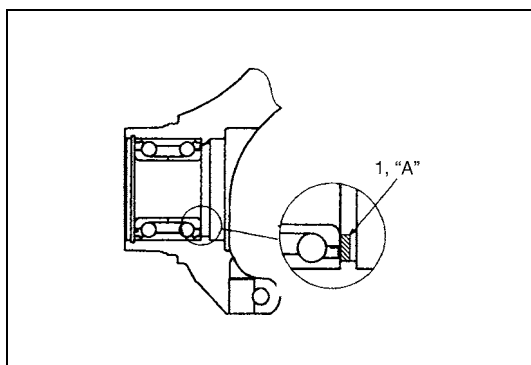
### Installation



- 1) Using special tool and hydraulic press, press-fit wheel hub (1) into wheel bearing (2) (Face grooved rubber seal side to wheel hub).

#### Special tool

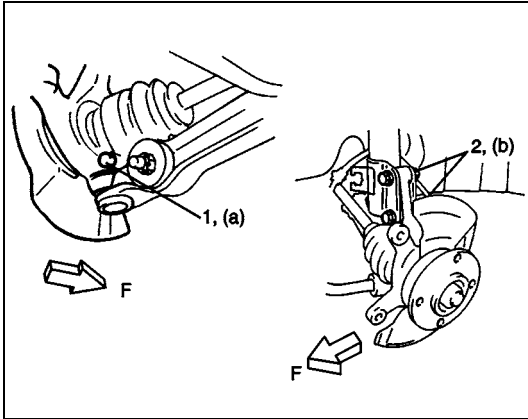
(A): 09913-75810



- 2) Apply grease lightly to contact part (1) of wheel bearing and drive shaft.

**“A”:** Grease 99000-25050





- 3) Install ball joint bolt (1) from the direction as shown.
- 4) Tighten suspension arm ball joint bolt (1) to specified torque.

**Tightening torque**

**Suspension arm ball joint bolt**

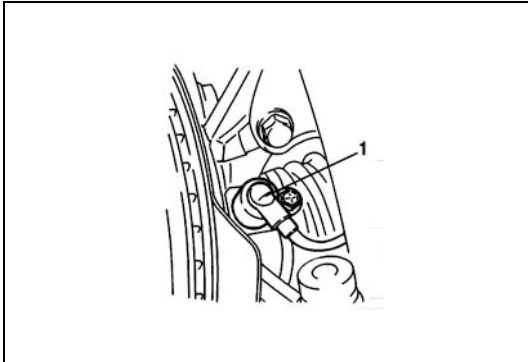
(a): 60 N·m (6.0 kg-m, 43.5 lb-ft)

- 5) Tighten strut bracket nuts (2) to specified torque.

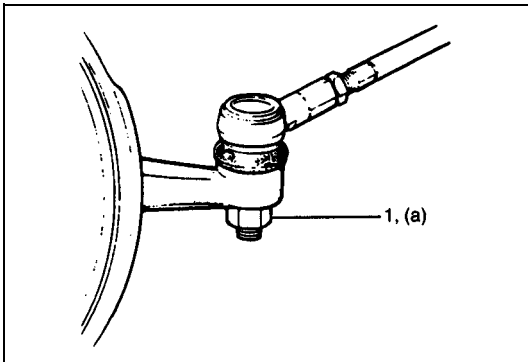
**Tightening torque**

**Strut bracket nut (b): 115 N·m (11.5 kg-m, 83.0 lb-ft)**

F: Forward



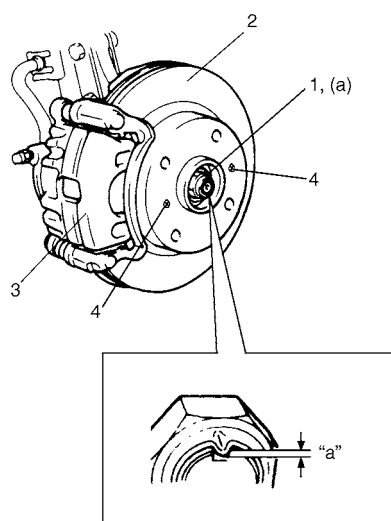
- 6) Install wheel speed sensor (1) (if equipped with ABS).



- 7) Connect tie rod end to steering knuckle, install new tie rod end nut and tighten nut (1) to specified torque.

**Tightening torque**

**The rod end nut (a): 40 N·m (4.0 kg-m, 29.0 lb-ft)**



- 8) Install brake disc (2) and brake caliper (3).
- 9) Tighten brake disc screws (4) and brake caliper bolt to specified torque.

#### Tightening torque

**Brake disc screw: 9 N·m (0.9 kg-m, 6.5 lb-ft)**

**Brake caliper bolt: 95 N·m (9.5 kg-m, 69.0 lb-ft)**

- 10) Depress foot brake pedal and hold it there.  
Tighten new drive shaft nut (1) to specified torque.

#### Tightening torque

**Drive shaft nut (a): 175 N·m (17.5 kg-m, 127.0 lb-ft)**

#### CAUTION:

**Never reuse drive shaft nut (1).**

- 11) Caulk drive shaft nut (1) as shown.

**Caulking specification "a": 0.5 mm (0.02 in.) or more**

#### CAUTION:

**Be careful while caulking nut so that no crack will occur in caulked part of nut. Cracked nut must be replaced with new one.**

- 12) Tightening wheel bolts to specified torque.

#### Tightening torque

**Wheel bolt: 95 N·m (9.5 kg-m, 69.0 lb-ft)**

## Tightening Torque Specifications

Fastening part	Tightening torque		
	N·m	kg-m	lb-ft
Brake caliper bolt	95	9.5	69.0
Brake disc screw	9	0.9	6.5
Control arm bolt	60	6.0	43.5
Control arm member bolt	60	6.0	43.5
Drive shaft nut	175	17.5	127.0
Stabilizer bar mounting bracket bolt	45	4.5	32.5
Stabilizer bar nut	50 – 150	5.0 – 15.0	36.5 – 108.0
Strut bracket nut	115	11.5	83.0
Strut nut	50	5.0	36.5
Strut support nut	23	2.3	17.0
Suspension arm ball joint bolt	60	6.0	43.5
The rod end nut	40	4.0	29.0
Control arm crossmember bolt	60	6.0	43.5
Wheel bolt	95	9.5	69.0



## SECTION 3E

# REAR SUSPENSION

### NOTE:

- All suspension fasteners are an important attaching part in that it could affect the performance of vital parts and systems, and/or could result in major repair expense. They must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.
- Never attempt to heat, quench or straighten any suspension part. Replace it with a new part, or damage to the part may result.
- For the items with asterisk (\*) in the “CONTENTS” below, refer to the same section of the Service Manual mentioned in “Foreword” of this manual.

3E

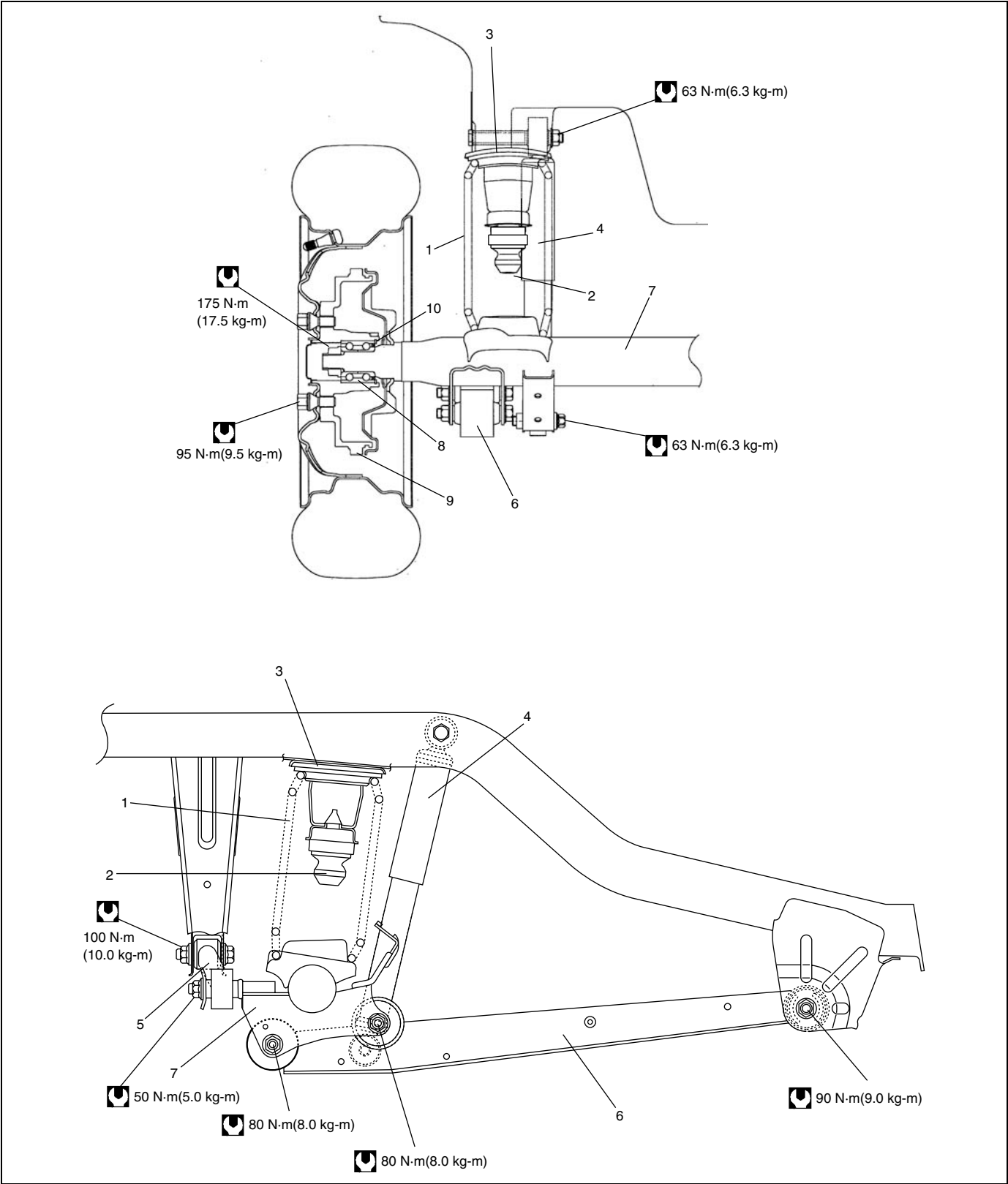
## CONTENTS


<b>General Description .....</b>	<b>3E-2</b>	Spring Upper Seat Removal and Installation .....	*
Rear Suspension Component Locator .....	*	Trailing Arm Removal and Installation .....	3E-6
Rear Suspension Construction .....	3E-2	Rear Axle Removal and Installation	
<b>Diagnosis .....</b>	<b>3E-4</b>	(for 2WD Model) .....	3E-8
Rear Shock Absorber Check .....	*	Wheel Bearing Removal and Installation	
Trailing Arm, Lateral Rod, Rear Axle, Rear		(for 2WD Model) .....	*
Axle (Housing) and Coil Spring Check .....	*	Rear Axle Shaft and Wheel Bearing Removal	
Bump Stopper / spring Upper Seat Check .....	*	and Installation (for 4WD Model) .....	*
Rear Suspension Fasteners .....	*	Rear Axle Shaft Oil Seal Removal and	
Wheel Disc, Nut and Bearing Check .....	3E-4	Installation (for 4WD Model) .....	*
<b>On-vehicle Service .....</b>	<b>3E-5</b>	Rear Axle Housing Removal and	
Lateral Rod Removal and Installation .....	*	Installation (for 4WD Model) .....	3E-11
Rear Shock Absorber Removal and		<b>Tightening Torque Specifications .....</b>	<b>3E-15</b>
Installation .....	*	<b>Required Service Material .....</b>	*
Coil Spring Removal and Installation .....	3E-5	<b>Special Tool .....</b>	*
Bump Stopper Removal and Installation .....	3E-6		

General Description

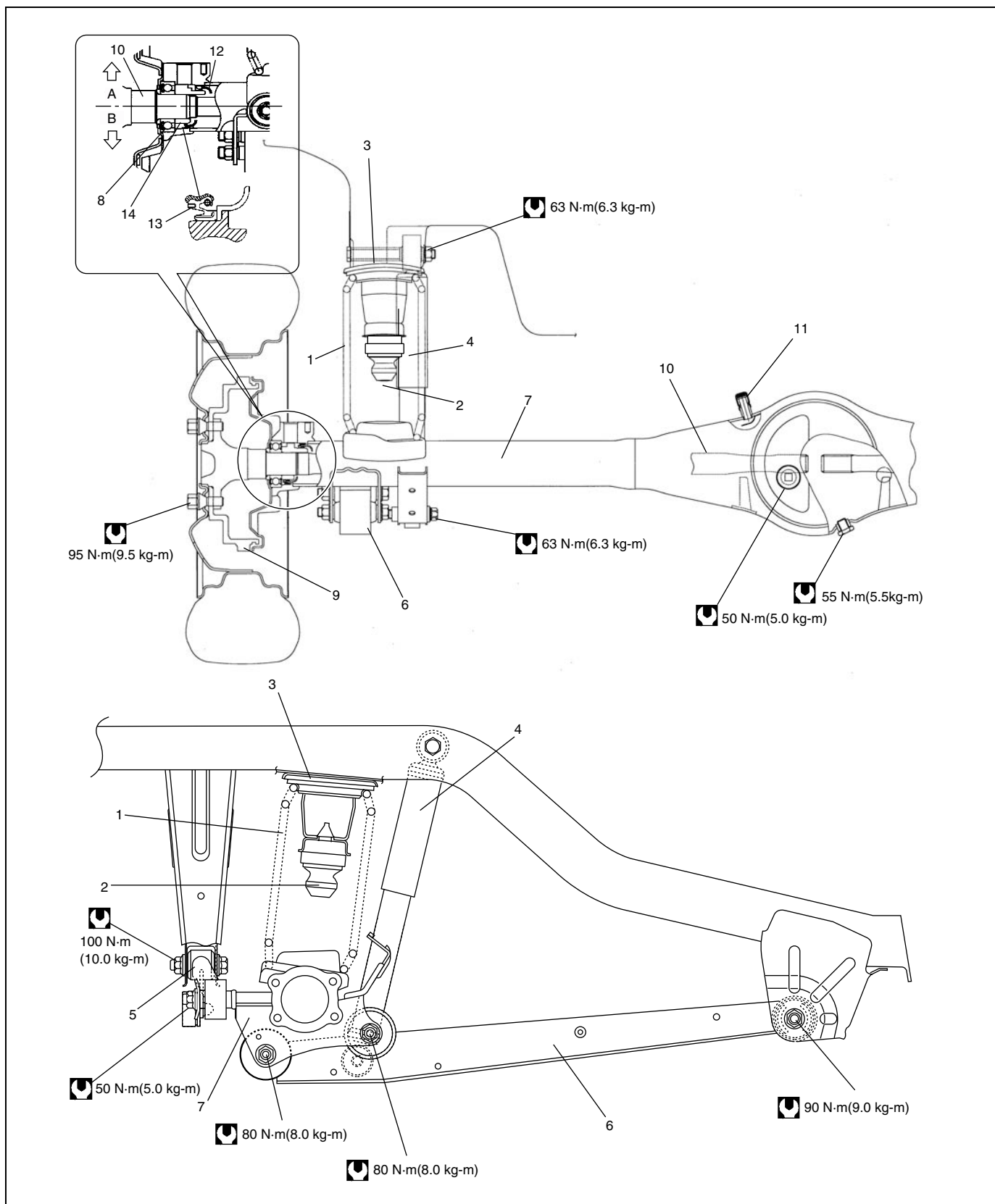
Rear Suspension Construction

2WD model



1. Rear coil spring	4. Rear shock absorber	7. Rear axle	10. Circlip
2. Rear bump stopper	5. Lateral rod	8. Wheel bearing	 Tightening torque
3. Rear spring upper seat	6. Trailing arm	9. Brake drum	

# 4WD model



A: With ABS	4. Rear shock absorber	9. Brake drum	14. Wheel bearing retainer ring or rear wheel sensor ring (if equipped with ABS)
B: Without ABS	5. Lateral rod	10. Rear axle shaft	Tightening torque
1. Rear coil spring	6. Trailing arm	11. Breather cap	
2. Rear bump stopper	7. Rear axle housing	12. Oil seal protector	
3. Rear spring upper seat	8. Wheel bearing	13. Oil seal	

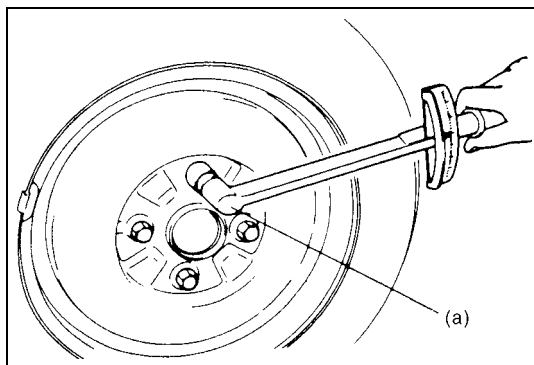
## Diagnosis

### Wheel Disc, Nut and Bearing Check

- Inspect each wheel disc for dents, distortion and cracks.  
A disc in badly damaged condition must be replaced.
- Check wheel bolts for tightness and, as necessary, retighten to specification.

#### Tightening torque

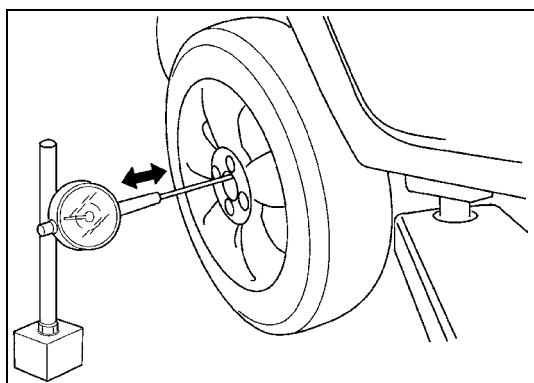
Wheel bolt (a): 95 N·m (9.5 kg-m, 69.0 lb-ft)



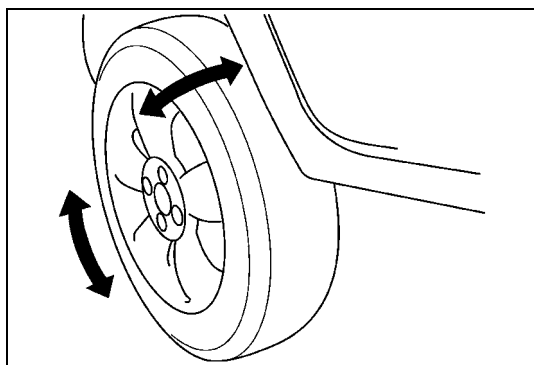
- Check wheel bearings for wear. When measuring thrust play, apply a dial gauge to axle shaft center.  
When measurement exceeds limit, replace bearing.

#### Thrust play limit

“a”: 0.1 mm (0.004 in.)



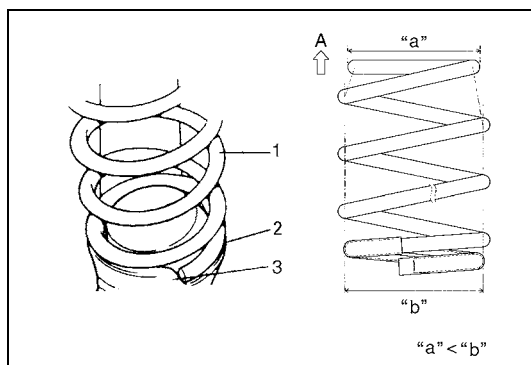
- By rotating wheel actually, check wheel bearing for noise and smooth rotation. If it is defective, replace bearing.



# On-vehicle Service

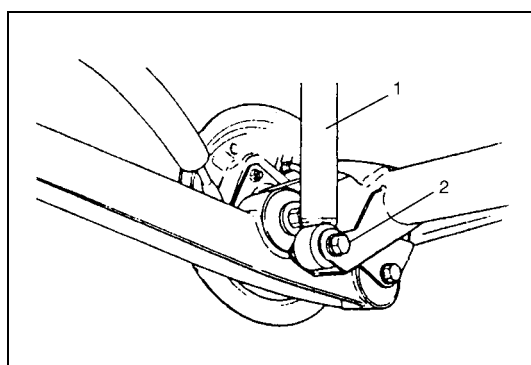
## Coil Spring Removal and Installation

### Installation

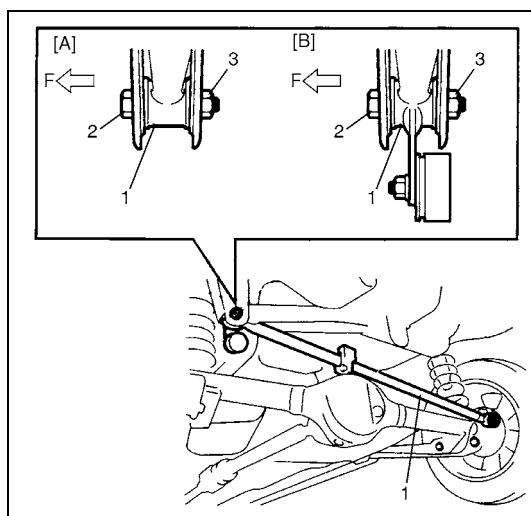


- 1) Install coil spring (1) on spring seat (2) of rear axle (or axle housing) and mate spring open end with stepped part (3) of spring lower seat and raise rear axle (or axle housing).

A :	Upper side
"a"	Small
"b"	Large



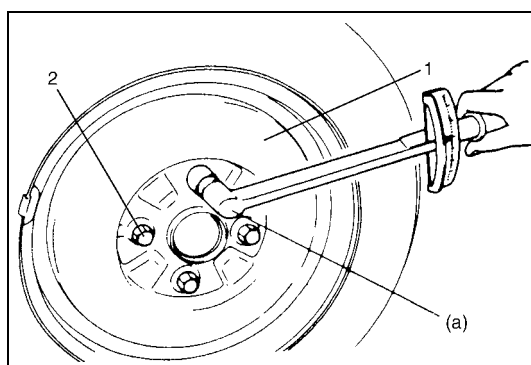
- 2) Install shock absorber (1) lower side to rear axle (or axle housing).  
Tighten shock absorber lower bolt (2) temporarily by hand at this step.



- 3) Install lateral rod (1) to vehicle body, refer to the figure for proper installing direction of bolt (2).  
Tighten nut (3) temporarily by hand at this step.
- 4) Remove floor jack from rear axle (or axle housing).

[A]:	2WD model
[B]:	4WD model
F:	Forward

- 5) Install brake flexible hose E-ring.
- 6) Install LSPV spring to rear axle. Tighten LSPV adjust nut temporarily at this step (if equipped with LSPV).

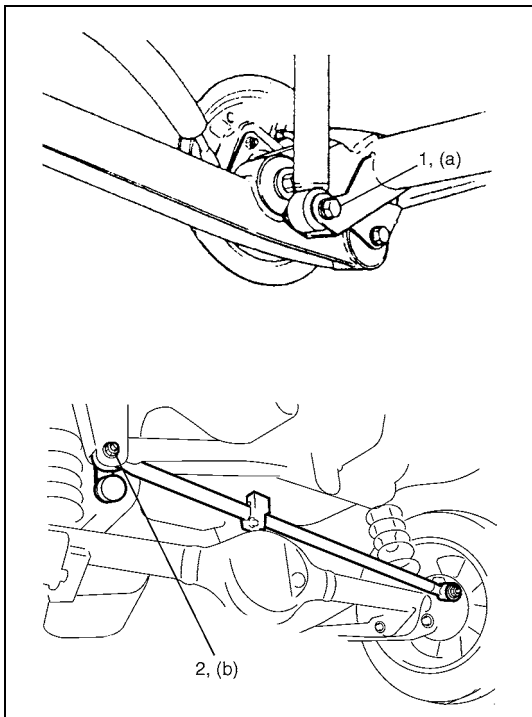


- 7) Install wheel (1) and tighten wheel bolts (2) to specified torque.

### Tightening torque

Wheel bolt (a): 95 N·m (9.5 kg-m, 69.0 lb-ft)





- 8) Lower hoist and vehicle in non-loaded condition, tighten absorber lower bolt (1) and lateral rod body side nut (2) to specified torque.

#### Tightening torque

##### Rear shock absorber lower bolt

(a): 63 N·m (6.3 kg-m, 45.5 lb-ft)

##### Lateral rod body side nut

(b): 100 N·m (10.0 kg-m, 72.5 lb-ft)

- 9) If equipped with LSPV, check and adjust LSPV spring referring to "LSPV (Load Sensing Proportioning Valve) Inspection and Adjustment" in Section 5A and "Brake Fluid Pressure Test (if equipped with LSPV)" in Section 5.

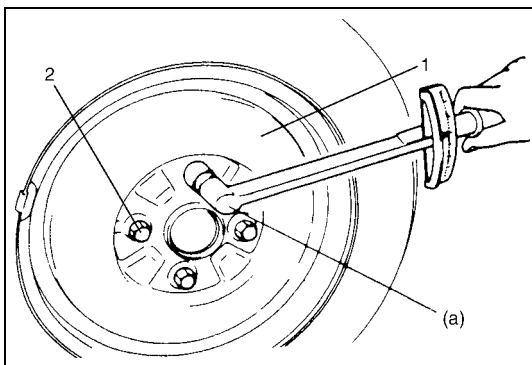
## Bump Stopper Removal and Installation

### Installation

- 1) Install bumper stopper.

#### NOTE:

Before installing bushing, apply soap water on it.



- 2) Install wheel (1) and tighten wheel bolts (2) to specified torque.

#### Tightening torque

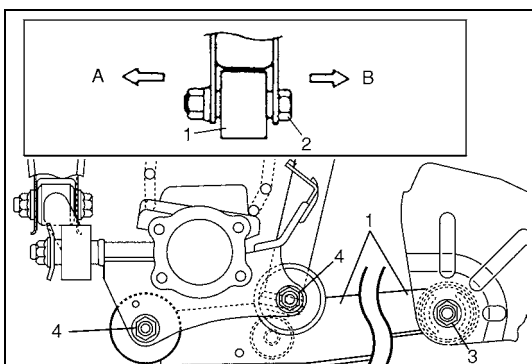
Wheel bolt (a): 95 N·m (9.5 kg-m, 69.0 lb-ft)

## Trailing Arm Removal and Installation

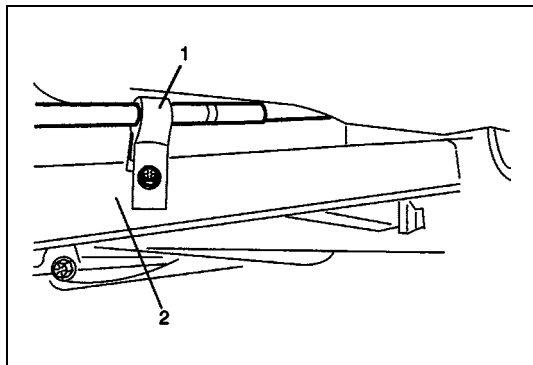
### Installation

- 1) Install trailing arm (1) to vehicle body and rear axle (or axle housing) referring to figure for proper installing direction of bolts (2).

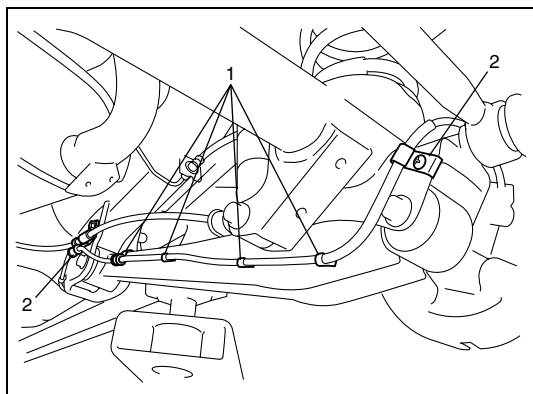
Tighten front nut (3) and rear nuts (4) temporarily by hand at this step.



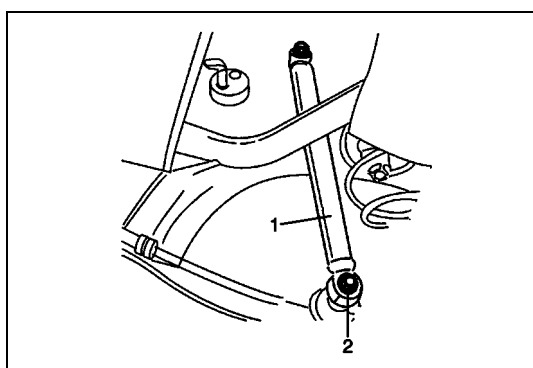
A :	Vehicle out side
B :	Vehicle center side



2) Install parking brake cable clamp (1) to trailing arm (2).



3) Clamp wheel speed sensor lead wire clamps (1) and (2) securely (if equipped with ABS).



4) Install shock absorber (1) lower side to rear axle (or axle housing).

Tighten shock absorber lower bolt (2) temporarily by hand at this step.

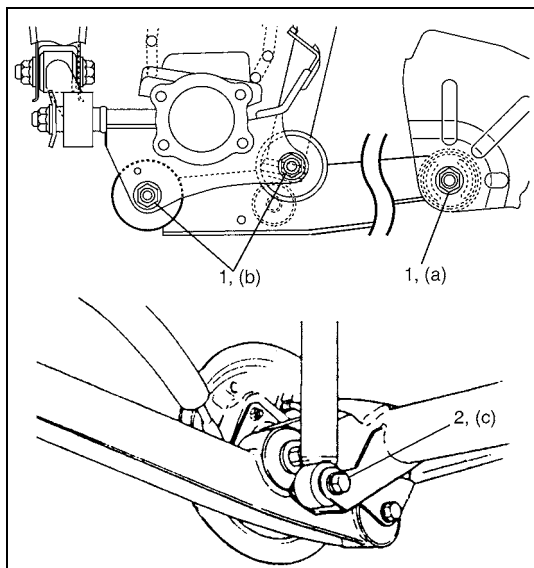
5) Remove floor jack from rear axle (or axle housing).

6) Install wheel and tighten wheel bolts to specified torque.

#### **Tightening torque**

**Wheel bolt: 95 N·m (9.5 kg-m, 69.0 lb-ft)**

7) Lower hoist.



- 8) Tighten front and rear trailing arm nuts (1), shock absorber lower bolts (2) and lateral rod right side nut (3) to specified torque.

#### NOTE:

When tightening these nuts, be sure that vehicle is off hoist and in no-loaded condition.

#### Tightening torque

Front trailing arm nut (a): 90 N·m (9.0 kg-m, 65.0 lb-ft)

Rear trailing arm nut (b): 80 N·m (8.0 kg-m, 58.0 lb-ft)

Rear shock absorber lower bolt

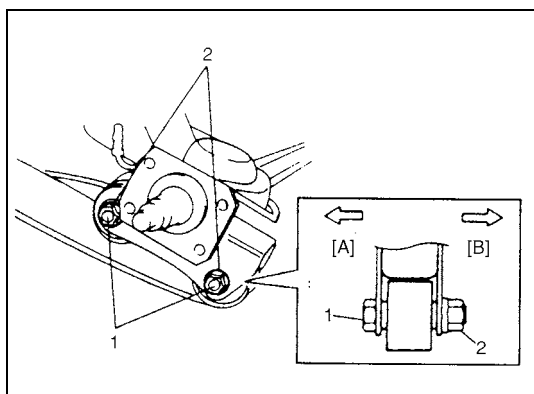
(c): 63 N·m (6.3 kg-m, 45.5 lb-ft)

## Rear Axle Removal and Installation (for 2WD Model)

### Installation

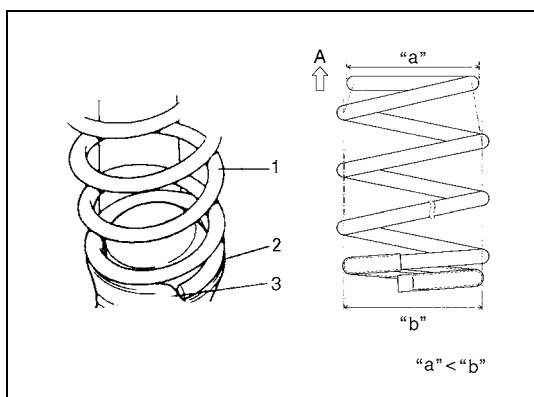
Install removed parts in reverse order of removal, noting the following points.

- 1) Place rear axle on floor jack. Then install lateral rod to rear axle and tighten nut temporarily by hand.
- 2) Install trailing arm rear bolts (1) (right & left) in proper direction as shown in figure. Then tighten nuts (2) temporarily by hand.



[A]: Vehicle center side

[B]: Vehicle outside



- 3) Install coil springs (1) (right & left) on spring seat (2) of rear axle as shown in figure and then raise rear axle.

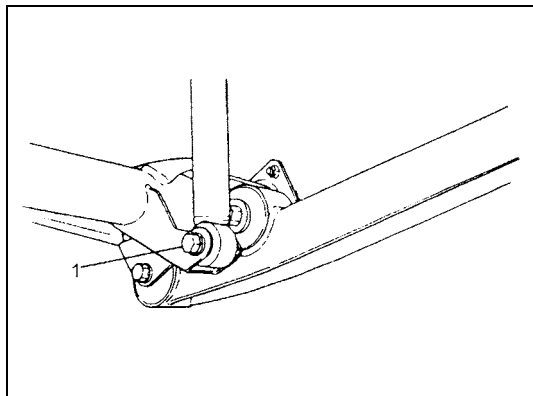
#### NOTE:

When seating coil spring (1), mate spring end with stepped part (3) of rear axle spring seat as shown.

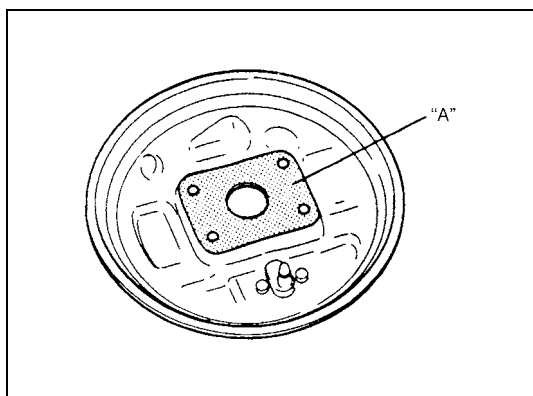
A: Upper side

"a": Small

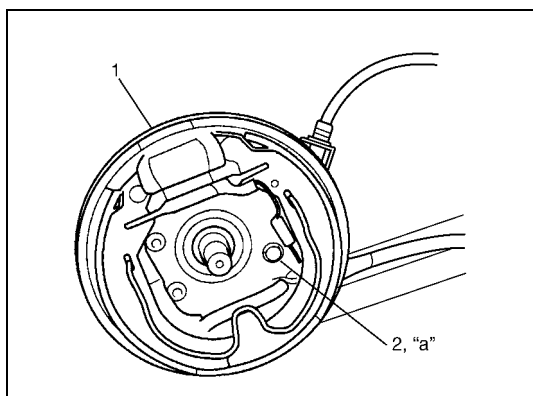
"b": Large



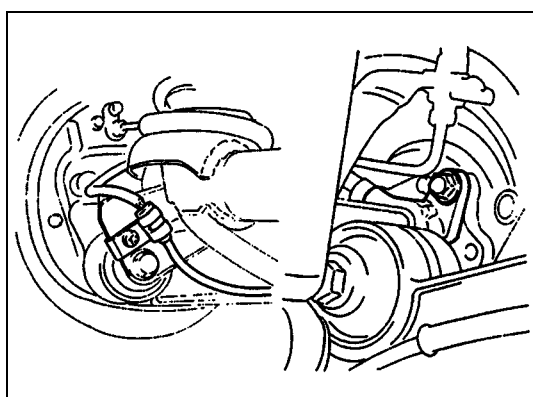
- 4) Tighten shock absorber lower bolts (1) (right & left) temporarily by hand.
- 5) Remove floor jack from rear axle.



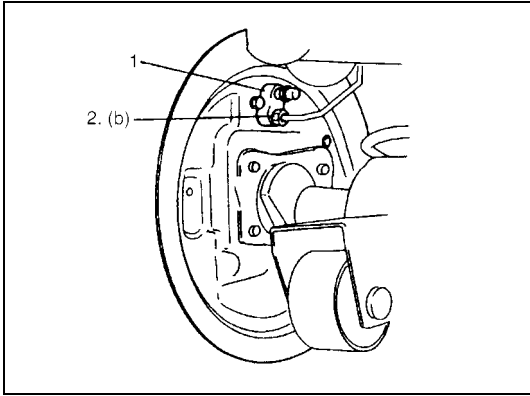
- 6) Clean mating surface of rear axle (right & left) with brake back plate and apply water tight sealant as shown in figure.  
**"A": Sealant 99000-31090**



- 7) Install brake back plates (1) and tighten back plate bolts (2) to specified torque.  
**Tightening torque**  
**Brake back plate bolt (a): 23 N·m (2.3 kg-m, 17.0 lb-ft)**



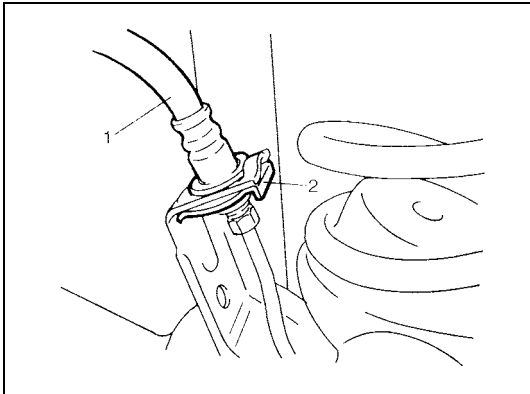
- 8) Connect wheel speed sensor and lead wire clamps (right & left) (if equipped with ABS).



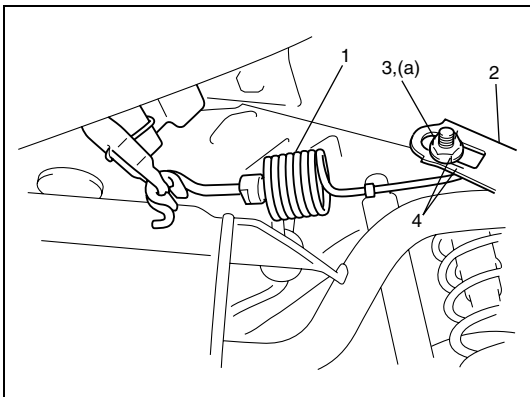
- 9) Connect brake pipes to wheel cylinders (1) (right & left) and tighten brake pipe flare nuts (2) to specified torque.

**Tightening torque**

**Brake pipe flare nut (b): 16 N·m (1.6 kg-m, 11.5 lb-ft)**



- 10) Connect brake flexible hoses (1) (right & left) to bracket on rear axle and secure it with E-rings (2) (right & left).



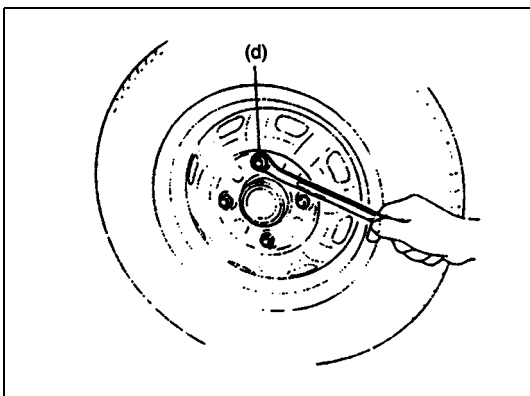
- 11) Install LSPV spring end nut (3) and spring (1) to rear axle bracket (2) (if equipped).

**NOTE:**

**When installing LSPV spring end nut (3) to bracket (2), make sure to align match marks (4) made during removal.**

**Tightening torque**

**LSPV spring end nut (a): 20 N·m (2.0 kg-m, 14.5 lb-ft)**



- 12) Install brake drums (right & left). For details, refer to "Brake Drum Removal and Installation (for 2WD Model)" in Section 5C.

- 13) Fill reservoir with brake fluid and bleed brake system. (For Bleeding Operation, see Section 5.)

- 14) Install wheel and tighten wheel bolts to specified torque.

**Tightening torque**

**Wheel bolt (d): 95 N·m (9.5 kg-m, 69.0 lb-ft)**

- 15) Upon completion of all jobs, depress brake pedal with about 300 N (30 kg, 66 lbs) load three to five times so as to obtain proper drum-to-shoe clearance.  
Adjust parking brake cable. (for Adjustment, see Section 5.)
- 16) Lower hoist and bounce vehicle up and down several times to stabilize suspension.
- 17) Tighten right and left trailing arm rear nuts, shock absorber lower bolts and lateral rod rear axle side nut to specified torque.

#### NOTE:

When tightening these nuts and bolts, be sure that vehicle is off hoist and in non loaded condition.

#### Tightening torque

##### Rear trailing arm nut

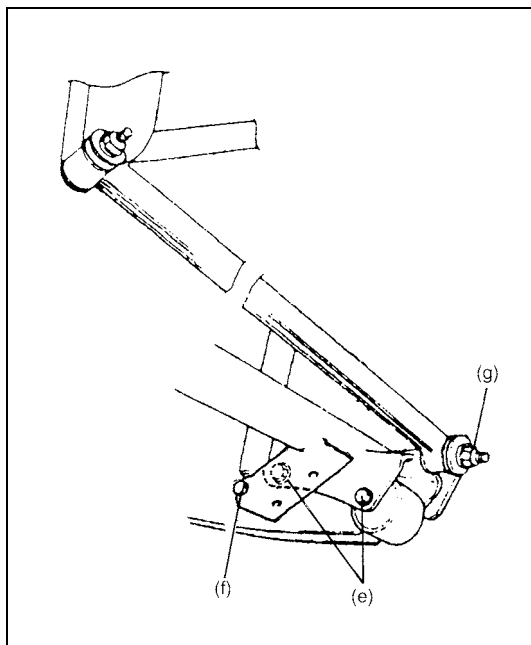
(e): 80 N·m (8.0 kg-m, 58.0 lb-ft)

##### Rear shock absorber lower bolt

(f): 63 N·m (6.3 kg-m, 45.5 lb-ft)

##### Lateral rod axle housing side nut

(g): 50 N·m (5.0 kg-m, 36.5 lb-ft)

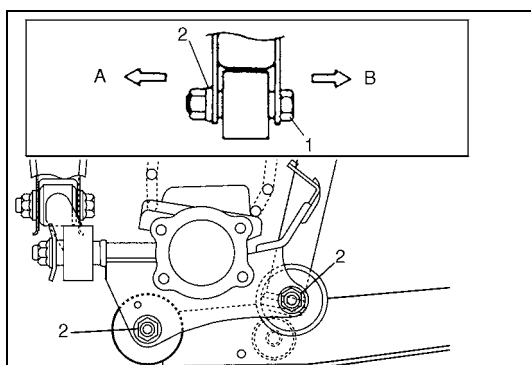


- 18) Check to ensure that brake drum is free from dragging and proper braking is obtained.
- 19) Perform brake test (foot brake and parking brake).
- 20) If equipped with LSPV, check and adjust LSPV spring referring to "LSPV (Load Sensing Proportioning Valve) Inspection and Adjustment" in Section 5A and perform "Brake Fluid Pressure test" in Section 5.
- 21) Check each installed part for oil leakage.

## Rear Axle Housing Removal and Installation (for 4WD Model)

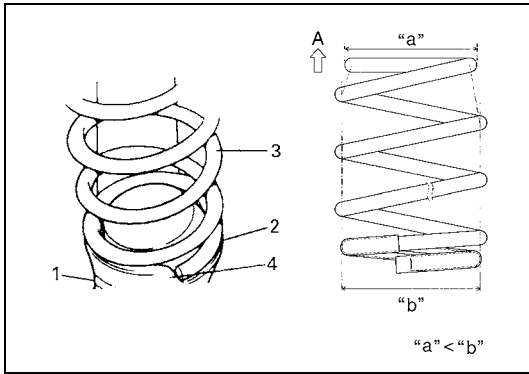
### Installation

Install removed parts in reverse order of removal, noting the following.



- 1) Place rear axle housing on floor jack. Then install rear trailing arm bolts (1) (right & left) in proper direction as shown. Then tighten nuts (2) temporarily by hand.

A :	Vehicle out side
B :	Vehicle center side

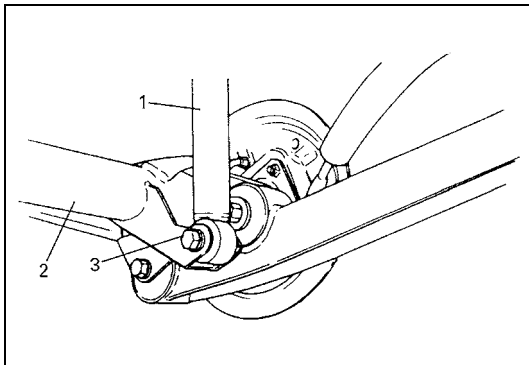


- 2) Install coil springs (3) (right & left) on spring seat (2) of axle housing (1) and raise axle housing.

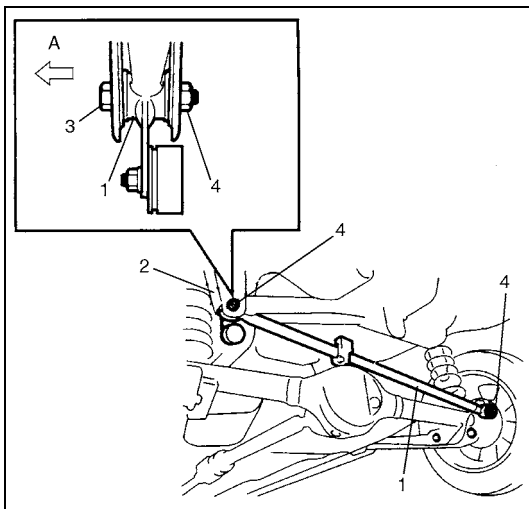
**NOTE:**

**Upper and lower diameters of coil spring are different.  
Bring larger diameter end at bottom and set its open end in place on spring seat.**

4. Stepped part
A : Upper side

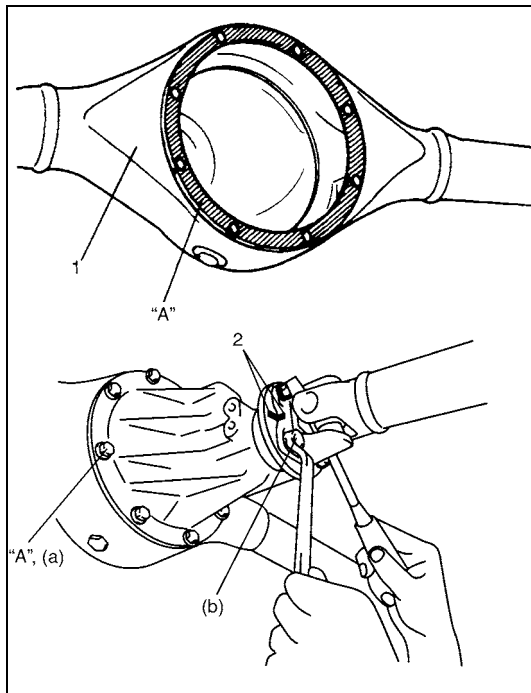


- 3) Install shock absorber (1) (right & left) to rear axle housing (2) and install bolts in proper direction as shown. Then tighten absorber lower bolts (3) (right & left) temporarily by hand at this step.



- 4) Install lateral rod (1) and install bolt (3) in proper direction as shown. Then tighten nuts (4) temporarily by hand.

2. Vehicle body
A : Forward



- 5) Clean mating surfaces of axle housing (1) and differential carrier and apply sealant to housing side.

**“A”:** Sealant 99000-31110

- 6) Apply sealant to thread part of carrier bolts and tighten carrier bolts to specified torque.

**“A”:** Sealant 99000-31110

**Tightening torque**

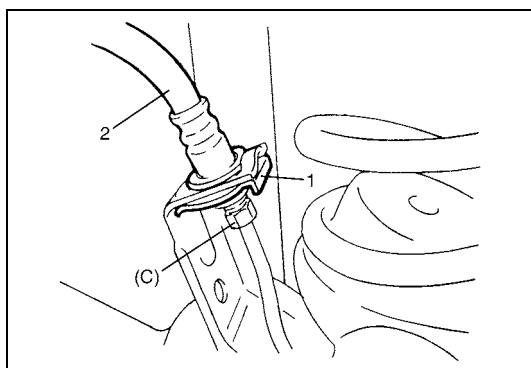
**Rear differential carrier bolt**

**(a): 23 N·m (2.3 kg-m, 17.0 lb-ft)**

- 7) Install propeller shaft to joint flange aligning match marks (2) and tighten flange bolts to specified torque.

**Tightening torque**

**Companion flange bolt (b): 23 N·m (2.3 kg-m, 17.0 lb-ft)**

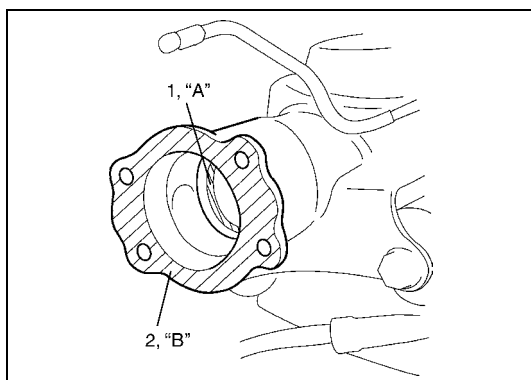


- 8) Remove floor jack from axle housing.

- 9) Connect brake flexible hoses (2) (right & left) to bracket on axle housing and secure it with E-rings (1).

**Tightening torque**

**Brake pipe flare nut (C): 16 N·m (1.6 kg-m, 11.5 lb-ft)**

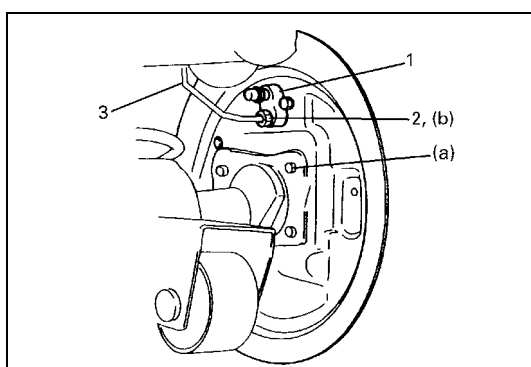


- 10) Apply grease to rear axle shaft oil seals (1) lip (right & left) as shown.

**“A”:** Grease 99000-25010

- 11) Clean mating surface (2) (right & left) of rear axle housing and brake back plate and apply sealant as shown in figure.

**“B”:** Sealant 99000-31090



- 12) Install rear axle shaft (right & left) to rear axle housing.

- 13) Tighten brake back plate bolts to specified torque.

**Tightening torque**

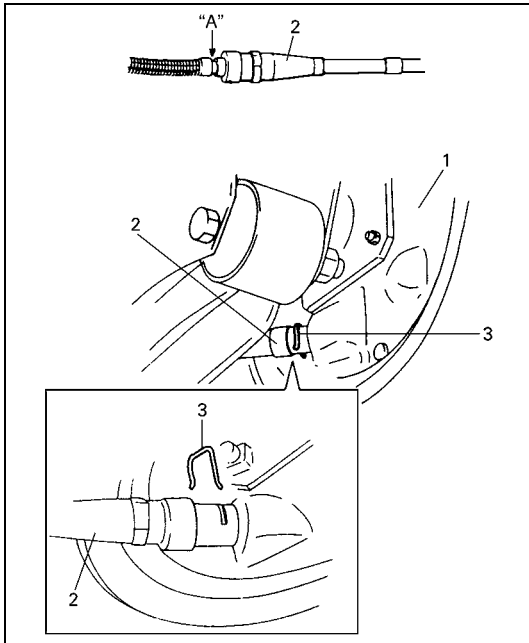
**Brake back plate bolt (a): 23 N·m (2.3 kg-m, 17.0 lb-ft)**

- 14) Connect brake pipes (3) to wheel cylinders (1) (right & left) and tighten brake pipe flare nuts (2) to specified torque.

**Tightening torque**

**Brake pipe flare nut (b): 16 N·m (1.6 kg-m, 11.5 lb-ft)**





- 15) Apply water tight sealant where brake back plate (1) and parking brake cable contact.

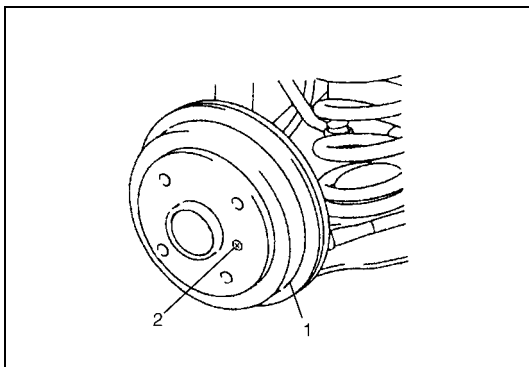
Connect parking brake cable (2) to brake back plate (right & left) and secure it with clip (3).

**“A”:** Sealant 99000-31090

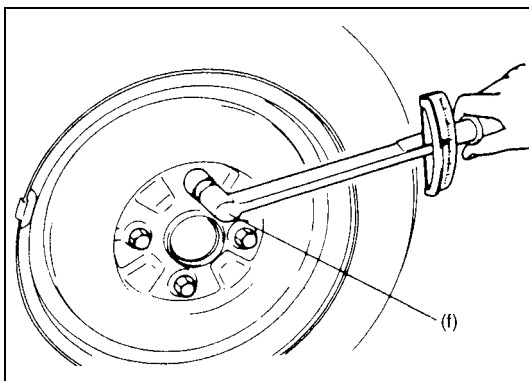
**NOTE:**

**Check to ensure that clip is in good condition before installing it. If deformed or broken, replace.**

- 16) Install parking brake cable clamps to trailing arm.
- 17) Install wheel speed sensors (right & left) and clamp wire securely (if equipped with ABS).
- 18) Install brake shoes (right & left) referring to “Brake Shoe Removal and Installation” in Section 5C.



- 19) Install brake drums (1) (right & left) after making sure that inside of brake drum and brake shoes are free from dirt and oil. Then tighten brake drum screw (2).
- 20) Fill reservoir with brake fluid and bleed brake system. (For bleeding operation, refer to “Air Bleeding of Brake System” in Section 5.)
- 21) Refill differential gear housing with new specified gear oil. Refer to “Oil Change” in Section 7F.

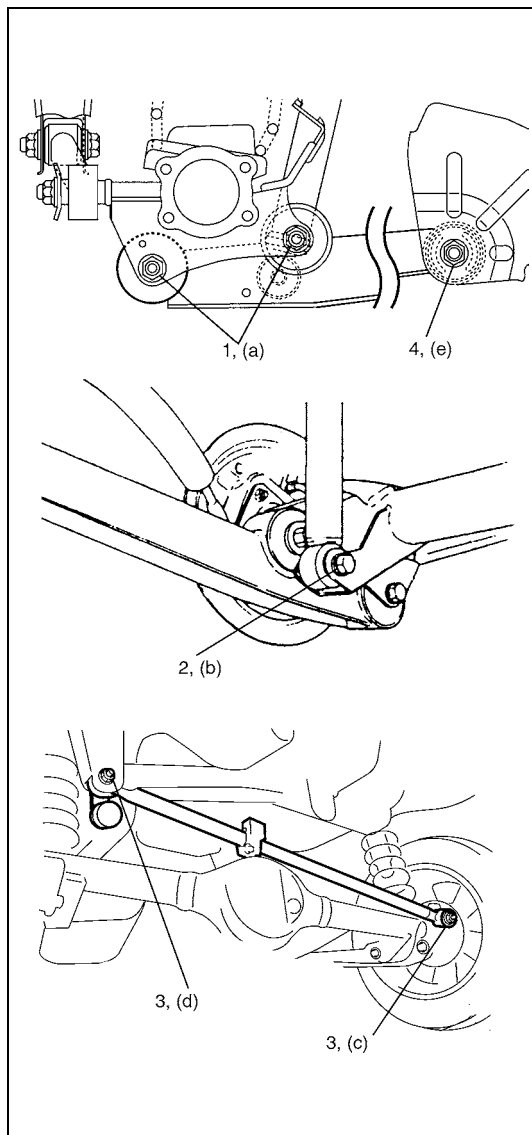


- 22) Install wheels and tighten wheel bolts to specified torque.

**Tightening torque**

**Wheel bolt (f): 95 N·m (9.5 kg-m, 69.0 lb-ft)**

- 23) Upon completion of all jobs, pull parking brake lever with about 200 N (20 kg, 44 lbs) load three to five times so as to obtain proper drum-to-shoe clearance. Adjust parking brake cable referring to “Parking Brake Inspection and Adjustment” in Section 5.
- 24) Lower hoist.



- 25) Tighten right and left trailing arm nuts (1), (4) and shock absorber lower bolts (2) to specified torque.  
Tighten lateral rod nuts (3) to specified torque.

#### NOTE:

When tightening these bolts and nuts, be sure that vehicle is off hoist and in non loaded condition.

#### Tightening torque

##### Rear trailing arm nut

(a): 80 N·m (8.0 kg-m, 58.0 lb-ft)

##### Rear shock absorber lower bolt

(b): 63 N·m (6.3 kg-m, 45.5 lb-ft)

##### Lateral rod axle housing side nut

(c): 50 N·m (5.0 kg-m, 36.5 lb-ft)

##### Lateral rod body side nut

(d): 100 N·m (10.0 kg-m, 72.5 lb-ft)

##### Front trailing arm nut

(e): 90 N·m (9.0 kg-m, 65.0 lb-ft)

- 26) Check to ensure that brake drum is free from dragging and proper braking is obtained.  
27) Perform brake test (foot brake and parking brake).  
28) Check each installed part for oil leakage.

## Tightening Torque Specifications

Fastening part	Tightening torque		
	N·m	kg-m	lb-ft
Brake back plate bolt	23	2.3	17.0
Brake pipe flare nut	16	1.6	11.5
Companion flange bolt	23	2.3	17.0
Front trailing arm nut	90	9.0	65.0
Lateral rod axle (housing) side nut	50	5.0	36.5
Lateral rod body side nut	100	10.0	72.5
LSPV spring end nut (2WD Model)	20	2.0	14.5
Rear differential carrier bolt (4WD Model)	23	2.3	17.0
Rear shock absorber lower bolt	63	6.3	45.5
Rear shock absorber upper nut	63	6.3	45.5
Rear trailing arm nut	80	8.0	58.0
Wheel bolt	95	9.5	69.0



SECTION 3F

WHEELS AND TIRES

NOTE:

- All wheel fasteners are important attaching parts in that they could affect the performance of vital parts and systems, and/or could result in major repair expense. They must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of all parts.  
There is to be no welding as it may result in extensive damage and weakening of the metal.
- For the items with asterisk (\*) in the “CONTENTS” below, refer to the same section of the Service Manual mentioned in “Foreword” of this manual.

3F

CONTENTS

<b>General Description .....</b>	*	Tire Placard.....	*
Tire and Wheel Description .....	*	Tire Rotation .....	*
Replacement Tires .....	*	<b>On-vehicle Service.....</b>	<b>3F-2</b>
Replacement Wheel.....	*	Wheel Removal and Installation .....	3F-2
How to measure wheel run-out .....	*	Tire Mounting and Dismounting .....	*
Wheel Bolts .....	*	Tire Repair .....	*
Matched Tires and Wheels .....	*	Balancing Wheels .....	*
<b>Diagnosis .....</b>	*	General balance procedures.....	*
Diagnosis Table .....	*	Off-vehicle balancing .....	*
<b>Maintenance and Minor Adjustments .....</b>	*	On-vehicle balancing .....	*
Wheel Maintenance .....	*	<b>Tightening Torque Specifications .....</b>	<b>3F-3</b>
Inflation of Tires.....	*		

## On-vehicle Service

### Wheel Removal and Installation

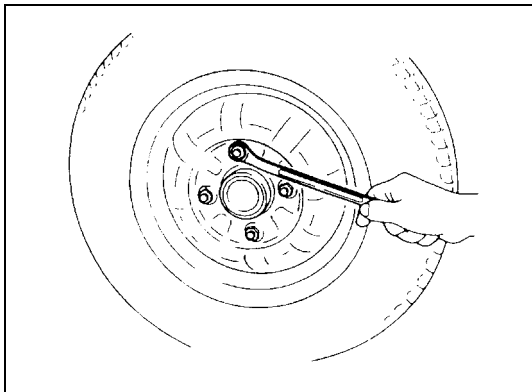
#### Removal

##### WARNING:

Do not removal all of the wheel bolts at once, because all the wheels of this vehicle are mounted by the wheel bolts.

Leave a bolt at least not to drop the wheel.

Support the wheel and/or tire and then remove the bolt(s) left with the wheel.



- 1) Loosen wheel bolts by approximately 180 ° (half a rotation).
- 2) Hoist vehicle.
- 3) Make sure that the Vehicle will not fall off by trying to move vehicle body in both ways.
- 4) Remove wheel bolts except one.
- 5) Support the wheel and/or tire not to drop the wheel and then remove the bolt left with the wheel.

##### CAUTION:

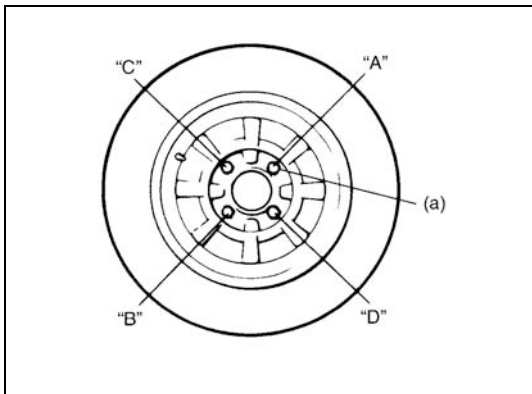
Never use heat to loosen tight wheel because application of heat to wheel can shorten life of wheel and damage wheel bearings.

#### Installation

For installation, reverse removal procedure, noting the flowing. Wheel bolts must be tightened in sequence and to proper torque to avoid bending wheel or brake disc, left figure.

##### NOTE:

Before installing wheels, remove any build-up of corrosion on wheel mounting surface and brake disc mounting surface by scraping and wire brushing. Installing wheels without good metal-to-metal contact at mounting surfaces can cause wheel bolts to loosen, which can later allow a wheel to come off while vehicle is moving.



#### Tightening order

“A” – “B” – “C” – “D”:

#### Tightening torque

Wheel bolt (a): 95 N·m (9.5 kg-m, 69.0 lb-ft)

## Tightening Torque Specifications

Fastening part	Tightening torque		
	N•m	kg-m	lb-ft
Wheel bolt	95	9.5	69.0



SECTION 4A

FRONT DRIVE SHAFT

**NOTE:**  
For the items with asterisk (\*) in the “CONTENTS” below, refer to the same section of the service manual mentioned in “Foreword” of this manual.

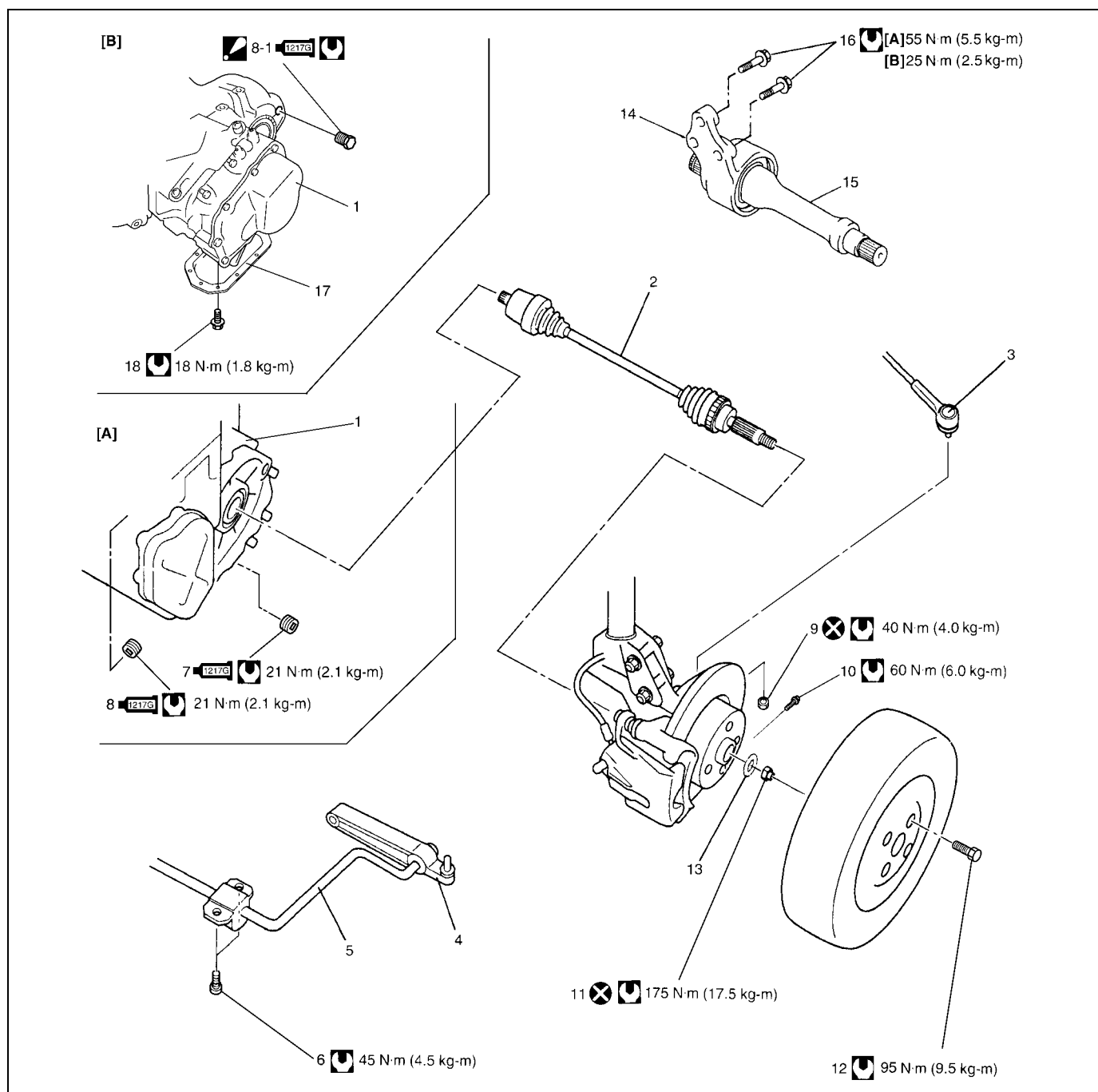
CONTENTS

<b>General Description .....</b>	<b>*</b>	Front Drive Shaft Disassembly and	
<b>Diagnosis .....</b>	<b>*</b>	Assembly .....	4A-6
<b>On-Vehicle Service .....</b>	<b>4A-2</b>	Front Drive Shaft Inspection .....	*
Front Drive Shaft Assembly Construction ....	4A-2	Center Shaft and Center Bearing Support	
Front Drive Shaft Assembly Removal and		Disassembly and Assembly .....	4A-15
Installation .....	4A-3	<b>Tightening Torque Specification .....</b>	<b>4A-17</b>
Front Drive Shaft Assembly Inspection .....	*	<b>Required Service Material .....</b>	<b>4A-17</b>
Front Drive Shaft Components.....	4A-5	<b>Special Tools.....</b>	<b>4A-18</b>



# On-Vehicle Service

## Front Drive Shaft Assembly Construction



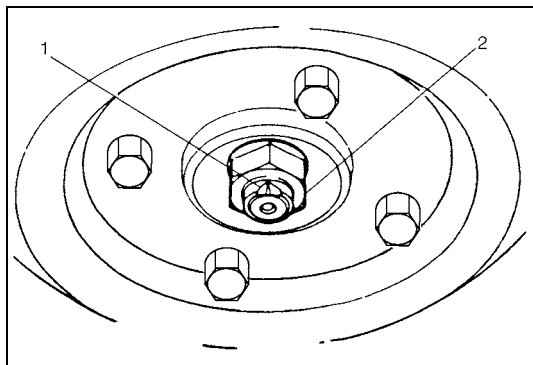
[A] : M15 engine model	7. Oil drain plug : Apply sealant 99000-31260 to plug thread.	14. Center bearing support
[B] : Z13DT engine model	8. Oil filler/level plug : Apply sealant 99000-31260 to plug thread.	15. Center shaft
1. Transaxle	8-1. Oil filler/level plug : Apply sealant 99000-31260 to plug thread. : Tighten the plug 4 N·m (0.4 kg-m), 45° and 135°.	16. Center bearing support bolts
2. Drive shaft assembly	9. Tie-rod end nut	17. Oil pan
3. Tie-rod end	10. Ball stud bolt	18. Oil pan bolt
4. Suspension control arm	11. Drive shaft nut	Do not reuse.
5. Stabilizer	12. Wheel bolt	Tightening torque
6. Stabilizer mount bracket bolt	13. Drive shaft washer	

## Front Drive Shaft Assembly Removal and Installation

### Removal

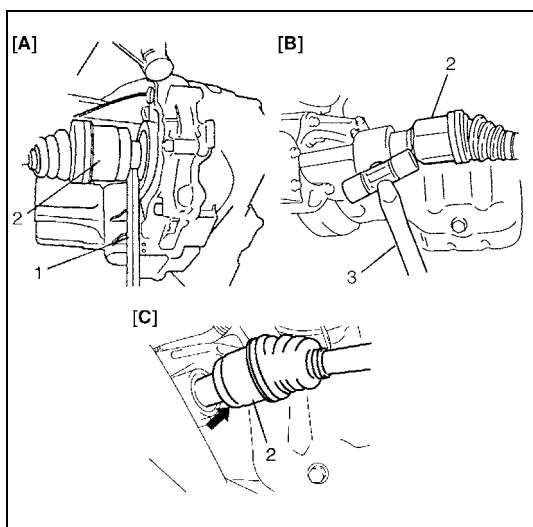
#### CAUTION:

To prevent the breakage of boots, be careful not to damage the boots when removing drive shaft assembly.



- 1) Disengage caulking (1) and remove drive shaft nut (2).
- 2) Loosen wheel bolts.
- 3) Hoist vehicle.
- 4) Remove wheel.

- 5) Drain transaxle oil referring to "Manual Transaxle Oil Change" in Section 7A2 (M/T vehicle with M15 engine), "Fluid change" in Section 7B (A/T vehicle with M15 engine), or "Manual Transaxle Oil Change" in Section 7A3 (vehicle with Z13DT engine), and drain transfer oil (4WD vehicle) referring to "Transfer Oil Change" in Section 7D.
- 6) Remove tie-rod end referring to "Suspension Control Arm/ Bushing Removal and Installation" in Section 3D.



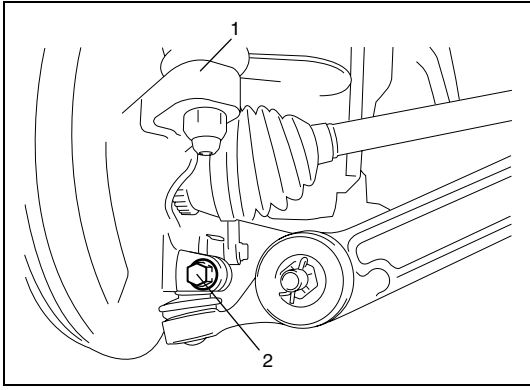
- 7) Pull out drive shaft joint (2) as follows.
  - a) Left side of 2WD vehicle and 4WD vehicle  
Using tire lever (1), pull out drive shaft joint (2) so as to release snap ring fitting of joint spline at differential side.
  - b) Right side of 2WD vehicle  
Using plastic hammer (3), drive out drive shaft joint (2) so as to release snap ring fitting of joint spline at center shaft.
  - c) Right side of 4WD vehicle  
Using plastic hammer, drive out drive shaft joint (2) so as to release snap ring fitting of joint spline at transfer side.

[A] : Left side shaft of 2WD vehicle and 4WD vehicle
--

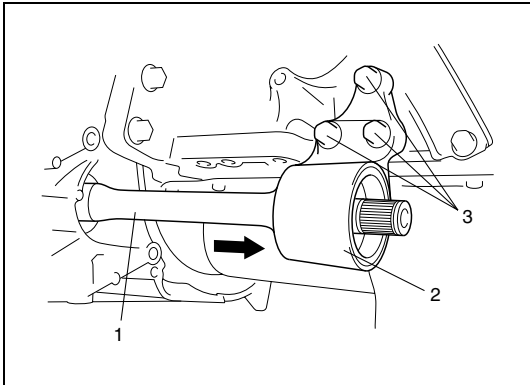
[B] : Right side shaft of 2WD vehicle
---------------------------------------

[C] : Right side shaft of 4WD vehicle
---------------------------------------

- 8) Remove two stabilizer mount brackets from vehicle body referring to "Wheel Hub and Steering Knuckle Removal and Installation" in Section 3D.



- 9) Disconnect front suspension control arm ball joint stud from steering knuckle (1) by pushing down stabilizer bar after removing ball stud bolt (2).
- 10) Remove drive shaft assembly.



- 11) For vehicle with center shaft, remove center bearing support bolts (3) and remove center bearing support (2) with center shaft (1) from differential side gear.

## Installation

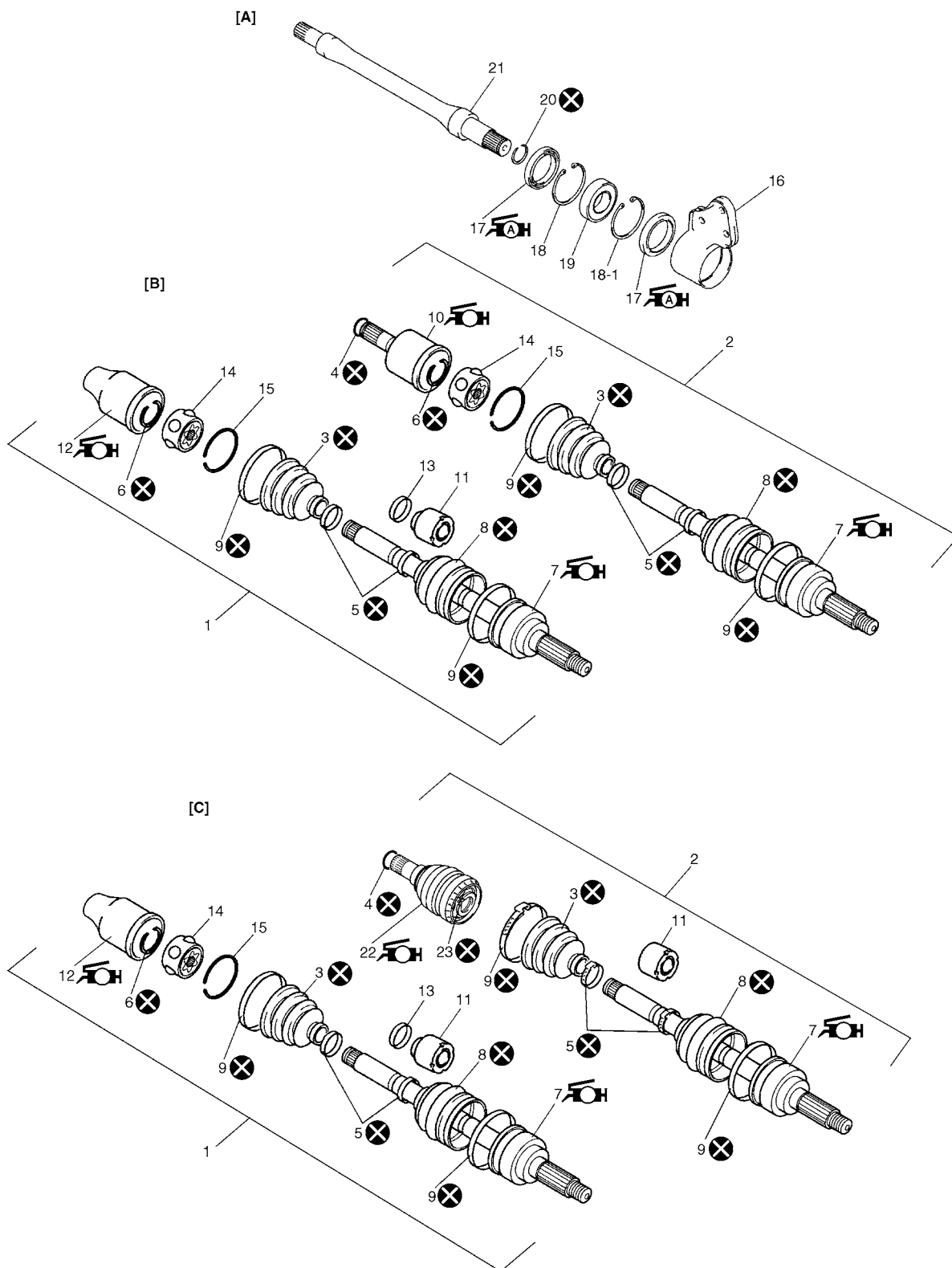
### CAUTION:

- Be careful not to damage oil seals and boots when installing drive shaft assembly.
- Do not hit joint with hammer. Inserting joint only by hands is allowed.
- Make sure that differential side joint is inserted fully and its snap ring is seated as it was.

Install drive shaft assembly by reversing removal procedure noting the following points.

- Install wheel side joint to steering knuckle first, and then differential side joint to transaxle.
- Tighten each bolt and nut to the specified torque referring to "Front Drive Shaft Assembly Construction" in this section.
- Fill transaxle with oil referring to "Manual Transaxle Oil Change" in Section 7A2 (M/T vehicle with M15 engine), "Fluid change" in Section 7B (A/T vehicle with M15 engine), or "Manual Transaxle Oil Change" in Section 7A3 (vehicle with Z13DT engine), and fill transfer with oil (4WD vehicle) referring to "Transfer Oil Change" in Section 7D.
- Check toe setting and adjust as required.

## Front Drive Shaft Components

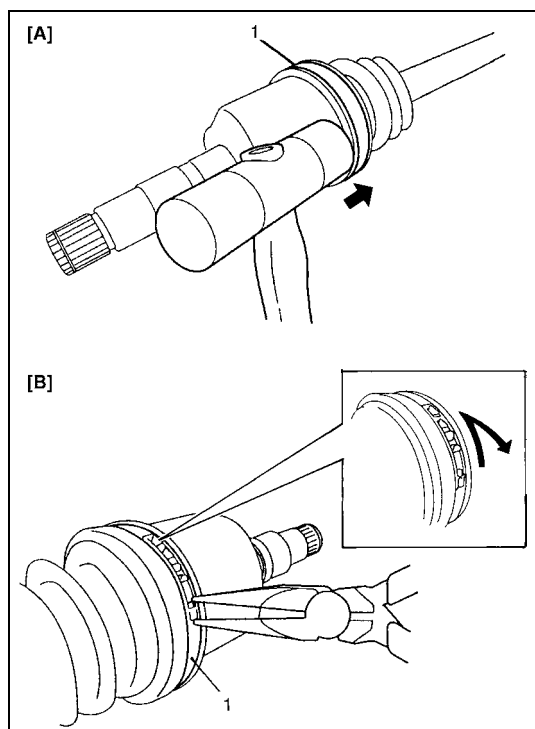


[A]: 2WD vehicle	8. Boot (Wheel side)	18. Circlip
[B]: M15 engine model	9. Boot big band	18-1. Circlip (M15 engine model)
[C]: Z13DT engine model	10. Differential side joint housing (for Double offset joint) : Apply black and grey grease included in spare part.	19. Center shaft support bearing
1. Right side drive shaft assembly	11. Damper (RH)	20. Snap ring
2. Left side drive shaft assembly	12. Differential side joint housing (for Double offset joint) : Apply black and grey grease included in spare part.	21. Center shaft
3. Boot (Differential or transfer side)	13. Damper band	22. Differential side joint (Cross groove joint) : Apply dark brown grease included in spare parts.
4. Circlip	14. Cage (for Double offset joint)	23. Circlip
5. Boot small band	15. Circlip	⊗ Do not reuse.
6. Snap ring	16. Center bearing support bracket	
7. Wheel side joint (Constant velocity ball joint) : Apply grease included in spare part. • Black grease (M15 engine model and right side shaft of Z13DT engine model) • Dark brown (Left side shaft of Z13DT engine model)	17. Oil seal : Apply grease 99000-25010 to seal lip.	

## Front Drive Shaft Disassembly and Assembly

### Disassembly

For M15 engine model and right side shaft of Z13DT engine model



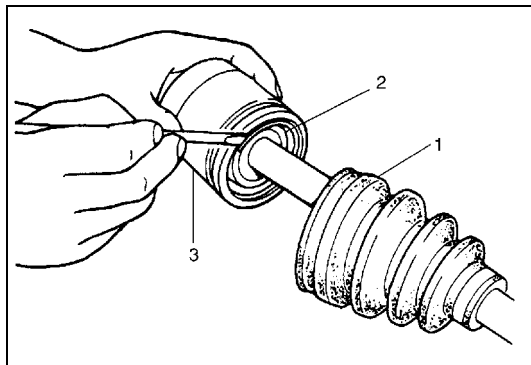
#### CAUTION:

**Disassembly of wheel side joint is not allowed. If any abnormality is found, replace it as assembly.**

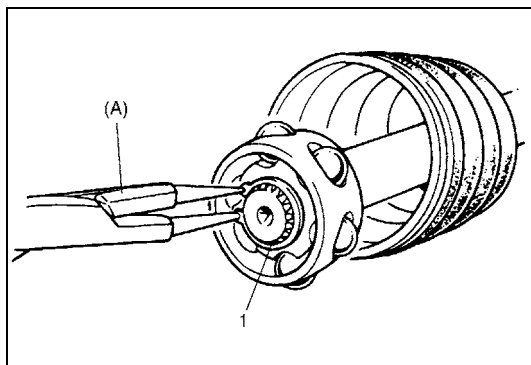
- 1) Remove differential side boot big band (1) as follows.
  - a) For boot big band without joint
    - i) Remove boot big band by tapping boot and band with plastic hammer. If it is hard to remove boot big band, cut it using a nipper or an iron saw with care not to damage DOJ housing.
  - b) For boot big band with joint
    - i) Draw hooks of boot big band together and remove band.

[A]: For boot big band without joint

[B]: For boot big band with joint



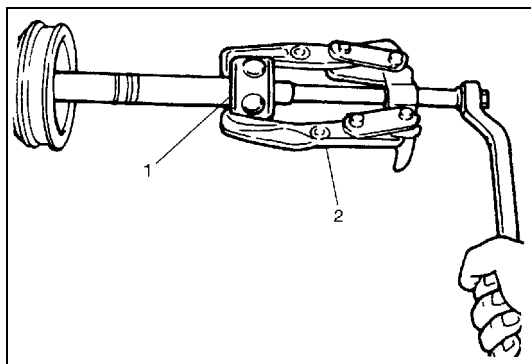
- 2) Move boot (1) toward the center of shaft and remove circlip (2) from differential side joint housing (3), and then take differential side joint housing from shaft.



- 3) Wipe off grease and remove snap ring (1) by using special tool.

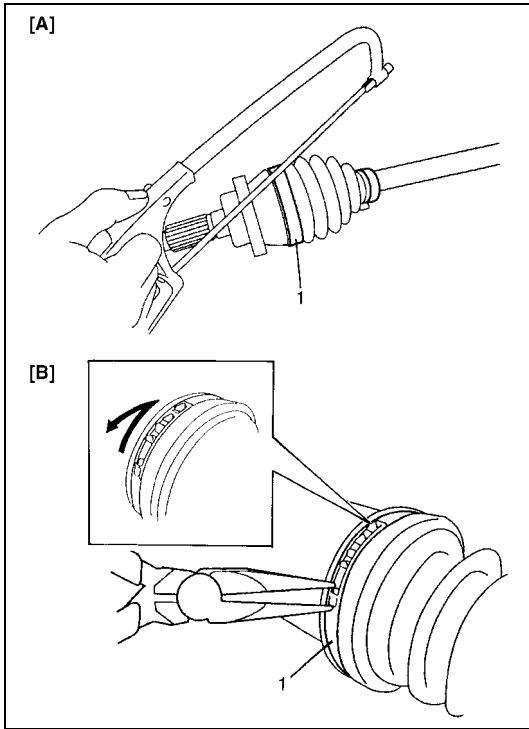
**Special tool**

**(A) : 09900-06107**



- 4) Pull out cage (1) by using bearing puller (2).

- 5) Remove differential side boot small band, and then pull out differential side boot from shaft.  
6) Remove damper band, and then pull out damper through shaft.



- 7) Remove wheel side boot big band (1) as follows.
  - a) For boot big band without joint
    - i) Cut boot big band by using an iron saw or a nipper with care not to damage wheel side joint housing.
  - b) For boot big band with joint
    - i) Draw hooks of boot big band together and remove band.
- 8) Remove wheel side small boot band, and then pull out wheel side boot from shaft.

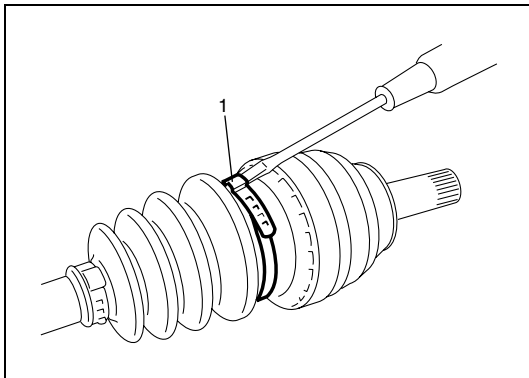
[A] : For boot big band without joint

[B] : For boot big band with joint

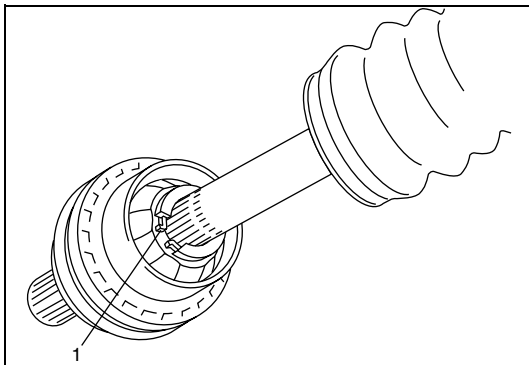
#### For left side shaft of Z13DT engine model

##### CAUTION:

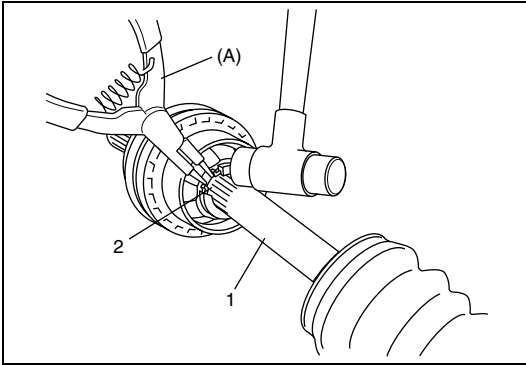
**Disassembly of wheel and differential side joints is not allowed. If any abnormality is found, replace it as assembly.**



- 1) Remove differential side boot big band (1) by using flat end rod or the like.



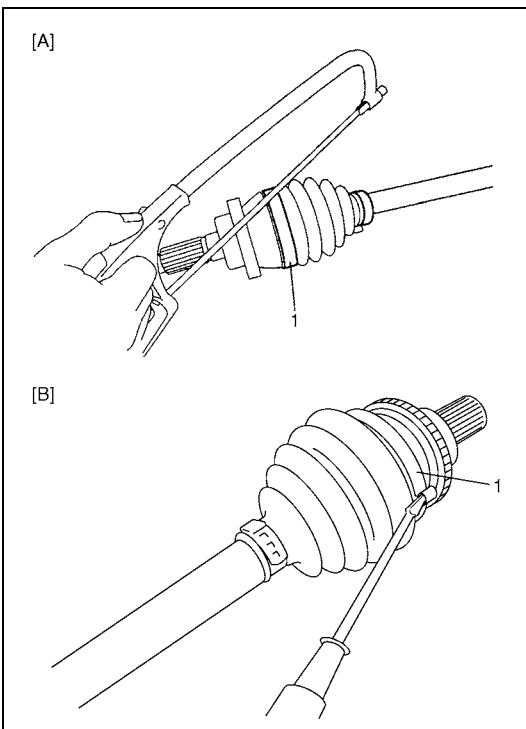
- 2) Remove differential side joint from shaft as follows.
  - a) Gather boot and remove old grease so that circlip (1) is visible.



- b) Clamp drive shaft in soft jawed vise, and then expand cir-clip (2) by using special tool and pull out differential side joint from drive shaft (1) by using plastic hammer.

### Special tool

(A) : 09900-06107



- 3) Remove differential side boot small band, and then pull out differential side boot from shaft.  
 4) Pull out damper through shaft.  
 5) Remove wheel side boot big band (1) as follows.  
 a) For boot big band without joint  
 i) Cut boot big band by using an iron saw or a nipper with care not to damage wheel side joint housing.  
 b) For boot big band with joint  
 i) Remove boot big band by using flat end rod or the like.  
 6) Remove wheel side boot small band, and then pull out wheel side boot from shaft.

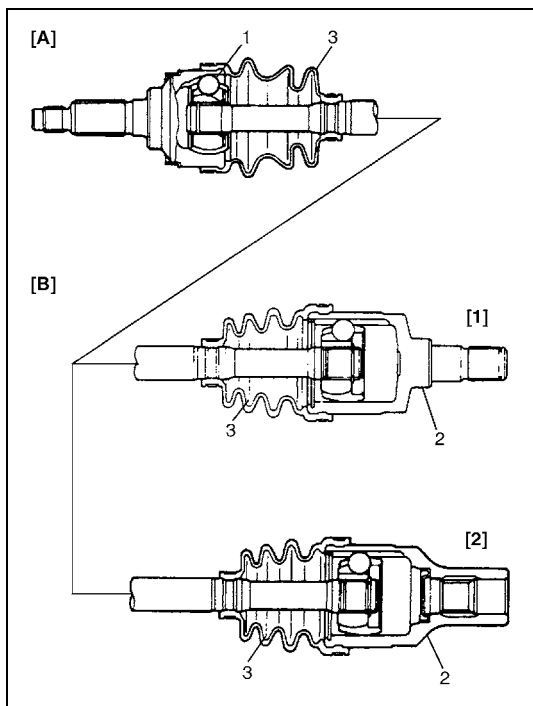
[A] : For boot big band without joint

[B] : For boot big band with joint



## Assembly

For M15 engine model and right side shaft of Z13DT engine model



### CAUTION:

- Do not wash boots in degrease, such as gasoline or kerosene, etc. Washing in degrease causes deterioration of boots.
- To ensure full performance of joint as designed, be sure to distinguish two types of grease in spare part and apply the specified amount of grease to each joint.

Judging from abnormality noted before disassembly and what is found through visual check of each component after disassembly, prepare replacement parts and start assembly, and make sure that wheel side joint (1) and differential side joint (2) are washed thoroughly and air dried, and boots (3) are cleaned with cloth if they are to be reused.

[A] :	Wheel side joint
[B] :	Transaxle or transfer side joint
[1] :	Left side shaft
[2] :	Right side shaft

- 1) Wash each component (except boots). After wash, dry each component completely by blowing air.
- 2) Clean boots with cloth.
- 3) Apply the specified amount of grease to the inside of joint housing.

### Grease color

For M15 engine model : Black

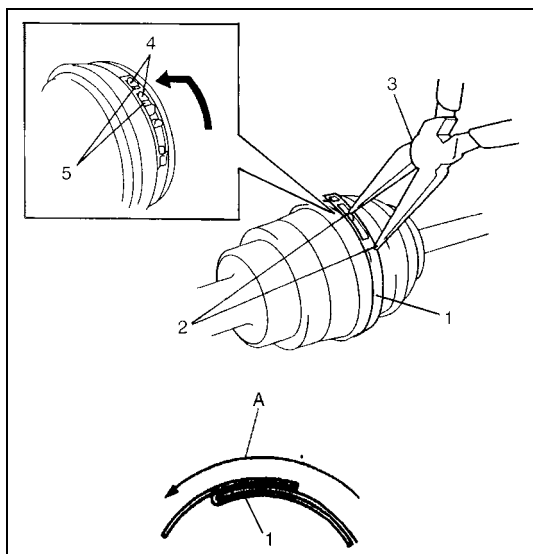
For right side shaft of Z13DT engine model : Black

### Amount

For M15 engine model : 60 – 80 g (2.1 – 2.8 oz)

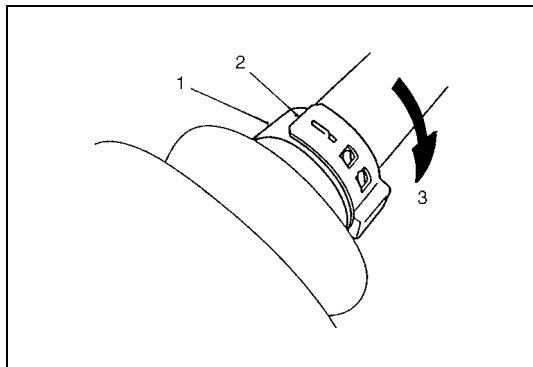
For right side shaft of Z13DT engine model :

75 – 95 g (2.6 – 3.4 oz)

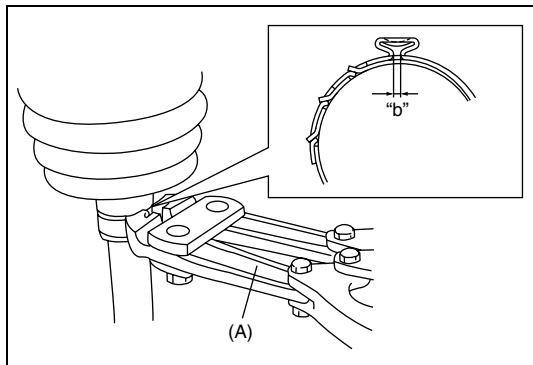


### CAUTION:

- Place boot band against forward rotation (A).
- Do not squeeze or distort boot when fastening it with bands. Distorted boot caused by squeezing air may reduce its durability.



- 5) Place new wheel side boot small band (1) onto boot putting band outer end (2) against forward rotation (3) as shown in figure.



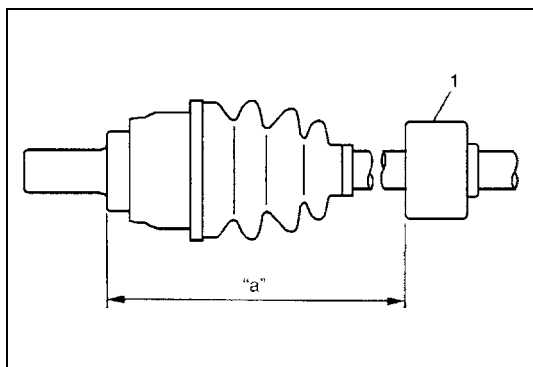
- 6) Fasten boot small band by using special tool.

**NOTE:**

- Small band must not come out of its installation section.
- Be sure to caulk small band securely until complete contact "b" is obtained.

**Special tool**

(A) : 09943-57010



- 7) Install damper (1) on right side drive shaft according to dimension specified below.

**Damper installation position**

**For M15 engine model**

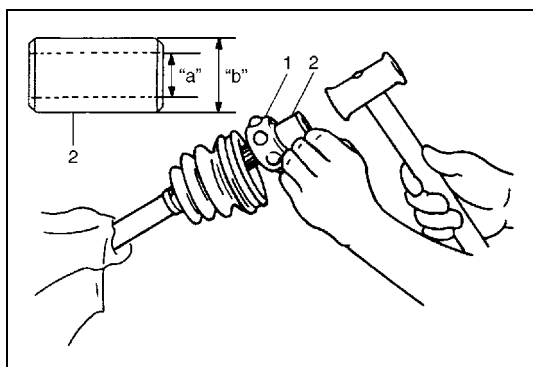
"a" : 174 – 180 mm (6.85 – 7.09 in.)

**For Z13DT engine model**

"a" : 157 – 163 mm (6.18 – 6.42 in.)

- 8) Fasten damper band referring to step 6) in assembly.

- 9) Set new differential side boot small band and differential side boot on shaft temporarily.



- 10) Install cage (1) onto shaft by using pipe (2).

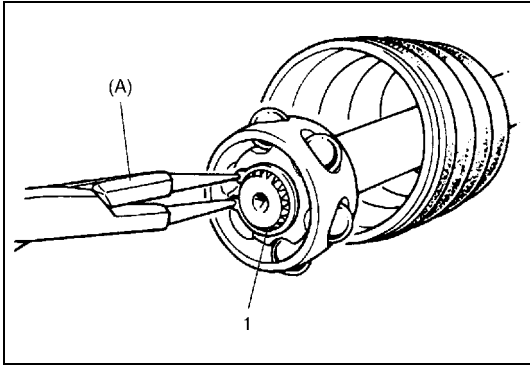
**Pipe diameter**

"a" : 25 mm (0.98 in.) or more

"b" : 33 mm (1.30 in.) or less

**CAUTION:**

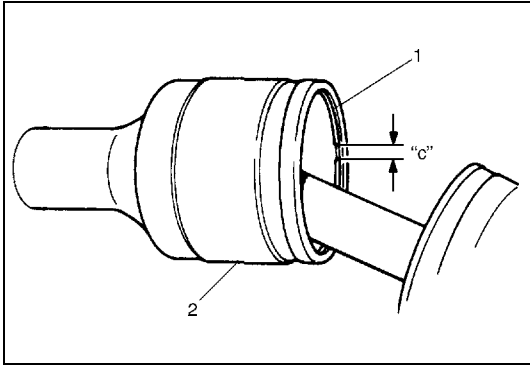
**Install cage directing smaller outside diameter side to wheel side.**



- 11) Install new snap ring (1) by using special tool.

**Special tool**

**(A) : 09900-06107**

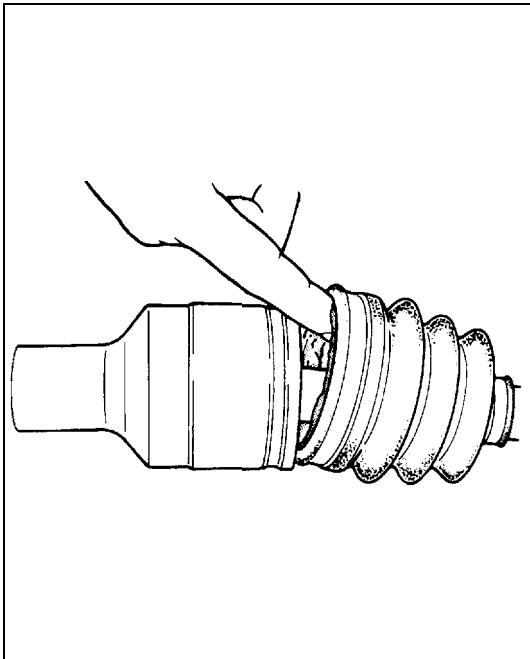


- 12) Apply grease to entire surface of cage using specified grease included in spare parts.

- 13) Insert cage into joint housing and fit circlip (1) into groove of joint housing (2).

**CAUTION:**

**Position opening of snap ring "c" so that it will not be lined up with a ball.**



- 14) Apply the specified amount of grease to the inside of joint housing, and fit boot to joint housing. After fitting boot, insert screwdriver into boot on joint housing side and allow air to enter boot so that air pressure in boot becomes the same as atmospheric pressure.

**Grease color**

**For right side shaft of M15 engine model : Black and grey**

**For left side shaft of M15 engine model : Black and grey**

**For right side shaft of Z13DT engine model**

**: Black and grey**

**Amount**

**For right side shaft of M15 engine model**

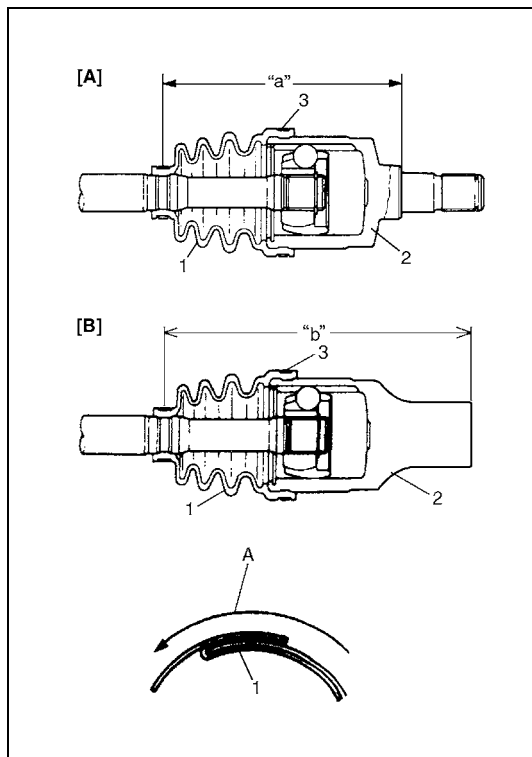
**: 75 – 95 g (2.6 – 3.4 oz)**

**For left side shaft of M15 engine model**

**: 70 – 90 g (2.5 – 3.2 oz)**

**For right side shaft of Z13DT engine model**

**: 80 – 100 g (2.8 – 3.5 oz)**



- 15) When fixing boot (1) to joint housing (2) with boot big band (3), adjust so that measurements become as indicated below. For fixing boot band, refer to steps 4) to 6).

#### Drive shaft boot fixing position

##### Left side shaft of vehicle with manual transaxle

“a” : 153.8 – 163.8 mm (6.06 – 6.45 in.)

##### Left side shaft of vehicle with automatic transaxle

“a” : 143.5 – 153.5 mm (5.65 – 6.04 in.)

##### Right side shaft

“b” : 182.8 – 192.8 mm (7.20 – 7.59 in.)

#### CAUTION:

- Bend each boot band against forward rotation (A).
- Do not squeeze or distort boot when fastening it with bands. Distorted boot caused by squeezing air may reduce its durability.

[A] : Left side shaft

[B] : Right side shaft

#### For left side shaft of Z13DT engine model

#### CAUTION:

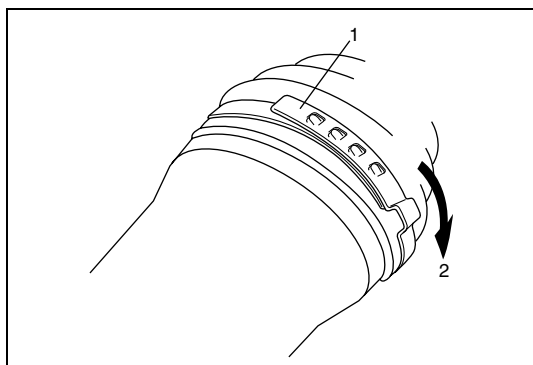
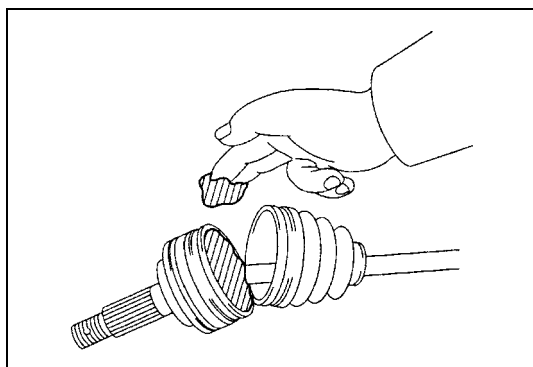
To prevent any problem caused by washing solution, do not wash boots. Degreasing boots with cloth is allowed.

- 1) Wash each component (except boots).  
After wash, dry each component completely by blowing air.
- 2) Clean boots with cloth.
- 3) Install wheel side boot on shaft temporarily.
- 4) Apply grease in the supplied parts to the inside of joint housing.

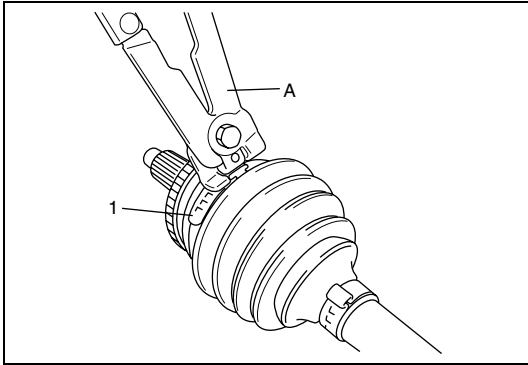
**Grease color : Dark brown**

**Amount : Approximately 85 g (3.0 oz)**

- 5) Fit wheel side boot onto grooves of housing and shaft.



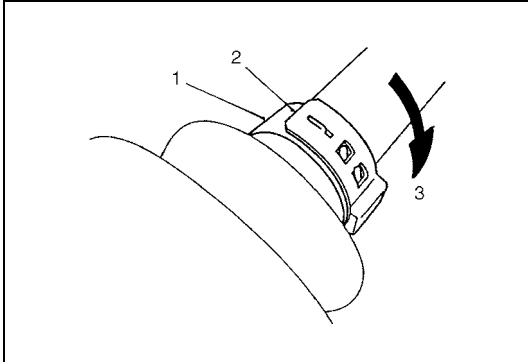
- 6) Place new wheel side boot big band onto boot putting band outer end (1) against forward rotation (2) as shown in figure.



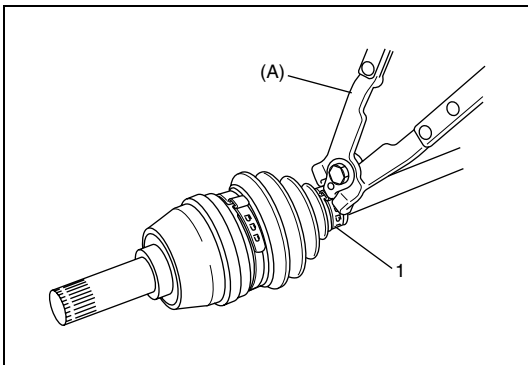
- 7) Confirm that wheel side boot is not stretched or contracted, and then fasten boot big band (1) securely by using special tool.

**Special tool**

(A) : 09943-55010 or 09943-57010



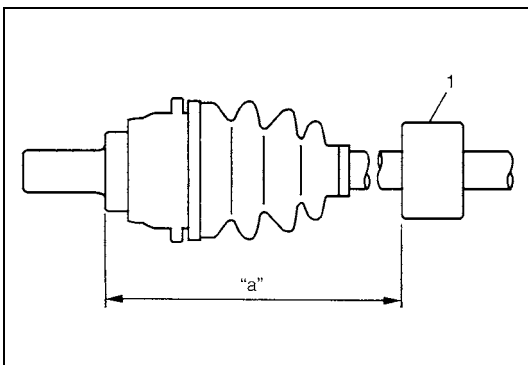
- 8) Place new wheel side boot small band (1) onto boot putting band outer end (2) against forward rotation (3) as shown in figure.



- 9) Confirm that wheel side boot is not stretched or contracted, and then fasten boot small band (1) securely by using special tool.

**Special tool**

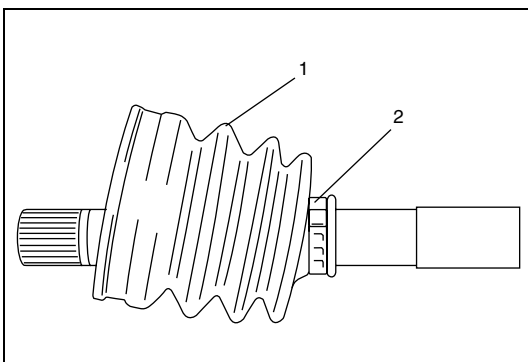
(A) : 09943-55010 or 09943-57010



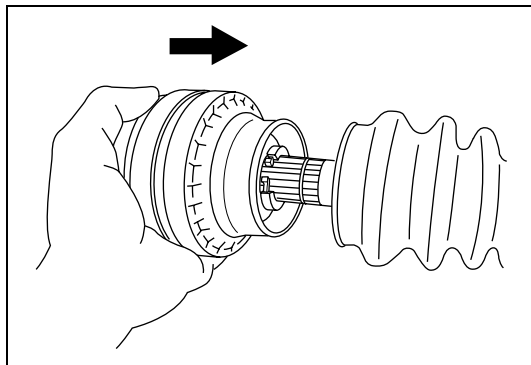
- 10) Install damper (1) on drive shaft according to dimension specified below.

**Damper installation position**

"a" : 157 – 163 mm (6.18 – 6.42 in.)



- 11) Set new differential side boot small band (2) and differential side boot (1) on shaft temporarily.

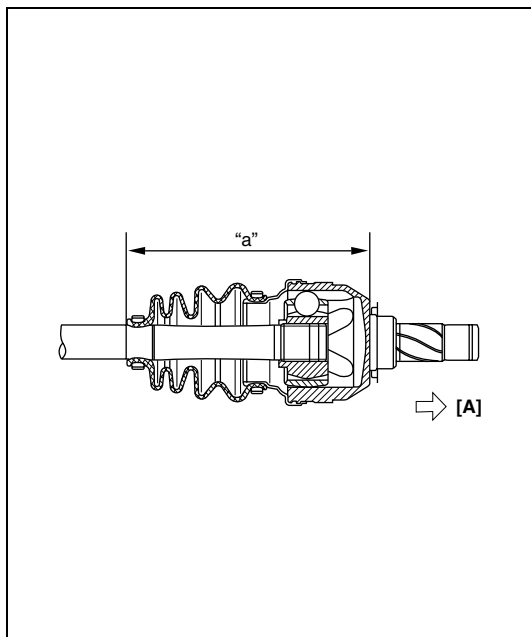


- 12) Apply grease in the supplied parts to the inside of differential side joint housing.

**Grease color : Dark brown**

**Amount : Approximately 80 g (2.8 oz)**

- 13) Place differential side joint onto spline of drive shaft and drive onto drive shaft by using plastic hammer until circlip engages.



- 14) Fit boot to grooves of shaft and housing and adjust length "a" to specification below. Insert screwdriver into boot and allow air to enter boot so that air pressure in boot becomes the same as atmospheric pressure.

**Drive shaft boot fixing position**

**"a" : Approximately 168.7 mm (6.64 in.)**

A : Differential side

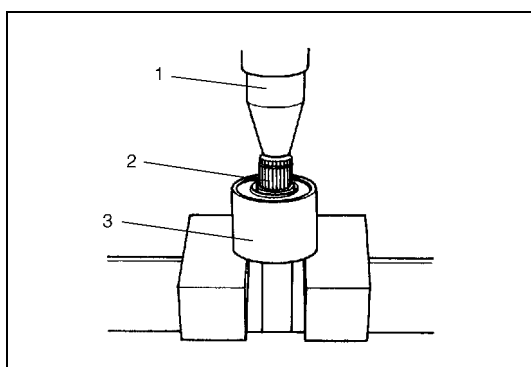
**CAUTION:**

**Do not squeeze or distort boot when fastening it with bands. Distorted boot caused by squeezing air may reduce its durability.**

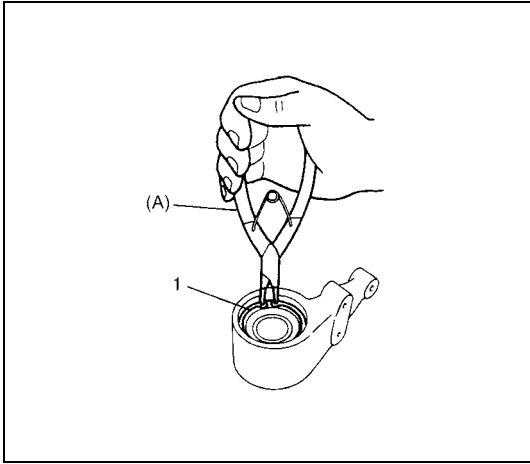
- 15) Install and fasten new boot big and small bands at that position of step 14) in the same procedure as steps 6) to 9).

## Center Shaft and Center Bearing Support Disassembly and Assembly

### Disassembly



- 1) For M/T vehicle, go to the next step. For A/T vehicle, remove wheel side oil seal and circlip from center bearing support bracket (3).
- 2) Using hydraulic press (1), draw out center shaft (2) from center shaft support bearing.
- 3) Remove oil seals from center bearing support bracket (3).



- 4) Remove bearing support circlip(s) (1) by using special tool.

#### Special tool

(A) : 09900-06108

#### NOTE:

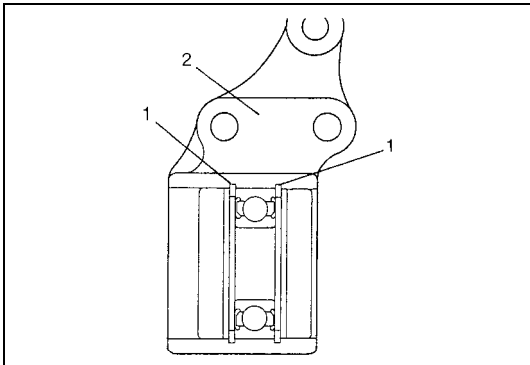
Two circlips are installed in center bearing support bracket of M15 engine model. On the other hand, one circlip is installed in center bearing support bracket of Z13DT engine model.

- 5) Remove center shaft support bearing from center bearing support bracket.

### Assembly

Install center shaft by reversing removal procedure and noting following points

- When installing circlip(s) (1), make sure that it fits in circlip groove in center bearing support bracket (2) securely as shown.



- When installing left oil seal (1) and right oil seal (2) to center bearing support bracket (3) by using special tools, use care so that the oil seals installed in proper direction and position as shown figure.

#### Special tool

(A) : 09913-76010 (For A/T vehicle)

(B) : 09951-46010 (For A/T vehicle)

(C) : 09944-66020 (For A/T vehicle)

09925-15410 (For M/T vehicle)

#### Distance

M/T vehicle with M15 engine

"a" : 8 – 9 mm (0.31 – 0.35 in.)

"b" : 2 – 3 mm (0.08 – 0.12 in.)

A/T vehicle with M15 engine

"a" : 0 mm (0 in.)

"b" : 0 mm (0 in.)

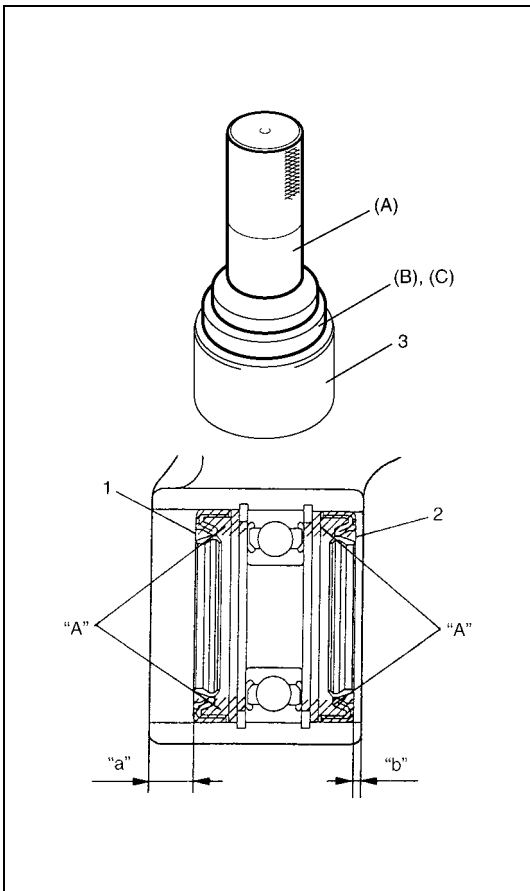
Z13DT engine model

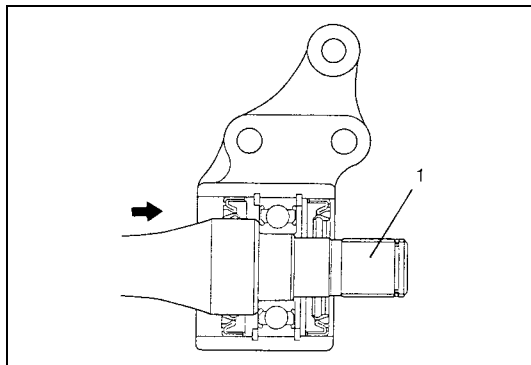
"a" : 3.5 – 4.5 mm (0.14 – 0.18 in.)

"b" : 3.5 – 4.5 mm (0.14 – 0.18 in.)

- Be sure to apply grease to oil seal lip and bearing side space indicated in figure.

"A" : Grease 99000-25010





- Press-fit center shaft (1) from transaxle side.

## Tightening Torque Specification

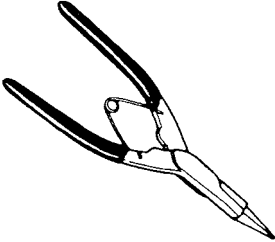
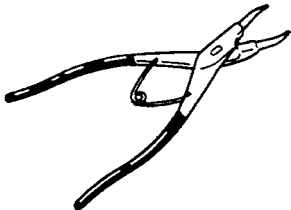
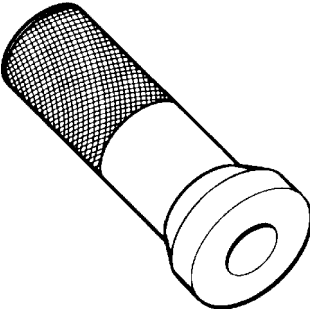
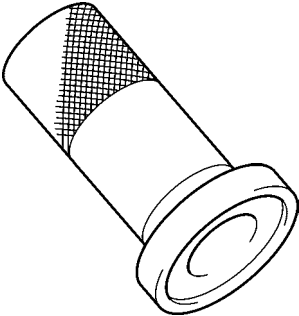
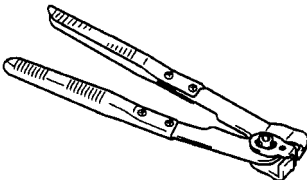
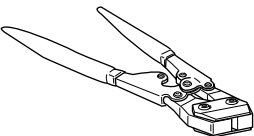
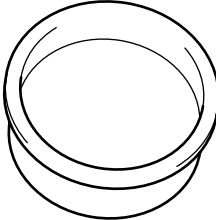
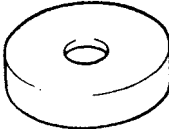
Fastening part	Tightening torque		
	N•m	kg-m	lb-ft
Oil drain plug	21	2.1	15.5
Oil filler/level plug (M15 engine model)	21	2.1	15.5
Oil filler/level plug (Z13DT engine model)	Tighten the plug 4 N•m (0.4 kg-m, 3.0 lb-ft), 45° and 135°.		
Ball stud bolt	60	6.0	43.5
Tie rod end nut	40	4.0	29.0
Drive shaft nut	175	17.5	126.5
Wheel bolt	95	9.5	69.0
Stabilizer mount bracket bolt	45	4.5	32.5
Center bearing support bolt (M15 engine model)	55	5.5	40.0
Center bearing support bolt (Z13DT engine model)	25	2.5	18.0
Oil pan bolt (Z13DT engine model)	18	1.8	13.0

## Required Service Material

Material	Recommended SUZUKI product (Part Number)	Use
Lithium grease	SUZUKI SUPER GREASE A (99000-25010)	• Oil seal lips
Sealant	SUZUKI BOND NO. 1217G (99000-31260)	• Oil drain and filler/level plugs for manual transmission



## Special Tools

			
09900-06107 Snap ring plier (Open type)	09900-06108 Snap ring plier (Close type)	09913-76010 Differential bearing race inst	09925-15410 Oil seal installer
			
09943-55010 Boot clamp plier	09943-57010 Band compressor	09944-66020 Installer bearing	09951-46010 Installer drive shaft oil seal

## SECTION 5

# BRAKES

### WARNING:

For vehicles equipped with Supplemental Restraint (Air Bag) System:

- Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to “Air Bag System Components and Wiring Location View” under “General Description” in air bag system section in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and “Service Precautions” under “On-Vehicle Service” in air bag system section before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.
- Technical service work must be started at least 90 seconds after the ignition switch is turned to the “LOCK” position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).

### NOTE:

- When inspecting and servicing vehicle equipped with ABS, be sure to refer to section 5E first.
- All brake fasteners are important attaching parts in that they could affect the performance of vital parts and systems, and/or could result in major repair expense. They must be replaced with one of same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of all parts. There is to be no welding as it may result in extensive damage and weakening of the metal.
- For the items with asterisk (\*) in the “CONTENTS” below, refer to the same section of the Service Manual mentioned in “Foreword” of this manual.

## CONTENTS

<b>General Description</b> .....	*	Brake Disc Check .....	*
<b>Diagnosis</b> .....	*	Brake Pad Check .....	*
Road Testing Brakes .....	*	Brake Shoe Check .....	*
Brake Fluid Leaks .....	*	Parking Brake Inspection and Adjustment .....	*
Substandard or Contaminated Brake Fluid .....	*	Flushing Brake Hydraulic System .....	*
Diagnosis Table .....	*	Brake Fluid Pressure Test	
<b>Check and Adjustment</b> .....	*	(if equipped with LSPV) .....	*
Air Bleeding of Brake System .....	*	Booster Operation Check .....	*
Brake Pedal Free Height Check .....	*	Check air tightness .....	*
Brake (Stop) Light Switch Check .....	*	Check operation .....	*
Excessive Pedal Travel Check .....	*	Check air tightness under load .....	*
Brake Pedal Play Check .....	*	<b>Tightening Torque Specifications</b> .....	5-2
Brake Fluid Level Check .....	*	<b>Required Service Material</b> .....	*
Brake Hose and Pipe Check .....	*	<b>Special Tool</b> .....	*
Master Cylinder Check .....	*		

## Tightening Torque Specifications

Fastening part		Tightening torque		
		N•m	kg-m	lb-ft
Brake pipe flare nut		16	1.6	11.5
Brake bleeder plug	Front caliper	6.5	0.65	5.0
	Wheel cylinder	8.5	0.85	6.5
LSPV mounting bolt		26	2.6	19.0
LSPV spring end nut		20	2.0	14.5
LSPV spring bracket screw		9	0.9	6.5
Wheel bolt		95	9.5	69.0

## SECTION 5A

## BRAKES PIPE / HOSE / MASTER CYLINDER

**WARNING:**

For vehicles equipped with Supplemental Restraint (Air Bag) System:

- Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to “Air Bag System Components and Wiring Location View” under “General Description” in air bag system section in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and “Service Precautions” under “On-Vehicle Service” in air bag system section before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.
- Technical service work must be started at least 90 seconds after the ignition switch is turned to the “LOCK” position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).

**NOTE:**

- All brake fasteners are important attaching parts in that they could affect the performance of vital parts and systems, and/or could result in major repair expense. They must be replaced with one of same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of all parts. There is to be no welding as it may result in extensive damage and weakening of the metal.
- For the items with asterisk (\*) in the “CONTENTS” below, refer to the same section of the Service Manual mentioned in “Foreword” of this manual.

5A

## CONTENTS

<b>General Description</b> .....	*	Master Cylinder Removal and Installation	
LSPV (Load Sensing Proportioning Valve)		(for RH Model) .....	*
Assembly Description (if equipped) .....	*	Master Cylinder Disassembly and	
<b>Diagnosis</b> .....	*	Assembly (for RH Model) .....	*
<b>Check and Adjustment</b> .....	*	Master Cylinder Assembly Inspection	
<b>On-Vehicle Service</b> .....	5A-3	(for RH Model) .....	*
Front Brake Hose Components		Master Cylinder Check (for LH Model) .....	*
Location .....	*	Master Cylinder Check (for RH Model) .....	*
Front Brake Pipe Components Location .....	5A-4	Brake Booster Components Locator .....	*
Rear Brake Hose / Pipe Components		Brake Booster Removal and Installation	
Location .....	*	(for LH Model) .....	*
Brake Hose / Pipe Removal and		Brake Booster Removal and Installation	
Installation .....	*	(for RH Model) .....	*
Master Cylinder Reservoir Removal and		Brake Booster Inspection (for LH Model) .....	*
Installation (for LH Model) .....	*	Brake Booster Inspection and Adjustment	
Master Cylinder Reservoir Removal and		(for RH Model) .....	*
Installation (for RH Model) .....	*	LSPV (Load Sensing Proportioning Valve)	
Master Cylinder Components .....	*	Assembly Components Locator	
Master Cylinder Removal and Installation		(if equipped) .....	*
(for LH Model) .....	*	LSPV (Load Sensing Proportioning Valve)	
		Removal and Installation .....	*

LSPV (Load Sensing Proportioning Valve)	
Inspection and Adjustment.....	*
Brake Pedal and Brake Pedal Bracket	
Components Location .....	*
Brake Pedal and Brake Pedal Bracket	
Removal and installation .....	*
Stop (Brake) Lamp Switch Removal and	
Installation.....	*
<b>Tightening Torque Specifications.....</b>	<b>*</b>
<b>Required Service Material.....</b>	<b>*</b>
<b>Special Tools.....</b>	<b>*</b>

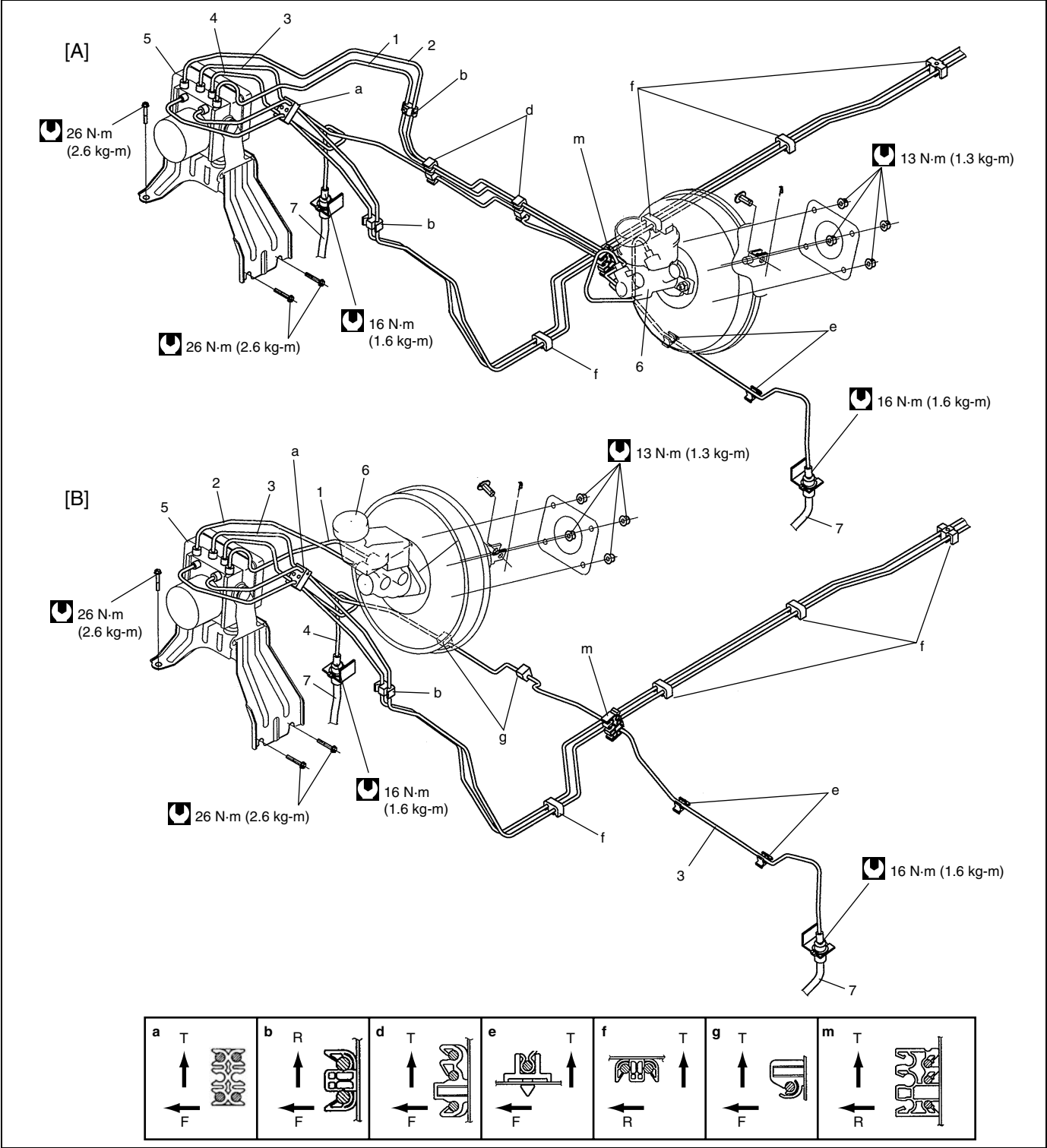
## On-Vehicle Service

**CAUTION:**

- Lubricate rubber parts with clean, fresh brake fluid to ease assembly.
- Do not use lubricated shop air on brake parts as damage to rubber components may result.
- If any hydraulic component is removed or brake line disconnected, bleed the brake system.
- The torque values specified are for dry, unlubricated fasteners.
- Do not allow brake fluid to get on painted surfaces. Painted surfaces will be damaged by brake fluid.

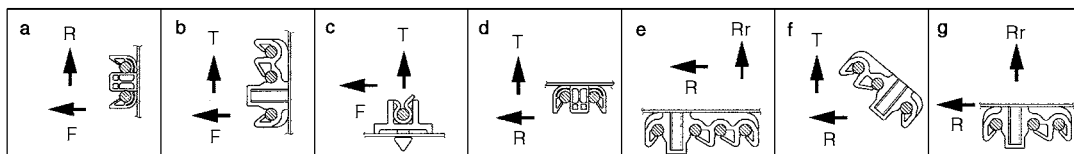
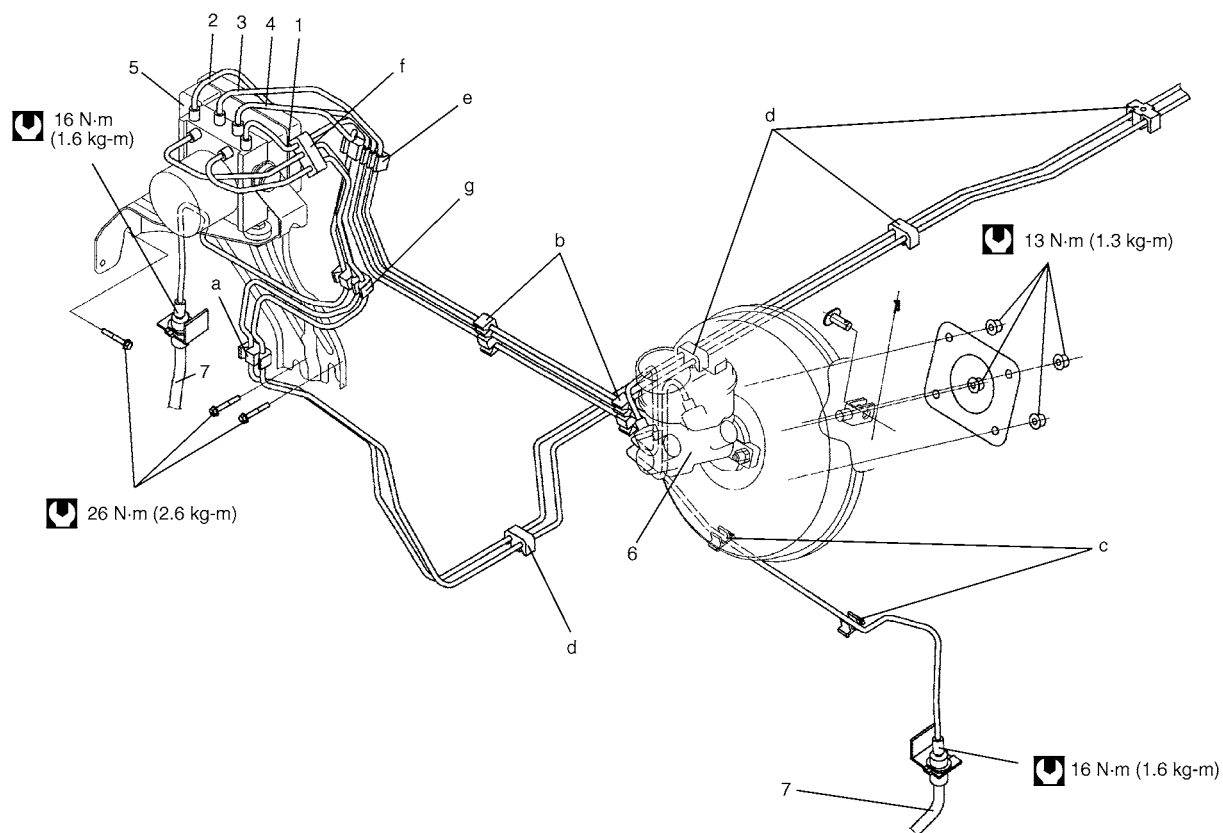
Front Brake Pipe Components Location


For vehicle with ABS (Gasoline Engine Model)



T: Top side	1. from master cylinder primary to ABS hydraulic unit	5. ABS hydraulic unit	[A]: For left-hand steering vehicle
F: Front side	2. from master cylinder secondary to ABS hydraulic unit	6. Master cylinder	[B]: For right-hand steering vehicle
R: Right side	3. from ABS hydraulic unit to left front brake	7. Front brake hose	Tightening torque
a-m: Clamp	4. from ABS hydraulic unit to right front brake		

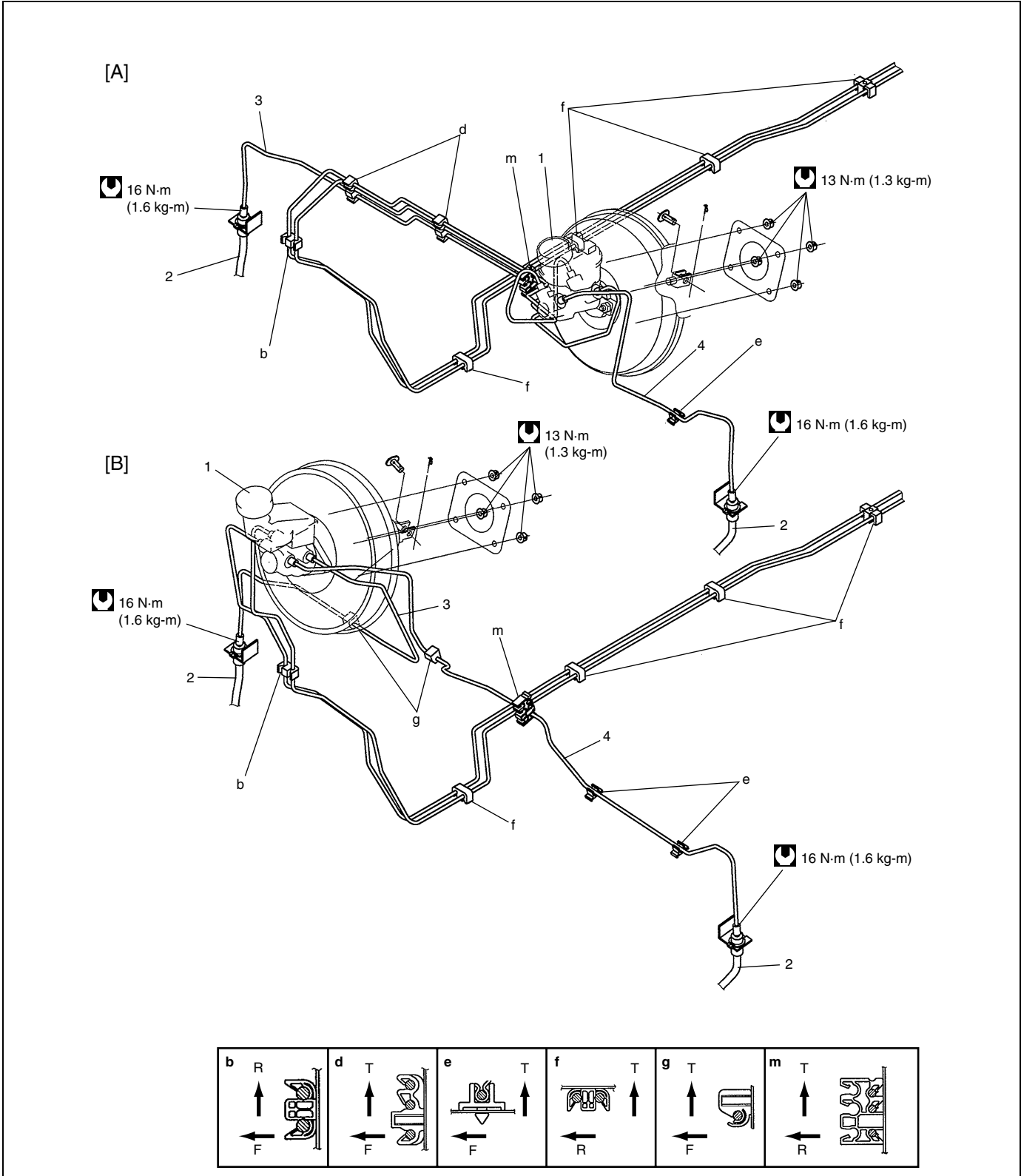
## For vehicle with ABS (Diesel Engine Model)




T: Top side	1. from master cylinder primary piston to ABS hydraulic unit	6. Master cylinder
F: Front side	2. from master cylinder secondary piston to ABS hydraulic unit	7. Front brake hose
R: Right side	3. Form ABS hydraulic unit to left front brake	 Tightening torque
Rr: Rear side	4. Form ABS hydraulic unit to right front brake	
a-g: Clamps	5. ABS hydraulic unit	



For vehicle without ABS



T: Top side	1. Master cylinder	[A]: For left-hand steering vehicle
F: Front side	2. Front brake hose	[B]: For right-hand steering vehicle
R: Right side	3. from master cylinder primary to right front brake	 Tightening torque
b-m: Clamp	4. from master cylinder secondary to left front brake	

## SECTION 5B

# FRONT BRAKE

### NOTE:

- All brake fasteners are important attaching parts in that they could affect the performance of vital parts and systems, and/or could result in major repair expense. They must be replaced with one of same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of all parts. There is to be no welding as it may result in extensive damage and weakening of the metal.
- For the items with asterisk (\*) in the “CONTENTS” below, refer to the same section of the Service Manual mentioned in “Foreword” of this manual.

## CONTENTS

<b>General Description .....</b>	*	Front Disc Brake Caliper Removal and	
Front Brake Component Location .....	*	Installation .....	5B-3
<b>Diagnosis .....</b>	*	Front Disc Brake Caliper Boot Inspection .....	*
<b>Check and Adjustment .....</b>	*	Front Disc Brake Caliper Disassembly	
<b>On-Vehicle Service .....</b>	<b>5B-2</b>	and Assembly .....	*
Front Disc Brake Pad Removal and		Front Brake Disc Removal and	
Installation .....	5B-2	Installation .....	5B-4
Front Disc Brake Pad Inspection .....	*	<b>Tightening Torque Specification .....</b>	<b>5B-4</b>
Front Brake Disc Inspection .....	*	<b>Required Service Material .....</b>	*
Brake Caliper Carrier Inspection .....	*	<b>Special Tool .....</b>	*

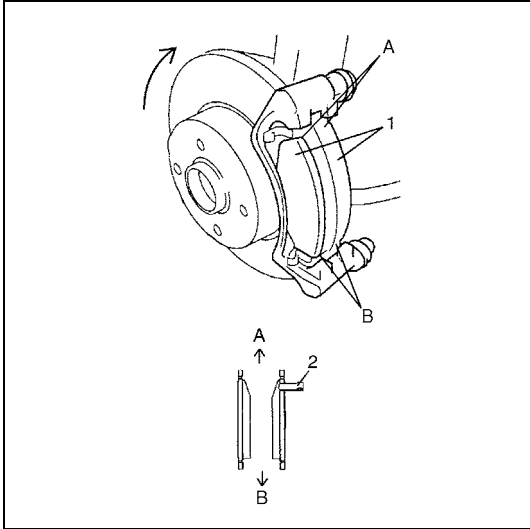
## On-Vehicle Service

### Front Disc Brake Pad Removal and Installation

#### Installation

##### CAUTION:

Observe CAUTION at the beginning of “Front Brake Components Location” in this section.



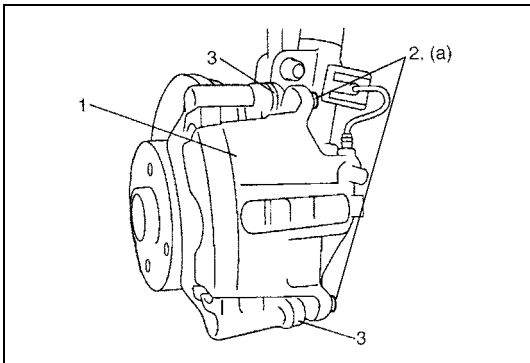
- 1) Install pads (1).

##### NOTE:

- When installing brake pad, make sure that its tapered side is positioned upward (A) as shown in figure.
- Install pad with sensor (2) to vehicle center side on right wheel brake.

A: Upper side
---------------

B: Lower side
---------------



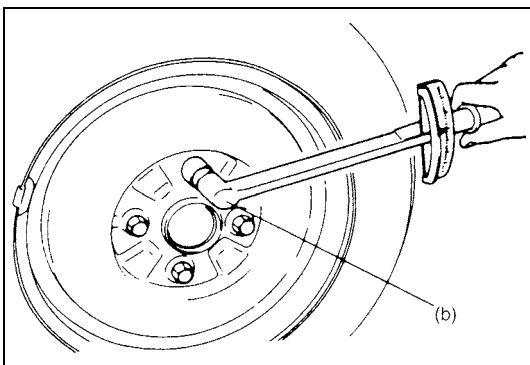
- 2) Install caliper (1) and tighten caliper pin bolts (2) to specification.

##### Tightening torque

Caliper pin bolt (a): 30 N·m (3.0 kg-m, 22.0 lb-ft)

##### NOTE:

Make sure that boots (3) are fit into groove securely.



- 3) Tighten front wheel bolts to specification.

##### Tightening torque

Wheel bolt (b): 95 N·m (9.5 kg-m, 69.0 lb-ft)

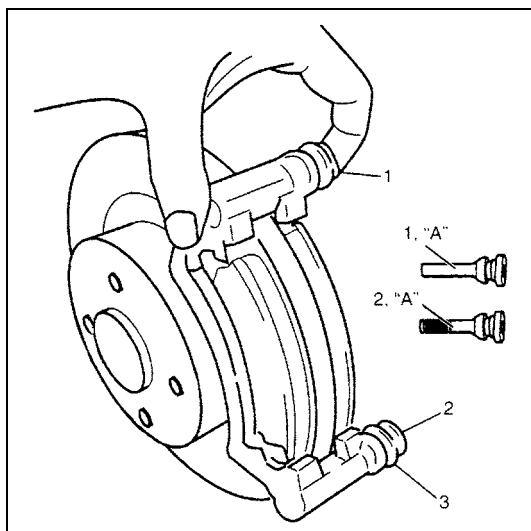
- 4) Upon completion of installation, perform brake test.

## Front Disc Brake Caliper Removal and Installation

### Installation

#### CAUTION:

Observe CAUTION at the beginning of "Front Brake Components Location" in this section.

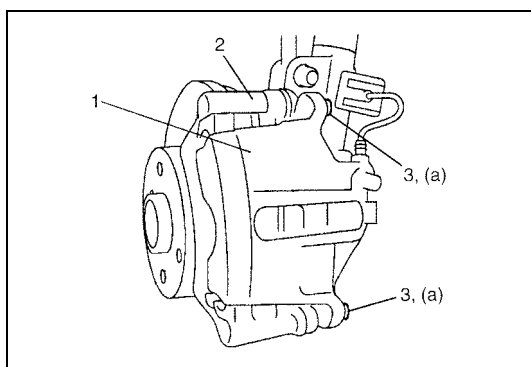


Before installing caliper (cylinder body) to carrier, check to ensure that guiding pin (1) and locking pin (2) inserted in each caliper carrier hole can be moved smoothly in thrust direction.

#### NOTE:

Use rubber grease whose viscosity varies very little even at  $-40^{\circ}\text{C}$  ( $-40^{\circ}\text{F}$ ) if applied.

"A": Rubber grease



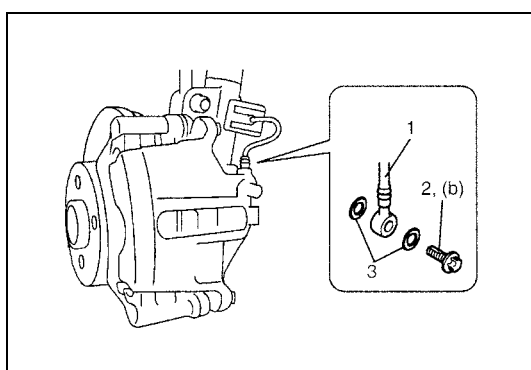
- 1) Install caliper (1) to caliper carrier (2).
- 2) Tighten caliper pin bolts (3) to specifications.

#### Tightening torque

Caliper pin bolt (a): 30 N·m (3.0 kg-m, 22.0 lb-ft)

#### NOTE:

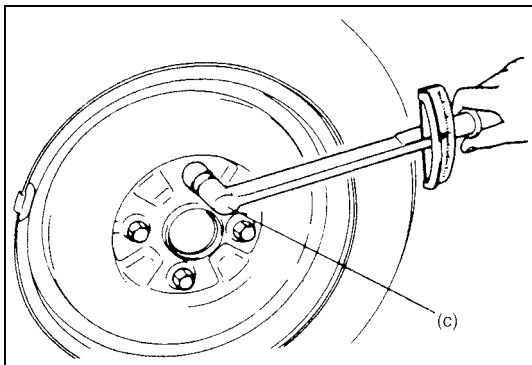
Make sure that boots are fit into groove securely.



- 3) Install brake flexible hose (1) and new gaskets (3) as shown and tighten hose bolt (2) to specification.

#### Tightening torque

Flexible hose bolt (b): 23 N·m (2.3 kg-m, 17.0 lb-ft)



- 4) Tighten wheel bolts to specification.

#### Tightening torque

**Wheel bolt (c): 95 N·m (9.5 kg-m, 69.0 lb-ft)**

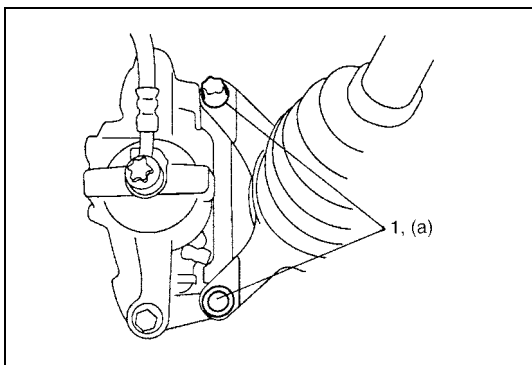
- 5) After completing installation, fill reservoir with brake fluid and bleed brake system. Perform brake test and check each installed part for oil leakage.

## Front Brake Disc Removal and Installation

### CAUTION:

During removal, be careful not to damage brake flexible hose and not to depress brake pedal.

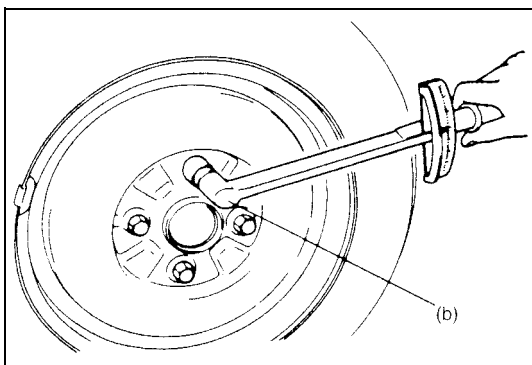
### Installation



- 1) Install disc to wheel hub and tighten disc securing screws.  
 2) Install caliper assembly to steering knuckle.  
 3) Tighten caliper carrier bolts (1) to specification.

#### Tightening torque

**Caliper carrier bolt (a): 95 N·m (9.5 kg-m, 69.0 lb-ft)**



- 4) Tighten front wheel bolts to specifications.

#### Tightening torque

**Wheel bolt (b): 95 N·m (9.5 kg-m, 69.0 lb-ft)**

- 5) Upon completion of installation, perform brake test.

## Tightening Torque Specification

Fastening part	Tightening torque		
	N·m	kg-m	lb-ft
Caliper pin bolt	30.0	3.0	22.0
Wheel bolt	95.0	9.5	69.0
Flexible hose bolt	23.0	2.3	17.0
Caliper carrier bolt	95.0	9.5	69.0
Brake disc securing screw	9.0	0.9	6.5

## SECTION 5C

# PARKING AND REAR BRAKE

### WARNING:

For vehicles equipped with Supplemental Restraint (Air Bag) System:

- Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to “Air Bag System Components and Wiring Location View” under “General Description” in air bag system section in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and “Service Precautions” under “On-Vehicle Service” in air bag system section before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.
- Technical service work must be started at least 90 seconds after the ignition switch is turned to the “LOCK” position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).

### NOTE:

- All brake fasteners are important attaching parts in that they could affect the performance of vital parts and systems, and/or could result in major repair expense. They must be replaced with one of same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of all parts. There is to be no welding as it may result in extensive damage and weakening of the metal.
- For the items with asterisk (\*) in the “CONTENTS” below, refer to the same section of the Service Manual mentioned in “Foreword” of this manual.

5C

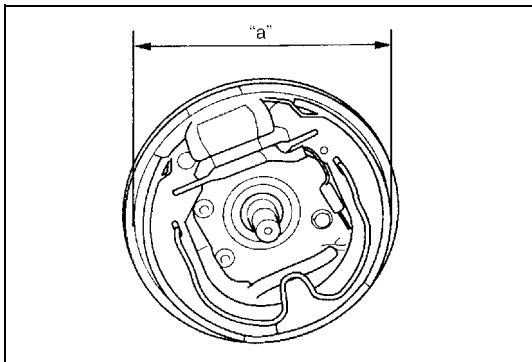
## CONTENTS

<b>Diagnosis</b> ..... *	Wheel Cylinder Inspection ..... *
<b>Check and Adjustment</b> ..... *	Brake Back Plate Removal and Installation (for 2WD Model)..... 5C-4
<b>On-Vehicle Service</b> ..... 5C-2	Brake Back Plate Removal and Installation (for 4WD Model) ..... *
Brake Drum Component Location..... *	Parking Brake Cable Component Location ..... *
Brake Drum Removal and Installation (for 2WD Model)..... 5C-2	Parking Brake Cable Removal and Installation..... *
Brake Drum Removal and Installation (for 4WD Model)..... 5C-3	Parking Brake Lever Removal and Installation..... *
Drum Brake Component Parts Inspection..... *	<b>Tightening Torque Specification</b> ..... 5C-5
ABS Sensor Ring Replacement (for 2WD Model)..... *	<b>Required Service Materials</b> ..... *
ABS Sensor Ring Replacement (for 4WD Model)..... *	<b>Special Tools</b> ..... *
Brake Shoe Removal and Installation ..... *	
Wheel Cylinder Removal and Installation ..... *	

## On-Vehicle Service

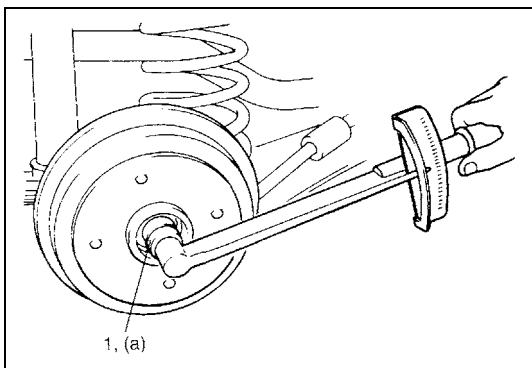
### Brake Drum Removal and Installation (for 2WD Model)

#### Installation



- 1) Before installing brake drum, check outer diameter "a" of brake shoes. If it is not within value as specified below, adjust it to specification by turning adjuster.

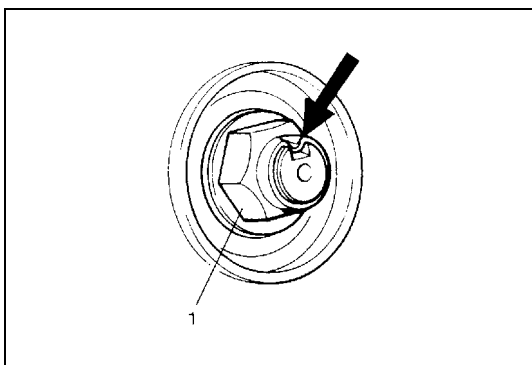
Brake shoes outer diameter "a"	=	Measured brake drum inside diameter	-	0.5 to 1.0 mm (0.02 to 0.04 in.)
--------------------------------------	---	---	---	-------------------------------------



- 2) Install brake drum after making sure that inside of brake drum and brake shoes are free from dirt and oil.
- 3) Install new spindle nut (1).
- 4) Tighten spindle nut (1) to specified torque.

