

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 mechanics only. Inexperienced mechanics or mechanics 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 mechanic and may render the vehicle unsafe for the driver and passengers.

WARNING:

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

- Service on or 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 “Precautions” 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 unintentional 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 air bag (inflator) modules, sensing and diagnostic module (SDM), seat belt pretensioner (if equipped) beforehand to avoid component damage or unintended activation.

FOREWORD

This manual contains procedures for diagnosis, maintenance, adjustments, minor service operations, replacement of components (service) and for disassembly and assembly of major components (Units Repair-Overhaul).

Applicable model: SY419 on and after the following VIN No.

SEDAN

ⓧJSAEGC51S00300001ⓧ

WAGON

ⓧJSAEGC51W00300001ⓧ

Whenever servicing the above applicable model, consult this manual.

And for any section, item or description not found in this manual, refer to the related manuals mentioned below.

The contents are classified into sections each of which is given a section number as indicated in the Table of Contents on the next page. And on the first page of each individual section is an index of that section.

This manual should be kept in a handy place for ready reference of the service work.

Strict observance of the so specified items will enable one to obtain the full performance of the vehicle.

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.

RELATED MANUALS

Manual Name	Manual No.
SY413/SY416/SY418 Service Manual	99500-60G20-01E
SY413/SY416/SY418/SY419 Wiring Diagram Manual	99512-60G60-015
All Models Deisel Diagnosis Manual	99501-66G10-01E (967-GB-04/97)
Overhaul Checking Tuning Manual	99501-66G21-01E (9608GB 15/06/2000)

SUZUKI MOTOR CORPORATION
OVERSEAS SERVICE DEPARTMENT

TABLE OF CONTENTS		SECTION
GENERAL INFORMATION		
General Information		0A
Maintenance and Lubrication		0B
HEATING AND AIR CONDITIONING		
Heater and Ventilation		1A
Air Conditioning		1B
STEERING, SUSPENSION, WHEELS AND TIRES		
Steering, Suspension, Wheels and Tires		3
Front End Alignment		3A
Power Steering (P/S) System		3B1
Steering Wheel and Column		3C1
Front Suspension		3D
Rear Suspension		3E
Wheel and Tires		3F
DRIVE SHAFT		
Front Drive Shaft		4
BRAKE SYSTEM		
Brakes		5
Antilock Brake System (ABS)		5B
ENGINE		
Engine General Information and Diagnosis		6
Engine (XUD9 BSD Engine)		6A4
Engine Cooling		6B
Engine Fuel		6C
Engine and Emission Control System (XUD9 BSD Engine)		6E3
Cranking System		6G4
Charging System		6H
Exhaust System		6K
TRANSMISSION AND CLUTCH		
Manual Transmission		7A
Clutch (Hydraulic Type)		7C1
BODY ELECTRICAL SERVICE		
		8
IMMOBILIZER CONTROL SYSTEM		
		8G
WIRING DIAGRAM		
		8A
BODY SERVICE		
		9
AIR BAG SYSTEM		
		9J

NOTE:

The screen toned sections are included in “SY413/SY416/SY418 SERVICE MANUAL”.

SECTION 0A

0A

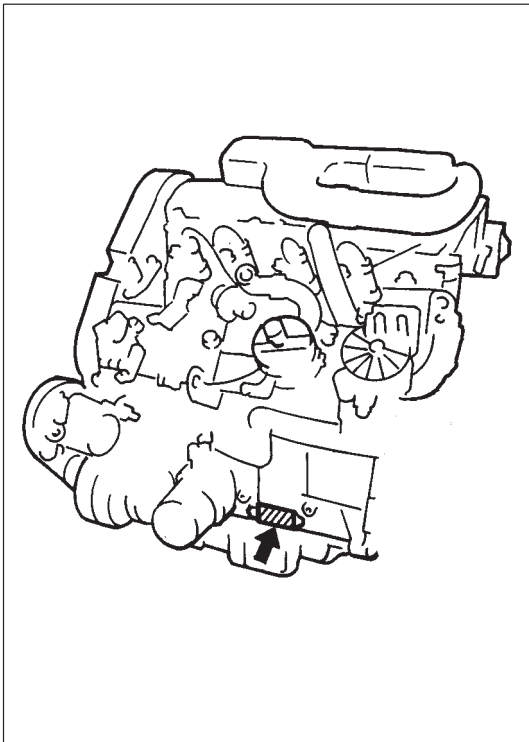
GENERAL INFORMATION

NOTE:

For the descriptions (items) not found in this section, refer to the same section of the Service Manual mentioned in FOREWORD of this manual.

CONTENTS

IDENTIFICATION INFORMATION	0A-1
Engine Identification Number	0A-1
WARNING, CAUTION AND INFORMATION LABELS	0A-2
FASTENER INFORMATION	0A-3
Metric Fasteners	0A-3



IDENTIFICATION INFORMATION

ENGINE IDENTIFICATION NUMBER

The number is punched on cylinder block.

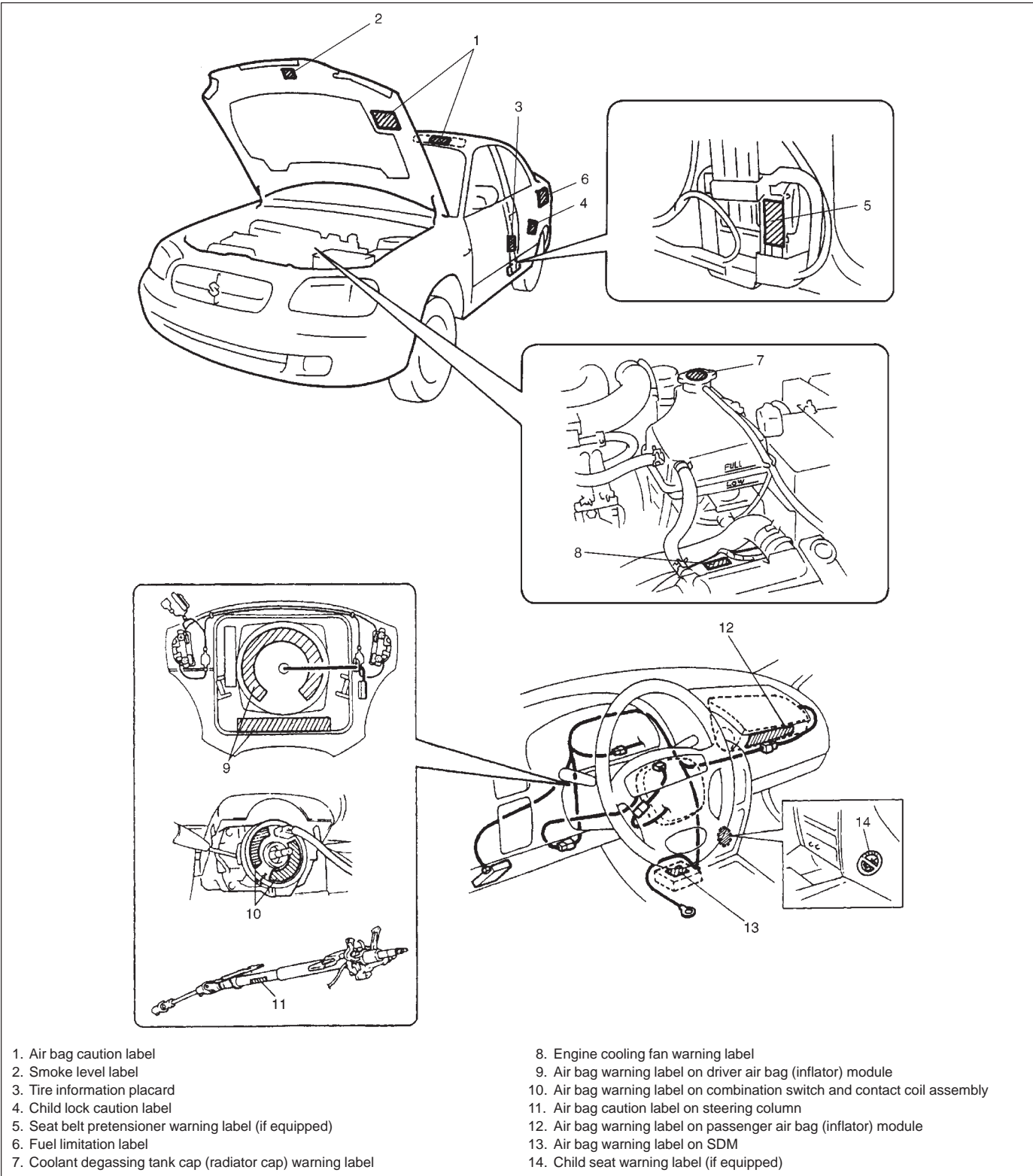
WARNING, CAUTION AND INFORMATION LABELS

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.

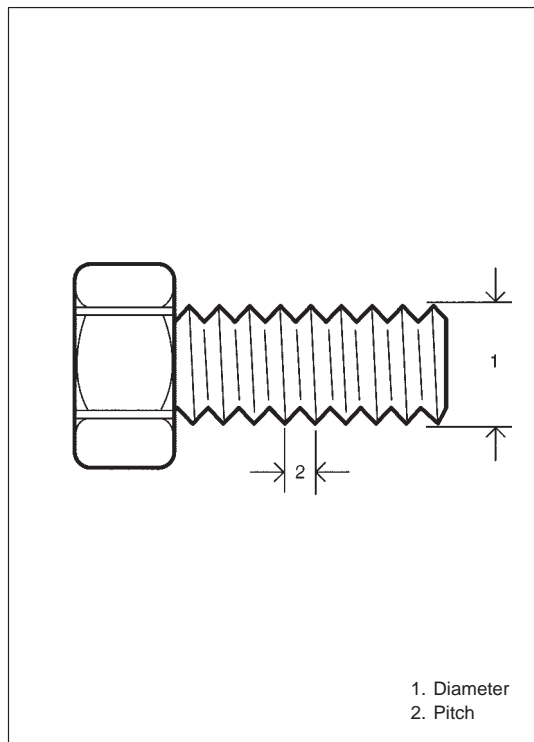
If any WARNING/CAUTION label is found stained or damaged, clean or replace it as necessary.

NOTE:

Air bag CAUTION/WARNING labels are attached on the vehicle equipped with air bag system only.



- | | |
|--|---|
| 1. Air bag caution label | 8. Engine cooling fan warning label |
| 2. Smoke level label | 9. Air bag warning label on driver air bag (inflator) module |
| 3. Tire information placard | 10. Air bag warning label on combination switch and contact coil assembly |
| 4. Child lock caution label | 11. Air bag caution label on steering column |
| 5. Seat belt pretensioner warning label (if equipped) | 12. Air bag warning label on passenger air bag (inflator) module |
| 6. Fuel limitation label | 13. Air bag warning label on SDM |
| 7. Coolant degassing tank cap (radiator cap) warning label | 14. Child seat warning label (if equipped) |



FASTENER INFORMATION

METRIC FASTENERS

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

CAUTION:

Note that both ISO and JIS type bolts and nuts are used for the engine assembly and related parts. Even when the diameter of the thread is the same, its pitch may vary between these two types. Installing a mismatched bolt or nut will cause damage to the thread. As the first step, make sure to tighten it by hand temporarily and if it feels tight, check the thread pitch for correct matching.

SECTION 0B

MAINTENANCE AND LUBRICATION

0B

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:

For the descriptions (items) not found in this section, refer to the same section of the Service Manual mentioned in FOREWORD of this manual.

CONTENTS

MAINTENANCE SCHEDULE	0B- 2
Normal Condition Schedule	0B- 2
Maintenance Recommended Under Severe Driving Conditions	0B- 4
MAINTENANCE SERVICE	0B- 5
Engine	0B- 5
Fuel System	0B-10
RECOMMENDED FLUIDS AND LUBRICANTS	0B-11

MAINTENANCE SCHEDULE

NORMAL CONDITION SCHEDULE

Interval: This interval should be judged by odometer reading or months, whichever comes first.	This table includes services 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.						
	km (× 1,000)	15	30	45	60	75	90
	Miles (× 1,000)	9	18	27	36	45	54
	Months	12	24	36	48	60	72
1. ENGINE							
1-1. Accessory drive belt		–	–	I	–	–	R
1-2. Camshaft timing belt		Replace every 120,000 km (72,000 miles).					
1-3. Engine oil and oil filter		Replace every 10,000 km (6,000 miles) or 8 months.					
1-4. Engine coolant		–	–	R	–	–	R
1-5. Exhaust system		–	I	–	I	–	I
1-6. Heater (Glow) plugs		–	–	–	–	I	–
3. FUEL SYSTEM							
3-1. Air cleaner filter	Paved-road	–	R	–	R	–	R
	Dusty condition	Refer to "Severe Driving Condition" schedule.					
3-2. Fuel lines		–	I	–	I	–	I
3-3. Fuel filter		Replace at 1st 10,000 km (6,000 miles) and then, every 20,000 km (12,000 miles). Drain water every 10,000 km (6,000 miles)					
3-4. Fuel tank		–	–	I	–	–	I

Interval: This interval should be judged by odometer reading or months, whichever comes first.	This table includes services 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.						
	km (× 1,000)	15	30	45	60	75	90
	Miles (× 1,000)	9	18	27	36	45	54
	Months	12	24	36	48	60	72
5. BRAKE							
5-1. Brake discs and pads (thickness, wear, damage)	I	I	I	I	I	I	I
Brake drums and shoes (wear, damage)	–	I	–	I	–	I	I
5-2. Brake hoses and pipes (leakage, damage, clamp)	–	I	–	I	–	I	I
5-3. Brake fluid	–	R	–	R	–	R	R
5-4. Brake lever and cable (damage, stroke, operation)	Inspect at first 15,000 km (9,000 miles) only.						
6. CHASSIS AND BODY							
6-1. Clutch (Travel and fluid level)	–	I	–	I	–	I	I
6-2. Tires/wheel discs (wear, damage, rotation)	I	I	I	I	I	I	I
6-3. Propeller shafts (4WD) and drive shafts	–	–	I	–	–	I	I
6-4. Suspension system (tightness, damage, rattle, breakage)	–	I	–	I	–	I	I
6-5. Steering system (tightness, damage, breakage, rattle)	–	I	–	I	–	I	I
6-6. Manual transmission oil (I: 1st 15,000 km only)	I	–	R	–	–	R	R
6-7. Rear differential oil (4WD) (R: 1st 15,000 km only)	R or I	–	I	–	I	–	–
6-8. Automatic transmission	Fluid level	–	I	–	I	–	I
	Fluid change	Replace every 165,000 km (99,000 miles).					
	Fluid hose	–	–	–	R	–	–
6-9. All latches, hinges and locks	–	I	–	I	–	I	I
6-10. Power steering (if equipped)	I	I	I	I	I	I	I

NOTES:

- “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 given in the chart below.

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- Town use/Towing a trailer/Sustained high speed driving/Hot climates above 30°C (86°F)/ Low quality lubricants or fuel

H- Trailer towing (if admitted)

Severe Condition Code	Maintenance	Maintenance Operation	Maintenance Interval
- B C D - - - -	ITEM 1-1 Accessory drive belt	I	Every 15,000km (9,000 miles) or 12 months
		R	Every 45,000km (27,000 miles) or 36 months
A - C D E - G -	ITEM 1-2 Camshaft timing belt	R	Every 75,000km (45,000 miles)
A - C D E F G H	ITEM 1-3 Engine oil and filter	R	Every 5,000km (3,000 miles) or 4 months
- - C - - - - -	ITEM 3-1 Air cleaner filter *1	I	Every 2,500km (1,500 miles)
		R	Every 30,000km (18,000 miles) or 24 months
- - C - - - G -	ITEM 3-3 Fuel filter	R	Every 10,000km (6,000 miles) or 8 months
- B C D - - - H	ITEM 6-2' Wheel bearings	I	Every 15,000km (9,000 miles) or 12 months
- B - D E - - H	ITEM 6-3 Propeller shafts (4WD) and drive shafts	I	Every 15,000km (9,000 miles) or 12 months
- B - - E - - H	ITEM 6-6 and 6-7 Manual transmission oil and differential oil (4WD)	R	Every 30,000km (18,000 miles) or 24 months
- B - - E - - H	ITEM 6-8 Automatic transmission fluid	R	Every 30,000km (18,000 miles) or 24 months

NOTES:

“R”: Replace or change

“I”: Inspect and correct or replace if necessary

*1 Inspect or replace more frequently if necessary.

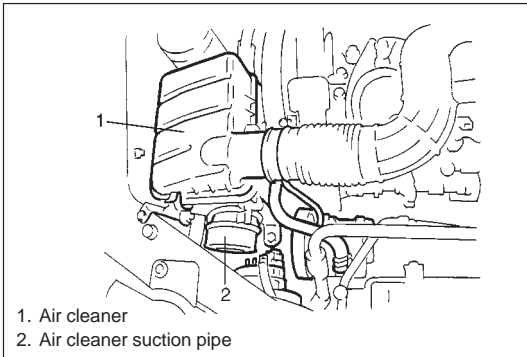
MAINTENANCE SERVICE

ENGINE

ITEM 1-1

Accessory Drive Belt Inspection and Replacement Inspection

1) Remove air cleaner and air cleaner suction pipe.

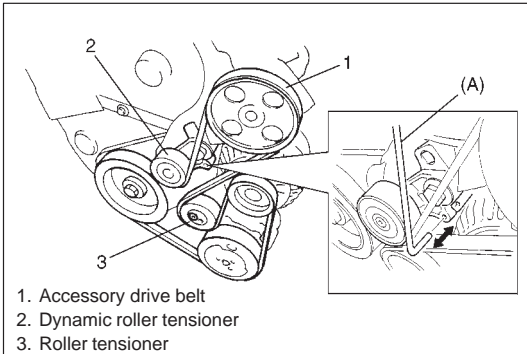


2) Inspect belt for cracks, cuts, deformation, wear and cleanliness. If any of above conditions are found replace accessory drive belt.

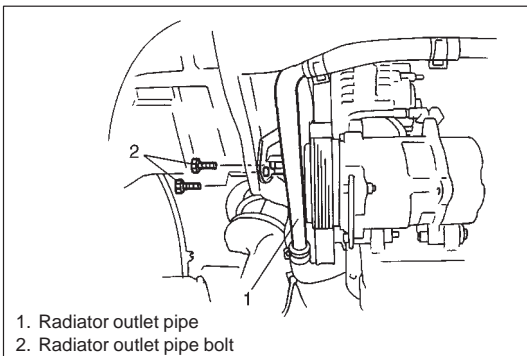
3) Using special tool (A), check that dynamic roller tensioner hole and generator mount bracket hole are aligned. If they are not aligned, perform following items.

Special Tool

(A): 09919-56520/OUT0000075

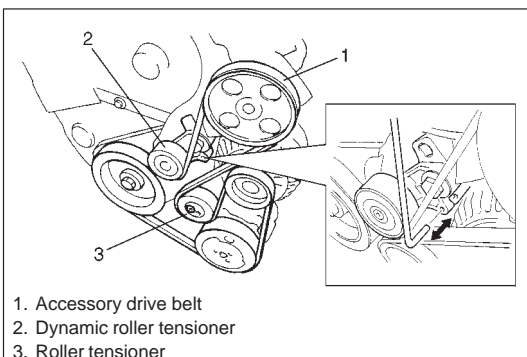


- i) Remove engine right side under cover.
- ii) Remove radiator outlet pipe tightening bolts.



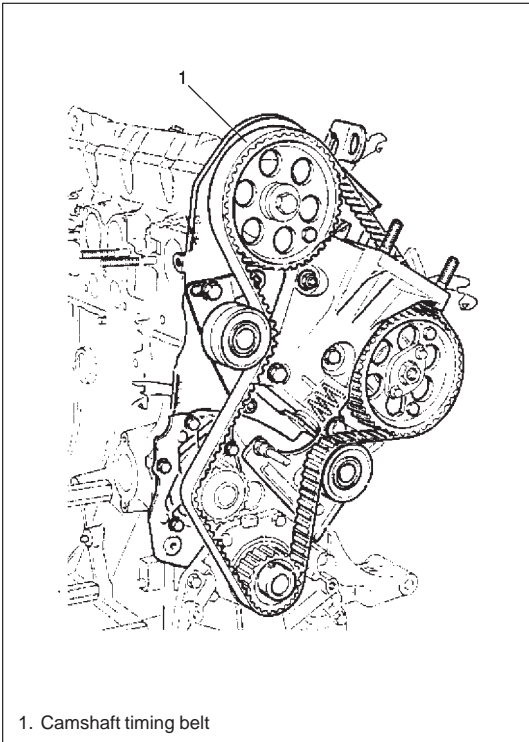
iii) Adjust belt tension by referring to step 3) to 7) of "Accessory Drive Belt Installation" in SECTION 6H.

If belt tension can not be adjusted within specified tension, replace the generator belt.



Replacement

Replace drive belt with new one. Refer to "Accessory Drive Belt" in SECTION 6H for replacement procedure.



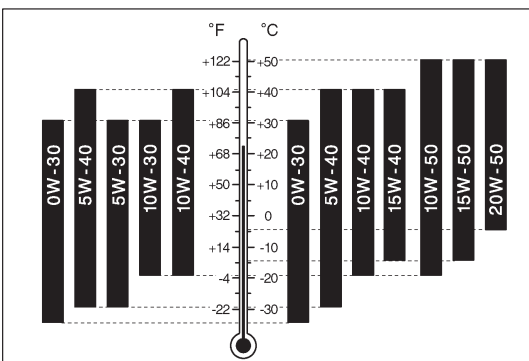
ITEM 1-2

Camshaft Timing Belt Replacement

Replace belt with new one. Refer to "Timing Belt" in SECTION 6A4 for replacement procedure.

CAUTION:

- Do not bend or twist timing belt.
- Do not allow timing belt to come into contact with oil, water, etc.

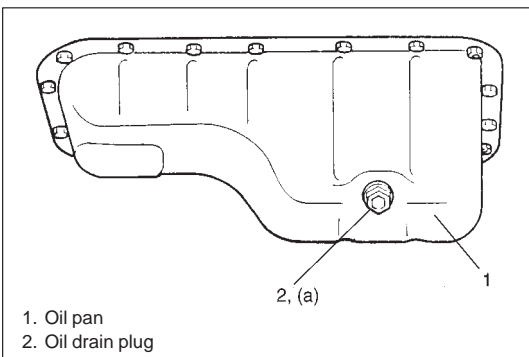


ITEM 1-3

Engine Oil and Oil Filter Change

It is recommended to use engine oil of ACEA B2-96, CCMC PD-2 or API CF (except CF-2) or higher quality level oils.

Select the appropriate oil viscosity according to the left chart. Always change oil and oil filter as soon as possible after driving in a dust storm.

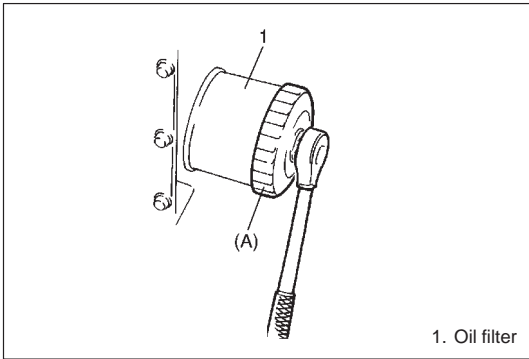


Before draining engine oil, check engine for oil leakage. If any evidence of leakage is found, make sure to correct defective part before performing the following work.

- 1) Drain engine oil by removing drain plug.
- 2) After draining oil, wipe drain plug clean. Reinstall drain plug, and tighten it securely as specified below.

Tightening Torque

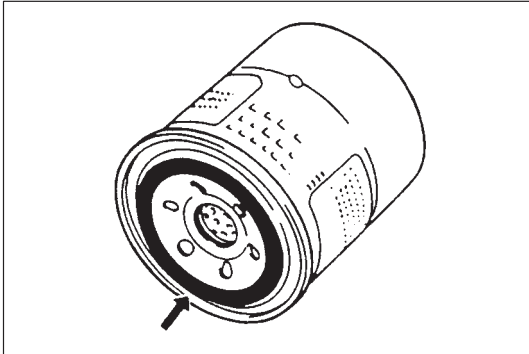
(a): 30 N·m (3.0 kg·m, 21.5 lb-ft)



3) Loosen oil filter by using oil filter wrench (Special tool).

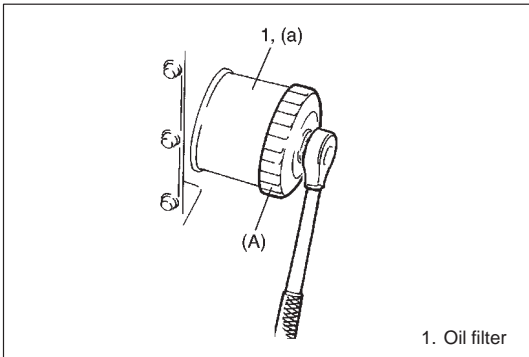
Special Tool

(A): 09915-46510



4) Apply engine oil to new oil filter O-ring.

5) Screw new filter on oil filter stand by hand until filter O-ring contacts with mounting surface.



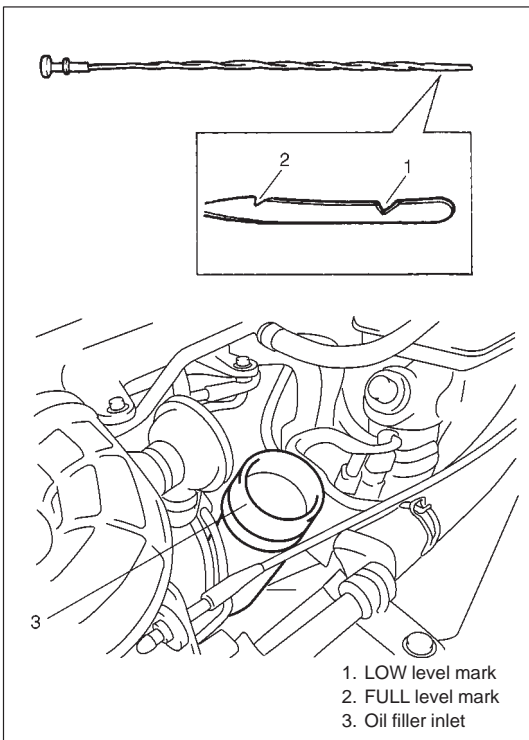
6) Tighten filter to specified torque.

Special Tool

(A): 09915-46510

Tightening Torque

(a): 14 N·m (1.4 kg·m, 10.5 lb·ft)



7) Remove dipstick and oil filler cap. Replenish oil through oil filler inlet until oil level is brought to FULL level mark on dipstick. (Amount of oil: about 3.5 liters or 7.4/6.2 US/Imp pt.).

NOTE:

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

8) Install oil filler cap and dipstick. Start engine and run it for three minutes. Stop it and wait another 5 minutes before checking oil level. Add oil, as necessary, to bring oil level to FULL level mark on dipstick.

9) Check oil filter and drain plug for oil leakage.

ITEM 1-4 Engine Coolant Change

WARNING:

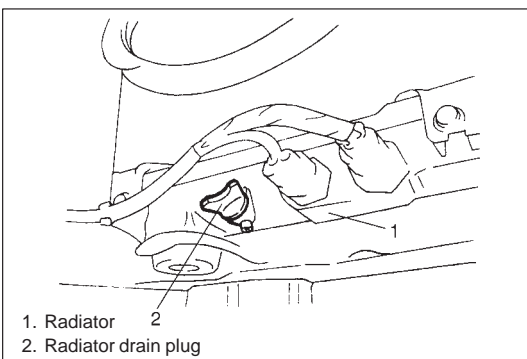
To help avoid danger of being burned, do not remove degassing tank cap while engine and radiator are still hot. Scalding fluid and steam can be blown out under pressure if cap is taken off too soon.

CAUTION:

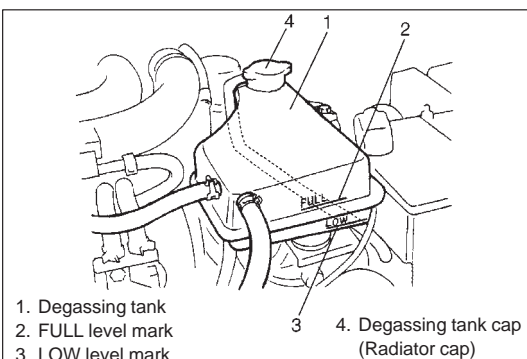
When changing engine coolant, use mixture of 50% water and 50% ethylene-glycol base coolant (Anti-freeze/ Anti-corrosion coolant) for the market where ambient temperature falls lower than -16°C (3°F) in winter and mixture of 70% water and 30% ethylene-glycol base coolant for the market where ambient temperature doesn't fall lower than -16°C (3°F).

Even in a market where no freezing temperature is anticipated, mixture of 70% water and 30% ethylene-glycol base coolant should be used for the purpose of corrosion protection and lubrication.

- 1) Remove degassing tank cap when engine is cool.



- 2) Loosen radiator drain plug to drain coolant.
- 3) Tighten drain plug securely.



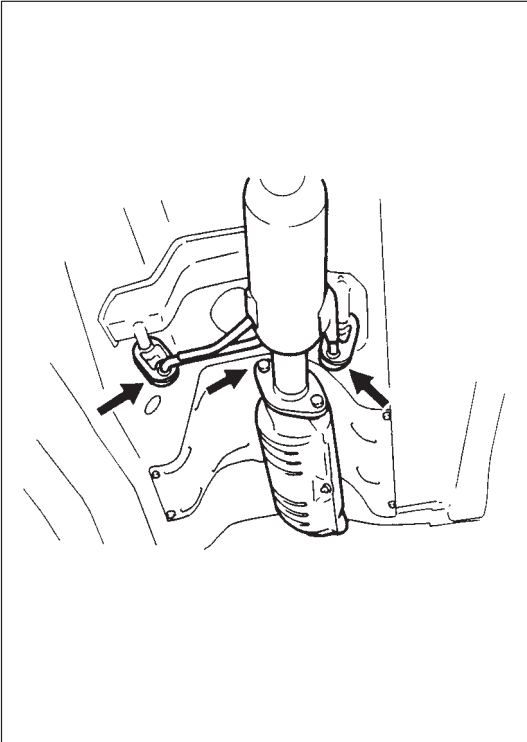
- 4) Fill cooling system with specified coolant through degassing tank filler inlet until coolant level reaches FULL level mark. Run engine until radiator upper hose is hot and then for 2 minutes at about 2,000 r/min, while replenishing coolant. This drives out any air which may still be trapped within cooling system. Add coolant as necessary until coolant level reaches FULL level mark. Reinstall degassing tank cap. Refer to Section 6B of this manual for "Coolant Capacity".

ITEM 1-5 Exhaust System Inspection

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.



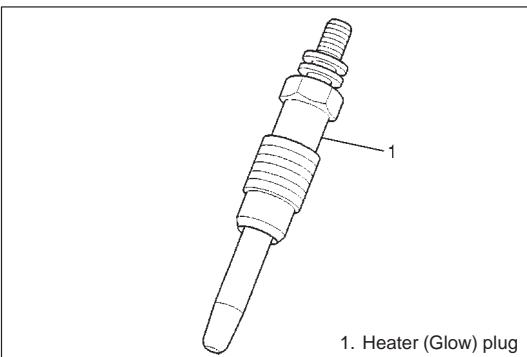
Check exhaust system as follows:

- Check rubber mountings for damage and deterioration.
- Check exhaust system for leakage, loose connections, dents, and damages.

If bolts or nuts are loose, tighten them to specification.

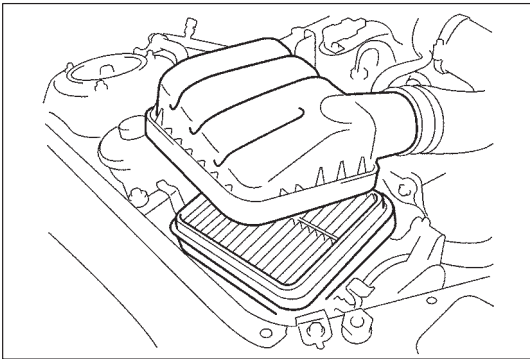
Refer to SECTION 6K for torque specification of bolts and nuts.

- 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 vehicle.
- Make sure that exhaust system components have enough clearance from underbody to avoid overheating and possible damage to floor carpet.
- Any defects should be fixed at once.



ITEM 1-6 Heater (Glow) Plugs Inspection

Check for external damage such as deformation, scratch, crack, etc.

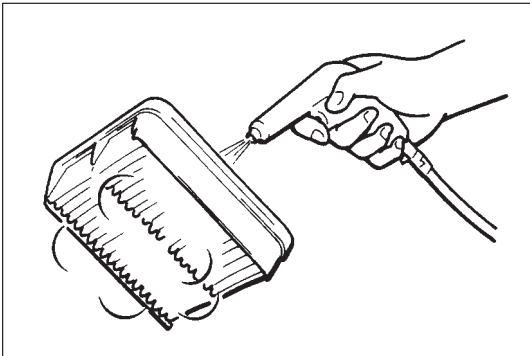


FUEL SYSTEM

ITEM 3-1

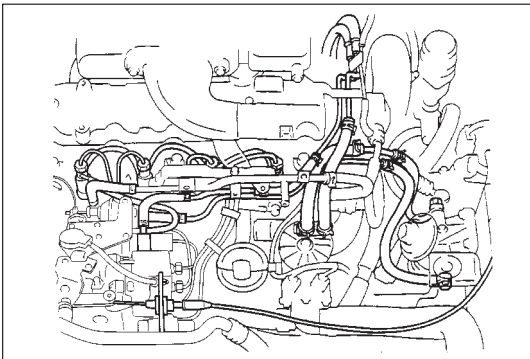
Air Cleaner Filter Replacement

- 1) Unclamp air cleaner case clamps.
- 2) Replace air cleaner filter with new one.
- 3) Clamp case securely.



