



**mazda**

# **Repair Manual**

## **T3000 T3500 T4000**



## GENERAL INFORMATION

<b>IMPORTANT INFORMATION</b> .....	GI- 2
BASIC ASSUMPTIONS .....	GI- 2
SAFETY RISK .....	GI- 2
POSSIBLE LOSS OF WARRANTY .....	GI- 2
WARNING ON LUBRICANTS AND GREASES .....	GI- 2
<b>HOW TO USE THIS MANUAL</b> .....	GI- 3
PREPARATION .....	GI- 3
REPAIR PROCEDURE .....	GI- 3
SYMBOLS .....	GI- 4
NOTES, CAUTIONS, AND WARNINGS .....	GI- 4
<b>FUNDAMENTAL PROCEDURES</b> .....	GI- 4
PROTECTION OF THE VEHICLE .....	GI- 4
A WORD ABOUT SAFETY .....	GI- 5
PREPARATION OF TOOLS AND MEASURING EQUIPMENT .....	GI- 5
SPECIAL TOOLS .....	GI- 5
REMOVAL OF PARTS .....	GI- 5
DISASSEMBLY .....	GI- 5
REASSEMBLY .....	GI- 6
ADJUSTMENTS .....	GI- 7
RUBBER PARTS AND TUBING .....	GI- 7
<b>JACK AND SAFETY STAND (RIGID RACK) POSITIONS</b> .....	GI- 8
<b>TOWING</b> .....	GI- 9
<b>IDENTIFICATION NUMBER LOCATIONS</b> .....	GI- 9
<b>UNITS</b> .....	GI-10
<b>ABBREVIATIONS</b> .....	GI-10
<b>CAUTION</b> .....	GI-11
ELECTRICAL TROUBLESHOOTING TOOLS .....	GI-11
CAUTION WITH ELECTRICAL PARTS .....	GI-12
INSTALLATION OF A MOBILE TWO-WAY RADIO SYSTEM .....	GI-14

**IMPORTANT INFORMATION****BASIC ASSUMPTIONS**

This repair manual assumes that you have certain special tools that are necessary for the safe and efficient performance of service operations on Ford vehicles and that you know how to use them properly. It also assumes that you are familiar with automobile systems and basic service and repair procedures. You should not attempt to use this manual unless these assumptions are correct and you understand the consequences described below.

**SAFETY RISK**

This manual contains certain notes, warnings, and other precautionary information that you should carefully read and follow to reduce the risk of personal injury to yourself or others and the risk of improper service that may damage the vehicle or render it unsafe. If there is no such information in regard to any specific service method, this does not mean there is no possibility that personal safety or vehicle safety will be jeopardized by the use of incorrect methods or tools.

**POSSIBLE LOSS OF WARRANTY**

The manufacturer's warranty on Ford vehicles and engines can be voided if improper service or repairs are performed by persons other than those at an Authorized Ford Dealer.

**WARNING ON LUBRICANTS AND GREASES**

Avoid all prolonged and repeated contact with mineral oils, especially used oils. Used oils contaminated during service (e.g., engine sump oils) are more irritating and more likely to cause serious effects, including skin cancer, in the event of gross and prolonged skin contact.

Wash skin thoroughly after work involving oil.

Protective hand cleaners may be of value provided they can be removed from the skin with water. Do not use gasoline, paraffin, or other solvents to remove oil from the skin.

Lubricants and greases may be slightly irritating to the eyes.

Repeated or prolonged skin contact should be avoided by wearing protective clothing if necessary. Particular care should be taken with used oils and greases containing lead. Do not allow work clothing to be contaminated with oil. Dry clean or launder such clothing at regular intervals.

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**HOW TO USE THIS MANUAL**

**PREPARATION**

PREPARATION points out the needed SST for the service operation that follows. It is best to gather all necessary SST before beginning work.

Example:

**N TIE-ROD END BOOT AND STEERING GEAR BOOT**

**TIE-ROD END BOOT AND STEERING GEAR BOOT**

**PREPARATION**

SST NUMBER	SST NAME	SST ILLUSTRATION
49 H228 301	TIE-ROD BOOT	

9MUCM 003

**REPAIR PROCEDURE**

1. Most repair operations begin with an overview illustration. It identifies the components, shows how the parts fit together, and visual parts inspections. If a damaged or worn part is found, repair or replace it as necessary.
2. Expendable parts, tightening torques, and symbols for oil, grease, and sealant are shown in the overview illustration.
3. Pages related to service procedures are shown under the illustration. Refer to this information when servicing the related part.

Example:

**SHOWS EXPENDABLE PARTS**

**SHOWS APPLICATION POINT OF OIL, ETC.**

**SHOWS TIGHTENING TORQUE SPECIFICATION \*2**

**SHOWS TIGHTENING TORQUE UNIT**

**SHOWS VISUAL INSPECTION INFORMATION**

1. Bolt	16. Bearing inner race	Remove	page M-22
2. Lock plate	Inspect for damage or rough wear		
3. Bearing cup	Insulation		page M-24
4. Adjusting screw	17. Spacer		
5. Bearing outer race	18. Drive pinion	Remove	page M-21
6. Locknut	Inspect splines and teeth for wear or damage		page M-22
7. Washer	Adjustment of height		page M-24
8. Comparison flange	Adjust		







\*1: The numbering (ex. ①) shows service procedure.

\*2: Units shown in N·m (m·kg, ft·lb) unless otherwise specified.



**SYMBOLS**

There are six symbols indicating oil, grease, and sealant. These symbols show the points of applying such materials during service.

Symbol	Meaning	Kind
	Apply oil	New engine oil or gear oil as appropriate
	Apply brake fluid	Only brake fluid
	Apply automatic transmission fluid	Only ATF
	Apply grease	Appropriate grease
	Apply sealant	Appropriate sealant
	Apply petroleum jelly	Appropriate petroleum jelly

35UGX-006

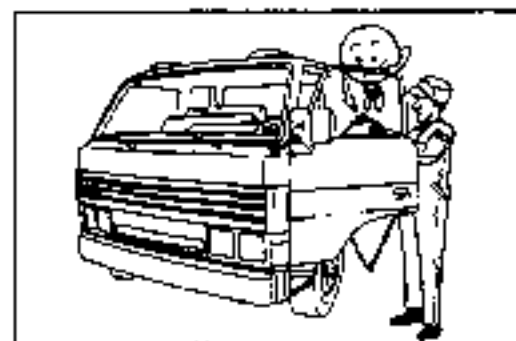
**Note**

- When special oil or grease is needed, this is shown in the illustration.

**NOTES, CAUTIONS, AND WARNINGS**

As you read through the procedures, you will come across **NOTES**, **CAUTIONS**, and **WARNINGS**. Each one is there for a specific purpose. **NOTES** give you **added information** that will help you to complete a particular procedure. **CAUTIONS** are given to prevent you from making an error that could **damage the vehicle**. **WARNINGS** remind you to be especially careful in those areas where carelessness can cause **personal injury**. The following list contains some general **WARNINGS** you should follow when you work on a vehicle.

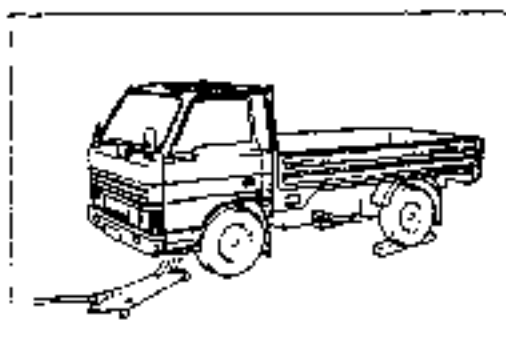
35UGX-006



5MUGX-037

**FUNDAMENTAL PROCEDURES****PROTECTION OF THE VEHICLE**

Always be sure to cover fenders, seats, and floor areas before starting work.



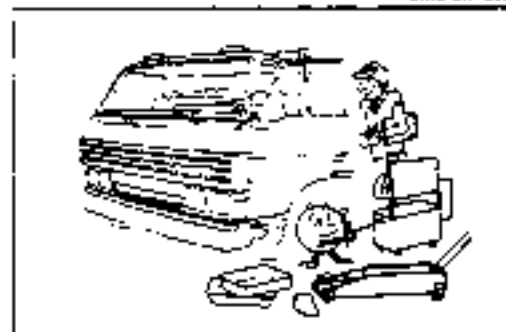
9MUGIX-003

**A WORD ABOUT SAFETY**

The following precautions must be followed when jacking up the vehicle.

1. Block the wheels.
2. Use only the specified jacking positions.
3. Support the vehicle with safety stands.

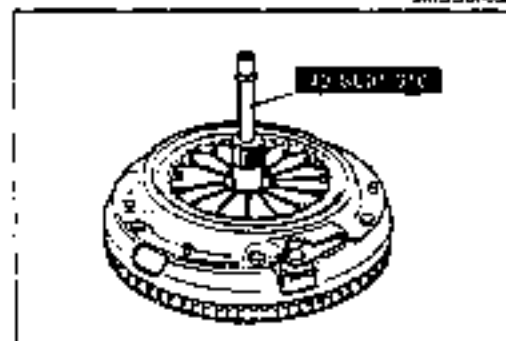
Start the engine only after making certain the engine compartment is clear of tools and people.



9MUGIX-008

**PREPARATION OF TOOLS AND MEASURING EQUIPMENT**

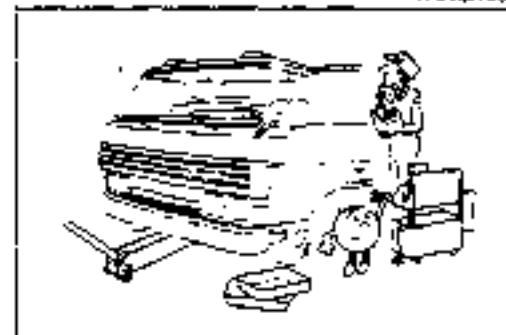
Be sure that all necessary tools and measuring equipment are available before starting any work.



9MUGIX-005

**SPECIAL TOOLS**

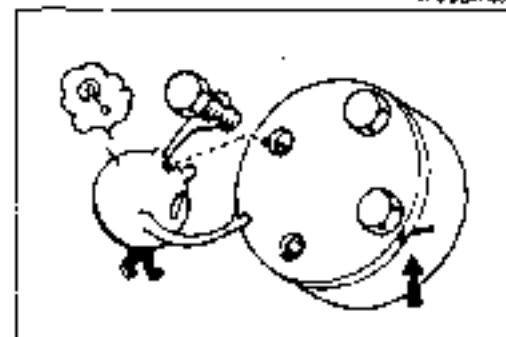
Use special tools when they are required.



9MUGIX-006

**REMOVAL OF PARTS**

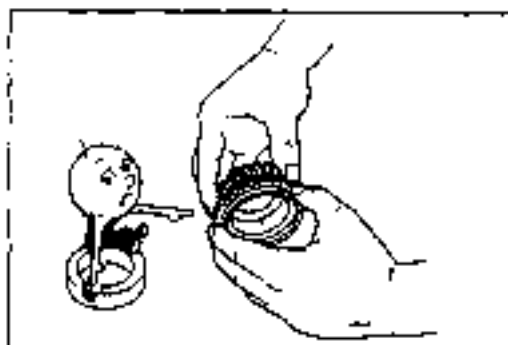
While correcting a problem, try also to determine its cause. Begin work only after first learning which parts and subassemblies must be removed and disassembled for replacement or repair.



9MUGIX-009

**DISASSEMBLY**

If the disassembly procedure is complex, requiring many parts to be disassembled, all parts should be disassembled in a way that will not affect their performance or external appearance and identified so that reassembly can be performed easily and efficiently.



9MUG X 040

### 1. Inspection of parts

When removed, each part should be carefully inspected for malfunctioning, deformation, damage, and other problems.

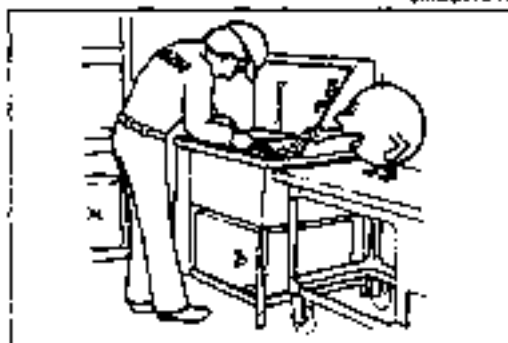


9MU3IK-061

### 2. Arrangement of parts

All disassembled parts should be carefully arranged for re-assembly.

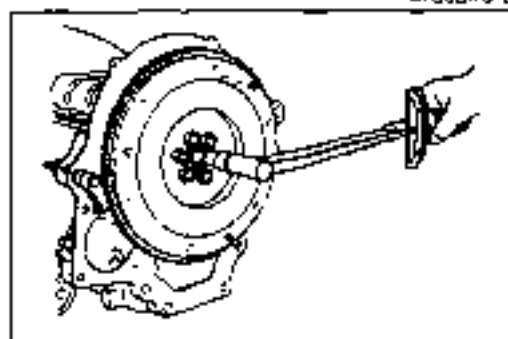
Be sure to separate or otherwise identify the parts to be replaced from those that will be reused.



47U05X-013

### 3. Cleaning parts for reuse

All parts to be reused should be carefully and thoroughly cleaned in the appropriate method.



9MUG X 004

### REASSEMBLY

Standard values, such as torques and certain adjustments, must be strictly observed in the reassembly of all parts.

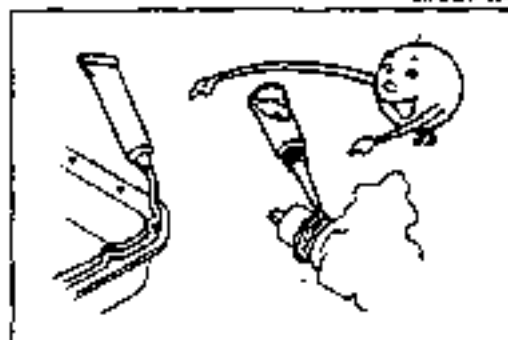
Refer to STANDARD BOLT AND NUT TIGHTENING TORQUE in Section TD for tightening torques not mentioned in the main text.

If removed, these parts should be replaced with new ones:

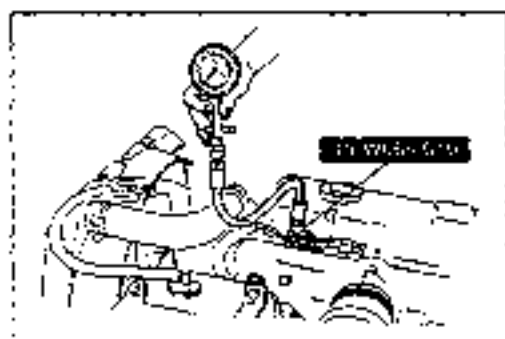
- |                |                 |
|----------------|-----------------|
| 1. Oil seals   | 2. Gaskets      |
| 3. O-rings     | 4. Lock washers |
| 5. Cotter pins | 6. Nylon nuts   |

Depending on location:

1. Sealant should be applied to gaskets
2. Oil should be applied to the moving components of parts
3. Specified oil or grease should be applied at the prescribed locations (such as oil seals) before reassembly.



9MU3IK-042



57U057-008

**ADJUSTMENTS**

Use suitable gauges and/or testers when making adjustments.



64U017-005

**RUBBER PARTS AND TUBING**

Prevent gasoline or oil from getting on rubber parts or tubing.

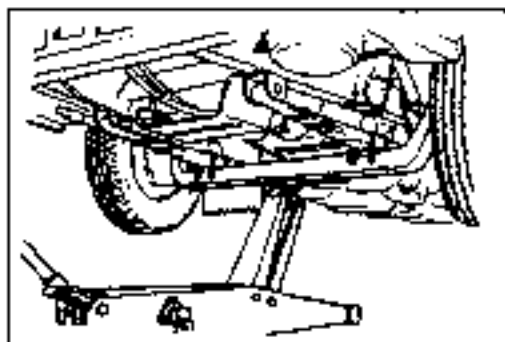
# GI JACK AND SAFETY STAND (RIGID RACK) POSITIONS

## JACK AND SAFETY STAND (RIGID RACK) POSITIONS

### FRONT END

#### Jack position:

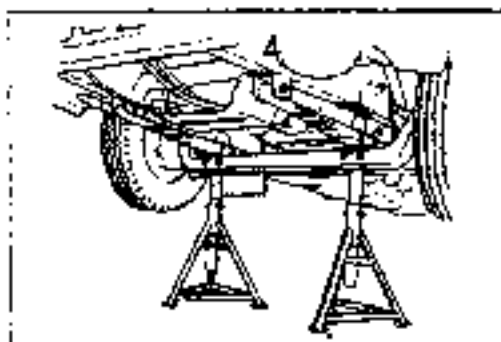
At the center of the front axle



9TFGIX-002

#### Safety stand positions:

On both sides of the front axle

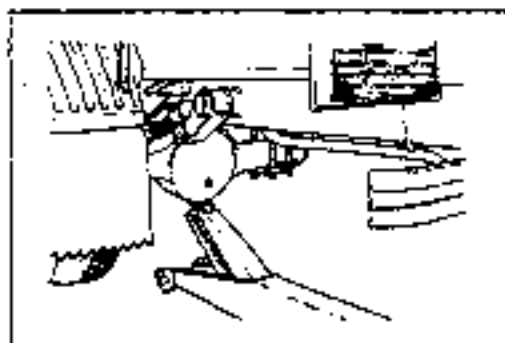


9TGGIX-003

### REAR END

#### Jack position

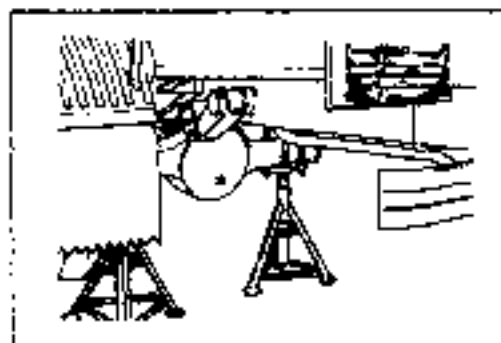
At the center of differential



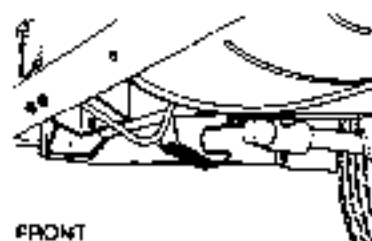
9TSGIX-005

#### Safety stand positions

Spring clamps at both sides of the differential

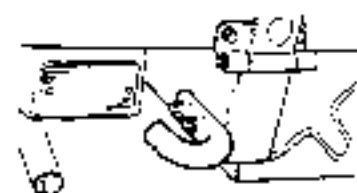


9TGGIX-007



FRONT

9TGG1X 008



REAR

9TGG1X 009

## TOWING

Proper towing equipment is necessary to prevent damage to the vehicle.

Laws and regulations applicable to vehicles in tow must always be observed.

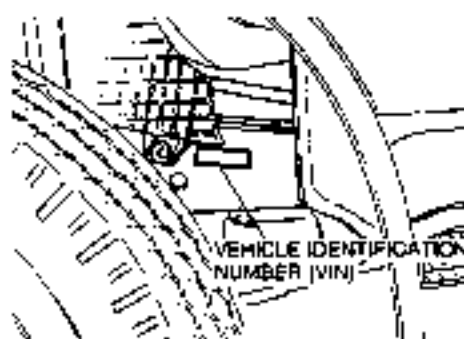
If the transmission, rear axle and steering system are not damaged, the vehicle may be towed on all four wheels. If they are damaged, use a towing dolly.

### Caution

- The gearshift lever must be set a **NEUTRAL**, the engine key in the "ACC" position and the parking brake released. Remember that power brake assist will not be available when the engine is inoperative.

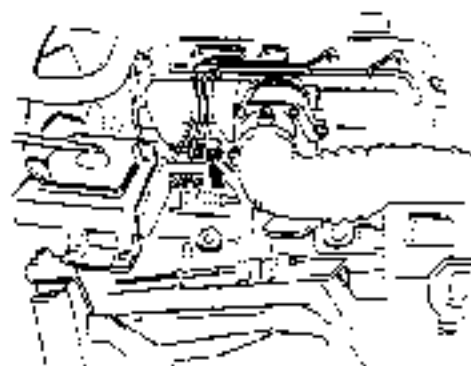
## IDENTIFICATION NUMBER LOCATIONS

### VEHICLE IDENTIFICATION NUMBER (VIN)

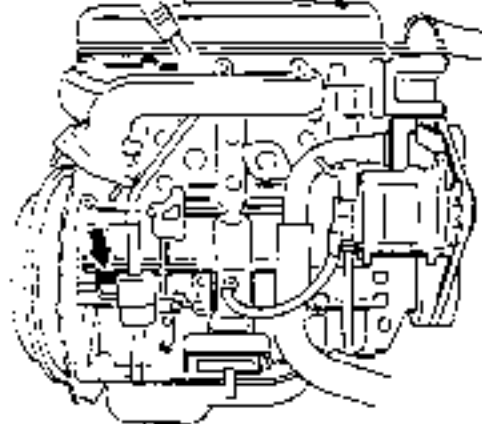


### ENGINE MODEL AND NUMBER

#### ENGINE NUMBER



#### ENGINE MODEL



## UNITS

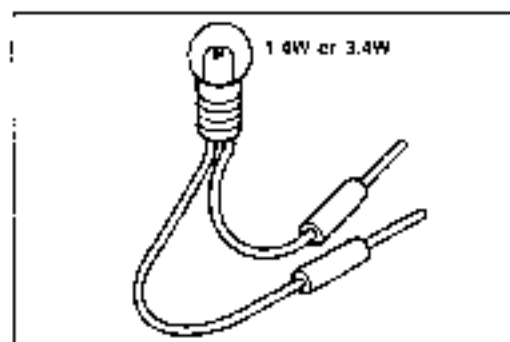
Nm (m·kg or cm·kg, ft·lb or in·lb) . . .	Torque
rpm . . . . .	Revolutions per minute
A . . . . .	Ampere(s)
V . . . . .	Volt(s)
$\Omega$ . . . . .	Ohm(s) (resistance)
kPa (kg/cm <sup>2</sup> , psi) . . . . .	Pressure (usually positive)
mmHg (cmHg) . . . . .	Pressure (usually negative)
W . . . . .	Watt
liters (US qt, Imp qt) . . . . .	Volume
mm (in) . . . . .	Length
$\mu$ F . . . . .	Electric capacity
°C . . . . .	Centigrade
°F . . . . .	Fahrenheit
T . . . . .	Ton
ft . . . . .	Feet

97G11X-011

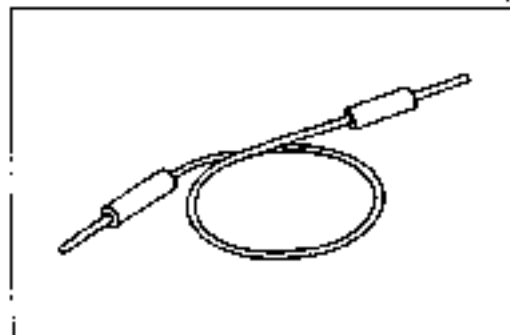
## ABBREVIATIONS

ABDC . . . . .	After bottom dead center
ACC . . . . .	Accessories
ASSY . . . . .	Assembly
ATDC . . . . .	After top dead center
ATF . . . . .	Automatic transmission fluid
BBDc . . . . .	Before bottom dead center
B7DC . . . . .	Before top dead center
CAB . . . . .	Cabin
ECU . . . . .	Engine control unit
ELR . . . . .	Emergency locking retarder
EX . . . . .	Exhaust
FIG . . . . .	Figure
IGN . . . . .	Ignition
IN . . . . .	Intake
INT . . . . .	Intermittent
LH . . . . .	Left hand
M . . . . .	Motor
MAX . . . . .	Maximum
MIN . . . . .	Minimum
OFF . . . . .	Switch off
OHV . . . . .	Overhead valve
ON . . . . .	Switch on
PCV . . . . .	Positive crankcase ventilation
P/S . . . . .	Power steering
PTC . . . . .	Positive temperature coefficient
QSS . . . . .	Quick start system
RH . . . . .	Right hand
Sec . . . . .	Second(s)
SS1 . . . . .	Special service tool
ST . . . . .	Start
SW . . . . .	Switch
TDC . . . . .	Top dead center

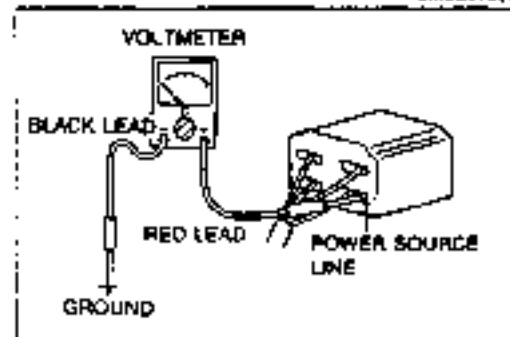
97G11X-008



9T5GIX-019



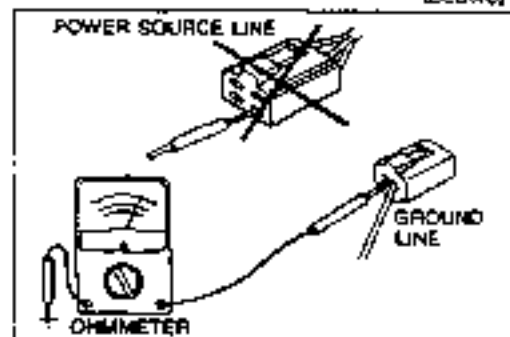
9HJ3GIX-020



5MUGIX-021



05L3IX-021



9WU3IX-065

## CAUTION

## ELECTRICAL TROUBLESHOOTING TOOLS

## Test Light

The test light, as shown in the figure, uses a 12V bulb. The two lead wires should be connected to probes.

The test light is used for simple voltage checks and for checking for short circuits.

## Caution

- When checking the control unit, never use a bulb over 3.4W.

## Jumper Wire

The jumper wire is used for testing by shunting across switch terminals and ground connections.

## Caution

- Do not connect a jumper wire from the power source line to a body ground; this may cause burning or other damage to harnesses or electronic components.

## Voltmeter

The DC voltmeter is used to measure of circuit voltage. A voltmeter with a range of 15V or more is used by connecting the positive (+) probe (red lead wire) to the point where voltage is to be measured and the negative (-) probe (black lead wire) to a body ground.

## Diagnosis Connector

Insert the probe into the service hole when connecting a jumper wire to the diagnosis connector.

## Caution

- Do not insert the jumper wire probe into the diagnosis connector terminal, which may damage the terminal.

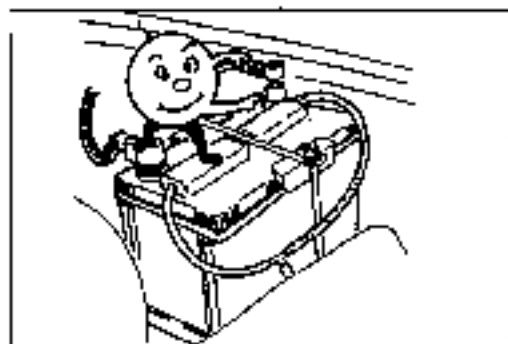
## Ohmmeter

The ohmmeter is used to measure the resistance between two points in a circuit and also to check for continuity and diagnosis of short circuits.

## Caution

- Do not attempt to connect the ohmmeter to any circuit to which voltage is applied; this may burn or otherwise damage the ohmmeter.

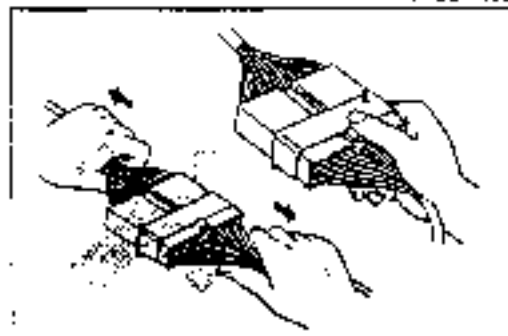




9MLGK022

**CAUTION WITH ELECTRICAL PARTS****Battery Cable**

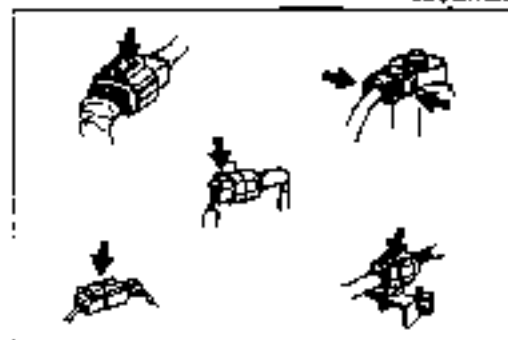
Before disconnecting connectors or replacing electrical parts, disconnect the negative battery cable.



9MLGK023

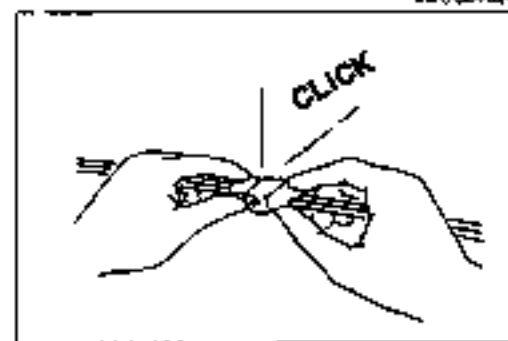
**Connectors****Removal of connector**

Never pull on the wiring harness when disconnecting connectors.



9MLGK024

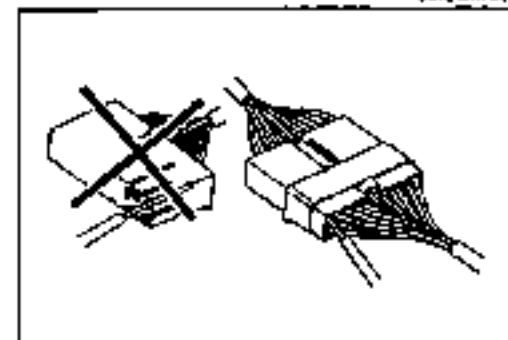
Connectors can be removed by pressing or pulling the lock lever as shown.



9MLGK025

**Locking of connector**

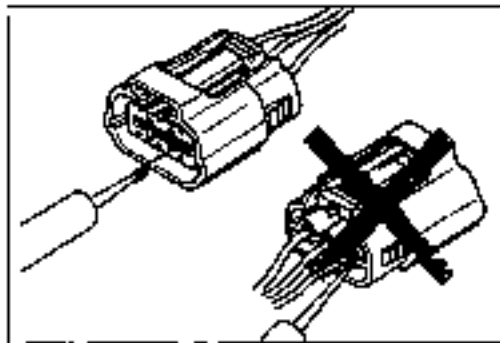
When locking connectors, make sure to listen for a click that will indicate they are securely locked.



03JGK011

**Inspection**

1. When a tester is used to check for continuity or to measure voltage, insert the tester probe from the wire harness side.

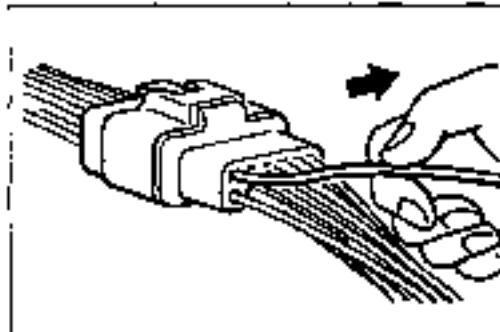


DSUGX-C28

2. Check the terminals of waterproof connectors from the connector side, as they cannot be accessed from the wire harness side.

**Caution**

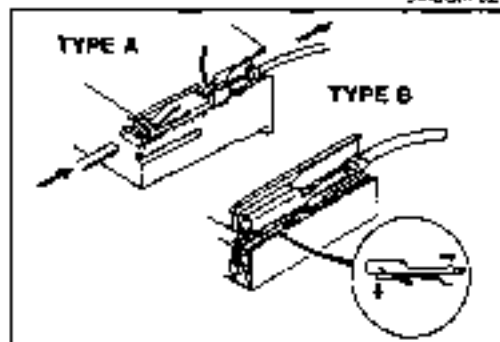
- Use fine wire to prevent damage to the terminal.
- Do not damage the terminal when inserting the tester lead.



SMUGIX-027

**Terminals Inspection**

Pull lightly on individual wires to check that they are secured in the terminal.



SMUGIX-028

**Replacement of terminals**

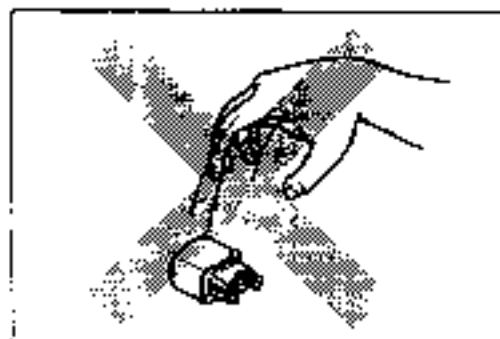
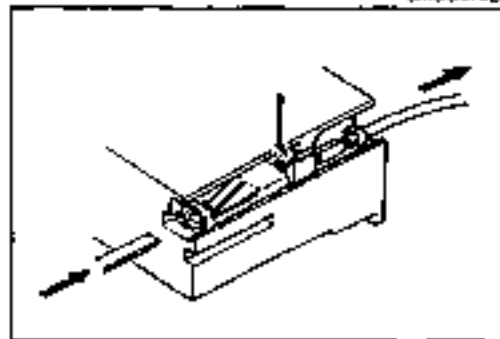
Use the appropriate tools to remove the terminal as shown. When installing the terminal, be sure to insert it until it locks securely.

**< Female >**

Insert a thin piece of metal from the terminal side of the connector, and then, with the terminal locking tab pressed down, pull the terminal out from the connector.

**< Male >**

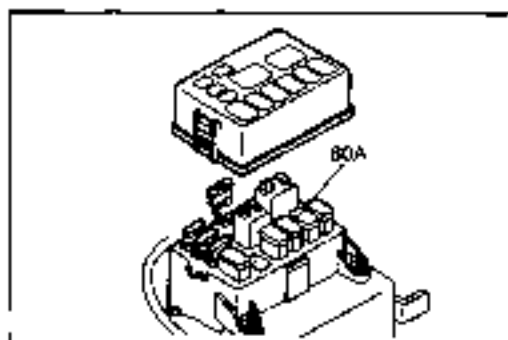
Same as the female type.



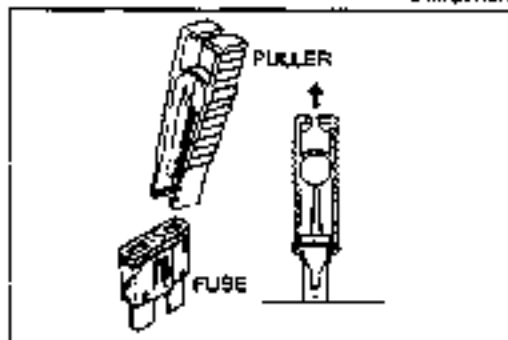
SMUGIX-030

**Sensors, Switches, and Relays**

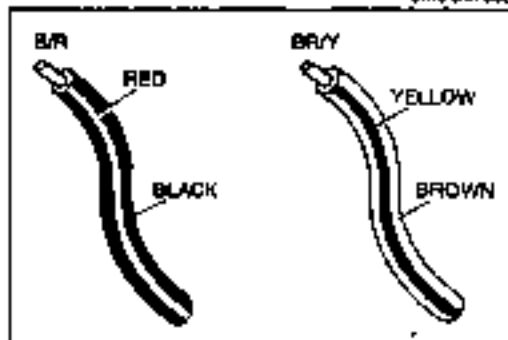
Handle sensors, switches, and relays carefully. Do not drop them or strike them against other parts.



94WJG0X.051



94WJG0X.052



94WJG0X.079

### Fuse Replacement

- When replacing a fuse, be sure to replace it with one of specified capacity.  
If a fuse again fails after it has been replaced, the circuit probably has a short circuit and the wiring should be checked.
- Be sure the negative battery terminal is disconnected before replacing a main fuse (80A).
- When replacing a pullout fuse, use the fuse puller supplied in the fuse box cover.

### Wiring Harness Wiring color codes

Two-color wires are indicated by a two-color code symbol. The first letter indicates the base color of the wire and the second the color of the stripe.

CODE	COLOR	CODE	COLOR
B	Black	O	Orange
BR	Brown	P	Pink
G	Green	R	Red
GY	Gray	V	Violet
L	Blue	W	White
LB	Light Blue	Y	Yellow
LG	Light Green	—	—

### INSTALLATION OF MOBILE TWO-WAY RADIO SYSTEM

If a mobile two-way radio system is installed improperly or if a high-powered type is used, the control unit may be affected.

When the vehicle is to be equipped with a mobile two-way radio, observe the following precautions:

- Install the antenna at the farthest point from control units.
- Install the antenna feeder as far as possible from the control unit harnesses (at least 30 cm [11.8 in]).
- Ensure that the antenna and feeder are properly adjusted.
- Do not install a high-powered mobile two-way radio system.

5T356X-314

# **PRE-DELIVERY INSPECTION AND SCHEDULED MAINTENANCE**

<b>PRE-DELIVERY INSPECTION TABLE .....</b>	<b>A- 2</b>
<b>SCHEDULED MAINTENANCE SERVICES..</b>	<b>A- 3</b>

0700AX-101

## PRE-DELIVERY INSPECTION TABLE

**1. EXTERIOR**

• **INSPECT** and **ADJUST**, if necessary, the following items to the specifications.

- Glass, exterior bright metal and paint for damage or rust
- Wheel lug nuts
- Tire pressures
- All weatherstrips for damage or detachment
- Operation of lift cab lock lever
- Door operation and alignment

• **INSTALL** the following parts:

- Outside rearview mirror(s)

**2. UNDER HOOD—ENGINE OFF**

• **INSPECT** and **ADJUST**, if necessary, the following items to the specifications:

- Fuel, coolant and hydraulic lines, fittings, connections and components for leaks
- Battery electrolyte level and specific gravity
- Engine oil level
- Oil level in steering gearbox (Manual steering)
- Power steering fluid level (if equipped)
- Brake and clutch master cylinder fluid levels
- Windshield washer reservoir fluid level
- Glow plugs (if equipped)
- Radiator coolant and specific gravity
- Tightness of water hose clamps (including heater hoses)
- Tightness of battery terminals
- Drive belt tensions
- Accelerator cable and linkage for free movement

**3. INTERIOR**

• **INSTALL** the following parts.

- Fuse for accessories

• **CHECK** the operations of the following items:

- Seat controls
- Seat belts and warning system (if equipped)
- Door locks
- Ignition switch and steering lock
- All lights including warning and indicator lights (if equipped)
- Warning buzzers (if equipped)
- Horn, windshield wipers and washers (if equipped)
- Radio and antenna (if equipped)
- Cigarette lighter and clock (if equipped)
- Fit Steering (if equipped)
- Heater, defroster and air conditioner at various modes (if equipped)

• **ADJUST** antenna trimmer on radio (if equipped)

**INTERIOR (cont'd)**

• **CHECK** the following items.

- Presence of spare fuse
- Upholstery and interior finish

• **CHECK** and **ADJUST**, if necessary, the following items:

- Operation and fit of windows
- Pedal height and free play of brake and clutch pedals
- Parking brake

**4. UNDER HOOD—ENGINE RUNNING AT OPERATING TEMPERATURE**

• **CHECK** the following items.

- Operation of cold start device (if equipped)
- Idle speed
- Injector timing

**5. ON HOIST**

• **CHECK** the following items:

- Rear axle oil level
- Underside fuel, coolant and hydraulic lines, fittings, connections and components for leaks
- Tires for cuts or bruises
- Steering linkage, suspension, exhaust system and all underside hardware for looseness or damage
- Tightness of cargo rack installation bolts

**6. ROAD TEST**

• **CHECK** the following items.

- Brake operation
- Clutch operation
- Steering control
- Operation of meters and gauges
- Squeaks, rattles or unusual noise
- Engine general performance
- Emergency locking retractors (if equipped)

**7. AFTER ROAD TEST**

• **REMOVE** seat and floor mat protective covers

• **CHECK** for necessary owner's information material, tools and spare tire in vehicle

97F04K-001

**SCHEDULED MAINTENANCE SERVICES**

**MAINTENANCE TABLE (General RHD Models)**

**Chart Symbols**

- I: Inspect and if necessary correct, clean, or replace
- A: Adjust
- R: Replace or change
- T: Tighten
- L: Lubricate
- C: Clean

- After 60,000 km (36,000 miles), continue to follow the prescribed maintenance items at the recommended intervals.
- For items marked \* in this maintenance chart, please pay attention to these points.
  - \*1 If the vehicle is operated under the following conditions, it is suggested that the engine oil and oil filter be changed more frequently.
    - a) Driving in dusty conditions
    - b) Extended periods of idling or low-speed operation
    - c) Driving for a prolonged period in cold temperatures, or driving short distances only
  - \*2 If the vehicle is operated in very dusty or sandy areas, clean or replace more often than at usual recommended intervals.
  - \*3 See page A-21 for detailed information.

**Emission Control and Related Systems**

The ignition and fuel systems are vitally important to the proper operation of the emissions control and related systems, as well as for efficient engine operation. It is strongly recommended that all servicing related to these systems be done by your Authorized Mazda Dealer.

97F003-002

Maintenance Interval	Kilometers (miles)															
	x1,000 km (x1,000 miles)	1	5	10	15	20	25	30	35	40	45	50	55	60		

**Engine**

Engine valve clearance		I		I		I		I		I		I		I
Cylinder head bolts	HA engine	T				T				T				T
Intake and exhaust manifold		T				T				T				T
Drive belts		A	I	I	I	I	I	I	I	I	I	I	I	I
Engine oil *1	HA and SL engine	R		R		R		R		R		R		R
	SL Turbo engine	R	R	R	R	R	R	R	R	R	R	R	R	R
Oil filter *1		R		R		R		R		R		R		R
Oil bypass filter	HA and SL engine					R				R				R
	SL Turbo engine			R		R		R		R		R		R

**Cooling System**

Cooling system	I		I		I		I		I		I		I
Engine coolant													(R) every 12 months

# A SCHEDULED MAINTENANCE SERVICES

## MAINTENANCE TABLE (Cont'd)

Maintenance Interval	Kilometers (miles)													
	x1,000 km	1	5	10	15	20	25	30	35	40	45	50	55	60
	(x1,000 miles)	0.6	3	6	9	12	15	18	21	24	27	30	33	36

### Fuel System

Fuel lines															
Fuel filter									R						R
Air cleaner element**									R						R

### Injection System

Injection timing	(I) every 40,000 km (24,000 miles)														
Injection nozzle															

### Electrical System

Battery electrolyte level and specific gravity															
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

### Chassis and Body

Brake and clutch lines and connections															
Brake fluid**										R					
Clutch fluid										R					
Brake and clutch pedals															
Drum brake															
Power brake unit and hoses															
Vacuum tank and hoses (Diesel)															
Parking brake															
Manual steering gear oil															
Steering operation and gear housing															
Power steering fluid and lines (if equipped)															
Manual transmission oil	R				R					R					R
Transmission linkage & cables															
Rear axle oil	R				R					R					R
Propeller shaft					L					L					L
Knockin oil															
Wheel bearing grease						R				R					R
Wheel nuts	T		T		T					T		T			T
Bolts and nuts on chassis and body	T				T					T					T
Steering linkage					L					L					L

## MAINTENANCE TABLE (Australia Models)

### Chart Symbols

- I: Inspect and if necessary correct, clean, or replace
- A: Adjust
- R: Replace or change
- T: Tighten
- L: Lubricate
- C: Clean

- After 60,000 km (36,000 miles) or 36 months, continue to follow the prescribed maintenance items at the recommended intervals.
- For items marked \* in this maintenance chart, please pay attention to these points.

- \*1 If the vehicle is operated under the following conditions, it is suggested that the engine oil and oil filter be changed more frequently.
  - a) Driving in dusty conditions
  - b) Extended periods of idling or low-speed operation
  - c) Driving for a prolonged period in cold temperatures, or driving short distances only
- \*2 If the vehicle is operated in very dusty or sandy areas, clean or replace more often than at usual recommended intervals.
- \*3 See page A-21 for detailed information.

### Emission Control and Related Systems

The ignition and fuel systems are vitally important to the proper operation of the emissions control and related systems, as well as for efficient engine operation. It is strongly recommended that all servicing related to these systems be done by your Authorized Mazda Dealer.

SF1042-300

Maintenance Interval	Number of months or km, whichever comes first													
	x1,000 km	1.5	5	10	15	20	25	30	35	40	45	50	55	60
	Months	—	—	6	—	12	—	18	—	24	—	30	—	36
Maintenance Item														

### Engine

Engine valve clearance		I	I			I				I			I	
Drive belts		A	I	I	I		I	I	I	I	I	I	I	I
Engine oil*	SL engine	R		R		R		R		R		R		R
	SL Turbo and TF engine	P	R	R	R	R	R	R	R	R	R	R	R	R
Oil filter**	SL engine	R		R		R		R		R		R		R
	SL Turbo engine													
	TF engine	R	R	R	R	R	R	R	R	R	R	R	R	R
Oil bypass filter	SL engine					R				R				R
	SL Turbo engine			R		R		R		R		R		R
	TF engine				R			R			R			R

### Cooling System

Cooling system	I		I			I				I			I	
Engine coolant														(R) every 12 months

### Fuel System

Fuel lines	I		I			I				I			I	
Fuel filter									R					R
Air cleaner element**									R					R





## SCHEDULED MAINTENANCE SERVICES

## MAINTENANCE TABLE (Cont'd)

Maintenance interval	Number of months or km, whichever comes first													
	x1,000 km	1.5	5	10	15	20	25	30	35	40	45	50	55	60
	Months	—	—	6	—	12	—	18	—	24	—	30	—	36

## Injection System

Injection timing	) every 40,000 km													
Injection nozzle														

## Electrical System

Battery electrolyte level and specific gravity														
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

## Chassis and Body



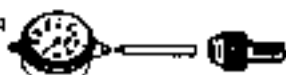
Brake and clutch lines and connections														
Brake fluid <sup>*)</sup>									R					
Clutch fluid									R					
Brake and clutch pedals														
Drum brake														
Power brake unit and hoses														
Vacuum tank and hoses														
Parking brake														
Manual steering gear oil														
Steering operation and gear housing														
Power steering fluid and lines (if equipped)														
Manual transmission oil	P					R			R					R
Transmission linkage & cables														
Rear axle oil	R					R			R					R
Propeller shaft						L			L					L
Kingpin oil														
Wheel bearing grease						R			R					R
Wheel nuts	T					T			T					T
Bolts and nuts on chassis and body						T			T					T
Steering linkage						L			L					L

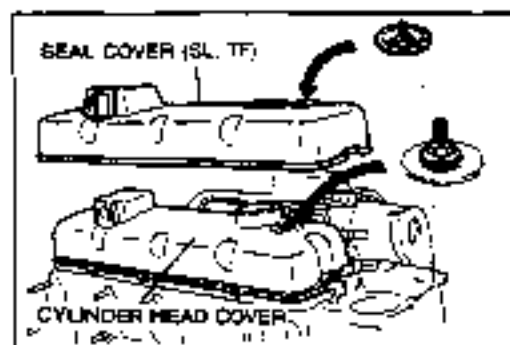


## SCHEDULED MAINTENANCE SERVICES

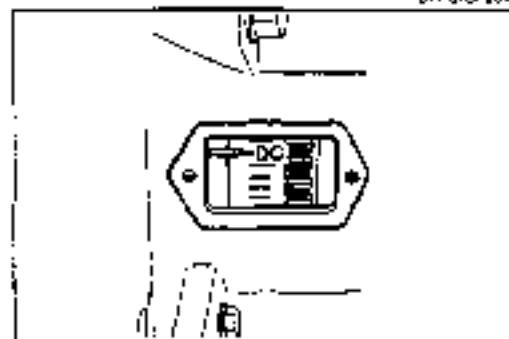
### Preparation

#### SST

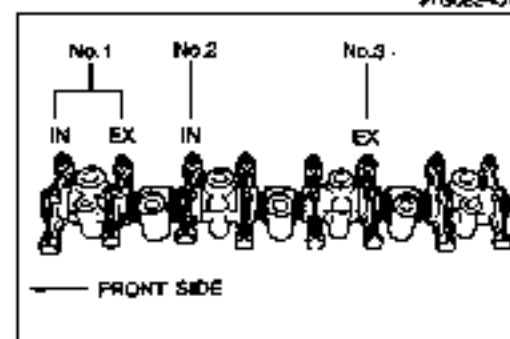
49 9200 020 Tension gauge, V-ribbed belt		For inspection of belt tension	49 9200 145 Radiator cap tester adapter set		For inspection of cooling system
49 5140 074 Cam lift measuring device		For inspection of injection timing	9T60AX-002		



9T60AX-004



9T60B2-457



5T60B2 019

### ADJUSTMENT OF ENGINE VALVE CLEARANCE

1. Remove the air intake pipe (SL Turbo).
2. Remove the seal cover (SL, TF) and the cylinder head cover.
3. Remove the cover from the clutch housing (HA, SL) or from the end plate (TF).

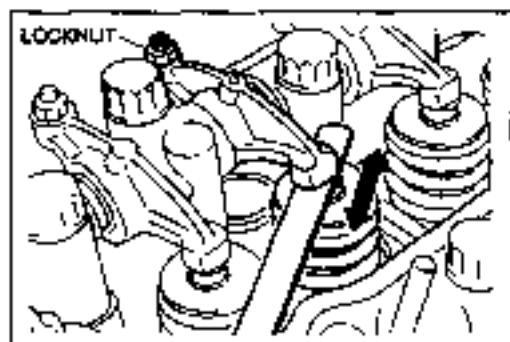
4. Turn the crankshaft clockwise and set the No.1 cylinder to compression TDC.

5. Measure the valve clearances as shown in the figure.

#### Valve clearance (Engine cold)

mm (in)

	IN	EX
HA	0.30 (0.012)	0.30 (0.012)
SL	0.30 (0.012)	0.35 (0.014)
TF	0.30 (0.012)	0.40 (0.016)

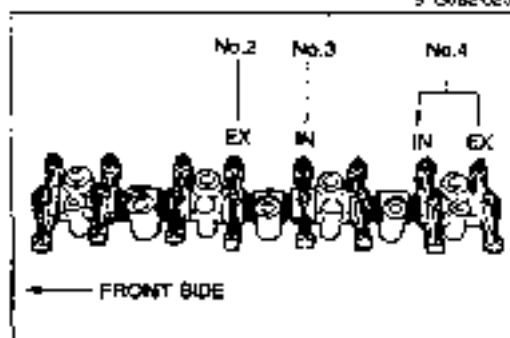


9TGOB2-023

6. If necessary, loosen the locknut and adjust the valve clearance by turning the adjusting screw.
7. Tighten the locknut.

**Tightening torque:**

12—17 N·m (120—170 cm·kg, 104—148 in·lb)



9TGOB2-027

8. Turn the crankshaft clockwise one full turn and set the No. 4 cylinder to compression TDC.
9. Measure the remaining valve clearances as shown in the figure.

10. Install the cover.
11. Install the cylinder head cover.

**Tightening torque:**

2.0—3.4 N·m (20—35 cm·kg, 17—30 in·lb)



9TGOB2-029

12. Install the seal cover (SL, TF).

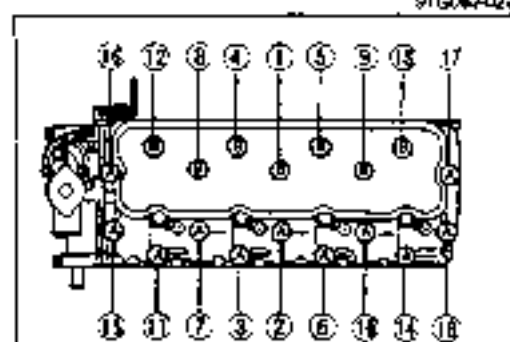
**Tightening torque:**

2.9—4.9 N·m (30—50 cm·kg, 26—43 in·lb)

13. Install the air intake pipe (SL Turbo)

**Tightening torque:**

7.8—11 N·m (80—110 cm·kg, 69—95 in·lb)



9TFOA1-005

**TIGHTENING OF CYLINDER HEAD BOLTS****Note (SL, TF)**

- The cylinder head bolts are pliant type bolt. Therefore retightening after installation is not necessary.

**HA**

1. Tighten the cylinder head bolts in the order shown in the figure.

**Tightening torque:**

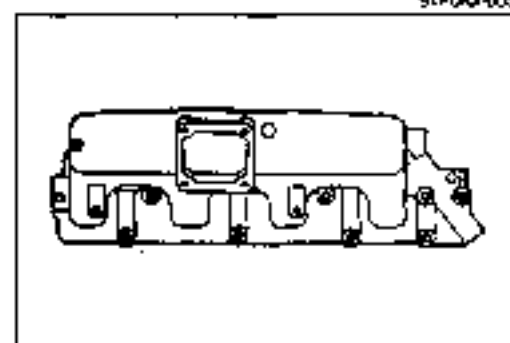
116—123 N·m (11.6—12.5 m·kg, 85—90 ft·lb)

**TIGHTENING OF INTAKE MANIFOLD****Tightening torque:**

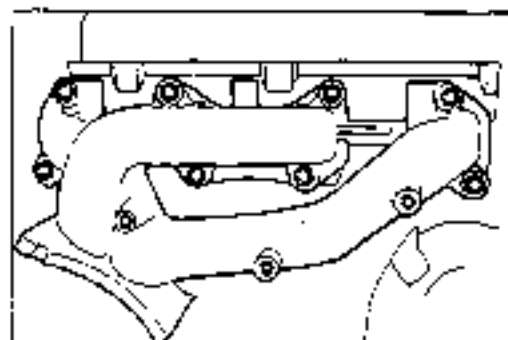
HA: 22—30 N·m (2.2—3.1 m·kg, 16—22 ft·lb)

SL: 16—24 N·m (1.6—2.4 m·kg, 12—17 ft·lb)

TF: 19—23 N·m (1.9—2.3 m·kg, 14—17 ft·lb)



9TFOA1-005



BT704X-007

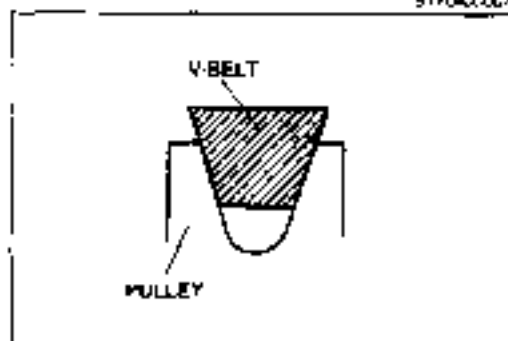
**TIGHTENING OF EXHAUST MANIFOLD**

Tightening torque:

HA: 26—32 Nm (2.7—3.3 m·kg, 20—24 ft·lb)

SL: 23—26 Nm (2.3—2.7 m·kg, 17—20 ft·lb)

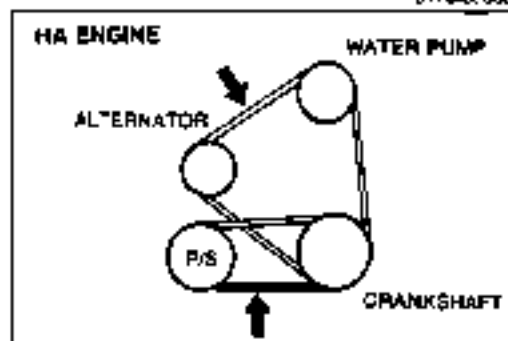
TF: 44—48 Nm (4.5—4.9 m·kg, 33—35 ft·lb)



BT704X-008

**INSPECTION AND ADJUSTMENT OF DRIVE BELTS**  
**Inspection**

1. Remove the undercover for inspection of the P/S belt.
2. Check the drive belts for wear, cracks, and fraying. Replace if necessary.
3. Verify that the drive belts are correctly mounted on the pulleys.



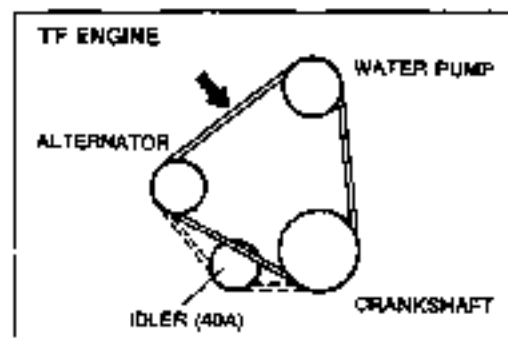
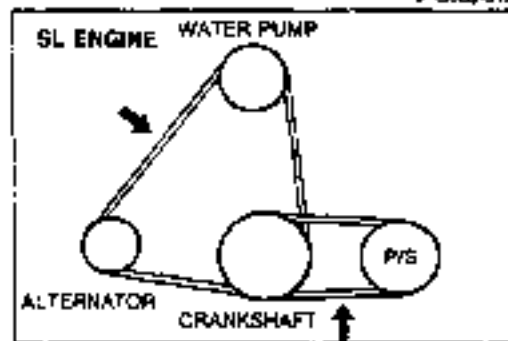
BT704X-012

4. Check the drive belt deflection by applying moderate pressure (98 N, 10 kg, 22 lb) midway between the pulleys as shown. Adjust if necessary.

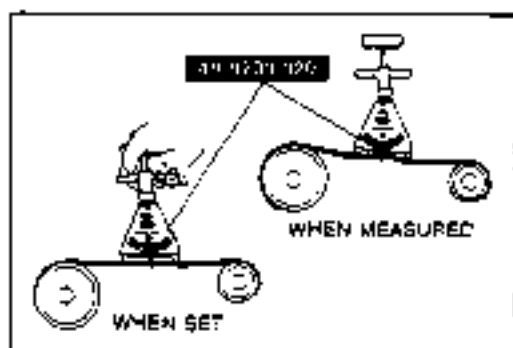
**Deflection**

mm (in)

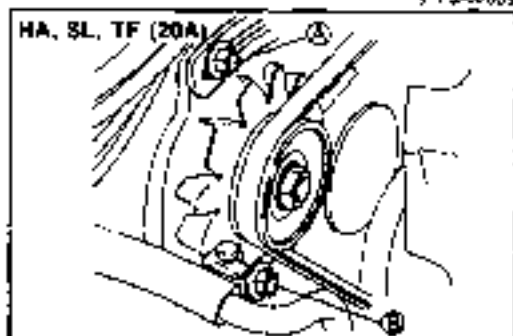
		New	Used
HA	Alternator	9.0—10.0 (0.35—0.39)	13.0—11.0 (0.39—0.43)
	P/S	9.0—11.0 (0.35—0.43)	12.0—13.0 (0.47—0.51)
SL	Alternator	9.0—10.0 (0.35—0.39)	13.0—11.0 (0.39—0.43)
	P/S	9.0—11.0 (0.35—0.43)	12.0—13.0 (0.47—0.51)
TF	Alternator	10.0—11.0 (0.39—0.43)	11.0—12.0 (0.43—0.47)



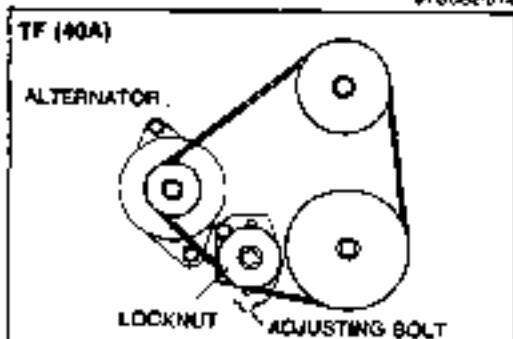
# A SCHEDULED MAINTENANCE SERVICES



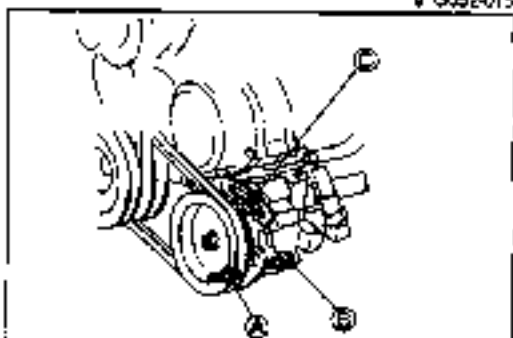
5TF3AG-005



9TF60B2-014



9TF60B2-015



8TF6AX-C10

5. Check the drive belt tension with the **SST**.

## Tension

N (kg, lb)

		New	Used
HA	Alternator	294—392 (30—40 66—88)	245—294 (25—30 55—66)
SL	Alternator	392—491 (40—50 88—110)	343—392 (35—40 77—88)
TF	Alternator	451—520 (46—53 101—117)	383—520 (39—52 86—117)

## Adjustment

### Caution

- If a new belt is used, adjust the belt deflection at the midpoint of new belt specification.

1. Alternator belt

(i) HA, SL, TF (20A)

Loosen alternator bolts A and B and adjust the belt deflection.

### Tightening torque:

**A:** 19—25 Nm (1.9—2.6 m·kg, 14—19 ft·lb)

**B:** 37—52 Nm (3.8—5.3 m·kg, 27—38 ft·lb)

(ii) TF (40A)

Loosen the locknut and adjust the belt deflection by turning the adjusting bolt.

### Tightening torque:

**37—52 Nm (3.8—5.3 m·kg, 27—38 ft·lb)**

2. P/S belt

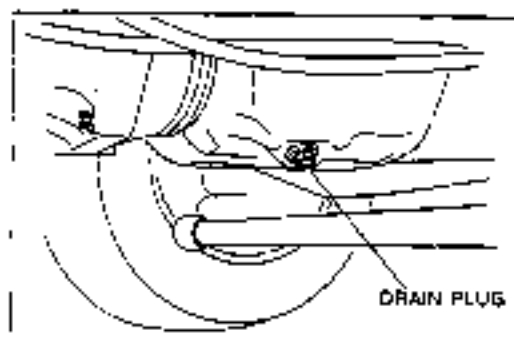
Loosen P/S oil pump bolts A, B, and C and adjust the belt deflection.

### Tightening torque:

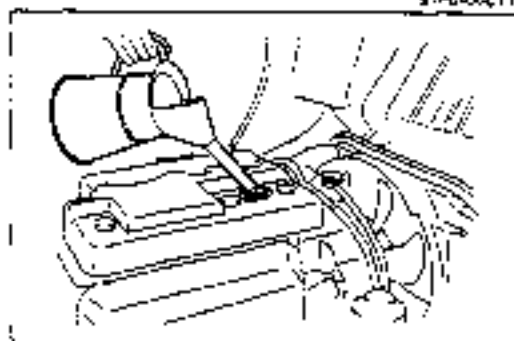
**A:** 37—52 Nm (3.8—5.3 m·kg, 27—38 ft·lb)

**B:** 37—52 Nm (3.8—5.3 m·kg, 27—38 ft·lb)

**C:** 37—52 Nm (3.8—5.3 m·kg, 27—38 ft·lb)



9TFC0X-011



9TFC0X-012

## REPLACEMENT OF ENGINE OIL

### Warning

- Be careful when draining; the oil is hot.

1. Warm up the engine to normal operating temperature and stop it.
2. Remove the oil filler cap and the oil pan drain plug.
3. Drain the oil into a suitable container.
4. Install a new gasket and the drain plug.

### Tightening torque:

29—41 N·m (3.0—4.2 m·kg, 22—30 ft·lb)

5. Refill the engine with the specified type and amount of engine oil.

### Oil pan capacity

HA, SL: 6.5 liters (6.9 US qt, 5.7 Imp qt)

TF: 7.0 liters (7.4 US qt, 6.2 Imp qt)

### Note

- The distance between the L and F marks on the level gauge represents 2.0 liters (2.11 US qt, 1.76 Imp qt).

6. Refit the oil filler cap.
7. Run the engine and check for leaks.
8. Stop the engine and check the oil level. Add oil if necessary.

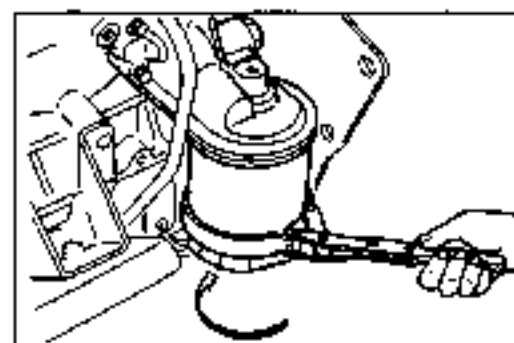
9TFC0X-017

## Recommended SAE Viscosity

Temperature	°C									
	-30	-20	-10	0	10	20	30	40	50	
	°F									
	-20	0	20	40	60	80	100	120		
Engine oil	30									
	40									
	10W-30									

05U3DX-004

Anticipated ambient temperature range before succeeding oil change. °C (°F)



9TFC0X-012

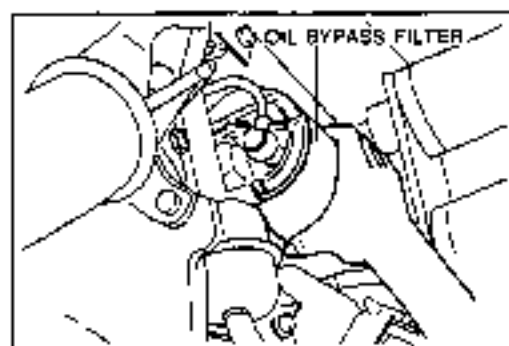
## REPLACEMENT OF OIL FILTER

1. Remove the oil filter with a suitable wrench.
2. Use a clean rag to wipe off the mounting surface on the engine.
3. Apply a small amount of clean engine oil to the rubber seal of the new filter.
4. Install the oil filter and tighten it by hand until the rubber seal contacts the base.
5. Tighten the filter 1/2 turn with a filter wrench.
6. Start the engine and check for leaks.
7. Check the oil level and add oil if necessary.

Oil filter capacity: 1.0 liter (1.06 US qt, 0.88 Imp qt)



## A SCHEDULED MAINTENANCE SERVICES



9TFCAX-013

### REPLACEMENT OF OIL BYPASS FILTER

1. Remove the oil bypass filter with a suitable wrench.
2. Use a clean rag to wipe off the mounting surface on the engine.
3. Apply a small amount of clean engine oil to the rubber seal of the new filter.
4. Install the oil bypass filter and tighten it by hand.
5. Start the engine and check for leaks.
6. Check the oil level and add oil if necessary.

#### Oil bypass filter capacity:

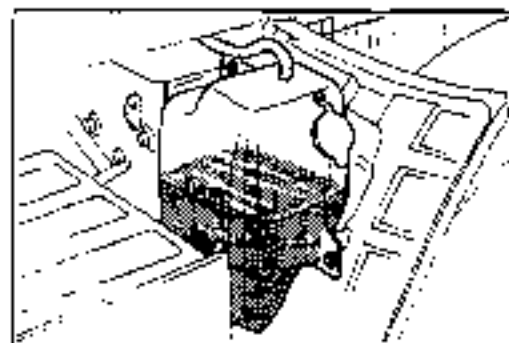
0.6 liter (0.63 US qt, 0.53 imp qt)

### INSPECTION OF COOLING SYSTEM

#### Warning

- Never remove the radiator cap while the engine is hot.
- Wrap a thick cloth around the cap before removing it.
- When removing the radiator cap, loosen it slowly to the first stop until the pressure in the radiator is released, and then remove it.

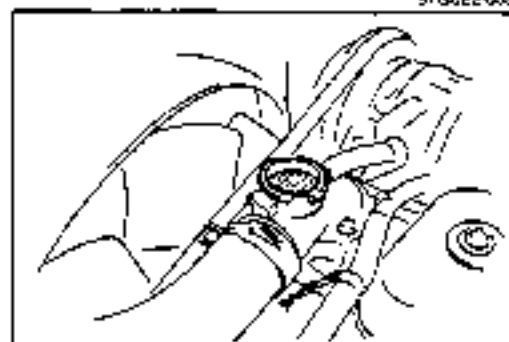
9TFBAX-014



9TGC02-008

#### Coolant level (Engine cold)

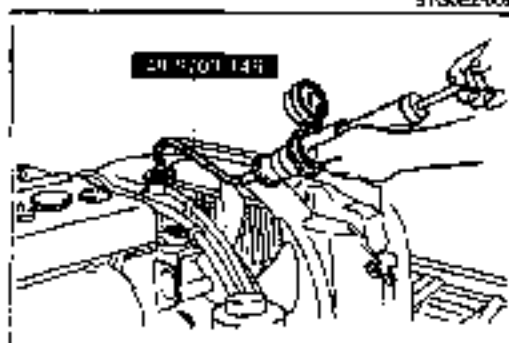
1. Verify that the coolant level is near the coolant inlet port.
2. Verify that the coolant level in the coolant reservoir is between the FULL and LOW marks. Add coolant if necessary.



9TGC02-009

#### Coolant quality

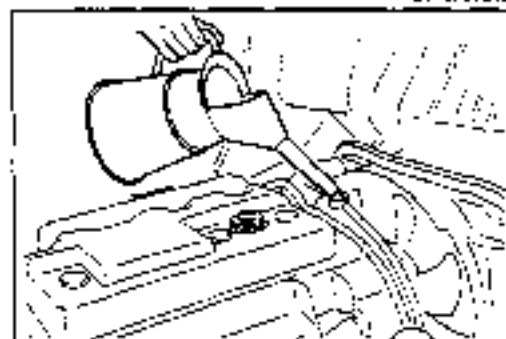
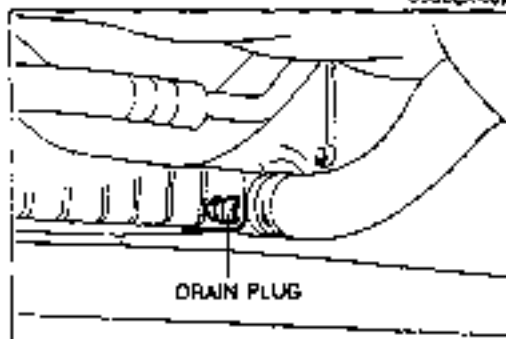
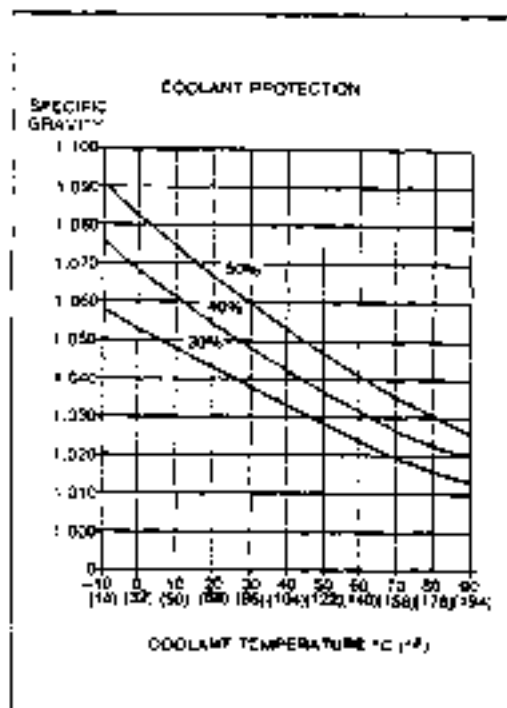
1. Verify that there is no buildup of rust or scale around the radiator cap or coolant inlet port.
2. Verify that coolant is free of oil.  
Replace the coolant if necessary.



9TGC02-010

#### Coolant leakage

1. Connect a radiator tester (commercially available) and the SST to the coolant inlet port.
2. Apply 88 kPa (0.9 kg/cm<sup>2</sup>, 13 psi) pressure to the system.
3. Verify that the pressure is held.  
If not, check for coolant leakage.



### Coolant Protection

#### Caution

- Do not use alcohol- or methanol-based coolant.
- Use only soft (demineralized) water in the coolant mixture.

1. Measure the coolant temperature and specific gravity with a thermometer and a hydrometer.
2. Determine the coolant protection by referring to the graph shown.

If the coolant protection is not proper, add water or coolant.

### Antifreeze solution mixture percentage

Coolant protection	Volume percentage (%)		Gravity at 20°C (68°F)
	Water	Coolant	
Above -18°C (3°F)	65	35	1.054
Above -28°C (-15°F)	55	45	1.065
Above -40°C (-40°F)	45	55	1.078

05J0EX.010

### REPLACEMENT OF ENGINE COOLANT

#### Warning

- Never open the radiator cap while the engine is hot.
- Wrap a thick cloth around the cap before loosening it.
- Use caution when draining hot coolant.

#### Caution

- Do not use alcohol- or methanol-based coolant.
- Use only soft (demineralized) water in the coolant mixture.

1. Remove the radiator cap and loosen the drain plug.
2. Drain the coolant into a suitable container.
3. Flush the cooling system with water until all traces of color are gone, then let the system drain completely.
4. Install the drain plug.
5. Fill with the proper amount and mixture of ethylene glycol-based coolant by referring to the table above.

#### Coolant capacity

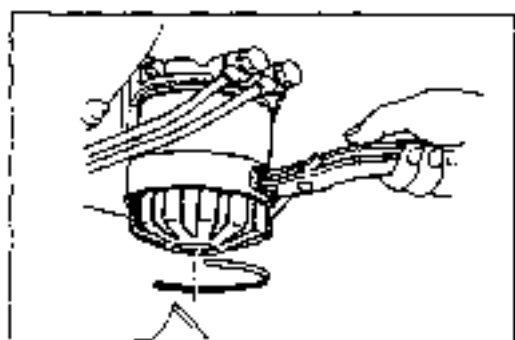
With heater core: 13.5 liters (14.3 US qt, 11.9 Imp qt)

Without heater core:

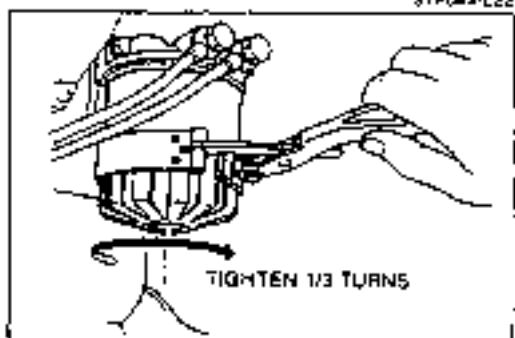
12.5 liters (13.2 US qt, 11.0 Imp qt)

6. Run the engine, with the radiator cap removed, until the upper radiator hose is hot.
7. With the engine idling, add coolant to the radiator until it reaches the bottom of the coolant inlet port.
8. Install the radiator cap.

# A SCHEDULED MAINTENANCE SERVICES

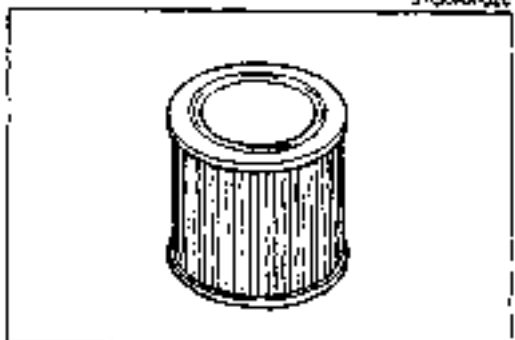


9T6G4X-C2E



TIGHTEN 1/3 TURNS

9T6G4X-Q2E



9T6G4X-Q2F

## REPLACEMENT OF FUEL FILTER

### Warning

- Keep sparks and open flames away from the fuel area.

1. Remove the fuel filter with a fuel filter wrench

2. Apply fuel on O-ring of the new fuel filter

3. Install the new fuel filter and tighten it fully by hand.

4. Additionally tighten the fuel filter with a fuel filter wrench 1/3 turns.

5. Bleed air in the filter

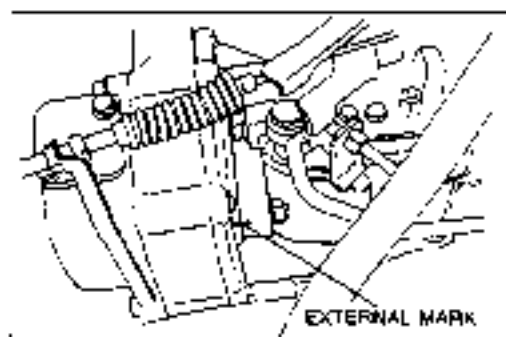
6. Start the engine and check for fuel leakage.

## INSPECTION OF AIR CLEANER ELEMENT

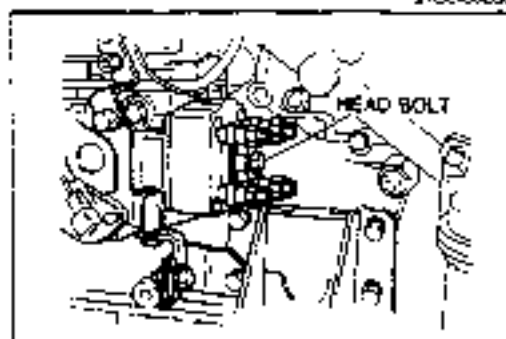
Visually check that the element for excessive dirt, damage or oil. Clean or replace it if necessary.

### Note

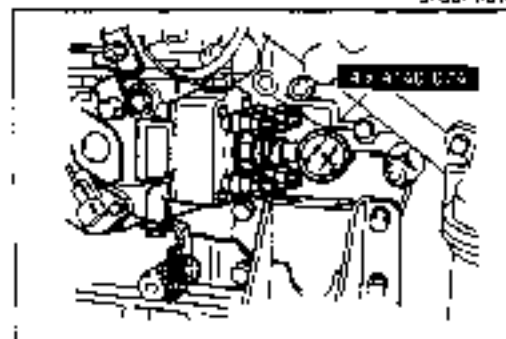
- When cleaning, first blow dust from inside then blow the dust off the outside of air cleaner element.



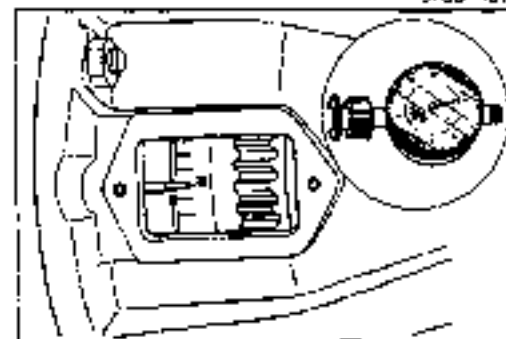
9TGCAK-030



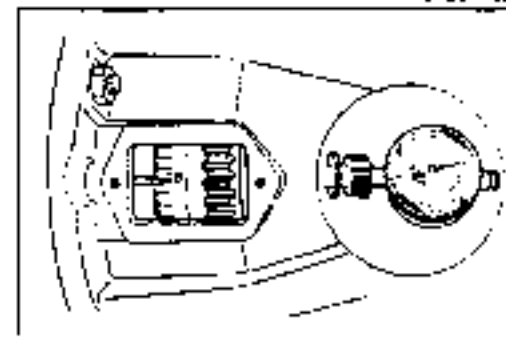
9TGF1-018



9TGF1-019



9TGF1-020



9TGCAK-033

## INSPECTION OF INJECTION TIMING

HA Engine  
Inspection

## Note

- Usually it is enough to confirm that the external marks are aligned.
- Set the injection timing after installment of the injection pump.

1. Disconnect the fuel injection pipes from the injection pump.
2. Remove the bolt and gasket from the distributor head of the injection pump

3. Screw the **SST** into the injection pump.  
Make sure that the tip of the feeler of the measuring device is in contact with the plunger end at this time.

## Note

- The **SST** specified by Diesel Kiki Co., Ltd. is 157629-3620.

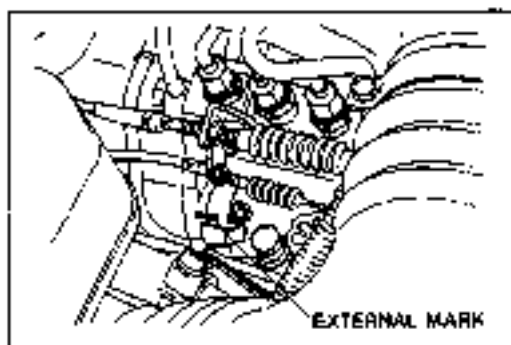
4. Turn the flywheel to set the flywheel to **approx. 30° BTDC** and find the position in which the needle of the dial gauge does not move when the flywheel is turned.
5. When the dial gauge needle does not deflect, set the needle to "0" on the scale.

6. Turn the flywheel in the normal direction until **3° BTDC** is indicated.  
The injection timing is normal when the dial gauge needle is advanced 1.00mm (0.039 in) ahead of the value set in Step 5.

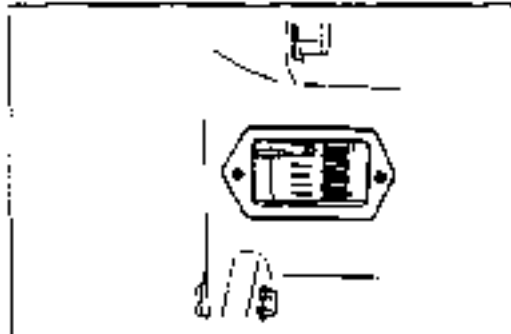
**Static injection: Cam lift 1.00mm (0.0394 in)**

7. If the change is not as specified, adjust the injection timing.

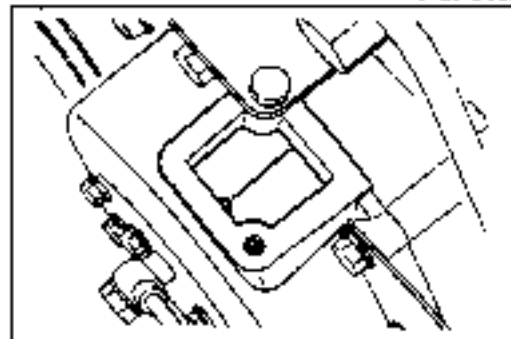
## A SCHEDULED MAINTENANCE SERVICES



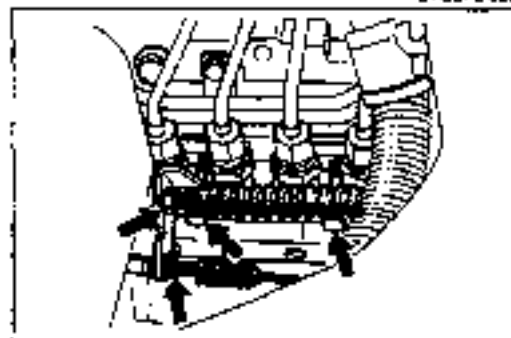
9T334X 031



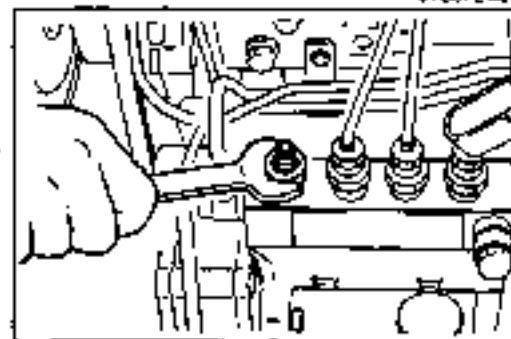
9T30F2 022



9T30F2 023



9T30F2 024



9T30F2 025

### SL, TF Engine Inspection

#### Note

- Usually it is enough to confirm that the external marks are aligned.

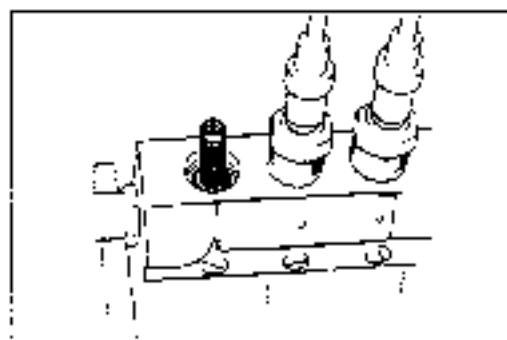
#### Caution

- Direct injection engines are sensitive to injection timing. Incorrect timing will cause engine knocking or low power output.  
Set the injection timing after installing the injection pump.

1. Remove the service hole covers from the clutch housing and the timing gear case.
2. Turn the flywheel in the direction of rotation until the indicator pin is at 30° BTDC
3. Verify that the pointer of the timing gear case and the mark on the timer are aligned
4. If not as specified, adjust the injection timing

### Adjustment

1. Remove the fuel stop cable from the cut lever.
2. Remove the accelerator cable from the control lever.
3. Remove the bracket.
4. Loosen injection pipes No 2—4 at the pump.
5. Remove No. 1 injection pipe and the delivery valve holder.

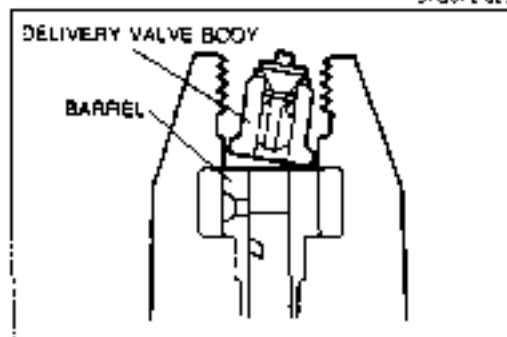


9TGC02-025

6. Remove the delivery valve spring seat and spring.

**Caution**

- Do not remove the delivery valve body.

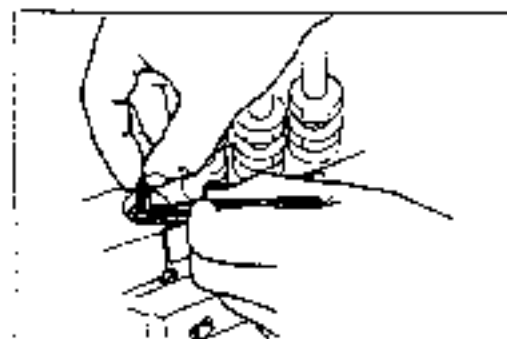
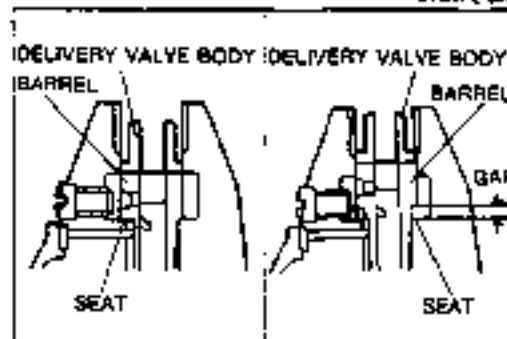


9TGC02-027

7. Rock the delivery valve to break it loose from the barrel.

**Note**

- If the delivery valve is lifted up without breaking it loose, the barrel may also be lifted out of the pump. If this happens the barrel may not reseal and may allow fuel into the engine and cause engine damage.



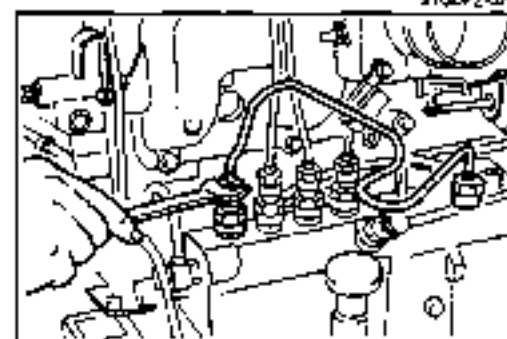
9TGC02-029

8. Remove the delivery valve, holding the flat washer with tweezers.

**Caution**

- Do not pinch the sliding surface of the delivery valve.

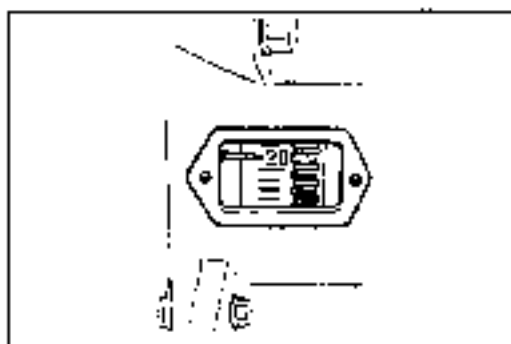
9. Reinstall the delivery valve holder.



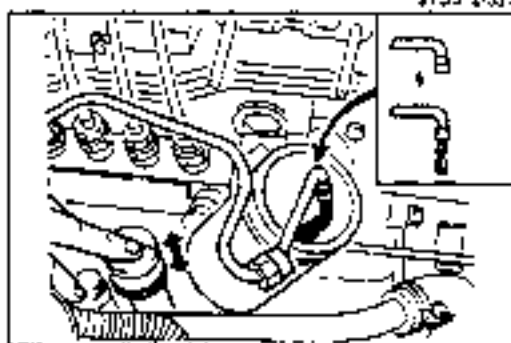
9TGC02-030

10. Tighten No. 1 injection pipe so that it points away from the pump.

# A SCHEDULED MAINTENANCE SERVICES



11. Turn the flywheel in the direction of rotation and set 1 at 20° BTDC.



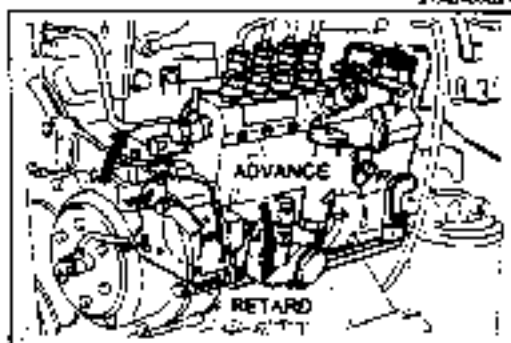
12. Place a container under No. 1 injector pipe and verify that fuel is expelled when pumping the primer pump.
13. While pumping the priming pump, turn the flywheel in the normal direction of rotation and verify that fuel flow stops as specified.

#### Fuel stops:

SL Non-turbo: 12° BTDC

SL Turbo : 13° BTDC

TF : 11° BTDC



14. If necessary, adjust the injection timing by loosening the pump mounting bolts and rotating the pump outward or inward as shown in the figure.

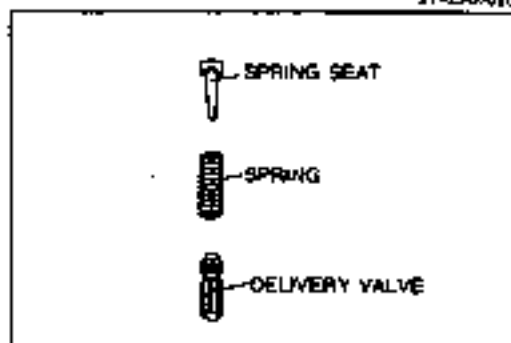
**When advanced:** turn to right (seen from front)

**When retarded :** turn to left (seen from front)

15. Tighten the mounting nuts

#### Tightening torque:

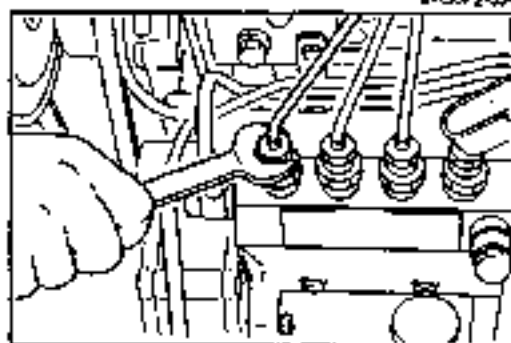
34—39 N·m (3.5—4.0 m·kg, 25—29 ft·lb)



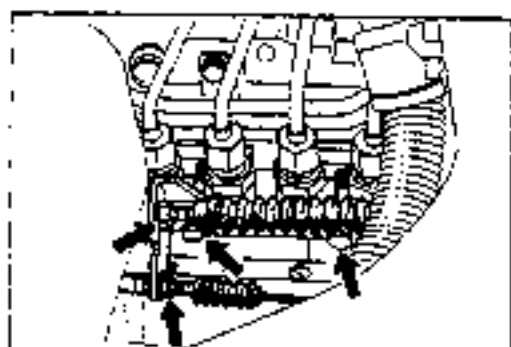
16. Mark the pump flange and pump body for future reference.
17. Install the delivery valve, spring, and spring seat.
18. Tighten the delivery valve holder

#### Tightening torque:

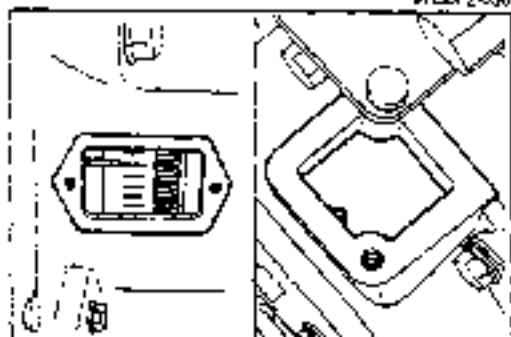
39—44 N·m (4.0—4.5 m·kg, 29—33 ft·lb)



19. Install No. 1 injection pipe.



9T6CF2-636



9T6CF2-637

20. Tighten injection pipes No.2—4.
21. Install the bracket.
22. Install the accelerator cable to the control lever.
23. Install the fuel stop cable to the cut lever.

24. Install the service hole covers onto the clutch housing and the timing gear case.
25. Bleed air from the system.
26. Start the engine, and check for fuel leaks.

## INSPECTION OF INJECTION NOZZLE

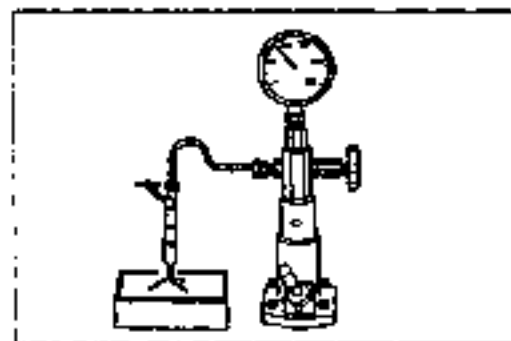
**Warning**

- Do not allow your hands or any other part of the body to come into the direct path of the fuel spray when using the nozzle tester because the spray has enough force to break the skin and possibly cause blood poisoning.

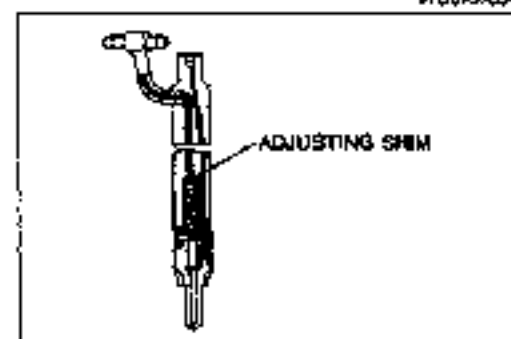
**Caution**

- The nozzle tester should be set up in a clean work place.

9T6QX-029



9T6QX-034



9T6CF2-100

**Injection starting pressure**

1. Connect the nozzle to a nozzle tester.
2. Pump the nozzle tester handle and note the pressure when injection is started.

**Injection starting pressure****HA engine**

13,244—13,734 kPa  
(135—140 kg/cm<sup>2</sup>, 1,920—1,991 psi)

**SL engine**

New nozzle : 17,168 kPa (175 kg/cm<sup>2</sup>, 2,489 psi)

Used nozzle: 16,677 kPa (170 kg/cm<sup>2</sup>, 2,417 psi)

**TF engine**

New nozzle : 20,580 kPa (210 kg/cm<sup>2</sup>, 2,986 psi)

Used nozzle: 19,620 kPa (200 kg/cm<sup>2</sup>, 2,844 psi)

3. If not within the specified pressure, adjust the starting pressure by adding or removing shims.

**Note**

- If not within the specified pressure, adjust the starting pressure by adding or removing shims.

HA engine: Refer to page F1-20.

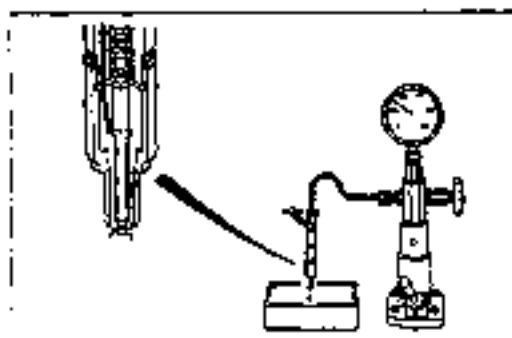
SL engine: Refer to page F2-38.

TF engine: Refer to page F3-26.

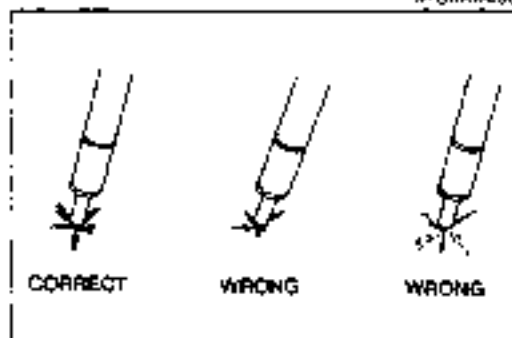


# A

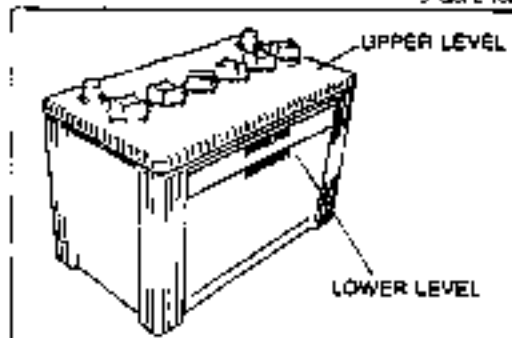
## SCHEDULED MAINTENANCE SERVICES



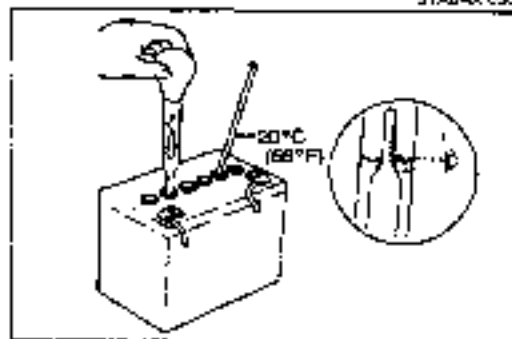
97G0A2-C36



97G0F2-108



97ADAX-030



97G0F2-016

### Leakage of Injector

Apply pressure SL engine: 14,715 kPa (150 kg/cm<sup>2</sup>, 2,133 psi), HA and TF engines: 1,962 kPa (20 kg/cm<sup>2</sup>, 284 psi) lower than the specified injection pressure and see if the fuel leaks from the nozzle injection hole.

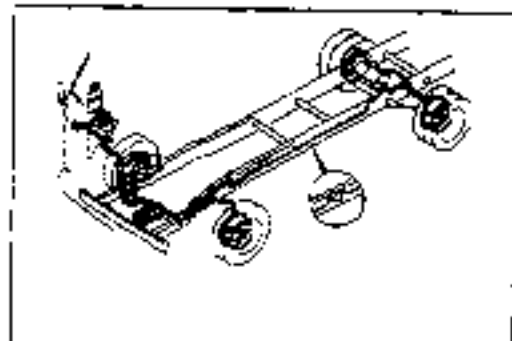
If the fuel leaks, it is necessary to disassemble, wash and recheck the nozzle or replace it.

### Atomizing Condition

1. Connect the nozzle on the nozzle tester.
2. Air bleed by operating the nozzle tester handle several times.
3. Keeping the pressure gauge of the nozzle tester in the non-functioning condition, quickly lower the handle (lower the handle as quickly as possible so that a pulsating whistling sound can be heard). Repeat this operation several times and check the atomizing condition.
4. Make sure that the fuel is atomized uniformly and properly.
5. Make sure that the injection angle and direction are normal.
6. If the atomizing condition is incorrect, it is necessary to disassemble, wash and recheck the nozzle, or to replace it.

### INSPECTION OF BATTERY

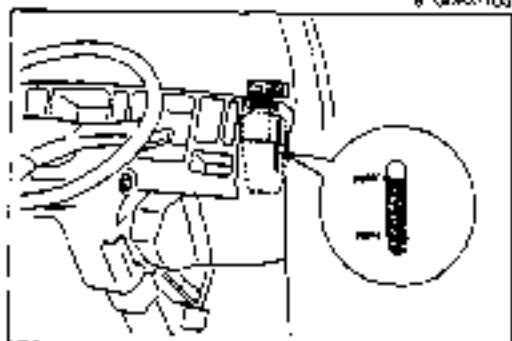
1. Check for corrosion on the terminals and for loose cable connections.
2. Check the electrolyte level.  
if the level is low, add distilled water to the "UPPER LEVEL" mark.
3. Check the specific gravity with a hydrometer. If the specific gravity reading is 1.23 or less, recharge the battery. (Refer to Section G.)



87G6AX-105

**INSPECTION OF BRAKE AND CLUTCH LINES, HOSES AND CONNECTIONS**

Check the brake and clutch lines and hoses for proper attachment and connections. There should not be any leaks, cracks, chafing, abrasion, deterioration, etc. on the lines or connections.

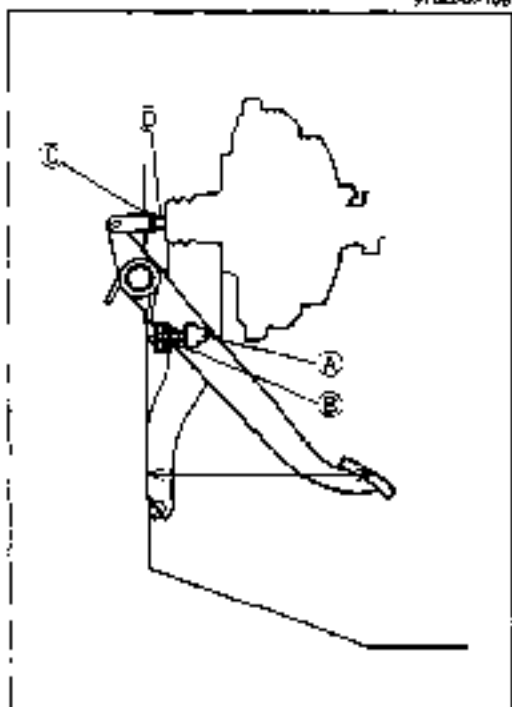


9T62AX-106

**INSPECTION OF BRAKE FLUID AND CLUTCH FLUID**

Check that the brake and clutch fluid level is near the "MAX" level line on the see-through reservoir. If necessary, add brake and clutch fluid to bring the level up to the "MAX" level line.

**Fluid specification: FMVSS 116: DOT-3 or SAE: J1703**



9T66AX-107

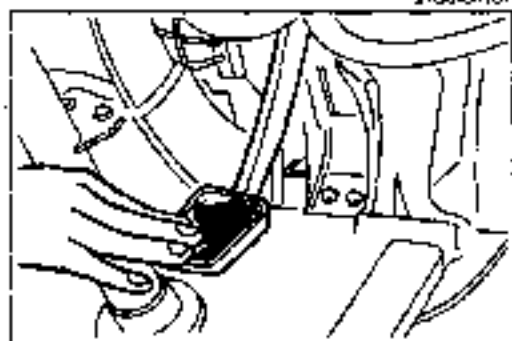
**INSPECTION OF BRAKE PEDAL****Pedal Height****Inspection**

Check that the distance from the center of the upper surface of the pedal pad to the dash panel is as specified.

**Pedal height: 226—231mm (8.90—9.09 in)**

**Adjustment**

1. Disconnect the stoplight switch connector.
2. Loosen locknut (B) and turn switch (A) until it does not contact the pedal.
3. Loosen locknut (C) and turn rod (D) to adjust the height.
4. Turn the stoplight switch until it contacts the pedal; then turn an additional 1/2 turn. Tighten locknut (B).
5. Check the pedal play and stoplight operation.



5T0CPX-022

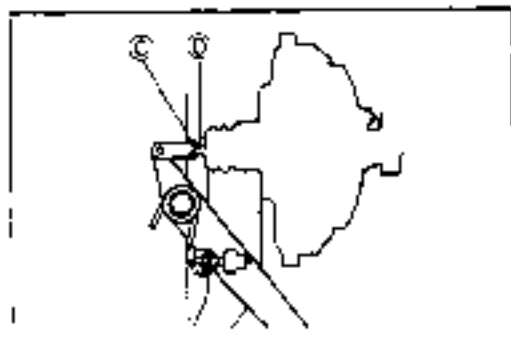
**Pedal Play****Inspection**

1. Depress the pedal a few times to eliminate the vacuum in the system.  
Gently depress the pedal again by hand and check the free play (until the valve plunger contacts the stopper plate - until the power piston begins to move).

**Pedal play: 9—11mm (0.35—0.43 in)**

**Caution (Australia payload 2,500 kg and 4,000 kg)**

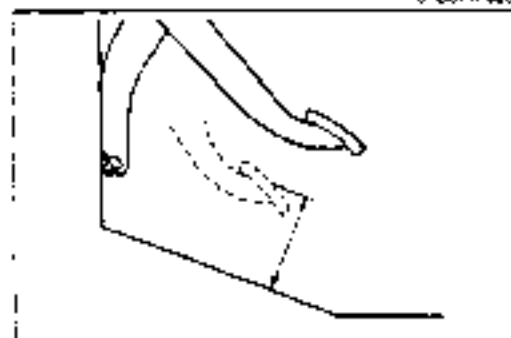
- Do not inspect the pedal play with the ignition switch ON. The brake vacuum warning buzzer will operate when the ignition switch is ON.



9T0CPX-043

**Adjustment**

1. Loosen locknut (C) of push rod (A) then turn the rod to adjust the free play.
2. Tighten locknut (C) and check the pedal height and stop-light operation.



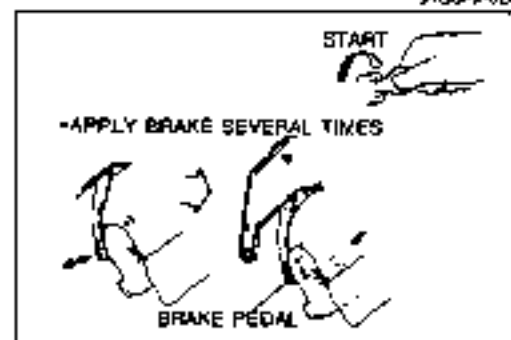
9T0DPZ-024

**Pedal-to-floor Clearance****Inspection**

1. Start the engine and depress the pedal with a force of 5.9 N (60 kg, 52 lb). Check that the distance from the floor panel to the center of the upper surface of the pedal pad is as specified.

**Pedal-to-floor clearance: 50mm (1.99 in) min.**

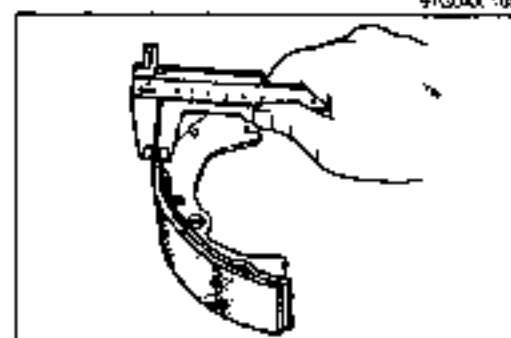
2. If the distance is less than specified, check for the following problems:
  - Air in brake system
  - Too much shoe clearance



9T0DAX-105

**INSPECTION OF POWER BRAKE UNIT AND HOSES**

1. Check the vacuum hoses, connectors and check-valve for cracks, chafing, deterioration, etc..
2. Check the power brake for proper operation. To check, depress the brake pedal several times to make sure the pedal travel does not change. Then, while depressing brake pedal, start the engine. At this time, the pedal should go down a little.



9T0DAX-105

**INSPECTION OF DRUM BRAKE**

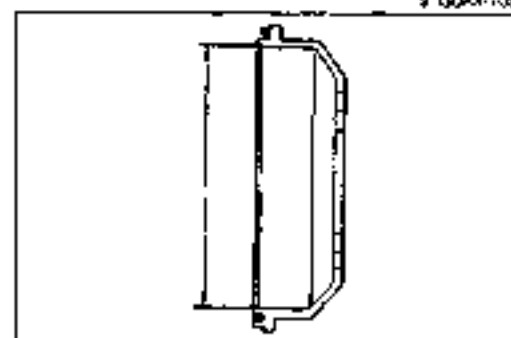
Check the following conditions of the brake drums and linings.

1. Check the wheel cylinder operation and inspect for leaks.
2. Check the linings for wear or damage.

**Standard lining thickness:**

**Refer to Section TD**

**Min: 1.0mm (0.04 in)**



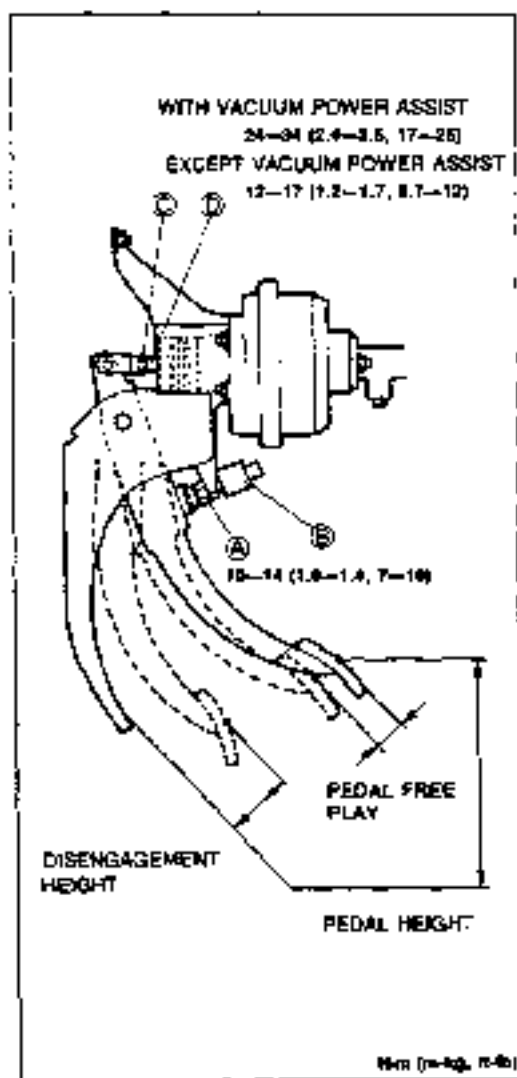
9T0DAX-110

3. Check condition of the inner surface and the inner diameter of the drum.

**Standard drum inner diameter:**

**Refer to Section TD**

**Max: Refer to Section TD**



9TGBAX-111

**INSPECTION OF CLUTCH PEDAL****Clutch Pedal Height****Inspection**

1. Measure the distance from the upper surface of the pedal pad to the floor panel.

**Pedal height: 188-193mm (7.40-7.60 in)**

2. If necessary, adjust the pedal height.

**Adjustment**

1. Disconnect the clutch switch connector.
2. Loosen locknuts A and turn clutch switch B until the height is correct.
3. Tighten locknuts A.

**Tightening torque:**

**9.8-14 Nm (100-140 cm-kg, 67-122 in-lb)**

4. After adjustment, measure the pedal free play.

**Clutch Pedal Free Play****Inspection**

1. Depress the clutch pedal by hand until resistance is felt.

**Pedal free play: 0.5-2.7mm (0.02-0.11 in)**

**Total pedal free play: 5.0-11.0mm (0.20-0.43 in)**

2. If necessary, adjust the pedal free play.

**Adjustment**

1. Loosen locknut C and turn push-rod D until pedal free play is correct.
2. Verify that the disengagement height (from the upper surface of the pedal to the floor panel) is correct when the pedal is fully depressed.

**Minimum disengagement height: 65mm (2.56 in)**

3. Tighten locknut C

**Tightening torque:**

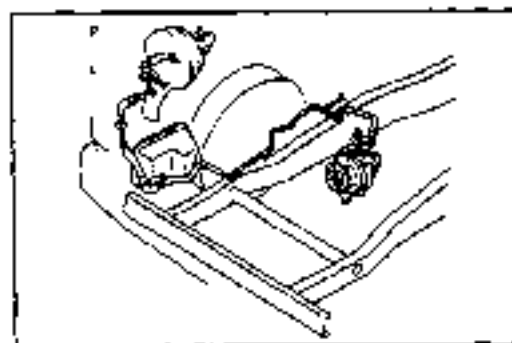
**With vacuum power assist**

**24-34 Nm (2.4-3.5 m-kg, 17-25 ft-lb)**

**Except vacuum power assist**

**12-17 Nm (1.2-1.7 m-kg, 8.7-12 ft-lb)**

4. After adjustment, inspect the pedal height.

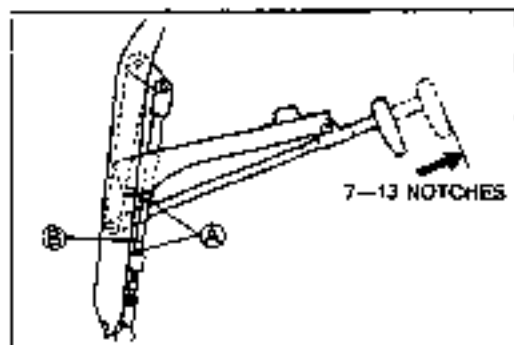


9TGBAX-112

**INSPECTION OF VACUUM TANK AND HOSES**

Check the vacuum tank for damage and check the vacuum hoses for proper attachment and connections. There should not be any leaks, cracks, chafing, abrasion, deterioration, etc. on the lines or connections.

# A SCHEDULED MAINTENANCE SERVICES



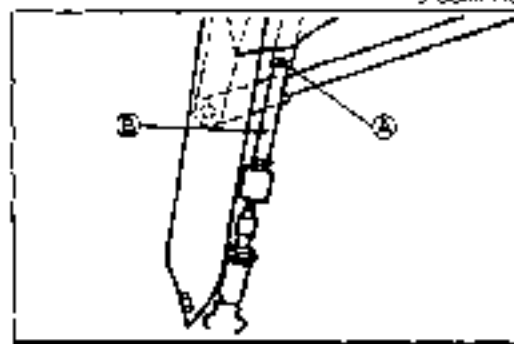
## INSPECTION OF PARKING BRAKE LEVER

### Inspection

#### Lever stroke

1. Check that the stroke is within specification when the parking brake lever is pulled with a force of 294 N (30 kg, 66 lb).

**Stroke: 7—13 notches**

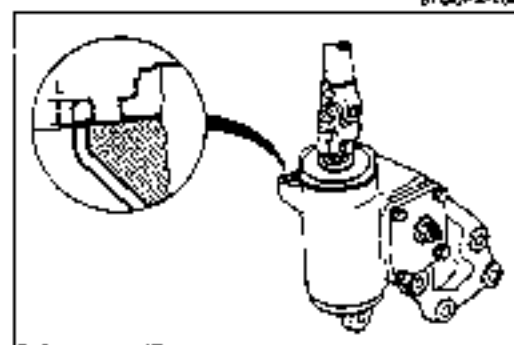


### Adjustment

1. Loosen locknut (B) and turn the adjusting bolt (A) so that the stroke is within the above range.

### Caution

- Before adjustment, adjust the clearance between the center brake drum and lining. (Refer to Section P.)
- After adjustment, make sure that the parking brake warning light illuminates when the brake lever is pulled one notch and the brakes are not dragging.

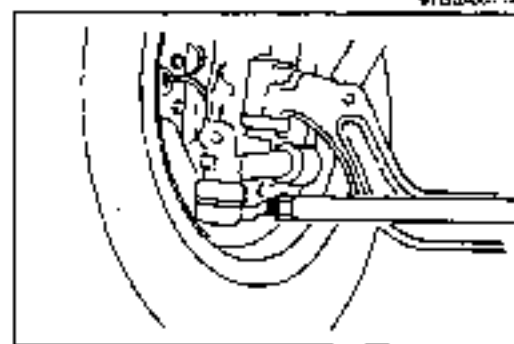


## INSPECTION OF MANUAL STEERING GEAR OIL LEVEL

1. Remove the filler plug.
2. Insert a scale through the oil filler hole.
3. Pull out the scale and measure the "L" dimension. Add the specified gear oil, if necessary.

**Standard "L" dimension: 10mm (0.39 in)**

**Specified gear oil: API service GL-4, Viscosity: SAE90**



## INSPECTION OF STEERING LINKAGE, TIE ROD ENDS AND ARMS

1. Check the steering linkage for looseness and damage.
2. Check the tie rod ends for excessive play.
3. Check the dust boots for damage.
4. Check the tie rod ends for looseness or grease leakage.

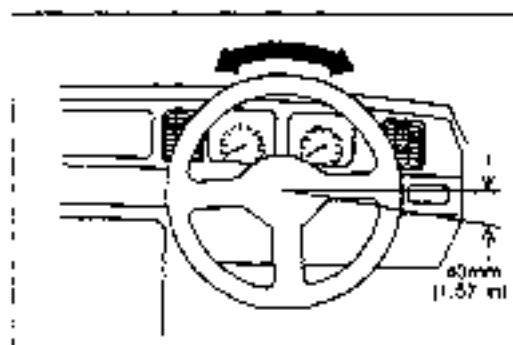


## INSPECTION OF POWER STEERING FLUID AND LINES (if equipped)

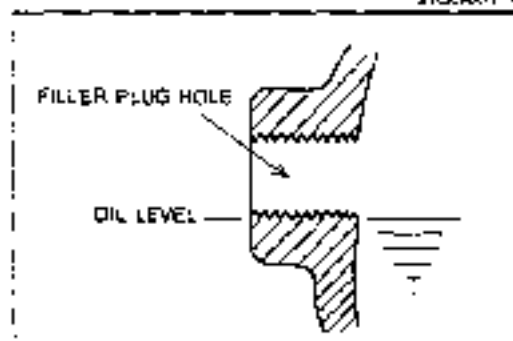
1. Check the fluid hoses, lines and connections for cracks, chafing, deterioration, etc.
2. Check the fluid level on the reservoir. The level should be between the "MAX" and "MIN" level. Add fluid if necessary.

### Fluid specification:

**ATF M2C33-F or DEXRON-II**



91GCAK-17



91GCAK-18

### INSPECTION OF STEERING OPERATIONS AND GEAR HOUSING

1. Check the steering wheel free play.

**Standard play: 5—20mm (0.2—0.8 in)**

2. Check the steering for proper operation and looseness of the steering housing.
3. Check the steering gear housing for fluid leakage or seepage.

### INSPECTION AND REPLACEMENT OF TRANSMISSION OIL

#### Inspection

##### Caution

- Position the vehicle on level ground.

1. Remove the filler plug.
2. Verify that the oil is at the bottom of the filler plug hole. If it is low, add the specified oil from filler plug.
3. Wipe clean and apply sealant to the plug threads before installing the plug.

##### Tightening torque:

**33—51 Nm (3.4—5.2 m·kg, 25—38 ft·lb)**

#### Replacement

1. Remove the drain plug, and drain the oil into a suitable container.
2. Wipe clean and apply sealant to the plug threads.
3. Install the drain plug.

##### Tightening torque:

**33—51 Nm (3.4—5.2 m·kg, 25—38 ft·lb)**

4. Add the specified oil from the filler plug hole until the level reaches the bottom of the hole.

##### Specified oil:

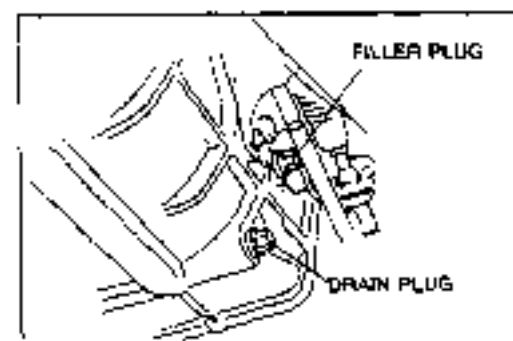
**Type: API Service GL-4 or GL-5  
SAE 75W-90**

**Capacity: HA, SL engine without sub-transmission  
3.5 liters (3.7 US qt, 3.1 Imp qt)  
SL, TF engine with sub-transmission  
3.3 liters (3.5 US qt, 2.9 Imp qt)**

5. Apply sealant to the filler plug threads.
6. Install the filler plug.

##### Tightening torque:

**33—51 Nm (3.4—5.2 m·kg, 25—38 ft·lb)**



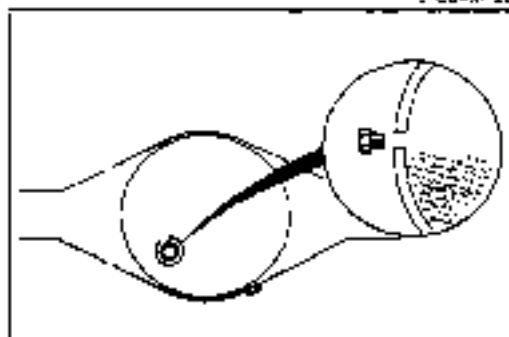
91GCAK-19

# A SCHEDULED MAINTENANCE SERVICES



## INSPECTION OF TRANSMISSION LINKAGE AND CABLES

Check the transmission linkage and cables for damage, twist and smooth operation.



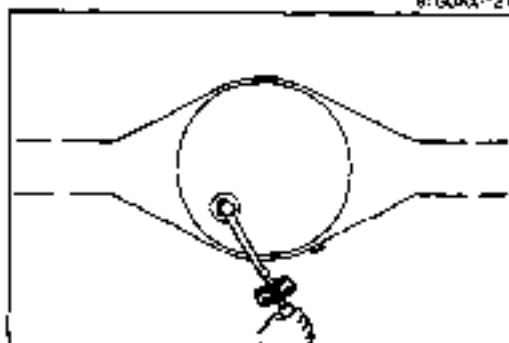
## INSPECTION AND REPLACEMENT OF DIFFERENTIAL OIL

### Inspection

1. Remove the oil filler plug.
2. Verify that the oil level is at the bottom of the plug hole.
3. If low, add the specified oil.

### Specified oil

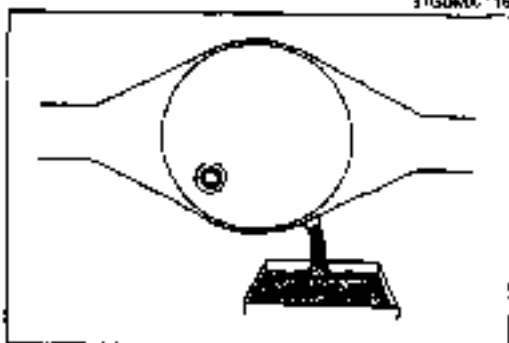
- Type: Above  $-18^{\circ}\text{C}$  ( $0^{\circ}\text{F}$ ): GL-5 SAE 90  
Below  $-18^{\circ}\text{C}$  ( $0^{\circ}\text{F}$ ): GL-5 SAE 80W



4. Install a new washer and tighten the oil filler plug.

### Tightening torque:

- 39—54 N·m (4.0—5.5 m·kg, 29—40 ft·lb)



### Replacement

1. Remove the magnetic plug and drain the differential oil.
2. Clean the magnetic plug.
3. Install a new washer and tighten the magnetic plug.

### Tightening torque:

- 39—54 N·m (4.0—5.5 m·kg, 29—40 ft·lb)

4. Remove the oil filler plug and fill the differential with the specified oil.

### Specified oil

- Type: Above  $-18^{\circ}\text{C}$  ( $0^{\circ}\text{F}$ ): GL-5 SAE 90  
Below  $-18^{\circ}\text{C}$  ( $0^{\circ}\text{F}$ ): GL-5 SAE 80W

### Capacity:

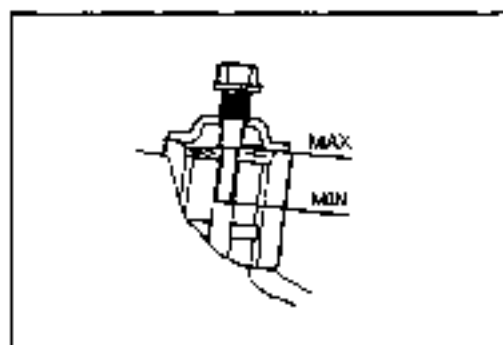
- W type: 2.6 liters (2.7 US qt, 2.3 Imp qt)  
Y type: 3.8 liters (3.8 US qt, 3.2 Imp qt)

5. Check the oil level.
6. Install a new washer and tighten the oil filler plug.

### Tightening torque:

- 39—54 N·m (4.0—5.5 m·kg, 29—40 ft·lb)

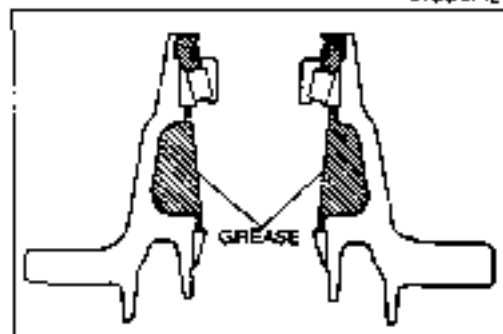
87G04X-118



9TG0AX-124

**INSPECTION OF KINGPIN OIL**

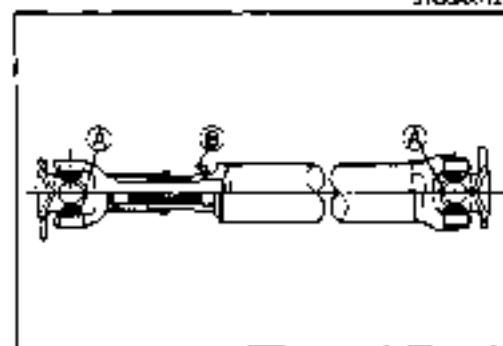
Check the kingpin oil level on the gauge.  
The level should be between the "MAX" and "MIN" level



9TG0AX-127

**LUBRICATION OF FRONT WHEEL BEARINGS**

1. Remove the hub and inner and outer bearing.  
Clean with solvent and inspect the bearings for damage.
2. Repack lithium grease (NLGI No.2) to the following parts.
  - 1) All rolling surfaces of the bearings
  - 2) Between the bearing and oil seal
  - 3) Between the bearings in the hub
3. Apply lithium grease (NLGI No.2) to the oil seal lip (use new oil seals).



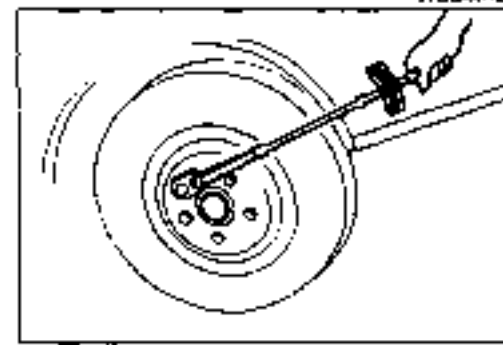
9TG0AX-129

**LUBRICATION OF PROPELLER SHAFT JOINTS**

Lubricate each part with the specified grease through the nipples.

**Nipples....Grease**

- Ⓐ .....NLGI No.2
- Ⓑ .....Disulphide molybdenum grease



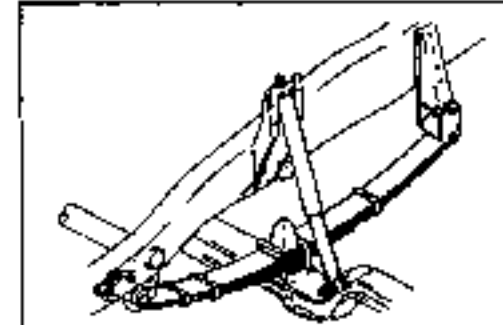
9TG0AX-017

**INSPECTION OF WHEEL LUG NUT**

Check the tightening torque.

**Tightening torque:**

Model	Single rear tire Nm (m-kg, ft-lb)	Dual rear tires Nm (m-kg, ft-lb)
Front	167-215 (17-22, 123-158)	491-735 (50-75, 362-542)
Rear		Inside 540-784 (55-80, 396-578)
		Outside 491-735 (50-75, 362-542)



9TG0AX-130

**TIGHTENING BOLTS AND NUTS ON CHASSIS AND BODY**

Retighten any loose nuts and bolts on chassis and body to the specified torque.



# ENGINE

<b>INDEX</b> .....	B- 2	CYLINDER BLOCK	
HA ENGINE .....	B- 2	(EXTERNAL PARTS I) .....	B- 65
SL ENGINE .....	B- 3	CYLINDER BLOCK	
TF ENGINE .....	B- 4	(EXTERNAL PARTS II) .....	B- 69
<b>OUTLINE</b> .....	B- 5	CYLINDER BLOCK	
SPECIFICATIONS .....	B- 5	(INTERNAL PARTS) .....	B- 72
<b>TROUBLESHOOTING GUIDE</b> .....	B- 5	<b>INSPECTION / REPAIR</b> .....	B- 76
<b>ENGINE TUNE-UP PROCEDURE</b> .....	B- 7	CYLINDER HEAD .....	B- 76
PREPARATION .....	B- 7	VALVE MECHANISM .....	B- 76
ENGINE OIL .....	B- 7	ROCKER ARM ASSEMBLY .....	B- 79
ENGINE COOLANT .....	B- 7	CYLINDER BLOCK .....	B- 80
DRIVE BELT .....	B- 8	PISTON, PISTON RING	
VALVE CLEARANCE .....	B- 9	AND PISTON PIN .....	B- 81
INJECTION TIMING .....	B- 11	CONNECTING ROD .....	B- 83
IDLE SPEED .....	B- 15	CRANKSHAFT .....	B- 84
AIR BLEEDING .....	B- 16	BEARING .....	B- 85
<b>COMPRESSION</b> .....	B- 18	CAMSHAFT .....	B- 85
PREPARATION .....	B- 18	TAPPET .....	B- 87
INSPECTION .....	B- 18	OIL JET .....	B- 87
<b>ON-VEHICLE MAINTENANCE</b> .....	B- 20	IDLER GEAR .....	B- 87
PREPARATION .....	B- 20	<b>ASSEMBLY</b> .....	B- 88
CYLINDER HEAD GASKET .....	B- 21	PREPARATION .....	B- 88
FRONT OIL SEAL .....	B- 28	CYLINDER BLOCK	
REAR OIL SEAL .....	B- 31	(INTERNAL PARTS) .....	B- 90
<b>REMOVAL</b> .....	B- 33	CYLINDER BLOCK	
PREPARATION .....	B- 33	(EXTERNAL PARTS I) .....	B- 97
PROCEDURE .....	B- 33	CYLINDER BLOCK	
<b>ENGINE STAND MOUNTING</b> .....	B- 56	(EXTERNAL PARTS I) .....	B- 106
PREPARATION .....	B- 56	CYLINDER HEAD .....	B- 113
PROCEDURE .....	B- 56	<b>ENGINE STAND DISMOUNTING</b> .....	B- 125
<b>DISASSEMBLY</b> .....	B- 58	PROCEDURE .....	B- 125
PREPARATION .....	B- 58	<b>INSTALLATION</b> .....	B- 127
CYLINDER HEAD .....	B- 60	PREPARATION .....	B- 127
		PROCEDURE .....	B- 127

## INDEX

## HA ENGINE

**EXHAUST MANIFOLD TIGHTENING TORQUE**  
25—32 Nm (2.7—3.5 m·kg, 20—24 ft·lb)

**INTAKE MANIFOLD TIGHTENING TORQUE**  
22—30 Nm (2.3—3.1 m·kg, 18—22 ft·lb)

**VALVE CLEARANCE (ENGINE COLD)**  
IN: 0.30mm (0.012 in)  
EX: 0.30mm (0.012 in)  
INSPECTION / ADJUSTMENT  
PAGE B-8

**DRIVE BELT DEFLECTION**

	mm (in)	
	New	Used
Alternator	9.0—10.0 (0.35—0.39)	10.0—11.0 (0.39—0.43)
P/S	9.0—11.0 (0.35—0.43)	12.0—13.0 (0.47—0.51)

**COMPRESSION STANDARD:**  
2,943 kPa (30.0 kg/cm<sup>2</sup>, 427 psi)—200 rpm  
INSPECTION, PAGE B-18

9TF08X-002

1. Cylinder head gasket:  
Replacement ..... page B- 21
2. Front oil seal  
Replacement ..... page B- 28
3. Rear oil seal  
Replacement ..... page B- 31

4. Engine  
Removal ..... page B- 33  
Engine stand mounting ..... page B- 56  
Disassembly ..... page B- 58  
Inspection / Repair ..... page B- 76  
Assembly ..... page B- 88  
Engine stand dismounting ..... page B-125  
Installation ..... page B-127

## SL ENGINE



VALVE CLEARANCE (ENGINE COLD)  
IN: 0.30mm (0.012 in)  
EX: 0.35mm (0.014 in)  
INSPECTION / ADJUSTMENT, PAGE B-9

EXHAUST MANIFOLD  
TIGHTENING TORQUE  
23-25 Nm (2.3-2.7 m-tg, 17-20 ft-lb)

INTAKE MANIFOLD  
TIGHTENING TORQUE  
15-20 Nm (1.5-2.0 m-tg, 12-17 ft-lb)

DRIVE BELT  
DEFLECTION

	New	Used
Alternator	3.0-10.0 (0.35-0.38)	10.0-11.0 (0.35-0.43)
P/S	9.0-11.0 (0.36-0.43)	12.0-13.0 (0.47-0.51)

INSPECTION, PAGE B-8  
ADJUSTMENT, PAGE B-9

COMPRESSION  
STANDARD  
NON-TURBO: 2,943 kPa (30.0 kg/cm<sup>2</sup>, 427 ps)-300 rpm  
TURBO : 2,551 kPa (26.0 kg/cm<sup>2</sup>, 370 ps)-320 rpm  
INSPECTION, PAGE B-18

1. Cylinder head gasket  
Replacement ..... page B- 21
2. Front oil seal  
Replacement ..... page B- 28
3. Rear oil seal  
Replacement ..... page B- 31

4. Engine  
Removal ..... page B- 33  
Engine stand mounting ..... page B- 56  
Disassembly ..... page B- 58  
Inspection / Repair ..... page B- 76  
Assembly ..... page B- 88  
Engine stand dismounting ..... page B-125  
Installation ..... page B-127

8TF08Z.009

## TF ENGINE

## VALVE CLEARANCE (ENGINE COLD)

IN: 0.30mm (0.012 in)

EX: 0.40mm (0.016 in)

INSPECTION / ADJUSTMENT, PAGE B-9

## EXHAUST MANIFOLD

## TIGHTENING TORQUE

44-48 Nm (4.5-4.9 m·kg, 33-35 ft·lb)

DRIVE BELT  
DEFLECTION (ALTERNATOR)

NEW: 10.0-11.0mm (0.39-0.43 in)

USED: 11.0-12.0mm (0.43-0.47 in)

INSPECTION, PAGE B-9

ADJUSTMENT, PAGE B-9

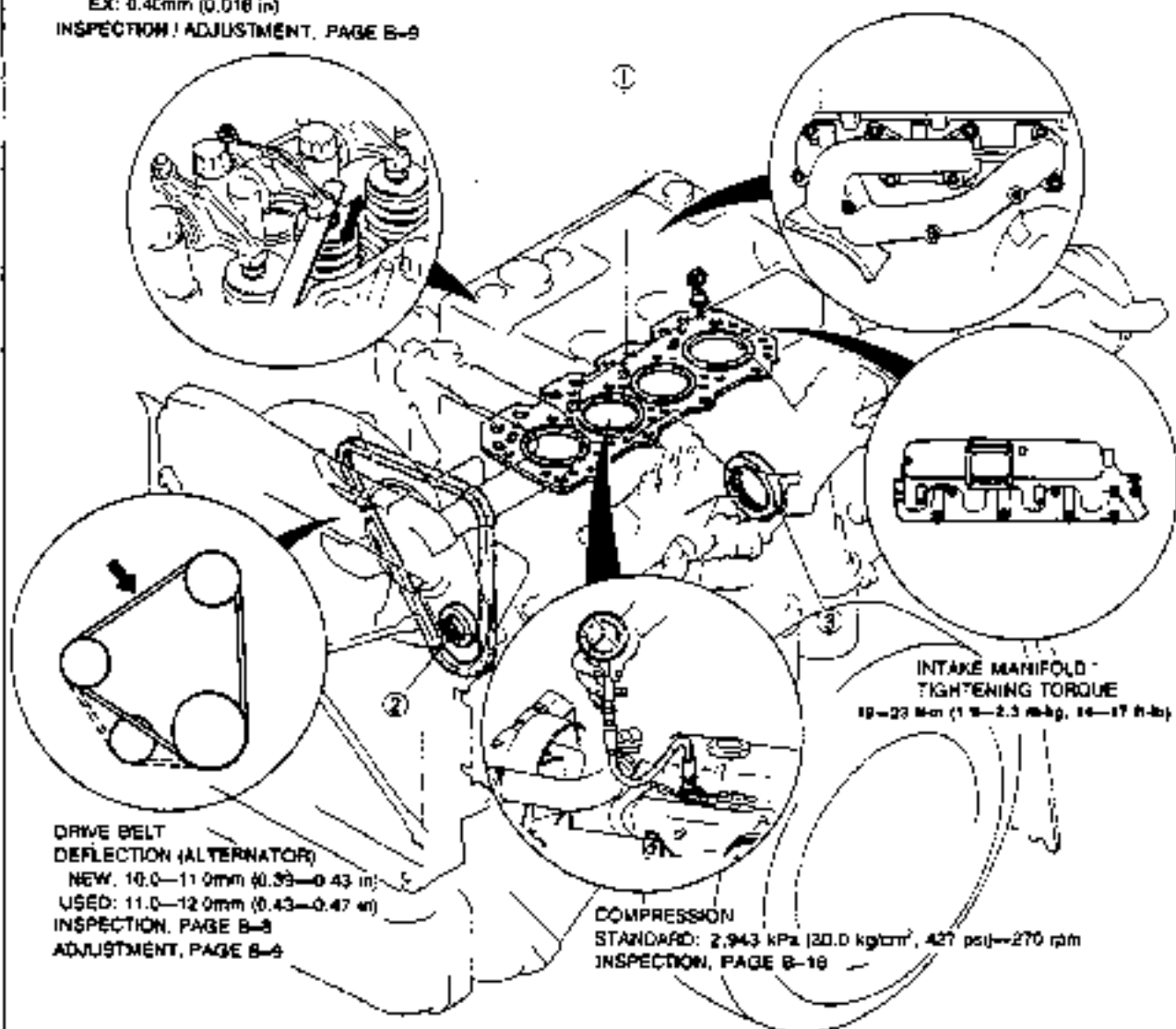
## COMPRESSION

STANDARD: 2,943 kPa (30.0 kg/cm<sup>2</sup>, 427 psi)→270 rpm

INSPECTION, PAGE B-16

INTAKE MANIFOLD  
TIGHTENING TORQUE

19-23 Nm (1.9-2.3 m·kg, 14-17 ft·lb)



9TFCBX004

- |  |            |                                |            |
|--|------------|--------------------------------|------------|
| 1. Cylinder head gasket<br>Replacement ..... | page B- 21 | 4. Engine<br>Removal .....     | page B- 33 |
| 2. Front oil seal<br>Replacement .....       | page B- 28 | Engine stand mounting .....    | page B- 56 |
| 3. Rear oil seal<br>Replacement .....        | page B- 31 | Disassembly .....              | page B- 58 |
|  |            | Inspection / Repair .....      | page B- 76 |
|  |            | Assembly .....                 | page B- 88 |
|  |            | Engine stand dismounting ..... | page B-125 |
|  |            | Installation .....             | page B-127 |

OUTLINE

SPECIFICATIONS

Item	Engine	NA	SL		TF
			Non-Turbo	Turbo	
Type			Diesel, 4-cycle		
Cylinder arrangement and number			In-line, 4-cylinders		
Combustion chamber		Pre-combustion chamber	Piston head		
Valve system			OHV, Gear-driven		
Displacement	cc (cu in)	2,977 (181.63)	3,455 (210.76)		4,021 (245.26)
Bore x Stroke	mm (in)	95.0 x 105.0 (3.74 x 4.13)	100.0 x 110.0 (3.94 x 4.33)		105.5 x 115.0 (4.15 x 4.53)
Compression ratio		21.0 : 1	16.0 : 1	17.0 : 1	18.0 : 1
Compression pressure	kPa (kg/cm <sup>2</sup> , psi)-rpm	2,943 (30.0, 427)-200	2,943 (30.0, 427)-300		2,551 (26.0, 370)-320
Valve timing	IN	Open BTDC	17°	19°	16°
		Close ABDC	47°	47°	45°
	EX	Open BBDC	51°	52°	49°
		Close ATDC	13°	14°	17°
Valve clearance (Engine cold)	mm (in)		0.30 (0.012)		
		EX	0.30 (0.012)	0.35 (0.014)	0.40 (0.016)

815082-000

TRUBLESHOOTING GUIDE

Problem	Possible Cause	Action	Page
Difficult starting	<b>Malfunction of engine-related components</b> Burned valve Worn piston, piston rings, or cylinder Failed cylinder head gasket	Replace Repair or replace Replace	B-76 B-80,81 B-21
	<b>Malfunction of fuel system</b>	Refer to Section F	
	<b>Malfunction of electrical system</b>	Refer to Section G	
Poor idling	<b>Malfunction of engine-related components</b> Improper valve clearance Poor valve to valve seat contact Failed cylinder head gasket	Adjust Repair or replace Replace	B-9 B-77 B-21
	<b>Malfunction of fuel system</b>	Refer to Section F	
Excessive oil consumption	<b>Oil working up</b> Worn piston ring groove or stuck piston ring Worn piston or cylinder	Replace Repair or replace	B-82 B-80,81
	<b>Oil working down</b> Worn valve seal Worn valve stem or guide	Replace Replace	B-114,120 B-76
	<b>Oil leakage</b>	Refer to Section D	

# B TROUBLESHOOTING GUIDE


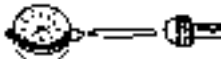
Problem	Possible Cause	Action	Page
Insufficient power	<b>Insufficient compression</b> Improper valve clearance Compression leakage from valve seat Seized valve stem Weak or broken valve spring Failed cylinder head gasket Cracked or distorted cylinder head Sticking, damaged, or worn piston rings Cracked or worn piston	Adjust Repair Replace Replace Replace Replace Replace Replace	B-9 B-77 B-76 B-79 B-21 B-76 B-62 B-61
	<b>Malfunction of fuel system</b>	Refer to Section F	
	<b>Others</b> Slipping clutch Dragging brakes Wrong size tires	Refer to Section H Refer to Section F Refer to Section O	
Abnormal combustion	<b>Malfunction of engine-related components</b> Improper valve clearance Sticking or burned valve Weak or broken valve spring Carbon accumulation in combustion chamber	Adjust Replace Replace Eliminate carbon	B-9 B-76 B-79 -
	<b>Malfunction of fuel system</b>	Refer to Section F	
Engine noise	<b>Crankshaft- or bearing-related parts</b> Excessive main bearing oil clearance Main bearing seized or heat-damaged Excessive crankshaft end play Excessive connecting rod bearing oil clearance Connecting rod bearing seized or heat-damaged	Repair or replace Replace Replace Repair or replace Repair or replace Replace	B-92 B-85 B-84 B-95 B-85
	<b>Piston-related parts</b> Worn cylinder Worn piston or piston pin Seized piston Damaged piston ring Bent connecting rod	Repair or replace Replace Replace Replace Replace	B-80 B-83 B-81 B-82 B-83
	<b>Valves or timing-related parts</b> Improper valve clearance Broken valve spring Excessive valve guide clearance	Adjust Replace Replace	B-9 B-79 B-77
	<b>Malfunction of cooling system</b>	Refer to Section E	
	<b>Malfunction of fuel system</b>	Refer to Section F	
	<b>Others</b> Malfunction of water pump bearing Improper drive belt tension Malfunction of alternator bearing Exhaust gas leakage	Refer to Section E Adjust Refer to Section G Refer to Section F	B-9

07F08-005

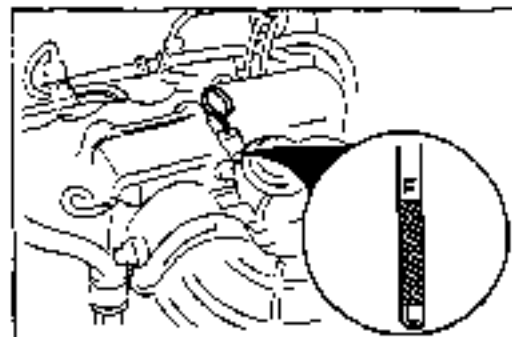
## ENGINE TUNE-UP PROCEDURE

## PREPARATION

## SST

<p>49 9200 020</p> <p>Tension gauge V-ribbed belt</p> 	<p>For inspection of drive belt tension</p>	<p>49 9140 074</p> <p>Cam lift measuring device (MA)</p> 	<p>For inspection of injection timing</p>
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9TGOB2-007



9TGOB2-006

## ENGINE OIL

## Inspection

1. Be sure the vehicle is on level ground.
2. Warm up the engine to normal operating temperature and stop it.
3. Wait for five minutes.
4. Remove the oil level gauge and check the oil level and condition.
5. Add or replace oil as necessary.

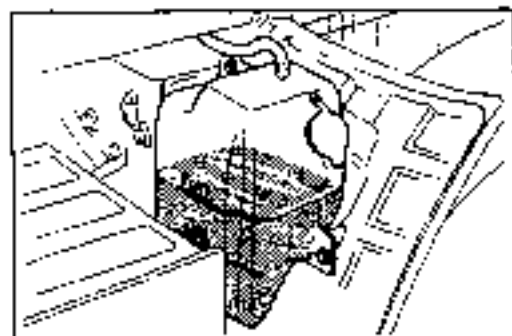
## Note

- The distance between the L and F marks on the level gauge represents 2.0 liters (2.11 US qt, 1.76 Imp qt).

## ENGINE COOLANT

## Inspection

## Coolant level (engine cold)



9TGOB2-009

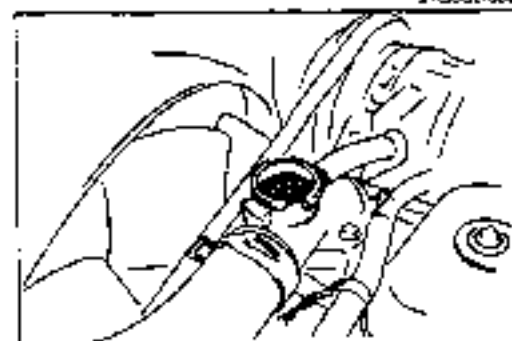
## Warning

- Never remove the radiator cap while the engine is hot.
- Wrap a thick cloth around the cap before removing it.

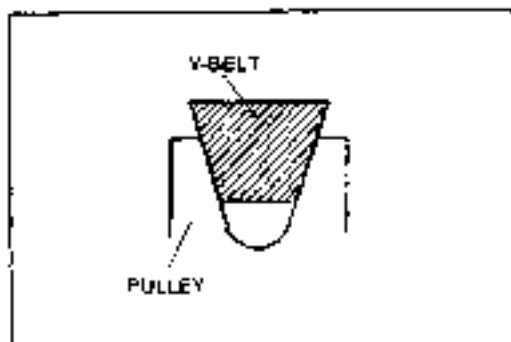
1. Verify that the coolant level is near the coolant inlet port.
2. Verify that the coolant level in the coolant reservoir is between the FULL and LOW marks.
3. Add coolant if necessary.

## Coolant quality

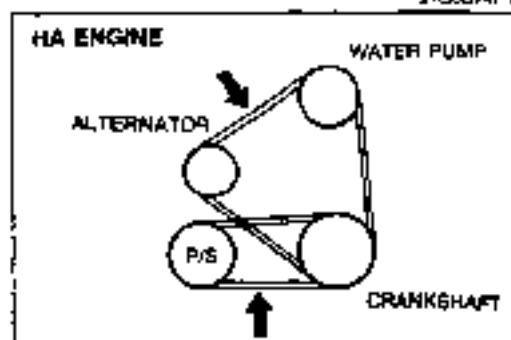
1. Verify that there is no buildup of rust or scale around the radiator cap or coolant inlet port.
2. Verify that the coolant is free of oil.
3. Replace the coolant if necessary.



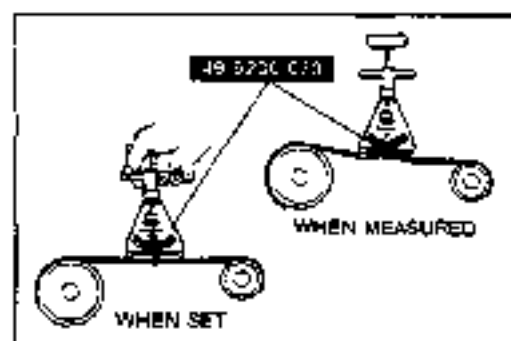
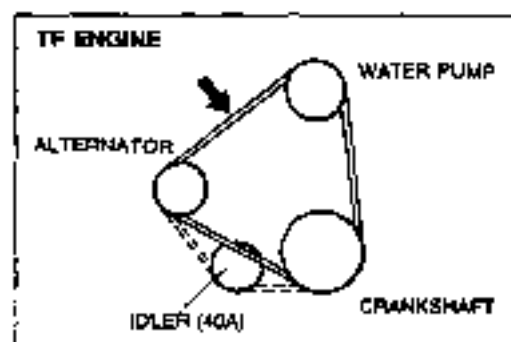
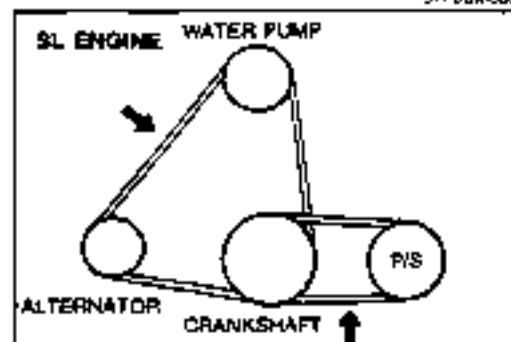
9TGOB2-010



9TFOBF-1



9TFOBX-005



9TFOBX-007

**DRIVE BELT****Inspection**

1. Remove the undercover for inspection of the P/S belt.
2. Check the drive belts for wear, cracks, and fraying. Replace if necessary.
3. Verify that the drive belts are correctly mounted on the pulleys.

4. Check the drive belt deflection by applying moderate pressure (**98 N, 10 kg, 22 lb**) midway between the pulleys as shown. Adjust if necessary.

**Deflection**

mm (in)

		New	Used
HA	Alternator	9.0—10.0 (0.35—0.39)	10.0—11.0 (0.39—0.43)
	P/S	9.0—11.0 (0.35—0.43)	12.0—13.0 (0.47—0.51)
SL	Alternator	9.0—10.0 (0.35—0.39)	10.0—11.0 (0.39—0.43)
	P/S	9.0—11.0 (0.35—0.43)	12.0—13.0 (0.47—0.51)
TF	Alternator	10.0—11.0 (0.39—0.43)	11.0—12.0 (0.43—0.47)

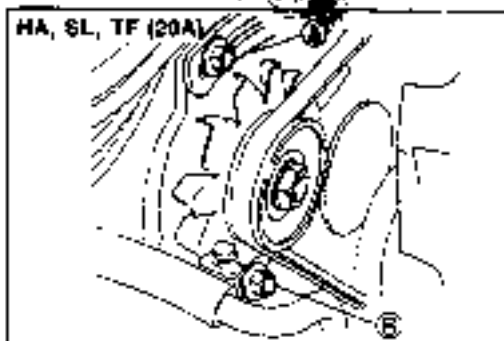
5. Check the drive belt tension with the SST.

**Tension**

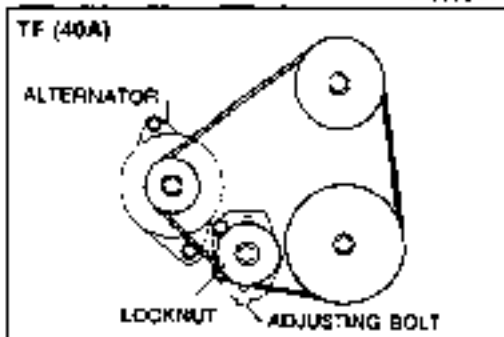
N (kg, lb)

		New	Used
HA	Alternator	294—392 (30—40, 66—86)	245—294 (25—30, 55—66)
	Alternator	332—491 (40—50, 88—110)	343—392 (35—40, 77—88)
TF	Alternator	451—520 (46—53, 101—117)	382—520 (39—53, 86—117)

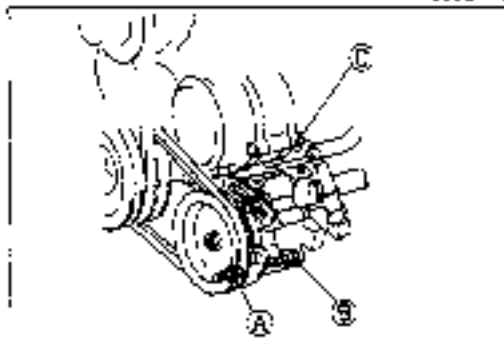




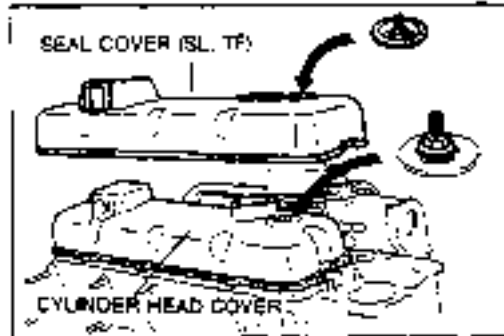
9T0082-014



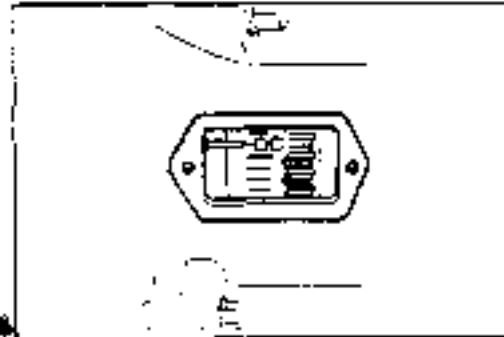
9T0082-015



9T0082-008



9T0082-019



9T0082-257

**Adjustment****Caution**

- If a new belt is used, adjust the belt deflection at the midpoint of new belt specification.

**1. Alternator belt****(i) HA, SL, TF (20A)**

- Loosen alternator bolts A and B and adjust the belt deflection.

**Tightening torque****A: 19–25 Nm (1.9–2.5 m·kg, 14–19 ft·lb)****B: 37–52 Nm (3.8–5.3 m·kg, 27–38 ft·lb)****(ii) TF (40A)**

- Loosen the locknut and adjust the belt deflection by turning the adjusting bolt.

**Tightening torque:****37–52 Nm (3.8–5.3 m·kg, 27–38 ft·lb)****2. P/S belt**

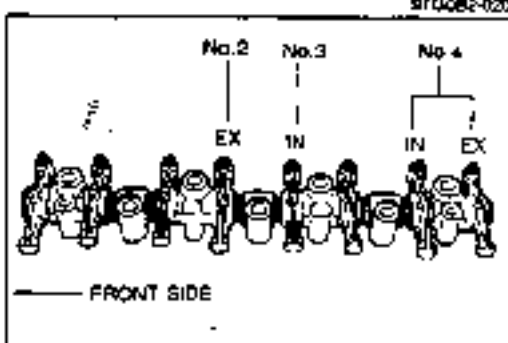
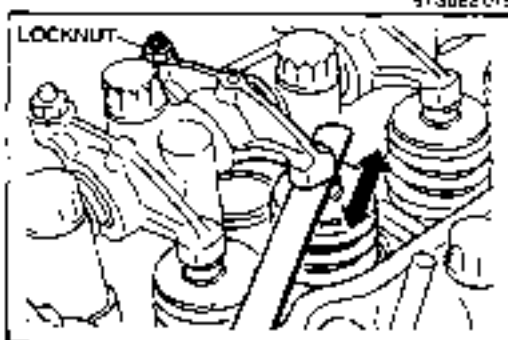
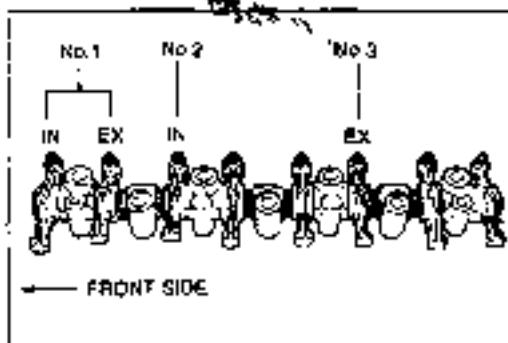
- Loosen P/S oil pump bolts A, B, and C and adjust the belt deflection.

**Tightening torque****A: 37–52 Nm (3.8–5.3 m·kg, 27–38 ft·lb)****B: 37–52 Nm (3.8–5.3 m·kg, 27–38 ft·lb)****C: 37–52 Nm (3.8–5.3 m·kg, 27–38 ft·lb)****VALVE CLEARANCE****Inspection / Adjustment**

1. Remove the air intake pipe (SL Turbo).
2. Remove the seal cover (SL, TF) and the cylinder head cover.
3. Remove the cover from the clutch housing (HA, SL) or from the end plate (TF).

4. Turn the crankshaft clockwise and set the No. 1 cylinder to compression TDC.

## B ENGINE TUNE-UP PROCEDURE



5 Measure the valve clearance as shown in the figure.

Valve clearance (Engine cold)

mm (in)

	IN	Ex
HA	0.30 (0.012)	0.30 (0.012)
SL	0.30 (0.012)	0.35 (0.014)
TF	0.30 (0.012)	0.40 (0.016)

6. If necessary, loosen the locknut and adjust the valve clearance by turning the adjusting screw.

7 Tighten the locknut.

Tightening torque:

12—17 Nm (120—170 cm-kg, 104—148 in-lb)

8. Turn the crankshaft clockwise one full turn and set the No. 4 cylinder to compression TDC.

9. Measure the remaining valve clearances as shown in the figure.

10. Install the cover.

11 Install the cylinder head cover.

Tightening torque:

2.0—3.4 Nm (20—35 cm-kg, 17—30 in-lb)

12. Install the seal cover (SL, TF).

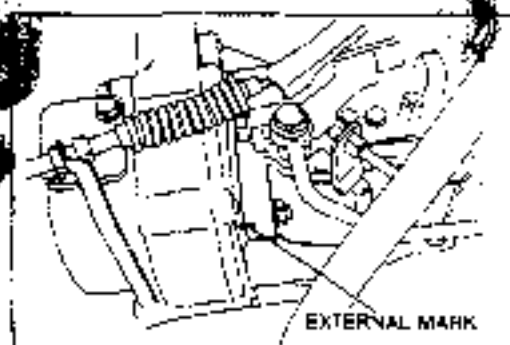
Tightening torque:

2.9—4.9 Nm (30—50 cm-kg, 26—43 in-lb)

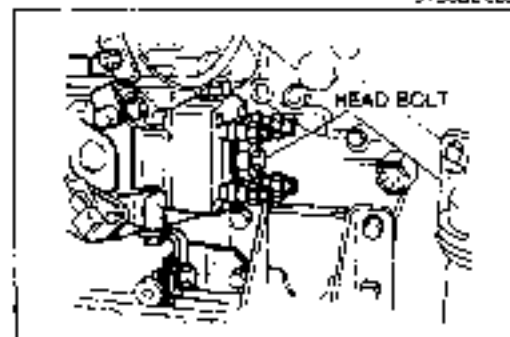
13. Install the air intake pipe (SL Turbo).

Tightening torque:

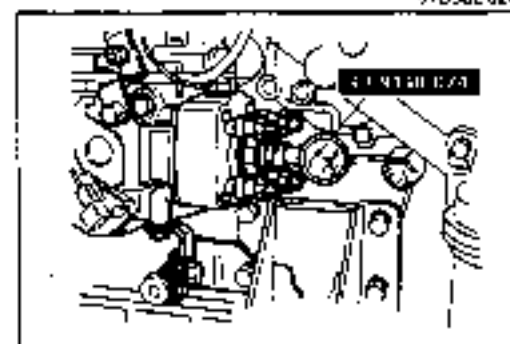
7.8—11 Nm (80—110 cm-kg, 69—95 in-lb)



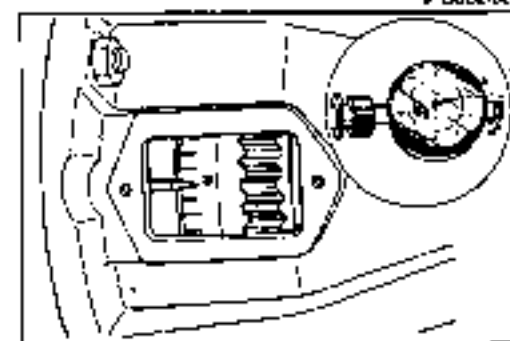
9T50B2-023



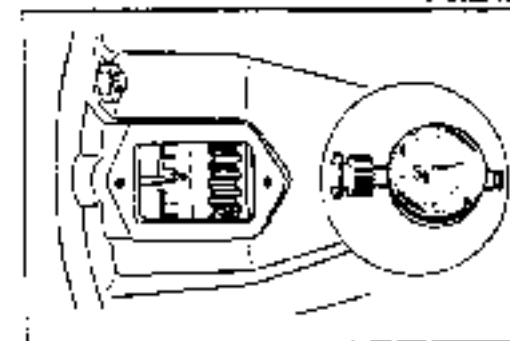
9T50B2-024



9T50B2-025



9T50B2-026



9T50B2-027

## INJECTION TIMING

HA Engine  
Inspection

## Note

- Usually it is enough to confirm that the external marks are aligned.
- Set the injection timing after installation of the injection pump.

1. Disconnect the fuel injection pipes from the injection pump.
2. Remove the bolt and gasket from the distributor head of the injection pump.

3. Screw the SST into the injection pump.
4. Make sure that the tip of the feeler of the measuring device is in contact with the plunger end at this time.

## Note

- The SST specified by Diesel Kiki Co., Ltd. is 157829-3520.

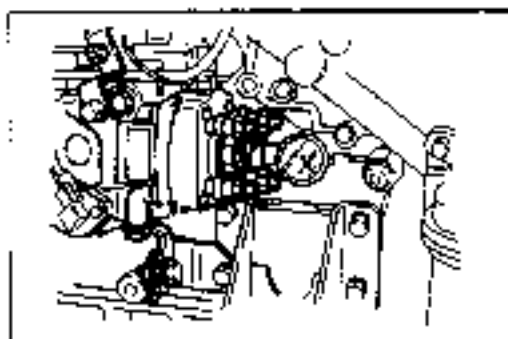
5. Turn the flywheel and set to approx. 30° BTDC.
6. Find the position in which the needle of the dial gauge does not move when the flywheel is turned.
7. When the dial gauge needle does not deflect, set the needle to "0" on the scale.

8. Turn the flywheel until 3° BTDC is indicated.
9. The injection timing is normal when the dial gauge needle is advanced 1.00mm (0.0394 in) ahead of the valve set in Steps 7.

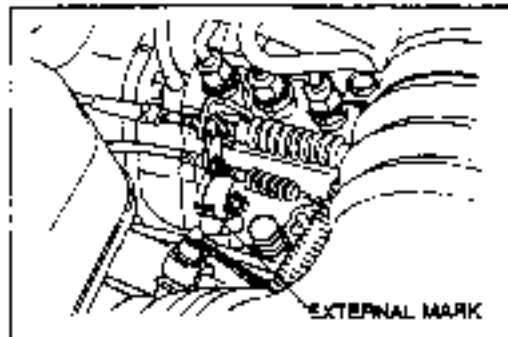
## Static injection:

Cam lift 1.00mm (0.0394 in)

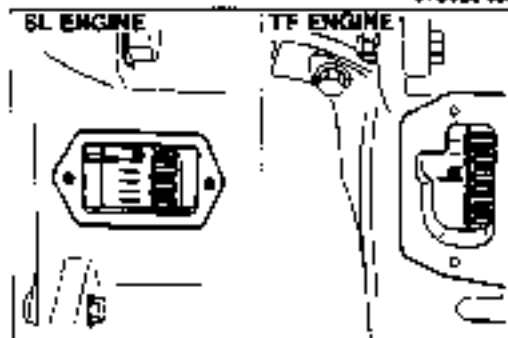
10. If the change is not as specified, adjust the injection timing.



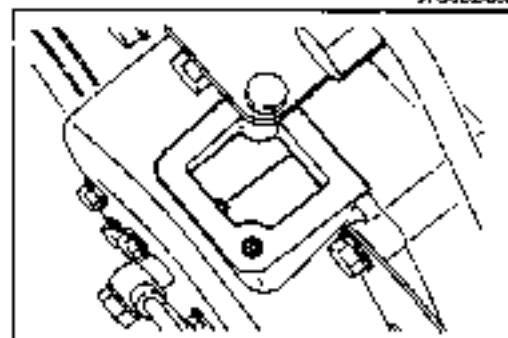
9TGCBZ-028



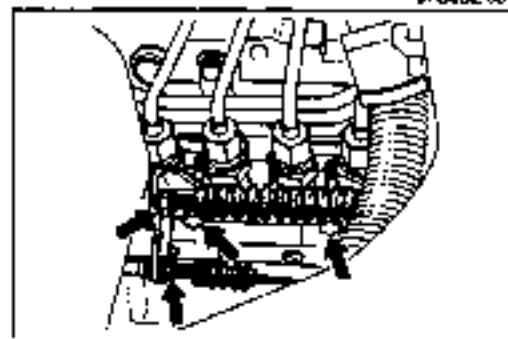
9TG0B3-029



9TG0B2-030



9TG0B2-031



9T34B3-032

**Adjustment**

- If the injection timing is faulty, turn the injection pump to a position in which the dial gauge needle indicates 1.00mm (0.0394 in).
  - When the cam lift is larger than 1.00mm (0.0394 in), turn the injection pump all the way in the engine revolving direction once, and then turn it in the reverse direction, adjusting the cam lift to the 1.00mm (0.0394 in) point.
  - If the cam lift is smaller than 1.00mm (0.0394 in), adjust the lift by turning the pump in the direction inverse to the engine revolving direction.
- After adjustment, install the new head bolt and new gasket.

**SL, TF Engine Inspection****Caution**

- Direct injection type engine is sensitive to injection timing. Incorrect timing will cause engine knocking or low power output. Set the injection timing after installation of the injection pump.

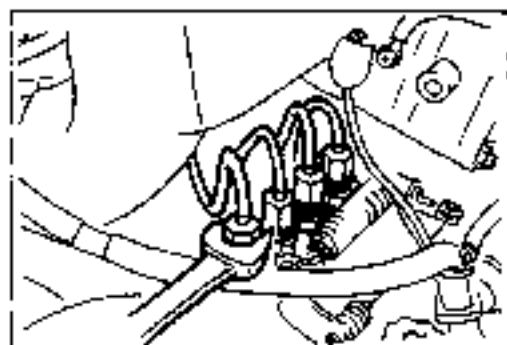
**Note**

- Usually it is enough to confirm that the external marks are aligned.

- Remove the blind covers from the clutch housing and the timing gear case.
- Turn the flywheel in the direction of rotation until the indicator pin comes to **30° BTDC**.
- Verify that the pointer of timing gear case and the mark on the timer are aligned.
- If not as specified, adjust the injection timing.

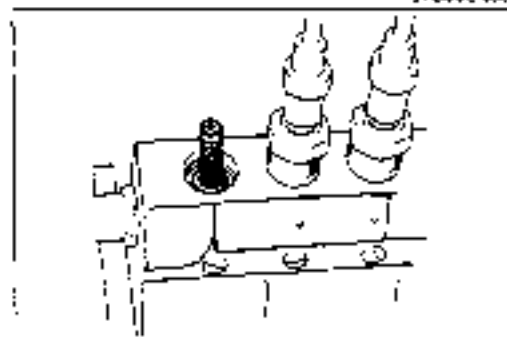
**Adjustment**

- Remove the fuel stop cable from the cut lever.
- Remove the accelerator cable from the control lever.
- Remove bracket
- Loosen injection pipes No.2—4 at the pump.



9TGC82-033

5. Remove No. 1 injection pipe and the delivery valve holder.

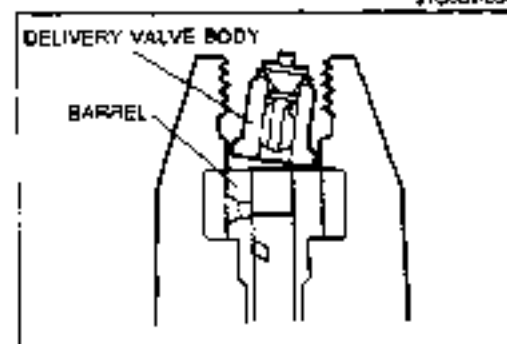


9TGC82-034

6. Remove the delivery valve spring seat and spring.

**Caution**

- Do not remove the delivery valve body.

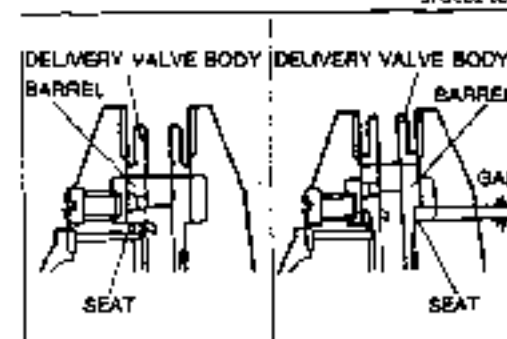


9TGC82-035

7. Rock the delivery valve to break it loose from the barrel.

**Note**

- If the delivery valve is lifted up without breaking it loose, the barrel may also be lifted out of the pump. If this happens the barrel may not reseal and may allow fuel into the engine and cause engine damage.

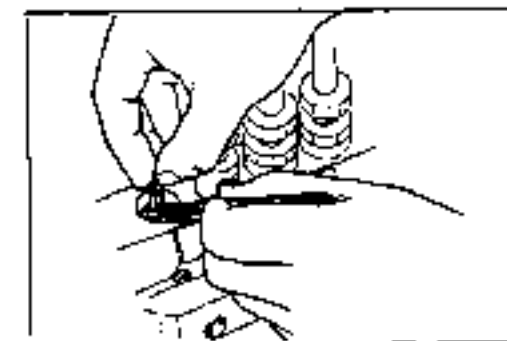


9TGC82-036

8. Remove the delivery valve, holding the flat washer with tweezers.

**Caution**

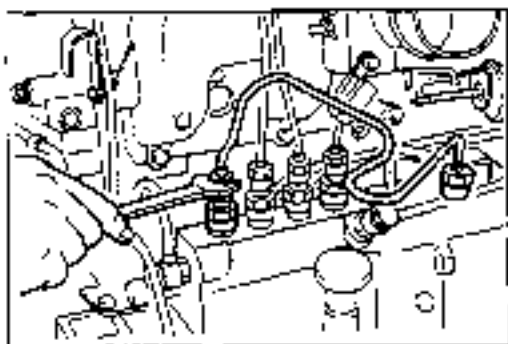
- Do not pinch the sliding surface of the delivery valve.



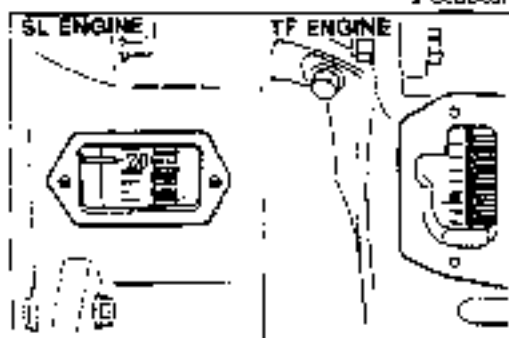
9TGC82-037

9. Install the delivery valve holder.

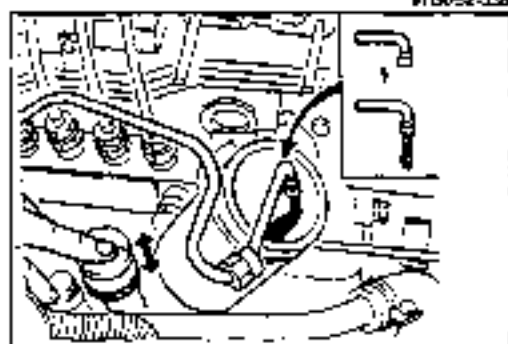
## B ENGINE TUNE-UP PROCEDURE



10. Tighten No. 1 injection pipe so that it points away from the pump.



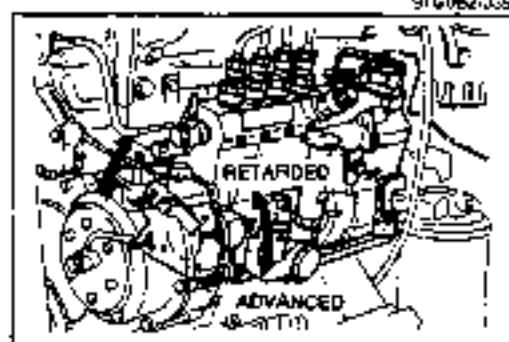
11. Turn the flywheel in the direction of rotation and set it at **20° BTDC**.



12. Place a container under No. 1 injector pipe and verify that fuel is expelled when pumping the primer pump.  
13. While pumping the priming pump, turn the flywheel in the normal direction of rotation and verify that fuel flow stops as specified.

### Fuel stops

SL Non-Turbo:	12° BTDC
SL Turbo	: 13° BTDC
TF	: 11° BTDC



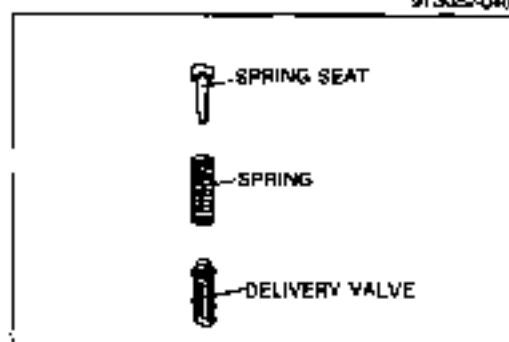
14. If necessary, adjust the injection timing by loosening the pump mounting bolts and rotating the pump outward or inward as shown in the figure.

**When advanced:** turn to right (seen from front)  
**When retarded :** turn to left (seen from front)

15. After adjustment, tighten the mounting nuts.

### Tightening torque:

**34—39 Nm (3.5—4.0 m·kg, 25—29 ft·lb)**

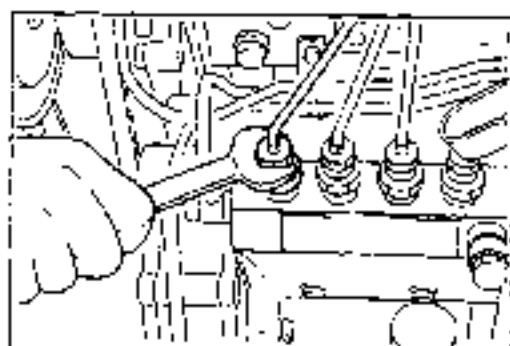


16. Mark the pump flange and the pump body for future reference.

17. Install the delivery valve, spring, and spring seat.  
18. Tighten the delivery valve holder.

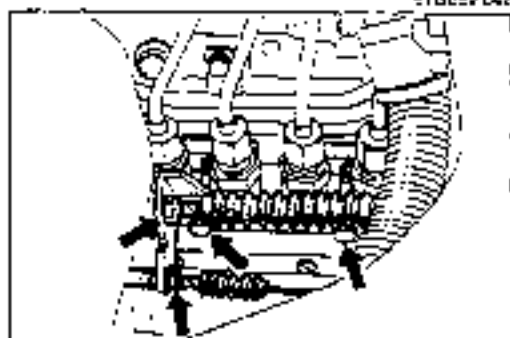
### Tightening torque:

**39—44 Nm (4.0—4.5 m·kg, 29—33 ft·lb)**



9TG022-042

19. Install No.1 injection pipe.



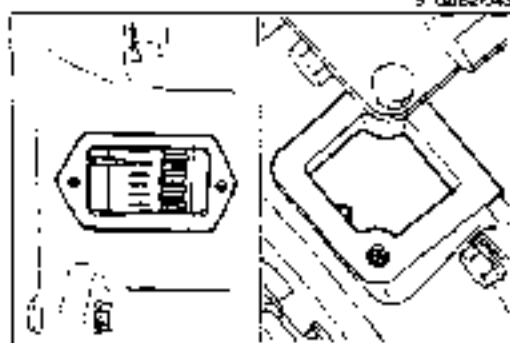
9TG022-043

20. Tighten injection pipes No.2—4.

21. Install the bracket.

22. Install the accelerator cable to the control lever.

23. Install the fuel stop cable to the cut lever.

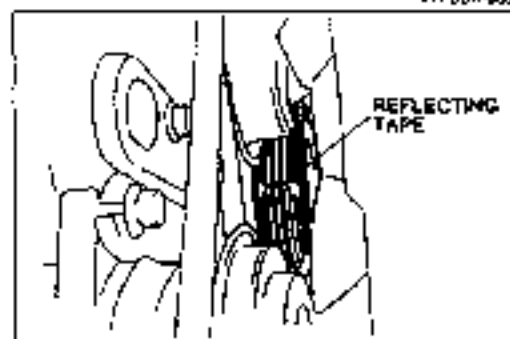


9TF02K-009

24. Install blink covers onto the clutch housing and the timing gear case.

25. Bleed air from the system. (Refer to page B-16.)

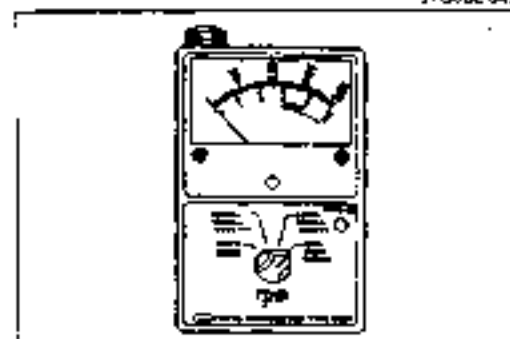
26. Start the engine and check for fuel leaks.



9TG082-045

**IDLE SPEED****Adjustment**

1. Attach suitable reflector tape to the crankshaft pulley.
2. Run the engine at idle to normal operating temperature.
3. Turn OFF all electrical loads.



9TC082-046

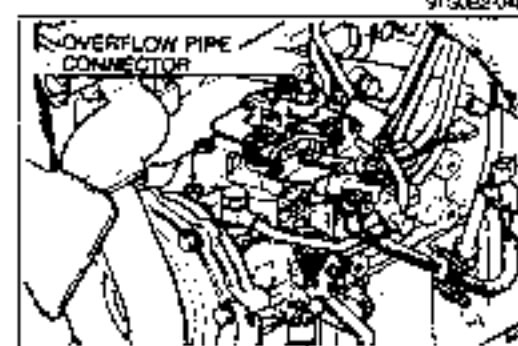
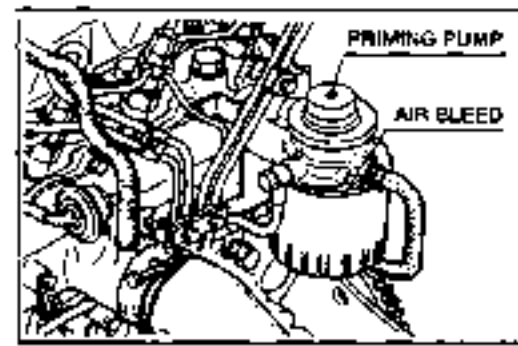
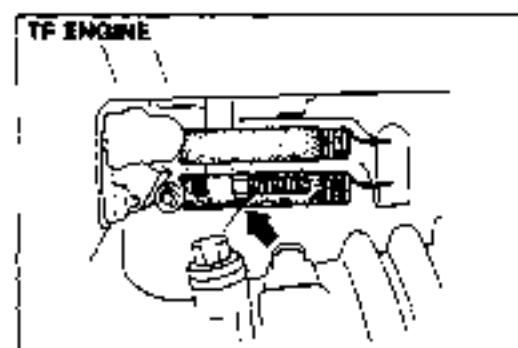
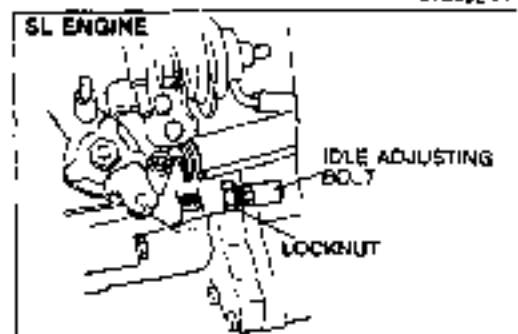
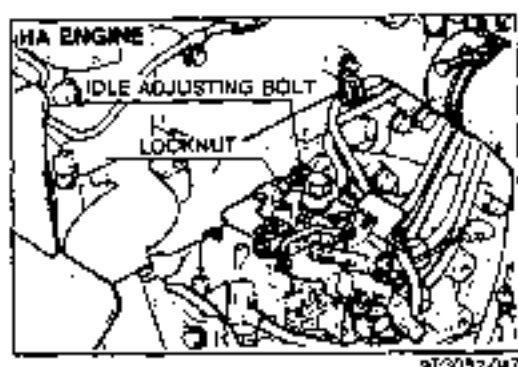
4. Confirm the free play of the accelerator cable.

**Free play: 1—3mm (0.04—0.12 in)**

5. Aim the light of the photo tachometer onto the reflecting tape to measure the engine speed.

<b>Idle speed</b>	HA	: 600—650 rpm
	SL Non-Turbo	: 620—670 rpm
	SL Turbo	: 660—710 rpm
	TF	: 620—700 rpm

## B ENGINE TUNE-UP PROCEDURE



6. If not as specified, loosen the locknut of the idle adjusting bolt and adjust by turning the bolt.
7. Tighten the locknut.

### Tightening torque

- HA :  
5.9—8.8 Nm (60—90 cm-kg, 52—78 in-lb)
- SL, TF:  
9.8—14 Nm (100—140 cm-kg, 87—122 in-lb)

### AIR BLEEDING

#### HA Engine

#### Warning

- Keep sparks, cigarettes, and open flames away from the fuel area.

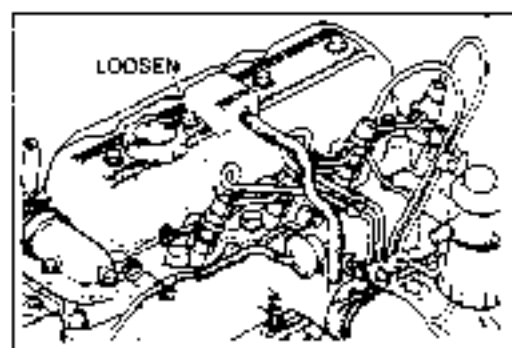
1. Remove the air bleeder plug.
2. Pump the priming pump until clear (no air bubbles) fuel flows from the bleeder plug hole.
3. Install the air bleeder plug.
4. Loosen the overflow pipe connector of the injection pump.
5. Pump the priming pump until fuel flows from the pipe.
6. Tighten the overflow pipe connector.

#### Tightening torque:

- 20—29 Nm (2.0—3.0 m-kg, 14—22 ft-lb)

7. Start the engine and run it at idle until it runs smoothly.



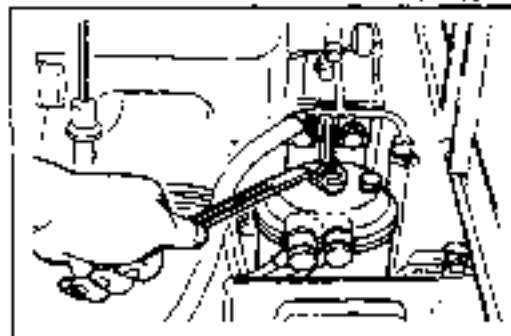


97GCB2-05C

8. Stop the engine.
9. Loosen the all flare nuts of the injection pipes of injection nozzle side.
10. Confirm fuel injection from the injection pipes while cranking.
11. Tighten the nuts.

**Tightening torque:**

20—25 N·m (2.0—2.5 m·kg, 14—18 ft·lb)

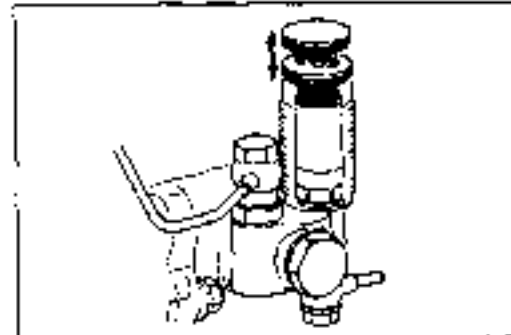


97GCB2-061

**SL, TF Engine****Warning**

- Keep sparks, cigarettes, and open flames away from the fuel area.

1. Loosen the air bleeder plug

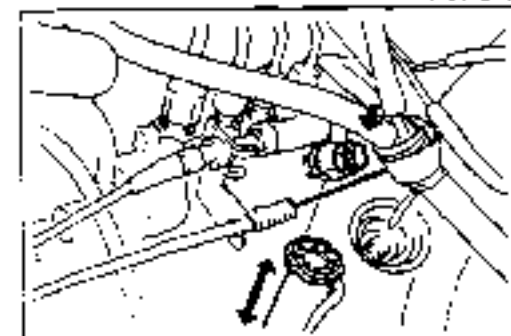


97GCB2-061

2. Pump the priming pump until no air is expelled.
3. Tighten the air bleeder plug.

**Tightening torque:**

5.9—6.8 N·m (60—90 cm·kg, 52—78 in·lb)



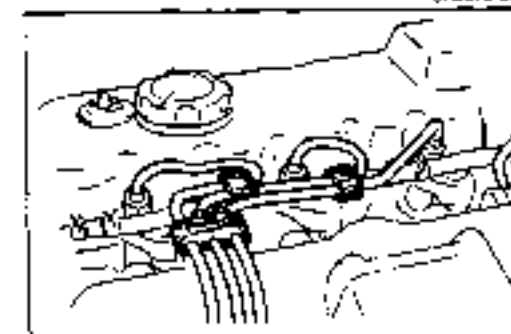
8T80F2-092

4. Loosen the return pipe at the injection pump, and pump the priming pump until no air is expelled.
5. Tighten the bolt.

**Tightening torque:**

12—15 N·m (120—150 cm·kg, 104—130 in·lb)

6. Push the priming pump down and tighten it



97GCB2-063

7. Loosen the injection pipes at the injection nozzles.
8. Crank the engine, and verify that fuel is expelled from each injection pipe
9. Tighten the injection pipes.

**Tightening torque:**

20—25 N·m (2.0—2.5 m·kg, 14—18 ft·lb)

# B

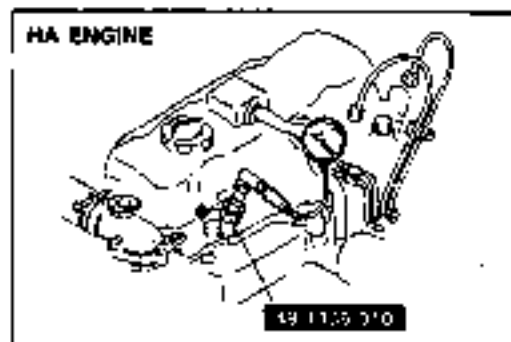
## COMPRESSION

### COMPRESSION

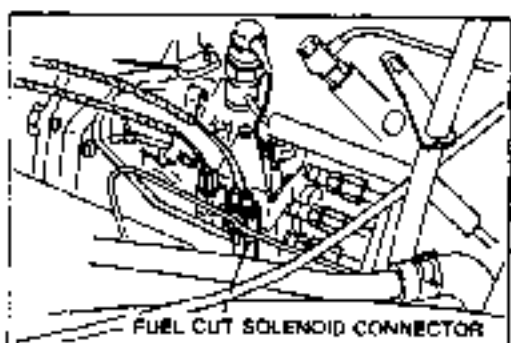
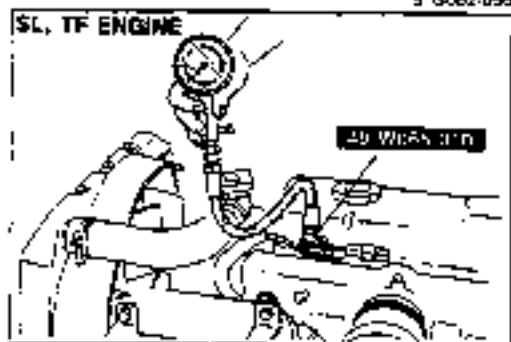
#### PREPARATION SST

49 1456 010 Adapter set, compression gauge (HA)		For inspection of engine compression	49 0638 011 Joint (Part of 49 1456 010)		For inspection of engine compression
49 1456 012 Adapter (Part of 49 1456 010)		For inspection of engine compression	49 W065 010 Adapter, compression gauge (SL, TF)		For inspection of engine compression

87G062-055



87G062-056



87G062-057

If the engine exhibits low power, poor fuel economy, or poor idle, check the following:

1. Compression.
2. Fuel system. (Refer to Section F.)

#### INSPECTION

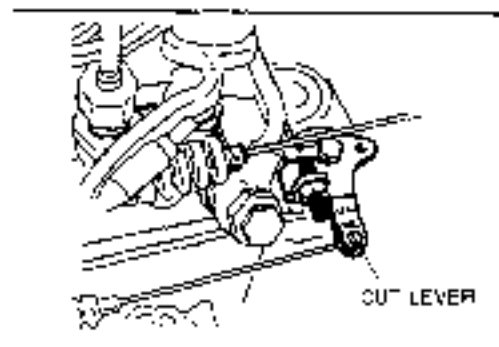
1. Verify that the battery is fully charged.  
Recharge it if necessary. (Refer to Section G.)
2. Warm up the engine to normal operating temperature.
3. Turn the engine OFF.
4. Remove all the fuel injection nozzles. (Refer to Section F.)
5. Connect a compression gauge with the SST to the No. 1 cylinder injection nozzle hole.

6. Prevent fuel injection as follows.

#### Warning

- If this is not done, fuel will be pumped from the fuel injection pump while cranking.

- (1) HA  
Disconnect the fuel cut solenoid connector.



97GC52-028

(2) SL, TF

Pull the fuel stop cable to position the cut lever to fuel stop position.

7. Crank the engine and record the maximum gauge reading.
8. Check each cylinder using the same procedure.

### Compression

kPa (kg/cm<sup>2</sup>, psi)-rpm

		Standard	Minimum
HA		2,943 (30.0, 427)-200	2,649 (27.0, 384)-200
SL	Non-Turbo	2,943 (30.0, 427)-300	2,649 (27.0, 384)-300
	Turbo	2,551 (26.0, 370)-320	2,256 (23.0, 327)-320
TF		2,943 (30.0, 427)-270	2,649 (27.0, 384)-270

### Variation between cylinders:

**294 kPa (3.0 kg/cm<sup>2</sup>, 43 psi) max.**

97GC52-066

9. If the compression in one or more cylinders is low, pour a small amount of engine oil into the cylinder and recheck the compression.
  - (1) If the compression increases, the piston, piston rings, or cylinder wall may be worn.
  - (2) If the compression stays low, the valve may be stuck or sealing improperly.
  - (3) If the compression in adjacent cylinders stays low, the cylinder head gasket may be defective or the cylinder head distorted.
10. Connect the fuel cut solenoid connector. (HA)
11. Remove the compression gauge and the SST.
12. Install all the fuel injection nozzles and pipes. (Refer to Section F.)
13. Bleed the air from the fuel line. (Refer to page B-16.)

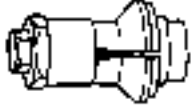


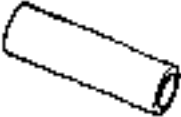
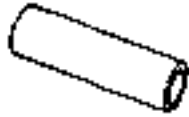
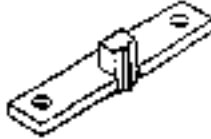
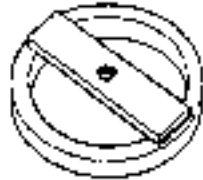


97GC52-010

# B ON-VEHICLE MAINTENANCE

## ON-VEHICLE MAINTENANCE

### PREPARATION

#### SST

<p>49 0559 210</p> <p>Oil seal installer and centering tool (HA)</p>		<p>For installation of front oil seal</p>	<p>49 W011 102</p> <p>Installer, oil seal (TF)</p>		<p>For installation of front oil seal</p>
<p>49 V101 080A</p> <p>Brake, ring gear (HA, SL)</p>		<p>For prevention of engine rotation</p>	<p>49 5501 062</p> <p>Collar (HA)</p>		<p>For prevention of engine rotation</p>
<p>49 W065 062</p> <p>Collar (SL)</p>		<p>For prevention of engine rotation</p>	<p>49 W011 103</p> <p>Brake, ring gear (TF)</p>		<p>For prevention of engine rotation</p>
<p>49 W011 101</p> <p>Installer, oil seal (TF)</p>		<p>For installation of rear oil seal</p>	<p>49 G030 797</p> <p>Handle (TF)</p>		<p>For installation of rear oil seal</p>
<p>49 SE01 310</p> <p>Centering tool, clutch disc</p>		<p>For installation of clutch disc</p>	9T00B2-063		

**CYLINDER HEAD GASKET****Replacement****Warning**

- Keep sparks and open flame away from the fuel area.

**Caution**

- Position hose clamps in their original location on hoses, and squeeze the clamps lightly with large pliers to ensure a good fit.

1. Disconnect the negative battery cable.
2. Drain the engine coolant.
3. Remove in the order shown in the figure, referring to **Removal Note**.
4. Install in the reverse order of removal, referring to **Installation Note**.

**Steps After Installation**

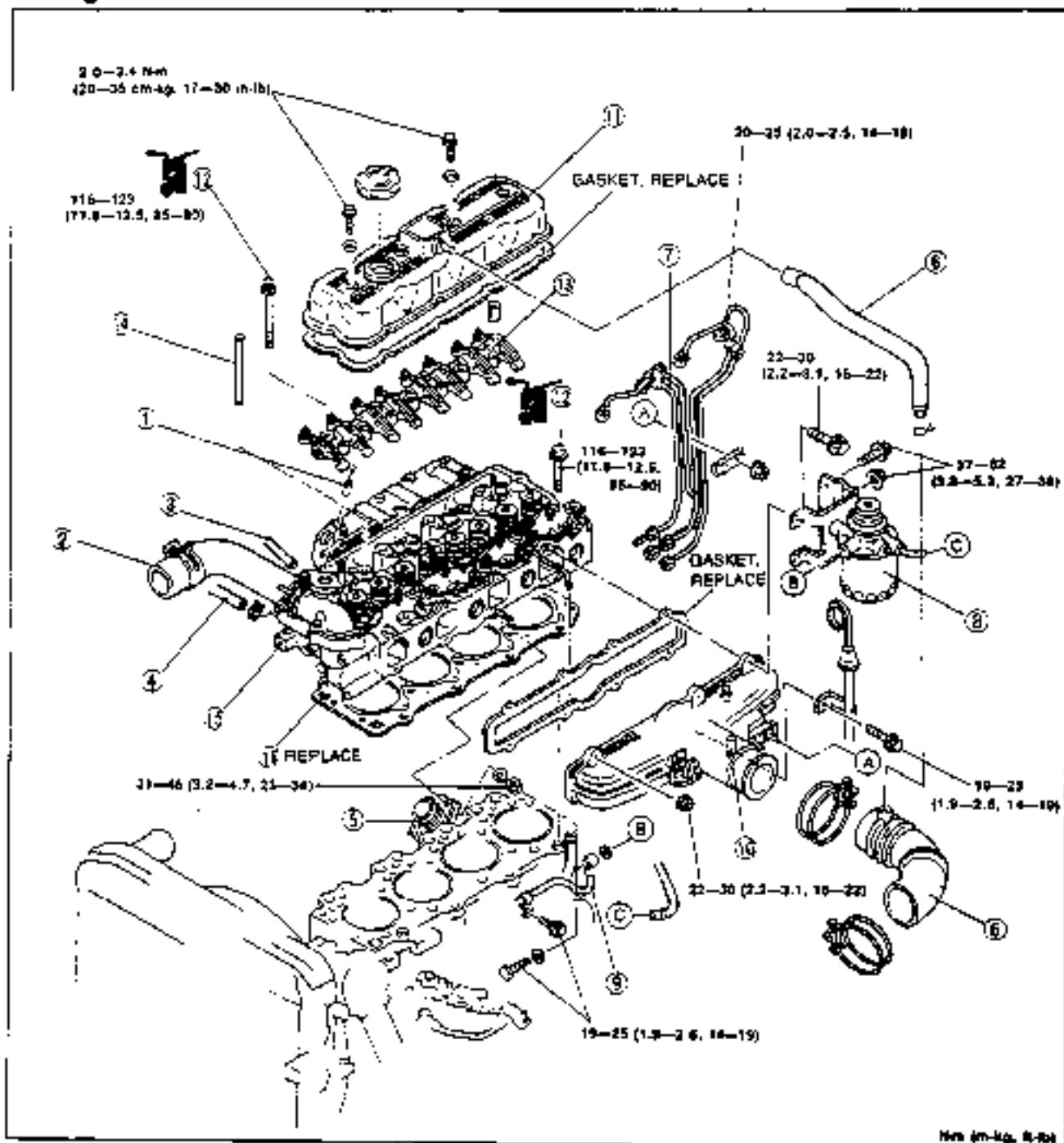
1. Fill the radiator with the specified amount and type of engine coolant. (Refer to Section E.)
2. Connect the negative battery cable.
3. Check as follows:
  - (1) Engine oil and engine coolant leakage.
  - (2) Compression. (Refer to page B-18.)
  - (3) Drive belt deflection. (Refer to page B-9.)
4. Start the engine and let it warm up to operating temperature.
5. Recheck the engine coolant levels.

9TF08X 011

# B

## ON-VEHICLE MAINTENANCE

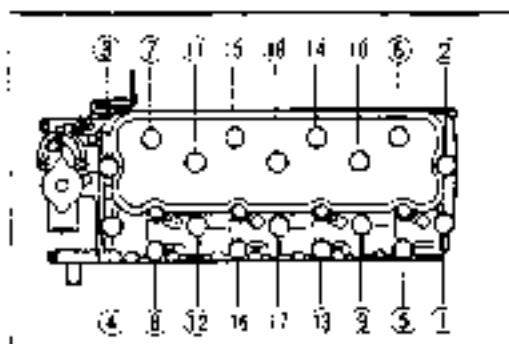
### HA Engine



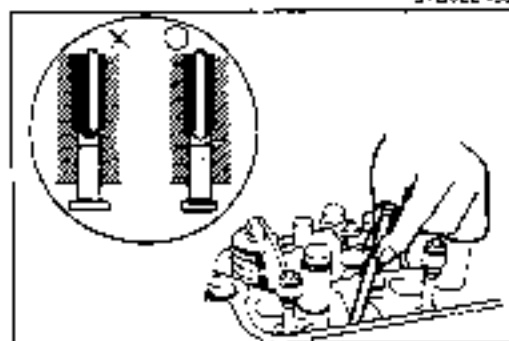
Hex (m-kg, ft-lb)  
STROBX-012

1. Harness connector
2. Upper radiator hose
3. Coolant reservoir hose
4. Heater hose
5. Exhaust pipe
6. Air hose
7. Injection pipe
8. Fuel filter body
9. Fuel pipe
10. Intake manifold assembly
11. Cylinder head cover

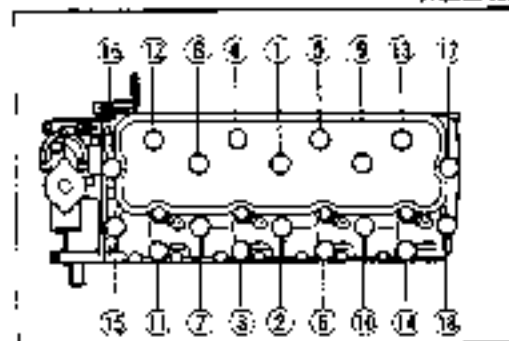
12. Cylinder head bolt  
Removal Note..... page B- 23  
Installation Note..... page B- 23
13. Rocker arm assembly
14. Push rod  
Installation Note..... page B- 23
15. Cylinder head  
Disassembly..... page B- 60  
Inspection..... page B- 76  
Assembly..... page B-113
16. Cylinder head gasket



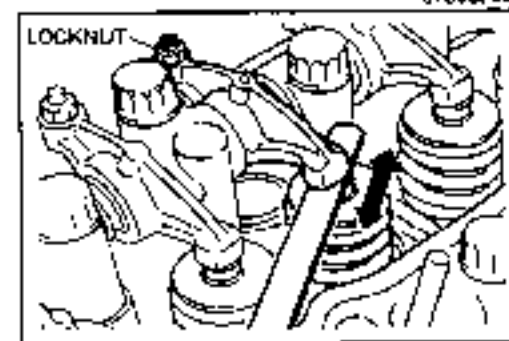
9T0C62-056



9T0C62-057



9T0C62-058



9T0C6X-013

**Removal note****Cylinder head bolt**

1. Loosen the cylinder head bolts in two or three steps in the order shown in the figure.
2. Remove the cylinder head bolts.

**Installation note****Push rod**

1. Insert the push rods.

**Caution**

- Verify that the ends of the push rods are properly set in to the tappets.

**Cylinder head bolt****Caution**

- Verify that the rocker arms and push rods are properly engaged while tightening.

1. Apply clean engine oil to the bolt threads and seat faces.
2. Install the cylinder head bolts.
3. Tighten the cylinder head bolts in two or three steps in the order shown in the figure.

**Tightening torque:**

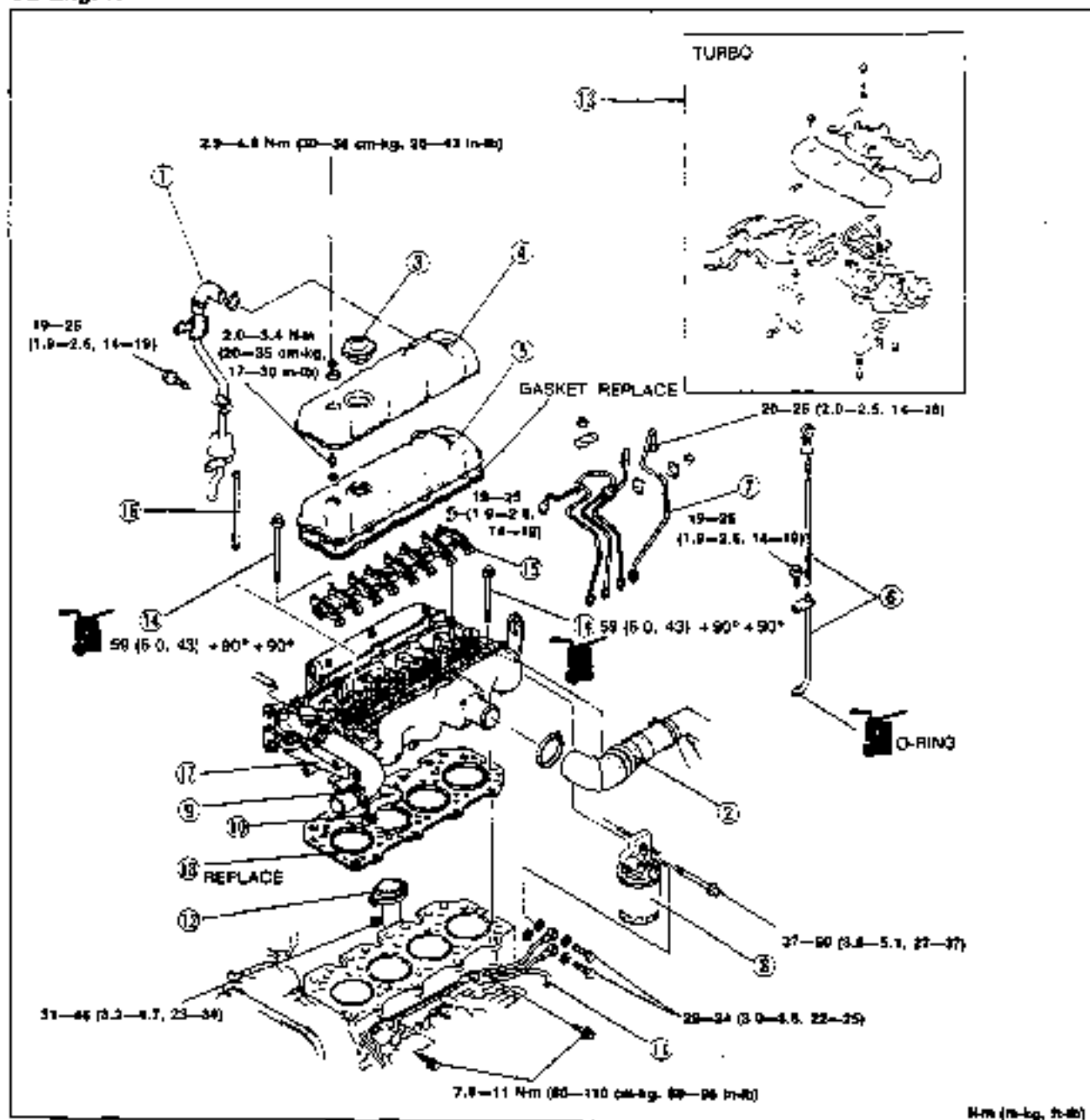
116–123 N·m (11.8–12.5 m·kg, 85–90 ft·lb)

**Caution**

- Adjust the valve clearance. (Refer to page B-9.)

# B ON-VEHICLE MAINTENANCE

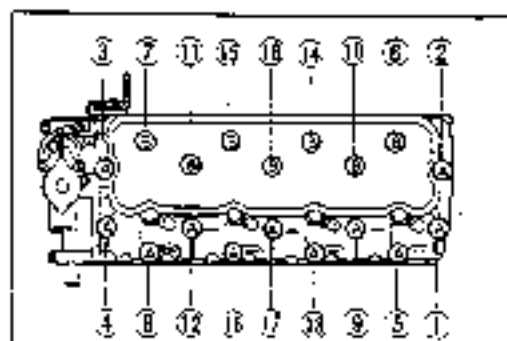
## SL Engine



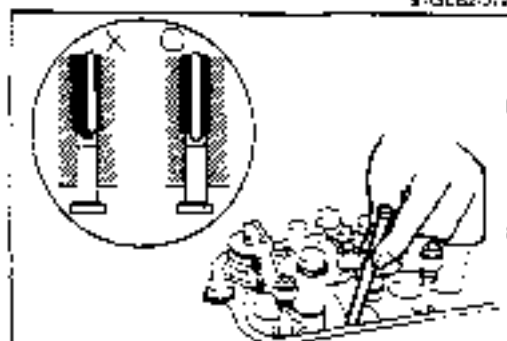
1. Breather pipe
2. Air pipe and hose
3. Oil filler cap
4. Seal cover
5. Cylinder head cover
6. Oil level gauge and guide pipe
7. Injection pipe and fuel hose
8. Fuel filler body
9. Upper radiator hose
10. Heater hose
11. Vacuum hose
12. Front exhaust pipe

13. Turbocharger (Turbo)
  - Service..... Section =
14. Cylinder head bolt
  - Removal Note..... page B- 25
  - Installation Note..... page B- 25
15. Rocker arm assembly
  - Installation Note..... page B- 25
17. Cylinder head
  - Disassembly..... page B- 60
  - Inspection..... page B- 76
  - Assembly..... page B-113
18. Cylinder head gasket

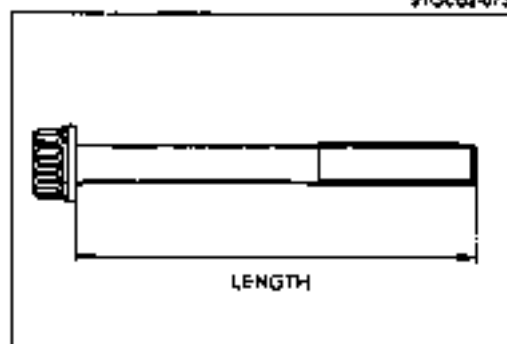




9TGC02-072

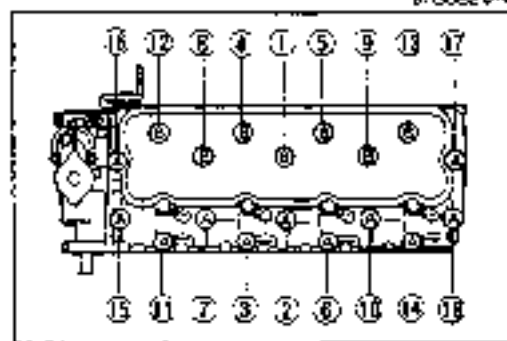


9TGC02-073



LENGTH

9TGC02-074



9TGC02-075



9TGC02-076

**Removal note****Cylinder head bolt**

1. Loosen the cylinder head bolts in two or three steps in the order shown in the figure.
2. Remove the cylinder head bolts.

**Installation note****Push rod**

1. Insert the push rods.

**Caution**

- Verify that the ends of the push rods are properly set in to the tappets.

**Cylinder head bolt**

1. Measure the length of the cylinder head bolt below the head. If the length exceeds the maximum, replace it.

**Length**

- Standard** (A): 121.7–122.3mm (4.791–4.815 in)  
 (B): 150.7–151.3mm (5.933–5.957 in)  
**Maximum** (A): 123.0mm (4.843 in)  
 (B): 152.0mm (5.984 in)

**Caution**

- Verify that the rocker arms and push rods are properly engaged while tightening.

2. Apply clean engine oil to the bolt threads and seal faces.
3. Install the cylinder head bolts.
4. Tighten the cylinder head bolts in two or three steps in the order shown in the figure.

**Tightening torque: 59 N·m (6.0 m·kg, 43 ft·lb)**

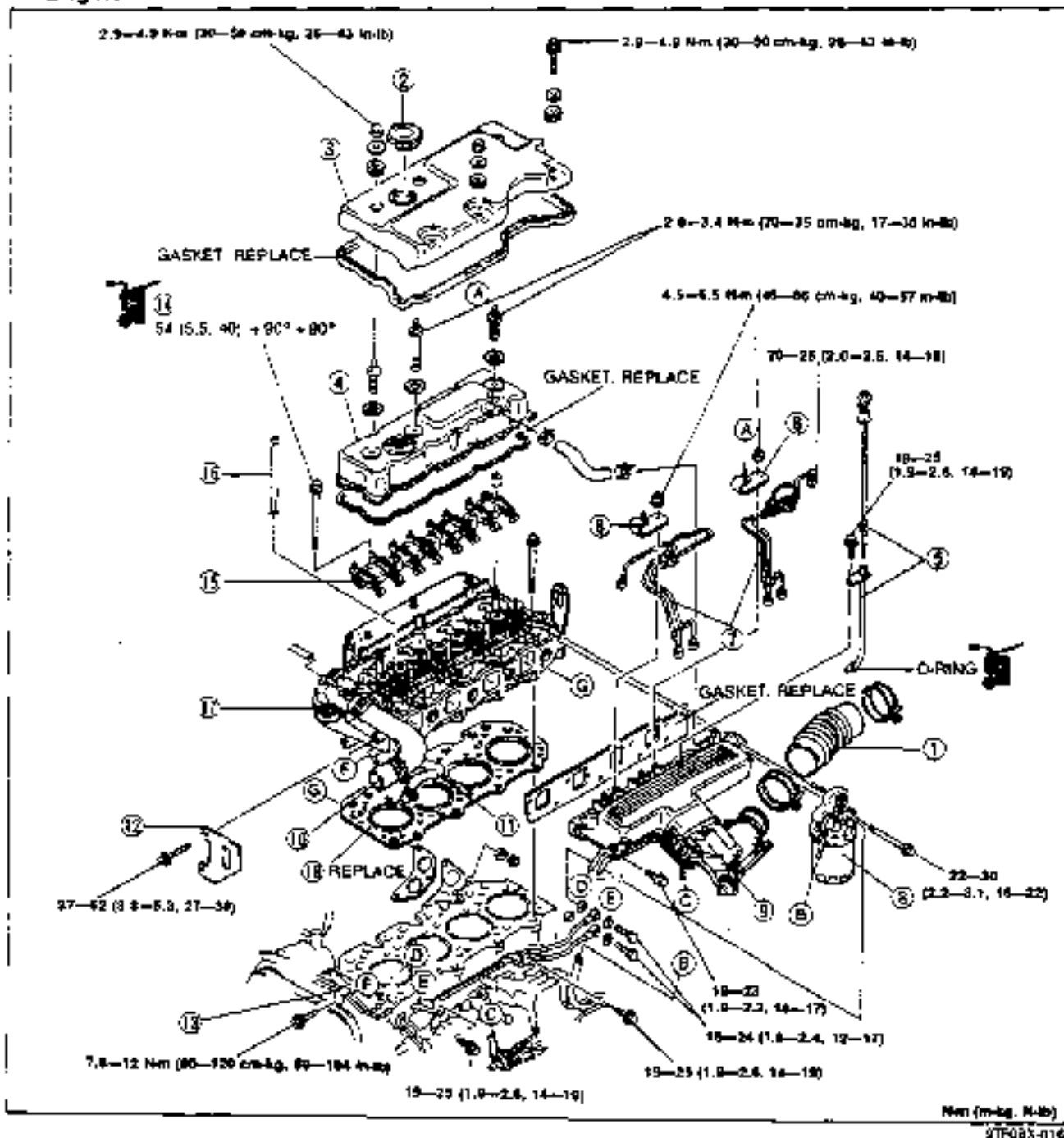
5. Make paint marks on the bolt heads as shown in the figure.
6. With the paint marks as a reference point, tighten the cylinder head bolts **another**  $90^\circ \pm 15^\circ$  in the tightening order.
7. Tighten the bolts **once again**  $90^\circ \pm 15^\circ$  in the tightening order.

**Caution**

- Adjust the valve clearance. (Refer to page B-9.)

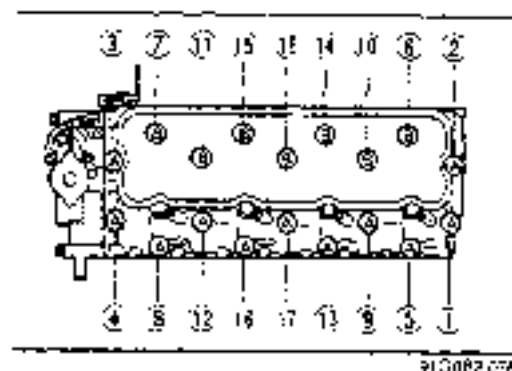
# B ON-VEHICLE MAINTENANCE

## TF Engine

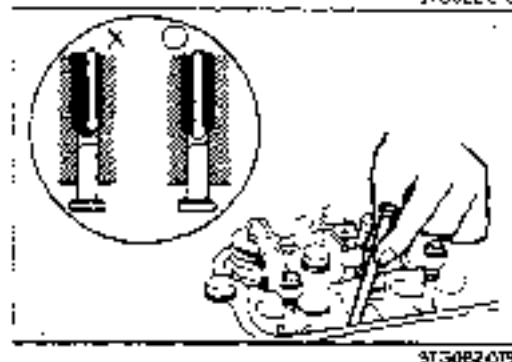


1. Air hose
2. Oil filler cap
3. Seal cover
4. Cylinder head cover
5. Oil level gauge and guide pipe
6. Injection pipe clip
7. Injection pipe
8. Fuel filter body
9. Intake manifold
10. Upper radiator hose
11. Heater hose
12. Front engine hanger

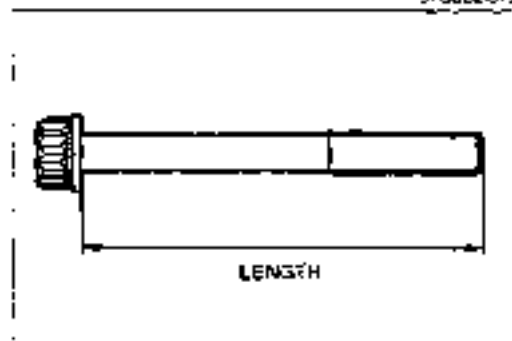
13. Vacuum pipe
14. Cylinder head bolt
- Removal Note..... page B- 27
- Installation Note..... page B- 27
15. Rocker arm assembly
16. Push rod
- Installation Note..... page B- 27
17. Cylinder head
- Disassembly..... page B- 60
- Inspection..... page B- 76
- Assembly..... page B-113
18. Cylinder head gasket



9T0082-074

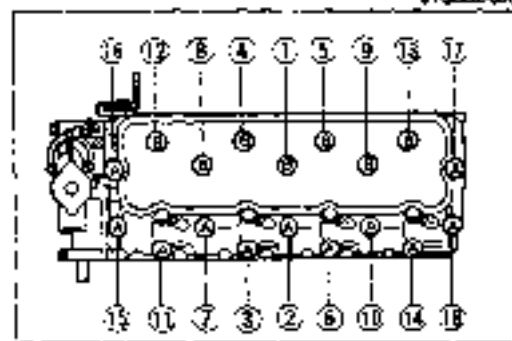


9T3082-079

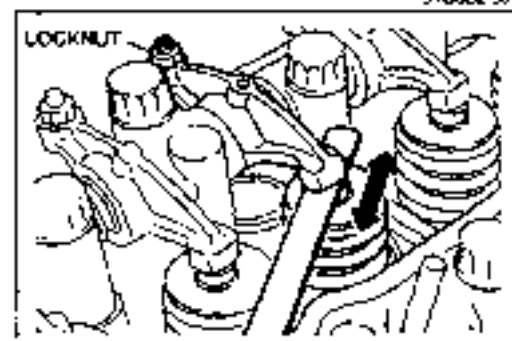


LENGTH

9T0082-080



9T0082-081



LOCKNUT

9TF98X-017

**Removal note****Cylinder head bolt**

1. Loosen the cylinder head bolts in two or three steps in the order shown in the figure.
2. Remove the cylinder head bolts.

**Installation note****Push rod**

1. Insert the push rods.

**Caution**

- Verify that the ends of the push rods are properly set in to the tappets.

**Cylinder head bolt**

1. Measure the length of the cylinder head bolt below the head. If the length exceeds the maximum, replace it.

**Length**

- Standard** (A): 130.2—130.8mm (5.126—5.150 in)  
 (B): 158.2—158.8mm (6.228—6.252 in)  
**Maximum** (A): 131.5mm (5.177 in)  
 (B): 159.5mm (6.280 in)

**Caution**

- Verify that the rocker arms and push rods are properly engaged while tightening.

2. Apply clean engine oil to the bolt threads and seat faces.
3. Install the cylinder head bolts.
4. Tighten the cylinder head bolts in two or three steps in the order shown in the figure.

**Tightening torque: 54 Nm (5.6 m-kg, 40 ft-lb)**

5. Make paint marks on the bolt heads as shown in the figure.
6. With the paint marks as a reference point, tighten the cylinder head bolts **another 90° ± 15°** in the tightening order.
7. Tighten the bolts **once again 90° ± 15°** in the tightening order.

**Caution**

- Adjust the valve clearance. (Refer to page B-9.)

## **B** ON-VEHICLE MAINTENANCE

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### **FRONT OIL SEAL Replacement**

#### **Caution**

- Position hose clamps in their original location on hoses, and squeeze the clamps tightly with large pliers to ensure a good fit.
- After radiator cowling installation, rotate the cooling fan by hand and verify that the fan blade does not touch the radiator cowling.  
If the fan touches the cowling, adjust the radiator cowling mounting position.

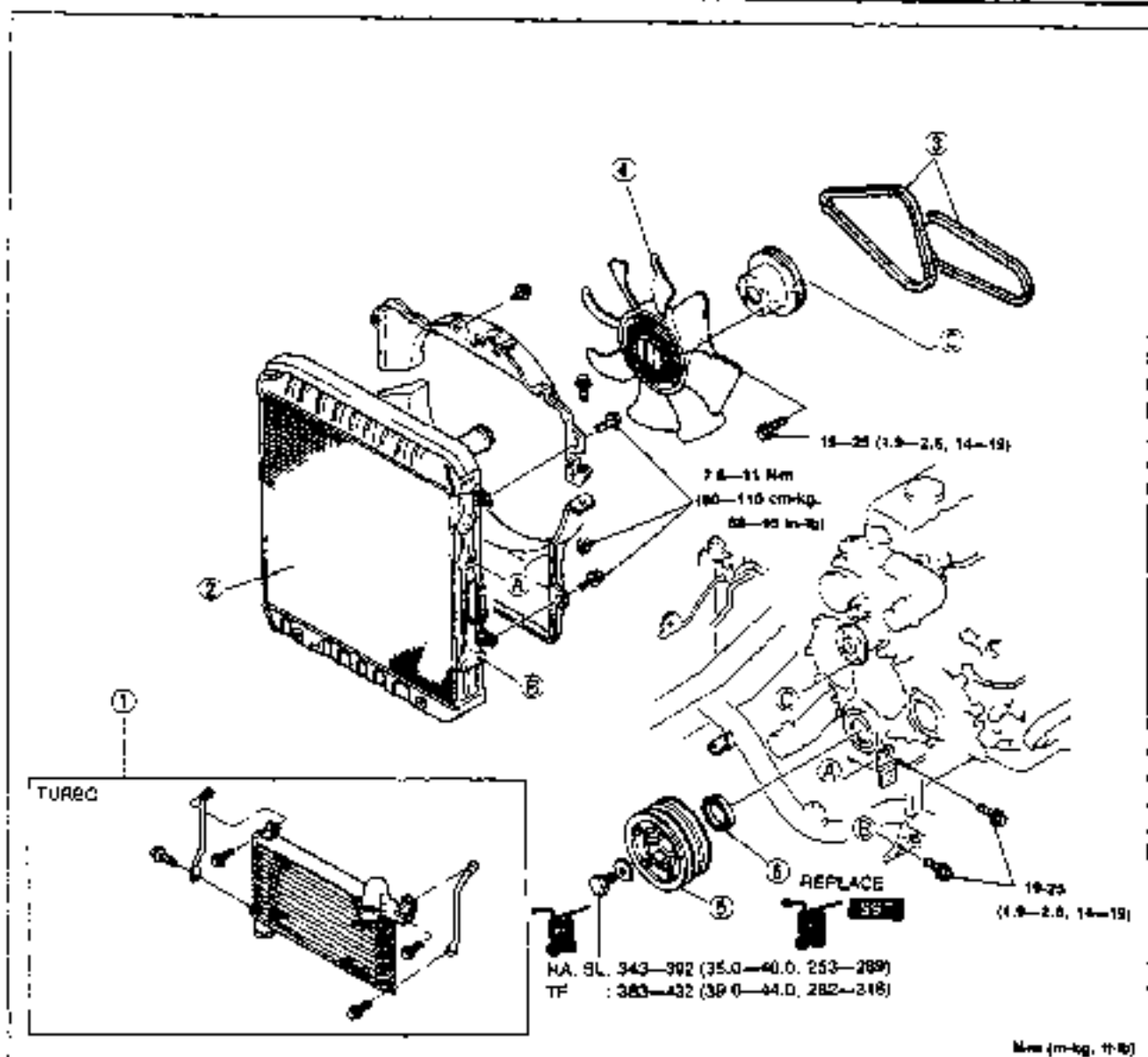
1. Disconnect the negative battery cable.
2. Remove the undercover.
3. Drain the engine coolant.
4. Remove in the order shown in the figure, referring to **Removal Note**.
5. Install in the reverse order of removal, referring to **Installation Note**.

97G082-083

#### **Steps After Installation**

1. Fill the radiator with the specified amount and type of engine coolant. (Refer to Section E.)
2. Install the undercover.
3. Connect the negative battery cable.
4. Start the engine and check as follows:
  - (1) Engine oil and engine coolant leakage.
  - (2) Drive belt deflection. (Refer to page B-8.)
5. Recheck the engine coolant levels.

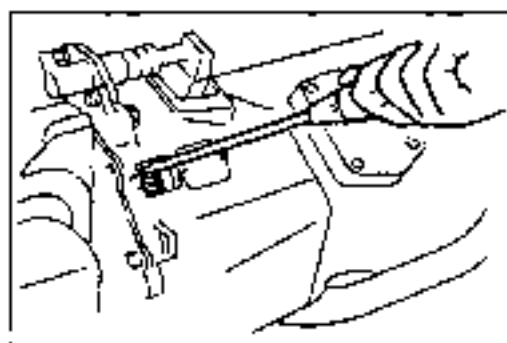
97F035-018



9TFOBC019

- |                        |           |
|------------------------|-----------|
| 1. Intercooler (Turbo) |           |
| Service                | Section F |
| 2. Radiator            |           |
| Service                | Section E |
| 3. Drive belt          |           |
| Adjustment             | page B-9  |
| 4. Cooling fan         |           |

- |                      |           |
|----------------------|-----------|
| 5. Crankshaft pulley |           |
| Removal Note         | page B-29 |
| Installation Note    | page B-30 |
| 6. Oil seal          |           |
| Removal Note (HA)    | page B-30 |
| Installation Note    | page B-30 |



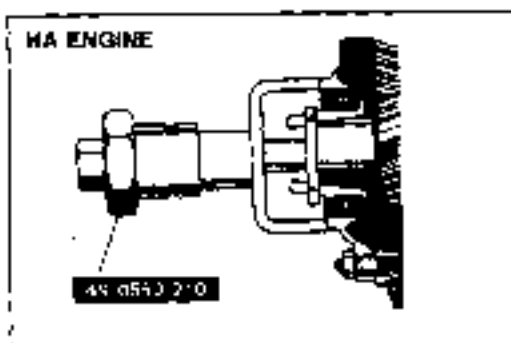
9TGOB2-096

**Removal note**  
**Crankshaft pulley**

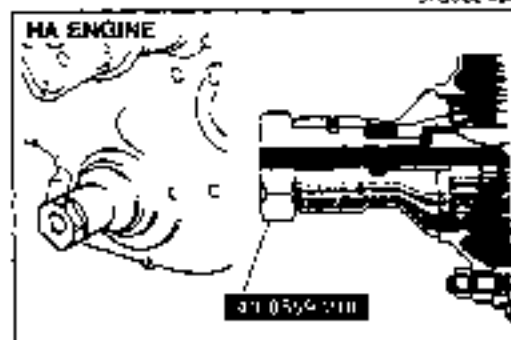
**Caution**

- Perform this operation with the aid of a helper.

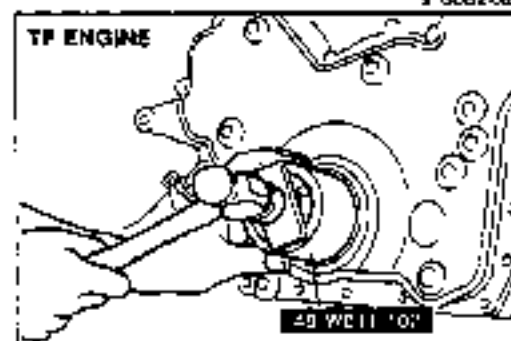
1. Remove the cover from the clutch housing (HA, SL) or from the end plate (TF).
2. Set a suitable tool against the flywheel ring gear for prevention of engine rotation.
3. Remove the pulley bolt (HA, SL) or nut (TF).
4. Remove the crankshaft pulley.



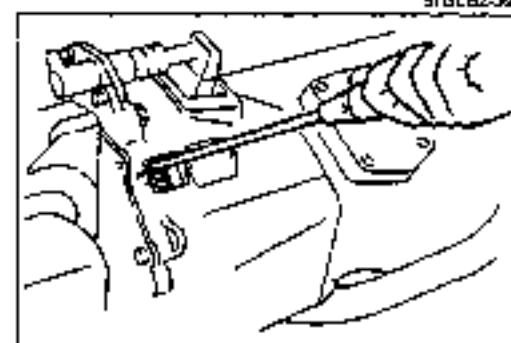
9T0082-082



9T0082-089



9T0082-090



9T0082-091

**Oil seal (HA)**

1. Assemble the **SST** as shown in the figure.
2. Set the **SST** against the oil seal and remove it by tightening the center bolt.

**Installation note****Oil seal**

1. Apply a small amount of clean engine oil to the lip of the new oil seal.
2. Push the oil seal slightly in by hand.

**Caution**

- The oil seal must be tapped in until it is 6.5mm (0.26 in) inside the edge of the timing gear cover.

3. Tap the oil seal in evenly with the **SST** (HA, TF) or a suitable pipe (SL) and a hammer.

**Crankshaft pulley**

1. Apply clean engine oil to the bolt threads and seat faces. (HA, SL)
2. Install the crankshaft pulley.
3. Install the bolt or nut and washer.

**Caution**

- Perform this operation with the aid of a helper.

4. Hold the flywheel and tighten the pulley bolt or nut.

**Tightening torque**

HA, SL:	343—392 Nm (35.0—40.0 m·kg, 253—289 ft·lb)
TF	: 383—432 Nm (39.0—44.0 m·kg, 282—318 ft·lb)

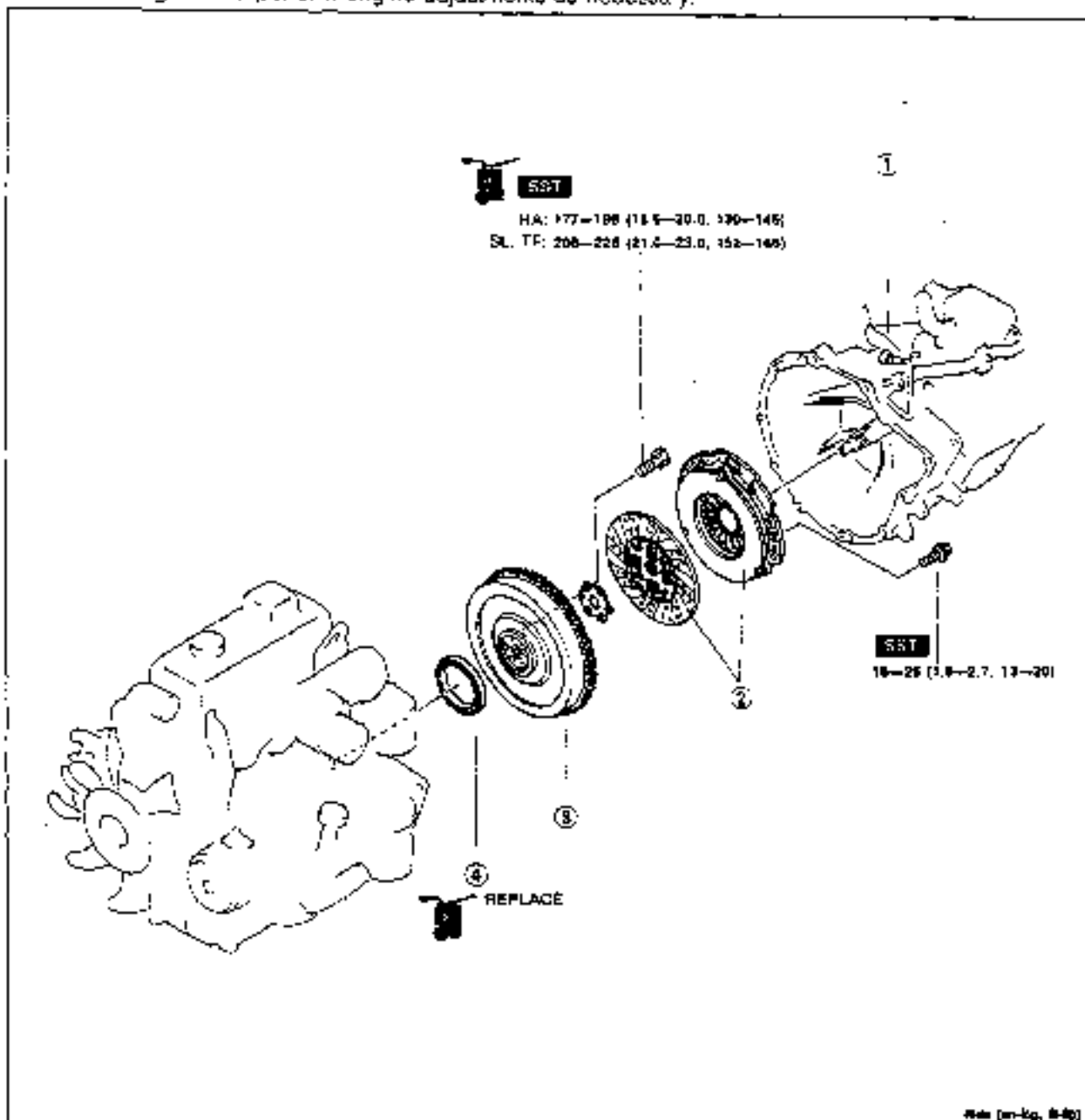
5. Install the cover to the clutch housing or to the end plate.

**REAR OIL SEAL****Replacement**

1. Disconnect the negative battery cable.
2. Remove in the order shown in the figure, referring to **Removal Note**.
3. Install in the reverse order of removal, referring to **Installation Note**.

**Steps After Installation**

1. Connect the negative battery cable.
2. Start the engine and perform engine adjustments as necessary.

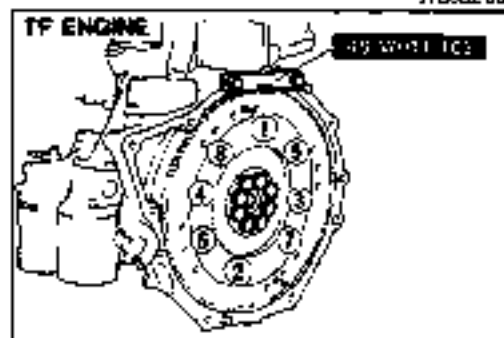
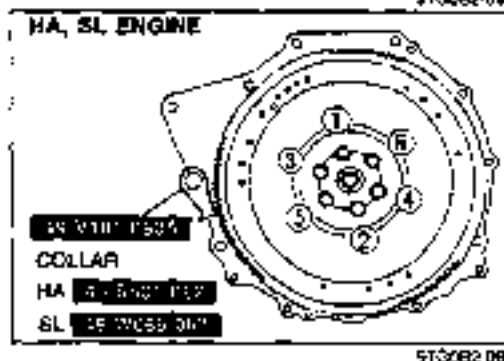
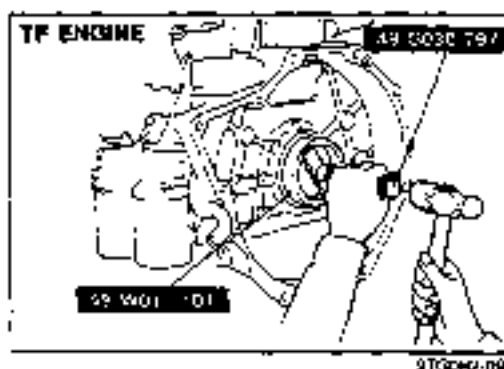
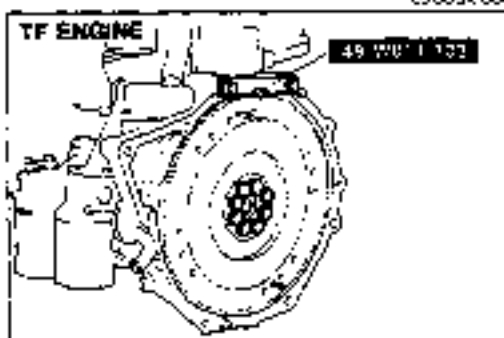
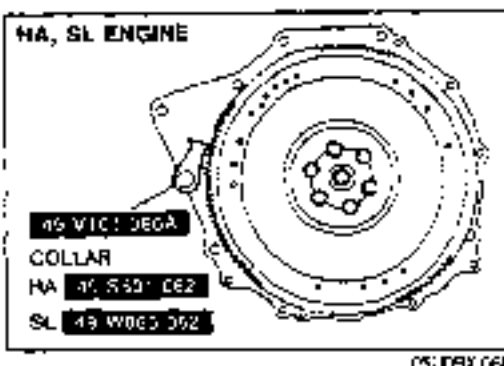


\*Note (m-kg, in-lb)

81F08X 020

- |   |           |                                    |           |
|---|-----------|------------------------------------|-----------|
| 1. Transmission Service.....              | Section J | 3. Flywheel Removal Note.....      | page B-32 |
| 2. Clutch cover, clutch disc Service..... | Section H | Installation Note.....             | page B-32 |
|   |           | 4. Oil seal Installation Note..... | page B-32 |

## B ON-VEHICLE MAINTENANCE



### Removal note

#### Flywheel

1. Hold the flywheel with the **SST**.
2. Remove the flywheel lock bolts.
3. Remove the flywheel.

### Installation note

#### Oil seal

1. Apply a small amount of clean engine oil to the lip of the new oil seal.
2. Push the oil seal slightly in by hand.

#### Caution

- The oil seal must be tapped in until it is flush with the edge of the rear oil seal cap.

3. Tap the oil seal in evenly with the **SST** (TF) or a suitable pipe (HA, SL) and a hammer.

#### Flywheel

1. Apply clean engine oil to the bolt threads and seal faces.
2. Set the flywheel onto the crankshaft and loosely install the bolts.
3. Hold the flywheel with the **SST**.
4. Tighten the bolts in two or three steps in the order shown in the figure.

#### Tightening torque

##### HA:

177—196 N·m (16.0—20.0 m·kg, 130—145 ft·lb)








##### SL, TF:

206—226 N·m (21.0—23.0 m·kg, 152—166 ft·lb)



## REMOVAL

PREPARATION  
SST

<p>49 0727 575</p> <p>Pulley, socket joint</p> 	<p>For removal of tie-rod end</p>	<p>49 0259 770B</p> <p>Wrench, flare nut (SL Turbo)</p> 	<p>For disconnection of clutch hose</p>
<p>49 0727 000</p> <p>Engine crane</p> 	<p>For removal of engine assembly</p>	<p>49 0636 000B</p> <p>Transmission filter</p> 	<p>For removal of engine assembly</p>
<p>49 W017 3A0</p> <p>Supporter set</p> 	<p>For removal of engine assembly</p>	<p>49 W017 3D3</p> <p>Arm (Part of 49 W017 3A0)</p> 	<p>For removal of engine assembly</p>
<p>49 W017 3D5</p> <p>Arm (Part of 49 W017 3A0)</p> 	<p>For removal of engine assembly</p>	9T3032-095	

## PROCEDURE

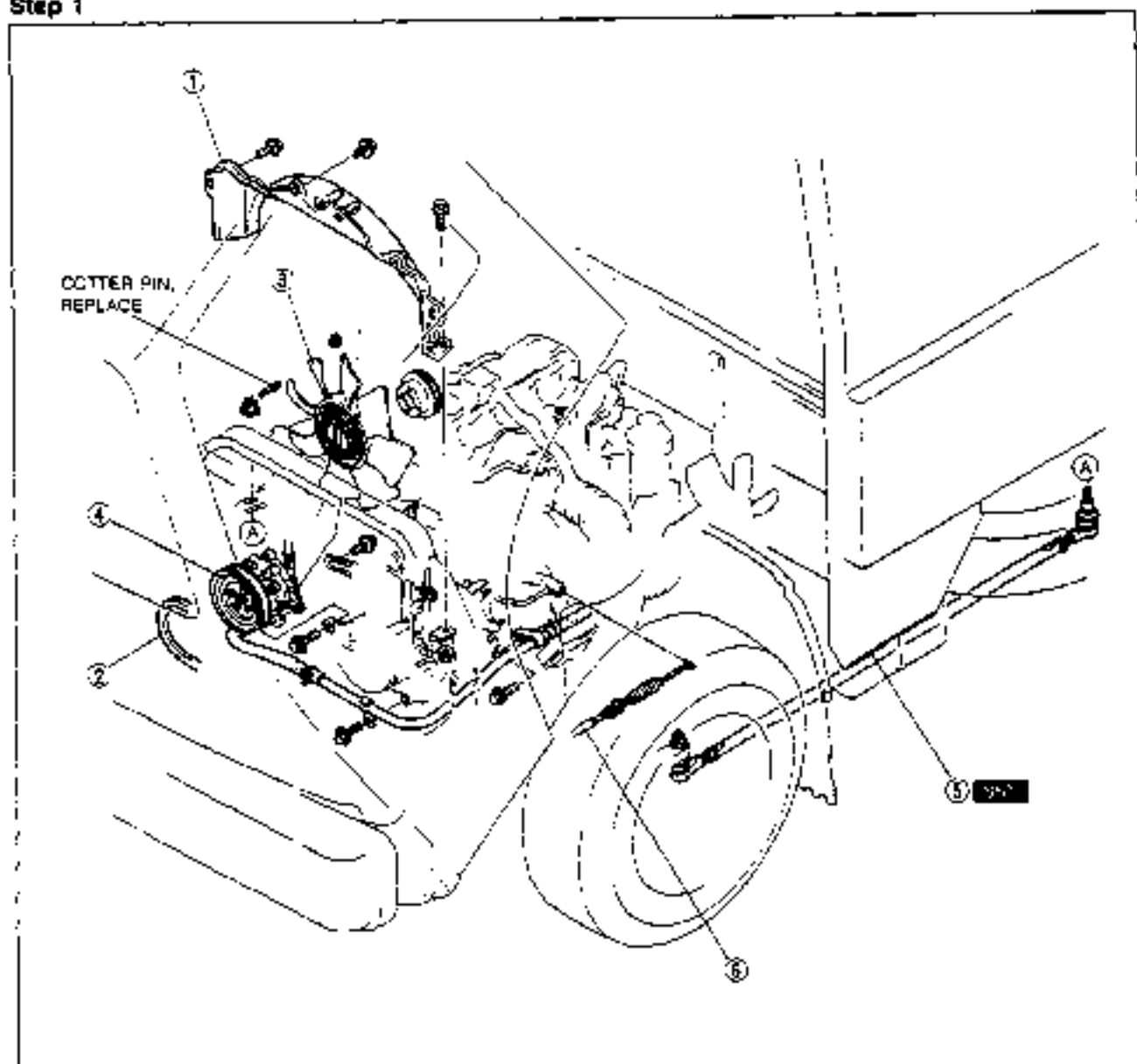
1. Disconnect the negative battery cable.
2. Remove the undercover.
3. Drain the engine coolant.
4. Remove in the order shown in the figure, referring to **Removal Note**.

9T3082-096

# B

## REMOVAL

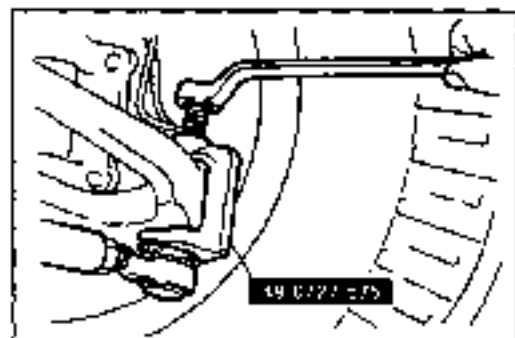
### HA Engine Step 1



5TPOEX021

1. Radiator cowling, upper
2. Drive belt
3. Cooling fan
4. P/S oil pump

5. Tie-rod  
Removal Note..... page B-34
6. Accelerator cable



8TG382-102

#### Tie-rod

1. Remove the cotter pin and loosen the nut.
2. Separate the tie-rod end from the knuckle with the SST.
3. Remove the nut and tie-rod.

#### Caution

- Do not reuse the cotter pin.

**Step 2**

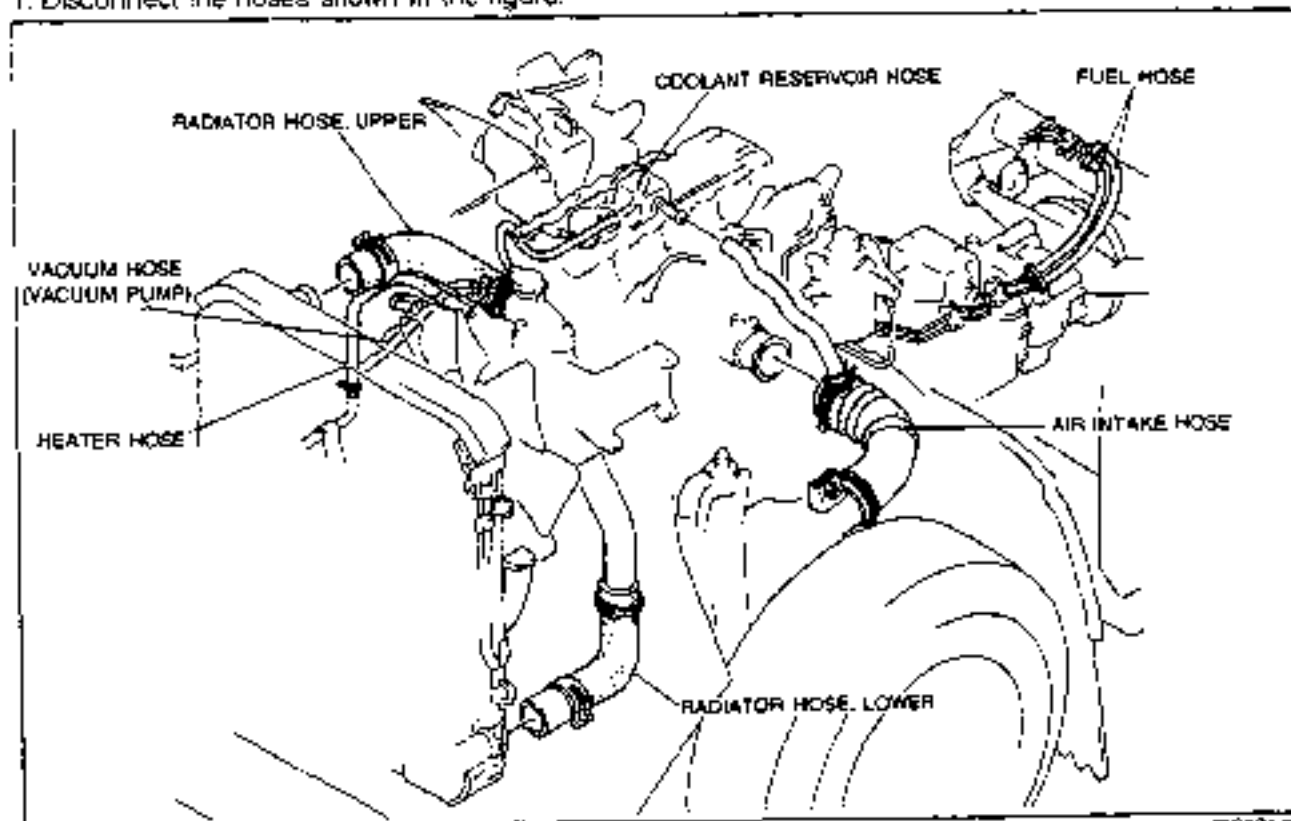
1. Disconnect the harness connectors shown in the figure.



970C82-390

**Step 3**

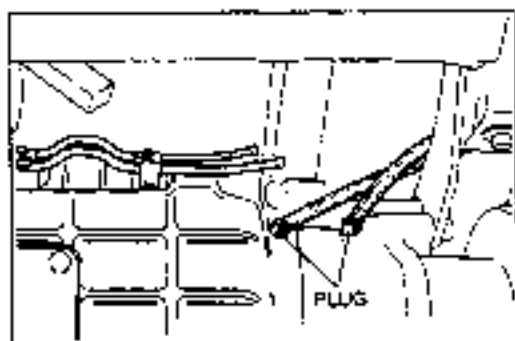
1. Disconnect the hoses shown in the figure.



970C82-390

# B

## REMOVAL



35A08X076

### Removal note

#### Fuel hose

#### Warning

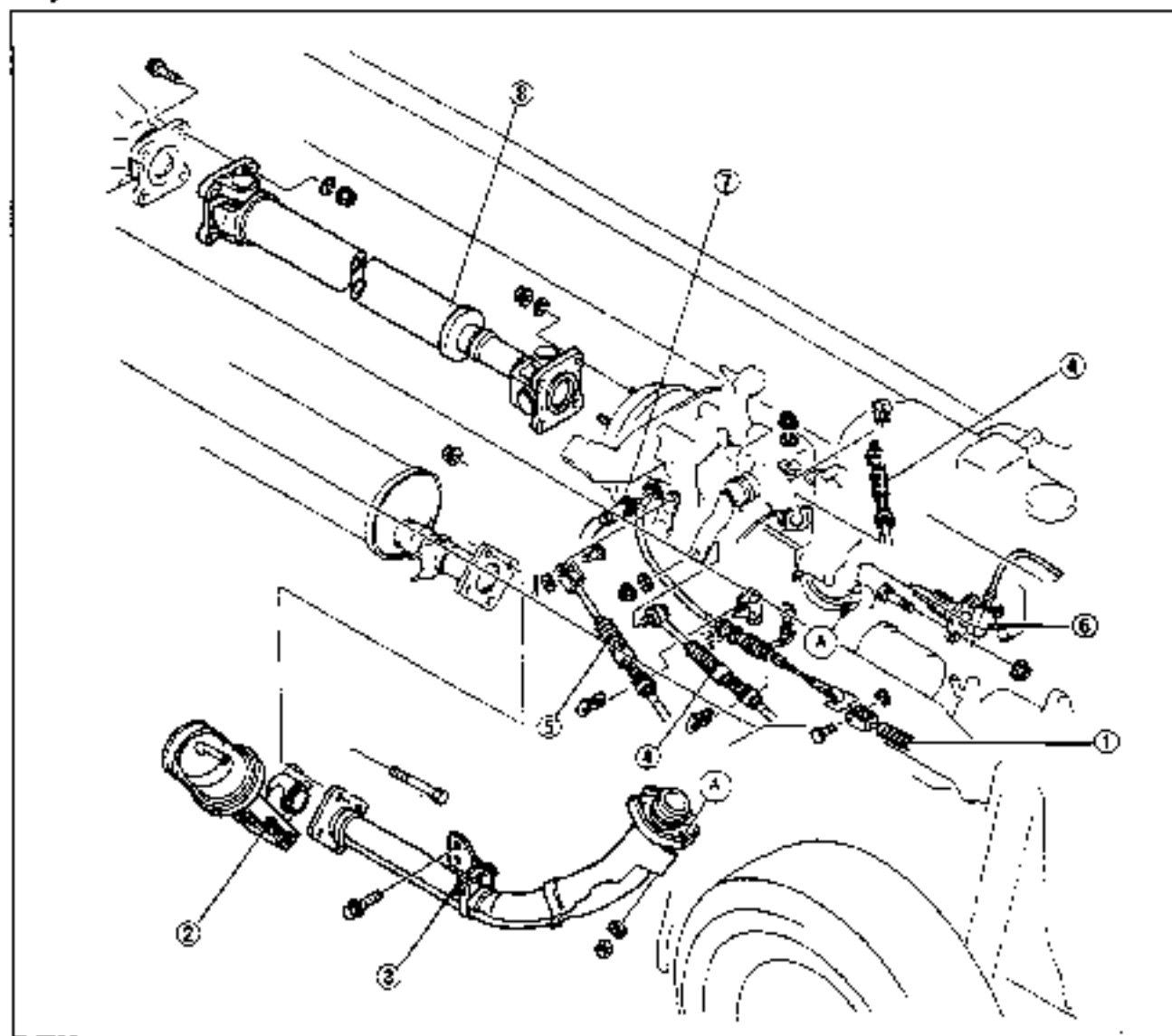
- Keep sparks and open flame away from the fuel area.

#### Caution

- Cover the hose with a rag because fuel will spray out when disconnecting.
- Plug the disconnected hoses to avoid fuel leakage.

- 1 Disconnect the fuel hoses.

### Step 4



9TRCBX-022

1. Parking brake cable

Removal Note..... page B-37

2. Exhaust shifter valve

3. Front exhaust pipe

4. Shift/select cable

5. Sub-select cable

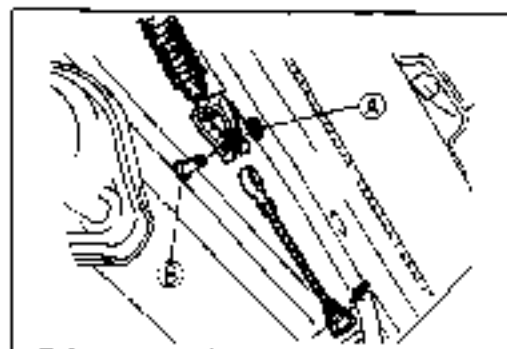
6. Clutch release cylinder

7. Speedometer cable

8. Propeller shaft

Service..... Section L

## REMOVAL

**B**

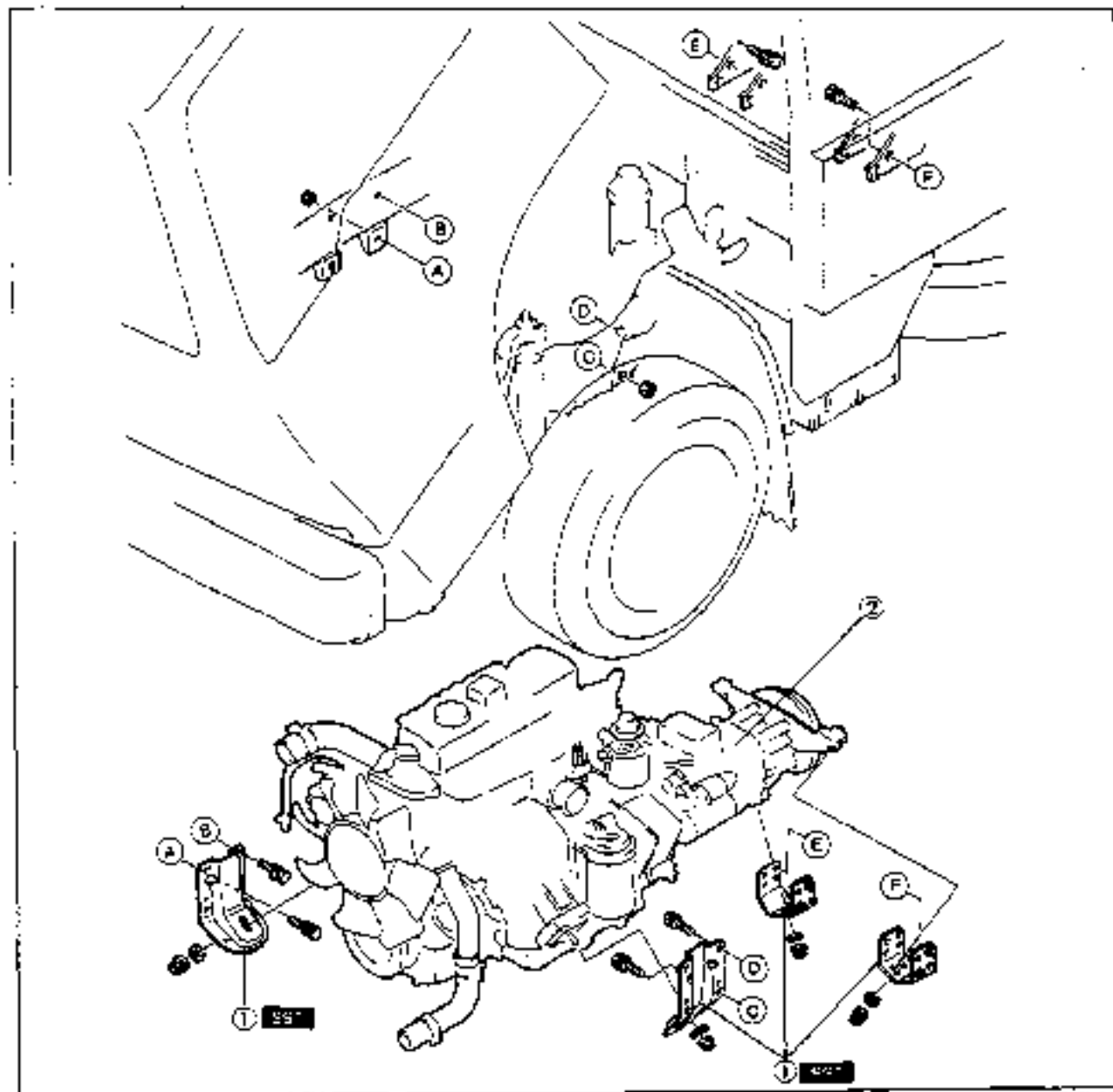
9T5CB2-101

### Removal note

#### Parking brake cable

1. Remove stop ring A and pin B.
2. Remove the parking brake rear cable from the frame

### Step 5



9TFO6X-223

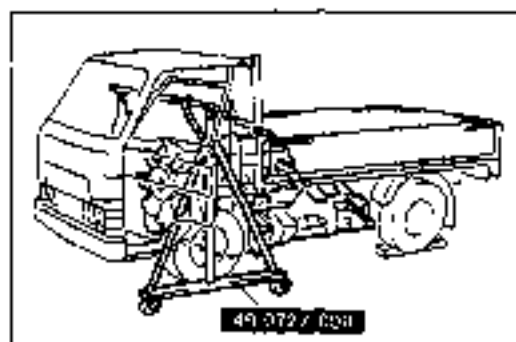
1. Engine support bracket

Removal Note..... page B-38

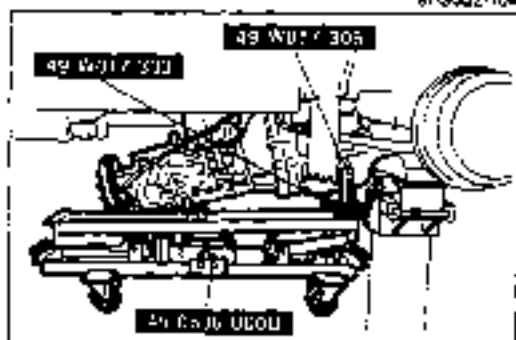
2. Engine and transmission assembly

## B

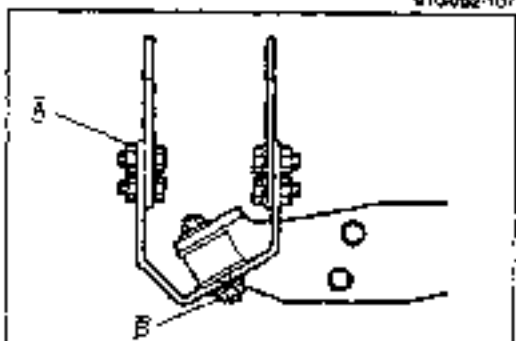
## REMOVAL



9FG082-104



9FG082-107



9FG082-108

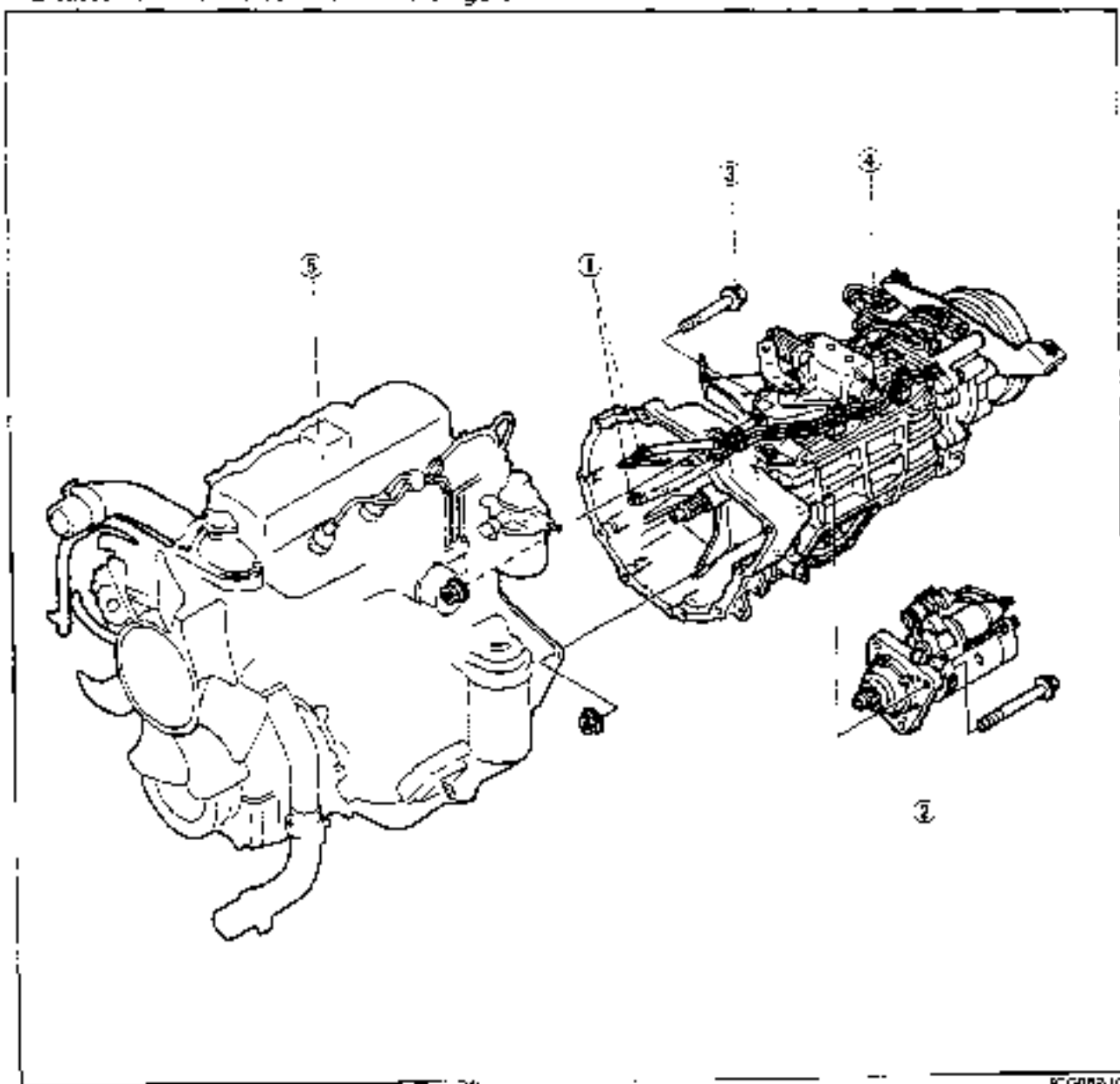
### Removal note

#### Engine support bracket

1. Raise the vehicle and support it on safety stands so that the distance between all wheels and the ground is at least 1 m (3.3 ft).
2. (Tilt cabin)  
Support the engine with a hoist.  
(Non-tilt cabin)  
Support the engine with the **SST**.
3. Remove the control cable holder.
4. Remove the right engine mount.
5. Remove the left engine mount.
6. Support the engine and transmission assembly with the **SST**.
7. Remove the transmission mount bracket.
8. Remove the engine and transmission assembly.

**Step 6**

1 Disassemble in the order shown in the figure



- 1 Fuel hose
- 2 Starter
- 3 Transmission mounting bolt

4. Transmission
5. Engine

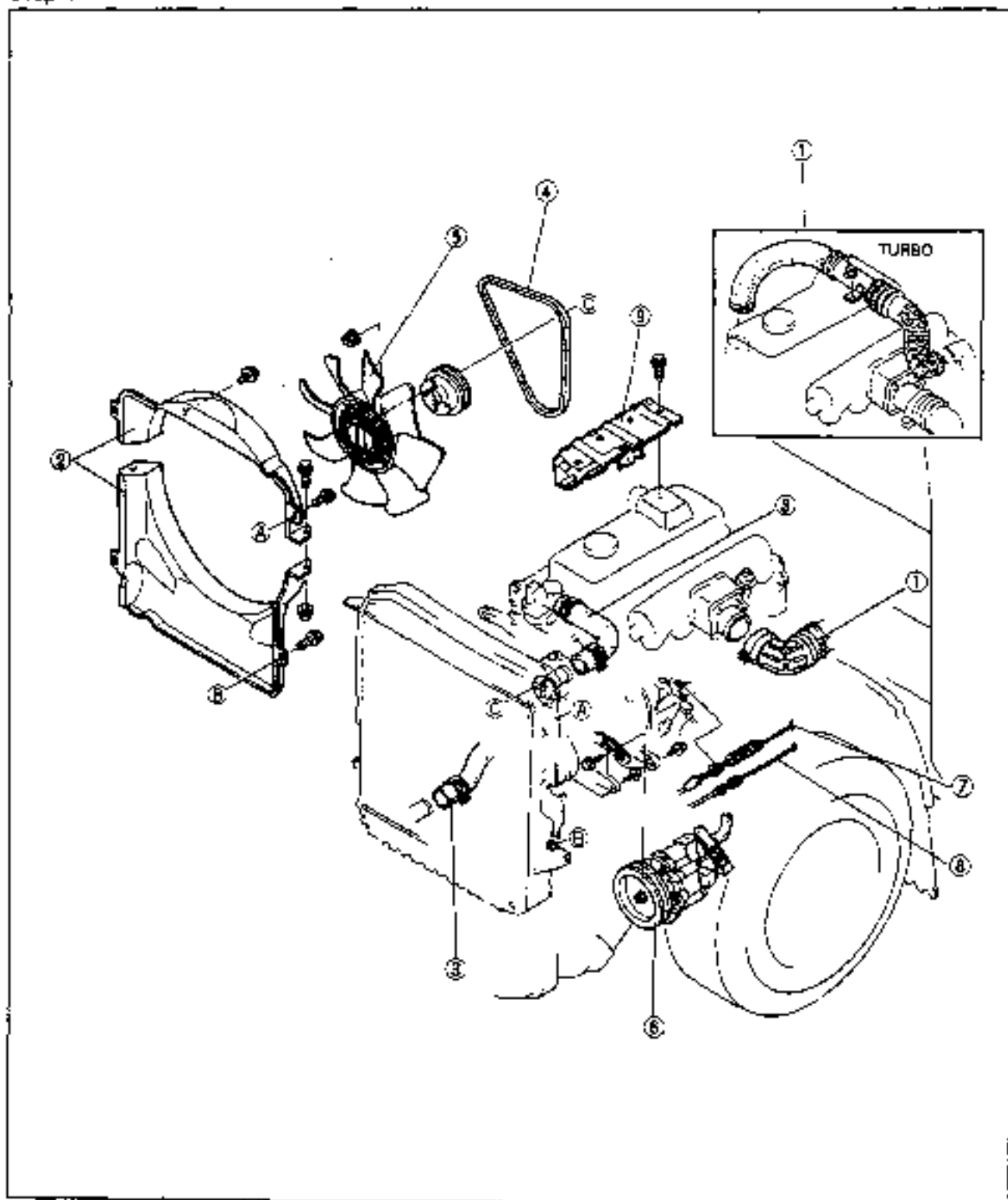
97-0282-109

# B

## REMOVAL

SL Engine

Step 1



1. Air intake hose
2. Radiator cowl
3. Radiator hose
4. Drive belt
5. Cooling fan

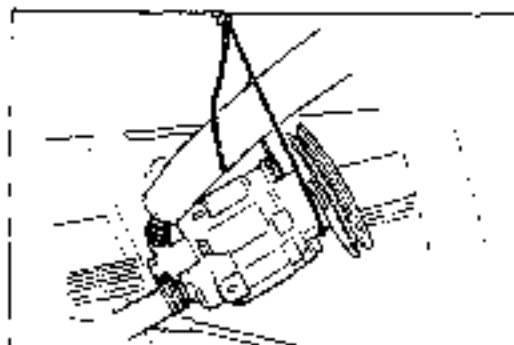
6. P/S oil pump
7. Accelerator cable
8. Fuel stop cable
9. Exhaust manifold insulator

Removal Note..... page B-41

STROBK 024



## REMOVAL

**B**

06U03x-07x

### Removal note P/S oil pump

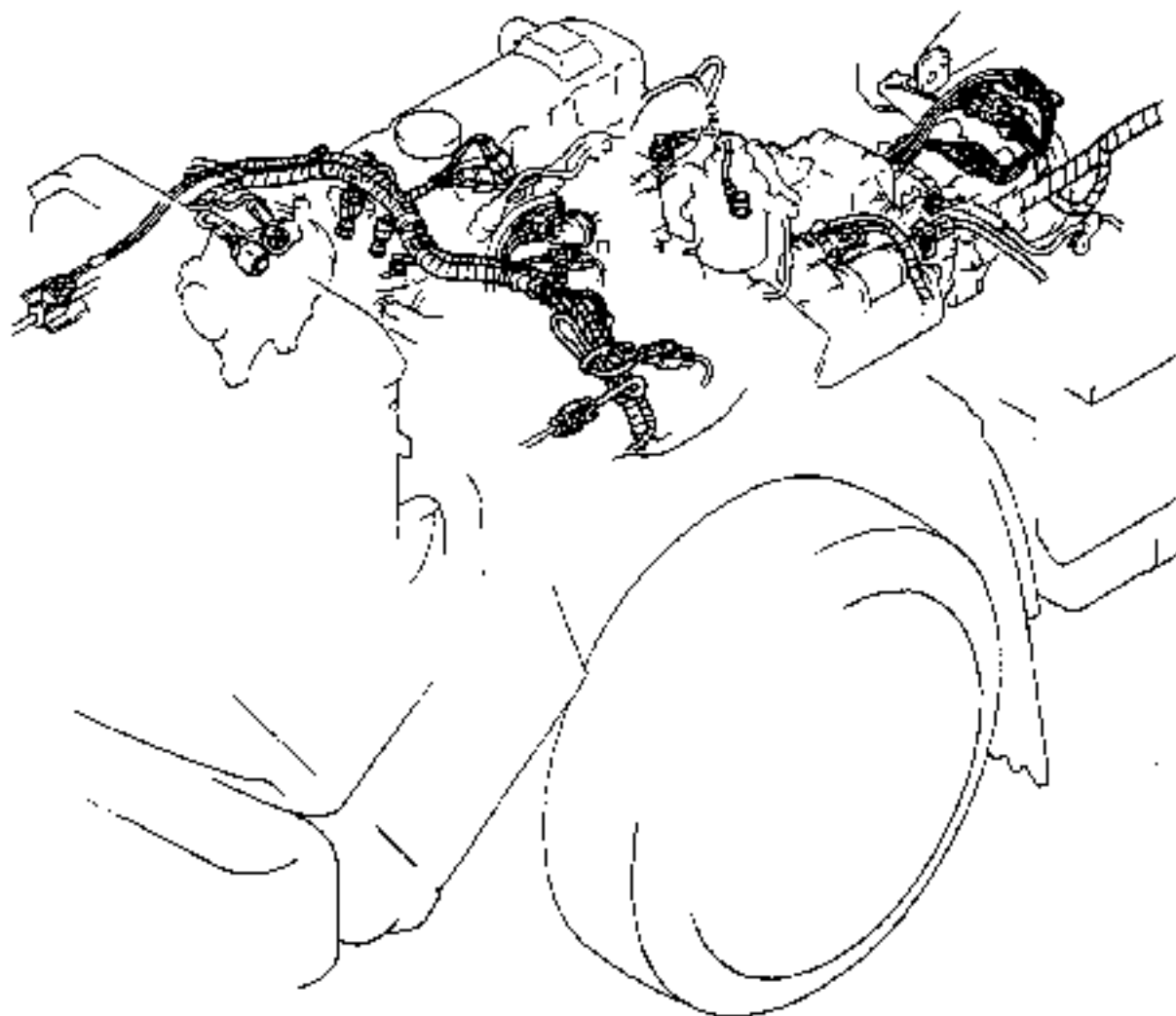
#### Caution

- Do not damage the hoses.

1. Remove the P/S oil pump with the hoses still connected
2. Position the pump away from the engine and affix it with wire.

### Step 2

1. Disconnect the harness connectors shown in the figure

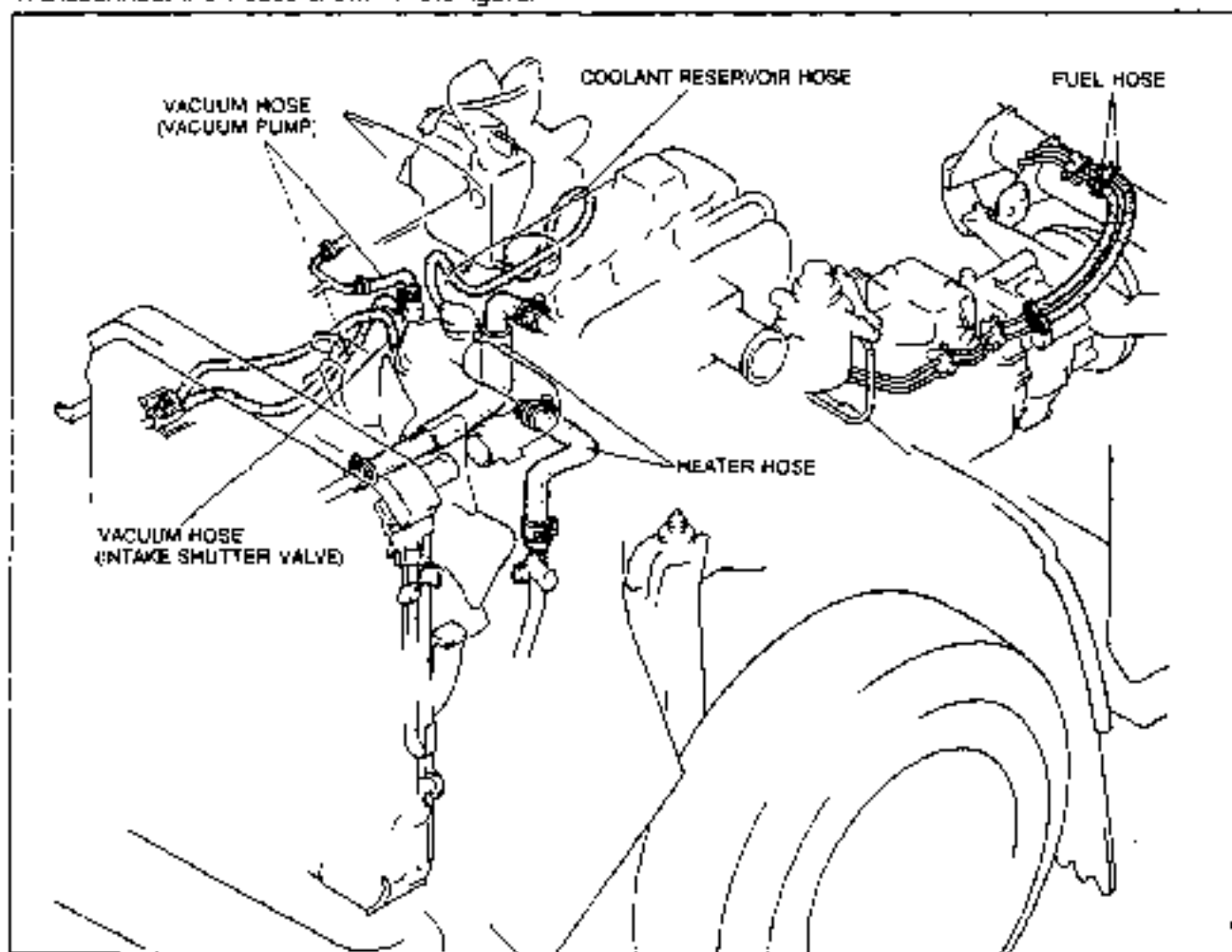


# B

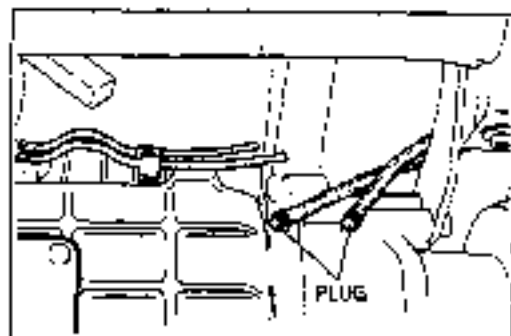
## REMOVAL

### Step 3

1. Disconnect the hoses shown in the figure.



5YQ082 112



25U08X 078

#### Removal note

##### Fuel hose

#### Warning

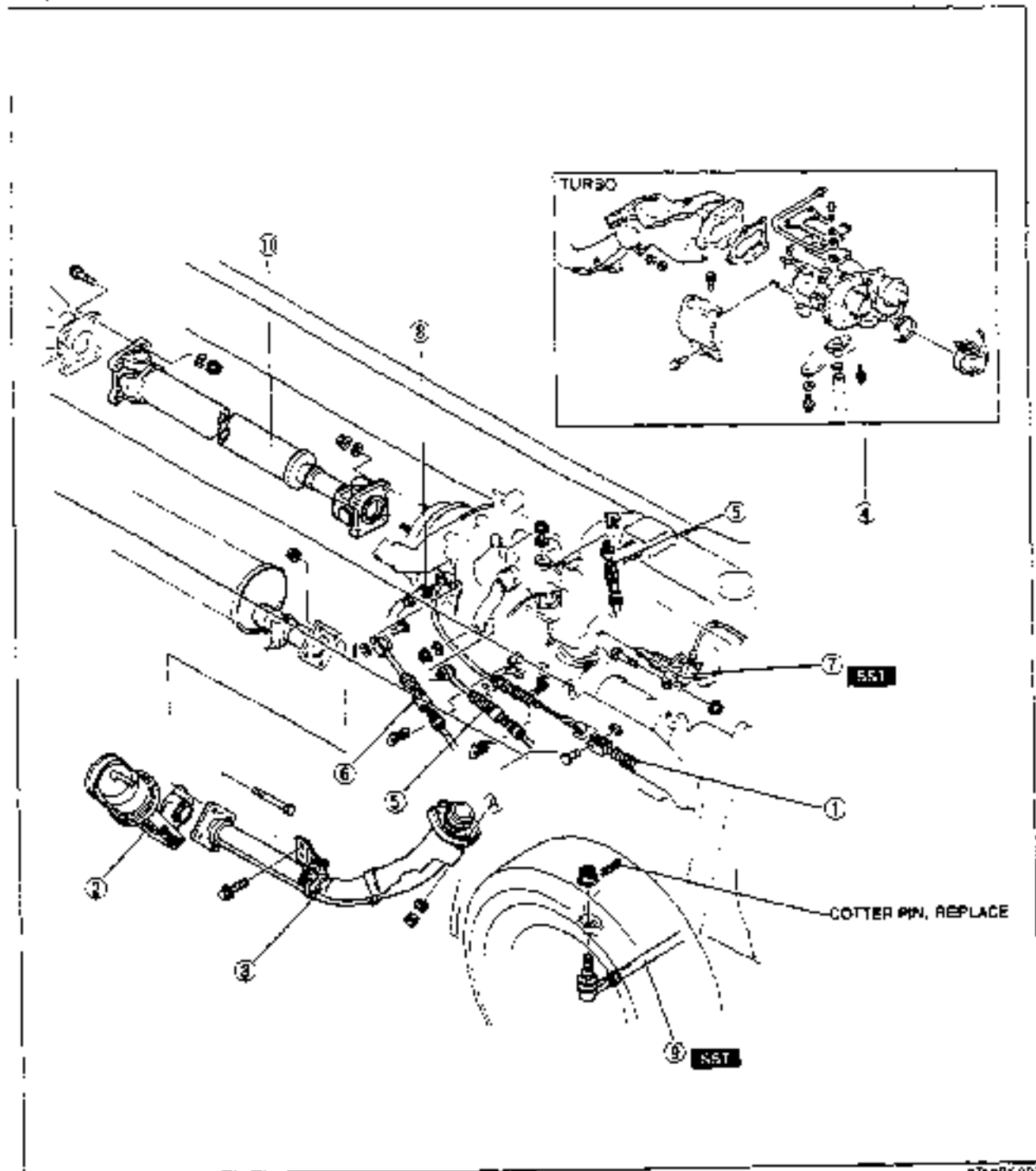
- Keep sparks and open flame away from the fuel area.

#### Caution

- Cover the hose with a rag because fuel will spray out when disconnecting.
- Plug the disconnected hoses to avoid fuel leakage.

1. Disconnect the fuel hoses.

## Step 4



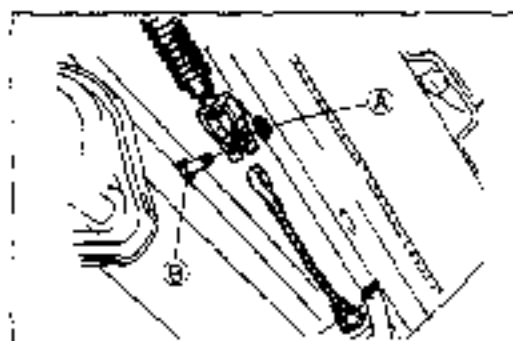
8T002425

1. Parking brake cable  
Removal Note..... page B-44
2. Exhaust shutter valve
3. Front exhaust pipe
4. Turbocharger (Turbo)  
Service..... Section F
5. Shift/select cable
6. Sub-select cable

7. Clutch release cylinder  
Removal Note..... page B-44
8. Speedometer cable
9. Tie-rod  
Removal Note..... page B-44
10. Propeller shaft  
Service..... Section L

## B

## REMOVAL

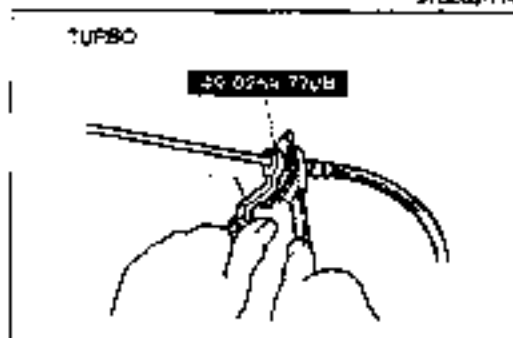


9T0085-114

### Removal note

#### Parking brake cable

1. Remove stop ring A and pin B.
2. Remove the parking brake rear cable from the frame.



8T0092-115

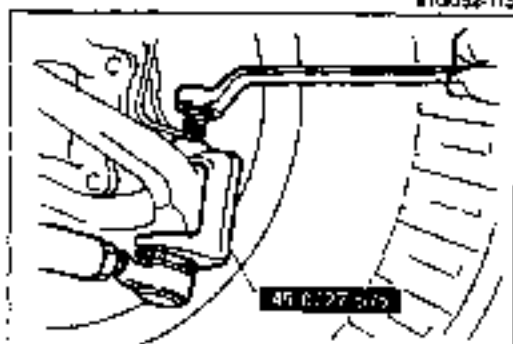
#### Clutch release cylinder

(Non-Turbo)

1. Remove the clutch release cylinder

(Turbo)

1. Disconnect the clutch hose with the SST.



8T0082-116

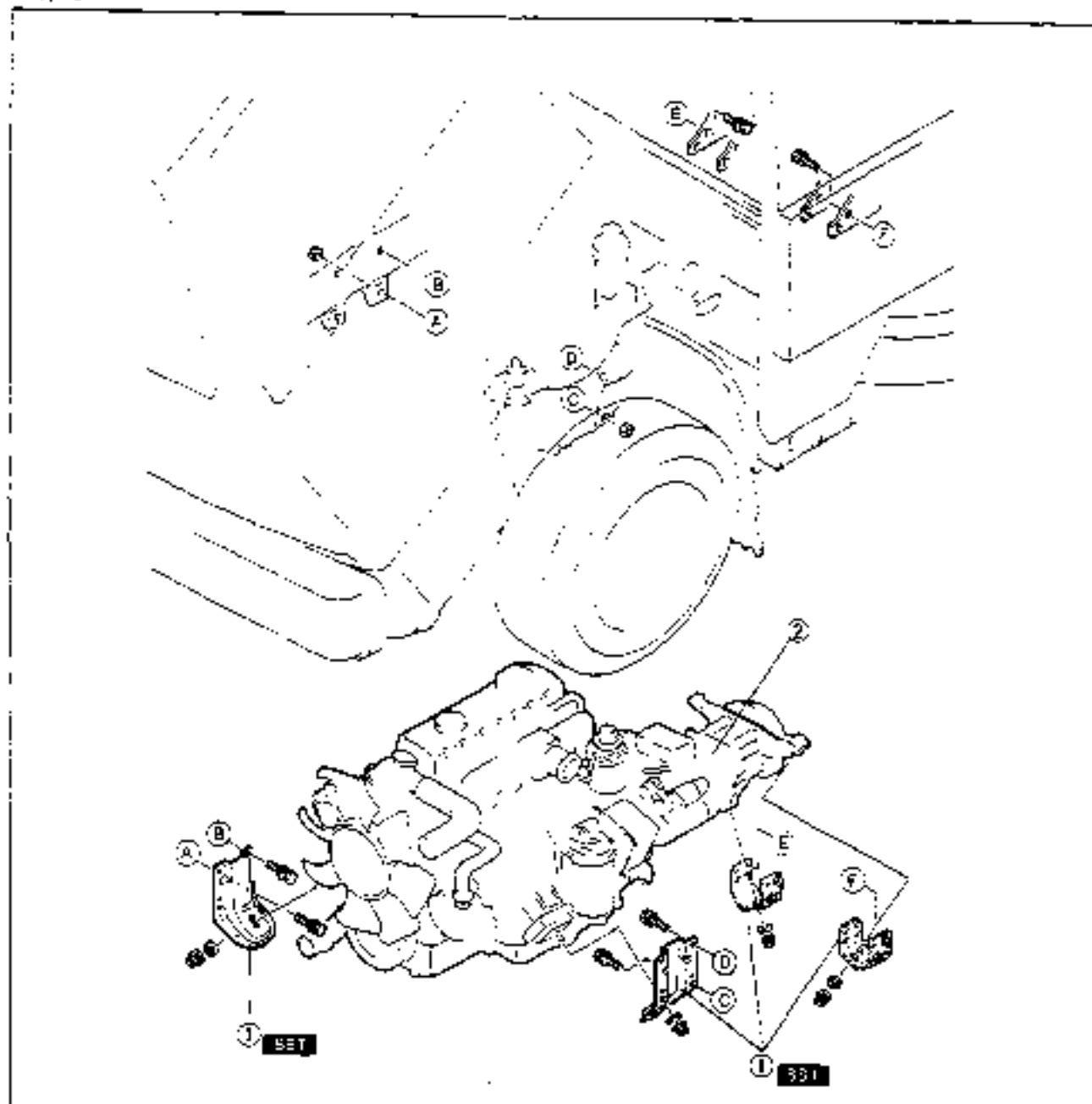
#### Tie-rod

1. Remove the cotter pin and loosen the nut.
2. Separate the tie-rod end from the knuckle with the SST.
3. Remove the nut and tie-rod.

#### Caution

- Do not reuse the cotter pin.

## Step 5

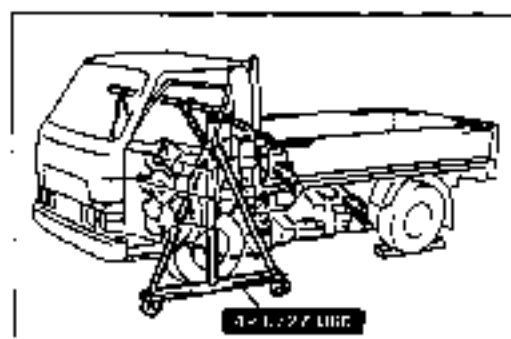


9T008X-026

1 Engine support bracket

Removal Note..... page B-45

2. Engine and transmission assembly



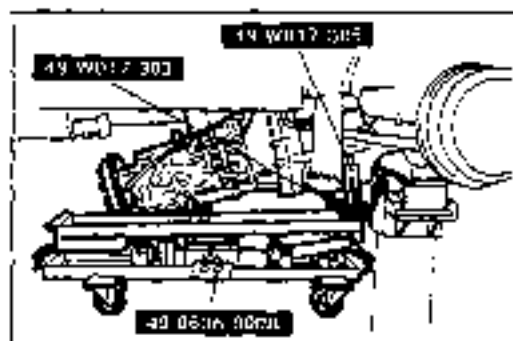
9T0082-116

**Removal note****Engine support bracket**

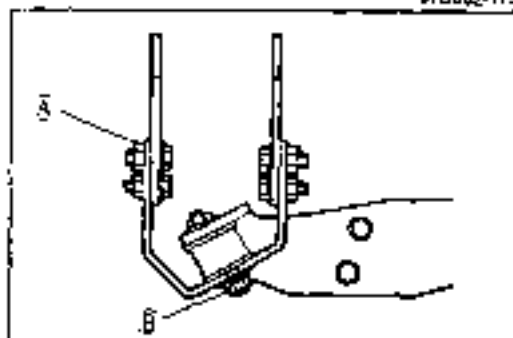
1. Raise the vehicle and support it on safety stands so that the distance between all wheels and the ground is at least 1 m (3.3 ft).
2. (Tilt cabin)  
Support the engine with a hoist.  
(Non-tilt cabin)  
Support the engine with the **SST**.

## B

## REMOVAL



9T5982-113



9T608X-027

3. Remove the control cable holder.
4. Remove the right engine mount.
5. Remove the left engine mount.
6. Support the engine and transmission assembly with the SST.