#### Tightening torque

**Spindle nut (a): 175 N·m (17.5 kg-m, 126.5 lb-ft)**

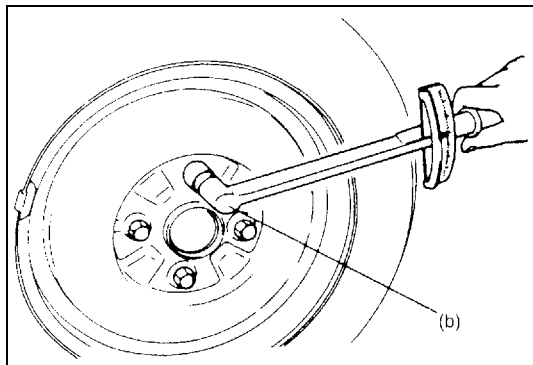


- 5) Calk spindle nut (1).
- 6) Install spindle cap.

#### NOTE:

- When installing spindle cap, hammer lightly several locations on the collar of cap until collar comes closely into contact with brake drum.
- If fitting part of cap is deformed or damaged or if it is fitted loosely, replace with new one.

- 7) Upon completion of all jobs, depress brake pedal with about 300 N (30 kg, 66 lbs) load at least 15 – 20 times until adjuster actuator clicking sound from drum brake can not be heard so as to obtain proper drum-to-shoe clearance. Adjust parking brake cable. For adjustment, refer to "Parking Brake Inspection and Adjustment" in Section 5.
- 8) Install console box cap if removed.



- 9) Install wheel and tighten wheel bolts to specified torque.

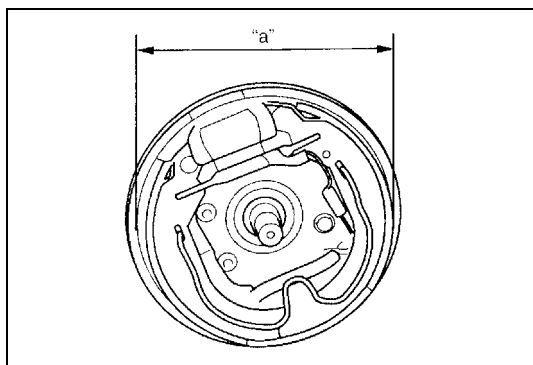
#### Tightening torque

**Wheel bolt (b): 95 N·m (9.5 kg-m, 69.0 lb-ft)**

- 10) Check to ensure that brake drum is free from dragging and proper braking is obtained. Then remove vehicle from hoist and perform brake test (foot brake and parking brake).

## Brake Drum Removal and Installation (for 4WD Model)

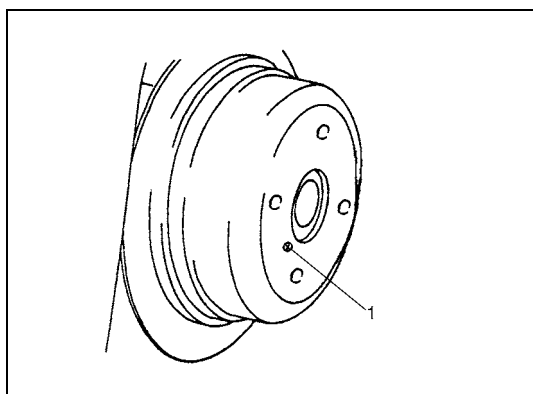
### Installation



- 1) Before installing brake drum, check outer diameter "a" of brake shoes. If it is not within value as specified below, adjust it to specification by turning adjuster.

Brake shoes outer diameter "a"	=	Measured brake drum inside diameter	-	0.5 to 1.0 mm (0.02 to 0.04 in.)
--------------------------------------	---	---	---	-------------------------------------

- 2) Install brake drum after making sure that inside of brake drum and brake shoes are free from dirt and oil.

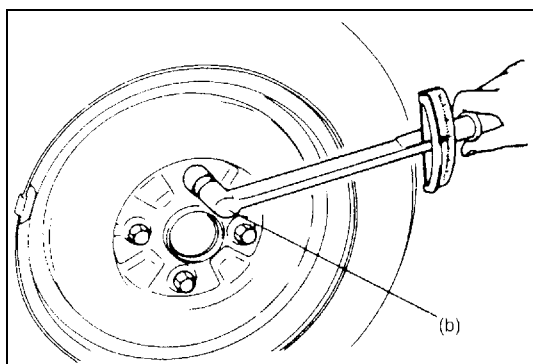


- 3) Tighten screw (1) to specified torque.

#### Tightening torque

**Brake drum screw (a): 9 N·m (0.9 kg-m, 6.5 lb-ft)**

- 4) Upon completion of all jobs, depress brake pedal with about 300 N (30 kg, 66 lbs) load at least 15 – 20 times until adjuster actuator clicking sound from drum brake can not be heard so as to obtain proper drum-to-shoe clearance. Adjust parking brake cable. For adjustment refer to "Parking Brake Inspection and Adjustment" in Section 5.
- 5) Install console box cap if removed.



- 6) Install wheel and tighten wheel bolts to specified torque.

#### Tightening torque

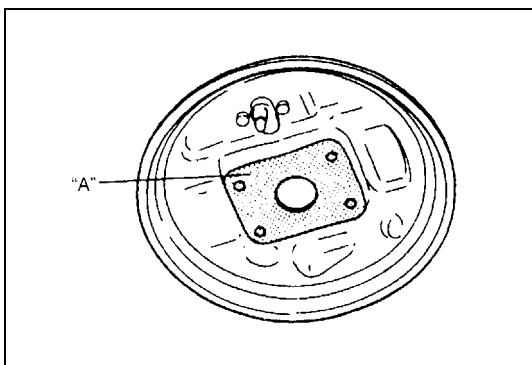
**Wheel bolt (b): 95 N·m (9.5 kg-m, 69.0 lb-ft)**

- 7) Check to ensure that brake drum is free from dragging and proper braking is obtained. Then remove vehicle from hoist and perform brake test (foot brake and parking brake).



## Brake Back Plate Removal and Installation (for 2WD Model)

### Installation

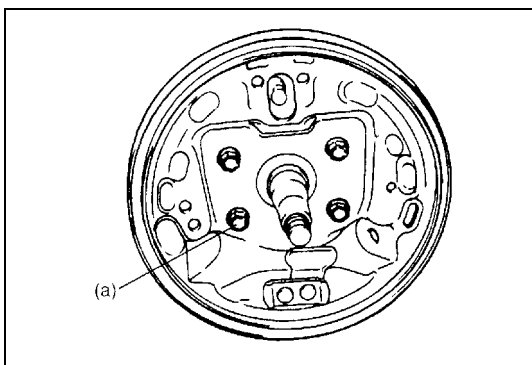


- 1) Apply water tight sealant to mating surfaces of brake back plate and rear axle.

**"A": Sealant 366E, 99000-31090**

#### NOTE:

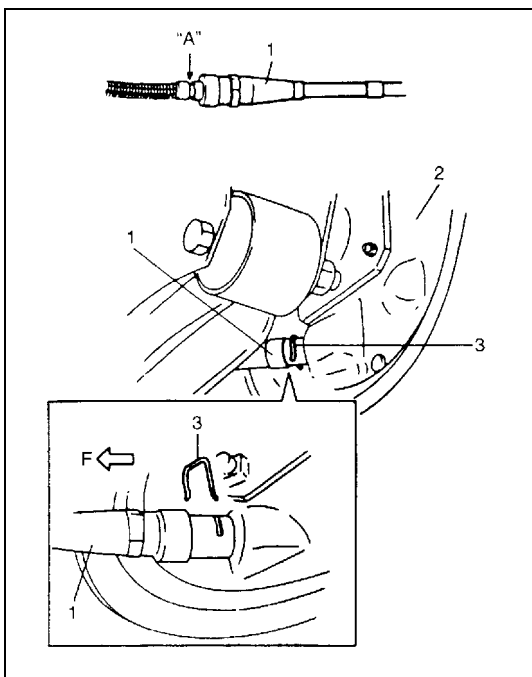
**In case of vehicle equipped with ABS, do not apply sealant around hole for wheel speed sensor.**



- 2) Install brake back plate and tighten back plate bolts to specified torque.

#### Tightening torque

**Brake back plate bolt (a): 23 N·m (2.3 kg-m, 17.0 lb-ft)**

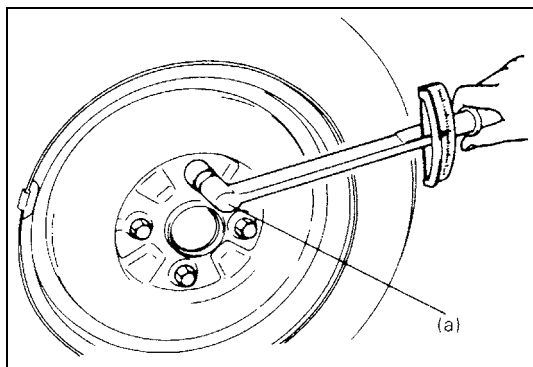


- 3) Apply water tight sealant where plate and cable contact, and run parking brake cable (1) through brake back plate (2) and secure it with clip (3).

**"A": Sealant 366E, 99000-31090**

F: Forward

- 4) Install wheel cylinder, and tighten wheel cylinder bolts and brake pipe flare nut to specified torque. Refer to "Installation" of "Wheel Cylinder Removal and Installation" in this section.
- 5) Install brake shoe referring to "Installation" of "Brake Shoe Removal and Installation" in this section.
- 6) Install brake drum. Refer to "Installation" of "Brake Drum Removal and Installation (for 2WD Model)" or "Brake Drum Removal and Installation (for 4WD Model)" in this section.



- 7) Fill reservoir with brake fluid and bleed brake system. For bleeding operation, referring to “Bleeding Brake” in Section 5.
- 8) Install wheel and tighten wheel bolts to specified torque.

#### **Tightening torque**

**Wheel bolt (a): 95 N·m (9.5 kg-m, 69.0 lb-ft)**

- 9) Upon completion of all jobs, depress brake pedal with about 300 N (30 kg, 66 lbs) load at least 10 – 15 times until adjuster actuator clicking sound from drum brake can not be heard so as to obtain proper drum-to-shoe clearance. Adjust parking brake cable. (For adjustment, refer to “Parking Brake Inspection and Adjustment” in Section 5.)
- 10) Install console box cap.
- 11) Check to ensure that brake drum is free from dragging and proper braking is obtained. Then remove vehicle from hoist and perform brake test (foot brake and parking brake).
- 12) Check each installed part for oil leakage.

## **Tightening Torque Specification**

Fastening part	Tightening torque		
	N·m	kg-m	lb-ft
Brake back plate bolt	23.0	2.3	17.0
Brake drum screw	9.0	0.9	6.5
Parking brake lever mounting bolt	26.0	2.6	19.0
Spindle nut	175.0	17.5	126.5
Wheel bolt	95.0	9.5	69.0



## SECTION 6

# ENGINE GENERAL INFORMATION AND DIAGNOSIS (M15 ENGINE)

**WARNING:**

For vehicles equipped with a Supplemental Restraint (Air Bag) System:

- Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to “Air Bag System Components and Wiring Location View” under “General Description” in air bag system section in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and “Service Precautions” under “On-Vehicle Service” in air bag system section before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.
- Technical service work must be started at least 90 seconds after the ignition switch is turned to the “LOCK” position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).

**NOTE:**

For the items with asterisk (\*) in the “CONTENTS” below, refer to the same section of the Service Manual mentioned in “Foreword” of this manual.

6

## CONTENTS

<b>General Information</b> .....	*	Visual Inspection.....	*
Statement on Cleanliness and Care .....	*	Engine Basic Inspection.....	*
Precaution .....	*	Engine Symptom Diagnosis.....	*
Precaution on engine service .....	*	Scan Tool Data .....	6-8
Precaution on fuel system service.....	*	Inspection of ECM and Its Circuits.....	6-13
Fuel pressure relief procedure .....	*	Table A-1 Malfunction Indicator Lamp	
Fuel leakage check procedure .....	*	Circuit Check – Lamp Does Not Come	
<b>Diagnosis</b> .....	*	“ON” with Ignition Switch ON (But	
Engine Diagnosis General Description .....	*	Engine Stops) .....	*
On-Board Diagnostic System Description.....	*	Table A-2 Malfunction Indicator Lamp	
Precaution in Diagnosing Trouble for		Circuit Check-lamp Remains “ON” after	
Engine .....	6-3	Engine Starts .....	*
Engine and Emission Control System		Table A-3 ECM Power and Ground	
Check .....	*	Circuit Check-MIL Doesn’t Light with	
Customer Problem Inspection Form		Ignition Switch ON and Engine Doesn’t	
(Example).....	*	Start Though It Is Cranked Up .....	*
Malfunction Indicator Lamp (MIL) Check .....	*	DTC P0010 Camshaft Position Actuator	
Diagnostic Trouble Code (DTC) Check.....	*	Circuit.....	*
Diagnostic Trouble Code (DTC)		DTC P0011 Camshaft Position – Timing	
Clearance.....	*	Over-Advanced or System Performance	
DTC Table.....	6-4	DTC P0012 Camshaft Position – Timing	
Fail-Safe Table.....	*	Over-Retarded .....	*

DTC P0101 Mass Air Flow Circuit Range/Performance .....	*	DTC P0420 Catalyst System Efficiency Below Threshold .....	*
DTC P0102 Mass Air Flow Circuit Low Input .....	*	DTC P0443 Evaporative Emission System Purge Control Valve Circuit .....	*
DTC P0103 Mass Air Flow Circuit High Input .....	*	DTC P0462 Fuel Level Sensor Circuit Low .....	*
DTC P0112 Intake Air Temperature Sensor Circuit Low .....	*	DTC P0463 Fuel Level Sensor Circuit High .....	*
DTC P0113 Intake Air Temperature Sensor Circuit High .....	*	DTC P0480 Fan 1 (Radiator Cooling Fan) Control Circuit .....	6-30
DTC P0117 Engine Coolant Temperature Circuit Low .....	*	DTC P0481 Fan 2 (A/C Condenser Fan) Control Circuit .....	*
DTC P0118 Engine Coolant Temperature Circuit High .....	*	DTC P0500 Vehicle Speed Sensor (VSS) Malfunction .....	*
DTC P0121 Throttle Position Sensor Circuit Range / Performance .....	*	DTC P0505 Idle Air Control System .....	*
DTC P0122 Throttle Position Sensor Circuit Low .....	*	DTC P0506 Idle Air Control System RPM Lower than Expected .....	*
DTC P0123 Throttle Position Circuit High Input .....	*	DTC P0507 Idle Air Control System RRM Higher than Expected .....	*
DTC P0131 O2 Sensor (HO2S) Circuit Low Voltage (Sensor-1) .....	*	Idle air control (IAC) valve operation check .....	*
DTC P0132 O2 Sensor (HO2S) Circuit High Voltage (Sensor-1) .....	*	Idle air control (IAC) valve check .....	*
DTC P0133 O2 Sensor (HO2S) Circuit Slow Response (Sensor-1) .....	*	DTC P0616 Starter Relay Circuit Low .....	*
DTC P0134 Heated Oxygen Sensor (HO2S) No Activity Detected (Sensor-1) .....	*	DTC P0617 Starter Relay Circuit High .....	*
DTC P0031 HO2S Heater Control Circuit Low (Sensor-1) .....	*	DTC P0107 Manifold Absolute Pressure Low Input .....	*
DTC P0032 HO2S Heater Control Circuit High (Sensor-1) .....	*	DTC P0108 Manifold Absolute Pressure High Input .....	*
DTC P0137 O2 Sensor (HO2S) Circuit Low Voltage (Sensor-2) .....	*	DTC P0601 Internal Control Module Memory Check Sum Error .....	*
DTC P0138 O2 Sensor (HO2S) Circuit High Voltage (Sensor-2) .....	*	DTC P0602 Control Module Programming Error .....	*
DTC P0037 HO2S Heater Control Circuit Low (Sensor-2) .....	*	DTC P1510 ECM Back-up Power Supply Malfunction .....	*
DTC P0038 HO2S Heater Control Circuit High (Sensor-2) .....	*	DTC P1601 CAN Communication Error .....	6-33
DTC P0171 System Too Lean .....	*	DTC P1603 TCM Trouble Code Detected .....	6-35
DTC P0172 System Too Rich .....	*	DTC P2227 Barometric Pressure Circuit Range/Performance .....	*
DTC P0300 Random Misfire Detected .....	*	DTC P2228 Barometric Pressure Circuit Low .....	*
DTC P0301 Cylinder 1 Misfire Detected .....	*	DTC P2229 Barometric Pressure Circuit High .....	*
DTC P0302 Cylinder 2 Misfire Detected .....	*	Table B-1 Fuel Injector Circuit Check .....	*
DTC P0303 Cylinder 3 Misfire Detected .....	*	Table B-2 Fuel Pump and Its Circuit Check .....	*
DTC P0304 Cylinder 4 Misfire Detected .....	*	Table B-3 Fuel Pressure Check .....	*
DTC P0327 Knock Sensor Circuit Low .....	*	Table B-4 Idle Air Control System Check .....	*
DTC P0328 Knock Sensor Circuit High .....	*	Table B-5 A/C Signal Circuits Check (Vehicle with A/C) .....	*
DTC P0335 Crankshaft Position (CKP) Sensor Circuit .....	*	Table B-6 Electric Load Signal Circuit Check .....	*
DTC P0340 Camshaft Position Sensor Circuit .....	*	Table B-7 Radiator Fan Control System Check .....	6-36
DTC P0401 Exhaust Gas Recirculation Flow Insufficient Detected .....	*	Table B-8 A/C Condenser Fan Control System .....	*
DTC P0402 Exhaust Gas Recirculation Flow Excessive Detected .....	*	<b>Special Tool</b> .....	*
DTC P0403 Exhaust Gas Recirculation Control Circuit .....	*		

## Precaution in Diagnosing Trouble for Engine

- Don't disconnect couplers from ECM, battery cable from battery, ECM ground wire harness from engine or main fuse before confirming diagnostic information (DTC, freeze frame data, etc.) stored in ECM memory. Such disconnection will erase memorized information in ECM memory.

- Diagnostic information stored in ECM memory can be cleared as well as checked by using SUZUKI scan tool or OBD generic scan tool. Before using scan tool, read its Operator's (Instruction) Manual carefully to have good understanding as to what functions are available and how to use it.

It is indistinguishable which module turns on MIL because not only ECM but also TCM turns on MIL. Therefore, check both ECM and TCM for DTC when MIL lights on.

When checking ECM for DTC, keep in mind that DTC is displayed on the scan tool as follows depending on the scan tool used.

- SUZUKI scan tool displays DTC detected by ECM.
- OBD-II generic scan tool displays DTC detected by each of ECM and TCM simultaneously.

- Priorities for diagnosing troubles

If two or more diagnostic trouble codes (DTCs) are stored, proceed to the flow table of the DTC which has detected earliest in the order and follow the instruction in that table.

If no instructions are given, troubleshoot diagnostic trouble codes according to the following priorities.

- Diagnostic trouble codes (DTCs) other than DTC P0171/P0172 (Fuel system too lean/too rich), DTC P0300/P0301/P0302/P0303/P0304 (Misfire detected) and DTC P0401/P0402 (EGR flow malfunction)
- DTC P0171/P0172 (Fuel system too lean/too rich) and DTC P0401/P0402 (EGR flow malfunction)
- DTC P0300/P0301/P0302/P0303/P0304 (Misfire detected)
- Be sure to read "Precautions for Electrical Circuit Service" in Section 0A before inspection and observe what is written there.

- ECM Replacement

When substituting a known-good ECM, check for the following conditions. Neglecting this check may cause damage to a known-good ECM.

- Resistance value of all relays, actuators is as specified respectively.
- MAP sensor and TP sensor are in good condition and none of power circuits of these sensors is shorted to ground.
- Communication of ECUs, ECM and TCM, is established by CAN (Computer Area Network).

Therefore, handle CAN communication line with care referring to "Precautions" described in Section 0A.

## DTC Table

DTC NO.	DETECTING ITEM	DETECTING CONDITION (DTC will set when detecting:)	MIL
P0010	Camshaft position actuator circuit	Actual valve timing fails to become close to target advance level of each function although advance control function or retarding control function is at work.	2 driving cycles
P0011	Camshaft position - timing over-advanced or system performance	Actual valve of advanced valve timing does not reach target value, or valve timing is advanced although ECM command is most retarding.	1 driving cycle
P0012	Camshaft position - timing over-retarded		1 driving cycle
P0031	HO2S heater control circuit low (Sensor-1)	Heater current is less than specification while heater ON.	2 driving cycles
P0032	HO2S heater control circuit high (Sensor-1)	Heater current is more than specification while heater ON.	2 driving cycles
P0037	HO2S heater control circuit low (Sensor-2)	Heater current is less than specification while heater ON.	2 driving cycles
P0038	HO2S heater control circuit high (Sensor-2)	Heater current is more than specification while heater ON.	2 driving cycles
P0101	Mass air flow circuit range/performance	Poor performance of MAF sensor	2 driving cycles
P0102	Mass air flow circuit low input	Low voltage	1 driving cycle
P0103	Mass air flow circuit high input	High voltage	
P0107	Manifold absolute pressure low input	Low voltage (or manifold absolute pressure sensor circuit open or shorted to ground)	1 driving cycle
P0108	Manifold absolute pressure high input	High voltage (or manifold absolute pressure sensor circuit shorted to power circuit)	1 driving cycle
P0112	Intake air temperature sensor circuit low	High temperature – low voltage (or IAT sensor circuit shorted to ground)	1 driving cycle
P0113	Intake air temperature sensor circuit high	Low temperature – high voltage (or IAT sensor circuit open)	
P0117	Engine coolant temperature sensor circuit low	High temperature – low voltage (or ECT sensor circuit shorted to ground)	1 driving cycle
P0118	Engine coolant temperature sensor circuit high	Low temperature – high voltage (or ECT sensor circuit open)	
P0121	Throttle position circuit range/performance	Poor performance of TP sensor	2 driving cycles
P0122	Throttle position circuit low	Low voltage (or TP sensor circuit shorted to ground)	1 driving cycle
P0123	Throttle position circuit high	High voltage (or TP sensor circuit open)	

DTC NO.	DETECTING ITEM	DETECTING CONDITION (DTC will set when detecting:)	MIL
P0131	O2 sensor (HO2S) circuit low voltage (Sensor-1)	Min. output voltage of HO2S-1 higher than specification	2 driving cycles
P0132	O2 sensor (HO2S) circuit high voltage (Sensor-1)	Max. output voltage of HO2S-1 is lower or higher than specification	
P0133	O2 sensor (HO2S) circuit slow response (Sensor-1)	Response time of HO2S-1 output voltage between rich and lean is longer than specification.	
P0134	O2 sensor (HO2S) circuit no activity detected (Sensor-1)	Output voltage of HO2S-1 fails to go above specification. (or HO2S-1 circuit open or short)	2 driving cycles
P0137	O2 sensor (HO2S) circuit low voltage (Sensor-2)	Min. output voltage of HO2S-2 is higher than specification	2 driving cycles
P0138	O2 sensor (HO2S) circuit high voltage (Sensor-2)	Max. output voltage of HO2S-2 is lower or higher than specification	2 driving cycles
P0171	System too lean	Total fuel trim is larger than specification for specified time or longer. (Fuel trim toward rich side is large.)	2 driving cycles
P0172	System too rich	Total fuel trim is smaller than specification for specified time or longer. (Fuel trim toward lean side is large.)	2 driving cycles
P0300	Random misfire detected	Misfire of such level as to cause damage to three way catalyst.	*1 driving cycle
P0301 P0302 P0303 P0304	Cylinder 1 misfire detected Cylinder 2 misfire detected Cylinder 3 misfire detected Cylinder 4 misfire detected	Misfire of such level as to deteriorate emission but not to cause damage to three way catalyst.	2 driving cycles
P0327	Knock sensor circuit low	Knock sensor circuit shorted to ground (low voltage)	1 driving cycle
P0328	Knock sensor circuit high	Knock sensor circuit open (high voltage)	1 driving cycle
P0335	Crankshaft position sensor circuit	No signal during engine running	1 driving cycle
P0340	Camshaft position sensor circuit	No reference signal during engine cranking or pulse number of position signal is out of specification.	
P0401	Exhaust gas recirculation flow insufficient detected	Insufficient EGR flow	2 driving cycles
P0402	Exhaust gas recirculation flow excessive detected	Excessive EGR flow	2 driving cycles
P0403	Exhaust gas recirculation control circuit	Low voltage (or EGR valve stepping motor coil circuit open or shorted to ground)	1 driving cycle
P0420	Catalyst system efficiency below threshold	Output waveforms of HO2S-1 and HO2S-2 are similar.	2 driving cycles
P0443	Evaporative emission system purge control valve circuit	Monitor signal of EVAP canister purge valve is different from command signal (circuit open or shorted to ground)	2 driving cycles
P0462	Fuel level sensor circuit low	Low voltage	2 driving cycles
P0463	Fuel level sensor circuit high	High voltage	2 driving cycles



DTC NO.	DETECTING ITEM	DETECTING CONDITION (DTC will set when detecting:)	MIL
P0480	Fan 1 (Radiator cooling fan) control circuit	Radiator cooling fan relay terminal voltage is low when cooling temp. is lower than specification.	2 driving cycles
P0481	Fan 2 (A/C condenser fan) control circuit	Monitor signal of A/C condenser fan relay is different from command signal.	2 driving cycles
P0500	Vehicle speed sensor	No signal during fuel cut for specified time or longer	2 driving cycles
P0505	Idle air control system	Voltage is out of specification for longer than specified time	1 driving cycle
P0506	Idle air control system RPM lower than expected	Engine idle speed is lower than target speed out of specified value for longer than specified time	2 driving cycles
P0507	Idle air control system RPM higher than expected	Engine idle speed is higher than target speed out of specified value for longer than specified time	2 driving cycles
P0601	Internal control module memory check sum error	Data write error or check sum error	1 driving cycle
P0602	Control module programming error	Data programming error	1 driving cycle
P0616	Starter relay circuit low	Starter signal circuit open (low voltage)	2 driving cycles
P0617	Starter relay circuit high	Starter signal circuit shorted to power supply (high voltage)	2 driving cycles
P1510	ECM backup power supply malfunction	Backup power voltage is out of specification after starting engine.	1 driving cycle
P1601	CAN communication error	Transmitting or receiving error detected to ECM for specified time continuously.	1 driving cycles
*P1603	TCM trouble code detected	When ECM receives a trouble code from TCM, which indicates that some problem occurred in sensor circuits and its calculated values used for operations such as idle speed control, engine power control, and so on by TCM, this DTC is detected by ECM.	1 driving cycle
P2227	Barometric pressure circuit range/performance	Difference between barometric pressure sensor value and calculated barometric pressure value is larger than specification.	2 driving cycles
P2228	Barometric pressure circuit low	Barometric pressure sensor circuit shorted to ground.	1 driving cycle
P2229	Barometric pressure circuit high	Barometric pressure sensor circuit open	1 driving cycle
*P1620	ECU code not registered	Refer to "Diagnostic Trouble Code (DTC) Table" in Section 8G.	
*P1621	No ECU code transmitted from Immobilizer Control Module		
*P1622	Fault in ECM		
*P1623	ECU code not matched		

**For A/t System (Only OBD-II Generic Scan Tool Is Displayed On Following DTC(s) At The Same Time)**

<b>DTC NO.</b>	<b>DETECTING ITEM</b>	<b>DETECTING CONDITION (DTC will set when detecting:)</b>
P0705	Transmission Range Sensor Circuit Malfunction (P, R, N, D, L Input)	Refer to "Diagnostic Trouble Code (DTC) Table" in Section 7B.
P0707	Transmission Range Sensor Circuit Low	
P0712	Transmission Fluid Temperature Sensor "A" Circuit Low	
P0713	Transmission Fluid Temperature Sensor "A" Circuit High	
P0717	Input/Turbine Speed Sensor Circuit No Signal	
P0722	Output Speed Sensor Circuit No	
P0741	Torque Converter Clutch Circuit Performance or Stuck Off	
P0742	Torque Converter Clutch Circuit Stuck On	
P0751	Shift Solenoid "A" Performance or Stuck Off	
P0752	Shift Solenoid "A" Stuck On	
P0756	Shift Solenoid "B" Performance or Stuck Off	
P0757	Shift Solenoid "B" Stuck On	
P0785	Shift/Timing Solenoid	
P0962	Pressure Control Solenoid "A" Control Circuit Low	
P0963	Pressure Control Solenoid "A" Control Circuit High	
P0973	Shift Solenoid "A" Control Circuit Low	
P0974	Shift Solenoid "A" Control Circuit High	
P0976	Shift Solenoid "B" Control Circuit Low	
P0977	Shift Solenoid "B" Control Circuit High	
P1701	CAN communication problem – TCM	
P1702	Internal Control Module Memory Check Sum Error	
*P1703	CAN invalid data – TCM	
P2769	Torque Converter Clutch Circuit Low	
P2770	Torque Converter Clutch Circuit High	

**NOTE:**

- **1 driving cycle:** MIL lights up when DTC is detected while 1 driving cycle.
- **2 driving cycles:** MIL lights up when the same DTC is detected also in the next driving cycle after DTC is detected and stored temporarily in the first driving cycle.
- **\*1 driving cycle:**  
MIL blinks or lights up. Refer to "DTC P0300/P0301/P0302/P0303/P0304: Random Misfire/Cylinder 1 Misfire/Cylinder 2 Misfire/Cylinder 3 Misfire/Cylinder 4 Misfire Detected" for details.
- For "\*" marked No. in DTC column, it is not indicated when generic scan tool is used.

## Scan Tool Data

As the data values given below are standard values estimated on the basis of values obtained from the normally operating vehicles by using a scan tool, use them as reference values. Even when the vehicle is in good condition, there may be cases where the checked value does not fall within each specified data range. Therefore, judgment as abnormal should not be made by checking with these data alone.

Also, conditions in the table below that can be checked by the scan tool are those detected by ECM and output from ECM as commands and there may be cases where the engine or actuator is not operating (in the condition) as indicated by the scan tool. Be sure to use the timing light to check the ignition timing.

### NOTE:

- With the generic scan tool, only star (\*) marked data in the table below can be read.
- When checking the data with the engine running at idle or racing, be sure to shift M/T gear to the neutral gear position and A/T gear to the "Park" position and pull the parking brake fully. Also, if nothing or "no load" is indicated, turn OFF A/C, all electric loads, P/S and all the other necessary switches.

	SCAN TOOL DATA	VEHICLE CONDITION		NORMAL CONDITION/ REFERENCE VALUES
*	COOLANT TEMP (ENGINE COOLANT TEMP.)	At specified idle speed after warming up		80 – 100°C, 176 – 212°F
*	INTAKE AIR TEMP	At specified idle speed after warming up		–5°C (23°F) + environmental temp. to 40°C (104°F) + environmental temp.
*	ENGINE SPEED	At idling with no load after warming up		Desired idle speed ±50 r/min
	INJ PULSE WIDTH (FUEL INJECTION PULSE WIDTH)	At specified idle speed with no load after warming up		2.0 – 4.0 msec.
		At 2500 r/min with no load after warming up		2.0 – 3.6 msec.
	TP SENSOR VOLT (THROTTLE POSITION SENSOR OUTPUT VOLTAGE)	Ignition switch ON/ warmed up engine stopped	Accelerator pedal released	0.5 – 1.0 V
			Accelerator pedal depressed fully	Less than 4.8 V
	DESIRED IDLE (DESIRED IDLE SPEED)	At idling with radiator cooling fan stopped and all electrical parts turned OFF after warming up, M/T at neutral		700 r/min
	IAC FLOW DUTY (IDLE AIR CONTROL FLOW DUTY)	At idling with no load after warming up		5 – 55%
*	SHORT FT B1 (SHORT TERM FUEL TRIM)	At specified idle speed after warming up		– 20 – +20%
*	LONG FT B1 (LONG TERM FUEL TRIM)	At specified idle speed after warming up		– 20 – +20%
*	MAF (MASS AIR FLOW RATE)	At specified idle speed with no load after warming up		1.0 – 4.0 g/s 0.14 – 0.52 lb/min
		At 2500 r/min with no load after warming up		4.0 – 12.0 g/s 0.53 – 1.58 lb/min

	SCAN TOOL DATA	VEHICLE CONDITION		NORMAL CONDITION/ REFERENCE VALUES
*	CALC LOAD (CALCULATED LOAD VALUE)	At specified idle speed with no load after warm- ing up		10 – 20%
		At 2500 r/min with no load after warming up		10 – 18%
*	THROTTLE POSITION (ABSOLUTE THROTTLE POSITION)	Ignition switch ON/ warmed up engine stopped	Accelerator pedal released	9 – 19%
			Accelerator pedal depressed fully	70 – 90%
*	O2S B1 S1 (HEATED OXYGEN SEN- SOR-1)	At specified idle speed after warming up		0 – 0.95 V
*	O2S B1 S2 (HEATED OXYGEN SEN- SOR-2)	When engine is running at 2000 r/min. for 3 min or longer after warming up.		0 – 0.95 V
	FUEL SYSTEM B1 (FUEL SYSTEM STATUS)	At specified idle speed after warming up		CLOSED (closed loop)
	TOTAL FUEL TRIM	At specified idle speed after warming up		– 35 – +35%
*	MAP (INTAKE MANIFOLD ABSOLUTE PRESSURE)	At specified idle speed with no load after warm- ing up		24 – 38 kPa 180 – 285 mmHg
	BAROMETRIC PRES	–		Display the barometric pres- sure
	STEP EGR FLOW DUTY	At specified idle speed after warming up		0%
	FUEL CUT	When engine is at fuel cut condition		ON
		Other than fuel cut condition		OFF
	CLOSED THROTTLE POS (CLOSED THROTTLE POSITION)	Throttle valve at idle position		ON
		Throttle valve opens larger than idle position		OFF
	CANIST PRG DUTY (EVAP CANISTER PURGE FLOW DUTY)	At specified idle speed after warming up		0%
*	IGNITION ADVANCE (IGNITION TIMING ADVANCE FOR NO.1 CYLINDER)	At specified idle speed with no load after warm- ing up		3 – 13° BTDC
	BATTERY VOLTAGE	Ignition switch ON/engine stop		10 – 14 V
	FUEL PUMP	Within 3 seconds after ignition switch ON or engine running		ON
		Engine stop at ignition switch ON		OFF
	ELECTRIC LOAD	Ignition switch ON/Headlight, small light, all turned OFF		OFF
		Ignition switch ON/Headlight, small light, turned ON		ON
	BRAKE SWITCH	Ignition switch ON	Brake pedal is released	OFF
			Brake pedal is depressed	ON
	RADIATOR FAN (RADIATOR FAN CON- TROL RELAY)	Ignition switch ON	Engine coolant temp.: Lower than 95°C (203°F)	OFF
			Engine coolant temp.: 97.5°C (208°F) or higher	ON

	SCAN TOOL DATA	VEHICLE CONDITION		NORMAL CONDITION/ REFERENCE VALUES
	BLOWER FAN	Ignition switch ON	Blower fan switch: 2nd speed position or more	ON
			Blower fan switch: under 2nd speed position	OFF
	A/C SWITCH (if equipped with A/C)	Engine running after warming up, A/C not operating		OFF
		Engine running after warming up, A/C operating		ON
	A/C MAG CLUTCH (if equipped with A/C)	Engine running	A/C switch and blower motor switch turned ON	ON
			A/C switch and blower motor switch turned OFF	OFF
	A/C COND FAN (if equipped with A/C)	Engine running	Blower motor switch and A/C switch turned ON	ON
			Blower motor switch and/or A/C switch turned OFF	OFF
	VVT GAP (TARGET-ACTUAL POSITION)	At specified idle speed after warming up		0 – 3°

### Scan Tool Data Definitions

#### COOLANT TEMP (ENGINE COOLANT TEMPERATURE, °C, °F)

It is detected by engine coolant temp. sensor.

#### INTAKE AIR TEMP. (°C, °F)

It is detected by intake air temp. sensor.

#### ENGINE SPEED (rpm)

It is computed by reference pulses from the camshaft position sensor.

#### INJ PULSE WIDTH (FUEL INJECTION PULSE WIDTH, msec.)

This parameter indicates time of the injector drive (valve opening) pulse which is output from ECM (but injector drive time of NO.1 cylinder for multiport fuel injection).

#### TP SENSOR VOLT (THROTTLE POSITION SENSOR OUTPUT VOLTAGE, V)

The Throttle Position Sensor reading provides throttle valve opening information in the form of voltage.

#### DESIRED IDLE (DESIRED IDLE SPEED, rpm)

The Desired Idle Speed is an ECM internal parameter which indicates the ECM requested idle. If the engine is not running, this number is not valid.

#### IAC FLOW DUTY (IDLE AIR (SPEED) CONTROL DUTY, %)

This parameter indicates current flow time rate within a certain set cycle of IAC valve (valve opening rate) which controls the amount of bypass air (idle speed).

#### SHORT FT B1 (SHORT TERM FUEL TRIM, %)

Short term fuel trim value represents short term corrections to the air/fuel mixture computation. A value of 0 indicates no correction, a value greater than 0 means an enrichment correction, and a value less than 0 implies an enleanment correction.

**LONG FT B1 (LONG TERM FUEL TRIM, %)**

Long term fuel trim value represents long term corrections to the air/fuel mixture computation. A value of 0 indicates no correction, a value greater than 0 means an enrichment correction, and a value less than 0 means an enrichment correction, and a value less than 0 implies an enleanment correction.

**MAF (MASS AIR FLOW RATE, g/s, lb/min)**

It represents total mass of air entering intake manifold which is measured by mass air flow sensor.

**CALC LOAD (CALCULATED LOAD VALUE, %)**

Engine load displayed as a percentage of maximum possible load. Value is calculated mathematically using the formula: actual (current) intake air volume ÷ maximum possible intake air volume x 100%

**THROTTLE POS (ABSOLUTE THROTTLE POSITION, %)**

When throttle position sensor is fully closed position, throttle opening is indicated as 0% and 90 – 100% full open position.

**O2S SENSOR B1 S1 (HEATED OXYGEN SENSOR-1, V)**

It indicates output voltage of HO2S-1 installed on exhaust manifold (pre-catalyst).

**O2S SENSOR B1 S2 (HEATED OXYGEN SENSOR-2, V)**

It indicates output voltage of HO2S-2 installed on exhaust pipe (post-catalyst). It is used to detect catalyst deterioration.

**FUEL SYSTEM (FUEL SYSTEM STATUS)**

Air/fuel ratio feedback loop status displayed as one of the followings.

OPEN: Open loop-has not yet satisfied conditions to go closed loop.

CLOSED: Closed loop-using oxygen sensor(s) as feedback for fuel control.

OPEN-DRIVE COND: Open loop due to driving conditions (Power enrichment, etc.).

OPEN SYS FAULT: Open loop due to detected system fault.

CLOSED-ONE O2S: Closed loop, but fault with at least one oxygen sensor-may be using single oxygen sensor for fuel control.

**TOTAL FUEL TRIM B1 (%)**

The value of Total Fuel Trim is obtained by calculating based on values of short Term Fuel Trim and Long Term Fuel Trim. This value indicates how much correction is necessary to keep the air/fuel mixture stoichiometrical.

**MAP (MANIFOLD ABSOLUTE PRESSURE, mmHg, kPa)**

This value indicates how much correction is necessary to keep the air/fuel mixture stoichiometrical.

It is detected by manifold absolute pressure sensor.

**BAROMETRIC PRESS (kPa, inHg)**

This parameter represents a measurement of barometric air pressure and is used for altitude correction of the fuel injection quantity and IAC valve control.

**STEP EGR FLOW DUTY (%)**

This parameter indicates opening rate of EGR valve which controls the amount of EGR flow.

**FUEL CUT (ON/OFF)**

ON: Fuel being cut (output signal to injector is stopped)

OFF: Fuel not being cut

**CLOSED THROTTLE POSITION (ON/OFF)**

This parameter will read ON when throttle valve is fully closed, or OFF when the throttle is not fully closed.

**CANIST PURGE DUTY (EVAP CANISTER PURGE FLOW DUTY, %)**

This parameter indicates valve ON (valve open) time rate within a certain set cycle of EVAP canister purge valve which controls the amount of EVAP purge.

**IGNITION ADVANCE (IGNITION TIMING ADVANCE FOR NO.1 CYLINDER, °)**

Ignition timing of NO.1 cylinder is commanded by ECM. The actual ignition timing should be checked by using the timing light.

**BATTERY VOLTAGE (V)**

This parameter indicates battery positive voltage inputted from main relay to ECM.

**FUEL PUMP (ON/OFF)**

ON is displayed when the ECM activates the fuel pump via the fuel pump relay switch.

**ELECTRIC LOAD (ON/OFF)**

ON: Headlight or small light ON signal inputted.

OFF: Above electric loads all turned OFF.

**BRAKE SW (ON/OFF)**

This parameter indicates the state of the brake switch.

**RADIATOR FAN (RADIATOR FAN CONTROL RELAY, ON/OFF)**

ON: Command for radiator fan control relay operation being output.

OFF: Command for relay operation not being output.

**BLOWER FAN (ON/OFF)**

This parameter indicates the state of the blower fan motor switch.

**A/C SWITCH (ON/OFF)**

ON: Command for A/C operation being output from ECM to A/C amplifier.

OFF: Command for A/C operation not being output.

**A/C MAG SWITCH (A/C COMPRESSOR RELAY, ON/OFF)**

This parameter indicates the state of the A/C switch.

**A/C COND FAN (ON/OFF)**

This parameter indicates the state of the A/C Condenser Fan control signal.

**VVT GAP [TARGET-ACTUAL POSITION] (°)**

It is calculated using the formula: target valve timing advance – actual valve timing advance.

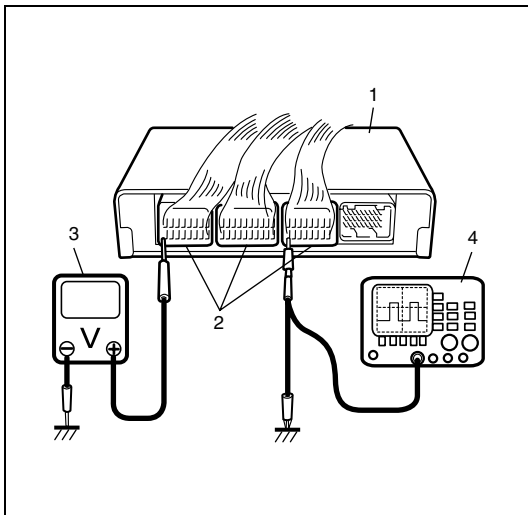
## Inspection of ECM and Its Circuits

ECM and its circuits can be checked at ECM wiring couplers by measuring voltage, pulse signal and resistance.

### CAUTION:

**ECM cannot be checked by itself. It is strictly prohibited to connect voltmeter or ohmmeter to ECM with coupler disconnected from it.**

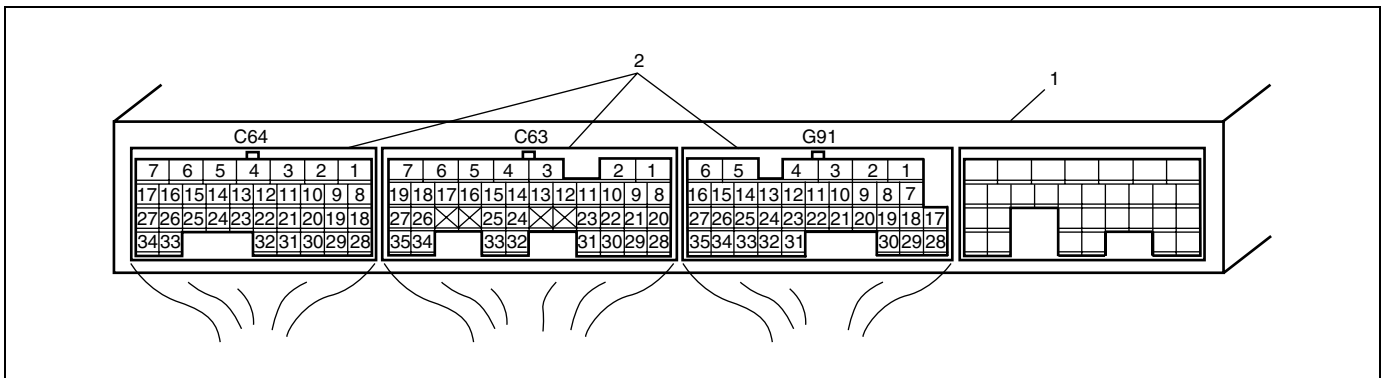
### Voltage Check



- 1) Remove ECM (1) from vehicle body referring to “Engine Control Module (ECM) Removal and Installation” in Section 6E1.
- 2) Check voltage and/or pulse signal at each terminal of couplers (2) connected, using voltmeter (3) and oscilloscope (4).

### NOTE:

- As each terminal voltage is affected by the battery voltage, confirm that it is 11 V or more when ignition switch is turned ON.
- Voltage with asterisk(\*) cannot be measured by voltmeter because it is pulse signal. Check it with oscilloscope if necessary.



1. ECM

2. ECM couplers (Viewed from harness side)



TERMINAL NUMBER	WIRE COLOR	CIRCUIT	NORMAL VOLTAGE	CONDITION
C64-1	BLK/ORN	Ground for ECM	Below 0.3 V	Ignition switch turned ON
C64-2	BLK	Ground for ECM	Below 0.3 V	Ignition switch turned ON
C64-3	RED/BLU	Heater output of heated oxygen sensor-2	10 – 14 V	Ignition switch turned ON
			0 – 1 V (Reference waveform No.1)	Engine running at idling after vehicle running over 30 km/h, 19ml/h for 5 min.
C64-4	BLK/WHT	Heater output of heated oxygen sensor-1	10 – 14 V	Ignition switch turned ON
			*0 – 2 V ↑↓ 13.5 – 14.8 V (Reference waveform No.2 and No.3)	Engine running at idling with after warming up. (Output signal is active low duty pulse. Duty ratio varies depending on engine condition.)
C64-5	GRN/YEL	A/C condenser fan motor relay No.2 output (if equipped)	10 – 14 V	Engine running, engine coolant temperature more than 113°C, 235°F or for about 7 sec. after A/C operated (A/C request signal inputted low voltage).
			0 – 1 V	Engine running, engine coolant temperature under than 110°C, 230°F and after about 7 sec. after A/C operated (A/C request signal inputted low voltage) or A/C OFF.
C64-6	PNK	Fuel cost output	*0 – 2 V ↑↓ 13.5 – 14.8 V	Engine running at idling with after warming up. (Output signal is 3.33 Hz duty pulse. Duty ratio varies depending on vehicle condition.)
C64-7	–	–	–	–
C64-8	RED/YEL	IAC valve output (step-per motor coil 3)	0 – 1 V	Ignition switch turned ON
			*0 – 2 V ↑↓ 8 – 14 V (Reference waveform No.4)	Ignition switch is turned to ST (cranking) position. (Output signal is active low duty pulse. Pulse generated times depending on vehicle condition)
C64-9	RED/BLU	IAC valve output (step-per motor coil 2)	8 – 14 V	Ignition switch turned ON
			*0 – 2 V ↑↓ 8 – 14 V (Reference waveform No.4)	Ignition switch is turned to ST (cranking) position. (Output signal is active low duty pulse. Pulse generated times depending on vehicle condition)
C64-10	RED/WHT	IAC valve output (step-per motor coil 1)	0 – 1 V	Ignition switch turned ON
			*0 – 2 V ↑↓ 8 – 14 V (Reference waveform No.4)	Ignition switch is turned to ST (cranking) position. (Output signal is active low duty pulse. Pulse generated times depending on vehicle condition)

TERMINAL NUMBER	WIRE COLOR	CIRCUIT	NORMAL VOLTAGE	CONDITION
C64-11	PNK/BLK	A/C compressor relay output (if equipped)	10 – 14 V	Engine running, A/C request signal high input
			0 – 1 V	Engine running, A/C request signal low input
C64-12	PNK	A/C condenser fan motor relay No.1 output (if equipped)	10 – 14 V	Ignition switch turned ON, coolant temperature under 113°C, 235°F or A/C request signal high input
			0 – 1 V	Ignition switch turned ON, coolant temperature more than 110°C, 230°F or A/C request signal low input
C64-13	BLU/BLK	EVAP canister purge valve output	10 – 14 V	Ignition switch turned ON with engine stop
			*0 – 0.6 V ↑↓ 10 – 14 V (Reference waveform No.25)	Engine running and vehicle running over 40 km/h, 25 ml/h (Output signal is 10 Hz duty pulse. Duty ratio varies depending on vehicle condition.)
C64-14	GRN	Fuel pump relay output	0 – 2.5 V	For 3 sec. from the time is ignition switch turned to ON or while engine is running
			10 – 14 V	On and after 3 sec. from the time is ignition switch turned to ON or while engine is stop
C64-15	BRN/WHT	Main power supply relay output	10 – 14 V	Ignition switch is turned OFF
			0 – 2 V	Ignition switch is turned ON
C64-16	WHT/RED	EGR valve (stepper motor coil 3) output	10 – 14 V	Ignition switch is turned ON
			*0 – 2 V ↑↓ 8 – 14 V (Reference waveform No.5)	Ignition switch is turned to ST (cranking) position. (Output signal is active low duty pulse. Pulse generated times depending on vehicle condition)
C64-17	GRN/RED	EGR valve (stepper motor coil 1) output	0 – 2 V	Ignition switch turned ON
			*0 – 2 V ↑↓ 8 – 14 V (Reference waveform No.5)	Ignition switch is turned to ST (cranking) position. (Output signal is active low duty pulse. Pulse generated times depending on vehicle condition)
C64-18	—	—	—	—
C64-19	—	—	—	—
C64-20	—	—	—	—
C64-21	—	—	—	—
C64-22	—	—	—	—
C64-23	—	—	—	—
C64-24	—	—	—	—
C64-25	—	—	—	—
C64-26	—	—	—	—
C64-27	—	—	—	—

TERMINAL NUMBER	WIRE COLOR	CIRCUIT	NORMAL VOLTAGE	CONDITION
C64-28	RED/BLK	IAC valve output (step-per motor coil 4)	8 – 14 V	Ignition switch turned ON
			*0 – 2 V ↑↓ 8 – 14 V (Reference wave-form No.4)	Ignition switch is turned to ST (cranking) position. (Output signal is active low duty pulse. Pulse generated times depending vehicle condition)
C64-29	–	–	–	–
C64-30	–	–	–	–
C64-31	GRN/WHT	Ignition coil No.2 and No.3 output	0 – 0.6 V	Ignition switch turned ON
			*0 – 0.6 V ↑↓ 2 – 5 V (Reference wave-form No.6)	Engine running (Output signal is active high pulse. Pulse frequency varies depending on engine speed.)
C64-32	GRN/YEL	Ignition coil No.1 and No.4 output	0 – 0.6 V	Ignition switch turned ON
			*0 – 0.6 V ↑↓ 2 – 5 V (Reference wave-form No.7)	Engine running (Output signal is active high pulse. Pulse frequency varies depending on engine speed.)
C64-33	BRN/YEL	EGR valve (stepper motor coil 4) output	0 – 2 V	Ignition switch turned ON
			*0 – 2 V ↑↓ 8 – 14 V (Reference wave-form No.5)	Ignition switch is turned to ST (cranking) position. (Output signal is active low duty pulse. Pulse generated times depending on vehicle condition)
C64-34	GRN/ORN	EGR valve (stepper motor coil 2) output	10 – 14 V	Ignition switch turned ON
			*0 – 2 V ↑↓ 8 – 14 V (Reference wave-form No.5)	Ignition switch is turned to ST (cranking) position. (Output signal is active low duty pulse. Pulse generated times depending on vehicle condition)
C63-1	BLK/ORN	Ground for ECM	Below 0.3 V	Ignition switch turned ON
C63-2	BLU	Oil control valve output	*0 – 0.6 V ↑↓ 13 – 14 V (Reference wave-form No.8 and No.9)	Ignition switch turned ON
				While engine running. (Output signal is active low duty pulse. Duty ratio varies depending on vehicle condition)
C63-3	–	–	–	–
C63-4	BLU/ORN	Fuel injector No.4 output	10 – 14 V	Ignition switch turned ON
			*0 – 0.6 V ↑↓ 10 – 14 V (Reference wave-form No.10 and No.11)	Engine running (Output signal is active low pulse. Pulse frequency varies depending on engine speed.)

TERMINAL NUMBER	WIRE COLOR	CIRCUIT	NORMAL VOLTAGE	CONDITION
C63-5	BLU/RED	Fuel injector No.3 output	10 – 14 V	Ignition switch turned ON
			*0 – 0.6 V ↑↓ 10 – 14 V (Reference waveform No.10 and No.12)	Engine running (Output signal is active low pulse. Pulse frequency varies depending on engine speed.)
C63-6	BLU/WHT	Fuel injector No.2 output	10 – 14 V	Ignition switch turned ON
			*0 – 0.6 V ↑↓ 10 – 14 V (Reference waveform No.10 and No.13)	Engine running (Output signal is active low pulse. Pulse frequency varies depending on engine speed.)
C63-7	BLU/YEL	Fuel injector No.1 output	10 – 14 V	Ignition switch turned ON
			*0 – 0.6 V ↑↓ 10 – 14 V (Reference waveform No.10 and No.14)	Engine running (Output signal is active low pulse. Pulse frequency varies depending on engine speed.)
C63-8	GRY/RED	Output of 5 V power source for throttle position (TP) sensor	4.5 – 5.5 V	Ignition switch turned ON
C63-9	RED	Knock sensor signal	*2 – 3 V (Reference waveform No.15 and No.16)	Ignition switch turned ON
				Engine running at idling with after warming up
C63-10	RED/YEL	Reference (classified cylinder) signal for CMP sensor	*0 – 0.6 V ↑↓ 4 – 5 V (Reference waveform No.17)	Engine running at idling with after warming up (Sensor signal is pulse. Pulse frequency varies depending on engine speed.) (6 pulses are generated per 1 camshaft revolution)
C63-11	WHT	Oxygen signal of heated oxygen sensor-1	0.5 – 1.5 V	Ignition switch turned ON
			*Deflects between over 0.5 V and under 0.45 V (Reference waveform No.2 and No.3)	While engine running at 2,000 r/min. for 1 min. or longer after warmed up
C63-12	—	—	—	—
C63-13	—	—	—	—
C63-14	PNK/BLK	Mass air flow (MAF) sensor signal	0.5 – 1.5 V	Ignition switch turned ON and engine stops
			1.3 – 1.8 V (Reference waveform No.18)	When engine running at specified idle speed after warming up

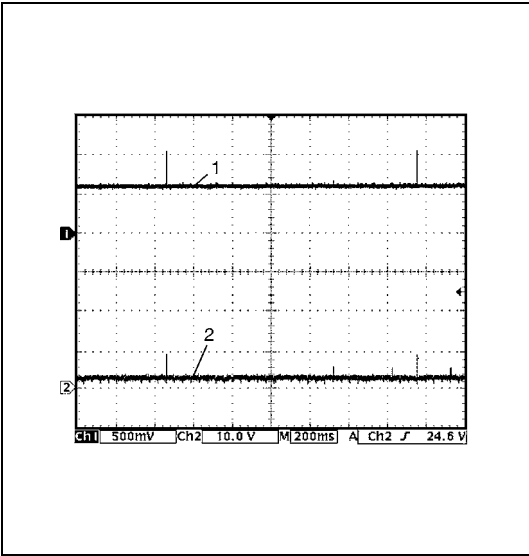
TERMINAL NUMBER	WIRE COLOR	CIRCUIT	NORMAL VOLTAGE	CONDITION
C63-15	RED/WHT	Manifold absolute pressure (MAP) sensor signal	About 4 V (Reference waveform No.19)	Ignition switch turned ON with barometric pressure at 100kPa, 760mmHg
			0.4 – 1.8 V (Reference waveform No.20)	While specified idle speed after warming up with barometric pressure at 100kPa, 760mmHg
C63-16	LT GRN	Engine coolant temp. (ECT) sensor signal	3.3 – 3.6 V	Ignition switch turned ON, ECT at 0°C, 32°F
			1.1 – 1.5 V	Ignition switch turned ON, ECT at 50°C, 122°F
			0.3 – 0.45 V	Ignition switch turned ON, ECT at 100°C, 212°F
C63-17	LT GRN/BLK	Intake air temperature (IAT) sensor signal	3.3 – 3.6 V	Ignition switch turned ON, IAT at 0°C, 32°F
			1.6 – 1.9 V	Ignition switch turned ON, IAT at 40°C, 104°F
			0.6 – 0.8 V	Ignition switch turned ON, IAT at 80°C, 176°F
C63-18	—	—	—	—
C63-19	YEL	Vehicle speed sensor signal	*0 – 1 V ↑↓ 10 – 14 V (Reference waveform No.21)	Vehicle running. (Sensor signal is pulse. Pulse frequency varies depending on vehicle speed. (8190 pulses are generated par 60 km/h, 37.5 ml/h))
C63-20	—	—	—	—
C63-21	—	—	—	—
C63-22	—	—	—	—
C63-23	—	—	—	—
C63-24	—	—	—	—
C63-25	—	—	—	—
C63-26	—	—	—	—
C63-27	—	—	—	—
C63-28	ORN	Ground for sensors	Below 0.3 V	Ignition switch turned ON
C63-29	—	—	—	—
C63-30	PNK	CKP sensor signal	0 – 1 V	Ignition switch turned ON
			*4.4 – 4.6 V ↑↓ 0.1 – 0.3 V (Reference waveform No.17)	Engine running at idling with after warming up. (Sensor signal is pulse. Pulse frequency varies depending on engine speed.) (31(34–4) pulses are generated par 1crankshaft revolution)
C63-31	GRN/YEL	Ground of ECM for shield wire	Below 0.3 V	Ignition switch turned ON
C63-32	—	—	—	—

TERMINAL NUMBER	WIRE COLOR	CIRCUIT	NORMAL VOLTAGE	CONDITION
C63-33	BRN	Oxygen signal of heated oxygen sensor-2	0.5 – 1.5 V	Ignition switch turned ON
			*Deflects between over 0.5 V and under 0.45 V (Reference waveform No.1)	While engine running at 2,000 r/min. for 1 min. or longer after vehicle running over 30 km/h, 19 ml/h
C63-34	GRY/BLU	Throttle position (TP) sensor signal	0.5 – 1.0 V	Ignition switch turned ON and throttle valve at idle position with warmed engine
			3.4 – 4.7 V	Ignition switch turned ON and throttle valve at full open position
C63-35	BLK/YEL	Starting motor signal	0 – 1 V	Ignition switch turned ON
			6 – 14 V	While engine cranking
G91-1	PPL/WHT	MIL (Malfunction indicator lamp) output	0 – 2.5 V	Ignition switch turned ON with engine stop
			10 – 14 V	Engine running
G91-2	LT GRN/BLK	Immobilizer indicator lamp output (if equipped)	10 – 14 V	While engine running
			0 – 1 V	Ignition switch turned ON with engine stop
G91-3	–	–	–	–
G91-4	BRN	Radiator fan motor relay output	10 – 14 V	Ignition switch turned ON, engine coolant temperature under 95°C, 203°F
			0 – 1 V	Ignition switch turned ON, engine coolant temperature more than 97.5°C, 207.5°F
G91-5	BLK/RED	Main power supply	10 – 14 V	Ignition switch turned ON
G91-6	BLK/RED	Main power supply	10 – 14 V	Ignition switch turned ON
G91-7	WHT	CAN communication line (Low)	*2.5 – 3.6 V ↑↓ 1.6 – 2.5 V (Reference waveform No.26)	Ignition switch turned ON with engine stop.
G91-8	RED	CAN communication line (High)		(CAN communication line signal is pulse. Pulse signal is displayed with a regular frequency varies depending on engine condition.)
G91-9	GRN/WHT	Electric load signal for stop lamp	0 – 1 V	Ignition switch turned ON, stop lamp not lighted up
			10 – 14 V	Ignition switch turned ON, stop lamp lighted up
G91-10	YEL	Serial communication line of data link connector 5 V	4 – 6 V	Ignition switch turned ON
G91-11	BLU	Serial communication line of data link connector 12 V	10 – 14 V	Ignition switch turned ON

TERMINAL NUMBER	WIRE COLOR	CIRCUIT	NORMAL VOLTAGE	CONDITION
G91-12	BRN	Engine revolution signal output for tachometer	0 – 0.8 V	Ignition switch turned ON with engine stop
			*0 – 1 V ↑↓ 8 – 14 V (Reference waveform No.22 and No.23)	While engine running. (Output signal is pulse. Pulse frequency varies depending on engine speed.) (2 pulses are generated per 1 crankshaft revolution.) (3000 r/min = 100 Hz)
G91-13	YEL	Electric load signal for heater blower motor	10 – 14 V	Ignition switch turned ON, blower fan selector selected at OFF
			0 – 1 V	Ignition switch turned ON, blower fan selector selected at 2nd speed position or more
G91-14	YEL/RED	Fuel level sensor signal	0 – 6 V	Ignition switch turned ON Voltage depends on fuel level
G91-15	WHT/BLK	A/C evaporator outlet air temp. sensor signal (if equipped)	3.3 – 3.8 V	Ignition switch turned ON at A/C evaporator inlet air temperature 0°C (32°F)
			2.5 – 2.9 V	Ignition switch turned ON at A/C evaporator inlet air temperature 15°C (59°F)
			1.9 – 2.3 V	Ignition switch turned ON at A/C evaporator inlet air temperature 25°C (77°F)
G91-16	WHT/RED	Power source for ECM internal memory	10 – 14 V	Ignition switch turned ON and turned OFF
G91-17	–	–	–	–
G91-18	–	–	–	–
G91-19	–	–	–	–
G91-20	–	–	–	–
G91-21	–	–	–	–
G91-22	–	–	–	–
G91-23	–	–	–	–
G91-24	–	–	–	–
G91-25	–	–	–	–
G91-26	–	–	–	–
G91-27	–	–	–	–
G91-28	BLK/WHT	Ignition switch signal	0 – 1 V	Ignition switch turned OFF
			10 – 14 V	Ignition switch turned ON
G91-29	–	–	–	–
G91-30	YEL/GRN	A/C request signal (if equipped)	10 – 14 V (High input)	Ignition switch turned ON, blower fan selector selected OFF position or A/C switch turned OFF or A/C evaporator temp. less than 2.5°C, 36.5°F
			0 – 1 V (Low input)	Ignition switch turned ON, blower fan selector selected other than OFF position and A/C switch turned ON with A/C evaporator temp. more than 4°C, 39.2°F

TERMINAL NUMBER	WIRE COLOR	CIRCUIT	NORMAL VOLTAGE	CONDITION
G91-31	PPL	Vehicle speed sensor signal for speedometer	*0 – 1 V ↑↓ 10 – 14 V (Reference wave- form No.21)	Vehicle running. (Sensor signal is pulse. Pulse frequency varies depending on vehicle speed.) (8190 pulses/sec. are generated per 60 km/h, 37.5 ml/h)
G91-32	GRY	ECT sensor signal for combination meter	*0 – 0.6 V ↑↓ 13 – 14 V (Reference wave- form No.24)	Ignition switch turned ON (Output signal is 5 Hz active low duty pulse. Duty ratio varies depending on ECT.) ECT –30°C = 10% ON duty ECT 130°C = 90% ON duty
G91-33	RED/YEL	Electric load signal for clearance lamp	0 – 1 V	Ignition switch turned ON, clearance lamp not lighted up
			10 – 14 V	Ignition switch turned ON, clearance lamp lighted up
G91-34	–	–	–	–
G91-35	ORN	Ground for A/C evapo- rator outlet air temp. sensor (if equipped)	Below 0.3 V	Ignition switch turned ON



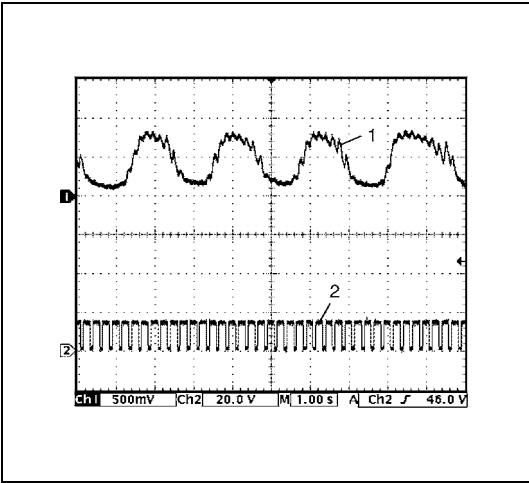


1. Reference waveform No.1

Heated oxygen sensor–2 heater signal at engine idling

Measurement terminal	CH1: C63-33 to C64-1 CH2: C64-3 to C64-1
Oscilloscope setting	CH1: 500 mV/DIV, CH2: 10 V/DIV TIME: 200 ms/DIV
Measurement condition	<ul style="list-style-type: none"><li>• After warmed up to normal operating temperature</li><li>• Drive vehicle at 60 km/h (37 mil/h) for 10 min.</li><li>• Engine at specified idle speed</li></ul>

1. Heated oxygen sensor–2 signal
2. Heated oxygen sensor–2 heater signal

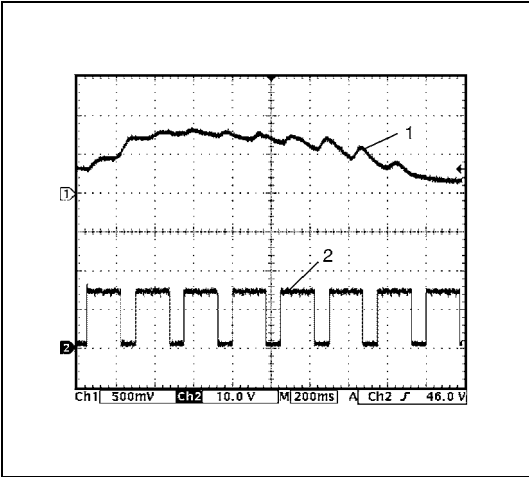


2. Reference waveform No.2

Heated oxygen sensor–1 signal at engine idling

Measurement terminal	CH1: C63-11 to C64-1 CH2: C64-4 to C64-1
Oscilloscope setting	CH1: 500 mV/DIV, CH2: 20 V/DIV TIME: 1 s/DIV
Measurement condition	<ul style="list-style-type: none"><li>• After warmed up to normal operating temperature</li><li>• Engine at specified idle speed</li></ul>

1. Heated oxygen sensor–1 signal
2. Heated oxygen sensor–1 heater signal

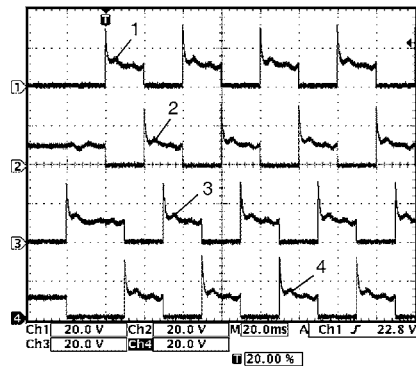


3. Reference waveform No.3

Heated oxygen sensor–1 heater signal at engine idling

Measurement terminal	CH1: C63-11 to C64-1 CH2: C64-4 to C64-1
Oscilloscope setting	CH1: 500 mV/DIV, CH2: 10 V/DIV TIME: 200 ms/DIV
Measurement condition	<ul style="list-style-type: none"><li>• After warmed up to normal operating temperature</li><li>• Engine at specified idle speed</li></ul>

1. Heated oxygen sensor–1 signal
2. Heated oxygen sensor–1 heater signal

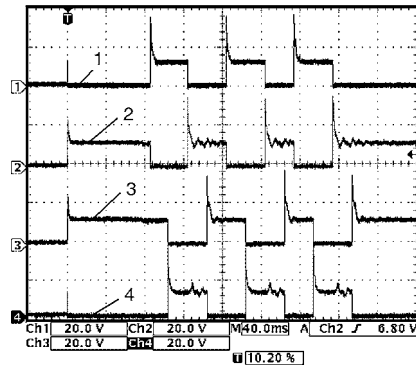


#### 4. Reference waveform No.4

IAC valve signal

Measurement terminal	CH1: C64-10 to C64-1 CH2: C64-9 to C64-1 CH3: C64-8 to C64-1 CH4: C64-28 to C64-1
Oscilloscope setting	CH1: 20 V/DIV, CH2: 20 V/DIV CH3: 20 V/DIV, CH4: 20 V/DIV TIME: 20 ms/DIV
Measurement condition	Ignition switch turned ON from ST (cranking) position

- |  |
|--|
| 1. IAC valve stepper motor coil 1 signal |
| 2. IAC valve stepper motor coil 2 signal |
| 3. IAC valve stepper motor coil 3 signal |
| 4. IAC valve stepper motor coil 4 signal |

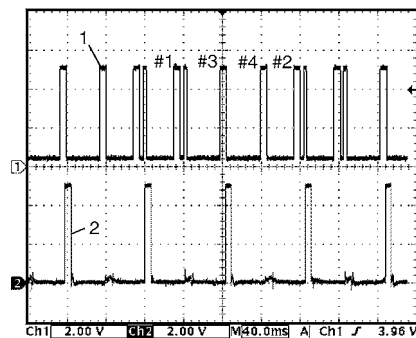


#### 5. Reference waveform No.5

EGR valve signal

Measurement terminal	CH1: C64-17 to C64-1 CH2: C64-34 to C64-1 CH3: C64-16 to C64-1 CH4: C64-33 to C64-1
Oscilloscope setting	CH1: 20 V/DIV, CH2: 20 V/DIV CH3: 20 V/DIV, CH4: 20 V/DIV TIME: 40 ms/DIV
Measurement condition	At the moment of the ignition switch in turned on

- |  |
|--|
| 1. EGR valve stepper motor coil 1 signal |
| 2. EGR valve stepper motor coil 2 signal |
| 3. EGR valve stepper motor coil 3 signal |
| 4. EGR valve stepper motor coil 4 signal |

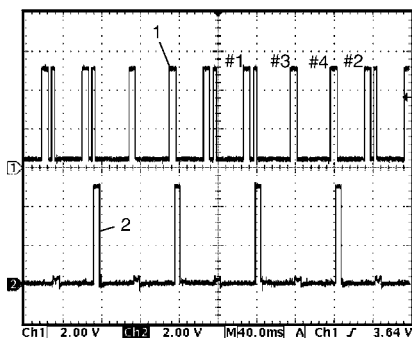


#### 6. Reference waveform No.6

Ignition coil No.2 and No.3 signal at engine idling

Measurement terminal	CH1: C63-10 to C64-1 CH2: C64-31 to C64-1
Oscilloscope setting	CH1: 2 V/DIV, CH2: 2 V/DIV TIME: 40 ms/DIV
Measurement condition	<ul style="list-style-type: none"> <li>After warmed up to normal operating temperature</li> <li>Engine at specified idle speed</li> </ul>

- |   |
|---|
| 1. Cylinder reference signal (CMP reference signal) |
| 2. No.2 and No.3 ignition signal                    |

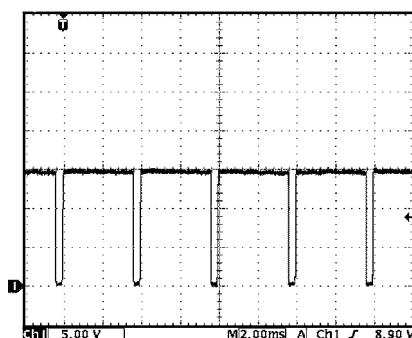


### 7. Reference waveform No.7

Ignition coil No.1 and No.4 signal at engine idling

Measurement terminal	CH1: C63-10 to C64-1 CH2: C64-32 to C64-1
Oscilloscope setting	CH1: 2 V/DIV, CH2: 2 V/DIV TIME: 40 ms/DIV
Measurement condition	<ul style="list-style-type: none"> <li>After warmed up to normal operating temperature</li> <li>Engine at specified idle speed</li> </ul>

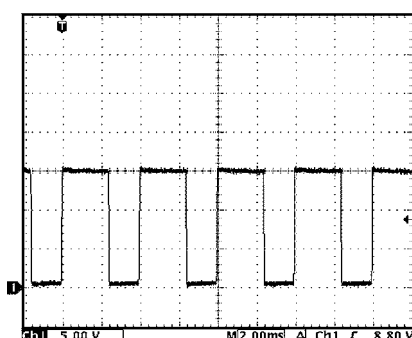
- |   |
|---|
| 1. Cylinder reference signal (CMP reference signal) |
| 2. No.1 and No.4 ignition signal                    |



### 8. Reference waveform No.8

Oil control valve signal at engine idling

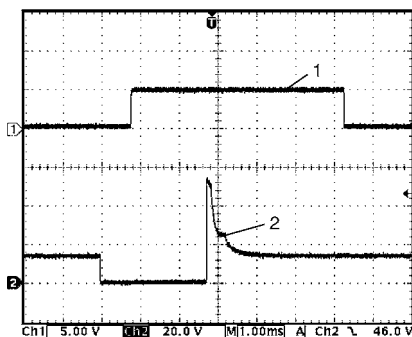
Measurement terminal	CH1: C63-2 to C64-1
Oscilloscope setting	CH1: 5 V/DIV TIME: 2 ms/DIV
Measurement condition	<ul style="list-style-type: none"> <li>After warmed up to normal operating temperature</li> <li>Engine at specified idle speed</li> </ul>



### 9. Reference waveform No.9

Oil control valve signal at engine racing

Measurement terminal	CH1: C63-2 to C64-1
Oscilloscope setting	CH1: 5 V/DIV TIME: 2 ms/DIV
Measurement condition	<ul style="list-style-type: none"> <li>After warmed up to normal operating temperature</li> <li>Engine at racing</li> </ul>

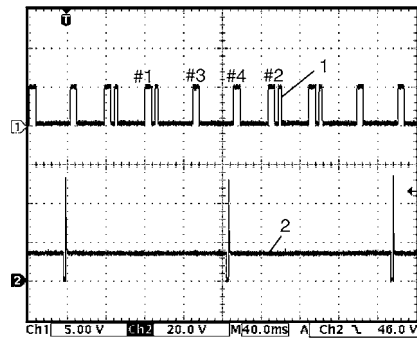


### 10. Reference waveform No.10

Fuel injector signal at engine idling

Measurement terminal	CH1: C63-10 to C64-1 CH2: C63-6 to C64-1
Oscilloscope setting	CH1: 5 V/DIV, CH2: 20 V/DIV TIME: 1 ms/DIV
Measurement condition	<ul style="list-style-type: none"> <li>After warmed up to normal operating temperature</li> <li>Engine at specified idle speed</li> </ul>

- |   |
|---|
| 1. Cylinder reference signal (CMP reference signal) |
| 2. Fuel injector signal                             |

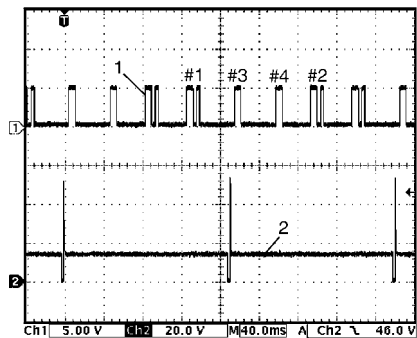


### 11. Reference waveform No.11

No.4 fuel injector signal at engine idling

Measurement terminal	CH1: C63-10 to C64-1 CH2: C63-4 to C64-1
Oscilloscope setting	CH1: 5 V/DIV, CH2: 20 V/DIV TIME: 40 ms/DIV
Measurement condition	<ul style="list-style-type: none"> <li>After warmed up to normal operating temperature</li> <li>Engine at specified idle speed</li> </ul>

- |   |
|---|
| 1. Cylinder reference signal (CMP reference signal) |
| 2. No.4 fuel injector signal                        |

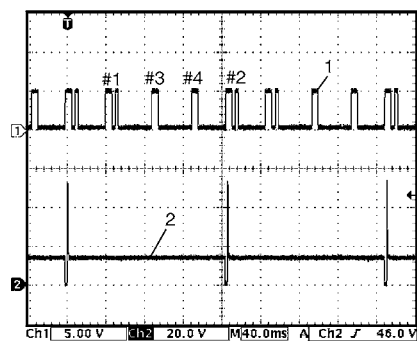


### 12. Reference waveform No.12

No.3 fuel injector signal at engine idling

Measurement terminal	CH1: C63-10 to C64-1 CH2: C63-5 to C64-1
Oscilloscope setting	CH1: 5 V/DIV, CH2: 20 V/DIV TIME: 40 ms/DIV
Measurement condition	<ul style="list-style-type: none"> <li>After warmed up to normal operating temperature</li> <li>Engine at specified idle speed</li> </ul>

- |   |
|---|
| 1. Cylinder reference signal (CMP reference signal) |
| 2. No.3 fuel injector signal                        |

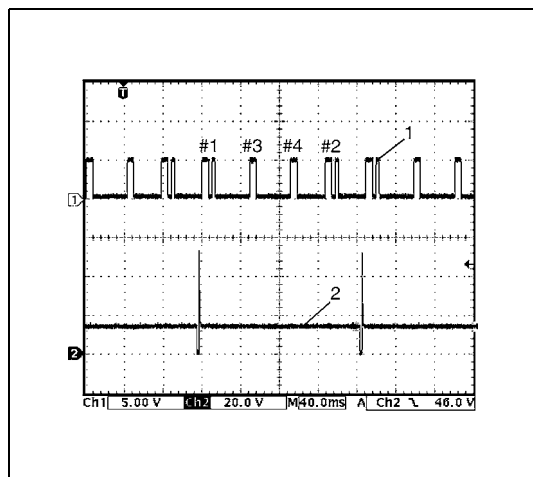


### 13. Reference waveform No.13

No.2 fuel injector signal at engine idling

Measurement terminal	CH1: C63-10 to C64-1 CH2: C63-6 to C64-1
Oscilloscope setting	CH1: 5 V/DIV, CH2: 20 V/DIV TIME: 40 ms/DIV
Measurement condition	<ul style="list-style-type: none"> <li>After warmed up to normal operating temperature</li> <li>Engine at specified idle speed</li> </ul>

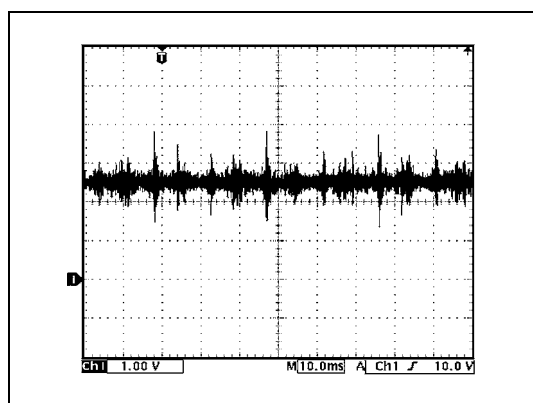
- |   |
|---|
| 1. Cylinder reference signal (CMP reference signal) |
| 2. No.2 fuel injector signal                        |

**14. Reference waveform No.14**

No.1 fuel injector signal at engine idling

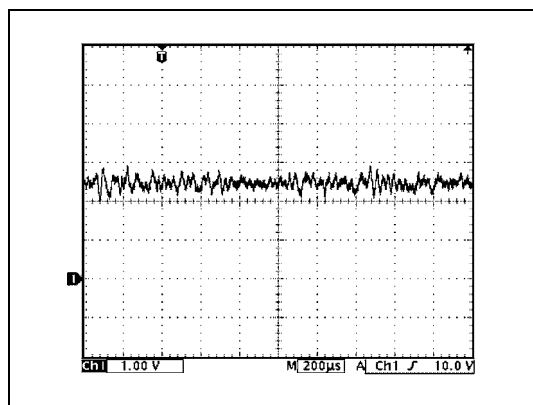
Measurement terminal	CH1: C63-10 to C64-1 CH2: C63-7 to C64-1
Oscilloscope setting	CH1: 5 V/DIV, CH2: 20 V/DIV TIME: 40 ms/DIV
Measurement condition	<ul style="list-style-type: none"> <li>After warmed up to normal operating temperature</li> <li>Engine at specified idle speed</li> </ul>

- |   |
|---|
| 1. Cylinder reference signal (CMP reference signal) |
| 2. No.1 fuel injector signal                        |

**15. Reference waveform No.15**

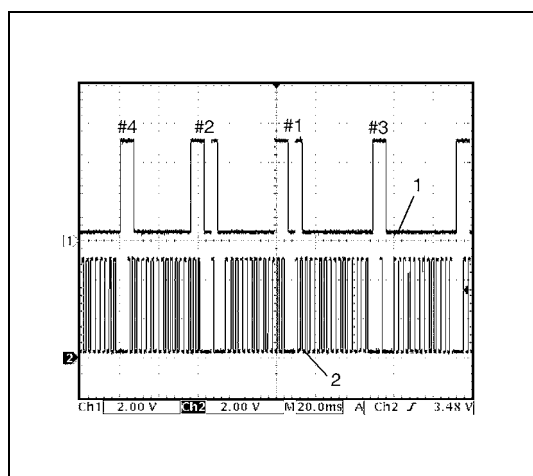
Knock sensor signal at engine speed 4000 r/min.

Measurement terminal	CH1: C63-9 to C64-1
Oscilloscope setting	CH1: 1 V/DIV TIME: 10 ms/DIV
Measurement condition	<ul style="list-style-type: none"> <li>After warmed up to normal operating temperature</li> <li>Run engine at 4000 r/min.</li> </ul>

**16. Reference waveform No.16**

Knock sensor signal at engine speed 4000 r/min.

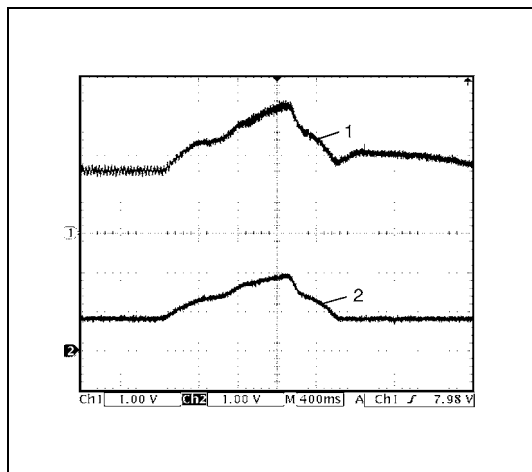
Measurement terminal	CH1: C63-9 to C64-1
Oscilloscope setting	CH1: 1 V/DIV TIME: 200 μs/DIV
Measurement condition	<ul style="list-style-type: none"> <li>After warmed up to normal operating temperature</li> <li>Run engine at 4000 r/min.</li> </ul>

**17. Reference waveform No.17**

CMP sensor signal at engine idling

Measurement terminal	CH1: C63-10 to C64-1 CH2: C63-30 to C64-1
Oscilloscope setting	CH1: 2 V/DIV, CH2: 2 V/DIV TIME: 20 ms/DIV
Measurement condition	<ul style="list-style-type: none"> <li>After warmed up to normal operating temperature</li> <li>Engine at specified idle speed</li> </ul>

- |   |
|---|
| 1. Cylinder reference signal (CMP reference signal) |
| 2. CKP signal                                       |

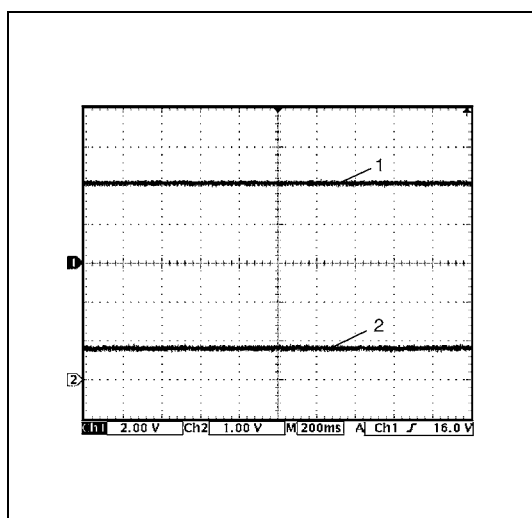


### 18. Reference waveform No.18

Mass air flow sensor signal at engine racing

Measurement terminal	CH1: C63-14 to C63-28 CH2: C63-34 to C63-28
Oscilloscope setting	CH1: 1 V/DIV, CH2: 1 V/DIV TIME: 400 ms/DIV
Measurement condition	<ul style="list-style-type: none"> <li>After warmed up to normal operating temperature</li> <li>Engine racing</li> </ul>

1. Mass air flow sensor signal
2. Throttle position sensor signal

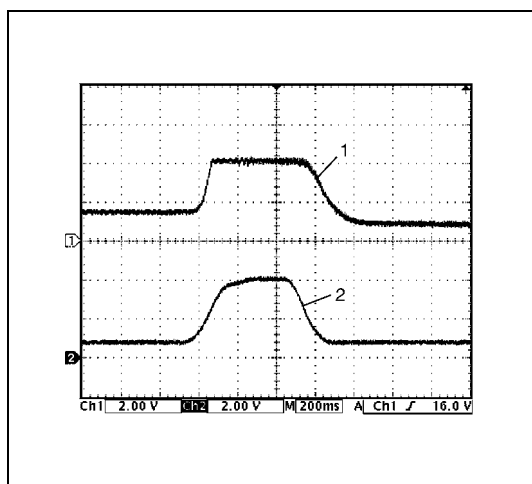


### 19. Reference waveform No.19

Manifold absolute pressure sensor signal at ignition switch turned ON

Measurement terminal	CH1: C63-15 to C63-28 CH2: C63-34 to C63-28
Oscilloscope setting	CH1: 2 V/DIV, CH2: 2 V/DIV TIME: 200 ms/DIV
Measurement condition	<ul style="list-style-type: none"> <li>After warmed up to normal operating temperature</li> <li>Ignition switch turned ON</li> </ul>

1. Manifold absolute pressure sensor signal
2. Throttle position sensor signal

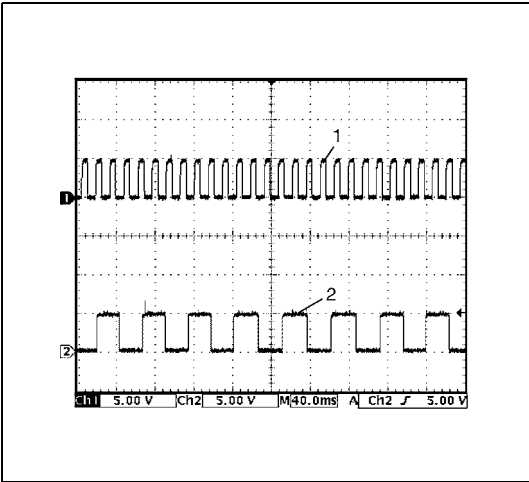


### 20. Reference waveform No.20

Manifold absolute pressure sensor signal at engine racing

Measurement terminal	CH1: C63-15 to C63-28 CH2: C63-34 to C63-28
Oscilloscope setting	CH1: 2 V/DIV, CH2: 2 V/DIV TIME: 200 ms/DIV
Measurement condition	<ul style="list-style-type: none"> <li>After warmed up to normal operating temperature</li> <li>Engine racing</li> </ul>

1. Manifold absolute pressure sensor signal
2. Throttle position sensor signal

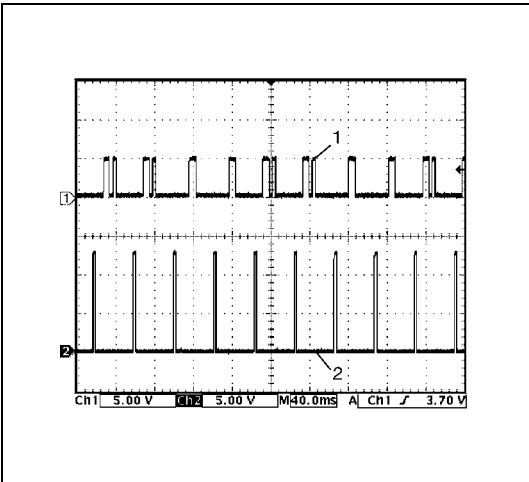


21. Reference waveform No.21

VSS signal at 30 km/h (19 mil/h)

Measurement terminal	CH1: G91-31 to C64-1 CH2: C63-19 to C64-1
Oscilloscope setting	CH1: 5 V/DIV, CH2: 5 V/DIV TIME: 40 ms/DIV
Measurement condition	<ul style="list-style-type: none"><li>After warmed up to normal operating temperature</li><li>Drive vehicle at 30 km/h (19 mil/h)</li></ul>

1. VSS signal for speedometer
2. VSS signal

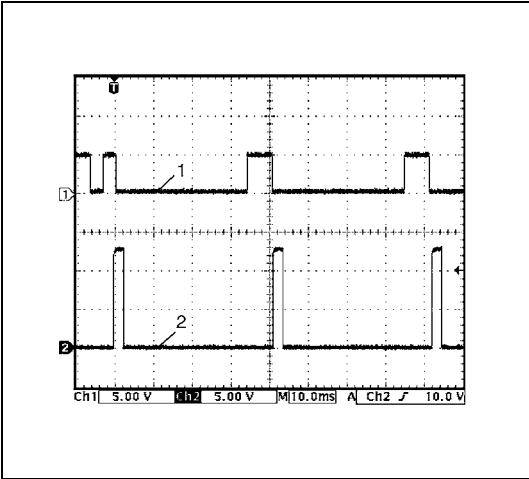


22. Reference waveform No.22

Ignition pulse (engine revolution) signal at engine idling

Measurement terminal	CH1: G63-10 to C64-1 CH2: G91-12 to C64-1
Oscilloscope setting	CH1: 5 V/DIV, CH2: 5 V/DIV TIME: 40 ms/DIV
Measurement condition	<ul style="list-style-type: none"><li>After warmed up to normal operating temperature</li><li>Engine at specified idle speed</li></ul>

1. Cylinder reference signal (CMP reference signal)
2. Ignition pulse signal

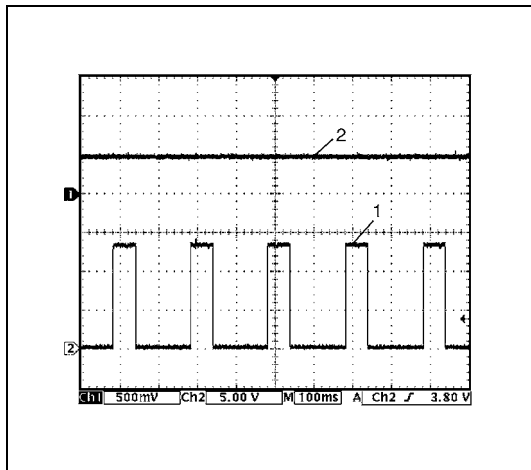


23. Reference waveform No.23

Ignition pulse (engine revolution) signal at engine idling

Measurement terminal	CH1: G63-10 to C64-1 CH2: G91-12 to C64-1
Oscilloscope setting	CH1: 5 V/DIV, CH2: 5 V/DIV TIME: 10 ms/DIV
Measurement condition	<ul style="list-style-type: none"><li>After warmed up to normal operating temperature</li><li>Engine at specified idle speed</li></ul>

1. Cylinder reference signal (CMP reference signal)
2. Ignition pulse signal



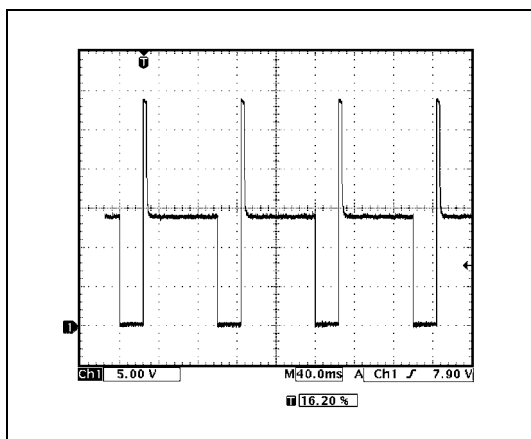
## 24. Reference waveform No.24

Engine coolant temperature signal at engine idling

Measurement terminal	CH1: C63-16 to C63-28 CH2: G91-32 to C64-1
Oscilloscope setting	CH1: 500 mV/DIV, CH2: 5 V/DIV TIME: 100 ms/DIV
Measurement condition	<ul style="list-style-type: none"> <li>After warmed up to normal operating temperature</li> <li>Engine at specified idle speed</li> </ul>

1. Engine coolant temperature signal for combination meter

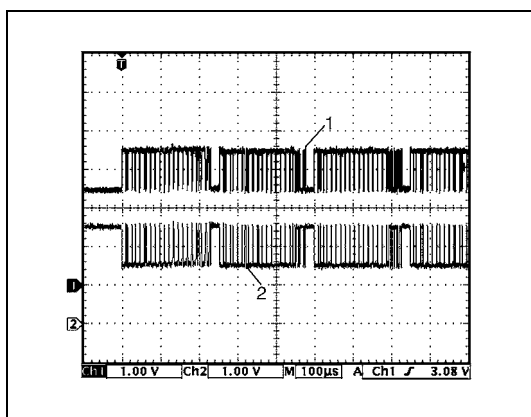
2. Engine coolant temperature sensor signal



## 25. Reference waveform No.25

EVAP canister purge valve signal

Measurement terminal	CH1: G64-13 to C64-1
Oscilloscope setting	CH1: 5 V/DIV TIME: 40 ms/DIV
Measurement condition	<ul style="list-style-type: none"> <li>After warmed up to normal operating temperature</li> <li>Drive vehicle at 40 km/h (25 mil/h) or more</li> </ul>



## 26. Reference waveform No.26

CAN communication line signal at ignition switch turned ON

Measurement terminal	CH1: G91-7 to C64-1 CH2: G91-8 to C64-1
Oscilloscope setting	CH1: 1 V/DIV, CH2: 1 V/DIV TIME: 100 μs/DIV
Measurement condition	Turn ignition switch to ON position (Depending on engine condition)

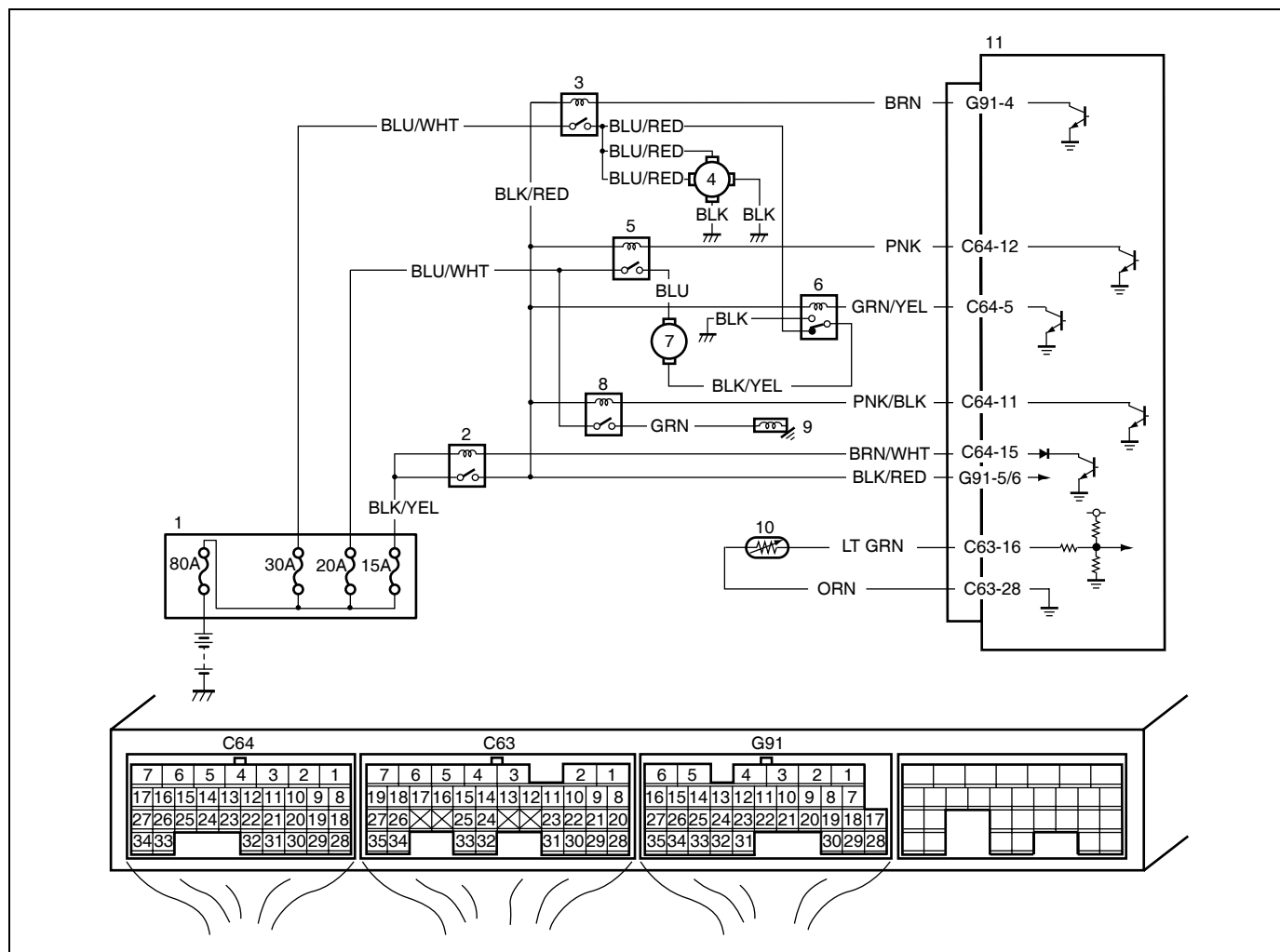
1. CAN communication line signal (High)

2. CAN communication line signal (Low)



## DTC P0480 Fan 1 (Radiator Cooling Fan) Control Circuit

### Wiring Diagram



1. Relay/fuse box	4. Radiator fan motor	7. A/C condenser fan motor	10. ECT sensor
2. Main relay	5. A/C condenser fan relay No.1	8. A/C compressor relay	11. ECM
3. Radiator fan relay	6. A/C condenser fan relay No.2	9. A/C compressor	

### Circuit Description

Radiator fan relay is controlled by ECM if ECT is specified value.

When A/C condenser fan motor is running while head light is turned ON and engine is running at below 1500 r/min, radiator fan relay is turned OFF for 2 sec. by ECM.

DTC DETECTING CONDITION	TROUBLE AREA
<ul style="list-style-type: none"> <li>Monitor signal of radiator fan relay is different from command signal.</li> </ul>	<ul style="list-style-type: none"> <li>"BLK/WHT", "BLK/RED" or "BRN" circuit open or short</li> <li>Radiator fan relay malfunction</li> <li>ECM malfunction</li> </ul>

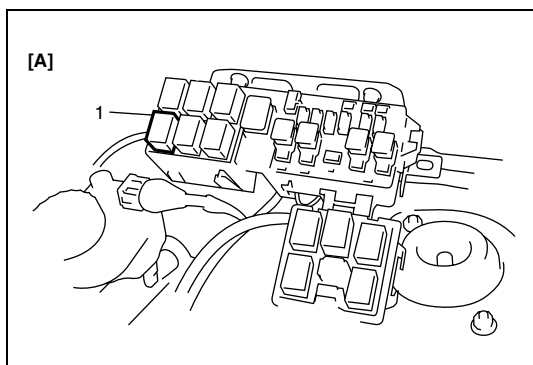
### Dtc Confirmation Procedure

- 1) With ignition switch turned OFF, connect scan tool to DLC.
- 2) Turn ON ignition switch and clear DTC using scan tool.
- 3) Warm up engine until radiator cooling fan starts to operate.
- 4) Check pending DTC in "ON BOARD TEST" or "PENDING DTC" mode and DTC in "DTC" mode.

## Troubleshooting

Step	Action	Yes	No
1	Was "Engine and Emission Control System Check" performed?	Go to Step 2.	Go to "Engine and Emission Control System Check" in this section.
2	Check Relay Circuit 1) Disconnect radiator fan relay from relay/fuse box with ignition switch turned OFF. (See Fig. 1.) 2) Turn ignition switch to ON position. 3) Measure voltage between "BLK/RED" wire terminal of radiator fan relay connector and engine ground. Is voltage 10 – 14 V?	Go to Step 3.	"BLK/RED" circuit is open or high resistance wire.
3	Check Relay Circuit 1) Turn ignition switch to OFF position. 2) Install radiator fan relay to relay/fuse box. 3) Disconnect connectors from ECM. 4) Remove ECM from vehicle body and then connect connectors to ECM. 5) Turn ignition switch to ON position. 6) Measure voltage between "G91-4" wire terminal of ECM connector and vehicle body ground. Is voltage 10 – 14 V?	Go to Step 4.	Go to Step 6.
4	Check Relay Circuit 1) Turn ignition switch to OFF position. 2) Disconnect connectors from ECM. 3) Remove radiator fan relay from relay/fuse box. 4) Measure voltage between "G91-4" wire terminal of ECM connector and vehicle body ground with ignition switch turned ON. Is voltage 0 V?	Go to Step 5.	"BRN" wire shorted to power circuit.
5	Radiator Fan Control Signal Check 1) Disconnect negative (–) cable at battery. 2) Disconnect connector from ECT sensor. 3) Connect connectors to ECM. 4) Install radiator fan relay to relay/fuse box. 5) Connect negative (–) cable to battery. 6) Measure voltage between "G91-4" wire terminal of ECM connector and vehicle body ground with ignition switch turned ON. Is voltage about 0 V?	System is in good condition.	Substitute a known-good ECM and recheck.

Step	Action	Yes	No
6	<b>Radiator Fan Control Signal Check</b> 1) Turn ignition switch to OFF position. 2) Disconnect connectors from ECM. 3) Measure voltage between "G91-4" wire terminal of ECM connector and vehicle body ground with ignition switch turned ON. Is voltage 10 – 14 V?	Substitute a known-good ECM and recheck.	Go to Step 7.
7	<b>Check Relay Circuit</b> 1) Turn ignition switch to OFF position. 2) Remove radiator fan relay from relay/fuse box. 3) Check for proper connection to "G91-4" wire terminal of ECM connector and "BRN" wire terminal of radiator fan relay connector. 4) If OK, measure resistance between "G91-4" wire terminal of ECM connector and "BRN" wire terminal of radiator fan relay connector. Is resistance 1 $\Omega$ or less?	Go to Step 8.	"BRN" circuit is open or high resistance wire.
8	<b>Check Relay Circuit</b> 1) Measure resistance between "G91-4" wire terminal of ECM connector and vehicle body ground. Is it infinite?	Go to Step 9.	"BRN" wire shorted to ground circuit.
9	<b>Check Radiator Fan Relay</b> 1) Check radiator fan relay referring to "Main Relay, Fuel Pump Relay and Radiator Fan Relay Inspection" in Section 6E1. Is it in good condition?	System is in good condition. Intermittent trouble. Check for intermittent referring to "Intermittent and Poor Connection Inspection" in Section 0A.	Replace radiator fan relay.

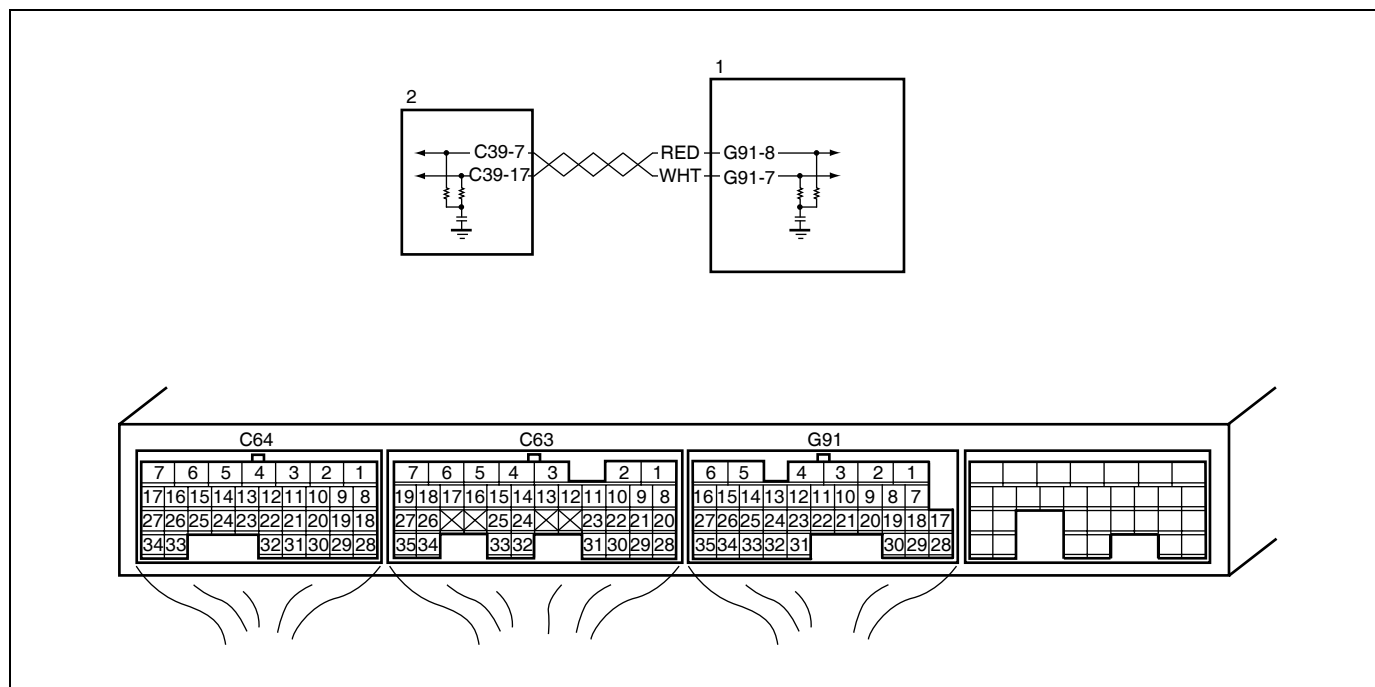


[A]: Fig. 1 for Step 2

1. Radiator fan relay

## DTC P1601 CAN Communication Error

### Wiring Diagram



- |        |
|--------|
| 1. ECM |
| 2. TCM |

### DTC Detecting Condition and Trouble Area

DTC DETECTING CONDITION	TROUBLE AREA
Transmission or reception error of communication data is detected by ECM for specified time continuously. (1 driving cycle detection logic)	<ul style="list-style-type: none"> <li>• “RED” or “WHT” wire circuit open or short</li> <li>• TCM malfunction</li> <li>• ECM malfunction</li> </ul>

### DTC Confirmation Procedure

- 1) With ignition switch turned OFF, connect scan tool to DLC.
- 2) Turn ON ignition switch and clear DTC using scan tool.
- 3) Start engine and run it for 5 seconds.
- 4) Check DTC and pending DTC.

### Troubleshooting

Step	Action	Yes	No
1	Was “Engine and Emission Control System Check” performed?	Go to Step 2.	Go to “Engine and Emission Control System Check” in this section.

Step	Action	Yes	No
2	Circuit Check 1) Turn ignition switch to OFF position. 2) Disconnect connectors from ECM and TCM. 3) Check for proper connection to "G91-7" terminal of ECM connector and "C39-7" terminal of TCM connector. 4) If OK, measure resistance between "G91-7" terminal of ECM connector and "C39-7" terminal of TCM connector. Is resistance 1Ω or less?	Go to Step 3.	"RED" wire circuit open or high resistance.
3	Circuit Check 1) Turn ignition switch to ON position. 2) Measure voltage between "G91-7" terminal of ECM connector and vehicle body ground. Is voltage 0 – 1 V?	Go to Step 4.	"RED" wire in shorted to power circuit.
4	Circuit Check 1) Turn ignition switch to OFF position. 2) Measure resistance between "G91-7" terminal of ECM connector and vehicle body ground. Is it infinite?	Go to Step 5.	"RED" wire in shorted to ground circuit.
5	Circuit Check 1) Check for proper connection to "G91-8" terminal of ECM connector and "C39-17" terminal of TCM connector. 2) If OK, measure resistance between "G91-8" terminal of ECM connector and "C39-17" terminal of TCM connector. Is resistance 1Ω or less?	Go to Step 6.	"WHT" wire circuit open or high resistance.
6	Circuit Check 1) Turn ignition switch to ON position. 2) Measure voltage between "G91-8" terminal of ECM connector and vehicle body ground. Is voltage 0 – 1 V?	Go to Step 7.	"WHT" wire in shorted to power circuit.
7	Circuit Check 1) Turn ignition switch to OFF position. 2) Measure resistance between "G91-8" terminal of ECM connector and vehicle body ground. Is it infinite?	Go to Step 8.	"WHT" wire in shorted to ground circuit.
8	DTC Check 1) Connect connectors to ECM and TCM. 2) Connect scan tool to DLC. 3) Check DTC of TCM. Is DTC P1701 indicated?	Substitute a known-good TCM and recheck. If OK, substitute a known-good ECM and recheck.	Substitute a known-good ECM and recheck.

## DTC P1603 TCM Trouble Code Detected

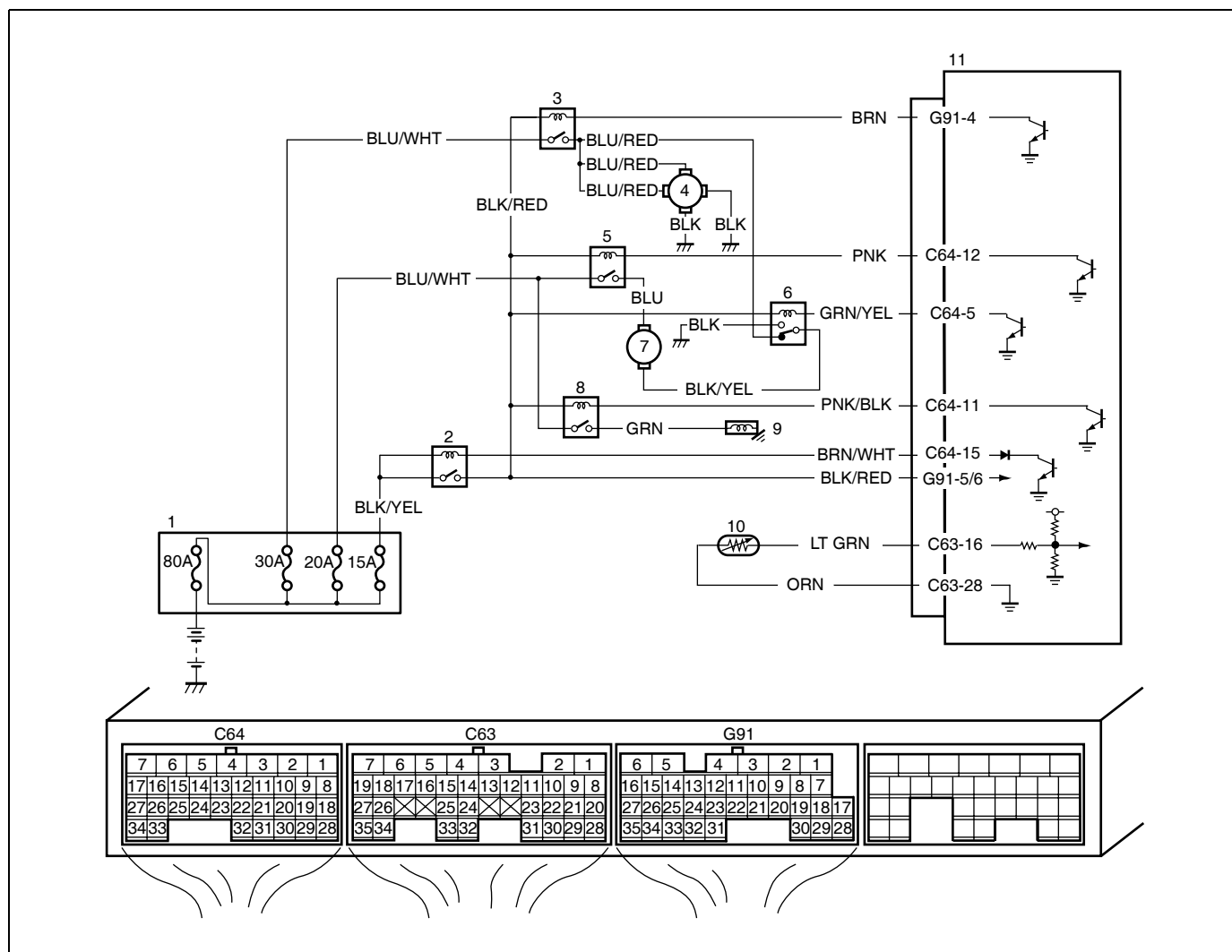
### DTC Detecting Condition

When ECM receives a trouble code from TCM, which indicates that some problem occurred in sensor circuits and its calculated values used for operations such as idle speed control, engine power control, and so on by TCM, ECM sets DTC P1603. (TCM outputs the trouble code to ECM when TCM cannot compute the engine control signal due to malfunctions of sensor circuits used for gear shift control.)

### DTC Troubleshooting

Step	Action	Yes	No
1	Was "Engine and Emission Control System Check" performed?	Go to Step 2.	Go to "Engine and Emission Control System Check" in this section.
2	DTC Check Check DTC of TCM. Is there any DTC(s)?	Go to applicable DTC troubleshooting.	Substitute a known-good ECM and recheck.

### Table B-7 Radiator Fan Control System Check



1. Relay/fuse box	5. A/C condenser fan relay No.1	9. A/C compressor
2. Main relay	6. A/C condenser fan relay No.2	10. ECT sensor
3. Radiator fan relay	7. A/C condenser fan motor	11. ECM
4. Radiator fan motor	8. A/C compressor relay	

## Troubleshooting

Step	Action	Yes	No
1	DTC Check Is there DTC(s) ETC sensor circuit (DTC P0117/P0118) and/or radiator fan circuit (DTC P0480) displayed?	Go to corresponding DTC diag. flow table.	Go to Step 2.
2	Radiator Fan Motor Check Check radiator fan motor referring to “Radiator Fan Motor Inspection” in Section 6B. Is it in good condition?	System is in good condition.	Go to Step 3.
3	Main Fuse Check 1) Turn ignition switch to OFF position. 2) Remove main fuse from relay/fuse box. Is main (30 A) fuse in good condition?	Go to Step 4.	Replace main fuse.

Step	Action	Yes	No
4	Radiator Fan Motor Circuit Check 1) Remove radiator fan relay from relay/fuse box. 2) Measure voltage between "BLU/WHT" wire terminal of radiator fan relay connector and vehicle body ground. Is voltage 10 – 14 V?	Go to Step 5.	"BLU/WHT" wire open or high resistance circuit.
5	Check Radiator Fan Relay 1) Check radiator fan relay referring to "Main Relay, Fuel Pump Relay and Radiator Fan Relay Inspection" in Section 6E1. Is it in good condition?	Go to Step 6.	Replace radiator fan relay.
6	Radiator Fan Control Circuit Check 1) Disconnect radiator fan motor connector. 2) Measure resistance between each "BLU/RED" wire terminal of radiator fan motor connector and "BLU/RED" wire terminal of radiator fan relay connector. Is each resistance 1Ω or less?	Go to Step 7.	"BLU/RED" wire circuit open or poor connection.
7	Radiator Fan Control Circuit Check 1) Measure resistance between each "BLU/RED" wire terminal of radiator fan motor connector and vehicle body ground. Is each resistance infinite?	Go to Step 8.	"BLU/RED" wire circuit shorted to ground.
8	Radiator Fan Control Circuit Check 1) Turn ON ignition switch. 2) Measure voltage between each "BLU/RED" wire terminal of radiator fan motor connector and vehicle body ground. Is each voltage 0 V?	Go to Step 9.	"BLU/RED" wire shorted to power circuit.
9	Radiator Fan Control Circuit Check 1) Measure resistance between each "BLK" wire terminal of radiator fan motor connector and vehicle body ground. Is each resistance 1Ω or less?	Replace radiator fan motor.	"BLK" wire open or high resistance circuit.





## SECTION 6A1

# ENGINE MECHANICAL (M15 ENGINE)

**WARNING:**

For vehicles equipped with a Supplemental Restraint (Air Bag) System :

- Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to “Air Bag System Components and Wiring Location View” under “General Description” in air bag system section in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and “Service Precautions” under “On-Vehicle Service” in air bag system section before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.
- Technical service work must be started at least 90 seconds after the ignition switch is turned to the “LOCK” position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).

**NOTE:**

For the items with asterisk (\*) in the “CONTENTS” below, refer to the same section of the Service Manual mentioned in “Foreword” of this Manual.

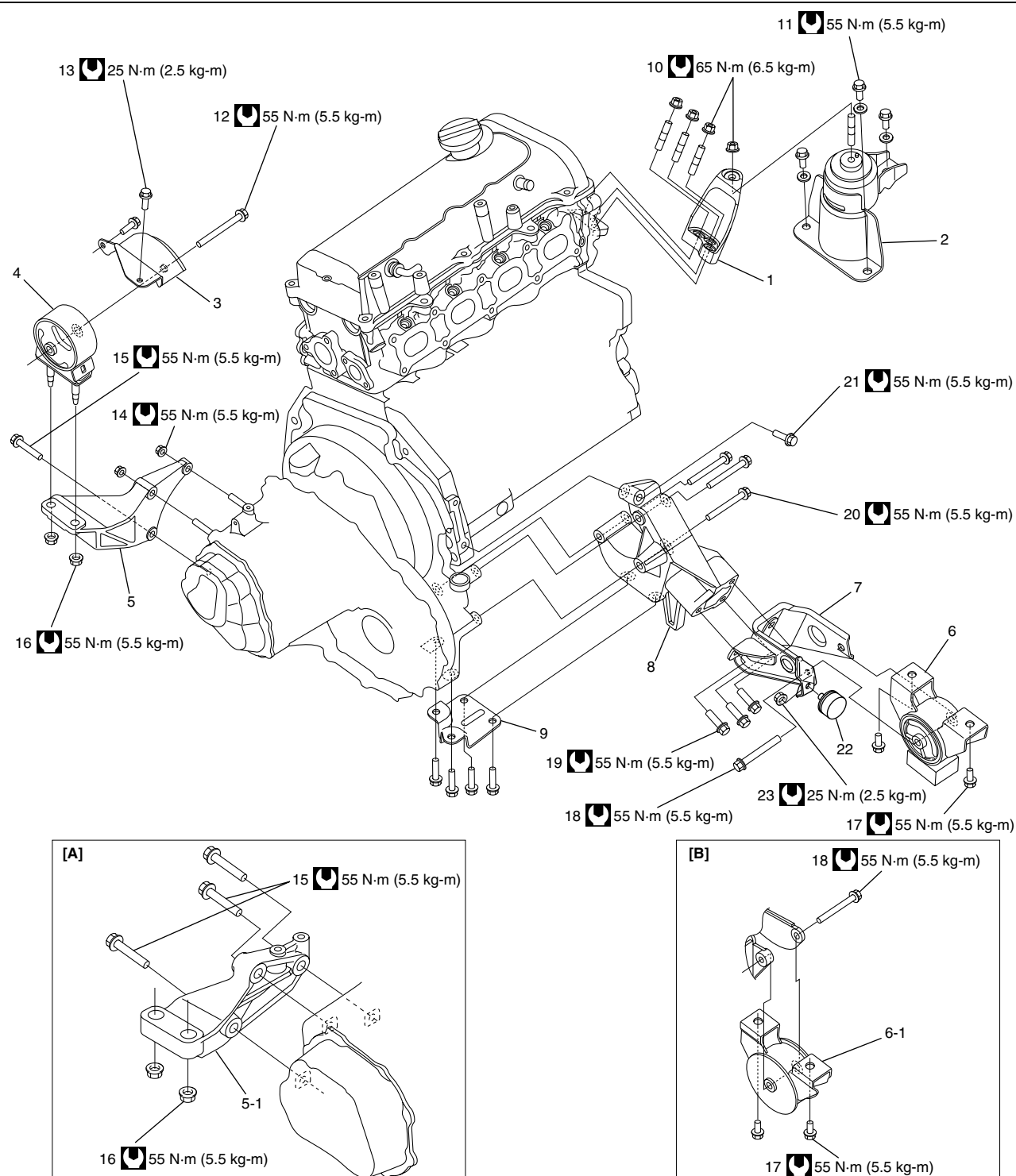
## CONTENTS


<b>General Description .....</b>	<b>*</b>		
Engine Construction Description .....	*	Cylinder Head Cover Removal and	
Engine Lubrication Description .....	*	Installation .....	*
Variable Valve Timing (VVT) System		Throttle Body and Intake Manifold	
Description .....	*	Components .....	*
System description .....	*	Throttle Body Removal and Installation .....	*
Oil control valve .....	*	Intake Manifold Removal and	
Cam timing sprocket .....	*	Installation .....	*
Timing advancing .....	*	Exhaust Manifold Components .....	*
Timing holding .....	*	Exhaust Manifold Removal and	
Timing retarding .....	*	Installation .....	*
Targeted timing varying operation .....	*	Oil Pan and Oil Pump Strainer	
		Components .....	*
<b>Diagnosis .....</b>	<b>*</b>	Oil Pan and Oil Pump Strainer Removal	
Diagnosis Table .....	*	and Installation .....	*
Compression Check .....	*	Engine Mountings Components .....	6A1-3
Engine Vacuum Check .....	*	<b>Unit Repair Overhaul .....</b>	<b>6A1-4</b>
Oil Pressure Check .....	*	Engine Assembly Removal and	
Valve Lash (Clearance) Inspection .....	*	Installation .....	6A1-4
Shim Replacement .....	*	Timing Chain Cover Components .....	*
<b>On-Vehicle Service .....</b>	<b>6A1-3</b>	Timing Chain Cover Removal and	
Air Cleaner Element Removal and		Installation .....	*
Installation .....	*	Timing Chain Cover Inspection .....	*
Air Cleaner Element Inspection and		Oil seal .....	*
Cleaning .....	*	Timing chain cover .....	*
Knock Sensor Removal and Installation .....	*	Oil control valve .....	*

Oil gallery pipe .....	*	Valve guides .....	*
Oil Pump Components .....	*	Valves .....	*
Oil Pump Removal and Installation .....	*	Cylinder head .....	*
Oil Pump Disassembly and Assembly .....	*	Valve springs .....	*
Oil Pump Inspection .....	*	Pistons, Piston Rings, Connecting Rods and Cylinders Components .....	*
Oil seal .....	*	Pistons, Piston Rings, Connecting Rods and Cylinders Removal and Installation .....	*
Oil pump assembly .....	*	Pistons, Piston Rings, Connecting Rods and Cylinders Disassembly and Assembly .....	*
Radial clearance .....	*	Pistons, Piston Rings, Connecting Rods and Cylinders Inspection .....	*
Side clearance .....	*	Cylinder .....	*
Relief valve spring free length and load .....	*	Pistons .....	*
Timing Chain and Chain Tensioner Components .....	*	Piston pin .....	*
Timing Chain and Chain Tensioner Removal and Installation .....	*	Piston rings .....	*
Timing Chain and Timing Chain Tensioner Inspection .....	*	Connecting rod .....	*
Timing chain tensioner .....	*	Crank pin and connecting rod bearings .....	*
Crankshaft timing sprocket .....	*	Main Bearings, Crankshaft and Cylinder Block Components .....	*
Timing chain .....	*	Main Bearings, Crankshaft and Cylinder Block Removal and Installation .....	*
Timing chain tensioner adjuster .....	*	Main Bearings, Crankshaft and Cylinder Block Inspection .....	6A1-8
Timing chain No.1 guide .....	*	Main bearing cap No.1 bolt .....	*
Camshaft, Tappet and Shim Components .....	*	Crankshaft .....	*
Camshaft, Tappet and Shim Removal and Installation .....	*	Main bearings .....	6A1-8
Camshaft, Tappet and Shim Inspection .....	*	Rear oil seal .....	*
Intake cam timing sprocket assembly .....	*	Flywheel .....	*
Cam wear .....	*	Sensor plate .....	*
Camshaft runout .....	*	Cylinder block .....	*
Camshaft journal wear .....	*	<b>Required Service Material .....</b>	*
Wear of tappet and shim .....	*	<b>Tightening Torque Specification .....</b>	6A1-13
Valves and Cylinder Head Components .....	*	<b>Special Tool .....</b>	*
Valves and Cylinder Head Removal and Installation .....	*		
Valves and Cylinder Head Disassembly and Assembly .....	*		
Valves and Cylinder Head Inspection .....	*		

# On-Vehicle Service

## Engine Mountings Components



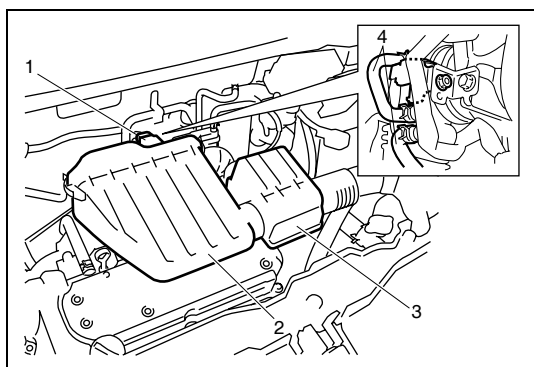
[A] : A/T vehicle	7. Engine rear mounting No.1 bracket	17. Engine rear mounting bolt
[B] : AWD vehicle	8. Engine rear mounting No.2 bracket	18. Engine rear mounting bolt
1. Engine right mounting	9. Engine rear mounting bracket stiffener	19. Engine rear mounting No.1 bracket bolt
2. Engine right body side bracket	10. Engine right mounting nut	20. Engine rear mounting No.2 bracket bolt
3. Engine left body side bracket	11. Engine right body side bracket bolt	21. Engine rear mounting No.2 bracket bolt
4. Engine left mounting	12. Engine left mounting bolt	22. Dynamic damper (for FWD vehicle)
5. Engine left mounting bracket (for M/T vehicle)	13. Engine left body side bracket bolt	23. Dynamic damper nut
5-1. Engine left mounting bracket (for A/T vehicle)	14. Engine left mounting bracket nut	 Tightening torque
6. Engine rear mounting (for FWD vehicle)	15. Engine left mounting bracket bolt	
6-1. Engine rear mounting (for AWD vehicle)	16. Engine left mounting bracket nut	

## Unit Repair Overhaul

### Engine Assembly Removal and Installation

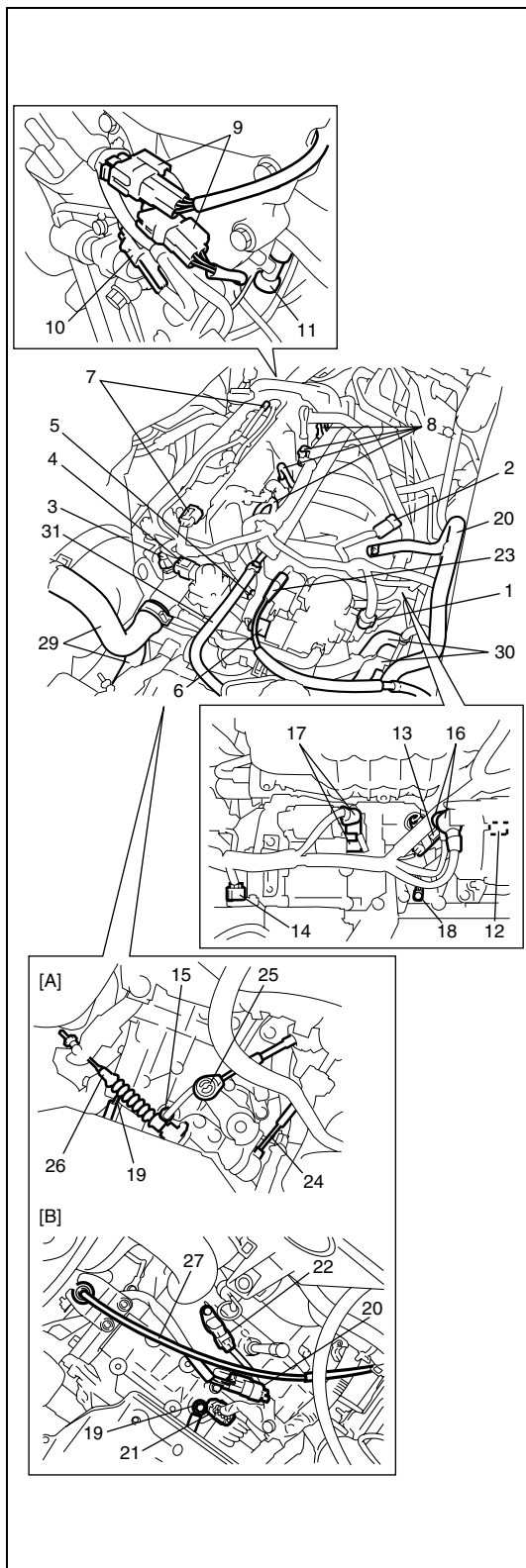
#### Removal

- 1) Relieve fuel pressure referring to “Fuel Pressure Relief Procedure” in Section 6.
- 2) Disconnect negative and positive cables at battery.
- 3) Remove engine hood after disconnecting windshield washer hose.
- 4) Remove right and left side engine under covers.
- 5) Remove A/C compressor belt by referring to “Compressor Drive Belt Replacement” in Section 1B (if equipped).
- 6) Drain engine oil referring to “Engine Oil and Filter Change” in Section 0B.
- 7) Drain transaxle oil referring to “Manual Transaxle Oil Change” in Section 7A2 (for M/T vehicle).
- 8) Drain A/T fluid referring to “Fluid change” in Section 7B (for A/T vehicle).
- 9) Drain transfer oil referring to “Transfer Oil Change” in Section 7D (for AWD vehicle).
- 10) Drain coolant by referring to “Cooling System Flush and Refill” in Section 6B.
- 11) Disconnect MAF sensor coupler (1).
- 12) Remove air cleaner case (2) and resonator (3).
- 13) Remove canister purge hose (4) from EVAP canister purge valve.
- 14) With hose connected, detach A/C compressor from its bracket (if equipped).



#### NOTE:

**Suspend removed A/C compressor at a place where no damage will be caused during removal and installation of engine assembly.**



## 15) Disconnect the following electric lead wires:

- TP sensor (1)
- MAP sensor (2)
- ECT sensor (3)
- EGR valve (4)
- CMP sensor (5)
- IAC valve (6)
- Ignition coil assembly (7)
- Injectors (8)
- Heated oxygen sensor (9)
- Oil control valve (10)
- Engine oil pressure switch (11)
- CKP sensor (12)
- Knock sensor (13)
- VSS (14)
- Back up light switch (15) (for M/T vehicle)
- Generator (16)
- Starting motor (17)
- Ground terminal (18) from cylinder block
- Battery ground cable (19) from transaxle
- Transmission range switch (20) (for A/T vehicle)
- A/T shift solenoid and A/T fluid temperature sensor (21) (for A/T vehicle)
- Input shaft speed sensor (22) (for A/T vehicle)
- Magnet clutch switch of A/C compressor (if equipped)
- Each wire harness clamps

## 16) Remove fuse box from its bracket.

## 17) Disconnect the following cables :

- Accelerator cable (23)
- Gear select control cable (24) (for M/T vehicle)
- Gear shift control cable (25) (for M/T vehicle)
- Clutch cable (26) (for M/T vehicle)
- A/T selector cable (27) (for A/T vehicle)

## 18) Disconnect the following hoses :

- Brake booster hose (28) from intake manifold
- Radiator inlet and outlet hoses (29) from each pipe
- Heater inlet and outlet hoses (30) from each pipe
- Fuel feed hoses (31) from fuel feed pipe
- A/T fluid hoses from radiator (for A/T vehicle)

[A]: M/T vehicle

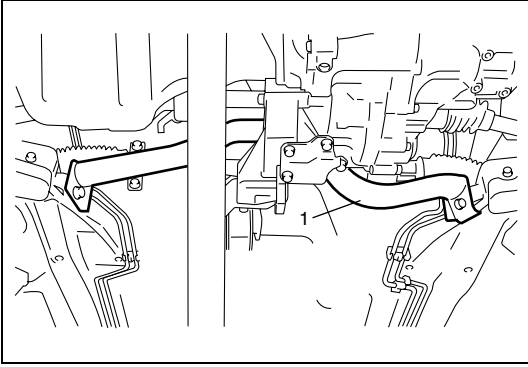
[B]: A/T vehicle

## 19) Remove exhaust No.1 pipe referring to "Exhaust Manifold Removal and Installation" in this section.

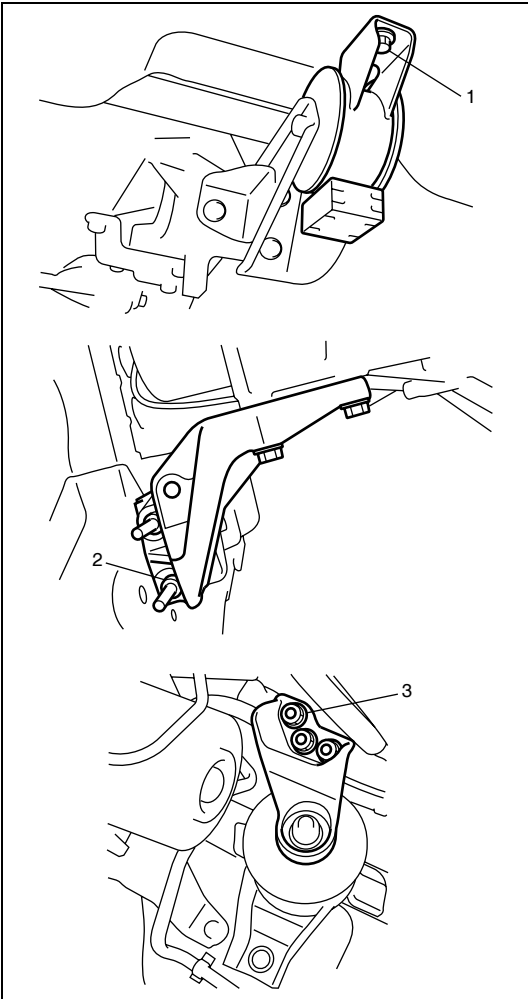
## 20) Disconnect right and left drive shaft joints to differential gear referring to "Drive Shaft Assembly Removal and Installation" in Section 4A.

For engine and transaxle removal, it is not necessary to remove drive shafts from steering knuckle.

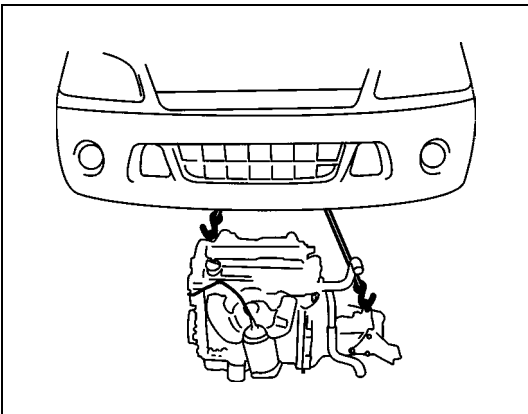
## 21) For AWD vehicle, remove propeller shaft referring to "Propeller Shaft Removal and Installation" in Section 4B.



- 22) Remove cross member (1).
- 23) Install lifting device.



- 24) Remove engine rear mounting bolts (1), engine left mounting bracket nuts (2) and engine right mounting nuts (3).



- 25) Before removing engine with transaxle from body, recheck to make sure all hoses, electric wires and cables are disconnected from engine and transaxle.
- 26) Lower engine with transaxle from body.

**NOTE:**

Before lowering engine, to avoid damage to A/C compressor, raise it through clearance made on engine crankshaft pulley side. At this time, use care so that no excessive force is applied to hoses.

- 27) Disconnect transaxle from engine referring to "Transaxle Unit Dismounting and Remounting" in Section 7A2(for M/T vehicle).
- 28) Disconnect automatic transaxle from engine referring to "Automatic Transaxle Assembly" in Section 7B (for A/T vehicle).
- 29) Remove clutch cover and clutch disk referring to "Clutch Cover, Clutch Disc and Flywheel Removal and Installation" in Section 7C1 (for M/T vehicle).

### Installation

- 1) Install clutch cover and clutch disk referring to "Clutch Cover, Clutch Disc and Flywheel Removal and Installation" in Section 7C1 (for M/T vehicle).
- 2) Connect transaxle to engine referring to "Transaxle Unit Dismounting and Remounting" in Section 7A2 (for M/T vehicle).
- 3) Connect automatic transaxle to engine referring to "Automatic Transaxle Assembly" in Section 7B (for A/T vehicle).
- 4) Lift engine with transaxle into engine compartment, but do not remove lifting device.
- 5) Install engine rear mounting bolts (1), engine left mounting bracket nuts (2) and engine right mounting nuts (3).  
Tighten these bolts and nuts to specified torque.

#### Tightening torque

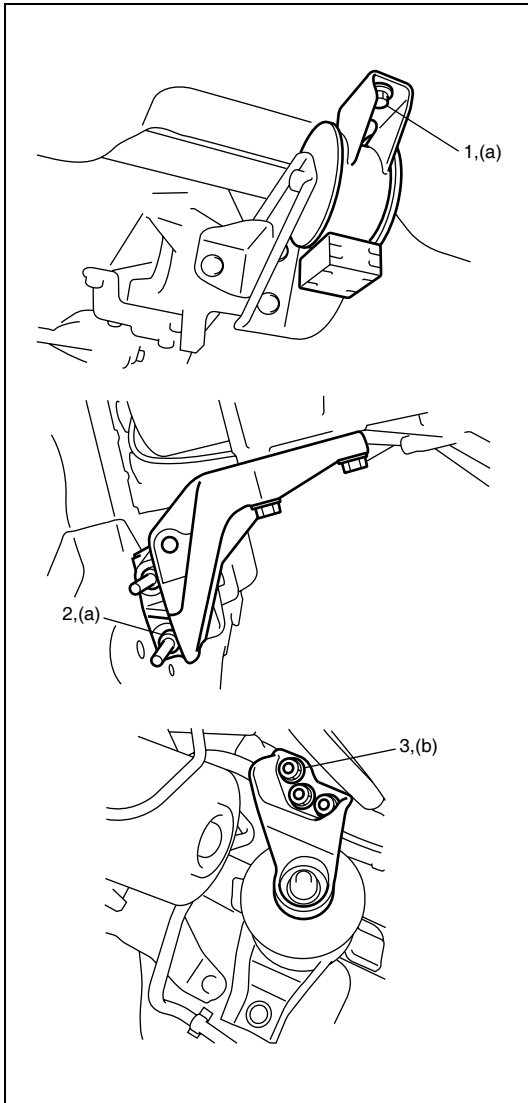
##### Engine left mounting bolts

(a) : 55 N·m (5.5 kg-m, 40.0 lb-ft)

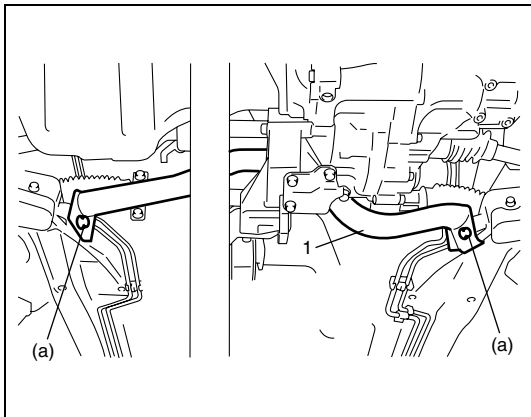
##### Engine right mounting bracket nuts

(b) : 65 N·m (6.5 kg-m, 47.0 lb-ft)

- 6) Remove lifting device.







- 7) Install cross member (1).  
Tighten bolts to specified torque.

#### **Tightening torque**

##### **Cross member bolts**

**(a) : 60 N·m (6.0 kg-m, 43.0 lb-ft)**

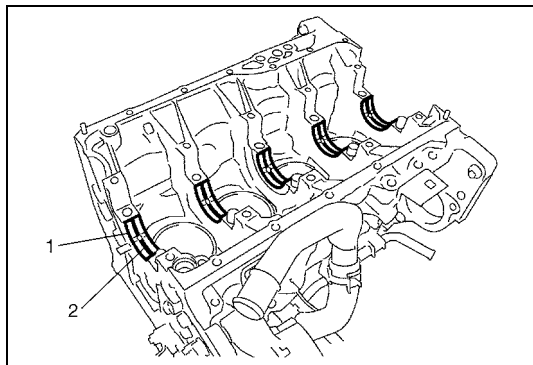
- 8) For AWD vehicle, install propeller shaft referring to “Propeller Shaft Removal and Installation” in Section 4B.
- 9) Connect drive shaft joints referring to Section 4A.
- 10) Install exhaust No.1 pipe referring to “Exhaust Manifold Removal and Installation” in this section.
- 11) Reverse disconnected hoses, cables and electric wires for connection.
- 12) Install air cleaner case and resonator.
- 13) Install A/C compressor to its bracket (if equipped).
- 14) Adjust A/C compressor belt tension (if equipped) referring to “Compressor Drive Belt Inspection and Adjustment” in Section 1B.
- 15) Adjust accelerator cable play referring to “Accelerator Cable Adjustment” in Section 6E1.
- 16) Check to ensure that all removed parts are back in place. Reinstall any necessary parts which have not been reinstalled.
- 17) Refill cooling system with coolant referring to “Cooling System Flush and Refill” in Section 6B.
- 18) Refill engine with engine oil referring to “Engine Oil and Filter Change” in Section 0B.
- 19) Refill transaxle with transaxle oil referring to “Manual Transaxle Oil Change” in Section 7A2 (for M/T vehicle).
- 20) Refill A/T fluid referring to “Fluid change” in Section 7B (for A/T vehicle).
- 21) Refill transfer with transfer oil referring to “Transfer Oil Change” in Section 7D (for AWD vehicle).
- 22) Connect negative cable at battery.
- 23) Verify that there is no fuel leakage, coolant leakage, oil leakage and exhaust gas leakage at each connection.

## **Main Bearings, Crankshaft and Cylinder Block Inspection**

### **Main bearings**

#### **General Information**

- Service main bearings are available in standard size and 0.25 mm (0.0098 in.) undersize, and each of them has 5 kinds of bearings differing in tolerance.



- Upper half of bearing (1) has an oil groove (2) as shown in figure.  
Install this half with oil groove to cylinder block.
- Lower half of bearing does not have an oil groove.

### Visual Inspection

Check bearings for pitting, scratches, wear or damage.

If any malcondition is found, replace both upper and lower halves.  
Never replace either half without replacing the other half.

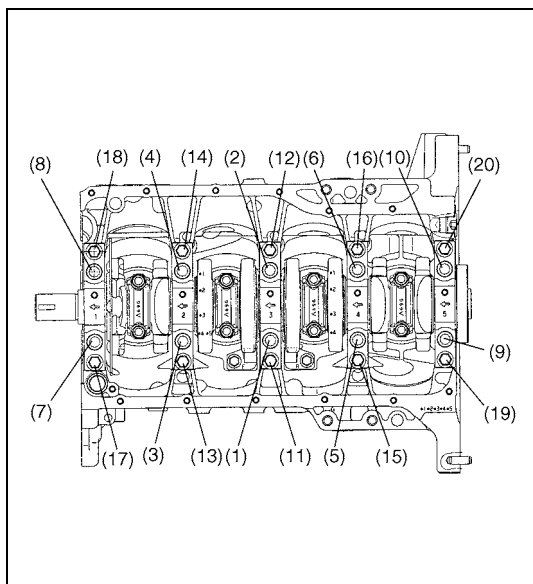
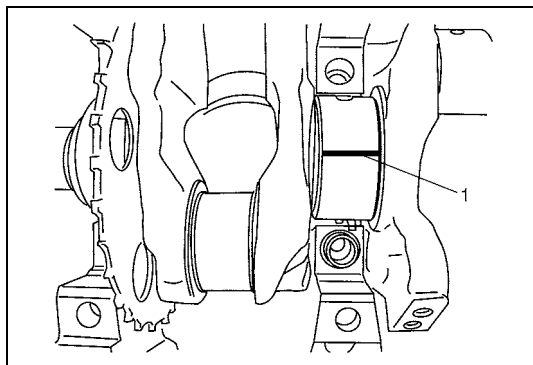
### Main Bearing Clearance

#### CAUTION:

**Do not rotate crankshaft while gaging plastic is installed.**

Check clearance by using gaging plastic according to the following procedure.

- 1) Remove bearing caps.
- 2) Clean bearings and main journals.
- 3) Place a piece of gaging plastic (1) the full width of bearing (parallel to crankshaft) on journal, avoiding oil hole.



- 4) Tighten main bearing cap No.1 bolts (1) – (10) and main bearing No.2 cap bolts (11) – (20) gradually as follows.
  - a) Tighten bolts (1) – (10) to 30 N·m (3.0 kg-m, 22.0 lb-ft) according to numerical order in figure.
  - b) In the same manner as in Step a), tighten them to 50 N·m (5.0 kg-m, 36.5 lb-ft).
  - c) In the same manner as in step a), retighten them to 60°.
  - d) Tighten bolts (11) – (20) to 25 N·m (2.5 kg-m, 18.0 lb-ft) according to numerical order in figure.

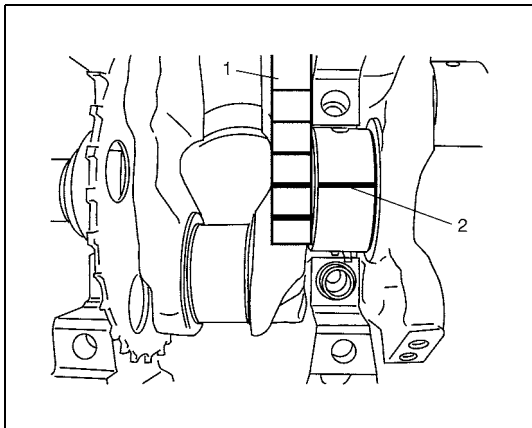
#### Tightening torque

**Main bearing cap No.1 bolts (1) – (10) :**

**30 N·m (3.0 kg-m, 22.0 lb-ft), 50 N·m (5.0 kg-m, 36.5 lb-ft)  
and then retighten by turning through 60°**

**Main bearing cap No.2 bolts (11) – (20) :**

**25 N·m (2.5 kg-m, 18.0 lb-ft)**



- 5) Remove bearing caps and using scale (1) on gaging plastic (2) envelop, measure gaging plastic width at its widest point. If clearance exceeds its limit, replace bearing. Always replace both upper and lower inserts as a unit.

A new standard bearing may produce proper clearance. If not, it will be necessary to regrind crankshaft journal for use of 0.25 mm (0.0098 in.) undersize bearing.

After selecting new bearing, recheck clearance.

#### Main bearing clearance

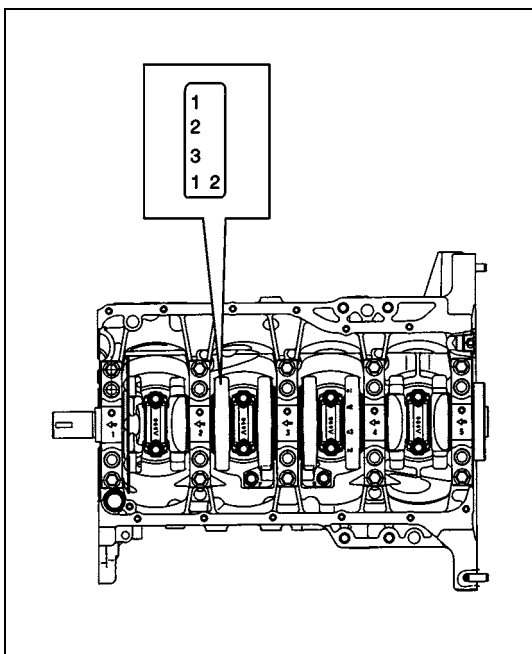
**Standard : 0.021 – 0.041 mm (0.0008 – 0.0016 in.)**

**Limit : 0.054 mm (0.0021 in.)**

#### Selection of Main Bearings

##### Standard Bearing

If bearing is in malcondition, or bearing clearance is out of specification, select a new standard bearing according to the following procedure and install it.



- 1) First check journal diameter. As shown in figure, crank web No.2 has stamped numbers.

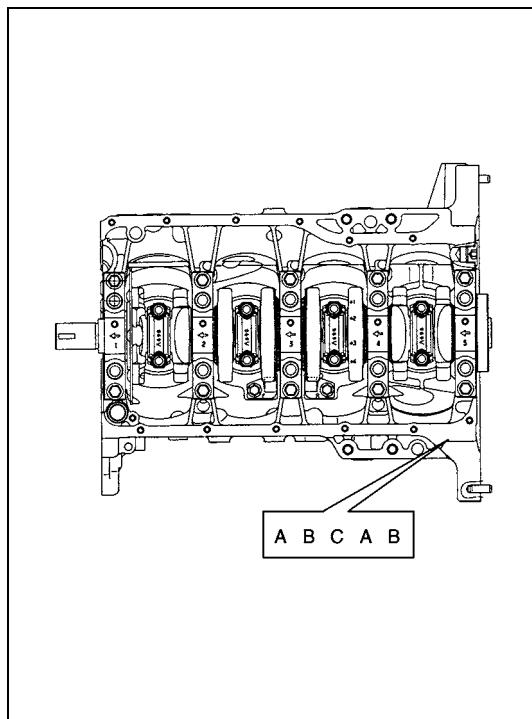
Three kinds of numbers (“1”, “2” and “3”) represent the following journal diameters.

Stamped numbers on crank web No.2 represent journal diameters marked with an arrow in figure respectively.

For example, stamped number “1” indicates that corresponding journal diameter is 51.994 – 52.000 mm (2.0471 – 2.0472 in.).

#### Crankshaft journal diameter

Stamped numbers	Journal diameter
1	51.9940 – 52.0000 mm (2.0471 – 2.0472 in.)
2	51.9880 – 51.9939 mm (2.0468 – 2.0470 in.)
3	51.9820 – 51.9879 mm (2.0465 – 2.0467 in.)



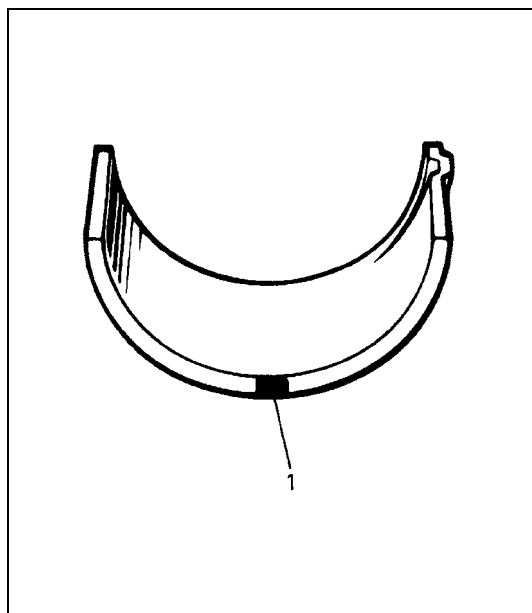
- 2) Next, check bearing cap bore diameter without bearing. On mating surface of cylinder block, five alphabets are stamped as shown in figure.

Three kinds of alphabets ("A", "B" and "C") or numbers ("1", "2" and "3") represent the following cap bore diameters.

Stamped alphabets or numbers on cylinder block represent bearing cap bore diameter marked with an arrow in figure respectively. For example, stamped "A" or "1" indicates that corresponding bearing cap bore diameter is 56.000 – 56.006 mm (2.2047 – 2.2050 in.).

#### Crankshaft bearing cap bore

Stamped alphabet (number)	Bearing cap bore diameter (without bearing)
A (1)	56.0000 – 56.0060 mm (2.2048 – 2.2049 in.)
B (2)	56.0061 – 56.0120 mm (2.2050 – 2.2051 in.)
C (3)	56.0121 – 56.0180 mm (2.2052 – 2.2054 in.)



- 3) There are five kinds of standard bearings differing in thickness. To distinguish them, they are painted in the following colors at the position as indicated in figure.

Each color indicated the following thickness at the center of bearing.

#### Standard size of crankshaft main bearing thickness

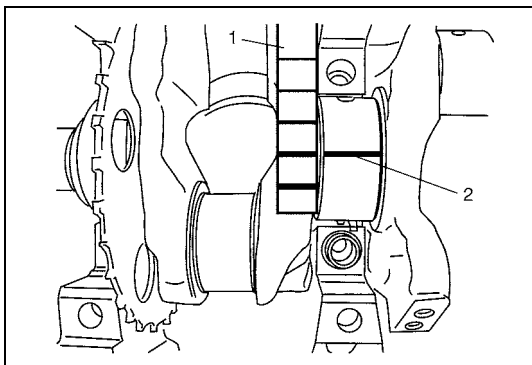
Color painted	Bearing thickness
Purple	1.992 – 1.996 mm (0.07843 – 0.07858 in.)
Brown	1.995 – 1.999 mm (0.07855 – 0.07870 in.)
Green	1.998 – 2.002 mm (0.07867 – 0.07882 in.)
Black	2.001 – 2.005 mm (0.07878 – 0.07893 in.)
Colorless (no paint)	2.004 – 2.008 mm (0.07890 – 0.07906 in.)

1. Paint

- 4) From number stamped on crank web No.2 and alphabets stamped on cylinder block, determine new standard bearing to be installed to journal, by referring to table shown below. For example, if number stamped on crank web No.2 is "1" and alphabet stamped on cylinder block is "B", install a new standard bearing painted in "Brown" to its journal.