Air Cleaner Filter Inspection

- 1) Visually check that air cleaner filter is not excessively dirty, damaged or oily.
- 2) Clean filter with compressed air from air outlet side of filter (i.e., the side facing up when installed).



ITEM 3-2

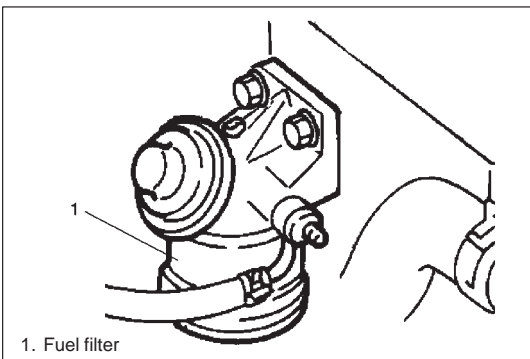
Fuel lines Inspection

Check fuel lines for loose connection, deterioration or damage which could cause leakage.

Make sure all clamps are secure.

Replace any damaged or deteriorated parts.

There should be no sign of fuel leakage or moisture at any fuel connection.



ITEM 3-3

Fuel Filter Replacement

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 with new one referring to FUEL FILTER in Section 6E3.

Water Draining of Fuel Filter

Bleed fuel filter of water referring to FUEL FILTER in Section 6E3.

ITEM 3-4**Fuel Tank Inspection**

Check fuel tank for corrosion, deterioration or damage which could cause leakage.

If a problem is found, repair or replace.

RECOMMENDED FLUIDS AND LUBRICANTS

Engine oil	Minimum quality level required is ; ACEA B2-96, CCMC PD-2 or API CF (except CF-2) (Refer to engine oil viscosity chart in item 1-3)
Engine coolant	Ethylene-glycol base coolant ("Antifreeze/Anticorrosion coolant")
Brake fluid	DOT 3
Manual transmission oil	See oil chart on Section 7A.
Power steering fluid	See material table on Section 3B1.
Door hinges	Engine oil
Engine hood latch	Engine oil
Key lock cylinder	Spray lubricant

SECTION 1B

AIR CONDITIONING (OPTIONAL)

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 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).

1B

CAUTION:

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

NOTE:

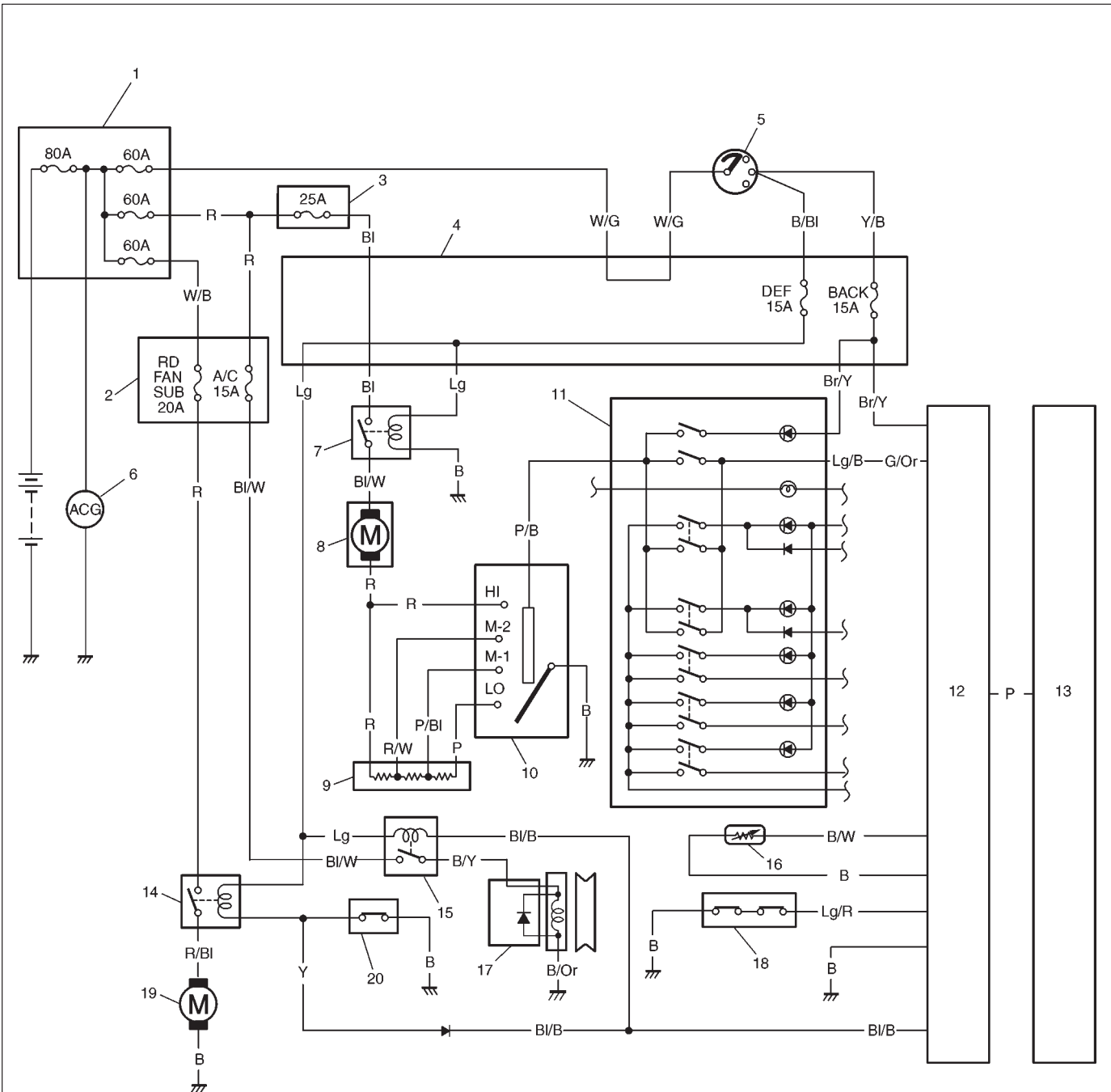
- For the descriptions (items) not found in this section, refer to the same section of the Service Manual mentioned in the FOREWORD of this manual.
- For basic servicing method of the air conditioning system that is not described in this section, refer to AIR CONDITIONING BASIC MANUAL (Part number: 99520-02130).

CONTENTS

GENERAL DESCRIPTION	1B- 2	Compression System	1B- 8
Wiring Circuit	1B- 2	Compressor	1B- 8
Function of Each Control Component	1B- 3	Compressor Mount	1B-10
DIAGNOSIS	1B- 4	Drive Belt	1B-10
ON-VEHICLE SERVICE	1B- 6	Magnet Clutch	1B-11
Refrigerating System	1B- 6	Lip Type Seal	1B-14
Condenser	1B- 6	REQUIRED SERVICE MATERIALS	1B-16
Receiver/Dryer	1B- 7	SPECIAL TOOLS	1B-16

GENERAL DESCRIPTION

WIRING CIRCUIT



- | | |
|------------------------------|----------------------------------|
| 1. Main fuse box | 11. Mode controller |
| 2. Fuse and relay box | 12. A/C amplifier |
| 3. Cassette fuse | 13. ECM |
| 4. Junction box (J/B) | 14. Sub radiator fan motor relay |
| 5. Ignition switch | 15. Compressor relay |
| 6. Generator | 16. A/C evaporator thermistor |
| 7. Blower fan motor relay | 17. Compressor |
| 8. Blower fan motor | 18. Dual pressure switch |
| 9. Blower fan motor resistor | 19. Sub radiator fan motor |
| 10. Blower fan switch | 20. Radiator fan switch |

FUNCTION OF EACH CONTROL COMPONENT

ECM

ECM output A/C control signal to A/C amplifier when ECM detect the following conditions.

- Engine coolant temperature:
 - above 113°C (235°F) OFF
 - (below 111°C (232°F) ON)
- Engine speed:
 - below 500 r/min. OFF
 - above 500 r/min. ON

DIAGNOSIS

GENERAL

Trouble	Possible Cause	Measure
Cool air does not come out (A/C system improper operation)	A/C system inoperative <ul style="list-style-type: none"> ● No refrigerant ● Fuse blown ● A/C switch faulty ● Blower motor switch faulty ● A/C thermistor faulty ● Dual pressure switch faulty ● Wiring or grounding faulty ● A/C controller and its circuit faulty ● A/C ON permission signal in ECM faulty 	Recover, evacuation and charging. Check "BACK", "DEF", "RD FAN SUB" and "A/C" fuses and check for short circuit. Check A/C switch. Check blower motor switch. Check A/C thermistor. Check dual pressure switch. Repair as necessary. Check A/C controller and its circuit. Check A/C ON permission signal.
	Compressor inoperative (dose not rotate) <ul style="list-style-type: none"> ● Fuse blown ● Compressor relay faulty ● Magnet clutch faulty ● Drive belt loose or broken ● Compressor faulty ● A/C ON permission signal in ECM faulty ● A/C controller faulty 	Check "A/C" and "DEF" fuses, and check for short circuit. Check compressor relay. Check magnet clutch. Tighten or replace drive belt. Check compressor. Check A/C ON permission signal. Check A/C controller.
	Sub radiator fan motor (condenser fan motor) inoperative <ul style="list-style-type: none"> ● Fuse blown ● Sub radiator fan motor relay faulty ● Wiring or grounding faulty ● Sub radiator fan motor faulty 	Check "SUB RD FAN" and "DEF" fuses, and check for short circuit. Check sub radiator fan motor relay. Repair as necessary. Check sub radiator fan motor.
	Blower motor inoperative <ul style="list-style-type: none"> ● Fuse blown ● Blower fan motor relay faulty ● Blower fan motor resistor faulty ● Blower fan motor switch faulty ● Wiring or grounding faulty ● Blower fan motor faulty 	Check "DEF" fuse and cassette fuse, and check for short circuit. Check blower fan motor relay. Check blower fan motor resistor. Check blower fan motor switch. Repair as necessary. Check blower fan motor.

Trouble	Possible Cause	Measure
Cool air does not come out or insufficient cooling (A/C system normal operative)	<ul style="list-style-type: none"> ● Insufficient or excessive charge of refrigerant ● Refrigerant leak in system ● Condenser clogged ● Evaporator clogged or frosted ● A/C evaporator thermistor faulty ● A/C controller faulty ● Expansion valve faulty ● Drive belt slipping ● Magnetic clutch faulty ● Compressor faulty ● Air in A/C system ● Air leaking from cooling unit or air duct ● Heater and ventilation system faulty ● Blower motor faulty ● Excessive compressor oil existing in A/C system 	<p>Check charge of refrigerant.</p> <p>Check system for leaks. Check condenser. Check evaporator Check A/C evaporator thermistor. Check A/C controller. Check expansion valve. Check or replace drive belt. Check magnetic clutch. Check compressor. Replace receiver/dryer, and evacuation and charging. Repair as necessary. Check air inlet box assembly (blower unit). Check heater control lever assembly. Check heater assembly. Check blower motor. Pull out compressor oil in A/C system, and replenish compressor oil, and replace compressor.</p>
Cool air does not come out, only intermittently	<ul style="list-style-type: none"> ● Wiring connection faulty ● Expansion valve faulty ● Excessive moisture in A/C system ● A/C controller faulty ● Magnetic clutch faulty ● Excessive charge of refrigerant 	<p>Repair as necessary. Check expansion valve. Replace receiver/dryer, and evacuation and charging. Check A/C controller. Check magnetic clutch. Check charge of refrigerant.</p>
Cool air comes out only at high speeds	<ul style="list-style-type: none"> ● Condenser clogged ● Insufficient charge of refrigerant ● Air in A/C system ● Drive belt slipping ● Compressor faulty 	<p>Check condenser. Check charge of refrigerant. Replace receiver/dryer, and evacuation and charging. Check or replace drive belt. Check compressor.</p>
Cool air does not come out, only at high speeds	<ul style="list-style-type: none"> ● Excessive charge of refrigerant ● Evaporator frosted 	<p>Check charge refrigerant. Check evaporator and A/C evaporator thermistor.</p>
Insufficient velocity of cooled air	<ul style="list-style-type: none"> ● Evaporator clogged or frosted ● Air leaking from cooling unit or air duct ● Blower motor faulty ● Wiring or grounding faulty 	<p>Check evaporator. Repair as necessary. Check blower motor. Repair as necessary.</p>

ON-VEHICLE SERVICE

REFRIGERATING SYSTEM

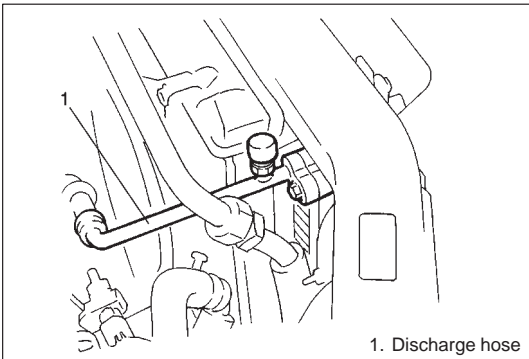
CONDENSER

REMOVAL

- 1) Disconnect negative (-) cable at battery.
- 2) Recover refrigerant by using recovery and recycling equipment. Be sure to follow the instruction manual for the equipment.

The amount of compressor oil removed must be measured and the same amount added to the system.

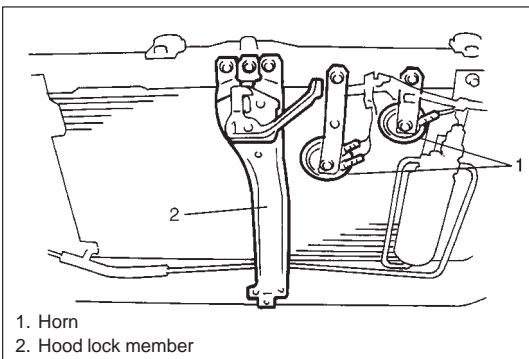
- 3) Remove front bumper referring to "FRONT BUMPER" in Section 9 of the Service Manual as mentioned in FOREWORD of this manual.



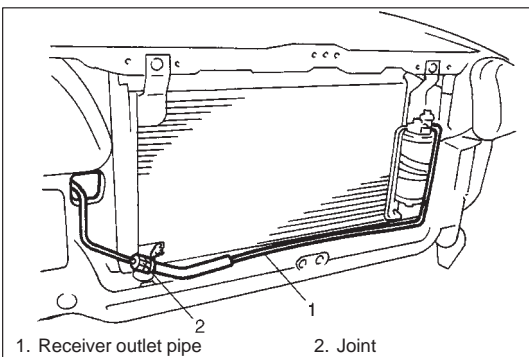
- 4) Disconnect compressor discharge hose from condenser inlet fittings.

NOTE:

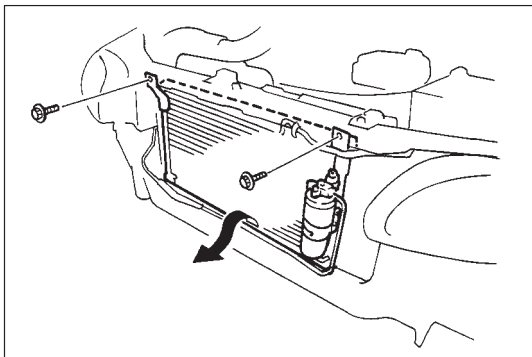
As soon as above hose and pipe are disconnected, cap opened fittings so that moisture and dust do not enter into condenser.



- 5) Remove horn.
- 6) Remove hood latch and hood lock member.



- 7) Disconnect coupler from dual pressure switch.
- 8) Remove receiver outlet pipe.



9) Remove condenser with receiver/dryer.

NOTE:

Be careful not to damage fins of condenser and radiator.

10) Remove receiver/dryer from condenser.

INSTALLATION

WARNING:

After installing hood latch, be sure to perform its adjustment according to procedure described in Service Manual. Failure to perform this adjustment may cause hood to be unlatched, resulting in an accident.

Reverse removal sequence to install condenser noting the following point.

- When replacing condenser, add 20 – 30 cm³ (20 – 30 cc) of compressor oil from compressor suction-side.
- Evacuate and charge system according to previously described procedure.
- Regulate hood latch referring to “HOOD” in Section 9 of the Service Manual mentioned in FOREWORD of this manual.

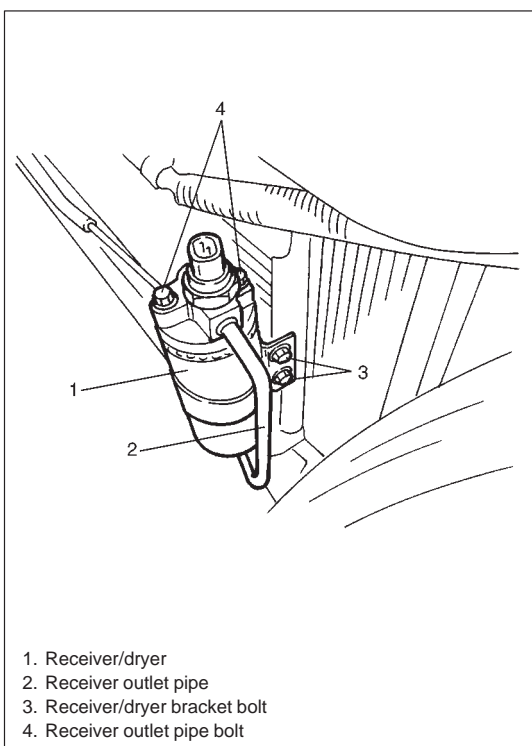
RECEIVER/DRYER

INSPECTION

Use a leak tester to check for gas leakage at sight glass and fittings.

REMOVAL

- 1) Recover refrigerant by using recovery and recycling equipment. Be sure to follow the instruction manual for the equipment.
The amount of compressor oil removed must be measured and the same amount added to the system.
- 2) Remove front bumper referring to “FRONT BUMPER” in Section 9 of the Service Manual mentioned in FOREWORD of this manual.
- 3) Disconnect receiver outlet pipe.
- 4) Remove receiver/dryer from its holder.



1. Receiver/dryer
2. Receiver outlet pipe
3. Receiver/dryer bracket bolt
4. Receiver outlet pipe bolt

INSTALLATION

Reverse removal sequence to install receiver/dryer noting the following points.

- When replacing receiver/dryer, add 10 cm³ (10 cc) of compressor oil from compressor suction-side.
- Blind plugs of receiver/dryer should not be removed until just before receiver/dryer is installed.
- Evacuate and charge system according to previously described procedure.

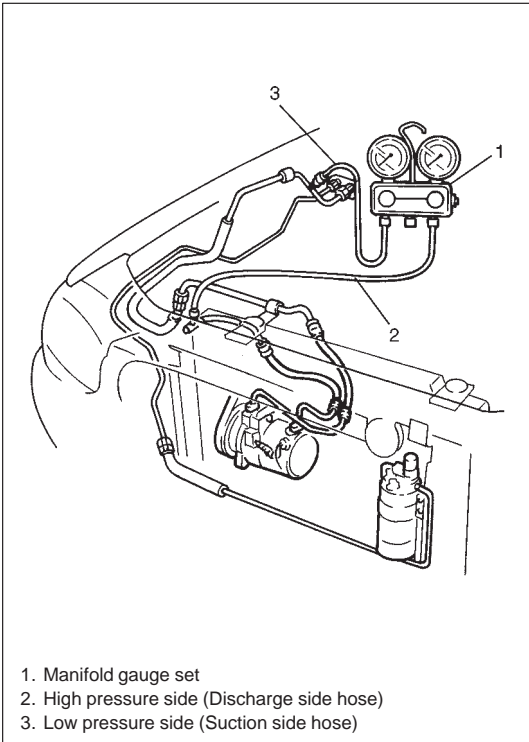
COMPRESSION SYSTEM

COMPRESSOR

INSPECTION

- 1) Install manifold gauge set, referring to "TROUBLESHOOTING PROCEDURE USING MANIFOLD GAUGE SET" in the same section of the Service Manual mentioned in FOREWORD of this manual.
- 2) Run engine at fast idle.
- 3) Check compressor for the following:
 - High pressure gauge reading is not low and low pressure gauge reading is not higher than normal, referring to "CORRECTIVE MEASURES FOR MALFUNCTION SYMPTOMS" under "DIAGNOSIS" in the same section of the Service Manual as mentioned in FOREWORD of this manual.
 - Metallic sound.
 - Leakage from shaft seal.

If any of the above checks indicates a defect, repair compressor.

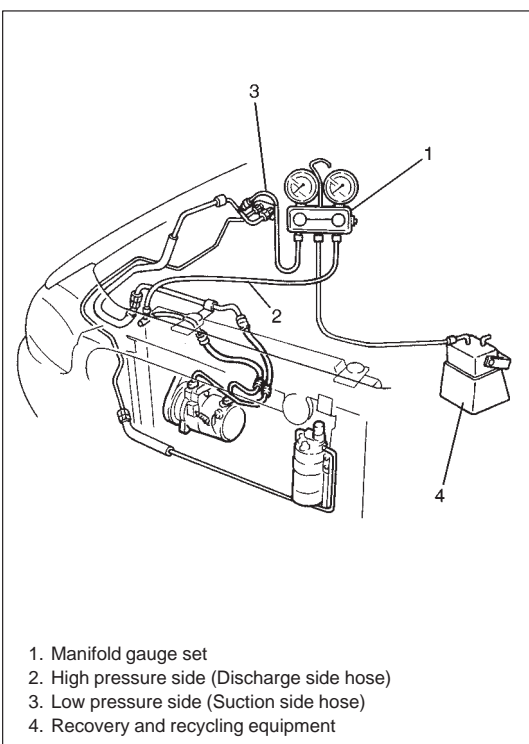


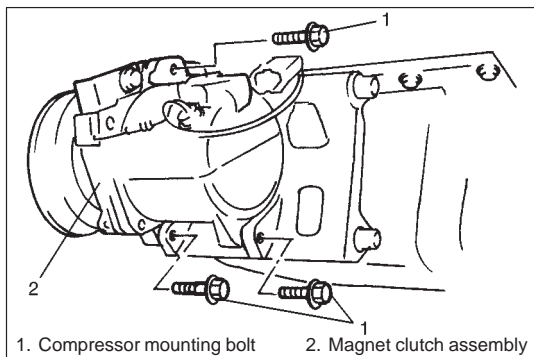
REMOVAL

- 1) Run engine at idle with air conditioning on for 10 minutes.
- 2) Disconnect negative (-) cable at battery.
- 3) Recover refrigerant from refrigeration system using recovery and recycling equipment.
- 4) Remove drive belt. Refer to Section 6H "CHARGING SYSTEM" section in this manual for removal.
- 5) Disconnect magnet clutch lead wire from engine wire harness.
- 6) Disconnect suction and discharge flexible hoses from compressor.

NOTE:

Cap open fittings immediately to keep moisture out of system.



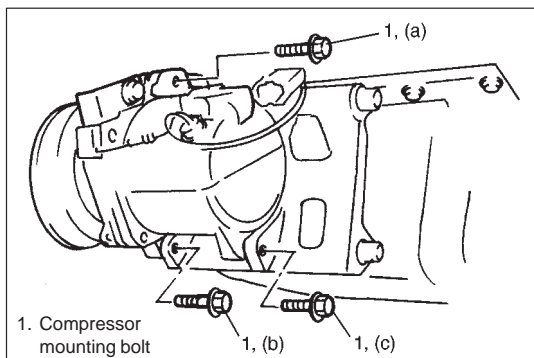


- 7) Loosen compressor mounting bolt, then remove compressor from its mounting bracket.

- 8) Drain compressor oil from compressor, and measure its amount.

NOTE:

When removing compressor, be careful not to damage fins of condenser.



INSTALLATION

Reverse removal procedure noting the following point.

- Tighten compressor mounting bolt as below order.

Compressor mounting bolt tightening order: (a) → (b) → (c)

- Tighten compressor mounting bolt as specified torque.

Tightening Torque

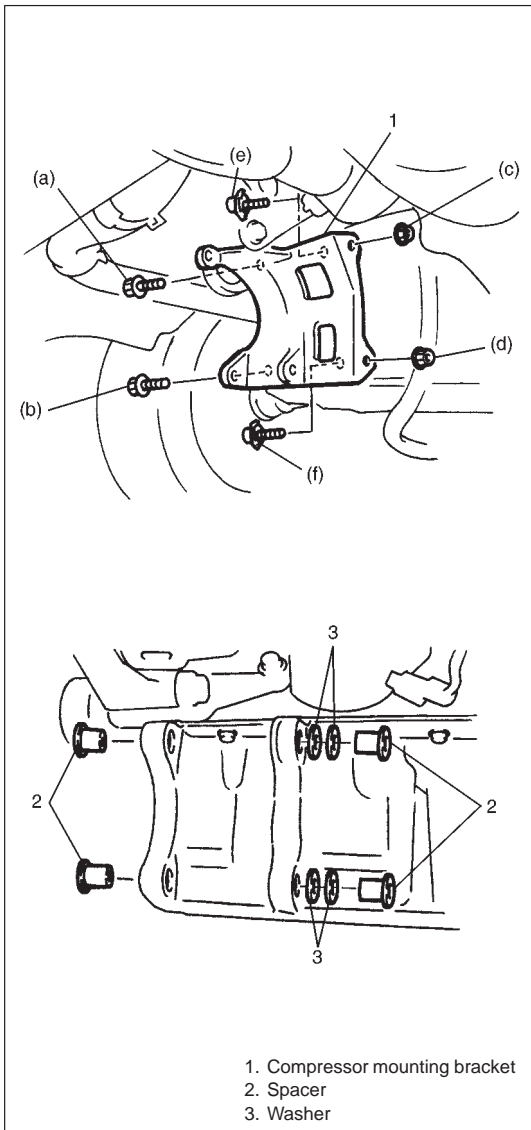
(a), (b) and (c): 26 N·m (2.6 kg·m, 19.0 lb·ft)

- Pour new compressor oil with the same amount as that drained from compressor.
- Evacuate and charge system according to previously described procedure.

NOTE:

Compressor supplied from factory is filled up with specified amount of compressor oil.

Compressor oil amount: 120 cm³ (120 cc)



COMPRESSOR MOUNT

INSPECTION

- 1) Remove compressor. Refer to "COMPRESSOR" in this section.
- 2) Check mounting bolts and nuts for looseness.
- 3) Check mounting bracket for crack and deformation.

If there is defect for its bracket, replace compressor mounting bracket.

REMOVAL

- 1) Remove compressor. Refer to "COMPRESSOR" in this section.
- 2) Loosen mounting bolts and nuts, and then remove compressor mounting bracket and its spacer.

INSTALLATION

Reverse removal procedure noting the following point.

- Tighten compressor mounting bracket bolts and nuts as below order.

Compressor mounting bracket bolts and nuts tightening order: (a) → (b) → (c) → (d)

- Tighten mounting bolts and nuts as specified torque.

Tightening Torque

(a), (b), (c) and (d): 50 N·m (5.0 kg·m, 36.0 lb·ft)

- When flange bolt (e), (f) is attached, be careful to kinds of flange bolt.

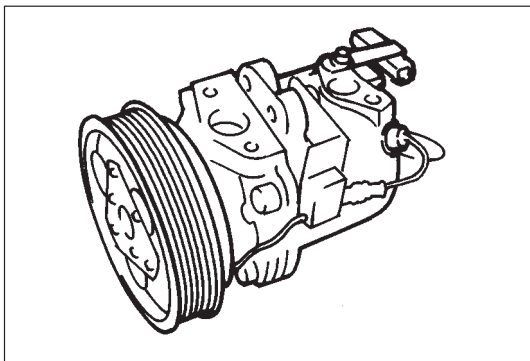
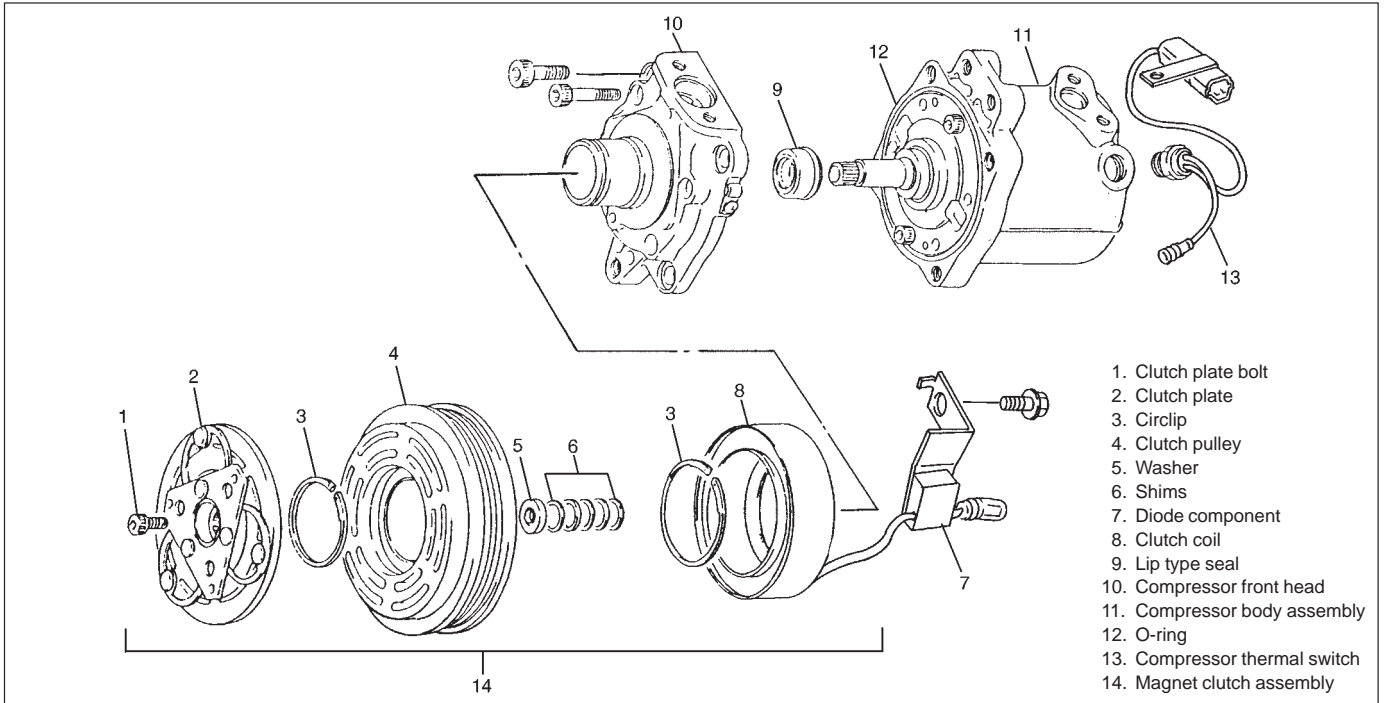
Flange bolt (e): Wide angle flange bolt.

Flange bolt (f): Narrow angle flange bolt.

DRIVE BELT

Refer to "ACCESSORY DRIVE BELT" in Section 6H for detail.

MAGNET CLUTCH

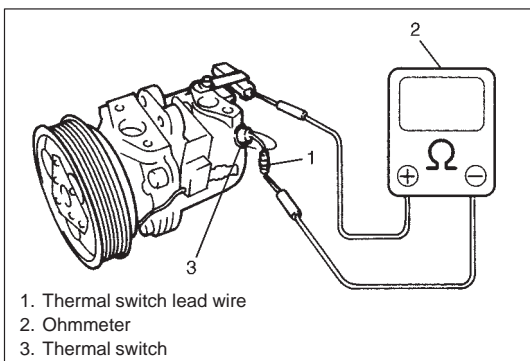


INSPECTION

Clutch plate and pulley

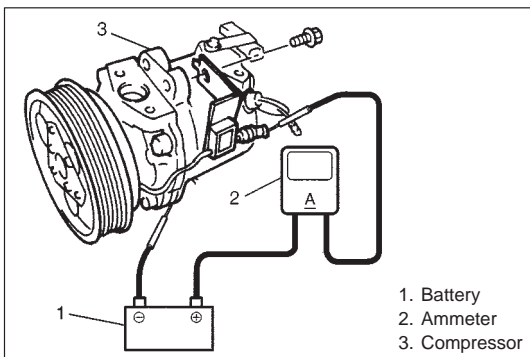
- 1) Check clutch plate and clutch pulley for wear and oil soaked conditions respectively.
- 2) Check clutch pulley bearing for noise, wear and grease leakage.

If there is any defect for clutch plate and clutch pulley, replace magnet clutch component.



Thermal switch

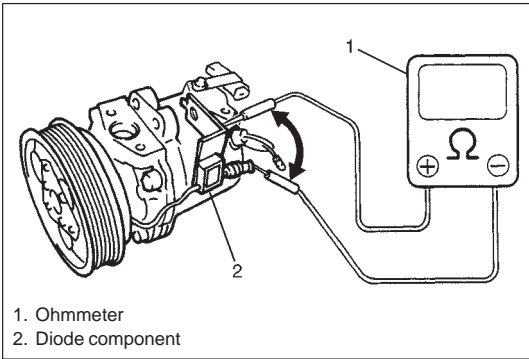
- 1) Disconnect thermal switch lead wire from clutch coil lead wire.
- 2) Use an ohmmeter to check thermal switch for continuity.
 If it is no continuity, replace thermal switch.



Clutch coil

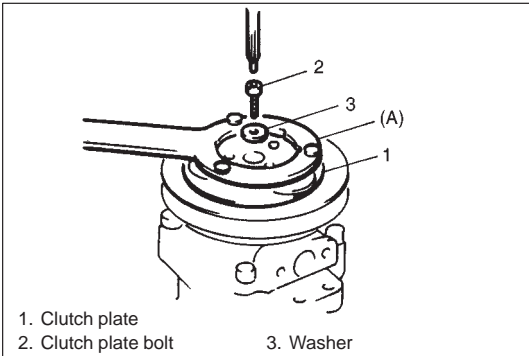
- 1) Connect battery and ammeter to compressor as shown.
- 2) Check that steadily locks between clutch plate and clutch pulley.
- 3) Check that ammeter indicates specified current.
 If check result is without specified current, replace magnet clutch assembly.