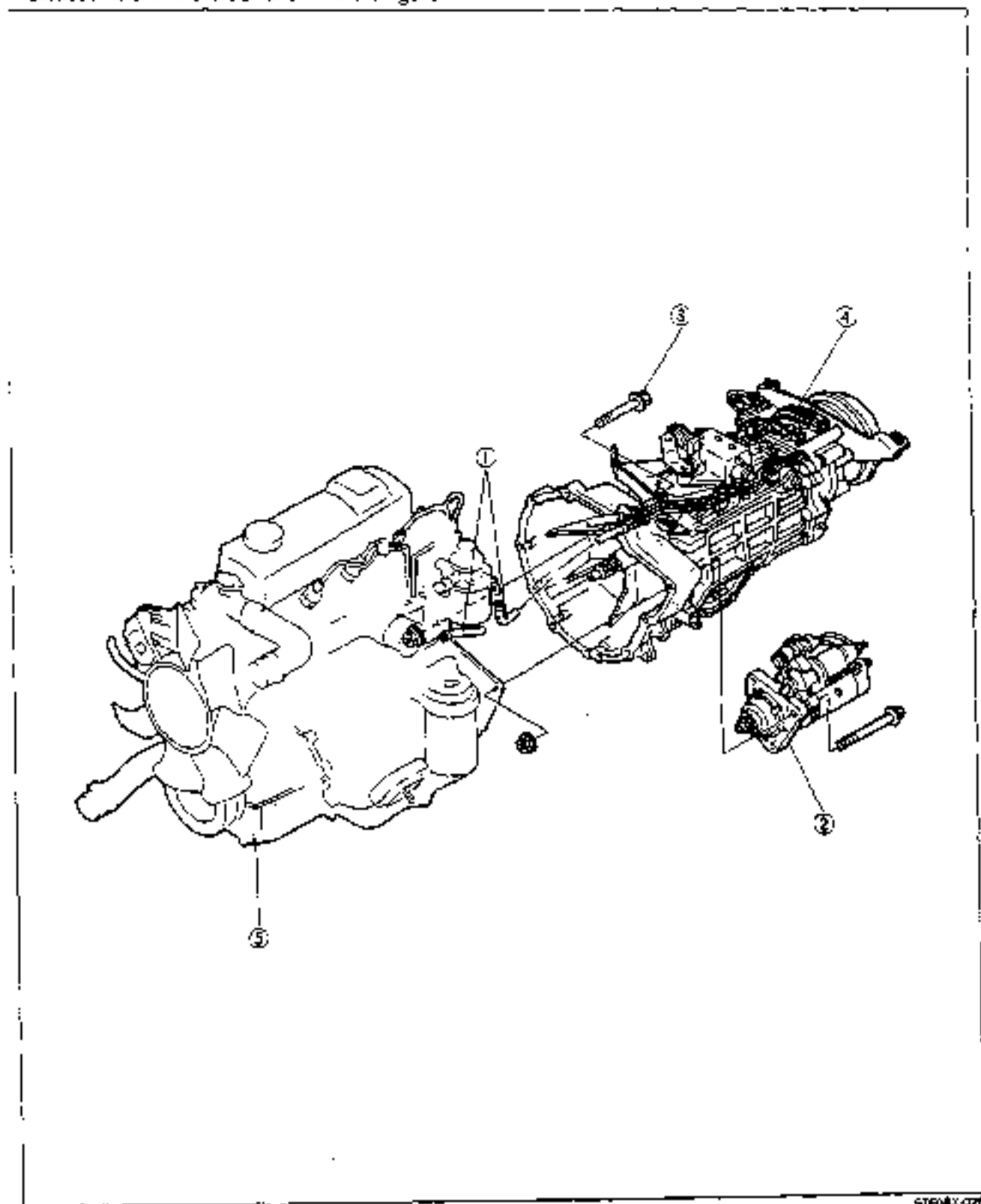
7. Remove the transmission mount bracket.
8. Remove the engine and transmission assembly.

## REMOVAL

**B**

### Step 6

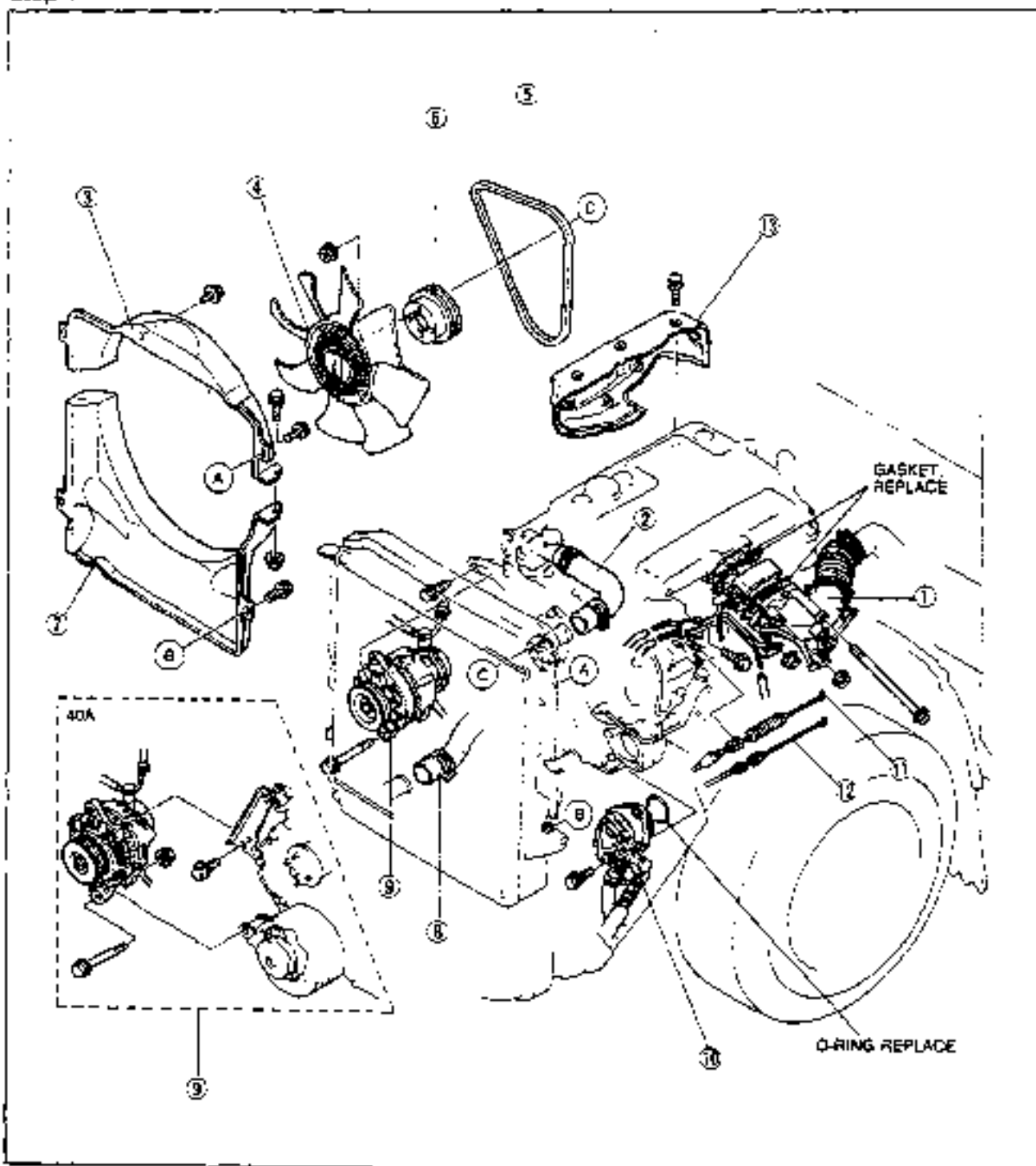
1. Disassemble in the order shown in the figure



- 1. Fuel hose
- 2. Starter
- 3. Transmission mounting bolt

- 4. Transmission
- 5. Engine

STF04X-078

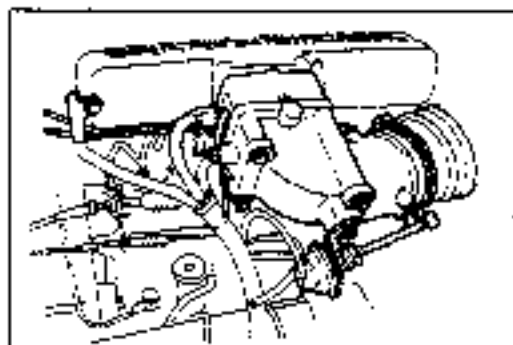
**B****REMOVAL****TF Engine  
Step 1**

91F082-328

- |   |   |
|---|---|
| 1. Air hose, intake manifold elbow<br>Removal Note..... page B-49 | 8. Radiator hose, lower                         |
| 2. Radiator hose, upper   | 9. Alternator<br>Removal Note..... page B-49    |
| 3. Radiator cowling, upper  | 10. P1S oil pump<br>Removal Note..... page B-49 |
| 4. Cooling fan  | 11. Accelerator cable                           |
| 5. Drive belt   | 12. Fuel stop cable                             |
| 6. Water pump pulley  | 13. Exhaust manifold insulator                  |
| 7. Radiator cowling, lower  |   |



## REMOVAL

**B**

97G052-125

### Removal note

#### Air hose, intake manifold elbow

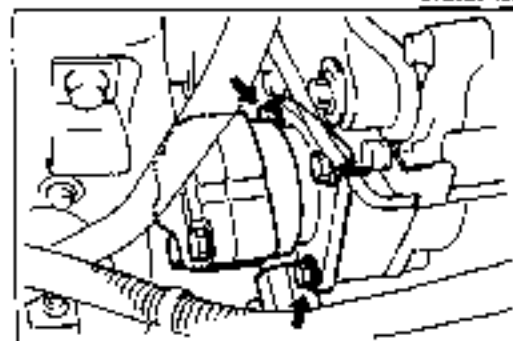
1. Disconnect the exhaust shutter valve vacuum hose.
2. Remove the vacuum pipe.
3. Disconnect the intake manifold elbow.



97G082-126

### Alternator

1. Disconnect the oil hose and vacuum hose shown in the figure.
2. Remove the alternator strap.
3. Remove the alternator.



97G082-128

### P/S oil pump

#### Caution

- Do not damage the hoses.

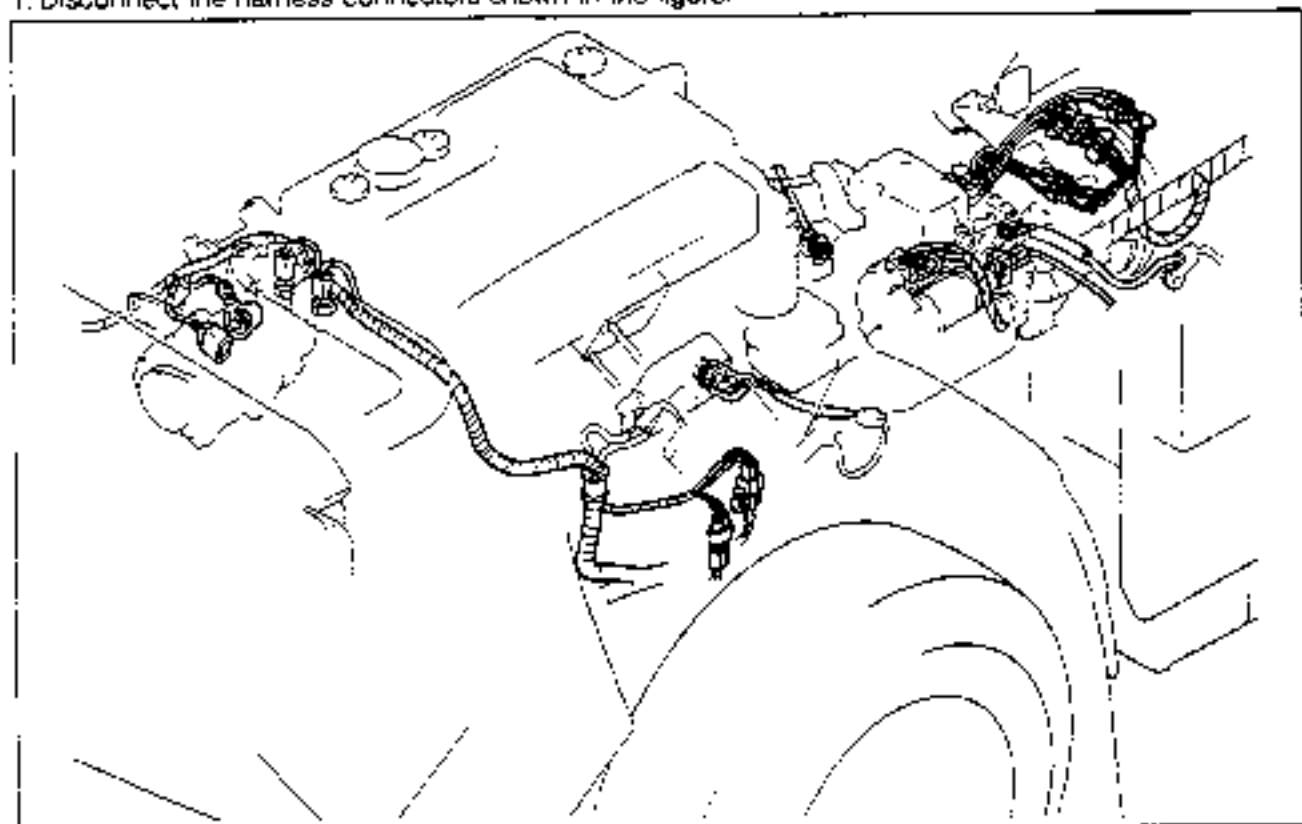
1. Remove the P/S oil pump with the hoses still connected.
2. Position the pump away from the engine and affix it with wire.

## B

## REMOVAL

### Step 2

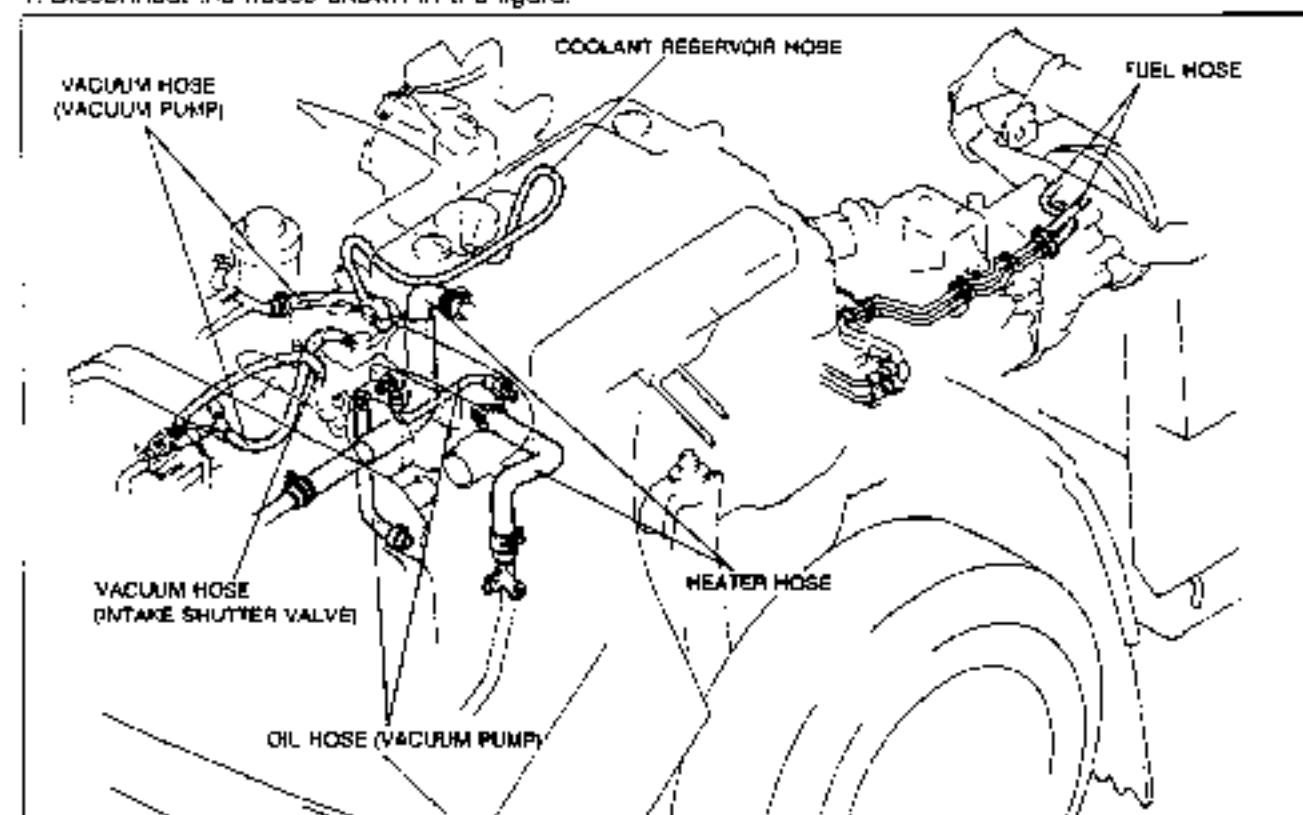
1. Disconnect the harness connectors shown in the figure.



9T0082-129

### Step 3

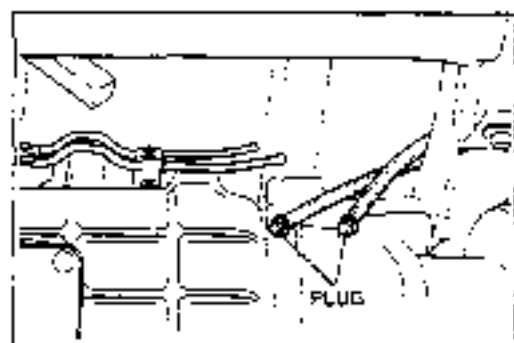
1. Disconnect the hoses shown in the figure.



9T0082-130

## REMOVAL

# B



### Removal note Fuel hose

#### Warning

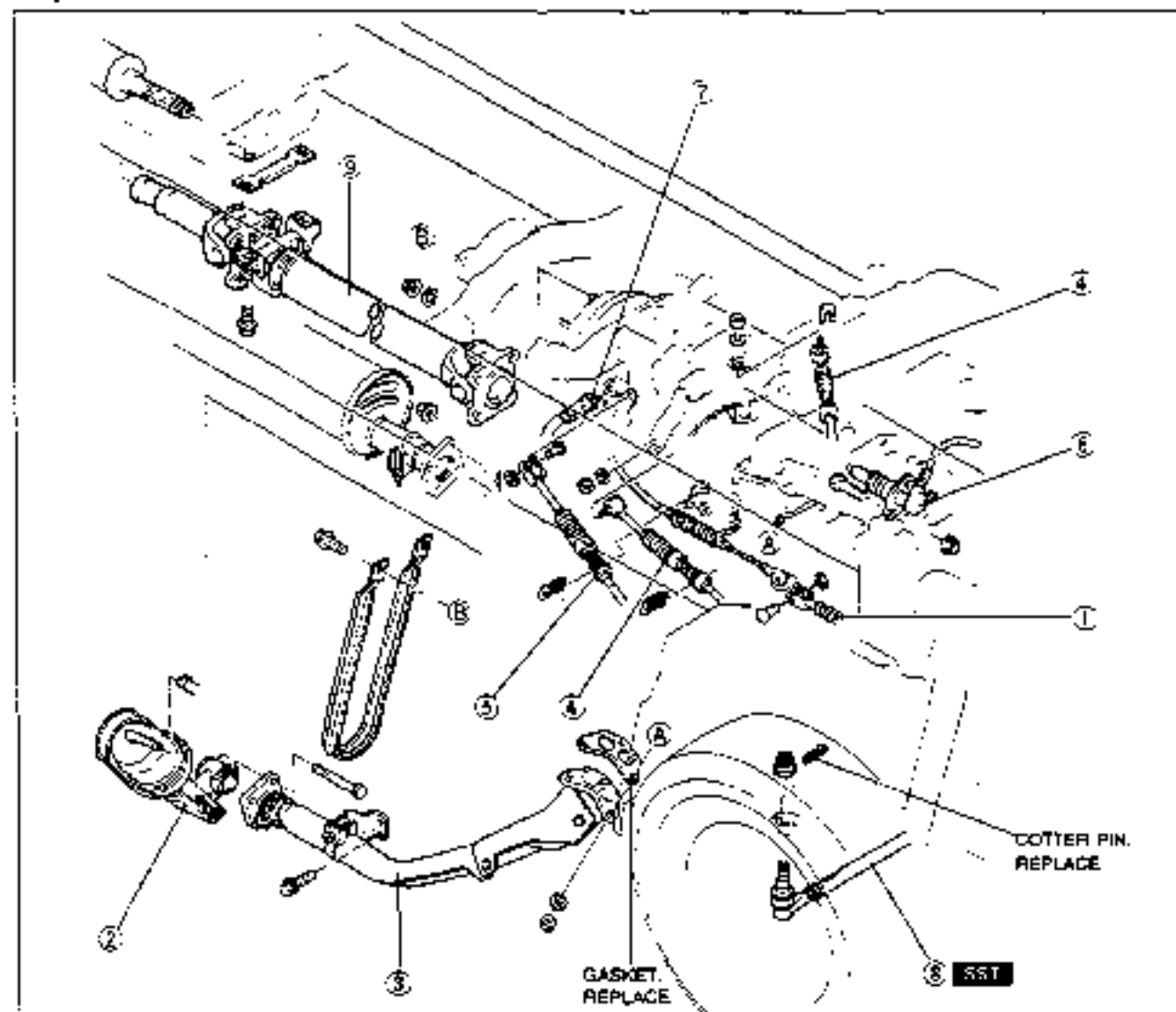
- Keep sparks and open flame away from the fuel area.

#### Caution

- Cover the hose with a rag because fuel will spray out when disconnecting.
- Plug the disconnected hoses to avoid fuel leakage.

1. Disconnect the fuel hoses.

### Step 4



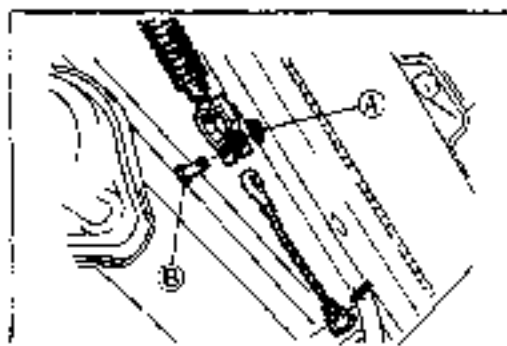
1. Parking brake cable  
Removal Note..... page B-52
2. Exhaust shutter valve
3. Front exhaust pipe
4. Shift/select cable
5. Sub-select cable

6. Clutch release cylinder
7. Speedometer cable
8. Tie-rod  
Removal Note..... page B-52
9. Propeller shaft  
Service..... Section L

97F0BX-030

## B

## REMOVAL

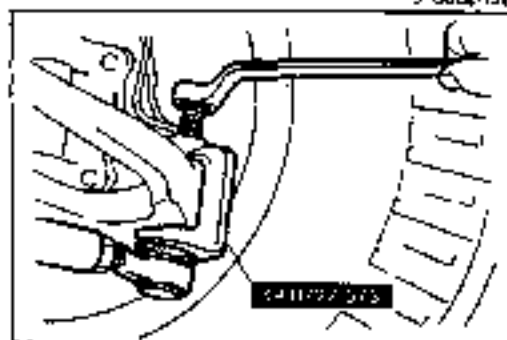


9TGC62-132

### Removal note

#### Parking brake cable

1. Remove stop ring A and pin B.
2. Remove the parking brake rear cable from the frame.



9TGC62-133

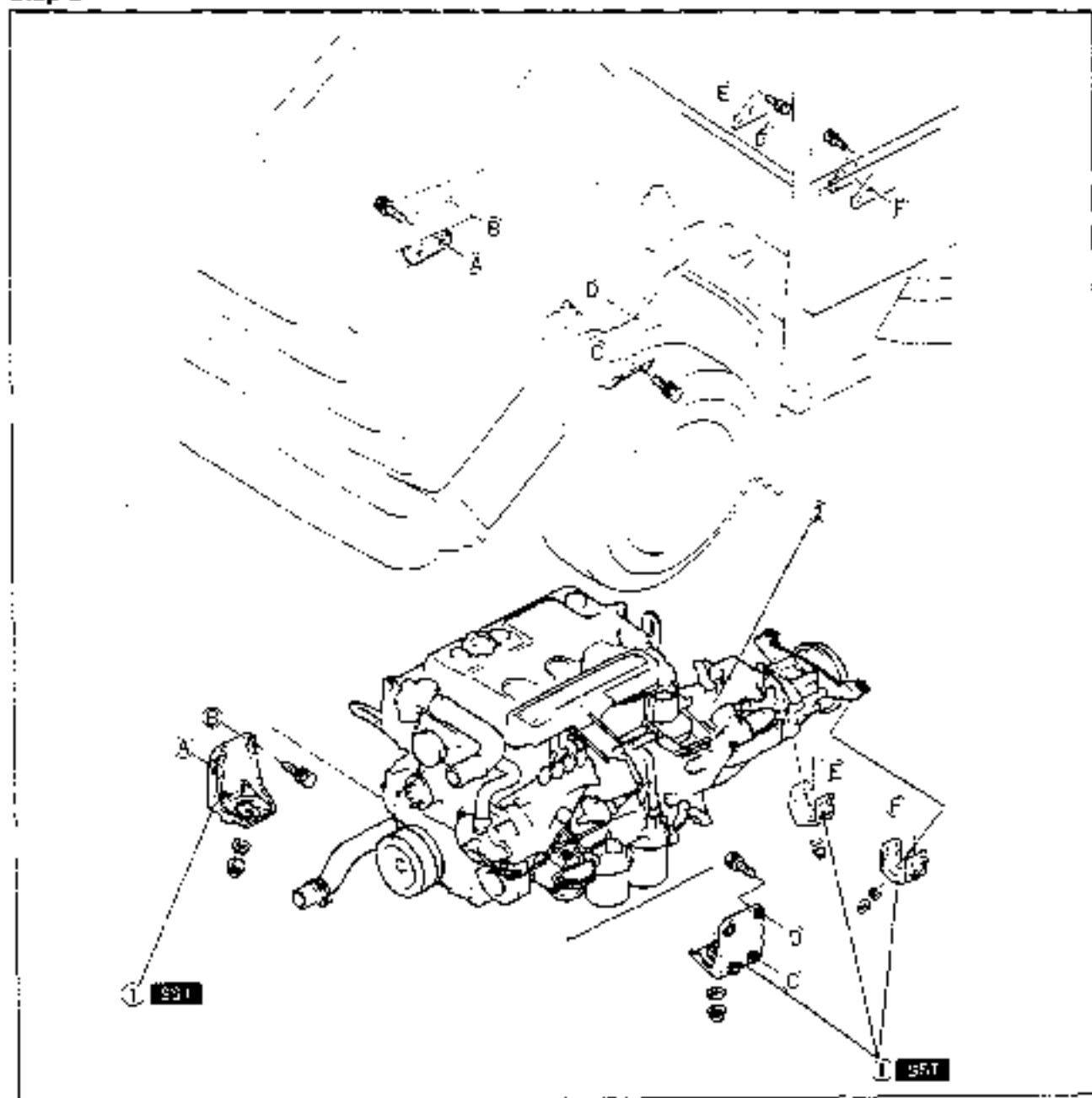
### Tie-rod

1. Remove the cotter pin and loosen the nut.
2. Separate the tie-rod end from the knuckle with the **SST**.
3. Remove the nut and tie-rod.

### Caution

- Do not reuse the cotter pin.

## Step 5

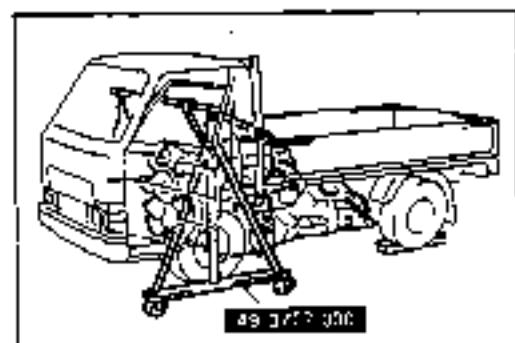


97F087-031

1. Engine support bracket  
Removal Note.....

... page B-53

2. Engine and transmission assembly



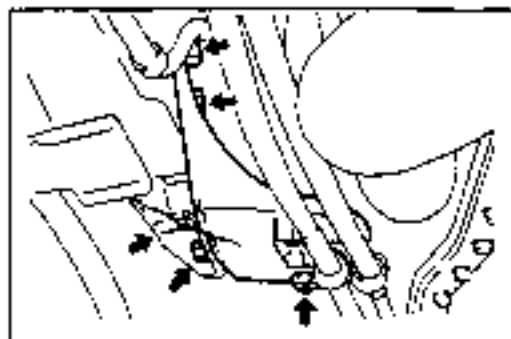
97G082-135

**Removal note****Engine support bracket**

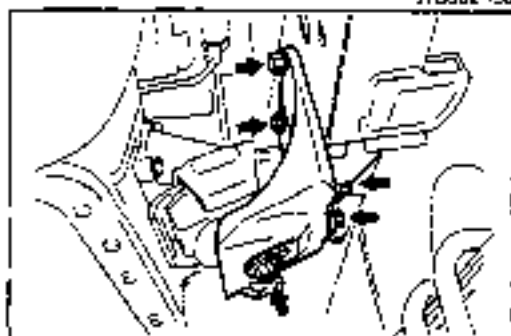
1. Raise the vehicle and support it on safety stands so that the distance between all wheels and the ground is at least 1 m (3.3 ft).
2. (Tilt cabin)  
Support the engine with a hoist.  
(Non-tilt cabin)  
Support the engine with the SST.

## B

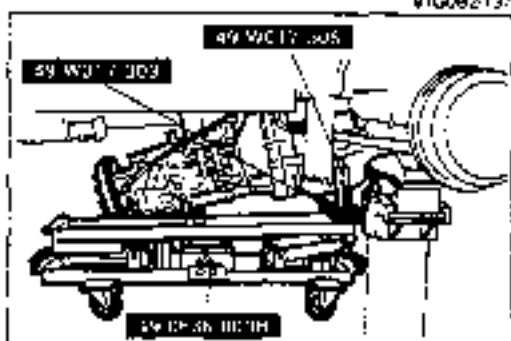
## REMOVAL



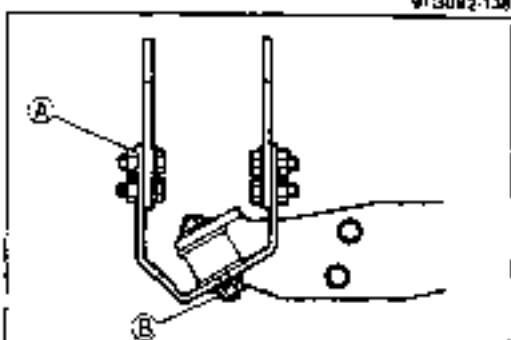
3. Remove the control cable holder.
4. Remove the right engine mount.



5. Remove the left engine mount.



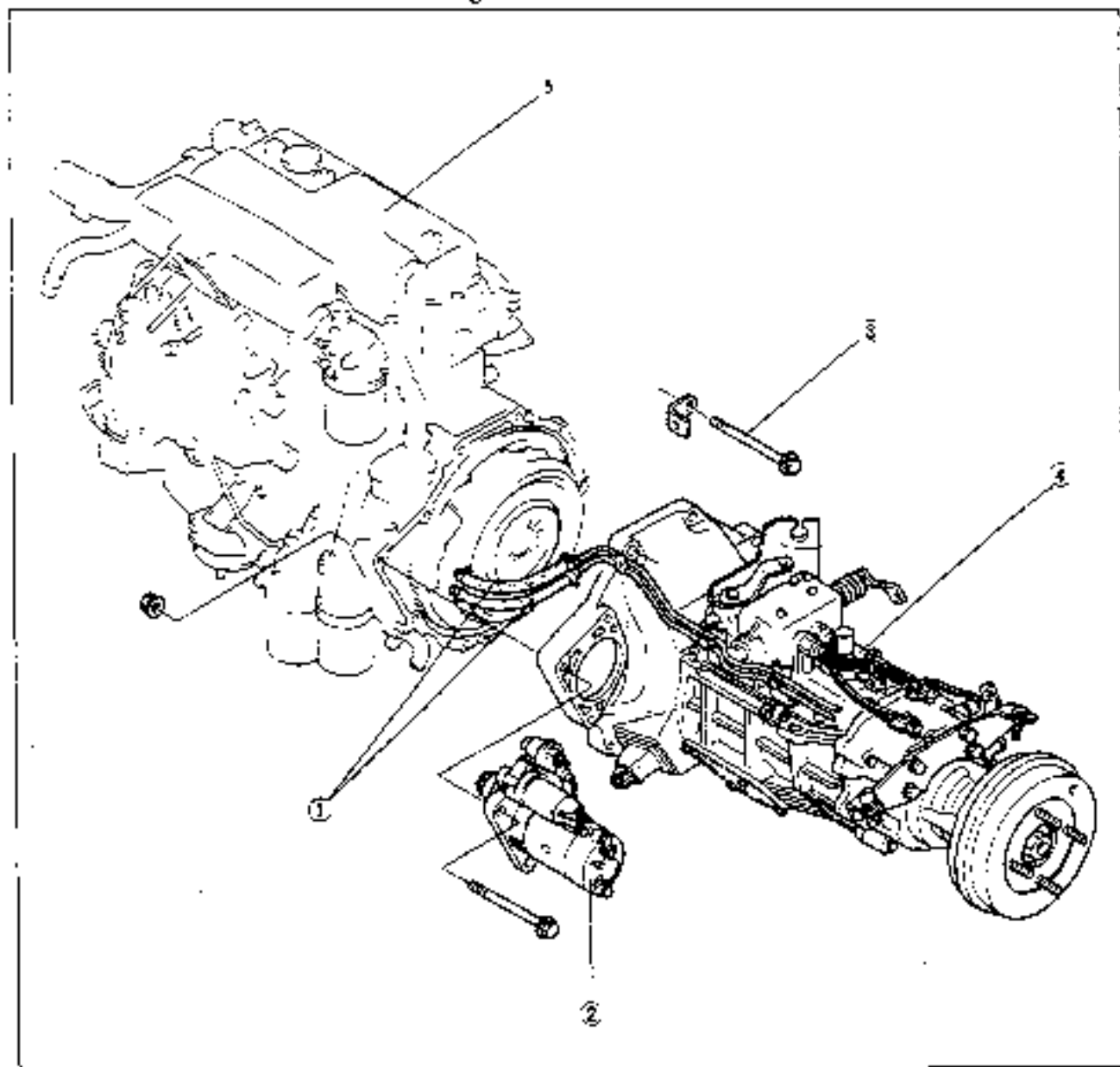
6. Support the engine and transmission assembly with the SST.



7. Remove the transmission mount bracket.
8. Remove the engine and transmission assembly.

**Step 6**

1. Disassemble in the order shown in the figure



- 1. Fuel hose
- 2. Starter
- 3. Transmission mounting bolt

- 4. Transmission
- 5. Engine




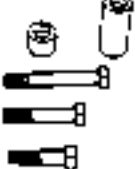


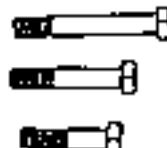
9T2082-1-80

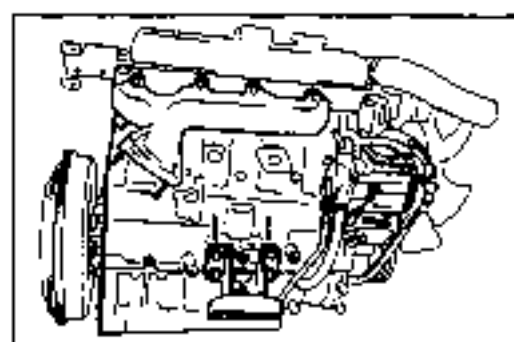
# B

## ENGINE STAND MOUNTING

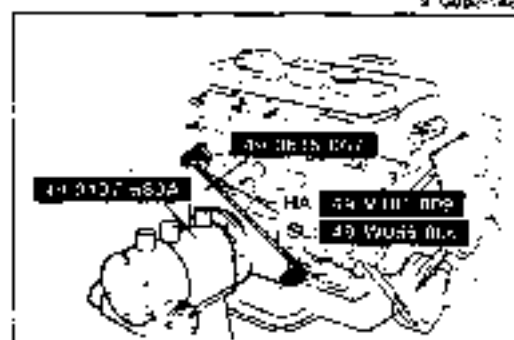
### ENGINE STAND MOUNTING

#### PREPARATION SST

<p>49 0107 680A Engine stand</p> 	<p>For disassembly/ assembly of engine</p>	<p>49 0636 007 Body</p> 	<p>For disassembly/ assembly of engine</p>
<p>49 V101 009 Bolt (HA)</p> 	<p>For disassembly/ assembly of engine</p>	<p>49 W065 006 Attachment set (SL, TF)</p> 	<p>For disassembly/ assembly of engine</p>
<p>49 W065 007 Collar A (Part of 49 W065 006)</p> 	<p>For disassembly/ assembly of engine</p>	<p>49 W065 008 Collar B (Part of 49 W065 006)</p> 	<p>For disassembly/ assembly of engine</p>
<p>49 W065 009 Bolt set (Part of 49 W065 006)</p> 	<p>For disassembly/ assembly of engine</p>	973057-147	



97G082-142



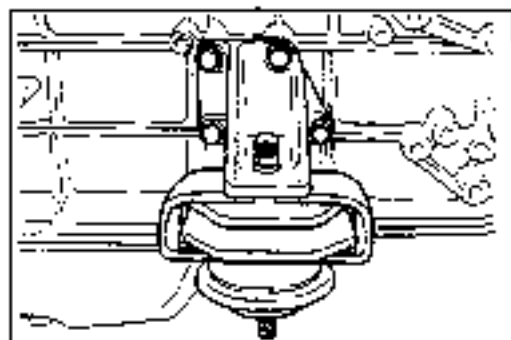
97G082-145

#### PROCEDURE

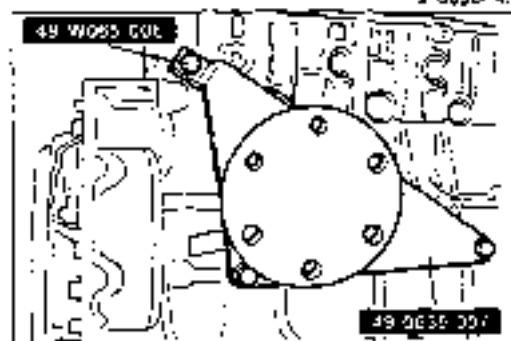
##### HA, SL Engine

1. Remove the breather pipe (SL).
2. Remove the exhaust manifold and gasket.
3. Remove the alternator and alternator bracket.
4. Remove the right engine mount.
5. Remove the oil bypass filter and oil pipe.
6. Install the **SST (engine hanger)** to the holes shown in the figure.
7. Mount the engine on the **SST (engine stand)**.

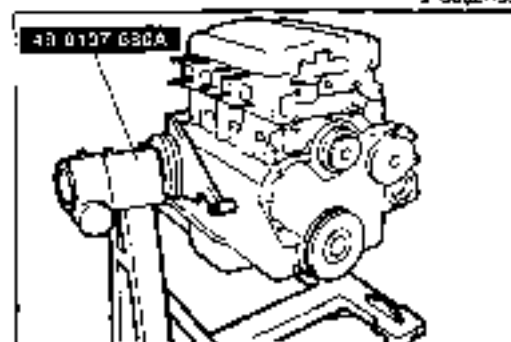




970090-47



970092-150



BT50E2-151







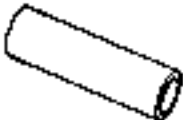
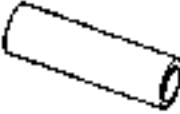
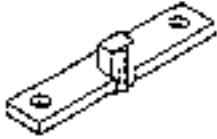





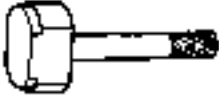
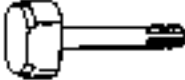
**TF Engine**

1. Remove the exhaust manifold and gasket.
2. Disconnect the oil nose.
3. Remove the right engine mount.

4. Install the **SST (engine hanger)** to the holes shown in the figure.


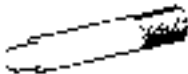
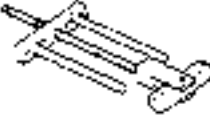
5. Mount the engine on the **SST (engine stand)**.

**B****DISASSEMBLY****DISASSEMBLY****PREPARATION  
SST**

49 0636 100A Arm, valve spring lifter		For removal of valves	49 0107 222A Pivot		For removal of valves
49 S120 170 Remover, valve seal		For removal of valve seals	49 0636 165A Remover & installer, valve guide (HA)		For removal of valve guides
49 0107 451A Remover & installer, valve guide (SL, TF)		For removal of valve guides	49 V101 060A Brake, ring gear (HA, SL)		For prevention of engine rotation
49 S501 062 Collar (HA)		For prevention of engine rotation	49 W066 062 Collar (SL)		For prevention of engine rotation
49 W011 103 Brake, ring gear (TF)		For prevention of engine rotation	49 0559 210 Oil seal installer and centering tool (HA)		For prevention of injection pump gear rotation
49 S120 710 Holder, coupling frame (TF)		For prevention of camshaft gear rotation	49 0223 061 Remover & installer, piston pin (HA)		For removal of piston pins
49 B043 002 Installer, bearing (SL)		For removal of piston pins	49 0636 040 Installer, piston pin (TF)		For removal of piston pins
49 1363 015 Replacer, cylinder liner (HA)		For removal of cylinder liners	49 W065 015 Replacer, cylinder liner (SL)		For removal of cylinder liners

## DISASSEMBLY

**B**

<p>49 W065 016</p> <p>Body (Part of 49 W065 015)</p>		<p>For removal of cylinder liners</p>	<p>49 W065 017</p> <p>Handle (Part of 49 W065 015)</p>		<p>For removal of cylinder liners</p>
<p>49 W010 140</p> <p>Remover set cylinder liner (TF)</p>		<p>For removal of cylinder liners</p>	91G082 152		

1. Code all identical parts (such as pistons, piston rings, connecting rods, and valve springs) so that they can be reinstalled in the cylinder from which they were removed.
2. Clean the parts with a steam cleaner. Blow off any remaining water with compressed air.

**Note**

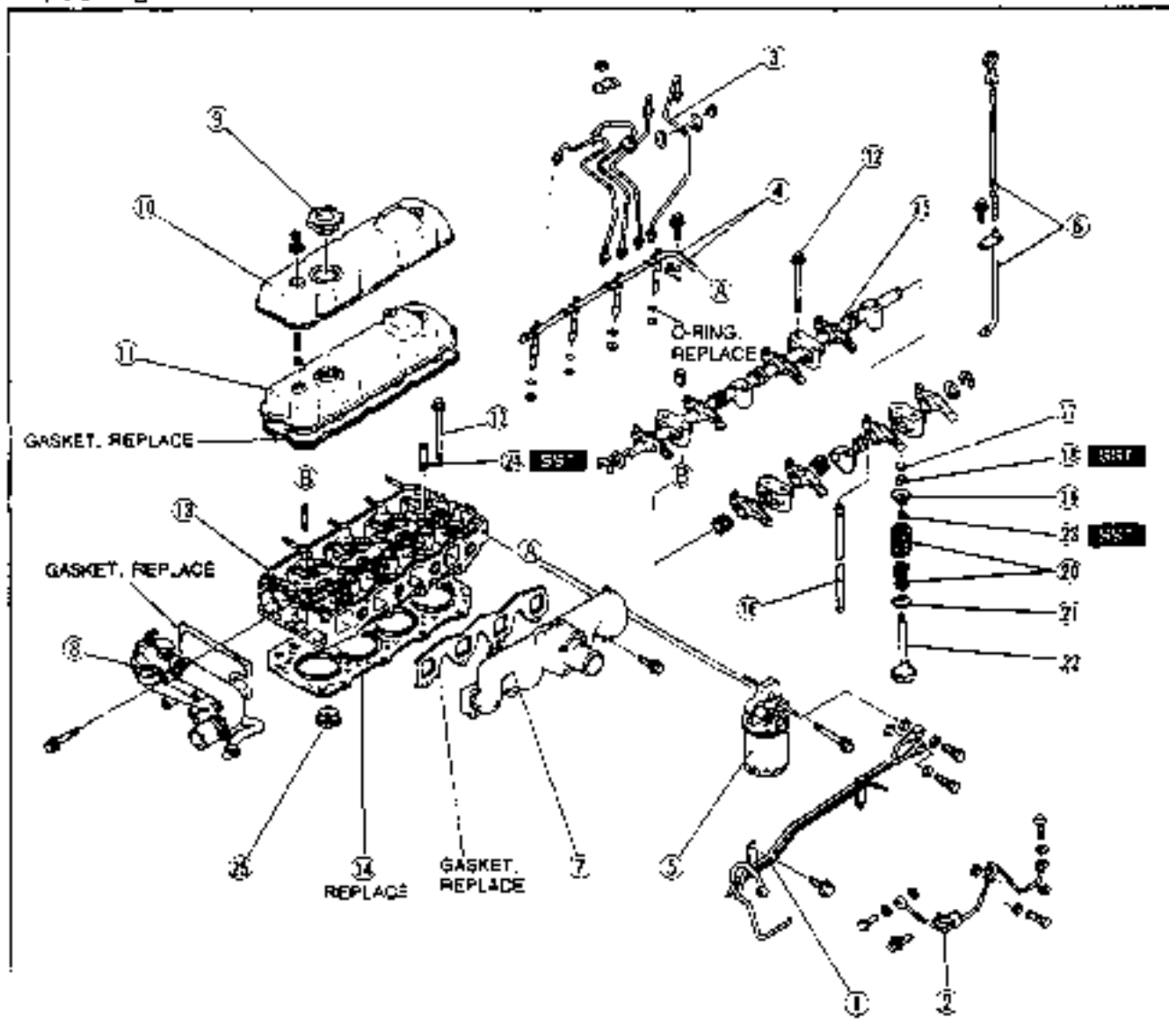
- During disassembly of any part or system, be sure to study its order of assembly. Also, note any deformation, wear, or damage.

91G082 153

# B

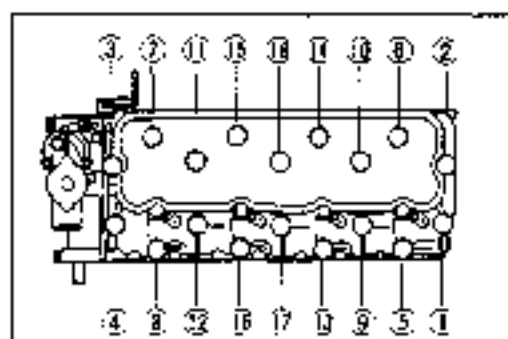
## DISASSEMBLY

### CYLINDER HEAD HA, SL Engine



9TF094-032

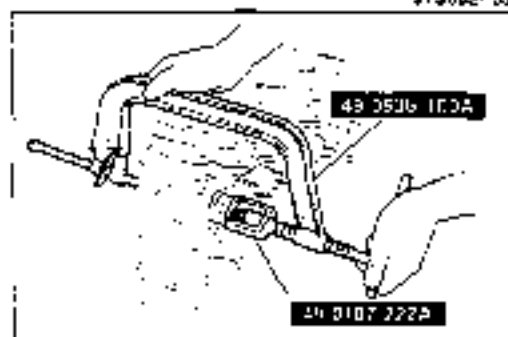
- |                                       |                                    |
|---------------------------------------|------------------------------------|
| 1. Fuel pipe                          | 16. Push rod                       |
| 2. Injection pump oil pipe (SL)       | 17. Valve cap                      |
| 3. Injection pipe                     | 18. Valve keeper                   |
| 4. Injection nozzle and nozzle holder | Disassembly Note ..... page B-61   |
| 5. Fuel filter body                   | 19. Valve spring seat, upper       |
| 6. Oil level gauge and guide pipe     | 20. Valve spring (outer and inner) |
| 7. Intake manifold assembly           | Inspection ..... page B-79         |
| 8. Water outlet housing               | 21. Valve spring seat, lower       |
| 9. Oil filler cap                     | 22. Valve                          |
| 10. Seal cover (SL)                   | Inspection ..... page B-76         |
| 11. Cylinder head cover               | 23. Valve seal                     |
| 12. Cylinder head bolt                | Disassembly Note ..... page B-61   |
| Disassembly Note ..... page B-61      | Inspect for wear or damage         |
| 13. Cylinder head                     | 24. Valve guide                    |
| Inspection ..... page B-76            | Disassembly Note ..... page B-61   |
| 14. Cylinder head gasket              | 25. Combustion chamber insert (HA) |
| 15. Rocker arm assembly               | Disassembly Note ..... page B-62   |
| Inspection ..... page B-79            |                                    |



9T00B2-155

**Disassembly Note****Cylinder head bolt**

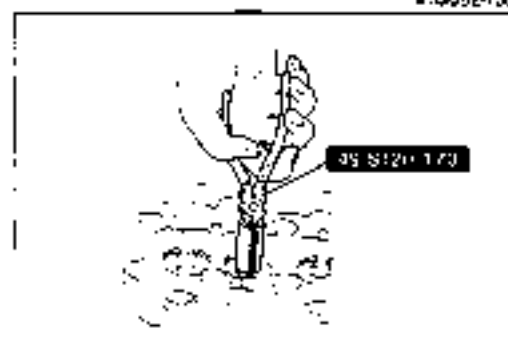
1. Loosen the cylinder head bolts in two or three steps in the order shown in the figure.
2. Remove the cylinder head bolts.



9T00B2-156

**Valve keeper**

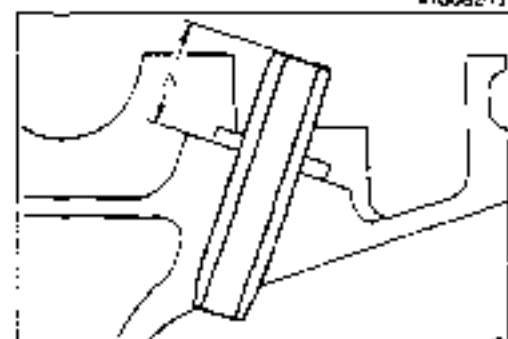
1. Set the **SST** against the upper valve spring seal as shown in the figure.
2. Remove the valve keepers.



9T00B2-157

**Valve seal**

1. Remove the valve seal with the **SST**.



9T00B2-158

**Valve guide****Caution**

- If the valve guide is removed, it must be replaced with a new one.

1. Measure height A of each valve guide.

**Height A: 15.2—15.4mm (0.598—0.606 in)**

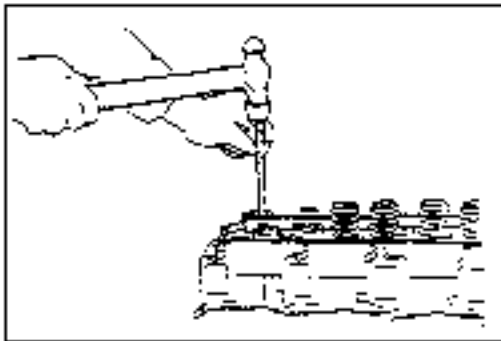


9T00B2-159

2. If height A is not within specification, replace the valve guide.
3. Remove the valve guide from the side opposite the combustion chamber with the **SST**.

# B

## DISASSEMBLY

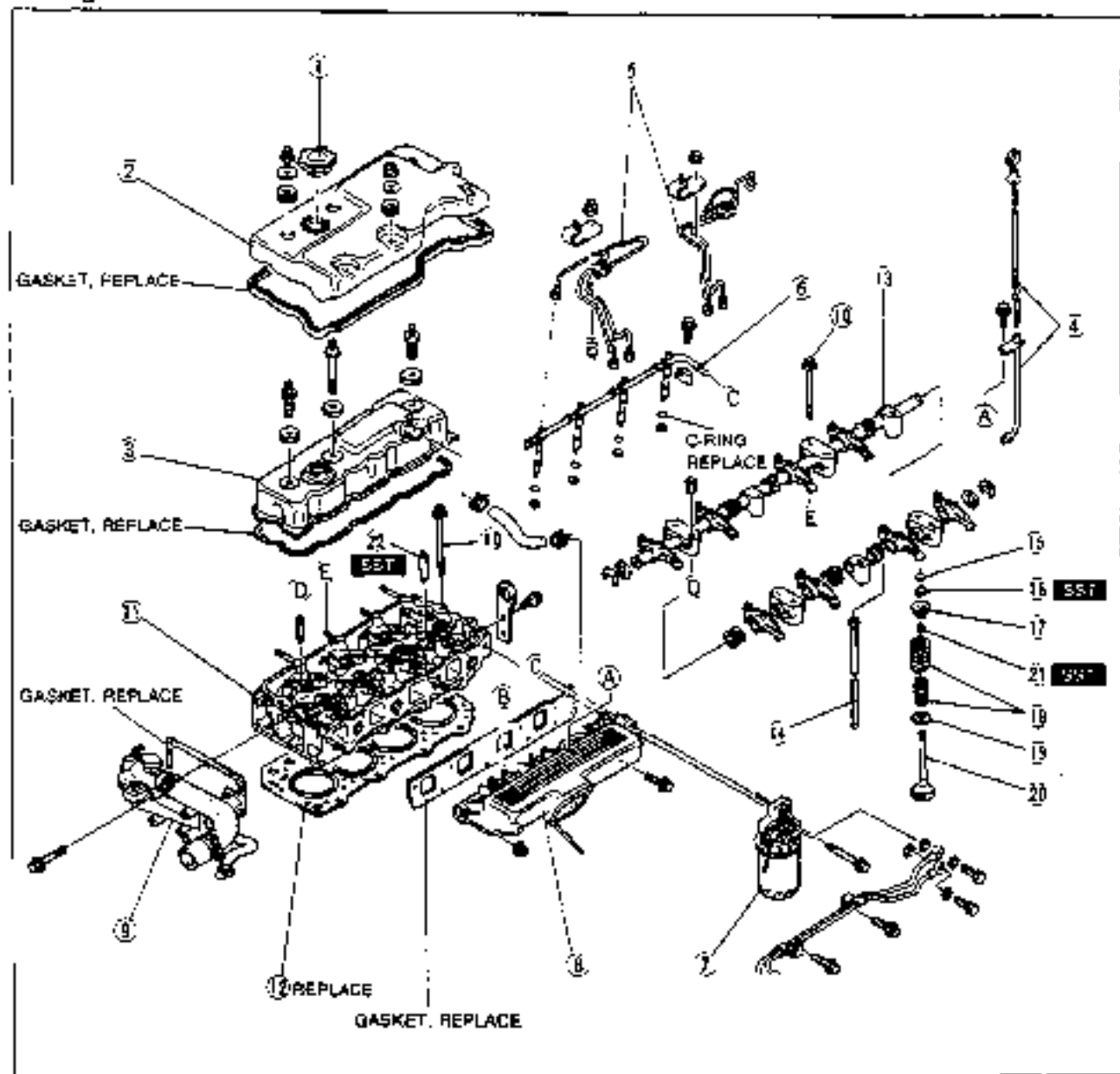


9TG29Q-160

### Combustion chamber insert

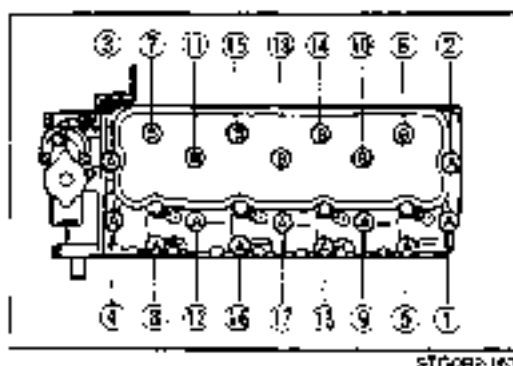
1. Inspect the combustion chamber insert for damage and cracks.
2. If necessary, remove the insert with a suitable mandrel, tapping through the nozzle hole

## TF Engine

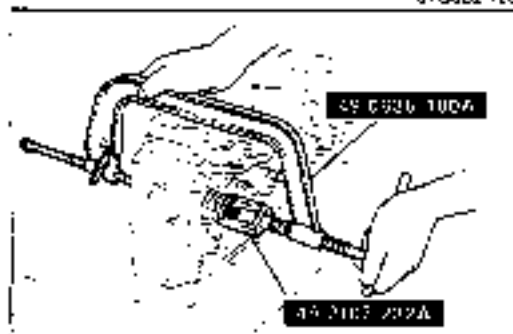


9708V-033

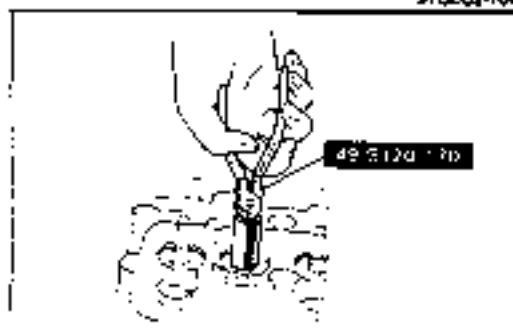
- |                                       |                                    |
|---------------------------------------|------------------------------------|
| 1. Oil filler cap                     | 14. Push rod                       |
| 2. Sea cover                          | 15. Valve cap                      |
| 3. Cylinder head cover                | 16. Valve keeper                   |
| 4. Oil level gauge and guide pipe     | Disassembly Note ..... page B-64   |
| 5. Injection pipe                     | 17. Valve spring seat, upper       |
| 6. Injection nozzle and nozzle holder | 18. Valve spring (outer and inner) |
| 7. Fuel filter body                   | Inspection ..... page B-79         |
| 8. Intake manifold assembly           | 19. Valve spring seat, lower       |
| 9. Water outlet housing               | 20. Valve                          |
| 10. Cylinder head bolt                | Inspection ..... page B-76         |
| Disassembly Note ..... page B-64      | 21. Valve seal                     |
| 11. Cylinder head                     | Disassembly Note ..... page B-64   |
| Inspection ..... page B-76            | Inspect for wear or damage         |
| 12. Cylinder head gasket              | 22. Valve guide                    |
| 13. Rocker arm assembly               | Disassembly Note ..... page B-64   |
| Inspection ..... page B-79            |                                    |



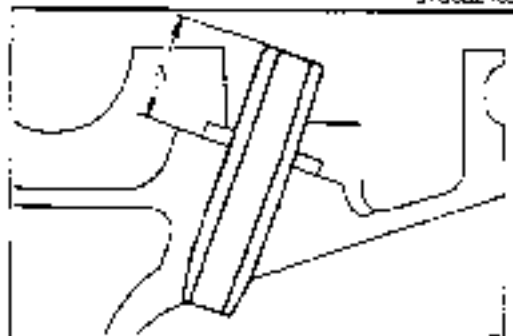
9TGOB2-163



9TGOB2-164



9TGOB2-165



9TGOB2-166



9TGOB2-167

**Disassembly Note****Cylinder head bolt**

1. Loosen the cylinder head bolts in two or three steps in the order shown in the figure.
2. Remove the cylinder head bolts.

**Valve keeper**

1. Set the SST against the upper valve spring seat as shown in the figure.
2. Remove the valve keepers.

**Valve seal**

1. Remove the valve seal with the SST.

**Valve guide****Caution**

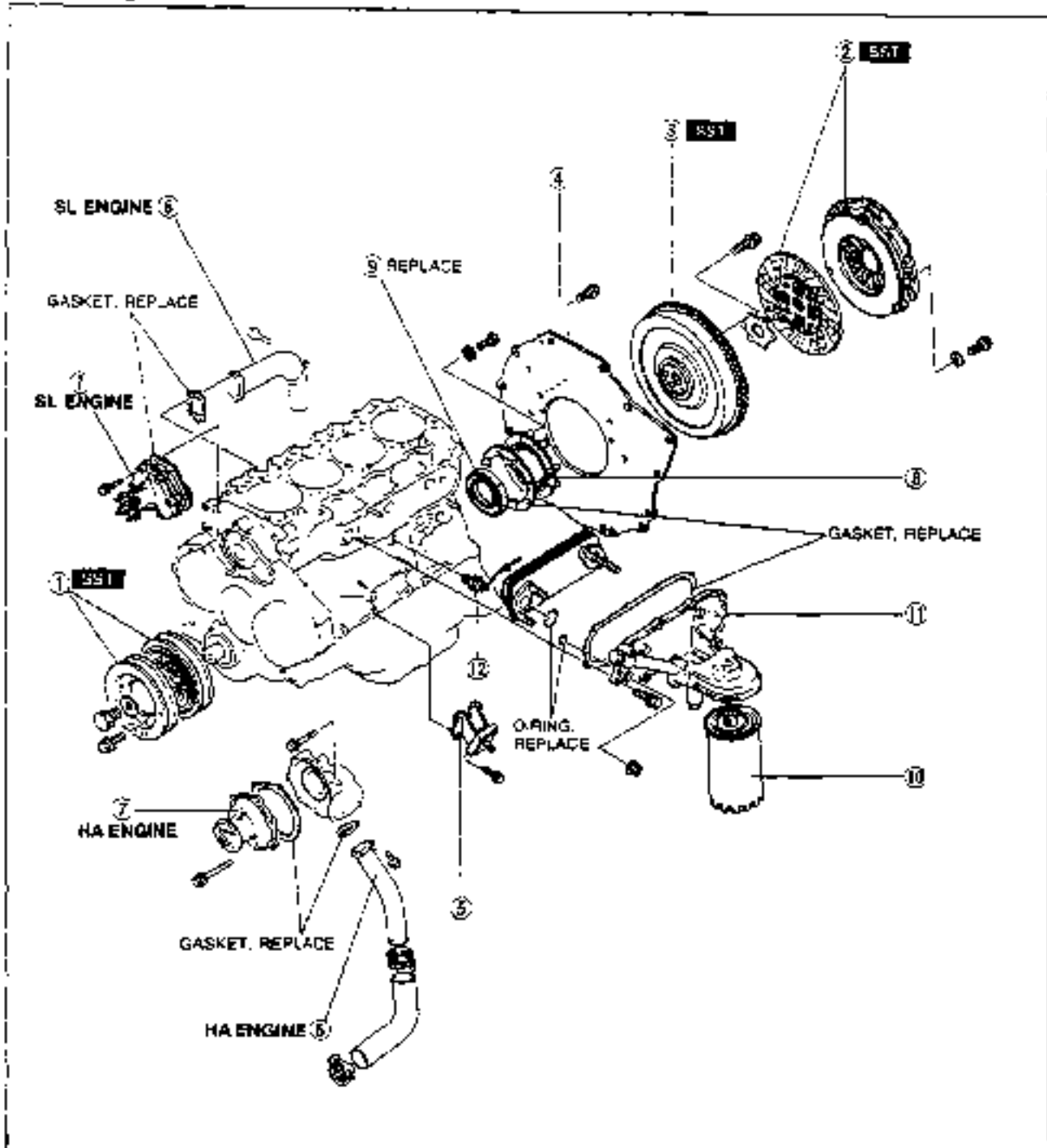
- If the valve guide is removed, it must be replaced with a new one.

1. Measure height A of each valve guide.

Height A: 14.2—14.4mm (0.559—0.567 in)

2. If height A is not within specification, replace the valve guide.
3. Remove the valve guide from the side opposite the combustion chamber with the SST.



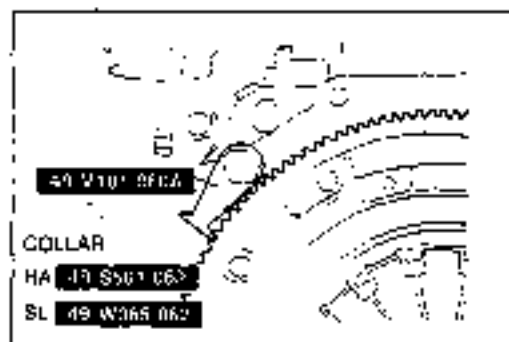
**CYLINDER BLOCK (EXTERNAL PARTS I)**  
**HA, SL Engine**


97P0EX-084

- |   |   |
|---|---|
| 1. Crankshaft pulley<br>Disassembly Note ..... page B-66                      | 6. Water inlet pipe                       |
| 2. Clutch cover, clutch disc<br>Service ..... Section H                       | 7. Water pump<br>Service ..... Section E  |
| 3. Flywheel<br>Disassembly Note ..... page B-66<br>Inspect for wear or damage | 8. Rear oil seal cap                      |
| 4. End plate  | 9. Rear oil seal                          |
| 5. Left engine mount  | 10. Oil filter                            |
|   | 11. Oil cooler<br>Service ..... Section D |
|   | 12. Oil pressure switch                   |

# B

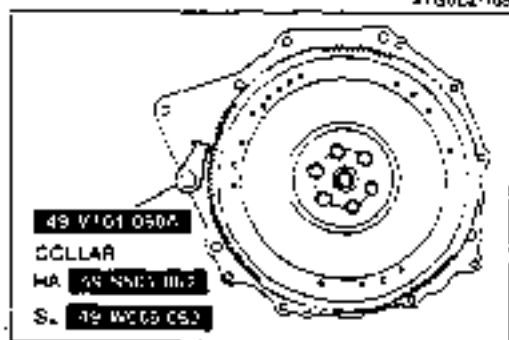
## DISASSEMBLY



### Disassembly Note

#### Crankshaft pulley

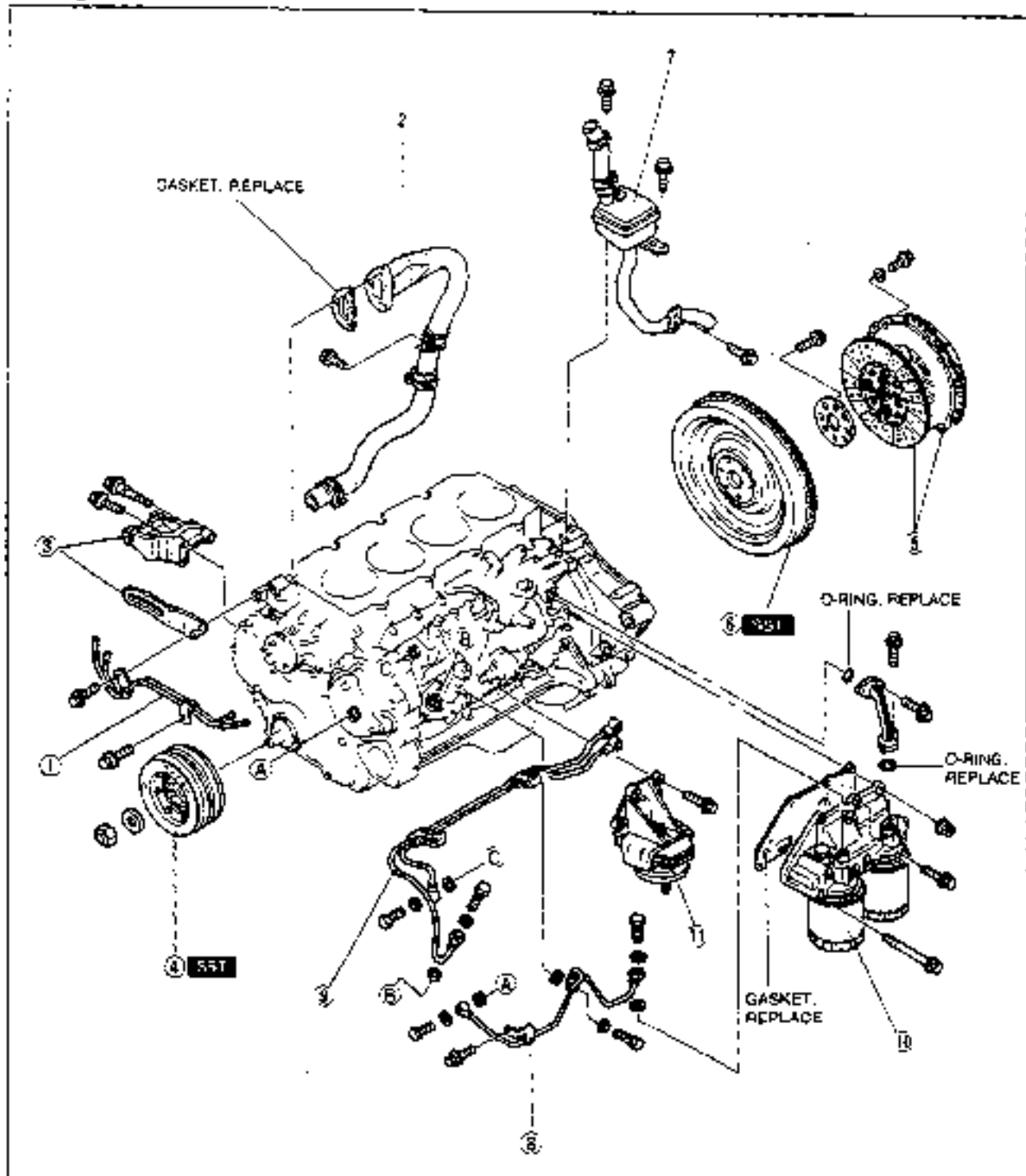
1. Hold the flywheel with the **SST**.
2. Loosen the pulley lock bolt.
3. Remove the lock bolt, washer, and crankshaft pulley.



#### Flywheel

1. Hold the flywheel with the **SST**.
2. Loosen the flywheel lock bolts.
3. Remove the lock bolts, washers, and flywheel.

## TF Engine



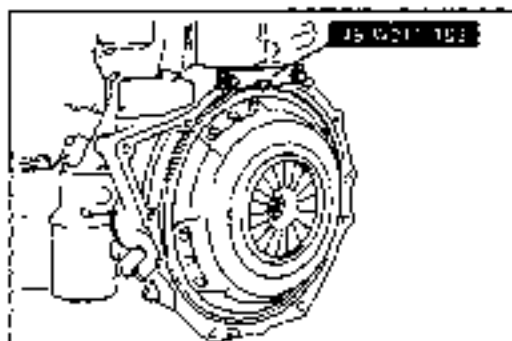
1. Vacuum pipe
2. Water pipe
3. Alternator bracket
4. Crankshaft pulley  
Disassembly Note ..... page B-68
5. Clutch cover, clutch disc  
Service ..... Section H

6. Flywheel  
Disassembly Note ..... page B-68  
Inspect for wear or damage
7. PCV chamber
8. Oil pipe
9. Fuel pipe
10. Oil filter body
11. Left engine mount

9T7089 038

# B

## DISASSEMBLY

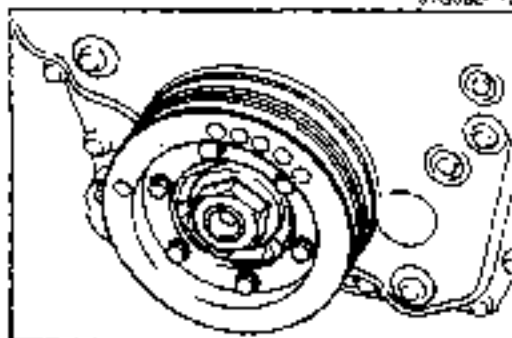


97G082-12

### Disassembly Note

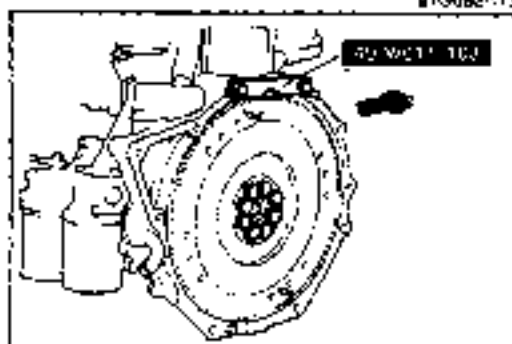
#### Crankshaft pulley

1. Hold the flywheel with the **SST**.
2. Loosen the pulley locknut.



97G082-13

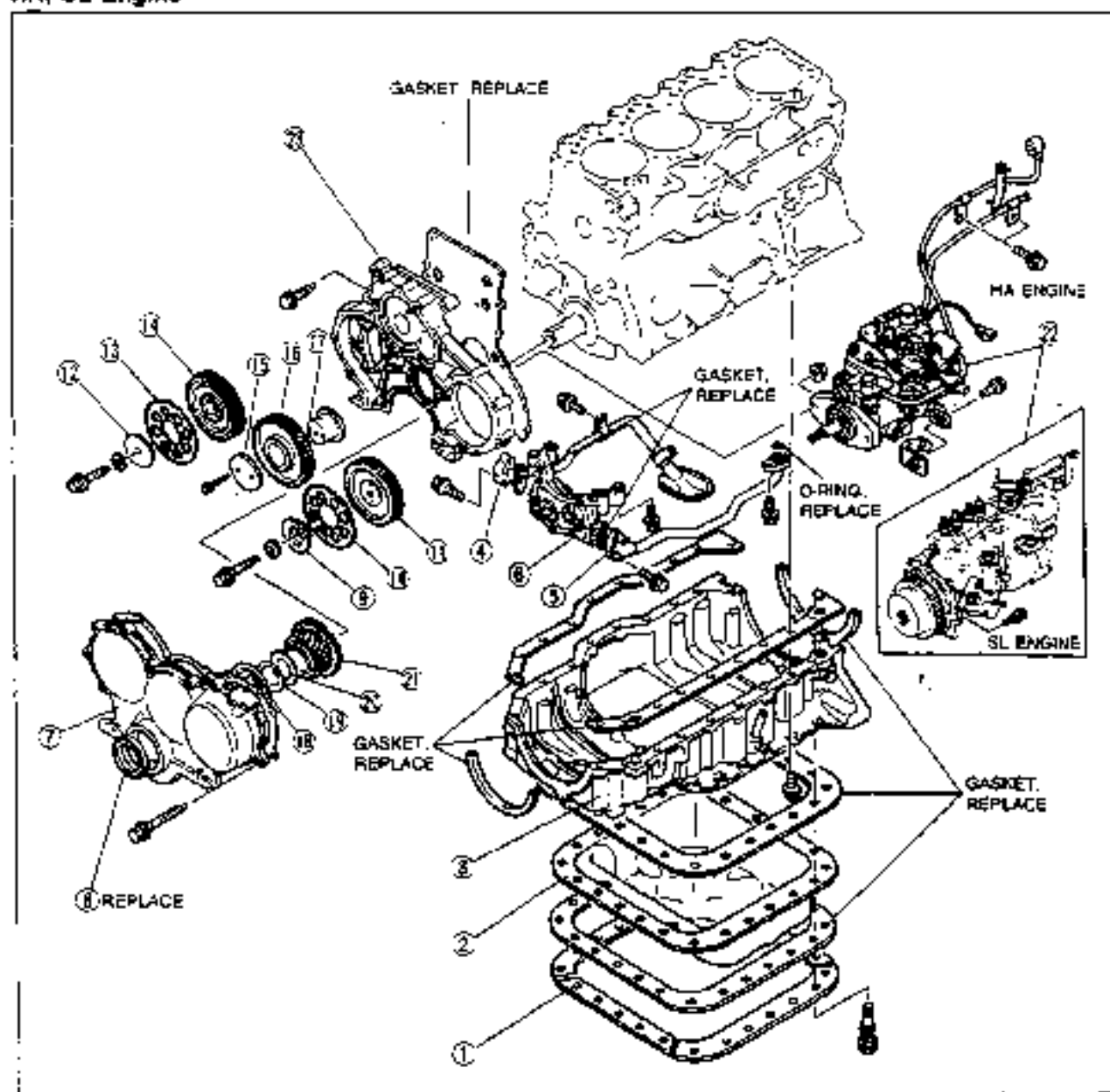
3. Remove the locknut, washer, and crankshaft pulley.



97G082-14

### Flywheel

1. Hold the flywheel with the **SST**.
2. Loosen the flywheel lock bolts.
3. Remove the lock bolts, washers, and flywheel.

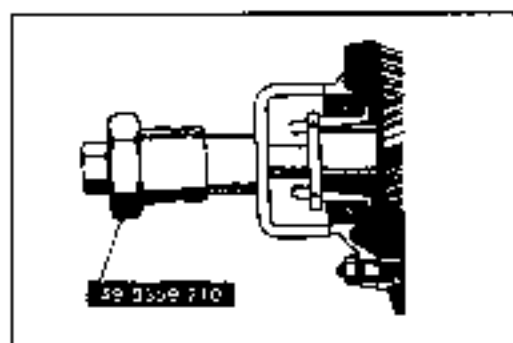
**CYLINDER BLOCK (EXTERNAL PARTS II)**  
**HA, SL Engine**


97F-200-036

- |   |  |
|---|--|
| 1. Stiffener  | 11. Injection pump gear (HA)                       |
| 2. Oil pan<br>Inspect for cracks, deformation, and damage | 12. Lock plate                                     |
| 3. Oil pan upper block                                    | 13. Friction gear                                  |
| 4. Oil strainer   | 14. Camshaft gear                                  |
| 5. Oil pipe   | 15. Thrust plate                                   |
| 6. Oil pump<br>Service ..... Section D                    | 16. Idler gear                                     |
| 7. Timing gear cover                                      | 17. Idler gear spindle                             |
| 8. Front oil seal<br>Disassembly Note ..... page S-70     | 18. Oil deflector                                  |
| 9. Lock plate (HA)  | 19. Friction gear spring                           |
| 10. Friction gear (HA)                                    | 20. Friction gear                                  |
|   | 21. Crankshaft timing gear                         |
|   | 22. Fuel injection pump<br>Service ..... Section F |
|   | 23. Timing gear case                               |

# B

## DISASSEMBLY



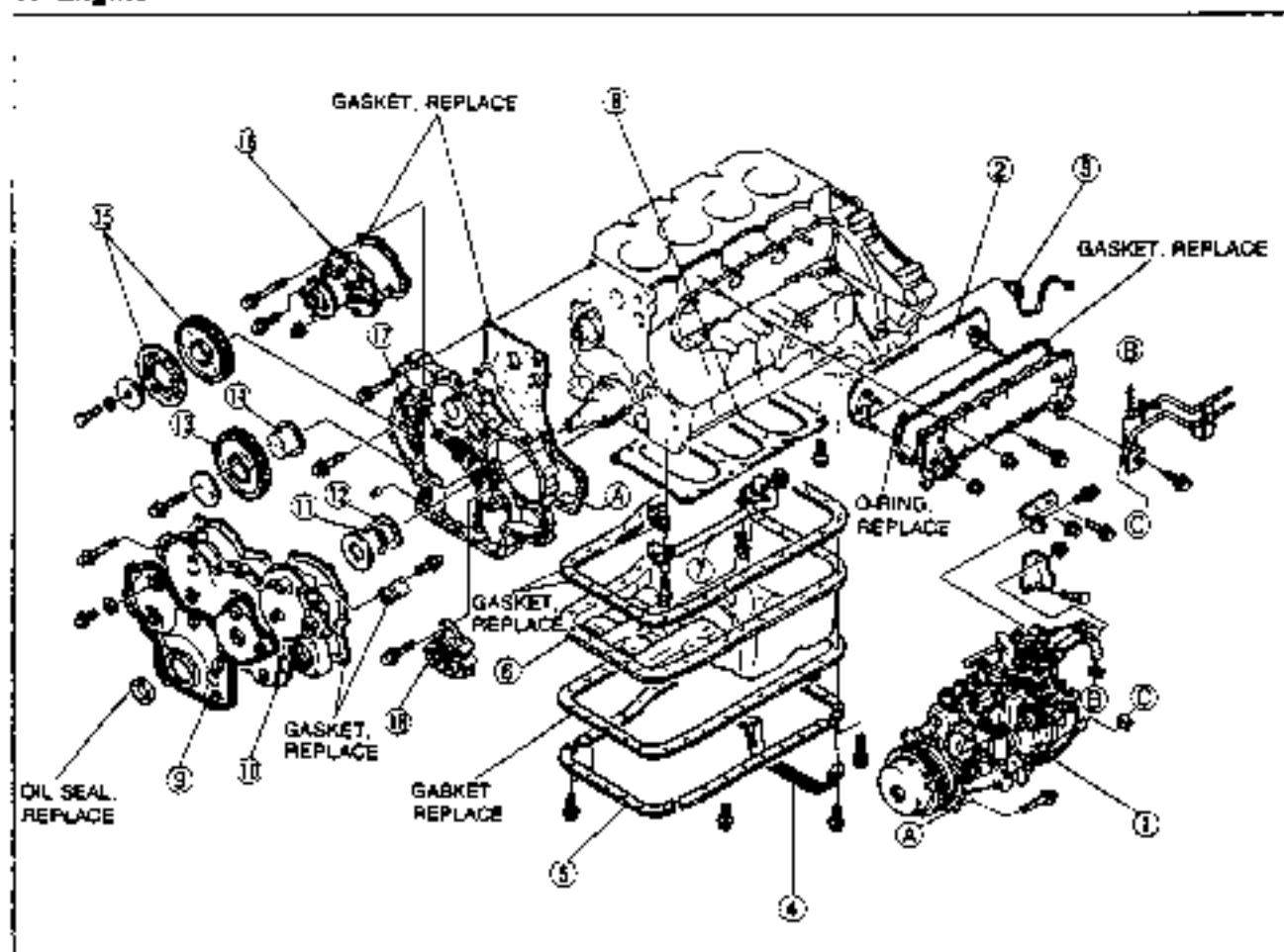
D'G082-178

### Disassembly Note

#### Front oil seal (HA)

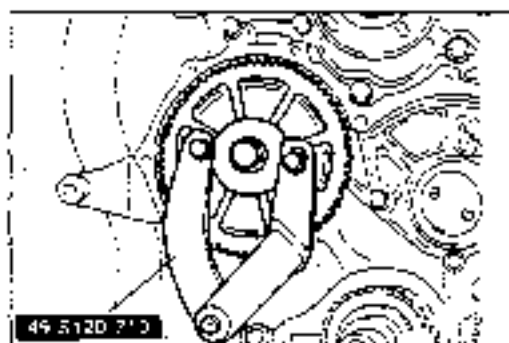
1. Assemble the **SST** as shown in the figure.
2. Set the **SST** against the oil seal and remove it by tightening the center bolt

### TF Engine



9TF087-037

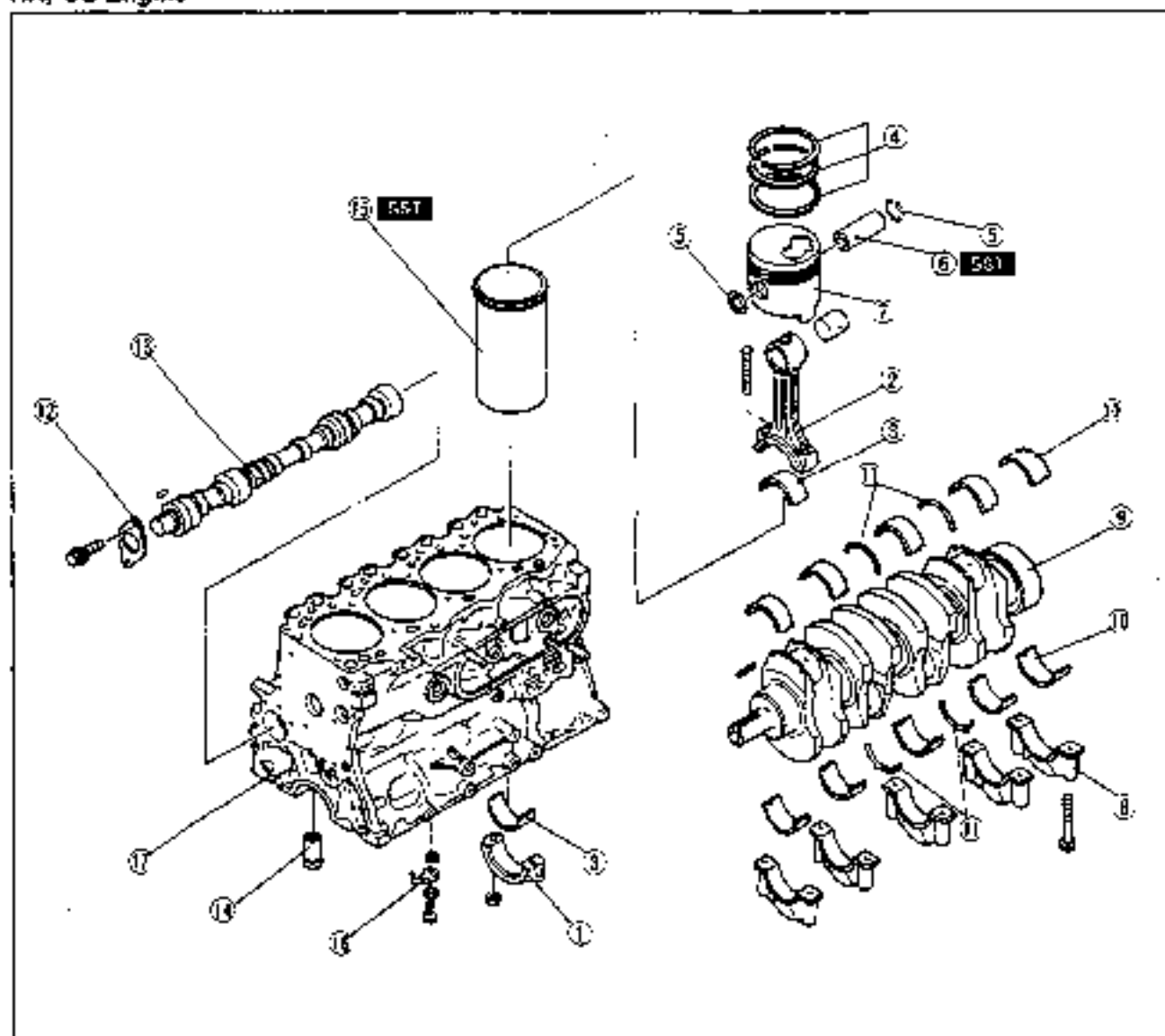
- |                                      |                                     |
|--------------------------------------|-------------------------------------|
| 1. Fuel injection pump               | 10. Timing gear cover               |
| 2. Oil cooler                        | 11. Friction gear spring            |
| Service ..... Section D              | 12. Friction gear                   |
| 3. Oil pressure switch               | 13. Idler gear                      |
| 4. Seal plate                        | 14. Idler gear spindle              |
| 5. Stiffener                         | 15. Camshaft gear and friction gear |
| 6. Oil pan                           | Disassembly Note ..... page B-71    |
| Inspect for cracks, deformation, and | 16. Water pump                      |
| damage                               | 17. Timing gear case                |
| 7. Oil strainer                      | 18. Oil pump                        |
| 8. Stiffening plate                  | Service ..... Section D             |
| 9. Timing gear cover insulator       |                                     |



9T0GE2 117

**Disassembly Note****Camshaft gear and friction gear**

- 1 Hold the camshaft gear with the **SST**.
- 2 Remove the camshaft gear lock bolt.
- 3 Remove the friction gear.
- 4 Remove the camshaft gear.

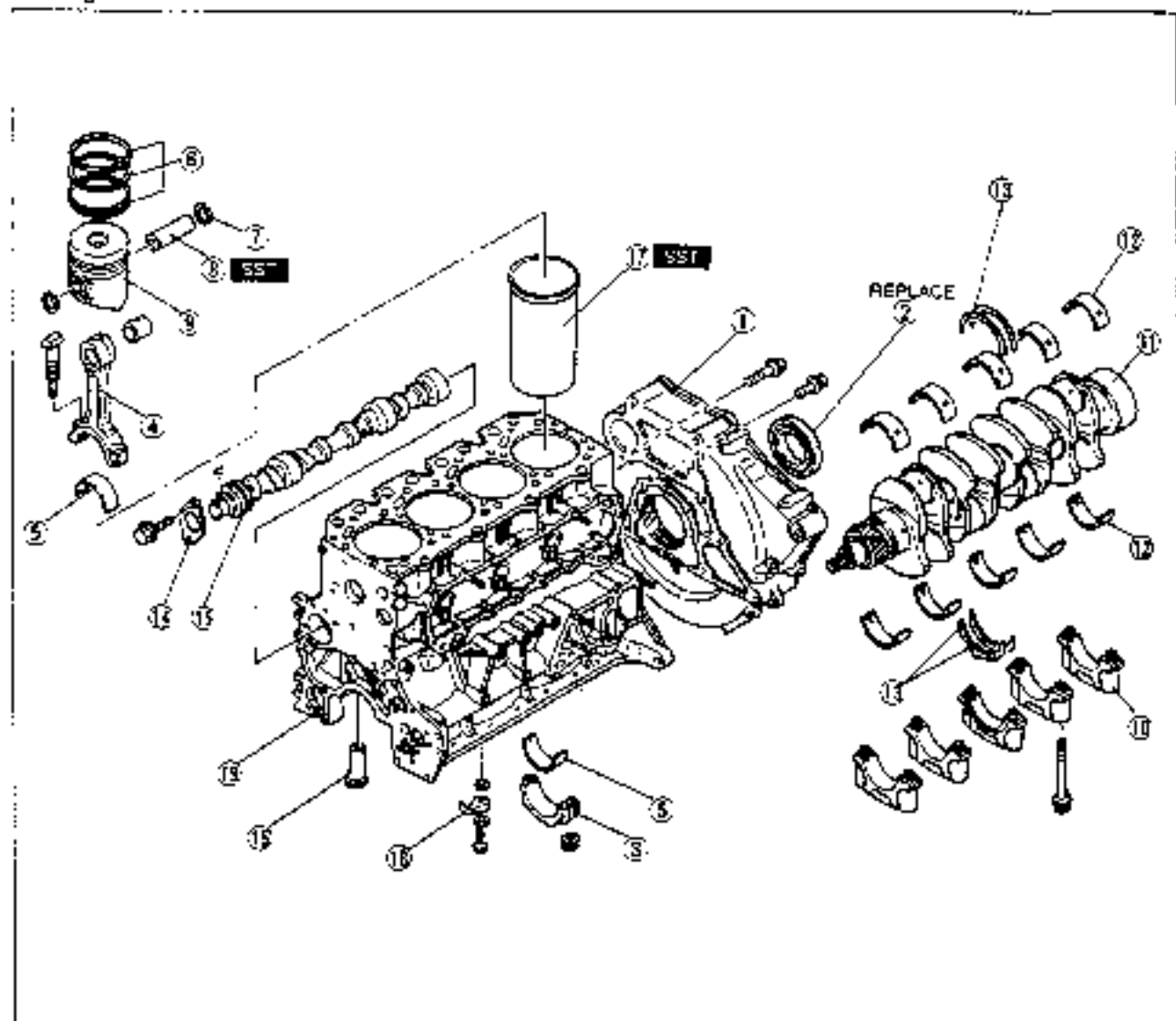
**CYLINDER BLOCK (INTERNAL PARTS)**  
 HA, SL Engine


9TF36X-029

- |   |           |  |           |
|---|-----------|--|-----------|
| 1. Connecting rod cap<br>Disassembly Note ..... | page B-74 | 9. Crankshaft<br>Disassembly Note .....      | page B-75 |
| 2. Connecting rod<br>Disassembly Note .....     | page B-74 | Inspection .....                             | page B-84 |
| 3. Connecting rod bearing<br>Inspection .....   | page B-85 | 10. Main bearing<br>Inspection .....         | page B-85 |
| 4. Piston ring<br>Disassembly Note .....        | page B-74 | 11. Thrust bearing                           |           |
| Inspection .....                                | page B-82 | 12. Camshaft thrust plate                    |           |
| 5. Piston pin clip                              |           | 13. Camshaft<br>Inspection .....             | page B-85 |
| 6. Piston pin<br>Disassembly Note .....         | page B-74 | 14. Tappet<br>Inspection .....               | page B-87 |
| Inspection .....                                | page B-83 | 15. Cylinder liner<br>Disassembly Note ..... | page B-75 |
| 7. Piston<br>Inspection .....                   | page B-81 | Inspection .....                             | page B-80 |
| 8. Main bearing cap<br>Disassembly Note .....   | page B-75 | 16. Oil jet<br>Inspection .....              | page B-87 |
|   |           | 17. Cylinder block<br>Inspection .....       | page B-80 |



## TF Engine

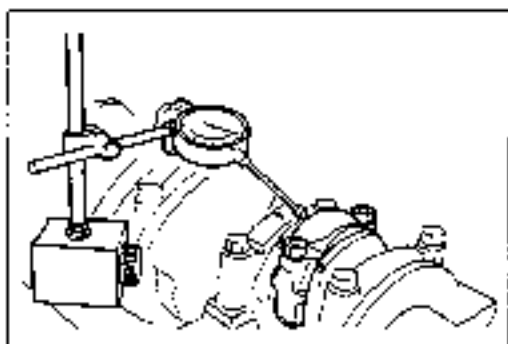


#TF-281-039

- |                           |           |                           |           |
|---------------------------|-----------|---------------------------|-----------|
| 1. End plate              |           | 11. Crankshaft            |           |
| 2. Rear oil seal          |           | Disassembly Note .....    | page B-75 |
| 3. Connecting rod cap     |           | Inspection .....          | page B-84 |
| Disassembly Note .....    | page B-74 | 12. Main bearing          |           |
| 4. Connecting rod         |           | Inspection .....          | page B-85 |
| Disassembly Note .....    | page B-74 | 13. Thrust bearing        |           |
| Inspection .....          | page B-83 | 14. Camshaft thrust plate |           |
| 5. Connecting rod bearing |           | 15. Camshaft              |           |
| Inspection .....          | page B-85 | Inspection .....          | page B-85 |
| 6. Piston ring            |           | 16. Tappet                |           |
| Disassembly Note .....    | page B-74 | Inspection .....          | page B-87 |
| Inspection .....          | page B-82 | 17. Cylinder liner        |           |
| 7. Piston pin clip        |           | Disassembly Note .....    | page B-75 |
| 8. Piston pin             |           | Inspection .....          | page B-80 |
| Disassembly Note .....    | page B-74 | 18. Oil jet               |           |
| Inspection .....          | page B-83 | Inspection .....          | page B-87 |
| 9. Piston                 |           | 19. Cylinder block        |           |
| Inspection .....          | page B-81 | Inspection .....          | page B-80 |
| 10. Main bearing cap      |           |                           |           |
| Disassembly Note .....    | page B-75 |                           |           |

## B

## DISASSEMBLY

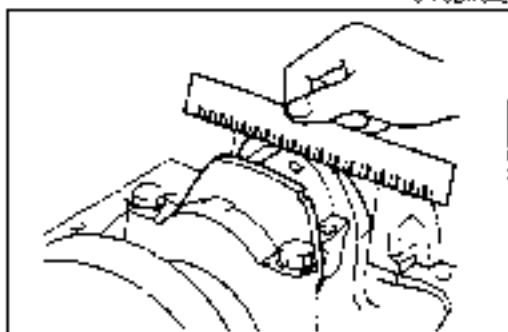


87F0Bx-040

### Disassembly Note

#### Connecting rod cap

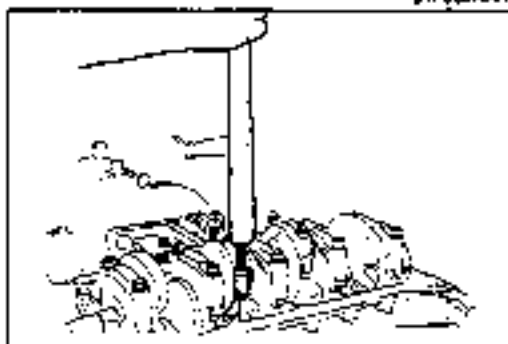
1. Before removing the connecting rod caps, measure the connecting rod side clearance. (Refer to page B-96.)



87F0Bx-041

#### Connecting rod

1. Before removing the connecting rods, measure the connecting rod oil clearance. (Refer to page B-95.)



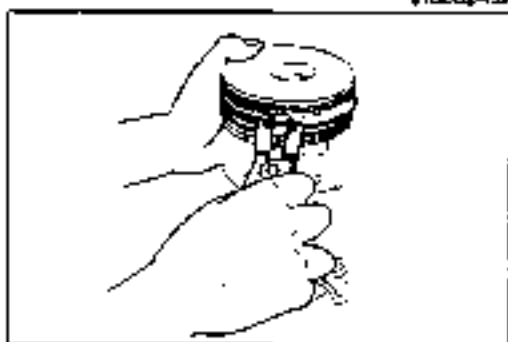
87G0B2-450

2. Remove the Plastigage from the crankpin journals.

#### Caution

- Do not scratch the crankpin journal or the cylinder liner.
- Protect the connecting rod bolts with rubber sleeves to prevent damage to the crankpin journal.

3. Use the handle of a hammer to remove the piston and connecting rod assembly through the top of the cylinder block.



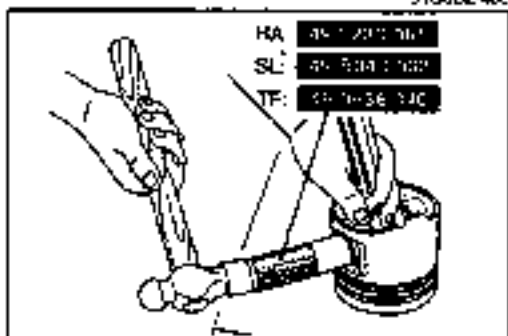
87G0B2-460

#### Piston ring

#### Caution

- Do not apply excessive tension, which may cause a ring to break.

1. Remove the piston rings with a piston ring expander (commercially available).



85U0Bx-114

#### Piston pin

#### Caution

- Mark the connecting rod direction for proper reassembly.

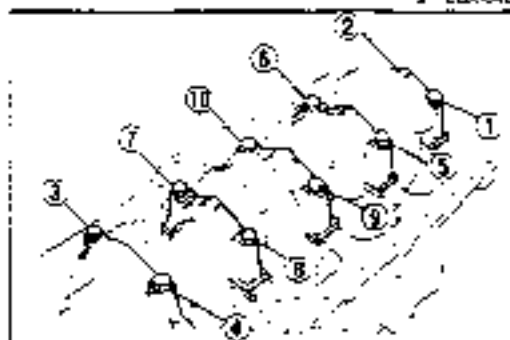
1. Remove the piston pin with the SST.



97CBX-042

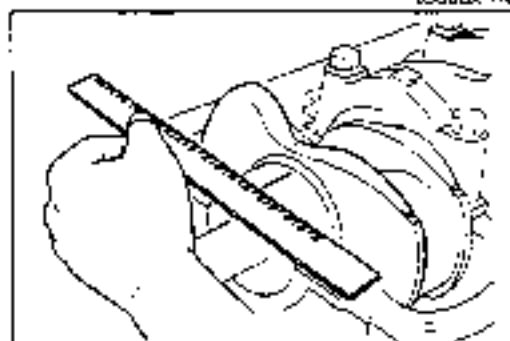
**Main bearing cap**

1. Before removing the main bearing caps, measure the crankshaft end play. (Refer to page B-94.)



05UDBX-116

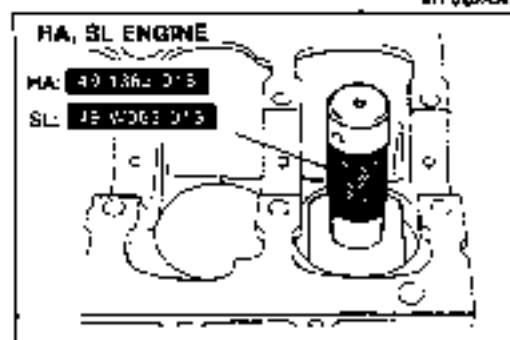
2. Loosen the main bearing cap bolts in two or three steps in the order shown in the figure.
3. Remove the main bearing caps.



07F0BX-045

**Crankshaft**

1. Before removing the crankshaft, measure the main bearing oil clearances. (Refer to page B-92.)



07G0B2-185

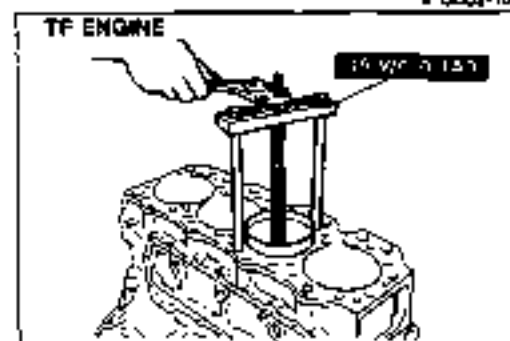
**Cylinder liner**

1. Mark the cylinder liner and the cylinder block for proper reassembly.

**Note**

- If necessary, remove the cylinder liner with the SST.

2. Remove the cylinder liner by hand.



07G0B2-186

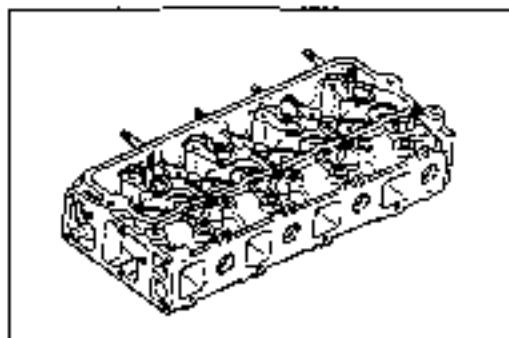
## INSPECTION / REPAIR

1. Clean all parts, being sure to remove all gasket fragments, dirt, oil or grease, carbon, moisture residue, and other foreign materials.
2. Inspection and repairs must be performed in the order specified.

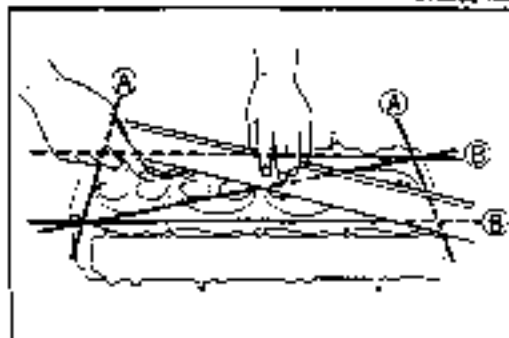
**Caution**

- Do not damage the joints or friction surfaces of aluminum alloy components (such as the pistons).

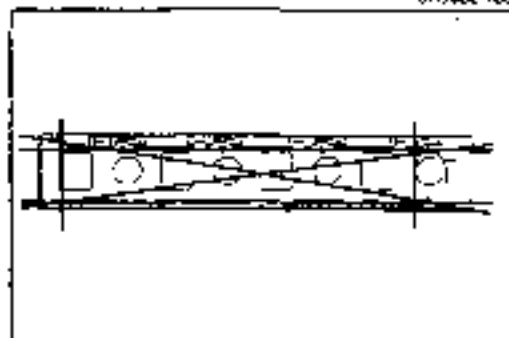
BTG082-187



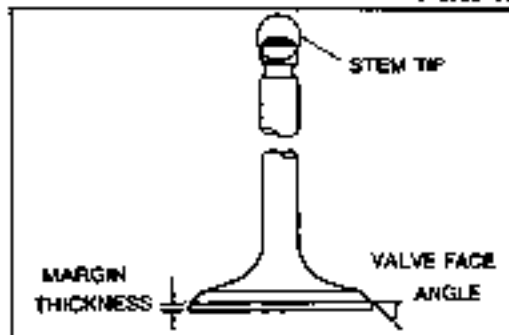
BTG082-188



BTG082-189



BTG082-190



BTG082-191

**CYLINDER HEAD**

1. Inspect the cylinder head for damage, cracks, and leakage of water and oil. Replace the cylinder head if necessary.
2. Measure the cylinder head distortion in the six directions shown in the figure.

**Distortion** (A) : 0.10mm (0.004 in) max.  
 (B) : 0.25mm (0.010 in) max.

3. If the cylinder head distortion exceeds specification, replace the cylinder head.

4. Measure the manifold contact surface distortion in the four directions shown in the figure

**Distortion:** 0.10mm (0.004 in) max.

5. If distortion exceeds specification, replace the cylinder head.

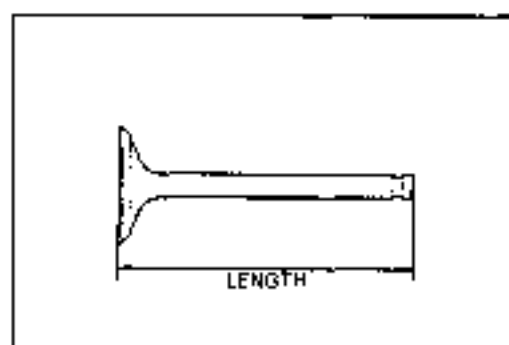
**VALVE MECHANISM****Valve and Valve Guide**

1. Inspect each valve for the following. Replace or resurface the valve as necessary.
  - (1) Damaged or bent stem.
  - (2) Rough or damaged face.
  - (3) Damaged or unevenly worn stem tip.
2. Measure the valve head margin thickness of each valve. Replace valves as necessary.

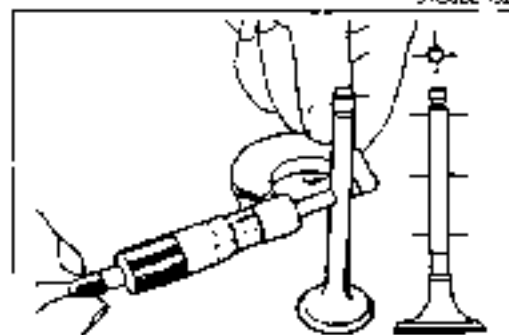
**Margin thickness**

mm (in) mm.

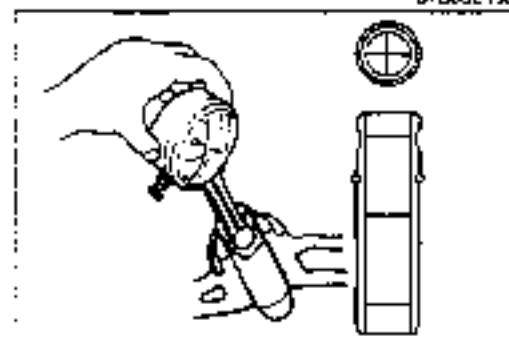
	HA	SL	TF
IN		1.0 (0.039)	
EX	1.0 (0.039)	1.2 (0.047)	1.5 (0.059)



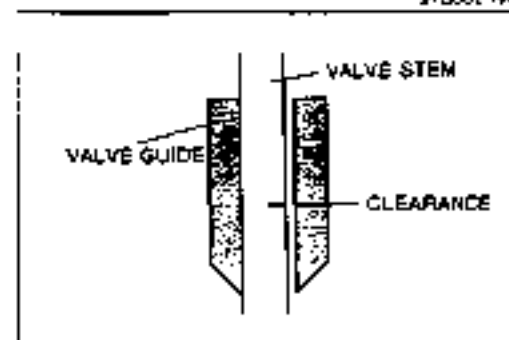
BTG082-132



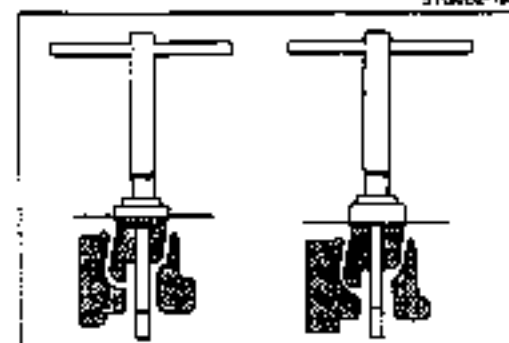
BTG082-130



BTG082-134



BTG082-135



OSU08X-13

3. Measure the length of each valve at the points shown.

### Length

mm (in)

		Standard	Minimum
HA	IN	114.6 (4.512)	114.1 (4.492)
	EX	114.6 (4.512)	114.7 (4.492)
SL	IN	114.5 (4.512)	114.1 (4.492)
	EX	114.5 (4.508)	114.3 (4.488)
TF	IN	119.7 (4.713)	119.2 (4.693)
	EX	119.3 (4.697)	118.8 (4.677)

4. Measure the stem diameter of each valve.

### Diameter

mm (in)

HA	IN	8.955—8.980 (0.3526—0.3535)
	EX	8.935—8.960 (0.3516—0.3528)
SL	IN	8.985—8.980 (0.3530—0.3535)
	EX	8.945—8.960 (0.3522—0.3528)

5. Measure the inner diameter of each valve guide at the points shown.

### Inner diameter

**IN:** 9.018—9.033mm (0.3550—0.3556 in)

**EX:** 9.018—9.033mm (0.3550—0.3558 in)

6. Subtract the outer diameter of the valve stem from the inner diameter of the corresponding valve guide to calculate the valve stem to guide clearance.

### Clearance

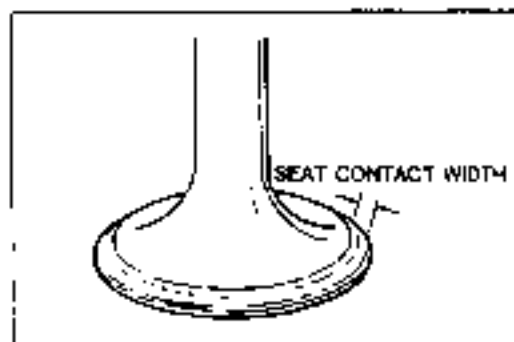
mm (in)

		Standard	Maximum
HA	IN	0.038—0.078 (0.0015—0.0031)	0.127 (0.0050)
	EX	0.058—0.098 (0.0023—0.0039)	
SL	IN	0.038—0.068 (0.0015—0.0027)	0.127 (0.0050)
	EX	0.058—0.088 (0.0023—0.0035)	

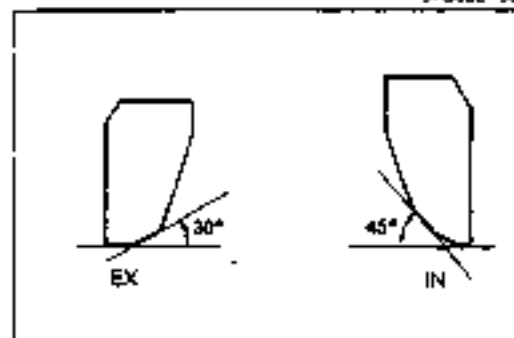
7. If the clearance exceeds specification, replace the valve and/or valve guide.

### Valve Seat

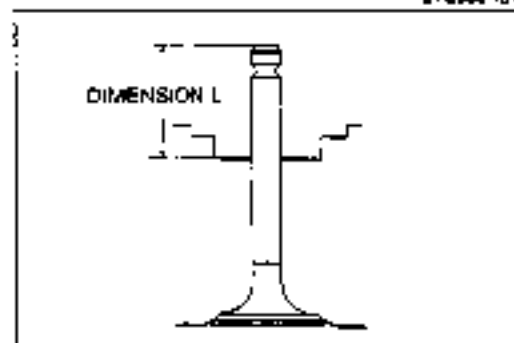
- Inspect the contact surface of each valve seat and valve face for the following.
  - Roughness
  - Damage.
- If necessary, resurface the valve seat with a **45° (IN)** or **30° (EX)** valve seat cutter and/or resurface the valve face.
- Apply a thin coat of Prussian blue to the valve face.
- Inspect the valve seating by pressing the valve against the seat.
  - If blue does not appear 360° around the valve face, replace the valve.
  - If blue does not appear 360° around the valve seat, resurface the seat.



9TGC82-96



9TGC82-107



9TGC82-109

5. Measure the seat contact width.

#### Width

mm (in)

	IN	EX
HA	2.0 (0.079)	2.0 (0.079)
SL, TF	1.7 (0.067)	1.7 (0.067)

5. Verify that the valve seating position is at the center of the valve face.  
 7. If the seating position is too high or too low, correct the valve seat with valve seat cutter.  
 8. Seal the valve to the valve seat with tapping compound.

9. Inspect the sinking of the valve seat.  
 10. Measure the protruding length (**dimension L**) of the valve stem.

#### Dimension L

mm (in)

	IN	EX
HA	48.05 (1.892)	48.05 (1.892)
SL	48.05 (1.892)	47.95 (1.888)
TF	48.40 (1.906)	48.40 (1.906)

(1) If **dimension L** is as below, no correction needed.

	IN	EX
HA	48.05—48.55 (1.892—1.911)	48.05—48.55 (1.892—1.911)
SL	48.05—48.55 (1.892—1.911)	47.95—48.45 (1.888—1.907)
TF	48.40—48.90 (1.906—1.925)	48.40—48.90 (1.906—1.925)

9TGC82-109

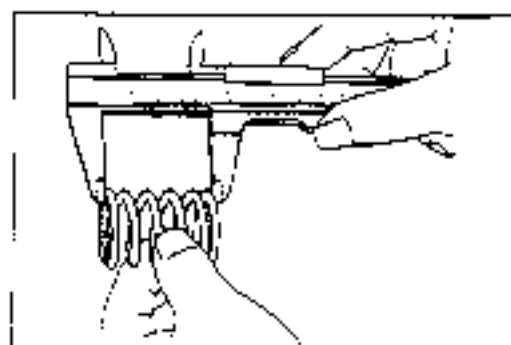
(2) If **dimension L** is as below, adjust with washer on spring seat area of cylinder head.

	IN	EX
HA	48.55—49.55 (1.911—1.951)	48.55—49.55 (1.911—1.951)
SL	48.55—49.55 (1.911—1.951)	48.45—49.45 (1.907—1.947)
TF	48.90—49.90 (1.925—1.965)	48.90—49.90 (1.925—1.965)

(3) If **dimension L** is more than as below, replace cylinder head.

	IN	EX
HA	49.55 (1.951)	49.55 (1.951)
SL	49.55 (1.951)	49.45 (1.947)
TF	49.90 (1.965)	49.90 (1.965)

9TGC82-200



9T3382-20\*

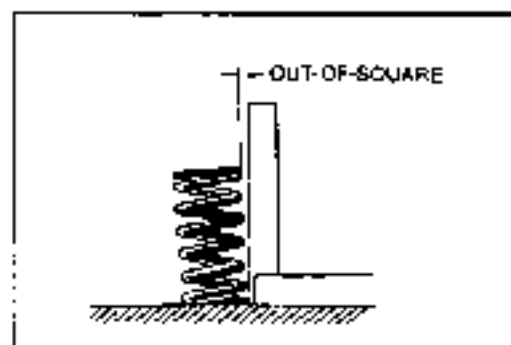
**Valve Spring**

1. Inspect each valve spring for cracks or damage.
2. Measure the free length and out-of-square. Replace the valve spring if necessary.

**Free length**

mm (in)

		Standard		Minimum
HA	IN	Inner	44.1 (1.736)	43.1 (1.697)
		Outer	55.7 (2.193)	54.7 (2.154)
	EX	Inner	44.1 (1.736)	43.1 (1.697)
		Outer	55.7 (2.193)	54.7 (2.154)
SL (Non-Turbo)	IN	Inner	46.6 (1.835)	45.6 (1.795)
		Outer	53.1 (2.091)	52.1 (2.051)
	EX	Inner	46.6 (1.835)	45.6 (1.795)
		Outer	53.1 (2.091)	52.1 (2.051)
SL (Turbo)	IN	Inner	46.6 (1.835)	45.6 (1.795)
		Outer	53.1 (2.091)	52.1 (2.051)
	EX	Inner	49.4 (1.945)	48.4 (1.906)
		Outer	56.1 (2.209)	55.1 (2.169)
TF	IN	Inner	51.4 (2.024)	50.4 (1.984)
		Outer	58.5 (2.303)	58.5 (2.303)
	EX	Inner	51.4 (2.024)	50.4 (1.984)
		Outer	58.5 (2.303)	58.5 (2.303)

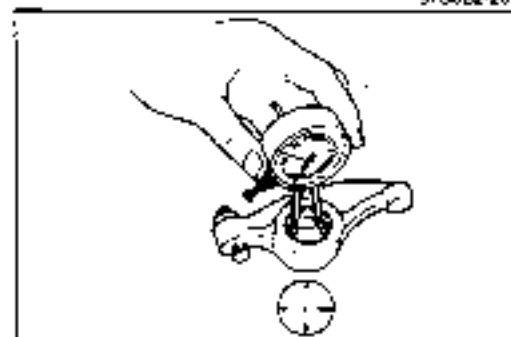


9T3082-20\*

**Out-of-square**

mm (in) max

		Outer	Inner
HA	IN	1.37 (0.0539)	1.25 (0.0492)
	EX	1.37 (0.0539)	1.25 (0.0492)
SL (Non-Turbo)	IN	1.65 (0.0728)	1.63 (0.0642)
	EX	1.65 (0.0728)	1.63 (0.0642)
SL (Turbo)	IN	1.65 (0.0728)	1.63 (0.0642)
	EX	1.95 (0.0772)	1.72 (0.0677)
TF	IN	2.07 (0.0815)	1.79 (0.0705)
	EX	2.07 (0.0815)	1.79 (0.0705)



9T3082-20\*

**ROCKER ARM ASSEMBLY**

1. Check for wear or damage to the contact surfaces of the rocker arm and shaft. Replace if necessary.
2. Measure the rocker arm inner diameter.

**Inner diameter**

mm (in)

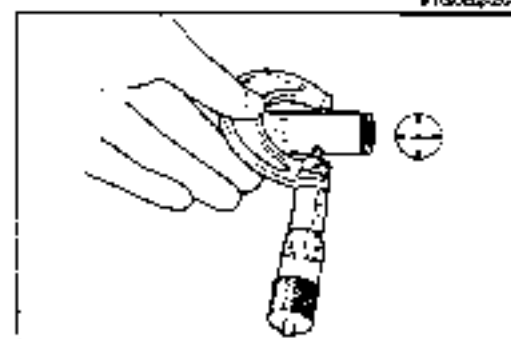
HA	15.876—15.896 (0.6250—0.6258)
SL (Non-Turbo)	19.000—19.021 (0.7480—0.7489)
SL (Turbo)	23.000—23.021 (0.9055—0.9063)
TF	21.000—21.021 (0.8268—0.8276)

3. Measure the rocker arm shaft diameter.

**Diameter**

mm (in)

HA	15.835—15.860 (0.6234—0.6244)
SL (Non-Turbo)	18.959—18.980 (0.7464—0.7472)
SL (Turbo)	22.959—22.980 (0.9039—0.9047)
TF	20.959—20.980 (0.8252—0.8260)



9T3382-20\*

- 4 Subtract the outer diameter of the rocker shaft from the inner diameter of the rocker arm to calculate the rocker arm to shaft clearance.

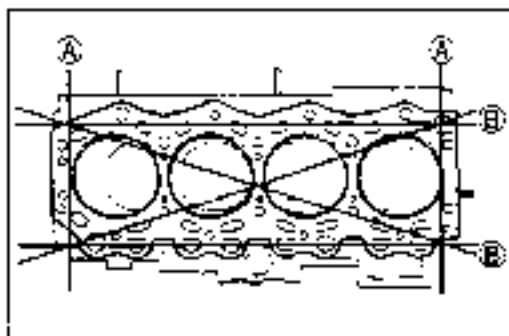
**Clearance**

mm (in)

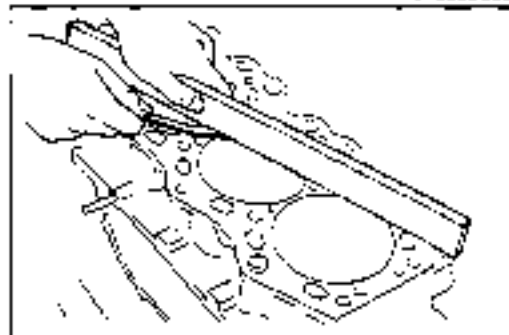
	Standard	Maximum
HA	0.016—0.061 (0.0006—0.0024)	0.07 (0.003)
SL TF	0.020—0.062 (0.0008—0.0024)	

- 5 If the clearance exceeds the maximum, replace the rocker arm and/or shaft.

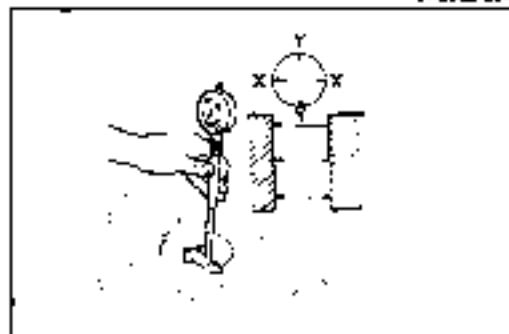
9T3082-206



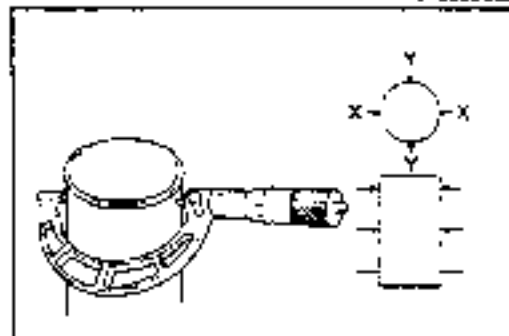
8T3082-206



9T3082-207



8T3082-208



9T3082-209

**CYLINDER BLOCK**

- 1 Inspect the cylinder block for the following. Repair or replace the cylinder block as necessary.
- (1) Leakage damage.
  - (2) Cracks.
  - (3) Scoring of cylinder liner.
- 2 Measure the distortion of the deck of the cylinder block in the six directions shown in the figure.

**Distortion:** A : 0.10mm (0.004 in) max.

B : 0.25mm (0.010 in) max.

- 3 If the distortion exceeds specification, replace the cylinder block.

- 4 Measure each cylinder liner bore in X and Y directions at three levels (upper, middle, and lower) as shown.

**Cylinder liner bore diameter**

mm (in)

	Mark	Bore diameter
HA	—	98.500—98.526 (3.8779—3.8790)
SL	A	103.500—103.513 (4.0748—4.0753)
	B	103.513—103.525 (4.0753—4.0758)
TF	A	109.000—109.013 (4.2913—4.2918)
	B	109.013—109.026 (4.2918—4.2924)

- 5 Measure each cylinder liner outer diameter in X and Y directions at three levels (upper, middle, and lower) as shown.

**Cylinder liner outer diameter**

mm (in)

	Mark	Outer diameter
HA	—	98.530—98.580 (3.8791—3.8811)
SL	A	103.474—103.487 (4.0738—4.0743)
	B	103.487—103.500 (4.0743—4.0748)
TF	A	108.974—108.887 (4.2903—4.2908)
	B	108.987—108.900 (4.2908—4.2913)



- 6 Subtract the cylinder liner outer diameter from the cylinder bore diameter to calculate the cylinder block to cylinder liner clearance.

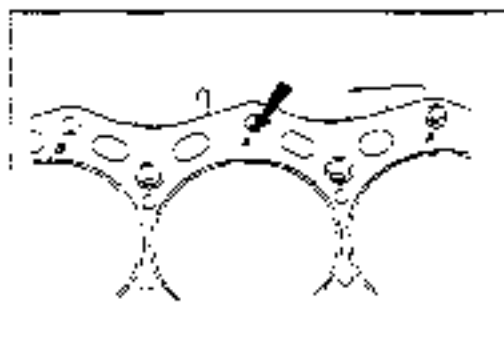
**Clearance**

.mm (in)

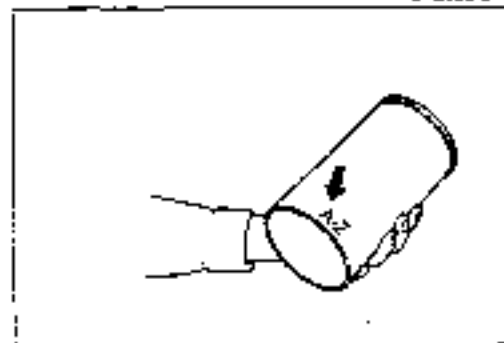
HA	-0.004—0.080 (-0.0002—0.0031)
SL, TF	0.013—0.039 (0.0005—0.0015)

7. If the clearance exceeds specification, replace the cylinder liner.

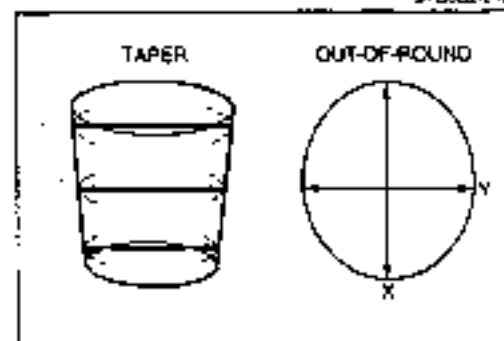
97G0B2-210



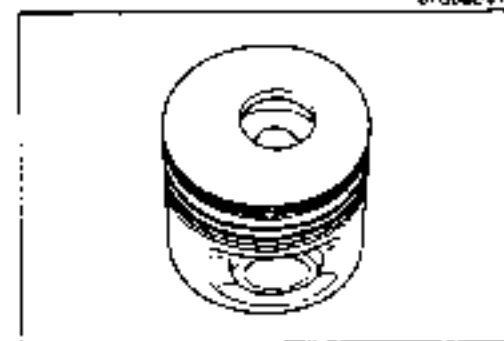
97G0B2-211



97G0B2-212



97G0B2-213



8TG0B2-213

**Caution (SL, TF)**

- When replacing a cylinder liner, replace it with one with the same mark (A or B), and verify that it agrees with the mark on the cylinder block.

8. If the difference between measurements of the cylinder liner exceeds the maximum taper, replace the cylinder liner.

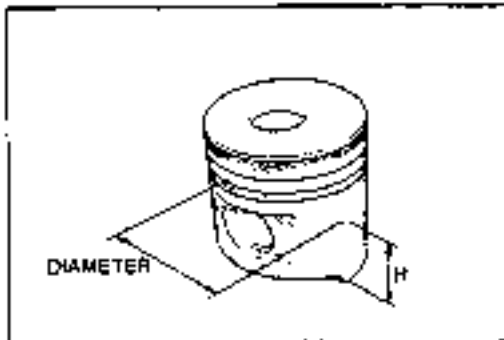
**Taper: 0.03mm (0.0012 in) max.**

9. If the difference between measurements X and Y of the cylinder liner exceeds the maximum out-of-round, replace the cylinder liner.

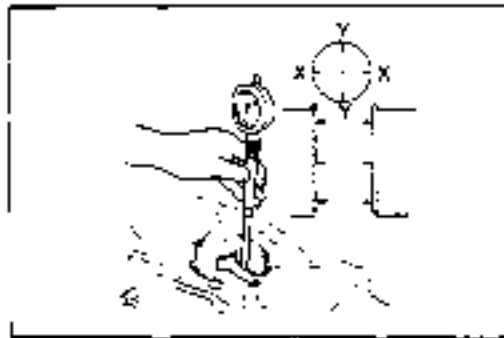
**Out-of-round: 0.03mm (0.0012 in) max.****PISTON, PISTON RING, AND PISTON PIN****Piston****Caution**

- If the piston is replaced, the piston rings must also be replaced.

1. Inspect the outer circumferences of all pistons for seizure or scoring. Replace pistons as necessary.



9TGO82-214



9TGO82-215

2. Measure the diameter of each piston at a right angle (90°) to the piston pin at **point H** (shown in the chart) as measured from the bottom of the piston

**Diameter**

mm (in)

	Mark	Diameter
HA H = 22.0 (0.866)	—	94.967—94.993 (3.7389—3.7399)
SL H = 27.0 (1.063)	Y	99.950—99.963 (3.9350—3.9355)
	Z	99.937—99.950 (3.9345—3.9350)
TF H = 27.0 (1.063)	Y	105.445—105.458 (4.1514—4.1519)
	Z	105.432—105.445 (4.1509—4.1514)

3. Measure each cylinder liner inner diameter in X and Y directions at three levels (upper, middle, and lower) as shown.

**Cylinder liner inner diameter**

mm (in)

	Mark	liner diameter
HA	—	95.025—95.050 (3.7411—3.7421)
SL	Y	100.013—100.026 (3.9375—3.9380)
	Z	100.000—100.013 (3.9371—3.9375)
TF	Y	105.518—105.533 (4.1542—4.1548)
	Z	105.499—105.516 (4.1535—4.1542)

4. Subtract the piston diameter from the cylinder liner inner diameter to calculate the piston to cylinder liner clearance.

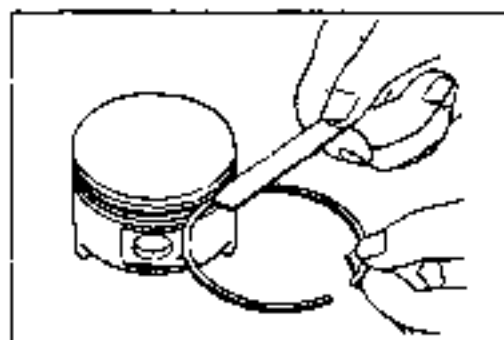
**Clearance**

mm (in)

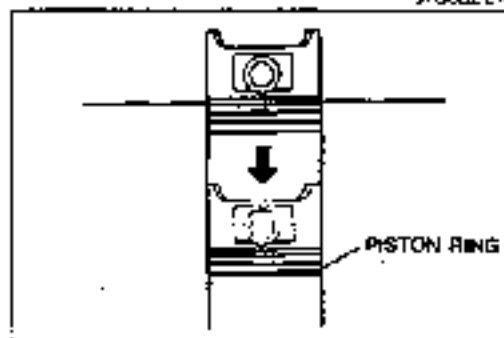
HA	0.032—0.083 (0.0013—0.0033)
SL	0.050—0.076 (0.0020—0.0030)
TF	0.058—0.084 (0.0023—0.0033)

5. If the clearance exceeds specification, replace the piston and/or the cylinder liner.

9TGO82-216



9TGO82-218



9TGO82-219

**Piston and Piston Rings**

1. Measure the piston ring to ring land clearance around the entire circumference using a new piston ring.

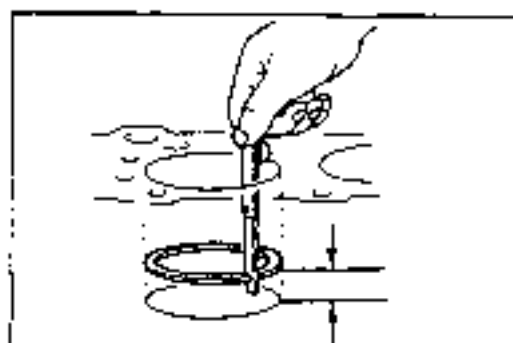
**Clearance**

mm (in)

	Top	Second	Oil
HA	0.05—0.18 (0.0020—0.0071)	0.04—0.08 (0.0016—0.0031)	0.03—0.07 (0.0012—0.0028)
SL	0.06—0.10 (0.0024—0.0039)	0.04—0.08 (0.0016—0.0031)	0.03—0.07 (0.0012—0.0028)
TF	0.173—0.213 (0.0068—0.0084)	0.04—0.08 (0.0016—0.0031)	0.03—0.07 (0.0012—0.0028)

**Maximum: 0.30mm (0.012 in)**

2. If the clearance exceeds the maximum, replace the piston.
3. Inspect the piston rings for damage, abnormal wear, or breakage. Replace the piston rings if necessary.
4. Insert the piston ring into the cylinder liner by hand and use the piston to push it to the bottom of the ring travel.



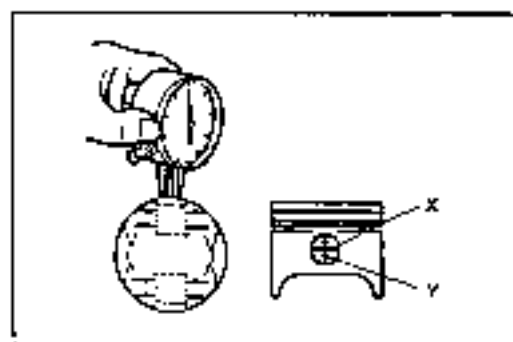
9TGC92-223

- 5 Measure the end gap of each piston ring with a feeler gauge. Replace the piston ring if necessary.

**End gap**

mm (in)

	Top	Second	Oil
HA	0.40-0.60 (0.016-0.024)	0.40-0.60 (0.016-0.024)	0.40-0.60 (0.016-0.024)
SL (Non-Turbo)	0.30-0.40 (0.012-0.016)	0.40-0.55 (0.016-0.022)	0.30-0.40 (0.008-0.016)
SL (Turbo)	0.30-0.45 (0.012-0.018)	0.30-0.50 (0.012-0.020)	0.30-0.50 (0.012-0.020)
TF	0.30-0.40 (0.012-0.016)	0.40-0.55 (0.016-0.022)	0.30-0.40 (0.008-0.016)

**Maximum: 1.5mm (0.059 in)**

9TGC92-221

**Piston and Piston Pin**

1. Measure each piston pin bore diameter in X and Y directions at four points.

**Diameter**

mm (in)

HA	29.996-30.008 (1.1809-1.1814)
SL	33.996-34.008 (1.3384-1.3389)
TF	34.896-35.008 (1.3776-1.3783)

2. Measure each piston pin diameter in X and Y directions at four points.

**Diameter**

mm (in)

HA	29.994-30.000 (1.1809-1.1811)
SL	33.999-34.000 (1.3383-1.3386)
TF	34.893-35.000 (1.3777-1.3780)

3. Calculate the piston pin to piston clearance

**Clearance**

mm (in)

HA	-0.004-0.014 (-0.0002-0.0006)
SL, TF	-0.004-0.015 (-0.0002-0.0006)

4. If the clearance exceeds specification, replace the piston and/or piston pin

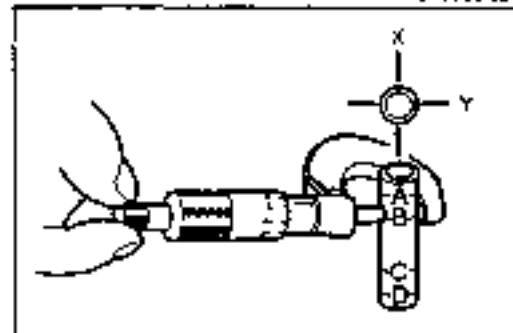
**CONNECTING ROD**

1. Measure each connecting rod bushing inner diameter.

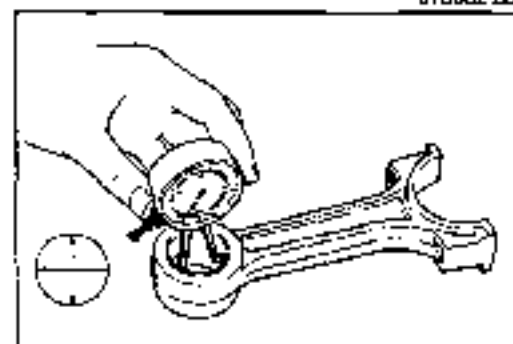
**Diameter**

mm (in)

HA	30.012-30.033 (1.1816-1.1824)
SL	34.012-34.033 (1.3391-1.3399)
TF	35.012-35.033 (1.3784-1.3792)



BTGBE2-222



9TGC92-225

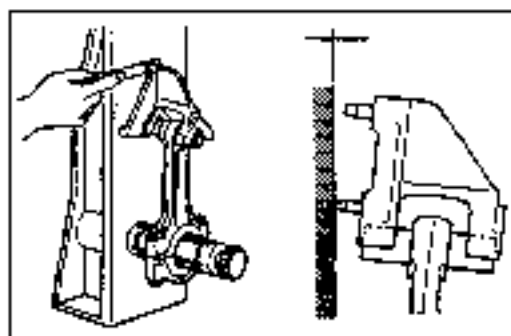
- Calculate the clearance between the connecting rod bushing and piston pin.

**Clearance**

mm (in)

	Standard	Maximum
HA	0.012—0.039 (0.0005—0.0015)	0.05 (0.0020)
SL, TF	0.012—0.040 (0.0005—0.0016)	

9TGOB2-224



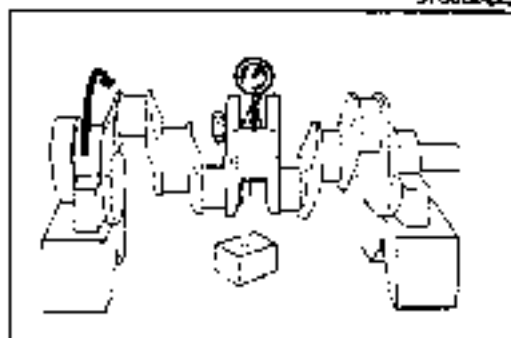
9TGOB2-225

- Measure each connecting rod for bending. Repair or replace the connecting rod if necessary.

**Bending**

mm (in)

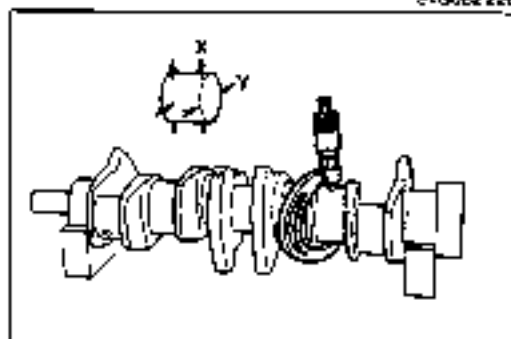
HA	0.05 (0.0020) max./ 100 (3.94)
SL, TF	0.10 (0.0039) max./ 100 (3.94)



9TGOB2-226

**CRANKSHAFT**

- Check the journals and pins for damage, scoring, and oil hole clogging.
- Set the crankshaft on V-blocks.
- Measure the crankshaft runout at the center journal. Replace the crankshaft if necessary.

**Runout: 0.05mm (0.0020 in) max.**

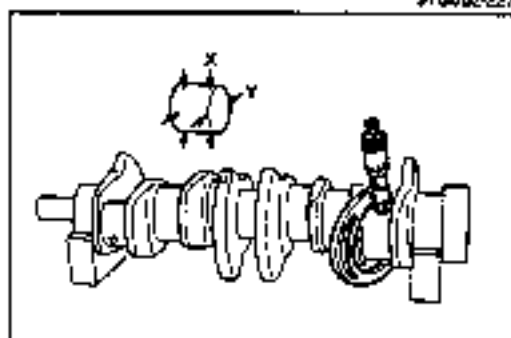
9TGOB2-227

- Measure each journal diameter in X and Y directions at two points.

**Main journal diameter**

mm (in)

HA, SL	74.905—75.825 (2.9544—2.9852)	
TF	No.1,2,4,5	78.980—79.000 (3.1094—3.1102)
	No.3	78.954—78.974 (3.1084—3.1092)

**Out-of-round: 0.003mm (0.00012 in) max.**

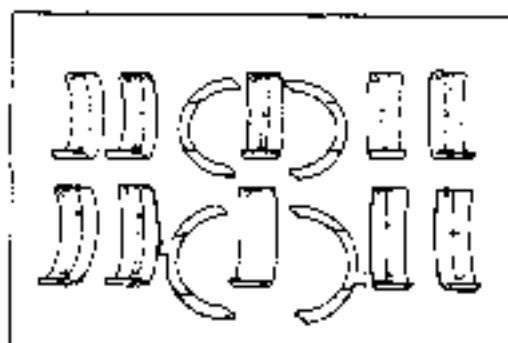
9TGOB2-228

**Crankpin journal diameter**

mm (in)

HA, SL	61.112—61.125 (2.4060—2.4085)
TF	63.887—64.000 (2.5192—2.5197)

**Out-of-round: 0.003mm (0.00012 in) max.**



9T30B2-239

- If the diameter is less than the minimum, grind the journals to match an undersize bearing.

**Undersize bearing:**

0.254mm (0.0100 in), 0.508mm (0.0200 in),  
0.762mm (0.0300 in)

**Main journal diameter undersize**

mm (in)

	Bearing size	Journal diameter
HA, SL	0.254 (0.0100) undersize	75.551—75.571 (2.9744—2.9752)
	0.508 (0.0200) undersize	75.297—75.317 (2.9644—2.9652)
	0.762 (0.0300) undersize	75.043—75.063 (2.9544—2.9552)
TF	0.254 (0.0100) undersize	No. 1, 2, 4, 5: 78.726—78.746 (3.0994—3.1002) No. 3: 78.700—78.720 (3.0984—3.0992)
	0.508 (0.0200) undersize	No. 1, 2, 4, 5: 78.472—78.492 (3.0894—3.0902) No. 3: 78.446—78.466 (3.0884—3.0892)
	0.762 (0.0300) undersize	No. 1, 2, 4, 5: 78.218—78.238 (3.0794—3.0802) No. 3: 78.192—78.212 (3.0784—3.0792)

9T30B2-290

**Crankpin journal diameter undersize**

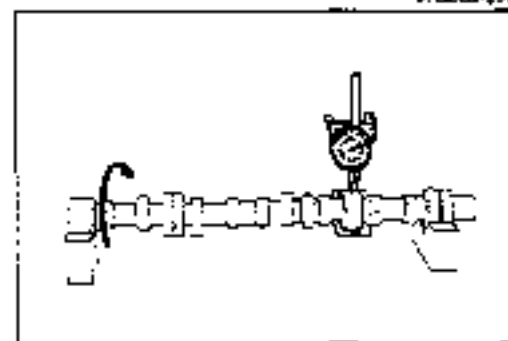
mm (in)

	Bearing size	Journal diameter
HA, SL	0.254 (0.0100) undersize	60.658—60.671 (2.3900—2.3965)
	0.508 (0.0200) undersize	60.604—60.617 (2.3860—2.3865)
	0.762 (0.0300) undersize	60.350—60.363 (2.3760—2.3765)
TF	0.254 (0.0100) undersize	63.733—63.746 (2.5092—2.5097)
	0.508 (0.0200) undersize	63.479—63.492 (2.4992—2.4997)
	0.762 (0.0300) undersize	63.225—63.238 (2.4892—2.4897)

9T30B2-291



9T30B2-232



9T30B2-237

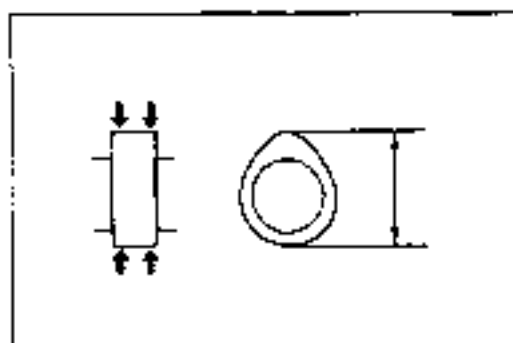
**BEARING****Main Bearing and Connecting Rod Bearing**

- Check the main bearings and the connecting rod bearings for peeling, scoring, and other damage.
- Replace as necessary.

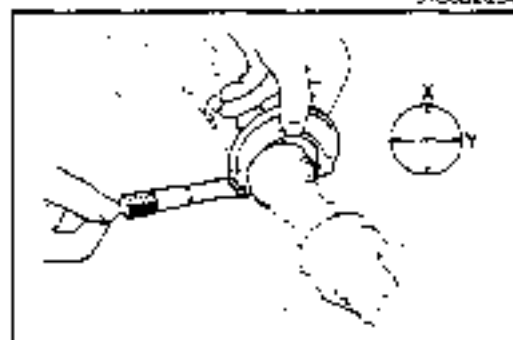
**CAMSHAFT**

- Set the front and rear journals on V-blocks.
- Measure the camshaft runout. Replace the camshaft if necessary.

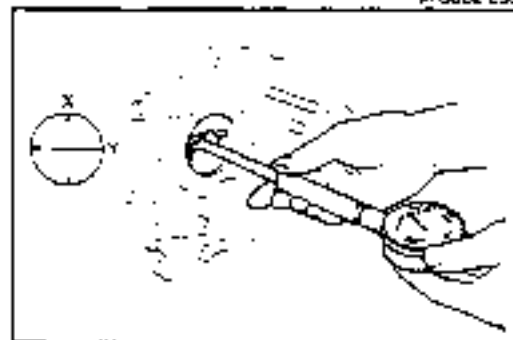
**Runout: 0.08mm (0.0031 in) max.**



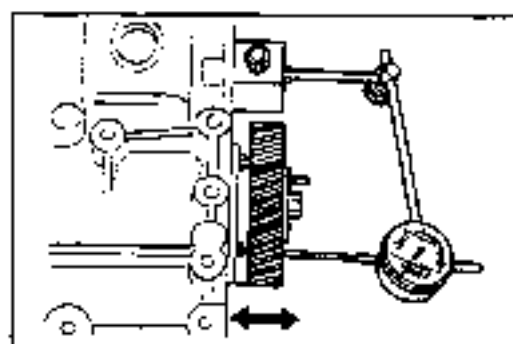
9TGC0B2-254



9TGC0B2-235



9TGC0B2-236



9TGC0B2-239

3. Inspect the camshaft for wear or damage. Replace the camshaft if necessary.
4. Measure the cam lobe heights at the two points as shown.

**Height**

mm (in)

HA	Standard		Minimum
	IN	mm	mm (in)
HA	IN	42.580 (1.6764)	42.080 (1.6567)
	EX	42.580 (1.6764)	42.080 (1.6567)
SL	IN	44.116 (1.7368)	43.616 (1.7172)
	EX	44.116 (1.7368)	43.616 (1.7172)
TF	IN	48.415 (1.9061)	47.915 (1.8864)
	EX	48.547 (1.9113)	48.047 (1.8916)

5. Measure the journal diameters in X and Y directions shown.

**Diameter**

mm (in)

HA	SL	No.1	51.910—51.940 (2.0437—2.0449)
		No.2	51.660—51.690 (2.0339—2.0350)
TF	SL	No.3	51.410—51.440 (2.0246—2.0252)
		No.4	51.160—51.190 (2.0142—2.0154)
TF	SL	No.1	58.410—58.440 (2.2998—2.3008)
		No.2	58.160—58.190 (2.2898—2.2909)
		No.3	57.910—57.940 (2.2798—2.2811)
		No.4	57.660—57.690 (2.2701—2.2713)

6. Measure the camshaft bore diameters in X and Y directions shown.

**Diameter**

mm (in)

HA	SL	No.1	52.000—52.030 (2.0472—2.0484)
		No.2	51.750—51.780 (2.0374—2.0386)
TF	SL	No.3	51.500—51.530 (2.0276—2.0287)
		No.4	51.250—51.280 (2.0177—2.0189)
TF	SL	No.1	58.500—58.530 (2.3031—2.3043)
		No.2	58.250—58.280 (2.2933—2.2945)
		No.3	58.000—58.030 (2.2835—2.2846)
		No.4	57.750—57.780 (2.2736—2.2748)

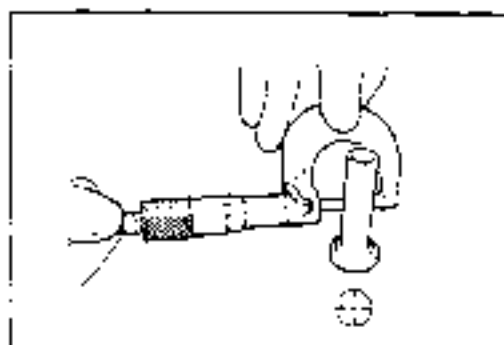
7. Subtract the camshaft journal diameter from the camshaft bore diameter to calculate the camshaft journal to bore clearance.

**Clearance****Standard : 0.06—0.12mm (0.0024—0.0047 in)****Maximum: 0.145mm (0.0057 in)**

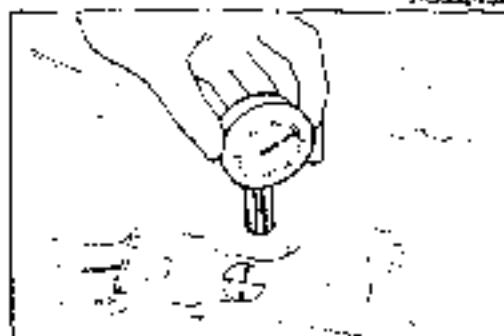
9TGC0B2-237

8. If the clearance exceeds the maximum, replace the camshaft and/or cylinder block.
9. Measure the camshaft end play. If the end play exceeds the maximum, replace the camshaft and/or the cylinder head.

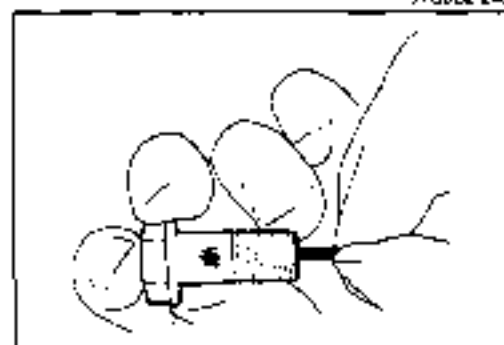
**End play****Standard : 0.02—0.18mm (0.0008—0.0071 in)****Maximum: 0.30mm (0.012 in)**



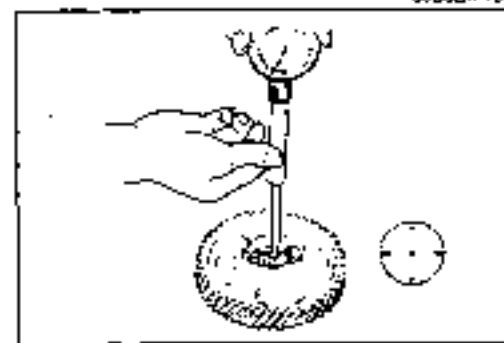
9T30B2-239



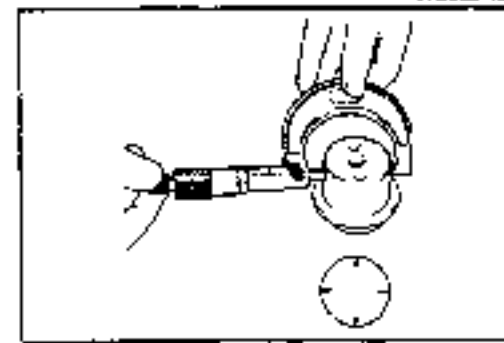
9T30B2-240



05J08-134



9T30B2-451



9T30B2-482

**TAPPET**

1. Inspect the tappets for wear or damage. Replace the tappet if necessary.
2. Measure the tappet outer diameter.

**Diameter**

mm (in)

HA, SL	14.215—14.233 (0.5598—0.5604)
TF	15.515—15.533 (0.6108—0.6115)

3. Measure the tappet bore diameter of the cylinder block.

**Diameter**

mm (in)

HA, SL	14.388—14.319 (0.5625—0.5637)
TF	15.588—15.619 (0.6137—0.6149)

4. Subtract the tappet outer diameter from the tappet bore diameter to calculate the tappet to tappet bore clearance.

**Clearance**

**Standard : 0.035—0.101mm (0.0022—0.0040 in)**  
**Maximum: 0.15mm (0.006 in)**

5. If the clearance exceeds the maximum, replace the tappet and/or cylinder block.

**OIL JET**

1. Push the check ball and verify that it moves smoothly.
2. Blow through the oil jet and verify that air flows.

**IDLER GEAR**

1. Measure the idler gear inner diameter.

**Diameter: 44.009—44.034mm (1.7328—1.7336 in)**

2. Measure the idler gear spindle outer diameter.

**Diameter: 43.950—43.975mm (1.7303—1.7313 in)**

3. Subtract the spindle outer diameter from the idler gear inner diameter to calculate the spindle to idler gear clearance.

**Clearance**







**Standard : 0.034—0.084mm (0.0013—0.0033 in)**  
**Maximum: 0.15mm (0.006 in)**

4. If the clearance exceeds the maximum, replace the idler gear and/or spindle.

**B****ASSEMBLY****ASSEMBLY****PREPARATION****SST**

49 0223 061 Remover & installer, piston pin (HA)		For installation of piston pins	49 B043 002 Installer, bearing (SL)		For installation of piston pins
49 0636 040 Installer, piston pin (TF)		For installation of piston pins	49 W011 101 Installer of seal (TF)		For installation of rear oil seal
49 B030 797 Handle (TF)		For installation of rear oil seal	49 SE01 157 Extractor (HA)		For prevention of injection pump gear rotation
49 0559 210 Oil seal installer and centering tool (HA)		For installation of front oil seal	49 S120 710 Holder, coupling fringe (TF)		For prevention of camshaft gear rotation
49 W011 102 Installer, oil seal (TF)		For installation of front oil seal	49 V101 060A Brake, ring gear (HA, SL)		For prevention of engine rotation
49 S501 062 Collar (HA)		For prevention of engine rotation	49 W065 062 Collar (SL)		For prevention of engine rotation
49 W011 103 Brake, ring gear (TF)		For prevention of engine rotation	49 SE01 310 Centering tool, clutch disc		For installation of clutch disc
49 L012 040 Installer set, valve seal & valve guide		For installation of valve guides and valve seals	49 L012 001 Installer (Part of 49 L012 040)		For installation of valve seals



<p>49 L012 002</p> <p>Body (Part of 49 L012 0A0)</p> 	<p>For installation of valve guides and valve seals</p>	<p>49 L012 003</p> <p>Installer (Part of 49 L012 0A0)</p> 	<p>For installation of valve guides</p>
<p>49 L012 004</p> <p>Nut (Part of 49 L012 0A0)</p> 	<p>For installation of valve guides</p>	<p>49 L012 007</p> <p>Spacer (Part of 49 L012 0A0)</p> 	<p>For installation of valve seals</p>
<p>49 0636 100A</p> <p>Arm, valve spring lifter</p> 	<p>For installation of valves</p>	<p>49 0107 222A</p> <p>Pivot</p> 	<p>For installation of valves</p>

9TG282-244

1. Clean all parts before reinstallation.
2. Apply new engine oil to all sliding and rotating parts.
3. Replace bearings if they are peeling, burned, or otherwise damaged.
4. Tighten all bolts and nuts to the specified torques.

**Caution**

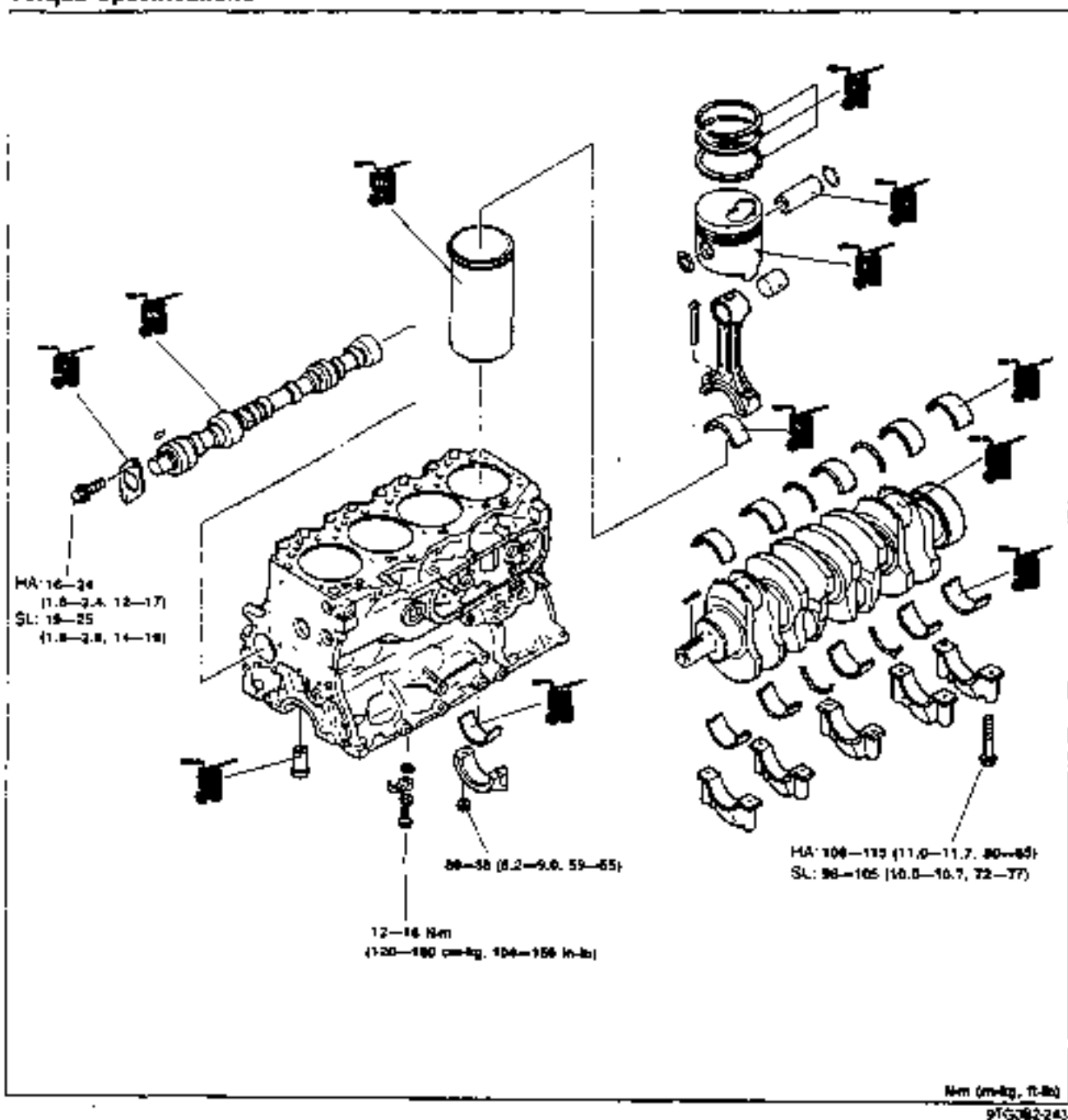
- Do not reuse gaskets or oil seals.

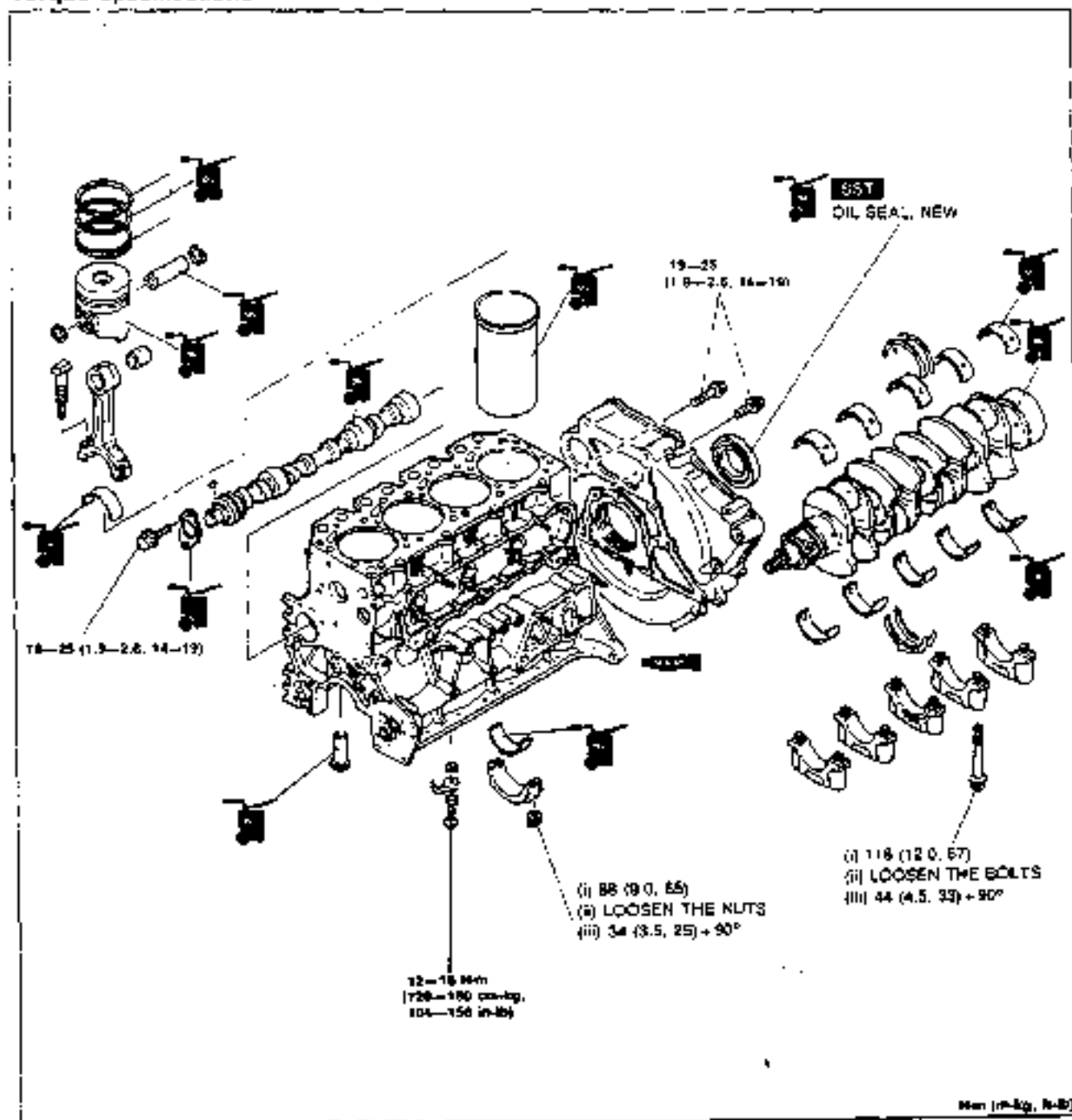
9TG082-242

## CYLINDER BLOCK (INTERNAL PARTS)

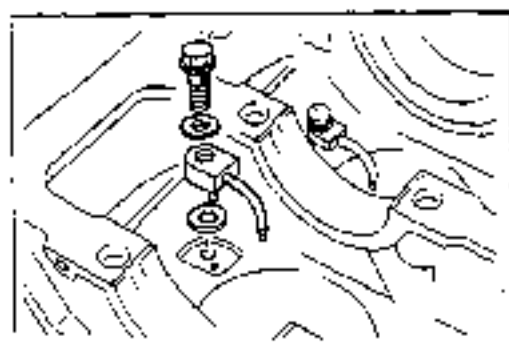
NA, SL Engine

Torque Specifications



**TF Engine  
Torque Specifications**


57 G083-244

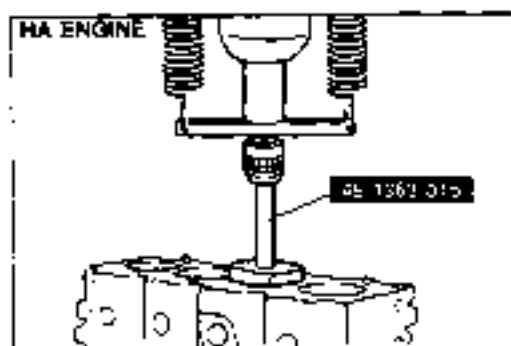


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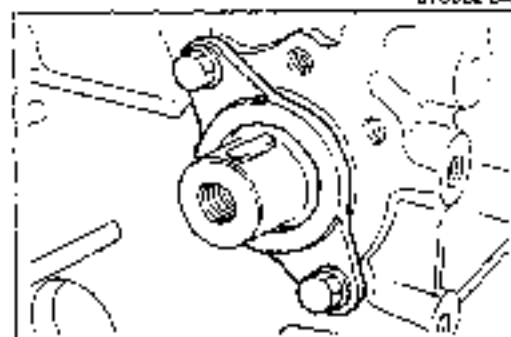
**Oil Jet**

1. Install the oil jets.

**Tightening torque:****12-16 Nm (120-180 cm-kg, 104-156 in-lb)**

**B****ASSEMBLY**

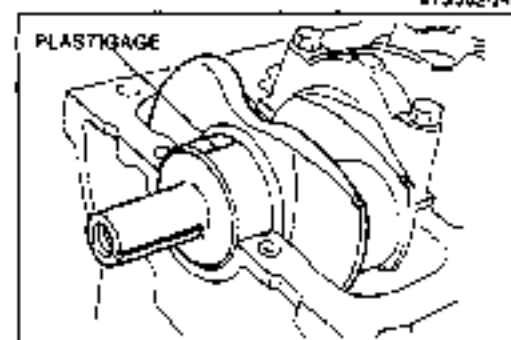
8TGOB2-246



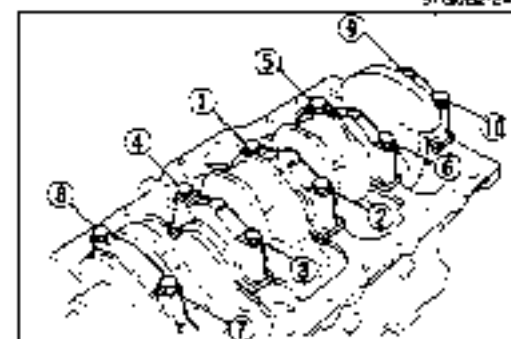
8TGOB2-247



8TGOB2-248



8TGOB2-249



8TGOB2-250

**Cylinder Liner**

1. Apply engine oil to the cylinder liner.

**Caution**

- Do not use a hammer.
- Align the marks on the cylinder liner and the cylinder block when installing.

2. Install the cylinder liner into the cylinder block with the SST (HA) or by hand.

**Pressure force (HA):**

9,810—29,430 N (1,000—3,000 kg, 2,200—6,500 lb)

**Tappet**

1. Apply clean engine oil to the tappet.
2. Install the tappet in the cylinder block.

**Camshaft**

1. Apply engine oil to the camshaft journals and cam faces.
2. Install the camshaft in the cylinder block.
3. Apply engine oil to the thrust plate.
4. Install the thrust plate with the flat side facing the cylinder block.

**Tightening torque**

HA : 16—24 N·m (1.6—2.4 m·kg, 12—17 ft·lb)

SL, TF: 19—25 N·m (1.9—2.6 m·kg, 14—19 ft·lb)

**Crankshaft**

1. Before installing the crankshaft, inspect the main bearing oil clearances as follows.
  - (1) Remove all foreign material and oil from the journals and bearings.

**Caution**

- Install the no grooved main bearing in the No.3 (center) main bearing cap.
- Install the thrust bearings with the oil groove facing the crankshaft.

- (2) Install the upper main bearings and thrust bearings.
- (3) Set the crankshaft in the cylinder block.

**Caution**

- Do not rotate the crankshaft when measuring the oil clearances.

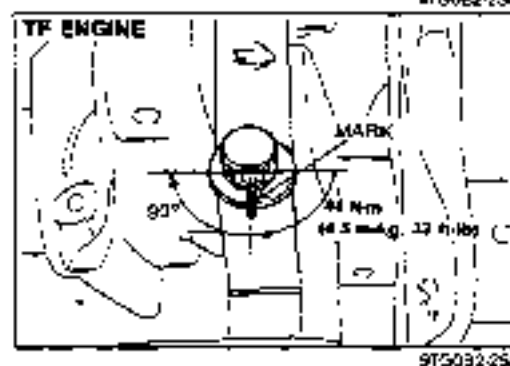
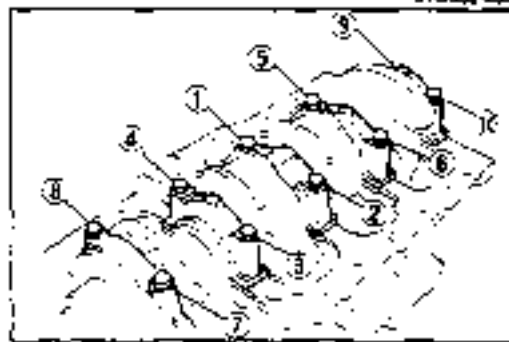
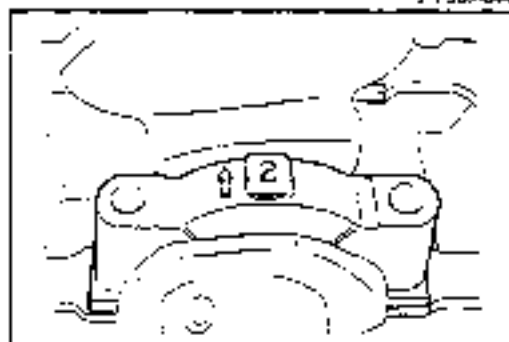
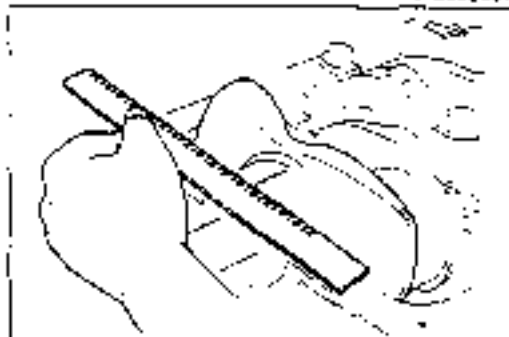
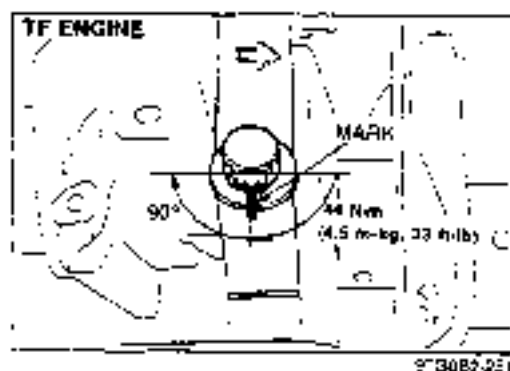
- (4) Position Plastigage atop the journals in the axial direction.
- (5) Install the lower main bearings and the main bearing caps according to the cap number and  $\infty$  mark.
- (6) Tighten the main bearing cap bolts in two or three steps in the order shown in the figure.

**Tightening torque**

HA: 106—115 N·m (11.0—11.7 m·kg, 80—85 ft·lb)

SL: 98—105 N·m (10.0—10.7 m·kg, 72—77 ft·lb)

TF: 118 N·m (12.0 m·kg, 87 ft·lb)

**(7) TF Engine**

- (i) Loosen the bolts in the reverse of tightening order.
- (ii) Retighten the bolts in two or three steps in the tightening order.

**Tightening torque: 44 Nm (4.5 m-kp, 33 ft-lb)**

- (iii) Tighten the bolts approx. 90° further in the tightening order.

- (8) Remove the main bearing caps, and measure the Plastigage at each journal at the widest point for the smallest clearance, and at the narrowest point for the largest clearance.

- (9) If oil clearance exceeds specification, grind the crankshaft and install undersize main bearings. (Refer to page B-84.)

**Oil clearance**

mm (in)

	Standard	Maximum
HA, SL	0.058—0.092 (0.0023—0.0036)	0.12 (0.005)
TF	No. 1, 2, 4, 5	0.058—0.092 (0.0023—0.0036)
	No. 3	0.064—0.118 (0.0033—0.0048)

2. Apply a liberal amount of clean engine oil to the main bearings, thrust bearings and main journals.

3. Install the crankshaft and the main bearing caps according to the cap number and  $\varphi$  mark.

4. Tighten the main bearing cap bolts in two or three steps in the order shown in the figure.

**Tightening torque**

**HA: 108—115 Nm (11.0—11.7 m-kp, 80—85 ft-lb)**

**SL: 98—105 Nm (10.0—10.7 m-kp, 72—77 ft-lb)**

**TF: 118 Nm (12.0 m-kp, 87 ft-lb)**

**5. TF Engine**

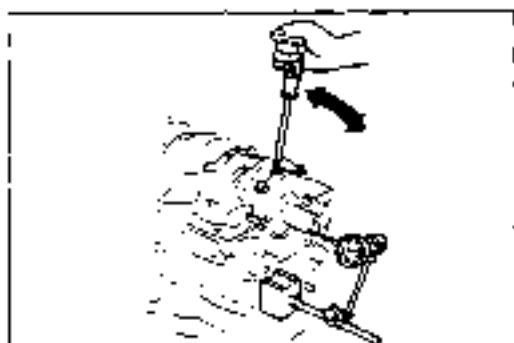
- (i) Loosen the bolts in the reverse of tightening order.
- (ii) Retighten the bolts in two or three steps in the tightening order.

**Tightening torque: 44 Nm (4.5 m-kp, 33 ft-lb)**

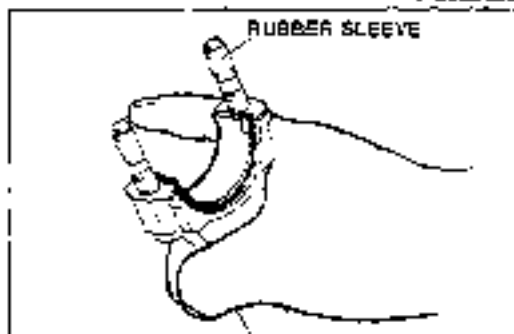
- (iii) Tighten the bolts approx. 90° further in the tightening order.

## B

## ASSEMBLY

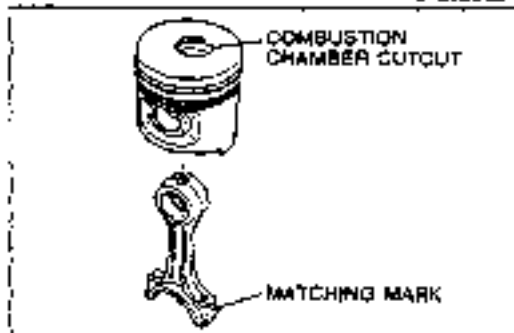


9TGOB2-255



RUBBER SLEEVE

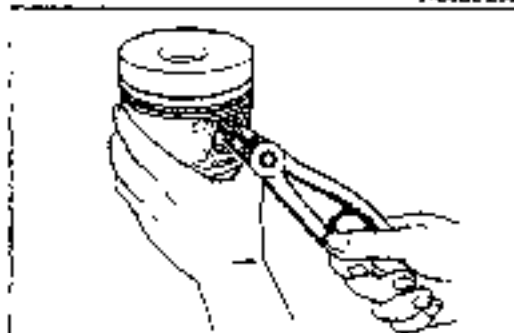
9TGOB2-257



COMBUSTION  
CHAMBER CUTOUT

MATCHING MARK

5TGOB2-258



9TGOB2-259



9TGOB2-260

6. Measure the crankshaft end play.

### End play

**Standard:** 0.14—0.39mm (0.0055—0.0154 in)

**Maximum:** 0.40mm (0.016 in)

7. If the end play exceeds the maximum, grind the crankshaft and install an oversize thrust bearing or replace the crankshaft and thrust bearing.

### Thrust bearing width

#### Standard:

2.275—2.325mm (0.0895—0.0915 in)

0.178mm (0.0070 in) oversize:

2.463—2.503mm (0.0966—0.0985 in)

### Piston and Connecting Rod

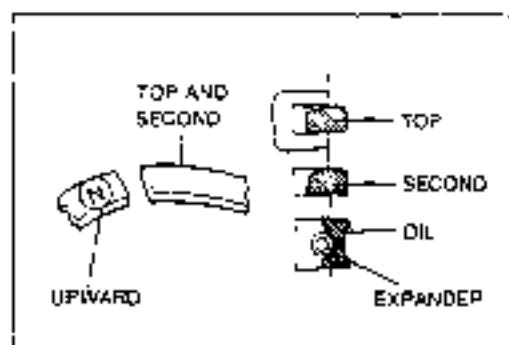
#### Caution

- Protect the connecting rod bolts with rubber sleeves to prevent damage to the crankpin journal.

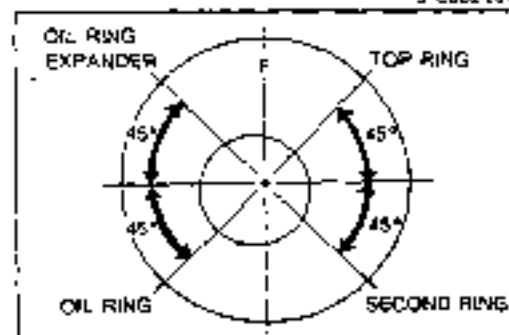
1. Install one piston pin clip into the clip groove in the piston.
2. Assemble the piston and the connecting rod so that the piston combustion chamber cutout and the connecting rod mark are faces at the same side.
3. Heat the piston to 50—60°C (122—140°F).
4. Apply clean engine oil to the piston pin.
5. Install the piston pin from the side opposite the clip.  
If the pin cannot be installed smoothly, replace the piston and/or connecting rod.

6. Install the second clip into the clip groove in the piston.

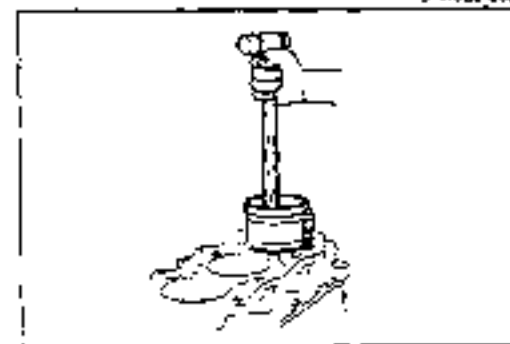
7. Check the oscillation torque of the connecting rod. If the large end does not drop by its own weight, replace the piston, connecting rod, and/or piston pin.



9T00B2-261



9T00B2-262



9T00B2-263

- 8 Apply clean engine oil to the piston rings.
- 9 Install the coil expander under the oil ring and set the end gaps approx. 90° apart.
- 10 Install the oil ring to the piston.

**Caution**

- The top and second rings must be installed with the N mark upward.

- 11 Using a piston ring expander (commercially available), install the second ring to the piston; then install the top ring.
- 12 Verify that the piston rings turn smoothly.
- 13 Position the end gaps of the rings as shown in the figure.

- 14 Apply clean engine oil to the cylinder liner walls and pistons.
- 15 Check the piston rings for correct end gap alignment.
- 16 Insert each piston assembly into the cylinder block with the marks (Y or Z) facing the front of the engine. Use a piston ring compressor (commercially available).
- 17 Remove the rubber sleeves from the connecting rod bolts.

- 18 Measure the connecting rod bearing oil clearance.

**Caution**

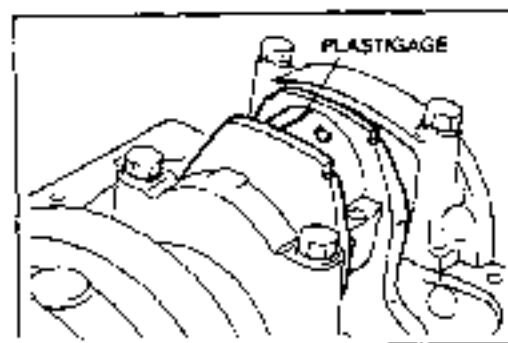
- Align the marks on the cap and the connecting rod when installing the connecting rod cap.

- (1) Remove all foreign material and oil from the journals and bearings.

**Caution**

- Do not rotate the crankshaft when measuring the oil clearances.

9T00B2-264

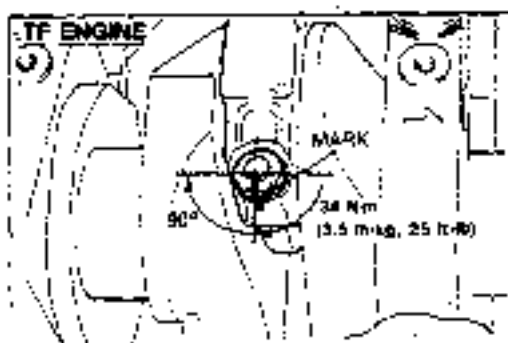


9T00B2-265

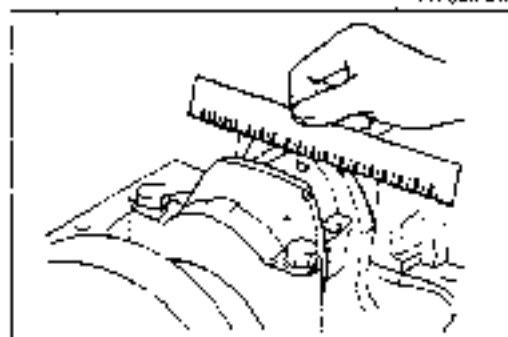
- (2) Position Plastigage atop the journals in the axial direction.
- (3) Install the connecting rod bearing and cap with the marks aligned.
- (4) Tighten the nuts in two or three steps.

**Tightening torque**

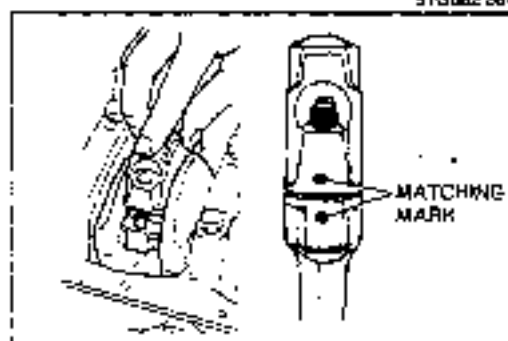
- HA, SL: 80–88 N·m (8.2–9.0 m·kg, 59–65 ft·lb)  
TF : 88 N·m (9.0 m·kg, 65 ft·lb)



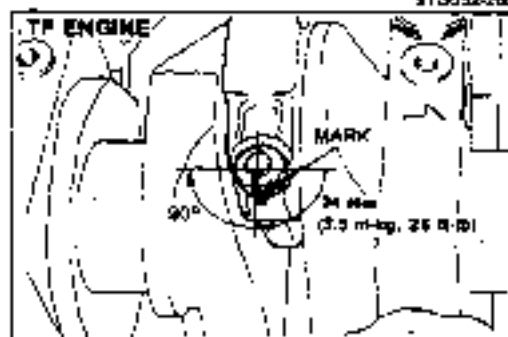
9TF03X-045



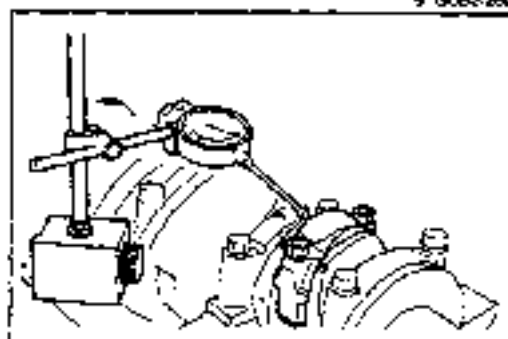
9TG0B2-267



9TG0B2-268



9TG0B3-269



9TG0B2-270

**(5) TF Engine**

- (i) Loosen the connecting rod nuts
- (ii) Retighten the nuts in two or three steps.

**Tightening torque: 34 N·m (3.5 m·kg, 25 ft·lb)**

- (iii) Tighten the nuts approx. 90°.
- (6) Remove the connecting rod caps, and measure the Plastigage at each journal at the widest point for the smallest clearance, and at the narrowest point for the largest clearance.
- (7) If oil clearance exceeds specification, grind the crankshaft and install undersize main bearings. (Refer to page B-84.)

**Oil clearance**

mm (in)

HA, SL	0.036—0.074 (0.0015—0.0029)
TF	0.040—0.075 (0.0016—0.0030)

**Maximum: 0.10mm (0.004 in)**

19. Apply a liberal amount of clean engine oil to the connecting rod bearings and crankpin journals.
20. Install the connecting rod bearings and caps with the marks aligned; and tighten the nuts in two or three steps.

**Tightening torque**

**HA, SL: 80—88 N·m (8.2—9.0 m·kg, 59—65 ft·lb)**  
**TF : 88 N·m (9.0 m·kg, 65 ft·lb)**

**21. TF Engine**

- (i) Loosen the connecting rod nuts.
- (ii) Retighten the nuts in two or three steps

**Tightening torque: 34 N·m (3.5 m·kg, 25 ft·lb)**

- (iii) Tighten the nuts approx. 90° further.

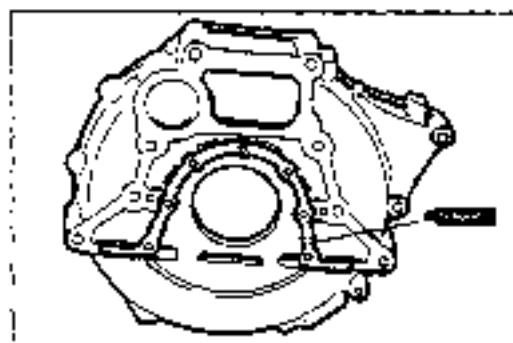
**22. Measure the connecting rod side clearance****Side clearance**

mm (in)

	Standard	Maximum
HA	0.299—0.330 (0.0094—0.0130)	0.40 (0.016)
SL	0.299—0.379 (0.0094—0.0149)	
TF	0.260—0.430 (0.0079—0.0157)	0.50 (0.020)

23. If the clearance exceeds the maximum, replace the connecting rod and cap.



**End Plate (TF)**

1. Apply silicone sealant to the shaded areas shown, then install the end plate.

**Tightening torque:**

18—25 Nm (1.9—2.6 m·kg, 14—19 ft·lb)

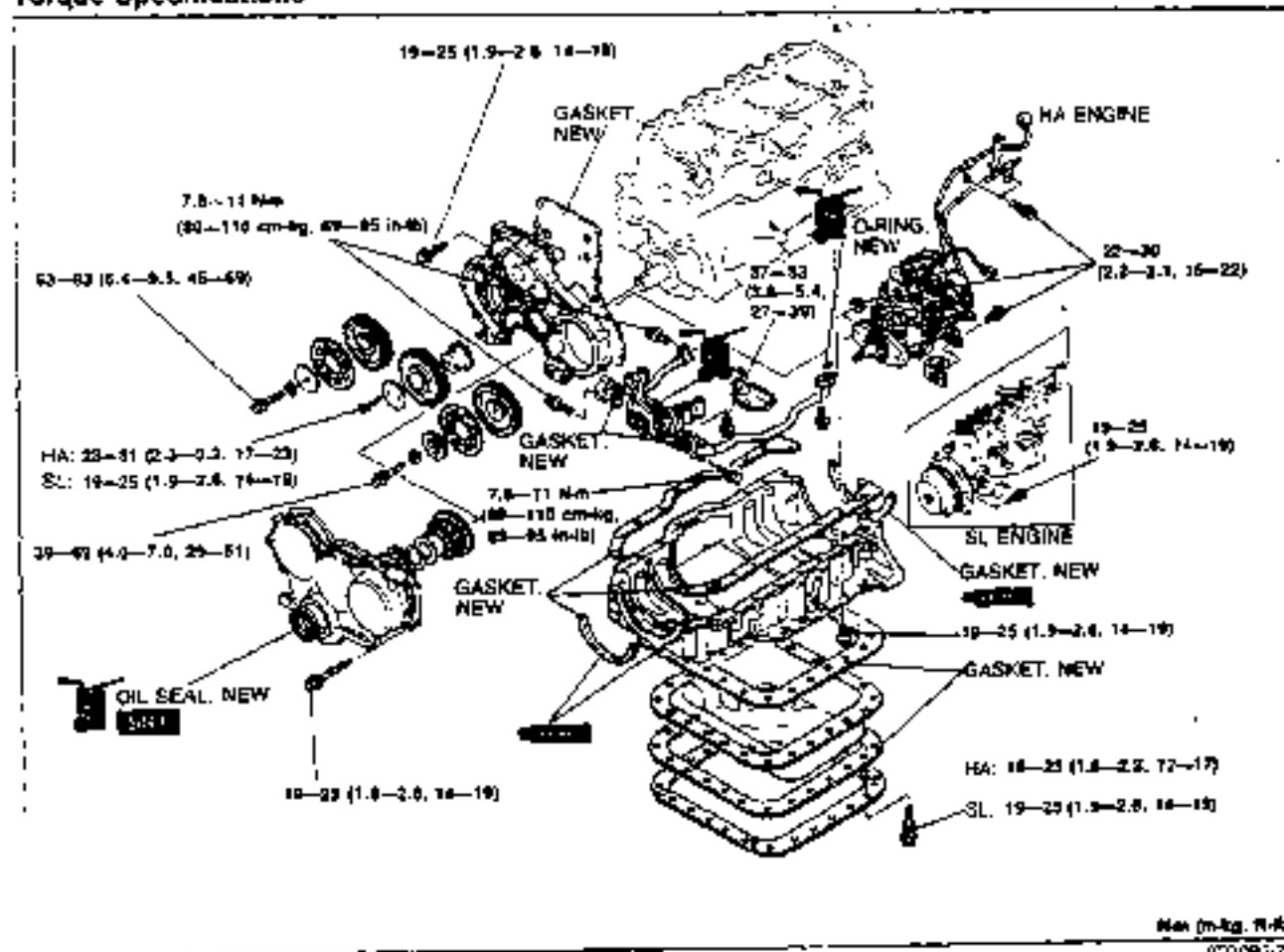


2. Apply a small amount of clean engine oil to the lip of the new oil seal.

3. Install the oil seal with the SST and a hammer.

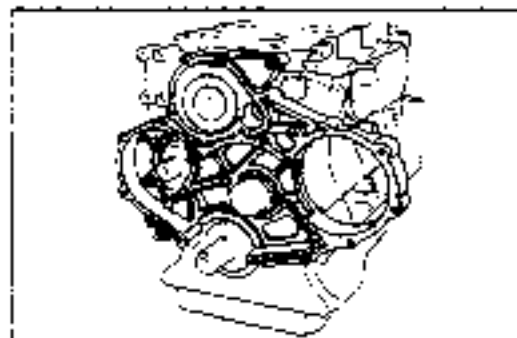
**CYLINDER BLOCK (EXTERNAL PARTS II)**

KA, SL Engine

**Torque Specifications**

Nm (m·kg, ft·lb)

970082-21

**B****ASSEMBLY**

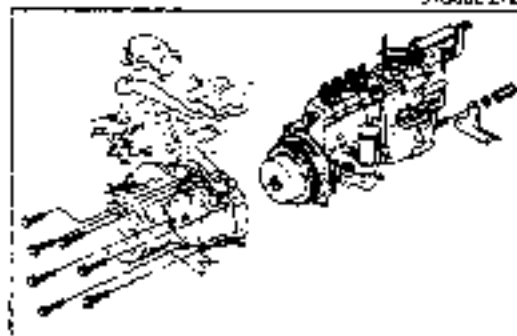
9T30B2-272

**Timing Gear Case**

1. Install the timing gear case and a new gasket.

**Tightening torque:**

19—25 Nm (1.9—2.6 m-kg, 14—19 ft-lb)



9T30B2-273

**Fuel Injection Pump**

1. Install the fuel injection pump.

**Tightening torque**

HA: 22—30 Nm (2.2—3.1 m-kg, 16—22 ft-lb)

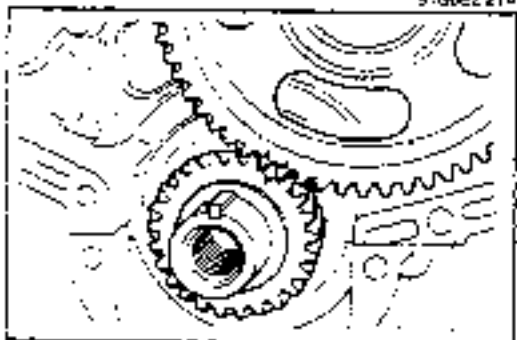
SL: 19—25 Nm (1.9—2.6 m-kg, 14—19 ft-lb)



9T30B2-274

**Crankshaft Timing Gear**

1. Align the Woodruff key, and install the crankshaft gear.
2. Install the friction gear, friction gear spring, and oil deflector.



9T30B2-275

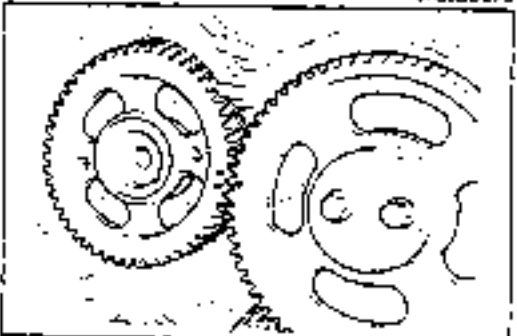
**Idler Gear**

1. Install the idler gear spindle.
2. Align the marks, and install the idler gear and thrust plate.

**Tightening torque**

HA: 23—31 Nm (2.3—3.2 m-kg, 17—23 ft-lb)

SL: 19—25 Nm (1.9—2.6 m-kg, 14—19 ft-lb)



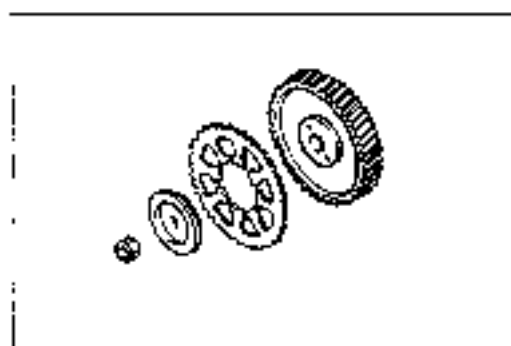
9T30B2-276

**Camshaft Gear and Injection Pump Gear**

1. Align the marks, and install the camshaft gear, lock plate, and friction gear.

**Tightening torque:**

63—93 Nm (6.4—9.5 m-kg, 46—69 ft-lb)



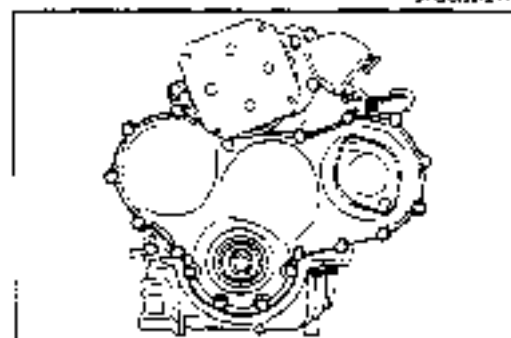
9TGC02-277

**2. HA Engine**

- (1) Align the marks, and instal the injection pump gear.
- (2) Install the friction gear and lock plate.

**Tightening torque:**

39—69 N·m (4.0—7.0 m·kg, 29—51 ft·lb)



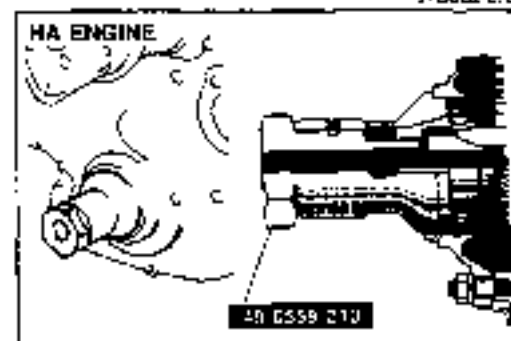
9TGC02-278

**Timing Gear Cover**

- 1 Install the timing gear cover and a new gasket.

**Tightening torque:**

19—25 N·m (1.9—2.6 m·kg, 14—19 ft·lb)

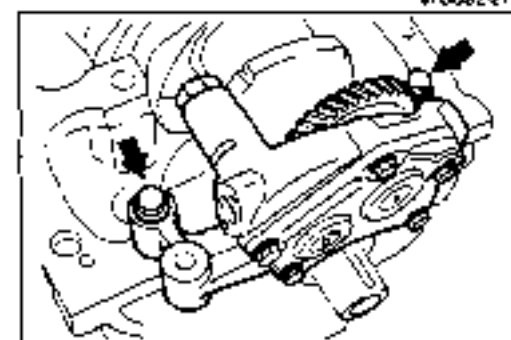


9TGC02-279

- 2 Apply a small amount of clean engine oil to the lip of the new oil seal.
3. Push the oil seal slightly in by hand.

**Caution**

- The oil seal must be pressed in until it is 6.5mm (0.26 in) inside the edge of the timing gear cover.
- 4 Press the oil seal in evenly with the SST (HA) or a suitable pipe (SL) and a hammer.



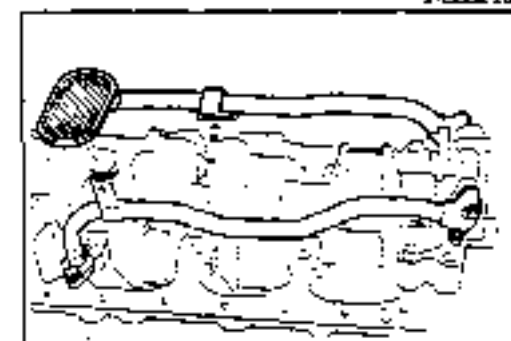
9TGC02-280

**Oil Pump**

- 1 Apply clean engine oil to the oil pump driven gear.
2. Install the oil pump.

**Tightening torque:**

37—63 N·m (3.8—5.4 m·kg, 27—39 ft·lb)



9TGC02-281

**Oil Strainer and Oil Pipe**

1. Install the oil strainer and a new gasket.

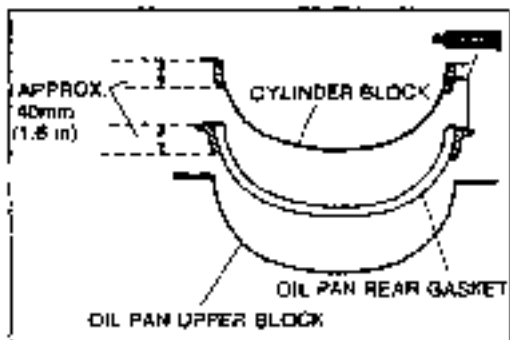
**Tightening torque:**

7.8—11 N·m (80—110 cm·kg, 69—95 in·lb)

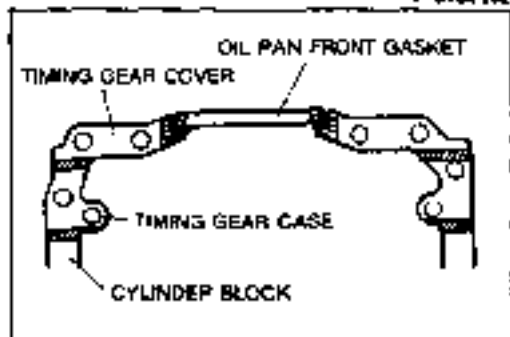
2. Install the oil pipe and a new gasket (oil pump side) and a new O-ring (cylinder block side).

**Tightening torque**

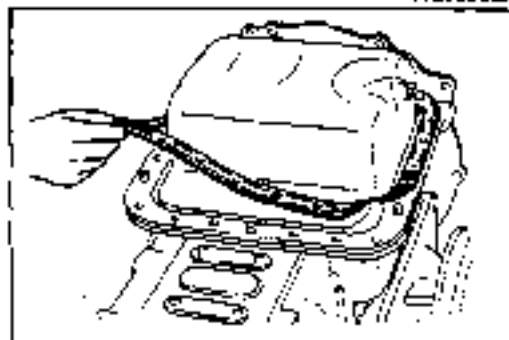
- Ⓐ: 7.8—11 N·m (80—110 cm·kg, 69—95 in·lb)
- Ⓑ: 19—25 N·m (1.9—2.6 m·kg, 14—19 ft·lb)



9T0082-262



9T0082-263



9T0082-264

### Oil Pan Upper Block

#### Caution:

- The oil pan upper block must be secured within 30 minutes after the sealant is applied.

1. Apply silicone sealant as shown to the shaded areas of a new oil pan gasket (front and rear)
2. Install the gaskets onto the cylinder block

3. Apply silicone sealant to the shaded areas of the cylinder block.
4. Install the oil pan upper block and a new gasket.

#### Tightening torque:

19—25 Nm (1.9—2.6 m·kg, 14—19 ft·lb)

### Oil Pan

1. Install the oil pan and a new gasket.
2. Install the stiffener.

#### Tightening torque

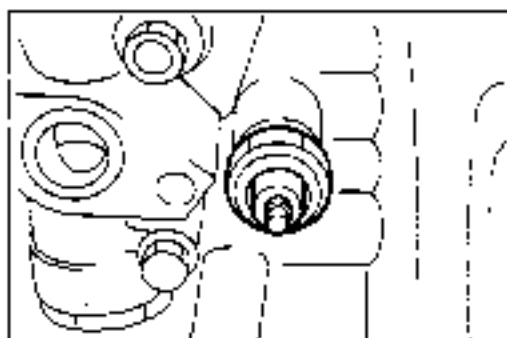
HA: 16—23 Nm (1.6—2.3 m·kg, 12—17 ft·lb)

SL: 19—25 Nm (1.9—2.6 m·kg, 14—19 ft·lb)



## B

### ASSEMBLY



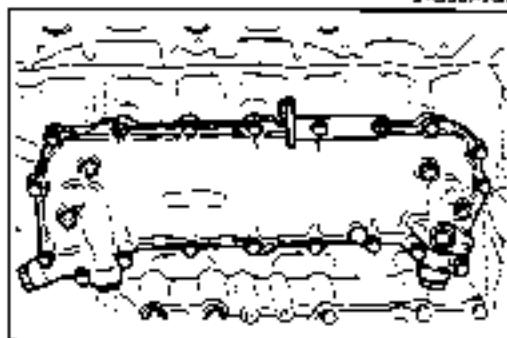
97G082-289

#### Oil Pressure Switch

1. Install the oil pressure switch.

#### Tightening torque:

12–18 N·m (120–180 cm·kg, 104–156 in·lb)



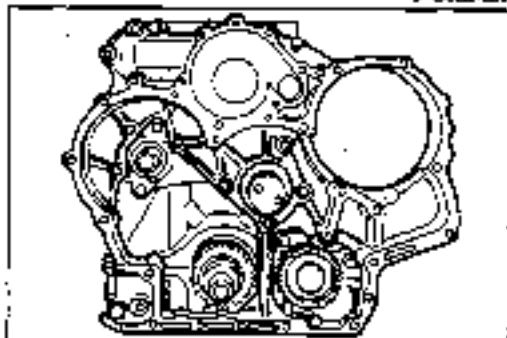
97G082-289

#### Oil Cooler

1. Install the oil cooler and a new gasket.

#### Tightening torque:

19–25 N·m (1.9–2.6 m·kg, 14–19 ft·lb)



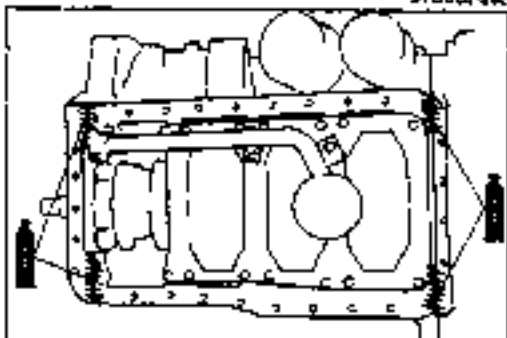
97G082-290

#### Timing Gear Case

1. Install the timing gear case.

#### Tightening torque:

19–25 N·m (1.9–2.6 m·kg, 14–19 ft·lb)



97G082-291

2. Apply silicone sealant as shown to the shaded areas of the timing gear case and the cylinder block.



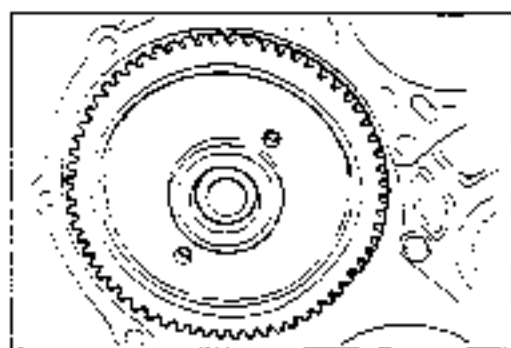
97G082-405

#### Water Pump

1. Install the water pump and a new gasket.

#### Tightening torque:

19–25 N·m (1.9–2.6 m·kg, 14–19 ft·lb)



97G082-291

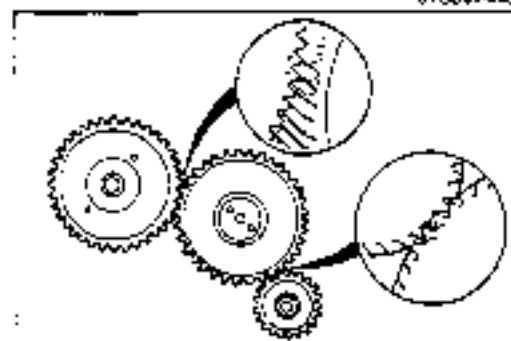
**Timing Gear Train**

1. Align the Woodruff key, and install the cam gear.



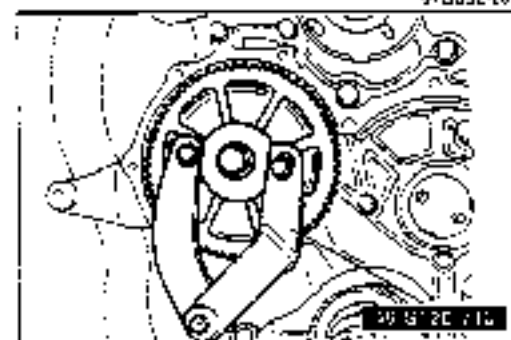
81G092-280

2. Align the idler gear spindle oil hole and the cylinder block oil hole.



97G082-284

3. Install the idler gear as shown in the figure.



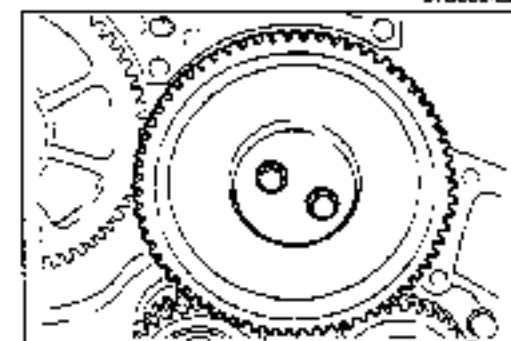
97G082-295

4. Install the friction plate and washer to the cam gear, and affix them with the SST.

5. Install and tighten the lock bolt.

**Tightening torque:**

83–93 Nm (6.4–9.5 m·kg, 46–69 ft·lb)

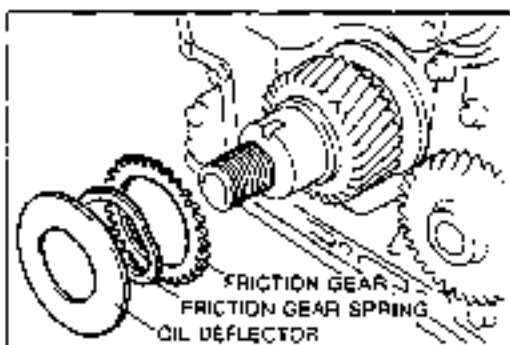


97G082-286

6. Install the idler gear and thrust plate.

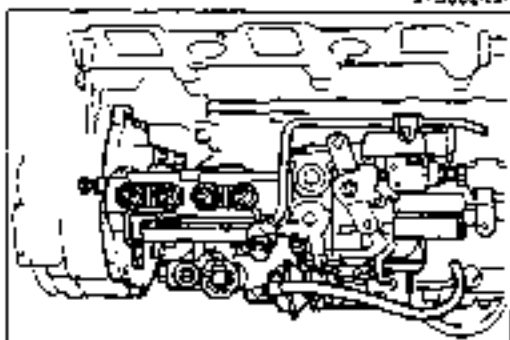
**Tightening torque:**

19–25 Nm (1.9–2.6 m·kg, 14–19 ft·lb)

**B****ASSEMBLY**

8TG0B2-297

- 7 Install the friction gear, gear spring and oil deflector on the crankshaft.



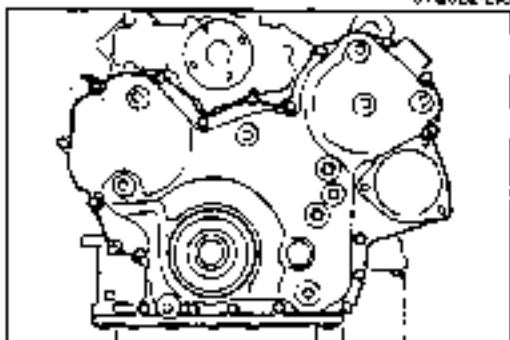
8TG0B2-298

**Fuel Injection Pump**

- 1 Align the marks of the idler gear and the injection pump gear.
- 2 Install the fuel injection pump.

**Tightening torque:**

19—25 Nm (1.9—2.6 m·kg, 14—19 ft·lb)



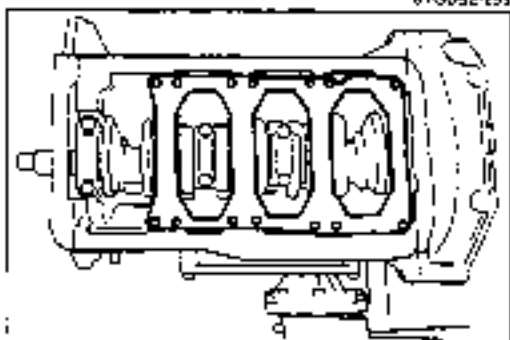
8TG0B2-299

**Timing Gear Cover**

1. Install the timing gear cover and a new gasket.

**Tightening torque:**

19—25 Nm (1.9—2.6 m·kg, 14—19 ft·lb)



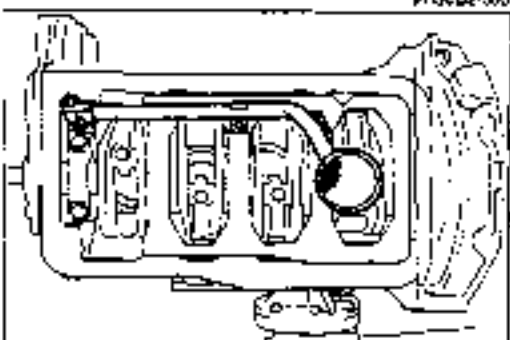
9TG0B2-300

**Stiffening Plate**

1. Install the stiffening plate.

**Tightening torque:**

19—25 Nm (1.9—2.6 m·kg, 14—19 ft·lb)



8TG0B2-301

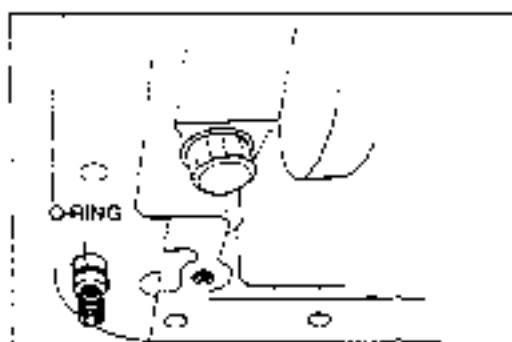
**Oil Strainer**

1. Install the oil strainer and a new gasket.

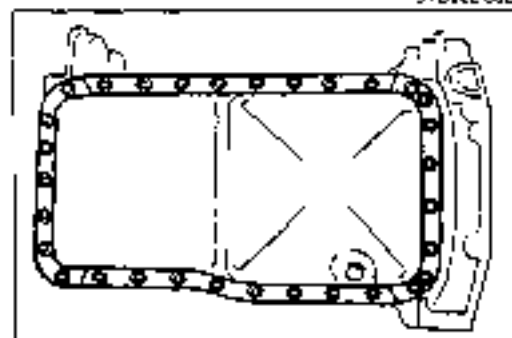
**Tightening torque:**

7.8—11 Nm (80—110 cm·kg, 69—95 in·lb)

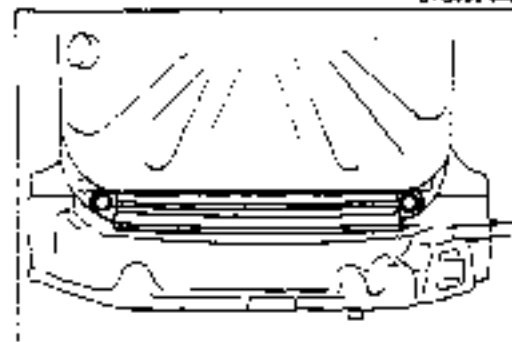




9T60E2302



8T60B2303



9T60E2306

**Oil Pan**

1. Install new O-rings on the bolts.

2. Install a new gasket

3. Install the oil pan.

4. Install the stiffener and a new gasket

**Tightening torque:**

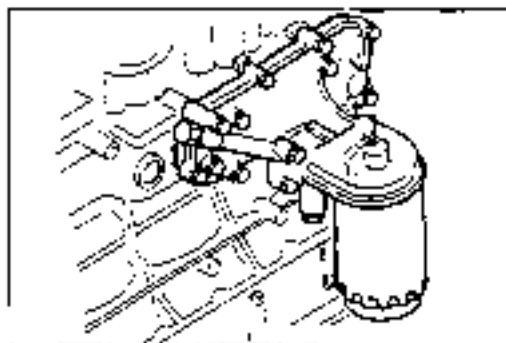
**19–25 N·m (1.9–2.5 m·kg, 14–19 ft·lb)**

5. Install the seal plate.

**Tightening torque:**

**19–25 N·m (1.9–2.5 m·kg, 14–19 ft·lb)**





57GB52-305

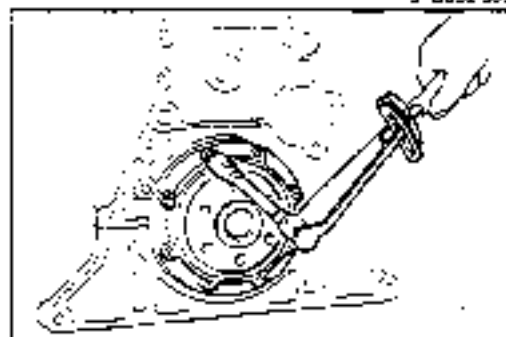
**Oil Cooler, Oil Filter**

1. Install the oil cooler and a new gasket.

**Tightening torque:**

19–25 Nm (1.9–2.6 m·kg, 14–19 ft·lb)

2. Apply a small amount of clean engine oil to the rubber seal of the new filter.
3. Install the oil filter and tighten it by hand until the rubber seal contacts the base.
4. Tighten the filter 1/2-turn with a filter wrench.



97GCB2-310

**Rear Oil Seal Cap**

1. Install the rear oil seal cap and a new gasket.

**Tightening torque:**

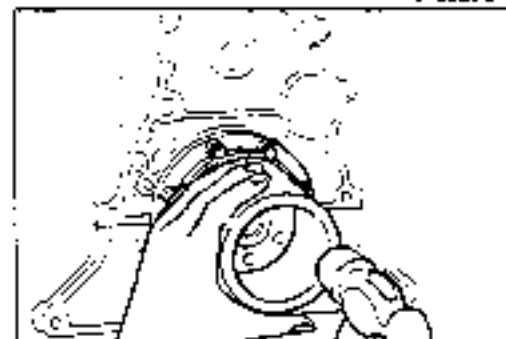
19–25 Nm (1.9–2.6 m·kg, 14–19 ft·lb)

2. Apply a small amount of clean engine oil to the lip of the new oil seal.
3. Push the oil seal slightly in by hand.

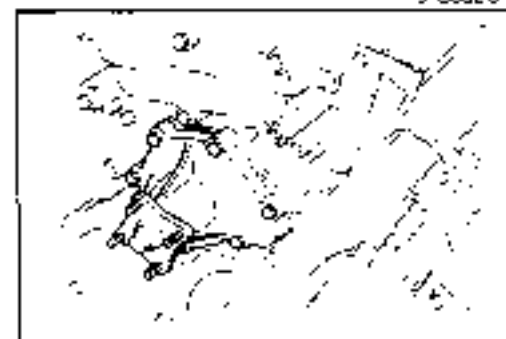
**Caution**

- The oil seal must be pressed in until it is flush with the edge of the rear oil seal cap.

4. Press the oil seal in evenly with a suitable pipe and a hammer.



37G082-311



97G092-312

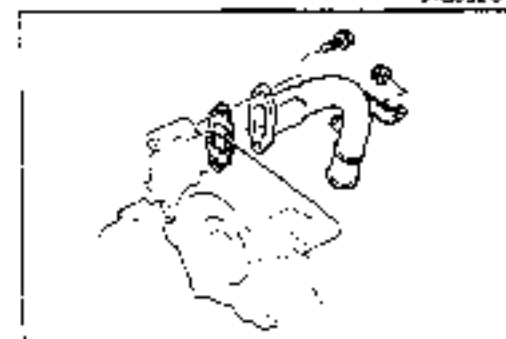
**Water Pump**

1. Install the water pump and a new gasket.

**Tightening torque**

HA: 16–23 Nm (1.6–2.3 m·kg, 12–17 ft·lb)

SL: 19–25 Nm (1.9–2.6 m·kg, 14–19 ft·lb)



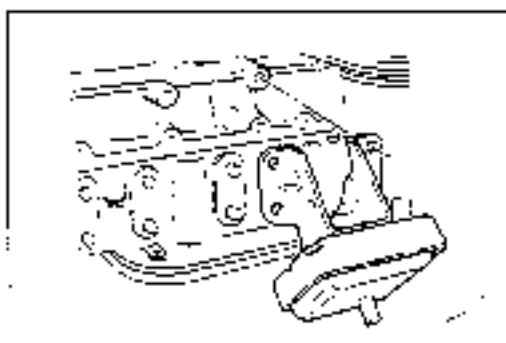
91G082-313

**Water Inlet Pipe**

1. Install the water inlet pipe and a new gasket.

**Tightening torque:**

19–25 Nm (1.9–2.6 m·kg, 14–19 ft·lb)



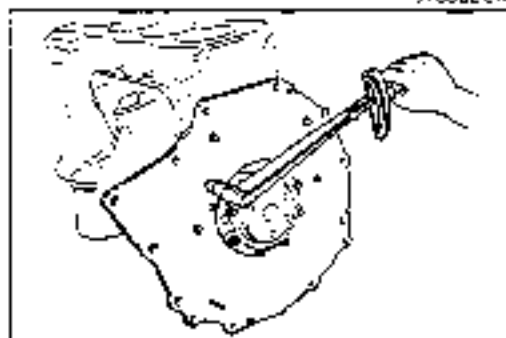
97G082-314

**Left Engine Mount**

1. Install the left engine mount.

**Tightening torque:**

31—46 Nm (3.2—4.7 m·kg, 23—34 ft·lb)



97G082-315

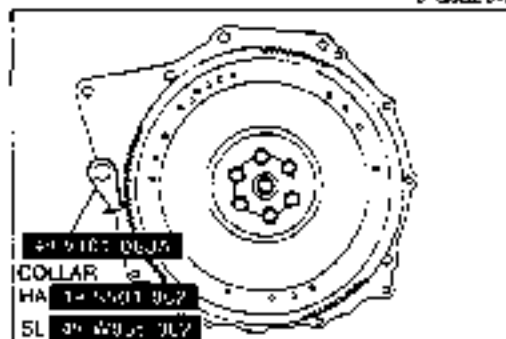
**End Plate**

1. Install the end plate.

**Tightening torque**

HA: 32—47 Nm (3.3—4.8 m·kg, 24—35 ft·lb)

SL: 37—52 Nm (3.9—5.3 m·kg, 27—38 ft·lb)



97G082-316

**Flywheel**

1. Apply clean engine oil to the bolt threads and seat faces.
2. Set the flywheel onto the crankshaft, and loosely install the bolts.
3. Hold the flywheel with the SST.
4. Tighten the bolts in two or three steps in the order shown in the figure.

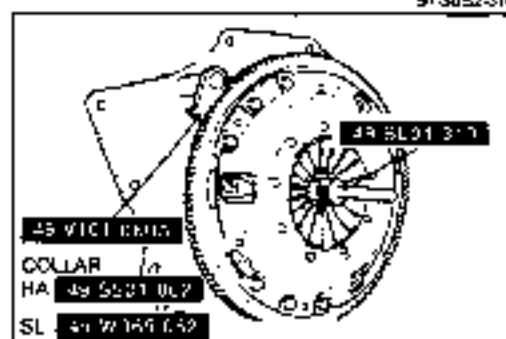
**Tightening torque**

HA:

177—196 Nm (18.0—20.0 m·kg, 130—145 ft·lb)

SL:

206—226 Nm (21.0—23.0 m·kg, 152—166 ft·lb)



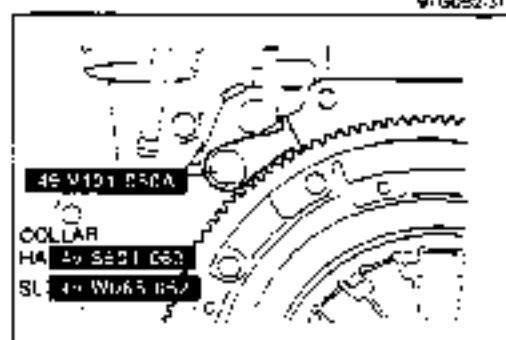
97G082-317

**Clutch Disc and Clutch Cover**

1. Install the clutch disc and the clutch cover using the SST. (Refer to Section H.)

**Tightening torque:**

18—26 Nm (1.8—2.7 m·kg, 13—20 ft·lb)



97G082-318

**Crankshaft Pulley**

1. Apply clean engine oil to the bolt threads and seat faces.
2. Install the crankshaft pulley.
3. Hold the flywheel with the SST.
4. Install the washer and lock bolt.

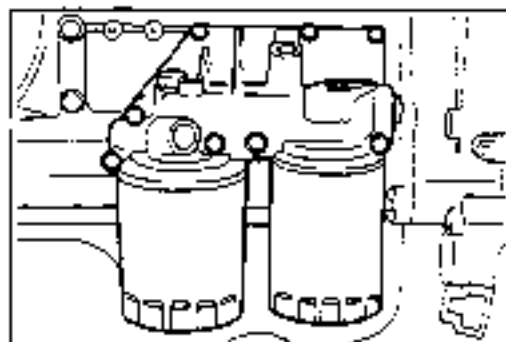
**Tightening torque:**

343—392 Nm (35.0—40.0 m·kg, 253—289 ft·lb)



## B

### ASSEMBLY



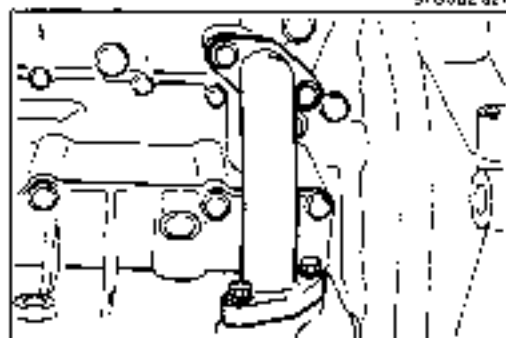
9F6302-321

#### Oil Filter Assembly

1. Install the oil filter and a new gasket.

#### Tightening torque:

19—25 Nm (1.9—2.6 m·kg, 14—19 ft·lb)

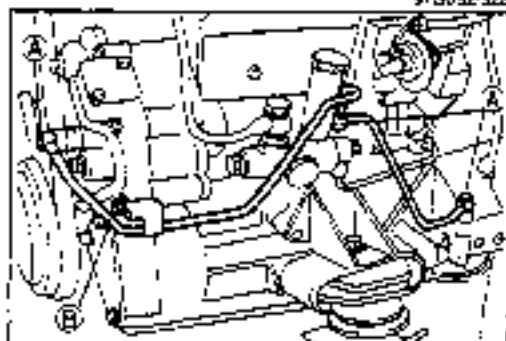


9F5092-322

2. Install the oil pipe and a new O-ring.

#### Tightening torque:

19—25 Nm (1.9—2.6 m·kg, 14—19 ft·lb)



8F6082-323

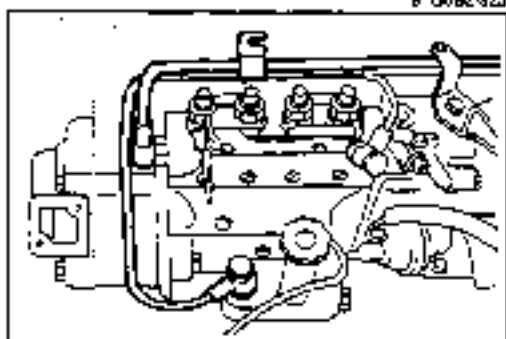
#### Injection Pump Oil Pipe

1. Install the injection pump oil pipe

#### Tightening torque

A: 9.8—13 Nm (100—130 cm·kg, 87—113 in·lb)

B: 19—25 Nm (1.9—2.6 m·kg, 14—19 ft·lb)



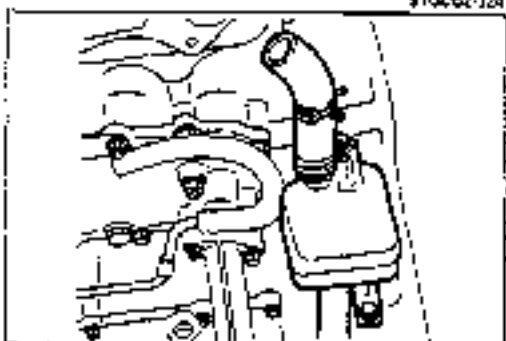
9T062-324

#### Fuel Pipe

1. Install the fuel pipe.

#### Tightening torque:

9.8—13 Nm (100—130 cm·kg, 87—113 in·lb)



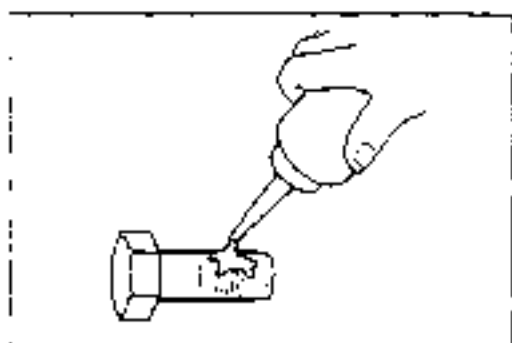
9T3083-325

#### PCV Chamber

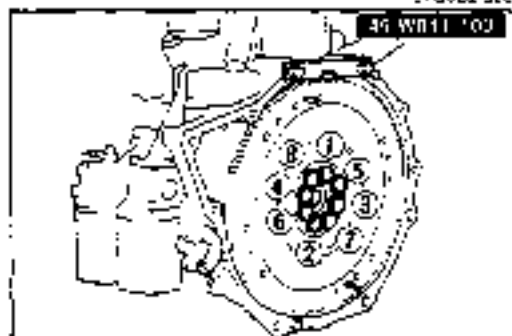
1. Install the PCV chamber.

#### Tightening torque:

19—25 Nm (1.9—2.6 m·kg, 14—19 ft·lb)

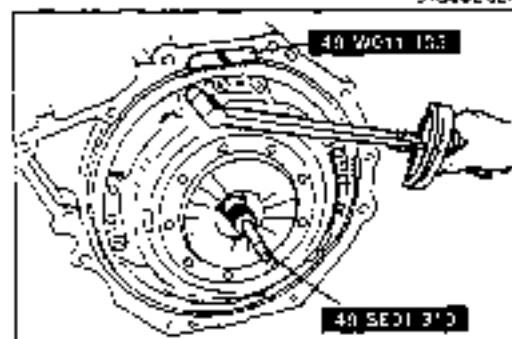


9T6082-326



40 W011-103

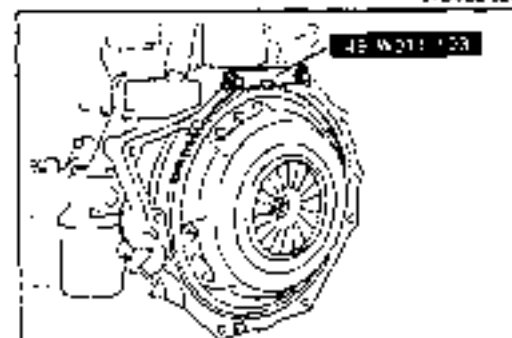
9T6082-327



40 W011-103

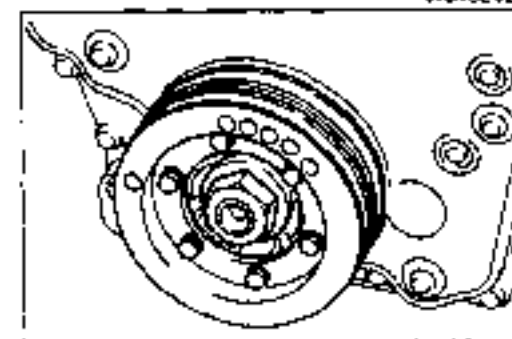
40 SE01-310

9T6082-328



40 W011-103

9T6082-329



9T6082-330

**Flywheel**

1. Apply clean engine oil to the bolt threads and seal faces.
2. Set the flywheel onto the crankshaft, and loosely install the bolts.
3. Hold the flywheel with the SST.
4. Tighten the bolts in two or three steps in the order shown in the figure.

**Tightening torque:**

206—226 N·m (21.0—23.0 m·kg, 152—166 ft·lb)

**Clutch Disc and Clutch Cover**

1. Install the clutch disc and the clutch cover with the SST. (Refer to Section H.)

**Tightening torque:**

18—26 N·m (1.8—2.7 m·kg, 13—20 ft·lb)

**Crankshaft Pulley**

1. Install the crankshaft pulley.
2. Hold the flywheel with the SST.

3. Install the washer and locknut.

**Tightening torque:**

383—432 N·m (39.0—44.0 m·kg, 282—318 ft·lb)

# B

## ASSEMBLY



9T6082 331

### Water Inlet Pipe

1. Install the water inlet pipe and a new gasket.

#### Tightening torque:

19–25 Nm (1.9–2.6 m·kg, 14–19 ft·lb)

### Alternator Bracket

1. Install the alternator bracket.

#### Tightening torque:

37–52 Nm (3.8–5.3 m·kg, 27–38 ft·lb)

### Vacuum Pipe

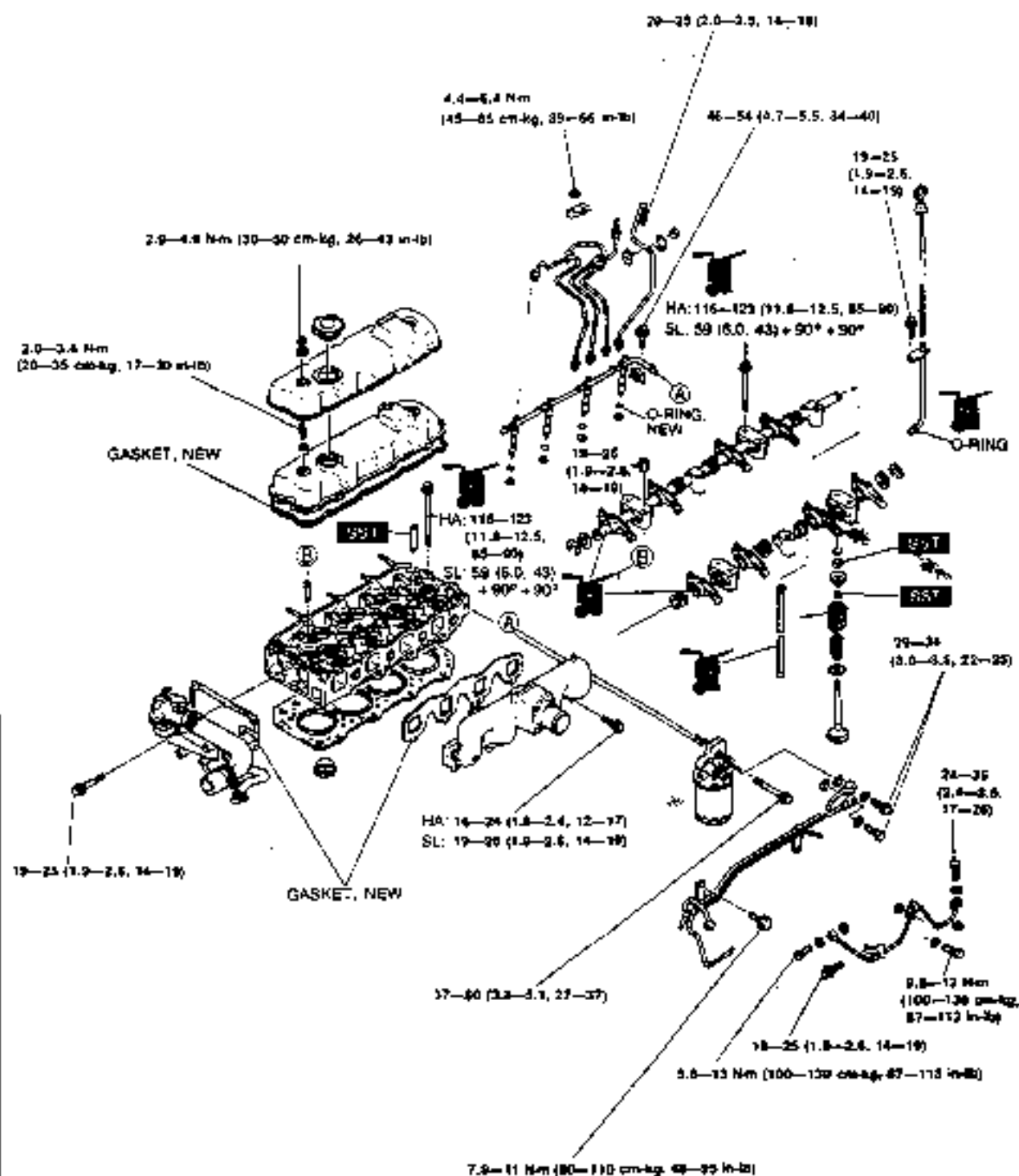
1. Install the vacuum pipe.

#### Tightening torque:

9.8–13 Nm (100–130 cm·kg, 87–113 in·lb)



**CYLINDER HEAD**  
**HA, SL Engine**  
**Torque Specifications**



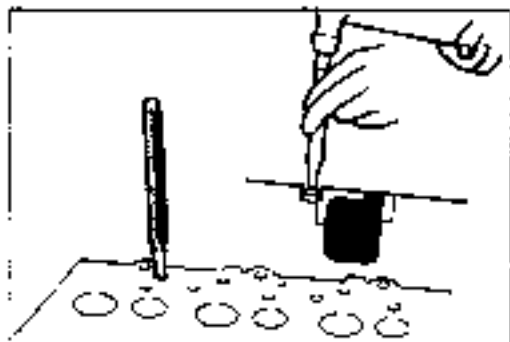
Nm (cm-kg, in-lb)

9TGC82-333

B-113

## B

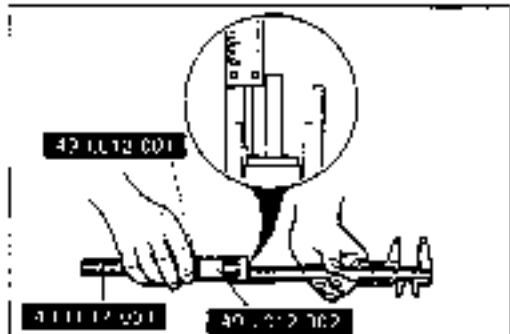
## ASSEMBLY



9TGB2-335

### Combustion Chamber Insert (HA)

- 1 Place the insert into position of the cylinder head and adjust the position in relation to the welsh washer. Set the welsh washer with the projected portion directed toward the cylinder head gasket side.
- 2 Seat the welsh washer by lightly striking its center with a punch.



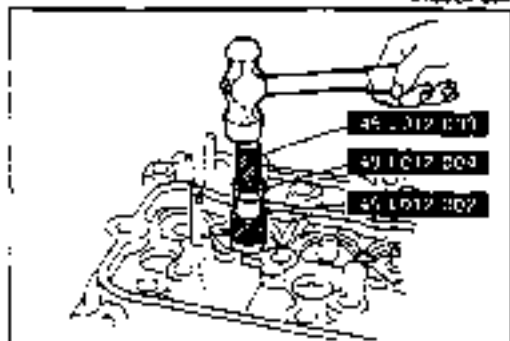
9TGB2-336

### Valve Guide

- 1 Assemble the SST so that depth L is as specified.

**Depth L: 15.2—15.4mm (0.598—0.606 in)**

- 2 Tighten the locknut.

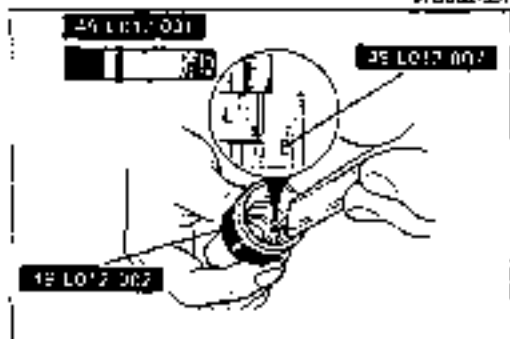


9TGB2-337

- 3 Tap the valve guide in from the side opposite the combustion chamber until the SST contacts the cylinder head.
- 4 Verify that the valve guide height is within specification.

**Height: 15.2—15.4mm (0.598—0.606 in)**

- 5 If not within specification, repeat Steps 1—4.



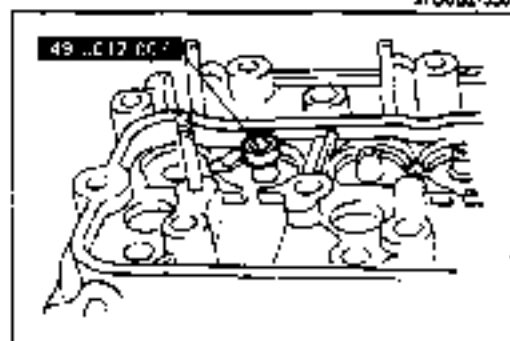
9TGB2-338

### Valve Seal

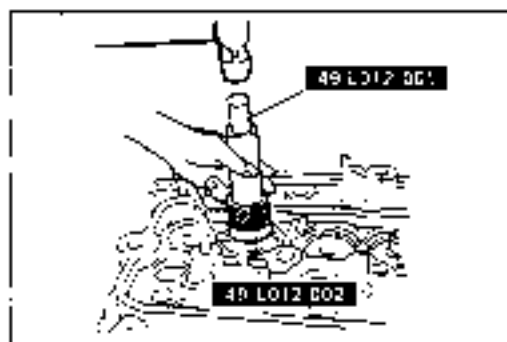
- 1 Assemble the SST so that depth L is as specified.

**Depth L: 16.5—16.9mm (0.650—0.665 in)**

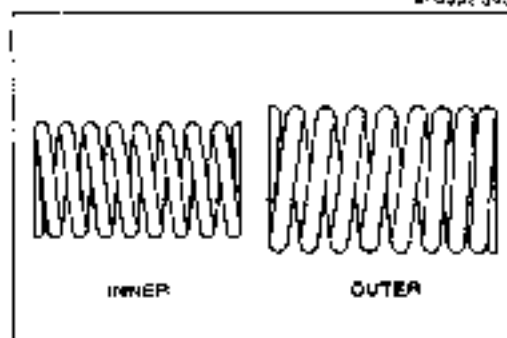
- 2 Slide the valve seal onto the valve guide.
- 3 Set the SST against the valve seal.



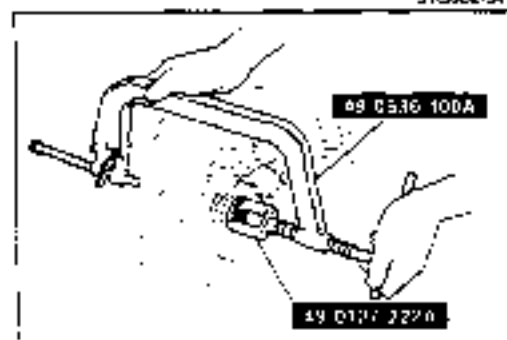
9TGB2-339



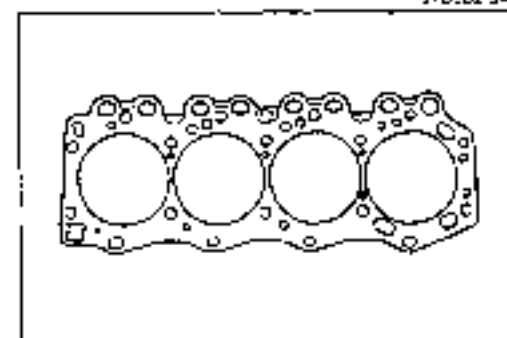
97G0B2-340



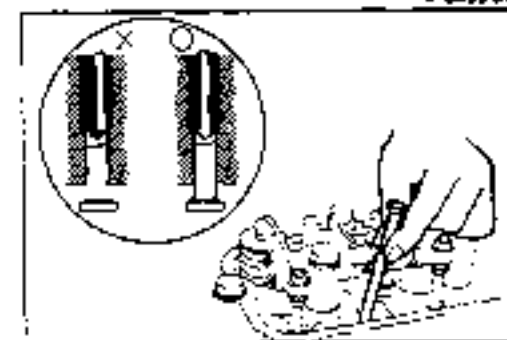
5TG0B2-341



97G0B2-342



97G0B2-343



5TG0B2-344

**Caution**

- Do not use a hammer.

4. Press the valve seal on until the **SST** contacts the cylinder head.

**Valve, Valve Spring and Valve Spring Seat**

1. Install the lower spring seat.
2. Install the valve.
3. Install the valve springs (outer and inner) and the upper spring seat.

4. Compress the valve spring with the **SST**.
5. Install the valve keepers.
6. Remove the **SST**.
7. Tap the end of the valve stem lightly two or three times with a plastic hammer to verify that the keepers are all fully seated.
8. Install the valve caps.

**Cylinder Head Gasket**

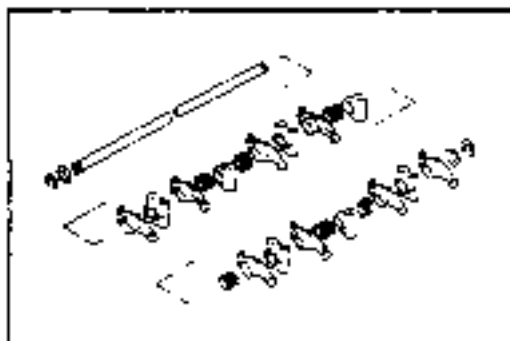
1. Remove all foreign material from the deck of the cylinder block.
2. Place the new cylinder head gasket in position.

**Cylinder Head**

1. Install the cylinder head assembly.
2. Apply clean engine oil to the push rod.
3. Install the push rods.

**Caution**

- Verify that the ends of the push rods are properly set in to the tappets.



9TGE02-345

4. Apply clean engine oil to the rocker arms and shaft.
5. Assemble the rocker arms, springs, and shaft.
6. Install the rocker arm and shaft assembly onto the cylinder head.

#### 7 SL Engine

- (1) Measure the length of the cylinder head bolt below the head.  
If the length exceeds the maximum, replace the bolt.

#### Length

Standard (A): 121.7–122.3mm (4.791–4.815 in)

(B): 150.7–151.3mm (5.933–5.957 in)

Maximum (A): 123.0mm (4.843 in)

(B): 152.0mm (5.984 in)

#### Caution

- Verify that the rocker arms and push rods are properly engaged while tightening.

8. Apply clean engine oil to the bolt threads and seat faces.
9. Install the cylinder head bolts.
10. Tighten the bolts in two or three steps in the order shown in the figure.

#### Tightening torque

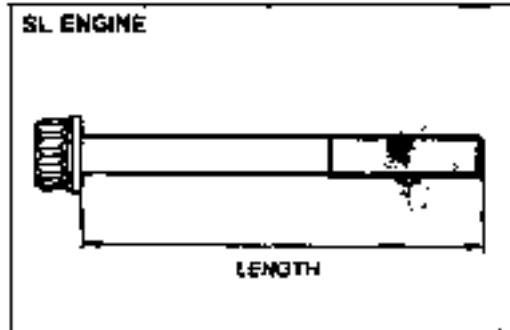
HA: 118–123 Nm (11.8–12.5 m·kg, 85–90 ft·lb)

SL: 59 Nm (6.0 m·kg, 43 ft·lb)

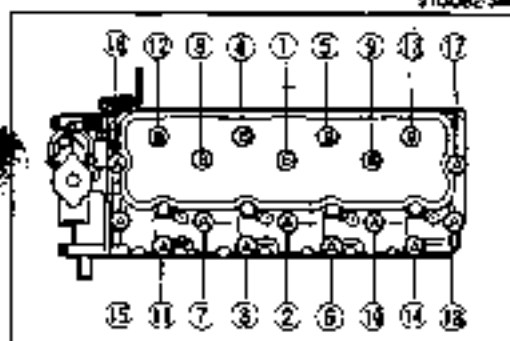
#### 11. SL Engine

- (1) Make paint marks on the bolt heads as shown in the figure.
- (2) With the paint marks as a reference point, tighten the cylinder head bolts **another**  $90^\circ \pm 15^\circ$  in the tightening order.
- (3) Tighten the bolts **once again**  $90^\circ \pm 15^\circ$  in the tightening order.

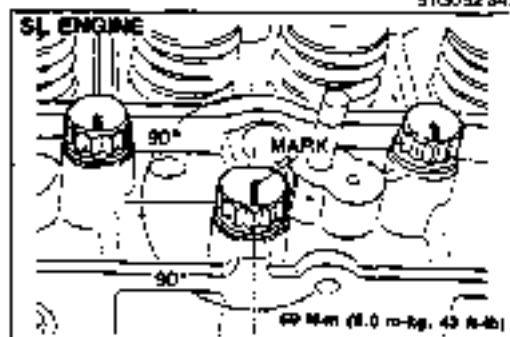
12. Adjust the valve clearance. (Refer to page B-9.)



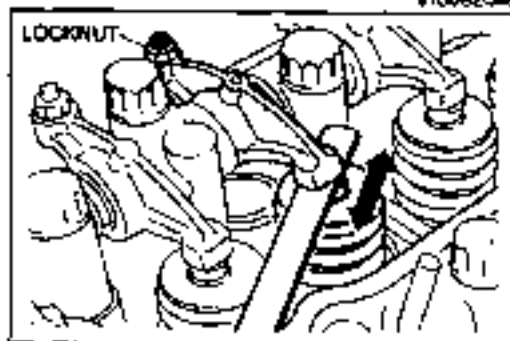
9TGE02-346



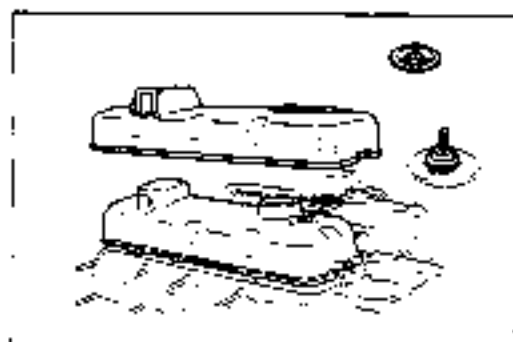
9TGE02-347



9TGE02-348



9TFC0X-045



9TGD2-150

**Cylinder Head Cover**

1. Install the cylinder head cover and a new gasket.

**Tightening torque:**

2.0–3.4 Nm (20–35 cm-kg, 17–30 in-lb)

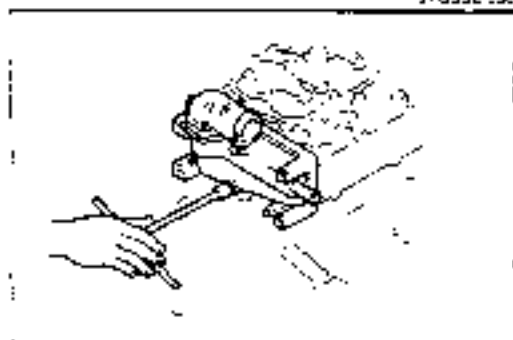
**Seal Cover (SL)**

1. Install the seal cover.

**Tightening torque:**

2.9–4.9 Nm (30–50 cm-kg, 26–43 in-lb)

2. Install the oil filler cap.



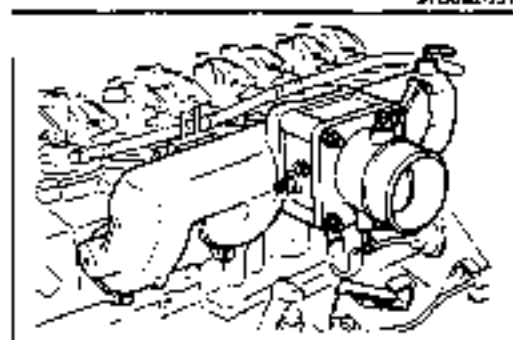
9TGD2-151

**Water Outlet Housing**

1. Install the water outlet housing and a new gasket.

**Tightening torque:**

19–25 Nm (1.9–2.6 m-kg, 14–19 ft-lb)



9TGD2-152

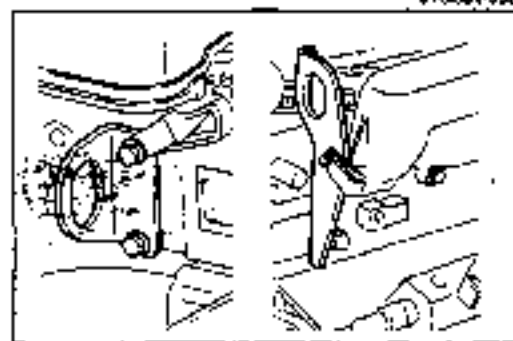
**Intake Manifold Assembly**

1. Install the intake manifold assembly and a new gasket.

**Tightening torque**

HA: 16–24 Nm (1.6–2.4 m-kg, 12–17 ft-lb)

SL: 19–25 Nm (1.9–2.6 m-kg, 14–19 ft-lb)



9TGD2-153

**Engine Hanger**

1. Install the front (right) engine hanger.

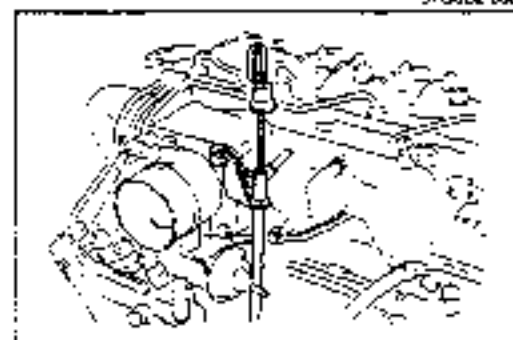
**Tightening torque:**

37–52 Nm (3.8–5.3 m-kg, 27–38 ft-lb)

2. Install the front (left) engine hanger.

**Tightening torque:**

64–89 Nm (6.5–9.1 m-kg, 47–66 ft-lb)



9TGD2-154

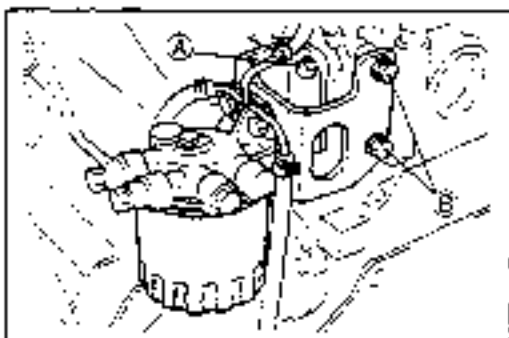
**Oil Level Gauge and Guide Pipe**

1. Apply clean engine oil to a new O-ring and install the oil level gauge guide pipe.

**Tightening torque:**

19–25 Nm (1.9–2.6 m-kg, 14–19 ft-lb)

2. Install the oil level gauge



870082-355

**Fuel Filter Body**

1. Install the rear engine hanger (fuel filter bracket).

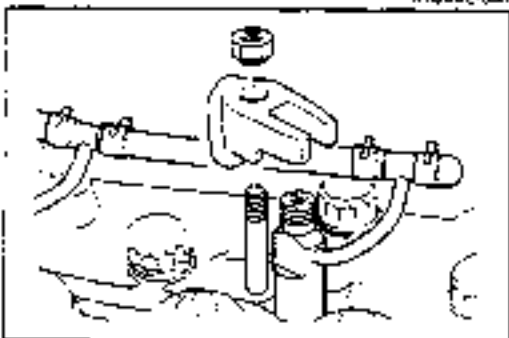
**Tightening torque**

- Ⓐ: 19—25 Nm (1.9—2.6 m·kg, 14—19 ft·lb)
- Ⓑ: 37—50 Nm (3.8—5.1 m·kg, 27—37 ft·lb)

2. Install the fuel filter body.

**Tightening torque:**

37—50 Nm (3.8—5.1 m·kg, 27—37 ft·lb)



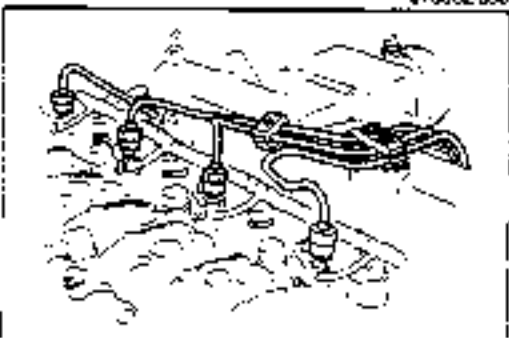
970082-356

**Injection Nozzle and Nozzle Holder**

1. Install the injection nozzle and a new O-ring.
2. Install the injection nozzle holder.

**Tightening torque:**

46—54 Nm (4.7—5.5 m·kg, 34—40 ft·lb)



970082-357

**Injection Pipe**

1. Install the injection pipe.

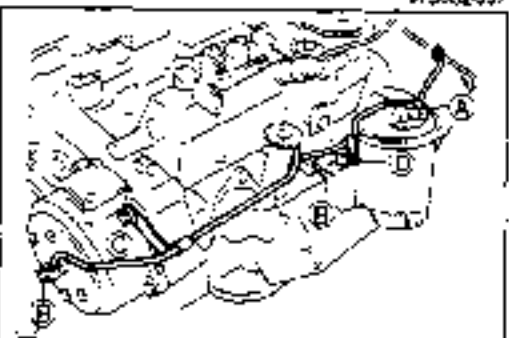
**Tightening torque:**

20—25 Nm (2.0—2.5 m·kg, 14—18 ft·lb)

2. Install the injection pipe dip.

**Tightening torque:**

4.4—6.4 Nm (45—65 cm·kg, 39—56 in·lb)



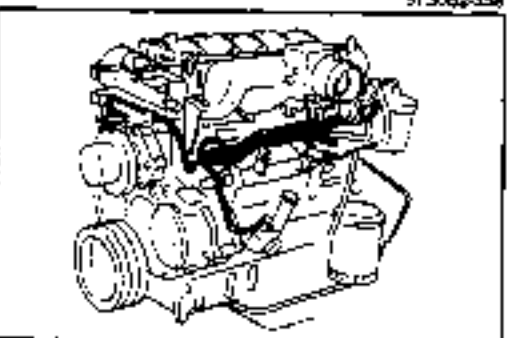
973082-358

**Injection Pump Oil Pipe (SL)**

1. Install the injection pump oil pipe

**Tightening torque**

- Ⓐ: 24—35 Nm (2.4—3.6 m·kg, 17—26 ft·lb)
- Ⓑ: 9.8—13 Nm (100—130 cm·kg, 87—113 in·lb)
- Ⓒ: 19—25 Nm (1.9—2.6 m·kg, 14—19 ft·lb)
- Ⓓ: 7.8—11 Nm (80—110 cm·kg, 69—95 in·lb)



870082-359

**Fuel Pipe**

1. Install the fuel pipe.

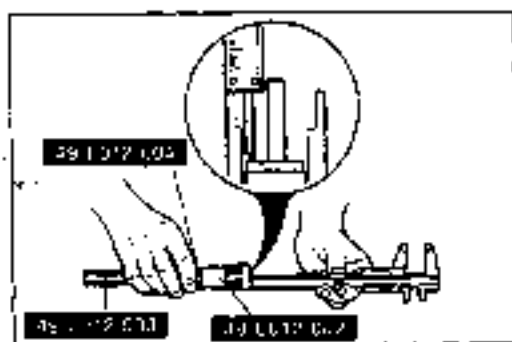
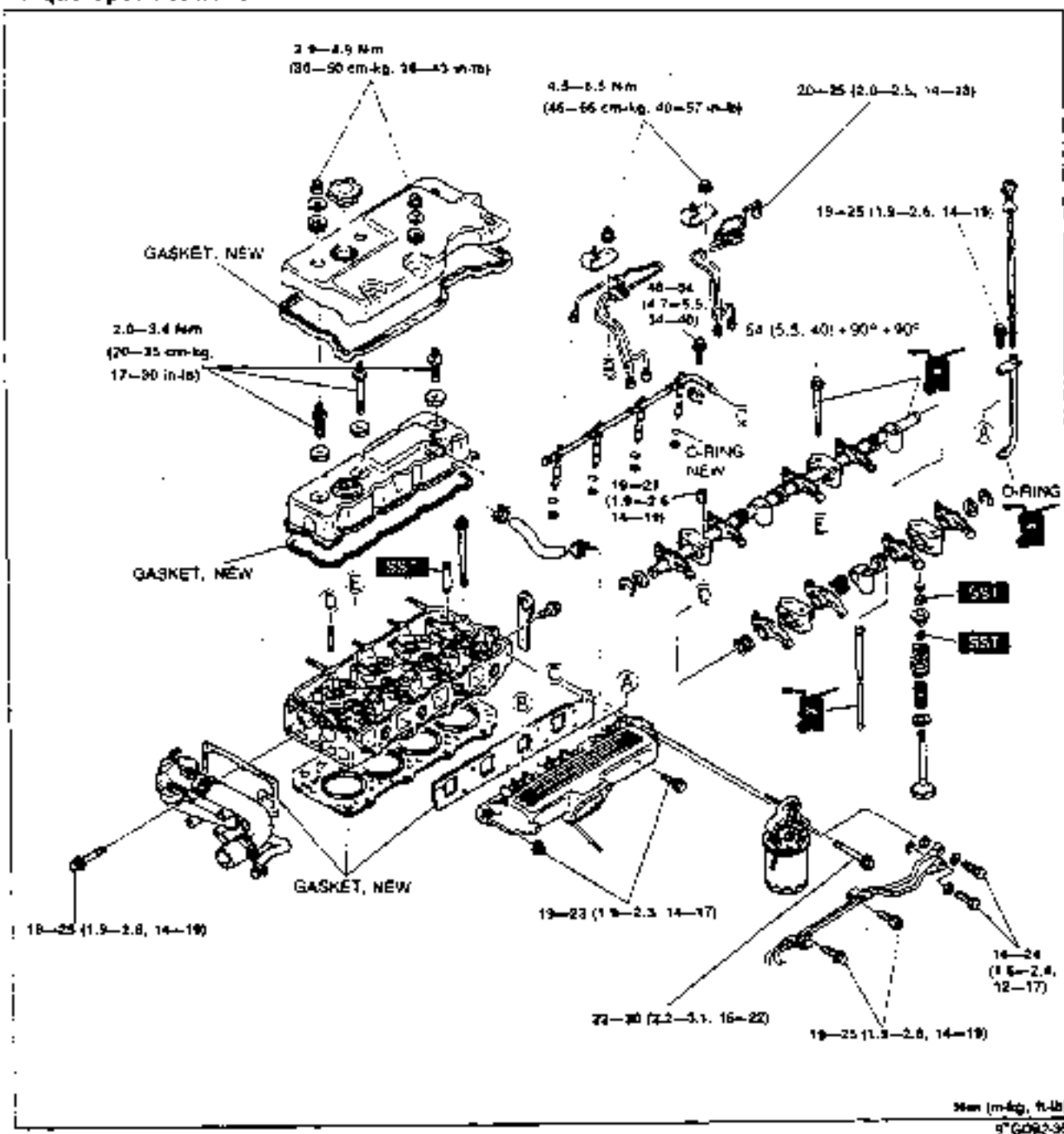
**Tightening torque****Connect bolt:**

29—34 Nm (3.0—3.5 m·kg, 22—25 ft·lb)

**Bracket:**

7.8—11 Nm (80—110 cm·kg, 69—95 in·lb)

TF Engine  
Torque Specifications



RTGC82-2E1

Valve Guide

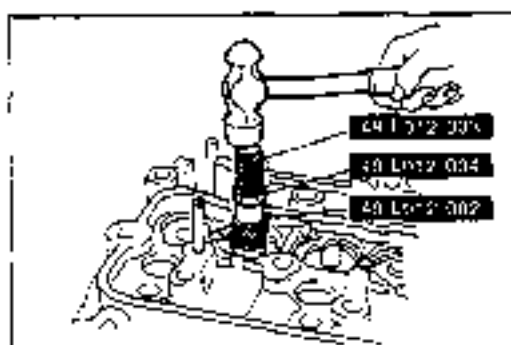
1. Assemble the SST so that depth L is as specified

Depth L: 14.2—14.4mm (0.559—0.567 in)

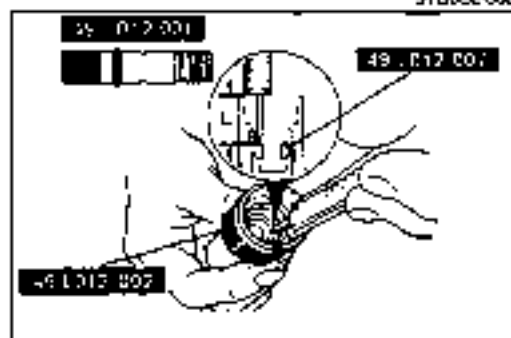
2. Tighten the locknut

## B

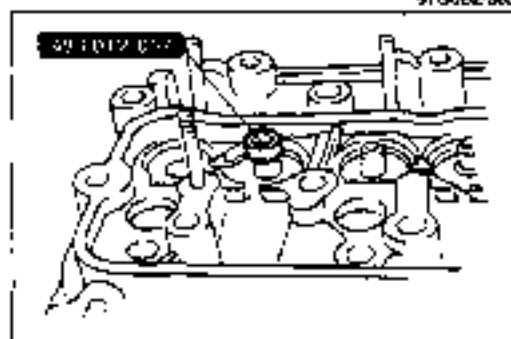
## ASSEMBLY



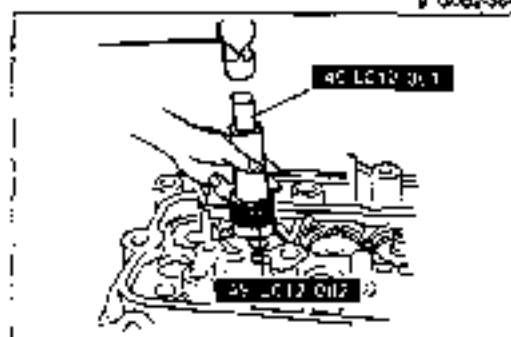
9TGD82-362



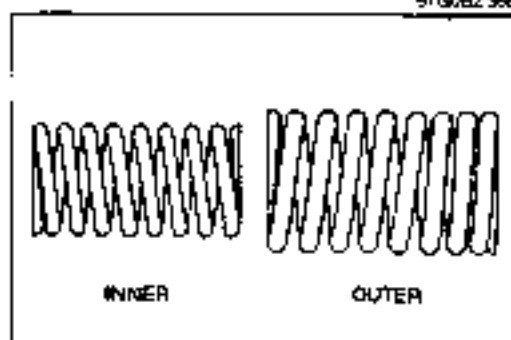
9TGD82-363



9TGD82-364



9TGD82-365



9TGD82-366

3. Tap the valve guide in from the side opposite the combustion chamber until the **SST** contacts the cylinder head.
4. Verify that the valve guide height is within specification

**Height: 14.2—14.4mm (0.559—0.567 in)**

5. If not within specification, repeat Steps 1—4.

### Valve Seal

1. Assemble the **SST** so that depth **L** is as specified.

**Depth L: 15.5—15.8mm (0.610—0.626 in)**

2. Slide the valve seal onto the valve guide
3. Set the **SST** against the valve seal.

### Caution

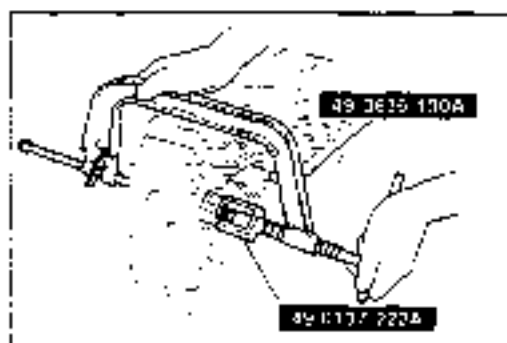
- Do not use a hammer.

4. Press the valve seal on until the **SST** contacts the cylinder head.

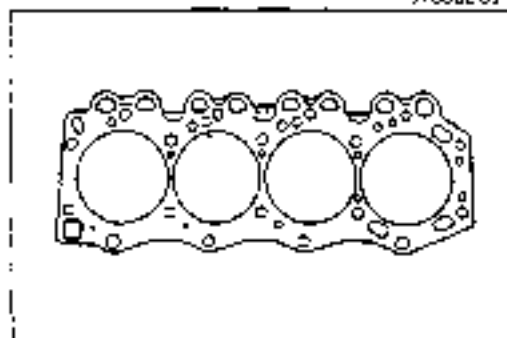
### Valve, Valve Spring and Valve Spring Seat

1. Install the lower spring seat.
2. Install the valve.
3. Install the valve springs (outer and inner) and the upper spring seat.

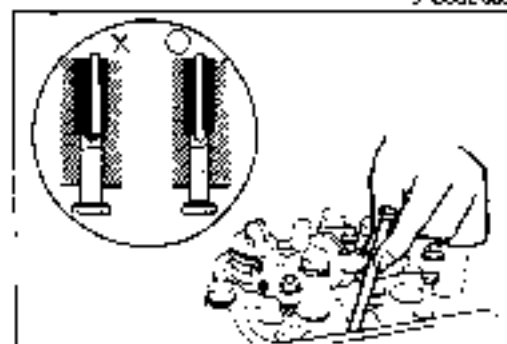




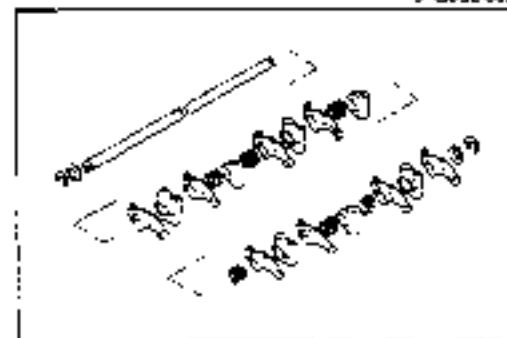
5TGD2-357



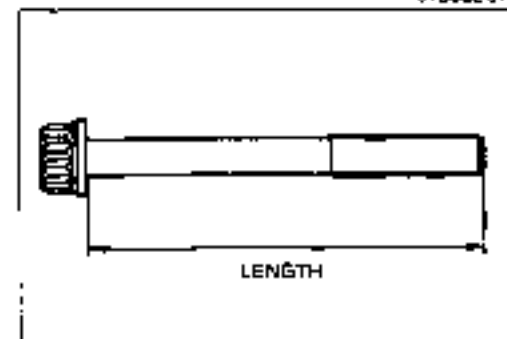
5TGD2-368



5TGD2-369



5TGD2-370



5TGD2-371

- 4 Compress the valve spring with the **SST**.
- 5 Install the valve keepers.
- 6 Remove the **SST**.
- 7 Tap the end of the valve stem lightly two or three times with a plastic hammer to verify that the keepers are all fully seated.
- 8 Install the valve caps.

#### Cylinder Head Gasket

- 1 Remove all foreign material from the deck of the cylinder block.
- 2 Place the new cylinder head gasket in position.

#### Cylinder Head

- 1 Install the cylinder head assembly.
- 2 Apply clean engine oil to the push rod.
- 3 Install the push rods.

#### Caution

- Verify that the ends of the push rods are properly set in to the tappets.

- 4 Apply clean engine oil to the rocker arms and shaft.
- 5 Assemble the rocker arms, springs, and shaft.
- 6 Install the rocker arm and shaft assembly onto the cylinder head.

- 7 Measure the length of the cylinder head bolt below the head. If the length exceeds the maximum, replace the bolt.

#### Length

- Standard** (A): 130.2–130.8mm (5.128–5.150 in)  
 (B): 158.2–158.8mm (6.228–6.252 in)  
**Maximum** (A): 131.5mm (5.177 in)  
 (B): 159.5mm (6.280 in)

## B

## ASSEMBLY

### Caution

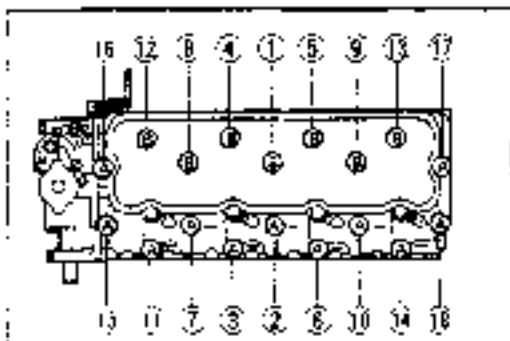
- Verify that the rocker arms and push rods are properly engaged while tightening.

8. Apply clean engine oil to the bolt threads and seal faces.
9. Install the cylinder head bolts.
10. Tighten the bolts in two or three steps in the order shown in the figure.

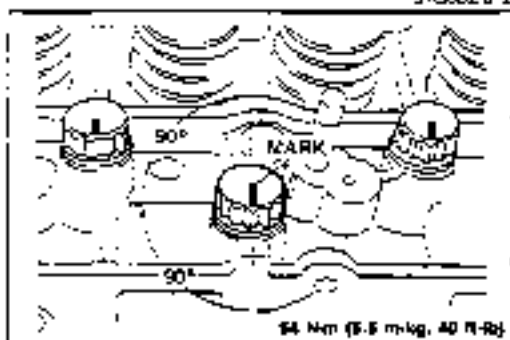
**Tightening torque: 54 Nm (5.5 m·kg, 40 ft·lb)**

11. Make paint marks on the bolt heads as shown in the figure.
12. With the paint marks as a reference point, tighten the cylinder head bolts **another**  $90^\circ \pm 15^\circ$  in the tightening order.
13. Tighten the bolts **once again**  $90^\circ \pm 15^\circ$  in the tightening order.

14. Adjust the valve clearance. (Refer to page B-9.)



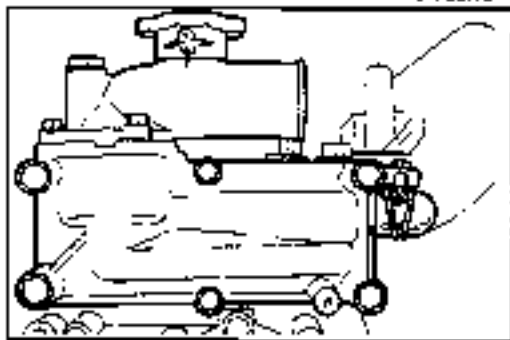
9TGO62 372



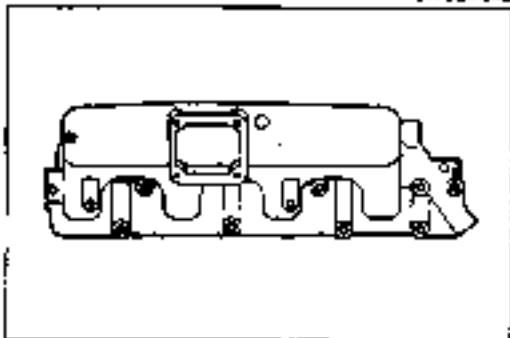
9TGO62 373



9TF08x-047



9TF06x-048



9TGO62 376

### Water Outlet Housing

1. Install the water outlet housing.

### Tightening torque:

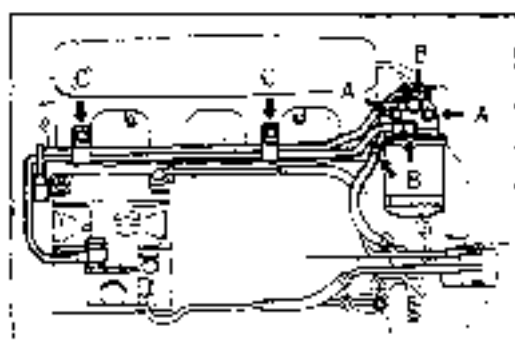
**19—25 Nm (1.9—2.6 m·kg, 14—19 ft·lb)**

### Intake Manifold Assembly

1. Install the intake manifold assembly and a new gasket.

### Tightening torque:

**19—23 Nm (1.9—2.3 m·kg, 14—17 ft·lb)**



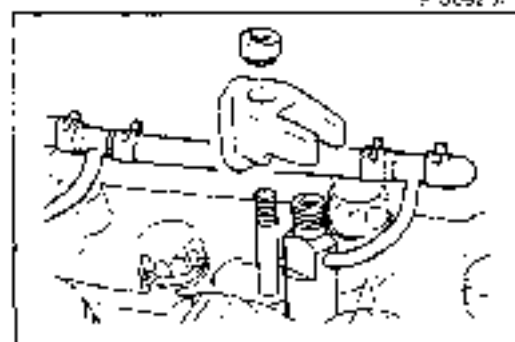
9T0092 37

**Fuel Filter Body**

1. Install the fuel filter body.

**Tightening torque**

- Ⓐ: 22—30 N·m (2.2—3.1 m·kg, 16—22 ft·lb)
- Ⓑ: 16—24 N·m (1.6—2.4 m·kg, 12—17 ft·lb)
- Ⓒ: 18—25 N·m (1.9—2.6 m·kg, 14—19 ft·lb)



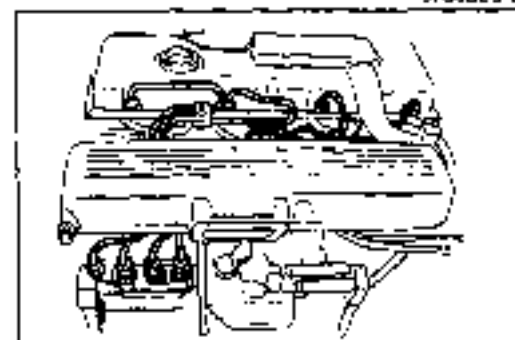
9T0092 37B

**Injection Nozzle and Nozzle Holder**

1. Install the injector, nozzle and a new O-ring.
2. Install the injection nozzle holder.

**Tightening torque:**

- 46—54 N·m (4.7—5.5 m·kg, 34—40 ft·lb)



9T0092 37C

**Injection Pipe**

1. Install the injection pipe.

**Tightening torque:**

- 25—29 N·m (2.5—3.0 m·kg, 18—22 ft·lb)

2. Install the injection pipe clip.

**Tightening torque:**

- 4.4—6.4 N·m (45—65 cm·kg, 39—56 in·lb)



9T0092 37D

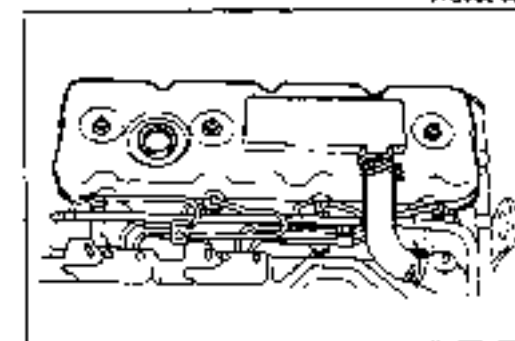
**Oil Level Gauge and Guide Pipe**

1. Apply clean engine oil to a new O-ring and install the oil level gauge guide pipe.

**Tightening torque:**

- 19—25 N·m (1.9—2.6 m·kg, 14—19 ft·lb)

2. Install the oil level gauge.



9T0092 37E

**Cylinder Head Cover**

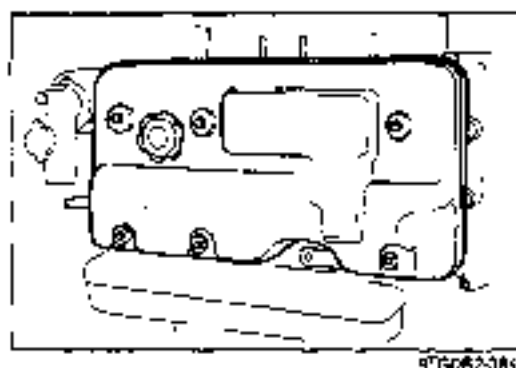
1. Install the cylinder head cover and a new gasket.

**Tightening torque:**

- 3.4—5.4 N·m (35—55 cm·kg, 30—48 in·lb)

## B

## ASSEMBLY



97G062-084

### Seal Cover

1. Install the seal cover.

### Tightening torque:

2.0—3.4 N·m (20—35 cm·kg, 17—30 in·lb)

2. Install the filler cap.

## ENGINE STAND DISMOUNTING

## PROCEDURE

1. Remove the engine from the **SST (engine stand)**
2. Remove the **SST (engine hanger)** from the engine.
3. Install the parts as follows

9TGC82-385

**HA, SL Engine**

1. Install the oil bypass filter and connect the oil pipe.

**Tightening torque****Filter body:**

19—25 N·m (1.9—2.6 m·kg, 14—19 ft·lb)

**Oil pipe:**

16—24 N·m (1.6—2.4 m·kg, 12—17 ft·lb)

9TGC82-386

2. Install the alternator bracket.

**Tightening torque:**

37—52 N·m (3.8—5.3 m·kg, 27—38 ft·lb)

3. Install the alternator.

**Tightening torque**

Ⓐ: 19—25 N·m (1.9—2.6 m·kg, 14—19 ft·lb)

Ⓑ: 37—52 N·m (3.8—5.3 m·kg, 27—38 ft·lb)

4. Install the right engine mount

**Tightening torque:**

31—46 N·m (3.2—4.7 m·kg, 23—34 ft·lb)

5. Install the exhaust manifold and a new gasket

**Tightening torque**

HA: 26—32 N·m (2.7—3.3 m·kg, 20—24 ft·lb)

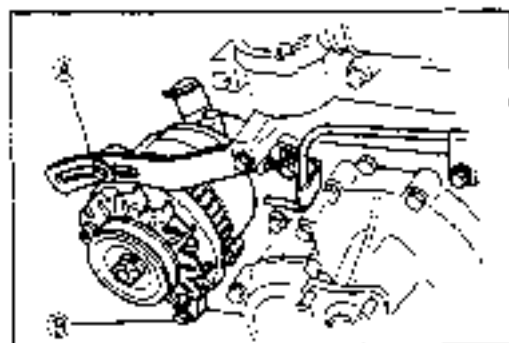
SL: 23—28 N·m (2.3—2.7 m·kg, 17—20 ft·lb)

6. Install the breather pipe (SL).

**Tightening torque**

Ⓐ: 19—25 N·m (1.9—2.6 m·kg, 14—19 ft·lb)

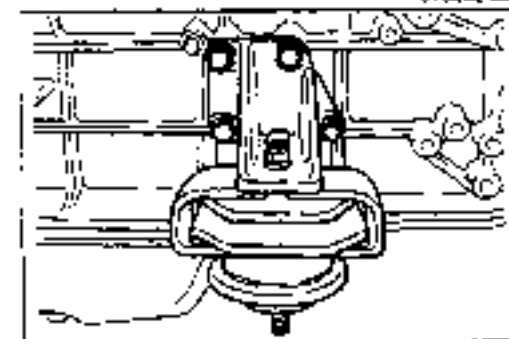
Ⓑ: 37—52 N·m (3.8—5.3 m·kg, 27—38 ft·lb)



9TGC82-387



9TGC82-388



9TGC82-389

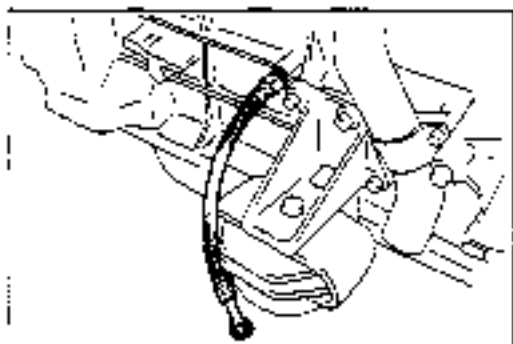
**TF Engine**

1. Install the right engine mount.

**Tightening torque:**

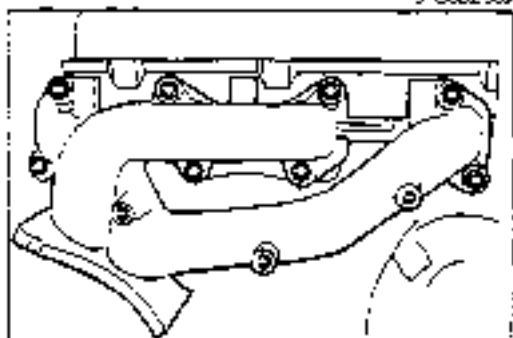
31—46 N·m (3.2—4.7 m·kg, 23—34 ft·lb)

## B ENGINE STAND DISMOUNTING



3\*6082 389

2. Connect the oil hose.



8T5212 390

3. Install the exhaust manifold and a new gasket

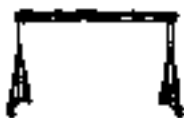





**Tightening torque:**

**44—48 N·m (4.5—4.9 m·kg, 33—35 ft·lb)**

## INSTALLATION

### PREPARATION

#### SST

<p>49 0727 000 Engine crane</p> 	<p>For installation of engine assembly</p>	<p>49 0636 000B Transmission filler</p> 	<p>For installation of engine assembly</p>
<p>49 W017 340 Supporter set</p> 	<p>For installation of engine assembly</p>	<p>49 W017 300 Arm (Part of 49 W017 340)</p> 	<p>For installation of engine assembly</p>
<p>49 W017 305 Arm (Part of 49 W017 340)</p> 	<p>For installation of engine assembly</p>	<p>49 0258 770B Wrench, flare nut (SL Turbo)</p> 	<p>For connection of clutch hose</p>

9TGB2391

### PROCEDURE

1. Tighten all bolts and nuts to the specified torques.

9TGB2392

# B

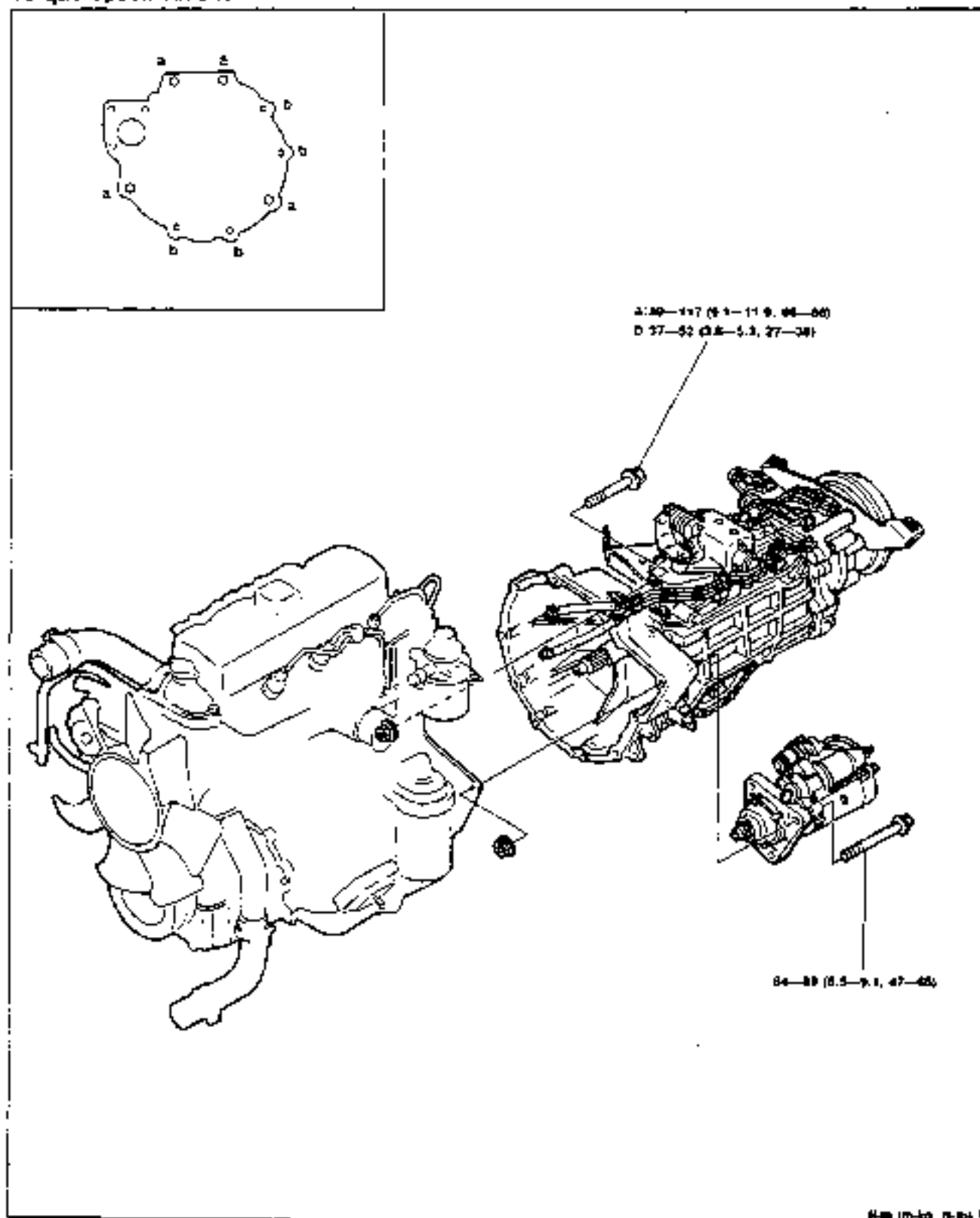
## INSTALLATION

### HA Engine

#### Step 1

1. Assemble the engine and transmission.

#### Torque Specifications



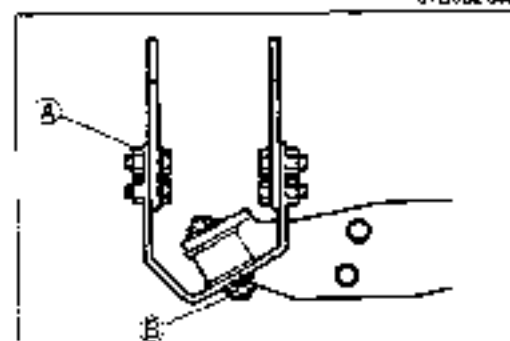
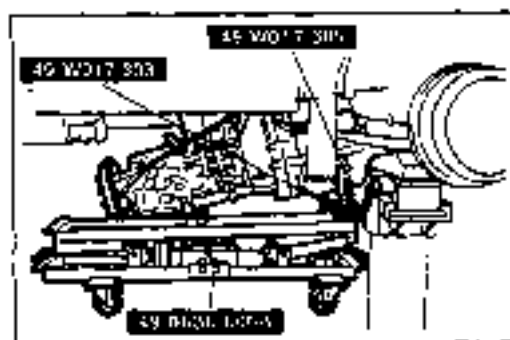
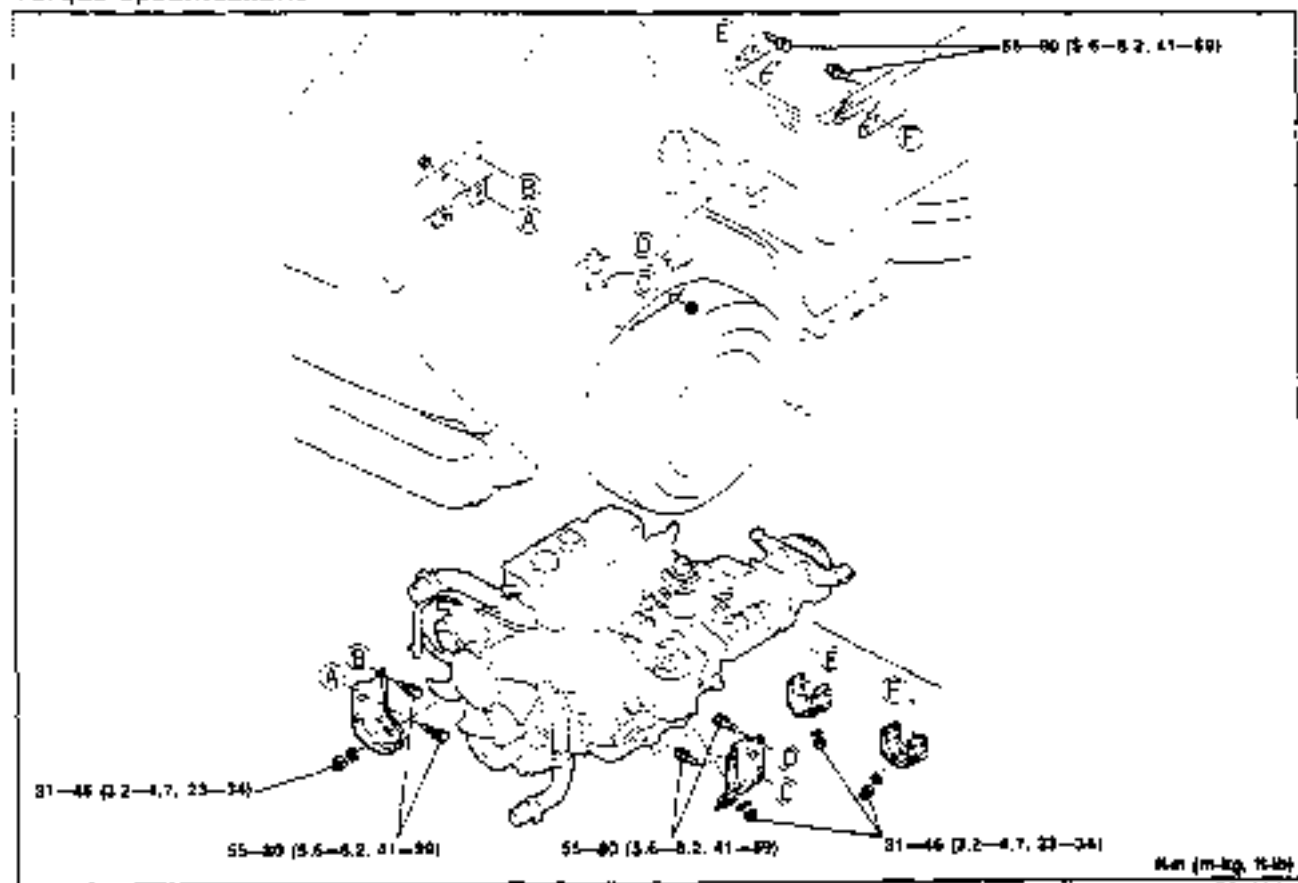


## Step 2

### Warning

- Be sure the vehicle is securely supported on safety stands.

### Torque Specifications



### Engine and transmission assembly

1. Set the engine on the SST.
2. Lift the engine into the engine compartment.
3. Mount the engine bracket to the vehicle.

#### Tightening torque:

55—80 N.m (5.6—8.2 m-kg, 41—59 ft-lb)

4. Lower the engine and align the engine mount rubber with the engine bracket.
5. Install the engine mount nuts and loosely tighten them.
6. Install and tighten the transmission mount bracket.