### Specification of new standard crankshaft main bearing size

		Number stamped on crank web No.2 (Journal diameter)		
		1	2	3
Alphabet stamped on cylinder block (Cap bore dia.)	A (1)	Purple	Brown	Green
	B (2)	Brown	Green	Black
	C (3)	Green	Black	Colorless
		New standard bearing to be installed.		



- 5) Using scale (1) on gaging plastic (2), check bearing clearance with newly selected standard bearing.  
If clearance still exceeds its limit, use next thicker bearing and recheck clearance.
- 6) When replacing crankshaft or cylinder block due to any reason, select new standard bearings to be installed by referring to number stamped on new crankshaft or alphabets stamped on new cylinder block.

### Undersize Bearing (0.25 mm (0.0098 in.))

- 0.25 mm (0.0098 in.) undersize bearing is available, in five kinds varying in thickness.  
To distinguish them, each bearing is painted in the following colors at such position as indicated in figure.  
Each color represents the following thickness at the center of bearing.

#### Undersize of crankshaft main bearing thickness

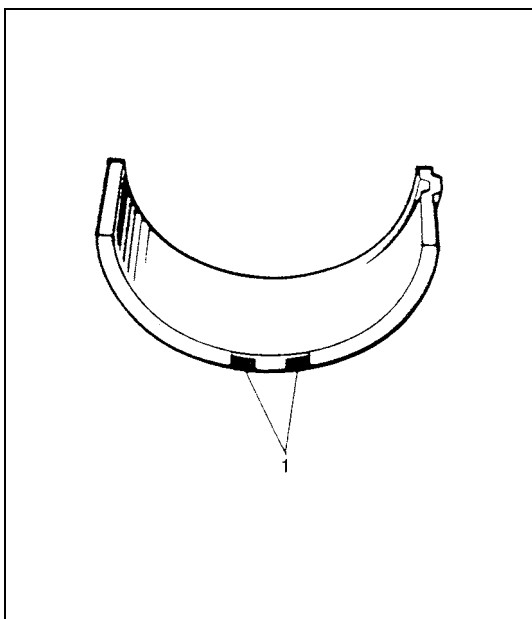
Color painted	Bearing thickness
Red and Purple	2.117 – 2.121 mm (0.08335 – 0.08350 in.)
Red and Brown	2.120 – 2.124 mm (0.08347 – 0.08362 in.)
Red and Green	2.123 – 2.127 mm (0.08359 – 0.08374 in.)
Red and Black	2.126 – 2.130 mm (0.08371 – 0.08385 in.)
Red only	2.129 – 2.133 mm (0.08382 – 0.08397 in.)

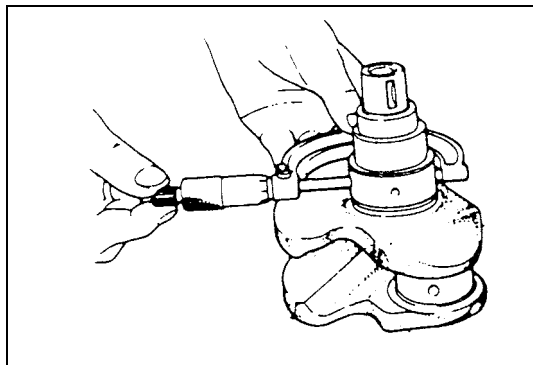
1. Paint

- If necessary, regrind crankshaft journal and select undersize bearing to use with it as follows.
- 1) Regrind journal to the following finished diameter.

#### Finished diameter

51.732 – 51.750 mm (2.0367 – 2.0374 in.)





- 2) Using micrometer, measure reground journal diameter. Measurement should be taken in two directions perpendicular to each other in order to check for out-of-round.
- 3) Using journal diameter measured above and alphabets stamped on cylinder block, select an undersize bearing by referring to table given below.  
Check bearing clearance with newly selected undersize bearing.

#### Specification of new standard undersize crankshaft main bearing

		Measured journal diameter		
		51.7320 – 51.7379 mm (2.0367 – 2.0369 in.)	51.7380 – 51.7439 mm (2.0370 – 2.0371 in.)	51.7440 – 51.7500 mm (2.0372 – 2.0373 in.)
Alphabets stamped on cylinder block	A (1)	Red and Green	Red and Brown	Red and Purple
	B (2)	Red and Black	Red and Green	Red and Brown
	C (3)	Red only	Red and Black	Red and Green
		Undersize bearing to be installed		

### Tightening Torque Specification

Fastening part	Tightening torque		
	N·m	kg-m	lb-ft
Oil pressure switch	14	1.4	10.5
Camshaft housing bolts (for replacement of shim)	8	0.8	6.0
Camshaft housing bolts	11	1.1	8.0
Engine cover bolts	8	0.8	6.0
Intake manifold bolts and nuts	25	2.5	18.0
Exhaust manifold bolts and nuts	50	5.0	36.5
Exhaust pipe No.1 bolts	50	5.0	36.5
Exhaust manifold stiffener bolts	50	5.0	36.5
Exhaust pipe No.2 bolts	43	4.3	31.5
Exhaust oxygen sensor	45	4.5	32.5
Oil pump strainer bolt	11	1.1	8.0
Oil pump strainer bracket bolt	11	1.1	8.0
Oil pan bolts and nuts	11	1.1	8.0
Oil pan drain plug bolt	50	5.0	36.5
Timing chain cover bolts	25	2.5	18.0
Crank shaft pulley bolt	150	15.0	108.5
Oil pump rotor plate bolts	11	1.1	8.0
Timing chain No.1 guide bolts	9	0.9	6.5
Timing chain tensioner adjuster bolts	11	1.1	8.0
Venturi plug	5	0.5	3.5
Cylinder head bolt for M8	25	2.5	18.0

Fastening part	Tightening torque		
	N·m	kg-m	lb-ft
Cylinder head bolts for M10	a) Tighten 20 N·m b) Tighten 40 N·m c) Retighten by turning through 60° d) Retighten by turning through 60°	a) Tighten 2.0 kg-m b) Tighten 4.0 kg-m c) Retighten by turning through 60° d) Retighten by turning through 60°	a) Tighten 14.5 lb-ft b) Tighten 29.0 lb-ft c) Retighten by turning through 60° d) Retighten by turning through 60°
Connecting rod bearing cap nuts	a) Tighten 15 N·m b) Retighten by turning through 45° c) Retighten by turning through 45°	a) Tighten 1.5 kg-m b) Retighten by turning through 45° c) Retighten by turning through 45°	a) Tighten 11.0 lb-ft b) Retighten by turning through 45° c) Retighten by turning through 45°
Engine mounting bolts for M8	25	2.5	18.0
Engine mounting bolts and nuts for M10	55	5.5	40.0
Engine right mounting nuts	65	6.5	47.0
Cross member bolts	60	6.0	43.0
Dynamic damper nut	25	2.5	18.0
Main bearing cap No.1 bolts	a) Tighten 30 N·m b) Tighten 50 N·m c) Retighten by turning through 60°	a) Tighten 3.0 kg-m b) Tighten 5.0 kg-m c) Retighten by turning through 60°	a) Tighten 22.0 lb-ft b) Tighten 36.5 lb-ft c) Retighten by turning through 60°
Main bearing cap No.2 bolts	25	2.5	18.0
Sensor plate bolts	11	1.1	8.0
Rear oil seal housing bolts	11	1.1	8.0
Flywheel or drive plate bolts	70	7.0	51.0
Transaxle stiffener bolts	50	5.0	36.5
Timing chain tensioner bolt	25	2.5	18.0
Oil gallery pipe No.1 bolts	30	3.0	21.5
Oil gallery pipe No.2 bolts	11	1.1	8.0
Oil gallery pipe No.3 bolts	11	1.1	8.0
Oil control valve mounting nuts	11	1.1	8.0
Intake camshaft sprocket bolt	60	6.0	43.0

SECTION 6B

ENGINE COOLING

(M15 ENGINE)

**NOTE:**

For the items with asterisk (\*) in the “CONTENTS” below, refer to the same section of the Service Manual mentioned in “Foreword” of this manual.

CONTENTS

<b>General Description .....</b>	*	Radiator Removal and Installation .....	6B-2
Cooling System Circulation .....	*	Radiator Inspection .....	*
Coolant .....	*	Radiator Cleaning .....	*
Diagnosis .....	*	Radiator Cooling Fan Relay Inspection .....	*
Diagnosis Table .....	*	Radiator Cooling Fan Removal and	
System Circuit Inspection .....	*	Installation .....	*
<b>Maintenance .....</b>	*	Radiator Cooling Fan Inspection for M/T	
Coolant Level Check .....	*	Vehicle .....	6B-3
Engine Cooling System Inspection and		Radiator Cooling Fan Inspection for A/T	
Service .....	*	Vehicle .....	6B-3
Cooling System Flush and Refill .....	*	Water Pump/Generator Drive Belt	
Water Pump/Generator Drive Belt Tension		Removal and Installation .....	*
Inspection and Adjustment .....	*	Water Pump Removal and Installation .....	*
<b>On-Vehicle Service .....</b>	<b>6B-2</b>	Water Pump Inspection .....	*
Cooling System Components .....	*	Engine Coolant Temperature Sensor	
Cooling System Draining .....	*	(ECT Sensor) Removal and Installation .....	*
Cooling System Refill .....	*	Engine Coolant Temperature Sensor	
Cooling Water Pipes or Hoses .....	*	(ECT Sensor) Inspection .....	*
Thermostat Removal and Installation .....	*	<b>Required Service Material .....</b>	*
Thermostat Inspection .....	*	<b>Tightening Torque Specification .....</b>	*



## On-Vehicle Service

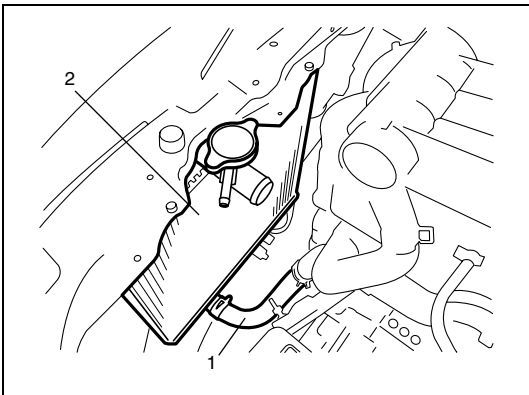
**WARNING:**

- Check to make sure that engine coolant temperature is cold before removing any part of cooling system.
- Also be sure to disconnect negative cord from battery terminal before removing any part.

### Radiator Removal and Installation

#### Removal

- 1) Disconnect negative cable at battery.
- 2) Drain engine coolant referring to “Cooling System Draining” in this section.
- 3) Remove cooling fan assembly referring to “Radiator Cooling Fan Removal and Installation” in this section.
- 4) Remove radiator outlet hose (1) from radiator (2).
- 5) Disconnect A/T fluid hoses from radiator (for A/T model).
- 6) Remove radiator (2) from vehicle.

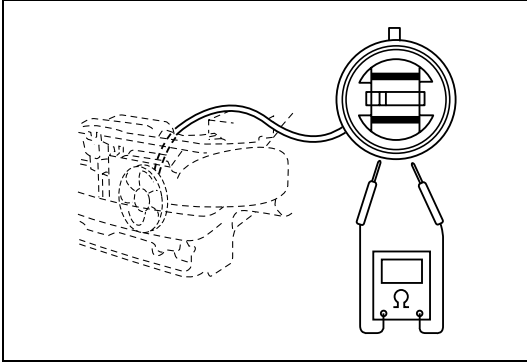


#### Installation

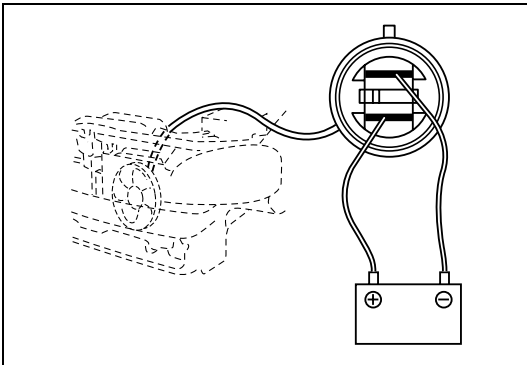
Reverse removal procedures noting the followings.

- Refill cooling system referring to step 7) to 22) of “Cooling System Flush and Refill” in this section.
- After installation, check each joint for leakage.

## Radiator Cooling Fan Inspection for M/T Vehicle



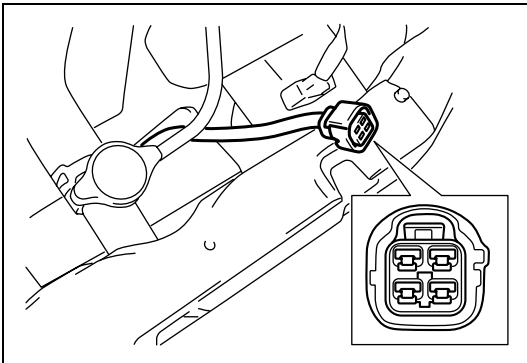
- 1) Check continuity between terminals. If there is no continuity, replace radiator fan motor.



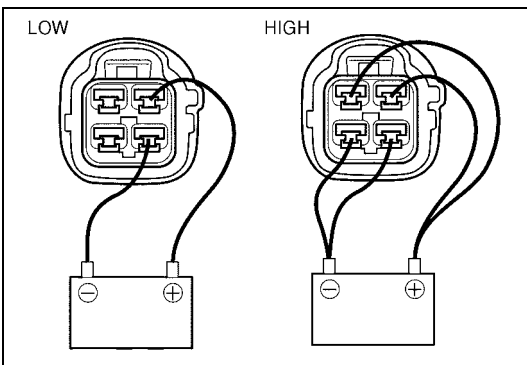
- 2) Connect battery to radiator fan motor coupler as shown in figure, then check that the radiator fan motor operates smoothly. If radiator fan motor does not operate smoothly, replace motor.

**Radiator cooling fan motor specified current at 12 V**  
**10.0 A maximum**

## Radiator Cooling Fan Inspection for A/T Vehicle



- 1) Check continuity between terminals.  
 If there is no continuity, replace radiator fan motor.



- 2) Connect battery to radiator fan motor coupler as shown in figure, then check that the radiator fan motor operates smoothly, fan speed varies and that specified current. If radiator fan motor does not operate smoothly, replace motor.

**Radiator cooling fan motor specified current at 12 V**  
**LOW : 10 A maximum**  
**HIGH : 15 A maximum**



## SECTION 6E1

# ENGINE AND EMISSION CONTROL SYSTEM (M15 ENGINE)

**WARNING:**

For vehicles equipped with a Supplemental Restraint (Air Bag) System:

- Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to "System Components and Wiring Location View and Connectors" under "General Description" in Section 10B in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and "Service Precautions" under "On-Vehicle Service" in Section 10B before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.
- Technical service work must be started at least 90 seconds after the ignition switch is turned to the "LOCK" position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).

**NOTE:**

For the items with asterisk (\*) in the "CONTENTS" below, refer to the same section of the Service Manual mentioned in "Foreword" of this manual.

## CONTENTS

<b>General Description .....</b>	<b>6E1-3</b>		
Engine and Emission Control System			
Construction .....	6E1-3		
Air Intake System Description .....	*		
Fuel Delivery System Description .....	*		
Electronic Control System Description .....	6E1-7		
<b>On-Vehicle Service .....</b>	<b>6E1-13</b>		
Accelerator cable adjustment .....	*		
Idle speed/idle air control (IAC) duty inspection .....	6E1-13		
Air Intake System .....	*		
Throttle body components .....	*		
Throttle body on-vehicle inspection .....	*		
Throttle body removal and installation .....	*		
Throttle body cleaning .....	*		
Idle air control (IAC) valve removal and installation .....	*		
Idle air control (IAC) valve inspection .....	*		
Oil control valve removal and installation .....	*		
Oil control valve inspection .....	*		
Fuel Delivery System .....	*		
Fuel pressure inspection .....	*		
		Fuel pump with pressure regulator on-vehicle inspection .....	*
		Fuel pump with pressure regulator removal and installation .....	*
		Fuel pump with pressure regulator inspection .....	*
		Fuel injector on-vehicle inspection .....	*
		Fuel injector removal and installation .....	*
		Fuel injector inspection .....	*
		Electronic Control System .....	*
		Engine control module (ECM) removal and installation .....	*
		Manifold absolute pressure sensor (MAP sensor) inspection .....	*
		Throttle position sensor (TP sensor) on-vehicle inspection .....	*
		Throttle position sensor (TP sensor) removal and installation .....	*
		Engine coolant temperature sensor (ECT sensor) removal and installation .....	*
		Engine coolant temperature sensor (ECT sensor) inspection .....	*

Heated oxygen sensor (HO2S-1 and HO2S-2) heater on-vehicle inspection .....	*
Heated oxygen sensor (HO2S-1 and HO2S-2) removal and installation .....	*
Camshaft position sensor (CMP sensor) inspection .....	*
Camshaft position sensor (CMP sensor) removal and installation .....	*
Crankshaft position sensor (CKP sensor) inspection .....	*
Crankshaft position sensor (CKP sensor) removal and installation .....	*
Fuel Level Sensor Removal and Installation .....	*
Fuel Level Sensor Inspection .....	*
Vehicle speed sensor (VSS) inspection .....	*
Vehicle speed sensor (VSS) removal and installation .....	*
Knock sensor inspection .....	*
Knock sensor removal and installation .....	*

Main relay, fuel pump relay and radiator fan relay inspection .....	*
Fuel cut operation inspection .....	*
Radiator fan control system inspection .....	*
Mass air flow (MAF) and intake air temperature (IAT) sensor on-vehicle inspection .....	*
Mass air flow (MAF) and intake air temperature (IAT) sensor removal and installation .....	*
Mass air flow (MAF) and intake air temperature (IAT) sensor inspection .....	*
Emission Control System .....	*
EGR system inspection .....	*
EGR valve removal and installation .....	*
EGR valve inspection .....	*
Evaporative emission control system inspection .....	*
PCV system inspection .....	*

## **General Description**

### **Engine and Emission Control System Construction**

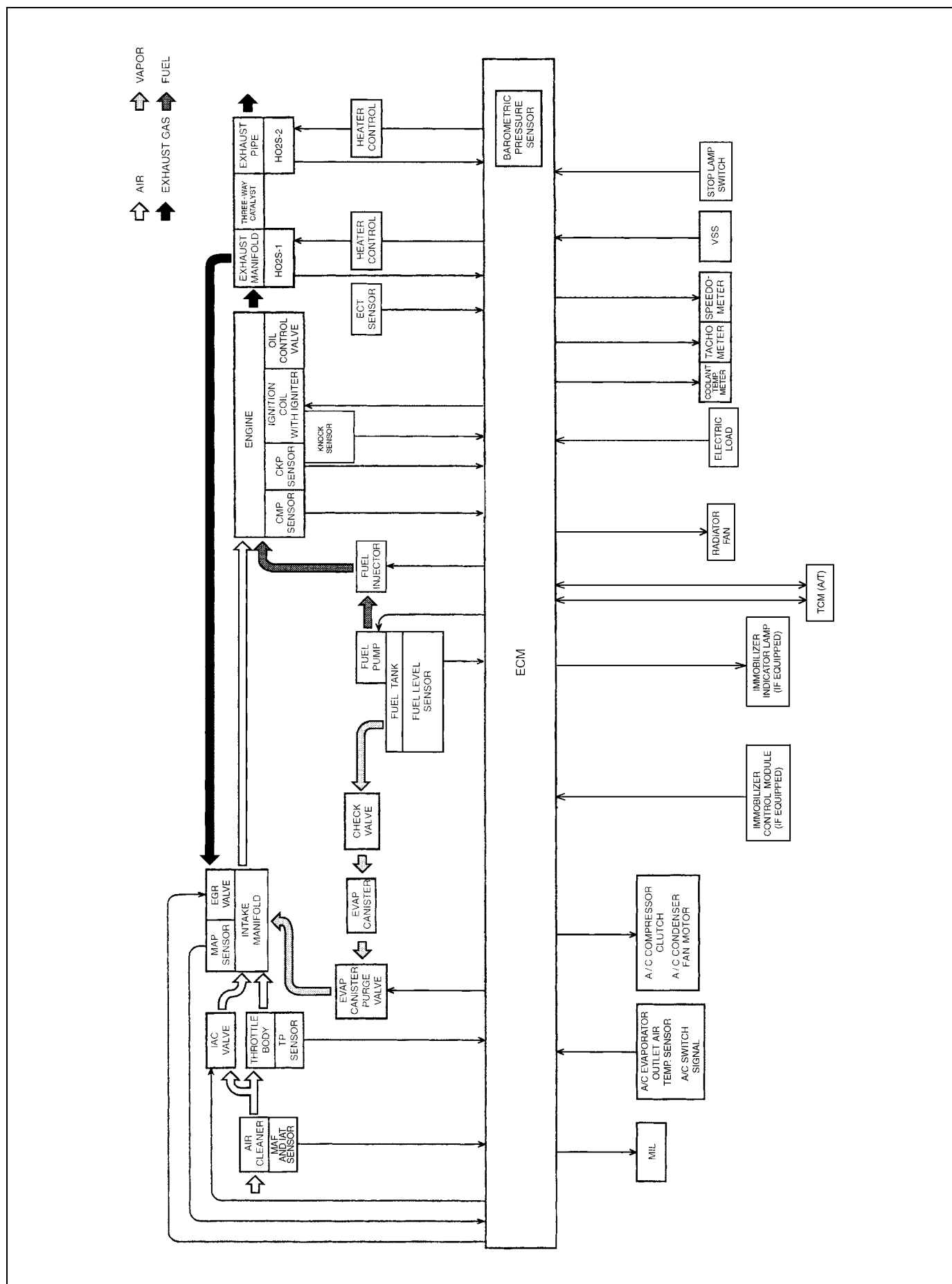
The engine and emission control system is divided into 4 major sub-systems: air intake system, fuel delivery system, electronic control system and emission control system.

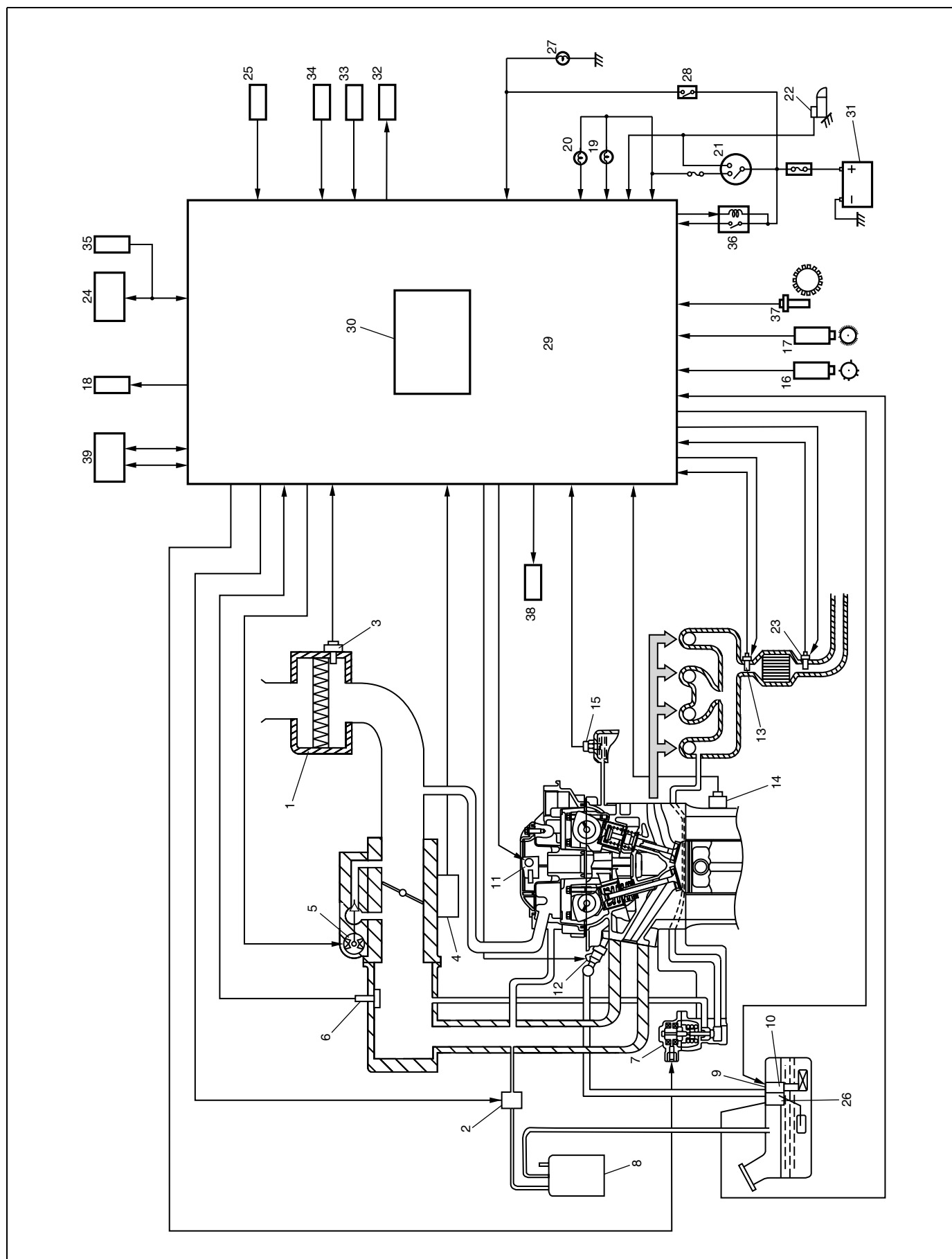
Air intake system includes air cleaner, throttle body, IAC valve and intake manifold.

Fuel delivery system includes fuel pump, delivery pipe, etc. Electronic control system includes ECM, various sensors and controlled devices.

Emission control system includes EGR, EVAP and PCV system.

## Engine and Emission Control System Flow Diagram







**6E1-6 ENGINE AND EMISSION CONTROL SYSTEM (M15 ENGINE)**

1. Air Cleaner	14. Knock sensor	27. Stop lamp
2. EVAP canister purge valve	15. ECT sensor	28. Stop lamp switch
3. MAF and IAT sensor	16. CMP sensor	29. ECM
4. TP sensor	17. CKP sensor	30. Barometric pressure sensor (if equipped)
5. IAC valve	18. Radiator fan	31. Battery
6. MAP sensor	19. Malfunction indicator lamp in combination meter	32. A/C compressor and condenser fan relay (if equipped)
7. EGR valve	20. Immobilizer indicator lamp in combination meter	33. A/C switch (if equipped)
8. EVAP canister	21. Ignition switch	34. A/C evaporator outlet air temp. sensor (if equipped)
9. Tank pressure control valve (built-in fuel pump)	22. Starter magnetic switch	35. Immobilizer control module (if equipped)
10. Fuel pump (with pressure regulator)	23. Heated Oxygen Sensor-2 (HO2S-2)	36. Main relay
11. Ignition coil assembly	24. DLC	37. VSS
12. Fuel injector	25. Electric load	38. Oil control valve
13. Heated Oxygen Sensor-1 (HO2S-1)	26. Fuel level sensor	39. TCM (A/T)

## Electronic Control System Description

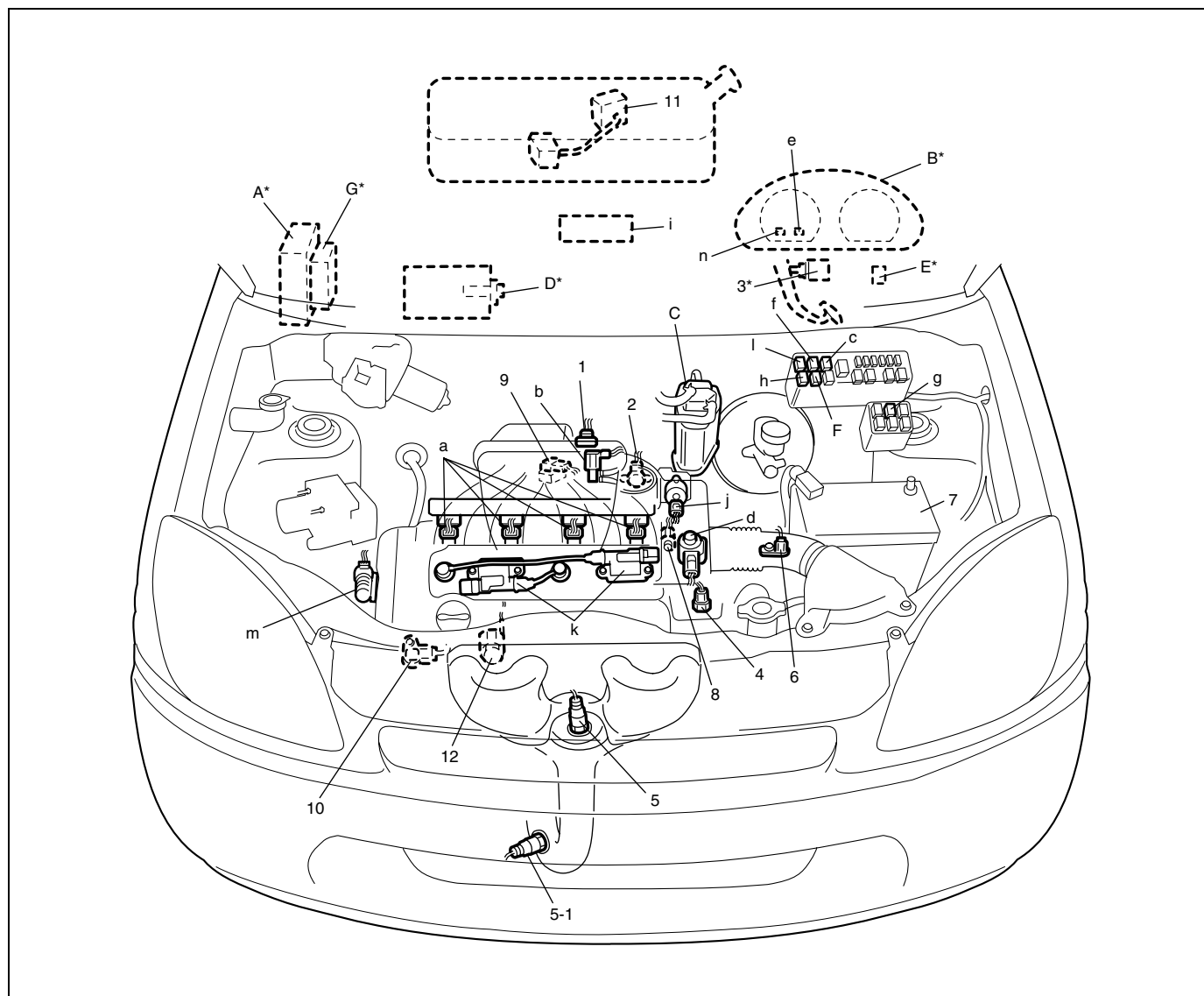
The electronic control system consists of 1) various sensors which detect the state of engine and driving conditions, 2) ECM which controls various devices according to the signals from the sensors and 3) various controlled devices.

Functionally, it is divided into nine sub systems:

- Fuel injection control system
- Idle speed control system
- Fuel pump control system
- A/C control system (if equipped)
- Radiator fan control system
- EGR system
- Evaporative emission control system
- Oxygen sensor heater control system
- Ignition control system

ECM (Engine Control Module) and TCM (Transmission Control Module) intercommunicate by CAN (Controller Area Network). (For A/T vehicle only)

## Electronic Control System Component Location

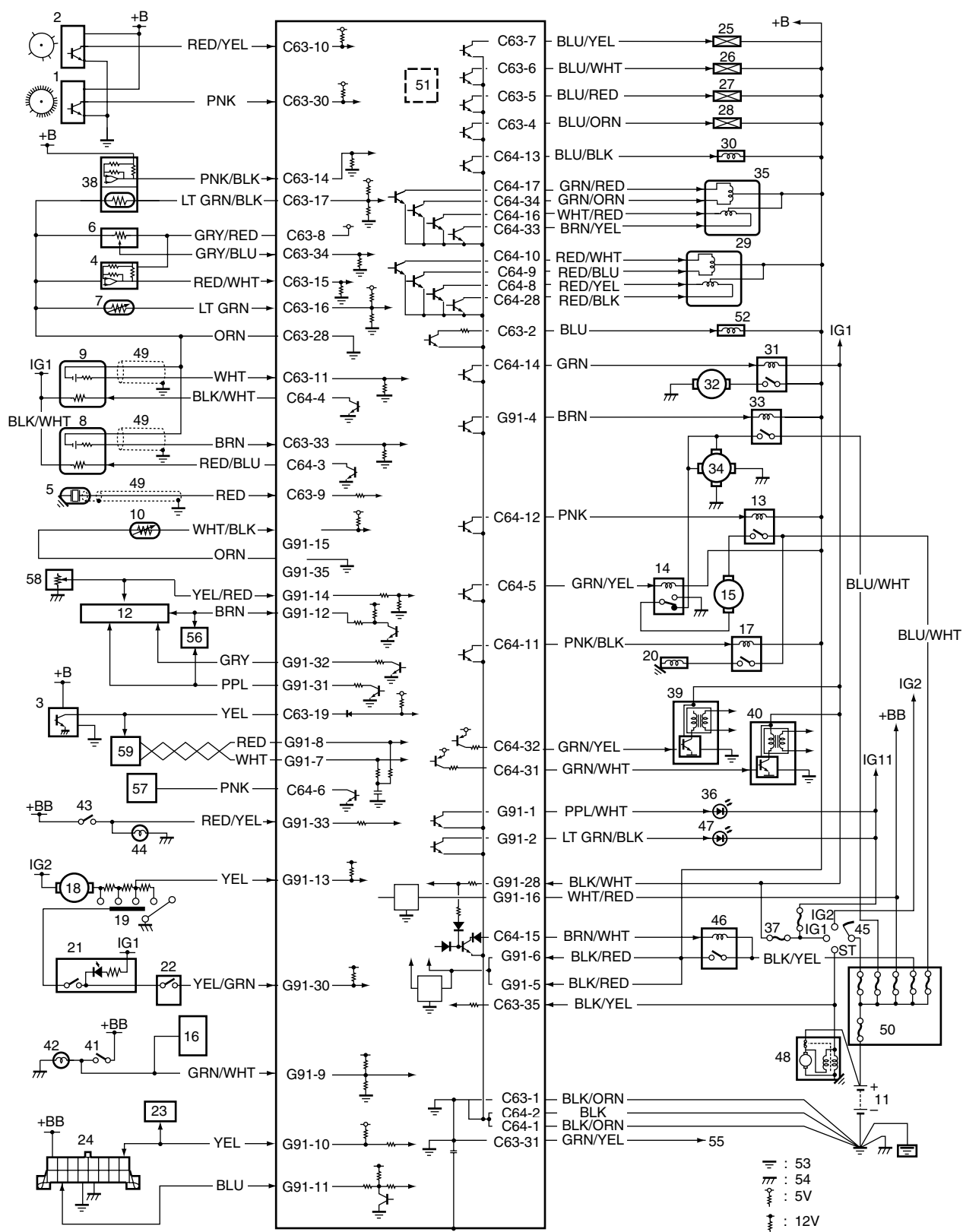


INFORMATION SENSORS	CONTROL DEVICES	OTHERS
1. MAF and IAT sensor	a: Fuel injector	A: ECM
2. TP sensor	b: EVAP canister purge valve	B: Combination meter
3. Stop lamp switch	c: Fuel pump relay	C: EVAP canister
4. ECT sensor	d: EGR valve	D: A/C evaporator outlet air temp. sensor (if equipped)
5. Heated oxygen sensor-1	e: Malfunction indicator lamp	E: Data link connector
5-1. Heated oxygen sensor-2	f: A/C condenser fan relay No.1 (if equipped)	F: A/C compressor relay (if equipped)
6. VSS	g: A/C condenser fan relay No.2 (if equipped)	G: TCM (A/T)
7. Battery	h: Radiator fan relay	
8. CMP sensor	i: Fuel cost meter	
9. MAP sensor	j: IAC valve	
10. CKP sensor	k: Ignition coil assembly (with ignitor)	
11. Fuel level sensor	l: Main relay	
12. Knock sensor	m: Oil control valve	
	n: Immobilizer indicator lamp	

**NOTE:**

Above figure shows left-hand steering vehicle. For right-hand steering vehicle, parts with (\*) are installed at the opposite side.

## ECM Input/Output Circuit Diagram

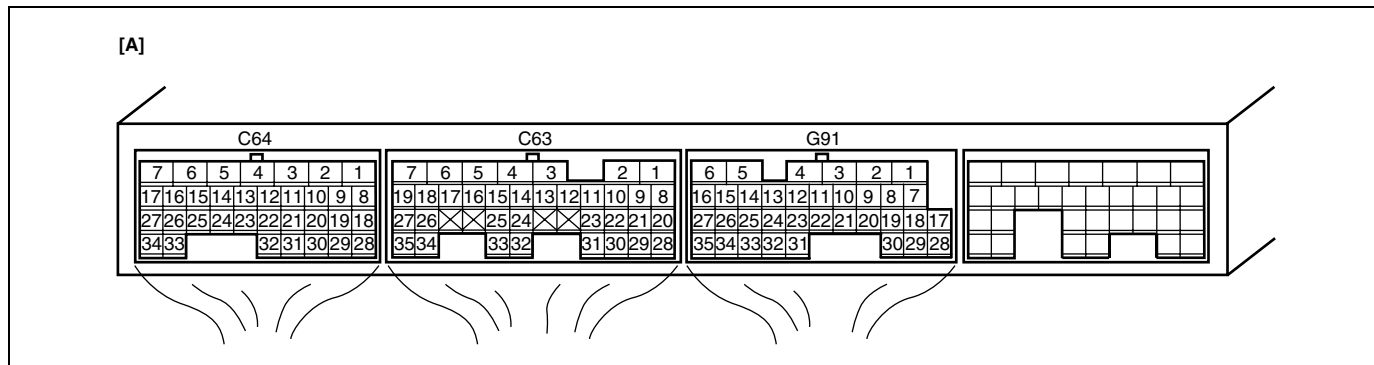


**6E1-10 ENGINE AND EMISSION CONTROL SYSTEM (M15 ENGINE)**

1. CKP sensor	21. A/C switch	41. Stop lamp switch
2. CMP sensor	22. A/C pressure switch	42. Stop lamp
3. VSS	23. Immobilizer control module	43. Lighting switch
4. MAP sensor	24. Data link connector	44. Position lamp
5. Knock sensor	25. Injector No.1	45. Ignition switch
6. TP sensor	26. Injector No.2	46. Main relay
7. ECT sensor	27. Injector No.3	47. Immobilizer indicator lamp
8. Heated oxygen sensor-2	28. Injector No.4	48. Starting motor
9. Heated oxygen sensor-1	29. IAC valve	49. Shield wire
10. A/C evaporator outlet air temp. sensor	30. EVAP canister purge valve	50. Main fuse
11. Battery	31. Fuel pump relay	51. Barometric pressure sensor
12. Combination meter	32. Fuel pump	52. Oil control valve
13. A/C condenser fan relay No.1	33. Radiator fan relay	53. Engine ground
14. A/C condenser fan relay No.2	34. Radiator fan motor	54. Body ground
15. A/C condenser fan motor	35. EGR valve	55. Shield ground
16. ABS control module	36. Malfunction indicator lamp	56. EPS control module
17. A/C compressor relay	37. "IG" fuse	57. Fuel cost meter in multi information display
18. Heater fan motor	38. MAF and IAT sensor	58. Fuel level sensor
19. Heater fan switch	39. Ignition coil assembly (for No.1 and No.4 spark plugs)	59. TCM (A/T)
20. A/C compressor clutch	40. Ignition coil assembly (for No.2 and No.3 spark plugs)	

ECM Terminal Arrangement Table

CON-NECTOR	TERMI-NAL	WIRE COLOR	CIRCUIT	CON-NECTOR	TERMI-NAL	WIRE COLOR	CIRCUIT
C64	1	BLK/ORN	Ground for ECM	C63	22	—	—
	2	BLK	Ground for ECM		23	—	—
	3	RED/BLU	Heater output of heated oxygen sensor-2		24	—	—
	4	BLK/WHT	Heater output of heated oxygen sensor-1		25	—	—
	5	GRN/YEL	A/C condenser fan motor relay No.2 output (if equipped)		26	—	—
	6	PNK	Fuel cost output		27	—	—
	7	—	—		28	ORN	Ground for sensors
	8	RED/YEL	IAC valve output (stepper motor coil 3)		29	—	—
	9	RED/BLU	IAC valve output (stepper motor coil 2)		30	PNK	CKP sensor signal
	10	RED/WHT	IAC valve output (stepper motor coil 1)		31	GRN/YEL	Ground of ECM for shield wire
	11	PNK/BLK	A/C compressor relay output (if equipped)		32	—	—
	12	PNK	A/C condenser fan motor relay No. 1 output (if equipped)		33	BRN	Oxygen signal of heated oxygen sensor-2
	13	BLU/BLK	EVAP canister purge valve output		34	GRY/BLU	Throttle position (TP) sensor signal
	14	GRN	Fuel pump relay output		35	BLK/YEL	Starting motor signal
	15	BRN/WHT	Main power supply relay output	G91	1	PPL/WHT	MIL (Malfunction indicator lamp) output
	16	WHT/RED	EGR valve (stepper motor coil 3) output		2	LT GRN/BLK	Immobilizer indicator lamp output (if equipped)
	17	GRN/RED	EGR valve (stepper motor coil 1) output		3	—	—
	18	—	—		4	BRN	Radiator fan motor relay output
	19	—	—		5	BLK/RED	Main power supply
	20	—	—		6	BLK/RED	Main power supply
	21	—	—		7	WHT	CAN communication line (active low signal)
	22	—	—		8	RED	CAN communication line (active high signal)
	23	—	—		9	GRN/WHT	Electric load signal for stop lamp
	24	—	—		10	YEL	Serial communication line of data link connector 5 V
	25	—	—		11	BLU	Serial communication line of data link connector 12 V
	26	—	—		12	BRN	Engine revolution signal output for tachometer
	27	—	—		13	YEL	Electric load signal for heater blower motor
	28	RED/BLK	IAC valve output (stepper motor coil 4)		14	YEL/RED	Fuel level sensor signal
	29	—	—		15	WHT/BLK	A/C evaporator outlet air temp. sensor signal (if equipped)
	30	—	—		16	WHT/RED	Power source for ECM internal memory
	31	GRN/WHT	Ignition coil No.2 and No.3 output		17	—	—
	32	GRN/YEL	Ignition coil No.1 and No.4 output		18	—	—
	33	BRN/YEL	EGR valve (stepper motor coil 4) output		19	—	—
	34	GRN/ORN	EGR valve (stepper motor coil 2) output		20	—	—
C63	1	BLK/ORN	Ground for ECM		21	—	—
	2	BLU	Oil control valve output		22	—	—
	3	—	—		23	—	—
	4	BLU/ORN	Fuel injector No.4 output		24	—	—
	5	BLU/RED	Fuel injector No.3 output		25	—	—
	6	BLU/WHT	Fuel injector No.2 output		26	—	—
	7	BLU/YEL	Fuel injector No.1 output		27	—	—
	8	GRY/RED	Output of 5V power source for throttle position (TP) sensor		28	BLK/WHT	Ignition switch signal
	9	RED	Knock sensor signal		29	—	—
	10	RED/YEL	Reference signal for CMP sensor		30	YEL/GRN	A/C request signal (if equipped)
	11	WHT	Oxygen signal of heated oxygen sensor-1		31	PPL	Vehicle speed sensor signal for speedometer
	12	—	—		32	GRY	ECT sensor signal for combination meter
	13	—	—		33	RED/YEL	Electric load signal for clearance lamp
	14	PNK/BLK	Mass air flow (MAF) sensor signal		34	—	—
	15	RED/WHT	Manifold absolute pressure (MAP) sensor signal		35	ORN	Ground for A/C evaporator outlet air temp. sensor (if equipped)
	16	LT GRN	Engine coolant temp. (ECT) sensor signal				
	17	LT GRN/BLK	Intake air temperature (IAT) sensor signal				
	18	—	—				
	19	YEL	Vehicle speed sensor signal				
	20	—	—				
	21	—	—				



[A]: Terminal arrangement of ECM coupler (viewed from harness side)

**NOTE:**

**For abbreviation of wire color, refer to “Abbreviations and Symbols May be Used in This Manual” in Section 0A.**

## On-Vehicle Service

### Idle speed/idle air control (IAC) duty inspection

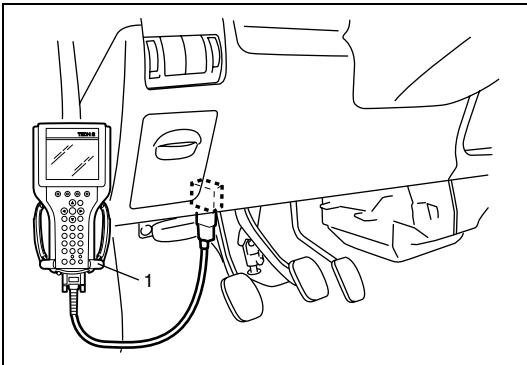
Before idle speed/IAC duty check, make sure of the following.

- Lead wires and hoses of Electronic Fuel Injection and engine emission control systems are connected securely.
- Accelerator cable has some play, that is, it is not tight.
- Valve lash is checked according to maintenance schedule.
- Ignition timing is within specification.
- All accessories (wipers, heater, lights, A/C, etc.) are out of service.
- Air cleaner has been properly installed and is in good condition.
- No abnormal air inhaling from air intake system.

After above items are all confirmed, check idle speed and IAC duty as follows.

#### NOTE:

**Before starting engine, place transmission gear shift lever in “Neutral” (shift selector lever to “P” range for A/T vehicle), and set parking brake and block drive wheels.**



- 1) Connect scan tool (1) to DLC with ignition switch OFF.

- 2) Warm up engine to normal operating temperature.
- 3) Check engine idle speed and “IAC duty” by using “Data List” mode on scan tool to check “IAC duty”.
- 4) If duty and/or idle speed is out of specifications, inspect idle air control system referring to “Diagnostic Flow Table B-4 Idle Air Control System Check” in Section 6.

#### Engine idle speed and IAC duty

	A/C OFF	A/C ON
<b>M/T vehicle</b>	<b>700 ± 50 r/min (rpm)</b> <b>10 – 55%</b>	<b>850 ± 50 r/min (rpm)</b>
<b>A/T vehicle at P/N range</b>	<b>700 ± 50 r/min (rpm)</b> <b>10 – 55%</b>	<b>850 ± 50 r/min (rpm)</b>

- 5) Check that specified engine idle speed is obtained with A/C ON if vehicle is equipped with A/C.  
If not, check A/C request signal circuit and idle air control system.





## MANUAL TRANSAXLE (M15 ENGINE MODEL)

**For vehicles equipped with a Supplemental Restraint (Air Bag) System :**

- **Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to “Air Bag System Components and Wiring Location View” under “General Description” in air bag system section in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and “Service Precautions” under “On-Vehicle Service” in air bag system section before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.**
- **Technical service work must be started at least 90 seconds after the ignition switch is turned to the “LOCK” position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).**

<b>General Description</b> .....	<b>7A2-2</b>	Gear Shift and Select Shaft Assembly Removal and Installation .....	<b>7A2-18</b>
Manual Transaxle Construction and Servicing .....	<b>7A2-2</b>	Gear Shift and Select Shaft Disassembly and Assembly .....	<b>7A2-20</b>
Construction Diagram of 2WD Transaxle....	<b>7A2-3</b>	Fifth Gear Disassembly and Assembly .....	<b>7A2-20</b>
Construction Diagram of 4WD Transaxle....	<b>7A2-4</b>	Gear Shift Shaft, Input Shaft and Counter Shaft Removal and Installation .....	<b>7A2-25</b>
<b>Diagnosis</b> .....	<b>7A2-5</b>	Transaxle Right Case Disassembly and Assembly .....	<b>7A2-31</b>
Manual Transaxle Symptom Diagnosis.....	<b>7A2-5</b>	Transaxle Left Case Disassembly and Assembly .....	<b>7A2-32</b>
<b>On-Vehicle Service</b> .....	<b>7A2-6</b>	Input & Counter Shaft Components .....	<b>7A2-34</b>
Manual Transaxle Oil Change.....	<b>7A2-6</b>	Input Shaft Disassembly and Assembly....	<b>7A2-35</b>
Differential Side Oil Seal Replacement .....	<b>7A2-6</b>	Counter Shaft Disassembly and Assembly .....	<b>7A2-38</b>
Gear Shift Control Lever and Cable Components .....	<b>7A2-8</b>	Gear Shift Shaft Components .....	<b>7A2-42</b>
Gear Shift Control Lever and Cable Removal and Installation .....	<b>7A2-9</b>	High Speed and Low Speed Gear Shift Shafts Inspection .....	<b>7A2-42</b>
Gear Shift Control Lever and Cable Adjustment.....	<b>7A2-10</b>	5th & Reverse Gear Shift Shafts Disassembly and Assembly .....	<b>7A2-43</b>
Vehicle Speed Sensor (VSS) Removal and Installation .....	<b>7A2-11</b>	Differential Components .....	<b>7A2-43</b>
Back Up Lamp Switch Removal and Installation .....	<b>7A2-12</b>	Differential Disassembly and Assembly ....	<b>7A2-44</b>
Back Up Lamp Switch Inspection.....	<b>7A2-12</b>	Differential Adjustment.....	<b>7A2-45</b>
<b>Unit Repair Overhaul</b> .....	<b>7A2-13</b>	<b>Tightening Torque Specification</b> .....	<b>7A2-47</b>
Transaxle Unit Components.....	<b>7A2-13</b>	<b>Required Service Material</b> .....	<b>7A2-48</b>
Transaxle Unit Dismounting and Remounting .....	<b>7A2-14</b>	<b>Special Tool</b> .....	<b>7A2-49</b>
Transaxle Case Components.....	<b>7A2-16</b>		
Gear Shift and Select Shaft Assembly Components .....	<b>7A2-18</b>		

## General Description

### Manual Transaxle Construction and Servicing

The transaxle provides five forward speeds and one reverse speed by means of three synchromesh and three shafts-input shaft, counter shaft and reverse gear shaft. All forward gears are in constant mesh, and reverse uses a sliding idler gear arrangement.

The low speed sleeve & hub is mounted on counter shaft and engaged with counter shaft 1st gear or 2nd gear, while the high speed sleeve & hub is done on input shaft and engaged with input shaft 3rd gear or 4th gear.

The 5th speed sleeve & hub on input shaft is engaged with input shaft 5th gear mounted on the input shaft.

To prevent the cracking noise from the reverse gear when shifting transaxle gear into the reverse gear, the reverse shift braking device is used.

The device utilizes the 5th synchromesh, which is the lever synchro type, to apply the brake on the input shaft rotation.

The double cone synchronizing mechanism is provided to 2nd gear synchromesh device for high performance of shifting to 2nd gear.

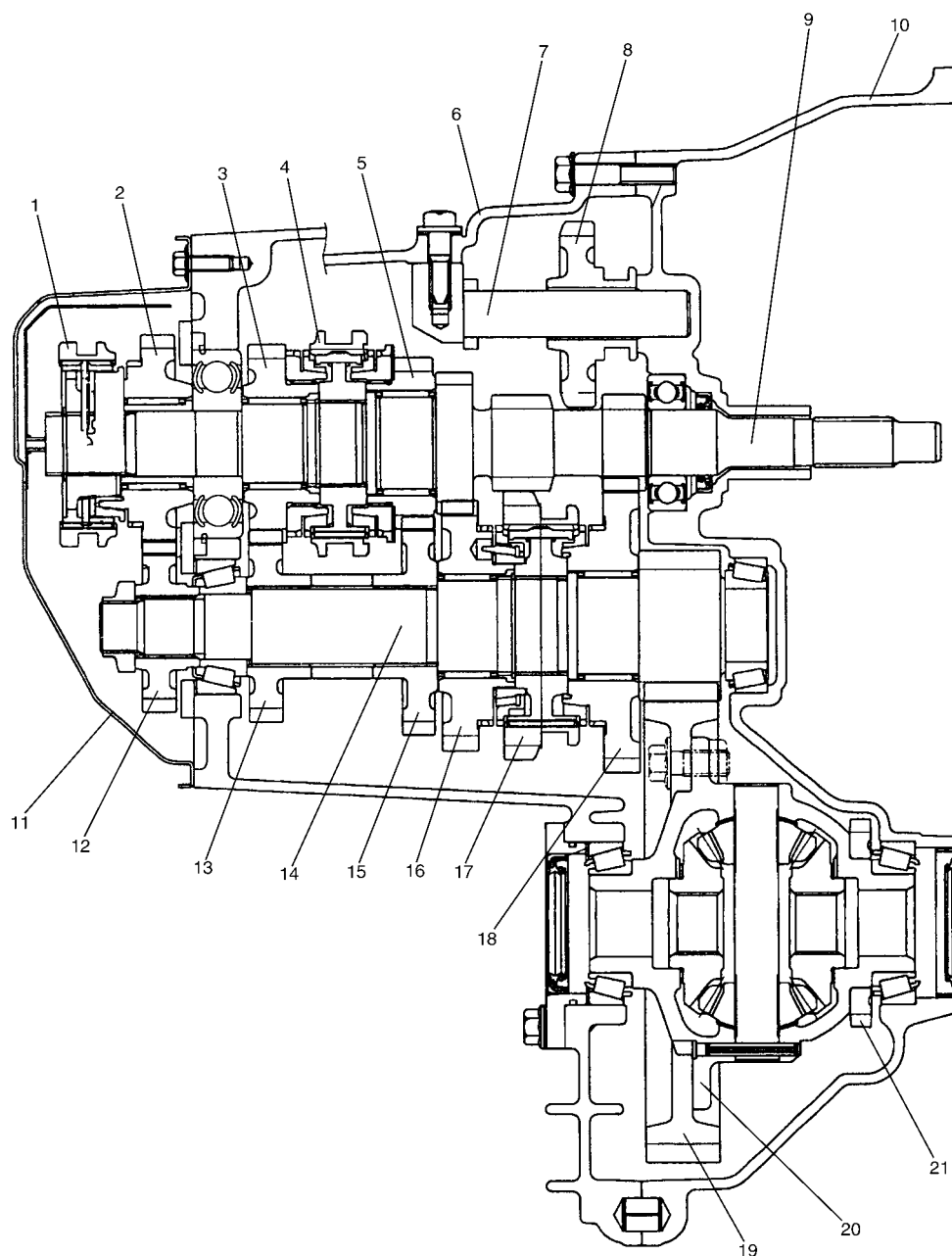
The counter shaft turns the final gear and differential assembly, thereby turning the front drive shafts which are attached to the front wheels.

4WD model is equipped with transfer assembly on transaxle being mated to right side of differential output in transaxle.

For servicing, it is necessary to use genuine sealant or its equivalent on mating surfaces of transaxle case which is made of aluminum. The case fastening bolts must be tightened to specified torque by means of torque wrench. It is also important that all parts are thoroughly cleaned with cleaning fluid and air dried before reassembling.

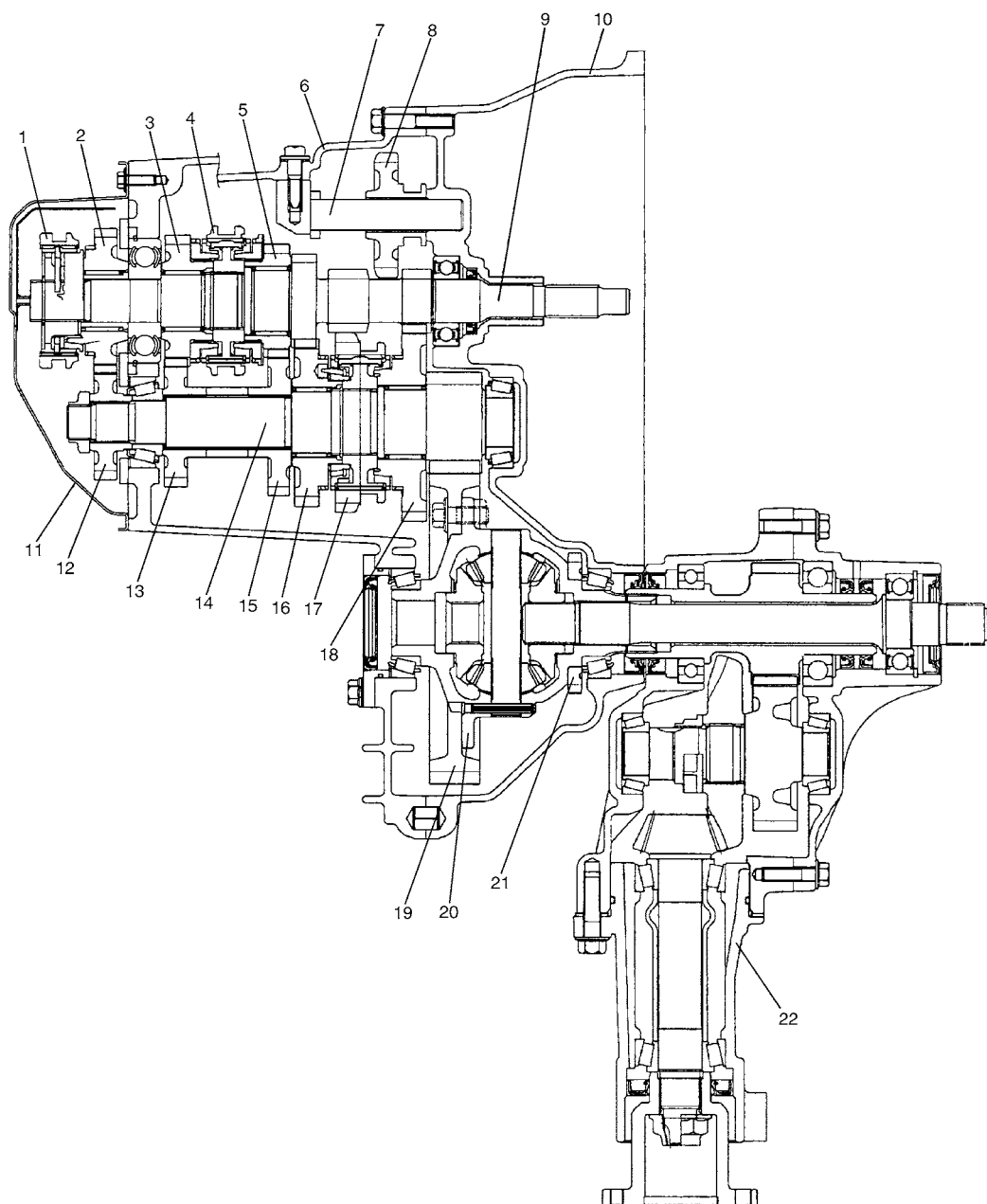
Further, care must be taken to adjust preload of counter shaft taper roller bearings. New synchronizer rings are prohibited from being lapped with respective gear cones by using lapping compound before they are assembled.

## Construction Diagram of 2WD Transaxle



1. 5th speed sleeve & hub	8. Reverse idler gear	15. counter shaft 3rd gear
2. Input shaft 5th gear	9. Input shaft	16. counter shaft 2nd gear
3. Input shaft 4th gear	10. Right case	17. Low speed sleeve & hub
4. High speed sleeve & hub	11. Side cover	18. counter shaft 1st gear
5. Input shaft 3rd gear	12. counter shaft 5th gear	19. Final gear
6. Left case	13. counter shaft 4th gear	20. Differential case
7. Reverse gear shaft	14. counter shaft	21. Vehicle speed sensor rotor

## Construction Diagram of 4WD Transaxle



1. 5th speed sleeve & hub	7. Reverse gear shaft	13. counter shaft 4th gear	19. Final gear
2. Input shaft 5th gear	8. Reverse idler gear	14. counter shaft	20. Differential case
3. Input shaft 4th gear	9. Input shaft	15. counter shaft 3rd gear	21. Vehicle speed sensor rotor
4. High speed sleeve & hub	10. Right case	16. counter shaft 2nd gear	22. Transfer assembly
5. Input shaft 3rd gear	11. Side cover	17. Low speed sleeve & hub	
6. Left case	12. counter shaft 5th gear	18. counter shaft 1st gear	

## Diagnosis

### Manual Transaxle Symptom Diagnosis

Condition	Possible Cause	Correction
<b>Gears slipping out of mesh</b>	Maladjusted gear shift/select control cables	Adjust.
	Worn shift fork shaft	Replace.
	Worn shift fork or synchronizer sleeve	Replace.
	Weak or damaged locating springs	Replace.
	Worn bearings on input shaft or counter shaft	Replace.
	Worn chamfered tooth on sleeve and gear	Replace sleeve and gear.
<b>Hard shifting</b>	Maladjusted gear shift/select control cables	Adjust.
	Inadequate or insufficient lubricant	Replenish.
	Improper clutch pedal free travel	Adjust.
	Distorted or broken clutch disc	Replace.
	Damaged clutch pressure plate	Replace clutch cover.
	Worn synchronizer ring	Replace.
	Worn chamfered tooth on sleeve or gear	Replace sleeve or gear.
	Worn gear shift/select control cables joint	Replace.
	Distorted shift shaft	Replace.
<b>Noise</b>	Inadequate or insufficient lubricant	Replenish.
	Damaged or worn bearing(s)	Replace.
	Damaged or worn gear(s)	Replace.
	Damaged or worn synchronizer parts	Replace.
	Maladjusted backlash between bevel pinion and gear	Adjust as prescribed
	Improper tooth contact in the mesh between bevel pinion and gear	Adjust or replace

## On-Vehicle Service

### CAUTION:

Do not reuse circlip, spring pin, E-ring, oil seal, gasket, self locking nut and specified parts. Reuse of it can result in trouble.

### Manual Transaxle Oil Change

- 1) Before changing or inspecting oil, be sure to stop engine and lift vehicle horizontally.
- 2) With vehicle lifted up, check oil level and leakage.  
If leakage exists, correct it.
- 3) Drain old oil and fill new specified oil by specified amount (up to level hole).
- 4) Apply sealant to thread of drain plug (1) and level/filler plug (2) and torque them as specified below.

“A” : Sealant 99000-31260

#### Tightening torque

Transaxle oil level/filler and drain plugs

(a) : 21 N·m (2.1 kg-m, 15.5 lb-ft)

#### NOTE:

- It is highly recommended to use API GL-4 75W-90 gear oil.
- Whenever vehicle is hoisted for any other service work than oil change, also be sure to check for oil leakage.

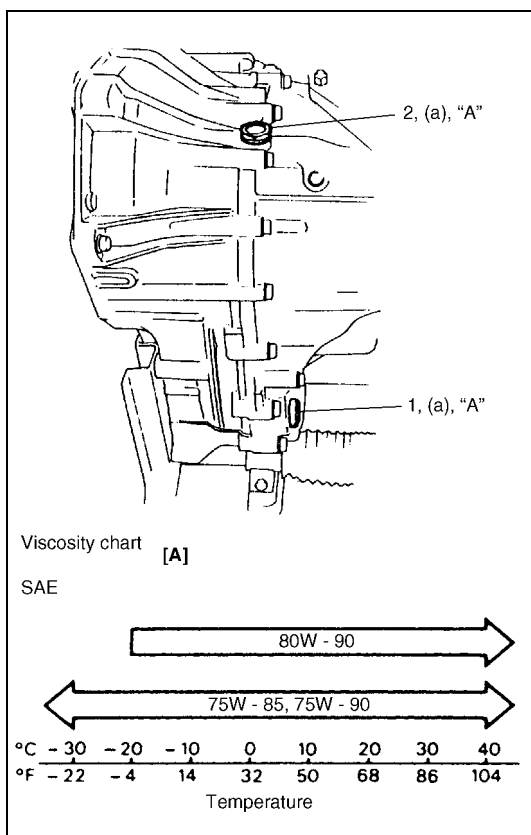
#### Transaxle oil

: API GL-4

For SAE classification, refer to viscosity chart [A] in the figure.

#### Transaxle oil capacity

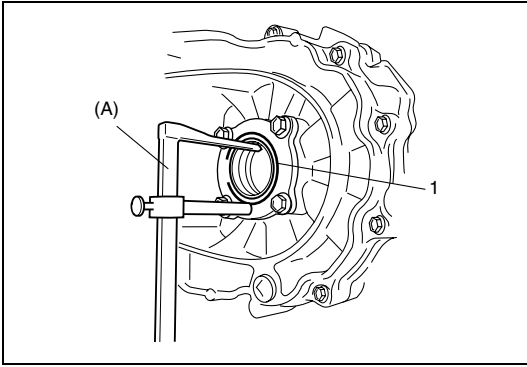
: 2.2 liters (4.8/3.9 US/Imp. pt.)



### Differential Side Oil Seal Replacement

#### Replacement

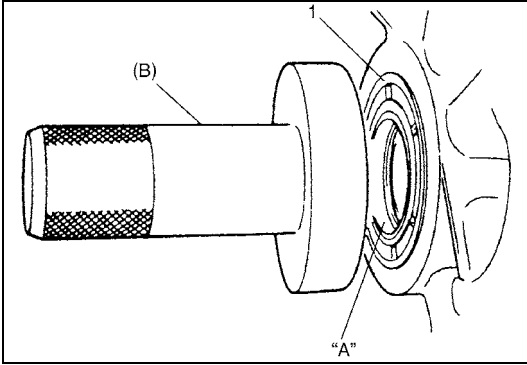
- 1) Lift up vehicle and drain transaxle oil.
- 2) Remove front drive shafts referring to “Drive Shaft Assembly Removal and Installation” in Section 4A.
- 3) Separate transfer from transaxle assembly. (for 4WD vehicle) referring to “Transfer Dismounting and Remounting” in Section 7D.



- 4) Remove oil seal (1) using special tool.

**Special tool**

**(A) : 09913-50121**



- 5) Install oil seal (1) facing its spring side upward.  
Use special tool and hammer for installation.

**Special tool**

**(B) : 09913-85210**

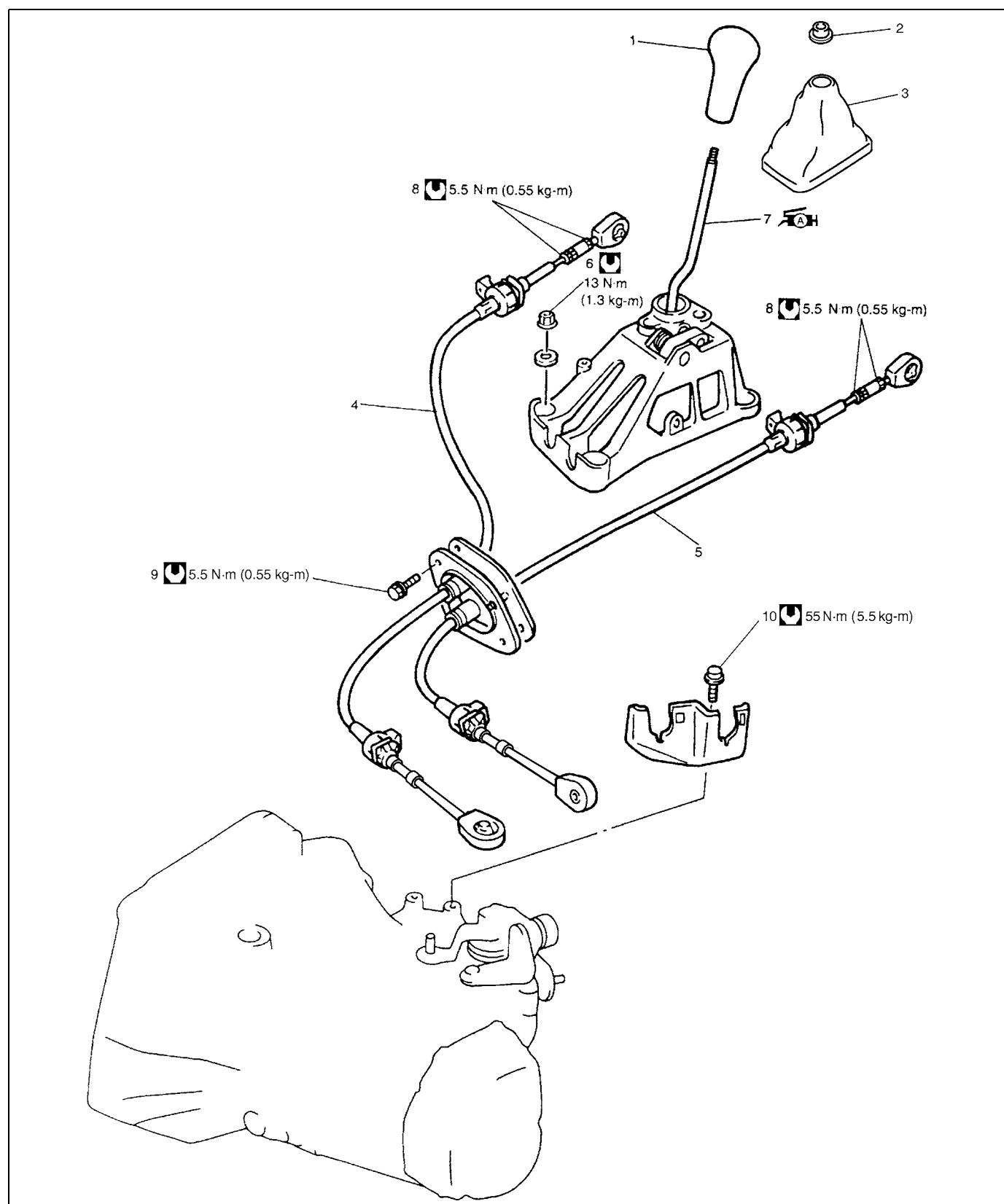
- 6) Apply grease to oil seal lip and at the same time check drive shaft where oil seal (1) contacts and make sure of its smoothness.


**“A” : Grease 99000-25010**

- 7) Install transfer referring to “Transfer Dismounting and Remounting” in Section 7D.
- 8) Insert front drive shafts referring to “Drive Shaft Assembly Removal and Installation” in Section 4A.
- 9) Install ball stud and stabilizer mount brackets referring to “Wheel Hub and Steering Knuckle Removal and Installation” and “Stabilizer Bar and Bushings Removal and Installation” in Section 3D.
- 10) Install tie-rod end referring to “Suspension Control Arm/ Bushing Removal and Installation” in Section 3D.
- 11) Fill transaxle oil as specified referring to “Manual Transaxle Oil Change” in this section, and make sure that oil has been sealed with oil seal.



## Gear Shift Control Lever and Cable Components

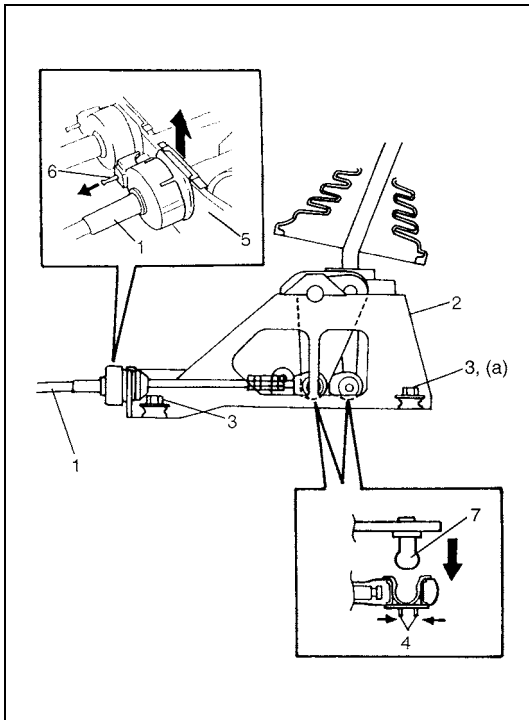


1. Gear shift control lever knob	5. Gear select control cable	9. Cable mounting bolt
2. Lever boot collar	6. Gear shift control lever assembly mounting nut	10. Cable bracket bolt
3. Gear shift lever boot	7. Gear shift control lever assembly : Apply grease 99000-25010 to pin ends to which shift and select cables are connected.	 Tightening torque
4. Gear shift control cable	8. Cable lock nut	

## Gear Shift Control Lever and Cable Removal and Installation

### Removal

- 1) Remove console box.
- 2) Disconnect gear shift and select control cables (1) from gear shift control lever assembly (2).
  - a) Disconnect cable end from pivot (7) while pushing cable end bush (4).
  - b) Detach cable from bracket (5) while pulling pin (6).
- 3) Remove gear shift control lever assembly mounting nuts (3) and gear shift lever assembly (2) from body.
- 4) Disconnect shift and select cables (1) from transmission in the same manner as step 2).
- 5) Remove cable grommet and cable clamp, and then remove shift and select cables (1) from body.



### Installation

Reverse removal procedure for installation noting the following.

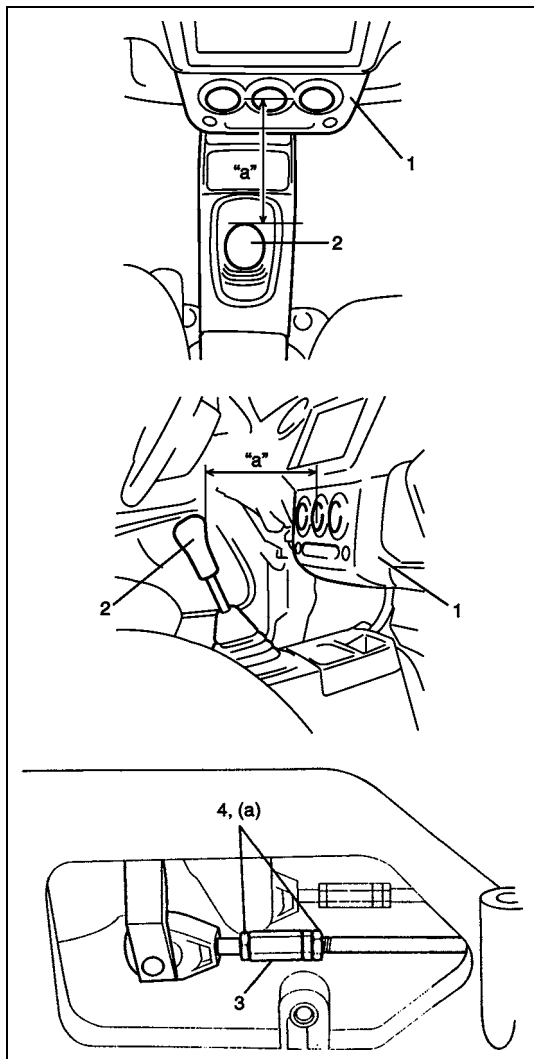
- Tighten gear shift control lever assembly mounting nuts (3) to specified torque.

#### Tightening torque

**Gear shift control lever assembly mounting nut**

**(a) : 13 N·m (1.3 kg-m, 9.5 lb-ft)**

## Gear Shift Control Lever and Cable Adjustment



- Adjustment of shift cable:

- a) With shift control lever in "NEUTRAL" position, adjust shift cable adjusting nut (3) so that distance "a" between edge of instrument panel (1) and center of shift knob (2) measured as specified value.

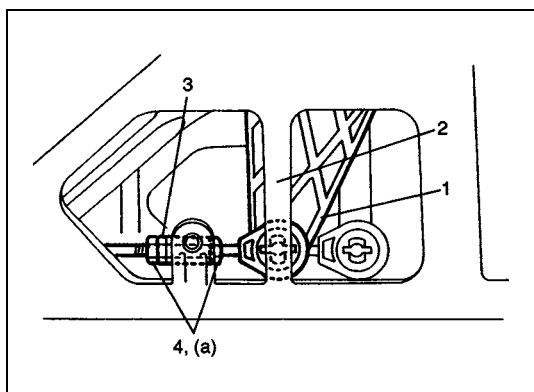
**Distance "a" : 158 mm (6.23 in.)**

- b) After shift cable adjustment, tighten cable lock nut (4) to specified torque.

**Tightening torque**

**Cable lock nut (a) : 5.5 N·m (0.55 kg-m, 4.0 lb-ft)**

- c) Make sure that boots are installed correctly.



- Adjustment of select cable:

- a) With shift control lever in "NEUTRAL" position, adjust select cable adjusting nut (3) so that the tip of select arm (cable joint point) (1) and the center rip of gear shift control lever assembly (2) are aligned as shown.

- b) After select cable adjustment, tighten cable lock nut (4) to specified torque.

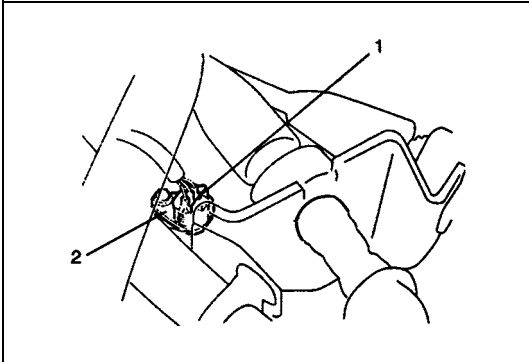
**Tightening torque**

**Cable lock nut (a) : 5.5 N·m (0.55 kg-m, 4.0 lb-ft)**

## Vehicle Speed Sensor (VSS) Removal and Installation

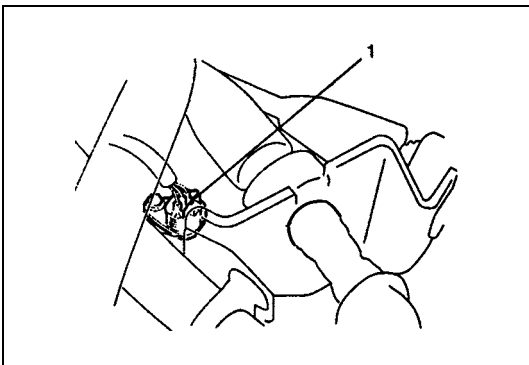
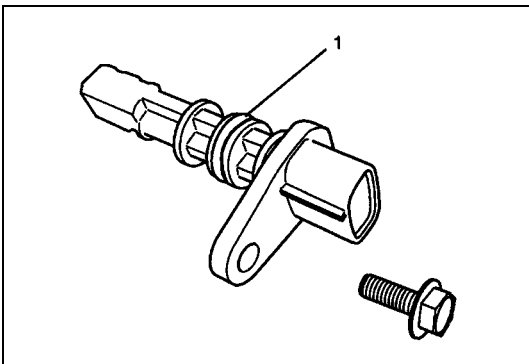
### Removal

- 1) Disconnect negative cable at battery.
- 2) Disconnect VSS coupler (1).
- 3) Remove VSS (2).



### Installation

- 1) Apply oil to new O-ring (1) and then install VSS to transaxle.



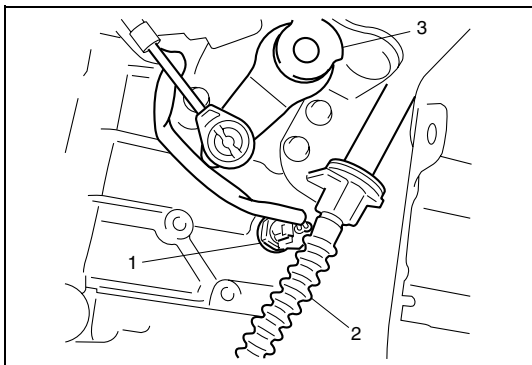
- 2) Connect VSS coupler (1).
- 3) Connect negative cable at battery.

## Back Up Lamp Switch Removal and Installation

### Removal

- 1) Disconnect negative cable at battery.
- 2) Disconnect back up lamp switch coupler (1).

2.	Clutch cable
3.	Gear shift and select shaft assembly



- 3) Remove back up lamp switch (1).

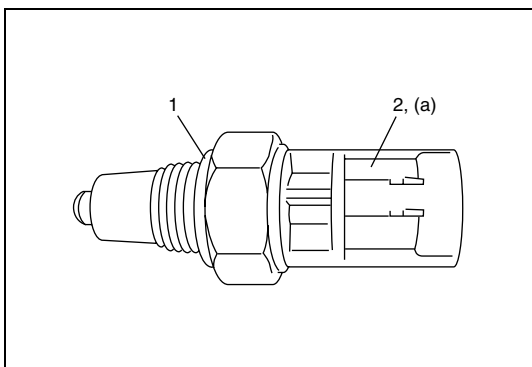
### Installation

- 1) Apply grease to new O-ring (1) and tighten back up lamp switch (2) to specified torque.

#### Tightening torque

**Back up lamp switch (a) : 23 N·m (2.3 kg-m, 17.0 lb-ft)**

- 2) Connect back up lamp switch coupler (1).
- 3) Connect negative cable at battery.

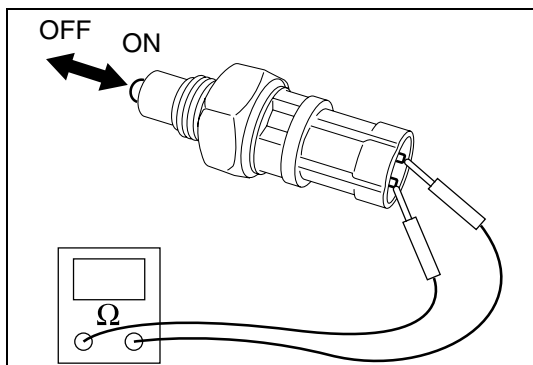


## Back Up Lamp Switch Inspection

Check backup lamp switch for function using ohmmeter.

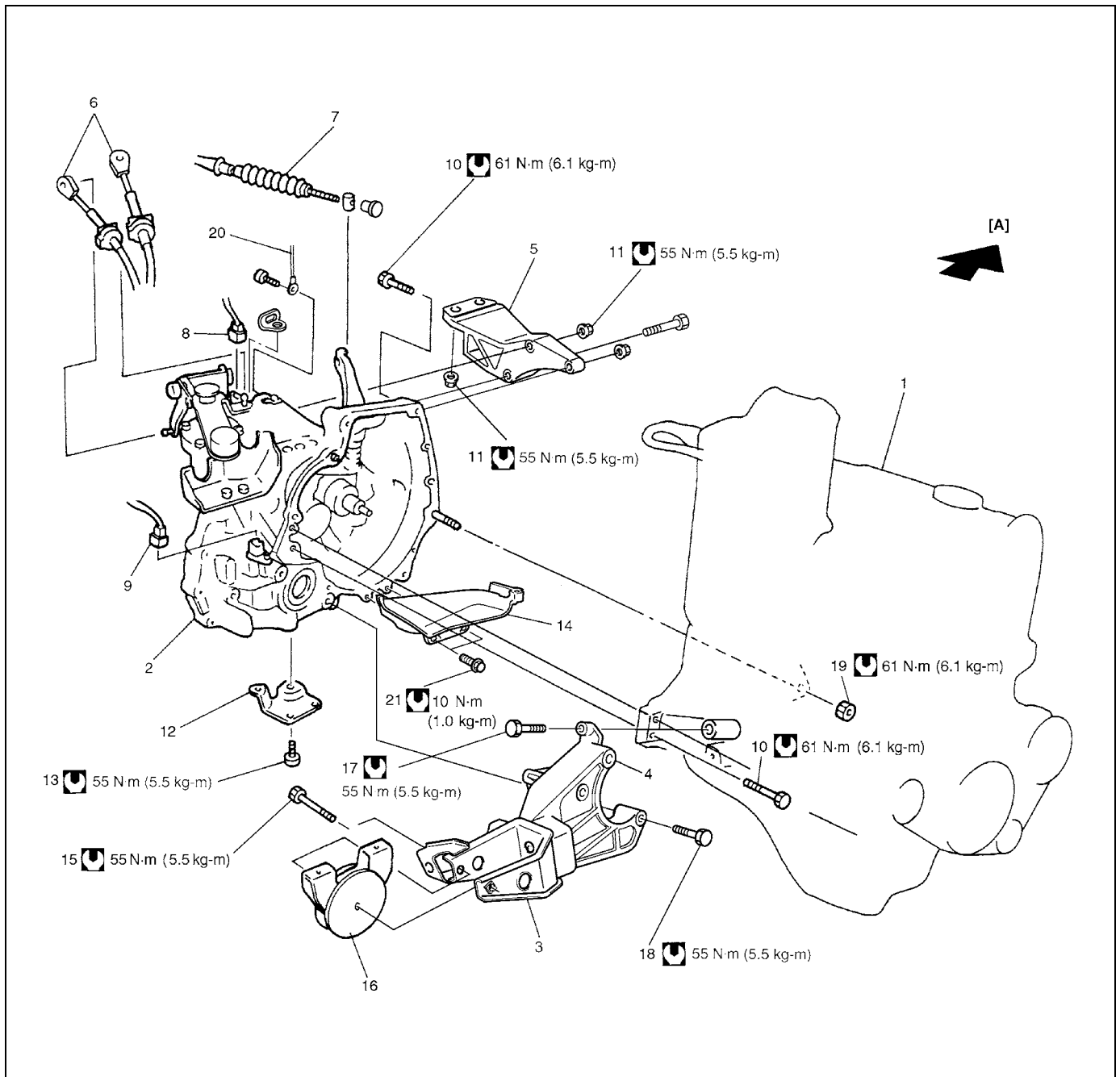
**Switch ON : Continuity**

**Switch OFF : No continuity**



# Unit Repair Overhaul

## Transaxle Unit Components



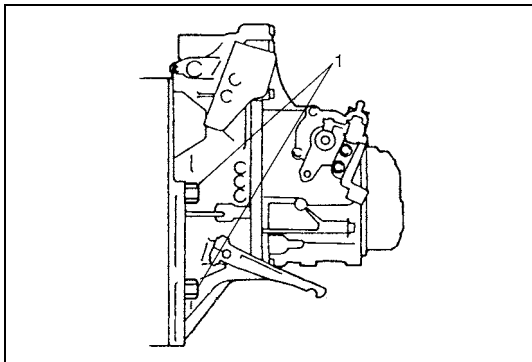
[A]: Forward	8. Backup lamp switch connector	16. Engine rear mounting
1. Engine	9. VSS connector	17. Engine rear mounting No.2 bracket bolts
2. Transaxle	10. Transaxle to engine bolts	18. Transaxle to engine rear mounting No.2 bracket bolt
3. Engine rear mounting No.1 bracket	11. Engine left mounting bracket bolt and nuts	19. Transaxle to engine nut
4. Engine rear mounting No.2 bracket	12. Engine rear mounting bracket stiffener	20. Ground cable
5. Engine left mounting bracket	13. Stiffener bolts	21. Clutch housing lower plate bolts
6. Shift & select control cables	14. Clutch housing lower plate	Tightening torque
7. Clutch cable	15. Engine rear mounting bolt	

## Transaxle Unit Dismounting and Remounting

### Dismounting

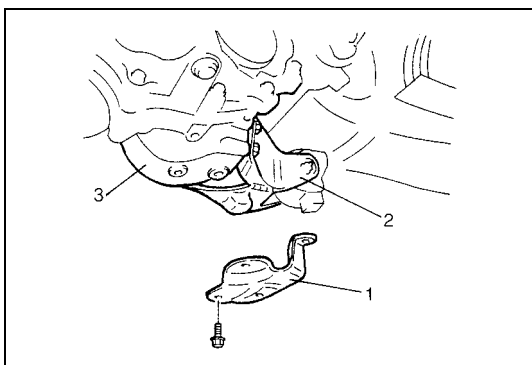
#### Under hood

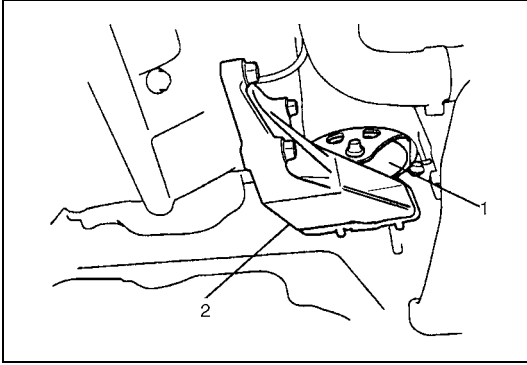
- 1) Remove battery and tray.
- 2) Undo wiring harness clamps, disconnect backup lamp switch coupler, VSS coupler and ground cable.
- 3) Disconnect clutch cable from clutch release lever and bracket.
- 4) Disconnect gear shift and select control cables.
- 5) Remove transaxle control cable bracket.
- 6) Remove water pipe bracket bolts from transaxle.
- 7) Remove transaxle to engine bolts (1).
- 8) Remove starting motor mounting bolt and nut.
- 9) Support engine by using lifting device.



#### On lift

- 10) Drain transaxle oil referring to "Manual Transaxle Oil Change" in this section.
- 11) Remove left and right front drive shaft referring to "Front Drive Shaft Assembly Removal and Installation" in Section 4A.
- 12) Remove center shaft referring to "Front Drive Shaft Assembly Removal and Installation" in Section 4A (for FWD model).
- 13) Remove left side of engine under cover.
- 14) Remove starting motor referring to "Starting Motor Dismounting and Remounting" in Section 6G.
- 15) Remove engine rear mounting bracket stiffener (1).
- 16) Remove clutch housing lower plate.
- 17) Remove engine rear mounting No.1 bracket (2) with No.2 bracket (3).
- 18) Remove transfer referring to "Transfer Dismounting and Remounting" in Section 7D, if equipped.
- 19) Remove transaxle to engine bolts and nut.
- 20) Lower vehicle and support transaxle with transaxle jack.





- 21) Remove engine left mounting (1) with bracket (2).
- 22) Remove other attached parts from transaxle, if any.
- 23) Pull transaxle out so as to disconnect input shaft from clutch disc and then lower it.

## Remounting

### CAUTION:

**Care should be taken not to scratch oil seal lip with drive shaft while raising transaxle.**

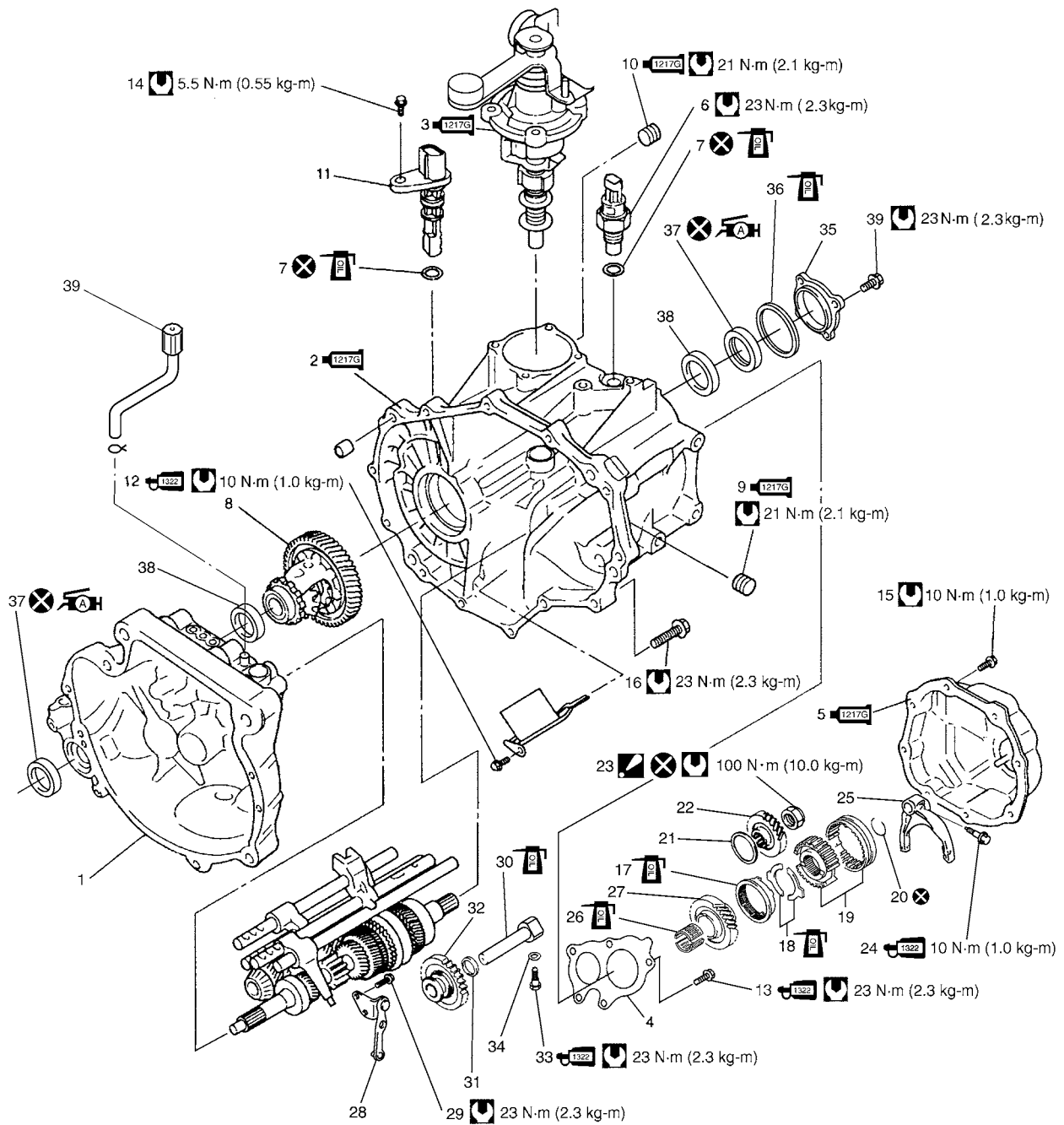
**Do not hit drive shaft joint with hammer when installing it into differential gear.**















Reverse dismounting procedure for remounting noting the following.

- Install transfer referring to “Transfer Dismounting and Remounting” in Section 7D, if equipped.
- Refer to “Transaxle Unit Components” for fastener specified torque.
- Push in drive shaft joints (right & left) referring to “Front Drive Shaft Assembly Removal and Installation” in Section 4A.
- Set each clamp for wiring securely.
- Install starting motor referring to “Starting Motor Dismounting and Remounting” in Section 6G.
- After connecting clutch cable, be sure to adjust its play properly.  
Refer to “Clutch Pedal Inspection” in Section 7C.
- Fill transaxle with oil as specified referring to “Manual Transaxle Oil Change” in this section.
- Connect battery and check function of engine, clutch and transaxle.

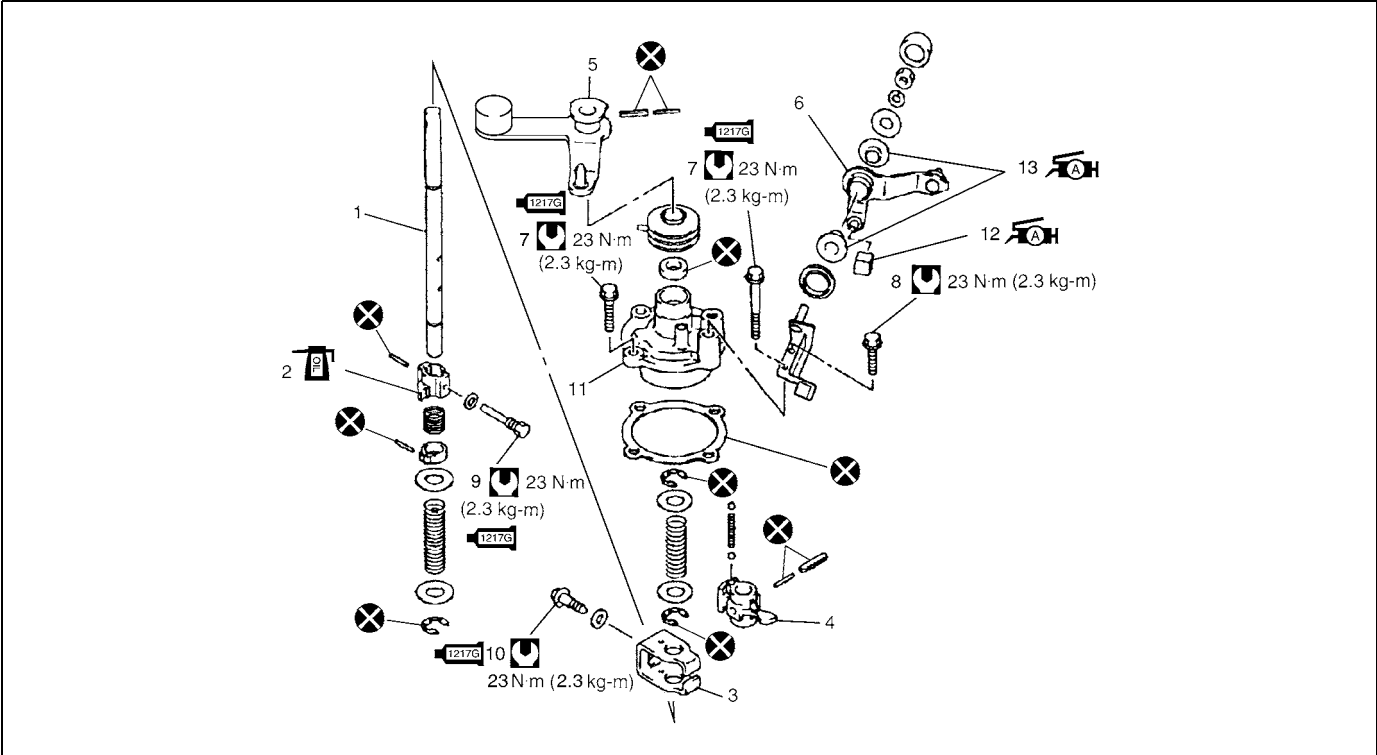










## Transaxle Case Components



1. Transaxle right case	22. Counter shaft 5th gear
 2. Transaxle left case : Apply sealant 99000-31260 to mating surface of left case and right case.	23. Counter shaft nut
 3. Gear shift and select shaft assembly	 24. Shift fork bolt : Apply thread lock 99000-32110 to all around thread part of bolt.
4. Transaxle left case plate	25. 5th gear shift fork
 5. Transaxle side cover : Apply sealant 99000-31260 to mating surface of side cover and left case.	26. Needle bearing (Separated steel cage type.)
6. Back up lamp switch	27. Input shaft 5th gear
7. O-ring	28. Reverse gear shift lever
8. Differential assembly	 29. Reverse gear shift lever bolt : Apply thread lock 99000-32110 to all around thread part of bolt.
 9. Oil level/filler plug : Apply sealant 99000-31260 to all around thread part of plug.	30. Reverse gear shaft
 10. Oil drain plug : Apply sealant 99000-31260 to all around thread part of plug.	31. Washer
11. VSS	32. Reverse idler gear
 12. Oil gutter bolt : Apply thread lock 99000-32110 to all around thread part of bolt.	 33. Reverse shaft bolt : Apply thread lock 99000-32110 to all around thread part of bolt.
 13. Left case plate bolts : Apply thread lock 99000-32110 to all around thread part of bolt.	34. Washer
14. VSS bolt	35. Side bearing retainer
15. Side cover bolts	36. O-ring
16. Transaxle case bolts	 37. Oil seal : Apply SUZUKI SUPER GREASE A 99000-25010 to Oil seal lip.
17. 5th speed synchronizer ring	38. Outer race
18. 5th speed synchronizer lever	39. Breather hose
19. 5th speed sleeve & hub	 Tightening torque
20. Circlip	 Do not reuse.
21. Bearing set shim	 Apply transaxle oil.

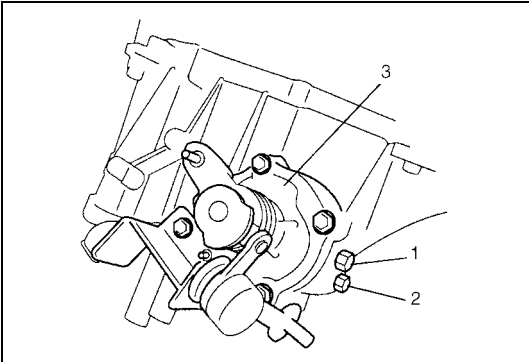
Gear Shift and Select Shaft Assembly Components



1. Gear shift & select shaft	 7. Gear shift guide case bolt	 13. Select lever boss :Apply grease 99000-25010 to internal and external diameter
2. 5th & reverse gear shift cam	8. Select lever bracket bolt	 Tightening torque
3. Gear shift interlock plate	 9. 5th to reverse interlock guide bolt :Apply sealant 99000-31260 to bolt thread.	 Do not reuse.
4. Gear shift & select lever	 10. Gear shift interlock bolt :Apply sealant 99000-31260 to bolt thread.	 Apply transaxle oil.
5. Shift cable lever	11. Guide case	
6. Select cable lever	 12. Select lever shaft bush :Apply grease 99000-25010 to whole area of bush.	

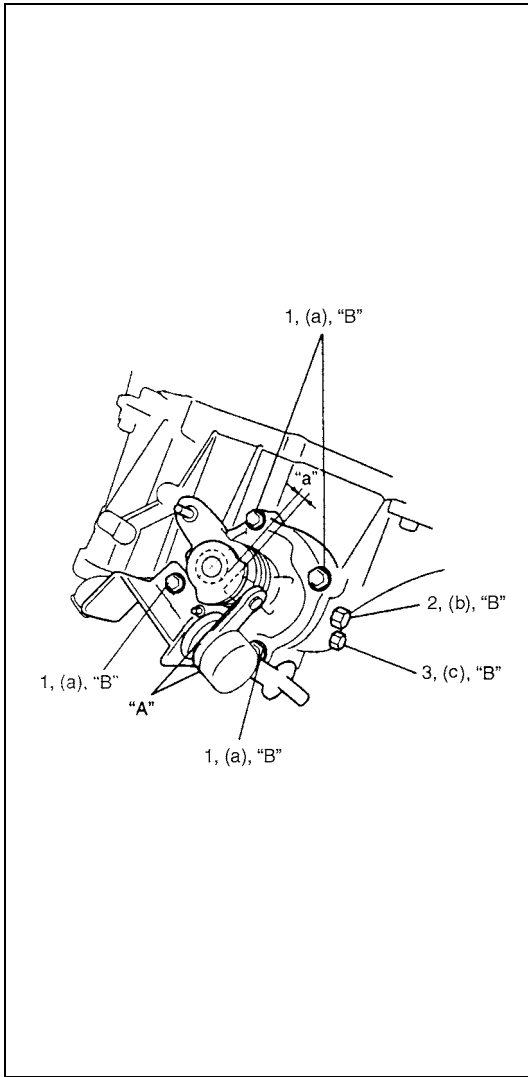
Gear Shift and Select Shaft Assembly Removal and Installation

Removal



- 1) Remove gear shift interlock bolt (1) and 5th to reverse interlock guide bolt (2) from transaxle case.
- 2) Remove gear shift and select shaft assembly (3).

## Installation



- 1) Apply grease to select lever shaft bush and select lever boss, and install gear shift and select shaft assembly with new gasket into transaxle.

**"A" : Grease 99000-25010**

- 2) Apply sealant to gear shift guide case bolts (1). Tighten gear shift guide case bolts (1) to specified torque at the position that clearance "a" is within 1 - 1.5 mm (0.04 - 0.06 in.).

**"B" : Sealant 99000-31260**

### Tightening torque

#### Gear shift guide case bolt

**(a) : 23 N·m (2.3 kg-m, 17.0 lb-ft)**

- 3) Install washer and gear shift interlock bolt (2) to which sealant have been applied and them tighten it to specified torque.

**"B" : Sealant 99000-31260**

### Tightening torque

**Gear shift interlock bolt (b) : 50 N·m (5.0 kg-m, 37.5 lb-ft)**

- 4) Install washer and 5th to reverse interlock guide bolt (3) to which sealant have been applied and then tighten it to specified torque.

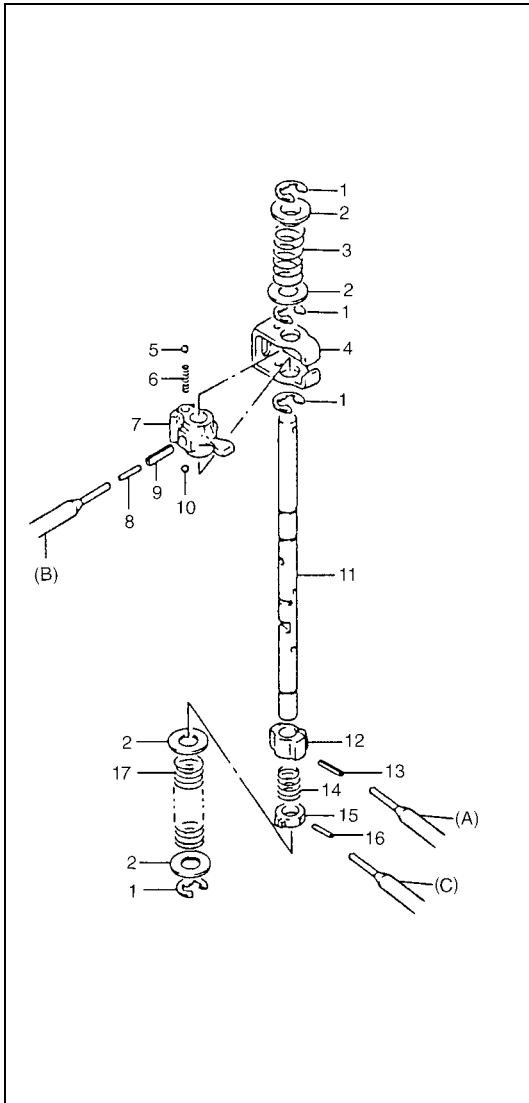
**"B" : Sealant 99000-31260**

### Tightening torque

#### 5th to reverse interlock guide bolt

**(c) : 23 N·m (2.3 kg-m, 17.0 lb-ft)**

## Gear Shift and Select Shaft Disassembly and Assembly



- 1) Push spring pins out using specified spring pin removers as shown below.

### Special tool

(A) : 09922-85811 (4.5 mm)

(B) : 09925-78210 (6.0 mm)

(C) : 2.8 – 3.0 mm (0.11 – 0.12 in.) Commercially available spring pin remover

- 2) Inspect component parts for wear, distortion or damage. If any defect is found, replace defective part with new one.

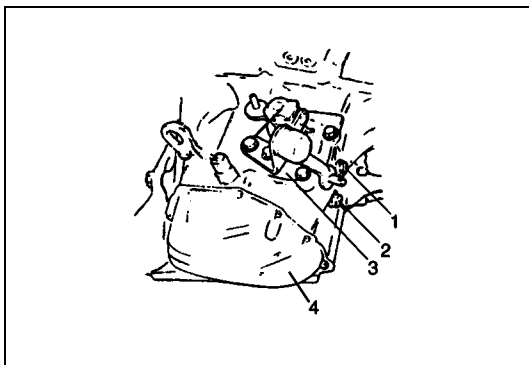
### NOTE:

- When driving in spring pins, prevent shaft from being bent by supporting it with wood block.
- Assemble 5th & reverse gear shift cam with its pit and spring pin aligned.
- Make sure to select an appropriate spring by identifying the painted colors to keep gear shifting performance as designed.
  - Low speed select spring - No paint
  - Reverse select spring - Pink

1. E-ring	10. Ball
2. Washer	11. Gear shift & select shaft
3. Reverse select spring	12. 5th & reverse gear shift cam
4. Gear shift interlock plate	13. Spring pin
5. Ball	14. Cam guide return spring
6. Gear shift interlock spring	15. 5th & reverse gear shift cam guide
7. Gear shift & select lever	16. Spring pin
8. Spring pin	17. Low speed select spring
9. Spring pin	

## Fifth Gear Disassembly and Assembly

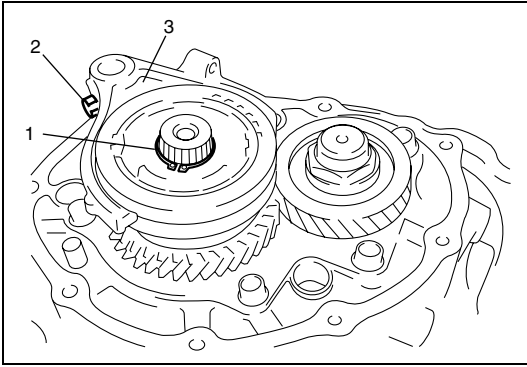
### Disassembly



- 1) Remove gear shift interlock bolt (1) and 5th to reverse interlock guide bolt (2) from transaxle case.
- 2) Remove gear shift & select shaft assembly (3).
- 3) Remove 9 bolts and take off transaxle side cover (4).

### CAUTION:

Care should be taken not to distort side cover when it is removed from left case.

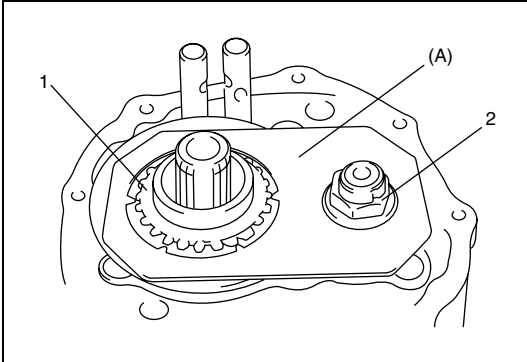


4) Using special tool, remove circlip (1).

**Special tool**  
**09900-06107**

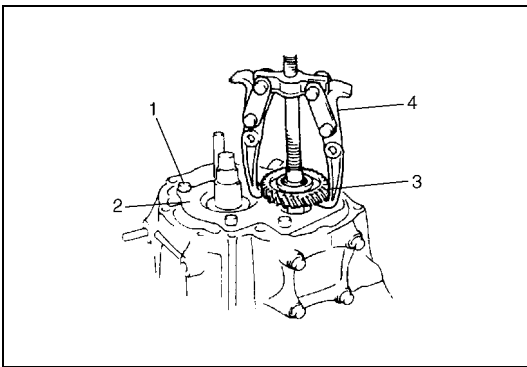
5) Remove 5th shift fork bolt (2).

6) Remove gear shift fork (3), sleeve & hub assembly, synchronizer levers, synchronizer ring and 5th gear all together. Use gear puller for removal if spline fitting of hub is tight.



7) Unfasten caulking of counter shaft nut (2), install input shaft 5th gear (1) and special tool to stop rotation of shafts, and then remove counter shaft nut (2).

**Special tool**  
**(A) : 09927-76060**



8) Remove input shaft 5th gear, needle bearing and then counter shaft 5th gear (3). Gear puller (4) would be necessary if spline fitting of counter shaft 5th gear is tight.

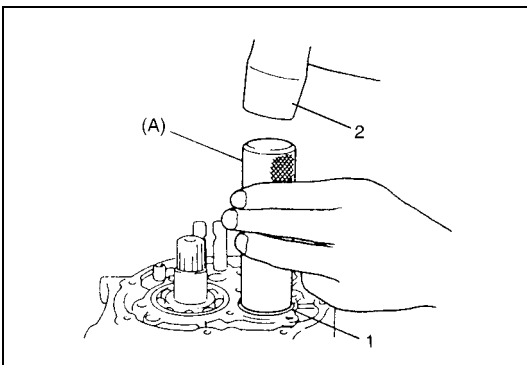
9) Remove bolts (1), and take off left case plate (2) and bearing set shim.

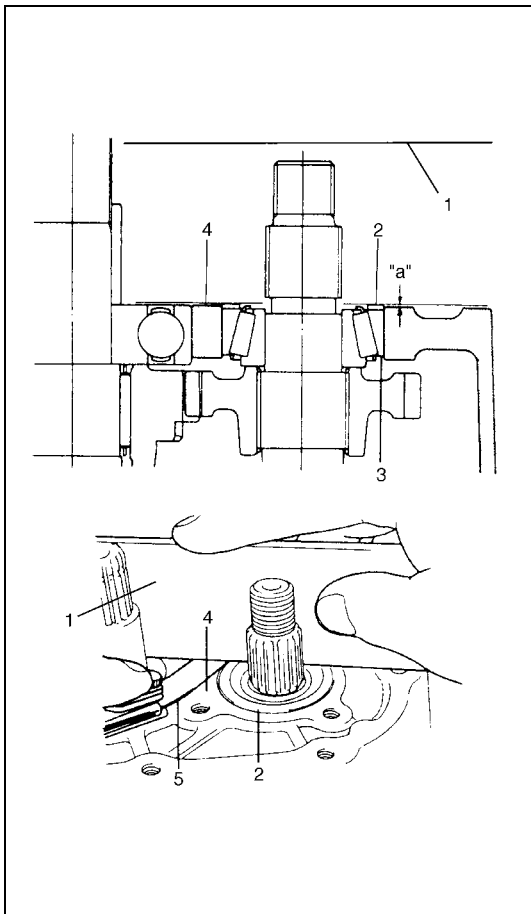
10) Remove bearing set shim.

### Assembly

1) Install counter shaft left bearing outer race (1) to bearing cone, and tap cup using special tool and plastic hammer (2).

**Special tool**  
**(A) : 09913-70123**





- 2) With putting a shim (2) on bearing outer race (3), place straight edge (1) over it and compress it by hand through straight edge, and then measure clearance "a" between case surface (4) and straight edge using feeler gauge (5).

#### Clearance between case surface and straight edge

"a" : 0.13 – 0.17 mm (0.0051 – 0.0067 in.)

(Shim protrusion)

- 3) By repeating above step, select a suitable shim which adjusts clearance "a" to specification and put it on bearing outer race.

#### NOTE:

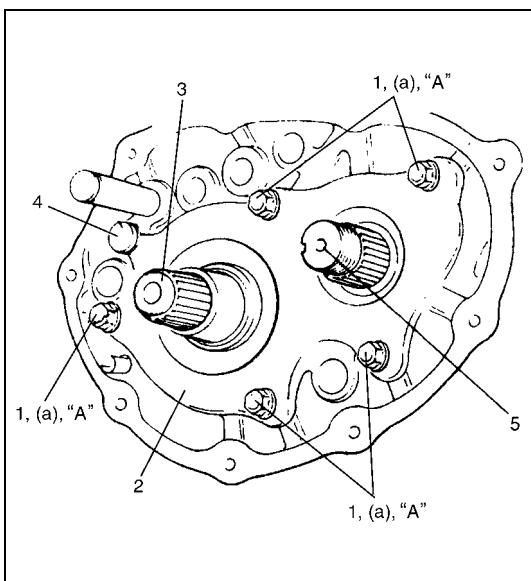
Insert 0.15 mm (0.0059 in.) feeler to know whether or not a shim fulfills specification quickly.

#### Available shim thickness

0.55, 0.6, 0.65, 0.7, 0.75, 0.8, 0.85, 0.9, 0.95, 1.0, 1.05 and 1.10 mm (0.021, 0.023, 0.025, 0.027, 0.029, 0.031, 0.033, 0.035, 0.037, 0.039, 0.041 and 0.043 in.)

#### CAUTION:

Do not reuse left case plate bolts (1). Be sure to use new adhesive pre-coated bolts. Otherwise, bolts may loosen.



- 4) Place left case plate (2) inserting its end in groove of shift guide shaft (4) and then tighten bolts (1) to which thread lock cement has been applied.

#### NOTE:

After tightening bolts, make sure that counter shaft can be rotated by hand feeling certain load.

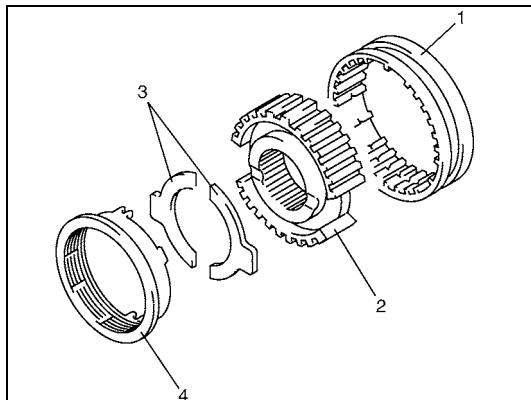
"A" : Cement 99000-32110

#### Tightening torque

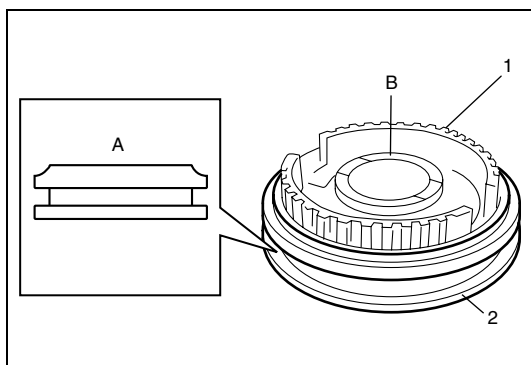
Left case plate bolt

(a) : 23 N·m (2.3 kg-m, 17.0 lb-ft)

3.	Input shaft
5.	Counter shaft

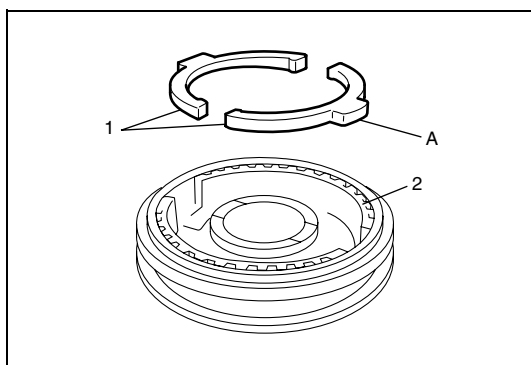


- 5) Assemble 5th speed synchronizer sleeve (1), hub (2), 5th speed synchronizer levers (3) and synchronizer ring (4) as follows.



- a) Install hub (1) to 5th speed synchronizer sleeves (2) in specified direction as shown in figure.

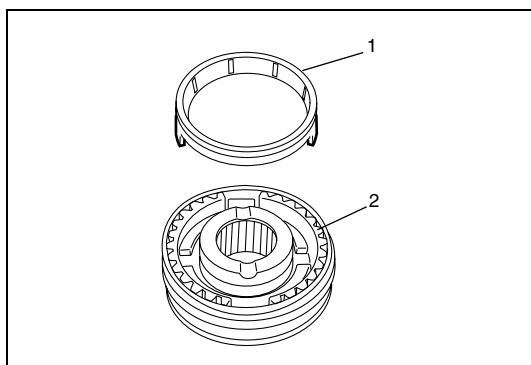
A :	Chamfered side
B :	Long boss



- b) Fit 5th speed synchronizer levers (1) to hub (2) as shown in figure.

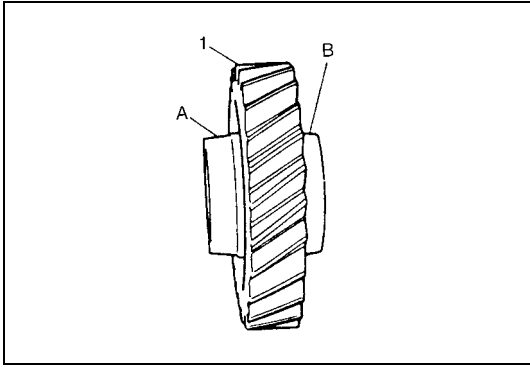
**NOTE:**

- Align protrusion “A” of 5th speed synchronizer levers (1) with groove of hub (2).



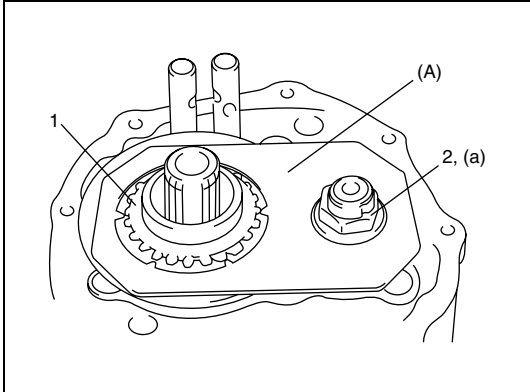
- c) Install synchronizer ring (1) to hub (2) as shown in figure.





- 6) Install 5th gear (1) to counter shaft facing machined boss A inward.

A :	Machined boss (Inside)
B :	No machining (Outside)



- 7) Install needle bearing of separated steel cage type to input shaft, apply oil then install 5th gear (1) and special tool to stop shaft rotation.

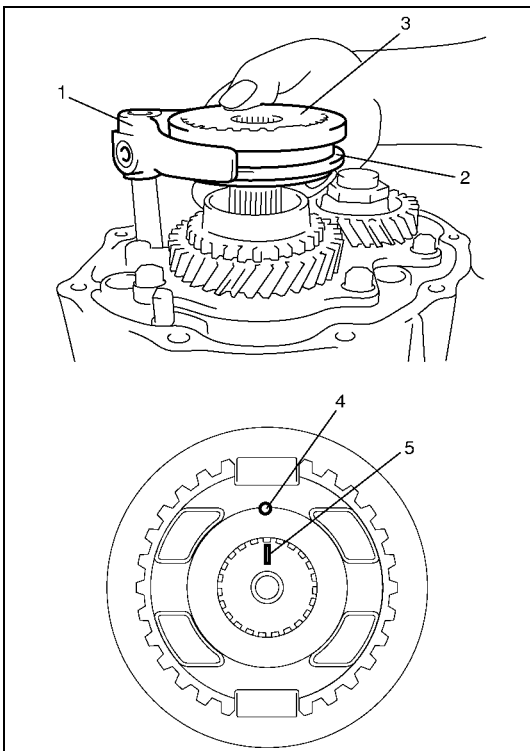
#### Special tool

(B) : 09927-76060

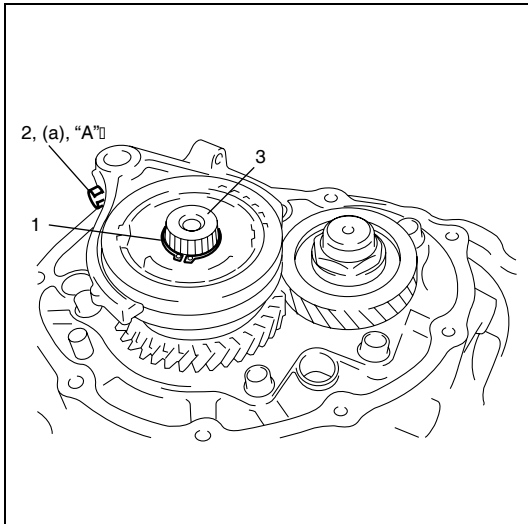
- 8) Tighten new counter shaft nut (2) to specified torque, and caulk counter shaft nut (2) securely.

#### Tightening torque

counter shaft nut (a) : 100 N·m (10.0 kg-m, 75.0 lb-ft)



- 9) Fit 5th gear shift fork (1) to sleeve (3) and hub (2) assembly, and install them to input shaft and gear shift shaft aligning punch mark (4) with matching mark (5) on input shaft.



- 10) Tighten shift fork shaft bolt (2) to which thread lock cement has been applied.

**“A” : Cement 99000-32110**

**Tightening torque**

**Shift fork bolt**

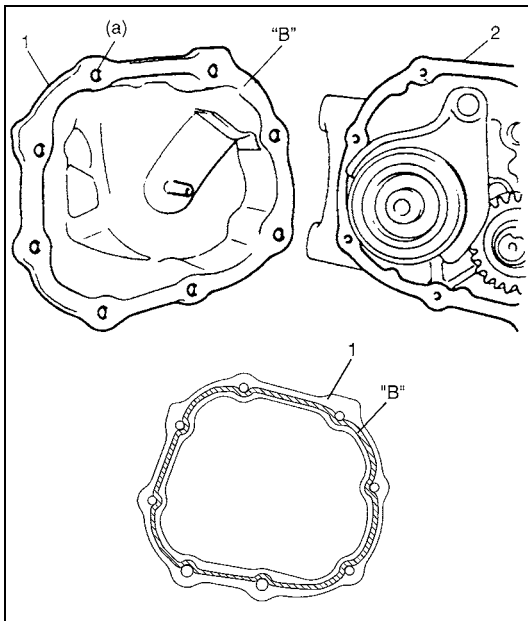
**(a) : 10 N·m (1.0 kg-m, 7.5 lb-ft)**

- 11) Using special tool, install new circlip (1) to input shaft (3) in specified direction as shown in the figure.

**Special tool**

**09900-06107**

4. Polished surface
---------------------



- 12) Clean mating surface of both left case (2) and side cover (1), apply sealant to side cover (1) as shown in figure by such amount that its section is 1.5mm (0.059 in.) in diameter, mate it with left case and then tighten bolts.

**“B” : Sealant 99000-31260**

**Tightening torque**

**Side cover bolt (a) : 10 N·m (1.0 kg-m, 7.5 lb-ft)**

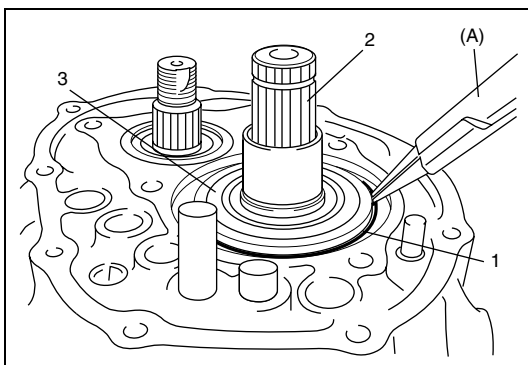
## Gear Shift Shaft, Input Shaft and Counter Shaft Removal and Installation

### Removal

- 1) Remove gear shift and select shaft assembly referring to “Gear Shift and Select Shaft Assembly Removal and Installation” in this section.
- 2) Remove fifth gear referring to “Fifth Gear Disassembly and Assembly” in this section.
- 3) Remove snap ring (1) using special tool.

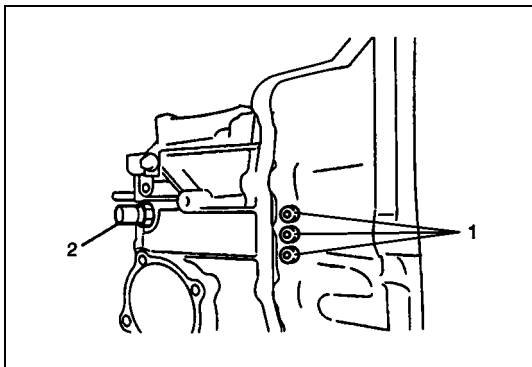
**Special tool**

**(A) : 09900-06107**

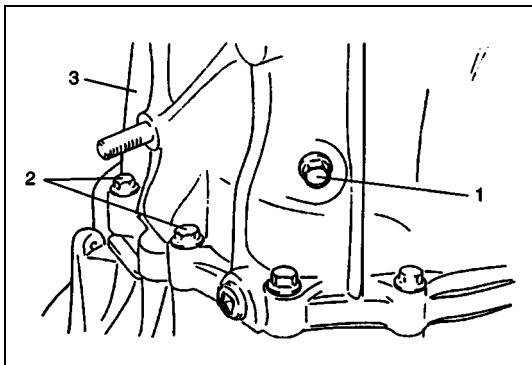


2. Input shaft
----------------

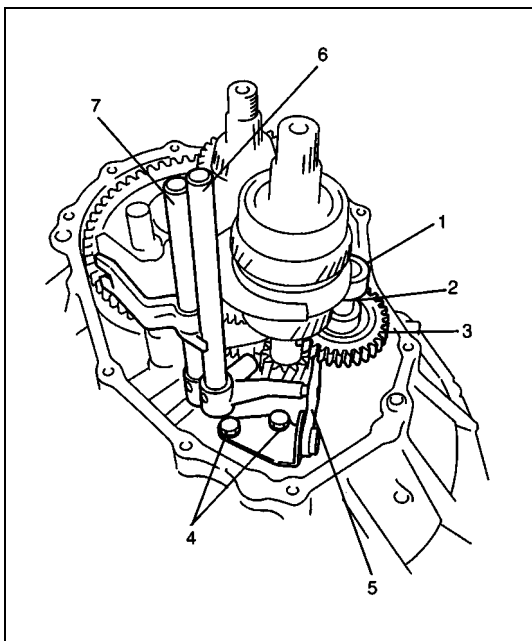
3. Input shaft left bearing
-----------------------------



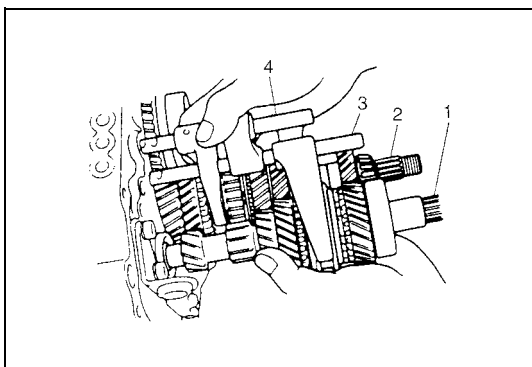
- 4) Remove gear shift locating bolts (1) with washers, then take out locating springs and steel balls.
- 5) Remove back up lamp switch (2).



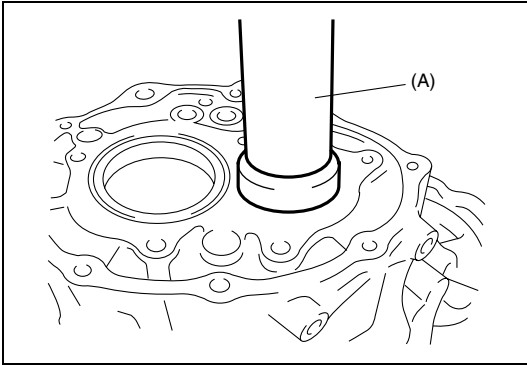
- 6) Remove reverse shaft bolt (1) with washer.
- 7) Remove case bolts (2) from outside and another bolts from clutch housing side.
- 8) Tapping left case (3) flanges with plastic hammer, remove left case.



- 9) Pull out reverse gear shaft (1) with washer (2), then take off reverse idler gear (3).
- 10) Remove reverse gear shift lever bolts (4) and reverse gear shift lever (5).
- 11) Pull out 5th & reverse gear shift guide shaft (6) together with 5th & reverse gear shift shaft (7).



- 12) Tapping input shaft end with plastic hammer, push it out as assembly from case a little, then take out input shaft assembly (1), counter shaft assembly (2), high speed gear shift shaft (3) and low speed gear shift shaft (4) all at once.

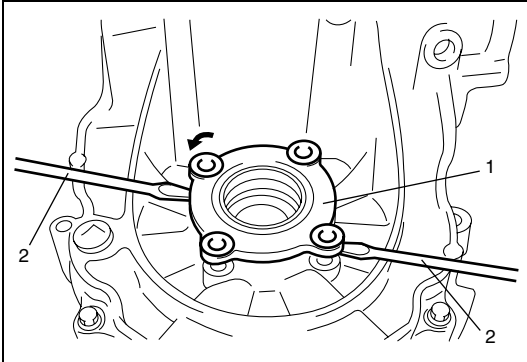


- 13) Remove counter shaft left bearing outer race from left case using special tool.

**Special tool**

**(A) : 09913-70123**

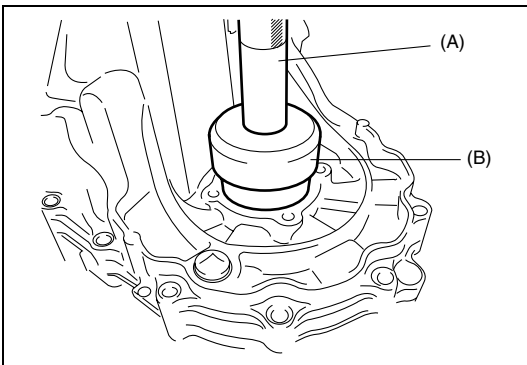
- 14) Remove side bearing retainer bolts.



- 15) Turn side bearing retainer (1) counterclockwise until it stops, and remove side bearing retainer using 2 flat end rods (2) or the like.

- 16) Remove O-ring from side bearing retainer (1).

- 17) Remove differential bearing shim.

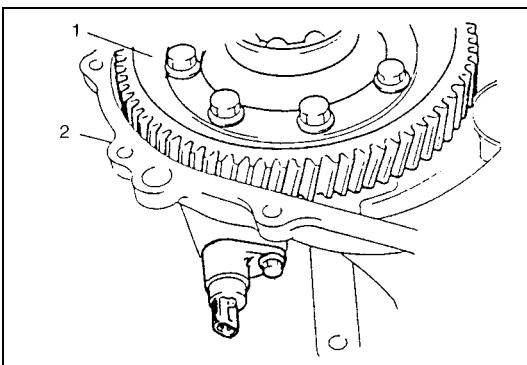


- 18) Remove differential side bearing outer race from left case using special tools.

**Special tool**

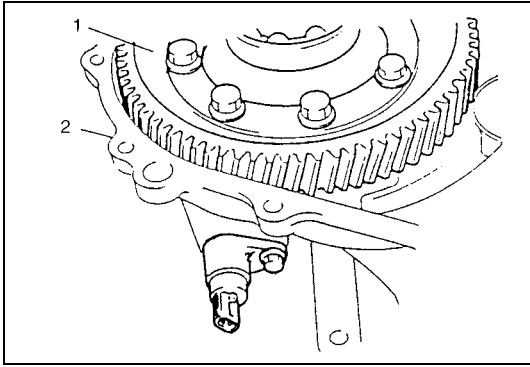
**(A) : 09924-74510**

**(B) : 09926-27610**

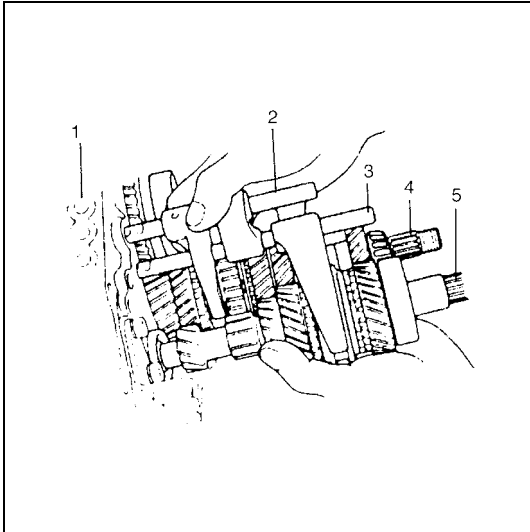


- 19) Remove differential gear assembly (1) from right case (2).

## Installation



- 1) Install differential assembly (1) into right case (2).



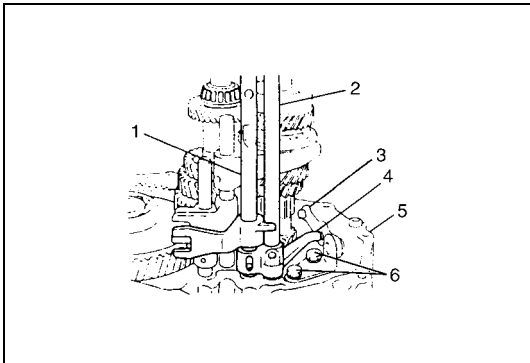
- 2) Join input shaft (5), counter shaft (4), low speed gear shift shaft (2) and high speed gear shift shaft (3) assemblies all together, then install them into right case (1).

### CAUTION:

Take care not to damage oil seal lip by input shaft, or oil leakage may take place.

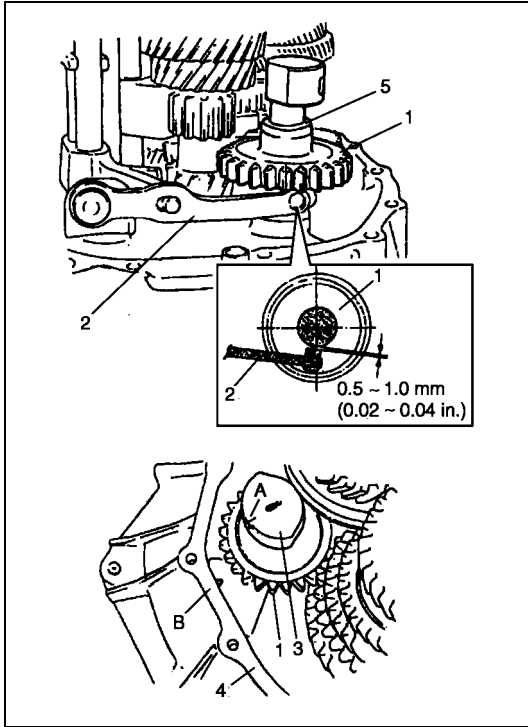
### NOTE:

- Input shaft right bearing on shaft can be installed into right case tapping shaft with plastic hammer.
- Check to make sure that counter shaft is engaged with final gear while installing.



- 3) Install 5th & reverse gear shift shaft (1) with 5th & reverse gear shift guide shaft (2) into right case (5). Reverse gear shift arm (4) has to be joined with reverse gear shift lever (3) at the same time.

6. Reverse gear shift lever bolts



- 4) Make reverse idler gear (1) with reverse gear shift lever (2), insert reverse gear shaft (3) into case (4) through idler gear and then align "A" in shaft with "B" in case.
- 5) Fasten reverse gear shift lever bolts after applying thread lock cement.

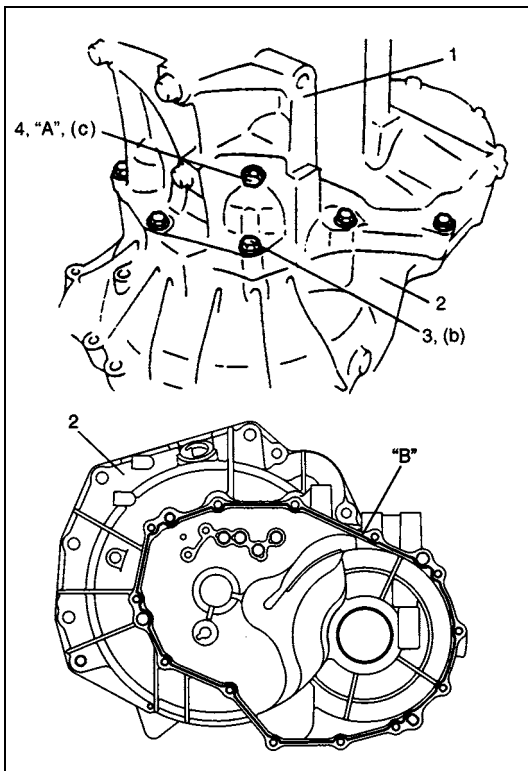
**Thread lock cement : 99000-32110**

**Tightening torque**

**Reverse gear shift lever bolt : 23 N·m (2.3 kg-m, 17.0 lb-ft)**

**NOTE:**

- Make sure that washer (5) has been installed in shaft at above the gear.
- Check to confirm that reverse gear shift lever end has clearance 0.5 – 1.0 mm (0.02 – 0.04 in.) to idler gear groove.



- 6) Clean mating surfaces of both right and left cases, apply sealant to right case (2) as shown in figure by such amount that its section is 1.5mm (0.059 in.) in diameter then mate it with left case (1).

**"B" : Sealant 99000-31260**

- 7) Tighten case bolts (3) from left outside to specified torque.

**Tightening torque**

**Transaxle case bolt (b) : 23 N·m (2.3 kg-m, 17.0 lb-ft)**

- 8) Install reverse shaft bolt (4), to which thread lock cement has been applied, with aluminum washer and tighten it.

**"A" : Thread lock cement 99000-32110**

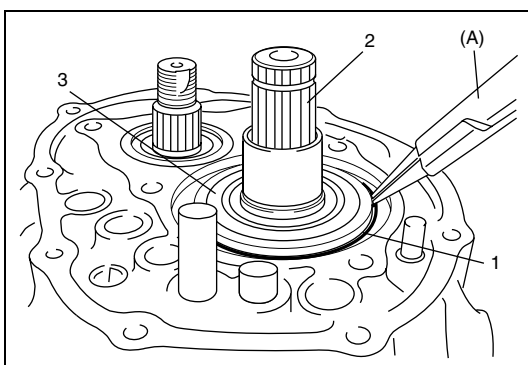
**Tightening torque**

**Reverse shaft bolt (c) : 23 N·m (2.3 kg-m, 17.0 lb-ft)**

- 9) Install another case bolts from clutch housing side and tighten them to specification.

**Tightening torque**

**Transaxle case bolt : 23 N·m (2.3 kg-m, 17.0 lb-ft)**

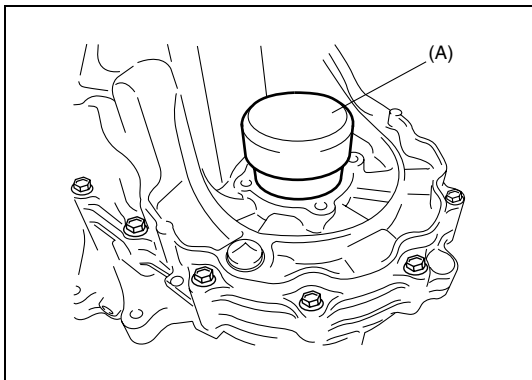


- 10) Install new snap ring (1) using special tool.

**Special tool**

**(A) : 09900-06107**

2. Input shaft
3. Input shaft left bearing



- 11) Install differential side bearing outer race to left case and then tap and accustom outer race by using special tool and plastic hammer.

**CAUTION:**

**Do not drive in a race with hammer.  
Driving it way cause to damage bearing.**

**Special tool**

**(A) : 09926-27610**

- 12) Select proper size shim according to "Differential Adjustment" in this section.  
13) Apply oil to new O-ring of side bearing retainer, and install it with new O-ring to left case.

**Grease : 99000-25010**

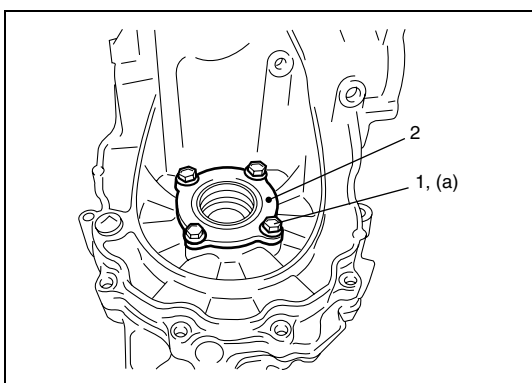
- 14) Tighten side bearing retainer bolts (1) to specified torque.

**NOTE:**

- Install side bearing retainer with its punch mark (2) facing upward.

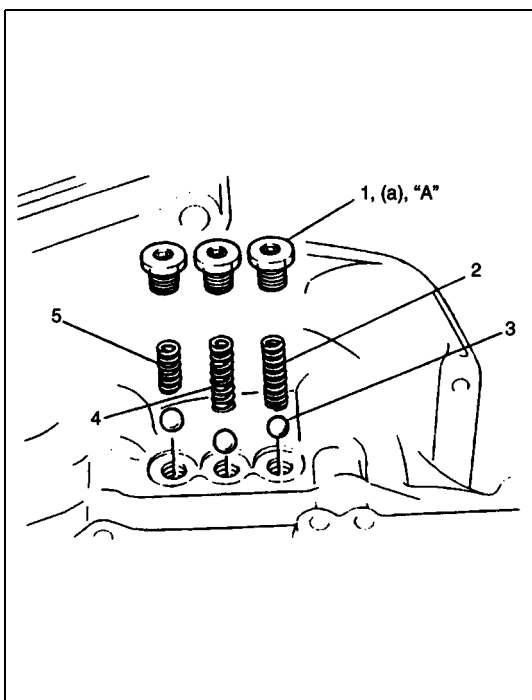
**Tightening torque**

**Side bearing retainer bolt (a) : 23 N·m (2.3 kg-m, 17.0 lb-ft)**



- 15) Install counter shaft left bearing outer race referring to "Fifth Gear Disassembly and Assembly" in this section.  
16) Check locating spring for deterioration and replace with new one as necessary.

Locating spring free length	Standard	Service limit
Low speed (2)	53.1 mm (2.091 in.)	50.5 mm (1.988 in.)
High speed (4)	45.9 mm (1.807 in.)	44.0 mm (1.732 in.)
5th & reverse (5)	29.9 mm (1.777 in.)	28.5 mm (1.122 in.)



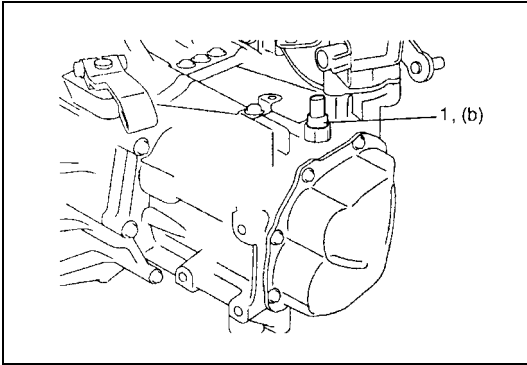
- 17) Install steel balls (3) and locating springs (2, 4 and 5) for respective gear shift shaft and tighten bolts (1) to which sealant has been applied.

**Sealant "A" : 99000-31260**

**Tightening torque**

**Gear shift locating bolt (a) : 13 N·m (1.3 kg-m, 9.5 lb-ft)**

- 18) Clean mating surface of guide case.  
19) Install fifth gear referring to "Fifth Gear Disassembly and Assembly."



20) Install gear shift and select shaft assembly referring to “Gear Shift Shaft, Input Shaft and Counter Shaft Removal and Installation” in this section.

21) Tighten back up lamp switch (1) to specified torque.

**Tightening torque**

**Back up lamp switch (b) : 23 N·m (2.3 kg-m, 17.0 lb-ft)**

22) Check input shaft for rotation in each gear position.

23) Also confirm continuity of back up lamp switch in reverse position using ohmmeter.

## Transaxle Right Case Disassembly and Assembly

### Disassembly

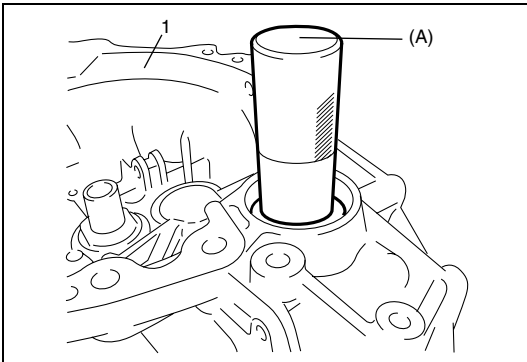
1) Remove gear shift shaft, input shaft and counter shaft referring to “Gear Shift Shaft, Input Shaft and Counter Shaft Removal and Installation” in this section.

2) Remove differential side bearing outer race using special tool.

**Special tool**

**(A) : 09925-15410**

1. Transaxle right case

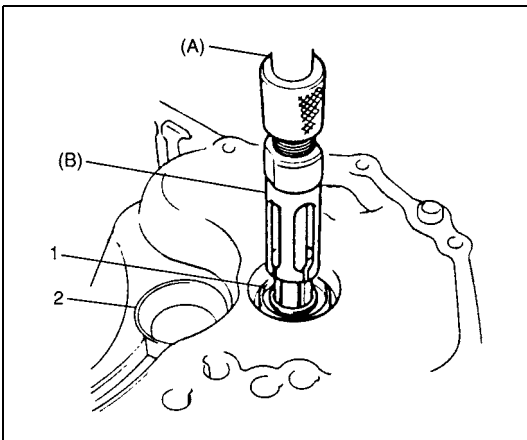


3) Remove input shaft oil seal (1) using special tools, if necessary.

**Special tool**

**(A) : 09930-30104**

**(B) : 09923-74510**



4) Pull out counter shaft right bearing outer race (2) using special tools, if necessary.

**Special tool**

**09930-30104**

**09941-64511**

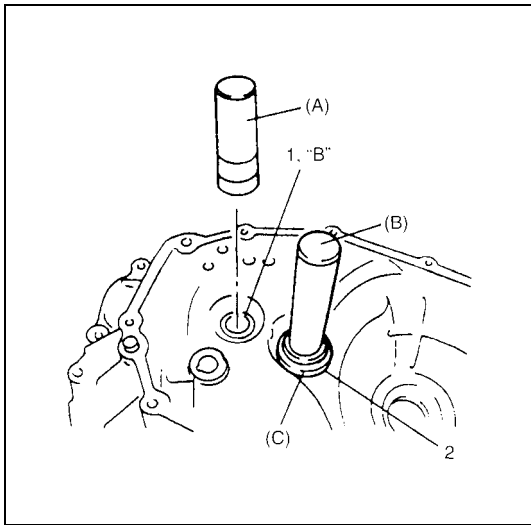
5) Replace differential side oil seal from right case referring to “Differential Side Oil Seal Replacement” in this section, if necessary.



## Assembly

### NOTE:

**Before installation, wash each part and apply specified transaxle oil to sliding faces of bearing and gear.**



- 1) If input shaft oil seal (1) has been removed, install it with its spring side facing upward.

Use special tool and hammer for installation and apply grease to oil seal lip.

**“B” : Grease 99000-25010**

### Special tool

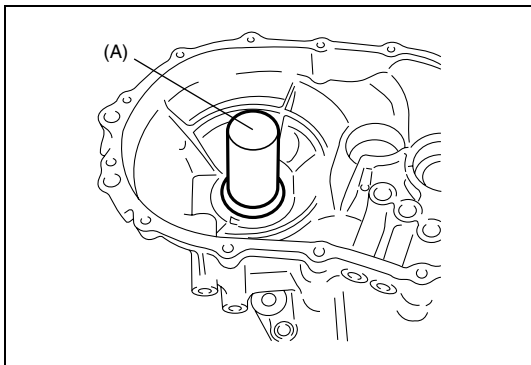
**(A) : 09913-84510**

- 2) If counter shaft right bearing cup (2) has been removed, install it using special tools and hammer.

### Special tool

**(B) : 09925-98210**

**(C) : 09924-84510**



- 3) Install differential side bearing outer race to right case using special tool and hammer.

### Special tool

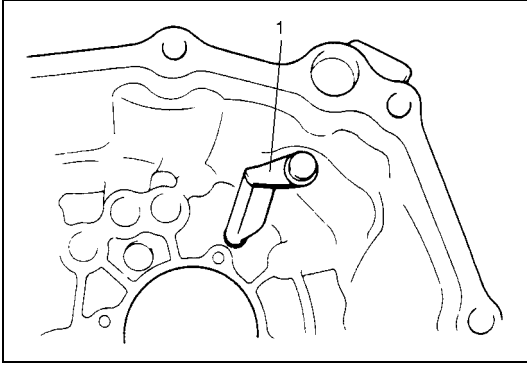
**(A) : 09913-85210**

- 4) Install gear shift shaft, input shaft and counter shaft referring to “Gear Shift Shaft, Input Shaft and Counter Shaft Removal and Installation” in this section.

## Transaxle Left Case Disassembly and Assembly

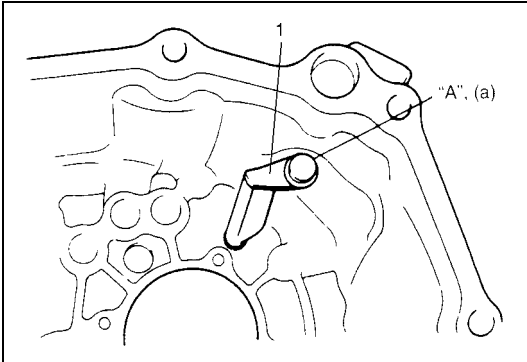
### Disassembly

- 1) Replace differential side oil seal from left case referring to “Differential Side Oil Seal Replacement” in this section, if necessary.



- 2) Remove input oil gutter (1) from left case, if necessary.

### Assembly



- 1) If input oil gutter (1) has been removed, install it with bolt to which thread lock cement have been applied.

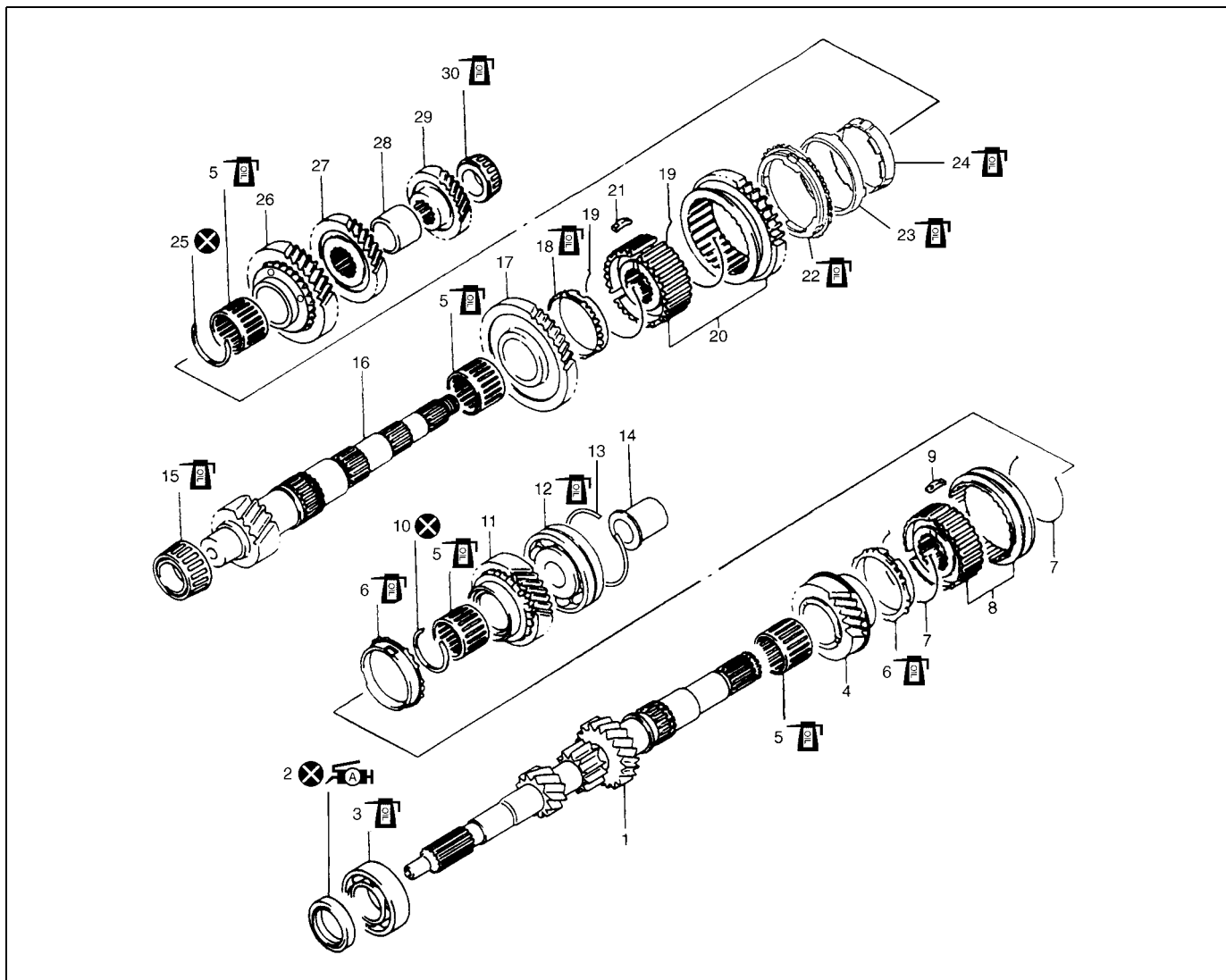
**“A” : Thread lock cement 99000-32110**

#### **Tightening torque**

**Oil gutter bolt (a) : 10 N·m (1.0 kg-m, 7.5 lb-ft)**

- 2) If differential side oil seal is removed, install it to left case referring to “Differential Side Oil Seal Replacement” in this section.