Specified current of magnet clutch: 4 A MAX at 12 V



Diode component

Check both directions by reversing probes of ohmmeter and there should be only one-way continuity for diode component. If check result is not satisfactory, replace magnet clutch component.

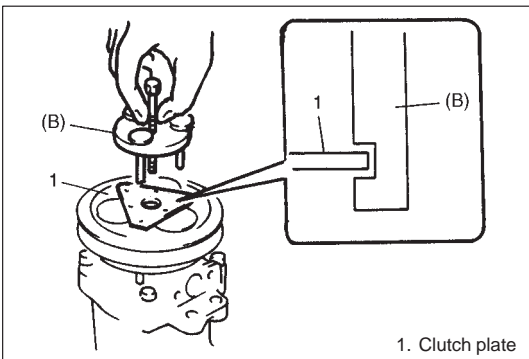


REMOVAL

- 1) Remove compressor. Refer to "COMPRESSOR" in this section.
- 2) Fix clutch plate with special tool (A) and remove clutch plate bolt.

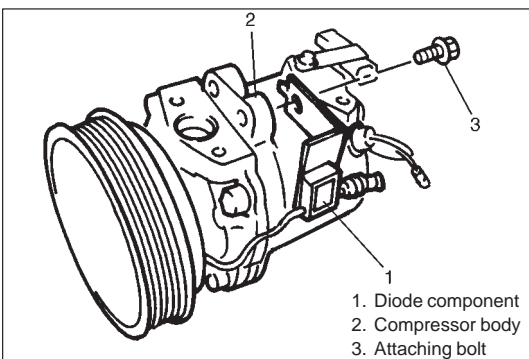
Special Tool
(A): 09991-06020

NOTE:
Do not reuse clutch plate bolt.

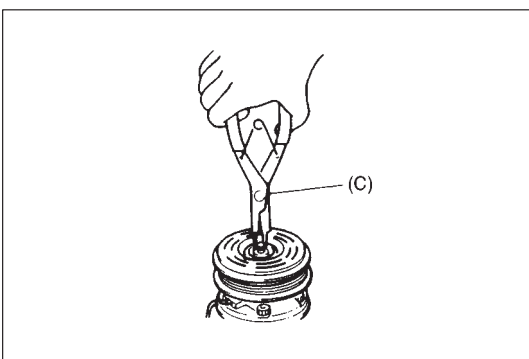


- 3) Using special tool (B), remove clutch plate.

Special Tool
(B): 09991-06030

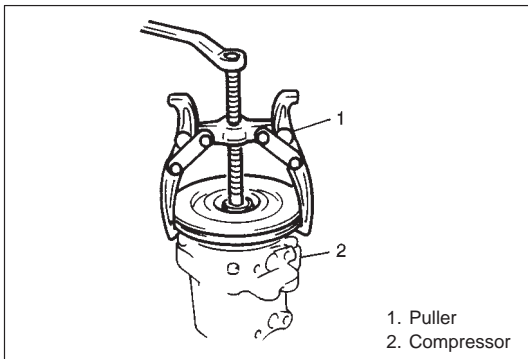


- 4) Disconnect clutch coil lead wire from thermal switch.
- 5) Remove diode component from compressor body by loosening attaching bolt.



- 6) Remove shims from shaft.
- 7) Using special tool (C), remove circlip.

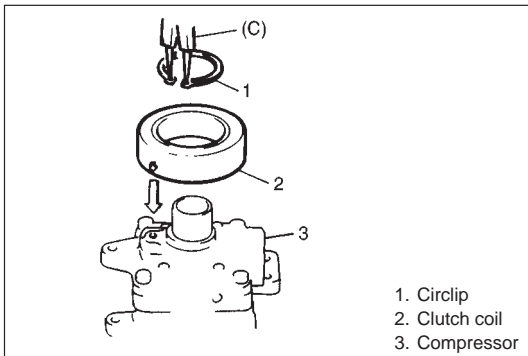
Special Tool
(C): 09900-06107



8) Remove clutch pulley with puller.

NOTE:

Be careful not to damage pulley when tapping clutch pulley.

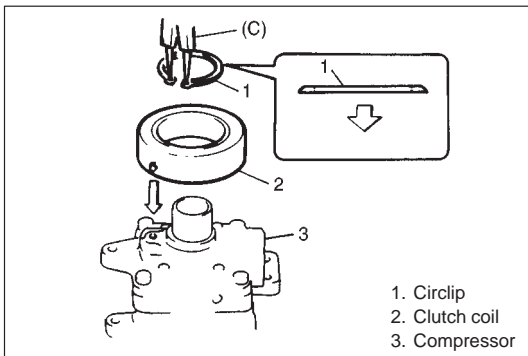


9) Remove circlip by using special tool (C).

10) Remove clutch coil from compressor.

Special Tool

(C): 09900-06107



INSTALLATION

1) Install clutch coil.

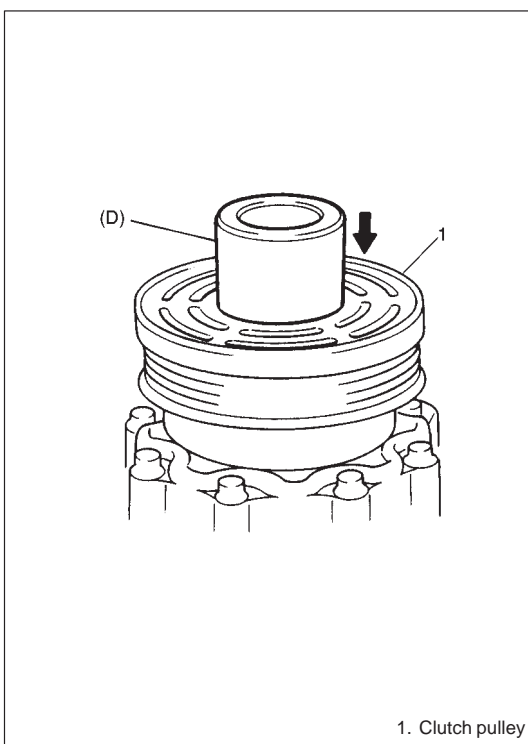
Protrusion on under side of clutch coil must match hole in compressor to prevent movement and correctly locate lead wire.

2) Using special tool (C), install circlip to compressor as shown.

Special Tool

(C): 09900-06107

3) Clamp covering portion of read wire.



4) Install clutch pulley.

a) Set clutch pulley squarely over clutch pulley installation boss.

b) Place special tool (D) onto clutch bearing.

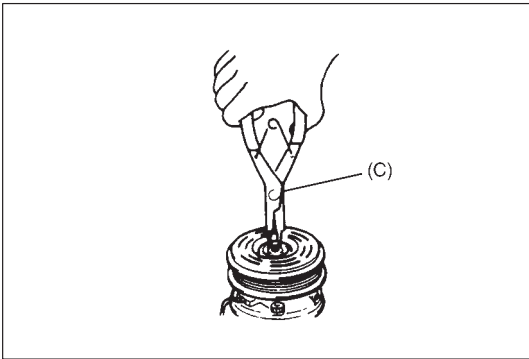
Ensure that edge rests only on inner race of bearing.

Special Tool

(D): 09991-06010

CAUTION:

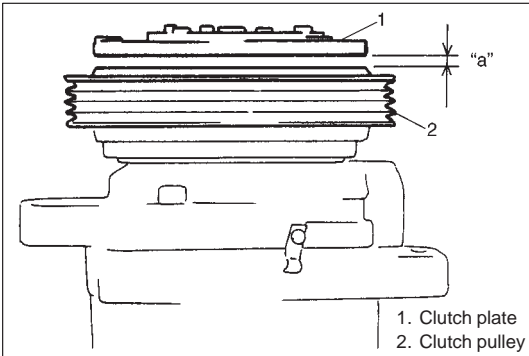
Be careful not to scratch bearing seal.



5) Install circlip by using special tool (C).

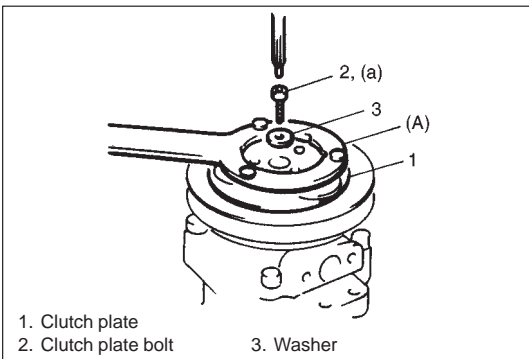
Special Tool
(C): 09900-06107

CAUTION:
Be careful not to scratch bearing seal.



6) Adjust clearance, between clutch plate and clutch pulley by putting shim(s) on compressor shaft.

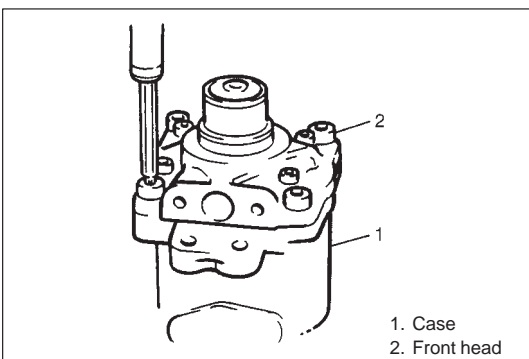
Standard clearance "a": 0.3 – 0.5 mm (0.012 – 0.020 in.)



7) Tighten new clutch plate bolt as specified below.

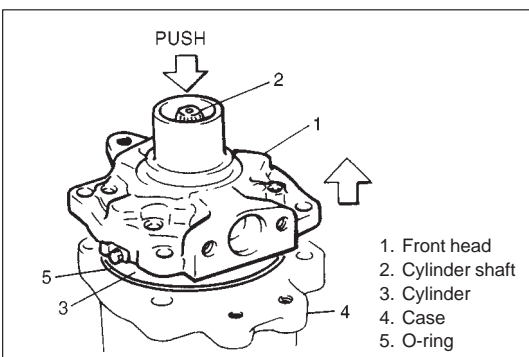
Tightening Torque
(a): 14 N·m (1.4 kg-m, 10.5 lb-ft)

Special Tool
(A): 09991-06020



**LIP TYPE SEAL
REMOVAL**

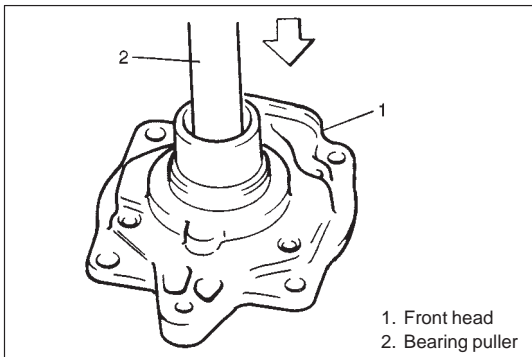
- 1) Remove magnet clutch referring to "MAGNET CLUTCH" in this section.
- 2) Remove front head mounting screws (8 pcs).



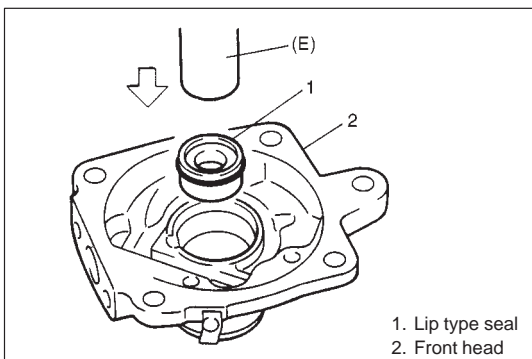
3) Remove front head by pushing cylinder shaft.

NOTE:
Be careful not to remove cylinder from case.

4) Remove O-ring.



5) Remove lip type seal from front head.



INSTALLATION

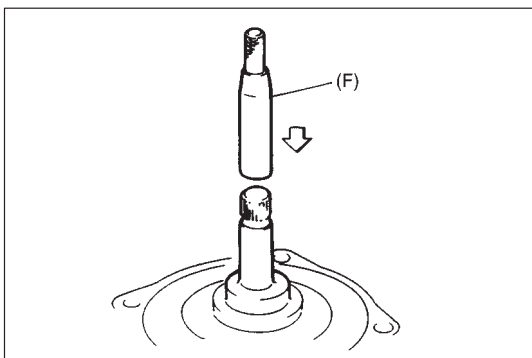
1) Press-fit lip type seal into front head using special tool (E).

Special Tool

(E): 09991-06050

CAUTION:

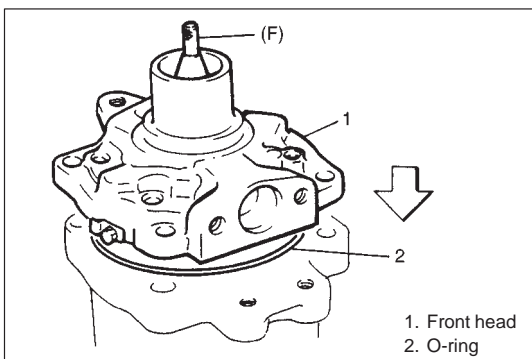
Do not reuse lip type seal once removed from compressor.



2) Coat special tool (F) surface with compressor oil and install it to the shaft.

Special Tool

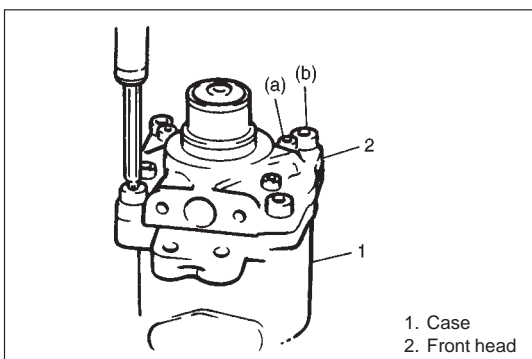
(F): 09991-06040



3) Install O-ring to case.

4) Apply compressor oil to lip type seal and O-ring.

5) Install front head assembly.



6) Tighten front head bolt as specified torque.

Tightening Torque

(a): 14 N·m (1.4 kg·m, 10.5 lb·ft)

(b): 23 N·m (2.3 kg·m, 17.0 lb·ft)

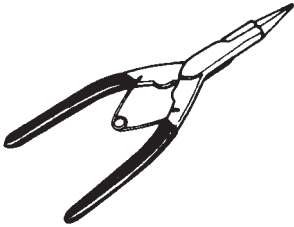
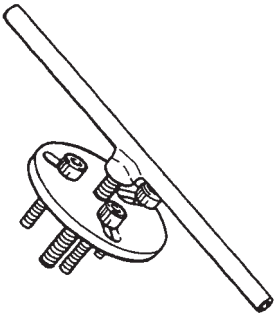
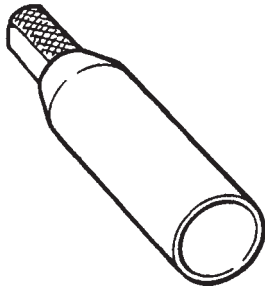
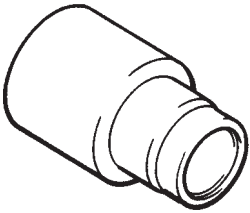
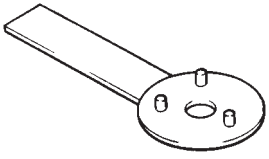
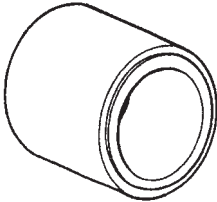
NOTE:

- Be sure to use new front head bolt and washer.
- Tighten bolt (a) first, and next (b).

REQUIRED SERVICE MATERIALS

MATERIALS	RECOMMENDED SUZUKI PRODUCT	USE
Compressor oil	COMPRESSOR OIL (RS-20, 150 cc) 99000-99088-00D0	<ul style="list-style-type: none"> ● O-ring ● Each component
Refrigerant	REFRIGERANT DRUM (200 g) 95794-50G00-0000	<ul style="list-style-type: none"> ● Refrigerant charge

SPECIAL TOOLS

			
09900-06107 Snap ring pliers (Opening type)	09991-06030 Armature plate remover	09991-06040 Lip type seal protector	09991-06050 Lip type seal installer
			
09991-06020 Armature plate spanner	09991-06010 Magnet clutch pulley installer		

SECTION 3B1

POWER STEERING (P/S) SYSTEM

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 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).

3B1

NOTE:

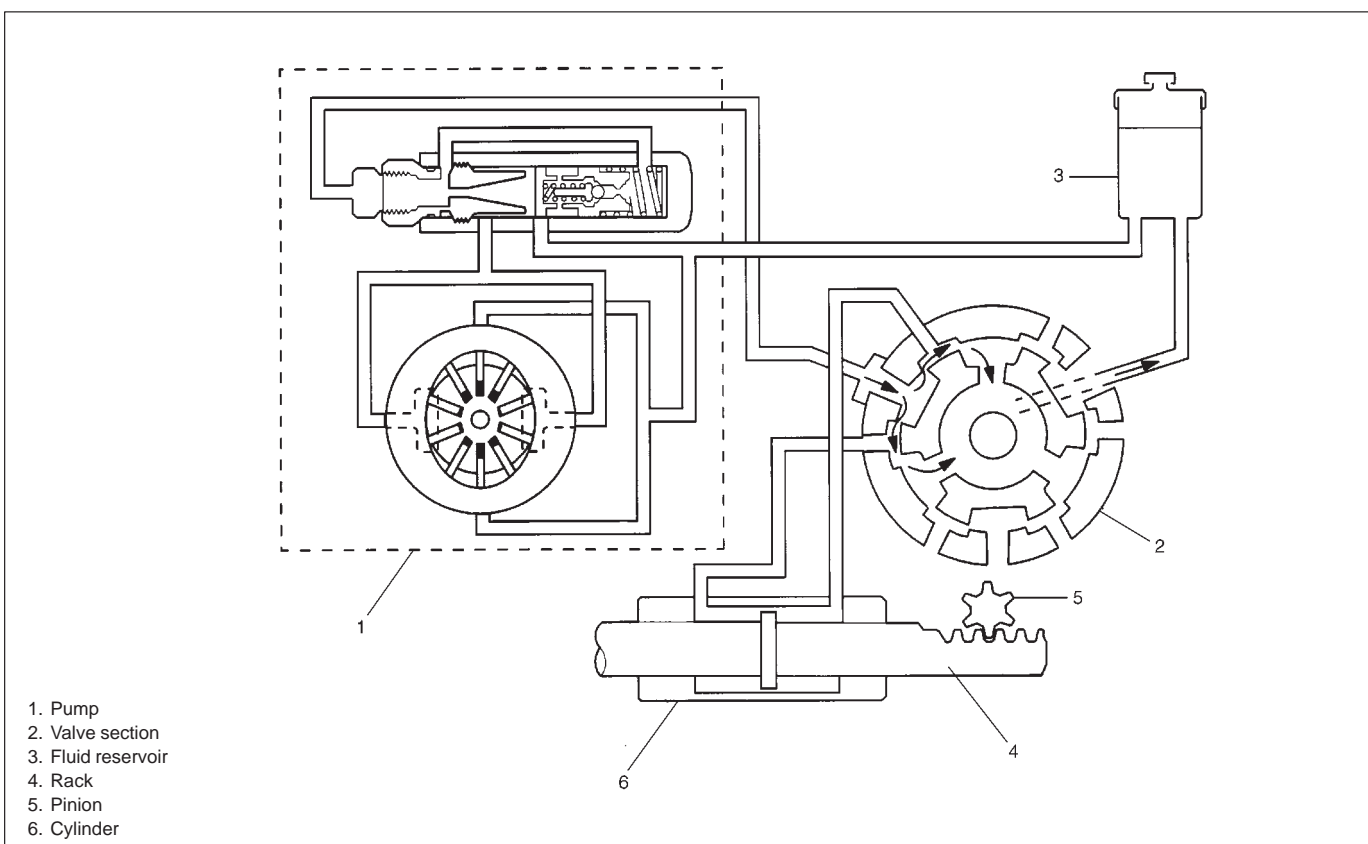
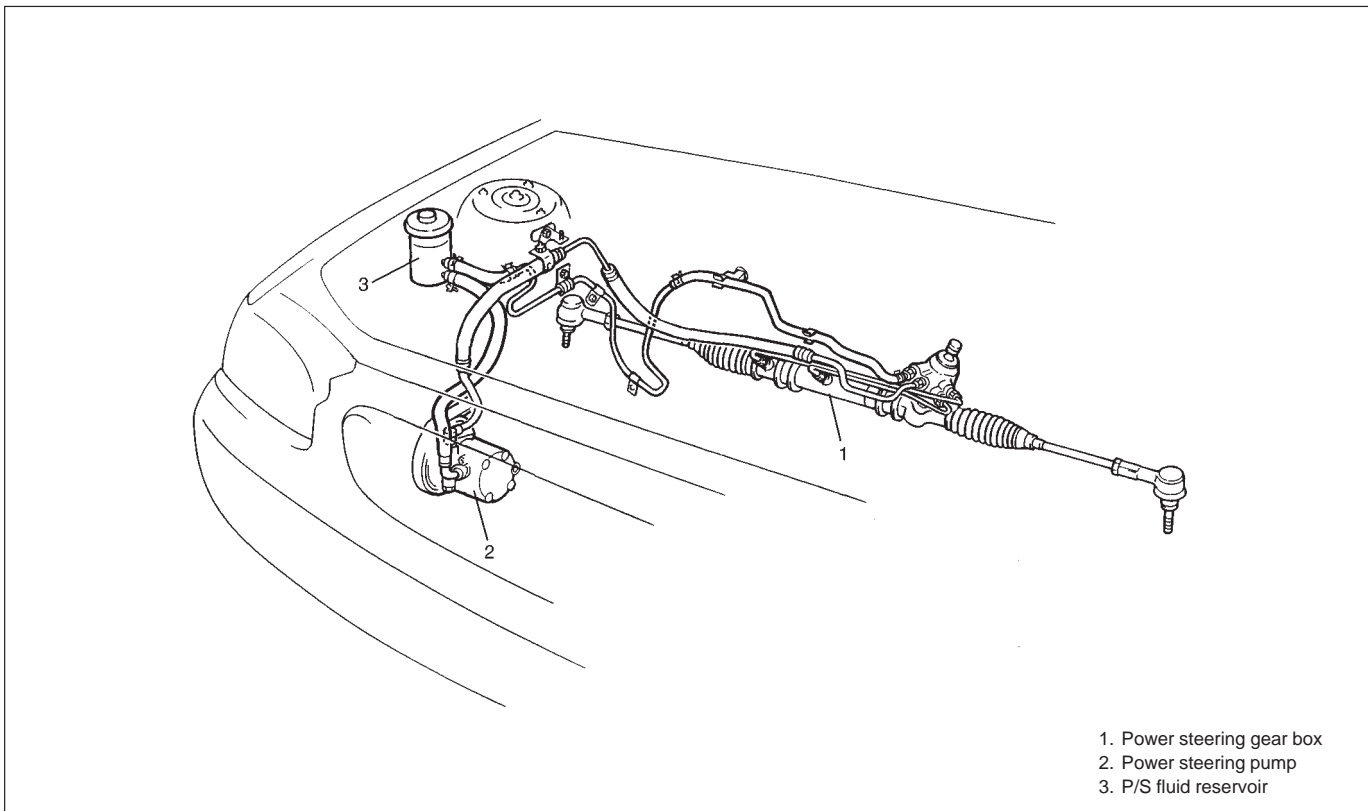
- For the descriptions (items) not found in this section, refer to the same section of the Service Manual mentioned in FOREWORD of this manual.
- Some parts in the Power Steering Gear Box cannot be disassembled or adjusted. For detailed information, refer to the description of POWER STEERING GEAR BOX COMPONENTS under REMOVE AND INSTALL POWER STEERING GEAR BOX, in same section of the service manual mentioned in FOREWORD of this manual.
- 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.

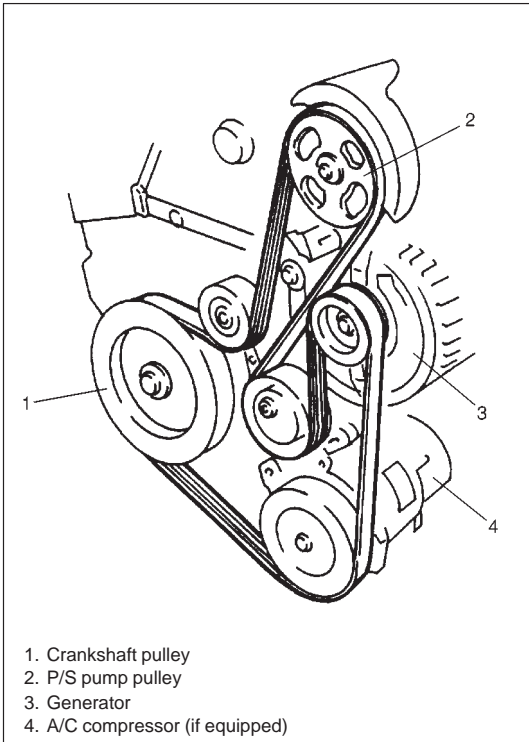
CONTENTS

GENERAL DESCRIPTION	3B1-2
Power Steering (P/S) Pump	3B1-3
ON-VEHICLE SERVICE	3B1-4
Inspection	3B1-4
Removal and installation power steering gear box	3B1-7
Removal and installation power steering pump	3B1-8
TIGHTENING TORQUE SPECIFICATIONS	3B1-9
REQUIRED SERVICE MATERIAL	3B1-9
SPECIAL TOOLS	3B1-9

GENERAL DESCRIPTION

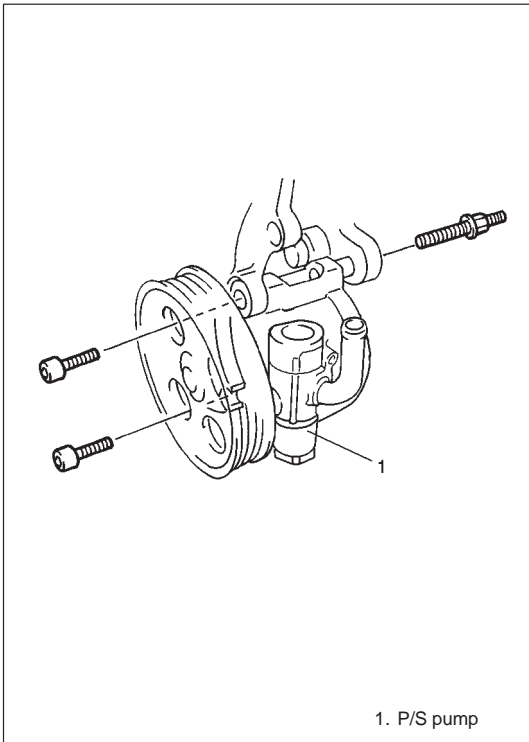
The power steering (P/S) system in this vehicle reduces the driver's effort needed in turning the steering wheel by utilizing the hydraulic pressure generated by the power steering (P/S) pump which is driven by the engine. The steering gear box consists of the rack and pinion gears and the control valve unit, hydraulic pressure cylinder unit.





POWER STEERING (P/S) PUMP

The power steering pump is a vane type and is driven by the V-ribbed belt from the crankshaft.



Model		Vane type
Hydraulic pressure control	Relieved pressure	8,400 kPa (84.0 kg/cm ² or 1,194 psi)
	Control device	Flow control valve
Relief valve		
Fluid capacity of system		760 – 850 cm ³ (1.61/1.34 – 1.80/1.50 US/Imp. pt)

ON-VEHICLE SERVICE

INSPECTION

DRIVE BELT INSPECTION

Refer to SECTION 6H.

DRIVE BELT ADJUSTMENT

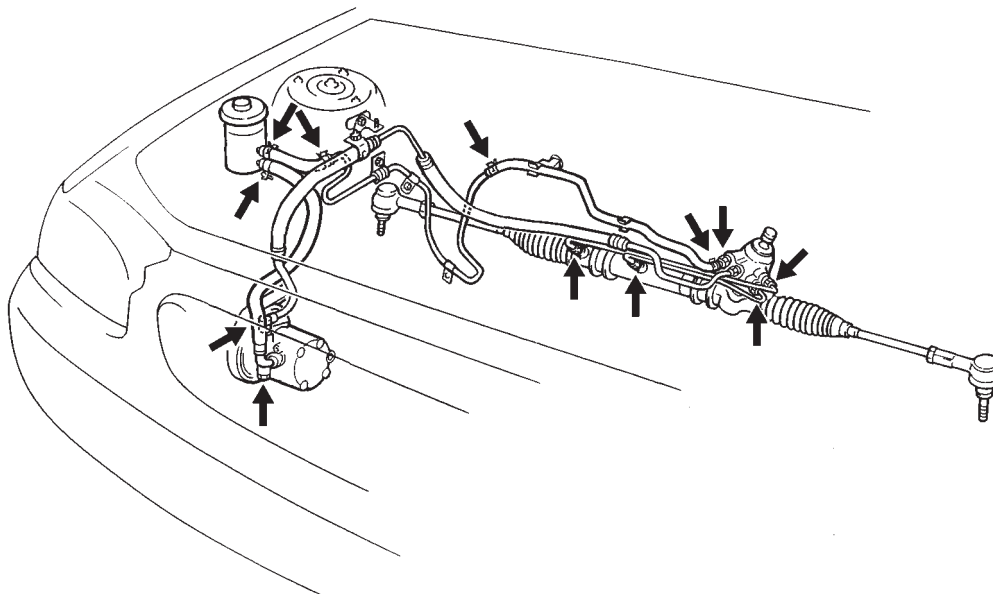
Refer to SECTION 6H.

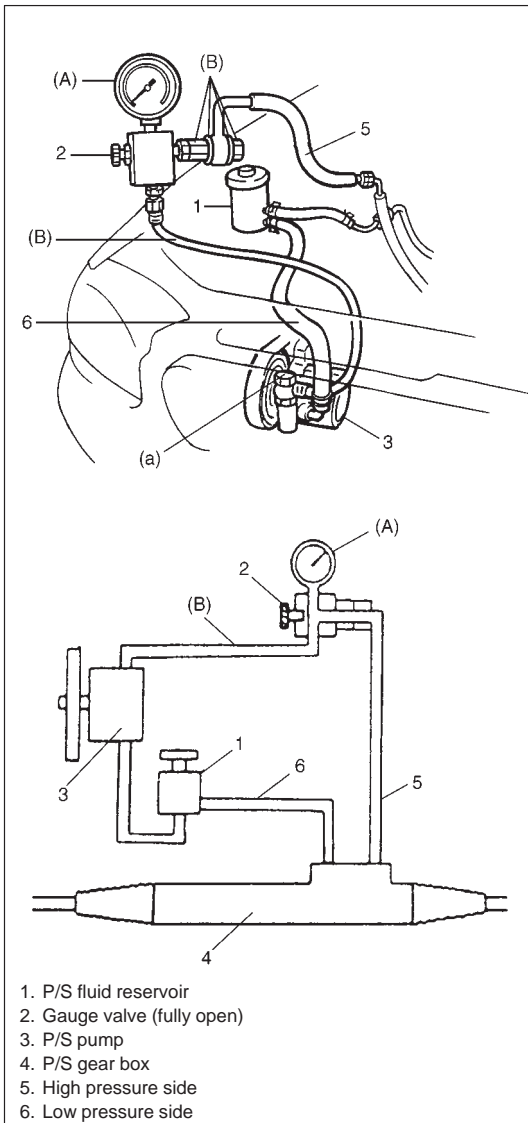
FLUID LEAKAGE

Start engine and turn steering wheel fully to the right and left so that maximum hydraulic pressure is provided. Then visually check gear box, P/S pump and fluid reservoir themselves and each joint of their connecting pipes for leakage.

CAUTION:

Never keep steering wheel turned fully for longer than 10 seconds.





HYDRAULIC PRESSURE IN P/S CIRCUIT

- 1) After cleaning joint of high pressure hose and P/S pump thoroughly, disconnect hose from pump and install special tool (oil pressure gauge, attachment and hose). Tighten bolt and attachment to specified torque.

Tightening torque

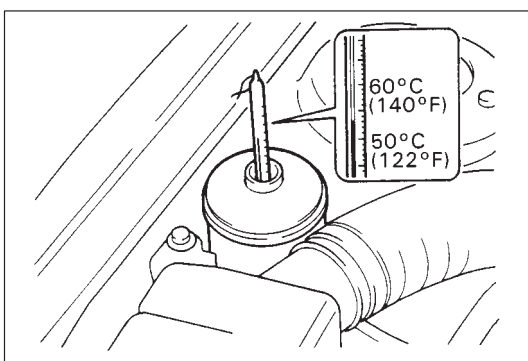
(a): 55 N·m (5.5 kg·m, 40.0 lb·ft)

Special Tool

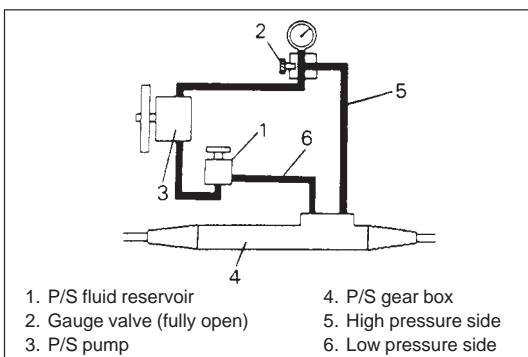
(A): 09915-77410 (Oil pressure gauge)

(B): 09915-77420 (Attachment & hose)

- 2) Check each connection for fluid leakage and bleed air.



- 3) With engine idling, warm up engine till temperature of fluid in reservoir rises to 50 – 60°C (122 – 140°F).