#### Tightening torque

(A): 55—80 N.m (5.6—8.2 m-kg, 41—59 ft-lb)

(B): 31—46 N.m (3.2—4.7 m-kg, 23—34 ft-lb)

7. Tighten the engine mount nuts.

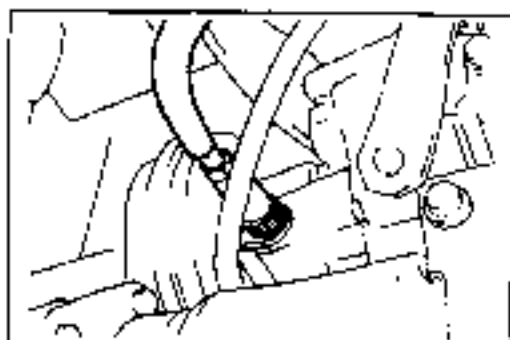
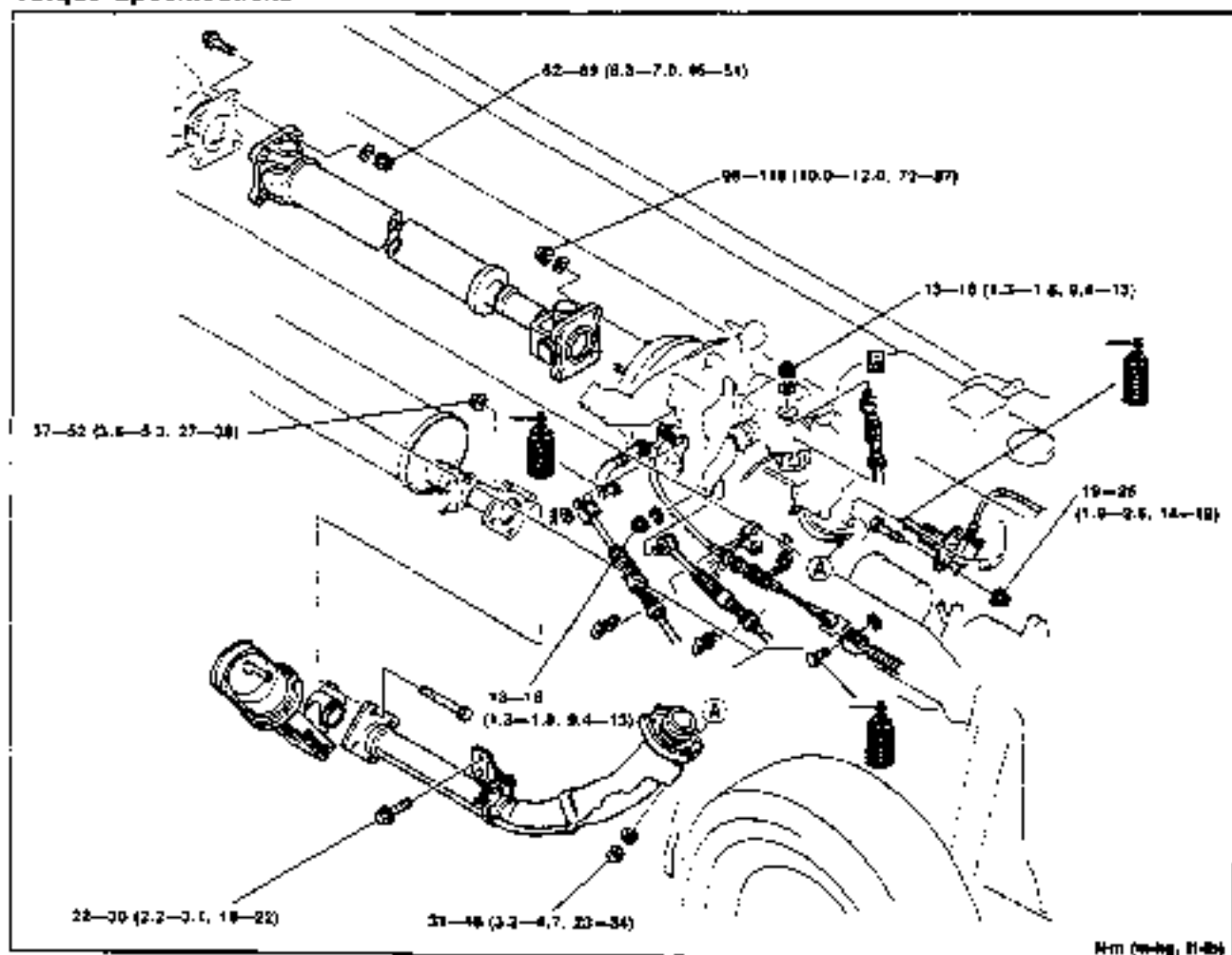
#### Tightening torque:

31—46 N.m (3.2—4.7 m-kg, 23—34 ft-lb)

# B

## INSTALLATION

### Step 3 Torque Specifications

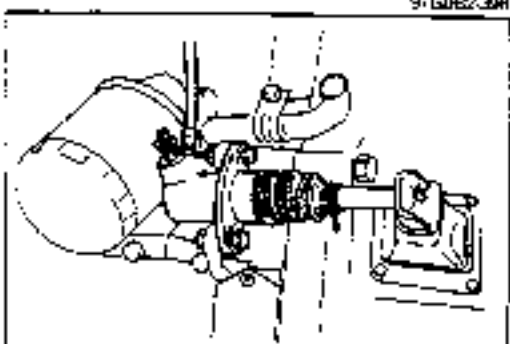


#### Propeller shaft

- 1 Install the propeller shaft. (Refer to Section L.)

#### Speedometer cable

- 1 Install the speedometer cable.

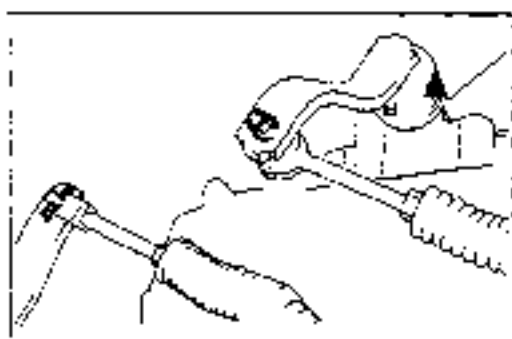


#### Clutch release cylinder

- 1 Install the clutch release cylinder.

#### Tightening torque:

18-25 Nm (1.9-2.6 m-kg, 14-19 ft-lb)



97G092-40

### Sub-select cable

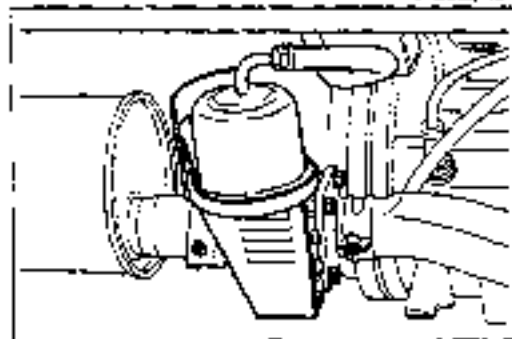
1. Install the sub-select cable. (Refer to Section J.)

### Shift/select cable

1. Install the shift/select cable.

### Tightening torque:

13—18 Nm (1.3—1.6 m·kg, 9.4—13 ft·lb)



97G092-402

### Front exhaust pipe

2. Install the front exhaust pipe.

### Tightening torque:

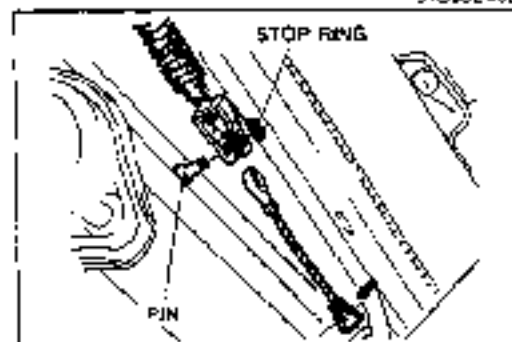
31—46 Nm (3.2—4.7 m·kg, 23—34 ft·lb)...Pipe  
22—30 Nm (2.2—3.1 m·kg, 16—22 ft·lb)...Bracket

### Exhaust shutter valve

1. Install the exhaust shutter valve.

### Tightening torque:

37—52 Nm (3.8—5.3 m·kg, 27—38 ft·lb)



97G092-403

### Parking brake cable

1. Mount the parking brake rear cable to the vehicle frame.

### Tightening torque:

31—46 Nm (3.2—4.7 m·kg, 23—34 ft·lb)

2. Connect the front and rear cable with the pin and install the stop ring.

# B

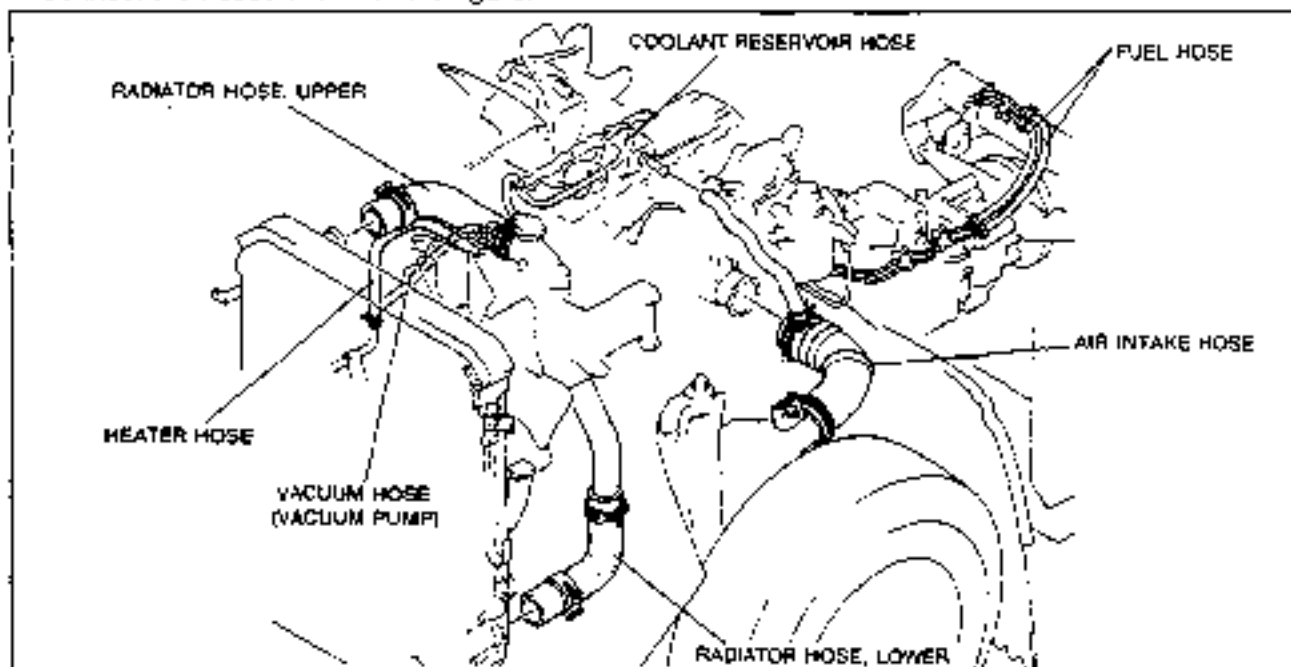
## INSTALLATION

### Step 4

#### Caution

- Position hose clamps in their original location on hoses, and squeeze the clamps tightly with large pliers to ensure a good fit.

- Connect the hoses shown in the figure.



97G082-404

### Step 5

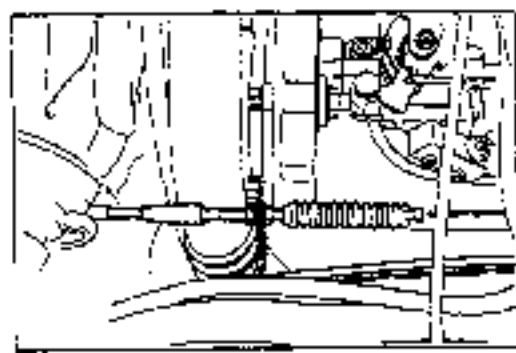
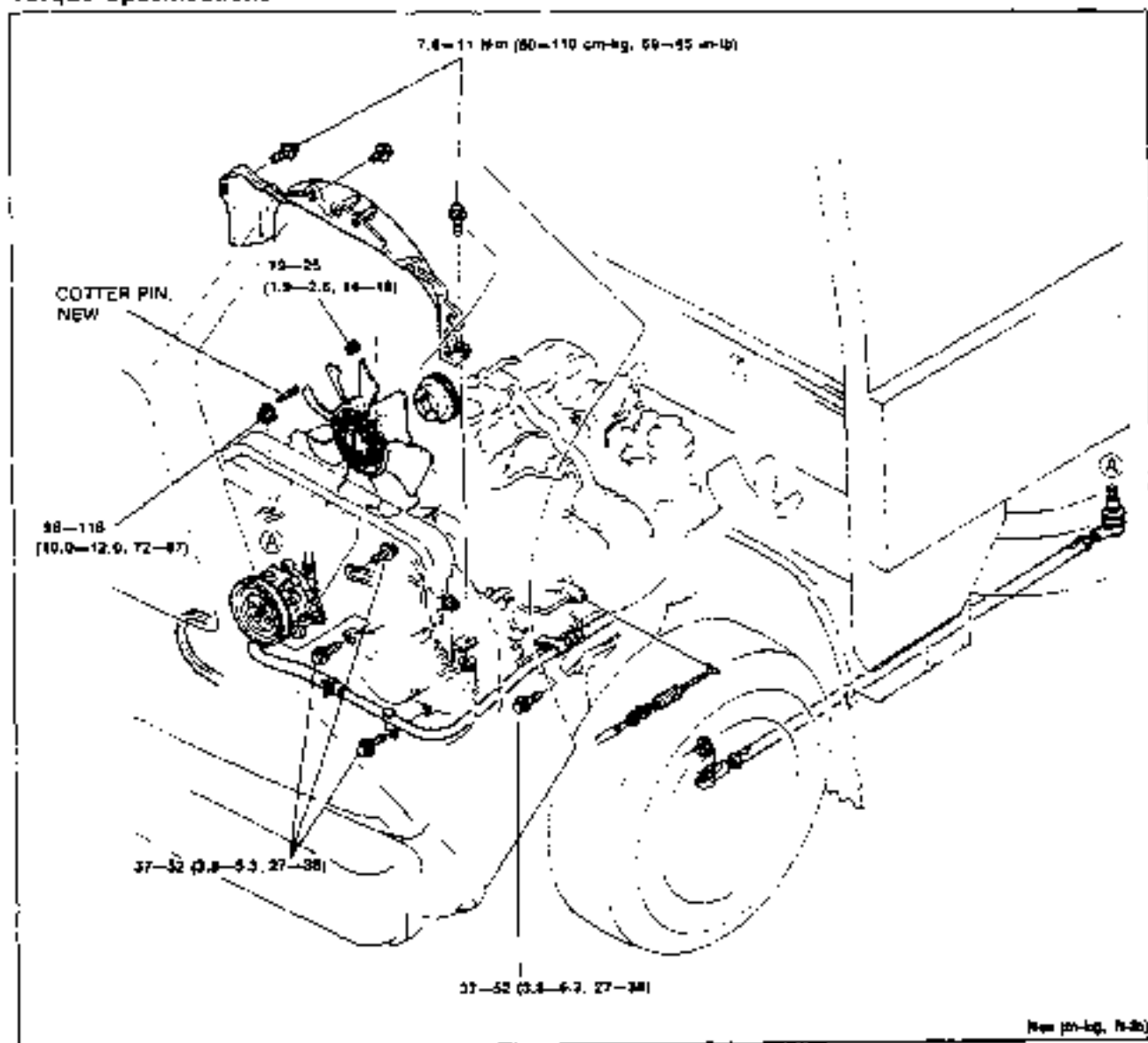
1. Connect the harness connectors shown in the figure.



## Step 6

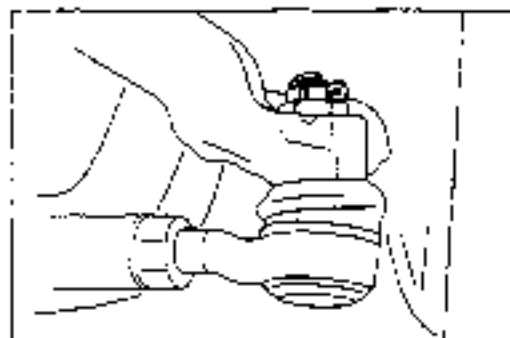
**Caution**

- After radiator cowling installation, rotate the cooling fan by hand and verify that the fan blade does not touch the radiator cowling. If the fan touches the cowling, adjust the radiator cowling mounting position.

**Torque Specifications****Accelerator cable**

1. Install the accelerator cable.
2. Adjust the cable deflection by turning the adjusting nut.

**Deflection: 1-3mm (0.04-0.12 in)**



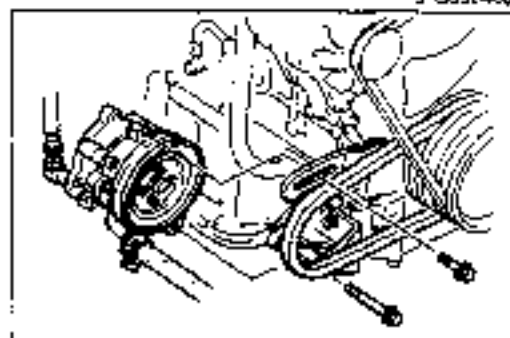
9T0392-406

**Tie-rod**

1. Apply grease to the ball joint of the tie-rod end.
2. Install the tie-rod to the knuckle.
3. Install the nut and a new cotter pin.

**Tightening torque:**

98—116 Nm (10.0—12.0 m·kg, 72—87 ft·lb)



9T0392-406

**P/S oil pump**

1. Install the P/S oil pump and loosely tighten the mounting bolts.

**Drive belt**

1. Install the drive belts.

**Cooling fan**

1. Install the cooling fan.

**Tightening torque:**

19—25 Nm (1.9—2.6 m·kg, 14—19 ft·lb)

**Radiator cowl, upper**

1. Install the upper radiator cowl.

**Tightening torque:**

7.8—11 Nm (80—110 cm·kg, 69—95 in·lb)

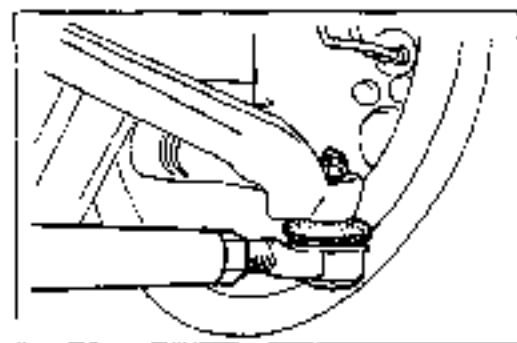
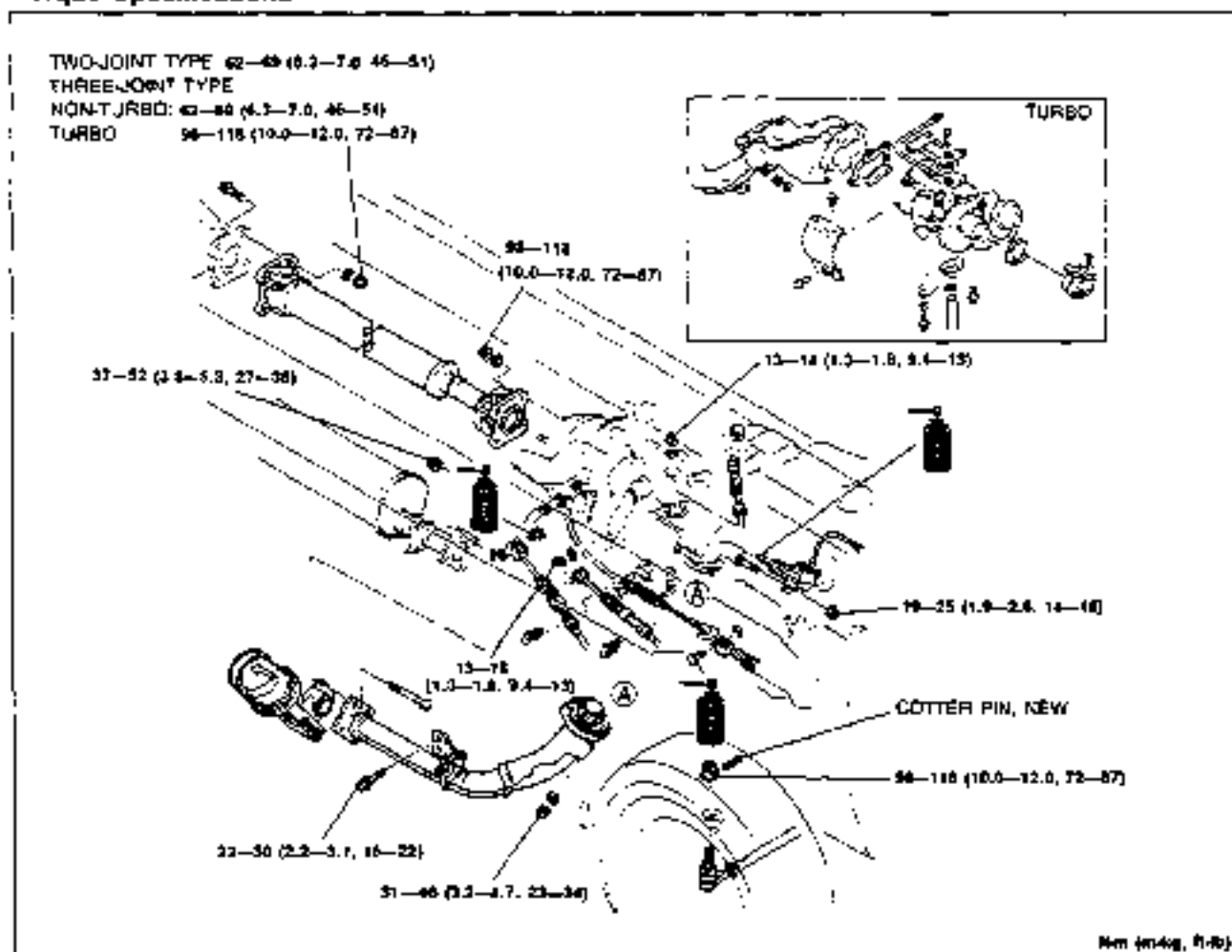
9T0392-410







## Step 3 Torque Specifications



9TG082416

### Propeller shaft

1. Install the propeller shaft. (Refer to Section L.)

### Tie-rod

1. Apply grease to the ball joint of the tie-rod end.
2. Install the tie rod to the knuckle.
3. Install the nut and a new cotter pin.

### Tightening torque:

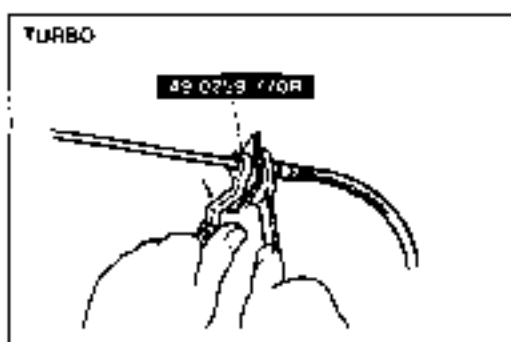
98-118 Nm (10.0-12.0 m-kg, 72-87 ft-lb)



9TG082417

### Speedometer cable

1. Install the speedometer cable.



97G032-418

### Clutch release cylinder (Non-Turbo)

1. Install the clutch release cylinder.

#### Tightening torque:

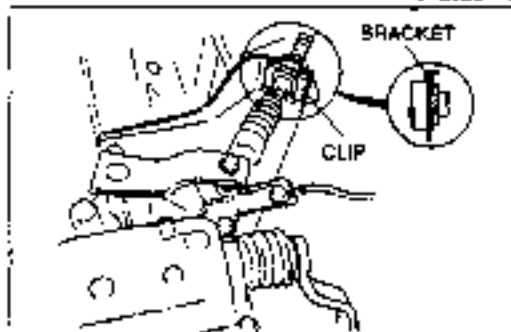
19—25 Nm (1.9—2.6 m·kg, 14—19 ft·lb)

### (Turbo)

1. Connect the clutch hose with the SST.

#### Tightening torque:

22—28 Nm (2.2—2.7 m·kg, 16—20 ft·lb)



97G032-420

### Sub-select cable

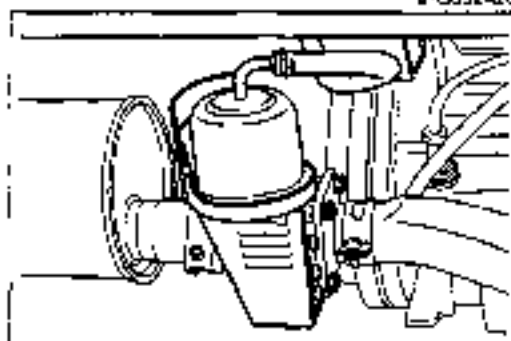
1. Install the sub-select cable. (Refer to Section J.)

### Shift/select cable

1. Install the shift/select cable.

### Turbocharger (Turbo)

1. Install the turbocharger. (Refer to Section F.)



97G032-422

### Front exhaust pipe

1. Install the front exhaust pipe.

#### Tightening torque:

31—45 Nm (3.2—4.7 m·kg, 23—34 ft·lb)...Pipe

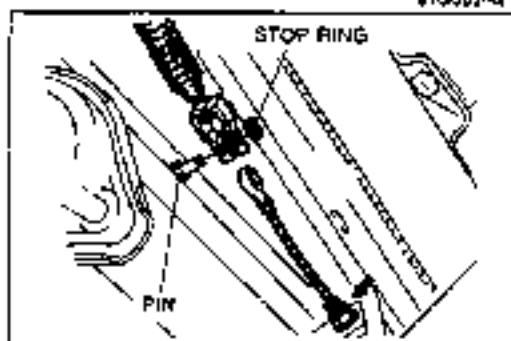
22—30 Nm (2.2—3.1 m·kg, 16—22 ft·lb)...Bracket

### Exhaust shutter valve

1. Install the exhaust shutter valve.

#### Tightening torque:

37—52 Nm (3.8—5.3 m·kg, 27—38 ft·lb)



97G032-422

### Parking brake cable

1. Mount the parking brake rear cable to the vehicle frame.

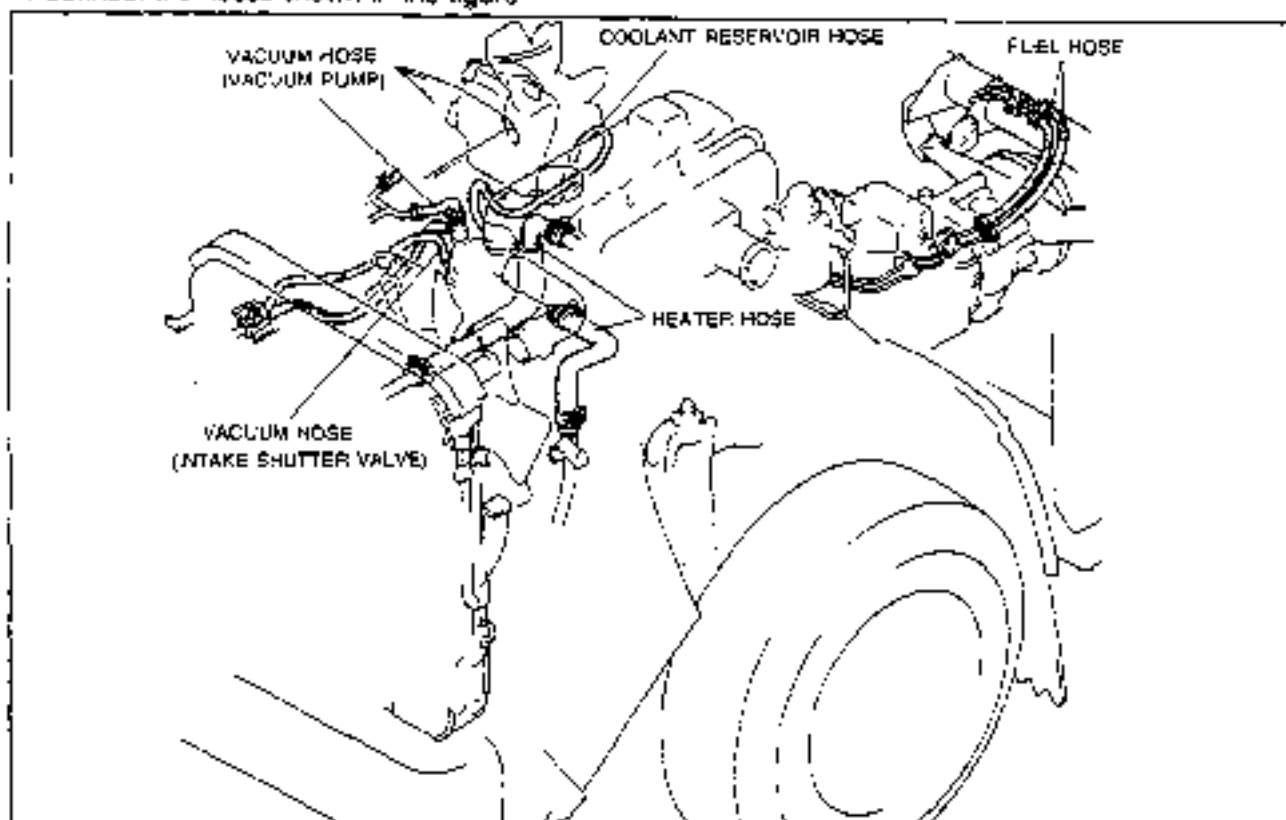
#### Tightening torque:

31—45 Nm (3.2—4.7 m·kg, 23—34 ft·lb)

2. Connect the front and rear cable with the pin and install the stop ring.

## Step 4

1. Connect the hoses shown in the figure



8\*G082-433

## Step 5

1. Connect the harness connectors shown in the figure.



9\*G092-434

# B

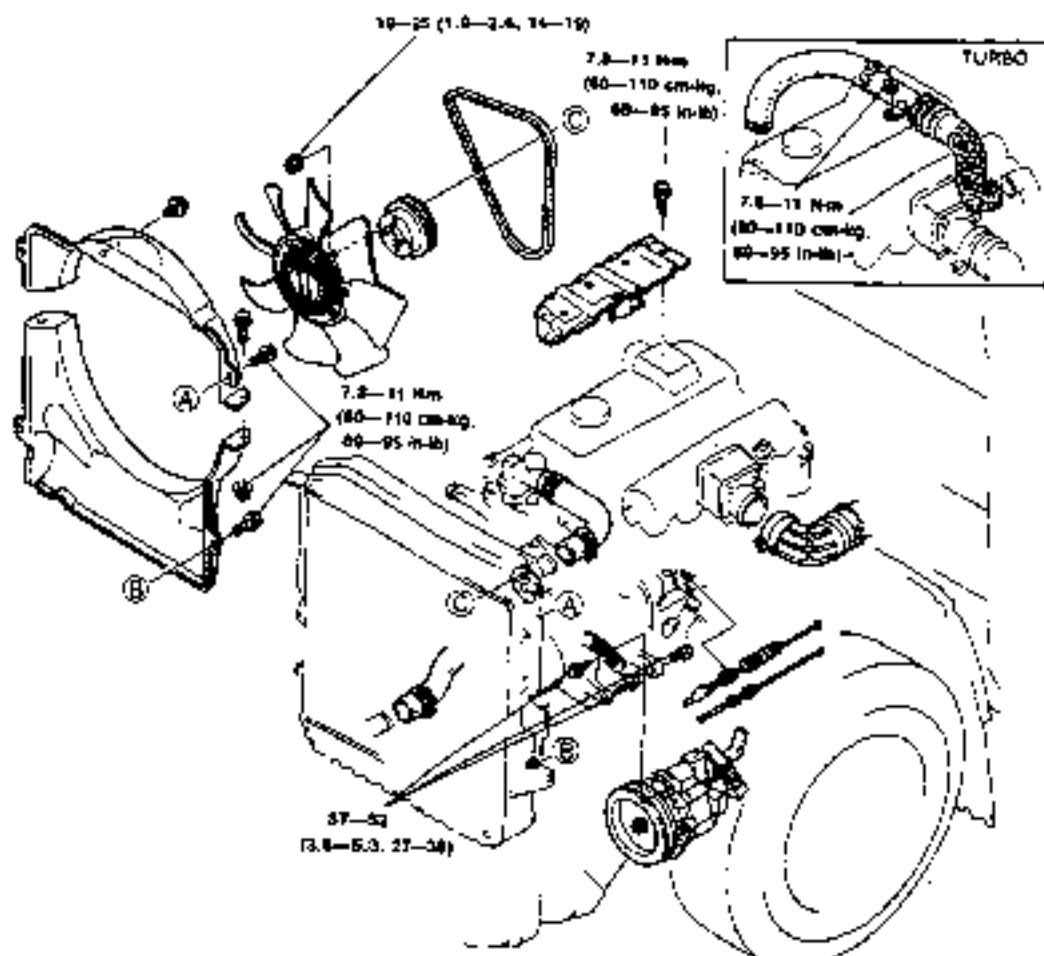
## INSTALLATION

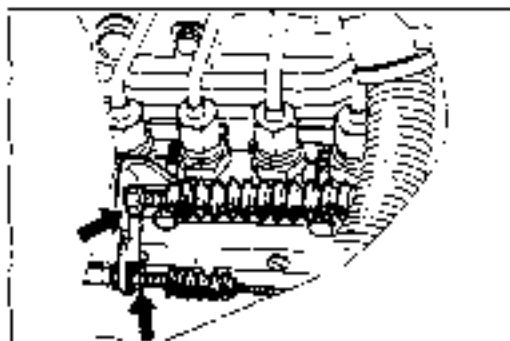
### Step 6

#### Caution

- Position hose clamps in their original location on hoses, and squeeze the clamps lightly with large pliers to ensure a good fit.
- After radiator cowling installation, rotate the cooling fan by hand and verify that the fan blade does not touch the radiator cowling.
- If the fan touches the cowling, adjust the radiator cowling mounting position.

#### Torque Specifications





9TGCB2-427

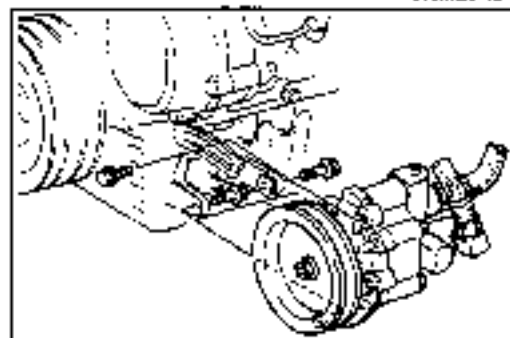
### Fuel stop cable

1. Install the fuel stop cable.

### Accelerator cable

1. Install the accelerator cable.
2. Adjust the cable deflection by turning the adjusting nut.

**Deflection: 1—3mm (0.04—0.12 in)**



9TGCB2-429

### P/S oil pump

1. Install the P/S oil pump and loosely tighten the mounting bolts.

### Drive belt

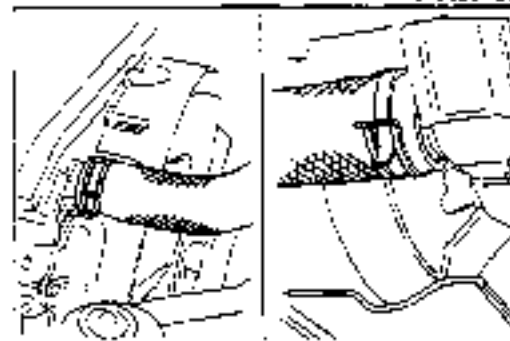
1. Install the drive belts.

### Cooling fan

1. Install the cooling fan.

### Tightening torque:

**19—25 N·m (1.9—2.6 m·kg, 14—19 ft·lb)**



9TGCB2-430

### Radiator hose

1. Connect the upper and lower radiator hoses.

### Radiator cowling

1. Install the radiator cowling.

### Exhaust manifold insulator

1. Install the exhaust manifold insulator.

### Tightening torque:

**7.8—11 N·m (80—110 cm·kg, 69—95 in·lb)**

### Air intake hose

1. Install the air intake pipe and hose.

# B

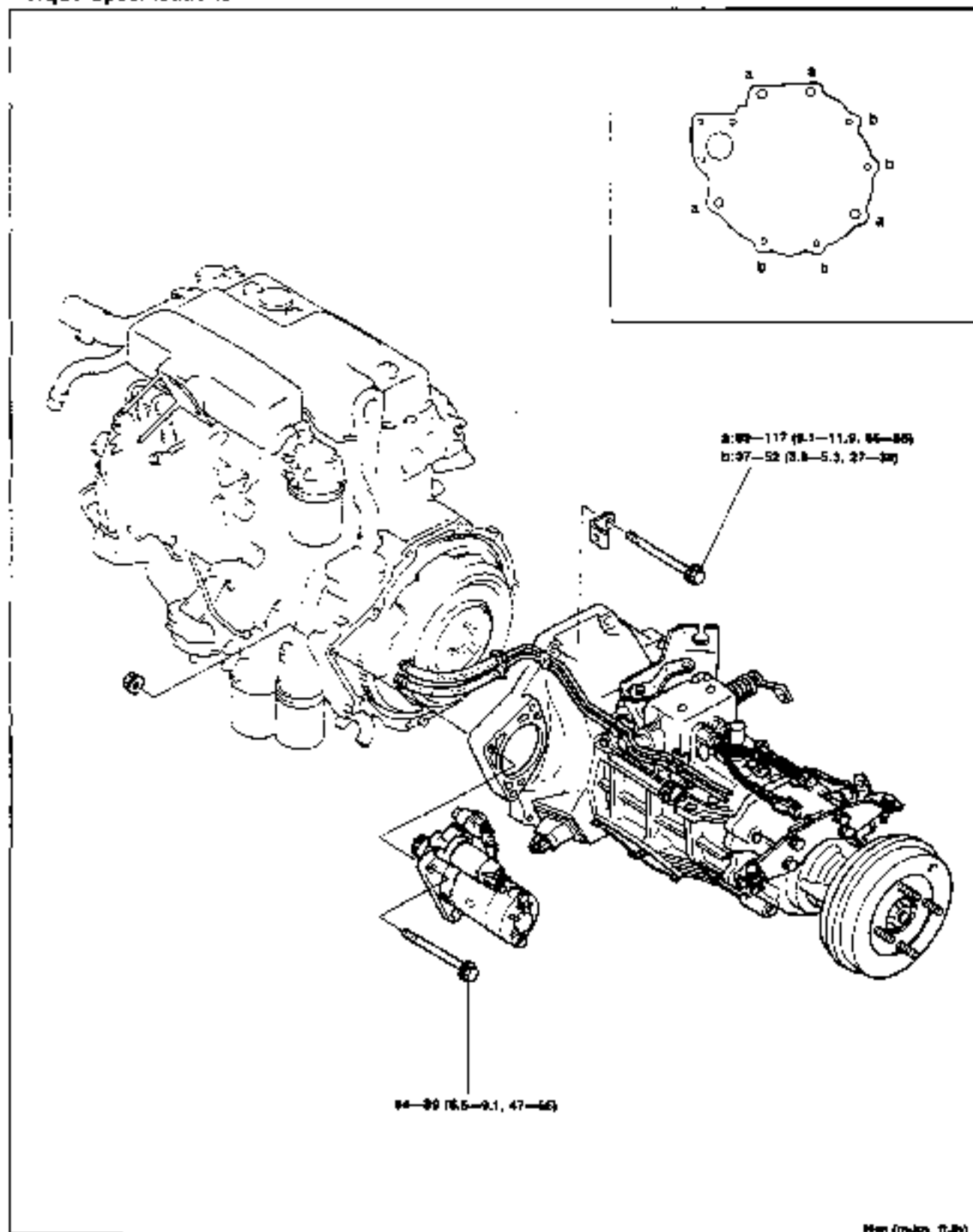
## INSTALLATION

### TF Engine

#### Step 1

1. Assemble the engine and transmission.

#### Torque Specifications

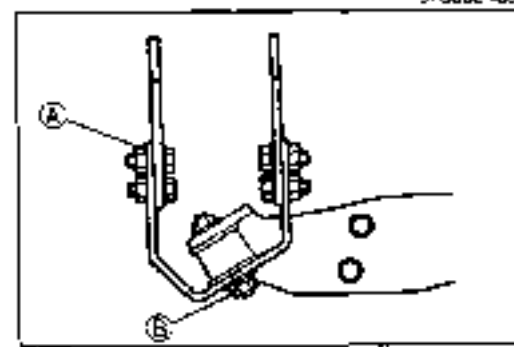
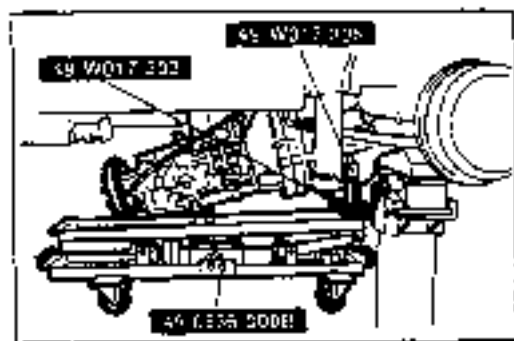
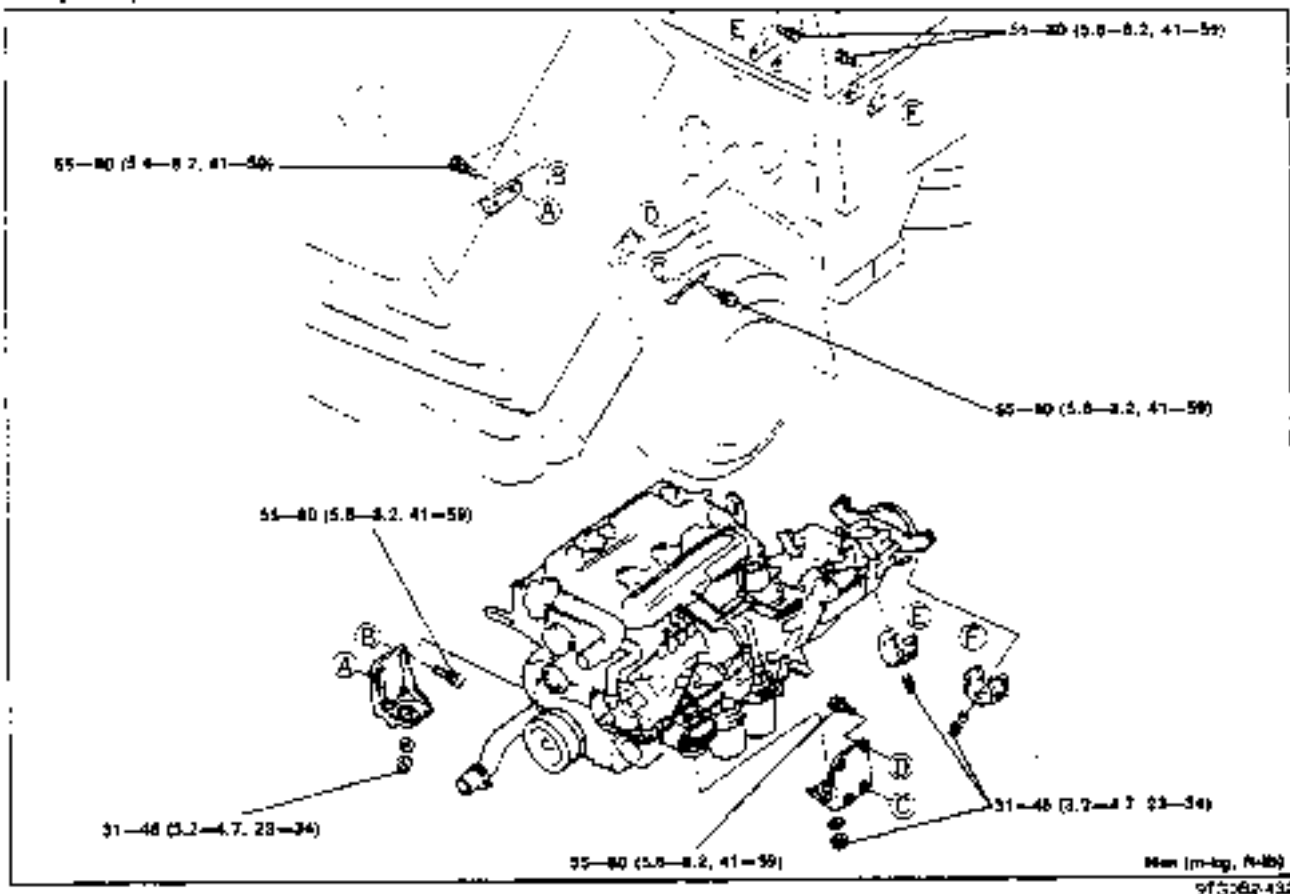


## Step 2

### Warning

- Be sure the vehicle is securely supported on safety stands.

### Torque Specifications



### Engine and transmission assembly

1. Set the engine on the SST.
2. Lift the engine into the engine compartment.
3. Mount the engine bracket to the vehicle.

### Tightening torque:

55-80 N·m (5.6-8.2 m·kg, 41-59 ft·lb)

4. Lower the engine and align the engine mount rubber with the engine bracket.
5. Install the engine mount nuts and loosely tighten them.
6. Install and tighten the transmission mount bracket.

### Tightening torque

Ⓐ: 55-80 N·m (5.6-8.2 m·kg, 41-59 ft·lb)  
 Ⓑ: 31-46 N·m (3.2-4.7 m·kg, 23-34 ft·lb)

7. Tighten the engine mount nuts.

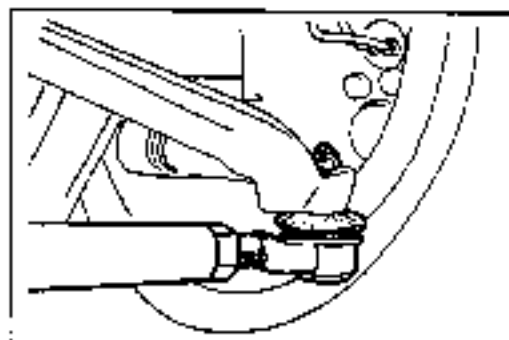
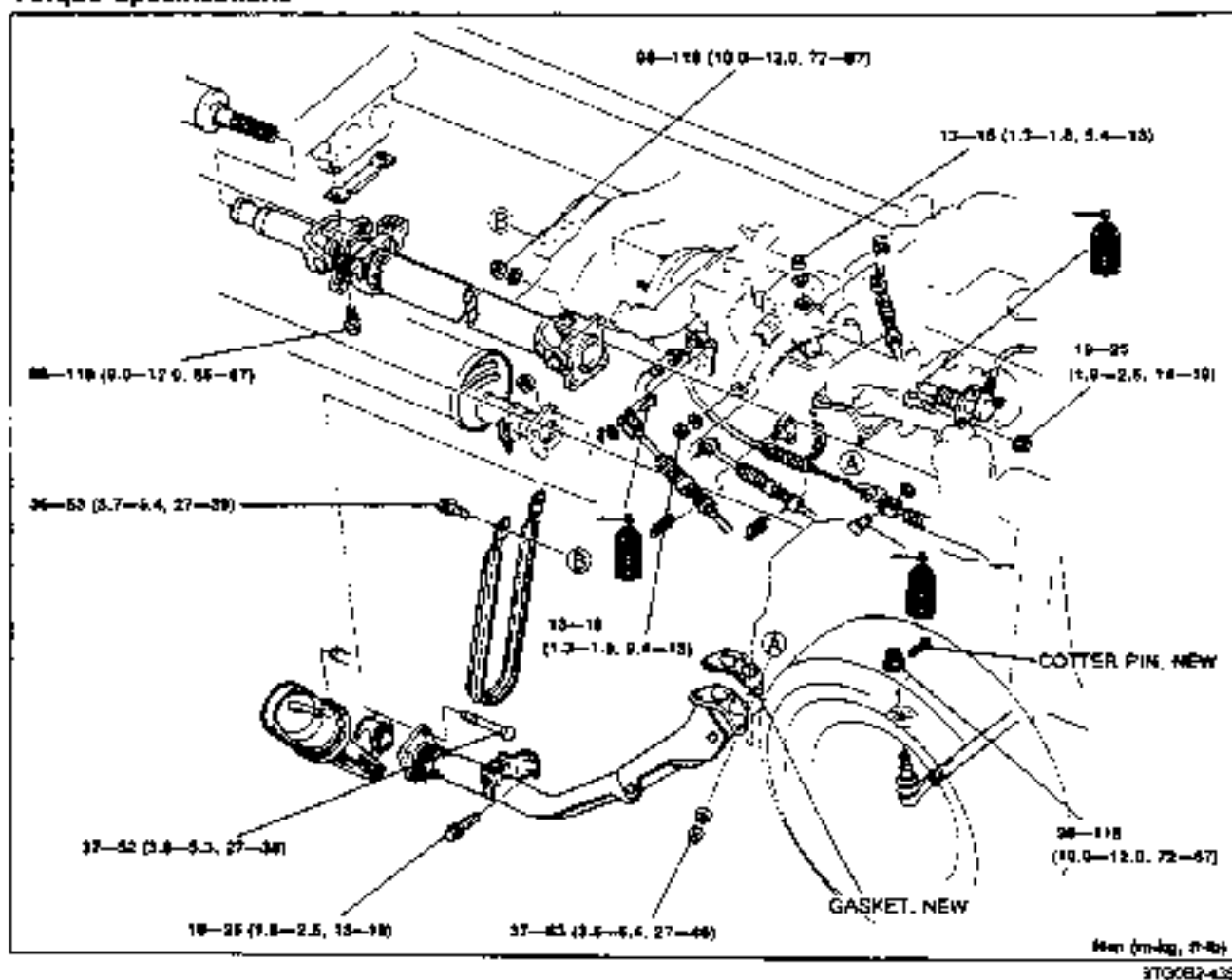
### Tightening torque:

31-46 N·m (3.2-4.7 m·kg, 23-34 ft·lb)

# B

## INSTALLATION

### Step 3 Torque Specifications



#### Propeller shaft

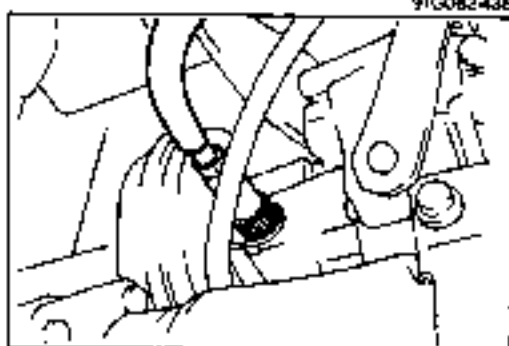
1. Install the propeller shaft. (Refer to Section L.)

#### Tie-rod

1. Apply grease to the ball joint of the tie-rod end.
2. Install the tie-rod to the knuckle.
3. Install the nut and a new cotter pin.

#### Tightening torque:

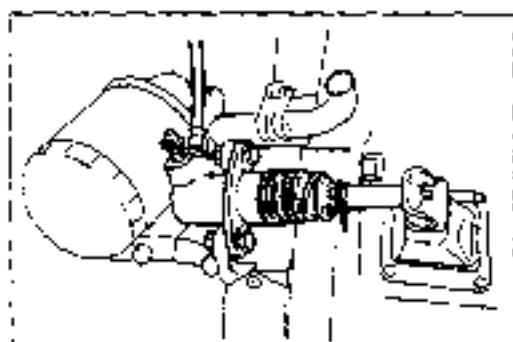
88-118 Nm (10.0-12.0 m-kg, 72-87 ft-lb)



#### Speedometer cable

1. Install the speedometer cable.





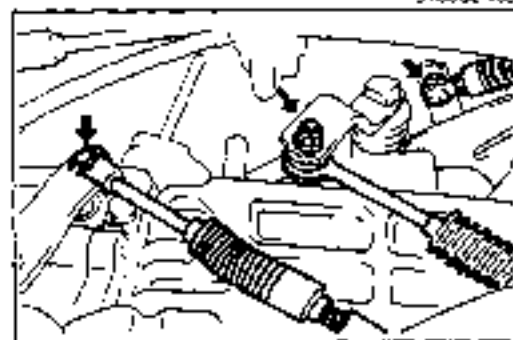
9TG082-435

### Clutch release cylinder

1. Install the clutch release cylinder.

#### Tightening torque:

19–25 Nm (1.9–2.6 m·kg, 14–18 ft·lb)



9TG082-439

### Sub-select cable

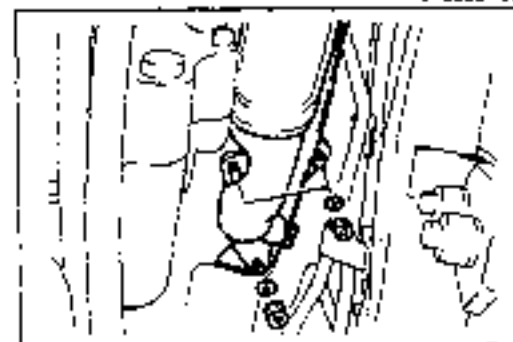
1. Install the sub-select cable. (Refer to Section J.)

### Shift/select cable

1. Install the shift/select cable.

#### Tightening torque:

13–15 Nm (1.3–1.6 m·kg, 9.4–13 ft·lb)



9TG082-440

### Front exhaust pipe

1. Install the front exhaust pipe.

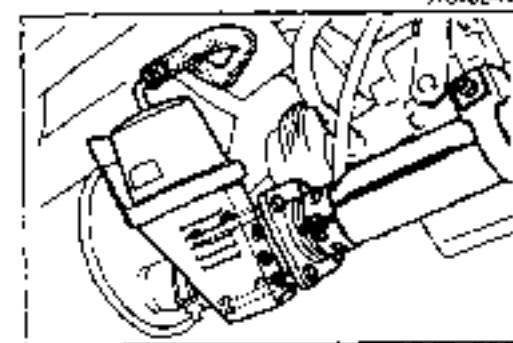
#### Tightening torque:

37–63 Nm (3.8–6.4 m·kg, 27–46 ft·lb)

2. Install the bracket to the transmission.

#### Tightening torque:

18–25 Nm (1.8–2.5 m·kg, 13–18 ft·lb)

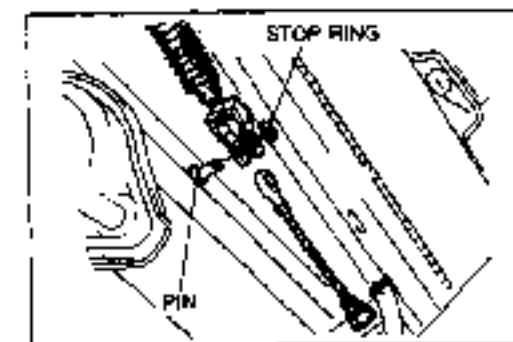


### Exhaust shutter valve

1. Install the exhaust shutter valve

#### Tightening torque:

37–52 Nm (3.8–5.3 m·kg, 27–38 ft·lb)



9TG082-444

### Parking brake cable

1. Mount the parking brake rear cable to the vehicle frame.

#### Tightening torque:

31–46 Nm (3.2–4.7 m·kg, 23–34 ft·lb)

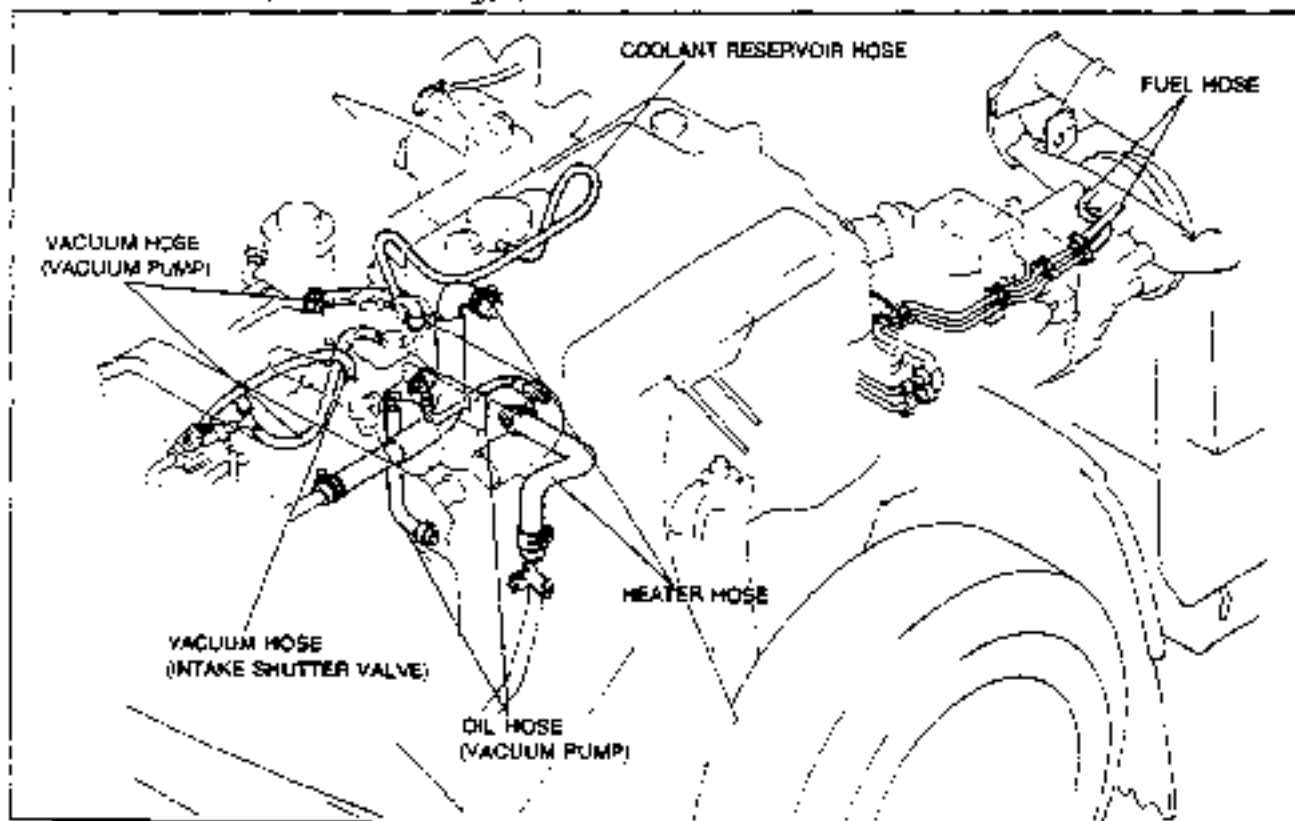
2. Connect the front and rear cable with the pin and install the stop ring.

# B

## INSTALLATION

### Step 4

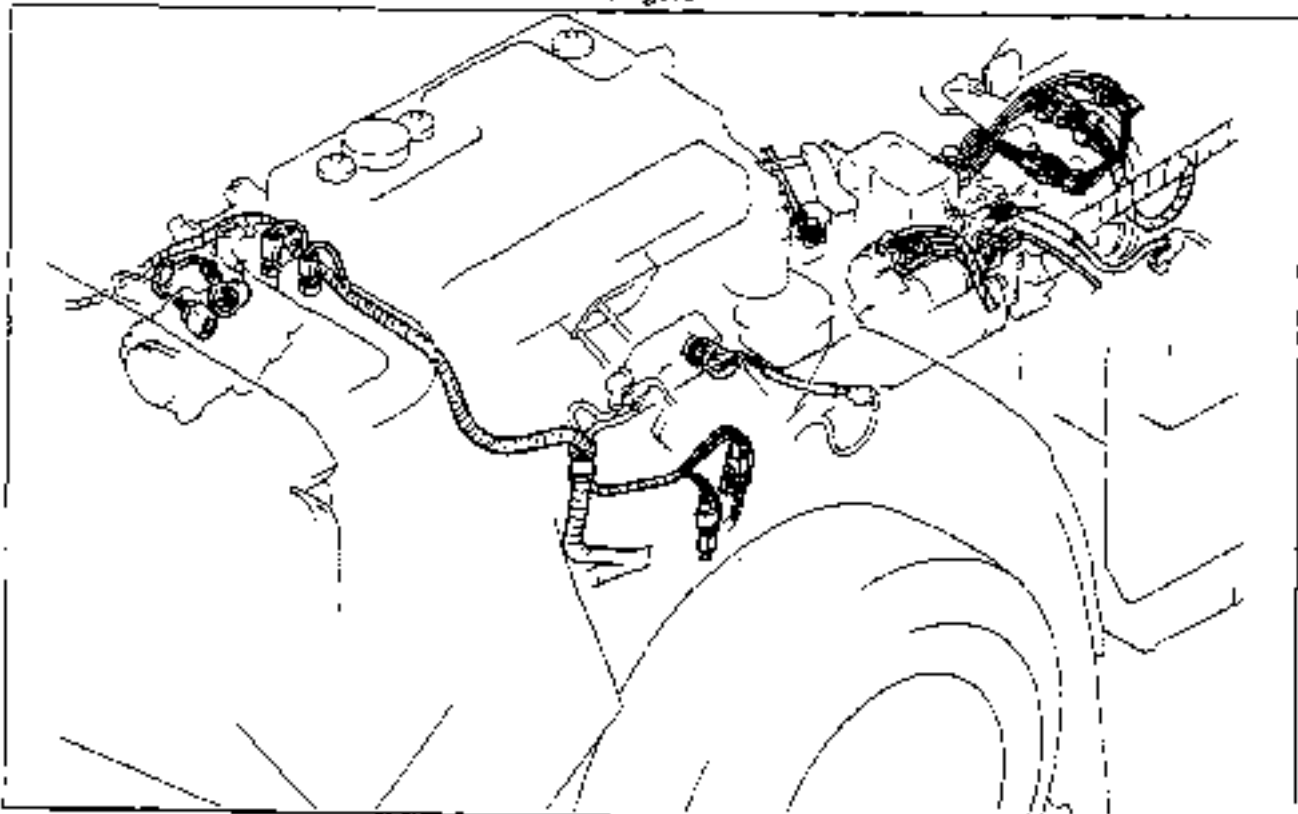
1 Connect the hoses shown in the figure.



6T00B2 442

### Step 5

1 Connect the harness connectors shown in the figure.



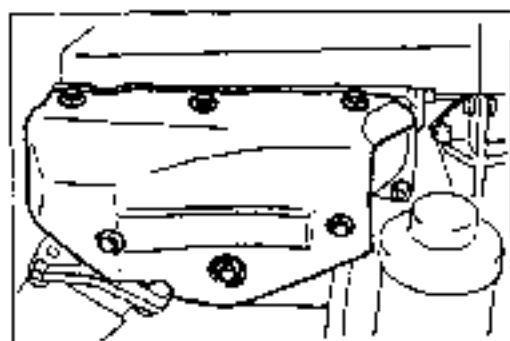
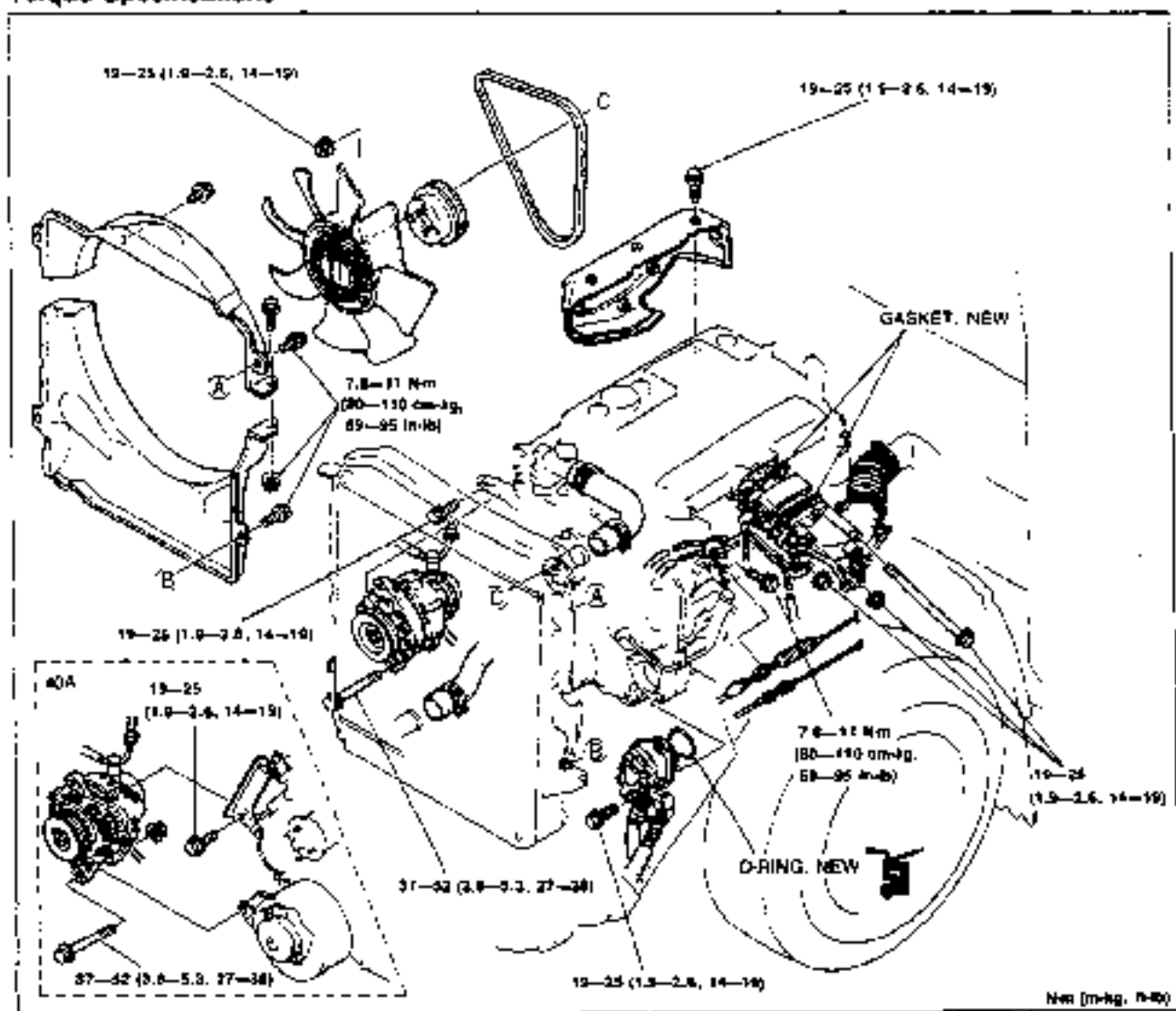
## Step 6

### Caution

- Position hose clamps in their original location on hoses, and squeeze the clamps lightly with large pliers to ensure a good fit.
- After radiator cowling installation, rotate the cooling fan by hand and verify that the fan blade does not touch the radiator cowling.

If the fan touches the cowling, adjust the radiator cowling mounting position.

### Torque Specifications



9T5082-445

### Exhaust manifold insulator

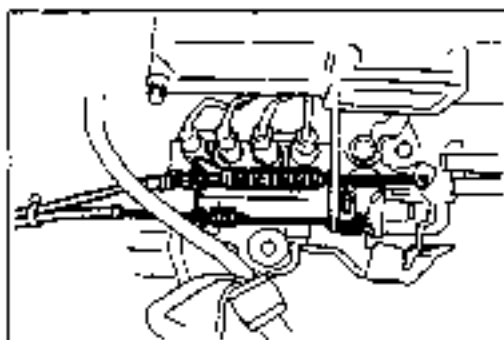
1. Install the exhaust manifold insulator.

### Tightening torque:

19-25 Nm (1.9-2.6 m-kg, 14-19 ft-lb)

Nuts (m-kg, in-lb)

9T3082-445



9T50B2-447

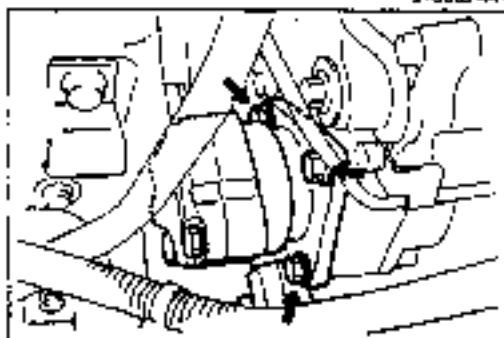
**Fuel stop cable**

1. Install the fuel stop cable.

**Accelerator cable**

1. Install the accelerator cable.
2. Adjust the cable deflection by turning the adjusting nut.

**Deflection:** 1—3mm (0.04—0.12 in)



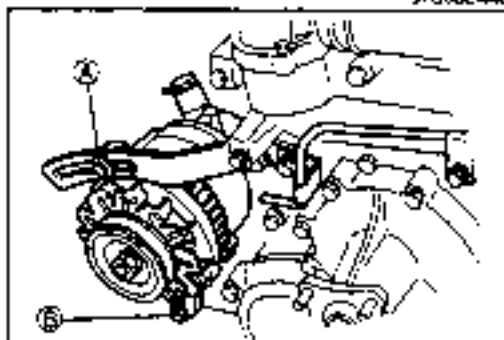
9T50B2-448

**P/S oil pump**

1. Install the P/S oil pump and new O-ring.

**Tightening torque:**

19—25 Nm (1.9—2.6 m·kg, 14—19 ft·lb)



9T50B2-449

**Alternator**

1. Install the alternator strap.

**Tightening torque:**

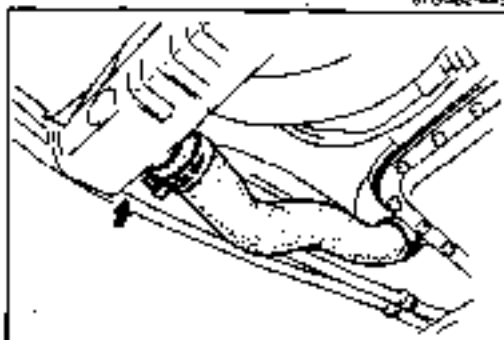
19—25 Nm (1.9—2.6 m·kg, 14—19 ft·lb)

2. Install the alternator.

**Tightening torque**

(A): 19—25 Nm (1.9—2.6 m·kg, 14—19 ft·lb)

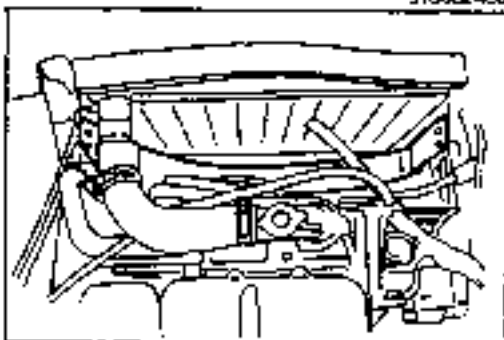
(B): 37—52 Nm (3.8—5.3 m·kg, 27—38 ft·lb)



9T50B2-450

**Radiator hose, lower**

1. Connect the lower radiator hose.



9T50B2-451

**Radiator cowling, lower**

1. Install the lower radiator cowling

**Tightening torque:**

7.6—11 Nm (80—110 cm·kg, 69—95 in·lb)

### Drive belt

1. Install the drive belts.

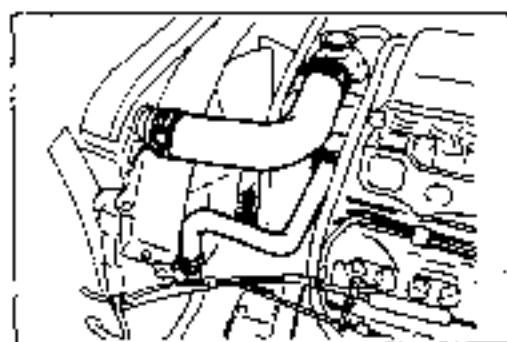
### Cooling fan

1. Install the cooling fan.

### Tightening torque:

18—25 N·m (1.9—2.6 m·kg, 14—19 ft·lb)

9T002452



81Q02454

### Radiator cowl, upper

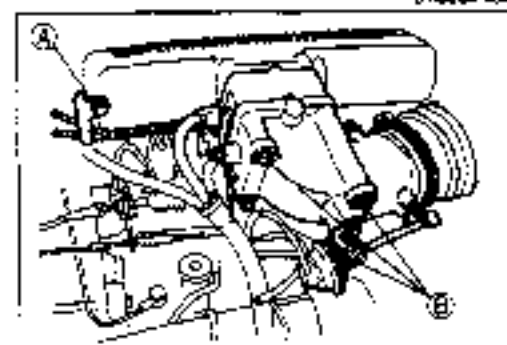
1. Install the upper radiator cowl.

### Tightening torque:

7.8—11 N·m (80—110 cm·kg, 69—95 in·lb)

### Radiator hose, upper

1. Connect the upper radiator hose.



9T002455

### Air hose, intake manifold elbow

1. Install the intake manifold elbow and air heater and a new gasket.
2. Install the vacuum pipe.

### Tightening torque

- Ⓐ: 7.8—11 N·m (80—110 cm·kg, 69—95 in·lb)
- Ⓑ: 18—25 N·m (1.9—2.6 m·kg, 14—19 ft·lb)

3. Connect the vacuum hose.

**Steps After Installation**

1. Install the undercover.
2. If the engine oil was drained, fill with the specified amount and type of engine oil. (Refer to Section D.)
3. Fill the radiator with the specified amount and type of engine coolant. (Refer to Section E.)
4. If the transmission oil was drained, fill with the specified amount and type of transmission oil. (Refer to Section J.)
5. Adjust the drive belt deflection. (Refer to page B-9.)
6. Bleed the air from the fuel system. (Refer to page B-16.)
7. Bleed the air from the clutch system. (Refer to Section H.)
8. Connect the negative battery cable.
9. Start the engine and check the following.
  - (1) Engine oil, transmission oil, and engine coolant leakage.
  - (2) Injection timing, idle speed. (Refer to page B-11.)
10. Perform a road test.
11. Recheck the engine oil and engine coolant levels.

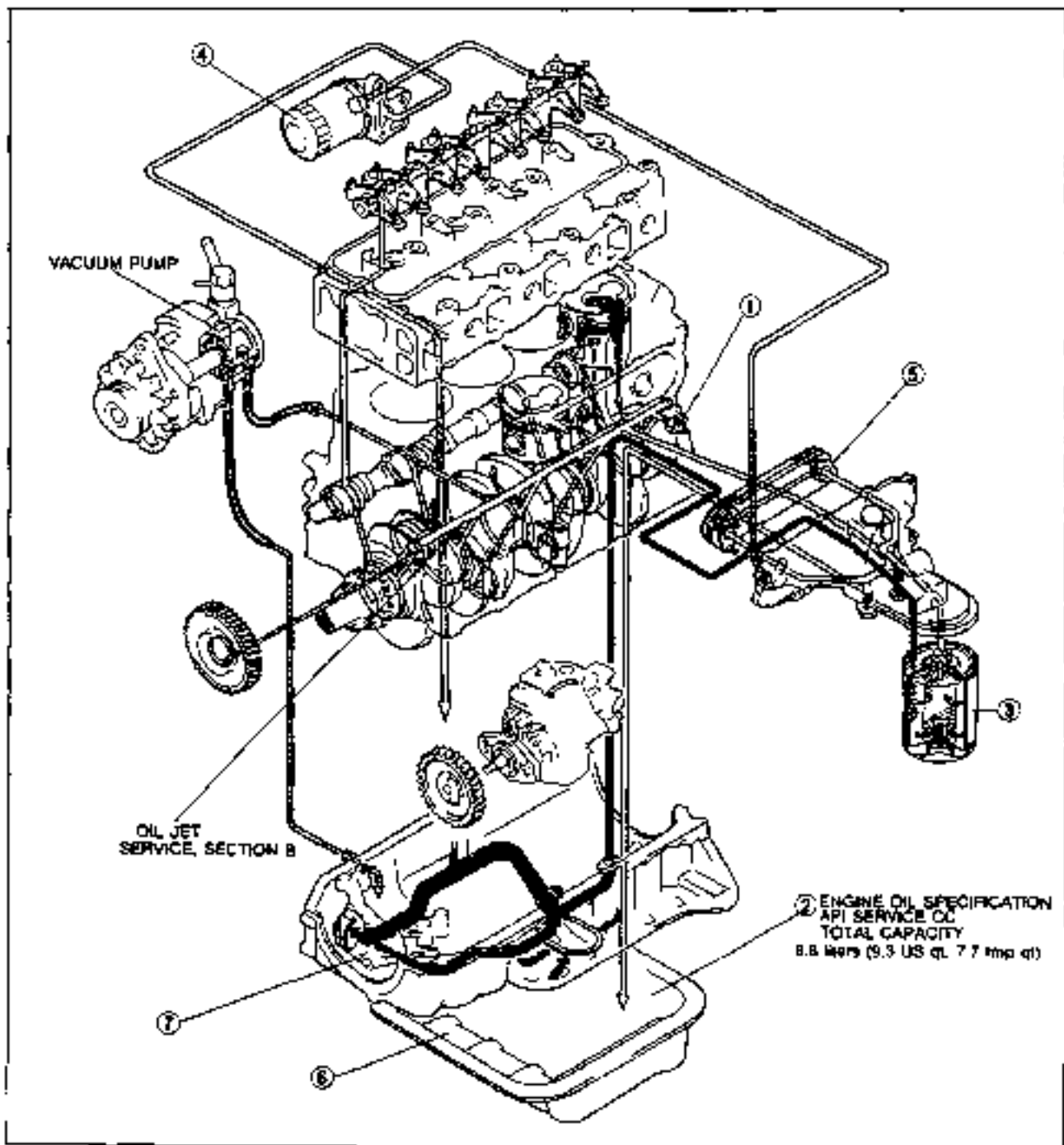
91P08X-052

# LUBRICATION SYSTEM

<b>INDEX</b> .....	D- 2
HA ENGINE.....	D- 2
SL ENGINE.....	D- 3
TF ENGINE.....	D- 4
<b>OUTLINE</b> .....	D- 5
SPECIFICATIONS.....	D- 5
<b>TROUBLESHOOTING GUIDE</b> .....	D- 6
<b>OIL PRESSURE</b> .....	D- 6
PREPARATION.....	D- 6
INSPECTION.....	D- 6
<b>ENGINE OIL</b> .....	D- 7
INSPECTION.....	D- 7
REPLACEMENT.....	D- 7
<b>OIL FILTER</b> .....	D- 8
REPLACEMENT.....	D- 8
<b>OIL BYPASS FILTER</b> .....	D- 8
REPLACEMENT.....	D- 8
<b>OIL COOLER</b> .....	D- 9
REMOVAL / INSTALLATION.....	D- 9
<b>OIL PAN</b> .....	D-11
REMOVAL / INSTALLATION.....	D-11
<b>OIL PUMP</b> .....	D-14
REMOVAL / INSTALLATION.....	D-14
DISASSEMBLY / INSPECTION / ASSEMBLY.....	D-17

## INDEX

## HA ENGINE

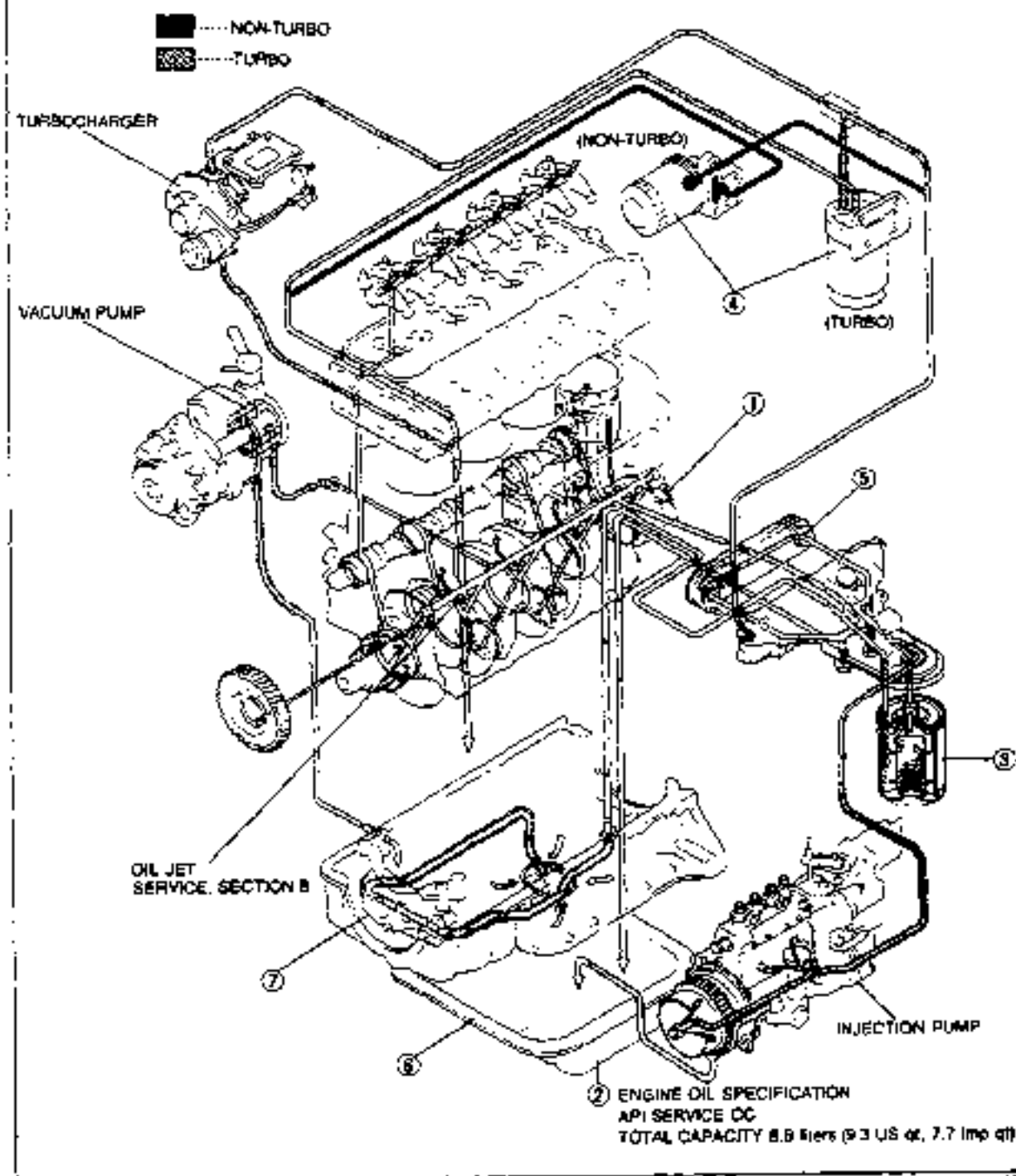


9TFO0X-02

- |  |           |  |           |
|--|-----------|--|-----------|
| 1. Oil pressure<br>Inspection.....       | page D- 6 | 5. Oil cooler<br>Removal / Installation..... | page D- 9 |
| 2. Engine oil<br>Inspection.....         | page D- 7 | 6. Oil pan<br>Removal / Installation.....    | page D-11 |
| Replacement.....                         | page D- 7 | 7. Oil pump<br>Removal / Installation.....   | page D-14 |
| 3. Oil filter<br>Replacement.....        | page D- 8 | Disassembly / Inspection /<br>Assembly ..... | page D-17 |
| 4. Oil bypass filter<br>Replacement..... | page D- 8 |  |           |



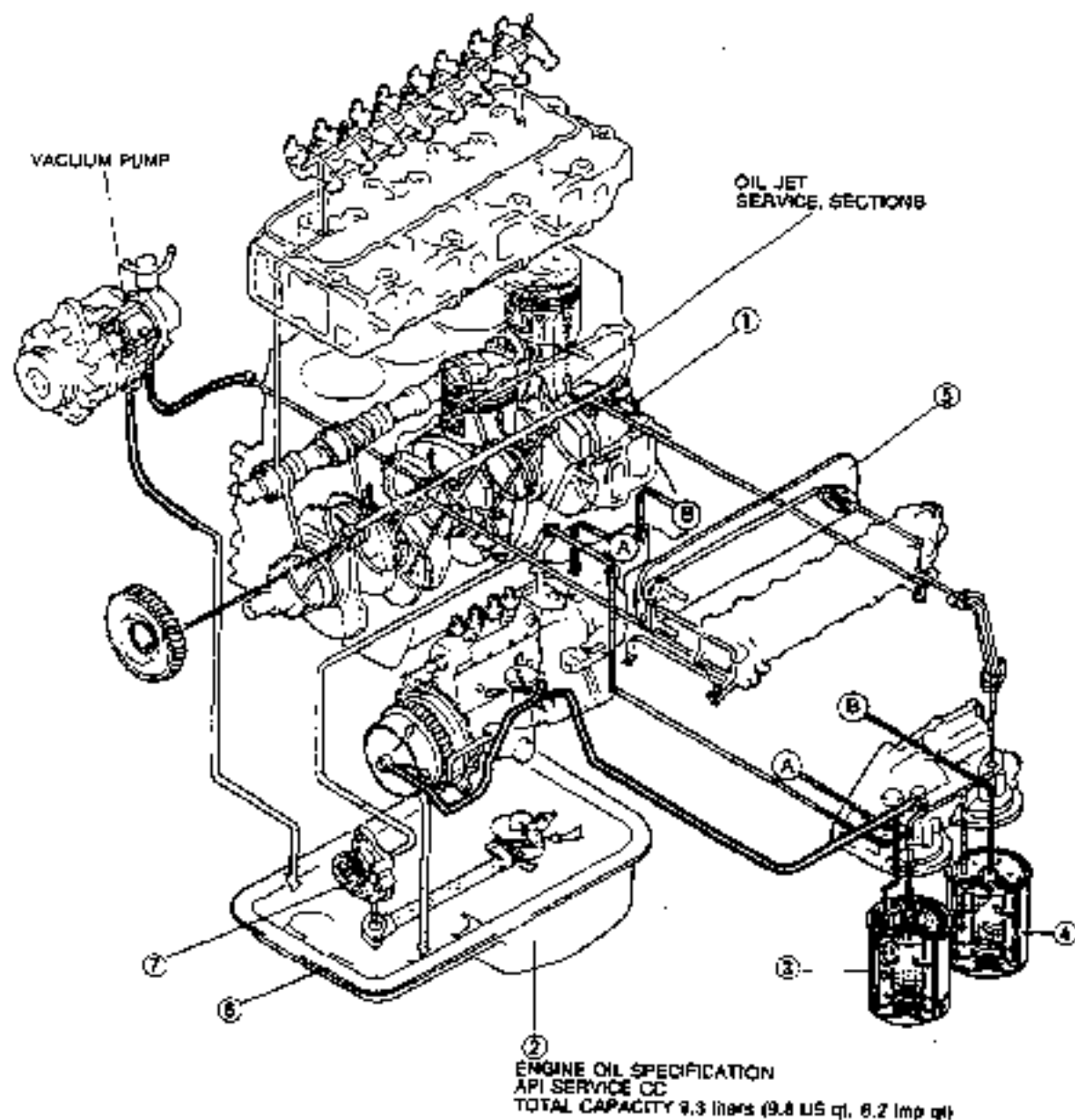
## SL ENGINE



81FC0X-003

- |  |           |  |           |
|--|-----------|--|-----------|
| 1. Oil pressure<br>Inspection .....      | page D- 6 | 5. Oil cooler<br>Removal / Installation..... | page D- 9 |
| 2. Engine oil<br>Inspection.....         | page D- 7 | 6. Oil pan<br>Removal / Installation.....    | page D-11 |
| Replacement.....                         | page D- 7 | 7. Oil pump<br>Removal / Installation.....   | page D-14 |
| 3. Oil filter<br>Replacement.....        | page D- 8 | Disassembly / Inspection /<br>Assembly.....  | page D-17 |
| 4. Oil bypass filter<br>Replacement..... | page D- 8 |  |           |

## TF ENGINE



3TF004-004

- |  |           |  |           |
|--|-----------|--|-----------|
| 1. Oil pressure<br>Inspection.....       | page D- 6 | 5. Oil cooler<br>Removal / Installation..... | page D- 9 |
| 2. Engine oil<br>Inspection.....         | page D- 7 | 6. Oil pan<br>Removal / Installation.....    | page D-11 |
| Replacement.....                         | page D- 7 | 7. Oil pump<br>Removal / Installation.....   | page D-14 |
| 3. Oil filter<br>Replacement.....        | page D- 8 | Disassembly / Inspection /<br>Assembly.....  | page D-17 |
| 4. Oil bypass filter<br>Replacement..... | page D- 8 |  |           |

OUTLINE

SPECIFICATIONS

Item	Engine	HA	SL	TF
Lubricator system:		Force-fed type		
Oil pump	Type	Positive displacement gear		
	Regulating pressure kPa (kg/cm <sup>2</sup> , ps)	606-667 (6.2-6.6, 88-97)		-
Oil filter	Type	Full-flow, paper element		
	Relief pressure differential kPa (kg/cm <sup>2</sup> , ps)	7.2-17.5 (0.8-1.2, 11-17)		
	Regulating pressure kPa (kg/cm <sup>2</sup> , ps)	-		606-667 (6.2-6.6, 88-97)
Oil bypass filter	Type	Paper element		
Oil cooler	Type	Water-cooled		
Oil capacity	Total (dry engine) liters (US qt., Imp qt.)	8.8 (9.3, 7.7)		9.3 (9.8, 8.2)
	Oil pan liters (US qt., Imp qt.)	6.5 (6.9, 5.7)		7.0 (7.4, 6.2)
	Oil filter liter (US qt., Imp qt.)	1.0 (1.06, 0.88)		
	Oil bypass filter liter (US qt., Imp qt.)	0.6 (0.63, 0.51)		
Engine oil		API service CC		

9TFC02 D05

TROUBLESHOOTING GUIDE

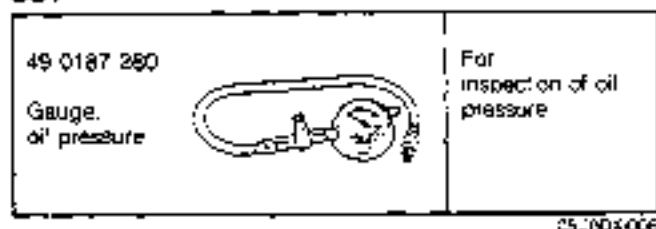
Problem	Possible Cause	Remedy	Page
Engine hard starting	Improper viscosity engine oil Insufficient engine oil	Replace Add oil	D-7 D-7
Excessive oil consumption	Oil working up or down Oil leakage	Refer to Section G Repair	-
Oil pressure low	Insufficient oil Oil leakage Worn and/or damaged oil pump gear Worn plunger (inside oil pump) or weak spring Clogged oil strainer Excessive main bearing or connecting rod bearing clearance	Add oil Repair Replace Replace Clean Refer to Section E	D-7 - D-17 D-17 - -
Warning lamp (oil pressure) illuminates while engine running	Oil pressure drop Insufficient oil Malfunction of oil pressure switch Malfunction of oil level sensor Malfunction of electrical system	As described above Add oil Refer to Section T Refer to Section T Refer to Section T	- D-7 - - -

9TFC02 D05

## OIL PRESSURE

## PREPARATION

## SST



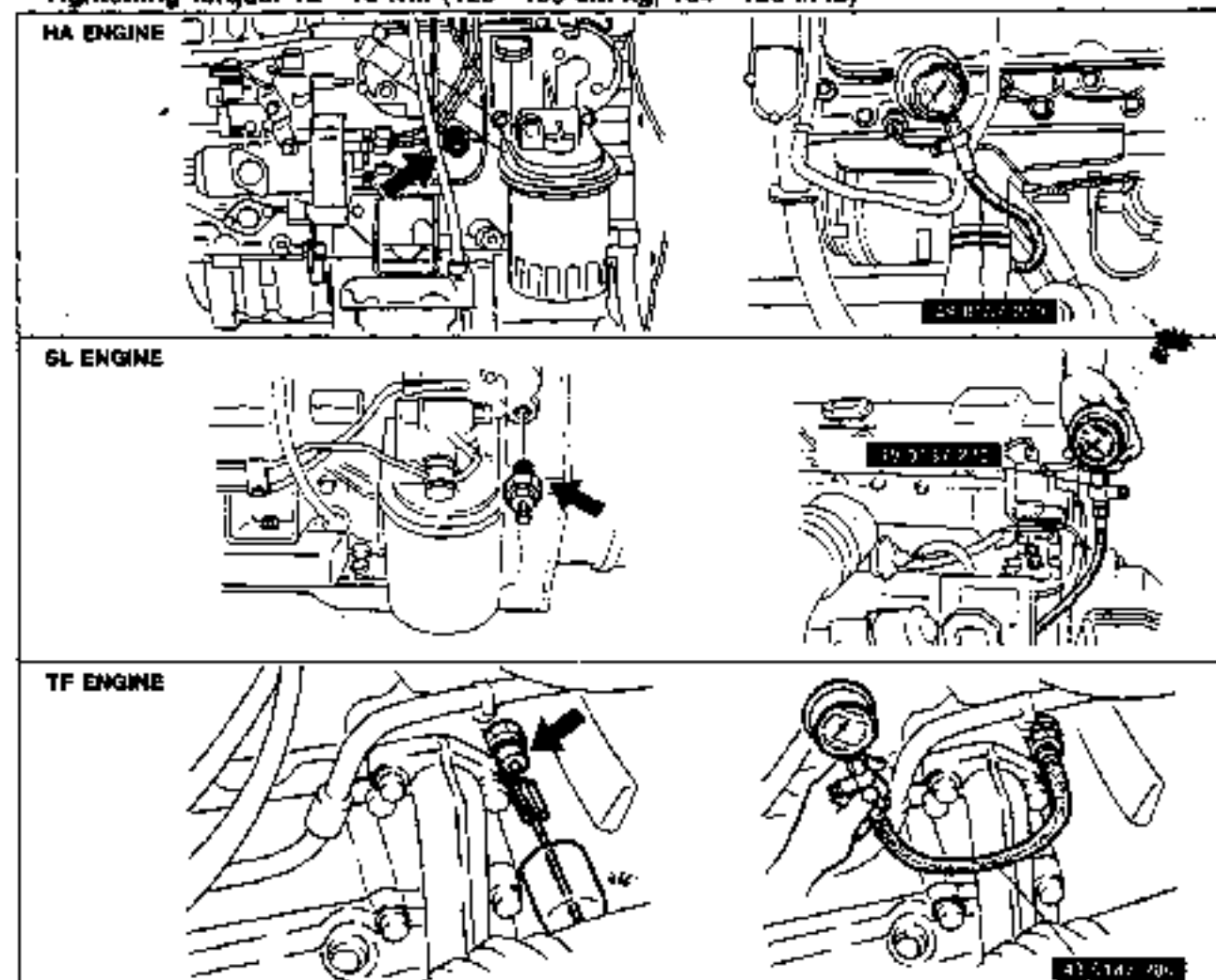
## INSPECTION

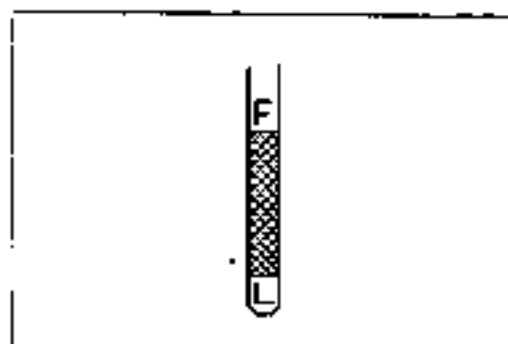
1. Remove the oil pressure switch
2. Screw the **SST** into the oil pressure switch installation hole
3. Warm up the engine to normal operating temperature
4. Run the engine at **3,600 rpm**, and note the gauge reading.

**Oil pressure: 373 kPa (3.8 kg/cm<sup>2</sup>, 54 psi) min.**

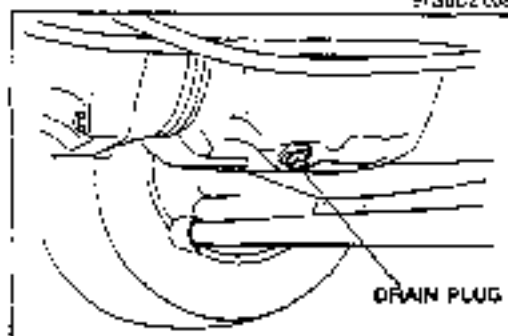
5. If the pressure is not as specified, check for the cause and repair (Refer to Troubleshooting Guide.)
6. Remove the **SST** and install the oil pressure switch.

**Tightening torque: 12–18 Nm (120–180 cm·kg, 104–156 in·lb)**



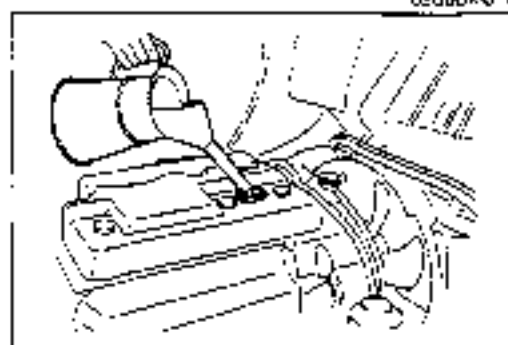


9TGD2 008



DRAIN PLUG

05JDDX 011



9TGD2 009

## ENGINE OIL

## INSPECTION

1. Be sure the vehicle is on level ground.
2. Warm up the engine to normal operating temperature and stop it.
3. Wait for five minutes.
4. Remove the oil level gauge and check the oil level and condition.
5. Add or replace oil as necessary.

## Note

- The distance between the L and F marks on the level gauge represents 2.0 liters (2.11 USqt, 1.76 Imp qt).

## REPLACEMENT

## Warning

- Be careful when draining; the oil is hot.

1. Warm up the engine to normal operating temperature and stop it.
2. Remove the oil filler cap and the oil pan drain plug.
3. Drain the oil into a suitable container.
4. Install a new gasket and the drain plug.

## Tightening torque:

29—41 Nm (3.0—4.2 m·kg, 22—30 ft·lb)

5. Refill the engine with the specified type and amount of engine oil.

## Oil pan capacity

HA, SL: 6.5 liters (6.9 US qt, 5.7 Imp qt)

TF: 7.0 liters (7.4 US qt, 6.2 Imp qt)

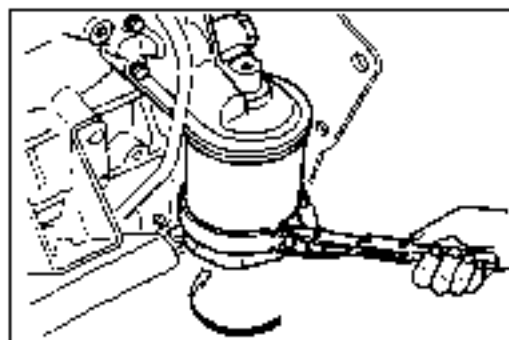
6. Refit the oil filler cap.
7. Run the engine and check for leaks.
8. Stop the engine and check the oil level. Add oil if necessary.

## Recommended SAE Viscosity

Temperature	(°C)	-30	-20	-10	0	10	20	30	40	50	
	(°F)	-20	0	20	40	60	80	100	120		
Engine oil		30									
		20W-20									
		10W-30									

Anticipated ambient temperature range before succeeding oil change, °C (°F).

## D OIL FILTER, OIL BYPASS FILTER

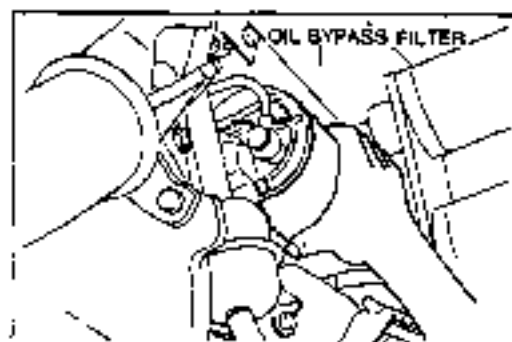


### OIL FILTER

#### REPLACEMENT

1. Remove the oil filter with a suitable wrench.
2. Use a clean rag to wipe off the mounting surface on the engine.
3. Apply a small amount of clean engine oil to the rubber seal of the new filter.
4. Install the oil filter and tighten it by hand until the rubber seal contacts the base.
5. Tighten the filter 1/2 turn with a filter wrench.
6. Start the engine and check for leaks.
7. Check the oil level and add oil if necessary.

**Oil filter capacity: 1.0 liter (1.06 US qt, 0.88 Imp qt)**



### OIL BYPASS FILTER

#### REPLACEMENT

1. Remove the oil bypass filter with a suitable wrench.
2. Use a clean rag to wipe off the mounting surface on the engine.
3. Apply a small amount of clean engine oil to the rubber seal of the new filter.
4. Install the oil bypass filter and tighten it by hand.
5. Start the engine and check for leaks.
6. Check the oil level and add oil if necessary.

**Oil bypass filter capacity:  
0.6 liter (0.63 US qt, 0.53 Imp qt)**

## OIL COOLER

## REMOVAL / INSTALLATION

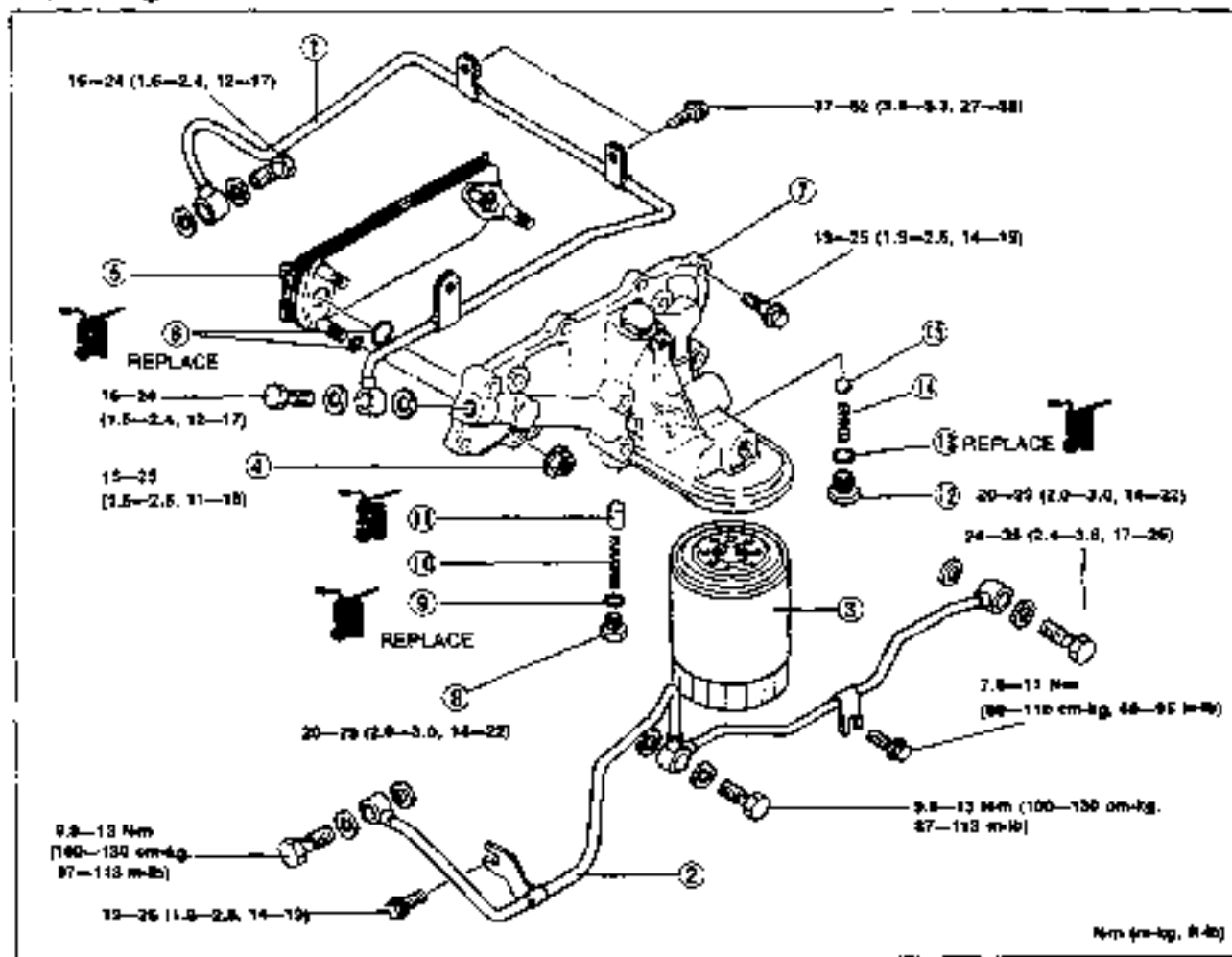
1. Disconnect the negative battery cable
2. Drain the engine oil.
3. Drain the engine coolant.
4. Remove in the order shown in the figure.
5. Install in the reverse order of removal.

## Steps After Installation

1. Fill the radiator with the specified amount and type of engine coolant. (Refer to Section E.)
2. Fill with the specified amount and type of engine oil. (Refer to page D-7.)
3. Connect the negative battery cable
4. Start the engine and check for leaks
5. Check the engine oil and engine coolant levels

97F0X007

## HA, SL Engine



87FC07-008

- |                                       |                         |
|---------------------------------------|-------------------------|
| 1. Oil pipe (Oil bypass filter)       | 8. Screw                |
| 2. Oil pipe (Fuel injection pump)     | 9. O-ring               |
| 3. Oil filter                         | 10. Pressure spring     |
| Removal / installation..... page D- 8 | 11. Control plunger     |
| 4. Oil cooler installation nut        | 12. Screw               |
| 5. Oil cooler                         | 13. O-ring              |
| 6. O-ring                             | 14. Relief valve spring |
| 7. Oil cooler cover                   | 15. Steel ball          |





## OIL PAN

## REMOVAL / INSTALLATION

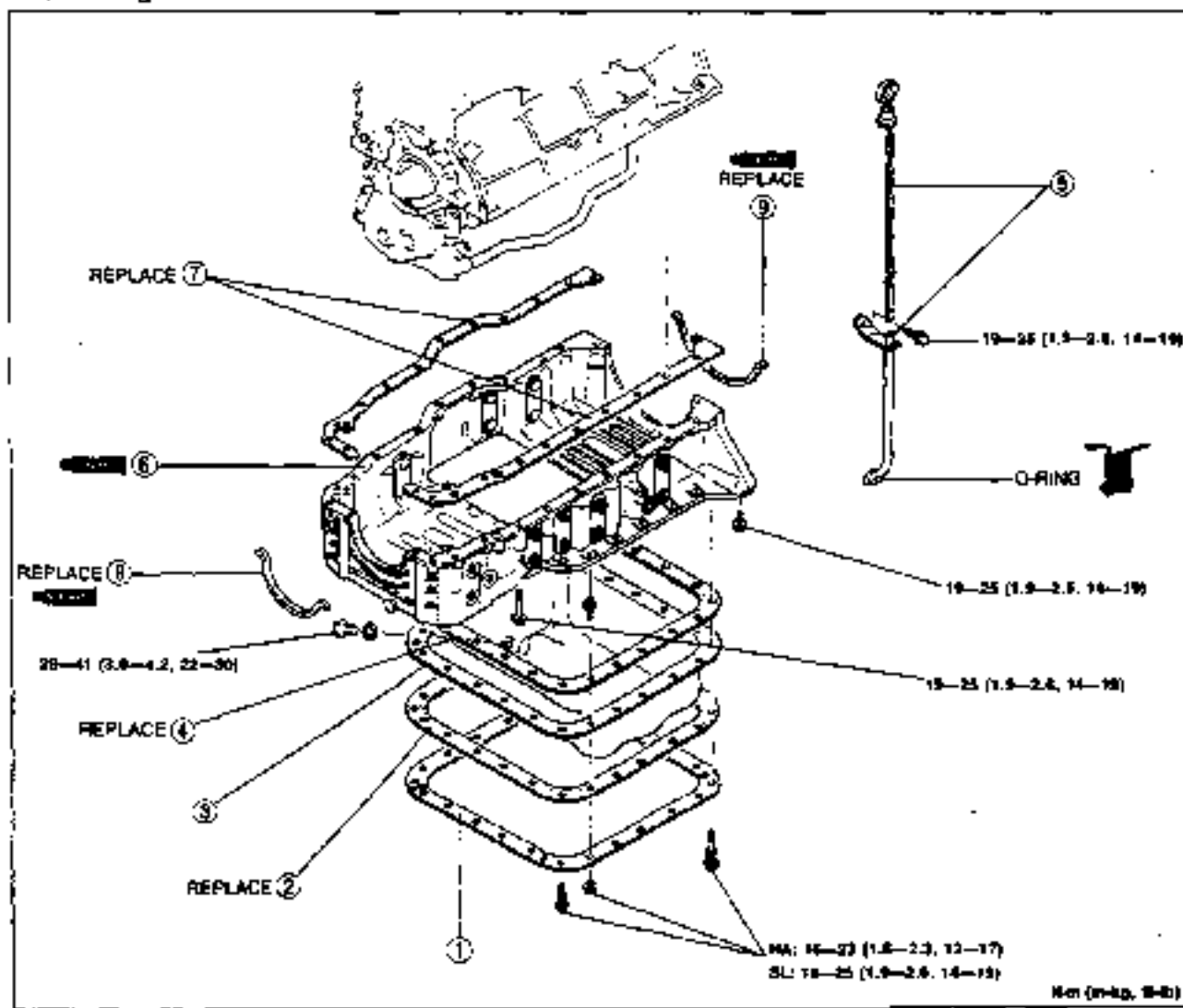
1. Disconnect the negative battery cable.
2. Drain the engine oil.
3. Remove in the order shown in the figure.
4. Install in the reverse order of removal, referring to **Installation Note**

## Steps After Installation

1. Fill with the specified amount and type of engine oil. (Refer to page D-7.)
2. Connect the negative battery cable.
3. Start the engine and check for leaks.
4. Check the oil level and add oil if necessary.

37FD00-00

## HA, SL Engine

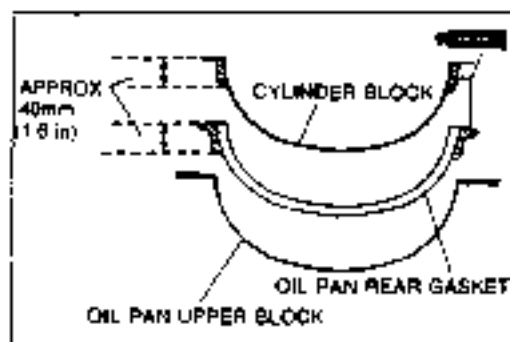


1. Stiffener
2. Rubber gasket
3. Oil pan  
Inspect for cracks, deformation, and damage
4. Rubber gasket
5. Oil level gauge and pipe

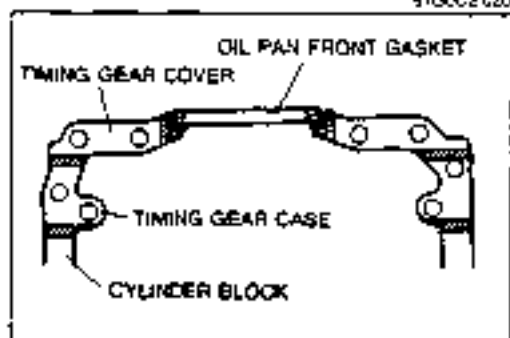
6. Oil pan upper block  
Installation Note ..... page D-12
7. Gasket
8. Oil pan gasket, front
9. Oil pan gasket, rear  
Installation Note..... page D-12

# D

## OIL PAN



9T60C2-020



9T60C2-021

### Installation Note

#### Oil pan gasket, rear

#### Caution

- The oil pan upper block must be secured within 30 minutes after the sealant is applied to the oil pan rear gasket.

1. Apply silicone sealant to the shaded areas of the new oil pan rear gasket.
2. Install the oil pan rear gasket to the oil pan upper block.

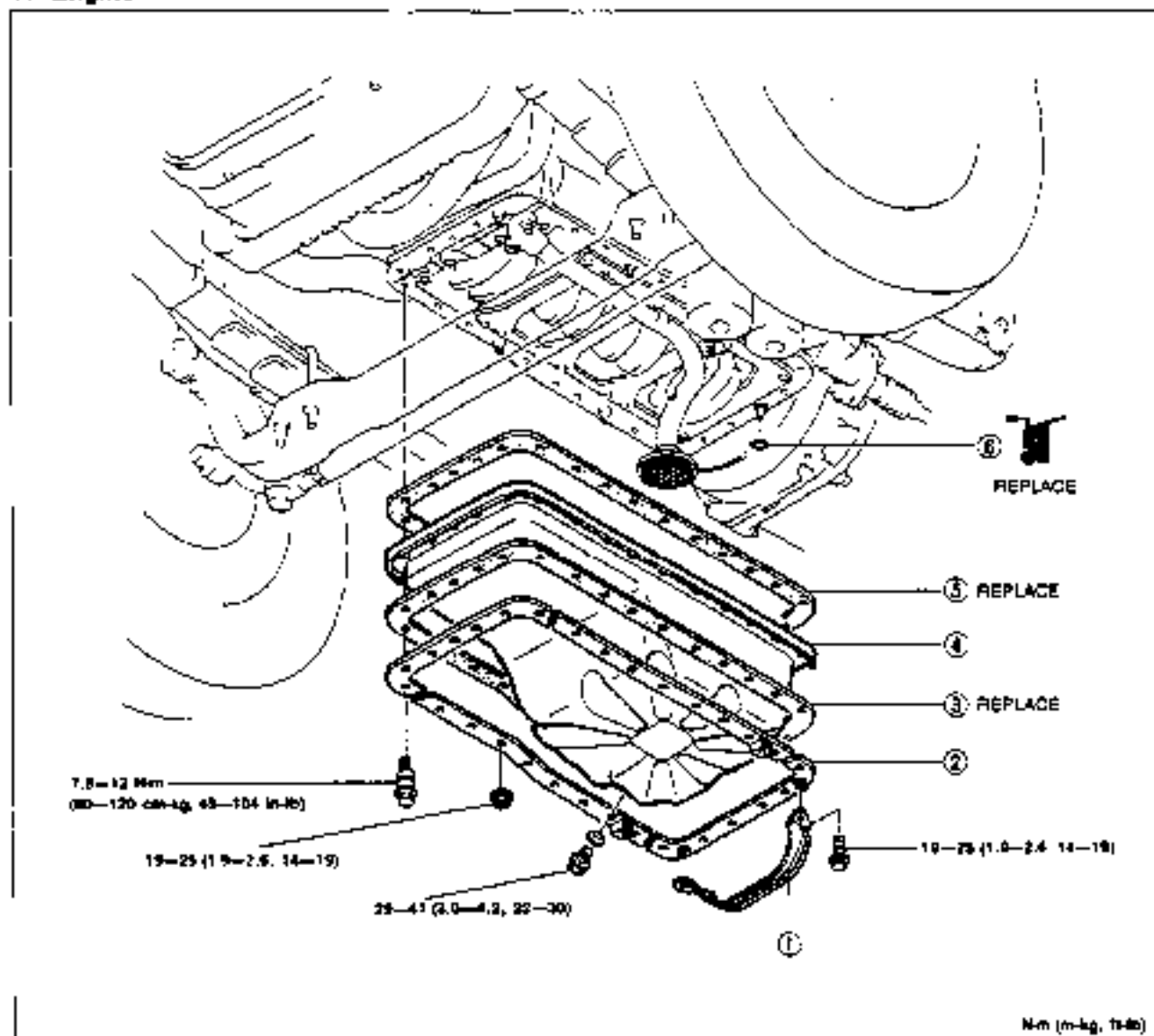
#### Oil pan upper block

1. Apply silicone sealant to the shaded areas of the cylinder block.
2. Install the oil pan upper block and new gaskets.

#### Tightening torque:

19—25 Nm (1.9—2.5 m·kg, 14—19 ft·lb)

## TF Engine

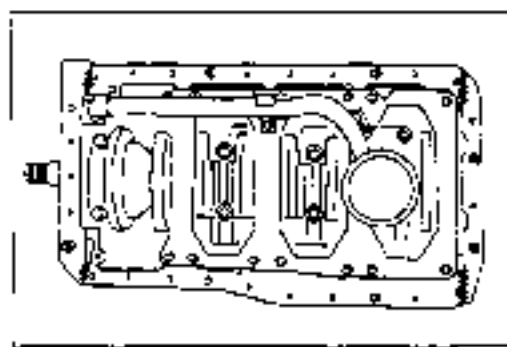


1. Seal plate
2. Stiffener
3. Rubber gasket
4. Oil pan

Inspect for cracks, deformation, and damage

Installation Note..... page D-13

5. Rubber gasket
6. O-ring

**Installation Note****Oil pan****Caution**

- The oil pan must be secured within 30 minutes after the sealant is applied to the cylinder block.

1. Apply silicone sealant to the shaded areas of the cylinder block.
2. Install the oil pan and a new gasket.

**Tightening torque:**

19-25 Nm (1.9-2.5 m-kg, 14-19 ft-lb)

## OIL PUMP

## REMOVAL / INSTALLATION

## Caution

- Position the hose clamp in the original location on the hose, and squeeze the clamp lightly with large pliers to ensure a good fit.
  - After radiator cowling installation, rotate the cooling fan by hand and verify that the fan blade does not touch the radiator cowling.
- If the fan touches the cowling, adjust the radiator cowling mounting position.

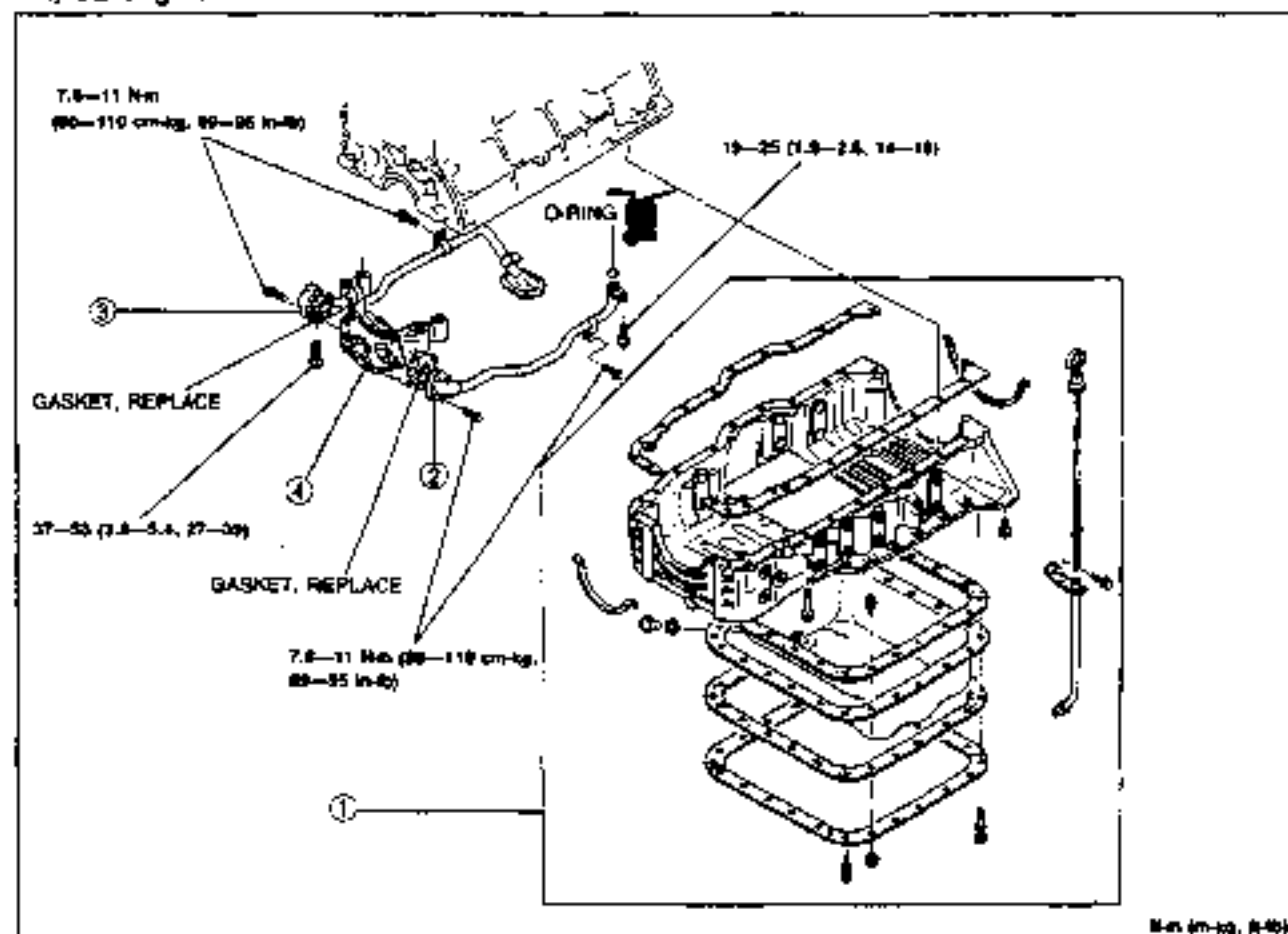
1. Disconnect the negative battery cable.
2. Drain the engine oil.
3. Remove in the order shown in the figure, referring to **Removal Note**
4. Install in the reverse order of removal, referring to **Installation Note**

## Steps After Installation

1. Fill with the specified amount and type of engine oil. (Refer to page D-7.)
2. Connect the negative battery cable.
3. Start the engine and check for leaks.
4. Check the oil level and add oil if necessary

97F00X-012

## HA, SL Engine



M-61 (m-kg, ft-lb)

97F00X-013

1. Oil pan  
Removal / Installation..... page D-11
2. Oil pipe

3. Oil strainer
4. Oil pump  
Disassembly / Inspection /  
Assembly..... page D-17



# D

## OIL PUMP

### Removal Note Crankshaft pulley

#### Caution

- This operation must be performed by two people.

1. Remove the blind cover from the end plate.
2. Set a screwdriver or a suitable tool against the flywheel ring gear to prevent the engine from rotating.

3. Loosen the pulley locknut.
4. Remove the crankshaft pulley

### Installation Note Crankshaft pulley

1. Install the crankshaft pulley.
2. Install the locknut and washer.

#### Caution

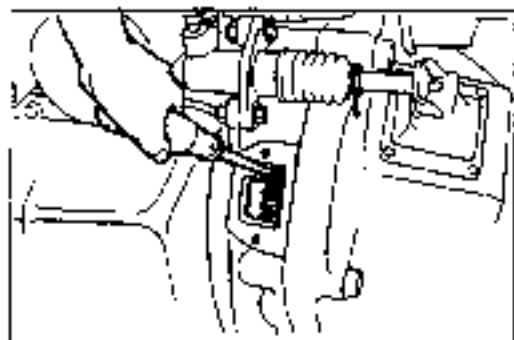
- This operation must be performed by two people.

3. Prevent the engine from rotating and tighten the locknut.

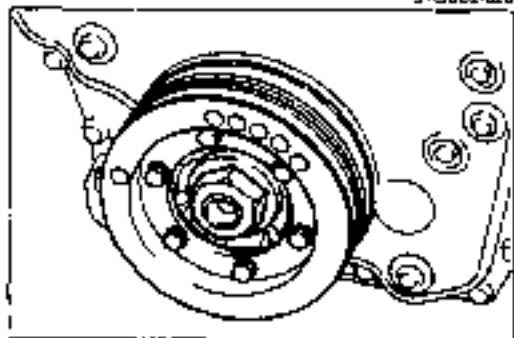
#### Tightening torque:

**383—432 Nm (39.0—44.0 m·kg, 282—316 ft·lb)**

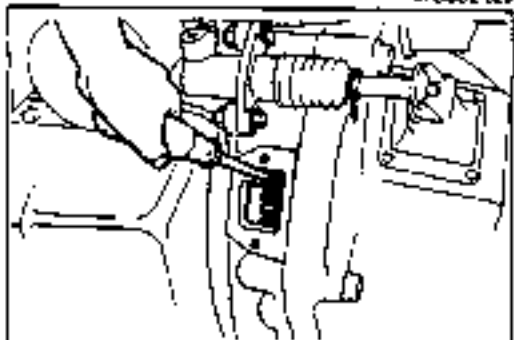
4. Install the blind cover to the end plate.



9TG902-028



9TG902-029



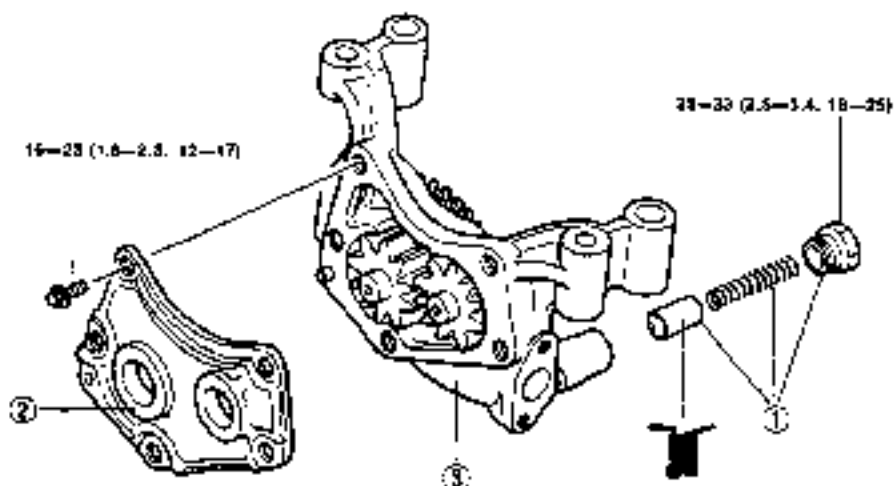
9TG902-030

## DISASSEMBLY / INSPECTION / ASSEMBLY

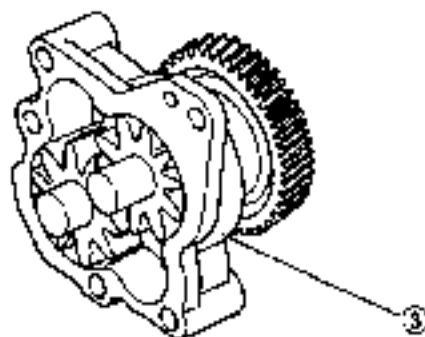
**Caution**

- If a problem is found, replace the pump as a unit.

1. Disassemble in the order shown in the figure, referring to **Disassembly Note**
2. Assemble in the reverse order of disassembly, referring to **Assembly Note**

**HA, SL ENGINE**

Nm (in-lb, ft-lb)

**TF ENGINE**

1. Relief valve (HA, SL)  
Inspect for wear or damage

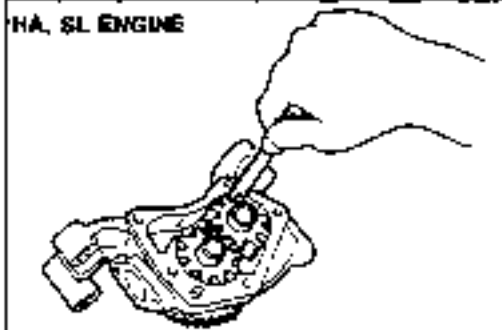
2. Pump cover (HA, SL)
3. Pump body

916002-002

# D

## OIL PUMP

HA, SL ENGINE



9T6002-036

### INSPECTION

#### Rotor Clearance

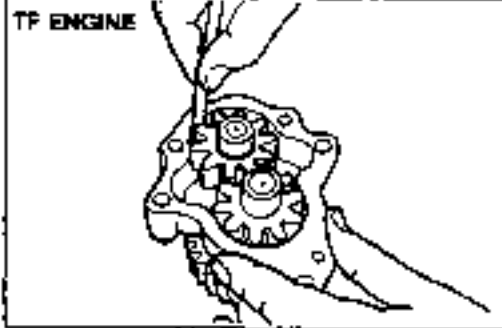
1. Measure the rotor to pump body clearance.

#### Clearance

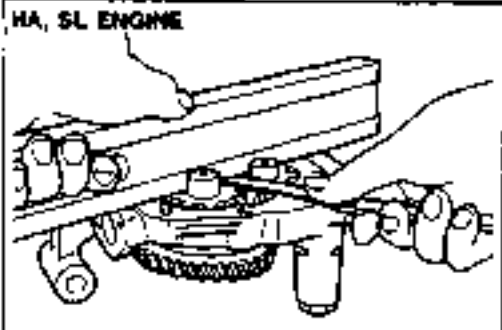
**Standard : 0.10—0.19mm (0.0039—0.0075 in)**

**Maximum: 0.20mm (0.0079 in)**

TF ENGINE



HA, SL ENGINE



9T6002-036

2. Measure the side clearance (between the rotor and the edge of the pump body).

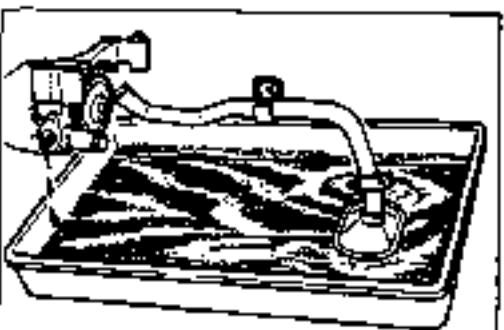
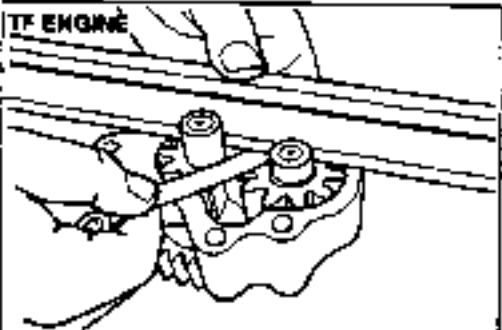
#### Clearance

**Standard : 0.04—0.09mm (0.0016—0.0035 in)**

**Maximum: 0.15mm (0.0059 in)**

3. If the clearance exceeds the maximum, replace the oil pump assembly.

TF ENGINE



9T6002-036

### Operation Check (HA, SL)

1. Install the relief valve to the pump body.
2. Install the oil strainer to the pump body.
3. Submerge the oil strainer in engine oil as shown in the figure.
4. Rotate the oil pump driven gear counterclockwise by hand and verify that engine oil flows

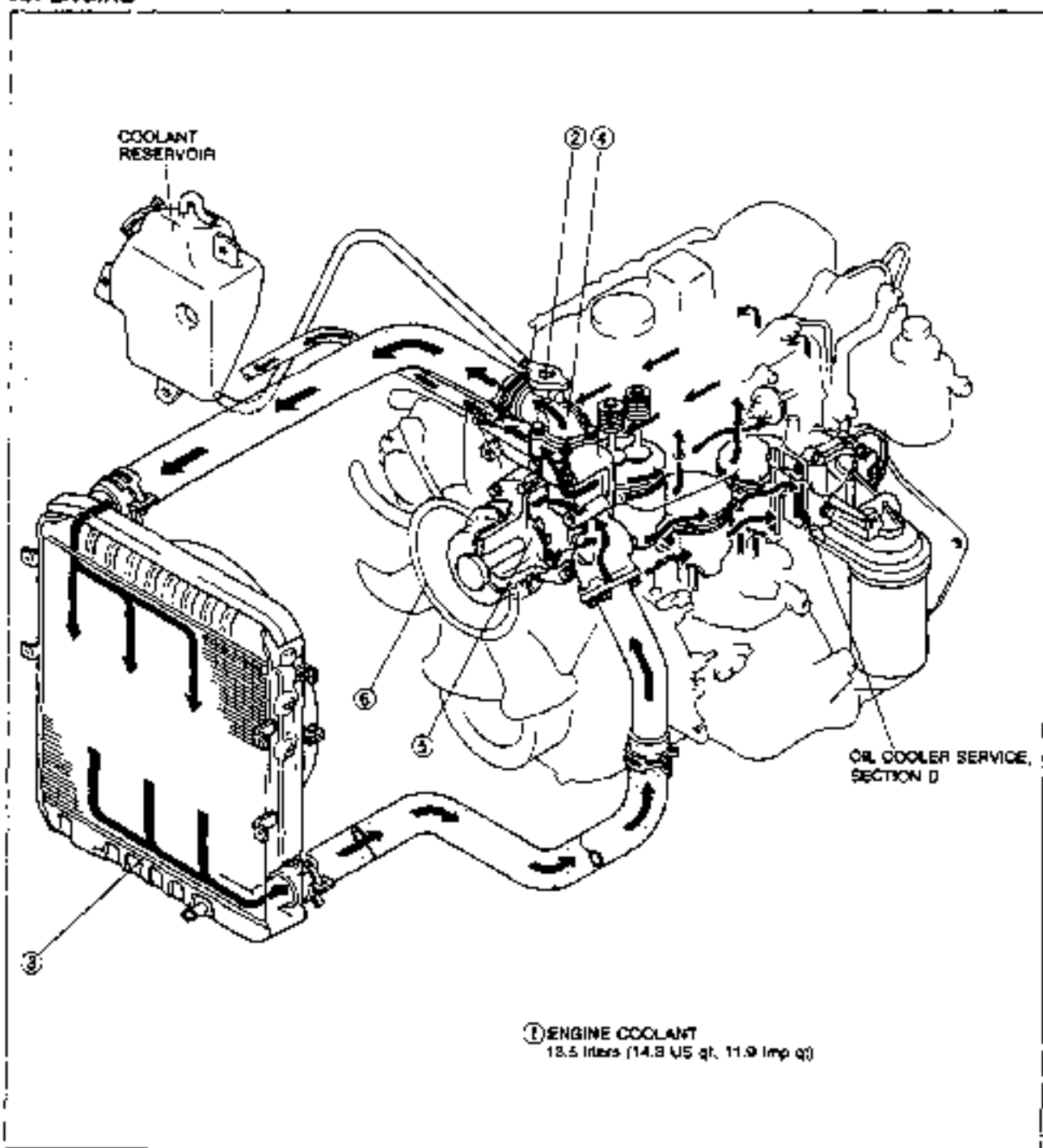


## COOLING SYSTEM

<b>INDEX</b> .....	<b>E- 2</b>
HA ENGINE .....	E- 2
SL ENGINE .....	E- 3
TF ENGINE .....	E- 4
<b>OUTLINE</b> .....	<b>E- 5</b>
SPECIFICATIONS .....	E- 5
<b>TROUBLESHOOTING GUIDE</b> .....	<b>E- 5</b>
<b>ENGINE COOLANT</b> .....	<b>E- 6</b>
PREPARATION .....	E- 6
INSPECTION .....	E- 6
REPLACEMENT .....	E- 7
<b>RADIATOR CAP</b> .....	<b>E- 8</b>
PREPARATION .....	E- 8
INSPECTION .....	E- 8
<b>RADIATOR</b> .....	<b>E- 9</b>
REMOVAL / INSTALLATION .....	E- 9
<b>THERMOSTAT</b> .....	<b>E-10</b>
REMOVAL / INSPECTION / INSTALLATION ..	E-10
<b>WATER PUMP</b> .....	<b>E-11</b>
REMOVAL / INSTALLATION .....	E-11
<b>COOLING FAN</b> .....	<b>E-12</b>
INSPECTION .....	E-12
REMOVAL / INSTALLATION .....	E-12

## INDEX

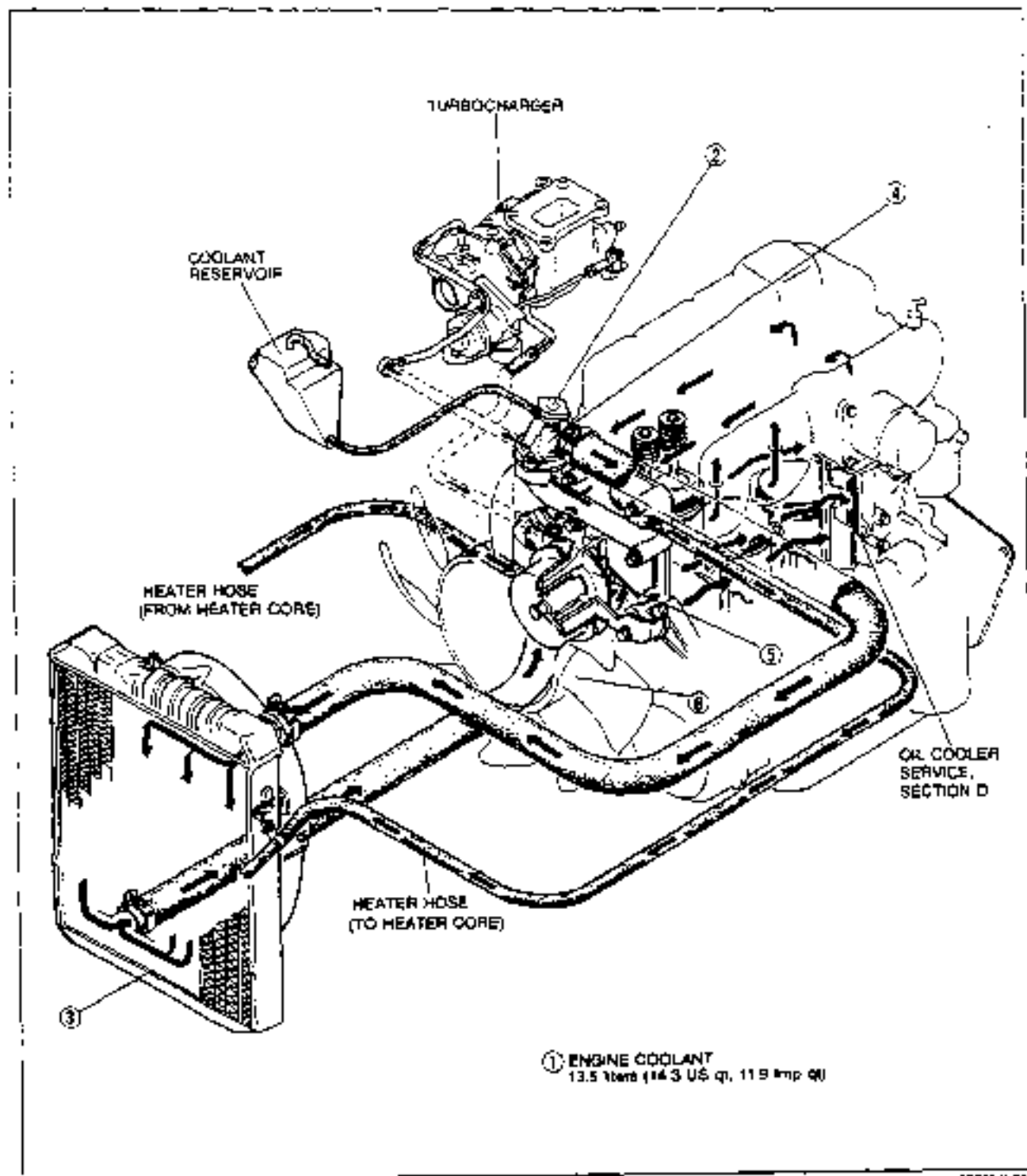
## HA ENGINE



9TFOEX-002

- |                             |           |                             |           |
|-----------------------------|-----------|-----------------------------|-----------|
| 1. Engine coolant           |           | 4. Thermostat               |           |
| Inspection .....            | page E- 6 | Removal / Inspection /      |           |
| Replacement.....            | page E- 7 | Installation.....           | page E-10 |
| 2. Radiator cap             |           | 5. Water pump               |           |
| Inspection .....            | page E- 8 | Removal / Installation..... | page E-11 |
| 3. Radiator                 |           | 6. Cooling fan              |           |
| Removal / Installation..... | page E- 9 | Inspection.....             | page E-12 |
|                             |           | Removal / Installation..... | page E-12 |

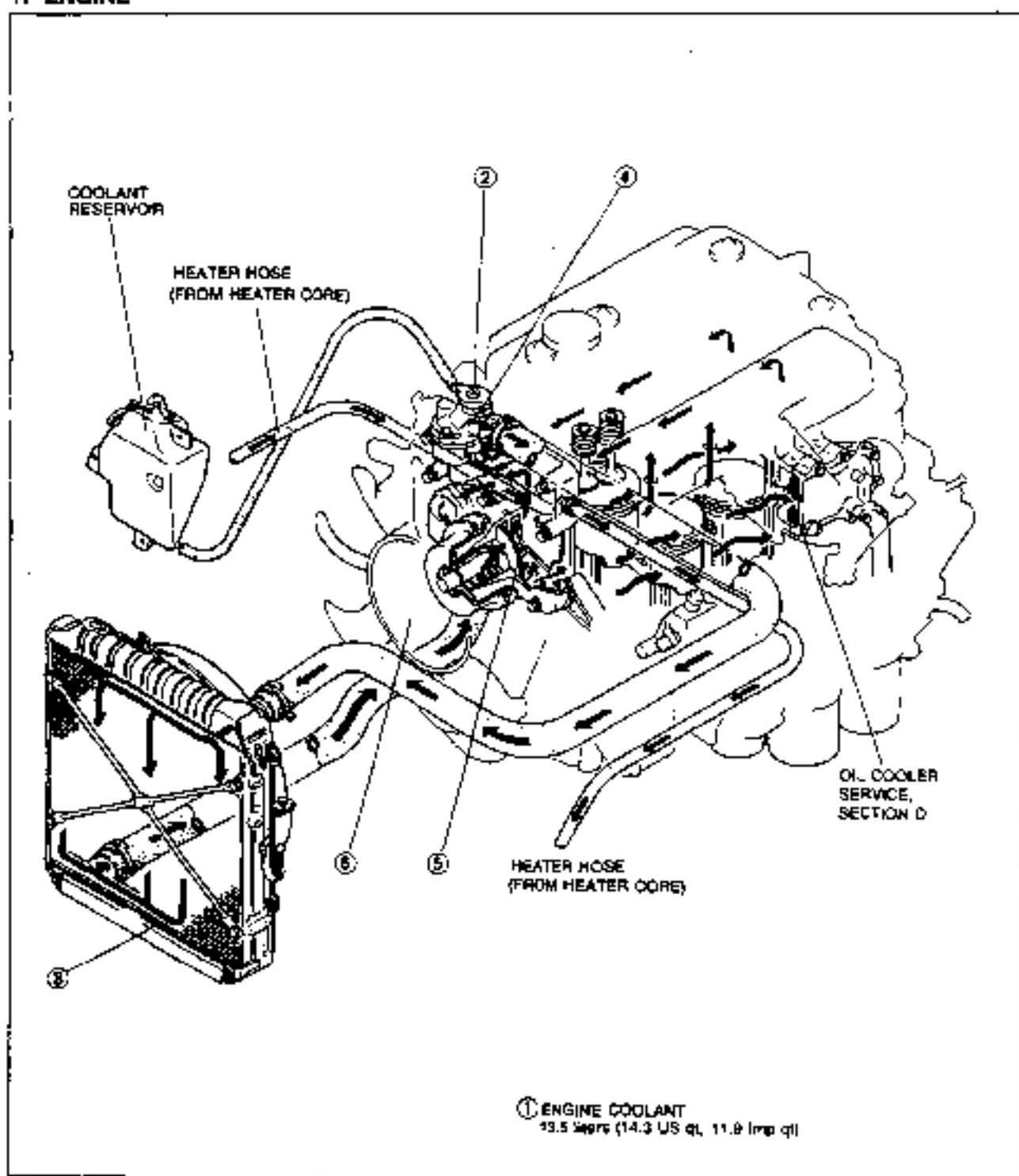
## SL ENGINE



9TFC6X-003

- |                              |           |                              |           |
|------------------------------|-----------|------------------------------|-----------|
| 1. Engine coolant            |           | 4. Thermostat                |           |
| Inspection .....             | page E- 6 | Removal / Inspection /       |           |
| Replacement.....             | page E- 7 | Installation.....            | page E-10 |
| 2. Radiator cap              |           | 5. Water pump                |           |
| Inspection .....             | page E- 8 | Removal / Installation ..... | page E-11 |
| 3. Radiator                  |           | 6. Cooling fan               |           |
| Removal / Installation ..... | page E- 9 | Inspection .....             | page E-12 |
|                              |           | Removal / Installation ..... | page E-12 |

## TF ENGINE



9TFC01-004

- |                              |           |                              |           |
|------------------------------|-----------|------------------------------|-----------|
| 1. Engine coolant            |           | 4. Thermostat                |           |
| Inspection .....             | page E- 6 | Removal / Inspection /       |           |
| Replacement .....            | page E- 7 | Installation .....           | page E-10 |
| 2. Radiator cap              |           | 5. Water pump                |           |
| Inspection .....             | page E- 8 | Removal / Installation ..... | page E-11 |
| 3. Radiator                  |           | 6. Cooling fan               |           |
| Removal / Installation ..... | page E- 9 | Inspection .....             | page E-12 |
|                              |           | Removal / Installation ..... | page E-12 |

OUTLINE

SPECIFICATIONS

Item	Engine	HA	SL	TF
Cooling system		Water-cooled, forced circulation		
Coolant capacity	liters (US qt., Imp. qt.)	13.5 (14.3, 11.9)		
Water pump	Type	Centrifugal		
	Water seal	United mechanical seal		
Thermostat	Type	Wax		
	Opening temperature	°C (°F)	80.5—83.5 (177—192)	
	Full-open temperature	°C (°F)	95 (203)	
	Full-open lift	mm (in.)	8.5 (0.33) min	
Radiator	Type	Corrugated fin		
	Cap valve opening pressure	kPa (kg/cm <sup>2</sup> , psi)	74—103 (0.75—1.05, 11—15)	
Cooling fan	Type	Thermomodulated		
	Blade	Number	8	
		Outer diameter	mm (in.)	410 (16.1)

9TFOEx-005

TROUBLESHOOTING GUIDE

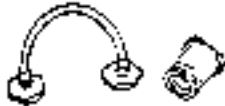

Problem	Possible Cause	Remedy	Page
<b>Overheating</b>	Coolant level insufficient	Add coolant	E-7
	Coolant leakage	Repair	—
	Radiator fins clogged	Clean	E-9
	Radiator cap malfunction	Replace	E-8
	Cooling fan malfunction	Replace	E-12
	Thermostat malfunction	Replace	E-10
	Water passage clogged	Clean	E-7
Water pump malfunction	Replace	E-11	
<b>Correction</b>	Impurities in coolant	Replace	E-7
<b>Warning buzzer sounds while engine running</b>	Coolant level insufficient Malfunction of coolant level sensor Malfunction of electrical system	Add coolant Refer to Section T Refer to Section T	E-7

9TFOEx-006

## ENGINE COOLANT

## PREPARATION

## SST

<p>49 9200 145</p> <p>Adapter set, radiator cap tester</p> 	<p>For inspection of cooling system pressure</p>	<p>49 9200 146</p> <p>Adapter A (Part of 49 9200 145)</p> 	<p>For inspection of cooling system pressure</p>
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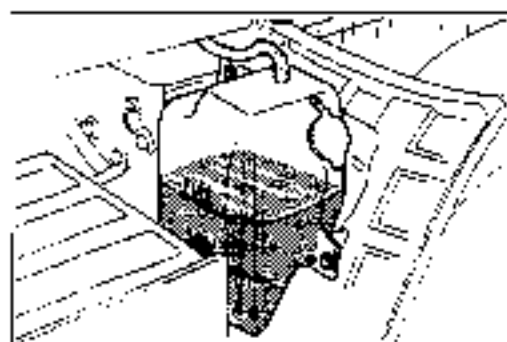
05U0E1-005

## INSPECTION

**Warning**

- Never remove the radiator cap while the engine is hot.
- Wrap a thick cloth around the cap before removing it.
- When removing the radiator cap, loosen it slowly to the first stop until the pressure in the radiator is released, and then remove it.

9T30E2-007



9T30E2-008

**Coolant Level (Engine Cold)**

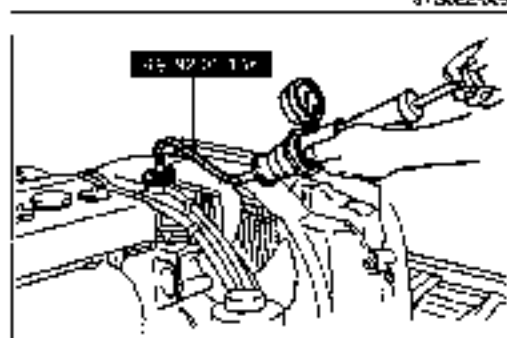
1. Verify that the coolant level is near the coolant inlet port.
2. Verify that the coolant level in the coolant reservoir is between the FULL and LOW marks. Add coolant if necessary.



9T30E2-009

**Coolant Quality**

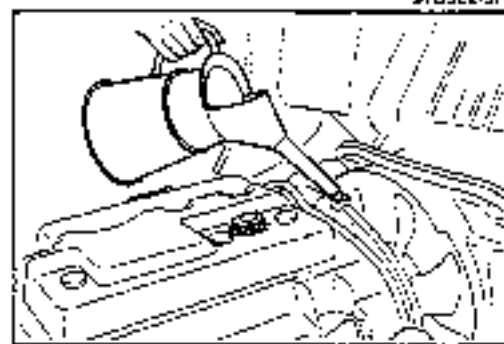
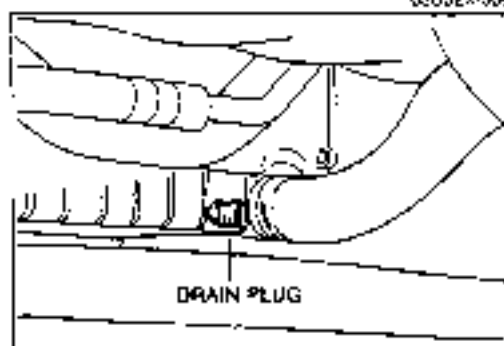
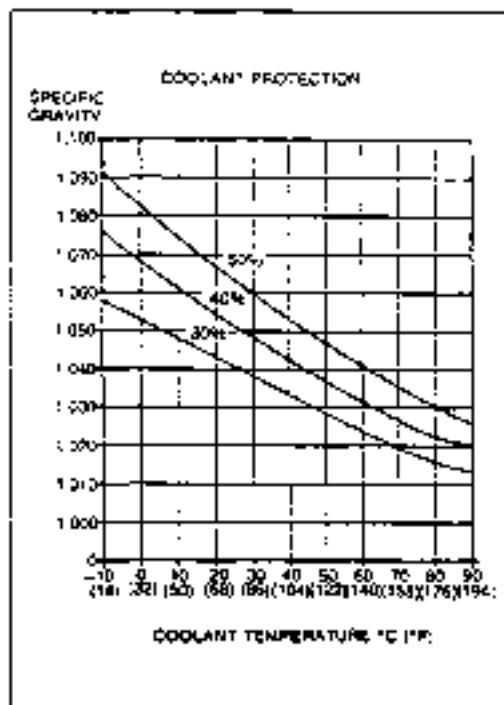
1. Verify that there is no buildup of rust or scale around the radiator cap or coolant inlet port.
2. Verify that coolant is free of oil.  
Replace the coolant if necessary.



9T30E2-010

**Coolant Leakage**

1. Connect a radiator tester (commercially available) and the SST to the coolant inlet port.
2. Apply 88 kPa (0.9 kg/cm<sup>2</sup>, 13 psi) pressure to the system.
3. Verify that the pressure is held.  
If not, check for coolant leakage.



### Coolant Protection

#### Caution

- Do not use alcohol- or methanol-based coolant.
- Use only soft (demineralized) water in the coolant mixture.

1. Measure the coolant temperature and specific gravity with a thermometer and a hydrometer.
  2. Determine the coolant protection by referring to the graph shown.
- If the coolant protection is not proper, add water or coolant.

### Antifreeze solution mixture percentage

Coolant protection	Volume percentage (%)		Gravity at 20°C (68°F)
	Water	Coolant	
Above -16°C (3°F)	65	35	1.054
Above -26°C (-15°F)	55	45	1.066
Above -40°C (-40°F)	45	55	1.078

06UJEX-010

### REPLACEMENT

#### Warning

- Never open the radiator cap while the engine is hot.
- Wrap a thick cloth around the cap before loosening it.
- Use caution when draining hot coolant.

#### Caution

- Do not use alcohol- or methanol-based coolant.
- Use only soft (demineralized) water in the coolant mixture.

1. Remove the radiator cap and loosen the drain plug.
2. Drain the coolant into a suitable container.
3. Flush the cooling system with water until all traces of color are gone, then let the system drain completely.
4. Install the drain plug.
5. Fill with the proper amount and mixture of ethylene glycol-based coolant by referring to the table above.

#### Coolant capacity:



13.5 liters (14.3 US qt, 11.9 Imp qt)

6. Run the engine, with the radiator cap removed, until the upper radiator hose is hot.
7. With the engine idling, add coolant to the radiator until it reaches the bottom of the coolant inlet port.
8. Install the radiator cap.

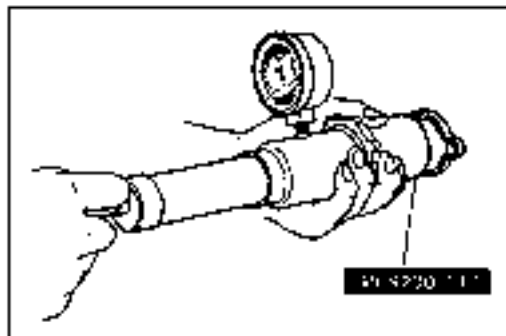
## RADIATOR CAP

## PREPARATION

## SST

<p>49 9200 145</p> <p>Adapter set, radiator cap tester</p> 	<p>For inspection of radiator cap valve</p>	<p>49 9200 147</p> <p>Adapter B (Part of 49 9200 145)</p> 	<p>For inspection of radiator cap valve</p>
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DSJDEZ-014



DSJDEZ-013

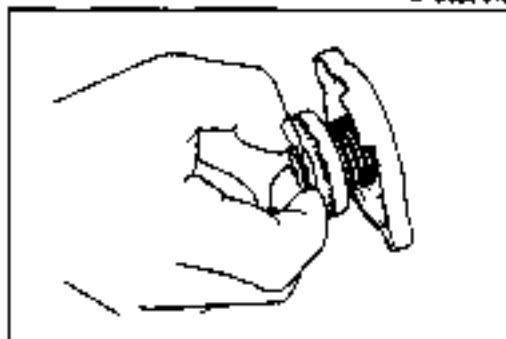
## INSPECTION

## Radiator Cap Valve

1. Remove foreign material (such as water residue) from between the radiator cap valve and the valve seat.
2. Attach the radiator cap to a radiator cap tester (commercially available) with the **SST**. Apply pressure gradually to **74–103 kPa (0.75–1.05 kg/cm<sup>2</sup>, 11–15 psi)**.
3. Wait about **10 sec.** Verify that the pressure has not decreased.

## Negative Pressure Valve

1. Pull the negative pressure valve to open it. Verify that it closes completely when released.
2. Check for damage on the contact surfaces and for cracked or deformed seal packing.
3. Replace the radiator cap if necessary.



DSJDEZ-015



## RADIATOR

## REMOVAL / INSTALLATION

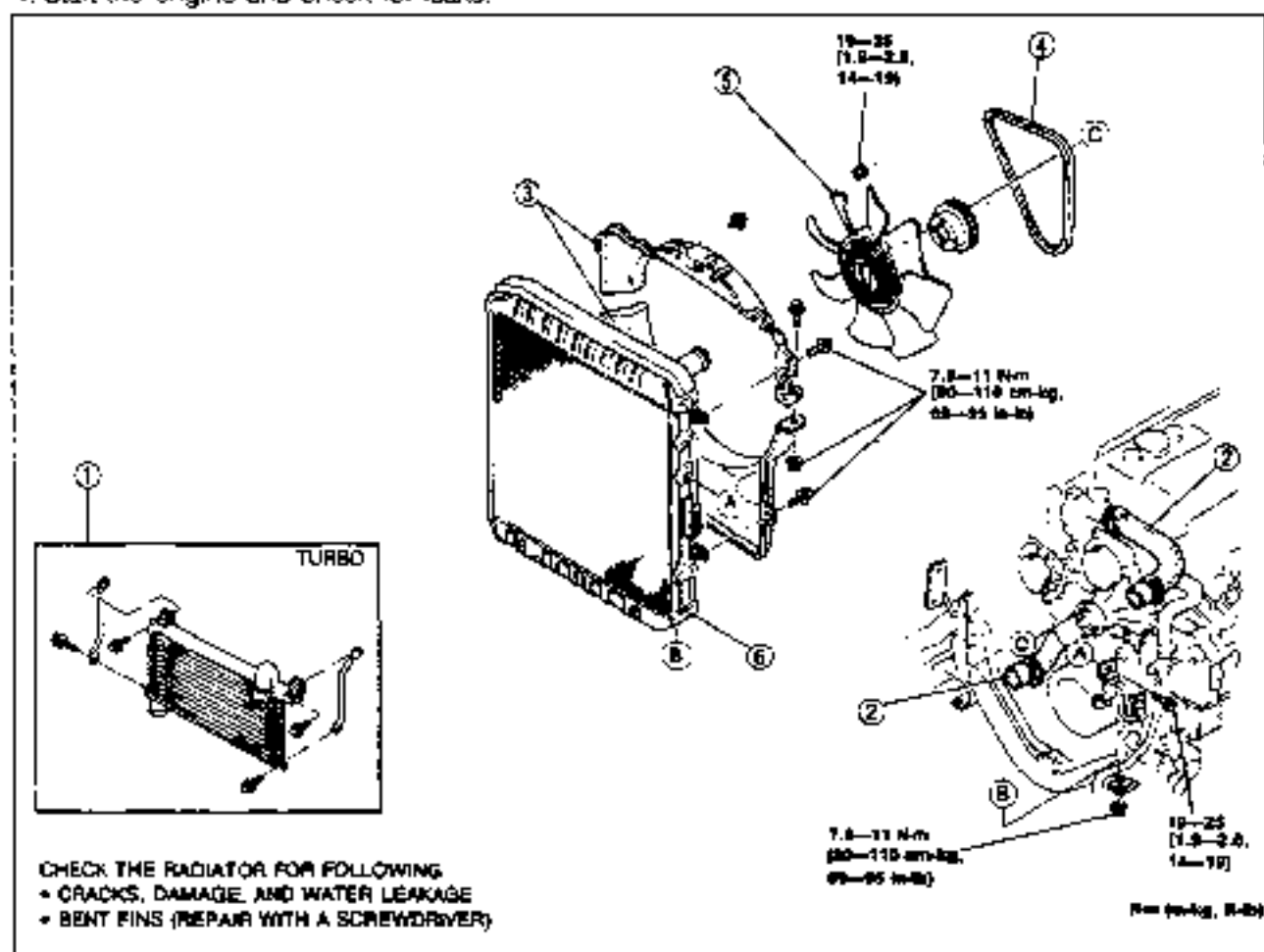
## Caution

- Position the hose clamp in the original location on the hose, and squeeze the clamp lightly with large pliers to ensure a good fit.
- After radiator cowl installation, rotate the cooling fan by hand and verify that the fan blade does not touch the radiator cowl.
- If the fan touches the cowl, adjust the radiator cowl mounting position.

1. Disconnect the negative battery cable.
2. Drain the engine coolant.
3. Remove the undercover.
4. Remove in the order shown in the figure.
5. Install in the reverse order of removal.

## Steps After Installation

1. Install the undercover.
2. Fill the radiator with the specified amount and type of engine coolant. (Refer to page E-7.)
3. Connect the negative battery cable.
4. Start the engine and check for leaks.



97R02E-008

1. Intercooler  
Service..... Section F2
2. Radiator hose
3. Radiator cowl

4. Cooling fan drive belt  
Adjustment..... Section B
5. Cooling fan
6. Radiator

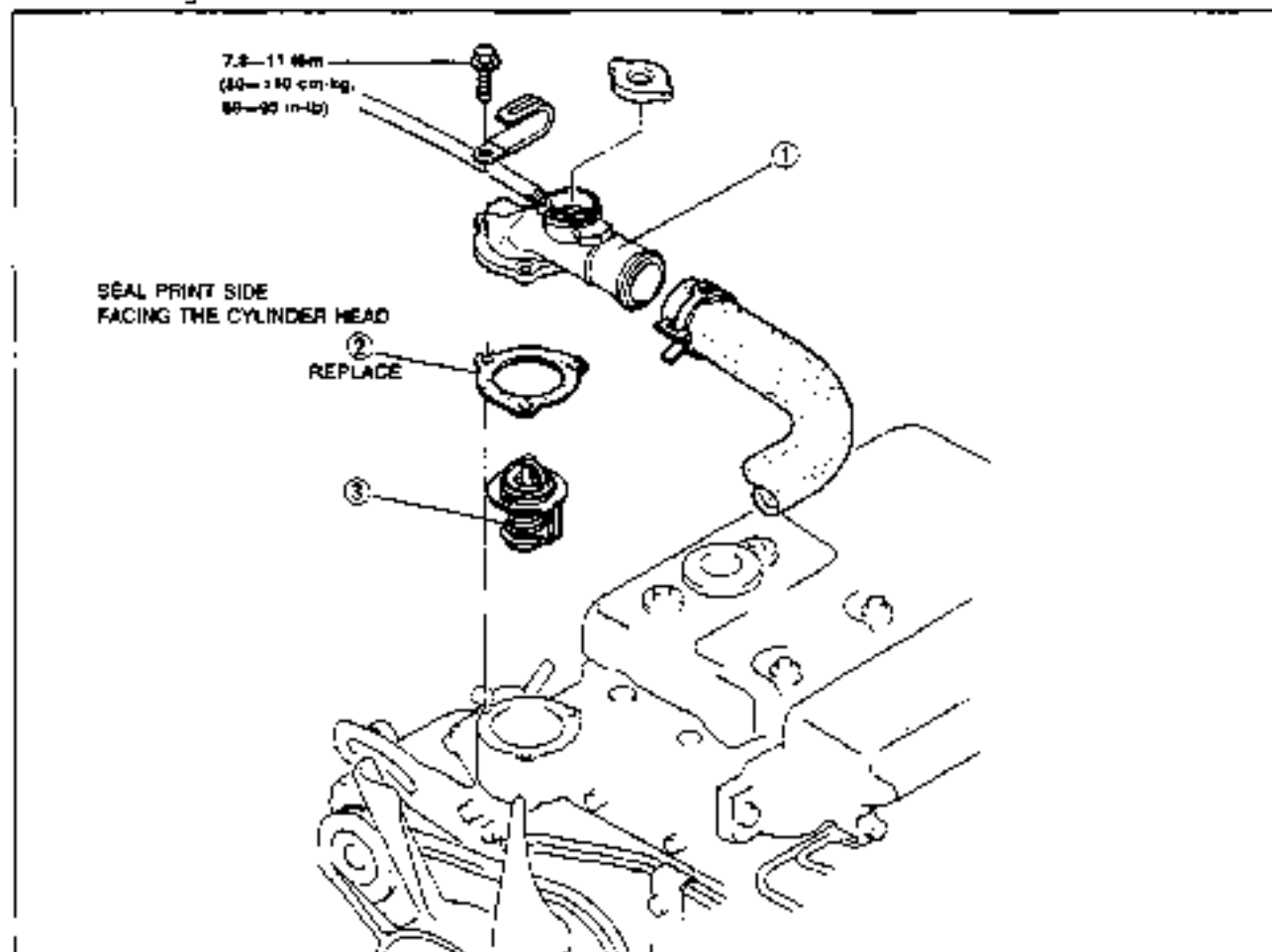
## THERMOSTAT

## REMOVAL / INSPECTION / INSTALLATION

1. Disconnect the negative battery cable.
2. Drain the engine coolant.
3. Remove in the order shown in the figure.
4. Install in the reverse order of removal.

## Steps After Installation

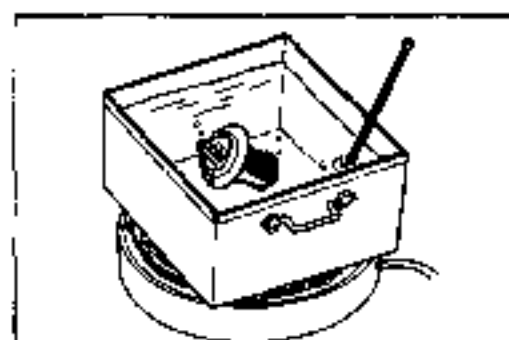
1. Fill the radiator with the specified amount and type of engine coolant. (Refer to page E-7.)
2. Connect the negative battery cable.
3. Start the engine and check for leaks.



9TFCX-006

1. Thermostat cover
2. Gasket

3. Thermostat  
Inspection ..... page E-10



9TGC2-016

## INSPECTION

1. Visually check that the thermostat valve is airtight.
2. Place the thermostat and a thermometer in water.
3. Heat the water and check the following:

**Initial-opening temperature:**

80.5—83.5°C (177—182°F)

**Full-open temperature:** 95°C (203°F)

**Full-open lift:** 8.5mm (0.33 in) min.

WATER PUMP

REMOVAL / INSTALLATION

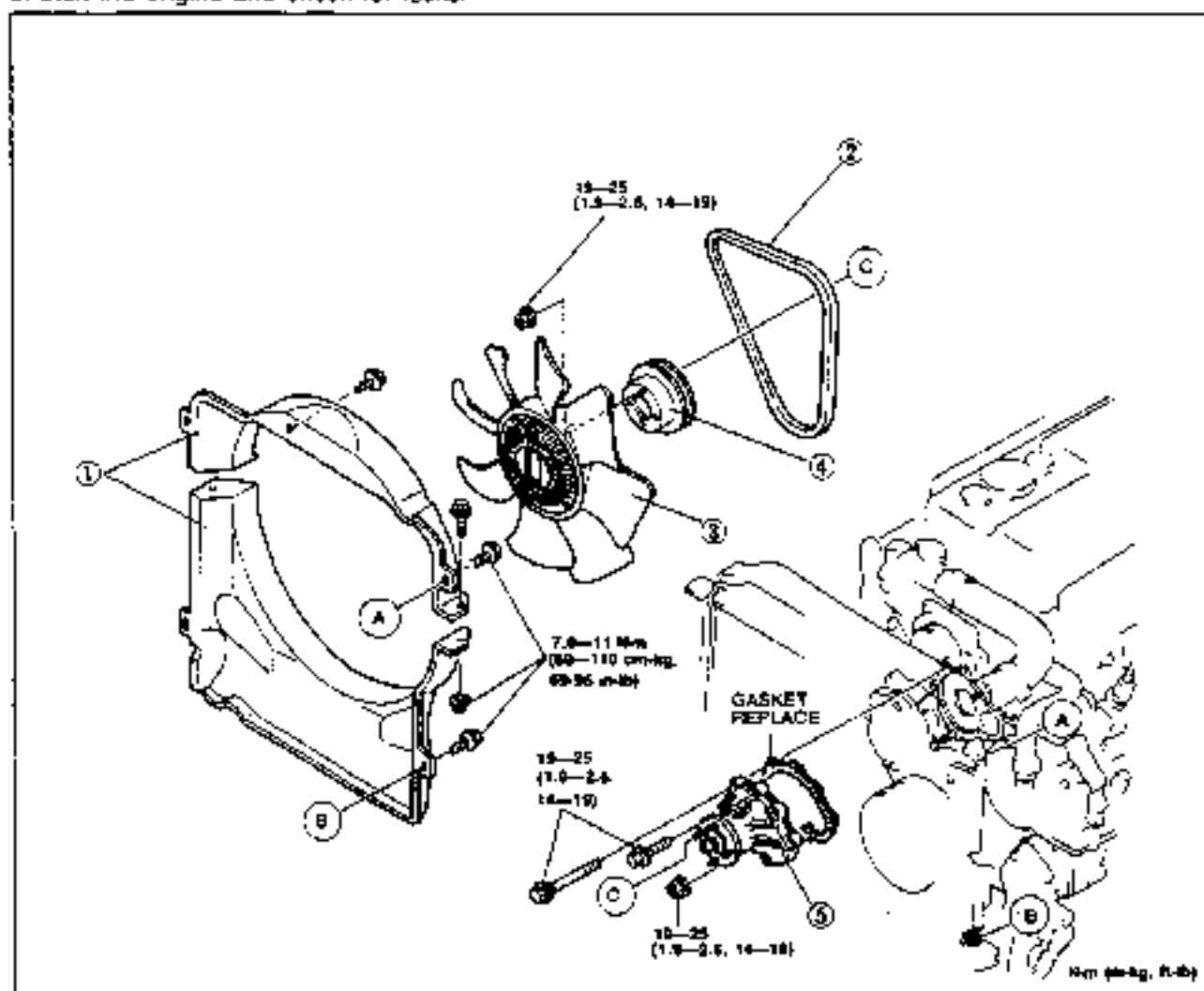
Caution

- Do not disassemble the water pump. If a problem is found, replace the pump as a unit.
  - After radiator cowling installation, rotate the cooling fan by hand and verify that the fan blade does not touch the radiator cowling.
- If the fan touches the cowling, adjust the radiator cowling mounting position.

1. Disconnect the negative battery cable
2. Drain the engine coolant.
3. Remove in the order shown in the figure.
4. Install in the reverse order of removal.

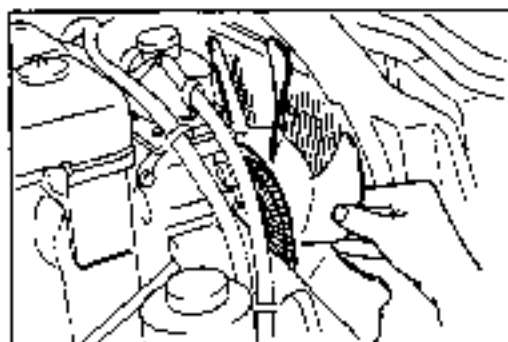
Steps After Installation

1. Fill the radiator with the specified amount and type of engine coolant. (Refer to page E-7.)
2. Connect the negative battery cable.
3. Start the engine and check for leaks.



1. Radiator cowling
2. Water pump drive belt  
Adjustment ..... Section B
3. Cooling fan

4. Water pump pulley
5. Water pump  
Inspect for cracked and damaged mounting surface, bearing condition, and leakage



9T06E9-3-18

## COOLING FAN

## INSPECTION

1. Inspect for the following. Replace if necessary.
  - (1) Fluid leakage from the fan drive.
  - (2) Deformation of the bimetal.
  - (3) Cracks and damage of the fan blade.
2. Warm up the engine and stop it.
3. With the engine stopped, turn the fan by hand and verify that resistance fall.
4. Replace the fan drive if necessary.

## REMOVAL / INSTALLATION

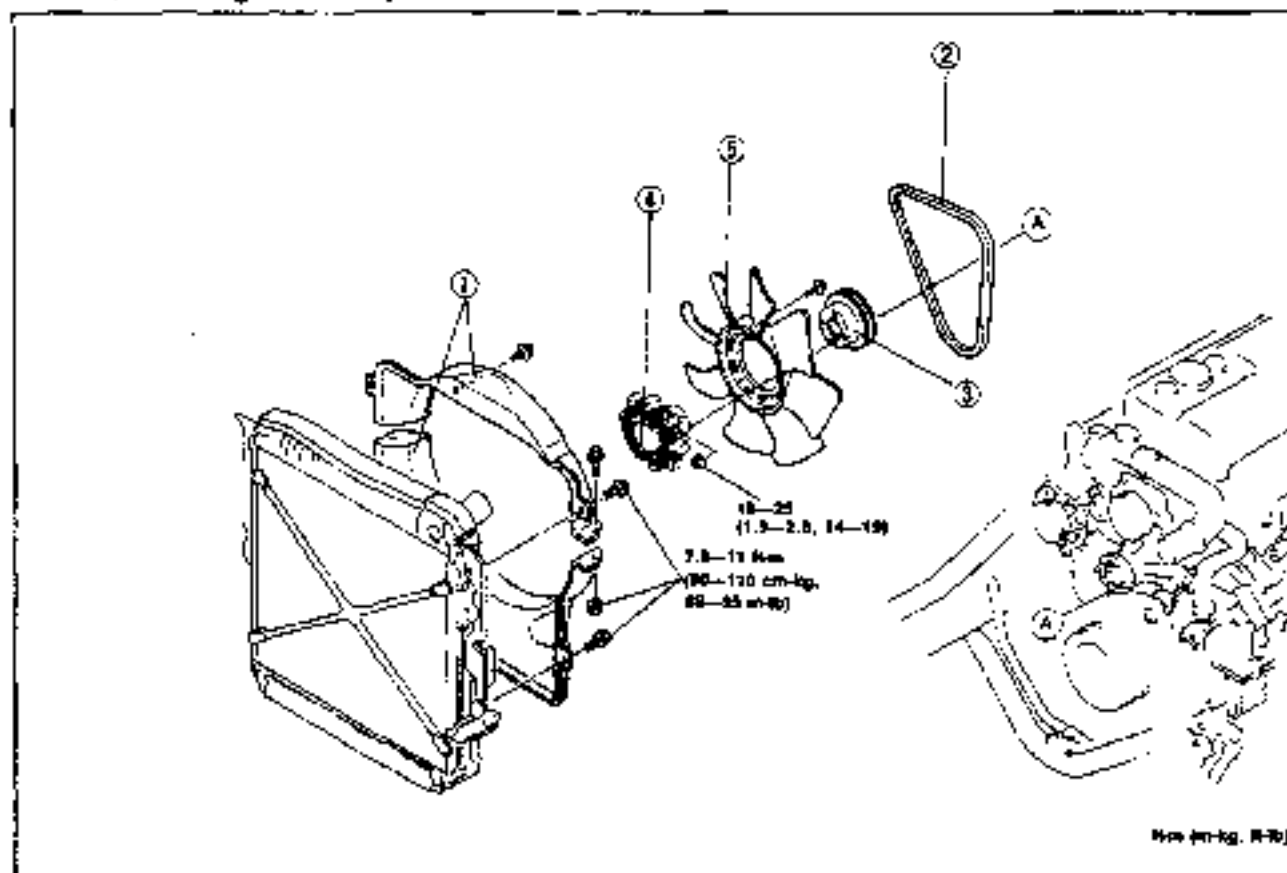
## Caution

- After radiator cowling installation, rotate the cooling fan by hand and verify that the fan blade does not touch the radiator cowling. If the fan touches the cowling, adjust the radiator cowling mounting position.

1. Disconnect the negative battery cable.
2. Remove in the order shown in the figure.
3. Install in the reverse order of removal.

## Steps After Installation

1. Connect the negative battery cable.



New (in-kg, R-R)

9\*POEX-11

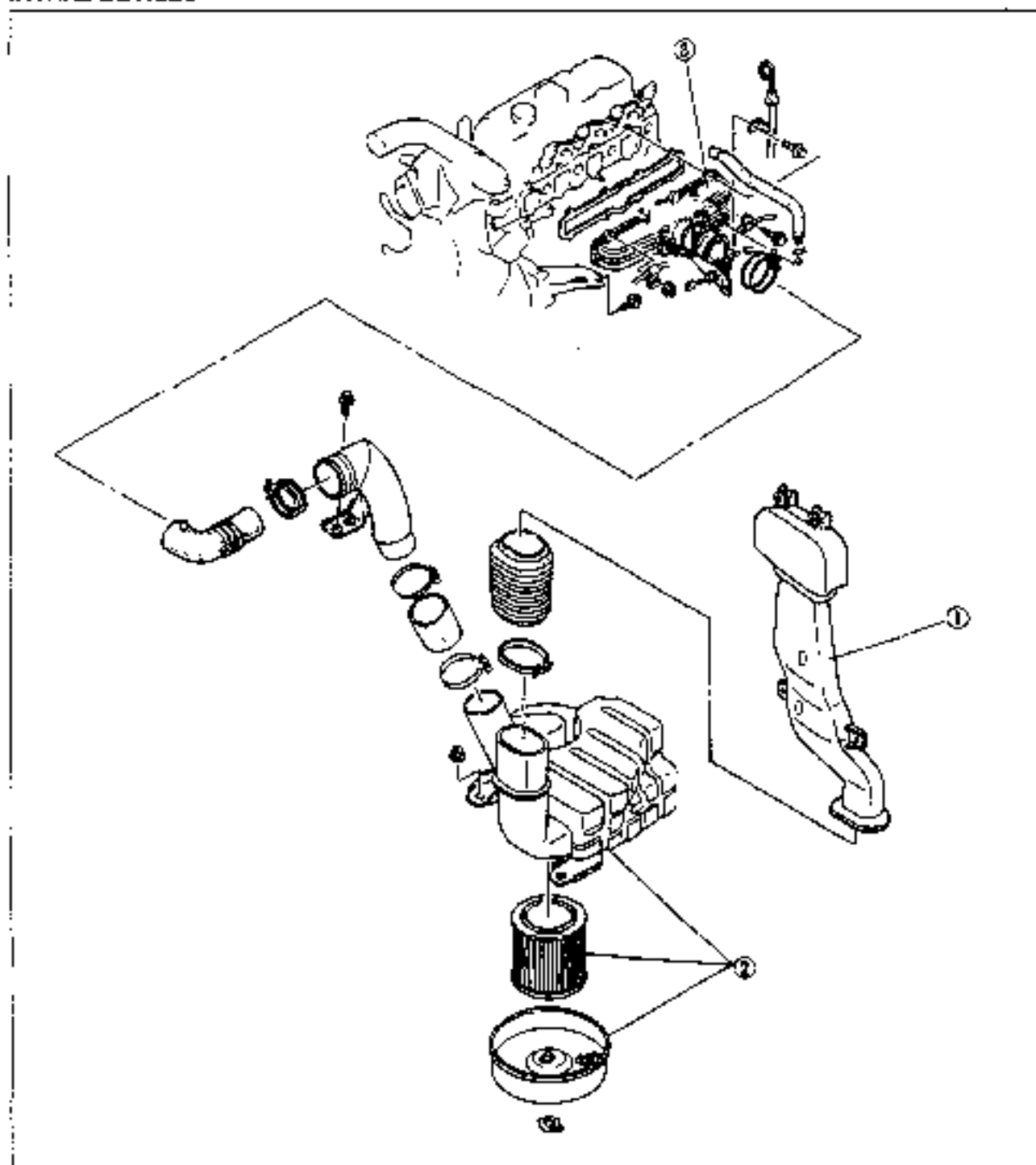
- |                           |                      |
|---------------------------|----------------------|
| 1. Radiator cowling       | 3. Water pump pulley |
| 2. Cooling fan drive belt | 4. Fan drive         |
| Adjustment..... Section B | 5. Fan blade         |

# FUEL AND EMISSION CONTROL SYSTEMS (HA ENGINE)

<b>INDEX</b> .....	<b>F1- 2</b>
<b>INTAKE DEVICES</b> .....	<b>F1- 2</b>
<b>EXHAUST DEVICES</b> .....	<b>F1- 3</b>
<b>FUEL DEVICES</b> .....	<b>F1- 4</b>
<b>OUTLINE</b> .....	<b>F1- 5</b>
<b>SYSTEM DIAGRAM</b> .....	<b>F1- 6</b>
<b>WIRING DIAGRAM</b> .....	<b>F1- 6</b>
<b>TROUBLESHOOTING GUIDE</b> .....	<b>F1- 7</b>
<b>ENGINE TUNE-UP</b> .....	<b>F1- 8</b>
<b>PREPARATION</b> .....	<b>F1- 8</b>
<b>BASIC INSPECTION</b> .....	<b>F1- 8</b>
<b>ADJUSTMENT</b> .....	<b>F1- 9</b>
<b>INTAKE AIR SYSTEM</b> .....	<b>F1-11</b>
<b>COMPONENTS</b> .....	<b>F1-11</b>
<b>FUEL SYSTEM</b> .....	<b>F1-13</b>
<b>PREPARATION</b> .....	<b>F1-13</b>
<b>FUEL TANK</b> .....	<b>F1-13</b>
<b>INJECTION PUMP</b> .....	<b>F1-14</b>
<b>SEDIMENTOR</b> .....	<b>F1-16</b>
<b>SEDIMENTOR SENSOR (DETECTOR)</b> .....	<b>F1-16</b>
<b>FUEL FILTER</b> .....	<b>F1-17</b>
<b>INJECTION NOZZLE</b> .....	<b>F1-19</b>
<b>ACCELERATOR PEDAL</b> .....	
<b>ACCELERATOR CABLE</b> .....	<b>F1-22</b>
<b>FUEL CUT CONTROL SYSTEM</b> .....	<b>F1-23</b>
<b>SYSTEM OPERATION</b> .....	<b>F1-23</b>
<b>FUEL CUT SOLENOID VALVE</b> .....	<b>F1-23</b>
<b>IDLE SPEED CONTROL SYSTEM</b> .....	<b>F1-24</b>
<b>STRUCTURAL VIEW</b> .....	<b>F1-24</b>
<b>IDLING KNOB, IDLING CABLE</b> .....	<b>F1-24</b>
<b>EXHAUST SYSTEM</b> .....	<b>F1-26</b>
<b>COMPONENTS</b> .....	<b>F1-26</b>

## INDEX

## INTAKE DEVICES

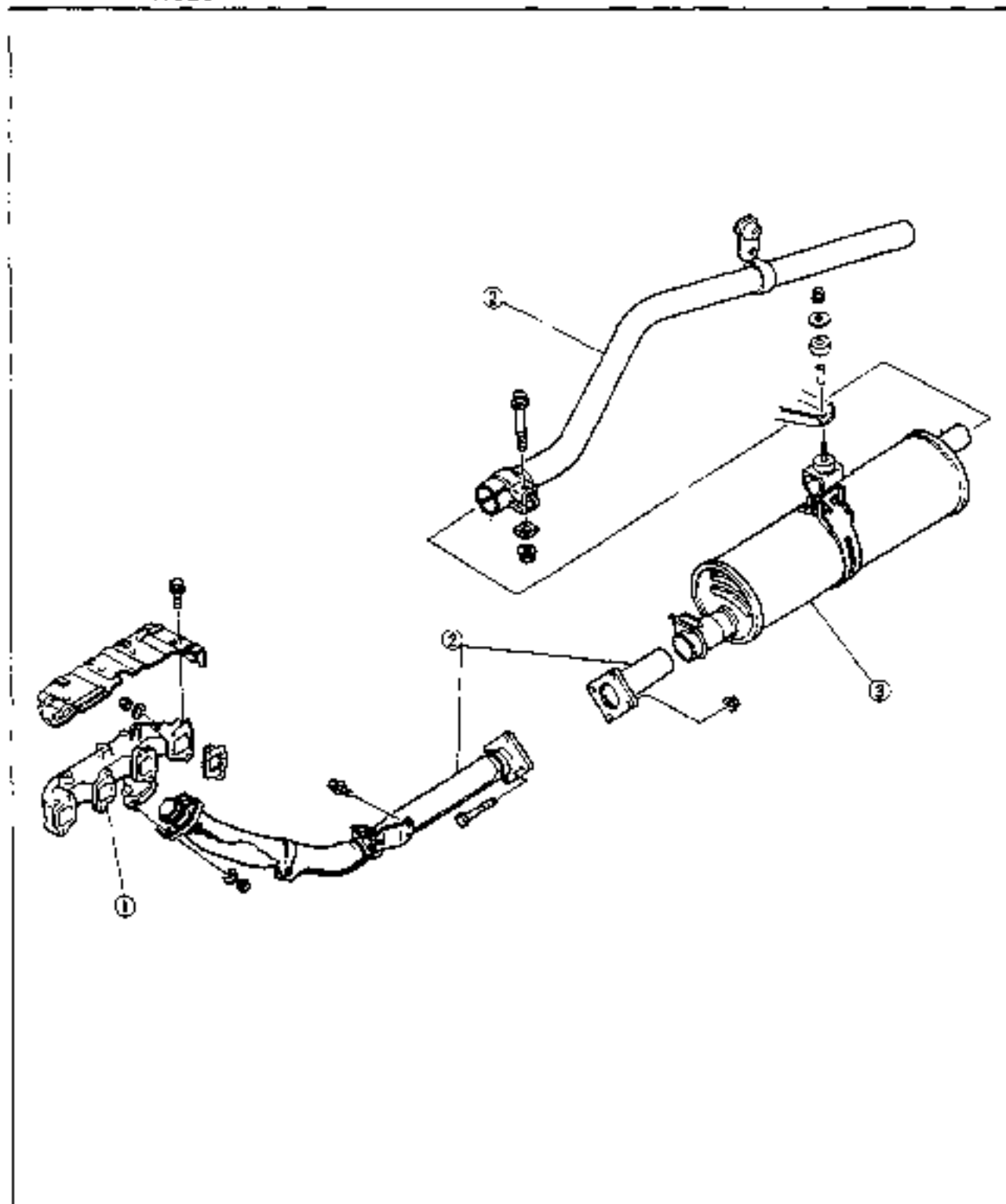


9T0GF1-002

1. Fresh air duct  
Removal / Inspection /  
Installation ..... page F1-11
2. Air cleaner  
Removal / Inspection /  
Installation ..... page F1-11  
Inspection of element

3. Intake manifold  
Removal / Inspection /  
Installation ..... page F1-11

## EXHAUST DEVICES

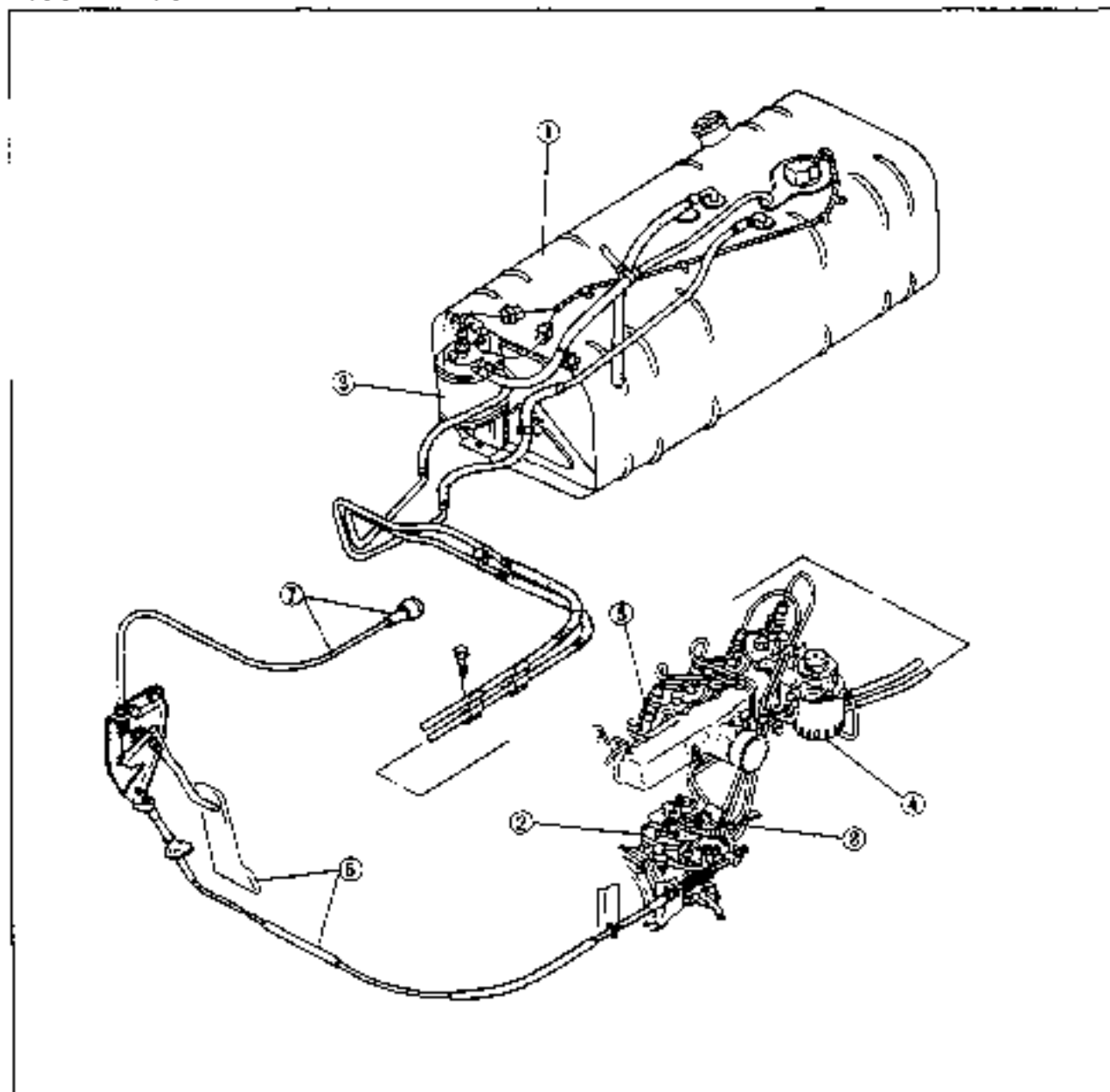


9TGD01 003

1. Exhaust manifold  
 Removal / Inspection /  
 Installation ..... page F1-26
2. Exhaust pipe  
 Removal / Inspection /  
 Installation ..... page F1-26

3. Silencer  
 Removal / Inspection /  
 Installation ..... page F1-26

## FUEL DEVICES



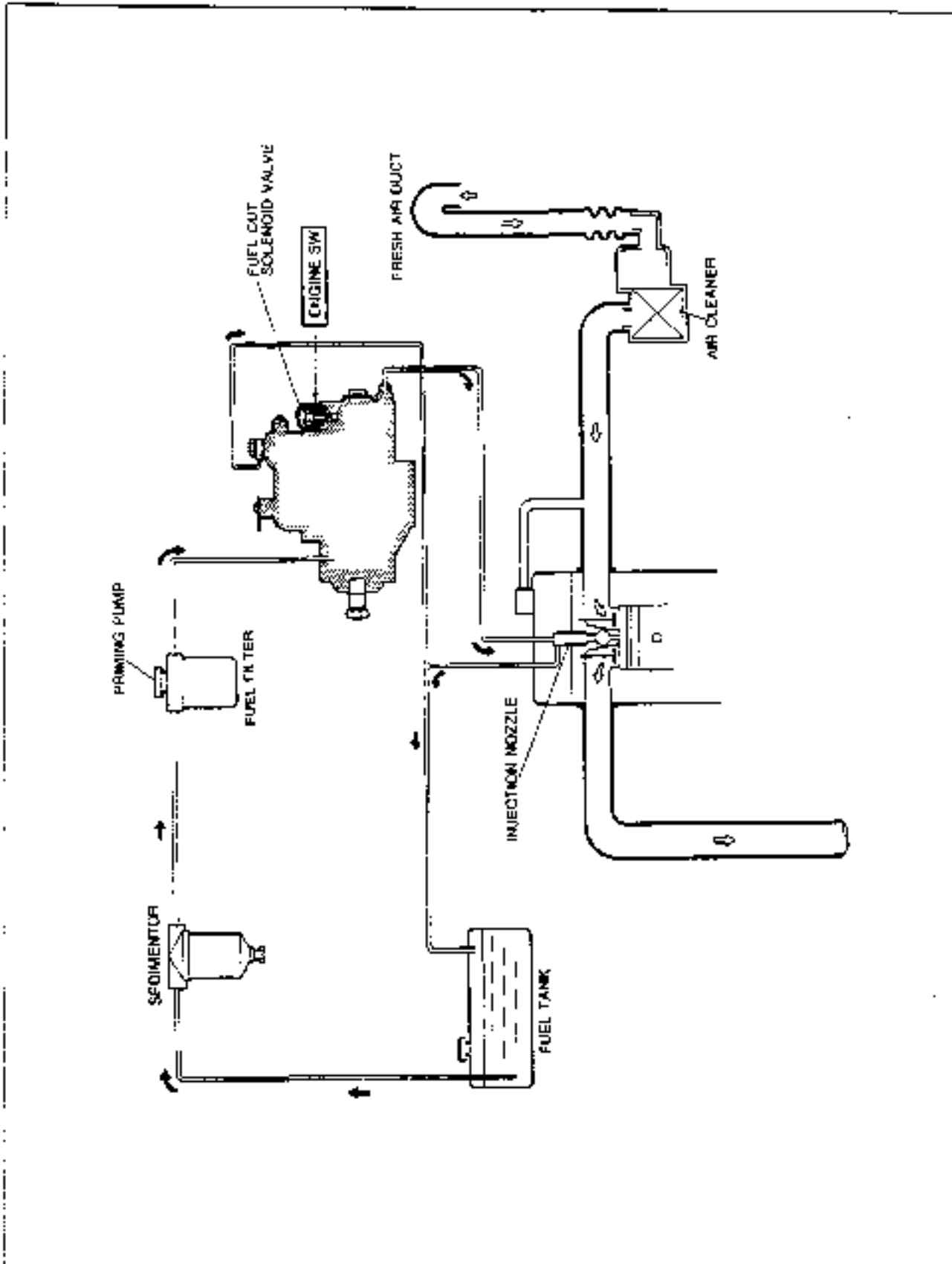
8700F1-004

- |   |            |
|---|------------|
| 1. Fuel tank                            |            |
| Removal / Inspection /                  |            |
| Installation.....                       | page F1-13 |
| 2. Injection pump                       |            |
| Removal / Installation.....             | page F1-14 |
| 3. Sedimentor                           |            |
| Draining water.....                     | page F1-16 |
| Inspection.....                         | page F1-16 |
| 4. Fuel filter                          |            |
| Air bleeding.....                       | page F1-17 |
| Inspection.....                         | page F1-17 |
| Replacement.....                        | page F1-18 |
| 5. Injection nozzle                     |            |
| Removal.....                            | page F1-19 |
| Inspection.....                         | page F1-19 |
| Disassembly.....                        | page F1-20 |
| Assembly.....                           | page F1-21 |
| Installation.....                       | page F1-21 |
| 6. Accelerator pedal, Accelerator cable |            |
| Inspection / Adjustment.....            | page F1-22 |
| Removal / Installation.....             | page F1-22 |
| 7. Idling knob, Idling cable            |            |
| Inspection / Adjustment.....            | page F1-24 |
| Removal / Installation.....             | page F1-25 |
| 8. Fuel cut solenoid valve              |            |
| Inspection.....                         | page F1-23 |
| Replacement.....                        | page F1-23 |

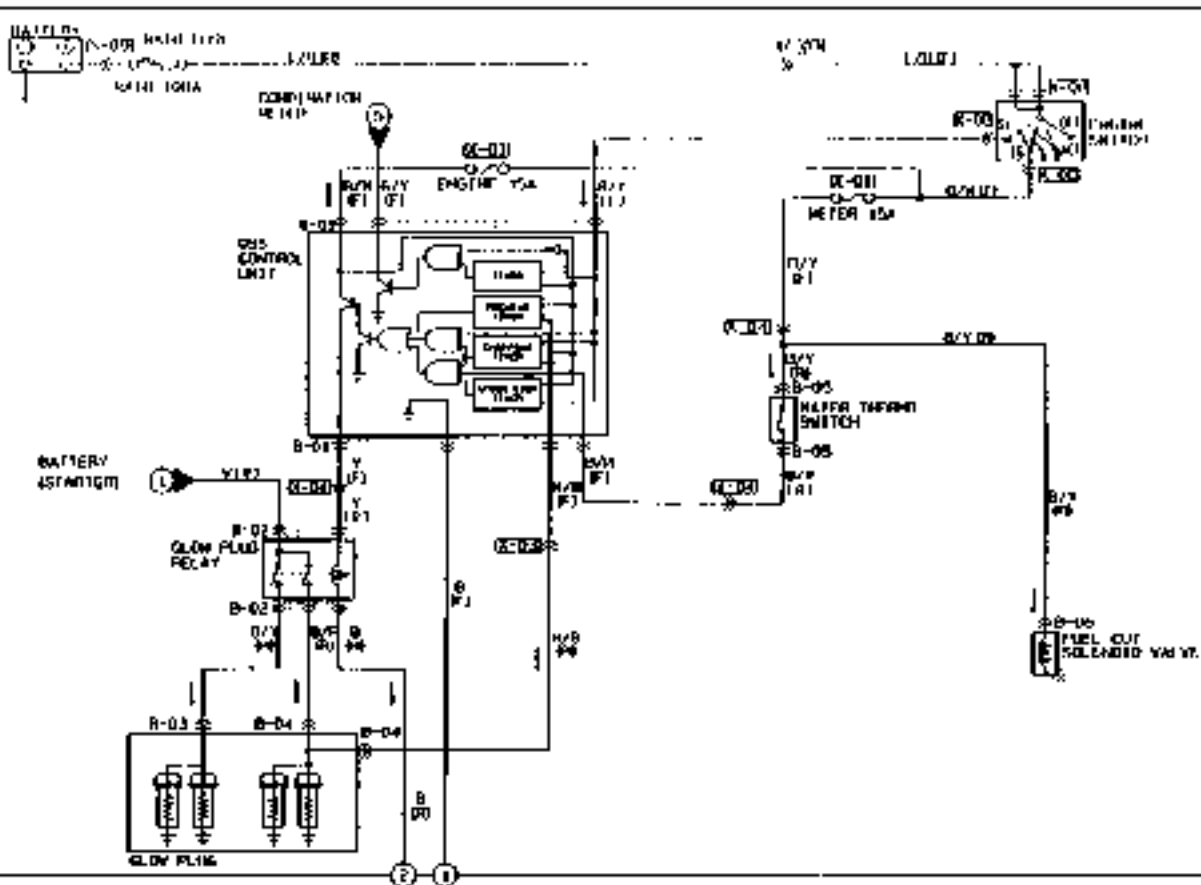


OUTLINE

SYSTEM DIAGRAM



WIRING DIAGRAM



B-01 GDS CONTROL UNIT (P)    B-02 GLOW PLUG RELAY (P)    B-03 GLOW PLUG (P)    B-04 GLOW PLUG (P)    B-05 WATER THERMO SWITCH (P)    B-06 FUEL CUT SOLENOID VALVE (P)



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NOTE: 1 - MIN USED

## TROUBLESHOOTING GUIDE

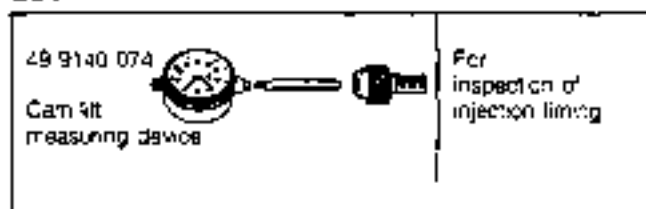
Trouble	Possible Cause	Action
Hard starting	<b>Fuel filter</b> Clogged Water or air in fuel filter	Replace Repair
	<b>Fuel injection pump</b> Faulty fuel cut solenoid Faulty injection timing Air in injection pump Faulty stop lever position Trouble inside pump	Replace Adjust Repair Adjust Replace
	<b>Fuel injection nozzle</b> Seized needle valve Fuel dripping from nozzle Faulty valve opening pressure Faulty glow plug	Replace Replace Adjust Replace
Rough idling	<b>Fuel filter</b> Clogged Water or air in fuel filter	Replace Repair
	<b>Fuel injection pump</b> Refer to "Hard starting"	
	<b>Fuel injection nozzle</b> Seized needle valve Faulty valve opening pressure Improper mounting to nozzle holder Leakage of nozzle holder copper washer	Replace Adjust Repair Replace
	<b>Fuel injection pipe</b> Cracks Leaking from joint Improper idle speed adjustment	Replace Repair Adjust
Engine knocking	Faulty injection timing Low quality fuel Faulty injection nozzle opening pressure Seized needle valve of injection nozzle Fuel dripping from injection nozzle	Adjust Replace Adjust Replace Replace
High fuel consumption	<b>Fuel injection pump</b> Faulty full load adjust screw Faulty injection timing High idling speed	Adjust Adjust Adjust
	<b>Fuel injection nozzle</b> Faulty valve opening pressure Fuel dripping from nozzle Leakage of nozzle holder copper washer Fuel leaking from joint Clogged fuel filter Clogged air cleaner	Repair Replace Replace Repair Replace Replace
Poor acceleration	<b>Fuel injection nozzle</b> Clogged air cleaner Seized needle valve Fuel dripping from nozzle	Adjust Replace Replace
	<b>Fuel injection pump</b> Refer to "Hard starting"	
	<b>Fuel injection pipe</b> Refer to "Rough idling"	
	<b>Fuel filter</b> Water, air, etc., in the fuel filter Clogged	Adjust Replace

9780F1-007

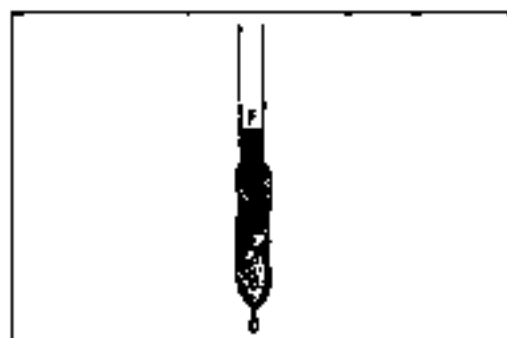
## ENGINE TUNE-UP

## PREPARATION

## SST



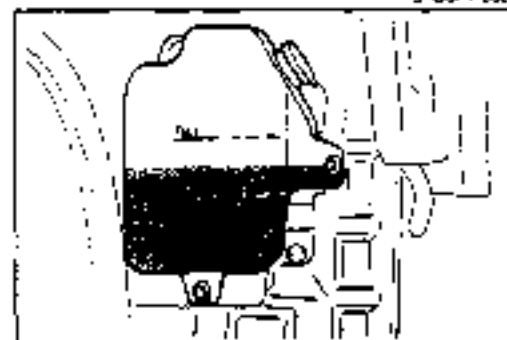
9TGC01-006



9TGC01-008

**BASIC INSPECTION****Engine Oil**

Check the engine oil level and condition with the level gauge. Add or change oil, if necessary.

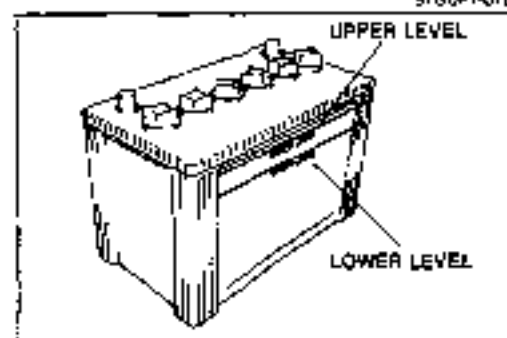


9TGC01-010

**Coolant****Warning**

- Never remove the radiator cap while the engine is hot.
- Wrap a thick cloth around the cap while carefully removing it.

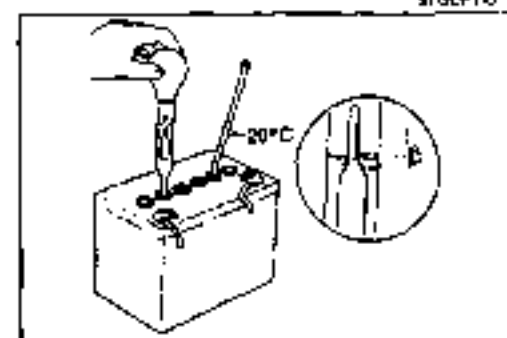
Verify that the coolant level is near the radiator inlet port and that the level in the reservoir is between the FULL and LOW marks. Add coolant as necessary.



9TGC01-011

**Battery**

1. Check for corrosion on the terminals and for loose cable connections.
2. Check the electrolyte level. If the level is too low, add distilled water to the "UPPER LEVEL" mark.



9TGC01-012

3. Check the specific gravity with a hydrometer.

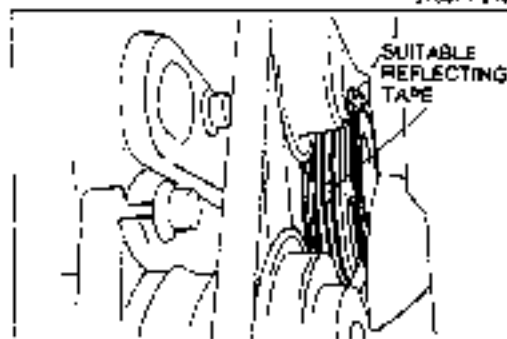
If the specific gravity reading is 1.23 or less, recharge the battery. (Refer to Section G.)



5TGF1-012

**Air Cleaner Element**

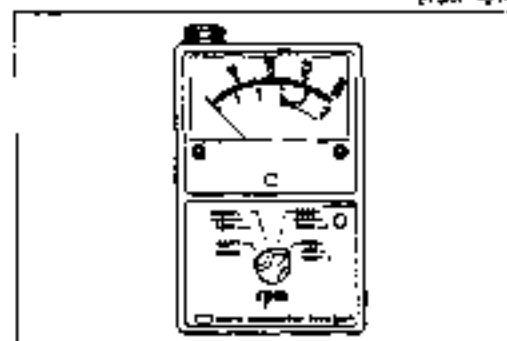
Visually check the air cleaner element for excessive dirt, damage or oil. Clean with compressed air if necessary.



5TGF1-014

**ADJUSTMENT****Idle Speed**

1. Attach suitable reflector tape to the crankshaft pulley.
2. Run the engine at idle at normal operating temperature. Turn off all unnecessary electrical loads.



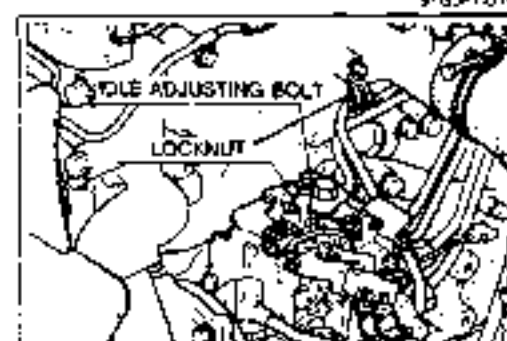
5TGF1-015

3. Confirm the free play of the accelerator cable.

**Free play:** 1.0—3.0mm (0.039—0.118 in)

4. Aim the light of the photo tachometer onto the reflecting tape to measure the engine speed.

**Idle speed:** 600—650 rpm

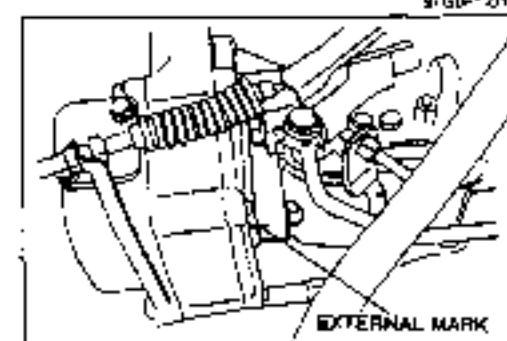


5TGF1-016

5. If not as specified, loosen the locknut of the idle adjusting bolt and turn the bolt to adjust the idle.
6. Tighten the locknut.

**Tightening torque:**

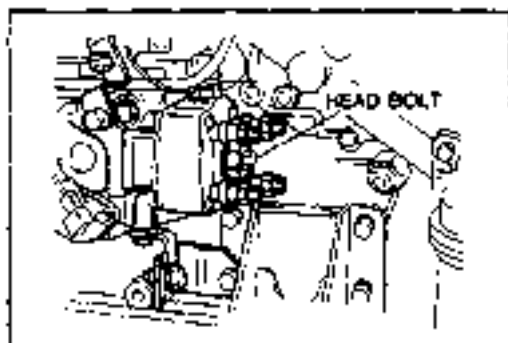
5.9—8.8 Nm (0.6—0.9 m·kg, 4.3—7.2 ft·lb)



5TGF1-017

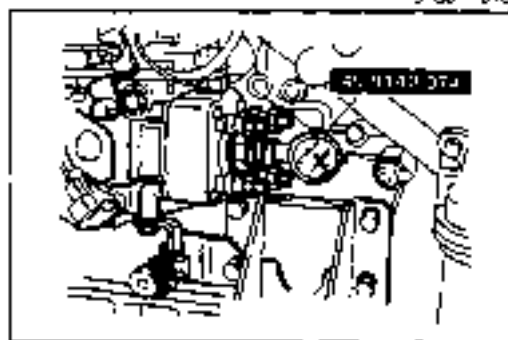
**Injection Timing Inspection****Note**

- Usually it is enough to confirm that the external marks are aligned.
- Set the injection timing after installation of the injection pump.



9TGF1-015

1. Disconnect the fuel injection pipes from the injection pump.
2. Remove the bolt and gasket from the distributor head of the injection pump.

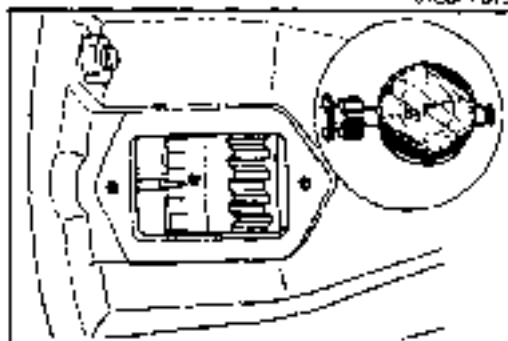


9TGF1-019

3. Screw the **SST** into the injection pump. Make sure that the tip of the feeler of the measuring device is in contact with the plunger end at this time.

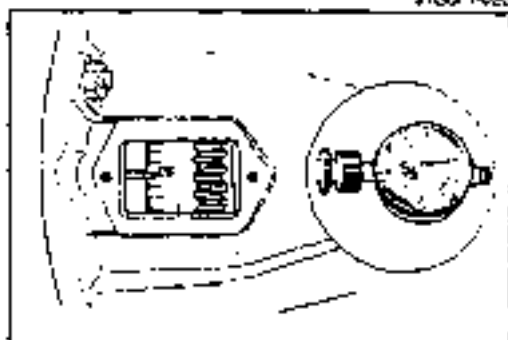
**Note**

- The **SST** specified by Diesel Kiki Co., Ltd. is 157629-3520.



9TGF1-020

4. Turn the flywheel to set the flywheel to **approx. 30° BTDC** and find the position in which the needle of the dial gauge does not move when the flywheel is turned.
5. When the dial gauge needle does not deflect, set the needle to "0" on the scale.



9TGF1-021

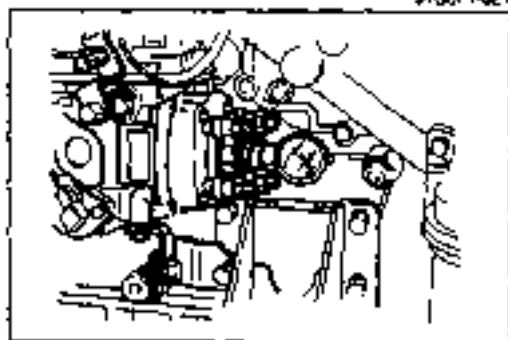
6. Turn the flywheel in the normal direction until **3° BTDC** is indicated. The injection timing is normal when the dial gauge needle is advanced 1.00mm (0.039 in) ahead of the value set in Step 5.

**Static injection: Cam lift 1.00mm (0.0394 in)**

7. If the change is not as specified, adjust the injection timing.

**Adjusting Injection Pump**

1. If the injection timing is faulty, turn the injection pump to a position in which the dial gauge needle indicates 1.00mm (0.039 in). When the cam lift is larger than 1.00mm (0.039 in), turn the injection pump all the way in the engine revolving direction once, and then turn it in the reverse direction, adjusting the cam lift to the 1.00mm (0.039 in) point. If the cam lift is smaller than 1.00mm (0.039 in), adjust the lift by turning the pump in the direction inverse to the engine revolving direction.
2. After the adjustment, install the head bolt and gasket.
3. Use a new head bolt and gasket.



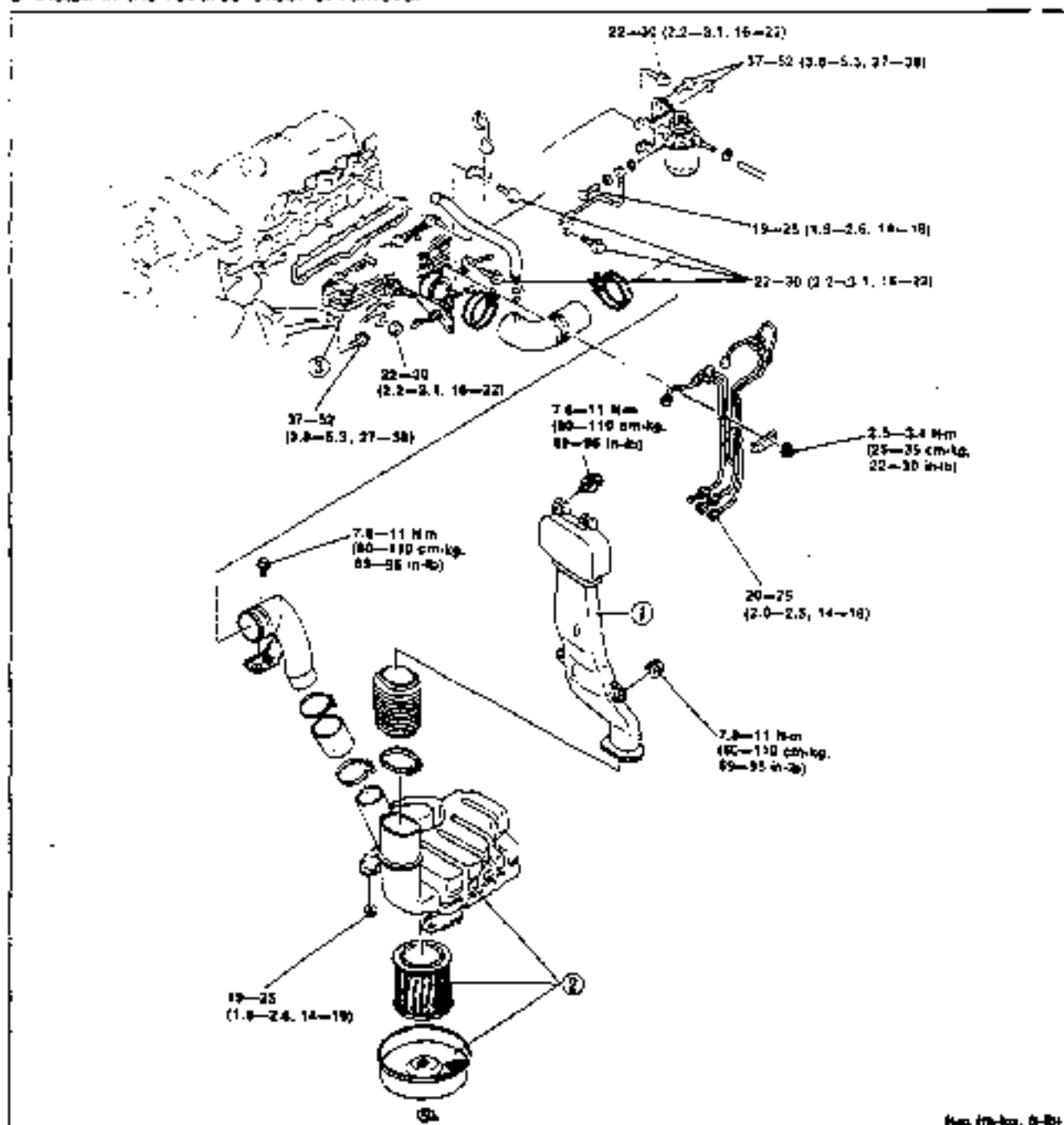
9TGF1-022

INTAKE AIR SYSTEM

COMPONENTS

Removal / Inspection / Installation

1. Remove in the order shown in the figure
2. Inspect all parts and repair or replace as necessary.
3. Install in the reverse order of removal

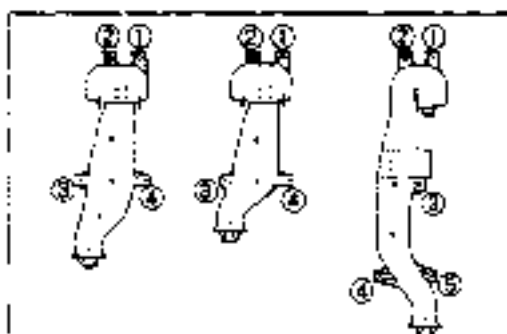


4mm (7/16)-lug, 4-B)

97GDF1-029

1. Fresh air duct  
Check for contamination, cracks and other damage  
Installation Note ..... page F1-12
2. Air cleaner  
Inspection of element, .... page F1- 9

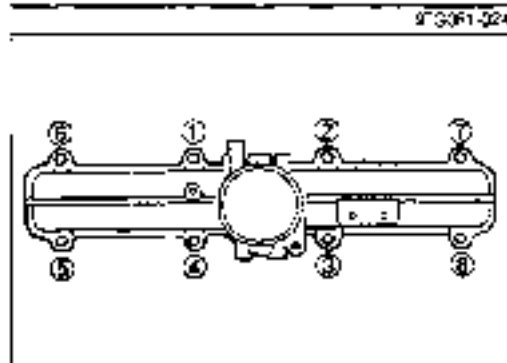
3. Intake manifold  
Check for contamination, cracks and other damage  
Installation Note ..... page F1-12



9T30F1-024

**Installation Note****Fresh air duct**

Install in the order shown in the figure.



9T30F1-025

**Intake manifold**

- 1 Use a new gasket.
- 2 Tighten in the order shown in the figure.

**Tightening torque:**

22–31 Nm (2.2–3.1 m·kg, 15–22 ft·lb)



## FUEL SYSTEM

## PREPARATION

## SST

49 SE0: 157

Extractor

For  
removal of  
injection pump

9TGF1-026

## FUEL TANK

## Removal / Inspection / Installation

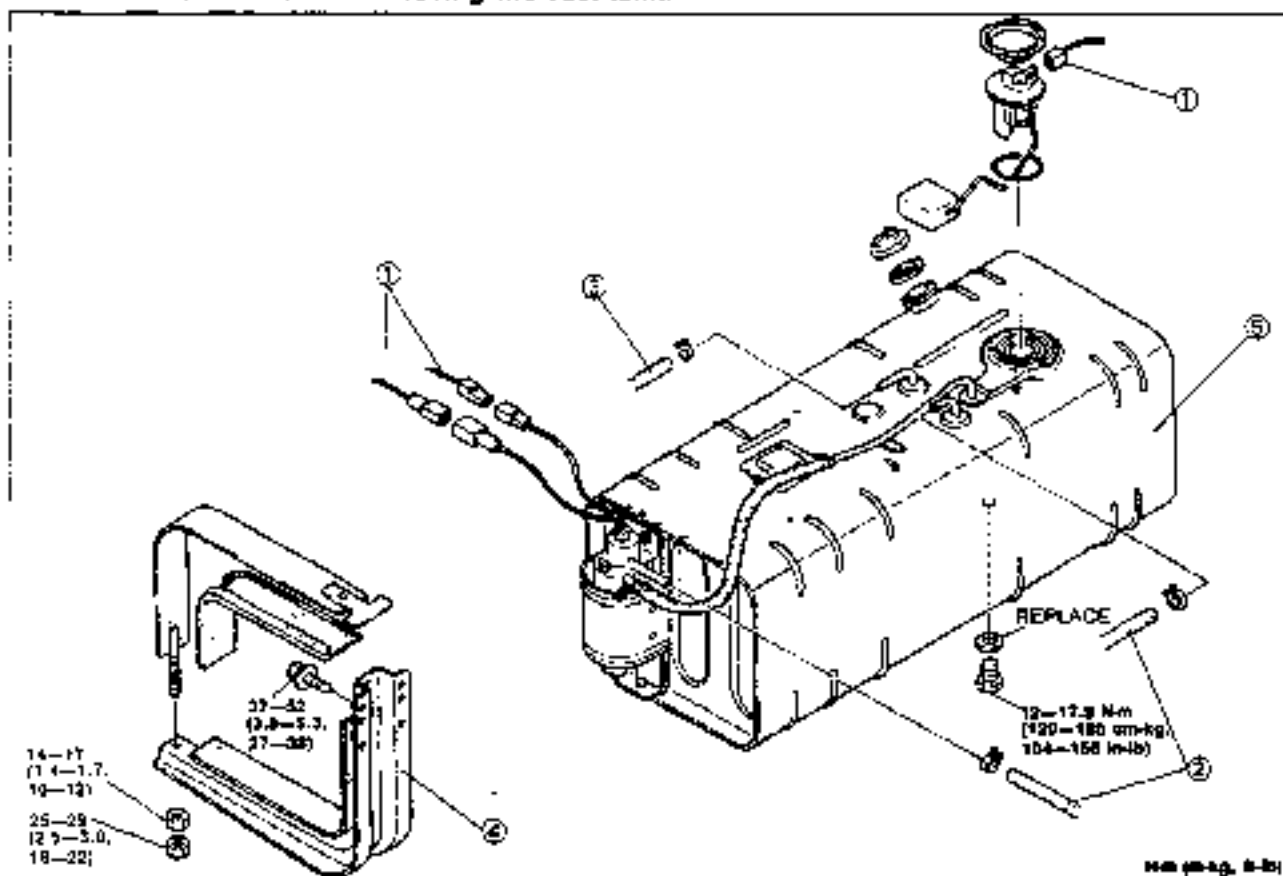
- 1 Remove in the order shown in the figure.
- 2 Inspect all parts and repair or replace as necessary.
- 3 Install in the reverse order of removal.

## Warning

- Keep sparks, cigarettes, and open flames away from the fuel tank.

## Note

- Drain the fuel before removing the fuel tank.



- 1 Connector
- 2 Fuel hose
3. Evaporative hose  
Be sure the air flows through the hose each side

- 4 Fuel tank strap
5. Fuel tank  
Check for contamination, cracks and other damage

## INJECTION PUMP

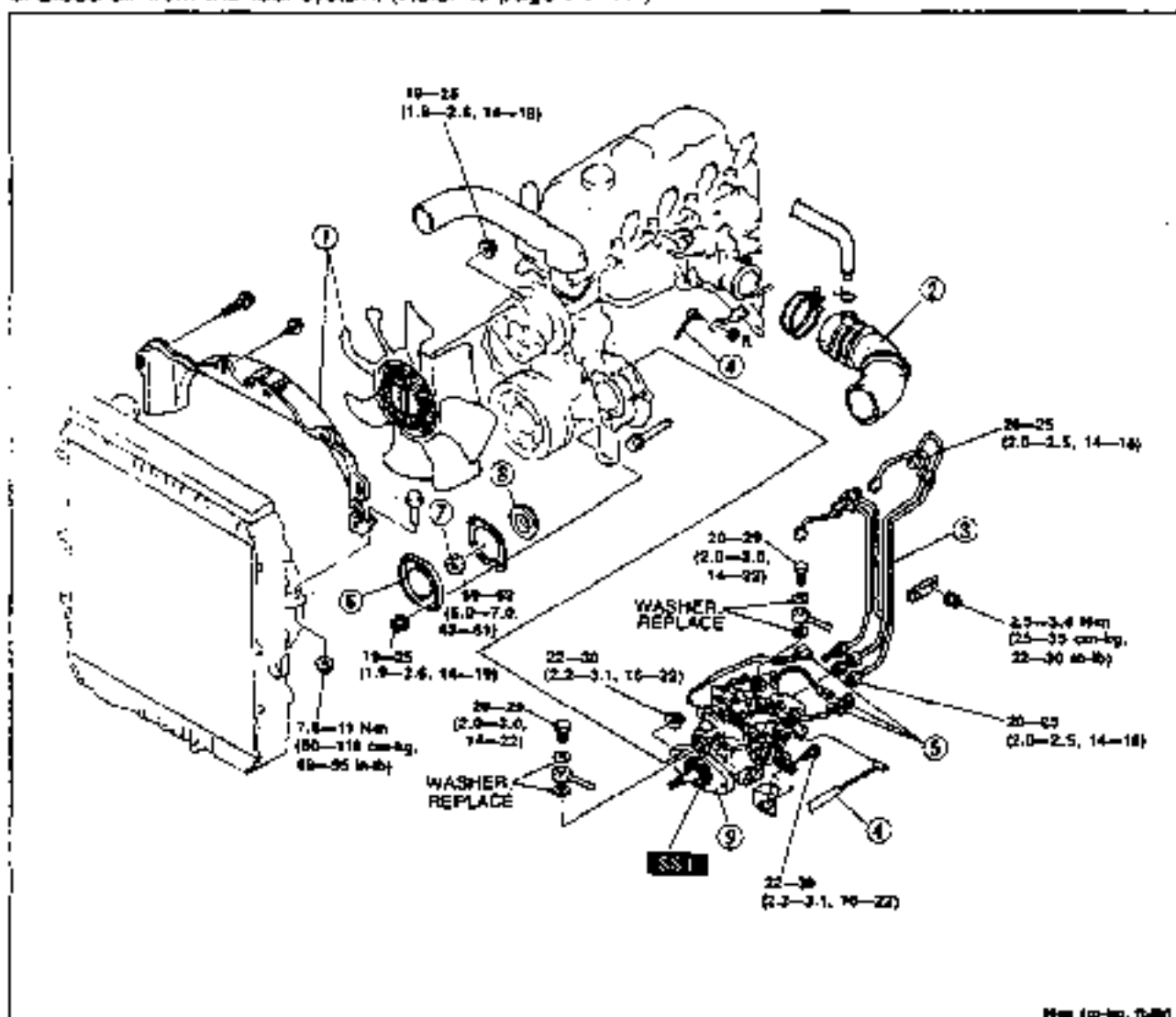
**Note**

- Special tools and testers are required for service of the injection pump. The pump should be serviced only by an authorized Diesel Kik distributor.

**Removal / Installation****Warning**

- Keep sparks cigarettes, and open flames away from the injection pump.

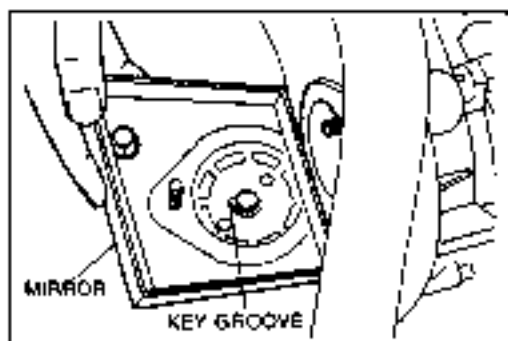
1. Remove the negative battery cable.
2. Remove in the order shown in the figure, referring to **Removal Note**.
3. Install in the reverse order of removal, referring to **Installation Note**.
4. Adjust the injection timing. (Refer to page F1-9.)
5. Bleed air from the fuel system. (Refer to page F1-17.)



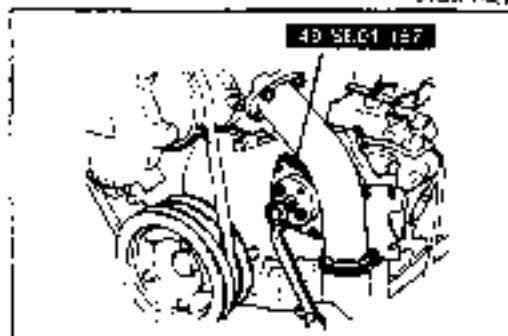
Nm (m-kg, ft-lb)

9TGM1-028

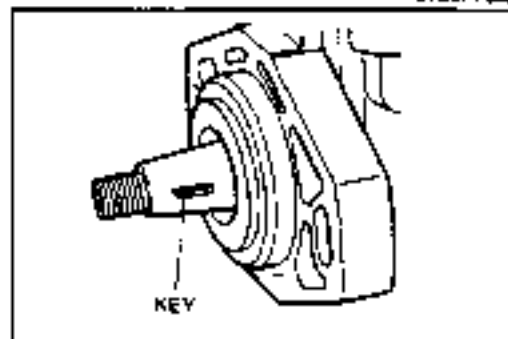
- |                                     |                   |
|-------------------------------------|-------------------|
| 1. Fan and upper cooling fan shroud | 6. Pump cover     |
| 2. Air hose                         | 7. Locknut        |
| 3. Injection pipe                   | 8. Washer         |
| 4. Accelerator pipe, Idle-up cable  | 9. Injection pump |
| 5. Harness                          |                   |



9T00F1-029



9T00F1-030



9T00F-031

**Removal Note**

1. Before removal the injection pump, turn the flywheel through the clutch cover timing hole until the key is at the top position. Use a mirror to see key.

2. Attach the **SST** (Use the side marked M.)

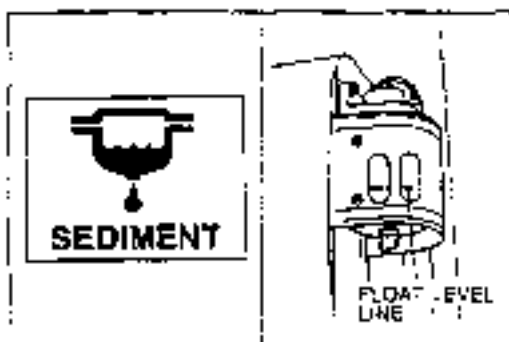
3. Turn the **SST** bolt to push the pump free of the drive gear.

**Caution**

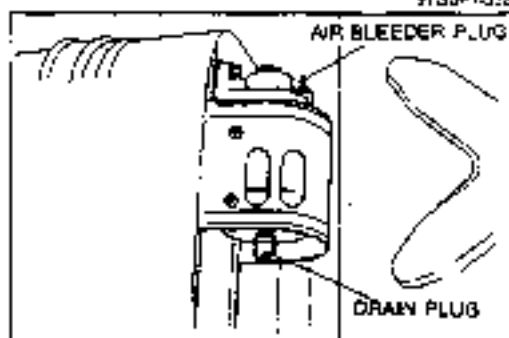
- Do not drop the key into the gear case.

**Installation Note**

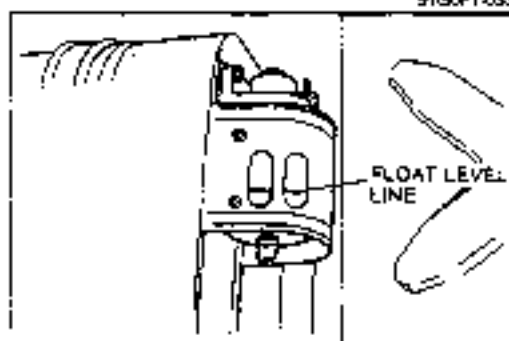
Before installing the key into the driveshaft of the injection pump, lightly tap the key groove of the shaft with a hammer to assure that the key is tightly held in the key groove.



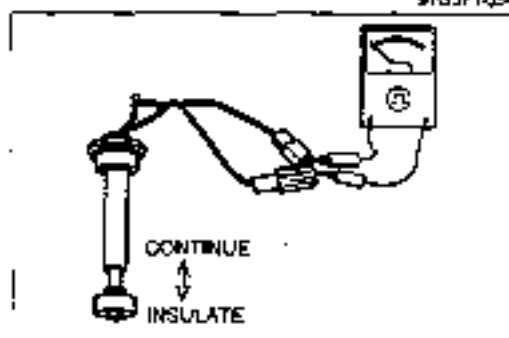
9T33F1-032



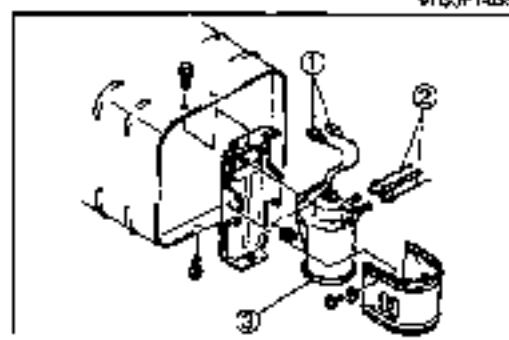
9T30F1-033



9T33F1-034



9T33F1-035



9T33F1-036

### SEDIMENTOR Draining water

#### Note

- Drain water when the sedimentor warning light is illuminated or when the float ring has risen near the float level line.

1. Loosen the drain plug.
2. Loosen the air bleeder plug.
3. After all of the water has been drained, install the drain plug.
4. Pump the priming pump at the fuel filter until clear (no air bubbles) fuel is expelled from the air bleeder plug. Tighten the bleeder plug.

#### Inspection

1. Visually check the sedimentor for damage and fuel leakage. Repair or replace, if necessary.
2. Check the position of the float ring. If the ring is near the float level line, drain the water.

### SEDIMENTOR SENSOR (DETECTOR)

#### Inspection

1. Remove the sedimentor sensor from sedimentor.
2. Check continuity of the detector.

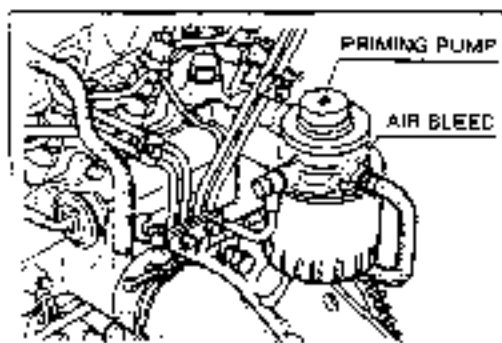
Float	Continuity
Up	Yes
Down	No

#### Replacement

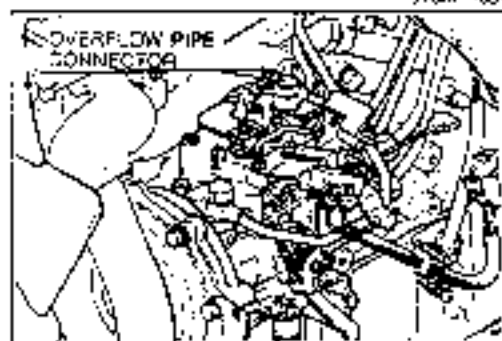
#### Warning

- Keep sparks, cigarettes, and open flames away from the sedimentor.

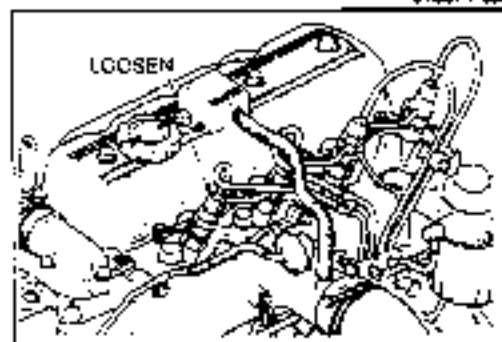
1. Disconnect the terminals.
2. Remove the fuel hoses.
3. Remove the sedimentor.
4. Install in the reverse order of removal.



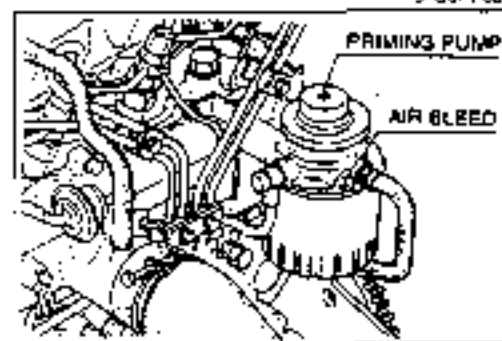
9TGF1-037



9TGF1-038



9TGF1-039



9TGF1-040



9TGF1-041

**FUEL FILTER****Air Bleeding****Warning**

- Keep sparks, cigarettes, and open flames away from the fuel filter.

1. Remove the air bleeder plug.
2. Pump the priming pump until clear (no air bubbles) fuel flows from the bleeder plug hole.
3. Install the air bleeder plug.
4. Loosen the overflow pipe connector of the injection pump.
5. Pump the priming pump until fuel flows from the pipe.
6. Tighten the overflow pipe connector.

**Tightening torque:**

20—29 Nm (2.0—3.0 m·kg, 14—22 ft·lb)

7. Start the engine and run it at idle until it runs smoothly. Stop the engine.
8. Loosen the all flare nuts of the injection pipes of injection nozzle side.
9. Confirm fuel injection from the injection pipes while cranking.
10. Tighten the nuts.

**Tightening torque:**

20—25 Nm (2.0—2.5 m·kg, 14—18 ft·lb)

**Inspection of priming pump****Warning**

- Keep sparks, cigarettes, and open flames away from the fuel filter.

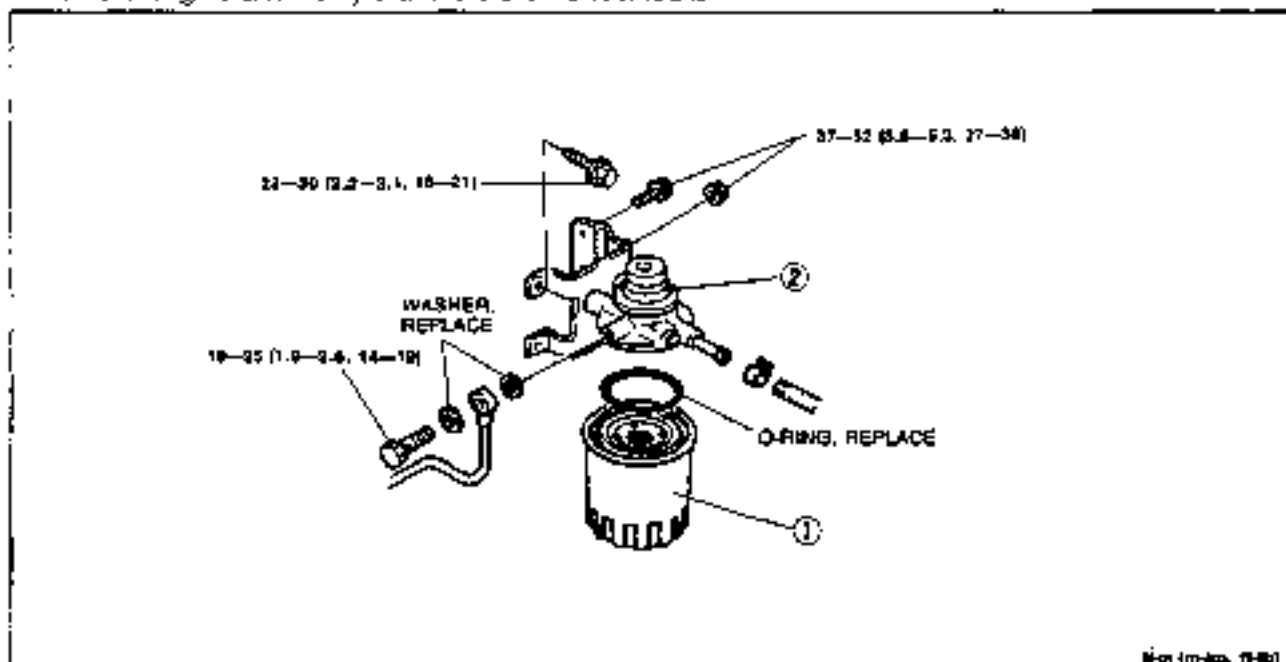
1. Remove the air bleeder plug and verify that fuel flows from the bleeder plug hole while pumping the priming pump. If it does not, continue with step 2.
2. Remove the fuel hose from the inlet side of the filter.
3. Place a finger over the inlet part and verify that vacuum is felt when the pump is operated.
4. Replace the priming pump if not as specified.

## Replacement

**Warning**

- Keep sparks, cigarettes, and open flames away from the priming pump.

1. Remove in the order shown in the figure.
2. Install in the reverse order of removal.
3. Bleed air from the fuel system. (Refer to page F1-17.)
4. Run the engine and verify that there are no fuel leaks.



New (mkg, 11-90)

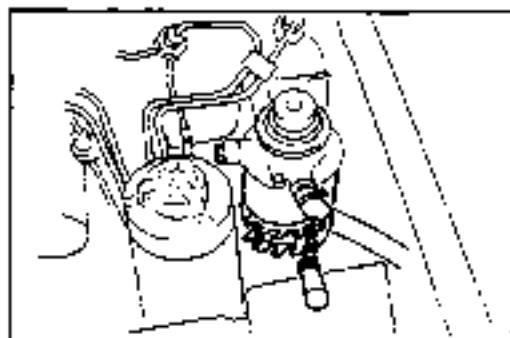
9TGF1-042

## 1. Filter element

Removal Note..... page F1-18

Installation Note..... page F1-18

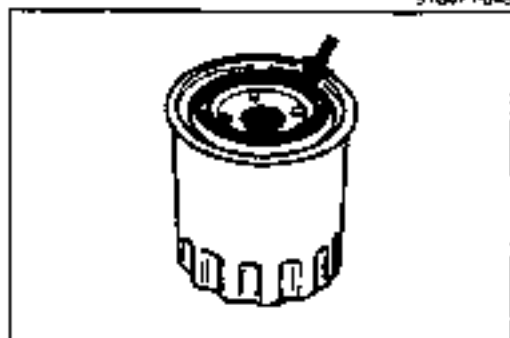
## 2. Fuel filter body



9TGF1-043

**Removal Note**

1. Remove the filter element with an oil filter wrench.



9TGF1-044

**Installation Note**

1. Apply fuel to the O-ring.
2. Install the filter element and tighten by hand, then tighten with an oil filter wrench an additional 1/3-turn.

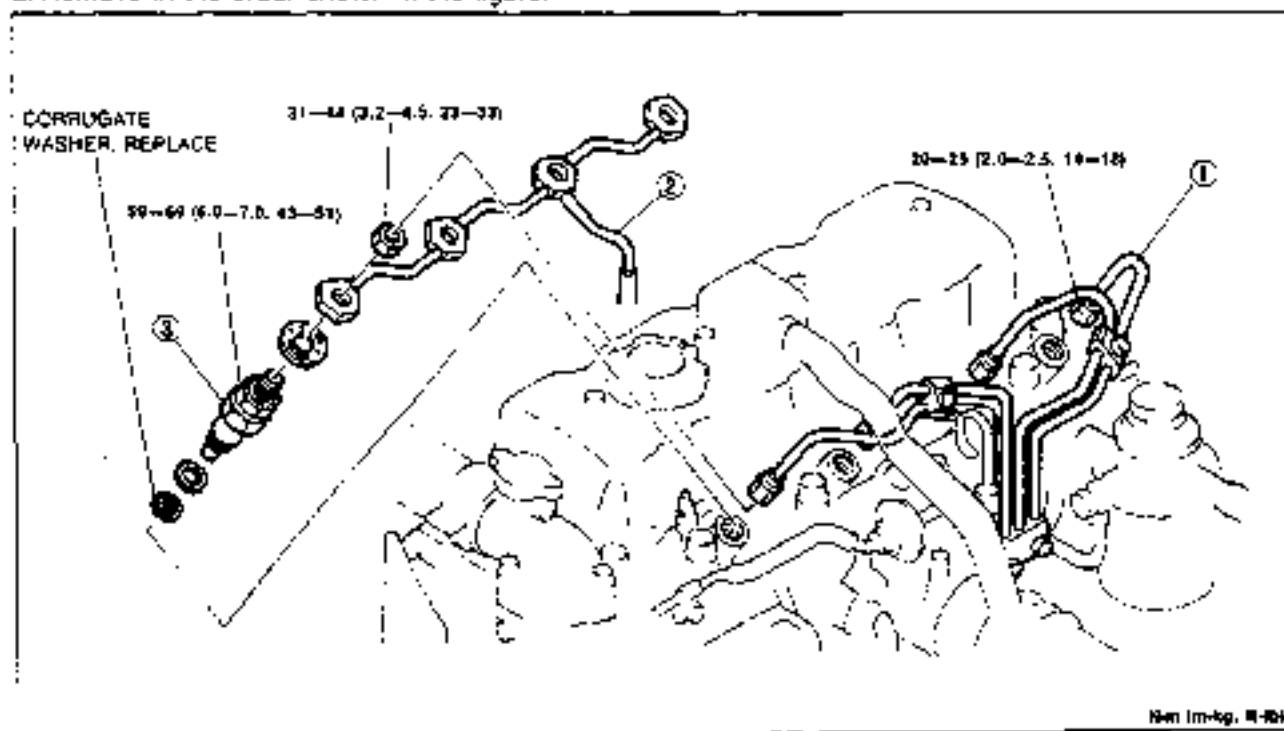
## INJECTION NOZZLE

## Removal

## Warning

- Keep sparks, cigarettes, and open flames away from the fuel area.

1. Remove the negative battery cable
2. Remove in the order shown in the figure.



1. Injection pipe
2. Return pipe

3. Injection nozzle

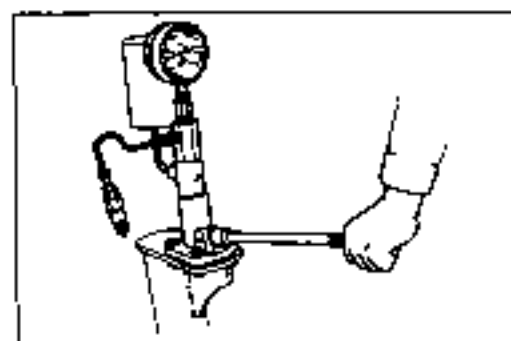
## Inspection

## Warning

- Do not allow your hands or any other part of the body to come into the direct path of the spray when using the nozzle tester because the spray has enough force to break the skin and possibly cause blood poisoning.

## Caution

- The nozzle tester should be set up in a clean work place.

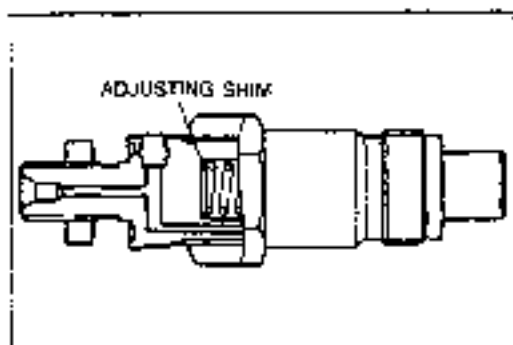


## Injection starting pressure

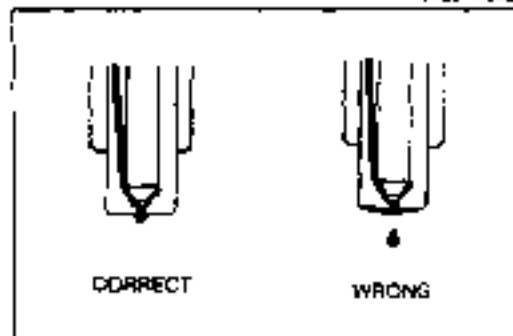
1. Connect the nozzle to a nozzle tester.
2. Pump the nozzle tester handle and note the pressure when injection is started.

## Injection starting pressure:

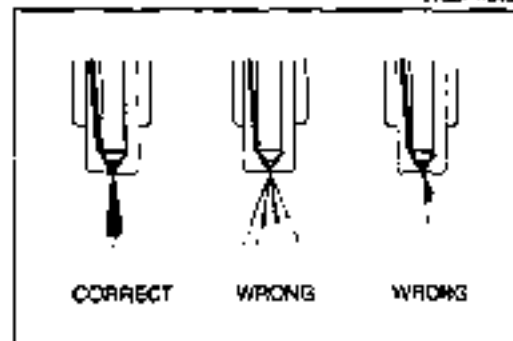
13,244—13,734 kPa  
(135—140 kg/cm<sup>2</sup>, 1,920—1,991 psi)



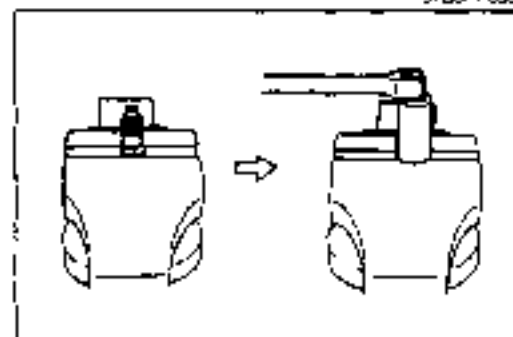
9TGF1-048



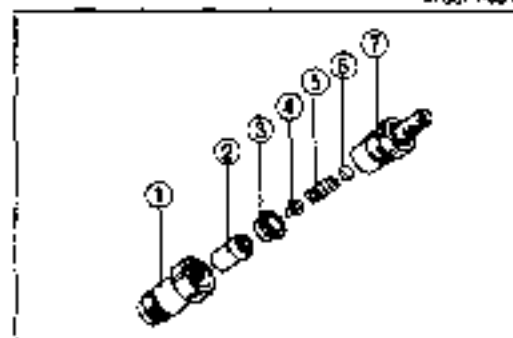
9TGF1-049



9TGF1-050



9TGF1-051



9TGF1-052

- If not within the specified pressure, adjust the starting pressure by adding or removing shims.

**Note**

- Shims are available in thicknesses of 0.5mm (0.0197 in) to 1.45mm (0.0571 in) in 0.04mm (0.0016 in) increments. Adding 0.04mm (0.0016 in) shim thickness increases injection starting pressure approx. 471 kPa (4.8 kg/cm<sup>2</sup>, 68 psi).

**Leakage of injector**

- Connect the nozzle to a nozzle tester.
- Apply pressure 1.962 kPa (20 kg/cm<sup>2</sup>, 284 psi) lower than the specified injection pressure, and verify that no fuel leaks from the injection nozzle.
- If fuel leaks, disassemble, clean and recheck the nozzle, or replace it.

**Atomizing condition**

- Connect the nozzle on the nozzle tester.
- Air bleed by operating the nozzle tester handle several times.
- Keeping the pressure gauge of the nozzle tester in the non-functioning condition, quickly lower the handle (lower the handle as quickly as possible so that a pulsating whistling sound can be heard). Repeat this operation several times and check the atomizing condition.
- Verify that the fuel is atomized uniformly and properly.
- Verify that the injection angle and direction are normal.
- If the atomizing condition is incorrect, it is necessary to disassemble, wash and recheck the nozzle, or to replace it.

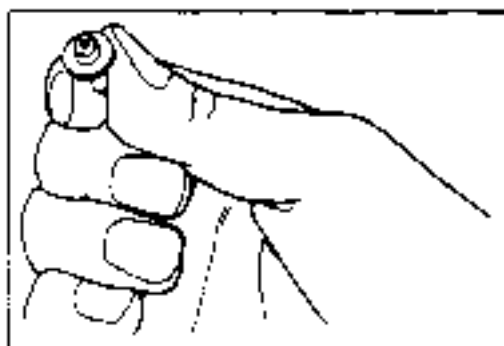
**Disassembly**

- Clamp the nozzle in a vise as shown in the figure.

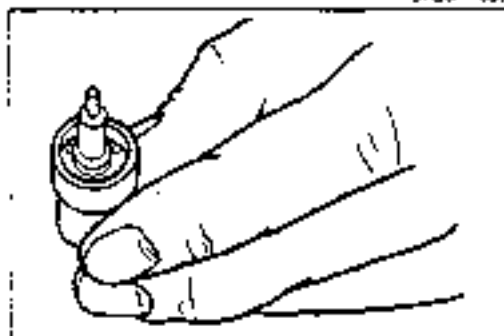
- Disassemble as shown in the figure.

- Retaining nut
- Nozzle body
- Distance piece
- Pressure pin
- Pressure spring
- Shim
- Nozzle holder

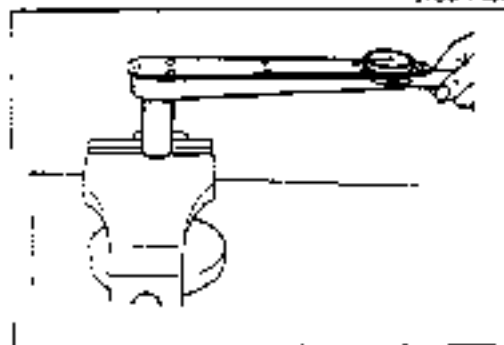




9TG2F1-053



9TG2F1-054



9TG2F1-055

### Checking Injection Nozzle

1. Verify that the seal of the pressure pin and other parts are free of damage.

2. Verify that the nozzle body is not damaged. Hold the nozzle body upright and insert the needle valve approximately two-thirds of the way into the body. Verify that the needle valve drops into the body under its own weight when released.

### Assembly

1. Assemble in the reverse order of disassembly.

#### Tightening torque:

76—98 N·m (8.0—10.0 m·kg, 58—72 ft·lb)

2. Retest the nozzle after assembly.

### Installation

#### Caution

- Do not reuse the copper washers.
- Tighten the nozzle into the cylinder head to the specified torque.

1. Install in the reverse order of removal.

#### Tightening torque:

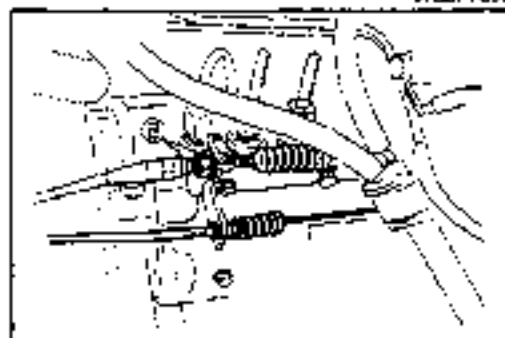
59—69 N·m (6.0—7.0 m·kg, 43—51 ft·lb)

2. Run the engine and check for fuel leakage.

9TG2F1-056



9T00F1-057



9T00F1-058

**ACCELERATOR PEDAL, ACCELERATOR CABLE****Inspection / Adjustment**

1. Verify that the control lever of injection pump is in the fully open position when the accelerator pedal is fully depressed.
2. Loosen nut A and adjust the stop bolt if necessary.

**Tightening torque:**

8.9—9.8 Nm (0.7—1.0 m·kg, 5.1—7.2 ft·lb)

3. Check the free play of the accelerator cable.

**Free play:** 1.0—3.0mm (0.039—0.12 in)

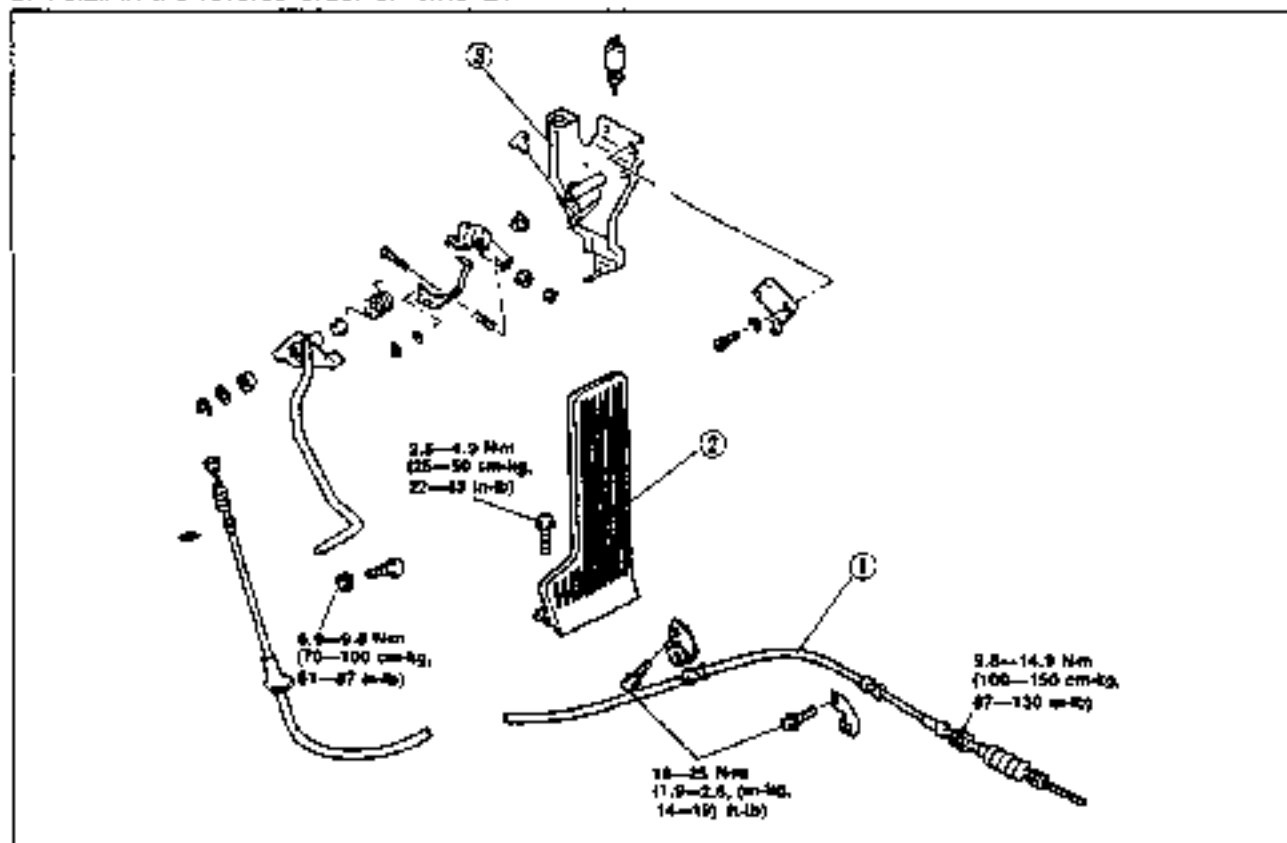
4. Adjust nuts B if necessary.

**Tightening torque:**

9.8—15 Nm (1.0—1.5 m·kg, 7.2—11 ft·lb)

**Removal / Installation**

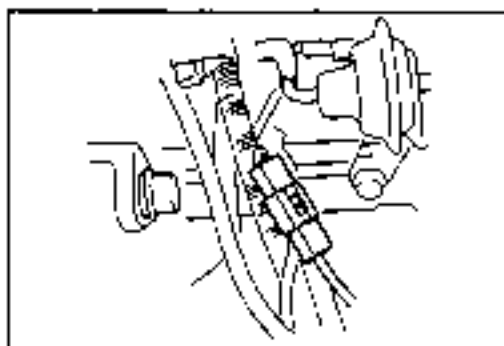
1. Remove in the order shown in the figure.
2. Install in the reverse order of removal.



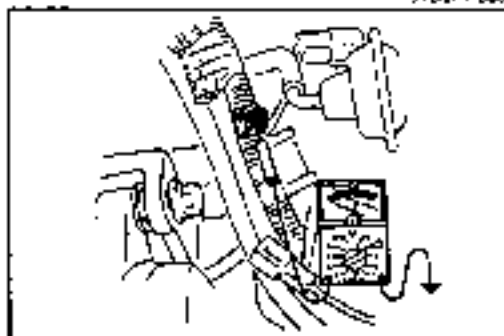
9T00F1-059

- 1 Accelerator cable
- 2 Accelerator pedal

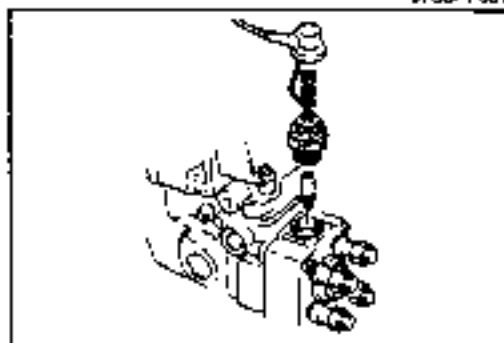
- 3 Bracket



97G0F1-060



97G0F1-061



97G0F1-062

## FUEL CUT CONTROL SYSTEM

### SYSTEM OPERATION

1. Verify that the engine stops when the fuel cut solenoid valve connector is disconnected.

### FUEL CUT SOLENOID VALVE

#### Inspection

1. Verify that the fuel cut solenoid valve clicks when the engine switch is turned ON and OFF.
2. If it does not, disconnect the fuel cut solenoid valve and check the voltage to the valve.

Engine switch	Voltage
ON	12V
OFF	0V

3. If as specified, replace the fuel cut solenoid valve.

#### Replacement

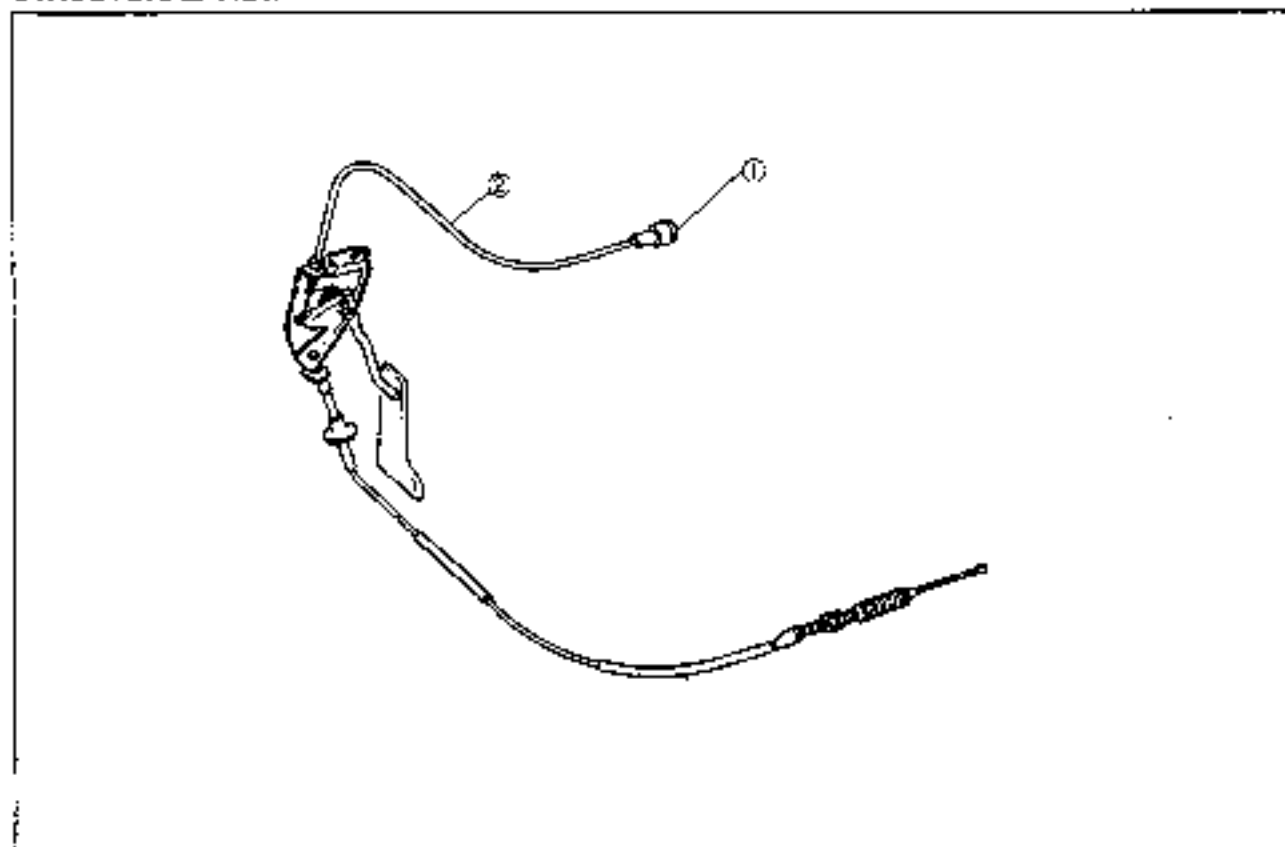
1. Disconnect the fuel cut solenoid valve connector.
2. Remove the fuel cut solenoid valve from the injection pump.
3. Install in the reverse order of removal.

#### Tightening torque:

39—44 Nm (4.0—4.5 m·kg, 29—33 ft·lb)

## IDLE SPEED CONTROL SYSTEM

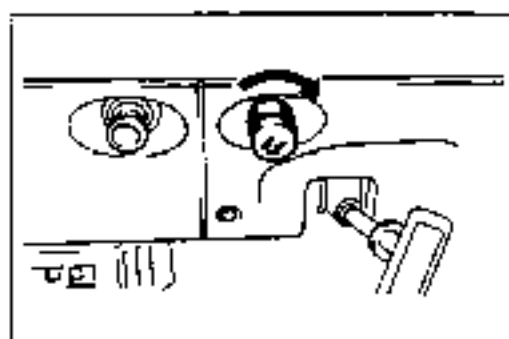
## STRUCTURAL VIEW



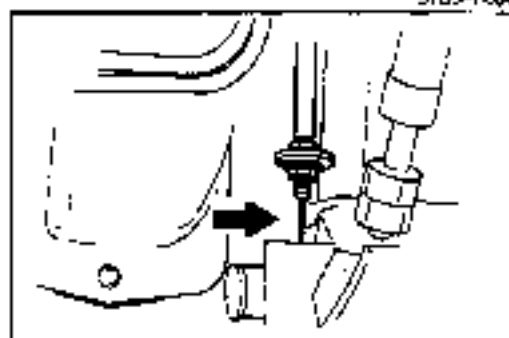
9T60F-063

1. Idling knob  
Removal / Installation ... page F1-25

2. Idling cable  
Inspection / Adjustment ..... page F1-24  
Removal / Installation ... page F1-25



9T62F1-064



9T63F1-065

**IDLING KNOB, IDLING CABLE**

1. Verify that the control lever of the injection pump is at idle position when the idling knob is not turned.
2. Verify that the idle speed increases when the knob is turned clockwise.

3. Check the free play of the cable when the idling knob is not turned.

**Free play: 0–5mm (0–0.2 in)**

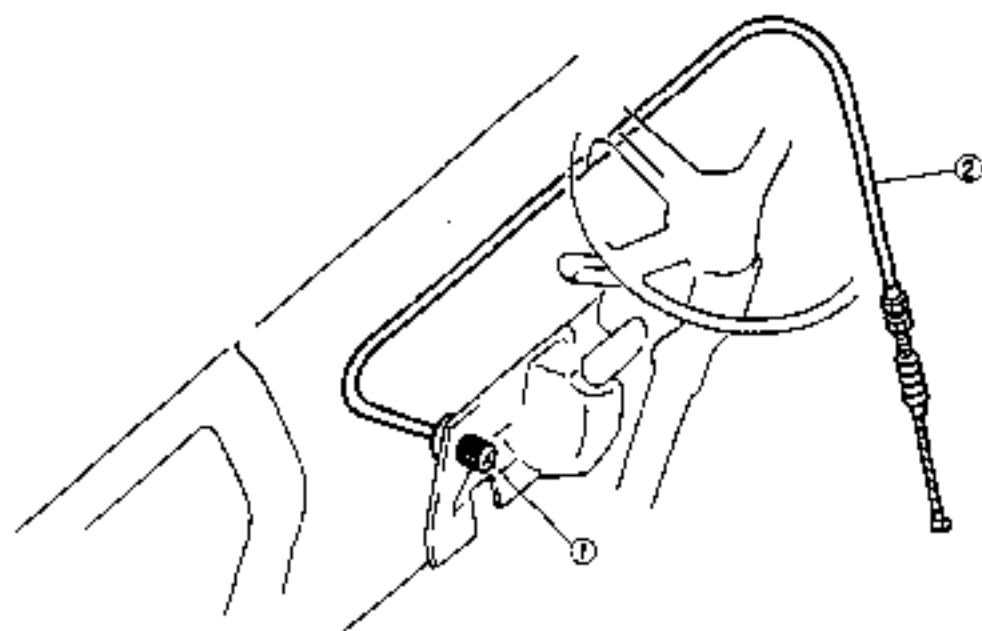
4. If not as specified, loosen the locknuts and adjust the free play.

**Tightening torque:**

**11–15 Nm (1.0–1.5 m·kg, 8–11 ft·lb)**

**Removal / Installation**

- 1 Remove in the order shown in the figure
- 2 Install in the reverse order of removal



1. Idling knob

2. Idling cable

## EXHAUST SYSTEM

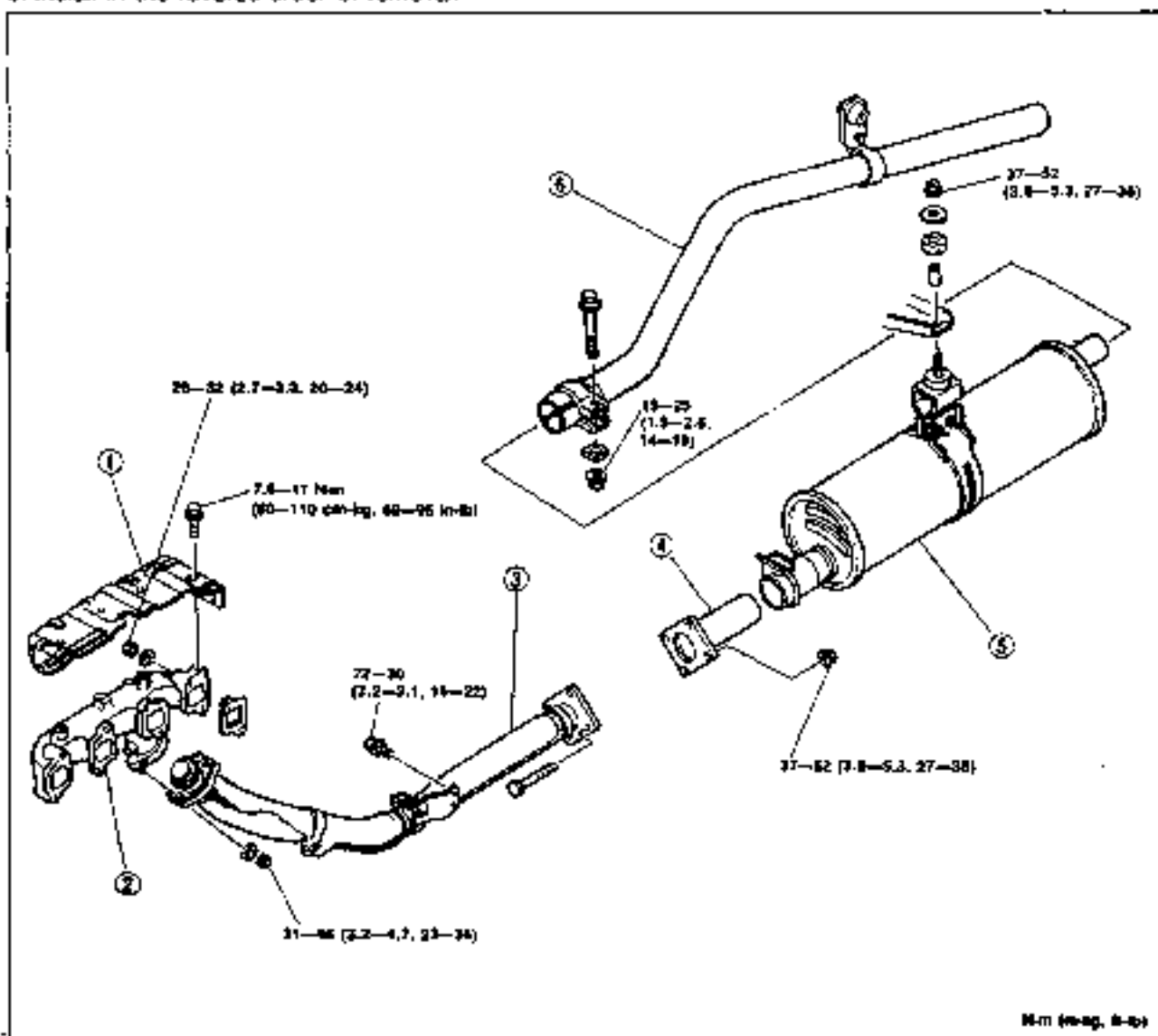
## COMPONENTS

## Vehicle Inspection

1. Run the engine and verify that there is no exhaust leakage

## Removal / Inspection / Installation

1. Remove in the order shown in the figure.
2. Inspect all parts and repair or replace as necessary.
3. Install in the reverse order of removal.