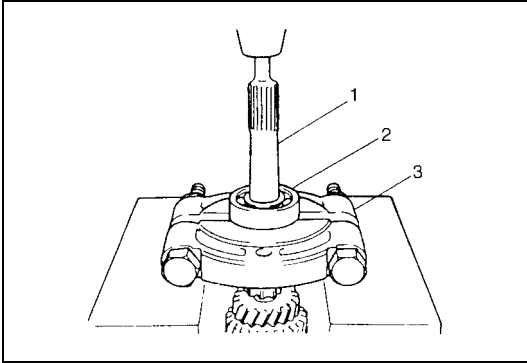
## Input & Counter Shaft Components



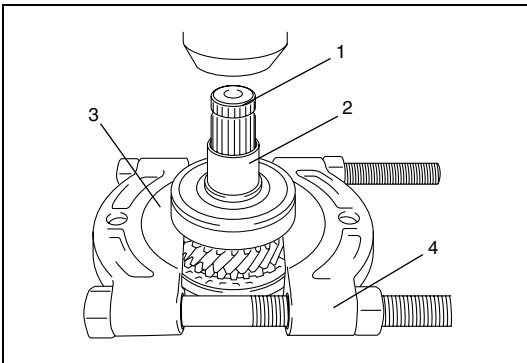
1. Input shaft	12. Input shaft left bearing	23. Center cone
2. Oil seal : Apply grease 99000-25010 to oil seal lip.	13. Circlip	24. 2nd gear synchronizer inner ring
3. Input shaft right bearing	14. 5th gear spacer	25. Circlip
4. Input shaft 3rd gear	15. counter shaft right bearing	26. counter shaft 2nd gear
5. Needle bearing (resin cage type)	16. counter shaft	27. counter shaft 3rd gear
6. High speed synchronizer ring	17. counter shaft 1st gear	28. 3rd & 4th gear spacer
7. High speed synchronizer spring	18. 1st gear synchronizer ring	29. counter shaft 4th gear
8. High speed sleeve & hub	19. Low speed synchronizer spring	30. counter shaft left bearing
9. High speed synchronizer key	20. Low speed sleeve & hub	⊗ Do not reuse.
10. Circlip	21. Low speed synchronizer key	🛢 Apply transaxle oil.
11. Input shaft 4th gear	22. 2nd gear synchronizer outer ring	

## Input Shaft Disassembly and Assembly

### Disassembly



- 1) Remove input shaft right bearing (2) from input shaft (1) using bearing puller (3) and press.

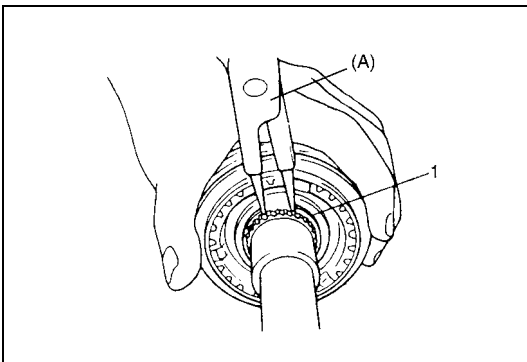


- 2) Drive out 5th gear spacer (2) and left bearing (3) from input shaft (1) using puller (4) and press.

#### CAUTION:

**To avoid gear tooth from being damaged, support it at flat side of bearing puller.**

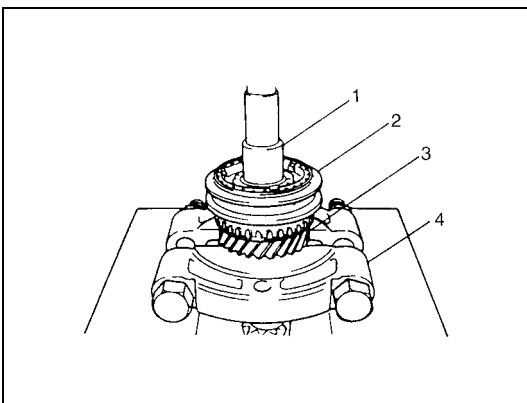
- 3) Take out 4th gear, 4th gear needle bearing of resin cage type and high speed synchronizer ring.



- 4) Using special tool, remove circlip (1).

#### Special tool

**(A) : 09900-06107**



- 5) Drive out high speed synchronizer sleeve & hub assembly (2) together with 3rd gear (3) from input shaft (1) using puller (4) and press.

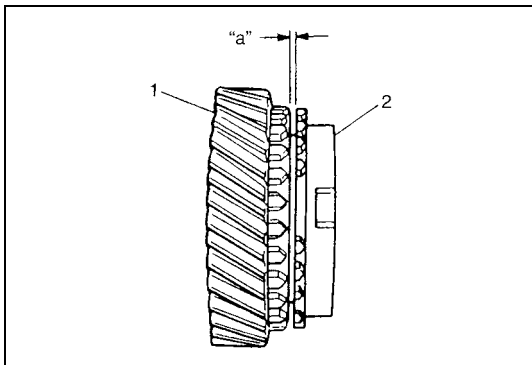
#### CAUTION:

**Make sure to use flat side of puller to avoid causing damage to 3rd gear tooth.**

- 6) Take out 3rd gear needle bearing of resin cage type from shaft.
- 7) Disassemble synchronizer sleeve & hub assembly.

### Assembly

- 1) Clean all components thoroughly, inspect them for any abnormality and replace with new ones as necessary.

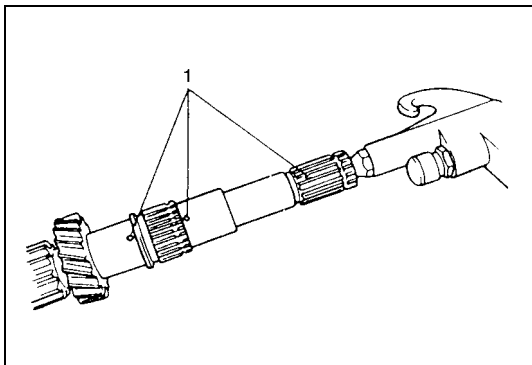


- 2) If synchronizer parts need to be repaired, check clearance "a" between ring (2) and gear (1), each chamfered tooth of gear, ring and sleeve, then determine parts replacement.

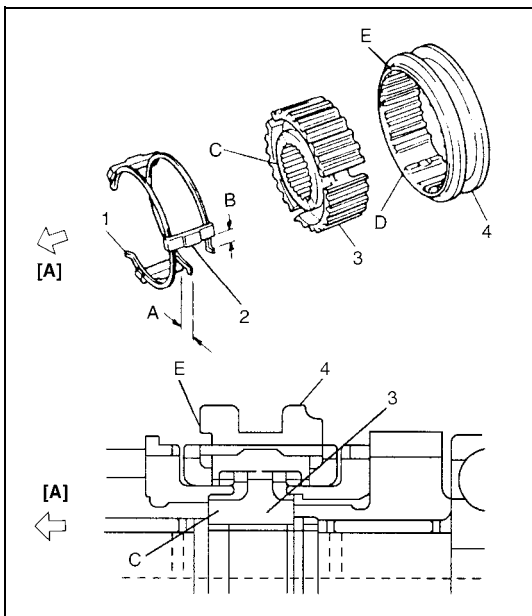
**Clearance between synchronizer ring and gear**

**Standard "a" : 1.0 – 1.4 mm (0.039 – 0.055 in.)**

**Service limit "a" : 0.5 mm (0.019 in.)**



- 3) To ensure lubrication, air blow oil holes (1) and make sure that they are free from any obstruction.



- 4) Fit high speed synchronizer sleeve (4) to hub (3), insert 3 keys (2) in it and then set springs (1) as shown in figure.

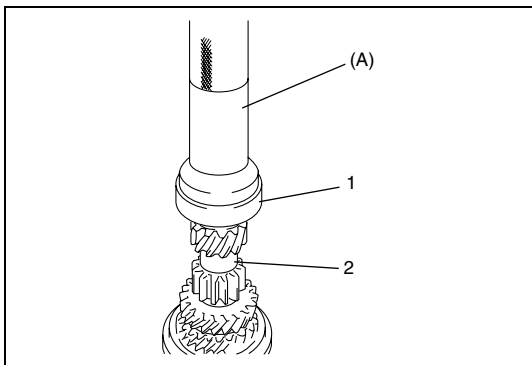
**NOTE:**

- **No specific direction is assigned to each key but it is assigned as sleeve & hub assembly.**
- **Size of high speed synchronizer sleeve, hub, keys and springs is between those of low speed and 5th speed ones.**

**Synchronizer key installation position**

**: A = B**

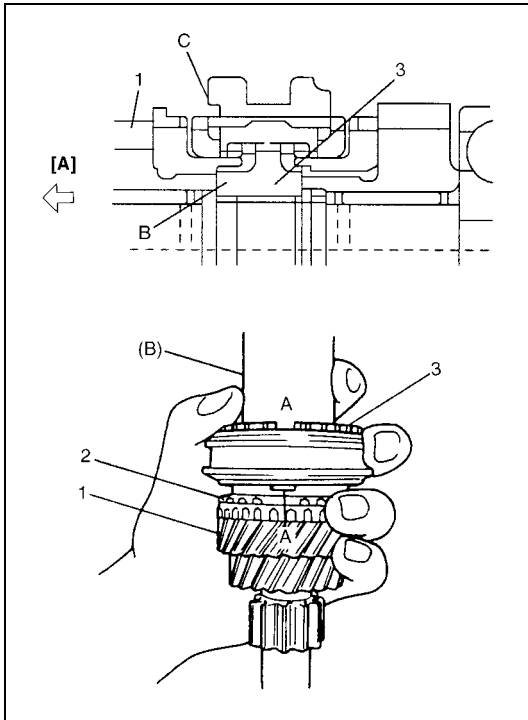
[A] : 3rd gear side
C : Long flange
D : Key way
E : Projecting end



- 5) Drive in right bearing (1) to input shaft (2) using special tool and hammer.

**Special tool**

**(A) : 09951-16080**



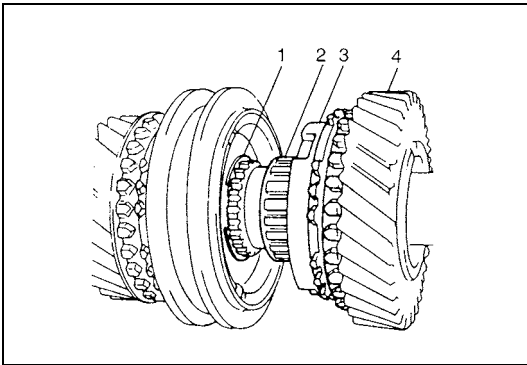
- 6) Install 3rd gear needle bearing of resin cage type, apply oil to it, then install 3rd gear (1) and synchronizer ring (2).
- 7) Drive in high speed sleeve & hub assembly (3) using special tool and hammer, facing long flange side of hub to 3rd gear.

**NOTE:**

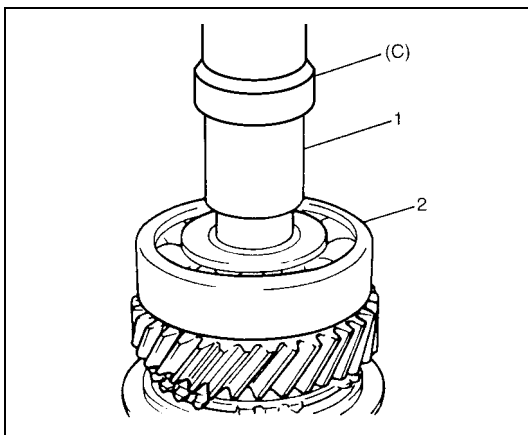
- While press-fitting sleeve & hub, make sure that synchronizer ring key slots are aligned with keys in sleeve & hub assembly.
- Check free rotation of 3rd gear after press-fitting sleeve & hub assembly.
- Synchronizer rings for 3rd and 4th are identical.

**Special tool****(B) : 09913-84510**

[A] : 3rd gear side
A : Key way
B : Long flange
C : Projecting end



- 8) Install circlip (1) and confirm that circlip is installed in groove securely.  
Install needle bearing (2) of resin cage type, apply oil to bearing and then install synchronizer ring (3) and 4th gear (4).



- 9) Press-fit left bearing (2) using special tool and hammer.

**Special tool****(C) : 09913-70123**

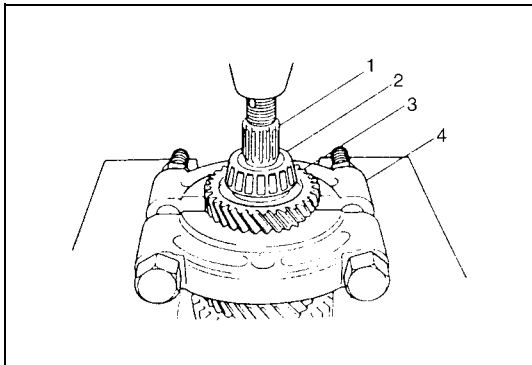
- 10) Using the same special tool at step 9), drive in 5th gear spacer (1).

**CAUTION:**

To prevent 5th gear spacer from being distorted because of excessive compression, do not press-fit it with left bearing at once.

## Counter Shaft Disassembly and Assembly

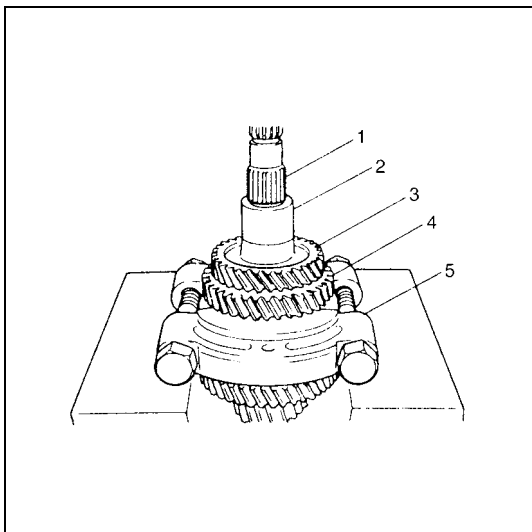
### Disassembly



- 1) Drive out left bearing cone (2) with 4th gear (3) from counter shaft (1) using puller (4) and press.

#### CAUTION:

- Use puller and press that will bear at least 5 ton (11,000 lb) safely.
- To avoid tooth damage, support 4th gear at flat side of puller.

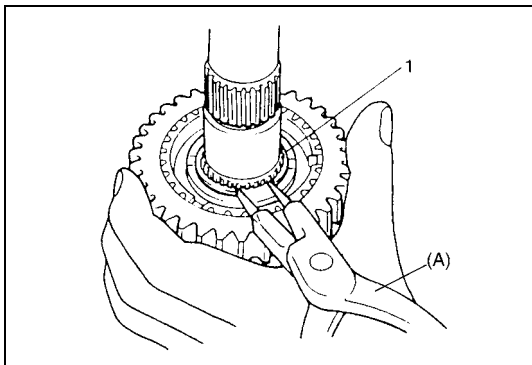


- 2) Apply puller (5) to 2nd gear (4) and drive out 3rd & 4th gear spacer (2) and 3rd gear (3) together with 2nd gear (4) from counter shaft (1) using press. Take out needle bearing of resin cage type from counter shaft.

#### CAUTION:

- If compression exceeds 5 ton (11,000 lb), release compression once, reset puller support and then continue press work again.
- To avoid gear tooth from being damaged, support it at flat side of bearing puller.

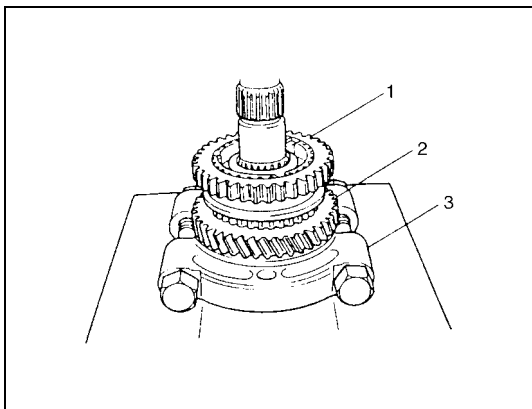
- 3) Take out 2nd synchronizer outer ring, center cone and inner ring.



- 4) Using special tool, remove circlip (1).

#### Special tool

(A) : 09900-06107

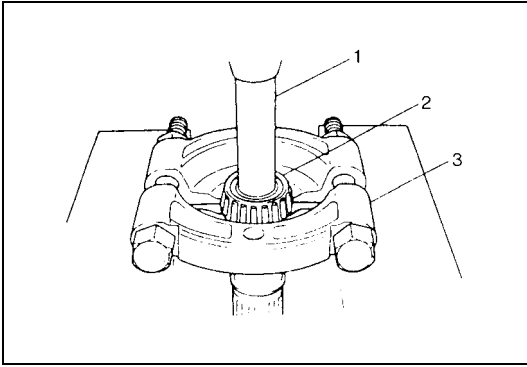


- 5) Apply puller (3) to 1st gear (2) and drive out low speed synchronizer sleeve & hub assembly (1) with 1st gear (1) using press.

#### CAUTION:

To avoid gear tooth from being damaged, support it at flat side of bearing puller.

- 6) Disassemble synchronizer sleeve & hub assembly.
- 7) Take out 1st gear needle bearing of resin cage type from shaft.



- 8) Remove right bearing cone (2) using puller (3), metal stick (1) and press.

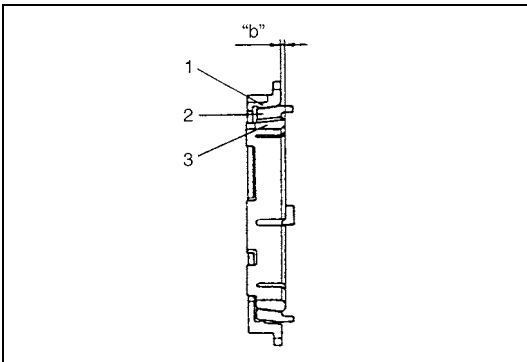
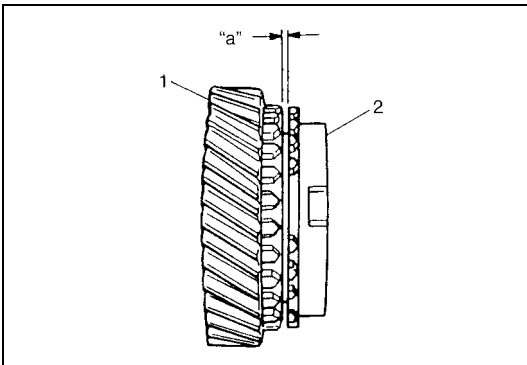
### Assembly

- 1) Clean all components thoroughly, inspect them for any abnormality and replace with new ones as necessary.
- 2) If synchronizer parts need to be repaired, check clearance "a" between ring (2) and gear (1), each chamfered tooth of gear, ring and sleeve, then determine parts replacement.

#### Clearance between synchronizer ring and gear

**Standard "a" : 1.0 – 1.4 mm (0.039 – 0.055 in.)**

**Service limit "a" : 0.5 mm (0.019 in.)**

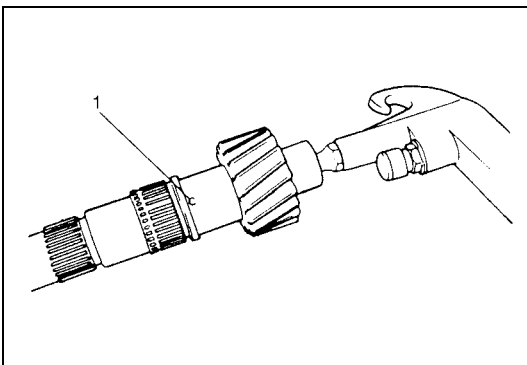


- 3) Put the synchronizer outer ring (1), inner ring (3) and the cone (2) together and then measure the step difference between the outer ring and the inner ring. And also check each chamfered tooth of gear and synchronizer ring and replace with new one, if necessary. Also, check gear tooth.

#### Difference between synchronizer outer ring and inner ring

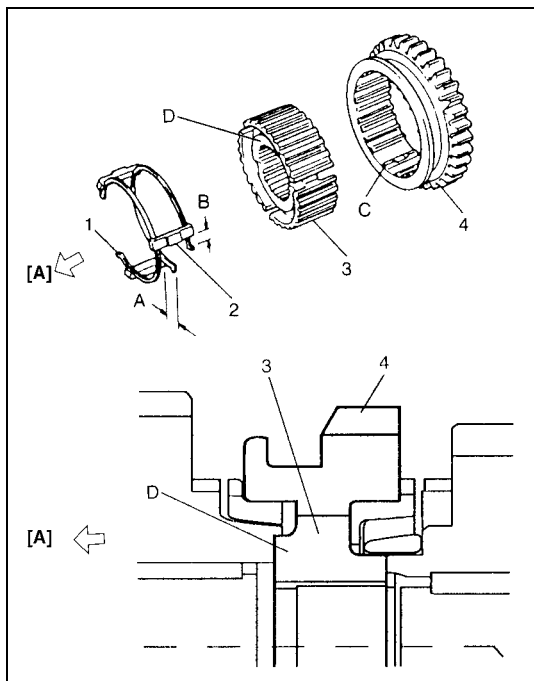
**Standard "b" : 1.0 – 1.4 mm (0.039 – 0.055 in.)**

**Service limit "b" : 0.5 mm (0.019 in.)**



- 4) To ensure lubrication, air blow oil holes (1) and make sure that they are free from any obstruction.





- 5) Fit low speed synchronizer sleeve (4) to hub (3), insert 3 keys (2) in it and then set springs (1) as shown in figure.

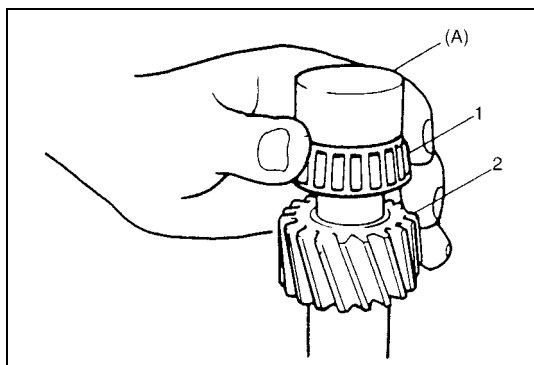
**NOTE:**

- No specific direction is assigned to each key but it is assigned as sleeve & hub assembly.
- Size of low speed synchronizer keys and springs are the largest compared with those of high speed and 5th speed ones.

**Synchronizer key installation position**

: A = B

[A] : 1st gear side
C : Key way
D : Short flange

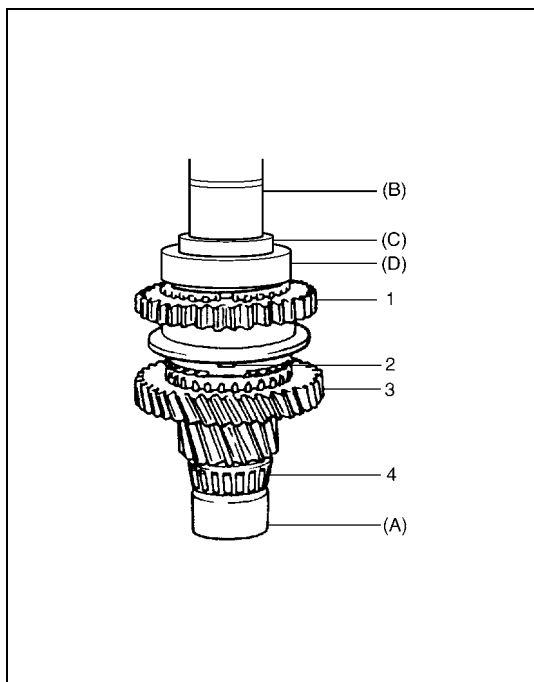


- 6) Install right bearing cone (1) to counter shaft (2) using special tool and hammer.

**Special tool**

(A) : 09923-78210

- 7) Install needle bearing of resin cage type, apply oil to it, then install 1st gear and 1st gear synchronizer ring.



- 8) Drive in low speed sleeve & hub assembly (1) using special tools and hammer, facing "B" side of sleeve to 1st gear.

**NOTE:**

- Support shaft with special tool as shown in figure so that retainer of bearing cone (4) will be free from compression.
- Make sure that synchronizer ring (2) key slots are aligned with keys while press-fitting sleeve & hub assembly.
- Check free rotation of 1st gear (3) after press-fitting sleeve & hub assembly.

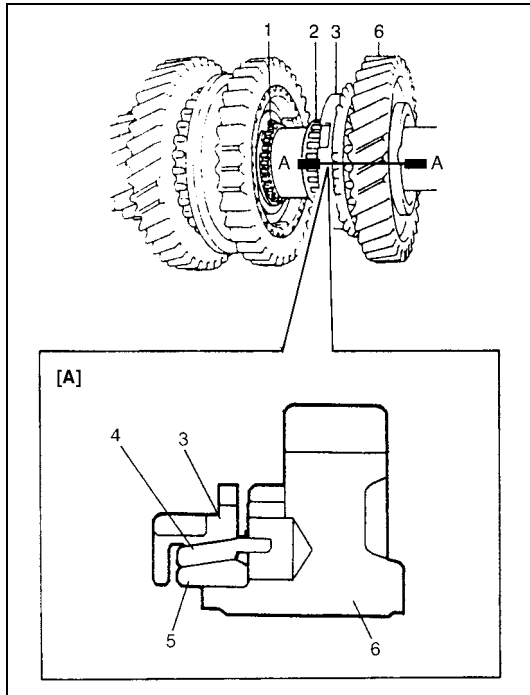
**Special tool**

(A) : 09923-78210

(B) : 09940-51710

(C) : 09924-07730

(D) : 09924-07710

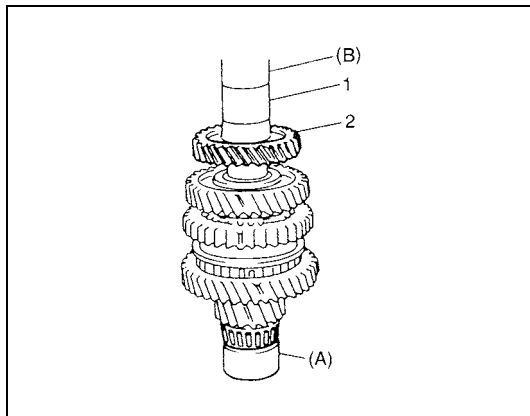


- 9) Install circlip (1) and confirm that circlip is installed in groove securely.

Install needle bearing (2) of separated steel cage type, apply oil to bearing.

With synchronizer outer ring (3), center cone (4) & inner ring (5) put together and installed to 2nd gear (6) as shown in figure.

[A]: SECTION A - A



- 10) Press-fit 3rd gear (2) and spacer (1) using special tools and press.

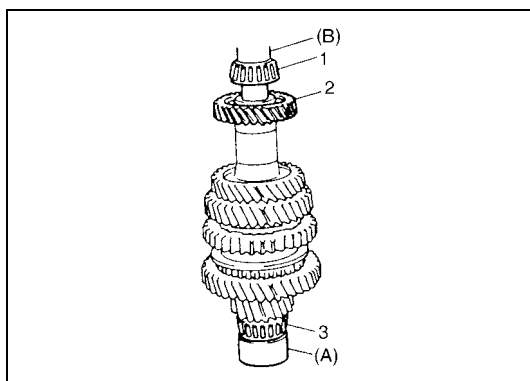
**CAUTION:**

**Press-fit 3rd gear (2) and spacer (1) first, and then 4th gear later separately so that counter shaft will not be compressed excessively.**

**Special tool**

(A) : 09923-78210

(B) : 09913-84510



- 11) Press-fit 4th gear (2) using the same procedure as step 10).  
12) Install left bearing cone (1) using special tools and hammer.

**NOTE:**

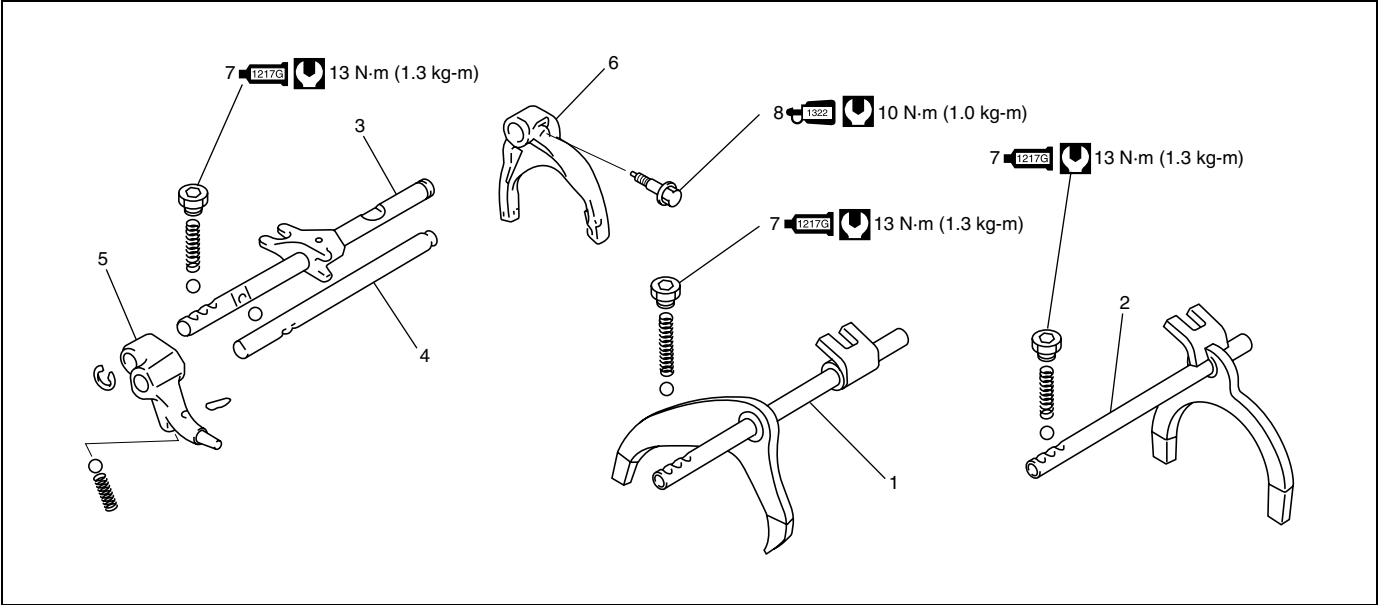
**For protection of right bearing cone (3), always support shaft with special tool as illustrated.**

**Special tool**

(A) : 09923-78210

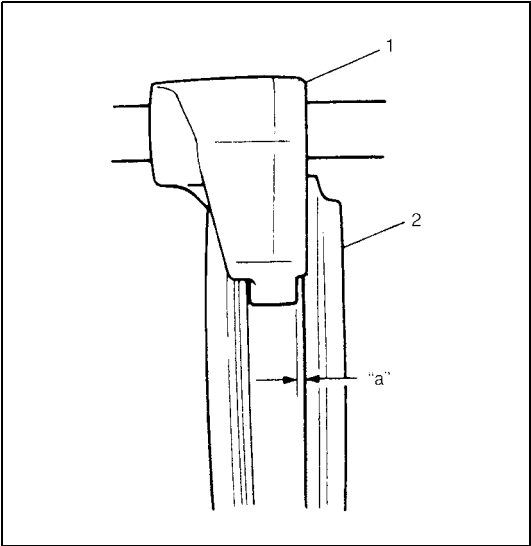
(B) : 09913-80113

Gear Shift Shaft Components



1. Low speed gear shift shaft	4. 5th & reverse gear shift guide shaft	13 N-m (1.3 kg-m)	7. Gear shift locating bolt : Apply sealant 99000-31260 to bolt thread.
2. High speed gear shift shaft	5. Reverse gear shift arm	10 N-m (1.0 kg-m)	8. Shift fork bolt : Apply thread lock 99000-32110 to bolt thread.
3. 5th & reverse gear shift shaft	6. 5th gear shift fork	13 N-m (1.3 kg-m)	Tightening torque

High Speed and Low Speed Gear Shift Shafts Inspection



- 1) Using feeler gauge, check clearance between fork (1) and sleeve (2) and replace those parts if it exceeds limit below.

**NOTE:**  
For correct judgement of parts replacement, carefully inspect contact portion of fork and sleeve.

**Clearance between fork and sleeve**  
**Service limit “a” : 1.0 mm (0.039 in.)**

- 2) Insert each gear shift shaft into case and check that it moves smoothly. If it doesn't, correct using oilstone, reamer or the like.

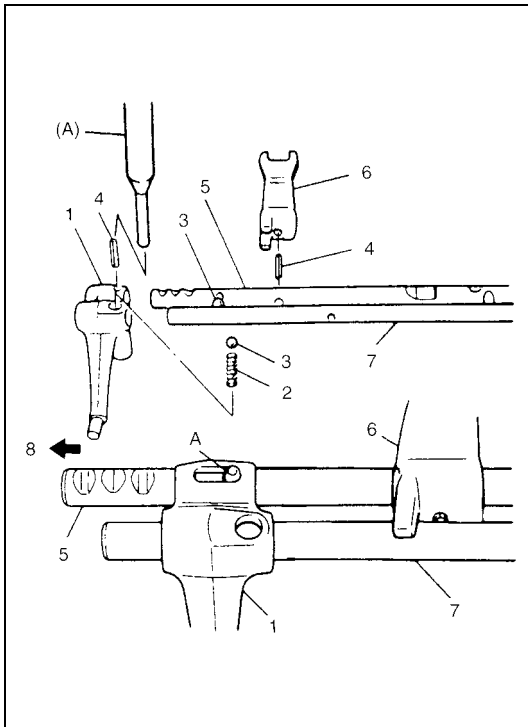
## Disassembly

**Special tool**  
**(A) : 09922-85811**

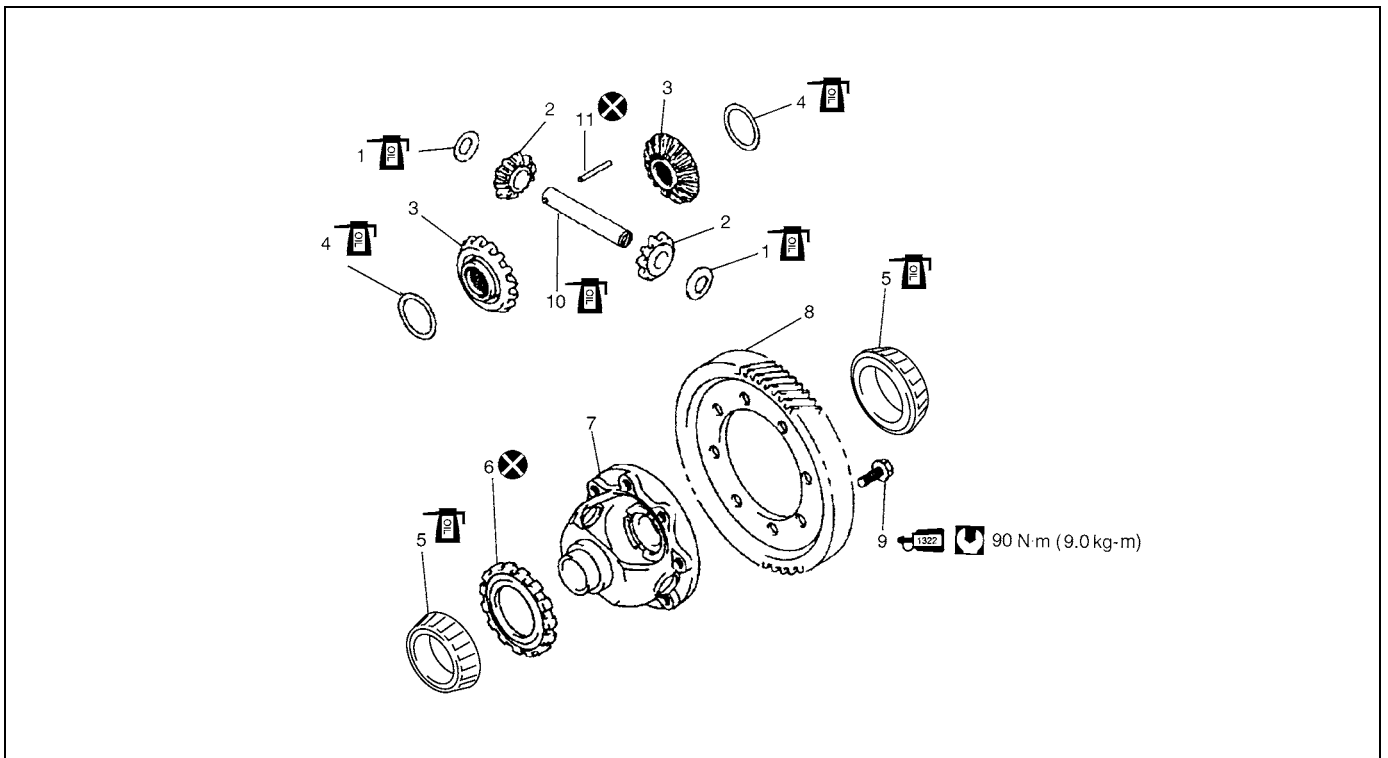
Replace or correct parts as required and assemble shafts making sure that component parts are in proper order as shown in figure.




- Distinguish reverse gear shift arm spring (Blue) (2) from low speed locating spring (Yellow).
- Install 2 steel balls (3) in reverse gear shift arm (1) without fail.
- Drive in spring pin for reverse gear shift arm (1) facing slit A toward 5th gear side.

4. Spring pin	7. 5th & reverse gear shift guide shaft
5. 5th & reverse gear shift shaft	8. 5th gear side
6. 5th & reverse gear shift yoke	A: Face pin slit toward 5th gear side



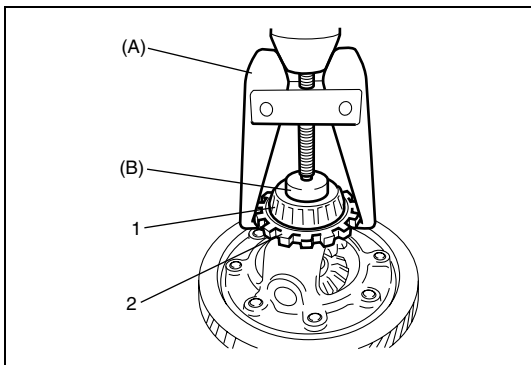
## Differential Components



1. Differential pinion washer	8. Final gear
2. Differential side pinion gear	9. Final gear bolt : Apply thread lock 99000-32110 to all around thread part of bolt
3. Differential side gear	10. Differential pinion shaft
4. Side gear washer	11. Differential pinion shaft pin
5. Differential side bearing	 Tightening torque
6. Speed sensor ring	 Do not reuse.
7. Differential case	 Apply transaxle oil.

## Differential Disassembly and Assembly

### Disassembly



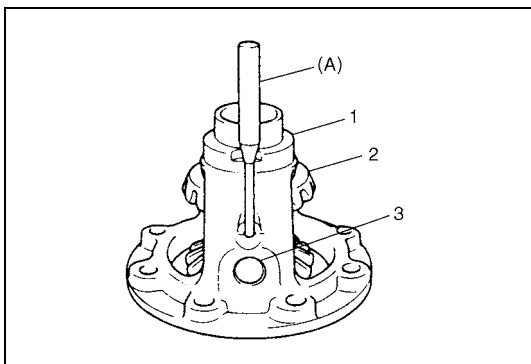
- 1) Using special tools, remove right bearing (1) and sensor rotor (2).

#### Special tool

(A) : 09913-60910

(B) : 09925-88210

- 2) Remove left bearing in the same manner at step 1).
- 3) Support differential case with soft jawed vise and remove final gear bolts then take out final gear.



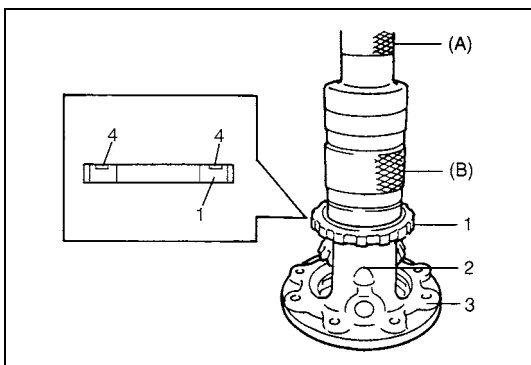
- 4) Using special tool and hammer, drive out differential pinion shaft pin and then disassemble component parts.

#### Special tool

(A) : 09922-85811

1. Differential case
2. Differential gear
3. Differential pinion shaft

### Assembly

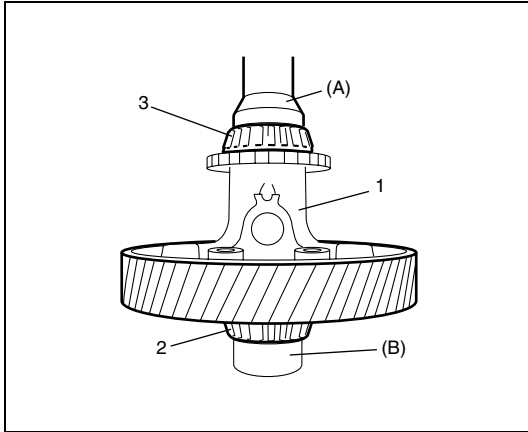


- 1) Drive in new differential pinion shaft pin (2) till the depth from differential case (3) surface is about 1 mm (0.04 in.).
- 2) Press-fit new sensor rotor (1) with groove (4) upward using special tools and copper hammer.

#### Special tool

(A) : 09913-76010

(B) : 09940-54910



- 3) Press-fit left bearing (2) using special tools and copper hammer.

**Special tool**

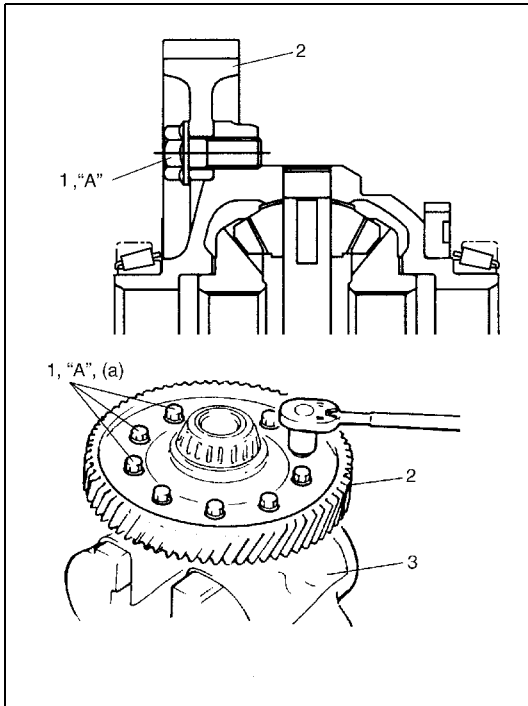
(A) : 09913-76010

- 4) Support differential assembly (1) as illustrated so as to left bearing (2) is floating, and then press-fit right bearing (3) using special tool.

**Special tool**

(A) : 09913-76010

(B) : 09951-16060



- 5) Hold differential assembly with soft jawed vise (3), install final gear (2) as shown in figure and then tighten bolts (1) with thread lock cement applied to specified torque. Apply thread lock cement to bolt thread when reusing bolts.

**CAUTION:**

Use of any other bolts than specified ones is prohibited.

“A” : Thread lock cement 99000-32110

**Tightening torque**

Final gear bolt (a) : 90 N·m (9.0 kg·m, 65.0 lb·ft)

## Differential Adjustment

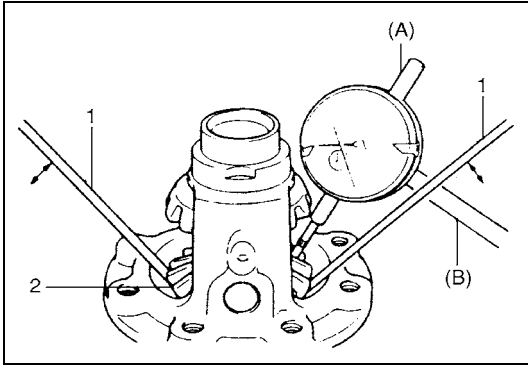
Judging from abnormality noted before disassembly and what is found through visual check of component parts after disassembly, prepare replacing parts and proceed to reassembly. Make sure that all parts are clean.

- 1) Assemble differential gear and measure thrust play of differential gear as follows.

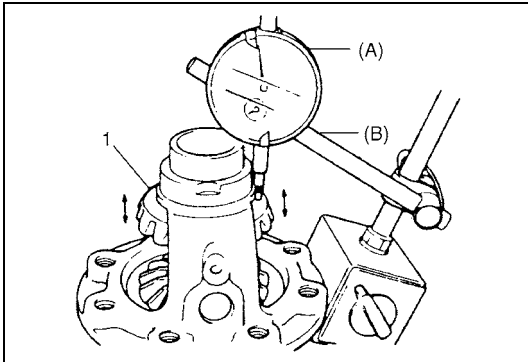
**Differential gear thrust play**

: 0.03 – 0.31 mm (0.001 – 0.012 in.)

- For left side



- Hold differential assembly with soft jawed vise and apply measuring tip of dial gauge to top surface of gear.
- Using 2 screwdrivers (1), move gear (2) up and down and read movement of dial gauge pointer.

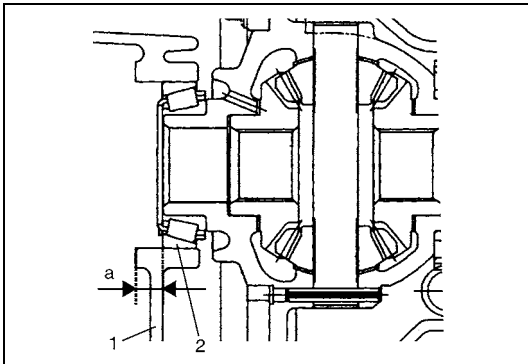
**Special tool****(A) : 09900-20606****(B) : 09900-20701**

- For right side

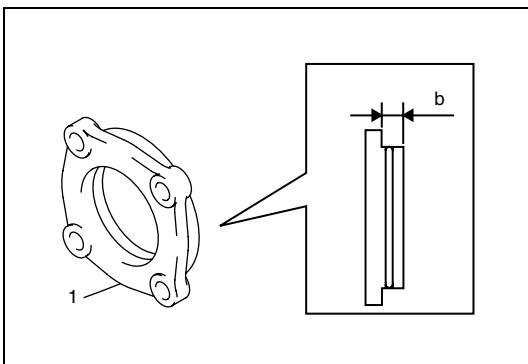
- Using similar procedure to the above, set dial gauge tip to gear (1) shoulder.
- Move gear up and down by hand and read dial gauge.

**Special tool****(A) : 09900-20606****(B) : 09900-20701**

- If thrust play is out of specification, select suitable thrust washer from among the following available size, install it and check again that specified gear play is obtained.

**Available thrust washer thickness****0.9, 0.95, 1.0, 1.05, 1.1 and 1.15 mm****(0.035, 0.037, 0.039, 0.041, 0.043 and 0.045 in.)**

- Measure depth "a" from left case (1) face to side bearing outer race (2) using depth gauge.



- Measure height "b" of side bearing retainer (1) with depth gauge.

- 5) Calculate clearance a – b, and select differential shim according to the following table.

#### Bearing shim

Clearance a – b	Thickness of bearing shim to be installed
0.636 – 0.665 mm (0.0250 – 0.0261 in.)	0.75 mm (0.030 in.)
0.666 – 0.695 mm (0.0262 – 0.0273 in.)	0.78 mm (0.031 in.)
0.696 – 0.725 mm (0.0274 – 0.0285 in.)	0.81 mm (0.032 in.)
0.726 – 0.755 mm (0.0286 – 0.0297 in.)	0.84 mm (0.033 in.)
0.756 – 0.785 mm (0.0298 – 0.0309 in.)	0.87 mm (0.034 in.)
0.786 – 0.815 mm (0.0310 – 0.0320 in.)	0.90 mm (0.035 in.)
0.816 – 0.845 mm (0.0321 – 0.0332 in.)	0.93 mm (0.037 in.)
0.846 – 0.875 mm (0.0333 – 0.0344 in.)	0.96 mm (0.038 in.)
0.876 – 0.905 mm (0.0345 – 0.0356 in.)	0.99 mm (0.039 in.)
0.906 – 0.935 mm (0.0357 – 0.0368 in.)	1.02 mm (0.040 in.)
0.936 – 0.965 mm (0.0369 – 0.0379 in.)	1.05 mm (0.041 in.)
0.966 – 0.995 mm (0.0380 – 0.0391 in.)	1.08 mm (0.043 in.)
0.996 – 1.025 mm (0.0392 – 0.0403 in.)	1.11 mm (0.044 in.)
1.026 – 1.055 mm (0.0404 – 0.0415 in.)	1.14 mm (0.045 in.)
1.056 – 1.085 mm (0.0416 – 0.0427 in.)	1.17 mm (0.046 in.)
1.086 – 1.115 mm (0.0428 – 0.0438 in.)	1.20 mm (0.047 in.)
1.116 – 1.145 mm (0.0439 – 0.0450 in.)	1.23 mm (0.048 in.)
1.146 – 1.175 mm (0.0451 – 0.0462 in.)	1.26 mm (0.050 in.)
1.176 – 1.205 mm (0.0463 – 0.0474 in.)	1.29 mm (0.051 in.)
1.206 – 1.235 mm (0.0475 – 0.0486 in.)	1.32 mm (0.052 in.)
1.236 – 1.265 mm (0.0487 – 0.0498 in.)	1.35 mm (0.053 in.)
1.266 – 1.295 mm (0.0499 – 0.0509 in.)	1.38 mm (0.054 in.)
1.296 – 1.325 mm (0.0510 – 0.0521 in.)	1.41 mm (0.056 in.)

## Tightening Torque Specification

Fastening part	Tightening torque		
	N•m	kg-m	lb-ft
Transaxle oil level/filler and drain plugs	21	2.1	15.5
Oil gutter bolt	10	1.0	7.5
Final gear bolt	90	9.0	65.0
Reverse gear shift lever bolt	23	2.3	17.0
Transaxle case bolt	23	2.3	17.0
Reverse shaft bolt	23	2.3	17.0
Gear shift locating bolt	13	1.3	9.5
Left case plate bolt	23	2.3	17.0
Counter shaft nut	100	10.0	75.0
Side cover bolt	10	1.0	7.5
Gear shift guide case bolt	23	2.3	17.0
Side fork bolt	10	1.0	7.5

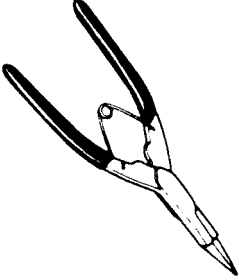
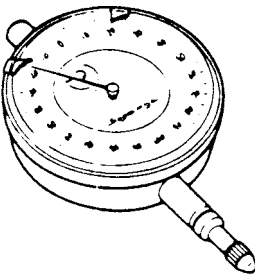
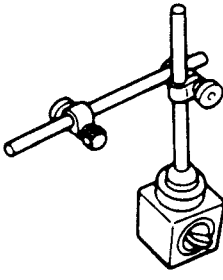
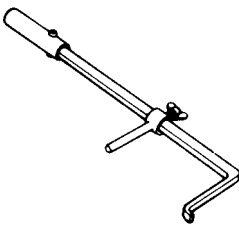
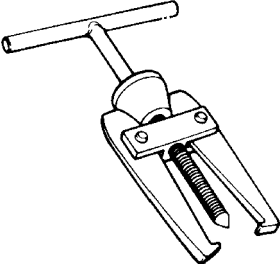
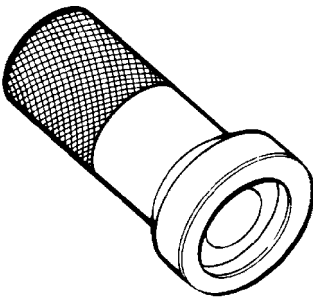
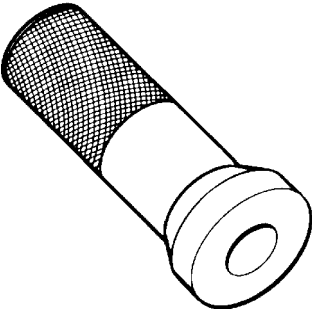
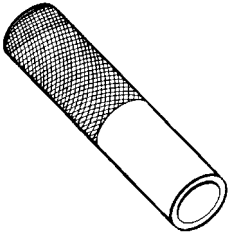
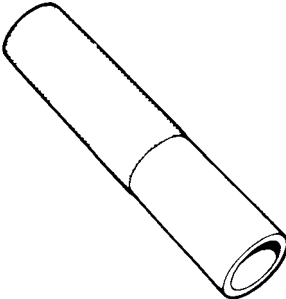
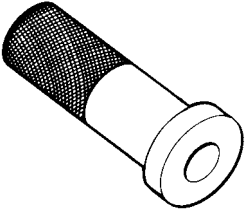
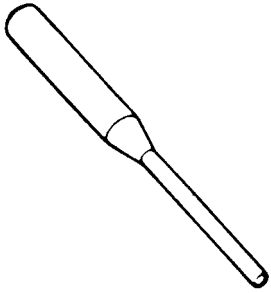
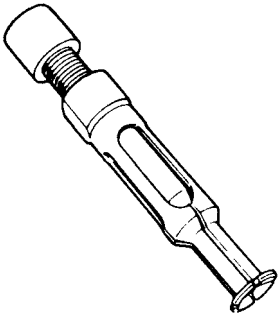
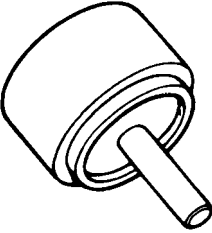
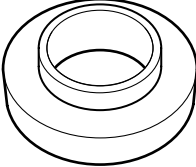
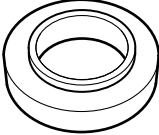
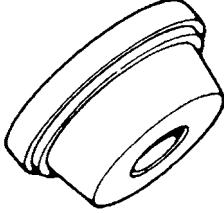


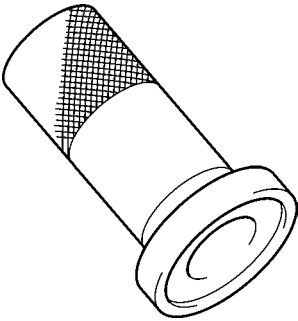
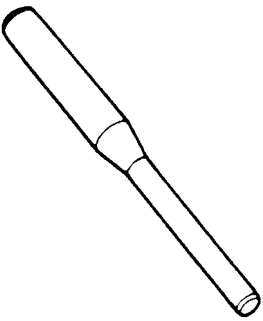
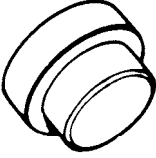
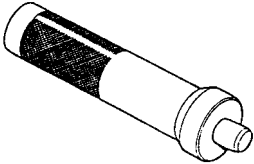
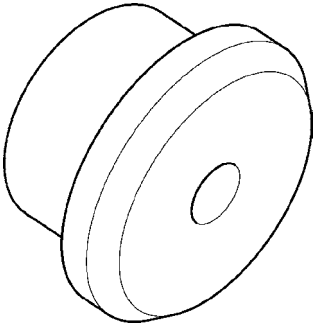
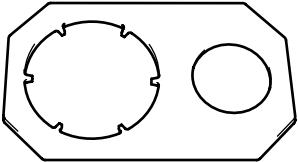
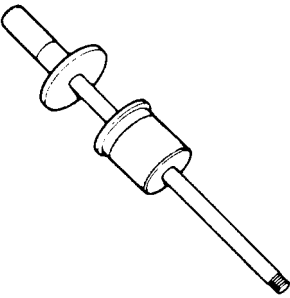
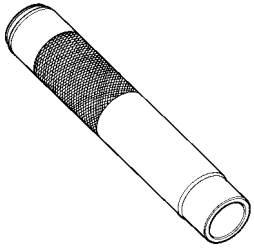

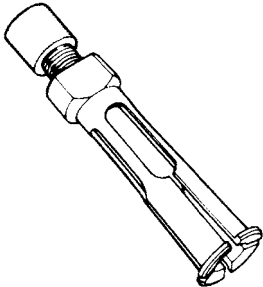
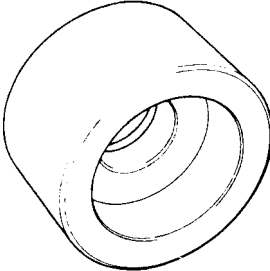
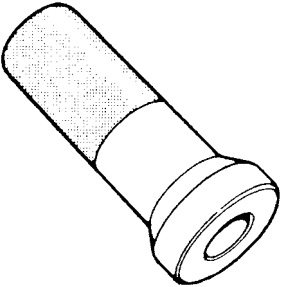
Fastening part	Tightening torque		
	N•m	kg-m	lb-ft
Gear shift interlock bolt	23	2.3	17.0
5th to reverse interlock guide bolt	23	2.3	17.0
Back up lamp switch	23	2.3	17.0
Gear shift control lever assembly mounting nut	13	1.3	9.5
Cable lock nut	5.5	0.55	4.0
Cable mounting bolt	5.5	0.55	4.0
Cable bracket bolt	55	5.5	42.0
Transaxle to engine bolt	61	6.1	45.0
Engine left mounting bracket bolt	55	5.5	42.0
Stiffener bolt	10	1.0	7.5
Engine rear mounting bolt	55	5.5	42.0
Engine rear mounting No.2 bracket bolt	55	5.5	42.0
Transaxle to engine rear mounting No.2 bracket bolt	55	5.5	42.0
Transaxle to engine nut	61	6.1	45.0
Clutch housing lower plate bolt	55	5.5	42.0
VSS bolt	5.5	0.55	4.0
Select lever bracket bolt	23	2.3	17.5
Side bearing retainer bolt	23	2.3	17.0

## Required Service Material

Material	Recommended SUZUKI product (Part Number)	Use
Lithium grease	SUZUKI SUPER GREASE A (99000-25010)	<ul style="list-style-type: none"> <li>Oil seal lips</li> <li>O-rings</li> <li>Select lever boss</li> <li>Select lever shaft bush</li> </ul>
Sealant	SUZUKI BOND NO.1217G (99000-31260)	<ul style="list-style-type: none"> <li>Oil drain plug and filler/level plug</li> <li>Locating spring bolts</li> <li>Mating surface of transaxle case</li> <li>Mating surface of side cover</li> <li>Gear shift interlock bolt</li> <li>5th to reverse interlock guide bolt</li> <li>Guide case bolts</li> </ul>
Thread lock cement	THREAD LOCK 1322 (99000-32110)	<ul style="list-style-type: none"> <li>Reverse gear shift lever bolts</li> <li>Oil gutter bolt</li> <li>Reverse shaft bolt</li> <li>Final gear bolts</li> <li>Left case plate bolts</li> <li>Shift fork bolt</li> </ul>

## Special Tool

 <p>09900-06107 Snap ring pliers (Opening type)</p>	 <p>09900-20606 Dial gauge</p>	 <p>09900-20701 Magnetic stand</p>	 <p>09913-50121-000 Oil seal remover</p>
 <p>09913-60910 Bearing puller</p>	 <p>09913-70123-000 Bearing installing tool</p>	 <p>09913-76010-000 Differential bearing race installer</p>	 <p>09913-80113 Bearing installer</p>
 <p>09913-84510 Bearing installer</p>	 <p>09913-85210-000 Bearing pulling holder</p>	 <p>09922-85811 Spring pin remover 4.5 mm (0.18 in.)</p>	 <p>09923-74510 Bearing remover</p>
 <p>09923-78210 Bearing installer</p>	 <p>09924-07710-000 Synchronizer hub, installer</p>	 <p>09924-07730-000 Bearing installer</p>	 <p>09924-84510-004 Installer, bearing</p>

 <p>09925-15410-000 Oil seal installer</p>	 <p>09925-78210 Spring pin remover 6 mm (0.24 in.)</p>	 <p>09925-88210 Bearing puller attachment</p>	 <p>09925-98210-000 Installer, input shaft bearing</p>
 <p>09926-27610-000 Oil seal installer</p>	 <p>09927-76060-000 Gear holder</p>	 <p>09930-30104 Sliding shaft</p>	 <p>09940-51710-000 Bearing, installer</p>
 <p>09940-54910 Sensor rotor installer</p>	 <p>09941-64511 Bearing remover</p>	 <p>09951-16060 Bush remover</p>	 <p>09951-16080-000 Installer, bearing</p>

## SECTION 7B

## AUTOMATIC TRANSAXLE

**WARNING:**

For vehicles equipped with Supplemental Restraint (Air Bag) System :

- Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to “System Components and Wiring Location View” under “General Description” in Section 10B in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and “Service Precautions” under “On-Vehicle Service” in Section 10B before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.
- Technical service work must be started at least 90 seconds after the ignition switch is turned to the “LOCK” position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).

7B

## CONTENTS

<b>General Description .....</b>	<b>7B-3</b>	Road Test .....	7B-34
Specifications .....	7B-5	Manual Road Test.....	7B-37
Clutch/Brake/Planetary Gear .....	7B-6	Engine Brake Test .....	7B-38
Functions.....	7B-6	Stall Test .....	7B-39
Table of Component Operation.....	7B-7	Time Lag Test.....	7B-40
Electronic Shift Control System.....	7B-8	Line Pressure Test.....	7B-41
Transmission Control Module (TCM) .....	7B-10	“P” Range Test.....	7B-42
Operation of shift solenoid valves, timing solenoid valve and TCC solenoid valve.....	7B-11	Diagnostic Flow Table A-1: No Gear Shift to O/D .....	7B-43
Automatic gear shift diagram.....	7B-12	Diagnostic Flow Table A-2: No Lock-Up Occurs.....	7B-44
<b>Diagnosis .....</b>	<b>7B-13</b>	Diagnostic Flow Table A-3: “O/D OFF” Lamp Circuit Check (“O/D OFF” Lamp Lights Steadily) .....	7B-45
General Description .....	7B-13	Diagnostic Flow Table A-4: “O/D OFF” Lamp Circuit Check (“O/D OFF” Lamp Does Not Light Anytime) .....	7B-47
On-board Diagnostic System .....	7B-14	Diagnostic Flow Table A-5: TCM Power and Ground Circuit Check.....	7B-48
Precaution in Diagnosing Trouble .....	7B-15	DTC P0705 Transmission Range Sensor Circuit Malfunction .....	7B-50
Automatic Transaxle Diagnostic Flow Table .....	7B-16	DTC P0707 Transmission Range Sensor Circuit Low .....	7B-53
“O/D OFF” Lamp Check .....	7B-20	DTC P0712 Transmission Fluid Temperature Sensor Circuit Low .....	7B-56
Malfunction Indicator Lamp (MIL) Check .....	7B-20	DTC P0713 Transmission Fluid Temperature Sensor Circuit High .....	7B-58
Diagnostic Trouble Code (DTC) Check.....	7B-20	DTC P0717 Input/Turbine Speed Sensor Circuit Malfunction .....	7B-60
Diagnostic Trouble Code (DTC) Clearance .....	7B-21	DTC P0722 Output Speed Sensor (VSS) Circuit No Signal .....	7B-62
Diagnostic Trouble Code (DTC) Table.....	7B-22		
Fail Safe Table .....	7B-24		
Visual Inspection .....	7B-26		
Automatic Transaxle Basic Check .....	7B-27		
Trouble Diagnosis Table .....	7B-28		
Trouble diagnosis table-1 .....	7B-28		
Trouble diagnosis table-2 .....	7B-31		
Trouble diagnosis table-3 .....	7B-33		

DTC P0741/P0742 TCC Circuit Performance or Stuck OFF/TCC Circuit Stuck ON.....	7B-65	Input Shaft Speed Sensor.....	7B-99
DTC P0751/P0752/P0756/P0757 Shift Solenoid-A (No.1) Performance or Stuck OFF/Shift Solenoid-A (No.1) Stuck ON/Shift Solenoid-B (No.2) Performance or Stuck OFF/Shift Solenoid-B (No.2) Stuck ON.....	7B-66	Throttle Position Sensor .....	7B-99
DTC P0785 Timing Solenoid.....	7B-68	Engine Coolant Temperature Sensor .....	7B-100
DTC P0962 Pressure Control Solenoid Control Circuit Low.....	7B-70	O/D Off Switch .....	7B-100
DTC P0963 Pressure Control Solenoid Control Circuit High.....	7B-72	Solenoid Valves (Shift Solenoid Valves, TCC Solenoid Valve and Timing Solenoid Valve).....	7B-101
DTC P0974/P0977 Shift Solenoid-A (No.1) Control Circuit High/Shift Solenoid-B (No.2) Control Circuit High .....	7B-74	Pressure Control Solenoid Valve.....	7B-106
DTC P1701 CAN Communication Error.....	7B-76	Transmission Control Module (TCM) .....	7B-109
DTC P1702 Internal Control Module Memory Check Sum Error.....	7B-78	A/T Relay .....	7B-110
DTC P1703 CAN Invalid Data-TCM.....	7B-78	Transmission Fluid Temperature Sensor .....	7B-111
DTC P2769 Torque Converter Clutch (TCC) Circuit Low.....	7B-79	Differential Side Oil Seal .....	7B-113
DTC P2770 Torque Converter Clutch (TCC) Circuit High.....	7B-81	Automatic Transaxle Assembly .....	7B-115
Scan Tool Data .....	7B-83	<b>Unit Repair.....</b>	<b>7B-118</b>
Inspection of TCM and Its Circuits .....	7B-87	Precautions.....	7B-118
<b>On-Vehicle Service .....</b>	<b>7B-91</b>	Part Inspection and Correction Table.....	7B-119
Maintenance Service.....	7B-91	Unit Disassembly .....	7B-120
Fluid level check at normal operating (hot) temperature (Hot check) .....	7B-91	Components.....	7B-120
Fluid level check at room (cold) temperature (Cold check).....	7B-92	Disassembly/Assembly of Subassembly .....	7B-141
Fluid change.....	7B-92	Oil pump assembly .....	7B-142
A/T fluid cooler hoses.....	7B-93	Direct clutch assembly .....	7B-146
Selector Lever.....	7B-94	Forward and reverse clutch assembly.....	7B-151
Select Cable.....	7B-95	2nd brake piston assembly .....	7B-159
Transmission Range Sensor (Shift Switch).....	7B-97	Transaxle rear cover assembly (O/D and 2nd coast brake piston) .....	7B-161
Output Shaft Speed Sensor (VSS).....	7B-98	Differential Assembly .....	7B-164
		Countershaft assembly .....	7B-168
		Valve body assembly .....	7B-170
		Torque converter housing .....	7B-172
		Transaxle case.....	7B-175
		Adjustment before unit assembly.....	7B-177
		Unit Assembly .....	7B-180
		<b>Tightening Torque Specification.....</b>	<b>7B-203</b>
		<b>Special Tool.....</b>	<b>7B-204</b>
		<b>Required Service Material.....</b>	<b>7B-206</b>

## General Description

This automatic transaxle is electronic control full automatic transaxle with forward 3-speed plus overdrive (O/D) and reverse 1-speed.

The torque converter is a 3-element, 1-step and 2-phase type and is equipped with an automatically controlled lock-up mechanism.

The gear change device consists of a ravigneau type planetary gear unit, 3 multiple disc type clutches, 3 multiple disc type brakes and 2 one-way clutches.

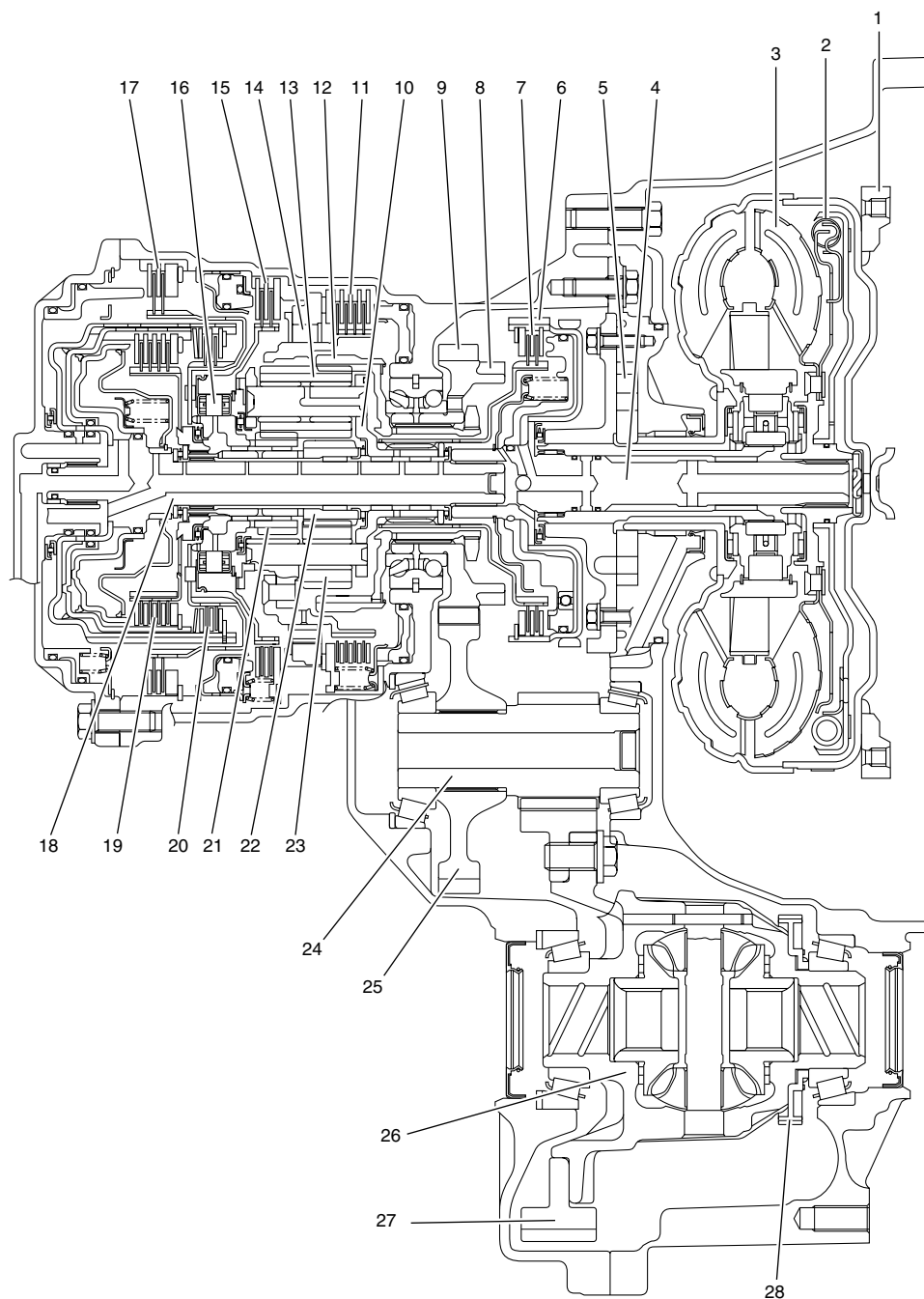
The hydraulic pressure control device consists of a valve body assembly, pressure control solenoid valve (linear solenoid), 2 shift solenoid valves, TCC (lock-up) solenoid valve and a timing solenoid valve. Optimum line pressure complying with engine torque is produced by the pressure control solenoid valve in dependence upon control signal from transmission control module (TCM). This makes it possible to control the line pressure with high accuracy in accordance with the engine power and running conditions to achieve smooth shifting characteristics and high efficiency.

A clutch-to-clutch control system is provided for shifting between 3rd gear and 4th gear. This clutch-to-clutch control system is made to function optimally, so that hydraulic pressure controls such as shown below are conducted.

- When upshifting from 3rd gear to 4th gear, to adjust the drain hydraulic pressure at releasing the forward clutch, a timing solenoid valve is used to switch a hydraulic passage with an orifice to another during shifting.
- When downshifting from 4th gear to 3rd gear, to adjust the line pressure applied to the forward clutch at engaging the forward clutch, a timing solenoid valve is used to switch a hydraulic passage with an orifice to another during shifting.
- When upshifting from 3rd gear to 4th gear with engine throttle opened, to optimize the line pressure applied to the forward clutch at releasing the forward clutch, the learning control is processed to compensate the switching timing of the timing solenoid at every shifting.
- When downshifting from 4th gear to 3rd gear with engine throttle opened, to optimize the line pressure applied to the forward clutch at engaging the forward clutch, the learning control is processed to compensate the line pressure every shifting.

Employing a ravigneau type planetary gear unit and this clutch-to-clutch control system greatly simplifies the construction to make possible a lightweight and compact transaxle.

A line pressure learning control is conducted to provide optimum shifting time at every upshifting with engine throttle opened. If long upshifting time is detected, the subsequent line pressure applied during upshifting is intensified. On the contrary, if short upshifting time is detected, the subsequent line pressure applied during upshifting is weakened.



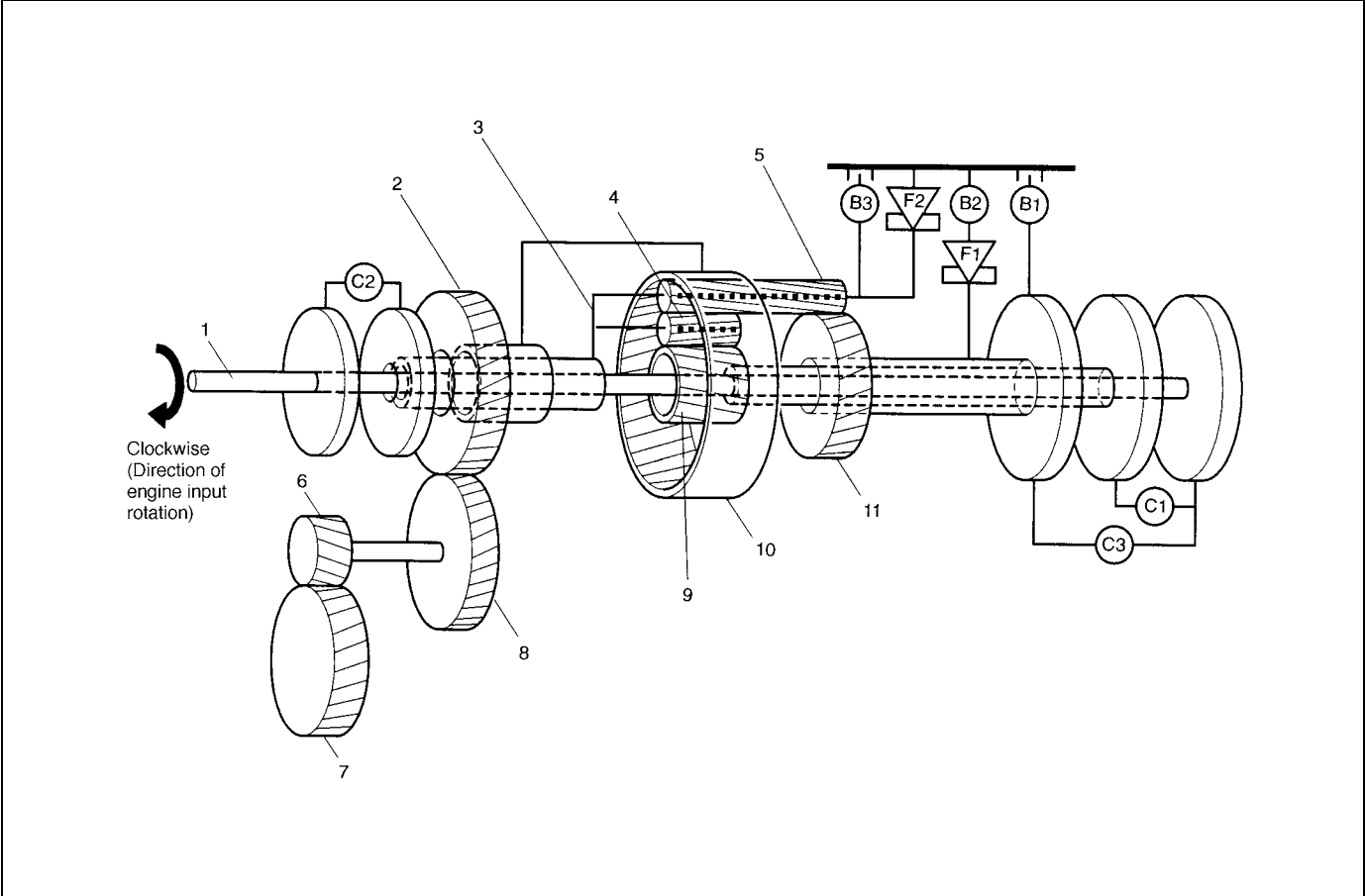
1. Drive plate	11. 1st and reverse brake	21. Rear sun gear
2. Torque converter clutch (TCC)	12. Ring gear	22. Front sun gear
3. Torque converter	13. Long planet pinion	23. Short planet pinion
4. Input shaft	14. One-way No.2 clutch	24. Countershaft
5. Oil pump	15. 2nd brake	25. Reduction driven gear
6. Direct clutch drum (double as sensor rotor for input shaft speed sensor)	16. One-way No.1 clutch	26. Differential case assembly
7. Direct clutch	17. O/D and 2nd coast brake	27. Final gear
8. Parking lock gear	18. Intermediate shaft	28. Output shaft speed sensor (VSS) drive gear
9. Reduction drive gear	19. Forward clutch	
10. Planet carrier	20. Reverse clutch	

## Specifications

Item			Specifications			
Torque converter	Type Stall torque ratio		3-element, 1-step, 2-phase type (with TCC (lock-up) mechanism) 1.9 – 2.1			
Oil pump	Type Drive system		Internal involute gear type oil pump (non crescent type) Engine driven			
Gear change device	Type		Forward 4-step, reverse 1-step planetary gear type			
	Shift position		“P” range	Gear in neutral, output shaft fixed, engine start		
			“R” range	Reverse		
			“N” range	Gear in neutral, engine start		
			“D” range (O/D ON)	Forward 1st ↔ 2nd ↔ 3rd ↔ 4th (O/D) automatic gear change		
			“D” range (O/D OFF)	Forward 1st ↔ 2nd ↔ 3rd ← 4th automatic gear change		
			“2” range	Forward 1st ↔ 2nd ← 3rd automatic gear change		
			“L” range	Forward 1st ← 2nd ← 3rd reduction, and fixed at 1st gear		
	Gear ratio	1st	2.875	Number of teeth	Front sun gear: 24	
		2nd	1.568		Rear sun gear: 30	
		3rd	1.000		Long planet pinion: 20	
		4th (overdrive gear)	0.697		Short planet pinion: 19	
		Reverse (reverse gear)	2.300		Ring gear: 69	
	Control elements		Wet type multiple-disc clutch ... 3 sets Wet type multiple-disc brake ... 3 sets One-way clutch ... 2 sets			
Reduction gear ratio		1.019				
Final gear reduction ratio		4.052				
Lubrication	Lubrication system		Force feed system by oil pump			
Cooling	Cooling system		Radiator assisted cooling (water-cooled)			
Fluid used			DEXRON®-III			



Clutch/Brake/Planetary Gear



1. Input shaft and intermediate shaft	8. Reduction driven gear	B1: O/D and 2nd coast brake
2. Reduction drive gear	9. Front sun gear	B2: 2nd brake
3. Planet carrier	10. Ring gear	B3: 1st and reverse brake
4. Short planet pinion	11. Rear sun gear	F1: One-way No.1 clutch
5. Long planet pinion	C1: Forward clutch	F2: One-way No.2 clutch
6. Final drive gear	C2: Direct clutch	
7. Final driven gear	C3: Reverse clutch	

Functions

PART NAME	FUNCTION
Forward clutch	Meshes intermediate shaft and front sun gear
Direct clutch	Meshes input shaft and planet carrier
Reverse clutch	Meshes intermediate shaft and rear sun gear
O/D and 2nd coast brake	Fixes rear sun gear
2nd brake	Fixes rear sun gear
1st and reverse brake	Fixes planet carrier
One-way No.1 clutch	Prevents rear sun gear from turning counterclockwise
One-way No.2 clutch	Prevents planet carrier from turning counterclockwise

## Table of Component Operation

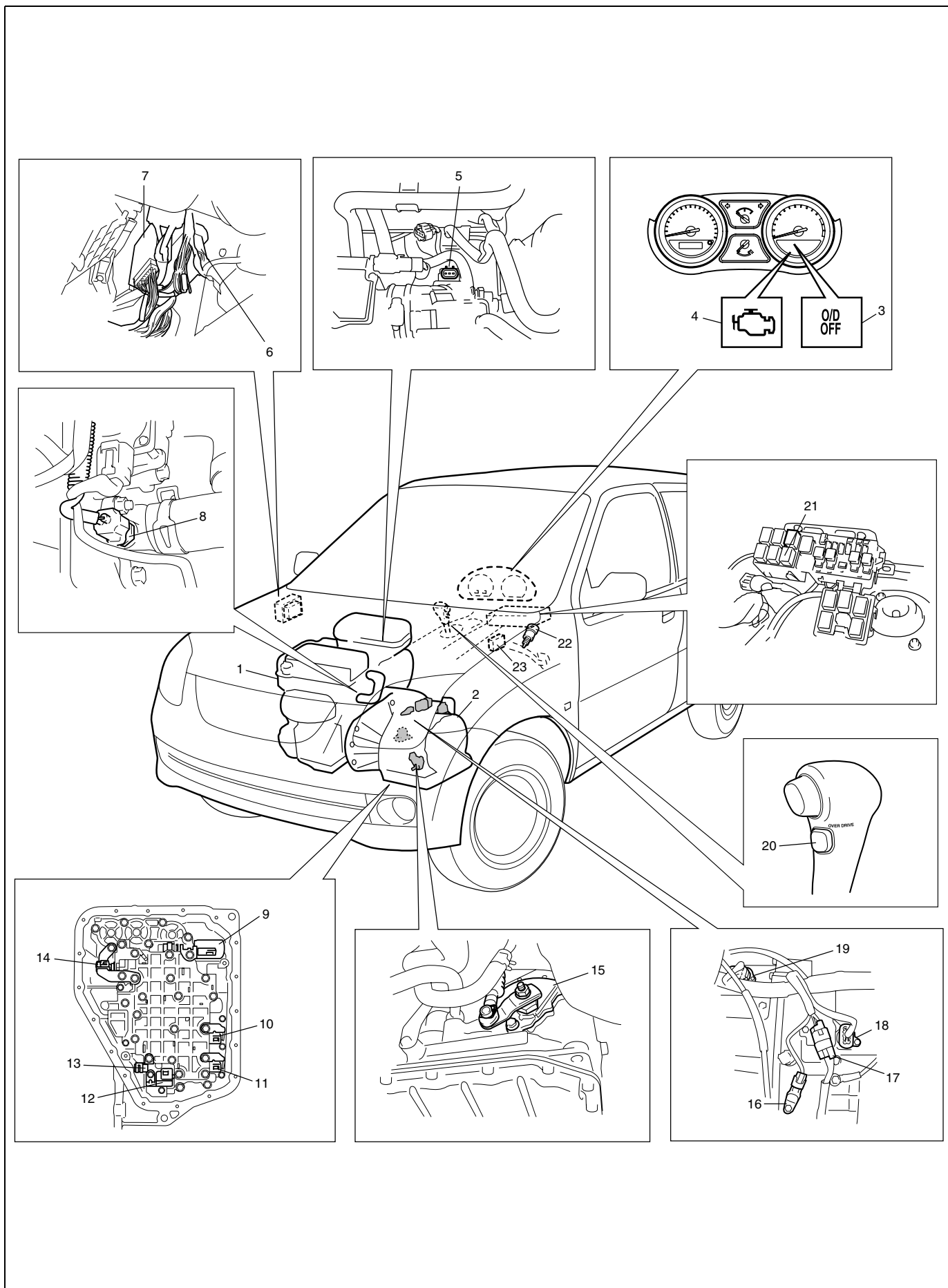
Selector position	Part Gear position	Shift solenoid valve-A (No.1)	Shift solenoid valve-B (No.2)	TCC solenoid valve	Forward clutch	Direct clutch	Reverse clutch	O/D and 2nd coast brake	2nd brake	1st and reverse brake	One-way No.1 clutch	One-way No.2 clutch
P	Parking	○	○	×	×	×	×	×	×	×	×	×
R	Reverse	○	○	×	×	×	○	×	×	○	×	×
N	Neutral	○	○	×	×	×	×	×	×	×	×	×
D	1st	○	○	×	○	×	×	×	×	×	×	○
	2nd	○	×	×	○	×	×	×	○	×	○	×
	3rd	×	×	△	○	○	×	×	○	×	×	×
	4th	×	○	△	×	○	×	○	○	×	×	×
2	1st	○	○	×	○	×	×	×	×	×	×	○
	2nd	○	×	×	○	×	×	○	○	×	○	×
L	1st	○	○	×	○	×	×	×	×	○	×	○

○ : ON

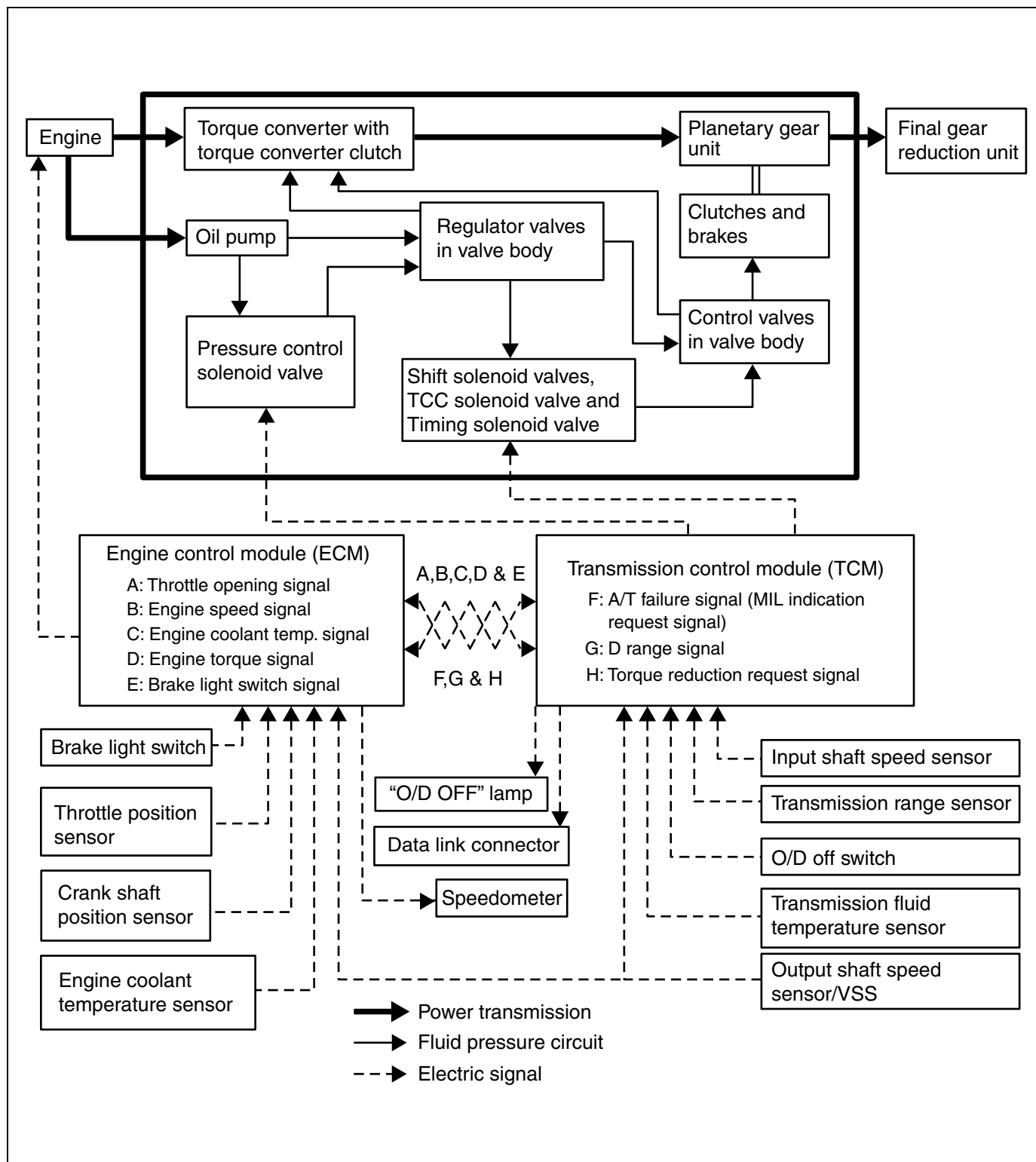
× : OFF

△ : ON only when TCC is operating

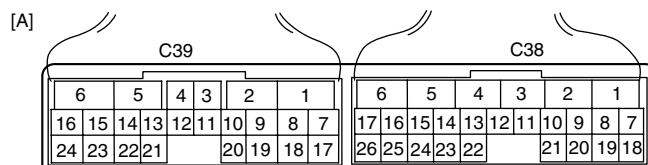
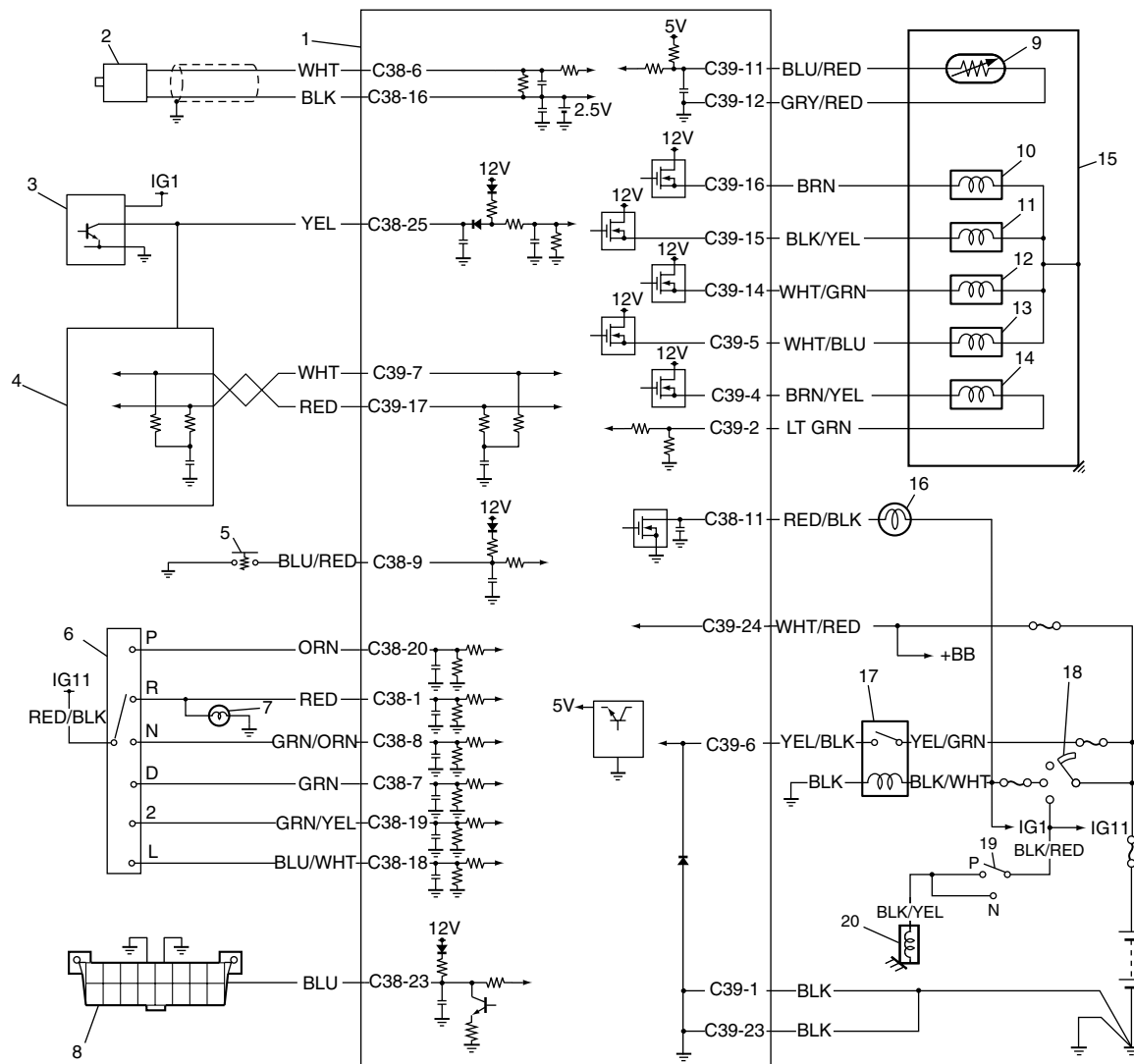
## Electronic Shift Control System



1. Engine	9. Pressure control solenoid valve	17. Transmission range sensor coupler
2. Transaxle	10. Shift solenoid valve-B (No.2)	18. Solenoid valve coupler
3. "O/D OFF" lamp	11. Shift solenoid valve-A (No.1)	19. Output shaft speed sensor (VSS)
4. MIL	12. Timing solenoid valve	20. O/D OFF switch
5. Throttle position (TP) sensor	13. Transmission fluid temperature sensor	21. A/T relay
6. ECM	14. TCC (lock-up) solenoid valve	22. Brake light switch
7. TCM	15. Transmission range sensor	23. Data link connector (DLC)
8. Engine coolant temperature (ECT) sensor	16. Input shaft speed sensor	



# Transmission Control Module (TCM)



1. TCM	8. Data link connector (DLC)	15. A/T
2. Input shaft speed sensor	9. Transmission fluid temperature sensor	16. "O/D OFF" lamp
3. Output shaft speed sensor (VSS)	10. Shift solenoid valve-A (No.1)	17. A/T relay
4. ECM	11. Shift solenoid valve-B (No.2)	18. Ignition switch
5. O/D off switch	12. Timing solenoid valve	19. Inhibitor switch
6. Transmission range sensor	13. TCC (lock-up) solenoid valve	20. Starter motor relay
7. Backup lamp	14. Pressure control solenoid valve	[A]: Terminal arrangement of TCM connector (viewed from harness)

## Operation of shift solenoid valves, timing solenoid valve and TCC solenoid valve

Selector position	Solenoid Gear position	Shift solenoid valve-A (No.1)	Shift solenoid valve-B (No.2)	Timing solenoid valve	TCC solenoid valve	Condition
P	Parking	○	○	×	×	
R	Reverse	○	○	×	×	When vehicle is traveling forwards in less than 9 km/h, 6 mile/h vehicle speed.
		○	○	○	×	When vehicle is traveling forwards in 11km/h, 7mile/h or more vehicle speed.
	(Reverse)	×	×	×	×	When fail safe function is operating.
N	Neutral	○	○	×	×	
D	Neutral → 1st			○		Timing solenoid is turned ON for about 0.5 sec. while on gear shifting
	1st	○	○	×	×	
	2nd	○	×	×	×	
	3rd	×	×	×	△	
	3rd ↔ 4th			○		Timing solenoid is turned ON for about 0.5 sec. while on gear shifting
	4th (O/D)	×	○	×	△	
	(3rd)	×	×	×	×	When fail safe function is operating.
2	1st	○	○	×	×	
	2nd	○	×	×	×	
	(3rd)	×	×	×	×	When fail safe function is operating.
L	1st	○	○	×	×	
	(3rd)	×	×	×	×	When fail safe function is operating.

○ : ON (Turn power ON)

× : OFF (Turn power OFF)

△ : ON only when TCC is operating

	Valve status	
	Turn power ON	Turn power OFF
Shift solenoid valve-A (No.1)	Close	Open
Shift solenoid valve-B (No.2)	Close	Open
Timing solenoid	Open	Close
TCC (lock-up) solenoid	Close	Open

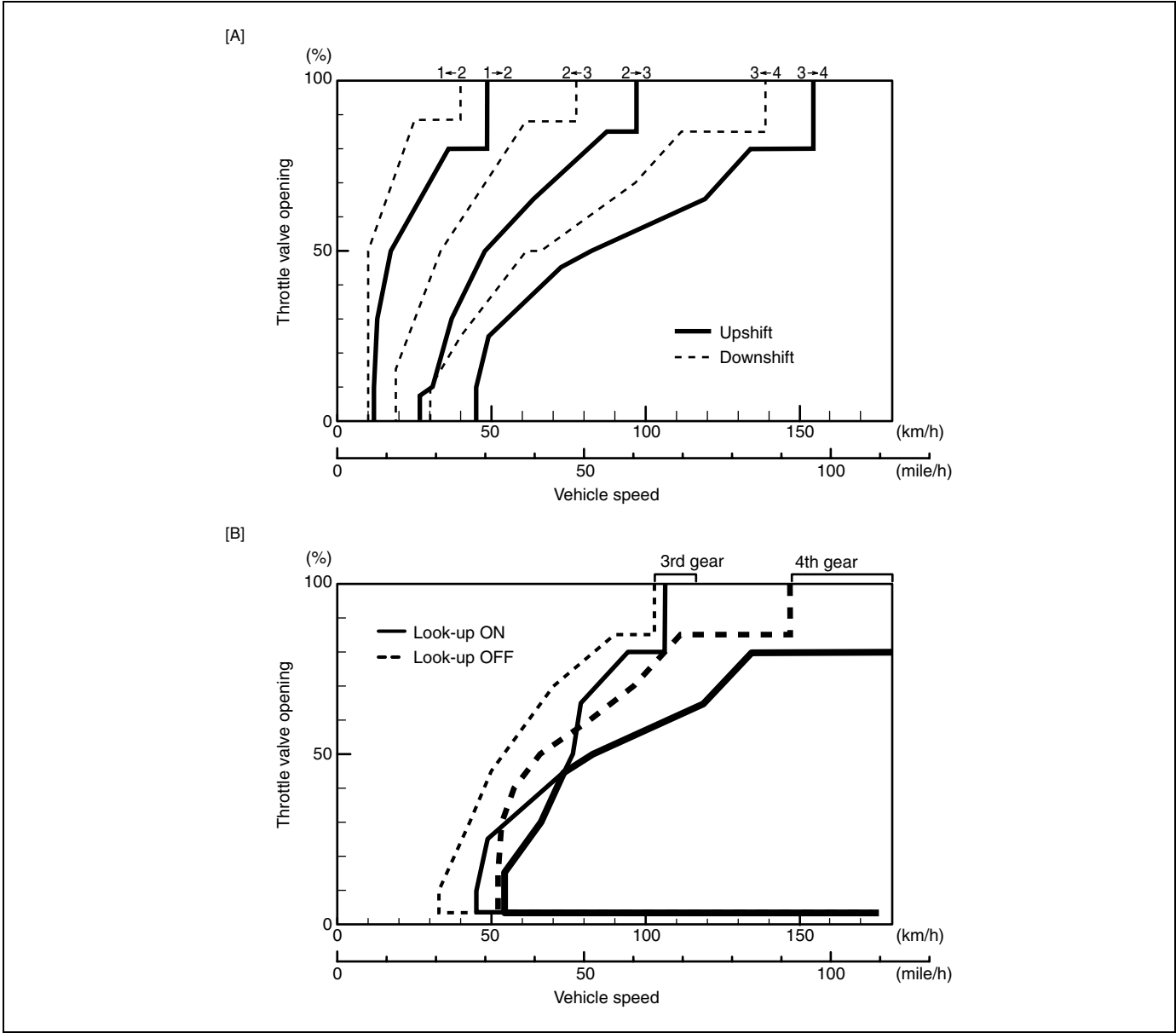
**Automatic gear shift diagram**

Automatic shift schedule as a result of shift control is shown below. In case that selector lever is shifted to “L” range at a higher than 49 km/h (30 mile/h) speed, 2nd gear is operated and then down shifts to 1st at a speed lower than that.

The same as, the select lever is shifted to “2” range at a higher than 97 km/h (60 mile/h) speed, 3rd gear is operated and then down shifts to 2nd at a speed lower than that.

	Shift					
Throttle opening	1→2	2→3	3→4	4→3	3→2	2→1
Full throttle km/h (mile/h)	49 (30)	97 (60)	154 (96)	139 (86)	78 (48)	40 (25)
Closed throttle km/h (mile/h)	12 (8)	27 (17)	45 (28)	30 (19)	19 (12)	10 (6)

**Gear Shift Diagram [A] and TCC Lock-up Diagram [B]**



## Diagnosis

### General Description

This vehicle is equipped with an electronic transaxle control system, which controls the automatic shift up and shift down timing, TCC operation, etc. suitably to vehicle driving conditions.

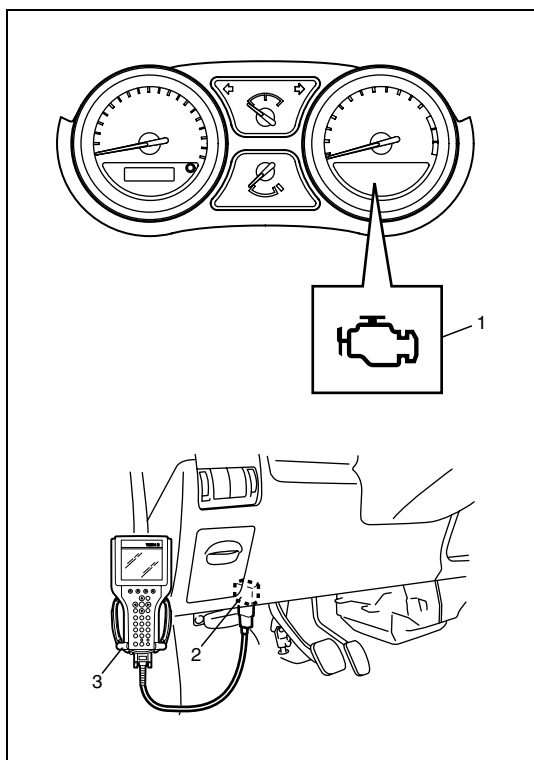
TCM has an On-Board Diagnosis System which detects a malfunction in this system.

When diagnosing a trouble in transaxle including this system, be sure to have full understanding of the outline of “On-Board Diagnostic System” and each item in “Precaution in Diagnosing Trouble” and execute diagnosis according to “Automatic Transaxle Diagnostic Flow Table” given below to obtain correct result smoothly.



## On-board Diagnostic System

For automatic transaxle control system, TCM has following functions.



- When ignition switch is turned ON with O/D off switch turned OFF and no malfunction in A/T control system is detected, “O/D OFF” lamp (1) lights for about 2 seconds after ignition switch is turned ON and then goes OFF for bulb check.
- When TCM detects a malfunction in A/T control system, TCM desire turning on malfunction indicator lamp (MIL) (1) to ECM and stores malfunction DTC in TCM memory.
- It is possible to communicate with TCM through data link connector (DLC) (2) by using scan tool (3). (Diagnostic information can be checked and erased by using scan tool.)

### Warm-up Cycle

A warm-up cycle means sufficient vehicle operation such that the coolant temperature has risen by at least 22°C (40°F) from engine starting and reaches a minimum temperature of 70°C (160°F).

### Driving Cycle

A “Driving Cycle” consists of engine startup, driving mode where a malfunction would be detected if present, and engine shutoff.

### 2 Driving Cycles Detection Logic

The malfunction detected in the first driving cycle is stored in TCM memory (in the form of pending DTC and freeze frame data) but the malfunction indicator lamp (MIL) does not light at this time. It lights up at the second detection of same malfunction also in the next driving cycle.

### Pending DTC

Pending DTC means a DTC detected and stored temporarily at 1 driving cycle of the DTC which is detected in the 2 driving cycle detection logic.

## Precaution in Diagnosing Trouble

- Don't disconnect couplers from TCM, battery cable from battery, TCM ground wire harness from engine or main fuse before checking the diagnosis information stored in TCM memory.  
Such disconnection will clear memorized information in TCM memory.
- Using scan tool the diagnostic information stored in TCM memory can be checked and cleared as well. Before its use, be sure to read Operator's (instruction) Manual supplied with it carefully to have good understanding of its functions and usage.
- Be sure to read "Precautions for Electrical Circuit Service" in Section 0A before inspection and observe what is written there.
- TCM and/or ECM replacement
  - When substituting a known-good TCM and/or ECM, check that all relays and actuators have resistance of specified value.  
Neglecting this check may result in damage to good TCM and/or ECM.
- Communication of ECUs, ECM and TCM, is established by CAN (Computer Area Network).  
Therefore, handle CAN communication line with care referring to "Precautions" described in Section 0A.

## Automatic Transaxle Diagnostic Flow Table

Refer to the following items for the details of each step.

Step	Action	Yes	No
1	Customer Complaint Analysis 1) Perform customer complaint analysis. Was customer complaint analysis performed according to instruction?	Go to Step 2.	Perform customer complaint analysis.
2	Diagnostic Trouble Code (DTC)/Freeze Frame Data Check, Record and Clearance 1) Check for DTC referring to the followings. Is there any DTC(s)?	1) Print DTC or write them down and clear them by referring to "Diagnostic Trouble Code (DTC) Clearance" in this section. 2) Go to Step 3.	Go to Step 4.
3	Visual Inspection 1) Perform visual inspection referring to the followings. Is there any faulty condition?	1) Repair or replace malfunction part. 2) Go to Step 11.	Go to Step 5.
4	Visual Inspection 1) Perform visual inspection referring to the followings. Is there any faulty condition?	1) Repair or replace malfunction part. 2) Go to Step 11.	Go to Step 8.
5	Trouble Symptom Confirmation 1) Confirm trouble symptom referring to the followings. Is trouble symptom identified?	Go to Step 6.	Go to Step 7.
6	Rechecking and Recording of DTC 1) Recheck for DTC referring to "Diagnostic Trouble Code (DTC) Check" in this section. Is there any DTC(s)?	Go to Step 9.	Go to Step 8.
7	Rechecking and Recording of DTC/Freeze Frame Data 1) Recheck for DTC referring to "Diagnostic Trouble Code (DTC) Check" in this section. Is there any DTC(s)?	Go to Step 9.	Go to Step 10.
8	Automatic Transaxle Basic Inspection and Trouble Diagnosis Table 1) Check and repair according to "Automatic Transaxle Basic Check" and "Trouble Diagnosis Table" in this section. Are check and repair complete?	Go to Step 11.	1) Check and repair malfunction part(s). 2) Go to Step 11.
9	Troubleshooting for DTC 1) Check and repair according to applicable DTC Flow Table. Are check and repair complete?	Go to Step 11.	1) Check and repair malfunction part(s). 2) Go to Step 11.
10	Check for Intermittent Problems 1) Check for intermittent problems referring to the followings. Is there any faulty condition?	1) Repair or replace malfunction part(s). 2) Go to Step 11.	Go to Step 11.

Step	Action	Yes	No
11	Final Confirmation Test 1) Clear DTC if any. 2) Perform final confirmation test referring to the followings. Is there any problem symptom, DTC or abnormal condition?	Go to Step 6.	End.

### 1. Customer Complaint Analysis (See Customer Problem Inspection Form (Example))

Record details of the problem (failure, complaint) and how it occurred as described by the customer.

For this purpose, use of such an inspection form will facilitate collecting information to the point required for proper analysis and diagnosis.

### 2. Diagnostic Trouble Code (DTC)/Freeze Frame Data Check, Record and Clearance

First, check DTC (including pending DTC) referring to “Diagnostic Trouble Code (DTC) Check” in this section. If DTC exists, print or write down DTC/Freeze frame data and then clear malfunction DTC(s) by referring to “Diagnostic Trouble Code (DTC) Clearance” in this section. Malfunction DTC indicates malfunction in the system but it is not possible to know from it whether the malfunction is occurring now or it occurred in the past and normal condition has been restored. In order to know that, check symptom in question according to Step 5 and then recheck DTC according to Step 6.

Diagnosing a trouble based on the DTC in this step only or failure to clear the DTC in this step may result in a faulty diagnosis, trouble diagnosis of a normal circuit or difficulty in troubleshooting which is otherwise unnecessary.

### 3 and 4. Visual Inspection

As a preliminary step, be sure to perform visual check of the items that support proper function of the engine and automatic transaxle referring to “Visual Inspection” in this section.

### 5. Trouble Symptom Confirmation

Check trouble symptoms based on information obtained in Step 1 Customer Complaint Analysis and Step 2 DTC Check.

Also, reconfirm DTC according to “DTC Confirmation Procedure” described in each DTC Flow Table.

### 6 and 7. Rechecking and Record of DTC/Freeze Frame Data

Refer to “Diagnostic Trouble Code (DTC) Check” in this section for checking procedure.

### 8. Automatic Transmission Basic Check and Trouble Diagnosis Table

Perform basic check of A/T according to flow table of “Automatic Transaxle Basic Check” first. When the end of the flow table has been reached, check the parts of the system suspected as a possible cause referring to “Trouble Diagnosis Table” and based on symptoms appearing on the vehicle (symptoms obtained through steps of customer complaint analysis, trouble symptom confirmation and/or A/T basic check) and repair or replace faulty parts, if any.

### 9. Diagnostic Trouble Code Flow Table (See each DTC Flow Table)

Based on the DTC indicated in Step 6/7 and referring to Diagnostic Trouble Code (DTC) Table in this section, locate the cause of the trouble, namely in a sensor, switch, wire harness, connector, actuator, TCM or other part and repair or replace faulty parts.

### 10. Check for Intermittent Problem

Check parts where an intermittent trouble is easy to occur (e.g. wire harness, connector, etc.), referring to “Intermittent and Poor Connection” in Section 0A and related circuit of DTC recorded in Step 2.

### **11. Final Confirmation Test**

Confirm that the problem symptom has gone and the vehicle is free from any abnormal conditions. If what has been repaired is related to the malfunction DTC, clear the DTC once and check to ensure that no malfunction DTC is indicated.

**Customer Problem Inspection Form (Example)**

User name:	Model:	VIN:	
Date of issue:	Date of Reg.:	Date of problem:	Mileage:

PROBLEM SYMPTOMS	
<input type="checkbox"/>	Vehicle does not move (R, D, 2, L or any range)
<input type="checkbox"/>	No upshift automatically ( <input type="checkbox"/> 1st to 2nd <input type="checkbox"/> 2nd to 3rd <input type="checkbox"/> 3rd to 4th (O/D) <input type="checkbox"/> 2 range <input type="checkbox"/> D range)
<input type="checkbox"/>	No downshift automatically ( <input type="checkbox"/> 3rd to 2nd <input type="checkbox"/> 2nd to 1st <input type="checkbox"/> 4th (O/D) to 3rd <input type="checkbox"/> 2 range <input type="checkbox"/> D range)
<input type="checkbox"/>	No gear change manually ( <input type="checkbox"/> 1st ↔ 3rd <input type="checkbox"/> 3rd ↔ 4th)
<input type="checkbox"/>	TCC no lock-up <input type="checkbox"/> TCC no lock-up off
<input type="checkbox"/>	Automatic shift point too high or too low
<input type="checkbox"/>	Excessive gear change shock (1st/2nd/3rd/4th (O/D)/Reverse)
<input type="checkbox"/>	No kickdown
<input type="checkbox"/>	Transmission slipping in (1st/2nd/3rd/4th (O/D)/Reverse)
<input type="checkbox"/>	Others _____

VEHICLE/ENVIRONMENTAL CONDITION WHEN PROBLEM OCCURS	
Environmental Condition	
Weather	<input type="checkbox"/> Fair <input type="checkbox"/> Cloudy <input type="checkbox"/> Rain <input type="checkbox"/> Always <input type="checkbox"/> Other _____
Temperature	(    °F/    °C) <input type="checkbox"/> Hot <input type="checkbox"/> Warm <input type="checkbox"/> Cool <input type="checkbox"/> Cold <input type="checkbox"/> always
Frequency	<input type="checkbox"/> Always <input type="checkbox"/> Sometimes (    times/    day, month) <input type="checkbox"/> Only once <input type="checkbox"/> Under certain condition
Road	<input type="checkbox"/> Urban <input type="checkbox"/> Suburb <input type="checkbox"/> Highway <input type="checkbox"/> Mountainous <input type="checkbox"/> Uphill <input type="checkbox"/> Downhill <input type="checkbox"/> Tarmacadam
	<input type="checkbox"/> Gravel <input type="checkbox"/> Other _____
Vehicle Condition	
Engine & transmission condition	<input type="checkbox"/> Cold/ <input type="checkbox"/> Warming up phase/ <input type="checkbox"/> Warmed up Engine speed (    r/min.) Throttle opening ( <input type="checkbox"/> Idle/ <input type="checkbox"/> About    % <input type="checkbox"/> full) O/D cut switch ( <input type="checkbox"/> ON/ <input type="checkbox"/> OFF)
Vehicle condition	<input type="checkbox"/> At stop/ <input type="checkbox"/> During driving ( <input type="checkbox"/> Constant speed <input type="checkbox"/> Accelerating <input type="checkbox"/> Decelerating <input type="checkbox"/> Braking) <input type="checkbox"/> Right hand corner <input type="checkbox"/> Left hand corner <input type="checkbox"/> Vehicle speed (    km/h    mile/h) <input type="checkbox"/> Other _____

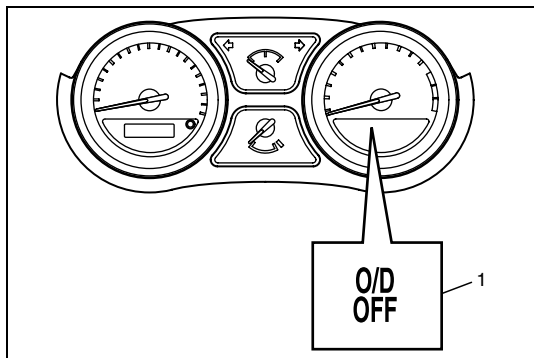
"O/D OFF" lamp	<input type="checkbox"/> Blink <input type="checkbox"/> Always ON <input type="checkbox"/> Sometimes ON <input type="checkbox"/> Always OFF <input type="checkbox"/> Good condition
Malfunction indicator lamp	<input type="checkbox"/> Blink <input type="checkbox"/> Always ON <input type="checkbox"/> Sometimes ON <input type="checkbox"/> Always OFF <input type="checkbox"/> Good condition
Diagnostic trouble code	First check: <input type="checkbox"/> No code <input type="checkbox"/> Malfunction code (    ) Second check: <input type="checkbox"/> No code <input type="checkbox"/> Malfunction code (    )

**NOTE:**

The above form is a standard sample. It should be modified according to conditions characteristic of each market.

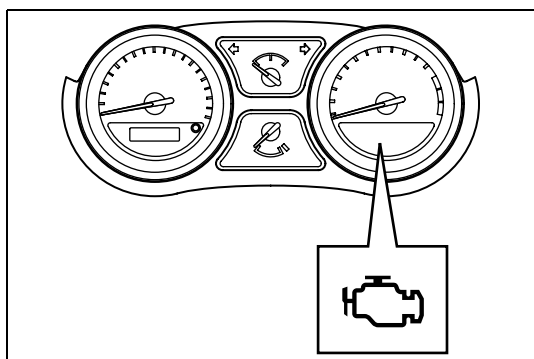
## “O/D OFF” Lamp Check

- 1) Turn ignition switch ON.
- 2) Check that “O/D OFF” lamp (1) lights for about 2 sec. and then goes OFF.  
If anything faulty is found, advance to “Diagnostic Flow Table A-3” or “Diagnostic Flow Table A-4”.



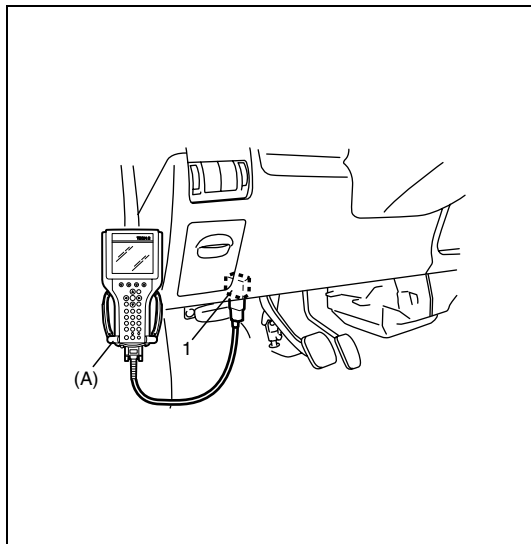
## Malfunction Indicator Lamp (MIL) Check

Refer to the same item in Section 6 for checking procedure.



## Diagnostic Trouble Code (DTC) Check

- 1) Turn ignition switch to OFF position.



- 2) Connect scan tool to data link connector (DLC) (1).

#### **Special tool**

**(A): SUZUKI scan tool**

- 3) Turn ignition switch ON.
- 4) Read DTC, pending DTC and freeze frame data according to instructions displayed on scan tool and print it down. Refer to scan tool operator's manual for further details.

#### **NOTE:**

**If SUZUKI scan tool cannot communicate TCM, perform "Serial Data Circuit Check" described in this section.**

- 5) After completing the check, turn ignition switch OFF and disconnect scan tool from data link connector (DLC) (1).

## **Diagnostic Trouble Code (DTC) Clearance**

#### **WARNING:**

**When performing a driving test, select a safe place where there is neither any traffic nor any traffic accident possibility and be very careful during testing to avoid occurrence of an accident.**

After repair or replace malfunction part(s), clear all DTCs by performing the following procedure.

- 1) Connect SUZUKI scan tool to data link connector in the same manner as when making this connection for DTC check.
- 2) Turn ignition switch ON.
- 3) Erase DTC and pending DTC according to instructions displayed on scan tool. Refer to scan tool operator's manual for further details.
- 4) After completing the clearance, turn ignition switch off and disconnect scan tool from data link connector.

#### **NOTE:**

**DTC and freeze frame data stored in TCM memory are also cleared in following cases. Be careful not to clear them before keeping their record.**

- When power to TCM is cut off (by disconnecting battery cable, removing fuse or disconnecting TCM connectors).
- When the same malfunction (DTC) is not detected again during 40 engine warm-up cycles.



## Diagnostic Trouble Code (DTC) Table

DTC No.	Detecting item	Detecting condition (DTC will set when detecting)	Driving cycle when MIL lighted
P0705	Transmission Range Sensor Circuit Malfunction (PRNDL Input)	Multiple signals are inputted simultaneously.	1 driving cycle
P0707	Transmission Range Sensor Circuit Low	No sensor signal is inputted.	2 driving cycles
P0712	Transmission Fluid Temperature Sensor "A" Circuit Low	Sensor output voltage is too low.	1 driving cycle
P0713	Transmission Fluid Temperature Sensor "A" Circuit High	Sensor output voltage is too high.	1 driving cycle
P0717	Input/Turbine Speed Sensor Circuit No Signal	No sensor signal is detected although output speed sensor signal is inputted.	1 driving cycle
P0722	Output Speed Sensor Circuit No Signal	No sensor signal is inputted although input speed sensor signal is inputted.	1 driving cycle
P0741	Torque Converter Clutch Circuit Performance or Stuck Off	Difference in revolution between engine and input shaft is too large although TCM is commanding TCC solenoid to turn ON.	2 driving cycles
P0742	Torque Converter Clutch Circuit Stuck On	Difference in revolution between engine and input shaft is too small although TCM is commanding TCC solenoid to turn OFF.	2 driving cycles
P0751	Shift Solenoid "A" Performance or Stuck Off	Actual gear position is 3rd gear although TCM command is for 2nd gear.	2 driving cycles
P0752	Shift Solenoid "A" Stuck On	Actual gear position is 2nd gear although TCM command is for 3rd gear.	2 driving cycles
P0756	Shift Solenoid "B" Performance or Stuck Off	Actual gear position is 3rd gear although TCM command is for 4th gear.	2 driving cycles
P0757	Shift Solenoid "B" Stuck On	Actual gear position is 4th gear although TCM command is for 3rd gear.	2 driving cycles
P0785	Shift/Timing Solenoid	Voltage of timing solenoid terminal is high although TCM is commanding timing solenoid to turn OFF. or Voltage of timing solenoid terminal is low although TCM is commanding timing solenoid to turn ON.	1 driving cycle
P0962	Pressure Control Solenoid "A" Control Circuit Low	No electric flow is detected on pressure control solenoid circuit.	1 driving cycle
P0963	Pressure Control Solenoid "A" Control Circuit High	Too much electric flow is detected on pressure control solenoid circuit.	1 driving cycle
P0973	Shift Solenoid "A" Control Circuit Low	Voltage of shift solenoid terminal is low although TCM is commanding shift solenoid to turn ON.	1 driving cycle
P0974	Shift Solenoid "A" Control Circuit High	Voltage of shift solenoid terminal is high although TCM is commanding shift solenoid to turn OFF.	1 driving cycle
P0976	Shift Solenoid "B" Control Circuit Low	Voltage of shift solenoid terminal is low although TCM is commanding shift solenoid to turn ON.	1 driving cycle

<b>DTC No.</b>	<b>Detecting item</b>	<b>Detecting condition (DTC will set when detecting)</b>	<b>Driving cycle when MIL lighted</b>
P0977	Shift Solenoid "B" Control Circuit High	Voltage of shift solenoid terminal is high although TCM is commanding shift solenoid to turn OFF.	1 driving cycle
P1701	CAN Communication Problem - TCM	No signal inputted from ECM to TCM for specified time continuously.	1 driving cycle
P1702	Internal Control Module Memory Check Sum Error	Calculation of current data stored in TCM is not correct comparing with pre-stored checking data in TCM.	1 driving cycle
P1703	CAN Invalid Data- TCM	TCM receives malfunction signal of throttle position, engine coolant temperature, engine revolution and engine torque from ECM.	*1
P2769	Torque Converter Clutch Circuit Low	No electric flow is detected on TCC solenoid circuit.	1 driving cycle
P2770	Torque Converter Clutch Circuit High	Too much electric flow is detected on TCC solenoid circuit.	1 driving cycle

**NOTE:**

**\*1: TCM does not desire turning on malfunction indicator lamp to ECM but DTC is stored in TCM memory.**

## Fail Safe Table

This function is provided by the safe mechanism that assures safe driveability even when the solenoid valve, sensor or its circuit fails.

The table below shows the fail safe function for each fail condition of solenoid, solenoid or its circuit.

DTC No.	Trouble Area	Fail Safe Operation
P0705	Transmission Range Sensor Circuit Malfunction (PRNDL Input)	<ul style="list-style-type: none"> <li>Selected range is set in priority order shown below. D&gt;2&gt;L&gt;R&gt;N&gt;P</li> <li>Lock-up function is inhibited to operate.</li> <li>Learning control is inhibited.</li> </ul>
P0707	Transmission Range Sensor Circuit Low	<ul style="list-style-type: none"> <li>Selected range is assumed to be "D" range.</li> <li>Lock-up function is inhibited to operate.</li> <li>Learning control is inhibited.</li> </ul>
P0712 P0713	Transmission Fluid Temperature Sensor "A" Circuit Low	<ul style="list-style-type: none"> <li>A/T fluid temperature is assumed to be 200°C (392°F).</li> <li>Upshifting to O/D is inhibited.</li> <li>Lock-up function is inhibited to operate.</li> <li>Garage shift control is inhibited.</li> <li>Learning control is inhibited.</li> </ul>
P0717	Input/Turbine Speed Sensor Circuit No Signal	<ul style="list-style-type: none"> <li>Upshifting to O/D is inhibited.</li> <li>Lock-up function is inhibited to operate.</li> <li>Line pressure control at gear shifting is inhibited.</li> <li>Torque reducing request to ECM (torque reduction control) is inhibited.</li> <li>Garage shift control is inhibited.</li> <li>Learning control is inhibited.</li> </ul>
P0722	Output Speed Sensor Circuit No Signal	<ul style="list-style-type: none"> <li>Vehicle speed which is calculated by input shaft speed sensor signal is used for gear shifting control instead of vehicle speed calculated by output shaft speed sensor (VSS) signal.</li> <li>Upshifting to O/D is inhibited.</li> <li>Lock-up function is inhibited to operate.</li> <li>Line pressure control at gear shifting is inhibited.</li> <li>Torque reducing request to ECM (torque reduction control) is inhibited.</li> <li>Garage shift control is inhibited.</li> <li>Learning control is inhibited.</li> </ul>
P0785	Shift/Timing Solenoid	<ul style="list-style-type: none"> <li>Power supply for all solenoid valves is cut.</li> <li>Gear position is fixed in 3rd gear.</li> <li>Line pressure control at gear shifting is inhibited.</li> <li>Look-up function is inhibited to operate.</li> </ul>
P0962	Pressure Control Solenoid "A" Control Circuit Low	
P0963	Pressure Control Solenoid "A" Control Circuit High	
P0973	Shift Solenoid "A" Control Circuit Low	
P0974	Shift Solenoid "A" Control Circuit High	
P0976	Shift Solenoid "B" Control Circuit Low	
P0977	Shift Solenoid "B" Control Circuit High	

DTC No.	Trouble Area	Fail Safe Operation
P1701	CAN Communication Problem - TCM	<ul style="list-style-type: none"> <li>• Throttle opening used for line pressure control is assumed to be 100%.</li> <li>• Throttle opening used for gear shifting control is assumed to be 0%.</li> <li>• After 15 minutes pass from detecting malfunction, engine coolant temperature is assumed to be 90°C (194°F).</li> <li>• Upshifting to O/D is inhibited.</li> <li>• Lock-up function is inhibited to operate.</li> <li>• Line pressure control at gear shifting is inhibited.</li> <li>• Torque reducing request to ECM (torque reduction control) is inhibited.</li> <li>• Learning control is inhibited.</li> <li>• Garage shift control is inhibited.</li> </ul>
P1702	Internal Control Module Memory Check Sum Error	<ul style="list-style-type: none"> <li>• Power supply for all solenoid valves is cut.</li> <li>• Gear position is fixed in 3rd gear.</li> <li>• Line pressure control at gear shifting is inhibited.</li> <li>• Lock-up function is inhibited to operate.</li> </ul>
P1703	CAN Invalid Data- TCM	<p>In case of throttle position signal malfunction:</p> <ul style="list-style-type: none"> <li>• Throttle opening used for line pressure control is assumed to be 100%.</li> <li>• Throttle opening used for gear shifting control is assumed to be 0%.</li> <li>• Upshifting to O/D is inhibited.</li> <li>• Lock-up function is inhibited to operate.</li> <li>• Garage shift control is inhibited.</li> <li>• Learning control is inhibited.</li> </ul> <p>In case of engine coolant temperature signal malfunction:</p> <ul style="list-style-type: none"> <li>• After 15 minutes pass from detecting malfunction, engine coolant temperature is assumed to be normal operating temperature, and controls of overdrive and lock-up is released from inhibition.</li> </ul> <p>In case of engine revolution signal malfunction:</p> <ul style="list-style-type: none"> <li>• Upshifting to O/D is inhibited.</li> <li>• Lock-up function is inhibited to operate.</li> <li>• Line pressure control at gear shifting is inhibited.</li> <li>• Torque reducing request to ECM (torque reduction control) is inhibited.</li> <li>• Garage shift control is inhibited.</li> <li>• Learning control is inhibited.</li> </ul>
P2769	Torque Converter Clutch Circuit Low	<ul style="list-style-type: none"> <li>• Lock-up function is inhibited to operate.</li> </ul>
P2770	Torque Converter Clutch Circuit High	<ul style="list-style-type: none"> <li>• Lock-up function is inhibited to operate.</li> <li>• Vehicle speed is slower than 15 km/h (9 mile/h), gear position is fixed in 1st gear for prevention of engine stall.</li> </ul>

## Visual Inspection

Visually check the following parts and systems.

INSPECTION ITEM	REFERRING SECTION
<ul style="list-style-type: none"> <li>• A/T fluid ----- level, leakage, color</li> <li>• A/T fluid hoses ----- disconnection, looseness, deterioration</li> <li>• Throttle cable ----- play (under warm engine), installation</li> <li>• A/T select cable ----- installation</li> <li>• Engine oil ----- level, leakage</li> <li>• Engine coolant ----- level, leakage</li> <li>• Engine mountings ----- play, looseness, damage</li> <li>• Suspension ----- play, looseness</li> <li>• Drive shafts ----- damage</li> <li>• Battery ----- indicator condition, corrosion of terminal</li> <li>• Connectors of electric wire harness ----- disconnection, friction</li> <li>• Fuses ----- burning</li> <li>• Parts ----- installation, damage</li> <li>• Bolts ----- looseness</li> <li>• Other parts that can be checked visually</li> </ul> <p>Also check the following items at engine start, if possible.</p> <ul style="list-style-type: none"> <li>• "O/D OFF" lamp ----- Operation</li> <li>• Malfunction indicator lamp ----- Operation</li> <li>• Charge warning lamp ----- Operation</li> <li>• Engine oil pressure warning lamp ----- Operation</li> </ul>	<p>Section 0B</p> <p>Section 7B</p> <p>Section 6E1</p> <p>Section 7B</p> <p>Section 0B</p> <p>Section 0B</p> <p>Section 6A1</p> <p>Section 3</p> <p>Section 4A</p> <p>Section 6E1</p> <p>Section 8</p> <p>Section 6E1</p> <p>Section 6H</p> <p>Section 8 (Section 6A1 for pressure check)</p>
<ul style="list-style-type: none"> <li>• Engine coolant temp. meter ----- Operation</li> <li>• Other parts that can be checked visually</li> </ul>	

## Automatic Transaxle Basic Check

This check is important for troubleshooting when TCM has detected no DTC and no abnormality has been noted in visual inspection. Follow the flow table carefully.

Step	Action	Yes	No
1	Was "Automatic Transaxle Diagnostic Flow Table" preformed?	Go to Step 2.	Go to "Automatic Transaxle Diagnostic Flow Table".
2	Perform "Road Test" in this section. Is it OK?	Go to Step 3.	Proceed to "Troubleshooting" in "Road Test".
3	Perform "Manual Road Test" in this section. Is it OK?	Go to Step 4.	Proceed to "Troubleshooting" in "Manual Road Test".
4	Perform "Engine Brake Test" in this section. Is it OK?	Go to Step 5.	Proceed to "Troubleshooting" in "Engine Brake Test".
5	Perform "Stall Test" in this section. Is it OK?	Go to Step 6.	Proceed to "Troubleshooting" in "Stall Test".
6	Perform "Time Lag Test" in this section. Is it OK?	Go to Step 7.	Proceed to "Troubleshooting" in "Time Lag Test".
7	Perform "Line Pressure Test" in this section. Is it OK?	Go to Step 8.	Proceed to "Troubleshooting" in "Line Pressure Test".
8	Proceed to "Trouble diagnosis table-1" in this section. Is trouble identified?	Repair or replace faulty parts.	Go to Step 9.
9	Proceed to "Trouble diagnosis table-2" in this section. Is trouble identified?	Repair or replace faulty parts.	Proceed to "Trouble diagnosis table-3" in this section.

## Trouble Diagnosis Table

### Trouble diagnosis table-1

#### Electrical Repair

Condition	Possible Cause	Correction
Excessive shift shock	Shift solenoid valve-A and/or-B circuit faulty	Inspect circuit for open, short and intermittent. If NG, repair.
	Pressure control solenoid valve circuit faulty	
	(Only when N→D or 3↔O/D shifting)	
	Timing solenoid valve circuit faulty	
	Output shaft speed sensor (VSS) circuit faulty	
	Input shaft speed sensor circuit faulty	
	Transmission fluid temperature sensor circuit faulty	Inspect circuit for open, short and intermittent referring to Section 6. If NG, repair.
	CAN communication circuit faulty	
	Throttle position sensor circuit faulty	
	Crank position sensor circuit faulty	
	TCM	
	ECM	
No gear shift as 3rd gear	Shift solenoid valve-A and/or-B circuit faulty	Inspect circuit for open, short and intermittent. If NG, repair.
	Pressure control solenoid valve circuit faulty	
	Timing solenoid valve circuit faulty	
	TCM	Substitute a known-good TCM and recheck.
Poor 1→2 shift	Shift solenoid valve-B circuit faulty	Inspect circuit for open, short and intermittent. If NG, repair.
	Output shaft speed sensor (VSS) circuit faulty	
	Transmission range sensor circuit faulty	
	CAN communication circuit faulty	
	Throttle position sensor circuit faulty	Inspect circuit for open, short and intermittent referring to Section 6. If NG, repair.
	TCM	Substitute a known-good TCM and recheck.
	ECM	Substitute a known-good ECM and recheck.
Poor 2→3 shift	Shift solenoid valve-A circuit faulty	Inspect circuit for open, short and intermittent. If NG, repair.
	Output shaft speed sensor (VSS) circuit faulty	
	Transmission range sensor circuit faulty	
	CAN communication circuit faulty	
	Throttle position sensor circuit faulty	Inspect circuit for open, short and intermittent referring to Section 6. If NG, repair.
	TCM	Substitute a known-good TCM and recheck.
	ECM	Substitute a known-good ECM and recheck.

Condition	Possible Cause	Correction
Poor 3→O/D shift	Shift solenoid valve-B circuit faulty	Inspect circuit for open, short and intermittent. If NG, repair.
	Pressure control solenoid valve circuit faulty	
	Timing solenoid valve circuit faulty	
	Output shaft speed sensor (VSS) circuit faulty	
	Input shaft speed sensor circuit faulty	
	Transmission range sensor circuit faulty	
	Transmission fluid temperature sensor circuit faulty	
	CAN communication circuit faulty	Inspect circuit for open, short and intermittent referring to Section 6. If NG, repair.
	Throttle position sensor circuit faulty	
	Engine coolant temperature sensor circuit faulty	
	Crank position sensor circuit faulty	Refer to “Diagnostic Flow Table A-1: No Gear Shift to O/D” in this section.
	O/D off switch circuit faulty	
	TCM	
	ECM	Substitute a known-good ECM and recheck.
Poor O/D→3 shift	Shift solenoid valve-B circuit faulty	Inspect circuit for open, short and intermittent. If NG, repair.
	Pressure control solenoid valve circuit faulty	
	Timing solenoid valve circuit faulty	
	Output shaft speed sensor (VSS) circuit faulty	
	Input shaft speed sensor circuit faulty	
	CAN communication circuit faulty	
	Throttle position sensor circuit faulty	Inspect circuit for open, short and intermittent referring to Section 6. If NG, repair.
	O/D off switch circuit faulty	Refer to “Fig.” in this section.
	TCM	Substitute a known-good TCM and recheck.
	ECM	Substitute a known-good ECM and recheck.
Poor 3→2 shift	Shift solenoid valve-A circuit faulty	Inspect circuit for open, short and intermittent. If NG, repair.
	Output shaft speed sensor (VSS) circuit faulty	
	CAN communication circuit faulty	
	Throttle position sensor circuit faulty	Inspect circuit for open, short and intermittent referring to Section 6. If NG, repair.
	TCM	Substitute a known-good TCM and recheck.
	ECM	Substitute a known-good ECM and recheck.
Poor 2→1 shift	Shift solenoid valve-B circuit faulty	Inspect circuit for open, short and intermittent. If NG, repair.
	Output shaft speed sensor (VSS) circuit faulty	
	CAN communication circuit faulty	
	Throttle position sensor circuit faulty	Inspect circuit for open, short and intermittent referring to Section 6. If NG, repair.
	TCM	Substitute a known-good TCM and recheck.
	ECM	Substitute a known-good ECM and recheck.



Condition	Possible Cause	Correction
Incorrect gear shift point	Output shaft speed sensor (VSS) circuit faulty	Inspect circuit for open, short and intermittent. If NG, repair.
	Pressure control solenoid valve circuit faulty	
	CAN communication circuit faulty	
	Pressure control solenoid valve circuit faulty	
	Throttle position sensor circuit faulty	Inspect circuit for open, short and intermittent referring to Section 6. If NG, repair.
	TCM	Substitute a known-good TCM and recheck.
	ECM	Substitute a known-good ECM and recheck.
Non operate TCC (lock-up) system	TCC solenoid valve-B circuit faulty	Inspect circuit for open, short and intermittent. If NG, repair.
	Shift solenoid valve-A and/or-B circuit faulty	
	Pressure control solenoid valve circuit faulty	
	Output shaft speed sensor (VSS) circuit faulty	
	Input shaft speed sensor circuit faulty	
	Transmission range sensor circuit faulty	
	Transmission fluid temperature sensor circuit faulty	
	CAN communication circuit faulty	
	Brake light switch circuit faulty	Refer to “Diagnostic Flow Table A-2: No Lock-Up Occurs” in this section.
	Throttle position sensor circuit faulty	Inspect circuit for open, short and intermittent referring to Section 6. If NG, repair.
	Engine coolant temperature sensor circuit faulty	
	TCM	Substitute a known-good TCM and recheck.
	ECM	Substitute a known-good ECM and recheck.
Higher or lower stall speed	Pressure control solenoid valve circuit faulty	Inspect circuit for open, short and intermittent. If NG, repair.
	TCM	Substitute a known-good TCM and recheck.
Excessive “N”→“D” or “N”→“R” time lag	Pressure control solenoid valve circuit faulty	Inspect circuit for open, short and intermittent. if NG, repair
	Transmission fluid temperature sensor circuit faulty	
	TCM	Substitute a known-good TCM and recheck.
Higher or lower line pressure	Pressure control solenoid valve circuit faulty	Inspect circuit for open, short and intermittent. If NG, repair.
	TCM	Substitute a known-good TCM and recheck.

## Trouble diagnosis table-2

### On-vehicle Repair

Condition	Possible Cause	Correction
Unable to run in all range	Faulty valve body component	Replace valve body assembly
Excessive shift shock	Engine abnormal condition	Inspect and repair engine
	Malfunction of shift solenoid valve-A and/or-B	Inspect. If NG, replace
	Malfunction of output shaft speed sensor (VSS)	
	Malfunction of input shaft speed sensor	
	Malfunction of transmission range sensor	
	Malfunction of Transmission fluid temperature sensor	
	(Only when N→D or 3↔O/D shifting) Malfunction of timing solenoid valve	
	Malfunction of pressure control solenoid valve	Inspect. If NG, replace valve body assembly.
	(Except N→D or N→R shifting) Malfunction of brake light switch	Inspect referring to Section 5. If NG, replace.
	Malfunction of crank position sensor	Inspect referring to Section 6E1. If NG, replace.
	Malfunction of throttle position sensor	If NG, replace.
	Faulty valve body component	Replace valve body assembly.
Poor 1→2 shift	Malfunction of shift solenoid valve-B	Inspect. If NG, replace.
	Malfunction of output shaft speed sensor (VSS)	
	Malfunction of transmission range sensor	
	Malfunction of throttle position sensor	Inspect referring to Section 6E1. If NG, replace.
	Faulty valve body component	Replace valve body assembly.
Poor 2→3 shift	Malfunction of shift solenoid valve-A	Inspect. If NG, replace.
	Malfunction of output shaft speed sensor (VSS)	
	Malfunction of transmission range sensor	
	Malfunction of throttle position sensor	Inspect referring to Section 6E1. If NG, replace.
	Faulty valve body component	Replace valve body assembly.
Poor 3→O/D shift	Malfunction of shift solenoid valve-B	Inspect. If NG, replace.
	Malfunction of timing solenoid valve	
	Malfunction of output shaft speed sensor (VSS)	
	Malfunction of input shaft speed sensor	
	Malfunction of transmission range sensor	
	Malfunction of Transmission fluid temperature sensor	
	Malfunction of O/D off switch	
	Malfunction of engine coolant temperature sensor	Inspect referring to Section 6E1. If NG, replace.
	Malfunction of throttle position sensor	If NG, replace.
	Malfunction of pressure control solenoid valve	Inspect. If NG, replace valve body assembly.
	Faulty valve body component	Replace valve body assembly.

Condition	Possible Cause	Correction
Poor O/D→3 shift	Malfunction of shift solenoid valve-B	Inspect. If NG, replace.
	Malfunction of timing solenoid valve	
	Malfunction of output shaft speed sensor (VSS)	
	Malfunction of input shaft speed sensor	
	Malfunction of O/D off switch	
	Malfunction of throttle position sensor	Inspect referring to Section 6E1. If NG, replace.
	Malfunction of pressure control solenoid valve	Inspect. If NG, replace valve body assembly.
	Faulty valve body component	Replace valve body assembly.
Poor 3→2 shift	Malfunction of shift solenoid valve-A	Inspect. If NG, replace.
	Malfunction of output shaft speed sensor (VSS)	
	Malfunction of throttle position sensor	Inspect referring to Section 6E1. If NG, replace.
	Faulty valve body component	Replace valve body assembly.
Poor 2→1 shift	Malfunction of shift solenoid valve-B	Inspect. If NG, replace.
	Malfunction of output shaft speed sensor (VSS)	
	Malfunction of throttle position sensor	Inspect referring to Section 6E1. If NG, replace.
	Faulty valve body component	Replace valve body assembly.
Incorrect shift point	Engine abnormal condition	Inspect and repair engine
	Malfunction of output shaft speed sensor (VSS)	Inspect. If NG, replace.
	Malfunction of throttle position sensor	Inspect referring to Section 6E1. If NG, replace.
Non operate TCC (lock-up) system	Malfunction of TCC solenoid valve	Inspect. If NG, replace.
	Malfunction of shaft solenoid valve-A and/or-B	
	Malfunction of output shaft speed sensor (VSS)	
	Malfunction of input shaft speed sensor	
	Malfunction of transmission range sensor	
	Malfunction of transmission fluid temperature sensor	
	Malfunction of pressure control solenoid valve	Inspect. If NG, replace valve body assembly.
	Malfunction of brake light switch	Inspect referring to Section 5. If NG, replace.
	Malfunction of throttle position sensor	Inspect referring to Section 6E1. If NG, replace.
	Malfunction of engine coolant temperature sensor	
	Faulty valve body component	Replace valve body assembly.
Excessive “N”→“D” or “N”→“R” time lag	Malfunction of transmission fluid temperature sensor	Inspect. If NG, replace.
	Pressure control solenoid valve circuit faulty	Inspect. If NG, replace valve body assembly.
	Clogged oil strainer	Replace.
	Faulty valve body component	Replace valve body assembly.

**Trouble diagnosis table-3****Off-vehicle Repair**

Condition	Possible Cause	Correction
Unable to run in all range	Faulty oil pump	Inspect. If NG, replace.
	Seized or broken planetary gear	
	Faulty one-way No.2 clutch	
	Damaged drive plate	
	Faulty forward clutch	
	Faulty reverse clutch	
	Faulty 1st and reverse brake	
	Faulty torque converter	Replace
Excessive "N"→"D" shift shock	Faulty forward clutch	Inspect. If NG, replace.
Excessive "N"→"R" shift shock	Faulty reverse clutch	Inspect. If NG, replace.
	Faulty 1st and reverse brake	
Poor 1→2 shift, excessive shock or slippage	Faulty 2nd brake	Inspect. If NG, replace.
	Faulty one-way No.1 clutch	
Poor 2→3 shift, excessive shock or slippage	Faulty direct clutch	Inspect. If NG, replace.
Poor 3↔O/D shift, excessive shock or slippage	Faulty forward clutch	Inspect. If NG, replace.
	Faulty O/D and 2nd coast brake	
Poor 3→2 shift, excessive shock or slippage	Faulty direct clutch	Inspect. If NG, replace.
	Faulty one-way No.1 clutch	
Poor 2→1 shift, excessive shock or slippage	Faulty 2nd brake	Inspect. If NG, replace.
	Faulty one-way No.2 clutch	
Non operate TCC (lock-up) system	Faulty torque converter	Replace.
Excessive "N"→"D" time lag	Faulty oil pump	Inspect. If NG, replace.
	Faulty forward clutch	
	Faulty one-way No.2 clutch	
	Leakage from "D" range fluid pressure circuit	Overhaul or replace valve body assembly.
Excessive "N"→"R" time lag	Faulty oil pump	Inspect. If NG, replace.
	Faulty reverse clutch	
	Faulty 1st and reverse brake	
	Leakage from "R" range fluid pressure circuit	Overhaul or replace valve body assembly.
Poor engine brake in downshift to "2" range	Faulty O/D and 2nd coast brake	Inspect. If NG, replace.
Poor engine brake in downshift to "L" range	Faulty 1st and reverse brake.	Inspect. If NG, replace.

## Road Test

This test is to check if upshift, downshift and lock-up take place at specified speeds while actually driving vehicle on a level road.

**WARNING:**

- Carry out test in very little traffic area to prevent an accident.
- Test requires 2 persons, a driver and a tester.

- 1) Warm up engine.
- 2) With engine running at idle, shift selector lever to “D” range.
- 3) Accelerate vehicle speed by depressing accelerator pedal gradually.
- 4) While driving in “D” range, check if gear shift and lock-up occur properly as shown in “Gear Shift Diagram [A] and TCC Lock-up Diagram [B]”. (Refer to “Automatic gear shift diagram” in this section.)

## Troubleshooting

Condition	Possible Cause	Correction
Unable to run in all range	Faulty valve body component	Replace valve body assembly
	Faulty oil pump	Inspect. If NG, replace.
	Seized or broken planetary gear	
	Faulty one-way No.2 clutch	
	Faulty forward clutch	
	Faulty reverse clutch	
	Faulty 1st and reverse brake	
	Damaged drive plate	
	Faulty torque converter	Replace.
No gear shift as 3rd gear	Malfunction of shift solenoid valve-A and/or-B	Inspect. If NG, replace.
	Malfunction of timing solenoid valve	
	Malfunction of pressure control solenoid valve	Inspect. If NG, replace valve body assembly.
1→2 upshift fails to occur	Malfunction of shift solenoid valve-B	Inspect. If NG, replace.
	Malfunction of output shaft speed sensor (VSS)	
	Malfunction of throttle position sensor	
	Malfunction of transmission range sensor	
	Faulty valve body component	Replace valve body assembly
	Faulty 2nd brake	Inspect. If NG, replace.
	Faulty one-way No.1 clutch	
2→3 upshift fails to occur	Malfunction of shift solenoid valve-A	Inspect. If NG, replace.
	Malfunction of output shaft speed sensor (VSS)	
	Malfunction of throttle position sensor	
	Malfunction of transmission range sensor	
	Faulty valve body component	Replace valve body assembly.
	Faulty direct clutch	Inspect. If NG, replace.

Condition	Possible Cause	Correction
3→O/D upshift fails to occur	Malfunction of shift solenoid valve-B	Inspect. If NG, replace.
	Malfunction of O/D off switch	
	Malfunction of engine coolant temperature sensor	
	Malfunction of output shaft speed sensor (VSS)	
	Malfunction of input shaft speed sensor	
	Malfunction of throttle position sensor	
	Malfunction of transmission range sensor	
	Malfunction of crankshaft position sensor	
	Malfunction of timing solenoid valve	
	Malfunction of transmission fluid temperature sensor	
	Malfunction of pressure control solenoid valve	Inspect. If NG, replace valve body assembly.
	Faulty valve body component	Replace valve body assembly.
	Faulty O/D and 2nd coast brake	Inspect. If NG, replace.
O/D→3 downshift fails to occur	Malfunction of shift solenoid valve-A	Inspect. If NG, replace.
	Malfunction of O/D off switch	
	Malfunction of output shaft speed sensor (VSS)	
	Malfunction of input shaft speed sensor	
	Malfunction of throttle position sensor	
	Malfunction of timing solenoid valve	
	Malfunction of pressure control solenoid valve	Inspect. If NG, replace valve body assembly.
	Faulty valve body component	Replace valve body assembly.
	Faulty forward clutch	Inspect. If NG, replace.
3→2 downshift fails to occur	Malfunction of shift solenoid valve-A	Inspect. If NG, replace.
	Malfunction of output shaft speed sensor (VSS)	
	Malfunction of throttle position sensor	
	Faulty valve body component	Replace valve body assembly.
	Faulty one-way No.1 clutch	Inspect. If NG, replace.
2→1 downshift fails to occur	Malfunction of shift solenoid valve-B	Inspect. If NG, replace.
	Malfunction of output shaft speed sensor (VSS)	
	Malfunction of throttle position sensor	
	Faulty valve body component	Replace valve body assembly.
	Faulty one-way No.2 clutch	Inspect. If NG, replace.
Gear shift point is incorrect	Abnormal engine condition	Inspect and repair engine.
	Malfunction of output shaft speed sensor (VSS)	Inspect. If NG, replace.
	Malfunction of throttle position sensor	
	Malfunction of pressure control solenoid valve	Inspect. If NG, replace valve body assembly.

Condition	Possible Cause	Correction
TCC (lock-up) function does not operate	Malfunction of TCC solenoid valve	Inspect. If NG, replace.
	Malfunction of shift solenoid valve-A and/or-B	
	Malfunction of brake light switch	
	Malfunction of engine coolant temperature sensor	
	Malfunction of output shaft speed sensor (VSS)	
	Malfunction of input shaft speed sensor	
	Malfunction of throttle position sensor	
	Malfunction of transmission range sensor	
	Malfunction of transmission fluid temperature sensor	
	Malfunction of pressure control solenoid valve	Inspect. If NG, replace valve body assembly.
	Faulty valve body component	Replace valve body assembly.
	Faulty torque converter	Replace.

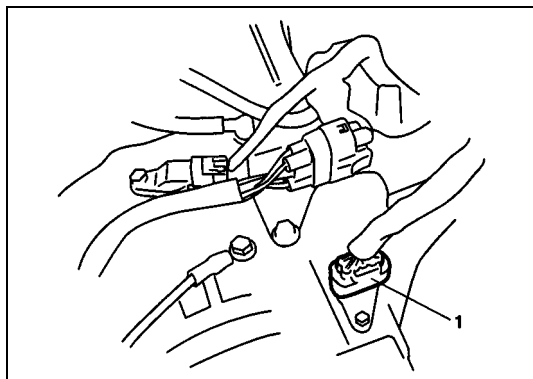
## Manual Road Test

This test checks the gears being used in “L”, “2” or “D” range when driven with unoperated gear shift control system. Test drive vehicle on a level road.

### NOTE:

**Before this test, check diagnostic trouble code (DTC).**

- 1) With select lever in “P”, start engine and warm it up.
- 2) After warming up engine, turn ignition switch OFF and disconnect valve body harness connector (1).



- 3) With select lever in “L” range, start vehicle and check that 3rd gear is being used referring to table shown below.

**Vehicle speed per 1000 rpm in engine speed (V1000 table, reference)**

Gear position	Vehicle speed
1st	9.2 km/h (5.7 mile/h)
2nd	16.8 km/h (10.4 mile/h)
3rd	26.4 km/h (16.4 mile/h)
4th (O/D)	37.9 km/h (23.6 mile/h)
Reverse	11.7 km/h (7.3 mile/h)

- 4) While vehicle is running, shift select lever to “2” range and check that 3rd gear is being used.
- 5) While vehicle is running, shift select lever to “D” range and check that 3rd gear is being used.
- 6) After above checks, stop vehicle then turn ignition switch OFF, and connect valve body harness connector.
- 7) Clear DTC.

## Troubleshooting

Condition	Possible Cause	Correction
Operated gear is not correct	Faulty valve body component	Replace valve body assembly.
	Faulty clutch or brake	Inspect clutch and brake. If any parts are faulty, replace them.



## Engine Brake Test

**WARNING:**

**Before test, make sure that there is no vehicle behind so as to prevent rear-end collision.**

- 1) While driving vehicle in 3rd gear of “D” range, shift select lever down to “2” range and check if engine brake operates.
- 2) In the same way as in Step 1), check engine brake for operation when select lever is shifted down to “L” range.
- 3) Engine brake should operate in above test.