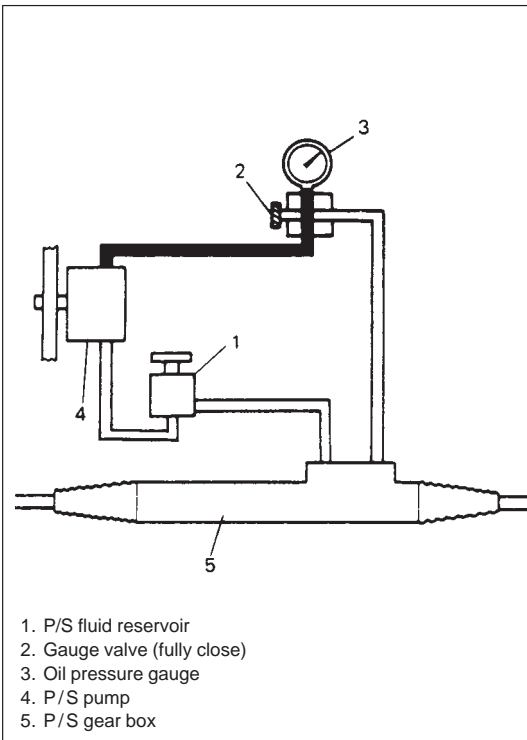


- 4) Check back pressure by measuring hydraulic pressure with gauge valve fully open, engine idling and hands off steering wheel.

Back pressure: Lower than 0 – 1500 kPa

(0 – 15 kg/cm², 0 – 213 psi)

When back pressure is higher than specified values, check control valve and piping for clogging.



5) Check relief pressure

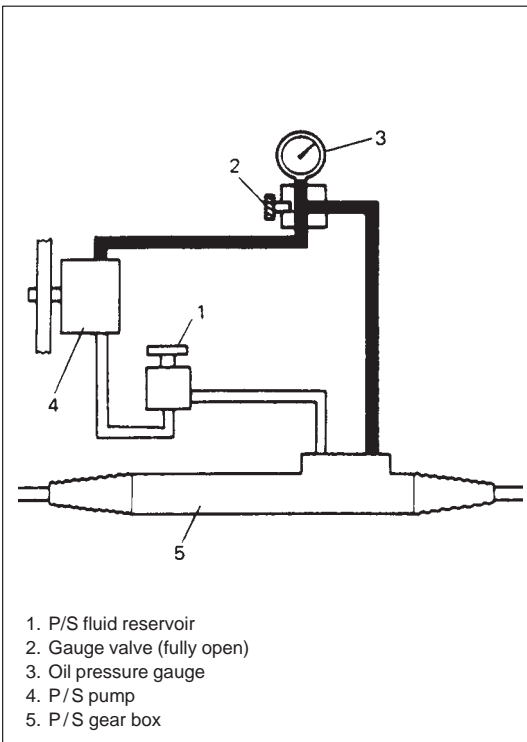
- Increase engine speed to about 1,500 r/min (rpm). Close gauge valve gradually while watching pressure increase indicated by gauge and take reading of relief pressure (maximum hydraulic pressure).

**Relief pressure: 8,200 – 8,900 kPa
(82 – 89 kg/cm², 1167 – 1265 psi)**

- When it is higher than specified values, possible cause is malfunction of relief valve.
- When it is lower than specified values, possible cause is either failure of P/S pump or settling of relief valve spring.

CAUTION:

Be sure not to close gauge valve for longer than 10 seconds.



- Next, open gauge valve fully and increase engine speed to about 1,500 r/min (rpm). Then turn steering wheel to the left or right fully and take reading of relief pressure.

**Relief pressure: 8,200 – 8,900 kPa
(82 – 89 kg/cm², 1167 – 1265 psi)**

- When it is higher than specified values, possible cause is malfunction of relief valve.
- When it is lower than specified values, possible cause is failure in steering gear box. Replace gear box.

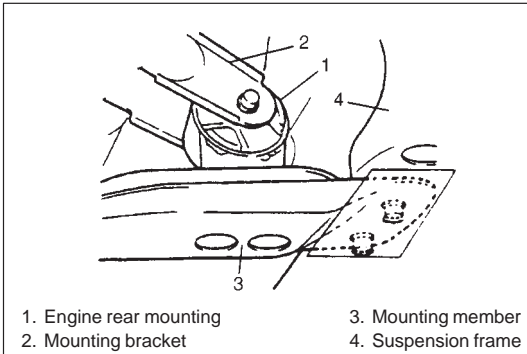
CAUTION:

Be sure not to hold steering wheel at fully turned position for longer than 10 seconds.

REMOVAL AND INSTALLATION POWER STEERING GEAR BOX

REMOVAL

1) Perform steps 1) to 6) written in REMOVAL, POWER STEERING GEAR BOX, SECTION 3B1 in service manual mentioned in FOREWORD of this manual.



2) Remove engine mounting member and then remove engine rear mounting bracket together with its mounting from engine.
3) Perform steps 9) to 11) written in REMOVAL, POWER STEERING GEAR BOX, SECTION 3B1 in service manual mentioned in FOREWORD of this manual.

INSTALLATION

Reverse removal procedure for installation of steering gear box noting the following points.

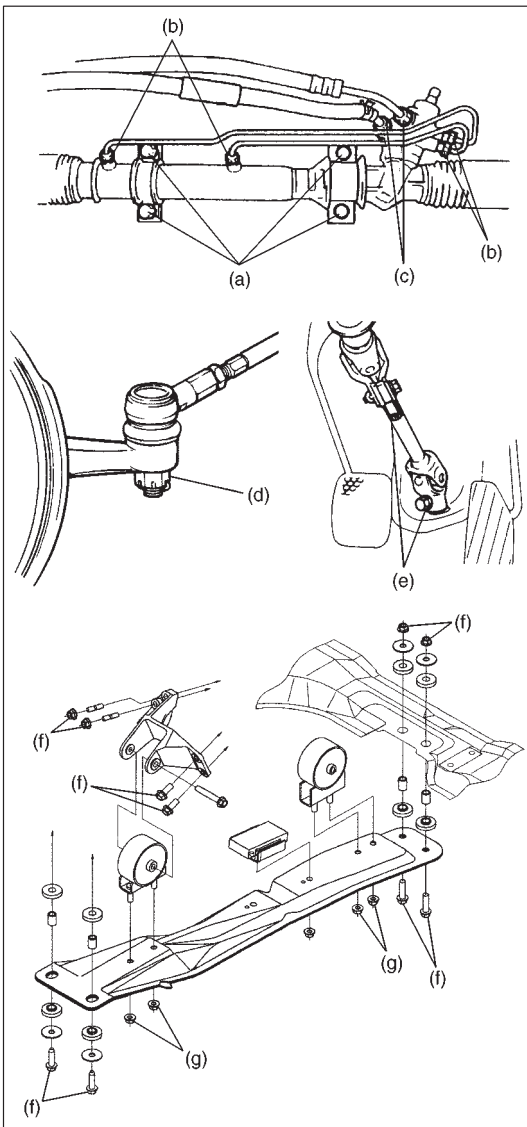
CAUTION:

Be sure to confirm that steering wheel and front tires (wheels) are in straight position when inserting steering lower joint into steering pinion shaft.

- If a plug was put to disconnected pipe when removing steering gear box, remove that plug before reconnecting pipe.
- Use specified torque as given below.

Tightening Torque

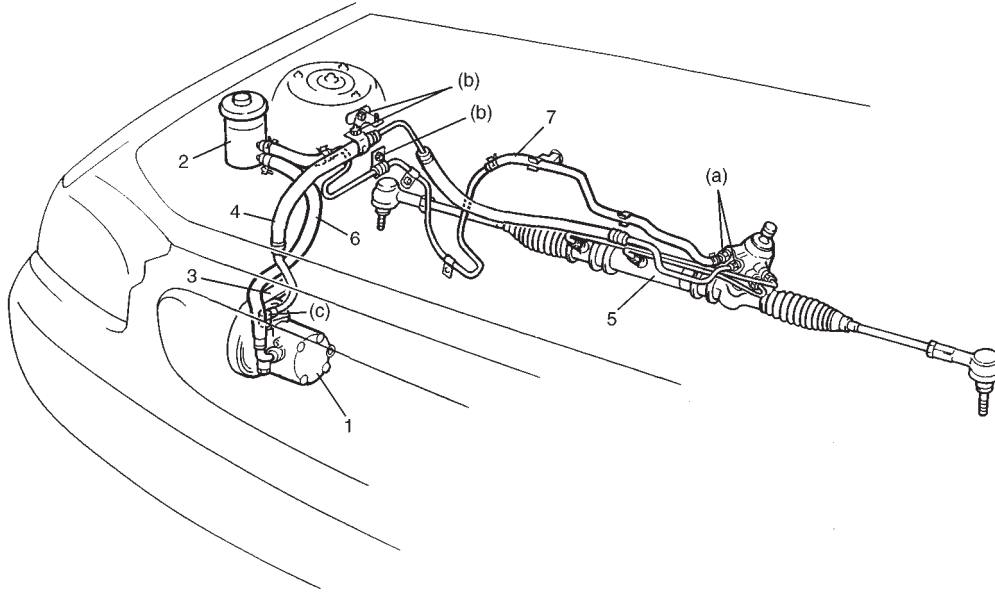
- (a): 55 N·m (5.5 kg-m, 40.0 lb-ft)
- (b): 20 N·m (2.0 kg-m, 14.5 lb-ft)
- (c): 35 N·m (3.5 kg-m, 25.5 lb-ft)
- (d): 35 – 55 N·m (3.5 – 5.5 kg-m, 25.5 – 39.5 lb-ft)
- (e): 25 N·m (2.5 kg-m, 18.0 lb-ft)
- (f): 55 N·m (5.5 kg-m, 40.0 lb-ft)
- (g): 45 N·m (4.5 kg-m, 32.5 lb-ft)



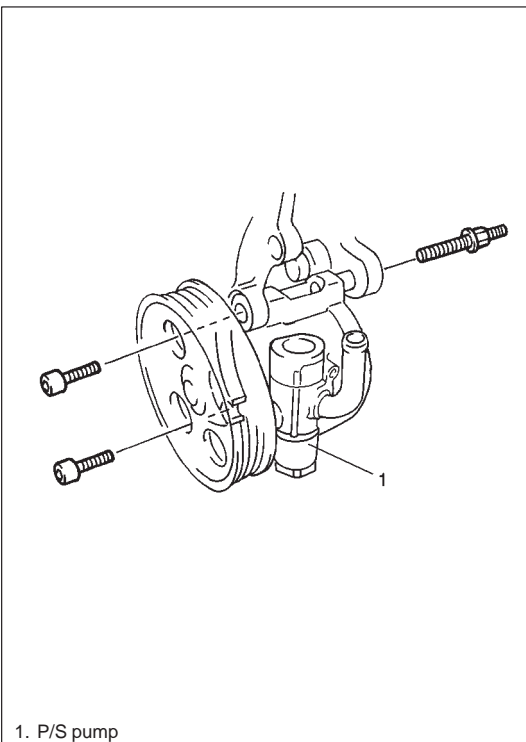
REMOVAL AND INSTALLATION POWER STEERING PUMP

Tightening Torque

- (a): 35 N·m (3.5 kg-m, 25.5 lb-ft)
 (b): 6.5 N·m (0.65 kg-m, 5.0 lb-ft)
 (c): 55 N·m (5.5 kg-m, 40.0 lb-ft)



- | | |
|-----------------------------------|--|
| 1. Power steering pump assembly | 5. Rack and pinion |
| 2. Power steering fluid reservoir | 6. Low pressure return hose (Tank side) |
| 3. Accessory drive belt | 7. Low pressure return hose & pipe (Gear box side) |
| 4. High pressure hose & pipe | |



1. P/S pump

REMOVAL

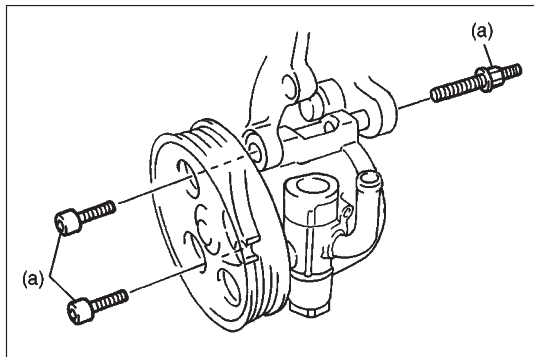
NOTE:

Be sure to clean each joint of suction and discharge sides thoroughly before removal.

- 1) Remove drive belt, referring to SECTION 6H.
- 2) Disconnect high pressure hose and low pressure return hose from pump. As fluid flows out of disconnected joints, put a container under joints or a plug to hose.
- 3) Remove P/S pump from engine assembly.

NOTE:

Plug each port of removed pump to prevent dust or any other foreign matter from entering.



INSTALLATION

Reverse removal procedure.

Tightening Torque

(a): 35 N·m (3.5 kg·m, 25.5 lb-ft)

NOTE:

- Fill specified power steering fluid after installation and bleed air without failure.
- Refer to structural diagram on previous page for tightening torque.
- Check each connection for fluid leakage.

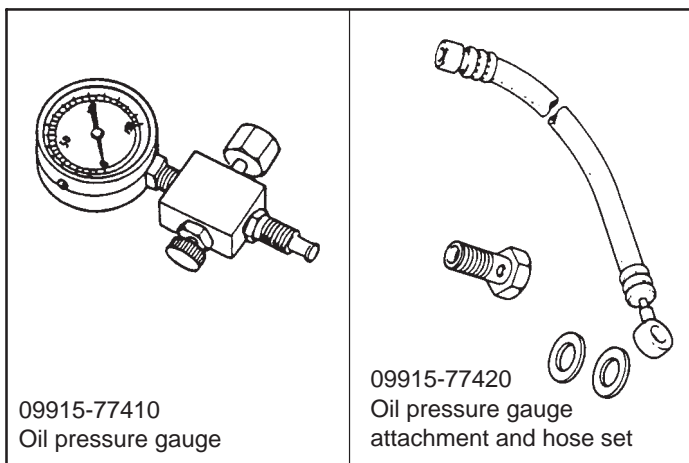
TIGHTENING TORQUE SPECIFICATIONS

Fastening parts	Tightening Torque		
	N·m	kg·m	lb-ft
High & low pressure pipe nut /bolt (pipe to gear box)	35	3.5	25.5
Pipe clamp bolt	6.5	0.65	5.0
High pressure pipe bolt (pipe to pump)	55	5.5	40.0
P/S pump mounting bolt	35	3.5	25.5

REQUIRED SERVICE MATERIALS

MATERIALS	RECOMMENDED SUZUKI PRODUCT	USE
Power steering fluid	An equivalent of DEXRON® -II, DEXRON® -IIE or DEXRON® -III	<ul style="list-style-type: none"> ● To fill power steering fluid reservoir ● Parts lubrication when installing

SPECIAL TOOLS



09915-77410
Oil pressure gauge

09915-77420
Oil pressure gauge attachment and hose set

SECTION 4

FRONT DRIVE SHAFT

NOTE:

For the descriptions (items) not found in this section of this manual, refer to the same section of Service Manual mentioned in FOREWORD of this manual.

CONTENTS

ON-VEHICLE SERVICE

CENTER SHAFT

Removal/Installation 4-1

ON-VEHICLE SERVICE

4

CENTER SHAFT

REMOVAL

- 1) Hoist vehicle.
- 2) Drain engine coolant and transmission oil.
- 3) Remove right side drive shaft.
- 4) Remove engine rear mounting and its bracket.
- 5) Remove water inlet pipe bolts.
- 6) Remove center shaft.

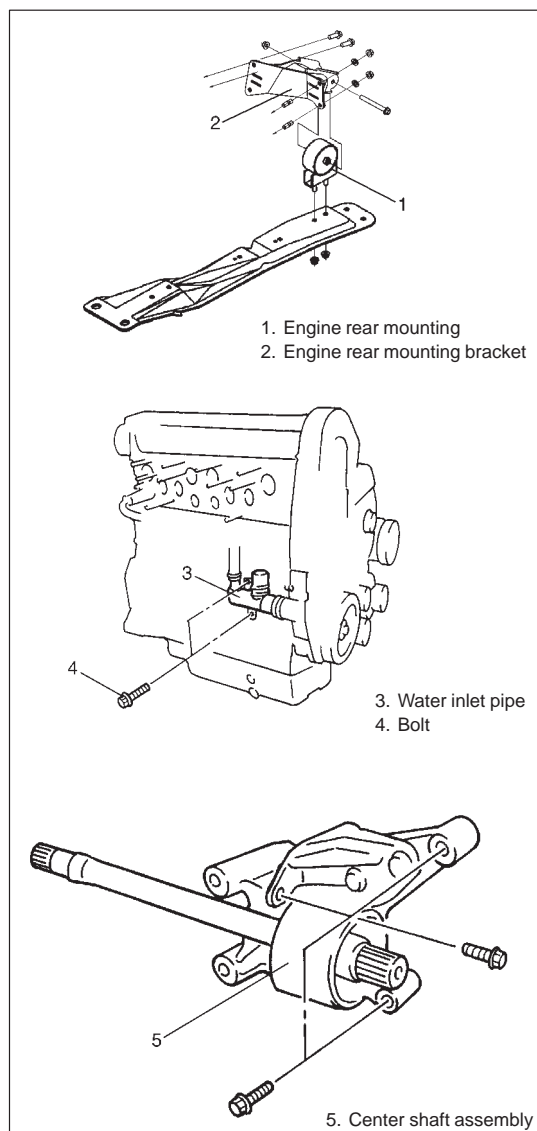
INSTALLATION

- 1) Install center shaft.

CAUTION:

- Protect differential side oil seal from any damage, preventing them from unnecessary contact while installing.
- Make sure that differential side joint is inserted fully and its snap ring is seated as it was.

- 2) Install water inlet pipe with new O-ring.
- 3) Install engine rear mounting and its bracket.
- 4) Install right side drive shaft.
- 5) Fill transmission oil and engine coolant.
- 6) Lower vehicle.



SECTION 5

BRAKES

WARNING:

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

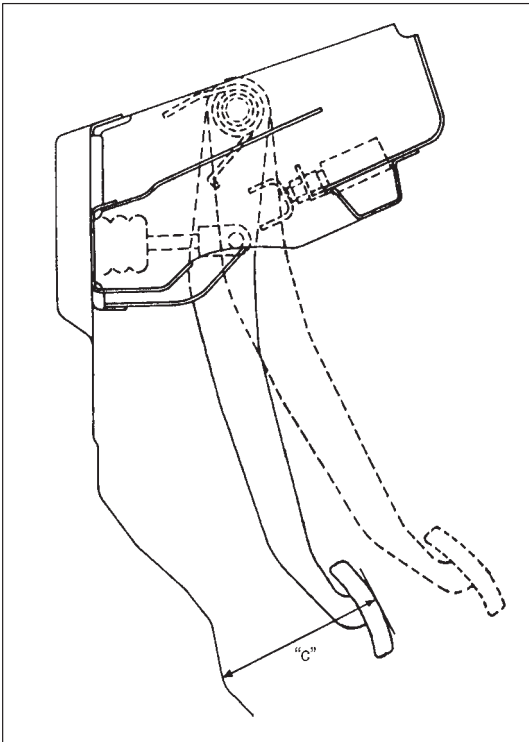
- Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to “System Components and Wiring Location View” under “General Description” in air bag system section in order to confirm whether you are performing service on or near the air 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 descriptions (items) not found in this section, refer to the same section of Service Manual mentioned in FOREWORD of this manual.
- 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.

CONTENTS

ON-VEHICLE SERVICE	5-2
Excessive Pedal Travel Check	5-2
Fluid Pressure Test	5-2
TIGHTENING TORQUE SPECIFICATIONS	5-4
SPECIAL TOOLS	5-4



ON-VEHICLE SERVICE

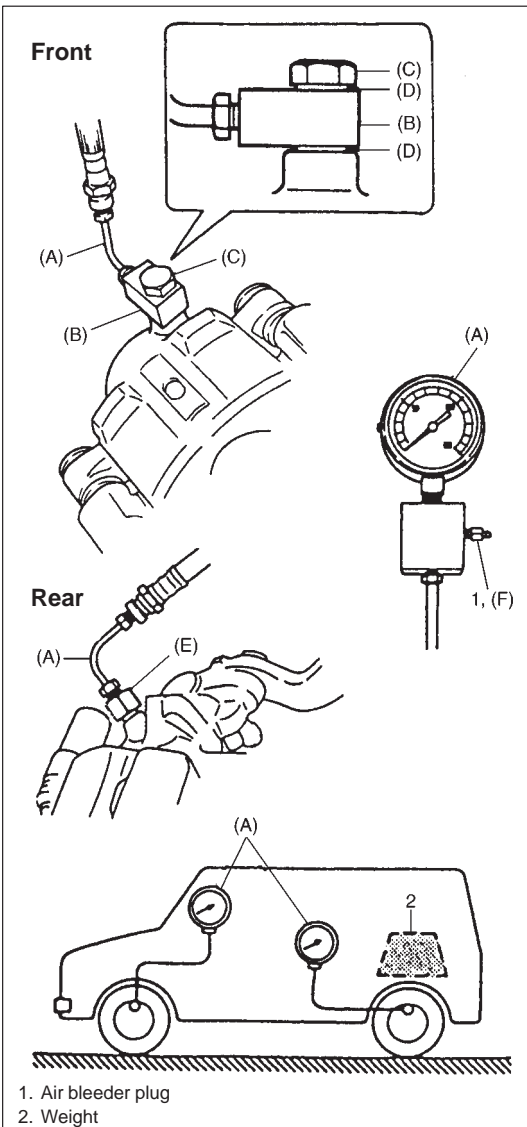
EXCESSIVE PEDAL TRAVEL CHECK

- 1) Start engine.
- 2) Depress brake pedal a few times.
- 3) With brake pedal depressed with approximately 30 kg (66 lbs) load, measure brake pedal to wall clearance "c".

Clearance "c": Over 70 mm (in.)

- 4) If clearance "c" is less than specification, the most possible cause is either rear brake shoes are worn out beyond limit or air is in lines.

Should clearance "c" remain less than specification even after replacement of brake shoes and bleeding of system, other possible but infrequent cause is malfunction of rear brake shoe adjusters or booster push rod length out of adjustment.



FLUID PRESSURE TEST

Test procedure for LSPV assembly is as follows.

Before testing, confirm the following.

- Fuel tank is filled with fuel fully.
 - Vehicle is equipped with spare tire, tools, jack and jack handle.
- 1) Place vehicle on level floor and set 200 kg (442 lbs) weight slowly on axle housing center.
 - 2) Install special tool to front and rear brake.

NOTE:

Pressure gauge should be connected to breather of front (left side brake) and rear (right side brake).

After testing front left side and rear right side, test front right side and rear left side in the same way.

Special Tool

Front brake

- (A): 09956-02310
- (B): 09952-36320
- (C): 09360-10026 (Union bolt as spare part)
- (D): 09161-10009 (Washer as spare part)

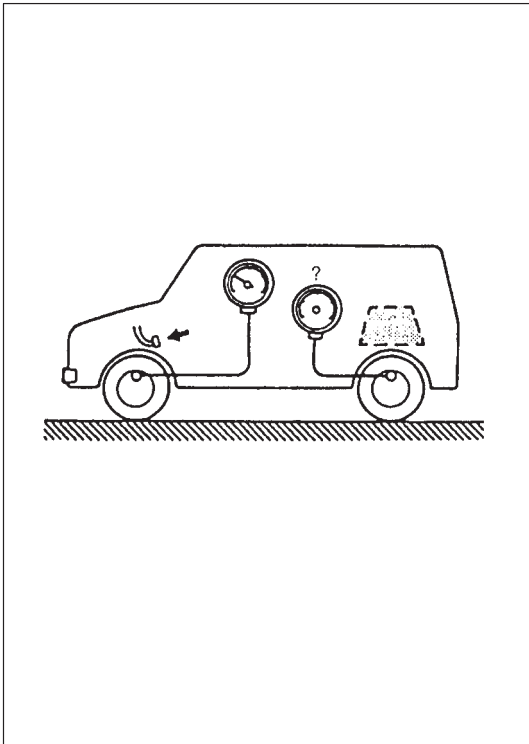
Rear brake

- (A): 09956-02310
- (E): 09952-36310
- (F): 55473-82030 (Air bleeder plug as a spare part)

NOTE:

Special tool (B) or (E) is used instead of thread diameter 10 mm attachment of special tool (A).

So remove the attachment from (A) and install (B) or (E) as shown in figure.

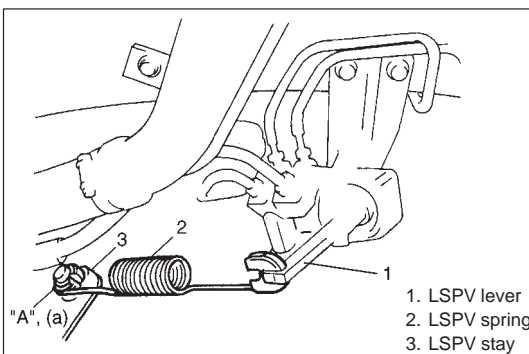


- 3) Depress brake pedal gradually till fluid pressure of front brake becomes as specified below and check corresponding pressure of rear brake then. It should be within specification given below.

Front brake	Rear brake	
5,000 kPa 50 kg/cm ² 711 psi	4 Door	3,900 – 4,300 kPa 39 – 43 kg/cm ² 555 – 611 psi
	WAGON	4,800 – 5,200 kPa 48 – 52 kg/cm ² 683 – 739 psi

As done above, apply 100 kg/cm² pressure to front brake and check that rear brake pressure then is within specification as given below.

Front brake	Rear brake	
10,000 kPa 100 kg/cm ² 1,422 psi	4 Door	5,400 – 5,800 kPa 54 – 58 kg/cm ² 768 – 825 psi
	WAGON	7,200 – 7,600 kPa 72 – 76 kg/cm ² 1024 – 1081 psi



- 4) If rear brake pressure is not within specification, adjust it by changing bolt "A" tightening position as follows.

Tightening Torque

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


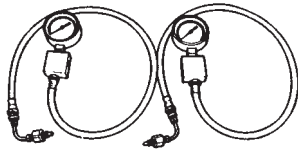
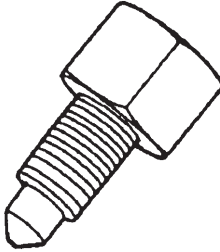
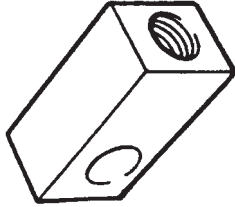
- If rear brake pressure is higher than specification, move bolt "A" rearward and if it is lower, forward.
- Repeat steps 3) and 4) until rear brake pressure is within specification.
- After adjustment, be sure to torque nut to specification.

- 5) Upon completion of fluid pressure test, bleed brake system and perform brake test.

TIGHTENING TORQUE SPECIFICATIONS

FASTENING PARTS		TIGHTENING TORQUE		
		N·m	kg·m	lb·ft
Brake bleeder plug	(Front caliper)	10	1.0	7.5
	(Rear wheel cylinder and caliper)	8	0.8	6.0
LSPV bolt/LSPV bracket bolt		23	2.3	17.0
LSPV adjusting nut				

SPECIAL TOOLS

			
<p>09950-78210 Flare nut wrench (10 mm)</p>	<p>09956-02310 Fluid pressure gauge</p>	<p>09952-36310 Fluid pressure gauge attachment (7 mm)</p>	<p>09952-36320 Fluid pressure gauge attachment</p>

SECTION 6

ENGINE GENERAL INFORMATION AND DIAGNOSIS

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 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 “Precautions” 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).

GENERAL INFORMATION AND ENGINE DIAGNOSIS	6
ENGINE MECHANICAL	6A4
ENGINE COOLING	6B
ENGINE AND EMISSION CONTROL SYSTEM	6E3
CRANKING SYSTEM	6G4
CHARGING SYSTEM	6H
EXHAUST SYSTEM	6K

CONTENTS

GENERAL INFORMATION	6- 2	Visual Inspection	6-14
Statement on Cleanliness and Care	6- 2	Engine Basic Inspection	6-15
General Information on Engine Service	6- 3	Engine Diagnosis Table	6-16
Precaution on Fuel System Service	6- 4	Scan Tool Data	6-25
Metric Information	6- 5	Scan Tool Data Definitions	6-26
ENGINE DIAGNOSIS	6- 6	Inspection of ECM and Its Circuits	6-27
General Description	6- 6	Voltage Check	6-27
On-Board Diagnostic System	6- 7	Resistance Check	6-30
Precaution in Diagnosing Trouble	6- 8	Component Location	6-31
Engine Diagnostic Flow Table	6- 9	Table A-1 Malfunction Indicator Lamp Circuit	
Customer Problem Inspection Form	6-11	Check – Lamp Does Not Come “ON” at	
Malfunction Indicator Lamp Check	6-12	Ignition Switch ON	6-32
Diagnostic Trouble Code Check	6-12	Table A-2 Malfunction Indicator Lamp Circuit	
Diagnostic Trouble Code Clearance	6-12	Check – Lamp Remains “ON” at Ignition	
Diagnostic Trouble Code Table	6-13	Switch ON	6-33

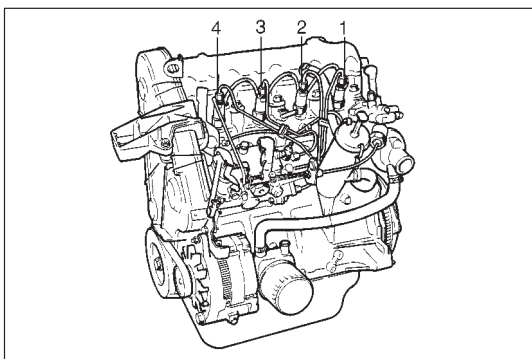
Table A-3 ECM Power and Ground Circuit	
Check – MIL Doesn't Start at Ignition Switch	
ON and Engine Doesn't Start Though It is	
Cranked Up	6-34
DTC No.1 Crankshaft Position (CKP) Sensor	
Circuit Malfunction	6-36
DTC No.3 Engine Coolant Temperature (ECT)	
Circuit Malfunction	6-39
DTC No.4 Throttle Position Circuit	
Malfunction	6-41
DTC No.13 Barometric Pressure Sensor	
Low/High Input	6-43
DTC No.14 Injector Needle Sensor Circuit	
Malfunction	6-44
DTC No.16 Injection Timing Actuator Control	
Malfunction	6-46
DTC No.34 Injection Timing Actuator Circuit	
Malfunction	6-46
DTC No.17 ECM Power Supply Circuit	
Malfunction	6-48
DTC No.22 Glow Plug Relay Control	
Malfunction (FeedBack Low Voltage)	6-49
DTC No.23 Glow Plug Relay Control Circuit	
Malfunction	6-49
DTC No.32 Glow Plug Relay Control	
Malfunction (FeedBack High Voltage)	6-49
DTC No.33 EGR No.1 Control Valve Circuit	
Malfunction	6-51
DTC No.36 EGR No.2 Control Valve Circuit	
Malfunction	6-51
DTC No.37 A/C Cut Off Control Circuit	
Malfunction	6-52
DTC No.38 Malfunction Indicator Lamp Circuit	
Malfunction	6-54
DTC No.39 Glow Plug Indicator Lamp Circuit	
Malfunction	6-56
DTC No.127 Internal Control Module Memory	
Check Sum Error	6-58
DIAGNOSIS IN TERMS OF SYMPTOM	6-59
The Engine Will Not Start with No Emission	
of Smoke (Engine Warm and Cold)	6-60
The Engine Will Not Start with Emission of	
Black Smoke (Engine Warm and Cold)	6-61
The Engine Will Not Start with Emission of	
Clear Smoke (Engine Cold)	6-62
The Engine Is Difficult to Start When Cold	
(with Emission of Black Smoke)	6-63
The Engine Starts Then Stops	6-64
Unstable Idling	6-65
Vibration at Idle	6-66
Unwanted Acceleration	6-67
The Engine Stalls/on Overrun	
(Slow Return to Idle)	6-68
Engine Miss-fire; Irregular Operation	6-69
The Engine Starts with Difficulty	
(Engine Hot)	6-70
Vehicle Lacks of Power	
(with or without Emission of Smoke)	6-71
Excessive Diesel Consumption	6-73
Engine Knocking	6-74
Hesitation at Steady Speed	6-75
Hesitation on Re-acceleration	6-76
With Emission of Black Smoke (at Idle)	
after Starting	6-77
Emission of Blue Smoke (at Idle; on Overrun;	
at Low Load)	6-78
With Emission of Black Smoke (at Load)	6-80
No Re-acceleration/No Liveliness	
(with or without Emission of Smoke)	6-81
The Vehicle Moves off with Difficulty	
(with or without Emission of Smoke)	6-82
SPECIAL TOOLS	6-83

GENERAL INFORMATION

STATEMENT ON CLEANLINESS AND CARE

An automobile engine is a combination of many machined, honed, polished and lapped surfaces with tolerances that are measured in the thousands of an millimeter (ten thousands of inch). Accordingly, when any internal engine parts are serviced, care and cleanliness are important. Throughout this section, it should be understood that proper cleaning and protection of machined surfaces and friction areas is part of the repair procedure. This is considered standard shop practice even if not specifically stated.

- A liberal coating of engine oil should be applied to friction areas during assembly to protect and lubricate the surfaces on initial operation.
- Whenever valve train components, pistons, piston rings, connecting rods, rod bearings, and crankshaft journal bearings are removed for service, they should be retained in order. At the time of installation, they should be installed in the same locations and with the same mating surfaces as when removed.
- Battery cables should be disconnected before any major work is performed on the engine. Failure to disconnect cables may result in damage to wire harness or other electrical parts.



- Throughout this manual, the four cylinders of the engine are identified by numbers No.1, No.2, No.3 and No.4 as counted from flywheel side to crankshaft pulley side.

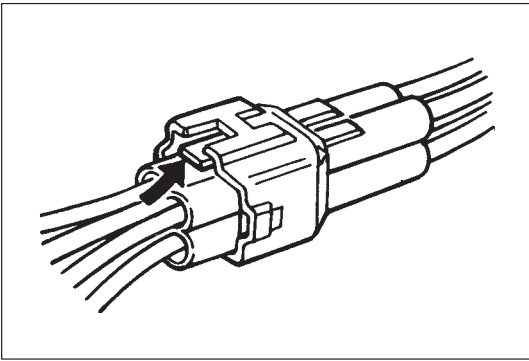
GENERAL INFORMATION ON ENGINE SERVICE

THE FOLLOWING INFORMATION ON ENGINE SERVICE SHOULD BE NOTED CAREFULLY, AS IT IS IMPORTANT IN PREVENTING DAMAGE, AND IN CONTRIBUTING TO RELIABLE ENGINE PERFORMANCE.