N-m (in-lb)

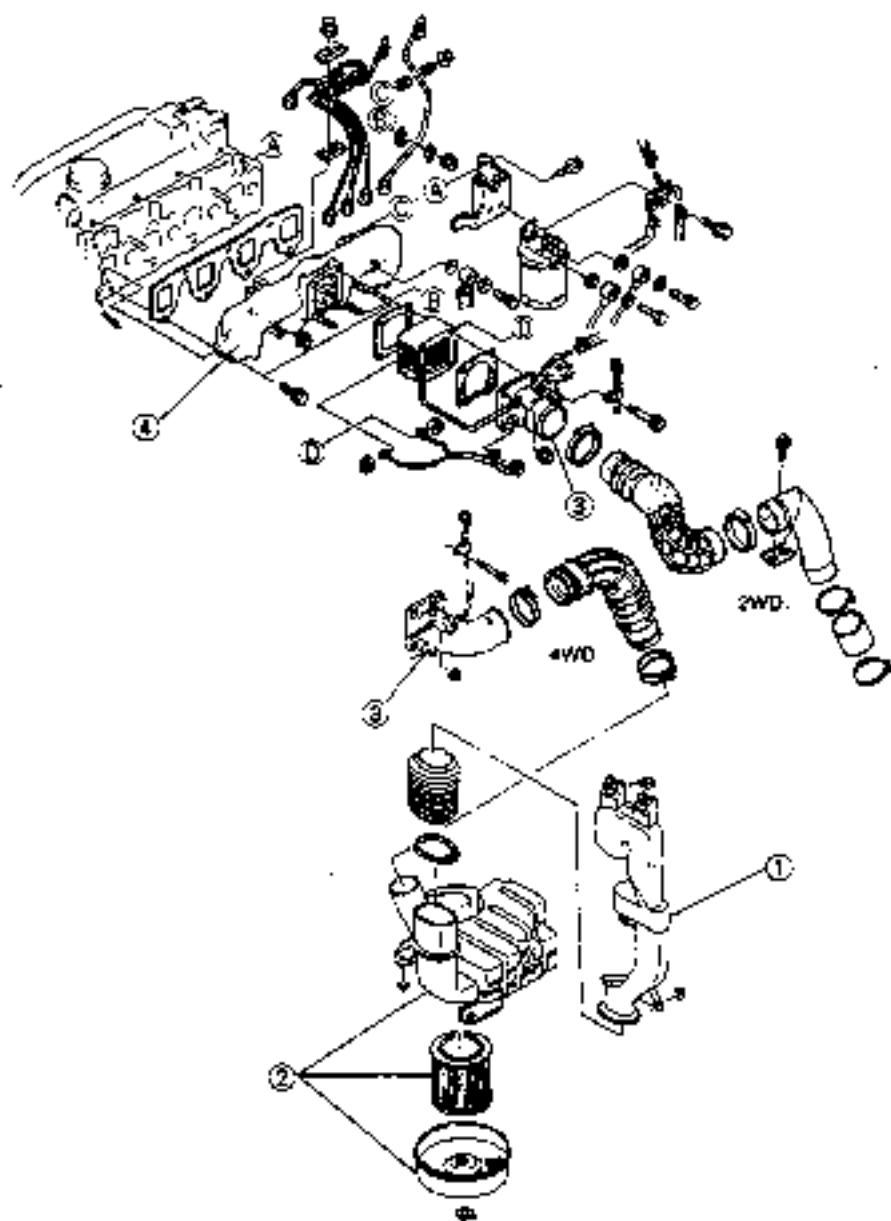
9'G0P1-00T

- |  |   |
|--|---|
| <ol style="list-style-type: none"> <li>1. Exhaust manifold insulator</li> <li>2. Exhaust manifold<br/>Check for contamination, cracks and other damage</li> <li>3. Front pipe assembly<br/>Check for contamination, cracks and other damage</li> <li>4. Middle pipe assembly<br/>Check for contamination, cracks and other damage</li> </ol> | <ol style="list-style-type: none"> <li>5. Main silencer<br/>Check for contamination, cracks and other damage</li> <li>6. Tail pipe assembly<br/>Check for contamination, cracks and other damage</li> </ol> |
|--|---|

# FUEL AND EMISSION CONTROL SYSTEMS (SL, SL TURBOCHARGED ENGINE)

<b>INDEX</b> .....	F2- 2	<b>FUEL CUT CONTROL SYSTEM</b> .....	F2-41
INTAKE DEVICES .....	F2- 2	SYSTEM OPERATION .....	F2-41
FUEL DEVICES .....	F2- 4	FUEL STOP CABLE .....	F2-41
EXHAUST CONTROLLED		<b>IDLE SPEED CONTROL SYSTEM</b> ...	F2-43
HEATING DEVICES .....	F2- 5	STRUCTURAL VIEW .....	F2-43
EXHAUST DEVICES .....	F2- 6	IDLING KNOB, IDLING CABLE .....	F2-43
<b>OUTLINE</b> .....	F2- 8	<b>EXHAUST SYSTEM</b> .....	F2-45
SYSTEM DIAGRAM .....	F2- 8	COMPONENTS.....	F2-45
WIRING DIAGRAM.....	F2-10	<b>EXHAUST CONTROLLED HEATING</b>	
VACUUM HOSE ROUTING		<b>SYSTEM</b> .....	F2-46
DIAGRAM .....	F2-11	STRUCTURAL VIEW .....	F2-46
<b>TROUBLESHOOTING GUIDE</b> .....	F2-12	EXHAUST HEATING CONTROL	
<b>ENGINE TUNE-UP</b> .....	F2-13	UNIT .....	F2-48
BASIC INSPECTION .....	F2-13	EXHAUST BRAKE UNIT	
ADJUSTMENT .....	F2-14	(POWER CHAMBER).....	F2-49
<b>INTAKE AIR SYSTEM</b> .....	F2-16	MAGNETIC VALVE	
COMPONENTS.....	F2-16	(FOR EXHAUST SHUTTER VALVE) F2-50	
<b>TURBOCHARGER</b> .....	F2-21	INTAKE SHUTTER VALVE .....	F2-51
PREPARATION .....	F2-21	INTAKE SHUTTER VALVE	
TURBOCHARGER .....	F2-21	ACTUATOR.....	F2-51
INTERCOOLER.....	F2-27	SOLENOID VALVE	
<b>FUEL SYSTEM</b> .....	F2-29	(FOR INTAKE SHUTTER VALVE)... F2-52	
FUEL TANK.....	F2-29	CANCEL RELAY .....	F2-52
INJECTION PUMP .....	F2-30	EXHAUST HEATING SWITCH .....	F2-53
SEDIMENTOR .....	F2-34	ACCELERATOR SWITCH.....	F2-53
SEDIMENTOR SENSOR		CLUTCH SWITCH .....	F2-54
(DETECTOR) .....	F2-34	NEUTRAL SWITCH .....	F2-54
FUEL FILTER .....	F2-35	EXHAUST BRAKE SWITCH.....	F2-55
INJECTION NOZZLE .....	F2-37		
ACCELERATOR PEDAL,			
ACCELERATOR CABLE .....	F2-40		

## INDEX

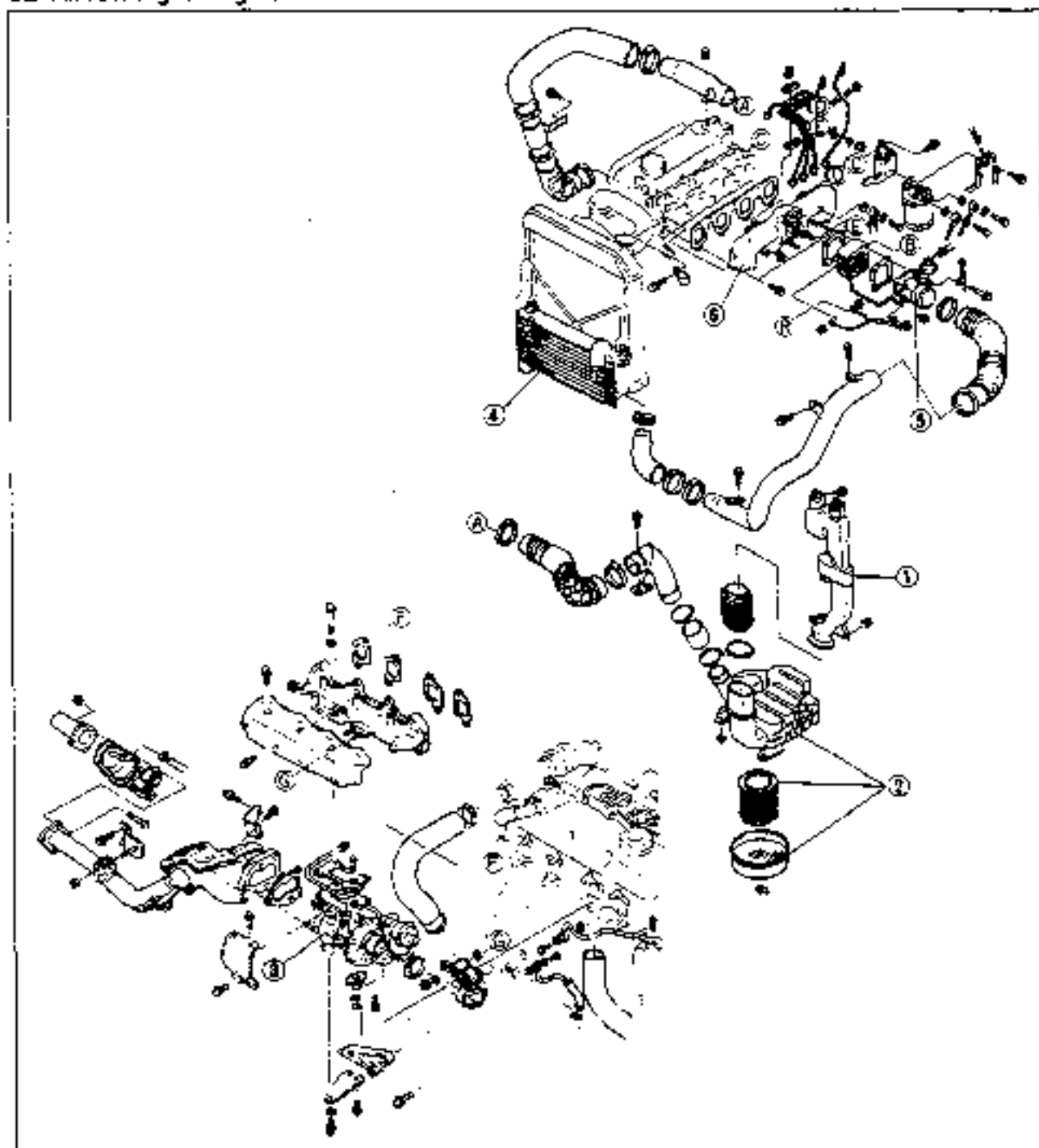
INTAKE DEVICES  
SL Engine

91G0F2002

- |                              |            |  |
|------------------------------|------------|--|
| 1. Fresh air duct            |            |  |
| Removal / Inspection /       |            |  |
| Installation .....           | page F2-18 |  |
| 2. Air cleaner               |            |  |
| Inspection .....             | page F2-13 |  |
| 3. Intake shutter valve      |            |  |
| Removal / Installation ..... | page F2-18 |  |
| Inspection .....             | page F2-49 |  |
| 4. Intake manifold           |            |  |
| Installation Note .....      | page F2-20 |  |



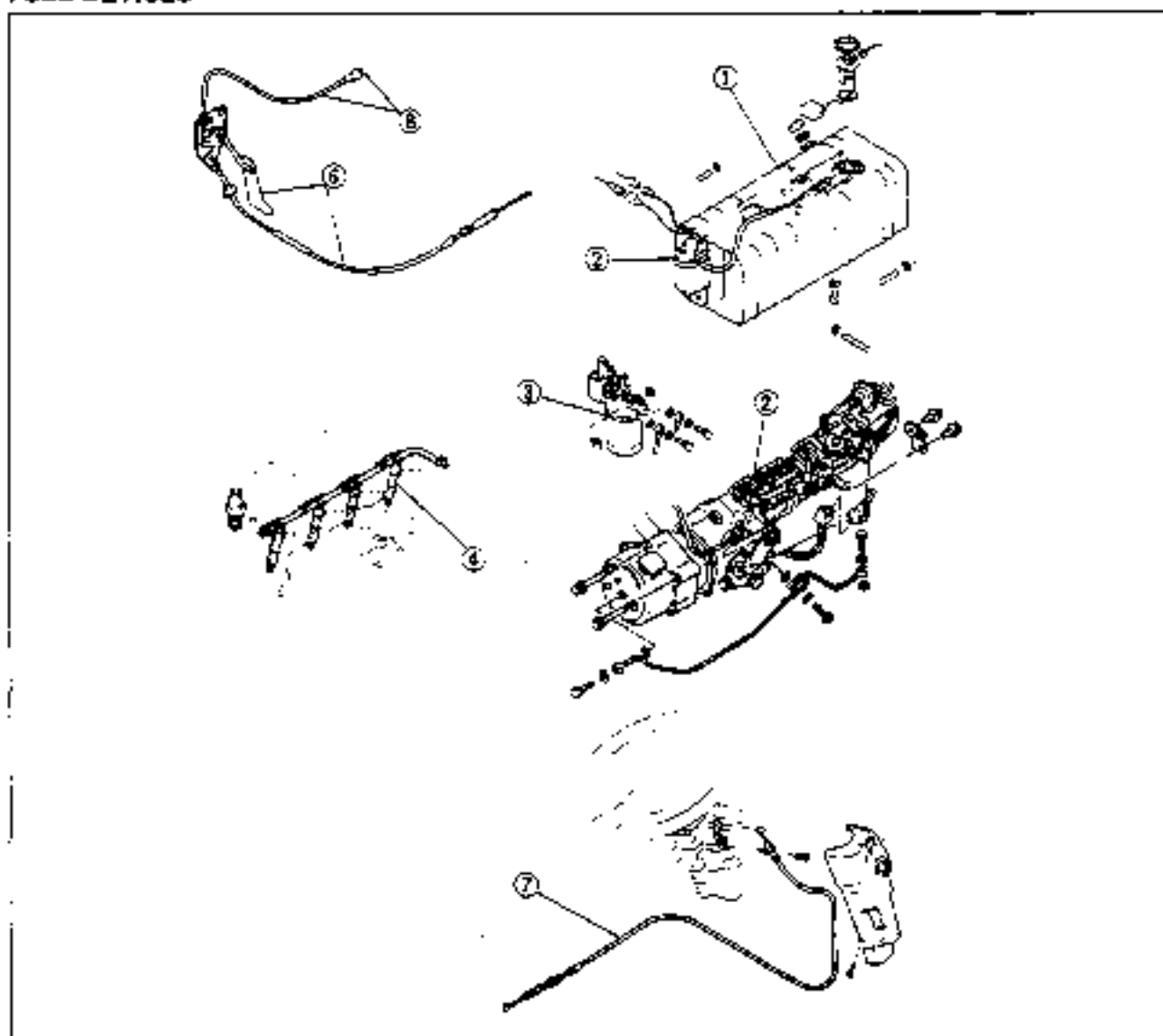
## SL Turbocharged Engine



31608-001

- |                             |            |
|-----------------------------|------------|
| 1. Fresh air duct           |            |
| Removal / Inspection /      |            |
| Installation.....           | page F2-18 |
| 2. Air cleaner              |            |
| Removal / Inspection /      |            |
| Installation.....           | page F2-18 |
| Inspection.....             | page F2-13 |
| 3. Turbocharger             |            |
| Removal.....                | page F2-22 |
| Inspection.....             | page F2-23 |
| Installation.....           | page F2-23 |
| 4. Intercooler              |            |
| Inspection.....             | page F2-28 |
| Replacement.....            | page F2-27 |
| 5. Intake shutter valve     |            |
| Removal / Installation..... | page F2-22 |
| Inspection.....             | page F2-51 |
| 6. Intake manifold          |            |
| Removal / Inspection /      |            |
| Installation.....           | page F2-22 |

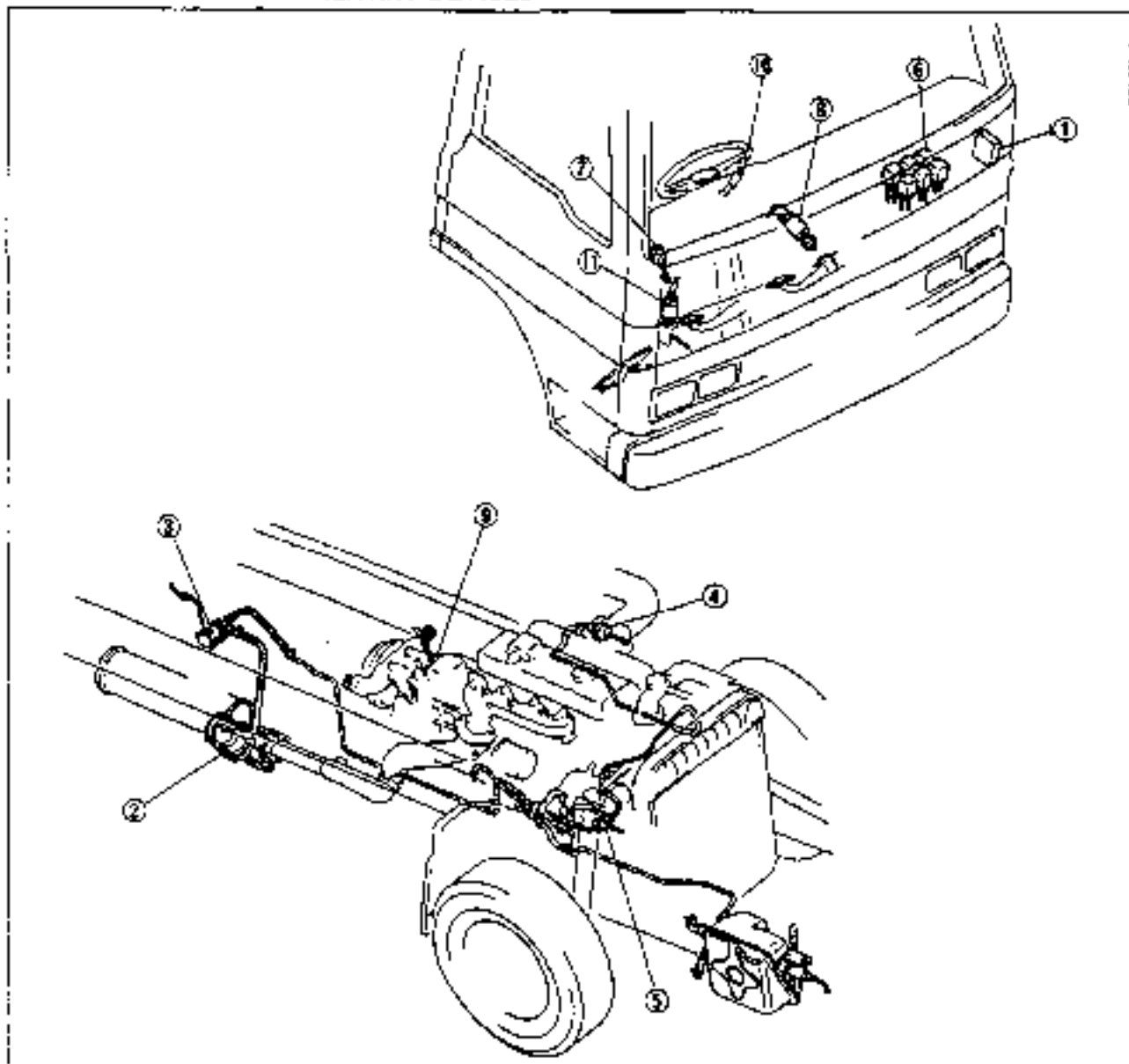
## FUEL DEVICES



9T50#2 004

- |  |            |
|--|------------|
| 1 Fuel tank                            |            |
| Removal / Inspection /                 |            |
| Installation .....                     | page F2-29 |
| 2 Injection pump                       |            |
| Removal .....                          | page F2-30 |
| Installation .....                     | page F2-33 |
| 3 Sedimentor                           |            |
| Water draining .....                   | page F2-34 |
| Replacement .....                      | page F2-29 |
| 4 Fuel filter                          |            |
| Air bleeding .....                     | page F2-35 |
| Replacement .....                      | page F2-36 |
| 5 Injection nozzle                     |            |
| Removal .....                          | page F2-37 |
| Inspection .....                       | page F2-37 |
| Disassembly .....                      | page F2-38 |
| Cleaning .....                         | page F2-39 |
| Assembly .....                         | page F2-39 |
| Installation .....                     | page F2-39 |
| 6 Accelerator pedal, Accelerator cable |            |
| Inspection / Adjustment .....          | page F2-40 |
| Removal / Installation .....           | page F2-40 |
| 7 Fuel stop cable                      |            |
| Inspection / Adjustment .....          | page F2-41 |
| Removal / Installation .....           | page F2-42 |
| 8 Idling knob, Idling cable            |            |
| Inspection / Adjustment .....          | page F2-43 |
| Removal / Installation .....           | page F2-44 |

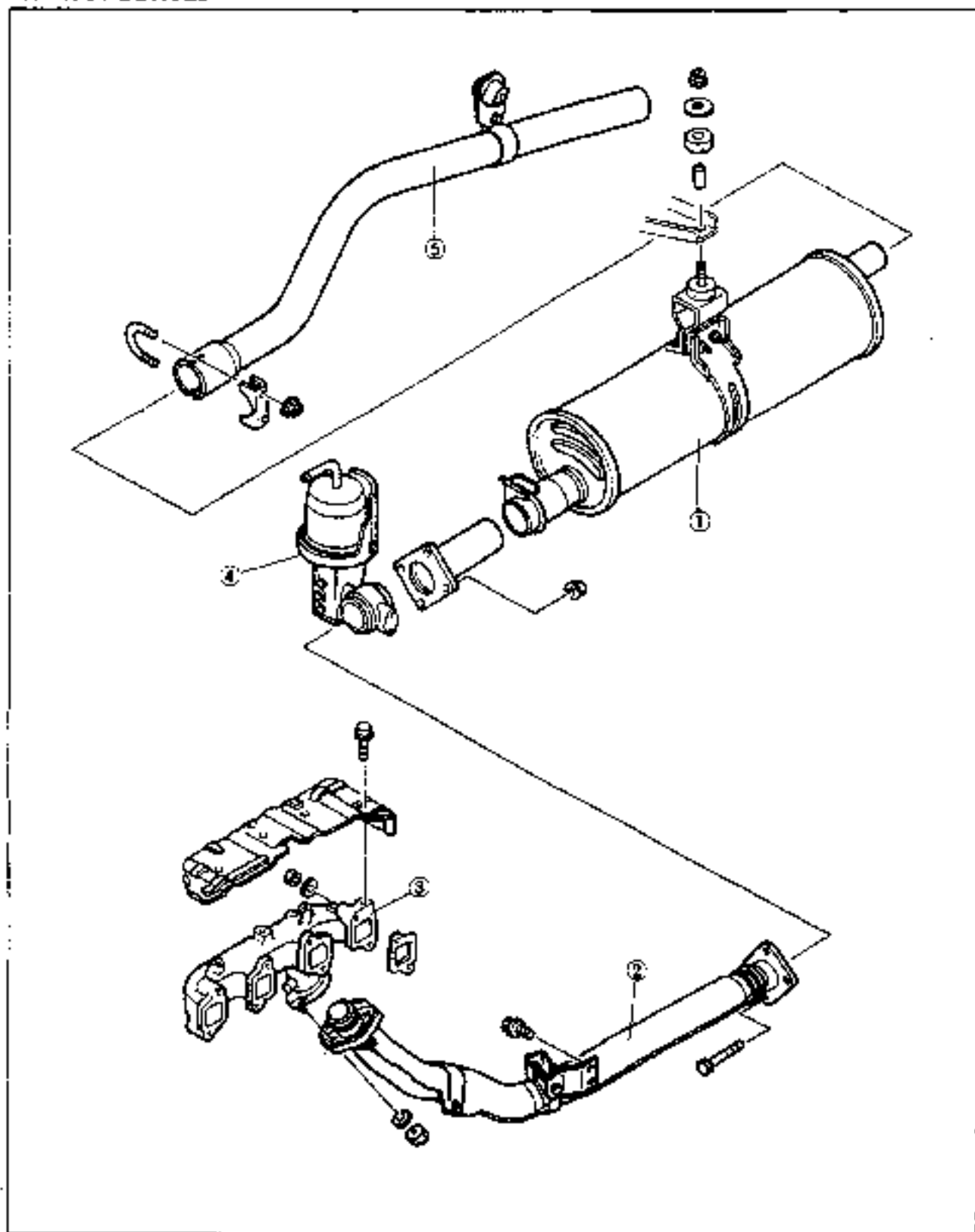
## EXHAUST CONTROLLED HEATING DEVICES



9700F2-006

1. Exhaust heating control unit	Inspection .....	page F2-48	Inspection .....	page F2-52
Inspection .....	page F2-48	Installation .....	page F2-52	
2. Exhaust brake unit	Removal .....	page F2-49	7. Exhaust heating switch	Removal .....
Removal .....	page F2-49	Inspection .....	Inspection .....	page F2-53
Inspection .....	page F2-49	Installation .....	Installation .....	page F2-53
Installation .....	page F2-50	8. Clutch switch	Inspection .....	page F2-54
3. Magnetic valve (Exhaust shutter valve)	Removal .....	page F2-50	Replacement .....	page F2-54
Removal .....	page F2-50	9. Neutral switch	Inspection .....	page F2-54
Inspection .....	page F2-50	Replacement .....	page F2-55	
Installation .....	page F2-50	10. Exhaust brake switch	Inspection .....	page F2-55
4. Actuator (Intake shutter valve)	Inspection .....	page F2-51	11. Accelerator switch	Inspection .....
Inspection .....	page F2-51	Replacement .....	page F2-53	
Replacement .....	page F2-51	Inspection .....	page F2-53	
5. Solenoid valve (Intake shutter valve)	Inspection .....	page F2-52	Replacement .....	page F2-54
Inspection .....	page F2-52			
6. Cancel relay (Pay load above 3.5t only)	Removal .....	page F2-52		
Removal .....	page F2-52			

## EXHAUST DEVICES



1. Main silencer
2. Exhaust pipe
3. Exhaust manifold

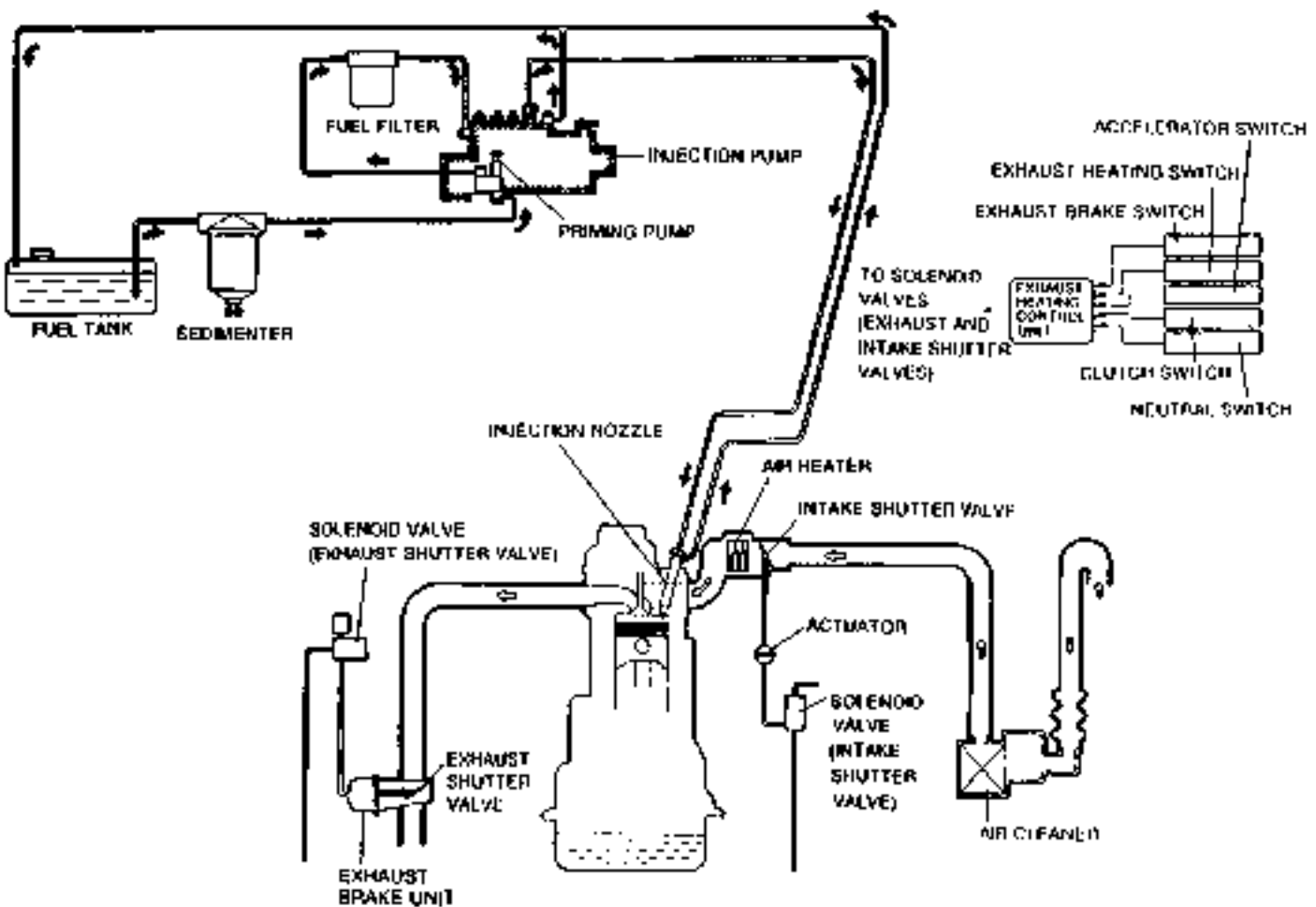
4. Exhaust brake unit
5. Tail pipe

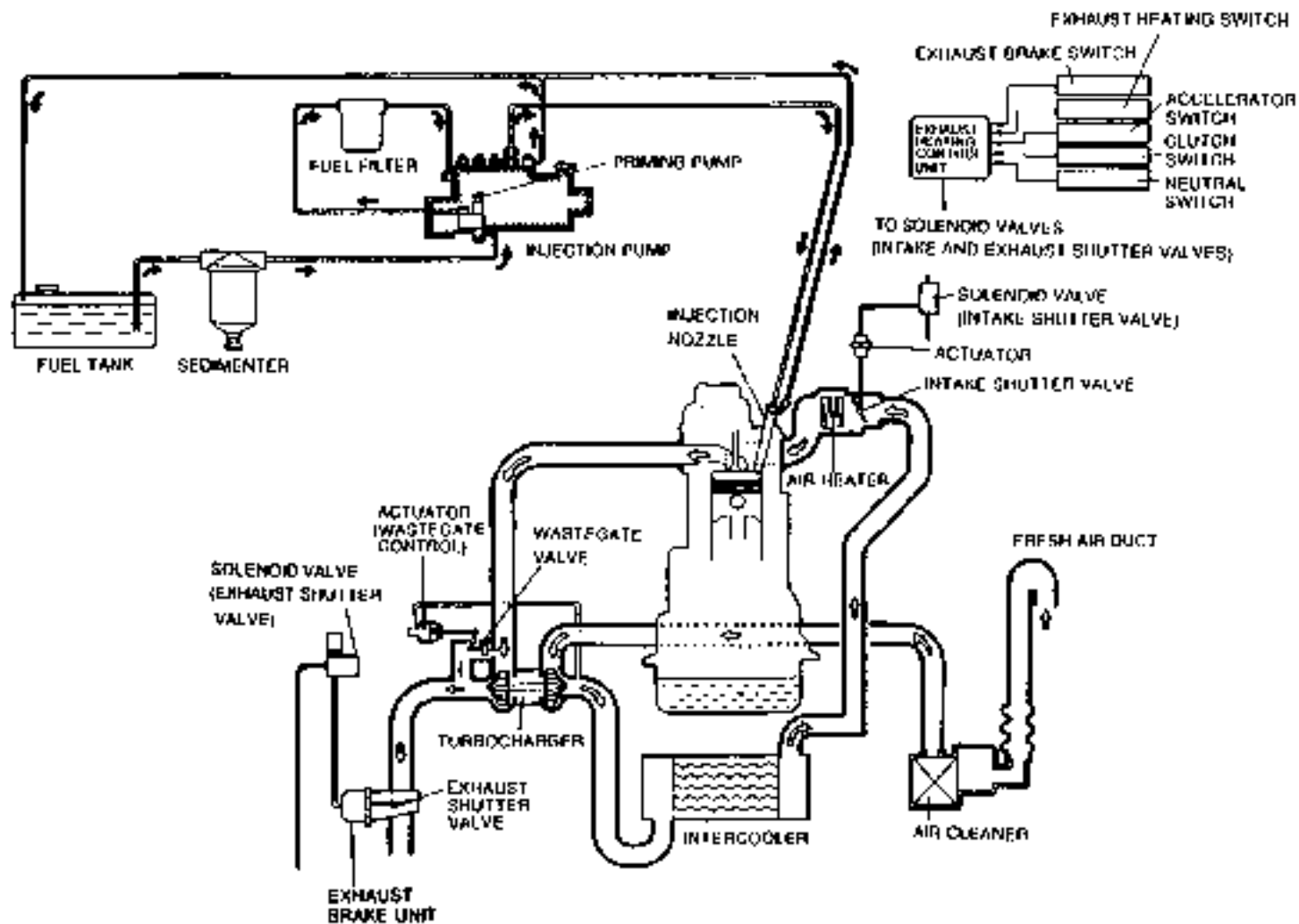
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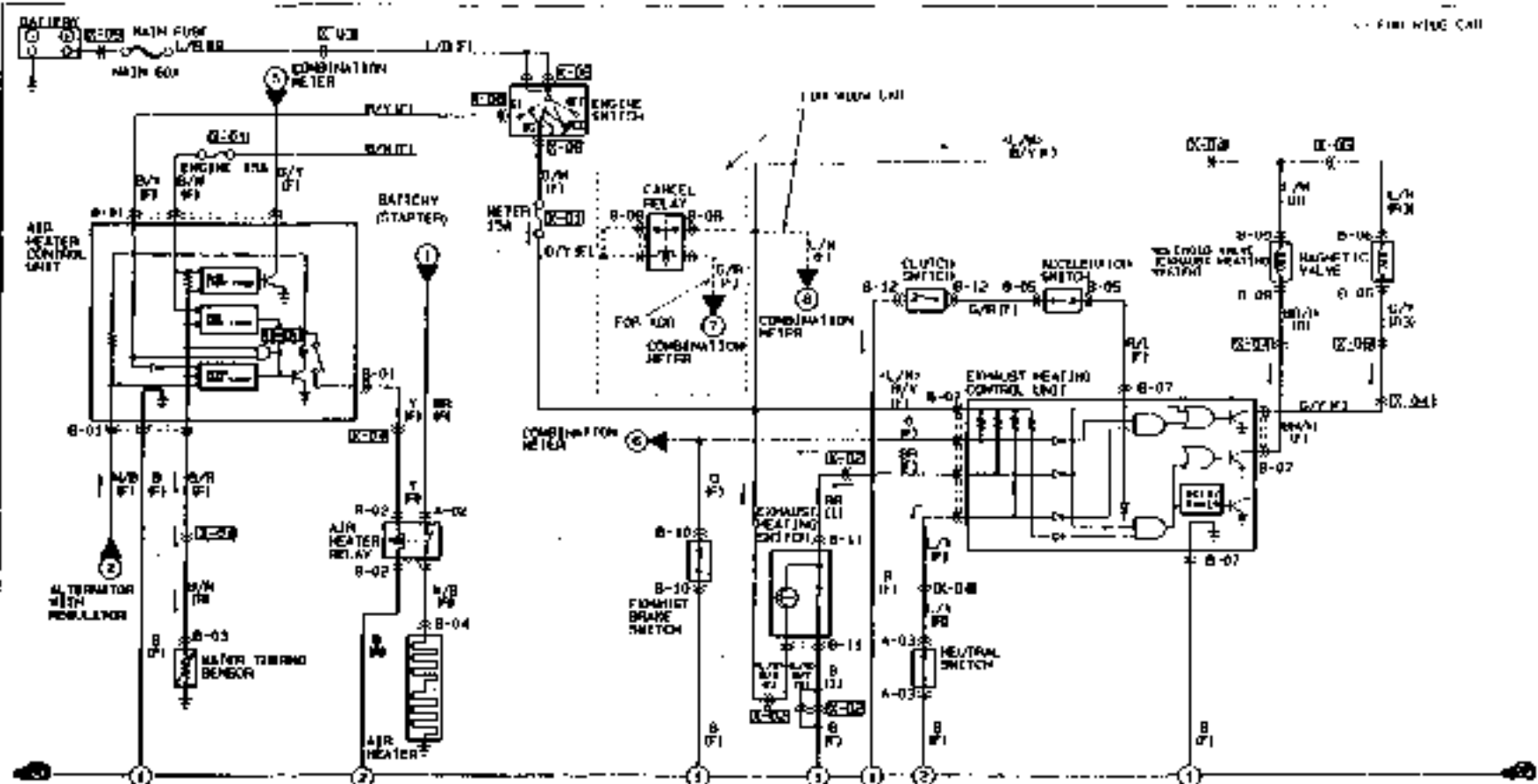
MEMO

## OUTLINE

SYSTEM DIAGRAM  
SL Engine



... FIRM WIRE CALL



<p>B-01 AIR HEATER CONTROL UNIT (F)</p>	<p>B-02 AIR HEATER RELAY (R)</p>	<p>B-03 WATER ENGINE SENSOR (M)</p>	<p>B-04 AIR HEATER (R)</p>	<p>B-05 ACCELERATOR SWITCH (F)</p>	<p>B-06 MAGNETIC VALVE (R)</p>	<p>B-07 EXHAUST HEATING CONTROL UNIT (F)</p>
<p>B-08 CANCEL RELAY (F)</p>	<p>B-09 SOLENOID VALVE EXHAUST HEATING SYSTEM (R)</p> <p>A-02 STARTING MOTOR (B) &amp; FUSIBLE LINK (R)</p>	<p>B-10 EXHAUST BRAKE SWITCH (F)</p>	<p>B-11 EXHAUST HEATING SWITCH (F)</p>	<p>B-12 CLUTCH SWITCH (F)</p>	<p>A-03 NEUTRAL SWITCH (R)</p> <p>(F) FOR CPM BAR</p>	

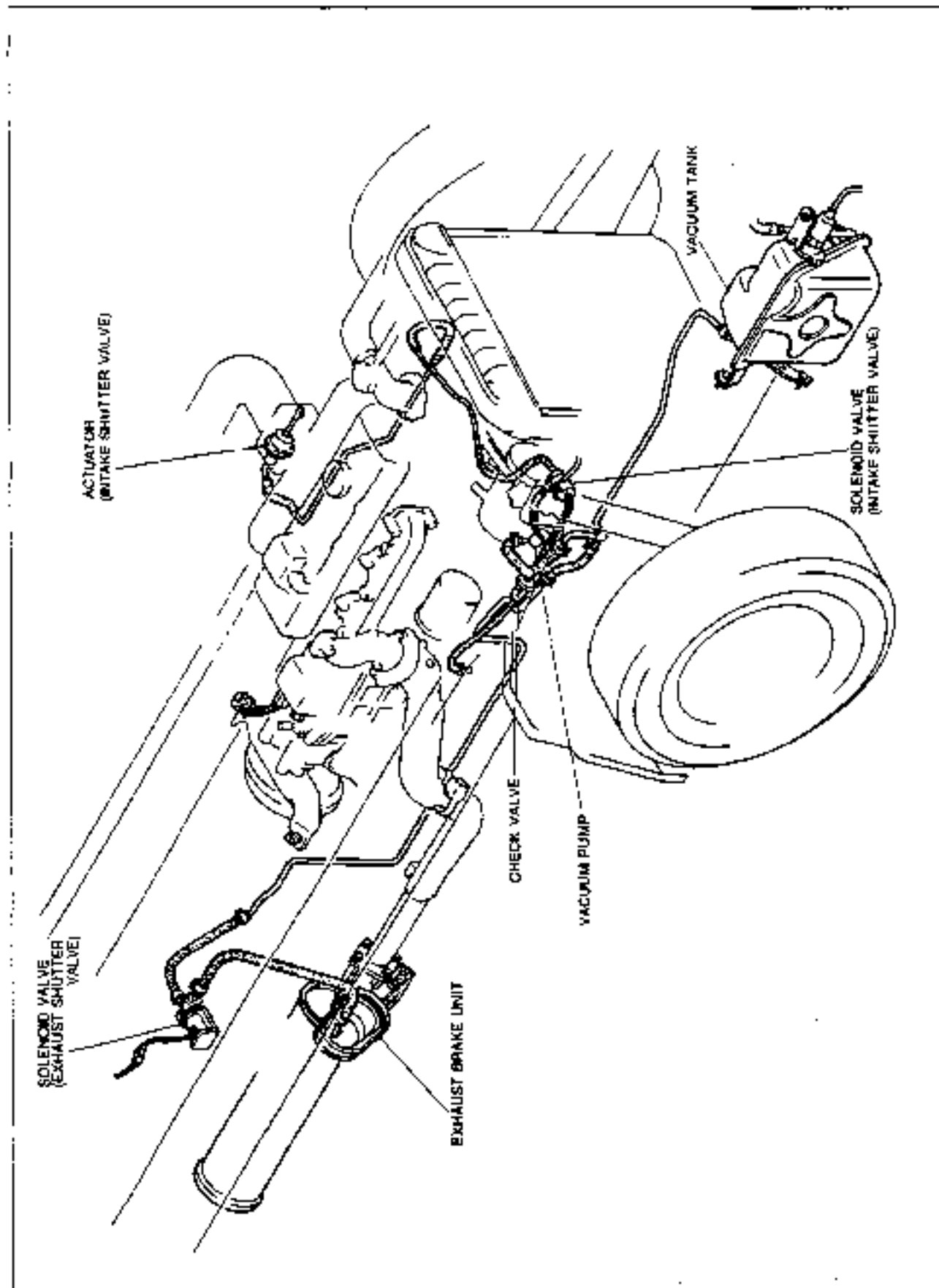
NOTE: --- NOT USED

F2-10

870022010



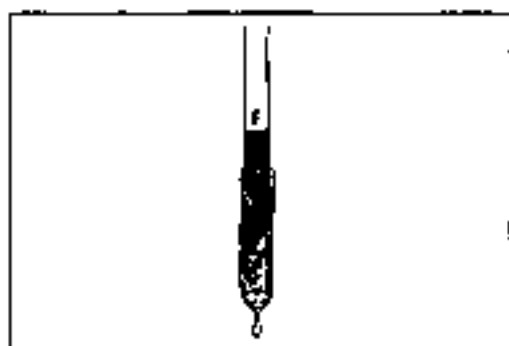
## VACUUM HOSE ROUTING DIAGRAM



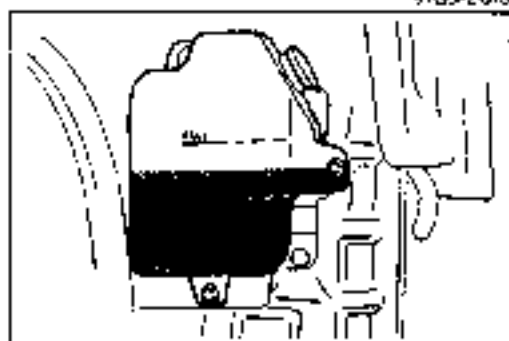
## TROUBLESHOOTING GUIDE

Trouble	Possible Cause	Action
<b>Hard starting</b>	Malfunction of stop system Air in injection pipe, injection pump, fuel filter or sedimentor Clogged fuel line or fuel filter Incorrect injection timing Seized or leaking delivery valve Incorrect injection starting pressure Malfunction of injection nozzle Malfunction of feed pump Malfunction of governor Malfunction of injection pump	Adjust or replace Bleed air  Replace Adjust Replace or clean Adjust Clean or replace Clean or replace Replace Replace
<b>Rough idling</b>	Incorrect idling speed Incorrect injection timing Clogged fuel line or fuel filter Leak in fuel line or fuel filter Air in injection pipe, injection pump, fuel filter or sedimentor Seized or leaking delivery valve Incorrect injection starting pressure Malfunction of injection nozzle Malfunction of feed pump Malfunction of timer Malfunction of injection pump	Adjust Adjust Clean or replace Repair or replace Bleed air  Replace or clean Adjust Clean or replace Clean or replace Replace Replace
<b>Engine knocking</b>	Incorrect injection timing Incorrect injection starting pressure Malfunction of injection nozzle Low quality of fuel	Adjust Adjust Clean or adjust Drain and replace
<b>Excessive exhaust smoke</b>	Incorrect injection timing Water in injection pump, fuel filter or sedimentor Incorrect injection starting pressure Clogged air cleaner Malfunction of delivery valve Malfunction of injection pump	Adjust Drain Adjust Clean or replace Clean or replace Replace
<b>Poor acceleration</b>	Low quality of fuel Incorrect injection timing Clogged fuel line or fuel filter Air in injection pump or fuel filter Clogged air cleaner Malfunction of delivery valve Incorrect injection starting pressure Malfunction of injection nozzle Malfunction of feed pump Malfunction of injection pump Malfunction of governor	Drain and replace Adjust Clean or replace Air bleed Clean or replace Clean or replace Adjust Clean or replace Clean or replace Replace Replace
<b>High fuel consumption</b>	Incorrect injection timing High idling speed Incorrect injection starting pressure Clogged air cleaner Clogged fuel filter Malfunction of injection nozzle	Adjust Adjust Adjust Clean or replace Replace Clean or replace
<b>Engine does not stop</b>	Malfunction of fuel stop system	Adjust or repair

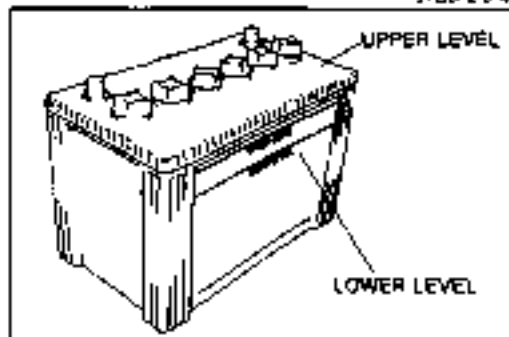
BT60F2-0-2



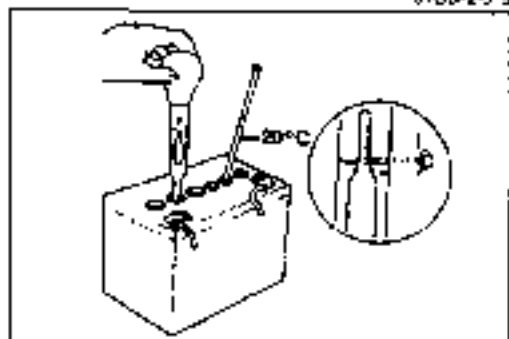
9TGF2-013



9TGF2-014



9TGF2-015



9TGF2-016



9TGF2-017

## ENGINE TUNE-UP

### BASIC INSPECTION

#### Engine Oil

Check the engine oil level and condition with the level gauge. Add or change oil if necessary.

#### Coolant

##### Warning

- Never remove the radiator cap while the engine is hot.
- Wrap a thick cloth around the cap while carefully removing it.

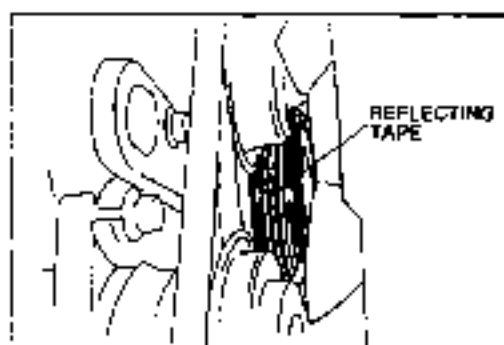
Verify that the coolant level is near the radiator inlet port, and that the level in the reservoir is between the FULL and LOW marks. Add coolant as necessary.

#### Battery

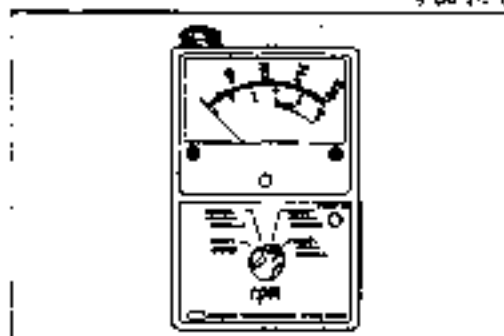
- 1 Check for corrosion on the terminals and for loose cable connections.
- 2 Check the electrolyte level. If the level is low, add distilled water to the "UPPER LEVEL" mark.
3. Check the specific gravity with a hydrometer. If the specific gravity reading is 1.23 or less, recharge the battery. (Refer to Section G.)

#### Air cleaner

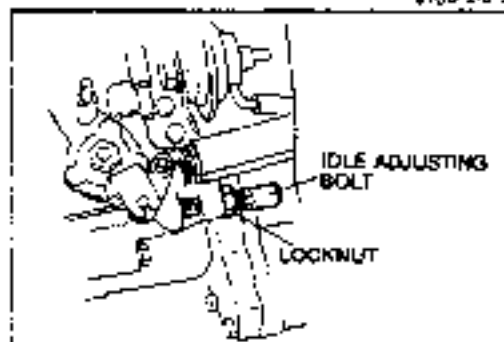
Visually check the air cleaner element for excessive dirt, damage or oil. Clean with compressed air if necessary.



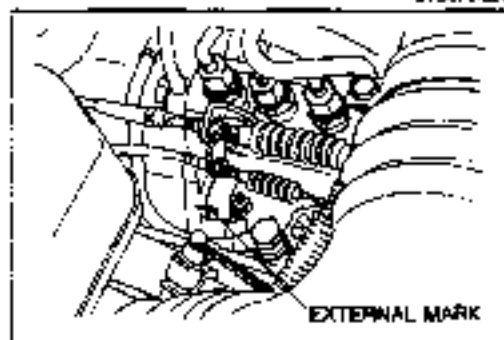
9TGF2-018



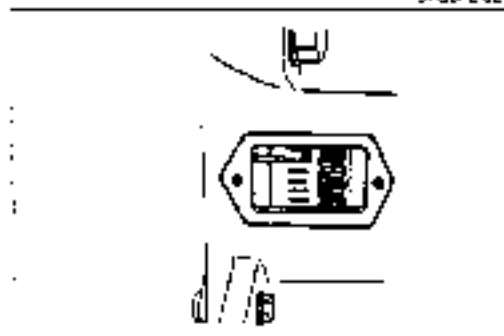
9TGF2-019



9TSCF2-020



9TGF2-021



9TGF2-022

**ADJUSTMENT****Idle Speed**

1. Attach suitable reflecting tape to the crankshaft pulley.
2. Run the engine at idle at normal operating temperature. Turn off all unnecessary electrical loads.

3. Verify the free play of the accelerator cable.

**Free play: 1.0—3.0mm (0.039—0.118 in)**

4. Aim the light of the photo tachometer onto the reflecting tape to measure the engine speed.

**Idle speed: 620—670 rpm (SL)  
650—710 rpm (SL Turbocharged Engine)**

5. If not as specified, loosen the locknut of the idle adjusting bolt and turn the bolt to adjust the idle.
6. Tighten the locknut.

**Tightening torque:  
9.8—14 Nm (100—140 cm-kg, 87—121 in-lb)**

**Injection Timing Inspection****Note**

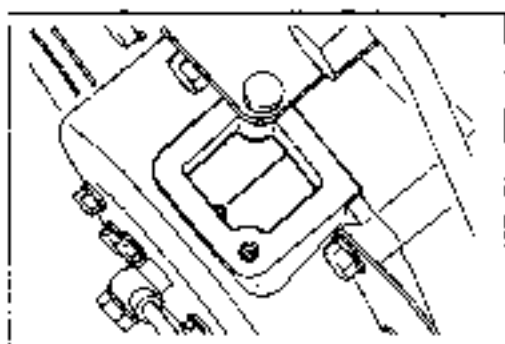
- Usually it is enough to confirm that the external marks are aligned.

**Caution**

- Direct injection engines are sensitive to injection timing. Incorrect timing will cause engine knocking or low power output.

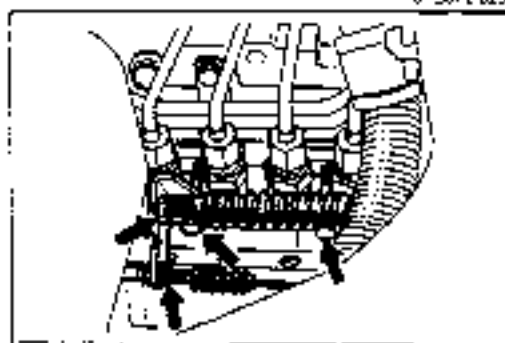
**Set the injection timing after installing the injection pump.**

1. Remove the service hole covers from the clutch housing and the timing gear case.
2. Turn the flywheel in the direction of rotation until the indicator pin is at 30° BTDC.



9T50F2-023

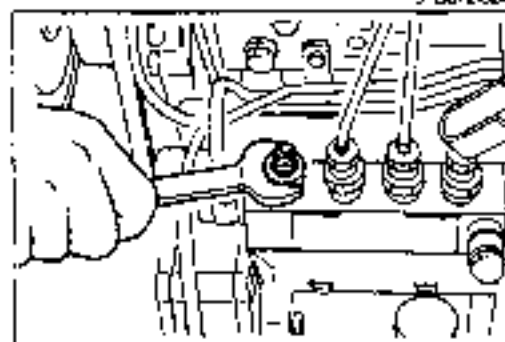
3. Verify that the pointer of the timing gear case and the mark on the timer are aligned.
4. If not as specified, adjust the injection timing.



9T50F2-024

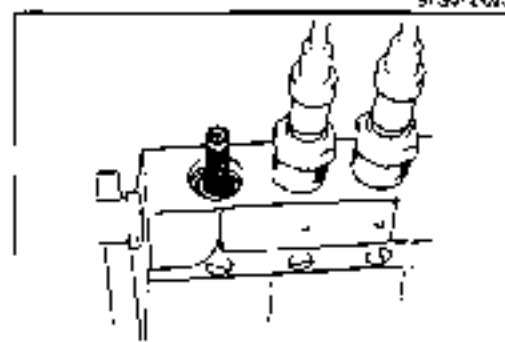
**Adjustment**

1. Remove the toe stop cable from the cut lever.
2. Remove the accelerator cable from the control lever.
3. Remove the bracket.
4. Loosen injection pipes No.2—4 at the pump.



9T50F2-025

5. Remove No.1 injection pipe and the delivery valve holder.

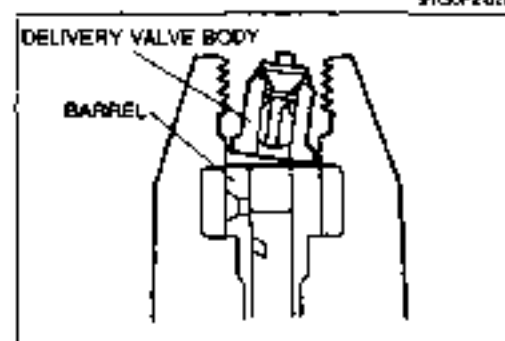


9T50F2-026

6. Remove the delivery valve spring seat and spring.

**Caution**

- Do not remove the delivery valve body.

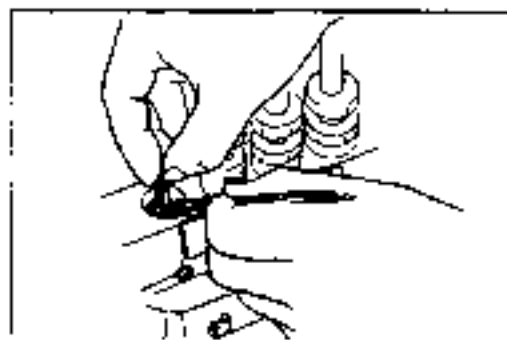
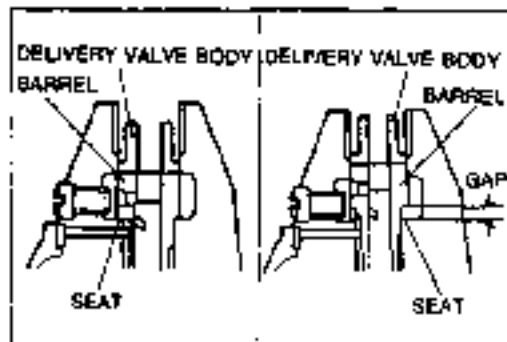


9T50F2-027

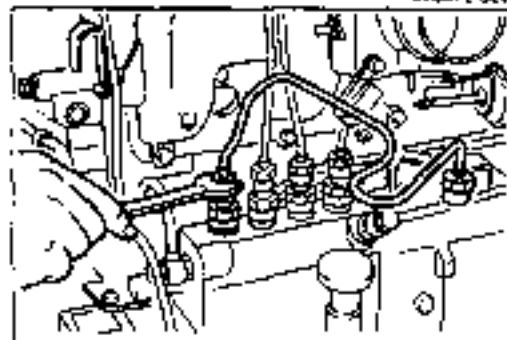
7. Rock the delivery valve to break it loose from the barrel.

**Note**

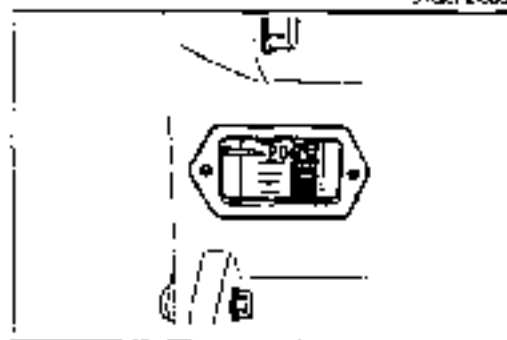
- If the delivery valve is lifted up without breaking it loose, the barrel may also be lifted out of the pump. If this happens the barrel may not reseat and may allow fuel into the engine and cause engine damage.



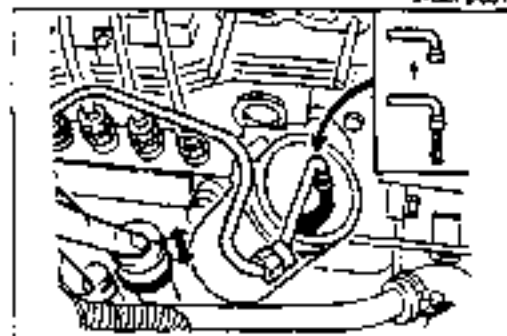
9TGF2-026



9TGF2-030



9TGF2-031



9TGF2-032

- 8 Remove the delivery valve, holding the flat washer with tweezers

**Caution**

- Do not pinch the sliding surface of the delivery valve.

- 9 Reinstall the delivery valve holder.

10. Tighten No. 1 injection pipe so that it points away from the pump.

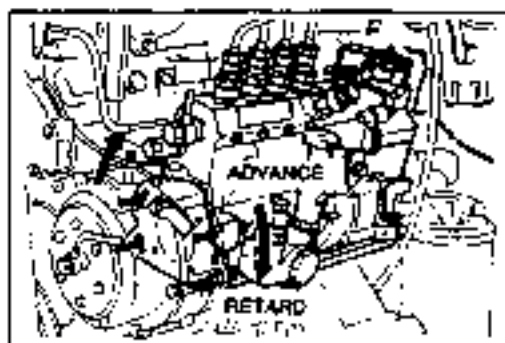
11. Turn the flywheel in the direction of rotation and set it at 20° BTDC.

- 12 Place a container under No 1 injector pipe and verify that fuel is expelled when pumping the primer pump.

13. While pumping the priming pump, turn the flywheel in the normal direction of rotation and verify that fuel flow stops as specified.

**Fuel stops:**

- 12° BTDC (SL Engine), 13° BTDC (SL Turbocharged Engine)

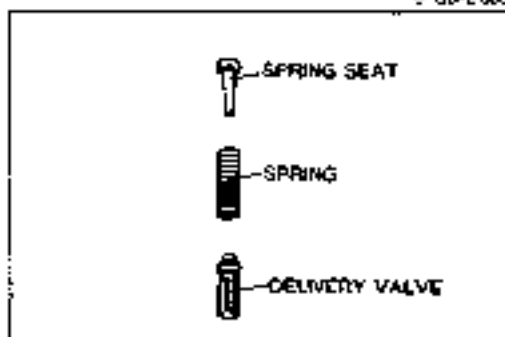


9°G0F2-030

14. If necessary, adjust the injection timing by loosening the pump mounting bolts and rotating the pump outward or inward as shown in the figure.
15. Tighten the mounting nuts.

**Tightening torque:**

34—39 Nm (3.5—4.0 m·kg, 25—29 ft·lb)

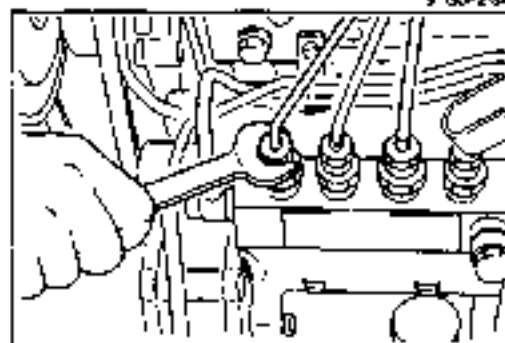


9°G0F2-34

16. Mark the pump flange and pump body for future reference.
17. Install the delivery valve, spring, and spring seat.
18. Tighten the delivery valve holder

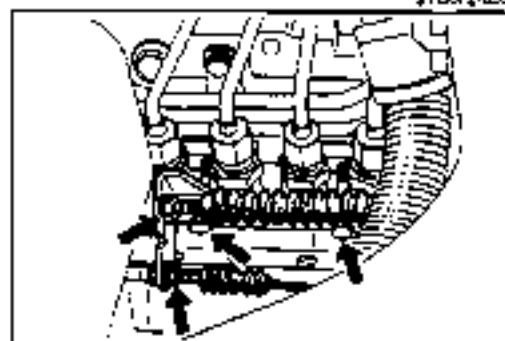
**Tightening torque:**

39—44 Nm (4.0—4.5 m·kg, 29—33 ft·lb)



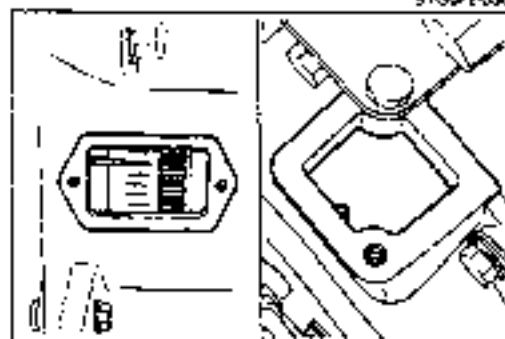
9°G0F2-03E

19. Install No. 1 injection pipe.



9°G0F2-03G

20. Tighten injection pipes No. 2—4.
21. Install the bracket
22. Install the accelerator cable to the control lever.
23. Install the fuel stop cable to the cut lever.



0T02F2-037

24. Install the service hole covers onto the clutch housing and the timing gear case.
25. Bleed air from the system. (Refer to page F2-35.)
26. Start the engine, and check for fuel leaks.

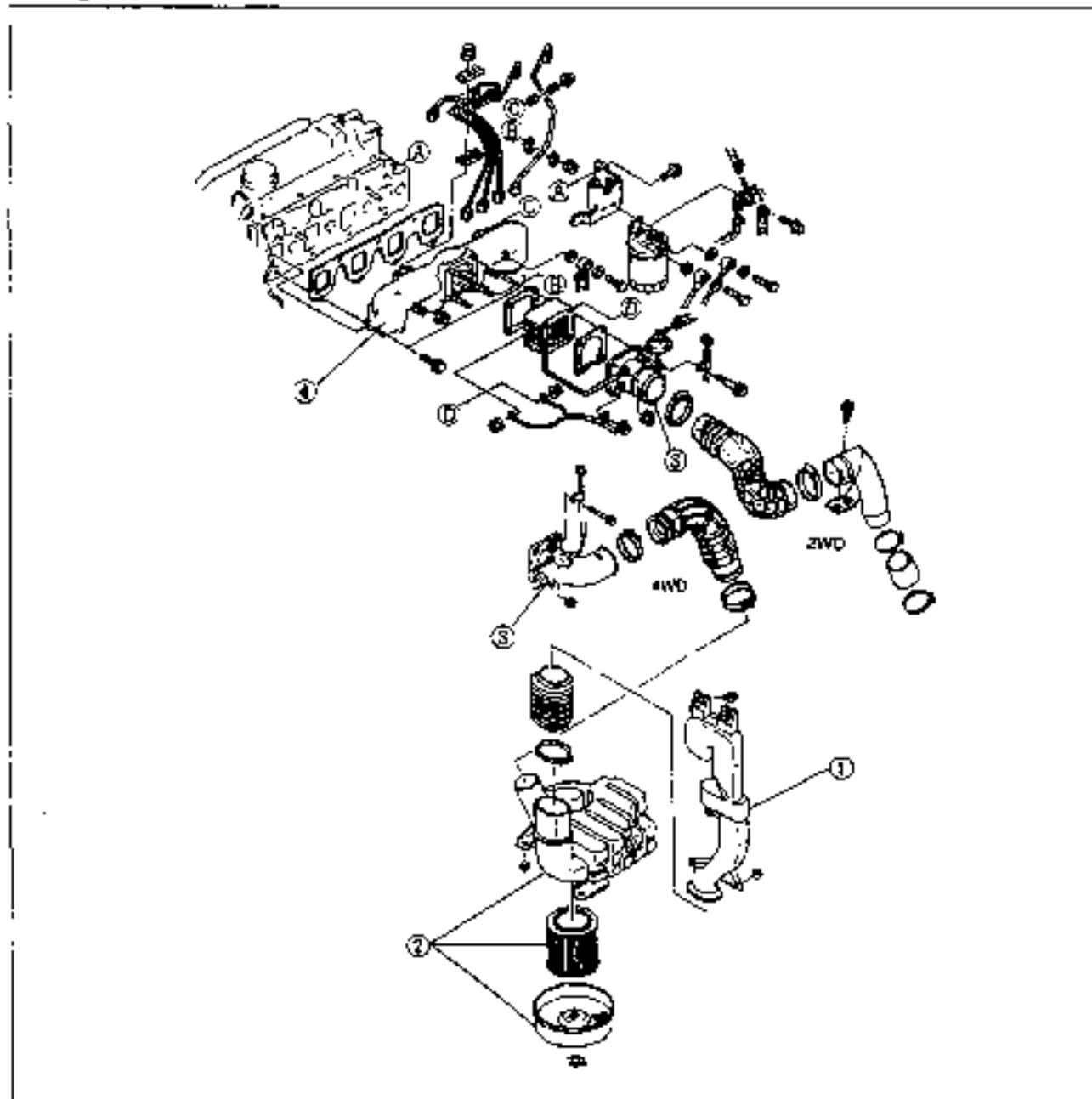
## INTAKE AIR SYSTEM

## COMPONENTS

## Removal / Inspection / Installation

- 1 Remove in the order shown in the figure.
- 2 Inspect all parts and repair or replace as necessary.
- 3 Install in the reverse order of removal, referring to **Installation Note**.

## SL Engine

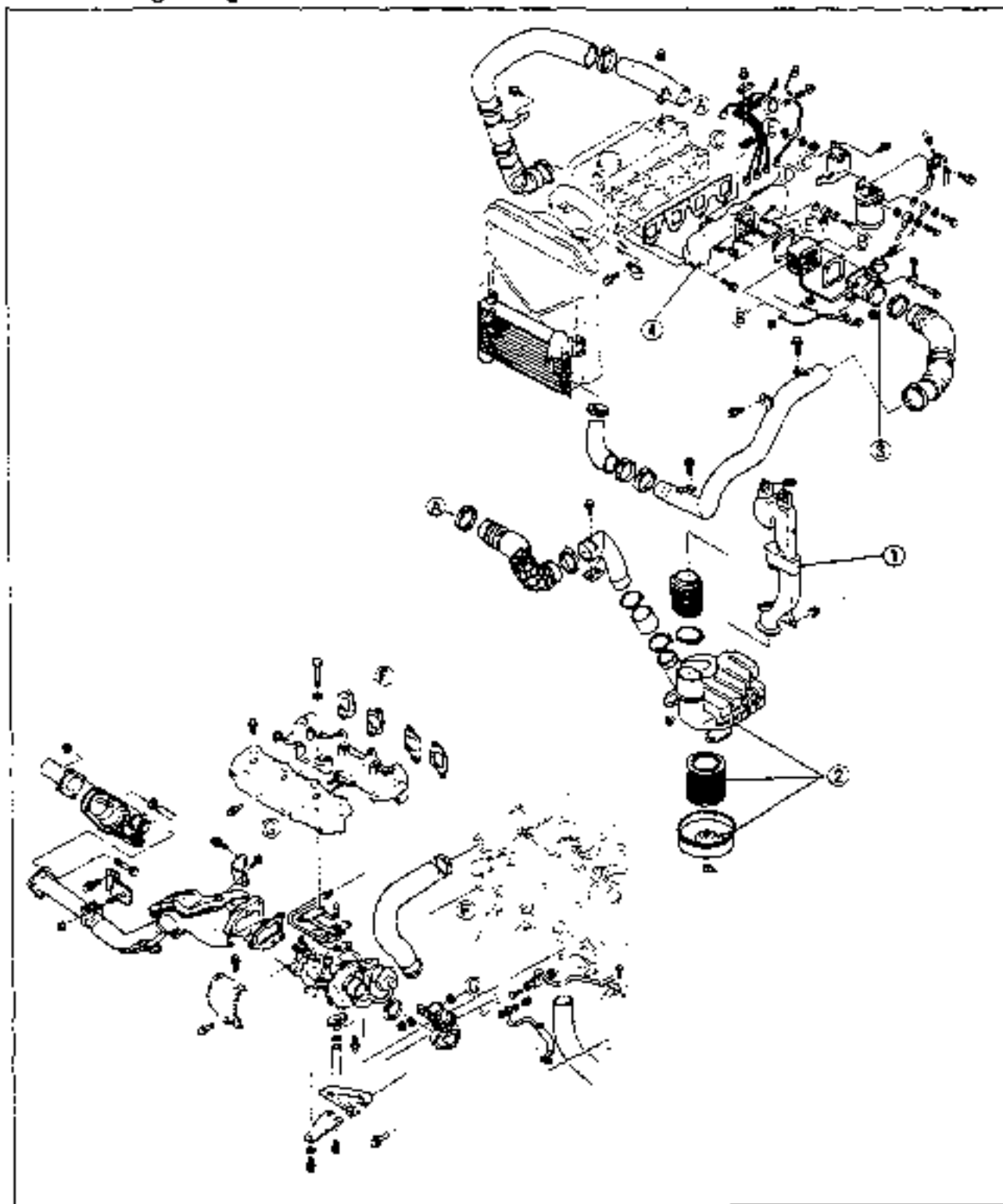


9M97F2-038

- |   |  |
|---|--|
| <p>1. Fresh air duct<br/>           Check for contamination, cracks and other damage ..... page F2-18<br/>           Installation Note ..... page F2-20</p> <p>2. Air cleaner<br/>           Inspection ..... .. page F2-13</p> | <p>3. Intake shutter valve<br/>           Inspection ..... .. page F2-49</p> <p>4. Intake manifold<br/>           Check for contamination, cracks and other damage ..... page F2-18<br/>           Installation Note ..... .. page F2-20</p> |
|---|--|



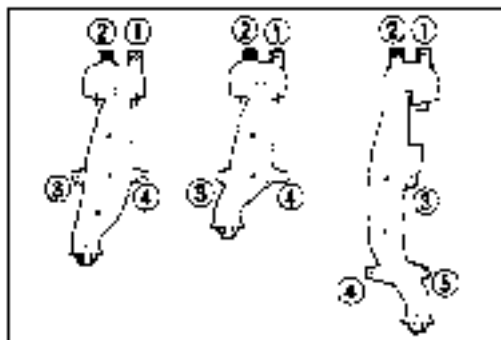
SL Turbocharged Engine



97GBF2-009

- 1. Fresh air duct
  - Check for contamination, cracks and other damage ..... page F2-19
  - Installation Note ..... page F2-20
- 2. Air cleaner
  - Inspection ..... page F2-13

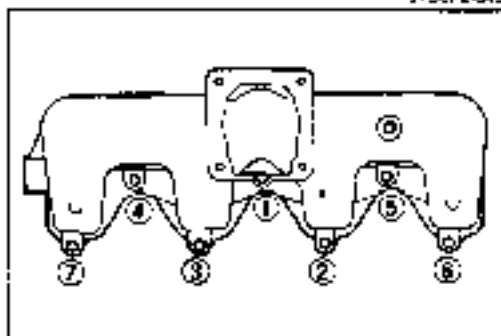
- 3. Intake shutter valve
  - Inspection ..... page F2-51
- 4. Intake manifold
  - Check for contamination, cracks and other damage ..... page F2-19
  - Installation Note .. page F2-20



9730F2-343

**Installation note****Fresh air duct**

Install in the order shown in the figure.



9730F2-341

**Intake manifold**

1. Use a new gasket.
2. Tighten in the order shown in the figure.

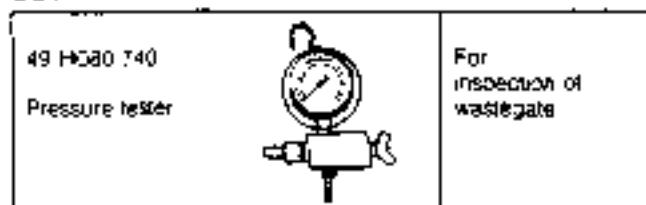
**Tightening torque:**

22—31 Nm (2.2—3.1 m-kg, 15—22 ft-lb)

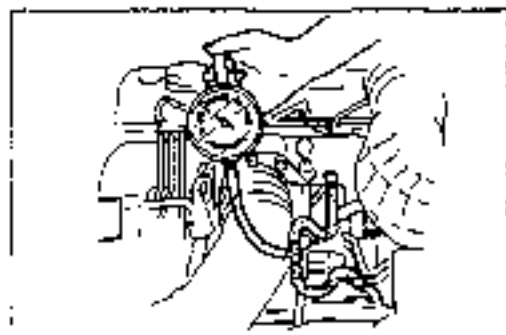
## TURBOCHARGER

## PREPARATION

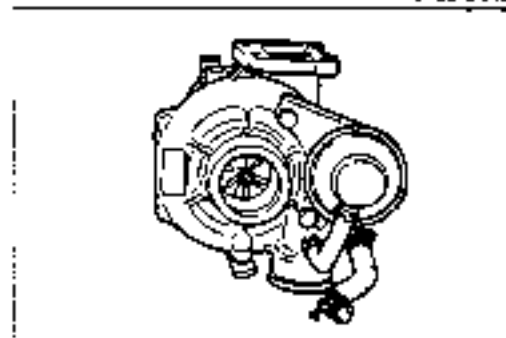
## SST



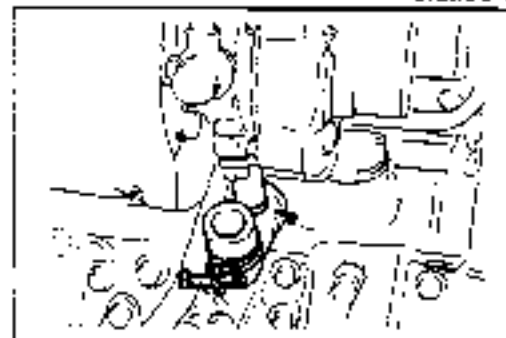
9TGF2-042



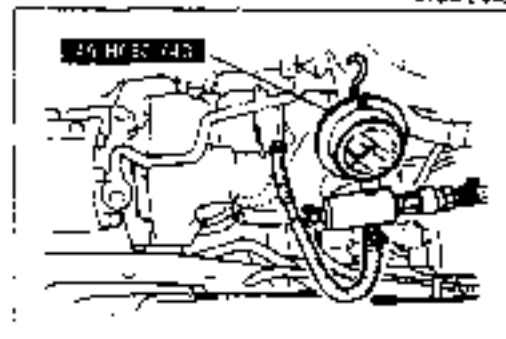
9TGF2-043



9TGF2-044



9TGF2-045



9TGF2-046

## TURBOCHARGER

## On-vehicle inspection

## Turbocharger boost pressure

1. Disconnect the air hose from the wastegate.
2. Connect a pressure gauge as shown.
3. Connect a tachometer to the engine.
4. Warm up the engine to operating temperature.
5. Increase the engine speed to 4,000 rpm and verify that the boost pressure is within specification.

## Boost pressure:

41.2–49.1 kPa (0.42–0.5 kg/cm<sup>2</sup>, 6.0–7.1 psi)

## Turbine wheel

1. Allow the engine to cool.
2. Remove the air hose.
3. Verify that the rotor assembly turns smoothly.
4. If there is excessive load or noise, replace the turbocharger.

## Oil passage

1. Allow the engine to cool.
2. Remove the oil return pipe.
3. Verify that carbonized oil has not blocked the oil passage of the turbocharger or the oil return pipe.
4. If the oil passage is clogged, replace the turbocharger and return pipe as necessary.

## Wastegate

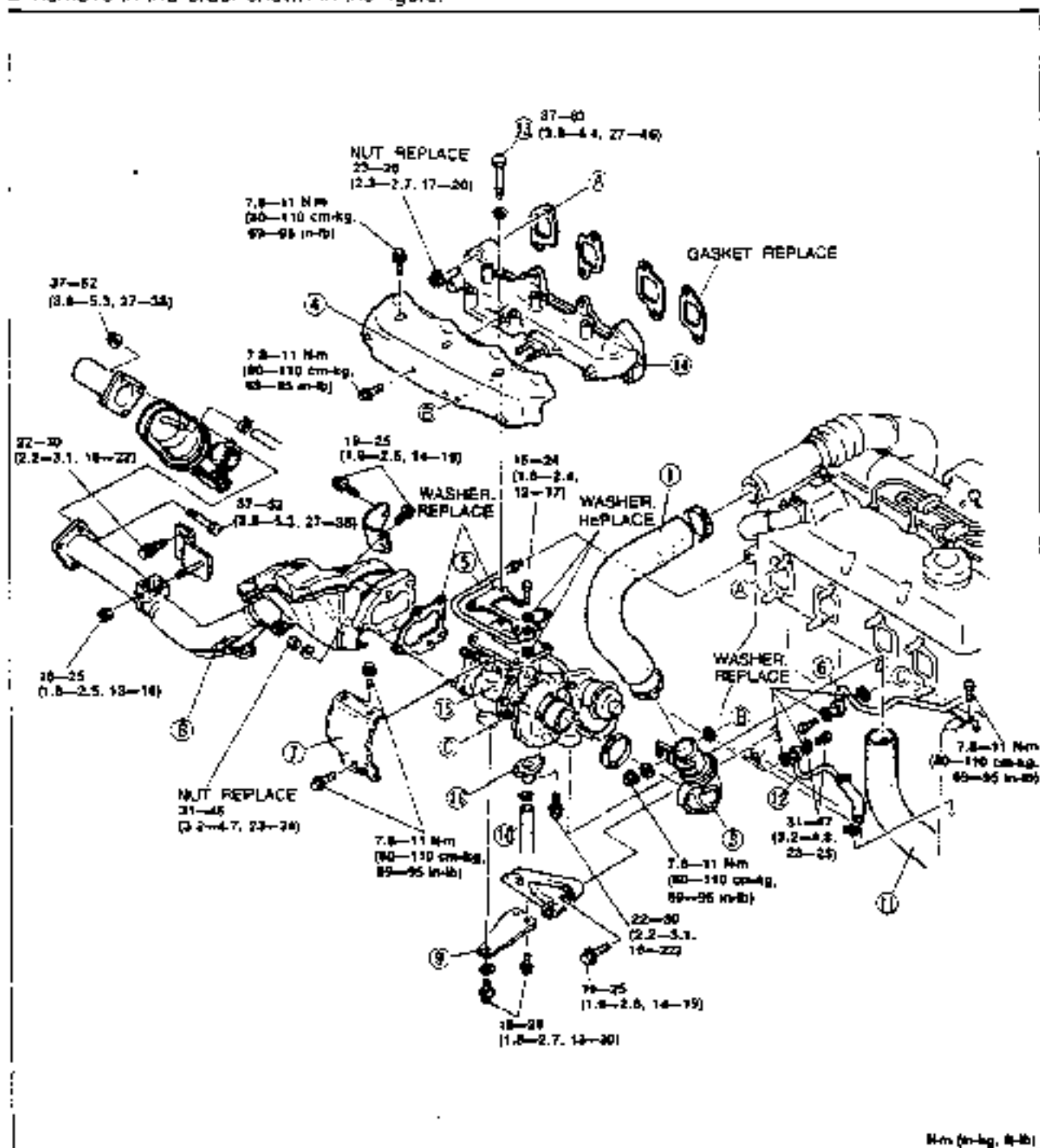
1. Allow the engine to cool.
2. Remove the wastegate actuator hose and attach the SST.
3. Adjust the compressed air pressure to 135 kPa (1.38 kg/cm<sup>2</sup>, 19.5 psi).
4. Verify that the rod moves when disconnecting and reconnecting the air supply hose.

## Caution

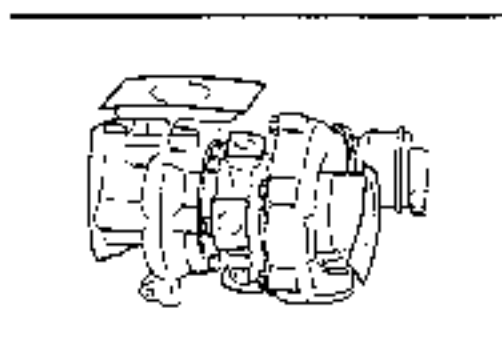
- Do not apply more than 196 kPa (2.0 kg/cm<sup>2</sup>, 28 psi) of air pressure.

## Removal

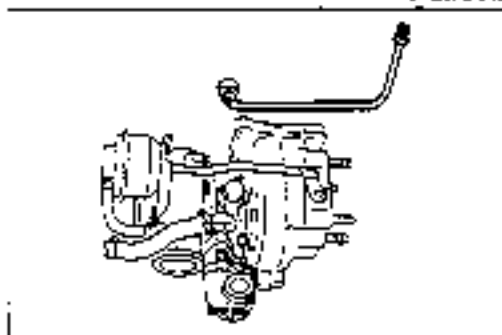
1. Drain the engine oil and coolant.
2. Remove in the order shown in the figure.



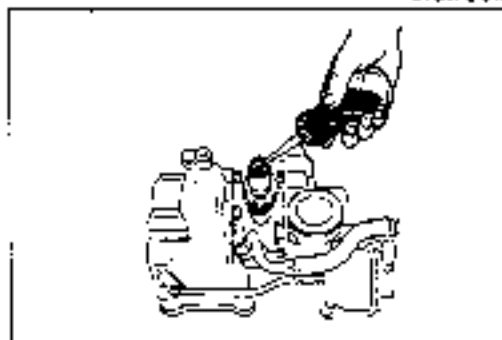
- |                       |                         |
|-----------------------|-------------------------|
| 1. Air intake hose    | 9. Turbo bracket spring |
| 2. Change rod bracket | 10. Oil hose            |
| 3. Joint rubber       | 11. Joint hose          |
| 4. Heat insulator     | 12. Water hose          |
| 5. Oil pipe           | 13. Stud bolt           |
| 6. Water pipe         | 14. Exhaust manifold    |
| 7. Insulator          | 15. Turbocharger        |
| 8. Front pipe         | 16. Oil pipe            |



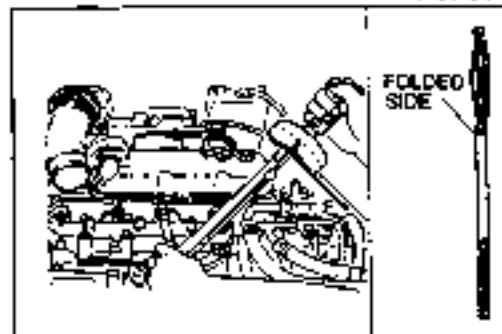
9TGF2-048



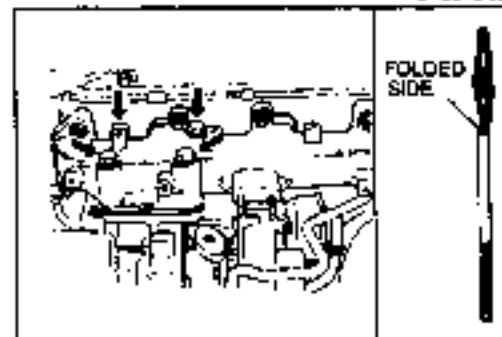
9TGF2-049



9TGF2-050



9TGF2-051



9TGF2-052

**Caution**

Note the following when removing, installing, and handling the turbocharger.

- Do not drop the turbocharger.
- Do not bend the wastegate actuator mounting or rod.
- Cover the intake, exhaust, and oil passages to prevent dirt or other objects from entering.

**Inspection**

After removing the turbocharger, check the oil feed pipe and oil return pipe for clogging. Replace if necessary.

**Installation**

- 1 Pour in 25 cc of oil through the oil inlet of the turbocharger

2. Install the exhaust manifold using a new gasket and nuts.

**Note**

- Install the gasket with the folded side facing the cylinder head.

**Tightening torque:**

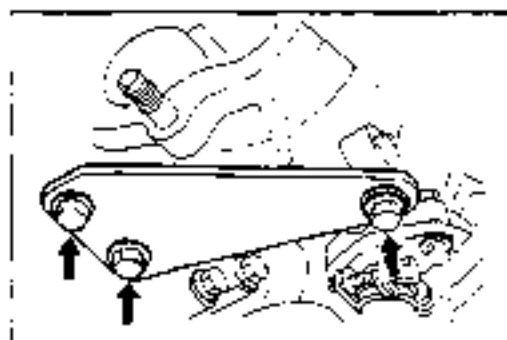
22.6–26.5 Nm (2.3–2.7 m-kg, 17–19 ft-lb)

3. Install the turbocharger and a new gasket.

**Note**

- Install the gasket with the folded side facing the exhaust manifold.

- 4 Loosely tighten the bolts.

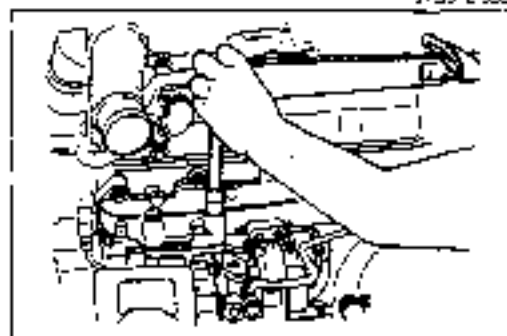


9TGD2-053

5. Install the turbocharger flex bracket.

**Tightening torque:**

17.7–26.5 Nm (1.8–2.7 m-kg, 13–19 ft-lb)

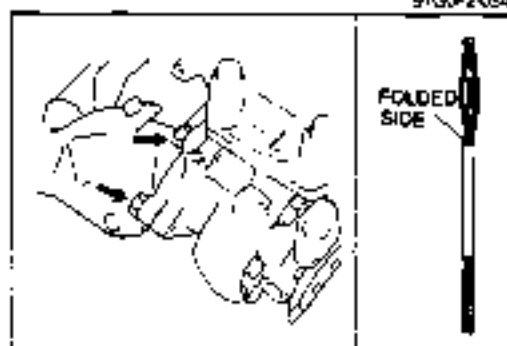


9TGD2-054

6. Tightening the turbocharger mounting bolts

**Tightening torque:**

37.3–62.8 Nm (3.8–6.4 m-kg, 28–46 ft-lb)



9TGD2-055

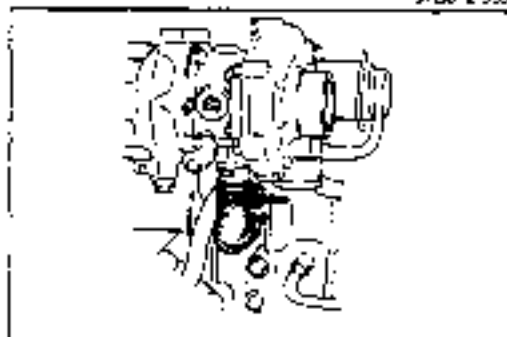
7. Install the front exhaust pipe using a new gasket and nuts.

**Note**

- Install the gasket with the folded side facing the turbocharger.

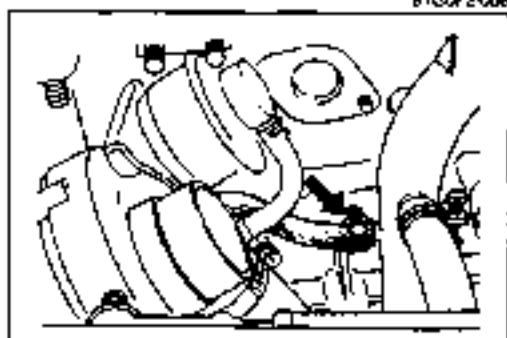
**Tightening torque:**

37.3–62.8 Nm (3.8–6.4 m-kg, 28–46 ft-lb)



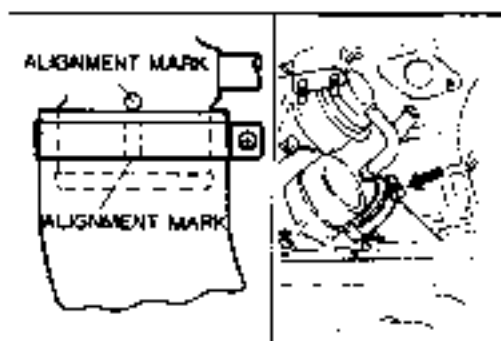
9TGD2-056

8. Connect the oil hose.



9TGD2-057

9. Connect the water hose.

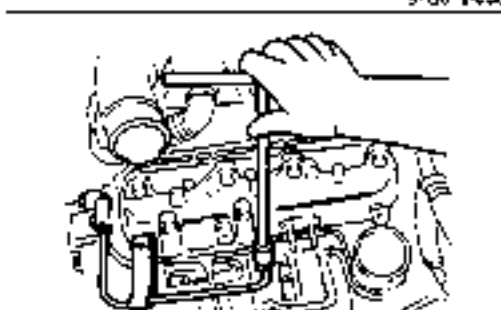


9T30F2-050

- 10 Connect the joint hose with the alignment mark matched, and tighten the hose clamp.

**Tightening torque:**

3.9—4.9 N·m (40—50 cm·kg, 35—43 in·lb)

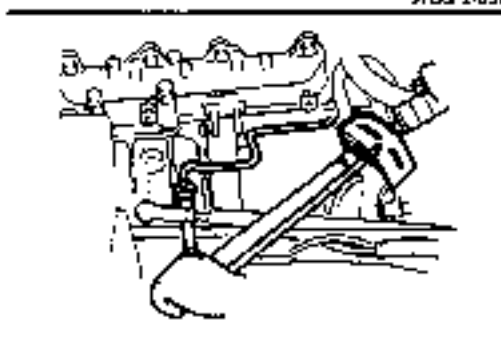


9T30F2-058

- 11 Install the oil pipe and a new washer.

**Tightening torque:**

15.7—23.5 N·m (1.6—2.4 m·kg, 12—17 ft·lb)

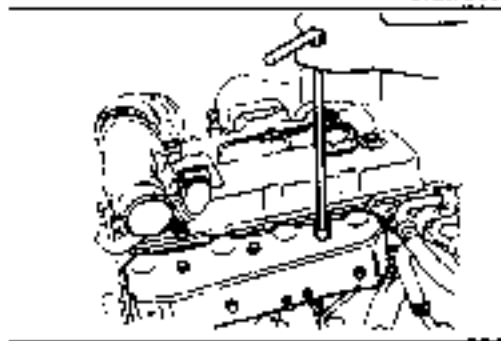


9T30F2-060

- 12 Install the water pipe and a new washer.

**Tightening torque:**

15.7—23.5 N·m (1.6—2.4 m·kg, 12—17 ft·lb)



9T30F2-061

- 13 Install the exhaust manifold heat insulator.

**Tightening torque:**

7.6—10.8 N·m (0.8—1.1 m·kg, 5.6—8.0 ft·lb)

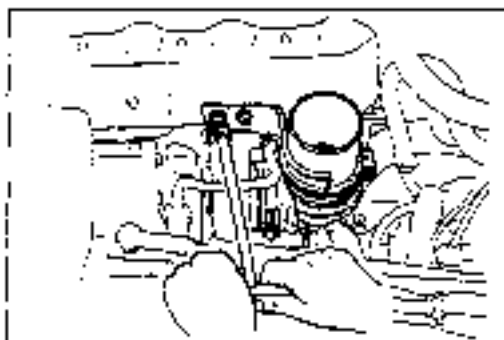


9T30F2-062

- 14 Install the turbocharger heat insulator.

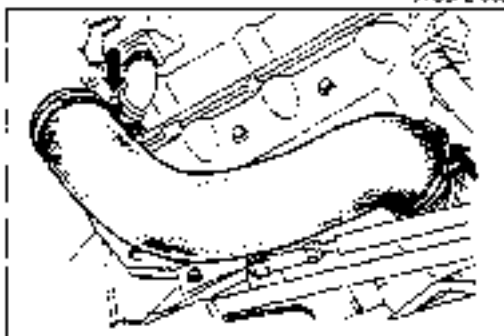
**Tightening torque:**

7.6—10.8 N·m (0.8—1.1 m·kg, 5.6—8.0 ft·lb)



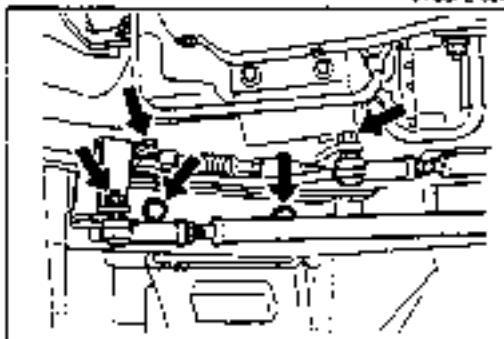
9T30F2-063

- 15 Connect the joint rubber.



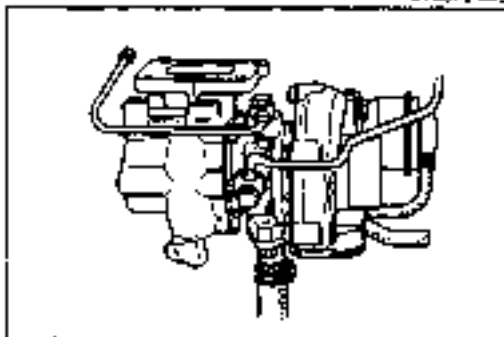
9T30F2-064

- 16 Connect the air intake hose.



9T30F2-065

- 17 Connect the counter lever bracket, change rod, and select rod.  
 18 Fill the radiator and subtank with coolant.  
 19 Fill the engine with the specified amount and type of engine oil. (Refer to Section D2.)



9T30F2-066

#### After Installation

1. Start the engine and let it idle.
2. Check for engine oil and coolant leakage.

#### Caution

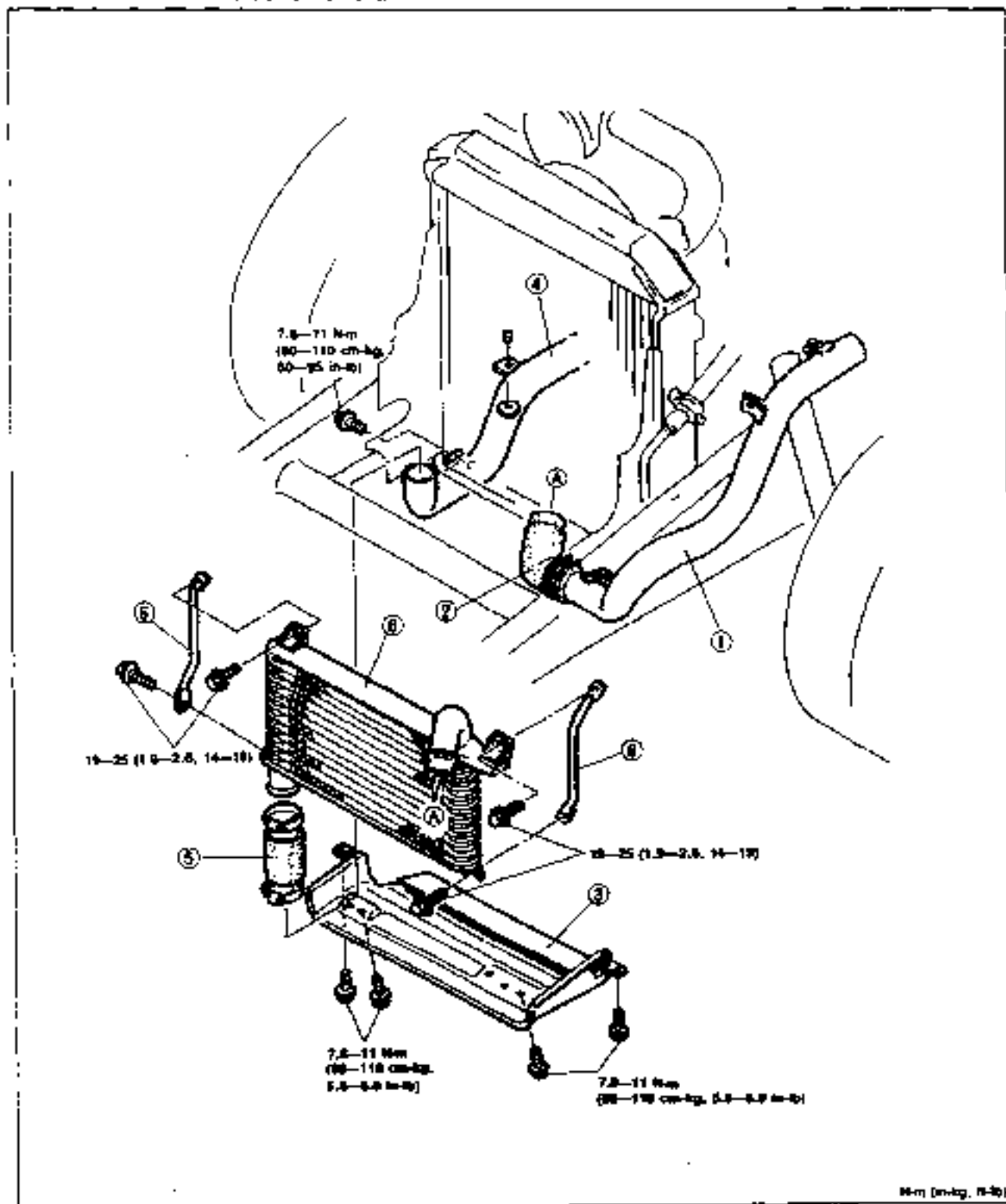
- Let the engine idle for a few minutes to lubricate the turbocharger.



## INTERCOOLER

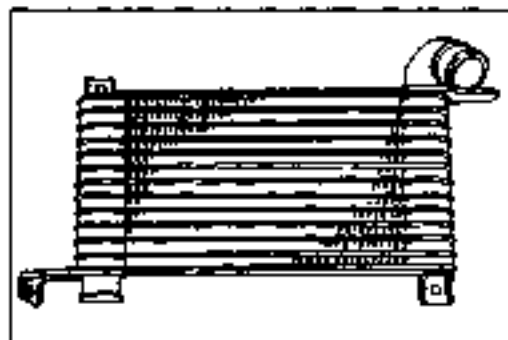
## Removal / Installation

- 1 Remove in the order shown in the figure.
- 2 Install in the reverse order of removal



1. Air intake pipe
2. Joint rubber (Outlet side)
3. Under cover

4. Air intake pipe
5. Joint rubber (Inlet side)
6. Intercooler, Intercooler stay



9TGF2-068

**Inspection and Repair**

1. Inspect the intercooler for cracks, restriction, or damage.



9TGF2-069

2. Repair bent fins with a screwdriver.

**Caution**

- Be careful not to break the fins when repairing them.

## FUEL SYSTEM

## FUEL TANK

## Removal / Inspection / Installation

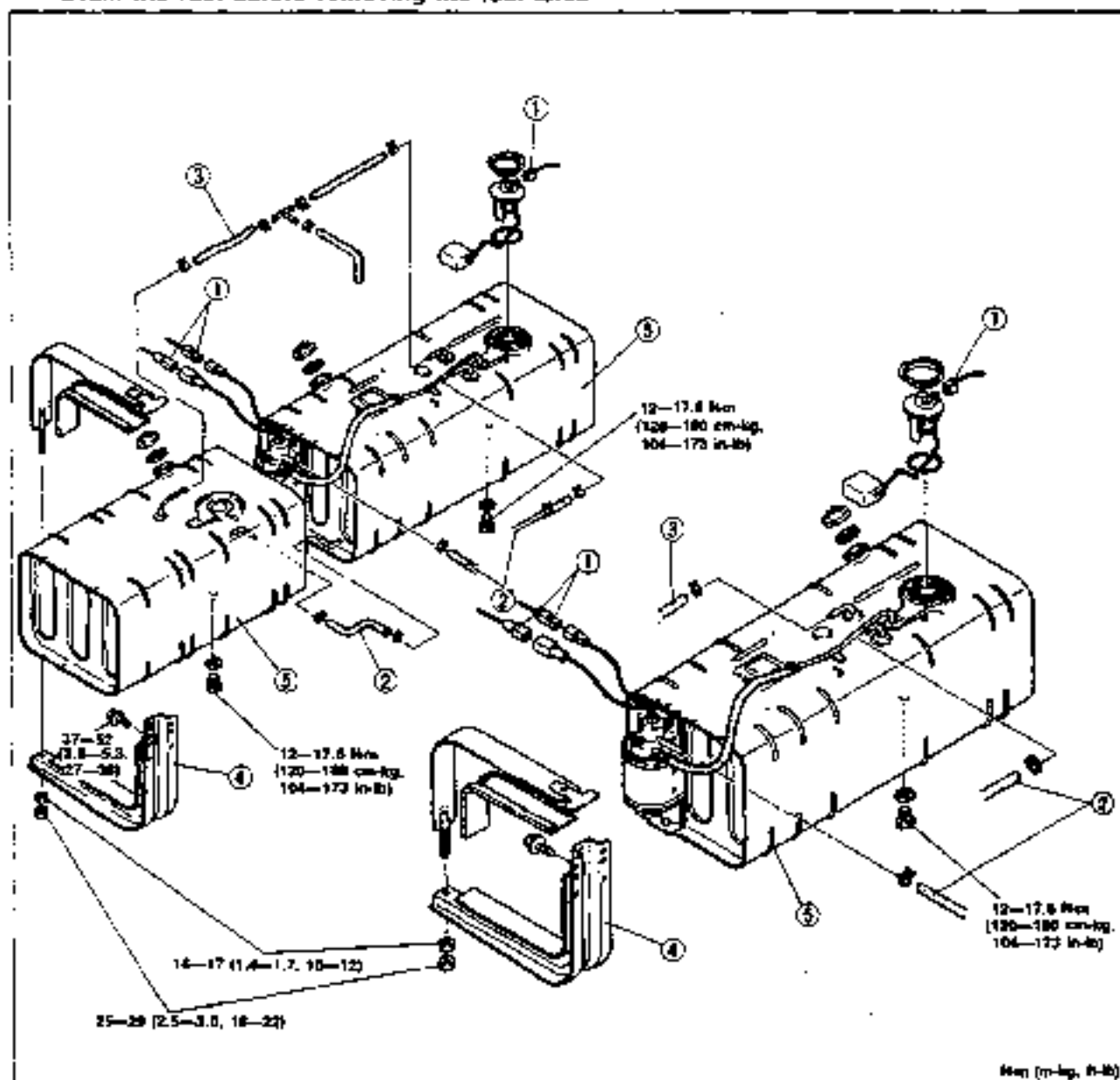
1. Remove in the order shown in the figure
2. Inspect all parts and repair or replace as necessary.
3. Install in the reverse order of removal

## Warning

- Keep sparks, cigarettes, and open flames away from the fuel tank.

## Note

- Drain the fuel before removing the fuel tank.



1. Connector
2. Fuel hose
3. Evaporative hose  
Verify air flows in both directions

4. Fuel tank strap
5. Fuel tank  
Check for contamination, corrosion and other damage

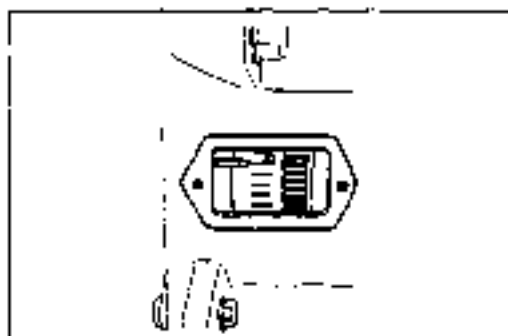
## INJECTION PUMP

## Removal

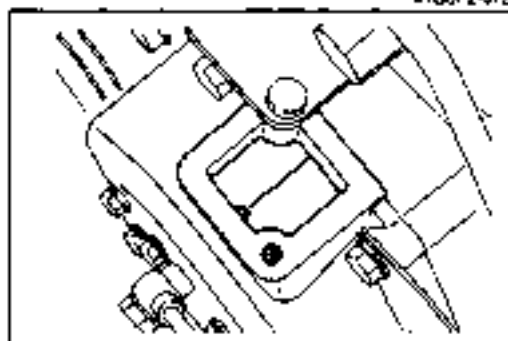
**Note**

- The in-line type pump used on the SL and SL turbocharged engines is removed with the drive gear. When replacing the pump be sure it is properly timed.
- Special tools and testers are required for service of the injection pump. The pump should be serviced only by an authorized Diesel Kiki distributor.

9TG0F2-071



9TG0F2-072



9TG0F2-073

**Caution**

- Before remove injection pump, perform the following.

1. Remove the negative battery cable.
2. Remove the cover from the flywheel and turn the flywheel until No.1 cylinder is at to 30° BTDC

3. Remove the cover from the gear case, and confirm that the mark on the timer and the pointer are aligned.

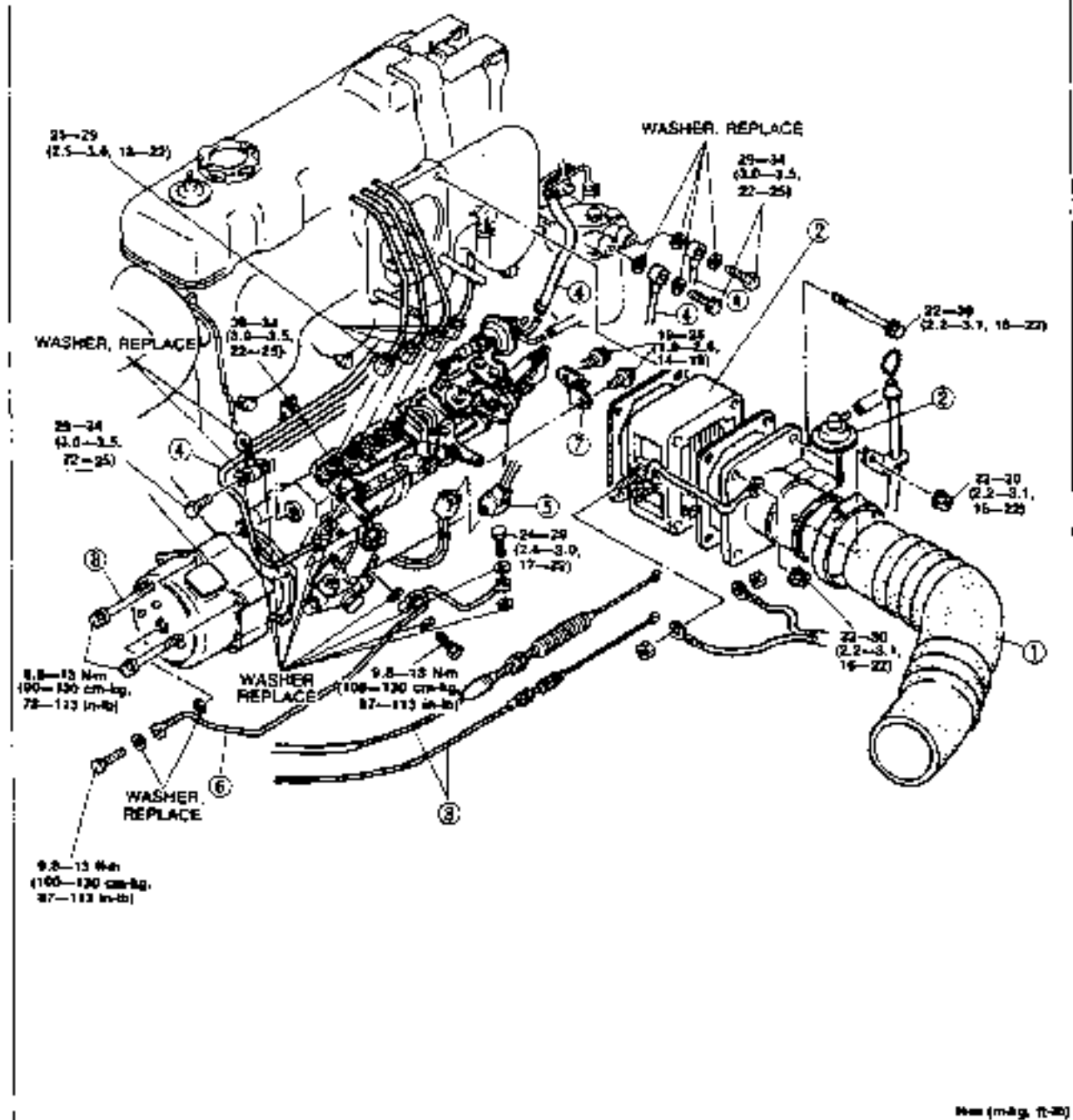
**Note**

- If they are not agreed, No.4 cylinder is at 30° BTDC.

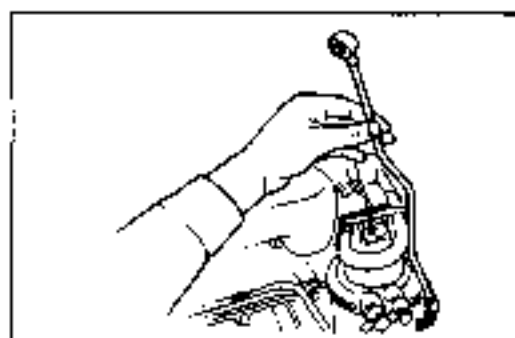
4. Remove in the order shown in the figure. (Refer to page F2-3\*)

**Caution**

- Cover the intake manifold and injection pipes after removal.
- After removing the pump, do not turn the engine.



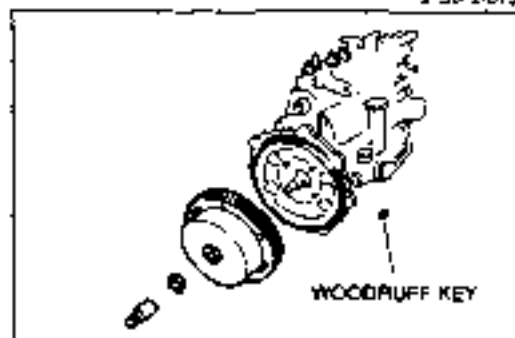
- |                                       |                        |
|---------------------------------------|------------------------|
| 1. Air hose                           | 5. Harness             |
| 2. Intake shutter valve, Air heater   | 6. Oil pipe            |
| 3. Fuel stop cable, Accelerator cable | 7. Bracket             |
| 4. Fuel hose, Fuel pipe               | 8. Bolts               |
| Removal Note..... page F2-32          | 9. Fuel injection pump |



9T50F2-075

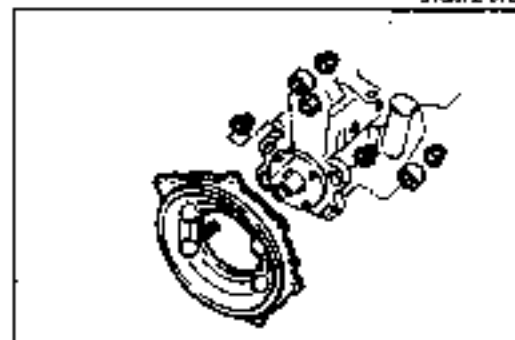
**Removal note****Note**

- When removing the fuel pipe from the bottom of the feed pump, remove it at the feed pump side and quickly hold the pipe up to prevent fuel leakage.

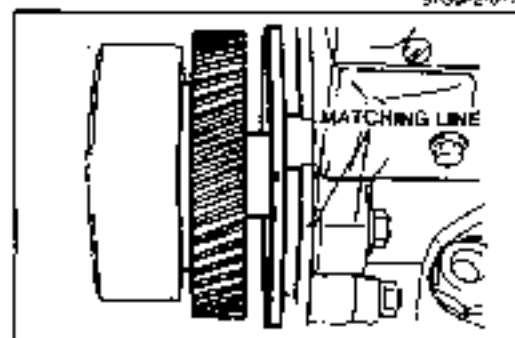


WOODRUFF KEY

9T50F2-076

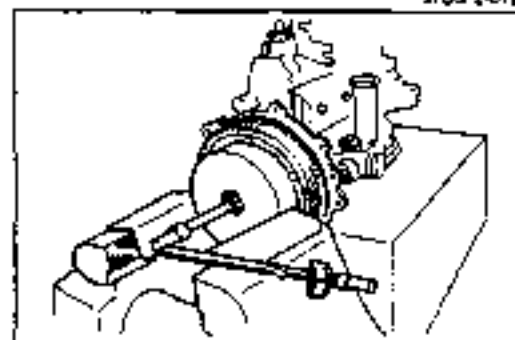


9T50F2-077



MATCHING LINE

9T50F2-078



9T50F2-079

**Disassembly / Assembly**

1. Affix the timer in a vise and remove the timer bolt.
2. Remove the timer and gear assembly from the pump.
3. Remove the woodruff key from the pump shaft.
4. Remove the flange plate.
5. Affix the pump in a vise, and install the flange plate.
6. Align the marks on the pump and flange plate, and tighten the mounting nuts.
7. Install the woodruff key, and install the timer and gear assembly onto the pump shaft.
8. Affix the timer in a vise, and tighten the nut.

**Tightening torque:**

34—39 Nm (3.5—4.0 m·kg, 25—29 ft·lb)

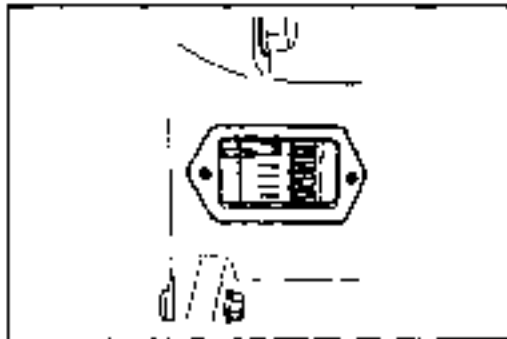
**Tightening torque:**

59—69 Nm (6.0—7.0 m·kg, 43—51 ft·lb)

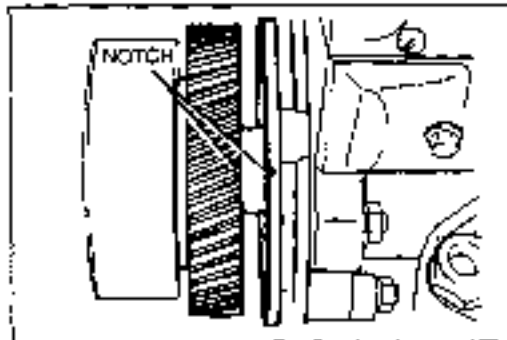
**Installation**

1. Install in the reverse order of removal, referring to **Installation Note**.
2. Adjust the injection timing. (Refer to page F2-14.)
3. Bleed air from the fuel system. (Refer to page F2-35.)

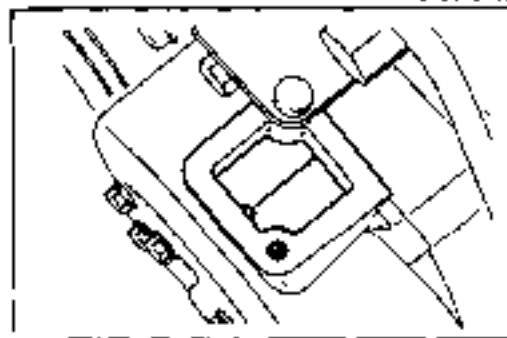
9TGF2-080



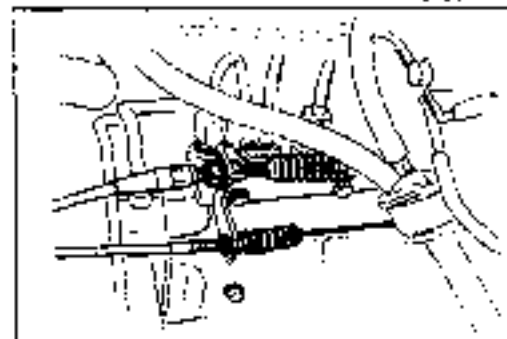
9TGF2-081



9TGF2-082



9TGF2-083



9TGF2-084

**Installation note****Injection pump**

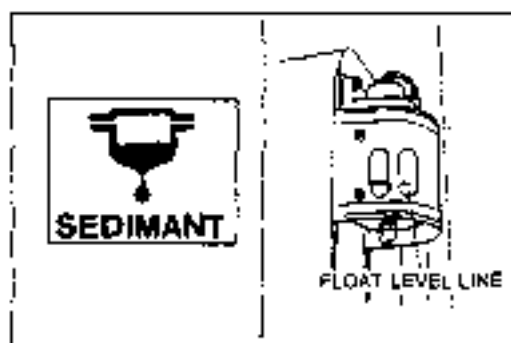
1. Before installing the injection pump, verify that No. 1 cylinder is at 30° BTDC.

2. Align the notches of the flange plate and the injection pump gear.
3. Install the injection pump.

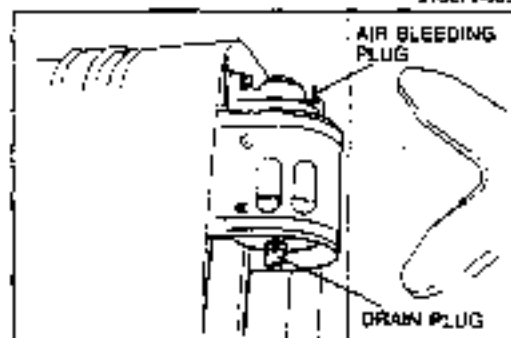
4. Verify that the mark on the timer and the tab of the timing gear case are aligned.

**Accelerator cable, fuel stop cable**

1. After installing the accelerator cable, adjust the free play of the cable. (Refer to page F2-40.)
2. After installing the fuel stop cable, adjust the free play of the cable. (Refer to page F2-41.)



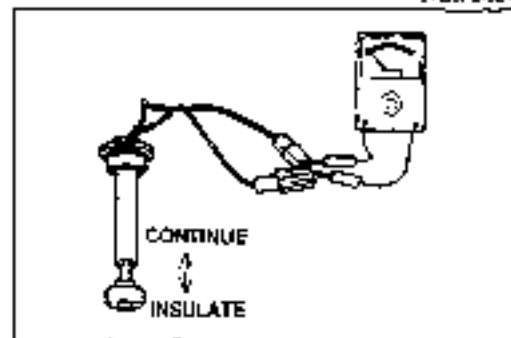
9TGCF2-085



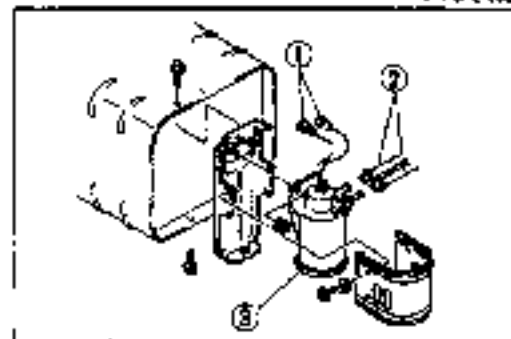
9TGCF2-086



9TGCF2-087



9TFOF2-002



9TGCF2-089

### SEDIMENTOR Draining Water

#### Note

- Drain the water when the sedimentor warning light is illuminated or when the float ring has risen near the float level line.

1. Loosen the drain plug.
2. Loosen the air bleeder plug.
3. After all of the water has been drained, install the drain plug.
4. Pump the priming pump at the fuel filter until clear (no air bubbles) fuel is expelled from the air bleeder plug. Tighten the bleeder plug.

#### Inspection

1. Visually check the sedimentor for damage and fuel leakage. Repair or replace it if necessary.
2. Check the position of the float ring. If the ring is near the float level line, drain the water.

### SEDIMENTOR SENSOR (DETECTOR)

#### Inspection

1. Remove the sedimentor sensor from the sedimentor.
2. Check continuity of the detector.

Float	Continuity
Up	Yes
Down	No

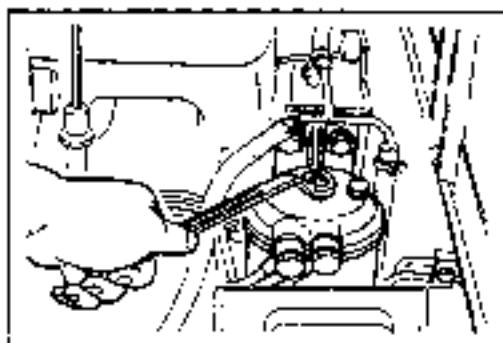
#### Replacement

#### Warning

- Keep sparks, cigarettes, and open flames away from the sedimentor.

1. Disconnect the connectors.
2. Remove the fuel hoses.
3. Remove the sedimentor.
4. Install in the reverse order of removal.





9TGF2-09C

**FUEL FILTER****Air Bleeding****Warning**

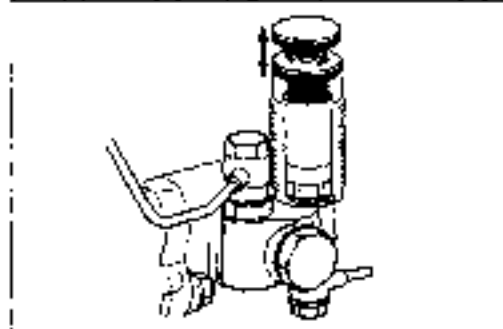
- Keep sparks, cigarettes, and open flames away from the fuel filter.

1. Loosen the air bleeder plug

2. Pump the priming pump until no air is expelled  
3. Tighten the air bleeder plug

**Tightening torque:**

5.9—8.8 N·m (60—90 cm·kg, 52—78 in·lb)



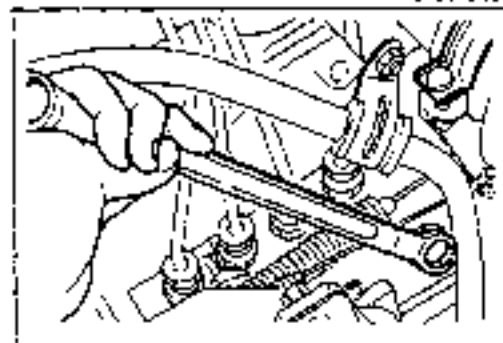
9TGF2-09

4. Loosen the return pipe at the injection pump, and pump the priming pump until no air is expelled.  
5. Tighten the bolt.

**Tightening torque:**

12—15 N·m (120—150 cm·kg, 104—130 in·lb)

6. Push the priming pump down and tighten it.

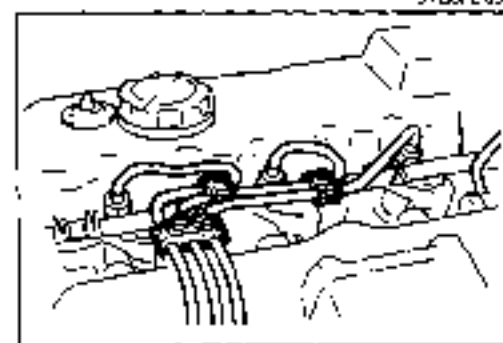


9TGF2-09E

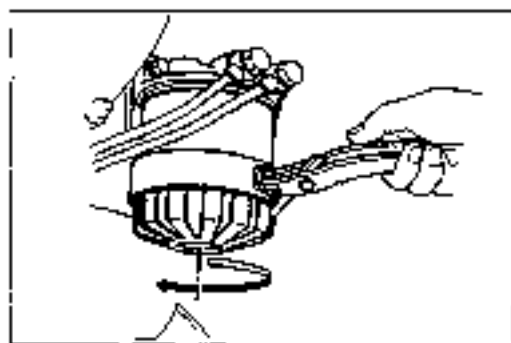
7. Loosen the injection pipes at the injection nozzles.  
8. Crank the engine, and verify that fuel is expelled from each injection pipe.  
9. Tighten the injection pipes.

**Tightening torque:**

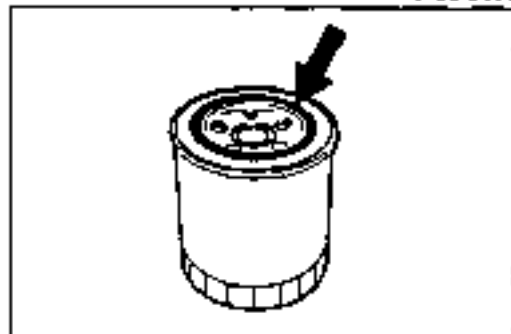
20—25 N·m (2.0—2.5 m·kg, 14—18 ft·lb)



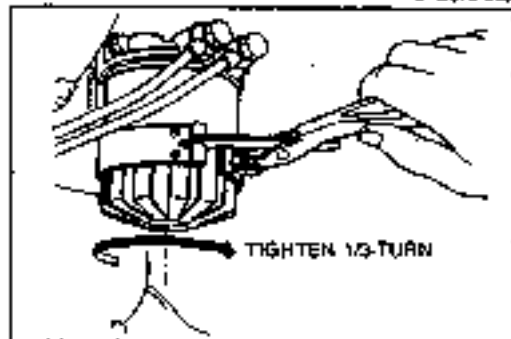
9TGF2-09F



91G0F2-094



91G0F2-095



91G0F2-096

### Replacement

#### Warning

- Keep sparks, cigarettes and open flames away from the fuel filter.

1. Remove the filter with a filter wrench
2. Apply fuel to the O-ring.
3. Install the filter and tighten by hand, then tighten with filter wrench an additional  $1/3$ -turn.
4. Bleed air from the filter. (Refer to page F2-35.)
5. Start the engine, and verify that there is no fuel leakage around the filter.

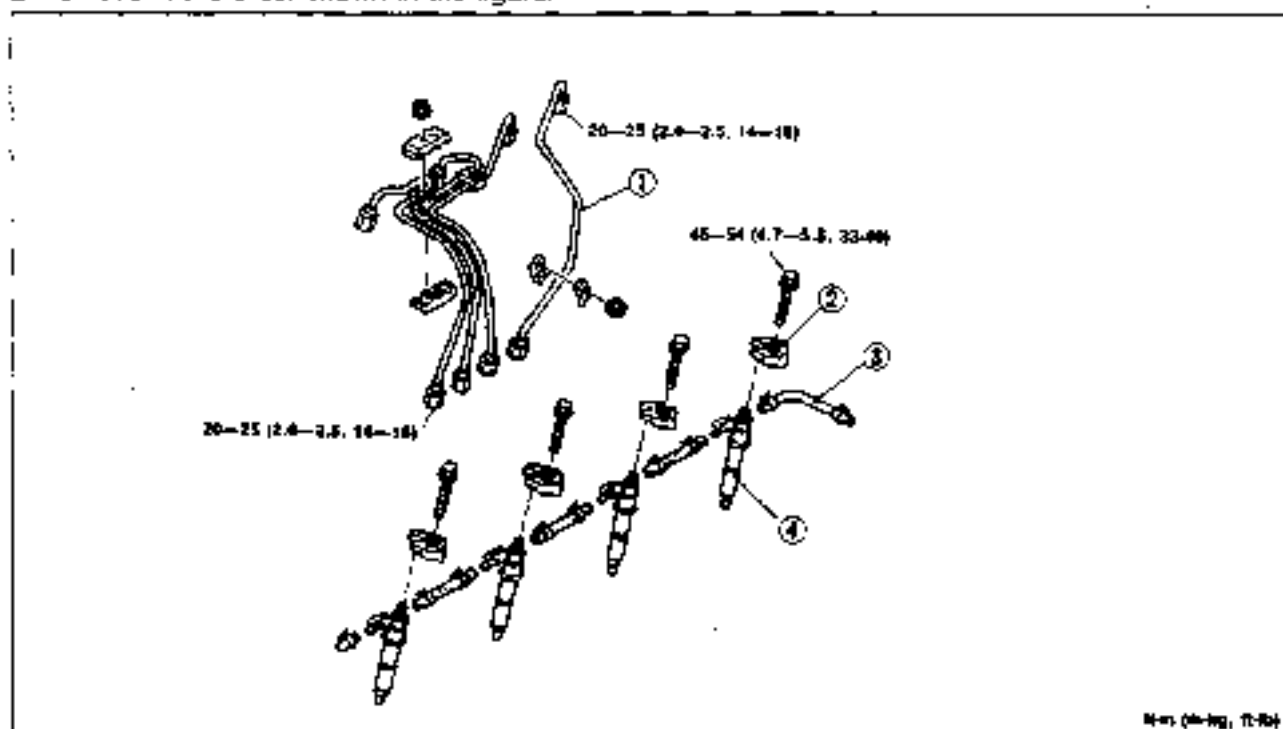
## INJECTION NOZZLE

## Removal

**Warning**

- Keep sparks, cigarettes, and open flames away from the fuel area.

1. Remove the negative battery cable
2. Remove in the order shown in the figure.



M-11 (04-10g, 11-10g)

9T00F2-097

- |                          |                     |
|--------------------------|---------------------|
| 1. Injection pipe        | 3. Fuel return hose |
| 2. Nozzle holder bracket | 4. Injection nozzle |

## Inspection

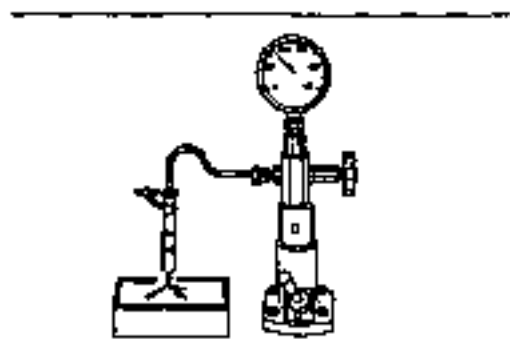
**Warning**

- Do not allow your hands or any other part of the body to come into the direct path of the fuel spray when using the nozzle tester because the spray has enough force to break the skin and possibly cause blood poisoning.

**Caution**

- The nozzle tester should be set up in a clean work place.

9T00F2-098



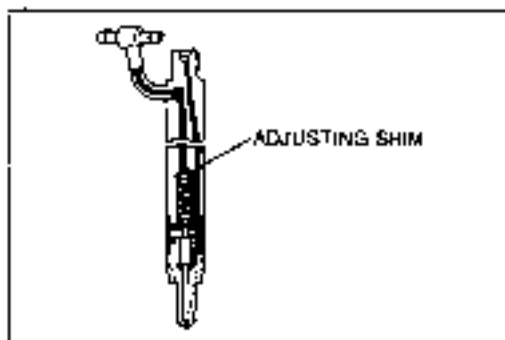
9T00F2-098

**Injection starting pressure**

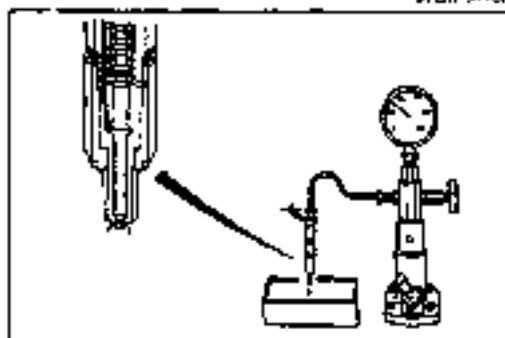
1. Connect the nozzle to a nozzle tester.
2. Pump the nozzle tester handle and note the pressure when injection is started.

**Injection starting pressure**

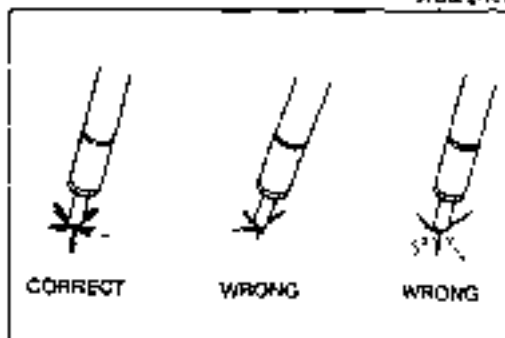
New nozzle : 17,168 kPa (175 kg/cm<sup>2</sup>, 2,489 psi)  
 Used nozzle: 16,577 kPa (170 kg/cm<sup>2</sup>, 2,417 psi)



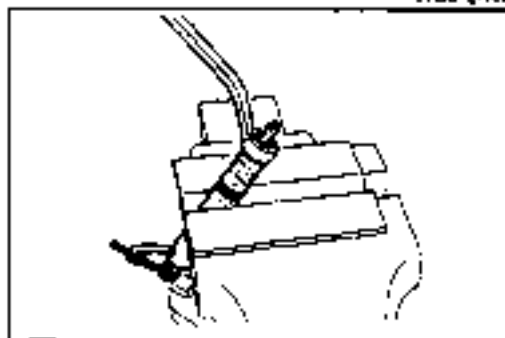
9T30F2-100



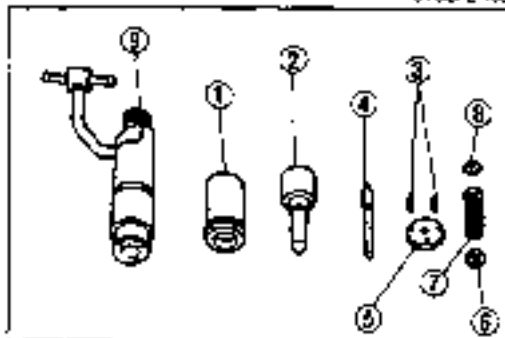
9T30F2-101



9T30F2-102



9T30F2-103



9T30F2-104

- If not within the specified pressure, adjust the starting pressure by adding or removing shims.

#### Note

- Shims 0.05 are available in 0.05mm (0.002 in) steps, from 0.5 to 1.5mm (0.02 to 0.06 in). Changing shim thickness by 0.05mm (0.002 in), changes the injection pressure approx. 491 kPa (5.0 kg/cm<sup>2</sup>, 71 psi).

#### Leakage of injector

Apply pressure 4.715 kPa (\*50 kg/cm<sup>2</sup>, 2,133 psi) and see if the fuel leaks from the nozzle injection hole.

If the fuel leaks, it is necessary to disassemble, wash and recheck the nozzle or replace it.

#### Atomizing condition

- Connect the nozzle on the nozzle tester.
- Air bleed by operating the nozzle tester handle several times.
- Keeping the pressure gauge of the nozzle tester in the non-functioning condition, quickly lower the handle (lower the handle as quickly as possible so that a pulsating whistling sound can be heard). Repeat this operation several times and check the atomizing condition.
- Make sure that the fuel is atomized uniformly and properly.

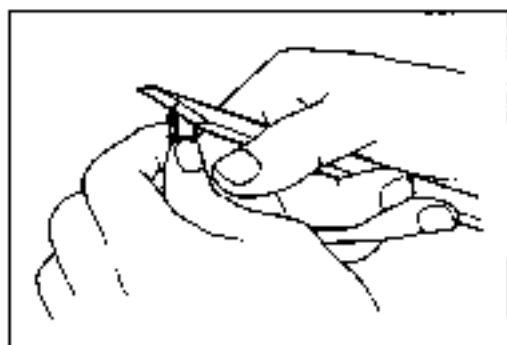
- Make sure that the injection angle and direction are normal.
- If the atomizing condition is incorrect, it is necessary to disassemble, wash and recheck the nozzle, or to replace it.

#### Disassembly

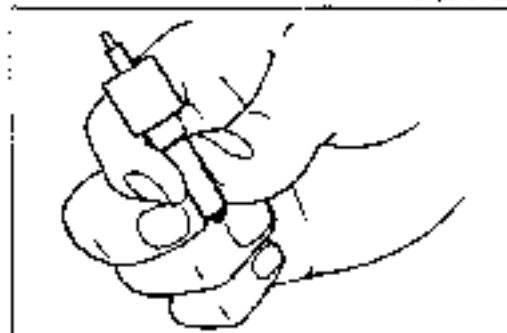
- Clamp the nozzle in a vise as shown in the figure.

- Disassemble as shown in the figure.

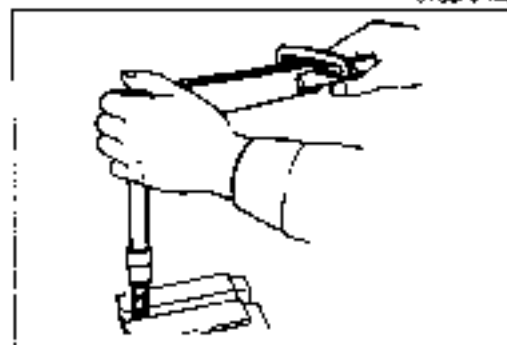
- Retaining ring
- Nozzle body
- Guide pin
- Needle valve
- Distance piece
- Pressure pin
- Pressure spring
- Shim
- Nozzle holder



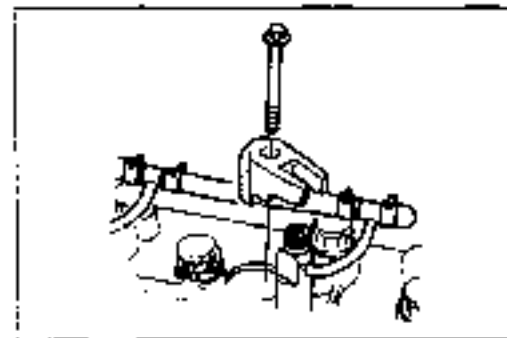
9T30F2-105



8T60F2-106



9T30F2-107



9T30F2-108

**Cleaning**

1. Clean the nozzle with new fuel.
2. Clean the carbon fixed on nozzle with a hard lumber.
3. Inspect for damaged or pitted parts, repair or replace as necessary.

4. Verify that the nozzle body is not damaged. Hold the nozzle body upright and insert the needle valve approximately two-thirds of the way into the body. Verify that the needle valve drops into the body under its own weight when released.

**Assembly**

1. Assemble in the reverse order of disassembly.

**Tightening torque:**

29—39 Nm (3.0—4.0 m·kg, 22—29 ft·lb)

2. Retest the nozzle after assemble (Refer to page F2-37.)

**Installation****Caution**

- Use new gaskets and O-rings.

1. Install in the reverse order of removal.

**Tightening torque****Retainer bolt:**

46—54 Nm (4.7—5.5 m·kg, 34—40 ft·lb)

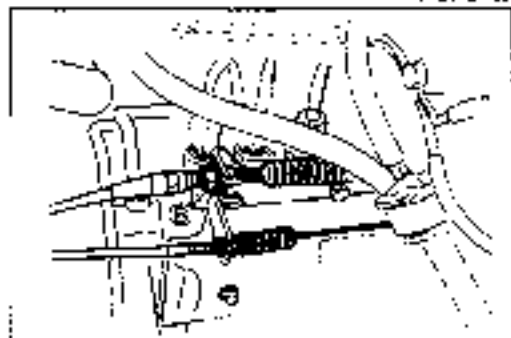
**Nozzle nut:**

20—25 Nm (2.0—2.5 m·kg, 14—18 ft·lb)

2. Run the engine and check for fuel leakage.



9T00F2-09



9T00F2-110

### ACCELERATOR PEDAL, ACCELERATOR CABLE Inspection / Adjustment

1. Verify that the control lever of the injection pump is in the full-open position when the accelerator pedal is fully depressed
2. Loosen nut A and adjust the stop bolt, if necessary

#### Tightening torque:

5.9—9.8 Nm (70—100 cm-kg, 81—87 in-lb)

3. Check the free play of the accelerator cable

**Free play: 1.0—3.0mm (0.039—0.12 in)**

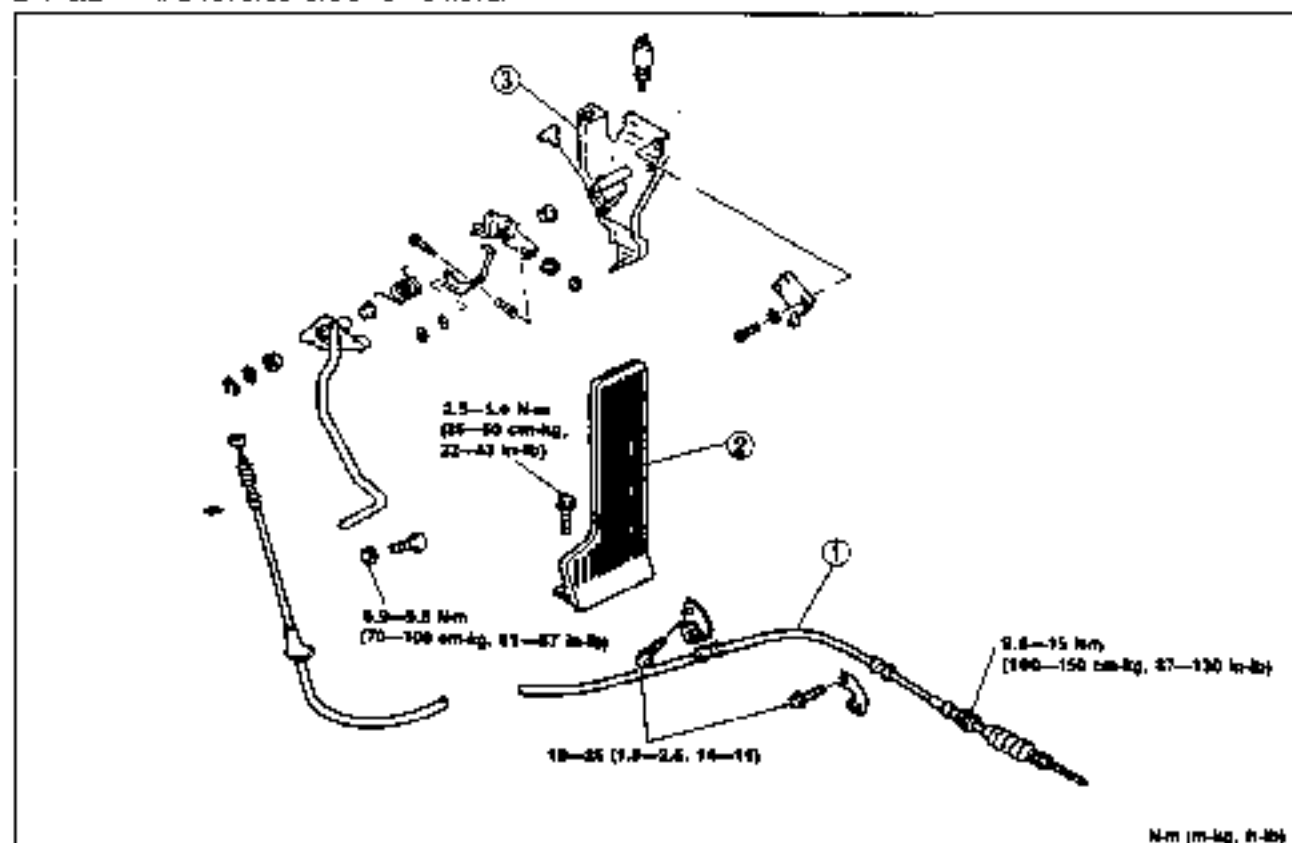
4. Adjust ruts B if necessary

#### Tightening torque:

9.8—15 Nm (100—150 cm-kg, 87—130 in-lb)

### Removal / Installation

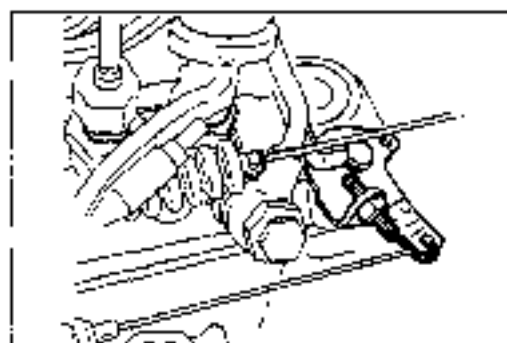
1. Remove in the order shown in the figure.
2. Install in the reverse order of removal



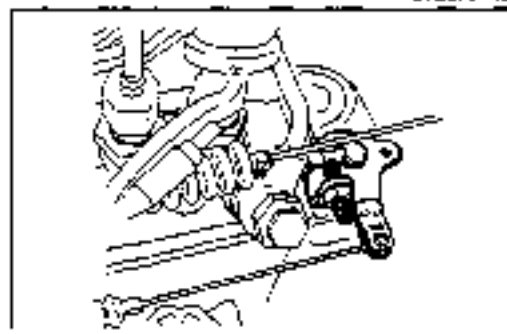
9T00F2-111

1. Accelerator cable
2. Accelerator pedal

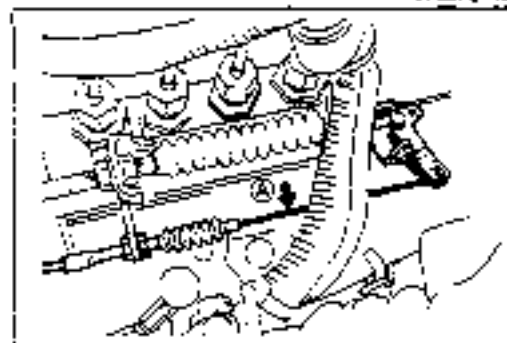
3. Bracket



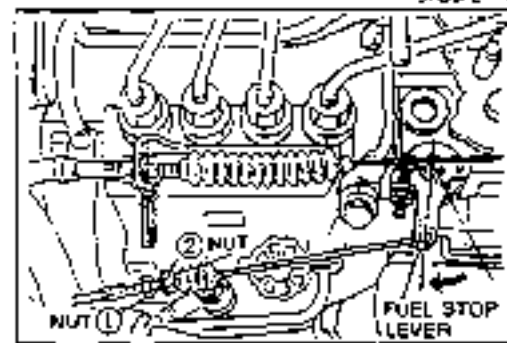
9TGO2-12



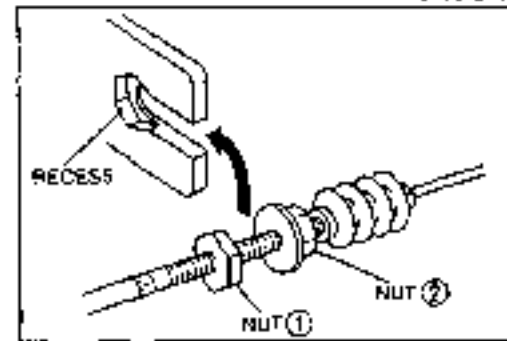
9TGO2-13



9TGO2-14



9TGO2-156



9TGO2-157

## FUEL CUT CONTROL SYSTEM

### SYSTEM OPERATION

1. Turn the engine switch OFF and verify that the stop lever is at the fuel stop position.
2. Turn the engine switch ON and verify that the stop lever is at the fuel inject position.
3. Run the engine.
4. Turn the engine switch OFF and be sure the engine will stop.

### FUEL STOP CABLE

#### inspection

1. Check the cable for damage or rust.
2. Turn the engine switch OFF.
3. Move the fuel stop lever to make the fuel line close.
4. Check the free play of cable in condition of tensed (A) position of the fuel stop cable.

**Free play: 0—2mm (0—0.078 in)**

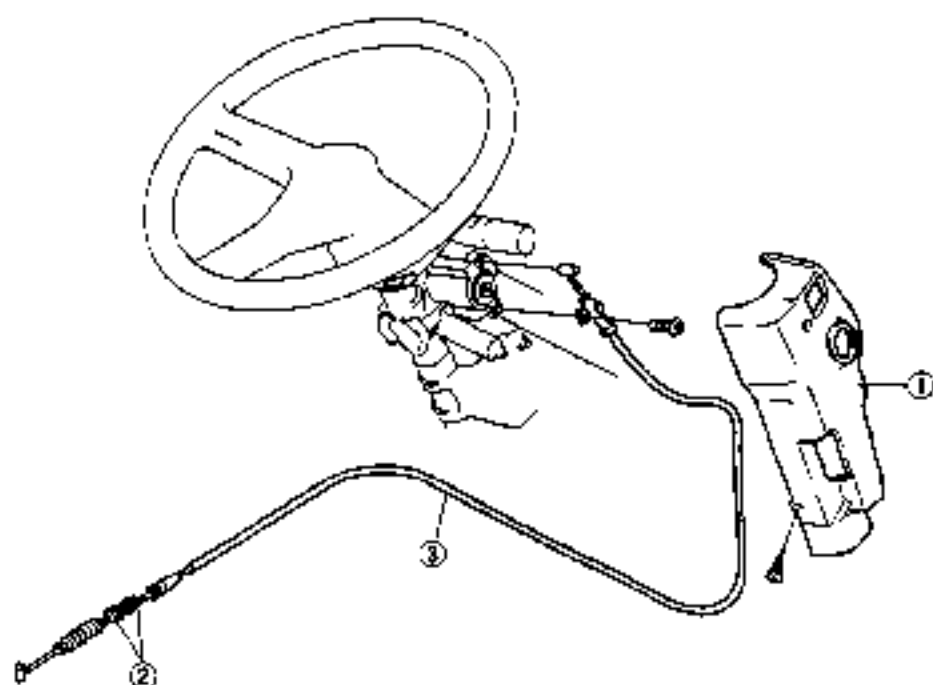
5. Verify that the engine stops when turn the engine switch OFF.
6. If not as specified, adjust the cable as follows.

#### Adjustment

1. Turn the engine switch OFF.
2. Loosen nut ② and remove the fuel stop cable from the bracket.
3. Pull the fuel stop cable and verify that the fuel stop lever is at the fuel stop position.
4. Adjust nut ① so that there is no clearance between it and the outside of the bracket.
5. Install the cable into the bracket, fitting nut ① into the recess.
6. Check the free play of the cable as above.
7. If not as specified perform steps 2—5 again.
8. If as specified, tighten nut ②.
9. Verify that the engine stops when turning the engine switch OFF.

**Removal / Installation**

1. Remove in the order shown in the figure
2. Install in the reverse order of removal.
3. Adjust the free play of the fuel stop cable.



1. Steering column cover  
2. Locknuts

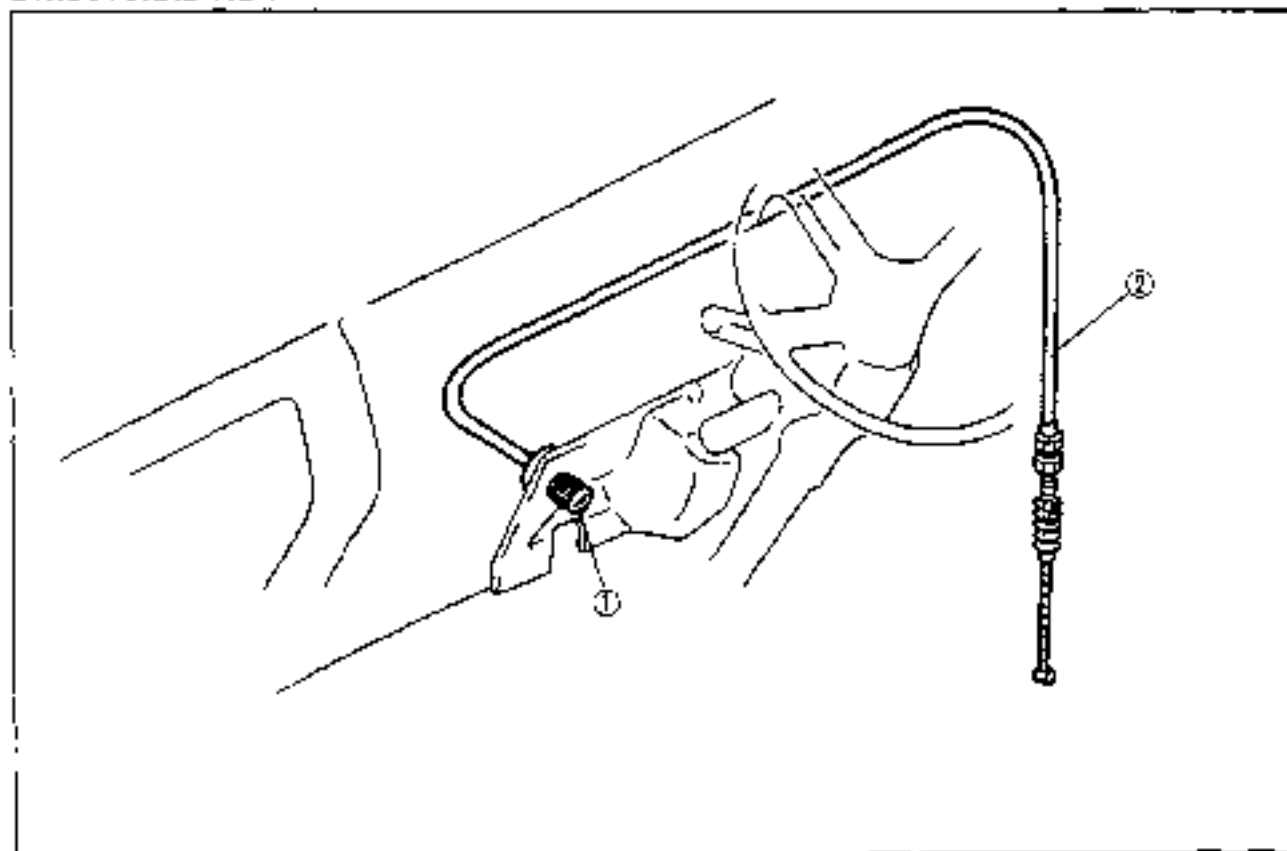
3 Fuel stop cable

5T00F2-115



## IDLE SPEED CONTROL SYSTEM

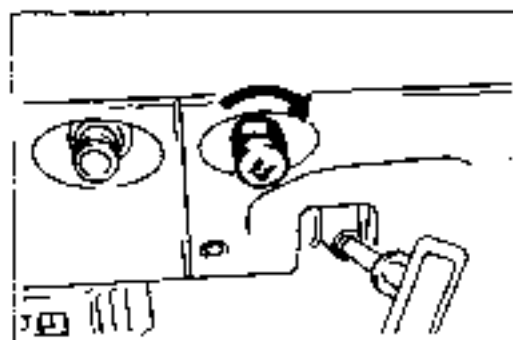
## STRUCTURAL VIEW



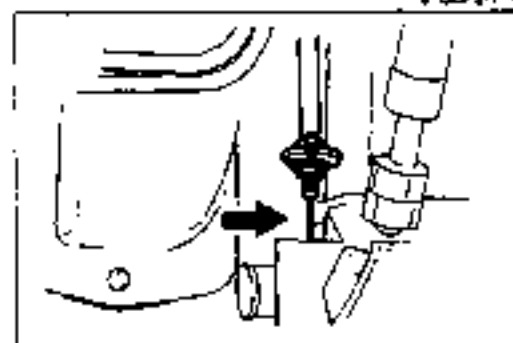
F7G0F2-16

1. Idling knob  
Removal / Installation ..... page F2-44

2. Idling cable  
Adjustment ..... page F2-43  
Removal / Installation ..... page F2-44



F7G0F2-17



F7G0F2-18

## IDLING KNOB, IDLING CABLE

## Adjustment

1. Verify that the control lever of the injection pump is at the idle position when the idling knob is not turned.
2. Verify that the idle speed increases when the knob is turned clockwise.

3. Check the free play of the cable when the idling knob is not turned.

**Free play:** 0—5mm (0—0.2 in)

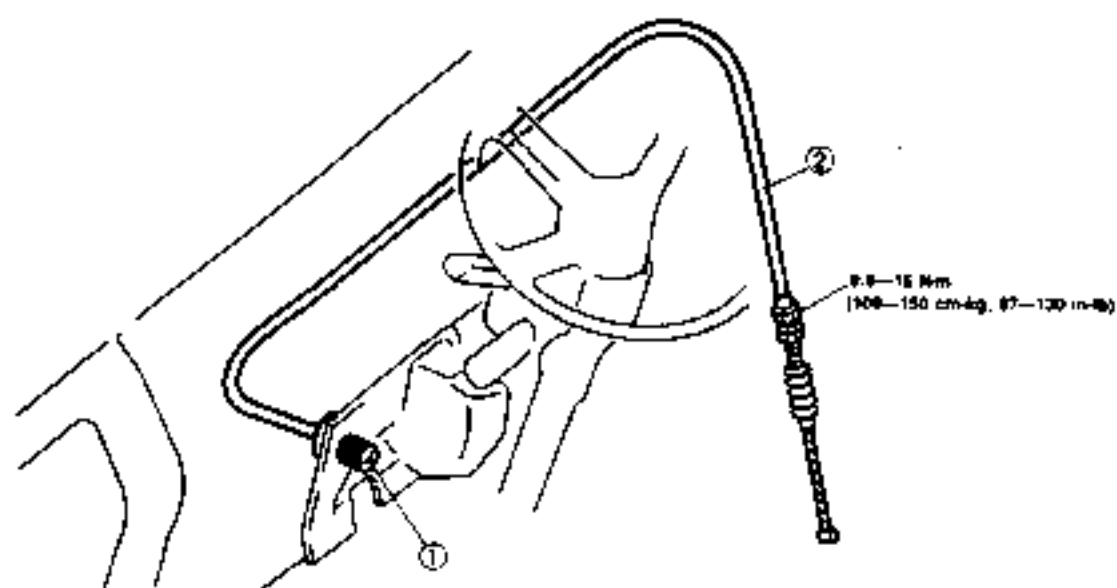
4. If not specified, loosen the locknuts and adjust the free play.

**Tightening torque:**

9.8—15 Nm (100—150 cm-kg, 87—130 in-lb)

**Removal / Installation**

1. Remove in the order shown in the figure
2. Install in the reverse order of removal.



1. Idling knob

2. Idling cable

97C6F3-113

## EXHAUST SYSTEM

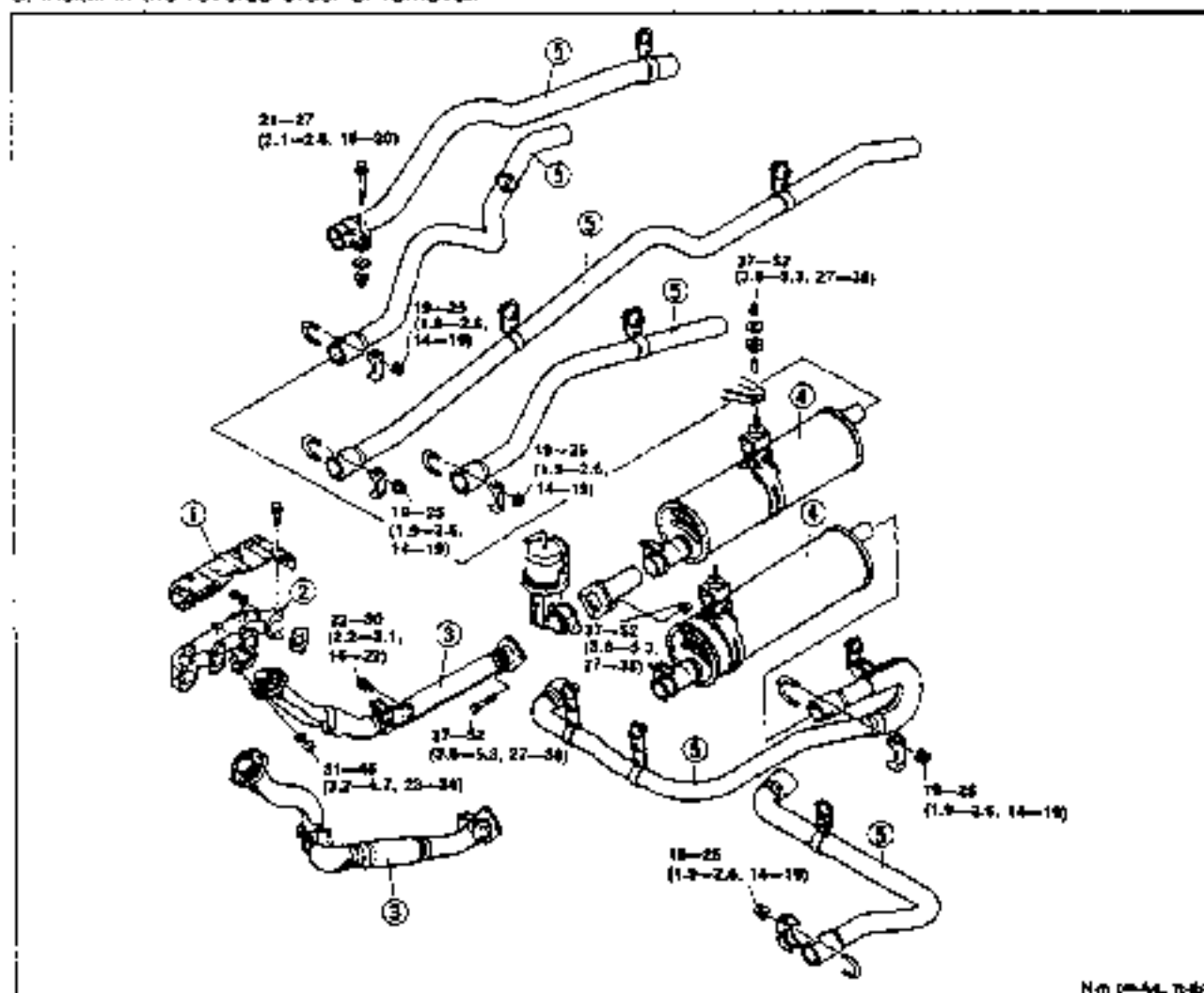
## COMPONENTS

## Vehicle Inspection

1. Run the engine and verify that there is no exhaust leakage

## Removal / Inspection / Installation

1. Removal in the order shown in the figure.
2. Inspect all parts and repair or replace as necessary.
3. Install in the reverse order of removal.

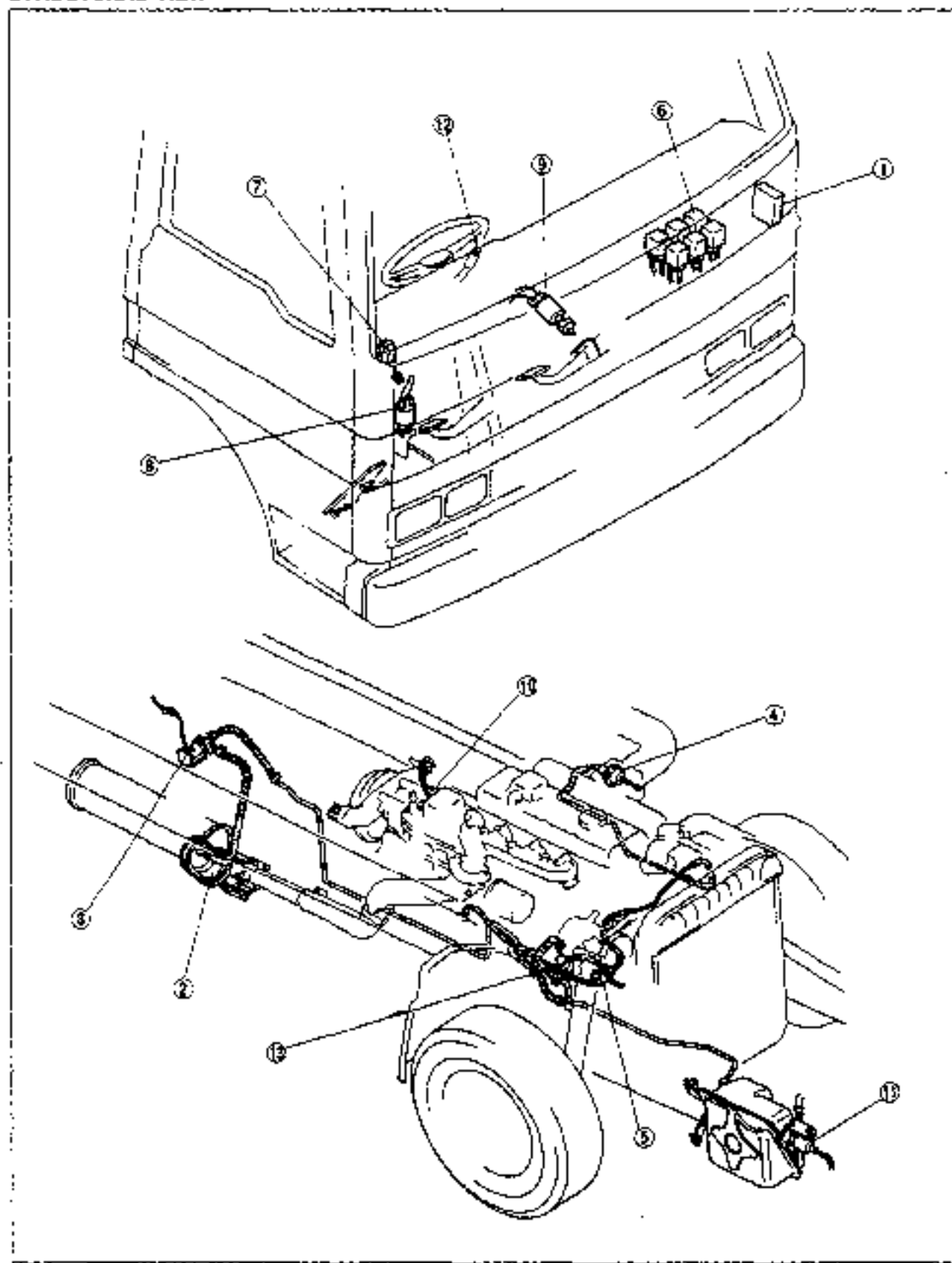


N.m (cm.kg, ft.lbf)  
97GDF2 13

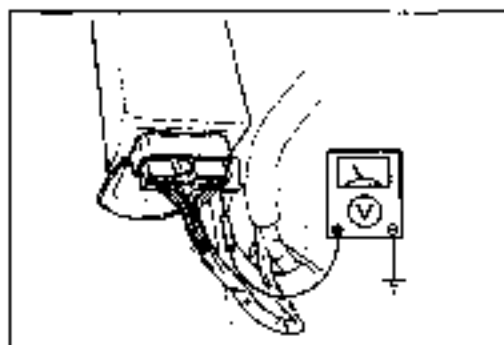
- |   |   |
|---|---|
| <ol style="list-style-type: none"> <li>1. Exhaust manifold insulator (SL engine only)<br/>SL turbocharged engine,<br/>refer to page F2-22</li> <li>2. Exhaust manifold (SL engine only)<br/>Check for contamination, cracks and other<br/>damage<br/>SL turbocharged engine,<br/>refer to page F2-22</li> <li>3. Front pipe assembly (SL engine only)<br/>Check for contamination, cracks and other<br/>damage<br/>SL turbocharged engine,<br/>refer to page F2-22</li> </ol> | <ol style="list-style-type: none"> <li>4. Main silencer<br/>Check for contamination, cracks and other<br/>damage</li> <li>5. Tail pipe assembly<br/>Check for contamination, cracks and other<br/>damage</li> </ol> |
|---|---|

## EXHAUST CONTROLLED HEATING SYSTEM

## STRUCTURAL VIEW



- |   |            |
|---|------------|
| 1. Exhaust heating control unit               |            |
| Inspection .....                              | page F2-48 |
| Replacement .....                             | page F2-49 |
| 2. Exhaust brake unit                         |            |
| Removal .....                                 | page F2-49 |
| Inspection .....                              | page F2-49 |
| Installation .....                            | page F2-50 |
| 3. Magnetic valve (for exhaust shutter valve) |            |
| Removal .....                                 | page F2-50 |
| Inspection .....                              | page F2-50 |
| Installation .....                            | page F2-50 |
| 4. Intake shutter valve actuator              |            |
| Inspection .....                              | page F2-51 |
| Replacement .....                             | page F2-51 |
| 5. Solenoid valve (for intake shutter valve)  |            |
| Inspection .....                              | page F2-52 |
| 6. Cancel relay (pay load above 3.5t only)    |            |
| Removal .....                                 | page F2-52 |
| Inspection .....                              | page F2-52 |
| Installation .....                            | page F2-52 |
| 7. Exhaust heating switch                     |            |
| Removal .....                                 | page F2-51 |
| Inspection .....                              | page F2-51 |
| Installation .....                            | page F2-51 |
| 8. Accelerator switch                         |            |
| Inspection .....                              | page F2-51 |
| Replacement .....                             | page F2-51 |
| 9. Clutch switch                              |            |
| Inspection .....                              | page F2-51 |
| Replacement .....                             | page F2-51 |
| 10. Neutral switch                            |            |
| Inspection .....                              | page F2-51 |
| Replacement .....                             | page F2-51 |
| 11. Vacuum switch (pay load above 3.5t only)  |            |
| Inspection .....                              | Section T  |
| 12. Exhaust brake switch                      |            |
| Inspection .....                              | page F2-51 |
| 13. Vacuum pump                               |            |
| Removal .....                                 | Section F  |
| Inspection .....                              | Section F  |
| Installation .....                            | Section F  |



9TGGF2-125

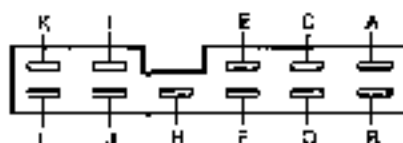
## EXHAUST HEATING CONTROL UNIT

## Inspection

1. Measure the terminal voltage of the exhaust heating control unit when the vacuum switch connector disconnected.
2. If not as specified repair the wire harness or replace the control unit.

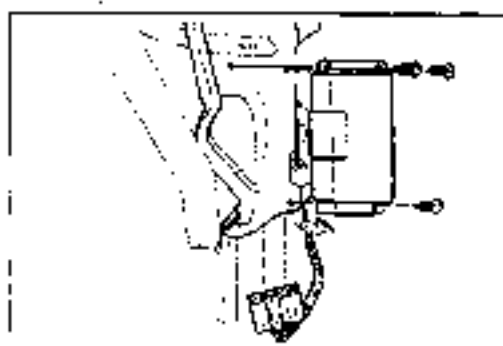
Terminal	Colour of wire	Connected to	Conditions of measuring (engine switch ON)	Voltage	Possible cause
A	BR	Exhaust heating switch	Exhaust heating switch OFF	Approx. 12V	Exhaust heating switch (Refer to page F2-53) Wire harness
			Exhaust heating switch ON	Approx. 0V	
B	RL	Clutch switch	Accelerator and clutch pedal released	Approx. 0V	Clutch switch (Refer to page F2-54) Accelerator switch (Refer to page F2-53) Wire harness
			Accelerator or clutch pedal depressed	Approx. 0V	
C	—	—	—	—	—
D	LY	Neutral switch	Neutral	Approx. 12V	Neutral switch (Refer to page F2-54) Wire harness
			In gear	Approx. 0V	
E	O	Exhaust brake switch	Exhaust brake switch OFF	Approx. 12V	Exhaust brake switch (Refer to page F2-55) Wire harness
			Exhaust brake switch ON	Approx. 0V	
F	BY, LW*	Exhaust brake switch Exhaust heating switch	Constant	Approx. 12V	Exhaust brake switch (Refer to page F2-55) Exhaust heating switch (Refer to page F2-53) Wire harness
H	B	Ground	Constant	Approx. 0V	Wire harness
I	GY	Magnetic valve (for exhaust shutter valve)	• Accelerator and clutch pedal released • Exhaust heating switch ON	Less than approx. 1V	Magnetic valve (Refer to page F2-50) Wire harness
			• Accelerator and clutch pedal released • Neutral • Exhaust brake switch ON	Less than approx. 1V	
			Except above conditions	Approx. 12V	
K	RBA	Solenoid valve (intake shutter valve)	• Accelerator pedal depressed less than half or clutch pedal depressed or both depressed • Exhaust heating switch ON	Less than approx. 1V	Solenoid valve (Refer to page F2-52) Wire harness
			Except above conditions	Approx. 12V	

Connector



\*... Pay load above 3.5t only

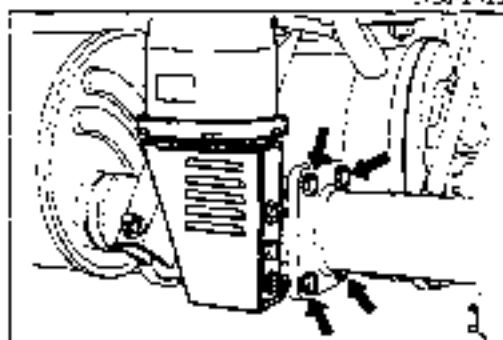
9TGGF2-124



9T00F2-125

**Replacement**

1. Disconnect the connector from the exhaust heating control unit.
2. Remove the exhaust heating control unit.
3. Install in the reverse order of removal.



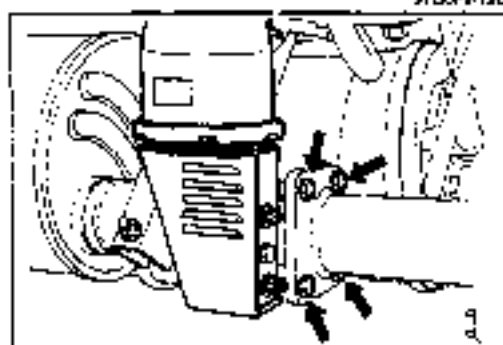
9T00F2-126

**EXHAUST BRAKE UNIT (POWER CHAMBER)****Removal**

1. Disconnect the vacuum hose from the exhaust brake unit.
2. Remove the exhaust brake unit assembly.

**Note**

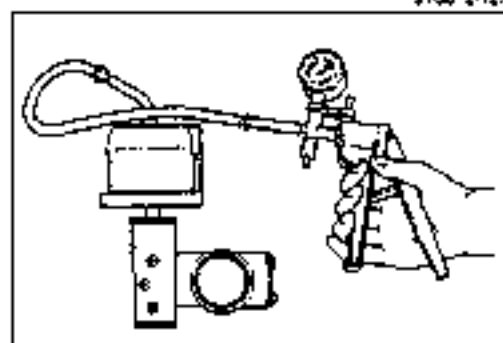
- It is difficult to remove the exhaust brake unit when the exhaust shutter valve is open. Connect a vacuum pump to hold the valve closed to remove it.



9T00F2-127

**Inspection**

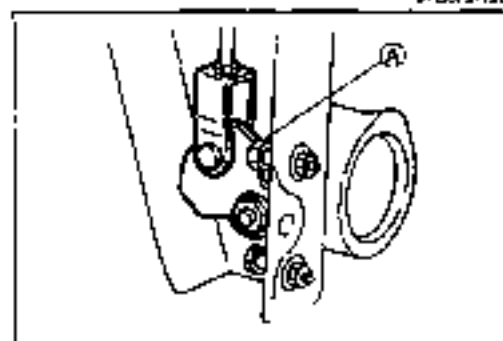
1. Remove the exhaust brake unit assembly.
2. Remove the service hole cover



9T00F2-128

3. Connect a vacuum pump and check the following.

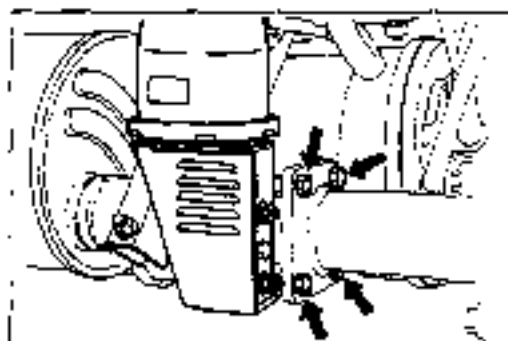
**Starts closing: 100 mmHg (3.9 inHg)**  
**Fully closed : 350 mmHg (13.8 inHg)**



9T00F2-129

4. When fully closed, adjust the gap of the valve by turning bolt A.

**Gap: 0.2—0.4mm (0.007—0.015 in)**



87G0F2-130

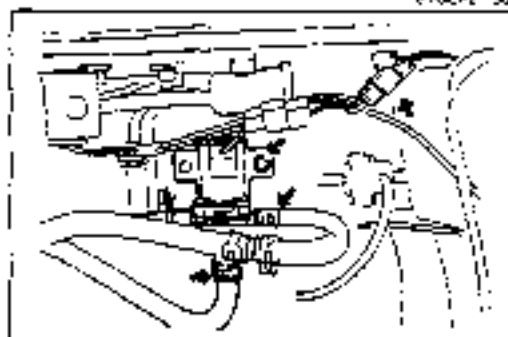
**Installation****Note**

- After installing the exhaust brake unit, the vacuum warning buzzer may ring until vacuum is built up.

Install in the reverse order of removal.

**Tightening torque:**

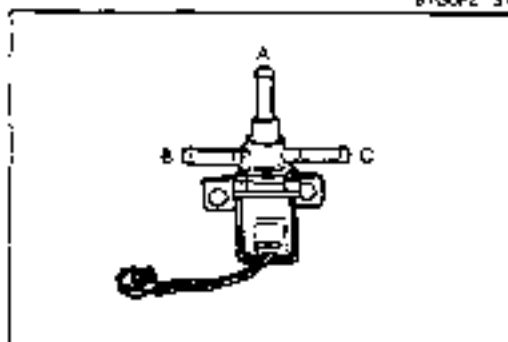
19–25 Nm (1.9–2.6 m·kg, 14–19 ft·lb)



87G0F2-131

**MAGNETIC VALVE (FOR EXHAUST SHUTTER VALVE)****Removal**

1. Remove the vacuum hose from the magnetic valve.
2. Disconnect the connector from the magnetic valve.
3. Remove the magnetic valve.

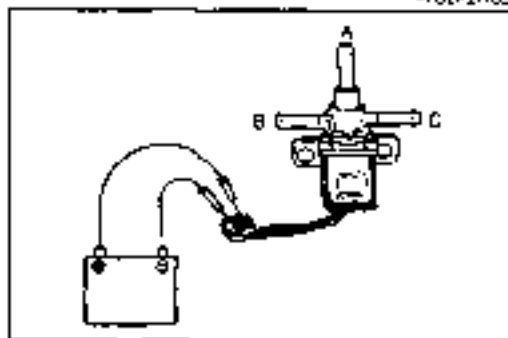


87G0F2-132

**Inspection**

1. Verify air flow through the valve.

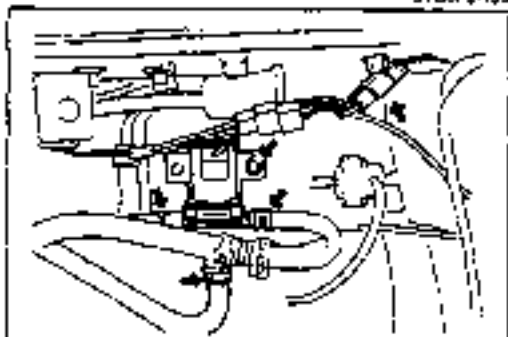
- A–B: Flow
- A–C: No flow
- B–C: No flow



87G0F2-133

2. Connect 12V to the valve and verify air flow.

- A–B: No flow
- A–C: Flow
- B–C: No flow



87G0F2-134

**Installation****Note**

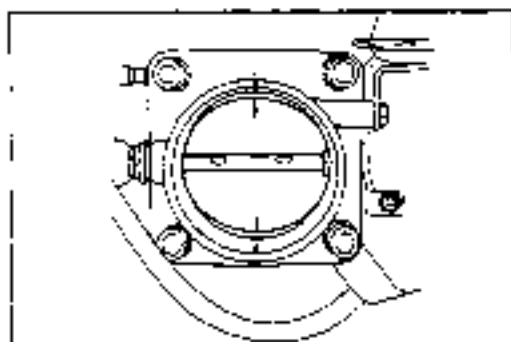
- After installing the magnetic valve, the vacuum warning buzzer may ring until vacuum is built up.

Install in the reverse order of removal.

**Tightening torque:**

43–61 Nm (4.4–6.2 m·kg, 32–45 ft·lb)





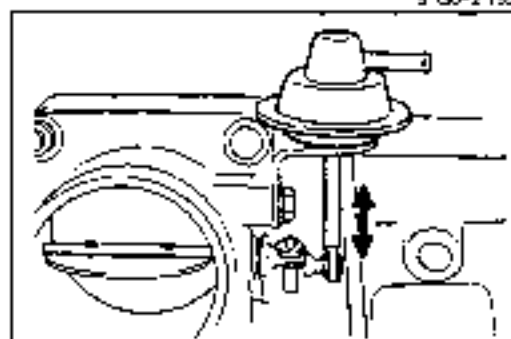
8TGF2-135

**INTAKE SHUTTER VALVE****Inspection**

1. Verify that the clearance at both sides of the valve is as specified when the valve is fully closed.

**Clearance:  $5.7 \pm 0.2\text{mm}$  ( $0.224 \pm 0.007$  in)**

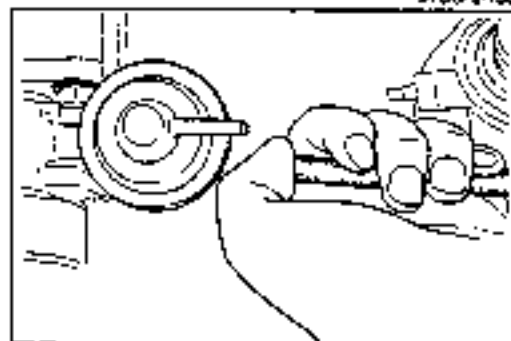
2. If not as specified, adjust by turning the adjusting screw.



9TGF2-136

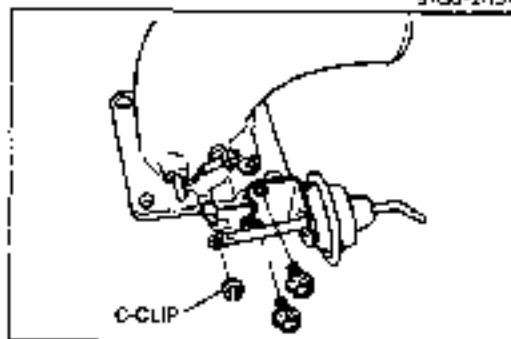
**INTAKE SHUTTER VALVE ACTUATOR****Inspection**

1. Remove the vacuum hose from the actuator.
2. Verify that the rod of the actuator moves smoothly when moved by hand.
3. Start the engine and run it at idle.



8TGF2-137

4. Verify that there is vacuum at the vacuum hose. If not, check the intake shutter valve solenoid valve. (Refer to page F2-52.)
5. Install the vacuum hose, and verify that the actuator rod is pulled.



9TGF2-138

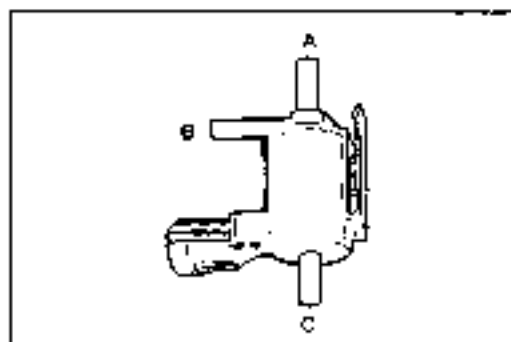
**Replacement****Note**

- After installing the actuator, the vacuum warning buzzer may ring until vacuum is built up.

1. Disconnect the vacuum hose from the actuator.
2. Remove the C-clip.
3. Remove the actuator.
4. Install in the reverse order of removal.

**Tightening torque:**

**7.5—11 Nm (80—110 cm·kg, 69—95 in·lb)**

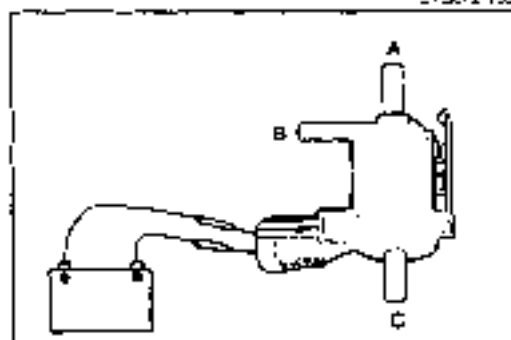


8TGOF2-135

**SOLENOID VALVE (INTAKE SHUTTER VALVE)****Inspection****Note**

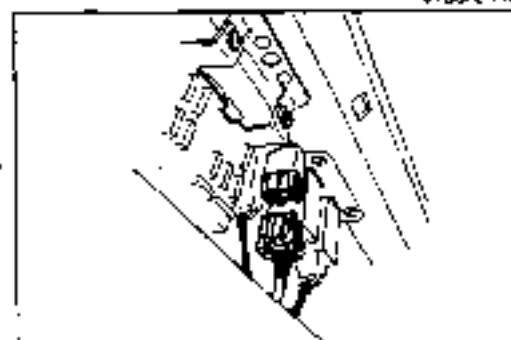
- After installing the solenoid valve, the vacuum warning buzzer may ring until vacuum is built up.

1. Remove the solenoid valve.
2. Verify air flow through the valve.

**A—B: No flow****A—C: No flow****B—C: Flow**

8TGOF2-140

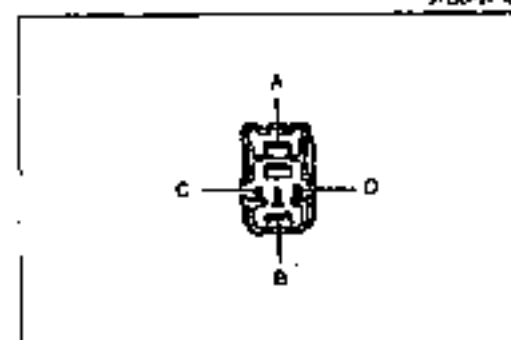
3. Connect 12V to the valve and verify air flow.

**A—B: Flow****A—C: No flow****B—C: No flow**

9TBDF2-41

**CANCEL RELAY****Removal**

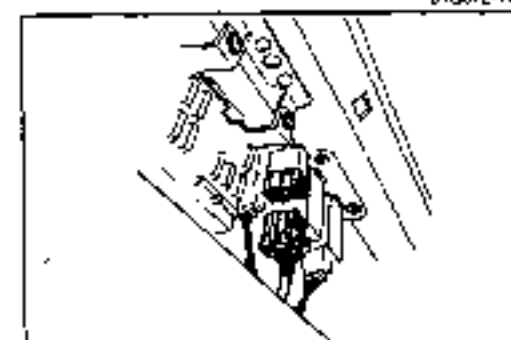
Remove as shown in the figure.



8TGOF2-142

**Inspection**

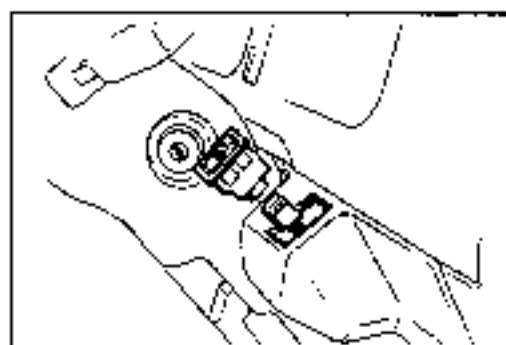
1. Disconnect the cancel relay.
2. Check for continuity between terminals A and D of the relay.
3. Connect 12V between terminals B and C, and verify that there is no continuity between terminals A and D.
4. If not as specified, replace the cancel relay.



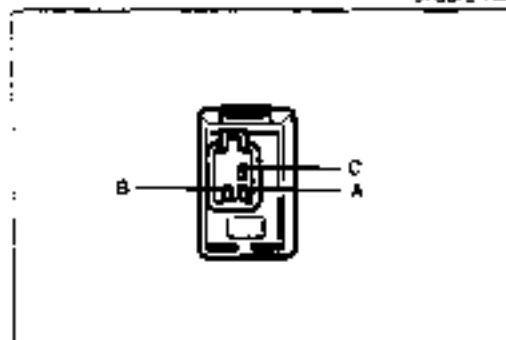
9TGOF2-142

**Installation**

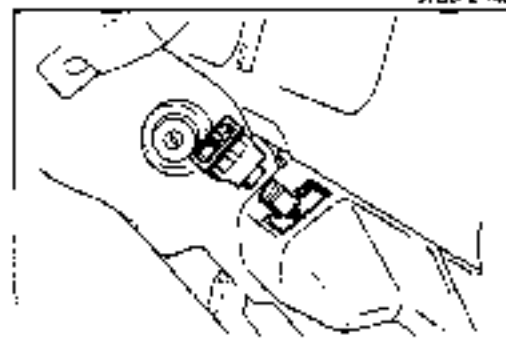
Install in the reverse order of removal.



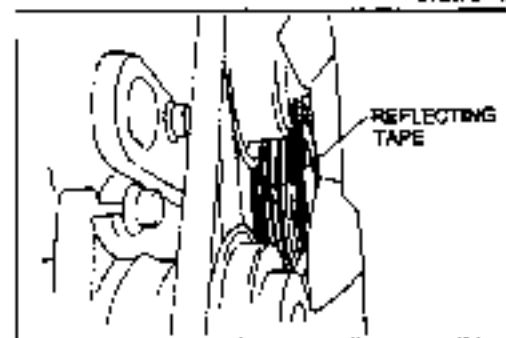
9TGF2-144



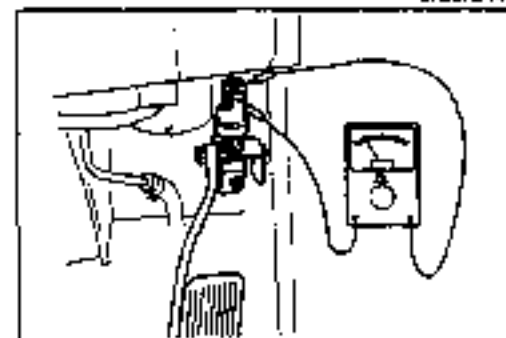
9TGF2-146



9TGF2-148



9TGF2-147



9TGF2-149

**EXHAUST HEATING SWITCH****Removal**

Remove as shown in the figure.

**Inspection**

1. Remove the exhaust heating switch.
2. Check continuity between terminals of the switch.

Switch	Terminal		
	A-B	A-C	B-C
OFF	Continuity	No continuity	No continuity
ON	Continuity	Continuity	Continuity

**Note**

- When checking continuity between A and B, and B and C, connect the negative (-) tester lead to terminal B.

**Installation**

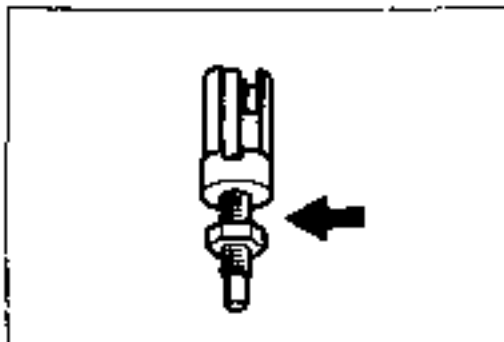
Install in the reverse order of removal.

**ACCELERATOR SWITCH****Inspection**

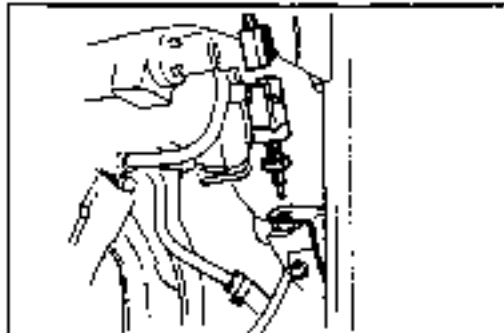
1. Run the engine until it is at normal operating temperature.
2. Stop the engine and affix reflecting tape to the crankshaft pulley.

3. Start the engine.
4. Disconnect the accelerator switch connector.
5. Connect a photo tachometer.
6. Verify that there is no continuity of the switch when the accelerator is not depressed.
7. Depressed the accelerator, and verify that there is continuity at the specified speed.

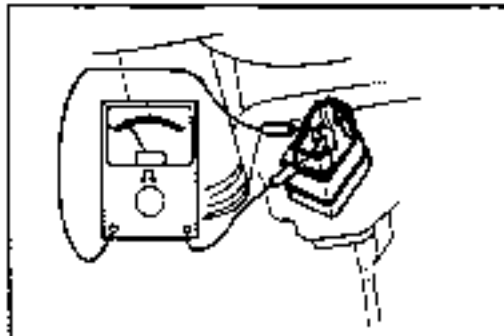
**Specified speed: 800—1,000 rpm**



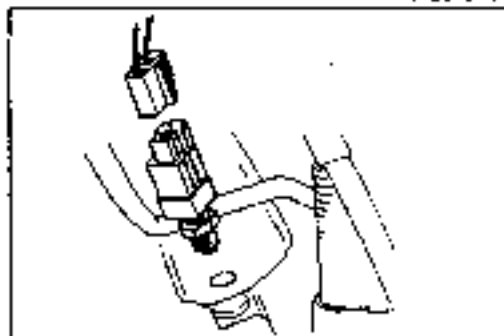
9T60F2-143



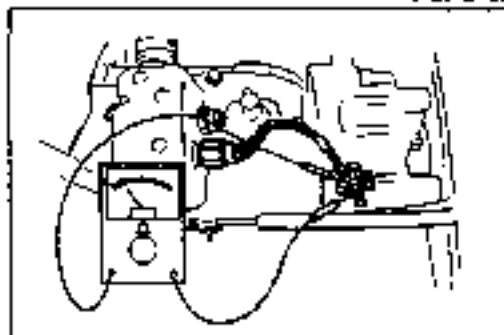
9T60F2-150



9T60F2-151



9T60F2-152



9T60F2-153

8. If not as specified, loosen the locknut and adjust the switch.
9. After adjusting, tightening the locknut.

**Tightening torque:**

14—18 Nm (1.4—1.8 m·kg, 10—13 ft·lb)

**Replacement**

1. Disconnect the accelerator switch connector.
2. Loosen the locknut and remove the switch.
3. Install the new accelerator switch.
4. Adjust the accelerator switch. (Refer to page F2-53.)
5. Tighten the locknut.

**CLUTCH SWITCH****Inspection**

1. Disconnect the clutch switch connector.
2. Check continuity of the switch.

Clutch pedal	Continuity
Depressed	No
Released	Yes

**Replacement**

1. Disconnect the clutch switch connector.
2. Loosen the locknut and remove the clutch switch.
3. Install the new clutch switch.
4. Adjust the switch as shown in "Inspection" above.
5. Tighten the locknut.

**Tightening torque:**

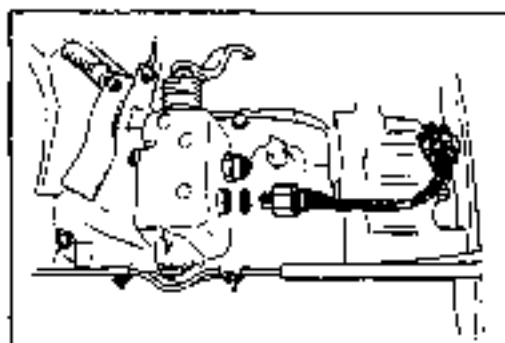
14—18 Nm (1.4—1.6 m·kg, 10—13 ft·lb)

**NEUTRAL SWITCH****Inspection**

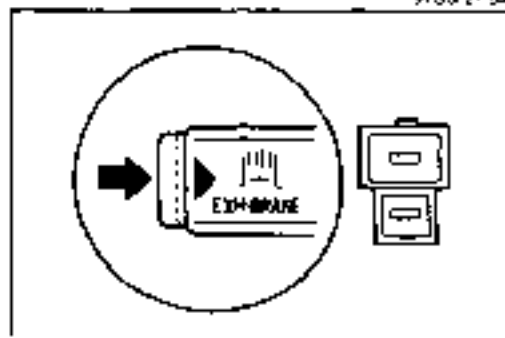
1. Disconnect the neutral switch connector at the upper part of the transmission.
2. Check continuity of the switch.

Transmission	Continuity
Neutral	No
In gear	Yes

3. If not as specified, replace the neutral switch.



9T33F2-54



9T33F2-55

**Replacement**

1. Disconnect the neutral switch connector at the upper part of the transmission.
2. Remove the neutral switch.
3. Install in the reverse order of removal.

**Tightening torque:**

14—18 N·m (1.4—1.8 m·kg, 10—13 ft·lb)

**EXHAUST BRAKE SWITCH****Inspection**

1. Remove the steering column cover.
2. Disconnect the exhaust brake switch connector.
3. Check continuity of the switch.

Exhaust brake switch	Continuity
OFF	No
ON	Yes

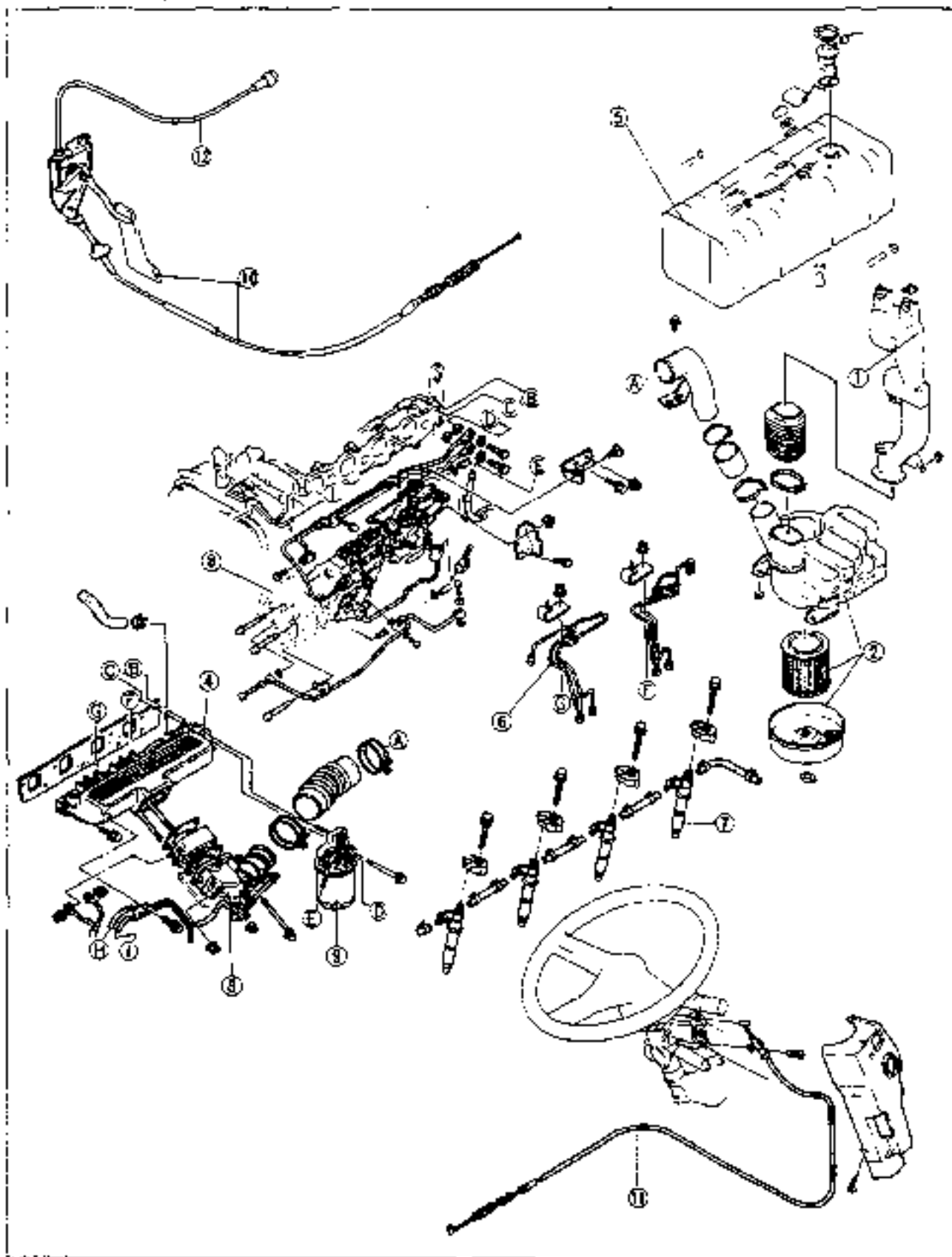
4. If not as specified, replace the switch. (Refer to Section T.)

## FUEL AND EMISSION CONTROL SYSTEMS (TF ENGINE)

<b>INDEX</b> .....	<b>F3- 2</b>	<b>IDLE SPEED CONTROL SYSTEM</b> ....	<b>F3-31</b>
<b>INTAKE AND FUEL DEVICES</b> .....	<b>F3- 2</b>	STRUCTURAL VIEW.....	<b>F3-31</b>
<b>EXHAUST AND EXHAUST</b>		IDLING KNOB, IDLING CABLE .....	<b>F3-31</b>
<b>CONTROLLED HEATING DEVICES</b>	<b>F3- 4</b>	<b>EXHAUST SYSTEM</b> .....	<b>F3-33</b>
<b>OUTLINE</b> .....	<b>F3- 6</b>	COMPONENTS.....	<b>F3-33</b>
SYSTEM DIAGRAM .....	<b>F3- 6</b>	<b>EXHAUST CONTROLLED</b>	
VACUUM HOSE ROUTING		<b>HEATING SYSTEM</b> .....	<b>F3-35</b>
DIAGRAM.....	<b>F3- 7</b>	STRUCTURAL VIEW.....	<b>F3-35</b>
WIRING DIAGRAM.....	<b>F3- 8</b>	EXHAUST HEATING	
<b>TROUBLESHOOTING GUIDE</b> .....	<b>F3- 9</b>	CONTROL UNIT.....	<b>F3-37</b>
<b>ENGINE TUNE-UP</b> .....	<b>F3-10</b>	EXHAUST BRAKE UNIT	
BASIC INSPECTION .....	<b>F3-10</b>	(POWER CHAMBER).....	<b>F3-38</b>
ADJUSTMENT.....	<b>F3-11</b>	MAGNETIC VALVE	
<b>INTAKE AIR SYSTEM</b> .....	<b>F3-15</b>	(FOR EXHAUST SHUTTER VALVE)	<b>F3-39</b>
COMPONENTS.....	<b>F3-15</b>	INTAKE SHUTTER VALVE .....	<b>F3-40</b>
<b>FUEL SYSTEM</b> .....	<b>F3-17</b>	INTAKE SHUTTER	
FUEL TANK.....	<b>F3-17</b>	VALVE ACTUATOR .....	<b>F3-40</b>
INJECTION PUMP .....	<b>F3-18</b>	SOLENOID VALVE	
SEDIMENTOR .....	<b>F3-22</b>	(INTAKE SHUTTER VALVE).....	<b>F3-41</b>
SEDIMENTOR SENSOR		CANCEL RELAY .....	<b>F3-41</b>
(DETECTOR) .....	<b>F3-22</b>	EXHAUST HEATING SWITCH .....	<b>F3-42</b>
FUEL FILTER.....	<b>F3-23</b>	ACCELERATOR SWITCH.....	<b>F3-42</b>
INJECTION NOZZLE .....	<b>F3-25</b>	CLUTCH SWITCH .....	<b>F3-43</b>
ACCELERATOR PEDAL		NEUTRAL SWITCH .....	<b>F3-43</b>
ACCELERATOR CABLE .....	<b>F3-28</b>	EXHAUST BRAKE SWITCH.....	<b>F3-44</b>
<b>FUEL CUT CONTROL SYSTEM</b> .....	<b>F3-29</b>		
SYSTEM OPERATION.....	<b>F3-29</b>		
FUEL STOP CABLE .....	<b>F3-29</b>		

## INDEX

## INTAKE AND FUEL DEVICES

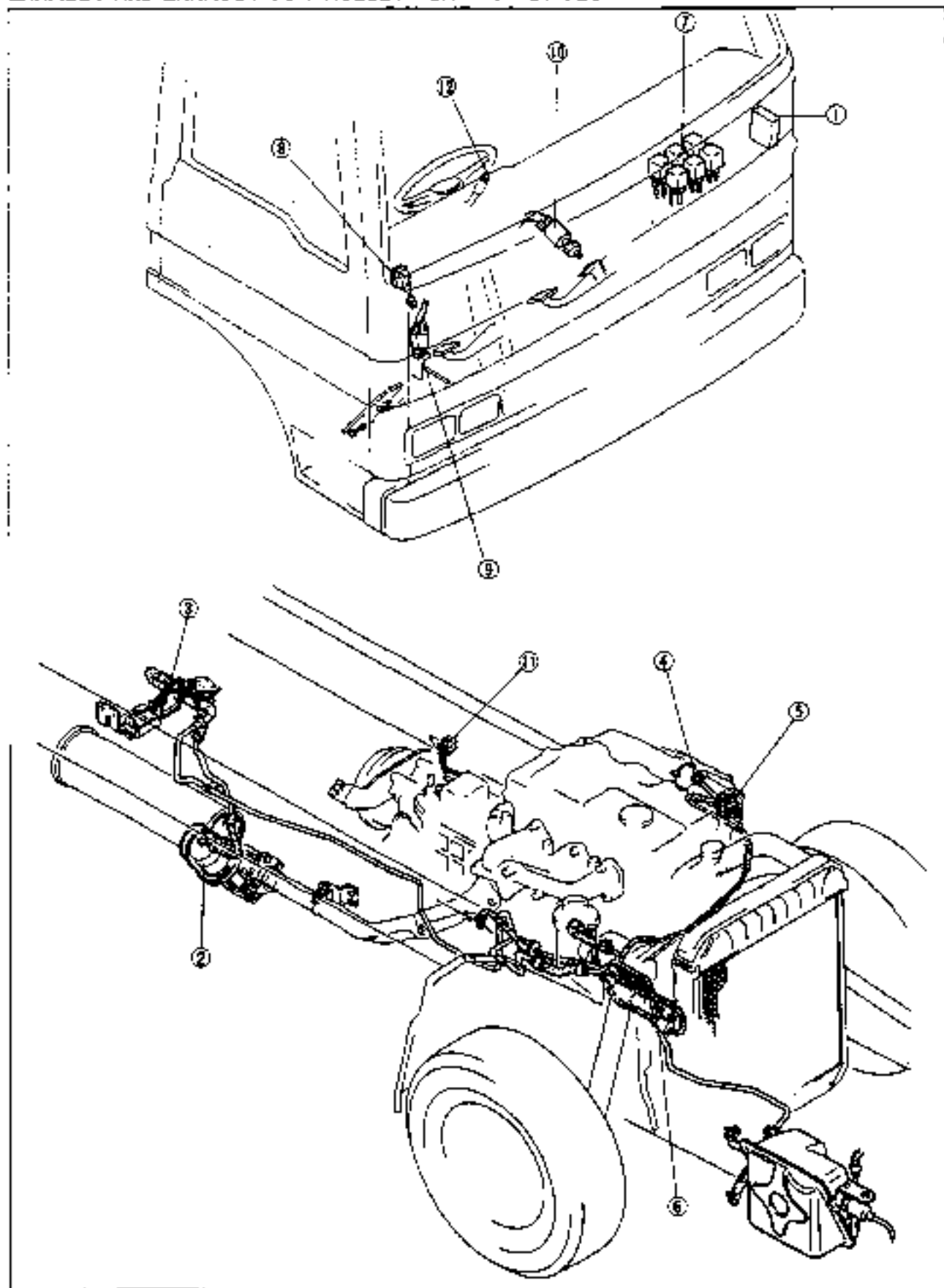


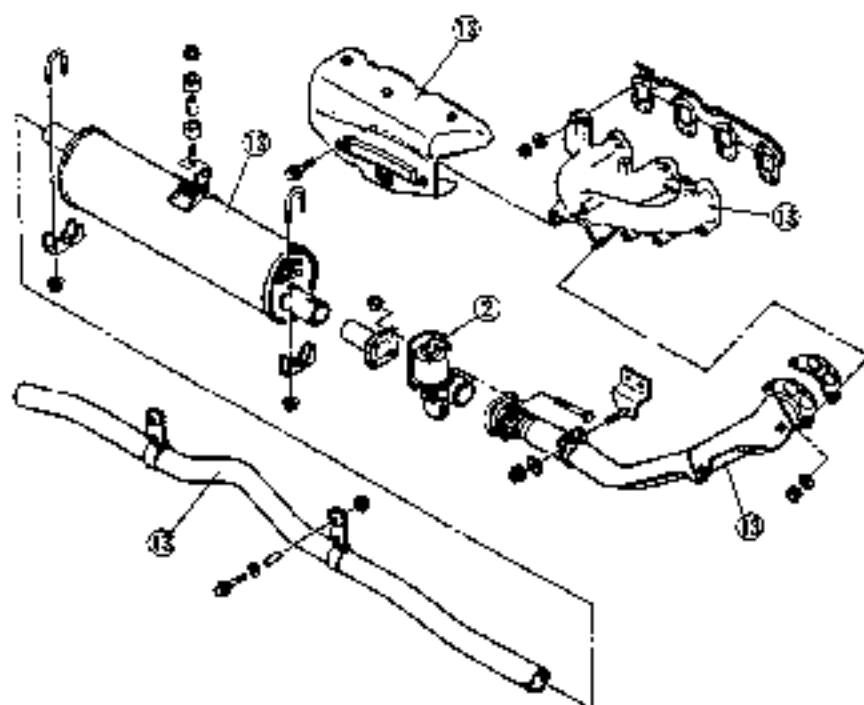
- |  |            |  |
|--|------------|--|
| 1. Fresh air duct                        |            |  |
| Removal / Inspection /                   |            |  |
| Installation .....                       | page F3-15 |  |
| 2. Air cleaner                           |            |  |
| Removal / Installation .....             | page F3-15 |  |
| Inspection .....                         | page F3-10 |  |
| 3. Intake shutter valve                  |            |  |
| Removal / Installation .....             | page F3-15 |  |
| Inspection .....                         | page F3-40 |  |
| 4. Intake manifold                       |            |  |
| Removal / Inspection /                   |            |  |
| Installation .....                       | page F3-15 |  |
| 5. Fuel tank                             |            |  |
| Removal / Inspection /                   |            |  |
| Installation .....                       | page F3-17 |  |
| 6. Injection pipe                        |            |  |
| Removal .....                            | page F3-19 |  |
| Installation .....                       | page F3-22 |  |
| 7. Injection nozzle                      |            |  |
| Removal / Inspection .....               | page F3-25 |  |
| Disassembly .....                        | page F3-26 |  |
| Installation .....                       | page F3-27 |  |
| 8. Injection pump                        |            |  |
| Removal .....                            | page F3-16 |  |
| Installation .....                       | page F3-21 |  |
| 9. Fuel filter                           |            |  |
| Air bleeding .....                       | page F3-23 |  |
| Replacement .....                        | page F3-24 |  |
| 10. Accelerator pedal, Accelerator cable |            |  |
| Inspection / Adjustment .....            | page F3-28 |  |
| Removal / Installation .....             | page F3-28 |  |
| 11. Fuel stop cable                      |            |  |
| Inspection / Adjustment .....            | page F3-30 |  |
| Removal / Installation .....             | page F3-30 |  |
| 12. Idling cable                         |            |  |
| Inspection / Adjustment .....            | page F3-31 |  |
| Removal / Installation .....             | page F3-32 |  |

9TGF3-003



## EXHAUST AND EXHAUST CONTROLLED HEATING DEVICES



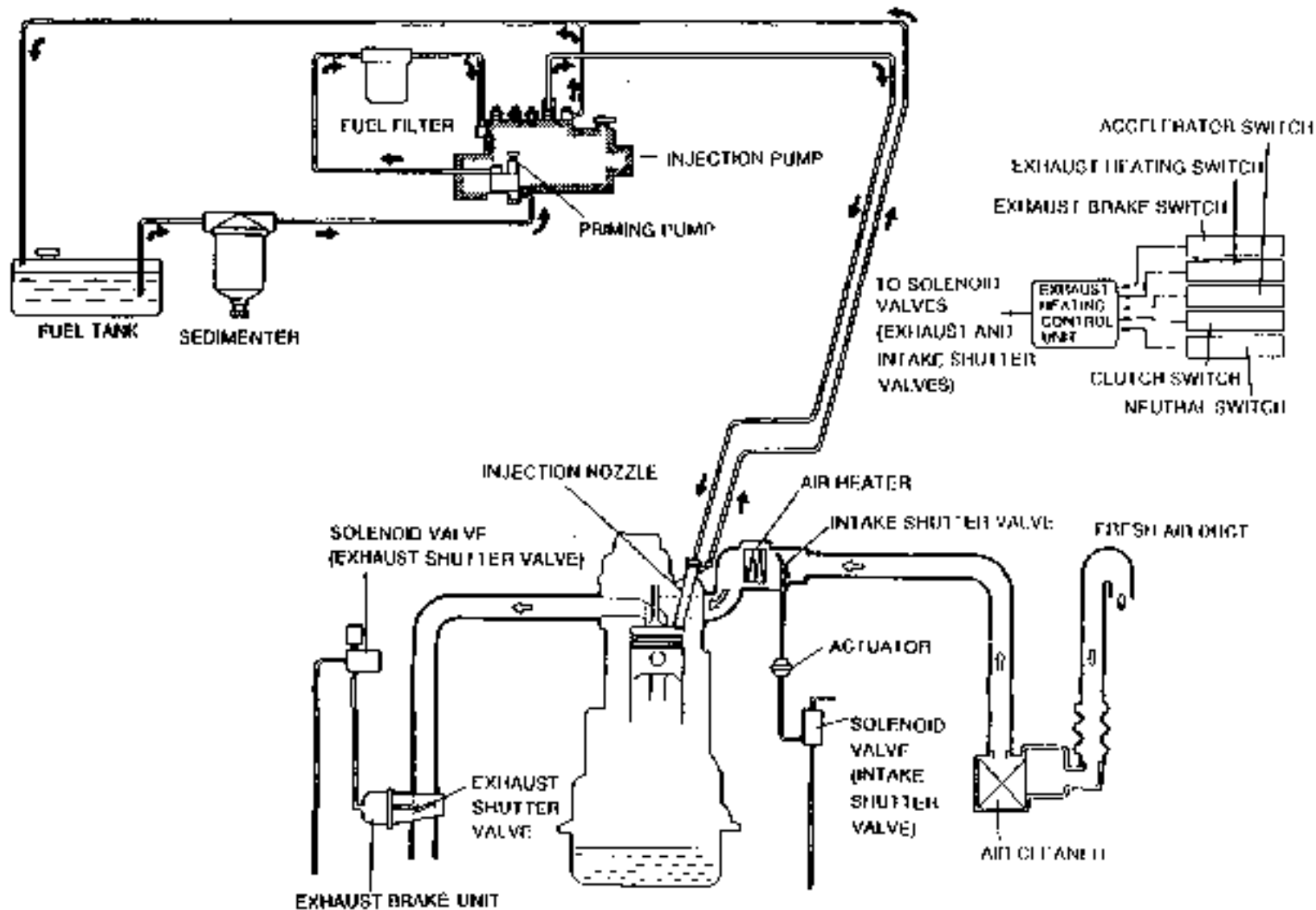


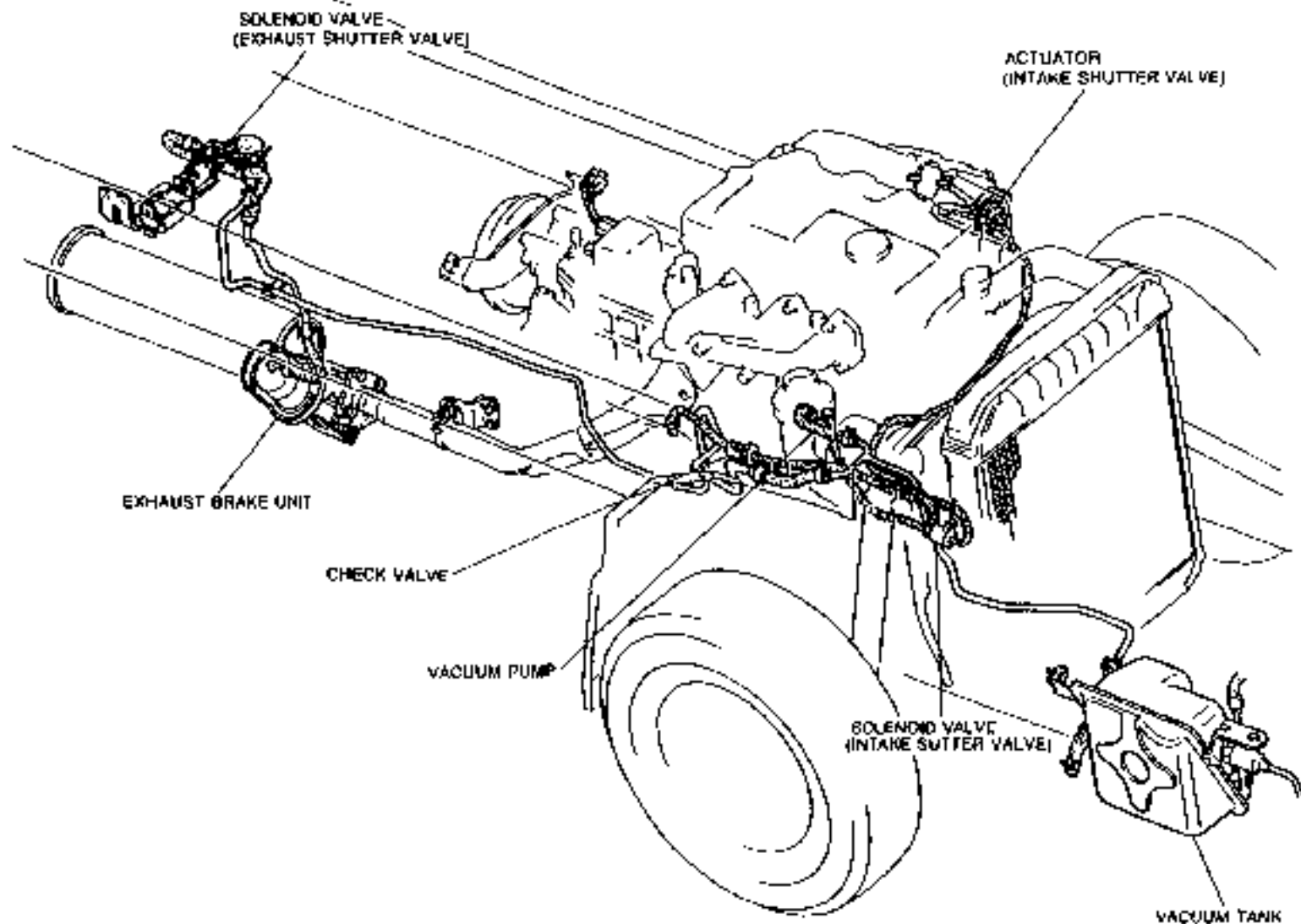
9T60F3-005

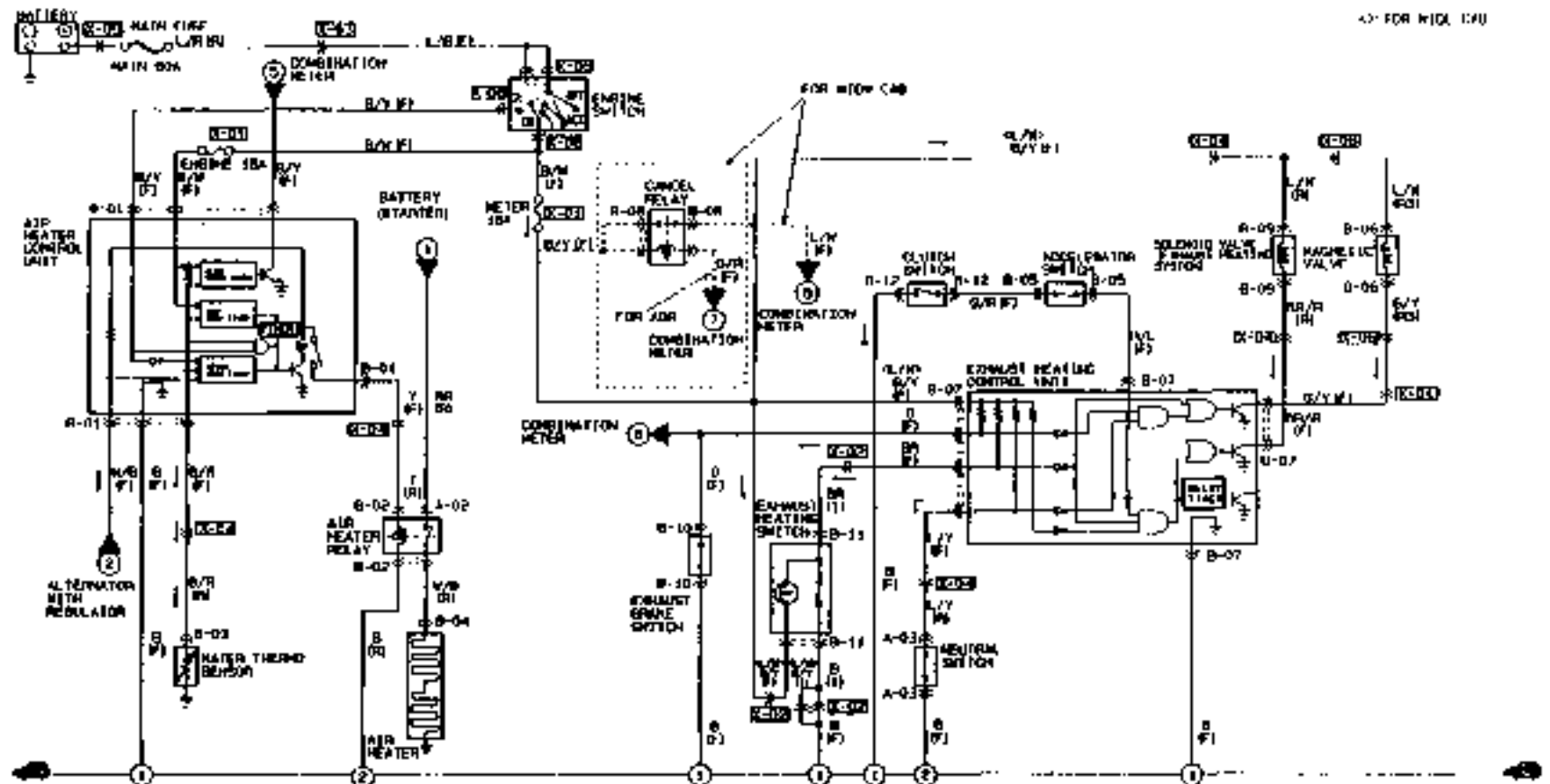
- |   |            |
|---|------------|
| 1. Exhaust heating control unit           |            |
| Inspection .....                          | page F3-37 |
| Replacement .....                         | page F3-38 |
| 2. Exhaust brake unit                     |            |
| Removal / Inspection .....                | page F3-38 |
| Installation .....                        | page F3-39 |
| 3. Magnetic valve (Exhaust shutter valve) |            |
| Removal / Inspection /                    |            |
| Installation .....                        | page F3-39 |
| 4. Intake shutter valve                   |            |
| Inspection .....                          | page F3-40 |
| 5. Intake shutter valve actuator          |            |
| Inspection / Replacement .....            | page F3-40 |
| 6. Solenoid valve (Intake shutter valve)  |            |
| Inspection .....                          | page F3-41 |
| 7. Cancel relay                           |            |
| Removal / Inspection /                    |            |
| Installation .....                        | page F3-41 |
| 8. Exhaust heating switch                 |            |
| Removal / Inspection /                    |            |
| Installation .....                        | page F3-42 |
| 9. Accelerator switch                     |            |
| Inspection .....                          | page F3-42 |
| Replacement .....                         | page F3-43 |
| 10. Clutch switch                         |            |
| Inspection / Replacement .....            | page F3-43 |
| 11. Neutral switch                        |            |
| Inspection .....                          | page F3-43 |
| Replacement .....                         | page F3-44 |
| 12. Exhaust brake switch                  |            |
| Inspection .....                          | page F3-44 |
| 13. Exhaust system                        |            |
| Removal / Inspection /                    |            |
| Installation .....                        | page F3-33 |

OUTLINE

SYSTEM DIAGRAM







<p>B-01 AIR HEATER CONTROL UNIT (1)</p>	<p>B-02 AIR HEATER RELAY (1)</p>	<p>B-03 WATER THERMO SENSOR (1)</p>	<p>B-04 AIR HEATER (1)</p>	<p>B-05 ACCELERATOR SWITCH (1)</p>	<p>B-06 MAGNETIC VALVE (1)</p>	<p>B-07 EXHAUST HEATING CONTROL UNIT (1)</p>
<p>B-08 CANCEL RELAY (1)</p>	<p>B-09 SOLENOID VALVE EXHAUST HEATING SYSTEM (1)</p>	<p>B-10 EXHAUST BRAKE SWITCH (1)</p>	<p>B-11 EXHAUST HEATING SWITCH (1)</p>	<p>B-12 CLUTCH SWITCH (1)</p>	<p>A-03 NEUTRAL SWITCH (1)</p> <p>(1) FOR CREW CAB.</p>	

F3-02

1000-540016

(1) FOR CREW CAB

FOR CREW CAB

L/W B-1

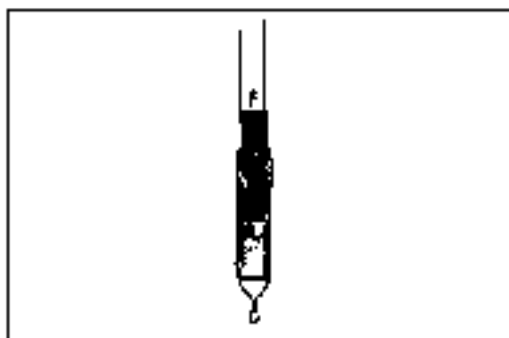
FOR CREW CAB

(1) FOR CREW CAB.

## TROUBLESHOOTING GUIDE

Trouble	Possible Cause	Action
<b>Hard starting</b>	Malfunction of stop system Air in injection pipe, injection pump, fuel filter or sedimentor Clogged fuel line or fuel filter Incorrect injection timing Seized or leaking delivery valve Incorrect injection starting pressure Malfunction of injection nozzle Malfunction of feed pump Malfunction of governor Malfunction of injection pump	Adjust or replace Bleed air  Replace Adjust Replace or clean Adjust Clean or replace Clean or replace Replace Replace
<b>Rough idling</b>	Incorrect idling speed Incorrect injection timing Clogged fuel line or fuel filter Leak in fuel line or fuel filter Air in injection pipe, injection pump, fuel filter or sedimentor Seized or leaking delivery valve Incorrect starting pressure Malfunction of injection nozzle Malfunction of feed pump Malfunction of timer Malfunction injection pump	Adjust Adjust Clean or replace Repair or replace Bleed air  Replace or clean Adjust Clean or replace Clean or replace Replace Replace
<b>Engine knocking</b>	Incorrect injection timing Incorrect injection starting pressure Malfunction of injection nozzle Low quality of fuel	Adjust Adjust Clean or adjust Drain and replace
<b>Excessive exhaust smoke</b>	Incorrect injection timing Water in injection pump, fuel filter or sedimentor Incorrect injection starting pressure Clogged air cleaner Malfunction of delivery valve Malfunction injection pump	Adjust Drain Adjust Clean or replace Clean or replace Replace
<b>Poor acceleration</b>	Low quality of fuel Incorrect injection timing Clogged fuel line or fuel filter Air in injection pump or fuel filter Clogged air cleaner Malfunction of delivery valve Incorrect injection starting pressure Malfunction of injection nozzle Malfunction of feed pump Malfunction of injection pump Malfunction of governor	Drain and replace Adjust Clean or replace Air bleed Clean or replace Clean or replace Adjust Clean or replace Clean or replace Replace Replace
<b>High fuel consumption</b>	Incorrect injection timing High idling speed Incorrect injection starting pressure Clogged air cleaner Clogged fuel filter Malfunction of injection nozzle	Adjust Adjust Adjust Clean or replace Replace Clean or replace
<b>Engine does not stop</b>	Malfunction of	Adjust or repair

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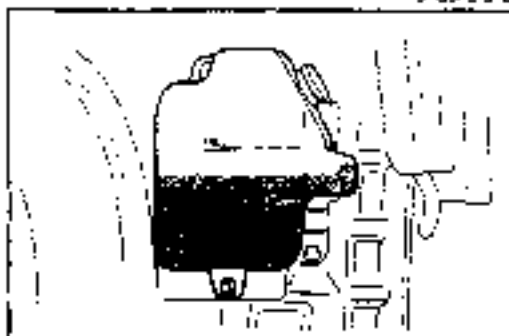
9TGF3 010

## ENGINE TUNE-UP

### BASIC INSPECTION

#### Engine Oil

Check the engine oil level and condition with the level gauge. Add or change oil if necessary.



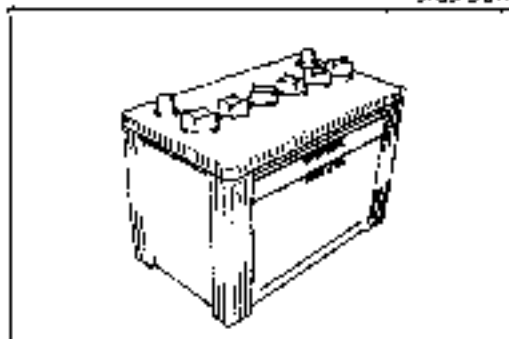
9TGF3 011

#### Coolant

##### Warning

- Never remove the radiator cap while the engine is hot.
- Wrap a thick cloth around the cap while carefully removing it.

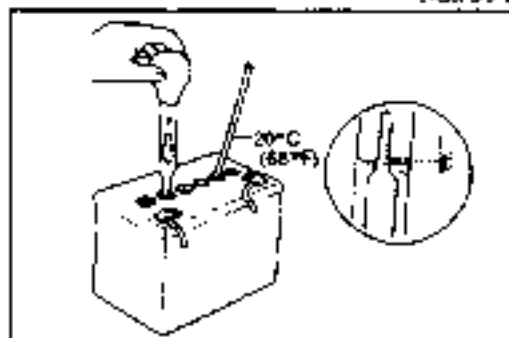
Verify that the coolant level is near the radiator inlet port, and that the level in the reservoir is between the FULL and LOW marks. Add coolant as necessary.



9TGF3 012

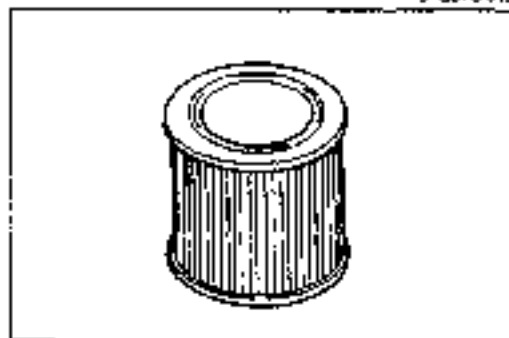
#### Battery

1. Check for corrosion on the terminals and for loose cable connections.
2. Check the electrolyte level. If the level is low, add distilled water to the "UPPER LEVEL" mark.



9TGF3 013

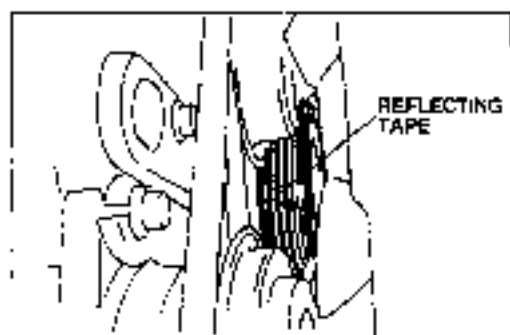
3. Check the specific gravity with a hydrometer. If the specific gravity reading is 1.23 or less, charge the battery. (Refer to Section G.)



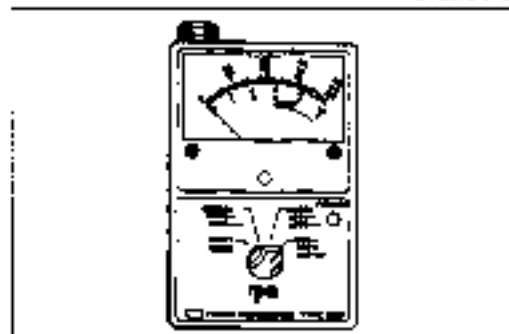
9TGF3 014

#### Air Cleaner

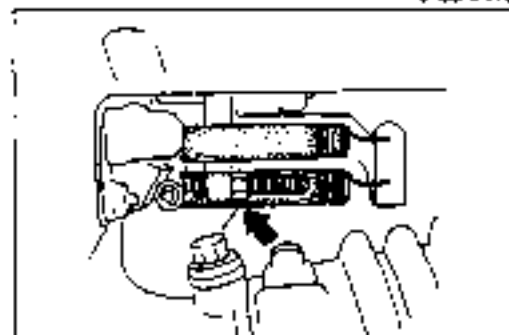
Visually check the air cleaner element for excessive dirt, damage or oil. Clean with compressed air if necessary.



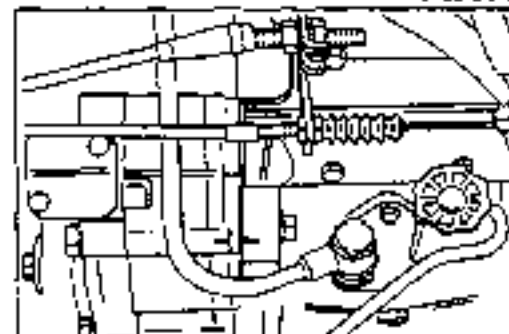
9TGF3-015



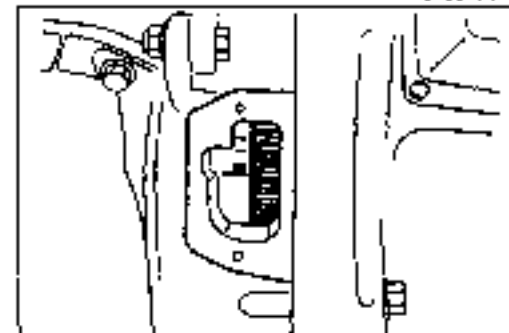
9TGF3-016



9TGF3-017



9TGF3-018



9TGF3-019

**ADJUSTMENT****Idle Speed**

1. Attach suitable reflecting tape to the crankshaft pulley.
2. Run the engine at idle at normal operating temperature. Turn off all unnecessary electrical load.

3. Verify the free play of the accelerator cable.

**Free play: 1.0—3.0mm (0.039—0.118 in)**

4. Aim the light of the photolachometer onto the reflecting tape to measure the engine speed.

**Idle speed: 620—700 rpm**

5. If not as specified, loosen the locknut of idle adjust bolt and then adjust turning the bolt.
6. Tighten the locknut.

**Tighting torque:**

**9.8—14 N·m (100—140 cm·kg, 67—121 in·lb)**

**Injection Timing Inspection****Note**

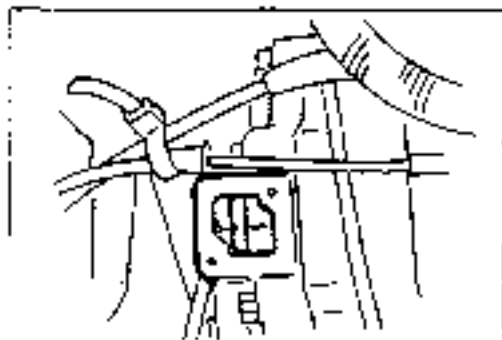
- Usually it is enough to confirm that the external marks are aligned.

**Caution**

- Direct injection engine is sensitive to injection timing. Incorrect timing will cause engine knocking or low power output. Set the injection timing after installing the injection pump.

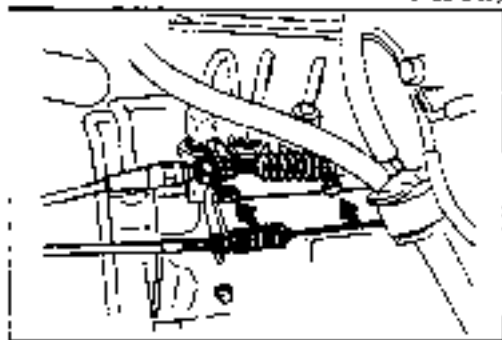
1. Remove the service hole covers from the clutch housing and the timing gear case.
2. Turn the flywheel in the direction of rotation until the indicator pin is at 30° BTDC.





9T00F3-020

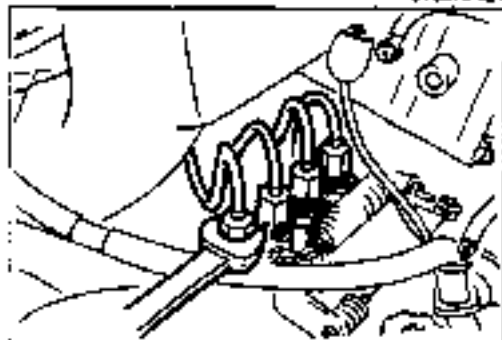
3. Verify that the pointer of the timing gear case and the mark on the limer are aligned.
4. If not, as specified, adjust the injection timing.



9T00F3-021

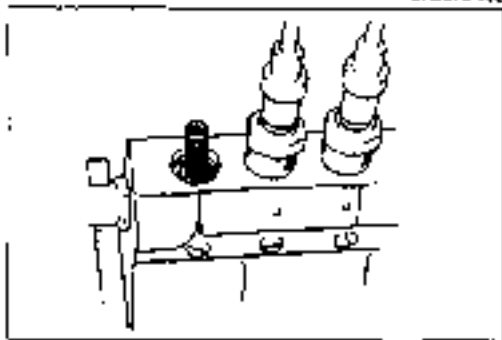
**Adjustment**

1. Remove the fuel stop cable from the cut lever.
2. Remove the accelerator cable from the control lever.
3. Remove the bracket.
4. Loosen injection pipes No.2—4 at the pump.



9T00F3-022

5. Remove No.1 injection pipe and the delivery valve holder.

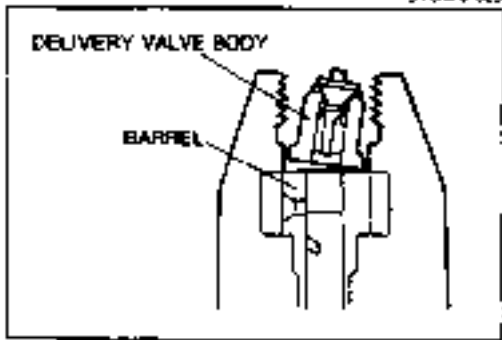


9T00F3-023

6. Remove the delivery valve spring seat and spring.

**Caution**

- Do not remove the delivery valve body.

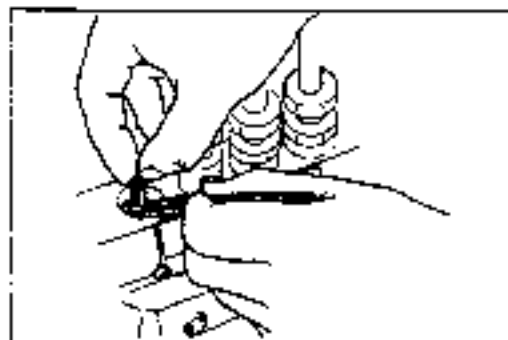
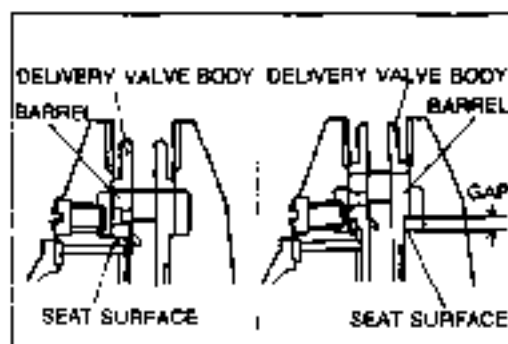


9T00F3-024

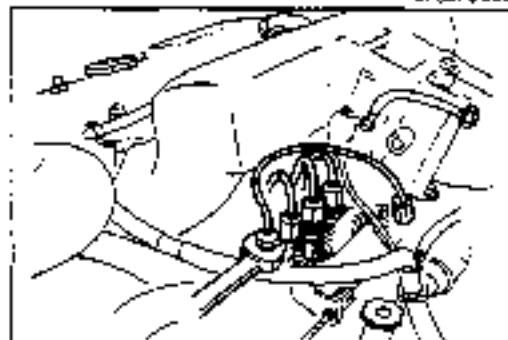
7. Rock the delivery valve to break it loose from the barrel.

**Note**

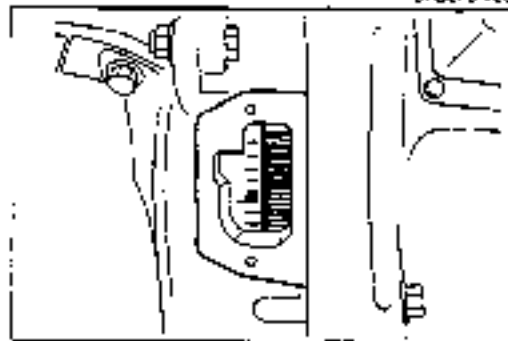
- If the delivery valve is lifted up without breaking it loose, the barrel may also be lifted out of the pump. If this happens the barrel may not reseat and may allow fuel into the engine and cause engine damage.



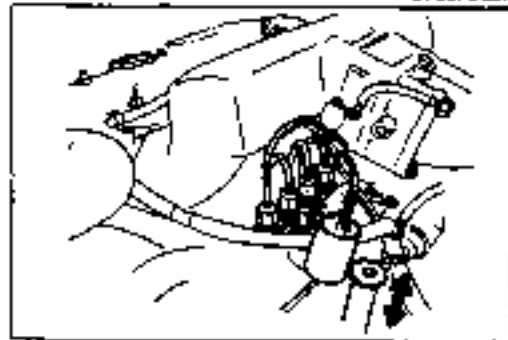
9TGCF3-025



9TGCF3-026



9TGCF3-027



9TGCF3-028

8. Remove the delivery valve, holding the flat washer with tweezers.

**Caution**

- Do not pinch the sliding surface of the delivery valve.

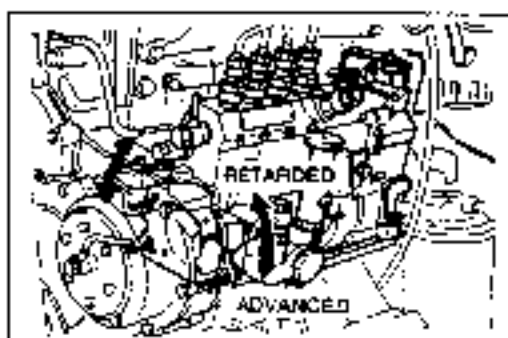
9. Reinstall the delivery valve holder

10. Tighten No.1 injection pipe so that it points away from the pump.

11. Turn the flywheel in the direction of rotation and set it at 20° BTDC.

12. Place a container under No.1 injection pipe and verify that fuel is expelled when pumping the primer pump.  
13. While pumping the priming pump, turn the flywheel in the normal direction of rotation and verify that fuel flow stops as specified.

**Fuel stops: 12° BTDC (SL Engine),  
13° BTDC (SL Turbocharged Engine)**

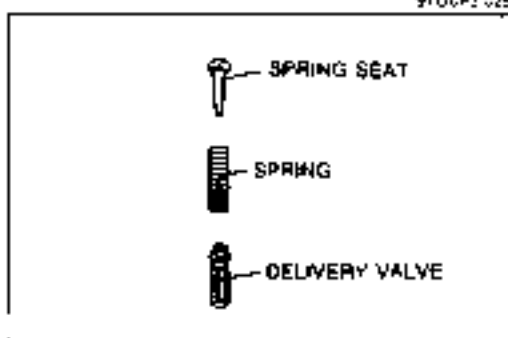


9T0GF3-029

14. If necessary, adjust the injection timing by loosening the mounting bolts and rotating the pump outward pump or inward as shown in the figure.
15. After adjustment, tighten nuts.

**Tighten torque:**

34—39 N·m (3.5—4.0 m·kg, 25—29 ft·lb)

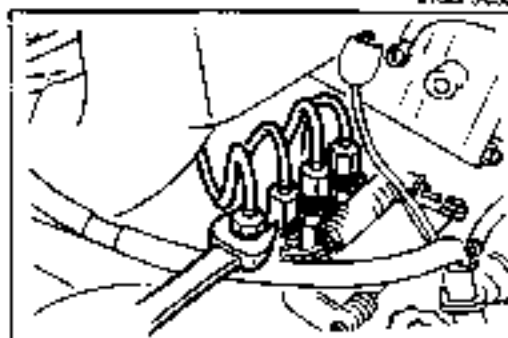


9T0GF3-030

16. Make the pump flange and pump body for future reference.
17. Install the delivery valve, spring, and spring seat.
18. Tighten the delivery valve holder.

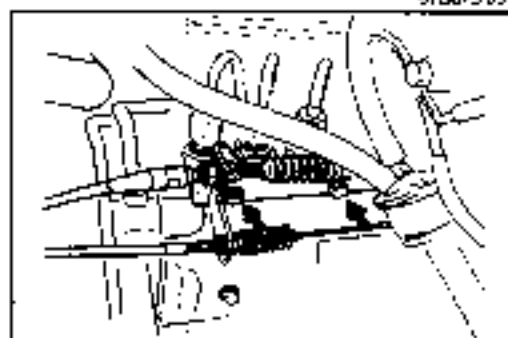
**Tighten torque**

39—44 N·m (4.0—4.5 m·kg, 29—33 ft·lb)



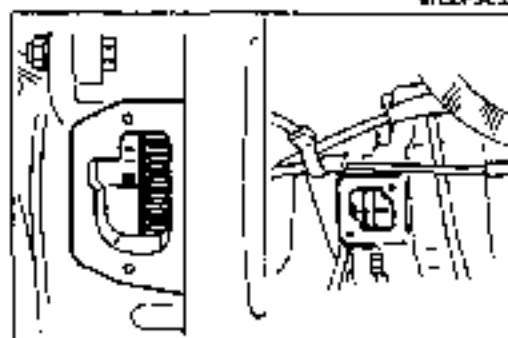
9T0GF3-031

19. Install No.1 injection pipe.



9T0GF3-032

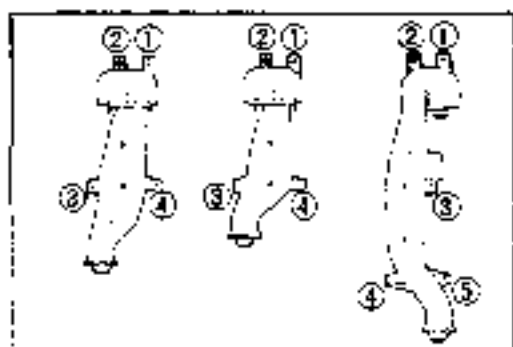
20. Tighten injection pipes No.2—4.
21. Install the bracket.
22. Install the accelerator cable to the control lever.
23. Install the fuel stop cable to the cut lever.



9T0GF3-033

24. Install the service hole covers onto the clutch housing and the timing gear case.
25. Bleed air from the system. (Refer to page F3-23.)
26. Start the engine, and check for fuel leaks.

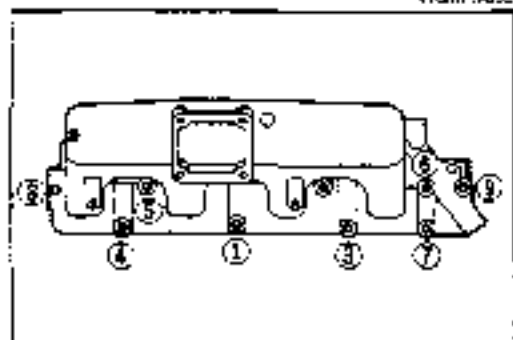




9TGF3-03E

**Installation note****Fresh air duct**

Install in the order shown in the figure.



9TGF3-03E

**Intake manifold**

1. Use a new gasket.
2. Tighten in the order shown in the figure.

**Tightening torque:**

22–31 N·m (2.2–3.1 m·kg, 15–22 ft·lb)

## FUEL SYSTEM

## FUEL TANK

## Removal / Inspection / Installation

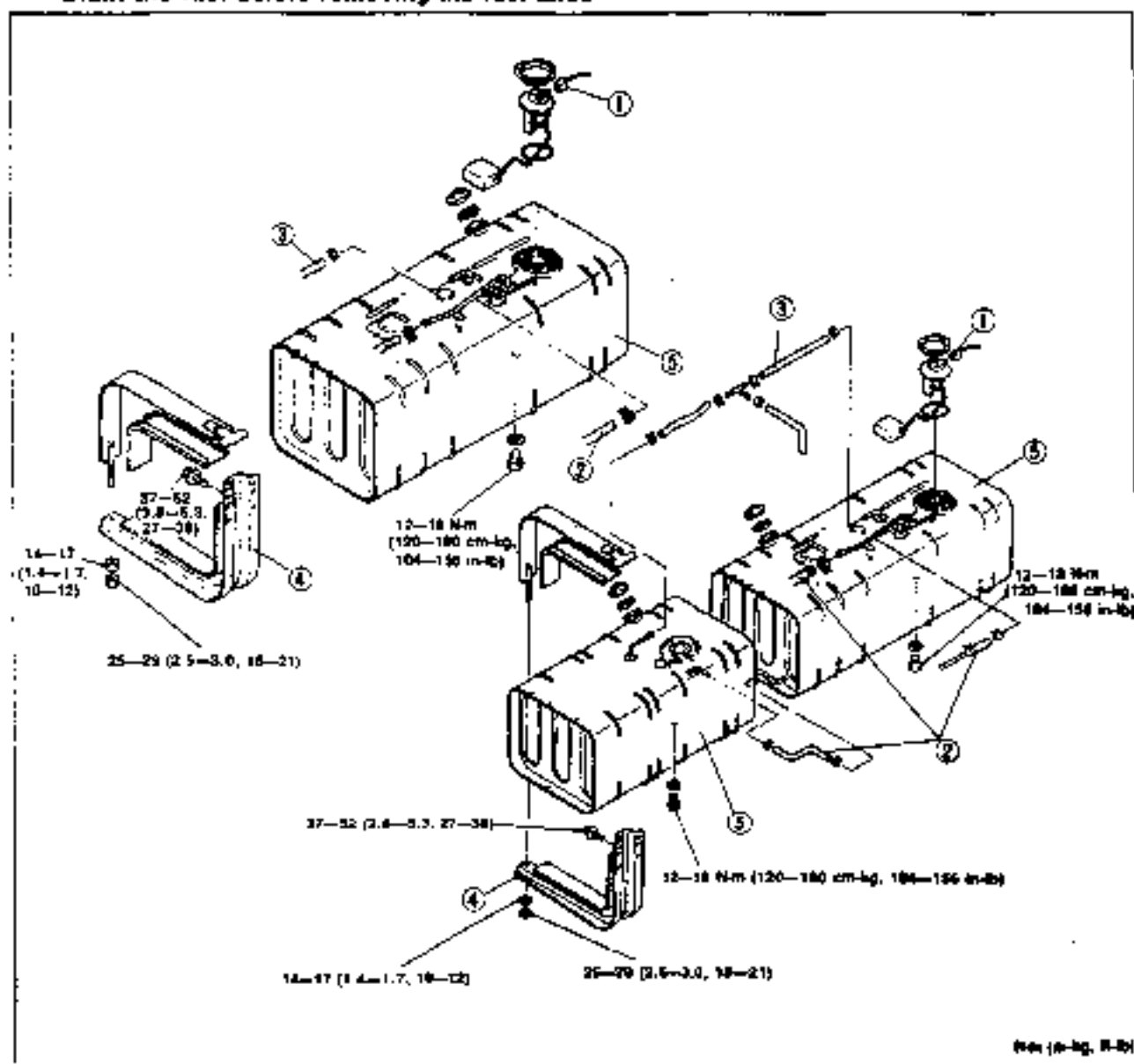
1. Remove in the order shown in the figure.
2. Inspect all parts and repair or replace as necessary
3. Install in the reverse order of removal

## Warning

- Keep sparks cigarettes, and open flames away from the fuel tank.

## Note

- Drain the fuel before removing the fuel tank.



95G02-027

1. Connector
2. Fuel hose
3. Evaporative hose  
Be sure the air flows through the hose each side

4. Fuel tank strap
5. Fuel tank  
Check for contamination, corrosion and other damage

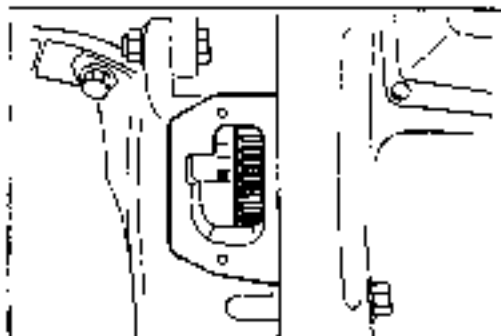
## INJECTION PUMP

## Removal

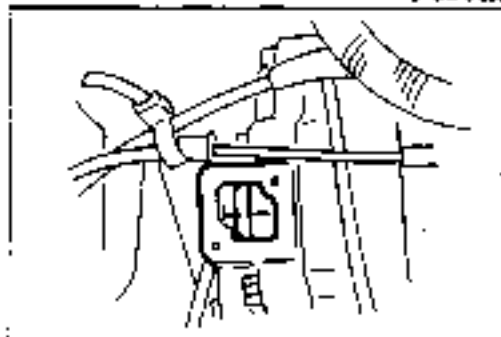
## Note

- The in-line type pump used on the SL and SL turbocharged engines are removed with the drive gear. When replacing the pump, be sure it is properly timed.
- Special tools and testers are required for service of the injection pump. The pump should be serviced only by an authorized Diesel Kiki distributor.

91F0F3-001



91G0F3-006



91R0F3-002

## Caution

- Before removing the injection pump, perform the following procedure.

1. Remove the negative battery cable.
2. Remove the cover from the flywheel, and turn the flywheel until No.1 cylinder is at 30° BTDC.

3. Remove the cover from the gear case, and verify that the mark on the timer and the pointer are aligned.

## Note

- If they are not aligned, No.4 cylinder is at 30° BTDC.

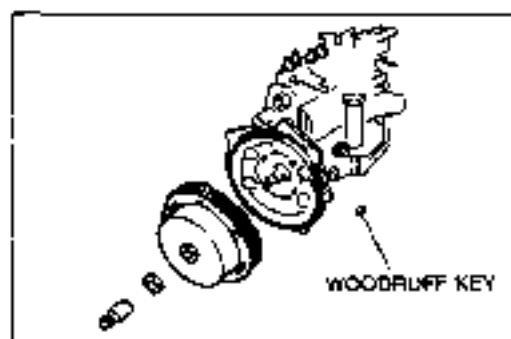
4. Remove in the order shown in the figure. (Refer to page F3-19.)

## Caution

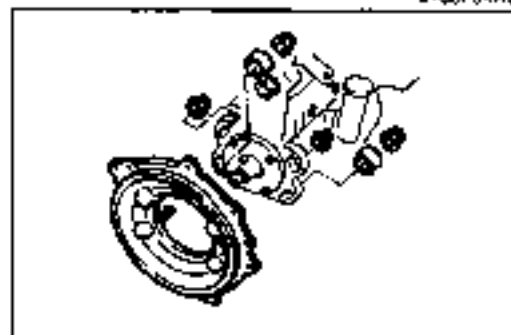
- Cover the intake manifold and injection pipes after removed.
- After removing the pump, do not turn the engine.



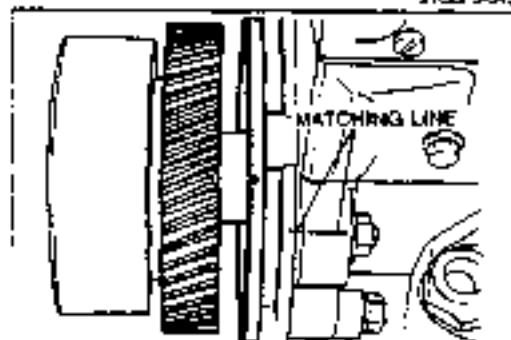




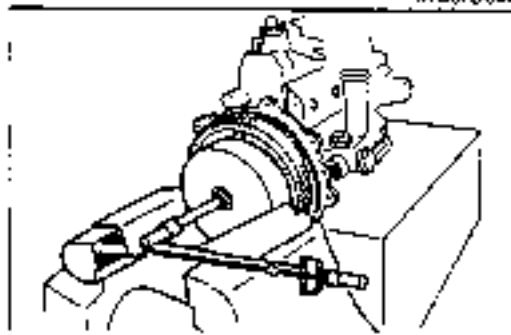
9TGF3-012



9TGF3-013



9TGF3-014



9TGF3-015

**Disassembly / Assembly**

1. Affix the timer in a vise and remove the timer bolt.
2. Remove the timer and gear assembly from the pump.
3. Remove the woodruff key from the pump shaft

4. Remove the flange plate

5. Affix the pump in a vise, and install the flange plate.
6. Align the marks on the pump and flange plate, and tighten the mounting nuts.

**Tightening torque:**

**34—39 N·m (3.5—4.0 m·kg, 25—29 ft·lb)**

7. Install the woodruff key, and install the timer and gear assembly onto the pump shaft.

8. Affix the timer in a vise, and tighten the nut.

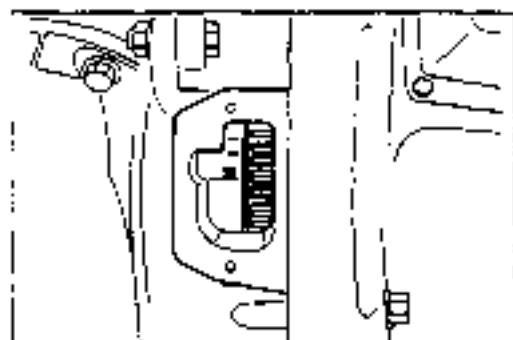
**Tightening torque:**

**59—69 N·m (6.0—7.0 m·kg, 43—51 ft·lb)**

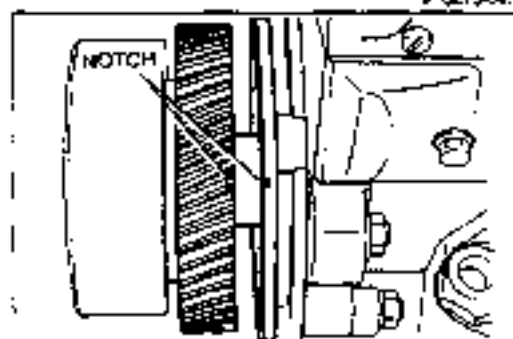
**Installation**

1. Install in the reverse order of removal, referring to **Installation note**.
2. Adjust the injection timing. (Refer to page F3-11.)
3. Bleed air from the fuel system. (Refer to page F3-23.)

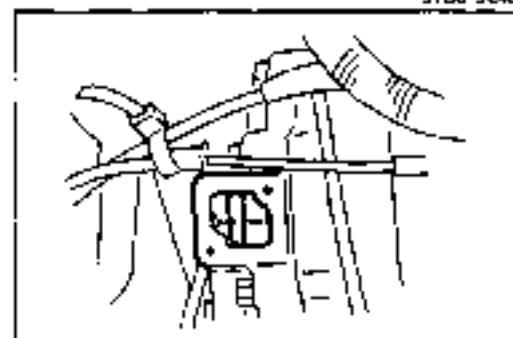
9TGF3-048



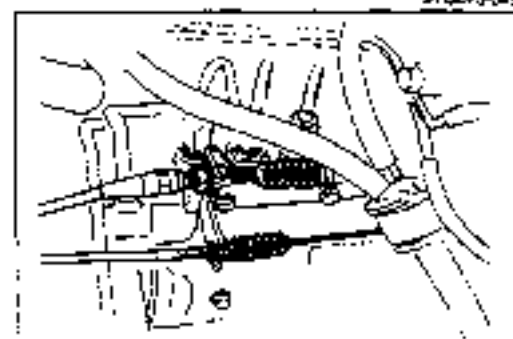
9TGF3-048



9TGF3-048



9TGF3-048



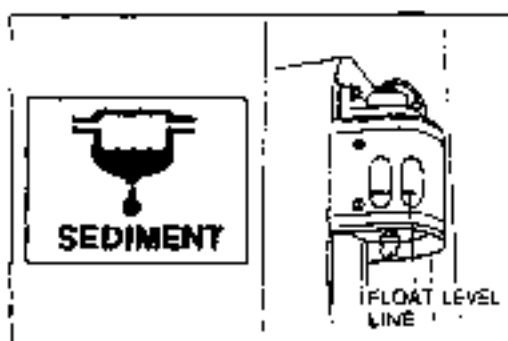
9TGF3-052

**Installation note**  
**Injection pump**

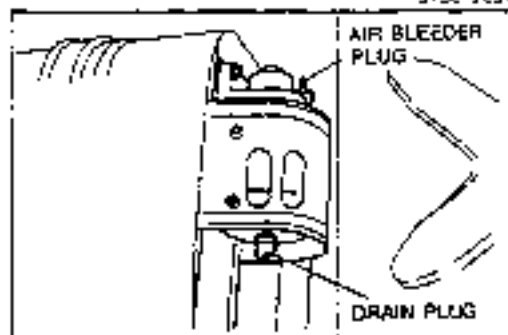
1. Before installing the injection pump, verify that No 1 cylinder is at 30° BTDC.
2. Align the notches of the flange plate and the injection pump gear.
3. Install the injection pump.
4. Verify that the mark on the timer and the tab of the timing gear case are aligned.

**Accelerator cable, fuel stop cable**

1. After installing the accelerator cable, adjust the free play of the cable. (Refer to page F3-28.)
2. After installing the fuel stop cable, adjust the free play of the cable. (Refer to page F3-30.)



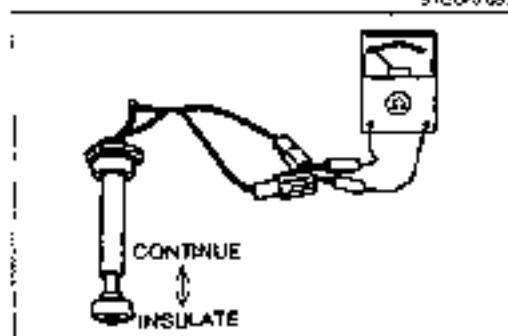
9T30F3-051



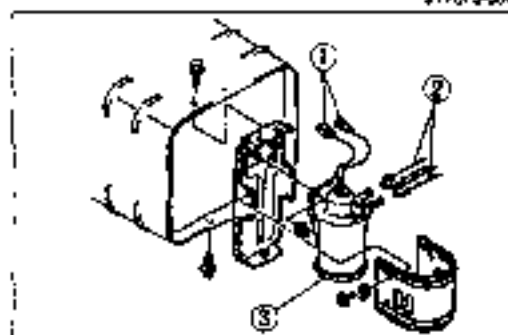
9T30F3-052



9T30F3-053



9T30F3-004



9T30F3-055

### SEDIMENTOR Draining Water

#### Note

- Drain the water when the sedimentor warning light is illuminated or the float ring has risen near the float level line.

1. Loosen the drain plug.
2. Loosen the air bleeding plug
3. When water has been drained, pump the fuel with the priming pump installed on the fuel filter
4. Loosen the bleeder screw of fuel filter and bleed the air

#### Inspection

1. Visually check the sedimentor for damage and fuel leakage. Repair or replace, if necessary.
2. Check the position of the float ring and if the ring is near the float level line, drain the water.

### SEDIMENTOR SENSOR (DETECTOR)

#### Inspection

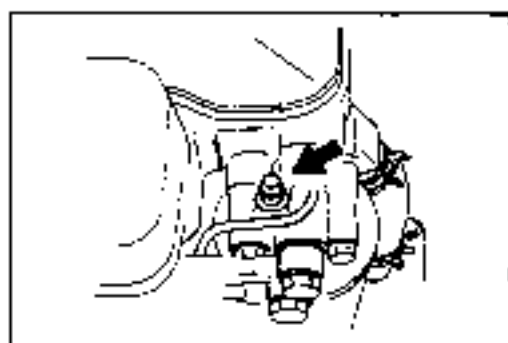
1. Remove the sedimentor sensor from the sedimentor
2. Verify that there is continuity with ohmmeter, when the float is up.

#### Replacement

#### Warning

- Keep sparks, cigarettes and open flames away from sedimentor.

1. Disconnect the connectors.
2. Remove the fuel hoses.
3. Remove the sedimentor.
4. Install in the reverse order of removal.



9T30F3-054

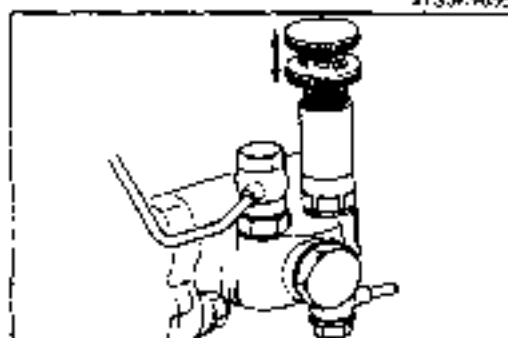
### FUEL FILTER

#### Air Bleeding

#### Warning

- Keep sparks, cigarettes and open flames away from the fuel filter.

1. Loosen the air bleeder plug.

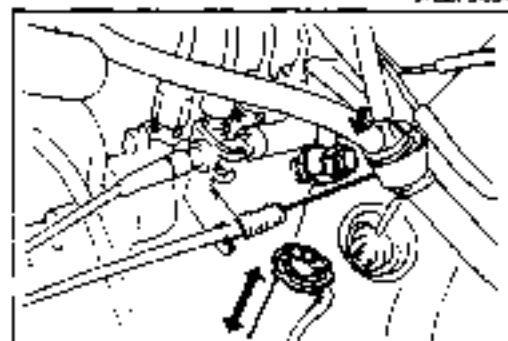


9T30F3-057

2. Pump the priming pump until no air is expelled.  
3. Tighten the air bleeder plug.

#### Tightening torque:

5.9—8.8 Nm (60—90 cm-kg, 52—78 in-lb)



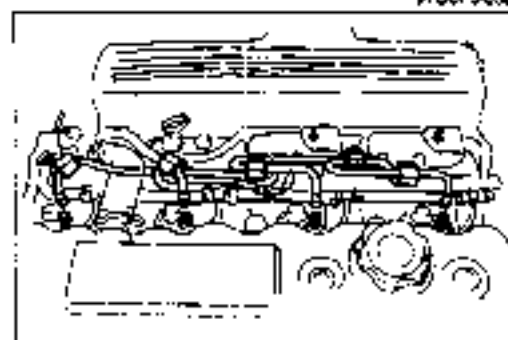
9T30F3-058

4. Loosen the return pipe at the injection pump, and pump the priming pump until no air is expelled.  
5. Tighten bolt.

#### Tightening torque:

12—15 Nm (120—150 cm-kg, 104—130 in-lb)

6. Push the priming pump down and tighten it.

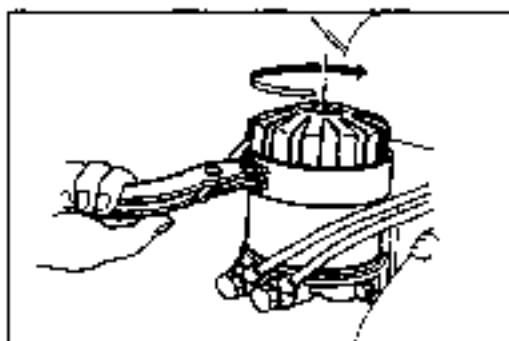


9T30F3-059

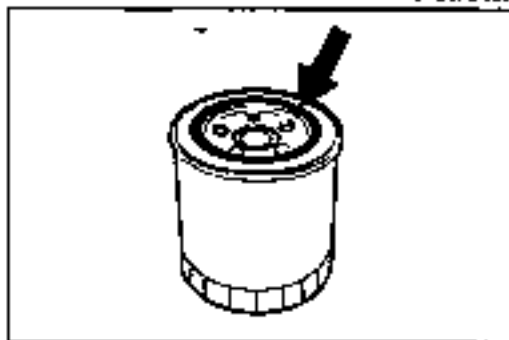
7. Loosen the injection pipes at the injection nozzles.  
8. Crank the engine, and verify that fuel is expelled from each injection pipe.  
9. Tighten the injection pipes.

#### Tightening torque:

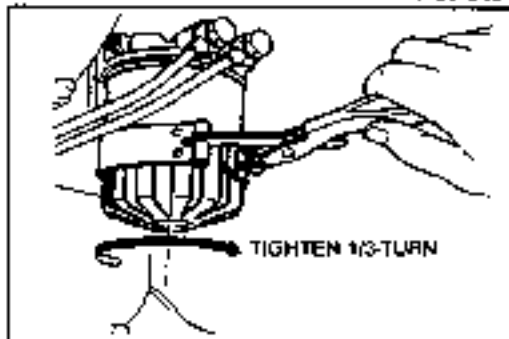
20—25 Nm (2.0—2.5 m-kg, 14—18 ft-lb)



9TSG0F3-060



9TSG0F3-061



9TSG0F3-062

### Replacement

#### Warning

- Keep sparks, cigarettes and open flames away.

- 1 Remove the filter with a filter wrench.
- 2 Apply to the O-ring.
- 3 Install the filter and tighten by hand. Then tighten with filter wrench an additional 1/3-turn.
- 4 Bleed air from the filter. (Refer to page F3-23.)
- 5 Start the engine, and verify that there is no fuel leakage around the filter.

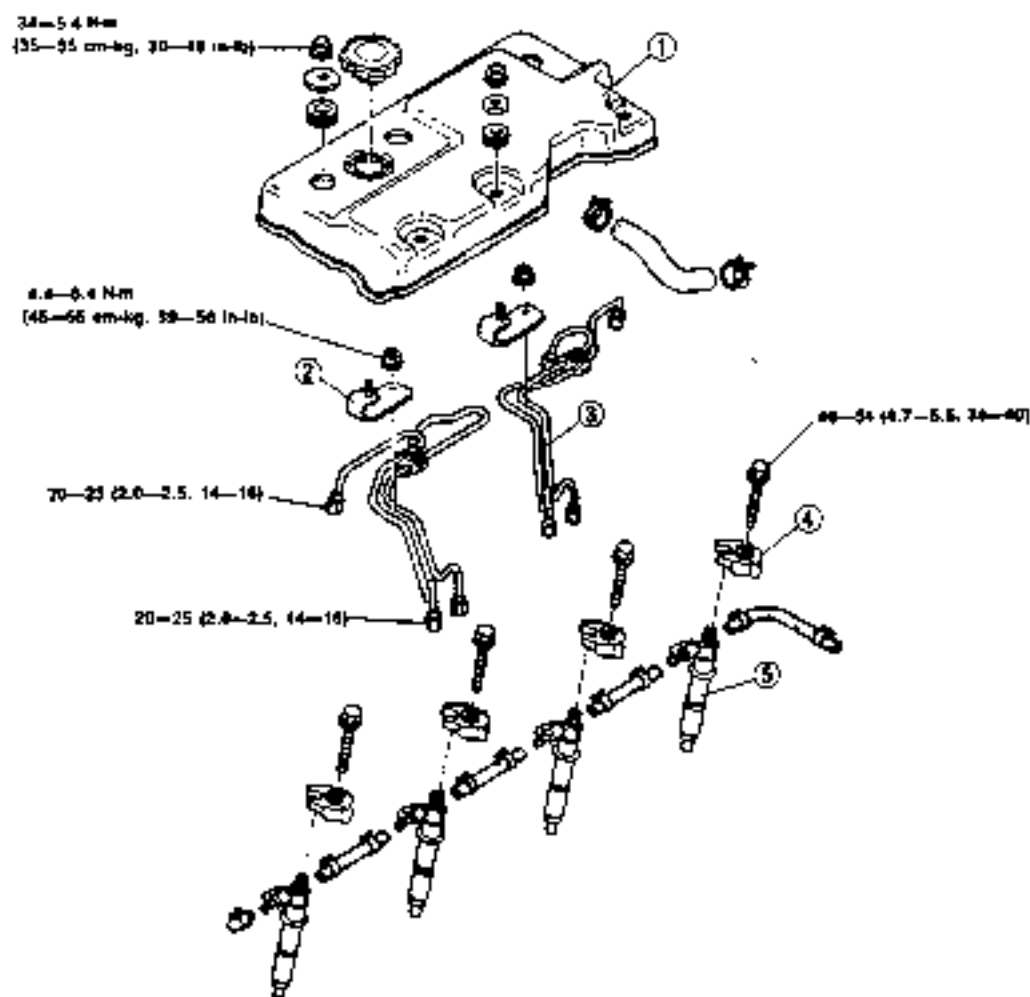
## INJECTION NOZZLE

## removal

## Warning

- Keep sparks, cigarettes and open flames away from the fuel area.

1. Remove the negative battery cable.
2. Remove in the order shown in the figure.



N-m (in-lb, ft-lb)

BTGP0-003

- |                          |                     |
|--------------------------|---------------------|
| 1. Seal cover            | 4. Holder bracket   |
| 2. Injection pipe holder | 5. Injection nozzle |
| 3. Injection pipe        |                     |

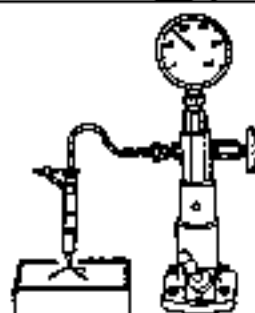
## Inspection

## Warning

- Do not allow your hands or any other part of the body to come into the direct path of the spray when using the nozzle tester because the spray has enough force to break the skin and possibly cause blood poisoning.

## Caution

- The nozzle tester should be set up in a clean work place.



9TGF3-064

**Injection starting pressure**

1. Connect the nozzle to a nozzle tester
2. Pump the nozzle tester handle and note the pressure when injection is started

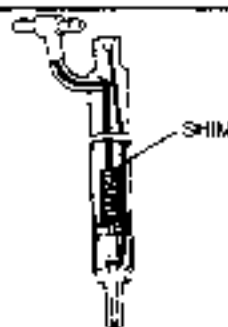
**Injection starting pressure**

New nozzle 20,560 kPa (210 kg/cm<sup>2</sup>, 2,986 psi)  
Used nozzle 19,620 kPa (200 kg/cm<sup>2</sup>, 2,844 psi)

3. If not within the specified pressure, adjust the starting pressure by adding or removal.

**Note**

- Shims are available in 0.05mm (0.002 in) steps, from 0.5 to 1.45mm (from 0.02 to 0.057 in). Changing shim thickness by 0.05mm (0.002 in), changes the injection pressure approx. 491 kPa (5.0 kg/cm<sup>2</sup>, 71 psi).

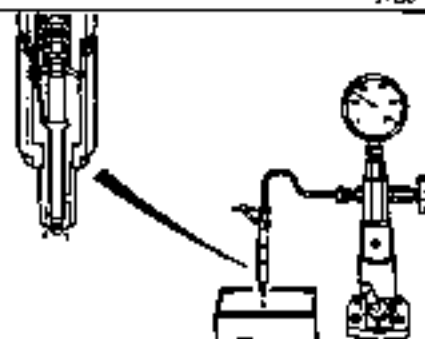


9TGF3-065

**Leakage of injector**

Apply pressure 1,962 kPa (20 kg/cm<sup>2</sup>, 284 psi) lower than the specified injection pressure, and see if the fuel leaks from the nozzle injection hole.

If the fuel leaks, it is necessary to disassemble, wash and recheck the nozzle or replace it.



9TGF3-066

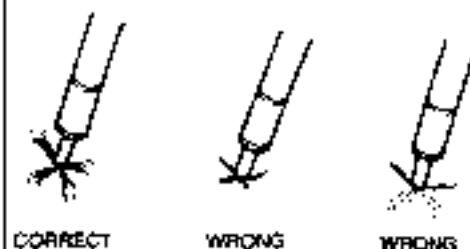
**Atomizing condition**

1. Connect the nozzle on the nozzle tester.
2. Bleed the air by operating the nozzle tester handle several times.
3. Keeping the pressure gauge of the nozzle tester in the non-functioning condition, quickly lower the handle (lower the handle as quickly as possible so that a pulsating whistling sound can be heard). Repeat this operation several times and check the atomizing condition.
4. Verify that the fuel is atomized uniformly and properly.

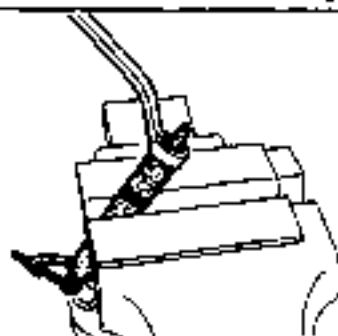
5. Verify that the injection angle and direction are normal.
6. If the atomizing condition is incorrect, it is necessary to disassemble, wash and recheck the nozzle, or to replace it.

**Disassembly**

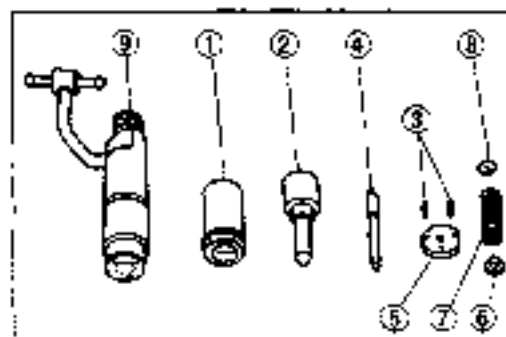
1. Clamp the nozzle in a vise as shown in the figure.



9TGF3-067



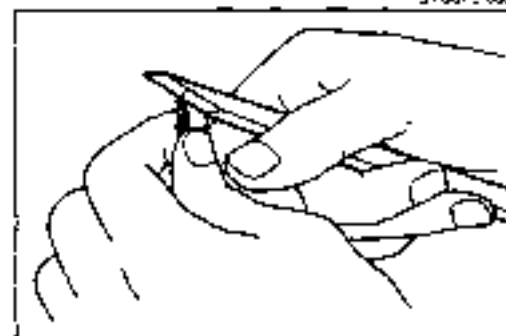
9TGF3-068



9TG0F3-068

2. Disassemble as shown in the figure.

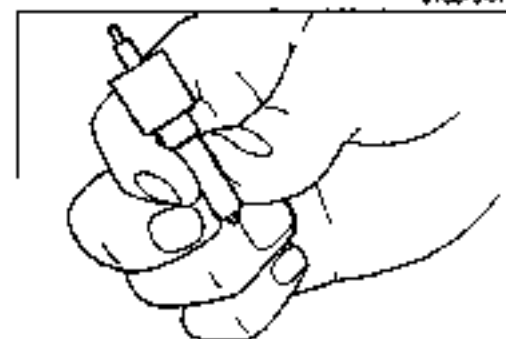
- ① Retaining ring
- ② Nozzle body
- ③ Guide pin
- ④ Needle valve
- ⑤ Distance piece
- ⑥ Pressure pin
- ⑦ Pressure spring
- ⑧ Shim
- ⑨ Nozzle holder



9TG0F3-070

#### Cleaning

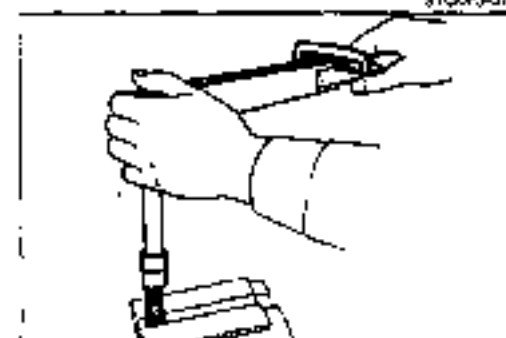
1. Clean the nozzle with new fuel.
2. Clean the carbon fixed on nozzle with a hard lumber.
3. Inspect for damaged or pitted parts. repair or replace as necessary.



9TG0F3-071

4. Verify that the nozzle body is not damaged.

Hold the nozzle body upright and insert the needle valve approximately two-thirds of the way into the body. Verify that the needle valve drops into the body under its own weight when released.



9TG0F3-072

#### Assembly

1. Assemble in the reverse order of disassembly.

#### Tightening torque:

29—39 N·m (3.0—4.0 m·kg, 22—29 ft·lb)

2. Retest the nozzle after assembly. (Refer to page F3-26.)

#### Installation

##### Caution

- Use new gaskets and O-rings.

1. Install in the reverse order of removal.

#### Tightening torque:

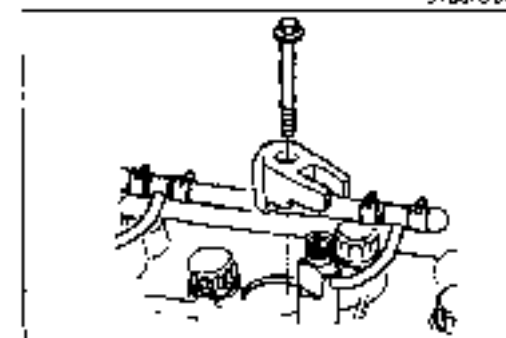
##### Retainer bolt:

46—54 N·m (4.7—5.5 m·kg, 34—40 ft·lb)

##### Nozzle nut:

20—25 N·m (2.0—2.5 m·kg, 14—18 ft·lb)

2. Run the engine and check for fuel leakage.

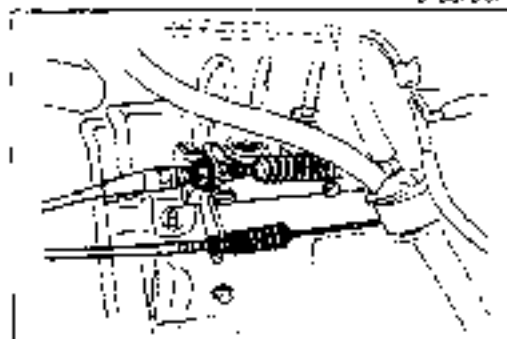


9TG0F3-073





9TGF3-074



9TGF3-075

### ACCELERATOR PEDAL, ACCELERATOR CABLE Inspection / Adjustment

1. Verify that the control lever of the injection pump is in the fully-open position when the accelerator pedal is fully depressed.
2. Loosen nut (A) and adjust the stop bolt, if necessary.

#### Tightening torque

6.9—9.8 N·m (70—100 cm·kg, 61—87 in·lb)

3. Check the free play of the accelerator cable.

Free play 1.0—3.0mm (0.039—0.12 in)

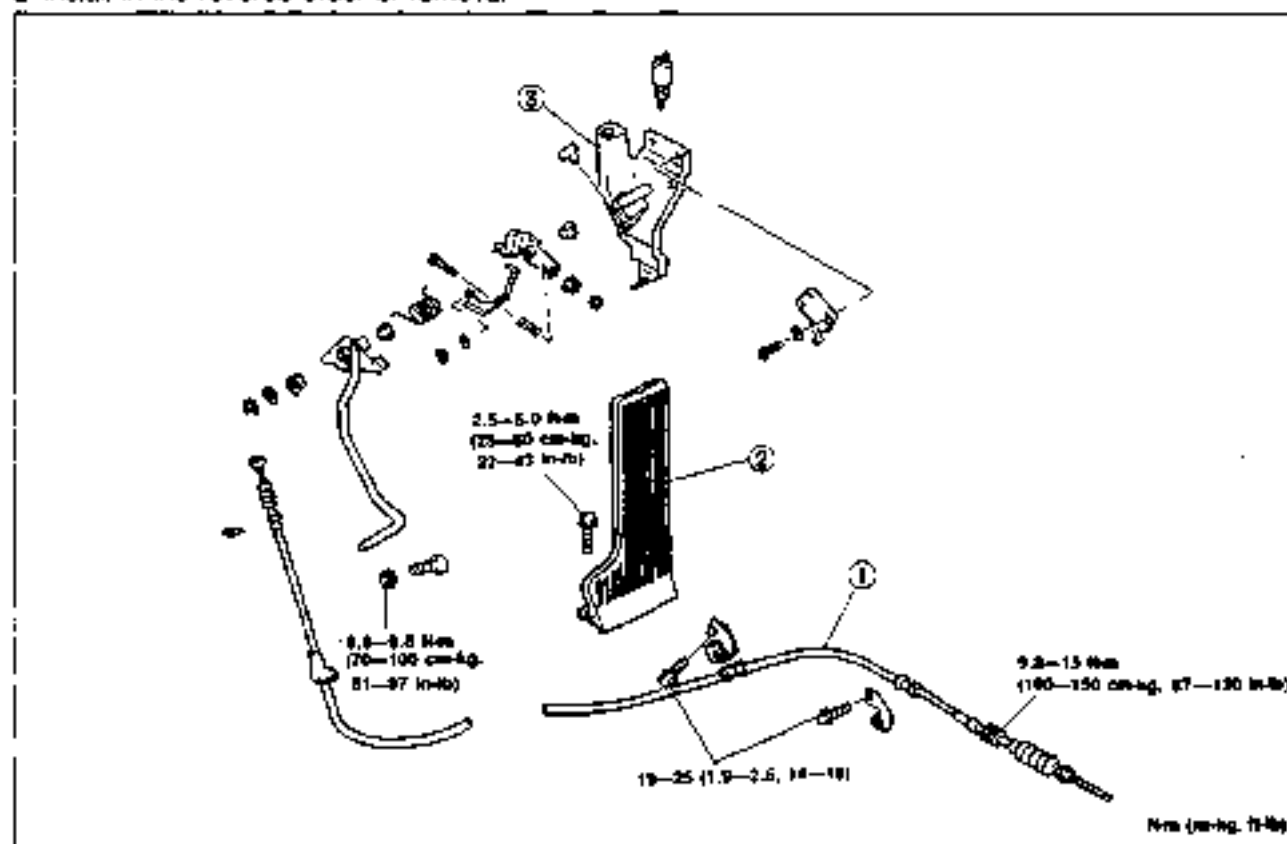
4. Adjust the nuts (B), if necessary.

#### Tightening torque:

9.8—15 N·m (100—150 cm·kg, 87—130 in·lb)

### Removal / Installation

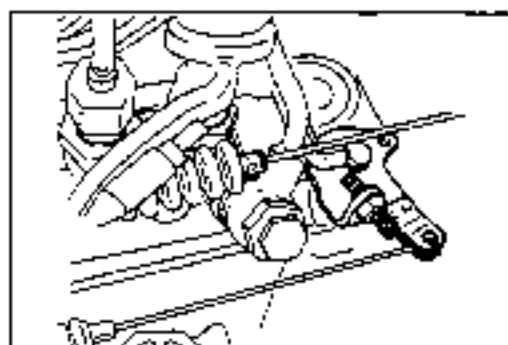
1. Remove in the order shown in the figure.
2. Install in the reverse order of removal.



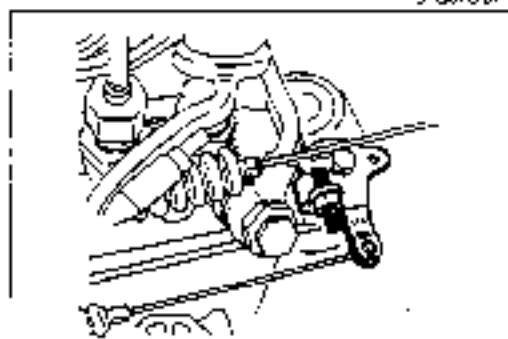
9TGF3-076

1. Accelerator cable
2. Accelerator pedal

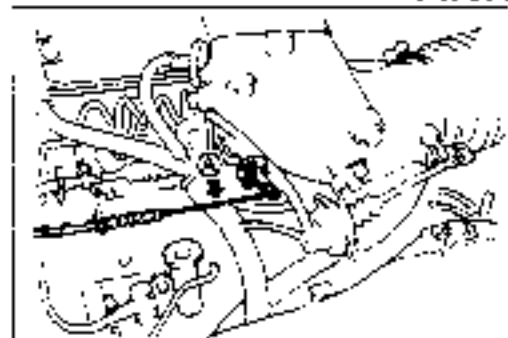
3. Bracket



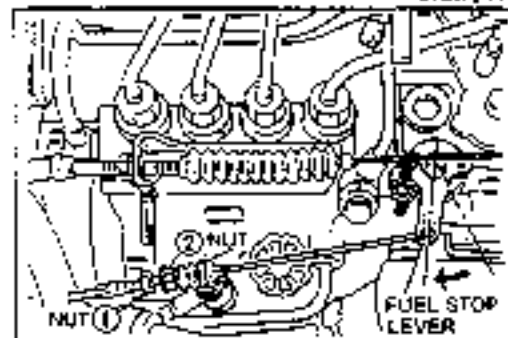
9TGF2-077



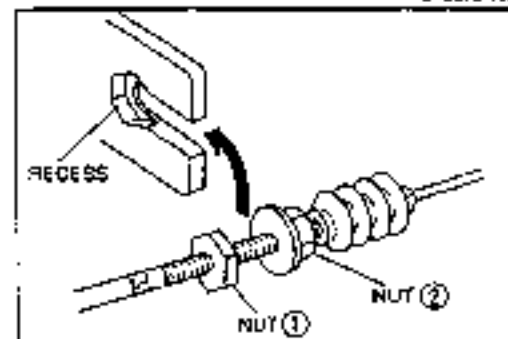
9TGF2-078



9TGF2-114



9TGF2-156



9TGF2-157

## FUEL CUT CONTROL SYSTEM

### SYSTEM OPERATION

1. Turn the engine switch OFF and verify that the stop lever is at the fuel stop position.
2. Turn the engine switch ON and verify that the stop lever is at the fuel inject position.
3. Run the engine.
4. Turn the engine switch OFF and verify that the engine will stop.

### FUEL STOP CABLE

#### Inspection

1. Check the cable for damage or rust.
2. Turn the engine switch OFF
3. Move the fuel stop lever to make the fuel line close.
4. Check the free play of cable in condition of tensed (A) position of the fuel stop cable

Free play: 0—2mm (0—0.078 in)

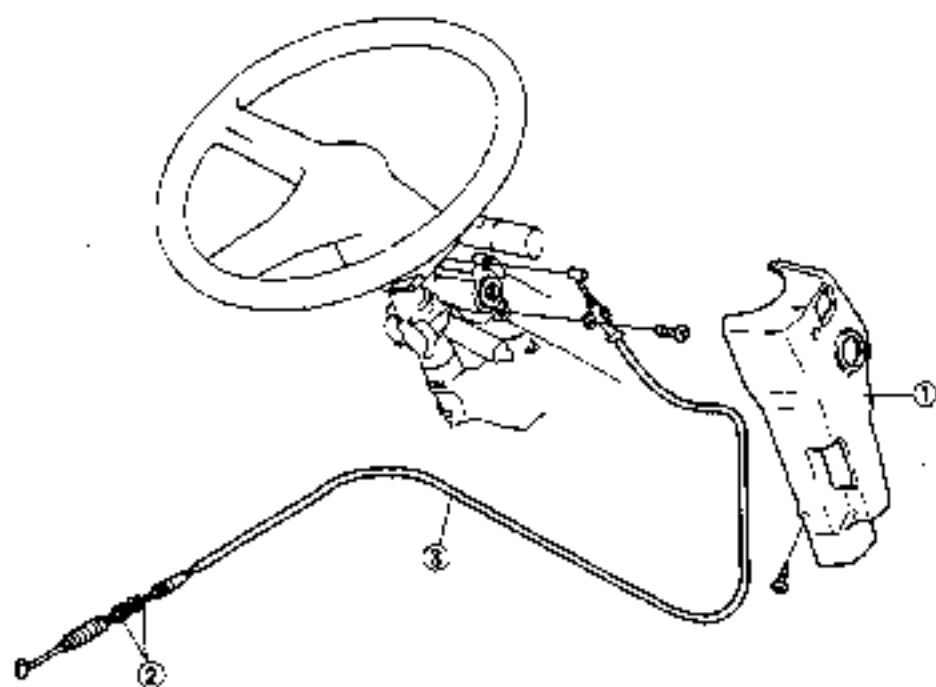
5. Verify that the engine stops when turn the engine switch OFF
6. If not as specified, adjust the cable as follows.

#### Adjustment

1. Turn the engine switch OFF.
2. Loosen nut ② and remove the fuel stop cable from the bracket.
3. Pull the fuel stop cable and verify that the fuel stop lever is at the fuel stop position.
4. Adjust nut ① so that there is no clearance between it and the outside of the bracket.
5. Install the cable into the bracket, fitting nut ① into the recess.
6. Check the free play of the cable as above.
7. If not as specified perform steps 2—5 again.
8. If as specified, tighten nut ②.
9. Verify that the engine stops when turning the engine switch OFF.

**Removal / Installation**

1. Remove in the order shown in the figure.
2. Install in the reverse order of removal.
3. Adjust the free play of the fuel stop cable



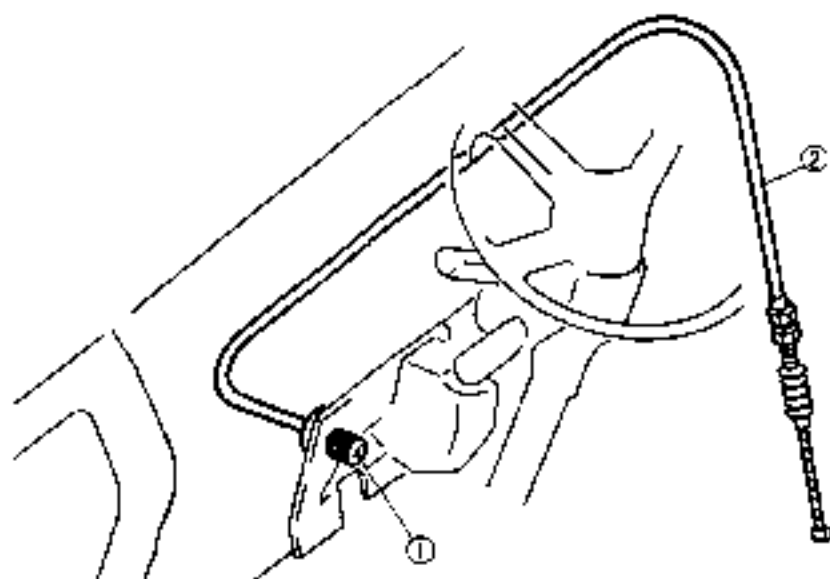
1. Steering column cover  
2. Locknuts

3. Fuel stop cable

9T30F3-003

## IDLE SPEED CONTROL SYSTEM

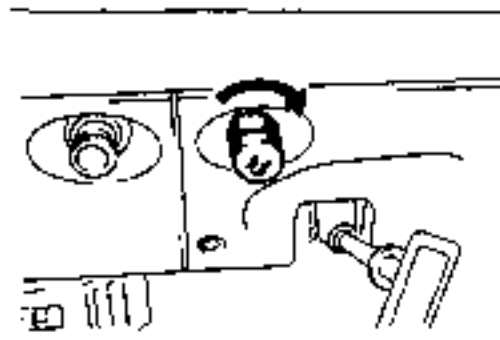
## STRUCTURAL VIEW



97G0F3 082

1. Idling knob  
Removal / Installation ..... page F3-32

2. Idling cable  
Inspection / Adjustment ..... page F3-31  
Removal / Installation ..... page F3-32



97G0F3 082

**IDLING KNOB, IDLING CABLE****Adjustment**

1. Verify that the control lever of the injection pump is at the idle position when the idling knob is not turned.
2. Verify that the idle speed increases when the knob is turned clockwise.

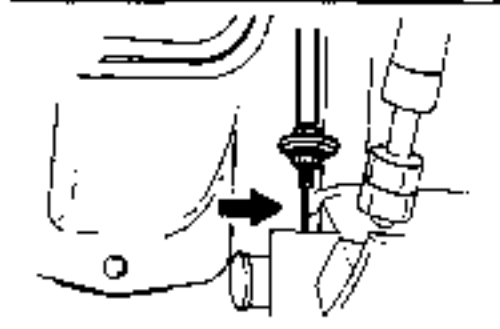
3. Check the free play of the cable when the idling knob is not turned.

**Free play: 0—5mm (0—0.2 in)**

4. If no, as specified, loosen the locknuts and adjust the free play.

**Tightening torque:**

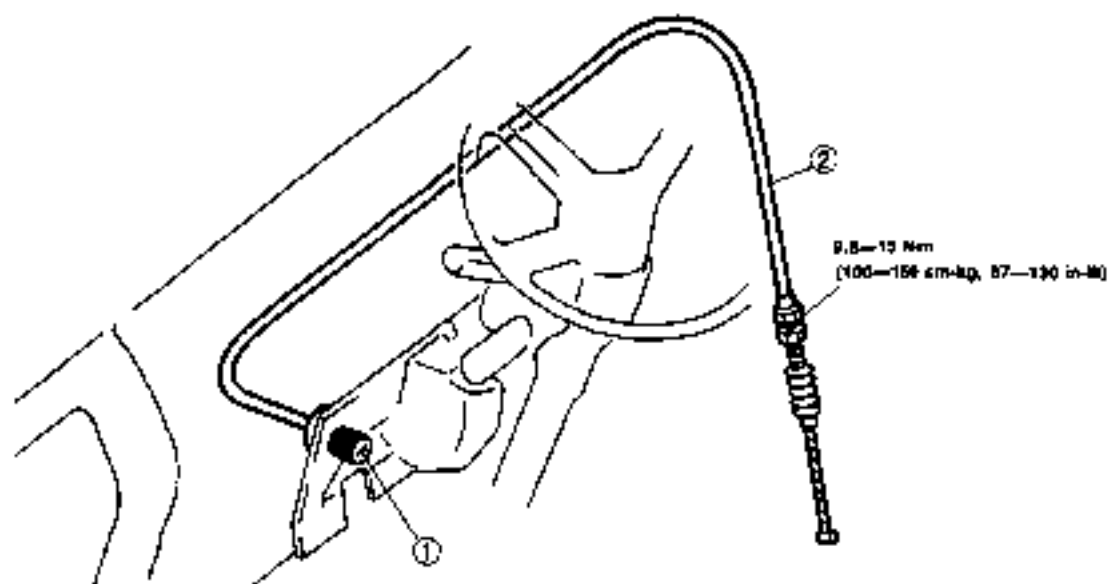
**9.8—15 N·m (100—150 cm·kg, 87—130 in·lb)**



97G0F3 082

**Removal / Installation**

1. Remove in the order shown in the figure.
2. Install in the reverse order of removal.



1. Idling knob

2. Idling cable

9T30F3084

## EXHAUST SYSTEM

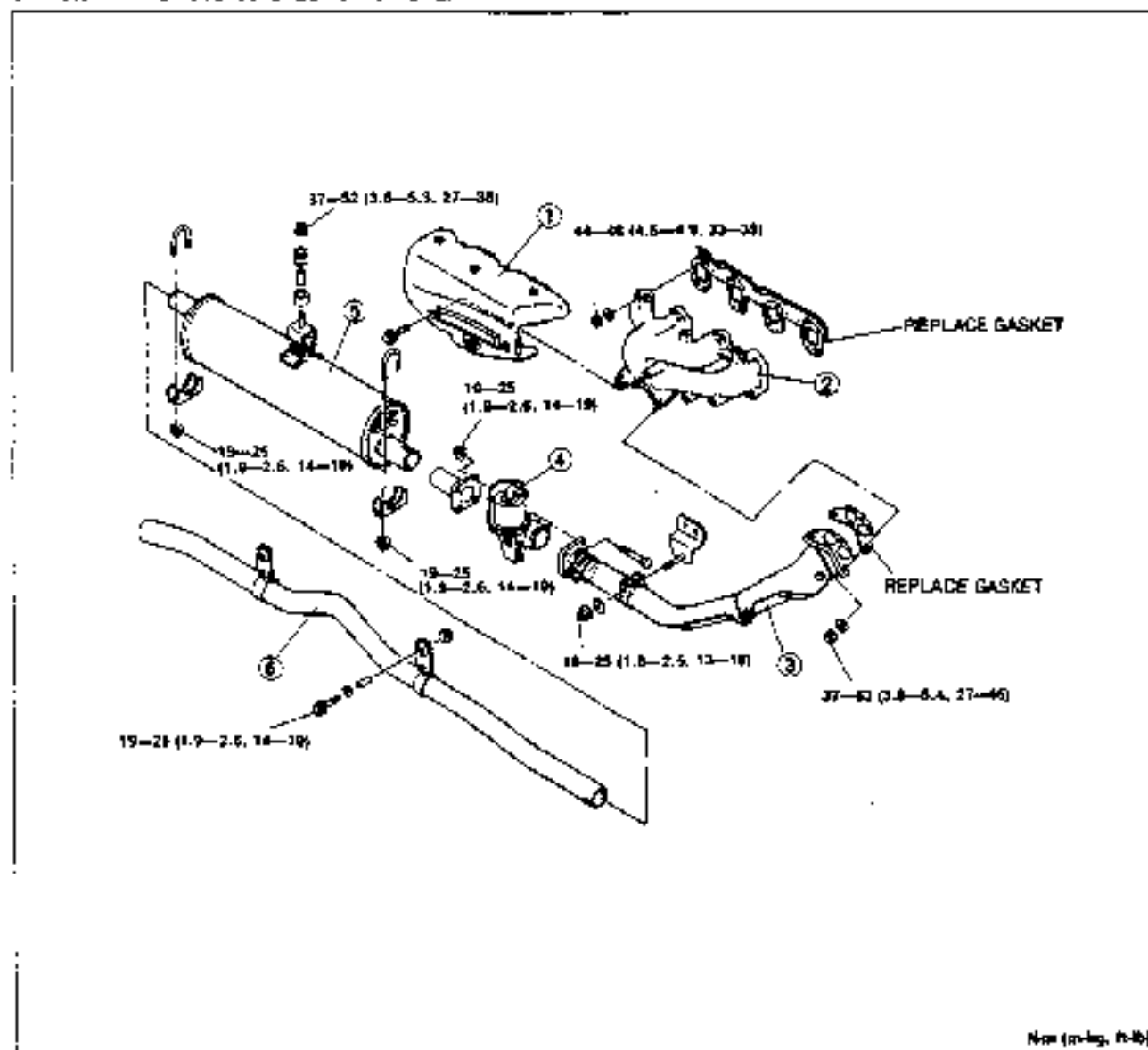
## COMPONENTS

## Vehicle Inspection

1. Run the engine and verify that there is no exhaust leakage.

## Removal / Inspection / Installation

1. Remove in the order shown in the figure.
2. Inspect all parts and repair or replace as necessary
3. Install in the reverse order of removal



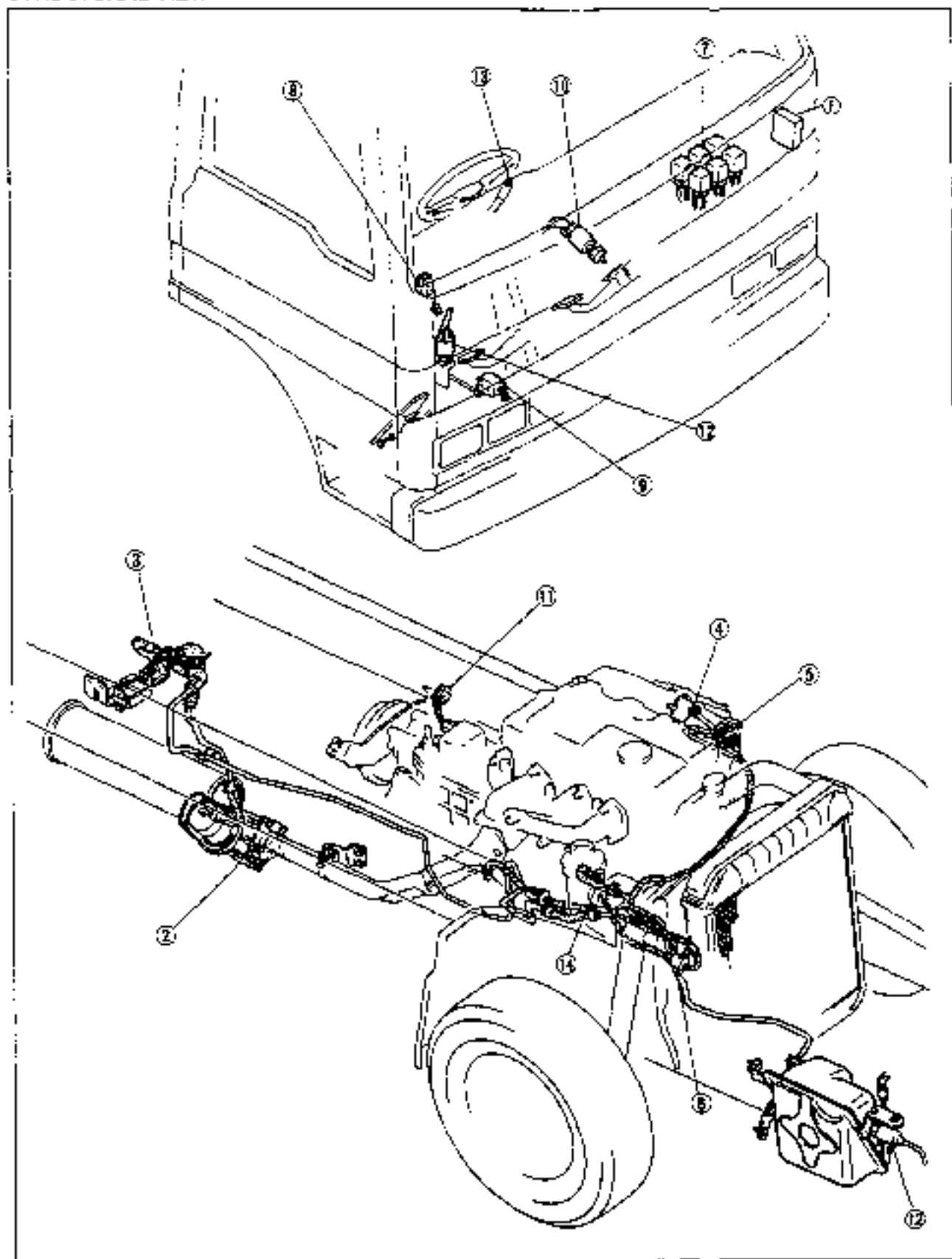
1. Exhaust manifold insulator
2. Exhaust manifold  
Check for contamination, cracks and other damage
3. Front pipe assembly  
Check for contamination cracks and other damage
4. Exhaust brake unit  
Inspection ..... page F3-38

5. Main silencer assembly  
Check for contamination, cracks and other corrosion
6. Tail pipe assembly  
Check for contamination, cracks and other damage

MEMO

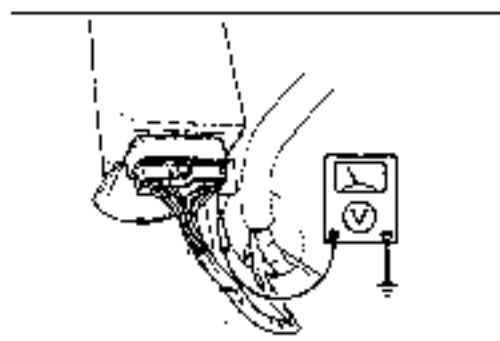
## EXHAUST CONTROLLED HEATING SYSTEM

## STRUCTURAL VIEW





1 Exhaust heating control unit	
Inspection .....	page F3-37
Replacement.....	page F3-38
2 Exhaust brake unit	
Removal.....	page F3-38
Inspection .....	page F3-38
Installation .....	page F3-39
3 Magnetic valve (Exhaust shutter valve)	
Removal.....	page F3-39
Inspection .....	page F3-39
Installation.....	page F3-39
4 Intake shutter valve	
Inspection .....	page F3-40
Removal / Installation.....	page F3-40
5 Intake shutter valve actuator	
Inspection.....	page F3-40
Replacement.....	page F3-40
6 Solenoid valve (for intake shutter valve)	
Inspection .....	page F3-41
7 Cancel relay (pay load above 3.5t only)	
Removal.....	page F3-41
Inspection .....	page F3-41
Installation.....	page F3-41
8 Exhaust heating switch	
Removal .....	page F3-42
Inspection .....	page F3-42
Installation .....	page F3-42
9 Accelerator switch	
Inspection .....	page F3-42
Replacement .....	page F3-43
10 Clutch switch	
Inspection .....	page F3-43
Replacement.....	page F3-43
11 Neutral switch	
Inspection .....	page F3-43
Replacement.....	page F3-44
12 Vacuum switch (pay load above 3.5t only)	
Inspection .....	Section T
13 Exhaust brake switch	
Inspection .....	page F3-44
Replacement .....	Section T
14 Vacuum pump	
Removal.....	Section P
Inspection .....	Section P
Installation.....	Section P



9TQCF-058

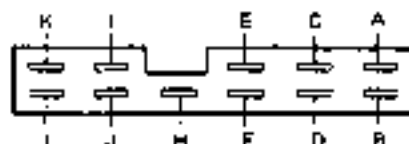
## EXHAUST HEATING CONTROL UNIT

## Inspection

1. Measure the terminal voltage of the exhaust heating control unit when the vacuum switch connector disconnected.
2. If not as specified, repair the wire harness or replace the control unit.