### Troubleshooting

Condition	Possible Cause	Correction
<b>Failure to operate when shifted down to “2” range</b>	Faulty valve body component	Replace valve body assembly.
	Faulty O/D and 2nd coast brake	Inspect. If NG, replace.
<b>Failure to operate when shifted down to “L” range</b>	Faulty valve body component	Replace valve body assembly.
	Faulty 1st and reverse brake	Inspect. If NG, replace.

## Stall Test

This test is to check overall performance of automatic transaxle and engine by measuring stall speed at “D” and “R” ranges. Be sure to perform this test only when transaxle fluid is at normal operating temperature and its level is between FULL and LOW marks.

### CAUTION:

- **Do not run engine at stall more than 5 seconds continuously, or fluid temperature may rise excessively high.**
- **After performing stall test, be sure to leave engine running at idle for longer than 1 minute before another stall test.**

- 1) Apply parking brake and block wheels.
- 2) Install tachometer.
- 3) Start engine with select lever shifted to “P” range.
- 4) Depress brake pedal fully.
- 5) Shift select lever to “D” range and depress accelerator pedal fully while watching tachometer. Read engine rpm quickly when it has become constant (stall speed).
- 6) Release accelerator pedal immediately after stall speed is checked.
- 7) In the same way, check stall speed in “R” range.
- 8) Stall speed should be within following specification.

### Engine stall speed

**Standard: 2,050 – 2,350 rpm**

## Troubleshooting

Condition	Possible Cause	Correction
<b>Lower than standard level in both “D” and “R” range</b>	Engine output torque failure	Inspect and repair engine.
	Faulty one-way clutch of torque converter	Replace torque converter.
<b>Higher than standard level in “D” range</b>	Malfunction of pressure control solenoid valve (Low line pressure)	Inspect. If NG, replace valve body assembly.
	Faulty valve body component	Replace valve body assembly.
	Slippery forward clutch	Inspect. If NG, replace.
	Faulty one-way No.2 clutch	
	Leakage from “D” range fluid pressure circuit	Overhaul or replace valve body assembly.
<b>Higher than standard level in “R” range</b>	Malfunction of pressure control solenoid valve (Low line pressure)	Inspect. If NG, replace valve body assembly.
	Faulty valve body component	Replace valve body assembly.
	Slippery reverse clutch	Inspect. If NG, replace.
	Slippery 1st and reverse brake	
	Leakage from “R” range fluid pressure circuit	Overhaul or replace valve body assembly.
<b>Higher than standard level in both “D” and “R” range</b>	Malfunction of pressure control solenoid valve (Low line pressure)	Inspect. If NG, replace valve body assembly.
	Faulty valve body component	Replace valve body assembly.
	Clogged oil strainer	Replace.
	Faulty oil pump	Inspect. If NG, replace.
	Leakage from both “D” and “R” range fluid pressure circuit	Overhaul or replace valve body assembly.

## Time Lag Test

This test is to check conditions of clutch, brake and fluid pressure. "Time lag" means time elapsed since selector lever is shifted with engine idling till shock is felt.

- 1) With chocks placed before and behind front and rear wheels respectively, depress brake pedal.
- 2) Start engine.
- 3) With stop watch ready, shift select lever from "N" to "D" range and measure time from that moment till shock is felt.
- 4) Similarly measure time lag by shifting select lever from "N" to "R" range.

### Gear shifting time lag

"N" → "D": Less than 0.7 sec.

"N" → "R": Less than 1.2 sec.

### NOTE:

- When repeating this test, be sure to wait at least one minute after select lever is shifted back to "N" range.
- Engine should be warmed up fully for this test.
- Repeat test 3 times and take average of those data for final time lag data.

## Troubleshooting

Condition	Possible Cause	Correction
<b>"N" → "D" time lag exceeds specification</b>	Malfunction of transmission fluid temperature sensor	Inspect. If NG, replace.
	Malfunction of pressure control solenoid valve (Low line pressure)	Inspect. If NG, replace valve body assembly.
	Faulty valve body component	Replace valve body assembly.
	Clogged oil strainer	Replace.
	Faulty oil pump	Inspect. If NG, replace.
	Faulty forward clutch	
	Faulty one-way No.2 clutch	
	Leakage from "D" range fluid pressure circuit	Overhaul or replace valve body assembly.
<b>"N" → "R" time lag exceeds specification</b>	Malfunction of transmission fluid temperature sensor	Inspect. If NG, replace.
	Malfunction of pressure control solenoid valve (Low line pressure)	Inspect. If NG, replace valve body assembly.
	Faulty valve body component	Replace valve body assembly.
	Clogged oil strainer	Replace.
	Faulty oil pump	Inspect. If NG, replace.
	Faulty reverse clutch	
	Faulty 1st and reverse brake	
	Leakage from "R" range fluid pressure circuit	Overhaul or replace valve body assembly.

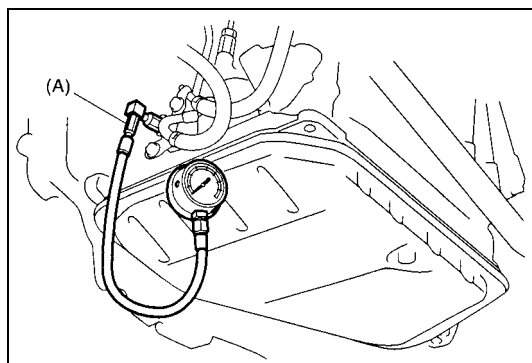
## Line Pressure Test

Purpose of this test is to check operating conditions of each part by measuring fluid pressure in fluid pressure line.

Line pressure test requires following conditions.

- Automatic fluid is at normal operating temperature (70 – 80°C / 158 – 176°F).
- Fluid is replenished to proper level (between FULL and LOW on dipstick).
- Air conditioner switch is turned OFF.

- 1) Apply parking brake securely and place chocks against wheels.
- 2) Remove fluid pressure check hole plug bolt.
- 3) Attach oil pressure gauge to fluid pressure check hole in transaxle case.



### Special tool

(A): 09925-37811-001

### CAUTION:

After attaching oil pressure gauge, check that no fluid leakage exists.

- 4) Depress foot brake fully, run engine at idle and stall then check fluid pressure in “D” or “R” range.

### CAUTION:

- Do not continue running engine at stall speed longer than 5 seconds.
- After performing line pressure test, be sure to leave engine running at idle for longer than one minute before performing another line pressure test.

### Automatic transmission line pressure

	“D” range	“R” range
At idle speed	3.6 – 4.0 kg/cm <sup>2</sup> 51 – 57 psi	5.8 – 6.7 kg/cm <sup>2</sup> 82 – 95 psi
At stall speed	12.3 – 13.4 kg/cm <sup>2</sup> 175 – 191 psi	16.2 – 18.6 kg/cm <sup>2</sup> 230 – 264 psi

## Troubleshooting

Condition	Possible Cause	Correction
<b>Higher than standard level in each range</b>	Malfunction of pressure control solenoid valve (Low line pressure)	Inspect. If NG, replace valve body assembly.
	Faulty valve body component	Replace valve body assembly.
<b>Lower than standard level in each range</b>	Malfunction of pressure control solenoid valve (Low line pressure)	Inspect. If NG, replace valve body assembly.
	Faulty valve body component	Replace valve body assembly.
	Clogged oil strainer	Replace.
	Faulty oil pump	Inspect. If NG, replace.
	Leakage from both "D" and "R" range fluid pressure circuit	Overhaul or replace valve body assembly.
<b>Lower than standard level only in "D" range</b>	Leakage from "D" range fluid pressure circuit	Overhaul or replace valve body assembly.
<b>Lower than standard level only in "R" range</b>	Leakage from "R" range fluid pressure circuit	Overhaul or replace valve body assembly.

## "P" Range Test

- 1) Stop vehicle on a slope of 5 degrees or more, shift select lever to "P" range and at the same time apply parking brake.
- 2) After stopping engine, depress brake pedal and release parking brake.
- 3) Then, release brake pedal gradually and check that vehicle remains stationary.
- 4) Depress brake pedal and shift select lever to "N" range.
- 5) Then, release brake pedal gradually and check that vehicle moves.

### WARNING:

**Before test, make sure no one is around vehicle or down on a slope and keep watchful for safety during test.**

## Troubleshooting

Condition	Possible Cause	Correction
<b>Vehicle moves at "P" range or remains stationary at "N" range</b>	Defective parking lock pawl or spring	Inspect. If NG, repair.

## Diagnostic Flow Table A-1: No Gear Shift to O/D

### System Description

TCM does not shift to O/D gear under any of the following conditions.

- O/D OFF switch is turned ON ("O/D OFF" lamp lights).
- Engine coolant temperature is less than 50°C (122°F).
- A/T fluid temperature is less than 20°C (68°F).
- TCM detects the following DTCs.

P0712/P0713/P0717/P0722/P0785/P0962/P0963/P0973/P0974/P0976/P0977/P1701/P1702/P1703

### Troubleshooting

#### WARNING:

- When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.
- Road test should be carried out with 2 persons, a driver and tester, on a level road.

Step	Action	Yes	No
1	Was "A/T System Check" performed?	Go to Step 2.	Go to "A/T System Check".
2	Check DTC. Is DTC P0712, P0713, P0717, P0722, P0785, P0962, P0963, P0973, P0974, P0976, P0977, P1701, P1702 and/or P1703 detected?	Perform DTC flow table to repair and retry.	Go to Step 3.
3	Perform running test under the following conditions and measure voltage between terminal "C39-16" of TCM connector and ground, terminal "C39-15" of TCM connector and ground. <ul style="list-style-type: none"> <li>• O/D OFF switch is turned OFF. ("O/D OFF" lamp does not light)</li> <li>• Engine coolant temperature is in normal operating temperature.</li> <li>• Select lever is in "D" range.</li> <li>• Drive vehicle with 4th gear condition referring to "Automatic gear shift diagram" in this section.</li> </ul> Do results satisfy the value as follows? Voltage between terminal "C39-16" of TCM connector and ground: 0 – 1 V Voltage between terminal "C39-15" of TCM connector and ground: 9 – 14 V	Faulty shift solenoid valve, circuit or transaxle.	"BRN" circuit shorted to power circuit or open, or "BLK/YEL" circuit shorted to ground. If wire is OK, go to Step 4.
4	O/D OFF switch signal inspection. With ignition switch ON, check voltage between terminal "C38-9" of TCM connector and ground. O/D OFF switch OFF ("O/D OFF" lamp does not light): 8 – 14 V O/D OFF switch ON ("O/D OFF" lamp lights): 0 – 1 V Is result as specified?	Substitute a known-good TCM and recheck.	Faulty O/D OFF switch or its circuit. If OK substitute a known-good TCM and recheck.

## Diagnostic Flow Table A-2: No Lock-Up Occurs

### System Description

TCM turns TCC solenoid OFF under any of the following conditions.

- Brake light switch is turned ON. (Brake pedal is depressed)
- Engine coolant temperature is less than 60°C (140°F).
- Throttle opening is as much as 0%.
- TCM detects the following DTCs.  
P0705/P0707/P0712/P0713/P0717/P0722/P0785/P0962/P0963/P0973/P0974/P0976/P0977/P1701/  
P1702/P1703/P2769/P2770

### Troubleshooting

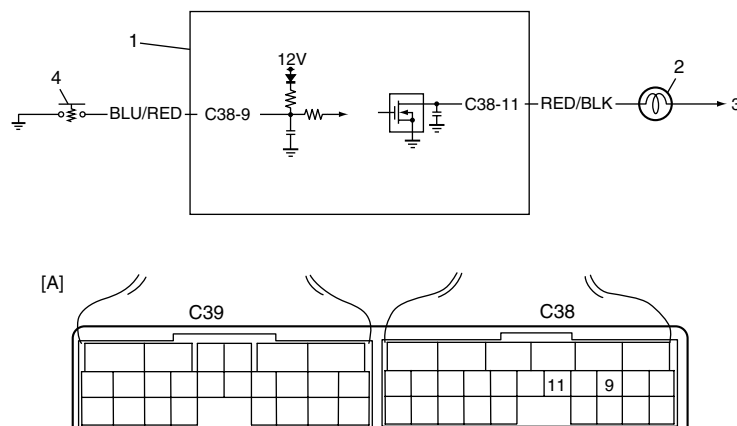
#### WARNING:

- When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.
- Road test should be carried out with 2 persons, a driver and tester, on a level road.

Step	Action	Yes	No
1	Was "A/T System Check" performed?	Go to Step 2.	Go to "A/T System Check".
2	Check DTC. Is DTC P0705, P0707, P0712, P0713, P0717, P0722, P0785, P0962, P0963, P0973, P0974, P0976, P0977, P1701, P1702, P1703, P2769 and/or P2770 detected?	Perform DTC flow table to repair and retry.	Go to Step 3.
3	Perform running test under the following conditions and measure voltage between terminal "C39-5" of TCM connector and ground. <ul style="list-style-type: none"> <li>• O/D OFF switch is turned OFF. ("O/D OFF" lamp does not light)</li> <li>• Engine coolant temperature is in normal operating temperature.</li> <li>• Select lever is in "D" range.</li> <li>• Brake pedal is released.</li> <li>• Drive vehicle with 4th gear and TCC ON condition referring to "Automatic gear shift diagram" in this section.</li> </ul> Is terminal voltage about 9 – 14 V?	Faulty TCC solenoid valve, circuit or transaxle.	"WHT/BLU" circuit shorted to ground. If wire is OK, go to step 4
4	Brake light switch signal inspection. With ignition switch ON, check voltage between terminal "G91-9" of ECM connector and ground. Brake pedal is released: 0 – 1 V Brake pedal is depressed: 8 – 14 V Is result as specified?	Substitute a known-good TCM and recheck.	Mis-adjusted brake light switch, faulty brake light switch or its circuit. If OK, substitute a known-good TCM and recheck.

## Diagnostic Flow Table A-3: “O/D OFF” Lamp Circuit Check (“O/D OFF” Lamp Lights Steadily)

### Wiring Diagram



1. TCM	4. O/D off switch
2. “O/D OFF” lamp	[A]: Terminal arrangement of TCM connector (viewed from harness side)
3. To ignition switch	

### Circuit Description

“O/D OFF” lamp operation of ON/OFF is controlled by transmission control module (TCM) and combination meter.

When ignition switch is turned ON with O/D OFF switch OFF and malfunction is not detected, TCM turn “O/D OFF” lamp ON only for 2 seconds to check bulb and turns it OFF.

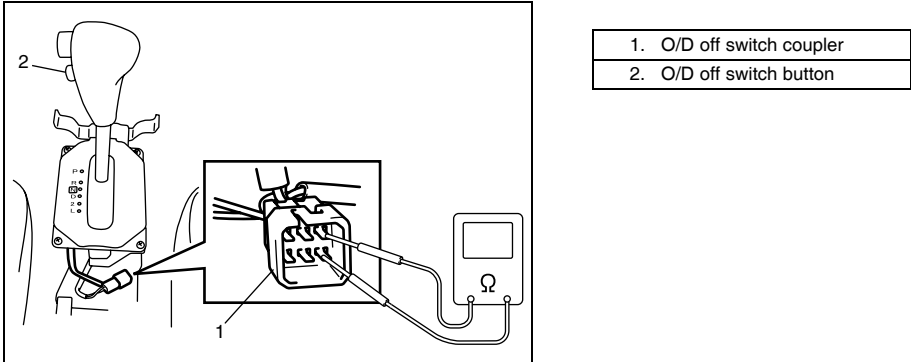
### Troubleshooting

Step	Action	Yes	No
1	Check O/D off switch status. Press O/D off switch button. Does “O/D OFF” lamp light steadily?	Go to Step 2.	System is OK.
2	Check “O/D OFF” lamp circuit for short. 1) Turn ignition switch OFF and disconnect TCM connectors. 2) Turn ignition switch ON. Does “O/D OFF” lamp light steadily yet?	“RED/BLK” circuit shorted to ground.	Go to Step 3.
3	Check O/D off switch circuit. 1) Turn ignition switch OFF. 2) Check continuity between terminal “C38-9” of disconnected harness side connector and ground. Is continuity indicated?	Go to step 4.	Substitute a known-good TCM and recheck.



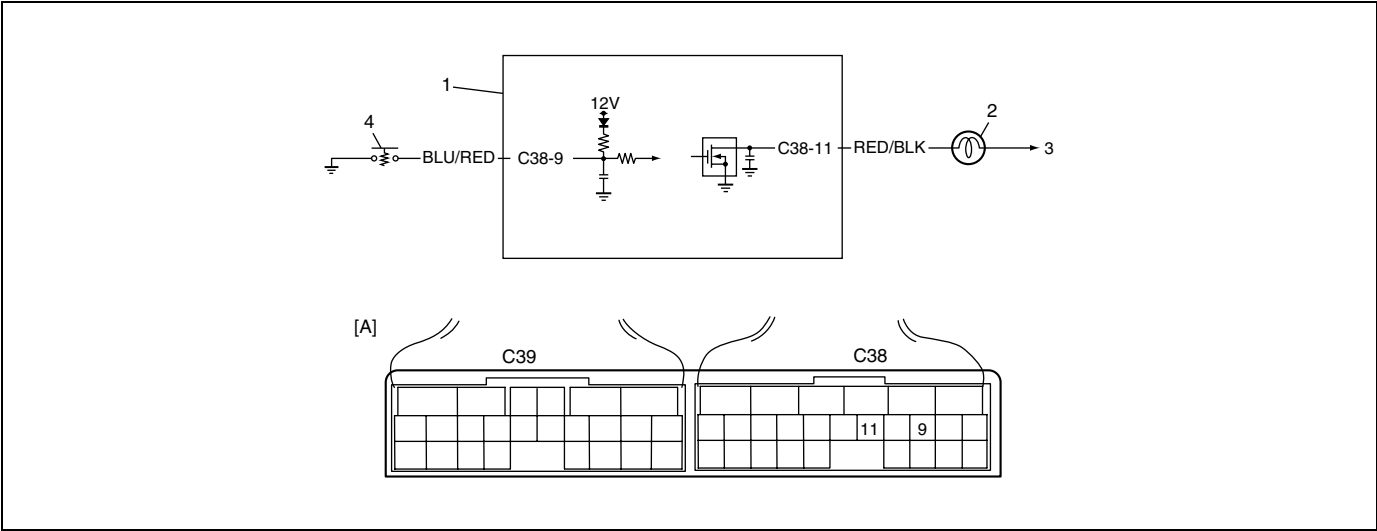
Step	Action	Yes	No
4	Check O/D off switch for operation. 1) Disconnect O/D off switch coupler. 2) Check continuity between terminals under each condition below. (See Fig.) O/D off switch under being released: No continuity O/D off switch under being pressed: Continuity Is check result satisfactory?	“BLU/RED” circuit shorted to ground.	Replace O/D off switch.

Fig. for Step 2 and Step 4



Diagnostic Flow Table A-4: “O/D OFF” Lamp Circuit Check (“O/D OFF” Lamp Does Not Light Anytime)

Wiring Diagram



1. TCM	4. O/D off switch
2. “O/D OFF” lamp	[A]: Terminal arrangement of TCM connector (viewed from harness side)
3. To ignition switch	

Circuit Description

“O/D OFF” lamp operation of ON/OFF is controlled by transmission control module (TCM) and combination meter.

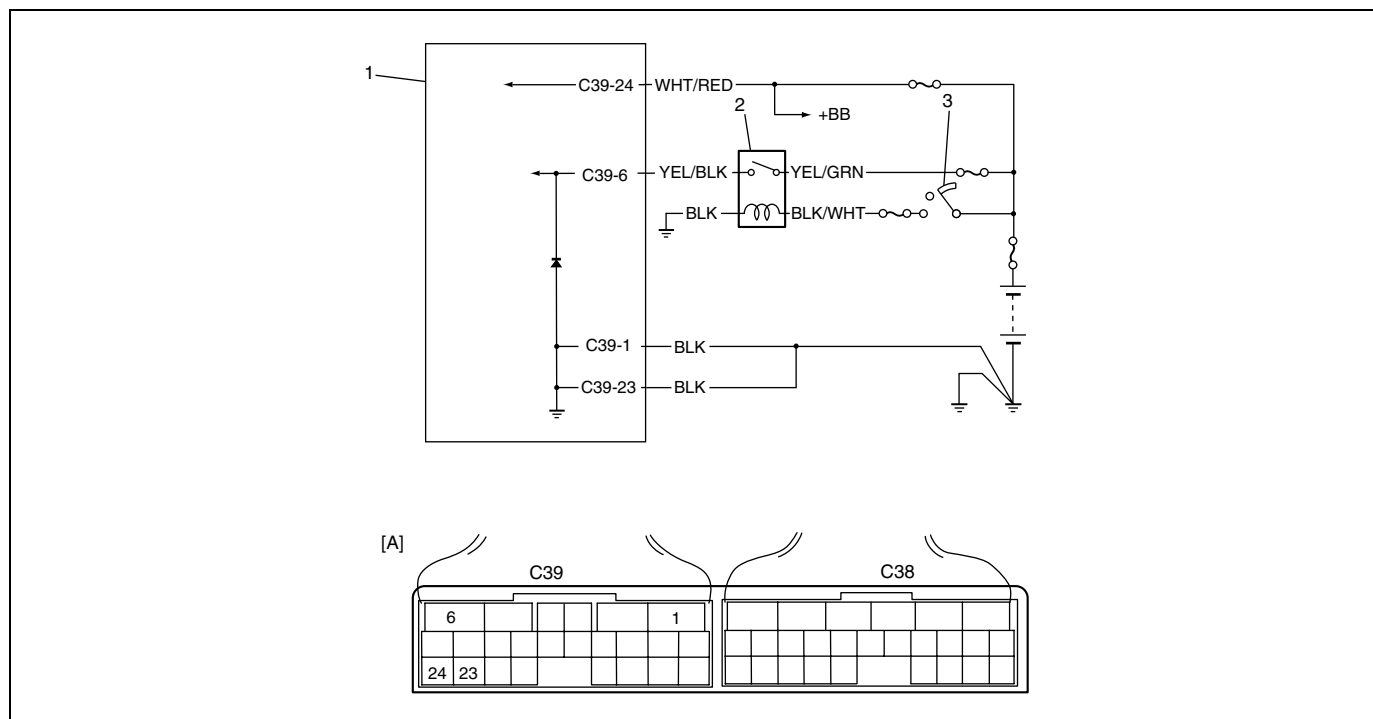
When ignition switch is turned ON with O/D OFF switch OFF and malfunction is not detected, TCM turn “O/D OFF” lamp ON only for 2 seconds to check bulb and turn it OFF.

Troubleshooting

Step	Action	Yes	No
1	Check “O/D OFF” lamp circuit. 1) Turn ignition switch OFF and disconnect TCM connectors. 2) Using service wire, connect terminal “C38-11” of disconnected harness side TCM connector and ground. 3) Turn ignition switch ON. Does “O/D OFF” lamp light?	Poor terminal “C38-11” connection. If OK, substitute a known-good TCM and recheck.	“RED/BLK” circuit open or bulb burned out.

## Diagnostic Flow Table A-5: TCM Power and Ground Circuit Check

### Wiring Diagram



1. TCM	3. Ignition switch
2. A/T relay	[A]: Terminal arrangement of TCM connector (viewed from harness side)

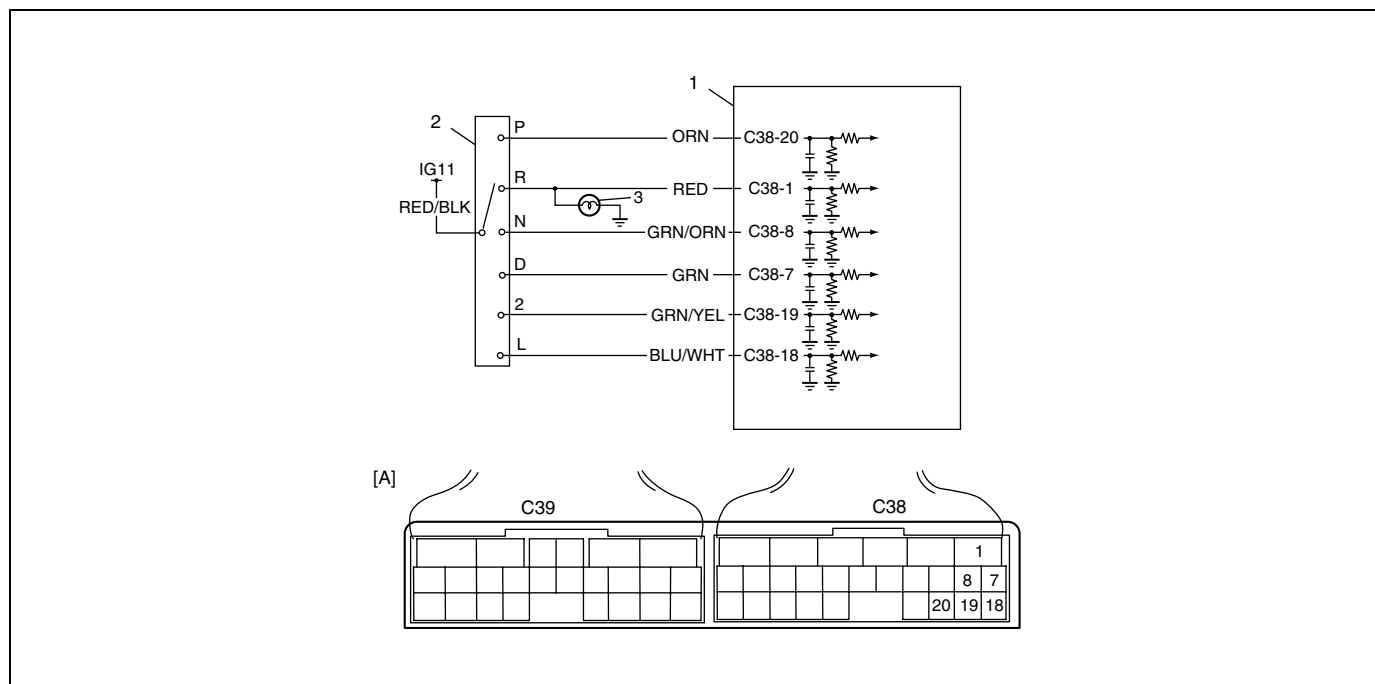
### Troubleshooting

Step	Action	Yes	No
1	Check TCM Back-up Power Circuit 1) Disconnect TCM connector with ignition switch OFF. 2) Check for proper connection to TCM at "C39-24" terminal. 3) If OK, check voltage at terminal "C39-24" of disconnected TCM connector. Is it 10 – 14 V?	Go to Step 2.	"WHT/RED" circuit open or shorted to ground.
2	Check TCM Power Circuit. 1) Disconnect TCM connector with ignition switch OFF. 2) Check for proper connection to TCM at "C39-6" terminal. 3) If OK, turn ignition switch ON and check voltage at terminal "C39-6" of disconnected TCM connector. Is it 10 – 14 V?	Go to Step 4.	Go to Step 3.
3	Check A/T Relay Operation. Check A/T relay operation referring to "A/T Relay" in this section. Is check result satisfactory?	"YEL/BLK", "YEL/GRN". "BLK/WHT" or "BLK" circuit for power supply open.	Replace A/T relay.

Step	Action	Yes	No
4	<p>Check TCM Ground Circuit.</p> <p>1) Turn ignition switch OFF.</p> <p>2) With TCM connectors disconnected, check for proper connection to TCM at "C39-1"/ "C39-23" terminal.</p> <p>3) If OK, check resistance between "C39-1"/ "C39-23" terminal of disconnected TCM connector and body ground.</p> <p>Is continuity indicated?</p>	<p>TCM power and ground circuits are in good condition.</p>	<p>"BLK" circuit for TCM ground open.</p>

## DTC P0705 Transmission Range Sensor Circuit Malfunction

### Wiring Diagram



1. TCM	3. Backup lamp
2. Transmission range sensor	[A]: Terminal arrangement of TCM connector (viewed from harness side)

### DTC Detecting Condition and Trouble Area

DTC DETECTING CONDITION	TROUBLE AREA
<ul style="list-style-type: none"> <li>Multiple signals are inputted simultaneously for 12 seconds.</li> </ul>	<ul style="list-style-type: none"> <li>Select cable maladjusted.</li> <li>Transmission range sensor (switch) maladjusted.</li> <li>Transmission range sensor (switch) or its circuit malfunction.</li> <li>TCM</li> </ul>

### DTC Confirmation Procedure

- 1) Connect scan tool to DLC with ignition switch OFF.
- 2) Clear DTCs in TCM memory by using scan tool.
- 3) Start engine and shift select lever to "D" range.
- 4) Keep engine running at idle speed for 25 seconds or more.
- 5) Stop vehicle and check DTC.

## Troubleshooting

Step	Action	Yes	No
1	Was "Automatic Transaxle Diagnostic Flow Table" performed?	Go to Step 2.	Go to "Automatic Transaxle Diagnostic Flow Table" in this section.
2	Do you have SUZUKI scan tool?	Go to Step 3.	Go to Step 4.
3	<p>Check Transmission range sensor(switch) circuit for operation.</p> <p>Check by using SUZUKI scan tool:</p> <ol style="list-style-type: none"> <li>1) Connect SUZUKI scan tool to DLC with ignition switch OFF.</li> <li>2) Turn ignition switch ON and check transmission range signal (P, R, N, D, 2 or L) on display when shifting select lever to each range.</li> </ol> <p>Is applicable range indicated?</p> <p>Are check results satisfactory?</p>	<p>Intermittent trouble.</p> <p>Check for intermittent referring to "Intermittent and Poor Connection" in Section 0A.</p>	Go to Step 5.
4	<p>Check Transmission range sensor(switch) circuit for operation.</p> <p>Check by not using SUZUKI scan tool:</p> <ol style="list-style-type: none"> <li>1) Turn ignition switch ON.</li> <li>2) Check voltage at terminals "C38-1", "C38-7", "C38-8", "C38-18", "C38-19" and "C38-20" respectively with select lever shifted to each range.</li> </ol> <p>Taking terminal G99-21 as an example, is battery voltage indicated only when select lever is shifted to "2" range and 0 V for other ranges as shown in table below?</p> <p>Check voltage at other terminals likewise, referring to Select Cable.</p> <p>Are check results satisfactory?</p>	<p>Intermittent trouble.</p> <p>Check for intermittent referring to "Intermittent and Poor Connection" in Section 0A.</p>	Go to Step 5.
5	<p>Check transmission range sensor for installation position.</p> <ol style="list-style-type: none"> <li>1) Shift select lever to "N" range.</li> <li>2) Check that "N" reference line on sensor and needle direction shaped on lock washer are aligned.</li> </ol> <p>Are they aligned?</p>	Go to Step 7.	Adjust.
6	<p>Check select cable for adjustment referring to "Select Cable" in this section.</p> <p>Is it adjusted correctly?</p>	Go to Step 6.	Adjust.

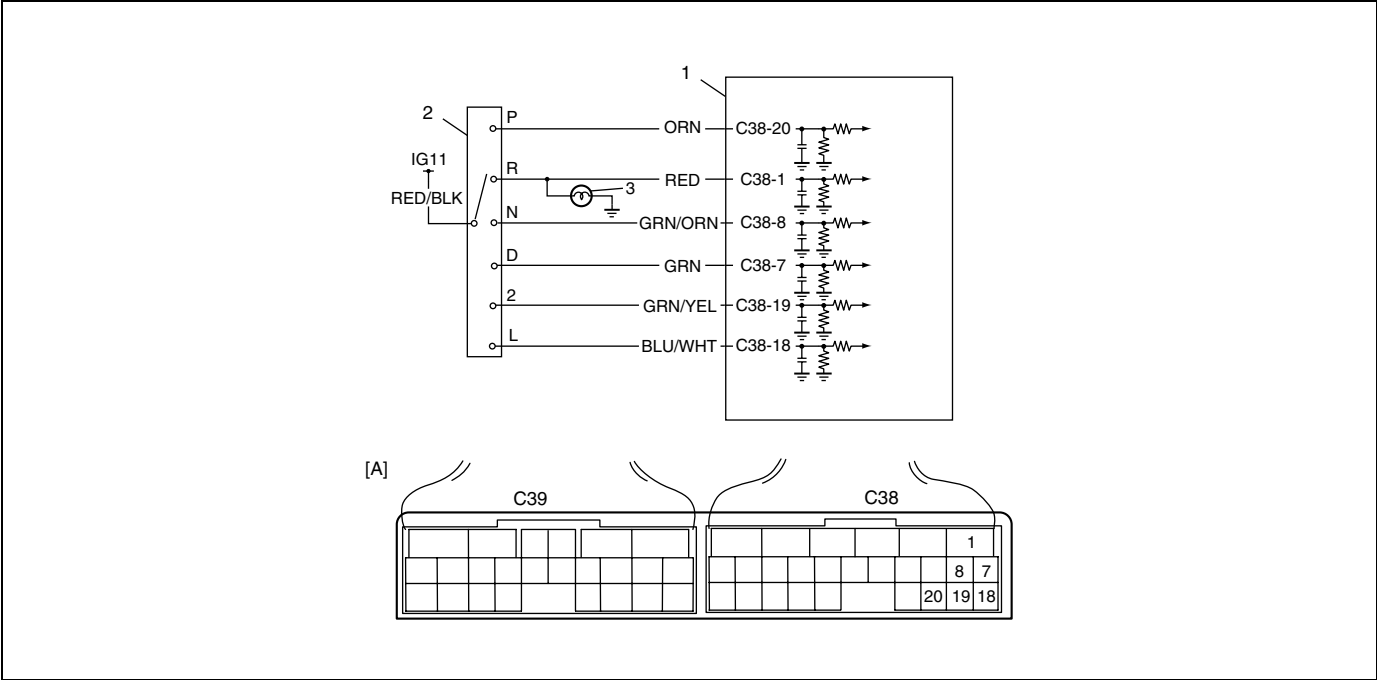
Step	Action	Yes	No
7	Check Transmission range sensor(switch) referring to "Transmission Range Sensor (Shift Switch)" in this section. Are check results satisfactory?	"RED/BLK", "ORN", "RED", "GRN/ORN", "GRN", "GRN/YEL" or "BLU/WHT" circuit shorted to power circuit or shorted each other. If wires and connections are OK, substitute a know-good TCM and recheck.	Replace Transmission range sensor.

Table for Step 4

		Terminal					
		C38-20	C38-1	C38-8	C38-7	C38-19	C38-18
Select lever position	P	8 – 14 V	0 V	0 V	0 V	0 V	0 V
	R	0 V	8 – 14 V	0 V	0 V	0 V	0 V
	N	0 V	0 V	8 – 14 V	0 V	0 V	0 V
	D	0 V	0 V	0 V	8 – 14 V	0 V	0 V
	2	0 V	0 V	0 V	0 V	8 – 14 V	0 V
	L	0 V	0 V	0 V	0 V	0 V	8 – 14 V

# DTC P0707 Transmission Range Sensor Circuit Low

## Wiring Diagram



1. TCM	3. Backup lamp
2. Transmission range sensor	[A]: Terminal arrangement of TCM connector (viewed from harness side)

## DTC Detecting Condition and Trouble Area

DTC DETECTING CONDITION	TROUBLE AREA
<ul style="list-style-type: none"><li>Transmission range switch signal (P, R, N, D, 2, or L) is not inputted for more than 32 seconds when vehicle speed is faster than 30 km/h (19 mile/h) and engine speed is faster than 1500 rpm.</li></ul>	<ul style="list-style-type: none"><li>Select cable maladjusted.</li><li>Transmission range sensor (switch) maladjusted.</li><li>Transmission range sensor (switch) or its circuit malfunction.</li><li>TCM</li></ul>

## DTC Confirmation Procedure

<b>WARNING:</b> <ul style="list-style-type: none"><li>When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.</li><li>Road test should be carried out with 2 persons, a driver and tester, on a level road.</li></ul>
---

- 1) Connect scan tool to DLC with ignition switch OFF.
- 2) Clear DTCs in TCM memory by using scan tool.
- 3) Start engine and shift select lever.
- 4) Shift select lever to "D" range.
- 5) Start vehicle and increase vehicle speed to 40 km/h (25 mile/h) or more for 1 minutes.
- 6) Stop vehicle and turn ignition switch OFF.
- 7) Repeat Step 3) to 5) one time.
- 8) Stop vehicle and check DTC.



## Troubleshooting

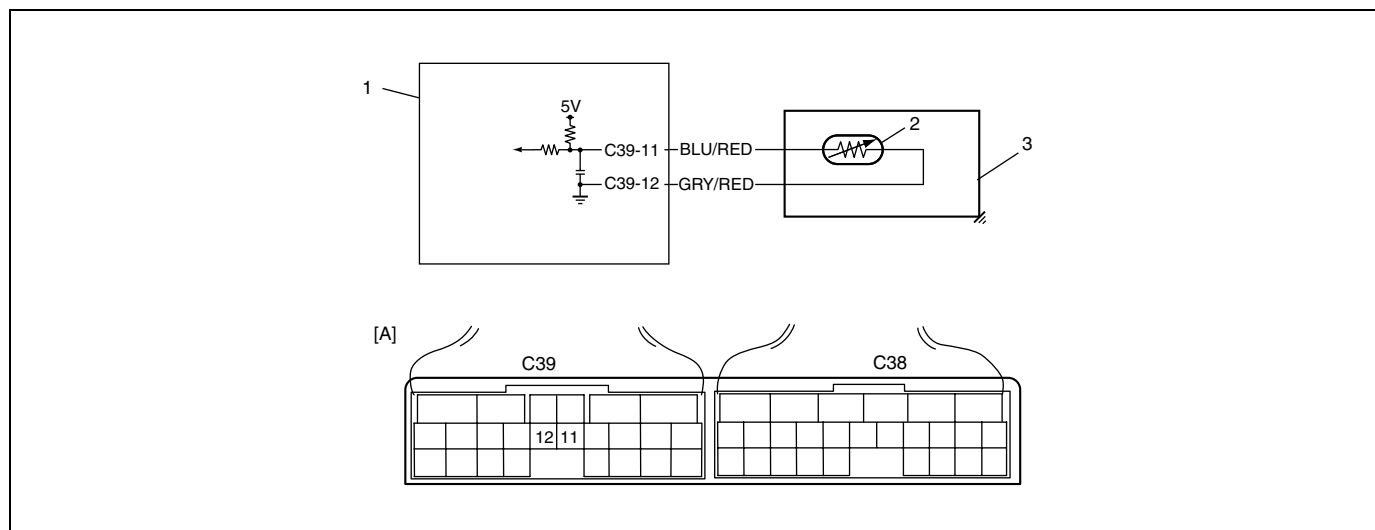
Step	Action	Yes	No
1	Was "Automatic Transaxle Diagnostic Flow Table" performed?	Go to Step 2.	Go to "Automatic Transaxle Diagnostic Flow Table" in this section.
2	Do you have SUZUKI scan tool?	Go to Step 3.	Go to Step 4.
3	Check Transmission range sensor(switch) circuit for operation. Check by using SUZUKI scan tool: 1) Connect SUZUKI scan tool to DLC with ignition switch OFF. 2) Turn ignition switch ON and check transmission range signal (P, R, N, D, 2 or L) on display when shifting select lever to each range. Is applicable range indicated? Are check results satisfactory?	Intermittent trouble. Check for intermittent referring to "Intermittent and Poor Connection" in Section 0A.	Go to Step 5.
4	Check Transmission range sensor(switch) circuit for operation. Check by not using SUZUKI scan tool: 1) Turn ignition switch ON. 2) Check voltage at terminals G99-1, G99-2, G99-8, G99-9, G99-20 and G99-21 respectively with select lever shifted to each range. Taking terminal G99-21 as an example, is battery voltage indicated only when select lever is shifted to "2" range and 0 V for other ranges as shown in table below? Check voltage at other terminals likewise, referring to Fig. Are check results satisfactory?	Intermittent trouble. Check for intermittent referring to "Intermittent and Poor Connection" in Section 0A.	Go to Step 5.
5	Check transmission range sensor for installation position. 1) Shift select lever to "N" range. 2) Check that "N" reference line on sensor and needle direction shaped on lock washer are aligned. Are they aligned?	Go to Step 7.	Adjust.
6	Check select cable for adjustment referring to "Select Cable" in this section. Is it adjusted correctly?	Go to Step 6.	Adjust.
7	Check Transmission range sensor(switch) referring to "Transmission Range Sensor (Shift Switch)" in this section. Are check results satisfactory?	"RED/BLK", "ORN", "RED", "GRN/ORN", "GRN", "GRN/YEL" or "BLU/WHT" circuit open or short to ground. If wires and connections are OK, substitute a know-good TCM and recheck.	Replace Transmission range sensor.

Table for Step 4

		Terminal					
		C38-20	C38-1	C38-8	C38-7	C38-19	C38-18
Select lever position	P	8 – 14 V	0 V	0 V	0 V	0 V	0 V
	R	0 V	8 – 14 V	0 V	0 V	0 V	0 V
	N	0 V	0 V	8 – 14 V	0 V	0 V	0 V
	D	0 V	0 V	0 V	8 – 14 V	0 V	0 V
	2	0 V	0 V	0 V	0 V	8 – 14 V	0 V
	L	0 V	0 V	0 V	0 V	0 V	8 – 14 V

## DTC P0712 Transmission Fluid Temperature Sensor Circuit Low

### Wiring Diagram



1. TCM	3. A/T
2. Transmission fluid temperature sensor	[A]: Terminal arrangement of TCM connector (viewed from harness side)

### DTC Detecting Condition and Trouble Area

DTC DETECTING CONDITION	TROUBLE AREA
Transmission temperature sensor terminal voltage is less than 0.05 V for 5 minutes or more after turning ignition switch ON.	<ul style="list-style-type: none"> <li>Transmission fluid temperature sensor or its circuit malfunction.</li> <li>TCM</li> </ul>

### DTC Confirmation Procedure

#### WARNING:

- When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.
- Road test should be carried out with 2 persons, a driver and tester, on a level road.

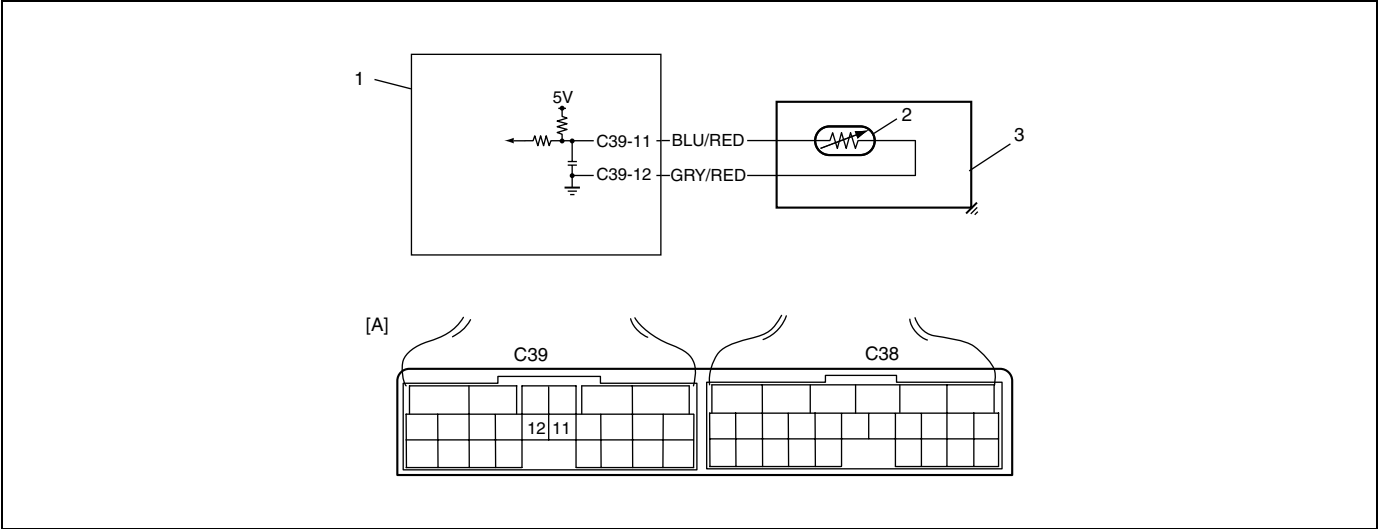
- 1) Connect scan tool to DLC with ignition switch OFF if available.
- 2) Clear DTC in TCM memory and start engine.
- 3) Keep engine running at idle speed for 10 minutes or more.
- 4) Stop vehicle and check DTC.

## Troubleshooting

Step	Action	Yes	No
1	Was "Automatic Transaxle Diagnostic Flow Table" performed?	Go to Step 2.	Go to "Automatic Transaxle Diagnostic Flow Table" in this section.
2	Check Transmission Fluid Temperature Circuit for Ground Short. Check continuity between terminal C39-11 of disconnected harness side TCM connector and ground. Is continuity indicated?	"BLU/RED" circuit shorted to ground.	Go to Step 3.
3	Check Transmission Fluid Temperature Circuit for IG Short. 1) Cool down A/T fluid temperature under ambient temperature. 2) Connect TCM connectors to TCM with ignition switch OFF. 3) Turn ignition switch ON. 4) Measure voltage between terminal C44-5 of TCM connector and ground. Is it 4.6 V or more?	"BLU/RED" circuit shorted to power circuit. If circuit is OK, go to Step 4.	Intermittent trouble or faulty TCM. Check for intermittent referring to "Intermittent and Poor Connection" in Section 0A. If OK, substitute a known-good TCM and recheck.
4	Inspect Transmission Fluid Temperature Sensor. Inspect transmission temperature sensor referring to "Transmission Fluid Temperature Sensor" in this section. Is result satisfactory?	Intermittent trouble or faulty TCM. Check for intermittent referring to "Intermittent and Poor Connection" in Section 0A. If OK, substitute a known-good TCM and recheck.	Replace transmission fluid temperature sensor.

DTC P0713 Transmission Fluid Temperature Sensor Circuit High

Wiring Diagram



1. TCM	3. A/T	[A]: Terminal arrangement of TCM connector (viewed from harness side)
2. Transmission fluid temperature sensor	4. Valve body connector	

DTC Detecting Condition and Trouble Area

DTC DETECTING CONDITION	TROUBLE AREA
<ul style="list-style-type: none"> <li>Transmission temperature sensor terminal voltage is more than 4.6 V and shift range is in “R”, “D”, “2” or “L” for 15 minutes after starting engine.</li> </ul>	<ul style="list-style-type: none"> <li>Transmission fluid temperature sensor or its circuit malfunction.</li> <li>TCM</li> </ul>

DTC Confirmation Procedure

**WARNING:**

- When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.
- Road test should be carried out with 2 persons, a driver and tester, on a level road.

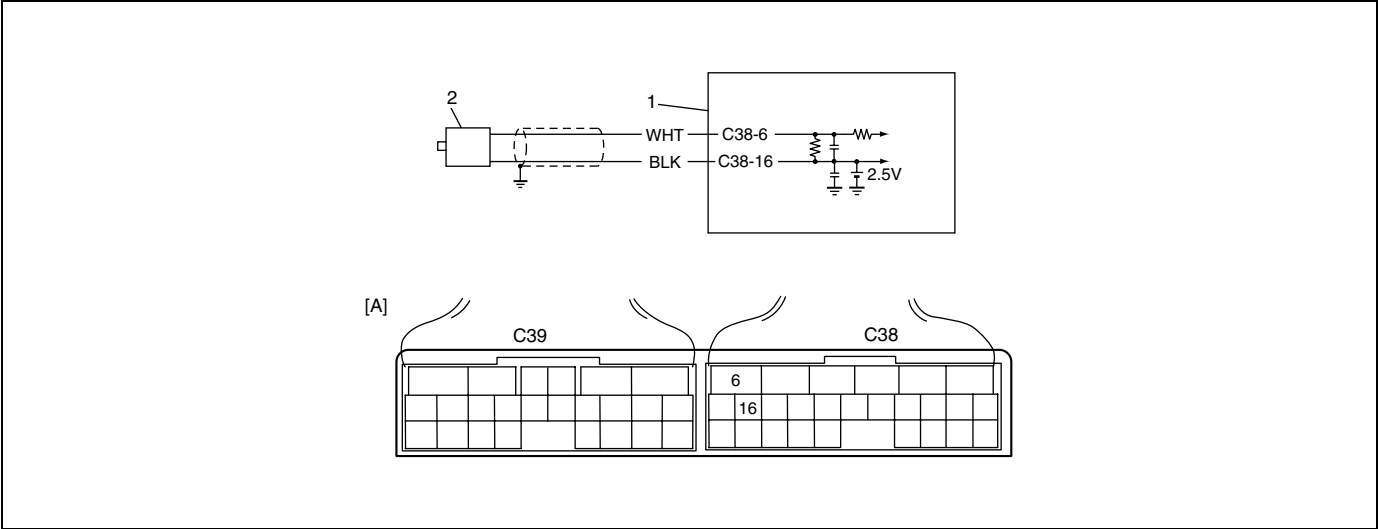
- 1) Connect scan tool to DLC with ignition switch OFF if available.
- 2) Clear DTC in TCM memory and start engine.
- 3) Start vehicle and increase vehicle speed to about 40 km/h (25 mile/h) for 20 minutes or more.
- 4) Stop vehicle and check DTC.

## Troubleshooting

Step	Action	Yes	No
1	Was "Automatic Transaxle Diagnostic Flow Table" performed?	Go to Step 2.	Go to "Automatic Transaxle Diagnostic Flow Table" in this section.
2	Check Transmission Fluid Temperature Circuit for Open. 1) Turn ignition switch OFF. 2) Disconnect TCM connectors from TCM. 3) Check for proper connection to transmission fluid temperature sensor at terminals C39-11 and C39-12. 4) If OK, check continuity between terminals C39-11 and C39-12 of disconnected harness side TCM connector. Is continuity indicated?	Go to Step 3.	"BLU/RED" or "GRN/RED" circuit open.
3	Check Transmission Fluid Temperature Circuit for IG Short. 1) Cool down A/T fluid temperature under ambient temperature. 2) Connect TCM connectors to TCM with ignition switch OFF. 3) Turn ignition switch ON. 4) Measure voltage between terminal C39-11 of TCM connector and ground. Is it 4.6 V or more?	"BLU/RED" circuit shorted to power circuit. If circuit is OK, go to Step 4.	Intermittent trouble or faulty TCM. Check for intermittent referring to "Intermittent and Poor Connection" in Section 0A. If OK, substitute a known-good TCM and recheck.
4	Inspect Transmission Fluid Temperature Sensor. Inspect transmission temperature sensor referring to "Transmission Fluid Temperature Sensor" Is result satisfactory?	Intermittent trouble or faulty TCM. Check for intermittent referring to "Intermittent and Poor Connection" in Section 0A. If OK, substitute a known-good TCM and recheck.	Replace transmission fluid temperature sensor.

DTC P0717 Input/Turbine Speed Sensor Circuit Malfunction

Wiring Diagram



1. TCM	2. Input shaft speed sensor	[A]: Terminal arrangement of TCM connector (viewed from harness side)
--------	-----------------------------	---

DTC Detecting Condition and Trouble Area

DTC DETECTING CONDITION	TROUBLE AREA
No input shaft speed sensor signal is detected although output shaft speed sensor signals are detected.	<ul style="list-style-type: none"> <li>Input shaft speed sensor or its circuit malfunction.</li> <li>Improper input shaft speed sensor installation.</li> <li>Damaged direct clutch drum.</li> <li>Foreign material attachment to sensor or drum.</li> <li>TCM</li> </ul>

DTC Confirmation Procedure

**WARNING:**

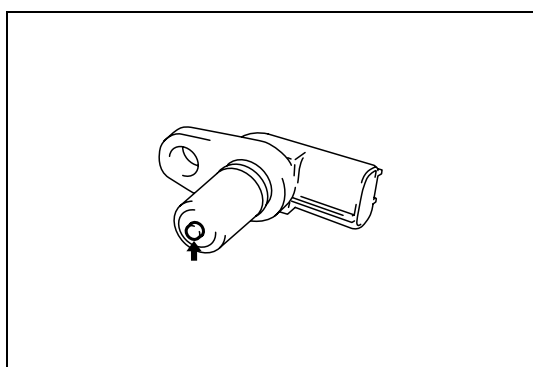
- When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.
- Road test should be carried out with 2 persons, a driver and tester, on a level road.

- 1) Connect scan tool to DLC with ignition switch OFF if available.
- 2) Clear DTC in TCM memory and start engine.
- 3) Shift selector lever to “D” range and drive vehicle at 50 km/h (31 mile/h) or more with 3rd gear at least for 5 minutes.
- 4) Stop vehicle and check DTC.

## Troubleshooting

Step	Action	Yes	No
1	Was "A/T System Check" performed?	Go to Step 2.	Go to "Automatic Transaxle Basic Check" in this section.
2	Check Input Shaft Speed Sensor Circuit. 1) Disconnect TCM connectors with ignition switch OFF. 2) Check for proper connection to input shaft speed sensor at C38-6 and C38-16 terminals. 3) If OK, check resistance of sensor circuit. Resistance between terminals C38-6 and C38-16 of disconnected harness side TCM connector: 560 – 680 $\Omega$ at 20°C (68°F) Continuity between terminal C38-6/C38-16 of disconnected harness side TCM connector and ground: No continuity Are check result satisfactory?	Go to Step 4.	Go to Step 3.
3	Inspect Input Shaft Speed Sensor. Inspect input shaft speed sensor referring to "Input Shaft Speed Sensor". Is result satisfactory?	"WHT" or "BLK" circuit open or short.	Replace input shaft speed sensor.
4	Check visually input shaft speed sensor and direct clutch drum for the followings. See Fig. <ul style="list-style-type: none"> <li>• No damage</li> <li>• No foreign material attached</li> <li>• Correct installation</li> </ul> Are they in good condition?	Intermittent trouble or faulty TCM. Check for intermittent referring to "Intermittent and Poor Connection" in Section 0A. If OK, substitute a known-good TCM and recheck.	Clean, repair or replace.

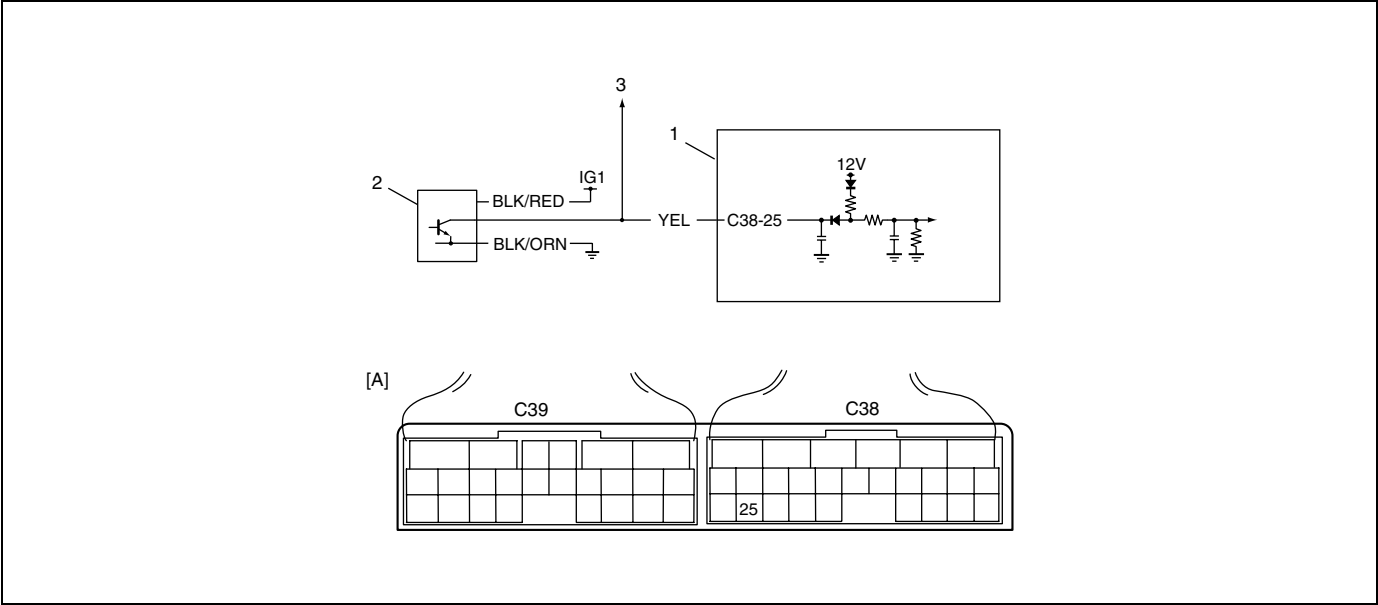
Fig. for Step 4





DTC P0722 Output Speed Sensor (VSS) Circuit No Signal

Wiring Diagram



1. TCM	2. Output shaft speed sensor (VSS)	3. To ECM	[A]: Terminal arrangement of TCM connector (viewed from harness side)
--------	------------------------------------	-----------	---

DTC Detecting Condition and Trouble Area

DTC DETECTING CONDITION	TROUBLE AREA
No output shaft speed sensor signal is detected although input shaft speed sensor signals are detected while vehicle is running at 5 km/h (3 mile/h) or more vehicle speed with “D”, “2” or “L” range.	<ul style="list-style-type: none"> <li>Output shaft speed sensor or its circuit malfunction.</li> <li>Damaged sensor gear (driven gear).</li> <li>Damaged output shaft speed sensor (VSS) drive gear.</li> <li>TCM</li> </ul>

DTC Confirmation Procedure

**WARNING:**

- When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.
- Road test should be carried out with 2 persons, a driver and tester, on a level road.

- 1) Connect scan tool to DLC with ignition switch OFF if available.
- 2) Clear DTC in TCM memory and start engine.
- 3) Shift selector lever to “D” range and drive vehicle at 50 km/h (31 mile/h) or more vehicle speed at least for 3 minutes.
- 4) Stop vehicle check DTC.

## Troubleshooting

Step	Action	Yes	No
1	Was "Automatic Transaxle Diagnostic Flow Table" in this section performed?	Go to Step 2.	Go to "Automatic Transaxle Diagnostic Flow Table" in this section.
2	Check Output Shaft Speed Sensor (VSS) Power Circuit. 1) Turn ignition switch OFF. 2) Disconnect output shaft speed sensor connector. 3) Turn ignition switch ON. 4) Measure voltage between "BLK/RED" wire terminal of disconnected output shaft speed sensor harness side connector and ground. Is it 10 – 14 V?	Go to Step 3.	"BLK/RED" wire open or shorted to ground.
3	Check Output Shaft Speed Sensor (VSS) Ground Circuit. 1) Turn ignition switch OFF. 2) Check continuity between "BLK/ORN" wire terminal of disconnected output shaft speed sensor harness side connector and ground. Is continuity indicated?	Go to Step 4.	"BLK" wire open.
4	Check Output Shaft Speed Sensor (VSS) Signal Circuit for short. 1) Disconnect TCM connectors. 2) Check continuity between "YEL" wire terminal of disconnected output shaft speed sensor harness side connector and ground. Is continuity indicated?	"YEL" wire shorted to ground.	Go to Step 5.
5	Check Output Shaft Speed Sensor (VSS) Signal Circuit for open. 1) Check continuity between "YEL" wire terminal of disconnected output shaft speed sensor harness side connector and terminal C38-25 of disconnected harness side TCM connector. Is continuity indicated?	Go to Step 6.	"YEL" wire open.
6	Inspect Output Shaft Speed Sensor (VSS). Inspect output shaft speed sensor referring to "Output Shaft Speed Sensor (VSS)" in this section. Is check result satisfactory?	Go to Step 7.	Replace output shaft speed sensor.

Step	Action	Yes	No
7	<p>Check Output Shaft Speed Sensor (VSS) Gears Visually.</p> <p>Check output shaft speed sensor gears for the followings.</p> <ul style="list-style-type: none"><li>• No damage in drive gear on differential case</li><li>• No damage in driven gear in output shaft speed sensor</li></ul> <p>Is result satisfactory?</p>	<p>Intermittent trouble or Faulty TCM.</p> <p>Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A.</p> <p>If OK, substitute a known-good TCM and recheck.</p>	<p>Replace drive gear and/or driven gear of output shaft speed sensor.</p>

## DTC P0741/P0742 TCC Circuit Performance or Stuck OFF/TCC Circuit Stuck ON

### DTC Detecting Condition and Trouble Area

#### [DTC P0741]

DTC DETECTING CONDITION	TROUBLE AREA
When driving vehicle with 3rd or 4th gear in "D" range, difference in revolution between engine and A/T input (input shaft speed) is larger than specification although TCM commanded TCC solenoid to turn ON.	<ul style="list-style-type: none"> <li>• Mechanical malfunction of TCC solenoid valve.</li> <li>• Malfunction of valve body assembly.</li> <li>• Fluid passage clogged or leaking.</li> <li>• Torque converter clutch malfunction.</li> </ul>

#### [DTC P0742]

DTC DETECTING CONDITION	TROUBLE AREA
When driving vehicle with 2nd, 3rd or 4th gear in "D" range, difference in revolution between engine and A/T input (input shaft speed) is smaller than specification although TCM commanded TCC solenoid to turn OFF.	<ul style="list-style-type: none"> <li>• Mechanical malfunction of TCC solenoid valve.</li> <li>• Malfunction of valve body assembly.</li> <li>• Fluid passage clogged or leaking.</li> <li>• Torque converter clutch malfunction.</li> </ul>

### DTC Confirmation Procedure

#### WARNING:

- When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.
- Road test should be carried out with 2 persons, a driver and tester, on a level road.

- 1) Connect scan tool to DLC with ignition switch OFF, if available.
- 2) Clear DTC in TCM memory.
- 3) Start engine and warm it up to normal operating temperature.
- 4) Shift select lever to "N" and "D" range for each 10 seconds.
- 5) Drive vehicle with 4th in "D" range and lock-up ON for 20 seconds or longer referring to "Automatic gear shift diagram" in this section.
- 6) Turn O/D OFF switch ON keeping on driving in "D" range. (Confirm "O/D OFF" lamp lights.)
- 7) Drive vehicle with 2nd or 3rd gear in "D" range, 15 – 20% throttle opening and at vehicle speed of 25 – 40 km/h (16 – 25 mile/h).
- 8) Stop vehicle and turn ignition switch OFF.
- 9) Repeat Step 3) to 7) one time.
- 10) Stop vehicle and check DTC.

### DTC Troubleshooting

Step	Action	Yes	No
1	Was "Automatic Transaxle Diagnostic Flow Table" performed?	Go to Step 2.	Go to "Automatic Transaxle Diagnostic Flow Table" in this section.
2	Check TCC solenoid valve for operation referring to "Solenoid Valves (Shift Solenoid Valves, TCC Solenoid Valve and Timing Solenoid Valve)" in this section. Are they in good condition?	Clean fluid passage or replace valve body assembly.	Replace TCC solenoid valve.

## DTC P0751/P0752/P0756/P0757 Shift Solenoid-A (No.1) Performance or Stuck OFF/Shift Solenoid-A (No.1) Stuck ON/Shift Solenoid-B (No.2) Performance or Stuck OFF/Shift Solenoid-B (No.2) Stuck ON

### DTC Detecting Condition and Trouble Area

#### [DTC P0751]

DTC DETECTING CONDITION	TROUBLE AREA
3rd gear ratio is detected although TCM command is for 2nd gear while vehicle running at 15 km/h (10 mile/h) or more in "D" range after engine being warmed up.	<ul style="list-style-type: none"> <li>• Mechanical malfunction of shift solenoid valve-A (No.1).</li> <li>• Malfunction of valve body assembly.</li> <li>• Fluid passage clogged or leaking.</li> <li>• Mechanical malfunction of automatic transaxle (clutch, brake or gear etc.).</li> </ul>

#### [DTC P0752]

DTC DETECTING CONDITION	TROUBLE AREA
2nd gear ratio is detected although TCM command is for 3rd gear while vehicle running at 15 km/h (10 mile/h) or more in "D" range after engine being warmed up.	<ul style="list-style-type: none"> <li>• Mechanical malfunction of shift solenoid valve-A (No.1).</li> <li>• Malfunction of valve body assembly.</li> <li>• Fluid passage clogged or leaking.</li> <li>• Mechanical malfunction of automatic transaxle (clutch, brake or gear etc.).</li> </ul>

#### [DTC P0756]

DTC DETECTING CONDITION	TROUBLE AREA
3rd gear ratio is detected although TCM command is for 4th gear while vehicle running at 15 km/h (10 mile/h) or more in "D" range after engine being warmed up.	<ul style="list-style-type: none"> <li>• Mechanical malfunction of shift solenoid valve-B (No.2).</li> <li>• Malfunction of valve body assembly.</li> <li>• Fluid passage clogged or leaking.</li> <li>• Mechanical malfunction of automatic transaxle (clutch, brake or gear etc.).</li> </ul>

#### [DTC P0757]

DTC DETECTING CONDITION	TROUBLE AREA
4th gear ratio is detected although TCM command is for 3rd gear while vehicle running at 15 km/h (10 mile/h) or more in "D" range after engine being warmed up.	<ul style="list-style-type: none"> <li>• Mechanical malfunction of shift solenoid valve-B (No.2).</li> <li>• Malfunction of valve body assembly.</li> <li>• Fluid passage clogged or leaking.</li> <li>• Mechanical malfunction of automatic transaxle (clutch, brake or gear etc.).</li> </ul>

### DTC Confirmation Procedure

#### WARNING:

- When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.
- Road test should be carried out with 2 persons, a driver and tester, on a level road.

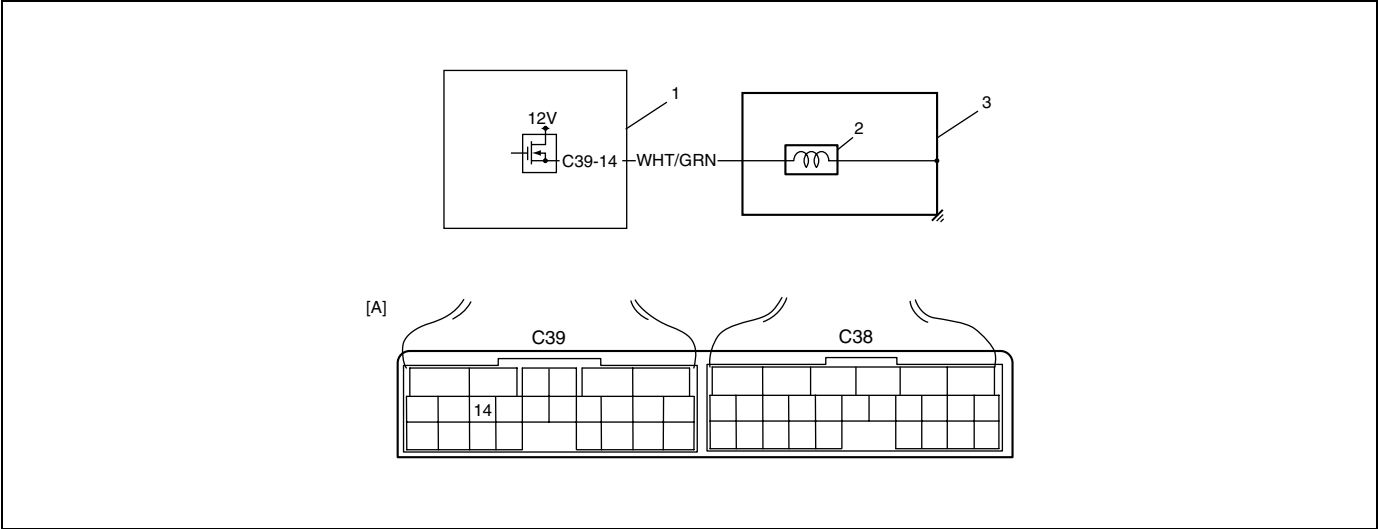
- 1) Connect scan tool to DLC with ignition switch OFF, if available.
- 2) Clear DTC in TCM memory.
- 3) Start engine and warm it up to normal operating temperature.
- 4) Shift select lever to "N" and "D" range for each 10 seconds.
- 5) Start vehicle and increase vehicle speed to 65 km/h (40 mile/h) with throttle position 10% or more.
- 6) Stop vehicle and turn ignition switch OFF.
- 7) Repeat Step 3) to 5) one time.
- 8) Stop vehicle and check DTC.

### DTC Troubleshooting

Step	Action	Yes	No
1	Was "Automatic Transaxle Diagnostic Flow Table" performed?	Go to Step 2.	Go to "Automatic Transaxle Diagnostic Flow Table" in this section.
2	Check shift solenoid valve-A (No.1) or -B (No.2) for operation referring to "Solenoid Valves (Shift Solenoid Valves, TCC Solenoid Valve and Timing Solenoid Valve)" in this section. Are they in good condition?	Clean fluid passage or replace valve body assembly.	Replace shift solenoid valve-A or -B.

DTC P0785 Timing Solenoid

Wiring Diagram



1. TCM	3. A/T
2. Timing solenoid valve	[A]: Terminal arrangement of TCM connector (viewed from harness side)

DTC Detecting Condition and Trouble Area

DTC DETECTING CONDITION	TROUBLE AREA
<ul style="list-style-type: none"> <li>Voltage of timing solenoid valve TCM terminal is low although TCM is commanding timing solenoid valve to turn ON.</li> </ul> or <ul style="list-style-type: none"> <li>Voltage of timing solenoid valve TCM terminal is high although TCM is commanding timing solenoid valve to turn OFF.</li> </ul>	<ul style="list-style-type: none"> <li>Timing solenoid valve circuit shorted to ground.</li> <li>Timing solenoid valve circuit open or shorted to power circuit.</li> <li>Timing solenoid valve malfunction.</li> <li>TCM</li> </ul>

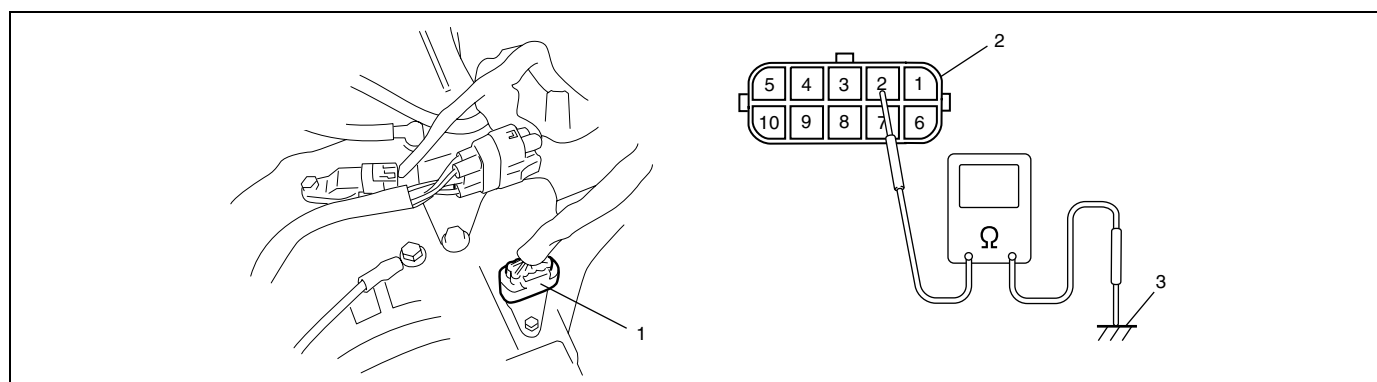
DTC Confirmation Procedure

- 1) Connect scan tool to DLC with ignition switch OFF, if available.
- 2) Clear DTC in TCM memory.
- 3) Start engine and shift selector lever to “N” range.
- 4) Repeat shifting selector lever from “N” range to “D” range and vice versa for 3 times.
- 5) Check DTC.

## Troubleshooting

Step	Action	Yes	No
1	Was "A/T System Check" performed?	Go to Step 2.	Go to "Automatic Transaxle Basic Check" in this section.
2	Check Timing Solenoid Valve Circuit for IG Short or Open. 1) Turn ignition switch ON and measure voltage between terminal "C39-14" of harness side TCM connector and ground. 2) Is it 0 – 1 V?	Go to Step 3.	"WHT/GRN" circuit shorted to power circuit or open.
3	Check Timing Solenoid Valve Resistance 1) Turn ignition switch OFF. 2) Disconnect valve body harness connector on transaxle. 3) Check for proper connection to solenoid valve at "WHT/RED" circuit. 4) Check resistance of solenoid valve. See Fig. Resistance between terminal of transaxle side valve body harness connector and transaxle: 11 – 15 $\Omega$ (at 20°C (68°F)) Is check result satisfactory?	Go to Step 4.	Replace timing solenoid valve or lead wire.
4	Check Timing Solenoid Valve Circuit for Ground Short. 1) Connect valve body harness connector. 2) Disconnect TCM connectors. 3) Measure resistance between terminal "C39-14" of disconnected harness side TCM connector and ground. Is it 11 – 15 $\Omega$ (at 20°C (68°F))	Intermittent trouble or faulty TCM. Check for intermittent referring to "Intermittent and Poor Connection" in Section 0A. If OK, substitute a known-good TCM and recheck.	"WHT/RED" circuit shorted to ground.

Fig. for Step 4

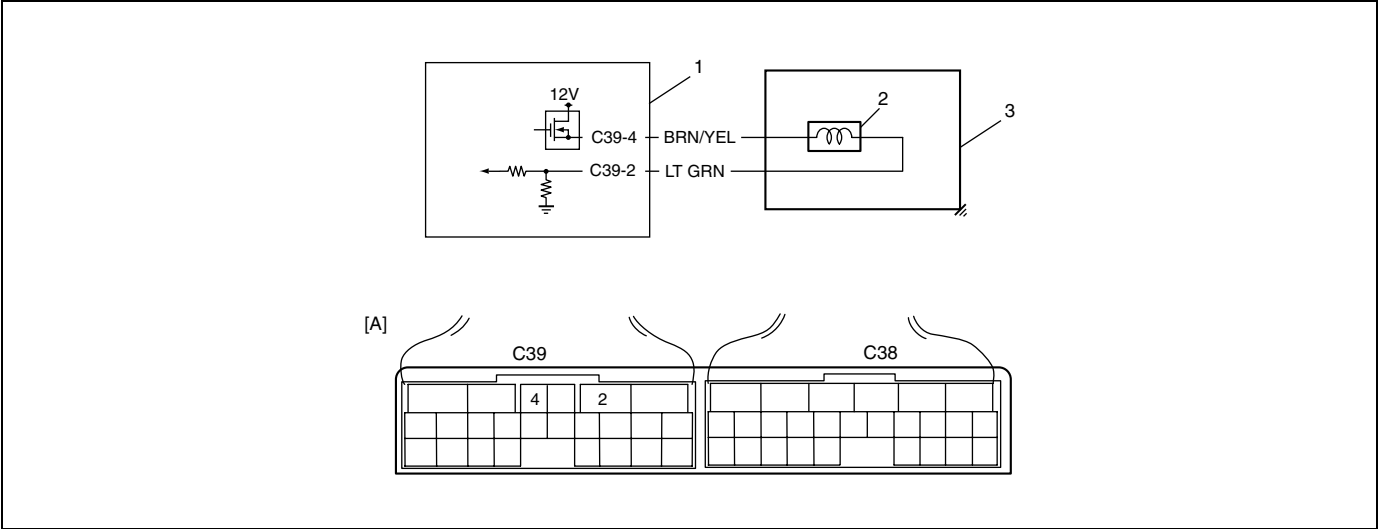


- |  |
|--|
| 1. Valve body harness connector on harness   |
| 2. Valve body harness connector on transaxle |
| 3. Ground (Transaxle)                        |



DTC P0962 Pressure Control Solenoid Control Circuit Low

Wiring Diagram



1. TCM	3. A/T
2. Pressure control solenoid valve	[A]: Terminal arrangement of TCM connector (Viewed from harness side)

DTC Detecting Condition and Trouble Area

DTC DETECTING CONDITION	TROUBLE AREA
Pressure control solenoid valve output voltage is too low comparing with TCM command value.	<ul style="list-style-type: none"> <li>Pressure control solenoid valve circuit open or shorted to ground.</li> <li>Malfunction of pressure control solenoid valve</li> <li>TCM</li> </ul>

DTC Confirmation Procedure

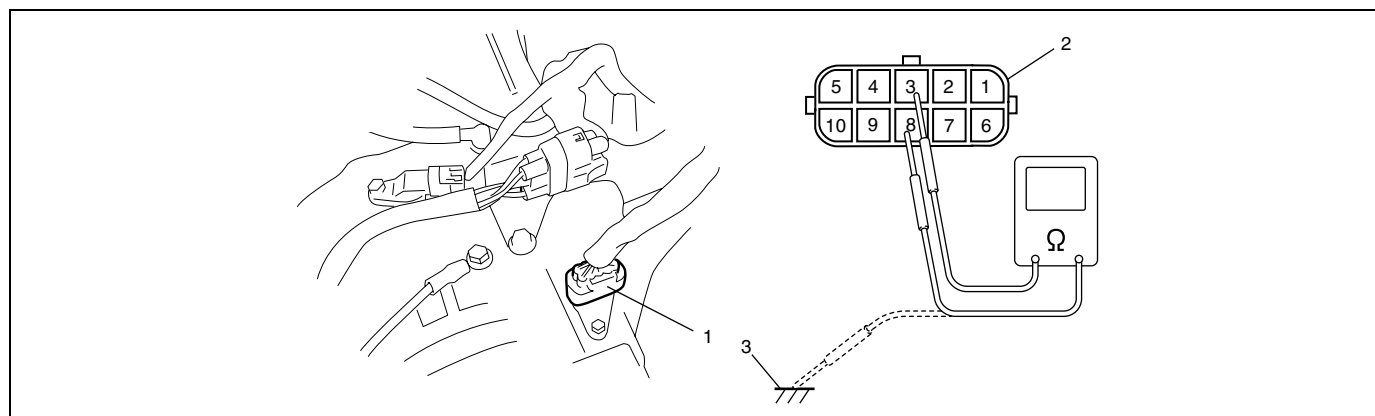
- 1) Connect scan tool to DLC with ignition switch OFF, if available.
- 2) Clear DTC in TCM memory.
- 3) Start engine.
- 4) Keep engine running at idle speed for 30 seconds or more.
- 5) Stop vehicle and check DTC.

DTC Troubleshooting

Step	Action	Yes	No
1	Was "Automatic Transaxle Diagnostic Flow Table" performed?	Go to Step 2.	Go to "Automatic Transaxle Diagnostic Flow Table" in this section.

Step	Action	Yes	No
2	<p>Check pressure control solenoid valve resistance</p> <ol style="list-style-type: none"> <li>1) Turn ignition switch OFF</li> <li>2) Disconnect valve body harness connector on automatic transmission.</li> <li>3) Check for proper connection to solenoid at "BRN/YEL" and "LT GRN" circuit.</li> <li>4) Check resistance of pressure control solenoid. See Fig.</li> </ol> <p>Resistance between pressure control solenoid valve terminals of transmission side valve body harness connector:  <math>5.0 - 5.6 \Omega</math> (at <math>20^{\circ}\text{C}</math> (<math>68^{\circ}\text{F}</math>))</p> <p>Resistance between pressure control solenoid valve terminals of transmission side valve body harness connector and transmission body:            Infinity</p> <p>Is check results satisfactory?</p>	Go to Step 3.	Replace pressure control solenoid valve or valve body harness.
3	<p>Check pressure control solenoid valve circuit for ground short</p> <ol style="list-style-type: none"> <li>1) Connect valve body harness connector.</li> <li>2) Disconnect TCM connectors.</li> <li>3) Check for proper connection to TCM at terminals "C39-2" and "C39-4".</li> </ol> <p>If connection is OK, check continuity between terminal "C39-4" of disconnected harness side TCM connector and ground.</p> <p>Is continuity indicated?</p>	"BRN/YEL" or "LT GRN/RED" circuit shorted to ground.	Go to Step 4.
4	<p>Check pressure control solenoid valve circuit for open</p> <ol style="list-style-type: none"> <li>1) Check resistance between terminals "C39-2" and "C39-4" of disconnected harness side TCM connector.</li> </ol> <p>Is it infinity?</p>	"BRN/YEL" or "LT GRN" circuit open.	Intermittent trouble or faulty TCM. Check for intermittent referring to "Intermittent and Poor Connection" in Section 0A. If OK, substitute a known-good TCM and recheck

Fig. for Step 2.



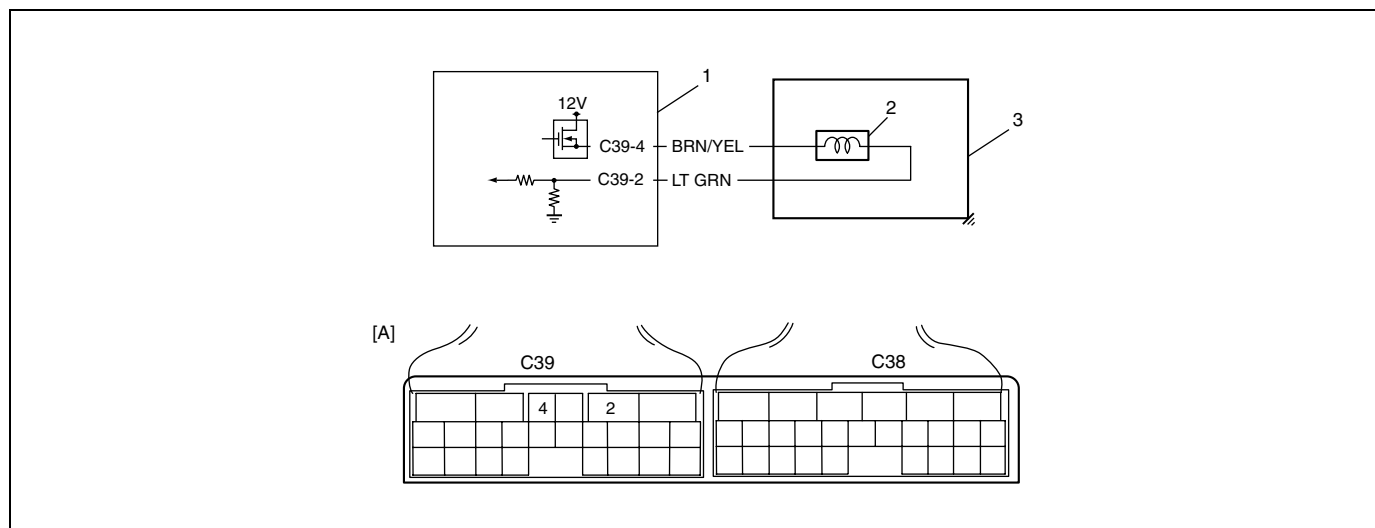
1. Valve body harness connector on harness

2. Valve body harness connector on transaxle

3. Ground (transaxle)

## DTC P0963 Pressure Control Solenoid Control Circuit High

### Wiring Diagram



1. TCM	3. A/T
2. Pressure control solenoid valve	[A]: Terminal arrangement of TCM connector (Viewed from harness side)

### DTC Detecting Condition and Trouble Area

DTC DETECTING CONDITION	TROUBLE AREA
Pressure control solenoid valve output voltage is too high comparing with TCM command value.	<ul style="list-style-type: none"> <li>Pressure control solenoid valve circuit shorted to power circuit.</li> <li>Pressure control solenoid valve malfunction</li> <li>TCM</li> </ul>

### DTC Confirmation Procedure

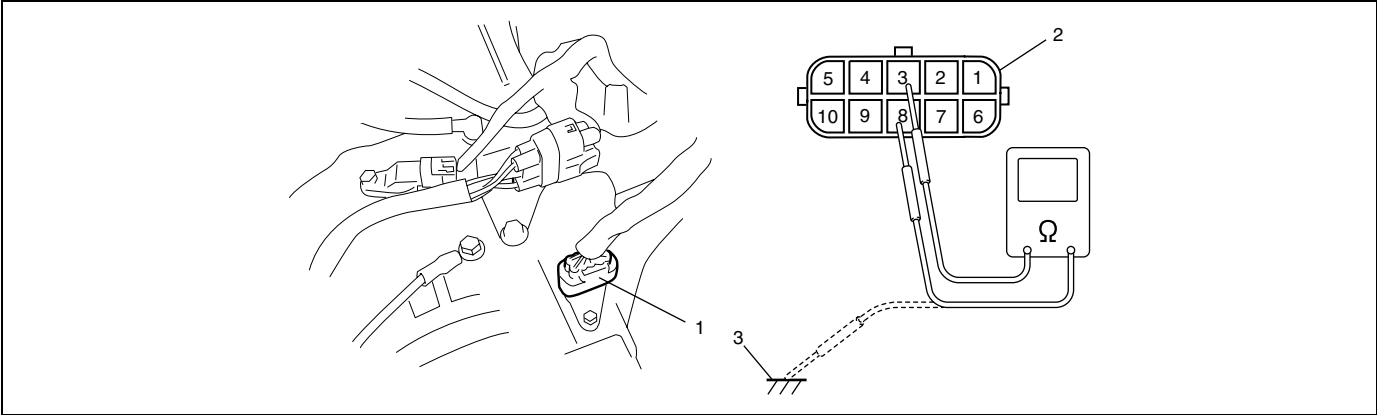
- 1) Connect scan tool to DLC with ignition switch OFF, if available.
- 2) Clear DTC in TCM memory.
- 3) Start engine.
- 4) Keep engine running at idle speed for 10 seconds or more.
- 5) Check DTC.

### DTC Troubleshooting

Step	Action	Yes	No
1	Was "Automatic Transaxle Diagnostic Flow Table" performed?	Go to Step 2.	Go to "Automatic Transaxle Diagnostic Flow Table" in this section.
2	Check pressure control solenoid circuit for IG short 1) Connect valve body harness connector. 2) Disconnect TCM connectors. 3) Check for proper connection to TCM at terminal "C39-2" and "C39-4". 4) If connection is OK, turn ignition switch ON and measure voltage between terminal "C39-4" of disconnected harness side TCM connector and ground. Is it 0 – 2 V?	Go to Step 3.	"BRN/YEL" or "LT GRN" circuit shorted to power circuit.

Step	Action	Yes	No
3	<p>Check pressure control solenoid valve resistance</p> <p>1) Turn ignition switch OFF</p> <p>2) Disconnect valve body harness connector on automatic transmission.</p> <p>3) Check for proper connection to solenoid at “BRN/YEL” and “LT GRN” circuit.</p> <p>4) Check resistance of pressure control solenoid. See Fig.</p> <p>Resistance between pressure control solenoid valve terminals of transmission side valve body harness connector:</p> <p>5.0 – 5.6 <math>\Omega</math> (at 20°C (68°F))</p> <p>Resistance between pressure control solenoid valve terminals of transmission side valve body harness connector and transmission body:</p> <p>Infinity</p> <p>Is check results satisfactory?</p>	<p>Intermittent trouble or faulty TCM. Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A. If OK, substitute a known-good TCM and recheck.</p>	<p>Replace pressure control solenoid valve or valve body harness.</p>

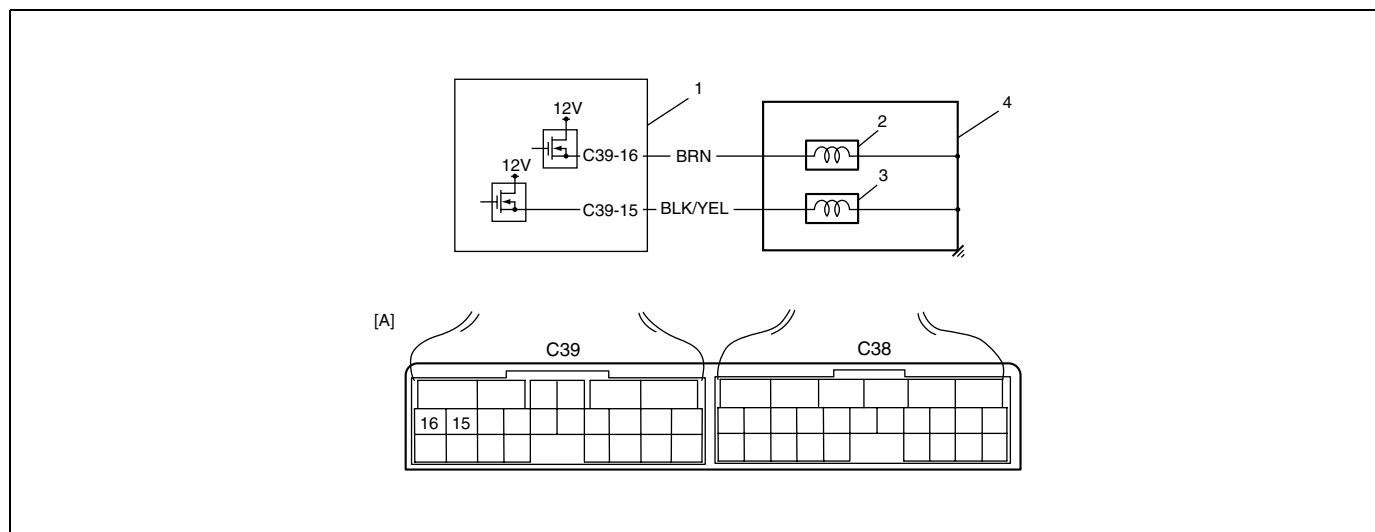
Fig. for Step 3.



1. Valve body harness connector on harness
2. Valve body harness connector on transaxle
3. Ground (transaxle)

## DTC P0974/P0977 Shift Solenoid-A (No.1) Control Circuit High/Shift Solenoid-B (No.2) Control Circuit High

### Wiring Diagram



1. TCM	3. Shift solenoid valve-B (No.2)	[A]: Terminal arrangement of TCM connector (Viewed from harness side)
2. Shift solenoid valve-A (No.1)	4. A/T	

### DTC Detecting Condition and Trouble Area

DTC DETECTING CONDITION	TROUBLE AREA
Voltage of shift solenoid valve TCM terminal is high although TCM is commanding shift solenoid to turn OFF	<ul style="list-style-type: none"> <li>Shift solenoid valve circuit open or shorted to power circuit.</li> <li>Malfunction of shift solenoid valve</li> <li>TCM</li> </ul>

### DTC Confirmation Procedure

#### WARNING:

- When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.
- Road test should be carried out with 2 persons, a driver and tester, on a level road.

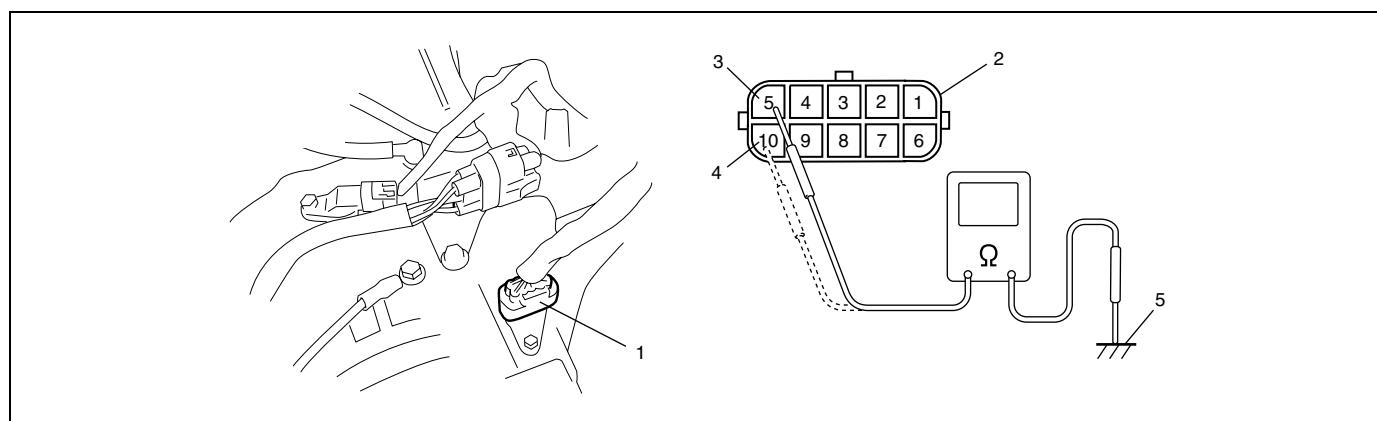
- 1) Connect scan tool to DLC with ignition switch OFF, if available.
- 2) Clear DTC in TCM memory.
- 3) Start engine shift select lever to "D" range.
- 4) Start vehicle and increase vehicle speed until gear position reaches 3rd or 4th gear.
- 5) Decrease vehicle speed and stop vehicle.
- 6) Check DTC.

### DTC Troubleshooting

Step	Action	Yes	No
1	Was "Automatic Transaxle Diagnostic Flow Table" performed?	Go to Step 2.	Go to "Automatic Transaxle Diagnostic Flow Table" in this section.

Step	Action	Yes	No
2	<p>Check shift solenoid valve circuit for IG short</p> <ol style="list-style-type: none"> <li>1) Connect valve body harness connector.</li> <li>2) Disconnect TCM connectors.</li> <li>3) Check for proper connection to TCM at terminal "C39-16" (for shift solenoid valve-A (No.1)) or "C39-15" (for shift solenoid valve-B (No.2)).</li> <li>4) If connection is OK, turn ignition switch ON and measure voltage between terminal "C39-16" (for shift solenoid valve-A (No.1)) or "C39-15" (for shift solenoid valve-B (No.2)) of disconnected harness side TCM connector and ground.</li> </ol> <p>Is it 0 – 2 V?</p>	Go to Step 3.	<p>DTC P0974: "BRN" circuit shorted to power circuit.</p> <p>DTC P0977: "BLK/YEL" circuit shorted to power circuit.</p>
3	<p>Check shift solenoid valve resistance</p> <ol style="list-style-type: none"> <li>1) Turn ignition switch OFF.</li> <li>2) Disconnect valve body harness connector on automatic transmission.</li> <li>3) Check for proper connection to solenoid at "BRN" (for shift solenoid valve-A (No.1)) or "BLK/YEL" (for shift solenoid valve-B (No.2)) circuit.</li> </ol> <p>Check resistance of solenoid valve. See Fig.</p> <p>Resistance between shift solenoid valve-A (No.1) terminal and transaxle: 11 – 15 <math>\Omega</math> at 20°C? (68°F)</p> <p>Resistance between shift solenoid valve-B (No.2) terminal and transaxle: 11 – 15 <math>\Omega</math> at 20°C? (68°F)</p> <p>Is check results satisfactory?</p>	Intermittent trouble or faulty TCM. Check for intermittent referring to "Intermittent and Poor Connection" in Section 0A. If OK, substitute a known-good TCM and recheck.	Replace applicable shift solenoid valve or valve body harness.

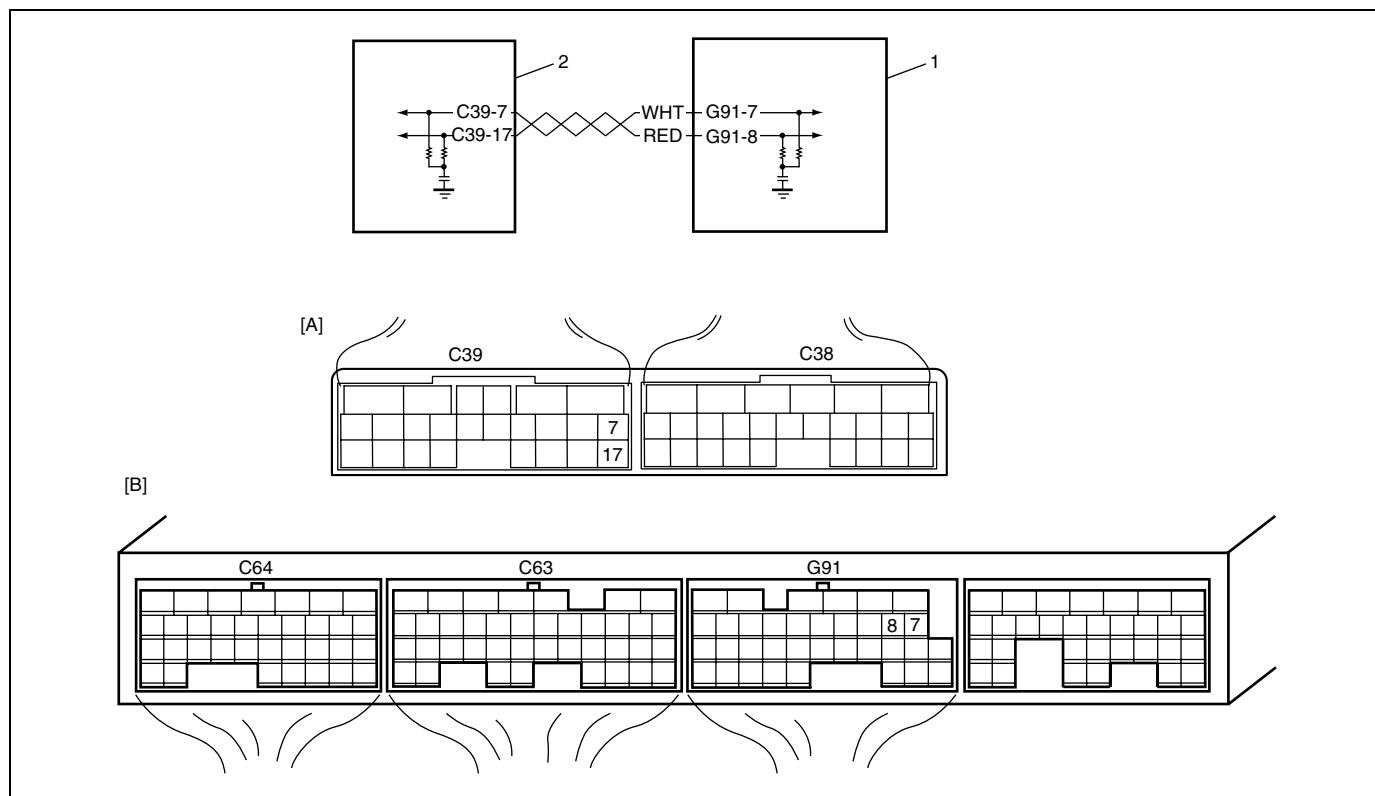
Fig. for Step 3.



1. Valve body harness connector on harness
2. Valve body harness connector on transaxle
3. Shift solenoid valve-A (No.1) terminal
4. Shift solenoid valve-B (No.2) terminal
5. Ground (transaxle)

## DTC P1701 CAN Communication Error

### Wiring Diagram



1. ECM	[A]: Terminal arrangement of TCM connector (Viewed from harness side)
2. TCM	[B]: Terminal arrangement of ECM connector (Viewed from harness side)

### DTC Detecting Condition and Trouble Area

DTC DETECTING CONDITION	TROUBLE AREA
Transmission or reception error of communication data is detected by TCM for specified time continuously.	<ul style="list-style-type: none"> <li>• “RED” or “WHT” wire circuit open or short</li> <li>• TCM</li> <li>• ECM</li> </ul>

### DTC Confirmation Procedure

- 1) Connect scan tool to DLC with ignition switch OFF, if available.
- 2) Clear DTC in TCM memory.
- 3) Start engine and warm it up to normal operating temperature.
- 4) Check DTC.

### DTC Troubleshooting

Step	Action	Yes	No
1	Was “Automatic Transaxle Diagnostic Flow Table” performed?	Go to Step 2.	Go to “Automatic Transaxle Diagnostic Flow Table” in this section.

Step	Action	Yes	No
2	<p>Check CAN communication circuit for open.</p> <ol style="list-style-type: none"> <li>1) Turn ignition switch to OFF position.</li> <li>2) Disconnect connectors from ECM and TCM.</li> <li>3) Check for proper connection to "G91-7" terminal of ECM connector and "C39-7" terminal of TCM connector.</li> </ol> <p>If OK, measure resistance between "G91-7" terminal of ECM connector and "C39-7" terminal of TCM connector.</p> <p>Is resistance 1 <math>\Omega</math> or less?</p>	Go to Step 3.	"RED" wire circuit open or high resistance.
3	<p>Check CAN communication circuit for power short.</p> <ol style="list-style-type: none"> <li>1) Turn ignition switch to ON position.</li> <li>2) Measure voltage between "C39-7" terminal of TCM connector and vehicle body ground.</li> </ol> <p>Is voltage 0 – 1 V?</p>	Go to Step 4.	"RED" wire circuit shorted to power circuit.
4	<p>Check CAN communication circuit for ground short.</p> <ol style="list-style-type: none"> <li>1) Turn ignition switch to OFF position.</li> <li>2) Measure resistance between "G91-7" terminal of ECM connector and vehicle body ground.</li> </ol> <p>Is it infinite?</p>	Go to Step 5.	"RED" wire circuit shorted to ground.
5	<p>Check CAN communication circuit for open.</p> <ol style="list-style-type: none"> <li>1) Turn ignition switch to OFF position.</li> <li>2) Disconnect connectors from ECM and TCM.</li> <li>3) Check for proper connection to "G91-8" terminal of ECM connector and "C39-17" terminal of TCM connector.</li> <li>4) If OK, measure resistance between "G91-8" terminal of ECM connector and "C39-17" terminal of TCM connector</li> </ol> <p>Is resistance 1 <math>\Omega</math> or less?</p>	Go to Step 6.	"WHT" wire circuit open or high resistance.
6	<p>Check CAN communication circuit for power short.</p> <ol style="list-style-type: none"> <li>1) Turn ignition switch to ON position.</li> <li>2) Measure voltage between "C39-17" terminal of TCM connector and vehicle body ground.</li> </ol> <p>Is voltage 0 – 1 V?</p>	Go to Step 7.	"WHT" wire circuit shorted to power circuit.
7	<p>Check CAN communication circuit for ground short.</p> <ol style="list-style-type: none"> <li>1) Turn ignition switch to OFF position.</li> <li>2) Measure resistance between "C39-17" terminal of ECM connector and vehicle body ground.</li> </ol> <p>Is it infinite?</p>	<p>Substitute a known-good TCM and recheck.</p> <p>If OK, substitute a known-good ECM and recheck.</p>	"WHT" wire circuit shorted to ground.



## DTC P1702 Internal Control Module Memory Check Sum Error

### DTC Detecting Condition and Trouble Area

DTC DETECTING CONDITION	TROUBLE AREA
Calculation of current data stored in TCM is not correct comparing with pre-stored checking data in TCM.	TCM

### DTC Confirmation Procedure

- 1) Connect scan tool to DLC with ignition switch OFF.
- 2) Clear DTC in TCM memory.
- 3) After 10 seconds passed from turning ignition switch ON, check DTC.

### Troubleshooting

Step	Action	Yes	No
1	Is DTC P1702 detected after performing "DTC Confirmation Procedure"?	Faulty TCM. Replace TCM.	Could be a temporary malfunction of TCM.

## DTC P1703 CAN Invalid Data-TCM

### DTC Detecting Condition and Trouble Area

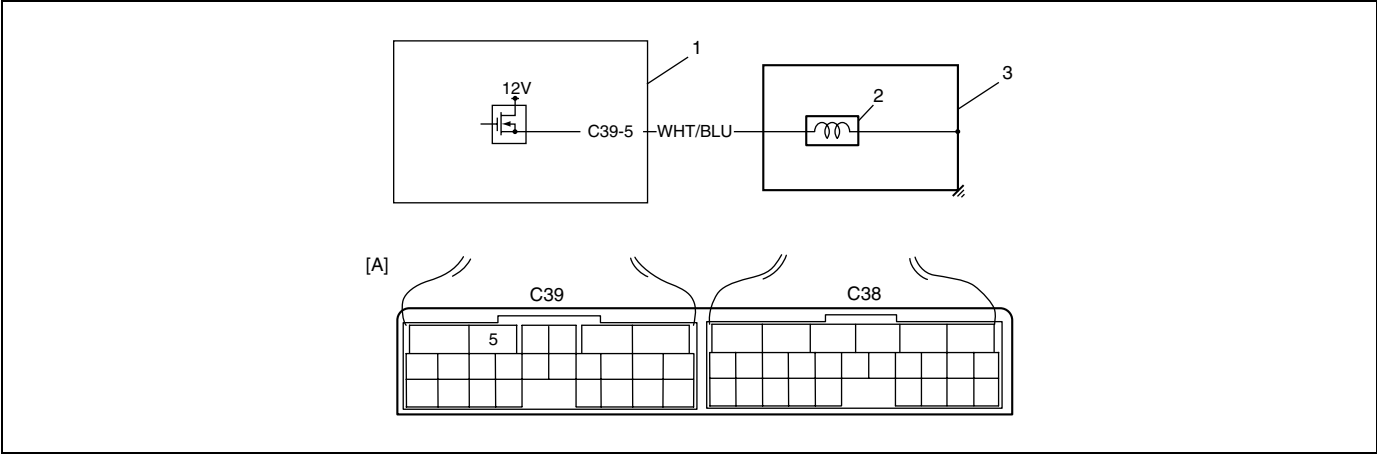
When abnormality either on the gear shift control signal from ECM is detected by TCM, TCM sets DTC P1703.

### DTC Troubleshooting

Step	Action	Yes	No
1	Was "Automatic Transaxle Diagnostic Flow Table" performed?	Go to Step 2.	Go to "Automatic Transaxle Diagnostic Flow Table" in this section.
2	DTC check. Check DTC of ECM referring to "DTC Check" in section 6. Is there any DTC (s)?	Go to applicable DTC diag. flow.	Substitute a known-good TCM and recheck. If OK, substitute a known-good ECM and recheck.

# DTC P2769 Torque Converter Clutch (TCC) Circuit Low

## Wiring Diagram



1. TCC solenoid valve	2. TCM	3. A/T	[A]: Terminal arrangement of TCM connector (Viewed from harness side)
-----------------------	--------	--------	---

## DTC Detecting Condition and Trouble Area

DTC DETECTING CONDITION	TROUBLE AREA
Voltage of TCC solenoid valve TCM terminal is low although TCM is commanding TCC solenoid to turn ON	<ul style="list-style-type: none"><li>• TCC solenoid valve circuit shorted to ground.</li><li>• Malfunction of TCC solenoid valve</li><li>• TCM</li></ul>

## DTC Confirmation Procedure

**WARNING:**

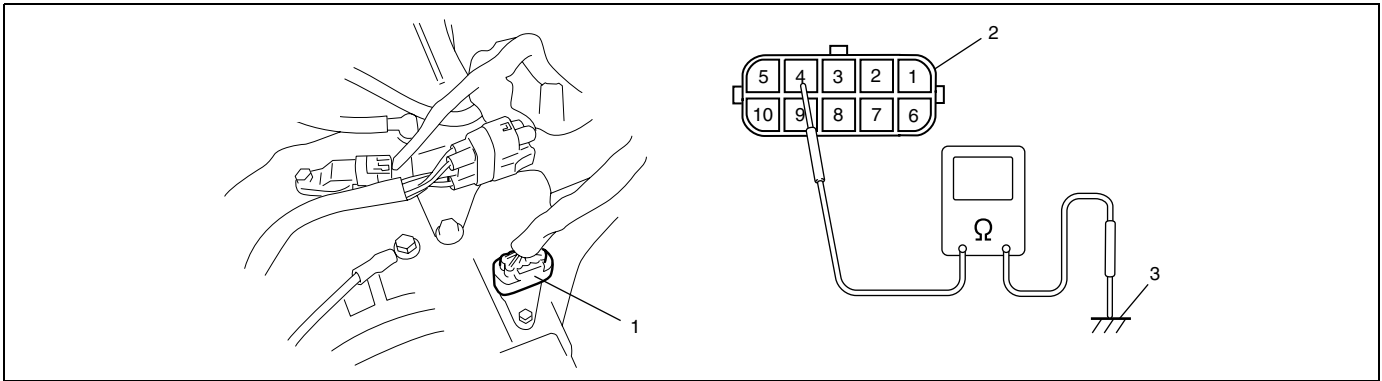
- When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.
- Road test should be carried out with 2 persons, a driver and tester, on a level road.

- 1) Connect scan tool to DLC with ignition switch OFF, if available.
- 2) Clear DTCs in TCM memory.
- 3) Start engine.
- 4) Keep engine running at idle speed in “P” range for 20 seconds or more.
- 5) Check DTC.

DTC Troubleshooting

Step	Action	Yes	No
1	Was “Automatic Transaxle Diagnostic Flow Table” performed?	Go to Step 2.	Go to “Automatic Transaxle Diagnostic Flow Table” in this section.
2	Check TCC solenoid valve resistance <div>             1) Turn ignition switch OFF             2) Disconnect valve body harness connector on automatic transmission.             3) Check for proper connection to solenoid at “WHT/BLU” circuit.             4) Check resistance of solenoid valve. See Fig.           </div> Resistance between TCC solenoid valve terminals of transmission side valve body harness connector: 11 – 15 Ω at 20°C (68°F) Resistance between TCC solenoid valve terminals of transmission side valve body harness connector and transmission body: Infinity Is check results satisfactory?	Go to Step 3.	Replace TCC solenoid valve or lead wire.
3	Check TCC solenoid valve circuit for ground short <div>             1) Disconnect TCM connectors.             2) Check for proper connection to TCM at terminals “C39-5”.             3) If connection is OK, check continuity between terminal “C39-5” of disconnected harness side TCM connector and ground.           </div> Is continuity indicated?	“WHT/BLU” circuit shorted to ground.	Intermittent trouble or faulty TCM. Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A. If OK, substitute a known-good TCM and recheck.

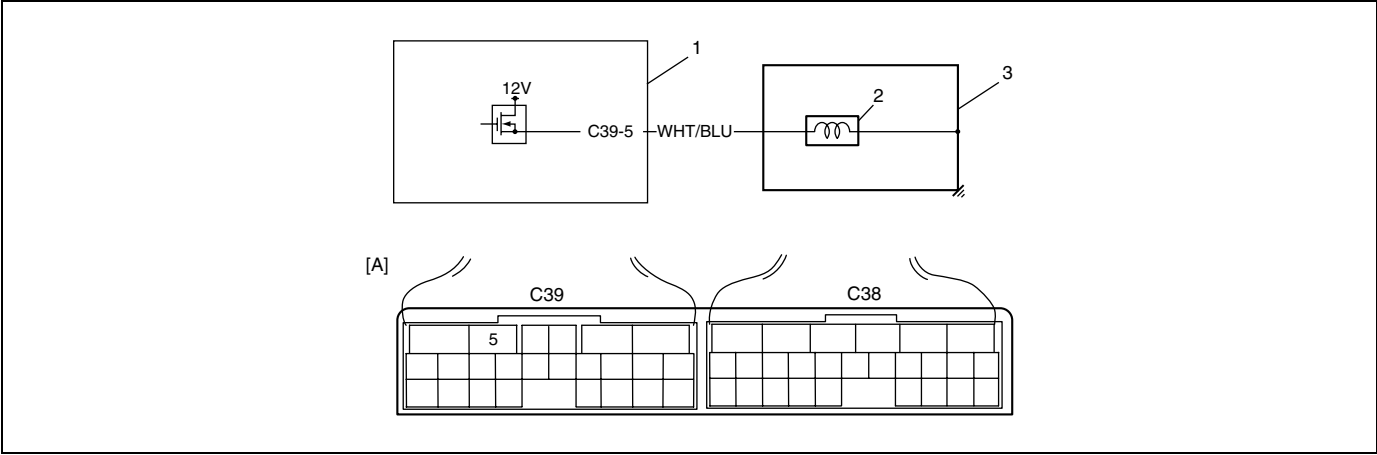
Fig. for Step 3.



1. Valve body harness connector on harness
2. Valve body harness connector on transaxle
3. Ground (transaxle)

# DTC P2770 Torque Converter Clutch (TCC) Circuit High

## Wiring Diagram



1. TCC solenoid valve	2. TCM	3. A/T	[A]: Terminal arrangement of TCM connector (Viewed from harness side)
-----------------------	--------	--------	---

## DTC Detecting Condition and Trouble Area

DTC DETECTING CONDITION	TROUBLE AREA
Voltage of TCC solenoid valve TCM terminal is high although TCM is commanding TCC solenoid to turn OFF	<ul style="list-style-type: none"><li>• TCC solenoid valve circuit shorted to ground.</li><li>• Malfunction of TCC solenoid valve</li><li>• TCM</li></ul>

## DTC Confirmation Procedure

**WARNING:**

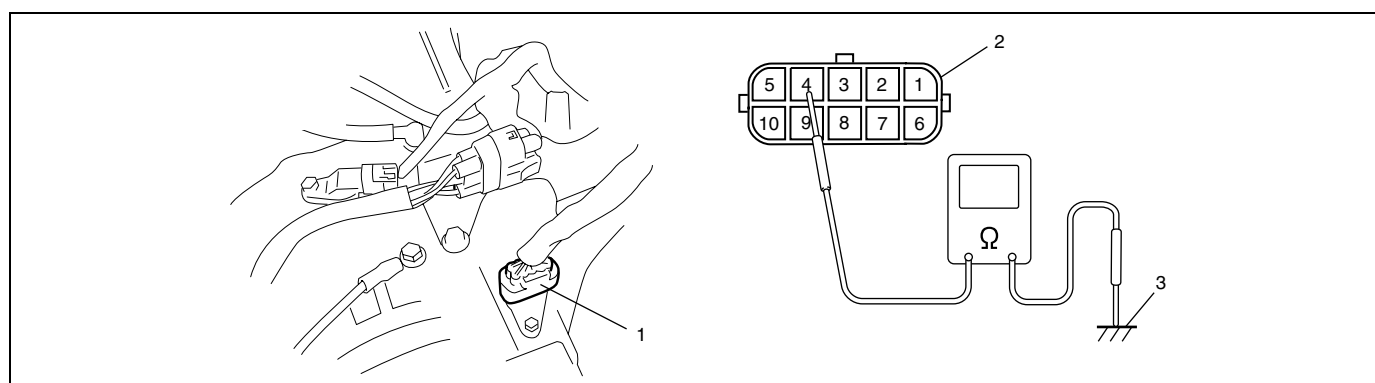
- When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.
- Road test should be carried out with 2 persons, a driver and tester, on a level road.

- 1) Connect scan tool to DLC with ignition switch OFF, if available.
- 2) Clear DTCs in TCM memory.
- 3) Start engine.
- 4) Keep engine running at idle speed in “P” range for 10 seconds or more.
- 5) Check DTC.

## DTC Troubleshooting

Step	Action	Yes	No
1	Was "Automatic Transaxle Diagnostic Flow Table" performed?	Go to Step 2.	Go to "Automatic Transaxle Diagnostic Flow Table" in this section.
2	Check TCC solenoid valve circuit for IG short 1) Connect valve body harness connector. 2) Disconnect TCM connectors. 3) Check for proper connection to TCM at terminal "C39-5". 4) If connection is OK, turn ignition switch ON and measure voltage between terminal "G08-23" of disconnected harness side TCM connector and ground. Is it 0 – 2 V?	Go to Step3.	"WHT/BLU" circuit shorted to power circuit.
3	Check TCC solenoid valve resistance 1) Turn ignition switch OFF 2) Disconnect valve body harness connector on automatic transmission. 3) Check for proper connection to solenoid at "WHT/BLU" circuit. 4) Check resistance of solenoid valve. See Fig. Resistance between TCC solenoid valve terminals of transmission side valve body harness connector: 11 – 15 $\Omega$ at 20°C (68°F) Resistance between TCC solenoid valve terminals of transmission side valve body harness connector and transmission body: Infinity Is check results satisfactory?	Intermittent trouble or faulty TCM. Check for intermittent referring to "Intermittent and Poor Connection" in Section 0A. If OK, substitute a known-good TCM and recheck.	Replace TCC solenoid valve or lead wire.

Fig. for Step 3.



- |  |
|--|
| 1. Valve body harness connector on harness   |
| 2. Valve body harness connector on transaxle |
| 3. Ground (transaxle)                        |

## Scan Tool Data

As the data values given below are standard values estimated on the basis of values obtained from the normally operating vehicles by using a scan tool, use them as reference values. Even when the vehicle is in good condition, there may be cases where the checked value does not fall within each specified data range. Therefore, judgment as abnormal should not be made by checking with these data alone.

Also, condition in the below table that can be checked by the scan tool are those detected by TCM and output from TCM as commands and there may be cases where the automatic transaxle or actuator is not operating (in the condition) as indicated by the scan tool.

### NOTE:

The following scan tool data related to automatic transaxle can be checked only by communicating with TCM.

SCAN TOOL DATA	VEHICLE CONDITION		NORMAL CONDITION/REFERENCE VALUES
GEAR POSITION	Ignition switch ON	Selector lever is in "P" position	P or N
		Selector lever is in "R" position	R
		Selector lever is in "N" position	P or N
		Selector lever is in "D" position	1
		Selector lever is in "2" position	1
		Selector lever is in "L" position	1
ENGINE SPEED	At engine idle speed		Engine idle speed is displayed
INPUT SHAFT REVOLUTION	Ignition switch ON and engine stop		0 RPM
	At 60 km/h (37.5 mile/h) constant speed, O/D off switch ON, 20% or less throttle opening and 3rd gear ("D" range)		2300 RPM (displayed in increments of 50 rpm)
OUTPUT SHAFT REVOLUTION	At vehicle stop		0 RPM
	At 60 km/h (37.5 mile/h) constant speed, O/D off switch ON, 20% or less throttle opening and 3rd gear		2300 RPM (displayed in increments of 50 rpm)
BATTERY VOLTAGE	Ignition switch ON and engine stop		Battery voltage is displayed (8 – 16 V)
ATF TEMPERATURE	After driving at 60 km/h (37.5 mile/h) for 15 minutes or more, and A/T fluid temperature around sensor reaches 70 – 80°C (158 – 176°F)		70 – 80°C, 158 – 176°F
SHIFT SOLENOID-A COMMAND	At vehicle stop		ON
	At 60 km/h (37.5 mile/h) constant speed, O/D off switch ON, 20% or less throttle opening and 3rd gear		OFF
SHIFT SOLENOID-A MONITOR	At vehicle stop		ON
	At 60 km/h (37.5 mile/h) constant speed, O/D off switch ON, 20% or less throttle opening and 3rd gear		OFF
SHIFT SOLENOID-B COMMAND	At vehicle stop		ON
	At 60 km/h (37.5 mile/h) constant speed, O/D off switch ON, 20% or less throttle opening and 3rd gear		OFF
SHIFT SOLENOID-B MONITOR	At vehicle stop		ON
	At 60 km/h (37.5 mile/h) constant speed, O/D off switch ON, 20% or less throttle opening and 3rd gear		OFF
TIMING SOLENOID COMMAND	Ignition switch ON and selector lever is in "N" range		OFF
	For about 0.5 sec. while on gear shifting between 3rd and 4th or gear shifting N to D		ON

SCAN TOOL DATA	VEHICLE CONDITION		NORMAL CONDITION/REFERENCE VALUES
TIMING SOLENOID MONITOR	Ignition switch ON and selector lever is in "N" range		OFF
	For about 0.5 sec. while on gear shifting between 3rd and 4th or gear shifting N to D		ON
TCC SOLENOID COMMAND	At 5 km/h (3 mile/h) constant speed, O/D off switch ON, closed throttle and 1st gear		OFF
	At 100 km/h (62.5 mile/h) constant speed, O/D off switch OFF, 20% or less throttle opening and 4th gear		ON
TCC SOLENOID COMMAND	At 5 km/h (3 mile/h) constant speed, O/D off switch ON, closed throttle and 1st gear		OFF
	At 100 km/h (62.5 mile/h) constant speed, O/D off switch OFF, 20% or less throttle opening and 4th gear		ON
PRESSURE CONTROL SOLENOID	At vehicle stop, closed throttle, engine idle speed and 1st gear		0%
VEHICLE SPEED	At vehicle stop		0 KPH, 0 MPH
O/D OFF SWITCH	Ignition switch ON	O/D off switch OFF	OFF
		O/D off switch ON	ON
TRANSAXLE	Ignition switch ON	Selector lever is in "P" position	P
		Selector lever is in "R" position	R
		Selector lever is in "N" position	N
		Selector lever is in "D" position	D
		Selector lever is in "2" position	2
		Selector lever is in "L" position	L
D RANGE SIGNAL	Ignition switch ON	Selector lever is in "P" position	OFF
		Selector lever is in "R" position	ON
		Selector lever is in "N" position	OFF
		Selector lever is in "D" position	ON
		Selector lever is in "2" position	ON
		Selector lever is in "L" position	ON
THROTTLE POSITION	Ignition switch ON	Accelerator pedal is released	0%
		Accelerator pedal is depressed	0 – 100% (Varies depending on depressed value)
BRAKE SWITCH	Ignition switch ON	Brake pedal is depressed	ON
		Brake pedal is released	OFF
TORQUE REDUCTION SIGNAL	While on gear upshifting with 25% or more throttle opening		ON
	Under condition of not shifting gear		OFF
ENGINE COOLANT TEMPERATURE	Ignition switch ON		Engine coolant temperature is displayed
AIR CONDITIONER SIGNAL	Ignition switch ON and air conditioner switch OFF		OFF
ENGINE TORQUE SIGNAL	Ignition switch ON and engine stop		0 N·m

**SCAN TOOL DATA DEFINITIONS:****GEAR POSITION**

Current gear position computed by throttle position coming from ECM and vehicle speed.

**ENGINE SPEED (RPM)**

Engine speed computed by reference pulses from crankshaft position sensor.

**INPUT SHAFT REVOLUTION (RPM)**

Input shaft revolution computed by reference pulses coming from input shaft speed sensor on transaxle case.

**OUTPUT SHAFT REVOLUTION (RPM)**

Output shaft revolution computed by reference pulses coming from output shaft speed sensor (VSS) on transaxle case.

**BATTERY VOLTAGE (V)**

Battery voltage read by TCM as analog input signal by TCM.

**ATF TEMPERATURE (°C, °F)**

ATF temperature decided by signal from transmission fluid temperature sensor installed on valve body.

**SHIFT SOLENOID-A COMMAND**

ON: ON command being outputted to shift solenoid valve-A (No.1)

OFF: ON command not being outputted to shift solenoid valve-A (No.1)

**SHIFT SOLENOID-A MONITOR**

ON: Electricity being passed to shift solenoid valve-A (No.1)

OFF: Electricity not being passed to shift solenoid valve-A (No.1)

**SHIFT SOLENOID-B COMMAND**

ON: On command being outputted to shift solenoid valve-B (No.2)

OFF: ON command not being outputted to shift solenoid valve-B (No.2)

**SHIFT SOLENOID-B MONITOR**

ON: Electricity being passed to shift solenoid valve-B (No.2)

OFF: Electricity not being passed to shift solenoid valve-B (No.2)

**TIMING SOLENOID COMMAND**

ON: ON command being outputted to timing solenoid valve

OFF: ON command not being outputted to timing solenoid valve

**TIMING SOLENOID MONITOR**

ON: Electricity being passed to timing solenoid valve

OFF: Electricity not being passed to timing solenoid valve

**TCC SOLENOID COMMAND**

ON: ON command being outputted to TCC solenoid valve

OFF: ON command not being outputted to TCC shift solenoid valve

**TCC SOLENOID MONITOR**

ON: Electricity being passed to TCC solenoid valve

OFF: Electricity not being passed to TCC solenoid valve

**PRESSURE CONTROL SOLENOID (%)**

Electric current value ratio between electric current value being outputted from TCM to solenoid and maximum value can be outputted by TCM.

**VEHICLE SPEED (KPH/MPH)**

Vehicle speed computed by reference pulse signals coming from vehicle speed sensor on transaxle case.



### **O/D OFF SWITCH**

Inputted signal from O/D off switch on selector knob.

ON: O/D off switch ON

OFF: O/D off switch OFF

### **TRANSAXLE RANGE**

Transaxle range detected by signal fed from transmission range sensor.

### **D RANGE SIGNAL**

ON: Signal which TCM require ECM to increase idle speed

OFF: Signal which TCM does not require ECM to increase idle speed

### **THROTTLE POSITION (%)**

Throttle opening ratio computed by duty pulse signal from ECM.

### **BRAKE SWITCH**

Inputted signal from brake light switch on pedal bracket.

ON: Brake pedal depressed

OFF: Brake pedal released

### **TORQUE REDUCTION SIGNAL**

ON: Signal which TCM require ECM to reduce output torque at shifting gear

OFF: Signal which TCM does not require ECM to reduce output torque

### **ENGINE COOLANT TEMPERATURE (°C, °F)**

Engine coolant temperature computed by duty pulse signal from ECM.

### **AIR CONDITIONER SIGNAL**

ON: Signal which inform that air conditioner compressor is turned ON.

OFF: Signal which inform that air conditioner compressor is not turned ON.

### **ENGINE TORQUE SIGNAL (N·m)**

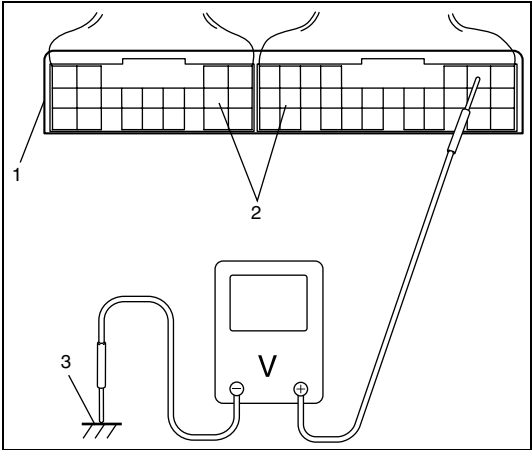
Engine torque computed by duty pulse signal outputted from ECM.

Inspection of TCM and Its Circuits

TCM and its circuits can be checked at TCM wiring connectors by measuring voltage and resistance.

**CAUTION:**  
TCM cannot be checked by itself, it is strictly prohibited to connect voltmeter or ohmmeter to TCM with connector disconnected from it.

INSPECTION

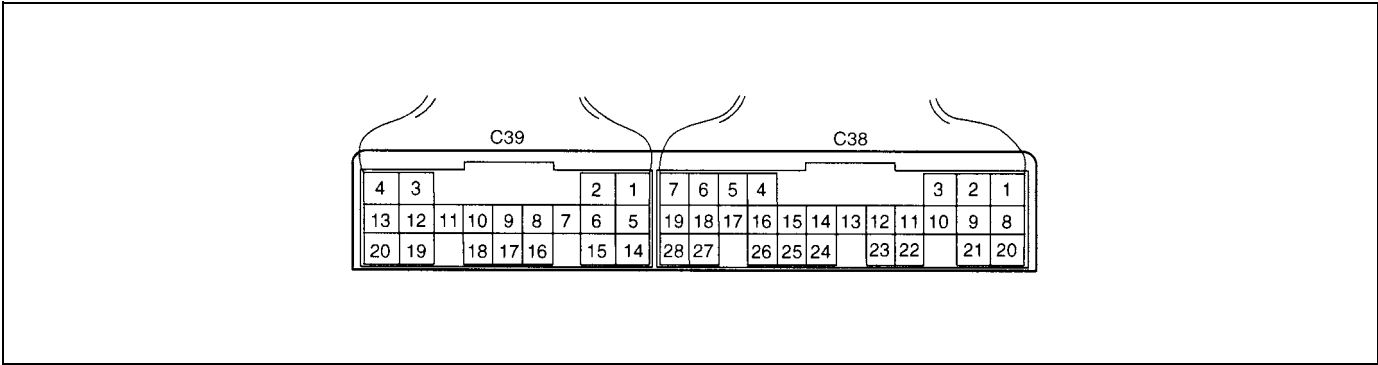


- 1) Remove TCM (1) from vehicle referring to “Transmission Control Module (TCM)” in this section.
- 2) Connect TCM connectors (2) to TCM.
- 3) Check voltage at each terminal of connectors connected.

**NOTE:**  
As each terminal voltage is affected by battery voltage, confirm that it is 11 V or more when ignition switch is ON.

3. Body ground

Terminal Arrangement of TCM Coupler (Viewed From Harness Side)



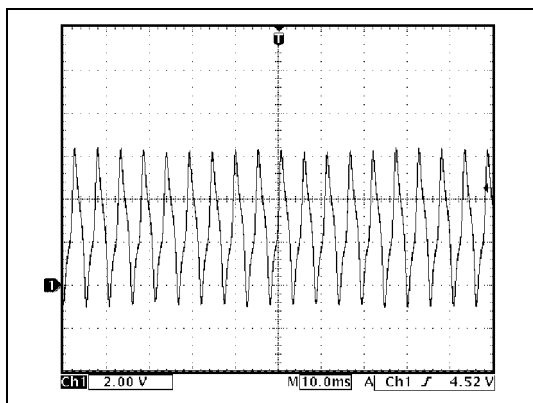
Con- nector	Terminal number	Wire color	Circuit	Normal Voltage	Condition
C38	1	RED	Transmission range sen- sor (“R” range)	8 – 14 V	Ignition switch ON, selector lever at “R” range
				0 – 1 V	Ignition switch ON, selector lever at other than “R” range
	2	—	—	—	—
	3	—	—	—	—
	4	—	—	—	—
	5	—	—	—	—

Con- nector	Terminal number	Wire color	Circuit	Normal Voltage	Condition
C38	6	WHT	Input shaft speed sensor (+)	2 – 3 V	Ignition switch turned ON, engine stops.
				(1. Reference waveform No.1)	While engine running. (Output signal is waveform. Waveform frequency varies depending on output shaft speed. (16 pulses are generated par 1 input shaft revolution.))
	7	GRN	Transmission range sensor ("D" range)	8 – 14 V	Ignition switch ON, selector lever at "R" range
				0 – 1 V	Ignition switch ON, selector lever at other than "R" range
	8	GRN/ORN	Transmission range sensor ("N" range)	8 – 14 V	Ignition switch ON, selector lever at "N" range
				0 – 1 V	Ignition switch ON, selector lever at other than "N" range
	9	BLU/RED	O/D OFF switch	0 – 1 V	O/D OFF switch pressed
				8 – 14 V	O/D OFF switch released
	10	–	–	–	–
	11	RED/BLK	"O/D OFF" light	0 – 1 V	Ignition switch ON (lamp turned ON)
				8 – 14 V	Ignition switch ON (lamp turned OFF)
	12	–	–	–	–
	13	–	–	–	–
	14	–	–	–	–
	15	–	–	–	–
	16	BLK	Input shaft speed sensor (–)	2 – 3 V	Ignition switch ON, engine at stop
	17	–	–	–	–
	18	BLU/WHT	Transmission range sensor ("L" range)	8 – 14 V	Ignition switch ON, selector lever at "L" range
				0 – 1 V	Ignition switch ON, selector lever at other than "L" range
	19	GRN/YEL	Transmission range sensor ("2" range)	8 – 14 V	Ignition switch ON, selector lever at "2" range
				0 – 1 V	Ignition switch ON, selector lever at other than "2" range
	20	ORN	Transmission range sensor ("P" range)	8 – 14 V	Ignition switch ON, selector lever at "P" range
				0 – 1 V	Ignition switch ON, selector lever at other than "P" range
	21	–	–	–	–
	22	–	–	–	–
	23	BLU	Data link connector	8 – 14 V	Ignition switch ON
	24	–	–	–	–
	25	YEL	Output shaft speed sensor (VSS)	8 – 14 V	Ignition switch ON
				0 – 1 V ↑↓ 10 – 14 V (2. Reference waveform No.2)	Vehicle running. (Sensor signal is pulse. Pulse frequency varies depending on vehicle speed. (8190 pulses are generated par 60 km/h, 37.5 ml/h)
	26	–	–	–	–

Con- nector	Terminal number	Wire color	Circuit	Normal Voltage	Condition
C39	1	BLK	Ground	0 – 1 V	Ignition switch ON
	2	LT GRN	Pressure control solenoid valve (–)	0.6 – 1.0 V	Ignition switch ON
	3	–	–	–	–
	4	BRN/YEL	Pressure control solenoid valve (+)	0 – 0.6 V ↑↓ 10 – 14 V (3. Reference waveform No.3)	Engine running at idling. (Output signal is duty pulse. Duty ratio varies depending on throttle valve opening.)
	5	WHT/BLU	TCC solenoid valve	0 – 1 V	Engine running at idling speed.
	6	YEL/BLK	Power source	10 – 14V	Ignition switch ON
	7	WHT	CAN communication line (Low)	2.5 – 3.6 V ↑↓ 1.6 – 2.5 V (4. Reference waveform No.4)	Engine running at idling with after warming up. (CAN communication signal is pulse. Pulse signal frequency varies depending on engine condition.)
	8	–	–	–	–
	9	–	–	–	–
	10	–	–	–	–
	11	BLU/RED	Transmission fluid temperature sensor (+)	2.9 – 3.1 V	Ignition switch ON, fluid temperature is 20°C (68°F)
				0.3 – 0.5 V	Ignition switch ON, fluid temperature is 100°C (212°F)
	12	GRY/RED	Transmission fluid temperature sensor (–)	0 – 1 V	Ignition switch ON
	13	–	–	–	–
	14	WHT/GRN	Timing solenoid valve	0 – 1 V	Ignition switch ON
	15	BLK/YEL	Shift solenoid valve-B (No.2)	9 – 14 V	Ignition switch ON, select lever in “P” range
	16	BRN	Shift solenoid valve-A (No.1)	9 – 14 V	Ignition switch ON, select lever in “P” range
	17	RED	CAN communication line (High)	2.5 – 3.6 V ↑↓ 1.6 – 2.5 V (4. Reference waveform No.4)	Engine running at idling with after warming up. (CAN communication signal is pulse. Pulse signal frequency varies depending on engine condition.)
	18	–	–	–	–
	19	–	–	–	–
	20	–	–	–	–
	21	–	–	–	–
	22	–	–	–	–
	23	BLK	Ground	0 – 1 V	Ignition switch ON
	24	WHT/RED	Power source for back-up	10 – 14 V	Constantly

**1. Reference waveform No.1**

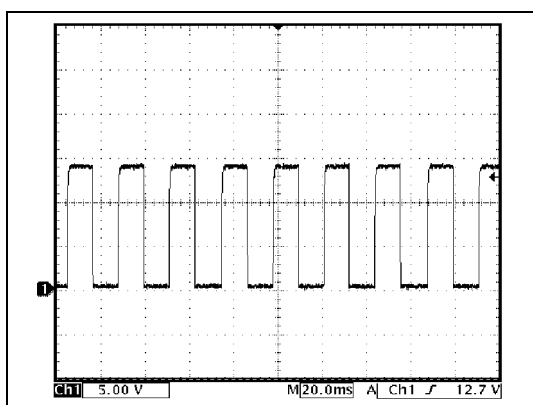
Input shaft speed sensor signal at engine idling.



Measurement terminal	CH1: C38-6 to C39-1
Oscilloscope setting	CH1: 2 V/DIV TIME: 10 ms/DIV
Measurement condition	<ul style="list-style-type: none"> <li>After warmed up to normal operating temperature</li> <li>Engine at specified idle speed with "P" range.</li> </ul>

**2. Reference waveform No.2**

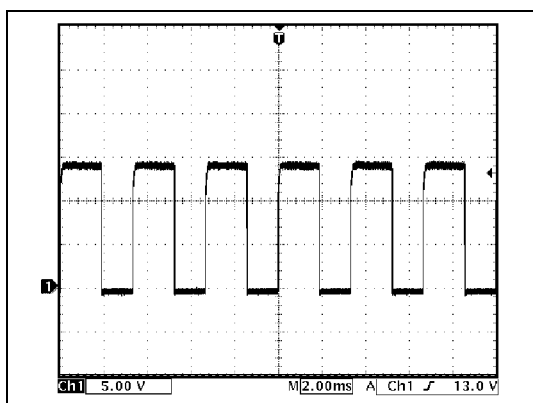
Output shaft speed sensor (VSS) signal at vehicle speed 60 km/h (37 mile/h).



Measurement terminal	CH1: C38-25 to C39-1
Oscilloscope setting	CH1: 5 V/DIV TIME: 2 ms/DIV
Measurement condition	<ul style="list-style-type: none"> <li>After warmed up to normal operating temperature</li> <li>Drive vehicle at 60 km/h (37 mile/h).</li> </ul>

**3. Reference waveform No.3**

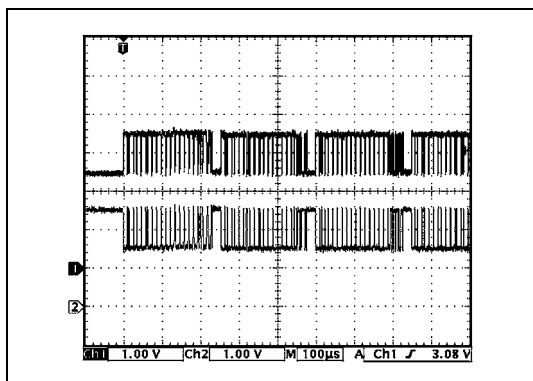
Pressure control solenoid valve signal at engine idling.



Measurement terminal	CH1: C39-4 to C39-1
Oscilloscope setting	CH1: 5 V/DIV TIME: 20 ms/DIV
Measurement condition	<ul style="list-style-type: none"> <li>After warmed up to normal operating temperature</li> <li>Engine at specified idle speed with "P" range.</li> </ul>

**4. Reference waveform No.4**

CAN communication line (High & Low) signal at engine idling



Measurement terminal	CH1: C39-7 to C39-1 CH2: C39-17 to C39-1
Oscilloscope setting	CH1: 1 V/DIV TIME: 100 μs/DIV
Measurement condition	<ul style="list-style-type: none"> <li>After warmed up to normal operating temperature</li> <li>Engine at specified idle speed with "P" range.</li> </ul>

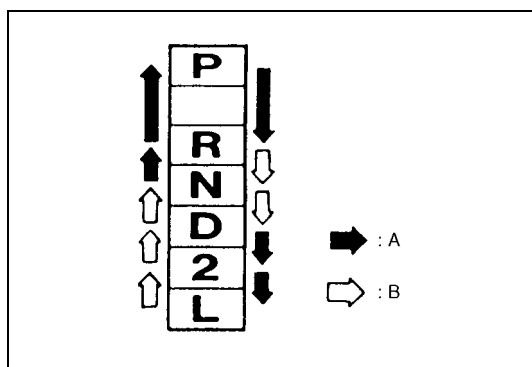
## On-Vehicle Service

### Maintenance Service

#### Fluid level check at normal operating (hot) temperature (Hot check)

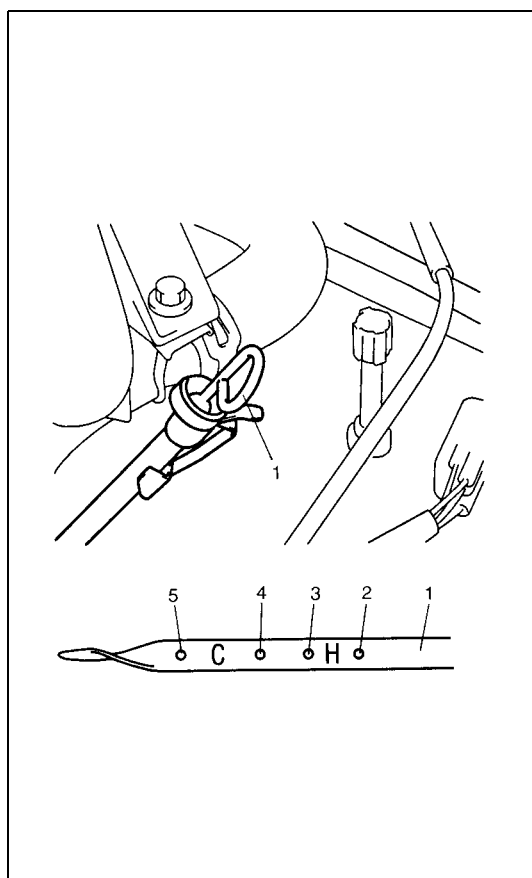
##### Inspection

- 1) Stop vehicle and place it level.
- 2) Apply parking brake and place chocks against wheels.
- 3) With selector at P position, start engine.
- 4) Warm up engine till fluid temperature reaches normal operating temperature (70 – 80°C/158 – 176°F). As a guide to check fluid temperature, warm up engine to normal operating.
- 5) Keep engine idling and shift selector slowly to “L” and back to “P” position.
- 6) With engine idling, pull out fluid level gauge, wipe it off with a clean cloth and put it back into place.



A. Shift the select lever with its button pushed in.

B. Shift the select lever without pushing its button.



- 7) Pull out fluid level gauge (1) again and check fluid level indicated on it. The lowest fluid level should be between FULL HOT and LOW HOT. If it is below LOW HOT, add an equivalent of DEXRON®-III up to FULL HOT.

#### Automatic transaxle fluid

#### An equivalent of DEXRON®-III

##### NOTE:

- Do not race engine while checking fluid level, even after the engine start.
- Do not overfill. Overfilling can cause foaming and loss of fluid through breather. Then slippage and transaxle failure can result.
- Bringing the level from LOW HOT to FULL HOT requires 0.4 liters (0.85/0.70 US/Imp. pt).
- If vehicle was driven under high load such as pulling a trailer, fluid level should be checked about half an hour after it is stopped.

2. "FULL HOT" mark

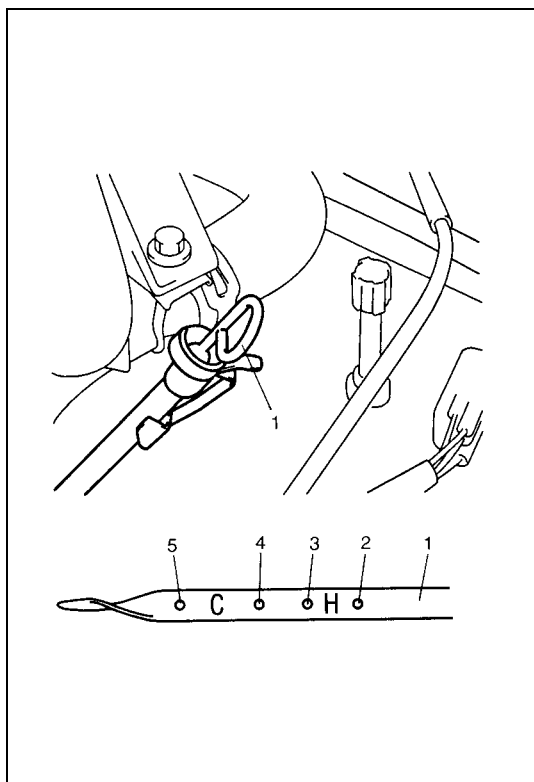
3. "LOW HOT" mark

4. "FULL COLD" mark

5. "LOW COLD" mark

## Fluid level check at room (cold) temperature (Cold check)

### Inspection



Fluid level can be checked temporarily at room (cold) temperature which correspond to 20 – 30°C (68 – 86°F). This level check is considered to be preparation before performing level check under normal operating (hot) temperature. Checking procedure itself is the same as that described in “Fluid Level Check at Normal Operating (Hot) Temperature (Hot Check)”. If fluid level is between FULL COLD and LOW COLD, proceed to test drive. And when fluid temperature has reached normal operating (hot) temperature, check fluid level again and adjust it as necessary.

#### CAUTION:

**Fluid level check at room (cold) temperature is recommended only for preparation of level check under normal (hot) operating condition.**

**Failure to perform fluid level check under normal (hot) operating temperature may result in damage to transaxle.**

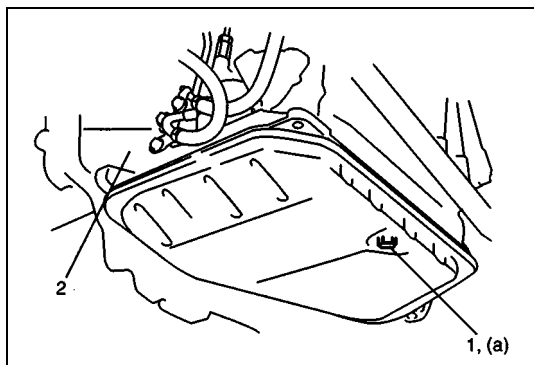
- |                      |
|----------------------|
| 1. Fluid level gauge |
| 2. “FULL HOT” mark   |
| 3. “LOW HOT” mark    |
| 4. “FULL COLD” mark  |
| 5. “LOW COLD” mark   |

## Fluid change

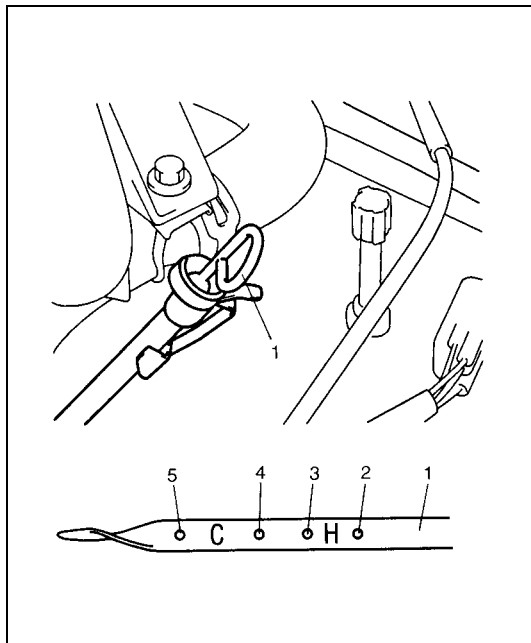
- 1) Lift up vehicle.
- 2) When engine is cool, remove drain plug (1) from transaxle housing (2) and drain A/T fluid.
- 3) Install drain plug (1).

#### Tightening torque

**A/T fluid drain plug (a): 17 N·m (1.7 kg-m, 12.5 lb-ft)**



- 4) Lower vehicle and fill proper amount of an equivalent of DEXRON®-III.



- 5) Check fluid level referring to “Fluid level check at room (cold) temperature (Cold check)” and “Fluid level check at normal operating (hot) temperature (Hot check)” in this section.

### Automatic transaxle fluid

**An equivalent of DEXRON®-III**

### Automatic transaxle fluid capacity

**When draining from drain plug hole:**

**3.3 liters (6.97/5.81 US/Imp. pt.)**

**When overhauling:**

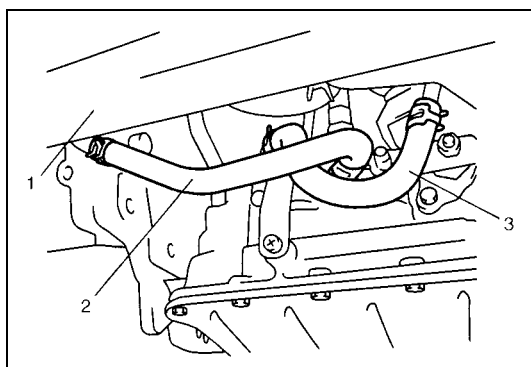
**5.6 liters (11.83/9.86 US/Imp. pt.)**

1.	Fluid level gauge
2.	“FULL HOT” mark
3.	“LOW HOT” mark
4.	“FULL COLD” mark
5.	“LOW COLD” mark

### A/T fluid cooler hoses

The rubber hoses for the A/T fluid cooler should be replaced at specified interval. When replacing them, be sure to note the following.

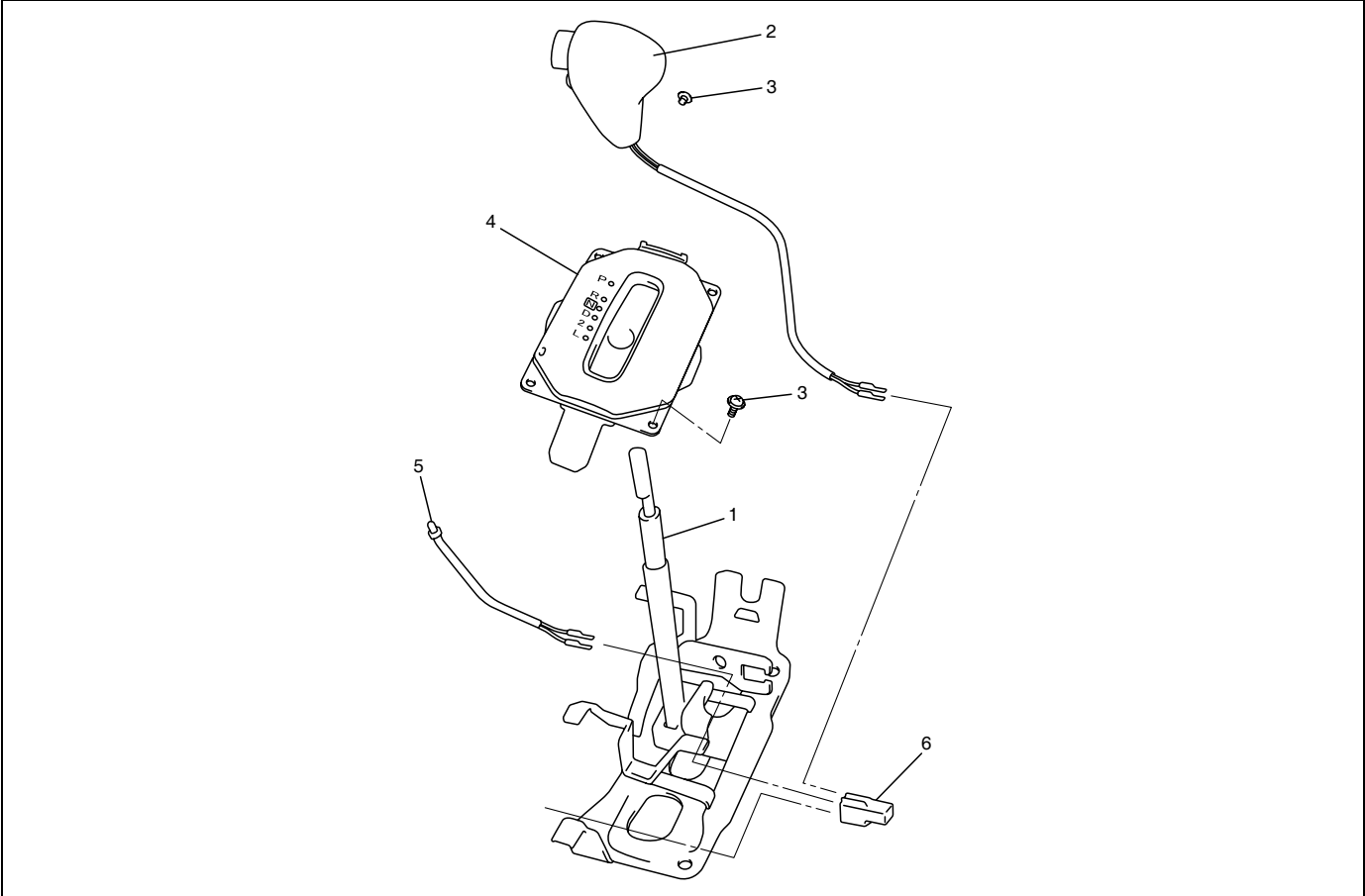
- to replace clamps at the same time
- to insert hose as far as its limit mark
- to clamp clamps securely



1.	Radiator
2.	Inlet hose (Outlet from A/T fluid cooler)
3.	Outlet hose (Inlet to A/T fluid cooler)

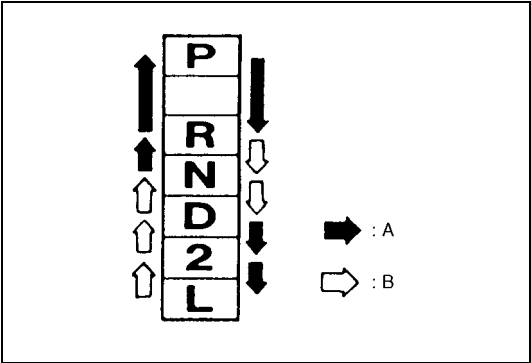


Selector Lever



1. Selector lever assembly	4. Indicator assembly
2. Knob assembly	5. Illumination lamp assembly
3. Screw	6. Connector

Inspection

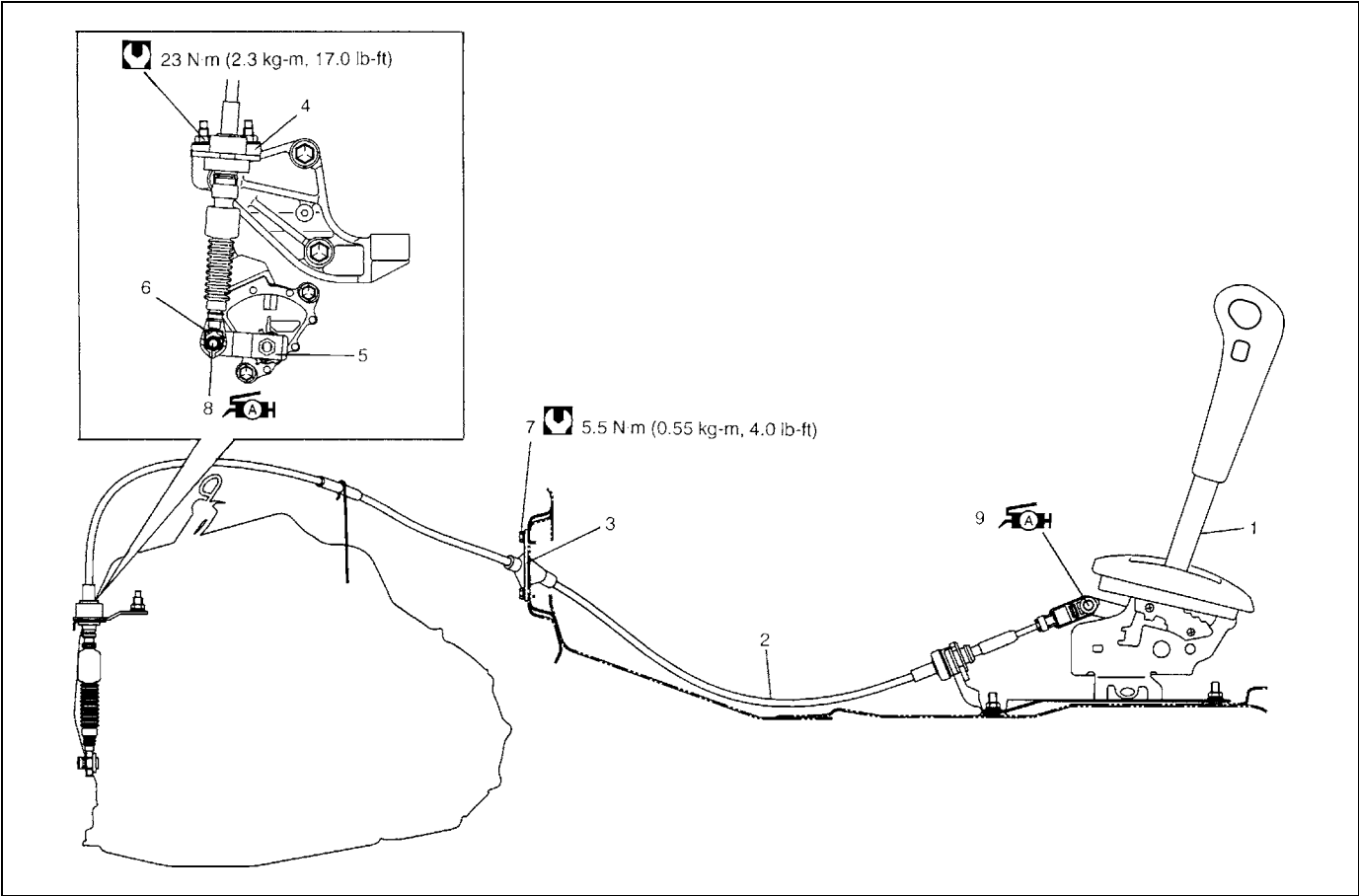


Check selector lever for smooth and clear-cut movement and position indicator for correct indication.