- When raising or supporting engine for any reason, do not use a jack under oil pan. Due to small clearance between oil pan and oil pump strainer, jacking against oil pan may cause it to be bent against strainer resulting in damaged oil pick-up unit.
- It should be kept in mind, while working on engine, that 12-volt electrical system is capable of violent and damaging short circuits.

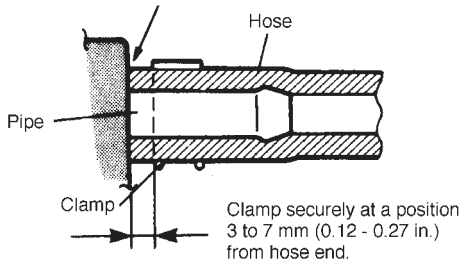
When performing any work where electrical terminals could possibly be grounded, ground cable of the battery should be disconnected at battery.

- Any time the air cleaner, air intake hose, turbo charger or intake manifold is removed, the intake opening should be covered. This will protect against accidental entrance of foreign material which could follow intake passage into cylinder and cause extensive damage when engine is started.

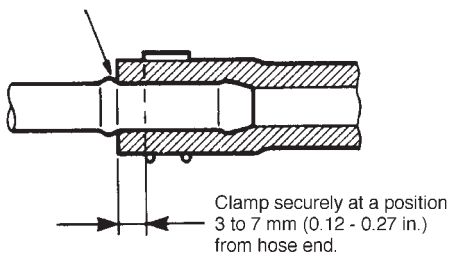


- When disconnecting couplers, don't pull wire harness but make sure to hold coupler itself. With lock type coupler, be sure to unlock before disconnection. Attempt to disconnect coupler without unlocking may result in damage to coupler. When connecting lock type coupler, insert it till clicking sound is heard and connect it securely.

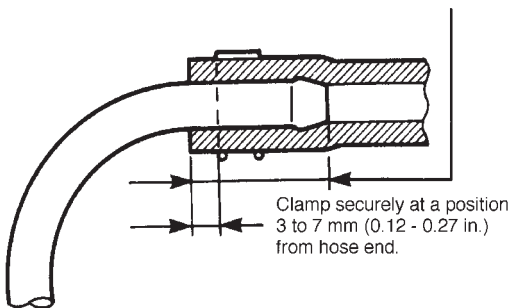
With short pipe, fit hose as far as it reaches pipe joint as shown.



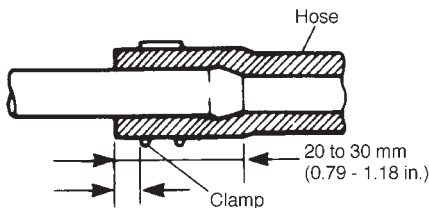
With following type pipe, fit hose as far as its peripheral projection as shown.



With bent pipe, fit hose as far as its bent part as shown or till pipe is about 20 - 30 mm (0.79 - 1.18 in.) into the hose.



With straight pipe, fit hose till pipe is about 20 to 30 mm (0.79 - 1.18 in.) into the hose.



Clamp securely at a position 3 to 7 mm (0.12 - 0.27 in.) from hose end.

PRECAUTION ON FUEL SYSTEM SERVICE

- Work must be done with no smoking, in a well-ventilated area and away from any open flames.
- As fuel feed line (between fuel injection pump and fuel pipe) is still under high fuel pressure even after engine was stopped, loosening or disconnecting fuel feed line directly may cause dangerous spout of fuel to occur where loosened or disconnected.

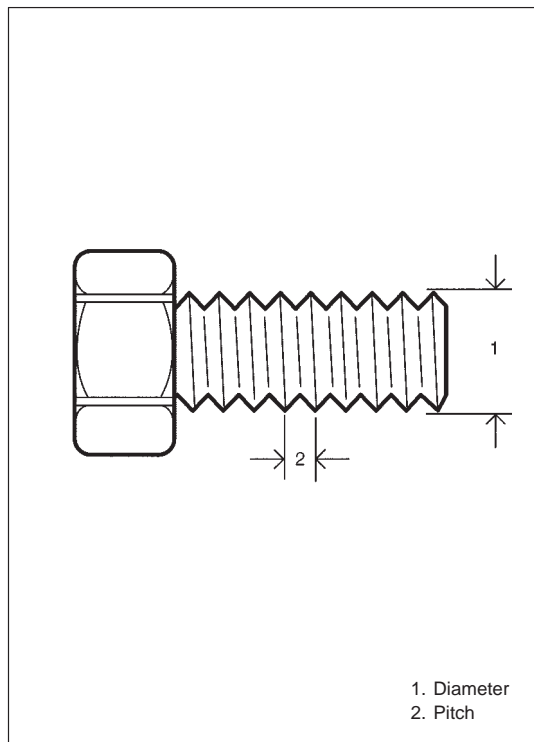
A small amount of fuel may be released after fuel line is disconnected.

In order to reduce the chance of personal injury, cover fitting to be disconnected with a shop cloth. Put that cloth in an approved container when disconnection is completed.

- Fuel hose connection varies with each type of pipe. When reconnecting fuel hose, be sure to connect and clamp each hose correctly referring to figure "Hose Connection".

After connecting, make sure that it has no twist or kink.

- When installing fuel filter union bolt or plug bolt on union bolt, always use new gasket and tighten it to specified torque.



METRIC INFORMATION

METRIC FASTENERS

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

CAUTION:

Note that both ISO and JIS type bolts and nuts are used for the engine assembly and related parts. Even when the diameter of the thread is the same, its pitch may vary between these two types. Installing a mismatched bolt or nut will cause damage to the thread. As the first step, make sure to tighten it by hand temporarily and if it feels tight, check the thread pitch for correct matching.

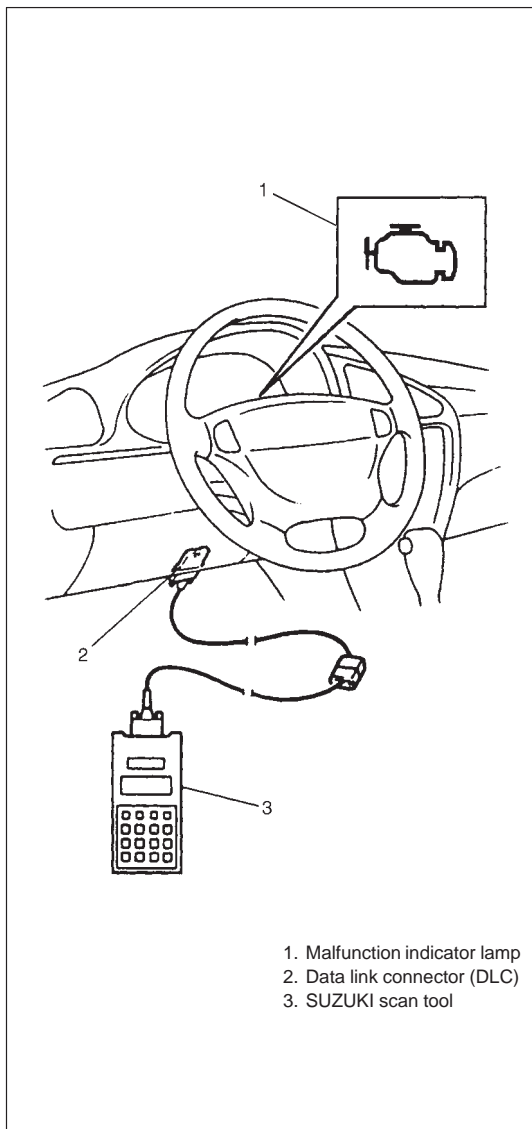
ENGINE DIAGNOSIS

GENERAL DESCRIPTION

This vehicle is equipped with an engine and emission control system which are under control of ECM.

The engine and emission control system in this vehicle are controlled by ECM. ECM has an On-Board Diagnostic system which detects a malfunction in this system and abnormality of those parts that influence the engine exhaust emission. When diagnosing engine troubles, 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 “ENGINE DIAGNOSTIC FLOW TABLE”.

There is a close relationship between the engine mechanical, engine cooling system, immobilizer system, exhaust system, etc. and the engine and emission control system in their structure and operation. In case of an engine trouble, even when the malfunction indicator lamp (MIL) doesn't turn ON, it should be diagnosed according to this flow table.



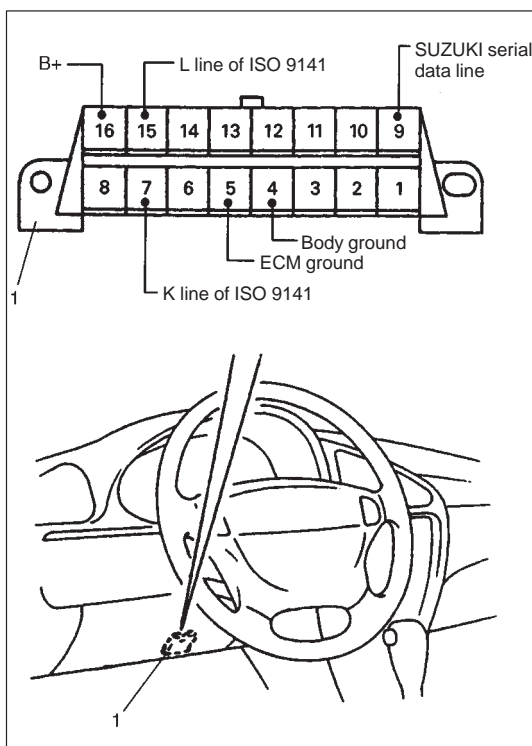
ON-BOARD DIAGNOSTIC SYSTEM

ECM diagnosis troubles which may occur in the area including the following parts when the ignition switch is ON and the engine is running, and indicates the result by turning on malfunction indicator lamp (1) for marked # following items.

- Injection timing actuator #
- Glow plug relay #
- CKP sensor
- ECT sensor
- TP sensor
- Barometric pressure sensor
- Injector needle sensor
- Power supply
- EGR No.1 solenoid valve
- EGR No.2 solenoid valve
- MIL
- CPU (Central Processing Unit) of ECM

ECM and malfunction indicator lamp (1) operate as follows.

- Malfunction indicator lamp (1) lights for 2 to 3 seconds when the ignition switch is turned ON (but the engine at stop). This is only to check the malfunction indicator lamp (1) bulb and its circuit.
- If the above areas of Engine and Emission Control system is free from any trouble, malfunction indicator lamp (1) turns OFF after 2 to 3 seconds from ignition switch turn ON.
- When ECM detects a trouble which has occurred in the above areas with marked #, it makes malfunction indicator lamp (1) stay ON after 2 to 3 seconds from ignition switch turn ON including while the engine is running to warn the driver of such occurrence of trouble and at the same time it stores the trouble area in ECM back-up memory. (The memory is kept as it is even if the trouble was only temporary and disappeared immediately.)



Data Link Connector (DLC)

DLC (1) is in compliance with SAEJ1962 in its installation position, the shape of connector and pin assignment.

Serial data line (K line and L line of ISO 9141) is used for SUZUKI scan tool (Tech-1) to communicate with ECM, Air Bag SDM and ABS control module.

SUZUKI serial data line is used for SUZUKI scan tool to communicate with immobilizer control module.

PRECAUTION IN DIAGNOSING TROUBLE

- Don't disconnect couplers from ECM, battery cable at battery, ECM ground wire harness from engine or main fuse before confirming diagnostic information (DTC, 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. 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.
- Priorities for diagnosing troubles.
If multiple diagnostic trouble codes (DTCs) are stored.
Troubleshoot diagnostic trouble codes according to the following priorities.
 1. DTC No.16/No.32/No.34 and DTC No.127
 2. Diagnostic trouble codes (DTCs) other than DTC No.16/No.32/No.34 and DTC No.127
- 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 following conditions. Neglecting this check may cause damage to a known-good ECM.
 - Resistance value of all relays, actuators is as specified respectively.

ENGINE DIAGNOSTIC FLOW TABLE

Refer to the following pages for the details of each step.

STEP	ACTION	YES	NO
1	Customer Complaint Analysis 1) Perform customer complaint analysis referring to the next page. Was customer complaint analysis performed?	Go to Step 2.	Perform customer complaint analysis.
2	Diagnostic Trouble Code (DTC) Check, Record and Clearance 1) Check for DTC referring to the next page. Is there any DTC(s)?	1) Print DTC or write them down and clear them by referring to "DTC Clearance" section. 2) Go to Step 3.	Go to Step 4.
3	Visual Inspection 1) Perform visual inspection referring to the next page. 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 next page. Is there any faulty condition?		Go to Step 8.
5	Trouble Symptom Confirmation 1) Confirm trouble symptom referring to the next page. Is trouble symptom identified?	Go to Step 6.	Go to Step 7.
6	Rechecking and Record of DTC 1) Recheck for DTC referring to "DTC Check" section. Is there any DTC(s)?	Go to Step 9.	Go to Step 8.
7	Rechecking and Record of DTC 1) Recheck for DTC referring to "DTC Check" section. Is there any DTC(s)?		Go to Step 10.
8	Engine Basic Inspection, Diagnosis in Terms of Symptom and Engine Diagnosis Table 1) Check and repair according to "Engine Basic Check", "Diagnosis in Terms of Symptom" and "Engine Diagnosis Table" section. Are check and repair complete?	Go to Step 11.	1) Check and repair malfunction part(s). 2) Go to Step 11.
9	Trouble shooting for DTC 1) Check and repair according to applicable DTC diag. flow table. Are check and repair complete?		
10	Check for Intermittent Problems 1) Check for intermittent problems referring to the next page. Is there any faulty condition?	1) Repair or replace malfunction part(s). 2) Go to Step 11.	Go to Step 11.
11	Final Confirmation Test 1) Clear DTC if any. 2) Perform final confirmation test referring to the next page. Is there any problem symptom, DTC or abnormal condition?	Go to Step 6.	End.

1. CUSTOMER COMPLAINT ANALYSIS

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) CHECK, RECORD AND CLEARANCE

First, check DTC, referring to “DTC check” section. If DTC is indicated, print it or write them down and then clear them by referring to “DTC clearance” section. DTC indicates malfunction that occurred in the system but does not indicate whether it exists now or it occurred in the past and the normal condition has been restored now. To check which case applies, check the symptom in question according to Step 4 and recheck DTC according to Step 5.

Attempt to diagnose a trouble based on DTC in this step only or failure to clear the DTC in this step will lead to incorrect diagnosis, trouble diagnosis of a normal circuit or difficulty in troubleshooting.

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 referring to “Visual Inspection” section.

5. TROUBLE SYMPTOM CONFIRMATION

Based on information obtained in Step 1 Customer complaint analysis and Step 2 DTC check, confirm trouble symptoms. Also, reconfirm DTC according to “DTC Confirmation Procedure” described in each DTC Diagnosis section.

6. and 7. RECHECKING AND RECORD OF DTC

Refer to “DTC check” section for checking procedure.

8. ENGINE BASIC INSPECTION, DIAGNOSIS IN TERMS OF SYMPTOM AND ENGINE DIAGNOSIS TABLE

Perform basic engine check according to the “Engine Basic Inspection Flow Table” first. When the end of the flow table has been reached, check the parts of the system suspected as a possible cause referring to ENGINE DIAGNOSIS TABLE, DIAGNOSIS IN TERMS OF SYMPTOM and based on symptoms appearing on the vehicle (symptoms obtained through steps of customer complaint analysis, trouble symptom confirmation and/or basic engine check) and repair or replace faulty parts, if any.

9. TROUBLESHOOTING FOR DTC (See each DTC Diag. Flow Table)

Based on the DTC indicated in Step 5 and referring to the applicable DTC diag. flow table in this section, locate the cause of the trouble, namely in a sensor, switch, wire harness, connector, actuator, ECM 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 engine is free from any abnormal conditions. If what has been repaired is related to the DTC, clear the DTC once, perform DTC confirmation procedure and confirm that no DTC is indicated.

CUSTOMER PROBLEM INSPECTION FORM (EXAMPLE)

User name:	Model:	VIN:	
Date of issue:	Date Reg.	Date of problem:	Mileage:

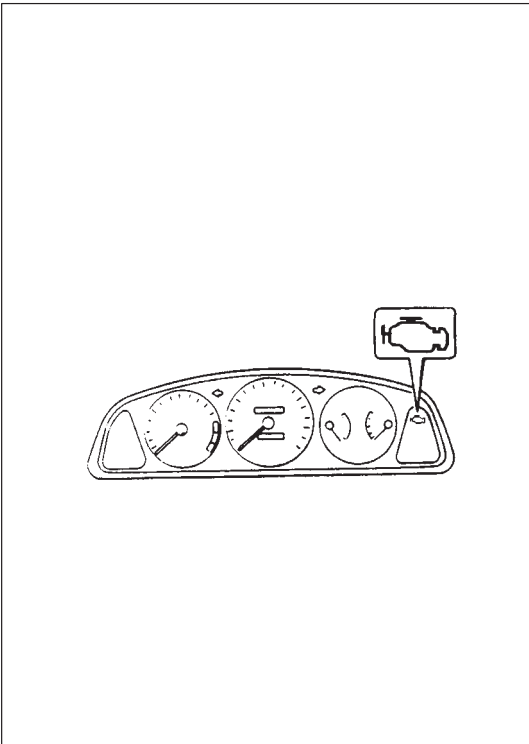
PROBLEM SYMPTOMS	
<input type="checkbox"/> Difficult Starting <input type="checkbox"/> No cranking <input type="checkbox"/> No initial combustion <input type="checkbox"/> No combustion <input type="checkbox"/> Poor starting at (<input type="checkbox"/> cold <input type="checkbox"/> warm <input type="checkbox"/> always) <input type="checkbox"/> Other _____	<input type="checkbox"/> Poor Driveability <input type="checkbox"/> Hesitation on acceleration <input type="checkbox"/> Back fire/ <input type="checkbox"/> After fire <input type="checkbox"/> Lack of power <input type="checkbox"/> Surging <input type="checkbox"/> abnormal knocking <input type="checkbox"/> Other _____
<input type="checkbox"/> Poor Idling <input type="checkbox"/> Poor fast idle <input type="checkbox"/> Abnormal idling speed (<input type="checkbox"/> High <input type="checkbox"/> Low) (r/min.) <input type="checkbox"/> Unstable <input type="checkbox"/> Hunting (r/min. to r/min.) <input type="checkbox"/> Other _____	<input type="checkbox"/> Engine Stall when <input type="checkbox"/> Immediately after start <input type="checkbox"/> Accel. pedal is depressed <input type="checkbox"/> Accel. pedal is released <input type="checkbox"/> Load is applied <input type="checkbox"/> A/C <input type="checkbox"/> Electric load <input type="checkbox"/> P/S <input type="checkbox"/> Other _____ <input type="checkbox"/> Other _____
<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"/> Snow <input type="checkbox"/> Always <input type="checkbox"/> Other _____
Temperature	<input type="checkbox"/> Hot <input type="checkbox"/> Warm <input type="checkbox"/> Cool <input type="checkbox"/> Cold (°F/ °C) <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 condition	<input type="checkbox"/> Cold <input type="checkbox"/> Warming up phase <input type="checkbox"/> Warmed up <input type="checkbox"/> Always <input type="checkbox"/> Other at starting <input type="checkbox"/> Immediately after start <input type="checkbox"/> Racing without load <input type="checkbox"/> Engine speed (r/min)
Vehicle condition	During driving: <input type="checkbox"/> Constant speed <input type="checkbox"/> Accelerating <input type="checkbox"/> Decelerating <input type="checkbox"/> Right hand corner <input type="checkbox"/> Left hand corner <input type="checkbox"/> When shifting (Lever position) <input type="checkbox"/> At stop <input type="checkbox"/> Vehicle speed when problem occurs (km/h, Mile/h) <input type="checkbox"/> Other _____

Malfunction indicator lamp condition	<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 ()

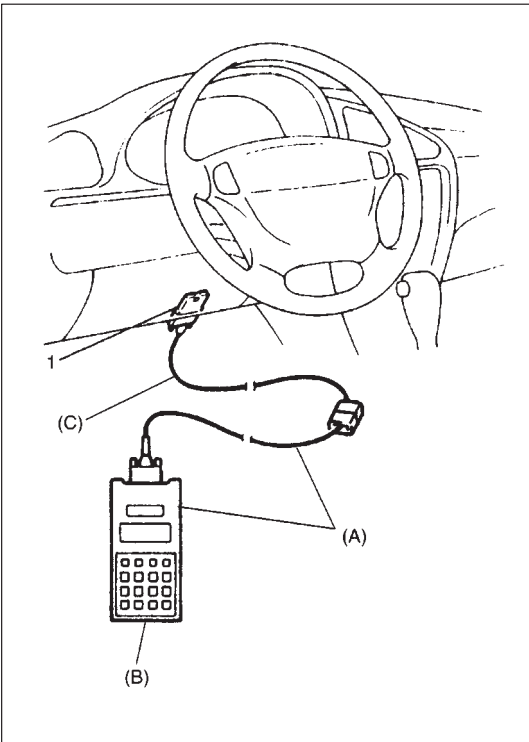
NOTE:

The above form is a standard sample. It should be modified according to conditions characteristic of each market.



MALFUNCTION INDICATOR LAMP (MIL) CHECK

- 1) Turn ON ignition switch (but the engine at stop) and check that MIL lights for 2 – 3 sec. and then goes out.
If MIL does not light up (or MIL dims), go to “Diagnostic Flow Table A-1” for troubleshooting.
- 2) If MIL remains ON and no DTC is stored in ECM, go to “Diagnostic Flow Table A-2” for troubleshooting.



DIAGNOSTIC TROUBLE CODE (DTC) CHECK

- 1) Prepare SUZUKI scan tool (Tech-1).
- 2) With ignition switch OFF, connect it to data link connector (DLC) (1) located on underside of instrument panel at driver's seat side.

Special Tool:

- (A): SUZUKI scan tool
- (B): Mass storage cartridge
- (C): 16/14 pin DLC cable

- 3) Turn ignition switch ON and confirm that MIL lights.
- 4) Read DTC according to instructions displayed on scan tool and print it or write it down.

Refer to scan tool operator's manual for further details.

If communication between scan tool and ECM is not possible, check if scan tool is communicable by connecting it to ECM in another vehicle. If communication is possible in this case, scan tool is in good condition. Then check data link connector and serial data line (circuit) in the vehicle with which communication was not possible.

- 5) After completing the check, turn ignition switch off and disconnect scan tool from data link connector.

DIAGNOSTIC TROUBLE CODE (DTC) CLEARANCE

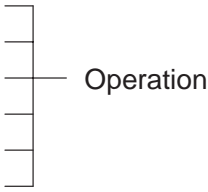
- 1) Connect SUZUKI scan tool (Tech-1) to data link connector in the same manner as when making this connection for DTC check.
- 2) Turn ignition switch ON.
- 3) Erase DTC according to instructions displayed on scan tool.
Refer to scan tool operator's manual for further details.
- 4) After completing the clearance, turn ignition switch off and disconnect scan tool from data link connector.

DIAGNOSTIC TROUBLE CODE (DTC) TABLE

DTC NO.	DETECTING ITEM	DETECTING CONDITION (DTC will set when detecting)	MIL
1	CKP sensor circuit malfunction	Implausible signal during engine running	No lights
3	Engine coolant temperature sensor circuit malfunction	Sensor circuit voltage low input Sensor circuit voltage high input	No lights
4	Throttle position sensor circuit malfunction	Sensor circuit voltage low input Sensor circuit voltage high input	No lights
13	Barometric pressure sensor malfunction	Sensor circuit in ECM voltage low Sensor circuit in ECM voltage high	No lights
14	Injector needle sensor circuit malfunction	Implausible signal during engine running Sensor circuit is open Sensor circuit is short to ground or battery voltage line	No lights
16	Injection timing actuator control malfunction	Implausible injection timing during engine running	Lights
17	Power supply circuit malfunction	Battery voltage is low Battery voltage is high	Lights (when undervoltage)
22	Glow plug relay diagnostic feedback malfunction	Low input when should be turn ON glow plug	Lights
23	Glow plug relay control circuit malfunction	Relay circuit is open Relay circuit is short to ground or battery voltage line	No lights
32	Glow plug relay diagnostic feedback malfunction	High input when should be turn OFF glow plug	Lights
33	EGR No.1 solenoid valve circuit malfunction	Solenoid valve circuit is open Solenoid valve circuit is short to ground or battery voltage line	No lights
34	Injection timing actuator circuit malfunction	Actuator circuit is open Actuator circuit is short to ground or battery voltage line	Lights
36	EGR No.2 solenoid valve circuit malfunction	Solenoid valve circuit is open Solenoid valve circuit is short to ground or battery voltage line	No lights
37	A/C cut off control circuit malfunction	Control circuit is open Control circuit is short to ground or battery voltage line	No lights
38	MIL circuit malfunction	MIL circuit is open MIL circuit is short to ground or battery voltage line	No lights
39	Glow plug indicator lamp malfunction	Lamp circuit is open Lamp circuit is short to ground or battery voltage line	No lights
127	Internal control module memory check sum error	Data write error (or check sum error) when written into ECM	Lights

VISUAL INSPECTION

Visually check following parts and systems.

INSPECTION ITEM	REFERRING SECTION
<ul style="list-style-type: none"> ● Engine oil ----- level, leakage ● Engine coolant ----- level, leakage ● Fuel ----- level, leakage ● Air cleaner element ----- dirt, clogging ● Battery ----- fluid level, corrosion of terminal ● Water pump belt ----- tension, damage ● Throttle cable ----- play, installation ● Vacuum hoses ----- disconnection, looseness, deterioration, bend ● Connectors of electric wire harness ----- disconnection, friction ● Fuses ----- burning ● Parts ----- installation, bolt ----- looseness ● Parts ----- deformation ● Other parts that can be checked visually <p>Also check following items at engine start, if possible</p> <ul style="list-style-type: none"> ● Malfunction indicator lamp ● Charge warning lamp ● Engine oil pressure warning lamp ● Engine coolant temp. meter ● Fuel level meter ● Tachometer ● Abnormal air being inhaled from air intake system ● Exhaust system ----- leakage of exhaust gas, noise ● Other parts that can be checked visually <div style="margin-left: 200px;">  </div>	<p>Section 0B</p> <p>Section 0B</p> <p>Section 0B</p> <p>Section 0B</p> <p>Section 0B</p> <p>Section 6E</p> <p>Section 8</p> <p>Section 6</p> <p>Section 6H</p> <p>Section 8 (section 6A4 for pressure check)</p> <p>Section 8</p> <p>Section 8</p>

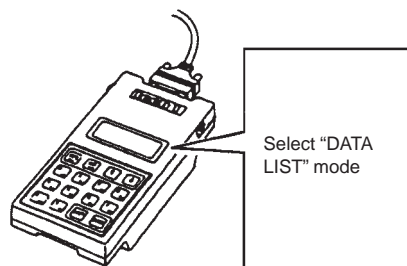
ENGINE BASIC INSPECTION

This check is very important for troubleshooting when ECM has detected no DTC and no abnormality has been found in visual inspection.

Follow the flow table carefully.

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	Check battery voltage. Is it 11 V or more?	Go to Step 3.	Charge or replace battery.
3	Is engine cranked?	Go to Step 4.	Go to "DIAGNOSIS" in Section 6G.
4	Does engine start?	Go to Step 5.	Go to Step 7.
5	Check idle speed as follows: 1) Warm up engine to normal operating temp. 2) Shift transmission to neutral position. 3) All of electrical loads are switched off. 4) Check engine idle speed with scan tool. See Fig. 1. Is it 845 – 895 r/min?	Go to Step 6.	Go to "IDLE SPEED INSPECTION AND ADJUSTMENT" in Section 6E3.
6	Check ignition pump static timing referring to "FUEL INJECTION PUMP STATIC TIMING ADJUSTMENT AND CHECKING" in Section 6E3. Is injection pump static timing correct?	Go to "DIAGNOSIS IN TERMS OF SYMPTOM".	Adjust injection pump static timing referring to Section 6E3.
7	Check immobilizer DTC with scan tool referring to Section 8G. Is it indicated the trouble code?	Go to "DIAGNOSIS" in Section 8G.	Go to Step 8.
8	Perform air evacuation in the fuel circuit as follows: 1) Pump the priming pump on fuel filter over 30 times. 2) Carry out cranking the engine over 3 times for 5 seconds. Does engine start?	Go to "ENGINE DIAGNOSTIC FLOW TABLE".	Go to "DIAGNOSIS IN TERMS OF SYMPTOM".

Fig. 1 for Step 5



ENGINE DIAGNOSIS TABLE

Perform troubleshooting referring to following table when ECM has no DTC and no abnormality found in visual inspection and engine basic inspection previously.

Condition	Possible Cause	Referring Item
Hard Starting (Engine cranks OK)	Injection system out of order <ul style="list-style-type: none"> Faulty fuel injection pump static timing Clogged fuel filter or lines Faulty fuel injection pump Faulty ignitor 	<p>Static timing in "ALL MODEL DIESEL DIAGNOSIS MANUAL" listed in FOREWORD of this manual</p> <p>Fuel filter in Section 6E3 and "ALL MODEL DIESEL DIAGNOSIS MANUAL" listed in FOREWORD of this manual</p> <p>Fuel injection pump in Section 6E3 and "ALL MODEL DIESEL DIAGNOSIS MANUAL" listed in FOREWORD of this manual</p> <p>Fuel injector in Section 6E3 and "ALL MODEL DIESEL DIAGNOSIS MANUAL" listed in FOREWORD of this manual</p>
	Immobilizer control system out of order	Immobilizer control system in Section 8G
	Engine and emission control system out of order <ul style="list-style-type: none"> Faulty CKP sensing rotor Faulty CKP sensor, injector needle sensor, ECT sensor and TP sensor Faulty fuel injection timing control actuator Faulty ECM Faulty glow plug control relay 	<p>CKP sensing rotor in Section 6E3</p> <p>CKP sensor, injector needle sensor, ECT sensor and TP sensor in Section 6E3</p> <p>Fuel injection timing control actuator in section 6E3</p> <p>Inspection of ECM and its circuit.</p> <p>Glow plug control relay in Section 6E3</p>
Low compression <ul style="list-style-type: none"> Improper valve lash Improper valve timing Compression leak from valve seat Sticky valve stem Weak or damaged valve spring Compression leak at cylinder head gasket Sticking or damaged ring Worn piston, ring or cylinder 	<p>Compression check in section 6A4</p> <p>Valve clearance in section 6A4</p> <p>Valve timing in "OVERHAUL CHECKING TUNING MANUAL" listed below in FOREWORD of this manual</p> <p>Valve seats in "OVERHAUL CHECKING TUNING MANUAL" listed below in FOREWORD of this manual</p> <p>Valves in "OVERHAUL CHECKING TUNING MANUAL" listed below in FOREWORD of this manual</p> <p>Valve spring in "OVERHAUL CHECKING TUNING MANUAL" listed below in FOREWORD of this manual</p> <p>Cylinder head in "OVERHAUL CHECKING TUNING MANUAL" listed in FOREWORD of this manual</p> <p>Piston and Connecting Rod in section 6A4</p> <p>Piston and Connecting Rod in section 6A4</p>	

Condition	Possible Cause	Reference Item
Engine has no power	Engine overheating	Refer to "Overheating" of this table.
	Injection system out of order <ul style="list-style-type: none"> ● Faulty fuel injection pump static timing ● Clogged fuel filter or lines ● Faulty fuel injection pump ● Faulty injector 	Static timing in "ALL MODEL DIESEL DIAGNOSIS MANUAL" listed in FOREWORD of this manual Fuel filter in Section 6E3 and "ALL MODEL DIESEL DIAGNOSIS MANUAL" listed in FOREWORD of this manual Fuel injection pump in Section 6E3 and "ALL MODEL DIESEL DIAGNOSIS MANUAL" listed in FOREWORD of this manual Fuel injector in Section 6E3 and "ALL MODEL DIESEL DIAGNOSIS MANUAL" listed in FOREWORD of this manual
	Engine and emission control system out of order <ul style="list-style-type: none"> ● Faulty CKP sensing rotor ● Faulty CKP sensor, injector needle sensor, ECT sensor and TP sensor ● Faulty fuel injection timing control actuator ● Faulty ECM ● Malfunctioning EGR valve ● Maladjusted accelerator cable play 	CKP sensing rotor in Section 6E3 CKP sensor, injector needle sensor, ECT sensor and TP sensor in section 6E3 Fuel injection timing control actuator in section 6E3 Inspection of ECM and its circuit EGR system inspection in section 6E3 Adjustment injection pump in "ALL MODEL DIESEL DIAGNOSIS MANUAL" listed in FOREWORD of this manual
	Low compression	Previously outlined.
	Others <ul style="list-style-type: none"> ● Dragging brakes ● Slipping clutch 	Diagnosis in Section 5. Diagnosis in Section 7C.

Condition	Possible Cause	Reference Item
Improper engine idling or engine fails to idle	Injection system out of order <ul style="list-style-type: none"> ● Faulty fuel injection pump static timing ● Clogged fuel filter or lines ● Faulty fuel injection pump ● Faulty injector 	Static timing in "ALL MODEL DIESEL DIAGNOSIS MANUAL" listed in FOREWORD of this manual Fuel filter in Section 6E3 and "ALL MODEL DIESEL DIAGNOSIS MANUAL" listed in FOREWORD of this manual Fuel injection pump in Section 6E3 and "ALL MODEL DIESEL DIAGNOSIS MANUAL" listed in FOREWORD of this manual Fuel injector in Section 6E3 and "ALL MODEL DIESEL DIAGNOSIS MANUAL" listed in FOREWORD of this manual
	Engine overheating	Refer to "Overheating" of this table.
	Engine and emission control system out of order <ul style="list-style-type: none"> ● Faulty CKP sensing rotor ● Faulty CKP sensor, injector needle sensor, ECT sensor and TP sensor ● Faulty fuel injection timing control actuator ● Faulty ECM ● Malfunctioning EGR valve ● Maladjusted accelerator cable play 	CKP sensing rotor in Section 6E3 CKP sensor, injector needle sensor, ECT sensor and TP sensor in section 6E3 Fuel injection timing control actuator in Section 6E3 Inspection of ECM and its circuit EGR system inspection in section 6E3 Adjustment injection pump in "ALL MODEL DIESEL DIAGNOSIS MANUAL" listed in FOREWORD of this manual
	Low compression	Previously outlined.