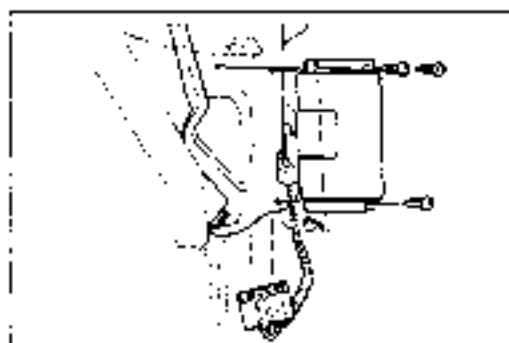
Terminal	Color of wire	Connected to	Conditions of measuring (engine sw ON)	Voltage	Possible cause
A	BR	Exhaust heating switch	Exhaust heating switch OFF	Approx. 12V	Exhaust heating switch (Refer to page F3-42) Wire harness
			Exhaust heating switch ON	Approx. 0V	
B	R/L	Clutch switch	Accelerator and clutch pedal released	Approx. 0V	Clutch switch (Refer to page F3-43) Accelerator switch (Refer to page F3-42) Wire harness
			Accelerator or clutch pedal depressed	Approx. 0V	
C	—	—	—	—	—
D	LY	Neutral switch	Neutral	Approx. 12V	Neutral switch (Refer to page F3-43) Wire harness
			In gear	Approx. 0V	
E	O	Exhaust brake switch	Exhaust brake switch OFF	Approx. 12V	Exhaust brake switch (Refer to page F3-44) Wire harness
			Exhaust brake switch ON	Approx. 0V	
F	BY, LW*	Exhaust brake switch Exhaust heating switch	Constant	Approx. 12V	Exhaust brake switch (Refer to page F3-44) Exhaust heating switch (Refer to page F3-42) Wire harness
H	E	Ground	Constant	Approx. 0V	Wire harness
I	GY	Magnetic valve (for exhaust shutter valve)	• Accelerator and clutch pedal released • Exhaust heating switch ON	Less than approx. 2V	Magnetic valve (Refer to page F3-39) Wire harness
			• Accelerator and clutch pedal released • Neutral • Exhaust brake switch ON	Less than approx. 1V	
			Except above conditions	Approx. 12V	
K	R/R	Solenoid valve (Intake shutter valve)	• Accelerator pedal depressed less than half or clutch pedal depressed or both depressed • Exhaust heating switch ON	Less than approx. 1V	Solenoid valve (Refer to page F3-40) Wire harness
			Except above conditions	Approx. 12V	

Connector



\* Pay load above 3.5t only

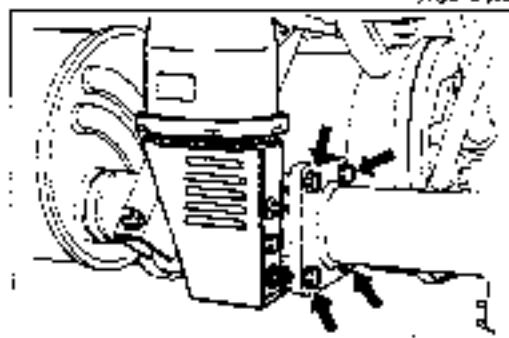
9TQCF-059



RTG0F3-260

**Replacement**

1. Disconnect the connector from the exhaust heating control unit.
2. Remove the exhaust heating control unit.
3. Install in the reverse order of removal.



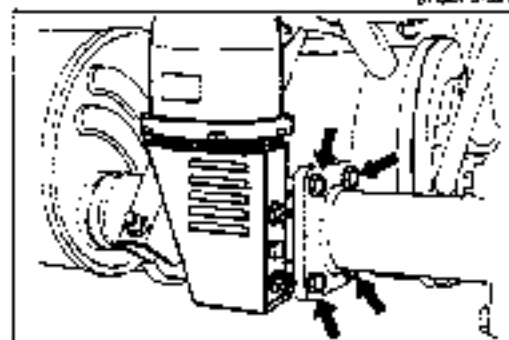
RTG0F3-261

**EXHAUST BRAKE UNIT (POWER CHAMBER)****Removal**

1. Disconnect the vacuum hose from the exhaust brake unit.
2. Remove the exhaust brake unit assembly.

**Note**

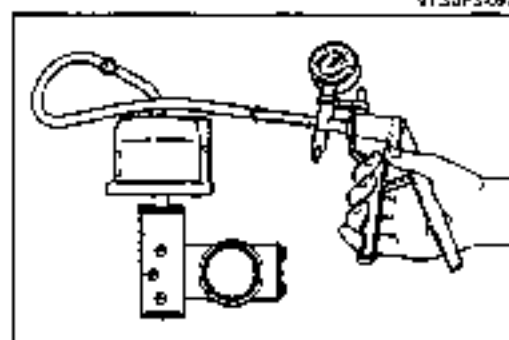
- It is difficult to remove the exhaust brake unit when the exhaust shutter valve is open. Connect a vacuum pump to hold the valve closed to remove it.



RTG0F3-262

**Inspection**

1. Remove the exhaust brake unit assembly.
2. Remove the service hole cover.



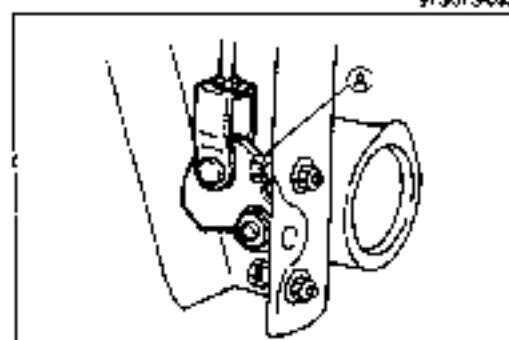
RTG0F3-263

3. Connect a vacuum pump and check the following.

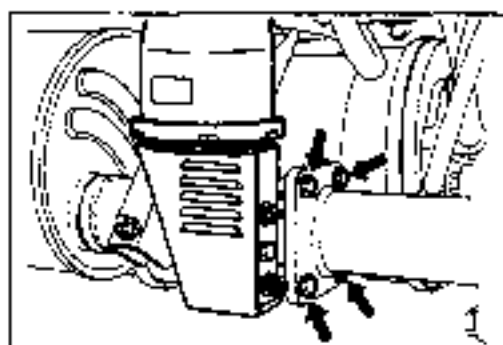
Starts closing 100mmHg (3.9 inHg)  
Fully closing 350mmHg (13.8 inHg)

4. When fully closed adjust the gap of the valve by turning bolt ④.

Gap 0.2—0.4mm (0.007—0.015 in)



RTG0F3-264



9TGD0F3-095

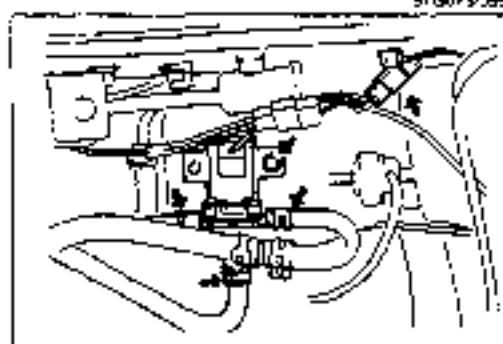
**Installation****Note**

- After installing the exhaust brake unit, the vacuum warning buzzer may ring until vacuum is built up.

Install in the reverse order of removal.

**Tightening torque:**

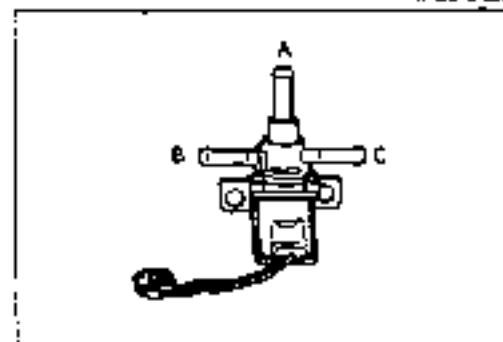
19–25 Nm (1.9–2.6 m·kg, 14–19 ft·lb)



8TGD0F3-096

**MAGNETIC VALVE (FOR EXHAUST SHUTTER VALVE)****Removal**

1. Remove the vacuum hose from the magnetic valve.
2. Disconnect the connector from the magnetic valve.
3. Remove the magnetic valve.

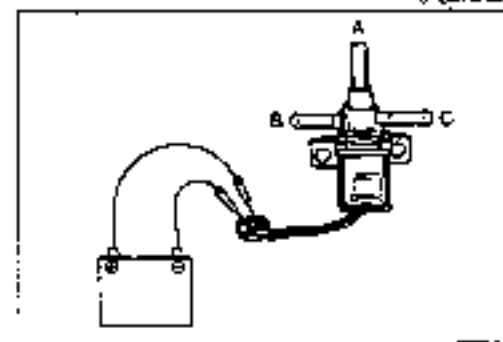


8TGD0F3-097

**Inspection**

1. Verify air flow through the valve.

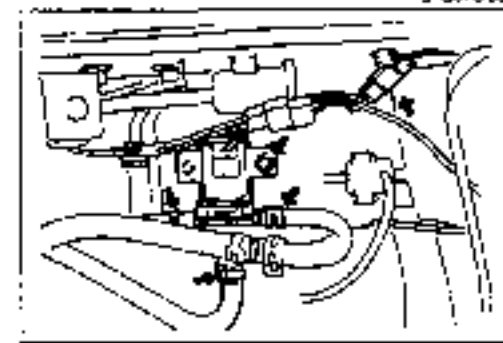
**A—B: Flow**  
**A—C: No flow**  
**B—C: No flow**



9TGD0F3-098

2. Connect 12V to the valve and verify air flow.

**A—B: No flow**  
**A—C: Flow**  
**B—C: No flow**



9TGD0F3-099

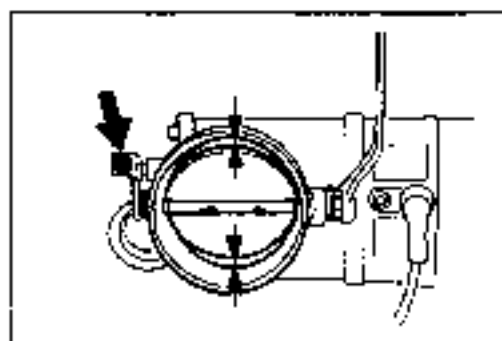
**Installation****Note**

- After installing the magnetic valve, the vacuum warning buzzer may ring until vacuum is built up.

Install in the reverse order of removal.

**Tightening torque:**

43–61 Nm (4.4–6.2 m·kg, 32–45 ft·lb)



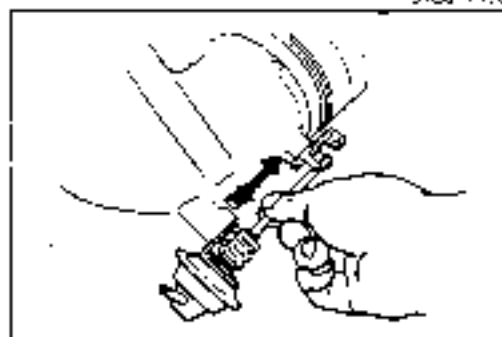
91G0F1-100

**INTAKE SHUTTER VALVE****Inspection**

1. Verify that the clearance at both sides of the valve is as specified when the valve is fully closed.

**Clearance:  $5.7 \pm 0.2\text{mm}$  ( $0.224 \pm 0.007$  in)**

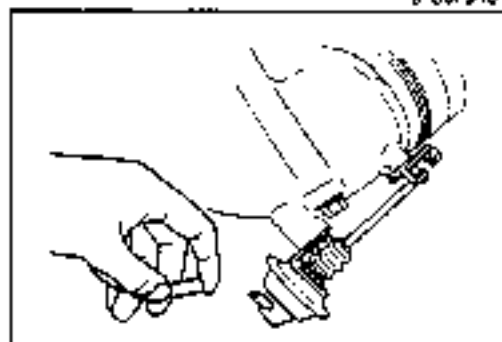
2. If not as specified, adjust by turning the adjusting screw.



91G0F3-101

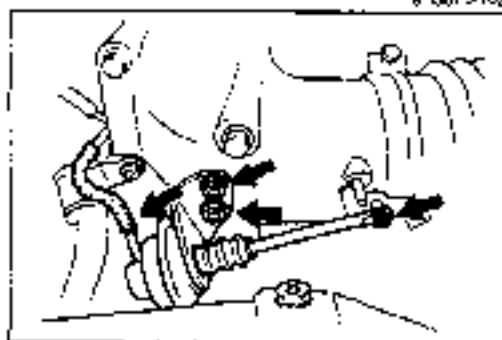
**INTAKE SHUTTER VALVE ACTUATOR****Inspection**

1. Remove the vacuum hose from the actuator.
2. Verify that the rod of the actuator smoothly when moved by hand.
3. Start the engine and run it at idle.



91G0F3-102

4. Verify that there is vacuum at the vacuum hose. If not, check the intake shutter solenoid valve. (Refer to page F3-41.)
5. Install the vacuum hose, and verify that the actuator rod is pulled.



97G0F3-103

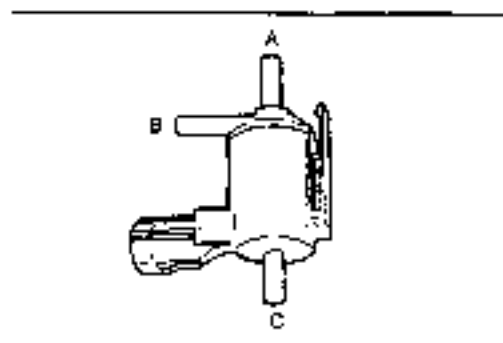
**Replacement****Note**

- After installing the actuator, the vacuum warning buzzer may ring until vacuum is built up.

1. Disconnect the vacuum hose from the actuator.
2. Remove the C-clip.
3. Remove the actuator.
4. Install in the reverse order of removal.

**Tightening torque:**

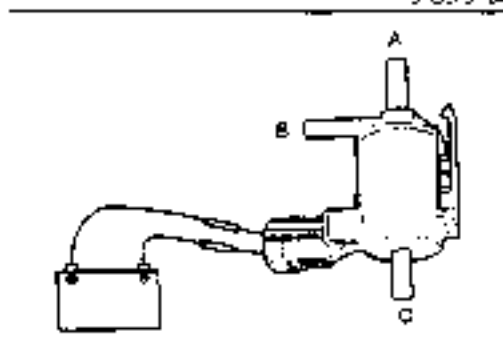
**7.8—11 N·m (88—110 cm·kg, 69—95 in·lb)**



97G0F3-104

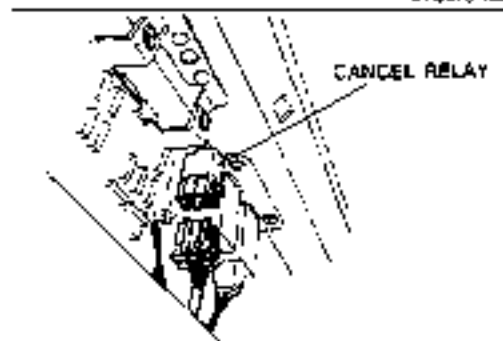
**SOLENOID VALVE (INTAKE SHUTTER VALVE)****Inspection****Note**

- After installing the solenoid valve, the vacuum warning buzzer may ring until vacuum is built up.



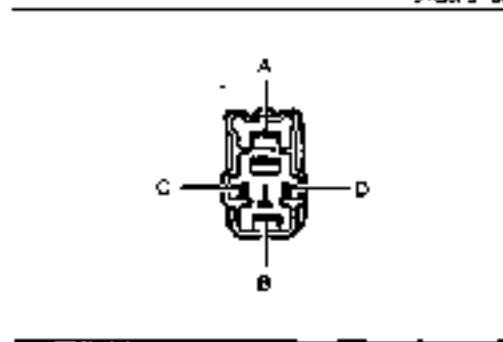
97G0F3-105

1. Remove the solenoid valve.
2. Check the bleeding condition of each pipe by breathing. It is normal if it is the same as following.

**A—B: No bleeding****A—C: No bleeding****B—C: Bleeding**

97G0F3-106

3. Check the bleeding condition of each pipe by breathing when there is battery voltage between terminals of the solenoid valve. It is normal if it is the same as following.

**A—B: Bleeding****A—C: No bleeding****B—C: No bleeding**

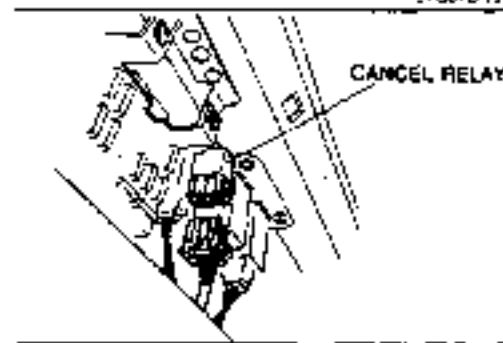
97G0F3-107

**CANCEL RELAY****Removal**

Remove as shown in the figure.

**Inspection**

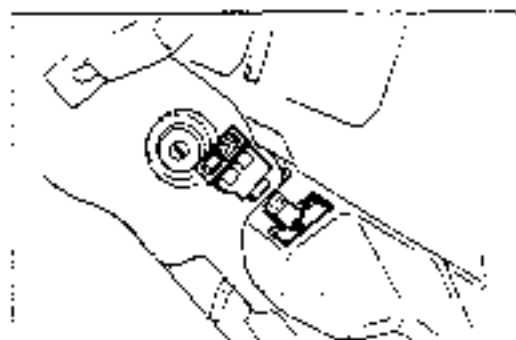
1. Disconnect the cancel relay.
2. Check for continuity between terminals A and D of the relay.
3. Connect 12V between terminals B and C, and verify that there is no continuity between terminal A and D.
4. If there is faulty, replace the cancel relay.



97G0F3-108

**Installation**

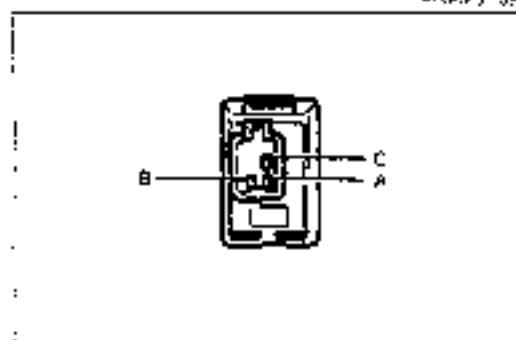
Install in the reverse order of removal.



9TGD93-109

**EXHAUST HEATING SWITCH****Removal**

Remove in the order shown in the figure.

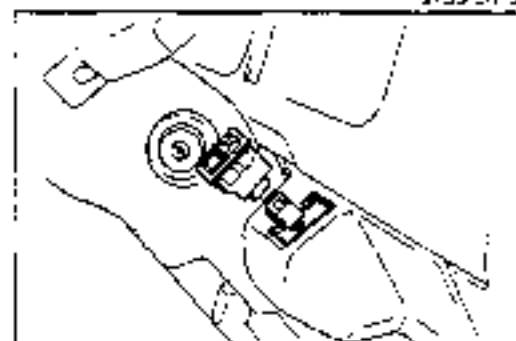


9TGD93-110

**Inspection**

1. Remove the exhaust heating switch.
2. Check continuity between terminals of the switch.

Switch	Terminal		
	A—B	A—C	B—C
OFF	Continuity	No continuity	No continuity
ON	Continuity	Continuity	Continuity



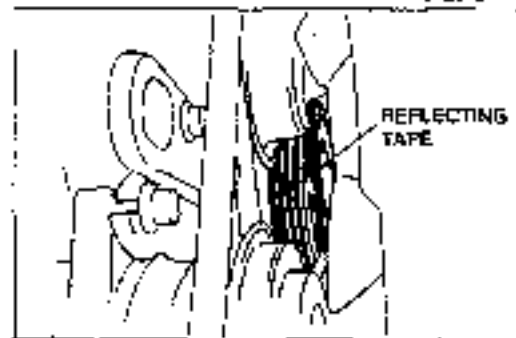
9TGD93-111

**Note**

- When checking continuity between A and B, B and C, connect the negative tester lead to terminal B.

**Installation**

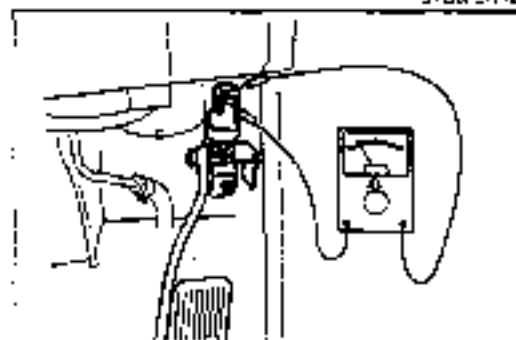
Install in the reverse order of removal.



9TGD93-112

**ACCELERATOR SWITCH****Inspection**

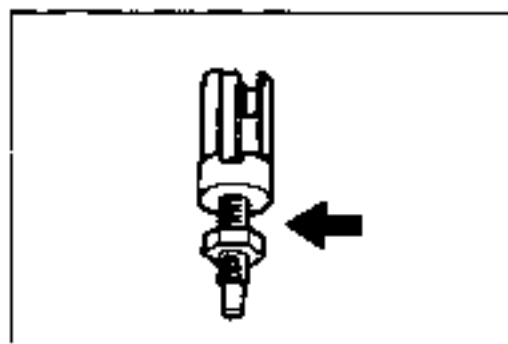
1. Run the engine to normal operating temperature.
2. Stop the engine and affix reflecting tape to the crankshaft pulley.



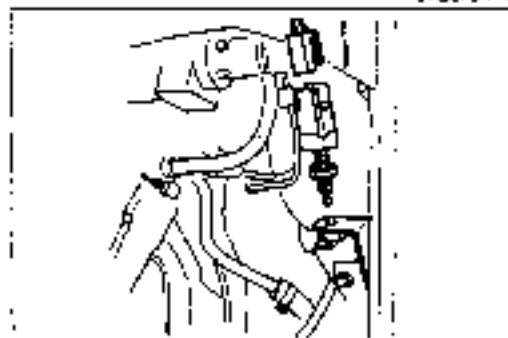
9TGD93-113

3. Start the engine.
4. Disconnect the accelerator switch connector.
5. Connect a photo tachometer.
6. Verify that there is no continuity of the switch when the accelerator is not depressed.
7. Depress the accelerator and verify that there is continuity at the specified speed.

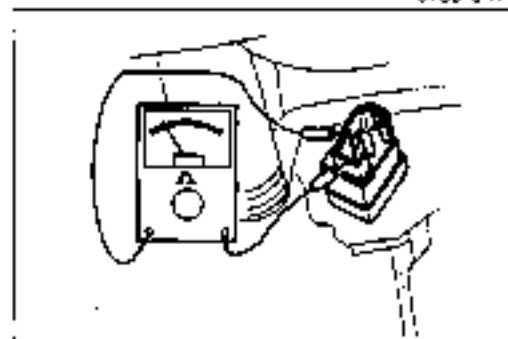
**Specified speed: 800—1,000 rpm**



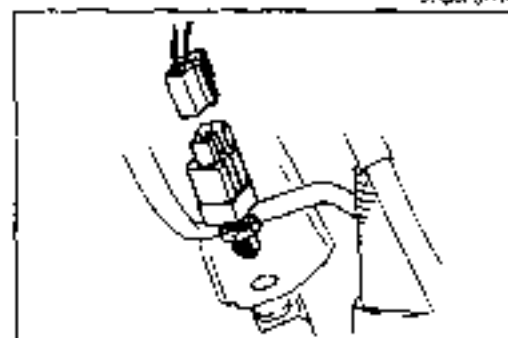
9TGCF3-114



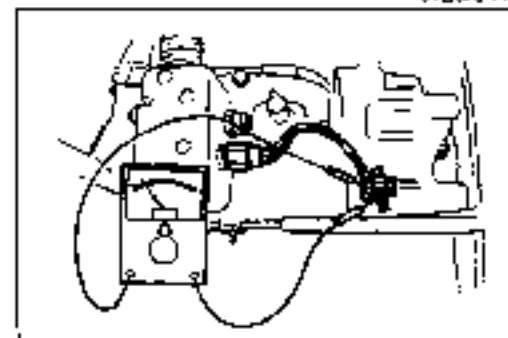
8TG0F3-115



9TG0F3-116



8TG0F3-117



9TG0F3-118

8. If not as specified, loosen the locknut and adjust the switch.
9. After adjusting, tighten the locknut.

**Tightening torque:**

14—18 N·m (1.4—1.8 m·kg, 10—13 ft·lb)

**Replacement**

1. Disconnect the accelerator switch connector.
2. Loosen the locknut and remove the switch.
3. Install the new accelerator switch.
4. Adjust the accelerator switch. (Refer to page F3-42.)
5. Tighten the locknut.

**CLUTCH SWITCH****Inspection**

1. Disconnect the clutch switch connector.
2. Check continuity of the switch.

Clutch pedal	Continuity
Depressed	No
Released	Yes

**Replacement**

1. Disconnect the clutch switch connector.
2. Loosen the locknut and remove the clutch switch.
3. Install the new clutch switch.
4. Adjust the switch as shown in "Inspection" above.
5. Tighten the locknut.

**Tightening torque:**

14—18 N·m (1.4—1.8 m·kg, 10—13 ft·lb)

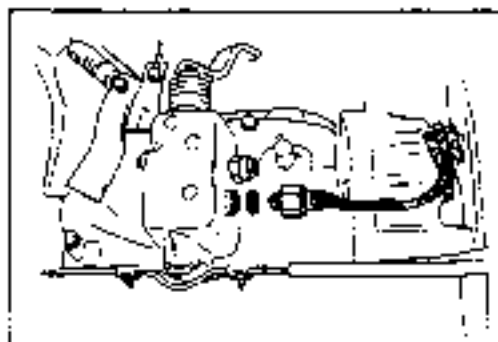
**NEUTRAL SWITCH****Inspection**

1. Disconnect the neutral switch connector at the upper part of the transmission.
2. Check continuity of the switch.

Transmission	Continuity
Neutral	No
In gear	Yes

3. If not as specified, replace the neutral switch.

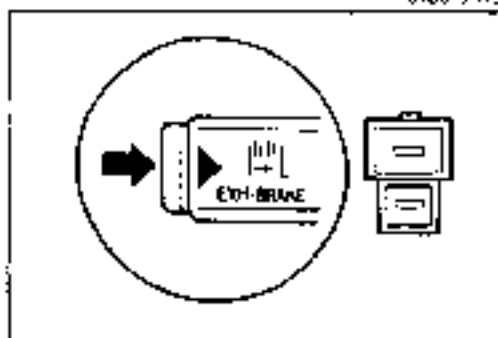


**Replacement**

1. Disconnect the neutral switch connector at the upper part of the transmission.
2. Remove the neutral switch.
3. Install in the reverse order of removal.

**Tightening torque:**

14—18 Nm (1.4—1.8 m·kg, 10—13 ft·lb)

**EXHAUST BRAKE SWITCH****Inspection**

1. Remove the steering column cover.
2. Disconnect the exhaust brake switch connector.
3. Check continuity of the switch.

Exhaust brake switch	Continuity
OFF	No
ON	Yes

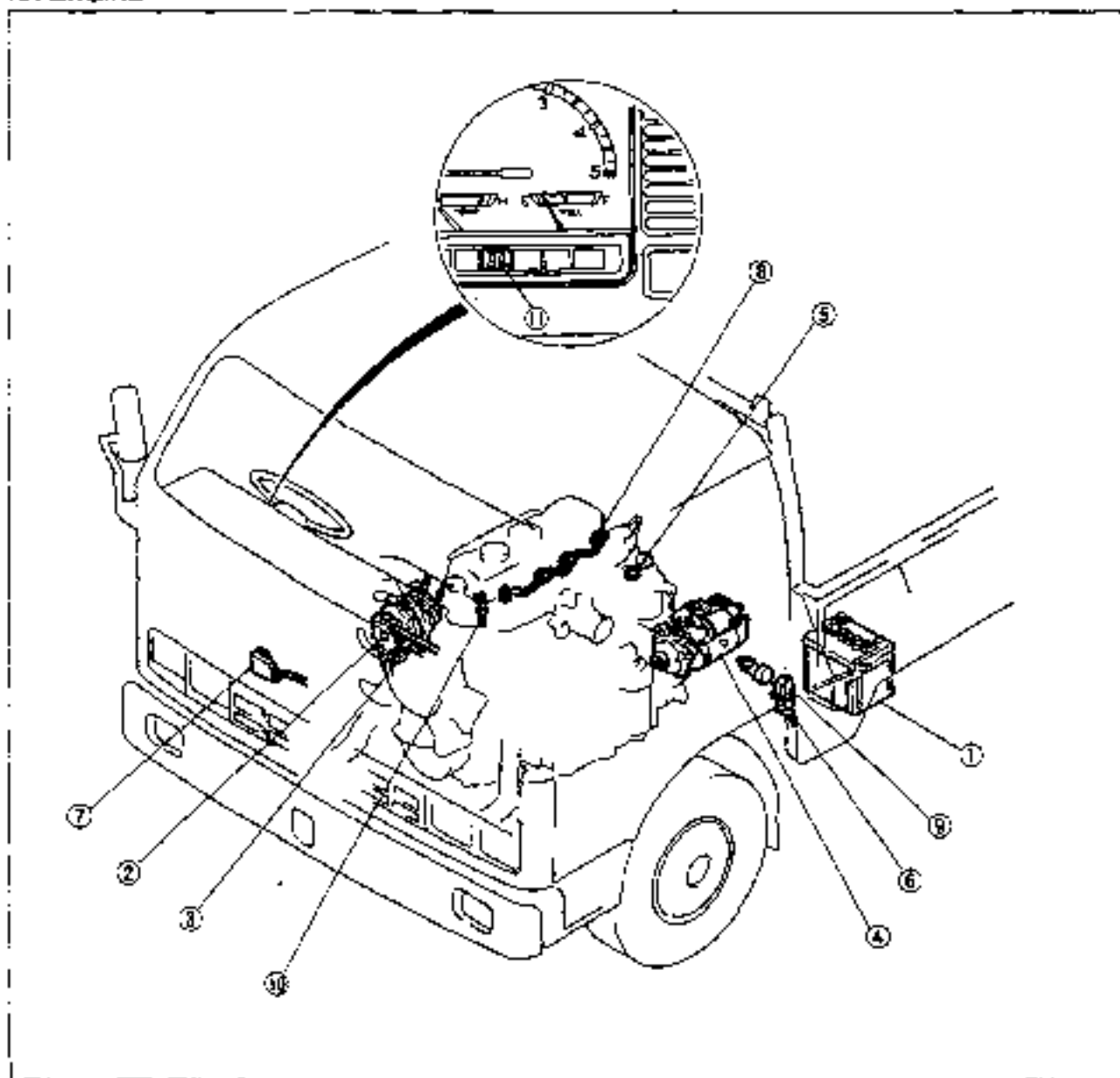
4. If not as specified, replace the switch. (Refer to Section T.)

# ENGINE ELECTRICAL SYSTEM

<b>INDEX</b> .....	G- 2
HA ENGINE.....	G- 2
SL, TF ENGINES.....	G- 3
<b>TROUBLESHOOTING</b> .....	G- 4
<b>CHARGING SYSTEM</b> .....	G- 5
BATTERY.....	G- 5
ALTERNATOR.....	G- 6
DRIVE BELT.....	G-10
<b>STARTER</b> .....	G-11
STARTER.....	G-11
SUB-STARTER SYSTEM.....	G-16
<b>AIR HEATER SYSTEM</b> .....	G-18
STRUCTURAL VIEW.....	G-17
CIRCUIT DIAGRAM.....	G-18
AIR HEATER CONTROL UNIT.....	G-19
AIR HEATER.....	G-20
AIR HEATER RELAY.....	G-20
WATER THERMOSENSOR.....	G-21
GLOW INDICATOR LAMP.....	G-21
<b>QUICK START SYSTEM (QSS)</b> .....	G-22
STRUCTURAL VIEW.....	G-22
CIRCUIT DIAGRAM.....	G-23
QSS CONTROL UNIT.....	G-23
GLOW PLUG.....	G-24
GLOW PLUG RELAY.....	G-25
WATER THERMOSENSOR.....	G-25

## INDEX

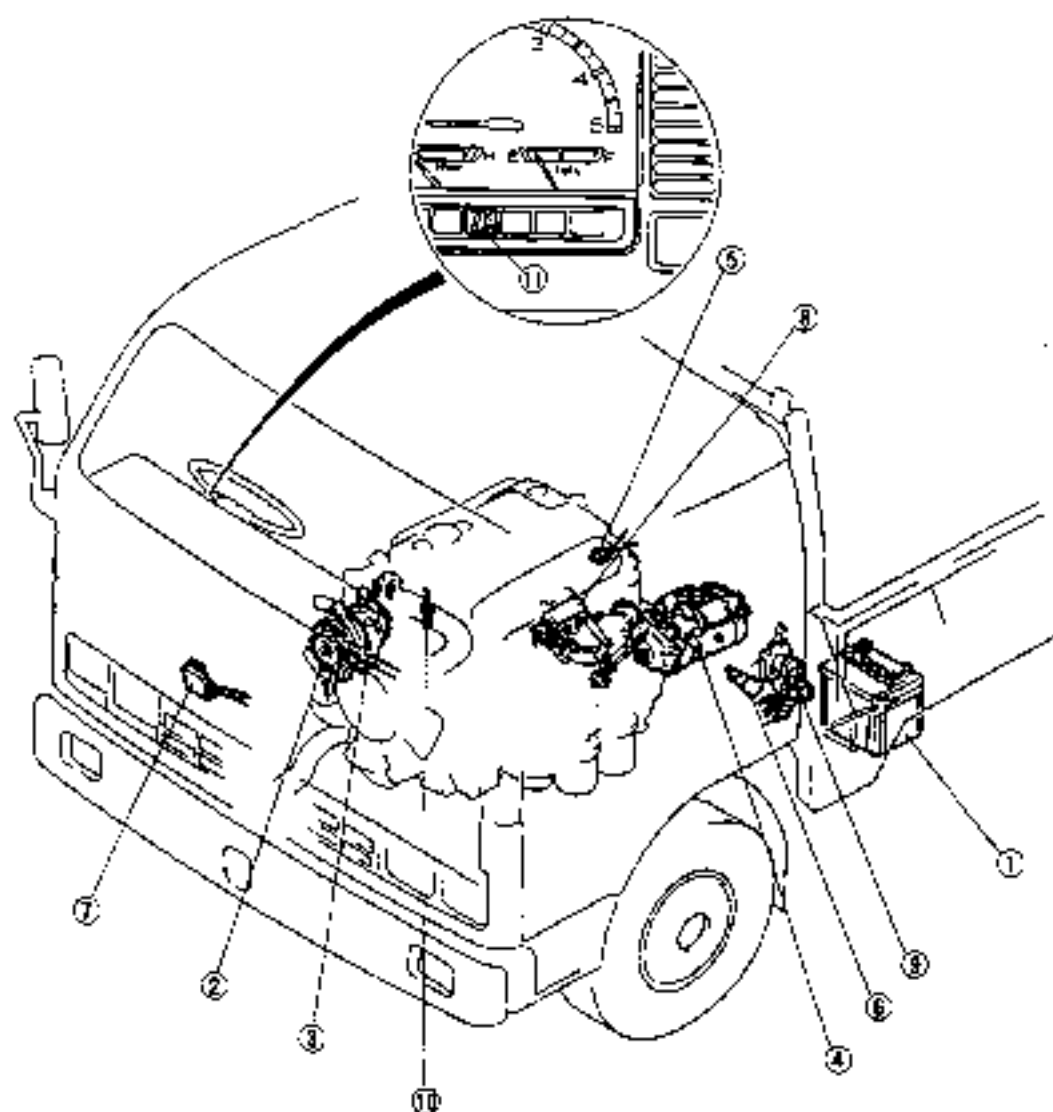
## HA ENGINE



87A06X-002

- |                              |           |  |
|------------------------------|-----------|--|
| 1. Battery                   |           |  |
| Inspection.....              | page G- 5 |  |
| Charging .....               | page G- 5 |  |
| 2. Alternator                |           |  |
| Inspection (On-vehicle)..... | page G- 5 |  |
| Removal / Installation.....  | page G- 7 |  |
| Disassembly / Assembly.....  | page G- 7 |  |
| Inspection.....              | page G- 8 |  |
| 3. Drive belt                |           |  |
| Inspection / Adjustment..... | page G-10 |  |
| 4. Starter                   |           |  |
| Inspection (On-vehicle)..... | page G-11 |  |
| Removal / Installation.....  | page G-11 |  |
| Disassembly / Assembly.....  | page G-12 |  |
| 5. Neutral switch            |           |  |
| Inspection.....              | page G-16 |  |
| 6. Sub-starter switch        |           |  |
| Inspection.....              | page G-16 |  |
| 7. OSS control unit          |           |  |
| Inspection.....              | page G-22 |  |
| 8. Glow plug                 |           |  |
| Inspection.....              | page G-24 |  |
| 9. Glow plug relay           |           |  |
| Inspection.....              | page G-26 |  |
| 10. Water thermostat         |           |  |
| Inspection.....              | page G-26 |  |
| 11. Glow indicator lamp      |           |  |
| Inspection.....              | page G-26 |  |

## SL, TF ENGINES



3TF0GX-003

- |                              |           |                            |           |
|------------------------------|-----------|----------------------------|-----------|
| 1 Battery                    |           | 5. Neutral switch          |           |
| Inspection.....              | page G- 5 | Inspection.....            | page G-16 |
| Charging.....                | page G- 5 | 6. Sub-starter switch      |           |
| 2. Alternator                |           | Inspection.....            | page G-16 |
| Inspection (On-vehicle)..... | page G- 5 | 7. Air heater control unit |           |
| Removal / Installation.....  | page G- 7 | Inspection.....            | page G-19 |
| Disassembly / Assembly.....  | page G- 7 | 8. Air heater              |           |
| Inspection.....              | page G- 8 | Inspection.....            | page G-20 |
| 3. Drive belt                |           | 9. Air heater relay        |           |
| Inspection / Adjustment..... | page G-10 | Inspection.....            | page G-20 |
| 4. Starter                   |           | 10. Water thermosensor     |           |
| Inspection (On-vehicle)..... | page G-11 | Inspection.....            | page G-21 |
| Removal / Installation.....  | page G-11 | 11. Glow indicator lamp    |           |
| Disassembly / Assembly.....  | page G-12 | Inspection.....            | page G-26 |

## TROUBLESHOOTING

Trouble	Possible Cause	Action to be Taken
Starting motor does not turn, or turns too slowly to start the engine	<p>Battery and related parts</p> <ul style="list-style-type: none"> <li>Faulty contact of battery terminal</li> <li>Faulty grounding of negative cable</li> <li>Voltage drop caused by discharging</li> <li>Insufficient voltage caused by faulty battery</li> </ul> <p>Engine switch</p> <ul style="list-style-type: none"> <li>Faulty contact on engine switch</li> <li>Loose engine switch wiring and connectors</li> <li>Broken wire between engine switch and magnetic switch</li> </ul> <p>Magnetic switch and related parts</p> <ul style="list-style-type: none"> <li>Loose wiring and connectors</li> <li>Broken wire of magnetic switch pull-in coil</li> <li>Faulty contact of magnetic switch contact plate</li> <li>Broken wire of magnetic switch holding coil</li> </ul> <p>Starting motor and related parts</p> <ul style="list-style-type: none"> <li>Faulty contact of brushes</li> <li>Fatigued brush spring</li> <li>Faulty grounding of field coil</li> <li>Faulty soldering of field coil</li> <li>Faulty commutator</li> <li>Faulty grounding of armature</li> <li>Wear on parts</li> </ul>	<p>Clean and tighten Clean and repair Charge Replace</p> <p>Replace</p> <p>Repair or Replace</p> <p>Repair Replace Replace Replace</p> <p>Repair or replace Replace Replace Repair Repair or replace Replace Replace</p>
Starting motor turns, but the engine does not start	<p>Insufficient battery capacity</p> <p>Air heater system and related parts (in cold)</p> <ul style="list-style-type: none"> <li>Faulty air heater control unit</li> <li>Faulty air heater relay</li> <li>Faulty air heater</li> <li>Faulty water thermostat</li> <li>Broken or grounded of harness in air heater system and related parts</li> </ul> <p>Quick start system and related parts</p> <ul style="list-style-type: none"> <li>Faulty QSS control unit</li> <li>Faulty glow plug relay</li> <li>Faulty glow plug</li> <li>Faulty water thermostat</li> <li>Broken or grounded of harness in QSS and related parts</li> </ul>	<p>Charge</p> <p>Replace Replace Replace Replace Repair or replace</p> <p>Replace Replace Replace Replace</p> <p>Repair or replace</p>
Starting motor turns, but pinion gear does not mesh with ring gear	<ul style="list-style-type: none"> <li>Tip of overrunning clutch pinion is worn</li> <li>Raced overrunning clutch drive spring</li> <li>Raced overrunning clutch</li> <li>Faulty sliding surface of spline</li> <li>Worn bushing</li> <li>Worn ring gear</li> </ul>	<p>Replace Replace Replace Repair or replace Replace Replace</p>
Starting motor turns continuously and does not stop	<ul style="list-style-type: none"> <li>Sticking contact plate of magnetic switch</li> <li>Lays short of magnetic switch coil</li> <li>Engine (ignition) switch does not return properly</li> </ul>	<p>Replace Replace Replace</p>
Battery discharge	<ul style="list-style-type: none"> <li>Loose drive belt</li> <li>Grounded or broken stator coil</li> <li>Faulty contact between brush and slip ring</li> <li>Faulty rectifier</li> <li>Faulty IC regulator</li> <li>Insufficient or unsuitable battery electrolyte</li> <li>Faulty battery electrode (internal short circuit)</li> <li>Faulty contact of battery terminal</li> <li>Excessive electric load</li> </ul>	<p>Adjust Replace Clean and replace Replace Replace Adjust Replace Clean and tighten Check power consumption</p>
Overcharged battery	<ul style="list-style-type: none"> <li>Faulty IC regulator</li> </ul>	<p>Replace</p>

## CHARGING SYSTEM

## BATTERY

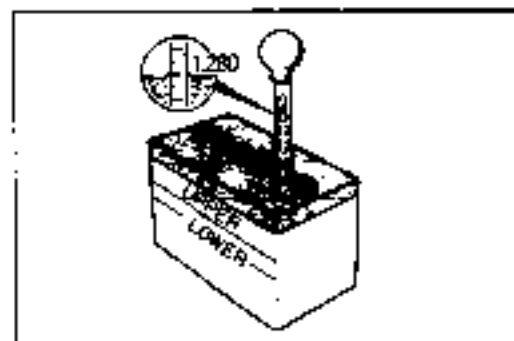
## Inspection

## Terminal and Cable

1. Check the tightness of the terminals to ensure good electrical connections. Clean the terminals and coat them with grease after tightening the terminal.
2. Inspect for corroded or frayed battery cables.
3. Check the rubber protector on the positive terminal for proper coverage.

**Tightening torque: 37—62 (3.8—5.3, 27—38) N·m (m·kg, ft·lb)**

9T33G1-005



9T33G1-006

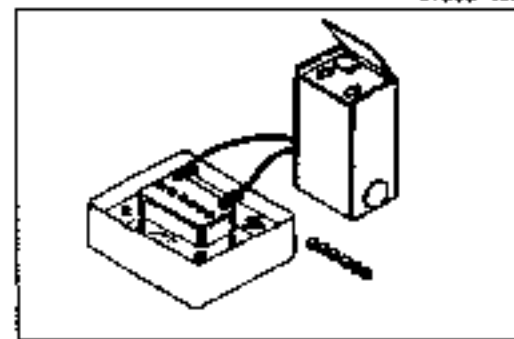
**Electrolyte Level**

1. Check that the electrolyte level lies between the upper and lower lines.
2. If low, add distilled water by the "UPPER LEVEL." Do not overfill.

**Specific Gravity**

1. Measure the specific gravity by using a hydrometer.
2. If the specific gravity reading is less than standard, recharge the battery.

**Standard specific gravity: 1.27—1.29 (20°C (68°F))**



9T33G1-007

**Charging**

1. Remove the battery cover and battery from the vehicle.
2. Remove all the vent caps.
3. Perform a charge.

**Standard Current**

Battery	Charging Electric Current (A)	Rapid Charging Electric Current (A)
55D26R	5—6	30
75D26R	6—7	30

4. Add distilled water if necessary while charging.
5. Cool the battery not to exceed the electrolyte temperature over 55°C (131°F) while charging.
6. Charge once more if the specific gravity is under fully charged gravity.

**Warning**

- When charging, keep fire away from the battery.
- When charging on vehicle, disconnect the battery cable.

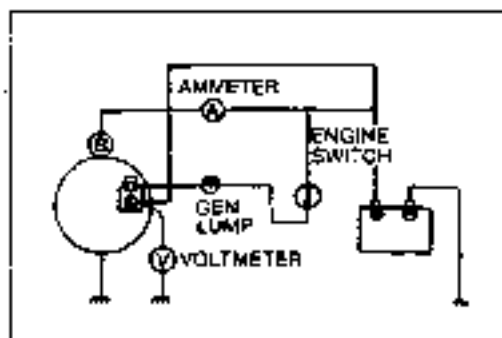
9T33G1-008

## ALTERNATOR

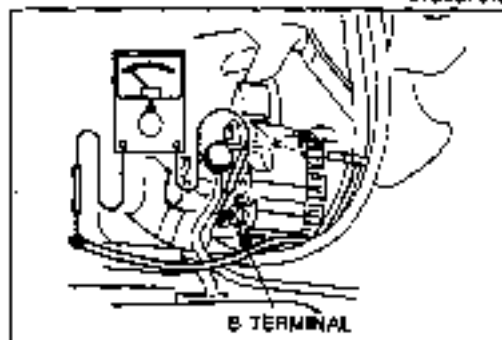
**Caution**

- Be sure the battery connections are not reversed, because this will damage the rectifier.
- Do not use high-voltage testers such as a megger, because they will damage the rectifier.
- Remember that battery voltage is always applied to the alternator B terminal.
- Do not ground the L terminal while the engine is running.
- Do not start the engine while the connector is disconnected from the L and S terminals.

9TG001-008



9TG001-010



9TG001-011

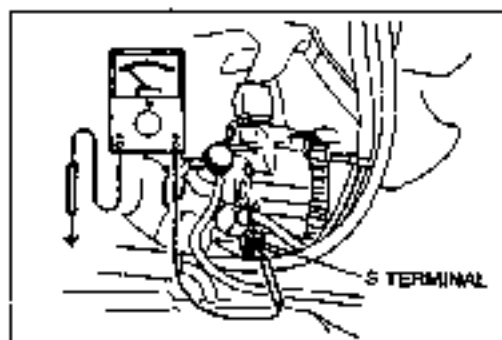
**Inspection (On-vehicle)****Checking no-load adjustment voltage**

1. Check to be sure that the battery is fully charged.
2. Connect an ammeter and a voltmeter as shown in the figure. Be sure that the voltmeter reading is 0V.
3. Turn the ignition key to ON, and then check to be sure that the voltmeter reading is significantly lower than the battery voltage (0.5–4V). If the voltmeter reading is the same as the battery voltage, there may be a malfunction in the alternator.
4. Short circuit the terminals of the ammeter, and then start the engine. After starting, discontinue the short circuiting.

**Caution**

- Be careful, when starting the motor, that the current of the starter doesn't flow to the ammeter.

5. Under no-load conditions, increase the alternator speed to 5,000 rpm (engine speed of 2,000–2,500 rpm).
6. Read the indication shown by the voltmeter and the ammeter.

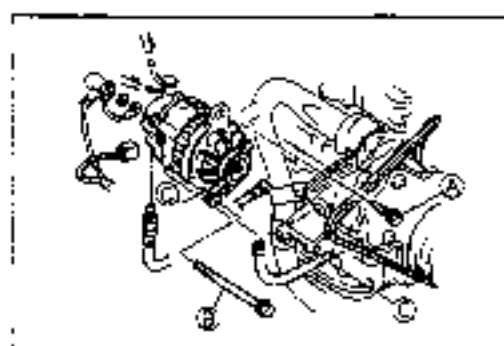
**Ammeter: 5A or less****Voltmeter (adjustment voltage):****14.4 ± 0.3V (at 20°C (68°F))**

9TG001-013

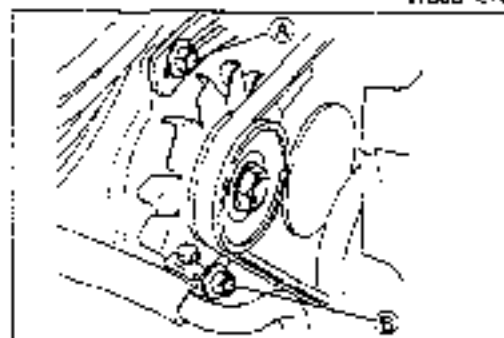
**CHECKING OUTPUT**

1. Disconnect the negative battery cable.
2. Connect an ammeter and a voltmeter as shown in the figure.
3. Connect the negative battery cable.
4. Start the engine.
5. Apply a load by turning on the headlights.
6. Gradually increase the engine speed, and read the output current.

If the voltage is higher than the battery voltage and there is an output current, there is no problem.



9T369-014



9T503-015

### Removal / Installation

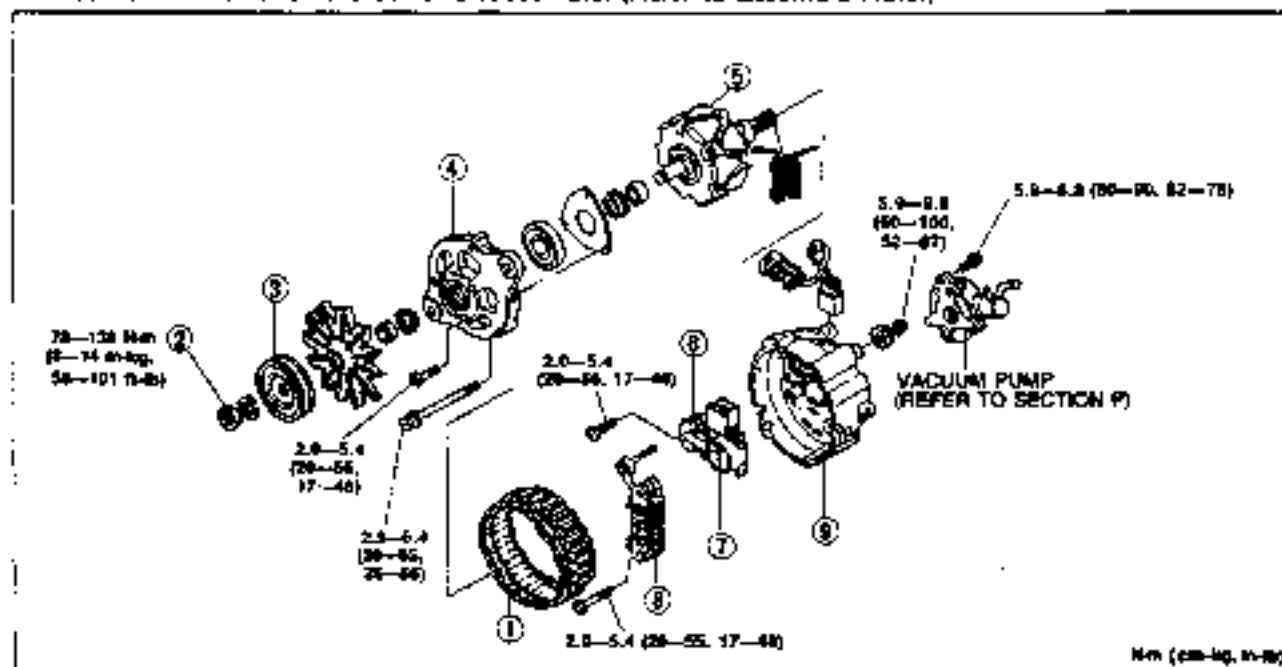
1. Disconnect the negative battery terminal.
2. Disconnect the alternator wiring (B terminal and LS connector).
3. Remove the bolt (A).
4. Remove the drive belt.
5. Disconnect the vacuum hose and oil hose.
6. Remove the bolt (B).
7. Remove the alternator.
8. Install in the reverse of removal.
9. Adjust the tension of drive belt. (Refer to page G-10.)
10. Tighten the bolt (A) and bolt (B).

### Tightening torque:

- Bolt (A)**  
19—25 N·m (1.9—2.6 m·kg, 14—19 ft·lb)
- Bolt (B)**  
37—52 N·m (3.8—5.3 m·kg, 27—38 ft·lb)

### Disassembly / Assembly

1. Disassemble in the numbered order shown in the figure. (Refer to disassemble Note.)
2. Assemble in the reverse order of disassemble. (Refer to assemble Note.)



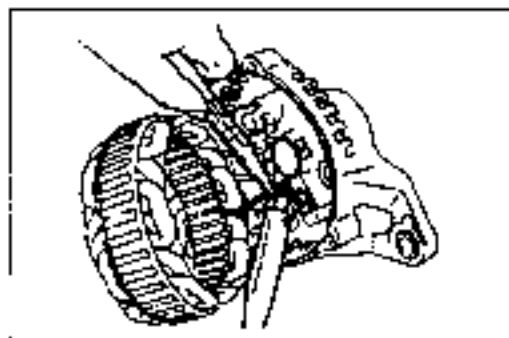
9T503X-004

1. Stator Inspection.....	page G- 8	6. Regulator Disassemble Note .....	page G- 8
2. Nut set		Assemble Note.....	page G- 8
3. Pulley		7. Brushes Inspection.....	page G- 9
4. Front bracket		8. Rectifier Inspection.....	page G- 9
5. Rotor Inspection.....	page G- 8	9. Rear bracket	



# G

## CHARGING SYSTEM



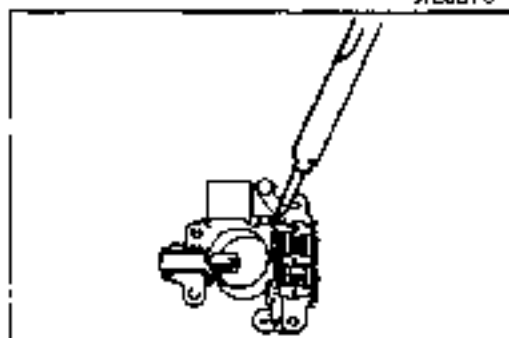
9TGG1 017

### Disassemble note / Assemble note

1. Use a soldering iron to disconnect the stator lead wiring.

### Caution

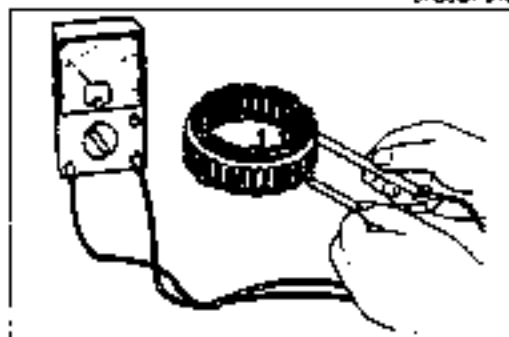
- Do the disconnecting quickly, using the soldering iron no more than about 5 seconds, because the rectifier may become damaged if the inside is overheated.



9TGG1 018

### Brush Holder and IC Regulator Assembly

1. Use a soldering iron to disconnect the brush holder and IC regulator assembly from the rectifier.



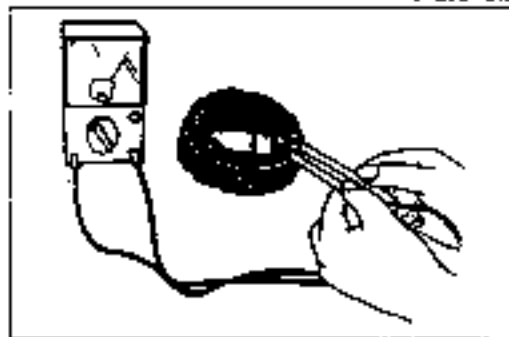
9TGG1 019

### Inspection

Inspect the following parts, and repair or replace if a problem is found.

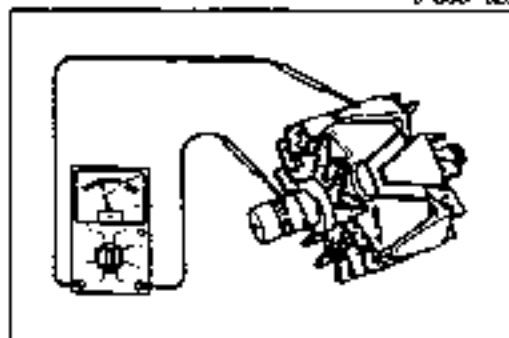
### Stator

1. Use a circuit tester to check for continuity between the core and each lead wire.  
No-continuity is the normal condition.



9TGG1 020

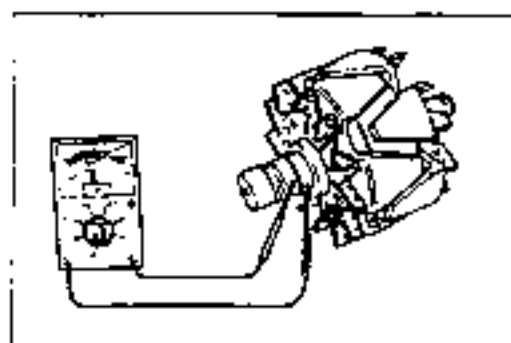
2. Use a circuit tester to check for continuity between lead wires.  
Continuity is the normal condition.



9TGG1 021

### Rotor

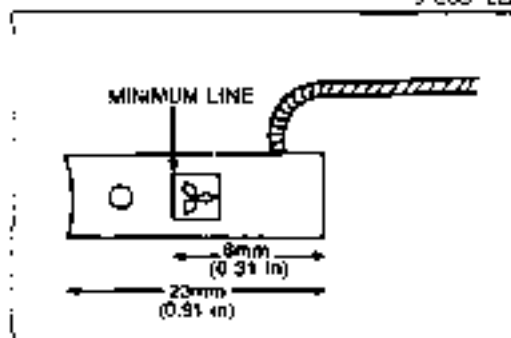
1. Use a circuit tester to check for continuity between the core and each slip ring.  
No-continuity is the normal condition.



87G06-C22

- Use an ohmmeter to check the resistance between each slip rings.

**Resistance: 2.5—3.5Ω (20°C (68°F))**

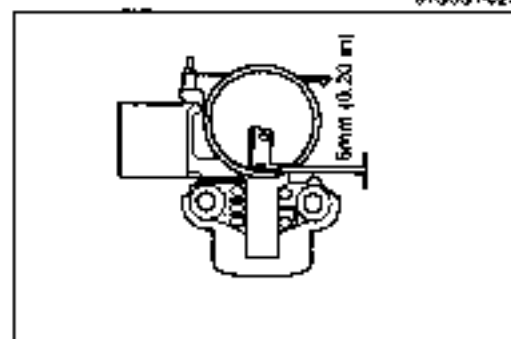


87G061-023

### Brushes

- If the brushes are worn almost to or beyond the limit, replace them.

**Minimum: 8mm (0.31 in)**

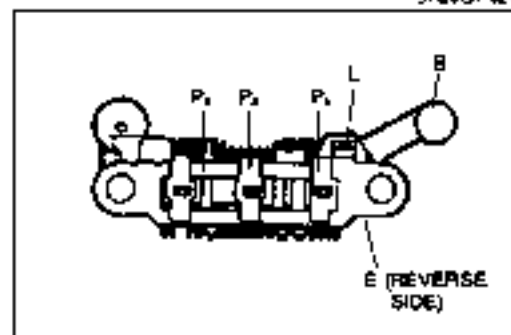


87G061-024

- When install new brush, pull lead wire to pull brush into approx. 5mm (0.2 in) holder and install with soldering iron.

### Caution

- Replace both brushes in the same time.

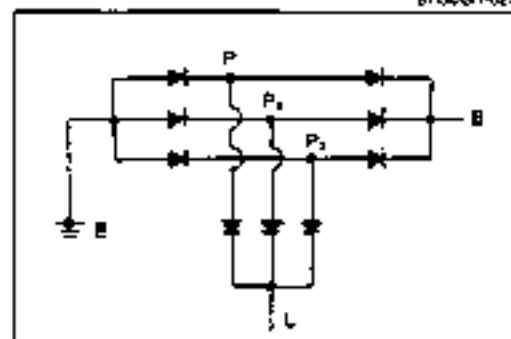


87G061-025

### Rectifier

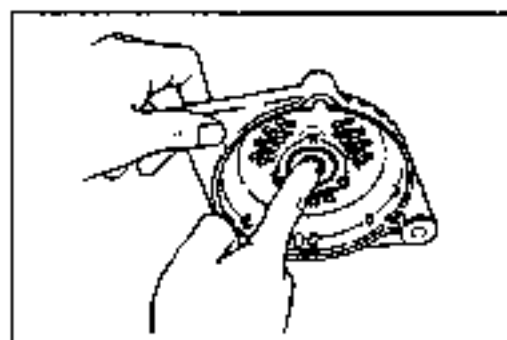
- Check for continuity of the diodes by using an ohmmeter.

Negative terminal	Positive terminal	Continuity
E	P1, P2, P3	Yes
B		No
L		No
P1, P2, P3	E	No
	B	Yes
	L	Yes



87G061-026

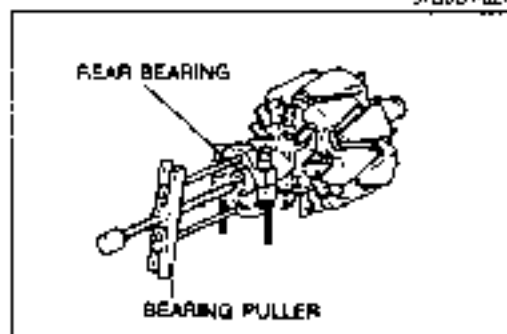
- Replace the rectifier.



9T3037-027

**Front bearing**

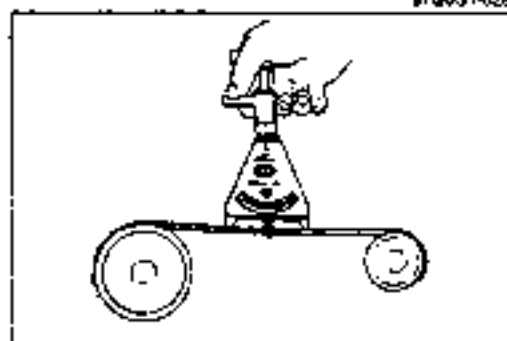
1. Check the bearing for improper rotation and/or abnormal noise.  
Replace if necessary.



9T3037-028

**Rear bearing**

1. Check the bearing for improper rotation and/or abnormal noise.  
Replace if necessary.



9T3037-025

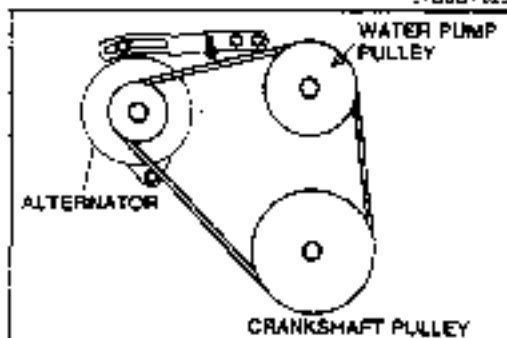
**DRIVE BELT****Inspection**

1. Visually check for wear, damage and injury on connection between belt and pulley or damage on pulley.  
Replace if necessary.
2. Check the drive belt tension with tension gauge.

**Tension**

(N (kg, lb))

Engine type	HA	SL	SL (4WD)	TF
Used one	245-294 (25-30, 55-66)	343-382 (35-40, 77-86)	373-471 (38-48, 93-106)	383-520 (39-53, 86-117)
New one	294-352 (30-40, 66-98)	392-491 (40-50, 88-110)	471-568 (48-60, 110-128)	451-520 (46-62, 101-117)



9T3037-030

3. Check the drive belt deflection by applying moderate pressure (10 kg load) midway between the pulleys.

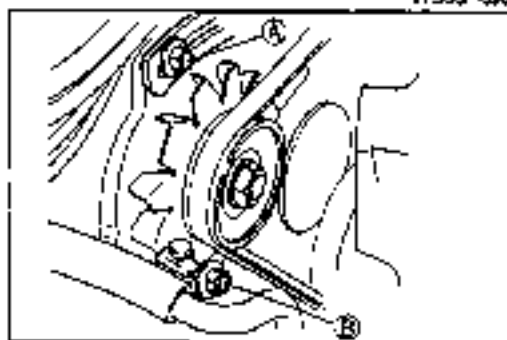
**Deflection**

- Used one:** 10-11mm (0.39-0.43 in)  
 14-16mm (0.55-0.63 in) (SL 4WD)  
 11-12mm (0.43-0.49 in) (TF engine)
- New One:** 9-10mm (0.35-0.39 in)  
 12-14mm (0.47-0.55 in) (SL 4WD)  
 10-11mm (0.39-0.43 in) (TF engine)

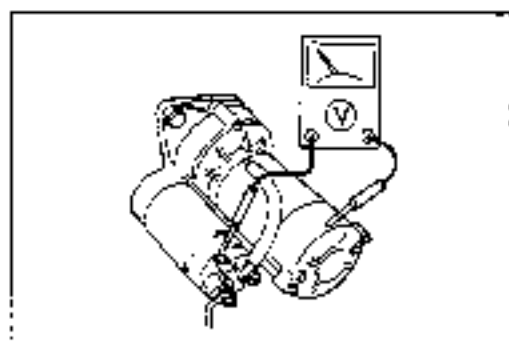
**Adjustment**

1. Loosen bolts A and B.
2. Move the alternator in or out to adjust the belt deflection.  
(Refer to inspection part.)
3. Tighten bolts A and B to the specified torque.

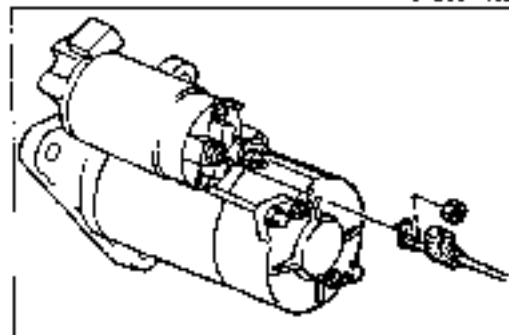
**Torque:** (A) 19-25 Nm (1.9-2.6 m·kg, 14-19 ft·lb)  
 (B) 37-52 Nm (3.8-5.3 m·kg, 27-38 ft·lb)



9T3037-031



9T0061-032



9T0031-038

**STARTER****STARTER****Inspection (On-vehicle)**

1. Use a fully charged battery.
2. Turn the engine switch to the start position.
3. Check that the starter operates smoothly.
4. If the starter does not operate, check the voltage between S terminal and ground by using a voltmeter.
5. If the voltage is 8V or more, the starter is malfunctioning.
6. If less than 8V, the wiring harness is malfunctioning.

**Removal / Installation**

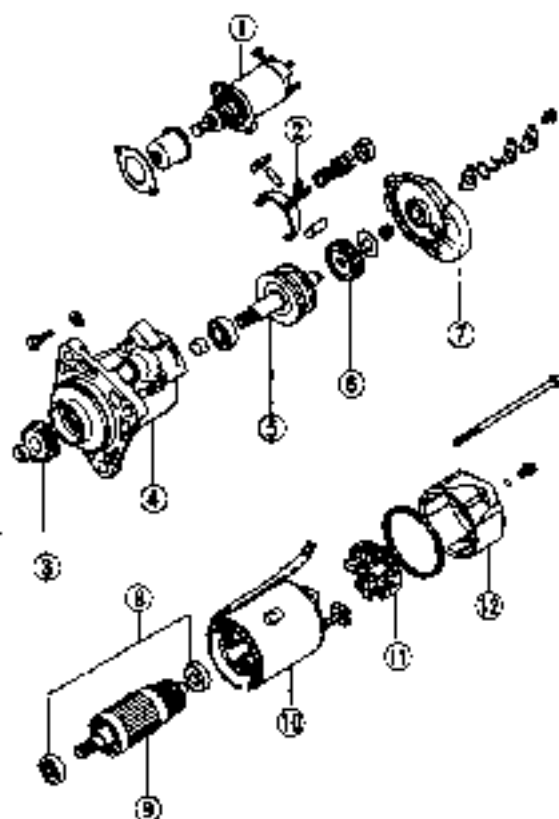
1. Disconnect the negative battery cable.
2. Disconnect the wiring from the starter.
3. Remove the starter bolts.
4. Draw out the starter from lower side of the vehicle.
5. Install in the reverse order of removal.

**Tightening torque:**

**64—89 N·m (8.5—9.1 m·kg, 47—65 ft·lb)**

**Disassembly / Assembly**

1. Disassemble in the order shown in the figure.
2. Assembly is in the reverse order of disassembly.



BT7031-005

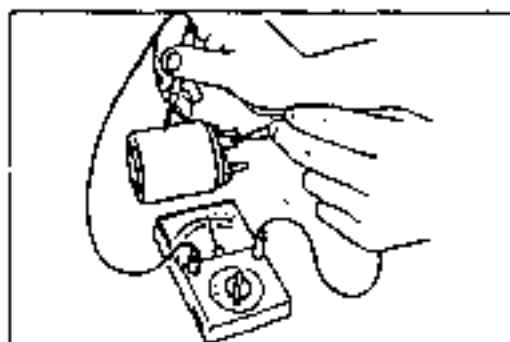
- |  |   |  |
|--|---|--|
| 1. Magnetic switch<br>Inspection ..... page G-12 | 7. Center bracket   | 11. Brushes and brush holder<br>Inspection ..... page G-16<br>Replacing<br>(brush) ..... page G-17 |
| 2. Lever   | 8. Bearing  |  |
| 3. Pinion gear                                   | 9. Armature<br>Inspection ..... page G-13   |  |
| 4. Front bracket                                 | 10. Yoke (field coil)<br>Inspection ..... page G-16<br>Replacing<br>(brush) ..... page G-17 |  |
| 5. Overrunning clutch                            |   |  |
| 6. Driving gear                                  |   | 12. Rear bracket   |



BT3031-036

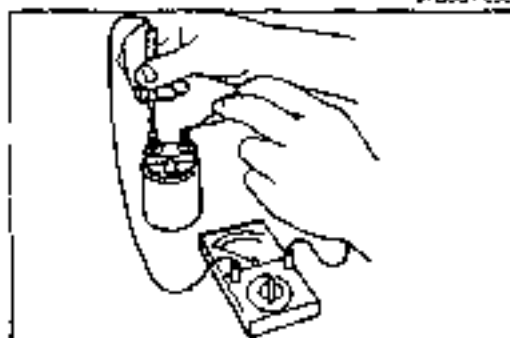
**Magnetic Switch**

1. Verify that there is continuity between ⑤ and ⑪ terminal by using a circuit tester.  
Replace if necessary.



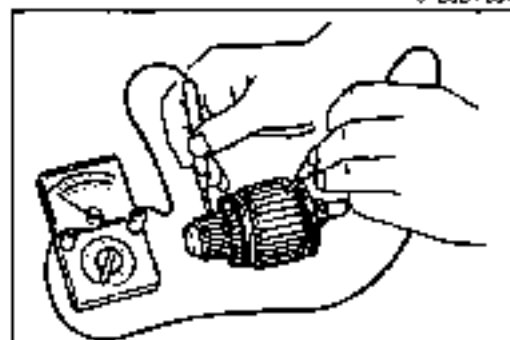
9T00G1-036

2. Check for continuity between the  $\text{Ⓢ}$  terminal and the body with a circuit tester. Replace the magnetic switch if there is no continuity.



8T30G1-037

3. Check for continuity between the  $\text{Ⓜ}$  and  $\text{Ⓢ}$  terminals. Replace the magnetic switch if there is continuity.

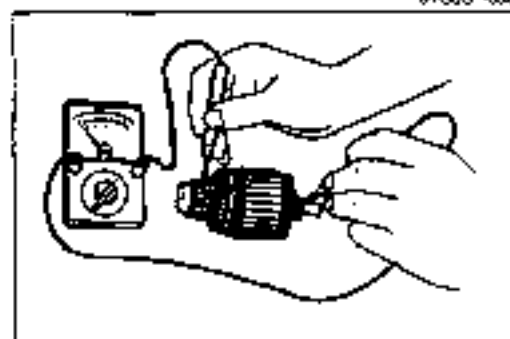


8T60G1-038

#### Armature

1. Ground of armature coil

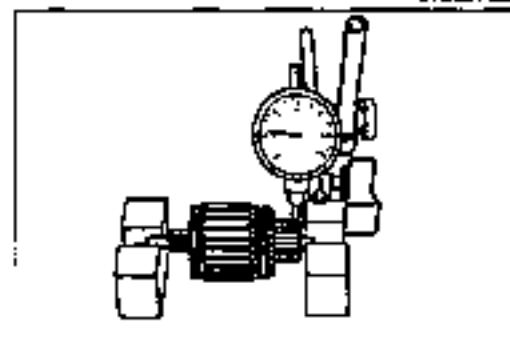
Check for continuity between the commutator and the core with a circuit tester. Replace the armature if there is continuity.



9T00G1-039

2. Insulation of armature coil

Check for continuity between the commutator and the shaft with a circuit tester. Replace the armature if there is continuity.



8T60G1-040

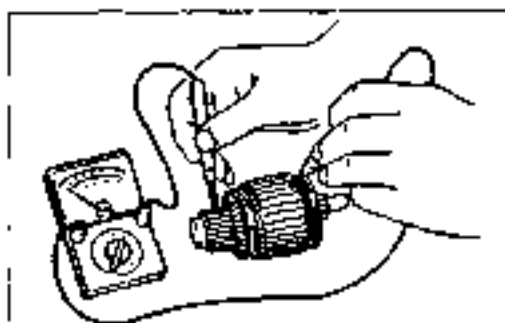
3. Vibration of the commutator

- (1) Place the armature on V blocks, and measure the vibration by using a dial gauge
- (2) If the vibration is at limit or more, repair with a lathe so that it becomes standard or replace the armature.

Standard vibration	mm (in)	0.05 (0.002)
Limit	mm (in)	0.1 (0.004)

#### Note

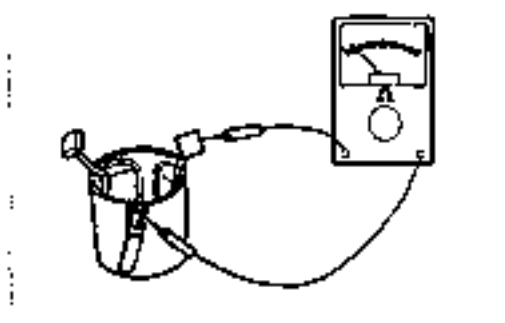
- Before checking, be sure that there is no play in the bearings.



9T5G01-041

4. Check the segment groove depth. If the depth of the mold between segments is limit depth or less, undercut the grooves by standard depth.

**Standard depth: 0.5—0.8mm (0.020—0.031 in)**  
**Limit depth: 0.2mm (0.008 in)**

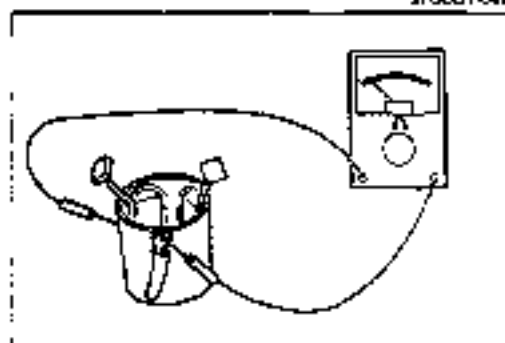


9T5G01-042

#### Field Coil

##### 1 Wiring damage

- (1) Check for continuity between the connector and brushes by using a circuit tester.
- (2) Replace the yoke assembly if there is no continuity.



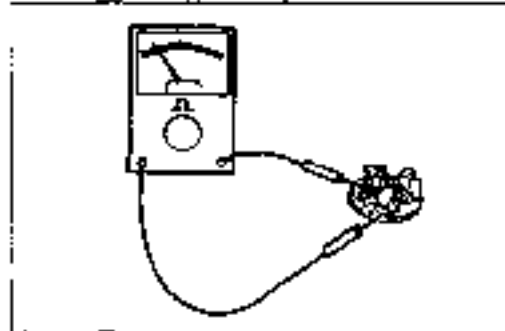
9T5G01-043

##### 2 Ground of the field coil

- (1) Check for continuity between the connector and yoke by using a circuit tester.
- (2) Repair or replace the yoke assembly if there is continuity.

##### 3 Installation of the field coil

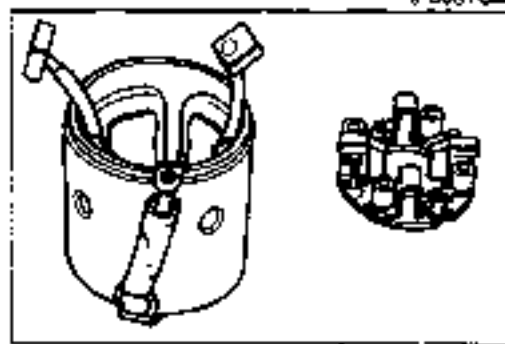
- Replace the yoke assembly if the field coil is loose.



9T5G01-044

#### Brushes and Brush Holder

1. Check for continuity between the insulated brush and the plate with a circuit tester. Replace the brush holder if there is continuity.



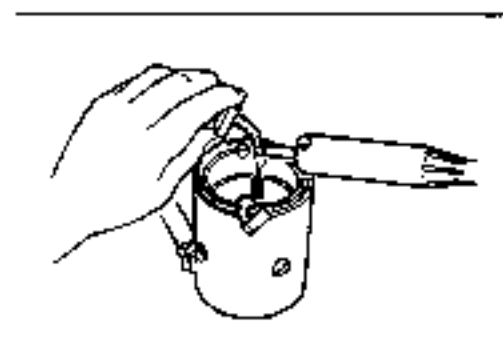
9T5G01-045

2. If the brushes are worn beyond the wear limit or if the wear is near the limit, replace the brushes.

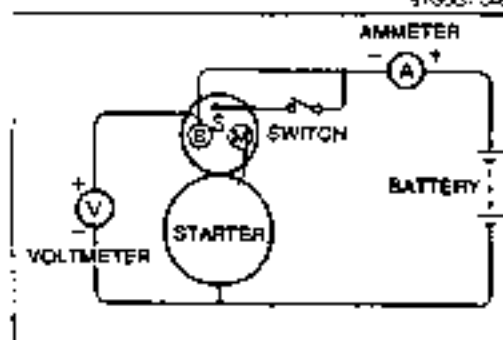
**Limit of brush: 11mm (0.43 in)**

#### Note

- New one: 18mm (0.71 in)



STG031-046



STG031-047

**Replacing Brush****Brush holder**

1. When replacing the brush, replace the whole holder assembly.

**Yoke**

1. Cut off the root of brush wire on yoke.
2. Solder a new brush around the cut part of the wire

**No-load Test**

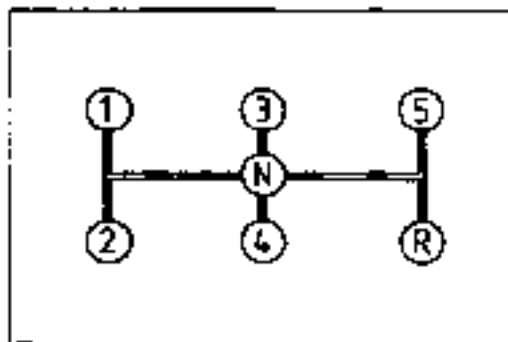
1. Connect the starter and the battery as shown in the figure.
2. If the conditions below are met when the starter is operated, the starter is functioning properly.

Output (KW)	2.7
Terminal voltage (V)	11
Electric current (A)	Less than 120
Rotating speed (rpm)	More than 4,000

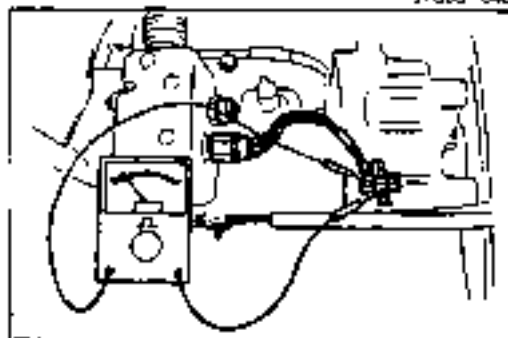


# G

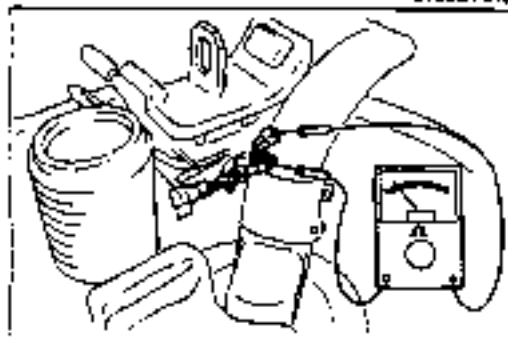
## STARTER



97G03-04E



97G03-04F



97G03-05G

### SUB-STARTER SYSTEM

#### Installation Starting System

1. Place the transmission in neutral and turn the engine switch ON.
2. Depress the sub-starter switch and verify that the engine starts.
3. If the engine does not start, check the neutral switch, sub-starter switch, and wire harness.

#### Inspection

##### Neutral switch

1. Disconnect the neutral switch connector.
2. Check continuity between terminals A and B

Transmission	Continuity
Neutral	Yes
In gear	No

##### Sub-starter switch

1. Disconnect the sub-starter switch connector.
2. Check continuity between terminals of the switch.

Sub-starter switch	Continuity
ON	Yes
OFF	No

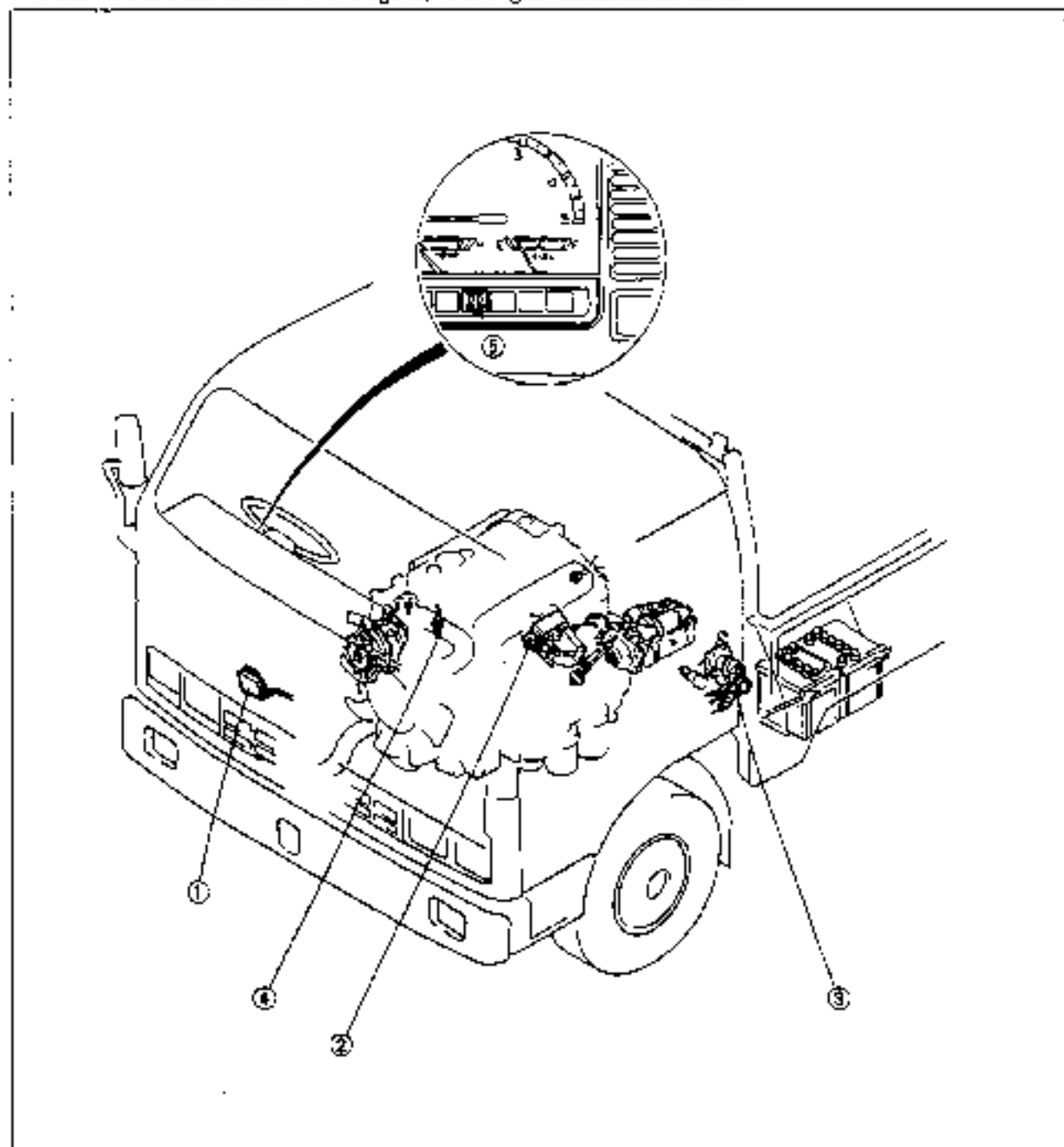
## AIR HEATER SYSTEM

## STRUCTURAL VIEW

## Removal / Installation

1. Remove in the order shown in the figure

Install in the order shown in the figure, referring to **Installation Note**.



1. Air heater control unit

Inspection ..... page G-21

2. Air heater

Inspection ..... page G-22

Installation Note ..... page G-20

3. Air heater relay

Inspection ..... page G-22

4. Water thermosensor

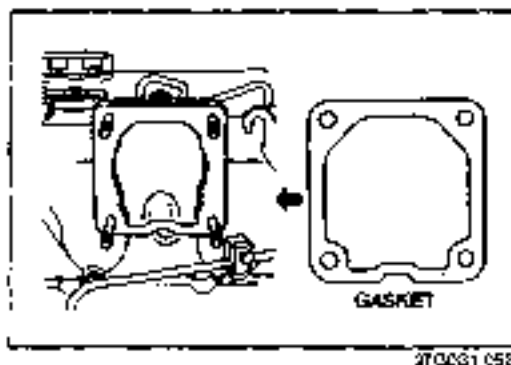
Inspection ..... page G-23

5. Glow indicator

Inspection ..... page G-23

BTFCGz.000

## AIR HEATER SYSTEM



270031-052

## Installation note

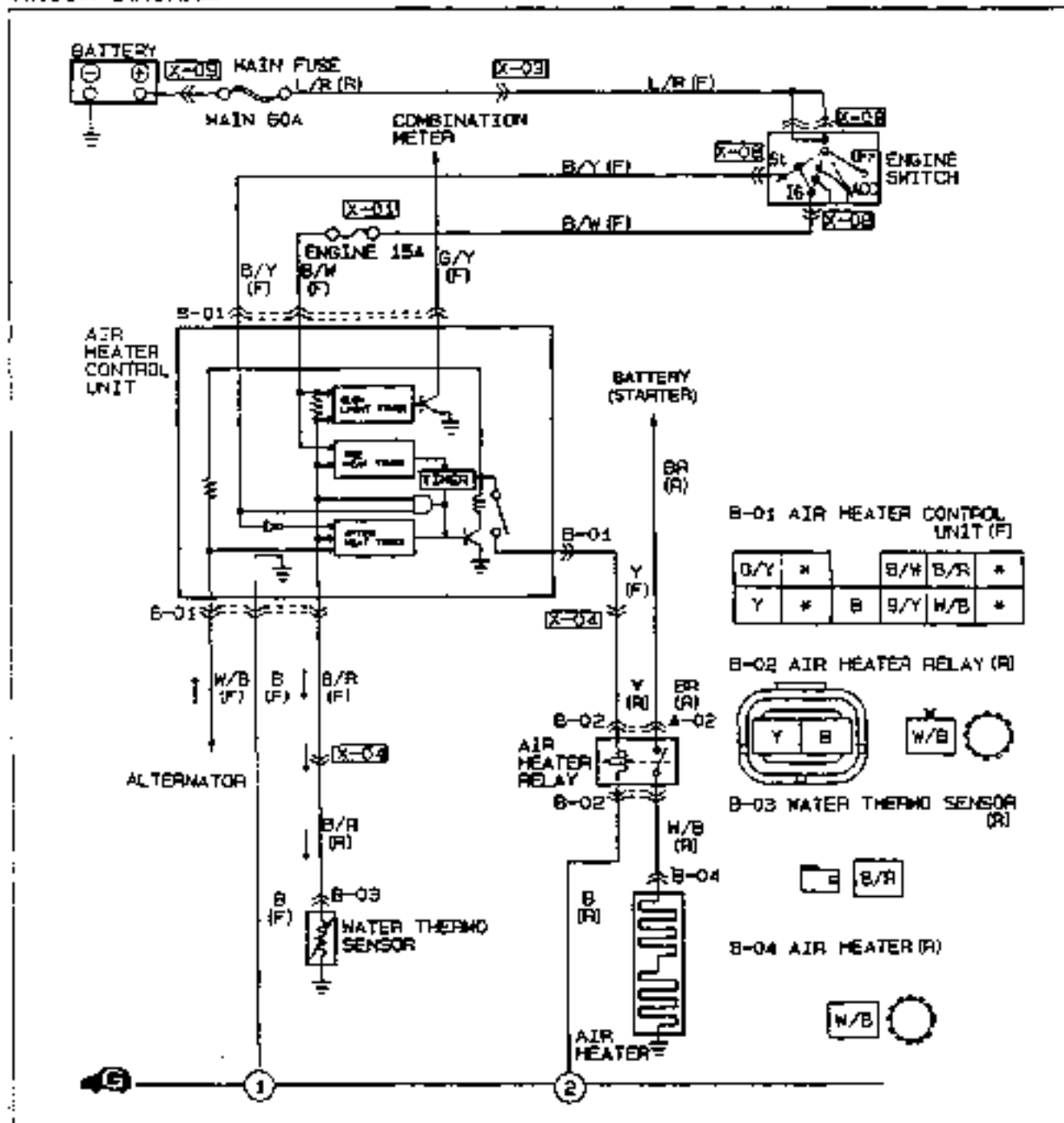
## Air heater

1. Replace the gaskets on both side of the air heater with new ones.

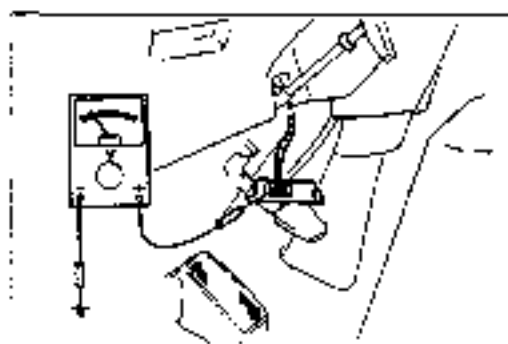
## Caution

- Install the gaskets in the direction shown in the figure.

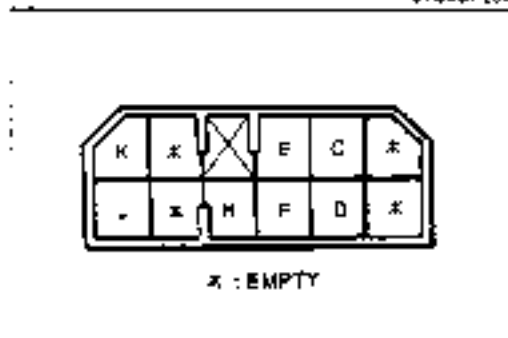
## CIRCUIT DIAGRAM



270031-053



9T0001-054



9T0001-055

**AIR HEATER CONTROL UNIT****Inspection**

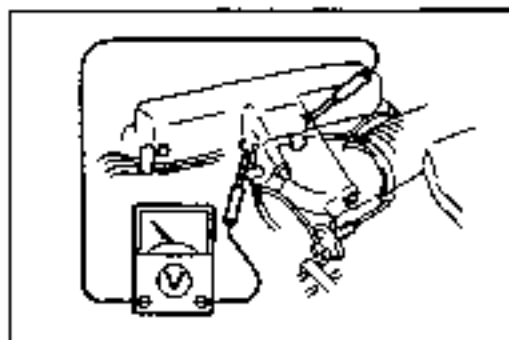
1. Remove control unit.
2. Measure the voltage at each terminal of the control unit.
3. If there is a problem, check and repair or replace the device connected to the terminal. If there is no problem on the devices, replace the control unit.

Terminal	Connection to	Test condition		Voltage (V)
C	Water thermosensor	Engine switch ON	Coolant temperature approx. 20°C (68°F)	3—4
			Coolant temperature approx. 80°C (176°F)	2—3
D	Alternator	Engine switch ON		0
		Engine running		Approx. 12
E	Engine switch (IG1)	Engine switch ON or ST		Approx. 12
		Engine switch ACC or OFF		0
F	Engine switch (S)	Engine switch ST		Approx. 12
		Engine switch ON, ACC or OFF		0
H	Ground	Always		0
K	Glow indicator lamp	Coolant temperature less than 20°C (68°F) <sup>*1</sup>	Engine SW ON for approx. 2 seconds <sup>*2</sup>	0
			Engine SW ON after approx. 2 seconds <sup>*2</sup>	Approx. 12
L	Air heater relay	Coolant temperature less than 20°C (68°F) <sup>*2</sup>	Engine SW ON for approx. 7 seconds <sup>*2</sup>	Approx. 12
			Engine SW ON <sup>*2</sup>	Approx. 12
			Engine switch on for 60 sec. after cranking. <sup>*3</sup>	Approx. 12
		Anything else	0	

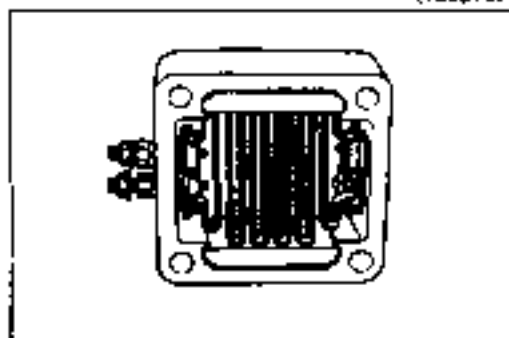
9T0001-056

**Note**

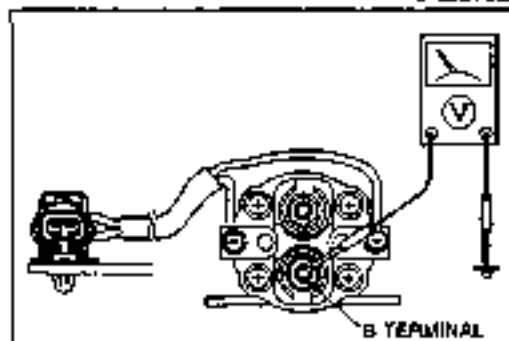
- <sup>\*1</sup> When the temperature of the engine coolant is more than 20°C (68°F), disconnect the water thermosensor connector, and connect approx. 600Ω resistance to the vehicle harness.
- <sup>\*2</sup> Times shown are based on engine coolant approx. 20°C (68°F).



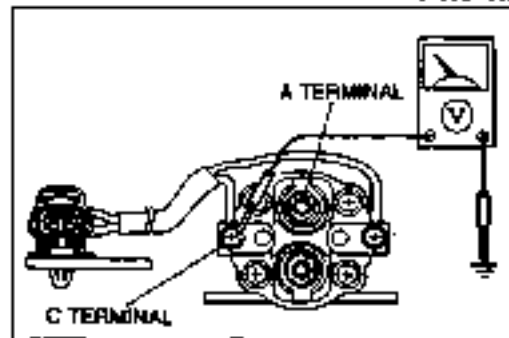
8T0001-057



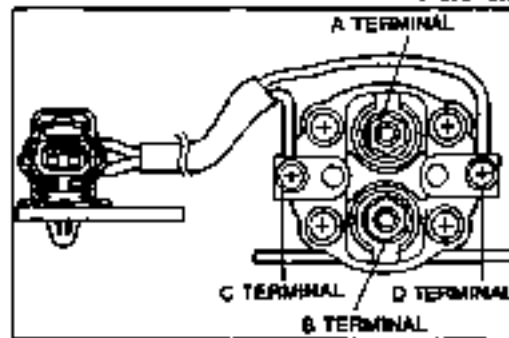
9T0001-058



9T0001-059



9T0001-060



8T0001-061

**AIR HEATER****Inspection**

1. Disconnect the air heater connector.
2. Measure the resistance between the terminals.

**Resistance**

Terminal	Resistance ( $\Omega$ )
A - B	0.053-0.064

3. Remove the air heater, and check for contamination of the heating element.
4. If necessary, wash with water.

**Caution**

- After washing with water, dry with compressed air.

**AIR HEATER RELAY****Inspection****Voltage inspection**

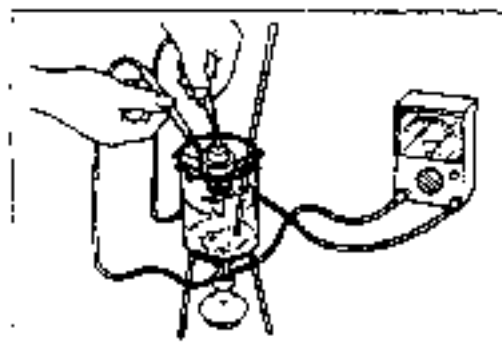
1. Check the engine coolant temperature.
2. If the temperature is more than 20°C (68°F), cut the connector of water thermosensor and connect a resistance (6000) to the wiring harness.
3. Check the voltage of the relay B terminal with circuit tester.

**Standard voltage: Approx. 12V**

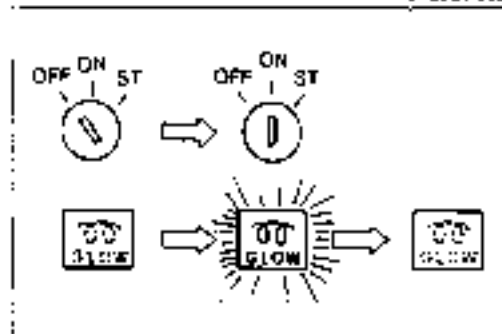
4. Be sure the voltage of the relay A terminal is approx. 12V for 7 seconds after engine switch is ON.
5. If not as specified, be sure the voltage of the relay C terminal is approx. 12V for 7 seconds after engine switch is ON.
6. If as specified, perform the resistance inspection as follows. If not as specified, check the air heater control unit.
7. Connect the water thermosensor.

**Resistance inspection**

1. Disconnect the negative battery terminal.
2. Remove the air heater relay.
3. Verify that there is continuity between the C (wiring color is white) and D (wiring color is black) terminal.
4. Verify that there is continuity between A and B terminal, when apply the battery voltage between C and D terminal.
5. If not as specified, replace the relay.



9TQ061-062



9TQ031-060

**WATER THERMOSENSOR****Inspection**

1. Remove the water thermosensor
2. Place the thermosensor in water with a thermometer and heat the water gradually
3. Measure the resistance as shown

**Standard resistance**

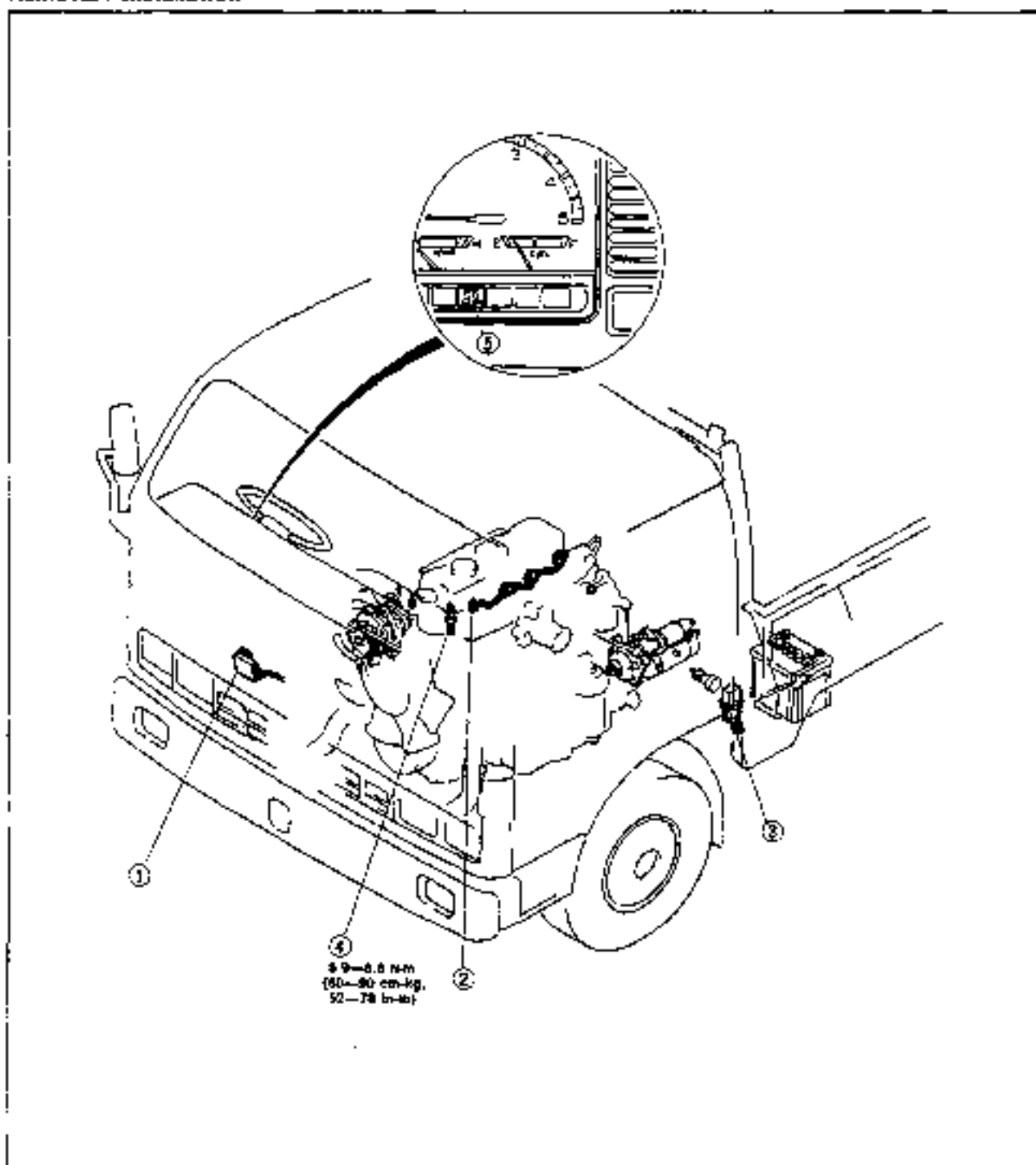
Water temperature (°C (°F))	Resistance (Ω)
0 (32)	∞
40 (104)	207-255
80 (176)	45.5-55.2
100 (212)	25.2-30.6

**GLOW INDICATOR LAMP****Inspection**

1. Turn the engine switch ON and verify that the GLOW indicator flashes for a few seconds.

## QUICK START SYSTEM (QSS)

STRUCTURAL VIEW  
Removal / Installation

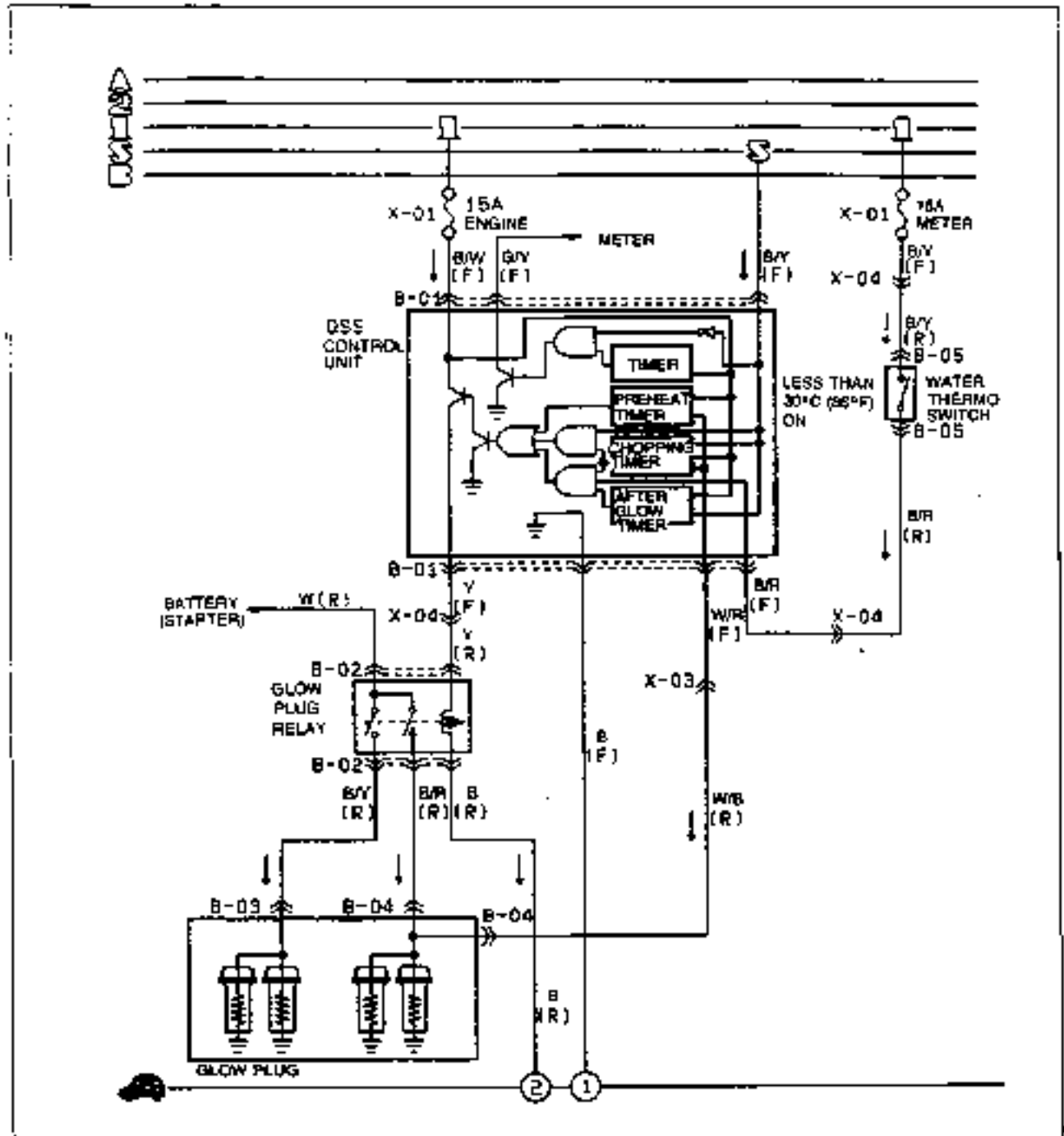


5TF025-007

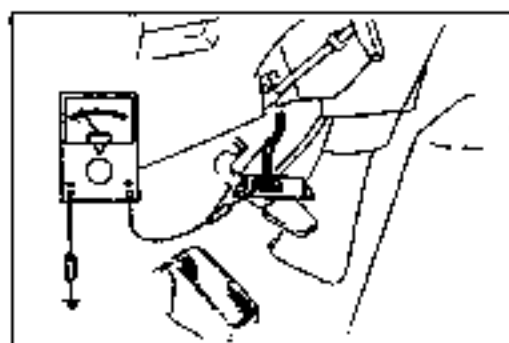
- 1. QSS control unit  
Inspection..... page G-25
- 2. Glow plug  
Inspection..... page G-26
- 3. Glow plug relay  
Inspection..... page G-27

- 4. Water thermostat sensor  
Inspection..... page G-27
- 5. Glow indicator lamp  
Inspection..... page G-27

CIRCUIT DIAGRAM



97G05-055



97G05-1-066

**QSS CONTROL UNIT**

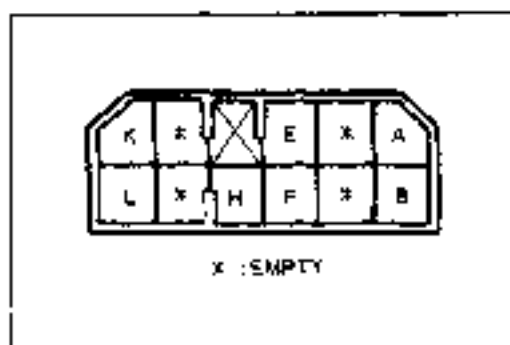
**Inspection**

1. Remove the QSS control unit.
2. Measure the voltage at each terminal of the control unit.



# G

## QUICK START SYSTEM (QSS)



9T50G1-067

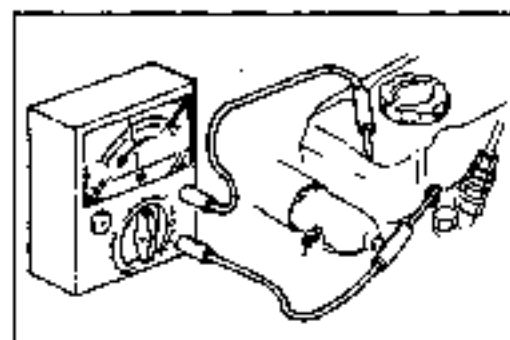
- If there is a problem, check and repair or replace the device connected to the terminal. If there is no problem on the devices replace the control unit.

Terminal	Connection to	Test condition	Voltage (V)
A	Water thermostat	Engine switch ON	Approx. 12
			0
B	Glow plug	Engine switch ON for approx. 6 sec.	Approx. 12
		Engine switch ON after approx. 6 sec.	0
		Cranking	Approx. 12→0
		After cranking, for approx. 15 sec. coolant temperature is less than 30°C (88°F)	Approx. 12→0
E	Engine switch	Engine switch ON or ST	Approx. 12
		Engine switch ACC or OFF	0
F	Engine switch	Engine switch ST	Approx. 12
		Engine switch ON, ACC or OFF	0
H	Ground	Constant	0
K	Glow indicator lamp	After Engine switch ON for approx. 3 sec.	0
		Engine switch ON, after approx. 3 sec.	Approx. 12
I	Glow plug relay	After engine switch ON, for approx. 6 sec.	Approx. 12
		The engine switch ON, after approx. 6 sec.	0
		Cranking	Approx. 12→0
		After cranking, for approx. 15 sec. coolant temperature is less than 30°C (88°F)	Approx. 12→0

9T50G1-068

### Note

\*12→0V: Indicates voltage fluctuates between 12V and 0V.



9T50G1-069

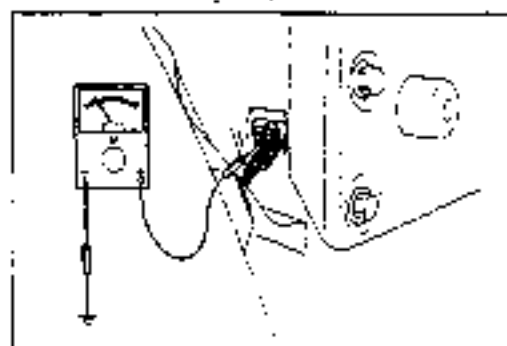
### GLOW PLUG

#### Inspection

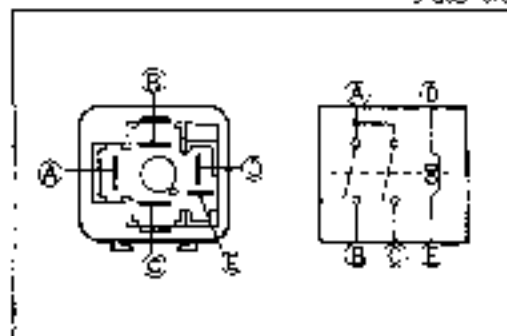
- Disconnect the glow plug connector.
- Measure resistance between the glow plug positive terminal and the cylinder head.

**Resistance: Approx. 0.1Ω (20°C (68°F))**

- Reconnect the glow plug connector.



9T50G1-070



9T00G1-071

**GLOW PLUG RELAY**

**Inspection**

**Voltage**

1. Remove the glow plug relay
2. Check terminal voltage from the back of the relay connector.

Terminal	Test condition	Voltage (V)
A	Constant	Approx. 12
B	For approx. 6 sec. after engine switch ON.	Approx. 12
	More than approx. 6 sec. after engine switch ON	0
C	Cranking	Approx. 12-0
D	For approx. 15 sec. after cranking when the coolant temperature is less than 30°C (86°F)	Approx. 12-0
E	Always	0

**Note**

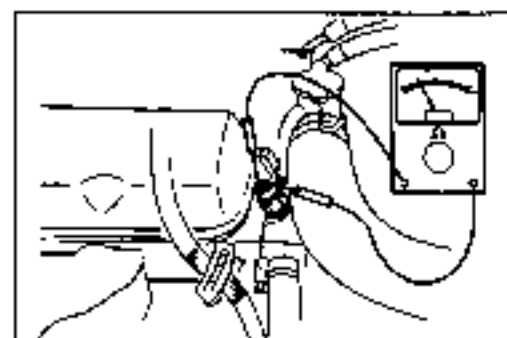
- 12-0V: Indicates voltage fluctuates between 12V and 0V.

**Operation**

1. Disconnect the negative battery terminal.
2. Remove the glow plug relay.
3. Measure resistance between terminals D and E

**Resistance: Approx. 13Ω**

4. Apply 12V between terminals D and E, and verify that there are continuity between terminals A and B, and A and C.



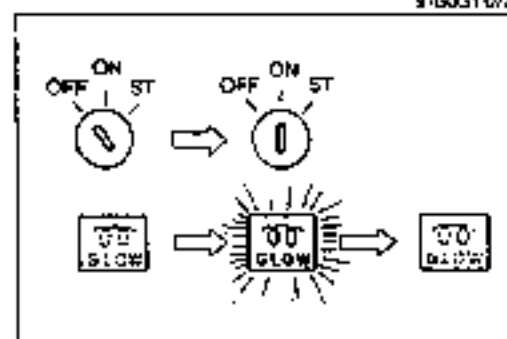
9T60G1-072

**WATER THERMOSENSOR**

**Inspection**

1. Disconnect the thermostat sensor connector.
2. Check continuity between the terminals.

Coolant temp	Continuity
Less than 30°C (86°F)	Yes
More than 30°C (86°F)	No



9T60G1-074

**GLOW INDICATOR LAMP**

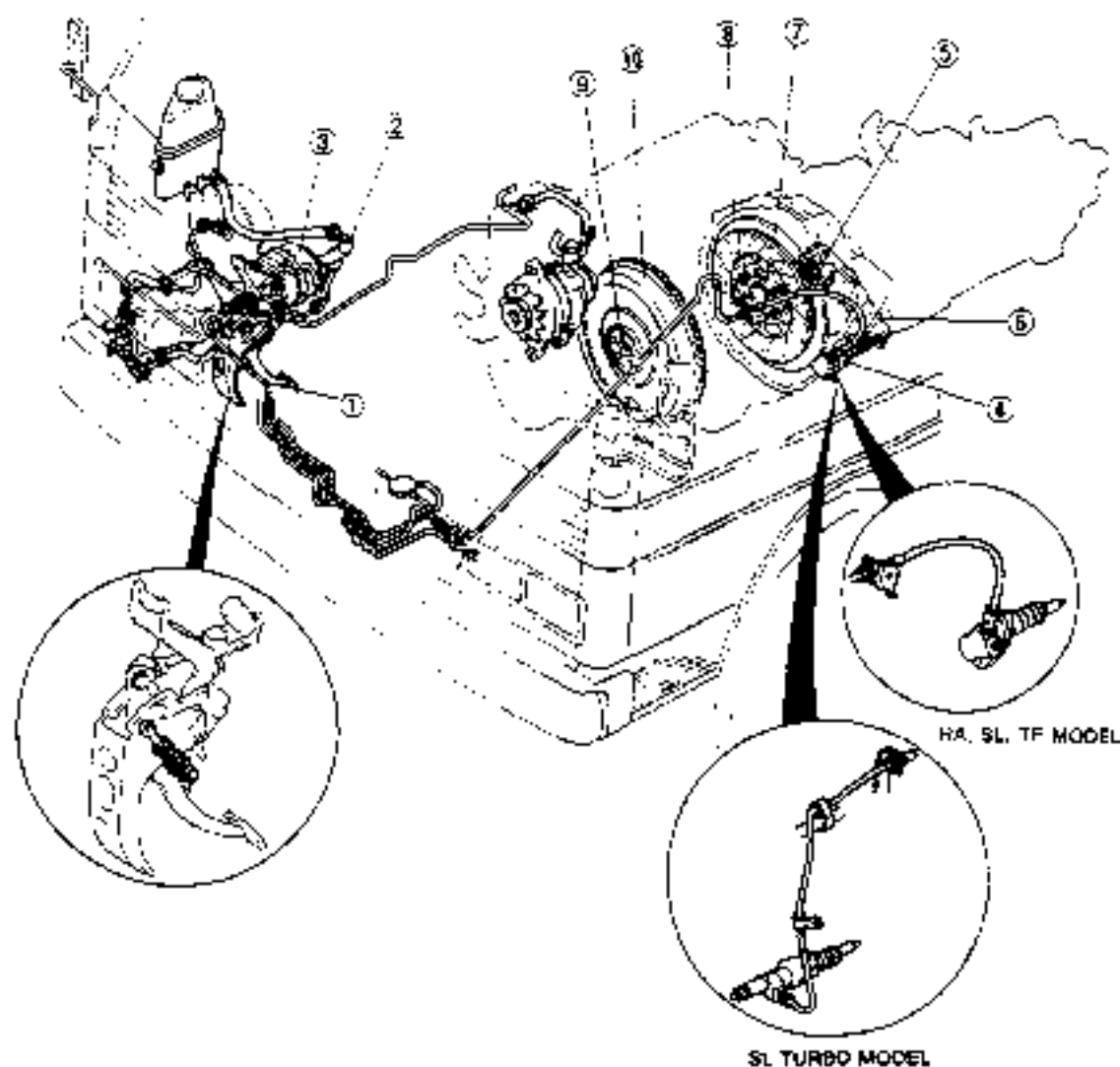
**Inspection**

1. When the engine switch ON, verify that the GLOW indicator lamp flashes for a few seconds.

# CLUTCH

<b>INDEX</b> .....	H- 2
<b>OUTLINE</b> .....	H- 3
SPECIFICATIONS.....	H- 3
<b>TROUBLESHOOTING GUIDE</b> .....	H- 3
<b>CLUTCH FLUID</b> .....	H- 4
PREPARATION.....	H- 4
REPLACEMENT.....	H- 4
<b>CLUTCH PEDAL</b> .....	H- 5
ADJUSTMENT.....	H- 5
REMOVAL / INSPECTION / INSTALLATION ..	H- 6
<b>CLUTCH MASTER CYLINDER</b> .....	H- 8
PREPARATION.....	H- 8
REMOVAL / INSPECTION / INSTALLATION ..	H- 8
AIR BLEEDING.....	H-10
OVERHAUL.....	H-11
<b>VACUUM POWER ASSIST</b> .....	H-13
INSPECTION.....	H-13
REMOVAL / INSPECTION / INSTALLATION ..	H-14
<b>CLUTCH RELEASE CYLINDER</b> .....	H-15
PREPARATION.....	H-15
REMOVAL / INSTALLATION.....	H-15
AIR BLEEDING (REFER TO PAGE H-10)	
OVERHAUL.....	H-16
<b>CLUTCH UNIT</b> .....	H-17
PREPARATION.....	H-17
REMOVAL / INSTALLATION.....	H-18
<b>RELEASE BEARING</b> .....	H-21
INSPECTION.....	H-21
<b>CLUTCH COVER</b> .....	H-21
INSPECTION.....	H-21
<b>CLUTCH DISC</b> .....	H-21
INSPECTION.....	H-21
<b>PILOT BEARING</b> .....	H-22
INSPECTION.....	H-22
<b>FLYWHEEL</b> .....	H-22
INSPECTION.....	H-22

## INDEX



9TQB-XJ001

- |                              |           |
|------------------------------|-----------|
| 1. Clutch pedal              |           |
| Adjustment.....              | page H- 5 |
| Removal / Inspection /       |           |
| Installation .....           | page H- 6 |
| 2. Clutch master cylinder    |           |
| Removal / Inspection /       |           |
| Installation .....           | page H- 8 |
| Air bleeding.....            | page H-10 |
| Overhaul.....                | page H-11 |
| 3. Vacuum power assist       |           |
| Inspection.....              | page H-13 |
| Removal / Inspection /       |           |
| Installation .....           | page H-14 |
| 4. Clutch release cylinder   |           |
| Removal / Installation.....  | page H-15 |
| Air bleeding.....            | page H-10 |
| Overhaul.....                | page H-16 |
| 5. Release bearing           |           |
| Removal / Installation.....  | page H-18 |
| Inspection.....              | page H-21 |
| 6. Clutch release fork       |           |
| Removal / Installation.....  | page H-18 |
| 7. Clutch cover              |           |
| Removal / Installation ..... | page H-18 |
| Inspection .....             | page H-21 |
| 8. Clutch disc               |           |
| Removal / Installation.....  | page H-18 |
| Inspection.....              | page H-21 |
| 9. Pilot bearing             |           |
| Inspection .....             | page H-18 |
| Removal / Installation ..... | page H-22 |
| 10. Flywheel                 |           |
| Removal / Installation ..... | page H-18 |
| Inspection.....              | page H-22 |

OUTLINE

SPECIFICATIONS

Item	Engine/Transmission Model	HA	SL	SL Turbo	TF	
		WEM-R	-	ZSM-R	WSM-R	
Clutch control		Hydraulic				
Vacuum power assist	Type	Vacuum booster				
	Size mm (in)	1"4.3 (4.5)				
Clutch cover	Type	Diaphragm spring				
	Serialized N (kg. lb)	5248 (535, 1177)	6228 (635, 1397)	7652 (760, 1716)	6377 (650, 1430)	
Clutch disc	Outer diameter mm (in)	260 (10.24)		275 (10.83)		
	Inner diameter mm (in)	170 (6.69)		180 (7.09)		
	Thickness	Pressure plate side mm (in)	3.8 (0.15)			
		Flywheel side mm (in)	3.5 (0.14)			
Clutch pedal	Type	Suspended				
	Pedal ratio	5.6				
	Full stroke mm (in)	153 (6.02)				
	Height mm (in)	186—193 (7.40—7.60)				
Master cylinder inner diameter	mm (in)	15.87 (0.62)				
Release cylinder inner diameter	mm (in)	22.22 (0.87)				
Clutch fluid		SAE J1703 or FMVSS116 DOT-3				

9TFCM-002

TROUBLESHOOTING GUIDE

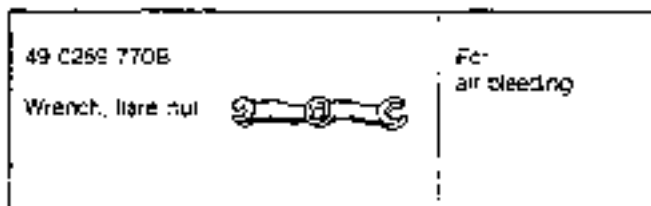
Problem	Possible Causes	Remedy	Page
Slipping	Clutch disc facing worn excessively	Replace	H-15, 21
	Clutch disc facing surface hardened or oil on surface	Repair or replace	H-18
	Pressure plate damaged	Repair or replace	H-18
	Diaphragm spring damaged or weakened	Replace	H-18
	Insufficient clutch pedal play	Adjust	H- 5
	Clutch pedal sticking	Repair or replace	H- 6
	Flywheel damaged	Repair or replace	H-18, 22
Faulty disengagement	Excessive runout or damaged clutch disc	Replace	H-18, 21
	Clutch disc splines rusted or worn	Remove rust or replace	H-18
	Oil on facing	Repair or replace	H-18
	Diaphragm spring weakened	Replace	H-18
	Excessive clutch pedal play	Adjust	H- 5
	Insufficient clutch fluid	Add fluid	H- 3
	Leakage of clutch fluid	Locate and repair or replace	-
Clutch vibrates when accelerating	Oil on facing	Repair or replace	H-18
	Torsion springs weakened	Replace	H-18
	Clutch disc facing hardened or damaged	Repair or replace	H-18
	Clutch disc facing rivets loose	Replace	H-18
	Pressure plate damaged or excessive runout	Replace	H-18
	Flywheel surface hardened or damaged	Repair or replace	H-18
	Loose or worn engine mount	Tighten or replace	-
Clutch pedal sticking	Pedal shaft not properly lubricated	Lubricate or replace	H- 6
Abnormal noise	Clutch release bearing damaged	Replace	H-18, 21
	Poor lubrication of release bearing sleeve	Lubricate or replace	H-18
	Torsion springs weakened	Replace	H-18
	Excessive crankshaft end play	Repair	Refer to Section B
	Pilot bearing worn or damaged	Replace	H-18, 22
	Worn pivot points of release fork	Repair or replace	H-18

9TGM-004

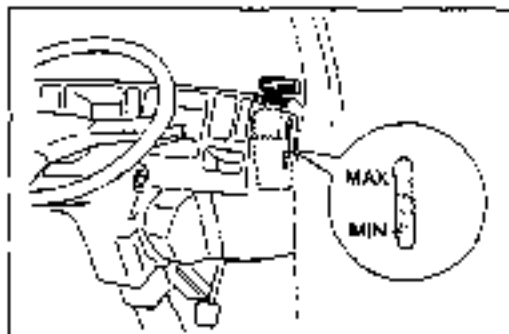
## CLUTCH FLUID

## PREPARATION

## SST



G3U6HX-003



G3U6HX-005

## REPLACEMENT

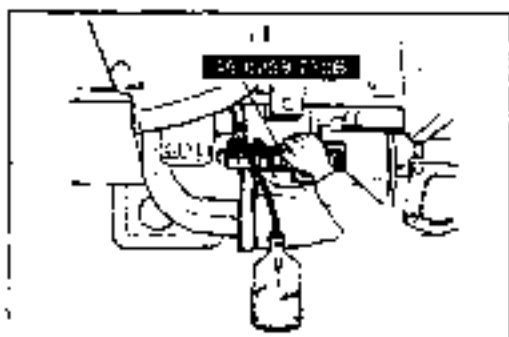
## Note

- A common reservoir is used for the clutch and brake system fluids.
- The fluid in the reservoir must be maintained at the 3/4 level or higher during replacement.

## Caution

- Be careful not to spill the fluid on a painted surface. If this should happen, wash it off immediately.
- Do not mix different brands of fluid.
- Do not reuse the clutch fluid that was drained.

1. Drain the brake fluid from the master cylinder through a wheel cylinder.
2. Remove the bleeder cap from the clutch release cylinder and attach a vinyl hose to the bleeder plug.



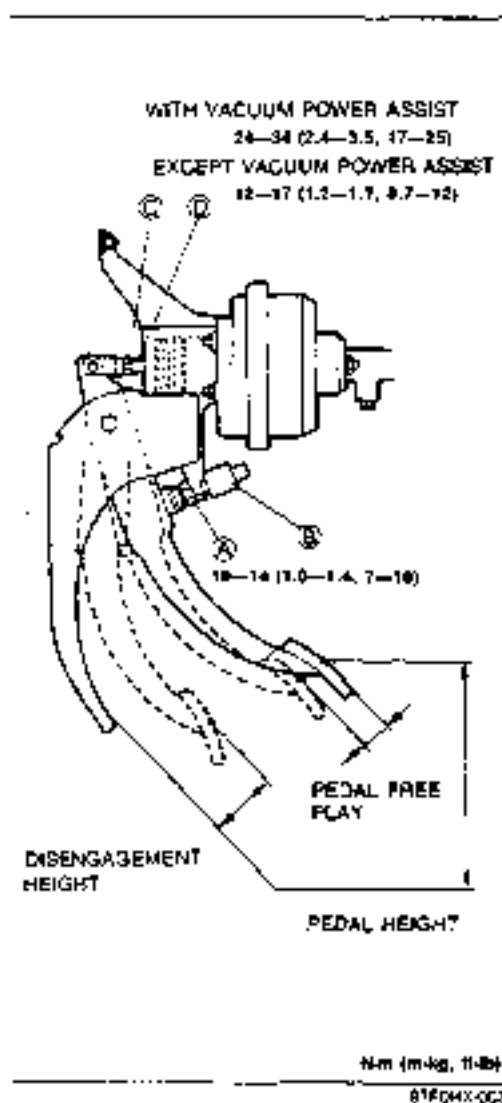
9T30HX-005

3. Place the other end of the vinyl hose in a clear container.
4. Slowly pump the clutch pedal several times.
5. With the clutch pedal depressed, loosen the bleeder screw with the SST to let the fluid escape. Close the bleeder screw with the SST.
6. Repeat Steps 4 and 5 until only clean fluid is seen.
7. Tighten the bleeder screw.

## Tightening torque:

5.9—8.8 Nm (60—90 cm-kg, 52—76 in-lb)

8. Add fluid to the MAX mark.
9. Slowly pump the clutch pedal several times.  
Verify that there is no fluid leakage.
10. Verify operation of the clutch system.
11. Verify operation of the brake system.



## CLUTCH PEDAL

### ADJUSTMENT

#### Clutch Pedal Height

##### Inspection

1. Measure the distance from the upper surface of the pedal pad to the floor panel.

**Pedal height:** 188–193mm (7.40–7.60 in)

2. If necessary, adjust the pedal height.

##### Adjustment

1. Disconnect the clutch switch connector.
2. Loosen locknuts A and turn clutch switch B until the height is correct.
3. Tighten locknuts A.

##### Tightening torque:

**9.8–14 Nm (100–140 cm-kg, 87–122 in-lb)**

4. After adjustment, measure the pedal free play.

#### Clutch Pedal Free Play

##### Inspection

1. Depress the clutch pedal by hand until resistance is felt.

**Pedal free play:** 0.5–2.7mm (0.02–0.11 in)

**Total pedal free play:** 5.0–11.0mm (0.20–0.43 in)

2. If necessary, adjust the pedal free play.

##### Adjustment

1. Loosen locknut C and turn push-rod D until pedal free play is correct.
2. Verify that the disengagement height (from the upper surface of the pedal to the floor panel) is correct when the pedal is fully depressed.

**Minimum disengagement height:** 65mm (2.56 in)

3. Tighten locknut C.

##### Tightening torque:

**With vacuum power assist**

**24–34 Nm (2.4–3.5 m-kg, 17–25 ft-lb)**

**Except vacuum power assist**

**12–17 Nm (1.2–1.7 m-kg, 8.7–12 ft-lb)**

4. After adjustment, inspect the pedal height.

## REMOVAL / INSPECTION / INSTALLATION

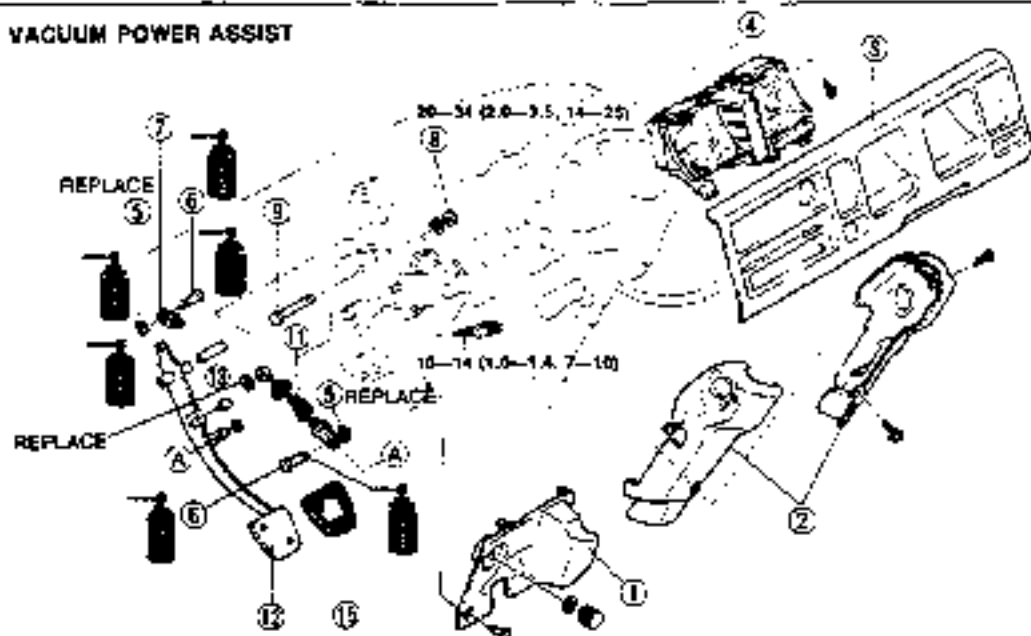
1. Remove in the order shown in the figure
2. Inspect all parts and repair or replace as necessary.

**Note**

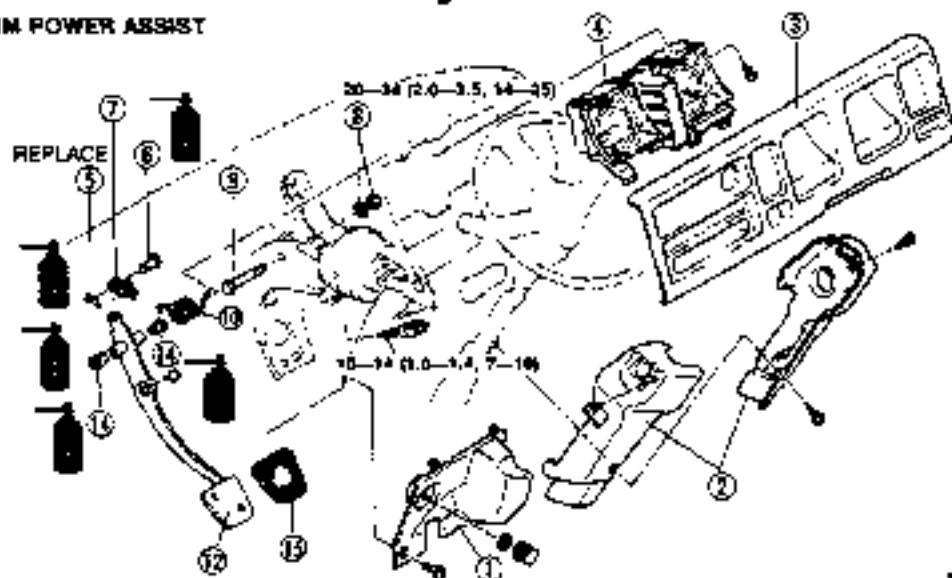
- Apply lithium based grease to the bushing and pins before installation.

3. Install in the reverse order of removal, referring to **Installation Note**

## EXCEPT VACUUM POWER ASSIST



## WITH VACUUM POWER ASSIST

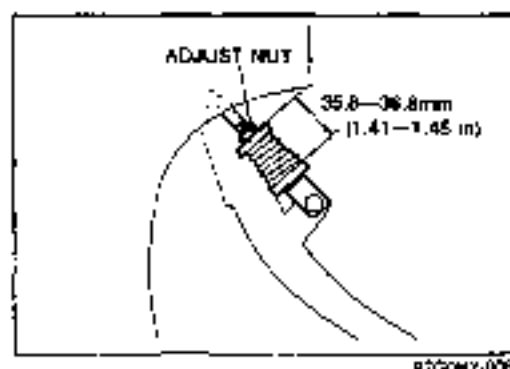


78cm (78-kg, 78-lb)

5TR0HX-004

- |                       |  |
|-----------------------|--|
| 1. Cover              | 9. Bolt  |
| 2. Column cover       | 10. Spring (With vacuum power assist)          |
| 3. Meter cover        | 11. Assist spring (Except vacuum power assist) |
| 4. Instrument cluster | Installation Note ..... page H-7               |
| 5. Retaining ring     | 12. Clutch pedal                               |
| 6. Pin                | Adjustment ..... page H-5                      |
| 7. Push rod           | 13. Spacer (Except vacuum power assist)        |
| 8. Nut and washer     | 14. Bushing (With vacuum power assist)         |
|                       | 15. Pedal pad                                  |





87G04X-008

**Installation Note****Assist Spring (Except vacuum power assist)**

1. Adjust the length of the assist spring by turning the adjusting nut, after installing the clutch pedal.



**Standard: 35.8—36.8mm (1.41—1.45 in)**

# H CLUTCH MASTER CYLINDER

## CLUTCH MASTER CYLINDER

### PREPARATION

#### SST

49 0259 7706		For disconnecting and connecting clutch pipe	49 F043 001		For adjustment of push rod
Wrench: flare nut			Adjust gauge		

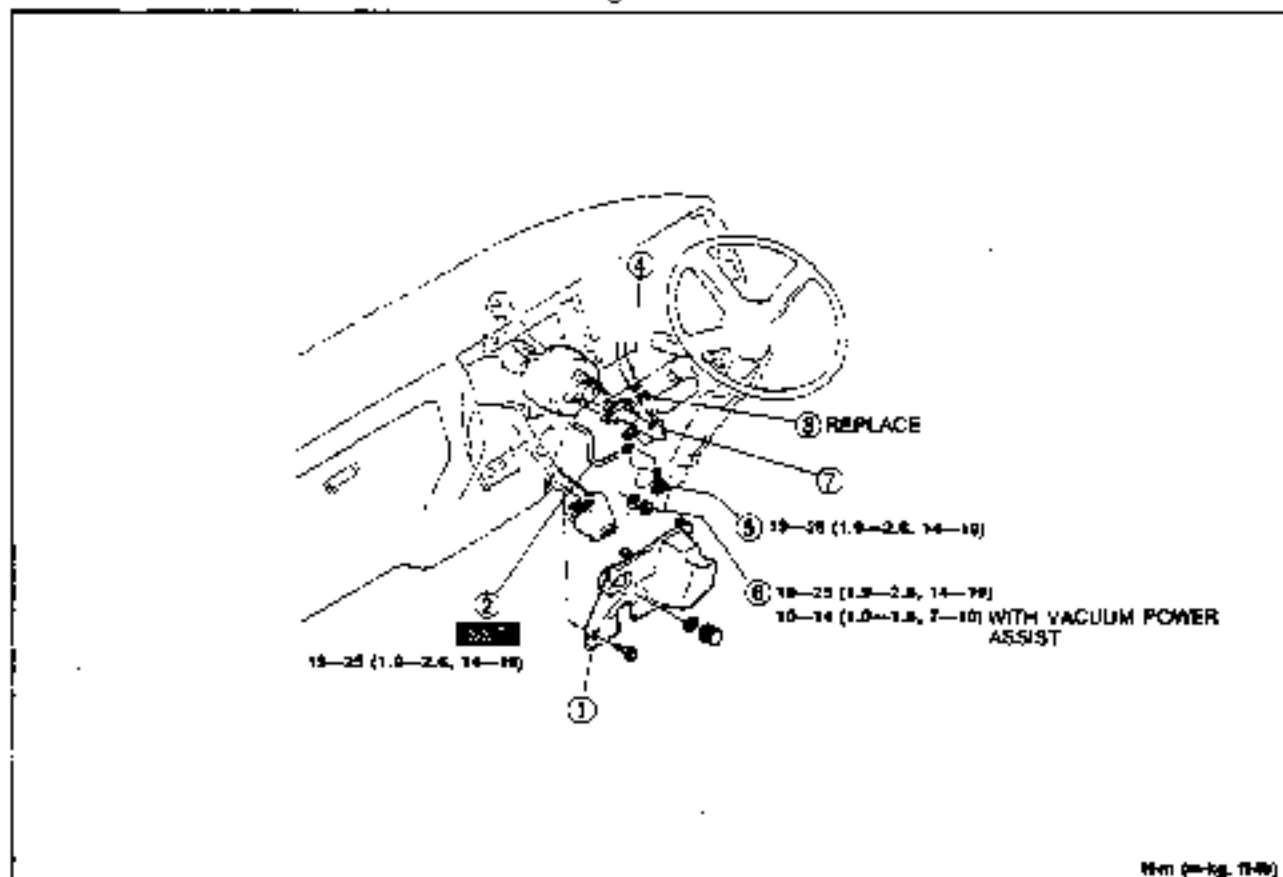
9763HX-005

### REMOVAL / INSPECTION / INSTALLATION

#### Caution

- Clutch fluid will damage painted surfaces. Be sure to use a container or rags to collect it. If fluid does get on a painted surface, wipe it off immediately with a rag.

1. Remove in the order shown in the figure, referring to **Removal Note**.
2. Inspect all parts and repair or replace as necessary.
3. Install in the reverse order of removal referring to **Installation Note**.



9763HX-005

9763HX-005

- |   |   |
|---|---|
| <ol style="list-style-type: none"> <li>1. Cover</li> <li>2. Clutch pipe<br/>Removal Note ..... page H- 9<br/>Installation Note ..... page H- 9</li> <li>3. Clip</li> <li>4. Clutch hose<br/>Removal Note . . . . . page H- 9</li> </ol> | <ol style="list-style-type: none"> <li>5. Bolt</li> <li>6. Nut</li> <li>7. Clutch master cylinder<br/>Overhaul..... page H-11<br/>Check for fluid leakage from cylinder bore<br/>Air bleeding..... page H-10</li> </ol> |
|---|---|



9T30HX-016

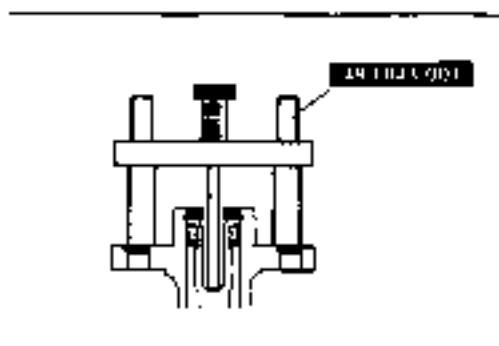
**Removal Note****Clutch pipe**

1. Disconnect the clutch pipe with the **SST**.

**Clutch hose**

1. Disconnect the clutch hose from the master cylinder.
2. Plug the outlet of the clutch hose.

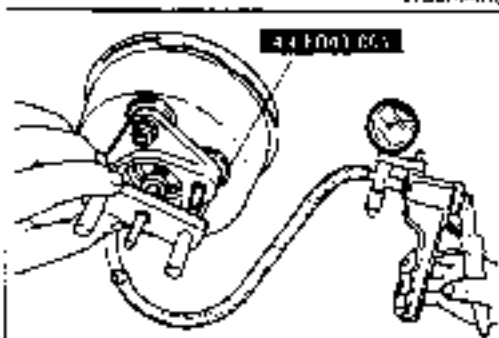
9T30HX-011



9T30HX-012

**Installation Note****Push rod (With vacuum power assist)**

1. Set the **SST** on the clutch master cylinder.
2. Turn the adjusting bolt, until the end of the bolt contacts the piston.



9T30HX-006

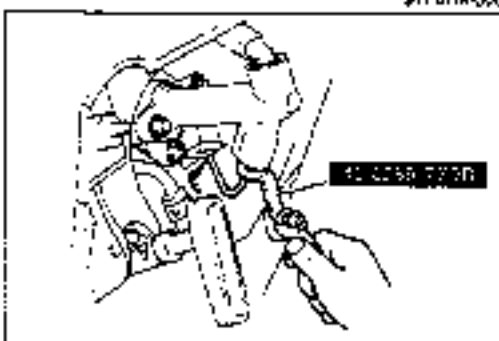
3. Apply a vacuum of 500 mmHg (19.7 inHg) to the vacuum power assist using a vacuum pump.
4. Turn over the **SST** and set it on the vacuum power assist.
5. Verify that the clearance between the **SST** and the push rod is 0.1—0.3mm (0.004—0.012 in). Adjust the push rod if necessary.

**Clutch pipe**

1. Tighten the clutch pipe with the **SST**.

**Tightening torque:**

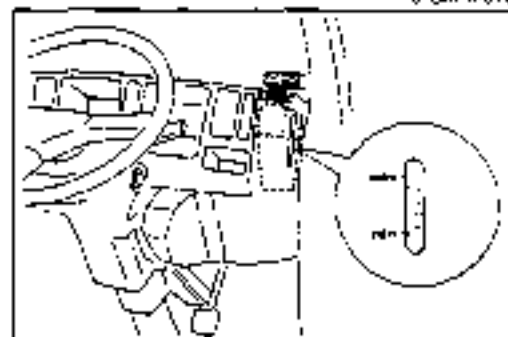
19—26 Nm (1.9—2.6 m·kg, 14—19 ft·lb)



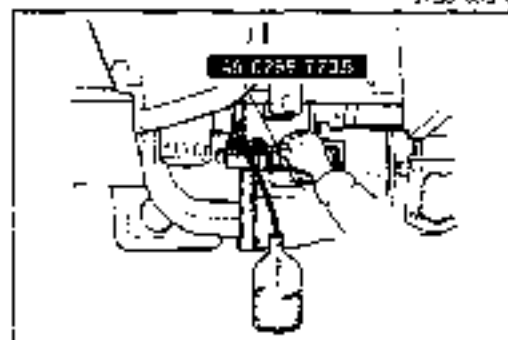
9T30HX-014



9T50-00-015



9T50-00-016



9T50HX 017

**Air Bleeding**

1. After installation, bleed the clutch system.  
(Refer to below.)

**Inspection and Adjustment****Clutch pedal height and free play**

(Refer to page H-5.)

**AIR BLEEDING**

The clutch hydraulic system must be bled to remove air introduced whenever a hydraulic line is disconnected.

**Note**

- The fluid in the reservoir must be maintained at the 3/4 level or higher during air bleeding.

**Caution**

- Clutch fluid will damage a painted surface. If fluid does get on a painted surface, wipe it off immediately.
- Do not mix different brands of clutch fluid.
- Do not reuse the clutch fluid that was drained.

1. Remove the bleeder cap from the clutch release cylinder and attach a vinyl hose to the bleeder plug.
2. Insert the other end of the vinyl hose in a clear container.
3. Slowly pump the clutch pedal several times.
4. While depressing the pedal, loosen the bleeder screw with the **SST** to let fluid and air escape.  
Close the bleeder screw with the **SST**.
5. Repeat Steps 3 and 4 until no air bubbles are seen in the fluid.
6. Tighten the bleeder screw.

**Tightening torque:**

5.9—8.8 N·m (60—90 cm·kg, 52—78 in·lb)

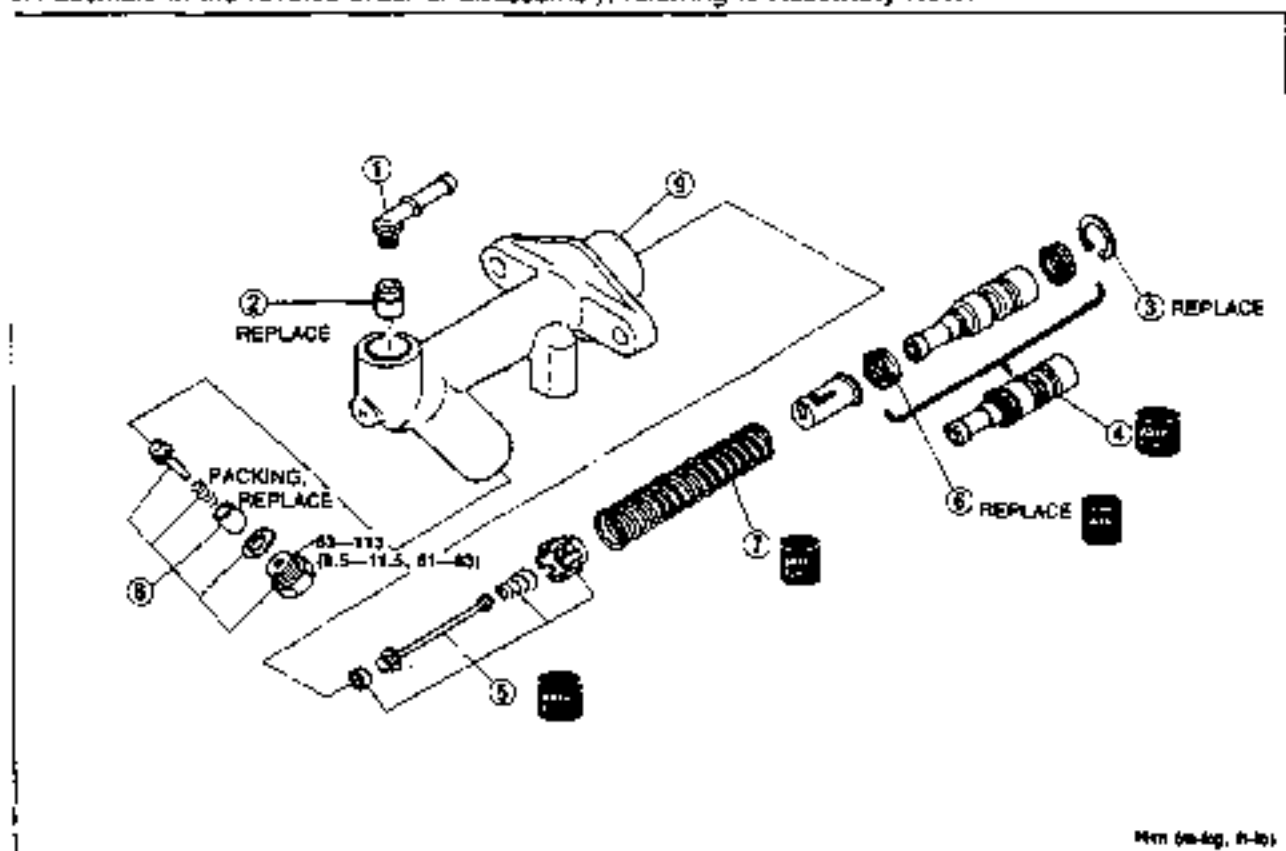
7. Verify clutch operation.
8. Verify that there is no fluid leakage.

## OVERHAUL

**Caution**

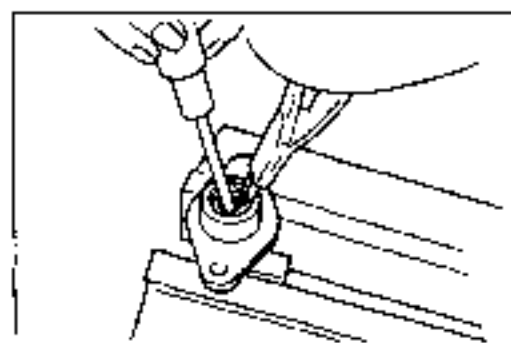
- Clean the disassembled parts in solvent and blow through all ports and passages with compressed air.

1. Disassemble in the order shown in the figure, referring to **Disassembly Note**.
2. Inspect all parts and repair or replace as necessary.
3. Assemble in the reverse order of disassembly, referring to **Assembly Note**.



Mm (9-4g, H-10)

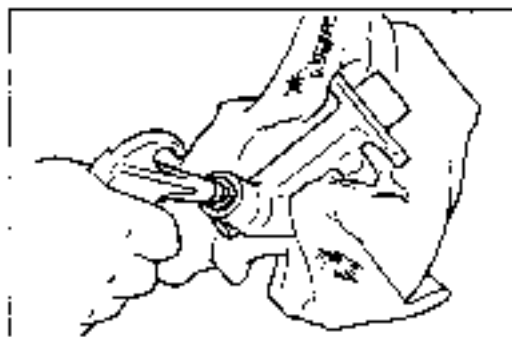
- |                                      |                                       |
|--------------------------------------|---------------------------------------|
| 1. Joint                             | 5. Spacer                             |
| 2. Bushing                           | 6. Primary cup                        |
| 3. Snap ring                         | Inspect for wear and cracks           |
| Disassembly Note . . . . . page H-11 | 7. Return spring                      |
| Assembly Note . . . . . page H-12    | 8. One-way check valve                |
| 4. Piston and secondary cup assembly | 9. Master cylinder body               |
| Disassembly Note . . . . . page H-12 | Inspect cylinder bore for scoring and |
| Assembly Note . . . . . page H-12    | corrosion                             |
| Inspect for wear, scoring and cracks |                                       |



03U0M7-01 B

**Disassembly Note**  
**Snap ring****Caution**

- Do not damage the push rod contact surface of the piston.
1. Press the piston down and remove the snap ring with snap ring pliers.



RM-1070-01-9

**Piston and secondary cup assembly.****Caution**

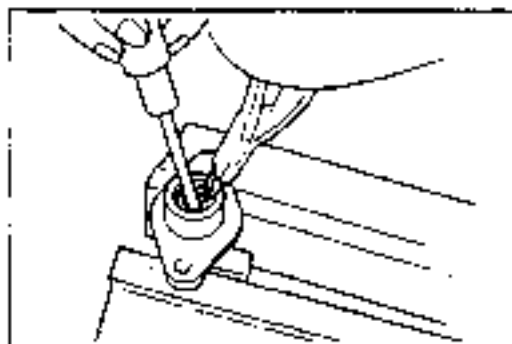
- Hold a rag over the master cylinder to prevent the piston and secondary cup assembly from jumping out.

1. Remove the piston and secondary cup assembly, spacer, and primary cup by applying compressed air through the clutch pipe installation hole.

**Assembly Note****Caution**

- Before assembly, make sure all parts are completely clean.
- Do not mix different brands of clutch fluid.
- Do not reuse the clutch fluid that was drained.
- Apply the specified clutch fluid to the piston and secondary cup assembly, spacer, primary cup, and cylinder bore before assembly.
- Replace parts with new ones whenever specified to do so.

CSU0-2/019



CSU0-2/021

**Snap ring****Caution**

- Do not damage the push rod contact surface of the piston.

1. While pressing the piston, install the snap ring.

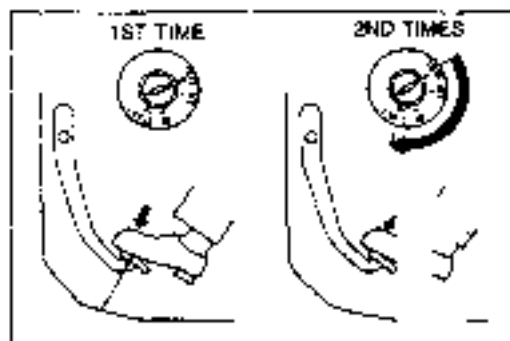
## VACUUM POWER ASSIST

## INSPECTION

## Note

- This inspection is performed to determine if the vacuum power assist is functioning.
- If a problem is found, replace the vacuum power assist assembly.

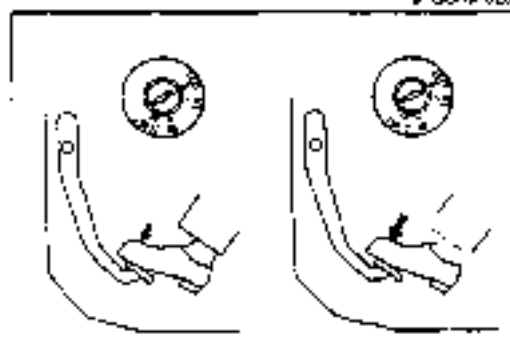
9TGMX-019



9TGMX-020

## Function Check

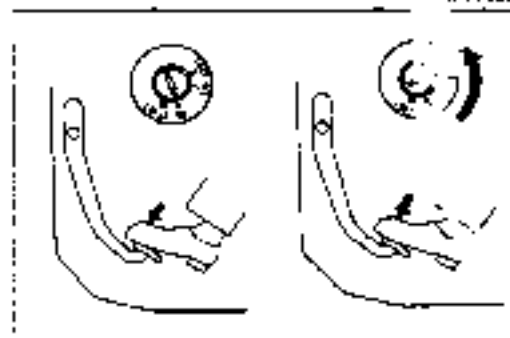
1. With the engine stopped, depress the pedal a few times, and confirm that the pedal height does not change.
2. Start the engine, and confirm that the pedal depression force is reduced.



9TGMX-005

## Vacuum Loss Check

1. Start the engine.
2. Stop the engine, after 1 or 2 minutes, and depress the pedal several times.
3. Verify that the pedal depression force becomes higher.



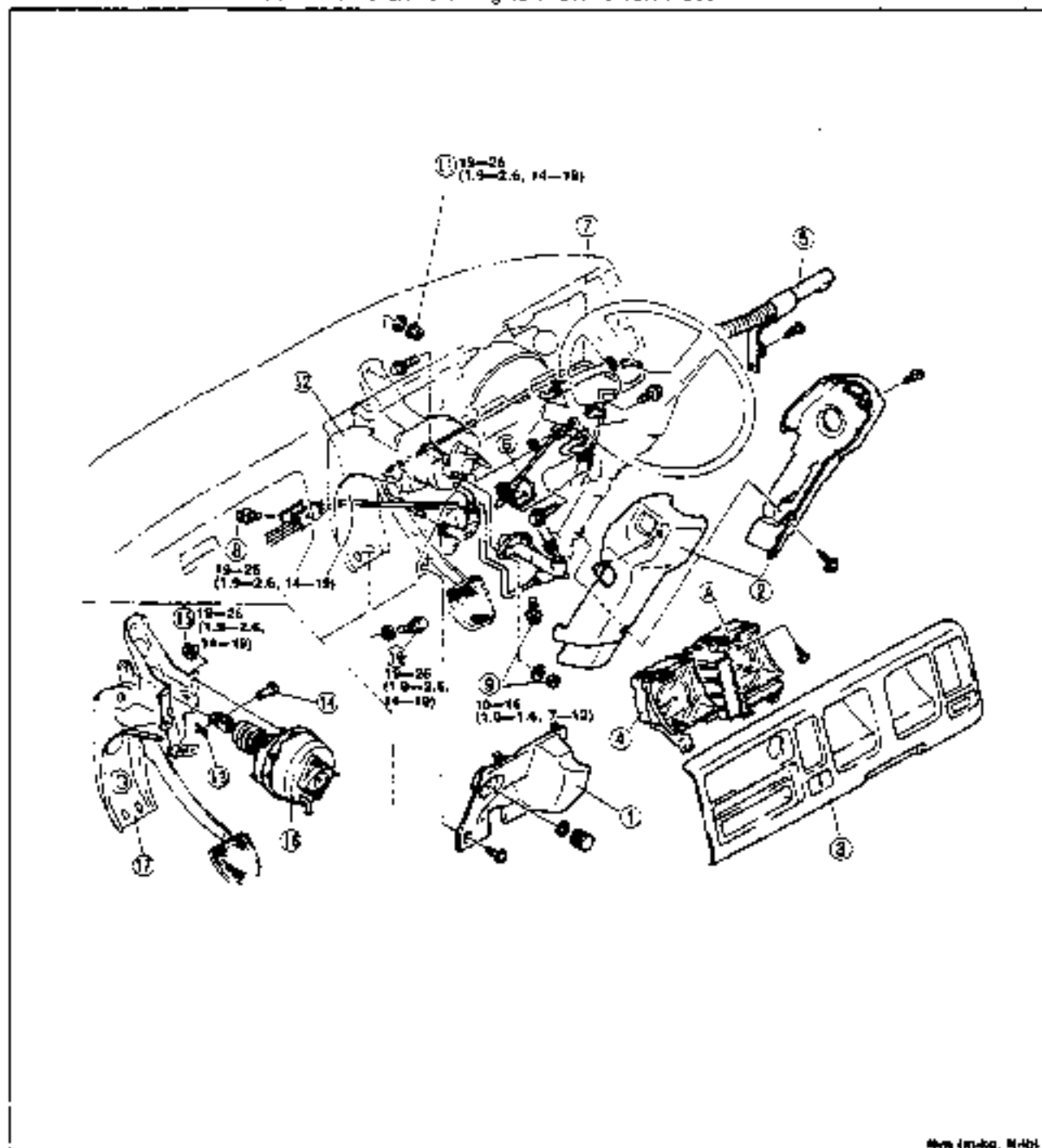
9TGMX-022

## Vacuum Loss Check (Loaded Condition)

1. Start the engine, and depress the pedal.
2. With the pedal held depressed, stop the engine.
3. Hold the pedal down for about 30 seconds.
4. Confirm the pedal height does not change.

## REMOVAL / INSPECTION / INSTALLATION

1. Remove in the order shown in the figure
2. Inspect all parts and repair or replace as necessary.
3. Install in the reverse order of removal, referring to **Installation Note**



490 (M-kg, N-kt)

9TFC13-008

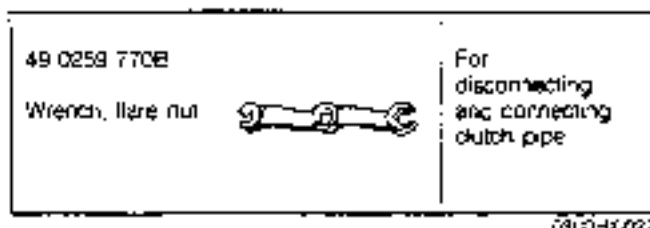
- |                       |   |                              |
|-----------------------|---|------------------------------|
| 1. Cover              | 7. Vacuum pipe                                    | 13. Retaining ring           |
| 2. Column cover       | 8. Bolt   | 14. Pin                      |
| 3. Meter cover        | 9. Bolt/Nut                                       | 15. Nut                      |
| 4. Instrument cluster | 10. Bolt  | 16. Vacuum power assist      |
| 5. Duct               | 11. Nut   | Installation note.. page H-9 |
| 6. Sub-select cable   | 12. Vacuum power assist/<br>clutch pedal assembly | 17. Clutch pedal assembly    |



## CLUTCH RELEASE CYLINDER

## PREPARATION

## SST

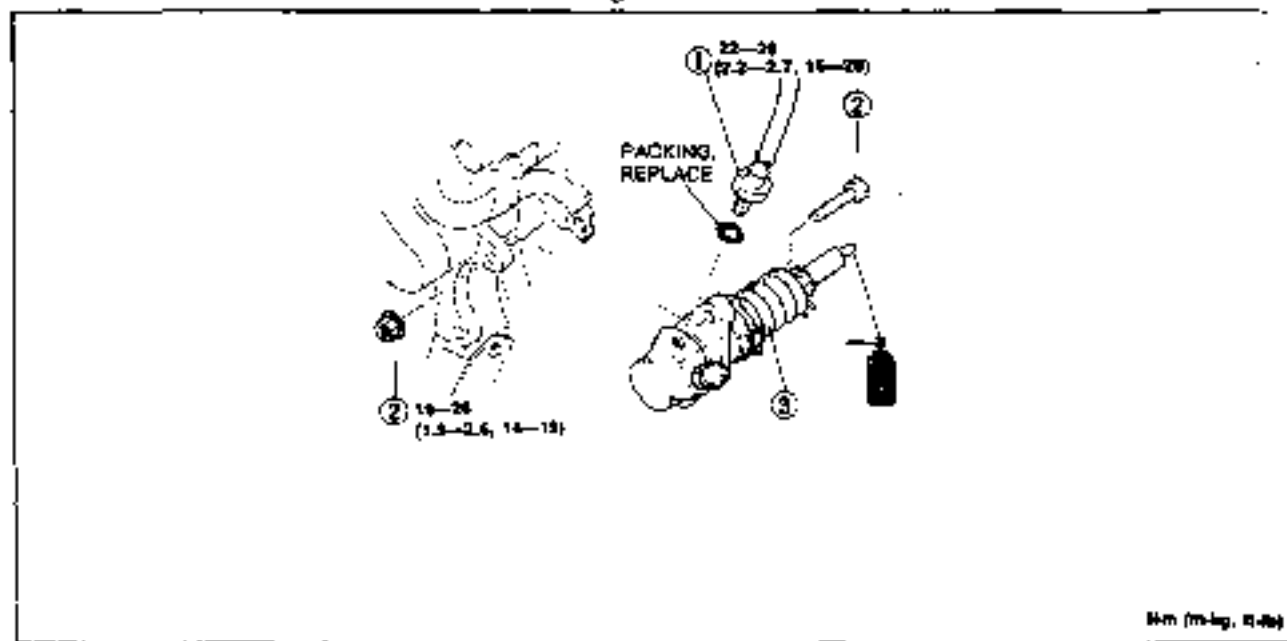


## REMOVAL / INSTALLATION

## Caution

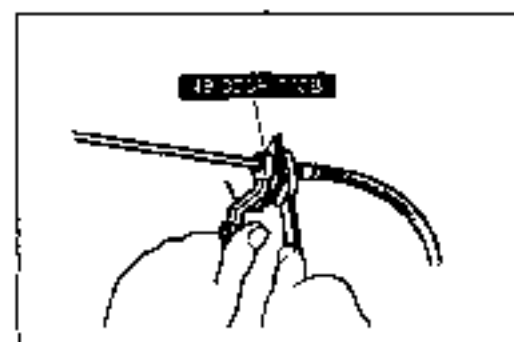
- Clutch fluid will damage painted surfaces. Be sure to use a container or rags to collect it. If fluid does get on a painted surface, wipe it off immediately with a rag.

1. Remove in the order shown in the figure, referring to **Removal Note**.
2. Install in the reverse order of removal, referring to **Installation Note**.



1. Flexible hose  
Removal Note ..... page H-15  
Installation Note ..... page H-16
2. Bolt/Nut

3. Clutch release cylinder  
Remove boot and check for fluid leakage  
Overhaul..... page H-16



97G0-H-025

## Removal Note

## Flexible hose

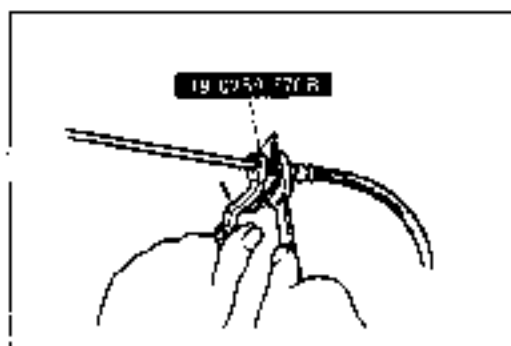
## Caution

- After removing the flexible hose, plug the pipe from the master cylinder to avoid fluid leakage.

1. Disconnect the flexible hose with the SST.

# H

## CLUTCH RELEASE CYLINDER



BTGMX-026

### Installation Note

#### Flexible hose

1. Tighten the flexible hose with the SST.

#### Tightening torque:

22–25 Nm (2.2–2.7 m·kg, 16–20 ft·lb)

#### Air Bleeding

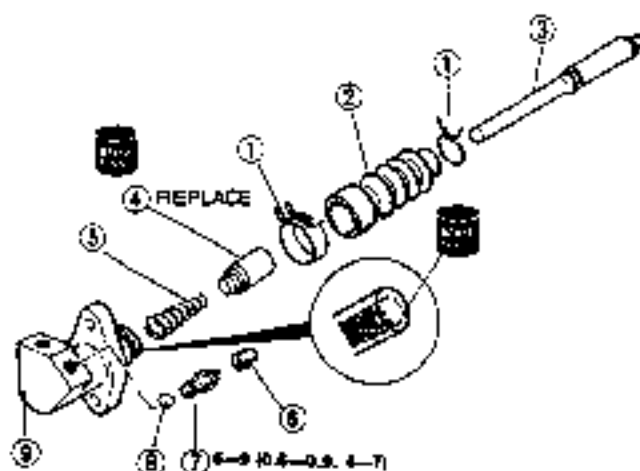
1. After installation, bleed the clutch system (Refer to page H-10.)

## OVERHAUL

### Caution

- Clean the disassembled parts in solvent and blow through all ports and passages with compressed air.
- Before assembly, make sure all parts are completely clean.
- Apply the specified clutch fluid to the piston and cup assembly and cylinder bore before assembly.

1. Disassemble in the order shown in the figure, referring to **Disassembly Note**.
2. Inspect all parts and repair or replace as necessary.
3. Assemble in the reverse order of disassembly, referring to **Installation Note**.



1-60 (rev. 11-81)








BTGMX 027

- |  |   |
|--|---|
| 1. Boot band   | 6. Bleeder cap  |
| 2. Boot  | 7. Bleeder screw  |
| 3. Push rod  | 8. Steel ball   |
| 4. Piston and cup assembly<br>Inspect for wear, scoring and cracks | 9. Release cylinder body<br>Inspect cylinder bore for scoring and corrosion |
| 5. Return spring   |   |

## CLUTCH UNIT

## PREPARATION

## SST

<p>49 E301 060</p> <p>Brake ring gear (HA SL engine)</p> 	<p>For prevention of engine rotation</p>	<p>49 W011 103</p> <p>Brake ring gear (TF engine)</p> 	<p>For prevention of engine rotation</p>
<p>49 S501 062</p> <p>Collar (HA engine)</p> 	<p>For prevention of engine rotation</p>	<p>49 W065 062</p> <p>Collar (SL engine)</p> 	<p>For prevention of engine rotation</p>
<p>49 SE01 310</p> <p>Clutch disc centering tool</p> 	<p>For alignment of clutch disc</p>	<p>49 1285 071</p> <p>Puller, bearing</p> 	<p>For removal of pilot bearing</p>
<p>49 B011 103</p> <p>Chuck (Part of 49 1285 071)</p> 	<p>For removal of pilot bearing</p>	<small>93F0HX-011</small>	

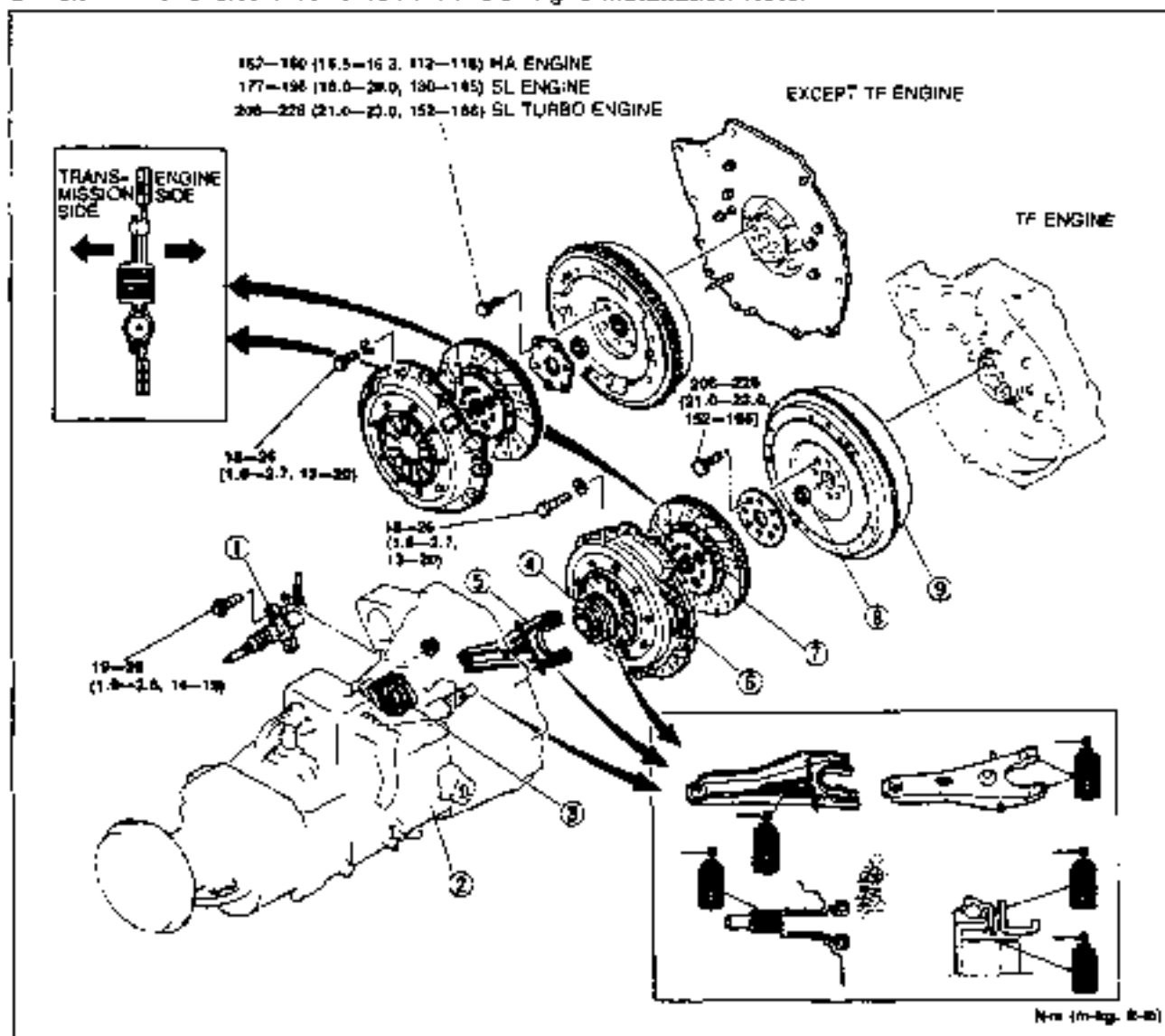
## REMOVAL / INSTALLATION

## Note

- Remove the clutch release cylinder with the flexible hose connected.
- Do not remove the pilot bearing if not necessary.

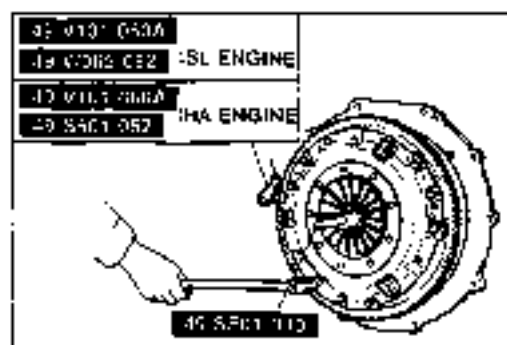
1. Remove in the order shown in the figure, referring to **Removal Note**

2. Install in the reverse order of removal, referring to **Installation Note**.

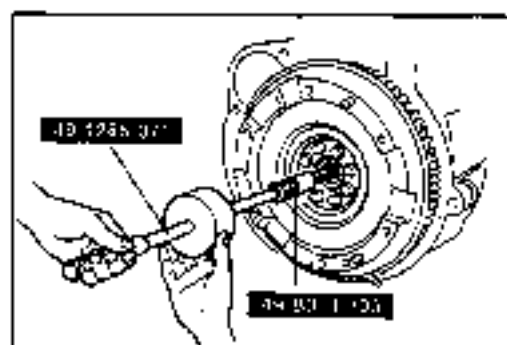
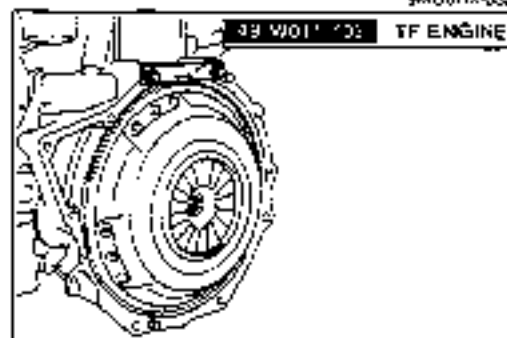


9TF0-06.012

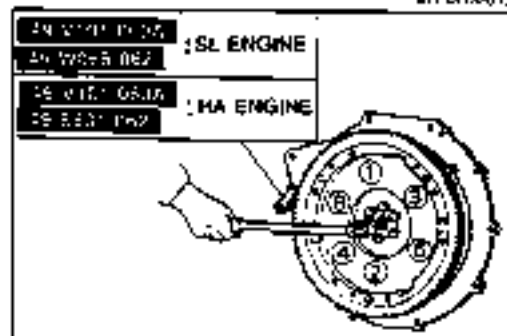
- |                                   |                |
|-----------------------------------|----------------|
| 1. Clutch release cylinder        |                |
| 2. Transmission and transfer case |                |
| Service.....                      | Section J1, J2 |
| 3. Boot                           |                |
| 4. Clutch release bearing         |                |
| Inspection.....                   | page H-21      |
| 5. Clutch release fork            |                |
| 6. Clutch cover                   |                |
| Removal Note.....                 | page H-19      |
| Inspection.....                   | page H-21      |
| Installation Note.....            | page H-21      |
| 7. Clutch disc                    |                |
| Removal Note.....                 | page H-19      |
| Inspection.....                   | page H-21      |
| Installation Note.....            | page H-20      |
| 8. Pilot bearing                  |                |
| Inspection.....                   | page H-19      |
| Removal Note.....                 | page H-22      |
| Installation Note.....            | page H-20      |
| 9. Flywheel                       |                |
| Removal Note.....                 | page H-19      |
| Inspection.....                   | page H-22      |
| Installation Note.....            | page H-20      |



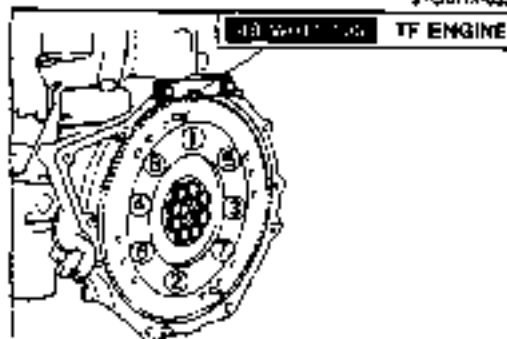
9M0HX-032



9TFDX-013



9T0HX-030

**Removal Note****Clutch cover and disc**

1. Install the **SST**.
2. Loosen each bolt one turn at a time in a crisscross pattern until spring tension is released. Then remove the clutch cover and disc.

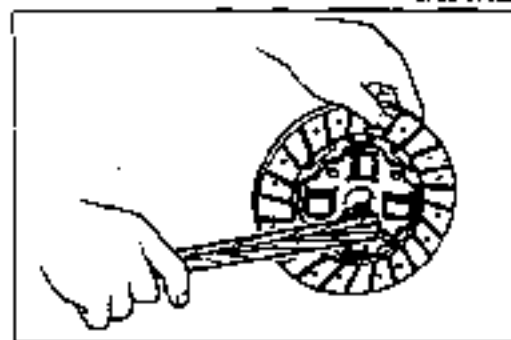
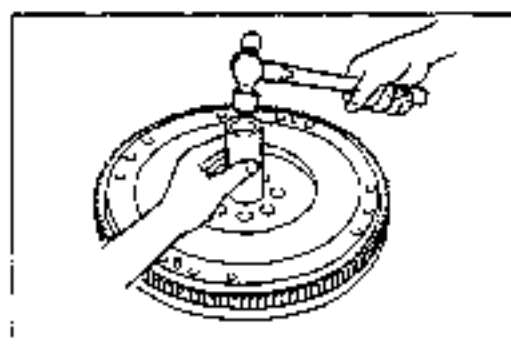
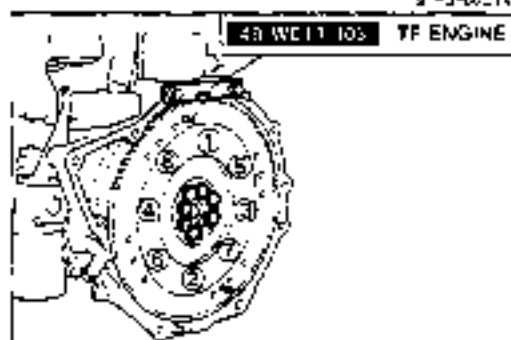
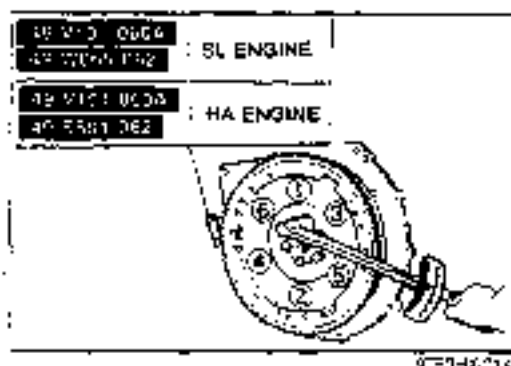
**Pilot bearing**

1. Remove the pilot bearing with the **SST**.

**Flywheel****Note**

- After removing the flywheel, inspect for oil leakage past the crankshaft rear oil seal. If necessary, replace the oil seal. (Refer to Section B.)

1. Hold the flywheel with the **SST**.
2. Remove the bolts and remove the flywheel.

**Installation Note****Flywheel**

1. Install the flywheel and **SST**.
2. Tighten the bolts in the pattern shown.

**Tightening torque:**

- 152—160 N·m (15.5—16.3 m·kg, 112—118 ft·lb)  
**HA engine**  
 177—196 N·m (18.0—20.0 m·kg, 130—145 ft·lb)  
**SL engine**  
 206—226 N·m (21.0—23.0 m·kg, 152—166 ft·lb)  
**SL Turbo, TF engine**

**Pilot bearing****Note**

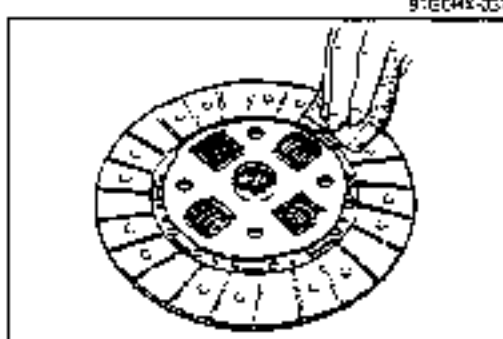
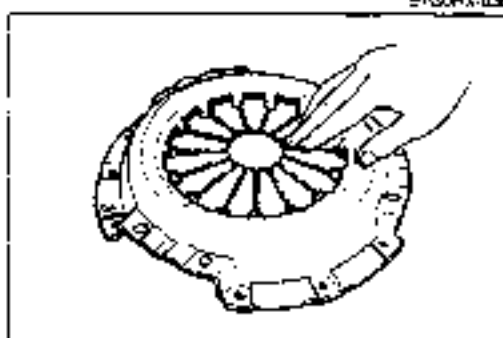
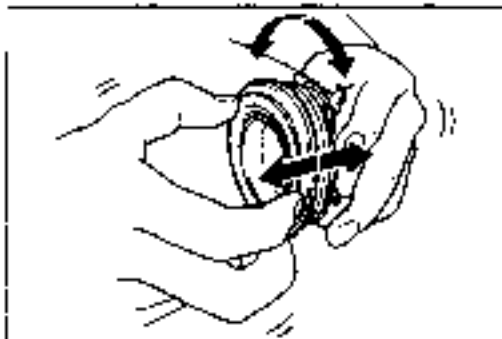
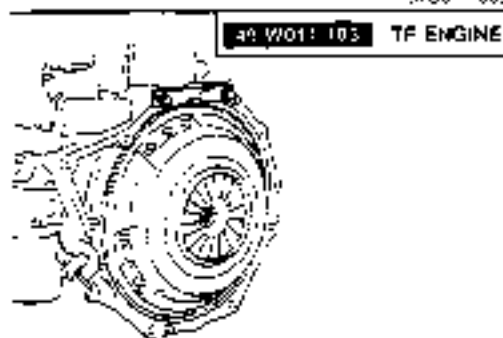
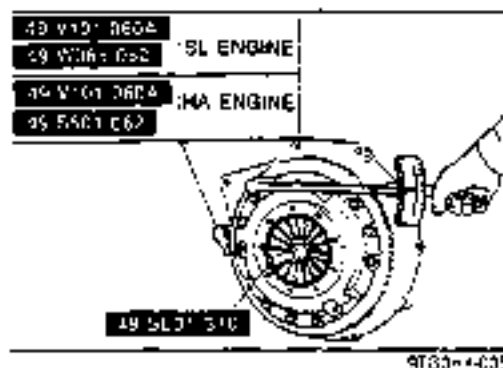
- Install the pilot bearing flush with the flywheel.

1. Install the new bearing with the suitable pipe.

**Clutch disc**

1. Clean the clutch disc splines and main drive gear splines; then apply organic molybdenum grease

2. Hold the clutch disc in position with the **SST**.

**Clutch cover**

1. Install the SST.
2. Align the dowel holes with the flywheel dowels.
3. Tighten the bolts evenly and gradually in a cross pattern.

**Tightening torque:**

18—26 Nm (1.8—2.7 m-kg, 13—20 ft-lb)

**RELEASE BEARING****INSPECTION****Note**

- The clutch release bearing is a sealed bearing and must not be washed.

1. Turn the bearing while applying force in the axial direction. If the bearing sticks or has excessive resistance, replace it.

**CLUTCH COVER****INSPECTION****Note**

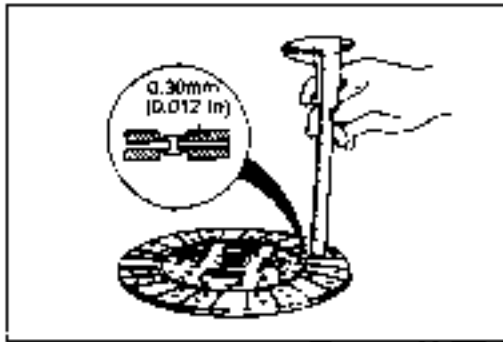
- Minor scoring or burning should be removed with emery paper.

1. Inspect the contact surface of the clutch disc for scoring, cracks, and burning. Repair or replace as necessary.
2. Inspect the contact surface of the clutch release bearing for wear and cracks. If there is wear or cracks, replace the clutch cover.

**CLUTCH DISC****INSPECTION****Note**

- Use sandpaper if the trouble is minor.

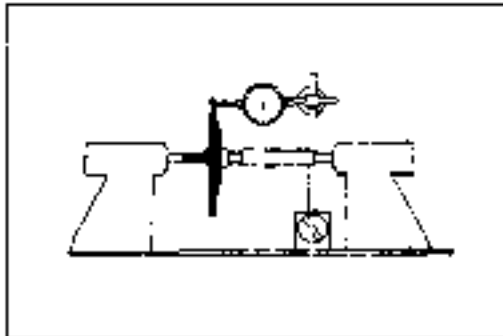
1. Inspect the lining surface for burning and oil contamination. Replace the clutch disc if it is badly burned or oil soaked.
2. Inspect for loose facing rivets. Replace the clutch disc if either is loose.



97GCHX-029

3. Measure the thickness of the lining at a rivet head on both sides with vernier calipers. Replace the disc if the thickness is less than minimum.

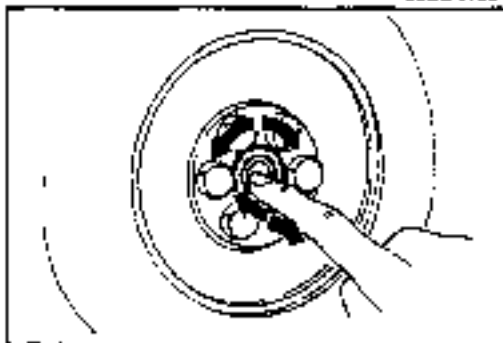
**Minimum thickness: 0.3mm (0.012 in)**



03U2-0023\*

4. Measure the clutch disc runout with a dial indicator. Replace the clutch disc if runout is excessive.

**Maximum runout: 0.7mm (0.027 in)**

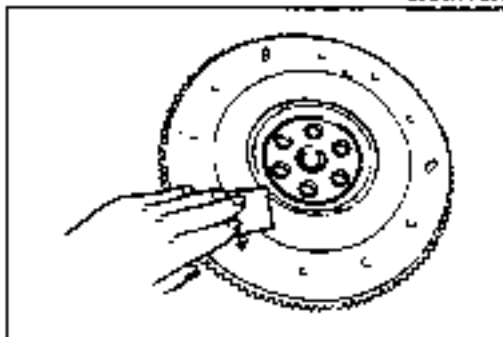


03UCHX-036

## PILOT BEARING

### INSPECTION

1. Turn the bearing while applying force in the axial direction. If the bearing sticks or has excessive resistance, replace it.



97GCHX-040

## FLYWHEEL

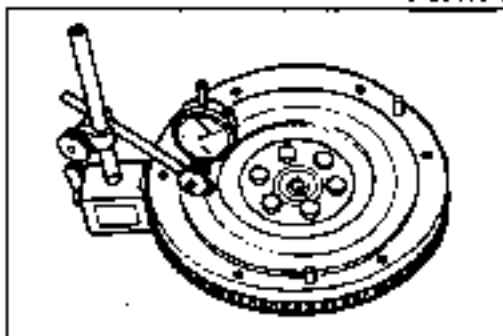
### INSPECTION

#### Note

- Minor scoring or burning should be removed with emery paper.

1. Inspect the contact surface of the clutch disc for scoring, cracks, and burning. Repair or replace as necessary.
2. Inspect the ring gear teeth for wear and damage. If necessary, replace the ring gear.
3. Measure the flywheel runout with a dial indicator. Replace the flywheel if runout is excessive.

**Maximum runout: 0.2mm (0.008 in)**



03U2-0023\*

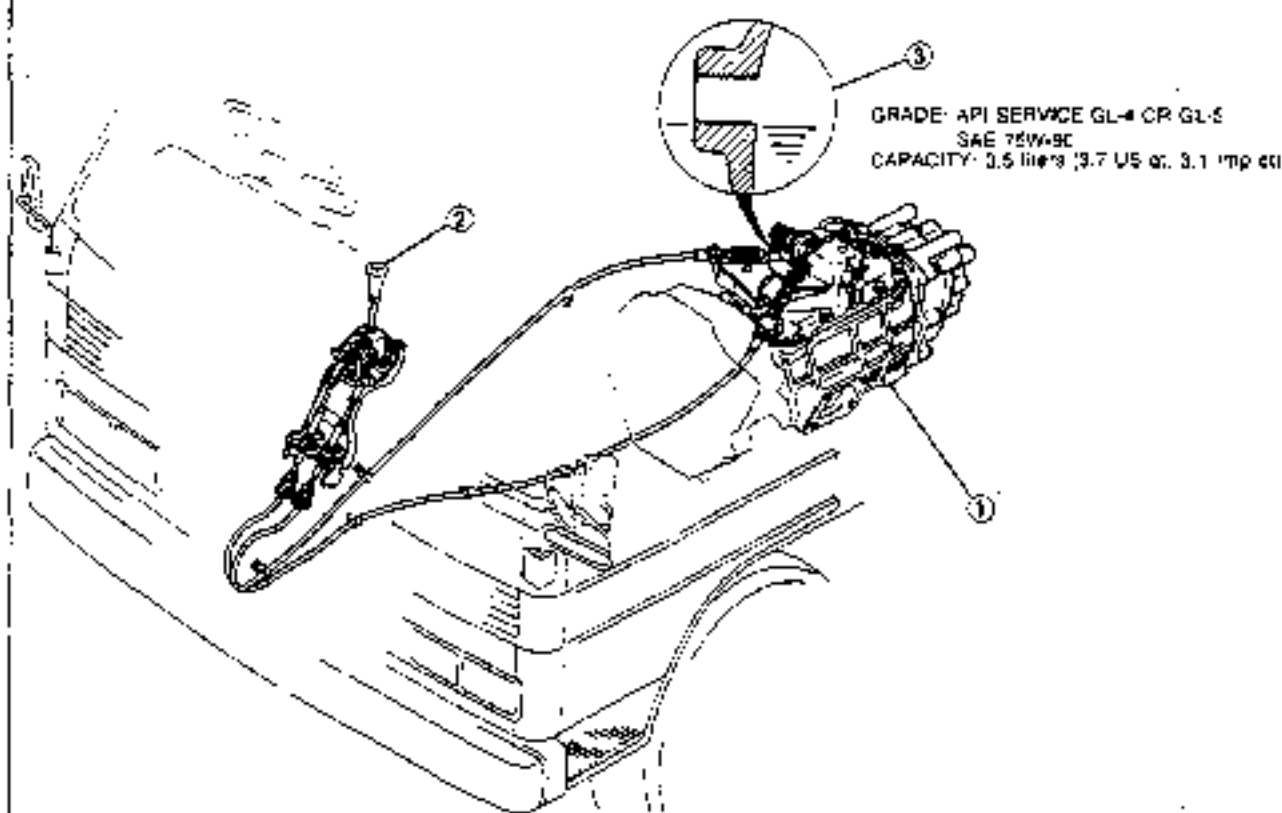


# MANUAL TRANSMISSION (W5M-R)

<b>INDEX</b> .....	J1- 2
<b>OUTLINE</b> .....	J1- 4
SPECIFICATION .....	J1- 4
STRUCTURAL VIEW.....	J1- 5
COMPONENTS.....	J1- 7
POWERFLOW .....	J1- 8
<b>TROUBLESHOOTING GUIDE</b> .....	J1-12
<b>TRANSMISSION OIL</b> .....	J1-13
INSPECTION.....	J1-13
REPLACEMENT.....	J1-13
<b>TRANSMISSION</b> .....	J1-14
PREPARATION .....	J1-14
REMOVAL / INSTALLATION .....	J1-14
DISASSEMBLY .....	J1-17
INSPECTION .....	J1-28
ASSEMBLY .....	J1-31
<b>SHIFT MECHANISM (TRANSMISSION)</b> .....	J1-47
REMOVAL / INSTALLATION .....	J1-47
<b>SHIFT MECHANISM (SUB-TRANSMISSION)</b> .....	J1-48
REMOVAL / INSTALLATION .....	J1-48

## INDEX

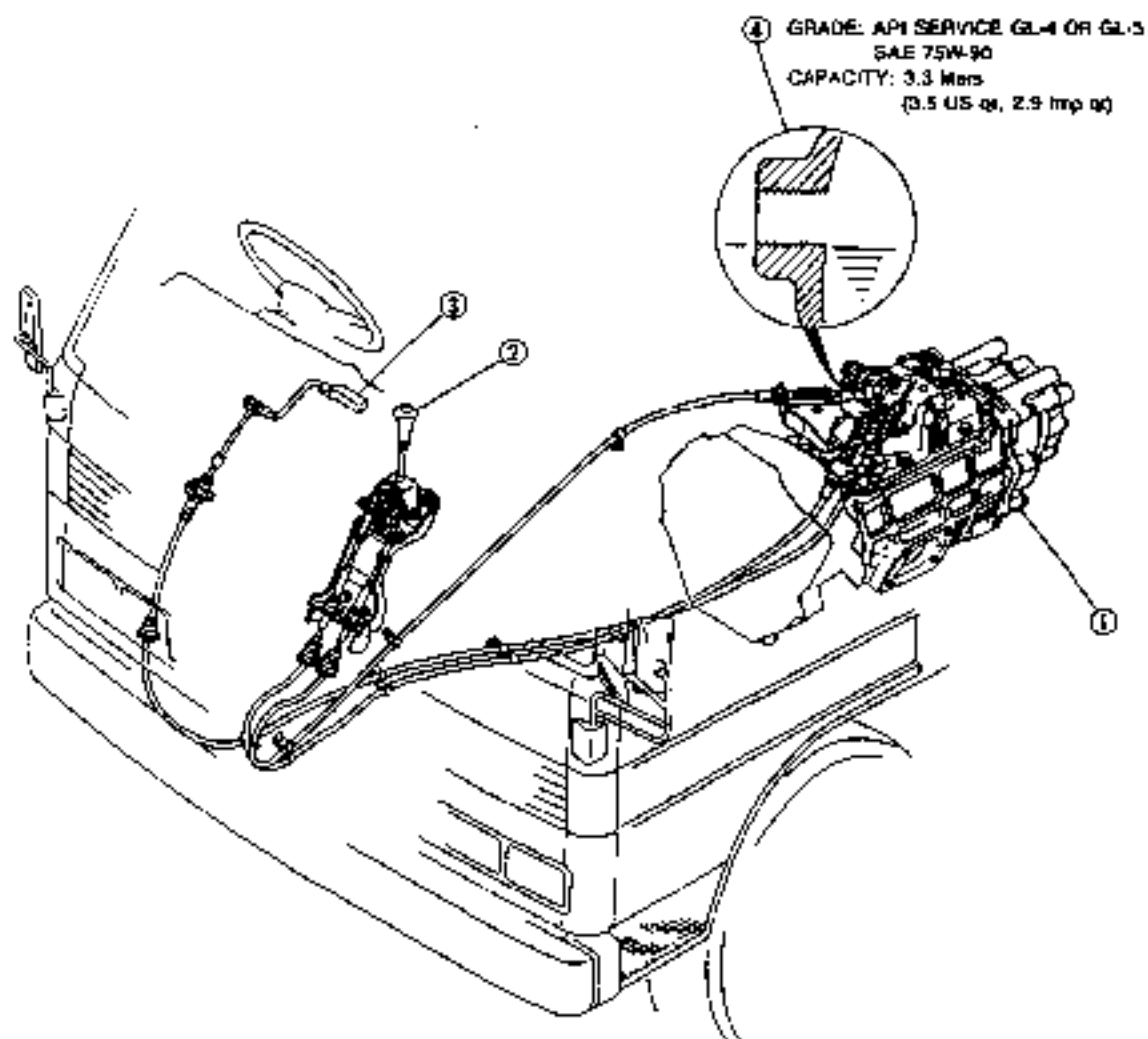
WITHOUT SUB-TRANSMISSION



97F0J1-002

- |                              |            |                                   |            |
|------------------------------|------------|-----------------------------------|------------|
| 1. Transmission              |            | 2. Shift mechanism (Transmission) |            |
| Removal / Installation ..... | page J1-14 | Removal / Installation .....      | page J1-47 |
| Disassembly .....            | page J1-17 | 3. Transmission oil               |            |
| Inspection .....             | page J1-28 | Inspection .....                  | page J1-13 |
| Assembly .....               | page J1-31 | Replacement .....                 | page J1-13 |

## WITH SUB-TRANSMISSION



9TRQJ1-000

- |                                   |            |                                       |            |
|-----------------------------------|------------|---------------------------------------|------------|
| 1. Transmission                   |            | 3. Shift mechanism (Sub-transmission) |            |
| Removal / Installation .....      | page J1-14 | Removal / Installation .....          | page J1-29 |
| Disassembly .....                 | page J1-17 | 4. Transmission oil                   |            |
| Inspection .....                  | page J1-28 | Inspection .....                      | page J1-13 |
| Assembly .....                    | page J1-31 | Replacement .....                     | page J1-13 |
| 2. Shift mechanism (Transmission) |            |                                       |            |
| Removal / Installation .....      | page J1-47 |                                       |            |

## OUTLINE

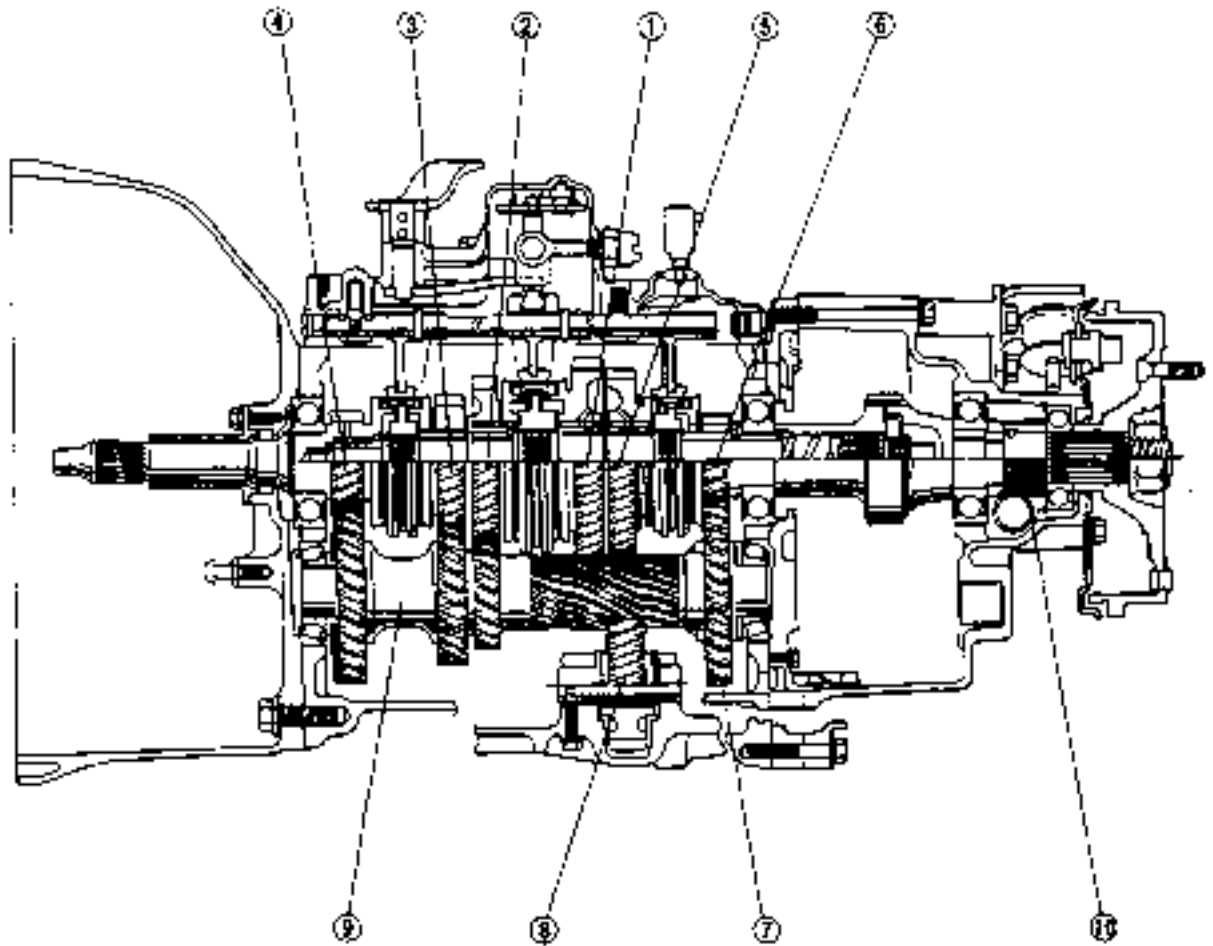
## SPECIFICATIONS

Transmission models		WSM-R Without sub-transmission		WSM-R With sub-transmission	
		HA	SL	TF	
Transmission mesh system		Forward: Synchronmesh Reverse: Constant-mesh			
Sub-transmission mesh system		—		Synchronmesh	
Shift pattern					
Gear ratio	Transmission	1st	5.833	5.478	
		2nd	2.856	3.075	
		3rd	1.657	1.637	
		4th	1.000	1.000	
		5th	0.800	0.794	
		Reverse	5.372	5.197	
	Sub-transmission	Economy	—		0.804
		Power	—		1.000
Oil	Type	AP. Service GL-4 or GL-5 SAE 75W-90			
	Capacity liters (US qt, Imp qt)	3.5 (3.7, 3.1)		3.3 (3.5, 2.9)	

97031-004

STRUCTURAL VIEW

W5M-R  
WITHOUT SUB-TRANSMISSION

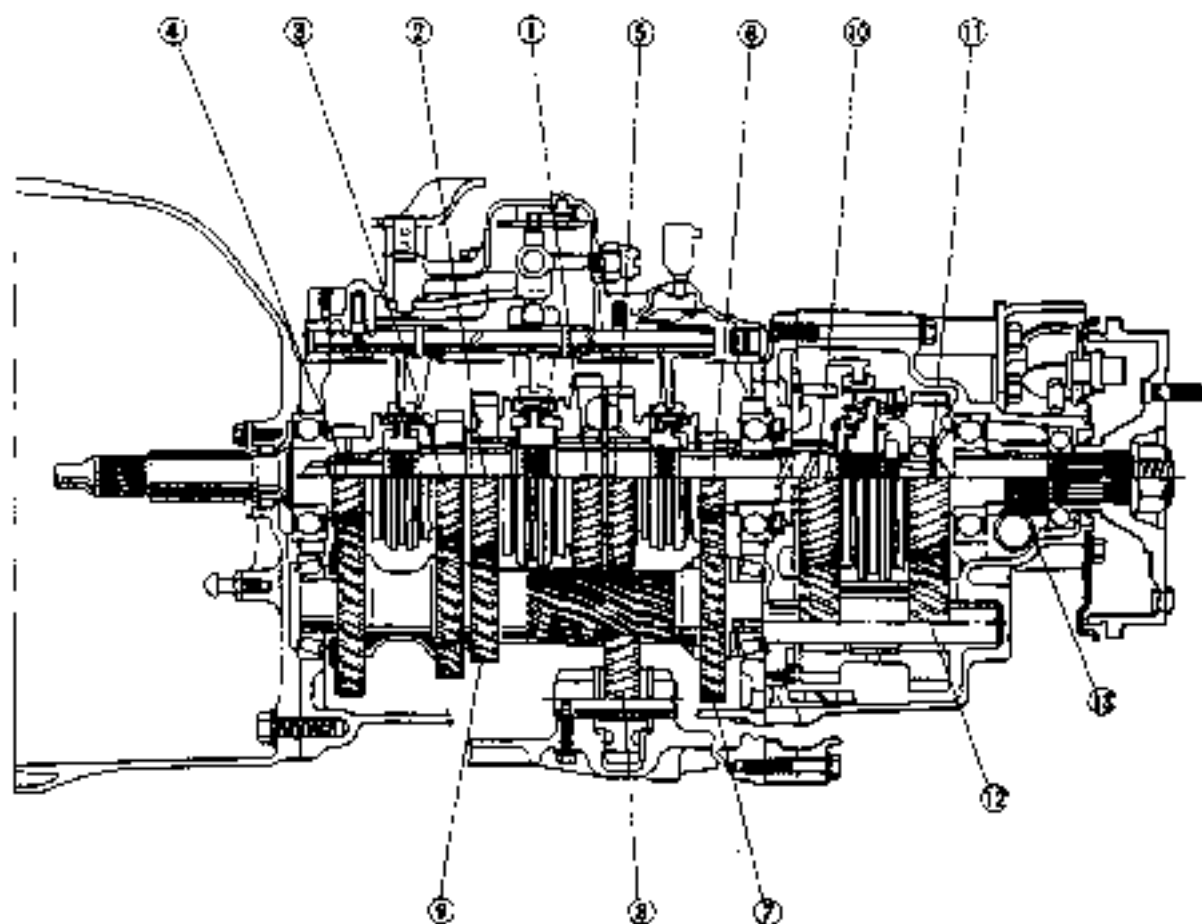


- 1. 1st gear
- 2. 2nd gear
- 3. 3rd gear
- 4. Main drive gear (4th gear)
- 5. Reverse gear

- 6. 5th gear
- 7. Counter 5th gear
- 8. Reverse idler gear
- 9. Countershaft gear
- 10. Speedometer drive gear

87A01-005

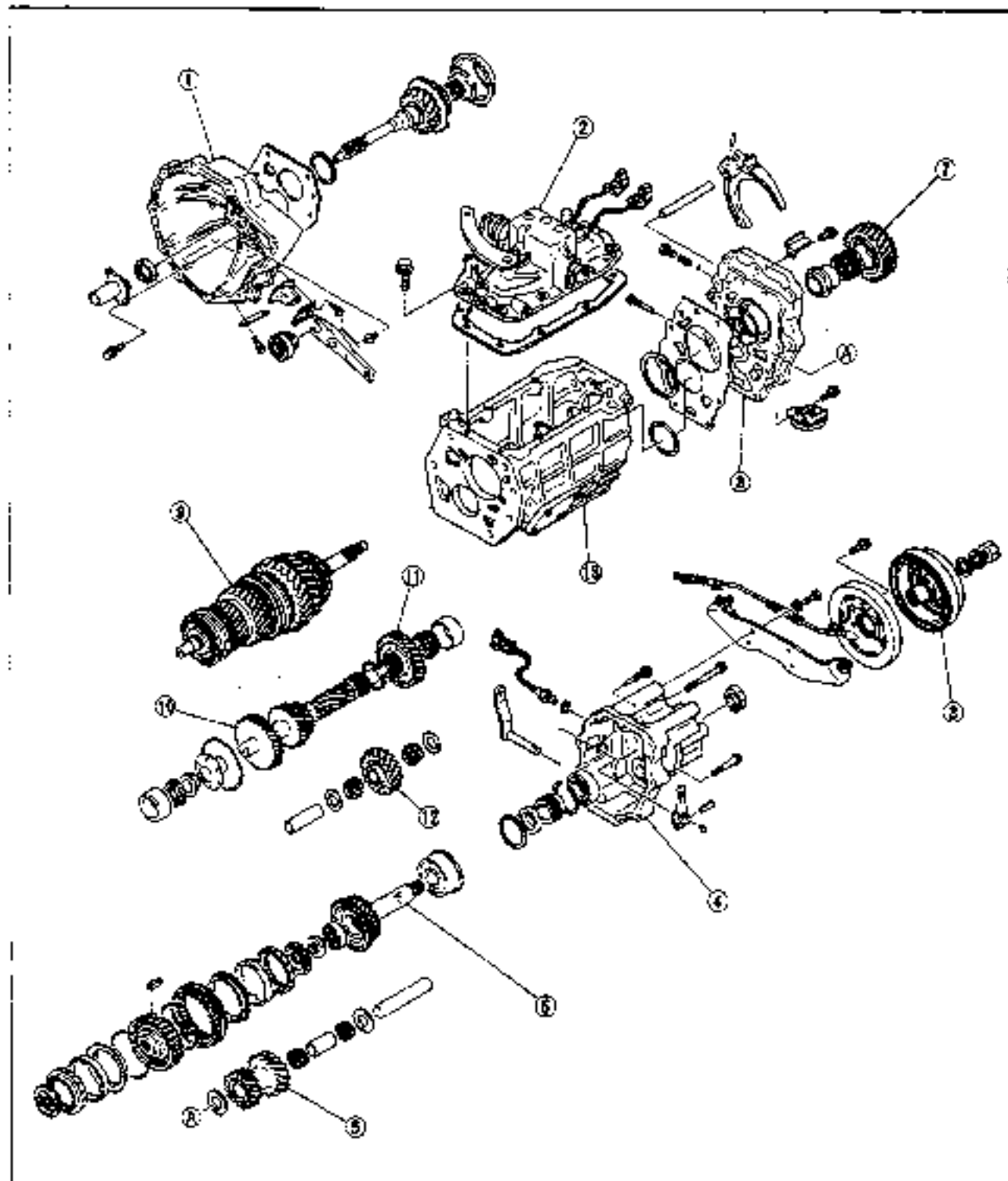
WSM-R  
WITH SUB-TRANSMISSION



970311-007

- |                               |                            |
|-------------------------------|----------------------------|
| 1. 1st gear                   | 8. Reverse idler gear      |
| 2. 2nd gear                   | 9. Countershaft gear       |
| 3. 3rd gear                   | 10. High gear              |
| 4. Main drive gear (4th gear) | 11. Output shaft           |
| 5. Reverse gear               | 12. Counter high gear      |
| 6. 5th gear                   | 13. Speedometer drive gear |
| 7. Counter 5th gear           |                            |

COMPONENTS



1. Clutch housing

2. Top cover

3. Center brake drum

4. Rear housing

5. Counter high gear

6. Output shaft

7. High gear

8. Case adapter

9. Main shaft assembly

10. Countershaft gear

11. Counter 5th gear

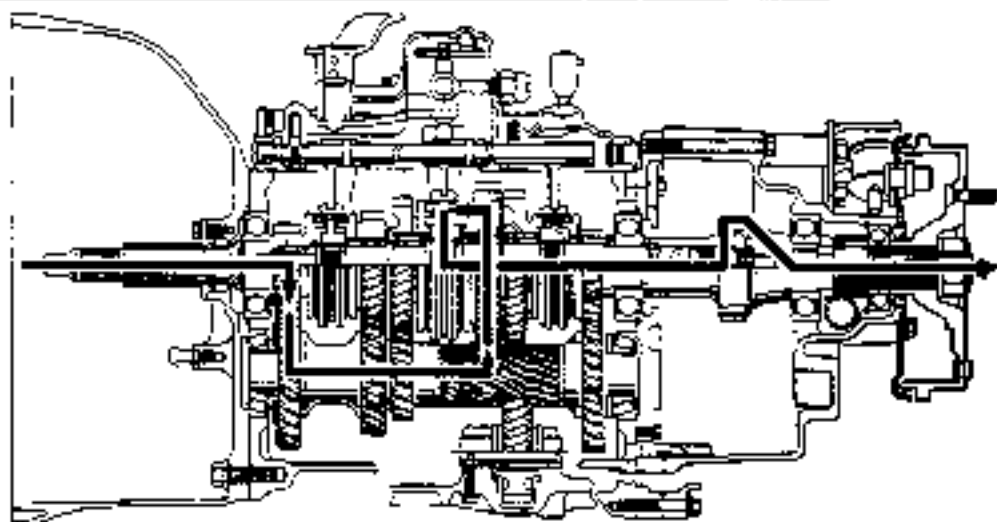
12. Reverse idler gear

13. Transmission case

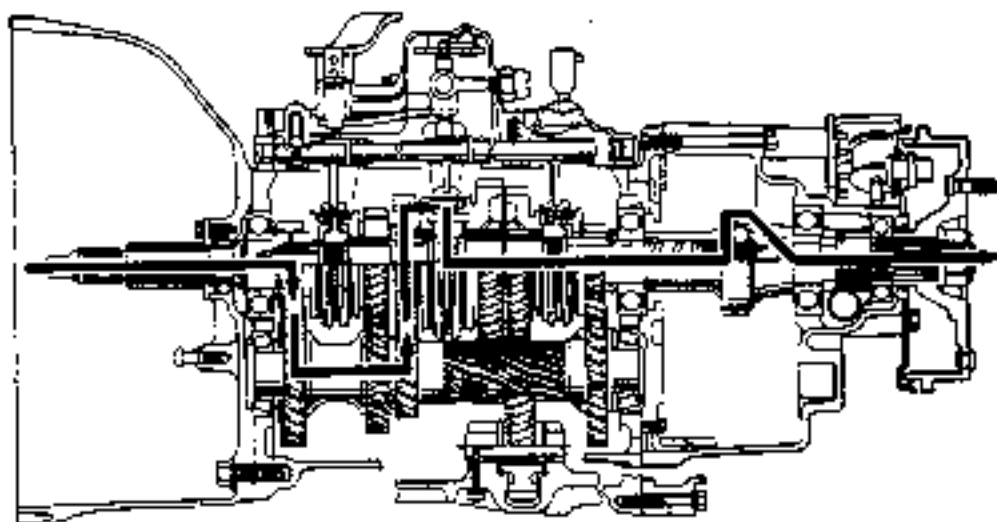
8TGM1-009

### POWERFLOW (Without Sub-transmission)

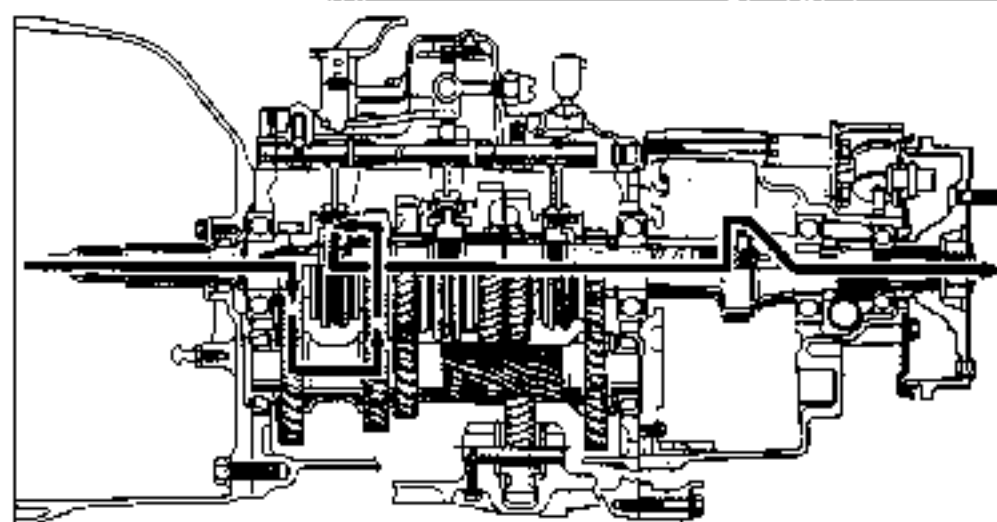
1ST



2ND

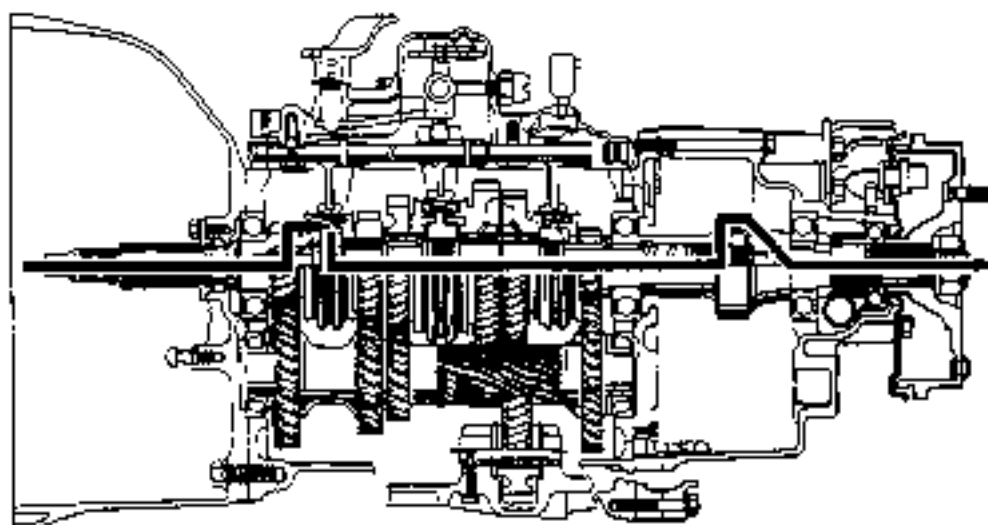


3RD

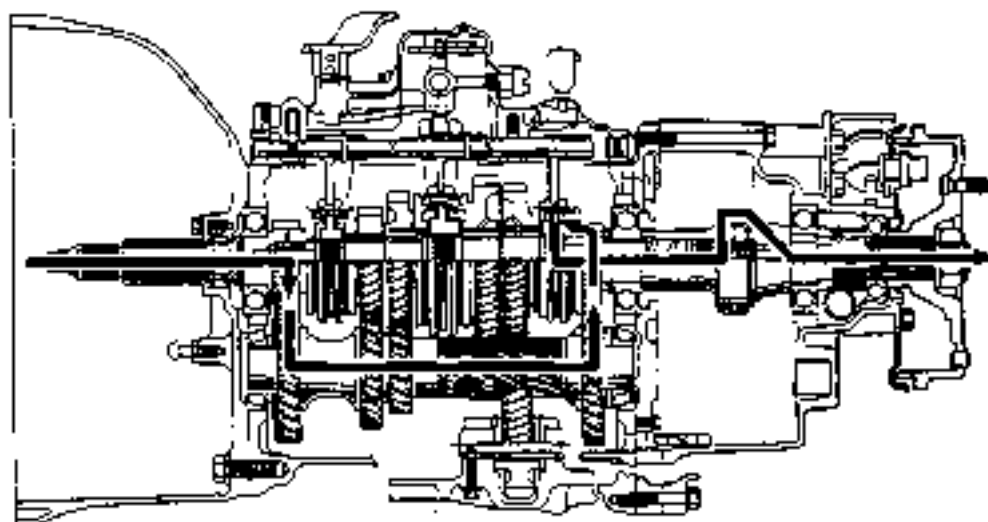




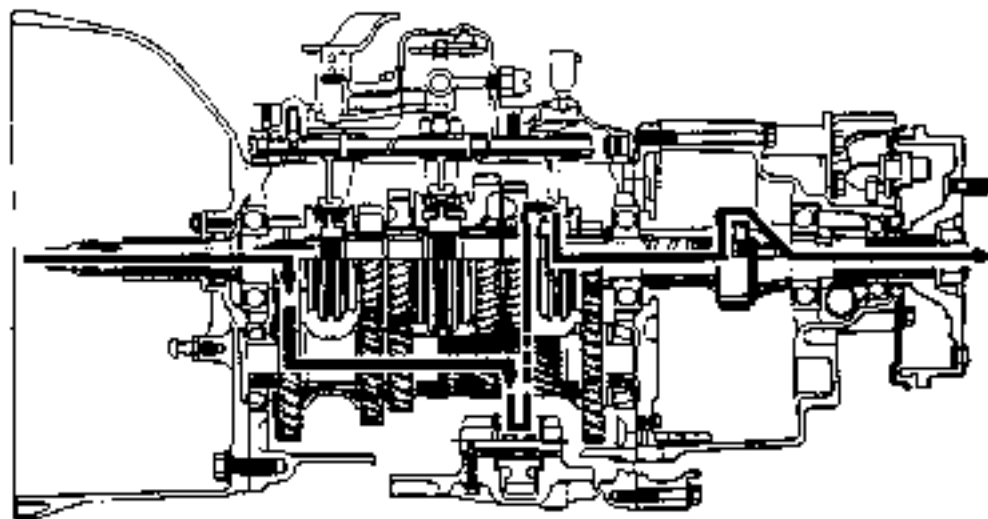
4TH



5TH

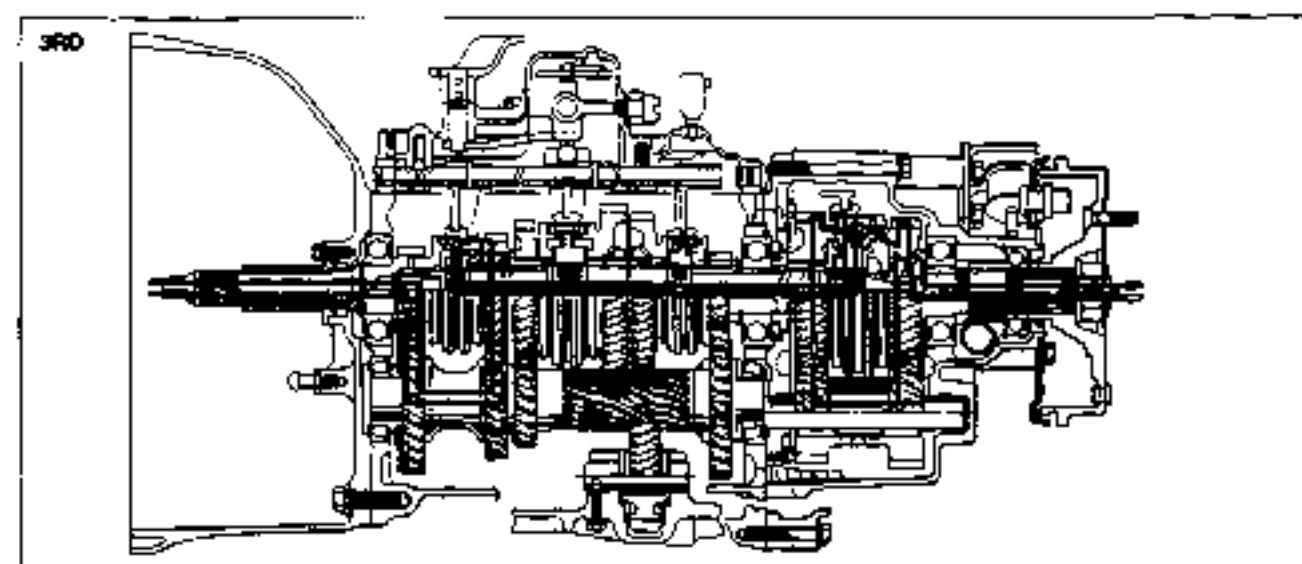
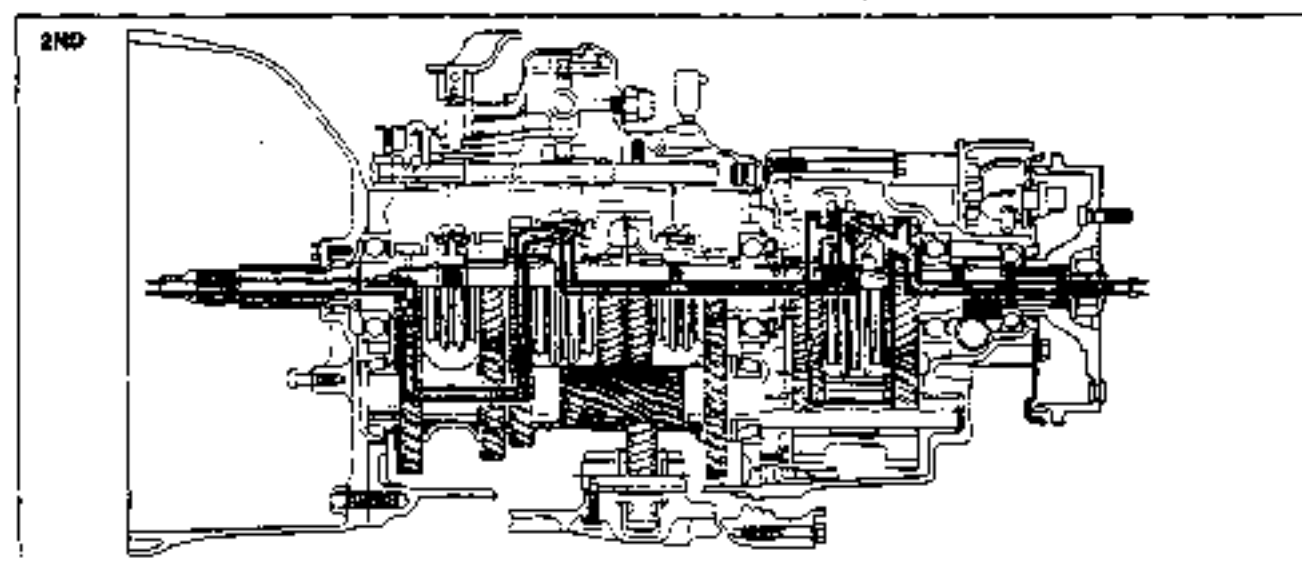
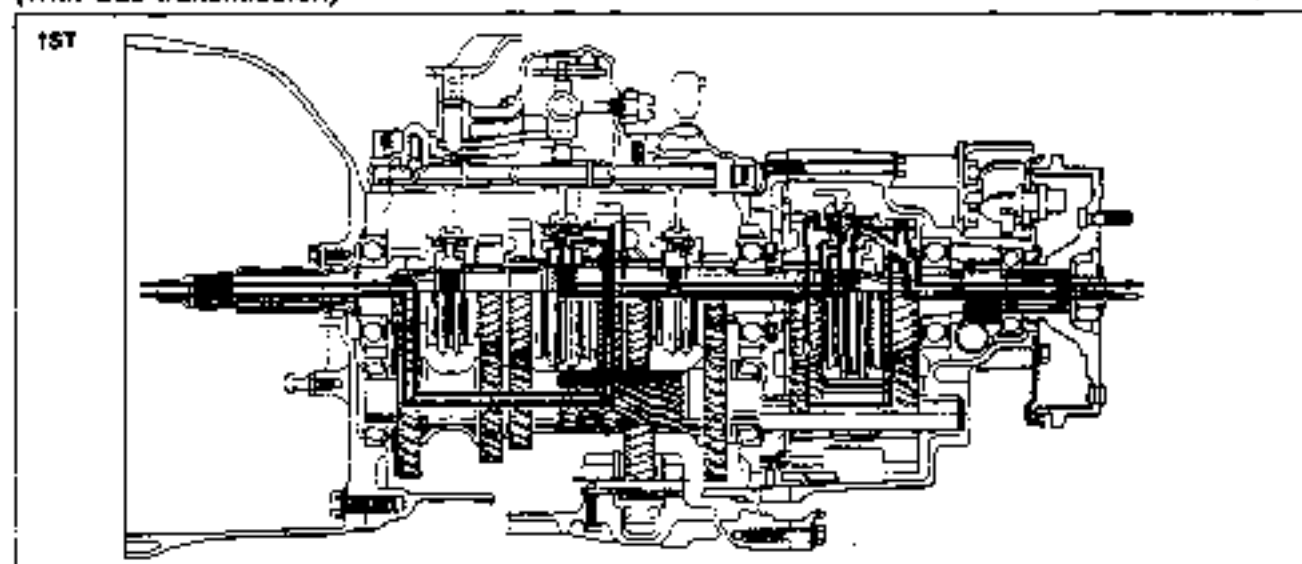


REVERSE

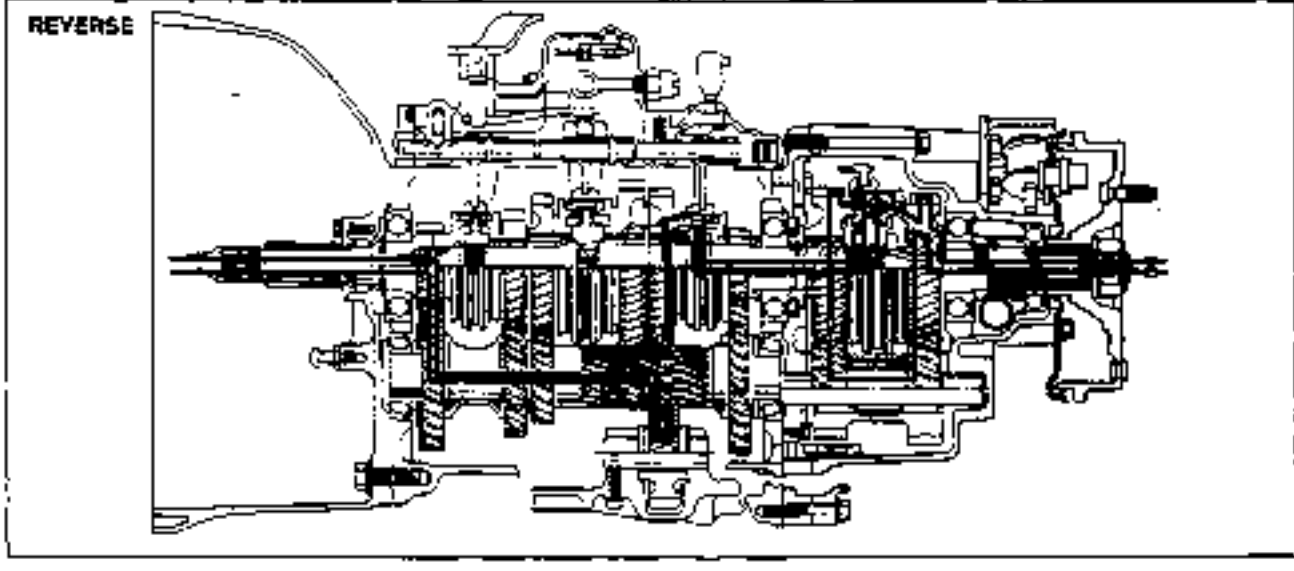
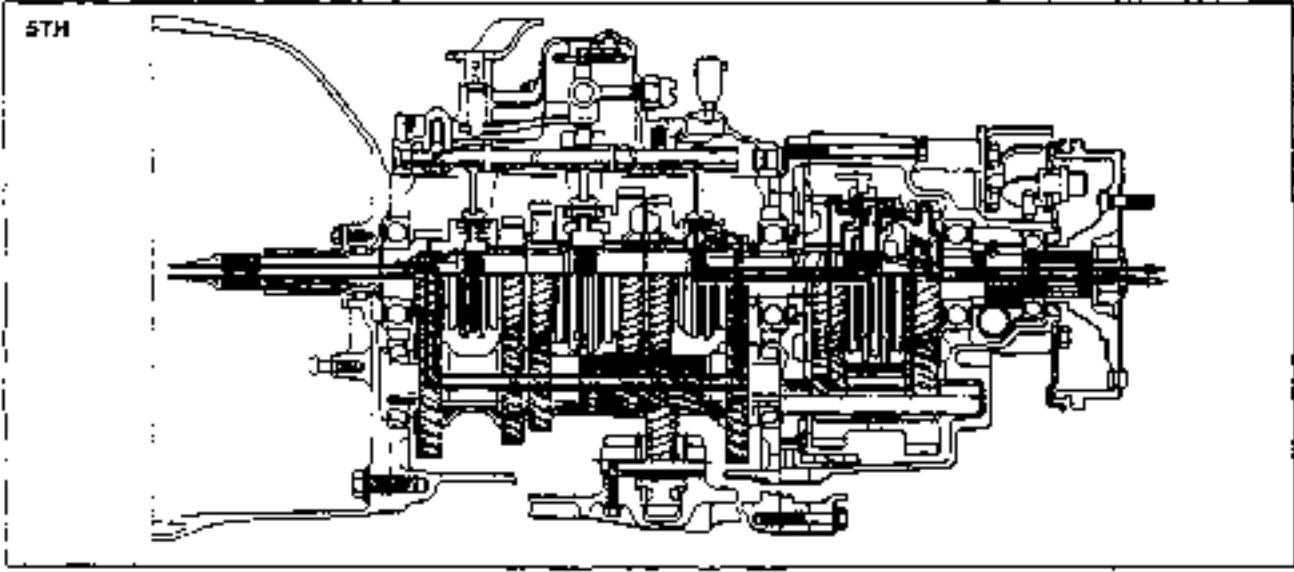
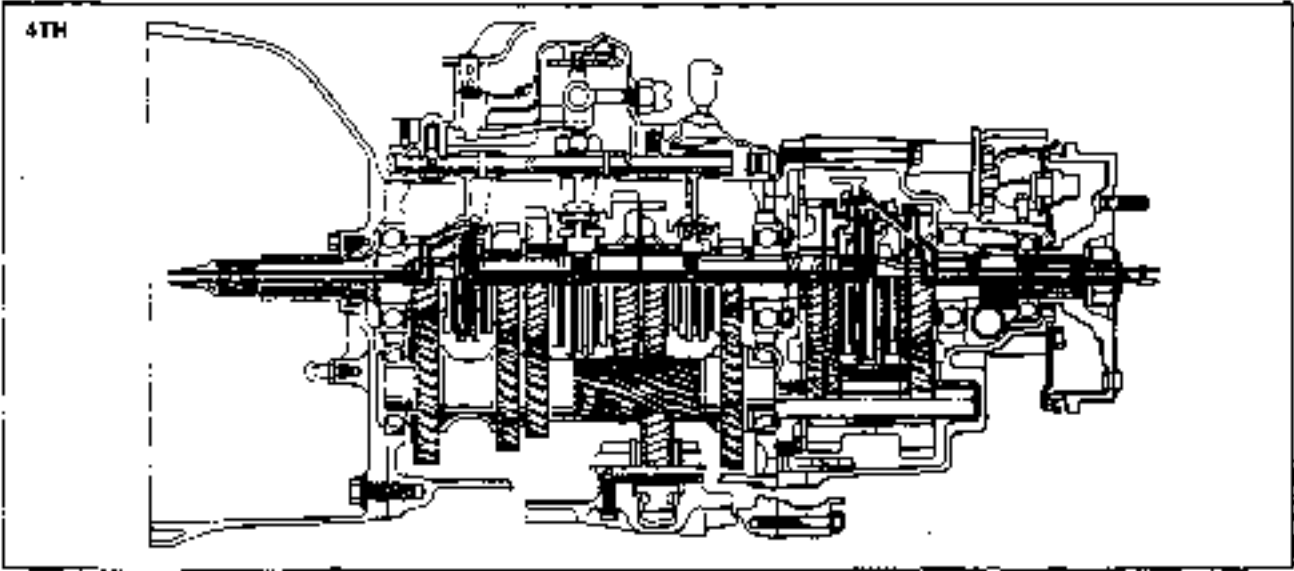


### POWERFLOW (With Sub-transmission)

Power →  
Economy ⇨

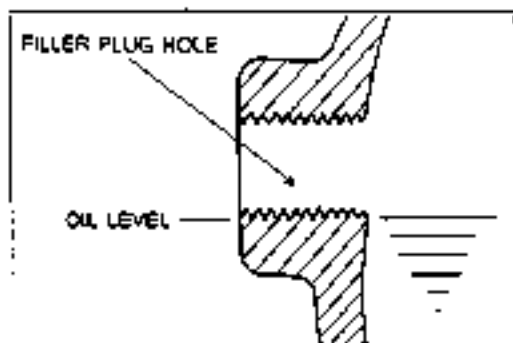


Power : →  
Economy: ←



## TROUBLESHOOTING GUIDE

Problem	Possible Cause	Action	Page
<b>Abnormal noise</b>	Insufficient oil	Add oil	J1-13
	Deterioration of oil quality	Replace with specified oil	J1-13
	Worn bearing	Replace	J1-31
	Worn contact surface of countershaft gear	Replace	J1-29
	Worn contact surface of gear	Replace	J1-26
	Excessive gear backlash	Replace	—
	Damaged gear teeth	Replace	J1-26
Foreign matter in transmission	Repair or re-ace	—	
<b>Difficult to shift</b>	Bent shift rod	Replace	—
	Insufficient oil	Add oil	J1-13
	Deterioration of oil quality	Replace with specified oil	J1-13
	Worn or loose shift fork and shift rod	Replace	—
	Worn synchronizer ring	Replace	J1-30
	Worn synchronizer cone of gear	Replace	J1-30
	Poor contact of synchronizer ring and gear cone	Replace	J1-30
	Excessive longitudinal play of gears	Replace	—
Worn bearing	Replace	J1-31	
Fatigued synchronizer key spring	Replace	—	
<b>Jumps out of gear</b>	Weak detent ball spring	Replace	—
	Worn shift fork	Replace	J1-30
	Worn clutch hub sleeve	Replace	J1-26
	Excessive gear backlash	Replace	—
	Worn bearing	Replace	J1-31
<b>Shift lever does not function smoothly or is difficult to operate</b>	Sticking control cable	Replace	J1-47
	Malfunction of control cable ball joint	Replace	J1-47
<b>Selector lever does not function smoothly or is difficult to operate</b>	Sticking control cable	Replace	J1-49
	Malfunction of control cable ball joint	Replace	J1-49



9:PO1-013

## TRANSMISSION OIL

## INSPECTION

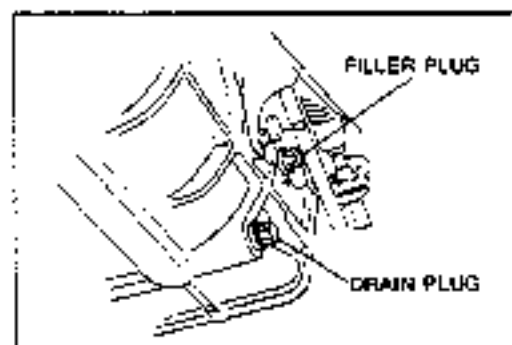
**Caution**

- Position the vehicle on level ground.

1. Remove the filler plug.
2. Verify that the oil is at the bottom of the filler plug hole. If it is low, add the specified oil from filler plug.
3. Wipe clean and apply sealant to the plug threads before installing the plug.

**Tightening torque:**

33–51 Nm (3.4–5.2 m·kg, 25–38 ft·lb)



9:PO1-306

## REPLACEMENT

1. Remove the drain plug, and drain the oil into a suitable container.
2. Wipe clean and apply sealant to the plug threads.
3. Install the drain plug.

**Tightening torque:**

33–51 Nm (3.4–5.2 m·kg, 25–38 ft·lb)

4. Add the specified oil from the filler plug hole until the level reaches the bottom of the hole.

**Specified oil:**

Type API Service GL-4 or GL-5

SAE 75W-90

Capacity Without sub-transmission

3.5 liters (3.7 US qt, 3.1 Imp qt)

With sub-transmission

3.3 liters (3.5 US qt, 2.9 Imp qt)




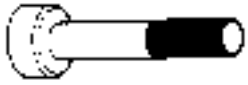



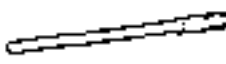






5. Apply sealant to the filler plug threads.
6. Install the filler plug.

**Tightening torque:**

33–51 Nm (3.4–5.2 m·kg, 25–38 ft·lb)

### TRANSMISSION

#### PREPARATION SST

<p>49 S120 710</p> <p>Holder, coupling flange</p> 	<p>For removal of center brake drum locknut</p>	<p>49 8501 631A</p> <p>Attachment, rear axle shaft pulser</p> 	<p>For removal of center brake drum</p>
<p>49 0223 630B</p> <p>Pulser, rear axle shaft</p> 	<p>For removal of center brake drum</p>	<p>49 0500 330</p> <p>Installer, transmission bearing</p> 	<p>For installation of oil seal</p>
<p>49 W017 101</p> <p>Remover, clutch hub</p> 	<p>For removal of clutch hub, bearing</p>	<p>49 0838 425C</p> <p>Pulser, set bearing</p> 	<p>For removal of bearing</p>
<p>49 H027 002</p> <p>Remover, bearing</p> 	<p>For removal of spacer</p>	<p>49 0862 350</p> <p>Guide, shift lock assembly</p> 	<p>For installation of interlock pin</p>
<p>49 F401 330B</p> <p>Installer, set, bearing</p> 	<p>For installation of bearing</p>	<p>49 F401 331</p> <p>Body (Part of 49 F401 330B)</p> 	<p>For installation of bearing</p>
<p>49 F401 337A</p> <p>Attachment C (Part of 49 F401 330B)</p> 	<p>For installation of bearing</p>	<p>49 0600 330</p> <p>Installer, transmission bearing</p> 	<p>For installation of bearing</p>
<p>49 W501 445</p> <p>Holder, synchronizer ring</p> 	<p>For installation of bearing</p>	<p>49 F015 002</p> <p>Installer, water seal</p> 	<p>For installation of bearing</p>

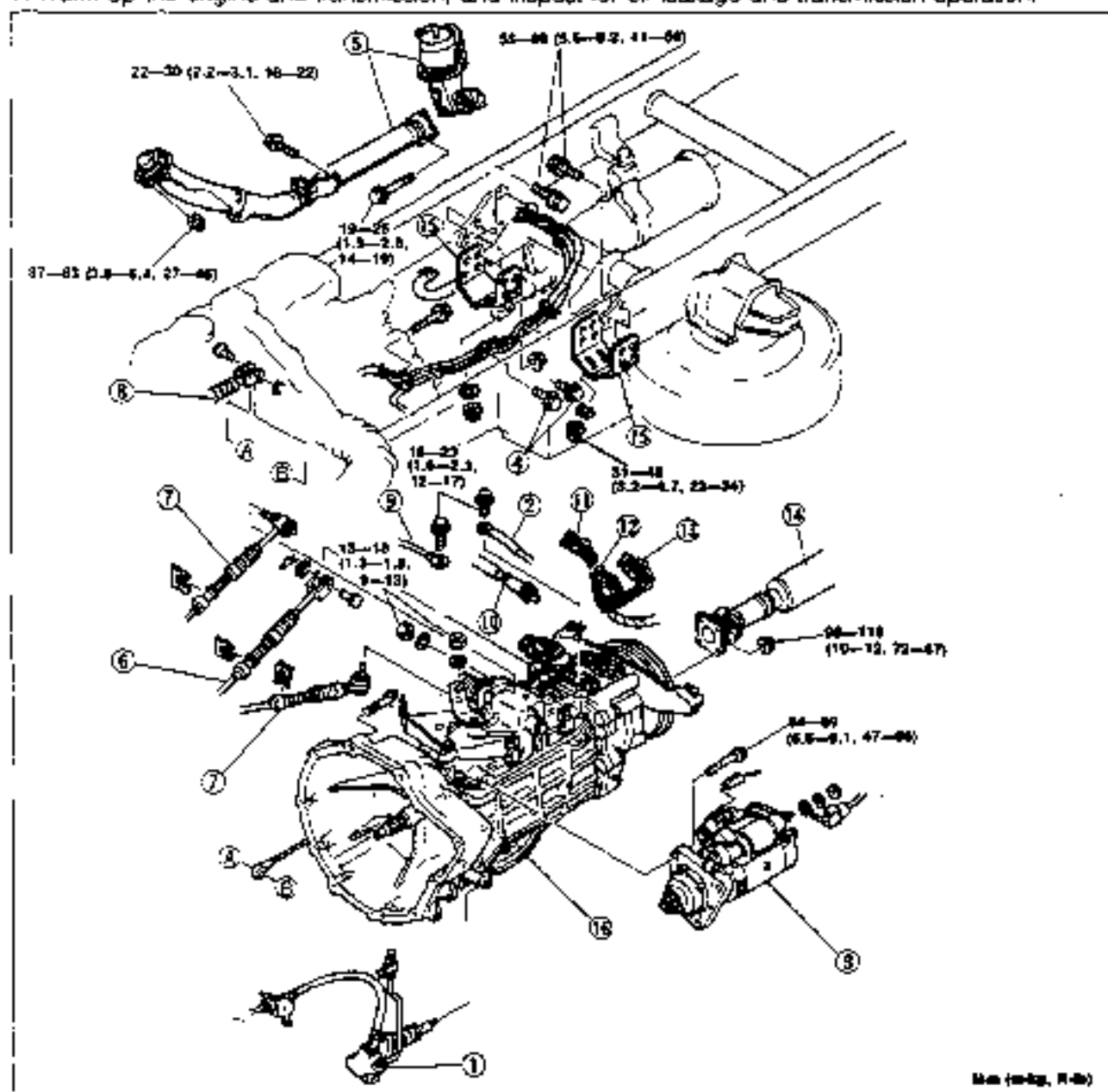
9TFCU1-007

#### REMOVAL / INSTALLATION

1. Disconnect the negative battery cable.
2. Raise the vehicle and support it with safety stands.

9TGU1-016

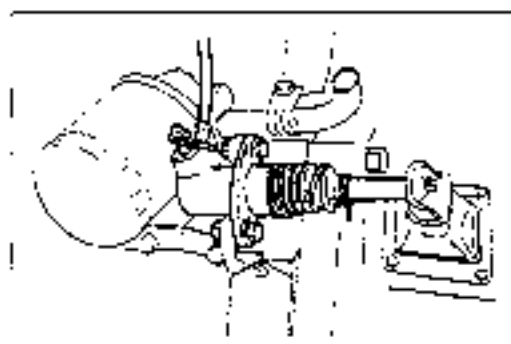
3. Drain the transmission oil into a suitable container.
4. Remove in the order shown in the figure, referring to **Removal Note**.
5. Install in the reverse order of removal, referring to **Installation Note**.
6. Add the specified amount of the specified transmission oil. (Refer to page J1-13.)
7. Warm up the engine and transmission, and inspect for oil leakage and transmission operation.



Man (m-kg, F-8)

YTR01-008

- |  |   |  |
|--|---|--|
| 1. Clutch release cylinder<br>Removal Note<br>..... page J1-16 | 7. Shift/selector cable                                 | 14. Propeller shaft<br>Service ..... Section L       |
| 2. Ground wire<br>Installation Note<br>..... page J1-16        | 8. Parking brake cable                                  | 15. Transmission mount bracket                       |
| 3. Starter   | 9. Ground wire<br>Installation Note<br>..... page J1-16 | 16. Transmission<br>Removal Note<br>..... page J1-16 |
| 4. Fuel pipe clip bolt   | 10. Speedometer cable                                   | Disassembly ... page J1-17                           |
| 5. Exhaust pipe and power<br>chamber                           | 11. Backup lamp switch con-<br>nector                   | Inspection ..... page J1-28                          |
| 6. Sub-selector cable  | 12. Neutral switch connector                            | Assembly ..... page J1-31                            |
|  | 13. Sub transmission switch con-<br>nector              | Installation Note<br>..... page J1-16                |

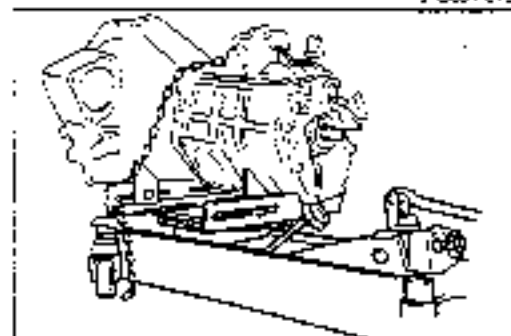


97G0J1-015

### Removal Note

#### Clutch release cylinder

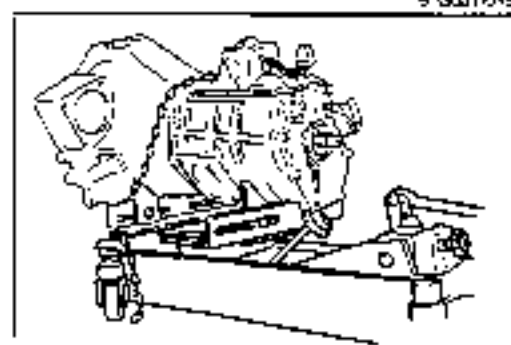
1. Remove the bolt and nut shown in the figure.
2. Move the clutch release cylinder out of the way to remove the transmission.



97G0J1-018

### Transmission

1. Support the engine with a jack under the oil pan.
2. Support the transmission with a transmission jack.
3. Remove the transmission mount bolts.
4. Remove the transmission from under the vehicle.

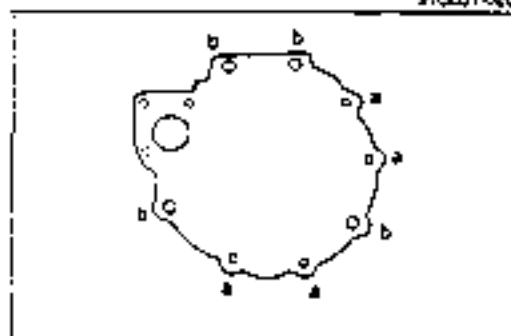


97G0J1-020

### Installation Note

#### Transmission

1. Install the transmission with the transmission jack.

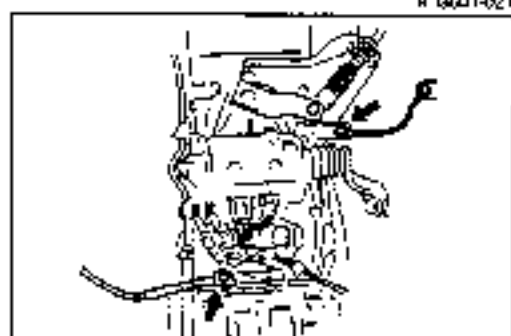


97G0J1-021

2. Tighten the transmission mount bolts.

#### Tightening torque

- a: 89—117 Nm (9.1—11.9 m·kg, 65—86 ft·lb)  
 b: 37—52 Nm (3.8—5.3 m·kg, 27—38 ft·lb)



97G0J1-022

#### Ground wire

1. Install the ground wires.

#### Tightening torque:

- 16—23 Nm (1.6—2.3 m·kg, 12—17 ft·lb)

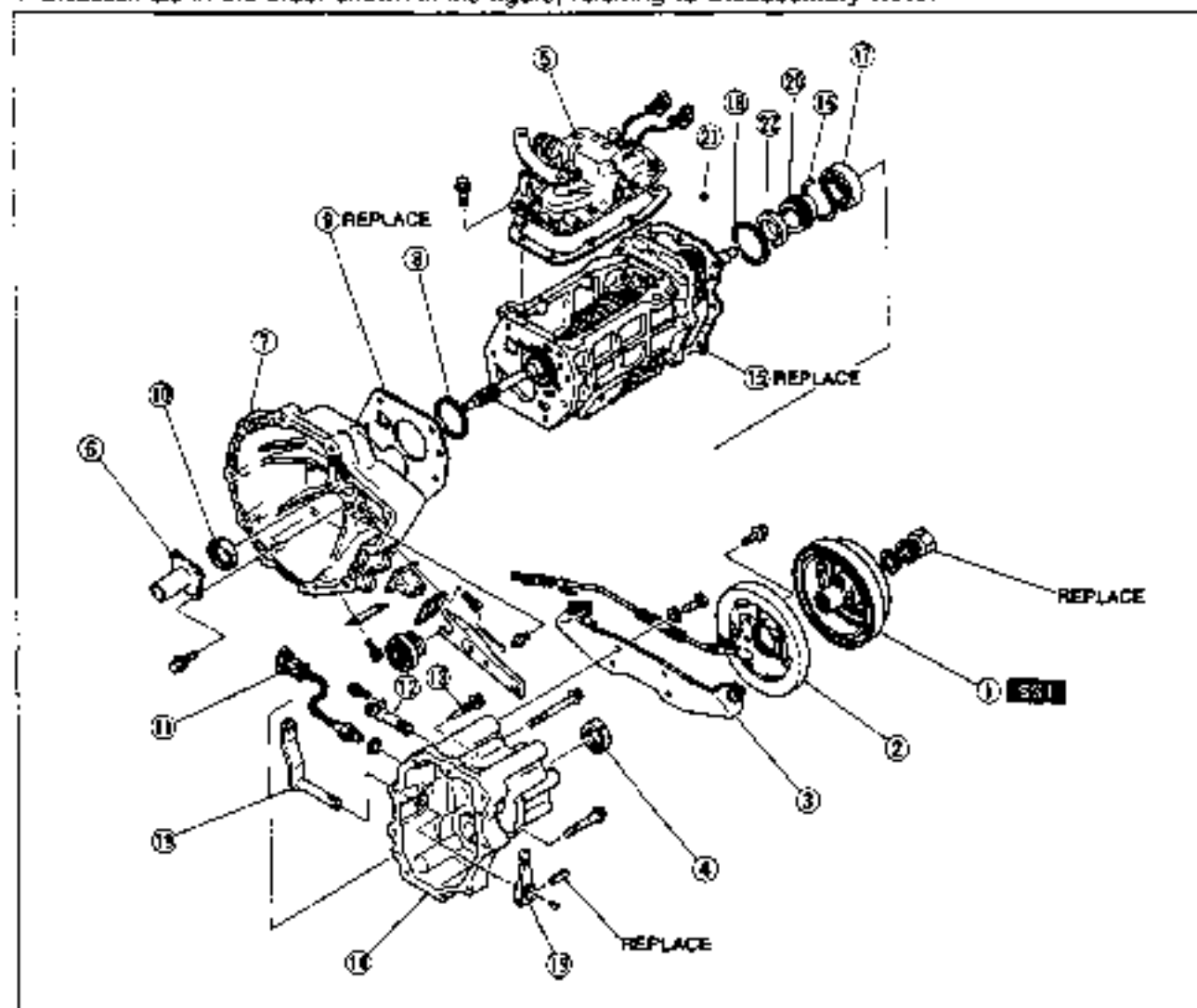


**DISASSEMBLY****Precaution**

1. Clean the transmission exterior thoroughly with a steam cleaner or cleaning solvents before disassembly.
2. Clean the removed parts with cleaning solvent, and dry with compressed air.  
Clean out all holes and passages with a compressed air, and check that there are no obstructions.
3. Wear eye protection when using compressed air to clean components.

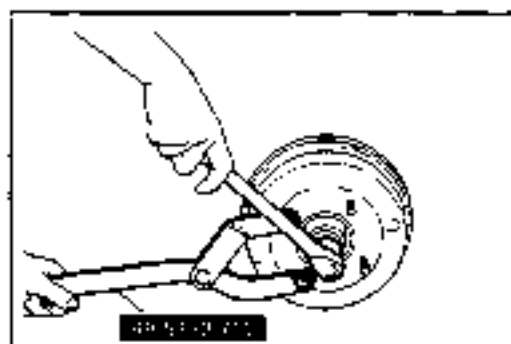
**Housing Components**

1. Disassemble in the order shown in the figure, referring to **Disassembly Note**.



9TFCU1-008

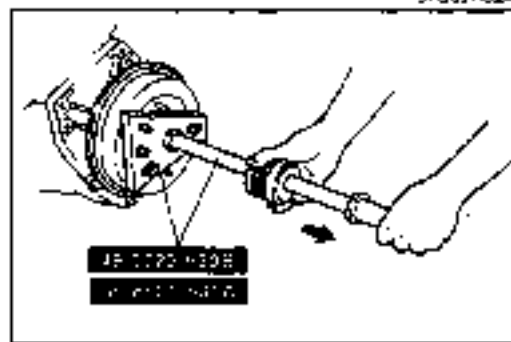
- |   |  |  |
|---|--|--|
| 1. Center brake drum<br>Disassembly Note<br>..... page J1-18  | 6. Front cover   | 15. Gasket   |
| 2. Center brake assembly  | 7. Clutch housing  | 16. Snap ring  |
| 3. Transmission mount   | 8. Adjustment shim<br>REPLACE                              | 17. Ball bearing<br>Disassembly Note<br>..... page J1-18 |
| 4. Oil seal<br>Inspect for damage<br>Replace if necessary<br>On-vehicle replacement<br>..... page J1-18 | 9. Gasket<br>REPLACE                                       | 18. Adjustment shim                                      |
| 5. Top cover<br>Disassembly ... page J1-27<br>Assembly ..... page J1-33                                 | 10. Oil seal<br>Inspect for damage<br>Replace if necessary | 19. Shift lever  |
|   | 11. Sub-transmission switch                                | 20. Speedometer drive gear                               |
|   | 12. Speedometer driven gear<br>REPLACE                     | 21. Ball   |
|   | 13. Bolt<br>REPLACE  | 22. Spacer   |
|   | 14. Rear housing<br>Disassembly Note<br>..... page J1-18   |  |



9FG011-024

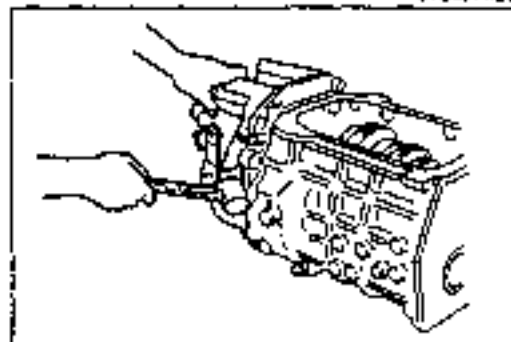
#### Disassembly Note Center brake drum

1. Hold the center brake drum with the **SST**, and remove the locknut.



9TQ011-025

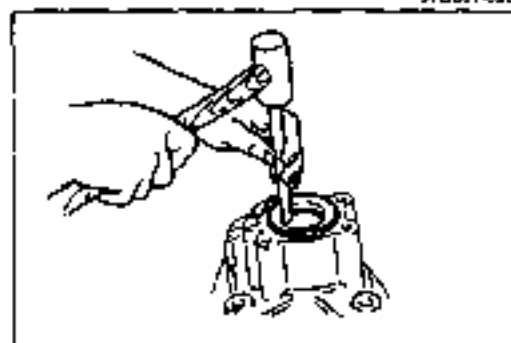
2. Remove the center brake drum with the **SST**.



9TBB11-026

#### Rear housing

1. Remove the rear housing. If necessary, tap the housing with a plastic hammer.



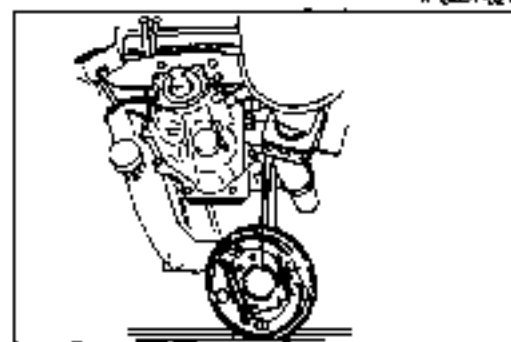
9TGA11-027

#### Ball bearing

##### Caution

- Do not damage the oil seal.

1. Remove the ball bearing with a brass bar and a hammer.

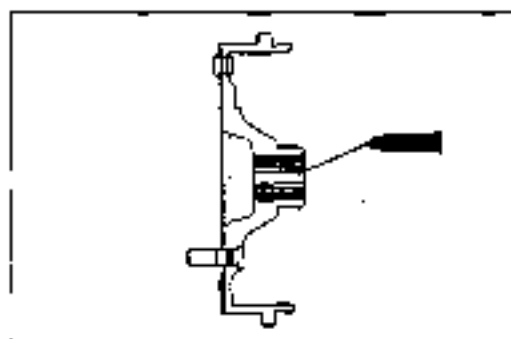


9TF011-010

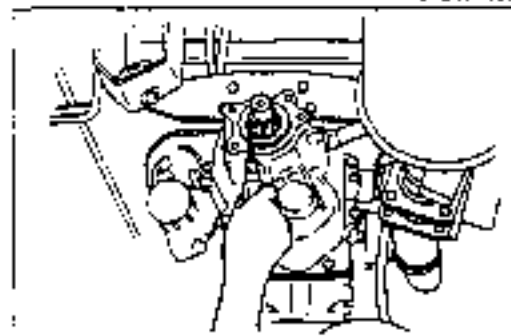
#### On-vehicle replacement

##### Oil seal (rear)

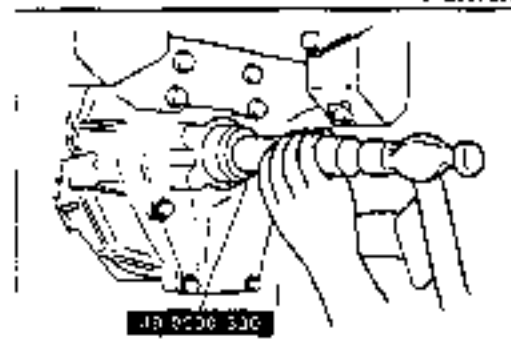
1. Remove the propeller shaft. (Refer to Section L.)
2. Remove the center brake drum. (Refer to page J1-18.)
3. Remove the center brake assembly, and suspend it with a rope.



8TG3J1-029



8TG3J1-030



8TG3J1-031

**Caution**

- Do not damage the mainshaft splines.

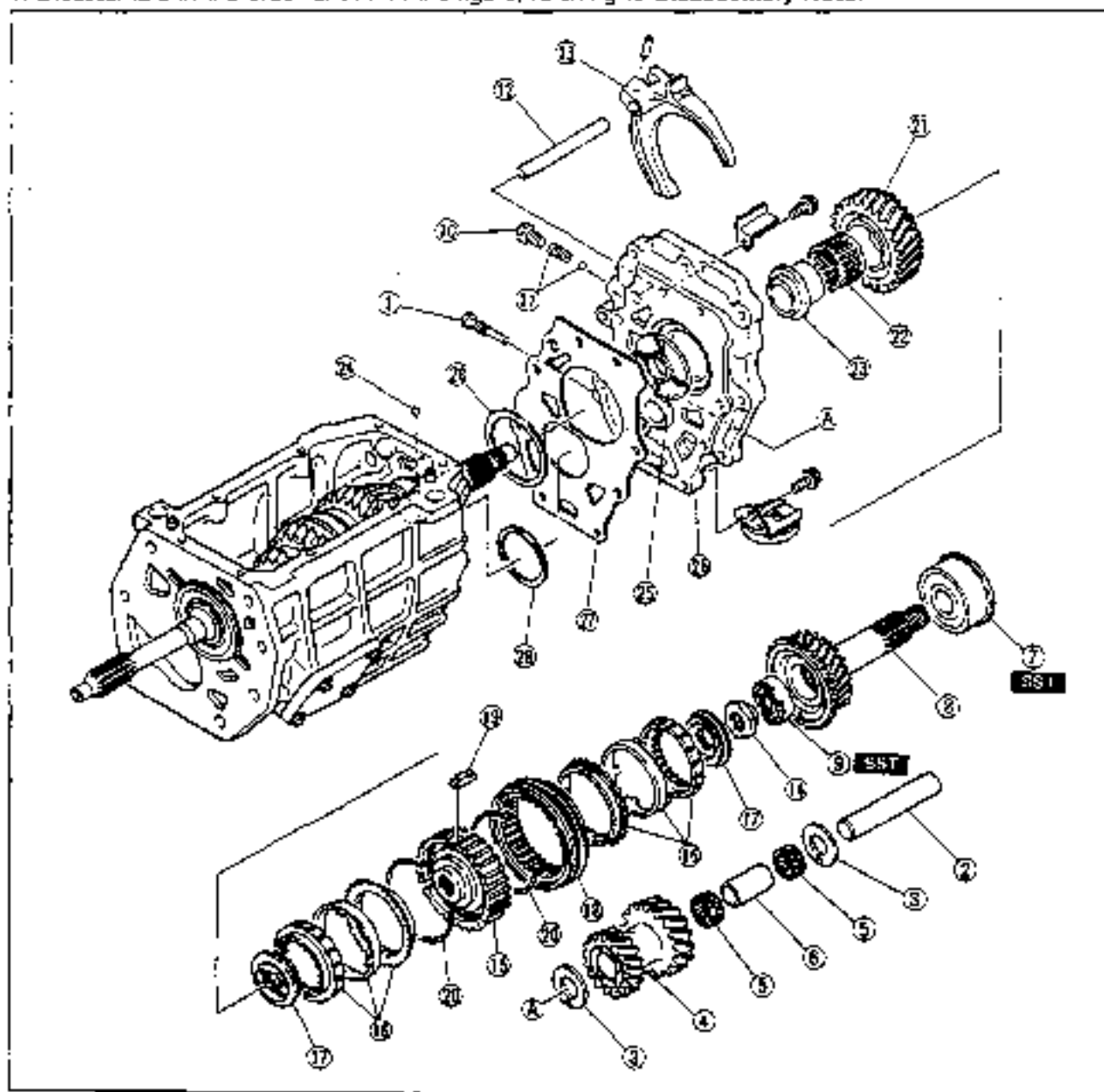
4. Remove the oil seal
5. Apply transmission oil to outer periphery and lip of the new oil seal.

6. Install the new oil seal with the SST
7. Install the center brake assembly

8. Apply sealant to center brake drum splines, and install it.
9. Install the propeller shaft. (Refer to Section L.)

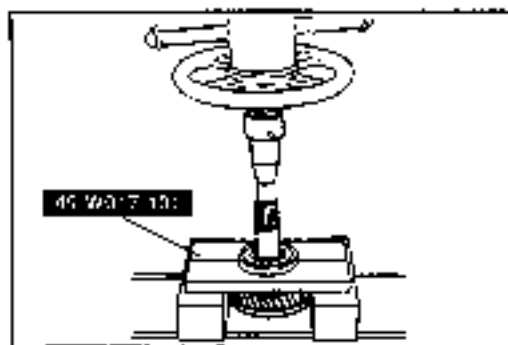
## Sub-transmission Parts

1. Disassemble in the order shown in the figure, referring to **Disassembly Note**.



9760101

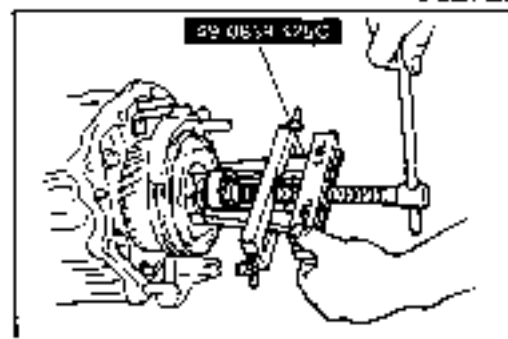
- |                            |                            |                             |
|----------------------------|----------------------------|-----------------------------|
| 1. Mounting bolt           | 9. Bearing                 | 17. Inner cone hub          |
| 2. Counter gear shaft      | Disassembly Note           | 18. Clutch hub sleeve       |
| 3. Thrust washer           | ..... page J1-21           | 19. Synchronizer key        |
| 4. Counter high gear       | Inspection..... page J1-31 | 20. Synchronizer key spring |
| Inspection..... page J1-28 | 10. Cap plug               | 21. High gear               |
| 5. Needle bearing          | 11. Steel ball and spring  | Inspection..... page J1-28  |
| Inspection.... page J1-31  | 12. Shift rod              | 22. Needle bearing          |
| 6. Spacer                  | 13. Shift fork             | Inspection..... page J1-31  |
| 7. Output shaft bearing    | 14. Locknut                | 23. Gear sleeve             |
| Disassembly Note           | Disassembly Note           | 24. Steel ball              |
| ..... page J1-21           | ..... page J1-21           | 25. Scoop ring              |
| Inspection..... page J1-31 | 15. Clutch hub assembly    | 26. Case adapter            |
| 8. Output shaft            | 16. Double cone assembly   | 27. Gasket                  |
| Inspection..... page J1-28 | Inspection..... page J1-30 | 28. Adjustment shim         |



8TGM1-033

**Disassembly Note**  
**Output shaft bearing**

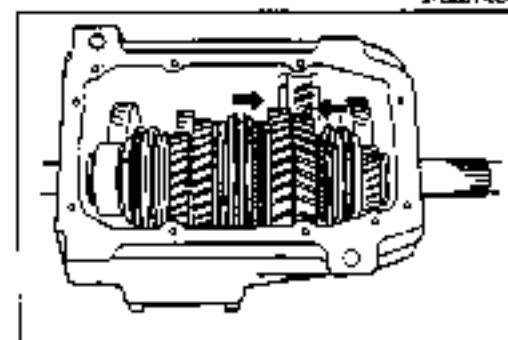
1. Remove the bearing from the output shaft with the **SST**.



8TGM1-034

**Bearing**

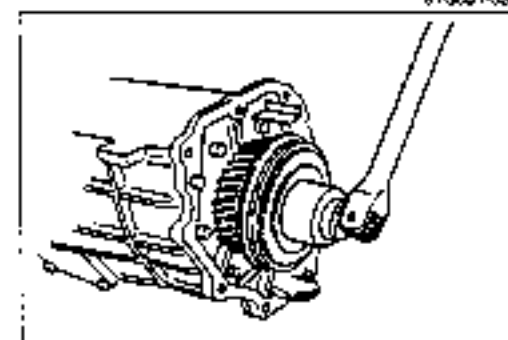
1. Remove the bearing with the **SST**.



8TGM1-035

**Locknut**

1. Uncrimp the tab of the locknut.
2. Shift the clutch hub sleeves to 1st gear and reverse gear to put the gears in a double-engaged condition.

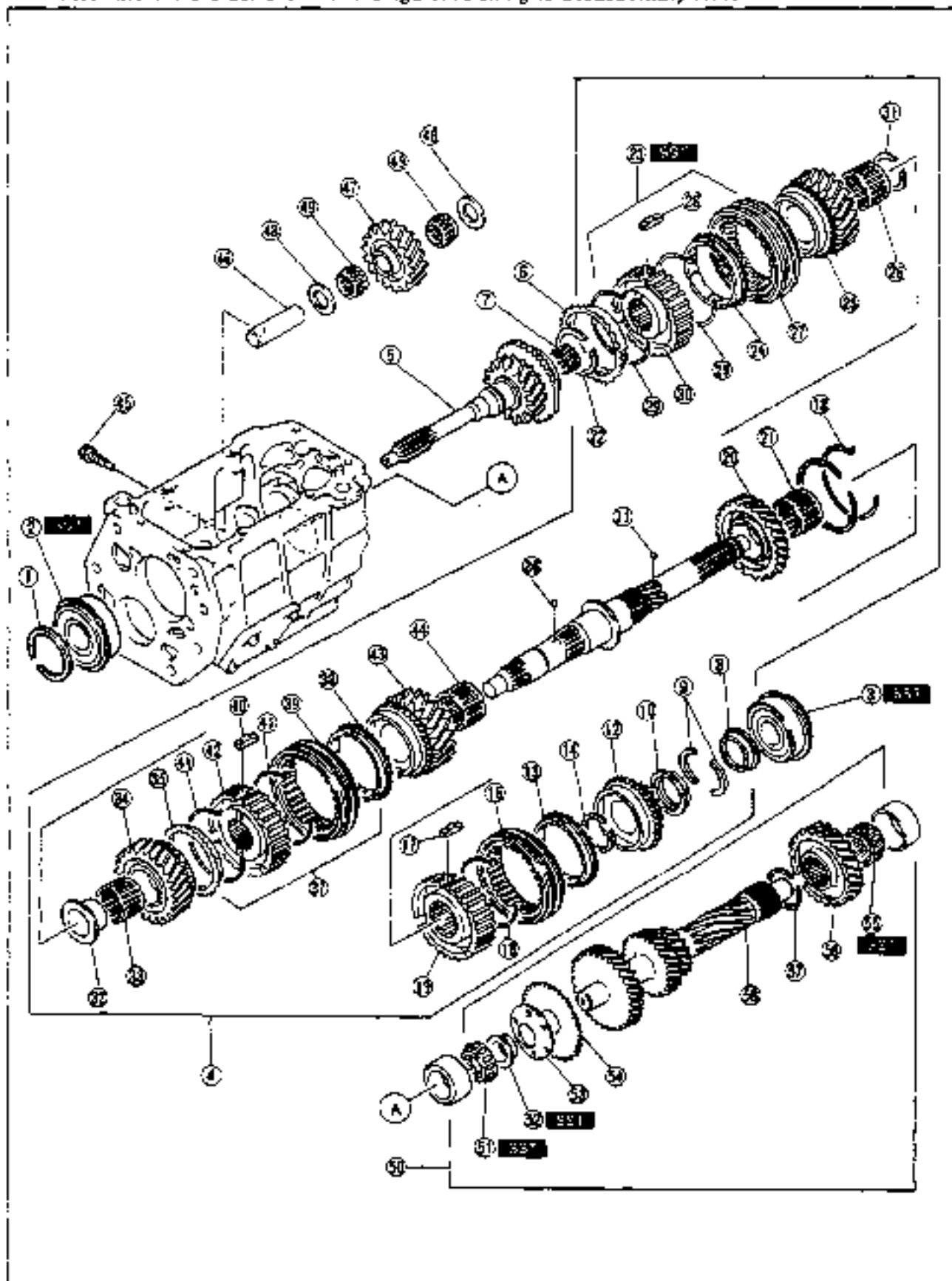


8TGM1-036

3. Remove the locknut.

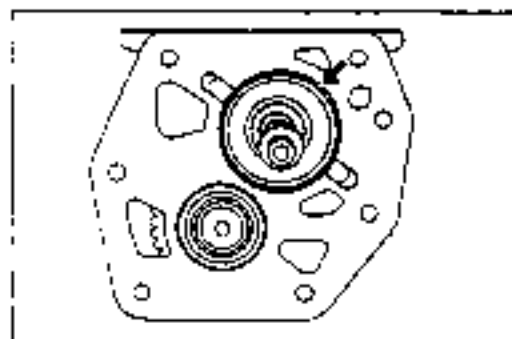
## Main shaft

1. Disassemble in the order shown in the figure, referring to **Disassembly Note**

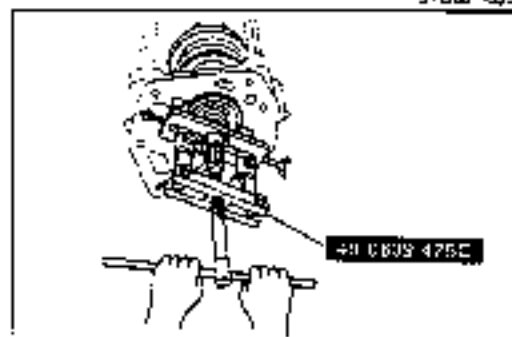


1. Snap ring	20. Reverse gear	42. Clutch hub
2. Main drive gear bearing	Inspection .. ... page J1-28	43. 1st gear
Disassembly Note	21. Needle bearing	Inspection .. ... page J1-28
..... .. page J1-23	Inspection .. ... page J1-31	44. Needle bearing
3. Mainshaft bearing	22. Snap ring	Inspection .. ... page J1-31
Disassembly Note	23. Clutch hub assembly	45. Mounting bolt
..... .. page J1-24	(3rd/4th)	46. Reverse idler gear shaft
Inspection .. ... page J1-31	Disassembly Note	47. Reverse idler gear
4. Mainshaft assembly	..... .. page J1-24	Inspection .. ... page J1-28
Disassembly Note	24. Synchronizer ring (3rd)	48. Thrust washer
..... .. page J1-24	Inspection .. ... page J1-30	49. Needle bearing
5. Main drive gear	25. 3rd gear	Inspection .. ... page J1-31
Disassembly Note	Inspection .. ... page J1-28	50. Countershaft assembly
..... .. page J1-24	26. Needle bearing	Disassembly Note
Inspection .. ... page J1-28	Inspection .. ... page J1-31	..... .. page J1-25
6. Synchronizer ring (4th)	27. Clutch hub sleeve	51. Countershaft front bearing
Inspection .. ... page J1-30	28. Synchronizer key	Disassembly Note
7. Needle bearing	29. Synchronizer key spring	..... .. page J1-25
Inspection .. ... page J1-31	30. Clutch hub	Inspection .. ... page J1-31
8. Retaining ring	31. Snap ring	52. Spacer
9. O washer	32. Gear sleeve	Disassembly Note
10. Thrust lock washer	33. Needle bearing	..... .. page J1-26
11. Steel ball	Inspection .. ... page J1-31	53. Diaphragm spring
12. 5th gear	34. 2nd gear	54. Friction gear
Inspection .. ... page J1-28	Inspection .. ... page J1-28	55. Countershaft rear bearing
13. Synchronizer ring (5th)	35. Synchronizer ring (2nd)	Disassembly Note
Inspection .. ... page J1-30	Inspection .. ... page J1-30	..... .. page J1-26
14. Snap ring	36. Steel ball	Inspection .. ... page J1-31
15. Clutch hub assembly	37. Clutch hub assembly	56. Counter 5th gear
(5th/reverse)	(1st/2nd)	Inspection .. ... page J1-28
16. Clutch hub sleeve	38. Synchronizer ring (1st)	57. Snap ring
17. Synchronizer key	Inspection .. ... page J1-30	58. Countershaft
18. Synchronizer key spring	39. Clutch hub sleeve	Inspection .. ... page J1-29
19. Clutch hub	40. Synchronizer key	
	41. Synchronizer key spring	

9T6U1-012



9T6U1-039



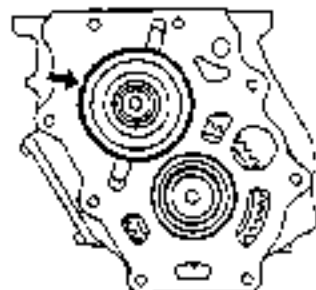
9T6U1-046

**Disassembly Note**

**Main drive gear bearing**

1. Turn the bearing snap ring so that the ends are 90° to the case grooves.

2. Remove the main drive gear bearing with the SST.



9T00J1-041

**Mainshaft bearing**

1. Turn the bearing snap ring so that the ends are **90°** to the case grooves.

2. Remove the mainshaft bearing with the **SST**.



9T00J1-042

**Mainshaft assembly**

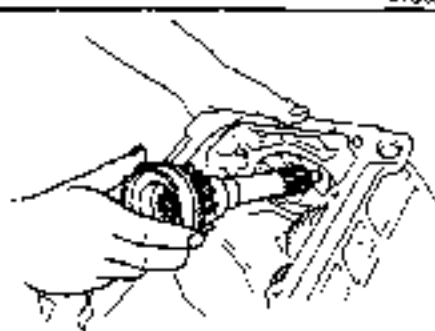
1. Remove the mainshaft assembly from the transmission case.



9T00J1-043

**Main drive gear**

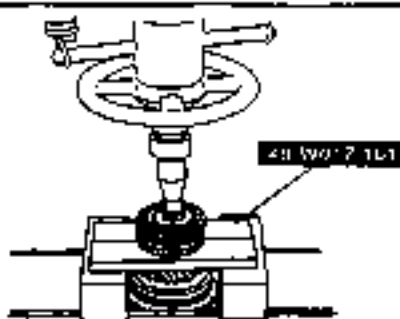
1. Remove the main drive gear from the transmission case.



9T00J1-044

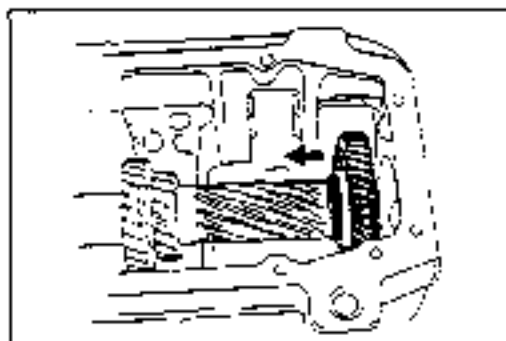
**Clutch hub assembly (3rd/4th)**

1. Remove the clutch hub assembly with the **SST**.



9T00J1-045

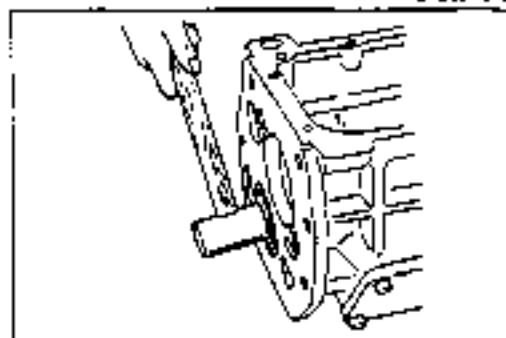




9TGGJ1-046

**Countershaft assembly**

1. Remove the snap ring from the counter 5th gear and move the counter 5th gear toward the front of the transmission.

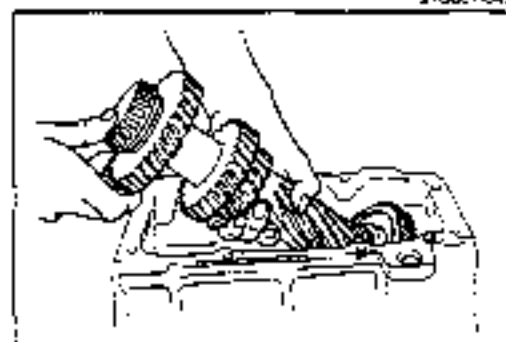


9TGGJ1-047

**Caution**

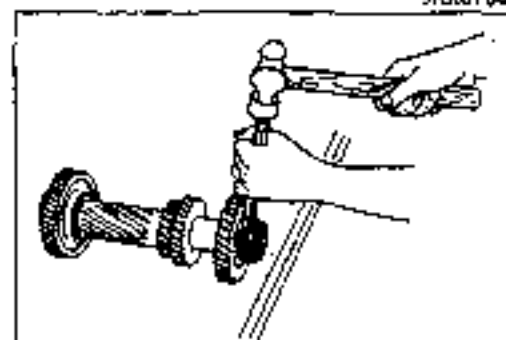
- Do not tap the bearing inner race.

2. Gently strike the front of the countershaft with a brass hammer and remove the bearing outer race from the rear.



9TGGJ1-048

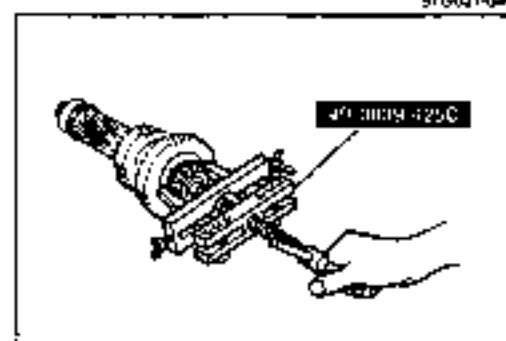
3. Remove the countershaft assembly from the transmission case.



9TGGJ1-049

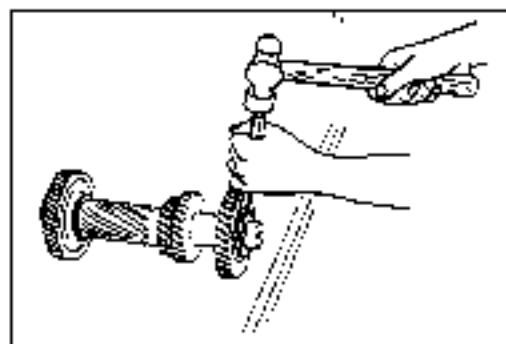
**Countershaft front bearing**

1. Move the bearing away from the spacer with a chisel and a hammer.



9TGGJ1-050

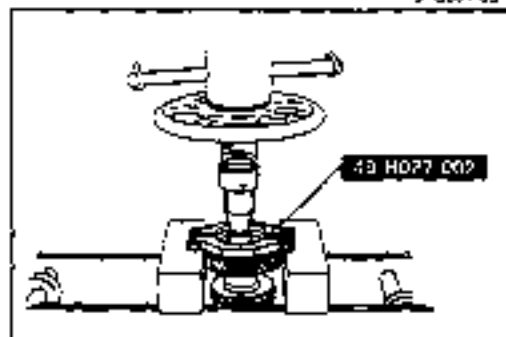
2. Remove the bearing with the SST.



9TGD105

**Spacer**

- 1 Move the spacer away from the diaphragm spring with a chisel and a hammer.



9TGD106

**Note**

- Do not reuse the diaphragm spring.

- 2 Remove the spacer, diaphragm spring and friction gear with the SST.



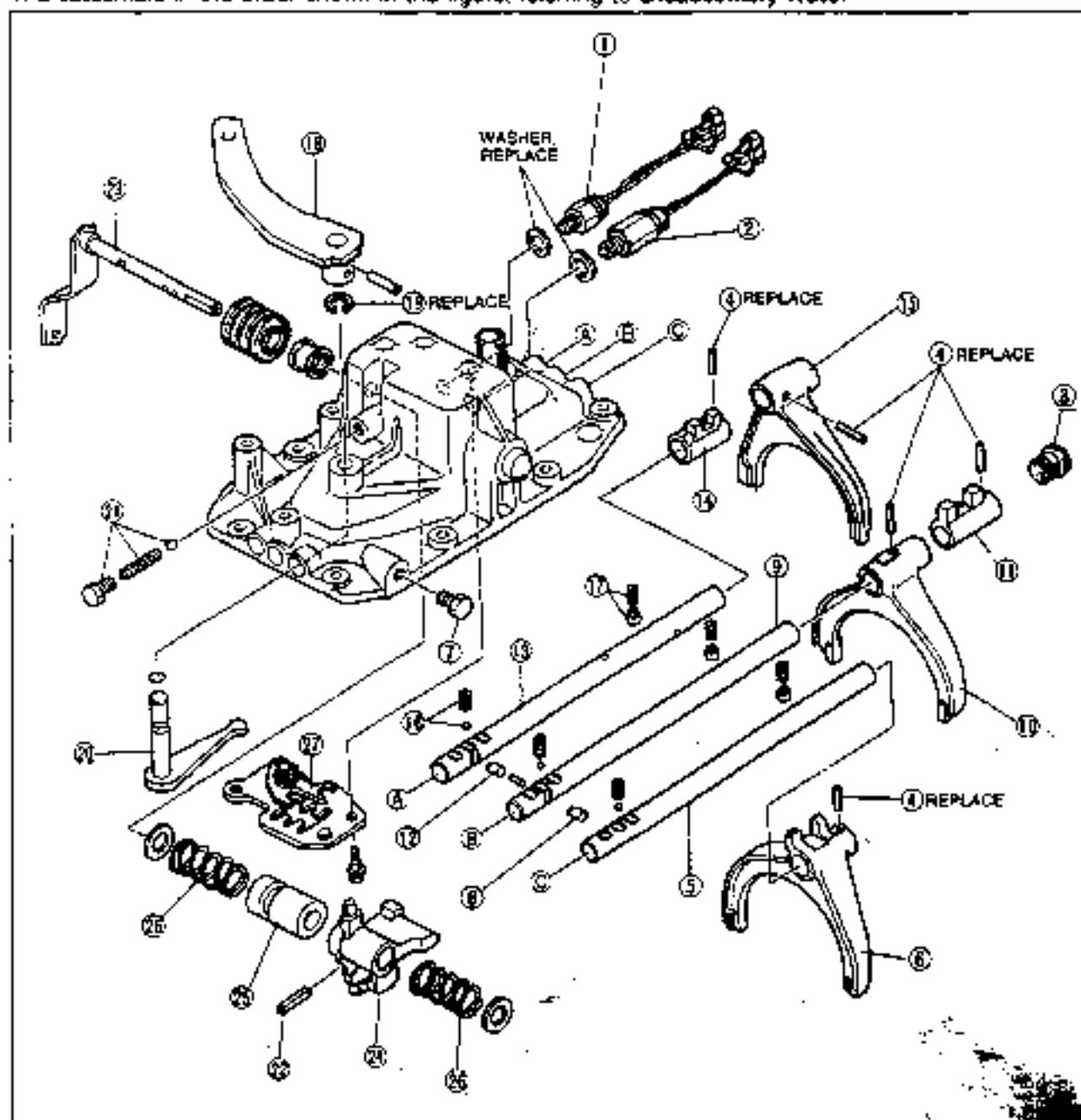
9TGD107

**Countershaft rear bearing**

1. Remove the bearing and thrust washer with the SST.

## Top Cover

1. Disassemble in the order shown in the figure, referring to **Disassembly Note**.



- 1. Backup light switch
- 2. Neutral switch
- 3. Rubber plug
- 4. Roll pin

Disassembly Note

..... page J1-28

- 5. Shift rod
- 6. Shift fork (1st/2nc)
- 7. Cap plug
- 8. Interlock pin

Disassembly Note

..... page J1-28

- 9. Shift rod
- 10. Shift fork (3rd/4th)
- 11. Shift rod end
- 12. Interlock pin

Disassembly Note

..... page J1-28

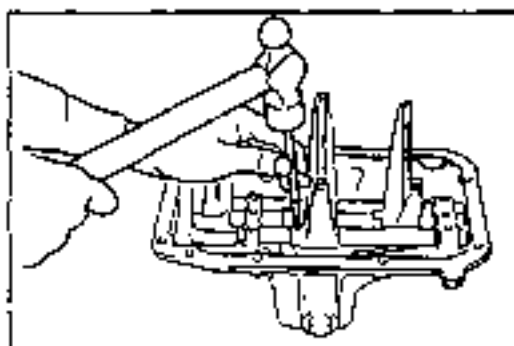
- 13. Shift rod
- 14. Shift rod end
- 15. Shift fork (5th/reverse)
- 16. Steel ball and spring
- 17. Spring seat and spring
- 18. Selector lever

- 19. Snap ring
- 20. Selector arm
- 21. Cap plug ball and spring
- 22. Roll pin

Disassembly Note

..... page J1-28

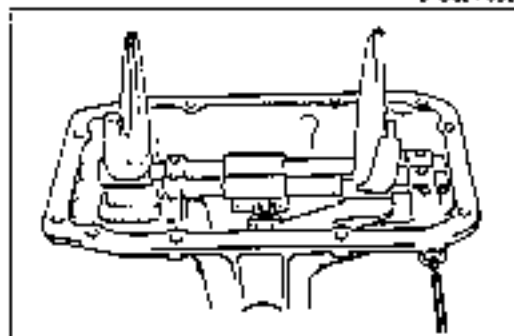
- 23. Shift lever
- 24. Change lever
- 25. Reverse lock stopper
- 26. Spring(s)
- 27. Change guide plate



9T6Q1-055

**Disassembly Note****Roll pin**

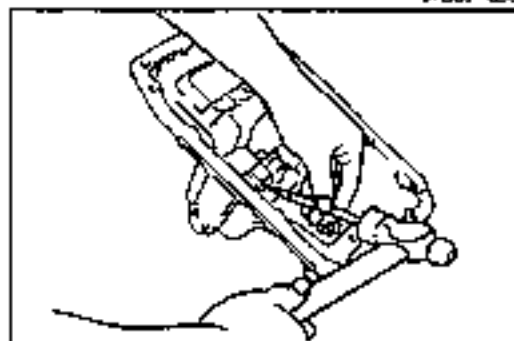
1. Remove the roll pins with a pin punch.