For operation of select lever, refer to the figure.

A.	Shift the selector lever with its button pushed in.
B.	Shift the selector lever without pushing its button.

Select Cable



1. Selector lever assembly	6. Clip
2. Select cable	7. Select cable retainer bolt
3. Select cable retainer	8. Manual select lever pin : Apply lithium grease 99000-25010 to all around pin (0.15 g)
4. Cable bracket	9. Selector lever pin : Apply lithium grease 99000-25010 to all around pin (0.15 g)
5. Manual select lever	Tightening torque

Removal

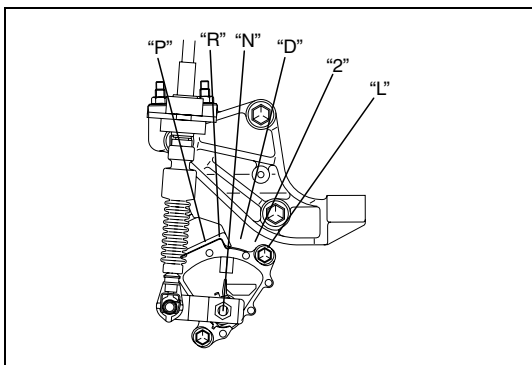
- 1) Remove parking brake lever cover.
- 2) Remove console box.
- 3) Disconnect select cable from selector lever and then detach from bracket.
- 4) Remove clip and disconnect select cable from manual select lever.
- 5) Remove select cable retainer from dash panel.

Installation

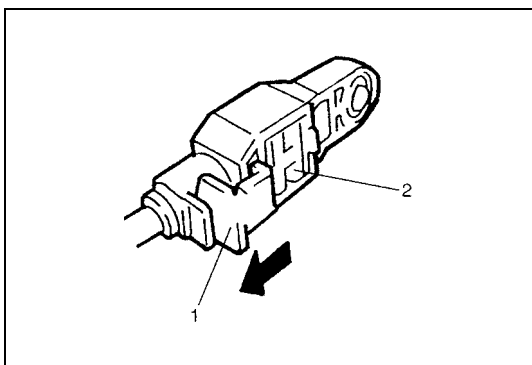
Install select cable by reversing removal procedure.  
The important steps in installation are as follows.

- Apply grease to pin and cable joint.
- Tighten bolts in upper figure to specified torque.
- Adjusting procedure is as follows.

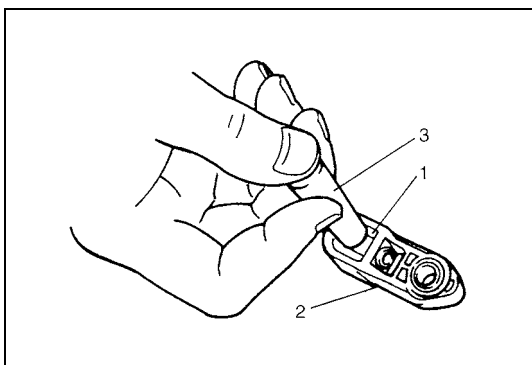
## Adjustment



- 1) Shift manual shift lever to "N" range (transmission range sensor "N" range).



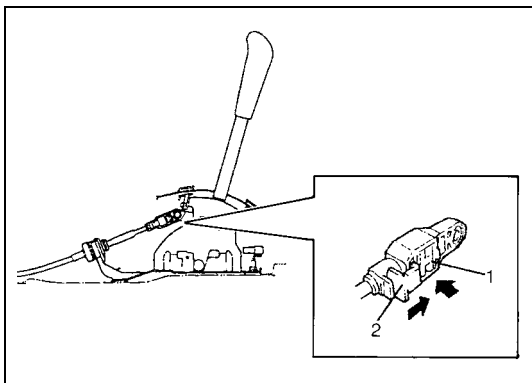
- 2) Remove adjuster (cable end) from selector lever pin of selector lever assembly.
- 3) Release lock plate (1) which restrict moving of cable end holder (2).



- 4) Push cable end holder (1) out from eye-end (2) using an appropriate tool (3) to disengage cable.

- 5) Shift selector lever to "N" position.
- 6) Apply grease to selector lever pin and install adjuster (cable end) to it.

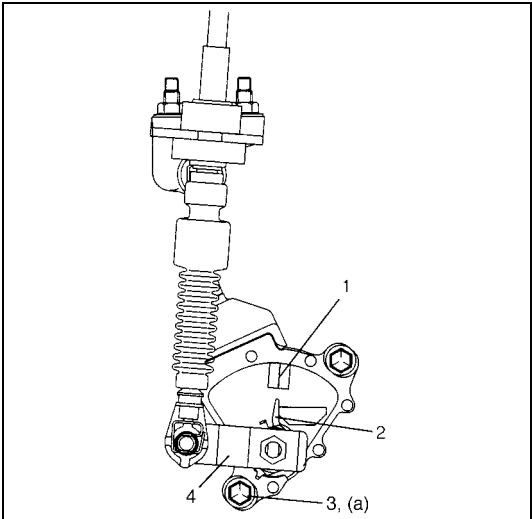
### Grease 99000-25010



- 7) With both selector lever and transmission range sensor kept each "N" position, drive cable end holder (1) in until it locks cable.
- 8) Slide lock plate (2) to secure cable end holder in position.
- 9) After select cable was installed, check for the following.
  - Push vehicle with selector lever shifted to "P" range. Vehicle should not move.
  - Vehicle can not be driven in "N" range.
  - Vehicle can be driven in "D", "2" and "L" ranges.
  - Vehicle can be backed in "R" range.

# Transmission Range Sensor (Shift Switch)

## Adjustment and Inspection



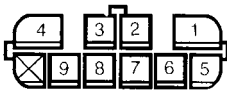
- 1) Shift manual select lever (4) to “N” range.
- 2) Check that needle direction shaped on lock washer (2) and “N” reference line (1) on transmission range sensor are aligned. If not, loosen sensor bolts (3) and align them.
- 3) Check that engine starts in “N” and “P” ranges but it does not start in “D”, “2”, “L” or “R” range. Also, check that back-up lamp lights in “R” range.

### Tightening torque

#### Transmission range sensor bolts

(a): 5.5 N·m (0.55 kg·m, 4.0 lb·ft)

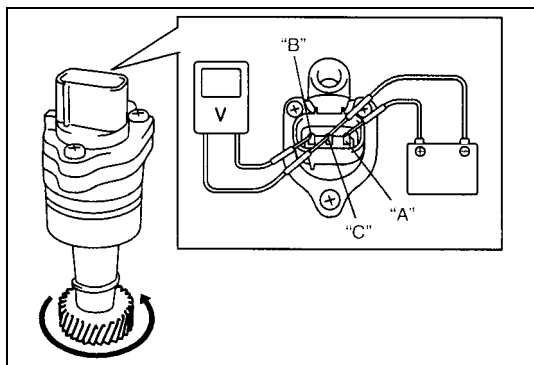
If faulty condition cannot be corrected by adjustment, disconnect transmission range sensor connector and check that continuity exists as shown by moving manual select lever.



		Terminal No.								
		1	2	3	4	5	6	7	8	9
Sensor Position	P	○			○			○		○
	R							○	○	
	N	○			○	○		○		
	D			○				○		
	2						○	○		
	L		○					○		

## Output Shaft Speed Sensor (VSS)

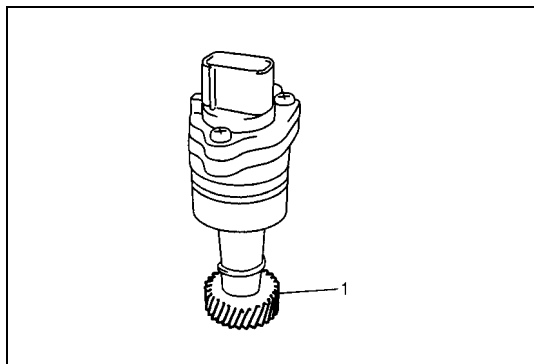
### Inspection



- 1) Connect positive cable of 12 volt battery to "A" terminal of sensor and ground cable to "C" terminal. Then using voltmeter, check voltage between "B" terminal and "C" terminal with output shaft speed sensor (VSS) driven gear rotated. If measured voltage (pulse signal) is not as specified, replace sensor.

#### Output shaft speed sensor (VSS) output voltage

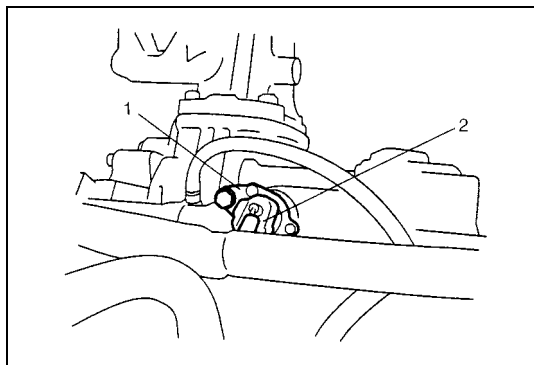
Pulse signal of alternating 0 – 1 V and 10 – 14 V



- 2) Check output shaft speed sensor (VSS) driven gear (1) for wear. Replace if necessary.

### Removal

- 1) Disconnect negative cable at battery.
- 2) Disconnect output shaft speed sensor connector (2).
- 3) Remove output shaft speed sensor (VSS) (1) by removing its bolt.



### Installation

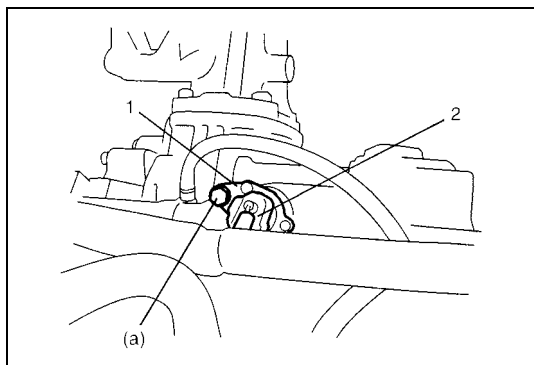
- 1) Apply A/T fluid to output shaft speed sensor O-ring.
- 2) Install output shaft speed sensor (VSS) (1) to A/T case and tighten bolt to specified torque.

#### Tightening torque

##### Output shaft speed sensor (VSS) bolt

(a): 13 N·m (1.3 kg-m, 9.5 lb-ft)

- 3) Connect output shaft speed sensor connector (2) to output shaft speed sensor (1).
- 4) Connect negative cable to battery.



## Input Shaft Speed Sensor

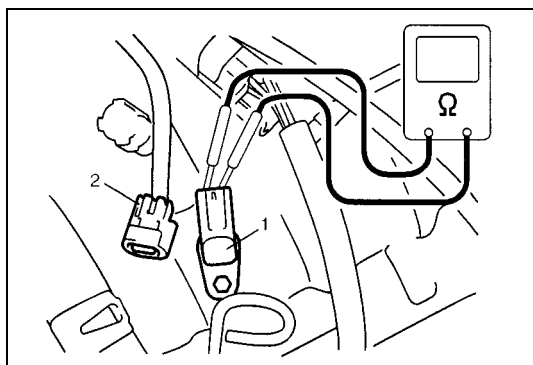
### Inspection

- 1) Disconnect negative cable at battery.
- 2) Disconnect input shaft speed sensor connector (2).
- 3) Check resistance between input shaft speed sensor terminals.

#### Input shaft speed sensor resistance

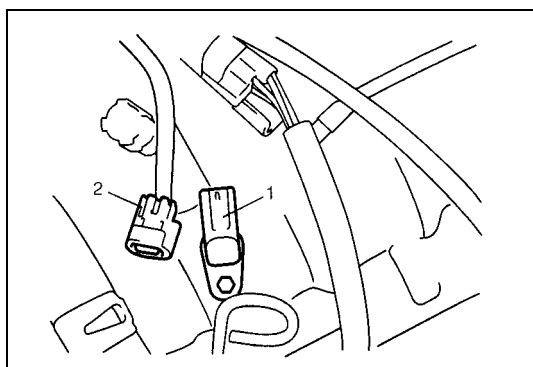
**Standard: 560 – 680  $\Omega$  at 20°C (68°F)**

1. Input shaft speed sensor



### Removal

- 1) Disconnect negative cable at battery.
- 2) Disconnect input shaft speed sensor connector (2).
- 3) Remove input shaft speed sensor (1) by removing its bolt.



### Installation

- 1) Apply A/T fluid to input shaft speed sensor O-ring.
- 2) Install input shaft speed sensor (1) to A/T case and tighten bolt to specified torque.

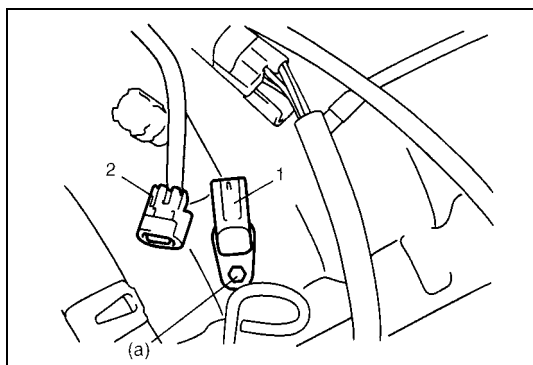
#### Tightening torque

##### Input shaft speed sensor bolt

**(a): 5.5 N·m (0.55 kg-m, 4.0 lb-ft)**

- 3) Connect input shaft speed sensor connector (2) to input shaft speed sensor (1).

- 4) Connect negative cable to battery.



## Throttle Position Sensor

### Inspection

Check throttle position sensor referring to "Throttle Position Sensor" in Section 6E1.

Engine Coolant Temperature Sensor

Inspection

Check engine coolant temperature sensor referring to “Engine Coolant Temperature Sensor” in Section 6E1.

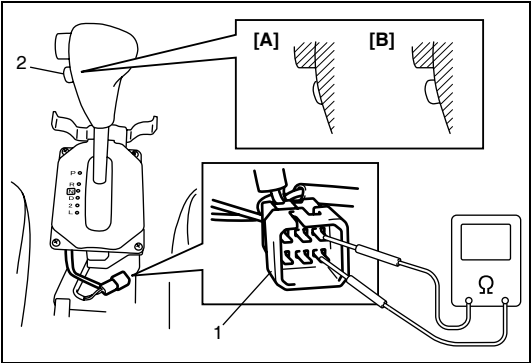
O/D Off Switch

Inspection

- 1) Remove console box.
- 2) Disconnect O/D off switch connector (1).
- 3) Check continuity between O/D off switch terminals.

O/D off switch	Pushing	Free
Continuity	Continuity	No continuity

[A]: Pushing position
[B]: Free position



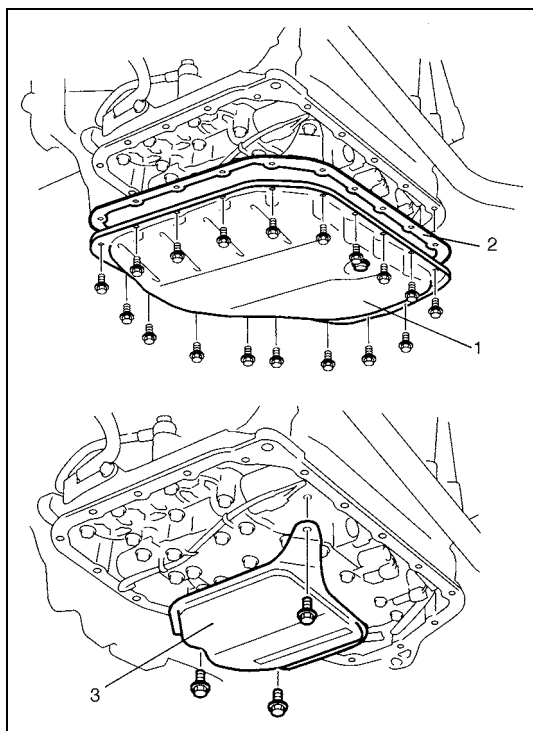
## Solenoid Valves (Shift Solenoid Valves, TCC Solenoid Valve and Timing Solenoid Valve)

### Removal

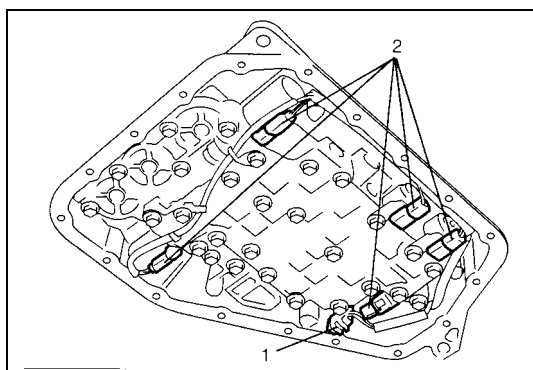
- 1) Disconnect negative cable at battery.
- 2) Lift up vehicle.
- 3) Remove drain plug and drain A/T fluid.
- 4) Install drain plug.

### Tightening torque

**A/T fluid drain plug: 17 N·m (1.7 kg-m, 12.5 lb-ft)**

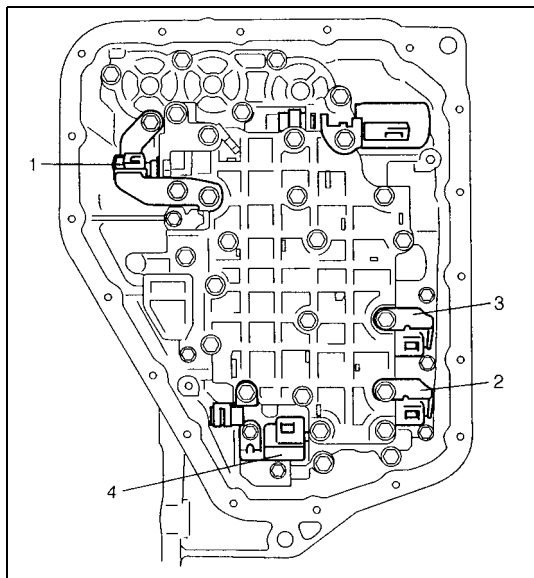


- 5) Remove A/T oil pan (1) and oil pan gasket (2).
- 6) Remove oil strainer assembly (3).



- 7) Remove transmission fluid temperature sensor (1) from sensor clamp.
- 8) Disconnect solenoid connectors (2).

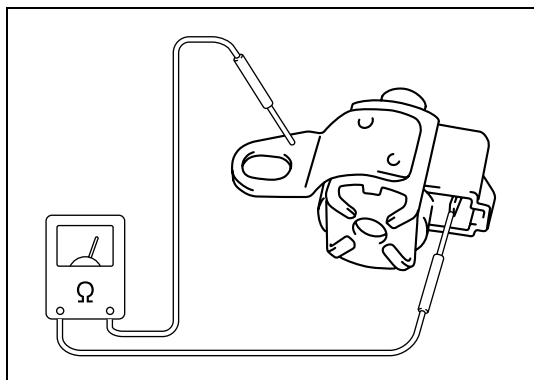




- 9) Remove TCC solenoid valve (1), shift solenoid valve-A (No.1) (2), shift solenoid valve-B (No.2) (3) and timing solenoid valve (4) by removing bolts.

### Inspection

#### Resistance Check

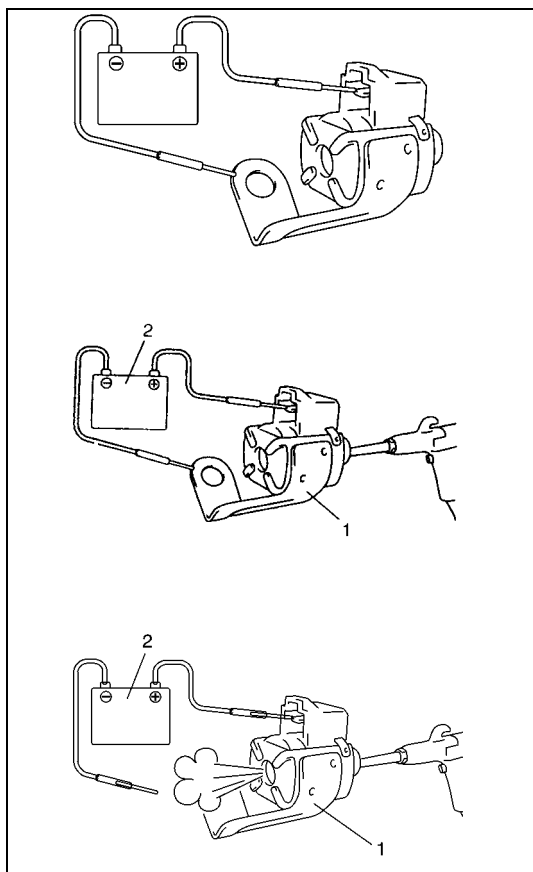


**Shift solenoid valves, Timing solenoid valve and TCC solenoid valve resistance**

**Standard: 11 – 15  $\Omega$  at 20°C (68°F)**

## Operation Check

### Shift solenoid valve-A (No.1), -B (No.2) and TCC solenoid valve



#### CAUTION:

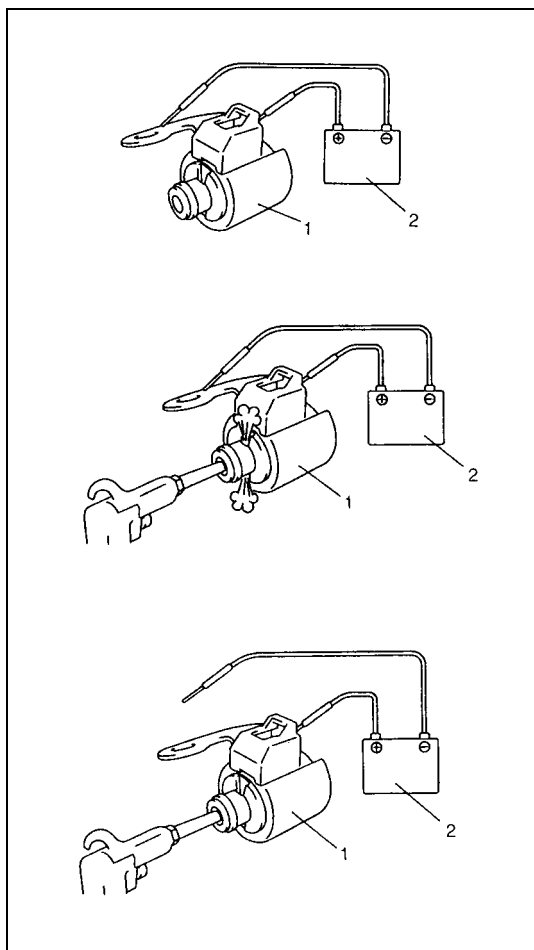
**Do not insert air gun against strainer installed on inlet of solenoid valve too deeply, when blowing air into solenoid valve. If not, the strainer will be damaged.**

- Check that solenoid valve (1) actuate with click sound when battery voltage is conducted.
- When solenoid valve (1) is connected to battery (2), confirm that solenoid valve is close condition by blowing air (50 – 200 kPa, 0.5 – 2.0 kg/cm<sup>2</sup>, 7 – 28.5 psi) into solenoid valve as shown in the figure.
- When solenoid valve (1) is not connected to battery (2), confirm that solenoid valve is open condition by blowing air (50 – 200 kPa, 0.5 – 2.0 kg/cm<sup>2</sup>, 7 – 28.5 psi) into solenoid valve as shown in the figure.

#### NOTE:

**Do not fail to inspect with air to prevent mistaken checking because return spring for valve is not installed into solenoid valve.**

## Timing solenoid valve

**CAUTION:**

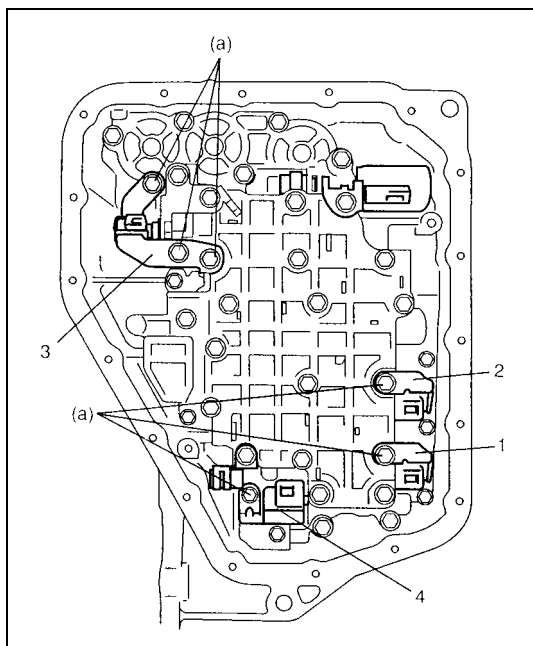
**Do not insert air gun against strainer installed on inlet of solenoid valve too deeply, when blowing air into solenoid valve. If not, the strainer will be damaged.**

- Check that solenoid valve (1) actuate with click sound when battery voltage is conducted.
- When timing solenoid valve (1) is connected to battery (2), confirm that timing solenoid valve is open condition by blowing air (50 – 200 kPa, 0.5 – 2.0 kg/cm<sup>2</sup>, 7 – 28.5 psi) into solenoid valve as shown in the figure.
- When timing solenoid valve (1) is not connected to battery (2), confirm that timing solenoid valve is close condition by blowing air (50 – 200 kPa, 0.5 – 2.0 kg/cm<sup>2</sup>, 7 – 28.5 psi) into solenoid valve as shown in the figure.

**NOTE:**

**Do not fail to inspect with air to prevent mistaken checking because return spring for valve is not installed into solenoid valve.**

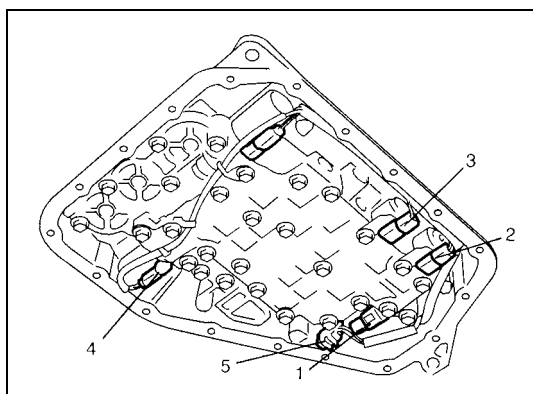
## Installation



- 1) Install shift solenoid valve-A (No.1) (1), shift solenoid valve-B (No.2) (2), TCC solenoid valve (3) and timing solenoid valve (4).

### Tightening torque

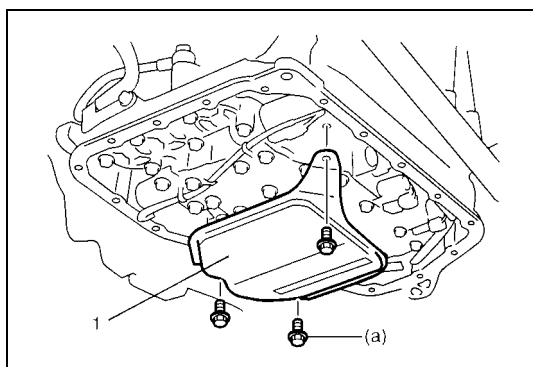
**Solenoid valve bolts (a): 11 N·m (1.1 kg-m, 8.0 lb-ft)**



- 2) Connect solenoid connectors identifying their installing positions by wire color.

Solenoid coupler	Wire color
Shift solenoid valve-A (No.1) (2)	White
Shift solenoid valve-B (No.2) (3)	Black
Timing solenoid valve (1)	Yellow
TCC solenoid valve (4)	Light Green

- 3) Install transmission fluid temperature sensor (5) to sensor clamp.

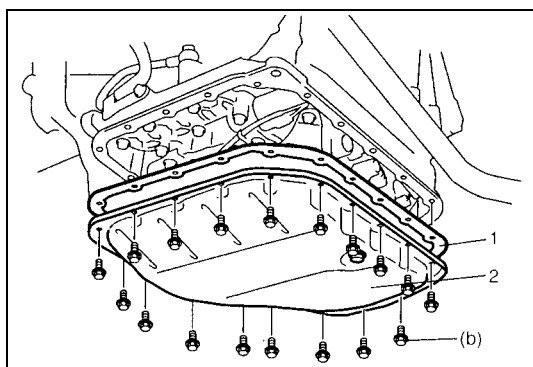


- 4) Install oil strainer assembly (1).

### Tightening torque

#### Oil strainer bolts

**(a): 10 N·m (1.0 kg-m, 7.5 lb-ft)**



- 5) Install new oil pan gasket (1) and oil pan (2).

### Tightening torque

#### Oil pan bolts

**(b): 7.0 N·m (0.7 kg-m, 5.0 lb-ft)**

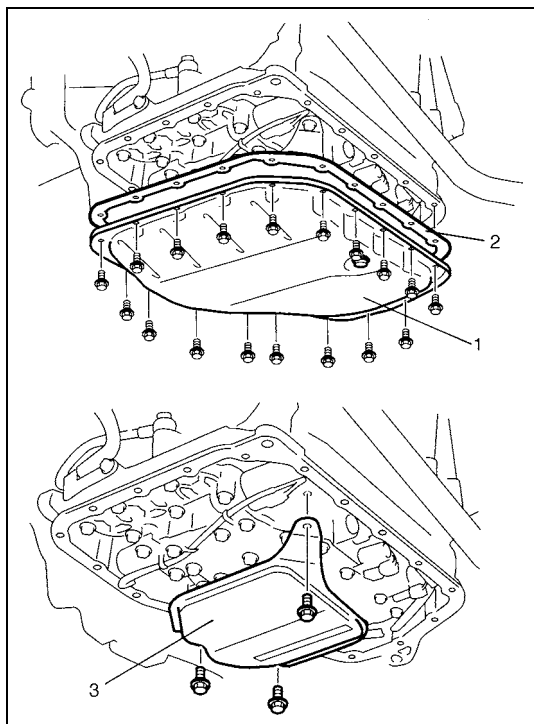
## Pressure Control Solenoid Valve

### Removal

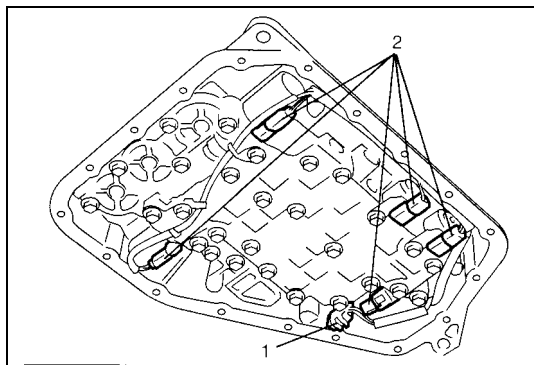
- 1) Disconnect negative cable at battery.
- 2) Lift up vehicle.
- 3) Remove drain plug and drain A/T fluid.
- 4) Install drain plug.

### Tightening torque

**A/T fluid drain plug: 17 N·m (1.7 kg-m, 12.5 lb-ft)**



- 5) Remove A/T oil pan (1) and oil pan gasket (2).
- 6) Remove oil strainer assembly (3).

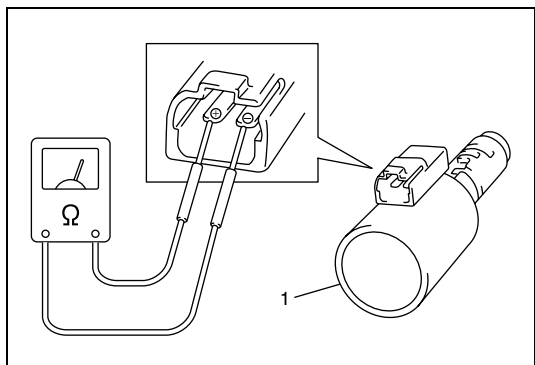


- 7) Remove transmission fluid temperature sensor (1) from sensor clamp.
- 8) Disconnect solenoid connectors (2).

- 9) Remove valve body assembly referring to "Unit Disassembly" in this section.
- 10) Remove pressure control solenoid valve referring to "Valve body assembly" in this section.

## Inspection

### Resistance Check



Measure resistance between pressure control solenoid valve (1) terminals.

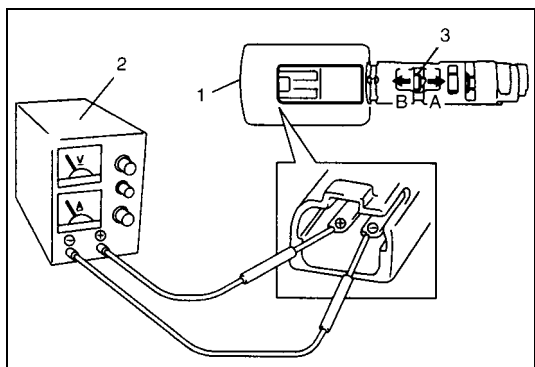
#### Pressure control solenoid valve resistance

**Standard: 5.0 – 5.6 Ω (at 20°C (68°F))**

### Operation Check

Check pressure control solenoid valve operation in the either manner of the followings.

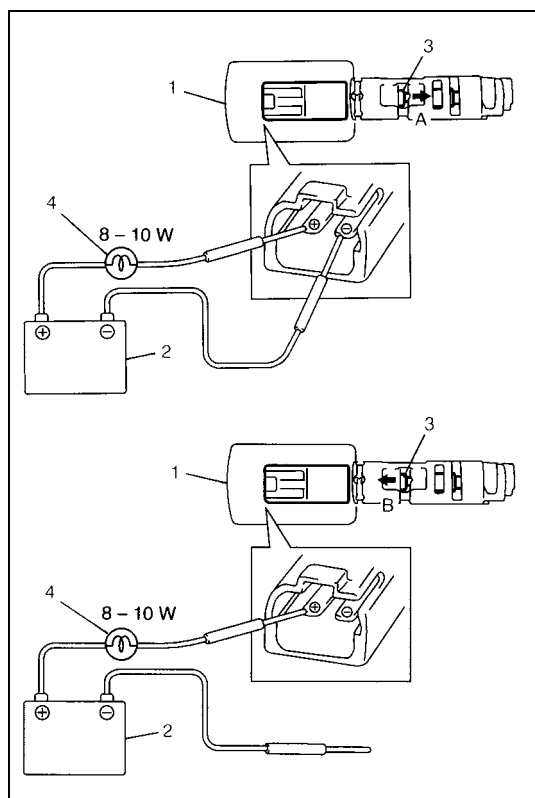
#### [Using regulated DC power supply]



- 1) Connect pressure control solenoid valve (1) to regulated DC power supply (2) as shown in the figure.
- 2) Turn regulated DC power supply switch ON, increase voltage of power supply keeping current within 1.0 A.
- 3) Check for gradual movement of valve (3) in the direction of arrow "A" as voltage is increased.
- 4) Check for movement of valve (3) in the direction of arrow "B" as voltage is decreased.
- 5) Turn power supply switch OFF.

#### CAUTION:

**Do not pass current 1.0 A or more, or pressure control solenoid is burned out.**

**[Not using regulated DC power supply]**

- 1) Connect pressure control solenoid valve (1) to battery (2) setting the 8 – 10 W bulb (4) on the way as shown in the figure.
- 2) Check for movement of valve (3) in the direction of arrow “A”.
- 3) Disconnect pressure control solenoid valve (1) from battery (2) and check for movement of valve (3) in the direction of arrow “B” as shown in the figure.

**CAUTION:**

**Set 8 – 10 W bulb on the way, or pressure control solenoid valve is burned out.**

**Installation**

Reverse removal procedure to install pressure control solenoid valve and valve body assembly noting the following points.

- For detail of pressure control solenoid valve installation, refer to “Valve body assembly” in this section.
- For detail of valve body assembly installation, refer to “Unit Assembly” in this section.
- For detail of installing wire harness for solenoid valves and sensor, refer to “Unit Assembly” in this section. Use new O-rings.
- For detail of A/T oil pan and oil strainer assembly installation, refer to “Unit Assembly” in this section. Use new oil pan gasket.
- Pour A/T fluid and check fluid level according to procedure described in “Fluid change” in this section.
- Check for fluid leakage after warming up A/T.

## Transmission Control Module (TCM)

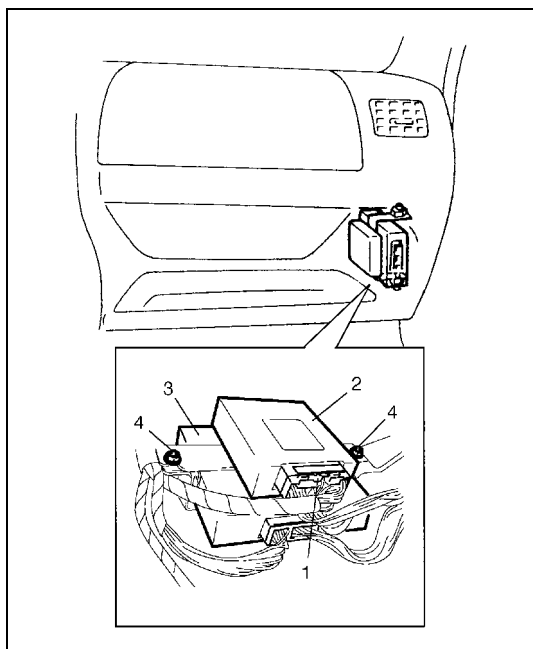
**CAUTION:**

- TCM and ECM consists of highly precise parts, therefore when handling it, be careful not to expose to excessive shock.
- When replacing TCM with used one, all learned contents, which have been stored in TCM memory by executing learning control, should be initialized after replacement.

**Removal**

- 1) Disconnect negative cable at battery.
- 2) If the vehicle is equipped with air bag system, disable air bag system. Refer to "Disabling Air Bag System" in Section 10B.
- 3) Disconnect connectors (1) from TCM (2).
- 4) Remove TCM (2) by removing its nuts (4).

3. ECM

**Installation**

Reverse removal procedure noting the following.

- Connect TCM connectors securely.
- If the vehicle is equipped with air bag system, be sure to enable air bag system after TCM is back in place. Refer to "Enabling Air Bag System" in Section 10B.



## A/T Relay

### Inspection

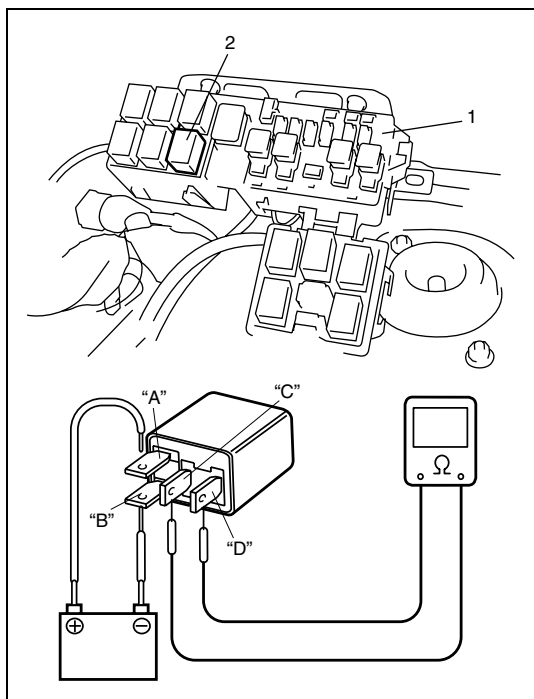
- 1) Disconnect negative cable at battery.
- 2) Remove A/T relay (2) from fuse and relay box (1).
- 3) Check that there is no continuity between terminal "C" and "D".

If continuity is indicated, replace A/T relay.

- 4) Connect battery positive (+) terminal to terminal "A" of A/T relay and battery negative (–) terminal to terminal "B" of A/T relay.

Check continuity between terminal "C" and "D" of A/T relay.

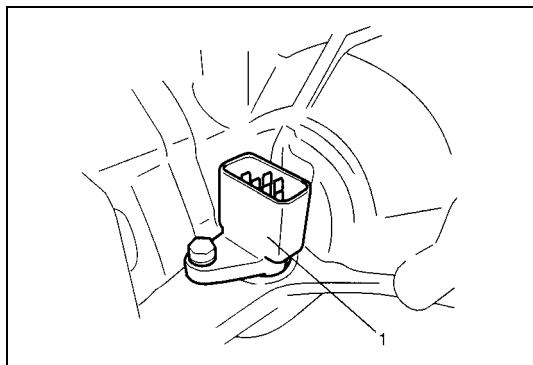
If continuity does not indicated, replace A/T relay.



## Transmission Fluid Temperature Sensor

### Inspection

- 1) Disconnect negative cable at battery.
- 2) Lift up vehicle.
- 3) With engine is cool, remove drain plug and drain A/T fluid.
- 4) Install drain plug. (Refer to "Fluid change" in this section.)
- 5) Remove A/T oil pan.
- 6) Remove oil strainer assembly.
- 7) Remove valve body assembly referring to "Unit Disassembly in this section.

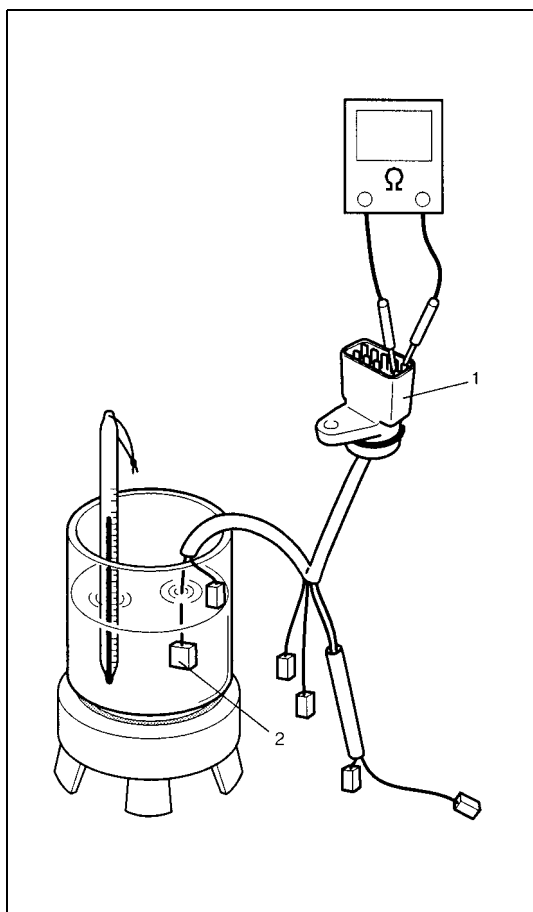


### CAUTION:

**When pulling solenoid wire harness out of transaxle case, take care not to damage transmission fluid temperature sensor at narrow exit of case.**

**Careless sensor treatment might cause sensor malfunction.**

- 8) Remove solenoid wire harness (1).



- 9) Warm up transmission fluid temperature sensor (2). Check resistance between terminals of valve body harness connector (1). Thus make sure its resistance decrease as its temperature increase.

### Transmission fluid temperature sensor resistance

Temperature	Resistance
10°C (50°F)	5.8 – 7.1 kΩ
110°C (230°F)	231 – 263 Ω
145°C (293°F)	105 – 117 Ω

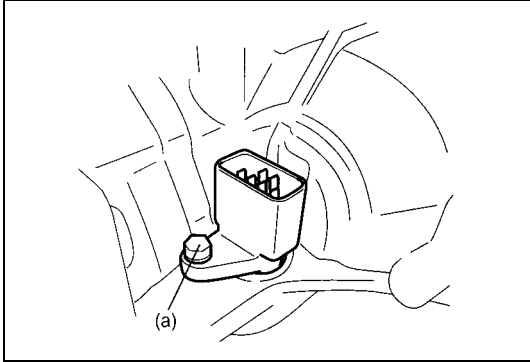
**Installation**

Reverse removal procedure to install solenoid wire harness and valve body assembly noting the following points.

- For details of valve body assembly and their connectors installation, refer to “Unit Assembly” in this section.
- For details of A/T oil pan installation, refer to “Unit Assembly” in this section. Use new oil pan gasket.
- Tighten valve body harness connector bolt to specified torque.

**Tightening torque****Valve body harness connector bolt**

**(a): 5.5 N·m (0.55 kg-m, 4.0 lb-ft)**

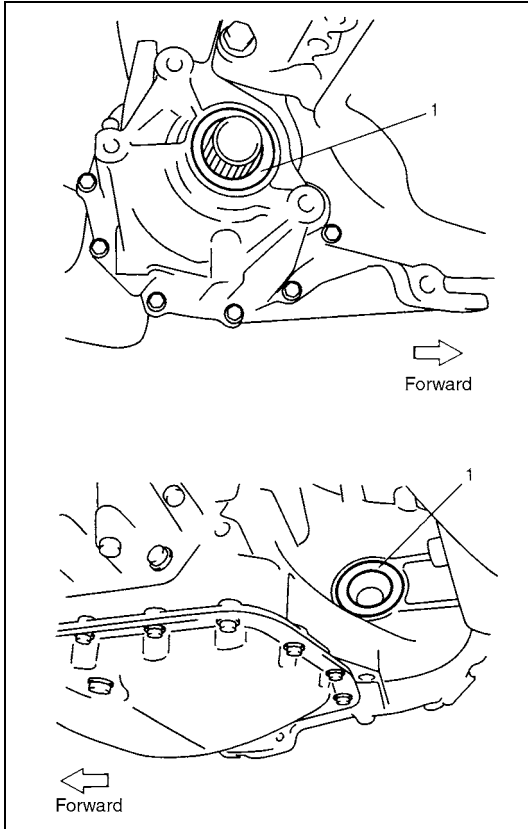


- Pour A/T fluid and check fluid level according to procedure described in “Fluid change” in this section.
- Check for fluid leakage after warming up A/T.

## Differential Side Oil Seal

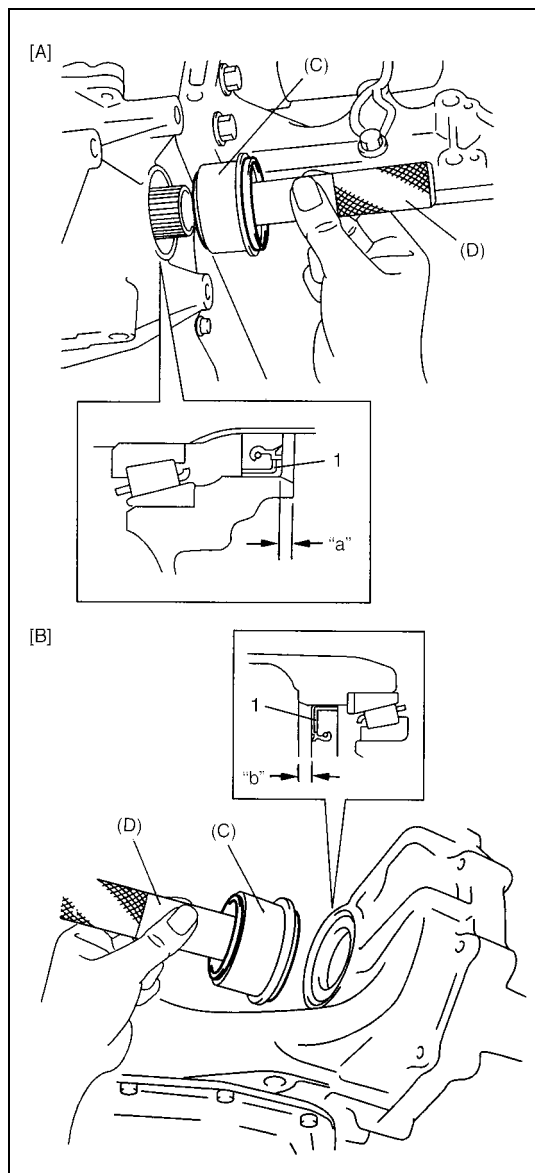
### Replacement

- 1) Lift up vehicle and drain automatic transaxle fluid.
- 2) Remove drive shaft joints from differential gear of transaxle.  
Refer to "Front Drive Shaft Assembly Removal and Installation" in Section 4A for procedure to disconnect drive shaft joints.  
For differential side oil seal removal, it is not necessary to remove drive shafts from steering knuckle.
- 3) Remove differential side oil seal (1) by using screw driver or like.



- 4) Apply grease to new differential side oil seal lips.

**Grease 99000-25030**



5) Install new differential side oil seals (1) by using special tool.

**Special tool**

(C): 09944-88220

(D): 09924-74510

**Differential side oil seal installing depth**

**Right side “a”:** 2.6 – 3.6 mm (0.10 – 0.14 in)

**Left side “b”:** 3.8 – 4.8 mm (0.15 – 0.19 in)

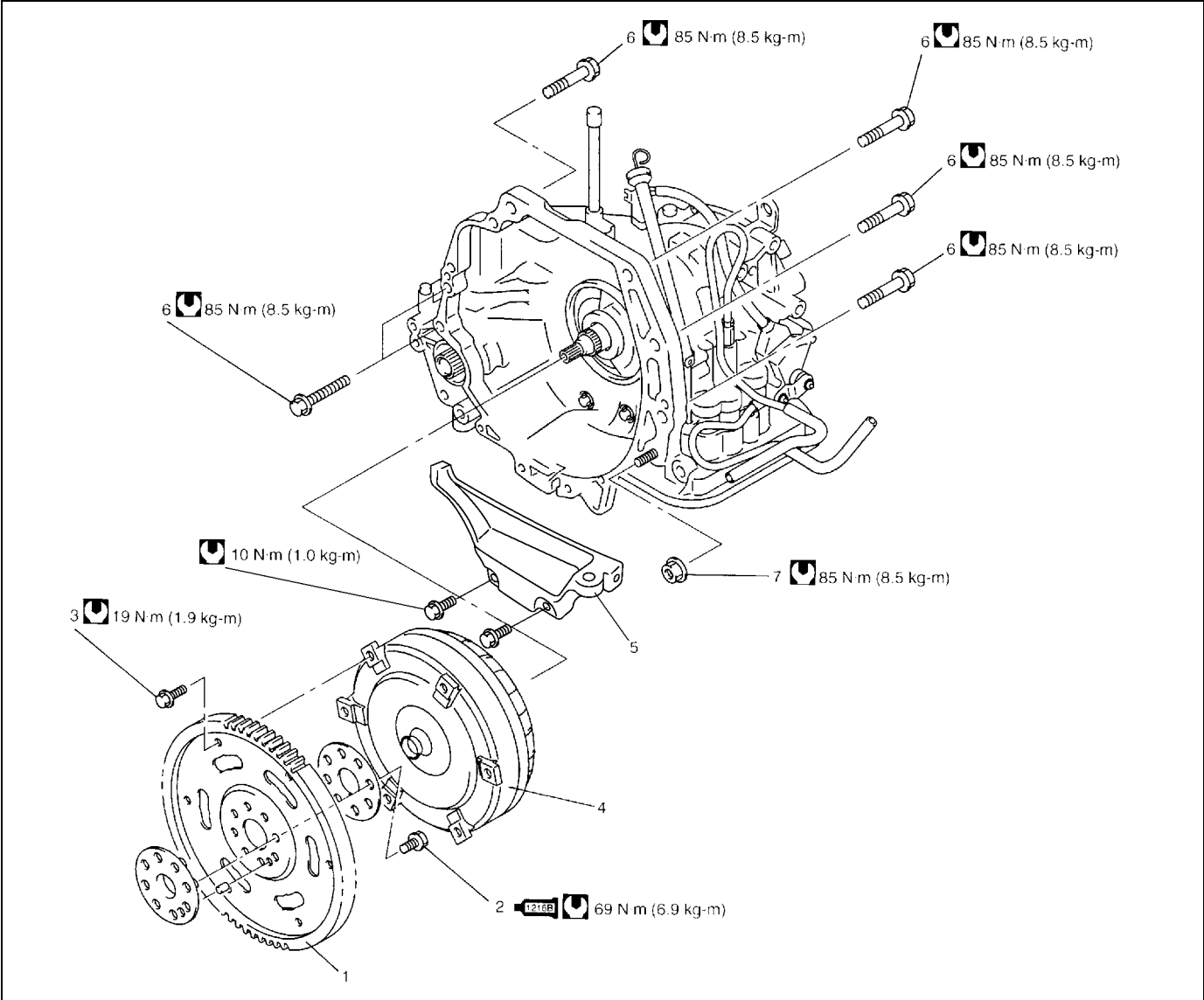
[A]: Right side
[B]: Left side

6) Install drive shaft referring to “Front Drive Shaft Assembly Removal and Installation” in Section 4A.

7) Pour A/T fluid referring to “Fluid change” in this section.

# Automatic Transaxle Assembly

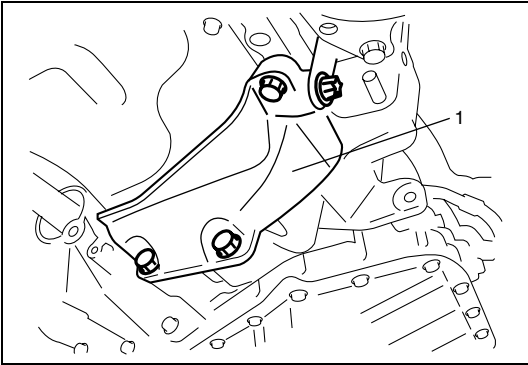
## Components



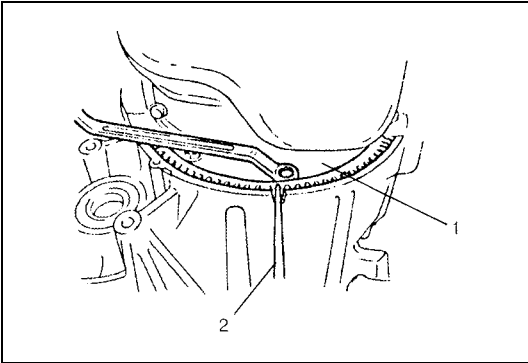
1. Drive plate	5. Lower stiffener
2. Drive plate bolt : Apply sealant 99000-31230 to thread.	6. Transaxle and engine fastening bolt
3. Drive plate to torque converter bolt	7. Transaxle and engine fastening nut
4. Torque converter	Tightening torque

## Dismounting

- 1) Take down transaxle with engine. For its procedure, refer to "Engine Assembly Removal and Installation" in Section 6A1.
- 2) Remove lower stiffener (1).



- 3) Remove drive plate to torque converter bolts.  
To lock drive plate (1), engage flat head rod or the like (2) with drive plate ring gear.



- 4) Remove starting motor.

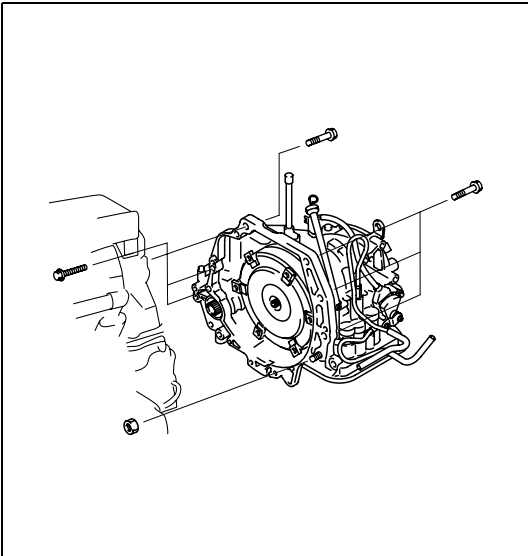
### WARNING:

Be sure to keep transaxle with torque converter horizontal or facing up throughout the work. Should it be tilted with torque converter down, converter may fall off and cause personal injury.

### NOTE:

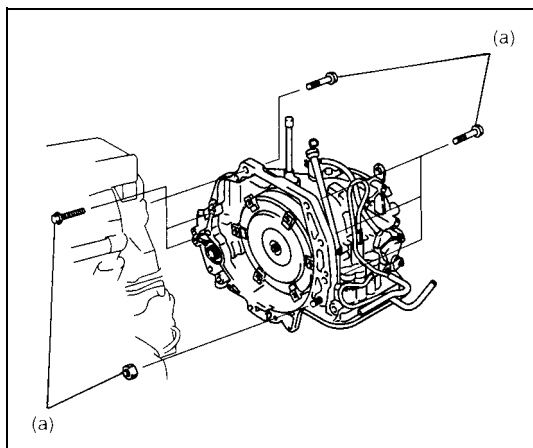
When detaching transaxle from engine, move it in parallel with crankshaft and use care so as not to apply excessive force to drive plate and torque converter.

- 5) Remove bolts and nut fastening engine and transaxle, then detach transaxle from engine.



## Remounting

- 1) Make sure that torque converter is installed correctly to transaxle.  
Refer to "Unit Assembly" in this section.



### WARNING:

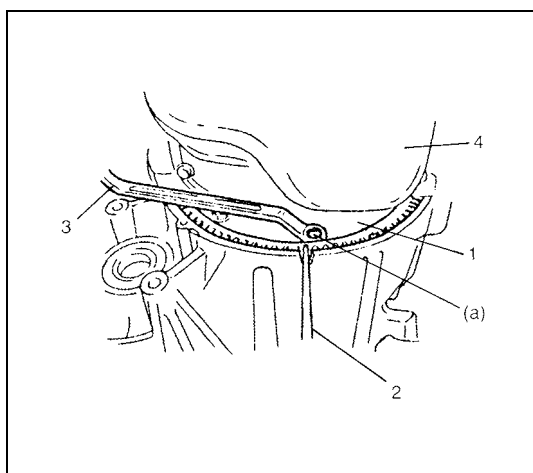
**Be sure to keep transaxle with torque converter horizontal or facing up throughout the work. Should it be tilted with torque converter down, converter may fall off and cause personal injury.**

- 2) Attach transaxle to engine.

### Tightening torque

**Transaxle and engine fastening bolts and nut**

**(a): 85 N·m (8.5 kg-m, 61.5 lb-ft)**



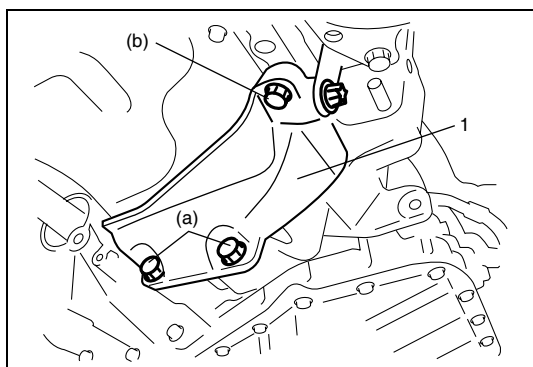
- 3) Tighten drive plate to torque converter bolts.  
Align bolt hole of drive plate and torque converter then tighten bolts through torque converter housing lower plate opening.  
Lock drive plate (1) by engaging flat head rod or the like (2) with drive plate gear.

### Tightening torque

**Drive plate to torque converter bolts**

**(a): 19 N·m (1.9 kg-m, 14.0 lb-ft)**

3. Wrench
4. Engine oil pan



- 4) Install lower stiffener (1).  
Tighten lower stiffener bolts (a) first and next (b) with specified torque.

### Tightening torque

**Lower stiffener bolts**

**(a): 55 N·m (5.5 kg-m, 40 lb-ft)**

**(b): 55 N·m (5.5 kg-m, 40 lb-ft)**

- 5) Install starter motor.

### Tightening torque

**Starter motor bolt and nut: 50 N·m (5.0 kg-m, 36.5 lb-ft)**

- 6) Remount engine with transaxle assembly to vehicle. Refer to "Engine Assembly Removal and Installation" in Section 6A1 for its procedure.



## Unit Repair

When repairing automatic transaxle, it is necessary to conduct the on-vehicle test to investigate where the cause of the trouble lies first.

Then whether overhaul should be done or not is determined. If the transaxle is disassembled without such preliminary procedure, not only the cause of the trouble would be unknown, but also a secondary trouble may occur and often time would be wasted.

### Precautions

As the automatic transaxle consists of high precision component, the following cautions should be strictly observed when handling its parts in disassembly and reassembly.

- Disassembling valve body assembly is prohibited essentially. However, a few parts can be disassembled. When disassembling valve body component parts, confirm whether their parts are allowed to disassemble or not referring to "Valve body assembly" in this section.
- Make sure to wash dirt off from the transaxle so that no such dirt will enter the transaxle during dismounting and remounting.
- Select a clean place free from dust and dirt for overhauling.
- Place a rubber mat on the work bench to protect parts from damage.
- Work gloves or shop cloth should not be used. (Use a nylon cloth or a paper towel.)
- When separating the case joint, do not pry with a screwdriver or such but tap with a plastic hammer lightly.
- Make sure to wash dirt off from the transaxle so that no such dirt will enter the transaxle during disassembly and reassembly.
- Wash the disassembled parts in ATF (Automatic Transaxle Fluid) or kerosene (using care not to allow ATF or kerosene to get on your face, etc.) and confirm that each fluid passage is not clogged by blowing air into it. But use kerosene to wash the discs, resin washers and rubber parts.
- Replace each gasket, oil seal and O-ring with a new one.
- Apply ATF to sliding or rotating parts before reassembly.
- A new discs should be soaked in ATF at least 2 hours before use.

## Part Inspection and Correction Table

Part	Inspect for	Correction
Casted part, machined part	Small flaw, burr	Remove with oil stone.
	Deep or grooved flaw	Replace part.
	Clogged fluid passage	Clean with air or wire.
	Flaw on installing surface, residual gasket	Remove with oil stone or replace part.
	Crack	Replace part.
Bearing	Unsmooth rotation	Replace.
	Streak, pitting, flaw, crack	Replace.
Bushing, thrust washer	Flaw, burr, wear, burning	Replace.
Oil seal, gasket	Flawed or hardened seal ring	Replace.
	Worn seal ring on its periphery or side	Replace.
	Piston seal ring, oil seal, gasket, etc.	Replace.
Gear	Flaw, burr	Replace.
	Worn gear tooth	Replace.
Splined part	Burr, flaw, torsion	Correct with oil stone or replace.
Snap ring	Wear, flaw, distortion	Replace.
	No interference	Replace.
Thread	Burr	Replace.
	Damage	Replace.
Spring	Settling, sign of burning	Replace.
Friction plate	Wear, burning, distortion, damaged claw	Replace.
Separator plate, retaining plate	Wear, burning, distortion, damaged claw	Replace.
Sealing surface (where lip contacts)	Flaw, rough surface, stepped wear, foreign material	Replace.

## Unit Disassembly

**CAUTION:**

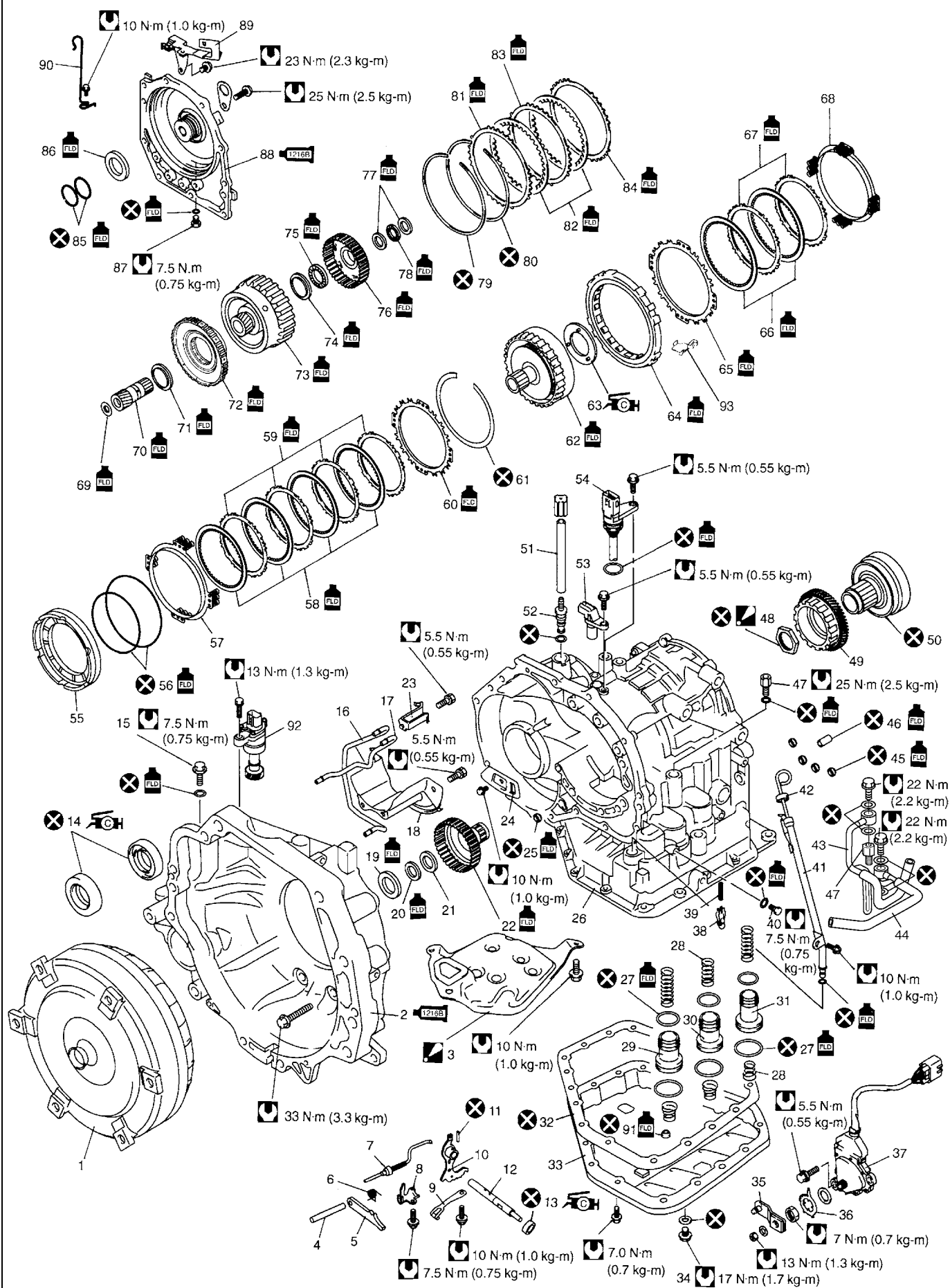
- Thoroughly clean transaxle exterior before overhauling it.
- Keep working table, tools and hands clean while overhauling.
- Use special care to handle aluminum parts so as not to damage them.
- Do not expose removed parts to dust. Keep them always clean.











## Components

**NOTE:**

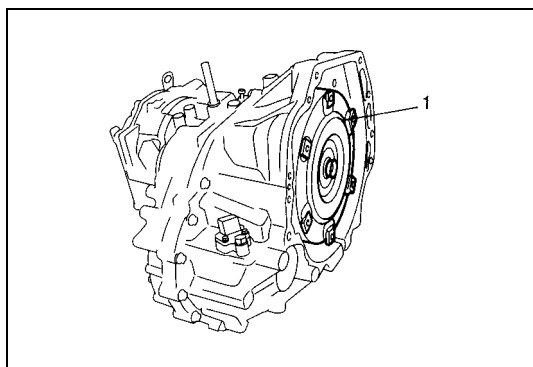
Oil pump assembly, direct clutch assembly, forward and reverse clutch assembly, 2nd brake piston assembly, O/D and 2nd coast brake piston and return spring, differential assembly, countershaft assembly and valve body assembly are not shown in figure below.

For the detail of these components, refer to “Disassembly/Assembly of Subassembly” in this section.



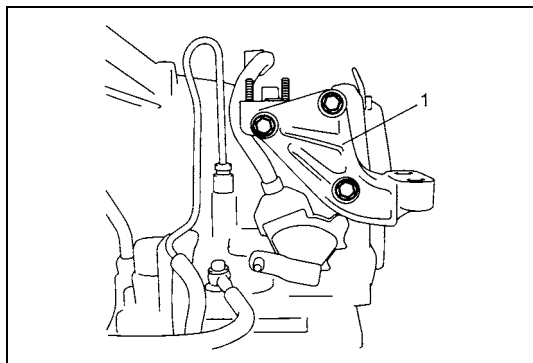
1. Torque converter	33. Oil pan	65. 2nd brake retaining plate
 2. Torque converter housing : Apply sealant 99000-31230 to mating surface to transaxle case.	34. A/T fluid drain plug	66. 2nd brake disc
 3. Oil strainer assembly : Replace oil strainer when overhauling.	35. Manual select lever	67. 2nd brake separator plate
4. Parking lock pawl shaft	36. Lock washer	68. 2nd brake return spring subassembly
5. Parking lock pawl	37. Transmission range sensor	69. Front sun gear thrust bearing race
6. Parking lock pawl return spring	38. Cooler check valve	70. Front planetary sun gear
7. Parking lock pawl rod	39. Spring	71. Planetary gear thrust bearing
8. Parking lock pawl bracket	40. Transaxle case plug	72. One-way clutch No.1 assembly
9. Manual detent spring	41. Fluid filler tube	73. Rear planetary sun gear subassembly
10. Manual valve lever	42. Fluid level gauge	74. Rear sun gear thrust bearing race
11. Manual valve lever pin	43. Fluid cooler inlet pipe	75. Rear sun gear thrust bearing
12. Manual shift shaft	44. Fluid cooler outlet pipe	76. Forward clutch hub
 13. Manual shift shaft oil seal : Apply grease 99000-25030 to oil seal lip.	45. 2nd brake gasket	77. Intermediate shaft thrust bearing race
 14. Differential side oil seal : Apply grease 99000-25030 to oil seal lip.	46. Brake drum gasket	78. Intermediate shaft thrust bearing
15. Torque converter housing plug	47. Pipe union	79. 2nd brake piston snap ring
16. Lubrication LH tube	 48. Reduction drive gear nut : After tightening nut so as rotational torque of reduction drive gear to be in specified value, caulk nut securely.	80. O/D and 2nd coast brake retaining plate snap ring
17. Lubrication RH tube	49. Reduction drive gear	81. O/D and 2nd coast brake retaining plate
18. Fluid reservoir RH plate	50. Planetary ring gear subassembly	82. O/D and 2nd coast brake disc
19. Input shaft front thrust bearing	51. Breather hose	83. O/D and 2nd coast brake separator plate
20. Input shaft rear thrust bearing	52. Breather union	84. O/D and 2nd coast brake rear plate
21. Input shaft rear thrust bearing race	53. Input shaft speed sensor	85. Rear cover seal ring
22. Direct clutch hub	54. Valve body harness	86. Reverse clutch drum thrust bearing
23. Lubrication tube clamp	55. 1st and reverse brake piston	87. Rear cover plug
24. Fluid reservoir LH plate	56. O-ring	 88. Transaxle rear cover : Apply sealant 99000-31230 to mating surface.
25. Governor apply No.2 gasket	57. 1st and reverse brake return spring subassembly	89. Harness bracket
26. Automatic transaxle case	58. 1st and reverse brake disc	90. Select cable clamp
27. Accumulator piston O-ring	59. 1st and reverse brake separator plate	91. Governor apply No.1 gasket
28. Accumulator spring	60. 1st and reverse brake retaining plate	92. Output shaft speed sensor (VSS)
29. C2 accumulator piston	61. 1st and reverse brake snap ring	93. One-way clutch outer race retainer
30. C1 accumulator piston	62. Planetary gear assembly	 Do not reuse.
31. B1 accumulator piston	 63. Planetary carrier thrust washer : Apply grease 99000-25030 to slide contact face.	 Apply automatic transaxle fluid.
32. Oil pan gasket	64. One-way clutch No.2 assembly	 Tightening torque

## Disassembly

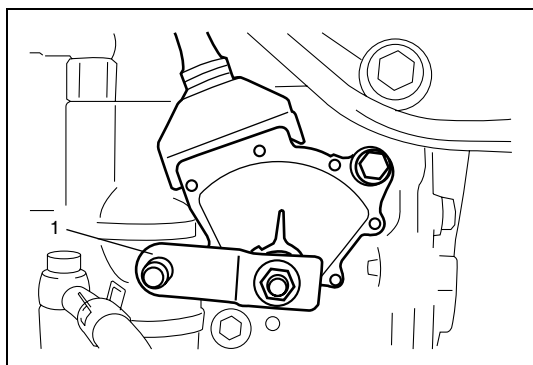
**CAUTION:**

**Remove torque converter as much straight as possible. Leaning it may cause to damage oil seal lip.**

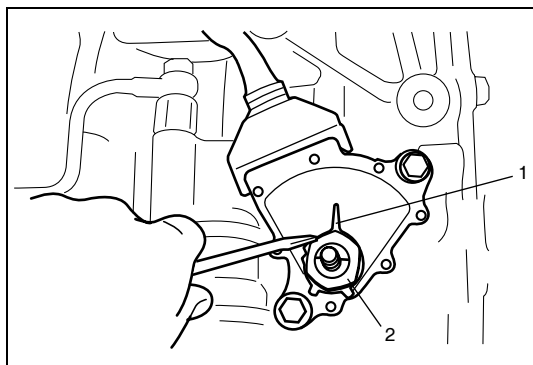
- 1) Remove torque converter (1).



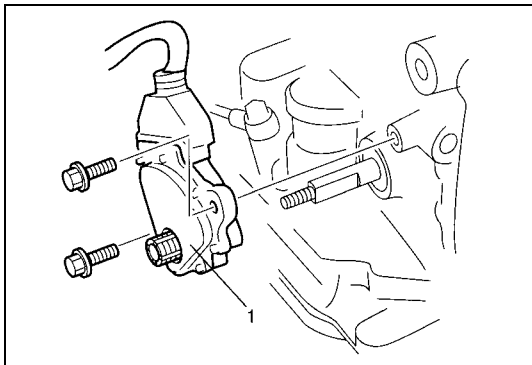
- 2) Remove engine mounting LH bracket (1).



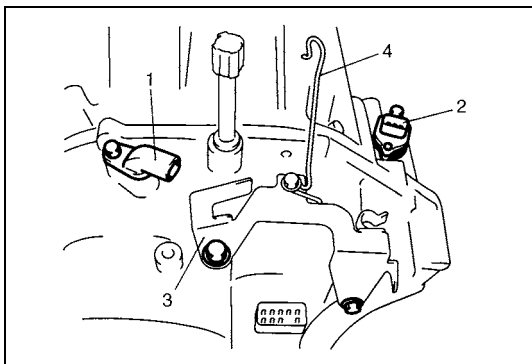
- 3) Remove manual select lever (1).



- 4) Uncaulk lock washer (1), then remove lock nut (2) and lock washer (1).

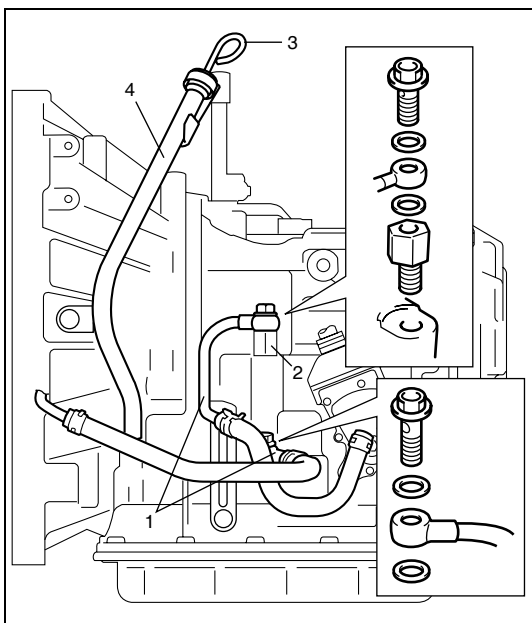


5) Remove transmission range sensor (1).



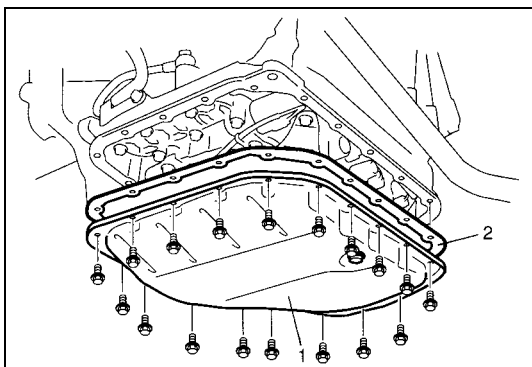
6) Remove input shaft speed sensor (1) and output shaft speed sensor (VSS) (2).

7) Remove harness bracket (3) and select cable clamp (4).



8) Remove fluid cooler pipes (1) and pipe union (2).

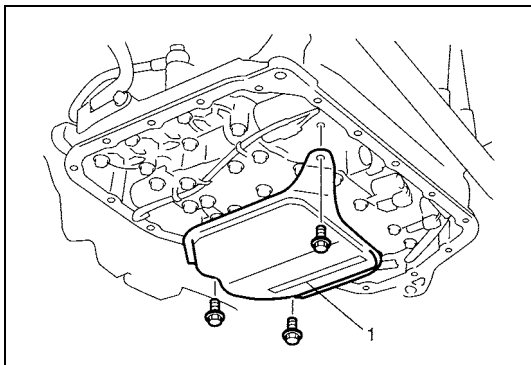
9) Remove fluid level gauge (3) and fluid filler tube (4).



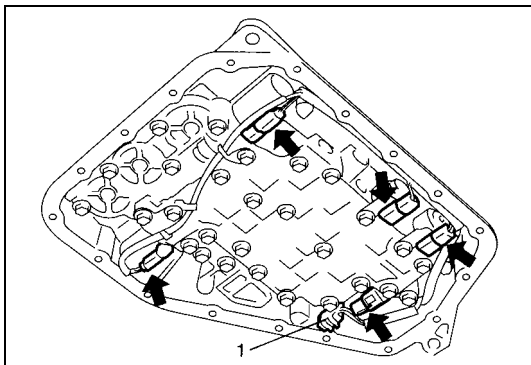
10) Remove oil pan (1) and oil pan gasket (2).

#### NOTE:

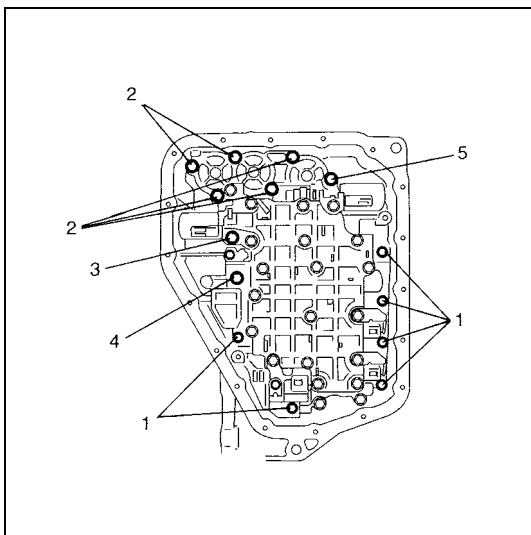
- For removal of oil pan, do not turn transaxle over as this will contaminate valve body with foreign materials in bottom of oil pan.
- When removing oil pan, tap around it lightly with plastic hammer. Do not force it off by using screwdriver or the like.



11) Remove oil strainer assembly (1).



12) Disconnect connectors from solenoid valves, and transmission fluid temperature sensor (1).



13) Remove valve body assembly bolts.

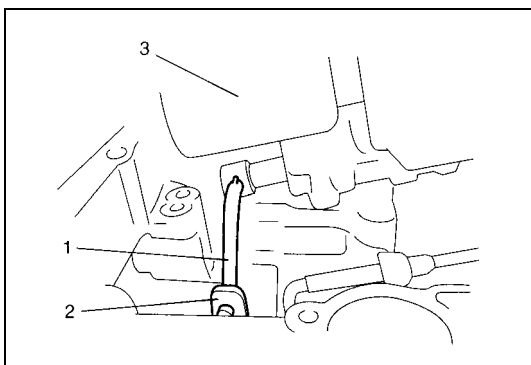
**CAUTION:**

**Be careful not to let manual valve fall off when removing valve body assembly.**

**NOTE:**

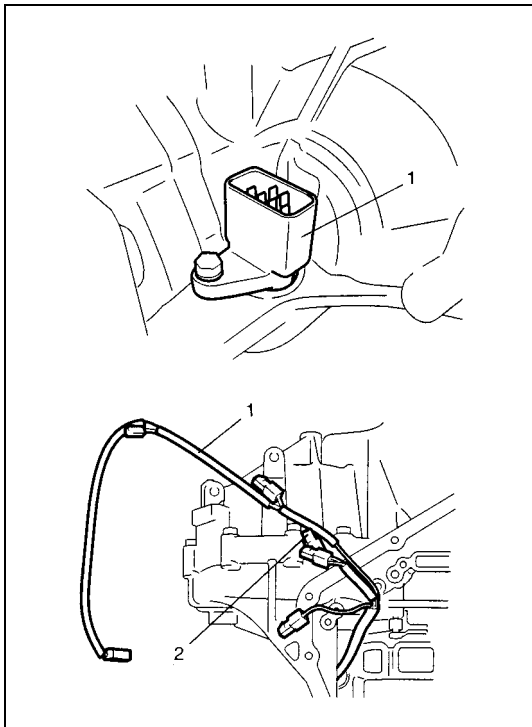
**There are five kinds of bolts (bolts A, B, C, D, and E) fixing valve body assembly**

1. Bolt A
2. Bolt B
3. Bolt C
4. Bolt D
5. Bolt E



14) Remove manual valve rod (1) from manual valve lever (2), then remove valve body assembly (3).



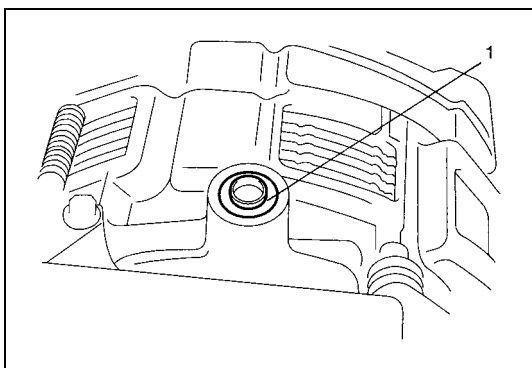


15) Remove valve body harness (1).

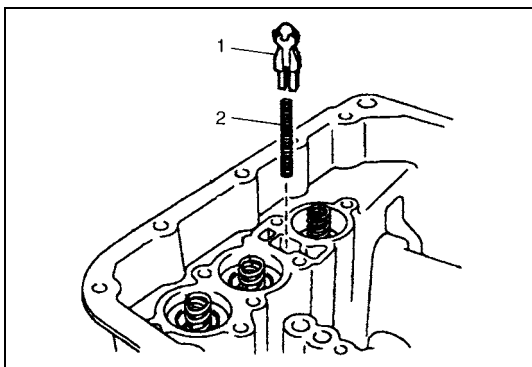
**CAUTION:**

When pulling valve body harness (1) out of transaxle case, take care not to damage transmission fluid temperature sensor (2) at narrow exit of case.

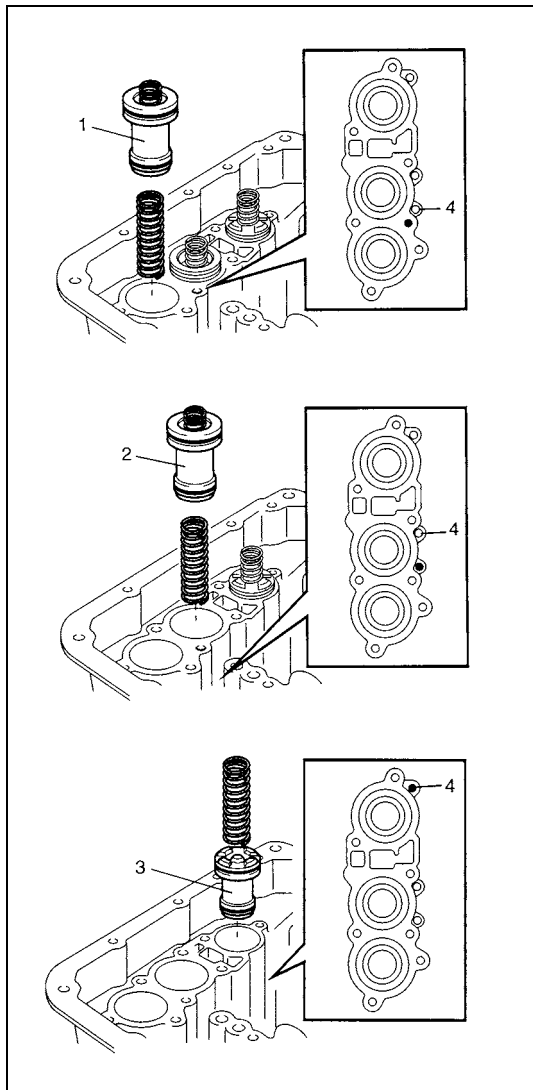
Careless sensor treatment might cause sensor malfunction.



16) Remove governor apply No.1 gasket (1).



17) Remove cooler check valve (1) and spring (2).

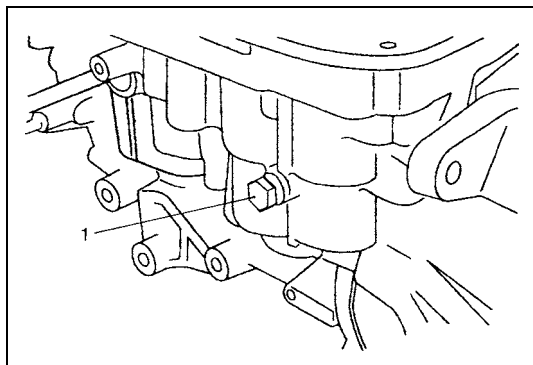


18) Remove accumulator pistons and springs.

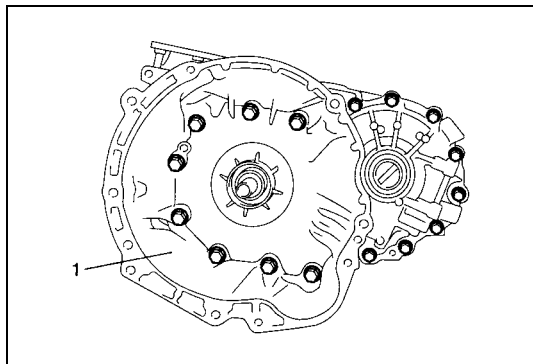
To remove C2 (1), C1 (2) and B1 (3) accumulator pistons and springs, position rag on pistons to catch each piston. To remove pistons, force low-pressure compressed air (1 kg/cm<sup>2</sup>, 15 psi, 100 kPa, max) into hole (4) as shown in figure, and pop each piston into rag.

**NOTE:**

**Do not push accumulator pistons with fingers or anything before removing them. Pushing them may cause compressed fluid in accumulator to spew out of hole and get to your face and clothes.**

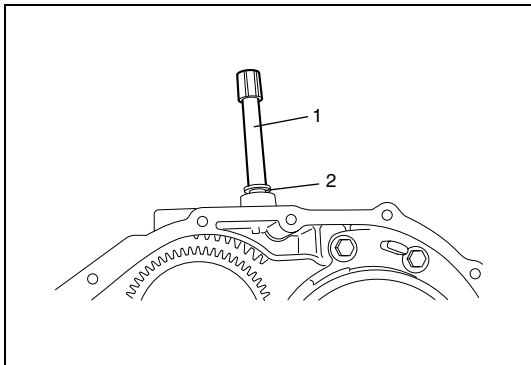


19) Remove transaxle case plug (1).



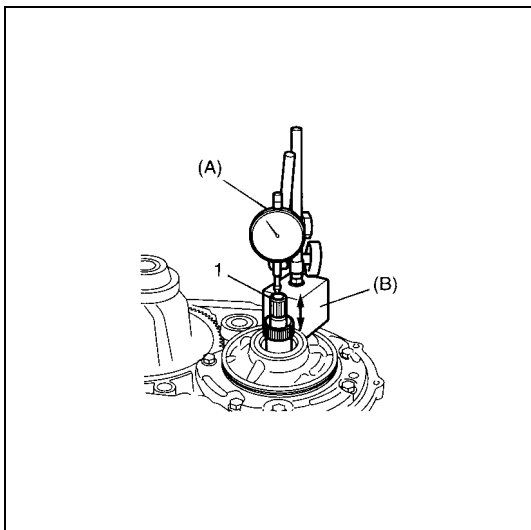
20) Remove torque converter housing bolts.

21) Remove torque converter housing (1) while tapping around it lightly with plastic hammer.



22) Remove breather hose (1).

23) Remove breather union (2).



24) Measure input shaft thrust play.

Apply dial gauge onto input shaft end (1) and measure thrust play of input shaft.

When input shaft thrust play is out of specification, select input shaft front thrust bearing with proper thickness from among the list below and replace it.

**Special tool**

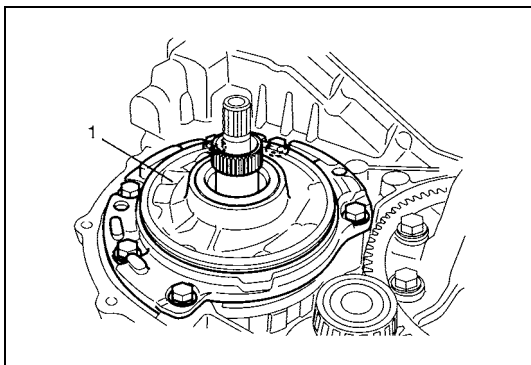
(A): 09900-20607

(B): 09900-20701

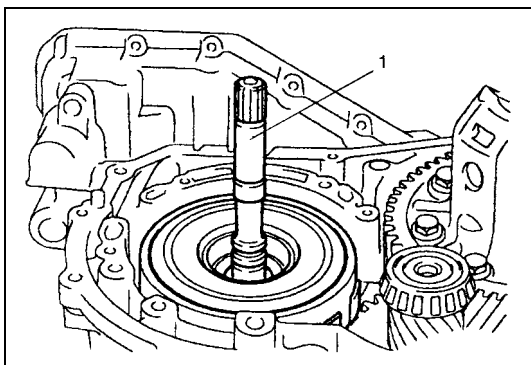
**Input shaft thrust play: 0.3 – 0.9 mm (0.012 – 0.035 in.)**

**Available input shaft front thrust bearing thickness**

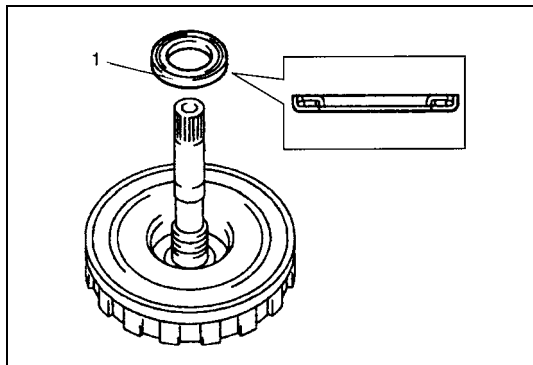
**0.8, 1.4 mm (0.032, 0.055 in.)**



25) Remove oil pump assembly (1).



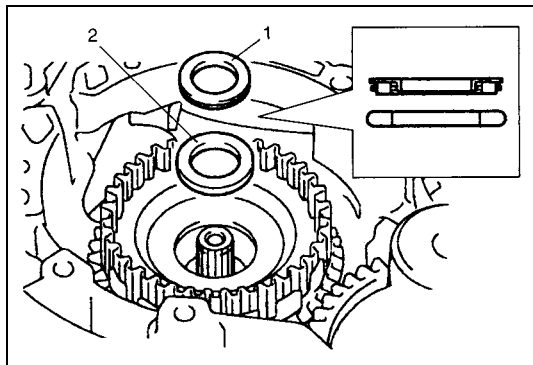
26) Remove direct clutch assembly (1).



27) Remove input shaft front thrust bearing (1).

**NOTE:**

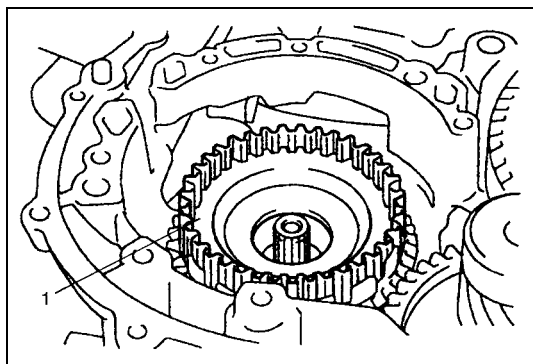
If input shaft front thrust bearing is not found, it may have been taken out with oil pump assembly.



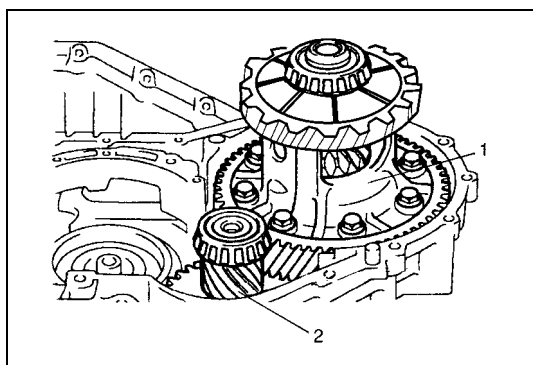
28) Remove input shaft rear thrust bearing (1) and thrust bearing race (2).

**NOTE:**

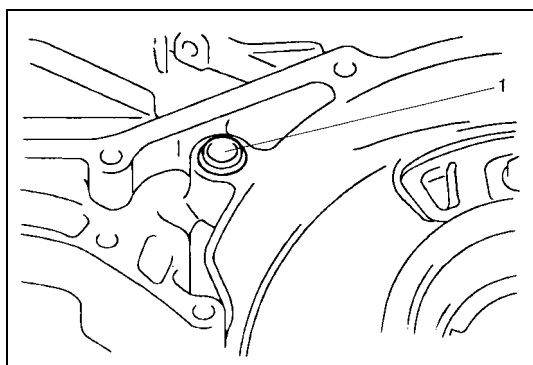
If input shaft rear thrust bearing is not found, it may have been taken out with direct clutch assembly.



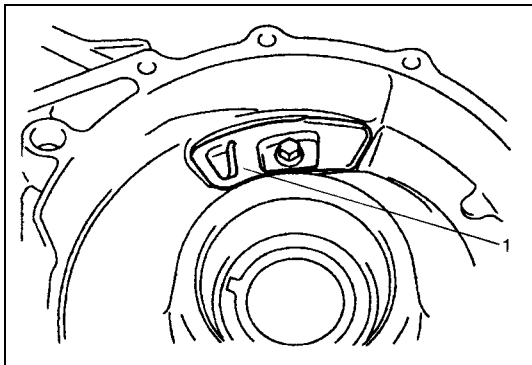
29) Remove direct clutch hub (1).



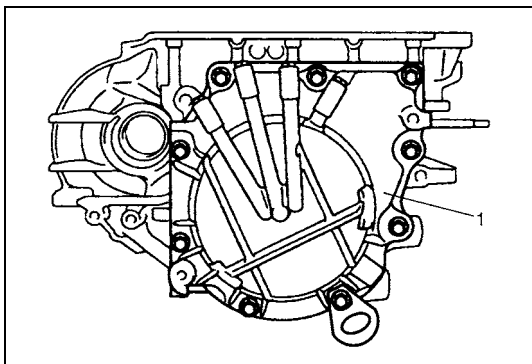
30) Remove differential assembly (1) and counter shaft assembly (2).



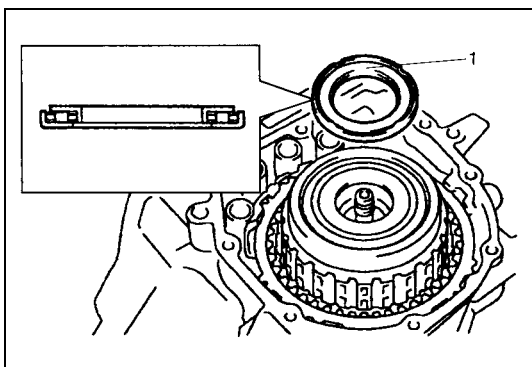
31) Remove governor apply No.2 gasket (1).



32) Remove fluid reservoir LH plate (1).



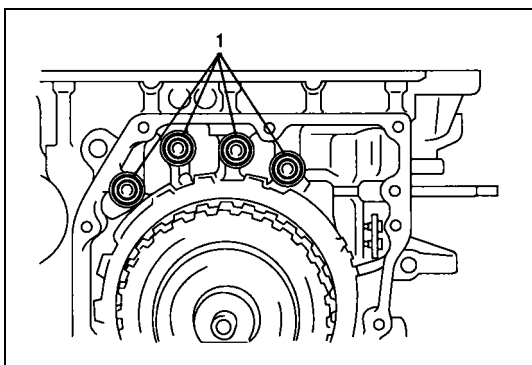
33) Turn over transaxle and remove rear cover assembly (1).



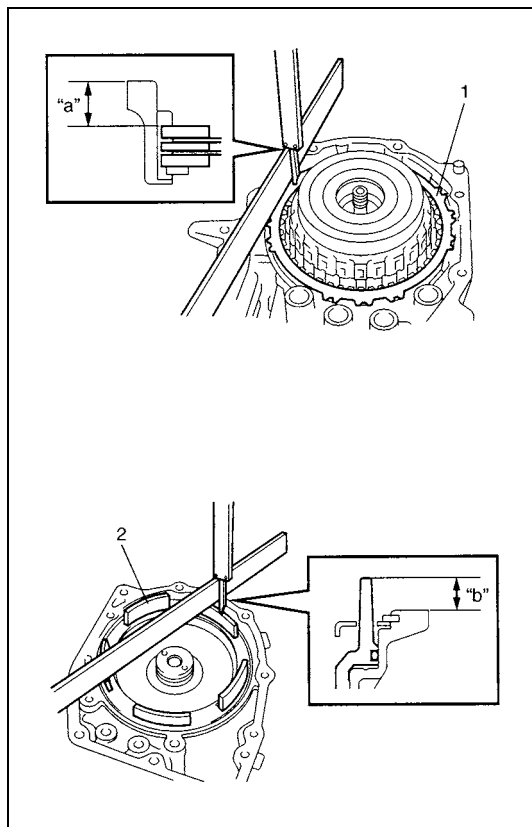
34) Remove reverse clutch drum thrust bearing (1).

**NOTE:**

**If reverse clutch drum thrust bearing is not found, it may have been taken out with rear cover assembly.**



35) Remove 2nd brake gasket (1).



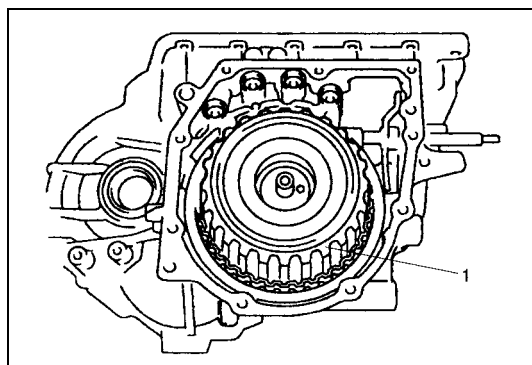
36) Measure O/D and 2nd coast brake piston stroke.

- Measure dimension "a" from mating surface of transaxle case to O/D and 2nd coast brake rear plate (1) using straightedge and micrometer caliper.
- Measure dimension "b" from O/D and 2nd coast brake piston (2) to rear cover assembly mating surface using straightedge and micrometer caliper.
- Calculate piston stroke from measured value of dimensions "a" and "b".
- Piston stroke = "a" – "b"

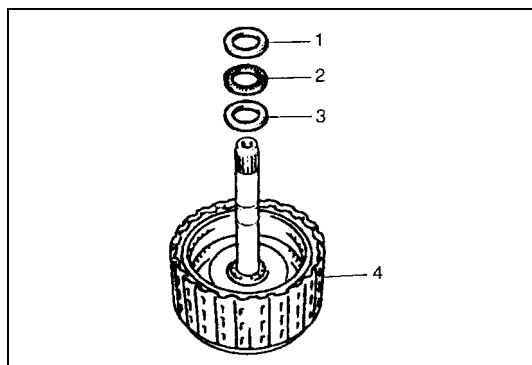
**O/D and 2nd coast brake piston stroke**

**Standard: 0.65 – 1.05 mm (0.026 – 0.041 in.)**

If piston stroke exceeds specification above, inspect and replace plates and discs.



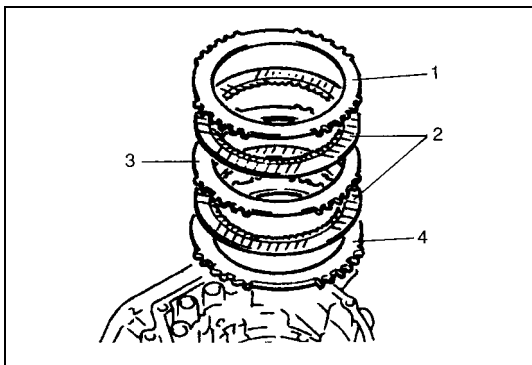
37) Remove forward and reverse clutch assembly (1).



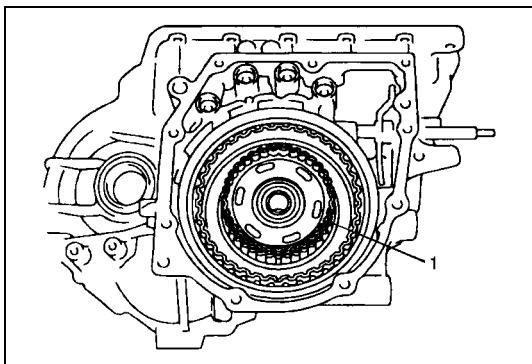
38) Remove intermediate shaft thrust bearing front race (1), thrust bearing (2) and rear race (3) from forward and reverse clutch assembly (4).

**NOTE:**

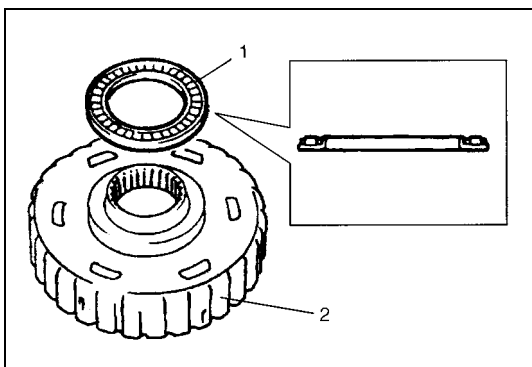
**If intermediate shaft thrust bearing and/or races are not found on forward and reverse clutch assembly, they may have been left in transaxle.**



- 39) Remove O/D and 2nd coast brake rear plate (1), discs (2), separator plate (3) and retaining plate (4).



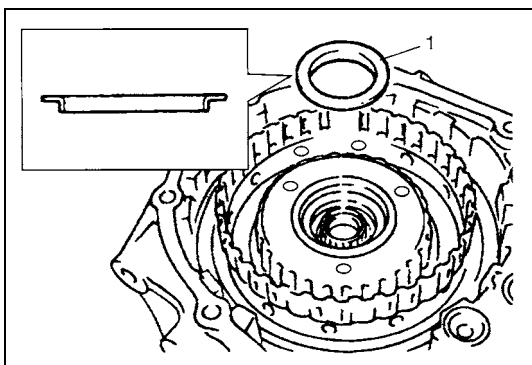
- 40) Remove forward clutch hub (1).



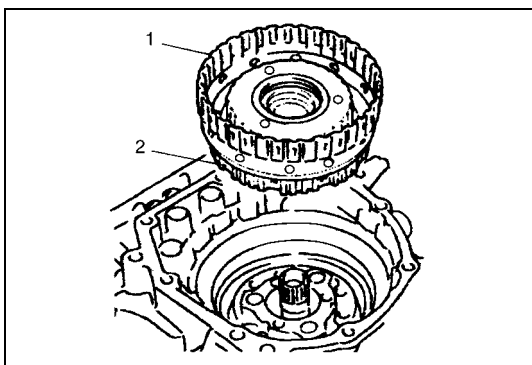
- 41) Remove rear sun gear thrust bearing (1) from forward clutch hub (2).

**NOTE:**

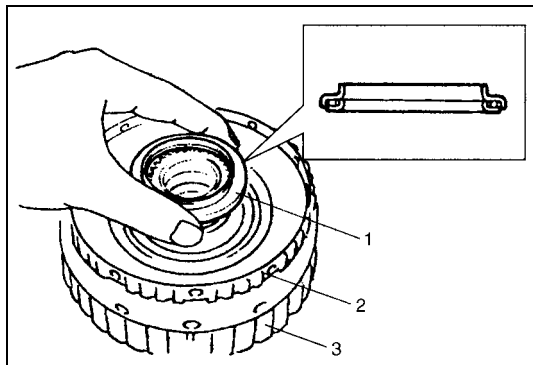
If rear sun gear thrust bearing is not found on forward clutch hub, it may have been left in transaxle.



- 42) Remove rear sun gear thrust bearing race (1).



- 43) Remove rear planetary sun gear subassembly (1) and one-way clutch No.1 assembly (2).

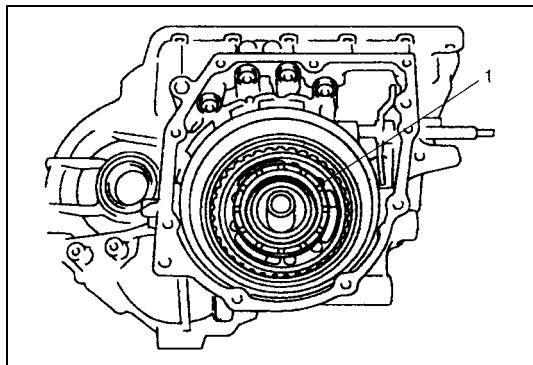


44) Remove planetary gear thrust bearing (1).

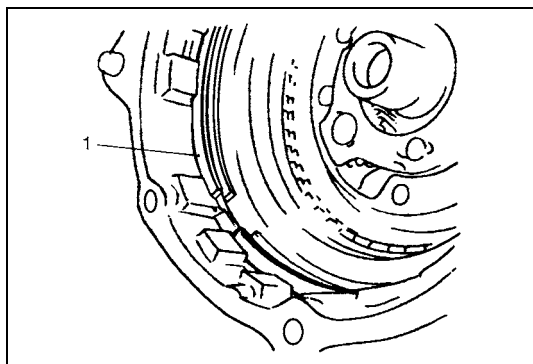
**NOTE:**

**If planetary gear thrust bearing is not found on one-way clutch No.1 assembly, it may have been left in trasaxle.**

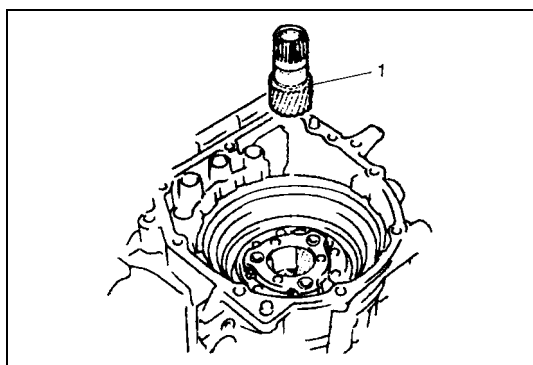
45) Remove one-way clutch No.1 assembly (2) from rear planetary sun gear subassembly (3).



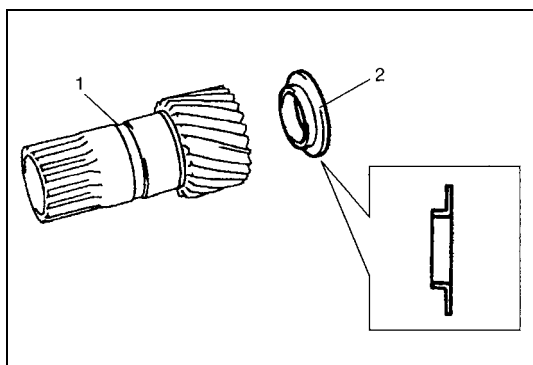
46) Remove planetary carrier thrust washer (1).



47) Remove O/D and 2nd coast brake retaining plate snap ring (1).

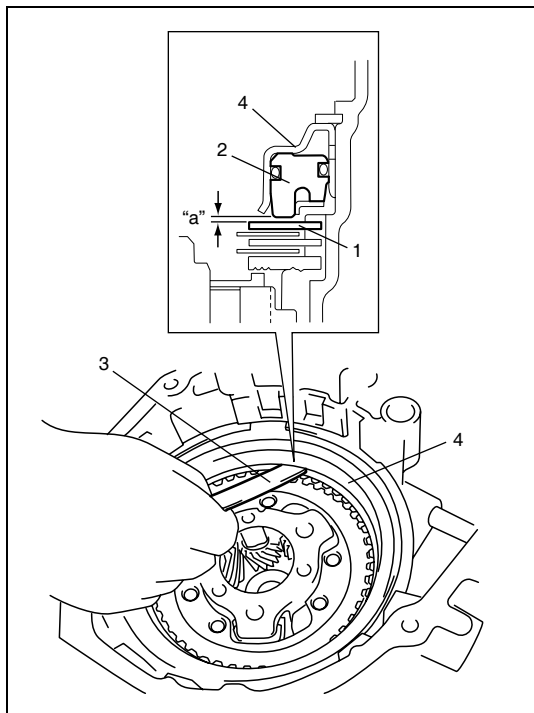


48) Remove front planetary sun gear (1).



49) Remove front sun gear thrust bearing race (2) from front planetary sun gear (1).



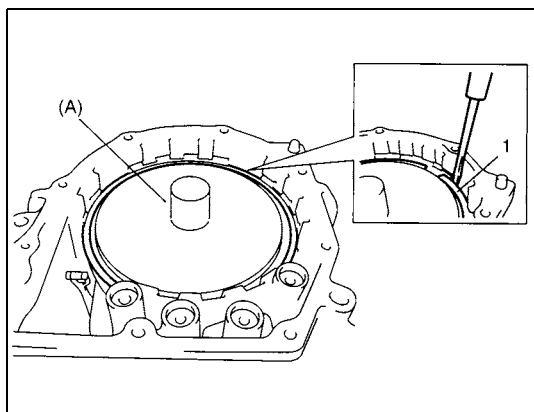


- 50) Before disassembling 2nd brake piston assembly (4), check 2nd brake piston stroke by measuring clearance between 2nd brake separator plate (1) and piston (2) with feeler gauge (3).

If clearance (piston stroke) is out of specification, replace brake discs and plates with new ones.

#### 2nd brake piston stroke

"a": 0.40 – 1.25 mm (0.016 – 0.049 in.)



- 51) Using special tool and hydraulic press, remove 2nd brake piston snap ring (1).

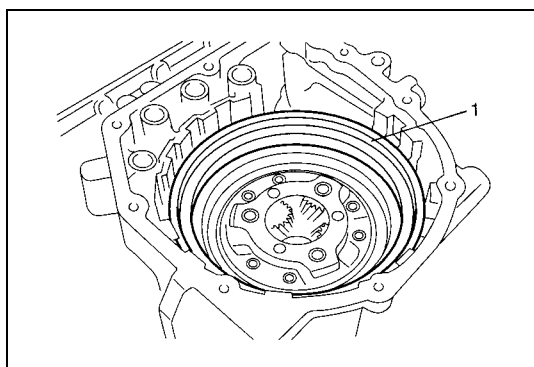
#### CAUTION:

**Do not press 2nd brake piston assembly in over 0.4 mm (0.016 in.).**

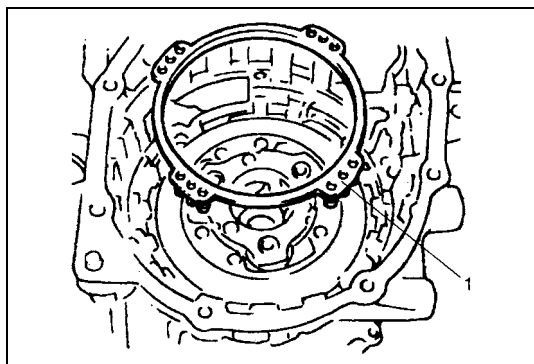
**Excessive compression may cause damage to piston assembly, return spring, plates and/or discs.**

#### Special tool

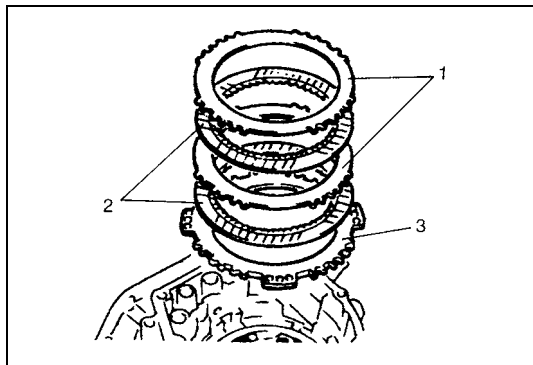
(A): 09926-96050



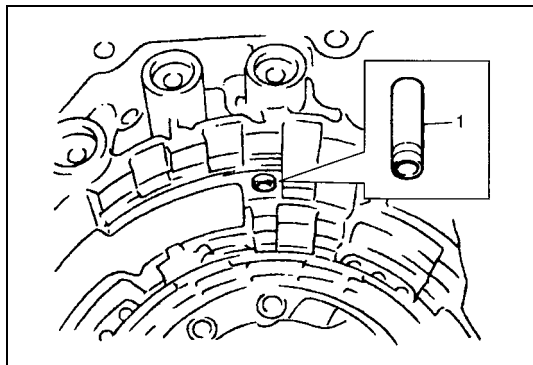
- 52) Remove 2nd brake piston assembly (1).



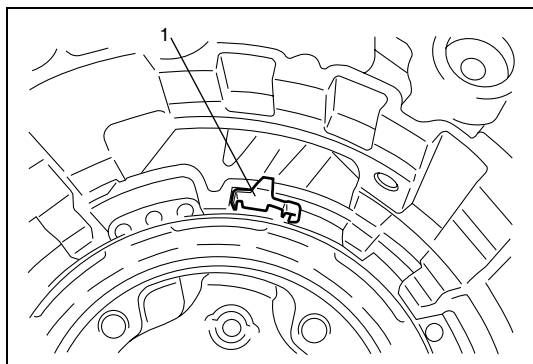
- 53) Remove 2nd brake return spring subassembly (1).



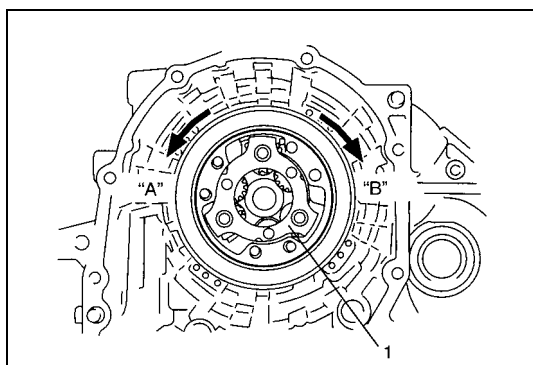
- 54) Remove 2nd brake separator plates (1) discs (2) and retaining plate (3).



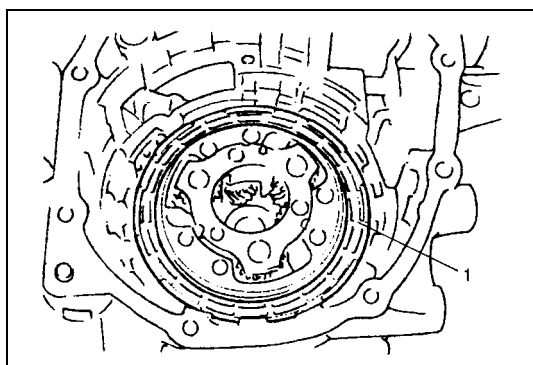
- 55) Remove brake drum gasket (1).



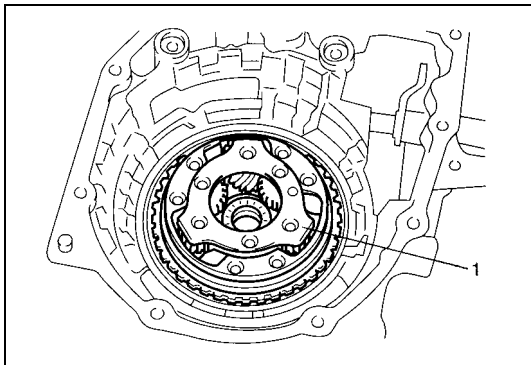
- 56) Remove one-way clutch outer race retainer (1).



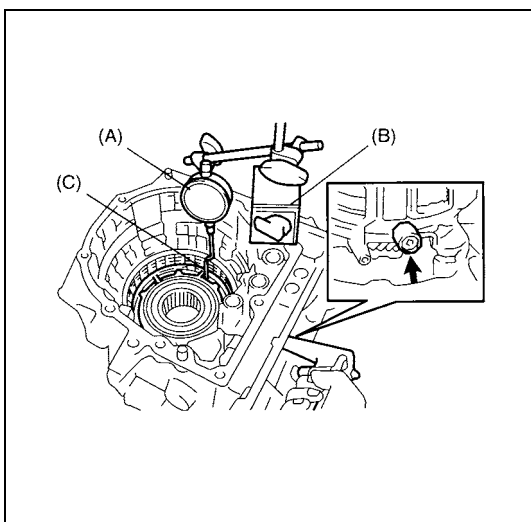
- 57) Check one-way clutch No.2 as follows.
- Ensure planetary carrier (1) rotates only in counterclockwise direction "A", never in clockwise direction "B".
  - If the planetary carrier rotates both ways or does not rotate either way, one-way clutch No.2 assembly will need to be replaced with new one-way clutch No.2 assembly.



- 58) Remove one-way clutch No.2 assembly (1).



59) Remove planetary gear assembly (1).



60) Measure 1st and reverse brake piston stroke

- Using special tool, measure 1st and reserve brake piston stroke when compressed air (400 – 800 kPa, 4 – 8 kg/cm<sup>2</sup>, 57 – 113 psi) is blown through oil hole.

**Special tool**

(A): 09900-20607

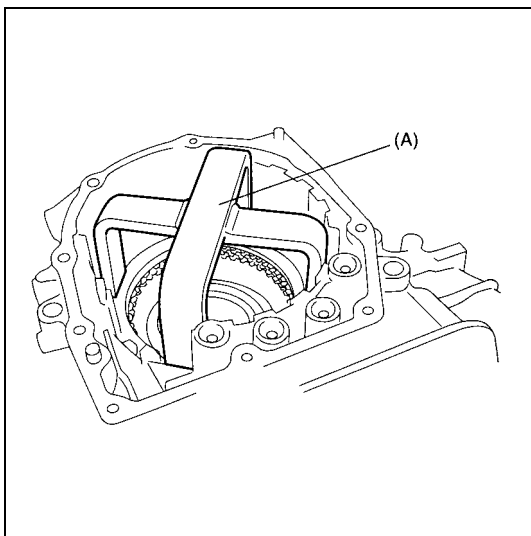
(B): 09900-20701

(C): 09952-06020

**1st and reverse brake piston stroke**

**Standard: 0.79 – 1.49 mm (0.031 – 0.059 in.)**

If piston stroke exceeds specified value, disassemble, inspect and replace discs and plates.



61) Remove snap ring while the 1st and reverse brake piston return springs are compressed using special tool and hydraulic press.

**CAUTION:**

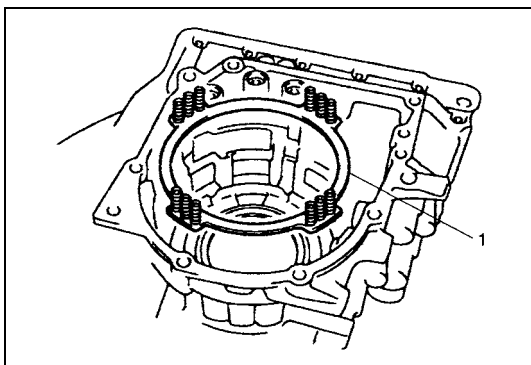
**Do not press 1st and reverse brake return spring subassembly in over 0.8 mm (0.031 in.).**

**Excessive compression may cause damage to return spring subassembly, discs, plates and/or piston.**

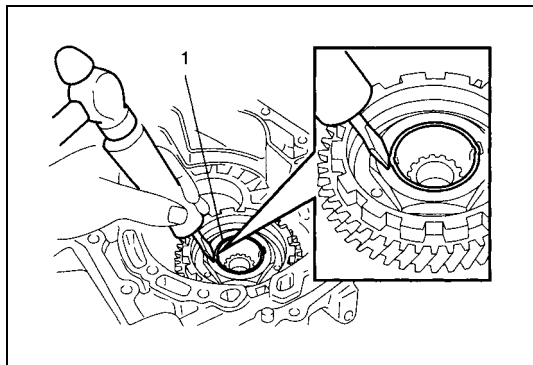
**Special tool**

(A): 09926-97620

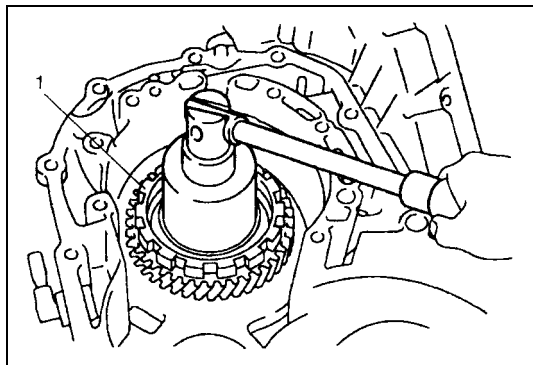
62) Remove 1st and reverse brake retaining plate, discs and separator plates.



63) Remove 1st and reverse brake return spring subassembly (1).



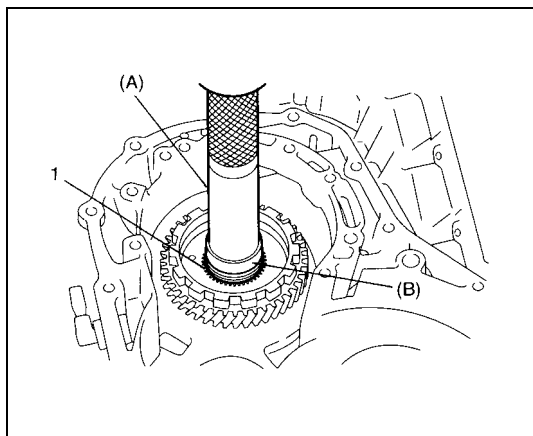
64) Turn over transaxle and uncaulk reduction drive gear nut (1).



65) Secure reduction drive gear (1) with parking lock pawl, then remove reduction drive gear nut.

**CAUTION:**

- It is recommended that this operation should be carried out on rubber mat to prevent damaging transaxle case.
- Never reuse removed nut.



66) Using special tools and hydraulic press, remove planetary ring gear subassembly (1).

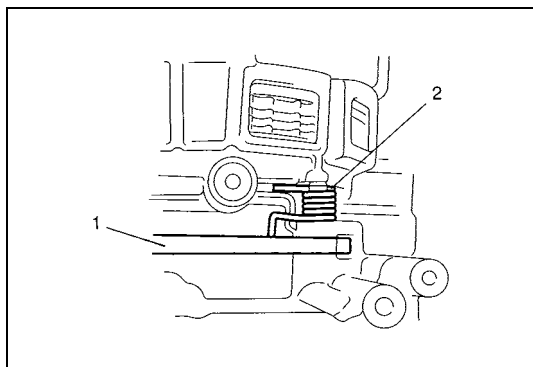
**Special tool**

(A): 09913-84510

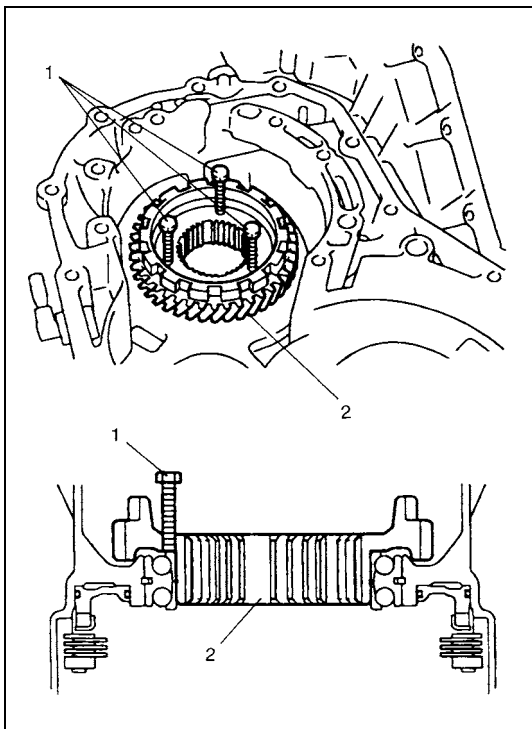
(B): 09923-78210

**CAUTION:**

**Do not reuse planetary ring gear subassembly. Otherwise it may cause damage to planetary gear unit and/or reduction gears.**



67) Remove parking lock pawl shaft, then spring (2) and parking lock pawl (1).

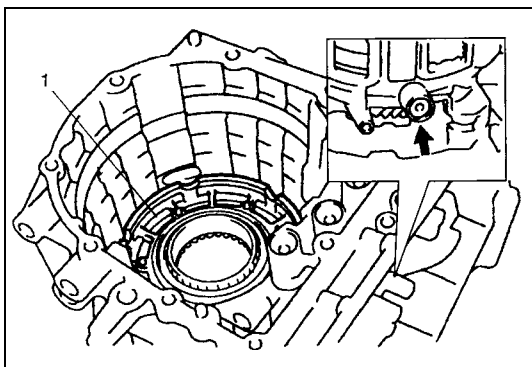


68) Screwing 3 bolts (1), remove reduction drive gear (2).

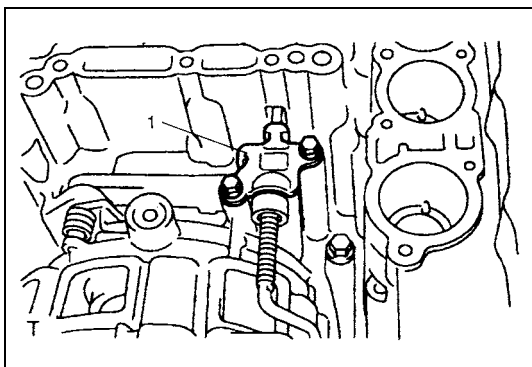
Bolt	Length
1	30 mm (1.20 in.)

**CAUTION:**

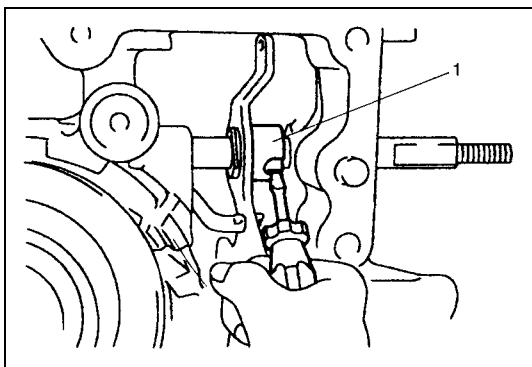
**Screw 3 bolts into reduction drive gear uniformly, or reduction drive gear, bearing and transaxle case may be damaged.**



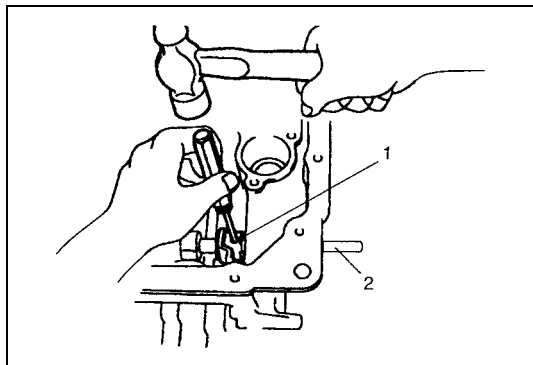
69) Blowing compressed air from oil hole of oil pump, remove 1st and reverse brake piston (1).



70) Remove parking lock pawl bracket (1).

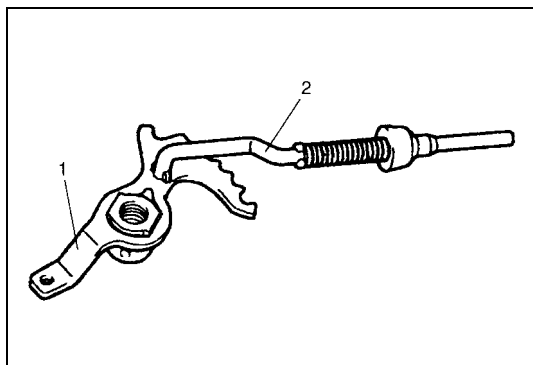


71) With slotted screw driver, cut and unfold manual valve lever spacer (1) and proceed to remove manual valve lever spacer.

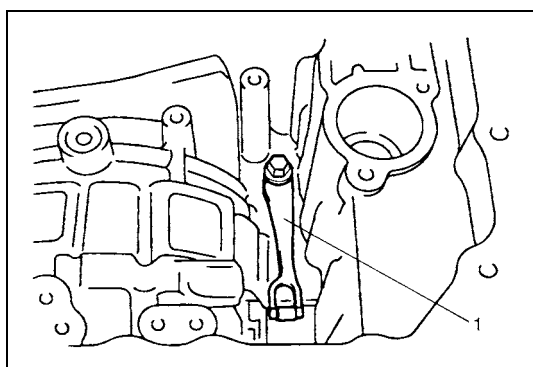


72) Using spring pin remover with 3 mm (0.12 in.) in diameter and hammer, drive out manual valve lever pin (1).

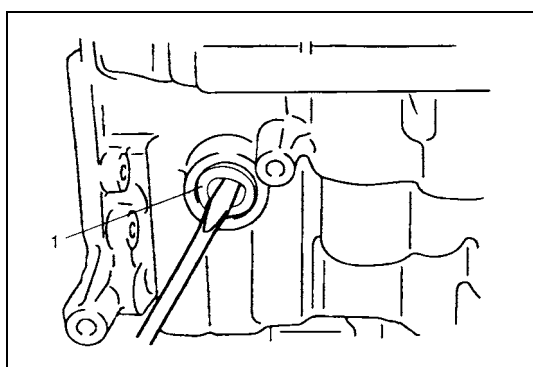
73) Remove manual shift shaft (2).



74) Remove parking lock pawl rod (2) from manual valve lever (1).



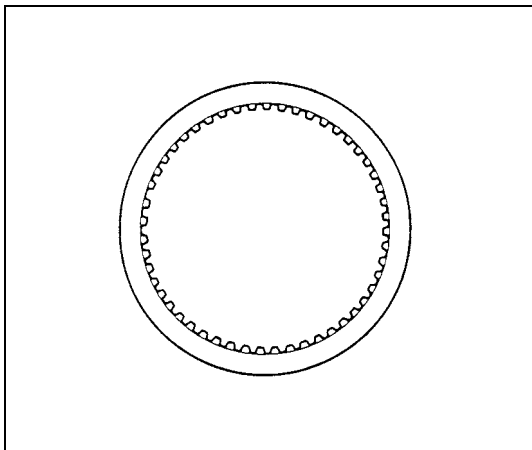
75) Remove manual detent spring (1).



76) Remove manual shift shaft oil seal (1).

## Inspection

### Brake Discs



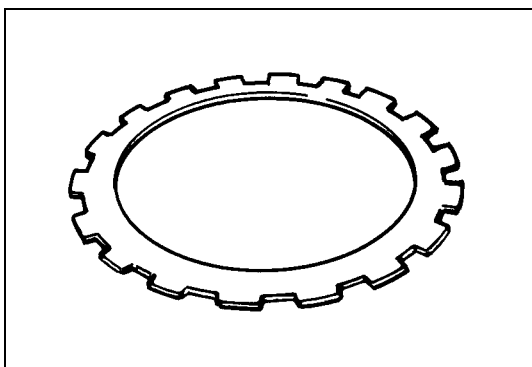
Dry and inspect them for pitting, burn flaking, significant wear, glazing, cracking, charring and chips or metal particles imbedded in lining.

If discs show any of the above conditions, replacement is required.

#### NOTE:

- If disc lining is exfoliated or discolored, replace all discs.
- Before assembling new discs, soak them in A/T fluid for at least two hours.

### Brake Separator Plates and Retaining Plates



Dry plates and check for discoloration. If plate surface is smooth and even color smear is indicated, plate should be reused. If severe heat spot discoloration or surface scuffing is indicated, plate must be replaced.

### Brake Return Spring Subassembly

Measure brake return springs.

#### Free length of 1st & reverse brake return spring

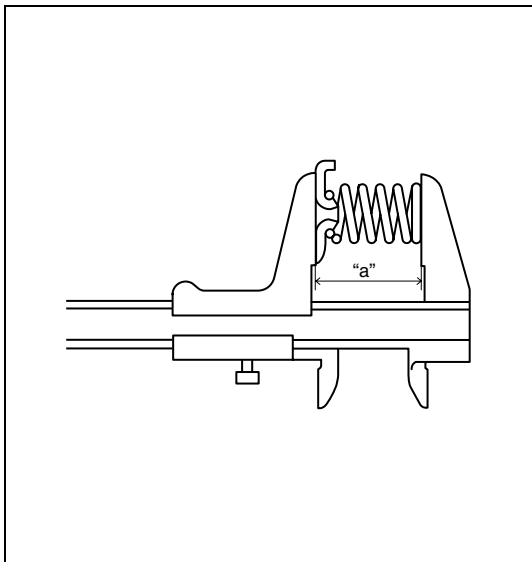
“a”: 21.71 mm (0.855 in.)

#### Free length of 2nd brake return spring

“a”: 15.85 mm (0.624 in.)

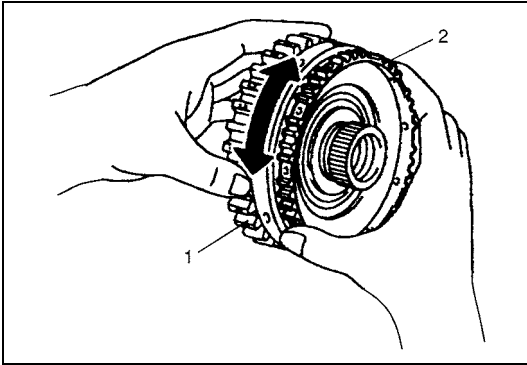
#### NOTE:

- Do not apply excessive force when measuring spring free length
- Perform measurement at several points.



Evidence of extreme heat or burning in the area of clutch may have caused springs to take heat set and would require their replacement.

### One-way Clutch No.1 Assembly



- 1) Install one-way clutch No.1 assembly (2) to rear planetary sun gear subassembly (1).
- 2) Securing rear planetary sun gear subassembly, ensure that one-way clutch No.1 assembly rotates only in one direction. If the one-way clutch rotates in both directions or it does not rotate in either direction, replace it with new one.

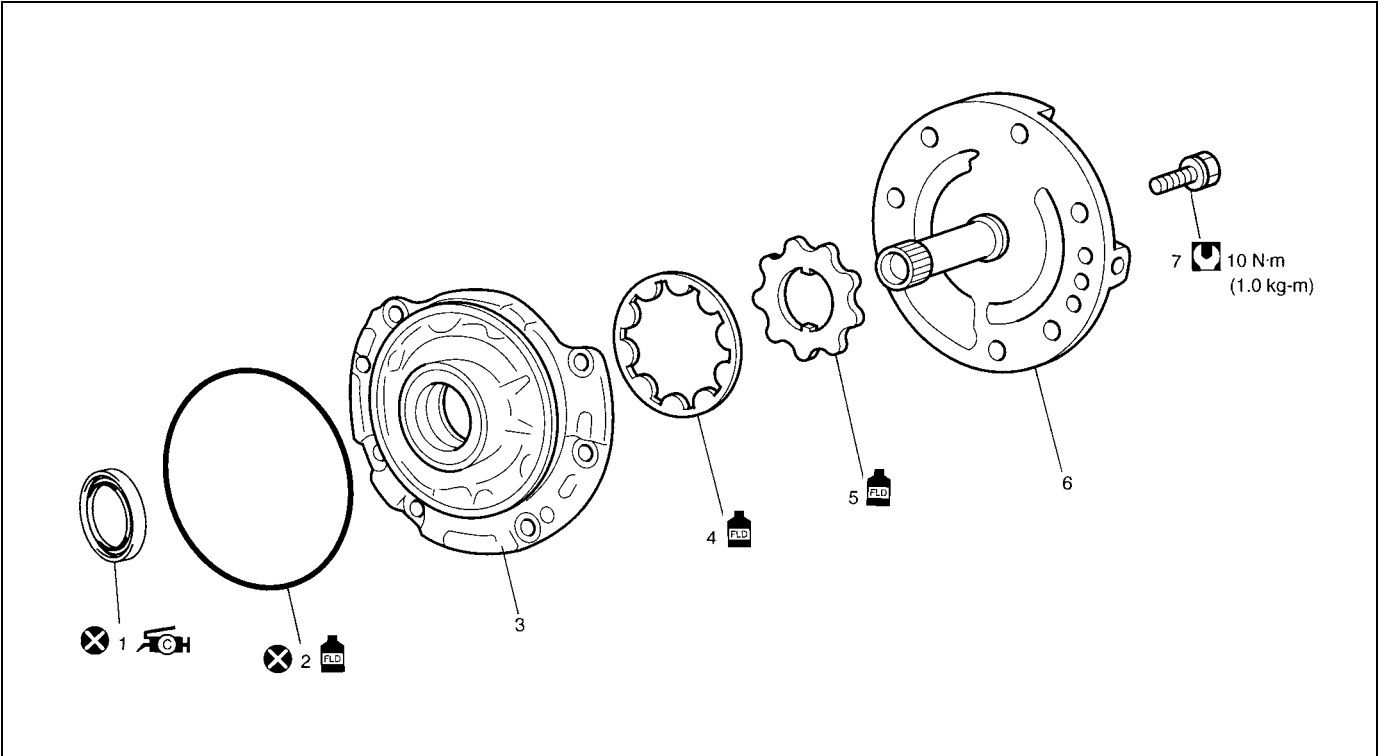
### Disassembly/Assembly of Subassembly





#### CAUTION:

- Keep component parts in group for each subassembly and avoid mixing them up.
- Clean all parts with cleaning solvent thoroughly and air dry them.
- Use kerosene or automatic transaxle fluid as cleaning solvent.
- Do not use wiping cloths or rags to clean or dry parts.
- All oil passages should be blown out and checked to make sure that they are not obstructed.
- Keep face and eyes away from solvent spray while air blowing parts.
- Check mating surface for irregularities and remove them, if any, and clean it again.
- Soak new clutch discs and brake discs in transaxle fluid for at least 2 hours before assembly.
- Replace all gaskets and O-ring with new ones.
- Apply automatic transaxle fluid to all O-rings.
- When installing seal ring, be careful so that it is not expanded excessively, extruded or caught.
- Replace oil seals that are removed and apply grease to their lips.
- Before installing, be sure to apply automatic transaxle fluid to sliding, rolling and thrusting surface of all component part. Also after installation, make sure to check each part for proper operation.
- Always use torque wrench when tightening bolts.



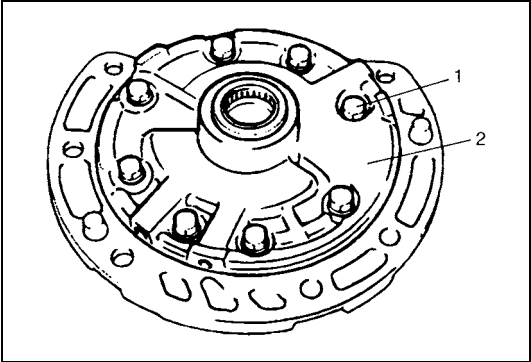
Oil pump assembly

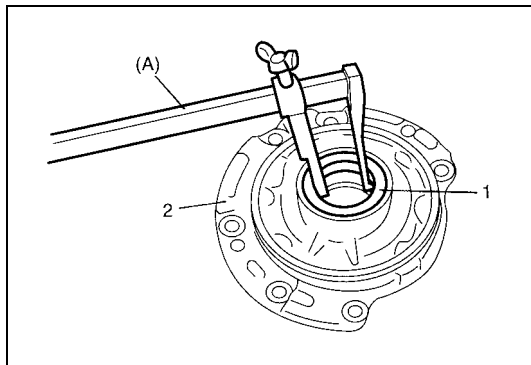


	1. Oil seal : Apply grease 99000-25030 to oil seal lip.	7. Oil pump subassembly bolts
	2. O-ring	 Apply automatic transaxle fluid.
	3. Oil pump body	 Tightening torque
	4. Oil pump driven gear	 Do not reuse.
	5. Oil pump drive gear	
	6. Stator shaft assembly	

Disassembly

- 1) Remove O-ring from pump body.
- 2) Remove 8 oil pump subassembly bolts (1) and stator shaft assembly (2).





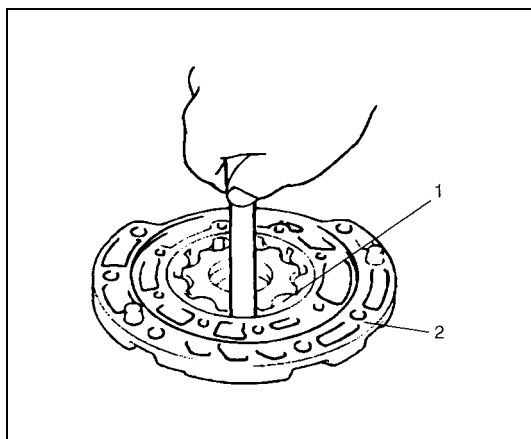
3) Remove oil seal (1) using special tool.

#### Special tool

(A): 09913-50121

2. Oil pump body
------------------

### Inspection



1) Check body clearance of driven gear.

Push driven gear to one side of body Using feeler gauge, measure clearance between driven gear and body.

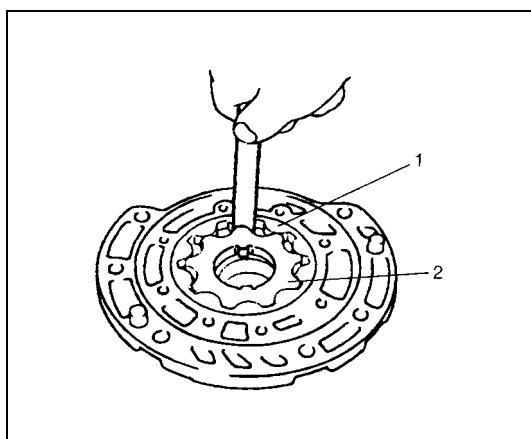
If clearance exceeds its standard value, replace oil pump assembly.

#### Clearance between oil pump driven gear and oil pump body

**Standard: 0.1 – 0.17 mm (0.0039 – 0.0067 in.)**

1. Oil pump driven gear
-------------------------

2. Oil pump body
------------------



2) Check tip clearance between drive and driven gear.

Using a feeler gauge, measure clearance between drive and driven gear tips.

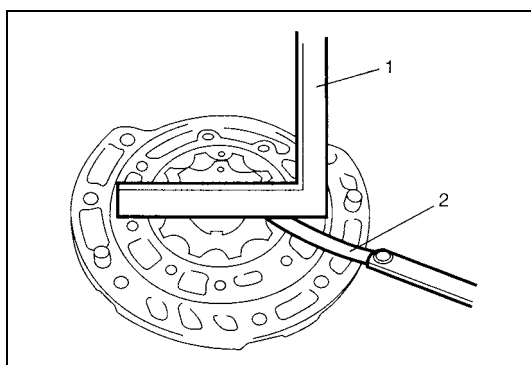
If clearance exceeds its standard value, replace oil pump assembly.

#### Tip clearance between oil pump drive gear and oil pump driven gear

**Standard: 0.07 – 0.15 mm (0.0028 – 0.0059 in.)**

1. Oil pump driven gear
-------------------------

2. Oil pump drive gear
------------------------



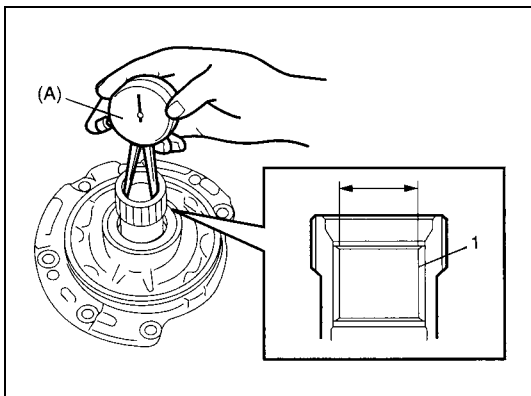
3) Check side clearance of both gears.

Using straightedge (1) and feeler gauge (2), measure side clearance between gears and pump body.

If clearance exceeds its standard value, replace oil pump assembly.

#### Side clearance between gears and oil pump body

**Standard: 0.02 – 0.05 mm (0.0008 – 0.0019 in.)**



- 4) Using special tool, measure stator shaft bush bore.  
If measured stator shaft bush bore is out of specifications, replace oil pump assembly with new one.

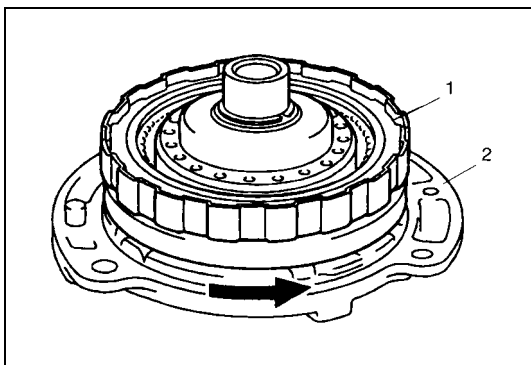
**Special tool**

(A): 09900-20605

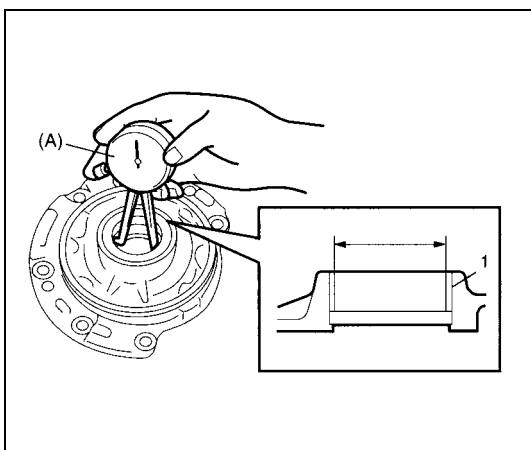
**Stator shaft bush bore**

**Standard: 18.424 – 18.450 mm (0.7254 – 0.7264 in.)**

1. Stator shaft bush



- 5) Install direct clutch assembly (1) to stator shaft assembly (2), then ensure that direct clutch assembly turns smoothly.  
If unsmooth rotation or noise are found in oil pump assembly, replace oil pump assembly with new one. This check should also be done to input shaft assembly and replace input shaft assembly if necessary.



- 6) Using special tool, measure oil pump body bush bore.

**Special tool**

(A): 09900-20605

**Oil pump body bush bore**

**Standard: 38.113 – 38.138 mm (1.5005 – 1.5015 in.)**

If measured oil pump body bush bore is out of specifications, replace oil pump assembly with new one. Torque converter also needs to be checked. Replace torque converter, if necessary.

1. Oil pump body bush

**Assembly**

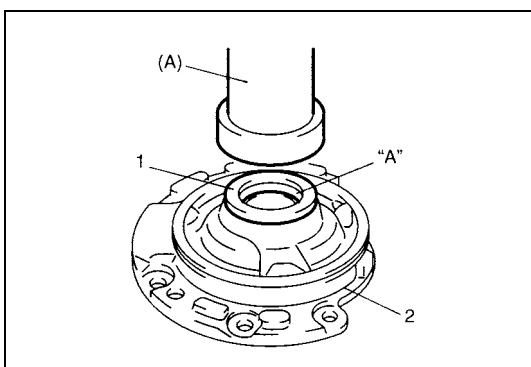
- 1) Install new oil pump body oil seal (1).  
Use special tool and hammer to install it, and then apply grease to its lip.

**Special tool**

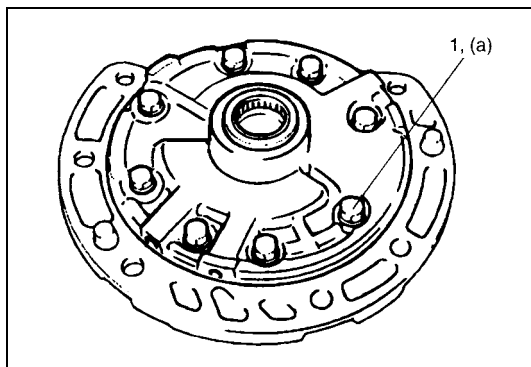
(A): 09913-85210

**“A”:** Grease 99000-25030

1. Oil pump body



- 2) Install driven gear and drive gear to oil pump body after applying A/T fluid.

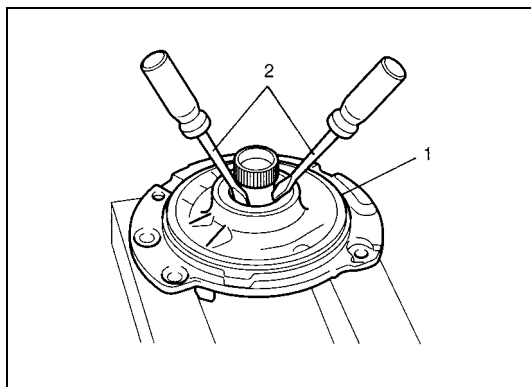


- 3) Install stator shaft assembly to oil pump body and tighten 8 pump subassembly bolts (1) to specification.

**Tightening torque**

**Oil pump subassembly bolts**

(a): 10 N·m (1.0 kg-m, 7.5 lb-ft)



- 4) After applying A/T fluid to new O-ring, install it to oil pump body.