Condition	Possible Cause	Reference Item
<p>Engine hesitates (Momentary lack of response as the accelerator is depressed. Can occur at all vehicle speeds. Usually most severe when first trying to make the vehicle move, as from a stop sign.)</p>	<p>Injection system out of order</p> <ul style="list-style-type: none"> ● Faulty fuel injection pump static timing ● Clogged fuel filter or lines ● Faulty fuel injection pump ● Faulty injector 	<p>Static timing in "ALL MODEL DIESEL DIAGNOSIS MANUAL" listed in FOREWORD of this manual</p> <p>Fuel filter in Section 6E3 and "ALL MODEL DIESEL DIAGNOSIS MANUAL" listed in FOREWORD of this manual</p> <p>Fuel injection pump in Section 6E3 and "ALL MODEL DIESEL DIAGNOSIS MANUAL" listed in FOREWORD of this manual</p> <p>Fuel injector in Section 6E3 and "ALL MODEL DIESEL DIAGNOSIS MANUAL" listed in FOREWORD of this manual</p>
	<p>Engine overheating</p>	<p>Refer to "Overheating" of this table.</p>
	<p>Engine and emission control system out of order</p> <ul style="list-style-type: none"> ● Faulty CKP sensing rotor ● Faulty CKP sensor, injector needle sensor, ECT sensor and TP sensor ● Faulty fuel injection timing control actuator ● Faulty ECM ● Malfunctioning EGR valve ● Maladjusted accelerator cable play 	<p>CKP sensing rotor in Section 6E3</p> <p>CKP sensor, injector needle sensor, ECT sensor and TP sensor in section 6E3</p> <p>Fuel injection timing control actuator in section 6E3</p> <p>Inspection of ECM and its circuit</p> <p>EGR system inspection in section 6E3</p> <p>Adjustment injection pump in "ALL MODEL DIESEL DIAGNOSIS MANUAL" listed in FOREWORD of this manual</p>
	<p>Low compression</p>	<p>Previously outlined.</p>
<p>Surges (Engine power variation under steady throttle or cruise. Feels like the vehicle speeds up and down with no change in the accelerator pedal.)</p>	<p>Injection system out of order</p> <ul style="list-style-type: none"> ● Faulty fuel injection pump static timing ● Clogged fuel filter or lines ● Faulty fuel injection pump ● Faulty injector 	<p>Static timing in "ALL MODEL DIESEL DIAGNOSIS MANUAL" listed in FOREWORD of this manual</p> <p>Fuel filter in Section 6E3 and "ALL MODEL DIESEL DIAGNOSIS MANUAL" listed in FOREWORD of this manual</p> <p>Fuel injection pump in Section 6E3 and "ALL MODEL DIESEL DIAGNOSIS MANUAL" listed in FOREWORD of this manual</p> <p>Fuel injector in Section 6E3 and "ALL MODEL DIESEL DIAGNOSIS MANUAL" listed in FOREWORD of this manual</p>
	<p>Engine and emission control system out of order</p> <ul style="list-style-type: none"> ● Faulty ECM ● Faulty fuel injection timing control actuator ● Malfunctioning EGR valve 	<p>Inspection of ECM and its circuit</p> <p>Fuel injection timing control actuator in section 6E3</p> <p>EGR system inspection in section 6E3</p>

Condition	Possible Cause	Reference Item
Excessive detonation (The engine makes sharp metallic knocks that change with throttle opening. Sounds like pop corn popping.)	Injection system out of order <ul style="list-style-type: none"> ● Faulty fuel injection pump static timing ● Clogged fuel filter or lines ● Faulty fuel injection pump ● Faulty injector 	Static timing in "ALL MODEL DIESEL DIAGNOSIS MANUAL" listed in FOREWORD of this manual Fuel filter in Section 6E3 and "ALL MODEL DIESEL DIAGNOSIS MANUAL" listed in FOREWORD of this manual Fuel injection pump in Section 6E3 and "ALL MODEL DIESEL DIAGNOSIS MANUAL" listed in FOREWORD of this manual Fuel injector in Section 6E3 and "ALL MODEL DIESEL DIAGNOSIS MANUAL" listed in FOREWORD of this manual
	Engine overheating	Refer to "Overheating" of this table.
	Engine and emission control system out of order <ul style="list-style-type: none"> ● Faulty ECM ● Faulty fuel injection timing control actuator ● Malfunctioning EGR valve 	Inspection of ECM and its circuit Fuel injection timing control actuator in Section 6E3 EGR system inspection in Section 6E3
	Others <ul style="list-style-type: none"> ● Excessive combustion chamber deposits 	Piston and cylinder head in Section 6A4
Overheating	<ul style="list-style-type: none"> ● Inoperative thermostat ● Faulty radiator fan motor or its circuit ● Poor water pump performance ● Clogged or leaky radiator ● Improper engine oil grade ● Clogged oil filter or oil strainer ● Poor oil pump performance ● Dragging brakes ● Slipping clutch ● Blown cylinder head gasket 	Thermostat in Section 6B Radiator fan control system in Section 6B Water pump in Section 6B Radiator in Section 6B ITEM 1-3 Engine oil and oil filter change in Section 0B Oil pressure check in Section 6A4 Oil pressure check in Section 6A4 Diagnosis in Section 5. Diagnosis in Section 7C. Valves and cylinder head in "OVERHAUL CHECKING TUNING MANUAL" listed below in FOREWORD of this manual

Condition	Possible Cause	Reference Item
Poor fuel mileage	Injection system out of order <ul style="list-style-type: none"> ● Faulty fuel injection pump static timing ● Clogged fuel filter or lines ● Faulty fuel injection pump ● Faulty injector 	Static timing in "ALL MODEL DIESEL DIAGNOSIS MANUAL" listed in FOREWORD of this manual Fuel filter in Section 6E3 and "ALL MODEL DIESEL DIAGNOSIS MANUAL" listed in FOREWORD of this manual Fuel injection pump in Section 6E3 and "ALL MODEL DIESEL DIAGNOSIS MANUAL" listed in FOREWORD of this manual Fuel injector in Section 6E3 and "ALL MODEL DIESEL DIAGNOSIS MANUAL" listed in FOREWORD of this manual
	Engine and emission control system out of order <ul style="list-style-type: none"> ● Air cleaner element clogged ● Faulty ECT sensor and TP sensor ● Faulty fuel injection timing control actuator ● Faulty ECM ● Malfunctioning EGR valve 	ITEM 3-1 Air cleaner element inspection in Section 0B ECT sensor and TP sensor in Section 6E3 Fuel injection timing control actuator in Section 6E3 Inspection of ECM and its circuit EGR system inspection in Section 6E3
	Low compression	Previously outlined.
	Others <ul style="list-style-type: none"> ● Dragging brakes ● Slipping clutch ● Thermostat out of order ● Improper tire pressure 	Diagnosis in Section 5. Diagnosis in Section 7C. Thermostat in Section 6B. Refer to Section 3F.

Condition	Possible Cause	Reference Item
Excessive engine oil consumption	Oil entering combustion chamber <ul style="list-style-type: none"> ● Sticky piston ring ● Worn piston and cylinder ● Worn piston ring groove and ring ● Improper location of piston ring gap ● Worn or damaged valve stem seal ● Worn valve stem 	<p>Valves and cylinder head in "OVERHAUL CHECKING TUNING MANUAL" listed below in FOREWORD of this manual</p> <p>Valves and cylinder head in "OVERHAUL CHECKING TUNING MANUAL" listed below in FOREWORD of this manual</p> <p>Valves and cylinder head in "OVERHAUL CHECKING TUNING MANUAL" listed below in FOREWORD of this manual</p> <p>Valves and cylinder head in "OVERHAUL CHECKING TUNING MANUAL" listed below in FOREWORD of this manual</p> <p>Valves and cylinder head in "OVERHAUL CHECKING TUNING MANUAL" listed below in FOREWORD of this manual</p> <p>Valves and cylinder head in "OVERHAUL CHECKING TUNING MANUAL" listed below in FOREWORD of this manual</p>
Low oil pressure	<ul style="list-style-type: none"> ● Improper oil viscosity ● Malfunctioning oil pressure switch ● Clogged oil strainer ● Functional deterioration of oil pump ● Worn oil pump relief valve ● Excessive clearance in various sliding parts 	<p>ITEM 1-3 Engine oil and oil filter change in Section 0B</p> <p>Oil pressure switch in Section 8</p> <p>Oil pan and oil pump strainer in "OVERHAUL CHECKING TUNING MANUAL" listed below in FOREWORD of this manual</p> <p>Oil pump in "OVERHAUL CHECKING TUNING MANUAL" listed below in FOREWORD of this manual</p> <p>Oil pump in "OVERHAUL CHECKING TUNING MANUAL" listed below in FOREWORD of this manual</p> <p>Refer to Section 6A4 and "OVERHAUL CHECKING TUNING MANUAL" listed below in FOREWORD of this manual</p>

Condition	Possible Cause	Reference Item
<p>Engine noise</p> <p>Note: Before checking the mechanical noise, make sure that:</p> <ul style="list-style-type: none"> ● Ignition timing is proper. ● Specified fuel is used. 	<p>Valve noise</p> <ul style="list-style-type: none"> ● Improper valve lash ● Worn valve stem and guide ● Weak or broken valve spring ● Warped or bent valve ● Loose camshaft housing bolts 	<p>Valve clearance in Section 6A4</p> <p>Valves and cylinder head in "OVERHAUL CHECKING TUNING MANUAL" listed below in FOREWORD of this manual</p> <p>Valve spring in "OVERHAUL CHECKING TUNING MANUAL" listed below in FOREWORD of this manual</p> <p>Valves and cylinder head in "OVERHAUL CHECKING TUNING MANUAL" listed below in FOREWORD of this manual</p> <p>Camshaft in "OVERHAUL CHECKING TUNING MANUAL" listed below in FOREWORD of this manual</p>
	<p>Piston, ring and cylinder noise</p> <ul style="list-style-type: none"> ● Worn piston, ring and cylinder bore 	<p>Valves and cylinder head in "OVERHAUL CHECKING TUNING MANUAL" listed below in FOREWORD of this manual</p>
	<p>Connecting rod noise</p> <ul style="list-style-type: none"> ● Worn crankpin bearing ● Worn crankpin ● Loose connecting rod nuts ● Low oil pressure 	<p>Crankpin and connecting rod in "OVERHAUL CHECKING TUNING MANUAL" listed below in FOREWORD of this manual</p> <p>Crankpin and connecting rod in "OVERHAUL CHECKING TUNING MANUAL" listed below in FOREWORD of this manual</p> <p>Connecting rod in "OVERHAUL CHECKING TUNING MANUAL" listed below in FOREWORD of this manual</p> <p>Previously outlined.</p>
	<p>Crankshaft noise</p> <ul style="list-style-type: none"> ● Low oil pressure ● Worn crankshaft journal bearing ● Worn crankshaft journal ● Loose lower crankcase (bearing cap) bolts ● Excessive crankshaft thrust play 	<p>Previously outlined.</p> <p>Crank shaft and bearing in "OVERHAUL CHECKING TUNING MANUAL" listed below in FOREWORD of this manual</p> <p>Crank shaft and bearing in "OVERHAUL CHECKING TUNING MANUAL" listed below in FOREWORD of this manual</p> <p>Crankshaft in "OVERHAUL CHECKING TUNING MANUAL" listed below in FOREWORD of this manual</p> <p>Crankshaft in "OVERHAUL CHECKING TUNING MANUAL" listed below in FOREWORD of this manual</p>

Condition	Possible Cause	Referring Item
Excessive hydrocarbon (HC) emission or excessive carbon monoxide (CO) emission	Injection system out of order <ul style="list-style-type: none"> ● Faulty fuel injection pump static timing ● Clogged fuel filter or lines ● Faulty fuel injection pump ● Faulty injector 	Static timing in "ALL MODEL DIESEL DIAGNOSIS MANUAL" listed in FOREWORD of this manual Fuel filter in Section 6E3 and "ALL MODEL DIESEL DIAGNOSIS MANUAL" listed in FOREWORD of this manual Fuel injection pump in Section 6E3 and "ALL MODEL DIESEL DIAGNOSIS MANUAL" listed in FOREWORD of this manual Fuel injector in Section 6E3 and "ALL MODEL DIESEL DIAGNOSIS MANUAL" listed in FOREWORD of this manual
	Engine and Emission control system out of order <ul style="list-style-type: none"> ● Air cleaner element clogged ● Faulty ECT sensor and TP sensor ● Faulty fuel injection timing control actuator ● Faulty ECM ● Malfunctioning EGR valve 	ITEM 3-1 Air cleaner element inspection in Section 0B ECT sensor and TP sensor in Section 6E3 Fuel injection timing control actuator in Section 6E3 Inspection of ECM and its circuit EGR system inspection in Section 6E3
	Low compression	Previously outlined.
Excessive nitrogen oxides (NOx) emission	Engine and emission control system out of order <ul style="list-style-type: none"> ● Air cleaner element clogged ● Faulty ECT sensor and TP sensor ● Faulty fuel injection timing control actuator ● Faulty ECM ● Malfunctioning EGR valve 	ITEM 3-1 Air cleaner element inspection in Section 0B ECT sensor and TP sensor in Section 6E3 Fuel injection timing control actuator in Section 6E3 Inspection of ECM and its circuit EGR system inspection in Section 6E3

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 below table 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.

NOTE:

- 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 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	CONDITION	REFERENCE VALUES
CALC LOAD (CALCULATED ENGINE LOAD VALUE)	At specified idle speed with no load after warming up	4 – 5 mg/str
	At 2000 r/min with no load after warming up	6 – 7 mg/str
COOLANT TEMP. SENSOR VOLTAGE (ENGINE COOLANT TEMPERATURE SENSOR)	At specified idle speed after warming up	0.1 V (80 – 100°C, 176 – 212°F)
ENGINE SPEED	At idling with no load after warming up	Desired idle speed ± 50 r/min
INJECTION TIMING	At specified idle speed with no load after warming up	3 – 4 deg
	At 2000 r/min with no load after warming up	6 – 7 deg
THROTTLE POS SENSOR VOLTAGE (THROTTLE POSITION SENSOR)	Throttle valve fully closed	0.6 – 1.0 V
	Throttle valve fully open	2.4 – 2.8 V
BATTERY VOLTAGE	Ignition switch ON/engine stop	12 – 15 V
BAROMETRIC PRESSURE VOLTAGE	Ignition switch ON	Display the barometric pressure voltage
INJECTOR NEEDLE SENSOR VOLTAGE	At specified idle speed with no load after warming up	0.8 – 1.2 V

SCAN TOOL DATA DEFINITIONS

CALC LOAD (CALCULATED LOAD VALUE, mg/str)

Engine load value calculated from throttle position and engine speed. Load is referred to in terms of fuel quantity per stroke.

COOLANT TEMP. VOLTAGE (ENGINE COOLANT TEMPERATURE VOLTAGE, V)

It is detected by engine coolant temp. sensor.

ENGINE SPEED (rpm)

It is computed by reference pulses from crankshaft position sensor.

INJECTION TIMING (START OF INJECTION, °)

Start of injection control is performed by calculating an optimal desired start of injection and closing the loop on it. ECM controls the injection start timing.

THROTTLE POSITION SENSOR VOLTAGE (TP SENSOR VOLT, V)

The Throttle Position Sensor reading provides throttle valve opening information in the form of voltage. This information is used for correction, such as enrichment correction during acceleration.

The voltage reading should increase as the throttle is opened. 0 V indicates a broken or shorted sensor.

BATTERY VOLTAGE (V)

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

NEEDLE SENSOR VOLTAGE (V)

The ECM detects the start of needle movement by triggering on the rising edge of the needle movement sensor signal.

BAROMETRIC SENSOR VOLTAGE (V)

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

INSPECTION OF ECM AND ITS CIRCUITS

ECM and its circuits can be checked at ECM wiring connectors by measuring voltage and resistance.

CAUTION:

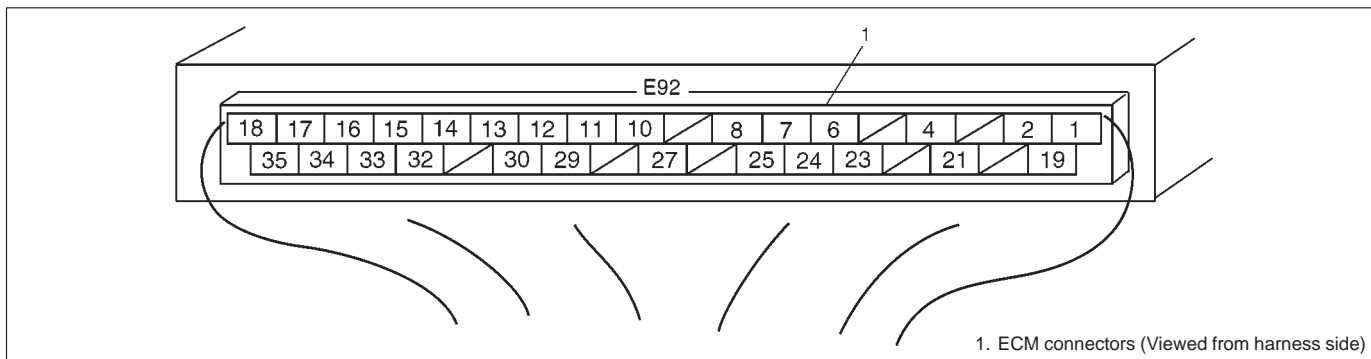
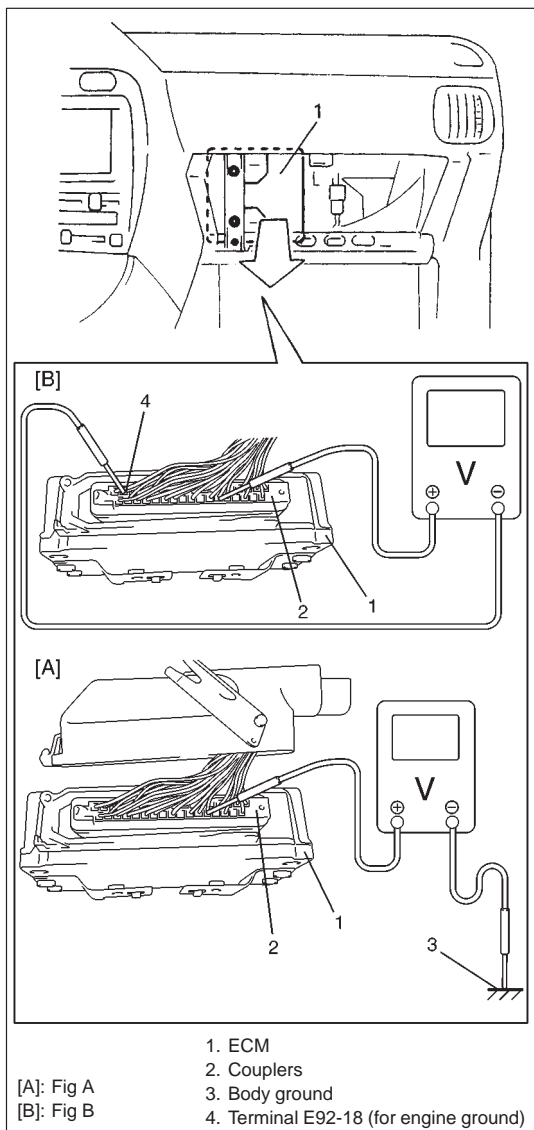
ECM cannot be checked by itself. It is strictly prohibited to connect voltmeter or ohmmeter to ECM with connector disconnected from it.

VOLTAGE CHECK

- 1) Remove ECM from body referring to Section 6E.
- 2) Check voltage at each terminal of connectors connected.

NOTE:

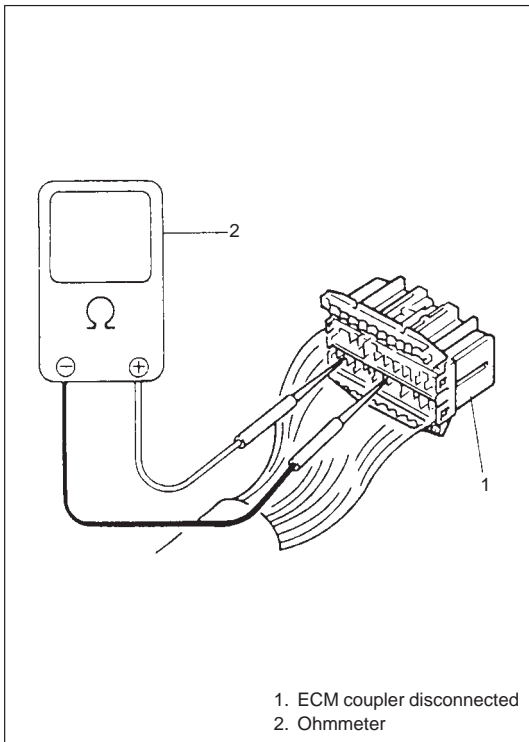
As each terminal voltage is affected by the battery voltage, confirm that it is 11 V or more when ignition switch is ON.



ECM VOLTAGE VALUES TABLE

Terminal	Wire	Circuit	Measurement ground	Normal value	Condition
E92-01	Bl/R	TP sensor power supply output	Ground to engine (Fig B)	4 – 6 volts	Ignition switch ON position
E92-02	Bl/B	TP sensor input	Ground to engine (Fig B)	0.6 – 1.0 volts	Ignition switch ON position and throttle lever at idle position.
				2.4 – 2.8 volts	Ignition switch ON position and throttle lever at fully open position.
E92-04	Br	ECT sensor signal input	Ground to engine (Fig B)	0.25 – 0.28 volt	Ignition switch ON position at engine coolant temp. 60°C (140°F)
				0.1 – 0.12 volt	Ignition switch ON position at engine coolant temp. 90°C (194°F)
E92-06	Bl	Glow plug control relay feed back signal	Ground to engine (Fig B)	8 – 12 volts	While turn ON ignition switch for several seconds
				– 0.5 – 0.5 volt	Engine running
E92-07	B	Injector needle sensor positive input	Ground to engine (Fig B)	3 – 4.5 volts	Ignition switch ON position
E92-08	R	CKP sensor positive input	Ground to engine (Fig B)	2 – 3 volts	Ignition switch ON position
E92-10	P/G	Data link connector (K-line)	Ground to engine (Fig B)	2 – 3 volts	Ignition switch ON position
E92-11	Br	Engine speed signal output	Ground to engine (Fig B)	4 – 6 volts	Ignition switch ON position
E92-12	Bl	Glow plug indicator lamp output	Ground to engine (Fig B)	8 – 12 volts	While turn ON ignition switch for several seconds
				0 – 1 volt	Engine running
E92-13	P	A/C CUT signal output	Ground to engine (Fig B)	10 – 14 volts	Engine running
E92-14	Bl/W	EGR valve No.2 output	Ground to engine (Fig B)	10 – 14 volts	Ignition switch ON position
				0 – 1 volt	Engine running
E92-15	G/R	Injection timing control actuator output	Ground to engine (Fig B)	10 – 14 volts	Ignition switch ON position
E92-16	G/W	ECM power source	Ground to engine (Fig B)	10 – 14 volts	Ignition switch ON position
E92-17	B	ECM ground	Ground to engine (Fig A)	– 0.5 – 0.5 volt	Ignition switch ON position
E92-18	B/Or	ECM ground	Ground to engine (Fig A)	– 0.5 – 0.5 volt	Ignition switch ON position
E92-19	Bl/Or	TP sensor ground	Ground to engine (Fig B)	– 0.5 – 0.5 volt	Ignition switch ON position
E92-21	Br/W	ECT sensor ground	Ground to engine (Fig B)	– 0.5 – 0.5 volt	Ignition switch ON position
E92-23	B/Bl	Sealed wire ground	Ground to engine (Fig B)	– 0.5 – 0.5 volt	Ignition switch ON position
E92-24	W	Injector needle sensor negative input	Ground to engine (Fig B)	– 0.5 – 0.5 volt	Ignition switch ON position
E92-25	G	CKP sensor negative input	Ground to engine (Fig B)	2 – 3 volts	Ignition switch ON position

Terminal	Wire	Circuit	Measurement ground	Normal value	Condition
E92-27	Br/Y	Data link connector (L-line)	Ground to engine (Fig B)	- 0.5 – 0.5 volt	Ignition switch ON position
E92-29	B/R	Glow plug control relay output	Ground to engine (Fig B)	0 – 1 volt	While turn ON ignition switch for several seconds
				10 – 14 volts	Engine running
E92-30	V	Malfunction indicator lamp output	Ground to engine (Fig B)	0 – 1 volt	While turn ON ignition switch for several seconds
				10 – 14 volts	Engine running
E92-32	R/Y	EGR valve No.1 output	Ground to engine (Fig B)	10 – 14 volts	Ignition switch ON position
				0 – 1 volt	Engine running
E92-33	G/Y	ECM power source	Ground to engine (Fig B)	10 – 14 volts	Ignition switch ON position
E92-34	B/Or	ECM ground	Ground to engine (Fig A)	- 0.5 – 0.5 volt	Ignition switch ON position
E92-35	B/Or	ECM ground	Ground to engine (Fig A)	- 0.5 – 0.5 volt	Ignition switch ON position



RESISTANCE CHECK

- 1) Disconnect ECM couplers from ECM with ignition switch OFF.

CAUTION:

Never touch terminals of ECM itself or connect voltmeter or ohmmeter.

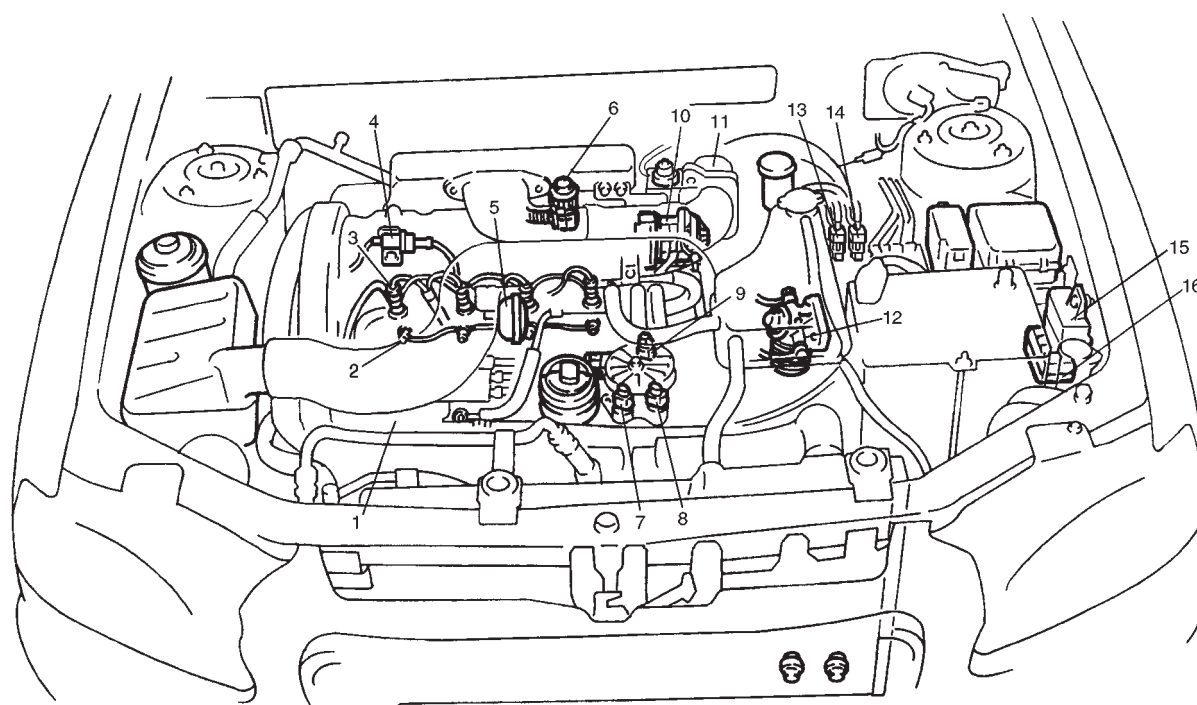
- 2) Check resistance between each terminal of couplers disconnected.

CAUTION:

- Be sure to connect ohmmeter probe from wire harness side of coupler.
- Be sure to turn OFF ignition switch for this check.
- Resistance in table below represents that when parts temperature is 20°C (68°F).

TERMINALS	CIRCUIT	STANDARD RESISTANCE
E92-7 to E92-24	Injector needle sensor	85 Ω – 130 Ω
E92-8 to E92-25	CKP sensor	330 Ω – 480 Ω
E92-4 to E92-24	ECT sensor	530 Ω – 590 Ω at 60°C, 140°F
		220 Ω – 240 Ω at 90°C, 194°F
E92-1 to E92-19	TP sensor	1.4 KΩ – 2.1 KΩ
E92-2 to E92-19		950 Ω – 1.5 KΩ
E92-12 to E92-18	Glow plug indicator	8 Ω – 14 Ω
E92-17 to E92-18	Ground	Continuity
E92-34 to E92-18	Ground	Continuity
E92-35 to E92-18	Ground	Continuity

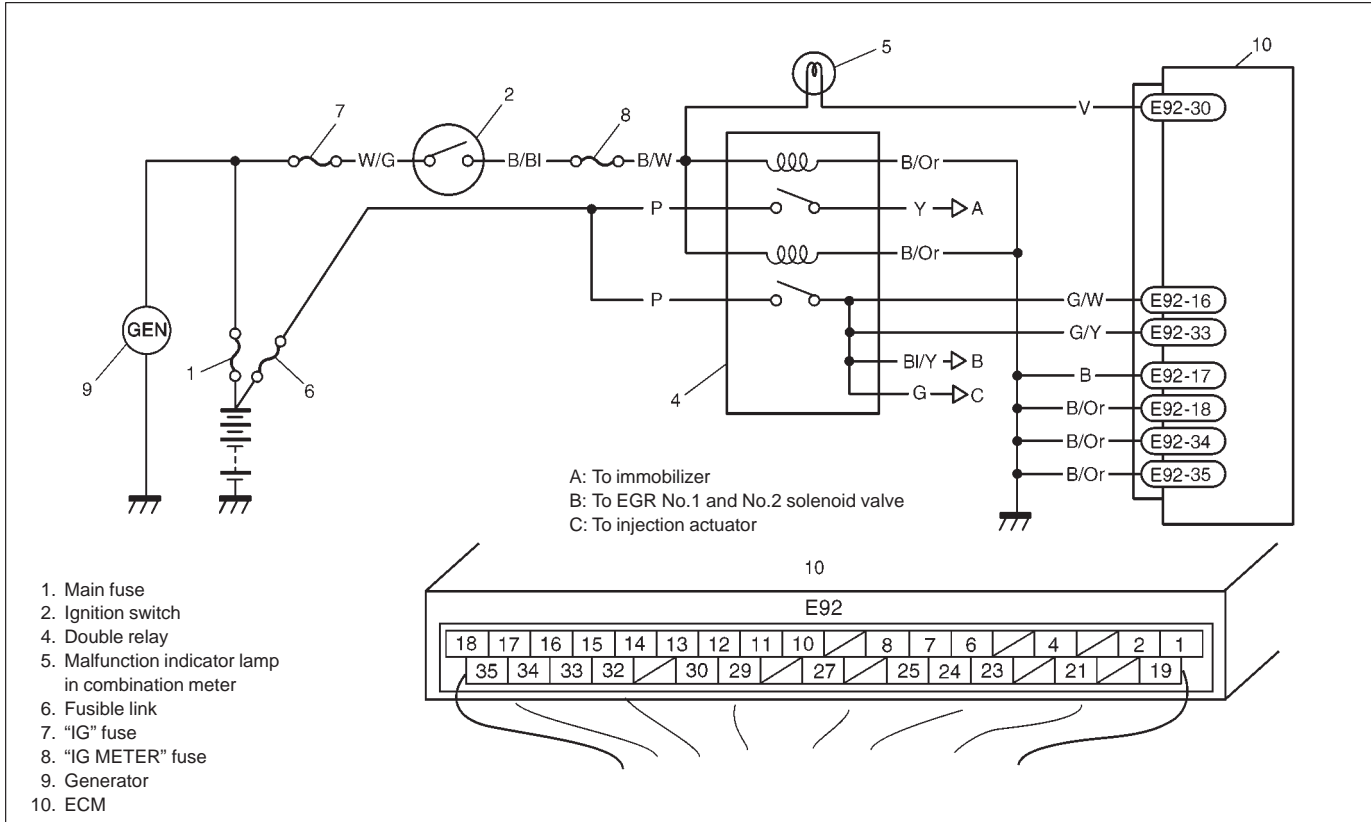
COMPONENT LOCATION



- | | |
|----------------------------|-----------------------------|
| 1. Fuel injection pump | 9. ECT sensor |
| 2. Glow plug | 10. Vacuum pump |
| 3. Fuel injector | 11. EGR No.2 valve |
| 4. Injection needle sensor | 12. Fuel filter |
| 5. Regulator | 13. EGR No.1 solenoid valve |
| 6. EGR No.1 valve | 14. EGR No.2 solenoid valve |
| 7. Coolant temp. gauge | 15. Double relay |
| 8. Coolant temp. switch | 16. Glow plug control relay |

TABLE A-1 MALFUNCTION INDICATOR LAMP CIRCUIT CHECK – LAMP DOES NOT COME “ON” AT IGNITION SWITCH ON (BUT ENGINE AT STOP)

CIRCUIT DESCRIPTION



When the ignition switch is turned ON, ECM causes the double relay to turn ON (close the contact point). Then, ECM being supplied with the main power, turns ON the malfunction indicator lamp (MIL). When the engine starts to run and no malfunction is detected in the system, MIL goes OFF but if a malfunction was or is detected, MIL remains ON even when the engine is running.