9T6Q1-056

**Interlock pin**

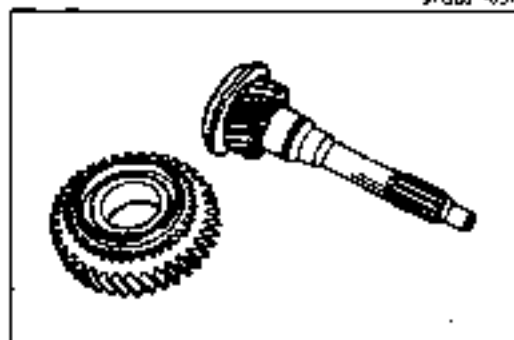
1. Remove the interlock pin with a magnet.



9T6G1-057

**Roll pin**

1. Align the groove, then remove the roll pin with a pin punch.



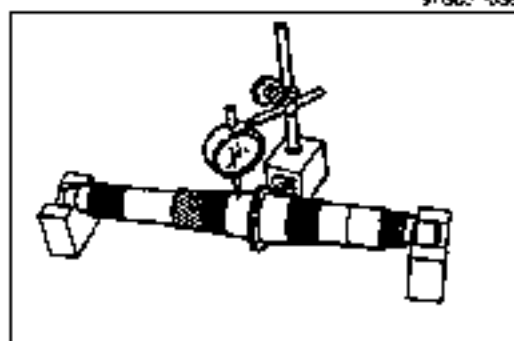
9T6G1-058

**INSPECTION**

Inspect all parts and repair or replace as necessary.

**Each gear and main drive gear**

1. Inspect synchronizer cones for wear.
2. Inspect individual gear teeth for damage, wear, and cracks.
3. Inspect synchronizer ring matching teeth for damage and wear.
4. Inspect main drive gear splines for damage and wear.



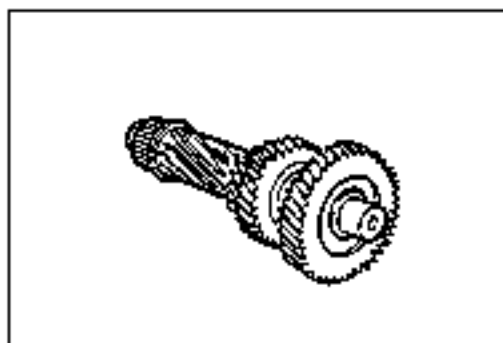
9T6Q1-059

**Mainshaft**

1. Measure the mainshaft runout.

**Runout: 0.035mm (0.0014 in) max.**

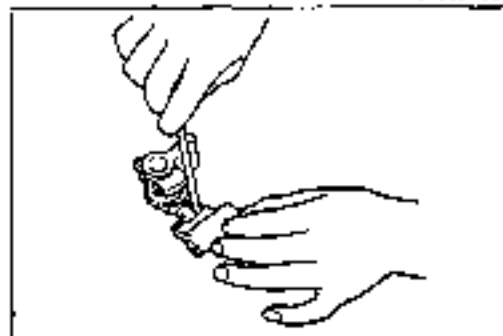
2. Inspect splines for damage and wear.



9T30J1-060

**Countershaft**

1. Inspect gear teeth for damage, wear, and cracks.
2. Inspect splines for damage and wear.

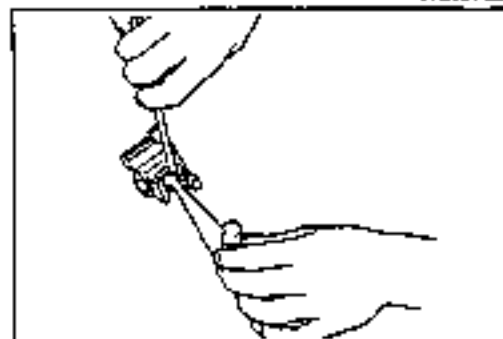


9T30J1-061

**Shift rod end and change lever**

1. Measure the clearance between the shift rod ends and change lever.

**Clearance: 0.8mm (0.031 in) max.**

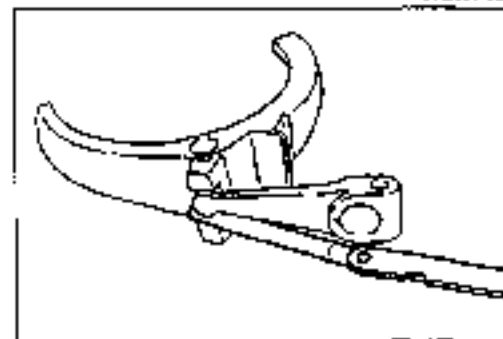


9T30J1-062

**Selector lever and change lever**

1. Measure the clearance between the selector lever and change lever.

**Clearance: 0.8mm (0.031 in) max.**

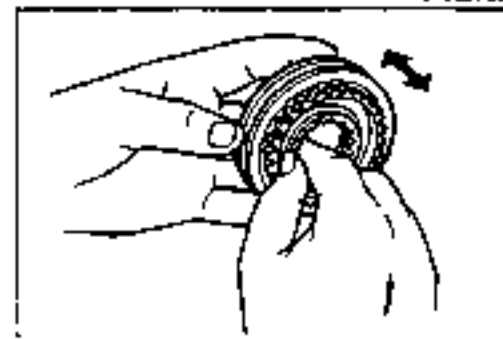


9T30J1-063

**Inner shift lever and shift fork**

1. Measure the clearance between the inner shift lever and shift fork.

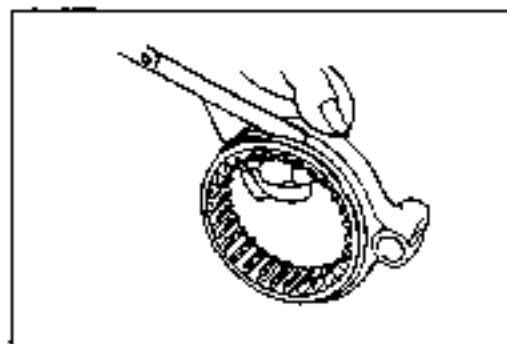
**Clearance: 0.8mm (0.031 in) max.**



9T30J1-064

**Clutch hub assembly**

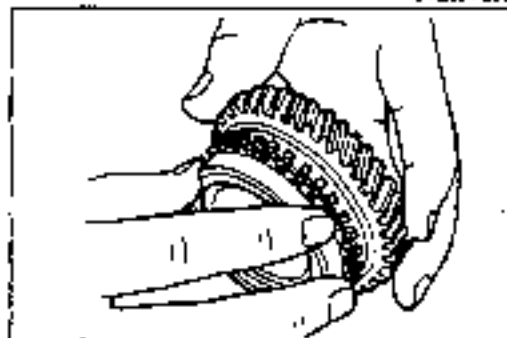
1. Inspect for clutch hub sleeve and hub operation.
2. Inspect individual gear teeth for damage, wear, and cracks.
3. Inspect synchronizer key for damage, wear, and cracks.



STGCJ1-053

4. Measure the clearance between the hub sleeve and release fork.

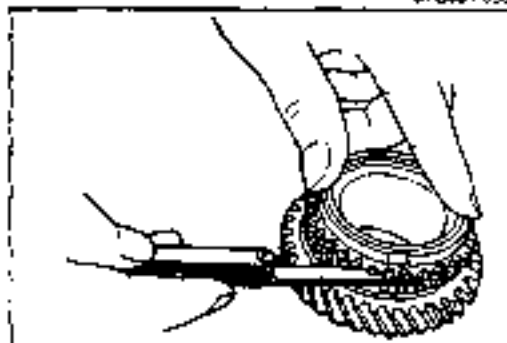
**Clearance: 0.8mm (0.031 in) max.**



STGCJ1-055

#### Synchronizer ring

1. Inspect individual synchronizer ring teeth for damage, wear, and cracks.
2. Inspect taper surface for wear and cracks.



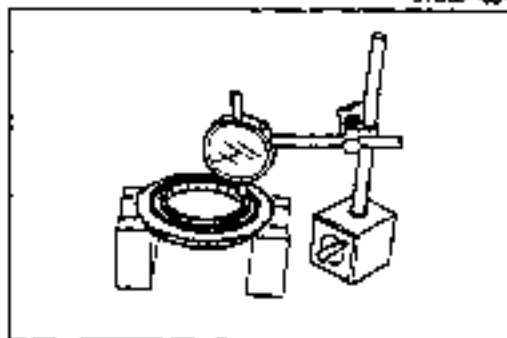
STGCJ1-057

#### Note

- Set the synchronizer ring squarely in the gear; then measure around the circumference.

3. Measure the clearance between the synchronizer ring and flank surface of gear.

**Clearance: 1.0mm (0.039 in) min.**



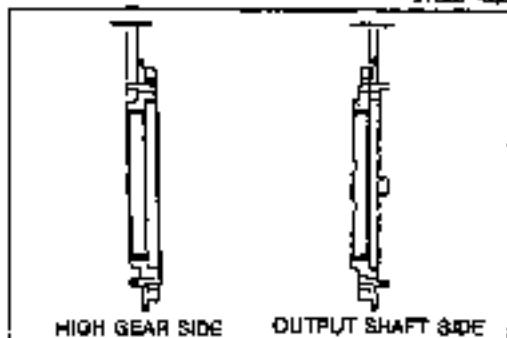
ST30J1-059

#### Double cone

#### Note

- If a problem exists, replace the assembly.

1. Inspect individual teeth for damage, wear, and cracks.
2. Inspect taper surface for wear and cracks.



STGCJ1-062

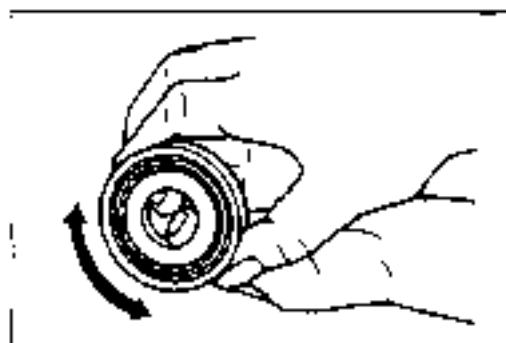
#### Note

- Measure around the circumference.

3. Measure the height between inner cone and outer cone as shown in the figure.

**High gear side: 4.7mm (0.185 in) min.**

**Output shaft side: 3.6mm (0.142 in) min.**



9TGU1-070

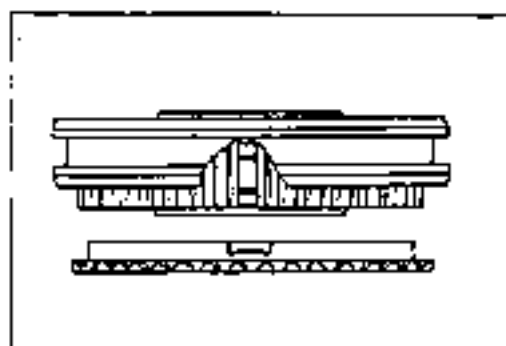
**Bearing**

Inspect for damage and rough rotation.

**ASSEMBLY****Precaution**

1. All O-rings and gaskets must be replaced with the new ones included in the overhaul kit.
2. Assemble the parts within 10 minutes after applying sealant. Allow all sealant to cure at least 30 minutes after assembly before filling the transmission with transmission oil.

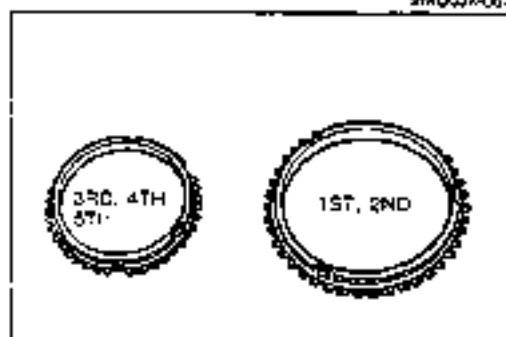
9TGU1-071



9MUG1-067

**Clutch hub****Caution**

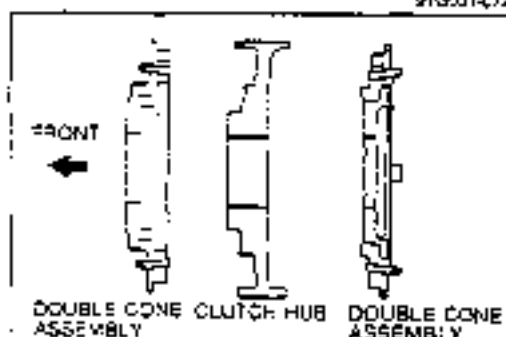
- Align the synchronizer ring grooves with the clutch hub keys during installation.



9TGU1-072

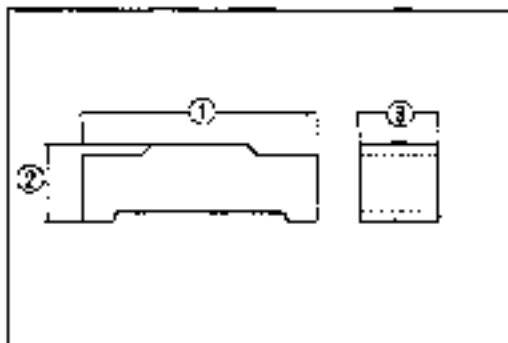
**Note**

- The synchronizer rings have the same basic shape. Carefully note these distinguishing features.
  - a) 3rd, 4th and 5th synchronizer rings are the same.
  - b) 1st and 2nd synchronizer rings are the same.

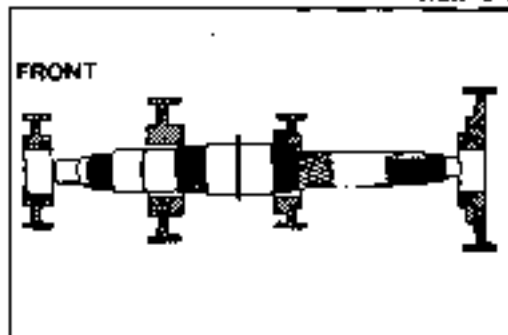


9TGU1-073

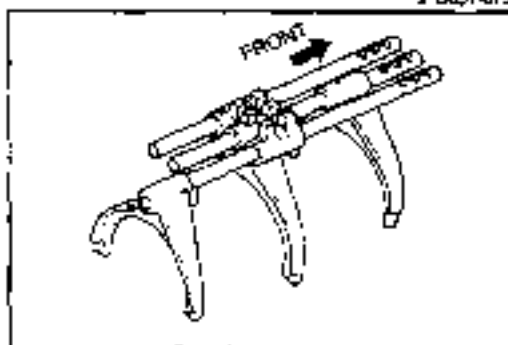
- Install the double cones as shown in the figure.



9TGDJ1-074



9TGDJ1-075



9TGDJ1-076

- There are three types of synchronizer keys.

Standard dimensions are as follows:

mm (in)

	①	②	③
1st and 2nd	18 (0.709)	5.45 (0.215)	6 (0.236)
3rd, 4th, 5th and Rev	17 (0.669)	4.25 (0.167)	5 (0.197)
Sub- Transmission	22 (0.866)	7.77 (0.306)	6 (0.236)

- Install the clutch hubs as shown in the figure.

Shift fork, shift rod and shift rod end.

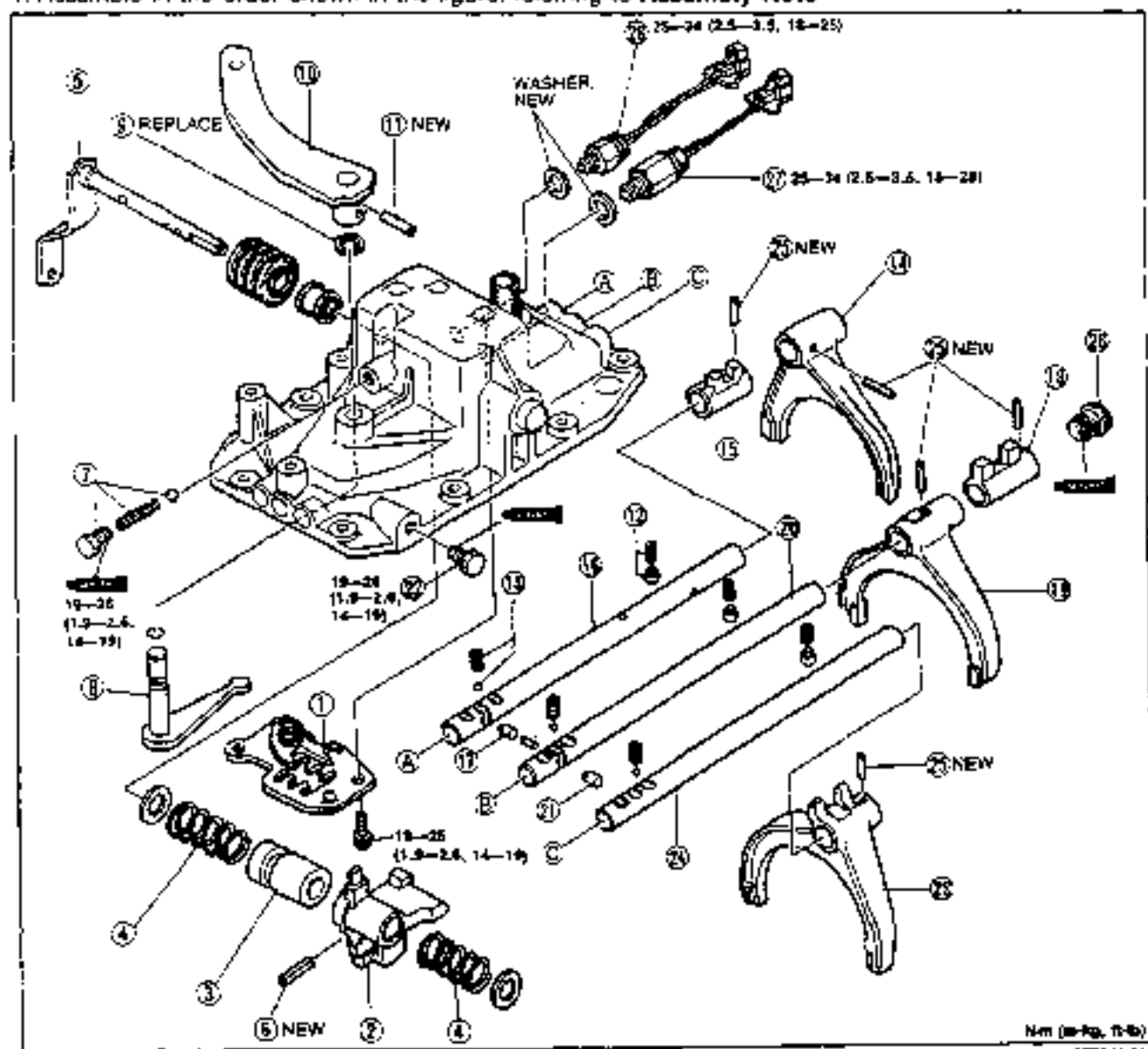
**Note**

- Install the shift forks, shift rods and shift rod ends as shown in the figure.



## Top Cover

1. Assemble in the order shown in the figure, referring to **Assembly Note**



N/m (M-Fig. 71-5b)  
3YFDJ1 014

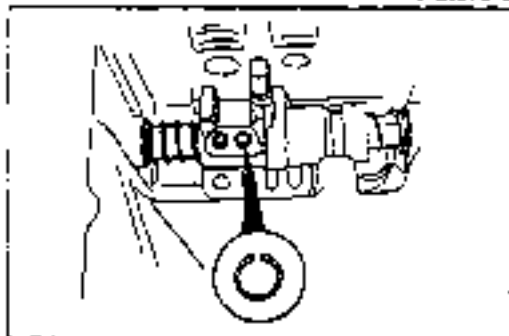
- |  |  |  |
|--|--|--|
| <p>1. Change guide plate<br/>2. Change lever<br/>    Assembly Note<br/>    ..... page J1-34</p> <p>3. Reverse lock stopper<br/>    Assembly Note<br/>    ..... page J1-34</p> <p>4. Spring(s)<br/>    Assembly Note<br/>    ..... page J1-34</p> <p>5. Shift lever</p> <p>6. Roll pin (change lever)<br/>    Assembly Note<br/>    ..... page J1-34</p> <p>7. Cap plug, ball and spring</p> <p>8. Selector arm</p> <p>9. Snap ring</p> | <p>10. Selector lever</p> <p>11. Roll pin (selector lever)<br/>    Assembly Note<br/>    ..... page J1-34</p> <p>12. Spring seal and spring</p> <p>13. Steel ball and spring</p> <p>14. Shift fork (5th/Reverse)</p> <p>15. Shift rod end</p> <p>16. Shift rod<br/>    Assembly Note<br/>    ..... page J1-34</p> <p>17. Interlock pin<br/>    Assembly Note<br/>    ..... page J1-34</p> <p>18. Shift rod end</p> <p>19. Shift fork (3rd/4th)</p> | <p>20. Shift rod<br/>    Assembly Note<br/>    ..... page J1-34</p> <p>21. Interlock pin<br/>    Assembly Note<br/>    ..... page J1-34</p> <p>22. Cap plug</p> <p>23. Shift fork (1st/2nd)</p> <p>24. Shift rod<br/>    Assembly Note<br/>    ..... page J1-34</p> <p>25. Roll pin<br/>    Assembly Note<br/>    ..... page J1-35</p> <p>26. Rubber plug</p> <p>27. Neutral switch</p> <p>28. Backup light switch</p> |
|--|--|--|



9T60J1-078

**Assembly Note****Change lever, reverse lock stopper and spring**

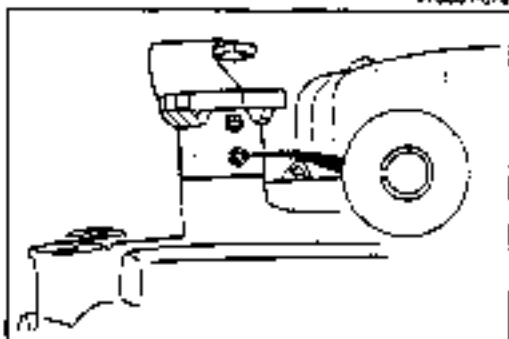
1. Install the change lever, reverse lock stopper and springs in the proper direction.



9T60J1-079

**Roll pin (change lever)**

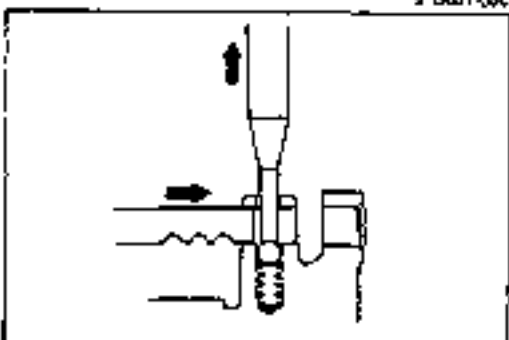
1. Install the roll pins as shown in the figure.



9T60J1-080

**Roll pin (Selector lever)**

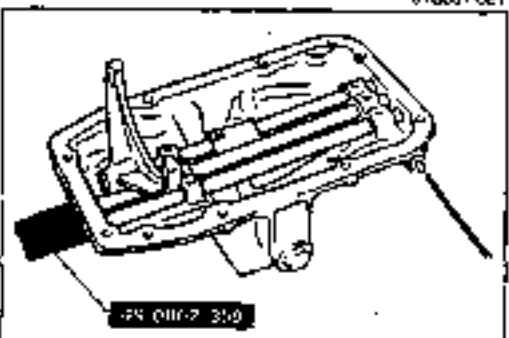
1. Install the roll pins as shown in the figure.



9T60J1-081

**Shift rod**

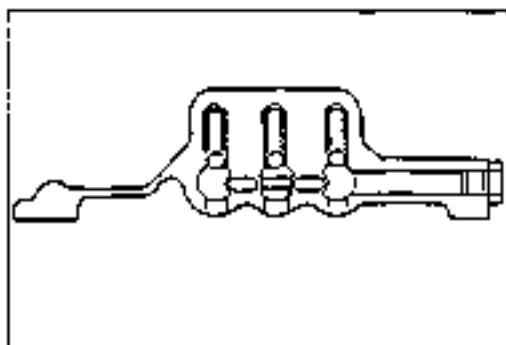
1. Slide the shift rod into the top cover while pushing the ball downward as shown in the figure.



9T60J1-082

**Interlock pin**

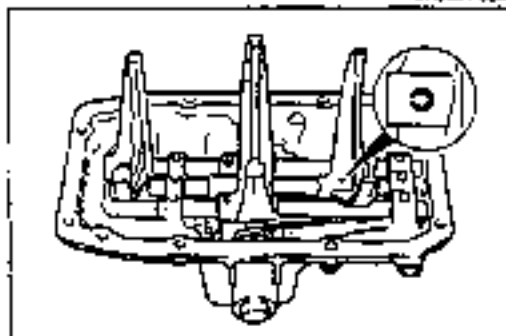
1. Slide the SST into the top cover to guide the interlock pin, and insert the pin.



9790J1-085

**Note**

- The interlock pins must be installed as shown.



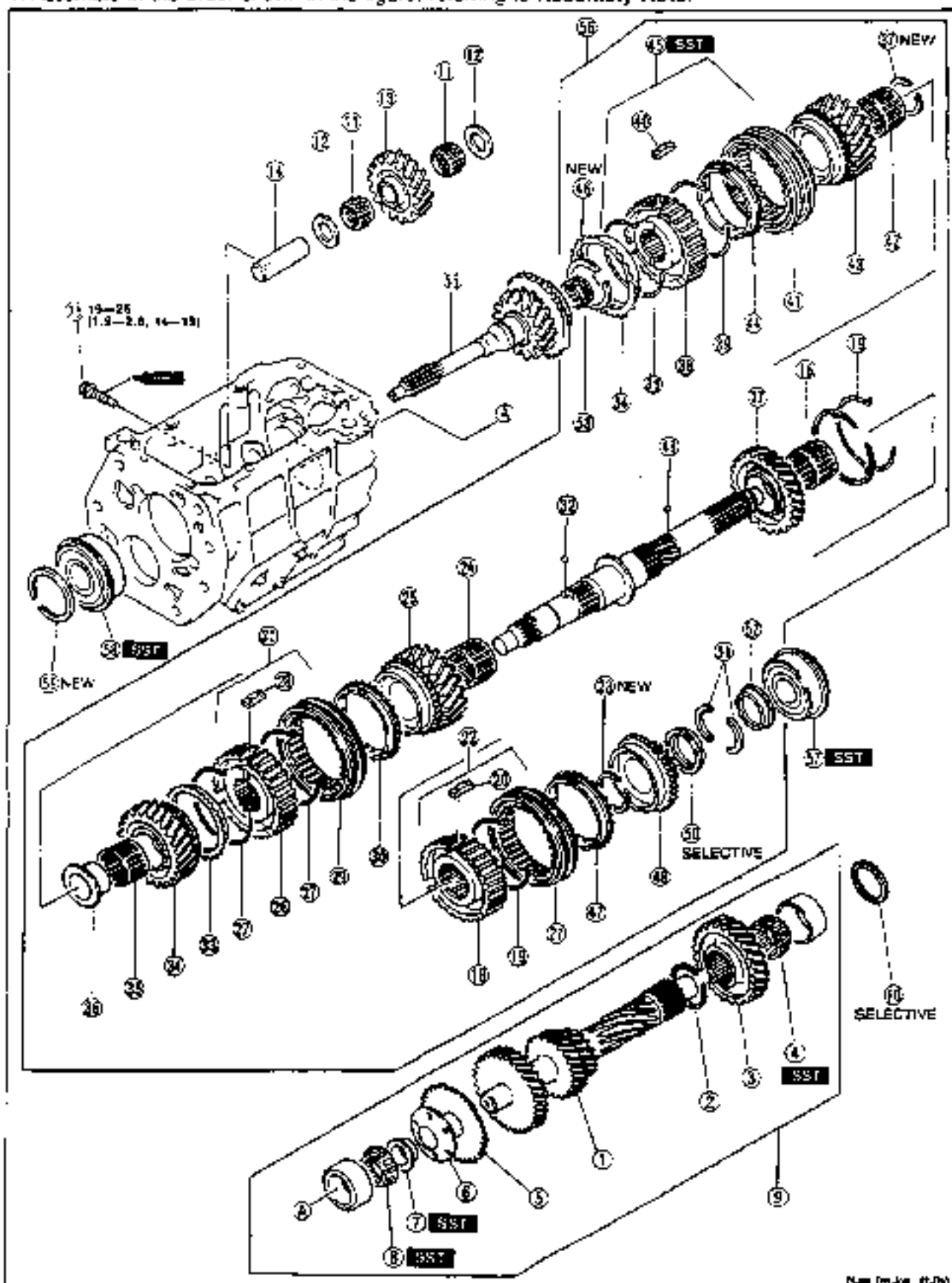
9790J1-094

**Roll pin**

1. Install the roll pin as shown in the figure.

### Mainshaft

1. Assemble in the order shown in the figure, referring to **Assembly Note**.

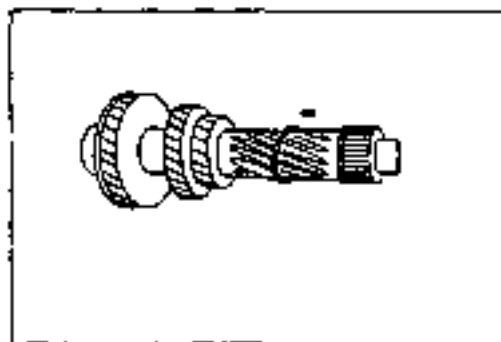


New (m-kg, ft-lb)

07901:083

- |                               |                             |                             |
|-------------------------------|-----------------------------|-----------------------------|
| 1. Countershaft               | 16. Needle bearing          | 41. Clutch hub sleeve       |
| 2. Snap ring                  | 17. Reverse gear            | 42. Needle bearing          |
| Assembly Note                 | 18. Clutch hub              | 43. 3rd gear                |
| ..... page J1-37              | 19. Synchronizer key spring | 44. Synchronizer ring (3rd) |
| 3. Counter 5th gear           | 20. Synchronizer key        | 45. Clutch hub assembly     |
| 4. Countershaft rear bearing  | 21. Clutch hub sleeve       | (3rd/4th)                   |
| Assembly Note                 | 22. Clutch hub assembly     | Assembly Note               |
| ..... page J1-37              | (5th/reverse)               | ..... page J1-39            |
| 5. Friction gear              | 23. Snap ring               | 46. Snap ring               |
| 6. Diaphragm spring           | 24. Needle bearing          | 47. Synchronizer ring (5th) |
| 7. Spacer                     | 25. 1st gear                | 48. 5th gear                |
| Assembly Note                 | 26. Clutch hub              | 49. Steel ball              |
| ..... page J1-38              | 27. Synchronizer key spring | 50. Thrust lock washer      |
| 8. Countershaft front bearing | 28. Synchronizer key        | Assembly Note               |
| Assembly Note                 | 29. Clutch hub sleeve       | ..... page J1-39            |
| ..... page J1-38              | 30. Synchronizer ring (1st) | 51. C-washer                |
| 9. Countershaft assembly      | 31. Clutch hub assembly     | 52. Retaining ring          |
| Assembly Note                 | (1st/2nd)                   | 53. Needle bearing          |
| ..... page J1-38              | 32. Steel ball              | 54. Synchronizer ring (4th) |
| 10. Adjustment shim           | 33. Synchronizer ring (2nd) | 55. Main drive gear         |
| Assembly Note                 | 34. 2nd gear                | 56. Manshaft assembly       |
| ..... page J1-38              | 35. Needle bearing          | 57. Manshaft bearing        |
| 11. Needle bearing            | 36. Gear sleeve             | Assembly Note               |
| 12. Thrust washer             | 37. Snap ring               | ..... page J1-39            |
| 13. Reverse idler gear        | 38. Clutch hub              | 58. Main drive gear bearing |
| 14. Reverse idler gear shaft  | 39. Synchronizer key spring | Assembly Note               |
| 15. Mounting bolt             | 40. Synchronizer key        | ..... page J1-40            |
| Assembly Note                 |                             |                             |
| ..... page J1-39              |                             |                             |

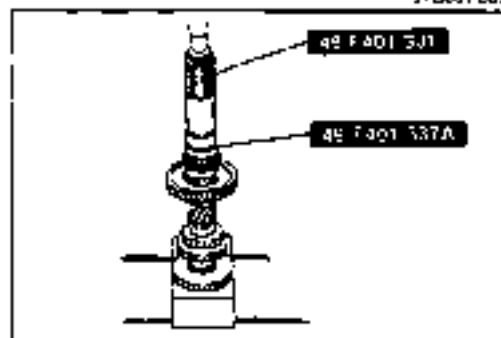
97G01-015



97G01-087

**Assembly Note**  
**Snap ring**

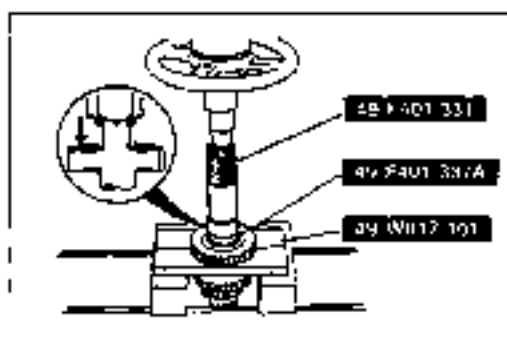
1. Install a new snap ring as shown in the figure.



97G01-088

**Countershaft rear bearing**

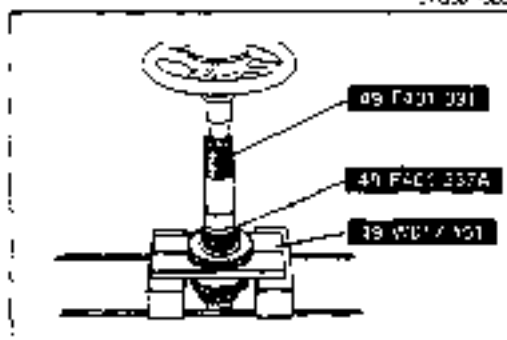
1. Press the bearing inner race onto the countershaft with the SST.



97G01-088

**Spacer**

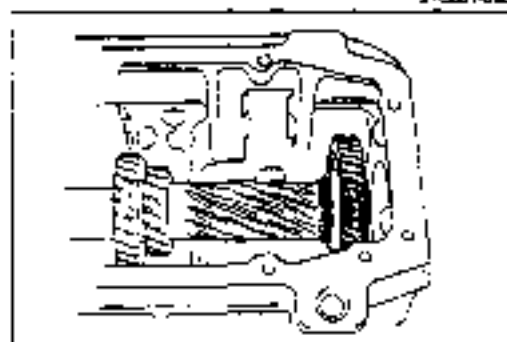
- 1 Install the new spacer with the SST.



97G01-089

**Counter shaft front bearing**

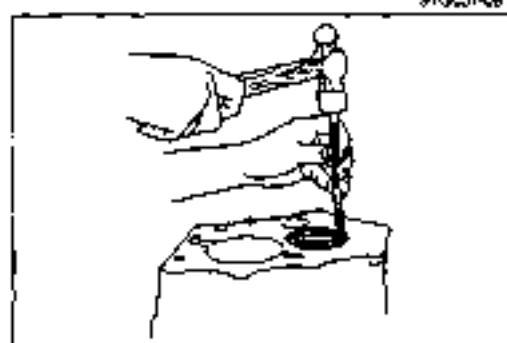
- 1 Press the bearing inner race onto the countershaft with the SST.



97G01-091

**Counter shaft assembly**

- 1 Set the countershaft assembly in the transmission case.
- 2 Set the counter 5th gear to its normal position and fit the snap ring.



97G01-092

**Adjustment shim**

- 1 Install the clutch housing.

**Tightening torque:**

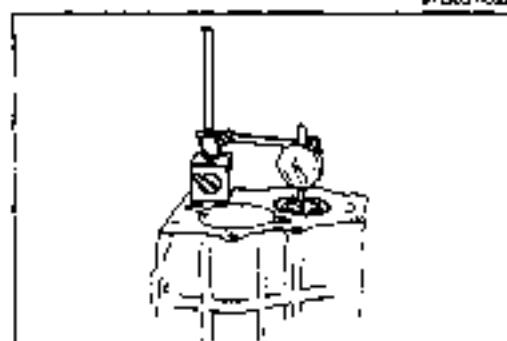
120—155 N·m (12.2—15.8 m·kg, 88—114 ft·lb)

- 2 Drive in the rear bearing outer race with a punch or similar tool.

- 3 Measure the depth of the rear bearing outer race in the transmission case. Select a shim(s) plus to adjust the clearance between the outer race and the case adapter to specification.

**Specification:**

Measured depth + 0.3mm (0.012 in) =  
0.01—0.05mm (0.0004—0.0019 in)



97G01-093

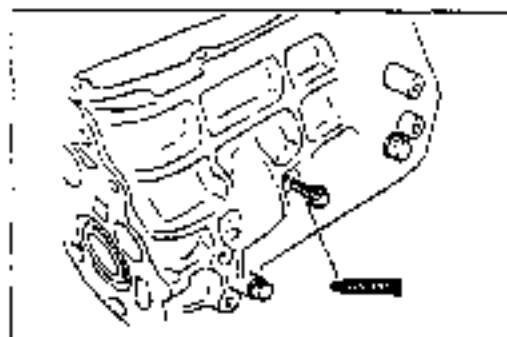
## Adjustment shim thickness

mm (in)

0.50 (0.020)	0.55 (0.022)	0.60 (0.024)
0.65 (0.026)	0.70 (0.028)	0.75 (0.030)
0.80 (0.031)	0.85 (0.033)	0.90 (0.035)
0.95 (0.037)	1.00 (0.039)	1.05 (0.041)
1.10 (0.043)	1.15 (0.045)	1.20 (0.047)
1.25 (0.049)	1.30 (0.051)	1.35 (0.053)
1.40 (0.055)	1.45 (0.057)	1.50 (0.059)

- Remove the clutch housing.

9TGBJ1-094



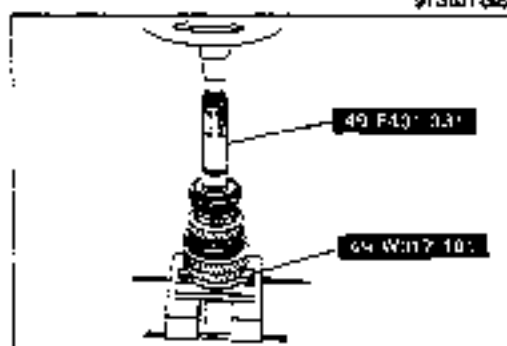
9TGBJ1-095

## Mounting bolt

- Align the reverse idler gear shaft with the mounting bolt hole.
- Apply sealant to the mounting bolt, then install the bolt.

## Tightening torque:

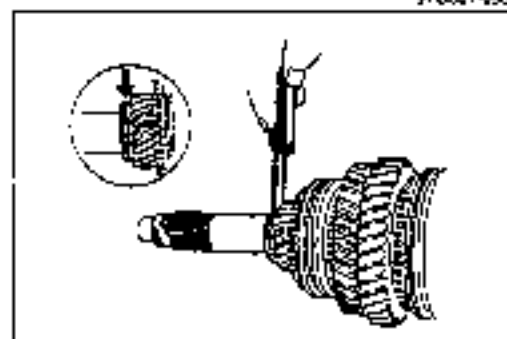
19—25 Nm (1.9—2.6 m·kg, 14—19 ft·lb)



9TGBJ1-096

## Clutch hub assembly (3rd/4th)

- Set the mainshaft with a press.
- Install the clutch hub assembly with the SST.



9TGBJ1-097

## Thrust lock washer

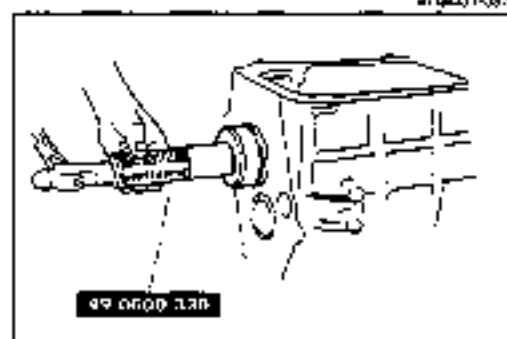
- Push the C-washers toward 5th gear and measure the clearance between the C-washers and the thrust lock washer. If the clearance is not as specified, select the proper thrust lock washer.

Standard: 0.35—0.45mm (0.014—0.018 in)

## Thrust lock washer thickness

mm (in)

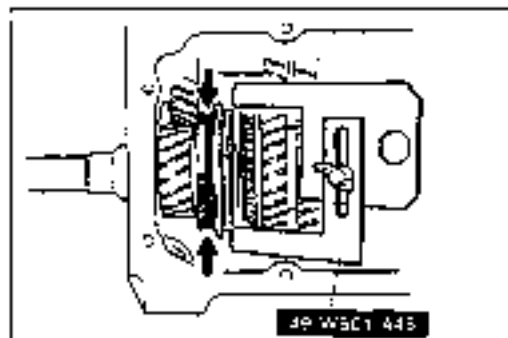
5.0 (0.197)	5.1 (0.201)	5.2 (0.205)
5.3 (0.209)	5.4 (0.213)	5.5 (0.217)



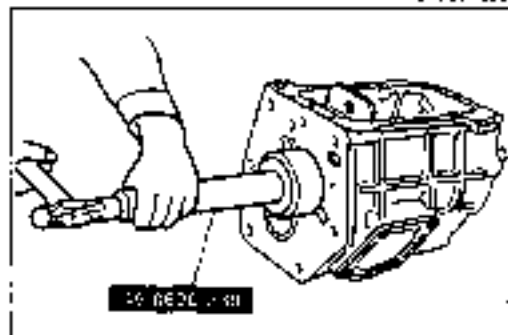
9TGBJ1-098

## Mainshaft bearing

- Install the mainshaft bearing with the SST.



9T6U1-099



9T6U1-100

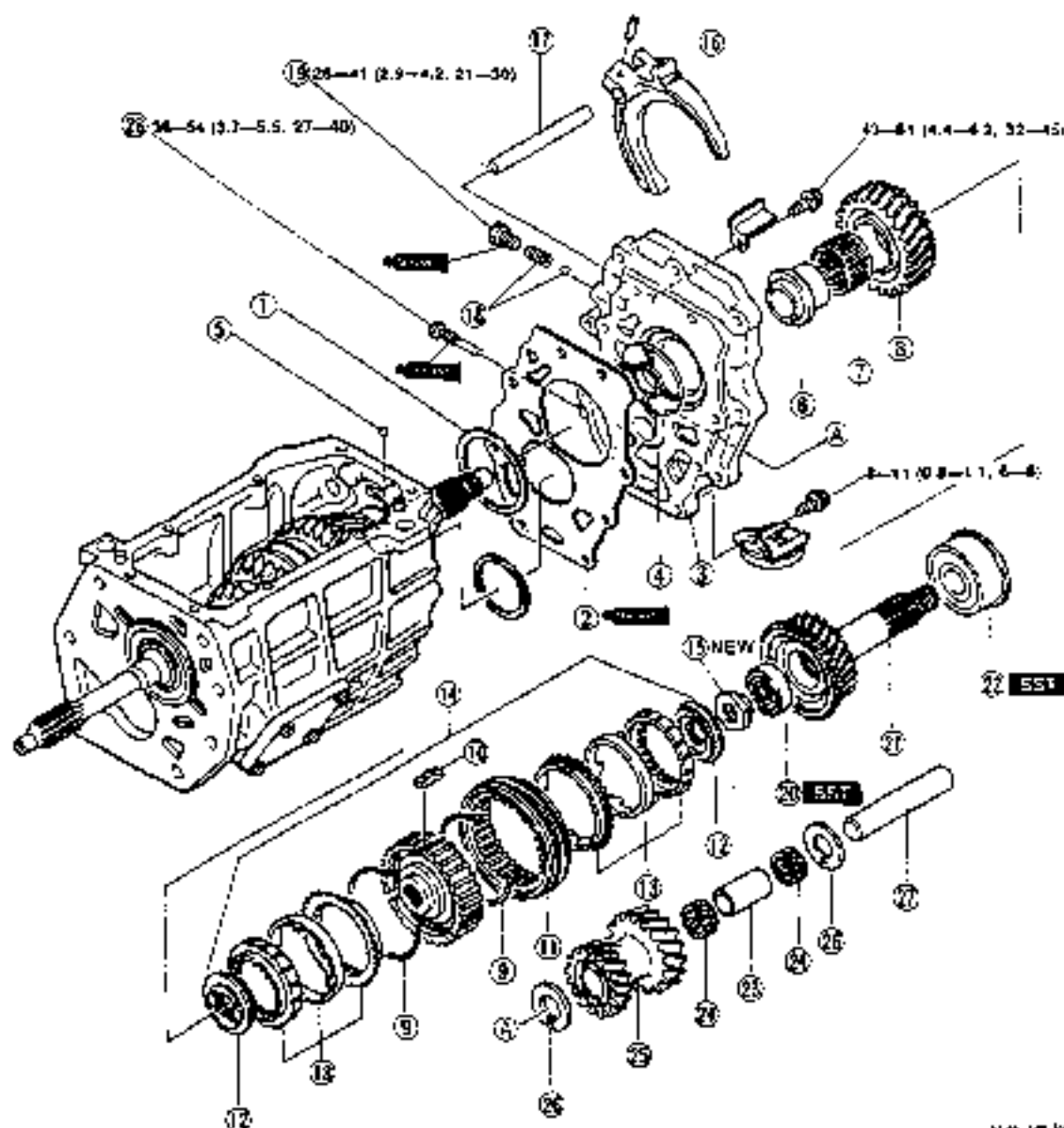
**Main drive gear bearing**

1. Install the **SST** between the 4th synchronizer ring and synchromesh gear on the main drive gear.
2. Install the main drive gear bearing with the **SST**.



## Sub-transmission Parts

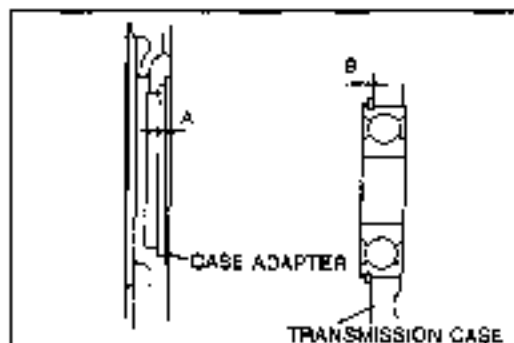
1. Assemble in the order shown in the figure, referring to **Assembly Note**.



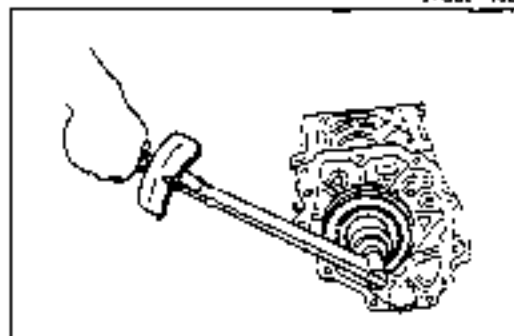
N.m (m.kg, ft.lb)

STP01-C16

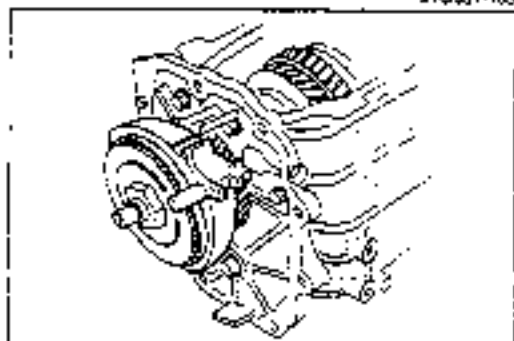
- |   |   |   |
|---|---|---|
| 1. Adjustment shim<br>Assembly Note<br>..... page J1-42 | 14. Clutch hub assembly<br>15. Locknut<br>Assembly Note<br>..... page J1-42 | 21. Output shaft<br>22. Output shaft bearing<br>Assembly Note<br>..... page J1-42 |
| 2. Gasket   | 16. Shift fork<br>Assembly Note<br>..... page J1-42                         | 23. Spacer  |
| 3. Case adapter   | 17. Shift rod<br>Assembly Note<br>..... page J1-42                          | 24. Needle bearing  |
| 4. Scoop ring   | 18. Steel ball and spring   | 25. Counter high gear   |
| 5. Steel ball   | 19. Cap plug  | 26. Thrust washer   |
| 6. Gear sleeve  | 20. Bearing<br>Assembly Note<br>..... page J1-42                            | 27. Counter gear shaft  |
| 7. Needle bearing                                       |   | 28. Mounting bolt<br>Assembly Note<br>..... page J1-43                            |
| 8. High gear  |   |   |
| 9. Synchronizer key spring                              |   |   |
| 10. Synchronizer key                                    |   |   |
| 11. Clutch hub sleeve                                   |   |   |
| 12. Inner cone hub                                      |   |   |
| 13. Double cone assembly                                |   |   |



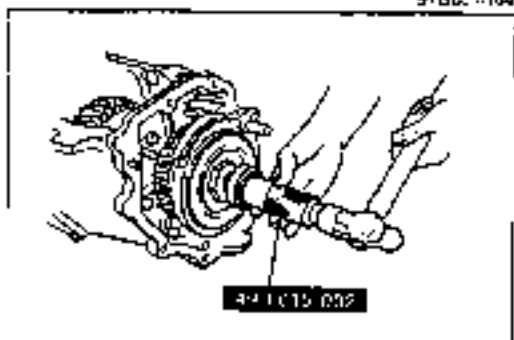
9TGD.1-102



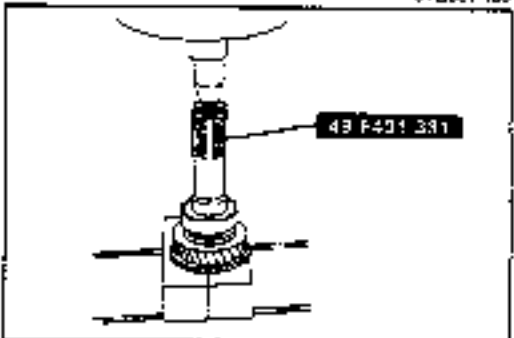
9TGD.1-103



5TGD.1-104



8TGD.1-105



8TGD.1-106

**Assembly Note****Adjustment shim**

1. After measuring dimensions A and B shown in the figure, use an adjustment shim(s) with the thickness corresponding to the value of A plus gasket thickness 0.3mm (0.012 in) minus B, so that bearing end play will be within specification.

**Bearing end play: 0—0.1mm (0—0.004 in)**

**Adjustment shim thickness:**

0.8 (0.031)	0.9 (0.035)	1.0 (0.039)
1.1 (0.043)	1.2 (0.047)	

**Locknut**

1. Slide the clutch hub sleeves onto 1st and reverse gears to lock the mainshaft.
2. Tighten the new locknut.

**Tightening torque:**

**167—235 Nm (16—24 m·kg, 116—174 ft·lb)**

3. Use a chisel to stake the locknut.

**Shift fork and shift rod**

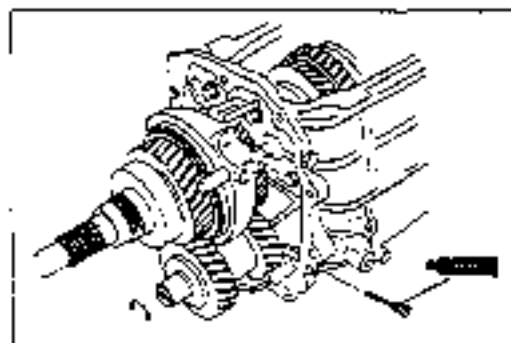
1. Install the shift fork and shift rod into the case adapter.

**Bearing**

1. Install the bearing with the SST.

**Output shaft bearing**

1. Install the bearing with the SST.



9T33U1 107

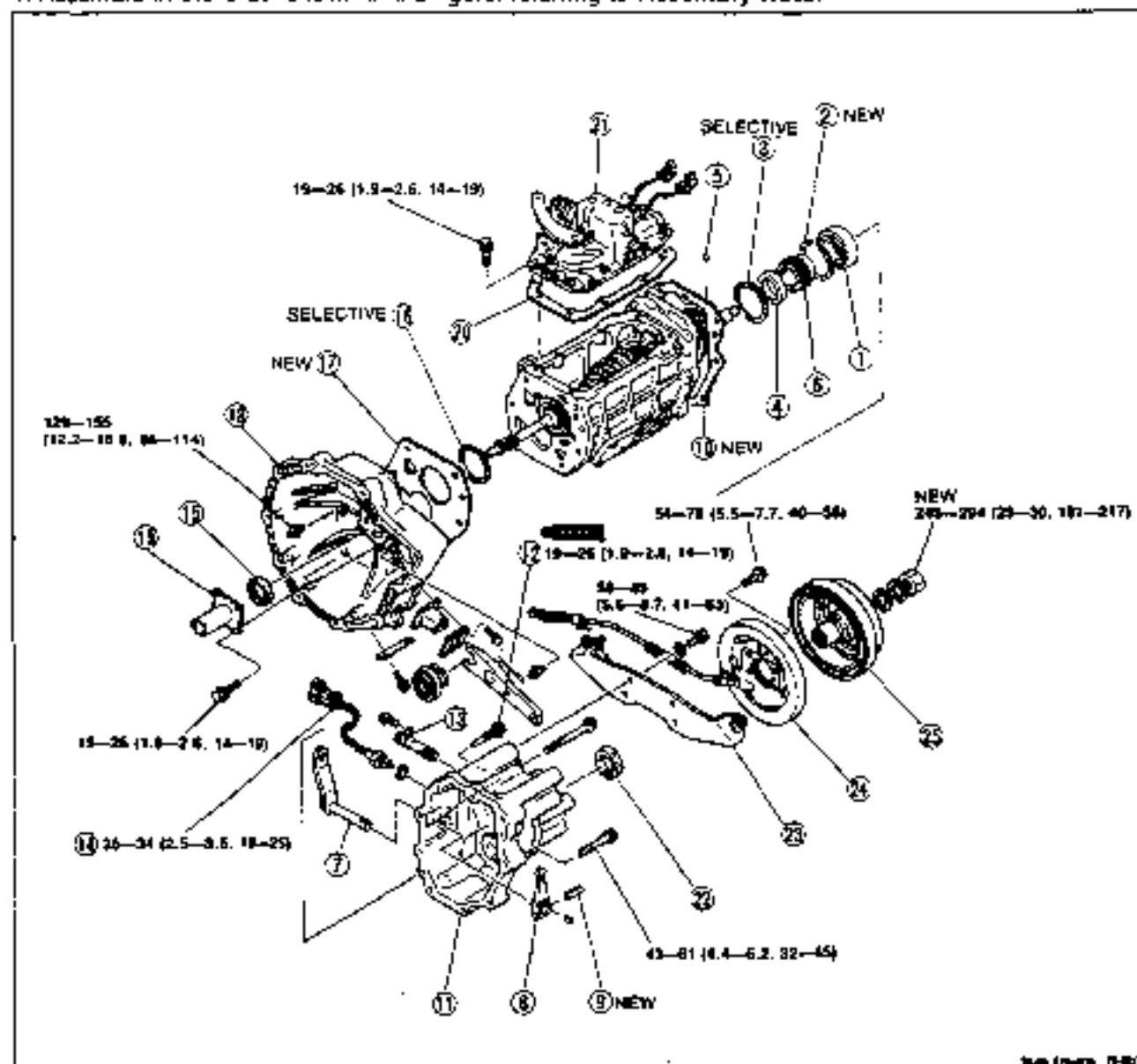
**Mounting bolt**

1. Align the counter gear shaft with the mounting bolt hole.
2. Apply sealant to the mounting bolt, then install the bolt.

**Tightening torque:****36—54 Nm (3.7—5.5 m-kg, 27—40 ft-lb)**

### Housing Components

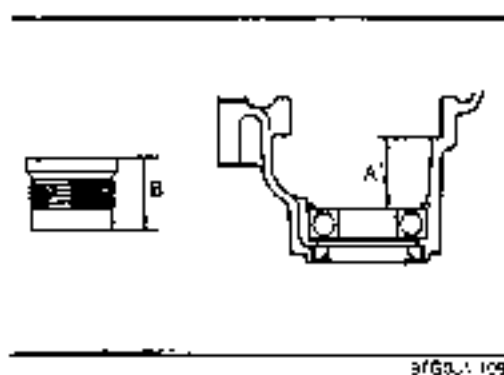
1. Assemble in the order shown in the figure, referring to **Assembly Note**.



1988 (17-83, 17-85)

9TPOJ1 017

- |                           |                             |                           |
|---------------------------|-----------------------------|---------------------------|
| 1. Bearing                | 9. Roll pin                 | 17. Gasket                |
| 2. Snap ring              | Assembly Note               | 18. Clutch housing        |
| 3. Adjustment shim        | ..... page J1-45            | 19. Front cover           |
| Assembly Note             | 10. Gasket                  | 20. Gasket                |
| ..... page J1-45          | 11. Rear housing            | 21. Top cover             |
| 4. Spacer                 | Assembly Note               | 22. Oil seal              |
| 5. Steel ball             | ..... page J1-45            | Assembly Note             |
| 6. Speedometer drive gear | 12. Lock bolt               | ..... page J1-46          |
| 7. Outer shift lever      | Assembly Note               | 23. Transmission mount    |
| Assembly Note             | ..... page J1-45            | 24. Center brake assembly |
| ..... page J1-45          | 13. Speedometer driven gear | 25. Center brake drum     |
| 8. Inner shift lever      | 14. Sub-transmission switch | Assembly Note             |
| Assembly Note             | 15. Oil seal                | ..... page J1-46          |
| ..... page J1-45          | 16. Adjustment shim         |                           |
|                           | Assembly Note               |                           |
|                           | ..... page J1-46            |                           |



9T60J1-109

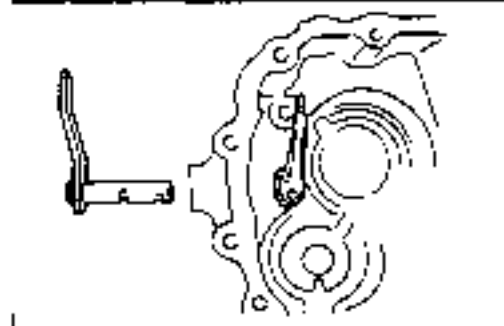
**Assembly Note****Adjustment shim**

1. After measuring dimensions A and B shown in the figure, use an adjustment shim(s) with the thickness corresponding to the value of A minus B, so that bearing end play will be within specification.

**Bearing end play:** 0—0.1mm (0—0.004 in)

**Adjustment shim thickness:**

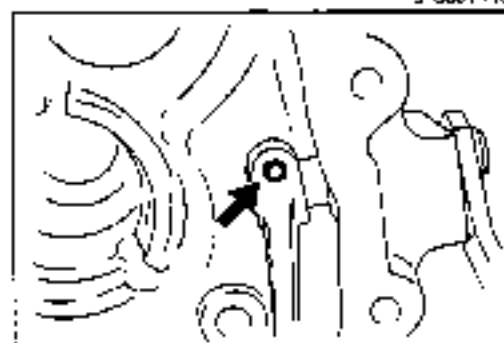
0.3 (0.031)	0.9 (0.035)	1.0 (0.039)
1.1 (0.043)	1.2 (0.047)	



9T60J1-110

**Outer and inner shift lever**

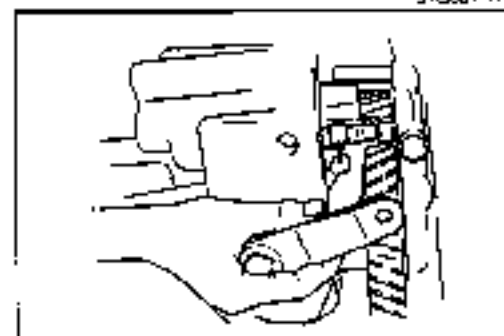
1. Install the shift lever as shown in the figure.



9T60J1-111

**Roll pin**

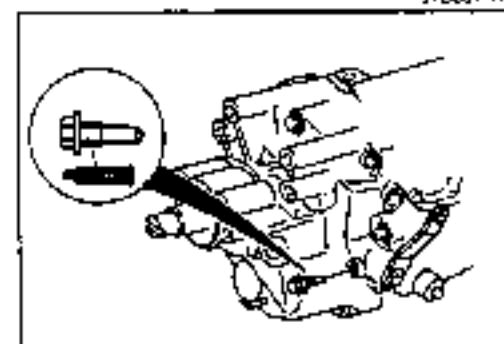
1. Install the roll pin as shown in the figure.



9T60J1-112

**Rear housing**

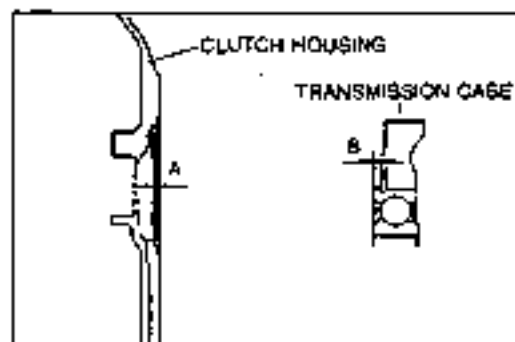
1. Align the thrust washer splines of the counter gear and the rear housing groove.
2. Align the inner shift lever and shift fork groove, and install the rear housing.



9T60J1-113

**Lock bolt**

1. Align the shift lever groove with the lock bolt hole, and install the lock bolt.



97G0J1-114

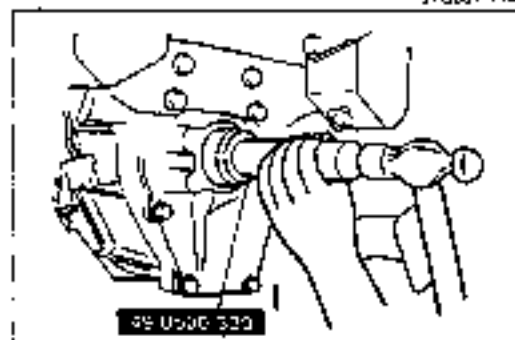
**Adjustment shim**

1. After measuring dimensions A and B shown in the figure, use an adjustment shim(s) with the thickness corresponding to the value of A plus gasket thickness 0.3mm (0.012 in) minus B, so that bearing end play will be within specification.

**Bearing end play: 0—0.1mm (0—0.004 in)**

**Adjustment shim thickness:**

0.6 (0.031)	0.8 (0.035)	1.0 (0.039)
1.1 (0.043)	1.2 (0.047)	

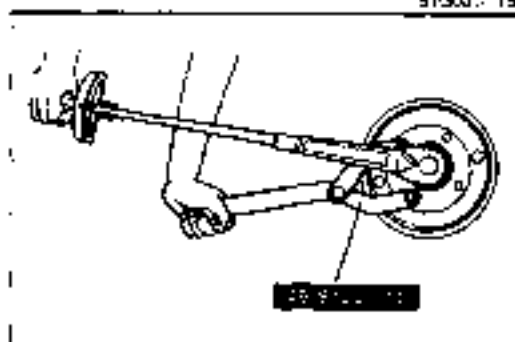


5T30J1-115

**Oil seal****Caution**

- Do not damage the mainshaft spline.

1. Install the oil seal with the SST.



97G0J1-116

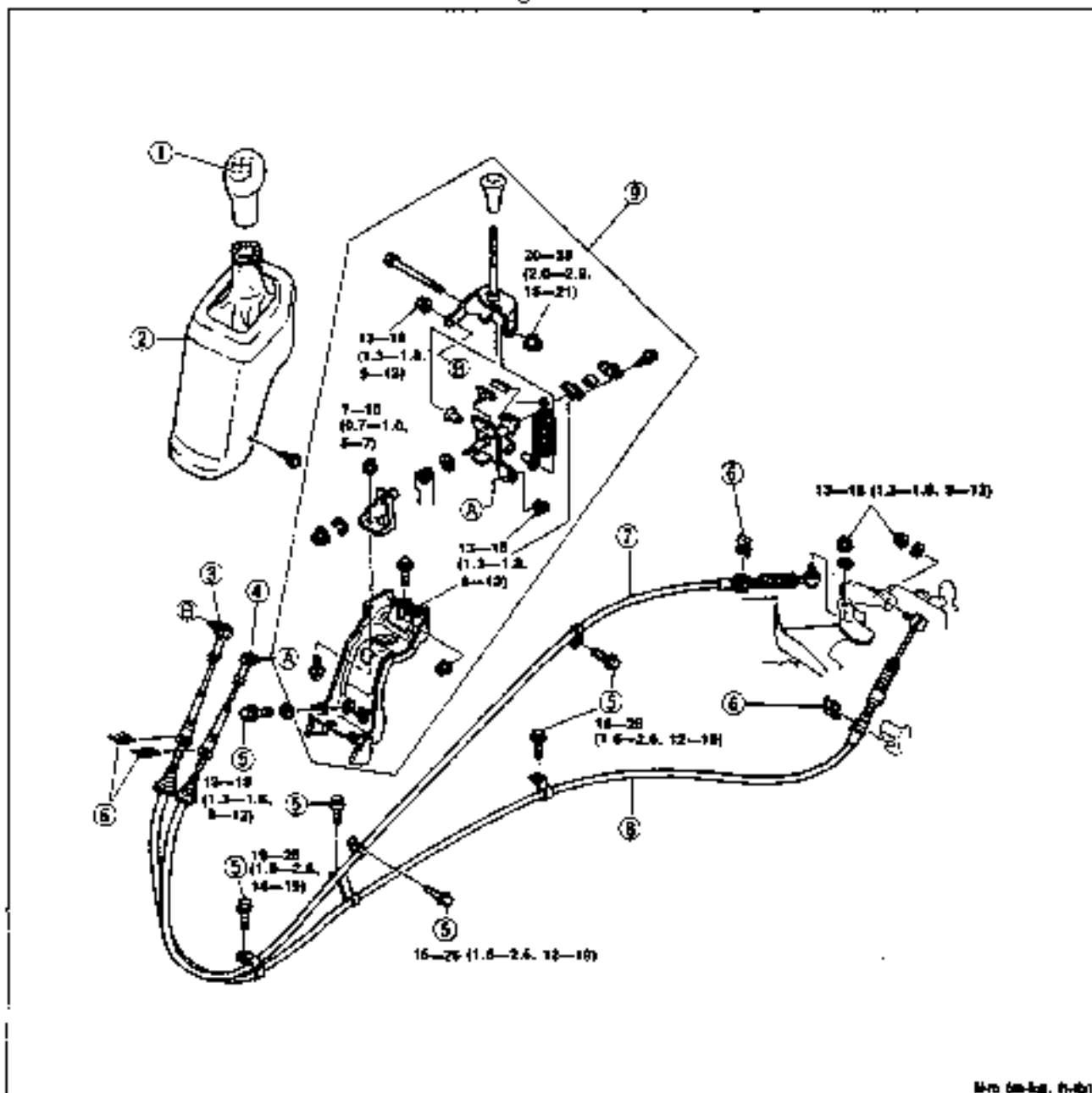
**Center brake drum**

1. Install the center brake drum.
2. Hold the drum with the SST, and tighten the locknut.

## SHIFT MECHANISM (TRANSMISSION)

## REMOVAL / INSTALLATION

- 1 Remove in the order shown in the figure, referring to **Removal Note**.
- 2 Inspect all parts and repair or replace as necessary.
- 3 Install in the reverse order of removal, referring to **Installation Note**.

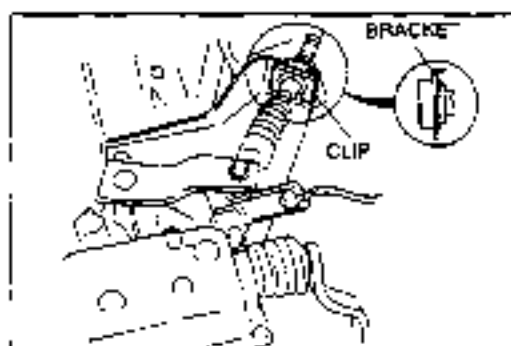


Mn (m-kg, 1-6)

JTRCJ1-078

- 1 Shift knob  
Installation Note ..... page J1-48
- 2 Console
- 3 Shift cable bail joint  
Installation Note ..... page J1-48
- 4 Selector cable ball joint  
Installation Note ..... page J1-48
- 5 Bolt

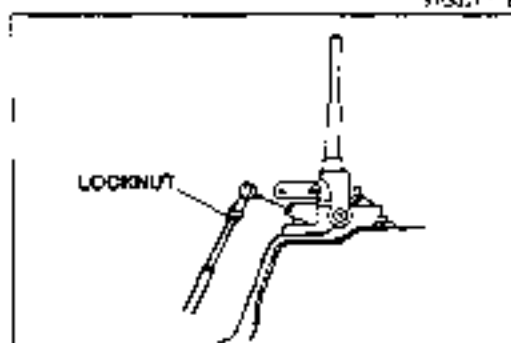
- 6 Clip  
Installation Note ..... page J1-48
- 7 Selector cable  
Inspect boots for damage  
Inspect cable for damage and function
- 8 Shift cable  
Inspect boots for damage  
Inspect cable for damage and function
- 9 Shift lever assembly



9TGGJ1-118

**Installation Note****Clips**

1. Install the clips as shown in the figure.



8TGGJ1-22

**Selector cable ball joint**

1. Loosen the locknut.

**Note**

- The shift lever will be set in neutral position by force of the spring.

2. Set the shift lever in neutral position.
3. Turn the ball joint so that the selector cable aligns with the installation hole of the shift lever.
4. Tighten the locknut.

**Tightening torque:**

10–15 Nm (1.0–1.6 m·kg, 7–11 ft·lb)

**Shift cable ball joint**

1. Measure A and B shown in the figure.
2. Calculate the neutral position of the shift lever as follows:

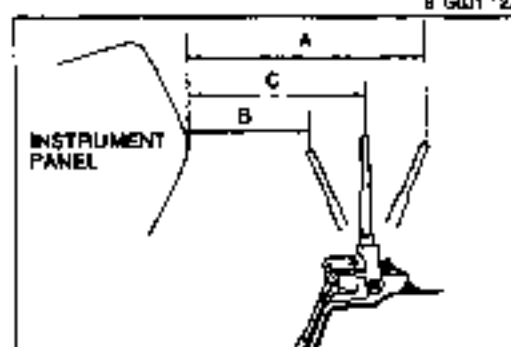
$$\text{Neutral position C} = B + \frac{A - B}{2}$$

3. Hold the shift lever in neutral position.
4. Loosen the shift cable locknut.
5. Turn the ball joint so that the shift cable aligns with the installation hole of the shift lever.
6. Tighten the locknut.

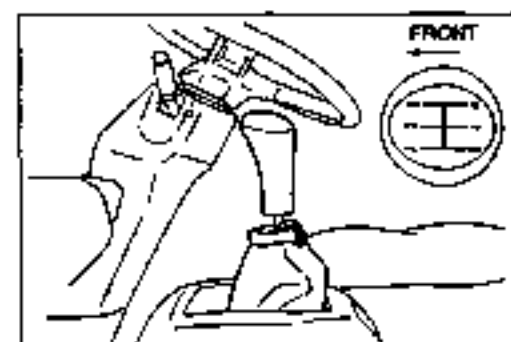
**Tightening torque:**

10–15 Nm (1.0–1.5 m·kg, 7–11 ft·lb)

7. After installation, verify that the shift lever operates smoothly.



9TGGJ1-23



9TGGJ1-119

**Shift knob**

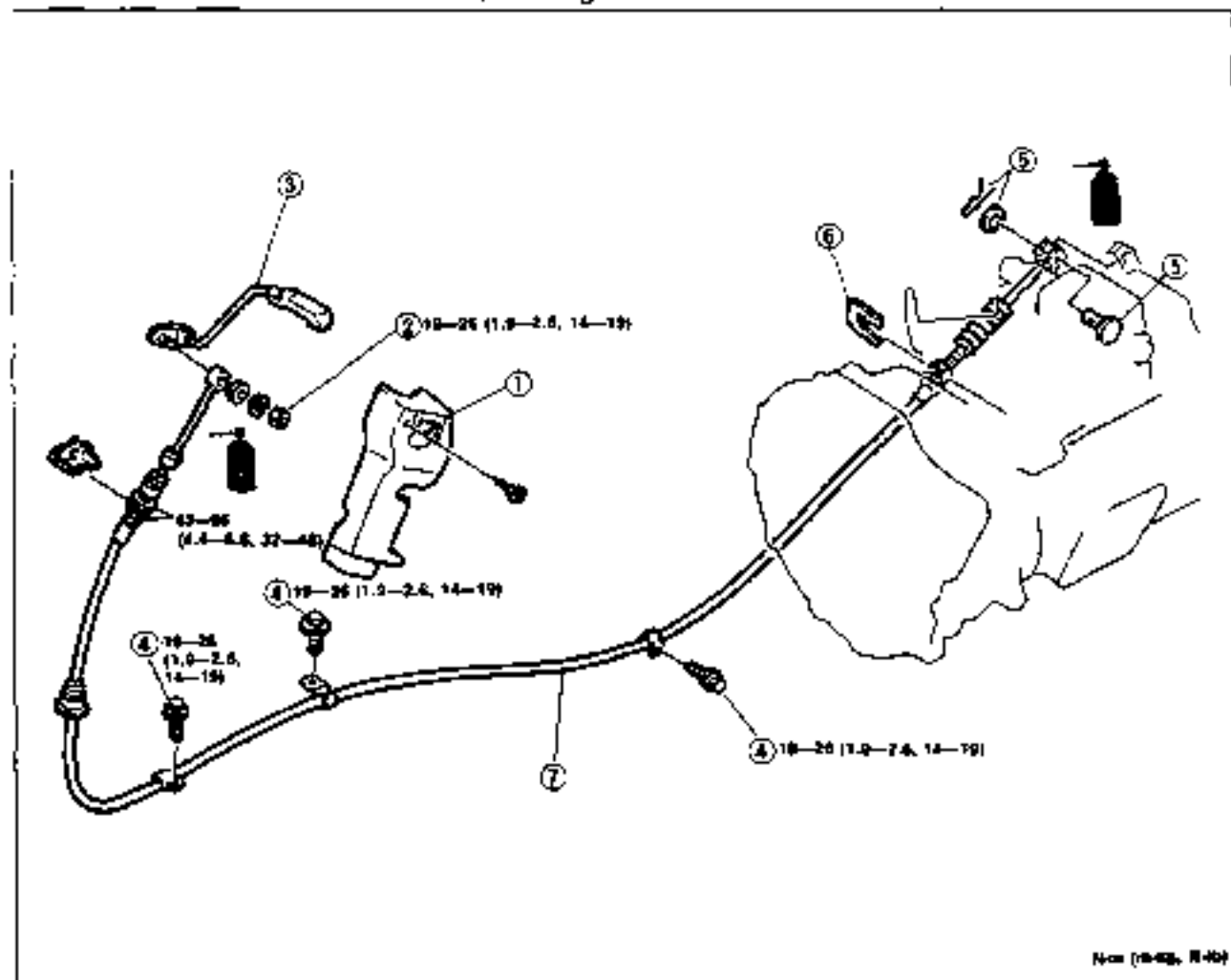
1. Install the shift knob as shown in the figure.



## SHIFT MECHANISM (SUB-TRANSMISSION)

## REMOVAL / INSTALLATION

1. Remove in the order shown in the figure, referring to **Removal Note**
2. Inspect all parts and repair or replace as necessary.
3. Install in the reverse order of removal, referring to **Installation Note**.



1. Steering column cover

2. Nut

Installation Note ..... page J1-48

3. Selector lever

4. Bolt

5. Spring pin and pin

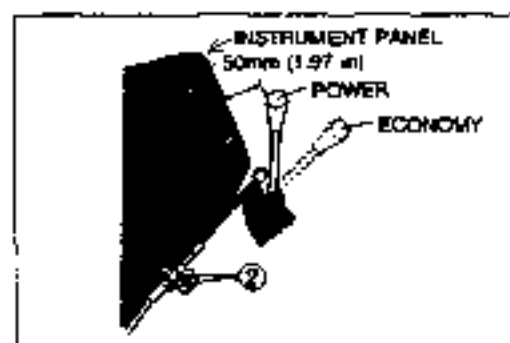
6. Clip

Installation Note ..... page J1-48

7. Sub-selector cable

Inspect boot for damage

Inspect cable for damage and function



8TQJ1-121

## Installation Note

## Nut

1. Shift the selector lever to POWER position.
2. Adjust the position of the lever as shown in the figure.

## Tightening torque:

43-65 Nm (4.4-6.6 m·kg, 32-48 ft·lb)

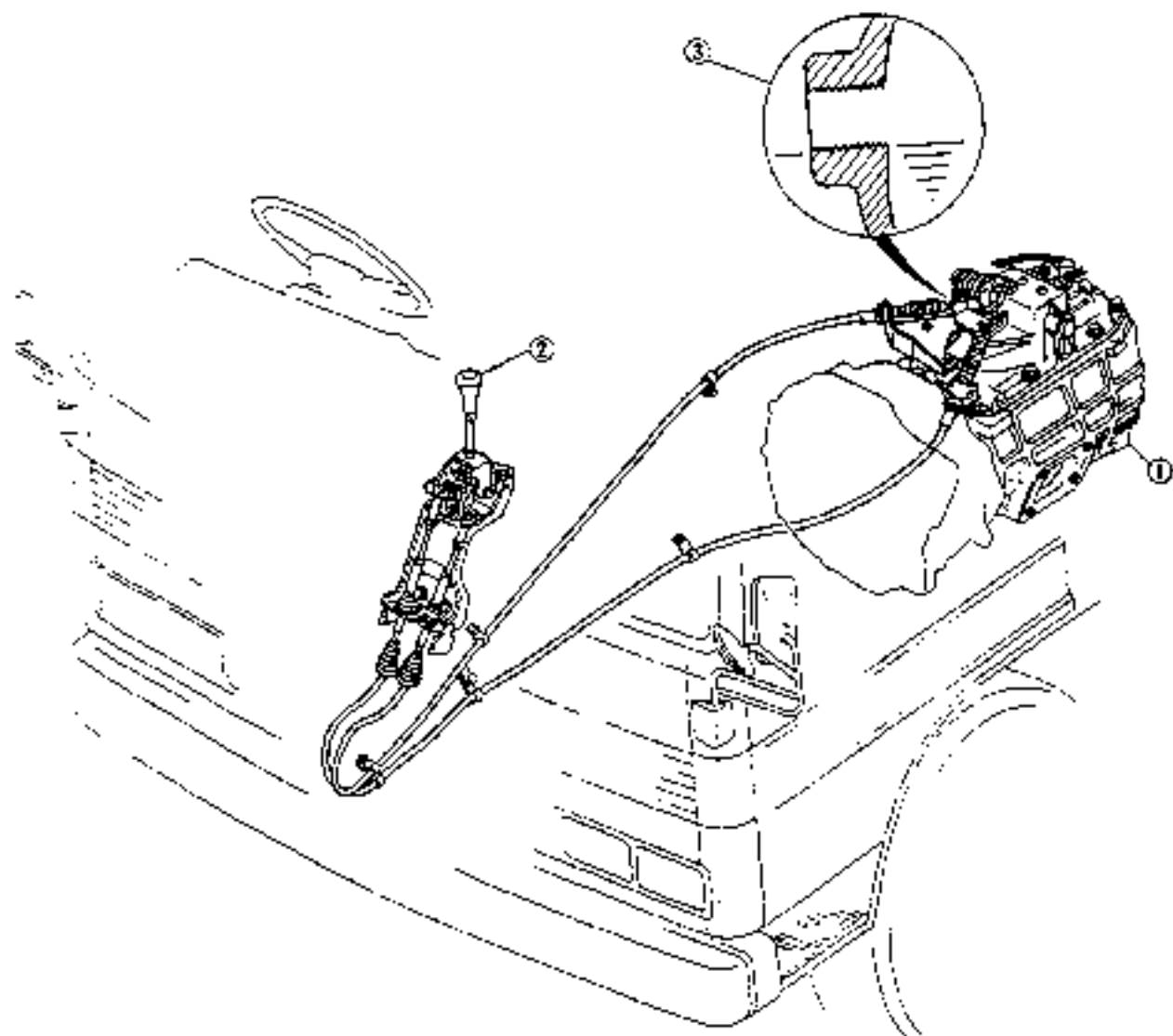
# MANUAL TRANSMISSION (Z5M-R)

<b>INDEX</b> .....	J2- 2
<b>OUTLINE</b> .....	J2- 4
SPECIFICATION .....	J2- 4
STRUCTURAL VIEW.....	J2- 5
COMPONENTS.....	J2- 7
POWERFLOW .....	J2- 8
<b>TROUBLESHOOTING GUIDE</b> .....	J2-12
<b>TRANSMISSION OIL</b> .....	J2-13
INSPECTION .....	J2-13
REPLACEMENT.....	J2-13
<b>TRANSMISSION</b> .....	J2-14
PREPARATION.....	J2-14
REMOVAL / INSTALLATION.....	J2-14
DISASSEMBLY .....	J2-18
INSPECTION.....	J2-30
ASSEMBLY .....	J2-33
<b>SHIFT MECHANISM (TRANSMISSION)</b> .....	J2-47
REMOVAL / INSTALLATION.....	J2-47
<b>SHIFT MECHANISM (SUB-TRANSMISSION)</b> J2-49	
REMOVAL / INSTALLATION.....	J2-49

## INDEX

WITHOUT SUB-TRANSMISSION

GRADE: API SERVICE GL-4 OR GL-5  
SAE 75W-90  
CAPACITY: 4.5 liters (4.8 US qt., 4.0 Imp qt.)



97G012-002

- |                        |                  |                                   |                  |
|------------------------|------------------|-----------------------------------|------------------|
| 1. Transmission        |                  | 2. Shift mechanism (Transmission) |                  |
| Removal / Installation | ..... page J2-14 | Removal / Installation            | ..... page J2-47 |
| Disassembly            | ..... page J2-18 | 3. Transmission oil               |                  |
| Inspection             | ..... page J2-30 | Inspection                        | ..... page J2-13 |
| Assembly               | ..... page J2-33 | Replacement                       | ..... page J2-13 |

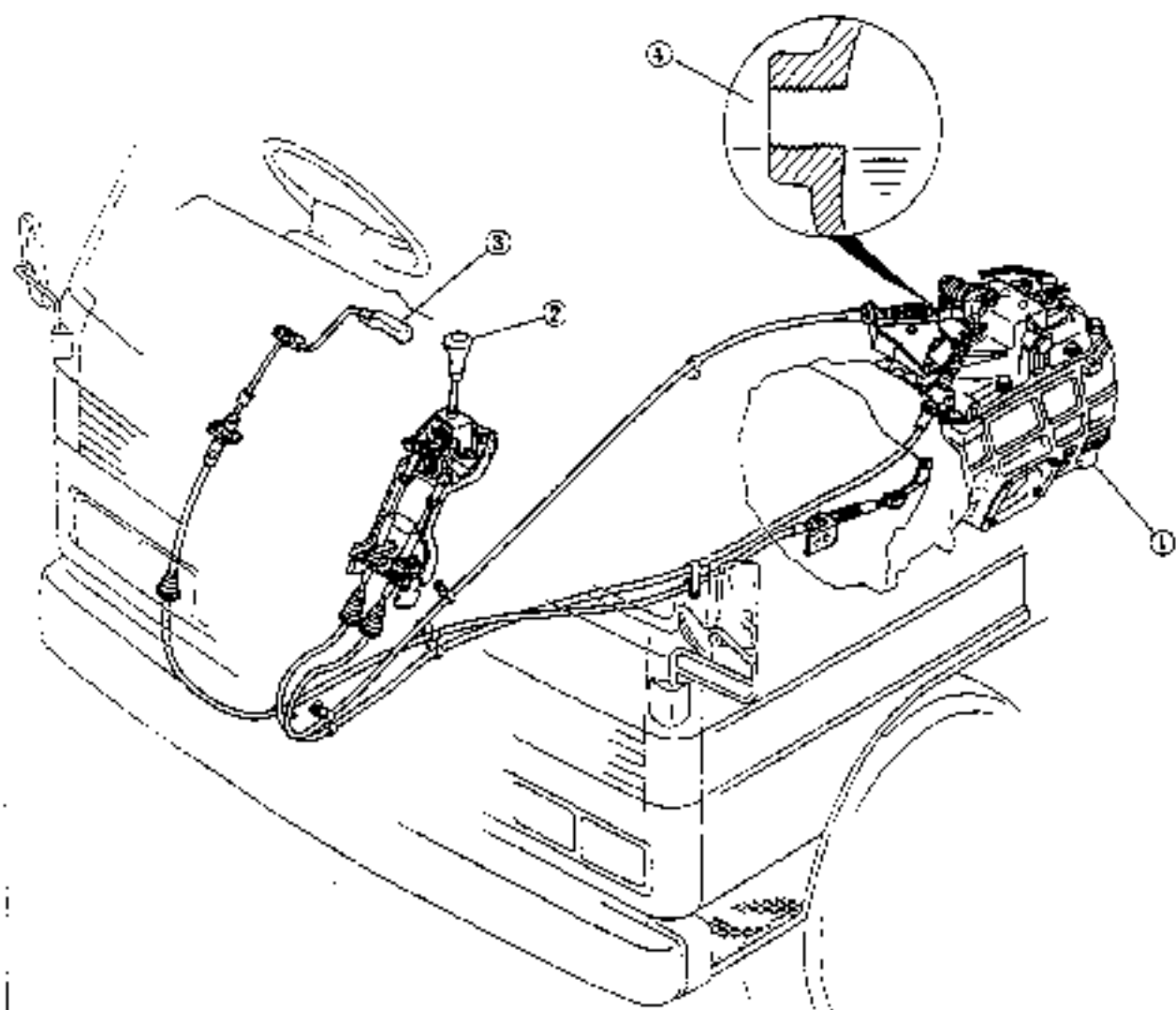
## INDEX

WITH SUB-TRANSMISSION

GRADE: API SERVICE GL-4 OR GL-5

SAE 75W-90

CAPACITY: 4.2 liters (4.4 US qt, 3.7 Imp qt)



9T30J2-023

- |                                   |            |                                       |            |
|-----------------------------------|------------|---------------------------------------|------------|
| 1. Transmission                   |            | 3. Shift mechanism (Sub-transmission) |            |
| Removal / Installation .....      | page J2-14 | Removal / Installation .....          | page J2-49 |
| Disassembly .....                 | page J2-18 | 4. Transmission oil                   |            |
| Inspection .....                  | page J2-30 | Inspection .....                      | page J2-13 |
| Assembly .....                    | page J2-33 | Replacement .....                     | page J2-13 |
| 2. Shift mechanism (Transmission) |            |                                       |            |
| Removal / Installation .....      | page J2-47 |                                       |            |

## OUTLINE

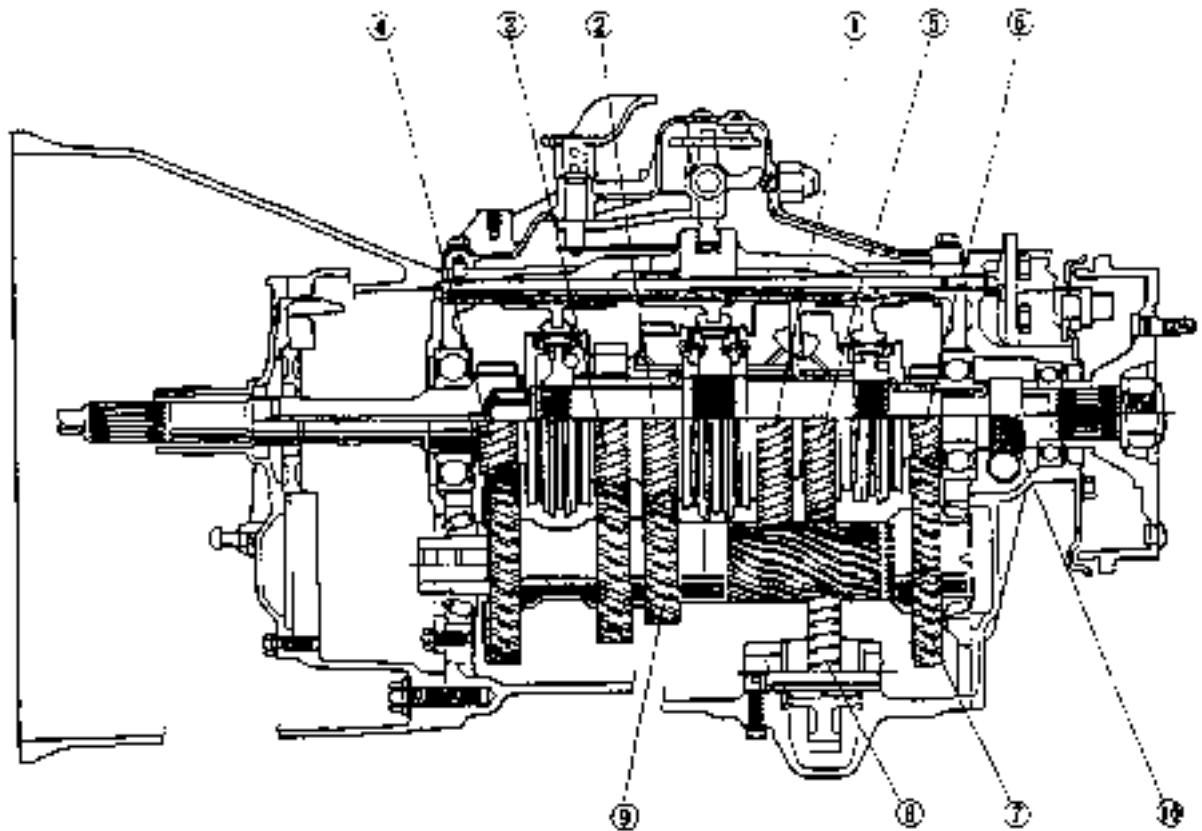
## SPECIFICATIONS

Item		Transmission model		
		Without Sub-Transmission	With Sub-Transmission	
		<b>Z5M-R</b>		
		<b>SL Turbo</b>		
Transmission mesh system		Forward: Synchronesh Reverse: Constant-mesh		
Sub-transmission mesh system		Synchronesh		
Shift pattern				
Gear ratio	Transmission	1st	5.962	
		2nd	2.954	
		3rd	1.661	
		4th	1.000	
		5th	0.783	
		Rev	5.318	
	Sub-transmission	Economy	—	0.812
		Power	—	1.000
Oil	Type	API Service GL-4 or GL-5 SAE 75W-90		
	Capacity liters (US qt. imp. gal.)	4.5 (4.8, 4.0)	4.2 (4.4, 3.7)	

97-3012-004

STRUCTURAL VIEW

WITHOUT SUB-TRANSMISSION



- 1. 1st gear
- 2. 2nd gear
- 3. 3rd gear
- 4. Main drive gear (4th gear)

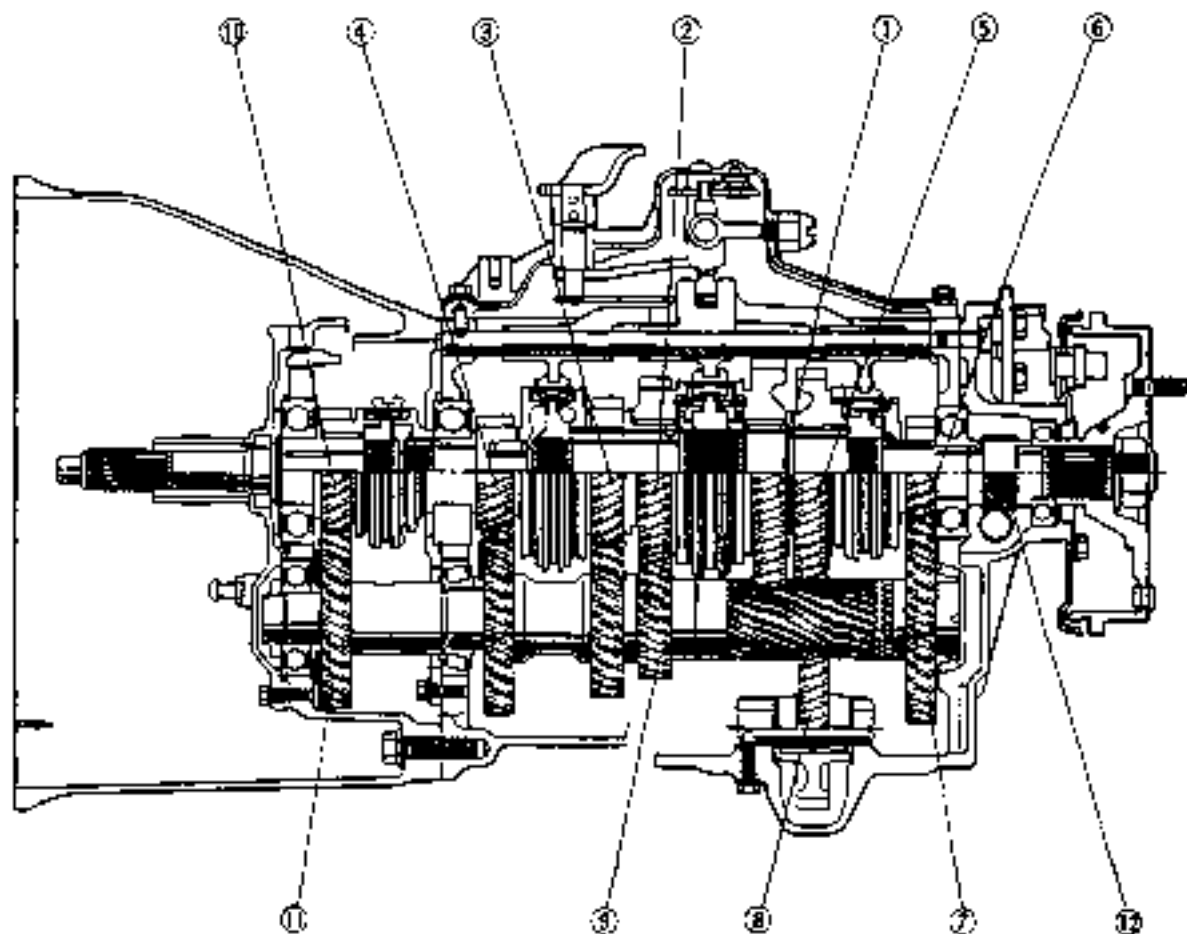
- 5. Reverse gear
- 6. 5th gear
- 7. Counter 5th gear

- 8. Reverse idler gear
- 9. Countershaft gear
- 10. Speedometer drive gear

875012-006

### STRUCTURAL VIEW

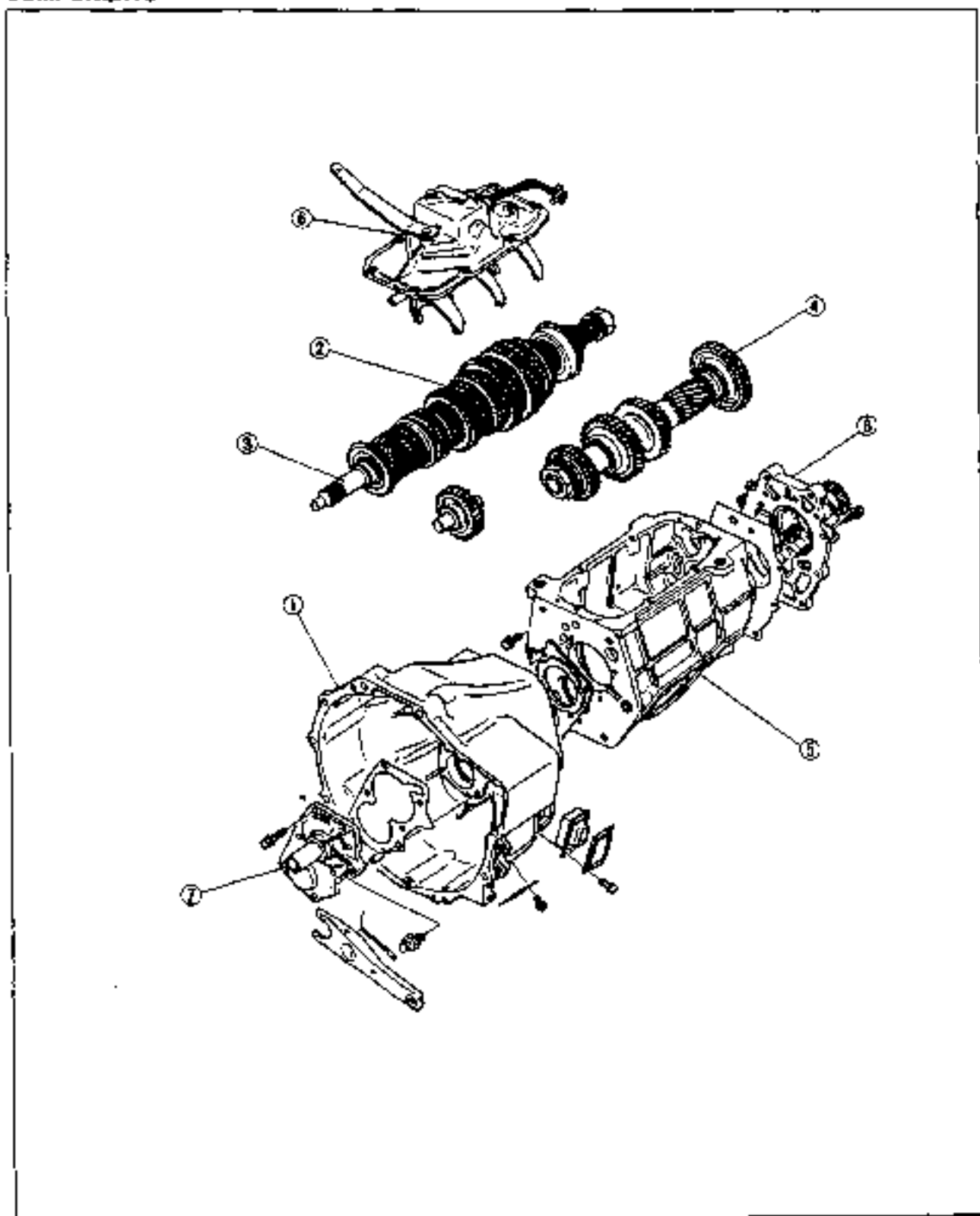
WITH SUB-TRANSMISSION



9700J2-006

- |                               |                       |                            |
|-------------------------------|-----------------------|----------------------------|
| 1. 1st gear                   | 5. Reverse gear       | 9. Countershaft gear       |
| 2. 2nd gear                   | 6. 5th gear           | 10. High gear              |
| 3. 3rd gear                   | 7. Counter 5th gear   | 11. Counter high gear      |
| 4. Main drive gear (4th gear) | 8. Reverse idler gear | 12. Speedometer drive gear |

COMPONENTS



9160, 2-997

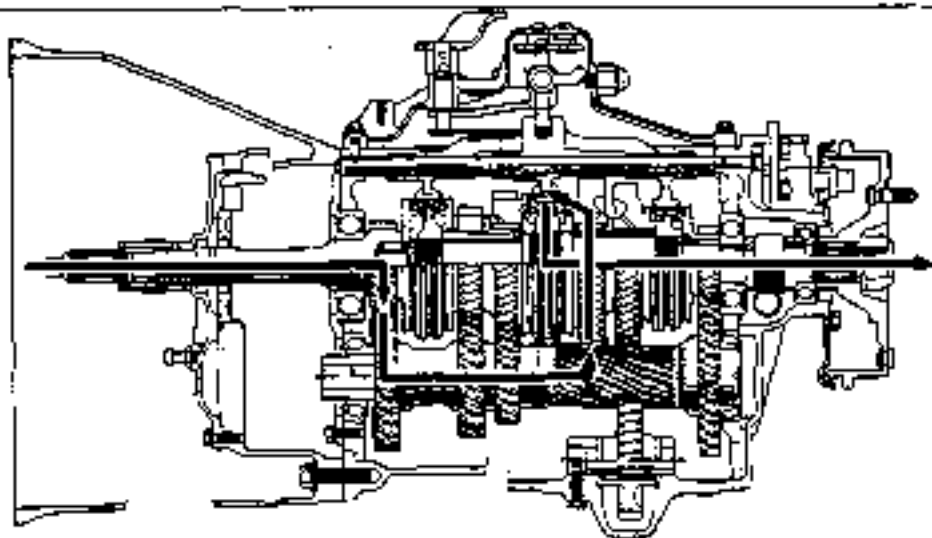
- 1. Clutch housing
- 2. Mainshaft assembly
- 3. High gear
- 4. Countershaft assembly

- 5. Transmission case
- 6. Top cover assembly
- 7. Front cover
- 8. Rear cover

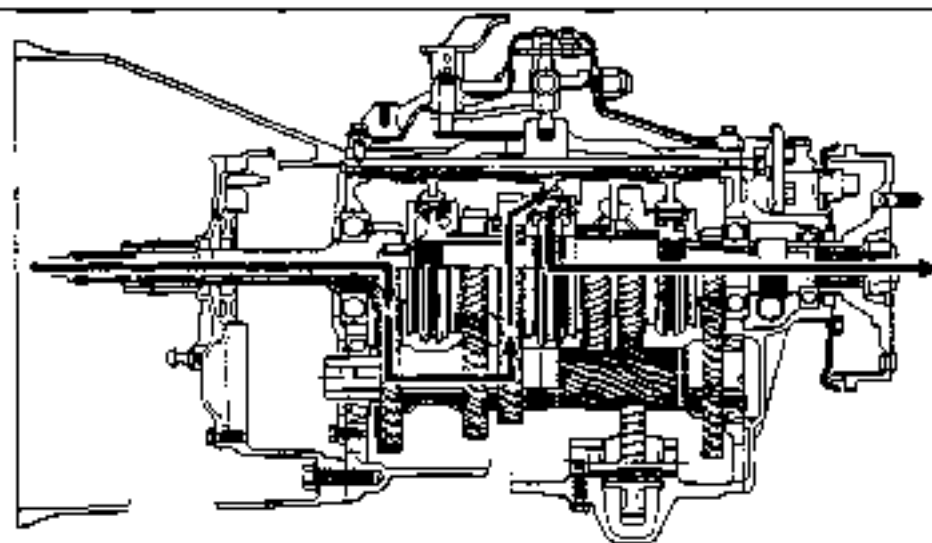


**POWERFLOW**  
Without Sub-Transmission

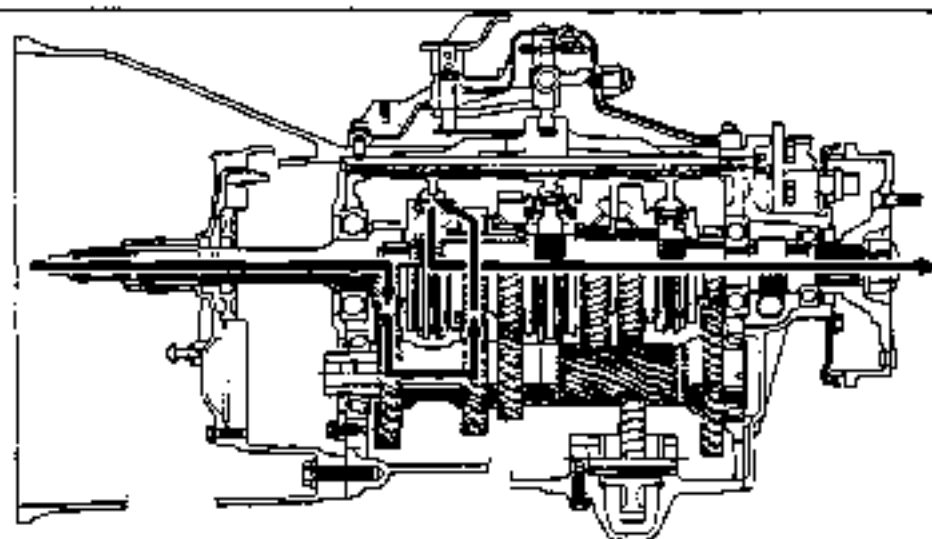
1ST

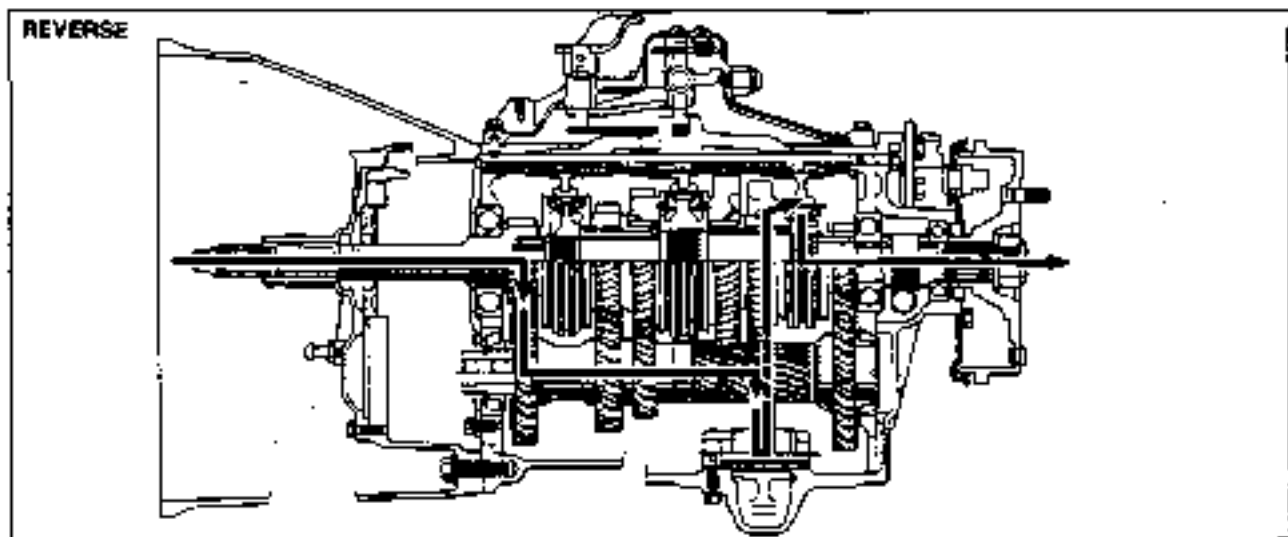
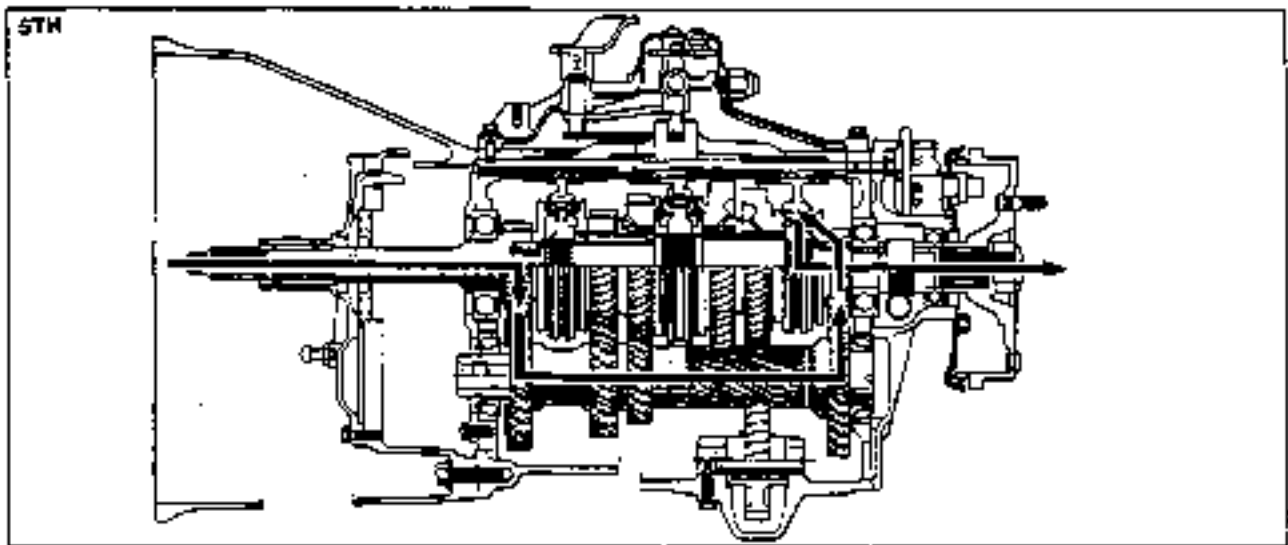
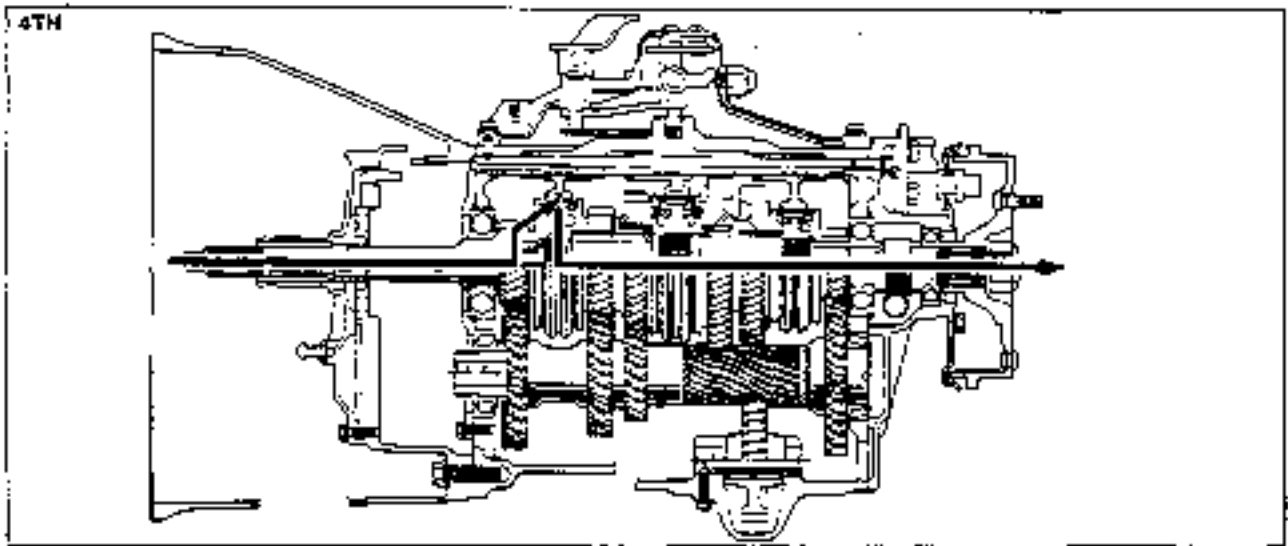


2ND



3RD

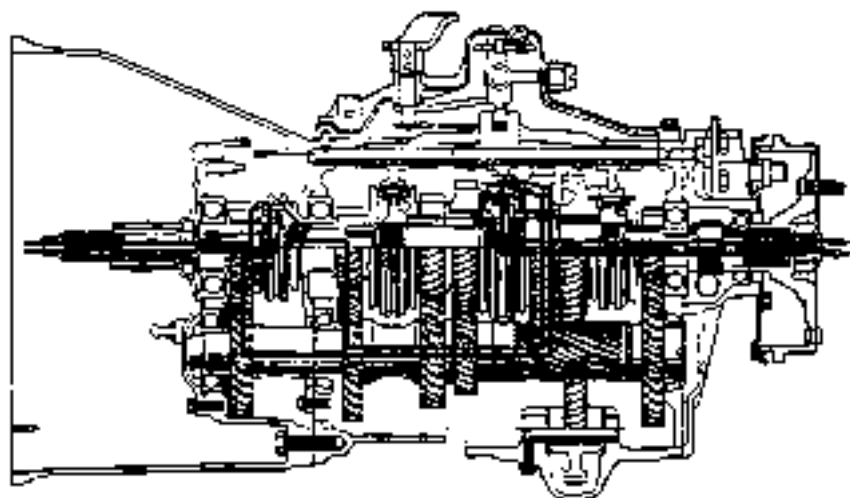




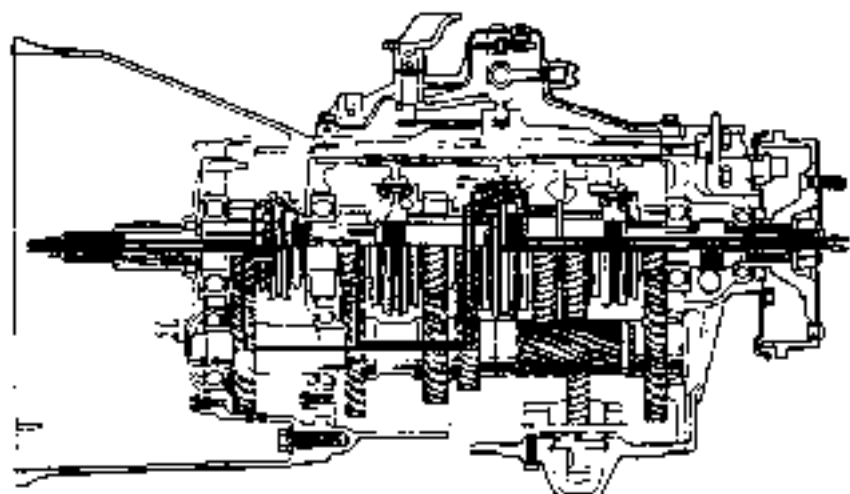
## With Sub-Transmission

Power : →  
Economy: ⇄

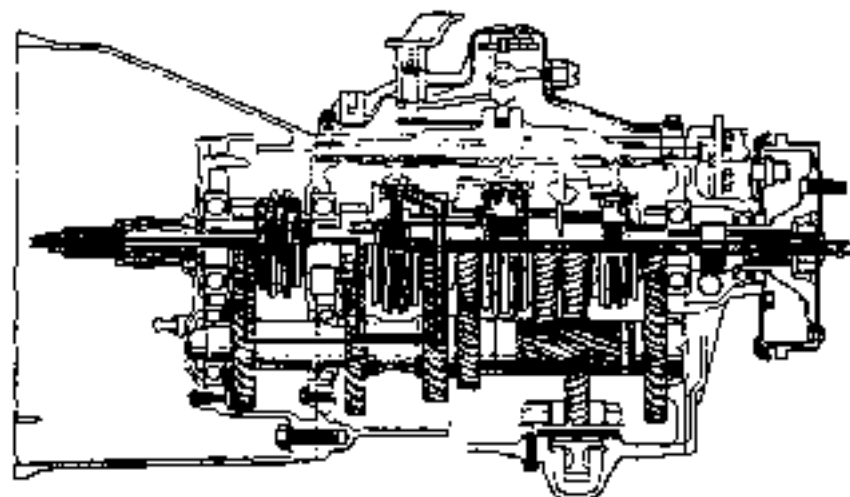
1ST



2ND

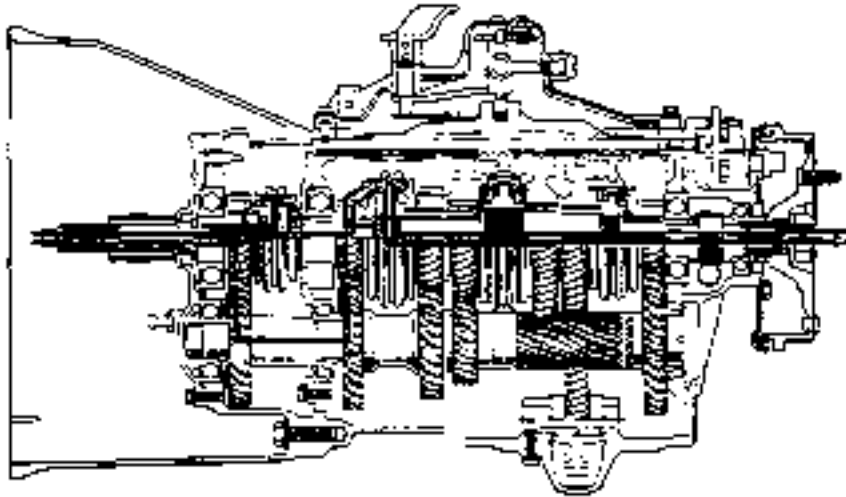


3RD

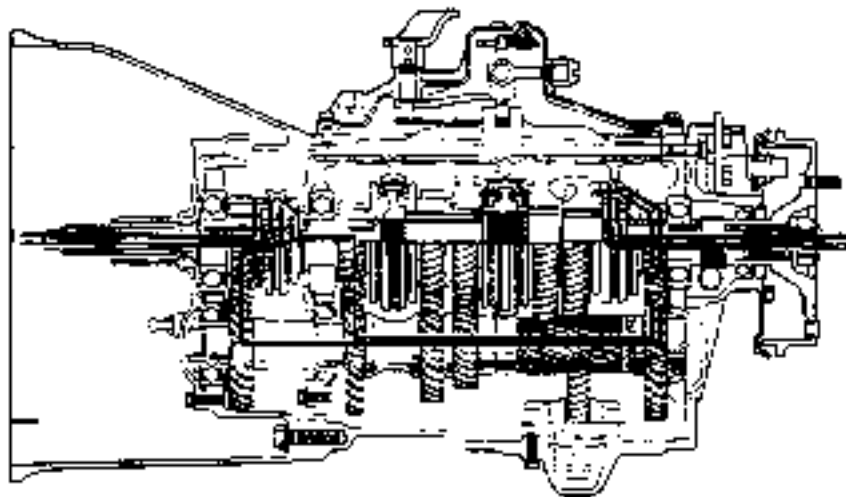


Power : ➔  
Economy : ⇐

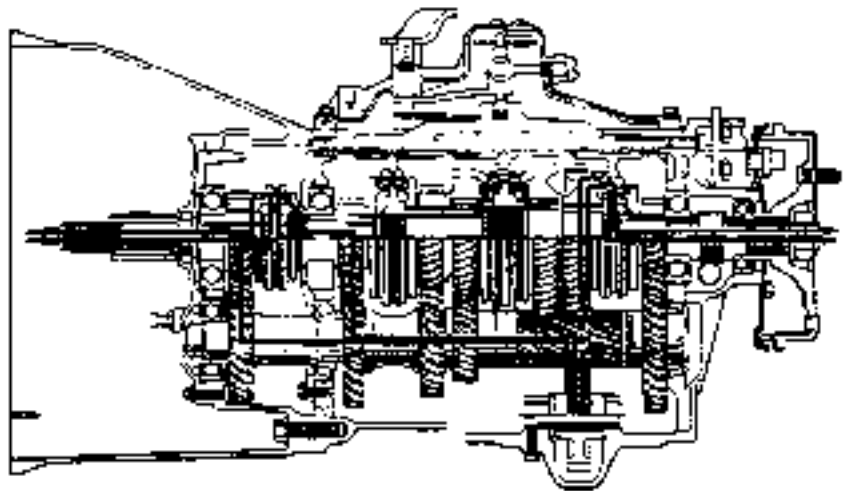
4TH



5TH



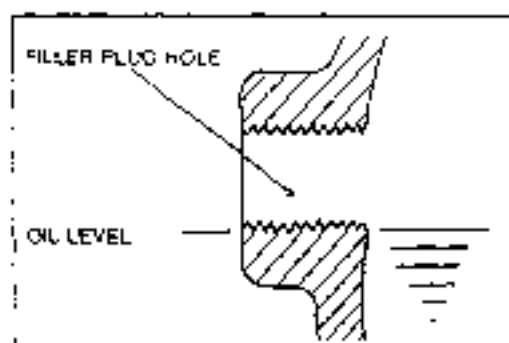
REVERSE



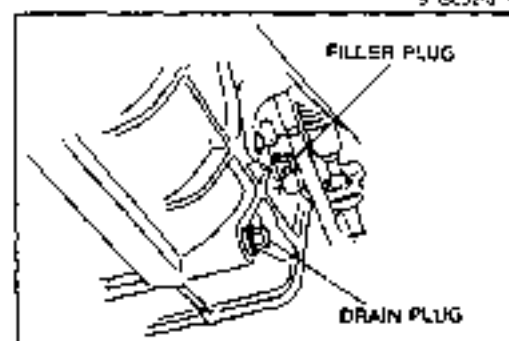
## TROUBLESHOOTING GUIDE

Problem	Possible Cause	Action	Page
Abnormal noise	Insufficient oil	Add oil	J2-13
	Deterioration of oil quality	Replace with specified oil	J2-13
	Worn bearing	Replace	J2-32
	Worn contact surface of countershaft gear	Replace	J2-30
	Worn contact surface of gear	Replace	J2-30
	Excessive gear backlash	Replace	—
	Damaged gear teeth	Replace	J2-30
Foreign matter in transmission	Repair or replace		
Difficult to shift	Bent shift rod	Replace	—
	Insufficient oil	Add oil	J2-13
	Deterioration of oil quality	Replace with specified oil	J2-13
	Worn or loose shift fork and shift rod	Replace	—
	Worn synchronizer ring	Replace	J2-31
	Worn synchronizer cone of gear	Replace	J2-31
	Poor contact of synchronizer ring and gear cone	Replace	J2-31
Excessive longitudinal play of gears	Replace	—	
Worn bearing	Replace	J2-32	
Fatigued synchronizer key spring	Replace	—	
Jumps out of gear	Weak detent ball spring	Replace	—
	Worn shift fork	Replace	J2-31
	Worn clutch hub sleeve	Replace	J2-31
	Excessive gear backlash	Replace	—
Worn bearing	Replace	J2-32	
Shift lever does not function smoothly or is difficult to operate	Stuck control cable	Replace	J2-47
	Malfunction of control cable ball joint	Replace	J2-47
Selector lever does not function smoothly or is difficult to operate	Stuck control cable	Replace	J2-49
	Malfunction of control cable ball joint	Replace	J2-49

87G0J2-010



97G0J231



97G0J2412

## TRANSMISSION OIL

## INSPECTION

**Caution**

- Position the vehicle on level ground.

1. Remove the filler plug.
2. Verify that the oil is at the bottom of the filler plug hole. If it is low, add the specified oil from filler plug.

**Specified oil:**

Type API Service GL-4 or GL-5  
SAE 75W-90

3. Wipe clean and apply sealant to the plug threads before installing the plug.

**Tightening torque:**

33—51 N·m (3.4—5.2 m·kg, 25—38 ft·lb)

## REPLACEMENT

1. Remove the drain plug, and drain the oil into a suitable container.
2. Wipe clean and apply sealant to the plug threads.
3. Install the drain plug.

**Tightening torque:**

33—51 N·m (3.4—5.2 m·kg, 25—38 ft·lb)

4. Add the specified oil from the filler plug hole until the level reaches the bottom of the hole.

**Specified oil:**

Type API Service GL-4 or GL-5  
SAE 75W-90

**Capacity Without sub-transmission**

4.5 liters (4.8 US qt, 4.0 Imp qt)

**With sub-transmission**

4.2 liters (4.4 US qt, 3.7 Imp qt)

5. Apply sealant to the filler plug threads.
6. Install the filler plug.

**Tightening torque:**



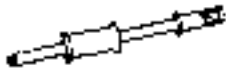
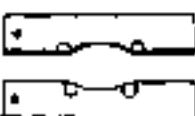








33—51 N·m (3.4—5.2 m·kg, 25—38 ft·lb)

97G0J2013

## TRANSMISSION

## PREPARATION

## SST

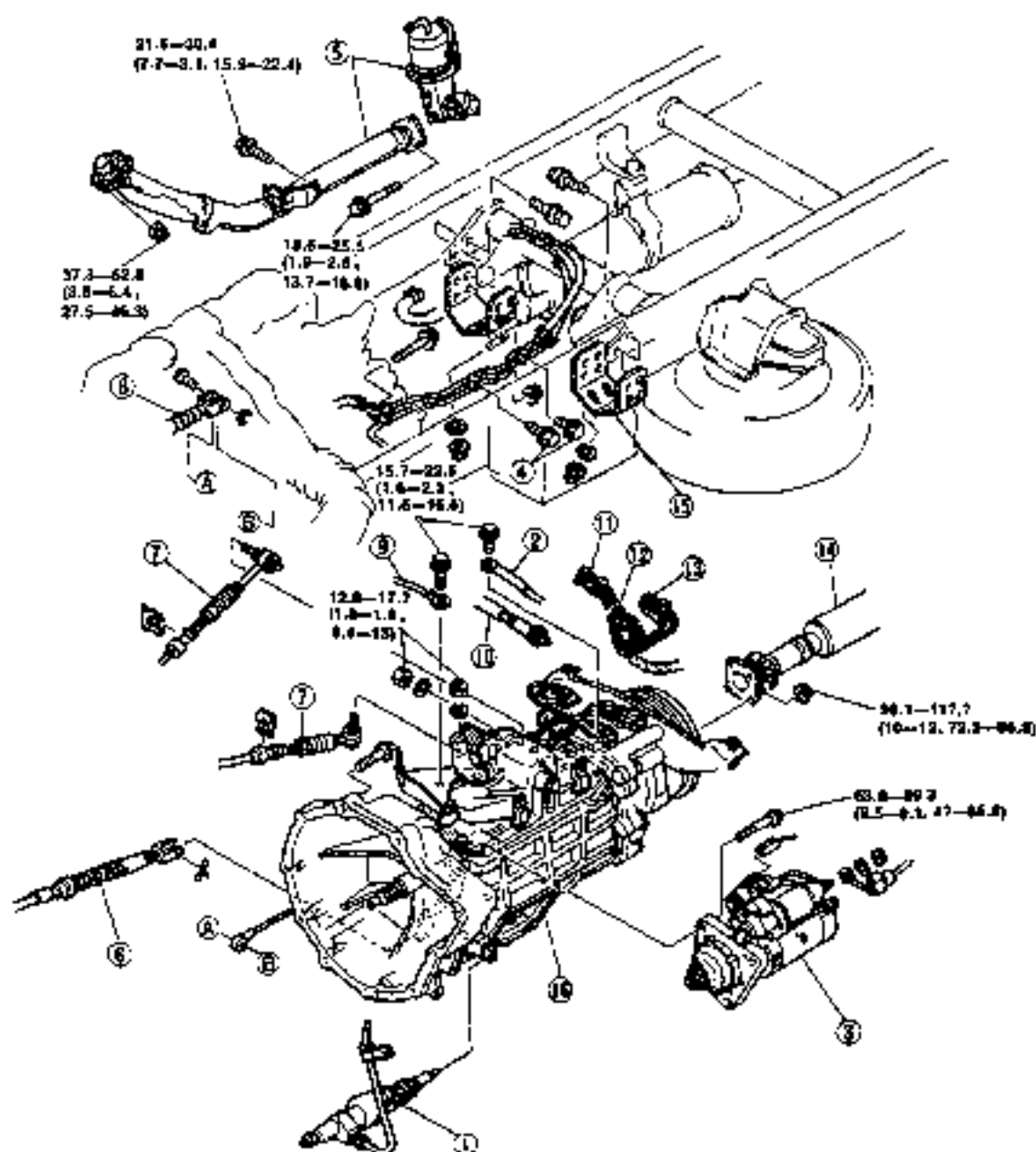
49 S120 710 Holder, coupling large 	For removal of center brake drum locknut	49 B501 631A Attachment, rear axle shaft puller 	For removal of center brake drum
49 0223 630B Puller, rear axle shaft 	For removal of center brake drum locknut	49 F026 103 Puller, wheel hub 	For removal of clutch hub
49 0839 425C Puller set, bearing 	For removal of bearing	49 F025 001 Installer, bearing 	For installation of bearing
49 0727 415 Installer, bearing 	For installation of bearing	49 F401 331 Body (Part of 49 F401 330B) 	For installation of bearing
49 S120 620 Installer, rear shaft bearing 	For installation of bearing	49 0600 330 Installer transmission bearing 	For installation of bearing
49 W501 445 Holder synchronizer ring 	For installation of bearing	49 F401 330B Installer set, bearing 	For installation of clutch hub

9790J2-014

## REMOVAL / INSTALLATION

1. Disconnect the negative battery cable.
2. Raise the vehicle and support it with safety stands.
3. Drain the transmission oil into a suitable container.
4. Remove in the order shown in the figure, referring to **Removal Note**.
5. Install in the reverse order of removal, referring to **Installation Note**.
6. Add the specified amount of the specified transmission oil. (Refer to page J2-13.)
7. Warm up the engine and transmission, and inspect for oil leakage and transmission operation.

9790J2-015

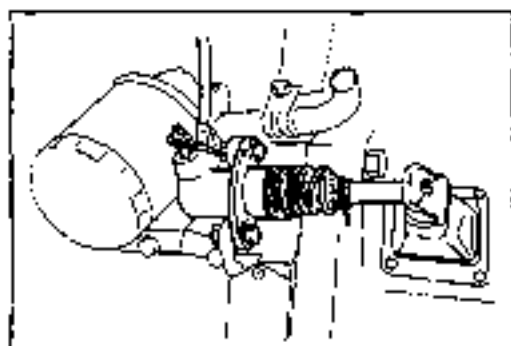


Rev (to-kg, 11-8)

97G0J2-016

- |   |   |
|---|---|
| 1. Clutch release cylinder<br>Removal Note ..... page J2-16 | 11. Back-up light switch connector  |
| 2. Ground wire<br>Installation Note ..... page J2-17        | 12. Neutral switch connector  |
| 3. Starter  | 13. Sub-transmission switch connector   |
| 4. Fuel pipe clip bolt                                      | 14. Propeller shaft<br>Service ..... Section L  |
| 5. Exhaust pipe and power chamber                           | 15. Transmission mount bracket  |
| 6. Sub-selector cable                                       | 16. Transmission<br>Removal Note ..... page J2-16<br>Disassembly ..... page J2-18<br>Inspection ..... page J2-30<br>Assembly ..... page J2-33<br>Installation Note ..... page J2-16 |
| 7. Shift/selector cable                                     |   |
| B. Parking brake cable                                      |   |
| 9. Ground wire<br>Installation Note ..... page J2-17        |   |
| 10. Speedometer cable                                       |   |





97G0J2-017

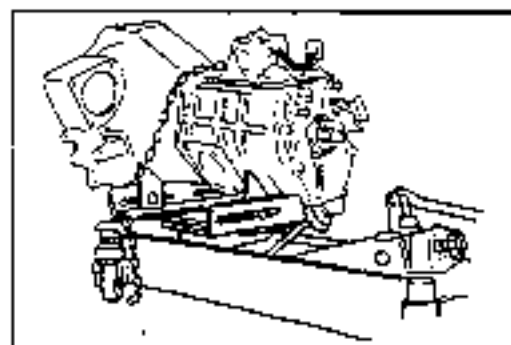
**Removal Note****Clutch release cylinder**

1. Remove the mounting bolts and nuts.
2. Move the clutch release cylinder out of the way to remove the transmission.

**Transmission**

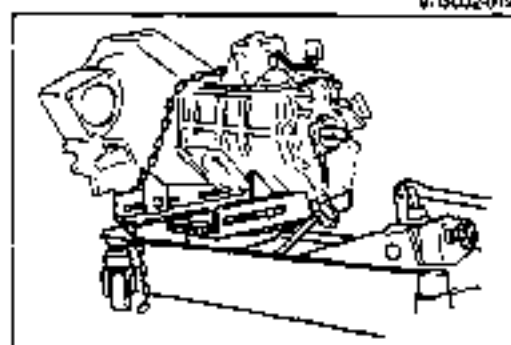
1. Support the engine with a jack under the oil pan.
2. Support the transmission with a transmission jack.
3. Remove the transmission mounting bolts.
4. Remove the transmission from under the vehicle.

97G0J2-018



97G0J2-019

4. Remove the transmission from under the vehicle.



97G0J2-020

**Installation Note****Transmission**

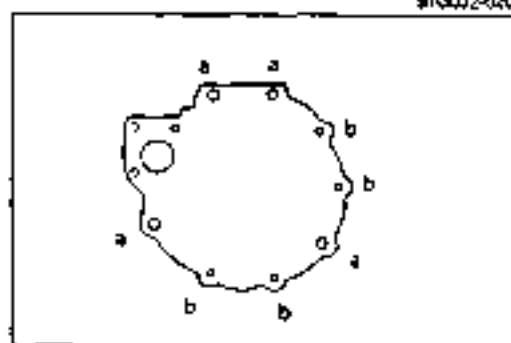
1. Install the transmission with the transmission jack.

2. Tighten the transmission mounting bolts.

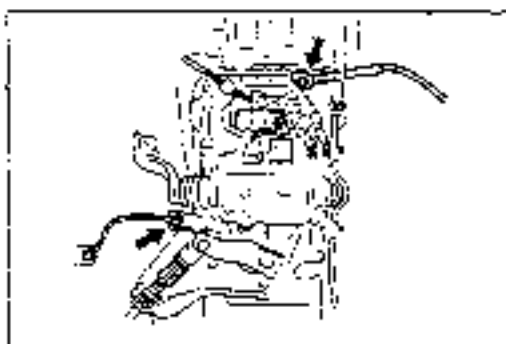
**Tightening torque:**

a: 89—117 N·m (9.1—11.9 m·kg, 65—86 ft·lb)

b: 37—52 N·m (3.8—5.3 m·kg, 27—38 ft·lb)



97G0J2-021



9T50.2 022

**Ground wire**

1. Install the ground wires.

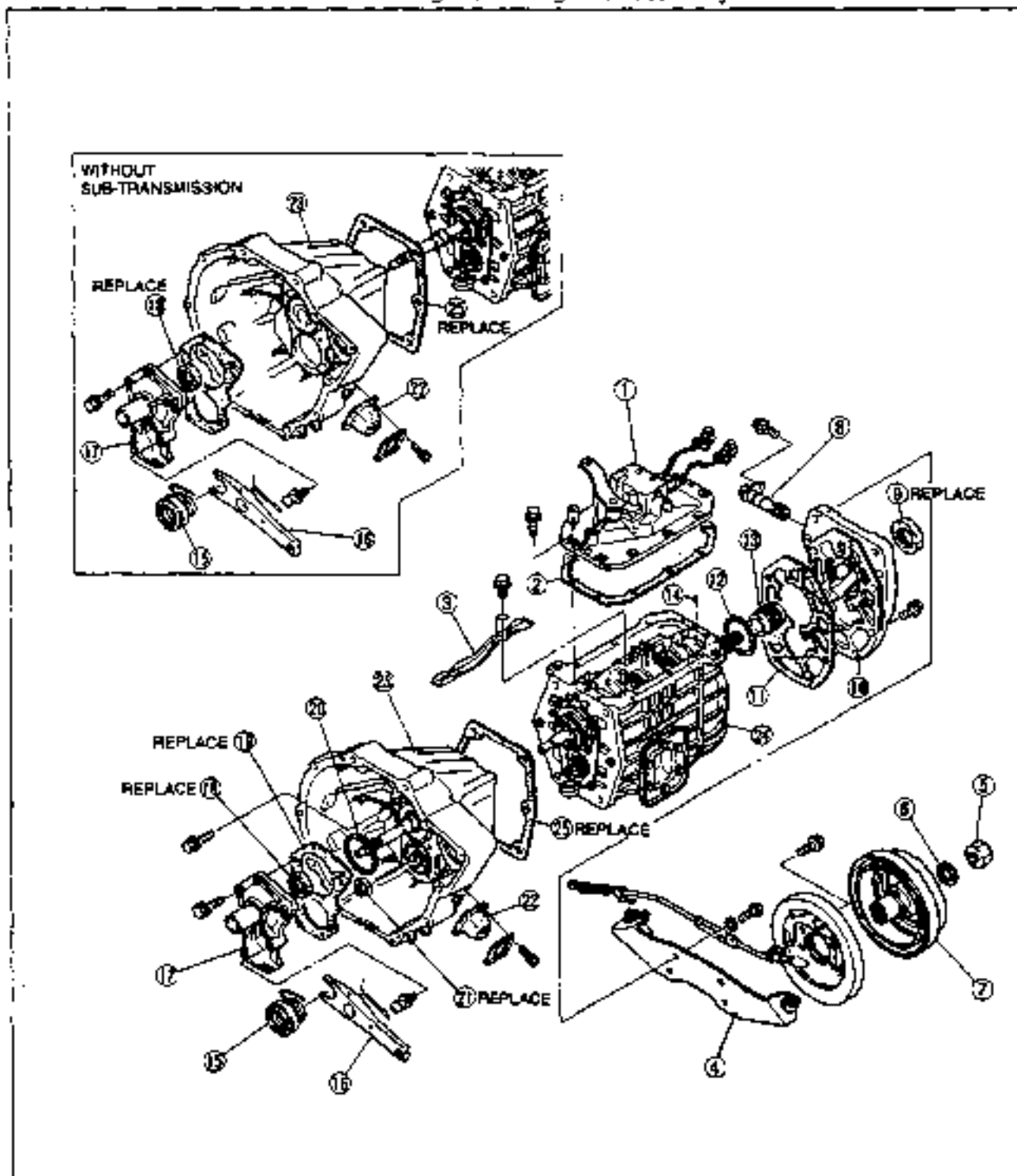
**Tightening torque:****16—23 Nm (1.6—2.3 m·kg, 12—17 ft·lb)**

**DISASSEMBLY****Precaution**

1. Clean the transmission exterior thoroughly with a steam cleaner or cleaning solvent before disassembly.
2. Clean the removed parts (except sealed bearings) and all sealing surfaces with cleaning solvent, and dry with compressed air.  
Clean out all holes and passages with a compressed air, and check that there are no obstructions.
3. Wear eye protection when using compressed air to clean components.

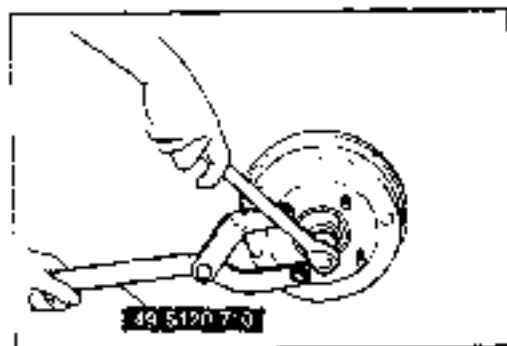
**Housing Components**

1. Disassemble in the order shown in the figure, referring to **Disassembly Note**.

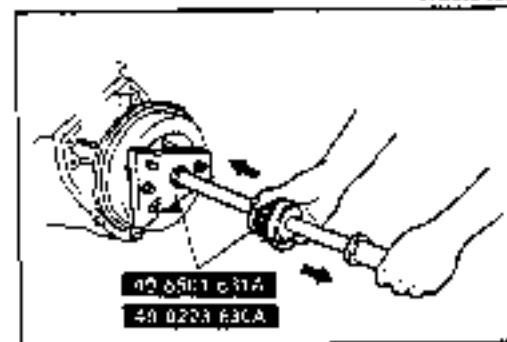


<p>1. Top cover assembly Disassembly ..... page J2-21</p> <p>2. Gasket</p> <p>3. Oil guide</p> <p>4. Transmission mount</p> <p>5. Locknut (Rear)</p> <p>6. Washer</p> <p>7. Center brake drum Disassembly Note ..... page J2-19</p> <p>8. Speedometer driven gear</p> <p>9. Oil seal (Rear) Inspect for damage On-vehicle replacement ..... page J2-20</p> <p>10. Rear cover</p> <p>11. Gasket</p> <p>12. Adjustment shim</p> <p>13. Speedometer drive gear</p>	<p>14. Steel ball</p> <p>15. Release bearing Inspection ..... page J2-32</p> <p>16. Release fork</p> <p>17. Front cover</p> <p>18. Oil seal (Front) Inspect for damage</p> <p>19. Gasket</p> <p>20. Adjustment shim</p> <p>21. Locknut (Front) Disassembly Note ..... page J2-19</p> <p>22. Dust boot</p> <p>23. Clutch housing assembly Disassembly ..... page J2-22</p> <p>24. Transmission case assembly Disassembly ..... page J2-26</p> <p>25. Gasket</p>
---	--

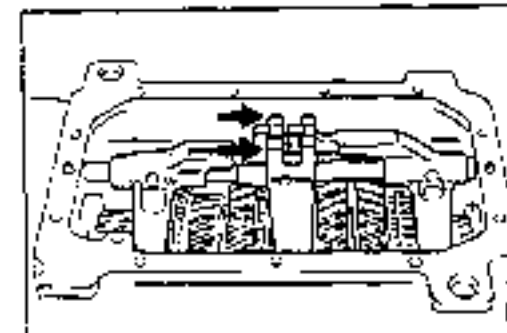
9T50J2-024



9T50J2-025



9T50J2-026



9T50J2-027

### Disassembly Note

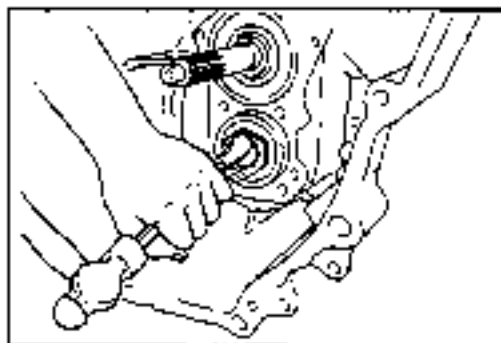
#### Center brake drum

1. Hold the center brake drum with the **SST**, and remove the locknut.

2. Remove the center brake drum with the **SST**.

#### Locknut (Front)

1. Shift the gears so that the transmission is locked



9T60J2-028

**Note**

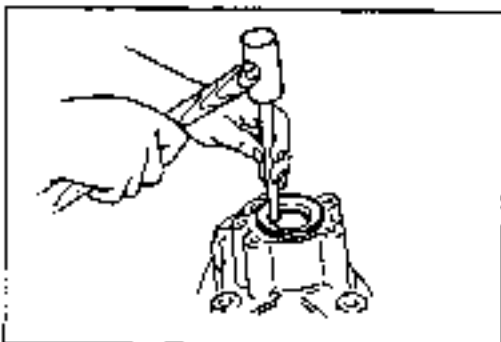
- Do not reuse the locknut.

2. Unclamp the locknut and remove it from the counter high gear.

**On-vehicle replacement****Oil seal (Rear)**

1. Remove the propeller shaft. (Refer to Section L.)
2. Remove the center brake drum. (Refer to page J2-19.)
3. Remove the center brake assembly, and suspend it with a rope.

9T60J2-029

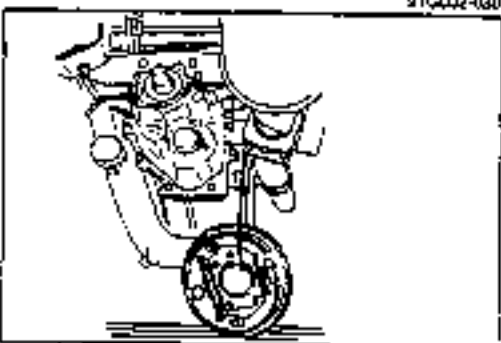


9T60J2-030

**Caution**

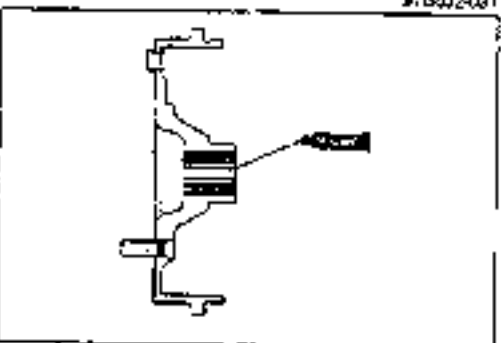
- Do not damage the mainshaft splines.

4. Remove the oil seal.
5. Apply transmission oil to outer edge and lip surface of the new oil seal.



9T60J2-031

6. Install the new oil seal with the SST.
7. Install the center brake assembly.

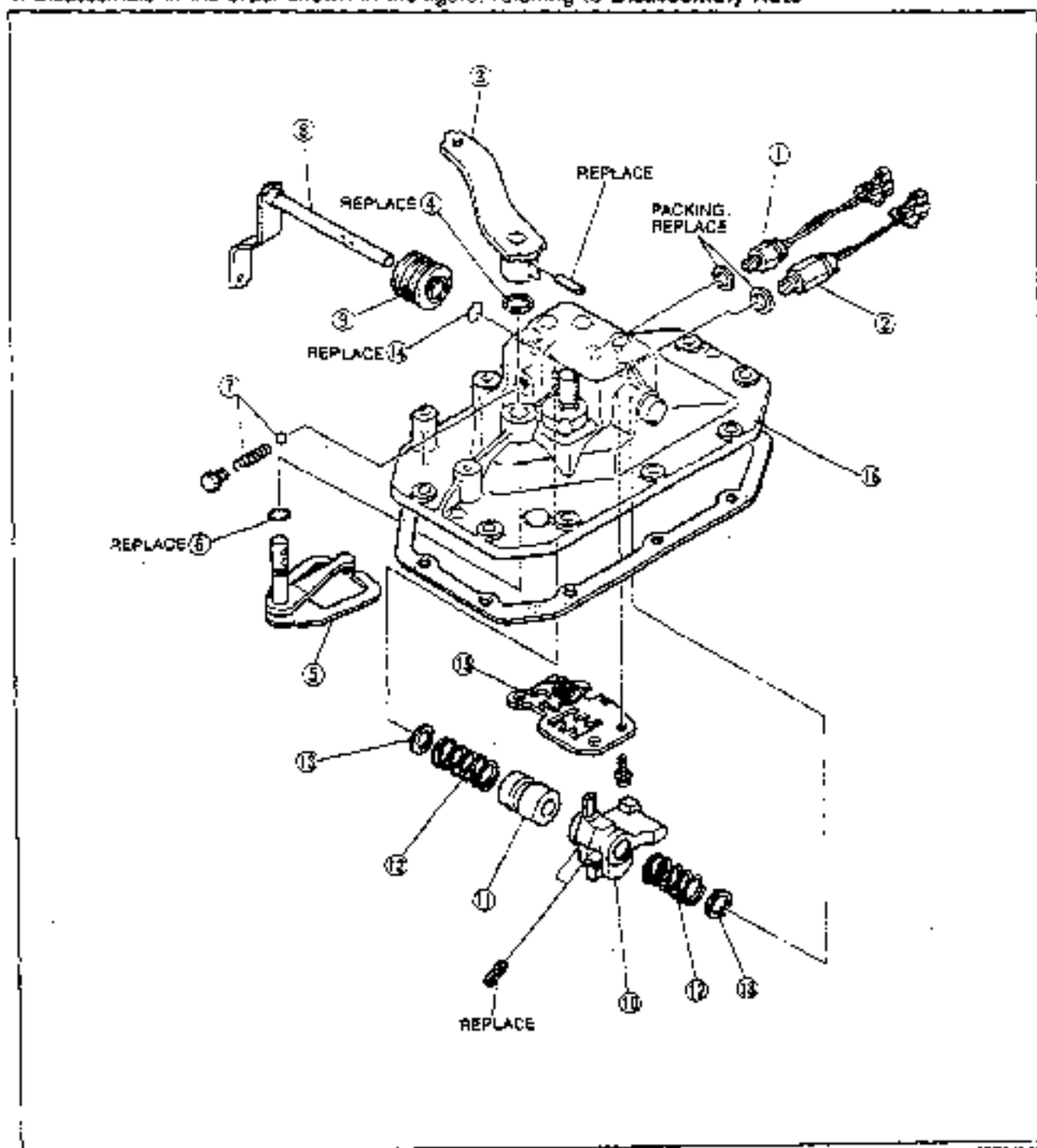


9T60J2-032

8. Apply sealant to the center brake drum splines, and install the drum.
9. Install the propeller shaft. (Refer to Section L.)

## Top Cover Components

1. Disassemble in the order shown in the figure, referring to **Disassembly Note**



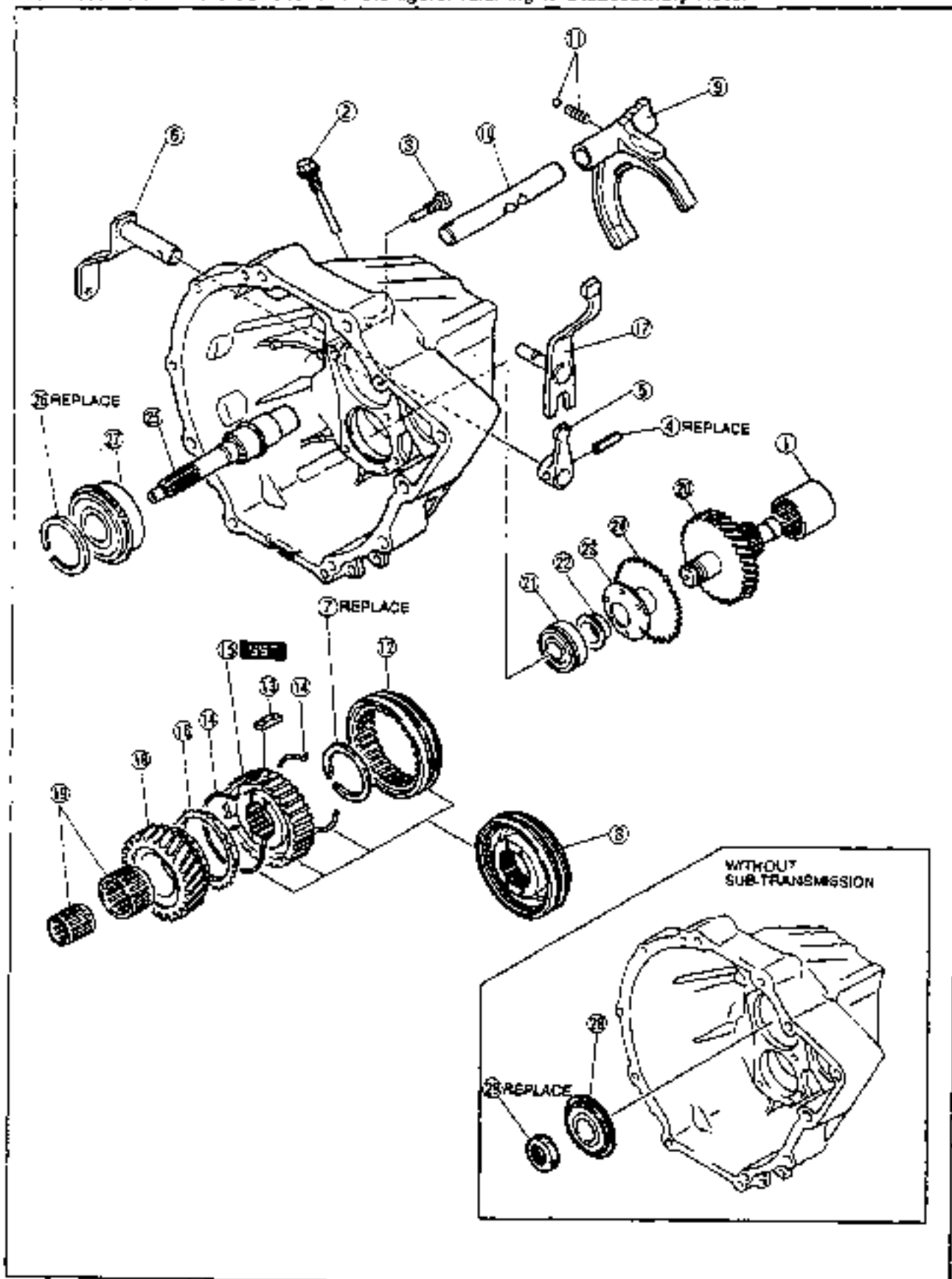
9T50J2-03

1. Back-up light switch
2. Neutral switch
3. Select lever
4. Snap ring
5. Selection arm;  
Inspection..... page J2-31
6. O-ring
7. Spring and steel ball
8. Control lever

9. Dust boot
10. Change lever  
Inspection..... page J2-30
11. Reverse lock stopper
12. Spring
13. Washer
14. Oil seal
15. Guide plate
16. Top cover

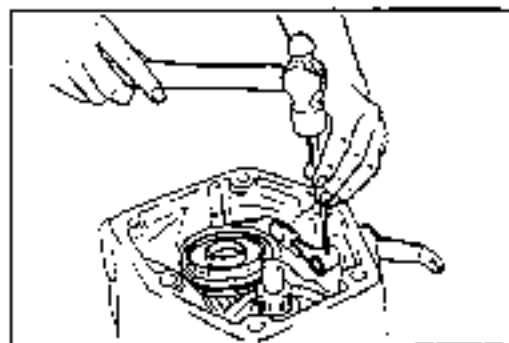
## Sub-transmission Components

1. Disassemble in the order shown in the figure, referring to **Disassembly Note**.



- |  |   |
|--|---|
| 1. Sleeve joint  | 17. Counter lever   |
| 2. Shift rod set bolt  | 18. High gear<br>Inspection..... page J2-30   |
| 3. Counter lever set bolt  | 19. Needle bearing<br>Inspection..... page J2-32  |
| 4. Roll pin  | 20. Counter high gear<br>Disassembly Note..... page J2-23<br>Inspection..... page J2-30 |
| 5. Inner shift lever<br>Disassembly Note..... page J2-23                                 | 21. Ball bearing<br>Inspection..... page J2-32  |
| 6. Outer shift lever   | 22. Spacer<br>Disassembly Note..... page J2-24  |
| 7. Snap ring   | 23. Diaphragm spring  |
| 8. Clutch hub assembly<br>Disassembly Note..... page J2-23<br>Inspection..... page J2-31 | 24. Friction gear   |
| 9. Shift fork<br>Inspection..... page J2-31  | 25. Input shaft<br>Disassembly Note..... page J2-24                                     |
| 10. Shift fork rod   | 26. Snap ring   |
| 11. Steel ball and spring  | 27. Ball bearing<br>Inspection..... page J2-32  |
| 12. Hub sleeve   | 28. Guide cover   |
| 13. Synchronizer key   | 29. Oil seal  |
| 14. Synchronizer key spring  |   |
| 15. Clutch hub   |   |
| 16. Synchronizer ring (High gear)<br>Inspection..... page J2-31                          |   |

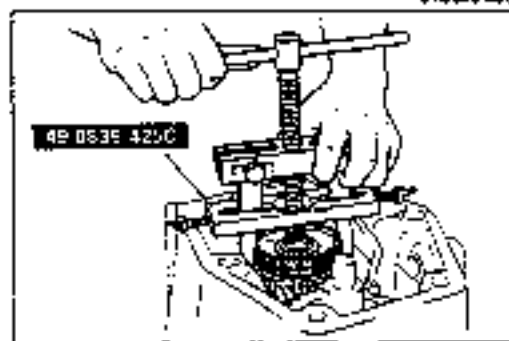
9T60J2-036



9T60J2-036

**Disassembly Note****Inner shift lever (Roll pin)**

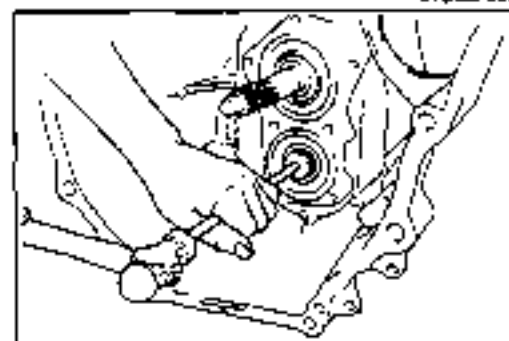
1. Remove the roll pin and remove the inner shift lever from the outer shift lever.



9T60J2-037

**Clutch hub assembly**

1. Use the SST to remove the clutch hub if it is tight.

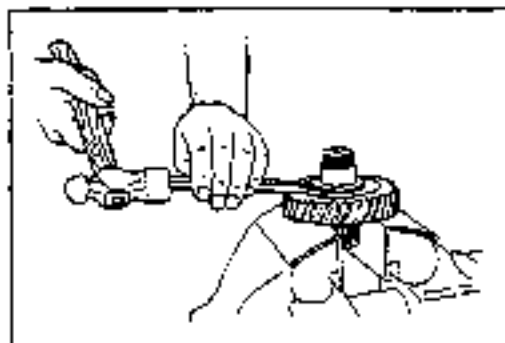


9T60J2-038

**Counter high gear**

1. Remove the counter high gear assembly by driving it out the front.

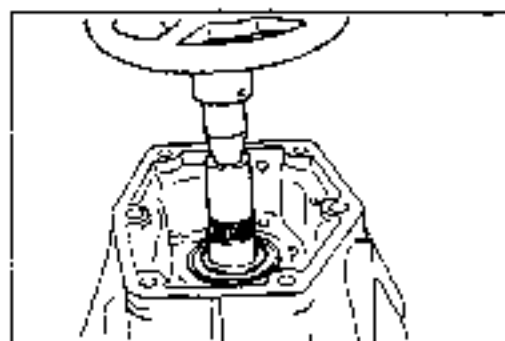
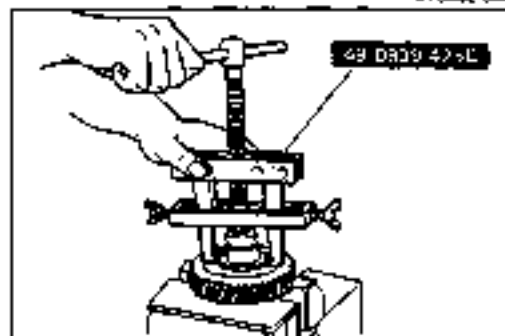




9T6GJ2-332

**Spacer**

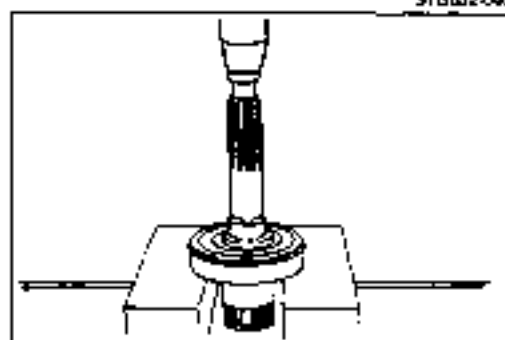
1. Remove the spacer from the counter high gear with the chisel and the SST.



9T6GJ2-060

**Input shaft**

1. Remove the input shaft assembly with a press.

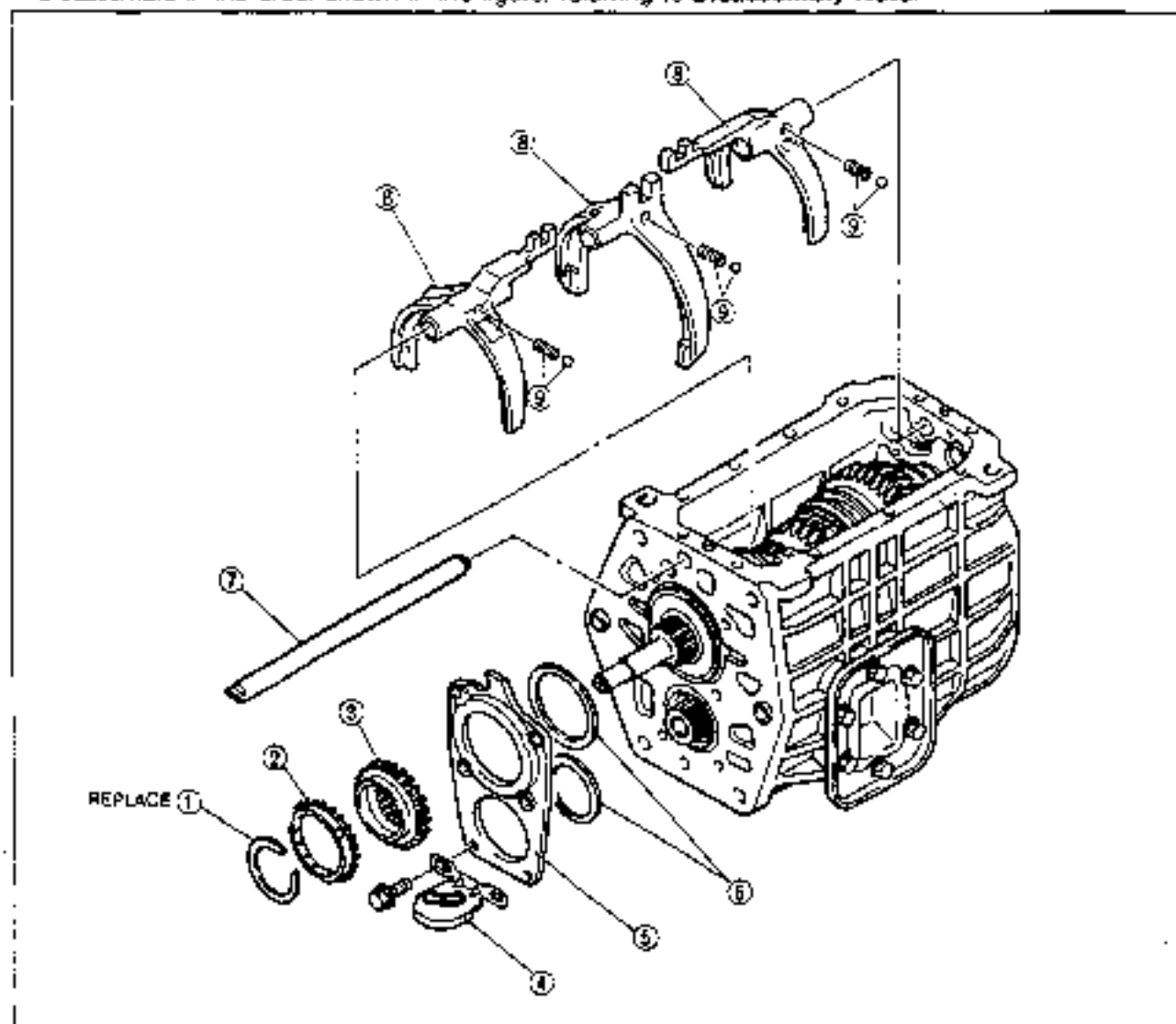


9T6GJ2-041

2. Remove the snap ring.
3. Remove the input shaft with a press.

## Shift Components

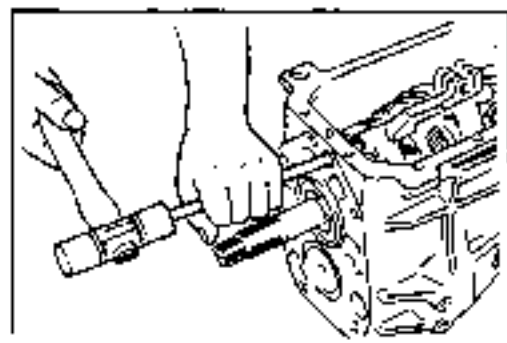
1. Disassemble in the order shown in the figure, referring to **Disassembly Note**.



9TGO.2 042

1. Snap ring  
 2. Synchronizer ring  
 (Input clutch)  
 Inspection..... page J2-31  
 3. Input clutch  
 4. Magnet  
 5. Bearing cover

6. Adjustment shim  
 7. Shift rod  
 Disassembly Note..... page J2-25  
 8. Shift fork  
 Inspection..... page J2-31  
 9. Steel ball and spring



9TGOJ2-043

### Disassembly Note

#### Shift rod

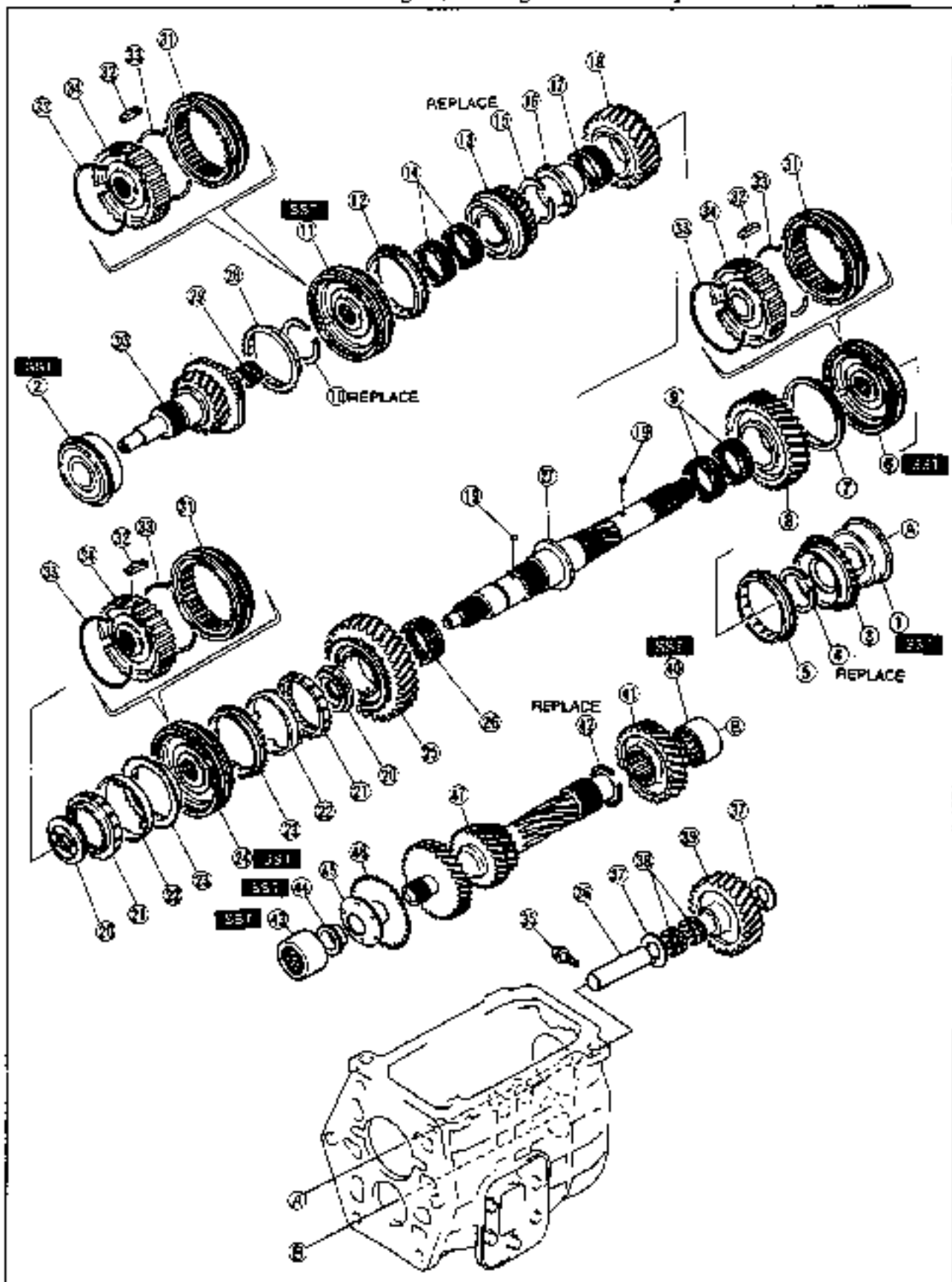
#### Note

- The steel detent balls will come out. Be careful not to lose them.

1. Remove the shift rod with the suitable bar and a plastic hammer.

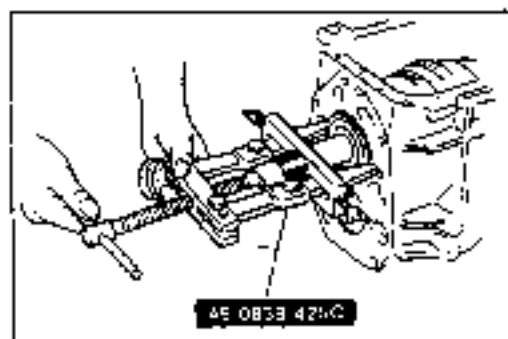
## Mainshaft Components

1. Disassemble in the order shown in the figure, referring to **Disassembly Note**.



- |   |   |  |
|---|---|--|
| 1. Mainshaft bearing<br>Disassembly Note<br>..... page J2-27<br>Inspection... page J2-32                      | 4. Needle bearing<br>Inspection..... page J2-32   | 32. Synchronizer key   |
| 2. Main drive gear bearing<br>Disassembly Note<br>..... page J2-27  | 15. Snap ring   | 33. Synchronizer key spring  |
| 3. 5th gear<br>Inspection... page J2-30   | 16. Gear sleeve   | 34. Clutch hub   |
| 4. Snap ring  | 17. Needle bearing<br>Inspection..... page J2-32  | 35. Bolt   |
| 5. Synchronizer ring (5th)<br>Inspection..... page J2-31  | 18. 2nd gear<br>Inspection..... page J2-30  | 36. Reverse idler gear shaft   |
| 6. Clutch hub assembly<br>(5th/reverse)<br>Disassembly Note<br>..... page J2-28<br>Inspection..... page J2-31 | 19. Steel ball  | 37. Thrust washer  |
| 7. Retaining ring   | 20. Inner cone hub  | 38. Needle bearing<br>Inspection..... page J2-32   |
| 8. Reverse gear<br>Inspection..... page J2-30   | 21. Inner cone  | 39. Reverse idler gear<br>Inspection..... page J2-30   |
| 9. Needle bearing<br>Inspection..... page J2-32   | 22. Double cone<br>Inspection..... page J2-32   | 40. Countershaft bearing (Rear)<br>Disassembly Note<br>..... page J2-29<br>Inspection..... page J2-32  |
| 10. Snap ring   | 23. Outer cone  | 41. Counter 5th gear<br>Inspection..... page J2-30   |
| 11. Clutch hub assembly (3rd/4th)<br>Disassembly Note<br>..... page J2-28<br>Inspection..... page J2-31       | 24. Clutch hub assembly (1st/2nd)<br>Disassembly Note<br>..... page J2-28<br>Inspection..... page J2-31 | 42. Snap ring  |
| 12. Synchronizer ring (3rd)<br>Inspection..... page J2-31   | 25. 1st gear<br>Inspection..... page J2-30  | 43. Countershaft bearing (Front)<br>Disassembly Note<br>..... page J2-29<br>Inspection..... page J2-32 |
| 13. 3rd gear<br>Inspection..... page J2-30  | 26. Needle bearing<br>Inspection..... page J2-32  | 44. Spacer<br>Disassembly Note<br>..... page J2-29   |
|   | 27. Mainshaft<br>Inspection..... page J2-30   | 45. Diaphragm spring   |
|   | 28. Synchronizer ring (4th)<br>Inspection..... page J2-31   | 46. Friction gear  |
|   | 29. Needle bearing<br>Inspection..... page J2-32  | 47. Countershaft gear<br>Inspection..... page J2-30  |
|   | 30. Main drive gear<br>Inspection..... page J2-30   |  |
|   | 31. Hub sleeve  |  |

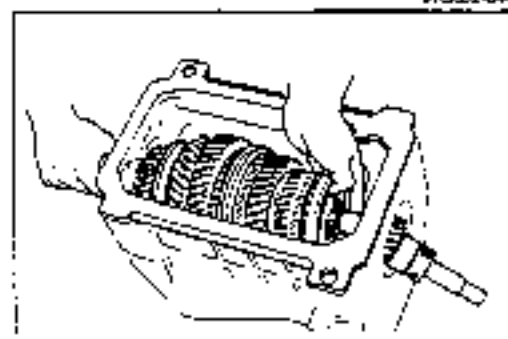
BTG0.2-045



BTG0.2-046

**Disassembly Note****Mainshaft bearing and main drive gear bearing**

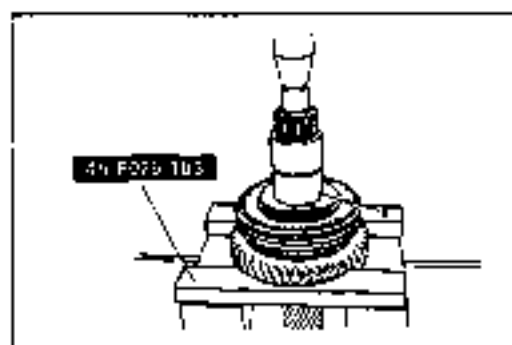
1. Turn the bearing snap rings so that the ends are 90° to the case grooves.
2. Remove the mainshaft bearing and main drive gear bearing with the SST.



BTG0.2-047

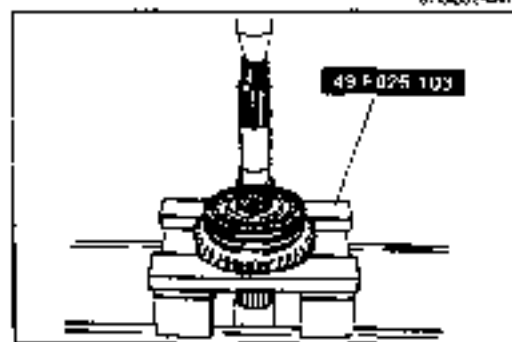
**Mainshaft assembly**

1. Remove the mainshaft assembly from the transmission case

**Clutch hub assembly (1st/2nd)****Caution**

- Hold the mainshaft with one hand so that it does not fall.

1. Press the mainshaft out of the clutch hub assembly (1st/2nd) and 2nd gear with the SST.

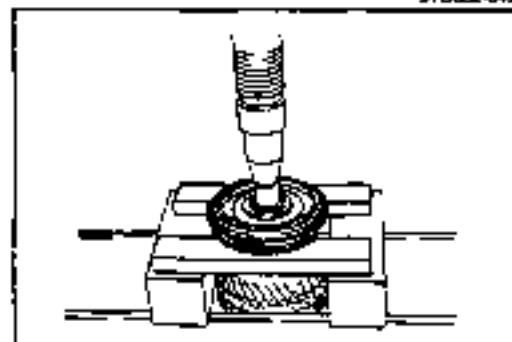
**Clutch hub assembly (5th/Reverse)**

1. Position the SST between 1st and reverse gears.

**Caution**

- Hold the mainshaft with one hand so that it does not fall.

2. Press the mainshaft out of the clutch hub assembly (5th/reverse) and reverse gear.

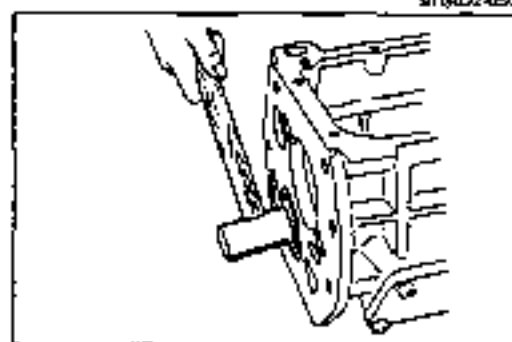
**Clutch hub assembly (3rd/4th)**

1. Position the SST between 2nd and 3rd gears.

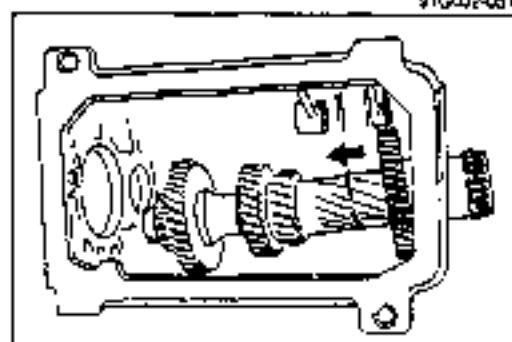
**Caution**

- Hold the mainshaft with one hand so that it does not fall.

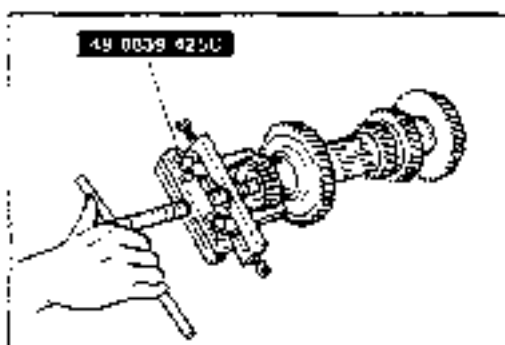
2. Press the mainshaft out of the clutch hub assembly (3rd/4th) and 3rd gear.

**Countershaft assembly**

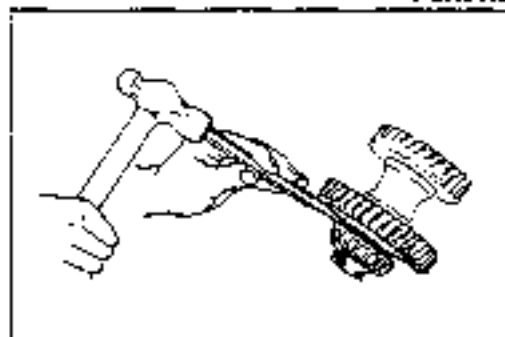
1. Remove the snap ring from the counter 5th gear and move the gear toward the front of the transmission.
2. Strike the countershaft at the front with a brass hammer to remove the bearing outer race from the rear.



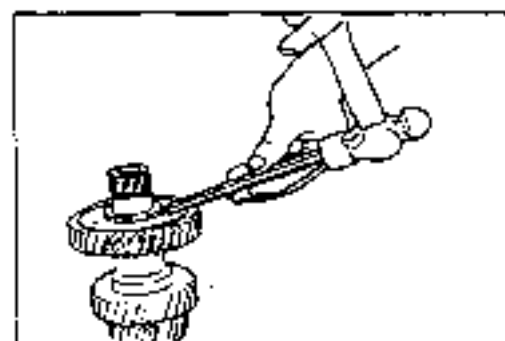
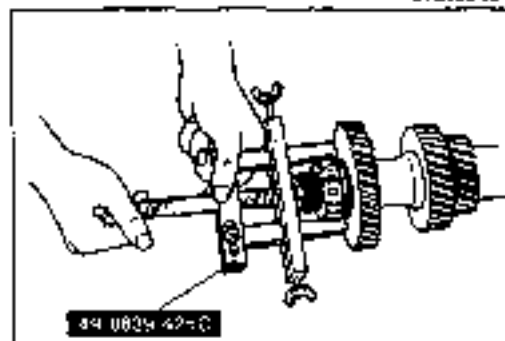
3. Remove the countershaft assembly from the transmission case.



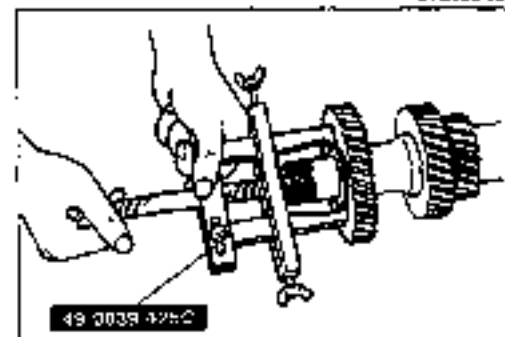
9T5DJB052



9T5DJB054



9T5DJB055

**Countershaft bearing**

1. Remove the rear bearing inner race with the **SST**.

2. Move the front bearing away from the spacer with a chisel.

3. Remove the front bearing with the **SST**.

**Spacer**

1. Move the spacer away from the diaphragm spring with a chisel.

**Note**

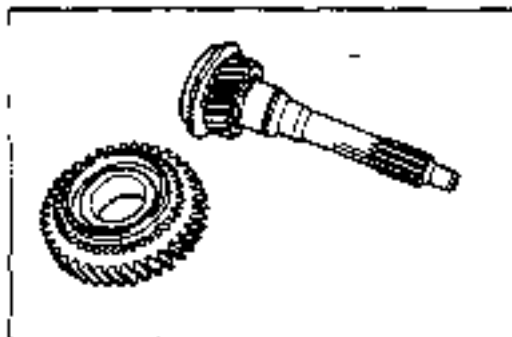
- Do not reuse the diaphragm spring.

2. Remove the spacer with the **SST**.

**INSPECTION**

Inspect all parts, and repair or replace as necessary.

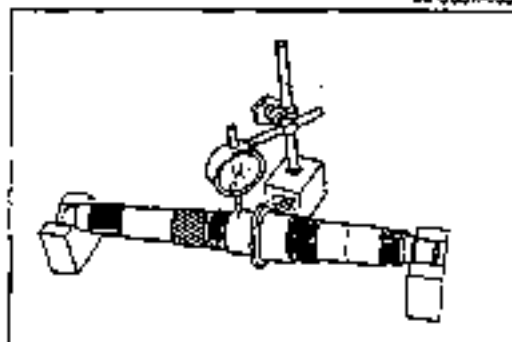
9TGU2-056



9TU037-055

**Each gear and main drive gear**

1. Inspect the synchronizer cones for wear.
2. Inspect the gear teeth for damage, wear, and cracks.
3. Inspect the synchronizer ring matching teeth for damage or wear.
4. Inspect the main drive gear splines for damage and wear.



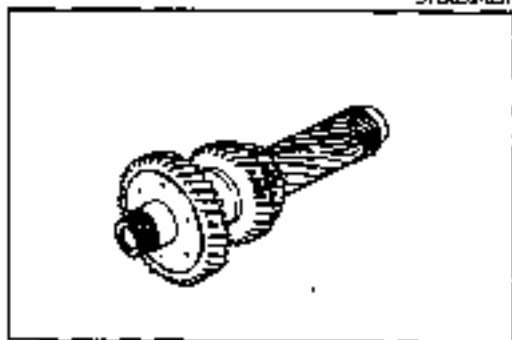
9TGD2-057

**Mainshaft**

1. Measure the mainshaft runout.

Runout: 0.035mm (0.0014 in) max.

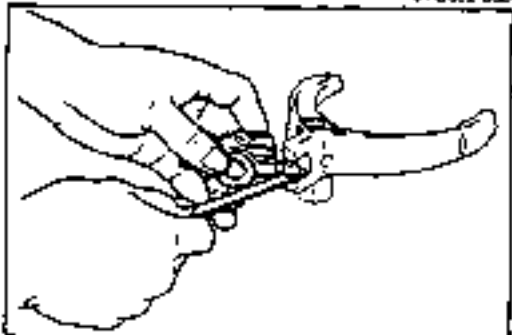
2. Inspect the splines for damage and wear.



9TGU2-058

**Countershaft**

1. Inspect gear teeth for damage, wear and cracks.
2. Inspect the splines for damage and wear.



9TGU2-059

**Shift fork and change lever**

1. Measure the clearance between the shift fork and the change lever.

Clearance: 0.8mm (0.032 in) max.

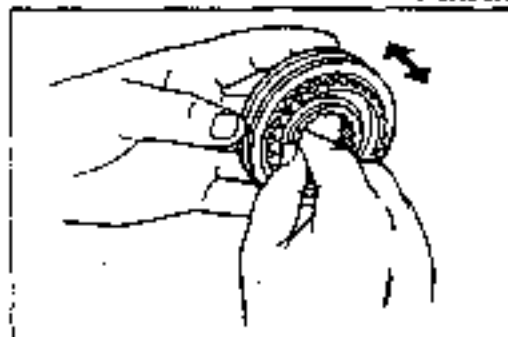


9T60J2-08C

**Selection arm and change lever**

1. Measure the clearance between the selection arm and the change lever.

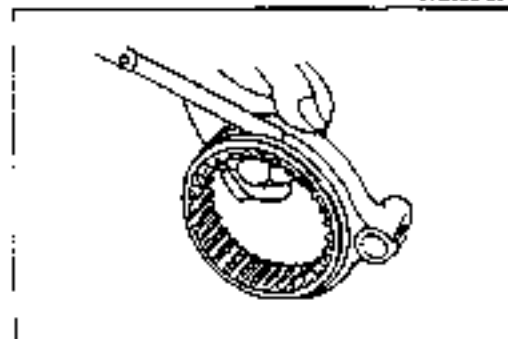
**Clearance: 0.8mm (0.032 in) max.**



9T60J2-36'

**Clutch hub assembly**

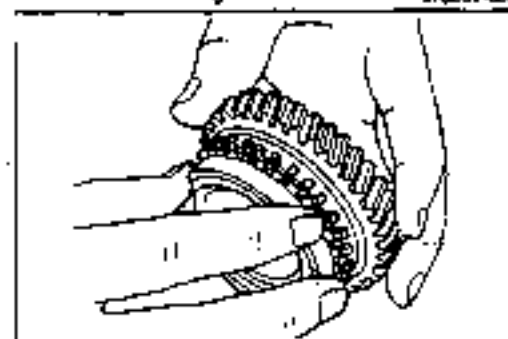
1. Inspect the clutch hub sleeve and hub operation.
2. Inspect the gear teeth for damage, wear and cracks.
3. Inspect the synchronizer keys for damage, wear and cracks.



9T60J2-062

4. Measure the clearance between the hub sleeve and the release fork

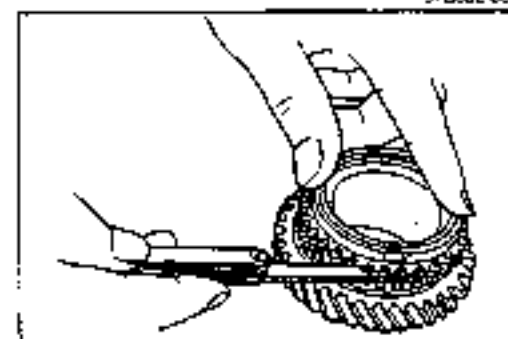
**Clearance: 0.8mm (0.031) max.**



9T60J2-063

**Synchronizer ring**

1. Inspect individual synchronizer ring teeth for damage, wear and cracks.
2. Inspect the taper surface for wear and cracks.



9T60J2-064

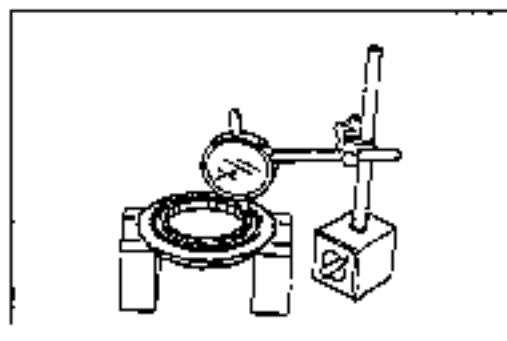
**Note**

- Set the synchronizer ring squarely in the gear; then measure around the circumference.

3. Measure the clearance between the synchronizer ring and the flank surface of the gear.

**Clearance: 1.0mm (0.039 in) min.**



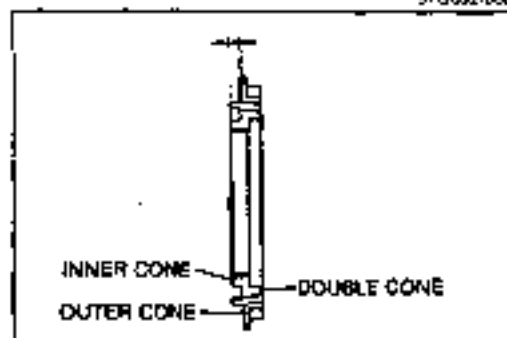


9TGCJ2-066

**Double cone****Note**

- If not as specified, replace the assembly.

1. Inspect the teeth for damage, wear and cracks.
2. Inspect the taper surface for wear and cracks.



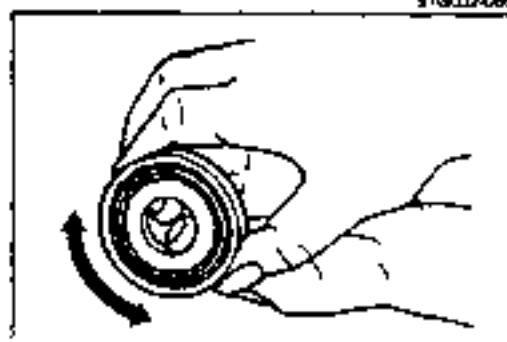
9TGCJ2-066

**Note**

- Measure around the circumference.

3. Measure the height between the inner cone and the outer cone as shown in the figure.

**Height: 2.8mm (0.110 in) min.**



9TGCJ2-067

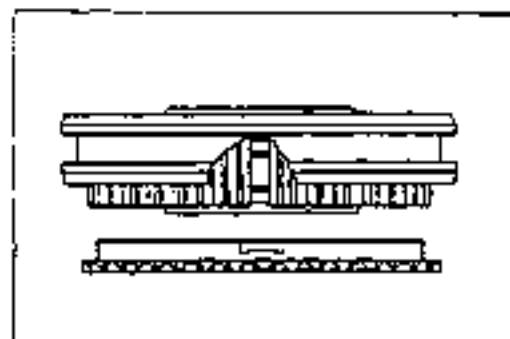
**Bearing**

1. Inspect for damage or rough rotation.

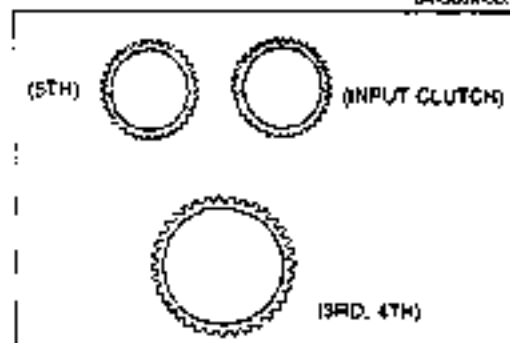
**ASSEMBLY****Precaution**

1. All O-rings and gasket must be replaced with the new ones supplied in the overhaul kit.
2. Assemble the parts within 10 minutes after applying sealant. Allow all sealant to cure at least 30 minutes after assembly before filling the transmission with transmission oil.

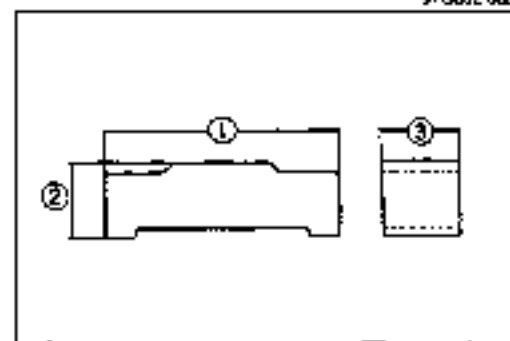
99LJGJX-066



84WJGJX-067



97GJGJZ-068



87GJGJZ-069

**Clutch hub****Caution**

- Align the synchronizer ring grooves with the clutch hub keys during installation.

**Note**

- The synchronizer rings have the same basic shape. Carefully note these distinguishing features.
  - a) Sub-transmission synchronizer rings are the smallest.
  - b) 5th synchronizer ring is next larger.
  - c) 3rd and 4th are the biggest and are exactly the same.

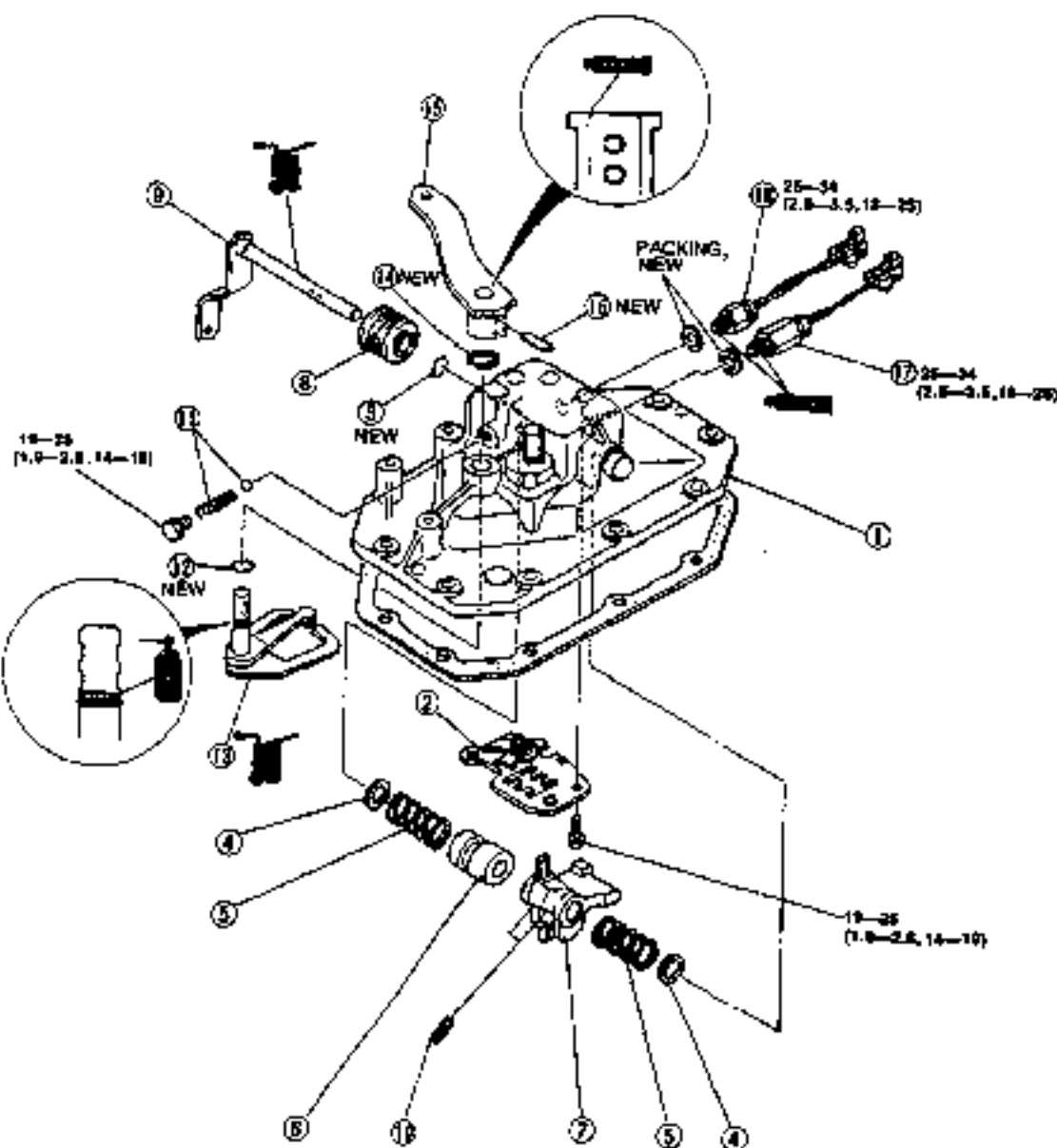
- There are two types of synchronizer keys. Standard dimensions are as follows:

mm (in)

	①	②	③
1st, 2nd, 3rd, 4th, 5th and Reverse	18 (0.709)	5.45 (0.215)	6 (0.236)
Sub-transmission	17 (0.670)	4.25 (0.167)	5 (0.197)

### Top Cover Components

1. Assemble in the order shown in the figure, referring to **Assembly Note**.



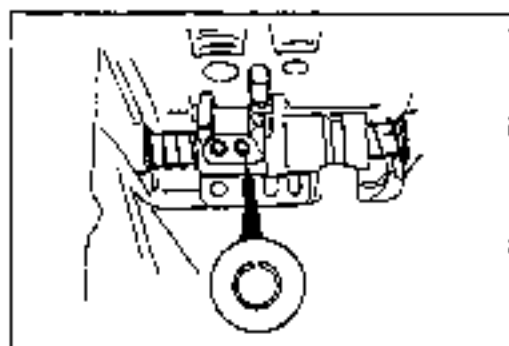
Rev (20-kg, 4-86)

970A2-070

- 1. Top cover
- 2. Guide plate
- 3. Oil seal
- 4. Washer
- 5. Spring
- 6. Reverse lock stopper
- 7. Change lever
- 8. Dust boot

- 9. Control lever
- 10. Roll pin (Change lever)  
Assembly Note  
..... page J2-35
- 11. Steel ball and spring
- 12. O-ring
- 13. Selection arm
- 14. Snap ring

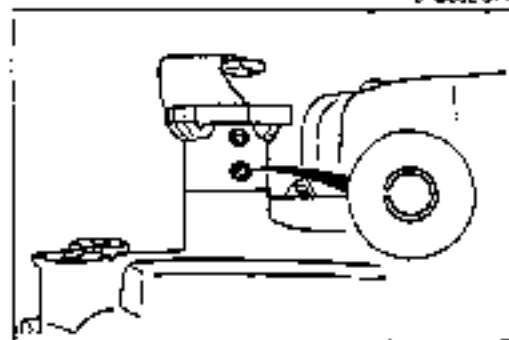
- 15. Select lever
- 16. Roll pin (Select lever)  
Assembly Note  
..... page J2-35
- 17. Neutral switch
- 18. Backup light switch



FTG0J2-071

**Assembly Note****Roll pin (Change lever)**

1. Install the roll pins as shown in the figure.



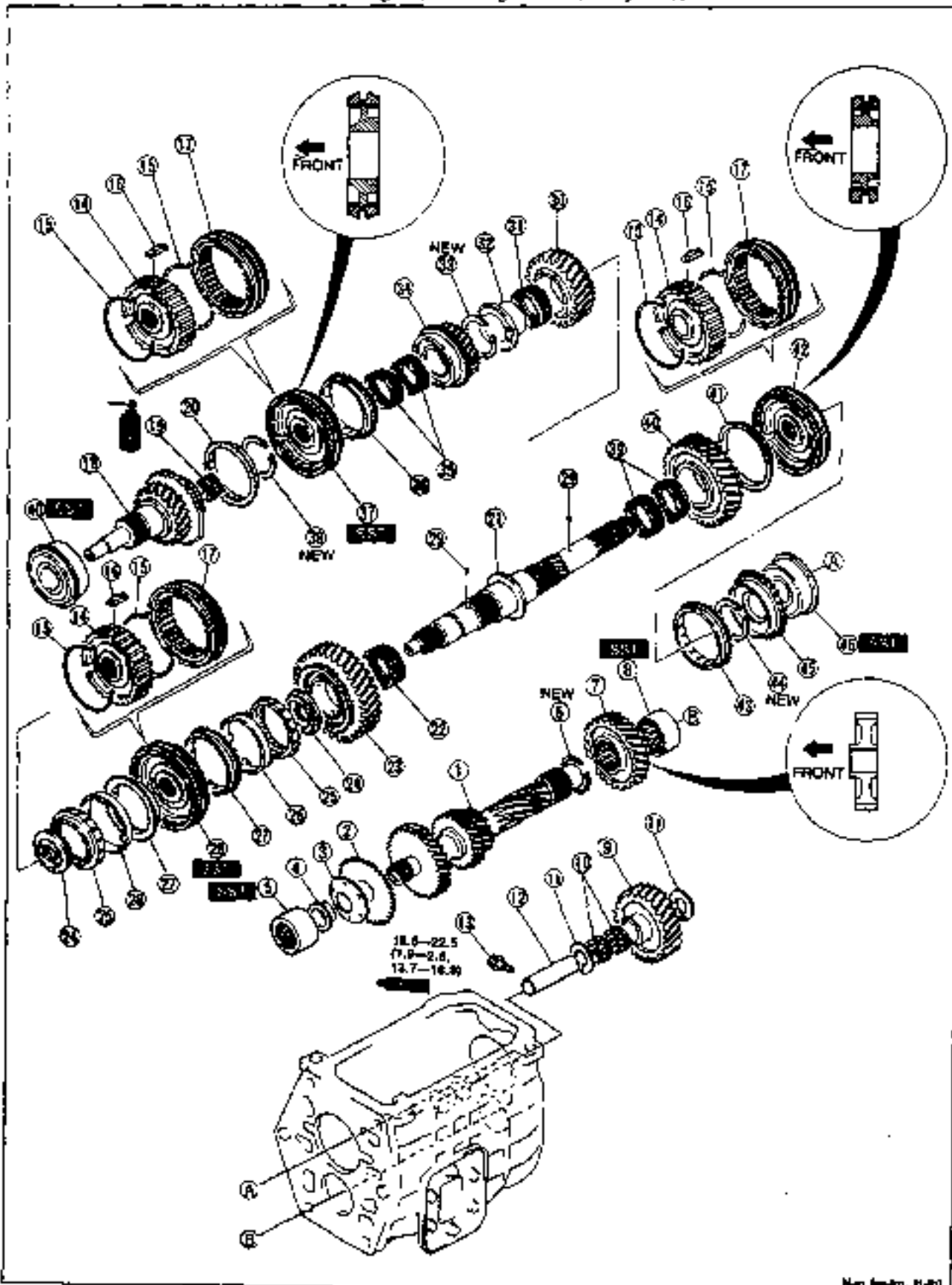
FTG0J2-072

**Roll pin (Select lever)**

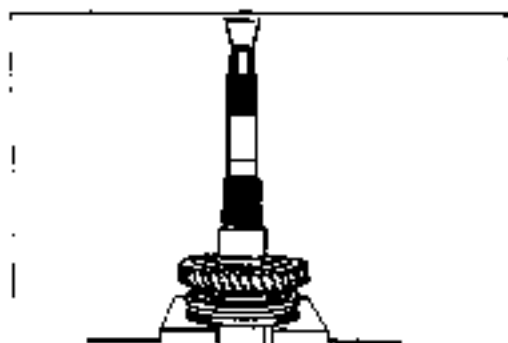
1. Install the roll pins as shown in the figure.

## Mainshaft Components

1. Assemble in the order shown in the figure, referring to **Assembly Note**



- |                                 |                                   |                                   |
|---------------------------------|-----------------------------------|-----------------------------------|
| 1. Countershaft gear            | 17. Hub sleeve                    | 34. 3rd gear                      |
| 2. Friction gear                | 18. Main drive gear               | 35. Needle bearing                |
| 3. Diaphragm spring             | 19. Needle bearing                | 36. Synchronizer ring (3rd)       |
| 4. Spacer                       | 20. Synchronizer ring (4th)       | 37. Clutch hub assembly (3rd/4th) |
| Assembly Note                   | 21. Mainshaft                     | Assembly Note                     |
| ..... page J2-36                | 22. Needle bearing                | ..... page J2-37                  |
| 5. Countershaft bearing (Front) | 23. 1st gear                      | 38. Snap ring                     |
| Assembly Note                   | 24. Inner cone hub                | 39. Needle bearing                |
| ..... page J2-36                | 25. Inner cone                    | 40. Reverse gear                  |
| 6. Snap ring                    | 26. Double cone                   | 41. Retaining ring                |
| 7. Counter 5th gear             | 27. Outer cone                    | 42. Clutch hub assembly           |
| 8. Countershaft bearing (Rear)  | 28. Clutch hub assembly (1st/2nd) | 43. Synchronizer ring (5th)       |
| Assembly Note                   | Assembly Note                     | 44. Snap ring                     |
| ..... page J2-38                | ..... page J2-37                  | 45. 5th gear                      |
| 9. Reverse idler gear           | 29. Steel ball                    | 46. Mainshaft bearing             |
| 10. Needle bearing              | 30. 2nd gear                      | Assembly Note                     |
| 11. Thrust washer               | Assembly Note                     | ..... page J2-38                  |
| 12. Reverse idle gear shaft     | ..... page J2-37                  | 47. Main drive gear bearing       |
| 13. Bolt                        | 31. Needle bearing                | Assembly Note                     |
| 14. Clutch hub                  | 32. Gear sleeve                   | ..... page J2-39                  |
| 15. Synchronizer key spring     | 33. Snap ring                     | 97G0J2-074                        |
| 16. Synchronizer key            |                                   |                                   |

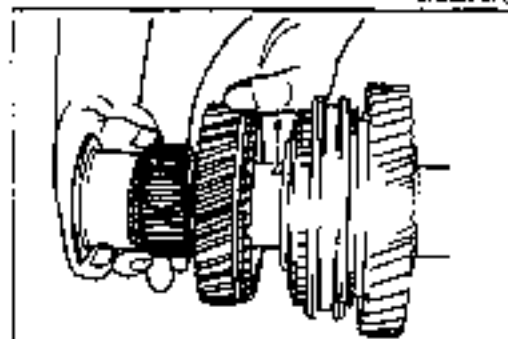


97B0J2-075

**Assembly note**

**Clutch hub assembly (1st/2nd)**

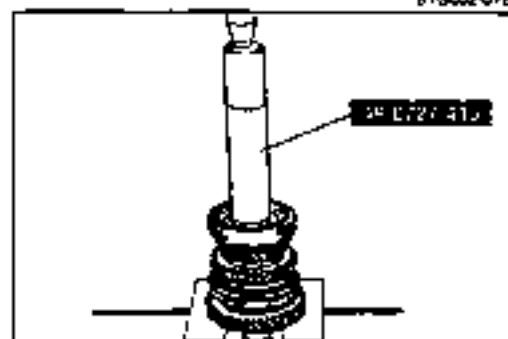
1. Set the 1st gear and the 1st/2nd clutch hub assembly on the press, then press in the mainshaft.



87G0J2-076

**2nd gear**

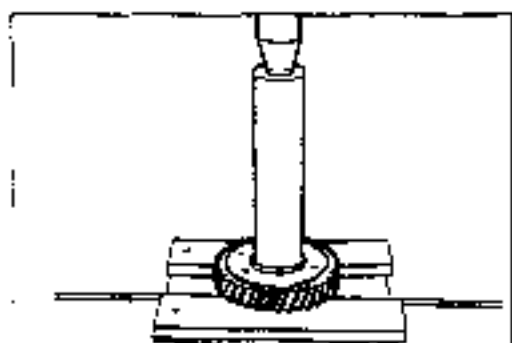
1. Install the steel ball, and then install the gear sleeve, needle bearing, and 2nd gear.



97G0J2-077

**Clutch hub assembly (3rd/4th)**

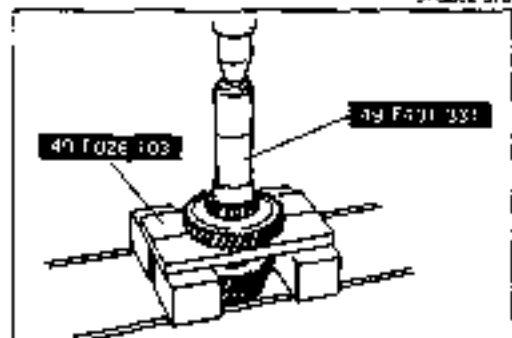
1. Set the 3rd gear and 3rd/4th clutch hub assembly on the mainshaft, then press on the 3rd/4th clutch hub assembly on with the SST.



9TGAJ2-078

**Spacer**

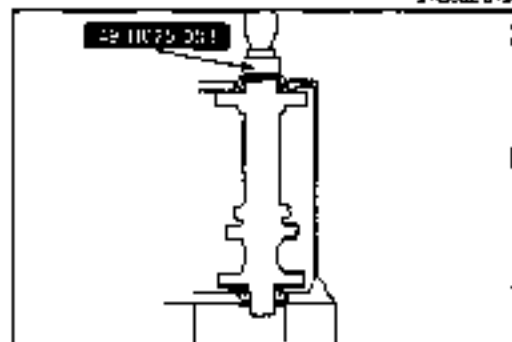
1. Install the new spacer with a suitable pipe.



9TGAJ2-079

**Countershaft bearing (Front)**

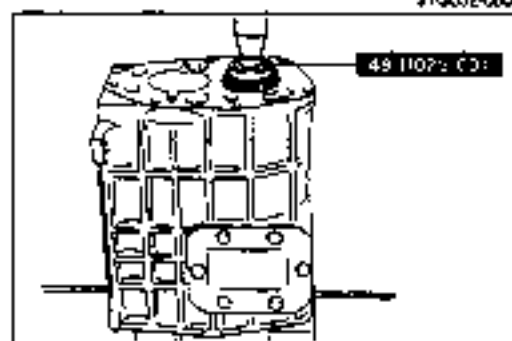
1. Install the countershaft bearing with the **SST**.



9TGAJ2-080

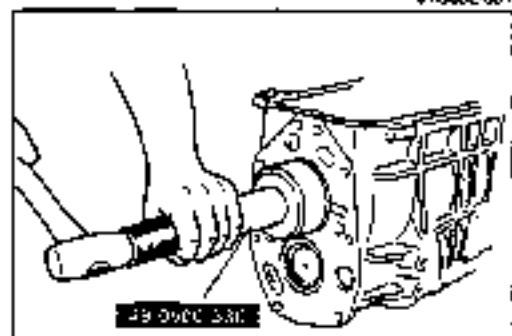
**Countershaft bearing (Rear)**

1. Install the new snap ring and counter 5th gear.
2. Set the countershaft gear in the transmission case.
3. Set the counter 5th gear into position and fit the snap ring.



9TGAJ2-081

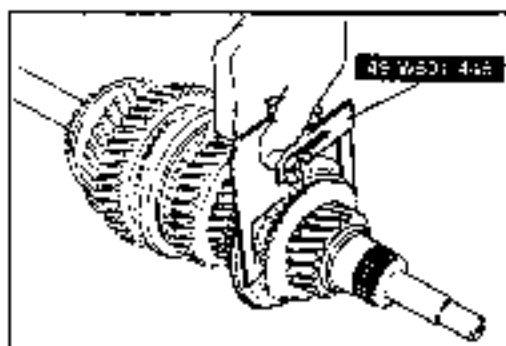
3. Install the countershaft bearing with the **SST**.



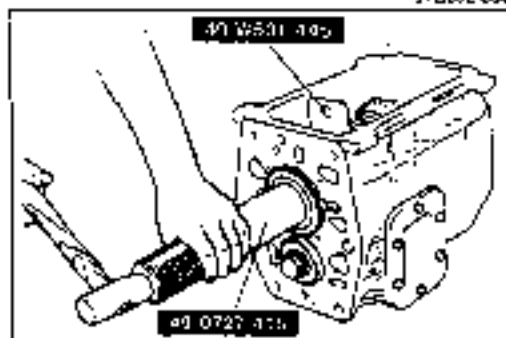
9TGAJ2-082

**Mainshaft bearing**

1. Install the mainshaft bearing with the **SST**.



9TQ0J2-063



9TQ0J2-064

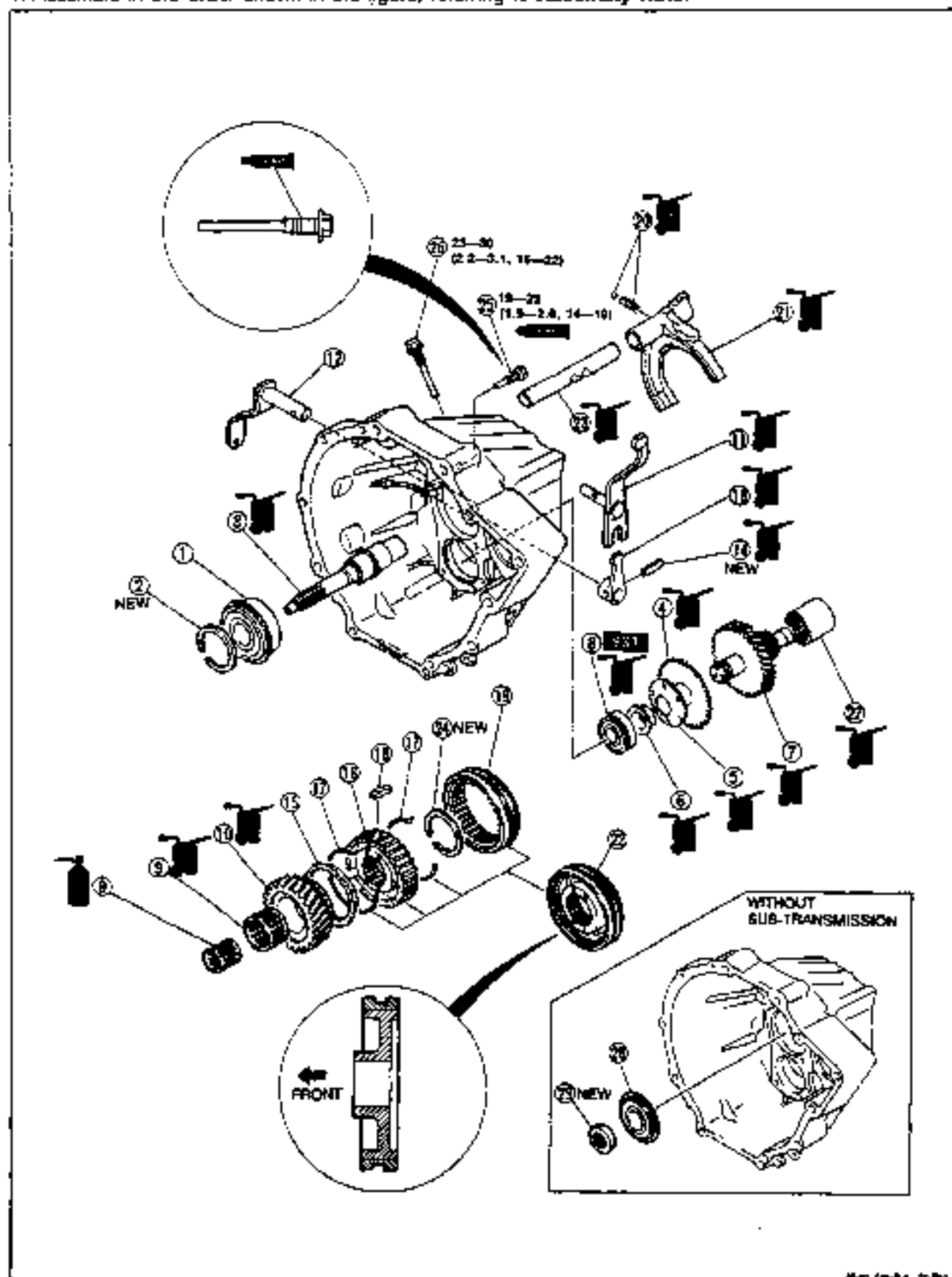
**Main drive gear bearing**

1. Set the **SST** between the 4th synchronizer ring and the synchronesh gear on the main drive gear.
2. Install the main drive gear bearing with the **SST**.



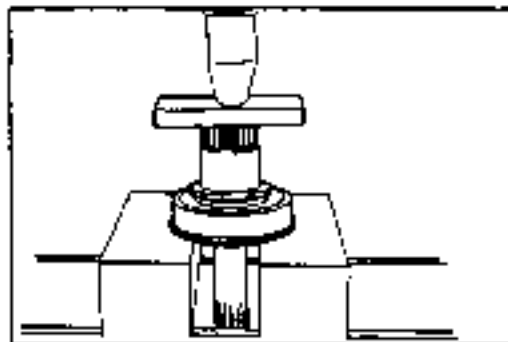
## Sub-Transmission Components

1. Assemble in the order shown in the figure, referring to **Assembly Note**.



- |  |   |
|--|---|
| 1. Input shaft bearing<br>Assembly Note ..... page J2-41         | 15. Synchronizer ring                                     |
| 2. Snap ring   | 16. Clutch hub  |
| 3. Input shaft<br>Assembly Note ..... page J2-41                 | 17. Synchronizer key spring                               |
| 4. Friction gear   | 18. Synchronizer key                                      |
| 5. Diaphragm spring  | 19. Hub   |
| 6. Spacer<br>Assembly Note ..... page J2-41                      | 20. Steel ball and spring                                 |
| 7. Counter high gear   | 21. Shift fork  |
| 8. Bearing (Counter high gear)<br>Assembly Note ..... page J2-42 | 22. Clutch hub assembly<br>Assembly Note ..... page J2-42 |
| 9. Needle bearing  | 23. Shift rod   |
| 10. High gear  | 24. Snap ring   |
| 11. Counter lever  | 25. Counter lever set bolt                                |
| 12. Outer shift lever  | 26. Shift rod set bolt                                    |
| 13. Inner shift lever  | 27. Sleeve joint  |
| 14. Roll pin<br>Assembly Note ..... page J2-42                   | 28. Guide cover   |
|  | 29. Oil seal  |

9TGOJ2-087

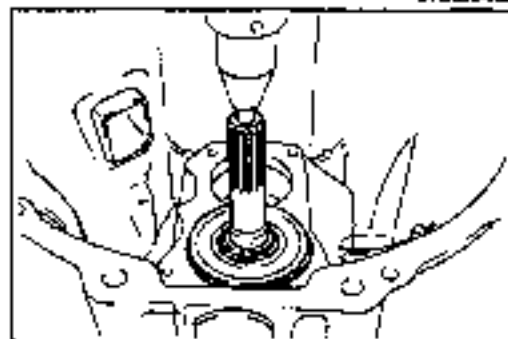


9TGOJ2-088

**Assembly Note**

**Input shaft bearing**

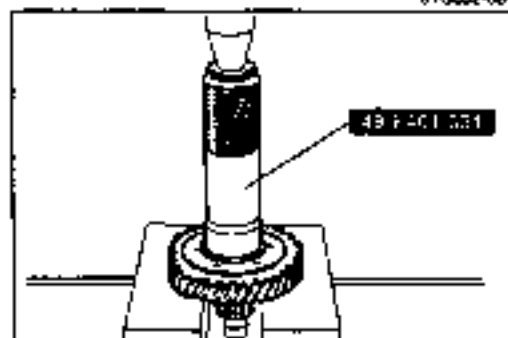
1. Press the ball bearing onto the input shaft with a press.
2. Install the snap ring.



9TGOJ2-089

**Input shaft**

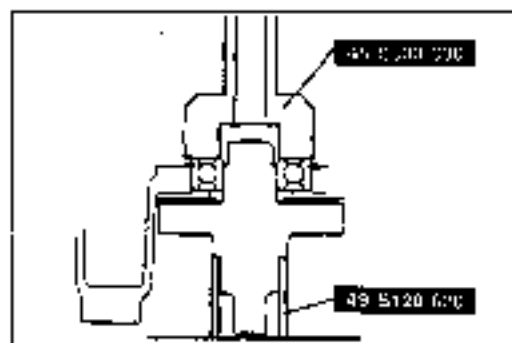
1. Press the input shaft into the clutch housing with a press.



9TGOJ2-090

**Spacer**

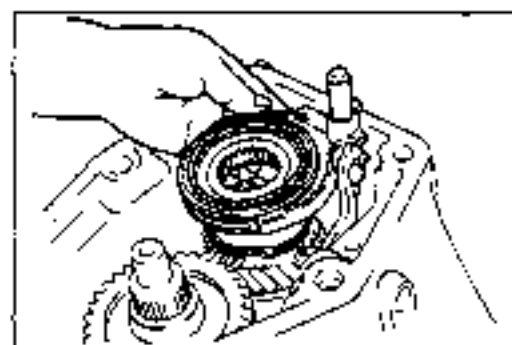
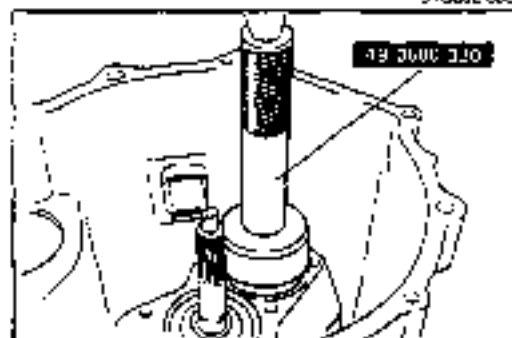
1. Press the friction gear, diaphragm spring and spacer onto the counter high gear with the SST and a press.



9TGDJ2-080

**Bearing (Counter high gear)**

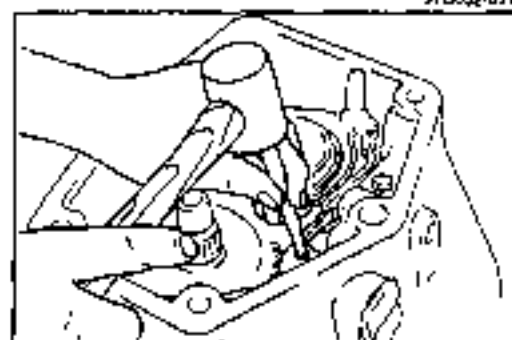
1. Slide the counter high gear assembly into position from the rear side of the clutch housing.
2. Press the bearing onto the counter high gear with the SST and a press.



9TGDJ2-091

**Clutch hub assembly**

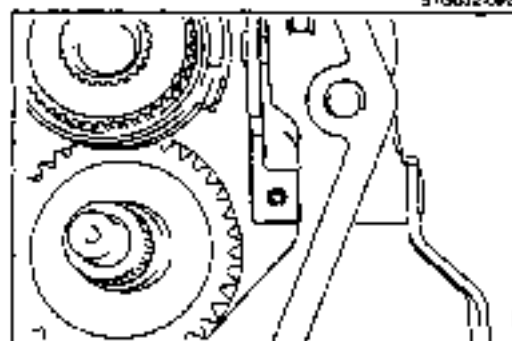
1. With the shift fork on the hub sleeve, install it to the high gear.



9TGDJ2-092

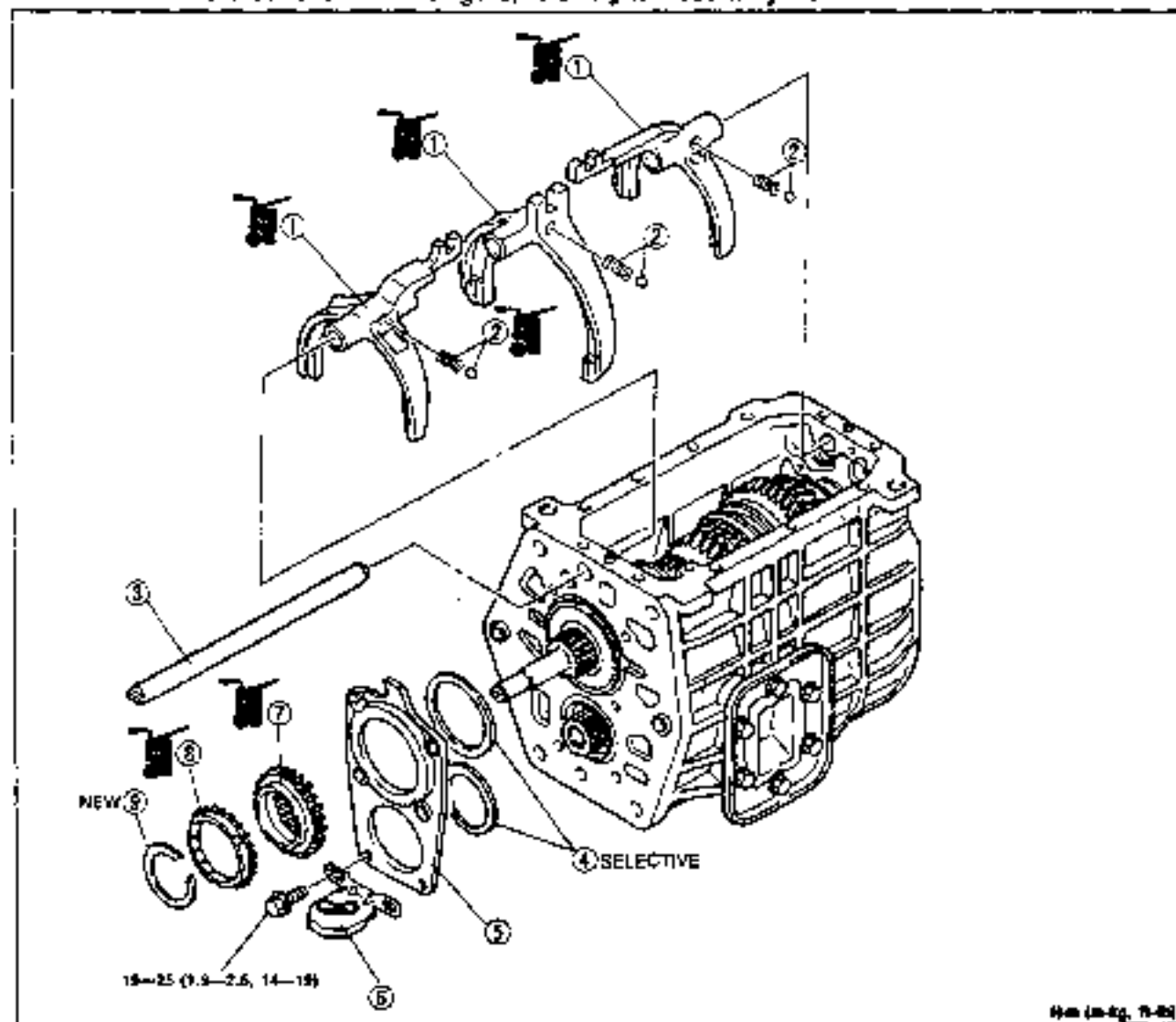
**Roll pin**

1. Install the roll pin as shown in the figure.



## Shift Components

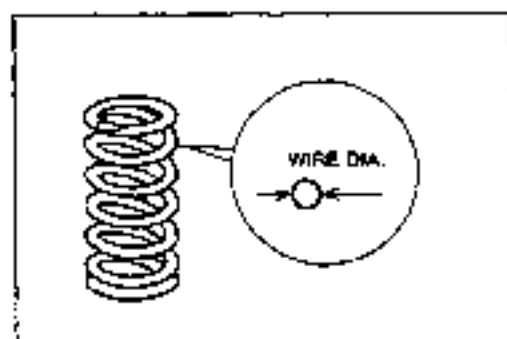
1. Assemble in the order shown in the figure, referring to **Assembly Note**



49m (10-4g, 75-82)

9TGDJ2-083

- |                                |                      |
|--------------------------------|----------------------|
| 1. Shift fork                  | 5. Bearing cover     |
| 2. Steel ball and spring       | 6. Magnet            |
| Assembly Note..... page J2-43  | 7. Input clutch      |
| 3. Shift fork rod              | 8. Synchronizer ring |
| Assembly Note ..... page J2-44 | (input clutch)       |
| 4. Adjustment shim             | 9. Snap ring         |
| Assembly Note ..... page J2-44 |                      |



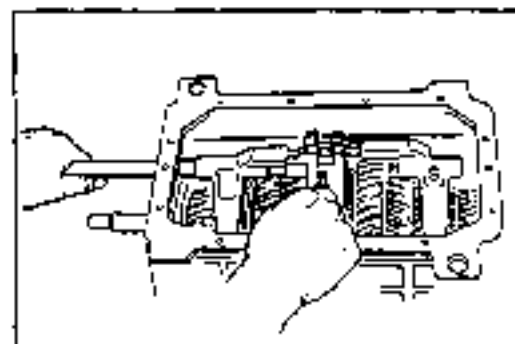
9TGDJ2-084

### Assembly Note Spring

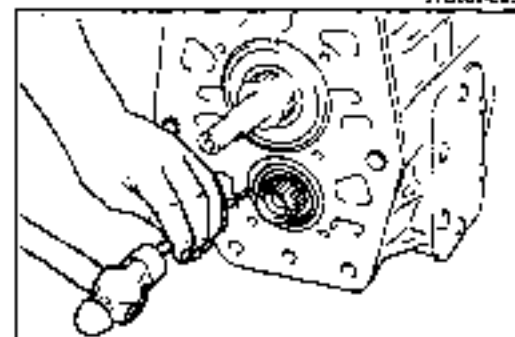
#### Note

- There are two types of springs; be sure to install them correctly.

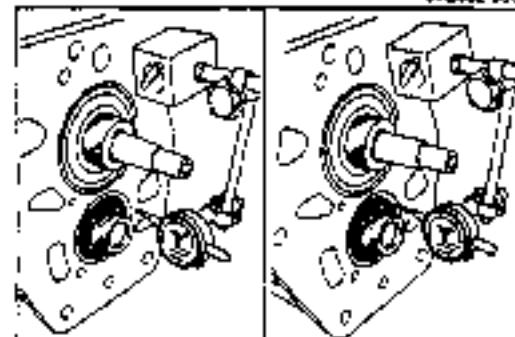
Wire dia.	Shift fork
φ1.4mm (0.055 in)	3RD, 4TH and 5TH, Rev
φ1.8mm (0.070 in)	1ST, 2ND



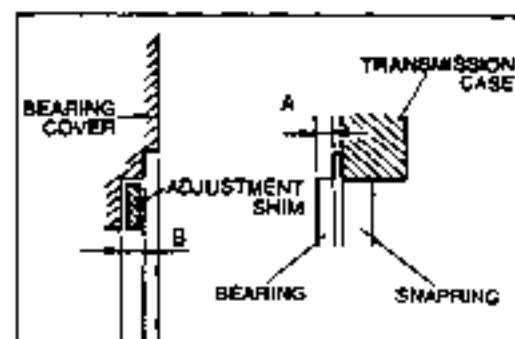
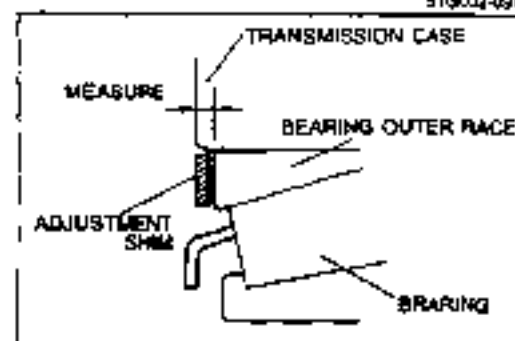
5T6J2-095



9T0CJ2-096



5T6J2-097



5T3D2-098

**Shift rod**

1. Slide the shift rod into the shift fork while pressing the ball downward as shown in the figure.

**Note**

- The steel detent balls will come out easily, be careful not to lose them.

**Adjustment shim (Countershaft)**

1. Temporarily tighten the rear cover and tap in the bearing outer race with a copper hammer.

2. Measure the clearance between the bearing outer race and the transmission case. If not within specification, adjust the clearance by installing the proper adjustment shim(s).

**Standard clearance:**

0.005mm—0.065mm (0.0002 in—0.002 in)

**Adjusting shim thickness:**

mm (in)

0.1 (0.004)	0.15 (0.006)
0.3 (0.012)	1.0 (0.039)

**Adjustment shim (Mainshaft)**

1. After measuring dimensions A and B shown in the figure, use an adjustment shim(s), as specified below, of the thickness corresponding to the value of A minus B, so that bearing end play will be within specification.

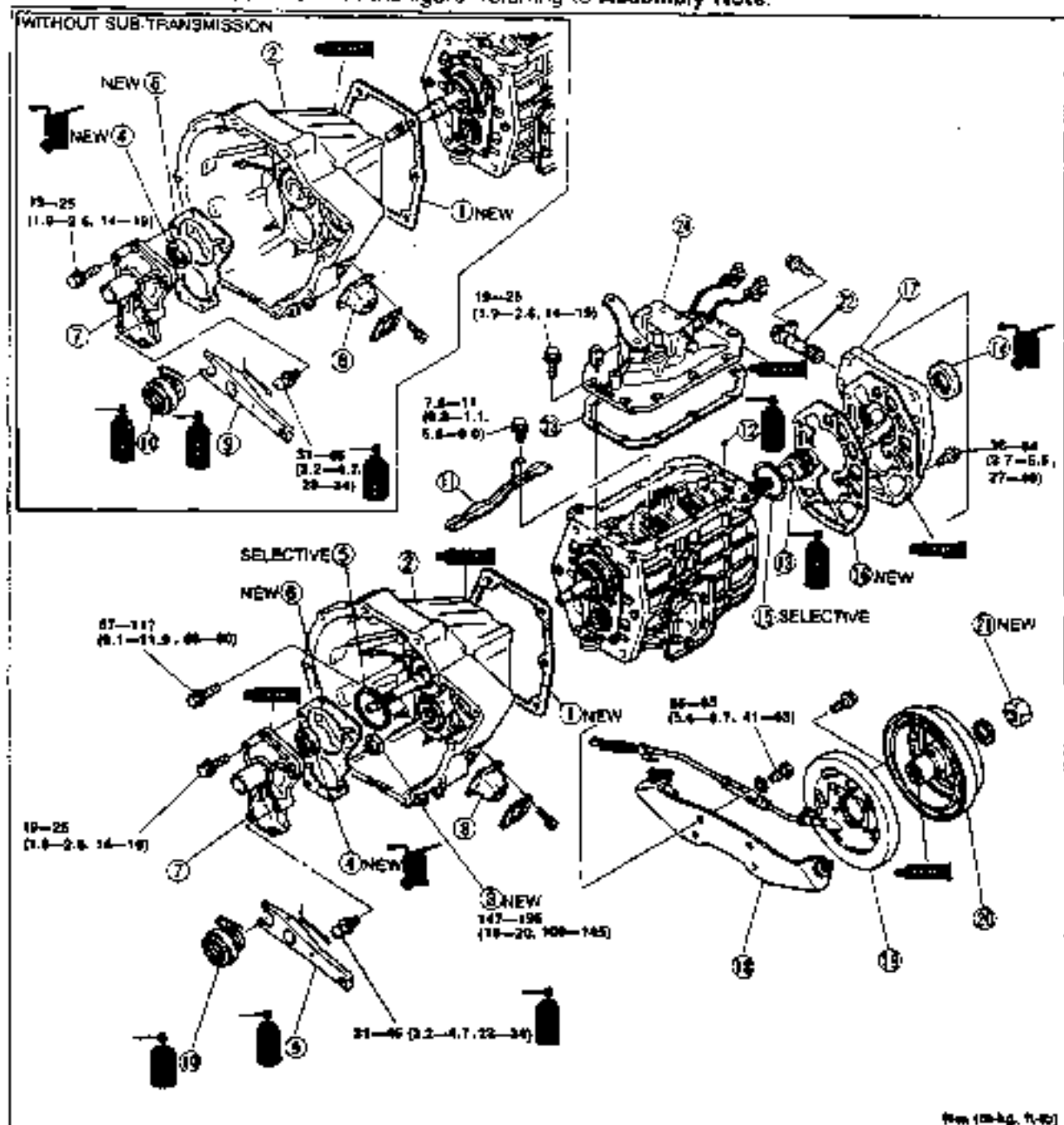
**Bearing end play: 0—0.1mm (0—0.004 in)****Adjustment shim thickness:**

mm (in)

0.1 (0.004)	0.3 (0.012)
-------------	-------------

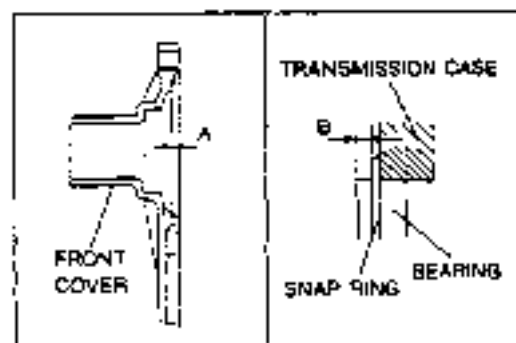
## Housing Components

1. Assemble in the order shown in the figure referring to **Assembly Note**.

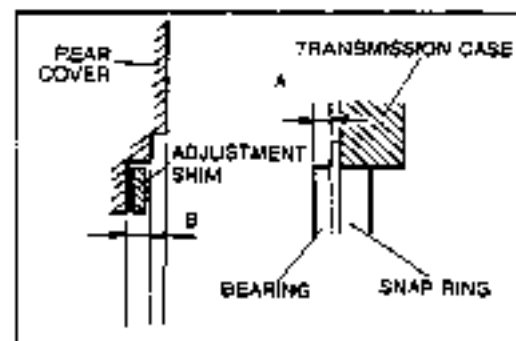
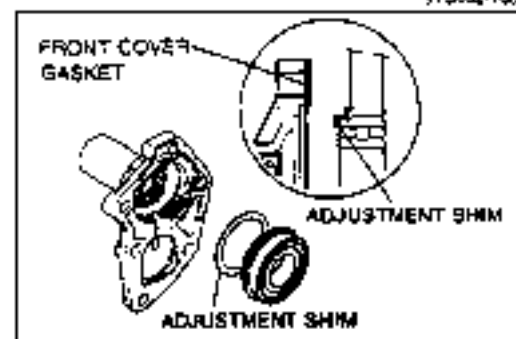


97G012-098

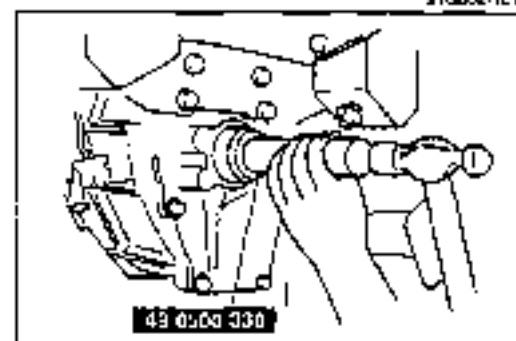
- |                            |                            |                             |
|----------------------------|----------------------------|-----------------------------|
| 1. Gasket                  | 10. Release bearing        | 17. Rear cover              |
| 2. Clutch housing assembly | 11. Oil guide              | 18. Transmission mount      |
| 3. Locknut                 | 12. Steel ball             | 19. Center brake assembly   |
| 4. Oil seal                | 13. Speedometer drive gear | 20. Center brake drum       |
| 5. Adjustment shim (Front) | 14. Oil seal               | Assembly Note               |
| Assembly Note              | Assembly Note              | ..... page J2-46            |
| ..... page J2-46           | ..... page J2-46           | 21. Locknut                 |
| 6. Gasket                  | 15. Adjustment shim (Rear) | 22. Speedometer driven gear |
| 7. Front cover             | Assembly Note              | 23. Gasket                  |
| 8. Dust boot               | ..... page J2-46           | 24. Top cover assembly      |
| 9. Release fork            | 16. Gasket                 |                             |



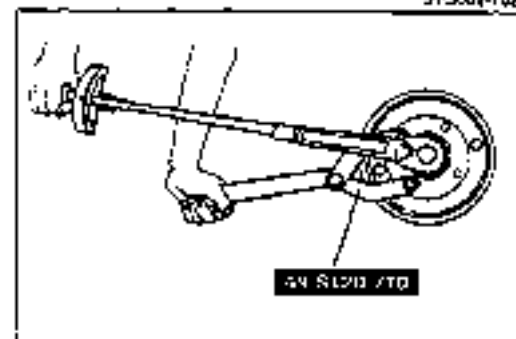
9T30J2-100



9T50J2-101



9T30J2-102



9T50J2-103

**Assembly Note****Adjustment shim (Front)**

1. After measuring dimensions A and B shown in the figure, use an adjustment shim(s), as specified below, of the thickness corresponding to the value of A plus gasket thickness 0.3mm (0.012 in) minus B, so that bearing end play will be within specification.

**Bearing end play: 0—0.1mm (0—0.004 in)****Adjustment shim thickness:**

mm (in)

0.1 (0.004)	0.3 (0.012)
0.6 (0.024)	0.7 (0.028)
0.8 (0.031)	0.9 (0.035)
1.0 (0.039)	

**Adjustment shim (Rear)**

1. After measuring dimensions A and B shown in the figure, use an adjustment shim(s), as specified below, of the thickness corresponding to the value of A plus gasket thickness 0.3mm (0.012 in) minus B, so that bearing end play will be within specification.

**Bearing end play: 0—0.1mm (0—0.004 in)****Adjustment shim thickness:**

mm (in)

0.8 (0.031)	0.9 (0.035)
1.0 (0.039)	1.1 (0.043)
1.2 (0.047)	

**Oil Seal****Caution**

- Do not damage the mainshaft splines.

1. Install the oil seal with the SST.

**Center brake drum**

1. Install the center brake drum.
2. Hold the drum with the SST, and tighten the locknut.

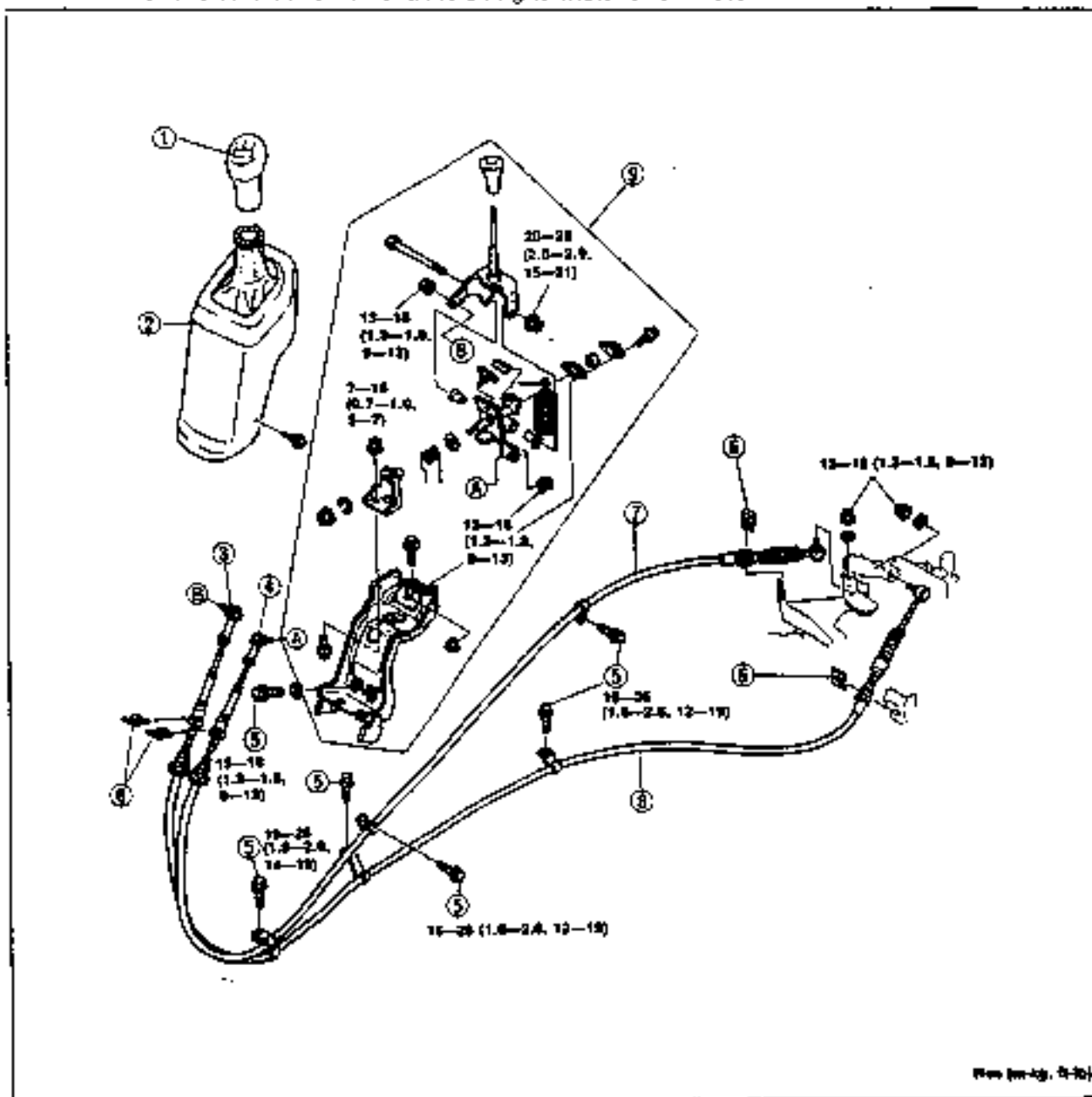
**Tightening torque:**

245—294 N·m (25—30 m·kg, 180—216 ft·lb)

## SHIFT MECHANISM (TRANSMISSION)

## REMOVAL / INSTALLATION

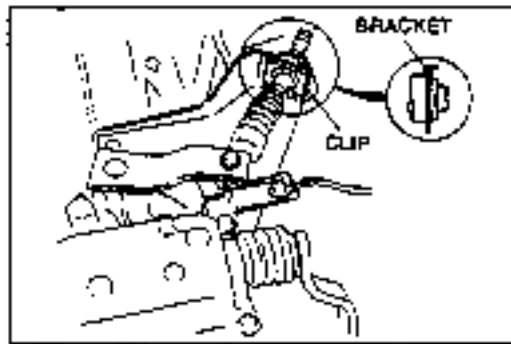
1. Remove in the order shown in the figure.
2. Inspect all parts and repair or replace as necessary.
3. Install in the reverse order of removal, referring to **Installation Note**



97GJ2 104

- |  |  |
|--|--|
| 1. Shift knob<br>Installation Note ..... page J2-48                | 6. Clip<br>Installation Note ..... page J2-48  |
| 2. Console   | 7. Selector cable<br>Inspect boots for damage<br>Inspect cable for damage and function |
| 3. Shift cable ball joint<br>Installation Note ..... page J2-48    | 8. Shift cable<br>Inspect boots for damage<br>Inspect cable for damage and function    |
| 4. Selector cable ball joint<br>Installation Note ..... page J2-48 | 9. Shift lever assembly  |
| 5. Bolt  |  |

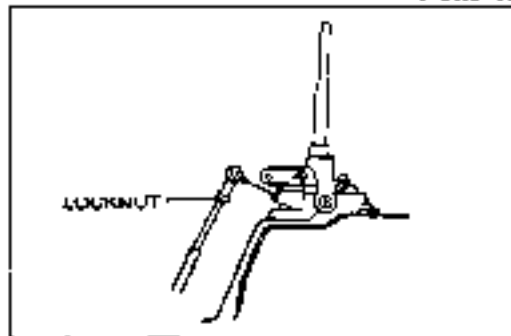




97G0J2-108

**Installation Note****Clip**

1. Install the clips as shown in the figure.



97G0J2-109

**Selector cable ball joint**

1. Loosen the locknut.

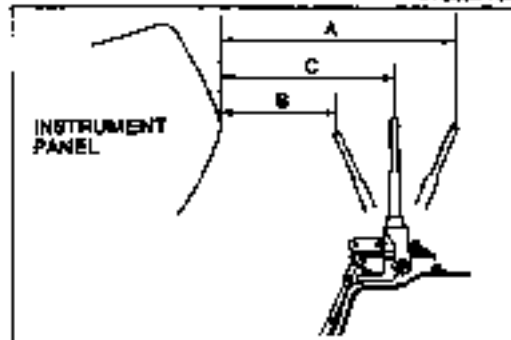
**Note**

- The shift lever will be set in neutral position by force of the spring.

2. Set the shift lever in neutral position.
3. Turn the ball joint so that the selector cable aligns with the installation hole of the shift lever.
4. Tighten the locknut.

**Tightening torque:**

10–15 Nm (1.0–1.5 m·kg, 7–11 ft·lb)



97G0J2-110

**Shift cable ball joint**

1. Measure A and B shown in the figure.
2. Calculate the neutral position of the shift lever as follows:

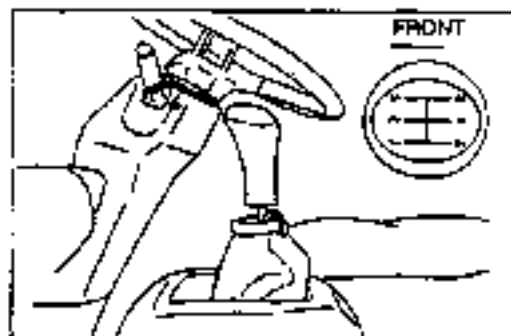
$$\text{Neutral position } C = B + \frac{A - B}{2}$$

3. Hold the shift lever in neutral position.
4. Loosen the shift cable locknut.
5. Turn the ball joint so that the shift cable aligns with the installation hole of the shift lever.
6. Tighten the locknut.

**Tightening torque:**

10–15 Nm (1.0–1.5 m·kg, 7–11 ft·lb)

7. After installation, verify that the shift lever operates smoothly.



97G0J2-106

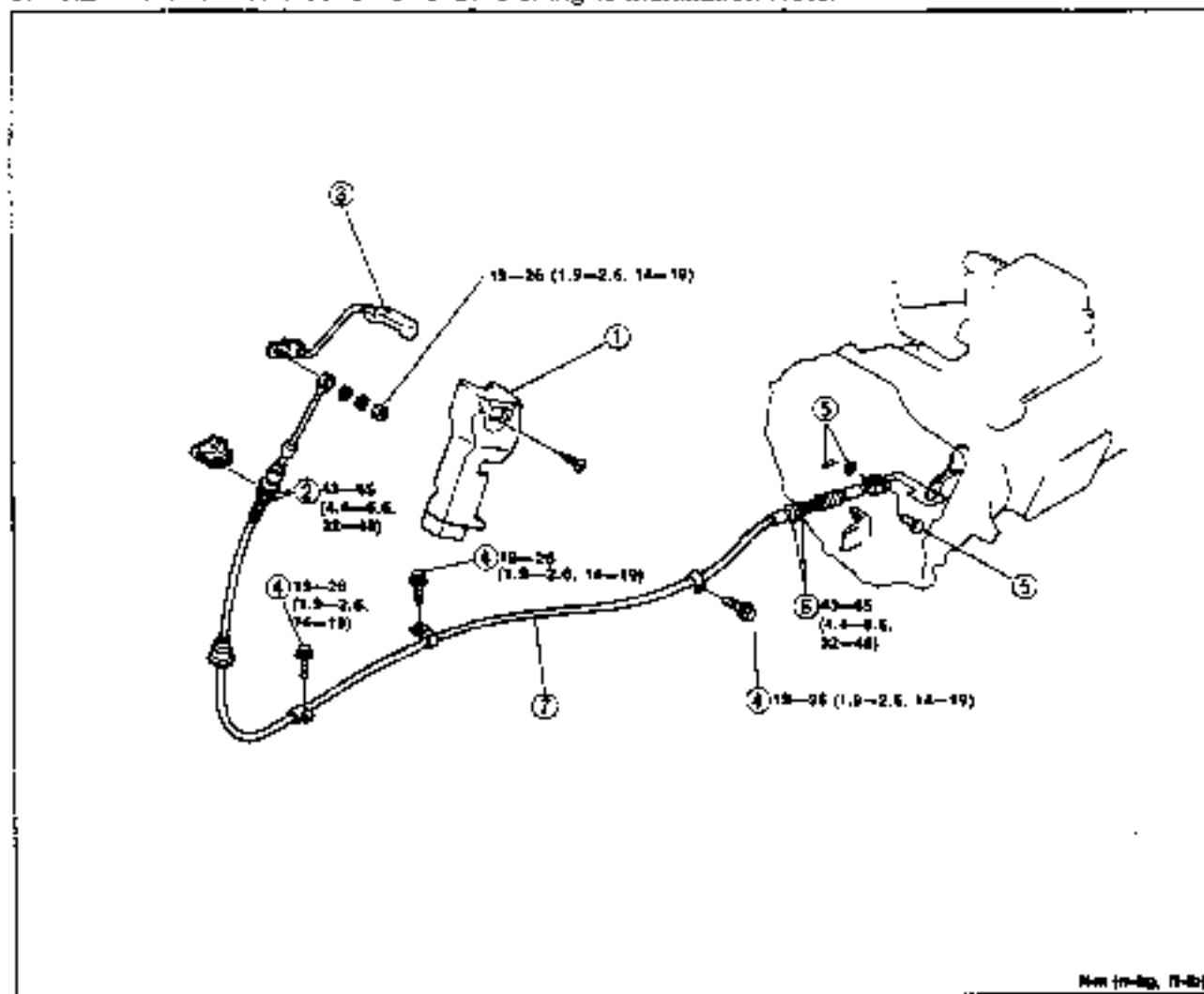
**Shift knob**

1. Install the shift knob as shown in the figure.

## SHIFT MECHANISM (SUB-TRANSMISSION)

## REMOVAL / INSTALLATION

1. Remove in the order shown in the figure.
2. Inspect all parts and repair or replace as necessary.
3. Install in the reverse order of removal, referring to **Installation Note**.



1. Steering column cover

2. Nut

Installation Note ..... page J2-49

3. Selector lever

4. Bolt

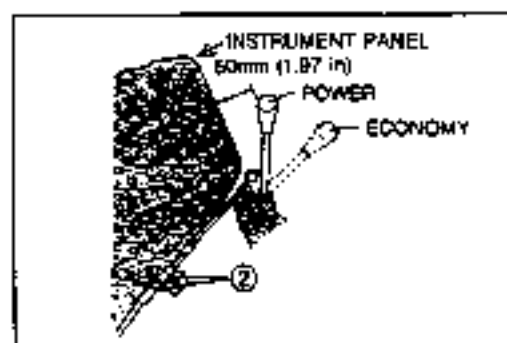
5. Spring pin and pin

6. Nut

7. Sub-selector cable

Inspect boot for damage

Inspect cable for damage and function



9TGDJ2-108

**Installation Note****Nut (Selector lever side)**

1. With the selector lever at power position, turn the nuts to adjust the position of the lever shown in the figure.

**Tightening torque:**

43-65 Nm (4.4-6.6 m-kg, 32-48 ft-lb)

# PROPELLER SHAFT

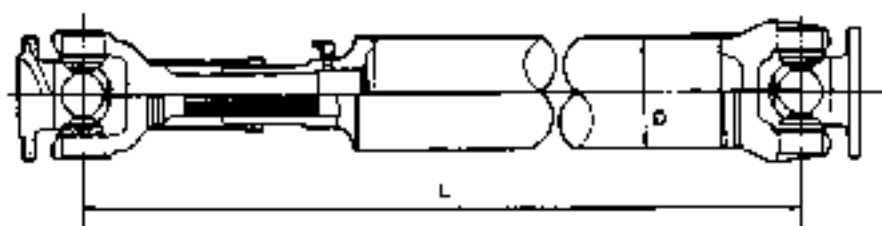
<b>OUTLINE</b> .....	L- 2
<b>SPECIFICATIONS</b> .....	L- 2
<b>TROUBLESHOOTING GUIDE</b> .....	L- 3
<b>PROPELLER SHAFT</b> .....	L- 3
<b>PREPARATION</b> .....	L- 3
<b>REMOVAL / INSPECTION / INSTALLATION</b> ..	L- 4
<b>OVERHAUL</b> .....	L- 5
<b>LUBRICATION</b> .....	L-11

ATPLX 001

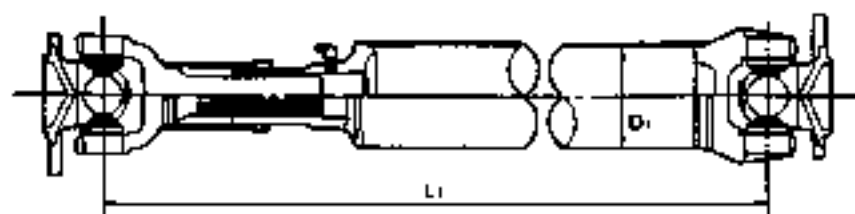
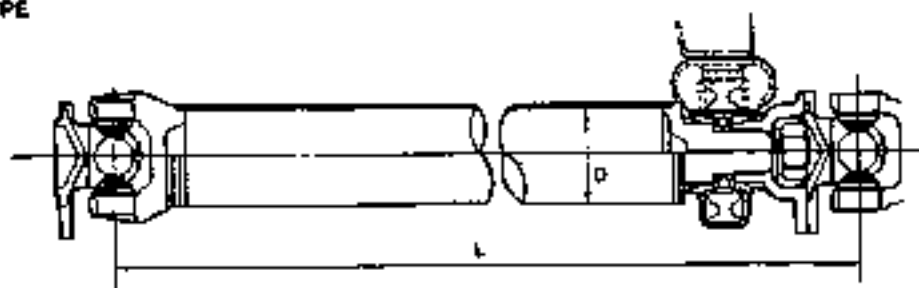
## OUTLINE

## SPECIFICATIONS

## TWO-JOINT TYPE



## THREE-JOINT TYPE



5T6DLX-002

Engine type		HA, SL		SL Turbo		TF		
		10	14	14	17	14	17	
Length	mm (in)	L	663-692 (34.76-35.12)	735 (28.94)	754 (29.68)	909 (39.33)	713 (28.07)	959 (37.72)
		L1	—	963-993 (38.11-38.70)	914-926 (35.96-36.54)	1,279-1,289 (50.35-50.75)	921-929 (36.26-36.54)	1,281-1,288 (50.43-50.71)
Outer diameter	mm (in)	D	82.6 (3.25)		90.0 (3.54)			
		D1	—	82.6 (3.25)	90.0 (3.54)			

5T6DLX-002

## TROUBLESHOOTING GUIDE

Problem	Possible cause	Action	Page
<b>Vibration</b>	Faulty assembly of sliding joint	Repair	L- 6
	Bent propeller shaft	Replace	L- 6
	Improperly installed universal joint snap ring	Repair	L- 6
	Worn or damaged center bearing	Replace	L- 6
	Loose center bearing mounting bolts	Tighten	L- 6
	Loose yoke mounting bolts	Tighten	L- 4
	Worn sliding joint splines	Replace	L- 6
	Improperly assembled center bearing yoke	Repair	L- 6
<b>Abnormal noise</b>	Worn or damaged bearing cup	Replace	L- 6
	Improperly installed universal joint snap ring	Repair	L- 6
	Worn or damaged center bearing	Replace	L- 6
	Loose yoke mounting bolts	Tighten	L- 4
	Worn or damaged sliding joint splines	Replace	L- 6
	Insufficient grease	Grease	L-11

9750X-003

## PROPELLER SHAFT

### PREPARATION

#### SST

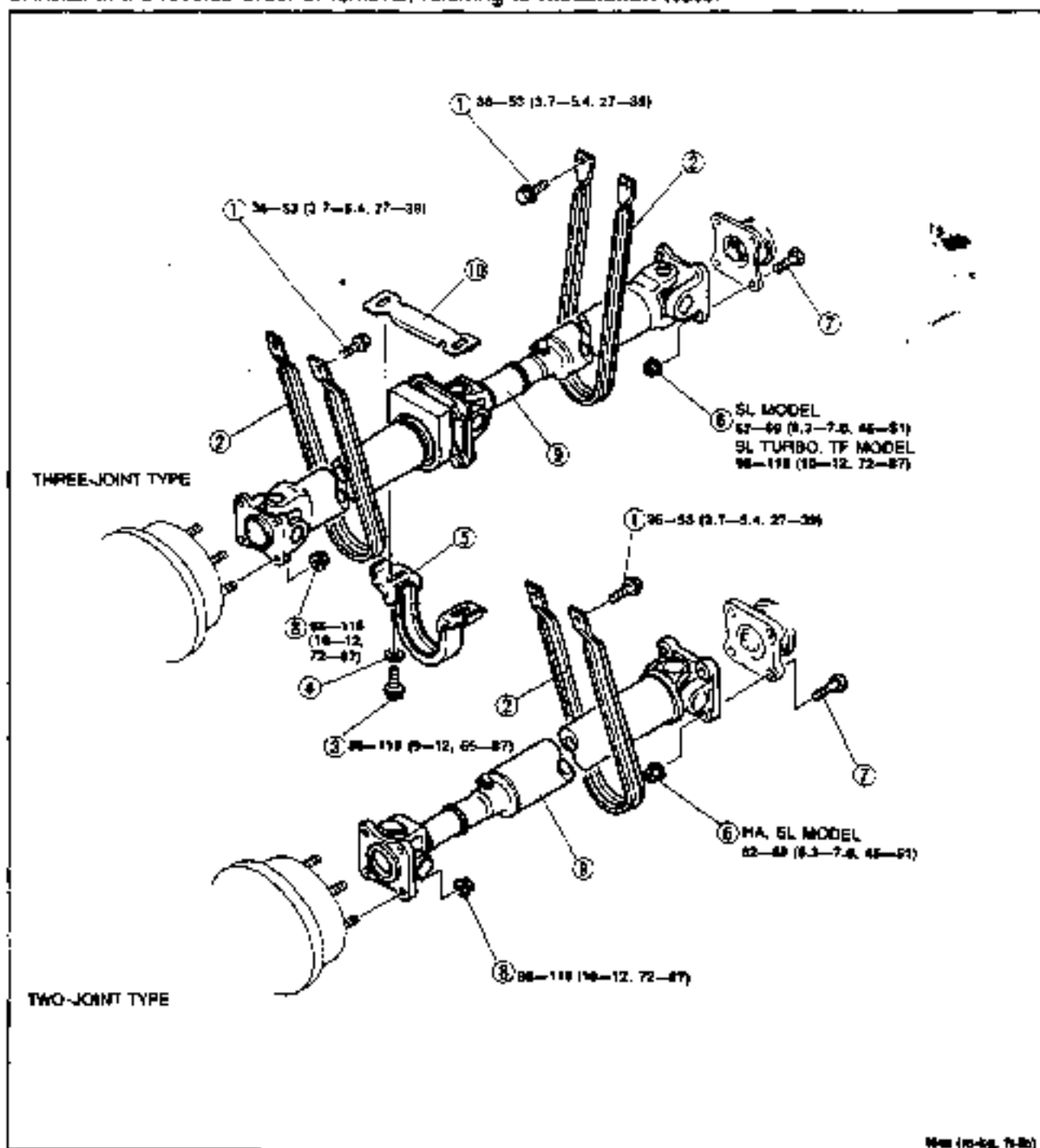
49 0639 425C  Puller set. bearing		For removal of center companion flange and center bearing
--	---	--

5750LX-006

## PROPELLER SHAFT

### REMOVAL / INSPECTION / INSTALLATION

1. Remove in the order shown in the figure, referring to **Removal Note**
2. Inspect all parts and repair or replace as necessary.
3. Install in the reverse order of removal, referring to **Installation Note**.

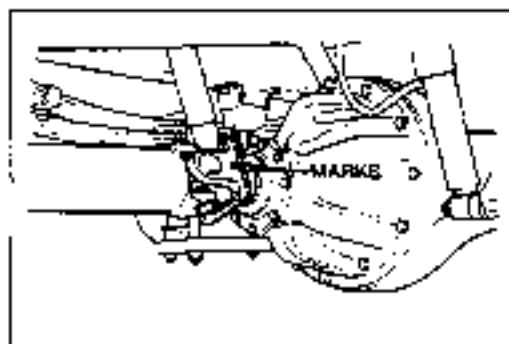


98-118 (10-12, 72-87)

V7POLY-004

- |                           |                        |          |
|---------------------------|------------------------|----------|
| 1. Bolt                   | 8. Nut                 |          |
| 2. Safety loop            | 9. Propeller shaft     |          |
| 3. Bolt                   | Removal Note.....      | page L-5 |
| 4. Washer                 | Overhaul.....          | page L-5 |
| 5. Center bearing bracket | Installation Note..... | page L-5 |
| 6. Nut                    |                        |          |
| 7. Bolt                   | 10. Plate              |          |

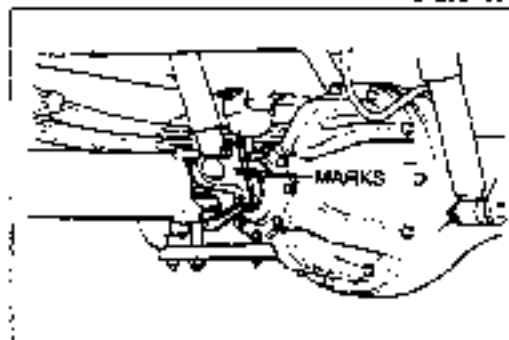
## PROPELLER SHAFT

**L**

9T6DLX-007

### Removal Note Propeller shaft

1. Mark the yoke, parking brake drum, and companion flange for correct reassembly.



9T6DLX-008

### Installation Note Propeller shaft

1. Align the marks and install the propeller shaft.

## OVERHAUL

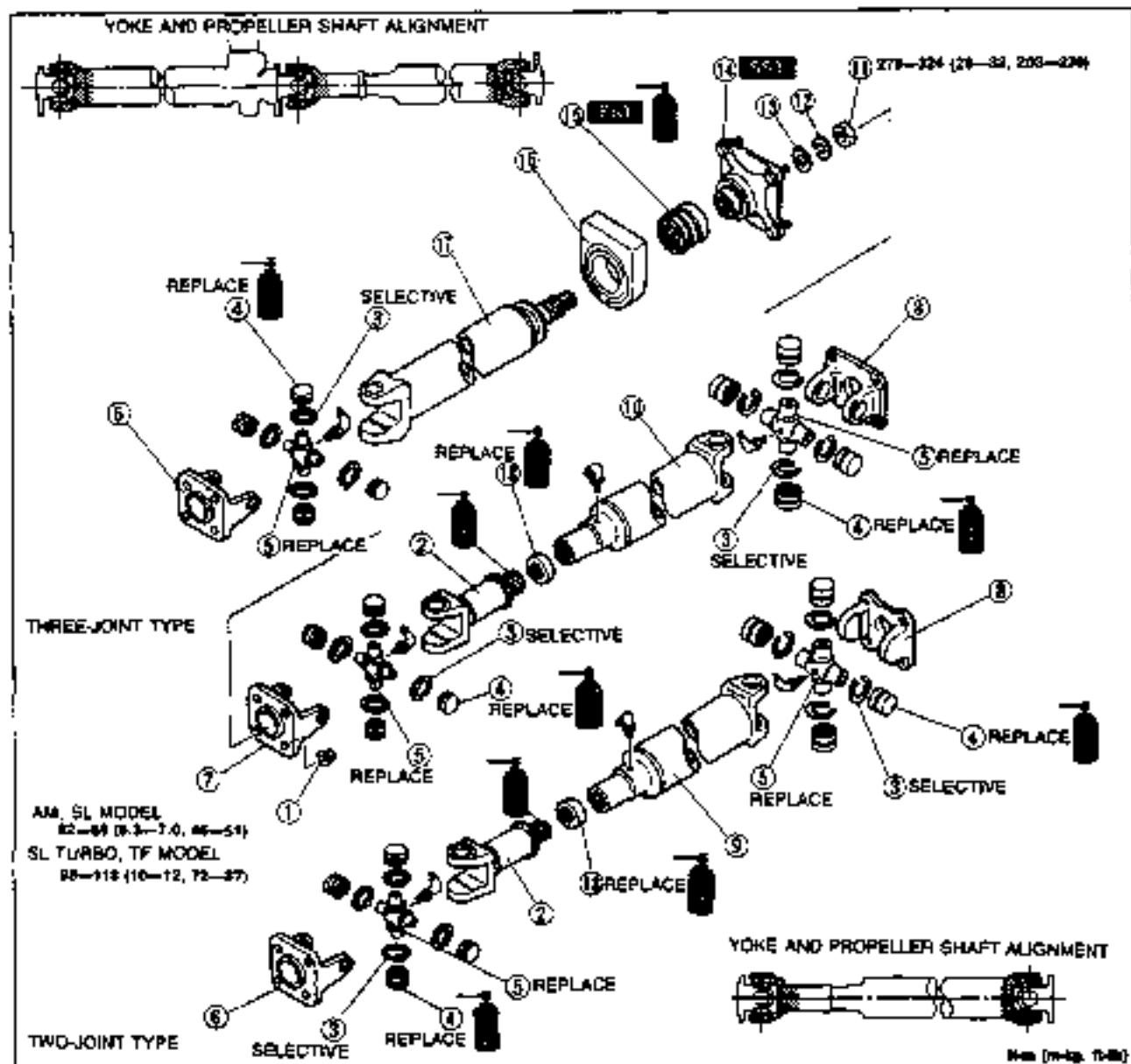
### Caution

- Use pads in the vise to prevent damaging the part.
- Do not remove the oil seal if not necessary.

1. Disassemble in the order shown in the figure, referring to **Disassembly Note**.
2. Inspect all parts and repair or replace as necessary.
3. Assemble in the reverse order of disassembly, referring to **Assembly Note**.
4. Lubricate the propeller shaft after assembling, referring to page L-11.

9T6DLX-005

# PROPELLER SHAFT

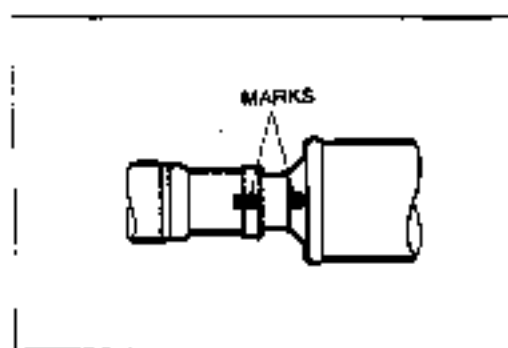


- |                                       |                                       |
|---------------------------------------|---------------------------------------|
| 1. Nut (Yoke)                         | 10. Propeller shaft No.2              |
| 2. Sliding joint                      | Inspection ..... page L-8             |
| Disassembly Note ..... page L-7       | 11. Flange nut                        |
| Inspect spines for wear and damage    | 12. Lock washer                       |
| 3. Snap ring                          | 13. Washer                            |
| Disassembly Note ..... page L-7       | 14. Center companion flange           |
| Assembly Note ..... page L-9          | Disassembly Note ..... page L-7       |
| 4. Bearing cup                        | Assembly Note ..... page L-9          |
| Disassembly Note ..... page L-7       | 15. Center bearing                    |
| Inspect for wear, damage and rotation | Disassembly Note ..... page L-8       |
| Assembly Note ..... page L-9          | Inspect for damage and rough rotation |
| 5. Spider                             | Assembly Note ..... page L-8          |
| Inspect for wear and damage           | 16. Center bearing rubber             |
| 6. Front yoke                         | Assembly Note ..... page L-9          |
| 7. Center yoke                        | 17. Propeller shaft No.1              |
| 8. Rear yoke                          | Inspection ..... page L-8             |
| 9. Propeller shaft                    | 18. Oil seal                          |
| Inspection ..... page L-6             |                                       |

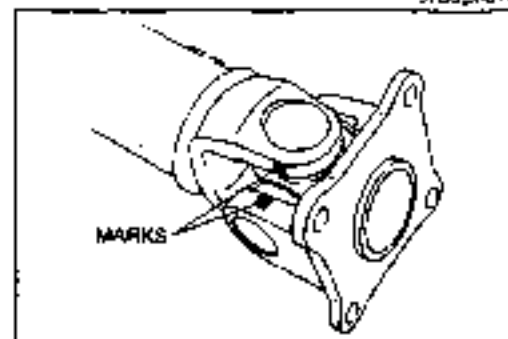


## PROPELLER SHAFT

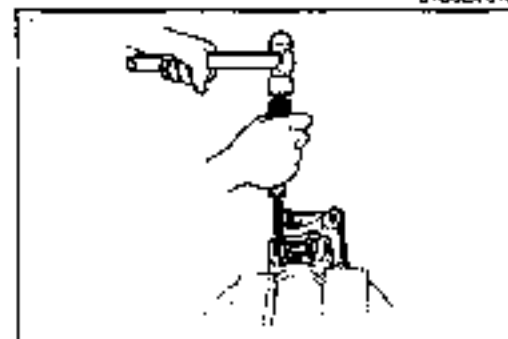
L



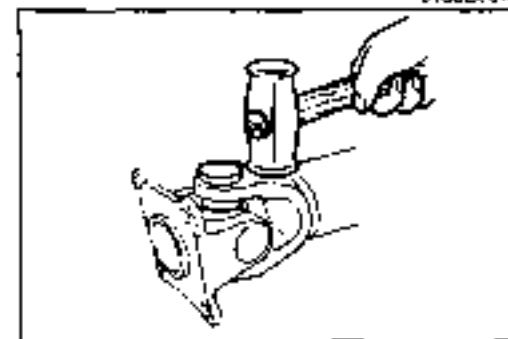
9TGO\_X-011



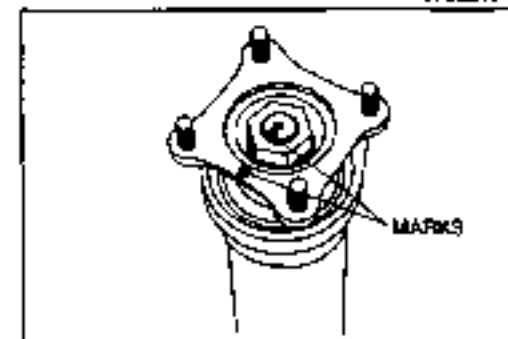
8TGOX-012



8TGOX-013



9TGO\_X-014



9TGOX-015

### Disassembly Note

#### Sliding joint

1. Mark the sliding joint and propeller shaft for proper reassembly.

#### Caution

- Replace the sliding joint and propeller shaft as a set if necessary.

2. Remove the sliding joint.

#### Snap ring

1. Mark the yoke and propeller shaft for proper reassembly.

2. Clamp the propeller shaft in a vise.

3. Remove the snap ring.

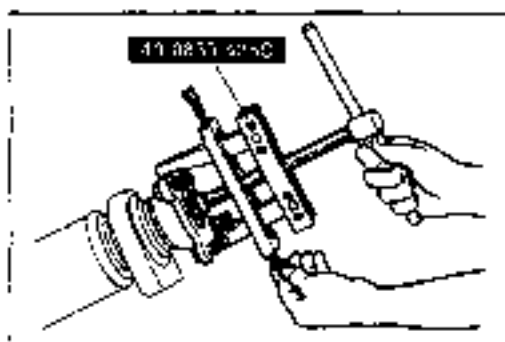
#### Bearing cup

1. Push one bearing cup out of the propeller shaft by tapping the propeller shaft yoke.
2. Remove the opposite bearing cup in the same manner.
3. Separate the propeller shaft and yoke.
4. Clamp the yoke in a vise.
5. Remove the bearing cups and the spider from the yoke as in Steps 1 and 2.

#### Center companion flange

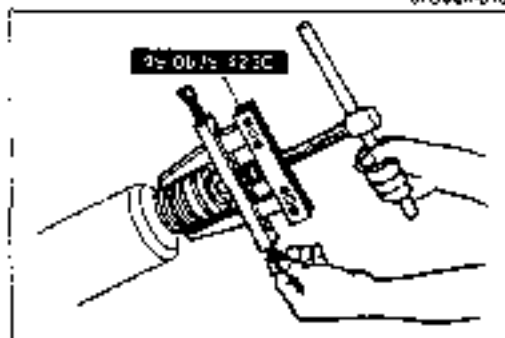
1. Mark the flange and shaft for proper reassembly.
2. Clamp the center companion flange in a vise.
3. Remove the flange nut and lock washer.

## PROPELLER SHAFT



9T00LX-016

- Remove the companion flange with the **SST**.



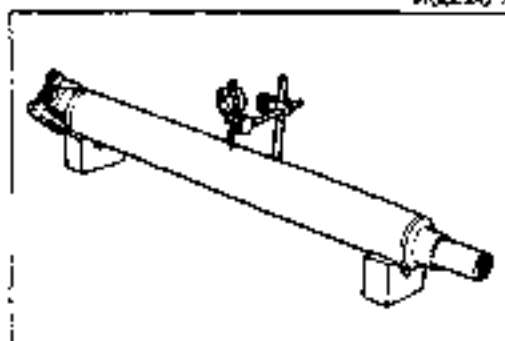
9T00LX-017

## Center bearing

## Caution

- Do not damage the oil seal.

- Remove the center bearing with the **SST**.



9T00LX-018

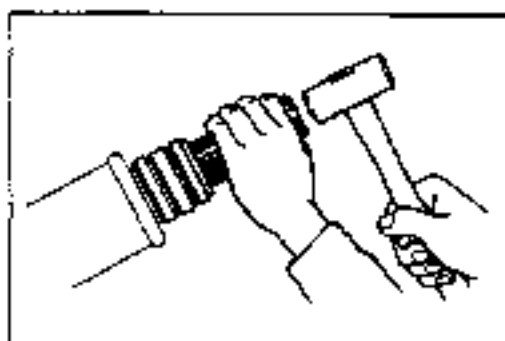
Inspection  
Propeller shaft

## Caution

- Measure the runout of No.1 and No.2 propeller shafts.
- Replace the propeller shaft as an assembly if runout is excessive.

- Measure the propeller shaft runout with a dial indicator.

Runout: 0.5mm (0.02 in) max.



9T00LX-019

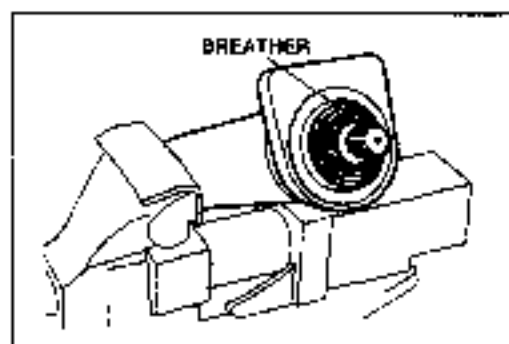
Assembly Note  
Center bearing

## Caution

- Face the oil seal breather rearward.

- Install the center bearing onto the propeller shaft with a suitable pipe and a hammer.

Pipe diameter: 45mm (1.77 in)



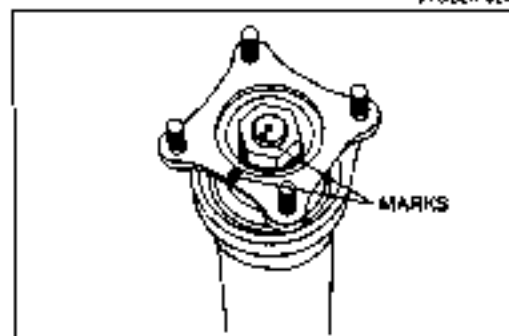
9T60LX-020

## Center bearing rubber

### Caution

- Face the oil seal breather upward.

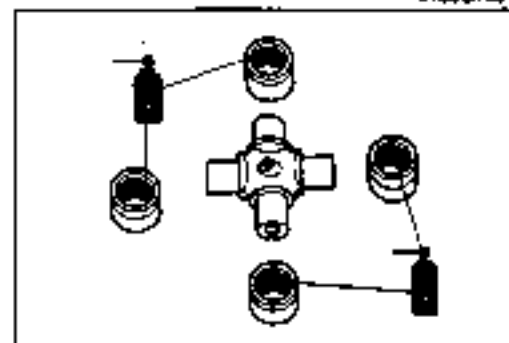
1. Install the center bearing rubber.



9T60LX-021

## Center companion flange

1. Align the marks on the flange and shaft, and install the center companion flange.



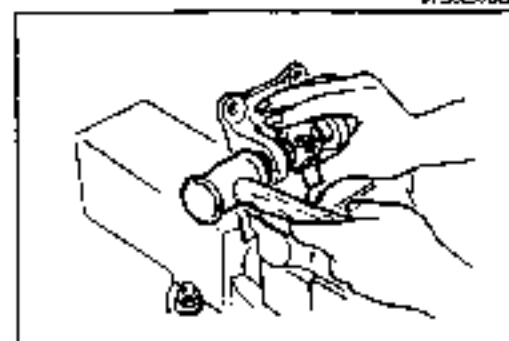
9T60LX-022

## Bearing cup

### Caution

- Do not reuse the snap ring, bearing cup, or spider.

1. Apply lithium based grease to the bearing rollers inside the bearing cups.
2. Clamp the yoke in a vise.

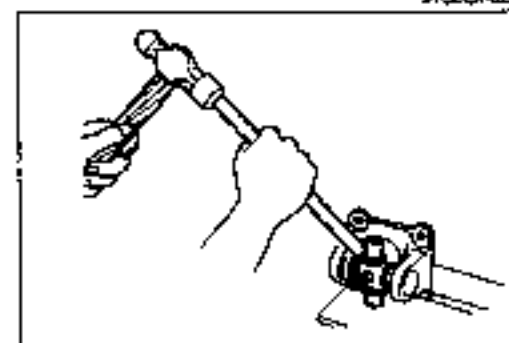


9T60LX-023

### Note

- Install the spider with the grease nipple toward the propeller shaft.

3. Set the new spider into the yoke and tap in a bearing cup using the spider to hold the rollers.
4. Slide the yoke to the opposite side and install the other bearing cup.



9T60LX-024

## Snap ring

### Caution

- Use only new snap rings and ones of the same thickness.

1. Install the thinnest snap rings.

## PROPELLER SHAFT

### Caution

- Align the marks on the propeller shaft and yoke.

2. Install the yoke to the propeller shaft.
3. Lightly tap around the universal joint with a plastic hammer to assure the installation.

4. Measure the starting torque of the spider.

		Starting torque	Scale reading
HA, SL	Front yoke		7.65—21.58 N (0.78—2.20 kg, 1.72—4.84 lb)
	Center yoke	0.49—1.37 Nm (5—14 cm·kg, 4.34—12.15 in·lb)	8.14—22.86 N (0.83—2.33 kg, 1.83—5.13 lb)
	Rear yoke		8.14—22.86 N (0.83—2.33 kg, 1.83—5.13 lb)
SL Turbo TF		0.78—1.76 Nm (8—18 cm·kg, 6.94—15.62 in·lb)	11.28—25.41 N (1.15—2.59 kg, 2.53—5.70 lb)

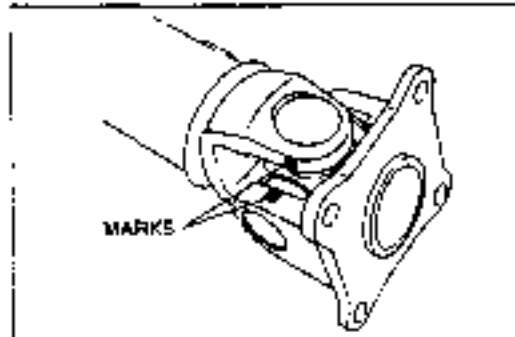
5. Install different snap rings to adjust the starting torque if necessary.

### Snap ring thickness:

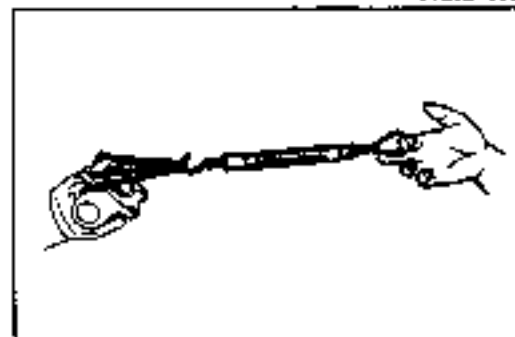
mm (in)

HA, SL		
1.45 (0.057)	1.48 (0.058)	1.50 (0.059)
1.54 (0.061)	1.57 (0.062)	1.60 (0.063)
1.63 (0.064)		

SL Turbo, TF		
2.00 (0.079)	2.03 (0.080)	2.06 (0.081)
2.09 (0.082)	2.12 (0.083)	2.15 (0.085)
2.18 (0.086)	2.21 (0.087)	2.24 (0.088)



31F0UX-028



31F0UX-007

# PROPELLER SHAFT

L

## LUBRICATION

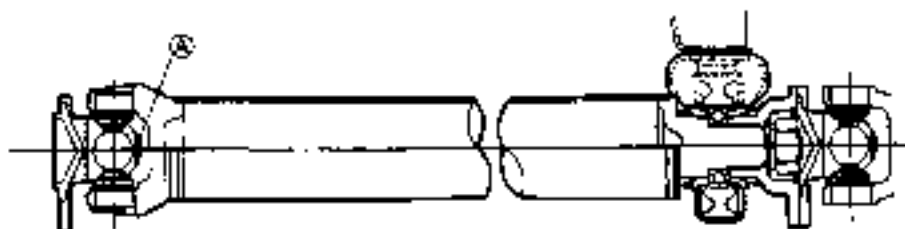
1. Lubrication fittings are installed to make possible regular lubrication. The type of grease used for the universal joints and slip yoke is different.

### Lubricant

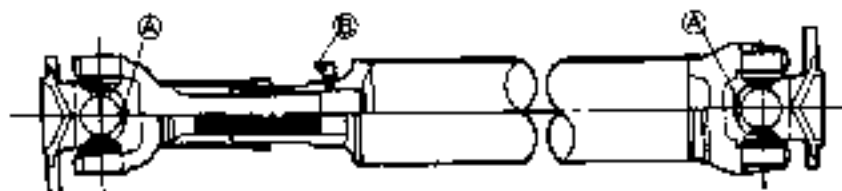
For fitting (A)..... Lithium based grease  
For fitting (B)..... Disulphide molybdenum grease

### THREE-JOINT TYPE

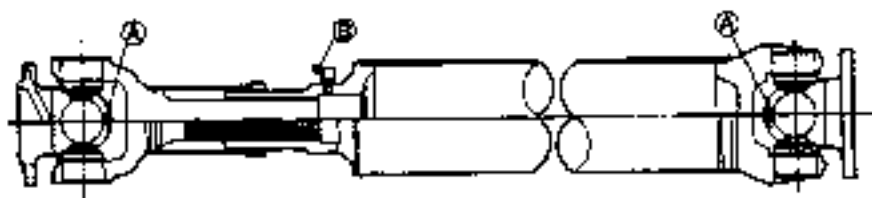
PROPELLER SHAFT NO. 1



PROPELLER SHAFT NO. 2



### TWO-JOINT TYPE



## FRONT AND REAR AXLES

<b>INDEX</b> .....	M- 2
<b>OUTLINE</b> .....	M- 3
SPECIFICATIONS.....	M- 3
<b>TROUBLESHOOTING GUIDE</b> .....	M- 4
<b>FRONT AXLE</b> .....	M- 4
PREPARATION.....	M- 4
WHEEL HUB, STEERING KNUCKLE.....	M- 5
<b>REAR AXLE</b> .....	M-15
PREPARATION.....	M-15
REAR AXLE.....	M-15
<b>DIFFERENTIAL</b> .....	M-20
PREPARATION.....	M-20
DIFFERENTIAL OIL.....	M-23
OIL SEAL .....	M-24
DIFFERENTIAL.....	M-26

91FDWY 001

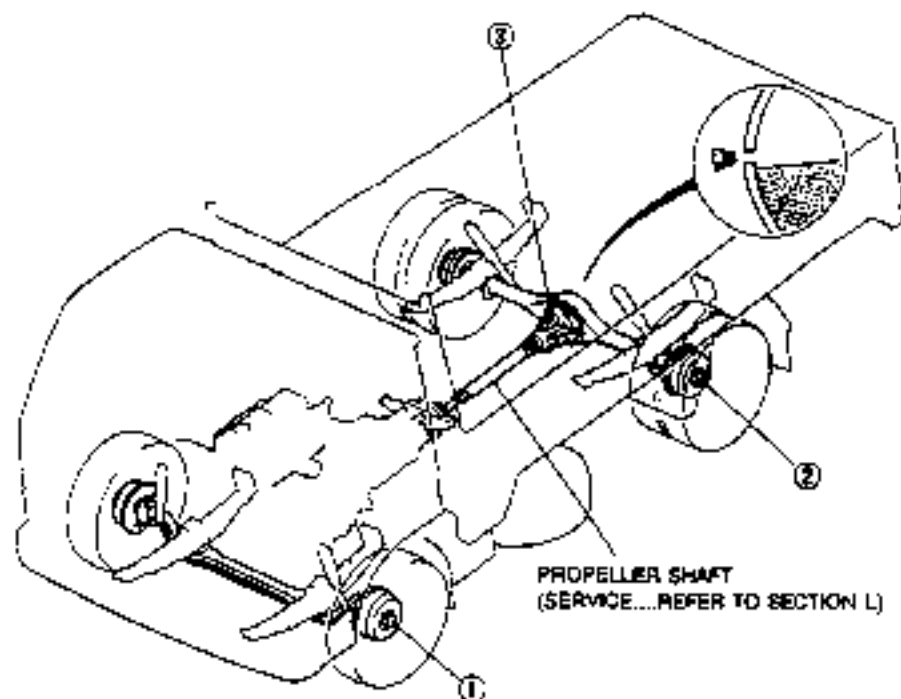
## INDEX

## OIL SPECIFICATION

ABOVE  $-18^{\circ}\text{C}$  ( $0^{\circ}\text{F}$ ): GL-5, SAE 90  
 BELOW  $-18^{\circ}\text{C}$  ( $0^{\circ}\text{F}$ ): GL-5, SAE 80W

## CAPACITY

W TYPE 2.6 liters (2.7 US qt, 2.3 imp qt)  
 Y TYPE 3.6 liters (3.8 US qt, 3.2 imp qt)



97FOMX-002

1. Front axle		2. Rear axle	
Preinspection .....	page M- 5	Preinspection .....	page M-15
Preload adjustment .....	page M- 5	Preload adjustment .....	page M-15
Wheel hub		Removal / Inspection /	
Removal / Inspection /		Installation .....	page M-16
Installation .....	page M- 6	Disassembly / Inspection /	
Disassembly / Inspection /		Assembly .....	page M-18
Assembly .....	page M- 8	3. Differential	
Steering knuckle		Differential oil .....	page M-23
Removal / Inspection /		Oil seal .....	page M-24
Installation .....	page M-10	Removal / Installation .....	page M-26
Disassembly / Inspection /		Overhaul .....	page M-28
Installation .....	page M-13		

OUTLINE

SPECIFICATIONS

Model		Engine type	HA		SL		SL Turbo	
		Cargo box length	ft		10		14	
Item		Cabin style	Std. cabin		Wide cabin			
		Body style	Truck		Crew cabin	Truck		
		Pay load	1	1.5	2	2.75	3	4
<b>Front axle</b>								
Bearing preload	Pull scale reading	N (kg, lb)	10.8—29.4 (1.1—3.0, 2.4—6.6)					
<b>Rear axle</b>								
Bearing preload	Pull scale reading	N (kg, lb)	10.8—29.4 (1.1—3.0, 2.4—6.6)					
Rear axle shaft	Length	mm (in)	739.5 (29.11)	788 (31.42)	790.5 (30.73)		806 (31.73)	
	Outer diameter	mm (in)	32 (1.26)	36 (1.42)	36 (1.42)		38 (1.50)	
<b>Differential</b>								
Reduction gear			Hypoid gear					
Differential gear			Straight bevel gear					
Reduction ratio			5.857	6.142	6.571		6.671	
Oil	Grade		API GL-5					
	Viscosity	Above -18°C (0°F)	SAE 90					
		Below -18°C (0°F)	SAE 80W					
	Amount		liters (US qt, Imp qt)		2.6 (2.7, 2.3)		3.6 (3.8, 3.2)	

Model		Engine type	SL Turbo		TF		
		Cargo box length	ft		17		14
Item		Cabin style	Wide cabin				
		Body style	Truck		Crew cabin	Truck	
		Pay load	1	4	3.5	4	
<b>Front axle</b>							
Bearing preload	Pull scale reading	N (kg, lb)	10.8—29.4 (1.1—3.0, 2.4—6.6)				
<b>Rear axle</b>							
Bearing preload	Pull scale reading	N (kg, lb)	10.8—29.4 (1.1—3.0, 2.4—6.6)				
Rear axle shaft	Length	mm (in)	806 (31.73)				
	Outer diameter	mm (in)	36 (1.50)				
<b>Differential</b>							
Reduction gear			Hypoid gear				
Differential gear			Straight bevel gear				
Reduction ratio			6.571		6.533		
Oil	Grade		API GL-5				
	Viscosity	Above -18°C (0°F)	SAE 90				
		Below -18°C (0°F)	SAE 80W				
	Amount		liters (US qt, Imp qt)		3.6 (3.8, 3.2)		

979400-003



# M

## TROUBLESHOOTING GUIDE, FRONT AXLE

### TROUBLESHOOTING GUIDE




Problem	Possible Cause	Remedy	Page
Abnormal noise	Worn or damaged pinion and side gear	Replace	M-28
	Excessive side gear backlash	Replace	M-28
	Worn or damaged side bearing	Adjust or replace	M-28
	Worn or damaged drive pinion bearing	Replace	M-28
	Worn or damaged ring gear	Replace	M-28
	Excessive ring gear backlash	Adjust	M-29
	Insufficient oil	Add	M-23
	Defective oil	Replace	M-23
	Foot contact of ring gear teeth	Adjust	M-40
	Worn side gear spline	Replace	M-28
	Worn companion flange spline	Replace	M-28
	Worn drive pinion spline	Replace	M-28
	Worn pinion shaft	Replace	M-28
Worn or damaged wheel bearing	Replace	M-6, 16	
Oil leakage	Insufficient sealant on differential carrier	Correct	M-26
	Damaged oil seal	Replace	M-24
	Loose drain plug	Tighten	M-23
Steering heavy	Binding kingpin	Replace	M-10
	Insufficient kingpin oil Steering unit related problem	Add —	M-10 Section N
Steering wheel pulls	Improperly adjusted front wheel bearing preload	Adjust	M-5
	Steering unit related problem	—	Section N
Steering wheel vibration	Worn or improperly adjusted front wheel bearing	Replace or adjust	M-5
	Worn kingpin	Replace	M-10
	Steering unit related problem	—	Section N
Excessive steering wheel play	Improperly adjusted front wheel bearing preload	Adjust	M-5
	Worn kingpin	Replace	M-10
	Steering unit related problem	—	Section N

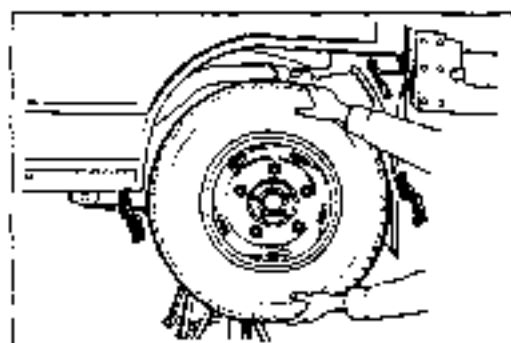
97F04M-004

## FRONT AXLE

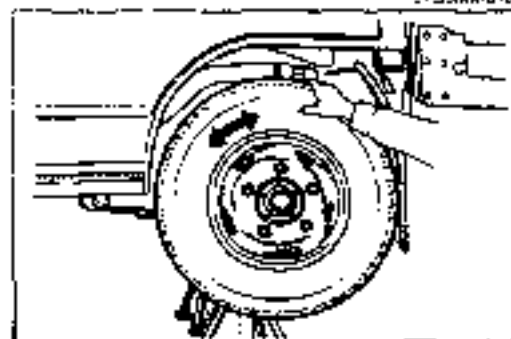
### PREPARATION

#### SST

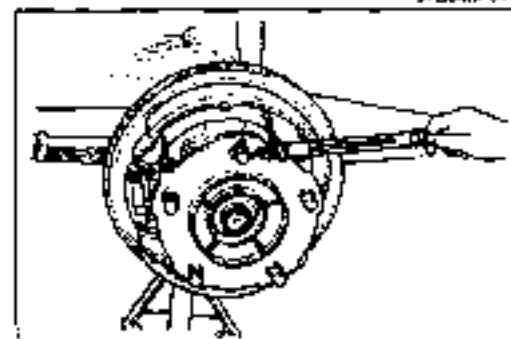
<p>49 1316 610</p> <p>Puller &amp; installer, kingpin bushing</p> 	<p>For removal and installation of kingpin bushing</p>	<p>49 1316 500</p> <p>Guide, kingpin</p> 	<p>For installation of kingpin</p>
<p>48 0727 575</p> <p>Puller, socket joint</p> 	<p>For removal of drag link and tie-rod end</p>	87F04M-006	



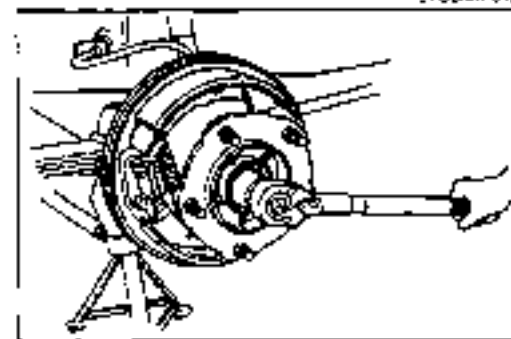
9T3GMX-010



9T3GMX-011



9T3GMX-012



9T3GMX-006

**WHEEL HUB, STEERING KNUCKLE****Preinspection****Wheel bearing play**

1. Push and pull the tire in the axial direction to check the wheel bearing play.

**Note**

- If the play remains after the brake is depressed, it indicates ball joint play.