**CAUTION:**

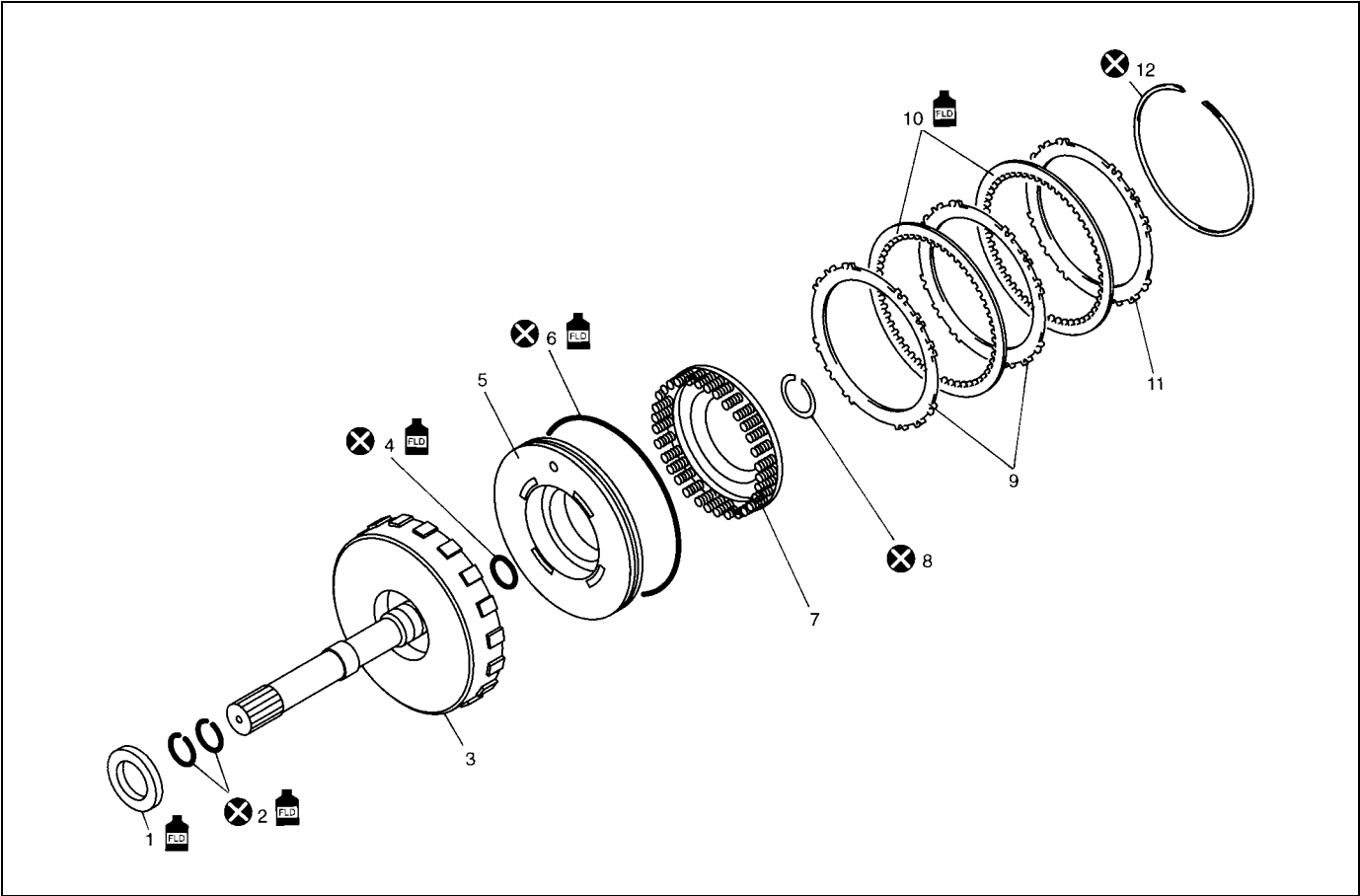
**Do not damage oil seal with slotted screw driver.**



- 5) Check drive gear for smooth rotation by using slotted screw driver.

1. Oil pump assembly

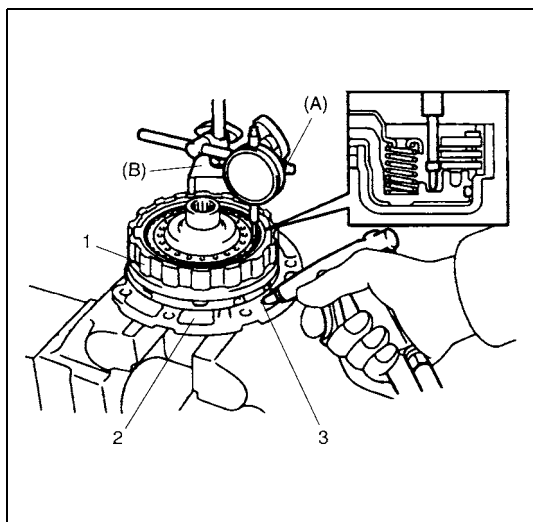
2. Slotted screw driver

Direct clutch assembly



1. Input shaft front thrust bearing	8. Shaft snap ring
2. Input shaft seal ring	9. Direct clutch separator plate
3. Input shaft subassembly	10. Direct clutch disc
4. Inner O-ring	11. Direct clutch retaining plate
5. Direct clutch piston	12. Plate snap ring
6. Outer O-ring	 Apply automatic transaxle fluid.
7. Direct clutch return spring subassembly	 Do not reuse.

## Preliminary Check



- 1) Install direct clutch assembly (1) to oil pump assembly (2), blow in air (400 – 800 kPa, 4 – 8 kg/cm<sup>2</sup>, 57 – 113 psi) through oil hole (3) of oil pump assembly with special tool attached on upper surface of direct clutch piston, and measure piston stroke of direct clutch.

### Special tool

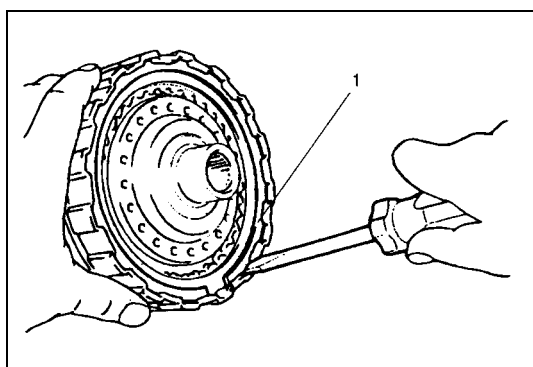
(A): 09900-20607

(B): 09900-20701

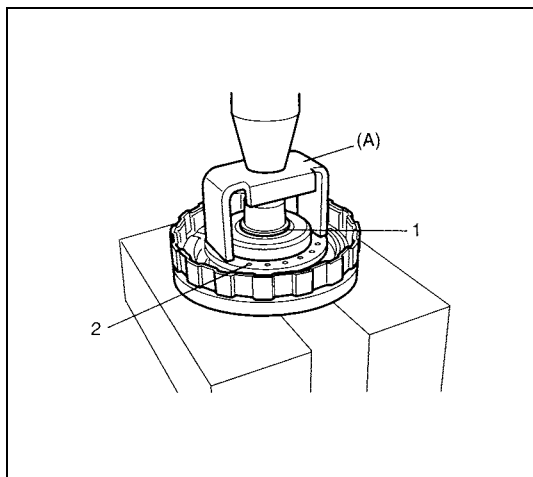
**Direct clutch piston stroke: 0.4 – 0.7 mm (0.016 – 0.027 in.)**

If piston stroke exceeds specified value, disassemble, inspect and replace inner parts.

## Disassembly



- 1) Remove plate snap ring (1), then remove direct clutch retaining plate, discs and separator plates.



- 2) Using special tool and hydraulic press, remove shaft snap ring (1).

### CAUTION:

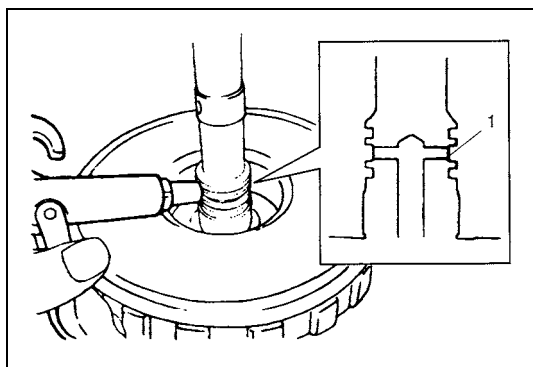
**Do not press direct clutch return spring subassembly in over 0.7 mm (0.027 in.).**

**Excessive compression may cause damage to direct clutch return spring subassembly and/or piston.**

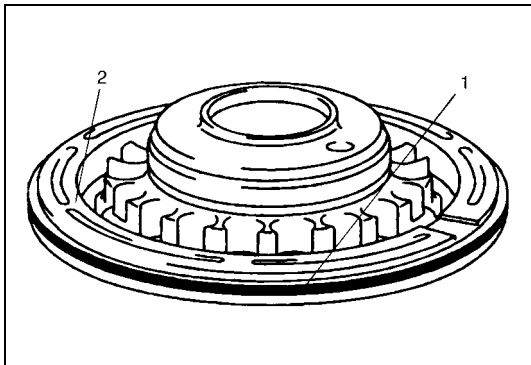
### Special tool

(A): 09926-98310

- 3) Remove direct clutch return spring assembly (2).

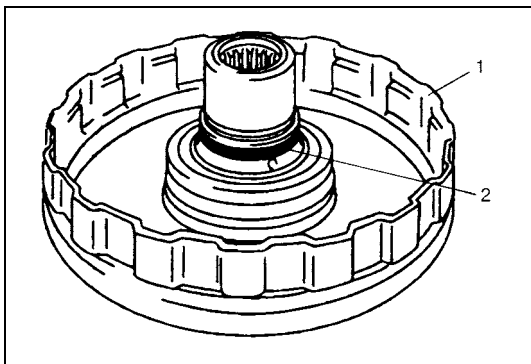


- 4) Using a finger to block oil hole (1), apply compressed air (400 – 800 kPa, 4 – 8 kg/cm<sup>2</sup>, 57 – 113 psi) to opposite hole, which will assist in removal of the clutch piston.



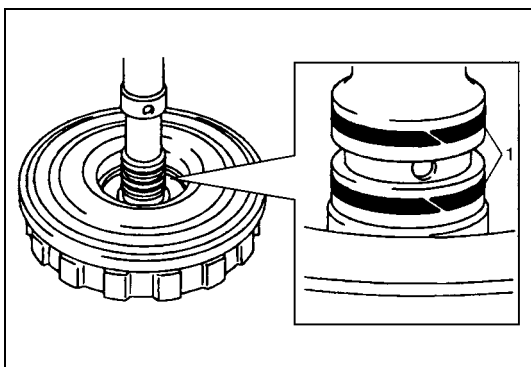
5) Remove outer O-ring (1).

2. Direct clutch piston



6) Remove inner O-ring (2).

1. Input shaft subassembly



7) Remove input shaft seal rings (1).

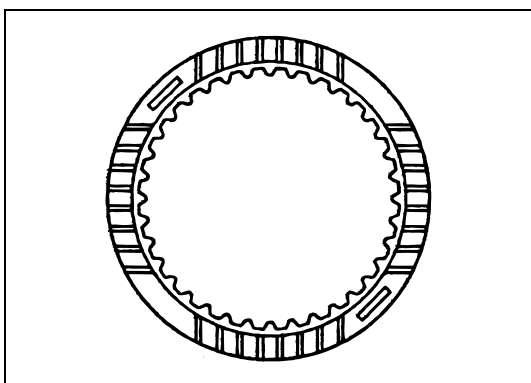
## Inspection

### Clutch Discs, Plates and Retaining Plate

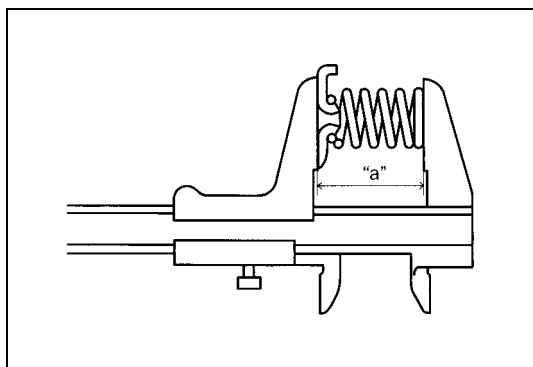
Check that sliding surfaces of discs, separator plates and retaining plate are not worn hard or burnt. If necessary, replace.

#### NOTE:

- If disc lining is exfoliated or discolored, replace all discs.
- Before assembling new discs, soak them in A/T fluid for at least two hours.



### Direct Clutch Return Spring Subassembly



Measure free length of direct clutch return spring.

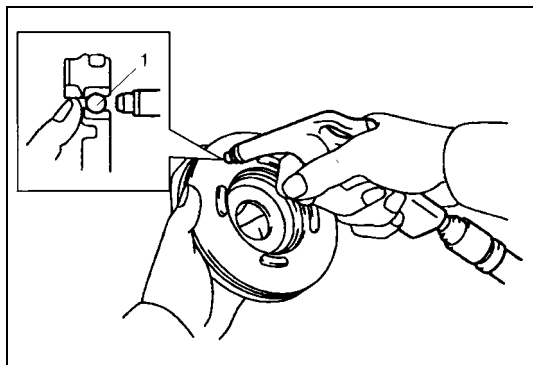
#### Free length of direct clutch return spring

“a”: 36.04 mm (1.419 in.)

#### NOTE:

- Do not apply excessive force when measuring spring free length.
- Perform measurement at several points.

### Direct Clutch Piston



Shake direct clutch piston lightly and check that check ball (1) is not stuck. Blow in low-pressure air (Max 100 kPa, 1 kg/cm<sup>2</sup>, 15 psi) to check ball to check that there is no air leakage.

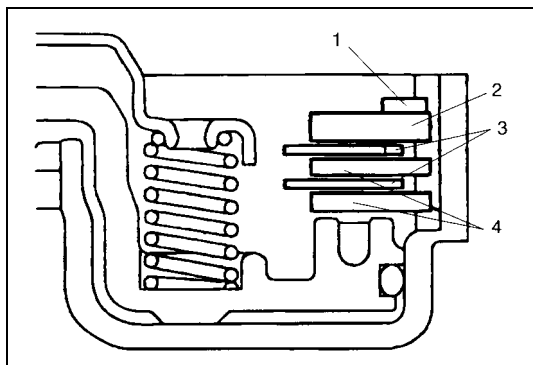
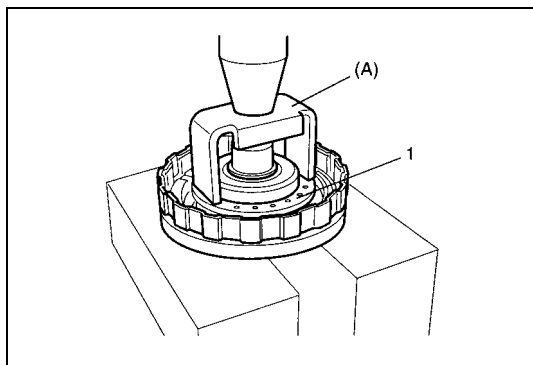
### Assembly

Reverse disassembly procedure for assembly, noting the following points.

- Use new seal ring and O-ring. Apply A/T fluid before installation.
- Do not damage direct clutch return spring subassembly (1) and piston by pressing in direct clutch return spring subassembly passing through its original installing position over 0.7 mm (0.027 in.).

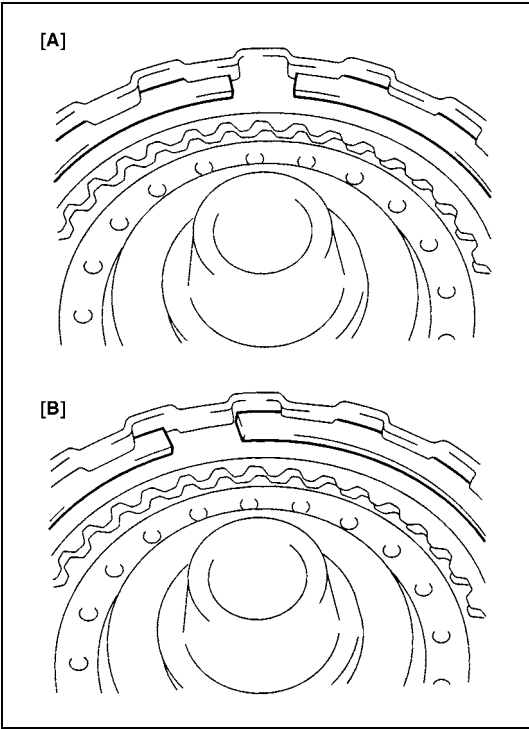
#### Special tool

(A): 09926-98310



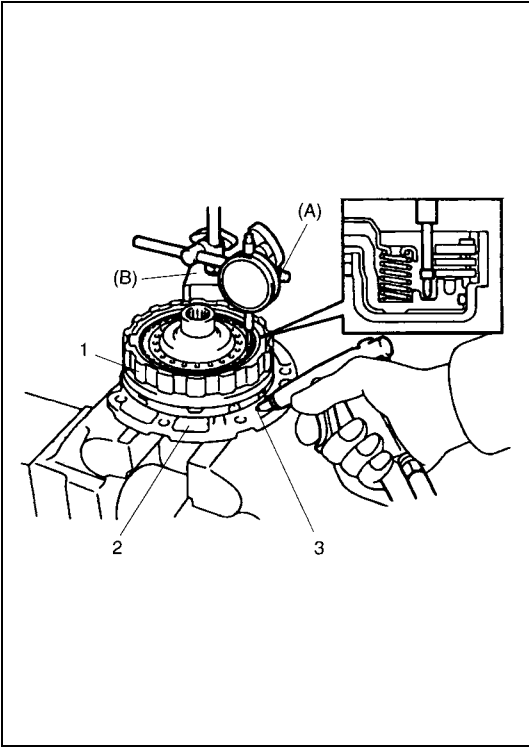
- Apply A/T fluid to direct clutch separator plates (4), discs (3) and retaining plate (2).
- Install direct clutch separator plates (4) discs (3) retaining plate (2) and snap ring (1) to input shaft subassembly.





- Install plate snap ring so that its both ends would be positioned in correct locations as shown in figure.

[A]	Correct
[B]	Incorrect



- After assembly, measure direct clutch piston stroke.

**Special tool**

**(A): 09900-20607**

**(B): 09900-20701**

**Direct clutch piston stroke: 0.4 – 0.7 mm (0.016 – 0.027 in.)**

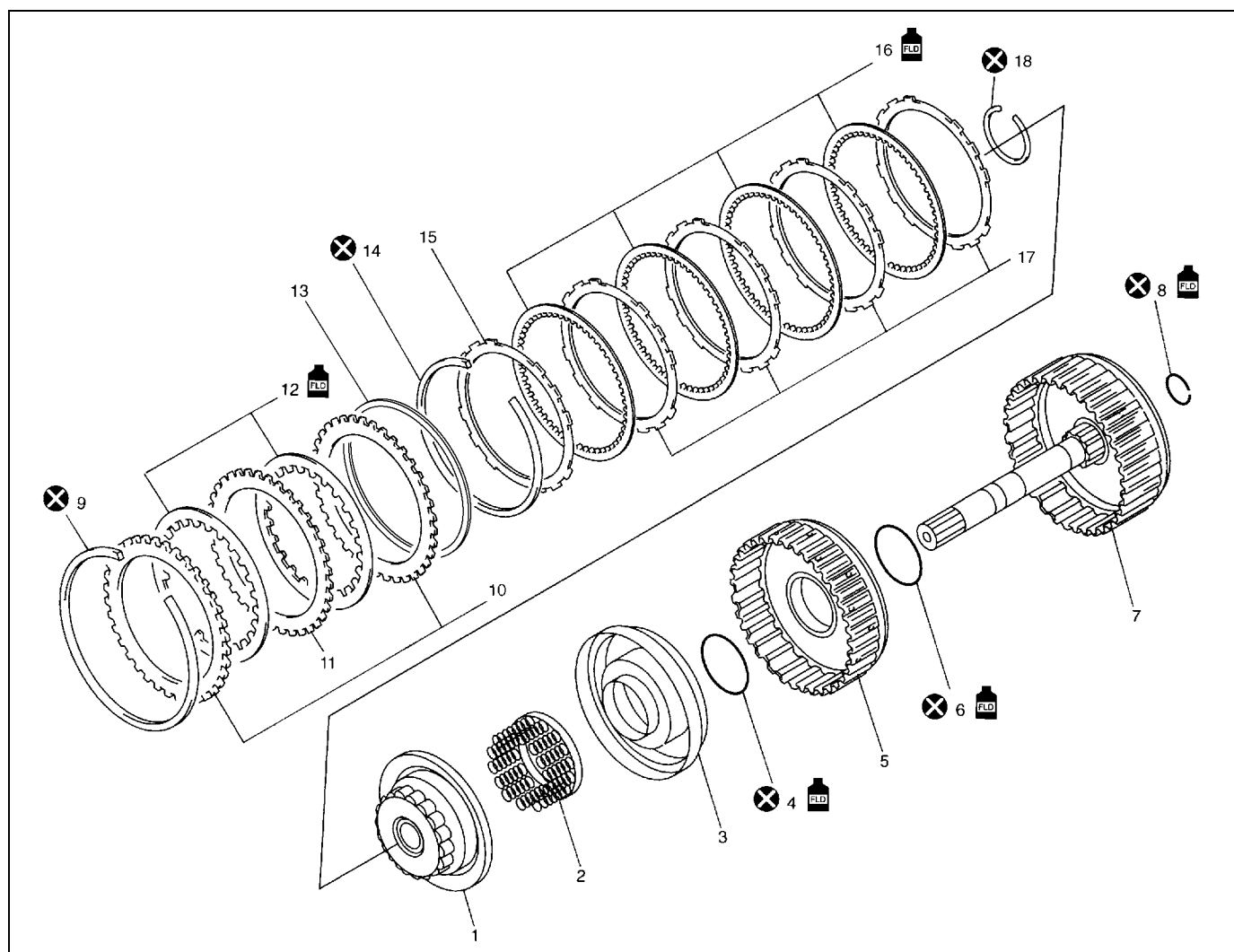
When piston strike is out of specification, select direct clutch retaining plate with suitable thickness from among the list below and replace it.



**Available direct clutch retaining plate thickness**

Thickness	Identification mark
2.8 mm	4
3.0 mm (0.118 in.)	1
3.2 mm (0.126 in.)	2
3.4 mm (0.134 in.)	3

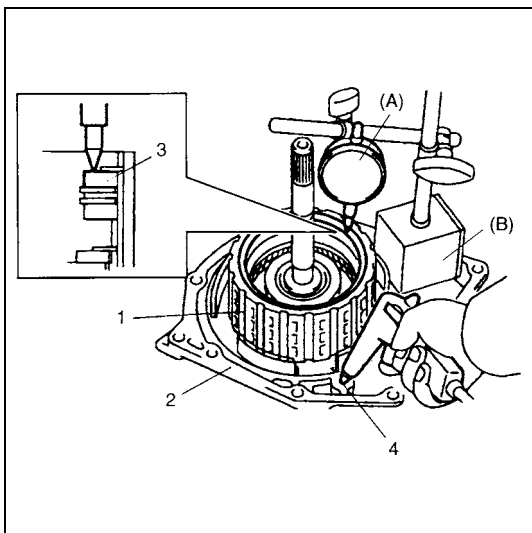
1.	Direct clutch assembly
2.	Oil pump assembly
3.	Oil hole

## Forward and reverse clutch assembly



1. Forward clutch balancer	11. Reverse clutch separator plate
2. Forward clutch return spring subassembly	12. Reverse clutch disc
3. Forward clutch piston	13. Reverse clutch cushion plate
4. Forward clutch piston O-ring	14. Forward clutch plate snap ring
5. Forward clutch drum	15. Forward clutch retaining plate
6. Forward clutch drum O-ring	16. Forward clutch disc
7. Intermediate shaft subassembly	17. Forward clutch separator plate
8. Inter mediate shaft seal ring	18. Balancer snap ring
9. Reverse clutch plate snap ring	 Apply automatic transaxle fluid.
10. Reverse clutch retaining plate	 Do not reuse.

## Preliminary Check



- 1) Install forward and reverse clutch assembly (1) to transaxle rear cover (2), blow in compressed air (400 – 800 kPa, 4 – 8 kg/cm<sup>2</sup>, 57 – 113 psi) through oil hole (4) of transaxle rear cover with the special tool attached on the upper surface of reverse clutch retaining plate (3), and measure reverse clutch piston stroke.

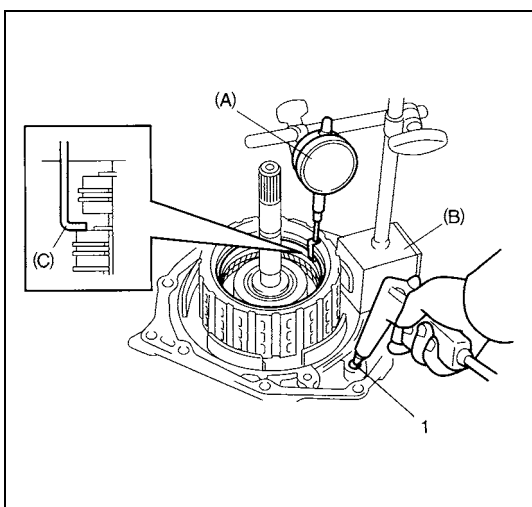
If piston stroke exceeds specified value, disassemble, inspect and replace inner parts.

### Special tool

(A): 09900-20607

(B): 09900-20701

**Reverse clutch piston stroke: 1.20 – 1.60 mm (0.047 – 0.063 in.)**



- 2) Blow compressed air (400 – 800 kPa, 4 – 8 kg/cm<sup>2</sup>, 57 – 113 psi) through oil hole (1) of transaxle rear cover with the special tool attached on the upper surface of forward clutch retaining plate, and measure forward clutch piston stroke.

If piston stroke exceeds specified value, disassemble, inspect and replace inner parts.

### Special tool

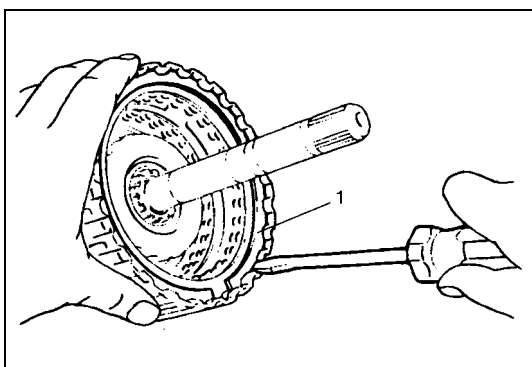
(A): 09900-20607

(B): 09900-20701

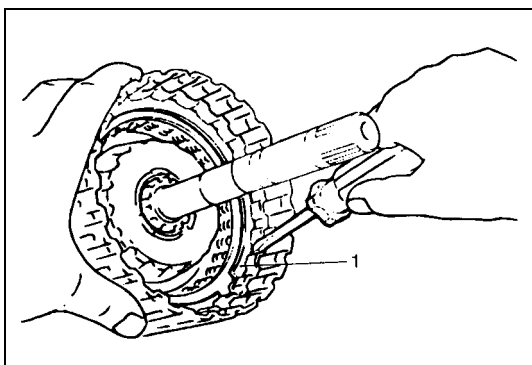
(C): 09952-06020

**Forward clutch piston stroke: 1.30 – 1.50 mm (0.051 – 0.059 in.)**

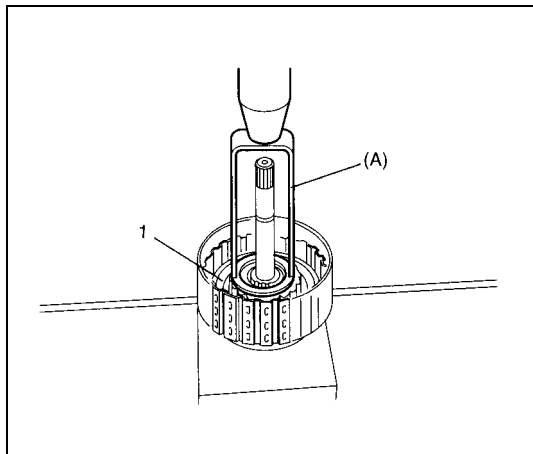
## Disassembly



- 1) Remove reverse clutch plate snap ring (1) and take out reverse clutch retaining plate, discs, separator plates and reverse clutch cushion plate from intermediate shaft sub-assembly.



- 2) Remove forward clutch plate snap ring (1) and take out forward clutch retaining plate, discs and separator plates from forward clutch drum.



- 3) Remove balancer snap ring by using special tool and hydraulic press.

**CAUTION:**

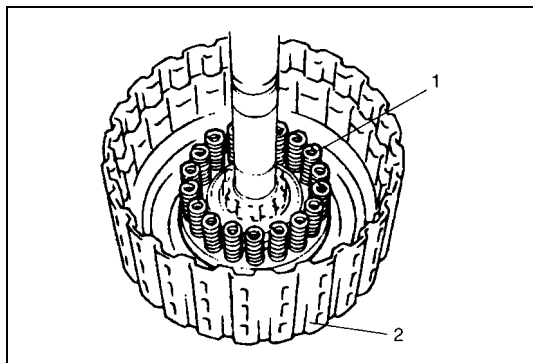
**Do not press forward clutch return spring subassembly in over 1.5 mm (0.059 in.).**

**Excessive compression may cause damage to return spring subassembly and/or balancer.**

**Special tool**

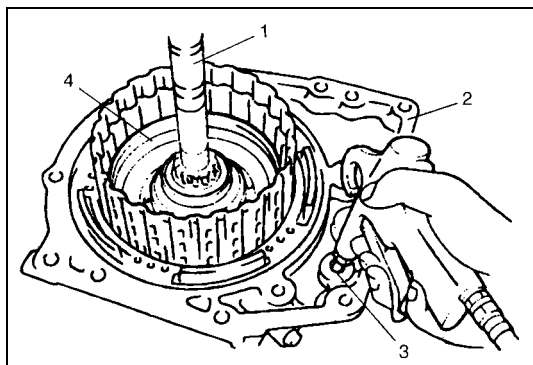
**(A): 09926-97610**

- 4) Remove forward clutch balancer (1).

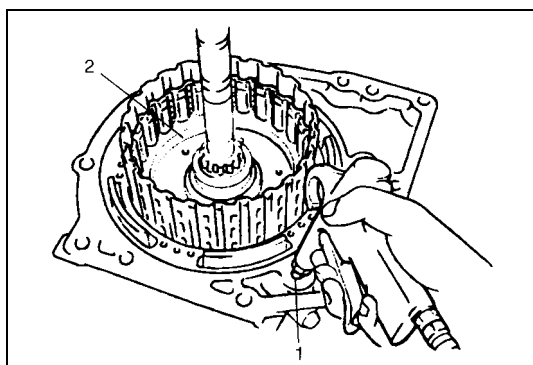


- 5) Remove forward clutch return spring subassembly (1).

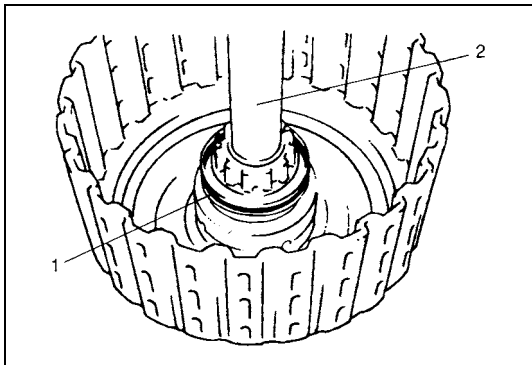
2. Intermediate shaft subassembly



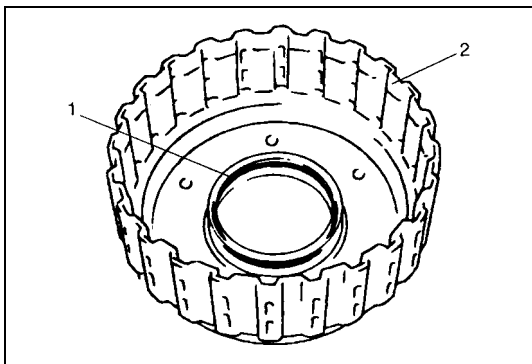
- 6) Install intermediate shaft subassembly (1) to transaxle rear cover (2). Apply compressed air (400 – 800 kPa, 4 – 8 kg/cm<sup>2</sup>, 57 – 113 psi) to oil hole (3) of transaxle rear cover to remove forward clutch piston (4).



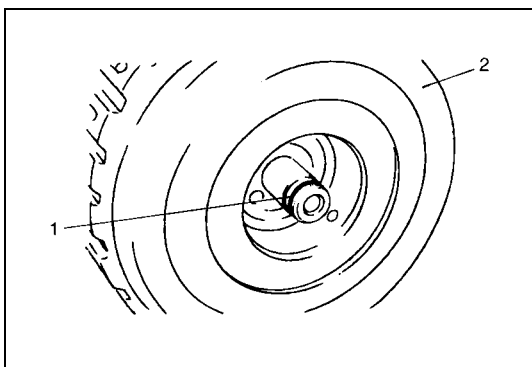
- 7) Apply compressed air (400 – 800 kPa, 4 – 8 kg/cm<sup>2</sup>, 57 – 113 psi) to oil hole (1) of transaxle rear cover to remove forward clutch drum (2).



- 8) Remove forward clutch piston O-ring (1) from intermediate shaft subassembly (2).



- 9) Remove forward clutch drum O-ring (1) from forward clutch drum (2).



- 10) Remove intermediate shaft seal ring (1) from intermediate shaft subassembly (2).

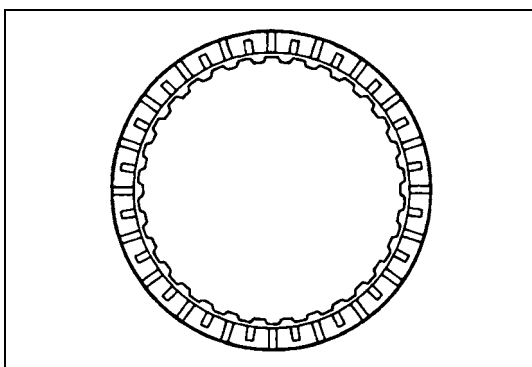
### Inspection

#### Clutch Discs, Separator Plates and Retaining Plate

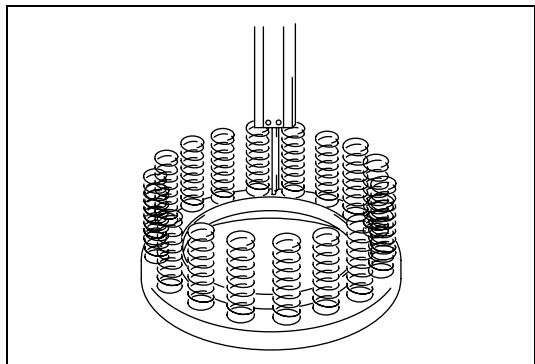
Check that sliding surfaces of discs, separator plates and retaining plate are not worn hard or burnt. If necessary, replace.

#### NOTE:

- If disc lining is exfoliated or discolored, replace all discs.
- Before assembling new discs, soak them in A/T fluid for at least two hours.



### Forward Clutch Return Spring Subassembly



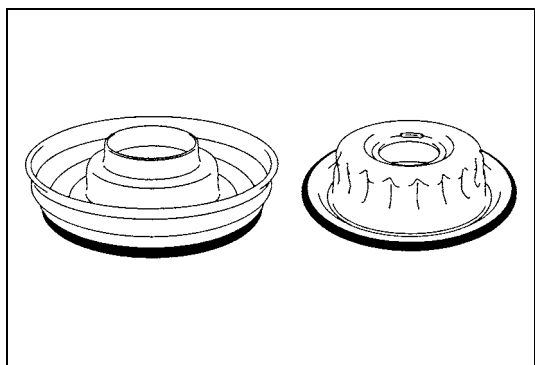
Measure free length of forward clutch return spring.

**Free length of forward clutch return spring:  
24.04 mm (0.946 in.)**

**NOTE:**

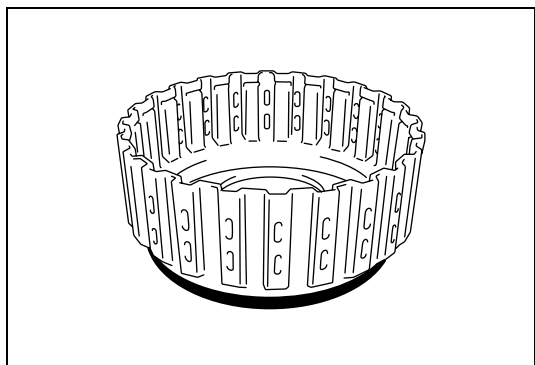
- Do not apply excessive force when measuring spring free length.
- Perform measurement at several points.

### Forward Clutch Piston Lip and Forward Clutch Balancer Lip



Check each lip for wear, deformation, cut, and/or hardening. If necessary, replace.

### Forward Clutch Drum Lip

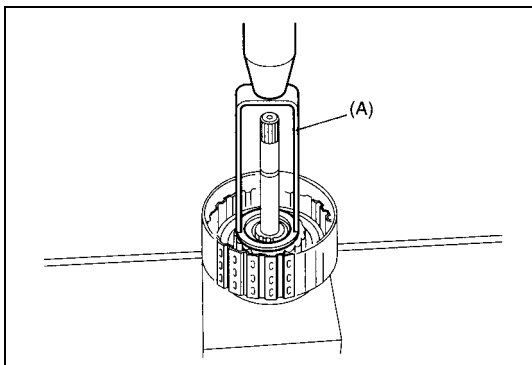


Check each lip for wear, deformation, cut, and/or hardening. If necessary, replace.

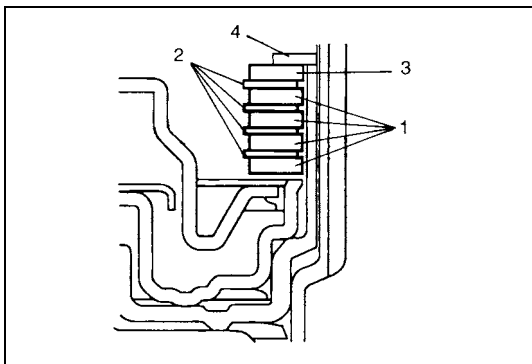
### Assembly

Reverse disassembly procedure for assembly, noting the following points.

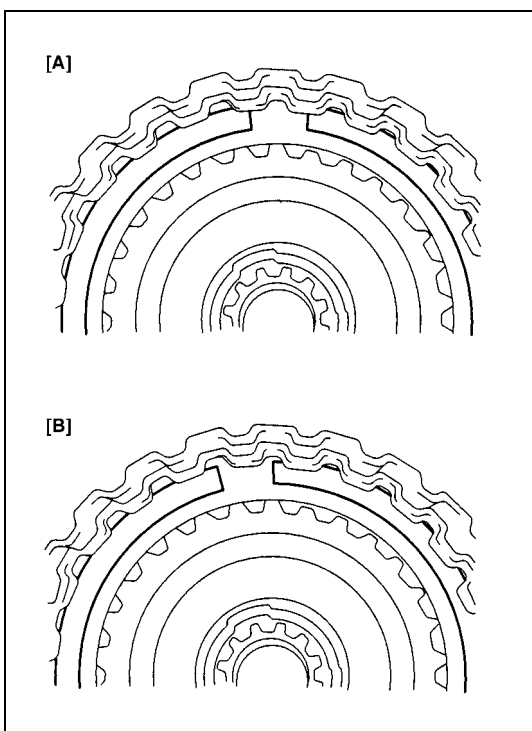
- Before assembling, apply automatic transaxle fluid to component parts.
- Replace O-rings and seal ring with new ones.



- Do not damage forward clutch return spring subassembly and balancer by pressing in forward clutch return spring subassembly passing through its original installing position over 1.5 mm (0.059 in.).

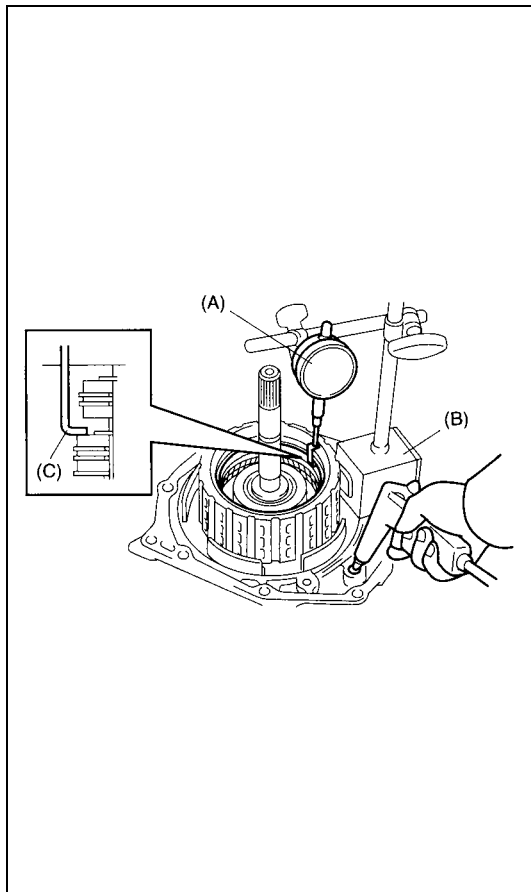
**Special tool**
**(A): 09926-97610**


- Apply A/T fluid to forward clutch separator plates (1), discs (2) and retaining plate (3).
- Install forward clutch separator plates (1), discs (2) and retaining plate (3), then snap ring (4) to forward clutch drum.



- Install forward clutch plate snap ring so that its both ends would be positioned in correct locations as shown in figure.

[A] Correct
[B] Incorrect



- Measure forward clutch piston stroke in the same manner as “Preliminary Check”.

#### Special tool

(A): 09900-20607

(B): 09900-20701

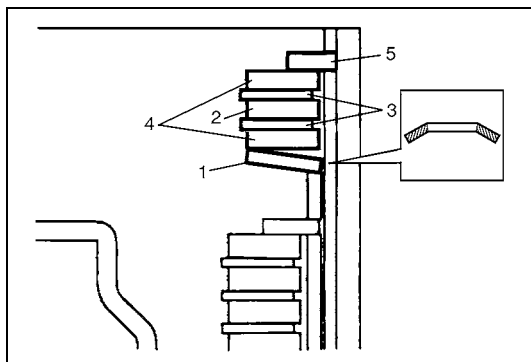
(C): 09952-06020

**Forward clutch piston stroke: 1.30 – 1.50 mm (0.051 – 0.059 in.)**

When piston stroke is out of specification, select forward clutch retaining plate with proper thickness from among the list below and replace it.

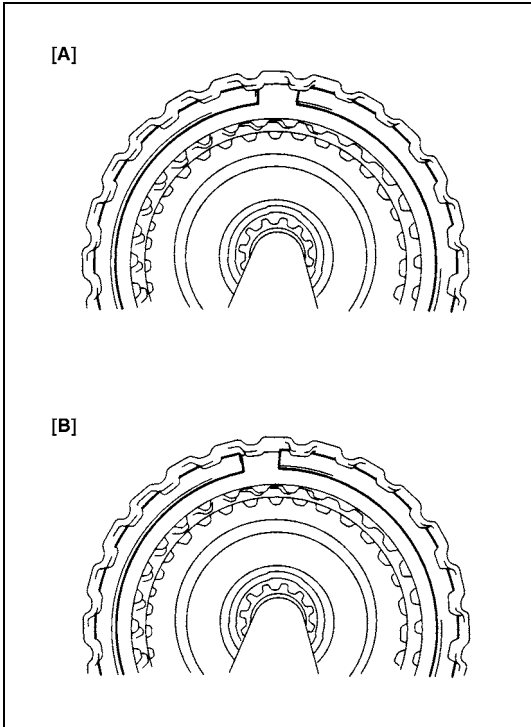
#### Available forward clutch retaining plate thickness

Thickness	Identification mark
3.0 mm (0.118 in.)	1
3.1 mm (0.122 in.)	5
3.2 mm (0.126 in.)	2
3.3 mm (0.130 in.)	6
3.4 mm (0.134 in.)	3
3.5 mm (0.138 in.)	7
3.6 mm (0.142 in.)	4



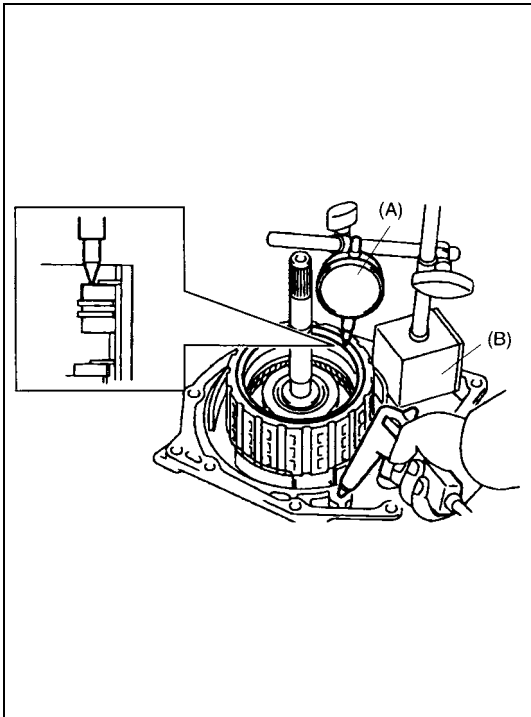
- Install reverse clutch cushion plate (1) in correct direction as shown in figure.
- Apply A/T fluid to reverse clutch cushion plate (1) reverse clutch separator plate (2) discs (3) and retaining plate (4).
- Install reverse clutch cushion plate (1) reverse clutch separator plate (2) discs (3) retaining plate (4) and then snap ring (5) to intermediate shaft subassembly.





- Install reverse clutch plate snap ring so that its both ends would be positioned in correct locations as shown in figure.

[A]:	Correct
[B]:	Incorrect



- Measure reverse clutch piston stroke in the same manner as “Preliminary Check”.

**Special tool**

**(A): 09900-20607**

**(B): 09900-20701**

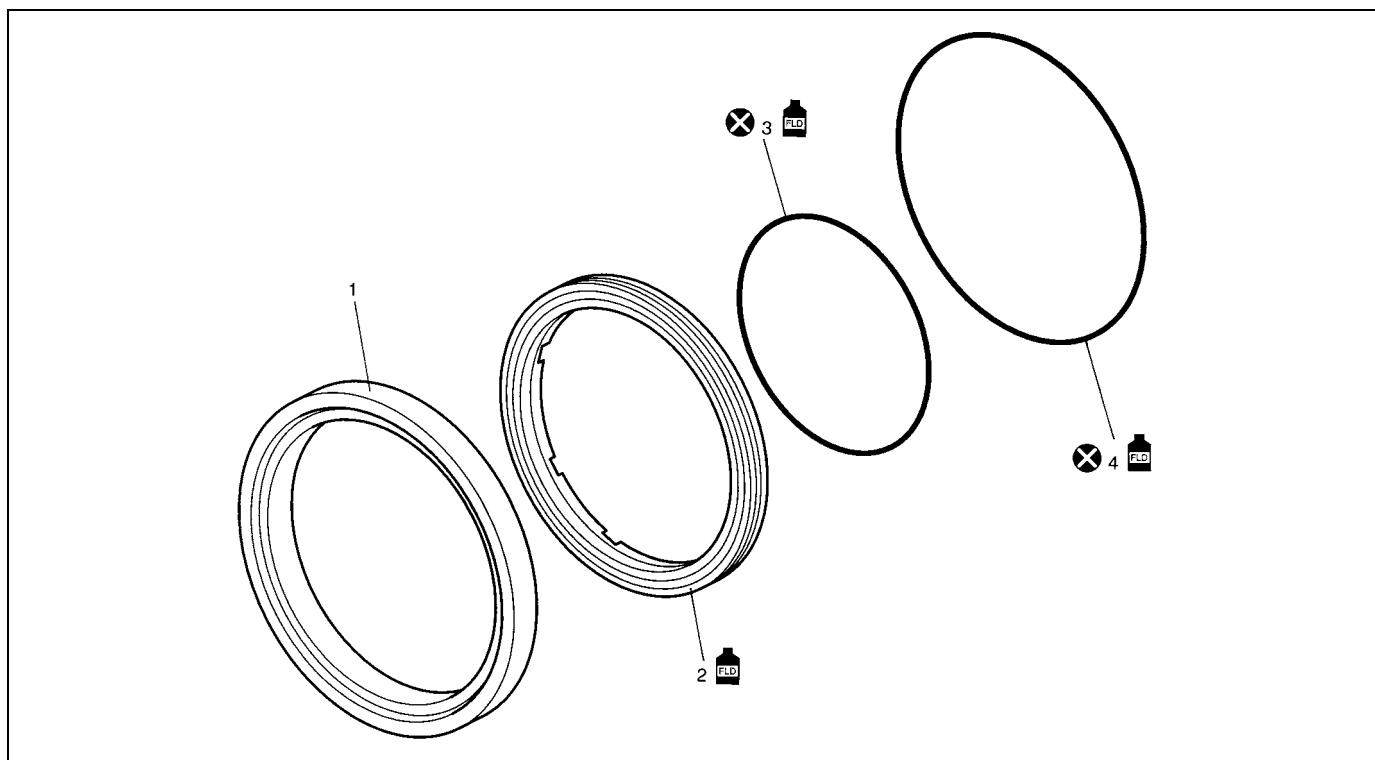
**Reverse clutch piston stroke: 1.20 – 1.60 mm (0.047 – 0.063 in.)**



When piston stroke is out of specification, select reverse clutch retaining plate with proper thickness from among the list below and replace it.

**Available reverse clutch retaining plate thickness**

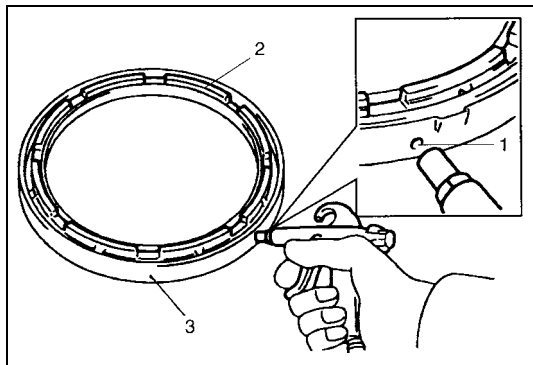
Thickness	Identification mark
3.0 mm (0.118 in.)	1
3.2 mm (0.126 in.)	2
3.4 mm (0.134 in.)	3
3.6 mm (0.142 in.)	4

## 2nd brake piston assembly

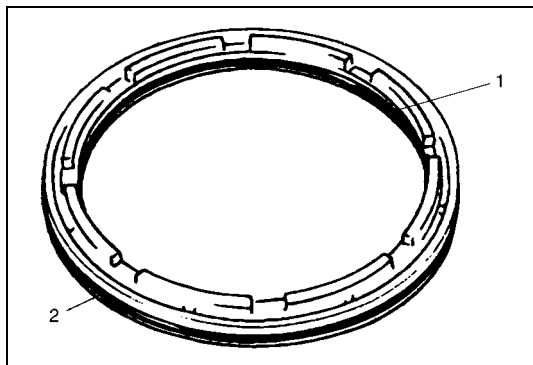


1. 2nd brake cylinder	4. Outer O-ring
2. 2nd brake piston	 Apply automatic transaxle fluid.
3. Inner O-ring	 Do not reuse.

### Disassembly



- 1) Apply compressed air (400 – 800 kPa, 4 – 8 kg/cm<sup>2</sup>, 57 – 113 psi) to oil hole (1) of 2nd brake cylinder (3) to remove 2nd brake piston (2).

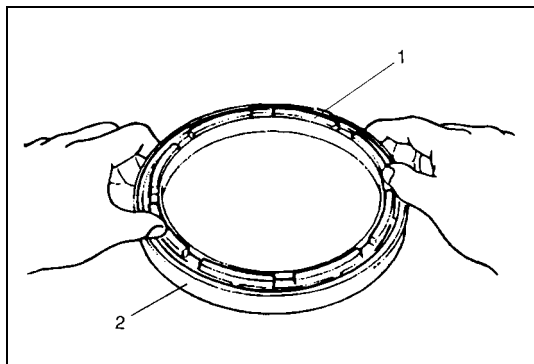


- 2) Remove inner O-ring (1) and outer O-ring (2).

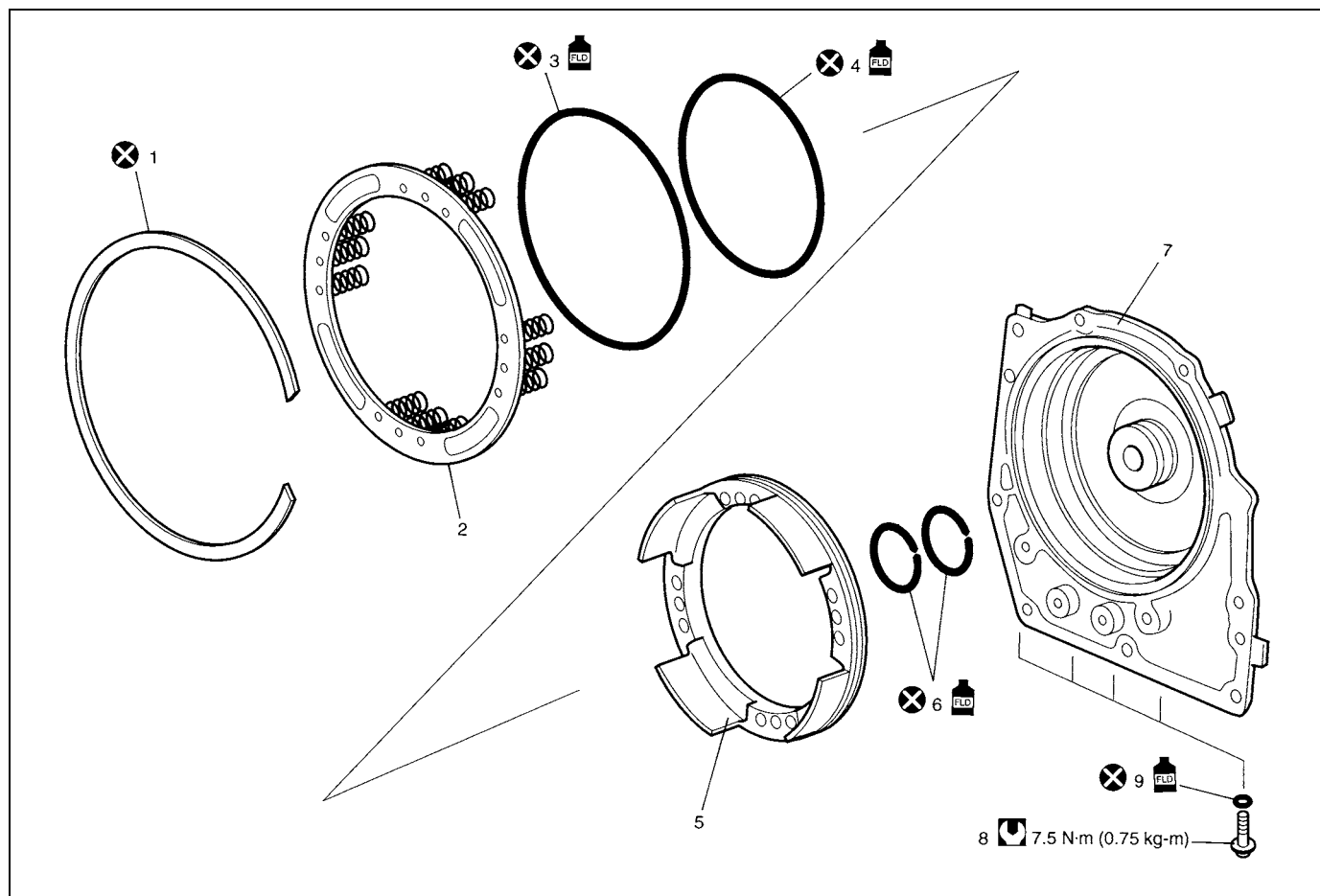
### Assembly

Reverse disassembly procedure for assembly, noting the following points.

- Use new O-rings. Apply A/T fluid to the O-rings, before installation.
- Install 2nd brake piston (1) to which A/T fluid is applied to 2nd brake cylinder (2).  
Do not damage O-ring when installing 2nd brake piston.

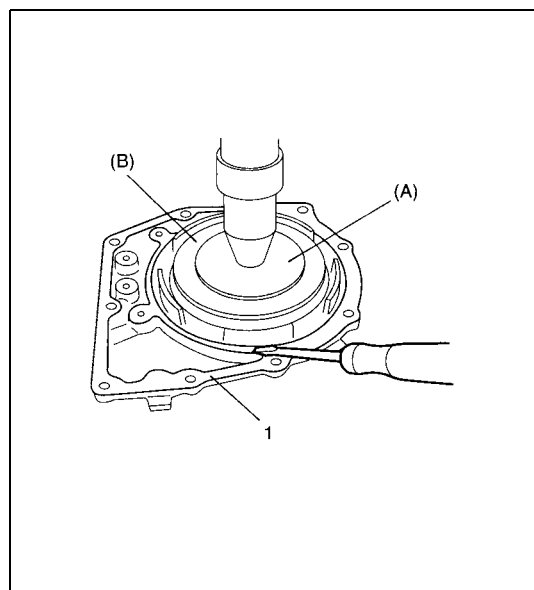


## Transaxle rear cover assembly (O/D and 2nd coast brake piston)



1. Snap ring	7. Transaxle rear cover
2. O/D and 2nd coast brake return spring subassembly	8. Rear cover plug
3. O/D and 2nd coast brake piston front O-ring	9. Rear cover plug O-ring
4. O/D and 2nd coast brake piston rear O-ring	Apply automatic transaxle fluid.
5. O/D and 2nd coast brake piston	Do not reuse.
6. Rear cover seal ring	Tightening torque

### Disassembly



- 1) Remove snap ring by using special tools and hydraulic press.

#### CAUTION:

**Do not press O/D and 2nd coast brake return spring sub-assembly in over 1.0 mm (0.039 in.).**

**Excessive compression may cause damage to O/D and 2nd coast brake return spring subassembly and/or piston.**

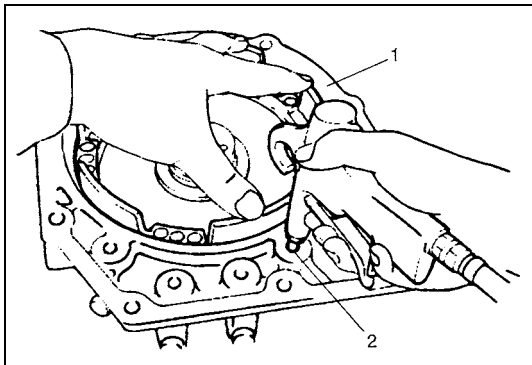
#### Special tool

(A): 09926-96030

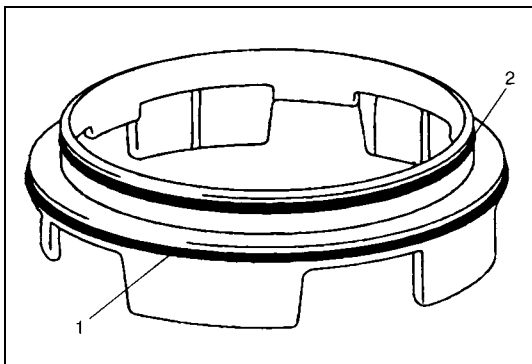
(B): 09946-06710

- 2) Remove O/D and 2nd coast brake return spring assembly.

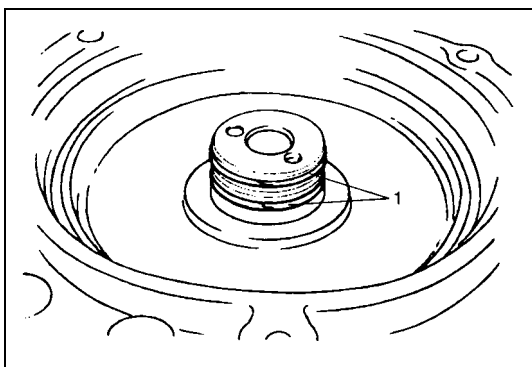
1. Transaxle rear cover



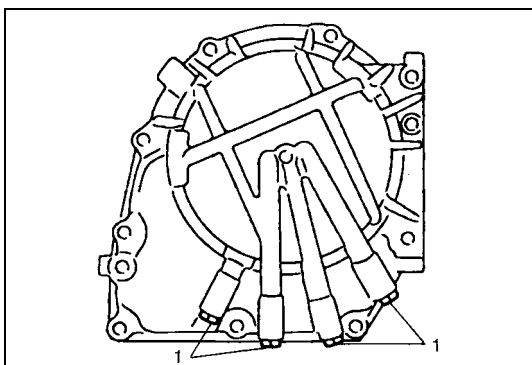
- 3) Apply compressed air (400 – 800 kPa, 4 – 8 kg/cm<sup>2</sup>, 57 – 113 psi) to oil hole (2) of transaxle rear cover (1) to remove O/D and 2nd coast brake piston.



- 4) Remove O/D and 2nd coast brake piston front O-ring (1) and rear O-ring (2).



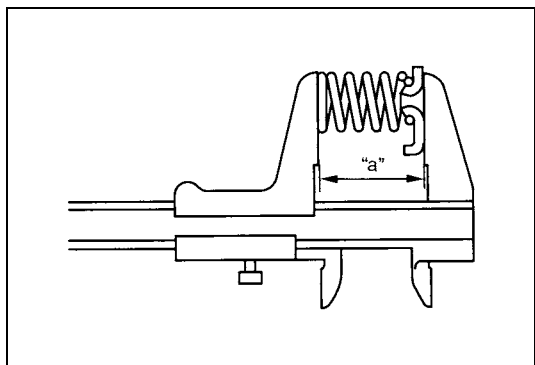
- 5) Remove rear cover seal rings (1).



- 6) Remove rear cover plugs (1).

## Inspection

### O/D and 2nd Coast Blake Return Spring Subassembly



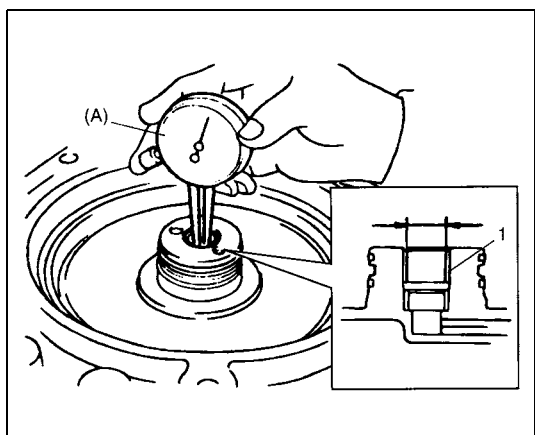
Measure free length of O/D and 2nd coast Blake return spring.

**Free length of O/D and 2nd coast Blake return spring**  
**"a": 18.99 mm (0.748 in.)**

#### NOTE:

- Do not apply excessive force when measuring spring free length.
- Perform measurement at several points.

### Transaxle Rear Cover Bush



- 7) Measure transaxle rear cover bush bore by using special tool.

#### Special tool

**(A): 09900-20605**

#### Transaxle rear cover bush bore

**Standard: 13.94 – 14.00 mm (0.549 – 0.551 in.)**

If measured transaxle rear cover bush bore is out of specifications, replace transaxle rear cover with new one. In replacement, intermediate shaft subassembly also needs to be checked. Replace intermediate shaft subassembly, if necessary.

## Assembly

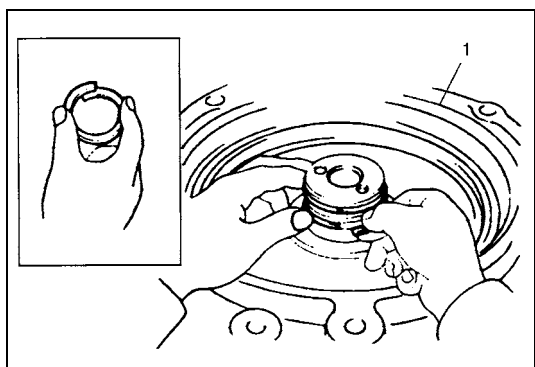
Reverse disassembly procedure for assembly, noting the following points.

- Use new seal rings and O-rings. Apply A/T fluid to seal rings and O-rings before installation.
- Tighten rear cover plugs to specified torque.

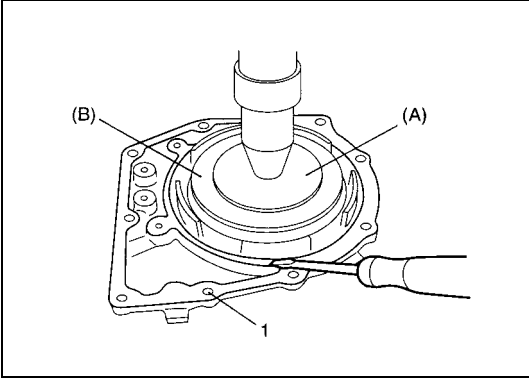
#### Tightening torque

**Rear cover plugs: 7.5 N·m (0.75 kg·m, 5.5 lb·ft)**

- Before installing rear cover seal ring, apply A/T fluid to ring. First, tighten seal ring to 5 mm (0.197 in.), then install seal ring.
- Do not open rear cover seal ring too wide to attach.



1. Transaxle rear cover

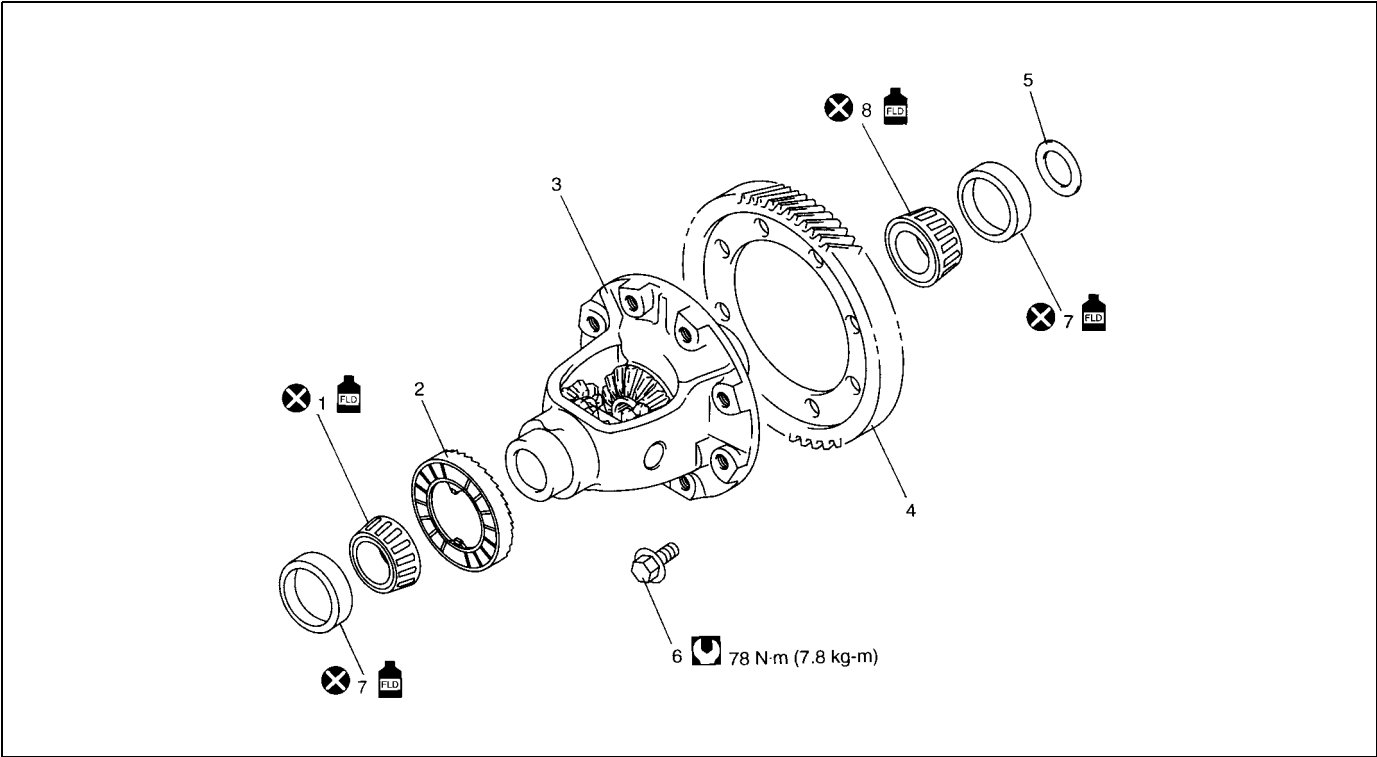





- Do not damage O/D and 2nd coast brake return spring sub-assembly and piston by pressing in O/D and 2nd coast brake return spring subassembly passing through its original installing position over 1.0 mm (0.039 in.).

**Special tool**  
**(A): 09926-96030**  
**(B): 09946-06710**

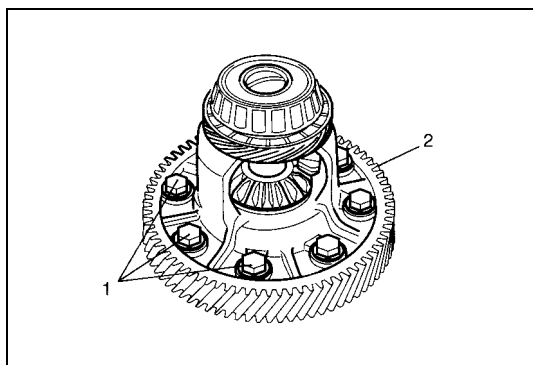
1. Transaxle rear cover

Differential Assembly

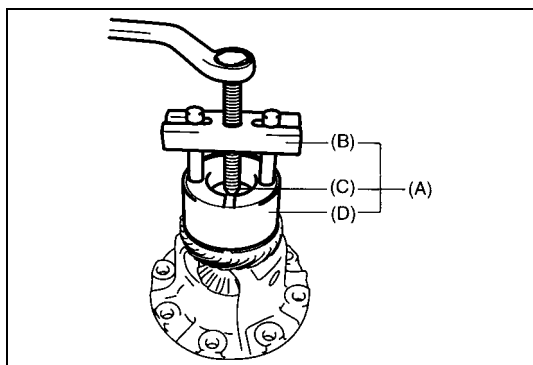


1. Differential side RH bearing	7. Side bearing cup
2. Output shaft speed sensor (VSS) drive gear	8. Differential side LH bearing
3. Differential case subassembly	 Apply automatic transaxle fluid.
4. Final gear	 Tightening torque
5. Side bearing shim	 Do not reuse.
6. Final gear bolt	

## Disassembly



- 1) Remove final gear bolts (1), and then final gear (2).



- 2) Remove differential side RH bearing by using special tools.

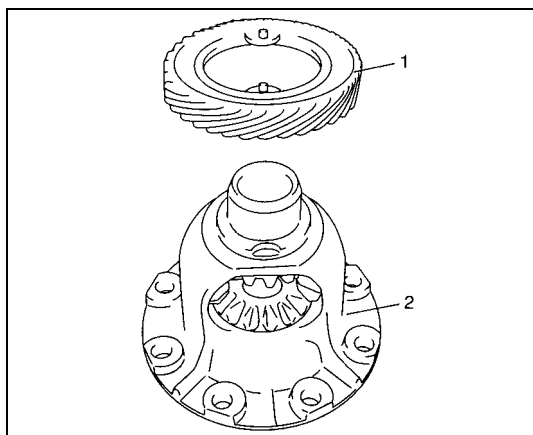
### Special tool

(A): 09926-37610

(B): 09926-37610-001

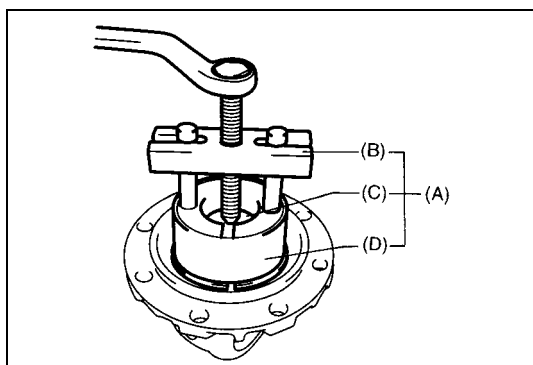
(C): 09926-37610-003

(D): 09926-47610-002



- 3) Remove output shaft speed sensor (VSS) drive gear (1).

2. Differential case subassembly



- 4) Remove differential side LH bearing by using special tools.

### Special tool

(A): 09926-37610

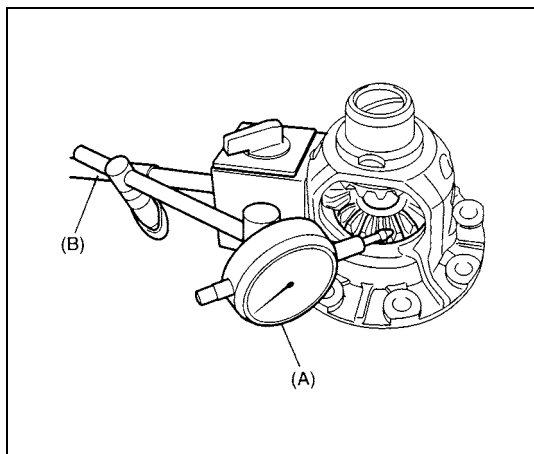
(B): 09926-37610-001

(C): 09926-37610-003

(D): 09926-37610-002



## Inspection



- 1) Hold differential case subassembly with soft jawed vice and set special tools as shown.

### Special tool

(A): 09900-20607

(B): 09900-20701

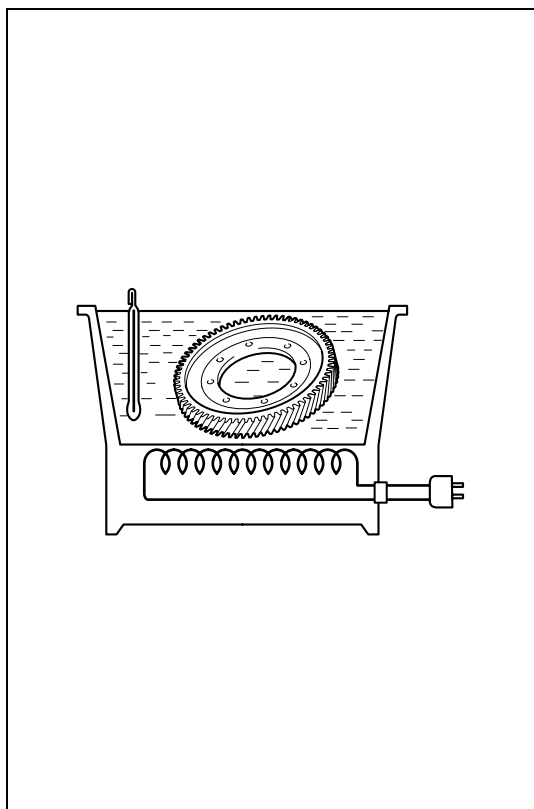
- 2) Measure differential gear thrust play.

### Differential gear thrust play:

0.05 – 0.20 mm (0.002 – 0.008 in.)

- 3) If thrust play is out of specification, replace differential case subassembly.

## Assembly



### WARNING:

- When taking warmed final driven gear out of vessel, use tongs or the like. Taking out it with bare hand will cause severe burn.
- While installing warmed final driven gear, use oven glove such as leather glove. Picking up it with bare hand may cause burn.

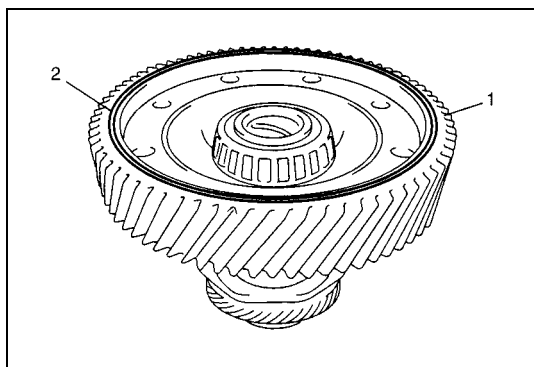
### CAUTION:

Do not leave final driven gear in boiling water for longer than 5 min. Overheating the gear may cause strength reduction of gear.

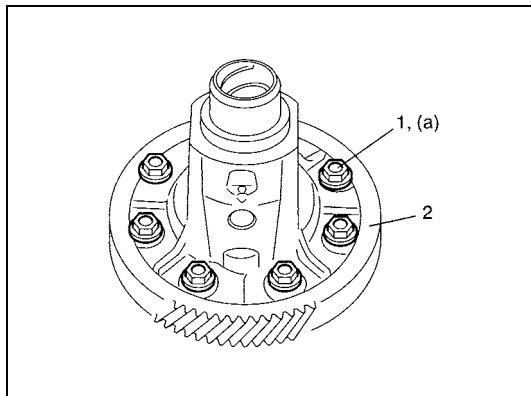
- 1) Put final driven gear in water vessel, heat and remove when it boils, then remove moisture.

### NOTE:

After removing moisture on final driven gear, install final driven gear to differential case as quickly as possible.



- 2) As shown in figure, facing groove (2) side upward, install final driven gear (1) to differential case.



3) Tighten final gear bolts (1) to specified torque.

#### **Tightening torque**

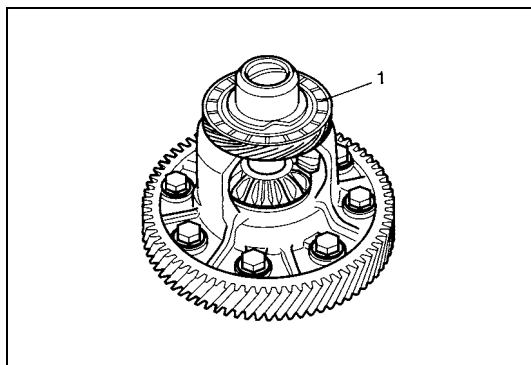
#### **Final gear bolts**

**(a): 78 N·m (7.8 kg-m, 56.5 lb-ft)**

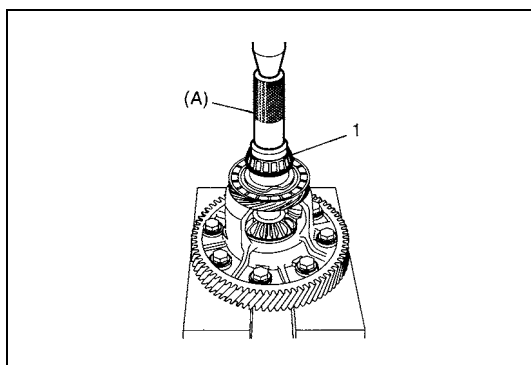
2. Final driven gear

#### **NOTE:**

- To avoid rust, apply A/T fluid to final driven gear after installation.



4) After applying A/T fluid to output shaft speed sensor (VSS) drive gear (1), install output shaft speed sensor drive gear.



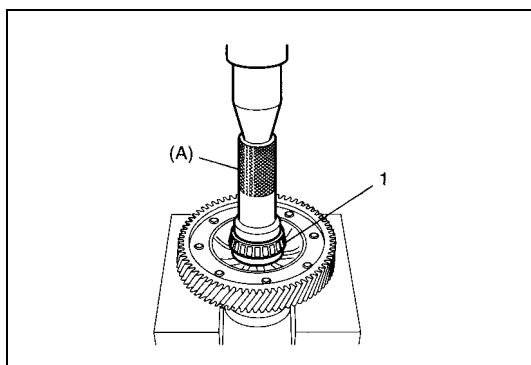
5) Install new differential side RH bearing (1) by using special tool and hydraulic press.

#### **Special tool**

**(A): 09913-70123**

#### **NOTE:**

**Replace differential side RH bearing together with bearing cup as a set.**



6) Install new differential side LH bearing (1) by using special tool and hydraulic press.

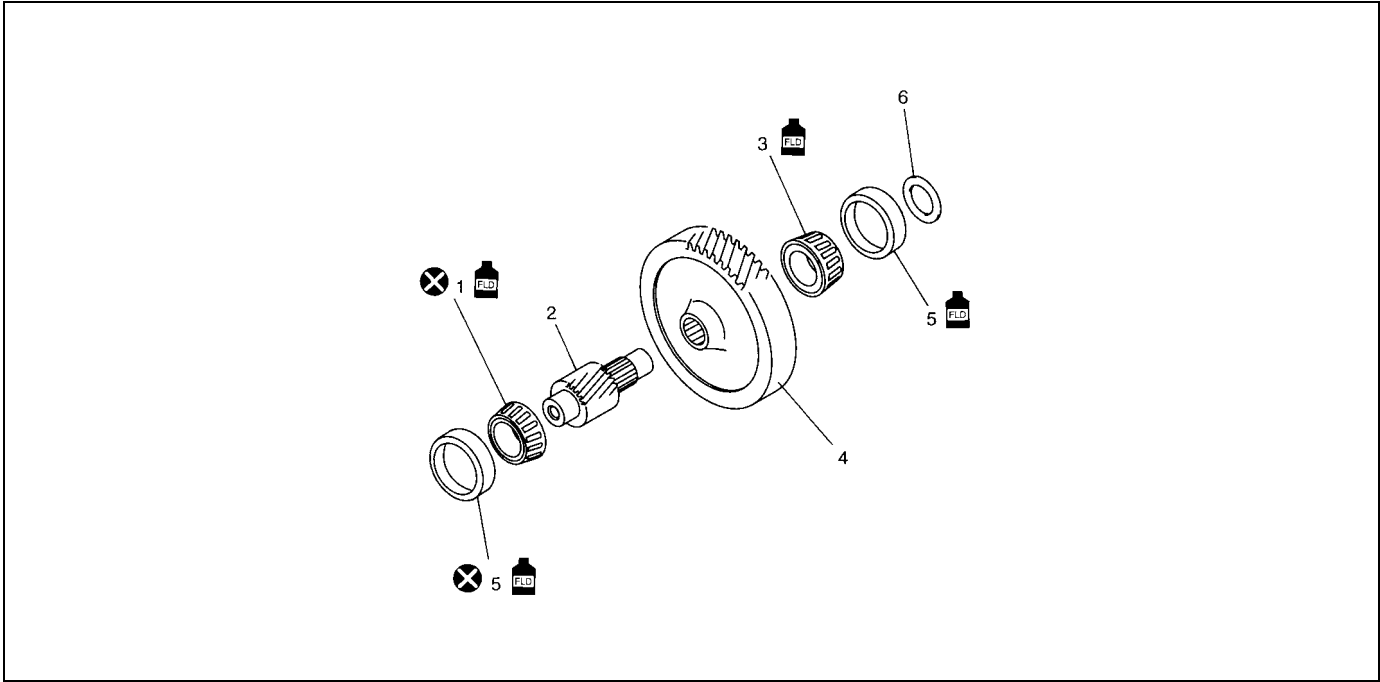
#### **Special tool**



**(A): 09913-70123**

#### **NOTE:**

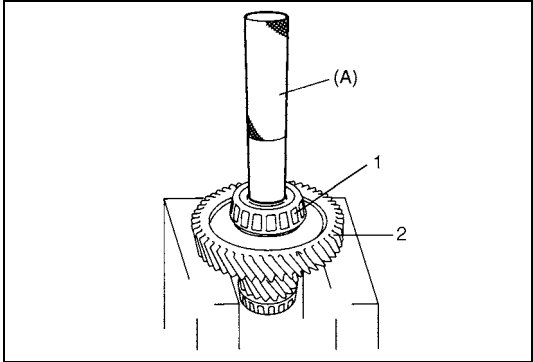
**Replace differential side LH bearing together with bearing cup as a set.**

Countershaft assembly



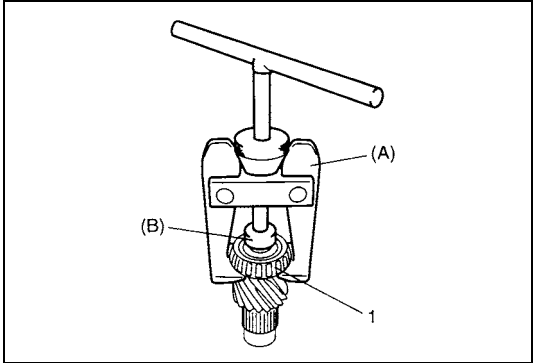
1. Countershaft RH bearing	5. Bearing cap
2. Countershaft	6. Countershaft bearing shim
3. Countershaft LH bearing	 Apply automatic transaxle fluid.
4. Reduction driven gear	 Do not reuse.

Disassembly



- 1) Remove countershaft LH bearing (1) and reduction driven gear (2) at once by using special tool and hydraulic press.

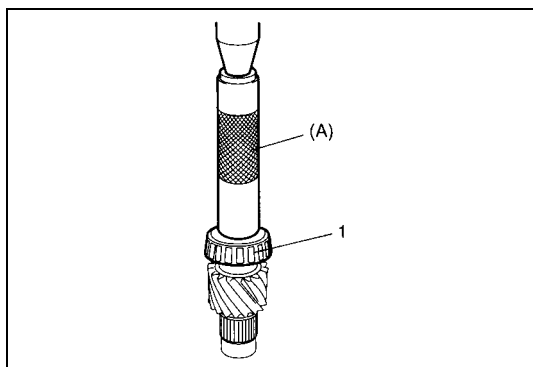
**Special tool**  
**(A): 09925-98221**



- 2) Remove countershaft RH bearing (1) by using special tools.

**Special tool**  
**(A): 09913-61510**  
**(B): 09926-58010**

## Assembly



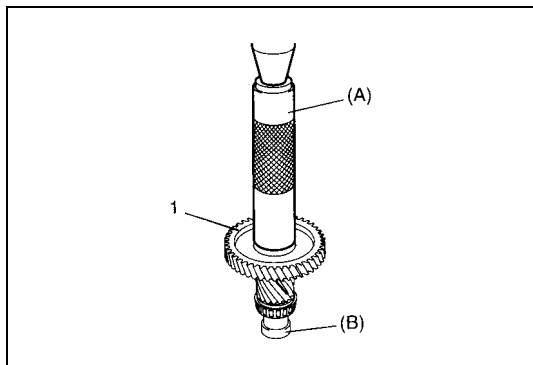
- 1) Install new countershaft RH bearing (1) by using special tool and hydraulic press.

### Special tool

(A): 09913-84510

### NOTE:

Replace countershaft RH bearing together with bearing cup as a set.

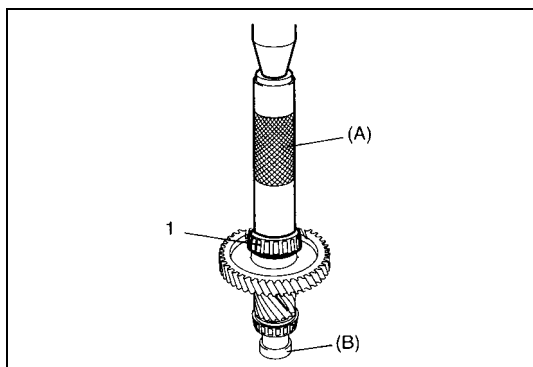


- 2) Install reduction driven gear (1) with special tools and hydraulic press.

### Special tool

(A): 09913-84510

(B): 09925-88210



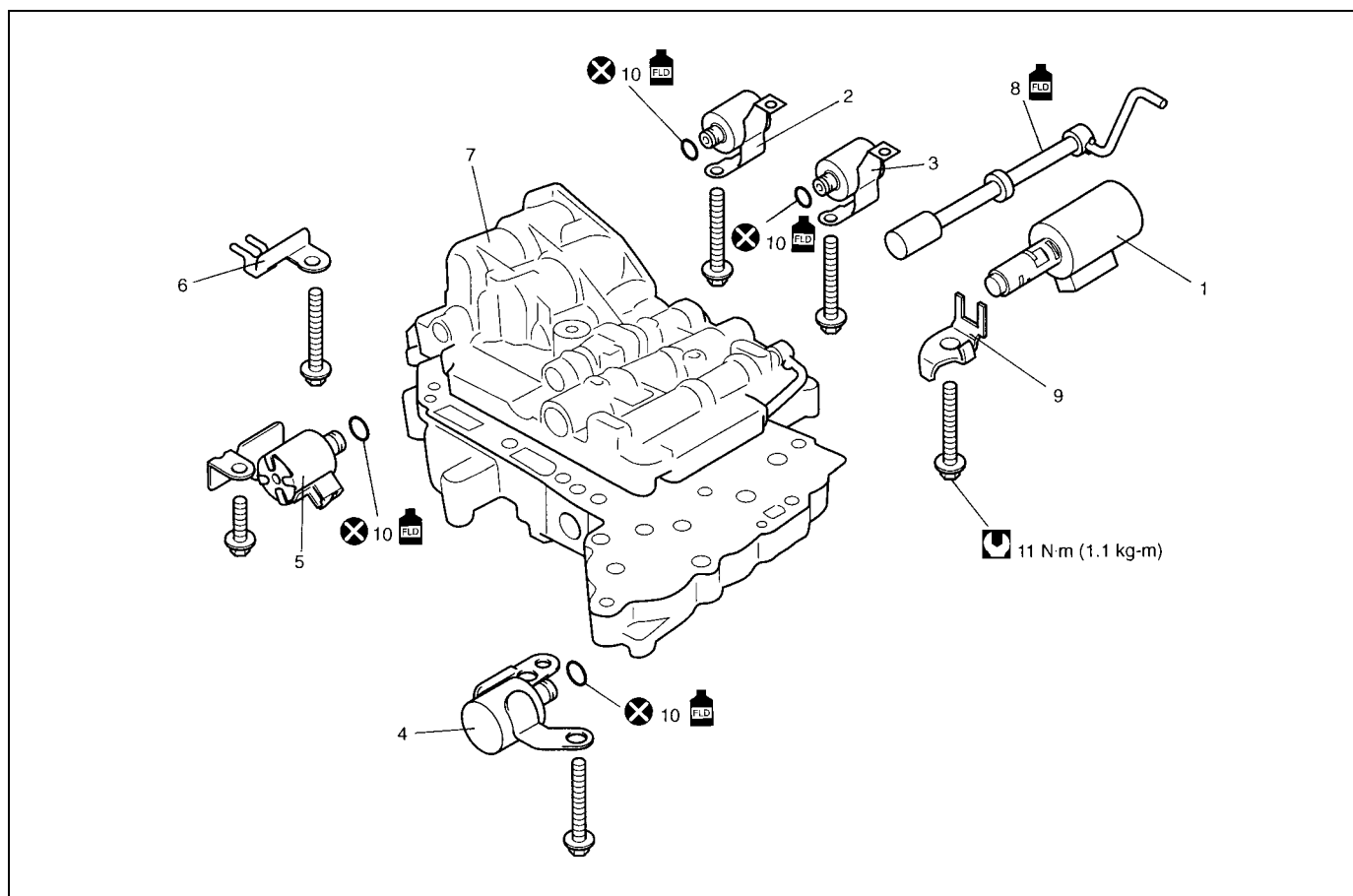
- 3) Install countershaft LH bearing (1) with special tools and hydraulic press.




### Special tool

(A): 09913-84510

(B): 09925-88210

## Valve body assembly

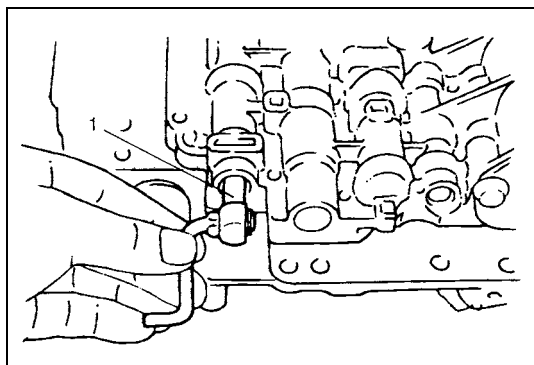


1. Pressure control solenoid valve	8. Manual valve
2. Shift solenoid valve-A (No.1)	9. Solenoid lock plate
3. Shift solenoid valve-B (No.2)	10. O-ring
4. TCC (Lock-up) solenoid valve	 Apply automatic transaxle fluid.
5. Timing solenoid valve	 Tightening torque
6. Temperature sensor clamp	 Do not reuse.
7. Valve body assembly	

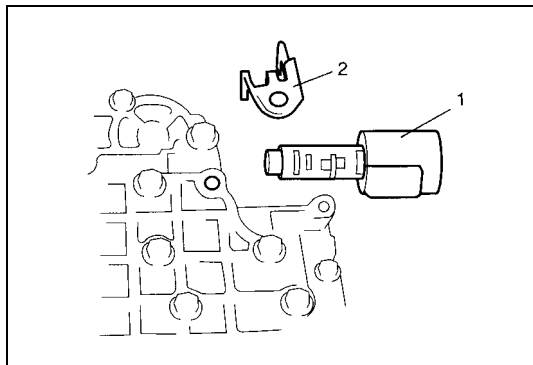
### CAUTION:

When replacing pressure control solenoid valve, it is strictly required to replace it together with valve body assembly as a set. Replacing pressure control solenoid independently may cause excessive shift shock.

### Disassembly

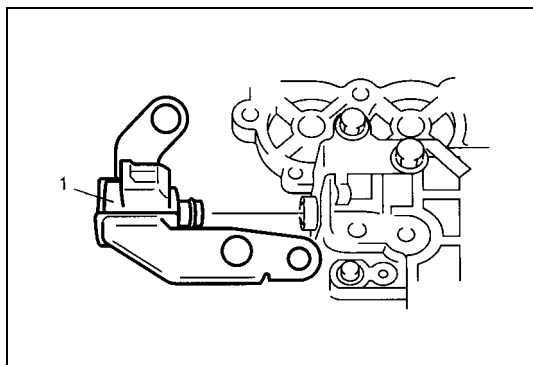


- 1) Pull out manual valve (1).

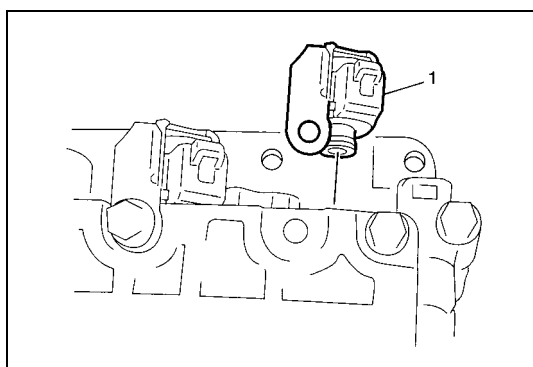


2) Remove pressure control solenoid valve (1).

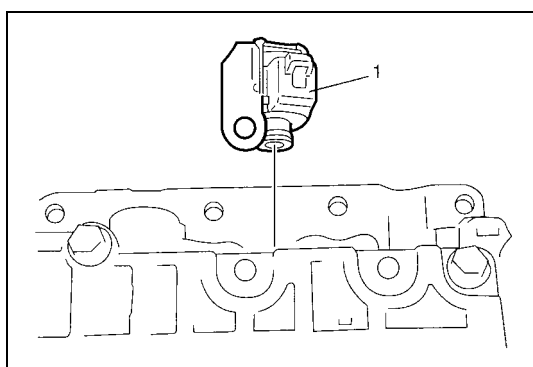
2. Solenoid lock plate



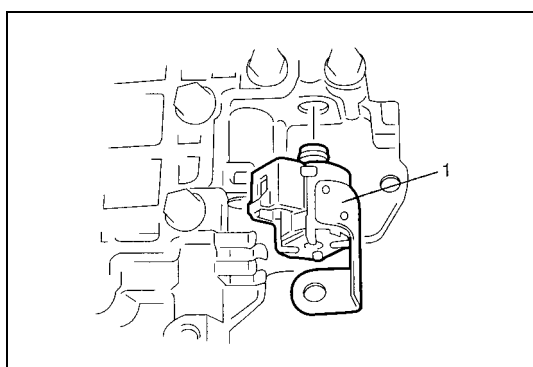
3) Remove TCC (Lock-up) solenoid valve (1).



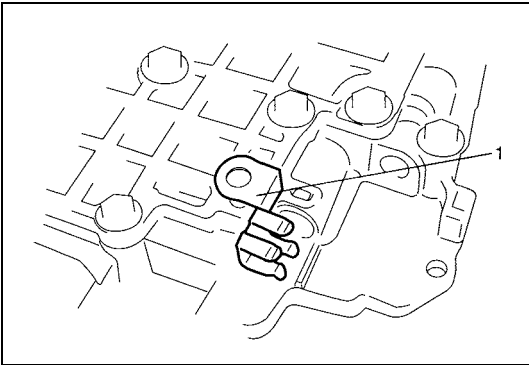
4) Remove shift solenoid valve-A (1).



5) Remove shift solenoid valve-B (1).



6) Remove timing solenoid valve (1).



7) Remove temperature sensor clamp (1).

**Assembly**

Reverse disassembly procedure for assembly, noting following points.

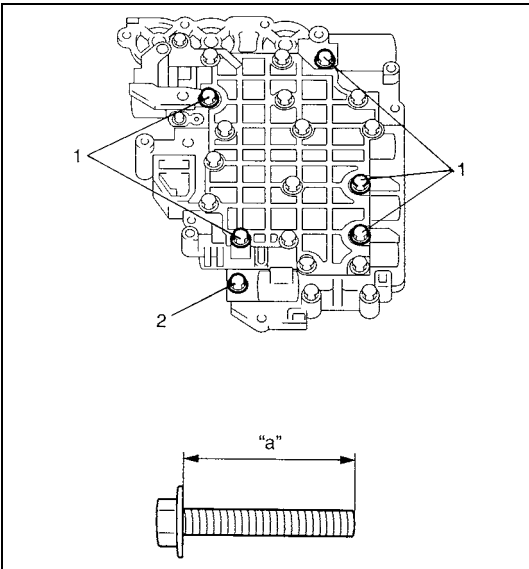
- Shift solenoid valve-A and -B are identical
- After applying A/T fluid to new O-rings, fit them to solenoid valves, then install solenoid valves to valve body.
- Tighten solenoid valve bolts to specified torque

**Tightening torque**

**Solenoid valve bolts**

(a): 11 N·m (1.1 kg-m, 8.0 lb-ft)

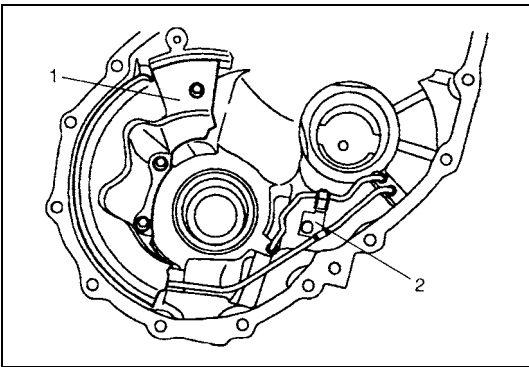
Bolt	Length “a”	Pieces
A (1)	49 mm (1.93 in.)	5
B (2)	20 mm (0.79 in.)	1

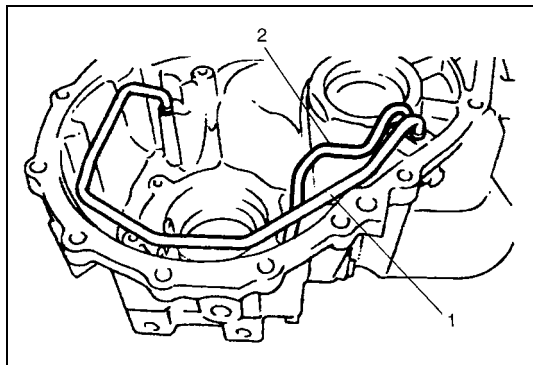


**Torque converter housing**

**Disassembly**

- 1) Remove fluid reservoir RH plate (1) and lubrication tube clamp (2).

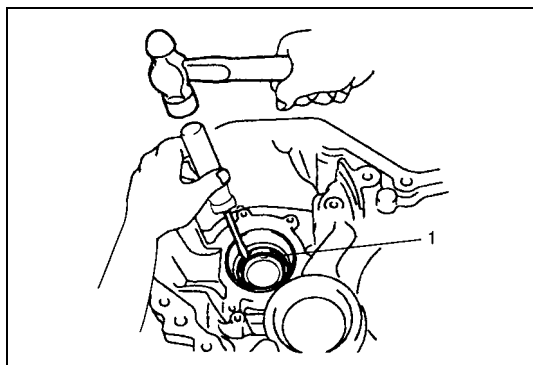




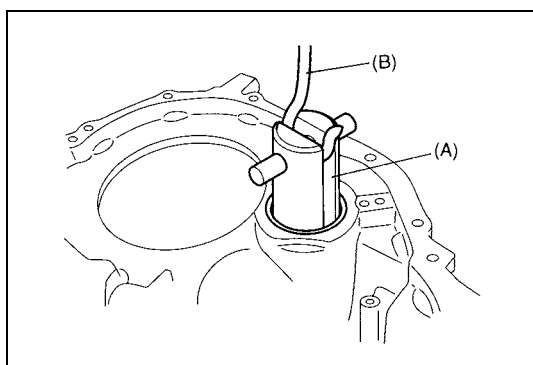
2) Remove lubrication LH tube (1) and RH tube (2).

**NOTE:**

**Do not bend lubrication tube with excessive force.**



3) Remove differential side oil seal (1).

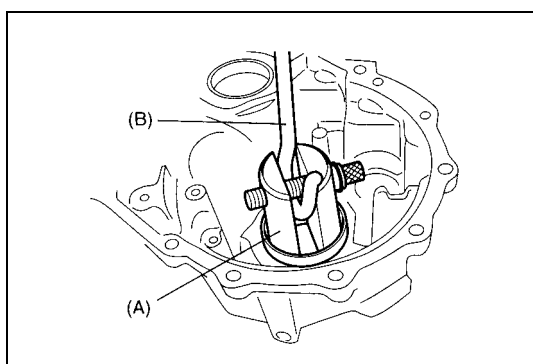


4) Remove countershaft RH bearing cup by using special tools.

**Special tool**

**(A): 09944-96011**

**(B): 09942-15511**

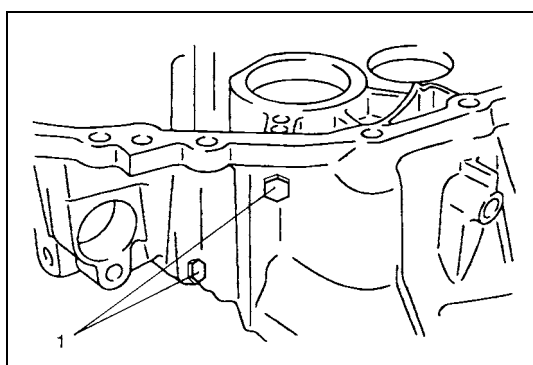


5) Remove differential side RH bearing cup by using special tools.

**Special tool**

**(A): 09944-96011**

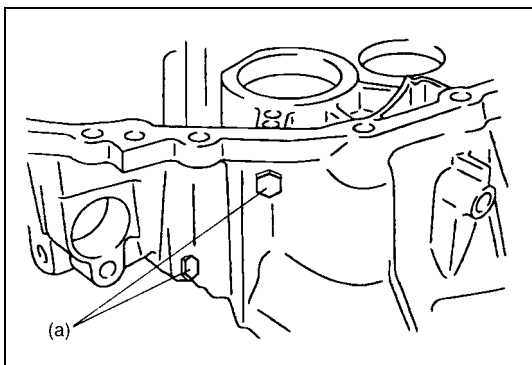
**(B): 09942-15511**



6) Remove torque converter case plugs (1).



## Assembly

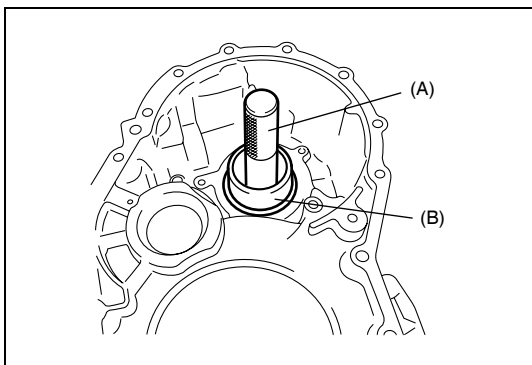


- 1) After applying A/T fluid to new O-rings, fit them to housing plugs. Finally install plugs to torque converter housing.

### Tightening torque

#### Torque converter housing plugs

(a): 7.5 N·m (0.75 kg-m, 5.5 lb-ft)

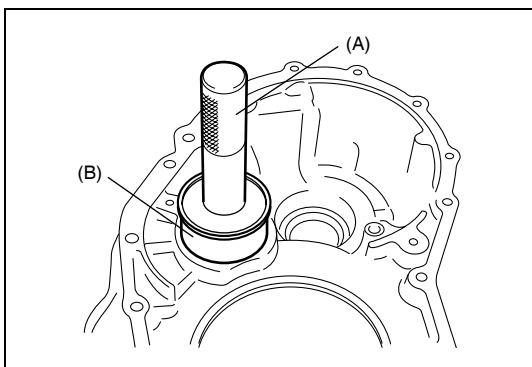


- 2) Using special tools, assemble differential side RH bearing cup.

### Special tool

(A): 09924-74510

(B): 09944-88220

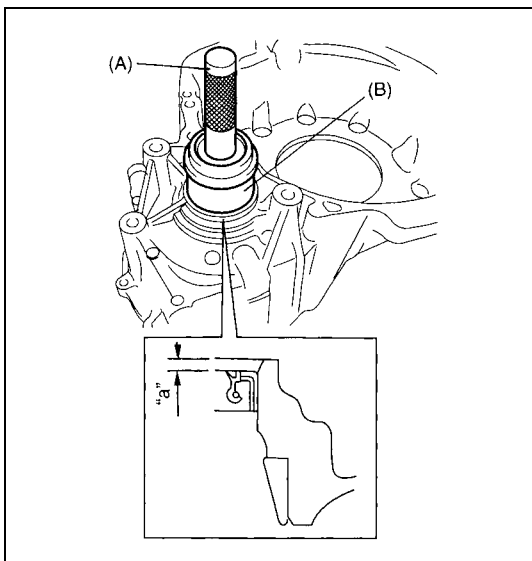


- 3) Using special tool, install countershaft RH bearing cup.

### Special tool

(A): 09924-74510

(B): 09944-88220



- a) Using special tools, install new differential side oil seal to torque converter housing.

### Special tool

(A): 09924-74510

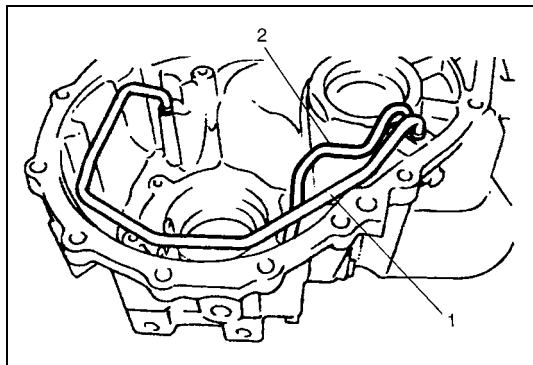
(B): 09944-88220

### Differential side oil seal installing depth

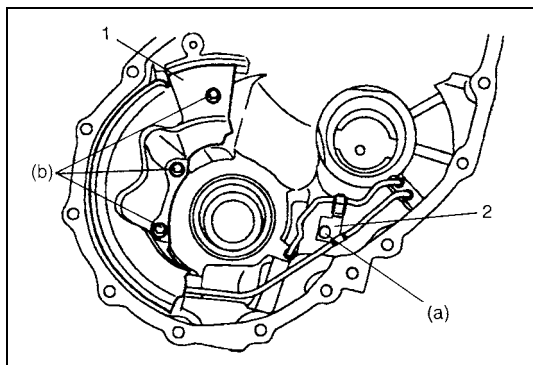
“a”: 2.6 – 3.6 mm (0.10 – 0.14 in.)

- 4) Apply grease to oil seal lip.

**Grease 99000-25030**



5) Install lubrication LH tube (1) and RH tube (2).



6) Install fluid reservoir RH plate (1) and lubrication tube clamp (2).

#### **Tightening torque**

#### **Lubrication tube clamp bolt**

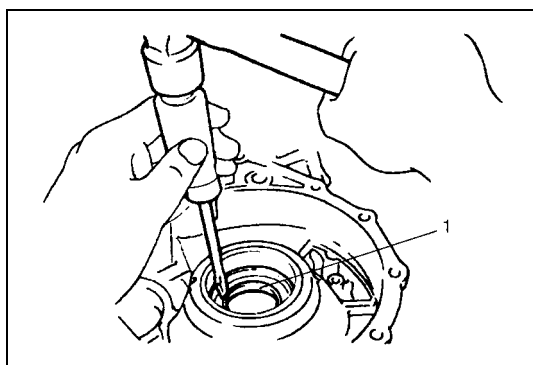
(a): 5.5 N·m (0.55 kg-m, 4.0 lb-ft)

#### **Fluid reservoir RH plate bolts**

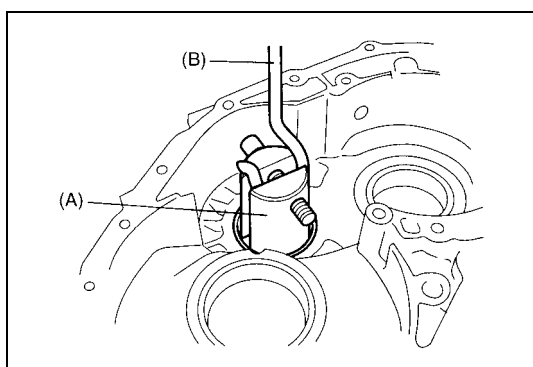
(b): 5.5 N·m (0.55 kg-m, 4.0 lb-ft)

### **Transaxle case**

#### **Disassembly**



1) Remove differential side oil seal (1).

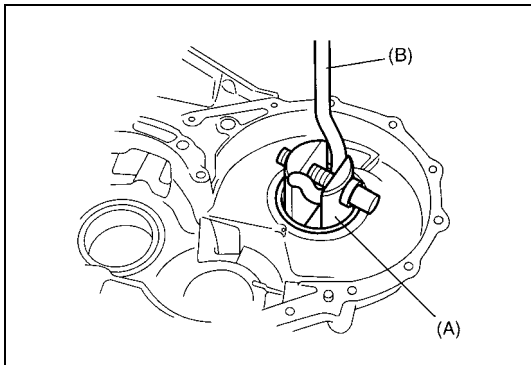


2) Remove countershaft LH bearing cup and shim with special tools.

#### **Special tool**

(A): 09944-96011

(B): 09942-15511



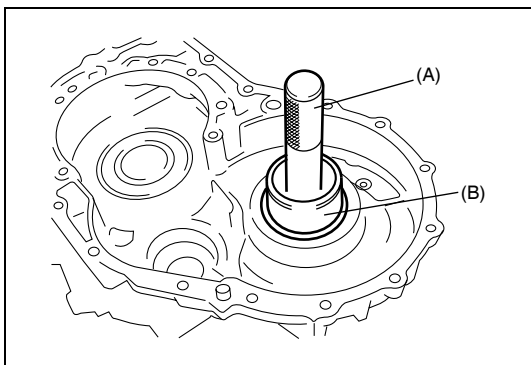
- 3) Remove differential side LH bearing cup and shim with special tools.

**Special tool**

(A): 09944-96011

(B): 09942-15511

**Assembly**



- 1) Using special tools, assemble shim and differential side LH bearing cup.

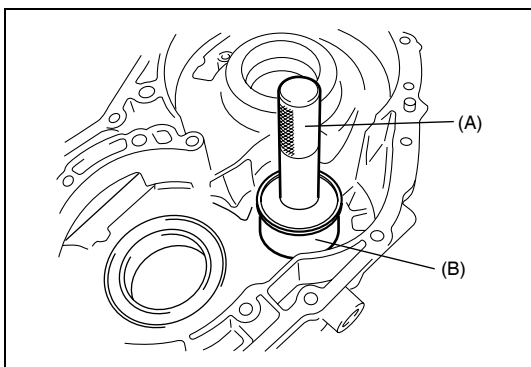
**Special tool**

(A): 09924-74510

(B): 09944-88220

**NOTE:**

Use shim with same thickness as the removed one.



- 2) Using special tools, assemble shim and countershaft LH bearing cup.

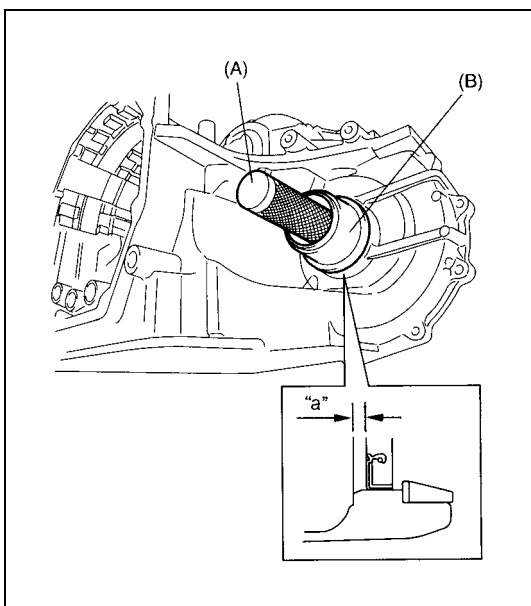
**Special tool**

(A): 09924-74510

(B): 09944-88220

**NOTE:**

Use shim with same thickness as the removed one.



- 3) Install new differential side oil seal to transaxle case by using special tools.

**Special tool**

(A): 09924-74510

(B): 09944-88220

**Differential side oil seal installing depth**

"a": 3.8 – 4.8 mm (0.15 – 0.19 in.)

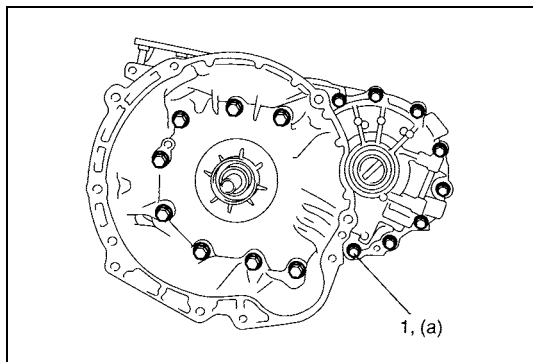
- 4) Apply grease to oil seal lip.

**Grease 99000-25030**

## Adjustment before unit assembly

### Differential Side Bearing Preload

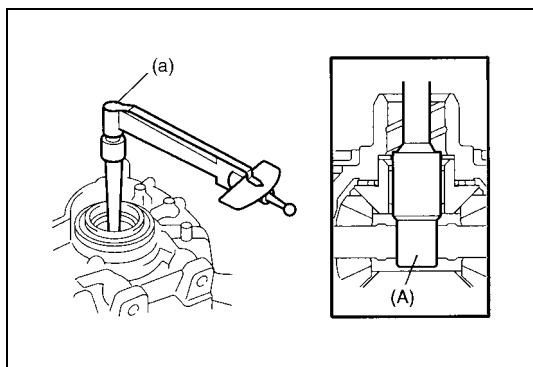
- 1) After applying A/T fluid to differential assembly, fit it to transaxle case.
- 2) Install torque converter housing to transaxle case, then tighten bolts (1) to specified torque.



#### Tightening torque

##### Torque converter housing bolts

(a): 33 N·m (3.3 kg-m, 24.0 lb-ft)



- 3) Measure bearing preload (a) by using a special tool.

#### Special tool

(A): 09928-06050

#### Differential side bearing preload (starting torque)

##### In the case of new bearing

(a): 0.8 – 1.4 N·m (8.0 – 14.0 kg-cm, 0.58 – 1.01 lb-ft)

##### In the case of reused bearing

(a): 0.4 – 0.7 N·m (4.0 – 7.0 kg-cm, 0.29 – 0.51 lb-ft)

- 4) If bearing preload is out of specification, select shim with suitable thickness from among the list below and replace it. Then adjust differential side bearing preload within specification.

## Available shim thickness

Thickness	Identification mark
1.80 mm (0.070 in.)	A
1.85 mm (0.072 in.)	B
1.90 mm (0.074 in.)	C
1.95 mm (0.076 in.)	D
2.00 mm (0.078 in.)	E
2.05 mm (0.080 in.)	F
2.08 mm (0.081 in.)	G
2.11 mm (0.083 in.)	H
2.14 mm (0.084 in.)	J
2.17 mm (0.085 in.)	K
2.20 mm (0.087 in.)	L
2.23 mm (0.088 in.)	M
2.26 mm (0.089 in.)	N
2.29 mm (0.090 in.)	P
2.32 mm (0.091 in.)	Q
2.35 mm (0.092 in.)	R
2.40 mm (0.094 in.)	S
2.45 mm (0.096 in.)	T
2.50 mm (0.098 in.)	U
2.55 mm (0.100 in.)	V
2.60 mm (0.102 in.)	W
2.65 mm (0.104 in.)	X
2.70 mm (0.106 in.)	Y

**NOTE:**

Record measured differential side bearing preload, because it is necessary to adjust counter shaft bearing preload.

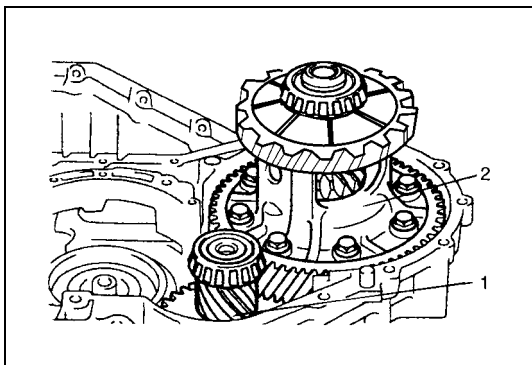
- 5) Remove differential assembly.

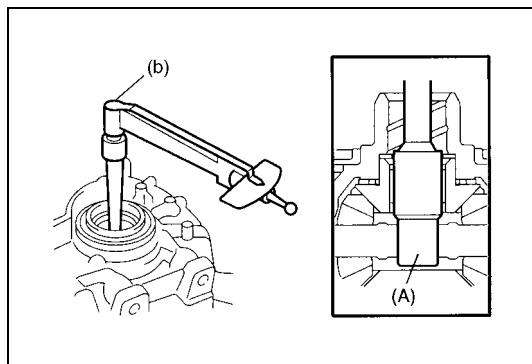
**Counter Shaft Bearing Preload**

- 1) After applying A/T fluid to countershaft assembly (1) and differential assembly (2), fit them.
- 2) Install torque converter housing to transaxle case, then tighten bolts to specified torque.

**Tightening torque**

**Torque converter housing bolts: 33 N·m (3.3 kg-m, 24 lb-ft)**





3) Measure bearing preload (b) by using special tool.

**Special tool**

**(A): 09928-06050**

Counter shaft bearing preload = (b) – Differential side bearing preload (a)

**Counter shaft bearing preload (Starting torque)**

**In the case of new bearing**

**0.33 – 0.76 N·m (3.3 – 7.6 kg-cm, 0.24 – 0.55 lb-ft)**

**In the case of reused bearing**

**0.17 – 0.38 N·m (1.7 – 3.8 kg-cm, 0.12 – 0.28 lb-ft)**

4) If bearing preload is out of specification, select shim with suitable thickness from among the list below and replace it. Then adjust countershaft bearing preload within specification.

**Available shim thickness**

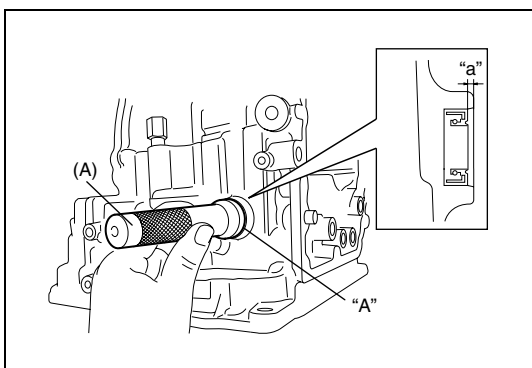
Thickness	Identification mark
1.70 (0.066 in.)	1
1.75 (0.068 in.)	2
1.80 (0.070 in.)	3
1.85 (0.072 in.)	4
1.90 (0.074 in.)	5
1.93 (0.075 in.)	6
1.96 (0.077 in.)	7
1.99 (0.078 in.)	A
2.02 (0.079 in.)	B
2.05 (0.080 in.)	C
2.08 (0.081 in.)	D
2.11 (0.083 in.)	E
2.14 (0.084 in.)	F
2.17 (0.085 in.)	G
2.20 (0.086 in.)	H
2.25 (0.088 in.)	K
2.30 (0.090 in.)	L
2.35 (0.092 in.)	M
2.40 (0.094 in.)	N
2.45 (0.096 in.)	P
2.50 (0.098 in.)	Q
2.55 (0.100 in.)	R
2.60 (0.102 in.)	S
2.65 (0.104 in.)	U
2.70 (0.106 in.)	W

5) Remove differential assembly and counter shaft assembly.

## Unit Assembly

### CAUTION:

- Automatic transaxle consists of highly precise parts. As even flaw in small part may cause oil leakage or decrease in function, check each part carefully before installation.
- Clean all parts with compressed air. Never use wiping cloths or rags.
- Before assembling new clutch or brake discs, soak them in automatic transaxle fluid for at least 2 hours.
- Be sure to use new gaskets and O-rings.
- Lubricate O-rings with automatic transaxle fluid.
- Apply automatic transaxle fluid on sliding or rotating surfaces of the parts before assembly.
- Use Suzuki Super Grease "C" to retain parts in place.
- Be sure to install thrust bearings and races in correct direction and position.
- Make sure that snap ring ends are not aligned with one of cutouts and are installed in groove correctly.
- Do not use adhesive cements on gaskets and similar parts.
- Be sure to torque each bolt and nut to specification.



- 1) Install new manual shift shaft oil seal to transaxle case.  
Use special tool and hammer to install it, and then apply grease to its lip.

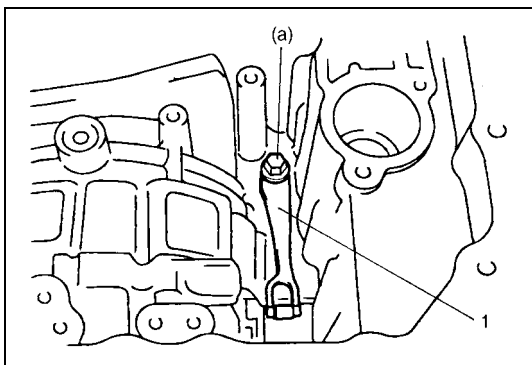
#### Special tool

(A): 09925-98210

"A": Grease 99000-25030

#### Manual shift shaft oil seal installing depth

"a": 0.75 – 1.25 mm (0.03 – 0.05 in.)

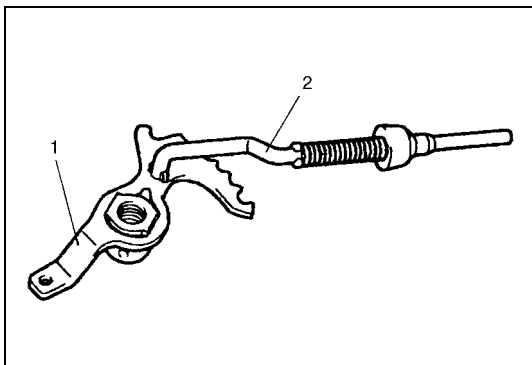


- 2) Install manual detent spring (1) to transaxle case and tighten manual detent spring bolt to specified torque.

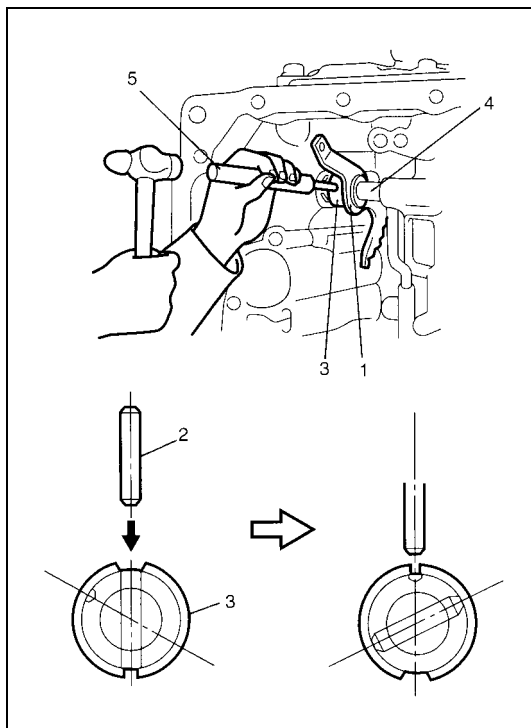
#### Tightening torque

#### Manual detent spring bolt

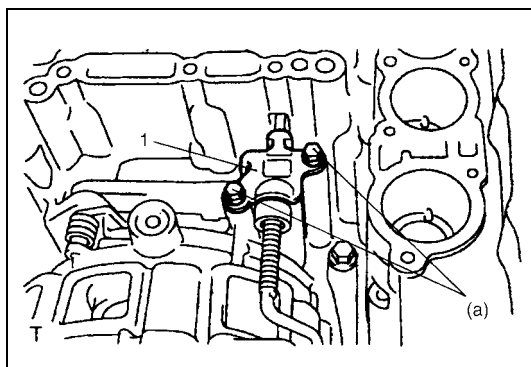
(a): 10 N·m (1.0 kg-m, 7.5 lb-ft)



- 3) Install parking lock pawl rod (2) to manual valve lever (1).



- 4) After applying A/T fluid to new manual valve lever (1), install new manual shift shaft (4), new spacer (3) and manual valve lever to transaxle case.
- 5) After installing manual valve lever pin (2) by using spring pin remover with 3 mm (0.12 in.) in diameter (5) and hammer, turn spacer to set the position as shown in the figure. Then calk spacer with a punch.

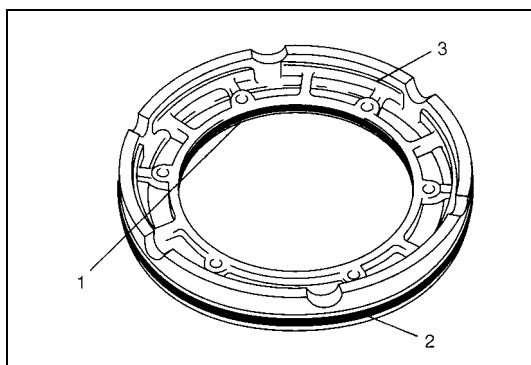


- 6) Install parking lock pawl bracket (1) to transaxle case.

#### **Tightening torque**

#### **Parking lock pawl bracket bolts**

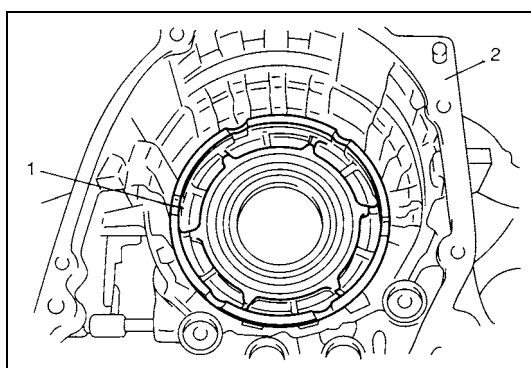
(a): 7.5 N·m (0.75 kg-m, 5.5 lb-ft)



- 7) After applying A/T fluid to new O-rings, install them to 1st and reverse brake piston (3).

1. Inner O-ring
-----------------

2. Outer O-ring
-----------------

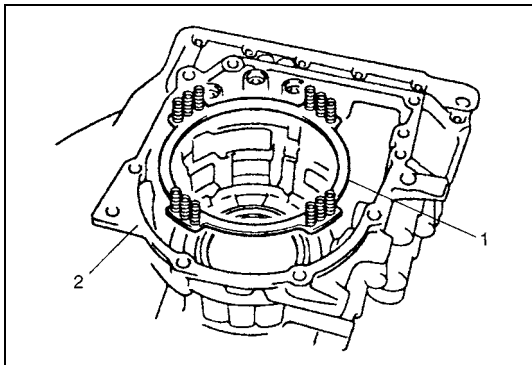


- 8) Install 1st and reverse brake piston (1) to transaxle case (2).

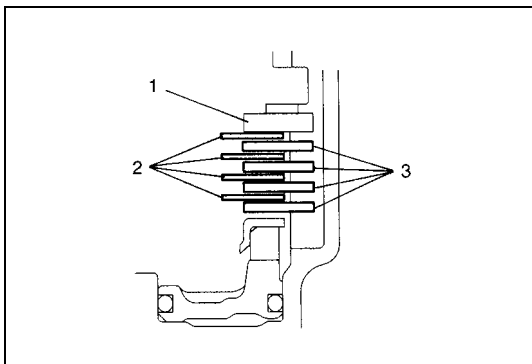
#### **NOTE:**

**Be careful not to damage O-ring when installing 1st and reverse brake piston.**

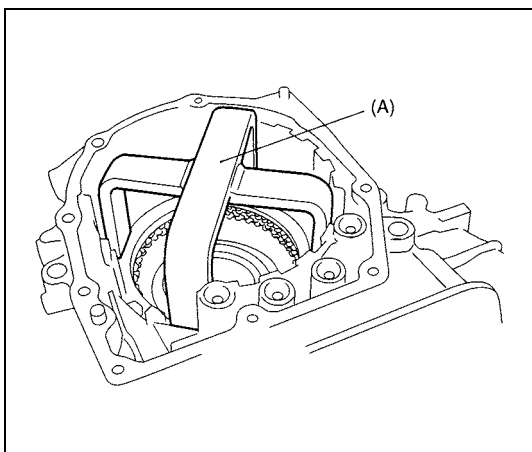




- 9) Install 1st and reverse brake return spring subassembly (1) to transaxle case (2).



- 10) Apply A/T fluid to 1st and reverse brake discs (2) separator plates (3) and retaining plate (1), then install them to transaxle case.



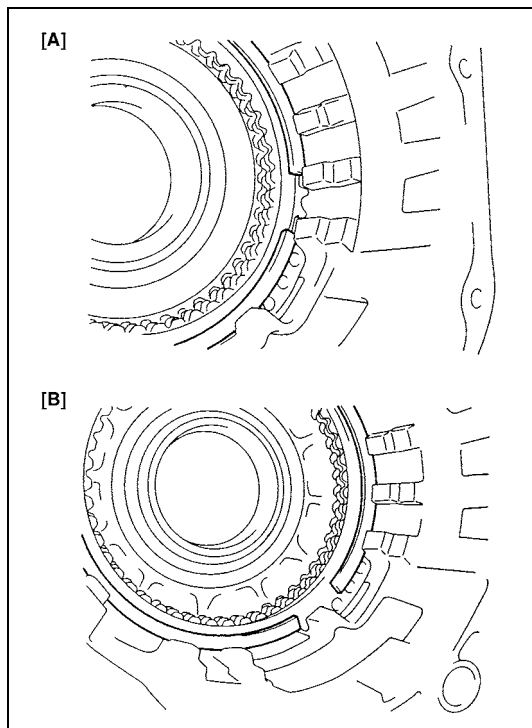
- 11) Compress 1st and reverse brake return spring using special tool and hydraulic press, then attach snap ring.

**CAUTION:**

**Do not damage 1st and reverse brake return spring subassembly discs, plates and piston by pressing in 1st and reverse brake return spring subassembly passing through its original installing position over 0.8 mm (0.031 in.)**

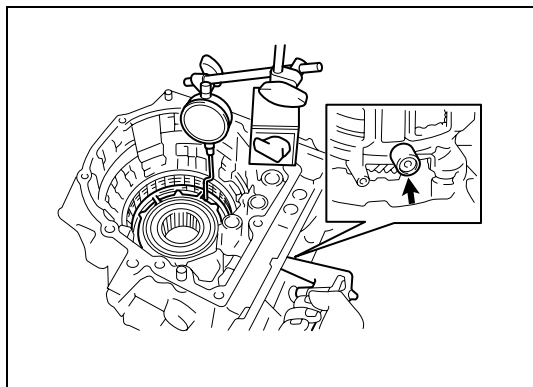
**Special tool**

**(A): 09926-97620**



- 12) Install 1st and reverse brake plate snap ring so that its both ends would be positioned in correct locations as shown in figure.

[A]	Correct
[B]	Incorrect



- 13) Using special tools, measure 1st and reverse brake piston stroke when compressed air (400 – 800 kPa, 4 – 8 kg/cm<sup>2</sup>, 57 – 113 psi) is blown through oil hole.

**Special tool**

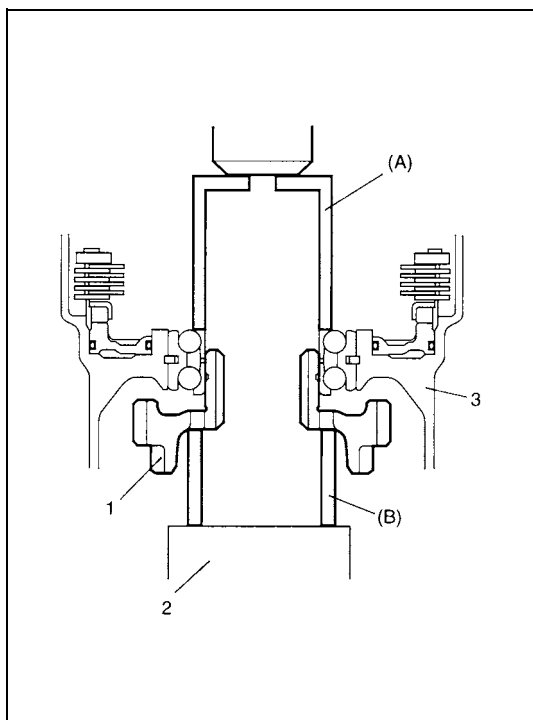
(A) 09900-20607

(B) 09900-20701

(C) 09952-06020

**1st and reverse brake piston stroke**

Standard: 0.791 – 1.489 mm (0.0311 – 0.0586 in.)



- 14) Install reduction drive gear (1) to transaxle case (3) by using special tools and hydraulic press.

**CAUTION:**

- Do not use transaxle case as groundwork to press fit reduction drive gear.
- Do not give load more than 20 kN (2000 kg, 4410 lb) with hydraulic press. Otherwise, it may result in damaging reduction drive gear bearing.

**Special tool**

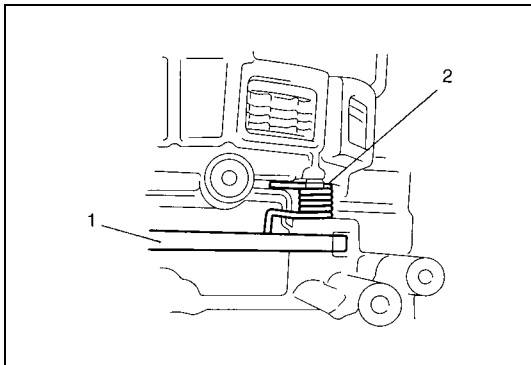
(A): 09951-18210

(B): 09944-78210

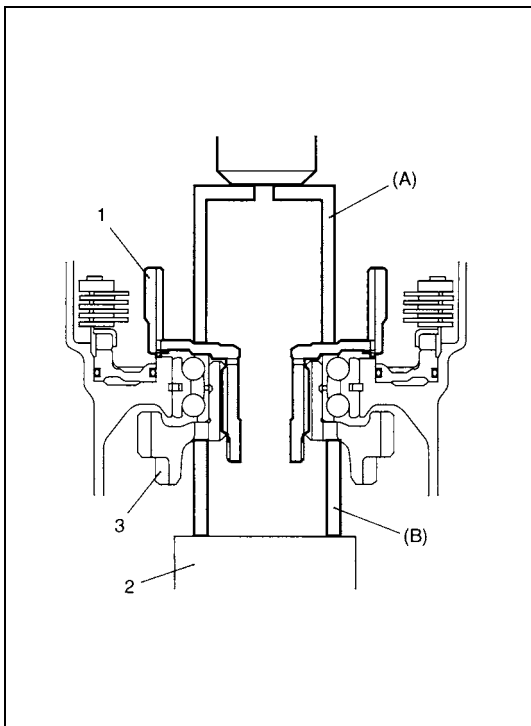
2. Stand that can slightly lift transaxle case.

**NOTE:**

When replacing reduction drive gear, replace it together with reduction driven gear as a set.



- 15) Install parking lock pawl (1) and spring (2). Apply A/T fluid to parking lock pawl shaft, then insert it into transaxle case.



- 16) Install new planetary ring gear subassembly (1) to reduction drive gear (3) by using special tools and hydraulic press.

**CAUTION:**

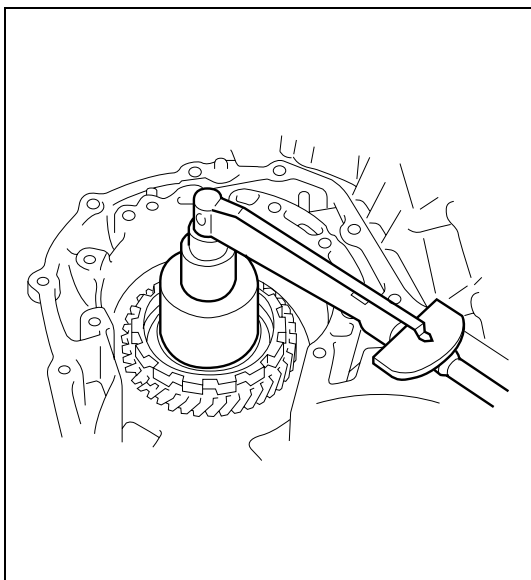
- Do not reuse planetary ring gear subassembly. Otherwise it may cause damage to planetary gear unit and/or reduction gears.
- Do not use transaxle case as groundwork to press fit planetary ring gear subassembly.
- Do not give load more than 20 kN (2000 kg, 4410 lb) with hydraulic press. Otherwise, it may result in damaging reduction drive gear bearing.

**Special tool**

(A): 09951-18210

(B): 09944-78210

2. Stand that can slightly lift transaxle case.



- 17) Tighten new reduction drive gear nut to planetary ring gear subassembly little by little until reduction drive gear bearing preload is within specification.

**CAUTION:**

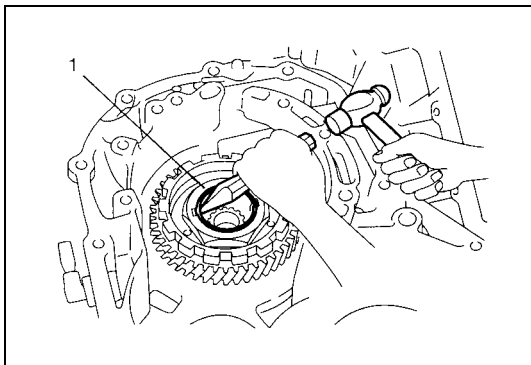
- Do not tighten nut over the specifications so that reduction drive gear nut would not be broken.
- Carry out this procedure on rubber mat in order not to damage transaxle case.

**Tightening torque**

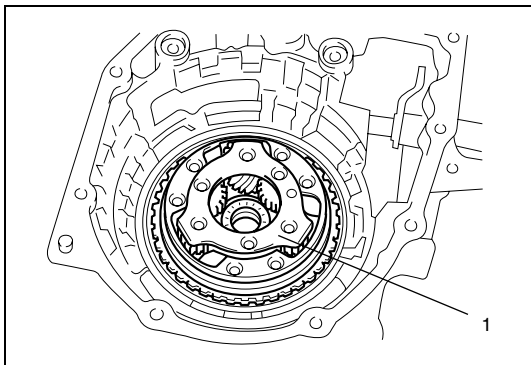
Reference: 100 N·m (10.0 kg-m, 72.5 lb-ft)

**Reduction drive gear bearing preload (turning torque)**

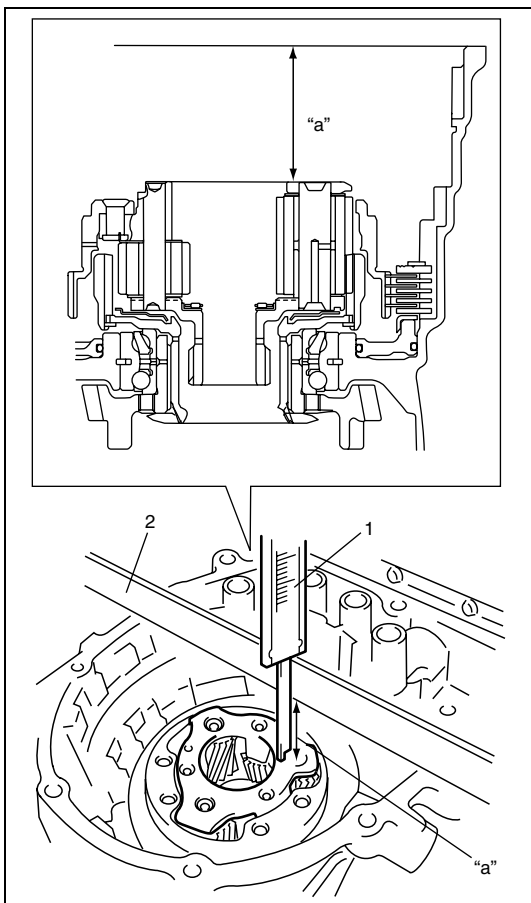
Standard: 0.05 – 0.35 N·m (0.5 – 3.5 kg-cm, 0.036 – 0.253 lb-ft)



18) Caulk reduction drive gear nut (1).



19) Apply A/T fluid to planetary gear assembly (1), then fit it to planetary ring gear assembly.

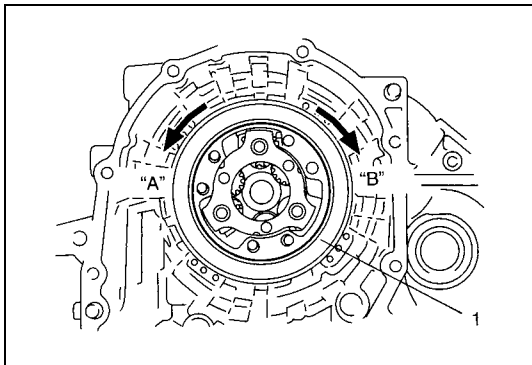


20) Check for correct installation of planetary gear assembly as follows.

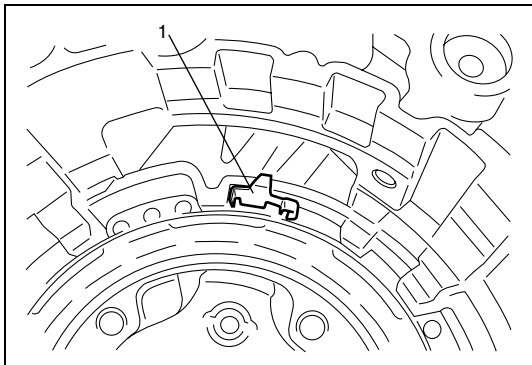
Measure the distance "a" by using micrometer caliper (1) and straightedge (2). If measured value is out of specification, remove planetary gear assembly and reinstall it properly.

**Distance between planetary gear assembly and mating surface of transaxle case**

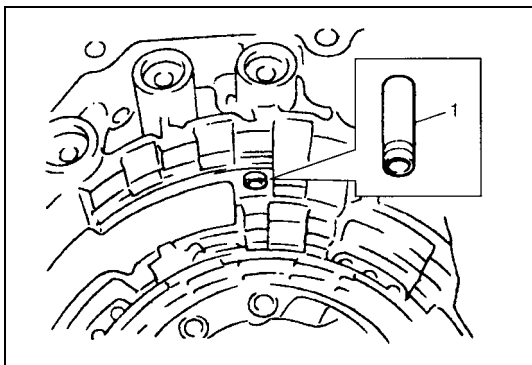
**"a": 51.3 – 52.0 mm (2.020 – 2.047 in.)**



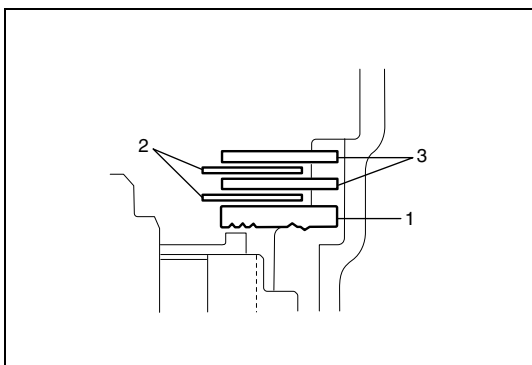
- 21) Apply A/T fluid to one-way clutch No.2 assembly (1), then install it to planetary gear assembly. After that, ensure that planetary carrier rotates only in counterclockwise direction "A", not in clockwise direction "B".



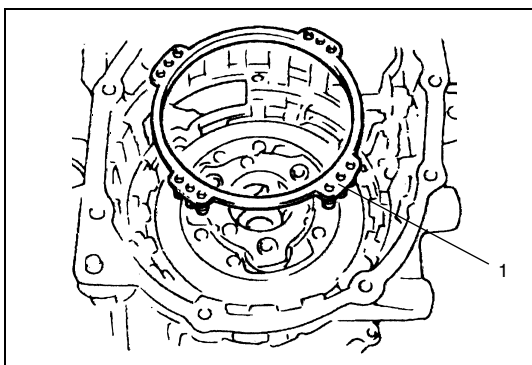
- 22) Install one-way clutch outer race retainer (1).



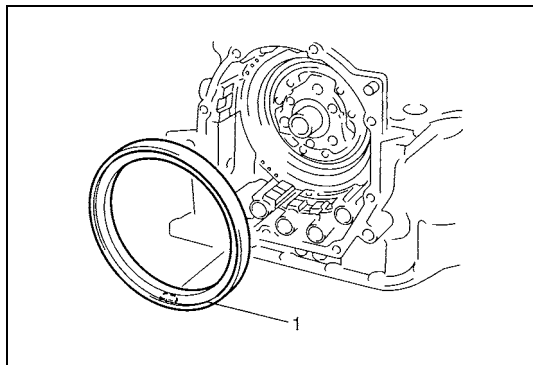
- 23) Apply A/T fluid to new brake drum gasket (1), then install it to transaxle case.



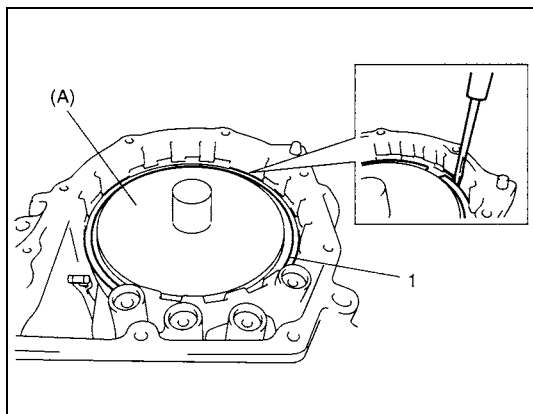
- 24) Apply A/T fluid to 2nd brake retaining plate (1), discs (2) and separator plates (3), then install them to transaxle case.



- 25) Install 2nd brake return spring subassembly (1) to transaxle case.



- 26) Apply A/T fluid to 2nd brake piston assembly (1), and align the projection of 2nd brake piston assembly with the groove of transaxle case, then put together.



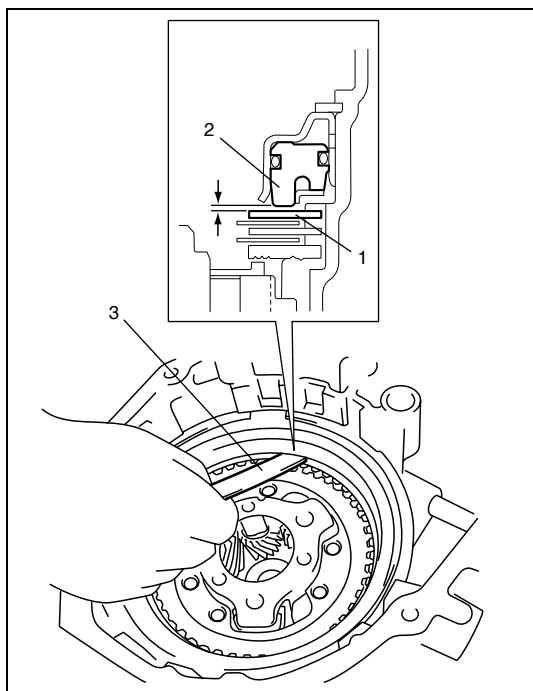
- 27) Install 2nd brake piston snap ring (1) by using special tool and hydraulic press.

**CAUTION:**

**Do not damage 2nd brake piston assembly, return spring subassembly, plates and discs by pressing in 2nd brake assembly passing through its original installing position over 0.4 mm (0.016 in.).**

**Special tool**

**(A): 09926-96050**

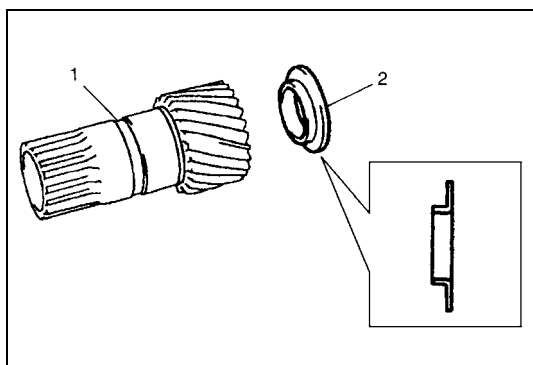


- 28) Check 2nd brake piston stroke by measuring clearance between 2nd brake separator plate (1) and piston (2) with feeler gauge (3).

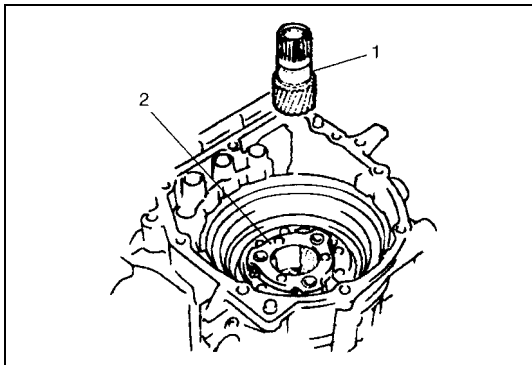
If clearance (piston stroke) is out of specification replace clutch discs and plates with new ones.

**2nd brake piston stroke**

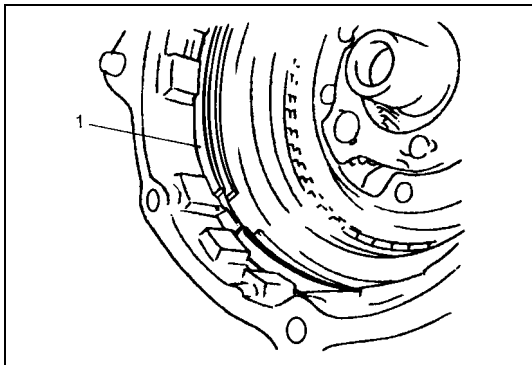
**Standard: 0.40 – 1.25 mm (0.016 – 0.049 in.)**



- 29) After applying A/T fluid to front sun gear thrust bearing race (2), install it to front planetary sun gear (1).



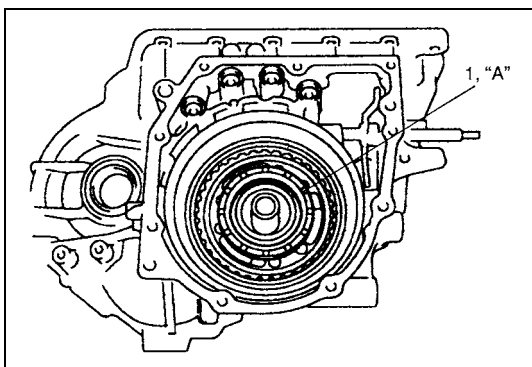
- 30) Apply A/T fluid to front planetary sun gear (1) and install it to planetary gear assembly (2).



- 31) Install O/D and 2nd coast brake retaining plate snap ring (1).

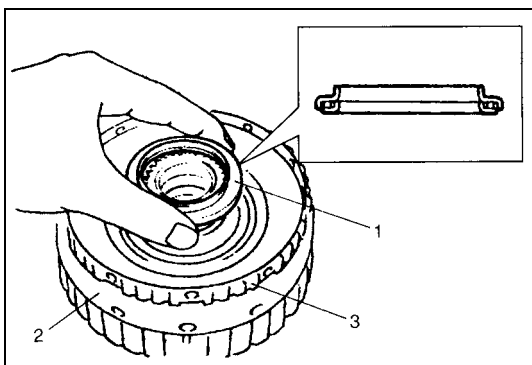
**CAUTION:**

**Be sure to install O/D and 2nd coast brake retaining plate snap ring correctly in groove of transaxle case.**



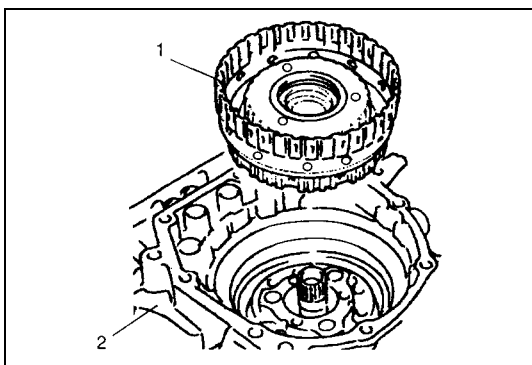
- 32) After applying grease to slide contact face of planetary carrier thrust washer (1), install it to planetary gear assembly.

**"A": Grease 99000-25030**

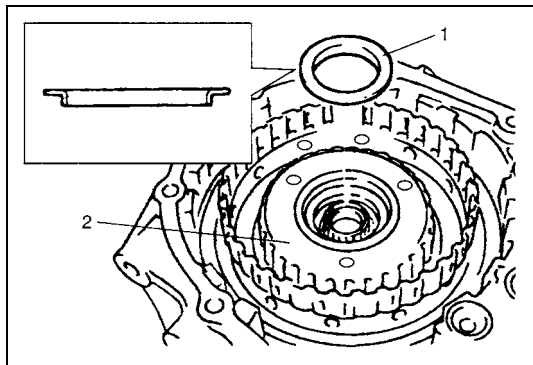


- 33) Apply A/T fluid to one-way clutch No.1 assembly (3) and install one-way clutch No.1 assembly (3) to rear planetary sun gear subassembly (2).