INSPECTION

STEP	ACTION	YES	NO
1	MIL Power Supply Check 1) Turn ignition switch ON. Do other indicator/warning lights in combination meter comes ON?	Go to Step 2.	"IG" fuse blown, main fuse blown, ignition switch malfunction, "B/W" circuit between "IG" fuse and combination meter or poor coupler connection at combination meter.
2	ECM Power and Ground Circuit Check Does engine start?	Go to Step 3.	Go to TABLE A-3 ECM POWER AND GROUND CIRCUIT CHECK. If these circuits are OK, go to DIAGNOSIS in SECTION 8G.
3	MIL Circuit Check 1) Turn ignition switch OFF and disconnect connectors from ECM. 2) Check for proper connection to ECM at terminal E92-30. 3) If OK, then using service wire, ground terminal E92-30 in connector disconnected. Does MIL turn on at ignition switch ON?	Substitute a known-good ECM and recheck.	Bulb burned out, "V" wire circuit open.

TABLE A-2 MALFUNCTION INDICATOR LAMP CIRCUIT CHECK – LAMP REMAINS “ON” WITH IGNITION SWITCH ON

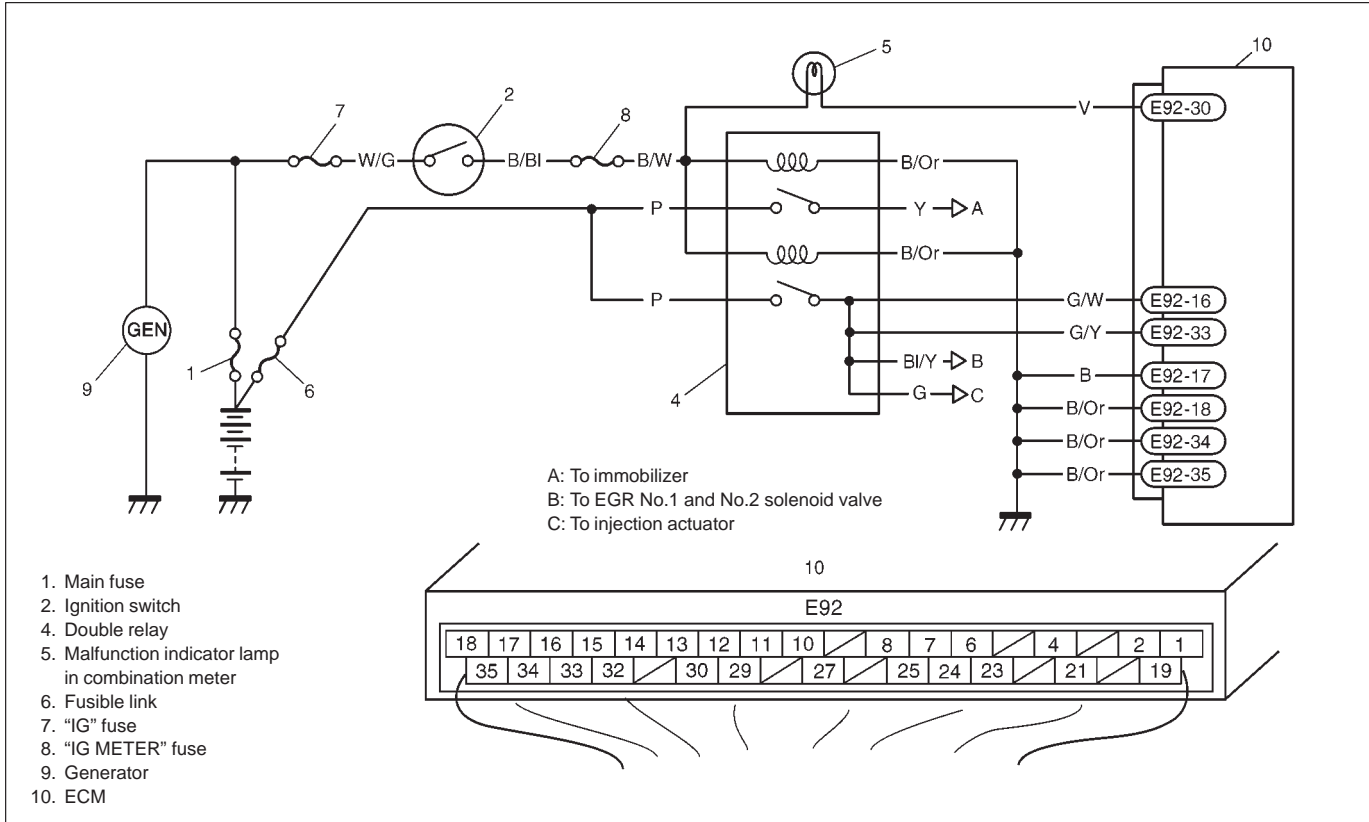
WIRING DIAGRAM/CIRCUIT DESCRIPTION – Refer to table A-1.

INSPECTION

STEP	ACTION	YES	NO
1	Diagnostic Trouble Code (DTC) check 1) Check DTC referring to DTC CHECK section. Is there any DTC(s)?	Go to Step 2 of ENGINE DIAG. FLOW TABLE.	Go to Step 2.
2	DTC check Start engine and recheck DTC while engine running. Is there any DTC(s)?		Go to Step 3.
3	MIL Circuit check 1) Turn OFF ignition switch. 2) Disconnect connectors from ECM. Does MIL turn ON at ignition switch ON?	“V” wire circuit shorted to ground.	Substitute a known-good ECM and recheck.

TABLE A-3 ECM POWER AND GROUND CIRCUIT CHECK – MIL DOESN'T LIGHT AT IGNITION SWITCH ON AND ENGINE DOESN'T START THOUGH IT IS CRANKED UP

CIRCUIT DESCRIPTION



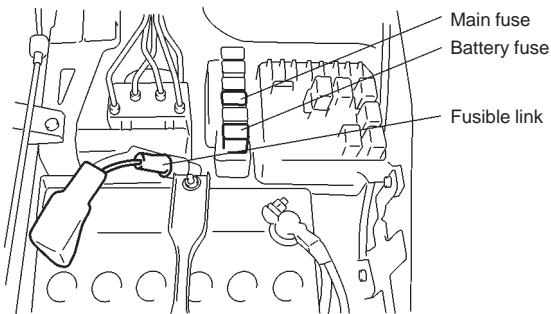
When the ignition switch turned ON, the double relay turns ON (the contact point closes) and the main power is supplied to ECM.

INSPECTION

STEP	ACTION	YES	NO
1	Double Relay Operating Sound Check Is operating sound of double relay heard at ignition switch ON?	Go to Step 3.	Go to Step 2.
2	Double Relay Check Refer to DOUBLE RELAY in Section 6E3. Is double relay in good condition?	Go to Step 3.	Replace double relay.
3	Fuse Check Is "Fusible link" and "IG METER" fuse in good condition? See Fig. 1.	Go to Step 4.	Check for short in circuits connected to this fuse.
4	Double Relay Power Circuit Check 1) Turn ignition switch OFF, and disconnect coupler from double relay. 2) Turn ignition switch ON, measure voltage between "B/W" terminal in double relay coupler and body ground, and "P" terminal in double relay coupler and body ground. Is each terminal voltage 10 to 14 V?	Go to Step 5.	"B/W" or "P" circuit in glow plug relay coupler open or shorted to ground.

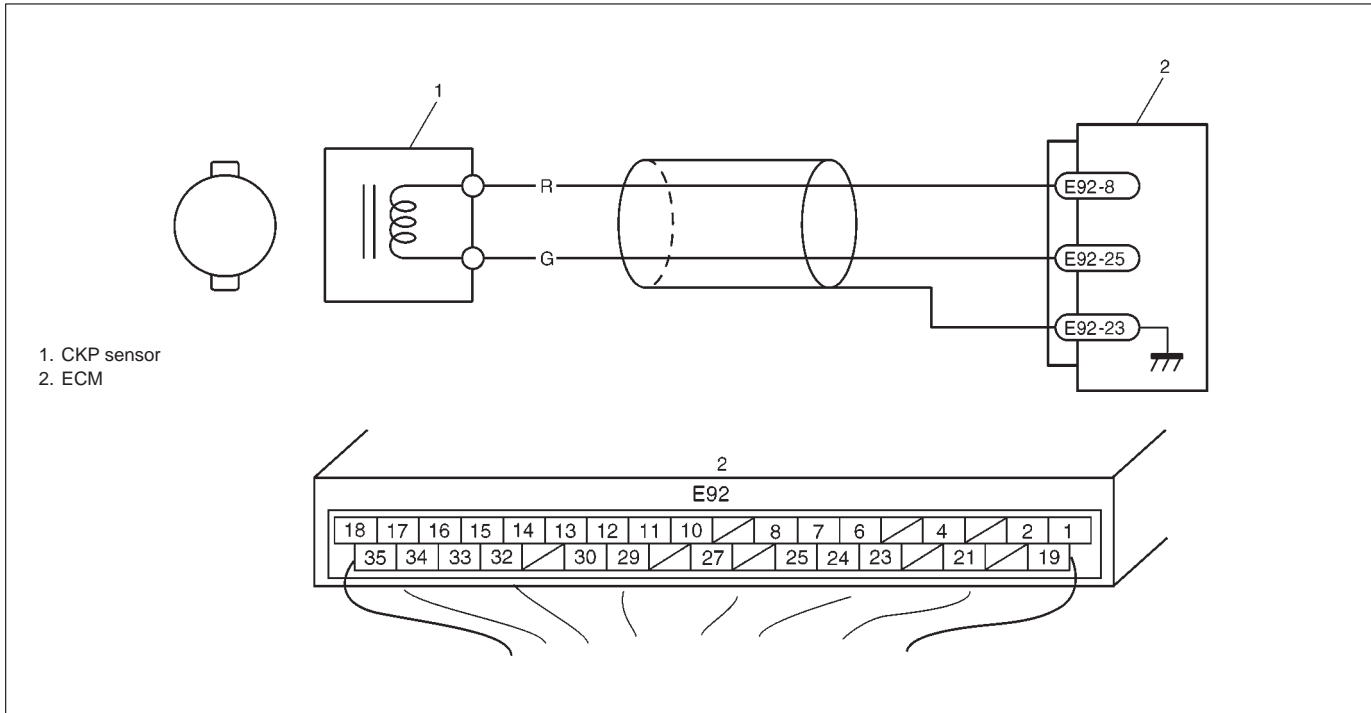
STEP	ACTION	YES	NO
5	Double Relay Ground Circuit Check 1) Turn ignition switch OFF. 2) Check continuity between "B/Or" terminal in double relay coupler and body ground. Is it continuity?	Go to Step 6.	"B/Or" circuit in glow plug relay coupler open.
6	1) Turn ignition switch ON. 2) Measure voltage between "G/Y", "G/W" terminals in double relay coupler with connect it coupler. Is it 10 to 14 V?	Go to Step 7.	Double relay malfunction.
7	ECM Power Circuit Check 1) Turn OFF ignition switch, disconnect connectors from ECM and install double relay. 2) Check for proper connection to ECM at terminals E92-16 and E92-33. 3) If OK, then measure voltage between terminal E92-16 and ground, E92-33 and ground with ignition switch ON. Is each voltage 10 – 14 V?	Substitute a known-good ECM and recheck.	"G/Y" or "G/W" circuit open.

Fig. 1 for Step 3



DTC No.1 CRANKSHAFT POSITION (CKP) SENSOR CIRCUIT MALFUNCTION

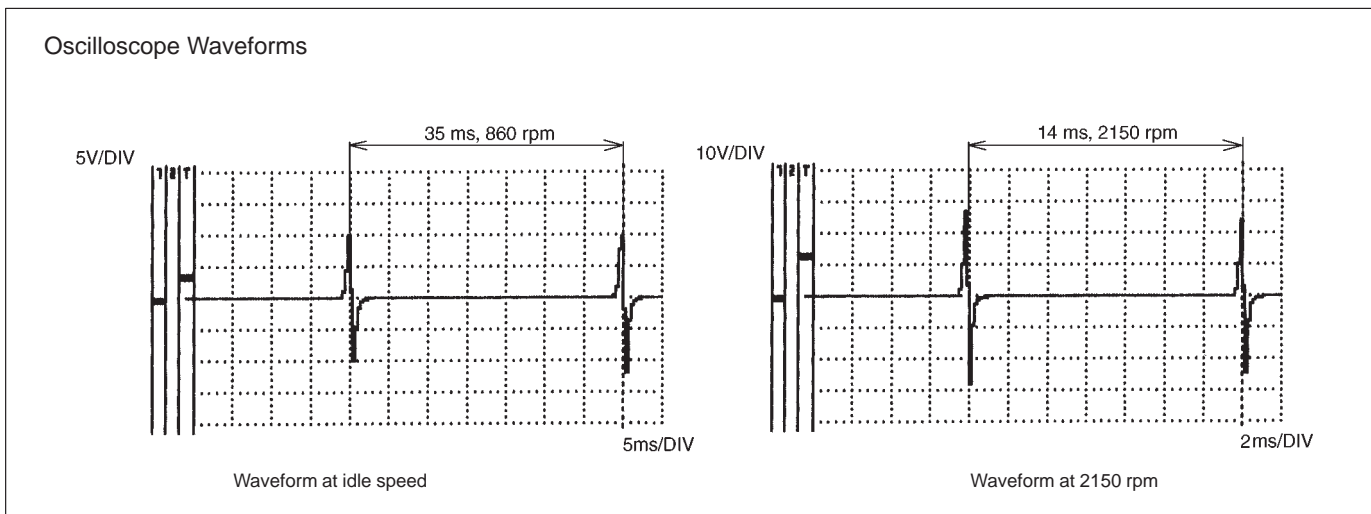
CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
<ul style="list-style-type: none"> No CKP sensor signal for 2 seconds at engine cranking. 	<ul style="list-style-type: none"> CKP sensor circuit open or short. Signal teeth damaged. CKP sensor malfunction, foreign material being attached or improper installation. ECM malfunction.

Reference

Connect oscilloscope between terminals E92-8 and E92-25 of ECM connector connected to ECM and body ground, then check CKP sensor signal.



DTC CONFIRMATION PROCEDURE

- 1) Clear DTC and crank engine for 2 sec.
- 2) Select "DTC" mode on scan tool and check DTC.

INSPECTION

STEP	ACTION	YES	NO
1	Was "ENGINE DIAGNOSIS FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAGNOSIS FLOW TABLE".
2	Check CKP sensor and connector for proper installation. Is CKP sensor installed properly and connector connected securely?	Go to Step 3.	Correct.
3	Check CKP sensor resistance as follows. 1) Disconnect CKP sensor connector with ignition switch OFF. 2) Measure resistance between sensor terminals. Refer to CKP SENSOR in Section 6E3. Is measured resistance value as specified?	Go to Step 4.	Replace CKP sensor.
4	Check ECM terminals voltage as follows. 1) Turn ignition switch OFF. 2) Disconnect ECM connector. 3) Check for proper connection to ECM at each sensor terminals. 4) If check is OK, then turn ignition switch ON and measure voltage between sensor terminal E92-8, E92-25 of ECM and body ground. See Fig. 1. Is it 0 V?	Go to Step 5.	CKP sensor circuit shorted to power.
5	Check continuity of CKP sensor circuit as follows. 1) Turn ignition switch OFF. 2) Connect CKP sensor coupler. 3) Measure resistance between the following points. <ul style="list-style-type: none"> ● Both ECM connector terminals of the CKP sensor circuit: continuity ● Either terminal of CKP sensor coupler and body ground: no-continuity Are both check results satisfactory?	Go to Step 6.	Circuit open or shorted to ground.
6	Check CKP sensor damage as follows. 1) Remove CKP sensor. 2) Check sensor for damage or foreign material attached. Is it in good condition?	Go to Step 7.	Clean, repair or replace.
7	Check CKP sensor voltage waveform as follows. 1) Install CKP sensor. 2) Check for voltage waveform as shown in reference of previous page. Is specified voltage and waveform obtained?	Substitute a known-good ECM and recheck.	Go to Step 8.
8	Check sensor rotor with flywheel for the following. <ul style="list-style-type: none"> ● Rotor teeth neither missing nor damaged. See Fig. 2. ● No foreign material being attached. ● Rotor being eccentric. Are they in good condition?	Replace CKP sensor.	Clean, repair or replace sensor rotor.

Fig. 1 for Step 4

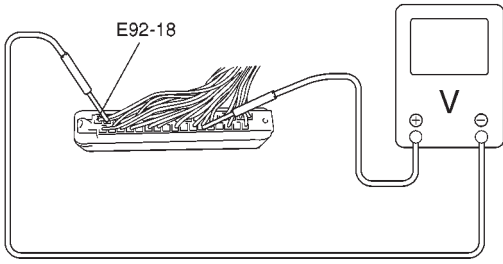
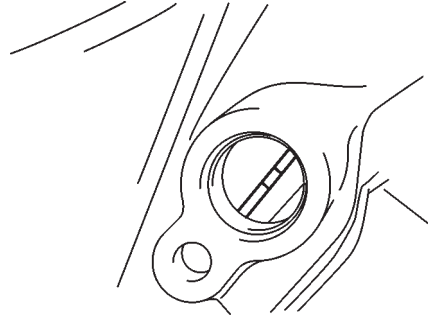
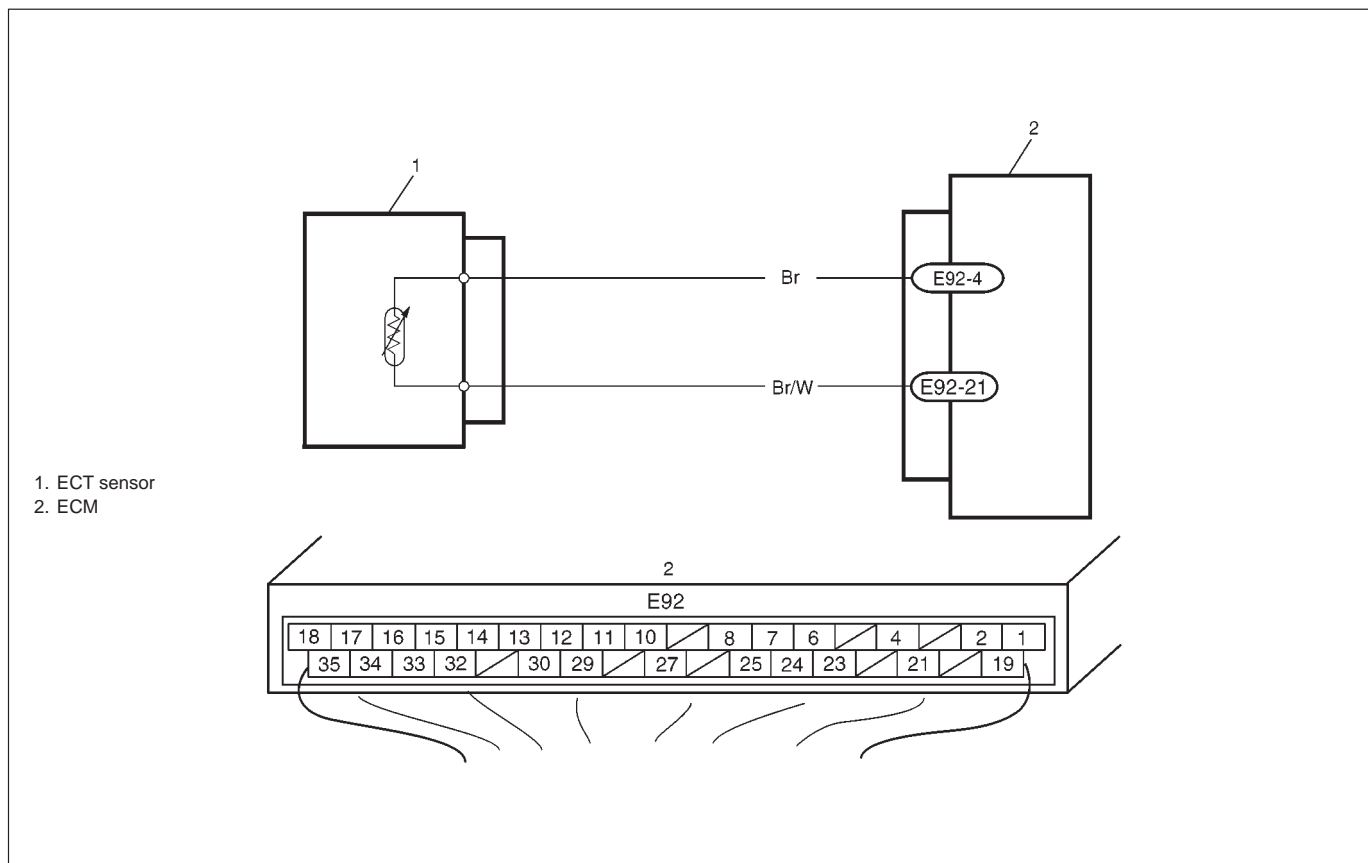


Fig. 2 for Step 8



DTC No.3 ENGINE COOLANT TEMPERATURE (ECT) CIRCUIT MALFUNCTION

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
<ul style="list-style-type: none"> ● Low engine coolant temperature (High voltage-High resistance) ● High engine coolant temperature (Low voltage-Low resistance) 	<ul style="list-style-type: none"> ● “Br” circuit open or shorted to power ● “Br/W” circuit open ● ECT sensor malfunction ● ECM malfunction

NOTE:

- Before inspecting, be sure to check that coolant temp. meter in combination meter indicates normal operating temperature (Engine is not overheating).

DTC CONFIRMATION PROCEDURE

- 1) Clear DTC, start engine and keep it at idle for 1 min.
- 2) Select “DTC” mode on scan tool and check DTC.

INSPECTION

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	Check ECT Sensor and Its Circuit. 1) Connect scan tool with ignition switch OFF. 2) Turn ignition switch ON. 3) Check engine coolant temp. displayed on scan tool. See Fig. 1. Is -40°C (-40°F) or 130°C (266°F) indicated?	Go to Step 3.	Intermittent trouble. Check for intermittent referring to "Intermittent and Poor Connection" in Section 0 A.
3	Check Wire Harness. 1) Disconnect ECT sensor connector. 2) Check engine coolant temp. displayed on scan tool. Is -40°C (-40°F) indicated?	Replace ECT sensor.	"Br" wire shorted to ground. If wire is OK, substitute a known-good ECM and recheck.
4	Does scan tool indicate -40°C (-40°F) at Step 2.	Go to Step 6.	Go to Step 5.
5	Check Wire Harness. 1) Disconnect ECT sensor connector with ignition switch OFF. 2) Check for proper connection to ECT sensor at "Br/W" and "Br" wire terminals. 3) If OK, then with ignition switch ON, is voltage applied to "Br" wire terminal about 4 – 6 V? See Fig. 2.	Go to Step 4.	"Br" wire open or shorted to power, or poor E92-4 connection. If wire and connection are OK, substitute a known-good ECM and recheck.
6	Check Wire Harness. 1) Using service wire, connect ECT sensor connector terminals. See Fig. 3. 2) Turn ignition switch ON and check engine coolant temp. displayed on scan tool. Is 130°C (266°F) indicated?	Replace ECT sensor.	"Br/W" wire open or poor E92-21 connection. If wire and connection are OK, substitute a known-good ECM and recheck.

Fig. 1 for Step 2

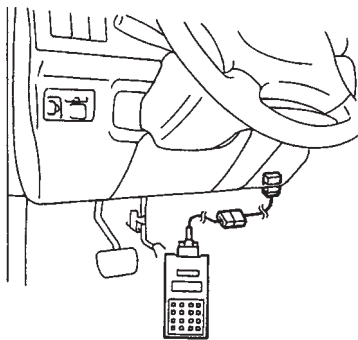


Fig. 2 for Step 5

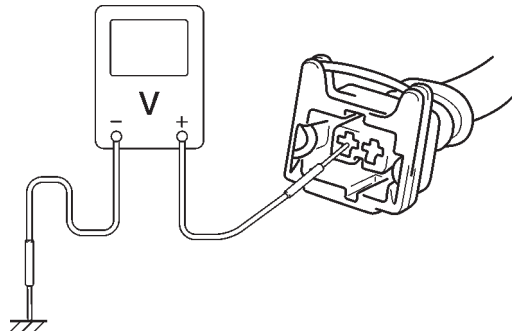
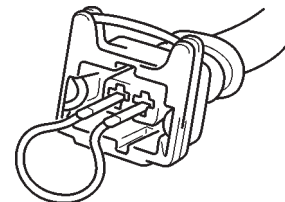
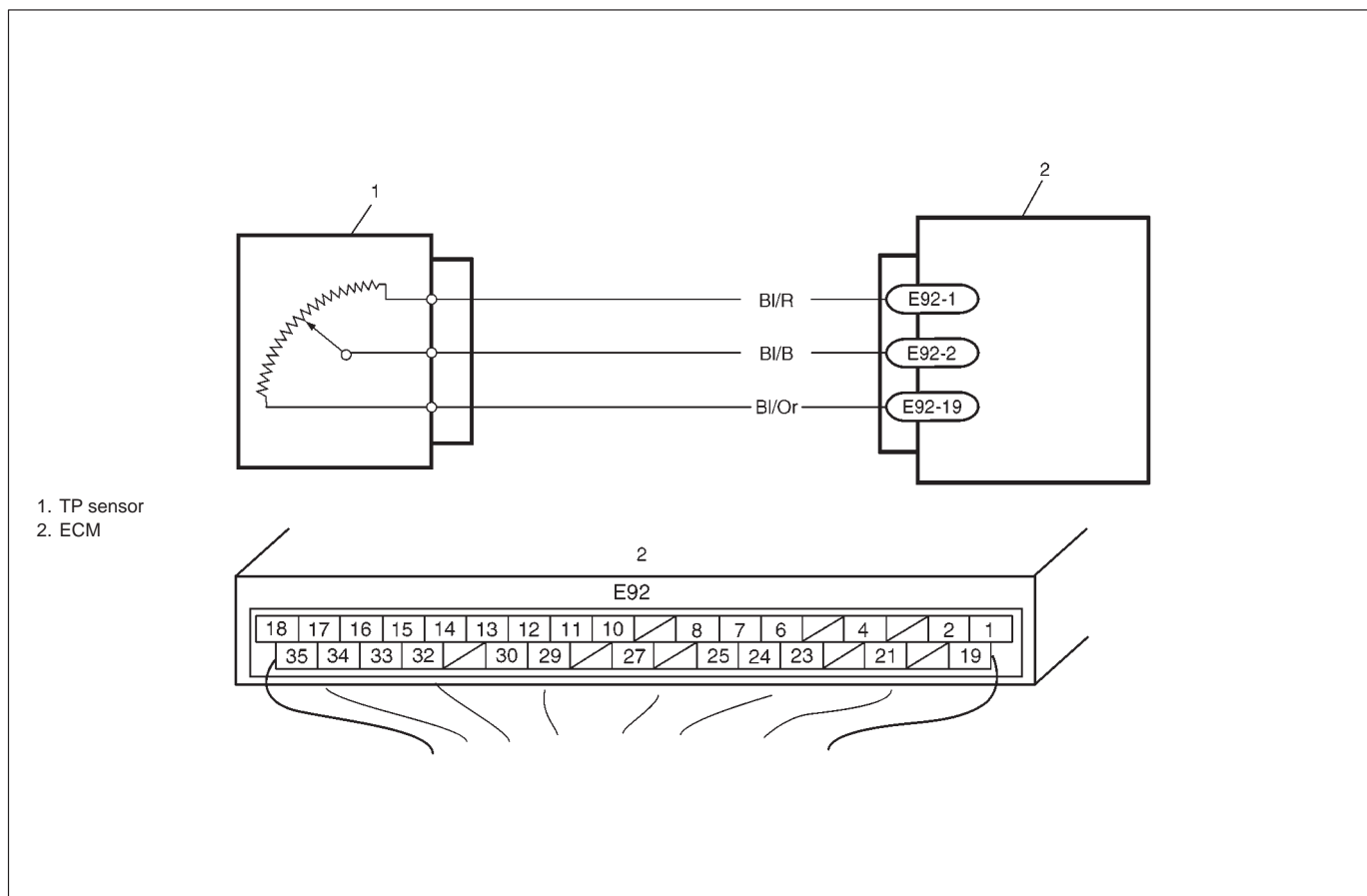


Fig. 3 for Step 6



DTC No.4 THROTTLE POSITION CIRCUIT MALFUNCTION

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
<ul style="list-style-type: none"> ● Signal voltage high ● Signal voltage low 	<ul style="list-style-type: none"> ● "BI/Or" circuit open or shorted to power ● "BI/B" circuit open or shorted to ground ● "BI/R" circuit open or shorted to power or ground ● TP sensor malfunction ● ECM malfunction

DTC CONFIRMATION PROCEDURE

- 1) Clear DTC, start engine and keep it at idle for 1 min.
- 2) Select "DTC" mode on scan tool and check DTC.

INSPECTION

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	Check TP Sensor and Its Circuit. 1) Connect scan tool to DLC with ignition switch OFF and then turn ignition switch ON. 2) Check throttle valve opening percentage displayed on scan tool. See Fig. 1. Is it displayed 0% or 100%?	Go to Step 3.	Intermittent trouble. Check for intermittent referring to "Intermittent and Poor Connection" in Section 0 A.
3	Check Wire Harness. 1) Disconnect connector from TP sensor with ignition switch OFF. 2) Check for proper connection to TP sensor at "BI/R", "BI/B" and "BI/Or" wire terminal. 3) If OK, then with ignition switch ON, check voltage at each of "BI/R" and "BI/B" wire terminals and body ground. See Fig. 2. Is voltage about 4 – 6 V at each terminal?	Go to Step 4.	"BI/R" wire open, "BI/R" wire shorted to ground circuit or power circuit or "BI/Or" wire, "BI/B" wire open or shorted to ground circuit or poor E92-1 or E92-2 connection. If wire and connection are OK, substitute a known-good ECM and recheck.
4	Check TP Sensor. Refer to TP SENSOR in Section 6E3. Is it in good condition?	"BI/Or" wire open or poor E92-19 connection. If wire and connection are OK, substitute a known-good ECM and recheck.	Replace TP sensor.

Fig. 1 for Step 2

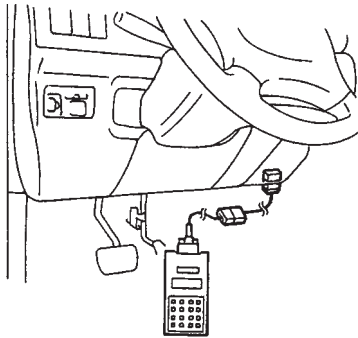
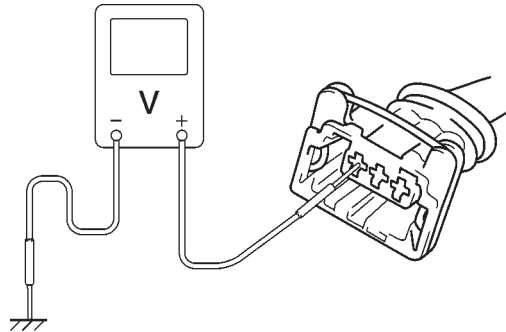


Fig. 2 for Step 3



DTC NO.13 BAROMETRIC PRESSURE SENSOR LOW/HIGH INPUT

WIRING DIAGRAM/CIRCUIT DESCRIPTION

Barometric pressure sensor is installed in ECM.

DTC DETECTING CONDITION	POSSIBLE CAUSE
● Barometric pressure sensor voltage is too high or too low	● ECM (barometric pressure sensor) malfunction

DTC CONFIRMATION PROCEDURE

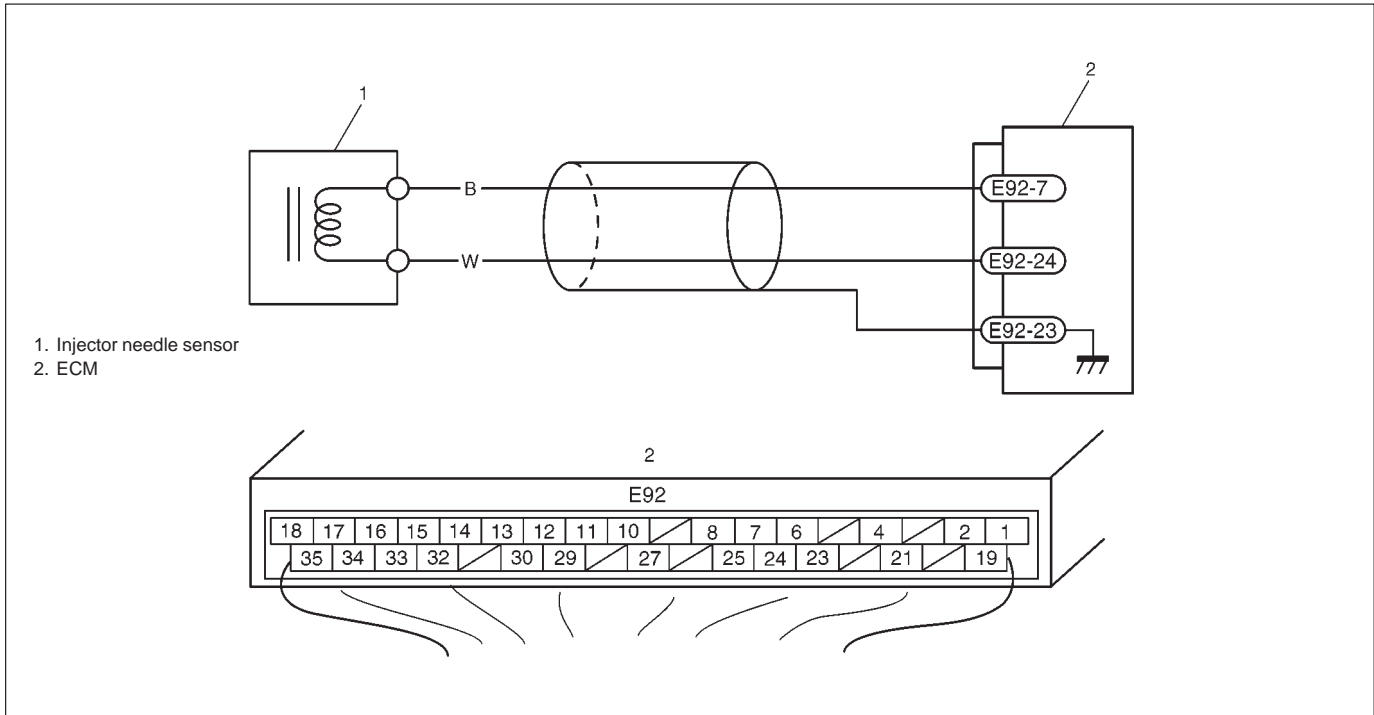
- 1) Turn ignition switch OFF.
- 2) Clear DTC with ignition switch ON.
- 3) Turn ignition switch ON for 2 sec., crank engine for 2 sec. and run it at idle for 1 min.
- 4) Check DTC in "DTC" mode.