2. Verify that there is no abnormal noise and that the tire rotates smoothly when rotated by hand.
3. Adjust the wheel bearing preload as necessary.

**Preload Adjustment**

1. Remove the wheel and tire
2. Remove the hub cap.

**Note**

- Do not remove the screw mounted type brake drum.
- Verify that the brake shoes do not drag.
- If there is drag, adjust the shoe clearance.

3. Remove the brake drum. (Refer to page M-6.)
4. Remove the stop retainer.
5. Loosen the hub nut until it can be turned by hand.
6. Attach a pull scale to a wheel lug bolt, and measure the frictional force while turning.  
Then tighten the hub nut until the preload is as specified.

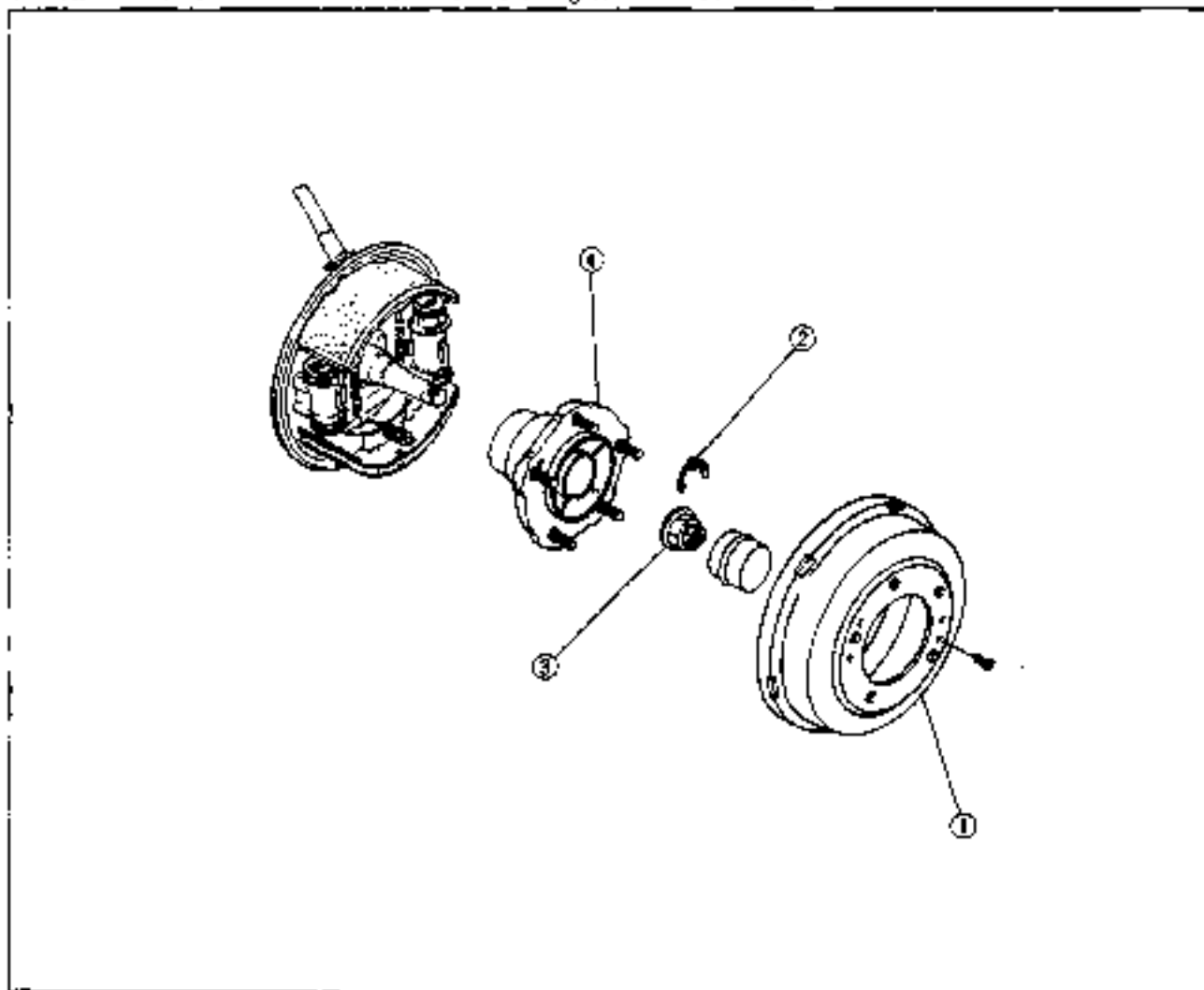
**Preload: Frictional force plus**

11–30 N (1.1–3.0 kg, 2.4–6.6 lb)

7. Install in the reverse order of removal.

**WHEEL HUB****Removal / Inspection / Installation**

1. Remove in the order shown in the figure, referring to **Removal Note**.
2. Inspect all parts and repair or replace as necessary.
3. Install in the reverse order of removal, referring to **Installation Note**.



9TFCM3-007

**1. Brake drum**

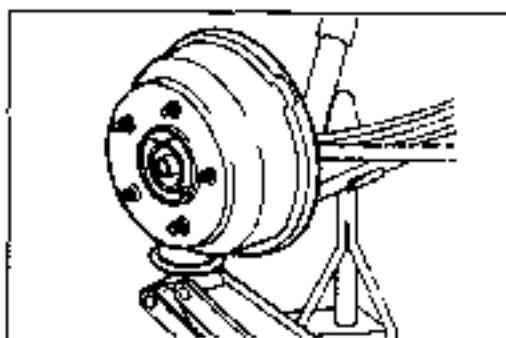
Removal Note ..... page M-6  
 Service ..... Section P

**2. Stop retainer****3. Hub nut**

Installation Note ..... page M-7

**4. Wheel hub**

Removal Note ..... page M-7  
 Disassembly / Inspection /  
 Assembly ..... page M-7



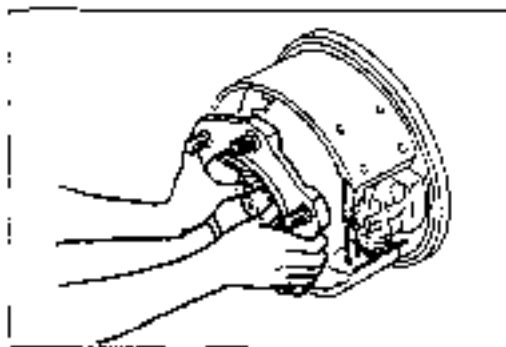
9TGM7-015

**Removal Note****Brake drum**

1. Support the brake drum with a jack and remove it.

**Caution**

- Do not damage the oil seal.

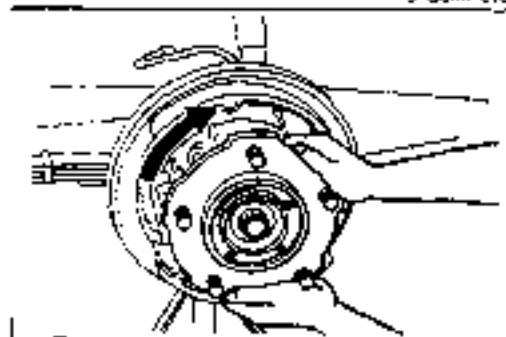


9TGMX-016

**Wheel hub****Caution**

- Do not drop the bearing inner race.

1. Remove the wheel hub from the steering knuckle.



9TGMX-017

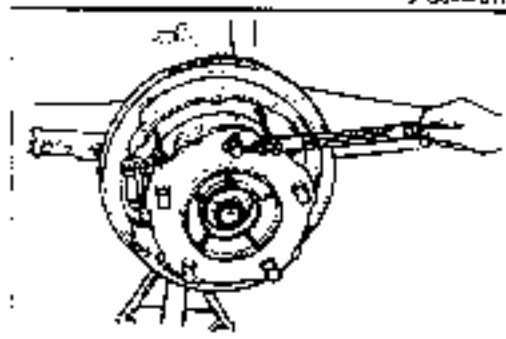
**Installation Note****Hub nut**

1. Temporarily install the hub nut to the specified torque.

**Tightening torque:**

29–39 N·m (3–4 m·kg, 22–29 ft·lb)

2. Turn the wheel hub several times to seat the bearings fully
3. Loosen the hub nut until it can be turned by hand.



9TGMX-018

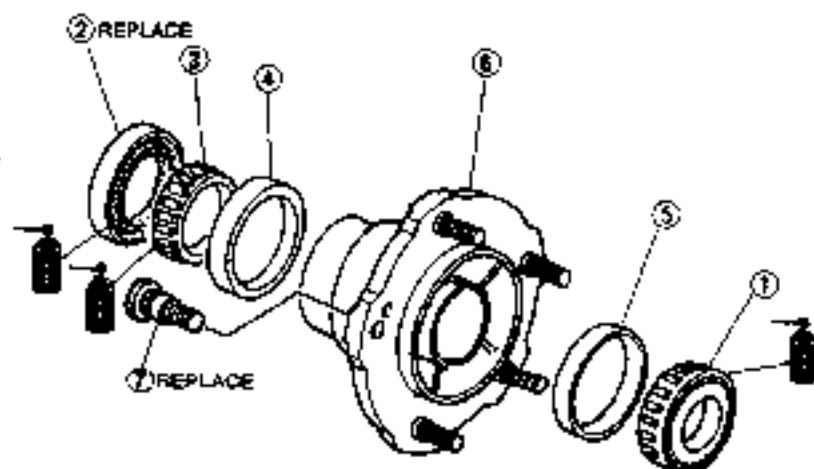
4. Attach a pull scale to a wheel hub bolt, and measure the frictional force while turning. Tighten the locknut until the preload is as specified.

**Preload: Frictional force plus**

11–30 N (1.1–3.0 kg, 2.4–6.6 lb)

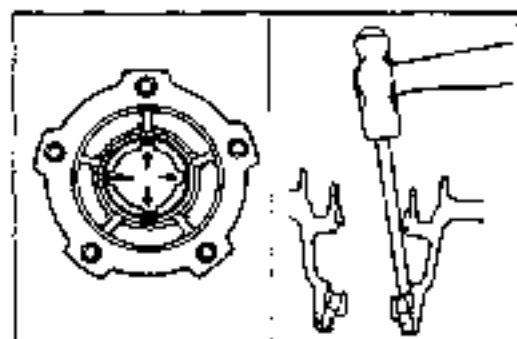
**Disassembly / Inspection / Assembly**

1. Disassemble in the order shown in the figure, referring to **Disassembly Note**
2. Inspect all parts and repair or replace as necessary.
3. Assemble in the reverse order of disassembly, referring to **Assembly Note**.



37FDAX-006

- |  |  |
|--|--|
| 1. Bearing inner race (Outer)<br>Inspect for damage and rotation                                 | 5. Bearing outer race (Outer)<br>Disassembly Note ..... page M-8<br>Assembly Note ..... page M-9 |
| 2. Oil seal<br>Assembly Note ..... page M-9  | 6. Wheel hub   |
| 3. Bearing inner race (Inner)<br>Inspect for damage and rotation                                 | 7. Hub bolt<br>Disassembly Note ..... page M-9<br>Assembly Note ..... page M-9                   |
| 4. Bearing outer race (Inner)<br>Disassembly Note ..... page M-8<br>Assembly Note ..... page M-9 |  |



37FDAX-006

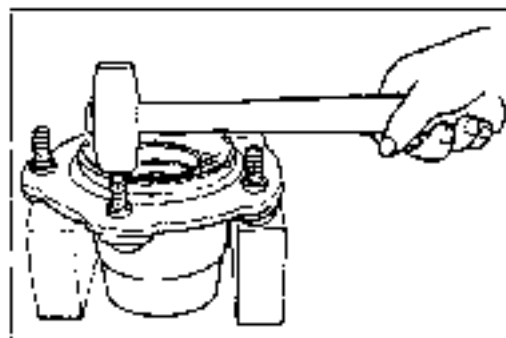
**Disassembly Note**  
**Bearing outer race****Caution**

- Replace the inner and outer race as a set.
- Do not reuse the removed oil seal.

**Note**

- When removing the bearing outer race (inner), the inner race (inner) and oil seal will also come out.

- 1 Tap the bearing outer race at the notches in the wheel hub (shown by arrows) with a brass bar and a hammer to remove it.

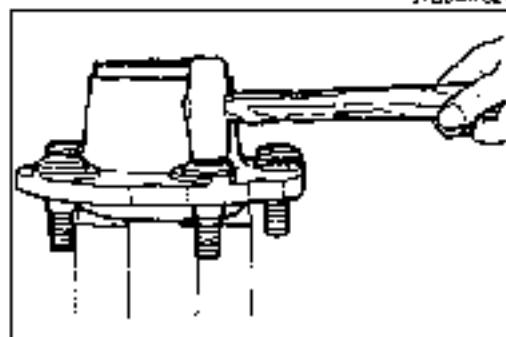


9TGMX-021

**Hub bolt****Caution**

- Do not remove the hub bolt if not necessary.
- Do not reuse a removed hub bolt.

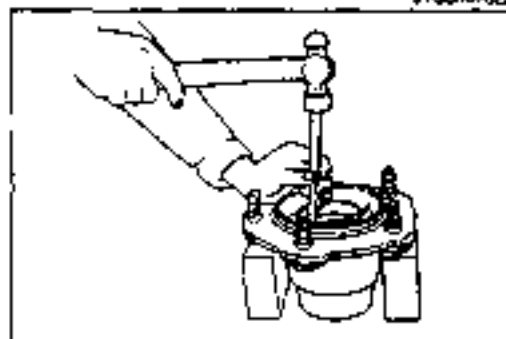
1. Remove the hub bolts with a brass hammer.



9TGMX-022

**Assembly Note****Hub bolt**

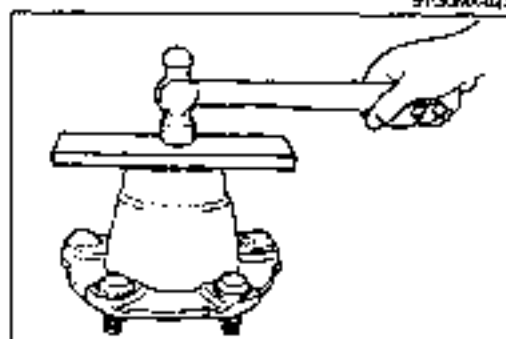
1. Install the hub bolts with a brass hammer.



9TGMX-023

**Bearing outer race**

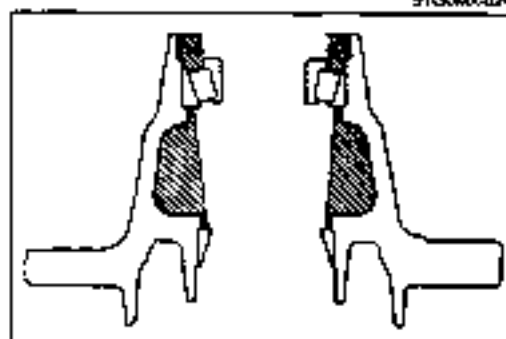
1. Install the bearing outer race with a brass bar and a hammer.



9TGMX-024

**Oil seal**

1. Apply grease around the new oil seal lip.
2. Drive the oil seal into the wheel hub with a suitable plate and a hammer.



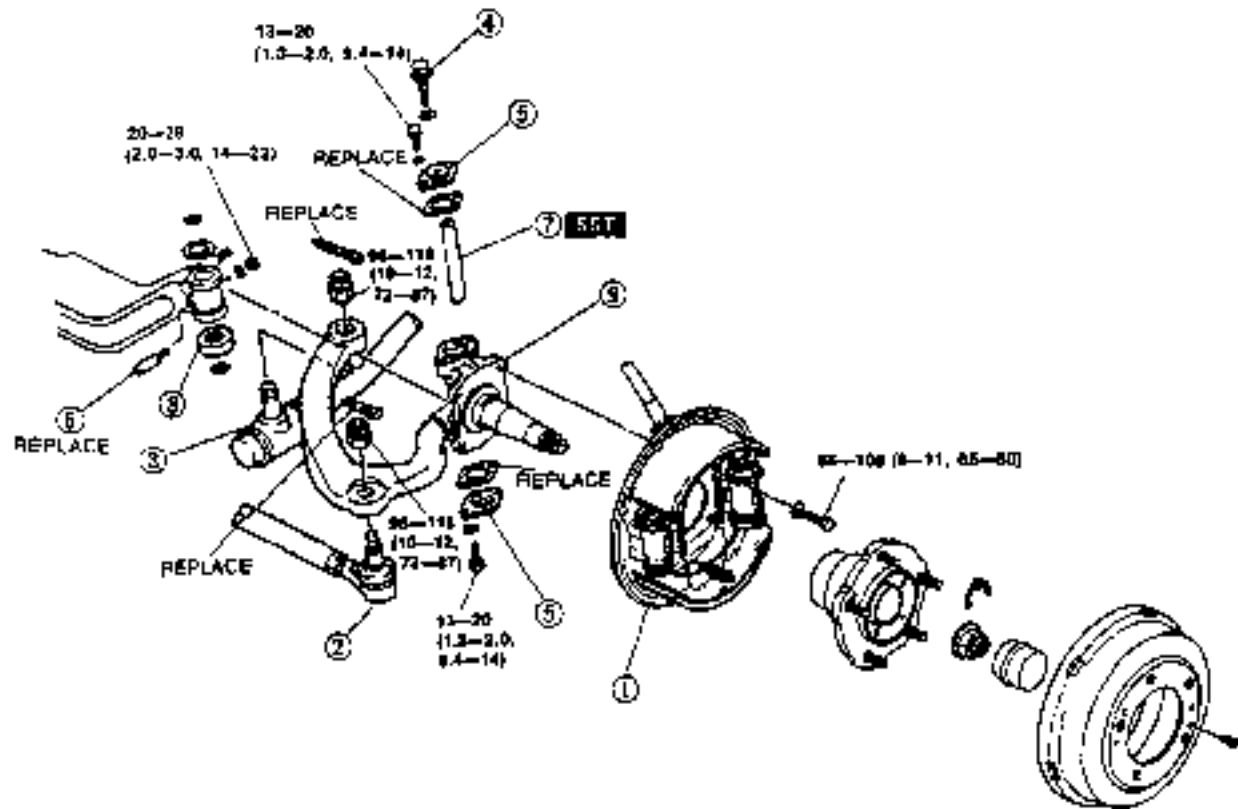
9TGMX-025

3. Pack grease into the shaded areas shown in the figure.

### STEERING KNUCKLE

#### Removal / Inspection / Installation

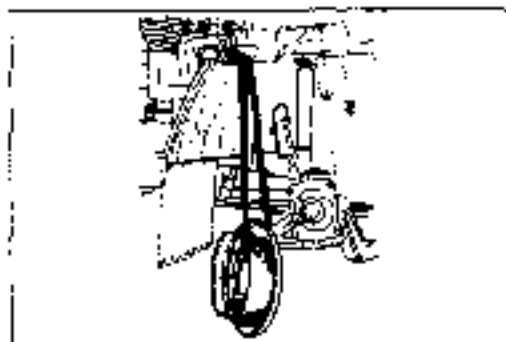
1. Remove the wheel hub assembly. (Refer to page M-6.)
2. Remove in the order shown in the figure, referring to **Removal Note**.
3. Inspect all parts and repair or replace as necessary.
4. Install in the reverse order of removal, referring to **Installation Note**.



New (No. 42, 48-50)

9TR0401-008

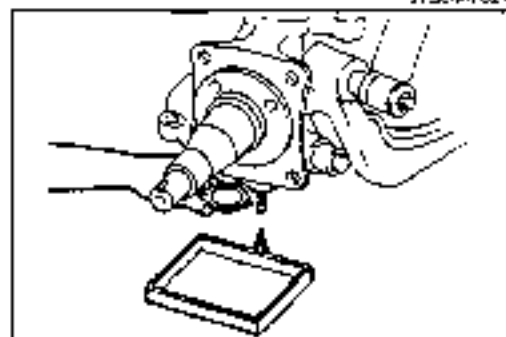
- |                            |           |                                 |           |
|----------------------------|-----------|---------------------------------|-----------|
| 1. Brake backing plate     |           | 6. Lock pin                     |           |
| Removal Note.....          | page M-11 | Removal Note.....               | page M-11 |
| Service.....               | Section P | 7. Kingpin                      |           |
| 2. Tie-rod ball joint      |           | Removal Note.....               | page M-11 |
| Service.....               | Section N | Inspection.....                 | page M-11 |
| 3. Drag link ball joint    |           | Installation Note.....          | page M-12 |
| Service.....               | Section N | 8. Kingpin bearing              |           |
| 4. Kingpin oil level gauge |           | Inspect for damage and rotation |           |
| Installation Note.....     | page M-13 | 9. Steering knuckle             |           |
| 5. Kingpin cap             |           | Disassembly / Inspection /      |           |
| Removal Note.....          | page M-11 | Assembly.....                   | page M-13 |
|                            |           | Installation Note.....          | page M-12 |



9TGD0X-027

#### Removal Note Brake backing plate

1. Remove the brake backing plate from the knuckle spindle.
2. Suspend it by a rope to prevent excessive brake hose tension.



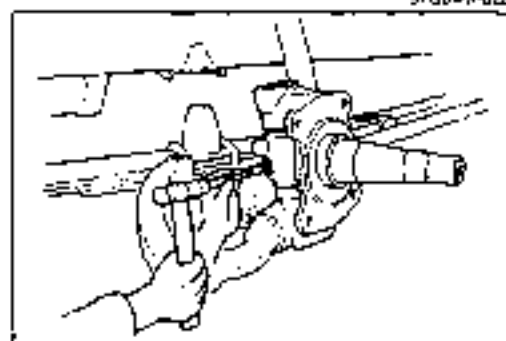
9TGD0X-028

#### Kingpin cap

##### Note

- Prepare a suitable drip pan.

1. Remove the upper and lower kingpin caps.



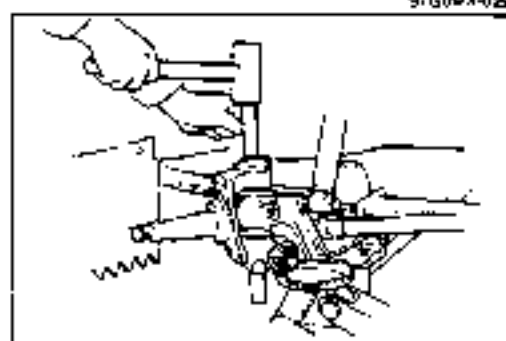
9TGD0X-026

#### Lock pin

##### Caution

- Do not reuse the removed lock pin.

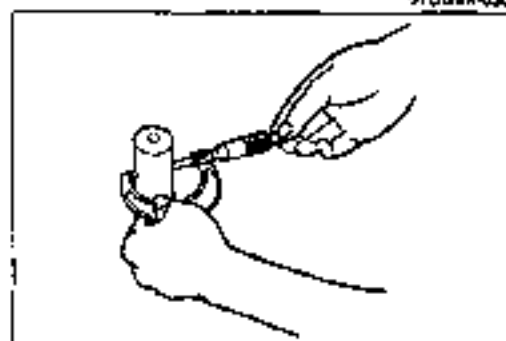
1. Remove the lock pin with a hammer.



9TGD0X-030

#### Kingpin

1. Remove the kingpin with a brass bar and a hammer.



9TGD0X-031

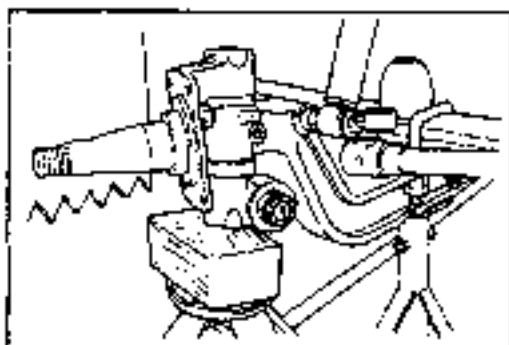
#### Inspection

##### Kingpin bushing and kingpin clearance

1. Measure the kingpin bushing inner diameter and kingpin outer diameter with a micrometer, then figure out the clearance between them.

**Clearance: 0.01—0.04mm (0.0004—0.0016 in)**





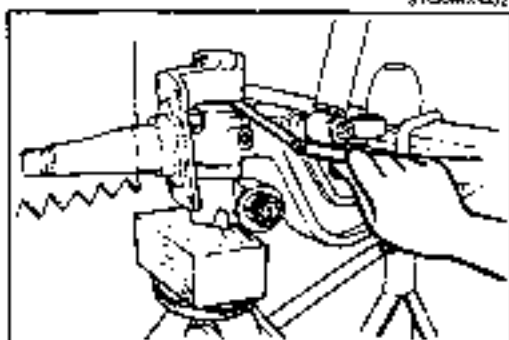
9T60MX-032

### Installation Note Steering knuckle

#### Note

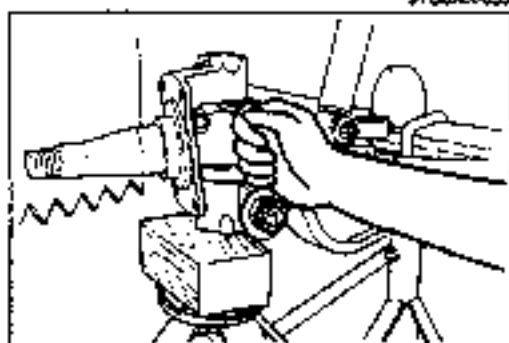
- Install the kingpin bearing with the oil seal face downward.

1. Install the knuckle and kingpin bearing to the front axle.
2. Lightly jack up the steering knuckle.



9T60MX-033

3. Measure clearance between the front axle and the knuckle with a feeler gauge.



9T60MX-034

4. Adjust the clearance to the specification by selecting the proper adjustment shim(s)

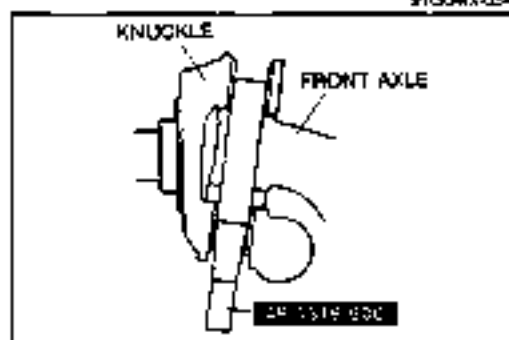
Clearance: 0.20—0.35mm (0.008—0.014 in)

#### Caution

- Use a maximum of three shims.

#### Adjustment shim thickness:

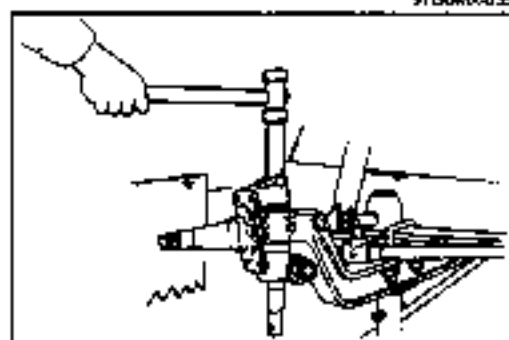
		mm (in)
0.35 (0.014)	0.5 (0.020)	
0.6 (0.024)	0.7 (0.028)	



9T60MX-035

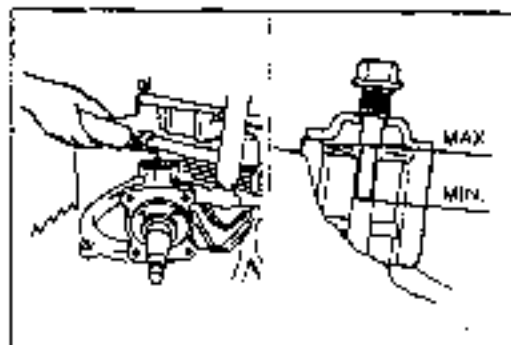
### Kingpin

1. Align the front axle and the knuckle with a SST.



9T60MX-036

2. Index the kingpin lock groove to the hole in the front axle, and install the kingpin with a plastic hammer.



97GDMX 037

## Kingpin oil level gauge

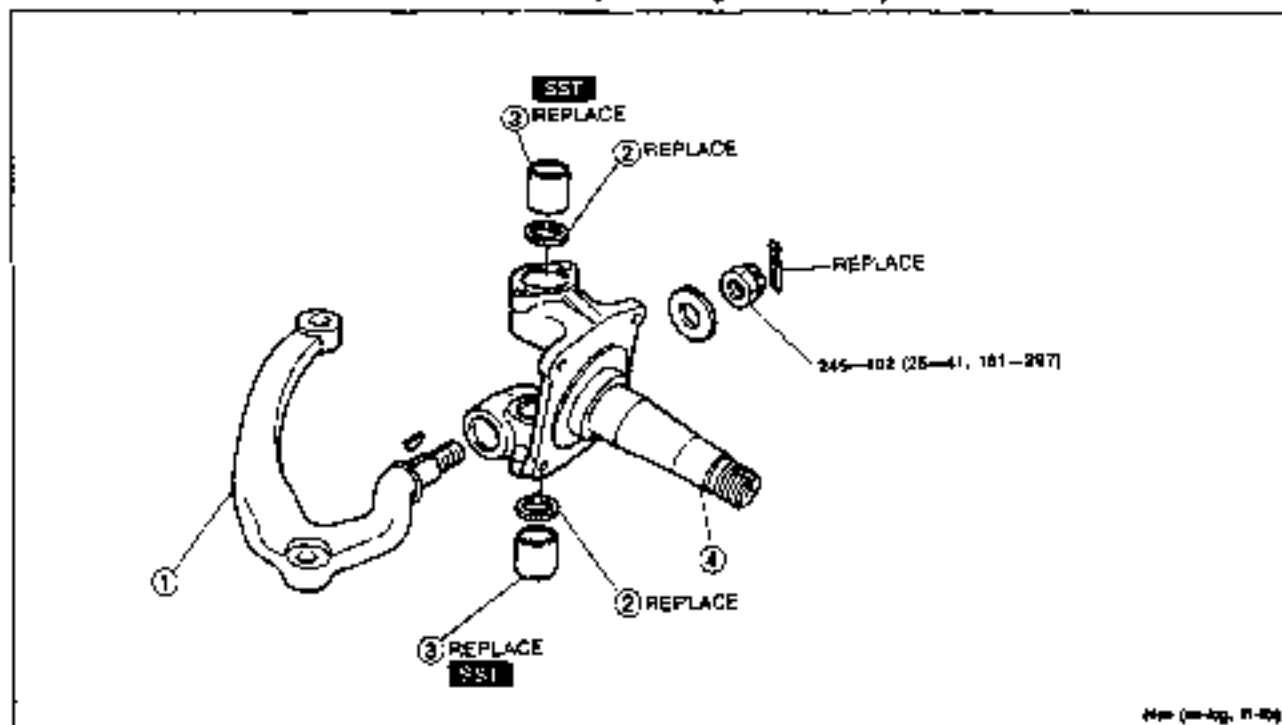
## Caution

- Do not screw in the level gauge when measuring the oil level.

- Pour in kingpin oil to the level marked on the level gauge as shown.

## Disassembly / Inspection / Assembly

- Disassemble in the order shown in the figure, referring to **Disassembly Note**.
- Inspect all parts and repair or replace as necessary.
- Assemble in the reverse order of disassembly, referring to **Assembly Note**.

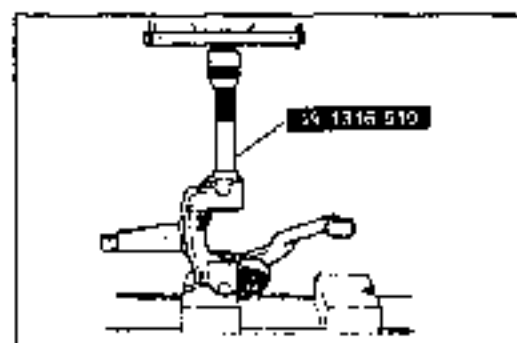


97FDMX-C10

97FDMX-C10

- Knuckle arm  
Inspect for damage and cracking
- O-ring

- Kingpin bushing  
Disassembly Note..... page M-13  
Assembly Note..... page M-14
- Steering knuckle  
Inspect for damage and cracking

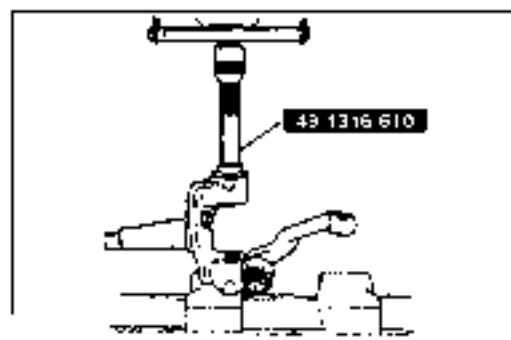


97GDMX 335

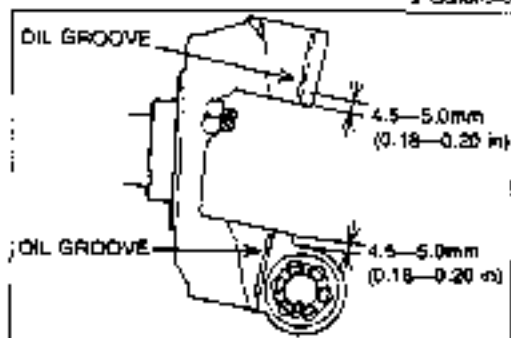
## Disassembly Note

## Kingpin bushing

- Remove the kingpin bushing with the SST and a press.



9TGMAR-040



9TGMAR-041

**Assembly Note**  
**Kingpin bushing****Caution**


- Install the kingpin bushing with the oil groove toward the front axle.

1. Install the kingpin bushing with the **SST** and a press.
2. When installing, allow **4.5—5.0mm (0.18—0.20 in)** clearance between the end of the bushing and the matching surface of the knuckle.

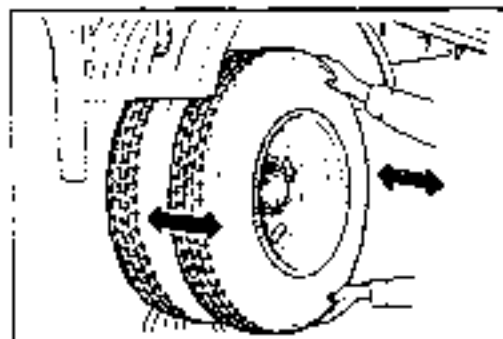
REAR AXLE

PREPARATION

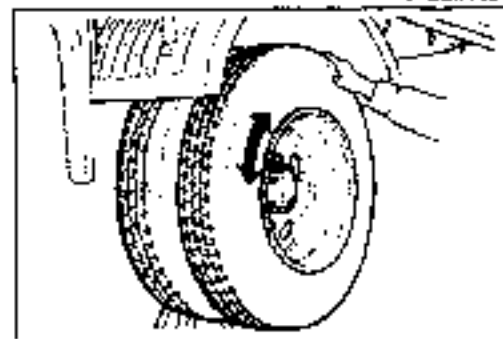
SST

<p>49 W033 10E</p> <p>Wrench, locknut</p> 	<p>For removal and installation of locknut</p>
---	--

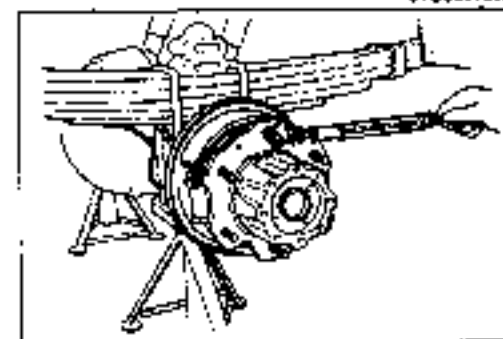
9TGMK-086



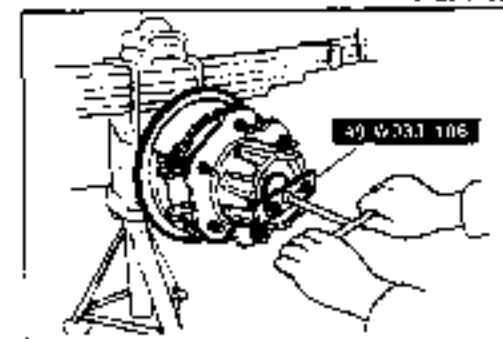
9TGMK-087



9TGMK-088



9TGMK-089



9TGMK-090

REAR AXLE  
Preinspection

Wheel bearing play

1. Push and pull the tire in the axial direction to check the wheel bearing play.
2. Check that there is no abnormal noise and that the tire rotates smoothly when rotated by hand.
3. Adjust the wheel bearing preload as necessary.

Preload Adjustment

1. Remove the wheel and tire assembly.
2. Remove the brake drum.
3. Remove the axle shaft.
4. Remove the set plate.
5. Loosen the hub nut until it can be turned by hand.
6. Tighten the locknut with the SST until the preload is as specified.

**Preload: Frictional force plus**  
11–30 N (1.1–3.0 kg, 2.4–6.6 lb)

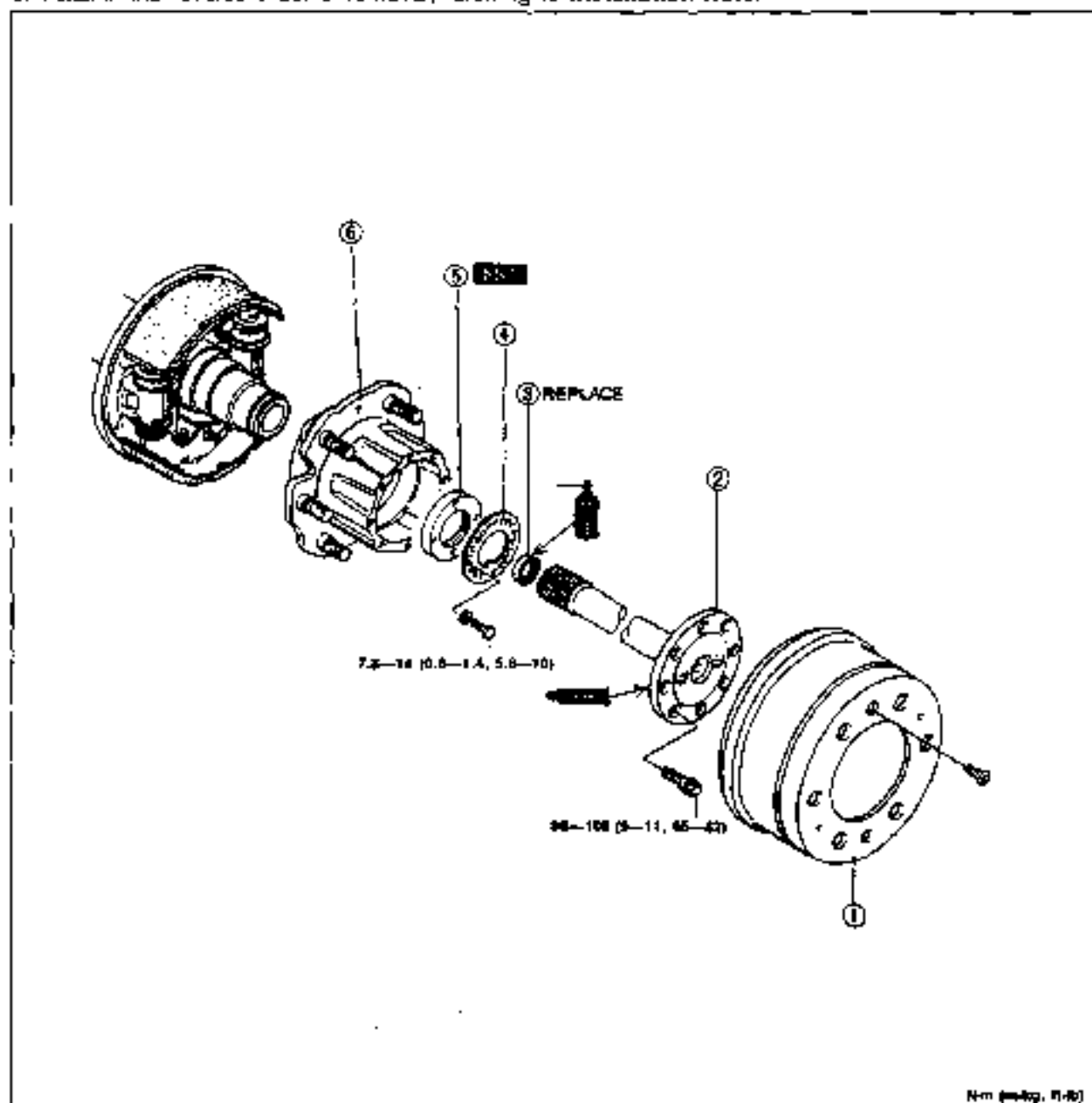
7. Install in the reverse order of removal.

## Removal / Inspection / Installation

## Caution

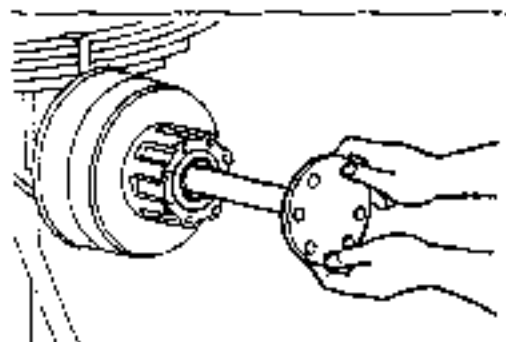
- Do not remove the oil seal if not necessary.

1. Remove in the order shown in the figure, referring to **Removal Note**.
2. Inspect all parts and repair or replace as necessary.
3. Install in the reverse order of removal, referring to **Installation Note**.



- |                        |           |
|------------------------|-----------|
| 1. Brake drum          |           |
| Removal Note.....      | page M-17 |
| 2. Axle shaft          |           |
| Removal Note.....      | page M-17 |
| 3. Oil seal            |           |
| Installation Note..... | page M-18 |
| 4. Set plate           |           |

- |                               |           |
|-------------------------------|-----------|
| 5. Locknut                    |           |
| 6. Wheel hub                  |           |
| Removal Note.....             | page M-17 |
| Inspect for damage and cracks |           |
| Disassembly / Inspection /    |           |
| Assembly.....                 | page M-18 |
| Installation Note.....        | page M-17 |



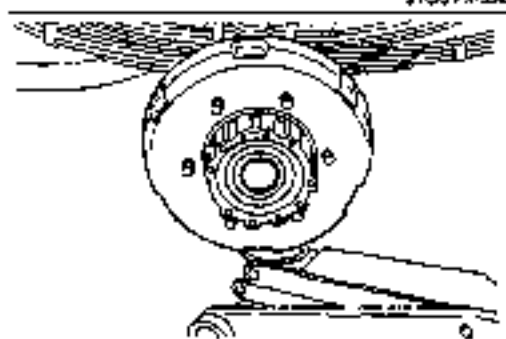
9TGMX-092

**Removal Note**  
**Axle shaft**

**Caution**

- Do not damage the axle housing oil seal.

1. Pull out the axle shaft straight out of the axle housing.



9TGMX-093

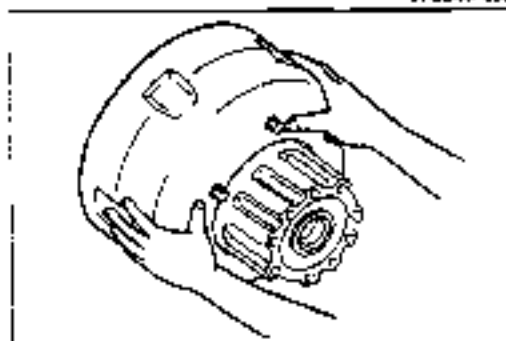
**Brake drum**

1. Support the brake drum with a jack

**Caution**

- Do not damage the oil seal.

2. Remove the brake drum



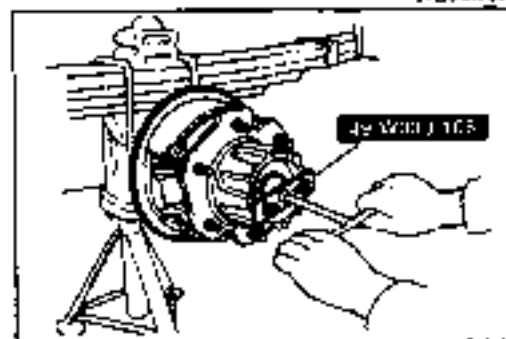
9TGMX-094

**Wheel hub**

**Caution**

- Do not drop the bearing inner race.

1. Remove the wheel hub from the axle housing.

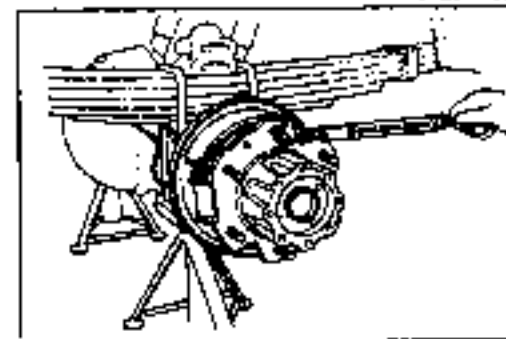


9TGMX-095

**Installation Note**

**Wheel hub**

1. Tighten the locknut with the **SST**
2. Turn the wheel hub several times to seat the bearings.
3. Loosen the locknut until it can be turned by hand.

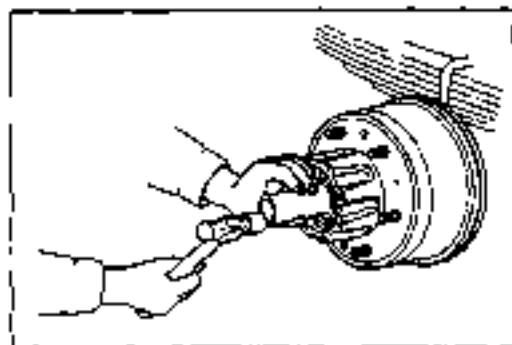


9TGMX-096

4. Attach a pull scale to a wheel hub bolt, and measure the frictional force while turning. Tighten the bearing locknut with the **SST** until the preload is as specified.

**Preload: Frictional force plus**

**11–30 N (1.1–3.0 kg, 2.4–6.6 lb)**



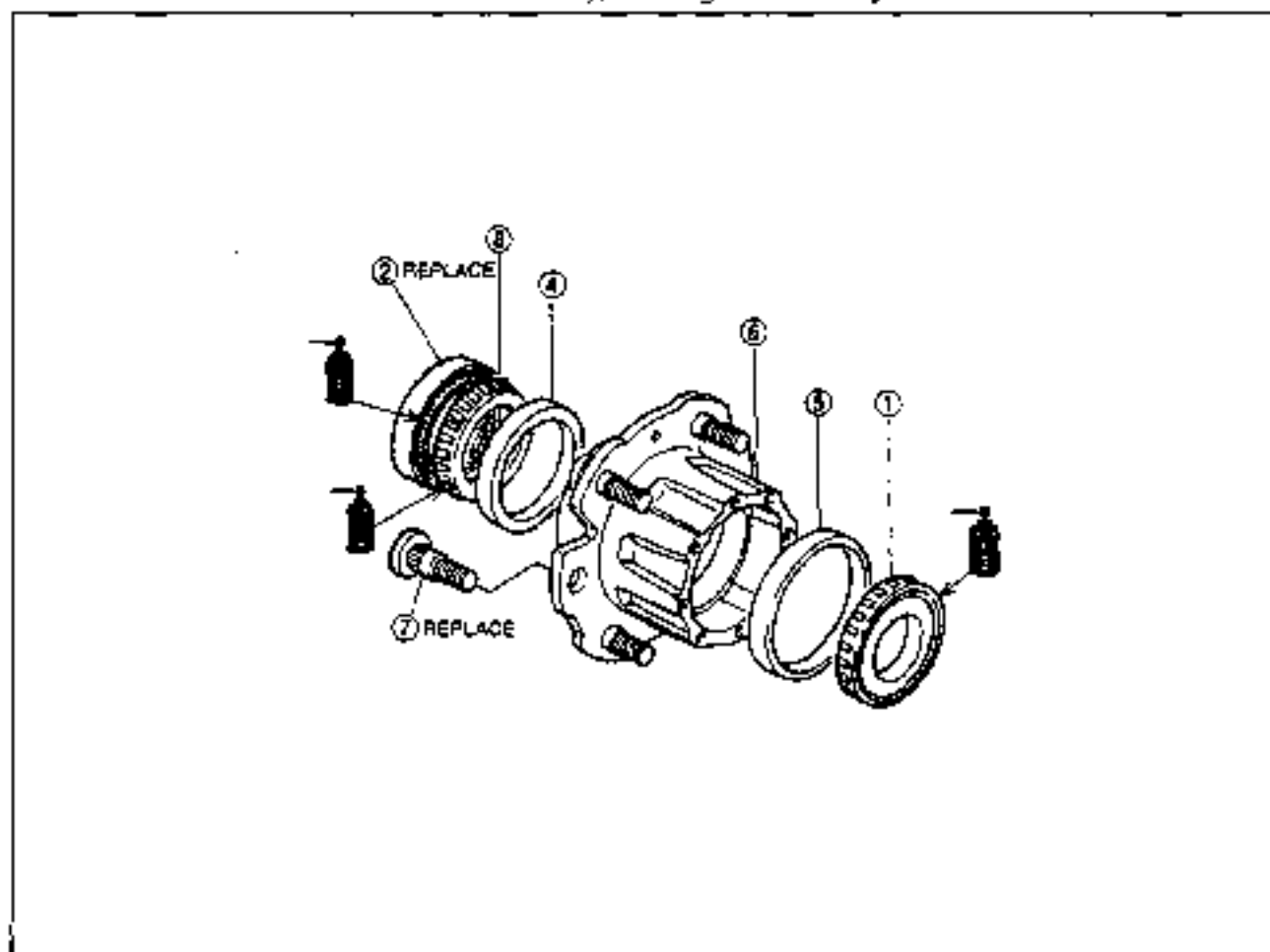
9T90M1-087

**Oil seal**

1. Apply grease to the lip of the new oil seal.
2. Install the oil seal into the axle housing with a suitable pipe and a hammer.

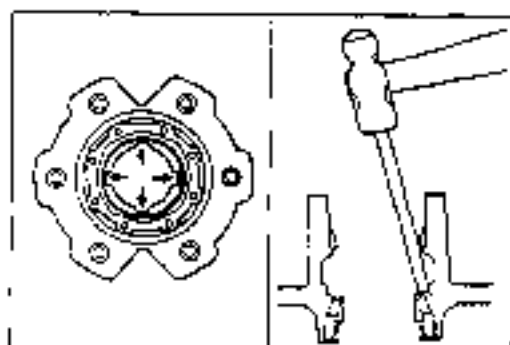
**Disassembly / Inspection / Assembly**

1. Disassemble in the order shown in the figure, referring to **Disassembly Note**.
2. Inspect all parts and repair or replace as necessary.
3. Assemble in the reverse order of disassembly, referring to **Assembly Note**



9T90M1-012

- |  |  |
|--|--|
| 1. Bearing inner race (Outer)<br>Inspect for damage and rotation                                   | 5. Bearing outer race (Outer)<br>Inspect for damage or wear<br>Assembly Note ..... page M-19 |
| 2. Oil seal<br>Assembly Note ..... page M-19   | 6. Wheel hub   |
| 3. Bearing inner race (Inner)<br>Inspect for damage and rotation                                   | 7. Hub bolt<br>Disassembly Note ..... page M-19  |
| 4. Bearing outer race (Inner)<br>Disassembly Note ..... page M-19<br>Assembly Note ..... page M-19 |  |



9TGMK-096

**Disassembly Note**  
**Bearing outer race (inner)**

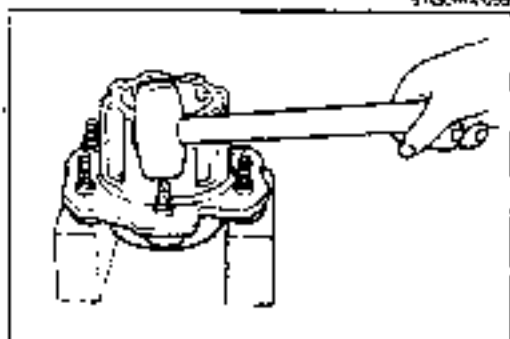
- Caution**
- Replace the inner and outer race as a set.
  - Do not reuse the removed oil seal.

- Note**
- When removing the bearing outer race (inner), the inner race and oil seal will also come out.

- 1 Tap the bearing outer race at the notches in the wheel hub (shown by arrows) with a brass bar and a hammer.

**Hub bolt**

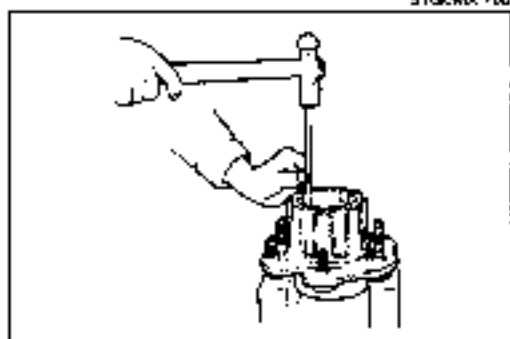
- 1 Remove the hub bolts with a brass hammer.



9TGMK-100

**Assembly Note**  
**Bearing outer race**

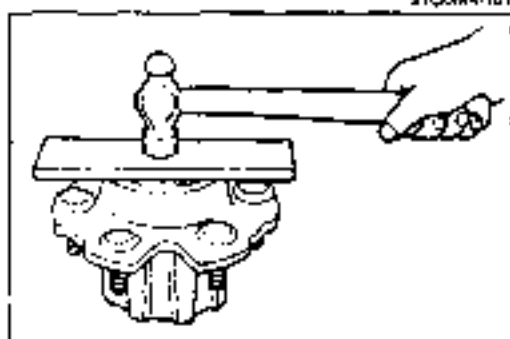
- 1 Apply grease to the new bearing outer race.
- 2 Install the outer race with a brass bar and a hammer



9TGMK-101

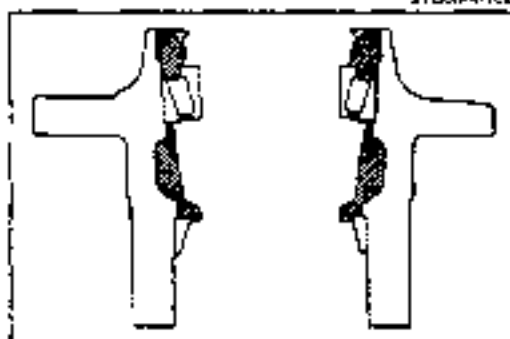
**Oil seal**

- 1 Apply grease to the lip of the new oil seal.
- 2 Drive the oil seal into the wheel hub with a suitable plate and a hammer.



9TGMK-102

- 3 Pack grease into the shaded areas shown in the figure.



9TGMK-103








## DIFFERENTIAL









## PREPARATION

## SST

## For W and Y type



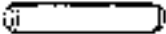



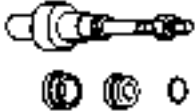





<p>49 0107 660A Engine stand</p> 	<p>For installation of differential carrier</p>	<p>49 M026 5B1 Hanger, diff. carrier</p> 	<p>For support of differential carrier</p>
<p>49 S120 710 Holder, coupling flange</p> 	<p>For removal and installation of locknut</p>	<p>49 6B39 425C Puller set, bearing</p> 	<p>For removal of companion flange and bearing</p>
<p>49 0258 720 Wrench, diff. side bearing adjusting nut</p> 	<p>For adjustment of drive pinion and ring gear backlash</p>	91Gomx-112	

## For W type

<p>49 U027 00B Installer, oil seal</p> 	<p>For installation of side bearing inner race</p>	<p>49 F401 330B Installer set, bearing</p> 	<p>For installation of rear bearing inner race</p>
<p>49 F401 331 Body (Part of 49 F401 330B)</p> 	<p>For installation of rear bearing inner race</p>	<p>49 F401 336B Attachment B (Part of 49 F401 330B)</p> 	<p>For installation of pilot bearing inner race</p>
<p>49 F027 0A1 Installer set, bearing</p> 	<p>For installation of front bearing outer race</p>	<p>49 F027 007 Attachment for bearing #72 (Part of 49 F027 0A1)</p> 	<p>For installation of front bearing outer race</p>
<p>49 W033 1A0 Installer set, bearing</p> 	<p>For installation of rear bearing outer race</p>	<p>49 W033 101 Body (Part of 49 W033 1A0)</p> 	<p>For installation of rear bearing outer race</p>





# DIFFERENTIAL









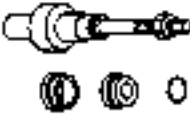




**M**

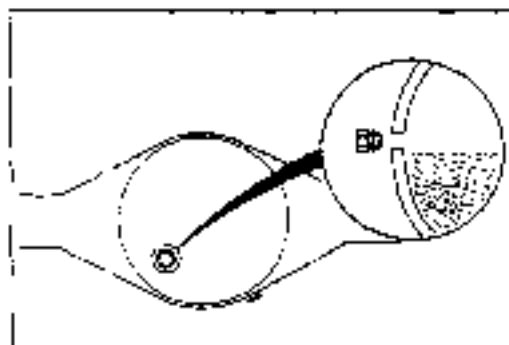
<p>49 W027 04C Installer set, oil seal</p> 	<p>For installation of oil seal</p>	<p>49 W027 001 Body (Part of 49 W027 04C)</p> 	<p>For installation of oil seal</p>
<p>49 C552 087 Installer camshaft bushing</p> 	<p>For installation of pivot bearing outer race (No stopper)</p>	<p>49 H033 101 Remover, bearing</p> 	<p>For installation of pivot bearing outer race (With stopper)</p>
<p>49 G030 795 Installer, oil seal</p> 	<p>For installation of rear bearing outer race</p>	<p>49 G030 797 Handle (Part of 49 G030 795)</p> 	<p>For installation of rear bearing outer race</p>
<p>49 1363 565 Pinion model</p> 	<p>For measurement of pinion height</p>	<p>49 0727 570 Gauge body, pinion height</p> 	<p>For measurement of pinion height</p>
<p>49 F027 04D Gauge set, pinion height adjusting</p> 	<p>For measurement of pinion height</p>	<p>49 0305 555 Gauge block (Part of 49 F027 04C)</p> 	<p>For measurement of pinion height</p>
<p>49 W027 004 Gauge block</p> 	<p>For measurement of pinion height</p>	<p>49 0710 520 Pulver bearing</p> 	<p>For removal of pivot bearing inner race</p>

97G000-113

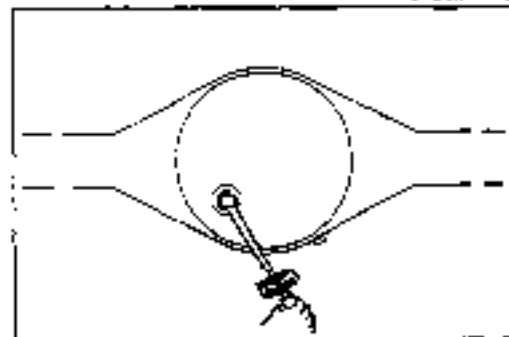
## For V type

<p>49 S231 625 Puller &amp; installer set, lower arm bushing</p> 	<p>For installation of side bearing inner race</p>	<p>49 S231 626 Support block (Part of 49 S231 625)</p> 	<p>For installation of side bearing inner race</p>
<p>49 W027 003 Installer, bearing</p> 	<p>For installation of rear bearing inner race</p>	<p>49 W033 105 Installer, oil seal</p> 	<p>For installation of rear bearing outer race</p>

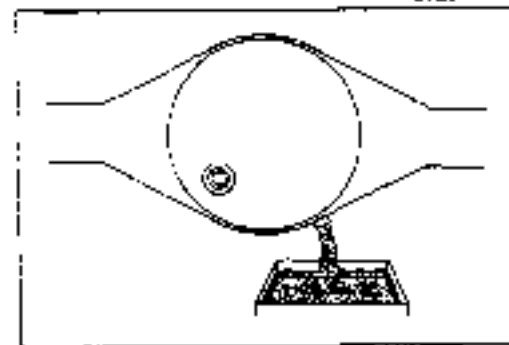
<p>49 W033 1A0 Installer set, bearing</p> 	<p>For installation of front bearing outer race</p>	<p>49 W033 101 Body (Part of 49 W033 1A0)</p> 	<p>For installation of front bearing outer race</p>
<p>49 F401 330B Installer set, bearing</p> 	<p>For installation of pivot bearing</p>	<p>49 F401 335A Attachment A (Part of 49 F401 330B)</p> 	<p>For installation of pivot bearing inner race</p>
<p>49 F401 337A Attachment C (Part of 49 F401 330B)</p> 	<p>For installation of pivot bearing outer race</p>	<p>49 G030 107 Installer, dust cover</p> 	<p>For installation of oil seal</p>
<p>49 G030 795 Installer, oil seal</p> 	<p>For installation of rear bearing outer race</p>	<p>49 G030 797 Handle (Part of 49 G030 795)</p> 	<p>For installation of rear bearing outer race</p>
<p>49 1383 585 Pinion model</p> 	<p>For measurement of pinion height</p>	<p>49 0727 570 Gauge body, pinion height</p> 	<p>For measurement of pinion height</p>
<p>49 1316 555 Gauge block</p> 	<p>For measurement of pinion height</p>	<p>49 Y001 555 Gauge block</p> 	<p>For measurement of pinion height</p>
<p>47 0710 520 Puller bearing</p> 	<p>For removal of pivot bearing inner race</p>	<p>910945-114</p>	



9TGMX-115



9TGMX-116



9TGMX-117

**DIFFERENTIAL OIL****Inspection**

1. Remove the oil filler plug.
2. Verify that the oil level is at the bottom of the plug hole.
3. If low, add the specified oil.

**Specified oil****Type:**

Above  $-18^{\circ}\text{C}$  ( $0^{\circ}\text{F}$ ): GL-5 SAE 90

Below  $-18^{\circ}\text{C}$  ( $0^{\circ}\text{F}$ ): GL-5 SAE 80W

4. Install a new washer and tighten the oil filler plug.

**Tightening torque:**

39—54 Nm (4.0—5.5 m·kg, 29—40 ft·lb)

**Replacement**

1. Remove the magnetic plug and drain the differential oil.
2. Clean the magnetic plug.
3. Install a new washer and tighten the magnetic plug.

**Tightening torque:**

39—54 Nm (4.0—5.5 m·kg, 29—40 ft·lb)

4. Remove the oil filler plug and fill the differential with the specified oil.

**Specified oil****Type:**

Above  $-18^{\circ}\text{C}$  ( $0^{\circ}\text{F}$ ): GL-5 SAE 90

Below  $-18^{\circ}\text{C}$  ( $0^{\circ}\text{F}$ ): GL-5 SAE 80W

**Capacity:**

W type: 2.6 liters (2.7 US qt, 2.3 imp qt)

Y type: 3.6 liters (3.8 US qt, 3.2 imp qt)

5. Check the oil level.
6. Install a new washer and tighten the oil filler plug.

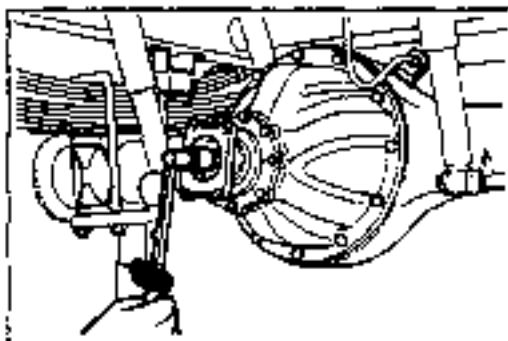
**Tightening torque:**

39—54 Nm (4.0—5.5 m·kg, 29—40 ft·lb)

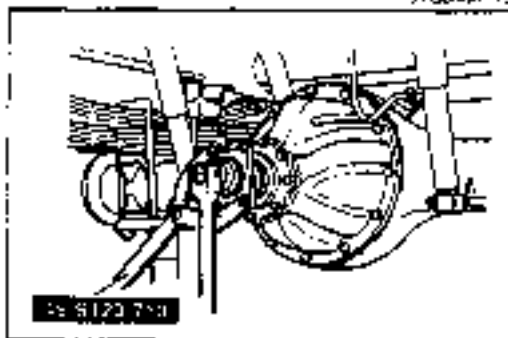
9TGMX-013

# M

## DIFFERENTIAL

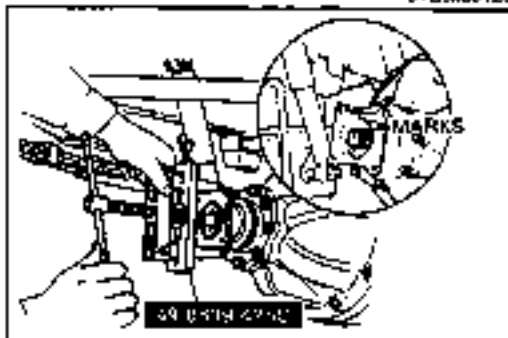


9TGMX-119



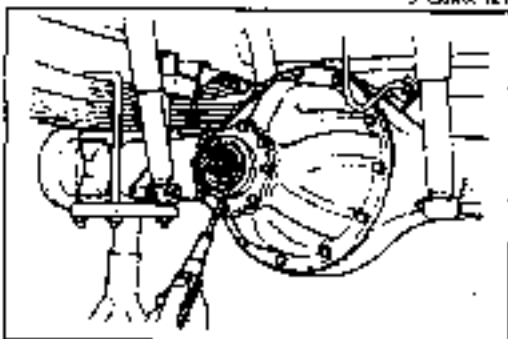
9TGMX-120

9TGMX-120

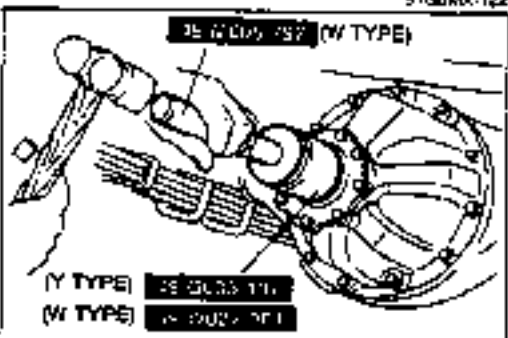


9TGMX-121

9TGMX-121



9TGMX-122



(Y TYPE) 9TGMX-119  
(W TYPE) 9TGMX-121

9TGMX-123

### OIL SEAL Replacement

1. Remove the propeller shaft (Refer to Section L.)
2. Measure the rotation starting torque of the drive pinion (within the range of the drive pinion to ring gear backlash).

#### Note

- Make a notation of this torque for proper reassembly.

3. Hold the companion flange with the **SST** and remove the locknut.

#### Note

- Mark the companion flange and the drive pinion for proper reassembly.

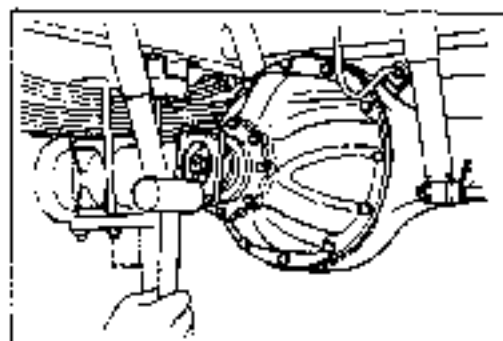
4. Remove the companion flange with the **SST**.

5. Pry out the oil seal.

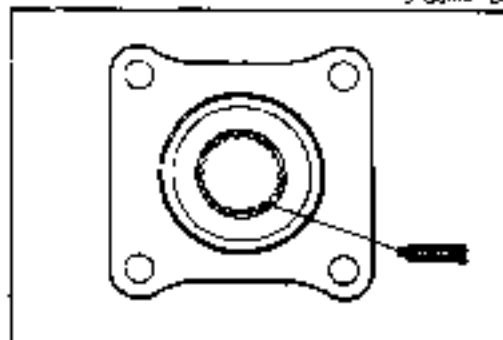
#### Note

- Apply a thin coat of differential oil to the lip of the oil seal.

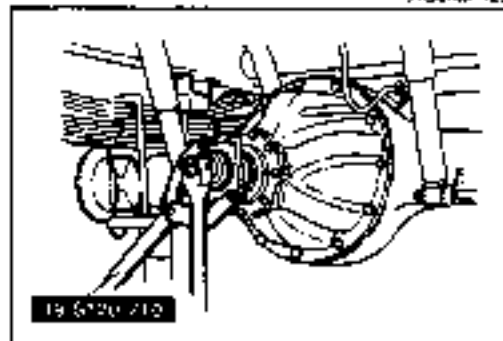
6. Install the new oil seal with the **SST**



9TGMX-124



9TGMX-125



9TGMX-126

7. Install the companion flange with a brass hammer.

B. Apply 0.5cc of sealant around the companion flange spines

#### Note

	W type	Y type
Tightening torque	235—392 Nm (24—40 T·kg, 174—289 ft·lb)	275—392 Nm (28—40 m·kg, 205—289 ft·lb)
Drive pinion preload	0.8—1.6 Nm (8—16 cm·kg, 7—14 in·lb)	2.5—3.4 Nm (27—35 cm·kg, 23—30 in·lb)

#### Caution

- If the specified preload cannot be obtained, remove the differential and replace the distance piece or adjust the shim thickness and check it again.

8. Hold the companion flange with the SST, and tighten lock nut and new washer until the specified drive pinion preload is obtained.

10. Install the propeller shaft. (Refer to Section L.)

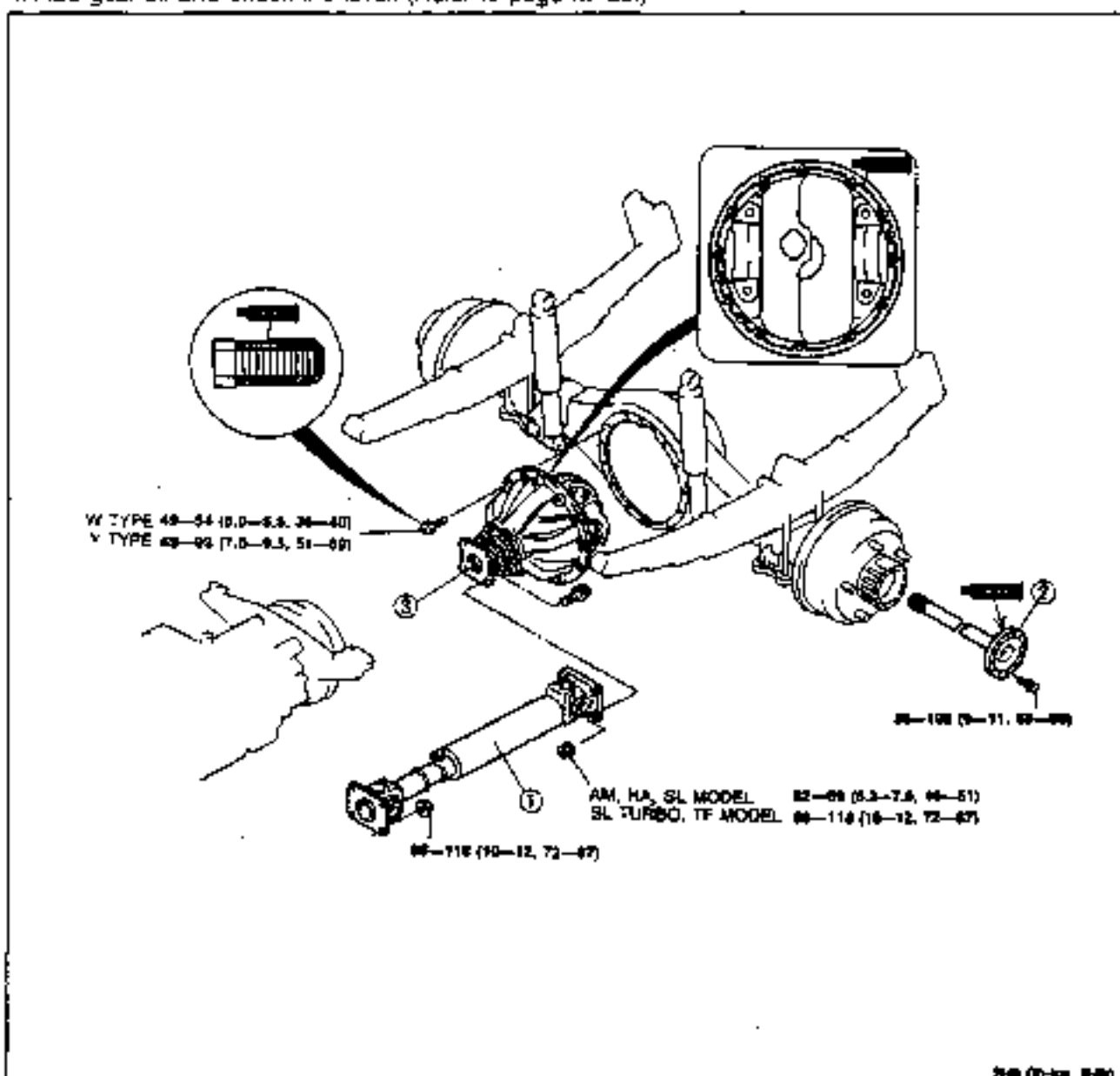
## DIFFERENTIAL

## Removal / Installation

## Caution

- Remove the old sealant before applying new sealant.
- Install the differential carrier within 10 minutes after application of the sealant.
- After installation, let the sealant cure more than 30 minutes before filling the differential with the specified type and quality of oil.

1. Remove the magnetic plug and drain the gear oil.
2. Remove in the order shown in the figure, referring to **Removal Note**.
3. Install in the reverse order of removal, referring to **Installation Note**.
4. Add gear oil and check the level. (Refer to page M-23.)

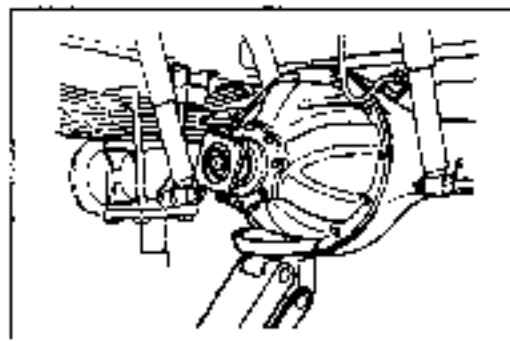


3-68 (2-kg, R-40)

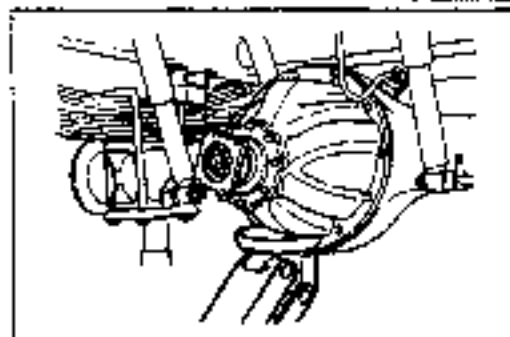
5TF04X 014

- |                    |           |
|--------------------|-----------|
| 1. Propeller shaft |           |
| Service.....       | Section L |
| 2. Rear axle shaft |           |
| Removal Note.....  | page M-17 |

- |                        |           |
|------------------------|-----------|
| 3. Differential        |           |
| Removal Note.....      | page M-27 |
| Overhaul.....          | page M-28 |
| Installation Note..... | page M-27 |



97GMX-129



97GMX-130

**Removal Note**  
**Differential assembly****Note**

- If removal is difficult, tap the differential hb with a brass hammer.

1. Support the differential assembly with a jack during removal

**Installation Note**  
**Differential assembly**

1. Apply gasket to the differential housing mounting surfaces and mounting bolts.
2. Support the differential assembly with a jack during installation.

**Tightening torque:**

W type: 40—54 Nm (5.0—5.5 m-kg, 36—40 ft-lb)

Y type: 69—93 Nm (7.0—9.5 m-kg, 51—69 ft-lb)



# M

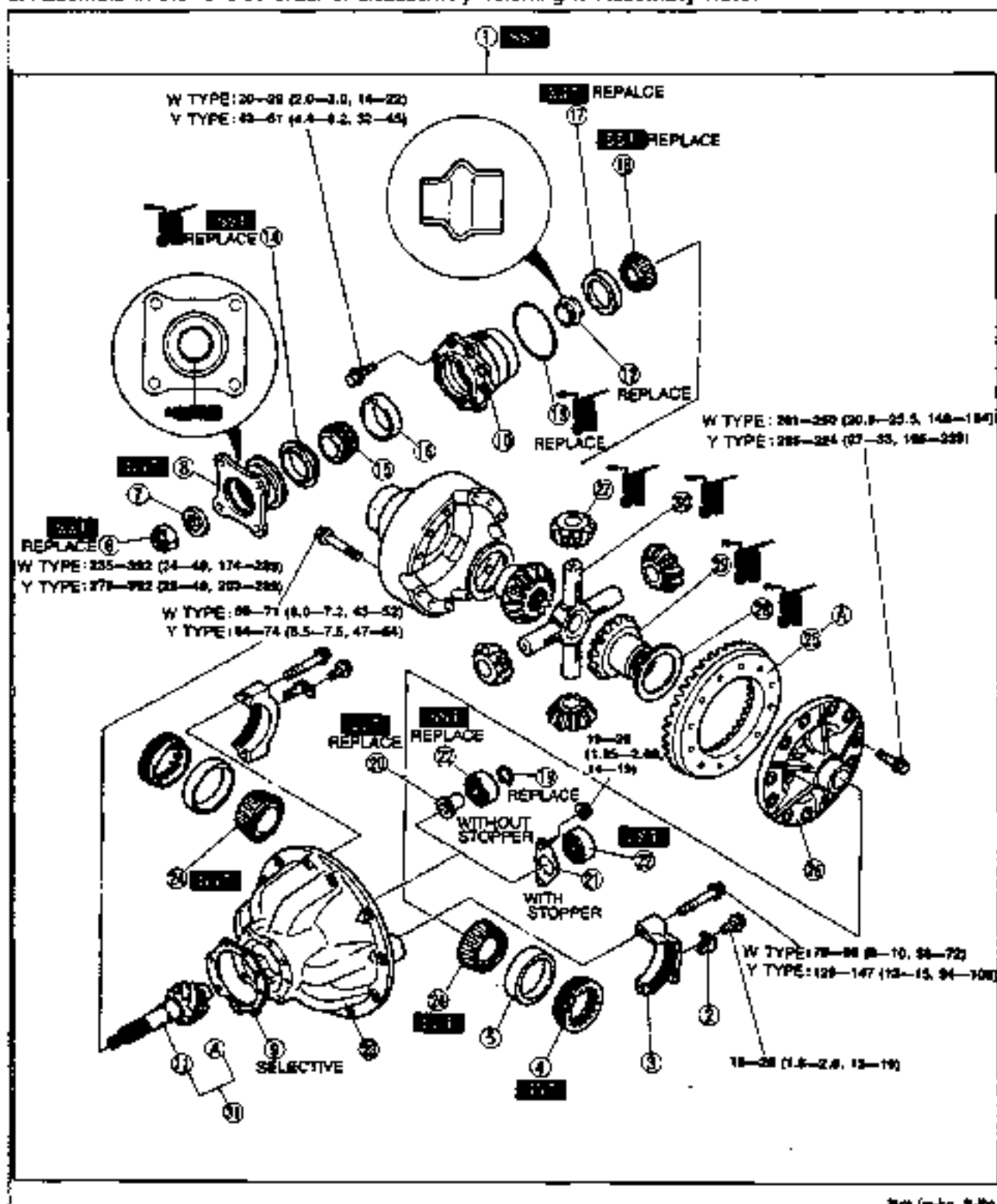
## DIFFERENTIAL

### Overhaul

#### Caution

- Use protective plates in the vise to prevent damaging parts.

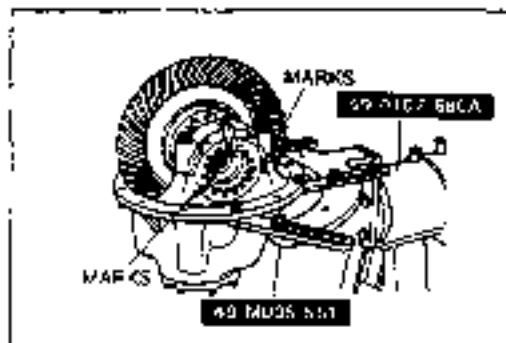
1. Disassemble in the order shown in the figure, referring to **Disassembly Note**.
2. Inspect all parts and repair or replace as necessary.
3. Assemble in the reverse order of disassembly referring to **Assembly Note**.



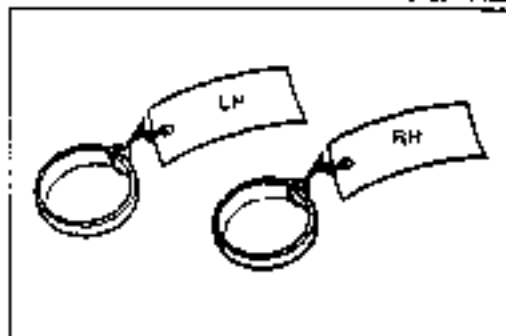
200 (m-kg, 9-10)

PT304X-13

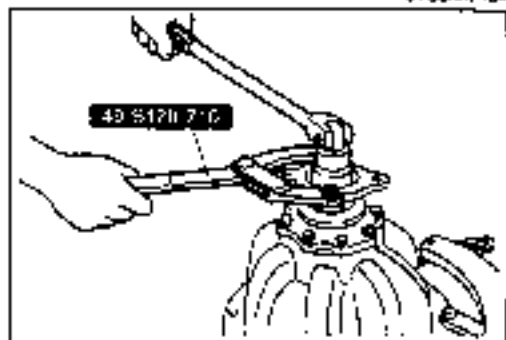
1. Differential gear assembly		17. Rear bearing outer race	
Disassembly Note .....	page M-30	Disassembly Note.....	page M-31
2. Lock plate		Assembly Note .....	page M-32
Assembly Note .....	page M-41	18. Rear bearing inner race	
3. Bearing cap		Disassembly Note .....	page M-31
Disassembly Note .....	page M-30	Assembly Note .....	page M-36
Assembly Note .....	page M-39	19. Snap ring (W type, no stopper)	
4. Adjusting screw		20. Pilot bearing inner race	
Disassembly Note .....	page M-30	(W type, no stopper)	
Assembly Note .....	page M-39	Disassembly Note.....	page M-31
5. Side bearing outer race		Assembly Note .....	page M-36
Disassembly Note .....	page M-30	21. Stopper plate (W type, with stopper)	
6. Locknut (Flange)		22. Pilot bearing outer race	
Disassembly Note .....	page M-30	Disassembly Note.....	page M-32
Assembly Note .....	page M-37	Assembly Note .....	page M-38
7. Washer		23. Differential carrier	
8. Companion flange		24. Side bearing inner race	
Disassembly Note .....	page M-30	Disassembly Note .....	page M-32
Inspect for damage and wear of splines		Inspect for damage and rotation	
Assembly Note .....	page M-37	Assembly Note .....	page M-39
9. Adjustment shim		25. Ring gear	
Assembly Note .....	page M-36	Disassembly Note.....	page M-32
10. Bearing housing		Inspect for damage, wear and chipped teeth	
Disassembly Note.....	page M-30	Assembly Note .....	page M-39
Assembly Note .....	page M-36	26. Gear case	
11. Drive pinion		Disassembly Note.....	page M-32
Disassembly Note .....	page M-31	Assembly Note .....	page M-38
Inspect for damage and wear of splines		27. Pinion gear	
Inspect for damage, wear and chipped teeth		Inspect for damage, wear and chipped teeth	
12. Collapsible spacer		28. Thrust washer	
13. O-ring		29. Side gear	
14. Oil seal		Inspect for damage, wear and chipped teeth	
Assembly Note .....	page M-37	30. Pinion shaft	
15. Front bearing inner race		31. Final gear set	
Inspect for damage and rotation			
16. Front bearing outer race			
Disassembly Note .....	page M-31		
Assembly Note .....	page M-32		



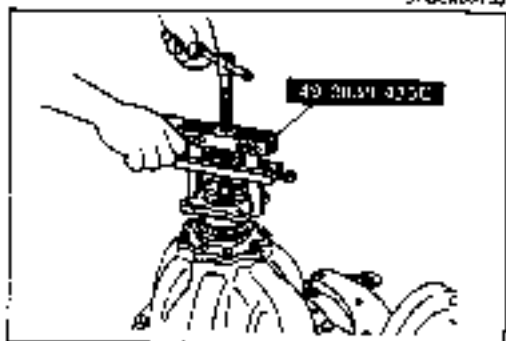
9TGMX-133



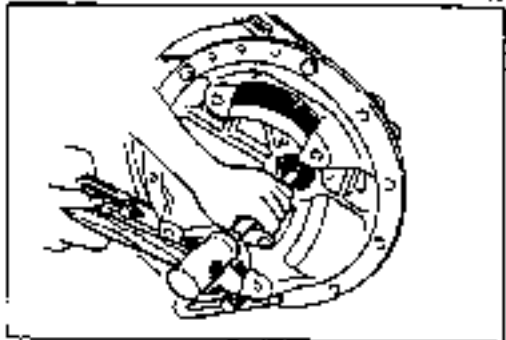
9TGMX-134



9TGMX-135



9TGMX-136



9TGMX-137

**Disassembly Note****Differential gear assembly**

1. Mount the differential gear assembly on the **SST**.

**Bearing cap**

1. Mark the bearing cap and the carrier for proper reassembly.

**Adjusting screw**

1. Mark the adjusting screw and the carrier for proper reassembly.

**Side bearing outer race****Note**

- Identify the left and right side bearing outer races for proper reassembly.

1. Remove the side bearing outer races.

**Locknut**

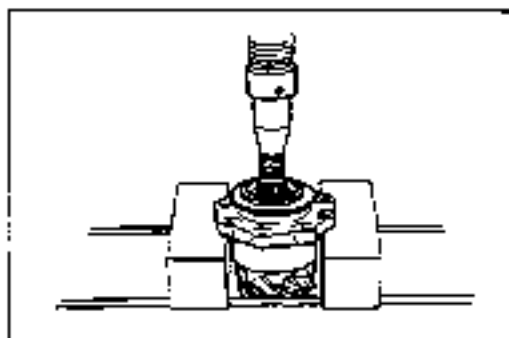
1. Hold the companion flange with the **SST**, and remove the locknut.

**Companion flange**

1. Pull the companion flange off with the **SST**.

**Bearing housing**

1. Drive the bearing housing from the carrier by tapping the drive pinion with a brass bar and a hammer.

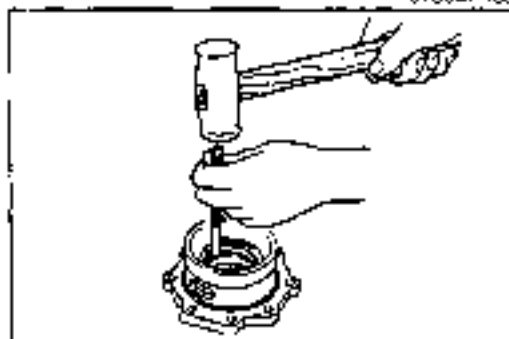


9TGMX-138

**Drive pinion****Note**

- Hold the drive pinion with a hand so that it does not fall.

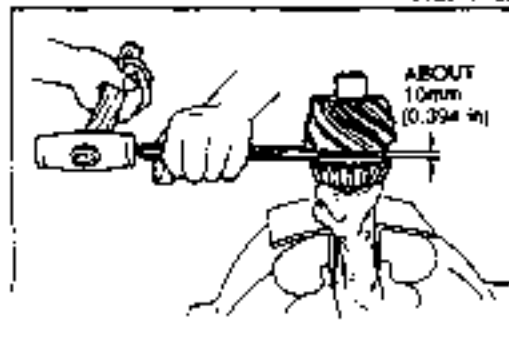
1. Push the drive pinion out of the bearing housing with the SST and press.



9TGMX-139

**Bearing outer race**

1. Remove the front and rear bearing outer races with a brass bar and a hammer.



9TGMX-140

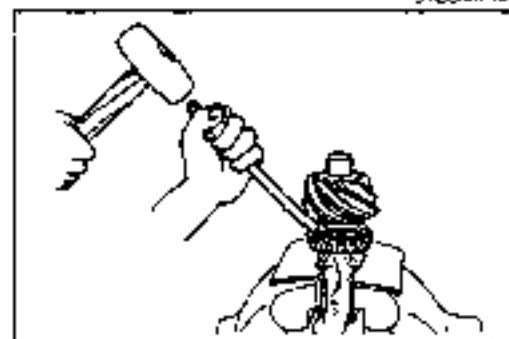
**Rear bearing inner race**

1. Protect the drive pinion with a rag and place it in a vise.

**Caution**

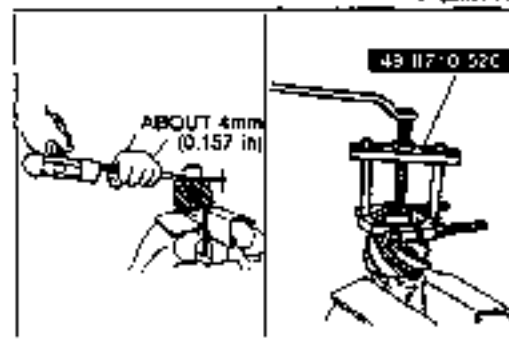
- Do not damage the drive pinion gear with the chisel.

2. Make approx. 10mm (0.39 in) of clearance between the drive pinion gear and the bearing inner race with a chisel. (W type)



9TGMX-141

3. Remove the bearing inner race with a brass bar and a hammer.



9TGMX-142

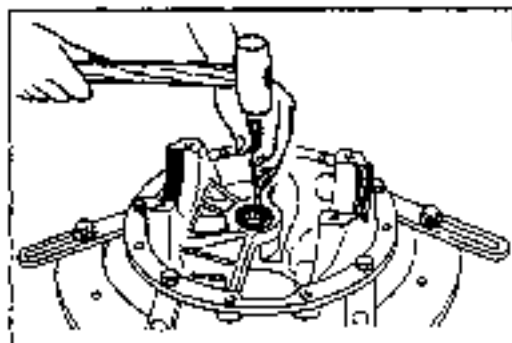
**Pilot bearing inner race (W type, no stopper)**

1. Protect the drive pinion with a rag and place it in a vise.

**Caution**

- Do not damage the drive pinion gear with the chisel.

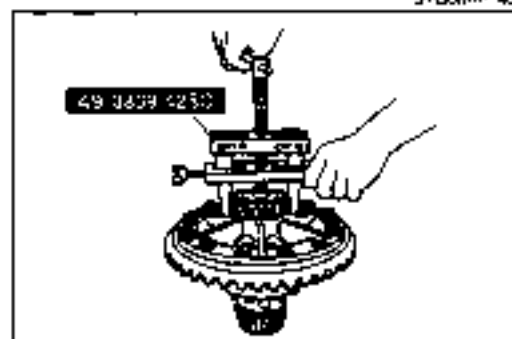
2. Make approx. 4mm (0.16 in) of clearance between the drive pinion and the pilot bearing inner race.
3. Remove the pilot bearing inner race from the drive pinion with the SST.



9TGMX-143

**Pilot bearing outer race**

1. Remove the pilot bearing outer race from the carrier with a brass bar and a hammer.

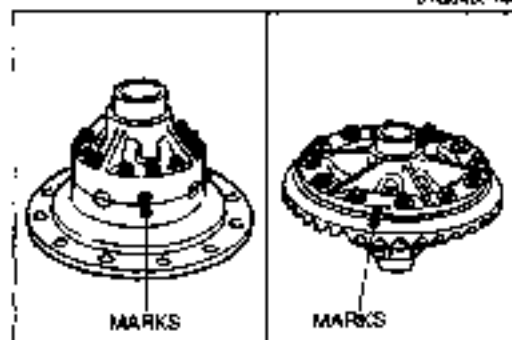


9TGMX-144

**Side bearing inner race****Note**

- Identify the left and right side bearing inner races for proper reassembly.

1. Remove the side bearing inner race from the gear case with the SST.



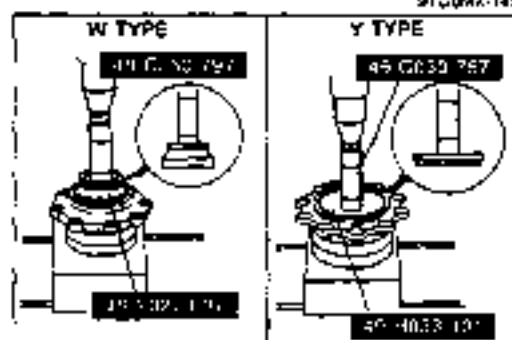
9TGMX-145

**Ring gear**

1. Mark the ring gear and the gear case for proper reassembly.

**Gear case**

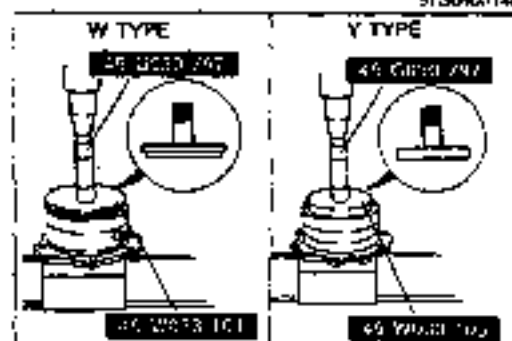
1. Mark the gear case for proper reassembly.



9TGMX-146

**Assembly Note****Front bearing outer race**

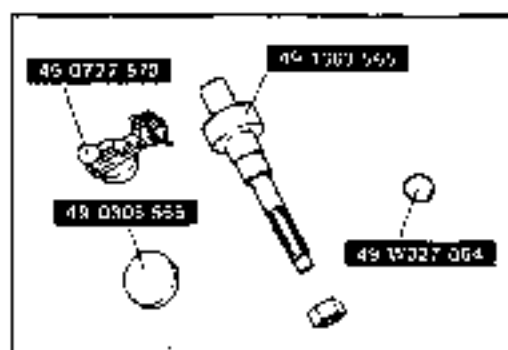
1. Press the front bearing outer race into the bearing housing with the SST and a press.



9TGMX-147

**Rear bearing outer race**

1. Press the new rear bearing outer race into the bearing housing with the SST and a press.

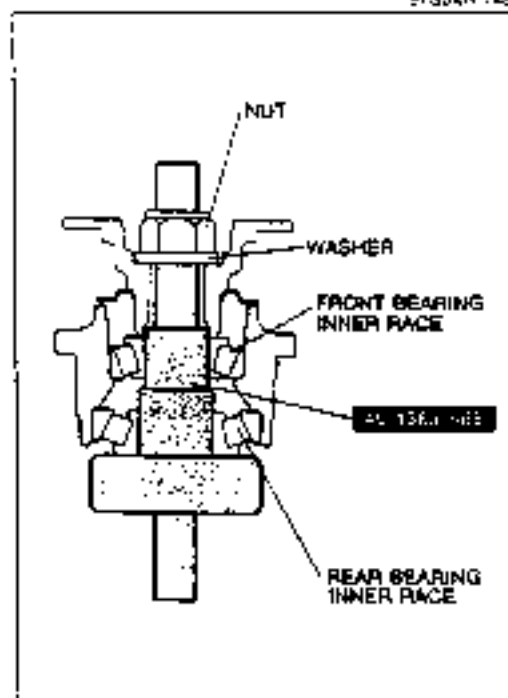


97G0MX-148

**[W type]****Adjustment of pinion height**

1. Adjust the pinion height as follows with the SST

- (1) Slide the new rear bearing inner race onto the **SST**, then install them into the carrier.
- (2) Install the front bearing inner race, companion flange and washer onto the **SST**, and tighten the nut so that the **SST** can still be turned by hand.



97G0MX-149

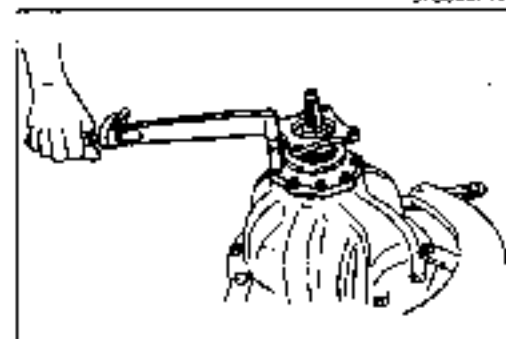
**Caution**

- Do not install the adjustment shim.

- (3) Install the bearing housing assembly into the carrier.

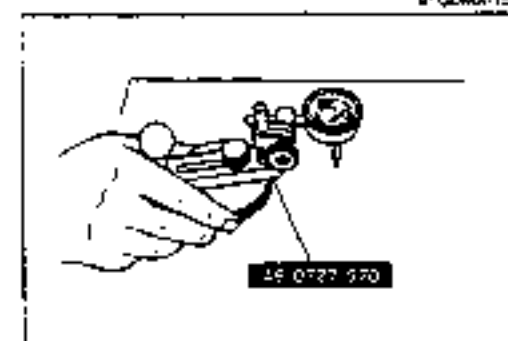
**Tightening torque:**

20—29 Nm (2.0—3.0 m·kg, 15—22 ft·lb)

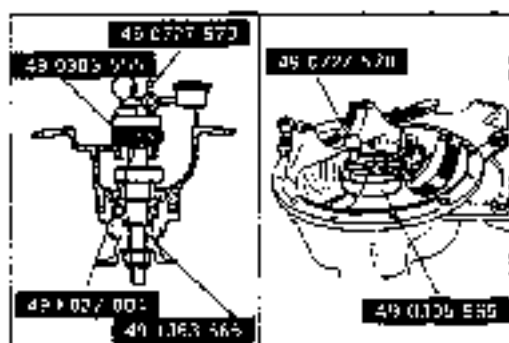


97G0MX-150

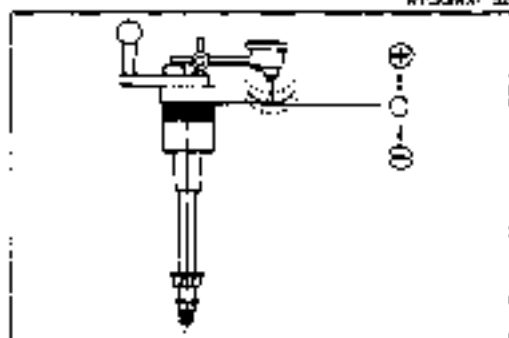
- (4) Place the **SST** on the surface plate and set the dial indicator to zero.



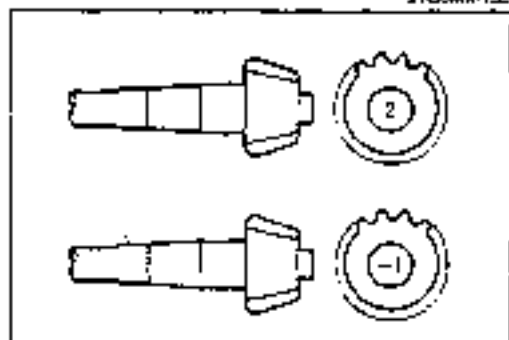
97G0MX-151



8T29MX-152



8T29MX-152



8T29MX-016

- (5) Set the **SST** as shown in the figure.  
 (6) Place the feeler of the dial indicator so that it contacts where the side bearing is installed in the carrier. Measure the lowest position on the left and right sides.

- (7) Add the two (left and right) values obtained in Step 6 and divide the total by 2.  
 Divide the number marked at the end of the drive pinion by 100 (No number indicates zero).  
 Figure the pinion height adjustment value.

**Drive pinion end mark**

- 2: +0.02mm (0.0008 in)  
 -1: -0.01mm (-0.0004 in)

**Example**

- The two values obtained in Step 6 are 0.18mm (0.007 in) and 0.26mm (0.010 in) and the drive pinion end mark is 2.

$$\frac{0.18 + 0.26}{2} - \frac{2}{100} = 0.20$$

$$\left( \frac{0.007 + 0.010}{2} - 0.0008 = 0.005 \right)$$

The drive pinion adjustment value is 0.20mm (0.005 in).

- Select the proper adjustment shim and install them between the bearing housing and the carrier. (Refer to page M-38.)

**Note**

- Select adjustment shims within  $0 \pm 0.03\text{mm}$  ( $0 \pm 0.001$  in) of the specified thickness.
- Use a maximum of five shims.

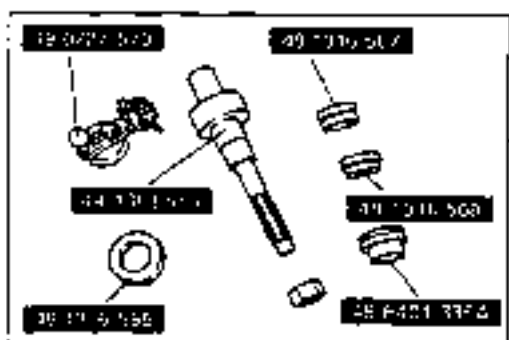
**Adjustment shim thickness:**

mm (in)

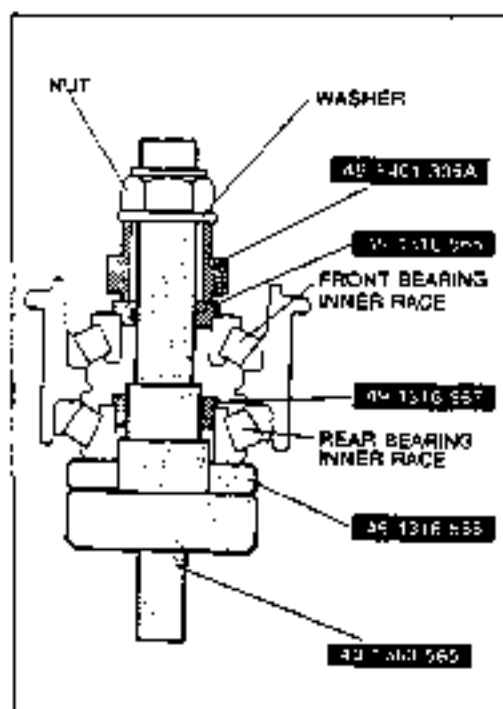
0.1 (0.004)	0.15 (0.006)
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**[Y type]****Adjustment of pinion height**

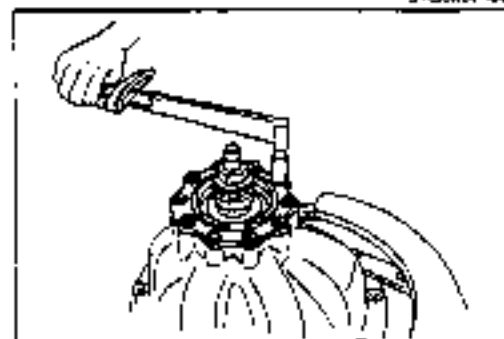
1. Adjust the pinion height as follows with the **SST**.



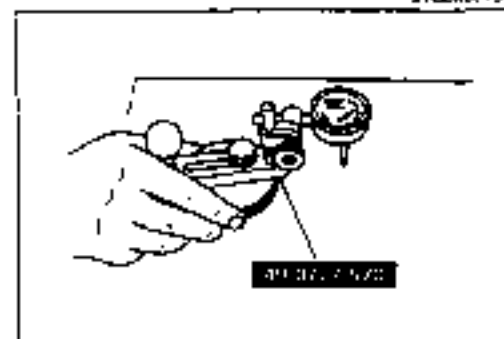
8T29MX-155



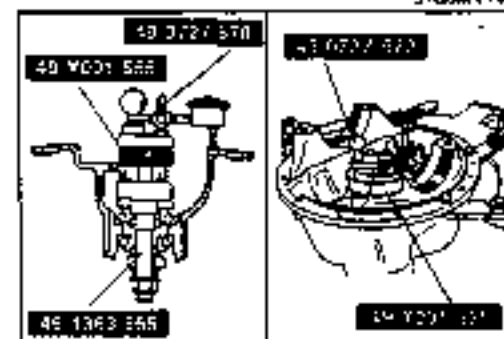
9TGM0X-156



9TGM0X-157



9TGM0X-158



9TGM0X-159

- (1) Slide the **SST** (49 1316 555), new rear bearing inner race, and the **SST** (49 1316 567) onto the **SST** (49 1363 565). Install the assembly into the carrier.
- (2) Install the front bearing inner race, **SST** (49 1316 568), **SST** (49 F401 335A), and the washer onto the **SST** (49 1363 565). Tighten the nut so that the **SST** (49 1363 565) can still be turned by hand.

**Caution**

- Do not install the adjustment shim.

- (3) Install the bearing housing assembly into the carrier.

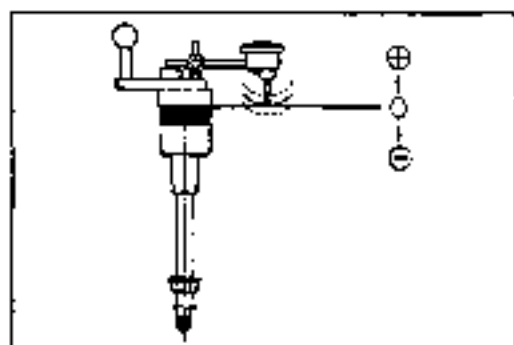
**Tightening torque:**

43—61 N·m (4.4—6.2 m·kg, 32—45 ft·lb)

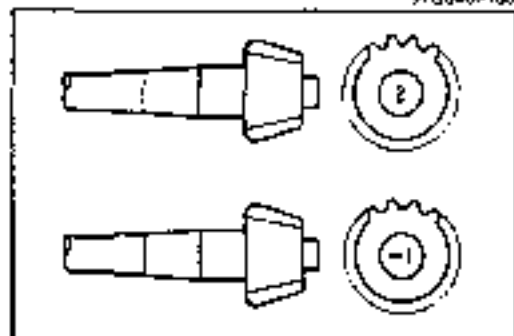
- (4) Place the **SST** on the surface plate and set the dial indicator to zero.

- (5) Set the **SST** as shown in the figure.
- (6) Place the feeler of the dial indicator so that it contacts where the side bearing is installed in the carrier. Measure the lowest position on the left and right sides.





9TGMX-153



9TGMX-157

- (7) Add the two (left and right) values obtained in Step 6 and divide the total by 2.  
Divide the number marked at the end of the drive pinion by 100 (No number indicates zero). Figure the pinion height adjustment value.

**Drive pinion end mark**

2: +0.02mm (0.0008 in)

-1: -0.01mm (-0.0004 in)

**Example**

- The two values obtained in Step 6 are 0.18mm (0.007 in) and 0.26mm (0.010 in) and the drive pinion end mark is 2.

$$\frac{0.18 + 0.26}{2} - \frac{2}{100} = 0.20$$

$$\left( \frac{0.007 + 0.010}{2} - 0.0008 = 0.008 \right)$$

- The drive pinion adjustment value is 0.20mm (0.008 in).
- Select the proper adjustment shims and install them between the bearing housing and the carrier. (Refer to page M-35.)

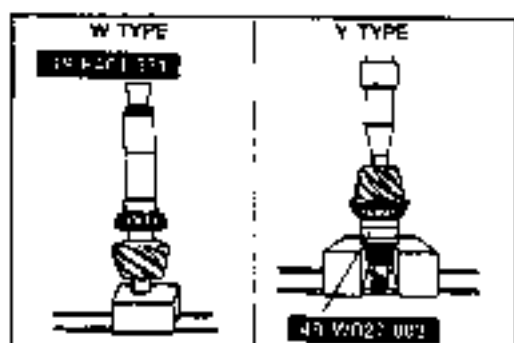
**Note**

- Select adjustment shims within  $0 \pm 0.03\text{mm}$  ( $0 \pm 0.001$  in) of the specified thickness.
- Use a maximum of five shims.

**Adjustment shim thickness:**

mm (in)

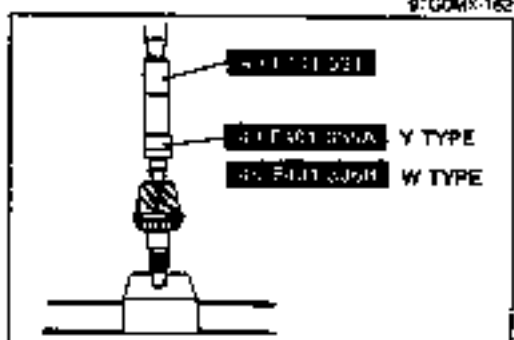
0.1 (0.004)	0.15 (0.006)
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9TGMX-162

**[W and Y type]****Rear bearing inner race**

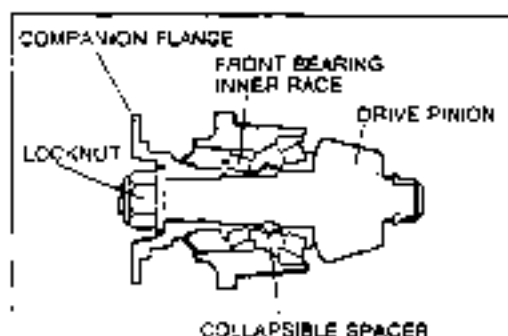
- Install the rear bearing inner race with the SST and a press.



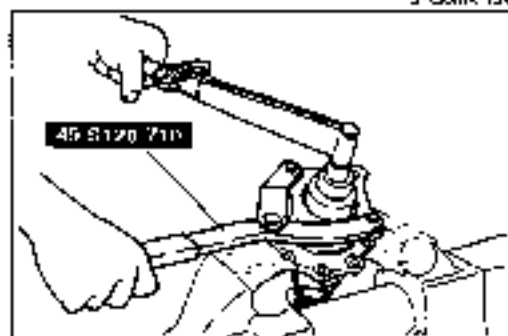
9TGMX-163

**[Y type and W type (no stopper)]****Pilot bearing inner race**

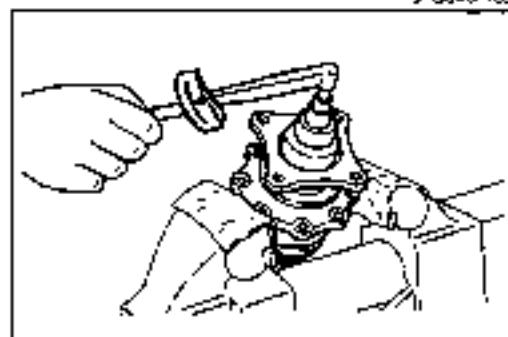
- Install the pilot bearing inner race with the SST and a press.



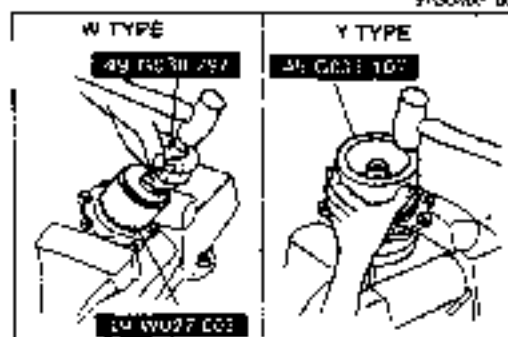
9TGMX-154



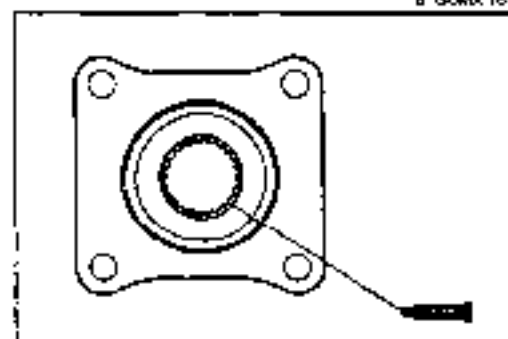
9TGMX-155



9TGMX-156



9TGMX-157



9TGMX-158

## Adjustment of drive pinion preload

## Caution

- Do not install the oil seal.

1. Install the drive pinion, new collapsible spacer, front bearing inner race, companion flange, washer, and new locknut onto the bearing housing. Temporarily tighten the locknut.

2. Place the bearing housing in a vise.  
3. Turn the companion flange by hand to seat the bearings.

## Note

- Make a notation of this torque for proper assembly.
- If the specified preload cannot be obtained, reassemble and check it again.

4. Hold the flange with the SST and tighten the locknut to the lowest value of the specified torque to obtain the specified preload.

	W type	Y type
Tightening torque	235—392 N·m (24—40 m·kg, 174—289 ft·lb)	275—382 N·m (28—40 m·kg, 203—289 ft·lb)
Preload	0.8—1.6 N·m (9—16 cm·kg, 7—14 in·lb)	2.6—3.4 N·m (27—35 cm·kg, 23—30 in·lb)

5. Remove the locknut, washer, and companion flange.

## Oil seal

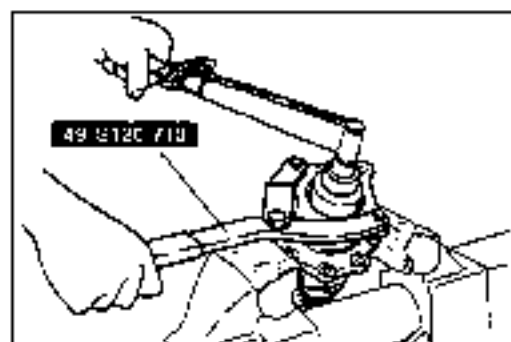
## Note

- Apply gear oil to the lip of the new oil seal.
- Push the oil seal fully into the carrier.

1. Install the new oil seal into the carrier with the SST.

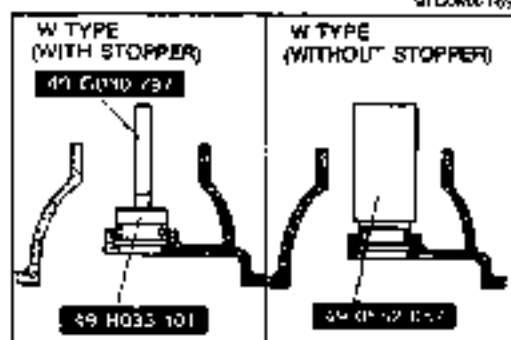
## Companion flange

1. Install the companion flange to the drive pinion. After installation, apply 0.5 cc (0.03 cu in.) of sealant around the splines of the companion flange.



9TGMX-169

2. Install the washer and locknut onto the drive pinion.
3. Hold the flange with the SST and tighten the locknut to the torque obtained in "drive pinion preload adjustment" in Step 3.



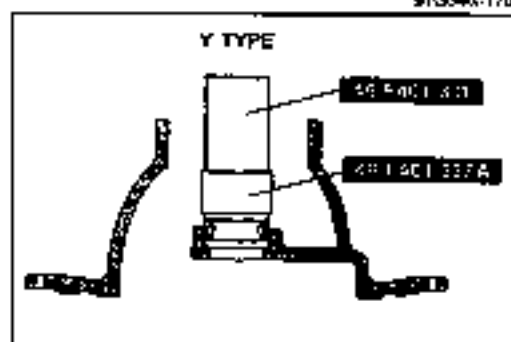
9TGMX-170

#### Pilot bearing outer race

1. Install the pilot bearing outer race into the carrier with the SST.
2. Install the stopper plate into the carrier. (W type, with stopper)

#### Tightening torque:

19–26 Nm (1.95–2.60 m·kg, 14–19 ft·lb)



9TGMX-171

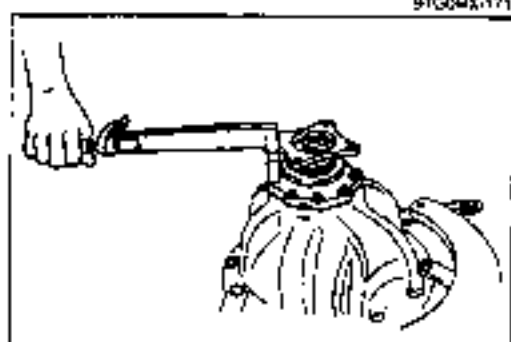
#### Bearing housing

1. Install the adjustment shim(s), selected in "pinion height adjustment", and the bearing housing to the carrier.

#### Tightening torque:

W type: 20–29 Nm (2.0–3.0 m·kg, 14–22 ft·lb)

Y type: 43–61 Nm (4.4–6.2 m·kg, 32–45 ft·lb)



9TGMX-172

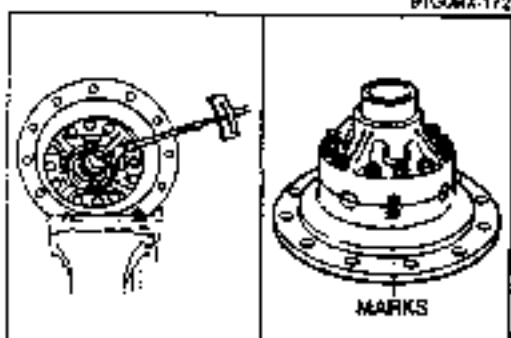
#### Gear case

1. Align the marks and assemble the gear case.

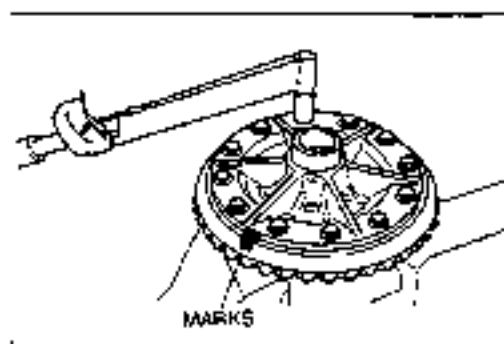
#### Tightening torque:

W type: 59–71 Nm (6.0–7.2 m·kg, 43–52 ft·lb)

Y type: 64–74 Nm (6.5–7.5 m·kg, 47–54 ft·lb)



9TGMX-173



9TGMX-174

**Ring gear**

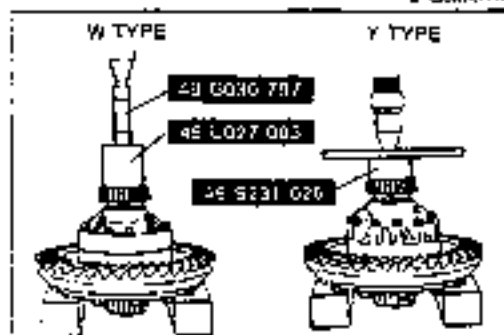
1. Align the marks on the ring gear and the gear case and assemble them.

**Tightening torque:****W type:**

201–250 Nm (20.5–25.5 m·kg, 146–184 ft·lb)

**Y type:**

265–324 Nm (27–33 m·kg, 195–239 ft·lb)



9TGMX-175

**Side bearing inner race****Note**

- Install the side bearing inner races on their respective sides.

1. Install the side bearing inner races with the SST and a press.

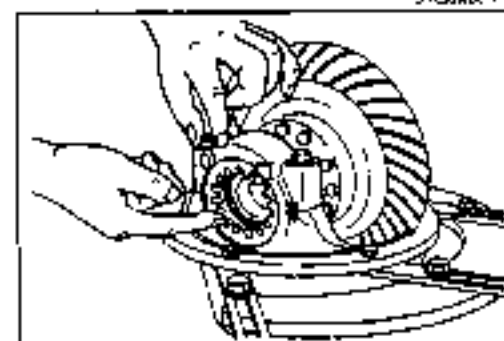


9TGMX-176

**Adjusting screw****Note**

- Install the adjusting screws on their respective sides.
- Align the adjusting screw and the differential carrier threads.

1. Install the adjusting screws to the differential carrier.

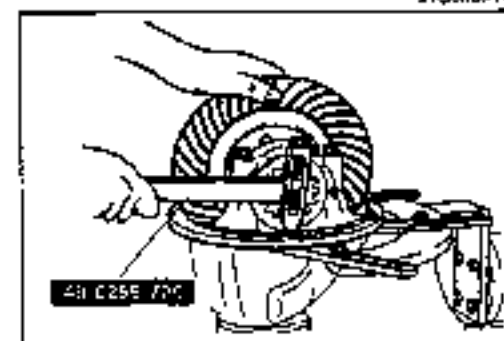


9TGMX-177

**Bearing cap****Note**

- Align the bearing cap and the adjusting screw threads.

1. Install the bearing cap, and apply a small amount of thread-locking compound (W type), then temporarily tighten the bolts.



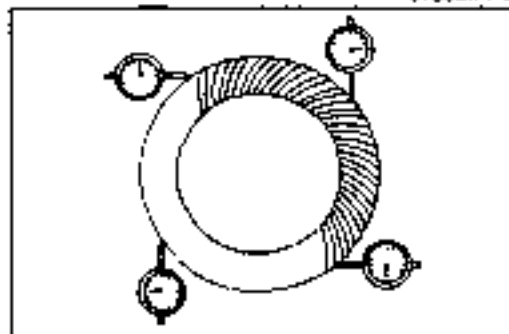
9TGMX-178

**Adjustment of backlash**

1. While turning the ring gear, tighten the left and right adjusting screws alternately with the SST to reduce the backlash.
2. Mark the ring gear at four points at 90° intervals.
3. Mount a dial indicator to the carrier so that the feeler comes in contact at a right angle with one of the ring gear teeth.
4. Hold the companion flange, and turn the ring gear and measure the backlash at the four marked points. Verify that one backlash is within the specified value and that the backlash variation is less than 0.11mm (0.0043 in).



9TG0M7-170



9TG0M6-180

**Note**

- The backlash variation is the difference between the maximum and minimum backlashes.

**Backlash:****Standard:**

W type: 0.25—0.27mm (0.0098—0.011 in)

Y type: 0.24—0.27mm (0.0094—0.011 in)

Backlash variation: 0.11mm (0.0043 in)

**Note**

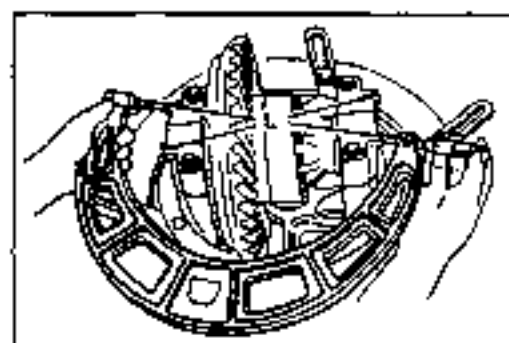
- For adjustment, loosen one side adjusting screw and tighten the opposite side screw to the same amount.

5. If the backlash is not as specified, readjust it by turning the adjusting screws alternately with the SST.

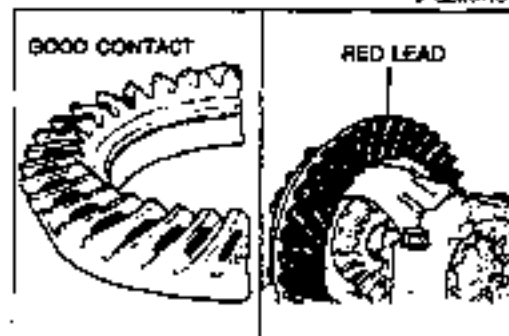
**Note**

- Tighten the adjusting screws equally when the distance between the pilot sections on the bearing caps is low and loosen when the distance is high.

6. Measure the distance between the pilot sections on the bearing caps (L) with a micrometer.

**Distance (L)**W type:  $279.5^{+0.08}$  mm (11.00  $\pm 0.003$  in)Y type:  $289.5^{+0.08}$  mm (11.40  $\pm 0.003$  in)

9TG0M7-18'

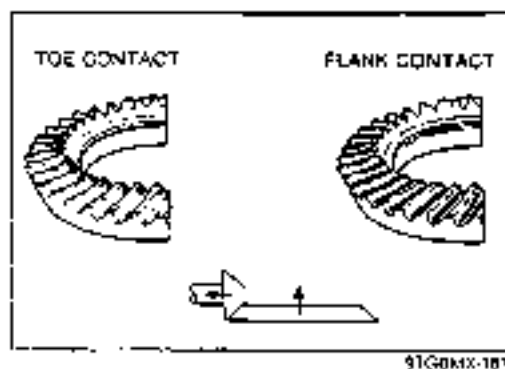


9TG0M6-182

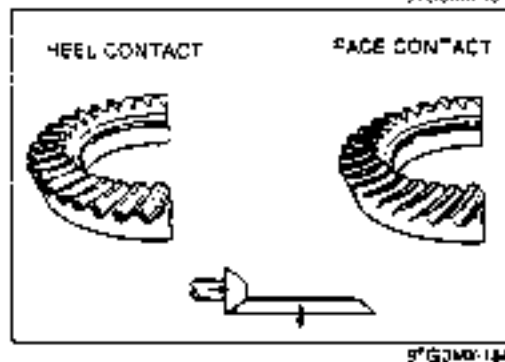
7. After adjustment of distance (L), recheck that the backlash is as specified.

**Inspection and adjustment of teeth contact**

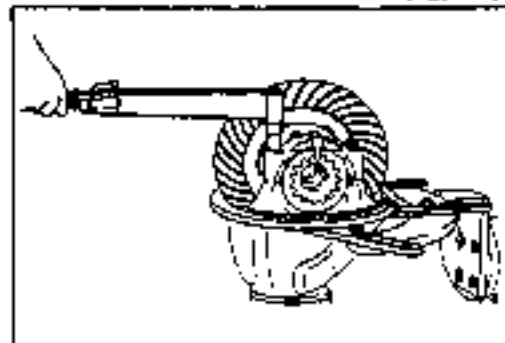
1. Coat both surfaces of 6—8 teeth of the ring gear with a thin coat of red lead.
2. While moving the ring gear back and forth by hand, rotate the drive pinion several times and check the tooth contact.
3. If the tooth contact is good, wipe off the red lead.
4. If it is not good, adjust the pinion height, and then adjust the backlash.



- (1) Toe and flank contact  
Replace the adjustment shim with a thinner one to move the drive pinion outward.



- (2) Heel and face contact  
Replace the adjustment shim with a thicker one to bring the drive pinion in.



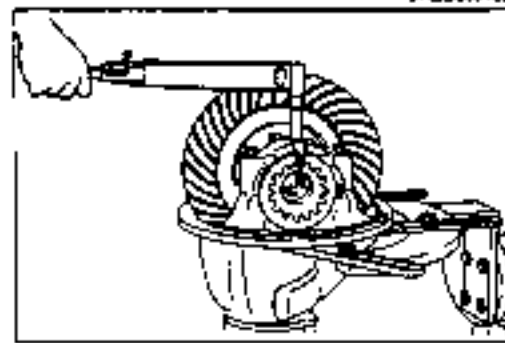
#### Lock plate

1. Tighten the bearing cap bolts to the specified torque.

#### Tightening torque:

W type: 79—98 N·m (8—10 m·kg, 58—72 ft·lb)

Y type: 128—147 N·m (13—15 m·kg, 94—108 ft·lb)



2. Install the lock plates on the bearing caps.

#### Tightening torque:

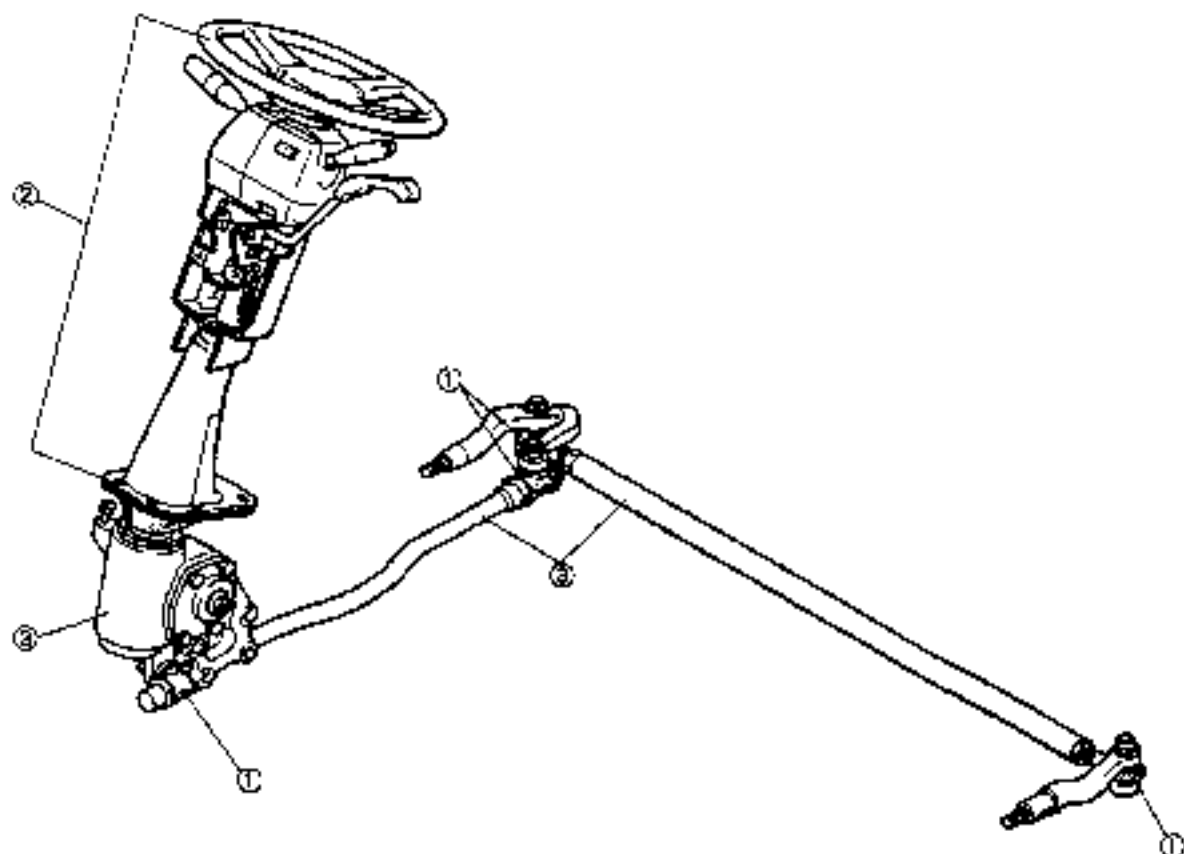
18—25 N·m (1.8—2.6 m·kg, 13—19 ft·lb)

# STEERING SYSTEM

<b>INDEX</b> .....	<b>N- 2</b>
<b>OUTLINE</b> .....	<b>N- 5</b>
SPECIFICATIONS .....	<b>N- 5</b>
<b>MANUAL STEERING</b> .....	<b>N- 5</b>
PREPARATION .....	<b>N- 5</b>
TROUBLESHOOTING GUIDE .....	<b>N- 6</b>
BOOT .....	<b>N- 8</b>
STEERING WHEEL AND COLUMN.....	<b>N-11</b>
STEERING GEAR AND LINKAGE .....	<b>N-15</b>
<b>ENGINE SPEED SENSING</b>	
<b>POWER STEERING</b> .....	<b>N-21</b>
PREPARATION .....	<b>N-21</b>
TROUBLESHOOTING GUIDE .....	<b>N-22</b>
AIR BLEEDING .....	<b>N-23</b>
POWER STEERING FLUID.....	<b>N-24</b>
STEERING WHEEL AND COLUMN.....	<b>N-27</b>
STEERING GEAR AND LINKAGE .....	<b>N-28</b>
POWER STEERING OIL PUMP.....	<b>N-37</b>
DRIVE BELT.....	<b>N-46</b>

## INDEX

## MANUAL STEERING

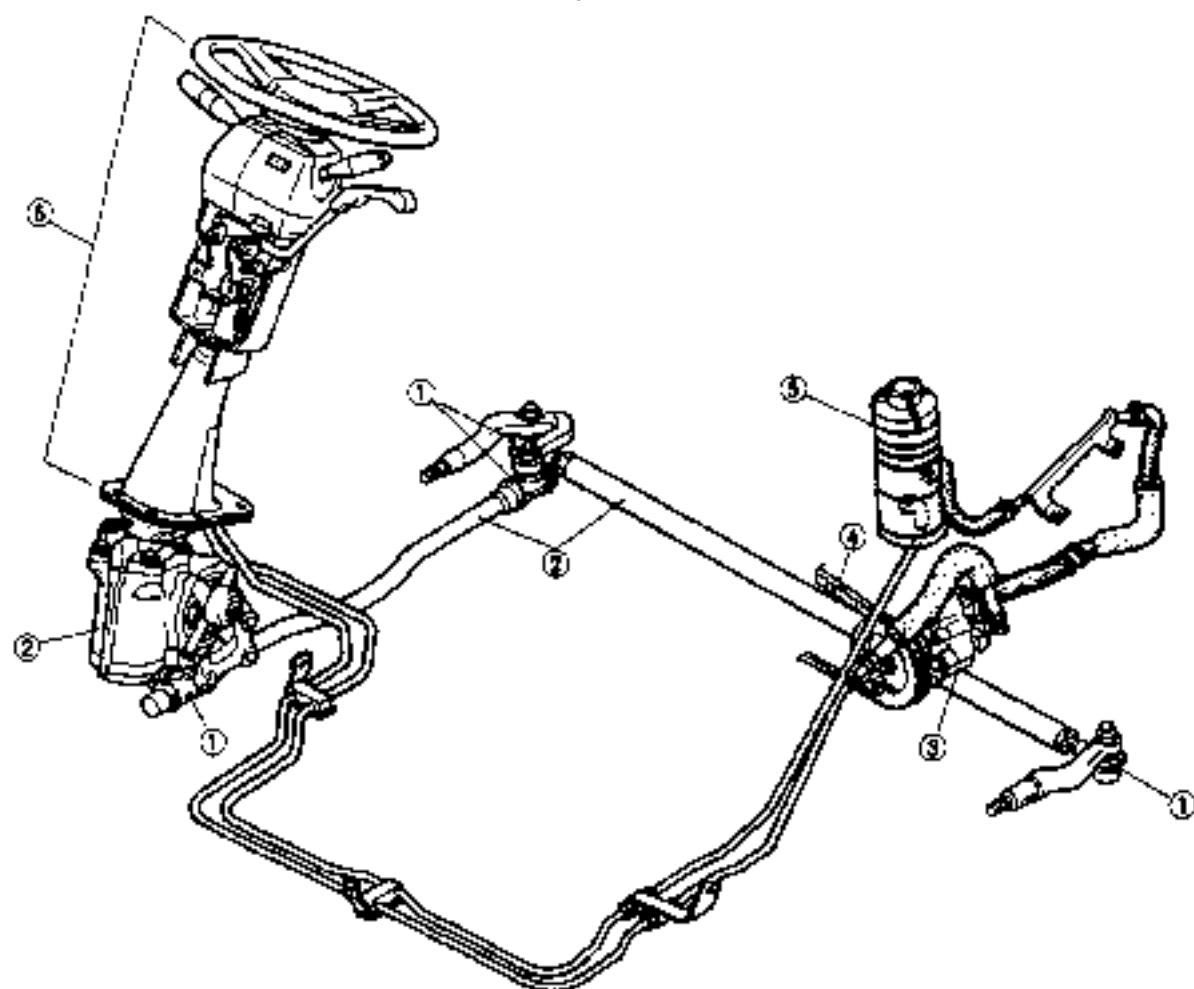


P770N-002

- |                              |           |                              |           |
|------------------------------|-----------|------------------------------|-----------|
| 1. Boot                      |           | 3. Steering gear and linkage |           |
| Removal / Installation.....  | page N- 8 | Removal / Inspection /       |           |
| 2. Steering wheel and column |           | Installation .....           | page N-15 |
| On-vehicle inspection.....   | page N-11 | Disassembly / Inspection /   |           |
| Removal / Installation.....  | page N-12 | Assembly.....                | page N-16 |
| Disassembly / Inspection /   |           |                              |           |
| Assembly.....                | page N-13 |                              |           |



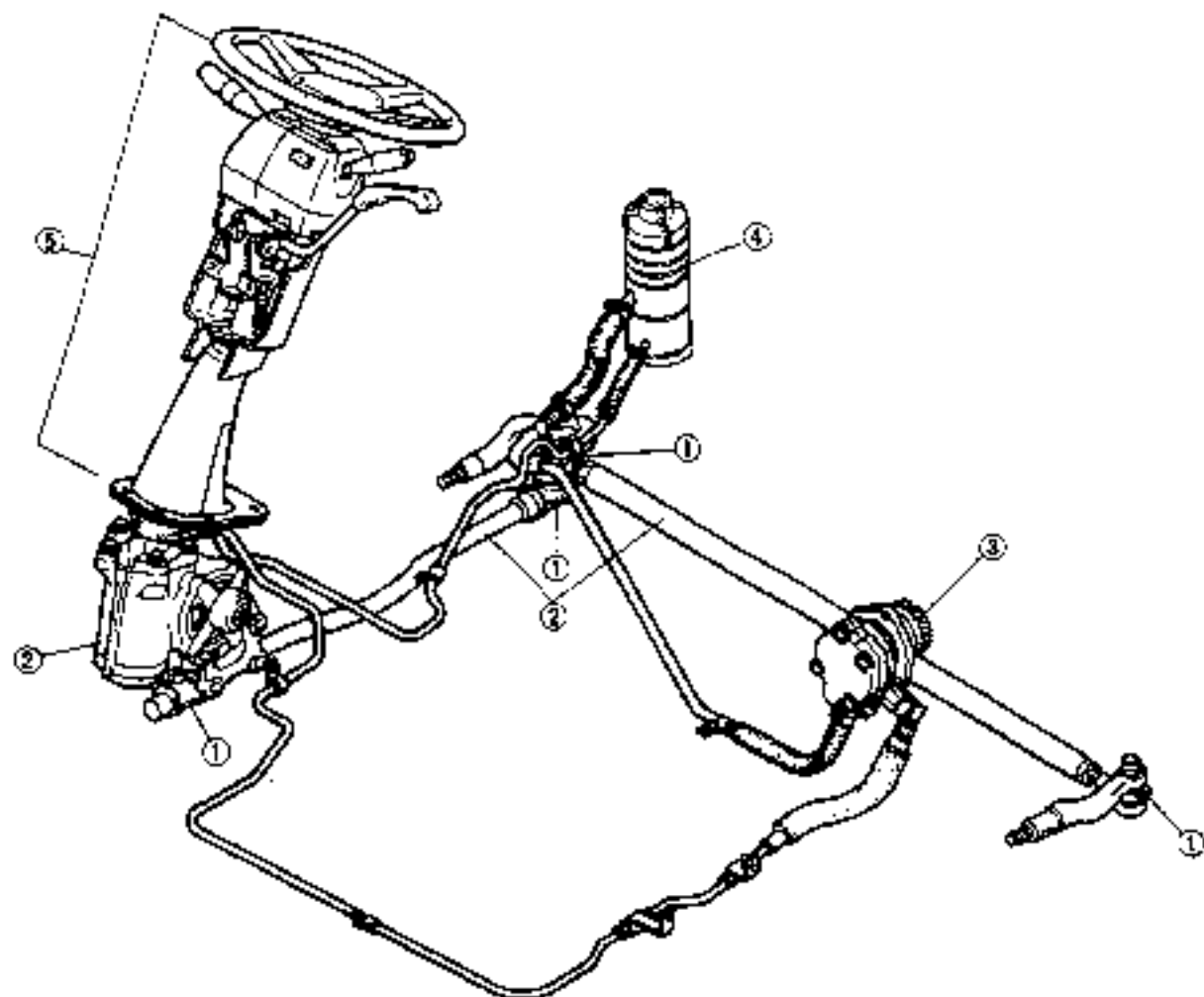
## POWER STEERING (3.5 L TURBO ENGINE MODEL)



9TFOHX-003

- |                              |           |                              |           |
|------------------------------|-----------|------------------------------|-----------|
| 1. Boot                      |           | 4. Drive belt                |           |
| Removal / Installation ..... | page N- 8 | Inspection.....              | page N-46 |
| 2. Steering gear and linkage |           | Adjustment .....             | page N-46 |
| Removal / Inspection /       |           | Replacement .....            | page N-47 |
| Installation .....           | page N-28 | 5. Power steering fluid      |           |
| Disassembly / Inspection /   |           | Inspection.....              | page N-24 |
| Assembly.....                | page N-29 | 6. Steering wheel and column |           |
| 3. Power steering oil pump   |           | On-vehicle inspection.....   | page N-27 |
| Removal / Installation.....  | page N-37 | Removal / Installation.....  | page N-12 |
| Disassembly / Inspection /   |           | Disassembly / Inspection /   |           |
| Assembly.....                | page N-39 | Assembly.....                | page N-13 |

## POWER STEERING (4.0 L ENGINE MODEL)



9TFRN1-004

- |                              |           |
|------------------------------|-----------|
| 1. Boot                      |           |
| Removal / Installation.....  | page N- 8 |
| 2. Steering gear and linkage |           |
| Removal / Inspection /       |           |
| Installation .....           | page N-28 |
| Disassembly / Inspection /   |           |
| Assembly.....                | page N-29 |
| 3. Power steering oil pump   |           |
| Removal / Installation.....  | page N-43 |
| Disassembly / Inspection /   |           |
| Assembly.....                | page N-44 |
| 4. Power steering fluid      |           |
| Inspection.....              | page N-24 |
| 5. Steering wheel and column |           |
| On-vehicle inspection .....  | page N-27 |
| Removal / Installation.....  | page N-12 |
| Disassembly / Inspection /   |           |
| Assembly.....                | page N-13 |

OUTLINE

SPECIFICATIONS

Item	Type	MANUAL STEERING	POWER STEERING
Steering wheel	Outer diameter mm (in)	430 (16.93)	
	Lock-to-lock turns	3.9, 4.2	
Steering shaft and joint	Shaft type	Collapsible	
	Joint type	1-cross joint (standard), 2-cross joint (fit)	
	Range of up/down movement mm (in)	*30 (1.18)	
	Amount of tilt mm (in)	*50 (1.97)	
Steering gear	Type	Ball nut	
	Gear ratio	28-33	22.6
Oil	Type	API service GL-4, SAE90	ATF M2C33F or DEXRON-II
	Capacity liters (US qt, Imp qt)	0.94 (0.99, 0.83)	2.0 (2.11, 1.76)











\* . . . . . equipped



5T10X-005

MANUAL STEERING

PREPARATION

SST

49 0727 575 Pulver, socket joint 	For removal of ball joint	49 0208 701A Air out tool, boot 	For removal of dust seal
49 W023 585A Adjust wrench 	For removal and installation of adjusting plug	49 0710 520 Pulver, bearing 	For removal of inner race
49 FT01 361 Remover, bearing 	For removal of outer race	49 W032 201 Remover, bearing 	For removal of outer race
49 F027 005 Attachment for bearing #62 (Part of 49 F027 0A1) 	For installation of outer race	49 0180 510B Attachment, preloaded measuring 	For adjustment of worm shaft preloaded
49 F401 331 Body 	For installation of inner race and oil seal	49 H025 005 Installer, bearing 	For installation of inner race

49 W023 78J Install: boot		For installation of tie-rod end boot	49 F07 140 Universal wrench		For removal and installation of rack
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9T0326-307

## TROUBLESHOOTING GUIDE

Problem	Possible Cause	Action	Page/Section
<b>Steering feels heavy</b> Jack up the front of vehicle (front tires off ground) and turn steering wheel	<b>Light (Jacked-up)</b> Incorrect tire pressure Irregular tire wear <b>Heavy (Jacked-up)</b> Faulty lubrication, abnormal wear, presence of foreign matters and stuck or damaged ball joints of steering system Improper adjustment of steering worm shaft preload Malfunctioning or damaged steering gear Insufficient oil in gear box Worn or damaged kingpin bushing Stuck kingpin Insufficient kingpin oil	Adjust Replace  Lubricate or replace  Adjust Replace Lubricate Replace Replace Lubricate	Section D Section C  N- 8  N-20 N-15 N-20 Section R Section R Section R
<b>Steering wheel pulls to one side</b>	Deformed steering linkage Improper adjustment of front wheel bearing preload Twisted front axle Fatigued front springs Faulty wheel alignment (toe-in) Incorrect tire pressure Irregular tire wear Dragging brakes	Replace Adjust Replace Replace Adjust Adjust Replace Adjust	N-15 Section R Section M Section R Section R Section C Section Q Section P
<b>General instability while driving</b>	Deformed steering linkage Worn or damaged joints of steering system Improper adjustment of steering worm shaft preload Improper adjustment of front wheel bearing preload Fatigued front spring Loose U-bolts Malfunctioning of shock absorber Faulty wheel alignment (toe-in) Incorrect tire pressure Deformed or unbalanced wheels	Replace Replace Adjust Adjust Replace Tighten Replace Adjust Adjust Repair or replace	N-15 N- 8 N-20 Section M Section R Section R Section R Section C Section Q
<b>Steering wheel effort uneven</b>	Malfunctioning steering gear Malfunctioning joints of steering system Steering linkage does not operate smoothly	Replace Replace Replace	N-15 N- 8 N-15
<b>Excessive steering wheel play</b>	Improper adjustment of gear box backlash Worn steering gear Worn or damaged joints of steering system Loose steering gear mounting bolts Worn kingpin Improper adjustment of front wheel bearing preload	Adjust Replace Replace Tighten Replace Adjust	N-20 N-15 N- 8 N-15 Section R Section R
<b>Poor steering wheel return</b>	Stuck or damaged steering joints Improper adjustment of steering worm shaft preload Incorrect tire pressure Malfunctioning suspension system	Repair or replace Adjust Adjust Repair or replace	N- 8 N-20 Section Q Section F

## TROUBLESHOOTING GUIDE (Cont'd)

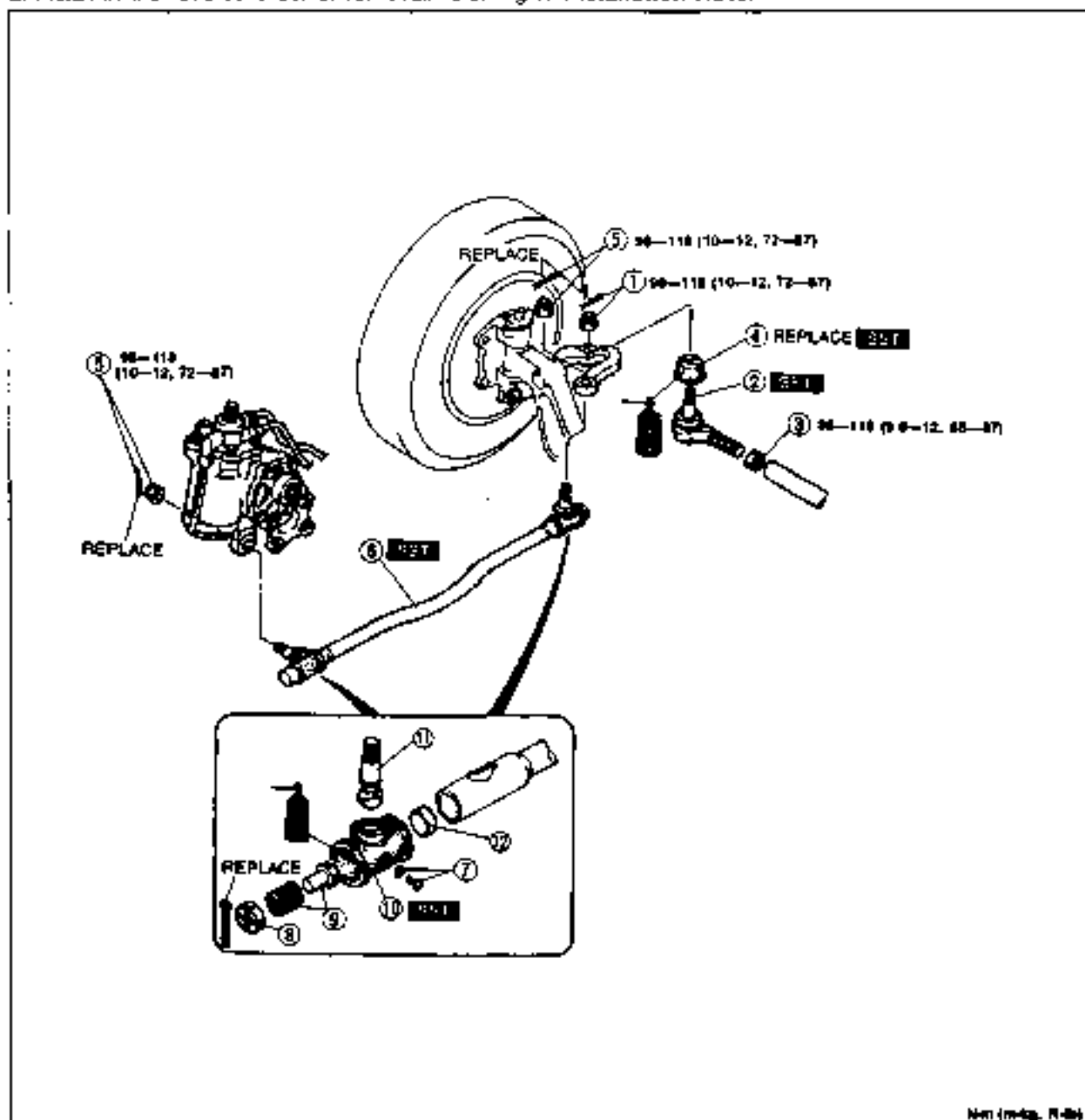
Problem	Possible Cause	Action	Page/Section
"Shimmy" occurs (Steering wheel vibrates left/right)	Deformed steering linkage	Replace	N-15
	Loose steering gear mounting bolts	Tighten	N-15
	Worn or damaged steering joints	Replace	N- 8
	Improper adjustment of steering worm shaft preload	Adjust	N-20
	Worn or improper adjustment of front wheel bearing preload	Adjust or replace	Section M
	Worn kingpin bushing	Replace	Section M
	Worn kingpin	Replace	Section M
	Incorrect tire pressure	Adjust	Section Q
	Irregular tire wear	Replace	Section Q
	Depth of tire tread is different between left and right tires	Replace	Section Q
	Deformed or unbalanced wheels	Repair or replace	Section Q
	Malfunctioning or loose shock absorbers	Replace or tighten	Section R
	Loose U-bolts	Tighten	Section R
Faulty wheel alignment (toe-in)	Adjust	Section R	
Abnormal noise from steering system.	Loose or worn steering linkage	Tighten or replace	N- 5
	Worn steering joints	Replace	N- 8
	Loose steering gear mounting bolts	Tighten	N-15
	Obstruction near steering column	Repair	N-12
	Malfunctioning steering gear	Replace	N-15
	Improper adjustment of gear box backlash	Adjust	N-20

†TPOU-006

## BOOT

## Removal / Installation

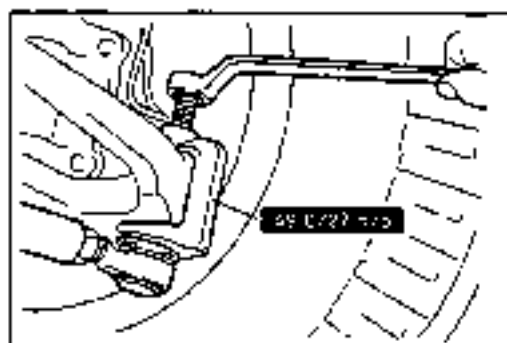
1. Remove in the order shown in the figure, referring to **Removal Note**.
2. Install in the reverse order of removal, referring to **Installation Note**.



N-8 (rev. 11-86)

9TFR06C-007

- |                        |           |
|------------------------|-----------|
| 1. Cotter pin, nut     |           |
| 2. Tie-rod end         |           |
| Removal note.....      | page N- 9 |
| 3. Locknut             |           |
| Removal note.....      | page N- 9 |
| 4. Tie-rod end boot    |           |
| Removal note.....      | page N- 9 |
| Installation note..... | page N-10 |
| 5. Cotter pin, nut     |           |
| 6. Drag link           |           |
| Removal note.....      | page N- 9 |
| 7. Plug                |           |
| 8. End plug            |           |
| Installation note..... | page N-10 |
| 9. Spring, ball seat   |           |
| 10. Dust seal          |           |
| Removal note.....      | page N- 9 |
| 11. Ball stud          |           |
| 12. Ball seat          |           |

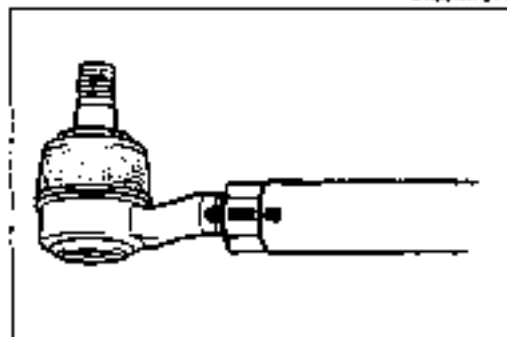


9TQGNX-011

**Removal note**

**Tie-rod end**

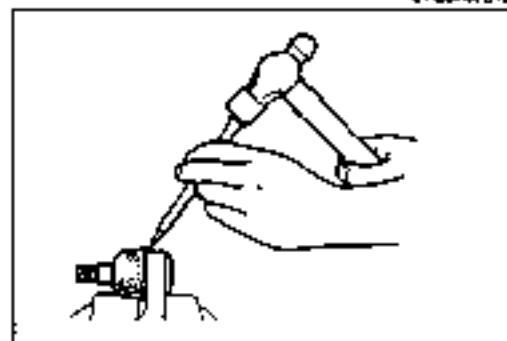
1. Separate the tie-rod end from the knuckle arm with the SST.



9TQGNX-012

**Locknut**

1. Mark the tie-rod end locknut for reference during installation before loosening.



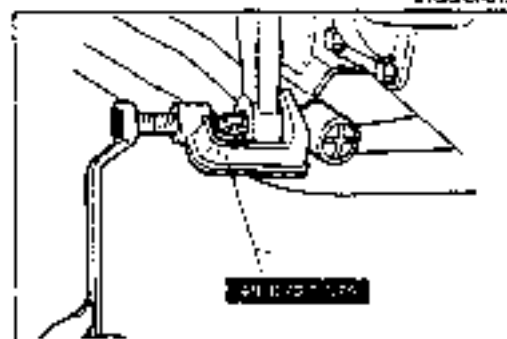
9TQGNX-013

**Tie-rod end boot**

1. Secure the tie-rod end in a vise. Place a chisel against the boot and hold it at the angle shown. Remove the boot.

**Caution**

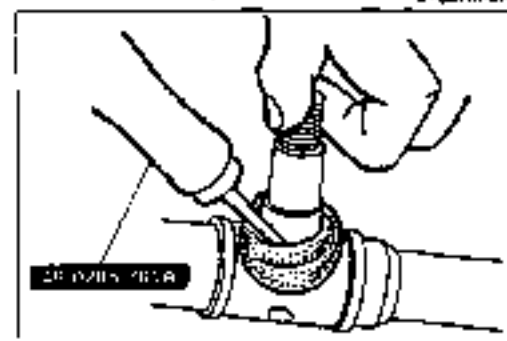
- Do not scar the part where the boot attaches to the tie-rod end.



9TQGNX-014

**Drag link**

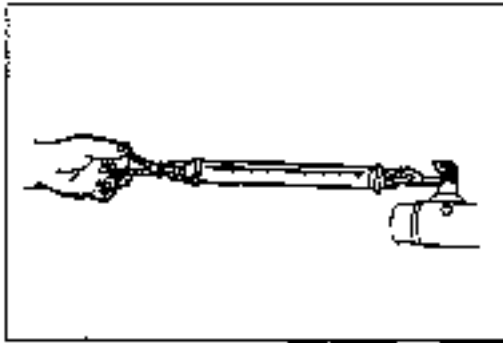
1. Separate the drag link with the SST.



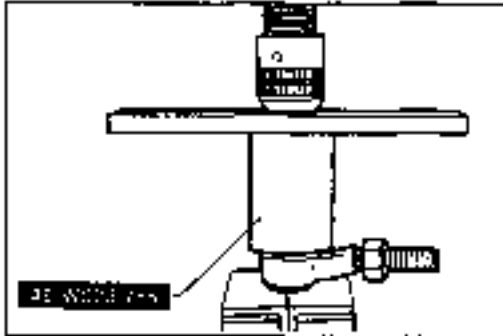
9TQGNX-015

**Dust seal**

1. Remove the dust seal with the SST.



STG3NA-016



STG3NX-017

**Installation note****End plug**

1. Fit a grease nipple in the plug hole and apply grease (lithium base NLGI No.2).

**Note**

- Tighten the end plug fully and then loosen it before the adjustment.

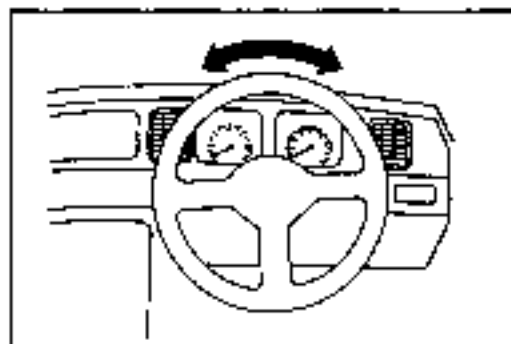
2. Adjust the starting torque of the ball stud by turning the end plug.

**Starting torque: 5—15 kg (11—33 lb)**

**Tie-rod end boot**

1. Put a small amount of grease (lithium base NLGI No.2) into the new boot and set it onto the tie-rod end. Install the boot to the tie-rod end with the \$\$\$ and a press.





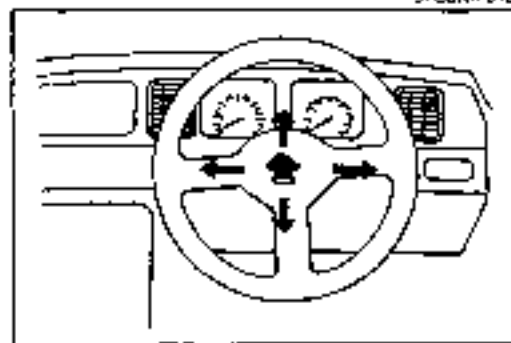
9TGNX-018

### STEERING WHEEL AND COLUMN ON-VEHICLE INSPECTION

#### Steering wheel play

1. With the wheels in the straight-ahead position, gently turn the steering wheel to the left and right and verify that the free play is within specification.

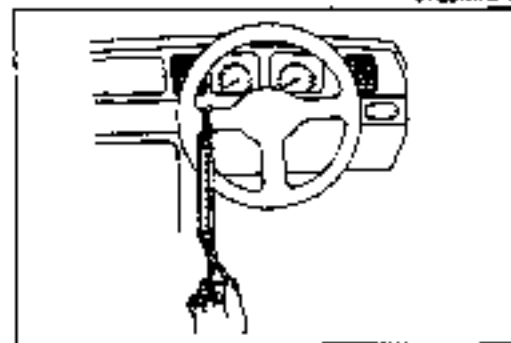
**Free play: 0—40mm (0—1.57 in)**



9TGNX-019

#### Looseness or play of steering wheel

1. Move the steering wheel in directions 1, 2, and 3 to check for column bearing wear, steering shaft joint play, steering wheel looseness, and column looseness.



9TGNX-020

#### Steering wheel effort

1. With the vehicle on a hard level surface, move the steering wheel to put the wheels in the straight-ahead position.

#### Note

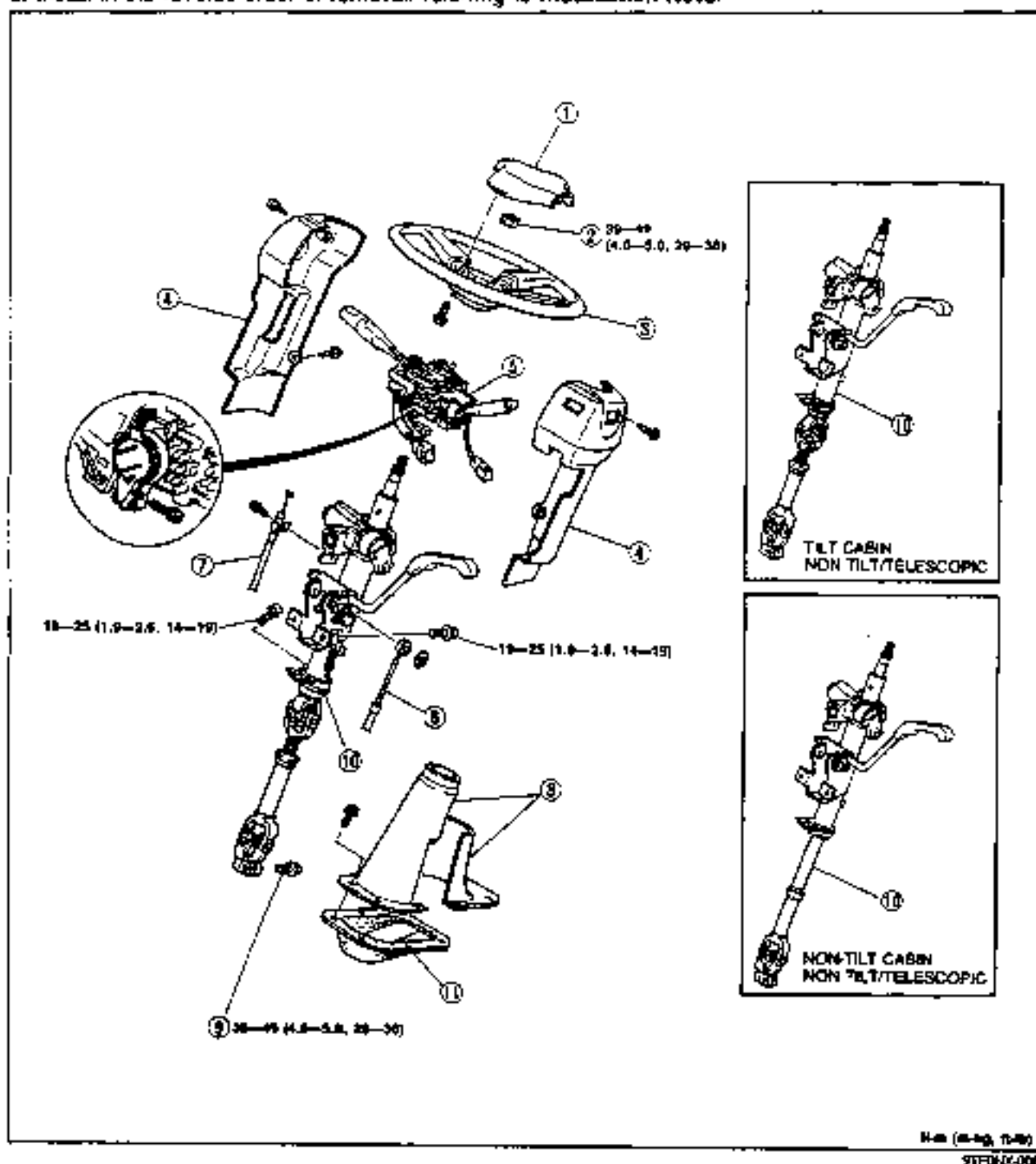
- Measure after turning the steering wheel to the left and right 5 times or more.

2. Measure the steering wheel effort by connecting a pull scale to the outer circumference of the steering wheel.

**Steering wheel effort: 245 N (25 kg, 55 lb) Max.**

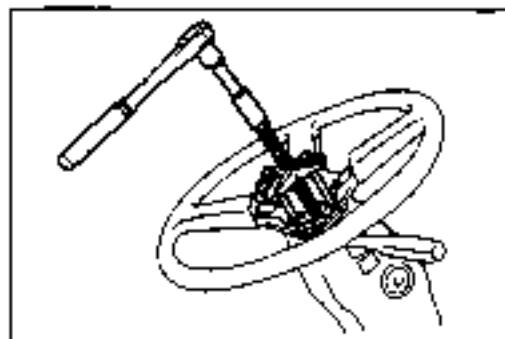
**Removal / Installation**

1. Remove the lower panel (left and center). (Refer to Section 5.)
2. Remove in the order shown in the figure, referring to **Removal Note**.
3. Install in the reverse order of removal, referring to **Installation Note**.



1. Horn cover
2. Locknut
3. Steering wheel  
Removal note..... page N-13
4. Column cover
5. Combination switch
6. Sub-transmission selection cable

7. Fuel stop cable (4.0 L, 3.5 L Turbo engine)
8. Joint cover
9. Fixing bolt
10. Steering shaft  
Installation note..... page N-13
11. Dust boot



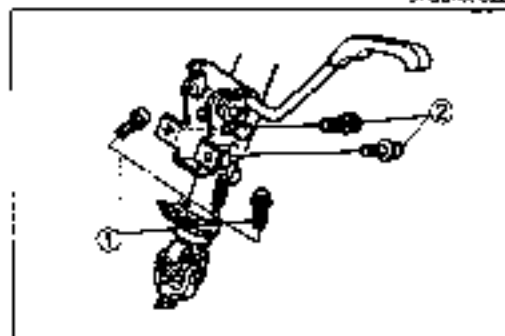
9TGD4X-022

### Removal note Steering wheel

1. Remove the steering wheel with a suitable puller.

### Caution

- Do not try to remove the steering wheel by hitting the shaft with a hammer. The column will collapse.



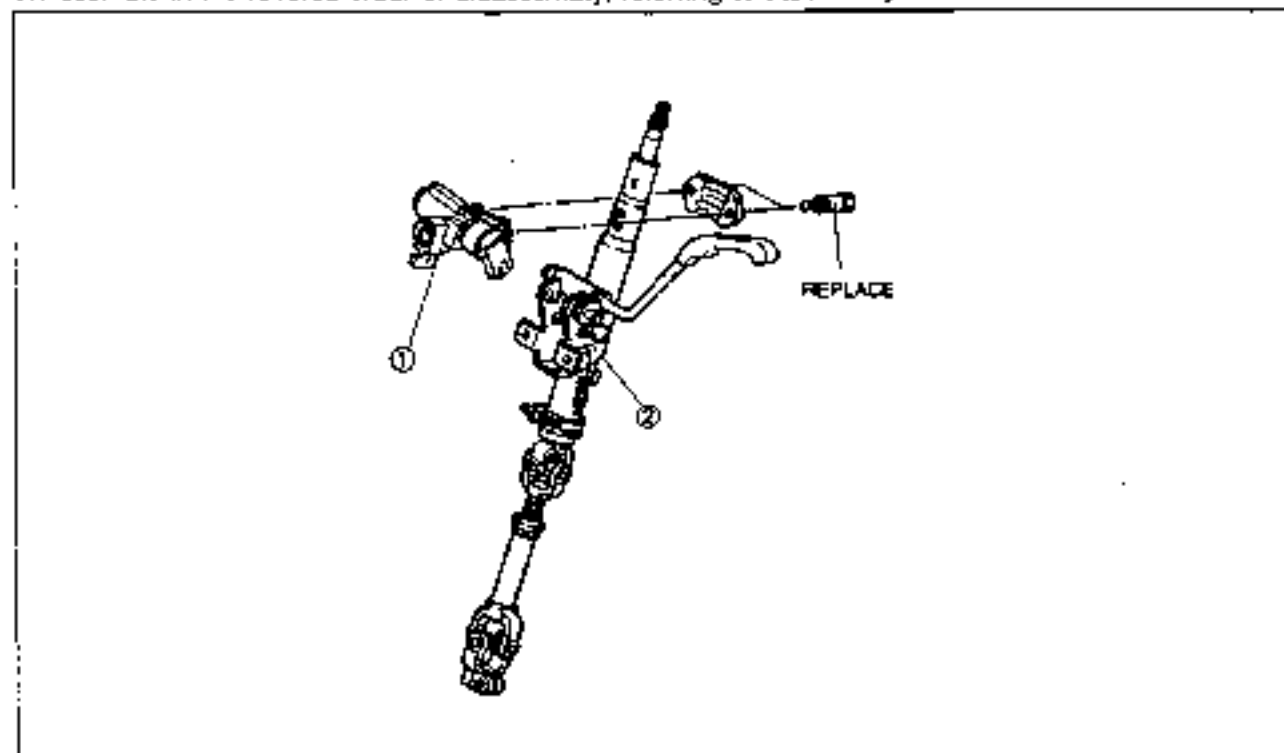
9TGCNK-023

### Installation note Steering shaft

1. Tighten the bolts in the order shown in the figure.

### Disassembly / Inspection / Assembly

1. Disassemble in the order shown in the figure, referring to **Disassembly Note**.
2. Inspect all parts and repair or replace as necessary.
3. Assemble in the reverse order of disassembly, referring to **Assembly Note**.



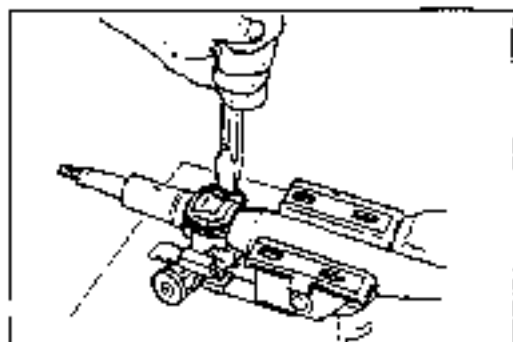
9TFCNK-009

#### 1. Steering lock assembly

- Disassembly note..... page N-14  
 Inspection..... page N-14  
 Assembly note..... page N-14

#### 2. Steering shaft

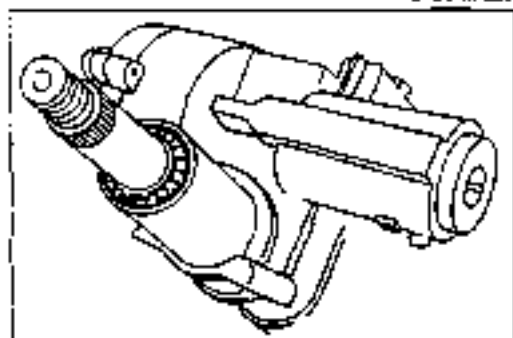
- Inspection..... page N-14



9TG0N1-C25

**Disassembly note****Steering lock assembly**

1. Use a chisel to make a groove in the heads of the steering lock mounting bolts. Remove the bolts with a screwdriver.
2. Remove the steering lock assembly.

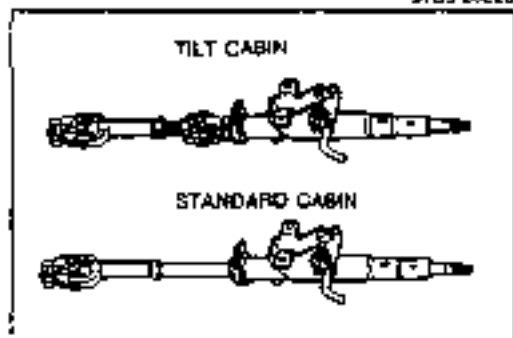


9TG0N1-C26

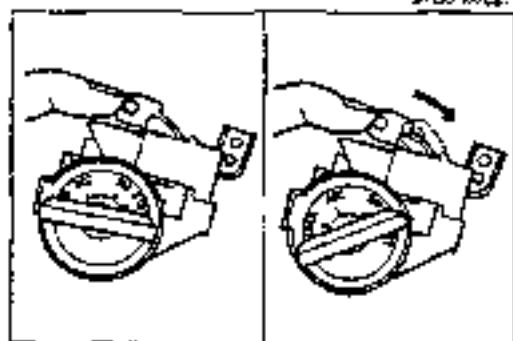
**Inspection****Steering shaft**

1. Column bearing damage.

2. Operation and damage of steering shaft and joint.



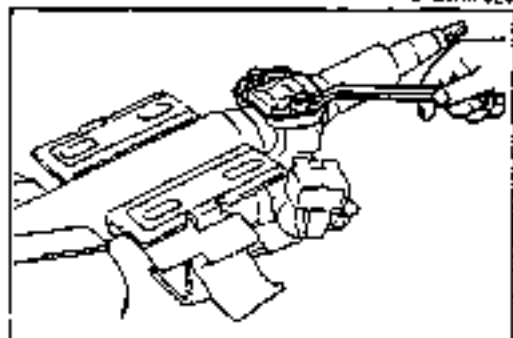
9TG0N1-C27



9TG0N1-C28

**Steering lock assembly (3.5 L TURBO and 4.0 L Engine type)**

1. Verify that the cable connector moves only as shown in the figure when the key is in the **LOCK** and **ACC** position.



9TG0N1-C29

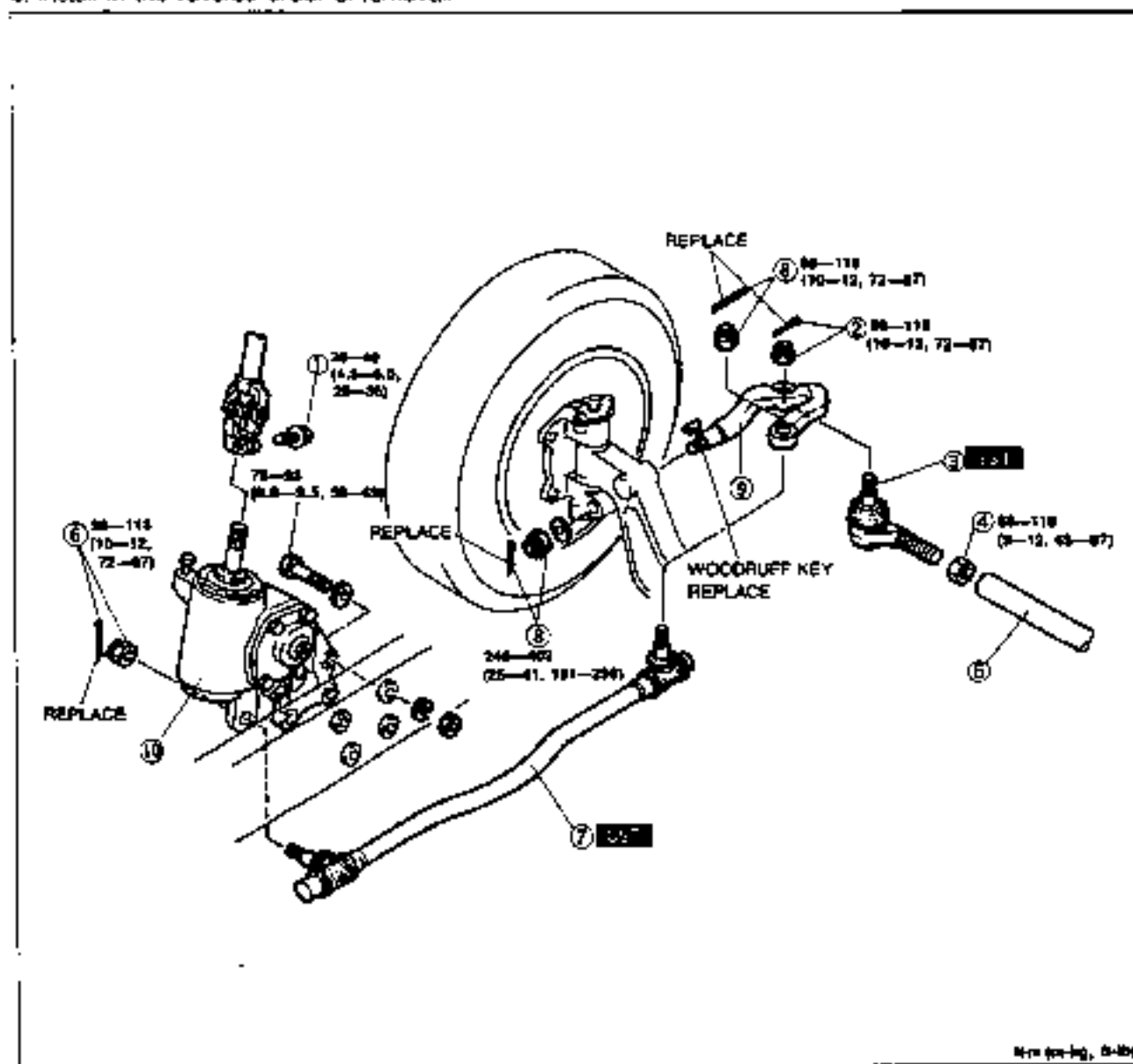
**Assembly note****Steering lock assembly**

1. Install the steering lock assembly on the jacket. Install new steering lock mounting bolts. Tighten the bolts until the heads break off.

## STEERING GEAR AND LINKAGE

### Removal / Inspection / Installation

1. Loosen the wheel lug nuts.
2. Jack up the front of the vehicle and support it with safety stands
3. Remove the wheel
4. Remove in the order shown in the figure, referring to **Removal Note**.
5. Inspect all parts and repair or replace as necessary.
6. Install in the reverse order of removal.



1. Fixing bolt
2. Cotter pin, nut
3. Tie-rod end  
Removal note..... page N- 9  
Inspect for damage  
Inspect operation of ball joint
4. Locknut  
Removal note..... page N- 9
5. Tie-rod  
Inspect for bending

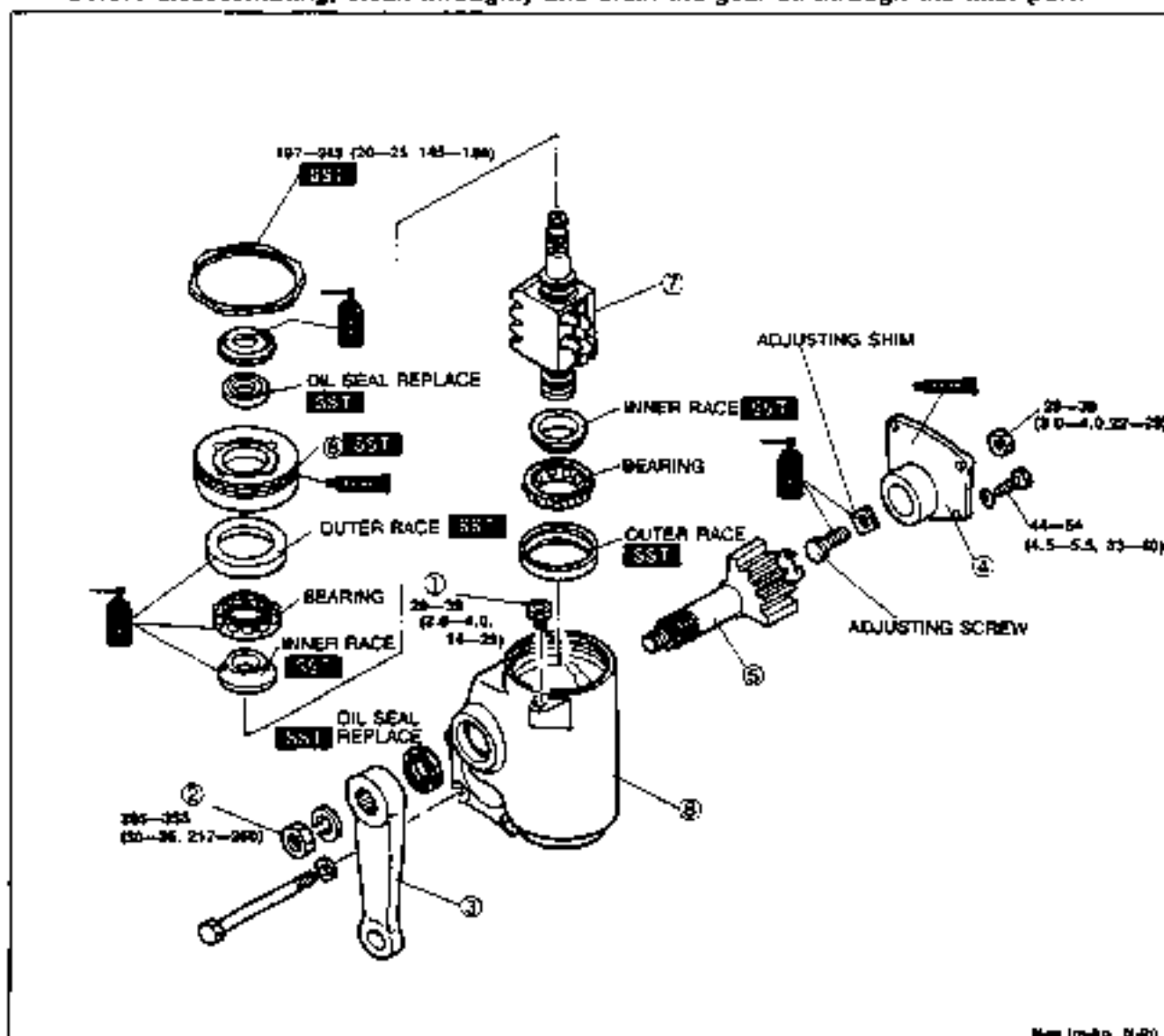
6. Cotter pin, nut
7. Drag link  
Removal note..... page N- 9  
Inspect for bending  
Inspect operation of ball stud
8. Cotter pin, nut
9. Knuckle arm
10. Steering gear  
Disassembly / Inspection /  
Assembly..... page N-16

**Disassembly / Inspection / Assembly**

1. Disassemble in the order shown in the figure, referring to **Disassembly Note**.
2. Inspect all parts and repair or replace as necessary.
3. Assemble in the reverse order of disassembly, referring to **Assembly Note**.

**Note**

- Before disassembling, clean thoroughly and drain the gear oil through the filler port.



1. Filler port plug

2. Locknut

3. Pitman arm

Disassembly note..... page N-30

Assembly note..... page N-36

4. Side cover

Disassembly note..... page N-30

Inspect bushing for damage and corrosion

Assembly note..... page N-34

5. Sector shaft

Disassembly note..... page N-30

Inspection..... page N-18

Assembly note..... page N-34

6. Adjusting plug

Disassembly note..... page N-17

Assembly note..... page N-19

7. Worm ball nut assembly

Disassembly note..... page N-17

Inspection..... page N-18

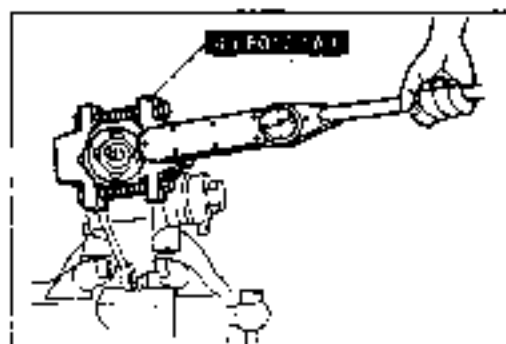
Assembly note..... page N-19

8. Gear housing

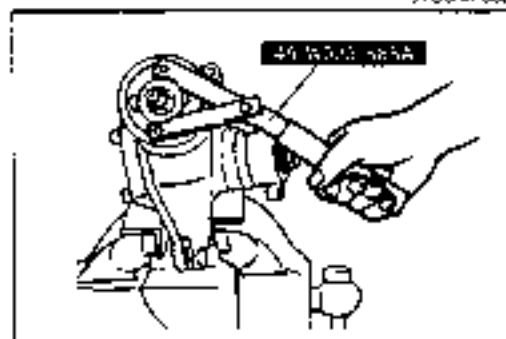
Disassembly note..... page N-18

Inspect bushing for damage and corrosion

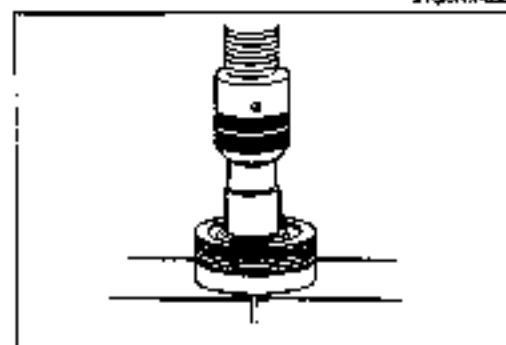
Assembly note..... page N-19, 20



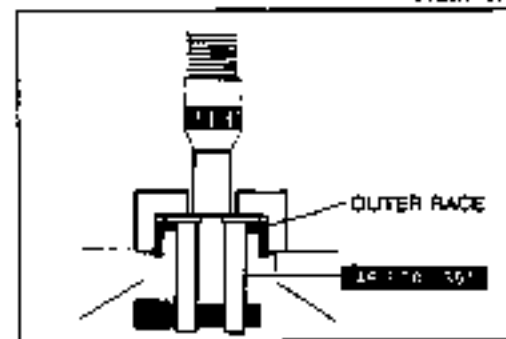
9TGD001-032



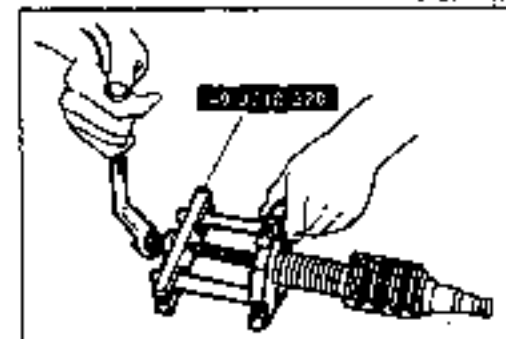
9TGD001-033



9TGD001-034



9TGD001-035



9TGD001-036

**Disassembly note**  
**Adjusting plug**

1. Remove the locknut with the **SST**.

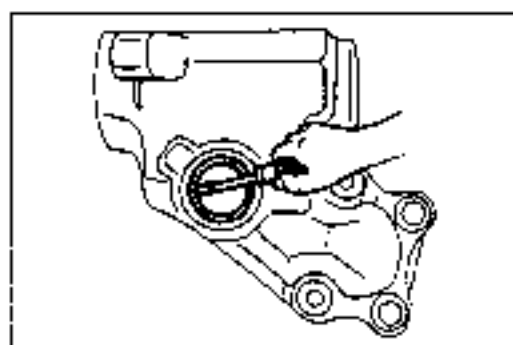
2. Remove the adjusting plug with the **SST**.

3. Press the oil seal out with a **23mm (15/16 in)** socket from the front side as shown.

4. Press the outer race out with a socket and the **SST** as shown.

**Worm ball nut assembly**

1. Remove the two inner races with the **SST**.



9TGCNK-037

**Gear housing**

1. Remove the oil seal with a screwdriver.

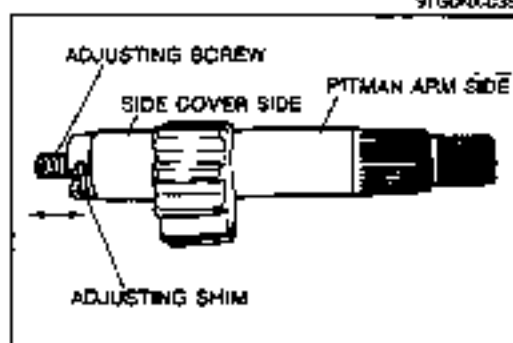
**Caution**

- Do not damage the bushing or the inside of the gear housing.



9TGCNK-038

2. Remove the outer race with the SST.



9TGCNK-039

**Inspection****Sector shaft**

1. Set the adjusting screw and the adjustment shim in the T-groove.
2. Measure the clearance with a feeler gauge in the axial direction.
3. If the clearance exceeds specification, adjust it with the adjustment shims supplied in the adjustment shim kit.

**Clearance in axial direction:**

0—0.1mm (0—0.004 in)

**Available adjustment shims:**

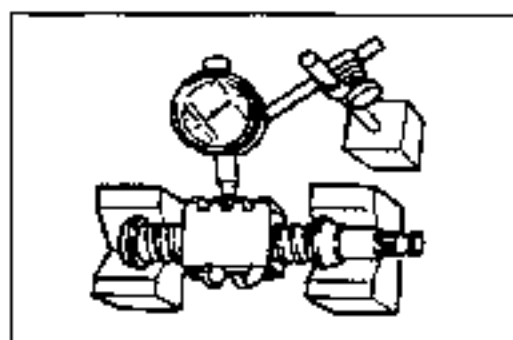
1.95mm (0.077 in), 2.00mm (0.079 in),

2.05mm (0.081 in)

4. Measure the outer diameter.

**Limit: 36.94mm (1.41 in)**

5. Check for damage and wear of the teeth.



9TBCNK-040

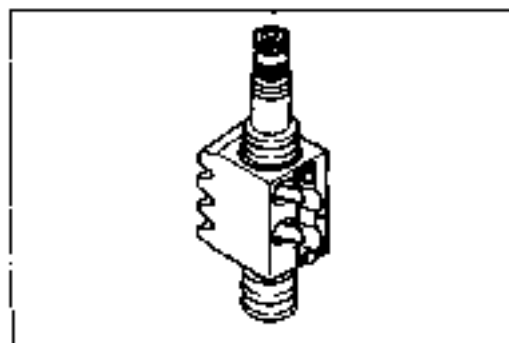
**Worm ball nut assembly**

1. Measure the play in the vertical direction as shown.

**Limit: 0.05mm (0.002 in)**

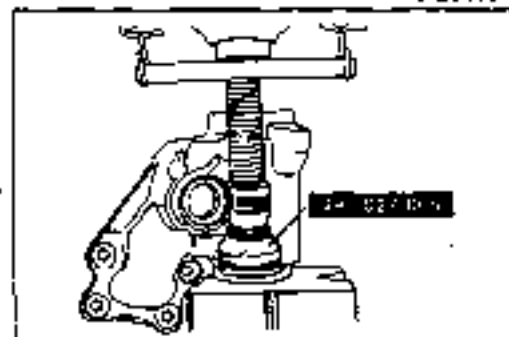
2. Check for damage and wear of the teeth.





9TQGNX-041

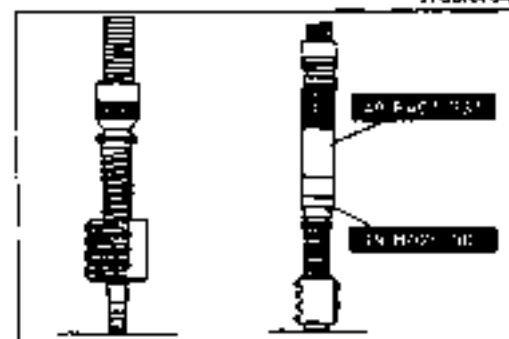
3. Verify that the worm ball nut turns and moves down by its own weight when holding the shaft as shown.



9TQGNX-042

**Assembly note**  
**Gear housing**

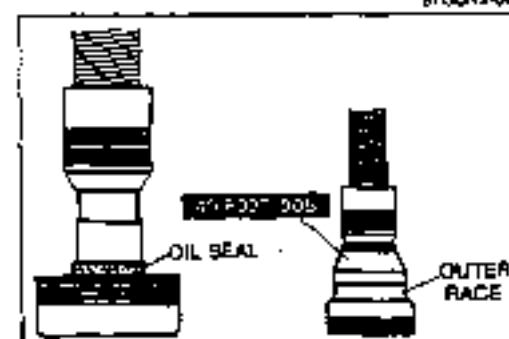
1. Press the outer race in with the **SST** as shown.



9TQGNX-043

**Worm ball nut assembly**

1. Press the two inner races on with the **SST** as shown.



9TQGNX-044

**Adjusting plug**

1. Press the oil seal in with a 23mm (15/16 in) socket as shown.
2. Press the outer race on with the **SST** as shown.
3. Insert the worm ball nut assembly into the gear housing.
4. Verify that the worm ball nut assembly turns smoothly.



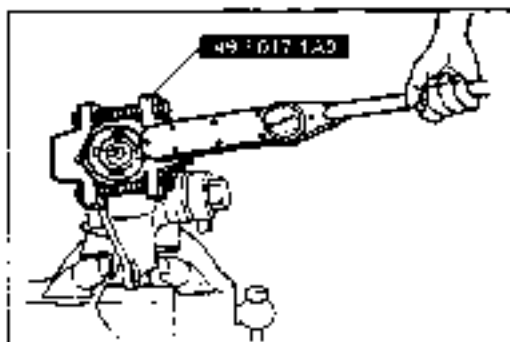
9TQGNX-045

5. Turn the adjusting plug with the **SST**.
6. Measure the worm shaft preload with the **SST** and a pull scale.
7. Turn the adjusting plug to obtain the specified preload.

**Worm shaft preload (without sector shaft):**

**Pull scale reading:**

**2.9—5.9 N (0.3—0.7 kg, 0.7—1.5 lb)**



9TQGNX-046

- 8 Tighten the locknut with the SST.

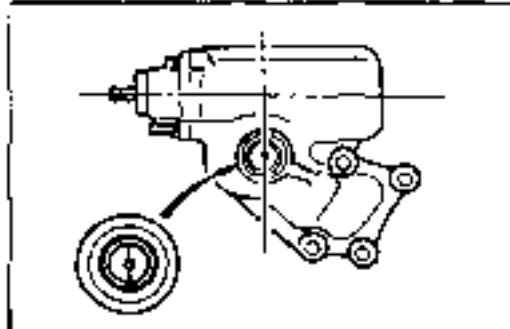
**Tightening torque (When using the SST):**  
177—206 N·m (18—21 m·kg, 131—151 ft·lb)

- 9 Verify the worm shaft preload.

#### Adjustment of preload

##### Note

- The following adjustment is made after the sector shaft is installed.

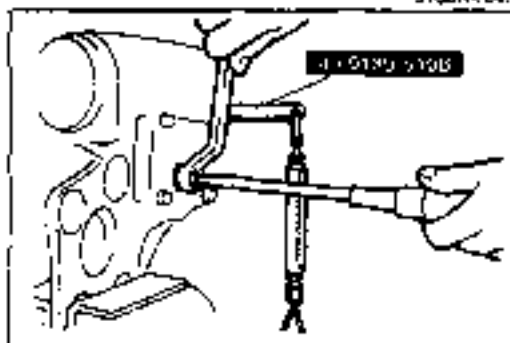


9TQGNX-047

- 1 Turn the worm shaft counterclockwise until it no longer turns
- 2 Turn it clockwise 2—3 turns
- 3 This position puts the steering gear in the straight-ahead position

##### Note

- At this position, the slit of the sector shaft end and the axis of the worm shaft cross are at a right angle.



9TQGNX-048

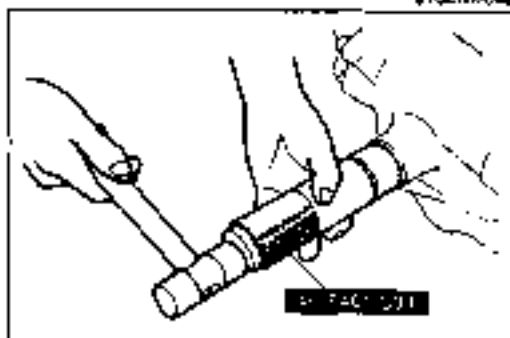
- 4 Turn the adjusting bolt
- 5 Measure the worm shaft preload in the straight-ahead position with the SST and a pull scale.
- 6 Turn the adjusting bolt to obtain the specified preload.

**Worm shaft preload (after sector shaft installed)**  
**Pull scale reading**  
6.9—11 N (0.7—1.1 kg, 1.5—2.4 lb)

- 7 Loosen the adjusting bolt one full turn, and then tighten it a half turn.
- 8 Tighten the locknut.
- 9 Verify the worm shaft preload

#### Gear housing

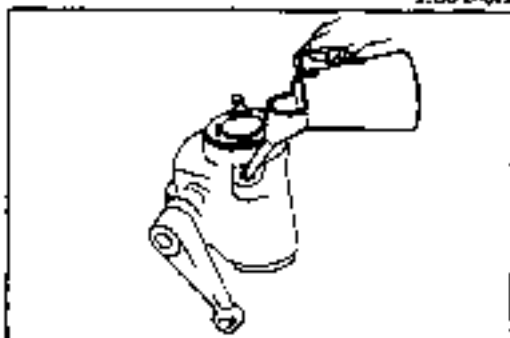
- 1 Tap the oil seal in with the SST and a plastic hammer



9TQGNX-049

- 2 Fill the gear housing with gear oil.


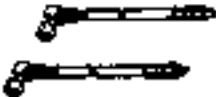












**Gear oil specification: API Service GL-4, SAE 90**  
**Amount: 0.94 liter (0.99 US qt, 0.83 imp qt)**



9TQGNX-050

## ENGINE SPEED SENSING POWER STEERING

PREPARATION  
SST

49 1232 670A Gauge set, power steering 	For inspection of fluid pressure	49 H002 671 Adapter, power steering gauge 	For inspection of fluid pressure
49 W032 502 Adapter 	For inspection of fluid pressure	49 0727 575 Puller, socket joint 	For removal of ball joint
49 0208 701A Air out tool, boot 	For removal of dust seal	49 0259 720 Wrench, drift side bearing adjust nut 	For removal and installation of adjusting plug
49 H022 327 Installer, bearing and oil seal 	For removal of bearing and oil seal	49 0180 510B Attachment, preload measuring 	For adjustment of worm shaft preload
49 F401 331 Body 	For installation of oil seal	49 0727 415 Installer bearing 	For installation of oil seal
49 G032 317 Hose (Part of 49 G032 3A1) 	For hermetic inspection	49 G032 316 Adapter 	For hermetic inspection
49 F015 032 Installer, water seal 	For installation of oil seal	49 F017 1A0 Universal wrench 	For installation of lock nut

57G01X-051

# N

## ENGINE SPEED SENSING POWER STEERING

### TROUBLESHOOTING GUIDE

Problem	Possible Cause	Action	Page/Section
<b>Steering feels heavy</b>	Poor lubrication, foreign material, or abnormal wear of steering ball joint Improper worm shaft preload Malfunctioning or damaged steering gear Leakage of fluid Low fluid level or air in fluid Insufficient oil pump pressure Clogged fluid pipe Loose or damaged oil pump drive belt Damaged oil pump drive gear (4.0 L Engine) Incorrect tire pressure Improperly adjusted wheel alignment	Lubricate or replace Adjust Replace Repair or replace Add fluid or bleed air Replace Repair or replace Adjust or replace Replace Adjust Adjust	N- 8 N-35 N-28 N-24 N-23 N-37 — N-46 N-43 Section Q Section R
<b>Steering wheel pulls to one side</b>	Dragging brake Incorrect tire pressure Unevenly worn tires Weak front spring Improperly adjusted wheel alignment	Repair Adjust Replace Replace Adjust	Section P Section Q Section Q Section R Section R
<b>General instability while driving</b>	Damaged steering linkage Worn or damaged steering ball joints Improper worm shaft preload Incorrect tire pressure Damaged or unbalanced wheel Weak front spring Malfunctioning shock absorber Improperly adjusted wheel alignment	Replace Replace Adjust Adjust Adjust or replace Replace Replace Adjust	N-28 N- 8 N-35 Section Q Section Q Section R Section R Section R
<b>Steering effort not uniform</b>	Loose oil pump drive belt Malfunctioning steering gear Malfunctioning steering joint Malfunctioning steering linkage	Adjust or replace Replace Replace Replace	N-46 N-28 N- 8 N-28
<b>Excessive steering wheel play</b>	Worn steering gear Worn or damaged steering joint Loose steering gear mounting bolts Improperly adjusted steering gear backlash Weak knuckle Improperly adjusted front wheel bearing preload	Replace Replace Tighten Adjust Replace Adjust	N-28 N- 8 N-28 N-35 Section M Section M
<b>Poor steering wheel return</b>	Stuck or damaged steering joint Improperly adjusted worm shaft preload Steering shaft contacting something Incorrect tire pressure Improperly adjusted front wheel alignment	Replace Adjust Repair or replace Adjust Adjust	N- 8 N-35 N-12 Section Q Section R
<b>Shimmy (Steering wheel vibrates left/right)</b>	Damaged steering linkage Loose steering gear mounting bolts Worn or damaged steering joint Improperly adjusted worm shaft preload Damaged or worn front wheel bearing Excessive tire or wheel runout Loose lug nuts Unbalanced wheel Incorrect tire pressure Unevenly worn tires Malfunctioning shock absorber Loose shock absorber mounting bolts Cracked or worn suspension bushings Improperly adjusted front wheel alignment	Replace Tighten Replace Adjust Replace Replace Tighten Adjust or replace Adjust Replace Replace Tighten Replace Replace Adjust	N-28 N-28 N- 8 N-35 Section M Section Q Section Q Section Q Section Q Section Q Section R Section R Section R Section R Section R

## TROUBLESHOOTING GUIDE (Cont'd)

Problem	Possible Cause	Action	Page/Section
Abnormal noise from steering system	Loose steering gear mounting bolts	Tighten	N-28
	Malfunctioning steering gear	Replace	N-28
	Loose or damaged steering linkage	Tighten or replace	N-28
	Worn steering joint	Replace	N- 8
	Obstruction near steering column	Repair or replace	N-12
	Improperly adjusted steering gear backlash	Adjust	V-35
	Loose oil pump	Tighten	N-37
	Loose oil pump bracket	Tighten	N-37
	Loose oil pump pulley	Tighten	V-37
	Loose or over tight oil pump drive belt	Adjust	N-46
	Worn or damaged oil pump drive gear (4.0 L Engine)	Replace	V-43
	Air in system	Bleed air	V-23
	Malfunctioning oil pump	Replace	N-37
Obstruction near steering column or pressure hose	Adjust or replace	—	

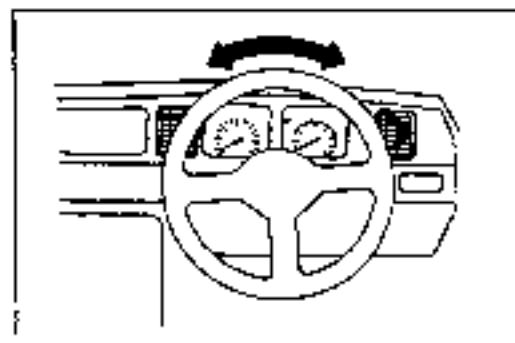
9TFOHX-014

## AIR BLEEDING

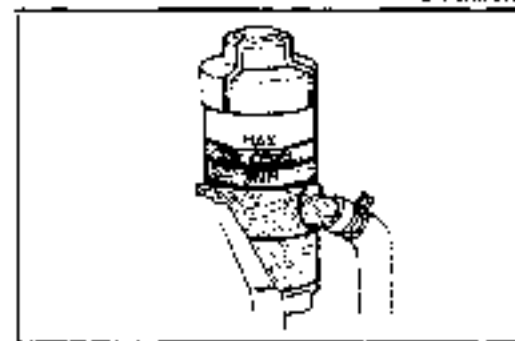
**Caution**

- While air bleeding, add fluid to ensure the proper fluid level, thus preventing air from getting into fluid.

9TGOHX-053

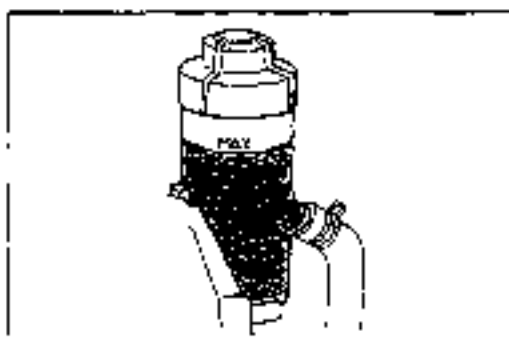


9TFOHX-013



9TGOHX-055

1. Jack up the front of the vehicle and support it with safety stands.
2. Check the fluid level. (Refer to page N-24.)
3. Turn the steering wheel fully to the left and right several times with the engine not running.
4. Recheck the fluid level. If the level has dropped, add fluid.
5. Repeat Steps 3 and 4 until the fluid level stabilizes.
6. Start the engine and let it idle.
7. Turn the steering wheel fully to the left and right several times.
8. Verify that the fluid is not foamy and that the fluid level has not dropped.
9. Add fluid if necessary and repeat Steps 7 and 8.

**POWER STEERING FLUID****Inspection****Fluid level**

1. Check the power steering fluid level. Add fluid to the specified level if necessary.

**Caution**

- Use only the specified power steering fluid.

**Fluid specification:**

ATF M2C33F or DEXRON-II

**Fluid leakage**

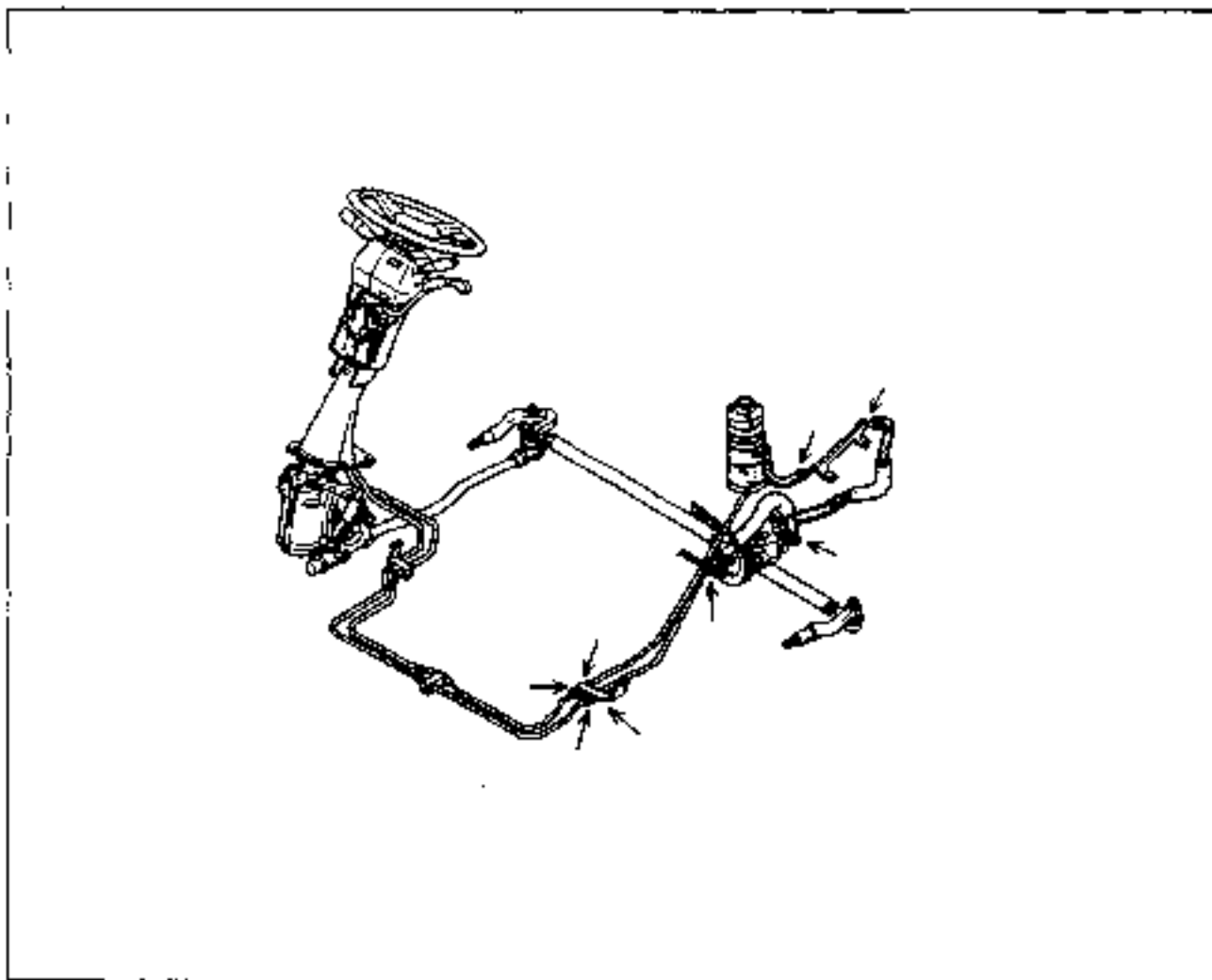
1. Start the engine. Turn the steering wheel fully to the left and right to apply fluid pressure. Check for fluid leakage.

**Caution**

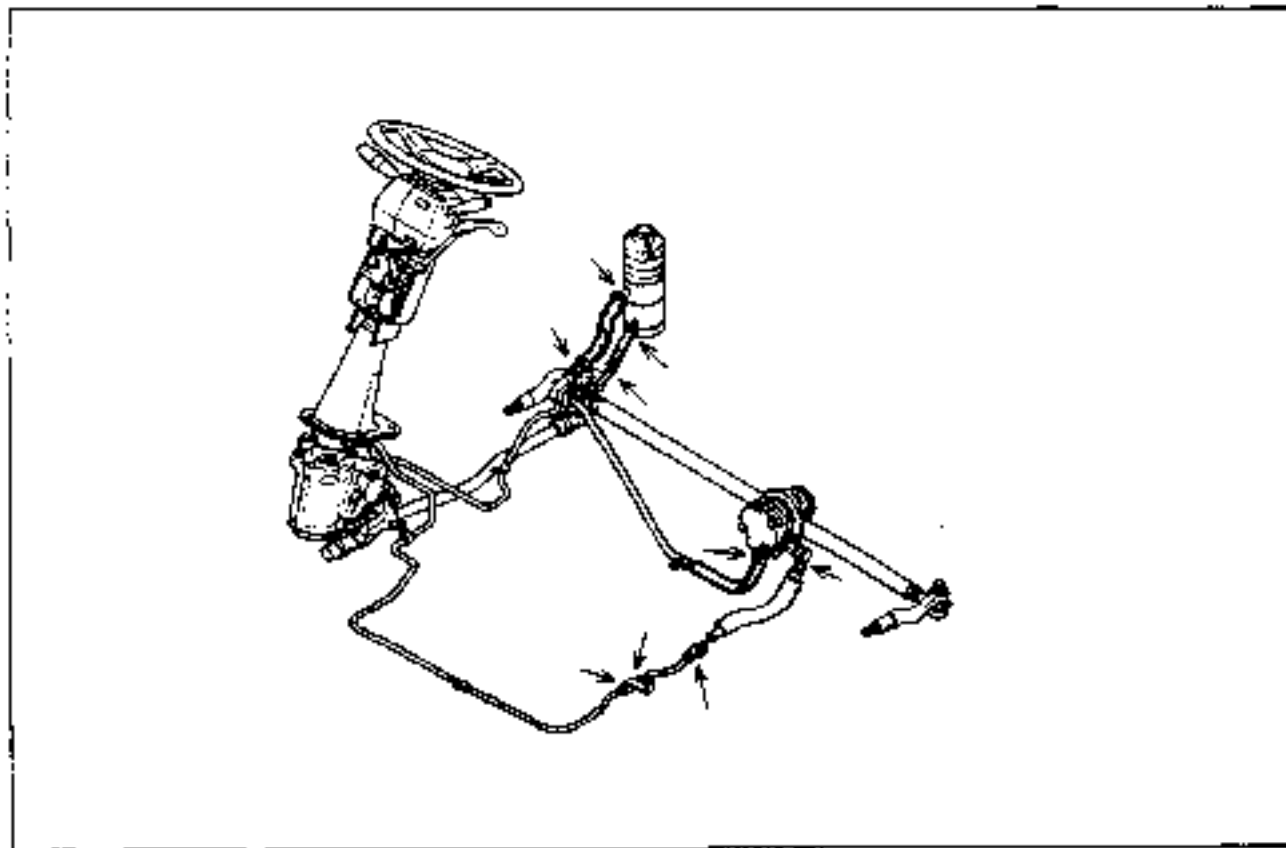
- To prevent damage to the steering system, do not keep the steering wheel in the fully turned position for more than 15 seconds.

**Note**

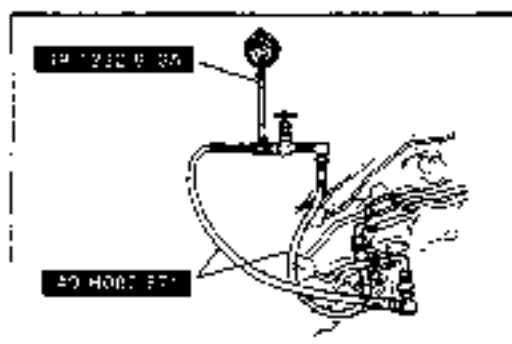
- The points where fluid leakage may occur are indicated by arrows in the figure.

**3.5 L TURBO MODEL**

## 4.0 L ENGINE MODEL



9TAPrec-015



9TFCNX-060

**Fluid pressure**

1. Assemble the SST as shown in the figure

**Tightening torque:**

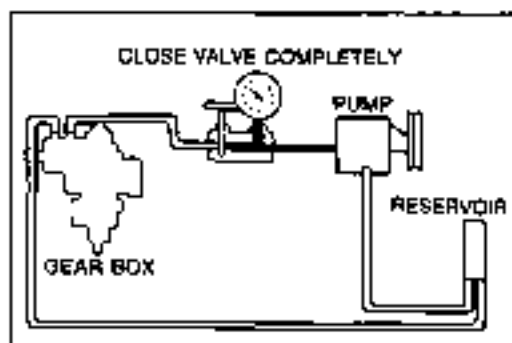
39–49 Nm (4.0–5.0 m·kg, 29–36 ft·lb)

**Note**

- Before disconnecting the hose, make marks at the connections for proper reinstallation.

2. Disconnect the high-pressure hose. Attach the SST.
3. Bleed the air from the system (Refer to page N-23.)

9TFCNX-016



9TFCNX-062

4. Open the gauge valve fully. Start the engine and turn the steering wheel fully left and right to raise the fluid temperature to 50–60°C (122–140°F).
5. Close the gauge valve completely. Increase the engine speed to 1,000–1,500 rpm and measure the fluid pressure generated by the oil pump. If the pressure is below specification, replace the oil pump assembly.

**Oil pump fluid pressure:**

10,301 kPa (105 kg/cm<sup>2</sup>, 1,493 psi)

**Caution**

- If the valve is left closed for more than 15 seconds, the fluid temperature will increase excessively and adversely affect the oil pump.

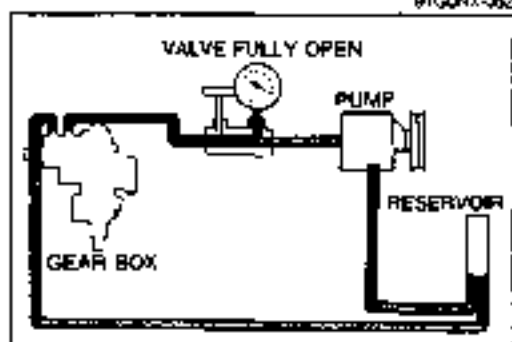
6. Open the gauge valve fully again and increase the engine speed to 1,000–1,500 rpm.
7. Turn the steering wheel fully to the left and right and measure the fluid pressure generated by the gear housing. If the pressure is below specification, replace the gear housing assembly.

**Gear housing fluid pressure:**

10,301 kPa (105 kg/cm<sup>2</sup>, 1,493 psi)

**Caution**

- If the steering wheel is kept in the fully turned position for more than 15 seconds, the fluid temperature will rise excessively and adversely affect the oil pump.



9TFCNX-063



- Remove the gauge set. Install and tighten the high-pressure hose to the specified torque.

**Tightening torque:**

**31—48 Nm (3.2—4.9 m·kg, 23—35 ft·lb)**

- Bleed the air from the system. (Refer to page N-23.)

9TFOHX-017

**STEERING WHEEL AND COLUMN****On-vehicle Inspection****Steering wheel play**

- Refer to page N-11.

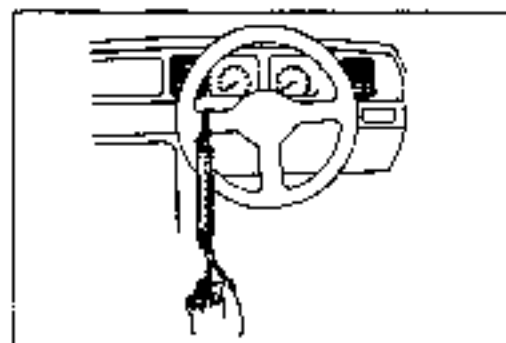
**Steering wheel effort**

- With the vehicle on a hard level surface, move the steering wheel to put the wheels in the straight-ahead position.
- Start the engine and warm the power steering fluid to 50—60°C (122—140°F).

**Note**

- To raise the fluid temperature, turn the steering wheel fully left and right several times.

9TFOHX-018



9TFOHX-059

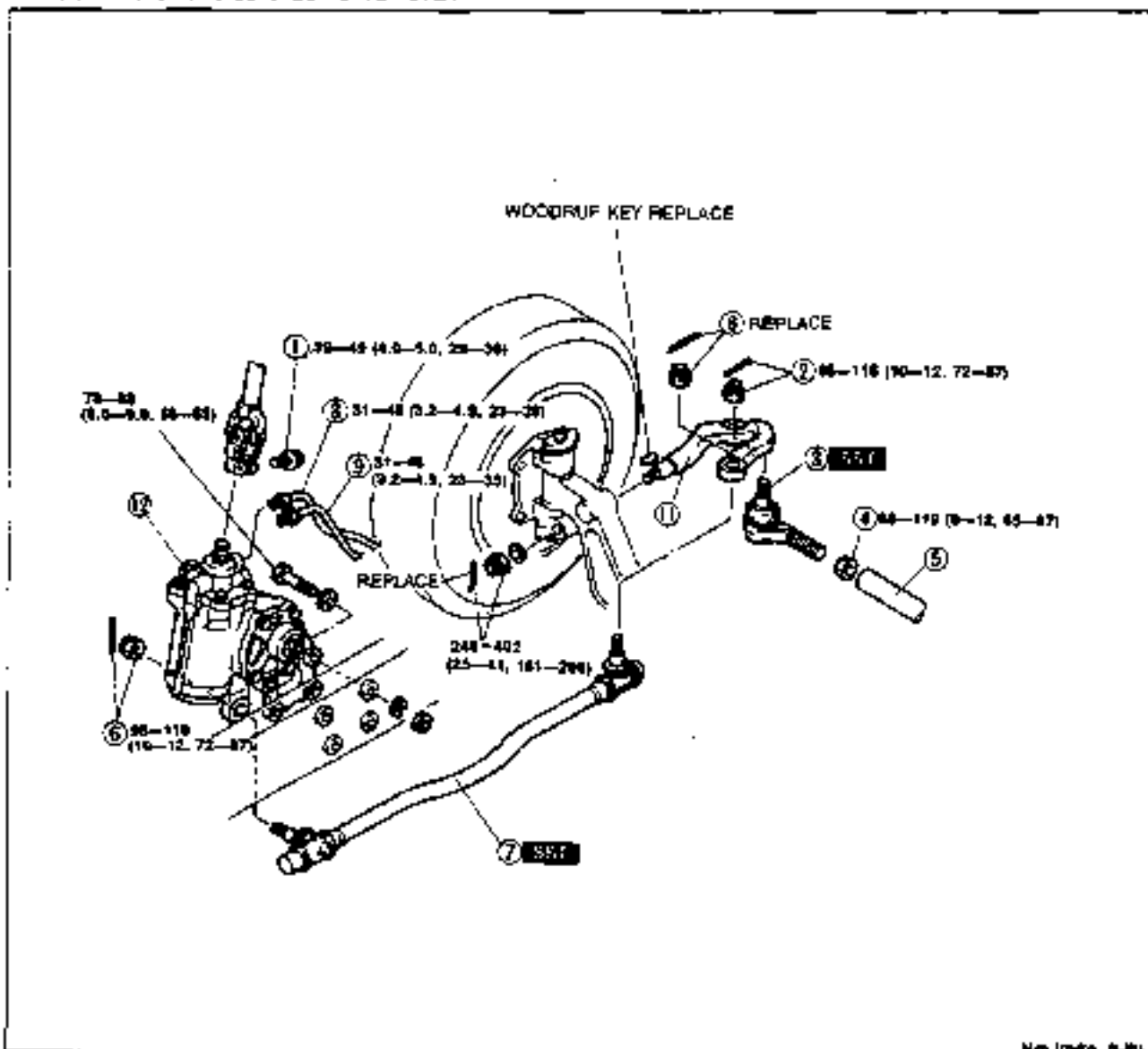
- With the engine running at idle speed, attach a pull scale to the outermost point of the steering wheel spoke. Then, starting with the wheels in the straight-ahead position, check the steering effort required to turn the steering wheel to the left and to the right.
- If the measured value exceeds specification, check the following: fluid level, air in system, fluid leakage at hose or connections, function of oil pump and gearbox, and tire pressure.

**Steering wheel effort: 39 N (4.0 kg, 8.8 lb) or less**

## STEERING GEAR AND LINKAGE

## Removal / Inspection / Installation

1. Loosen the wheel lug nuts.
2. Jack up the front of the vehicle and support it with safety stands.
3. Remove the wheels.
4. Remove in the order shown in the figure, referring to **Removal Note**.
5. Inspect for all parts and repair or replace as necessary.
6. Install in the reverse order of removal.

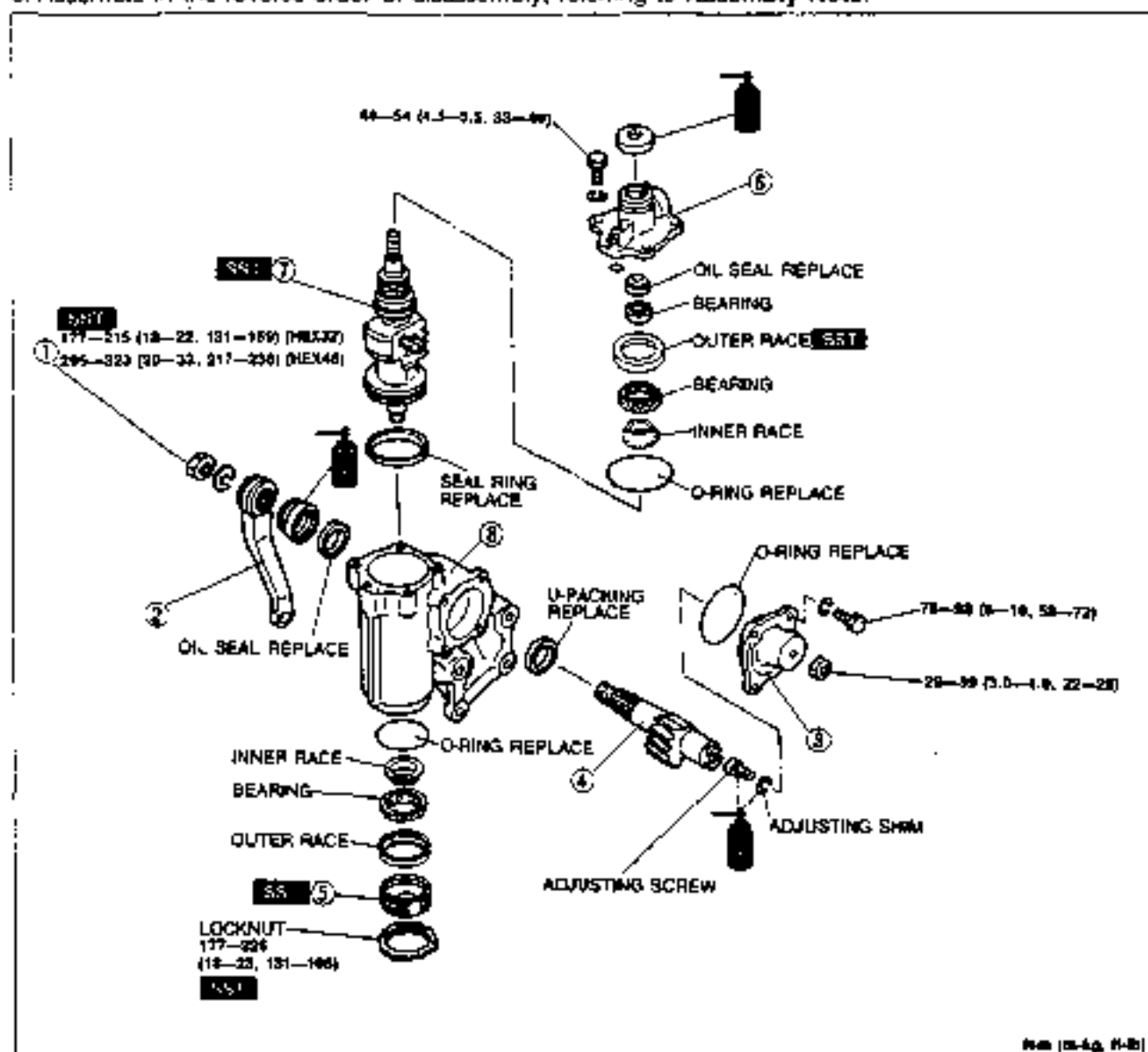


44mm (1.73in) (N-10)  
9TFOHX01B

- |                                 |                                |
|---------------------------------|--------------------------------|
| 1. Fixing bolt                  | 7. Drag link                   |
| 2. Cotter pin, nut              | Removal note..... page N- 9    |
| 3. Tie-rod end                  | Inspect for bending            |
| Removal note..... page N- 9     | Inspect operation of ball stud |
| Inspect for damage              | 8. Pressure pipe               |
| Inspect operation of ball joint | 9. Return pipe                 |
| 4. Locknut                      | 10. Cotter pin, nut            |
| Removal note..... page N- 9     | 11. Knuckle arm                |
| 5. Tie-rod                      | 12. Steering gear              |
| Inspect for bending             | Disassembly / Inspection /     |
| 6. Cotter pin, nut              | Assembly..... page N-29        |

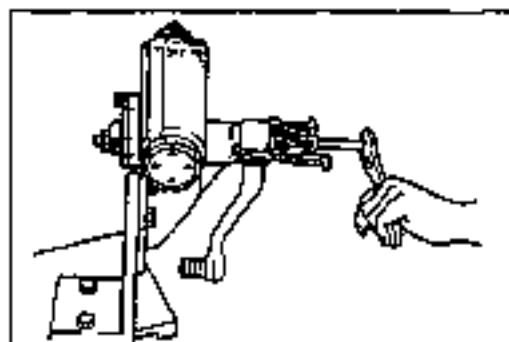
## Disassembly / Inspection / Assembly

1. Disassemble in the order shown in the figure, referring to **Disassembly Note**.
2. Inspect for all parts and repair or replace as necessary.
3. Assemble in the reverse order of disassembly, referring to **Assembly Note**.



91-1044-020

<ol style="list-style-type: none"> <li>1. Locknut</li> <li>2. Pitman arm                     <ul style="list-style-type: none"> <li>Disassembly note..... page N-30</li> <li>Assembly note..... page N-36</li> </ul> </li> <li>3. Side cover                     <ul style="list-style-type: none"> <li>Disassembly note..... page N-30</li> <li>Inspect bearing for damage or corrosion</li> <li>Assembly note..... page N-34</li> </ul> </li> <li>4. Sector shaft                     <ul style="list-style-type: none"> <li>Disassembly note..... page N-30</li> <li>Inspection..... page N-32</li> <li>Assembly note..... page N-34</li> </ul> </li> <li>5. Adjusting plug                     <ul style="list-style-type: none"> <li>Disassembly note..... page N-30</li> <li>Assembly note..... page N-34</li> </ul> </li> </ol>	<ol style="list-style-type: none"> <li>6. Valve housing                     <ul style="list-style-type: none"> <li>Disassembly note..... page N-31</li> <li>Inspect for damage</li> <li>Assembly note..... page N-33</li> </ul> </li> <li>7. Worm ball nut assembly                     <ul style="list-style-type: none"> <li>Disassembly note..... page N-31</li> <li>Inspection..... page N-33</li> <li>Assembly note..... page N-32</li> </ul> </li> <li>8. Gear housing                     <ul style="list-style-type: none"> <li>Disassembly note..... page N-31</li> <li>Inspect for damage</li> <li>Assembly note..... page N-33, 35</li> </ul> </li> </ol>
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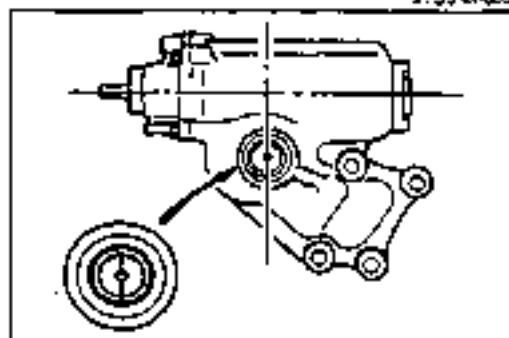
9T3344-069

**Disassembly note****Pitman arm**

1. Remove the pitman arm with a suitable puller

**Caution**

- Do not hit the pitman arm and do not use a chisel.



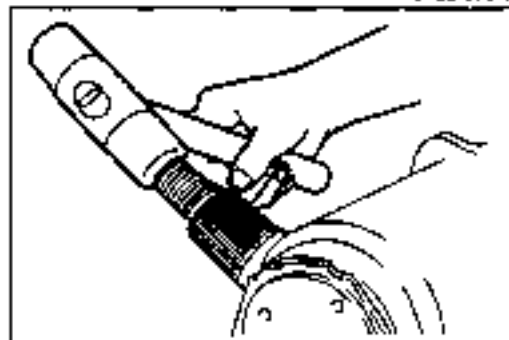
9T6040-070

**Sector shaft, Side cover**

1. Turn the worm shaft counterclockwise until it no longer turns
2. Turn it clockwise 2–3 turns.
3. This position sets the steering gear in the straight-ahead position.

**Note**

- At this position, the slit of the sector shaft end and the axis of the worm shaft cross at a right angle.

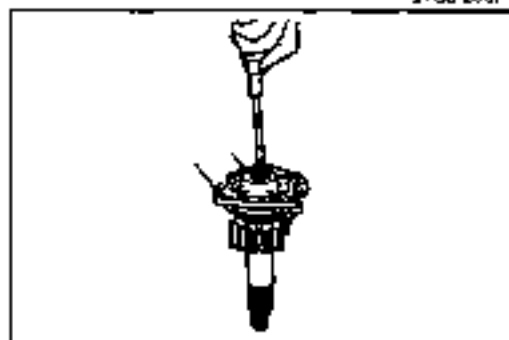


9T6040-071

4. Remove the side cover and the sector shaft together by striking the sector shaft end with a plastic hammer.

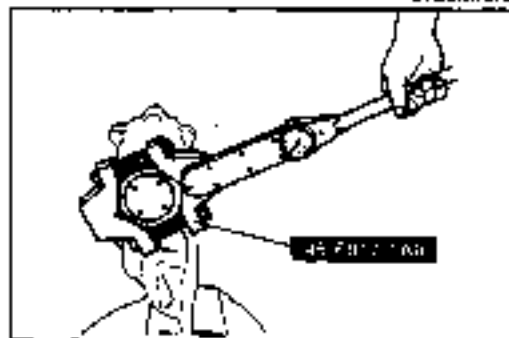
**Caution**

- Before removing, remove all dirt and oil from the serrations of the sector shaft.



9T6040-072

5. Remove the side cover from the sector shaft by turning the adjusting screw clockwise as shown.



9T6040-073

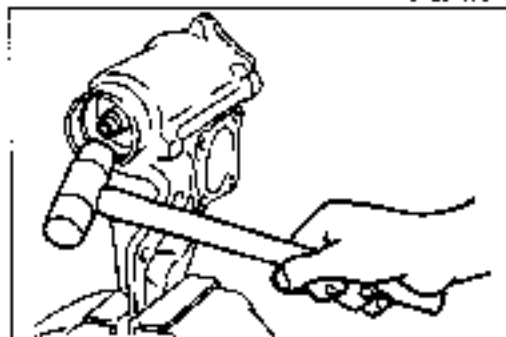
**Adjusting plug**

1. Remove the locknut with the SST.



9T3GNX-074

2. Remove the adjusting plug with the SST.



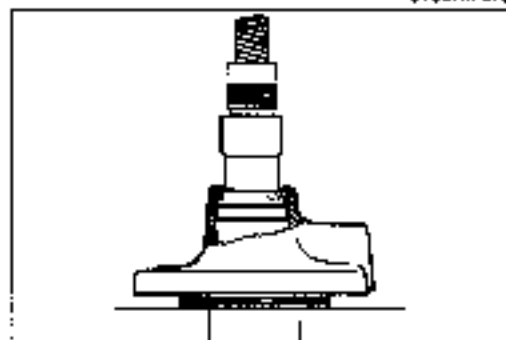
9T3GNX-075

#### Valve housing, Worm ball nut assembly

##### Caution

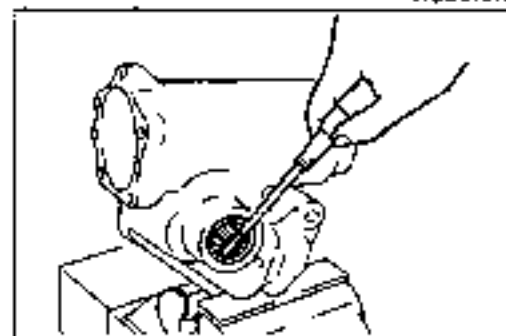
- Do not damage the inside of the gear housing and the worm ball nut assembly.

1. Remove the valve housing and the worm ball nut assembly together by hitting the worm shaft end with a plastic hammer.



9T3GNX-076

2. Press the ball bearing and the O seal out with the a socket
3. Remove the outer race with a screwdriver.



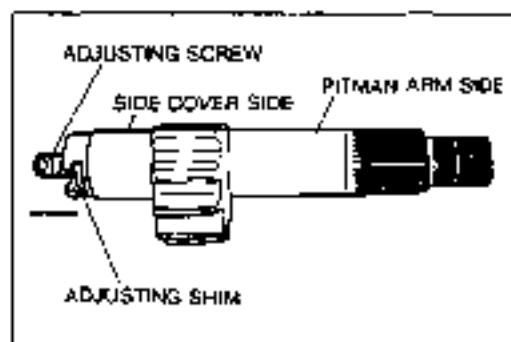
9T3GNX-077

#### Gear housing

1. Remove the oil seal, the U-packing and the O-ring with a screwdriver.

##### Caution

- Do not remove the needle bearing.
- Do not damage the inside of the gear housing or the needle bearing.



9T50K018

**Inspection****Sector shaft**

1. Set the adjusting screw and the adjustment shim in the T-groove.
2. Measure the clearance with a feeler gauge in the axial direction.
3. If the clearance exceeds specification, adjust it with the adjustment shims supplied in the adjustment shim kit.

**Clearance in axial direction:**

0—0.1mm (0—0.004 in)

**Available adjustment shims:**

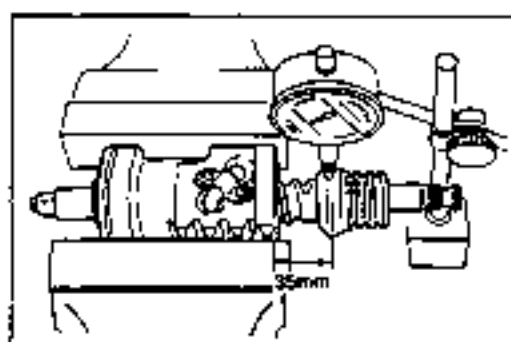
1.95mm (0.077 in), 2.00mm (0.079 in),  
2.05mm (0.081 in)

4. Measure the outer diameter.

**Limit:**

Models	Side cover side	Pitman arm side
General RHD (10 N, 2,000 kg)	34.95mm (1.38 in)	34.55mm (1.36 in)
Others	39.94mm (1.57 in)	44.39mm (1.75 in)

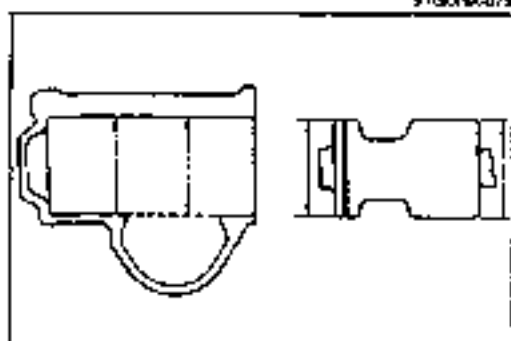
5. Check for damage and wear of the teeth and the shaft.



9T50K0179

**Worm ball nut assembly**

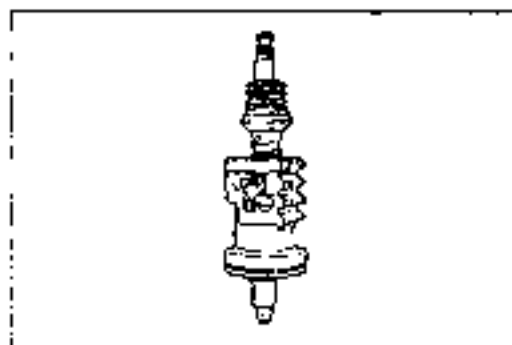
1. Measure the play in the vertical direction as shown.

**Limit: 0.4mm (0.016 in)**

9T50K0180

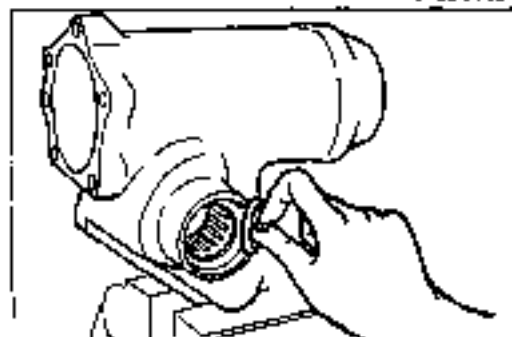
2. Measure the clearance of gear housing inner diameter and worm ball nut assembly outer diameter.

**Limit: 0.15mm (0.006 in)**



9TGD1X-081

3. Verify that the worm ball nut turns and moves down by its own weight when holding the shaft as shown.
4. Check for damage of the worm ball nut assembly.



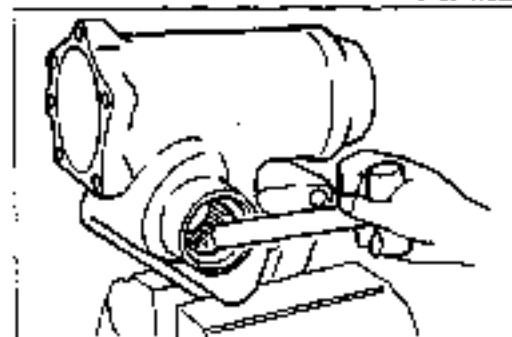
9TGD1X-082

**Assembly note****Gear housing**

1. Apply ATF to a new O-ring, and install it into the gear housing.
2. Apply ATF to the U-packing, and install it into the gear housing as shown.

**Note**

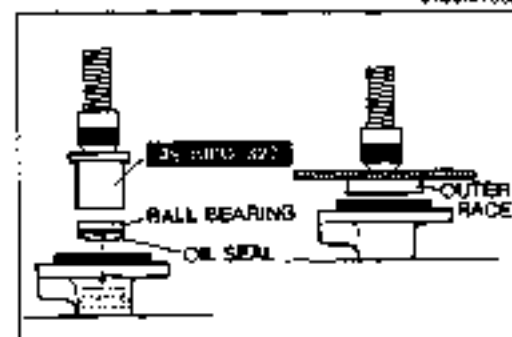
- Pinch the U-packing as shown to install it. Smooth it into place by hand after installation.
- Install the U-packing into position with a hammer handle.



9TGD1X-083

**Caution**

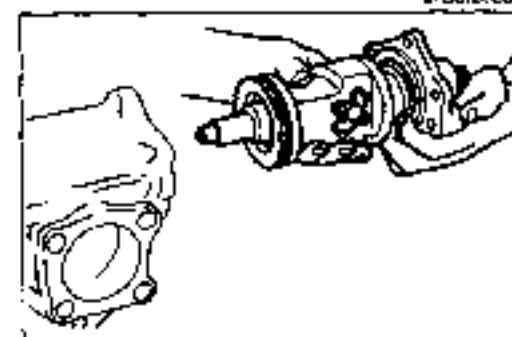
- Do not damage the inside of the gear housing or the needle bearing.



9TGD1X-084

**Valve housing**

1. Press the oil seal and the ball bearing in with the SST and apply ATF to the oil seal.
2. Press the outer race in with a flat plate.

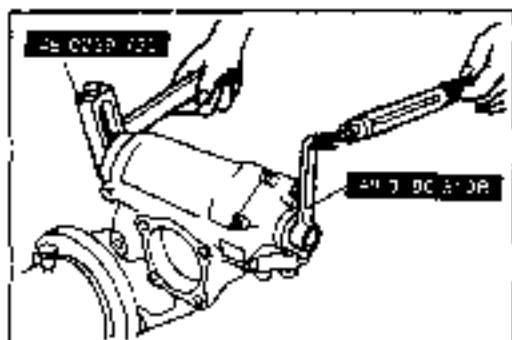


9TGD1X-085

**Worm ball nut assembly****Caution**

- Do not damage the seal ring.
- Before inserting, set the rack position in the center position of the worm shaft.

1. Apply ATF to the seal ring, then insert the worm ball nut assembly and the valve housing into the gear housing together.



9TGD04-002

**Adjusting plug**

1. Install the inner race on the worm shaft.
2. Apply ATF to the O-ring
3. Install the adjusting plug and the outer race by hand.
4. Verify that the worm shaft turns smoothly.
5. Turn the adjusting plug with the **SST**.
6. Measure the worm shaft preload with the **SST** and a pull scale.
7. Turn the adjusting plug to obtain the specified preload

**Worm shaft preload (without sector shaft)****Pull scale reading:**

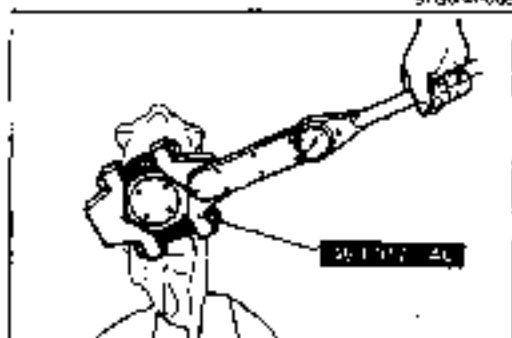
3.9—5.9 N (0.4—0.6 kg, 0.9—1.3 lb)

8. Tighten the locknut with the **SST**.

**Tightening torque (When using the SST):**

167—196 Nm (17—20 m·kg, 123—144 ft·lb)

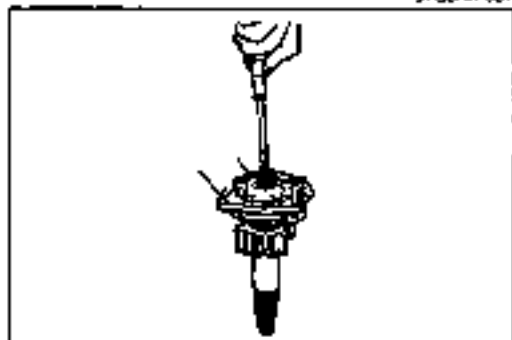
9. Verify the worm shaft preload.



9TGD04-007

**Sector shaft, side cover**

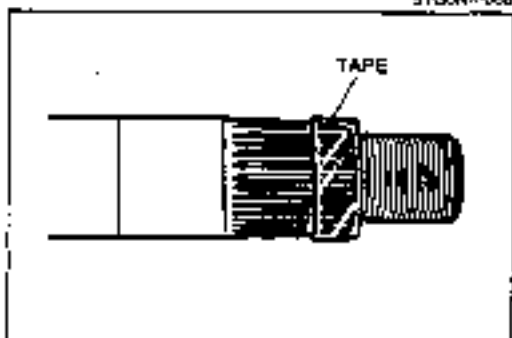
1. Insert the sector shaft into the side cover
2. Turn the adjusting bolt counterclockwise with a screwdriver until it no longer turns. Return one turn.
3. Temporarily tighten the locknut



9TGD04-008

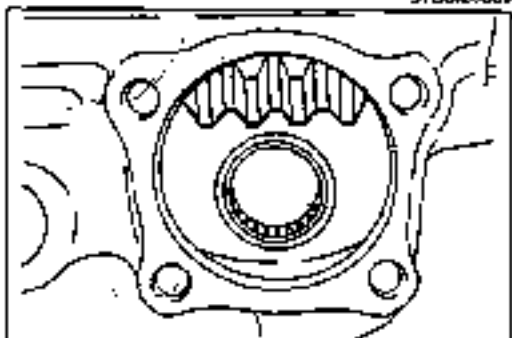
**Caution**

- Not to damage the needle bearing, use tape on the sector shaft as shown.



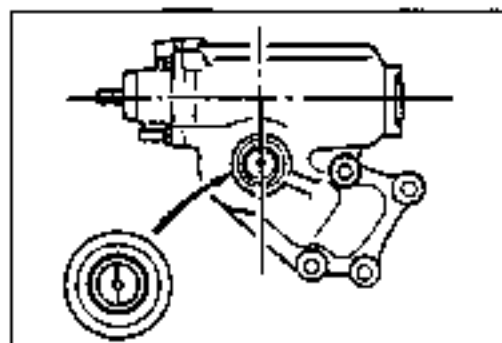
9TGD04-009

4. Center the worm shaft teeth as shown in the figure.
5. Tilt the worm shaft teeth down as shown.
6. Install the sector shaft and the side cover into the gear housing.
7. Verify that the worm shaft turns **approx. 5 turns** lock-to-lock.



9TGD04-010



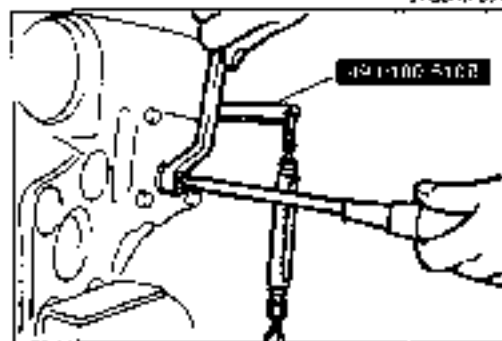


9TGMX-091

**Adjustment of preload****Caution**

- The following adjustment is made after the sector shaft is installed.

1. Turn the worm shaft counterclockwise until it no longer turns.
2. Turn it clockwise 2—3 turns.
3. This sets the steering gear in the straight-ahead position.



9TGMX-092

**Note**

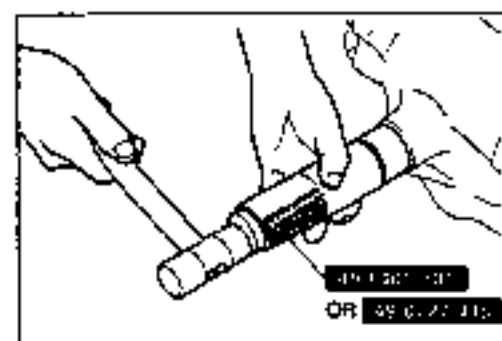
- At this position, the slit of the sector shaft end and the axis of the worm shaft cross at a right angle.

4. Turn the adjusting bolt.
5. Measure the worm shaft preload in the straight-ahead position with the SST and a pull scale.
6. Turn the adjusting bolt to obtain the specified preload.

**Worm shaft preload (after sector shaft installed)****Pull scale reading**

5.9—7.6 N (0.6—0.8 kg, 1.3—1.8 lb)

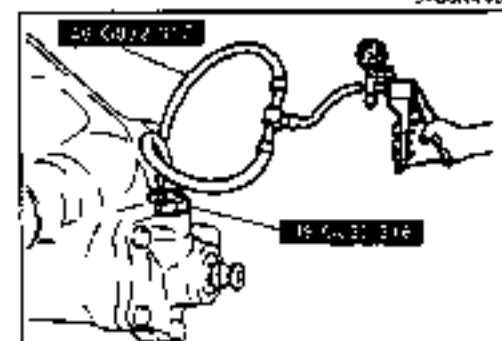
7. Loosen the adjusting bolt one full turn and then tighten it a half turn.
8. Tighten the locknut.
9. Verify the worm shaft preload.



9TGMX-093

**Gear housing**

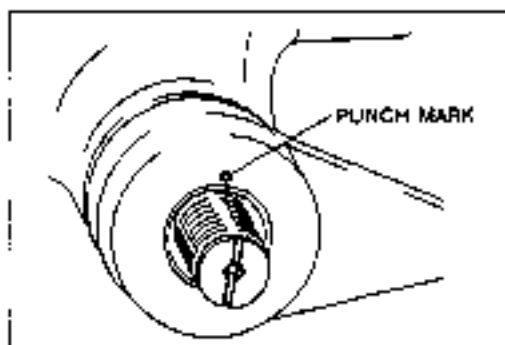
1. Tap the oil seal in with the SST and a plastic hammer.



9TGMX-094

**Hermetic inspection**

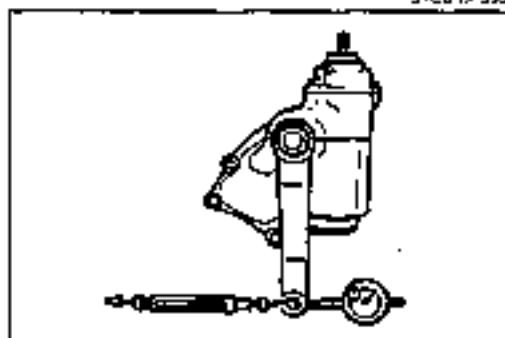
1. Connect the SST to the cylinder housing.
2. Connect a vacuum pump to the SST.
3. Apply 400 mmHg (15.7 inHg) vacuum.
4. Verify that vacuum is held for at least 30 sec.



37C017-096

**Pilman arm**

1. Align the slot of the sector shaft end and the punch mark as shown and install the pilman arm.



37C017-096

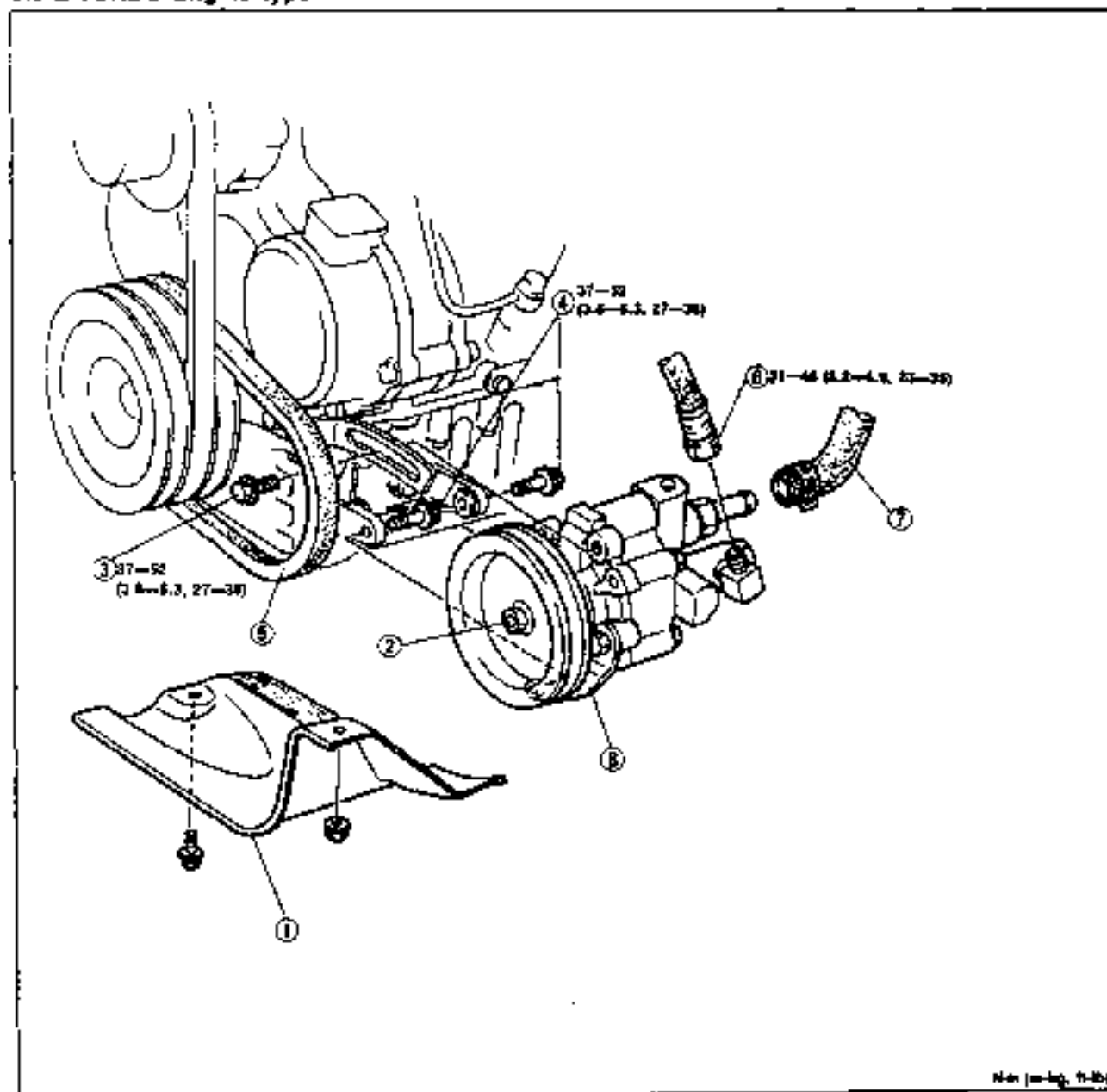
**Measurement of the backlash**

1. Set the steering gear in the straight-ahead position.
2. Pull the pilman arm with the specified force.
3. Measure the backlash.

**Specified force: 20 N (2.0 kg, 4.4 lb)****Backlash: 0.25mm (0.010 in) max.**

**POWER STEERING OIL PUMP****Removal / Installation**

1. Remove in the order shown in the figure referring to **Removal Note**.
2. Install in the reverse order of removal, referring to **Installation Note**.

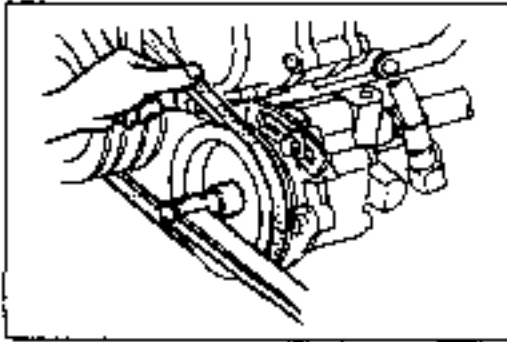
**3.5 L TURBO Engine type**

N-on (m-hg, 11-15)  
97F04C-021

- |   |                            |
|---|----------------------------|
| 1. Pump protector                           | 6. Pressure pipe           |
| 2. Locknut (Do not remove if not necessary) | 7. Return hose             |
| Removal note ..... page N-38                | B. Oil pump assembly       |
| Installation note ..... page N-38           | Disassembly / Inspection / |
| 3. Strap bolt                               | Assembly ..... page N-39   |
| 4. Bolt                                     |                            |
| 5. Drive belt                               |                            |
| Inspection ..... page N-46                  |                            |
| Adjustment ..... page N-46                  |                            |
| Replacement ..... page N-47                 |                            |

# N

## ENGINE SPEED SENSING POWER STEERING

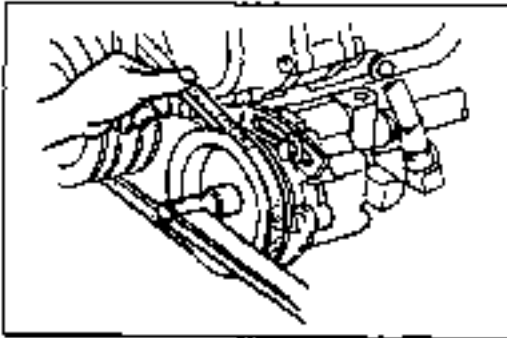


9T20HX-099

### Removal note

#### Locknut

1. Push the drive belt as shown and loosen the locknut.



8T60HX-000

### Installation note

#### Locknut

1. Push the drive belt as shown and tighten the locknut to the specified torque

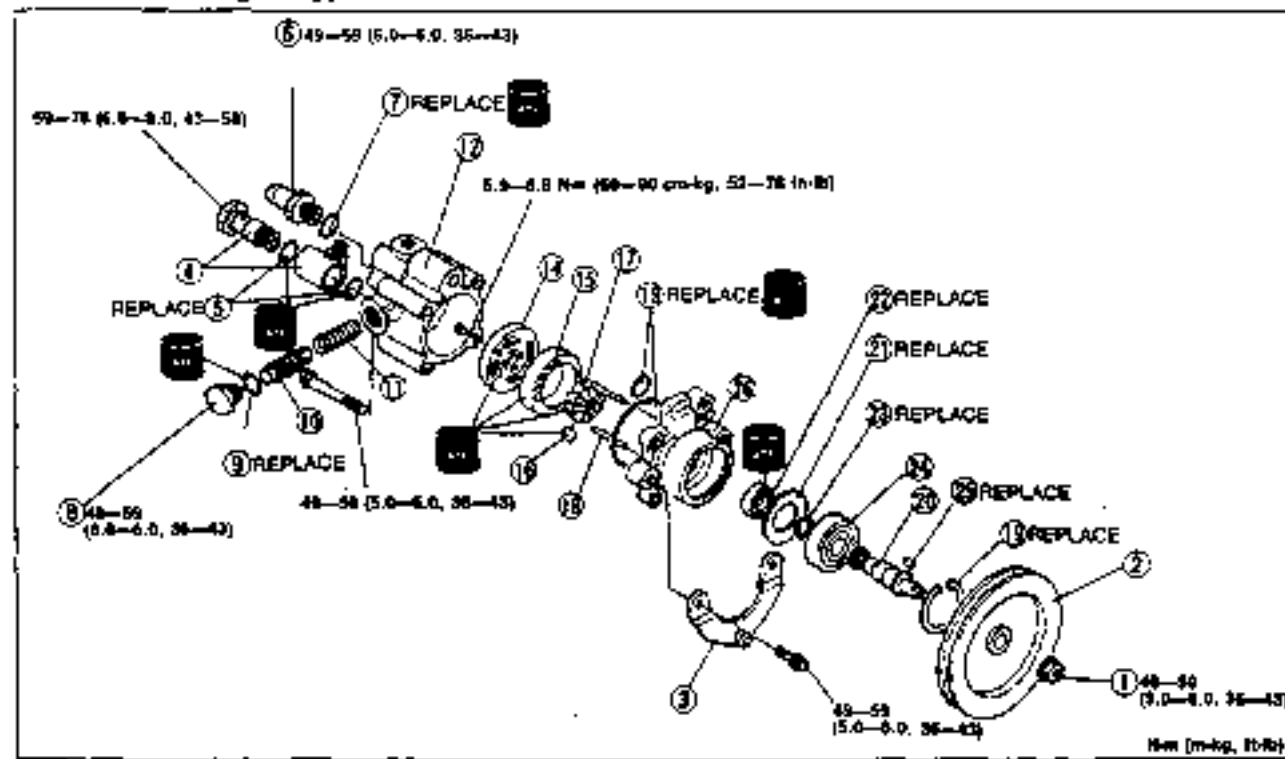
#### Tightening torque:

49—59 N·m (5.0—6.0 m·kg, 36—43 ft·lb)

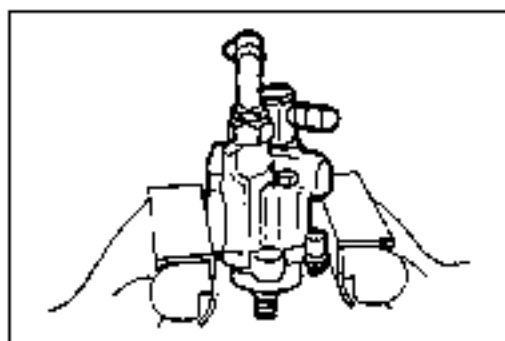
**Disassembly / Inspection / Assembly**

- 1 The following procedures show replacement of the O-ring, bearing, Woodruff key and oil seal. If a problem is found in other parts, replace the oil pump assembly.
- 2 Disassemble in the order shown in the figure, referring to **Disassembly Note**.
- 3 Inspect all parts and repair or replace as necessary.
- 4 Assemble in the reverse order of disassembly, referring to **Assembly Note**.

**3.5 L TURBO Engine type**



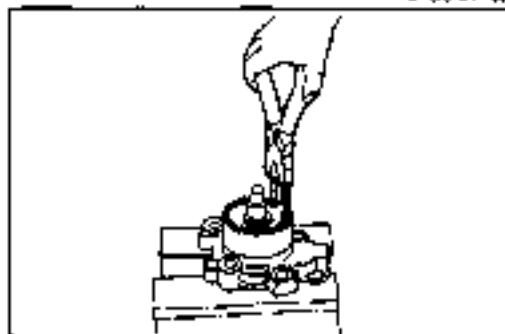
- |  |  |
|--|--|
| <ol style="list-style-type: none"> <li>1. Locknut</li> <li>2. Pulley</li> <li>3. Bracket</li> <li>4. Connector (Return)</li> <li>5. O-ring</li> <li>6. Connector (Pressure)</li> <li>7. O-ring</li> <li>8. Plug</li> <li>9. O-ring</li> <li>10. Control valve assembly<br/>Inspect for damage and wear</li> <li>11. Spring<br/>Inspect for damage</li> <li>12. Rear body<br/>Inspect for damage and wear</li> <li>13. O-ring</li> <li>14. Pressure plate<br/>Inspect for damage and wear<br/>Assembly note ..... page N-42</li> <li>15. Cam ring<br/>Inspect for damage and wear<br/>Assembly note ..... page N-42</li> <li>16. Vane<br/>Inspect for wear<br/>Assembly note ..... page N-42</li> </ol> | <ol style="list-style-type: none"> <li>17. Rotor<br/>Inspect for damage and wear<br/>Assembly note ..... page N-42</li> <li>18. Pin</li> <li>19. Snap ring<br/>Disassembly note ..... page N-40</li> <li>20. Driveshaft<br/>Disassembly note ..... page N-40<br/>Inspect for damage and wear<br/>Assembly note ..... page N-41</li> <li>21. Retaining ring</li> <li>22. Oil seal<br/>Disassembly note ..... page N-41</li> <li>23. Snap ring</li> <li>24. Bearing<br/>Inspect operation</li> <li>25. Woodruff key<br/>Disassembly note ..... page N-40<br/>Assembly note ..... page N-41</li> <li>26. Front body<br/>Inspect for damage<br/>Inspect operation of needle bearing<br/>Assembly note ..... page N-41</li> </ol> |
|--|--|



9TGDNR-100

**Disassembly note****Caution**

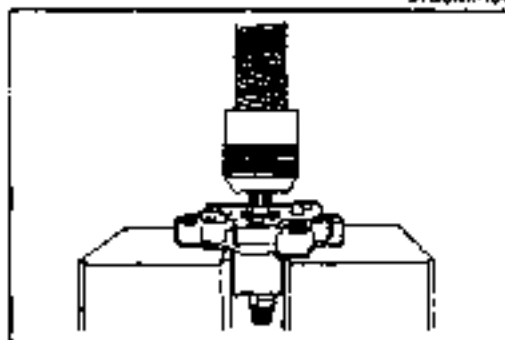
- When securing the oil pump in a vise, use protective plates as shown in the figure.



9TGDNR-104

**Snap ring**

1. Remove the snap ring with snap-ring pliers.



9TGDNR-105

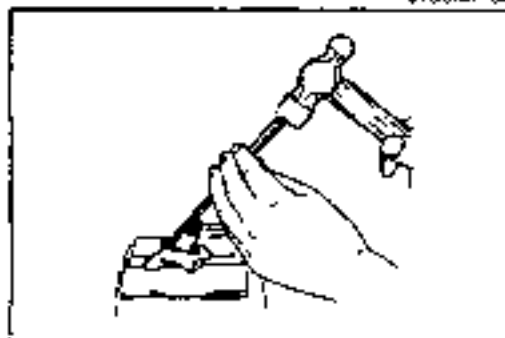
**Driveshaft**

1. Press the driveshaft and bearing out as shown.
2. Remove the snap ring.



9TGDNR-106

3. Press the bearing out as shown.



9TGDNR-107

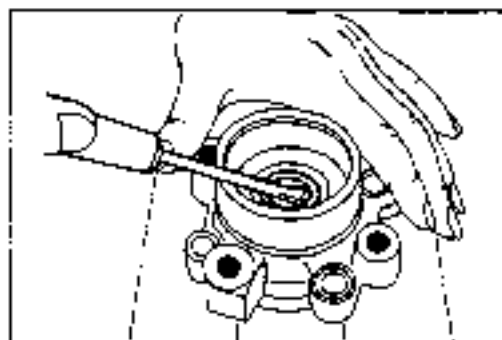
**Woodruff key (if necessary)**

1. Secure the driveshaft in a vise with rag as shown.

**Caution**

- Do not damage the shaft.
- Do not remove the woodruff key if it is not defective.

2. Remove the Woodruff key with a chisel and a hammer.



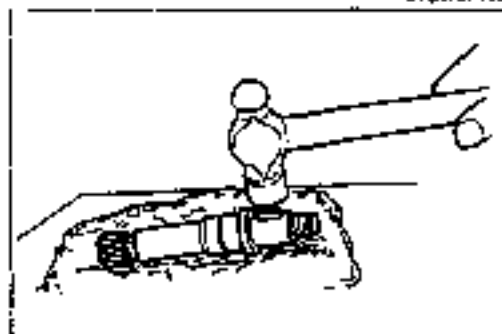
9T50HX-108

**Oil seal**

1. Secure the front body in a vise.
2. Remove the oil seal with a screwdriver

**Caution**

- Do not damage the front body and the needle bearing.



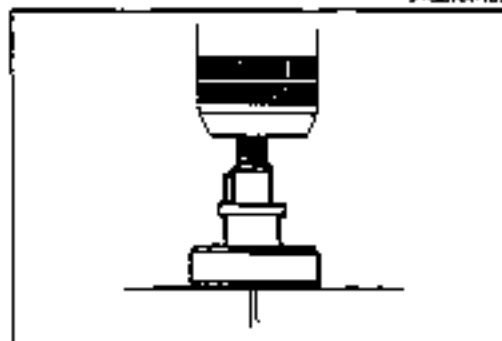
9T50HX-109

**Assembly note****Woodruff key**

1. Tap the Woodruff key into the shaft.

**Caution**

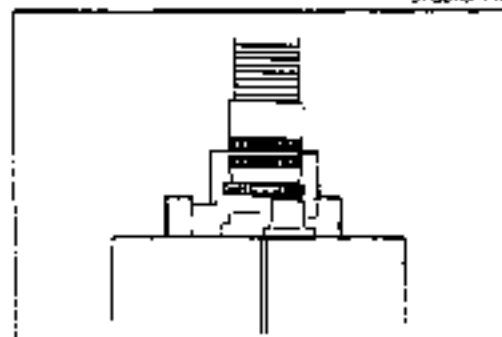
- Not to damage the shaft, use a rag under the shaft for protection.



9T50HX-110

**Driveshaft**

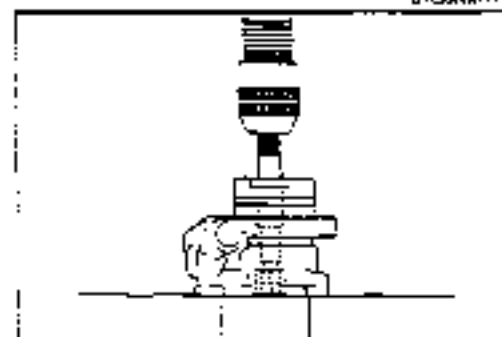
1. Press the bearing on as shown.
2. Install the snap ring.



9T50HX-111

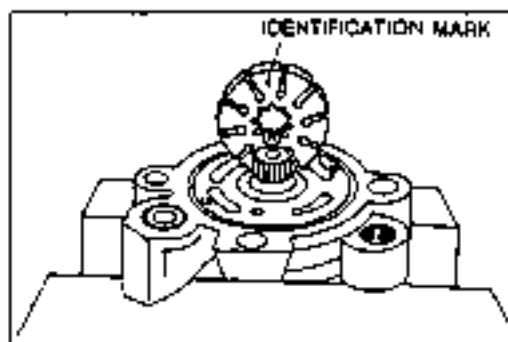
**Front body**

1. Press the oil seal in as shown.



9T50HX-112

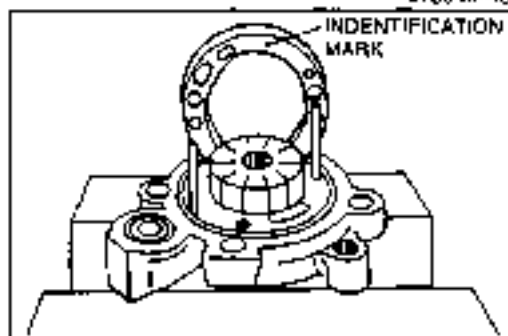
2. Press the driveshaft and the bearing in as shown.
3. Install the snap ring.



9TGMX-113

**Rotor**

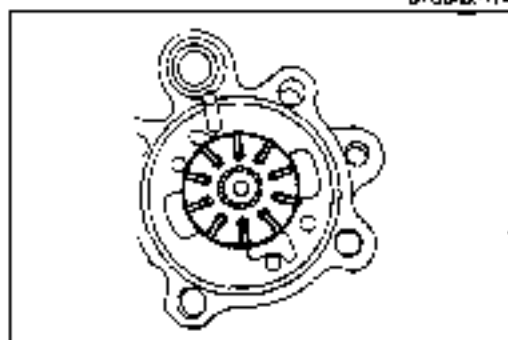
1. Apply ATF to the rotor and install it with the identification mark facing the front body as shown.



9TGMX-114

**Cam ring**

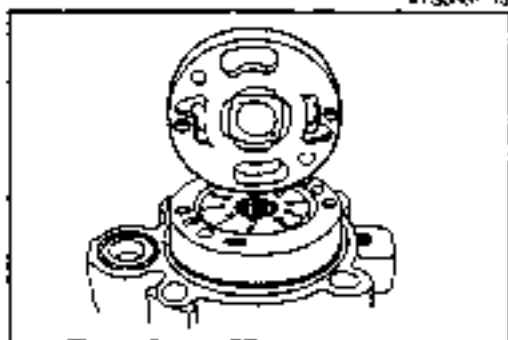
1. Install the pin.
2. Apply ATF to the cam ring and install it with the identification mark facing the front body as shown.



9TGMX-115

**Vane**

1. Apply ATF to the vanes and place them in the rotor with the rounded edges against the cam ring.



9TGMX-116

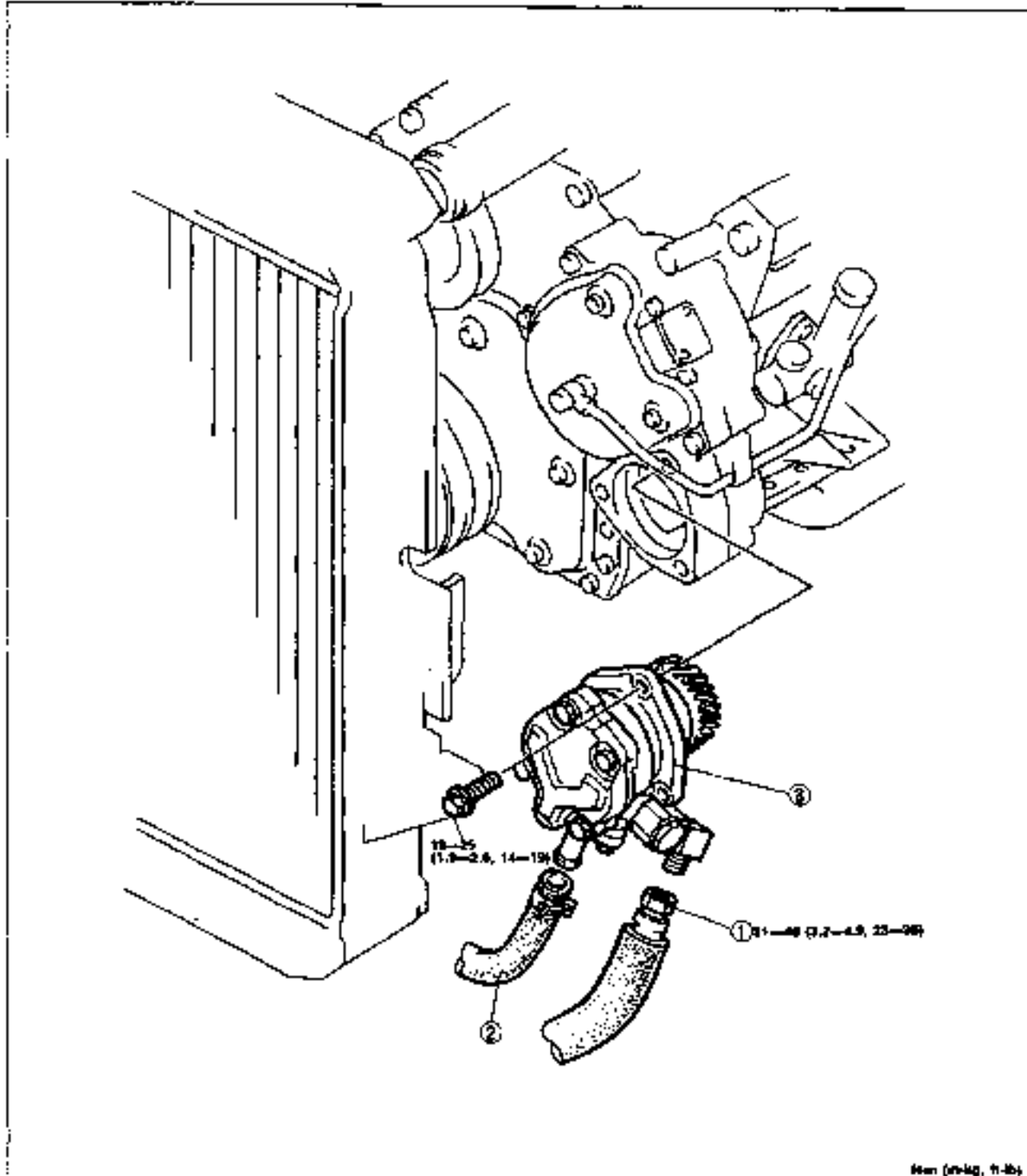
**Pressure plate**

1. Apply ATF to the pressure plate and install it.



**Removal / Installation**

1. Remove the radiator cowl (upper and lower) and the cooling fan. (Refer to Section E.)
2. Remove in the order shown.
3. Install in the reverse order of removal.

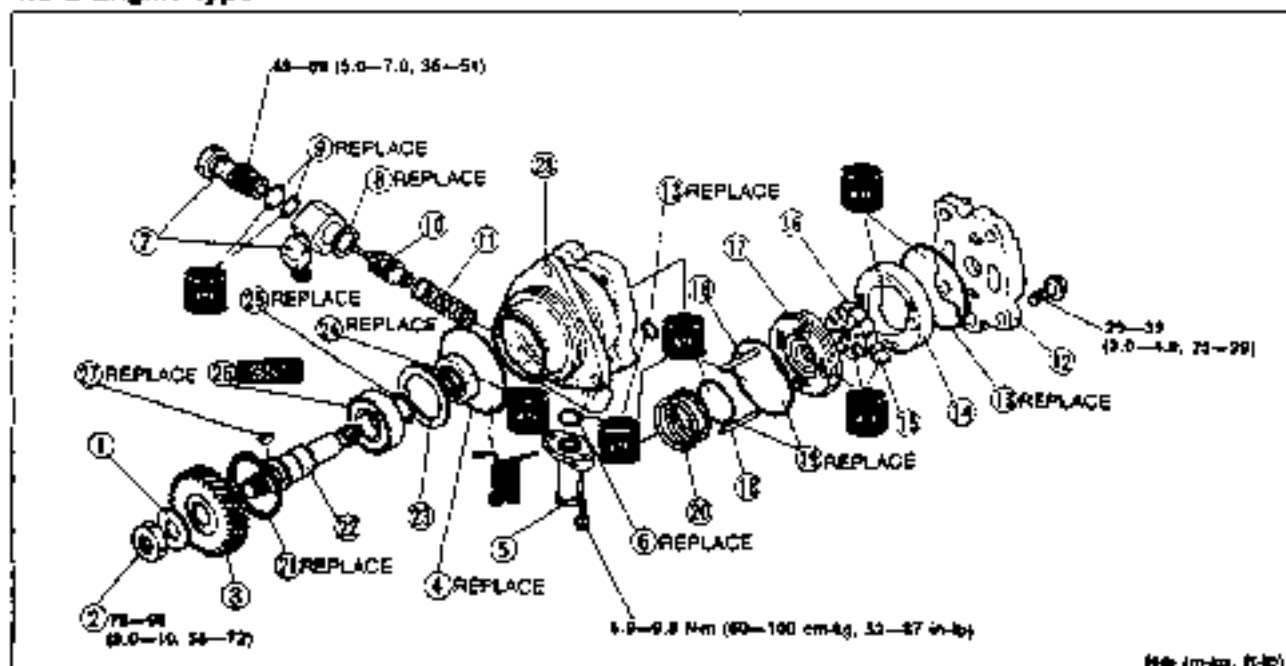
**4.0 L Engine type**

1. Pressure pipe
2. Return hose

3. Oil pump assembly  
Disassembly / Inspection /  
Assembly

**Disassembly / Inspection / Assembly**

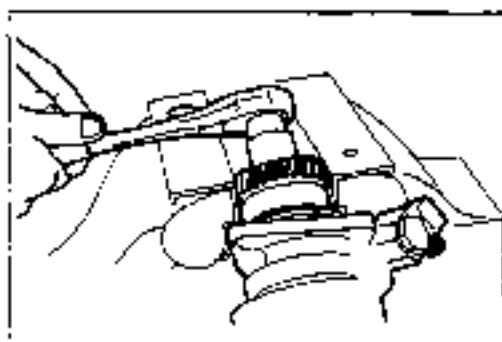
1. The following procedures show replacement of the O-ring, bearing, Woodruff key, and oil seal. If a problem is found in other parts, replace the oil pump assembly.
2. Disassemble in the order shown in the figure, referring to **Disassembly Note**.
3. Inspect for all parts and replace as necessary.
4. Assemble in the reverse order of disassembly, referring to **Assembly Note**.

**4.0 L Engine type**

M6 (m-kg, ft-lb)

STR01X 024

- |   |  |
|---|--|
| 1. Locknut<br>Disassembly note..... page N-45<br>Assembly note..... page N-46 | 17. Pressure plate<br>Inspect for damage and wear<br>Assembly note..... page N-42                                |
| 2. Washer   | 18. Pin  |
| 3. Drive gear<br>Inspect for damage   | 19. Spring<br>Inspect for damage   |
| 4. O-ring   | 20. Snap ring<br>Disassembly note..... page N-40   |
| 5. Suction pipe   | 21. Driveshaft<br>Disassembly note..... page N-40<br>Inspect for damage and wear<br>Assembly note..... page N-41 |
| 6. O-ring   | 22. Spacer   |
| 7. Connector  | 23. Oil seal<br>Disassembly note..... page N-45  |
| 8. Spacer   | 24. Snap ring  |
| 9. O-ring   | 25. Bearing<br>Inspect for operation   |
| 10. Control valve assembly<br>Inspect for damage and wear                     | 26. Woodruff key<br>Disassembly note..... page N-40<br>Assembly note..... page N-41                              |
| 11. Spring<br>Inspect for damage  | 27. Front body<br>Inspect for damage and wear<br>Assembly note..... page N-45                                    |
| 12. Rear body<br>Inspect for damage   |  |
| 13. O-ring  |  |
| 14. Cam ring<br>Inspect for damage and wear<br>Assembly note..... page N-46   |  |
| 15. Vane<br>Inspect for wear<br>Assembly note..... page N-42                  |  |
| 16. Rotor<br>Inspect for damage and wear<br>Assembly note..... page N-45      |  |



9TGCN4-119

**Disassembly note****Locknut**

1. Secure the oil pump. Use in a vise.

**Caution**

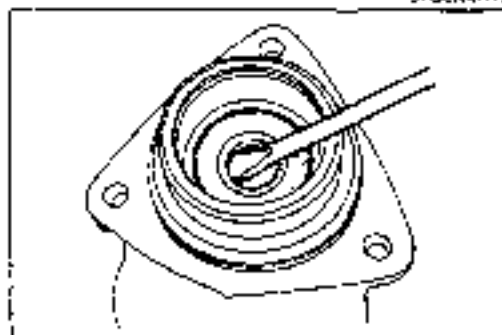
- Not to damage the pump, use protective plates.

2. Remove the washer with a chisel and a hammer.

**Caution**

- Do not damage the driveshaft or the drive gear.

3. Remove the locknut.



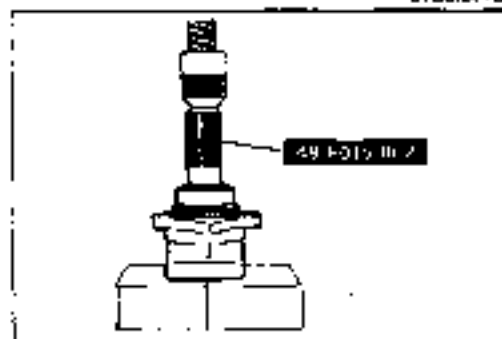
8T304X-120

**Oil seal**

1. Remove the oil seal with a screwdriver as shown.

**Caution**

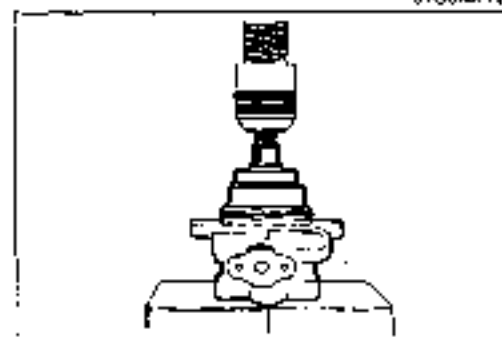
- Do not damage the front body or the bushing.



8T304X-121

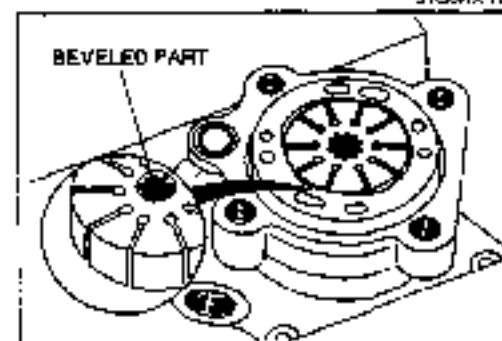
**Assembly note****Front body**

1. Press the oil seal in with the SST.



8T304X-122

2. Press the driveshaft and the bearing in together as shown.
3. Install the snap ring.

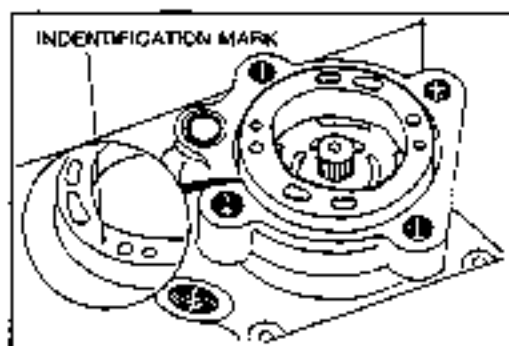


9T604X-123

**Rotor**

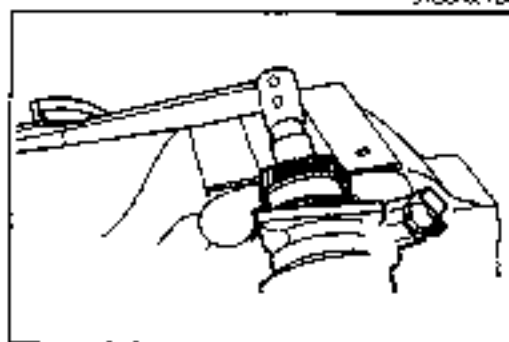
1. Apply ATF to the rotor and install it with the beveled side facing the front body as shown.

# N ENGINE SPEED SENSING POWER STEERING



## Cam ring

1. Apply ATF to the cam ring and install it with the identification mark facing the front body as shown.



## Locknut

1. Secure the oil pump in a vise.

### Caution

- Do not damage the pump, use protective plates.

2. Install the washer.
3. Tighten the locknut.
4. Pry up the washer to lock the nut.

## DRIVE BELT

### Inspection

1. Check the drive belt for wear, cracks, and fraying. Replace if necessary.
2. Check the drive belt deflection by applying moderate pressure (98 N, 10 kg, 22 lb) midway between the pulleys. Adjust if necessary.

### Deflection (Depressed at 98 N [10 kg, 22 lb])

New : 9—11mm (0.35—0.43 in)

Used: 12—13mm (0.47—0.51 in)

### Adjustment

#### 3.5 L Turbo Engine type

1. Loosen bolts A and B and strap bolt C.
2. Move the oil pump until the correct deflection is obtained and tighten strap bolt C.
3. Tighten bolts A and B.