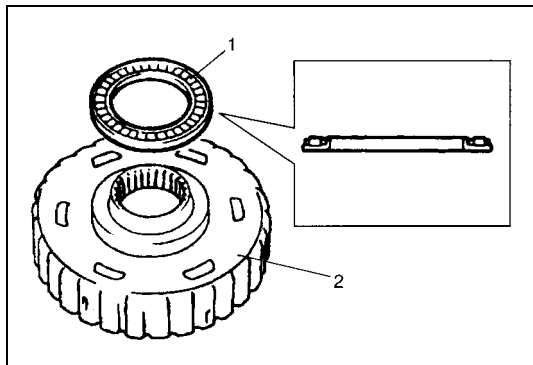
- 34) Apply A/T fluid to planetary gear thrust bearing (1), then install it to one-way clutch No.1 assembly (3).



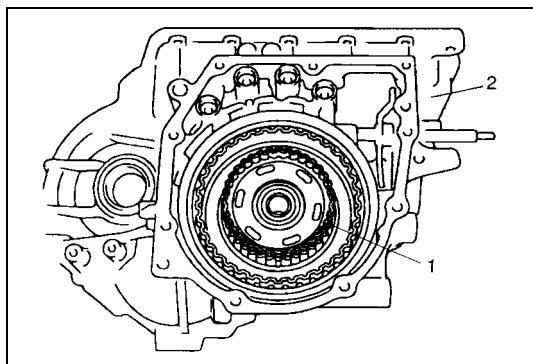
- 35) After applying A/T fluid to rear planetary sun gear subassembly and one-way clutch No.1 assembly (1), install them in transaxle case (2).



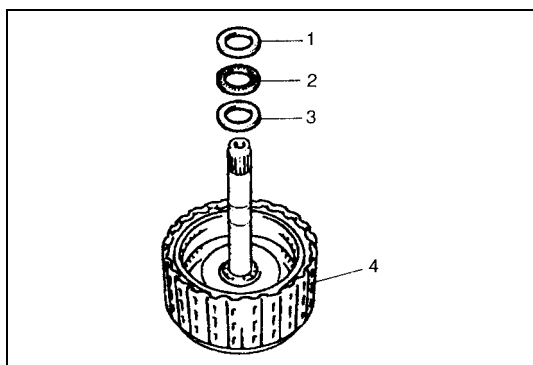
- 36) After applying A/T fluid to rear sun gear thrust bearing race (1), install it to rear planetary sun gear (2).



- 37) After applying A/T fluid to rear sun gear thrust bearing (1), install it to forward clutch hub (2).



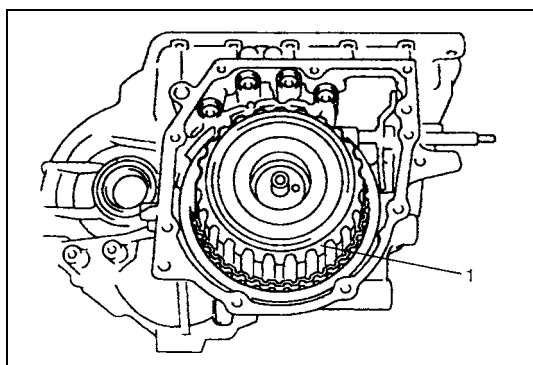
- 38) After applying A/T fluid to forward clutch hub (1), install it in transaxle case (2).



- 39) After applying A/T fluid to intermediate shaft thrust bearing rear race (3), thrust bearing (2) and front race (1), install them to forward and reverse clutch assembly (4).

#### Bearing race dimension

	Front race	Rear race
Outside diameter	30.6 mm (1.20 in.)	28.2 mm (1.11 in.)
Thickness	2.0 mm (0.08 in.)	2.0 mm (0.08 in.)

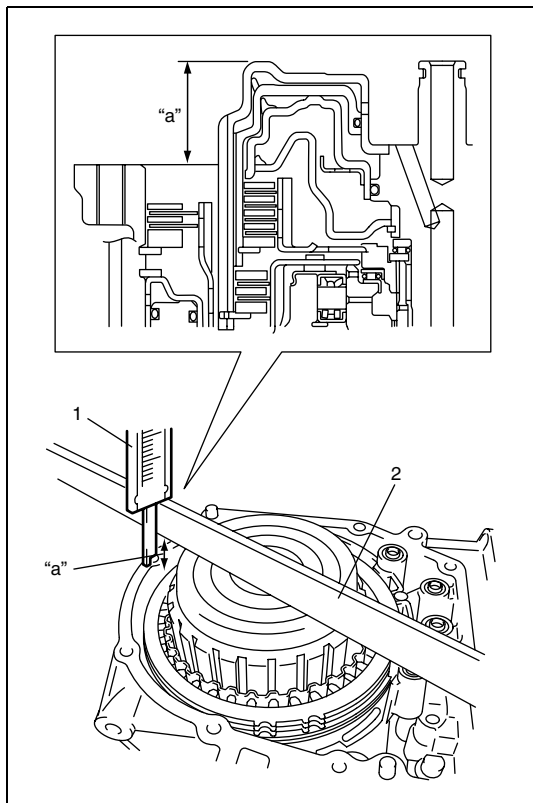


- 40) Apply A/T fluid to forward and reverse clutch assembly (1). Install forward and reverse clutch assembly while rotating clockwise and counter clockwise frequently to fit clutch discs to mating hubs.

#### NOTE:

**Before installation, align teeth of forward and reverse clutch discs to facilitate installation.**



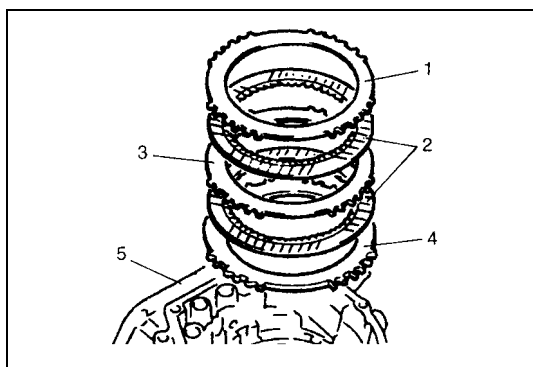


- 41) Check for correct installation of forward and reverse clutch assembly as follows.

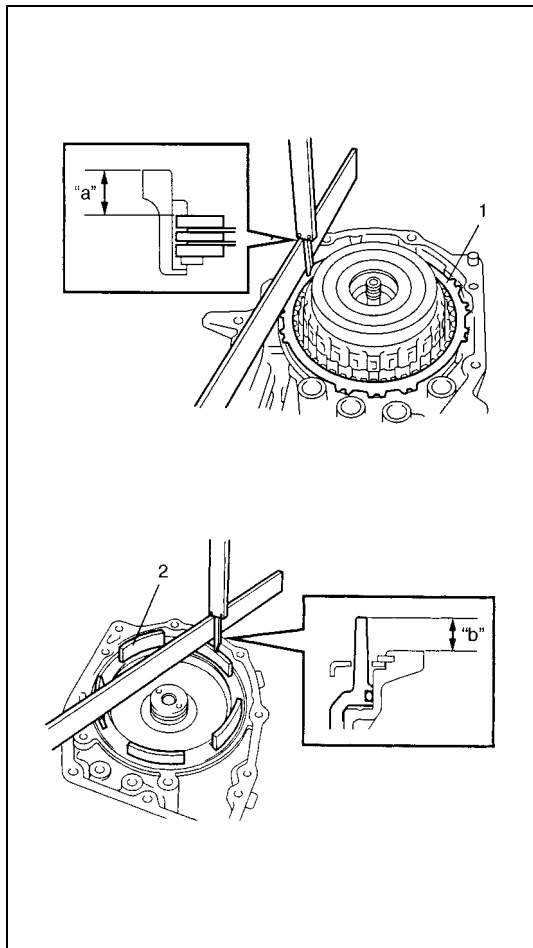
Measure distance "a" by using micrometer caliper (1) and straightedge (2). If out of specification, remove forward and reverse clutch assembly, forward clutch hub, rear planetary sun gear subassembly and one-way clutch No.1 assembly, and reinstall them properly.

**Distance between forward and reverse clutch assembly and mating surface of transaxle case**

**"a": 27.1 – 29.4 mm (1.067 – 1.157 in.)**



- 42) After applying A/T fluid to O/D and 2nd coast brake retaining plate (4), separator plate (3), discs (2) and rear plate (1), install them to transaxle case (5).



43) Measure O/D and 2nd coast brake piston stroke.

- Measure dimension "a" from end face of transaxle case to O/D and 2nd coast brake rear plate (1) using straightedge and micrometer caliper.
- Measure dimension "b" from O/D and 2nd coast brake piston (2) to rear cover assembly mating surface using straightedge and micrometer caliper.
- Calculate piston stroke from measured value of dimensions "a" and "b".
- Piston stroke = "a" – "b"

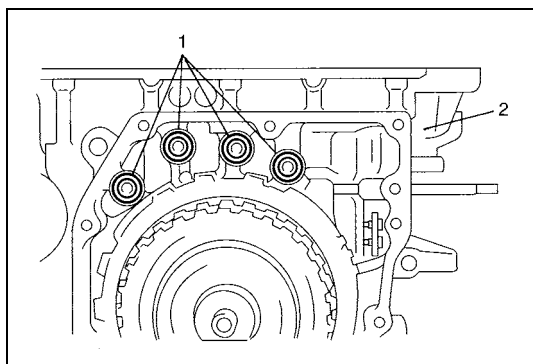
#### O/D and 2nd coast brake piston stroke

**standard: 0.65 – 1.05 mm (0.026 – 0.041 in.)**

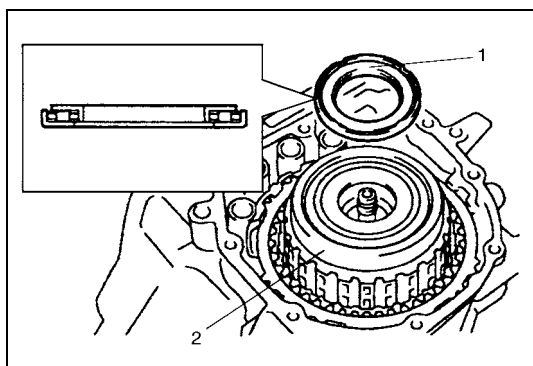
When piston stroke is out of specification, select O/D and 2nd coast brake rear plate with proper thickness from among the list below and replace it.

#### Available O/D and 2nd coast brake rear plate thickness

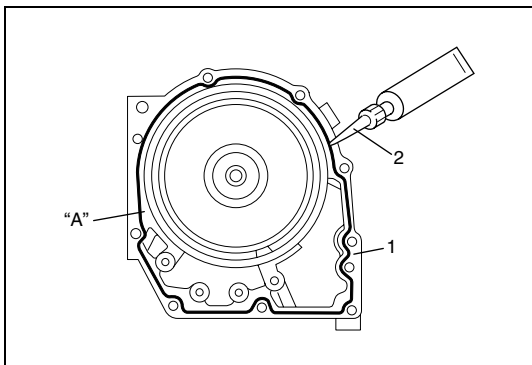
Thickness	Identification mark
1.8 mm (0.071 in.)	1
2.0 mm (0.079 in.)	2
2.2 mm (0.087 in.)	3
2.4 mm (0.094 in.)	4
2.6 mm (0.102 in.)	5
5.0 mm	



44) After applying A/T fluid to new 2nd brake gaskets (1), install them to transaxle case (2).



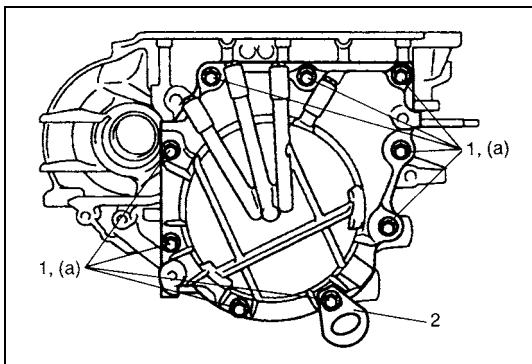
45) After applying A/T fluid to reverse clutch drum thrust bearing (1), install it to forward and reverse clutch assembly (2).



- 46) Remove sealant attached to mating surface of transaxle rear cover (1) completely.
- 47) Apply sealant to mating surface of transaxle rear cover (1) by using a nozzle (2) as shown in figure by such amount that its section is 1.2 mm (0.047 in.) in diameter.

**“A”: Sealant 99000-31230**

- 48) Install transaxle rear cover assembly on transaxle case.



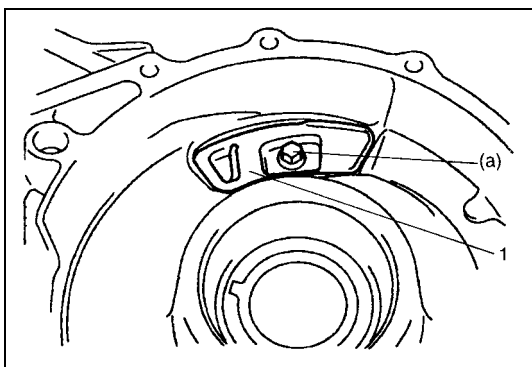
- 49) Install hook (2) to location shown in figure.

**Tightening torque**

**Rear cover bolts**

**(a): 25 N·m (2.5 kg-m, 18.0 lb-ft)**

- 50) Tighten rear cover bolts (1).

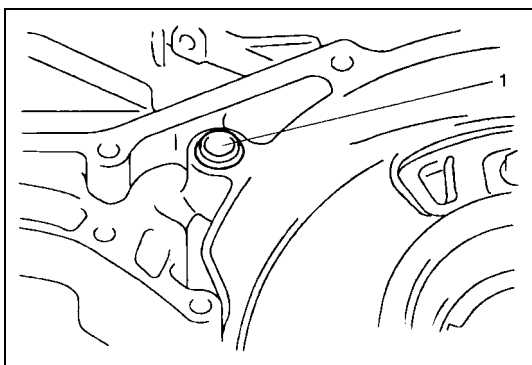


- 51) Install fluid reservoir LH plate (1).

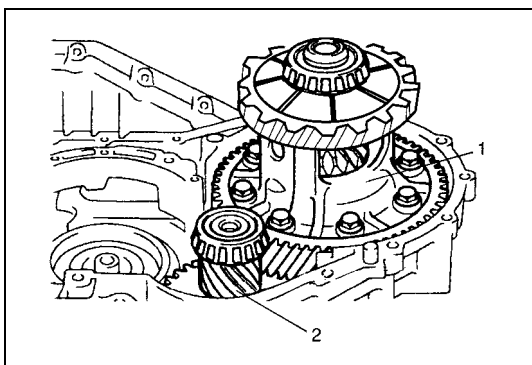
**Tightening torque**

**Fluid reservoir LH plate bolt**

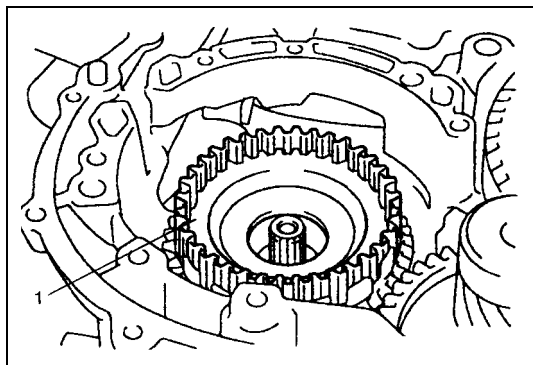
**(a): 10 N·m (1.0 kg-m, 7.5 lb-ft)**



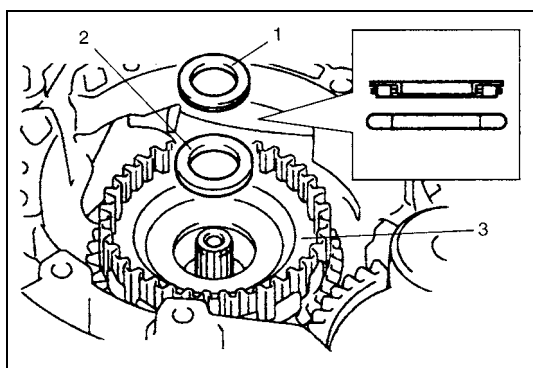
- 52) After applying A/T fluid to new governor apply No.2 gasket (1), install it to transaxle case.



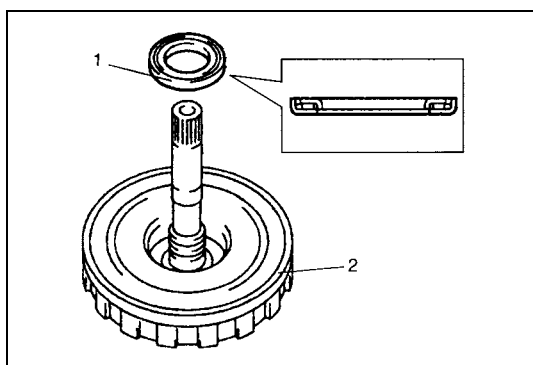
- 53) After applying A/T fluid to differential assembly (1) and countershaft assembly (2), install them to transaxle case.



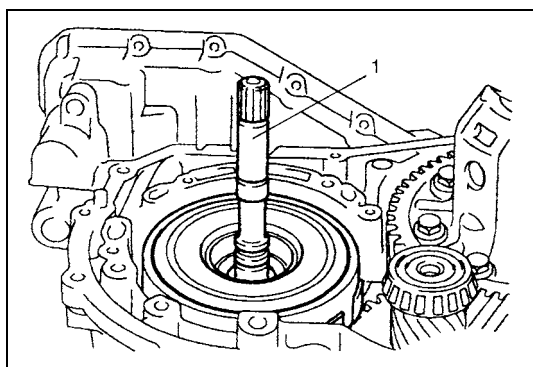
- 54) After applying A/T fluid to direct clutch hub (1), install it to planetary gear assembly.



- 55) After applying A/T fluid to input shaft rear thrust bearing (1) and thrust bearing race (2), install them into direct clutch hub (3).



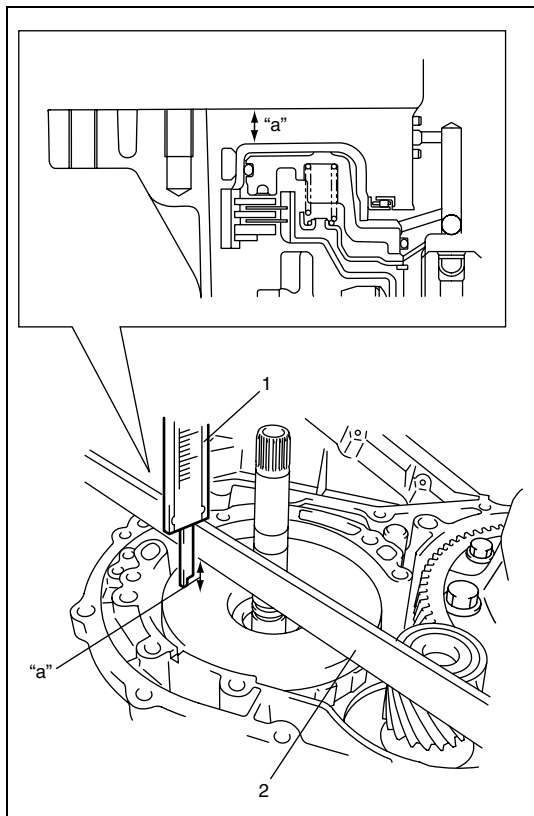
- 56) After applying A/T fluid to input shaft front thrust bearing (1), install it to direct clutch assembly (2).



- 57) Apply A/T fluid to direct clutch assembly (1).  
Install direct clutch assembly while rotating clockwise and counter clockwise frequently to fit clutch discs to mating hub.

**NOTE:**

**Before installation, align teeth of direct clutch discs to facilitate installation.**

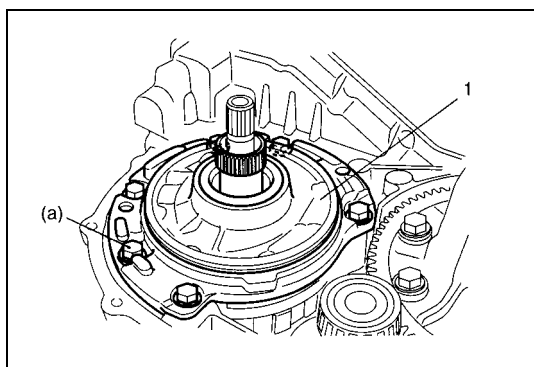


- 58) Check for correct installation of direct clutch assembly as follows.

Measure distance "a" by using micrometer caliper (1) and straightedge (2). If out of specification, remove direct clutch assembly, direct clutch hub and reinstall them properly.

**Distance between direct clutch assembly and mating surface of transaxle case**

**"a": 10.5 – 11.3 mm (0.413 – 0.445 in.)**

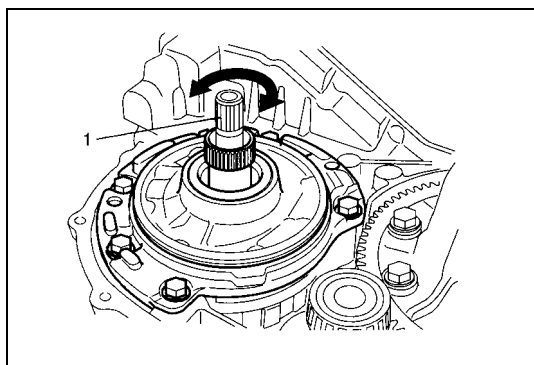


- 59) Install oil pump assembly (1) to transaxle case.

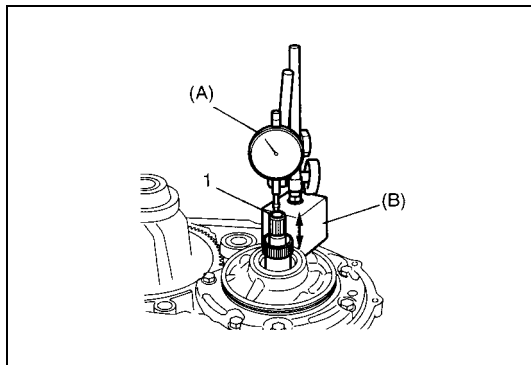
**Tightening torque**

**Oil pump assembly bolts**

**(a): 25 N·m (2.5 kg-m, 18.0 lb-ft)**



- 60) Make sure that input shaft (1) turns smoothly.



61) Measure input shaft thrust play.

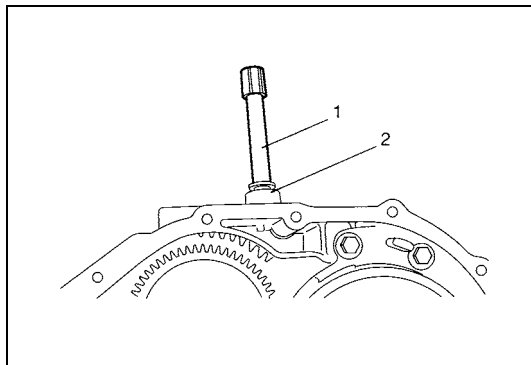
Apply dial gauge onto input shaft end (1) and measure thrust play of input shaft.

**Special tool**

**(A): 09900-20607**

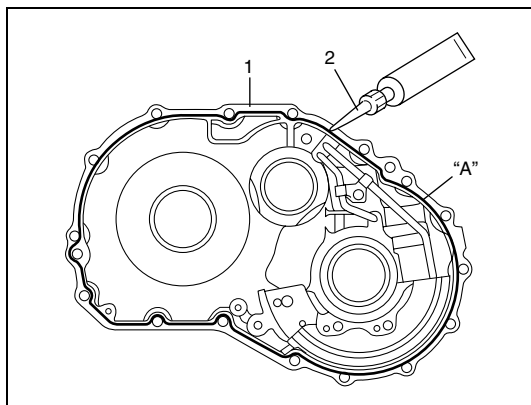
**(B): 09900-20701**

**Input shaft thrust play: 0.3 – 0.9 mm (0.012 – 0.035 in.)**



62) After applying A/T fluid to new O-ring, fit it to breather union (2). Then install breather union to transaxle case.

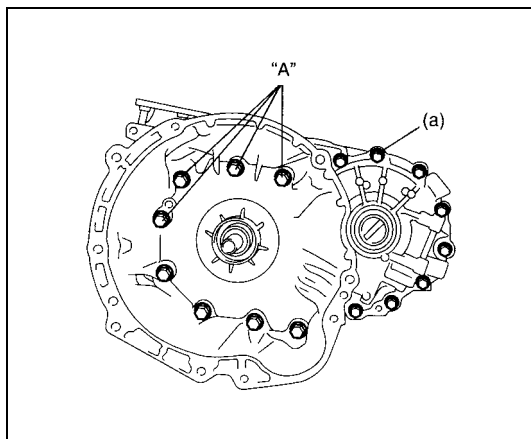
63) Install breather hose (1).



64) Wipe off and clean mating surface between transaxle case (1) and torque converter housing.

65) Apply sealant to torque converter housing (1) by using a nozzle (2) as shown in figure by such amount that its section is 1.2 mm (0.047 in.) in diameter.

**“A”: Sealant 99000-31230**



66) Install torque converter housing to transaxle case, tighten bolts to specified torque.

**CAUTION:**

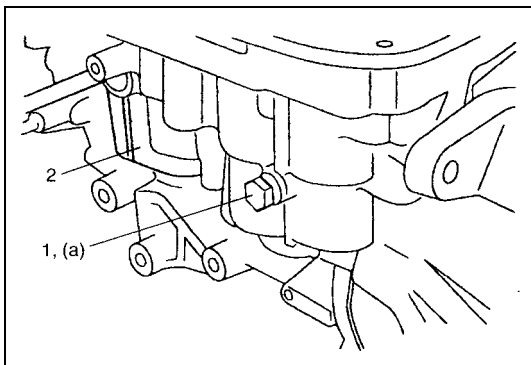
**Apply sealant to threads of four bolts shown in figure before tightening.**

**“A”: Sealant 99000-31230**

**Tightening torque**

**Torque converter housing bolts**

**(a): 33 N·m (3.3 kg-m, 24.0 lb-ft)**

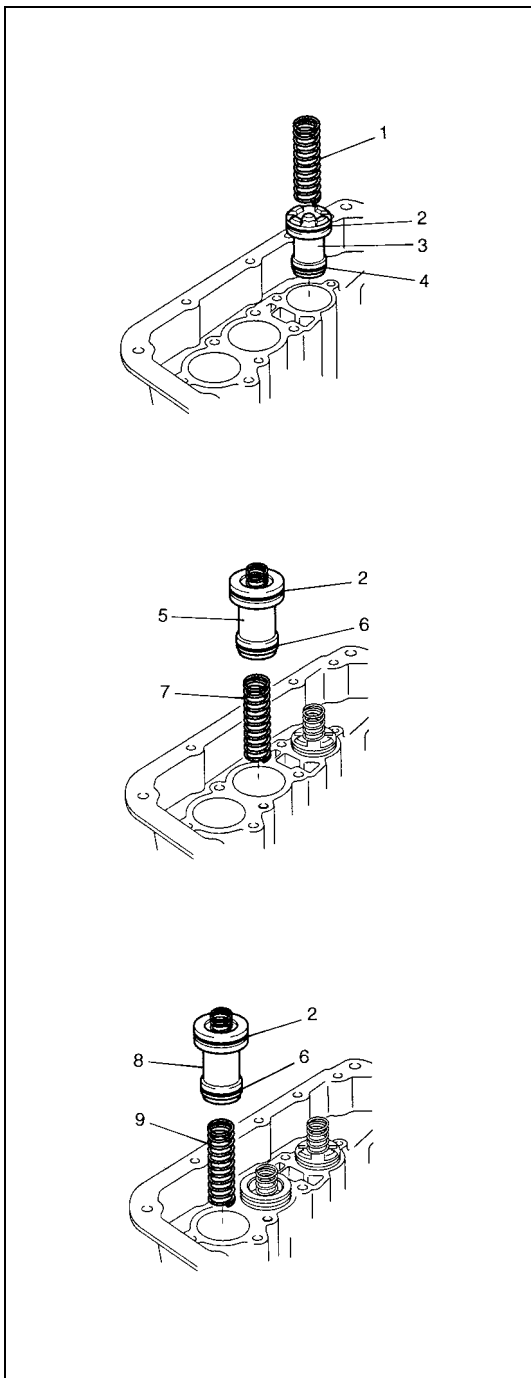


- 67) After applying A/T fluid to new O-ring, fit it to transaxle case plug (1). Then install the transaxle case plug to transaxle case (2).

#### Tightening torque

##### Transaxle case plug

(a): 7.5 N·m (0.75 kg-m, 5.5 lb-ft)



- 68) Install new O-rings to each accumulator piston and apply A/T fluid to them.

#### Accumulator O-ring dimension

O-ring name	Inside diameter	Section diameter
B1 accumulator O-ring (Large) (2)	29.4 mm (1.16 in.)	2.6 mm (0.10 in.)
C1 accumulator O-ring (Large) (2)		
C2 accumulator O-ring (Large) (2) (Above three O-rings are same.)		
B1 accumulator O-ring (Small) (4)	19.7 mm (0.78 in.)	2.6 mm (0.10 in.)
C1 accumulator O-ring (Small) (6)	21.8 mm (0.86 in.)	2.6 mm (0.10 in.)
C2 accumulator O-ring (Small) (6) (Above two O-rings are same.)		

#### NOTE:

Make sure that O-rings are not twisted or caught when installing.

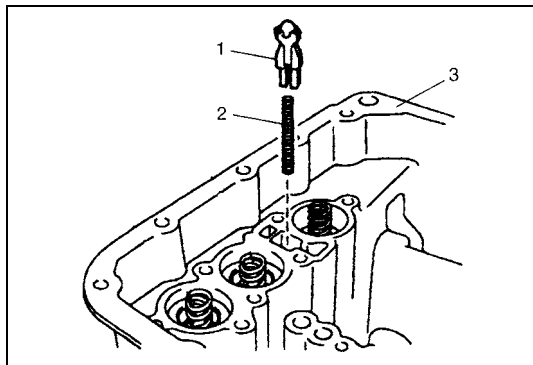
- 69) Install B1, C1, C2 accumulator pistons and springs.

#### Accumulator piston identification

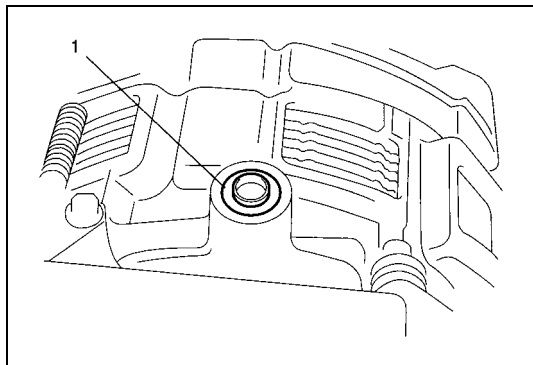
Piston name	Identification (Embossed letters on piston)
B1 accumulator piston (3)	SB-1
C1 accumulator piston (5)	S2C-1
C2 accumulator piston (8)	S2C-2

#### Accumulator spring identification

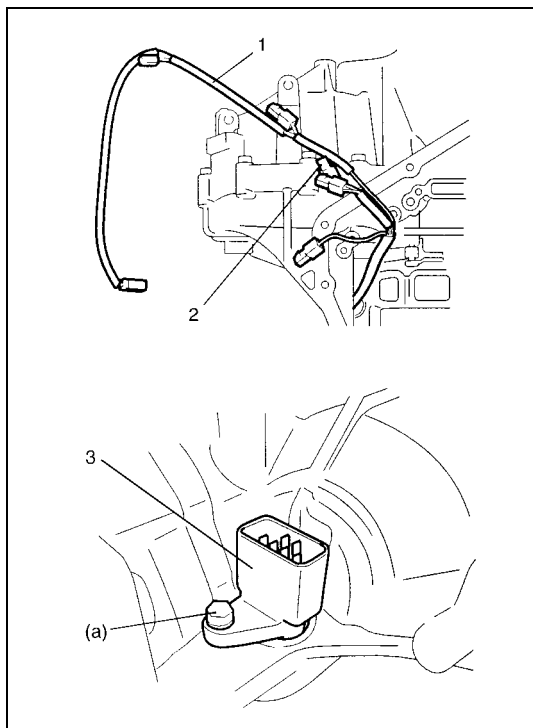
Spring name	Color of identification paint
B1 accumulator No.2 spring (1)	Pink
C1 accumulator No.2 spring (7)	Light Blue
C2 accumulator No.2 spring (9)	Yellow



- 70) After applying A/T fluid to cooler check valve (1) and spring (2), install them to transaxle case (3).



- 71) After applying A/T fluid to new governor apply No.1 gasket (1), install it to transaxle case.



- 72) After applying A/T fluid to new O-ring, fit it to valve body harness connector (3), then install valve body harness to transaxle case.

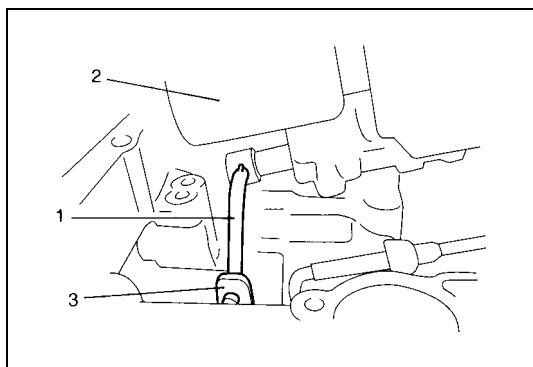
**CAUTION:**

When put valve body harness (1) into transaxle case, take care not to damage transmission fluid temperature sensor (2) at narrow entrance of case. Careless sensor treatment might cause sensor malfunction.

**Tightening torque**

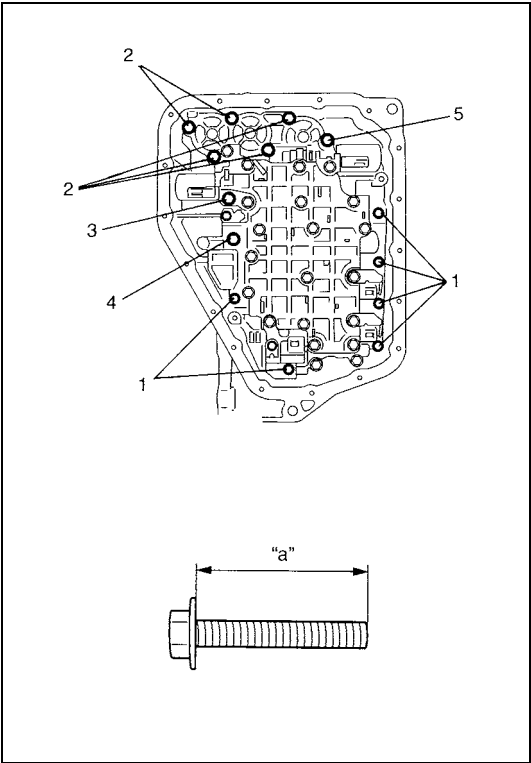
**Valve body harness connector bolt**

(a): 5.5 N·m (0.55 kg-m, 4.0 lb-ft)



- 73) Install manual valve rod (1) to manual valve lever (3) and then install valve body assembly (2) to transaxle case.



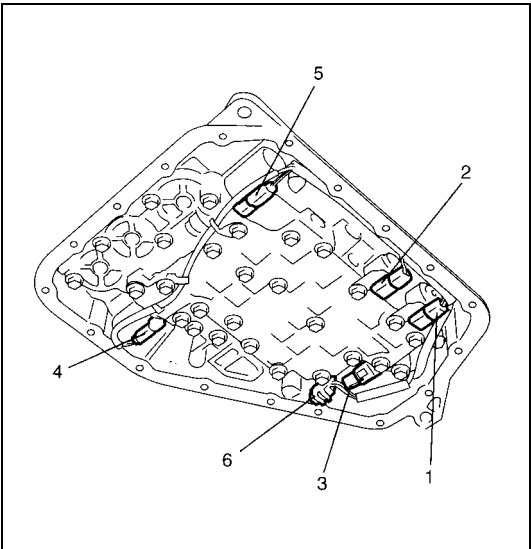


74) Tighten valve body bolts to specified torque.

**Tightening torque**  
**Valve body bolts**  
**11 N·m (1.1 kg-m, 8.0 lb-ft)**  
**Valve body bolt length**

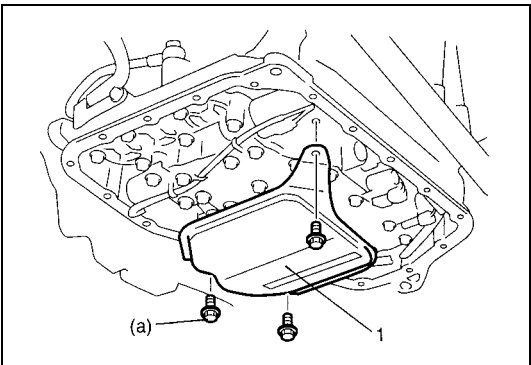
Bolt	Length “a”	Pieces
A	20 mm (0.79 in.)	6
B	28 mm (1.10 in.)	5
C	49 mm (1.93 in.)	1
D	36 mm (1.42 in.)	1
E	40 mm (1.58 in.)	1

1. Bolt A
2. Bolt B
3. Bolt C
4. Bolt D
5. Bolt E



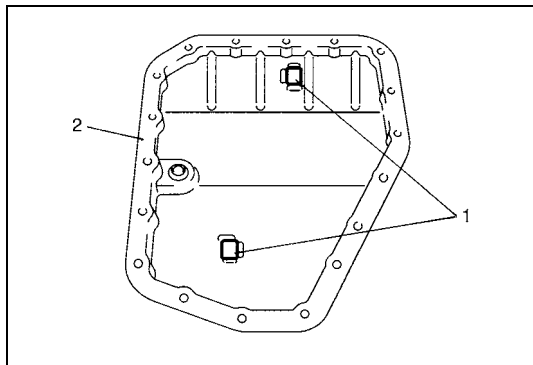
75) Connect solenoid connectors to solenoid valves identifying their installing positions by wire colors, and install transmission fluid temperature sensor to its clamp.

Solenoid valve coupler	Wire Color
Shift solenoid valve-A (1)	White
Shift solenoid valve-B (2)	Black
Timing solenoid valve (3)	Yellow
TCC (Lock-up) solenoid valve (4)	Light Green
Pressure control solenoid valve (5)	Gray + Green
Transmission fluid temperature sensor (6)	Orange



76) Install oil strainer assembly (1).

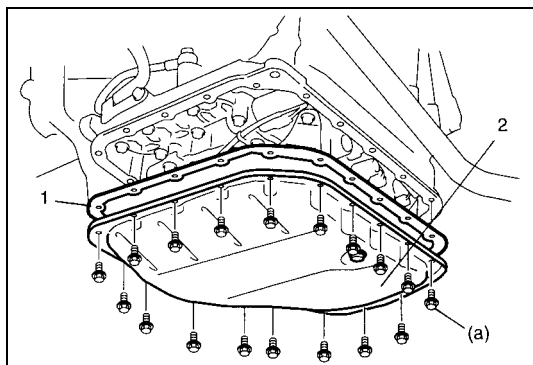
**Tightening torque**  
**Oil strainer bolts**  
**(a): 10 N·m (1.0 kg-m, 7.5 lb-ft)**



77) Install oil cleaner magnets (1) in oil pan (2).

**NOTE:**

**If metal particles are attached to the magnets, clean them before installing.**

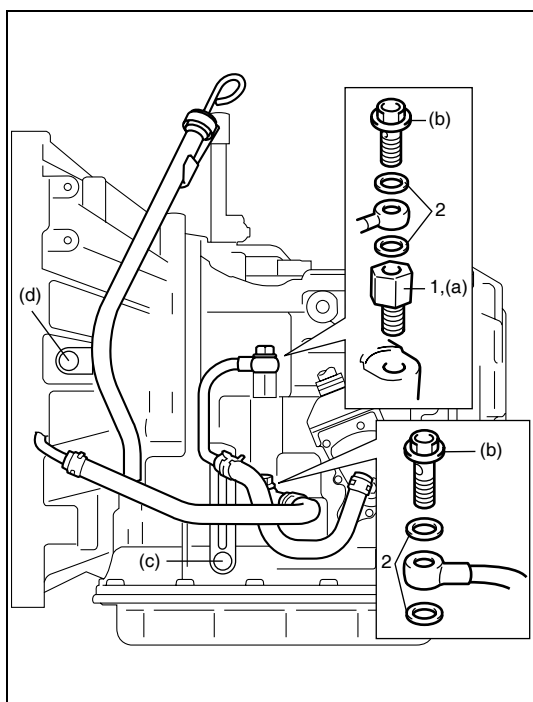


78) Install new oil pan gasket (1) between transaxle case and oil pan (2).

**Tightening torque**

**Oil pan bolts**

**(a): 7.0 N·m (0.7 kg-m, 5.0 lb-ft)**



79) After applying A/T fluid to new O-ring, fit it to fluid inlet union (1). Then install fluid outlet union to transaxle case.

**Tightening torque**

**Fluid outlet union**

**(a): 25 N·m (2.5 kg-m, 18.0 lb-ft)**

80) Install new gasket (2) and then install fluid cooler pipes.

**Tightening torque**

**Fluid cooler pipe bolt**

**(b): 22 N·m (2.2 kg-m, 16.0 lb-ft)**

**Fluid cooler pipe bracket bolt**

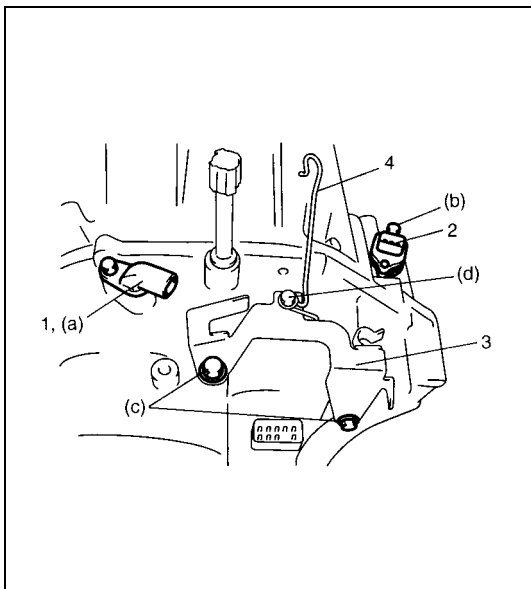
**(c): 10 N·m (1.0 kg-m, 7.5 lb-ft)**

81) After applying A/T fluid to new O-ring, fit it to fluid filler tube. Then install fluid filler tube to transaxle case.

**Tightening torque**

**Fluid filler tube bolt**

**(d): 10 N·m (1.0 kg-m, 7.5 lb-ft)**



- 82) Apply A/T fluid to O-rings of each sensor and install input shaft speed sensor (1) and output shaft speed sensor (VSS) (2).

**Tightening torque**

**Input shaft speed sensor bolt**

(a): 5.5 N·m (0.55 kg-m, 4.0 lb-ft)

**Output shaft speed sensor (VSS) bolt**

(b): 13 N·m (1.3 kg-m, 9.5 lb-ft)

- 83) Install harness bracket (3) and select cable clamp (4).

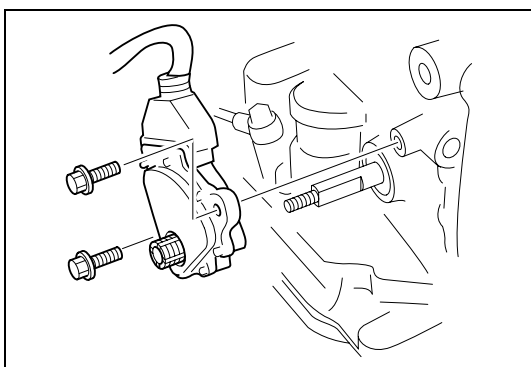
**Tightening torque**

**Harness bracket bolts**

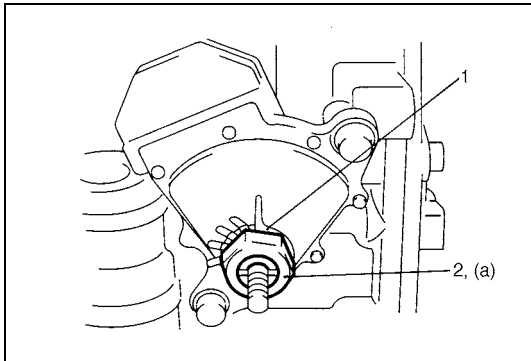
(c): 23 N·m (2.3 kg-m, 17.0 lb-ft)

**Select cable clamp bolt**

(d): 10 N·m (1.0 kg-m, 7.5 lb-ft)



- 84) Install transmission range sensor to transaxle case, tighten bolts temporarily at this step.

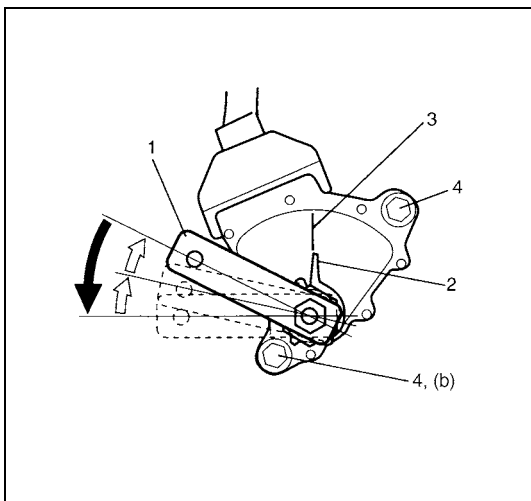


- 85) Install lock washer (1) and tighten lock nut (2) to specified torque.

**Tightening torque**

**Transmission range sensor lock nut**

(a): 7 N·m (0.7 kg-m, 5.0 lb-ft)

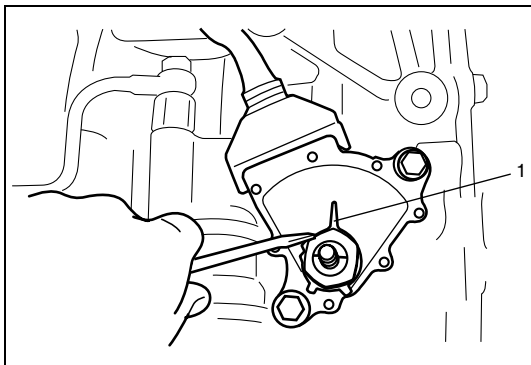


- 86) Install manual select lever (1) temporarily at this step.  
 87) After shifting manual select lever counterclockwise fully, select "N" range position by bringing it back 2 notches clockwise.  
 88) Remove manual select lever (1) at this step.  
 89) Loosen sensor bolts (4) and align needle direction shaped on lock washer (2) with "N" reference line (3) on transmission range sensor by moving sensor in rotative direction.  
 90) Tighten sensor bolts (4) to specified torque.

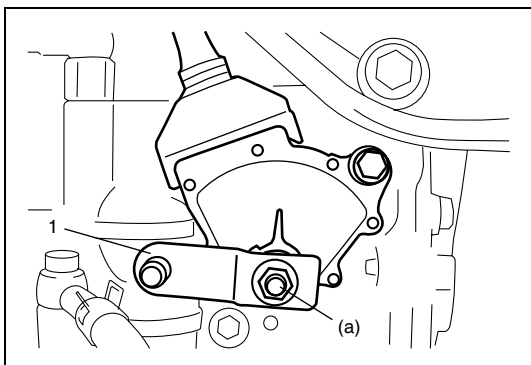
**Tightening torque**

**Transmission range sensor bolts**

(b): 5.5 N·m (0.55 kg-m, 4.0 lb-ft)



- 91) Bend dents of lock washer (1) in order to prevent displacement of lock washer.

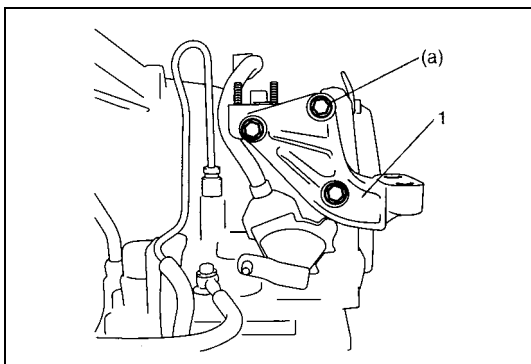


- 92) Install manual select lever (1).

**Tightening torque**

**Manual select lever nut**

**(a): 13 N·m (1.3 kg-m, 9.5 lb-ft)**

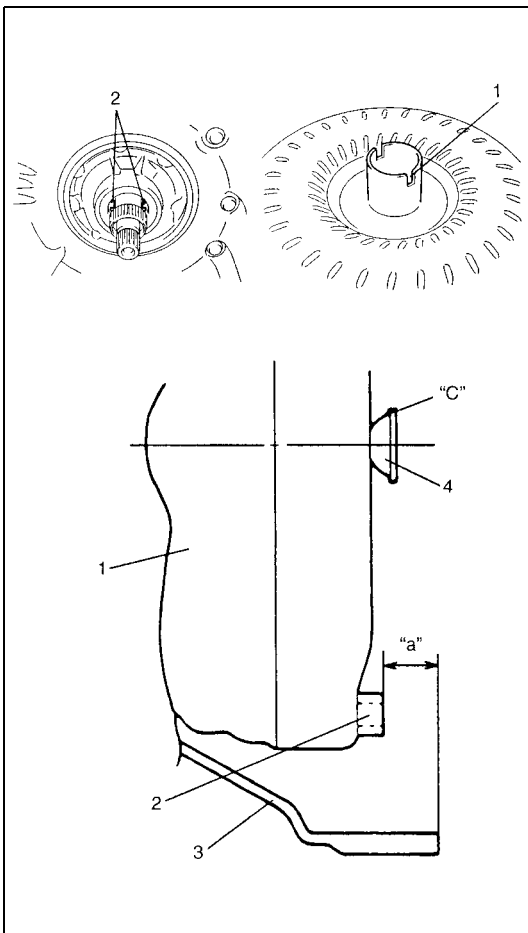


- 93) Install engine mounting LH bracket (1).

**Tightening torque**

**Engine mounting LH bracket bolts**

**(a): 55 N·m (5.5 kg-m, 40.0 lb-ft)**

**CAUTION:**

- Before installing converter, make sure that its pump hub portion is free from nicks, burrs or damage which may cause oil seal to leak.
- Be very careful not to drop converter on oil pump gear. Damage in gear, should it occur, may cause a critical trouble.

- Install torque converter aligning grooves (1) of torque converter and projection (2) of oil pump drive gear.
- Install torque converter, using care not to damage oil seal of oil pump.
- After installing torque converter, check that distance "a" is within specification.

**Torque converter installing position**

**"a": More than 19.9 mm (0.783 in.)**

- Check torque converter for smooth rotation.
- Apply grease around cup at the center of torque converter.

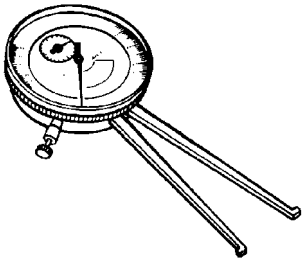
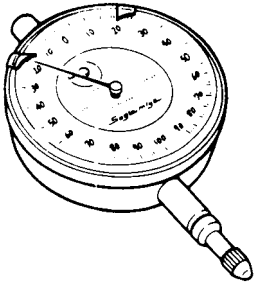
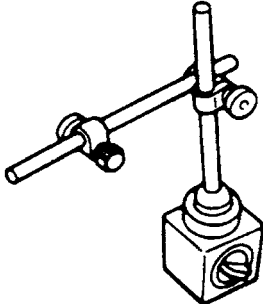
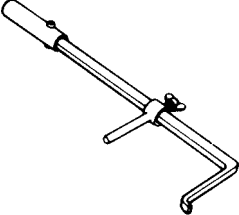
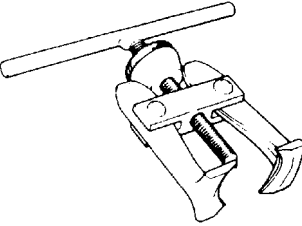
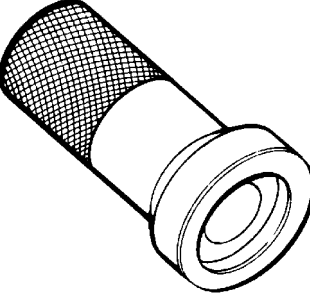
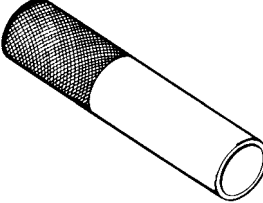
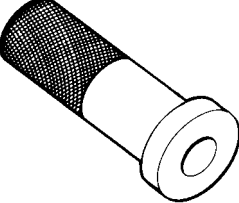
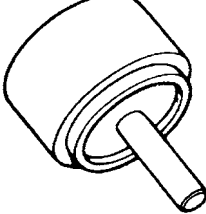
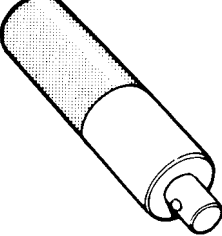
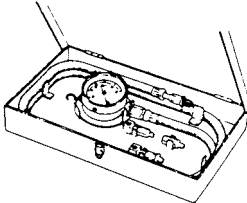
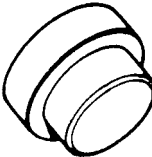
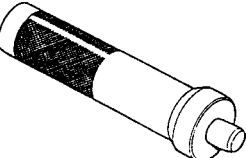
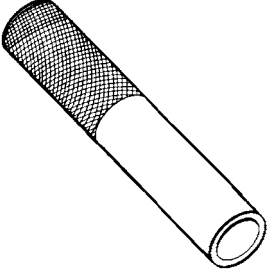
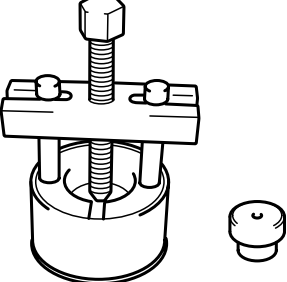
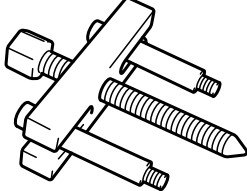
**"C": Grease 99000-25010**

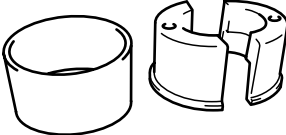
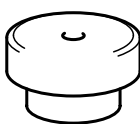

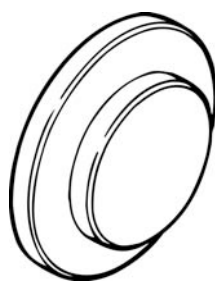
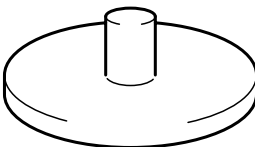
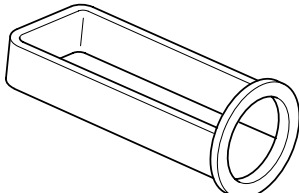
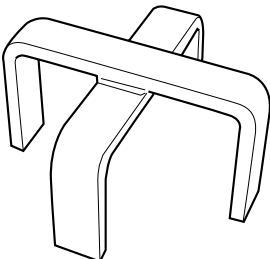
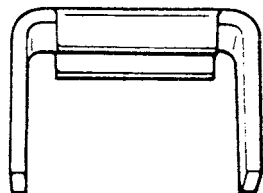
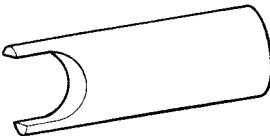
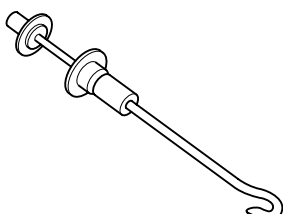
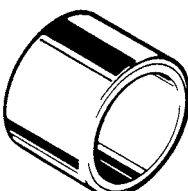
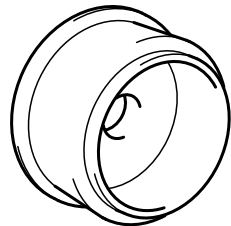
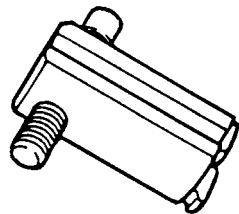
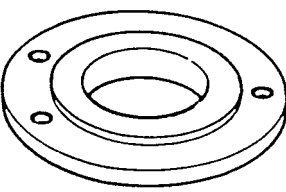
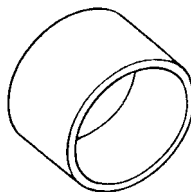
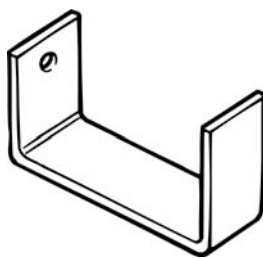
1.	Torque converter
2.	Flange nut
3.	Torque converter housing
4.	Cup

## Tightening Torque Specification

Fastening part	Tightening torque		
	N•m	kg-m	lb-ft
A/T fluid drain plug	17	1.7	12.5
Output shaft speed sensor bolt	13	1.3	9.5
Input shaft speed sensor bolt	5.5	0.55	4.0
Transaxle case plug	7.5	0.75	5.5
Solenoid valve bolts	11	1.1	8.0
Rear cover plugs	7.5	0.75	5.5
Transaxle and engine fastening bolts and nut	85	8.5	61.5
Drive plate to torque converter bolts	19	1.9	14.0
Lower stiffener bolts	55	5.5	40.0
Starter motor bolt and nut	50	5.0	36.5
Oil pump subassembly bolts	10	1.0	7.5
Valve body bolts	11	1.1	8.0
Final gear bolts	78	7.8	56.5
Reduction drive gear nut (Reference)	100	10.0	72.5
Rear cover bolts	25	2.5	18.0
Fluid reservoir LH plate bolt	10	1.0	7.5
Manual detent spring bolt	10	1.0	7.5
Parking lock pawl bracket bolts	7.5	0.75	5.5
Oil pump assembly bolts	25	2.5	18.0
Torque converter housing bolts	33	3.3	24.0
Torque converter housing plugs	7.5	0.75	5.5
Lubrication tube clamp bolt	5.5	0.55	4.0
Fluid reservoir RH plate bolts	5.5	0.55	4.0
Valve body harness connector bolt	5.5	0.55	4.0
Oil pan bolts	7.0	0.7	5.0
Oil strainer bolts	10	1.0	7.5
Fluid outlet union	25	2.5	18.0
Fluid cooler pipe flare nut	35	3.5	25.5
Fluid cooler pipe bolt	22	2.2	16.0
Fluid cooler pipe bracket bolt	10	1.0	7.5
Fluid filler tube bolt	10	1.0	7.5
Transmission range sensor lock nut	7	0.7	5.0
Transmission range sensor bolts	5.5	0.55	4.0
Manual select lever nut	13	1.3	9.5
Engine mounting LH bracket bolts	55	5.5	40.0
Harness bracket bolts	23	2.3	17.0
Select cable clamp bolt	10	1.0	7.5

## Special Tool

 <p>09900-20605 Dial caliper gauge</p>	 <p>09900-20607 Dial gauge</p>	 <p>09900-20701 Magnetic stand</p>	 <p>09913-50121 Oil seal remover</p>
 <p>09913-61510 Bearing puller</p>	 <p>09913-70123 Bearing installer</p>	 <p>09913-84510 Bearing installer</p>	 <p>09913-85210 Bearing installer</p>
 <p>09923-78210 Bearing installer</p>	 <p>09924-74510 Bearing installer handle</p>	 <p>09925-37811-001 Oil pressure gauge</p>	 <p>09925-88210 Bearing puller attachment</p>
 <p>09925-98210 Bearing installer</p>	 <p>09925-98221 Bearing installer</p>	 <p>09926-37610 Bearing remover See NOTE 1.</p>	 <p>09926-37610-001 Bearing puller See NOTE 2.</p>

 <p>09926-37610-002 Bearing puller attachment See NOTE 2.</p>	 <p>09926-37610-003 Bearing remover attachment See NOTE 2.</p>	 <p>09926-58010 Bearing remover attachment</p>	 <p>09926-96030 Clutch spring compressor</p>
 <p>09926-96050 Brake piston compressor</p>	 <p>09926-97610 Spring compressor</p>	 <p>09926-97620 Spring compressor</p>	 <p>09926-98310 Clutch spring compressor</p>
 <p>09928-06050 Differential preload adapter</p>	 <p>09942-15511 Sliding hammer</p>	 <p>09944-78210 Bearing installer support</p>	 <p>09944-88220 Oil seal installer</p>
 <p>09944-96011 Bearing outer race remover</p>	 <p>09946-06710 Bearing retainer dummy</p>	 <p>09951-18210 Oil seal installer</p>	 <p>09952-06020 Dial gauge plate No.2</p>



**NOTE:**

- “1”: This tool consists of Bearing Puller with 09926-37610-001, Bearing Puller Attachment with 09926-37610-002 and Bearing Remover Attachment with 09926-37610-003.
- “2”: This tool is constituent of Bearing Remover with 09926-37610.

## Required Service Material

Material	Recommended SUZUKI product (Part Number)	Use
Automatic transmission fluid	An equivalent of DEXRON®-III	<ul style="list-style-type: none"> <li>• Automatic transaxle</li> <li>• Parts lubrication when installing</li> <li>• O-rings</li> </ul>
Sealant	SUZUKI BOND No. 1216B (99000-31230)	<ul style="list-style-type: none"> <li>• Mating surface of torque converter housing</li> <li>• Mating surface of rear cover assembly</li> <li>• Torque converter housing bolts</li> <li>• Drive plate bolts</li> </ul>
Lithium grease	SUZUKI SUPER GREASE C (99000-25030)	<ul style="list-style-type: none"> <li>• Oil seal lips</li> <li>• Planetary carrier thrust washer</li> </ul>
	SUZUKI SUPER GREASE A (99000-25010)	<ul style="list-style-type: none"> <li>• Cable ends</li> <li>• Converter center cup</li> </ul>

## SECTION 8C1

# INSTRUMENTATION/DRIVER INFORMATION (Z13DT ENGINE MODEL)

**WARNING:**

For vehicles equipped with Supplemental Restraint (Air Bag) System:

- Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to “System Components and Wiring Location View and Connections” under “General Description” in Section 10B in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and “Service Precautions” under “On-Vehicle Service” in Section 10B before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.
- Technical service work must be started at least 90 seconds after the ignition switch is turned to the “LOCK” position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).

**NOTE:**

For the items with asterisk (\*) in the “CONTENTS” below, refer to Section 8C of the Service Manual mentioned in “Foreword” of this manual.

8C1

## CONTENTS

<b>Diagnosis</b> .....	<b>8C1-2</b>	Combination Meter Circuit .....	8C1-3
Low Engine Oil Level Warning Light		Combination Meter Removal and	
Symptom Diagnosis (If Equipped).....	8C1-2	Installation.....	*
Speedometer and VSS Symptom		Fuel Gauge Inspection.....	*
Diagnosis .....	*	Fuel Level Sensor (Gauge Unit)	
Fuel Meter and Fuel Gauge Unit		Removal and Installation.....	*
Symptom Diagnosis .....	*	Fuel Level Sensor (Gauge Unit)	
Engine Coolant Temperature (ECT)		Inspection.....	*
Gauge and ECT Sensor Symptom		VSS Removal and Installation .....	*
Diagnosis .....	*	VSS Inspection .....	*
Engine Oil Pressure Warning Light		Engine Coolant Temperature (ECT)	
Symptom Diagnosis .....	*	Gauge Inspection.....	*
Brake System Warning Light (Parking		Operation check.....	*
Brake Indicator, Brake Fluid Warning and		ECT sensor Removal and Installation.....	*
EBD System Warning Light) .....	*	ECT Sensor Inspection .....	*
Ignition Key Remainder and Light Remainder		Ignition Key Remainder and Light	
Warning Buzzer Symptom Diagnosis.....	*	Remainder Warning Buzzer Inspection .....	*
<b>On-Vehicle Service</b> .....	<b>8C1-3</b>	Engine Oil Pressure Switch Inspection .....	8C1-5
Cautions in Body Electrical System		Low Fuel Warning System .....	8C1-6
Servicing .....	*	Engine Oil Level Switch Inspection	
Ignition (Main) Switch ON-Vehicle		(If Equipped) .....	8C1-6
Inspection.....	*	Brake Fluid Level Switch Inspection .....	*
Ignition (Main) Switch Removal and		Parking Brake Switch Inspection .....	*
Installation .....	*		

## Diagnosis

### Low Engine Oil Level Warning Light Symptom Diagnosis (If Equipped)

**NOTE:**

There are three types of vehicle below. Refer to corresponding table for symptom diagnosis.

- Vehicle with wire harness for low engine oil level warning light between “G22-20” and “G83-3” wire harness.
- Vehicle without wire harness for low engine oil level warning light between “G22-20” and “G83-3” wire harness.
- Vehicle whose wire harness for low engine oil level warning light is cut at “G83-3” connector side (“G83-3” wire harness of instrument panel harness “G83” connector located in the back of the glove box is cut).

#### Vehicle with Wire Harness for Low Engine Oil Level Warning Light

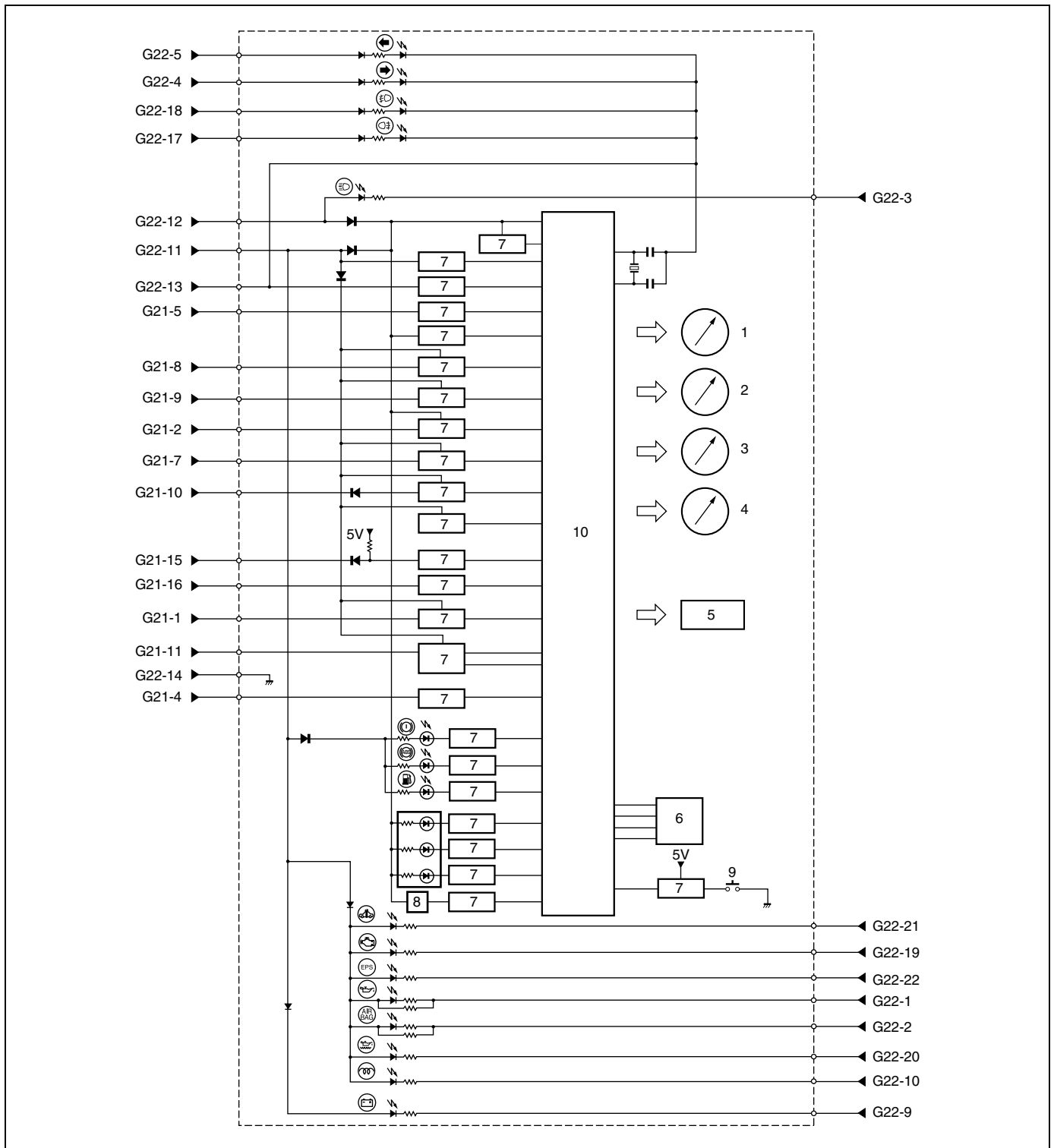
Condition	Possible Cause	Correction
<b>Low engine oil level warning light does not light up when low engine oil level</b>	Fuse blown	Replace fuse to circuit for short.
	Wiring or grounding faulty	Repair circuit.
	Engine oil level switch faulty	Check engine oil level switch referring to “Engine Oil Level Switch Inspection” in Section 6E3.
	Combination meter faulty	Check combination meter circuit referring to “Combination Meter Circuit” in this section.
	ECM faulty	Check ECM referring to “C-38, Oil Level Telltale Circuit” in Section 6-3.
<b>Low engine oil level warning light stays ON</b>	Low engine oil	Refill engine oil referring to “Engine Oil and Oil Filter Replacement” in Section 0B.
	Wiring or grounding faulty	Repair circuit.
	Engine oil level switch faulty	Check engine oil level switch referring to “Engine Oil Level Switch Inspection” in Section 6E3.
	Combination meter faulty	Check combination meter circuit referring to “Combination Meter Circuit” in this section.
	ECM faulty	Check ECM referring to “C-38, Oil Level Telltale Circuit” in Section 6-3.

#### Vehicle without Wire Harness for Low Engine Oil Level Warning Light and Vehicle whose Wire Harness for Low Engine Oil Level Warning Light is Cut.

Condition	Possible Cause	Correction
<b>Low engine oil level warning light stays ON</b>	Wiring or grounding faulty	Repair wiring harness.
	Combination meter faulty	Replace combination meter.

# On-Vehicle Service

## Combination Meter Circuit

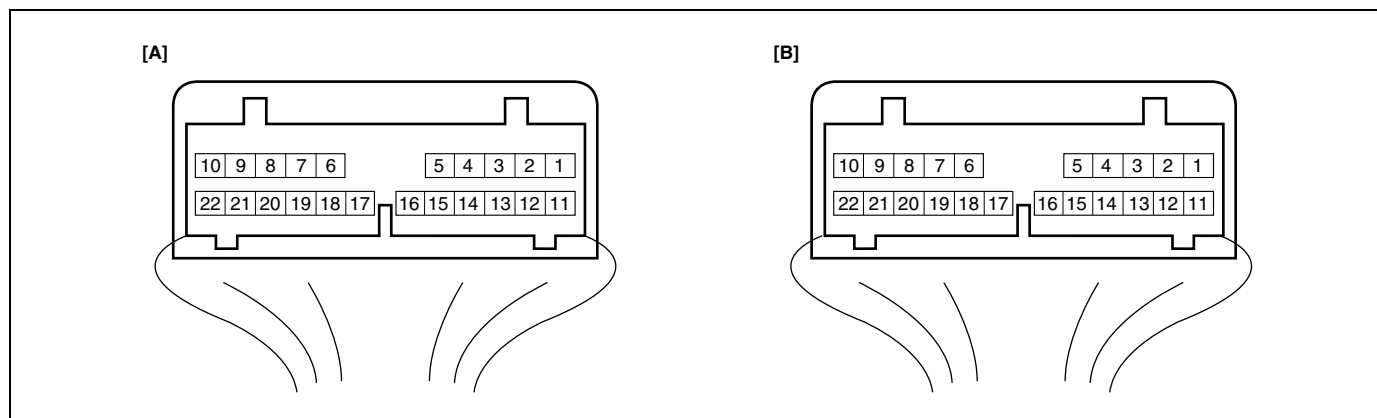


1. Speedometer	4. Engine coolant temperature gauge	7. Interface	10. CPU
2. Tachometer	5. ODO-TRIP	8. Buzzer	
3. Fuel gauge	6. EEPROM	9. Trip switch	

Terminal G21	Wire Color	Circuit
G21-1	GRY	To ECM (Engine coolant temperature meter signal)
G21-2	BLK/YEL	To door switch
G21-3	–	–
G21-4	ORN	To lighting switch (illumination control signal)
G21-5	WHT/BLK	To “ACC” fuse (key remainder signal)
G21-6	–	–
G21-7	PNK/BLU	To ABS control module (EBD warning indicator control signal)
G21-8	RED/BLU	To ABS control module (ABS indicator control signal)
G21-9	RED/BLK	To brake fluid level switch
G21-10	YEL/GRN	To parking brake switch
G21-11	YEL/RED	To fuel level gauge
G21-12	–	–
G21-13	–	–
G21-14	RED/YEL	To lighting switch
G21-15	PPL	To ECM (Speedometer signal)
G21-16	BRN	To ECM (Tachometer signal)
G21-17	–	–
G21-18	–	–
G21-19	–	–
G21-20	–	–
G21-21	–	–
G21-22	–	–

Terminal G22	Wire Color	Circuit
G22-1	BLU	To oil pressure switch
G22-2	YEL/GRN	To SDM (AIR BAG indicator control signal)
G22-3	RED	To combination switch (High beam indicator control signal)
G22-4	BLU/YEL	To combination switch (Turn R signal indicator control signal)
G22-5	GRN/RED	To combination switch (Turn L signal indicator control signal)
G22-6	–	–
G22-7	–	–
G22-8	–	–
G22-9	WHT/BLU	To generator (charge warning indicator control signal)
G22-10	GRN/YEL	To ECM (glow plug indicator control signal)
G22-11	BLU/ORN	To “METER” fuse (ignition ON signal)
G22-12	WHT/RED	To “RADIO DOME” fuse (power supply)
G22-13	BLK	To body ground
G22-14	BLK/ORN	To engine ground
G22-15	–	–
G22-16	–	–
G22-17	YEL	To lighting switch (rear fog lamp indicator control signal)
G22-18	LT GRN	To lighting switch (front fog lamp indicator control signal)
G22-19	PPL/WHT	To ECM (MIL indicator control signal)
G22-20	GRY	To ECM (low engine oil level warning indicator control signal)
G22-21	GRY/RED	To ECM (Immobilizer indicator control signal)
G22-22	PNK	To EPS control module (EPS indicator control signal)

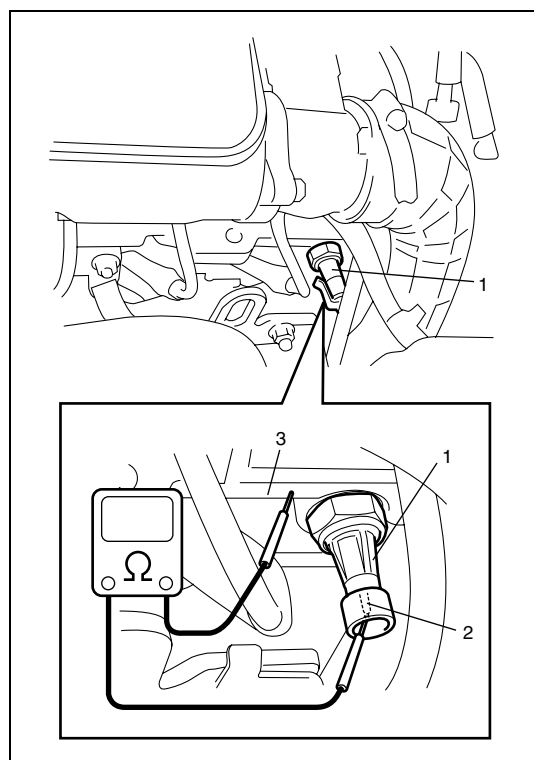
## Terminal arrangement of combination meter connector viewed from harness side



[A]: Connector "G21" (Green)

[B]: Connector "G22" (Light blue)

## Engine Oil Pressure Switch Inspection



- 1) Disconnect engine oil pressure switch (1) lead wire.
- 2) Check for continuity between engine oil pressure switch terminal (2) and cylinder head (3) as shown in the figure.  
If not as specified, replace engine oil pressure switch (1).

### Engine oil pressure switch specification

**During engine running: No continuity**

**At engine stop: Continuity**

## Low Fuel Warning System

### Operation

When fuel level gets low, this light comes on by the following operation.

#### Low fuel warning light operation

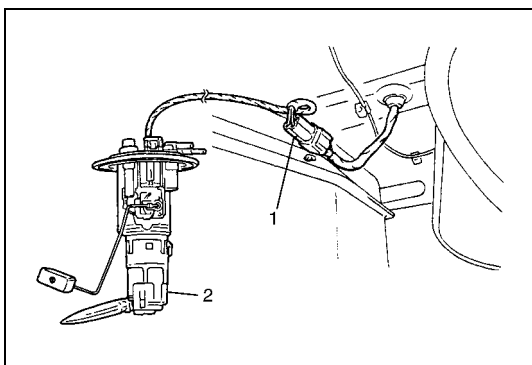
Low fuel warning light operation	Fuel level in fuel tank
OFF	6.0 litre (1.32 gal/Imp) or more
ON	2.9 – 6.0 litre (0.64 – 1.32 gal/Imp)

#### NOTE:

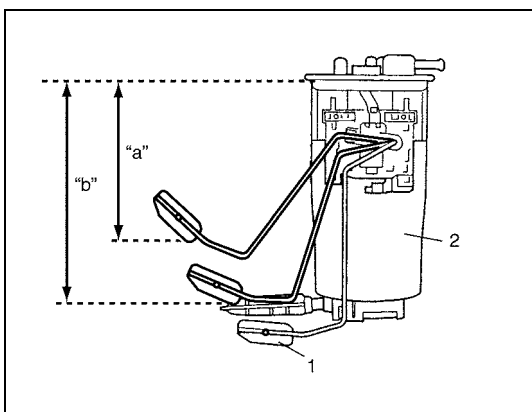
**Lighting low fuel warning light will go off when fuel is refilled up to 10 litre (2.2 gal/Imp) fuel level.**

### System Inspection

- 1) Remove fuel pump assembly referring to “Fuel Pump Assembly Removal and Installation” in Section 6C1.
- 2) Check fuel sender gauge referring to “Fuel Level Sensor (Gauge Unit) Inspection” in Section 8C.
- 3) Connect fuel pump connector (1) to fuel pump (2).



- 4) Connect negative (–) cable to battery.
- 5) Turn ignition switch to ON position.
- 6) Check for low fuel warning lamp operation under the following each float position (1) of fuel pump (2).  
If faulty condition is found, replace combination meter.



#### Low fuel warning light operation

Float position	Low fuel warning light operation
“a” Above “b” position	OFF
“b” 184 mm (7.24 in.) or more	ON

## Engine Oil Level Switch Inspection (If Equipped)

Refer to “Engine Oil Level Switch Inspection” in Section 6E3.

## SECTION 8G3

# IMMOBILIZER CONTROL SYSTEM (Z13DT ENGINE MODEL)

**WARNING:**

For vehicles equipped with a Supplemental Restraint (Air Bag) System:

- Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to “Air Bag System Components and Wiring Location View” under “General Description” in air bag section in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and “Service Precautions” under “On-Vehicle Service” in air bag system section before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative.

Either of these two conditions may result in severe injury.

- Technical service work must be started at least 90 seconds after the ignition switch is turned to the “LOCK” position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).

## CONTENTS

<b>General Description</b> .....	<b>8G3-3</b>	DTC B3043 W-Line CKT Malf (Short to Battery).....	8G3-16
Immobilizer Control System Operation Description .....	8G3-3	DTC B3055 No Transponder .....	8G3-17
Immobilizer Control System Wiring Circuit Diagram.....	8G3-3	DTC B3056 No Fix Code Registered.....	8G3-18
Immobilizer Control System Components Description .....	8G3-4	DTC B3057 No Password Registered .....	8G3-18
On-Board Diagnostic System Description .....	8G3-5	DTC B3059 No Request From ECM.....	8G3-19
<b>Diagnosis</b> .....	<b>8G3-7</b>	DTC B3060 Incorrect Transponder Detected.....	8G3-20
Precautions in Diagnosing Troubles .....	8G3-7	DTC B3061 Transponder Communication Fail .....	8G3-21
Precautions after Replacing ECM or Immobilizer Control Module .....	8G3-7	DTC B3077 Read-Only Transponder Detected.....	8G3-22
Diagnostic Flow Table.....	8G3-8	DTC P1610 Secret Key and Password Not Registered .....	8G3-22
Diagnostic Trouble Code (DTC) Check.....	8G3-9	DTC P1611 Password Not Matched .....	8G3-23
Diagnostic Trouble Code (DTC) Clearance.....	8G3-9	DTC P1612/P1613 No Signal From Immobilizer.....	8G3-23
Diagnostic Trouble Code (DTC) Table.....	8G3-10	DTC P1614 Incorrect Signal from Immobilizer.....	8G3-24
Scan Tool Data .....	8G3-11	<b>On-vehicle Service</b> .....	<b>8G3-25</b>
Inspection of Immobilizer Control Module and Its Circuits.....	8G3-12	Precautions in Handling Immobilizer Control System .....	8G3-25
DTC B1000 Immobi Cont Module Internal Fail .....	8G3-13	Immobilizer Control Module Removal and Installation.....	8G3-25
DTC B3040 W-Line Communication Fail .....	8G3-14	Registration Procedure of Immobilizer System Components.....	8G3-27
DTC B3042 W-Line CKT Malf (Short to Ground) .....	8G3-15	Registration flow table of immobilizer control system components .....	8G3-27



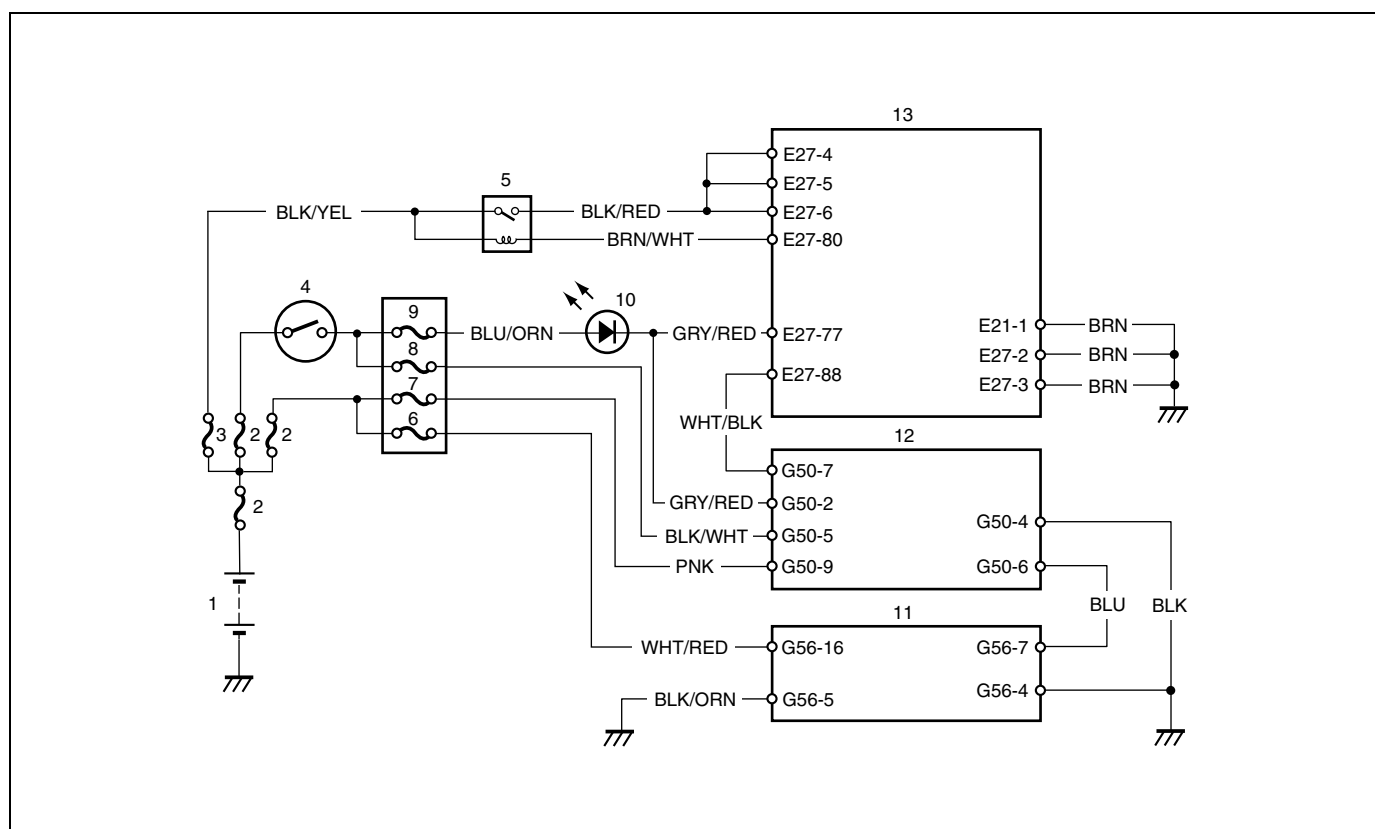
How to register ignition key .....	8G3-28	Procedure after ECM replacement .....	8G3-28
Procedure after Immobilizer Control		<b>Special Tools.....</b>	<b>8G3-29</b>
Module replacement.....	8G3-28		

## General Description

### Immobilizer Control System Operation Description

- 1) Each ignition key has its own FIX CODE (FC) stored in memory. When the ignition switch is turned to ON (II) position, Immobilizer Control Module reads the FC through its coil antenna from ignition key.
- 2) Immobilizer Control Module compares FC read in Step 1 and that registered in Immobilizer Control Module. Then, it checks if they match.
- 3) ECM sends variable (generated randomly) to transponder via Immobilizer Control Module, and then ECM calculates it with SECRET KEY CODE (SKC) stored in its memory according to specified algorithm. On the other hand, transponder also calculates received variable with SKC stored in its memory by means of same algorithm and sends back to ECM.
- 4) Only when ECM/transponder calculated values match, ECM keeps running engine.  
If two calculated values do not match, ECM stops operation of injectors and ignitor to stop engine after about 1.8 seconds at the first time. After the second time, ECM does not let engine start. And, so it does when FIX CODEs in Step 2 do not match.

### Immobilizer Control System Wiring Circuit Diagram



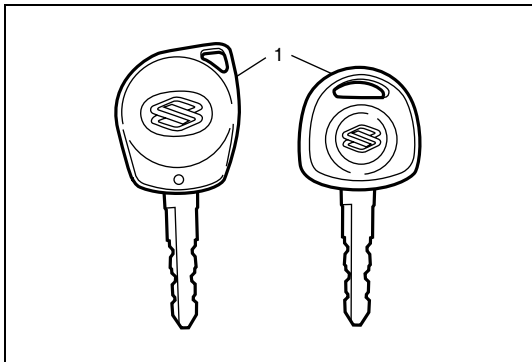
1. Battery	6. DOME RADIO fuse (15 A)	11. Data link connector (DLC)
2. Fuse	7. STOP fuse (15 A)	12. Immobilizer Control Module
3. FI fuse (20 A)	8. IG COIL fuse (15 A)	13. ECM
4. Ignition switch	9. METER fuse (10 A)	
5. Main relay	10. Service vehicle soon (SVS) lamp	

## Immobilizer Control System Components Description

The immobilizer control system designed to prevent vehicle burglar and it consists of following components.

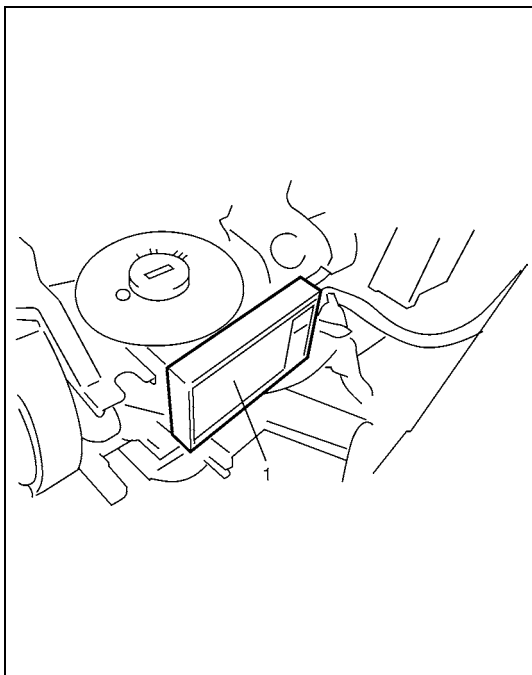
- Engine Control Module (ECM)
- Immobilizer Control Module (with coil antenna)
- Ignition key (with built-in transponder)

### Ignition Key (With Built-in Transponder)



Transponder is built in an ignition key grip (1). Each transponder in the key has a FIX CODE (FC) and SECRET KEY CODE (SKC). The FC will be transmitted from the transponder via the coil antenna to Immobilizer Control Module when the ignition switch is turned to ON (II) position. SKC is used for calculation with variable sent from ECM. SKC is preset (programmed) at factory shipment.

### Immobilizer Control Module



Immobilizer Control Module (1) is installed to steering column beside ignition key switch. The coil antenna is installed to Immobilizer Control Module. It energizes transponder and transmits the FIX CODE (FC) and data between transponder and Immobilizer Control Module.

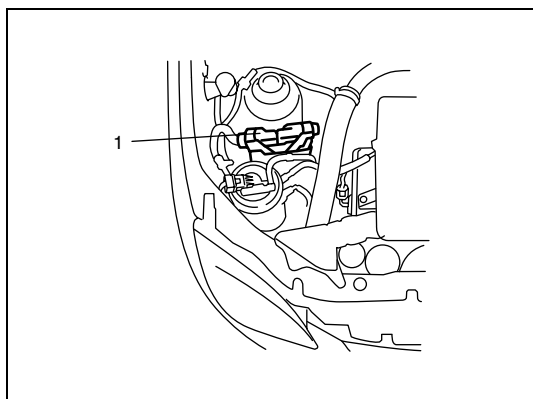
As main function, Immobilizer Control Module checks if FC transmitted from transponder and that registered in Immobilizer Control Module (up to 5 different FC can be registered) match.

Immobilizer Control Module controls serial communication between scan tool and ECM.

Immobilizer Control Module has 3 different values as the follows.

- Password (PWD): for accessing to program by means of scan tool.
- SKC: for ECM and transponder to calculate with.
- FC: for checking if transponder is the registered one.

## ECM



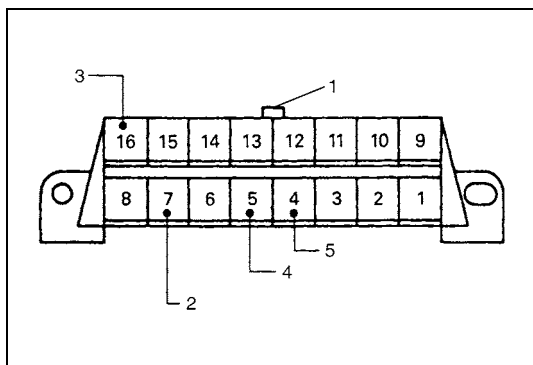
As main function other than engine control, ECM (1) sends randomized data to transponder and checks if a response from transponder and the value calculated in ECM match.

According to matching result, ECM decides to keep engine running or not.

ECM has 2 different values as follows.

- Password (PWD): for accessing to program immobilizer control system.
- SECRET KEY CODE (SKC): for calculating with this value for permission of engine start.

## Data Link Connector (DLC)



DLC (1) is in compliance with SAE J1962 in its installation position, the shape of connector and pin assignment.

OBD-II serial data line (K line of ISO 9141) (2) is used for SUZUKI scan tool to communicate with Immobilizer Control Module, Air bag SDM, ABS control module, etc.

3. B+
4. ECM ground
5. Body ground

## On-Board Diagnostic System Description

ECM and Immobilizer Control Module diagnose troubles which may occur in the area including the following parts when the ignition switch is turned to ON position.

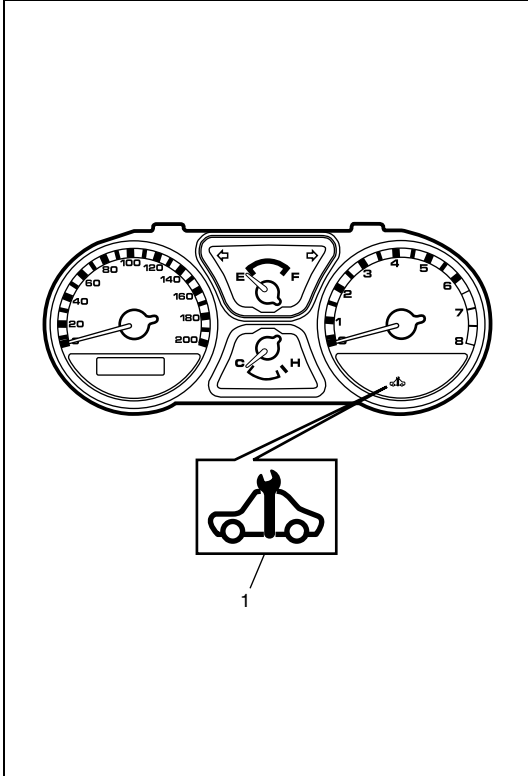
### Immobilizer Control Module

- W-line (communication line between ECM and Immobilizer Control Module)
- Password (PWD)
- MIL circuit
- Transponder (ignition key)
- FIX CODE (FC)

### ECM

- SECRET KEY CODE (SKC)
- PWD

When a trouble exists in the immobilizer control system (when Immobilizer Control Module or ECM detects a diagnostic trouble code (DTC)), ECM stops operation of the injector and igniter.



With the ignition switch at ON (but the engine at stop) regardless of the condition of the engine and emission control system, ECM indicates whether some trouble has occurred in the immobilizer control system or not by turning ON or flashing ON and OFF the SVS lamp (1).

**SVS lamp is ON, and then OFF after 3 seconds:**

**No trouble exists in the immobilizer control system.**

**SVS lamp flashes ON and OFF at 0.25-sec. intervals:**

**ECM or Immobilizer Control Module has detected some trouble in the immobilizer control system.**

**NOTE:**

As soon as the ignition switch is turned to ON position, ECM and Immobilizer Control Module diagnose if a trouble has occurred in the immobilizer control system in about 3 seconds at maximum.

While the diagnosis is being made, the SVS lamp stays on and diagnosis result is abnormal, it immediately starts flashing but if the result is normal, it remains on.

## Diagnosis

ECM and Immobilizer Control Module have on-board diagnostic system. Investigate where the trouble is by referring to “Diagnostic Flow Table” and “Diagnostic Trouble Code (DTC) Table” in this section.

### Precautions in Diagnosing Troubles

- Before confirming diagnostic trouble code, do not disconnect connector from ECM, battery cable from battery, ground wire harness or main fuse.  
Such disconnection will erase memorized information in ECM.
- Diagnostic trouble code stored in Immobilizer Control Module memory can be cleared as well as checked by using SUZUKI scan tool. Before using scan tool, read its Operator's (Instruction) Manual. Carefully to have good understanding as to what functions are available and how to use it.
- Be sure to read “Precautions for Electrical Circuit Service” in Section 0A before inspection and observe what is written there.
- There are cases where SVS lamp indicates that some trouble has occurred only temporarily and has gone. In such case, it may occur that good parts are replaced unnecessarily. To prevent such case, be sure to follow instructions given below when checking by using “Diagnostic Flow Table” in this section.
- When trouble can be identified, it is not an intermittent one: check ignition key, wires and each connector and if they are all in good condition, substitute a known-good ECM and recheck.

### Precautions after Replacing ECM or Immobilizer Control Module

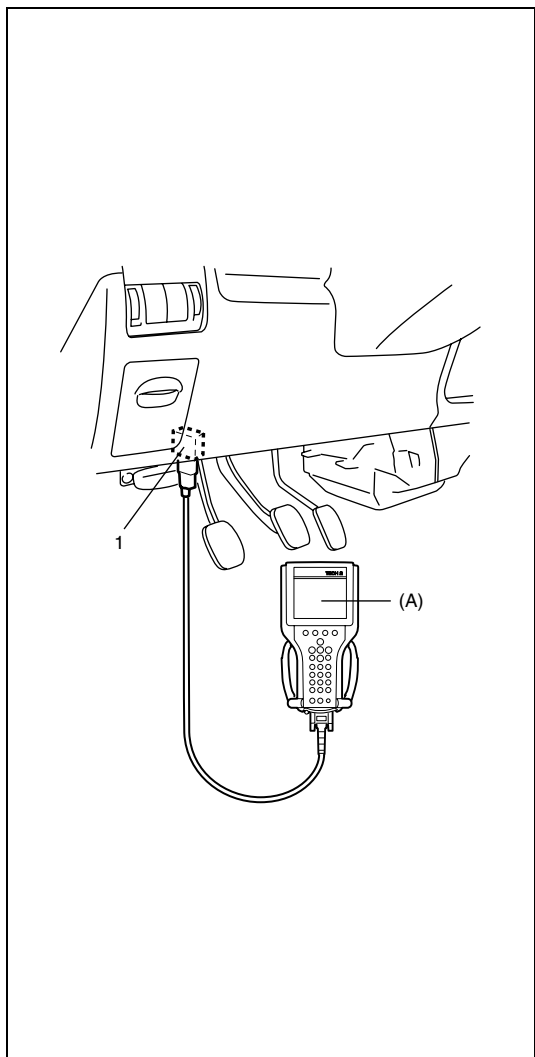
- When ECM is replaced, including when replaced because rechecking by using a known-good ECM is necessary during trouble diagnosis, secret key and password must be registered in ECM by performing procedure described in “Procedure after ECM replacement” in this section.
- When Immobilizer Control Module is replaced, including when replaced because rechecking by using a known-good Immobilizer Control Module is necessary during trouble diagnosis, transponder fix code, secret key and/or password must be registered in Immobilizer Control Module by performing procedure described in “Procedure after Immobilizer Control Module replacement” in this section.

## Diagnostic Flow Table

Step	Action	Yes	No
1	Turn ignition switch to start engine. Does engine run?	Go to Step 5.	Go to Step 2.
2	W-line circuit check Measure terminal voltage of Immobilizer Control Module connector G50-7. Is it 10 - 14 V with ignition switch at ON position, 0 - 1 V with ignition switch at OFF position?	W-line circuit is in good condition. Go to step3.	W-line circuit open or short. Check and repair. Then, go to Step 3.
3	Check for DTC referring to "Diagnostic Trouble Code (DTC) Check" in Section 6-3. Is there any DTC(s)?	Go to Step 4.	Go to Step 5.
4	Check, repair and/or perform necessary registration procedure according to flow table corresponding to DTC(s). Is there other DTC(s)?	Repeat Step 4 until no DTC is indicated.	Go to Step 5.
5	Check for DTC referring to "Diagnostic Trouble Code (DTC) Check" in this section. Is there any DTC(s)?	Go to Step 6.	Immobilizer control system is in good condition. If engine does not run, electronic fuel injection system is failed. Proceed to "A, Diagnostic System Check" in Section 6-3.
6	Check and repair according to flow table corresponding to DTC(s). Is there other DTC(s)?	Repeat Step 6 until no DTC is indicated.	Immobilizer control system is in good condition. If engine does not run, electronic fuel injection system is failed. Proceed to "A, Diagnostic System Check" in Section 6-3.

## Diagnostic Trouble Code (DTC) Check

### Immobilizer Control Module



- 1) Prepare SUZUKI scan tool.
- 2) With ignition switch OFF position (●), connect SUZUKI scan tool to data link connector (DLC) (1) located under instrument panel at driver's seat side.

#### Special tool

(A): SUZUKI scan tool

- 3) Turn ignition switch to ON position (II).  
Read DTC according to instructions displayed on SUZUKI scan tool referring to scan tool operator's manual for further details.  
If communication between scan tool and Immobilizer Control Module can not be established, check if SUZUKI scan tool is communicable by connecting it to immobilizer control system of another vehicle. If communication is possible in this case, SUZUKI scan tool is in good condition. Then, check data link connector and serial data line (circuit) in the vehicle with which communication can not be established.

#### NOTE:

**DTC No. B3040, B3042 and B3043 can not be confirmed by scan tool unless W-line circuit is in good condition.**

- 4) After completing the check, turn ignition switch to OFF position and disconnect SUZUKI scan tool from DLC.

### ECM

Refer to "Diagnostic Trouble Code (DTC) Check" in Section 6-3.

## Diagnostic Trouble Code (DTC) Clearance

### Immobilizer Control Module

- 1) Connect SUZUKI scan tool to data link connector (DLC) located under instrument panel at driver's seat side.
- 2) Turn ignition switch to ON position (II).
- 3) Erase DTC according to instructions displayed on SUZUKI scan tool referring to scan tool operator's manual for further details.
- 4) After completing the clearance, turn ignition switch to OFF position and disconnect SUZUKI scan tool from DLC.

### ECM

Refer to "Diagnostic Trouble Code (DTC) Clearance" in Section 6-3.



## Diagnostic Trouble Code (DTC) Table

### Immobilizer Control Module

DTC No.	Detected Item	Detecting Condition
B1000	Immobilizer Control Module internal failure	Immobilizer Control Module failure
B3040	W-line communication failure	Communication not finished correctly
B3042	W-line circuit shorted to ground	W-line circuit voltage low
B3043	W-line circuit shorted to battery	W-line circuit voltage high
B3055	No transponder	Ignition key without transponder is used.
B3056	No FIX CODE (FC) registered	FC is not registered in Immobilizer Control Module.
B3057	No password (PWD) registered	PWD is not registered in Immobilizer Control Module.
B3059	No request from ECM	ECM/Immobilizer Control Module line (SVS lamp) is open or shorted.
B3060	Incorrect transponder detected	Unregistered transponder is detected.
B3061	Transponder communication fail	Incorrect signal or no response from transponder
B3077	Read-only transponder detected	Transponder not for this system is detected.

### ECM

DTC No.	Detected Item	Detecting Condition
Display on Scan Tool		
P1610	SECRET KEY CODE (SKC) and password (PWD) not registered	SKC and PWD are not registered in ECM.
P1611	PWD not matched	Stored PWD is incorrect.
P1612	No signal from Immobilizer Control Module	Invalid signal from Immobilizer Control Module
P1613	No signal from Immobilizer Control Module	Invalid signal from Immobilizer Control Module
P1614	Incorrect signal from Immobilizer Control Module	Received response from transponder is incorrect.

#### NOTE:

- DTC B3040, B3042 and B3043 not be confirmed by scan tool unless W-line circuit is in good condition.
- DTC B3059 is detected when ignition switch is turned to ON (I) position within 5 seconds after ignition switch turned to (I) or (•) position from (II) position.

## Scan Tool Data

As the data value given below are standard values estimated on the basis of values obtained from the normally operating vehicles by using SUZUKI scan tool, use them as reference values. Even when the vehicle is in good condition, there may be cases where the checked value does not fall within normal conditions and reference values. Therefore, judgement as abnormal should not be made by checking with there data alone.

Also, conditions in the table below that can be checked by SUZUKI scan tool are those detected by Immobilizer Control Module and output from Immobilizer Control Module as commands.

Scan Tool Data	Vehicle Condition	Normal Condition/ Reference Values
IGNITION SW	Ignition switch turned to ON position	ON
TRANSPONDER	Ignition switch turned to ON position	DETECTED
TRANS SKC	Ignition switch turned to ON position	REGISTERED
FIX CODE	Ignition switch turned to ON position	REGISTERED
NUMBER OF FC	(Vehicle is in normal condition)	1-5 pcs
PASSWORD	(Vehicle is in normal condition)	PROGRAMMED
WAIT LOOP	(Vehicle is in normal condition)	INACTIVE
WAIT TIME	(Vehicle is in normal condition)	0 SEC

### Scan Tool Data Definitions

#### IGNITION SW

Ignition key switch position

ON: Ignition switch at ON position

OFF: Ignition switch at OFF position

#### TRANSPONDER

DETECTED: Transponder in ignition key is detected by Immobilizer Control Module.

NOT DETECTED: Transponder in ignition key is not detected.

#### TRANS SKC

REGISTERED: SECRET KEY CODE (SKC) is registered in ignition key with built-in transponder.

NOT REGISTERED: SKC is not registered in ignition key with built-in transponder yet.

#### FIX CODE

REGISTERED: FIX CODE (FC) of ignition key, which is inserted in key cylinder, is registered in Immobilizer Control Module.

NOT REGISTERED: FC of ignition key, which is inserted in key cylinder, is not registered in Immobilizer Control Module.

#### NUMBER OF FC (PCS)

The number of registered ignition key.

#### PASSWORD

REGISTERED: Password (PWD) is registered in Immobilizer Control Module.

NOT REGISTERED: PWD is not registered. It is necessary to register PWD to set Immobilizer Control Module in normal operation status.

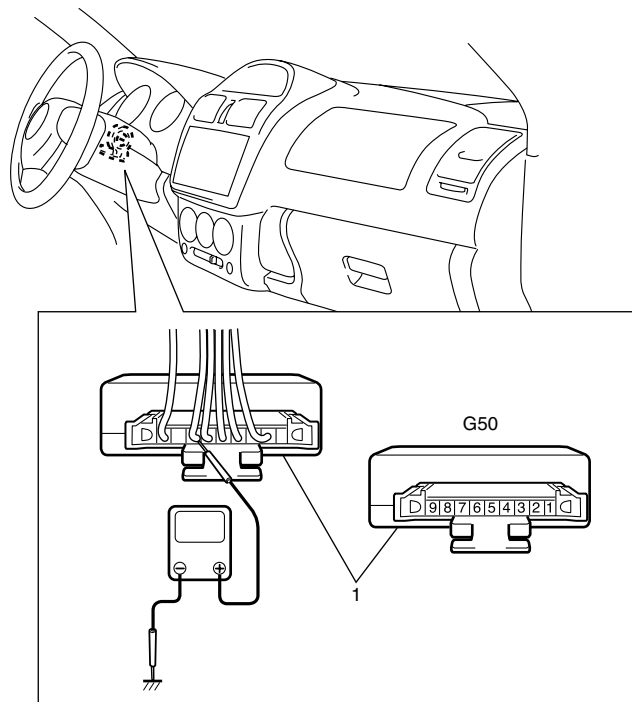
**WAIT-LOOP**

INACTIVE: Security system is inactive. It is ready for password (PWD) input by using SUZUKI scan tool.

ACTIVE: Incorrect PWD was inputted and system is in wait-loop status. Inputting PWD is inhibited during the period of wait time.

**WAIT TIME (SEC, MIN)**

When an incorrect password (PWD) is inputted, the security system is activated. And, the immobilizer control system is in the wait-loop status for the period of wait time indicated on the SUZUKI scan tool. As an incorrect PWD is inputted repeatedly, the wait time becomes longer.

**Inspection of Immobilizer Control Module and Its Circuits****Voltage Inspection**

Immobilizer Control Module (1) can be checked at wiring connectors by measuring voltage.

**CAUTION:**

Immobilizer Control Module can not be checked by itself. It is strictly prohibited to connect voltmeter or ohmmeter to Immobilizer Control Module with coupler disconnected from it.

**NOTE:**

As the battery voltage affects each terminal voltage, confirm that it is 11 V or more when ignition switch is turned to ON position.

Con- nector	Terminal		Circuit	Normal Voltage	Condition
G50	1	—	Not used	—	—
	2	GRY/RED	SVS lamp	0 – 1 V	SVS lamp lights on.
	3	—	Not used	—	—
	4	BLK	Ground	0 – 1 V	Anytime
	5	BLK/WHT	Ignition switch signal	10 – 14 V	Ignition switch at ON position
				0 – 1 V	Ignition switch at OFF position
	6	BLU	Data link connector (Serial data line)	10 – 14 V	SUZUKI scan tool connected
				0 – 1 V	SUZUKI scan tool disconnected
	7	WHT/BLK	W-line	10 – 14 V	SUZUKI scan tool connected or ignition switch at ON position
				0 – 1 V	SUZUKI scan tool disconnected and ignition switch at OFF position
	8	—	Not used	—	—
	9	PNK	Power supply	10 – 14 V	Anytime

## DTC B1000 Immobi Cont Module Internal Fail

### DTC Detecting Condition and Trouble Area

DTC Detecting Condition	Trouble Area
Internal fault of Immobilizer Control Module	Immobilizer Control Module

### Troubleshooting

Step	Action	Yes	No
1	1) Ignition switch at OFF position. 2) Disconnect connector from Immobilizer Control Module. 3) Check for proper connection to Immobilizer Control Module at all terminals. Are they in good condition?	Substitute a known-good Immobilizer Control Module according to “Immobilizer Control Module Removal and Installation” in this section and recheck.	Repair or replace.

## DTC B3040 W-Line Communication Fail

### Wiring Circuit

Refer to “Immobilizer Control System Wiring Circuit Diagram” in this section.

### DTC Detecting Condition and Trouble Area

DTC Detecting Condition	Trouble Area
No response from ECM while Immobilizer Control Module requests signal	<ul style="list-style-type: none"> <li>W-line circuit</li> <li>ECM power circuit</li> </ul>

### Troubleshooting

Step	Action	Yes	No
1	1) Ignition switch at OFF position. 2) Disconnect connector from ECM. 3) Check for proper connection to ECM at E27-88 terminal. Is it in good condition?	Go to Step 2.	Repair or replace.
2	1) Ignition switch at OFF position. 2) Disconnect connector from Immobilizer Control Module. 3) Check for proper connection to Immobilizer Control Module at G50-7 terminal. Is it in good condition?	Go to Step 3.	Repair or replace.
3	With connectors connected, measure voltage between terminal G50-7 and ground with ignition switch at ON position. Is it 10 - 14 V?	Go to Step 4.	W-line (WHT/BLK) circuit open.
4	With ignition switch at ON position, measure voltage between E27-4, E27-5, or E27-6 and ground. Are they 10 - 14 V?	Substitute a known-good ECM according to “Procedure for ECM replacement” in this section and recheck.	ECM power supply (BLK/RED) circuit open.

## DTC B3042 W-Line CKT Malf (Short to Ground)

### Wiring Circuit

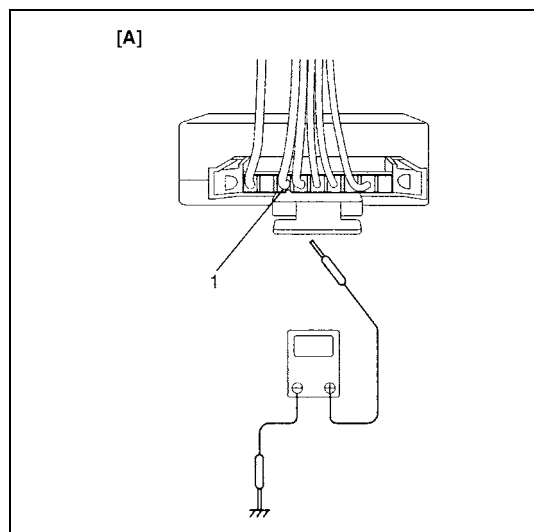
Refer to “Immobilizer Control System Wiring Circuit Diagram” in this section.

### DTC Detecting Condition and Trouble Area

DTC Detecting Condition	Trouble Area
W-line circuit voltage is low.	W-line circuit

### Troubleshooting

Step	Action	Yes	No
1	1) Ignition switch at OFF position. 2) Disconnect connector from ECM. 3) Check for proper connection to ECM at E27-88 terminal. Is it in good condition?	Go to Step 2.	Repair or replace.
2	1) Connect connector to ECM. 2) Measure voltage between G50-7 terminal of Immobilizer Control Module and body ground with ignition switch at ON position referring to the figure below. Is it 10 – 14 V?	Substitute a known-good ECM according to “Procedure for ECM replacement” in this section and recheck.	W-line (WHT/BLK) is shorted to ground. Repair and recheck.



[A]: Fig. for Step 2

1. G50-7

## DTC B3043 W-Line CKT Malf (Short to Battery)

### Wiring Circuit

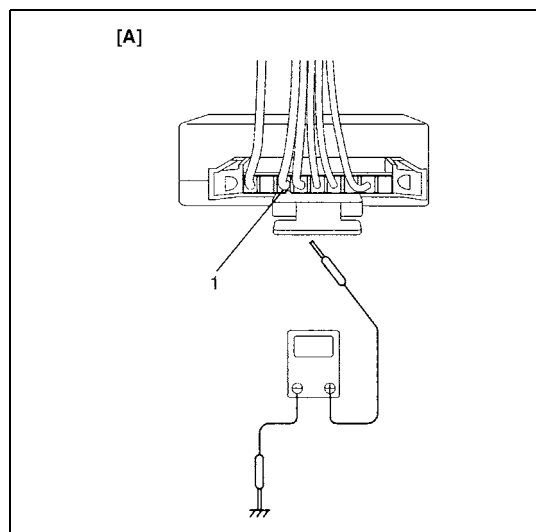
Refer to “Immobilizer Control System Wiring Circuit Diagram” in this section.

### DTC Detecting Condition and Trouble Area

DTC Detecting Condition	Trouble Area
W-line circuit voltage is high.	W-line circuit

### Troubleshooting

Step	Action	Yes	No
1	1) Ignition switch at OFF position. 2) Disconnect connector from ECM. 3) Check for proper connection to ECM at E27-88 terminal. Is it in good condition?	Go to Step 2.	Repair or replace.
2	1) Connect connector to ECM. 2) Measure voltage between G50-7 terminal of Immobilizer Control Module and body ground with ignition switch at OFF position and scan tool disconnected referring to the figure below. Is it 0 – 1 V?	Substitute a known-good ECM according to “Procedure for ECM replacement” in this section and recheck.	W-line (WHT/BLK) is shorted to power supply circuit. Repair and recheck.



[A]: Fig. for Step 2

1. G50-7

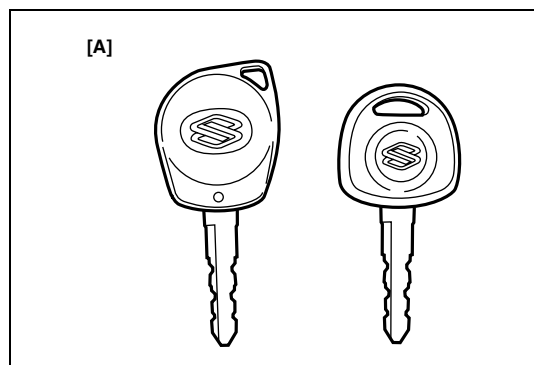
## DTC B3055 No Transponder

### DTC Detecting Condition and Trouble Area

DTC Detecting Condition	Trouble Area
<ul style="list-style-type: none"> <li>No FIX CODE (FC) is transmitted from transponder.</li> <li>FC transmission error.</li> </ul>	Ignition key

### Troubleshooting

Step	Action	Yes	No
1	1) Ignition switch at OFF position and leave it for 5 seconds or more. 2) Pull out ignition key and reinsert it. 3) Turn ignition switch to run engine. Does engine start?	Temporal error in code reading. Immobilizer control system is in good condition.	Go to Step 2.
2	1) Check ignition key for shape by referring to the figure below. Is it the original one?	Check ignition key referring to "Precautions in Handling Immobilizer Control System" in this section and repair or replace.	Ignition key with built-in transponder unusable. Replace, register it if necessary and recheck.



[A]: Fig. for Step 2



## DTC B3056 No Fix Code Registered

### DTC Detecting Condition and Trouble Area

DTC Detecting Condition	Trouble Area
No transponder FIX CODE (FC) is registered in Immobilizer Control Module.	Immobilizer Control Module

### Troubleshooting

Step	Action	Yes	No
1	Check DATA LIST "NUMBER OF FC". Is it 0?	Go to Step 2.	Substitute a known-good Immobilizer Control Module according to "Procedure after Immobilizer Control Module replacement" in this section and recheck.
2	Is DTC B3057 also output?	Proceed to DTC FLOW TABLE of DTC B3057. Then go to Step 3.	Go to Step 3.
3	Register ignition key(s) with built-in transponder according to "How to register ignition key". Check SUZUKI scan tool DATA LIST "NUMBER OF FC". Is it 1 or more?	Transponder FC(s) is registered.	Transponder registration procedure is not completed correctly. Register ignition key again.

## DTC B3057 No Password Registered

### DTC Detecting Condition and Trouble Area

DTC Detecting Condition	Trouble Area
Password (PWD) is not registered in Immobilizer Control Module.	Immobilizer Control Module

### Troubleshooting

Step	Action	Yes	No
1	1) Register PWD by using SUZUKI scan tool. Refer to "Procedure after ECM replacement" in this section. 2) Confirm that PWD is registered correctly, referring to SUZUKI scan tool DATA LIST. Is PASSWORD REGISTERED message output?	PWD registration is completed.	Register PWD again and recheck.

## DTC B3059 No Request From ECM

### Wiring Circuit

Refer to “Immobilizer Control System Wiring Circuit Diagram” in this section.

### DTC Detecting Condition and Trouble Area

DTC Detecting Condition	Trouble Area
<ul style="list-style-type: none"> <li>No request from ECM via SVS lamp circuit</li> <li>Ignition switch is not reset correctly.</li> </ul>	<ul style="list-style-type: none"> <li>SVS lamp circuit</li> <li>Communication between ECM and Immobilizer Control Module</li> </ul>

### Troubleshooting

Step	Action	Yes	No
1	Turn ignition switch to (I) position or (•) position for more than 5 seconds, then turn ignition switch to ON (II) position. Recheck DTC. Is DTC B3059 current?	Go to Step 2.	Communication between ECM and Immobilizer Control Module was not finished correctly.
2	1) Check for proper connection to ECM at E27-77 terminal. Is it in good condition?	Go to Step 3.	Repair or replace.
3	1) Check for proper connection to immobilizer control module at G50-2 terminal. Is it in good condition?	Go to Step 4.	Repair or replace.
4	1) Check GRY/RED line for open or short. Is it in good condition?	Substitute a known-good ECM according to “Procedure for ECM replacement” in this section and recheck.	Repair or replace.

## DTC B3060 Incorrect Transponder Detected

### DTC Detecting Condition and Trouble Area

DTC Detecting Condition	Trouble Area
<ul style="list-style-type: none"> <li>• FIX CODE (FC) does not match with registered one.</li> <li>• FC is not registered in Immobilizer Control Module.</li> </ul>	<ul style="list-style-type: none"> <li>• Ignition key with built-in transponder</li> <li>• Immobilizer Control Module</li> </ul>

### Troubleshooting

Step	Action	Yes	No
1	Is DTC B3056 also output?	Proceed to DTC FLOW TABLE of DTC B3056. Then, go to Step 2.	Go to Step 2.
2	Check DATA LIST "TRANSPONDER FC". Is it registered?	Replace ignition key with built-in transponder. Then go to Step 3.	Go to Step 3.
3	Register transponder according to "How to register ignition key" in this section. Check SUZUKI scan tool DATA LIST for "FIX CODE". Is it registered?	Transponder FIX CODE is registered.	Transponder registration procedure is not completed correctly. Register ignition key again.

## DTC B3061 Transponder Communication Fail

### DTC Detecting Condition and Trouble Area

DTC Detecting Condition	Trouble Area
<ul style="list-style-type: none"> <li>No response from transponder</li> <li>SECRET KEY CODE (SKC) is not matched between ignition key (transponder).</li> <li>FIX CODE (FC) does not match with registered one.</li> <li>FC is not registered in Immobilizer Control Module.</li> </ul>	<ul style="list-style-type: none"> <li>Ignition key with built-in transponder</li> <li>SKC is not registered in transponder.</li> <li>SKC is not registered in ECM.</li> <li>SKC is different between ECM and transponder.</li> <li>Unregistered ignition key (FC) with built-in transponder is detected.</li> <li>No FC in Immobilizer Control Module</li> </ul>

### Troubleshooting

Step	Action	Yes	No
1	Is DTC B3060 also output?	Proceed to DTC FLOW TABLE of DTC B3060. Then go to Step 2.	Go to Step 2.
2	Is DTC B3055 also output?	Proceed to DTC FLOW TABLE of DTC B3055. Then go to Step 3.	Go to Step 3.
3	Check scan tool DATA LIST "TRANS SKC". Is it REGISTERED?	Go to Step 5.	Go to Step 4.
4	1) Register SKC by performing REGI SKC/FC. 2) Check DTC. Is DTC B3061 still output?	Go to Step 5.	Register SKC and recheck.
5	1) Register SKC and PWD to ECM by referring to "Procedure after ECM replacement" in this section. 2) Check DTC. Is DTC B3061 still output?	Go to Step 6.	If there is other DTC, proceed to the DTC FLOW TABLE.
6	1) Replace ignition key with new one and register it by referring to "How to register ignition key" in this section. 2) Check DTC. Is DTC B3061 still output?	Substitute a known-good Immobilizer Control Module according to "Procedure after Immobilizer Control Module replacement" in this section and recheck.	If there is other DTC, proceed to DTC FLOW TABLE.

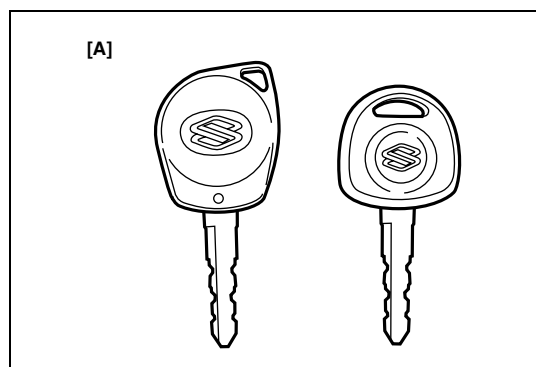
## DTC B3077 Read-Only Transponder Detected

### DTC Detecting Condition and Trouble Area

DTC Detecting Condition	Trouble Area
Transponder for other system is detected.	Ignition key with built-in transponder

### Troubleshooting

Step	Action	Yes	No
1	1) Ignition switch at OFF position and leave it for 5 seconds or more. 2) Pull out ignition key and reinsert it. 3) Turn ignition switch to run engine. Does engine start?	Temporary error in reading. Immobilizer control system is in good condition.	Replace ignition key with built-in transponder. Register transponder according to "How to register ignition key" in this section.
2	Check ignition key for shape by referring to the figure below. Is it the original one?	Check ignition key referring to "Precautions in Handling Immobilizer Control System" in this section and repair or replace.	Ignition key with built-in transponder unusable. Replace, register it if necessary and recheck.



[A]: Fig. for Step 2

## DTC P1610 Secret Key and Password Not Registered

### DTC Detecting Condition and Trouble Area

DTC Detecting Condition	Trouble Area
SECRET KEY CODE (SKC) and password (PWD) are not registered in ECM.	ECM

### Troubleshooting

Step	Action	Yes	No
1	1) Register SKC and PWD by using SUZUKI scan tool. Refer to "Procedure for ECM replacement" in this section. 2) Check DTC. Is DTC P1610 still output?	ECM is registered correctly.	Perform registration procedure again and recheck.

## DTC P1611 Password Not Matched

### DTC Detecting Condition and Trouble Area

DTC Detecting Condition	Trouble Area
Password (PWD) registered in ECM is not correct.	ECM

### Troubleshooting

Step	Action	Yes	No
1	Register PWD and SECRET KEY CODE (SKC) by using scan tool. Turn ignition switch to OFF position and leave it for 5 seconds or more. Then turn ignition switch to ON position. Is DTC P1611 still output?	Substitute a known-good ECM according to "Procedure for ECM replacement" in this section and recheck.	ECM is in good condition.

## DTC P1612/P1613 No Signal From Immobilizer

### DTC Detecting Condition and Trouble Area

DTC Detecting Condition	Trouble Area
Signal from Immobilizer Control Module is not received correctly.	<ul style="list-style-type: none"> <li>W-line circuit</li> <li>Immobilizer Control Module</li> </ul>

### Troubleshooting

Step	Action	Yes	No
1	Is DTC B3040, B3042 or B3043 output at Immobilizer Control Module?	W-line (WHT/BLK) fail. Proceed to each DTC FLOW TABLE according to that DTC number. Check B3042 or B3043 first and then B3040 if two codes are output at the same time.	Go to Step 2.
2	1) Ignition switch at OFF position and leave it for 5 seconds or more. 2) Pull out ignition key and reinsert it. 3) Turn ignition switch to run engine. Does engine start?	Temporary error in reading. Immobilizer control system is in good condition.	Substitute a known-good ECM according to "Procedure for ECM replacement" in this section and recheck.

## DTC P1614 Incorrect Signal from Immobilizer

### DTC Detecting Condition and Trouble Area

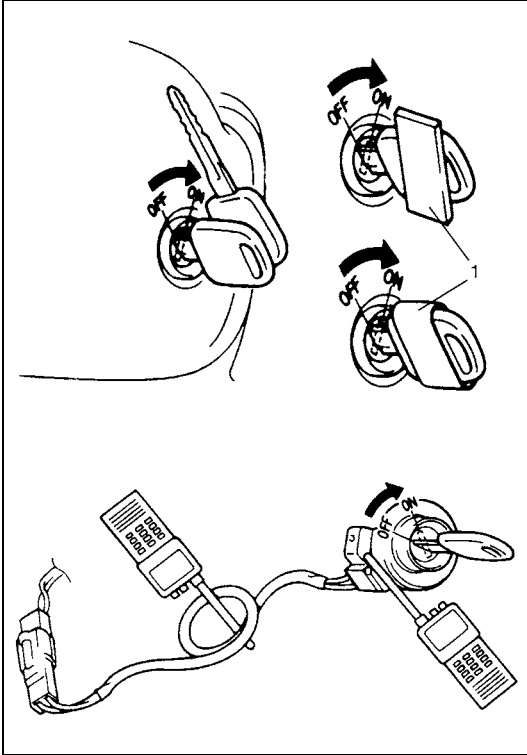
DTC Detecting Condition	Trouble Area
Signal from Immobilizer Control Module is not matched.	<ul style="list-style-type: none"> <li>Ignition key with built-in transponder internally faulty</li> <li>SECRET KEY CODE (SKC) is not registered in transponder.</li> <li>SKC key is not registered in ECM.</li> <li>SKC is different between ECM and transponder.</li> <li>Unregistered ignition key (FIX CODE (FC)) with built-in transponder is detected.</li> <li>No FC in Immobilizer Control Module</li> </ul>

### Troubleshooting

Step	Action	Yes	No
1	Proceed DTC FLOW TABLE of DTC B3061. Recheck DTC. Is DTC P1614 still output?	Substitute a known-good ECM according to "Procedure for ECM replacement" in this section and recheck.	ECM and Immobilizer Control Module are programmed correctly.

## On-vehicle Service

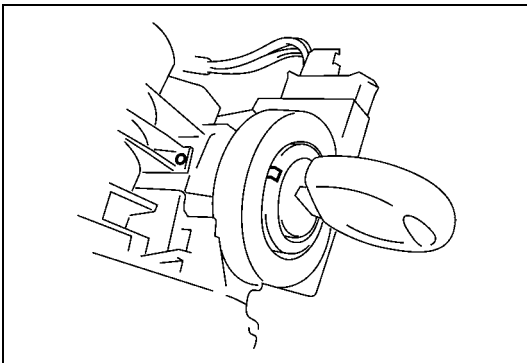
### Precautions in Handling Immobilizer Control System



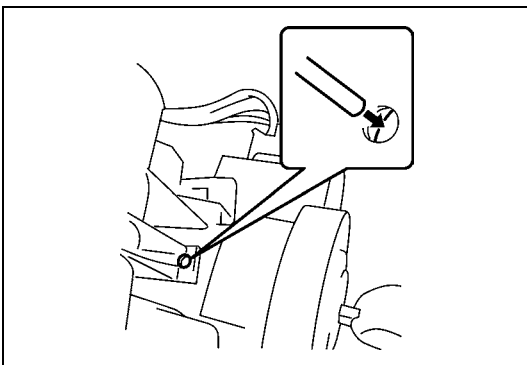
- Do not turn ignition switch to ON position (II) with ignition key with built-in transponder put together with another one or placed quite close to another one. Or, the system may detect abnormal condition and prevent engine from running.
- Do not turn ignition switch to ON position (II) by using ignition key with built-in transponder with any type of metal wound (1) around its grip (housing) or in contact with it. Or, the system may detect abnormal condition and prevent engine from starting.
- Do not leave ignition key with built-in transponder where high temperature is anticipated. High temperature will cause transponder in ignition key to be abnormal or damaged.
- Do not turn ignition switch to ON position (II) with a radio antenna placed near coil antenna or its harness to Immobilizer Control Module.  
Or the system may detect abnormal condition and prevent engine from starting.

### Immobilizer Control Module Removal and Installation

#### Removal

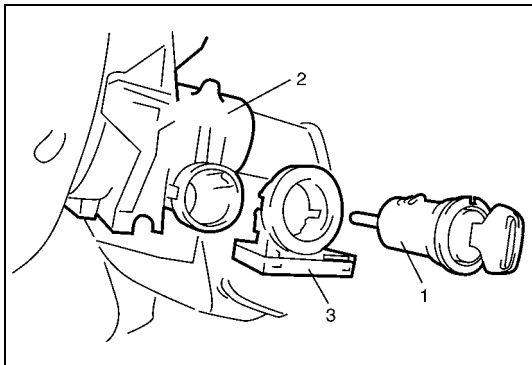


- 1) Remove steering column cover.
- 2) Remove key cylinder cap from key cylinder switch.
- 3) Turn ignition switch to (I) position.



- 4) Push the protrusion in the hole.





- 5) Pull off key cylinder (1) from column assembly (2).
- 6) Disconnect wire harness connector from Immobilizer Control Module.
- 7) Remove Immobilizer Control Module (3).

### Installation

Reverse removal procedure noting the following instruction.

- Insert key cylinder to steering column referring to “Steering Column Removal and Installation” in Section 3C.

## Registration Procedure of Immobilizer System Components

### Registration flow table of immobilizer control system components

When replacing any component of immobilizer control system, perform registration procedure according to following flow table.

**NOTE:**

When replacing Immobilizer Control Module and ECM at the same time, the ignition key with built-in transponder that has been registered to the system (SECRET KEY CODE (SKC) registered to transponder) can not be used. Prepare new ignition key with built-in transponder (SKC unregistered to transponder), and perform Steps 1 to 4 as follows.

Step	Action	Yes	No
1	DTC CHECK. Check for DTC referring to referring to “Diagnostic Trouble Code (DTC) Check” in this section. Are there DTC B1000, B3040, B3042, and/or B3043?	Proceed to each diagnostic flow table corresponding to that DTC(s).	Go to Step 2.
2	Confirmation of password (PWD) registration. Is there DTC B3057?	Register PWD by referring to “Procedure after ECM replacement” in this section. Then, go to Step 3.	Go to Step 3.
3	ECM replacement. Is ECM replaced?	Proceed to “Procedure after ECM replacement” in this section. Then, go to Step 4.	Go to Step 4.
4	Immobilizer Control Module replacement. Is Immobilizer Control Module replaced?	Proceed to “Procedure after Immobilizer Control Module replacement” in this section.	Go to Step 5.
5	Ignition key with built-in transponder registration. Is ignition key registered?	Proceed to “How to register ignition key” in this section.	End.

### **How to register ignition key**

To register ignition key with built-in transponder, perform “Register New IG Key (Fix Code)” mode by using SUZUKI scan tool. For your details, refer to “SUZUKI Tech2 Operator’s Manual”.

#### **NOTE:**

**Registering SECRET KEY CODE (SKC) to ignition key with built-in transponder is available only once.**

### **Procedure after Immobilizer Control Module replacement**

When Immobilizer Control Module must be replaced including when replaced because rechecking by using a known-good Immobilizer Control Module is necessary during trouble diagnosis, register FIX CODE (FC) and SECRET KEY CODE (SKC) to Immobilizer Control Module by performing the following procedure.

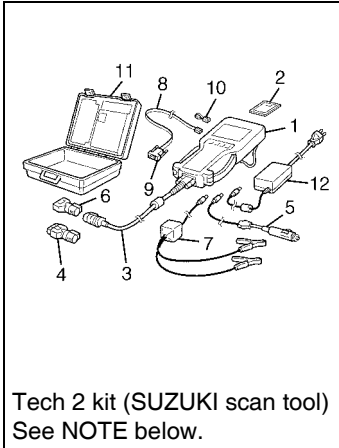
Perform “IMM Cont (Register Secret Key Code)” and “Register New IG Key (Fix Code)” modes by using SUZUKI scan tool. For your details, refer to “SUZUKI Tech2 Operator’s Manual”.

### **Procedure after ECM replacement**

When ECM is replaced, including when replaced because rechecking by using a known-good ECM is necessary during trouble diagnosis, register password (PWD) and SECRET KEY CODE (SKC) to ECM by performing following procedure.

Refer to “Procedure After ECM Replacement” under “ECM Registration” in Section 6E3.

## Special Tools

**NOTE:**

This kit includes the following items.

1. Tech 2, 2. PCMCIA card, 3. DLC cable, 4. SAE 16/19 adapter, 5. Cigarette cable,
6. DLC loopback adapter, 7. Battery power cable, 8. RS232 cable, 9. RS232 adapter,
10. RS232 loopback connector, 11. Storage case, 12. Power supply



SECTION 9

BODY SERVICE

**WARNING:**

For vehicles equipped with Supplemental Restraint (Air Bag) System:

- Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to “System Components and Wiring Location View and Connectors” under “General Description” in Section 10B in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and “Service Precautions” under “On-Vehicle Service” in Section 10B before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.
- Technical service work must be started at least 90 seconds after the ignition switch is turned to the “LOCK” position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).
- When body servicing, if shock may be applied to air bag system component parts, remove those parts beforehand. (Refer to Section 10B.)

**NOTE:**

- Fasteners are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. They must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary.
- Do not use a replacement part of lesser quality or substitute a design. Torque values must be used as specified during reassembly to assure proper retention of these parts.
- For the items with asterisk (\*) in the “CONTENTS” below, refer to the same section of the Service Manual mentioned in the “Foreword” of this manual.

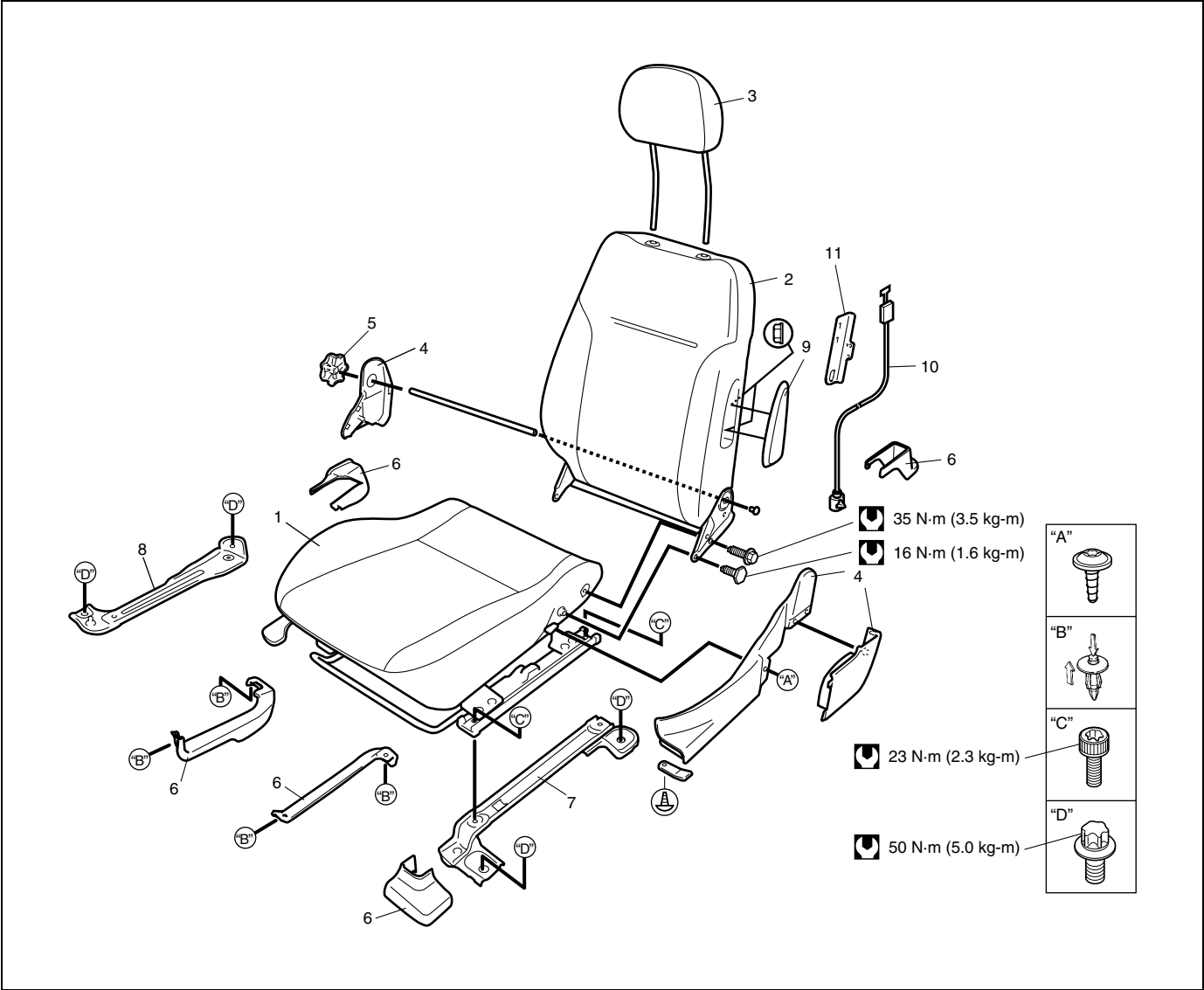
CONTENTS

<b>Glass, Windows and Mirrors.....*</b>	Front Door Removal and Installation .....	*
Front Door Window Removal and Installation .....	Rear Door Removal and Installation .....	*
Front Door Window Inspection .....	Rearend Door Removal and Installation .....	*
Front Door Window Regulator Removal and Installation .....	Hood Removal and Installation .....	*
Front Door Window Regulator Inspection .....	Hood Adjustment .....	*
Door Mirror Removal and Installation.....*	Hood Inspection .....	*
Rear Door Window Removal and Installation .....	Front Fender Removal and Installation.....*	*
Rear Door Window Inspection .....	Front Bumper and Rear Bumper Removal and Installation.....*	*
Rear Door Window Regulator Removal and Installation .....	Bumper Extension and Splash Guard Removal and Installation (If Equipped) .....	*
Rear Door Window Regulator Inspection.....*	Rearend Door Spoiler Removal and Installation (If Equipped) .....	*
Windshield Removal and Installation .....	Roof Rail Removal and Installation (If Equipped) .....	*
Preparation.....*	Body Dimensions .....	*
Quarter Window Removal and Installation.....*	Engine room.....*	*
Rearend Glass Removal and Installation.....*	Rearend door .....	*
<b>Body Structure .....</b>	Side body .....	*

Under body.....	*	Key Usage and Identification .....	*
Panel Clearance .....	*	Ignition switch lock cylinder removal and installation .....	*
<b>Instrumentation and Driver Information .....</b>	<b>*</b>	<b>Exterior and Interior Trim.....</b>	<b>*</b>
Instrument Panel Removal and Installation .....	*	Floor Carpet Removal and Installation .....	*
<b>Seats .....</b>	<b>9-3</b>	Center Console Box Removal and Installation.....	*
Front Seat Removal and Installation .....	9-3	Head Lining Removal and Installation .....	*
Rear Seat Removal and Installation.....	9-4	Roof Molding Removal and Installation .....	*
<b>Security and Locks .....</b>	<b>*</b>	<b>Paint and Coatings .....</b>	<b>9-5</b>
Front Door Lock Assembly Removal and Installation .....	*	Anti-Corrosion Treatment .....	*
Front Door Lock Assembly Inspection .....	*	Sealant Application Areas.....	*
Rear Door Lock Assembly Removal and Installation .....	*	Under Coating Application Areas.....	9-5
Rear Door Lock Assembly Inspection .....	*	Anti-Corrosion Compound Application Area .....	9-6
Rearend Door Lock Assembly Removal and Installation .....	*	Plastic Parts Finishing .....	*
Key Coding .....	*	<b>Required Service Material.....</b>	<b>*</b>

# Seats

## Front Seat Removal and Installation



1. Seat cushion assembly	4. Cover	7. Seat adjuster outer bracket	10. Side air bag harness (if equipped)
2. Seat back	5. Knob	8. Seat adjuster inner bracket	11. Harness bracket
3. Headrest	6. Cover	9. Side air bag module (if equipped)	Tightening torque

### Removal

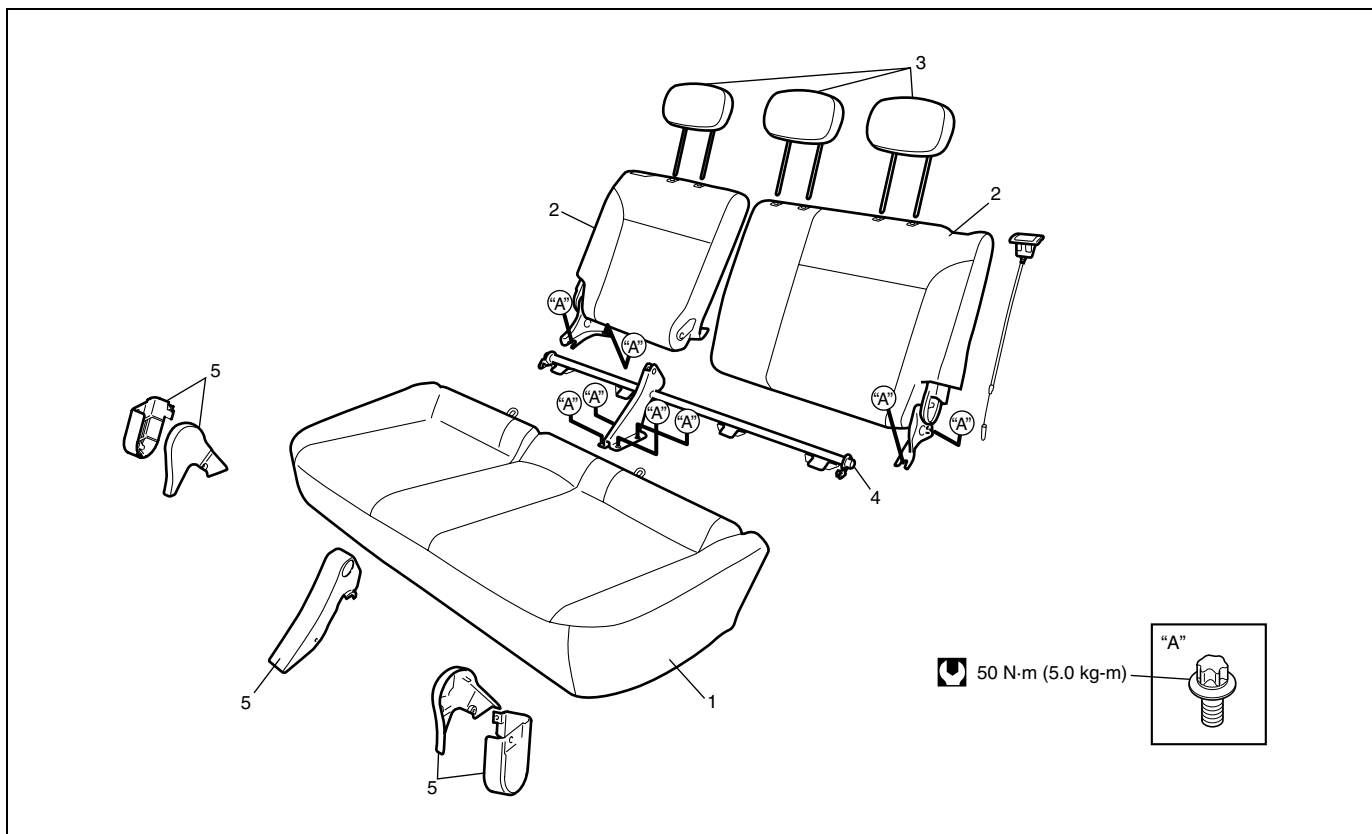
- 1) Remove console box.
- 2) Disable air bag system referring to “Disabling Air Bag System” in Section 10B.
- 3) Disconnect heat seater coupler and side air bag coupler, if equipped.
- 4) Remove 4 mounting bolts to remove seat assembly.
- 5) Disassemble and repair seat as necessary.

### Installation

Reverse removal procedure to install front seat.  
Torque to specifications as shown in above figure.



## Rear Seat Removal and Installation



1. Seat cushion	3. Headrest	5. Cover
2. Seat back	4. Rear seat back bracket	Tightening torquer

### Removal

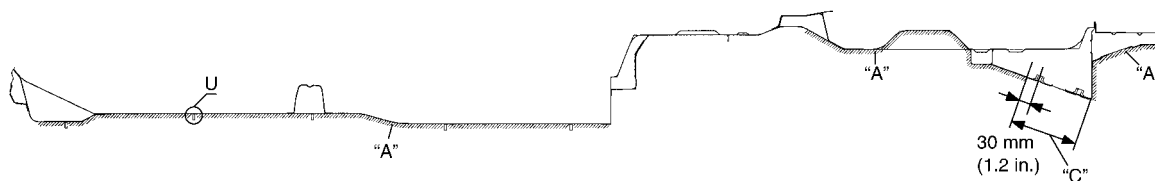
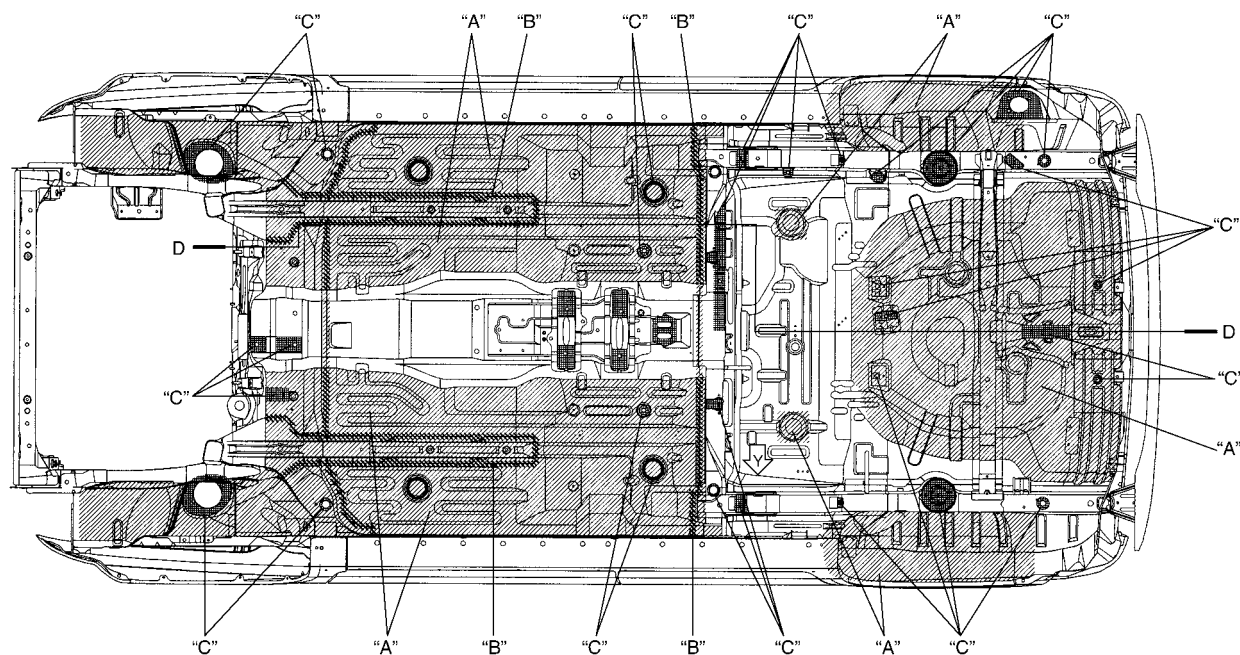
- 1) Remove seat cushion.
- 2) Remove 8 seat back bolts to remove seat back.
- 3) Disassemble and repair seat as necessary.

### Installation

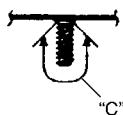
Reverse removal procedure to install rear seat.  
Torque to specifications as shown in above figure.

# Paint and Coatings

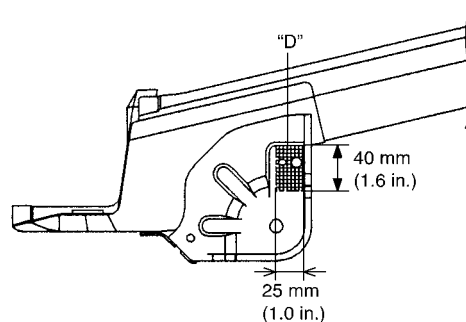
## Under Coating Application Areas



D-D



U



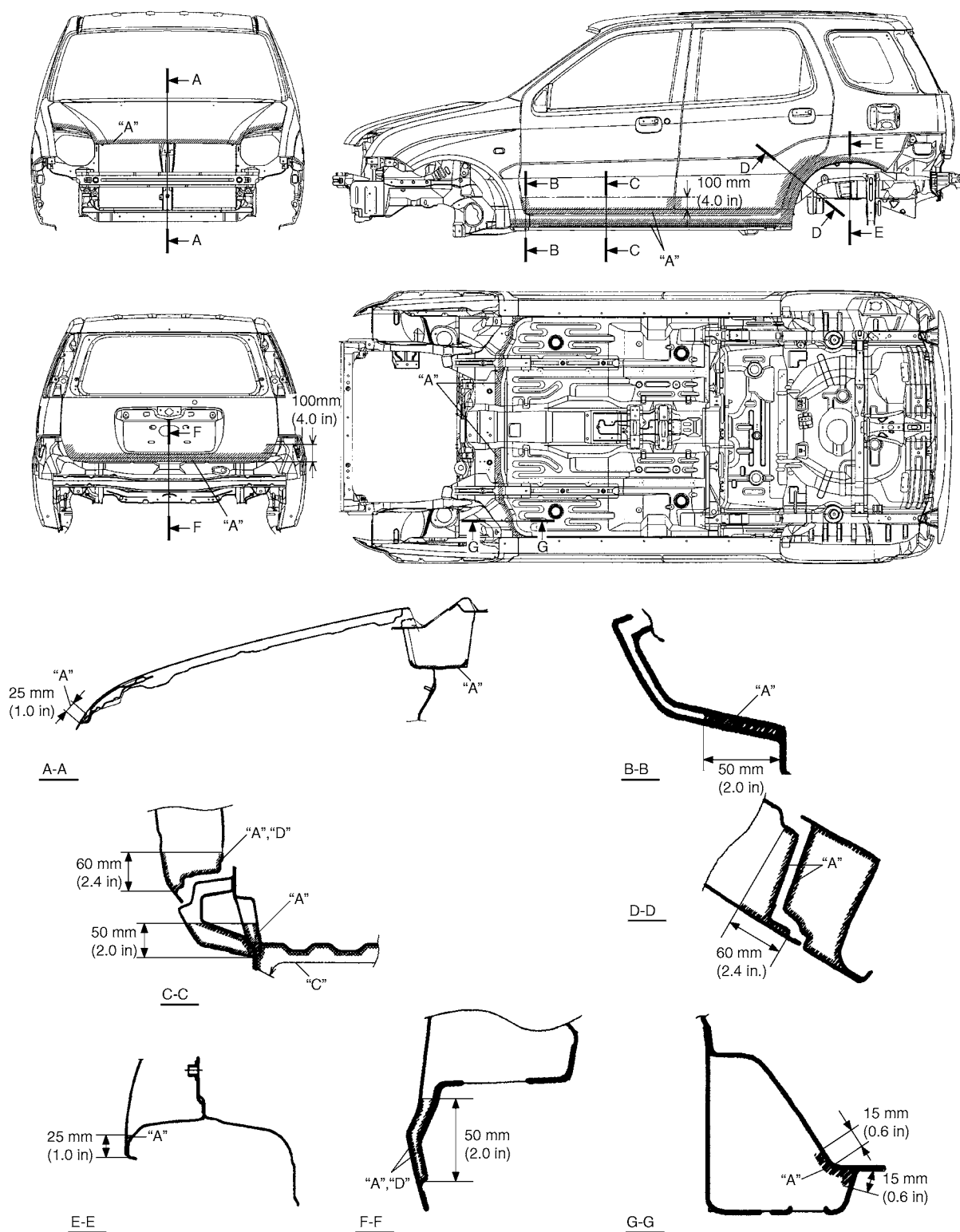
Y

"A": Apply undercoating (PCV, 400 µm or more)

"B": Apply undercoating (PCV, 600 µm or more)

"C": Do not apply undercoating

## Anti-Corrosion Compound Application Area



"A": Apply rust proof wax (hot wax 50 µm or more)

"B": Apply rust proof wax (low viscosity wax 10 µm or more)

"C": Apply rust proof wax (high viscosity wax 50 µm or more)

"D": Never fill up drain holes with rust proof wax

Prepared by  
**MAGYAR SUZUKI CORPORATION**

1st Ed. Nov., 2003

Printed in Hungary

Printing: December, 2003

504