INSPECTION

Substitute a known-good ECM and recheck.

DTC No.14 INJECTOR NEEDLE SENSOR CIRCUIT MALFUNCTION

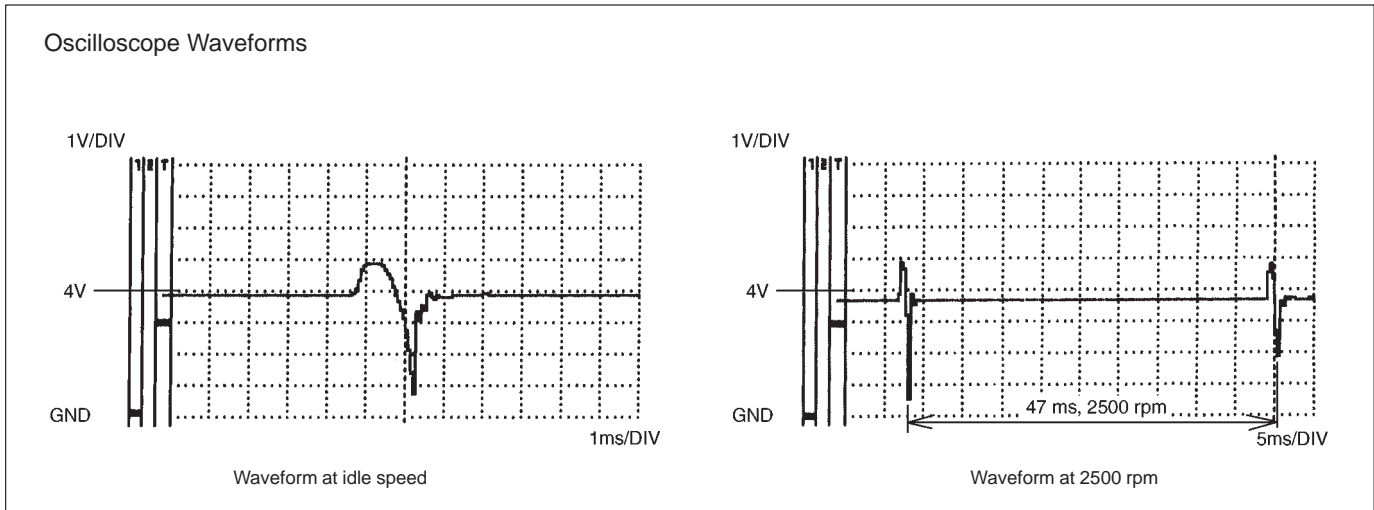
CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
<ul style="list-style-type: none"> No injector needle sensor signal for 2 seconds at engine cranking. 	<ul style="list-style-type: none"> Injector needle sensor circuit open or short. Injector damaged. Injector needle sensor malfunction. ECM malfunction.

Reference

Connect oscilloscope between terminals E92-7, E92-24 of ECM connector connected to ECM and check CKP sensor signal.



DTC CONFIRMATION PROCEDURE

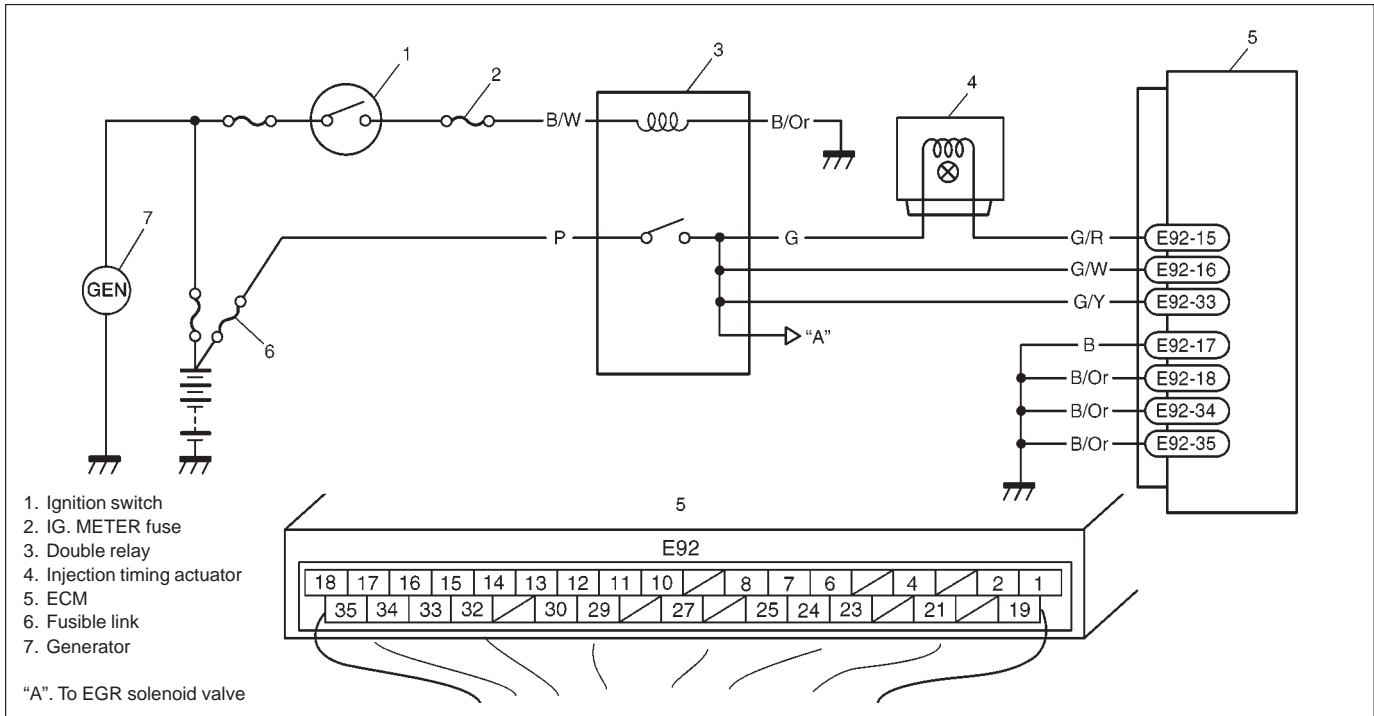
- 1) Clear DTC and crank engine for 2 sec.
- 2) Select "DTC" mode on scan tool and check DTC.

INSPECTION

STEP	ACTION	YES	NO
1	Was "ENGINE DIAGNOSIS FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAGNOSIS FLOW TABLE".
2	Check injector needle sensor and connector for proper installation. Is injector needle sensor installed properly and connector connected securely?	Go to Step 3.	Correct.
3	Check injector needle sensor resistance as follows. 1) Disconnect injector needle sensor connector with ignition switch OFF. 2) Measure resistance between sensor terminals. Refer to INJECTOR NEEDLE SENSOR in Section 6E3. Is measured resistance value as specified?	Go to Step 4.	Replace injector needle sensor.
4	Check ECM terminal voltage as follows. 1) Turn ignition switch OFF. 2) Disconnect ECM connector. 3) Check for proper connection to ECM at each sensor terminals. 4) If check is OK, then turn ignition switch ON and measure voltage between sensor terminal of ECM and body ground. Is it 0 V?	Go to Step 5.	Injector needle sensor circuit shorted to power.
5	Check continuity of injector needle sensor circuit as follows. 1) Turn ignition switch OFF. 2) Connect injector needle sensor coupler. 3) Measure resistance between the following points. <ul style="list-style-type: none"> ● Both ECM connector terminals of the injector needle sensor: continuity ● Either terminal of injector needle sensor coupler and body ground: no-continuity Are both check results satisfactory?	Go to Step 6.	Circuit open or shorted to ground.
6	Check injector damage as follows. 1) Remove needle sensor with injector. 2) Check injector for damage, pollution and clogs. Refer to INJECTOR in Section 6A4. Is it in good condition?	Go to Step 7.	Clean, repair or replace.
7	Check voltage waveform for injector needle sensor as follows. 1) Install needle sensor with injector. 2) Check for voltage waveform as shown in reference of previous page. Is specified voltage and/or waveform obtained?	Substitute a known-good ECM and recheck.	Replace injector.

DTC No.16 INJECTION TIMING ACTUATOR CONTROL MALFUNCTION DTC No.34 INJECTION TIMING ACTUATOR CIRCUIT MALFUNCTION

CIRCUIT DESCRIPTION



ITEM	DTC DETECTING CONDITION	POSSIBLE CAUSE
DTC No.16	Injection timing actuator improper operative	<ul style="list-style-type: none"> ● Injection pump static timing is displacement ● Injection pump malfunction ● ECM malfunction
DTC No.34	Injection timing actuator circuit is opened or shorted	<ul style="list-style-type: none"> ● "G" circuit open or short ● "G/R" circuit open or short ● Injection timing actuator malfunction

DTC CONFIRMATION PROCEDURE

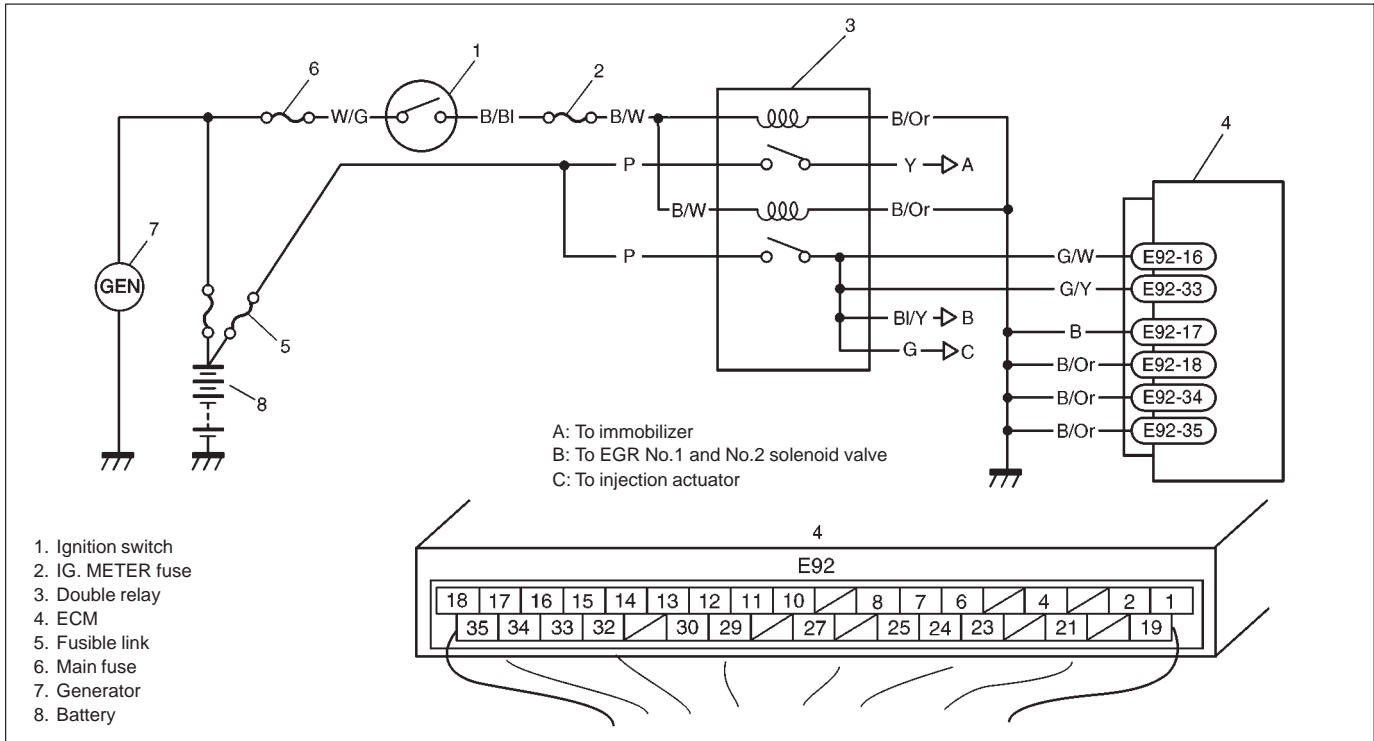
- 1) Clear DTC with ignition switch ON.
- 2) Select "DTC" mode on scan tool and check DTC.

INSPECTION

STEP	ACTION	YES	NO
1	Was "ENGINE DIAGNOSIS FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAGNOSIS FLOW TABLE".
2	Check injection timing actuator connector for proper installation. Is injection timing actuator connector connected securely?	Go to Step 3.	Correct.
3	Check injection timing actuator operation as follows. 1) With ignition switch OFF, disconnect coupler from injection timing actuator. 2) Check injection timing actuator resistance. Refer to INJECTOR TIMING ACTUATOR in Section 6E3. Is it as specified?	Go to Step 4.	Remove the injection pump and have it checked by BOSCH dealer. (Refer to FUEL INJECTION PUMP in Section 6E3.)
4	Check ECM terminal voltage as follows. 1) Disconnect ECM coupler. 2) Connect injection timing actuator coupler. 3) Turn ignition switch ON. 4) Measure voltage between E92-15 terminal in ECM coupler and body ground. Is it over 10 V?	Go to Step 5.	"G" and "G/R" circuits open or shorted to ground.
5	Check injection timing actuator circuit voltage as follows. 1) Disconnect injection timing actuator coupler. 2) Turn ignition switch ON. 3) Measure voltage between E92-15 terminal in ECM coupler and body ground. Is it 0 V?	Go to Step 6.	"G/R" circuit shorted to power supply.
6	Check injection pump static timing. Refer to FUEL INJECTION PUMP in Section 6E3. Is it as specified?	Go to Step 7.	Adjust injection pump static timing. (Refer to FUEL INJECTION PUMP in Section 6E3.)
7	Substitute a known-good ECM and recheck. Is DTC detected?	Remove the injection pump and have it checked by BOSCH dealer. (Refer to FUEL INJECTION PUMP in Section 6E3.)	Faulty ECM.

DTC No.17 ECM POWER SUPPLY CIRCUIT MALFUNCTION

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
<ul style="list-style-type: none"> ● ECM power supply circuit is 6 V or lower ● ECM power supply circuit is 16 V or higher 	<ul style="list-style-type: none"> ● Poor charge battery. ● Fuse blown. ● "G/Y" and "G/W" circuit open or shorted to ground. ● "B/W" and "P" circuit open or shorted to ground. ● Double relay ground open or shorted to power supply. ● Generator malfunction. ● Double relay malfunction.

DTC CONFIRMATION PROCEDURE

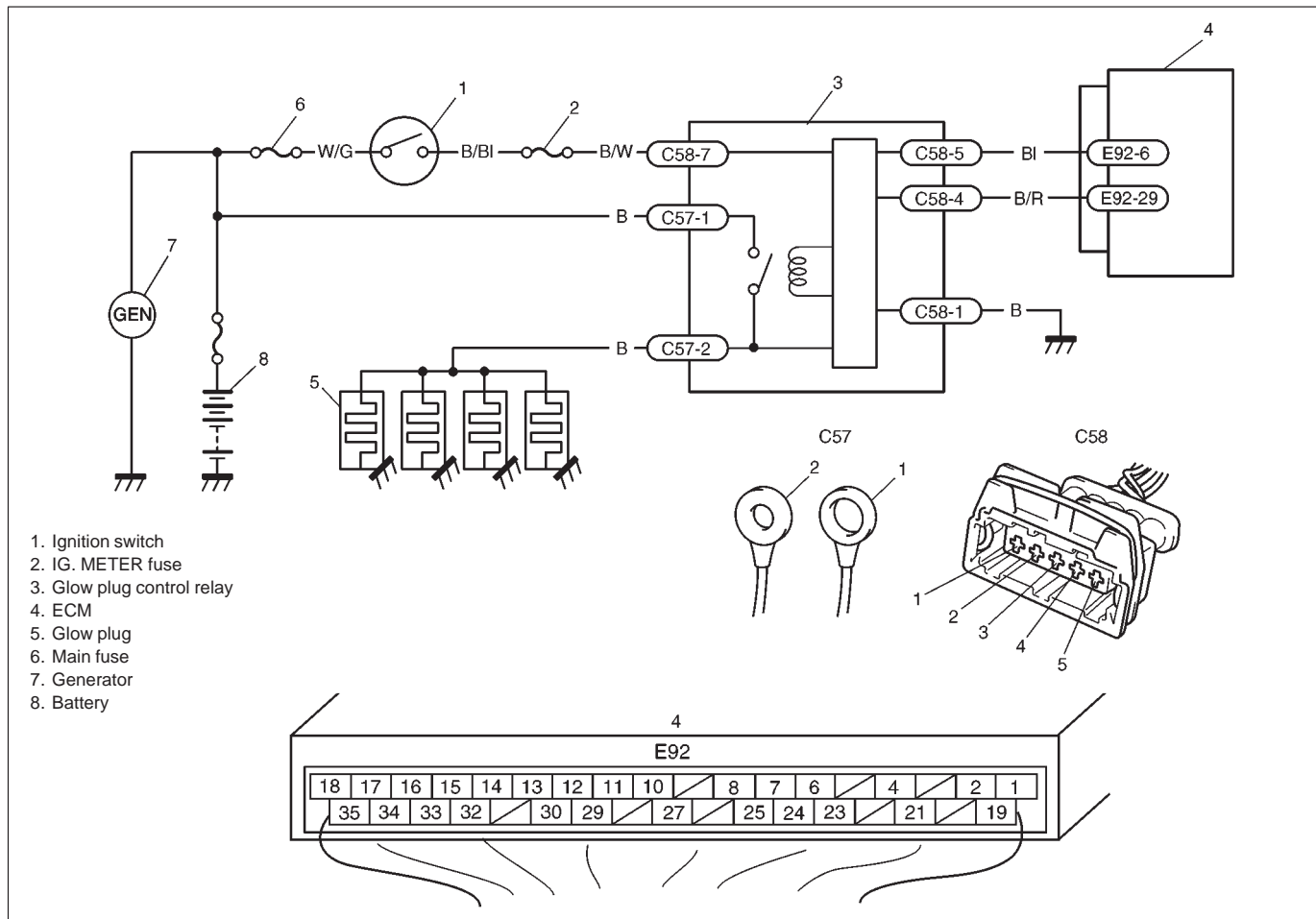
- 1) Clear "DTC".
- 2) Start engine and run it at 3000 r/min.
- 3) Select "DTC" mode on scan tool and check DTC.

INSPECTION

STEP	ACTION	YES	NO
1	Was "ENGINE DIAGNOSIS FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAGNOSIS FLOW TABLE".
2	Check battery voltage. Is it over 12 V?	Go to Step 3.	Battery poor charge or malfunction.
3	Check ECM power circuit. Go to TABLE A-2 ECM POWER AND GROUND CIRCUIT CHECK. Is check results OK?	Go to Step 4.	ECM power circuit malfunction.
4	Check generator voltage as follows. 1) Run engine at 3000 rpm. 2) Measure battery voltage. Is it 12 to 16 V?	Substitute a known-good ECM and recheck.	Generator malfunction.

DTC No.22 GLOW PLUG RELAY CONTROL MALFUNCTION (FEEDBACK LOW VOLTAGE)
DTC No.23 GLOW PLUG RELAY CONTROL CIRCUIT MALFUNCTION
DTC No.32 GLOW PLUG RELAY CONTROL MALFUNCTION (FEEDBACK HIGH VOLTAGE)

CIRCUIT DESCRIPTION



ITEM	DTC DETECTING CONDITION	POSSIBLE CAUSE
DTC No.22	Glow plug relay control malfunction. (Glow plug relay feedback voltage is low when E92-29 terminal on ECM output voltage is low.)	<ul style="list-style-type: none"> ● “BI” circuit short to ground. ● Glow plug relay malfunction. ● Glow plug relay C57-1, C58-3 terminal circuit open or short to ground. ● Glow plug relay C57-2 terminal circuit short to ground.
DTC No.23	Glow plug relay control circuit open or short	<ul style="list-style-type: none"> ● “B/R” circuit open or short to ground.
DTC No.32	Glow plug relay control malfunction. (Glow plug relay feedback voltage is high when E92-29 terminal on ECM output voltage is high.)	<ul style="list-style-type: none"> ● “BI” circuit short to power supply. ● Glow plug relay malfunction. ● Glow plug relay C57-2 terminal circuit short to power supply.

DTC CONFIRMATION PROCEDURE

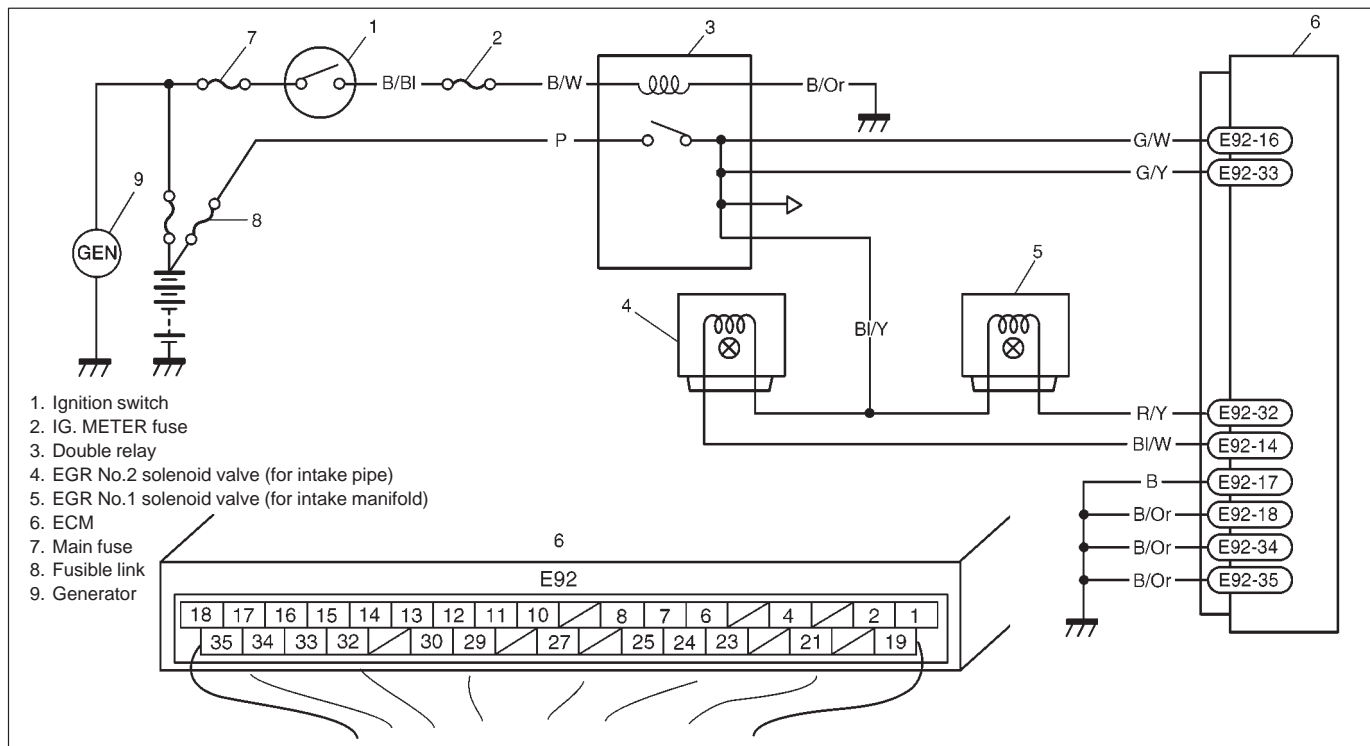
- 1) Clear DTC, start engine and keep it at idle for 1 min.
- 2) Select “DTC” mode on scan tool and check DTC.

INSPECTION

STEP	ACTION	YES	NO
1	Was "ENGINE DIAGNOSIS FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAGNOSIS FLOW TABLE".
2	Check glow plug relay and connector for proper installation. Is glow plug relay installed properly and connector connected securely?	Go to Step 3.	Correct.
3	Check glow plug relay operation as follows. 1) Disconnect negative cable terminal at battery. 2) Disconnect coupler and terminals from glow plug relay and remove it. 3) Check glow plug relay. Refer to GLOW PLUG RELAY in Section 6E3. Is check results as specified?	Go to Step 4.	Glow plug relay malfunction.
4	Check glow plug relay power supply circuit as follows. 1) Insulate C57-1 and C57-2 terminals in glow plug harness. 2) Connect negative cable to battery terminal. 3) Turn ignition switch ON. 4) Measure voltage between C57-1 terminal in glow plug harness terminal and ground, C57-2 terminal in glow plug harness terminal and ground. Is voltage at each terminal over 10 V?	Go to Step 5.	C57-1 and C57-2 circuits open or shorted to ground.
5	Check glow plug relay circuit continuity as follows. 1) Turn ignition switch OFF. 2) Check continuity between C58-1 terminal in glow plug relay coupler and body ground. Is it continuity?	Go to Step 6.	C58-1 circuit open.
6	Check glow plug relay circuit insulation as follows. 1) Disconnect coupler from ECM. 2) Check continuity between C57-2 terminal in glow plug harness and body ground. Is it continuity?	Go to Step 7.	C57-2 circuit open or glow plug malfunction.
7	Check terminal E92-29 circuit voltage as follows. 1) Connect coupler and terminal to glow plug relay. 2) Disconnect coupler from ECM. 3) Turn ignition switch ON. 4) Measure voltage between E92-29 terminal in ECM coupler and body ground. Is voltage over 10 V?	Go to Step 8.	E92-29 circuit open or shorted to ground.
8	Check terminal E92-29 circuit voltage as follows. 1) Disconnect coupler from glow plug relay. 2) Measure voltage between E92-29 terminal in ECM coupler and body ground with ignition switch ON. Is it 0 V?	Go to Step 9.	E92-29 circuit shorted to power supply.
9	Check terminal E92-6 circuit voltage as follows. 1) Connect shorting harness between E92-29 terminal in ECM coupler and body ground. 2) Measure voltage between E92-6 terminal in ECM coupler and body ground with ignition switch ON. Is it over 6 V?	Go to Step 10.	E92-6 circuit open or shorted to ground.
10	1) Disconnect shorting harness in Step 7. 2) Measure voltage E92-6 terminal in ECM coupler and body ground with ignition switch ON. Is it over 0 V?	Substitute a known-good ECM and recheck.	E92-6 circuit shorted to power supply.

DTC NO.33 EGR NO.1 CONTROL VALVE CIRCUIT MALFUNCTION DTC NO.36 EGR NO.2 CONTROL VALVE CIRCUIT MALFUNCTION

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
EGR No.1 or No.2 solenoid valve circuit is opened or shorted.	<ul style="list-style-type: none"> • “R/Y”, “BI/W” circuit open or short • “BI/Y” circuit open or short • EGR solenoid valve malfunction

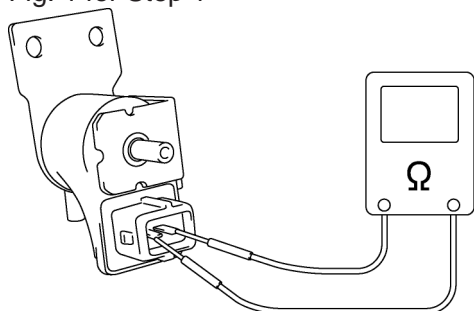
DTC CONFIRMATION PROCEDURE

- 1) Clear DTC with ignition switch ON.
- 2) Select “DTC” mode on scan tool and check DTC.

INSPECTION

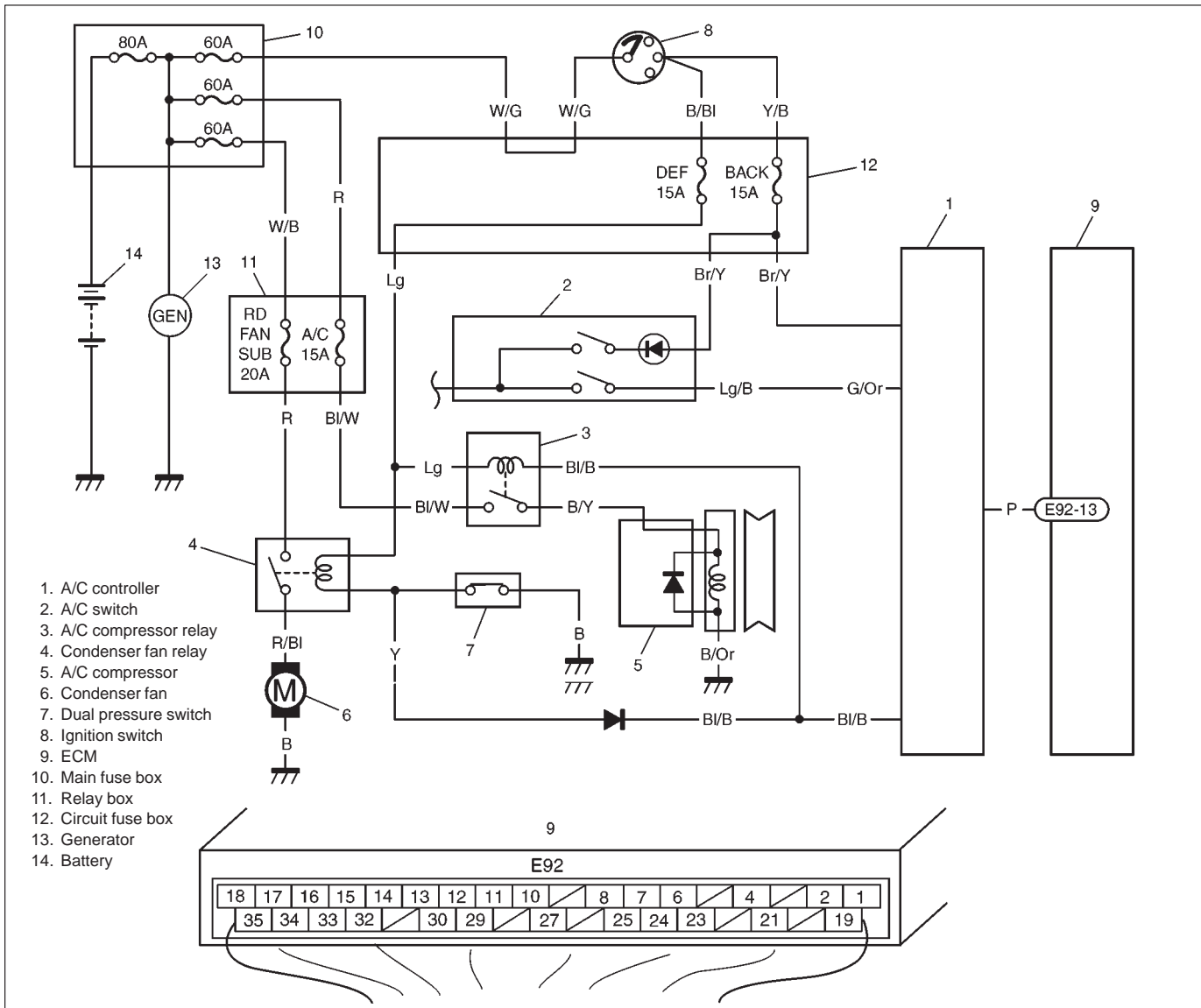
STEP	ACTION	YES	NO
1	Check EGR No.1, No.2 solenoid valve for resistance. 1) With ignition switch OFF, disconnect coupler from canister purge valve. 2) Check resistance of EGR No.1, No.2 solenoid valve. Resistance between two terminals. See Fig.1. : 23 – 40 Ω at 20°C (68°F) Resistance between terminal and body : 1M Ω or higher Is it as specified?	“R/Y”, “BI/Y” circuit open or short.	Replace EGR No.1 or No.2 solenoid valve.

Fig. 1 for Step 1



DTC NO.37 A/C CUT OFF CONTROL CIRCUIT MALFUNCTION

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
<ul style="list-style-type: none"> Low voltage at terminal E92-13 when ECM doesn't output A/C ON signal to A/C amplifier or when engine coolant temp. is not 110°C (230°F) or more. 	<ul style="list-style-type: none"> "P" circuit open or short Each engine emission control sensor faulty ECM malfunction

DTC CONFIRMATION PROCEDURE

- 1) Clear DTC with ignition switch ON.
- 2) Select "DTC" mode on scan tool and check DTC.

DTC NO.37**INSPECTION**

STEP	ACTION	YES	NO
1	Was "ENGINE DIAGNOSIS FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAGNOSIS FLOW TABLE".
2	Check A/C Cut Signal Circuit. 1) Check voltage at terminal E92-13 A/C cut signal specification: While engine running: 0 – 1.5 V Ignition switch turn ON or while cranking engine: 10 – 14 V Are check results as specified?	Substitute a known-good ECM and recheck.	"P" circuit open or short.