### Tightening torque (A, B, C):

37—52 Nm (3.8—5.3 m·kg, 27—38 ft·lb)

### Replacement

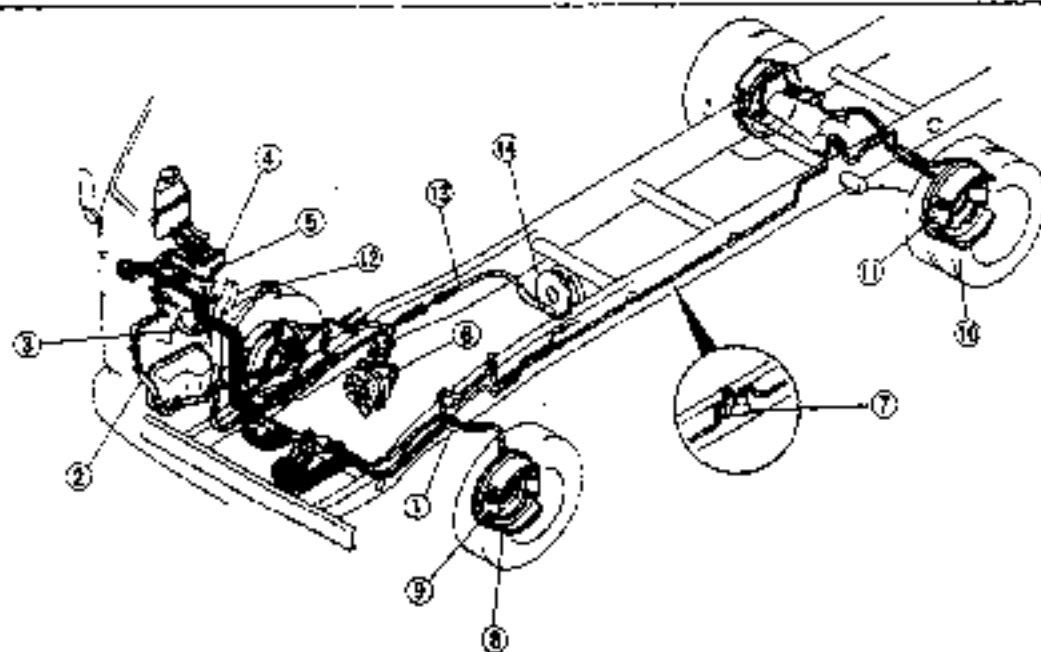
#### 3.5 L Turbo Engine type

1. Loosen bolts A and B and strap bolt C.
2. Remove and replace the drive belt.
3. Adjust the deflection. (Refer to above.)

## BRAKING SYSTEM

<b>INDEX</b> .....	P- 2
<b>OUTLINE</b> .....	P- 3
OUTLINE OF CONSTRUCTION.....	P- 3
SPECIFICATIONS.....	P- 3
<b>BRAKE SYSTEM</b> .....	P- 4
PREPARATION .....	P- 4
TROUBLESHOOTING GUIDE .....	P- 5
AIR BLEEDING .....	P- 6
BRAKE HYDRAULIC LINE .....	P- 7
BRAKE FLUID .....	P- 8
VACUUM LINE .....	P- 9
BRAKE PEDAL .....	P-10
MASTER CYLINDER .....	P-12
POWER BRAKE UNIT .....	P-15
VACUUM PUMP .....	P-22
LOAD-SENSING G-VALVE (LSGV).....	P-25
FRONT BRAKE (DRUM) .....	P-27
WHEEL CYLINDER.....	P-31
REAR BRAKE (DRUM) .....	P-32
WHEEL CYLINDER.....	P-36
<b>PARKING BRAKE SYSTEM</b> .....	P-37
TROUBLESHOOTING GUIDE .....	P-37
PARKING BRAKE LEVER .....	P-37
PARKING BRAKE CABLE .....	P-39
CENTER BRAKE .....	P-40
<b>EXHAUST BRAKE SYSTEM</b>	
Refer to Section F2 and F3.	

## INDEX



9TFOFX002

- |  |           |
|--|-----------|
| 1. Brake hydraulic line                |           |
| On-vehicle inspection .....            | page P- 7 |
| Removal / Installation .....           | page P- 7 |
| 2. Vacuum line                         |           |
| On-vehicle inspection .....            | page P- 9 |
| 3. Brake pedal                         |           |
| On-vehicle inspection .....            | page P-10 |
| Removal / Inspection /                 |           |
| Installation .....                     | page P-11 |
| 4. Master cylinder                     |           |
| Removal / Installation .....           | page P-12 |
| Disassembly / Inspection /             |           |
| Assembly .....                         | page P-14 |
| 5. Power brake unit                    |           |
| On-vehicle inspection .....            | page P-15 |
| Removal / Installation .....           | page P-18 |
| Disassembly / Inspection /             |           |
| Assembly .....                         | page P-18 |
| 6. Vacuum pump                         |           |
| On-vehicle inspection .....            | page P-22 |
| Removal / Installation .....           | page P-23 |
| Inspection .....                       | page P-23 |
| Disassembly / Assembly .....           | page P-24 |
| Inspection .....                       | page P-24 |
| 7. Load-sensing G-valve (LSGV)         |           |
| (Except LHD 14 and 17 feet cargo deck) |           |
| On-vehicle inspection .....            | page P-25 |
| Removal / Installation .....           | page P-26 |
| 8. Front brake (drum)                  |           |
| On-vehicle inspection .....            | page P-27 |
| Adjustment (shoe) .....                | page P-27 |
| Replacement (shoe) .....               | page P-27 |
| Removal / Inspection /                 |           |
| Installation .....                     | page P-28 |
| Inspection .....                       | page P-29 |
| 9. Wheel cylinder                      |           |
| Disassembly / Inspection /             |           |
| Assembly .....                         | page P-31 |
| 10. Rear brake (drum)                  |           |
| On-vehicle inspection .....            | page P-32 |
| Adjustment (shoe) .....                | page P-32 |
| Replacement (shoe) .....               | page P-32 |
| Removal / Inspection /                 |           |
| Installation .....                     | page P-33 |
| Inspection .....                       | page P-35 |
| 11. Wheel cylinder                     |           |
| Disassembly / Inspection /             |           |
| Assembly .....                         | page P-36 |
| 12. Parking brake lever                |           |
| On-vehicle inspection .....            | page P-37 |
| Adjustment .....                       | page P-37 |
| Removal / Inspection /                 |           |
| Installation .....                     | page P-38 |
| 13. Parking brake cable                |           |
| Removal / Inspection /                 |           |
| Installation .....                     | page P-39 |
| 14. Center brake                       |           |
| On-vehicle inspection .....            | page P-40 |
| Adjustment .....                       | page P-40 |
| Replacement (shoe) .....               | page P-40 |
| Removal / Inspection /                 |           |
| Installation .....                     | page P-41 |

OUTLINE

OUTLINE OF CONSTRUCTION

1. Front drum brake (2-leading type) and rear drum brake (Dual 2-leading type) are used on all models.
2. A tandem diaphragm power brake unit is used on all models.

9TGF0X-003

SPECIFICATIONS

Item		Engine type	HA	SL, SL TURBO	TF
Brake pedal	Type		Suspended		
	Pedal lever ratio		4.5		
	Maximum stroke	mm (in)	149.2 (5.87)		
Master cylinder	Type		Tandem		
	Cylinder inner diameter	mm (in)	26.8 (1.06)		
	Reservoir capacity	cc (cu in)	182 (11.1)		
Front brake (Drum)	Type		2-leading		
	Wheel cylinder inner diameter	mm (in)	28.5 (1.12)		
	Lining dimensions		Refer to next page		
	Drum inner diameter		Refer to next page		
	Shoe clearance adjustment		Manual adjustment		
Rear brake (Drum)	Type		Dual 2-leading		
	Wheel cylinder inner diameter	mm (in)	25.4 (1.00)		
	Lining dimensions		Refer to next page		
	Drum inner diameter		Refer to next page		
	Shoe clearance adjustment		Manual adjustment		
Power brake unit	Type		Tandem diaphragm		
	Diameter	mm (in)	(a) 188 + 215 (7.4 + 8.5)	(b) 213 + 240 (8.4 + 9.4)	
Parking brake	Type		Center brake		
	Operating type		Stick type		
	Lever ratio		5.125		
	Maximum notch number		20		
	Lining dimensions (Length x width x thickness)	mm (in)	190.6x35.0x3.6 (7.5x1.38x0.13)		
	Drum inner diameter	mm (in)	190 (7.48)		
Auxiliary brake system			Exhaust brake system		
Rear braking force control device			Load-sensing G-valve		
Brake fluid			FMVSS 110 DOT 3, SAE J1703		

(a): Payload 1,500 kg and 2,000 kg

(b): Except payload 1,500 kg and 2,000 kg

9TGF0X-003

## Lining and Drum Dimensions









Engine	Body type	Rear wheel	Front brake		Rear brake	
			Lining dimensions mm (in) (Length x width x thickness)	Drum inner diameter mm (in)	Lining dimensions mm (in) (Length x width x thickness)	Drum inner diameter mm (in)
HA	10 feet cargo deck	Single	293.1x60x6.8 (11.53x2.36x0.26)	300 (11.81)	229.3x75.0x6.0 (9.02x2.95x0.24)	228.6 (9.00)
SL		Dual	14 feet cargo deck	307.0x75.0x8.0 (12.09x2.95x0.31)	320 (12.60)	304.0x75.0x8.0 (12.09x2.95x0.31)
SL TURBO	14 and 17 feet cargo deck		307.0x90.0x8.0 (12.09x3.54x0.31)	307.0x90.0x8.0 (12.09x3.54x0.31)		
TF	334.8x110.0x10.5 (13.18x4.33x0.41)		334.9x110.0x10.5 (13.18x4.33x0.41)			

9TFOFX-004

## BRAKE SYSTEM

## PREPARATION

## SST

49-0259-7709 Wrench, flare nut 	For removal and installation of brake pipe	49-W033-106 Wrench, locknut 	For removal and installation of hub locknut
49-F043-001 Adjust gauge 	For adjustment of clearance between master cylinder and power brake unit	49-G030-797 Handle 	For disassembly and assembly of power brake unit
49-L043-001 Retainer setting tool 	For disassembly and assembly of power brake unit	49-L043-002 Retainer setting tool 	For disassembly and assembly of power brake unit
49-L043-003 Retainer setting tool 	For disassembly and assembly of power brake unit	49-L034-004 Protector 	For disassembly and assembly of power brake unit

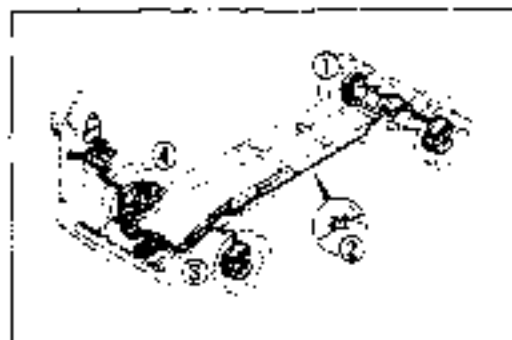
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## TROUBLESHOOTING GUIDE

Problem	Possible cause	Remedy	Page
<b>Poor braking</b>	Leakage of brake fluid Air in system Worn lining Brake fluid, grease, oil, or water on lining Hardening of lining surface or poor contact Malfunction of master cylinder or wheel cylinder Malfunction of power brake unit Malfunction of check valve (vacuum hose) Damaged vacuum hose Deterioration of flexible hose Malfunction of LSGV Worn drum Malfunction of vacuum pump Overloaded Wheel and tire related problem	Repair Air bleed Replace Clean or replace Grind or replace Repair or replace Repair or replace Repair or replace Replace Replace Replace Replace Inspect Correct	— P- 6 P-27,32 P-27,32 P-27,32 P-12,28,33 P-18 P-17,24 P- 9 P- 7 P-26 P-26,33 P-22 — Section Q
<b>Brakes pull to one side</b>	Worn lining Brake fluid, grease, oil, or water on lining Hardening of lining surface or poor contact Abnormal wear or distortion of drum, or lining Looseness of backing plate mounting bolts Malfunction of wheel cylinder Malfunction of master cylinder Wheel and tire related problem Looseness of wheel bearing or improper adjustment of preload	Replace Clean or replace Grind or replace Repair or replace Tighten Repair or replace Repair or replace — Replace or adjust	P-27,32 P-27,32 P-27,32 P-28,33 P-28,33 P-28,33 P-12 Section Q Section M
<b>Brakes do not release</b>	No brake pedal play Improperly adjusted push rod clearance Clogged master cylinder return port Weak shoe return spring Wheel cylinder not returning properly Improperly adjusted pedal height Improperly adjusted wheel bearing preload	Adjust Adjust Clean Replace Clean or replace Adjust Adjust	P-10 P-12 — P-28,33 P-28,33 P-10 Section M
<b>Pedal goes too far (too much pedal stroke)</b>	Improperly adjusted pedal play Worn pad or lining Air in system	Adjust Replace Air bleed	P-10 P-27,32 P- 6
<b>Excessive steering wheel play</b>	Brake drag Steering related problem Wheel and tire related problem Suspension related problem	Repair — — —	— Section N Section Q Section R
<b>Vacuum warning buzzer is operating (Australia payload 3,500 kg and 4,000 kg)</b>	Malfunction of vacuum pump Damaged vacuum hose Malfunction of check valve (vacuum hose) Faulty vacuum switch	Inspect Repair or replace Repair or replace Inspect	P-22 P- 9 P-17,24 Section T
<b>Abnormal noises or vibration during braking</b>	Worn lining Deteriorated lining Brakes do not release Foreign material or scratches on drum contact surface Looseness of backing plate mounting bolts Damaged drum contact surface Poor contact of lining Insufficient grease on sliding parts Looseness of wheel bearing or improper adjustment of preload	Replace Grind or replace Repair Clean Tighten Replace Repair or replace Apply grease Replace or adjust	P-27,32 P-27,32 — — P-28,33 P-28,33 P-27,32 — Section M

9TR3PX-005



9T60PX-007

## AIR BLEEDING

## Caution

- Air bleeding must be done from the wheel cylinder farthest from the master cylinder. (Bleed air in the order shown in the figure.)
- Do not perform air bleeding with the ignition switch ON because the brake vacuum decreases by depressing the brake pedal during working and the vacuum warning buzzer will operate when the ignition switch is ON. (Australia 3,500 kg and 4,000 kg)

1. Fill the reserve tank with brake fluid.

## Caution

- Be careful not to spill brake fluid onto other parts.

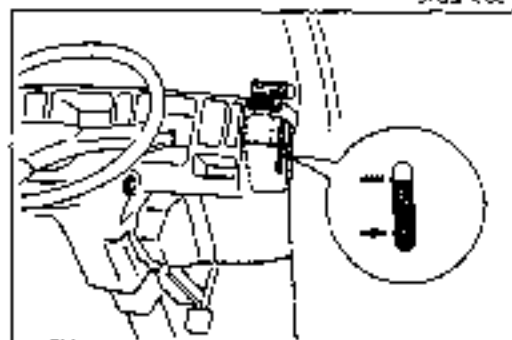
2. After removing the bleeder cap, connect one end of a transparent vinyl tube to the bleeder screw and place the other end in a receptacle.
3. One person should depress the brake pedal a few times, and then hold it in the depressed position.
4. A second person should loosen the bleeder screw, drain out the fluid, and retighten the screw.

## Tightening torque:

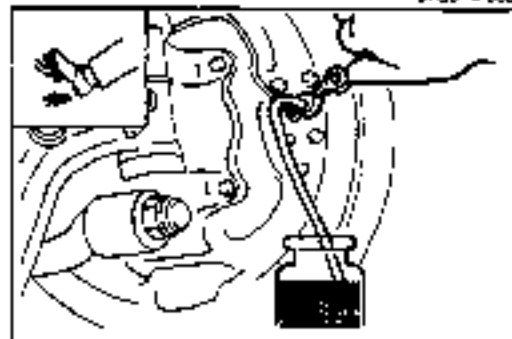
5.9—8.8 Nm (0.6—0.9 m·kg, 4.3—6.5 ft·lb)

## Note

- The two people should stay in voice contact with each other.

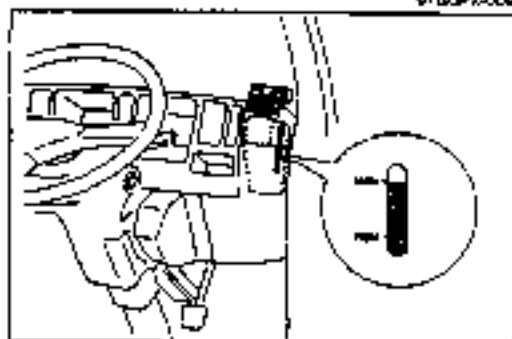


9T60PX-008



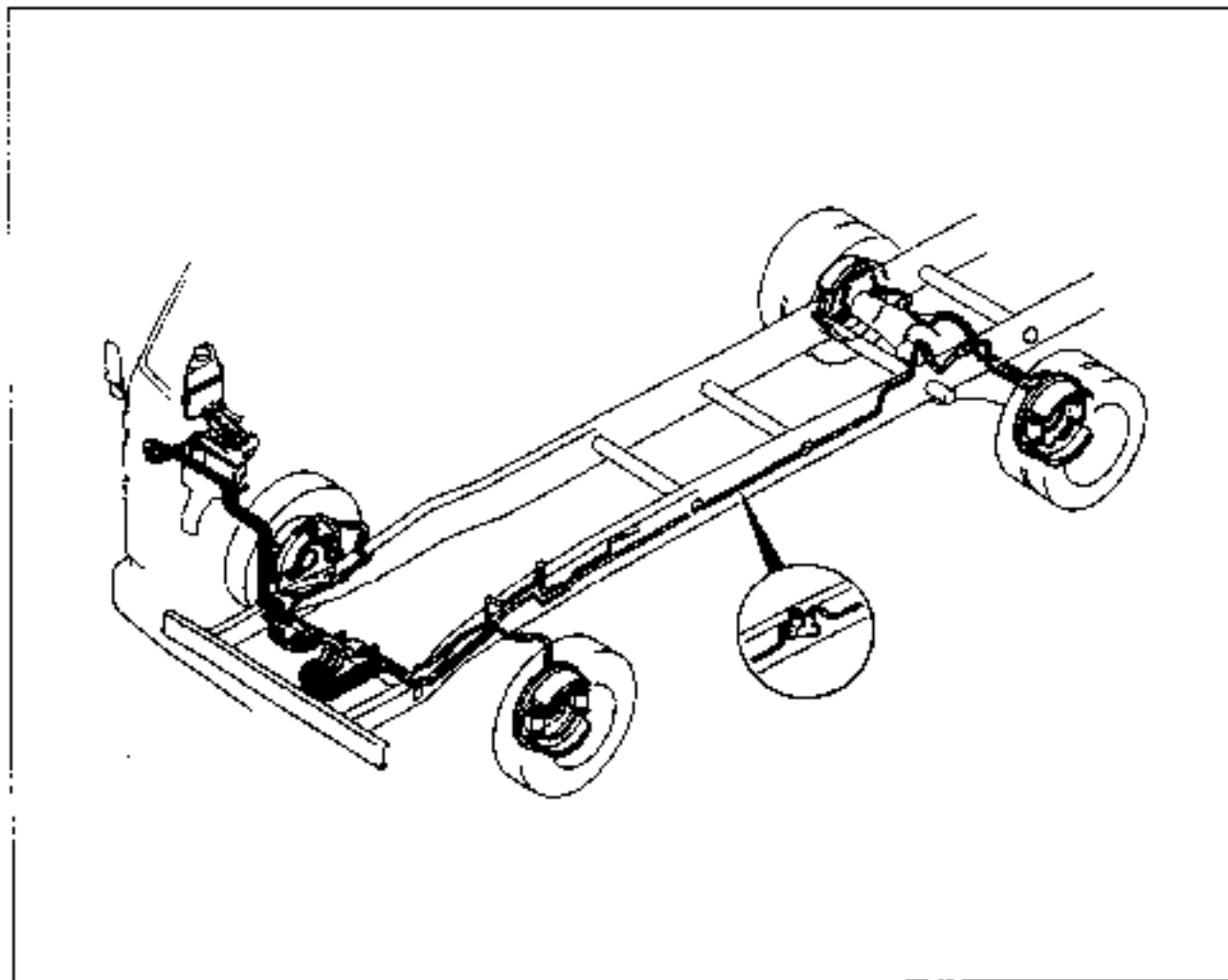
9T60PX-009

5. Repeat steps 3 and 4 until no air bubbles are seen.
6. Bleed air at all the bleeder screws as described before.
7. After bleeding the air, add brake fluid to the reserve tank up to the specified level if necessary.

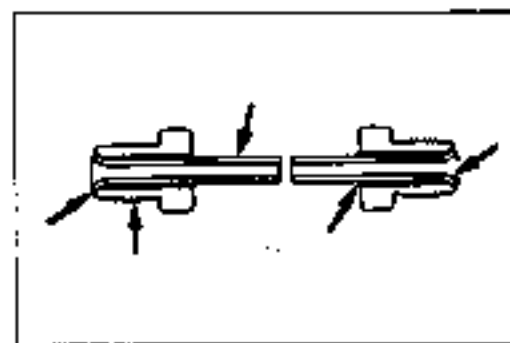


9T60PX-010

## BRAKE HYDRAULIC LINE



BTGPX-011

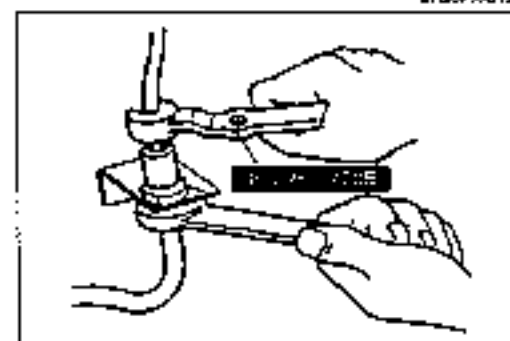


BTGPX-012

**On-vehicle Inspection**

Check for the following and replace parts as necessary.

1. Cracking, damage, or corrosion of brake pipe
2. Damage of brake pipe threads
3. Scars, cracks, or swelling of flexible hose
4. All lines for fluid leakage
5. Looseness or damage of pipe and hose connection



BTGPX-013

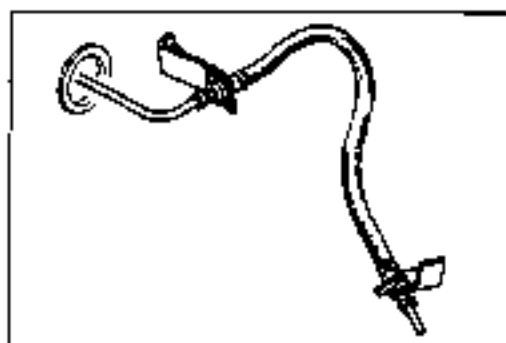
**Removal / Installation****Removal / Installation note**

1. Remove or install the brake pipe with the SST.
2. Tighten the flare nut to the specified torque.

**Flare nut tightening torque:**

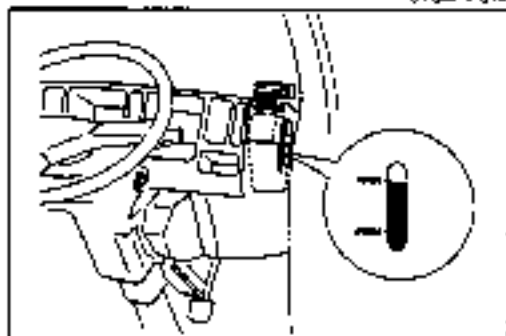
13–22 Nm (1.3–2.2 m·kg, 9.4–16 ft·lb)

## BRAKE SYSTEM



9TG0PX-014

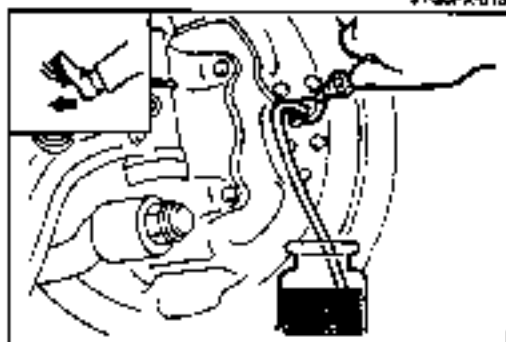
3. Secure the brake pipe firmly, with a clip so that it does not contact other parts.
4. When connecting the brake pipe with the joints, do not over-tighten. 1.
5. When connecting the flexible hose, do not twist it.
6. After installation, check that the flexible hose does not contact other parts when the vehicle bounces or when the steering wheel is turned fully right or left.
7. Bleed the air from the brake system when the pipe or hose is removed.



9TG0PX-015

**BRAKE FLUID****On-vehicle inspection**

1. Check that the fluid level in the reserve tank is between Max and Min.  
If necessary, add brake fluid up to the specified level.

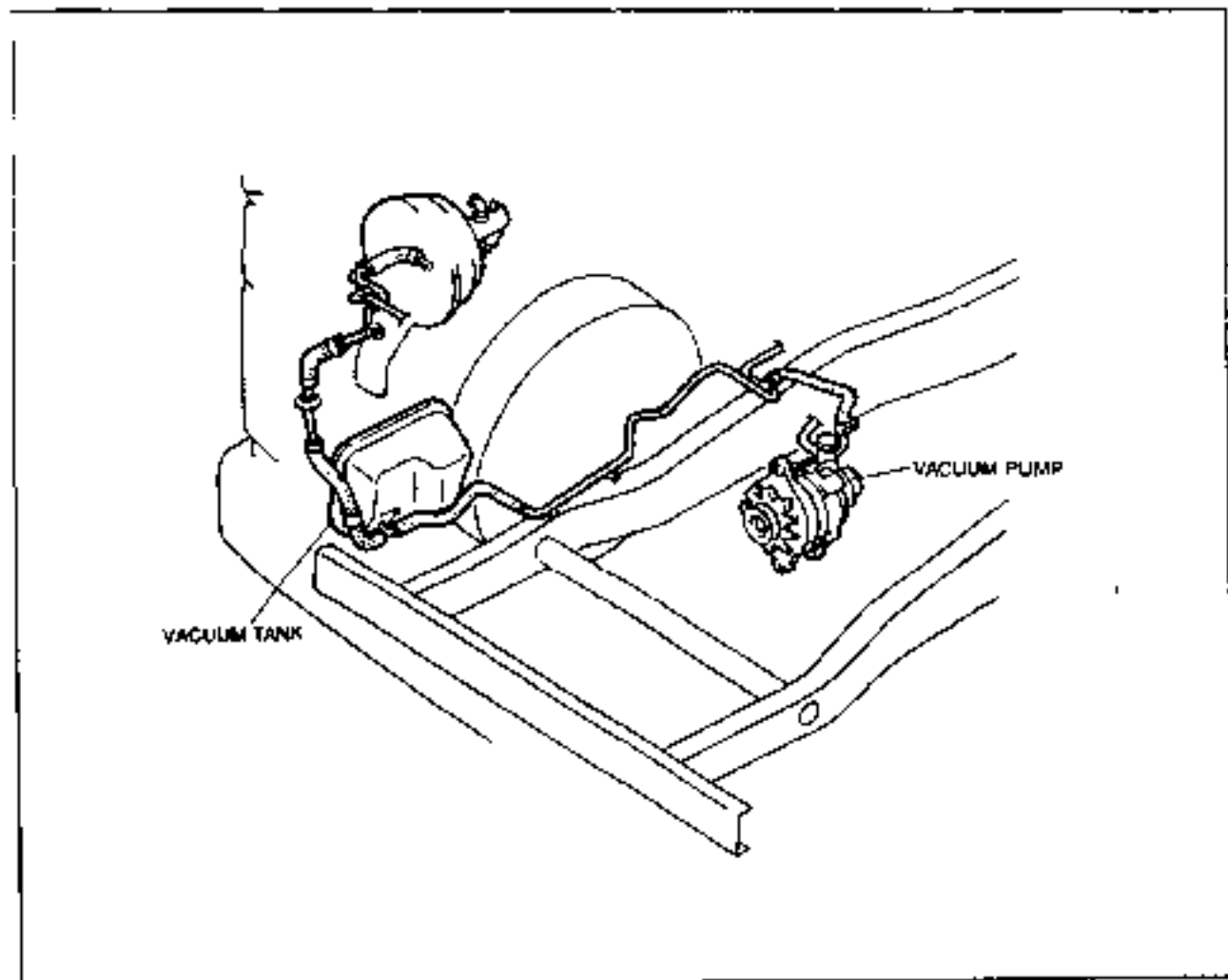


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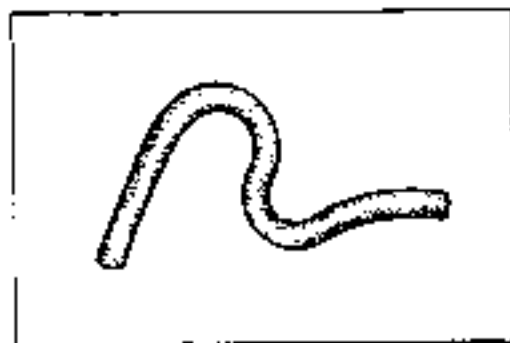
**Replacement**

1. Operate the same procedure as air bleeding.  
(Refer to page P-6.)
2. Repeat the operation until the new fluid comes out from the bleeder.

## VACUUM LINE



9TB0PX-017



9TB0PX-018

**On-vehicle inspection**

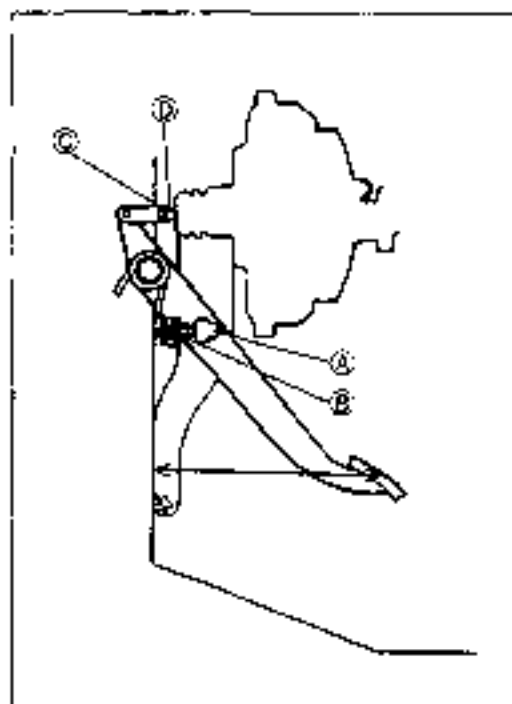
Check for the following and replace parts as necessary.

1. Cracking, damage, or corrosion of vacuum pipe
2. Scars, cracks, or swelling of vacuum hose
3. Looseness of pipe and hose connection
4. All lines for vacuum leakage
5. Cracking or damage of vacuum tank

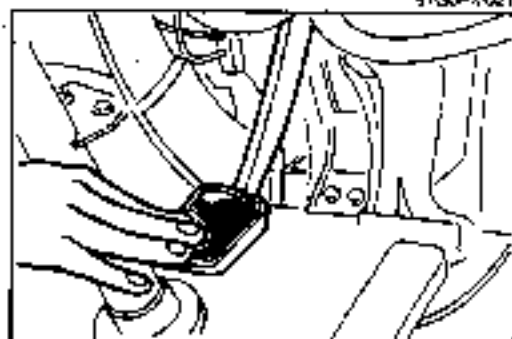
**Note (Australia payload 3,500 kg and 4,000 kg)**

- A vacuum switch is equipped in the vacuum tank. When the vacuum amount in the tank becomes less than the specification, the switch activates the brake vacuum warning buzzer to notify a driver it.

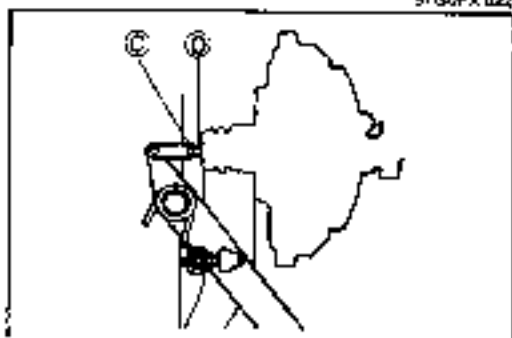
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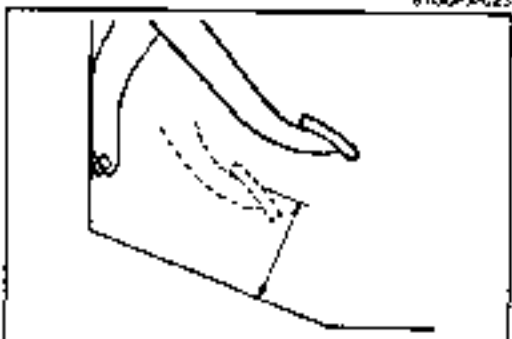
5TGGPX-021



9TGGPX-022



8TGGPX-023



0TGGPX-024

**BRAKE PEDAL****On-vehicle Inspection****Pedal height  
Inspection**

Check that the distance from the center of the upper surface of the pedal pad to the dash panel is as specified.

**Pedal height:** 225—231mm (8.90—8.09 in)

**Adjustment**

1. Disconnect the stoplight switch connector.
2. Loosen locknut (B) and turn switch (A) until it does not contact the pedal.
3. Loosen locknut (C) and turn rod (D) to adjust the height.
4. Turn the stoplight switch until it contacts the pedal; then turn an additional 1/2 turn. Tighten locknut (B).
5. Check the pedal play and stoplight operation.

**Pedal play  
Inspection**

1. Depress the pedal a few times to eliminate the vacuum in the system.

Gently depress the pedal again by hand and check the free play (until the valve plunger contacts the stopper plate — until the power piston begins to move).

**Pedal play:** 9—11mm (0.35—0.43 in)

**Caution (Australia payload 3,500 kg and 4,000 kg)**

• Do not inspect the pedal play with the ignition switch ON. The brake vacuum warning buzzer will operate when the ignition switch is ON.

**Adjustment**

1. Loosen locknut (C) of push rod (D) then turn the rod to adjust the free play.
2. Tighten locknut (C) and check the pedal height and stoplight operation.

**Pedal-to-floor clearance****Inspection**

1. Start the engine and depress the pedal with a force of 5.9 N (60 kg, 52 lb).

Check that the distance from the floor panel to the center of the upper surface of the pedal pad is as specified.

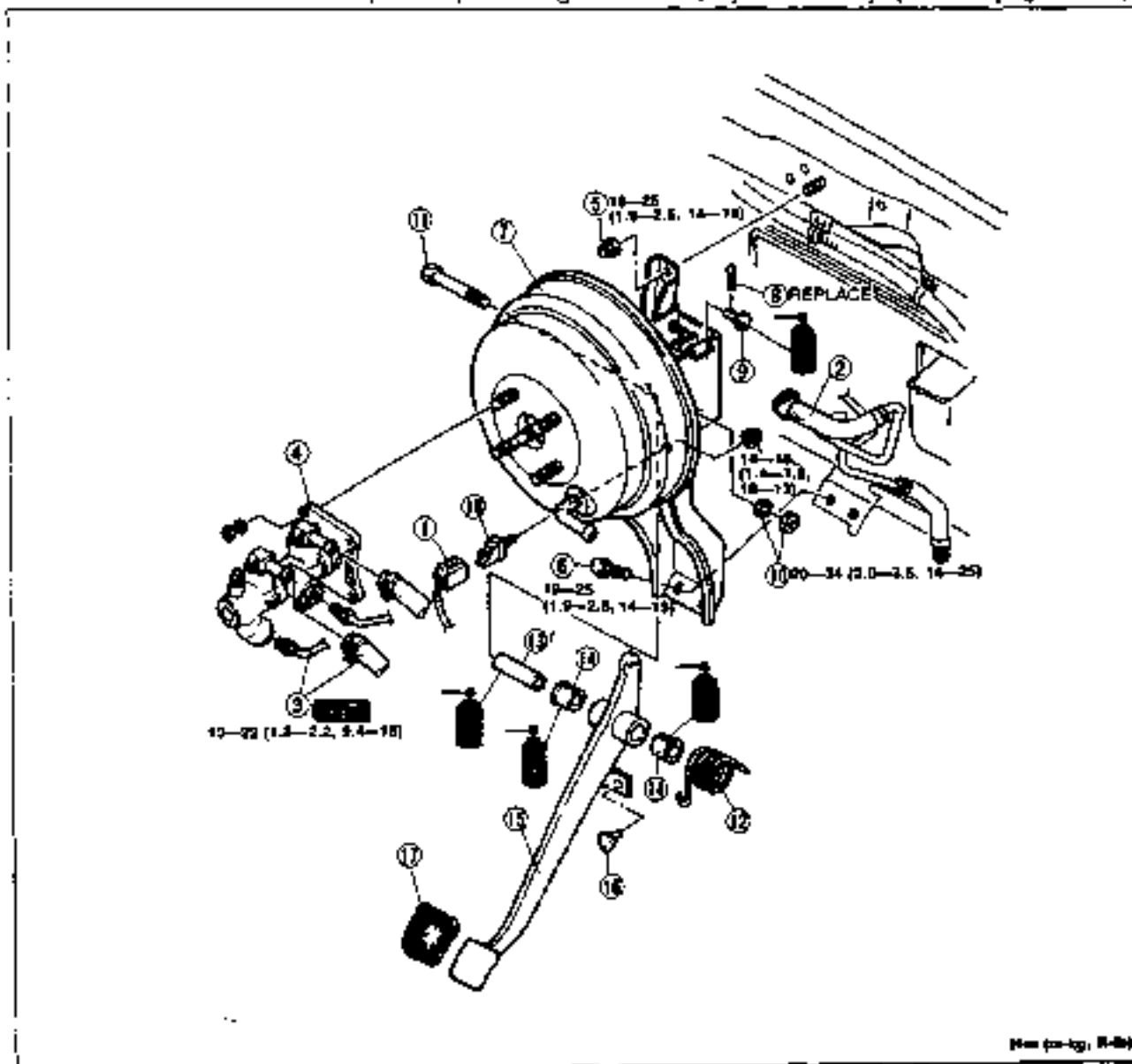
**Pedal-to-floor clearance:** 50mm (1.99 in) min.

2. If the distance is less than specified, check for the following problems:

- Air in brake system
- Too much shoe clearance

**Removal / Inspection / Installation**

1. Remove the meter set. (Refer to Section S.)
2. Remove in the order shown in the figure.
3. Install in the reverse order of removal.
4. Inspect all parts and repair or replace as necessary.
5. After installation, check and adjust the pedal height and free play if necessary. (Refer to page P-10.)



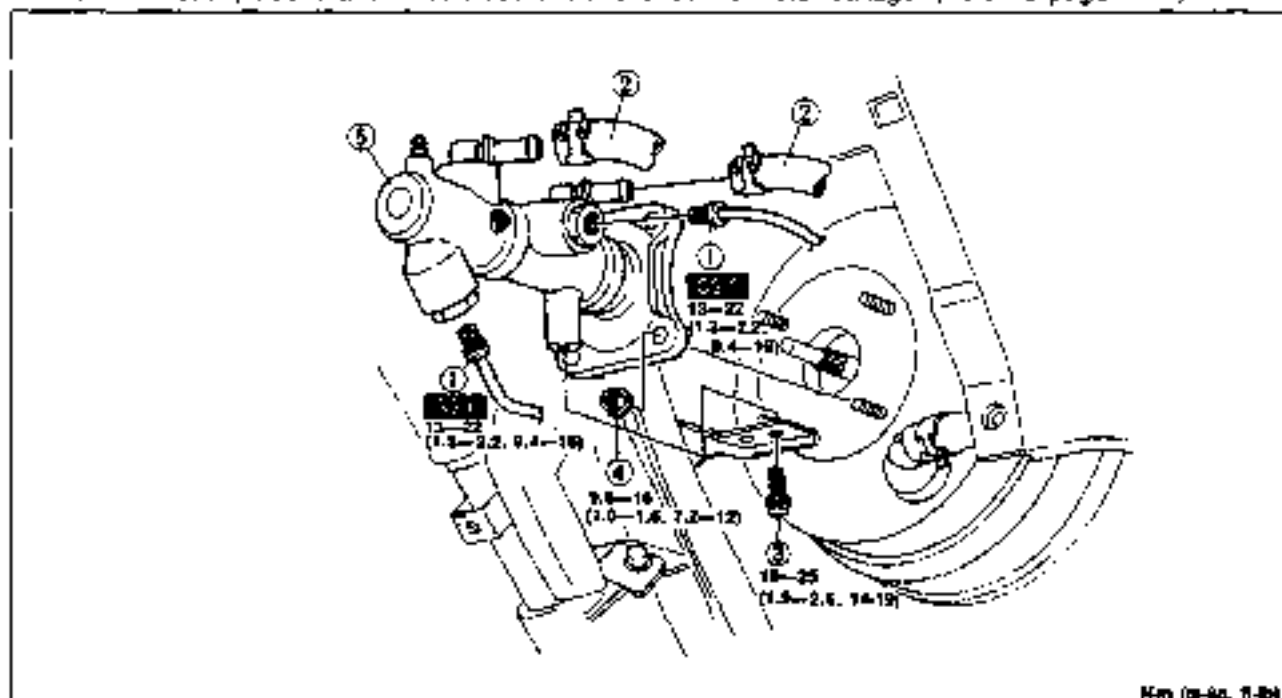
Non (a-b), B-6)

8100PX-025

- |  |   |
|--|---|
| 1. Coupler (Stoplight switch)                                | 12. Return spring<br>Inspect for weakness or damage |
| 2. Vacuum hose   | 13. Spacer  |
| 3. Brake pipe and hose                                       | 14. Bushing<br>Inspect for weakness or damage       |
| 4. Master cylinder<br>Removal / Installation ..... page P-12 | 15. Brake pedal<br>Inspect for bending or damage    |
| 5. Nut   | 16. Stop rubber<br>Inspect for wear                 |
| 6. Bolt  | 17. Pedal pad<br>Inspect for wear                   |
| 7. Power brake unit and pedal assembly                       | 18. Stoplight switch                                |
| 8. Snap pin  |   |
| 9. Clevis pin  |   |
| 10. Nut and washer   |   |
| 11. Bolt   |   |

**MASTER CYLINDER****Removal / Installation**

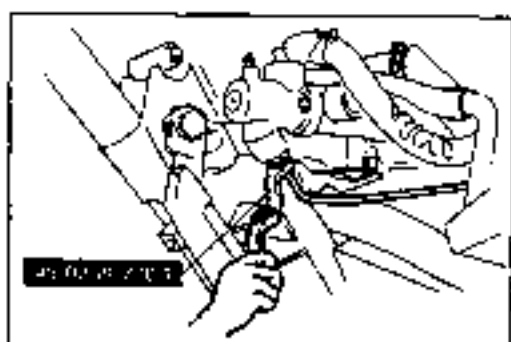
1. Remove the lower panel.
2. Remove in the order shown in the figure referring to **Removal Note**.
3. Install in the reverse order of removal, referring to **Installation Note**.
4. After installation, add brake fluid, bleed air, and check for fluid leakage (Refer to page P-6.)



Nm (lb-kg, ft-lb)

97G0PX-026

- |  |  |
|--|--|
| 1. Brake pipe<br>Removal note..... below | 5 Master cylinder<br>Installation note..... below<br>Disassembly / Inspection /<br>Assembly..... page P-14 |
| 2. Brake hose                            |  |
| 3. Bolt                                  |  |
| 4. Nut                                   |  |



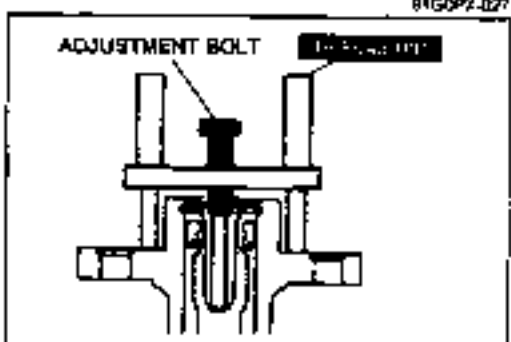
97G0PX-027

**Removal note****Brake pipe**

1. Disconnect the brake pipe from the master cylinder with the SST.

**Caution**

- Brake fluid will damage painted surfaces. If it does get on a painted surface, wipe it off immediately.

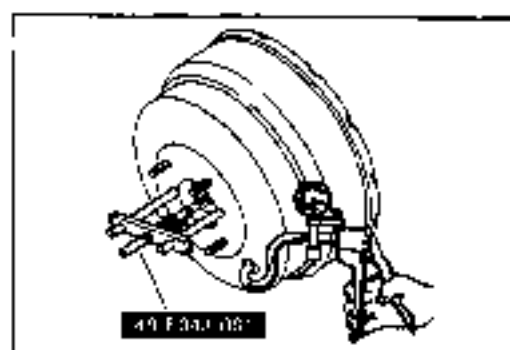


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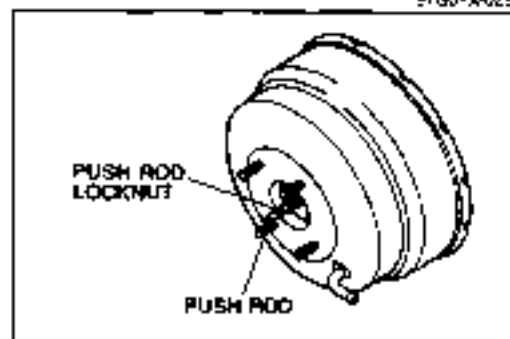
**Installation note****Master cylinder****Push rod clearance****Inspection**

1. Place the SST atop the master cylinder. Turn the adjustment bolt until it bottoms in the piston.

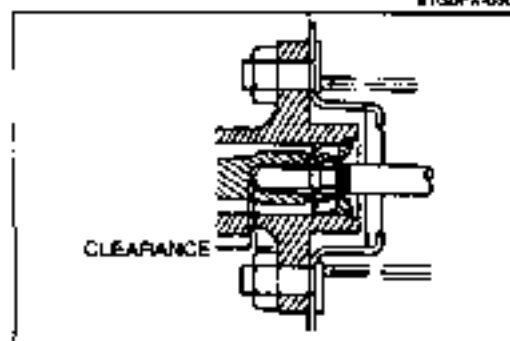




9TGGPX-029



9TGGPX-030



9TGGPX-031

2. Apply a vacuum of 500 mmHg (19.7 inHg) to the vacuum power assist with a vacuum pump.
3. Invert the **SST** used in step 1, and place it on top of the vacuum power assist.
4. Check the clearance between the end of the **SST** and the push rod of the power brake unit.
5. If it is not 0mm (0 in), loosen the push rod locknut, and turn the push rod to make the adjustment.

#### Adjustment

1. Loosen the push rod locknut.
2. Turn the tip of the push rod and adjust the push rod clearance.
3. Recheck the clearance.

#### Note

- By making the above adjustment, the clearance between the push rod and piston (after installation of the master cylinder and the power brake unit) will be as shown in the table below.

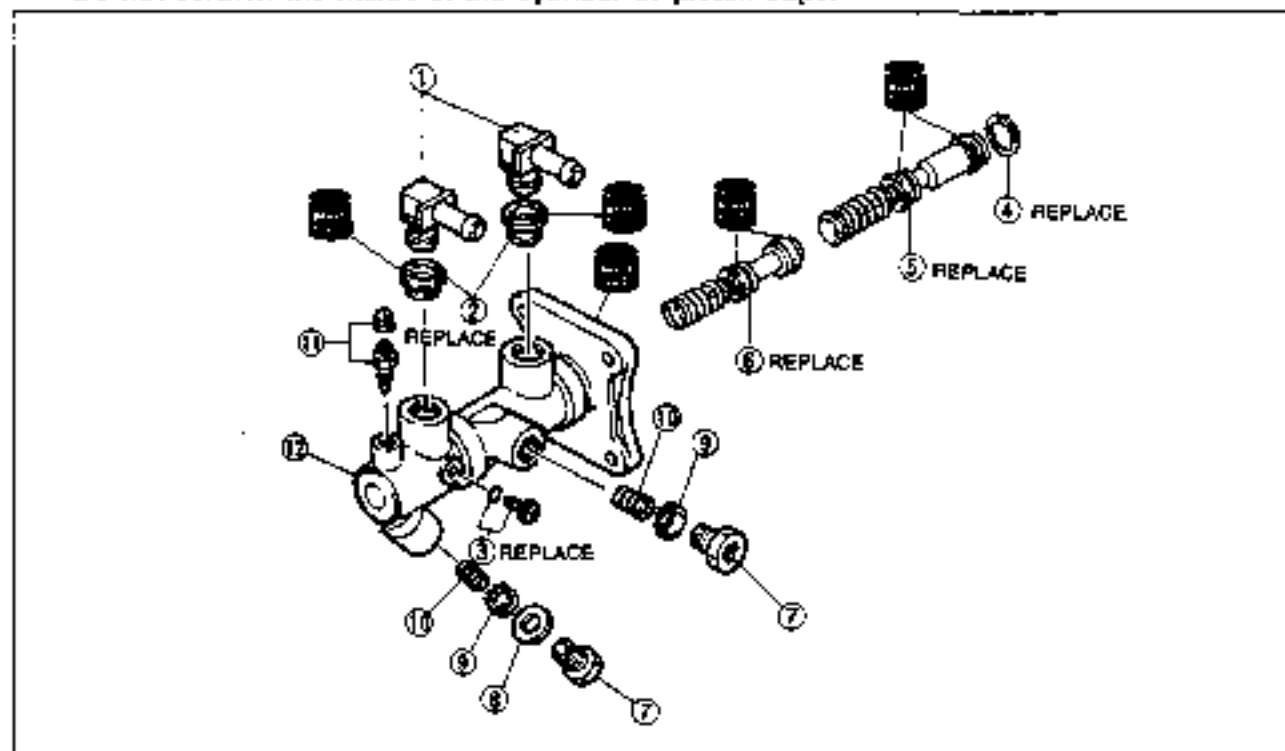
	Push rod-to-piston clearance
When no vacuum applied to unit	0.4—0.6mm (0.015—0.024 in)
When vacuum applied to unit is approx. 500 mmHg (19.7 inHg)	0.1—0.3mm (0.004—0.012 in)

**Disassembly / Inspection / Assembly**

1. Remove the brake fluid from the master cylinder.
2. Disassemble in the order shown in the figure, referring to **Disassembly Note**.
3. Assemble in the reverse order of removal, referring to **Assembly Note**.
4. Inspect all parts and repair or replace as necessary.

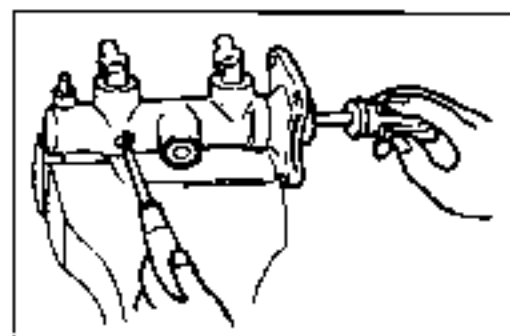
**Caution**

- Do not let foreign material enter the cylinder.
- Do not scratch the inside of the cylinder or piston cups.



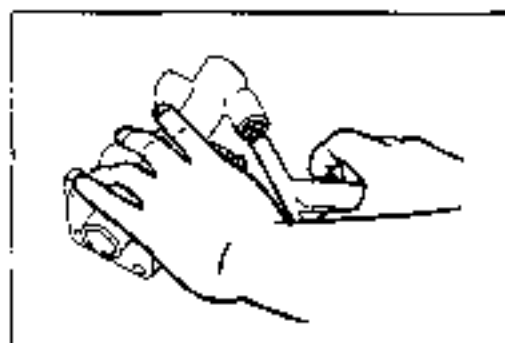
9TSG0PX-032

- |   |  |
|---|--|
| 1. Hose connector   | 7. Joint bolt                                    |
| 2. Bushing<br>Inspect for wear or damage  | 8. O-ring  |
| 3. Stopper screw and O-ring<br>Disassembly note..... below<br>Assembly note..... page P-15        | 9. Oil seal                                      |
| 4. Snap ring  | 10. Spring<br>Inspect for wear                   |
| 5. Primary piston assembly<br>Inspect piston cups for damage                                      | 11. Bleeder cap and screw                        |
| 6. Secondary piston assembly<br>Inspect piston cups for damage<br>Disassembly note..... page P-15 | 12. Cylinder body<br>Inspect for crack or damage |

**Disassembly note****Stopper screw**

1. Push the primary piston assembly in fully, then remove the stopper screw.

9TSG0PX-033



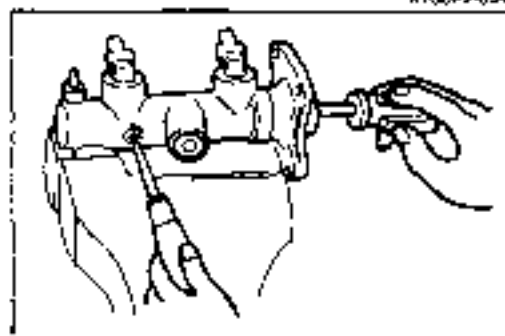
ATG09X-G34

**Secondary piston assembly**

Remove the secondary piston assembly by gradually blowing compressed air into the cylinder.

**Caution**

- Use a rag to catch the secondary piston assembly.



9TG09X-035

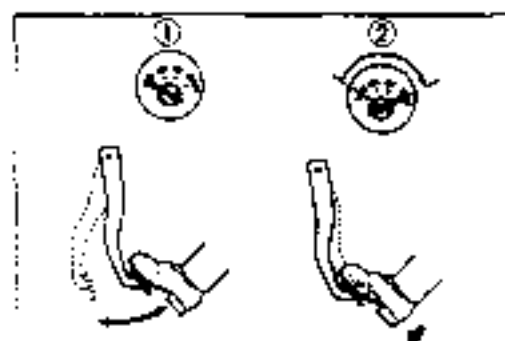
**Assembly note****Stopper screw**

1. Push the primary piston assembly in fully.
2. Install and tighten the stopper screw.
3. Push and release the piston to verify that it is held by the stopper screw.

**POWER BRAKE UNIT****On-vehicle inspection****Note**

- Following inspections are simple method to roughly inspect the power brake unit function. If the unit is defective, repair or replace the power brake unit.

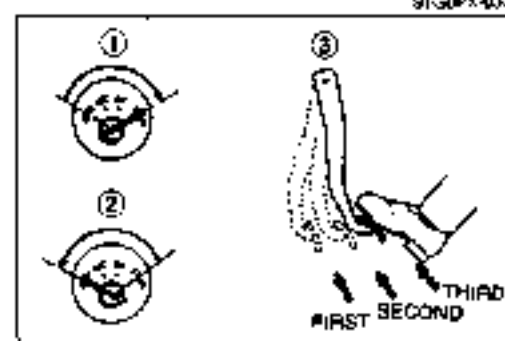
8TG09X-036



9TG09X-037

**Power brake unit function check  
(Method-without tester)****Step 1**

1. With the engine stopped, depress the pedal a few times.
2. With the pedal depressed, start the engine.
3. If immediately after the engine starts the pedal moves down slightly, the unit is operating.



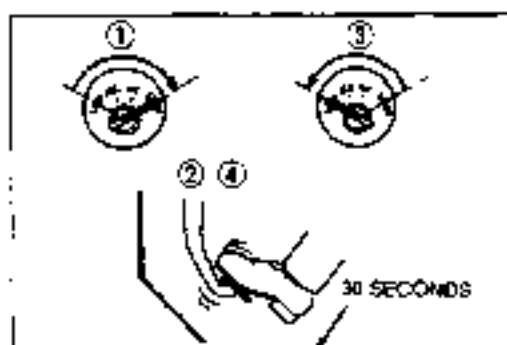
9TG09X-038

**Step 2**

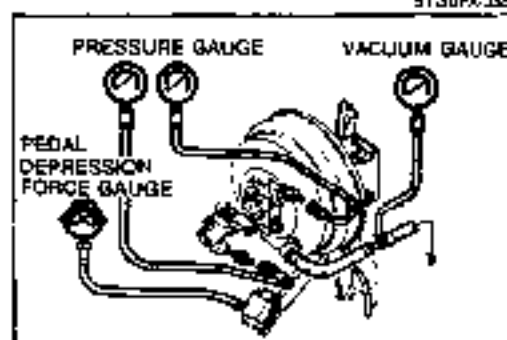
1. Start the engine.
2. Stop the engine after it has run for 1 or 2 minutes.
3. Depress the pedal with the usual force.
4. If the first pedal stroke is long and becomes shorter with subsequent strokes, the unit is operating.

**Note**

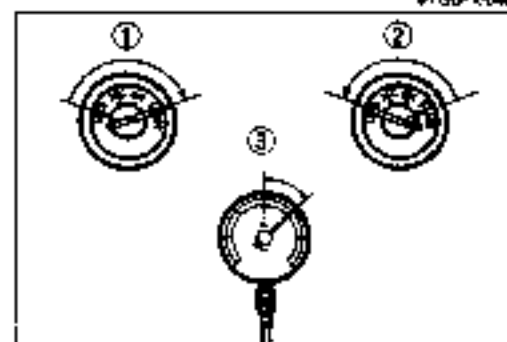
- If a problem is found, inspect for damage of the check valve or vacuum hose, and examine the installation. Repair if necessary, and inspect it once again.



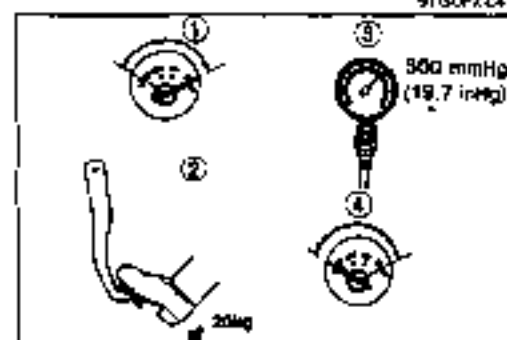
9T307A-239



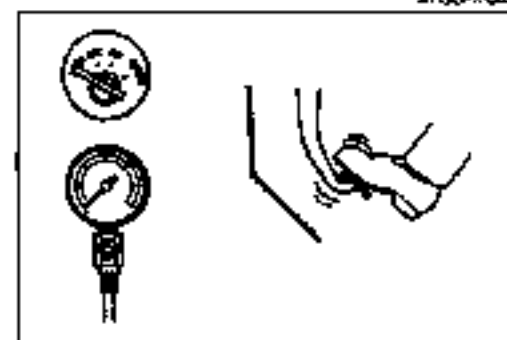
9T307A-040



9T307A-041



9T307A-042



9T307A-043

**Step 3**

1. Start the engine.
2. Depress the pedal with the usual force.
3. Stop the engine with the pedal held depressed.
4. Hold the pedal down for **about 30 seconds**.
5. If the pedal height does not change, the unit is operating.

**Function check (Method-using tester)****Preparation**

1. Connect a pressure gauge, vacuum gauge, and pedal depression force gauge as shown in the figure and bleed the air from the pressure gauge.

**Note**

- Use commercially available gauges and pedal depression force gauge.

**a) Checking for vacuum loss****Unloaded condition**

1. Start the engine.
2. Stop the engine when the vacuum gauge reading reaches **500 mmHg (19.7 inHg)**.
3. Observe the vacuum gauge for **15 seconds**. If the gauge shows **475—500 mmHg (18.7—19.7 inHg)**, the unit is operating.

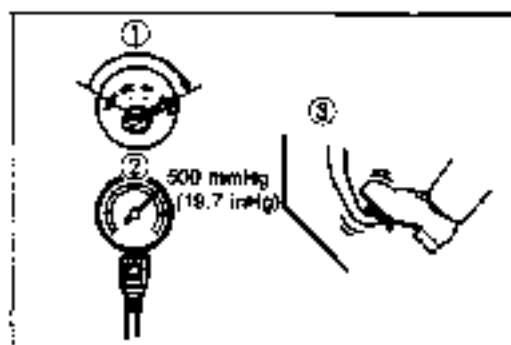
**Loaded condition**

1. Start the engine.
2. Depress the brake pedal with a force of **196 N (20 kg, 44 lb)**.
3. With the brake pedal depressed, stop the engine when the vacuum gauge reading reaches **500 mmHg (19.7 inHg)**.
4. Observe the vacuum gauge for **15 seconds**. If the gauge shows **475—500 mmHg (18.7—19.7 inHg)**, the unit is operating.

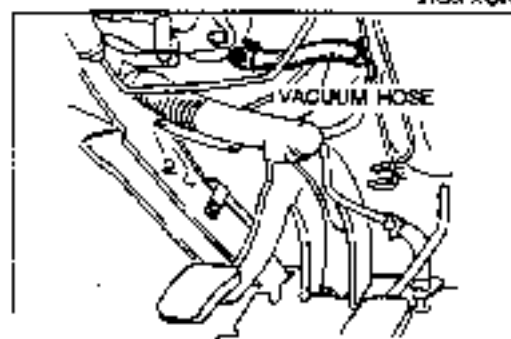
**b) Checking for hydraulic pressure**

1. If with the engine stopped (vacuum **0 mmHg**) the fluid pressure is within specification, the unit is operating.

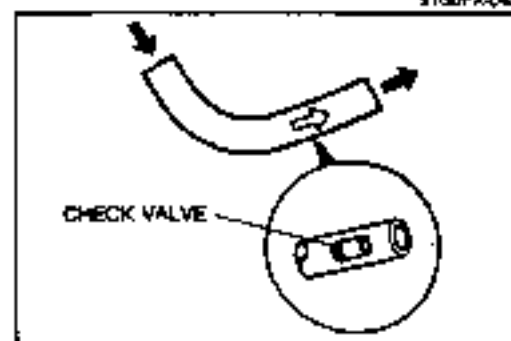
Pedal force	Fluid pressure	Diameter of unit
196 N (20 kg, 44 lb)	588 kPa (6.0 kg/cm <sup>2</sup> , 85 psi)	213+240mm (8.4+9.4 in)
196 N (20 kg, 44 lb)	687 kPa (7.0 kg/cm <sup>2</sup> , 100 psi)	188+215mm (7.4+8.5 in)



9TG0PX-043



9TG0PX-045



9TG0PX-046

2. Start the engine. Depress the brake pedal when the vacuum reaches **500 mmHg (19.7 inHg)**. If the fluid pressure is within specification, the unit is operating.

Pedal force	Fluid pressure	Diameter of unit
196 N (20 kg, 44 lb)	6.180 kPa (63.0 kg/cm <sup>2</sup> , 896 psi)	188 + 215mm (7.4 + 8.5 in)
196 N (20 kg, 44 lb)	6.276 kPa (64.0 kg/cm <sup>2</sup> , 910 psi)	213 + 240mm (8.4 + 9.4 in)

#### Inspection of check valve

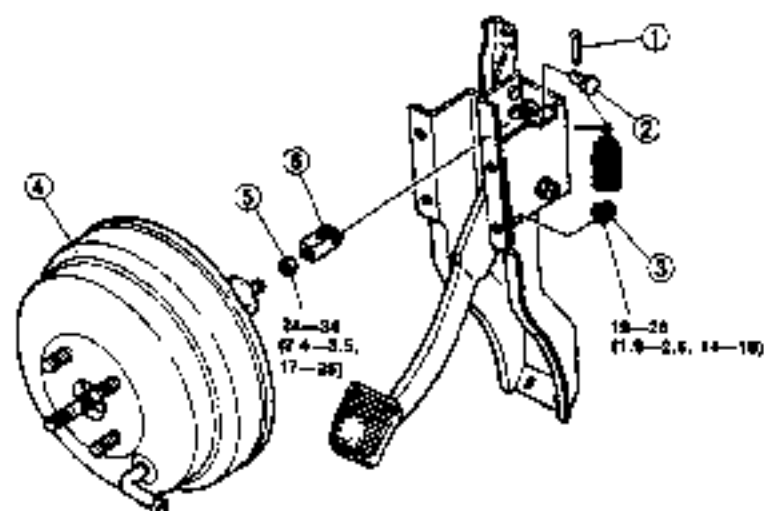
1. Disconnect the vacuum hose from the power brake unit.
2. Apply suction and pressure to the hose from the power brake unit side.  
Check that air flows only toward the vacuum pump.

#### Note

- If the air passes in both directions or not at all, replace the check valve along with the hose.

**Removal / Installation**

- 1 Remove the power brake unit and pedal assembly (Refer to page P-11.)
- 2 Remove in the order shown in the figure.
- 3 Install in the reverse order of removal.
- 4 Take the following steps after installation
  - (1) Add brake fluid.
  - (2) Bleed the air from the system. (Refer to page F-6.)
  - (3) Check all parts for fluid leakage.
  - (4) Check and adjust the brake pedal (Refer to page P-10.)
  - (5) Check function of the power brake unit; (Refer to page P-15.)



N·m (in·lb, ft·lb)

97G0PX-047

- |               |                            |                    |
|---------------|----------------------------|--------------------|
| 1. Snap pin   | 4. Power brake unit        | 5. Nut             |
| 2. Clevis pin | Disassembly / Inspection / | 6. Operating lever |
| 3. Nut        | Assembly ..... page P-19   |                    |

**Disassembly / Inspection / Assembly**

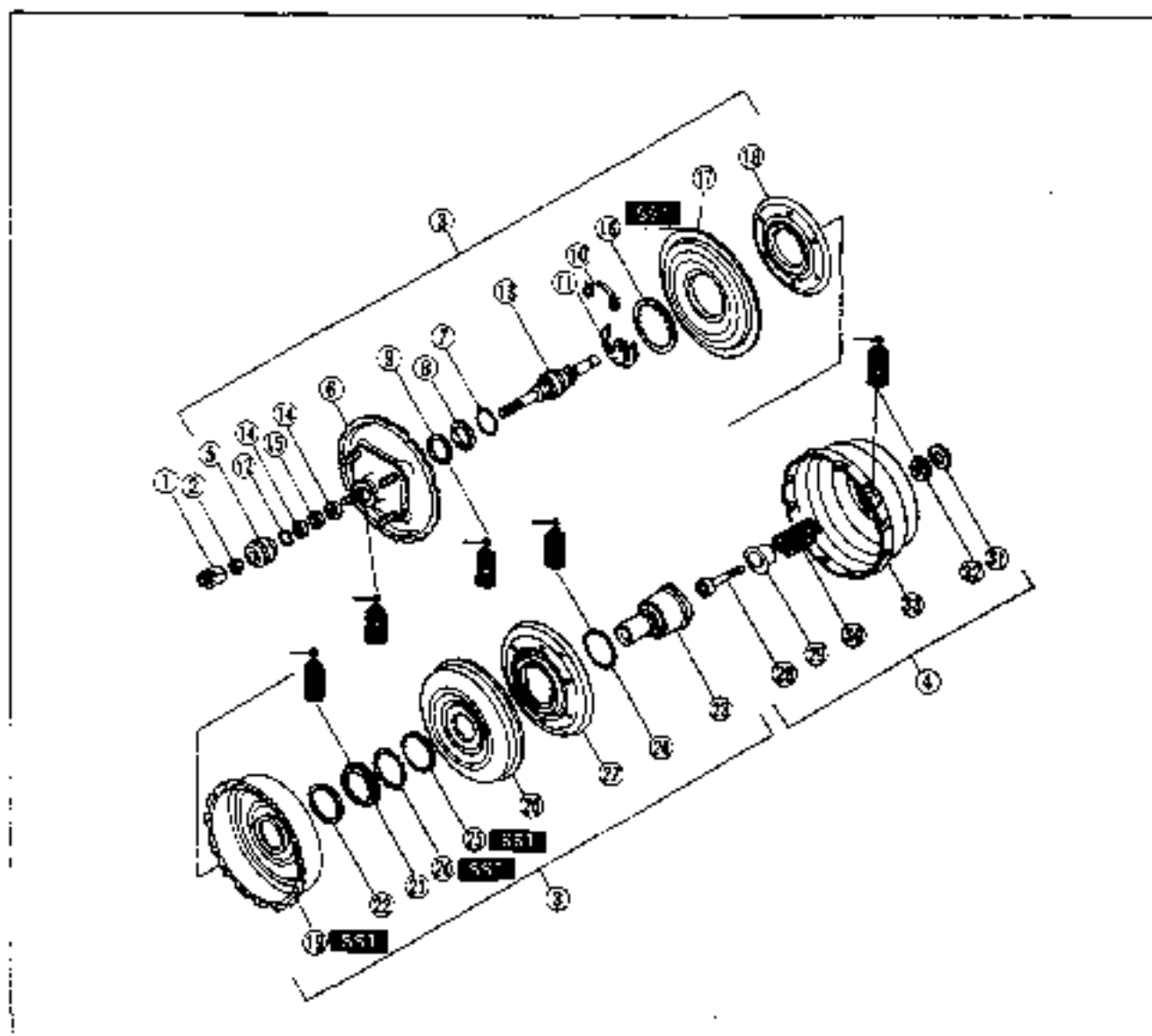
1. Disassemble in the order shown in the figure, referring to **Disassembly Note**.

**Caution**

- Remove all the retainers with a screwdriver. When removing them, do not damage the valve body or diaphragm.

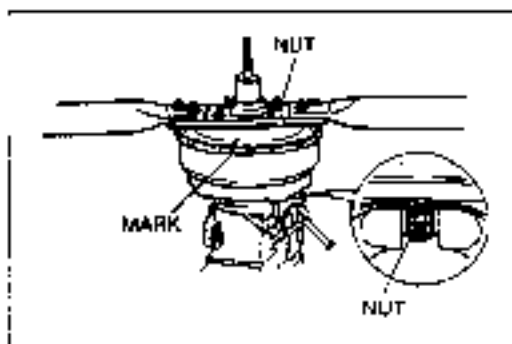
2. Inspect all parts and repair or replace as necessary.
3. Assemble in the reverse order of removal, referring to **Assembly Note**.

97G0PX-048



97GDF6048

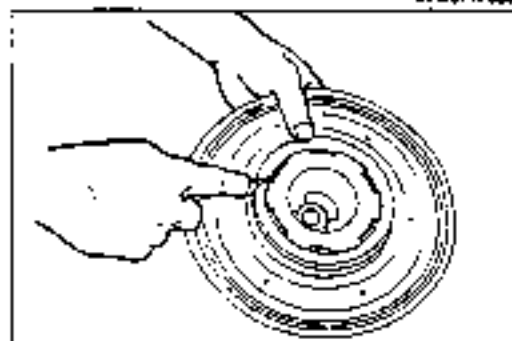
- |                           |                               |                                |
|---------------------------|-------------------------------|--------------------------------|
| 1. Clevis                 | 11. Stop key                  | 21. Seal                       |
| 2. Nut                    | Assembly Note, page P-21      | 22. Bearing                    |
| 3. Rear shell assembly    | 12. Retainer (valve rod)      | 23. Valve body                 |
| Disassembly Note          | 13. Valve rod assembly        | Disassembly Note               |
| ..... page P-20           | 14. Air filter                | ..... page P-20                |
| Assembly Note, page P-22  | 15. Silencer                  | Inspect for cracks and         |
| 4. Front shell assembly   | 16. Retainer (rear diaphragm) | other damage                   |
| Disassembly Note          | Assembly Note, page P-21      | 24. O-ring                     |
| ..... page P-20           | 17. Rear diaphragm            | 25. Retainer (front diaphragm) |
| Assembly Note, page P-22  | Inspect for cuts and other    | Assembly Note, page P-20       |
| 5. Boot                   | damage                        | 26. Front diaphragm            |
| 6. Rear shell             | 18. Rear diaphragm plate      | Inspect for cuts and other     |
| Inspect for scratches,    | Disassembly Note              | damage                         |
| scuffs, pits, dents, and  | ..... page P-20               | 27. Front diaphragm plate      |
| other damage              | Assembly Note, page P-21      | 28. Push rod                   |
| 7. Retainer (rear shell)  | 19. Center plate              | 29. Disc                       |
| 8. Bearing                | Assembly Note, page P-21      | 30. Return spring              |
| 9. Seal                   | 20. Retainer (center plate)   | 31. Retainer (front shell)     |
| 10. Retainer (valve body) | Assembly Note, page P-20      | 32. Seal                       |
|                           |                               | 33. Front shell                |



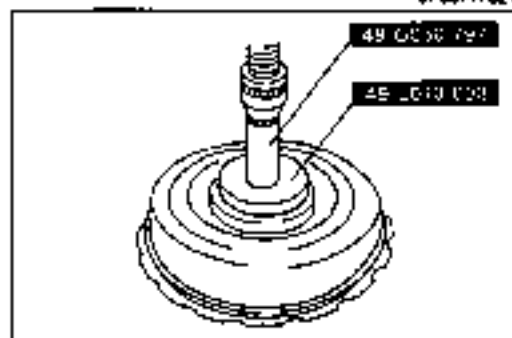
97G0PX-018



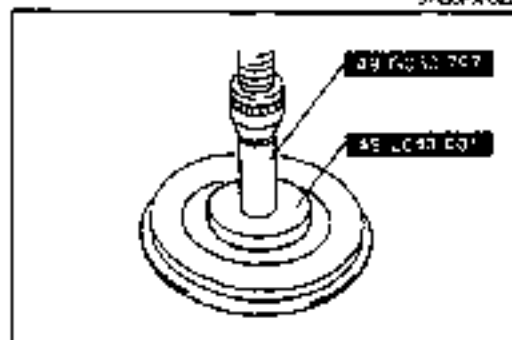
97G0PX-020



97G0PX-021



97G0PX-022



97G0PX-023

**Disassembly note****Front and Rear Shell Assembly**

1. Secure the front shell studs in a vise after attaching suitable nuts to them to prevent damage to the studs.
2. Before separating the front and rear shell assemblies, make matching marks to be used in reassembly.
3. Fit a wrench onto the rear shell studs, and fasten it with two suitable nuts.

**Caution**

- The rear shell is spring loaded; loosen it carefully.

4. Rotate the rear shell counterclockwise to unlock

**Rear diaphragm plate**

Remove the diaphragm plate while holding it at an angle.

**Valve body**

1. Pry up the diaphragm plate.
2. Remove the valve body.

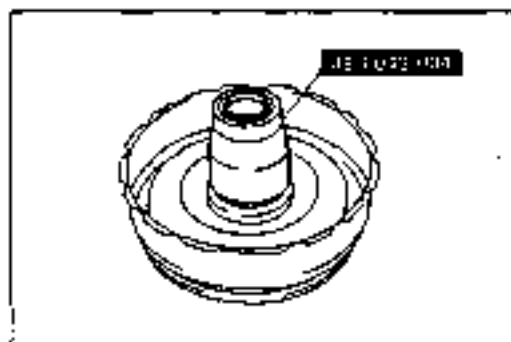
**Assembly note****Retainer (center plate)**

1. Fit the seal to the bearing.
2. Apply grease to the inner surface of the center plate.
3. Install the seal and bearing to the center plate.
4. Press in the retainer with the SST.
5. Apply grease to the seal lip.

**Retainer (front diaphragm)**

Press in the retainer with the SST.

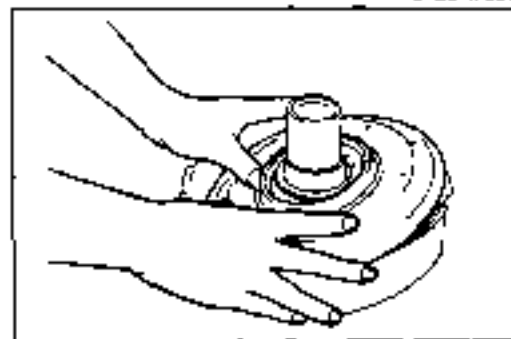




97G0PX-024

**Center plate**

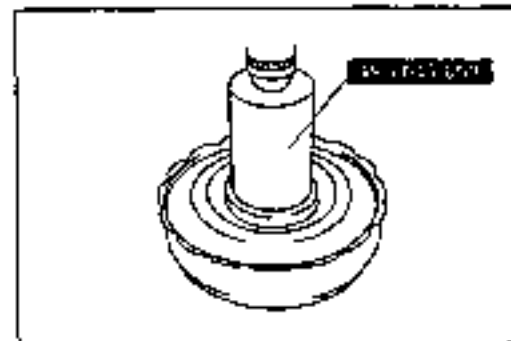
1. Apply grease to the outer surface of the SST.
2. Install the SST to the valve body to protect the seal from damage.
3. Install the center plate.



97G0PX-025

**Rear diaphragm plate**

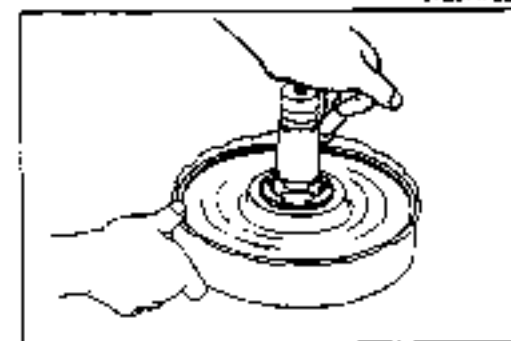
Install the diaphragm plate while holding it at an angle.



97G0PX-026

**Retainer (rear diaphragm)**

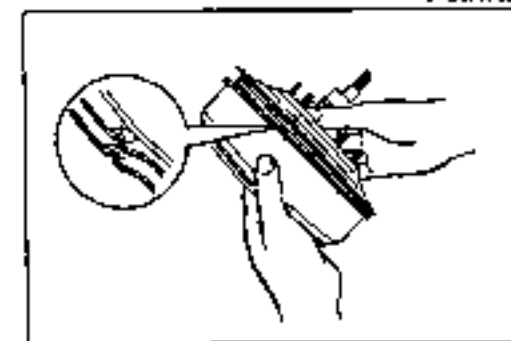
Press in the retainer with the SST.



97G0PX-027

**Stop key**

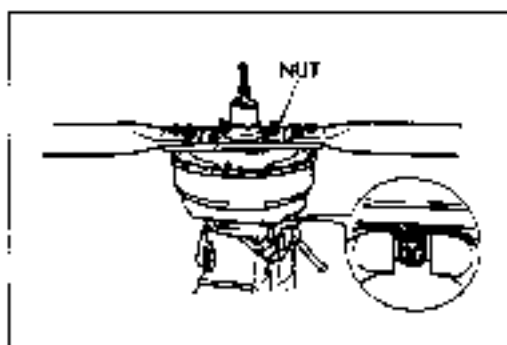
Install the stop key while pushing the valve rod.



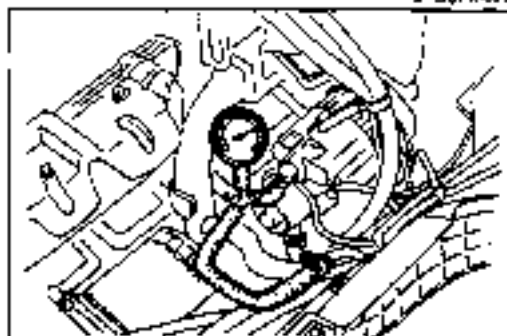
97G0PX-028

**Rear shell assembly and center plate**

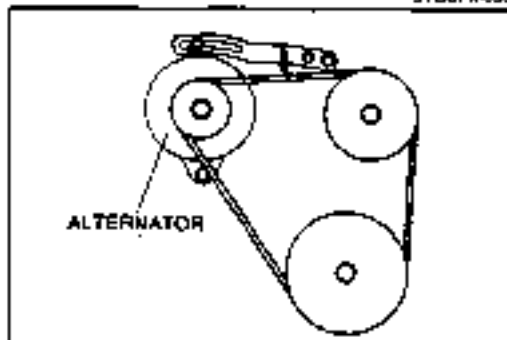
Align the notches of the rear shell and the center plate.



9T50PX-009



9T50PX-050



9T50PX-006

**Front and rear shell assembly**

1. Align the notches of the rear shell and front shell.
2. Apply **500 mmHg (19.7 inHg)** vacuum to pull the rear shell assembly into the front shell.
3. Fit a wrench onto the rear shell studs and fasten it with two suitable nuts.
4. Rotate the rear shell assembly clockwise until the marks are aligned.

**VACUUM PUMP****On-vehicle inspection****Function check**

1. Warm up the engine.
2. Disconnect the vacuum hose from the vacuum pump and connect a vacuum gauge as shown in the figure, then check the vacuum.

**Vacuum specification (in 20 seconds)**

1,500 rpm: -440 mmHg (-17.3 inHg)

3,000 rpm: -580 mmHg (-22.8 inHg)

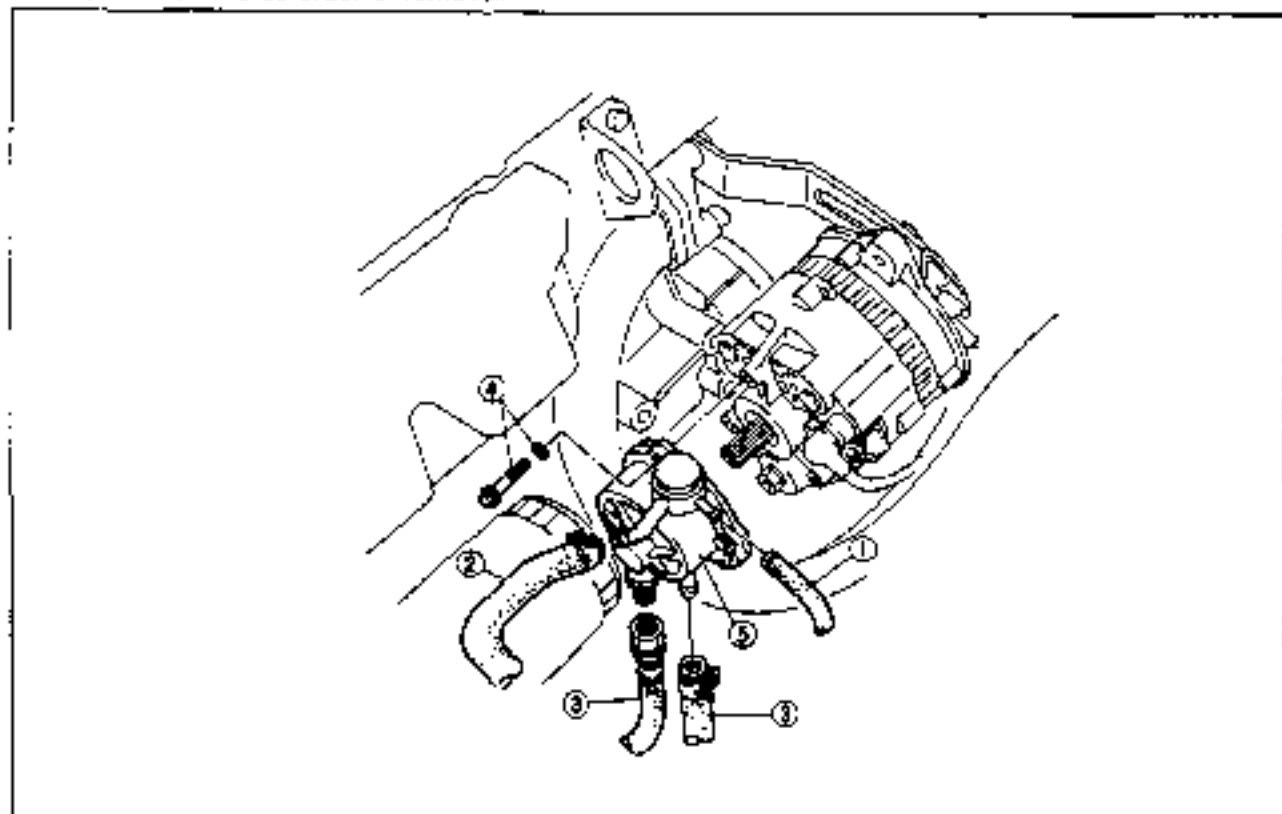
**Maximum vacuum**

-700 mmHg (-27.6 inHg) or more

3. If the pressure is less than specified, check for the following.
  - (1) Tension of the alternator drive belt  
(Refer to Section G.)
  - (2) Shortage of the lubrication oil pressure  
(Refer to Section B.)

**Removal / Installation**

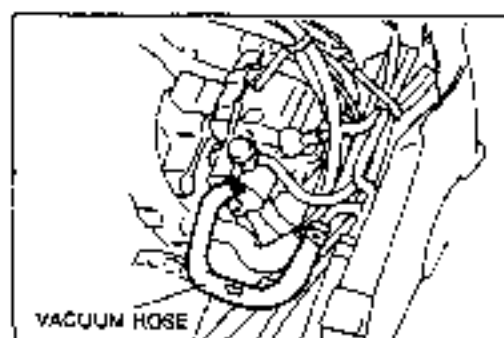
1. Remove in the order shown in the figure.
2. Install in the reverse order of removal.



9T00PX-062

1. Intake hose
2. Vacuum hose  
Inspection..... below
3. Oil hose

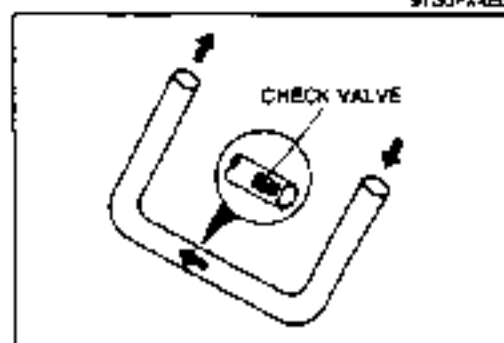
4. Bolt and washer
5. Vacuum pump assembly  
Disassembly / Assembly..... page P-24  
Inspection..... page P-24



9T00PX-063

**Inspection**  
**Vacuum hose**  
**Function check**

1. Disconnect the vacuum hose.



9T00PX-064

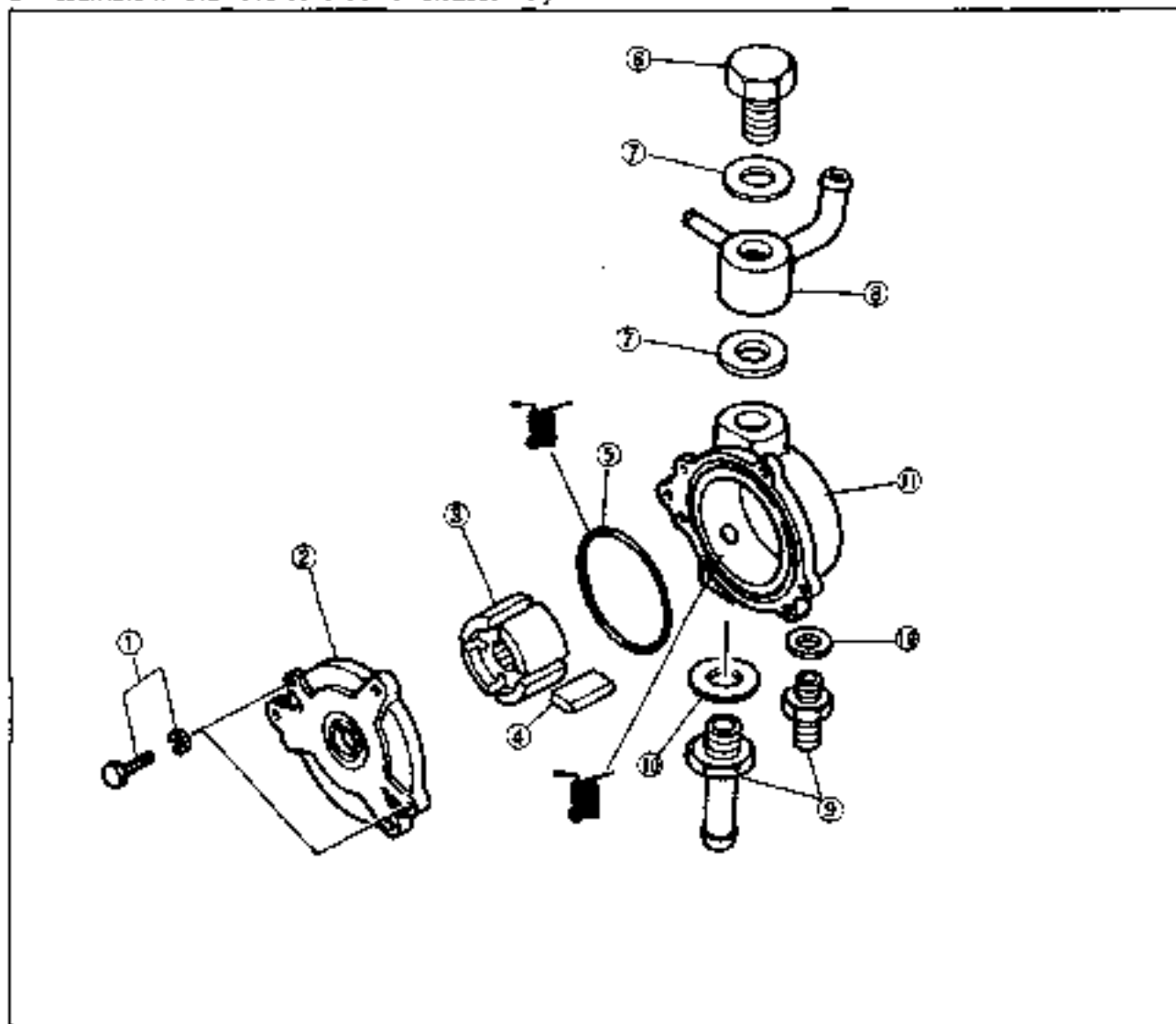
2. Apply suction and pressure to the hose from the vacuum tank side.  
Check that air flows only toward the vacuum pump.

**Note**

- If the air passes in both directions or not at all, replace the check valve along with the hose.

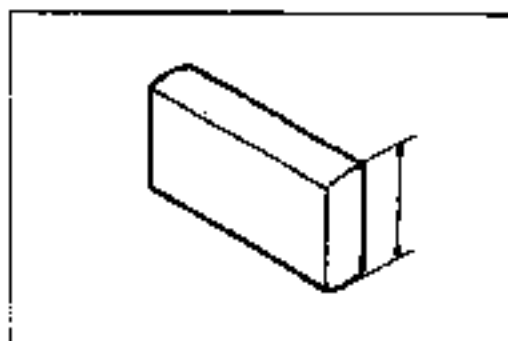
**Disassembly / Assembly**

1. Disassemble in the order shown in the figure.
2. Assemble in the reverse order of disassembly



97G0P1-005

- |                       |                  |
|-----------------------|------------------|
| 1. Bolt and washer    | 6. Set bolt      |
| 2. Bracket            | 7. Washer        |
| 3. Rotor              | 8. Connector     |
| 4. Vane               | 9. Joint         |
| 5. O-ring             | 10. O-ring       |
| Inspection..... below | 11. Pump housing |



97G0P1-006

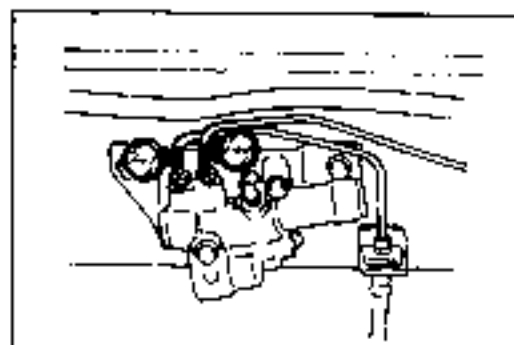
**Inspection**

Check the following and replace if necessary.

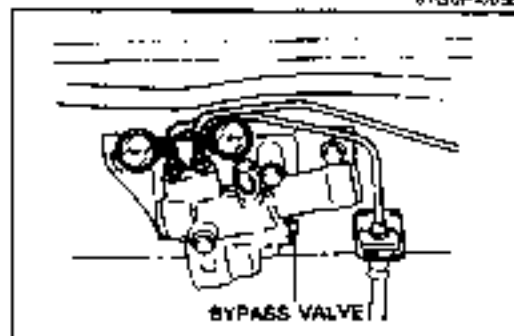
1. Worn or damaged rotor
2. Worn or damaged vane

**Limit: Vane height 7.6mm (0.299 in)**  
**Vane width 4.9mm (0.193 in)**

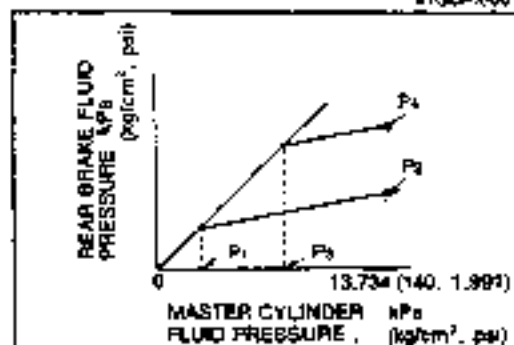
3. Worn or damaged housing



8TG6PX-058



8TG6PX-061



9TG6PX-052

### LOAD-SENSING G-VALVE (LSGV) (EXCEPT LHD 14 AND 17 FEET CARGO DECK)

#### On-vehicle Inspection

#### Function check

1. Connect pressure gauges (commercially available) to the input and output sides of the LSGV as shown.
2. Bleed the air from the bleeder screw.
3. Jack up the rear of the vehicle so that it is at an angle of 15 degrees (rear tires 50–60 cm (19.69–23.82 in) above the ground).
4. Open the bypass valve of the LSGV.
  - Caution**
  - Do not turn the valve more than 360°.
5. Gently depress the brake pedal until the master cylinder pressure becomes P<sub>1</sub>.
6. Close the bypass valve and confirm the P<sub>1</sub> value won't change.
7. Apply additional pressure until the master cylinder pressure becomes 13,734 kPa (140 kg/cm<sup>2</sup>, 1,991 psi), and then measure output fluid pressure P<sub>2</sub>.
8. After the measurement, release the input side fluid pressure.
9. Change P<sub>1</sub> to P<sub>3</sub> and follow step 4 to 8.
10. If the measured value is within the standard pressure shown in the table below, the LSGV is good. If the value is out of standard, replace the LSGV assembly.

kPa (kg/cm<sup>2</sup>, psi)

	Part No.	P <sub>1</sub>	P <sub>2</sub>	P <sub>3</sub>	P <sub>4</sub>
Type 1	W210 43 900	98 (10, 14)	4,120 (42, 897)–4,905 (50, 711)	3,138 (32, 456)	10,595 (108, 1,536) min
Type 2	W211 43 900	98 (10, 14)	4,807 (49, 897)–5,592 (57, 811)	4,905 (50, 711)	10,595 (108, 1,536) min
Type 3	W221 43 900	98 (10, 14)	4,807 (49, 897)–5,592 (57, 811)	4,905 (50, 711)	11,772 (120, 1,708) min
Type 4	W840 43 900	98 (10, 14)	4,513 (46, 854)–5,297 (54, 763)	3,531 (36, 512)	13,832 (141, 2,005) min

8TG6PX-007

Type 1: 10 feet cargo deck (rear single tire)

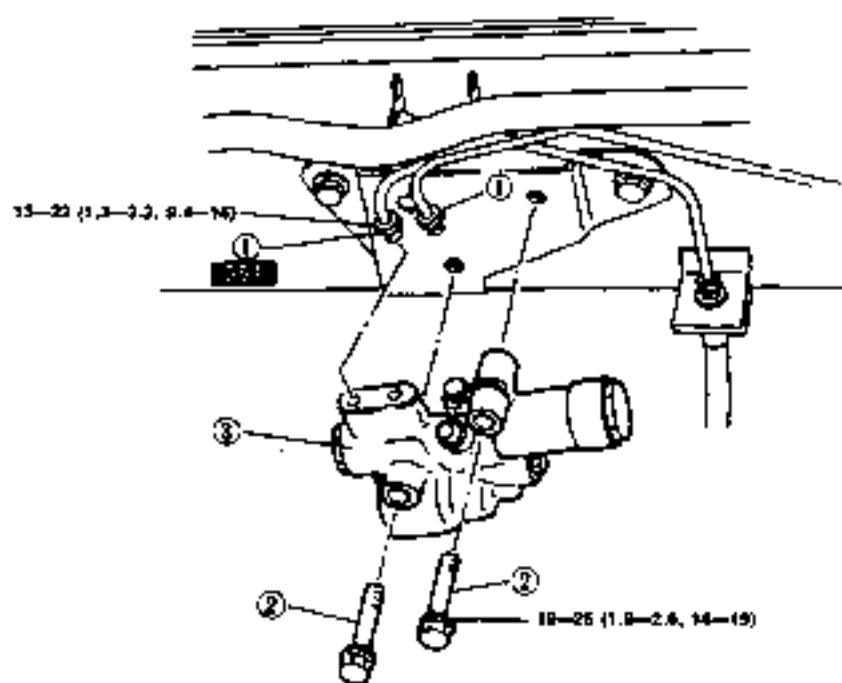
Type 2: 10 feet cargo deck (rear double tire)

Type 3: 14 feet cargo deck (SL engine)

Type 4: 14 feet cargo deck and 17 feet cargo deck (SL TURBO and TF engine)

**Removal / Installation**

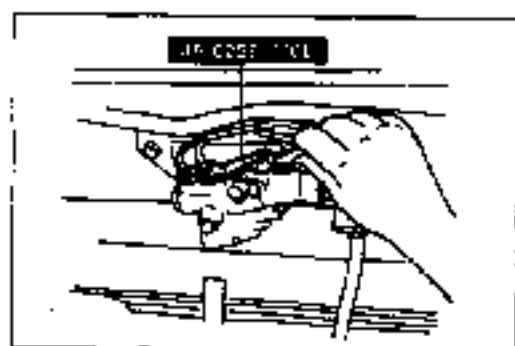
1. Remove in the order shown in the figure, referring to **Removal Note**
2. Install in the reverse order of removal.
3. Bleed the air after installation. (Refer to page P-6.)



REV (20-10, 2-11)

9TGDPR-004

- |                         |                                |
|-------------------------|--------------------------------|
| 1. Brake pipe           | 2. Bolt                        |
| Removal note..... below | 3. Load-sensing G-valve (LSGV) |

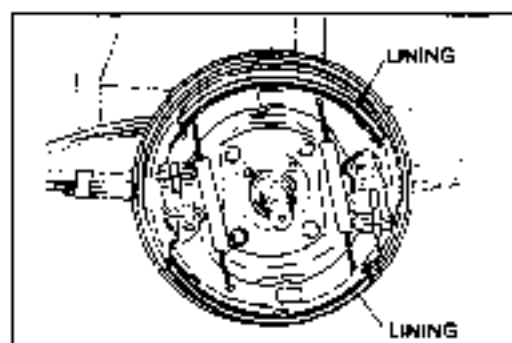


**Removal note**

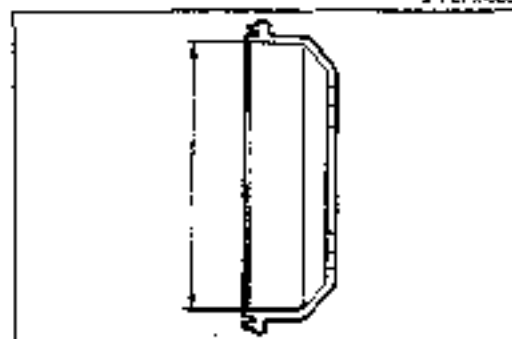
**Brake pipe**

1. Remove the brake pipe with the SST.

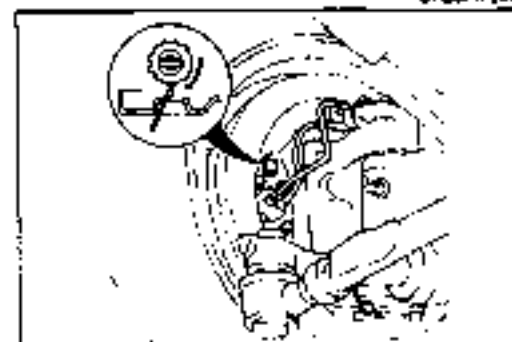
9TGDPR-003



9TF0PX-008



9TG0PX-067



9TG0PX-068

**FRONT BRAKE (DRUM)****On-vehicle Inspection****Lining thickness and drum inner diameter**

1. Jack up the front of the vehicle and support it with safety stands.
2. Remove the wheels and tires.
3. Remove the brake drum. (Refer to page P-28.)
4. Inspect the lining. If the thickness is less than specified, replace the shoe.

**Thickness: 1.0mm (0.04 in) min.**

5. Measure the drum inner diameter. If the diameter exceeds the limit, replace the drum.

**Diameter limit: Refer to Section TD**

**Adjustment****Adjustment of brake shoes**

1. Remove the rubber plug from the backing plate.
2. Place a screwdriver against the adjuster through hole and turn the adjuster in the direction of the arrow until the drum is locked.
3. Turn the adjuster in the reverse direction from the locked position 5 notches.
4. Confirm the parking brake function.

**Replacement****Replacement of brake shoes**

Refer to page P-28.

**Caution**

- Replace the left and right shoes at the same time.

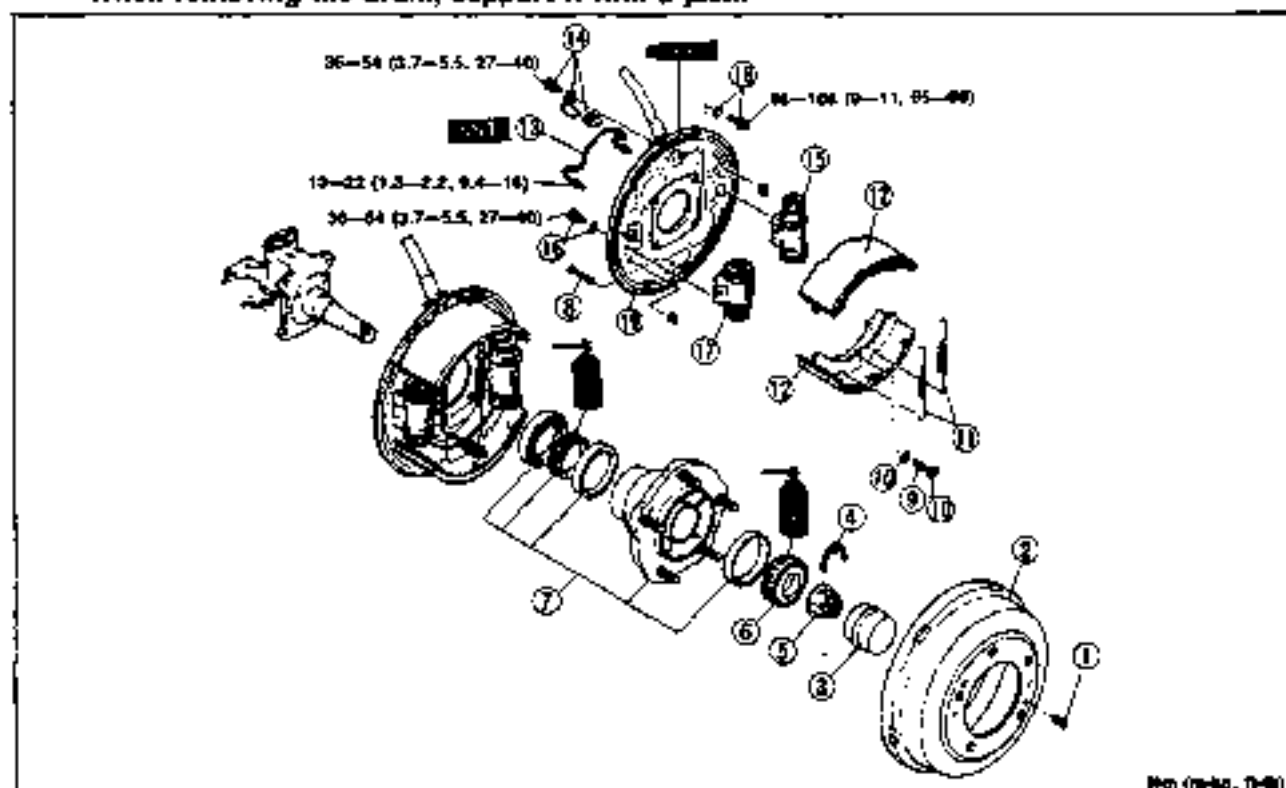
9TF0PX-009

**Removal / Inspection / Installation**

1. Jack up the front of the vehicle and support it with safety stands.
2. Remove the wheels and tires.
3. Remove in the order shown in the figure, referring to **Removal Note**.
4. Install in the reverse order of removal, referring to **Installation Note**.
5. Inspect all parts and repair or replace as necessary.
6. After installation, take the following steps:
  - (1) Air bleeding (Refer to page P-6.)
  - (2) Inspect for brake fluid leakage
  - (3) Adjustment of brake shoe clearance
  - (4) Inspect for the parking brake function and the brake drag.

**Caution**

- Use a specially designed vacuum cleaner or equivalent to clean the brake assembly.
- When removing the drum, support it with a jack.

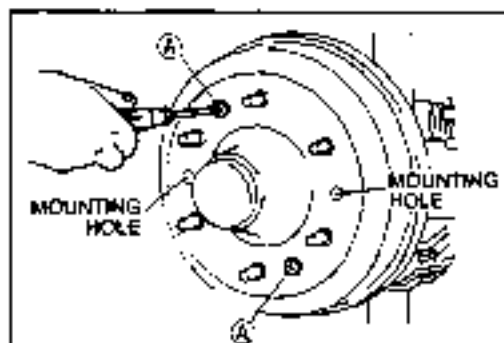


Wen (m-hg, 7-8)

9TROPY-040

- |                                      |           |
|--------------------------------------|-----------|
| 1. Set screw                         |           |
| 2. Brake drum                        |           |
| Removal note .....                   | page P-29 |
| Inspection .....                     | page P-29 |
| 3. Hub cap                           |           |
| 4. Stop retainer                     |           |
| 5. Locknut                           |           |
| Installation note.....               | page P-29 |
| 6. Bearing                           |           |
| Inspect for wear or damage           |           |
| 7. Front hub                         |           |
| 8. Hold pin                          |           |
| 9. Set spring                        |           |
| Inspect for weakness or deformation  |           |
| 10. Cup                              |           |
| 11. Return spring                    |           |
| Inspect for weakness or deformation. |           |
| 12. Brake shoes                      |           |
| Installation note.....               | page P-29 |
| Inspection.....                      | page P-30 |
| 13. Brake pipe                       |           |
| Removal note .....                   | page P-29 |
| 14. Bolt, pipe clip                  |           |
| 15. Wheel cylinder                   |           |
| Disassembly / Inspection /           |           |
| Assembly.....                        | page P-31 |
| 16. Bolt and washer                  |           |
| 17. Wheel cylinder                   |           |
| Disassembly / Inspection /           |           |
| Assembly.....                        | page P-31 |
| 18. Bolt and washer                  |           |
| 19. Backing plate                    |           |
| Inspect for deformation or damage    |           |

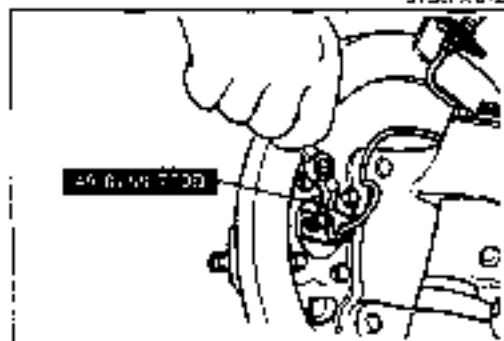




5T3GPFX-072

**Removal note****Brake drum**

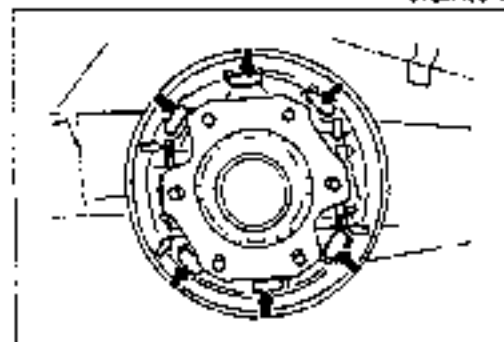
1. Remove the brake drum with the set screw tightened into the hole (A), if the drum is hard to remove.



5T3GPFX-076

**Brake pipe**

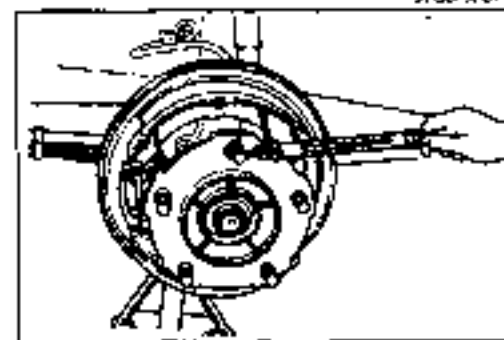
1. Remove the brake pipe with the SST.



5T3GPFX-077

**Installation note****Brake shoe**

1. Before installation, apply grease to the wheel cylinder and anchor sliding parts (⇐), the projections of the backing plate (⇒).
2. Install the brake shoe.



5T3GPFX-081

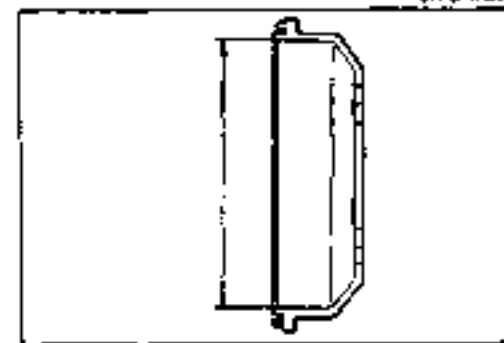
**Locknut**

1. Loosely tighten the locknut to the hub spindle.
2. Rotate the front hub 2–3 times to settle the bearing.
3. Measure the bearing preload. If necessary, tighten (or loosen) the locknut.

**Bearing preload (Scale reading):**

11–29 N (1.1–3.0 kg, 2.4–6.6 lb)

4. Install the stop retainer.



5T3GPFX-087

**Inspection****Brake drum**

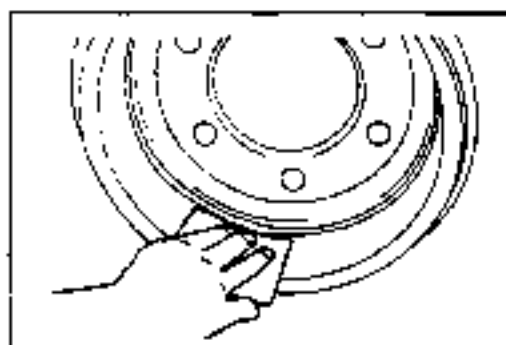
1. Measure the drum inner diameter.

**Diameter limit: Refer to Section TD**

**Caution**

- If there are extremely uneven wear, grind (within the limit) or replace the drum.

## BRAKE SYSTEM



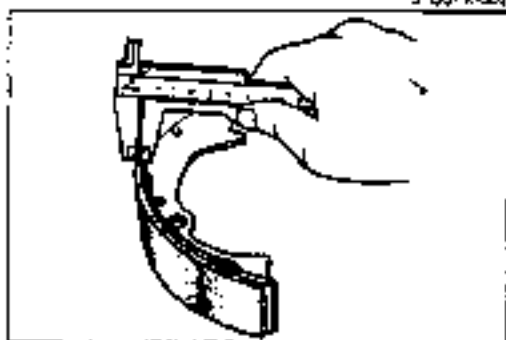
9T00PX-082

2. Check the contact of drum and lining.  
Apply chalk to the inside of the drum and rub the shoe against the drum.

**Note:** Check for extremely poor contact.

**Caution**

- If there are extremely uneven wear, grind (within the limit) or replace the drum.
- After the check, wipe off the chalk.



9T00PX-083

**Brake shoe**

1. Inspect for peeling, cracks, or abnormal wear of the lining. If necessary, replace the brake shoe.
2. Measure thickness of the lining. If thickness is less than specified, replace the brake shoe.

**Lining thickness:** 1.0mm (0.04 in) min.

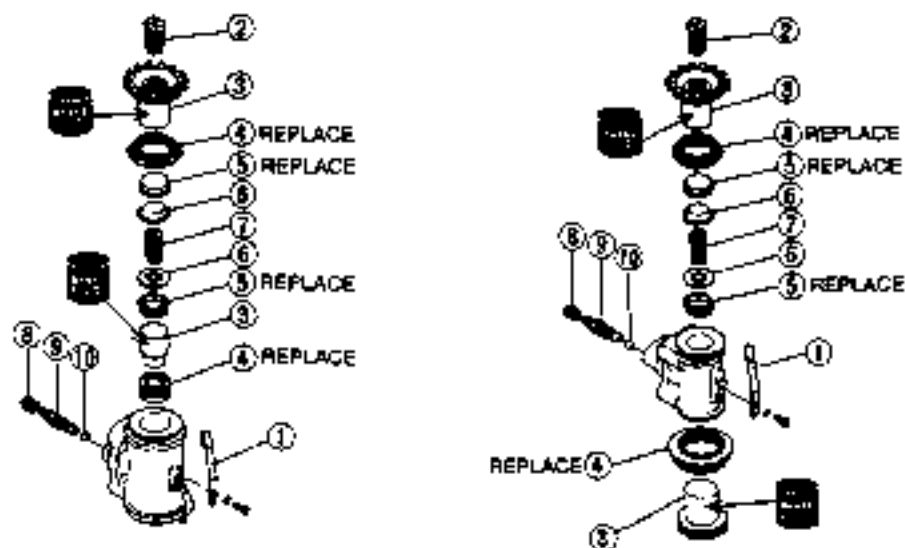
## WHEEL CYLINDER

## Disassembly / Inspection / Assembly

- 1 Disassemble in the order shown in the figure
- 2 Assemble in the reverse order of disassembly.
3. Inspect all parts and repair or replace as necessary.

## Caution

- Do not let foreign material enter the cylinder.



## 1. Spring

Inspect for deformation or weakness

## 2. Adjusting screw

## 3. Pistons

Inspect for damage

## 4. Dust boots

## 5. Piston rubber cups

## 6. Feeling block

## 7. Spring

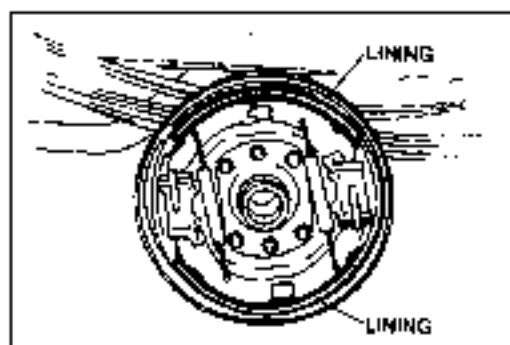
Inspect for deformation or weakness

## 8. Bleeder cap

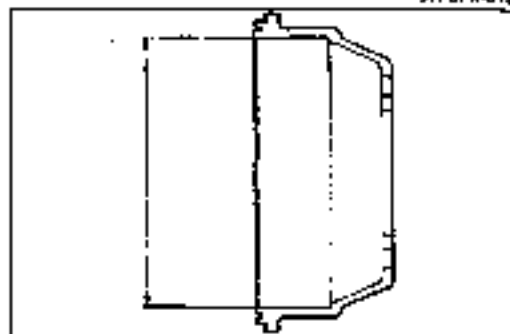
## 9. Bleeder screw

## 10. Steel ball

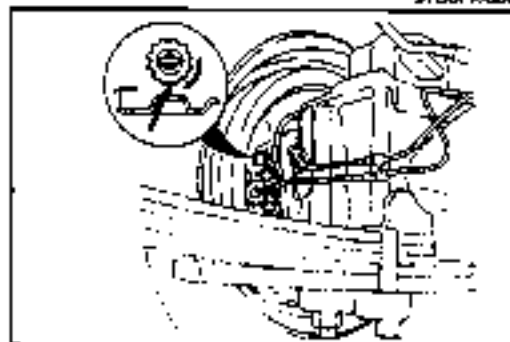
07G0PX 08A



9TF0PX-012



9TGDPX-086



9TGDPX-087

**REAR BRAKE (DRUM)****On-vehicle Inspection****Lining thickness and drum inner diameter**

1. Jack up the rear of the vehicle and support it with safety stands.
2. Remove the wheels and tires.
3. Remove the brake drum. (Refer to page P-33.)
4. Inspect the lining. If the thickness is less than specified, replace the shoe.

**Thickness: 1.0mm (0.04 in) min.**

5. Measure the drum inner diameter. If the diameter exceeds the limit, replace the drum.

**Diameter limit: Refer to Section TD**

**Adjustment****Adjustment of brake shoes**

1. Remove the rubber plug from the backing plate.
2. Place a screwdriver against the adjuster through hole and turn the adjuster in the direction of the arrow until the drum is locked.
3. Turn the adjuster in the reverse direction from the locked position 5 notches.
4. Inspect for the parking brake function and the brake drag.

**Replacement****Replacement of brake shoes**

Refer to page P-33.

**Caution**

- Replace the left and right shoes at the same time.

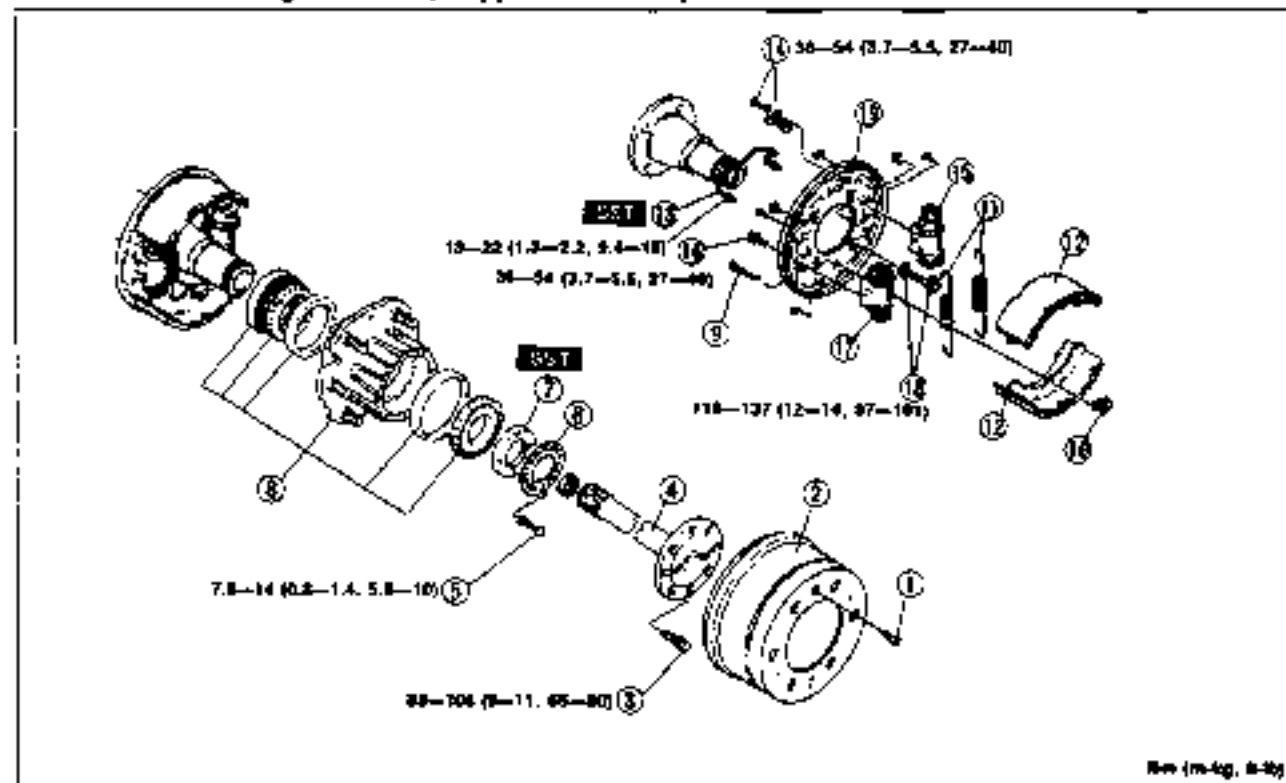
9TF0PX-013

### Removal / Inspection / Installation

- 1 Jack up the rear of the vehicle and support it with safety stands.
- 2 Remove the wheels and tires.
- 3 Remove in the order shown in the figure, referring to **Removal Note**.
- 4 Install in the reverse order of removal, referring to **Installation Note**.
- 5 Inspect all parts and repair or replace as necessary.
- 6 After installation, take the following steps.
  - (1) Air bleeding (Refer to page P-8.)
  - (2) Inspect for brake fluid leakage
  - (3) Adjustment of brake shoe clearance
  - (4) Inspect for the parking brake function and the brake drag.

### Caution

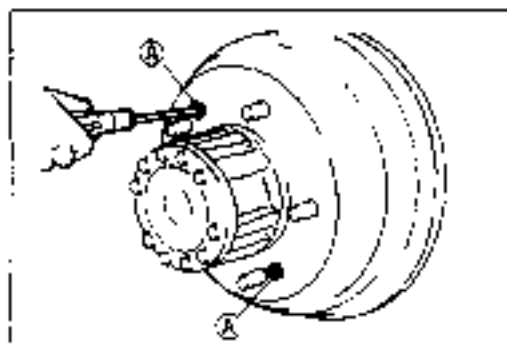
- Use a specially designed vacuum cleaner or equivalent to clean the brake assembly.
- When removing the drum, support it with a jack.



Rev. (m-kg), 8-89

87P0PX 014

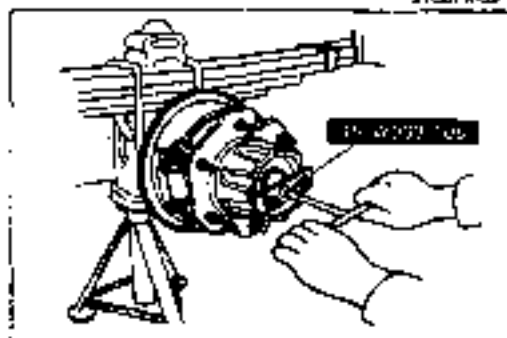
<ol style="list-style-type: none"> <li>1. Set screw</li> <li>2. Brake drum Removal note ..... page P-34 Inspection ..... page P-35</li> <li>3. Bolt</li> <li>4. Rear axle shaft</li> <li>5. Bolt</li> <li>6. Set plate</li> <li>7. Locknut Removal note ..... page P-34 Installation note ..... page P-34</li> <li>8. Rear hub</li> <li>9. Hold pin</li> <li>10. Set spring Inspect for deformation or weakness</li> <li>11. Return spring Inspect for deformation or weakness</li> </ol>	<ol style="list-style-type: none"> <li>12. Brake shoe Installation note ..... page P-34 Inspection ..... page P-35</li> <li>13. Brake pipe Removal note ..... page P-34</li> <li>14. Bolt, pipe clip</li> <li>15. Wheel cylinder Disassembly / Inspection / Assembly ..... page P-36</li> <li>16. Bolt and washer</li> <li>17. Wheel cylinder Disassembly / Inspection / Assembly ..... page P-36</li> <li>18. Bolt and washer</li> <li>19. Backing plate Inspect for deformation or damage</li> </ol>
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9TGDPK-09

**Removal note****Brake drum**

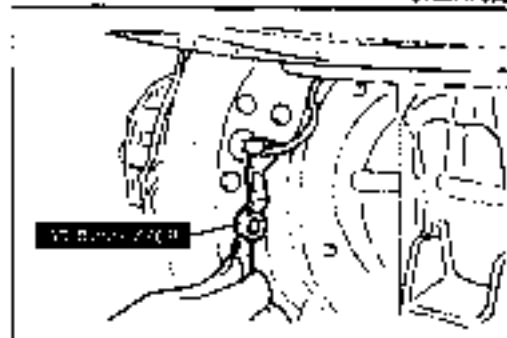
1. Remove the brake drum with the set screw tightened into the hole (A), if the drum is hard to remove.



9TGDPK-092

**Locknut**

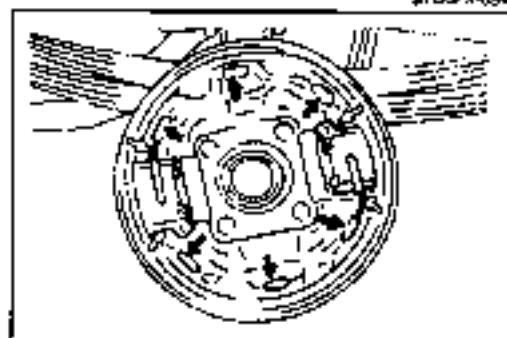
1. Remove the locknut with the SST.



9TGDPK-094

**Brake pipe**

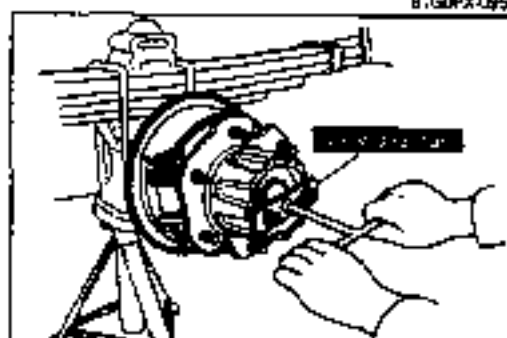
1. Remove the brake pipe with the SST.



8TGDPK-095

**Installation note****Brake shoe**

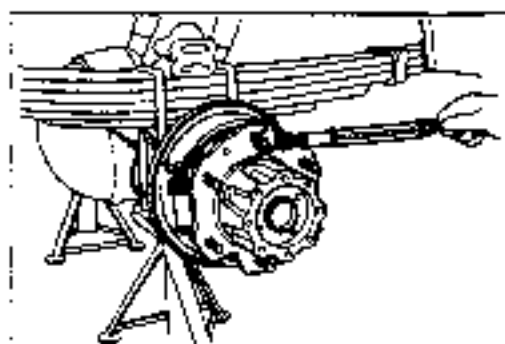
1. Before installation, apply grease to the wheel cylinder and anchor sliding parts (⇨), the projections of the backing plate (⇨).



8TGDPK-096

**Locknut**

1. Tighten the locknut with the SST.

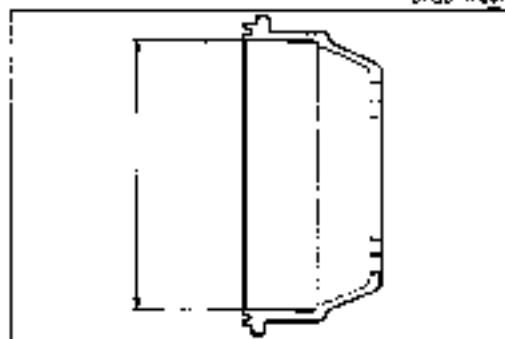


BTG0P4-097

2. Turn the rear hub 2–3 times to settle the bearing.
3. Loosen the locknut until it can be moved manually.
4. Measure the bearing preload.

**Bearing preload (Scale reading):**  
11–29 N (1.1–3.0 kg, 2.4–6.6 lb)

5. Tighten the locknut and adjust the bearing preload.



BTG0P4-098

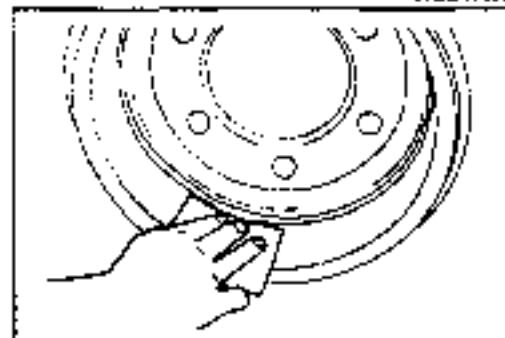
#### Inspection Brake drum

1. Measure the drum inner diameter.

**Diameter limit: Refer to Section TD.**

#### Caution

- If there are extremely uneven wear, grind (within the limit) or replace the drum.



BTG0P4-099

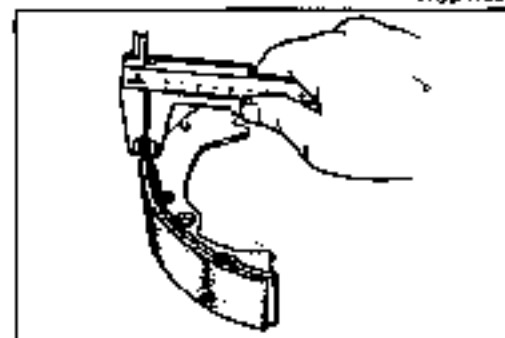
2. Check the contact of drum and lining. Apply chalk to the inside of the drum and rub the shoe against the drum.

#### Note

- Check for extremely bad contact.

#### Caution

- If there are extremely uneven wear, grind (within the limit) or replace the drum.
- After the check, wipe off the chalk.



BTG0P4-100

#### Brake shoe

1. Inspect for peeling, cracks, or abnormal wear of the lining. If necessary, replace the brake shoe.
2. Measure thickness of the lining. If thickness is less than specified, replace the brake shoe.

**Lining thickness: 1.0mm (0.04 in) min.**

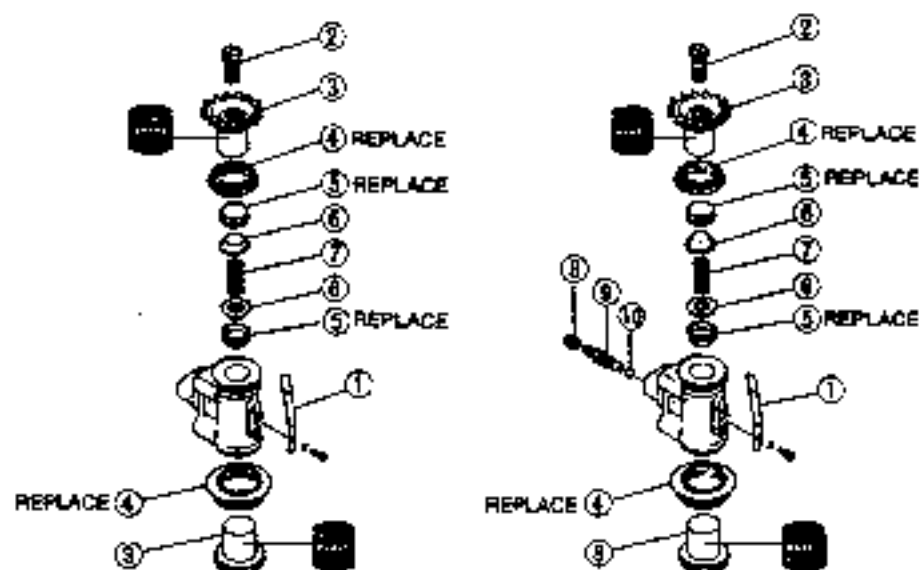
## WHEEL CYLINDER

## Disassembly / Inspection / Assembly

1. Disassemble in the order shown in the figure.
2. Assemble in the reverse order of disassembly.
3. Inspect all parts and repair or replace as necessary.

## Caution

- Do not let foreign material enter the cylinder.



9TGPX-101


- |  |  |
|--|--|
| 1. Spring<br>Inspect for deformation or weakness | 6. Feeling block                                 |
| 2. Adjusting screw                               | 7. Spring<br>Inspect for deformation or weakness |
| 3. Pistons<br>Inspect for damage                 | 8. Bleeder cap                                   |
| 4. Dust boots                                    | 9. Bleeder screw                                 |
| 5. Piston rubber cups                            | 10. Steel ball                                   |



## PARKING BRAKE SYSTEM

## PREPARATION

## SST

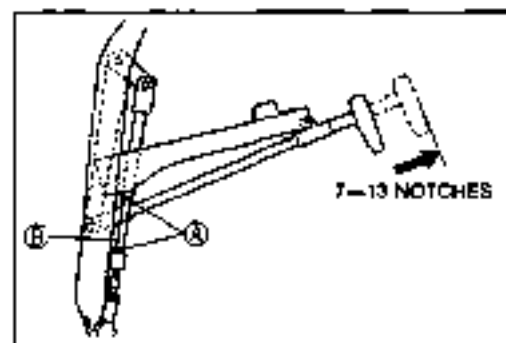
49 S120 710 Coupling flange holder		For removal and installation of center brake drum
---------------------------------------	---	---

9TGD0PX-13

## TROUBLESHOOTING GUIDE

Problem	Possible cause	Remedy	Page
Brakes do not release	Improper routing or adjusted parking brake cable	Replace or adjust	Below
Poor parking braking	Too much lever stroke Hardened or damaged brake cable Surface hardening or poor contact of center brake shoe Worn center brake drum	Adjust Repair or replace Clean or replace Grind or replace	Below P-39 P-40 P-41

9TGD0PX-015



9TGD0PX-103

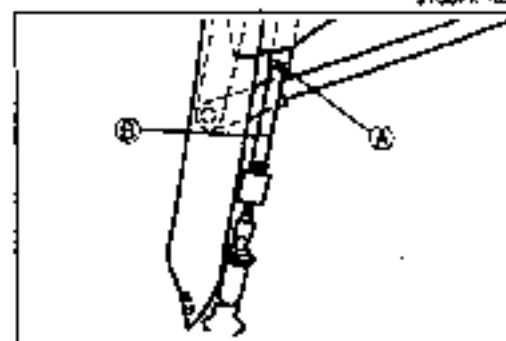
## PARKING BRAKE LEVER

## On-vehicle Inspection

## Lever stroke

1. Check that the stroke is within specification when the parking brake lever is pulled with a force of **294 N (30 kg, 66 lb)**.

Stroke: 7—13 notches



9TGD0PX-104

## Adjustment

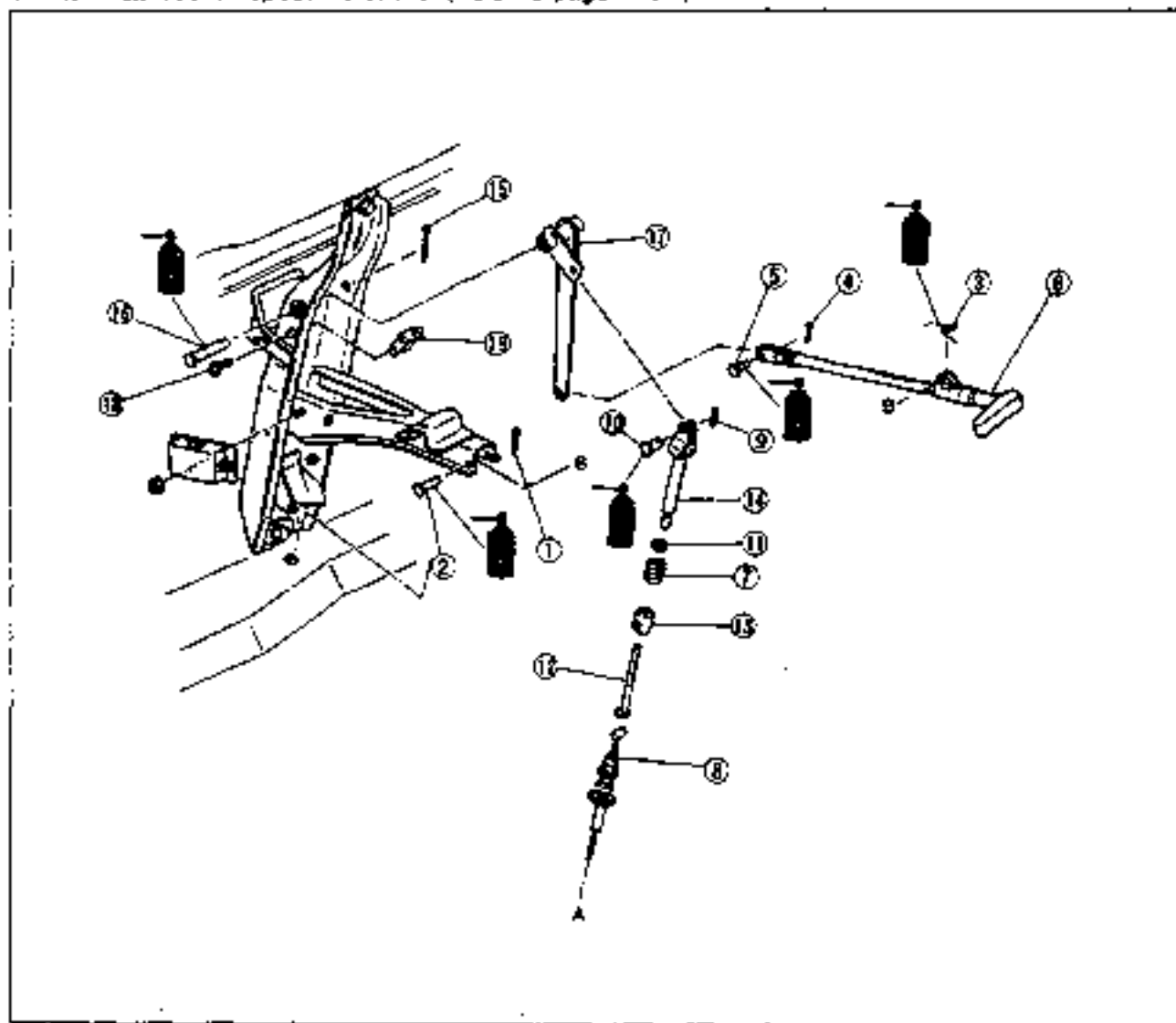
1. Loosen locknut (A) and turn the adjusting bolt (B) so that the stroke is within the above range.

## Caution

- Before adjustment, adjust the clearance between the center brake drum and spring. (Refer to page P-41.)
- After adjustment, make sure that the parking brake warning light illuminates when the brake lever is pulled one notch and the brakes are not dragging.

**Removal / Inspection / Installation**

1. Release the parking brake.
2. Remove the lower panel. (Refer to Section S.)
3. Remove in the order shown in the figure.
4. Install in the reverse order of removal.
5. Inspect all parts and repair or replace as necessary.
6. After installation, inspect the stroke. (Refer to page P-37.)



8TFRP-016

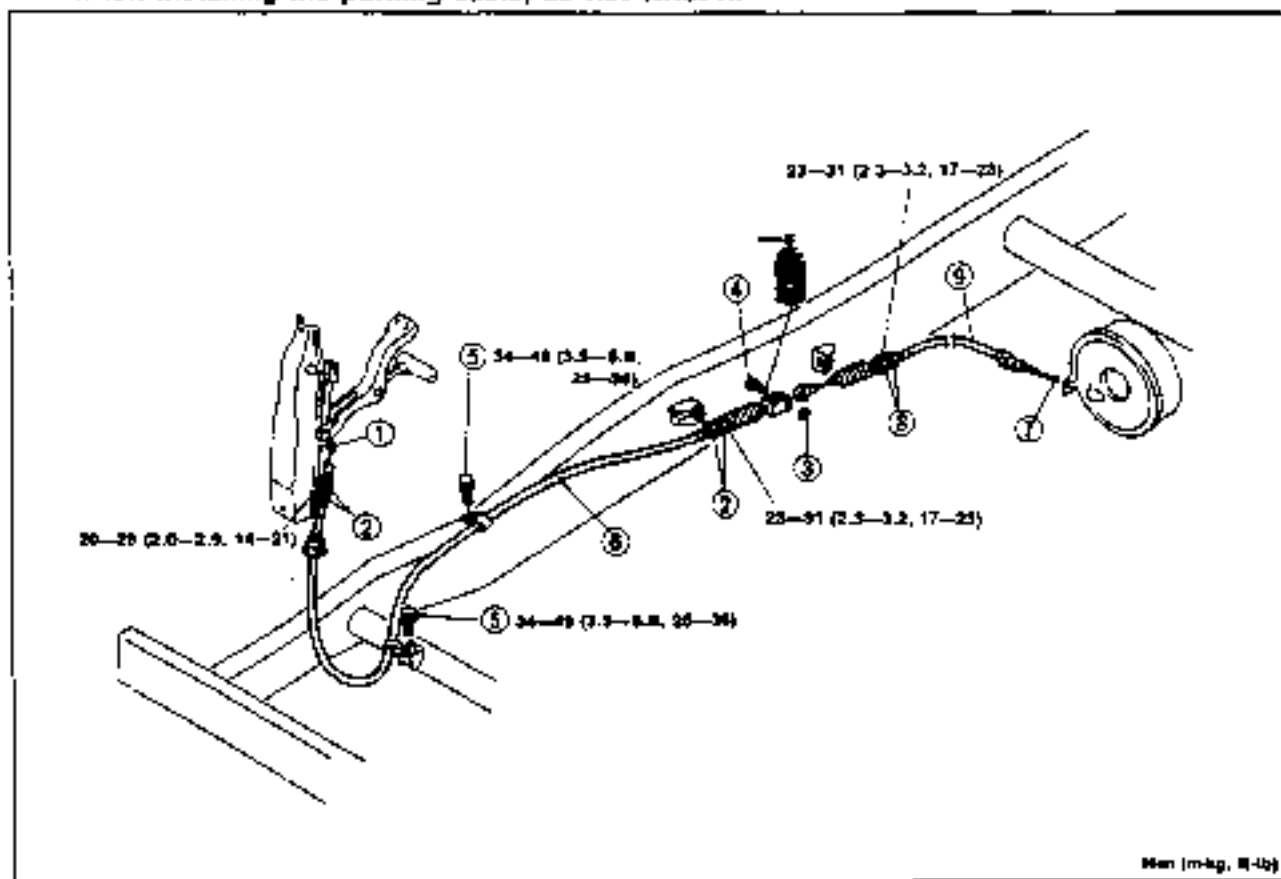
- |  |  |
|--|--|
| 1. Split pin   | 10. Clevis pin   |
| 2. Clevis pin  | 11. Nut  |
| 3. Return spring<br>Inspect for deformation or weakness                  | 12. Adjusting bolt   |
| 4. Split pin   | 13. Joint  |
| 5. Clevis pin  | 14. Tension rod<br>Inspect for damage or deformation         |
| 6. Parking brake rod<br>Inspect for wear or damage of ratchet pawl       | 15. Split pin  |
| 7. Spring<br>Inspect for deformation or weakness                         | 16. Clevis pin   |
| 8. Front cable<br>Removal / Inspection /<br>Installation ..... page P-39 | 17. Parking brake lever<br>Inspect for damage or deformation |
| 9. Split pin   | 18. Screw  |
|  | 19. Parking brake switch<br>Inspection ..... Section T       |

**PARKING BRAKE CABLE****Removal / Inspection / Installation**

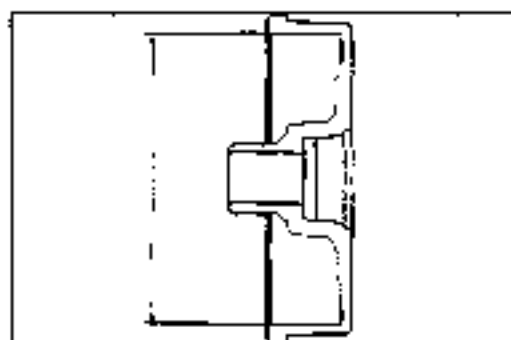
1. Remove in the order shown in the figure.
2. Install in the reverse order of removal.
3. Inspect all parts and repair or replace as necessary.
4. After installation, adjust the parking brake lever stroke. (Refer to page P-37.)

**Caution**

- When installing the parking cable, do not twist it.



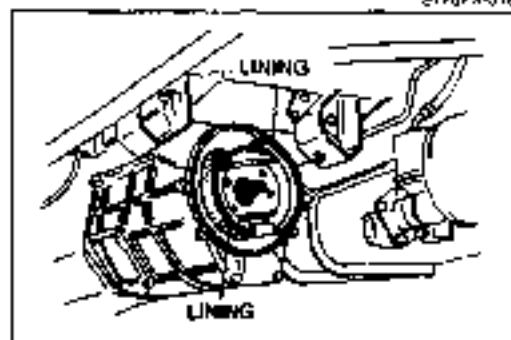
- |                    |                    |
|--------------------|--------------------|
| 1. Front cable end | 7. Rear cable end  |
| 2. Nuts            | 8. Nuts            |
| 3. Stop ring       | 9. Rear cable      |
| 4. Clevis pin      | Inspect for damage |
| 5. Bolt            |                    |
| 6. Front cable     |                    |
| Inspect for damage |                    |



9TFOFX-018

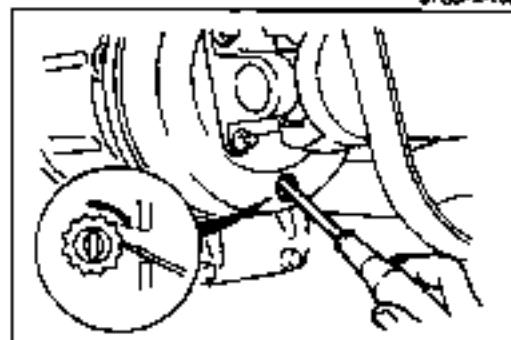
**CENTER BRAKE****On-vehicle Inspection****Lining thickness and drum inner diameter**

1. Jack up the vehicle and support it with safety stands.
2. Remove the center brake drum. (Refer to page P-41.)
3. Inspect the drum inner diameter.

**Diameter: 190mm (7.48 in)****Limit : 191mm (7.52 in)**

9TGOFX-108

4. Visual inspect the lining thickness.

**Thickness: 3.6mm (0.14 in)****Limit : 1.0mm (0.04 in)**

9TGOFX-102

**Adjustment****Center brake shoe clearance**

1. Remove the plug.
2. Place a screwdriver against the adjuster through hole and turn the adjuster in the direction of the arrow until the drum is locked.
3. Turn the adjuster in the reverse direction from the locked position 6—7 notches.

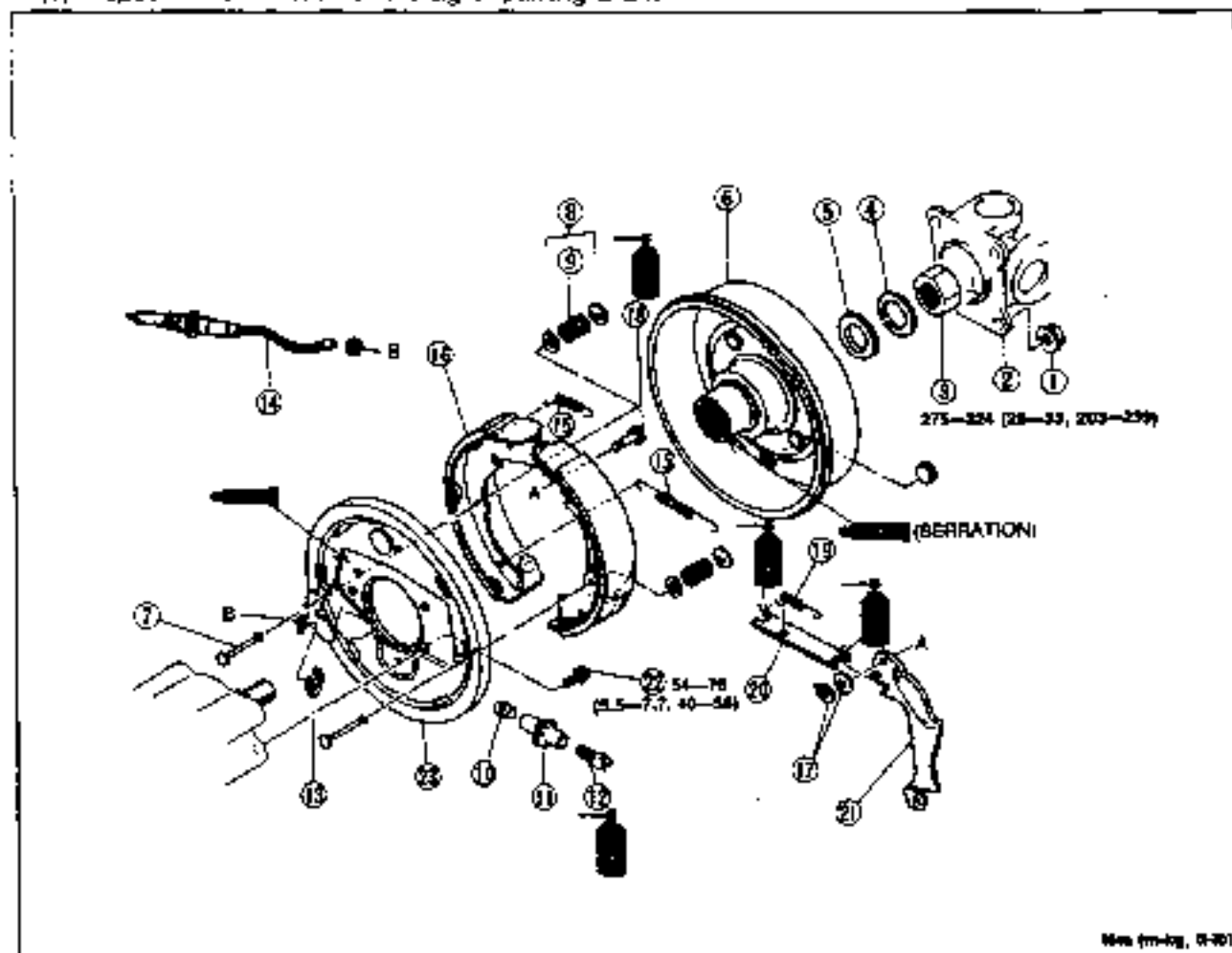
**Replacement****Replacement of center brake shoe**

Refer to page P-41.

9TFOFX-019

### Removal / Inspection / Installation

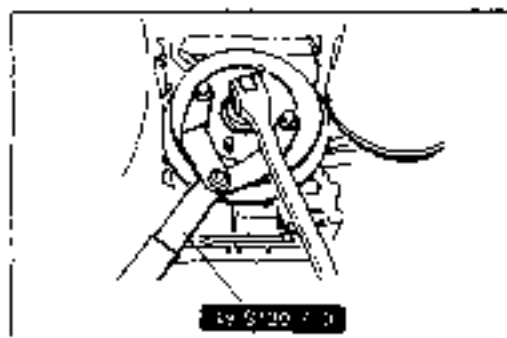
1. Jack up the vehicle and support it with safety stands.
2. Remove in the order shown in the figure, referring to **Removal Note**.
3. Install in the reverse order of removal.
4. Inspect all parts and repair or replace as necessary.
5. After installation, take the following steps:
  - (1) Adjustment of center brake shoe (Refer to page P-43.)
  - (2) Adjustment of parking brake lever stroke (Refer to page P-37.)
  - (3) Inspection for function and drag of parking brake



New (m-k), 0-201

9TR0PX-020

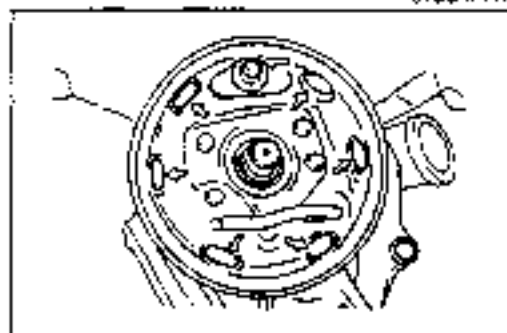
- |   |  |
|---|--|
| <ol style="list-style-type: none"> <li>1. Nut</li> <li>2. Propellershaft</li> <li>3. Locknut<br/>Removal note ..... page P-42</li> <li>4. Washer</li> <li>5. Oil seal</li> <li>6. Center brake drum<br/>Inspection ..... page P-43</li> <li>7. Hold pin</li> <li>8. Stop plate</li> <li>9. Spring<br/>Inspect for weakness or deformation</li> <li>10. Sleeve</li> <li>11. Adjusting nut</li> <li>12. Adjusting screw</li> <li>13. Stop retainer</li> </ol> | <ol style="list-style-type: none"> <li>14. Parking cable</li> <li>15. Return spring<br/>Inspect for weakness or deformation</li> <li>16. Center brake shoe<br/>Installation note ..... page P-42<br/>Inspection ..... page P-42</li> <li>17. Retainer</li> <li>18. Pin</li> <li>19. Return spring<br/>Inspect for weakness or deformation</li> <li>20. Strut</li> <li>21. Lever</li> <li>22. Bolt</li> <li>23. Backing plate<br/>Inspect for damage</li> </ol> |
|---|--|



9T60PX-111

**Removal note****Locknut**

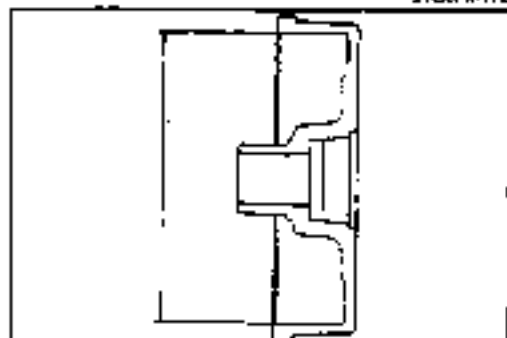
1. Remove the locknut with the drum locked with the **SST**.



9T60PX-112

**Installation note****Center brake shoe**

1. Before installation, apply grease to all sliding parts (⇄).



9T60PX-113

**Inspection****Brake drum**

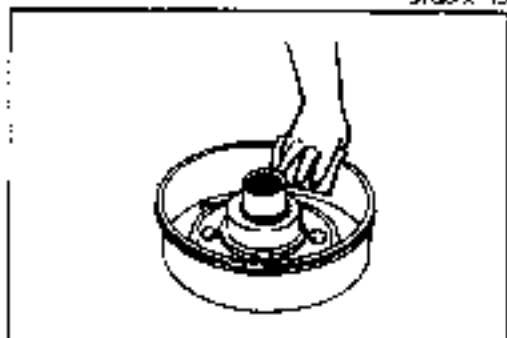
1. Measure the brake drum inner diameter.

**Standard diameter: 190mm (7.48 in)**

**Limit diameter : 191mm (7.52 in)**

**Caution**

- If there are extremely uneven wear, grind (within the limit) or replace the drum.



9T60PX-114

2. Check the contact of drum and lining.

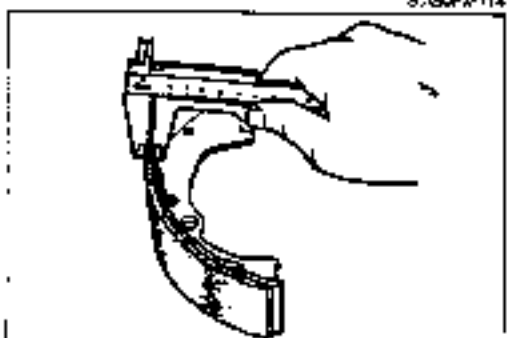
Apply chalk to the inside of the drum and rub the shoe against the drum.

**Note**

- Check for extremely bad contact.

**Caution**

- If there are extremely uneven wear, grind (within the limit) or replace the drum.
- After the check, wipe off the chalk.



9T60PX-115

**Brake shoe**

1. Inspect for peeling, cracks, or abnormal wear of the lining. If necessary, replace the brake shoe.
2. Measure thickness of the lining. If thickness is less than specified, replace the brake shoe.

## WHEELS AND TIRES

<b>OUTLINE</b> .....	<b>Q- 2</b>
SPECIFICATION.....	<b>Q- 2</b>
<b>TROUBLESHOOTING GUIDE</b> .....	<b>Q- 3</b>
<b>WHEELS AND TIRES</b> .....	<b>Q- 4</b>
SPECIAL NOTES ABOUT WHEELS AND TIRES .....	<b>Q- 4</b>
NOTES REGARDING TIRE REPLACEMENT.....	<b>Q- 4</b>
INSPECTION / ADJUSTMENT.....	<b>Q- 4</b>
REMOVAL / INSTALLATION.....	<b>Q- 7</b>

9TFC0X-001

## OUTLINE

## SPECIFICATION

## Single tire

Specifications		Wheel			Tire	
		Size	Offset mm (in)	Diameter of pitch circle mm (in)	Size	Tire pressure kPa (kg/cm <sup>2</sup> , psi)
3CL	Front	5.50F×16	30 (1.181)	184.15 (7.25)	7.00-15-10	392 (4.00, 55)
	Rear					417 (4.25, 60)

STP00X-002

## Dual tires

Specifications			Wheel			Tire					
			Size	Offset mm (in)	Diameter of pitch circle mm (in)	Size	Tire pressure kPa (kg/cm <sup>2</sup> , psi)				
2,000 kg	3.5L	Front	4.50E×16	108 (4.252)	203.2 (8)	6.50-16-10	491 (5.00, 71)				
			5.50F×16	115 (4.528)		6.50R16-10	540 (5.50, 78)				
		Rear	4.50E×16	108 (4.252)		8.50-16-8	417 (4.25, 60)				
			5.50F×16	115 (4.528)		6.50-16-10	441 (4.50, 64)				
2,750 kg	3.5L	Front	5.50F×16	115 (4.528)	203.2 (8)	7.00-16-10	466 (4.75, 68)				
						7.00-16-12	466 (4.75, 68)				
						7.00R16-10	441 (4.50, 64)				
		Rear				7.00-16-10	491 (5.00, 71)				
						7.00-16-12	515 (5.25, 75)				
						7.00R16-10	540 (5.50, 78)				
3,000 kg	3.5L	Front	5.50F×16	115 (4.528)	203.2 (8)	7.00-16-10	515 (5.25, 75)				
						7.00-16-12	540 (5.50, 78)				
						7.00R16-10	515 (5.25, 75)				
		Rear				7.00-16-10	491 (5.00, 71)				
						7.00-16-12	515 (5.25, 75)				
						7.00R16-10	515 (5.25, 75)				
3,600 kg	4.0L	Rear	6.00GS×16	127 (5)	222.25 (8.75)	7.50-16-12	441 (4.50, 64)				
		Rear				7.50R16-12	441 (4.50, 64)				
						7.50-16-12	540 (5.50, 78)				
						7.50R16-12	564 (5.75, 82)				
4,000 kg	3.5L 4.0L	14 feet body	6.00GS×16	127 (5)	222.25 (8.75)	7.50-16-12	564 (5.75, 82)				
						Front	7.50R16-12	638 (6.50, 93)			
		Rear					7.50-16-10	515 (5.25, 75)			
						17 feet body	Front	6.00GS×16	127 (5)	222.25 (8.75)	7.50-16-12
		Rear									7.50R16-12

STP00X-003



## TROUBLESHOOTING GUIDE

Problem	Possible Cause	Action	Page
Excessive or irregular tire wear	Refer to page Q-7 for details		
Premature tire wear	Incorrect tire pressure	Adjust	Q-2
Tire squeal	Incorrect tire pressure Tire deterioration	Adjust Replace	Q-2 —
Road noise or body vibration	Incorrect tire pressure Unbalanced wheel Deformed wheel or tire Irregular tire wear	Adjust Adjust Repair or replace Replace	Q-2 Q-8 — —
"Shake" occurs (Steering wheel vibrates up/down)	Excessive tire and wheel runout Loose lug nuts Unbalanced wheel Cracked or worn engine mounting rubber Cracked or worn transmission mounting rubber	Replace Tighten Adjust or replace Replace Replace	— Q-5 Q-8 Section C Sections J1, J2, K
"Shimmy" occurs (Steering wheel vibrates left/right)	Cracked or worn steering gear mounting rubber Loose steering gear mounting bolts Stuck or damaged steering ball joint Excessive tire and wheel runout Loose lug nuts Unbalanced wheel Incorrect tire pressure Unevenly worn tires Malfunction of shock absorber Loose shock absorber mounting bolts Struck or damaged lower arm ball joint Cracked or worn suspension bushings Damaged or worn front wheel bearing Improperly adjusted front wheel alignment	Replace Tighten Replace Replace Tighten Adjust or replace Adjust Replace Replace Tighten Replace Replace Replace Replace Adjust	Section N Section N Section N — Q-5 Q-8 Q-2 — Section R Section R Section R Section R Section M Section R
Uneven (one-sided) braking	Unequal tire pressures	Adjust	Q-2
Steering wheel doesn't return properly or pulls to left or right	Incorrect tire pressure Irregular tire wear (left/right) Unequal tire pressures Different types or brands of tires mixed (left/right) Loose lug nuts	Adjust Replace Adjust Replace Tighten	Q-2 — Q-2 — Q-5
General driving instability	Unequal tire pressures Damaged or unbalanced wheel Loose lug nuts	Adjust Replace or adjust Tighten	Q-2 Q-8 Q-5
Excessive steering wheel play	Loose lug nuts	Tighten	Q-5

eTR00X-004

## WHEELS AND TIRES

## SPECIAL NOTES ABOUT WHEELS AND TIRES

1. Do not use wheels or tires other than the specified types.

## NOTES REGARDING TIRE REPLACEMENT

Note the following points when tires are to be removed from or mounted onto the wheels.

1. Be careful not to damage the tire bead, the rim bead, and the edge of the rim.
2. Apply a soapy solution to the tire bead and the edge of the rim.
3. Use a wire brush, sandpaper, or cloth to clean and remove all rust and dirt from the rim edge and the rim bead.
4. Remove all pebbles, glass, nails, and other foreign items embedded in the tire tread.
5. Be sure the air valve is installed correctly.
6. After mounting a tire onto a wheel, inflate it to a little higher pressure than specified level. Verify that the bead is seated correctly onto the rim and that there are no air leaks. Then reduce the pressure to the specified level.

ET3004-006



9TFC0X-006

## INSPECTION / ADJUSTMENT

## Air pressure

1. Check the air pressure of all tires, including the spare tire, with an air pressure gauge.
2. Adjust the air pressure if necessary.

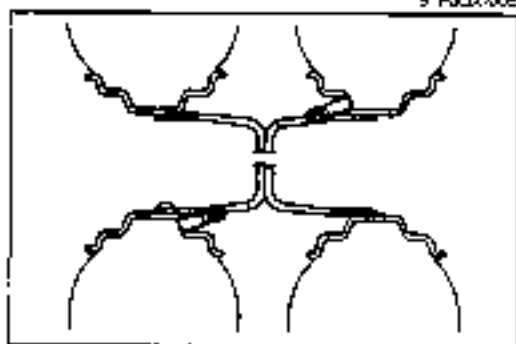
**Air pressure:** Refer to page Q-2.

## Caution

- \* The air pressure must be measured when the tire is cold.

## Air leakage

1. Verify that there is no air leakage from valve stem.



9T000X-007

## Tire wear

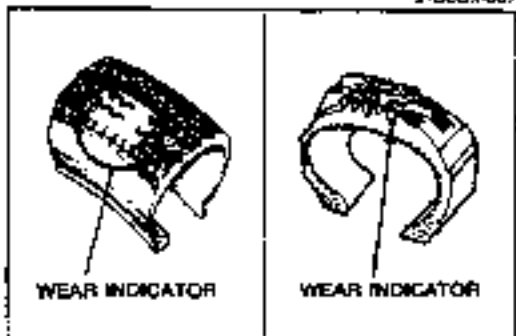
1. Measure the depth of tread.

## Remaining tread limit

Ordinary tires: 1.6mm (0.063 in)

Snow tires: 50% of tread

(Tires should be replaced if wear indicators are exposed.)



WEAR INDICATOR

WEAR INDICATOR

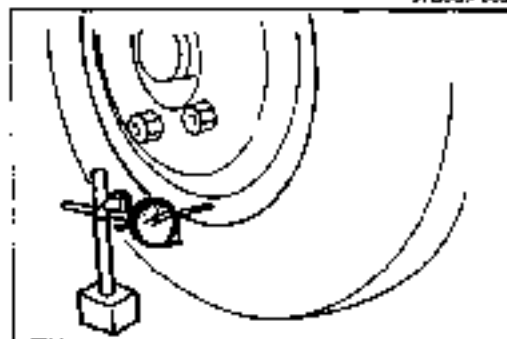
9T000X-008



9T600X-009

### Visual inspection

1. Check for cracks, damage, and foreign matter (such as metal pieces, nails, and stones) in tire and cracks, deformation, and damage to the wheel.
2. Replace the tire or wheel if necessary.

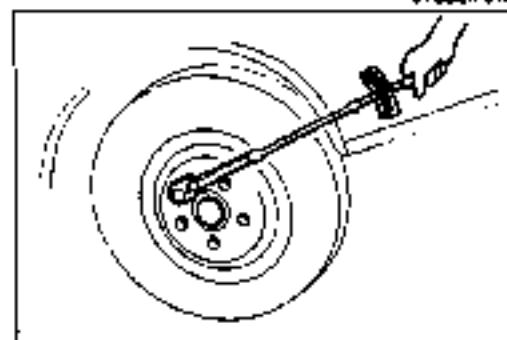


9T600X-010

### Wheel runout

1. Set the probe of a dial indicator against the wheel, and turn the wheel one full revolution.

**Wheel runout: Horizontal 3.0mm (0.120 in) max.  
Vertical 2.5mm (0.098 in) max.**



9T600X-011

### Wheel lug nut

1. Check the tightening torque.

### Tightening torque:



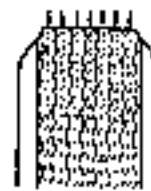

Item	Model	Single rear tire N·m (m·kg, ft·lb)	Dual rear tires N·m (m·kg, ft·lb)
Front		167-215 (17-22, 123-159)	491-735 (50-75, 362-542)
			540-784 (55-80, 398-578)
Rear		167-215 (17-22, 123-159)	491-735 (50-75, 362-542)
			540-784 (55-80, 398-578)

# Q

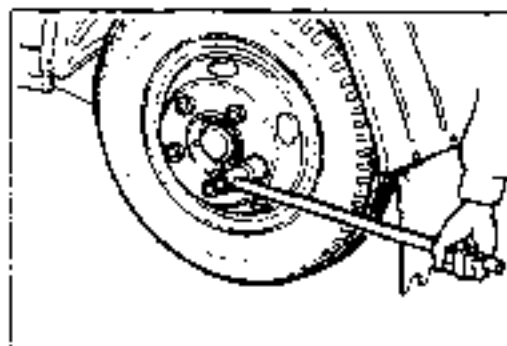
## WHEELS AND TIRES

### Abnormal tire wear

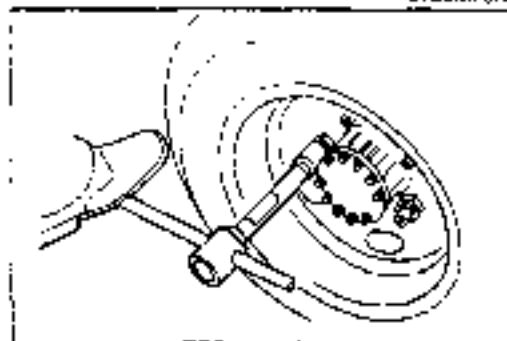
1. Refer to the chart below for the possible causes and actions.

Wear pattern	Possible cause	Action
<b>SHOULDER WEAR</b> 	Underinflation (both sides worn) Incorrect camber (one side worn)  Hard cornering Lack of rotation	Adjust tire pressure Repair or replace axle and suspension parts Reduce speed Rotate tires
<b>CENTER WEAR</b> 	Overinflation Lack of rotation	Adjust tire pressure Rotate tires
<b>FEATHERED EDGE</b> 	Incorrect toe-in	Adjust toe-in
<b>UNEVEN WEAR</b> 	Incorrect camber or caster  Malfunctioning suspension Unbalanced wheel Out-of-round brake drum or disc Lack of rotation Other mechanical conditions	Repair or replace axle and suspension parts Repair or replace Balance or replace Correct or replace Rotate tire Correct or replace

9FG00X 0-2



9T600X-013



9T600X-014

## REMOVAL / INSTALLATION

### Removal

#### Caution

- The left wheel lug nuts are left-hand threaded.

1. Loosen/Remove the lug nuts. (Single/Dual tires)
2. Loosen the inner lug nuts. (Dual tires)

#### Caution

- Block the opposite diagonal tire.

3. Jack up the vehicle and support it with safety stands.
4. Remove the tire(s).

### Installation

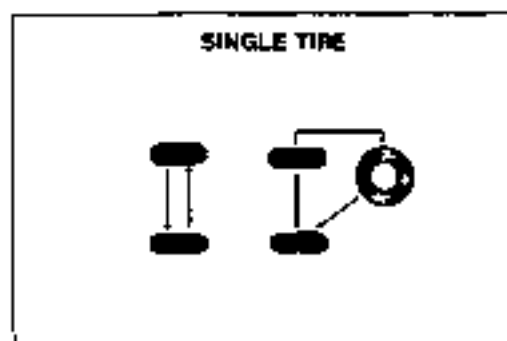
1. Clean the wheel-to-hub contact surfaces.
2. Set the wheels so that the air valves of the inner tire and outer tire are not be in the same position (Dual tires).
3. Tighten the lug nuts in two or three times steps in a criss-cross fashion. Tighten to the specified torque.

**Tightening torque: Refer to page Q-5.**

#### Caution

- Tighten the lug nuts to the specified torque again when the vehicle has run about 1,000 km (500 miles).
- Never apply oil to the nuts, bolts, or wheels; doing so might cause looseness or seizure of the lug nuts.

9T600X-008



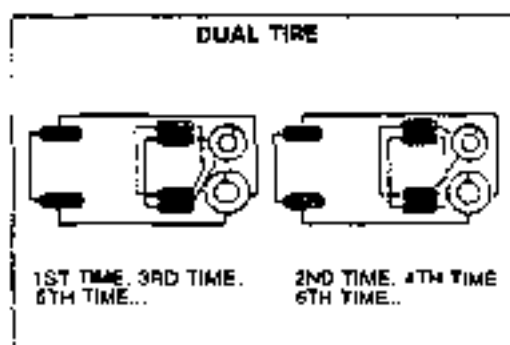
9T300X-016

### Tire Rotation

1. To prolong tire life and assure uniform tire wear, rotate the tires every 6,000 km (3,750 miles), sooner if irregular wear develops.

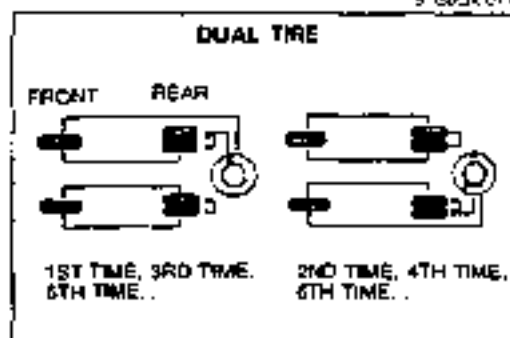
#### Caution

- After rotating the tires, adjust each tire to the specified air pressure. (Refer to page Q-2.)



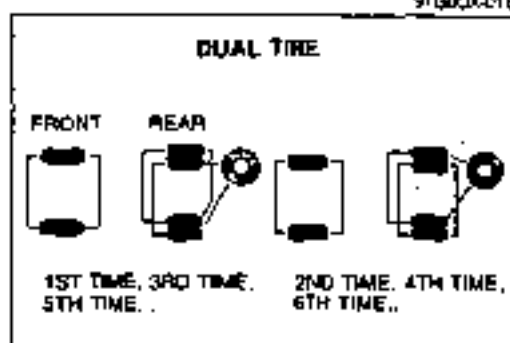
9T60QX-017

When the front wheels are different from rear wheels in size.



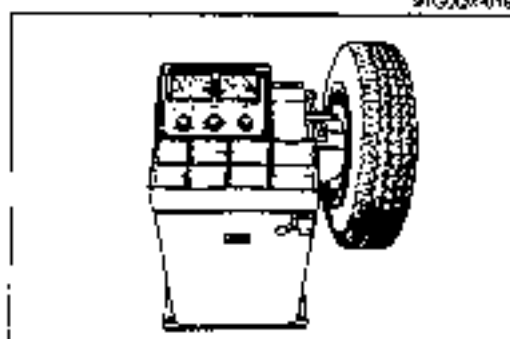
9T60QX-018

When the front and rear wheels are the same in size and number of tires.



9T60QX-019

When the front tires are different from rear tires in number of tires.



9T60QX-007

#### Wheel Balance Adjustment

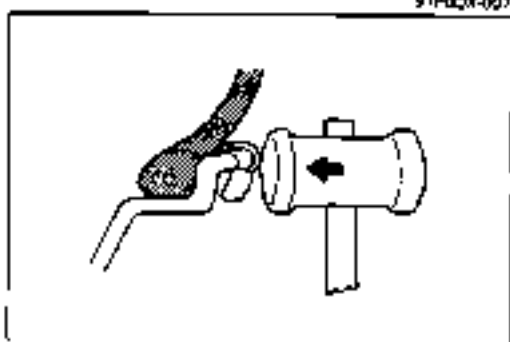
1. If a wheel becomes unbalanced or if a tire is replaced or repaired, the wheel must be rebalanced to within specification.

**Maximum unbalance (at rim edge): 30 g (1.06 oz)**

**Balance weight: 100 g (3.5 oz) max.**

#### Caution

- Do not use more than two balance weights on each side.
- Attach the balance weights tightly.

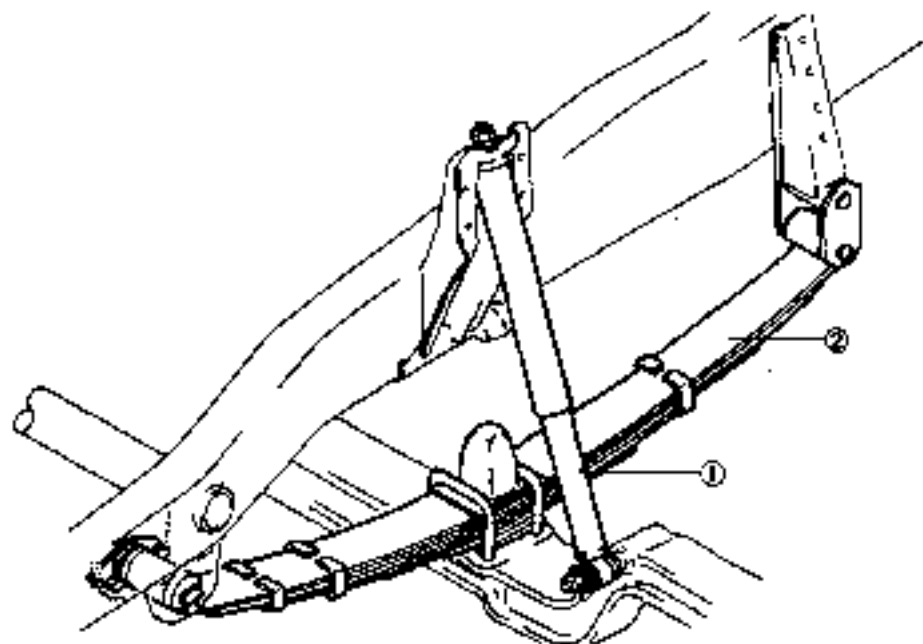


# SUSPENSION

<b>INDEX</b> .....	R- 2
<b>OUTLINE</b> .....	R- 4
OUTLINE OF CONSTRUCTION .....	R- 4
SPECIFICATIONS .....	R- 4
<b>TROUBLESHOOTING GUIDE</b> .....	R- 7
<b>WHEEL ALIGNMENT</b> .....	R- 8
PREPARATION .....	R- 8
PREINSPECTION .....	R- 8
FRONT WHEEL ALIGNMENT .....	R- 9
<b>FRONT SUSPENSION (LEAF SPRING)</b> .....	R-12
PREPARATION .....	R-12
FRONT SHOCK ABSORBER .....	R-13
FRONT LEAF SPRING .....	R-14
<b>REAR SUSPENSION (LEAF SPRING)</b> .....	R-17
PREPARATION .....	R-17
REAR SHOCK ABSORBER .....	R-18
REAR LEAF SPRING .....	R-19

## INDEX

## FRONT SUSPENSION



9TFR0X-002

## 1. Front shock absorber

Removal / Inspection /

Installation..... page R-13

Inspection..... page R-13

## 2. Front leaf spring

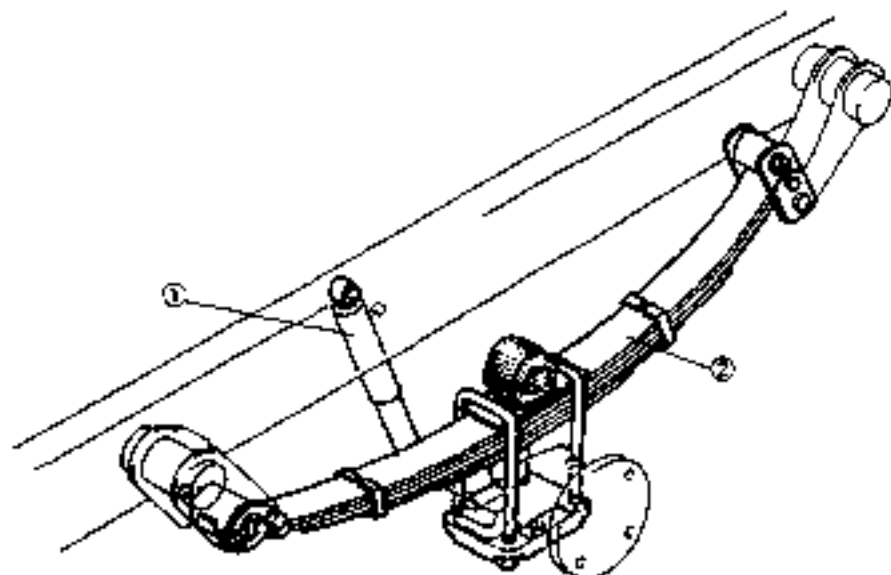
Removal / Inspection /

Installation..... page R-14

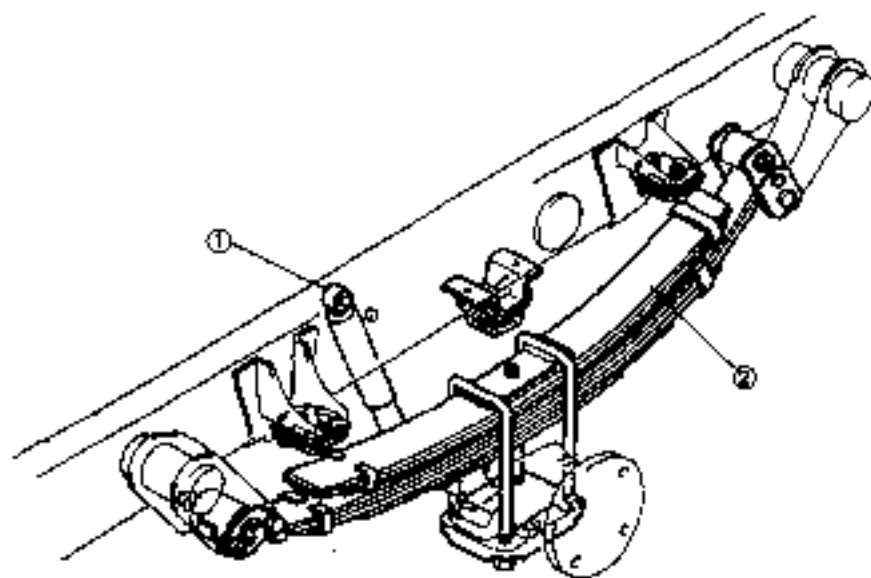


## REAR SUSPENSION

## SINGLE LEAF SPRING



## DOUBLE LEAF SPRING



1. Rear shock absorber  
 Removal / Inspection /  
 Installation..... page R-18  
 Inspection..... page R-18

2. Rear leaf spring  
 Removal / Inspection /  
 Installation..... page R-19

9TR0AX-000

## OUTLINE

## OUTLINE OF CONSTRUCTION

1 The front and rear suspension is a leaf spring suspension.

## SPECIFICATIONS

Item		Specifications
<b>Front Suspension</b>		
Suspension type		Leaf spring
Spring	Type	Semielliptic leaf spring
	Dimension	See next page
Shock absorber type		Cylindrical double-acting
<b>Rear Suspension</b>		
Suspension type		Leaf spring
Spring	Type	Semielliptic leaf spring
	Dimension	See next page
Shock absorber type		Cylindrical double-acting

JTFPRX-004

Wheel Alignment (<sup>-1</sup>Unladen condition)

Item	Body		Truck	Truck and Crew cab
	Cargo deck	Cabin type	10 feet	14, 17 feet
			Standard cabin	Wide cabin
<b>Front wheel alignment</b>				
Total toe-in	mm (in)		0-3 (0-0.12)	-
	degree		0°-0.3°	-
Camber			0°40' ± 30'	-
Caster			2°30' ± 20'	-
King-pin angle			7°00'	-
Maximum steering angle	Inner		38° ± 2°	42° ± 2°
	Outer		29° ± 2°	31° ± 2°
<b>Rear wheel alignment</b>				
Total toe-in	mm (in)		0 (0)	-
	degree		0°00'	-
Camber			0°00'	-

JTFPRX-006

<sup>-1</sup> Fuel tank full; radiator coolant and engine oil at specified level, and spare tire, jack and tools in designated position.

Leaf Spring Dimensions (Refer to page R-6 for Spring Applications)

Front leaf spring

Front spring dimensions Length x Width x Thickness mm (in)		Front spring dimensions Length x Width x Thickness mm (in)			
A	1,367 x 70 x 7	(53.8 x 2.8 x 0.28)	C	1,367 x 70 x 7	(53.8 x 2.8 x 0.28)
	1,145 x 70 x 7	(45.1 x 2.8 x 0.28)		1,145 x 70 x 8	(45.1 x 2.8 x 0.31)
	960 x 70 x 6	(33.9 x 2.8 x 0.31)		1,090 x 70 x 8	(42.9 x 2.8 x 0.31)
	690 x 70 x 8	(27.2 x 2.8 x 0.31)		784 x 70 x 8	(30.9 x 2.8 x 0.31)
	520 x 70 x 8	(20.5 x 2.8 x 0.31)		584 x 70 x 8	(23.0 x 2.8 x 0.31)
	340 x 70 x 8	(13.4 x 2.8 x 0.31)		384 x 70 x 8	(15.1 x 2.8 x 0.31)
200 x 70 x 7	(7.9 x 2.8 x 0.28)	208 x 70 x 6	(8.2 x 2.8 x 0.31)		
B	1,367 x 70 x 7	(53.8 x 2.8 x 0.28)	D	1,374 x 70 x 8	(54.1 x 2.8 x 0.31)
	1,156 x 70 x 8	(45.5 x 2.8 x 0.31)		1,150 x 70 x 8	(45.3 x 2.8 x 0.31)
	784 x 70 x 8	(30.9 x 2.8 x 0.31)		618 x 70 x 8	(24.3 x 2.8 x 0.31)
	584 x 70 x 8	(23.0 x 2.8 x 0.31)		666 x 70 x 8	(26.3 x 2.8 x 0.31)
	384 x 70 x 8	(15.1 x 2.8 x 0.31)		516 x 70 x 8	(20.4 x 2.8 x 0.31)
	208 x 70 x 8	(8.2 x 2.8 x 0.31)		368 x 70 x 8	(14.5 x 2.8 x 0.31)
				260 x 70 x 7	(10.2 x 2.8 x 0.28)
				180 x 70 x 7	(7.1 x 2.8 x 0.28)

97FORX-006

Rear leaf spring

Rear spring dimensions: Length x Width x Thickness mm (in)				
Main		Auxiliary		
E	1,496 x 70 x 9	(59.0 x 2.8 x 0.35)		
	1,246 x 70 x 9	(49.1 x 2.8 x 0.35)		
	970 x 70 x 9	(38.2 x 2.8 x 0.35)		
	830 x 70 x 10	(32.7 x 2.8 x 0.39)		
	700 x 70 x 10	(27.6 x 2.8 x 0.39)		
	570 x 70 x 11	(22.4 x 2.8 x 0.43)		
	410 x 70 x 11	(16.1 x 2.8 x 0.43)		
260 x 70 x 11	(10.2 x 2.8 x 0.43)			
F	1,506 x 70 x 10	(59.3 x 2.8 x 0.39)		
	1,248 x 70 x 10	(49.1 x 2.8 x 0.39)	960 x 70 x 12	(37.4 x 2.8 x 0.47)
	880 x 70 x 10	(34.6 x 2.8 x 0.39)	900 x 70 x 12	(35.4 x 2.8 x 0.47)
	660 x 70 x 11	(26.0 x 2.8 x 0.43)	900 x 70 x 12	(35.4 x 2.8 x 0.47)
380 x 70 x 11	(15.0 x 2.8 x 0.43)	850 x 70 x 13	(33.5 x 2.8 x 0.51)	
G	1,506 x 70 x 10	(59.3 x 2.8 x 0.39)		
	1,253 x 70 x 10	(49.3 x 2.8 x 0.39)	960 x 70 x 12	(37.4 x 2.8 x 0.47)
	880 x 70 x 10	(34.6 x 2.8 x 0.39)	900 x 70 x 12	(35.4 x 2.8 x 0.47)
	660 x 70 x 11	(26.0 x 2.8 x 0.43)	850 x 70 x 13	(33.5 x 2.8 x 0.51)
380 x 70 x 11	(15.0 x 2.8 x 0.43)			
H	1,506 x 70 x 10	(59.3 x 2.8 x 0.39)		
	1,253 x 70 x 10	(49.3 x 2.8 x 0.39)	960 x 70 x 12	(37.4 x 2.8 x 0.47)
	880 x 70 x 10	(34.6 x 2.8 x 0.39)	900 x 70 x 12	(35.4 x 2.8 x 0.47)
	660 x 70 x 11	(26.0 x 2.8 x 0.43)	900 x 70 x 12	(35.4 x 2.8 x 0.47)
380 x 70 x 11	(15.0 x 2.8 x 0.43)	850 x 70 x 13	(33.5 x 2.8 x 0.51)	
I	1,506 x 70 x 10	(59.3 x 2.8 x 0.39)		
	1,248 x 70 x 10	(49.1 x 2.8 x 0.39)	960 x 70 x 13	(37.4 x 2.8 x 0.51)
	940 x 70 x 10	(37.0 x 2.8 x 0.39)	900 x 70 x 13	(35.4 x 2.8 x 0.51)
	760 x 70 x 11	(30.0 x 2.8 x 0.43)	900 x 70 x 13	(35.4 x 2.8 x 0.51)
	520 x 70 x 11	(20.5 x 2.8 x 0.43)	850 x 70 x 13	(33.5 x 2.8 x 0.51)
300 x 70 x 11	(11.8 x 2.8 x 0.43)			

97FORX-007

## Leaf Spring Applications

Engine	Body	Cabin	Cargo deck length (feet)	Cargo deck height/ Rear tire	Payload (ton)	Front	Rear
HA	Truck	Sid	10	High/Single	1.5	A	E
SL		Crew cab			Wide	14	2.0
	3.0		C	F			
SL TURBO	Truck	Wide	17	High/Double	4.0	D	I
						D	I
TF	Crew cab	Wide	14	High/Double	3.5	D	I
	Truck					17	4.0

9TPOB-000

## TROUBLESHOOTING GUIDE

Problem	Possible cause	Action	Page
Body "rolls"	Malfunction of shock absorber	Replace	R-13, 18
Poor riding comfort	Malfunction of shock absorber Weak leaf spring	Replace Replace	R-13, 18 R-14, 19
Body leans	Malfunction of shock absorber Weak leaf spring	Replace Replace	R-13, 18 R-14, 19
Abnormal noise from suspension system	Looseness of peripheral connections Malfunction of shock absorber	Tighten Replace	— R-13, 18
General instability	Malfunction of shock absorber Improperly adjusted wheel alignment Steering system related problem Wheel and tire related problem	Replace Adjust — —	R-13, 18 R- 8 Section N Section Q
Steering feel heavy	Improperly adjusted wheel alignment Steering system related problem Wheel and tire related problem	Adjust — —	R- 8 Section N Section Q
Steering wheel pulls to one side	Weak leaf spring Improperly adjusted wheel alignment Steering system related problem Brake system related problem Wheel and tire related problem	Replace Adjust — — —	R-14, 19 R- 8 Section N Section P Section Q
"Shimmy" occurs (Steering wheel vibrates left/right)	Malfunction of shock absorber Loose shock absorber fastener Improperly adjusted wheel alignment Malfunction of wheel bearing Steering system related problem Wheel and tire related problem	Replace Tighten Adjust Replace — —	R-13, 18 R-13, 18 R- 8 Section M Section N Section Q
Poor steering wheel return	Improperly adjusted wheel alignment Steering system related problem Wheel and tire related problem	Adjust — —	R- 8 Section N Section Q

9TFR01-009

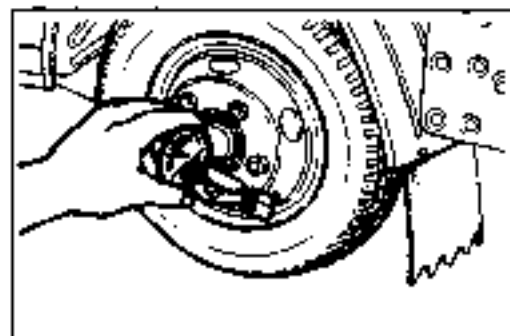
## WHEEL ALIGNMENT

## PREPARATION

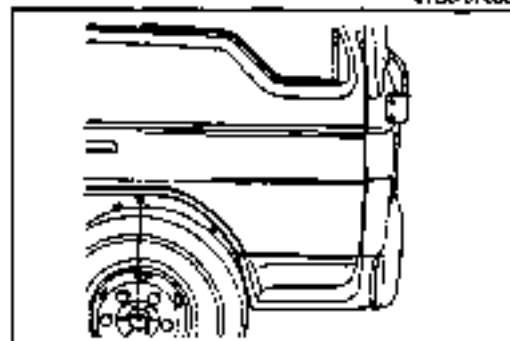
## SST

<p>49 0559 603A</p> <p>Adapter, caster/ camber gauge</p> 	<p>For adjustment of wheel alignment</p>
--	--

BTGPRX-010



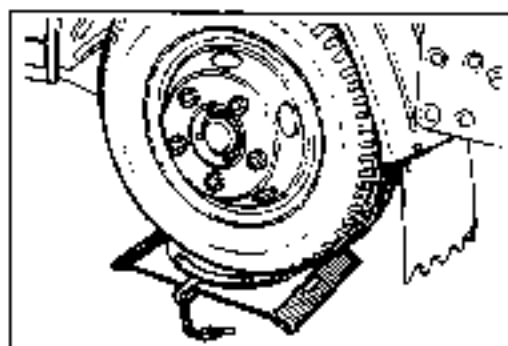
BTGPRX-008



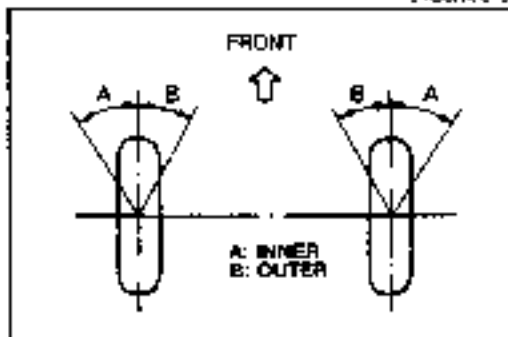
BTGPRX-009

## PREINSPECTION

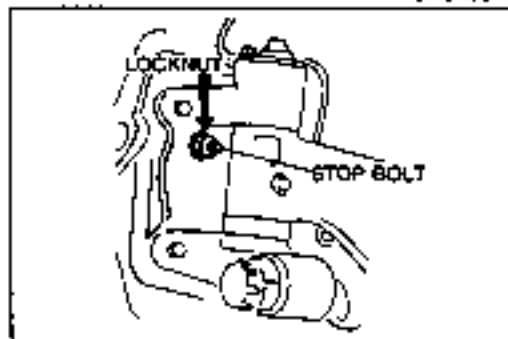
1. Locate the vehicle on level ground in an unloaded condition and set the wheels straight-ahead.
  2. Check the tire inflation and bring to recommended pressure.
  3. Inspect the front wheel bearing play and correct it if necessary.
  4. Inspect the wheel and tire runout.
  5. Shake the vehicle and check the operation of the shock absorber.
- 
6. Verify that the difference between the left and right sides of the vehicle (from the fender brim to the center of the wheel) is less than 15mm (0.59 in).



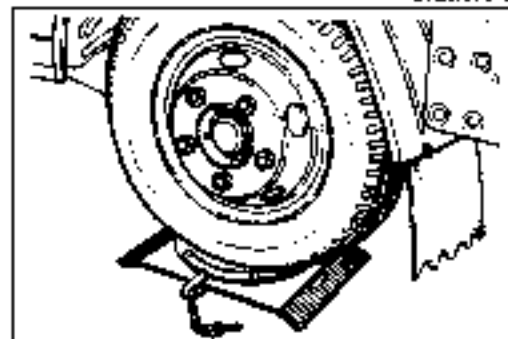
9TGORX-010



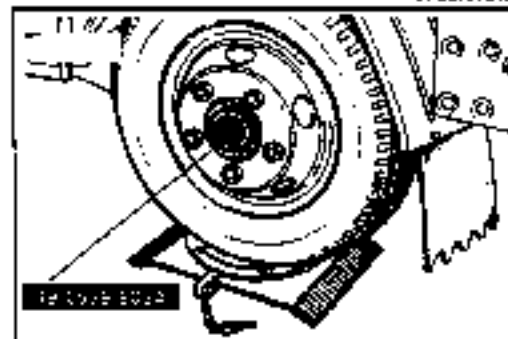
9TGORX-011



9TGORX-012



9TGORX-013



9TGORX-014

## FRONT WHEEL ALIGNMENT

### Steering Angle

#### Inspection

1. Lock the turning-radius gauge at 0° position.
2. Place the front wheels on the turning-radius gauge at the center, then unlock the gauge.

#### Note

- When using a portable turning-radius gauge, place a suitable stands under the rear wheels to keep the vehicle level.

3. Check the steering angle.

### Standard steering angle:

	10 feet cargo deck	14 and 17 feet cargo deck
	Standard cabin	Wide cabin
Inner	38° ± 2°	42° ± 2°
Outer	29° ± 2°	31° ± 2°

### Adjustment

1. Loosen the steering stop bolt locknut.
2. Turn the stop bolt and adjust the steering angle.
3. Tighten the stop bolt locknut to the specified torque.

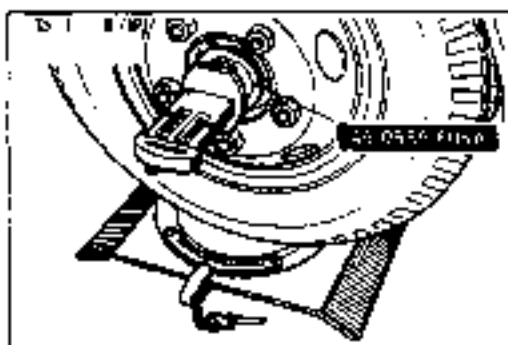
#### Tightening torque:

59–66 N·m (6–9 m·kg, 43–65 ft·lb)

### Camber/Caster/King-pin Angle

#### Inspection

1. Place the front wheels on the turning-radius gauge.
2. Remove the wheel cap.
3. Attach the SST to the wheel hub.



9TFR0X-013

- Attach the caster/camber gauge to the **SST** and measure the camber, caster, and king-pin angle.

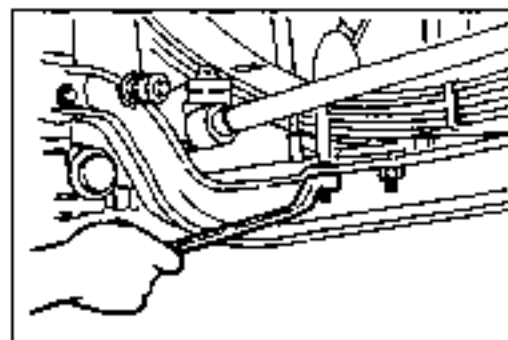
**Standard angle**Camber angle :  $0^{\circ}40' \pm 30'$ Caster angle :  $2^{\circ}30' \pm 20'$ King-pin angle:  $7^{\circ}00'$ **Adjustment (Caster)****Caution**

- Adjustment of the camber and king-pin angles are not possible. Check the king-pin and front axle component parts and repair or replace them if necessary.

- Jack up the front axle and support the front frame with safety stands.

**Warning**

- Support the front axle with the jack.



9TFR0X-014

- Remove the leaf spring U-bolts.

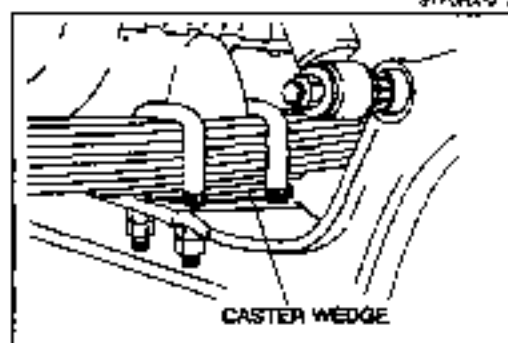
9TFR0X-014

- Lower the front axle and replace the caster wedge.

Caster wedge	
Part No.	Change of Angle
W023 34 142A	$0^{\circ}20'$
W023 34 143A	$0^{\circ}50'$
W023 34 144A	$1^{\circ}20'$
W023 34 145A	$1^{\circ}50'$
W023 34 146A	$2^{\circ}20'$
W023 34 147A	$2^{\circ}50'$

**Caution**

- When installing the caster wedge, face the thicker end toward the rear.
- Use only one caster wedge can be installed on one side.

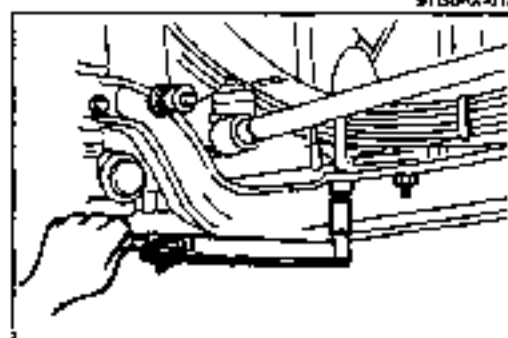


9TBDRX-018

- Install the U bolt.
- Lower the vehicle and tighten the U-bolt to the specified torque.

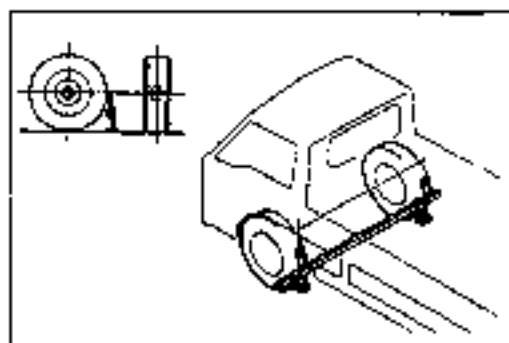
**Tightening torque:**

118—147 N·m (12—15 m·kg, 87—108 ft·lb)

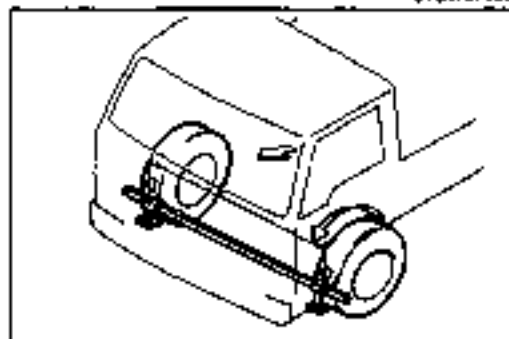


9TFR0X-016

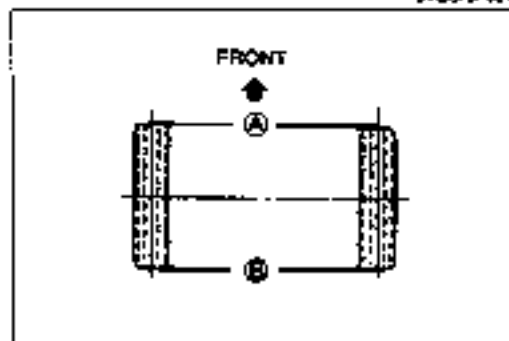




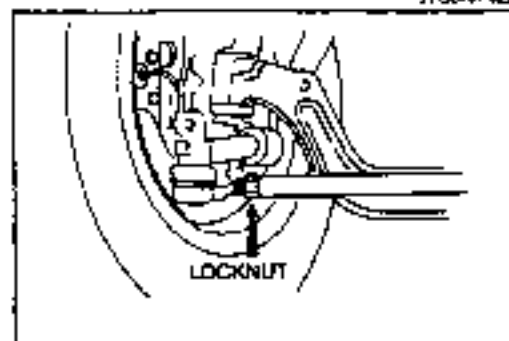
9TGF0X-C20



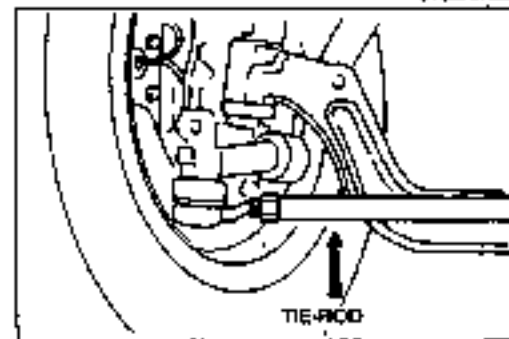
9TGF0X-C21



9TGF0X-C22



9TGF0X-C23



9TGF0X-C24

### Total Toe-in Inspection

1. Shake the vehicle to stabilize the vehicle height.
2. Place a toe-in gauge at the rear of the front tires and align the height of the gauge with the center of the front wheels.
3. Mark the tires in the center of the tire tread at the rear of the wheels.
4. Measure the distance between marks (B).
5. Push the vehicle forward to turn the front wheels 180°.

6. Measure the distance between the marks now toward the front of the vehicle (A).

7. If the difference between B and A is not as specified, adjust the toe-in.

**Total toe-in: 3 ± 3mm (0.12 ± 0.12 in)**

### Adjustment

1. Loosen the tie-rod locknuts.

#### Note

- The right tie-rod locknut is left-hand threaded.

2. Turn the left and right tie-rods equally to adjust the toe-in.

#### Note

- To increase the toe-in, turn both tie-rods toward the rear.
- One turn of both tie-rods changes the toe-in about 3mm (0.12 in).

3. Tighten the tie-rod locknuts to the specified torque.

#### Tightening torque:

**88–116 Nm (9–12 m·kg, 65–87 ft·lb)**







# R

## FRONT SUSPENSION (LEAF SPRING)

### FRONT SUSPENSION (LEAF SPRING)

#### PREPARATION

#### SST

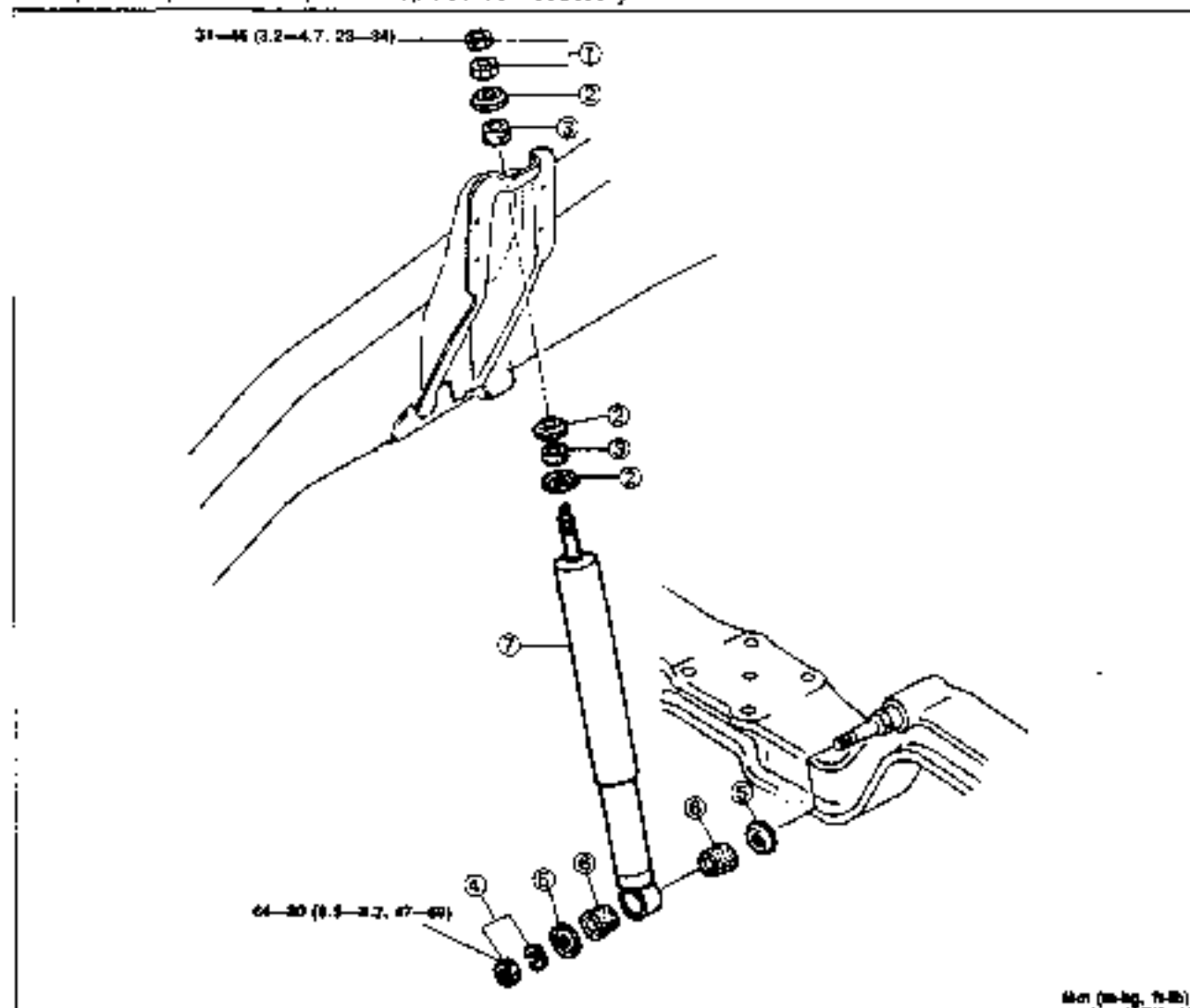
<p>49 W038 040</p> <p>Installer set, shackle pin bushing</p> 	<p>For removal and installation of shackle pin bushing</p>	<p>49 W038 001</p> <p>Shaft (Part of 49 W038 040)</p> 	<p>For removal and installation of shackle pin bushing</p>
<p>49 W038 002</p> <p>Nut (Part of 49 W038 040)</p> 	<p>For removal and installation of shackle pin bushing</p>	<p>49 W038 003</p> <p>Support block (Part of 49 W038 040)</p> 	<p>For removal and installation of shackle pin bushing</p>
<p>49 W038 004</p> <p>Attachment (Part of 49 W038 040)</p> 	<p>For removal and installation of shackle pin bushing</p>	<p>49 W038 005</p> <p>Bearing (Part of 49 W038 040)</p> 	<p>For removal and installation of shackle pin bushing</p>

5TFC00X-017

## FRONT SHOCK ABSORBER

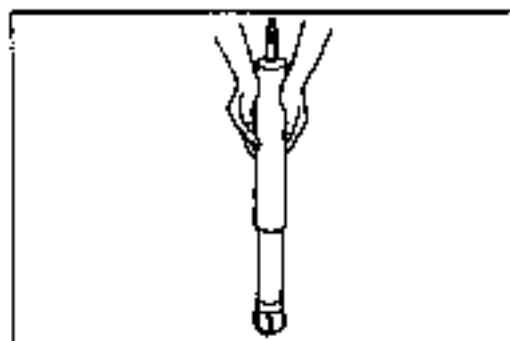
### Removal / Inspection / Installation

1. Remove in the order shown in the figure.
2. Install in the reverse order of removal.
3. Inspect all parts and repair or replace as necessary.



1. Nut
2. Retainer
3. Bushing  
Inspect for damage and deterioration
4. Nut and washer

5. Retainer
6. Bushing  
Inspect for damage and deterioration
7. Shock absorber  
Inspection..... below



9T30RX-028

### Inspection

#### Shock absorber

Check for the following and replace as necessary.

- (1) Oil leakage from shock absorbers
- (2) Poor operation of shock absorbers
  - ① Depress the shock absorbers several times to check for no binding or noise.

# R

## FRONT SUSPENSION (LEAF SPRING)

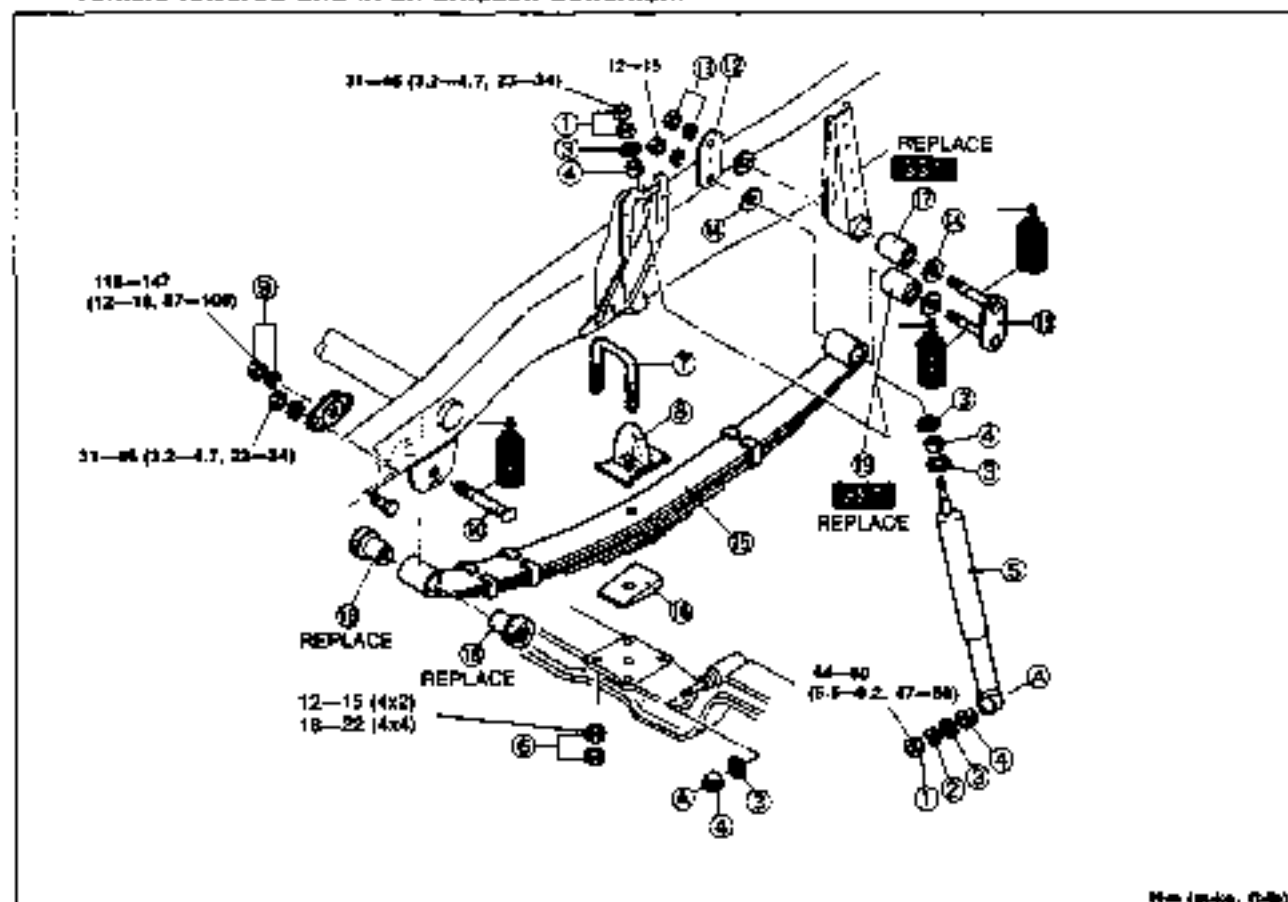
### FRONT LEAF SPRING

#### Removal / Inspection / Installation

1. Jack up the front of the vehicle and support it with safety stands.
2. Remove the front wheels.
3. Remove in the order shown in the figure, referring to **Removal Note**.
4. Install in the reverse order of removal, referring to **Installation Note**.
5. Inspect all parts and repair or replace as necessary.
6. After installation, check the front wheel alignment. (Refer to page R-8.)

#### Caution

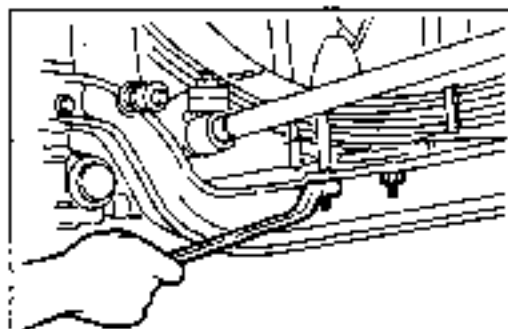
- Tighten the mounting nuts of the shackle pin and spring pin to the specified torque with the vehicle lowered and in an unladen condition.



R- (R-14, R-15)

97FORX-018

- |                                      |                                   |
|--------------------------------------|-----------------------------------|
| 1. Nut                               | 13. Shackle pin                   |
| 2. Washer                            | Removal note ..... page R-15      |
| 3. Retainer                          | 14. Thrust washer                 |
| 4. Bushing                           | 15. Leaf spring assembly          |
| Inspect for damage and deterioration | Inspect for weakness of spring    |
| 5. Shock absorber                    | 16. Caster wedge                  |
| 6. Nut                               | Installation note ..... page R-16 |
| 7. U-bolt                            | 17. Shackle pin bushing           |
| Removal note ..... page R-15         | Removal note ..... page R-15      |
| 8. Bound stop                        | Installation note ..... page R-16 |
| Inspect for damage and deterioration | 18. Spring bushing (Front)        |
| 9. Nut and washer                    | Removal note ..... page R-15      |
| 10. Spring pin                       | Installation note ..... page R-16 |
| Removal note ..... page R-15         | 19. Spring bushing (Rear)         |
| 11. Nut and washer                   | Removal note ..... page R-15      |
| 12. Shackle plate                    | Installation note ..... page R-16 |

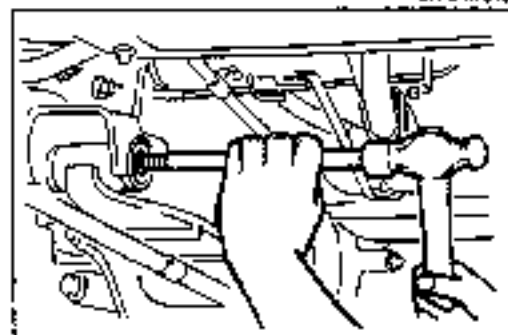


9TF39Z-019

### Removal note

#### U-bolt

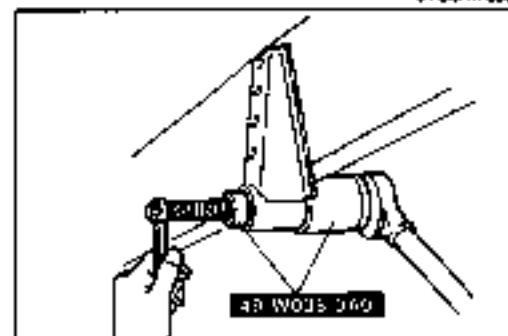
1. Jack up the front axle.
2. Remove the U-bolt mounting nuts.
3. Remove the U-bolt and the bound stop.
4. Lower the front axle.



9T30RX-022

### Spring pin and shackle pin

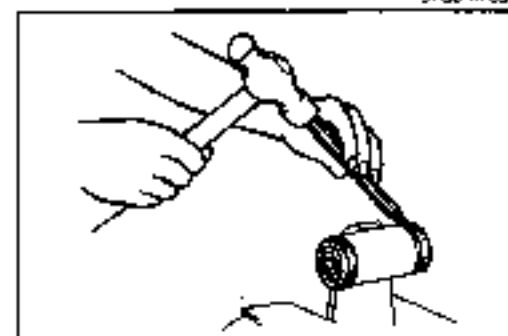
1. Remove the spring pin and shackle pin with a brass bar.



9T60RX-033

### Shackle pin bushing

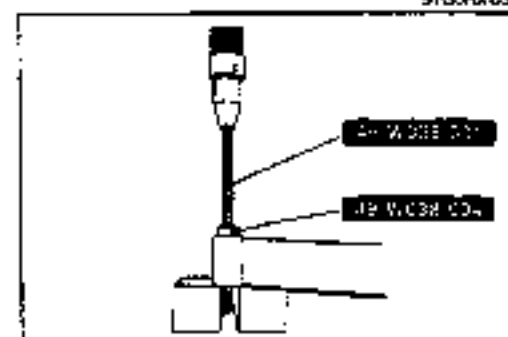
1. Remove the shackle pin bushing from the frame with the SST.



9T30RX-034

### Spring bushings (Front side)

1. Remove one side of the bushing with a chisel.
2. Remove the remaining bushing with a suitable pipe.

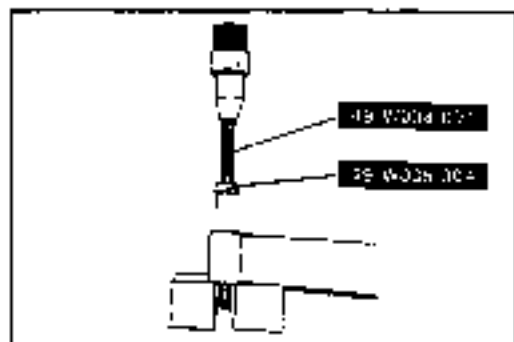


9T60RX-035

### Spring bushing (Rear side)

1. Remove the bushing with the SST and a press.

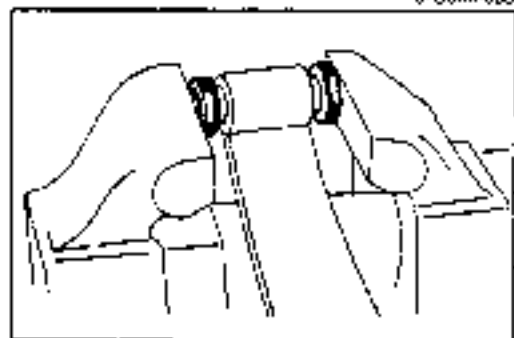
## FRONT SUSPENSION (LEAF SPRING)



87G0RX-026

**Installation note****Spring bushing (Rear side)**

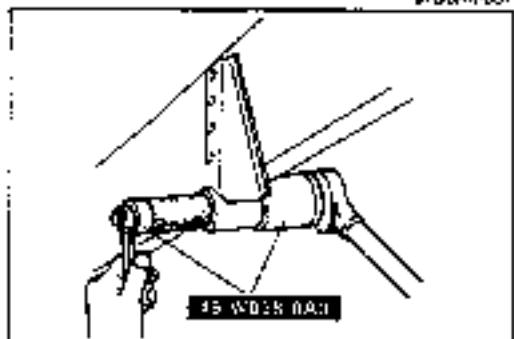
1. Install the bushing with the **SST** and a press.



87G0RX-037

**Spring bushings (Front side)**

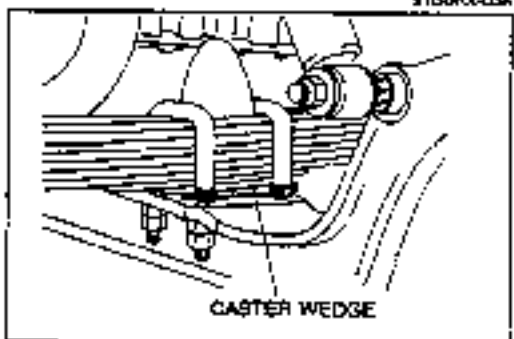
1. Install the bushings with a vise.



87G0RX-038

**Shackle pin bushing**

1. Install the new bushing into the frame with the **SST**.









87G0RX-039

**Caster wedge**

1. Install the caster wedge with the thicker side facing toward rear.

REAR SUSPENSION (LEAF SPRING)

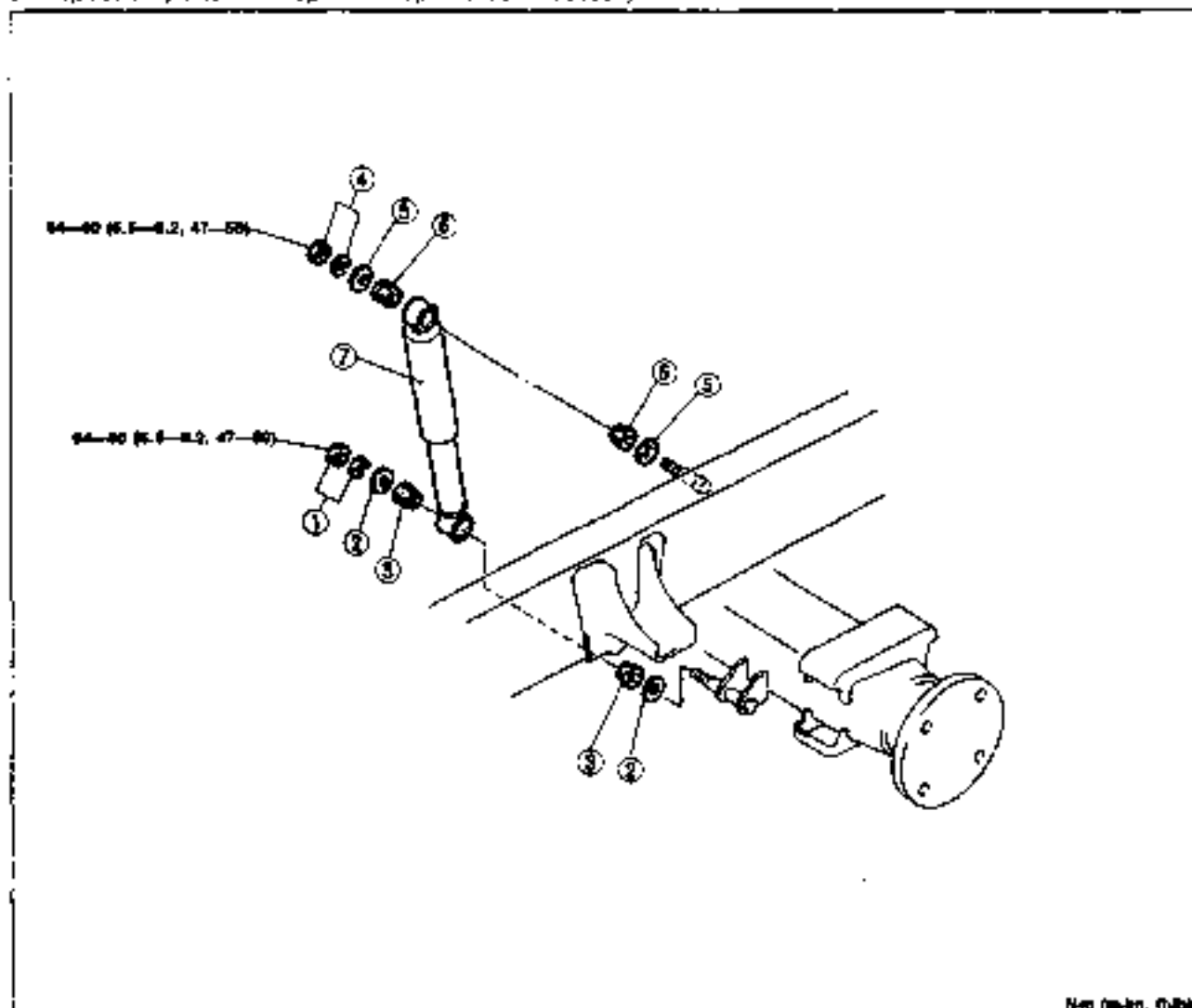
PREPARATION  
SST

<p>49 W038 0A0 Installer, shackle pin bushing</p> 	<p>For removal and installation of shackle pin bushing</p>	<p>49 W038 0C1 Shaft (Part of 49 W038 0A0)</p> 	<p>For removal and installation of shackle pin bushing</p>
<p>49 W038 002 Nut (Part of 49 W038 0A0)</p> 	<p>For removal and installation of shackle pin bushing</p>	<p>49 W038 003 Support block (Part of 49 W038 0A0)</p> 	<p>For removal and installation of shackle pin bushing</p>
<p>49 W038 004 Washers (Part of 49 W038 0A0)</p> 	<p>For removal and installation of shackle pin bushing</p>	<p>49 W038 005 Bearing (Part of 49 W038 0A0)</p> 	<p>For removal and installation of shackle pin bushing</p>

9TGDRC-056

**REAR SHOCK ABSORBER****Removal / Inspection / Installation**

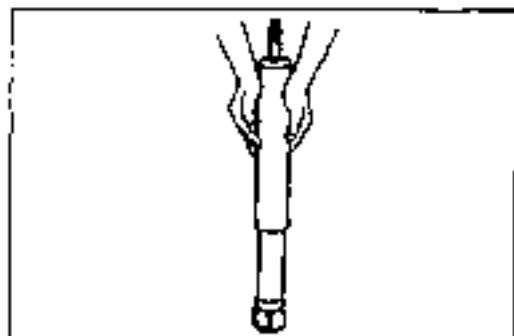
1. Remove in the order shown in the figure.
2. Install in the reverse order of removal.
3. Inspect all parts and repair or replace as necessary.



Non (bearing, tube)  
BTG0FX-067

1. Nut and washer
2. Retainer
3. Bushing  
Inspect for damage and deterioration
4. Nut and washer

5. Retainer
6. Bushing  
Inspect for damage and deterioration
7. Shock absorber  
Inspection..... below

**Inspection****Shock absorber**

Check for the following and replace parts as necessary.

- (1) Oil leakage from shock absorbers
- (2) Poor operation of the absorbers
  - ① Depress the shock absorbers several times to check for no binding or noise.



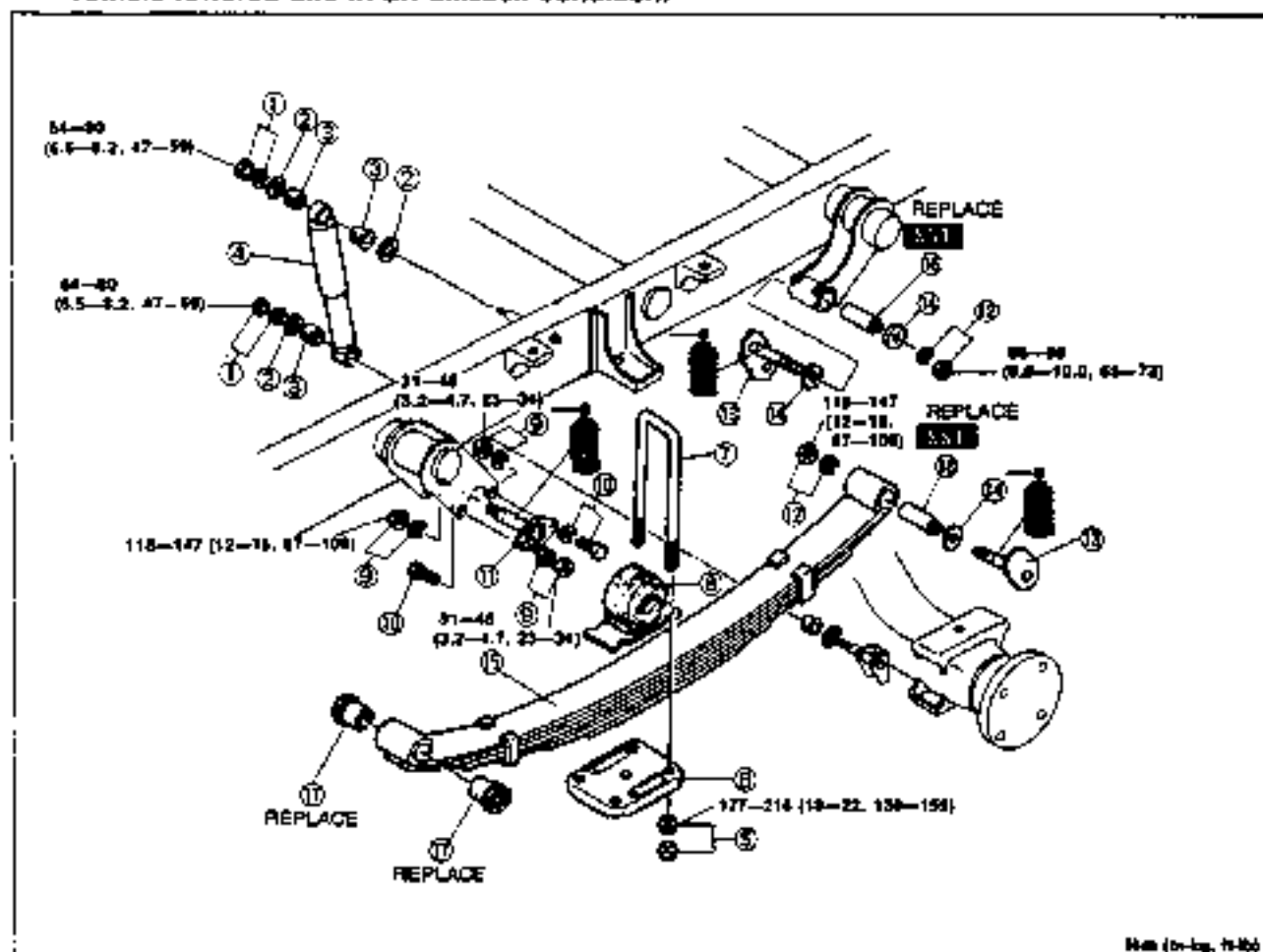
## REAR LEAF SPRING

### Removal / Inspection / Installation

1. Jack up the rear of the vehicle and support it with safety stands.
2. Remove the wheels
3. Remove in the order shown in the figure, referring to **Removal Note**.
4. Install in the reverse order of removal, referring to **Installation Note**
5. Inspect all parts and repair or replace as necessary.

### Caution

- Tighten the mounting nuts of the shackle pin and spring pin to the specified torque with the vehicle lowered and in an unladen condition.



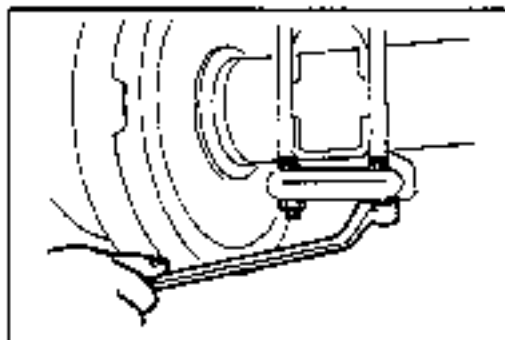
Notes (in-kg, in-lb)

WTF/OK 020

- |  |   |
|--|---|
| <ol style="list-style-type: none"> <li>1. Nut and washer</li> <li>2. Retainer</li> <li>3. Bushing<br/>Inspect for damage and deterioration</li> <li>4. Shock absorber</li> <li>5. Nut</li> <li>6. Spring clamp</li> <li>7. U-bolt<br/>Removal note ..... page R-20</li> <li>8. Bound stop<br/>Inspect for damage and deterioration</li> <li>9. Nut and washer</li> <li>10. Bolt and washer</li> <li>11. Spring pin<br/>Removal note ..... page R-20</li> </ol> | <ol style="list-style-type: none"> <li>12. Nut and washer</li> <li>13. Shackle pin<br/>Removal note ..... page R-20</li> <li>14. Thrust washer</li> <li>15. Leaf spring assembly<br/>Inspect for weakness of spring</li> <li>16. Shackle pin bushing<br/>Removal note ..... page R-20<br/>Installation note ..... page R-21</li> <li>17. Spring bushing (front)<br/>Removal note ..... page R-20<br/>Installation note ..... page R-21</li> <li>18. Spring bushing (rear)<br/>Removal note ..... page R-20<br/>Installation note ..... page R-21</li> </ol> |
|--|---|

# R

## REAR SUSPENSION (LEAF SPRING)

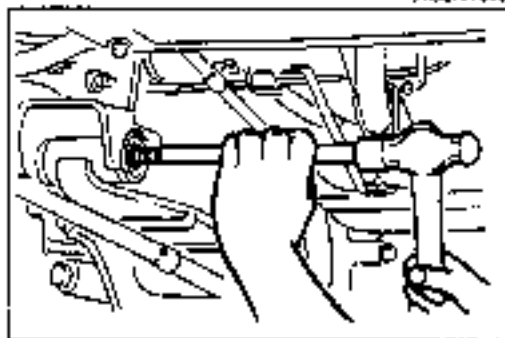


9TGA00-000

### Removal note

#### U-bolt

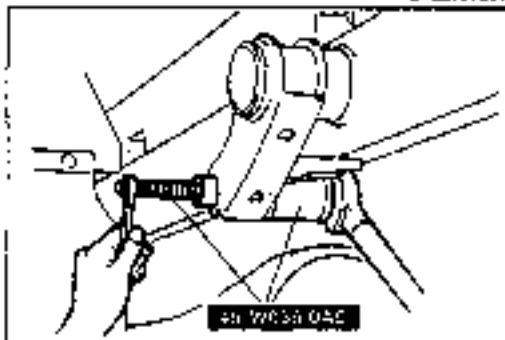
1. Jack up the rear axle.
2. Remove the U-bolt mounting nuts.
3. Remove the U-bolts and bound stops.
4. Lower the rear axle.



9TGA00-001

### Spring pin and shackle pin

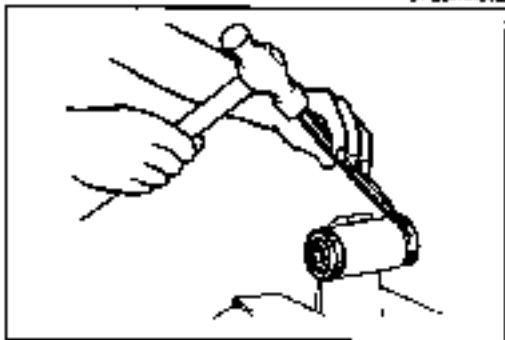
1. Remove the spring pin and shackle pin with a brass bar.



9TGA00-002

### Shackle pin bushing

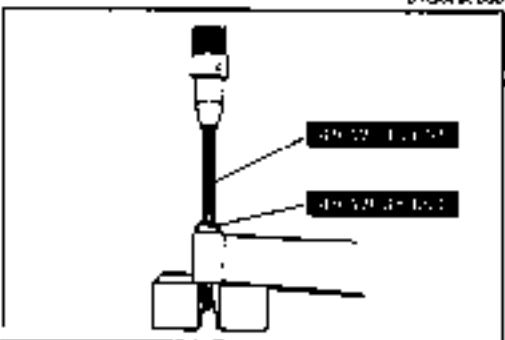
1. Remove the shackle pin bushing from the frame with the SST.



9TGA00-003

### Spring bushings (Front side)

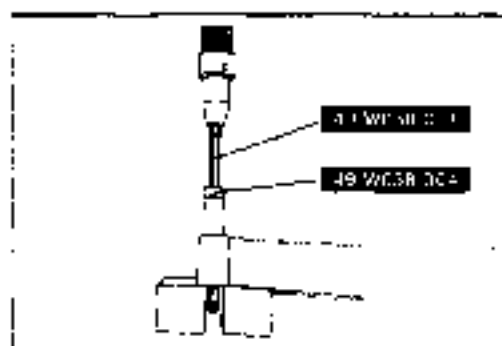
1. Remove one side of the bushing with a chisel.
2. Remove the remaining bushing with a suitable pipe.



9TGA00-004

### Spring bushing (Rear side)

1. Remove the bushing with the SST and a press

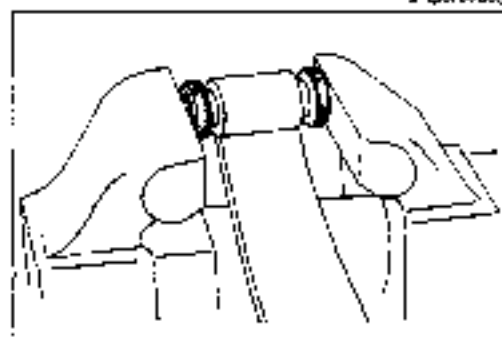


97C6R4.065

### Installation note

#### Spring bushing (Rear side)

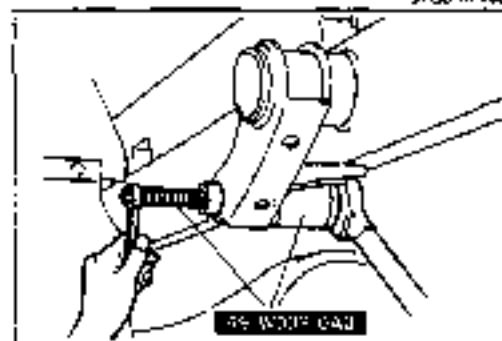
1. Install the new bushing with the **SST** and a press.



97G04x.066

#### Spring bushing (Front side)

1. Install the new rubber bushing with a vise.



97C6R4.067

#### Shackle pin bushing

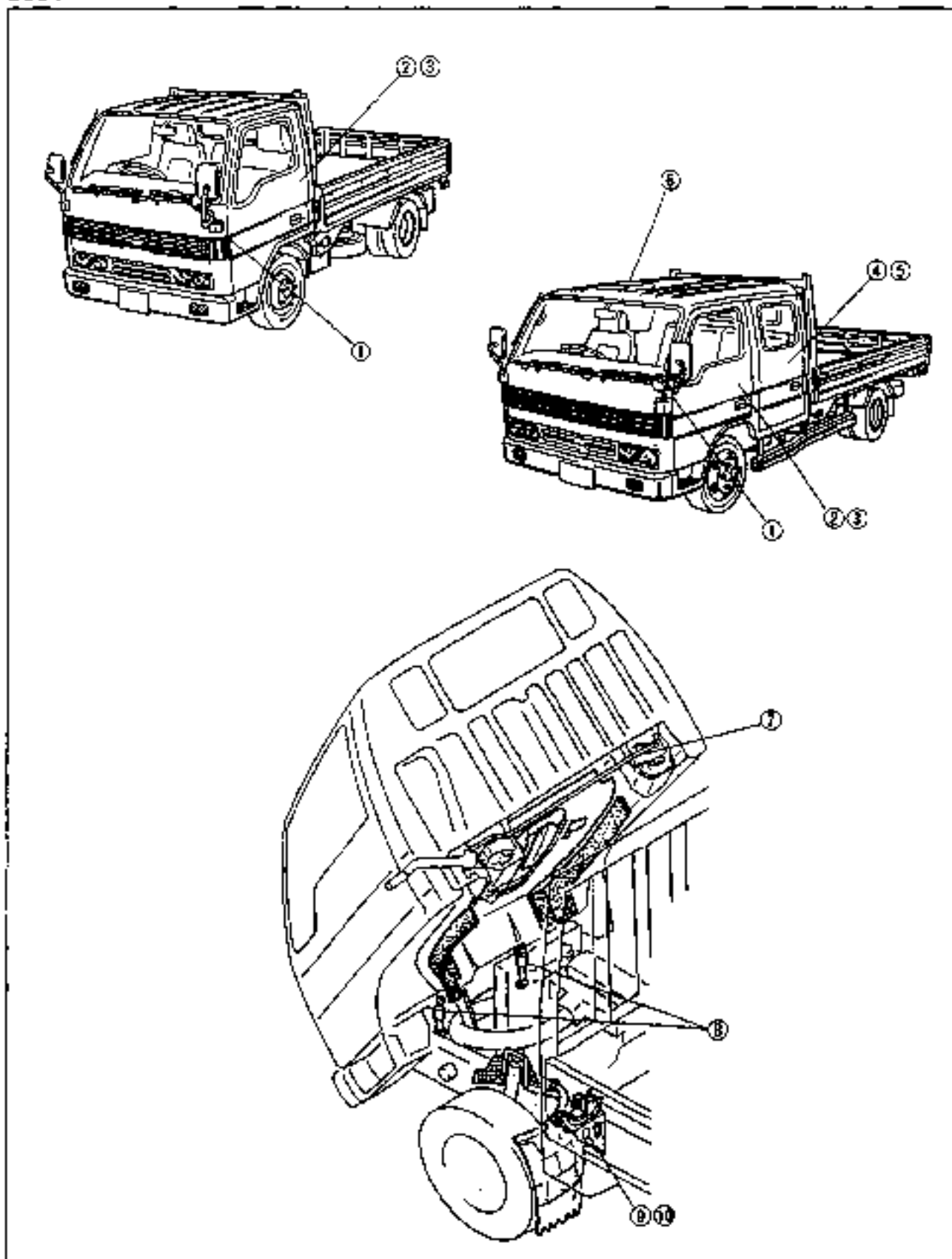
1. Install the new bushing into the frame with the **SST**.

## BODY

INDEX .....	S-2	ROOF VENTILATOR .....	S-35
FRONT FENDER PANEL .....	S-7	WINDSHIELD .....	S-36
FRONT DOOR .....	S-8	BACK WINDOW .....	S-38
FRONT WINDOW REGULATOR AND GLASS .....	S-10	TILT LOCK SYSTEM .....	S-40
FRONT DOOR LOCK AND OPENER ..	S-12	CABIN MOUNT .....	S-42
REAR DOOR .....	S-13	DAMPER .....	S-42
REAR WINDOW REGULATOR AND GLASS .....	S-15	CABIN MOUNT .....	S-42
REAR DOOR LOCK AND OPENER ....	S-17	FRONT CABIN DAMPER .....	S-42
FRONT BUMPER .....	S-18	REAR CABIN MOUNT .....	S-44
REAR BUMPER .....	S-19	CONSOLE .....	S-49
RADIATOR GRILLE/FRONT GRILLE ..	S-20	INSTRUMENT PANEL .....	S-50
STEP .....	S-21	SEAT .....	S-53
MIRROR .....	S-22	SEAT BELT .....	S-59
WINDSHIELD WIPER AND WASHER ..	S-23	CLOCK .....	S-61
STRUCTURAL VIEW .....	S-23	FLOORMAT .....	S-62
TROUBLESHOOTING GUIDE .....	S-24	HEADLINER .....	S-63
COMPONENTS .....	S-29	TRIM .....	S-68
WIPER MOTOR .....	S-33	UNDERBODY DIMENSIONS .....	S-69
WASHER MOTOR .....	S-34		
INTERMITTENT WIPER RELAY .....	S-34		
WIPER AND WASHER SWITCH .....	S-34		

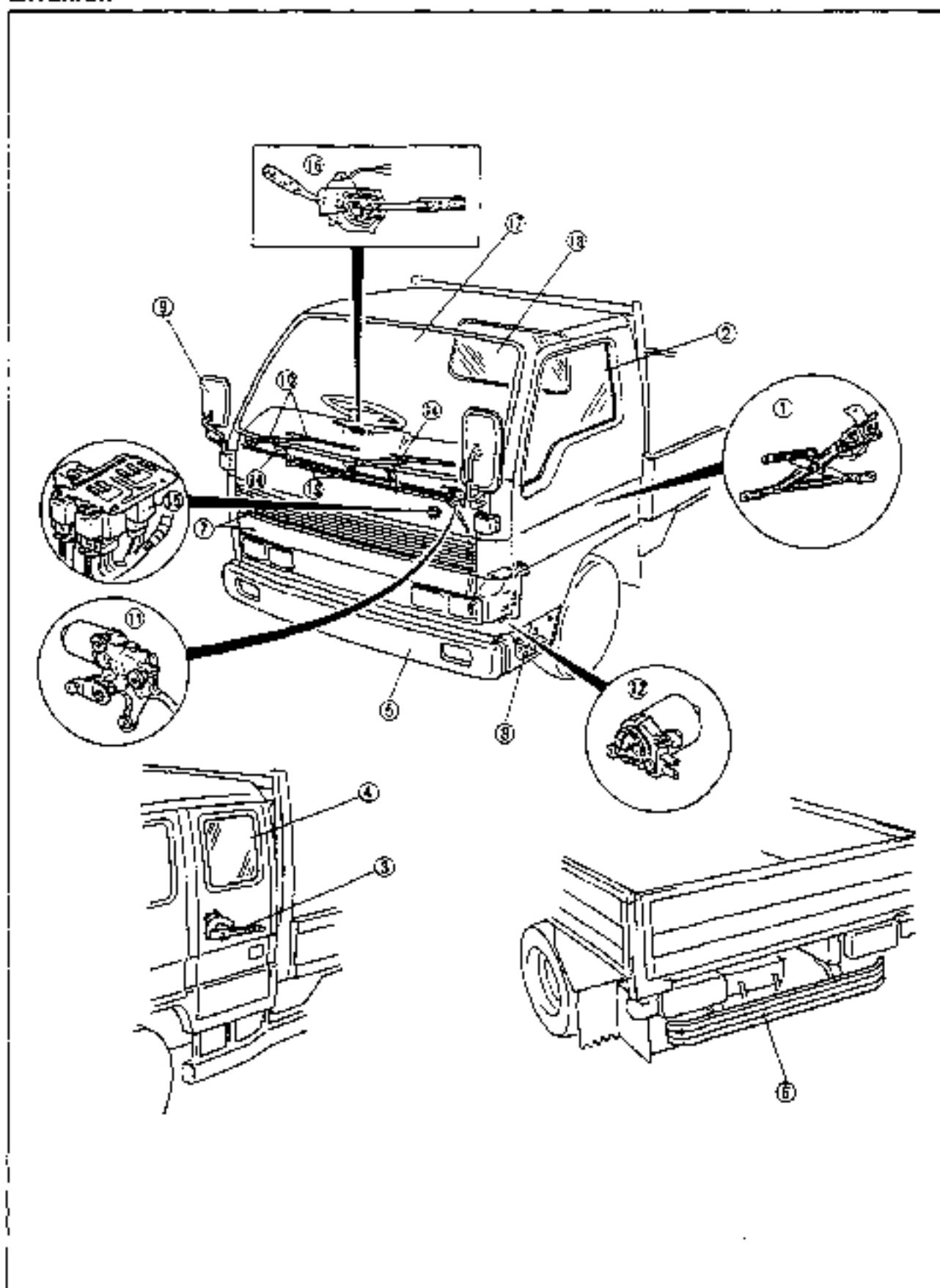
## INDEX

## BODY



1. Front fender panel			
Removal / Installation .....	page S-	7	
2. Front door			
Removal / Installation .....	page S-	8	
Adjustment.....	page S-	9	
3. Front door lock and opener			
Removal / Installation .....	page S-	12	
4. Rear door			
Removal / Installation .....	page S-	13	
Adjustment.....	page S-	14	
5. Rear door lock and opener			
Removal / Installation .....	page S-	17	
6. Roof ventilator			
Removal / Installation .....	page S-	35	
7. Tilt lock system			
Removal / Installation .....	page S-	40	
Inspection .....	page S-	41	
8. Front cabin damper			
Inspection (On-vehicle) .....	page S-	42	
Removal.....	page S-	43	
Installation.....	page S-	43	
9. Rear cabin mount (with damper)			
Inspection (On-vehicle) .....	page S-	42	
Removal.....	page S-	44	
Installation.....	page S-	46	
10. Rear cabin mount (without damper)			
Removal / Installation.....	page S-	48	

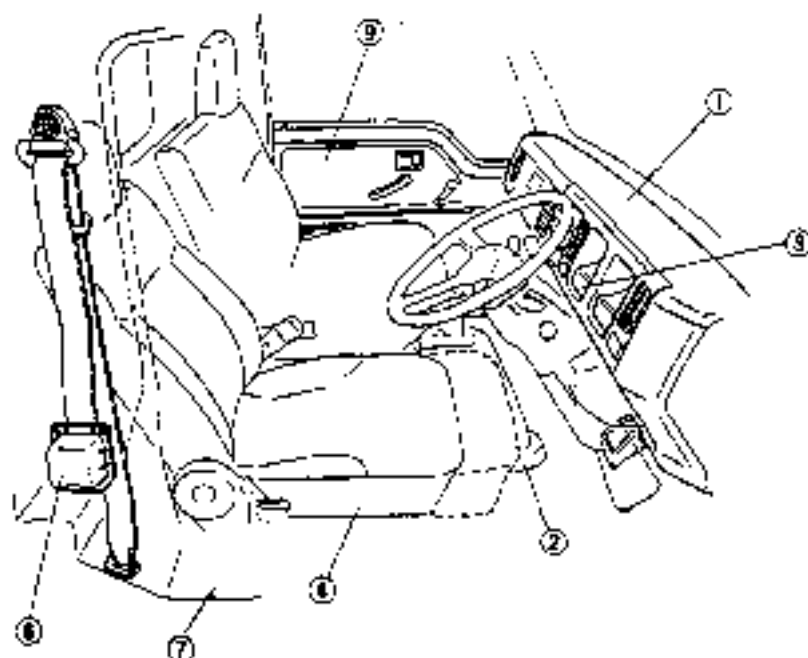
## EXTERIOR



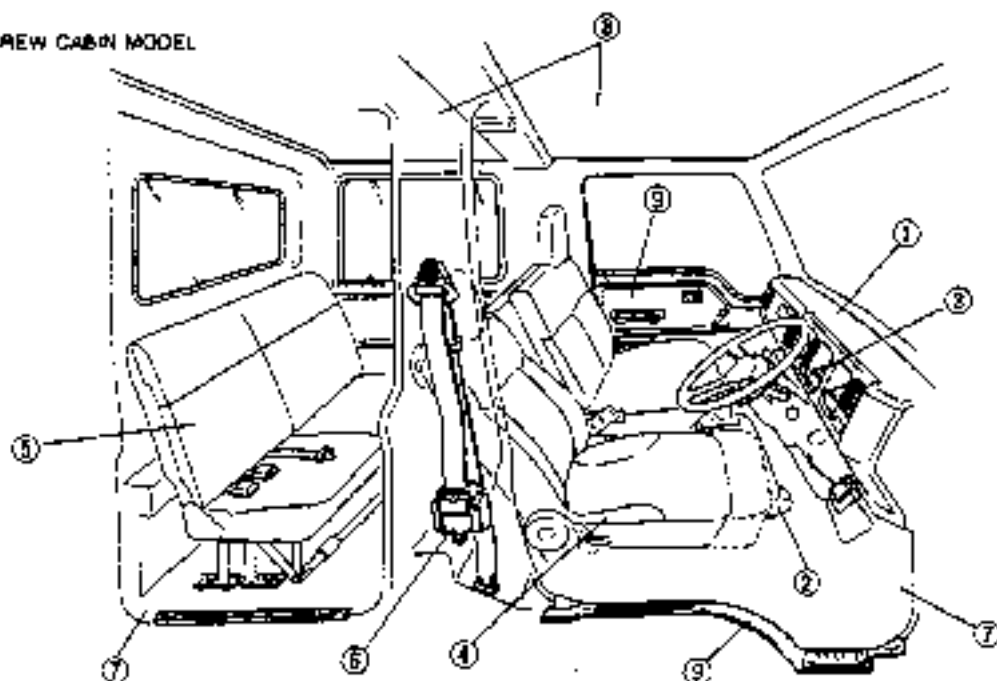
- |   |           |   |           |
|---|-----------|---|-----------|
| 1. Front window regulator<br>Removal / Installation .....         | page S-10 | 11. Wiper motor<br>Removal / Installation .....           | page S-29 |
| 2. Front window glass<br>Removal / Installation .....             | page S-10 | Disassembly / Assembly .....                              | page S-33 |
| 3. Rear window regulator<br>Removal / Installation .....          | page S-15 | Inspection .....  | page S-33 |
| 4. Rear window glass<br>Removal / Installation .....              | page S-15 | 12. Washer motor<br>Removal / Installation .....          | page S-29 |
| 5. Front bumper<br>Removal / Installation .....                   | page S-18 | Inspection .....  | page S-34 |
| 6. Rear bumper<br>Removal / Installation .....                    | page S-19 | 13. Windshield wiper link<br>Removal / Installation ..... | page S-30 |
| 7. Radiator grille / Front grille<br>Removal / Installation ..... | page S-20 | 14. Washer nozzle<br>Removal / Installation .....         | page S-31 |
| 8. Step<br>Removal / Installation .....                           | page S-21 | Adjustment .....  | page S-32 |
| 9. Mirror<br>Removal / Installation .....                         | page S-22 | 15. Intermittent wiper relay<br>Inspection .....          | page S-34 |
| 10. Wiper arm and blade<br>Removal / Installation .....           | page S-29 | 16. Wiper and washer switch<br>Inspection .....           | page S-34 |
| Adjustment .....  | page S-32 | 17. Windshield<br>Removal / Installation .....            | page S-36 |
|   |           | 18. Back window<br>Removal / Installation .....           | page S-36 |



## INTERIOR



CREW CABIN MODEL



9T0057-008

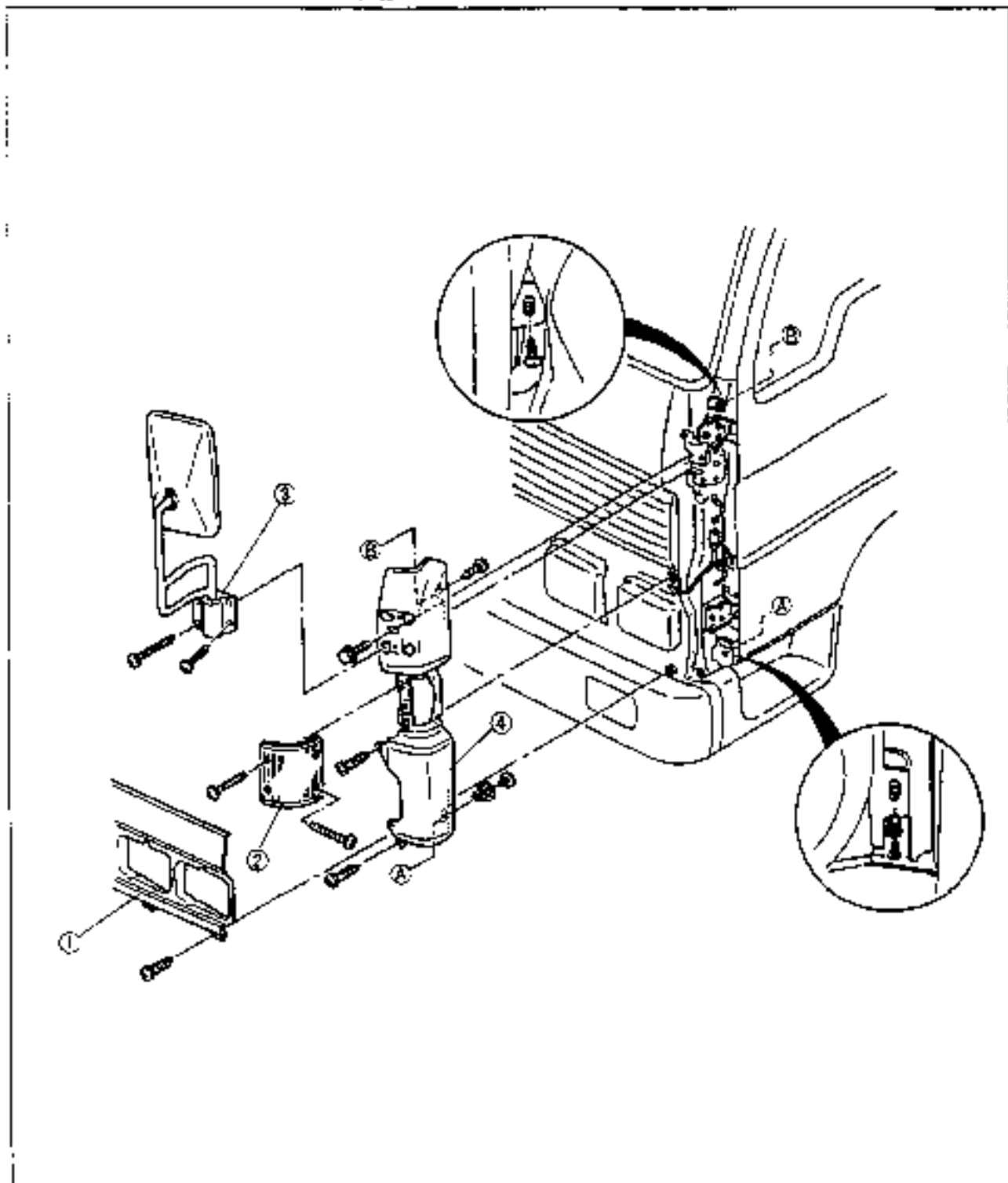
- |   |           |  |           |
|---|-----------|--|-----------|
| 1. Instrument panel<br>Removal / Installation ..... | page S-50 | 6. Seat belt<br>Removal / Installation ..... | page S-59 |
| 2. Console<br>Removal / Installation .....          | page S-49 | Inspection .....                             | page S-60 |
| 3. Clock<br>Removal / Installation .....            | page S-61 | 7. Floor mat<br>Removal / Installation ..... | page S-62 |
| 4. Front seat<br>Removal / Installation .....       | page S-53 | 8. Headliner<br>Removal .....                | page S-63 |
| Disassembly / Assembly .....                        | page S-55 | Installation .....                           | page S-65 |
| 5. Rear seat<br>Removal / Installation ..           | page S-54 | 9. Trim<br>Removal / Installation .....      | page S-68 |

## FRONT FENDER PANEL

## COMPONENTS

## Removal / Installation

1. Remove in the order shown in the figure.
2. Install in the reverse order of removal.



1. Radiator grille
2. Front combination light

3. Mirror
4. Front fender panel

9TQ09X-007

## FRONT DOOR

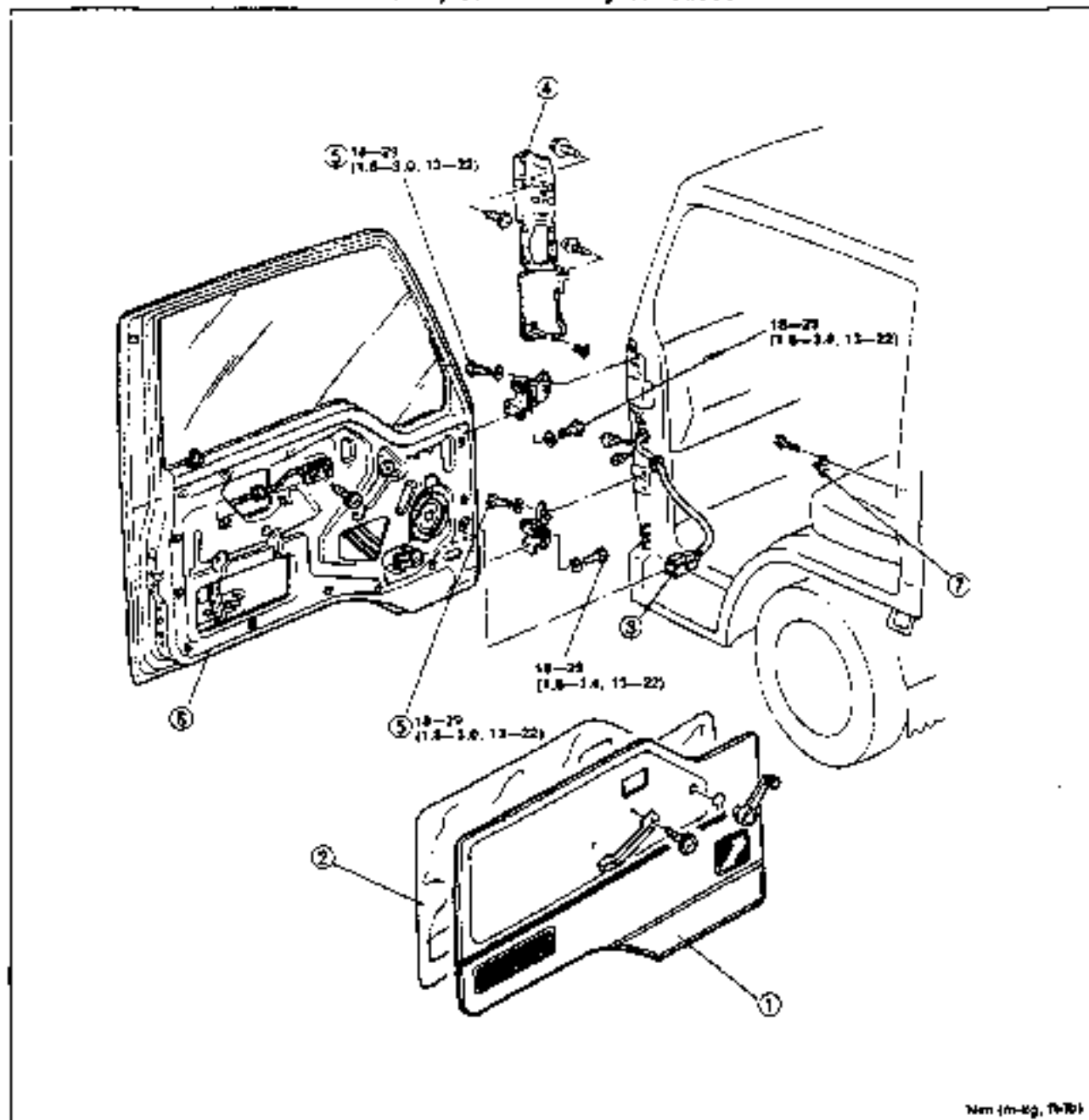
## COMPONENTS

## Removal / Installation

- 1 Remove in the order shown in the figure.
- 2 Install in the reverse order of removal, referring to **Installation Note**.

## Caution

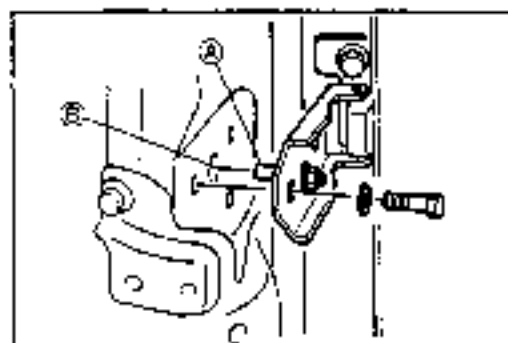
- Remove the door screen carefully so that it may be reused.



Nem (16-kg, 70lb)

9TQ05X-008

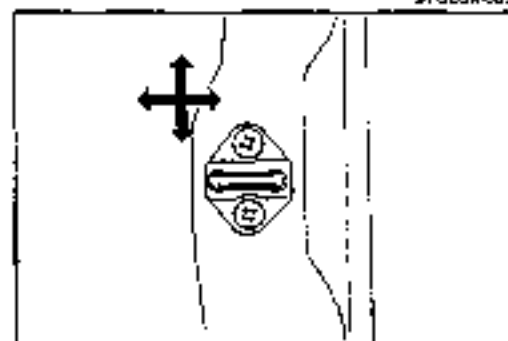
- |  |                                 |
|--|---------------------------------|
| 1 Trim (with door speaker model)         | 6. Front door                   |
| 2. Door screen (with door speaker model) | Installation Note..... page S-8 |
| 3. Connector (door speaker)              | Adjustment..... page S-9        |
| 4. Front tender panel                    | 7. Door lock striker            |
| 5. Bolt                                  | Adjustment..... page S-9        |



9TG05K-009

**Installation note****Front door**

1. Align the pin and install the front door.



8TG05K-010

**Adjustment****Door lock striker**

1. Check if the door can be closed easily and whether there is any looseness. If there is a problem, loosen the striker mounting screws and adjust by moving the striker down or laterally.
2. Check the rear offset of the door to the body or rear door (crew cabin). If there is a problem, adjust by moving the door lock striker laterally.

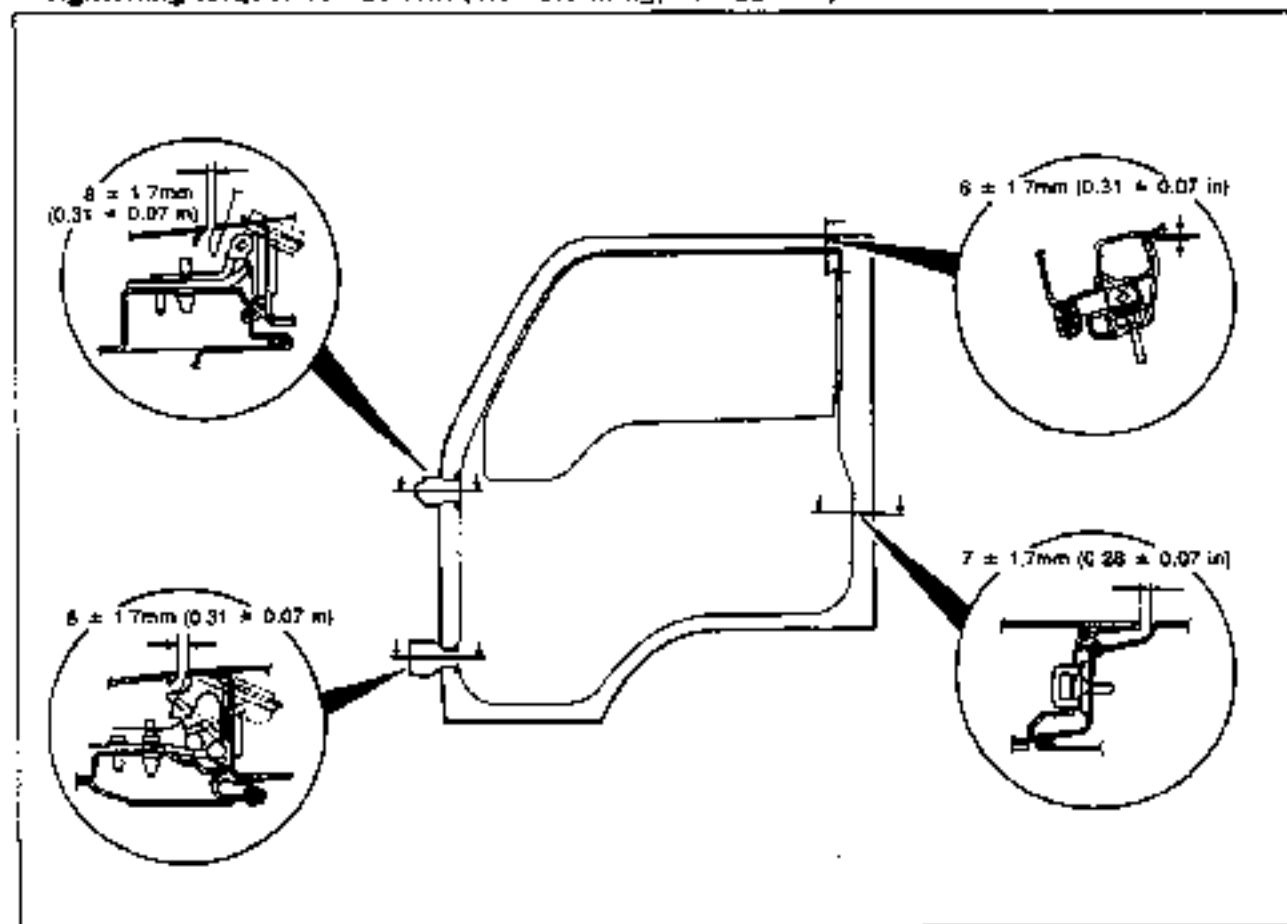
**Tightening torque:**

18–26 Nm (1.8–2.7 m·kg, 13–20 ft·lb)

**Front door**

1. Loosen the hinge bolts and adjust as shown in the figure.

**Tightening torque: 18–26 Nm (1.8–3.0 m·kg, 13–22 ft·lb)**



9TG05K-011

## FRONT WINDOW REGULATOR AND GLASS

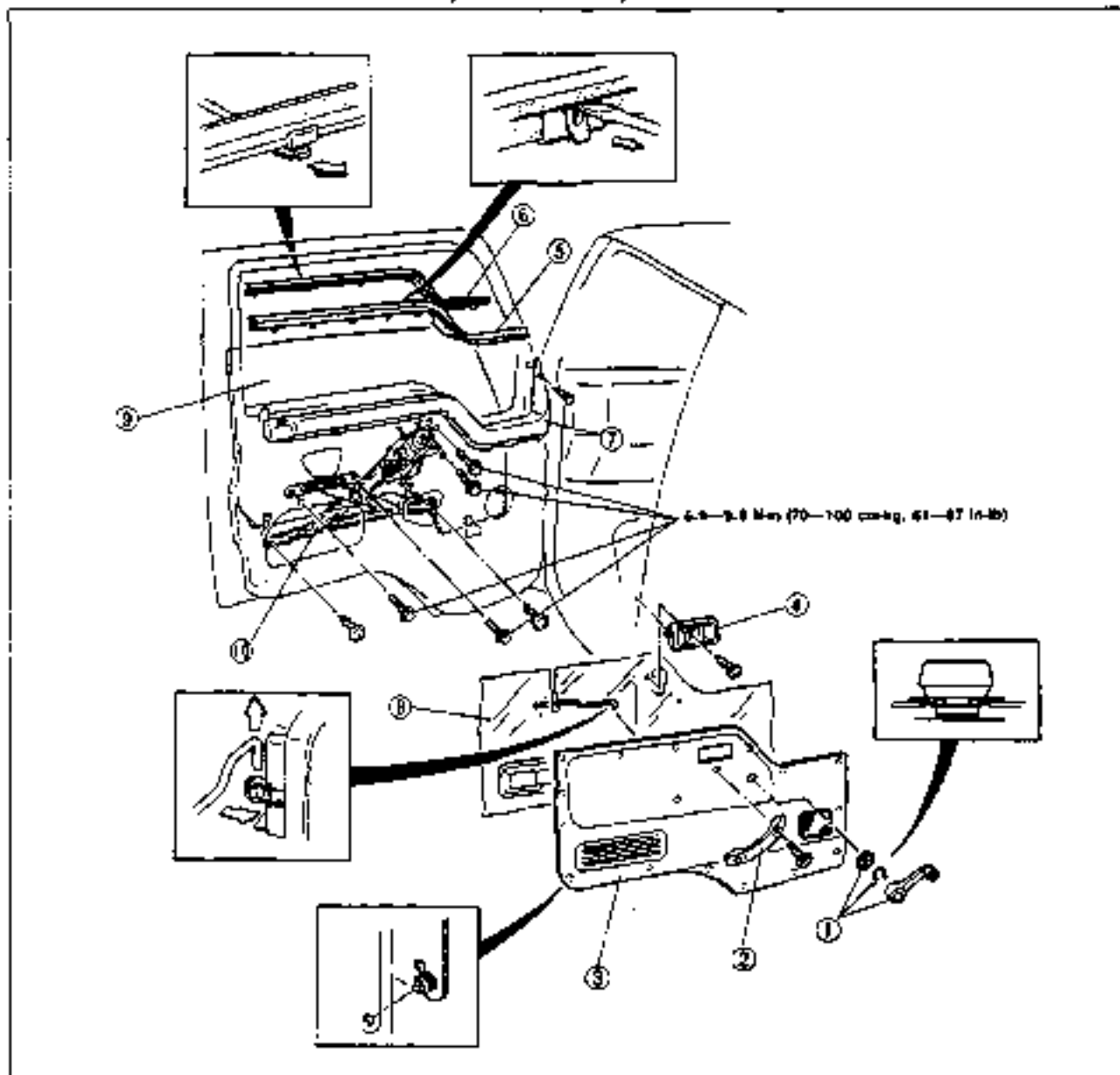
## COMPONENTS

## Removal / Installation

1. Raise the door glass **approx. 115mm (4.53 in)** from the fully open position.
2. Disconnect the negative battery cable.
3. Remove in the order shown in the figure, referring to **Removal Note**.
4. Install in the reverse order of removal.

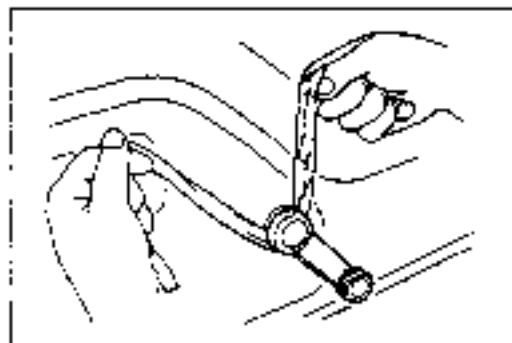
## Caution

- Remove the door screen carefully so that it may be reused.



91069X-012

- |  |  |
|--|--|
| 1. Regulator handle<br>Removal Note..... page S-11 | 6. Outer weatherstrip                              |
| 2. Armrest   | 7. Cover   |
| 3. Door trim                                       | 8. Door screen                                     |
| 4. Inner handle                                    | 9. Front door glass<br>Removal Note..... page S-11 |
| 5. Inner weatherstrip                              | 10. Window regulator                               |



5T66X013

**Removal note**  
**Regulator handle**

1. Remove the regulator handle with a rag as shown in the figure



B7G05X014

**Front door glass**

1. Remove the door glass from the door while lifting the rear of the glass.

## FRONT DOOR LOCK AND OPENER

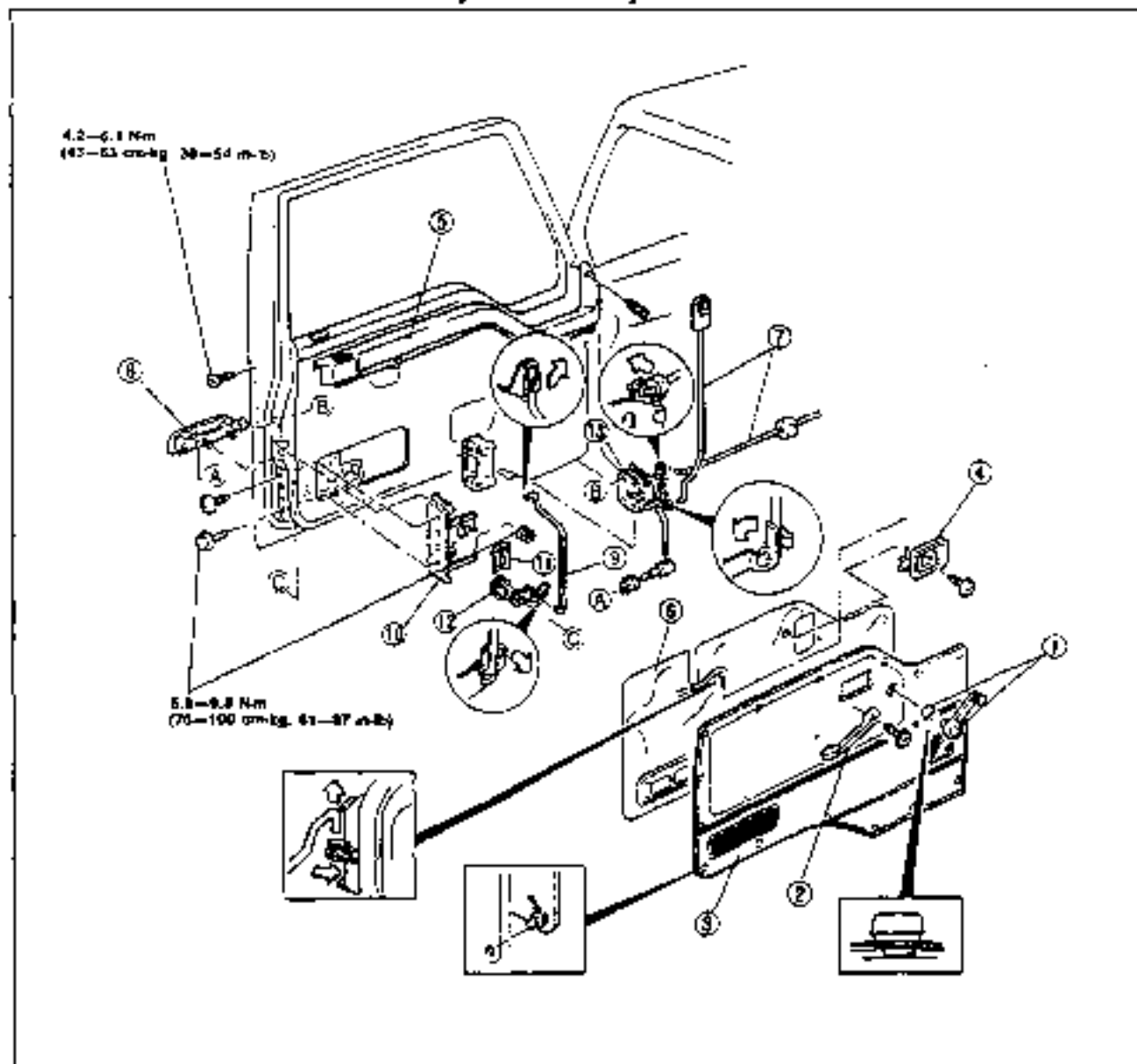
## COMPONENTS

## Removal / Installation

1. Raise the door glass fully.
2. Disconnect the negative battery cable
3. Remove in the order shown in the figure, referring to **Removal Note**
4. Install in the reverse order of removal.

## Caution

- Remove the door screen carefully so that it may be reused.



9TGSX-015

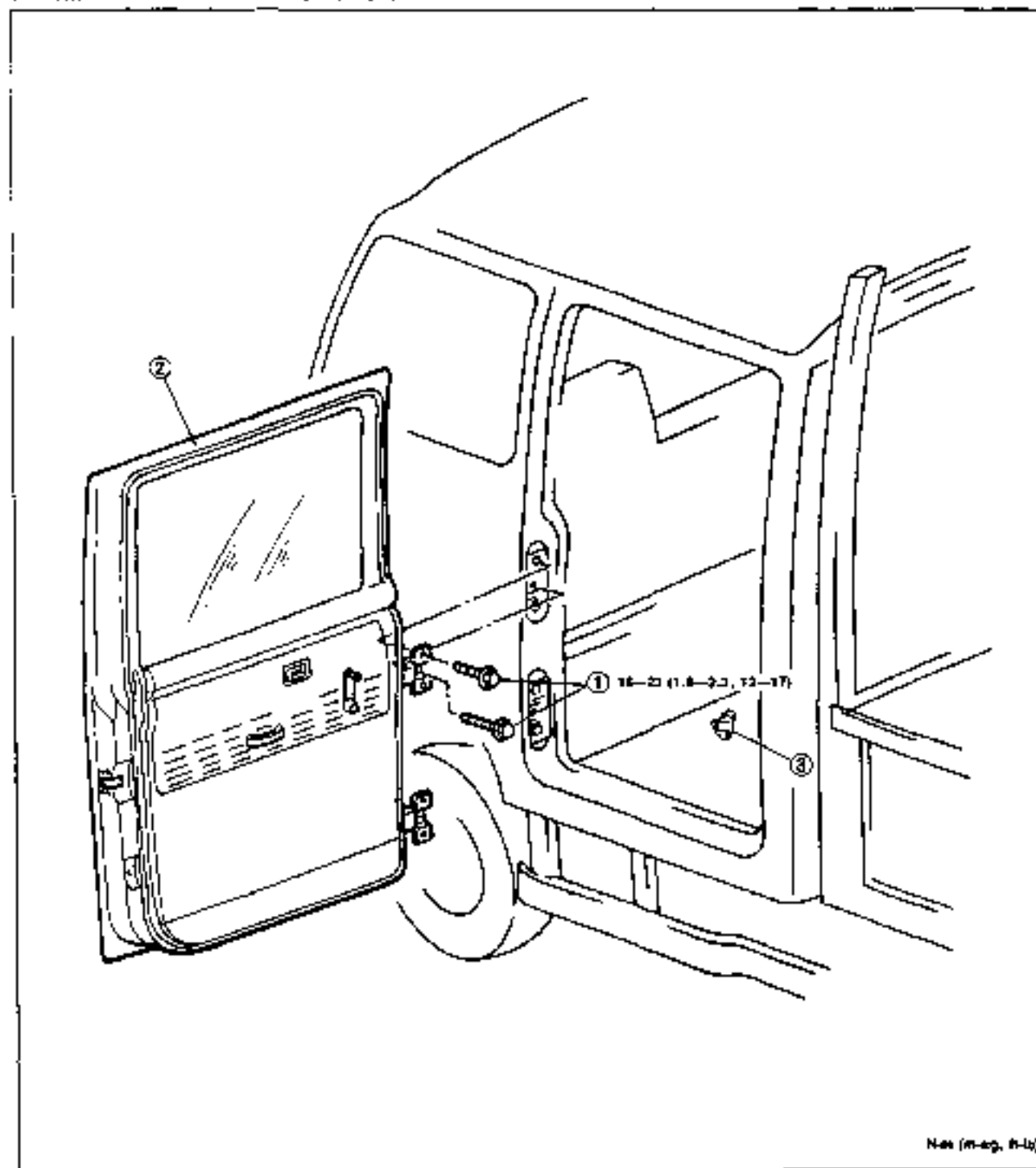
- |  |                            |
|--|----------------------------|
| 1. Regulator handle<br>Removal Note..... page S-11 | 7. Opener link             |
| 2. Armrest   | 8. Outer door handle       |
| 3. Door trim                                       | 9. Door lock link          |
| 4. Inner handle                                    | 10. Bracket                |
| 5. Cover   | 11. Lock cylinder retainer |
| 6. Door screen                                     | 12. Lock cylinder          |
|  | 13. Door lock assembly     |

REAR DOOR

COMPONENTS

Removal / Installation

1. Disconnect the negative battery cable.
2. Remove in the order shown in the figure.
3. Install in the reverse order of removal.



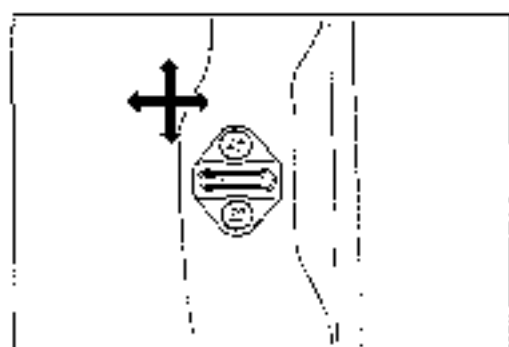
Not (M-eg. 8-14)

21G03X, 015

1 Bolt  
 2 Rear door  
 Adjustment..... page S-14

3 Door lock striker  
 Adjustment..... page S-14





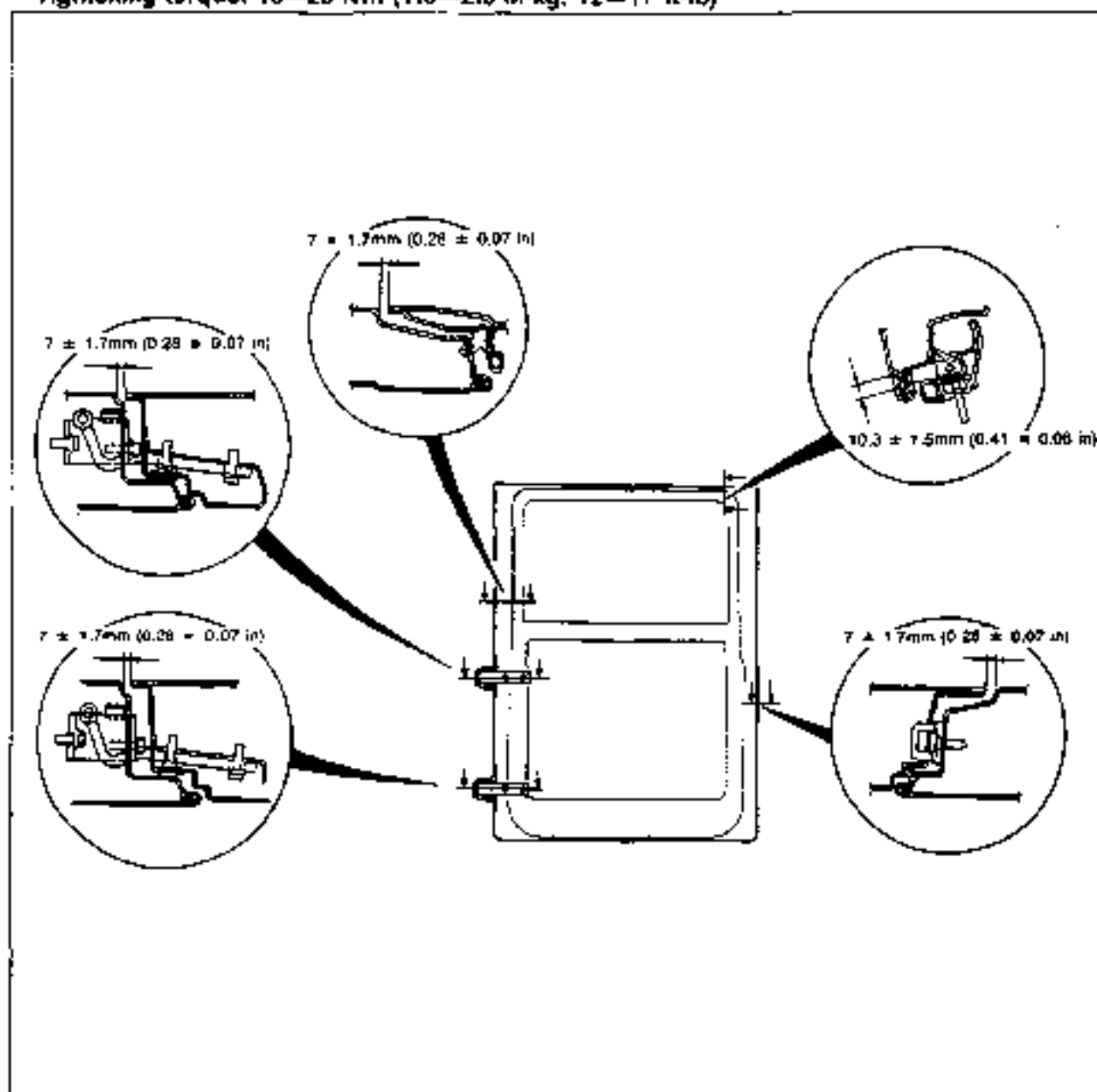
9T025X-017

**Adjustment****Door lock striker**

1. Check if the door can be closed easily and whether there is any looseness. If there is a problem, loosen the striker mounting screws and adjust by moving the striker down or laterally.
2. Check the rear offset of the door to the body or front door (crew cabin). If there is a problem, adjust by moving the door lock striker laterally.

**Tightening torque:****18—25 Nm (1.6—2.7 m·kg, 13—20 ft·lb)****Rear door**

1. Loosen the hinge bolts and adjust as shown in the figure.

**Tightening torque: 15—23 Nm (1.6—2.3 m·kg, 12—17 ft·lb)**

9T025X-018

REAR WINDOW REGULATOR AND GLASS

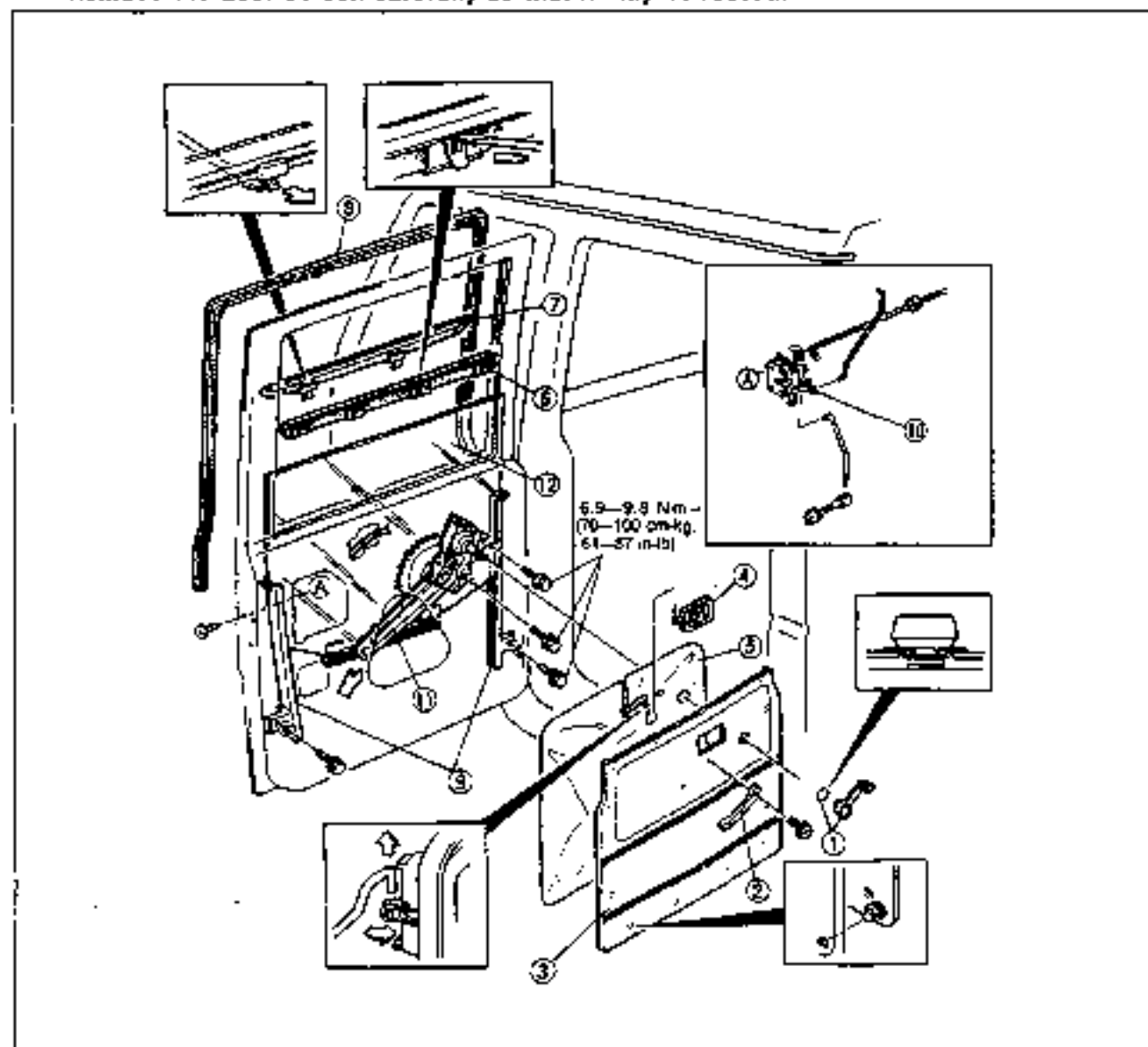
COMPONENTS

Removal / Installation

1. Operate the rear door glass fully.
2. Disconnect the negative battery cable.
3. Remove in the order shown in the figure, referring to **Removal Note**.
4. Install in the reverse order of removal.

Caution

- Remove the door screen carefully so that it may be reused.

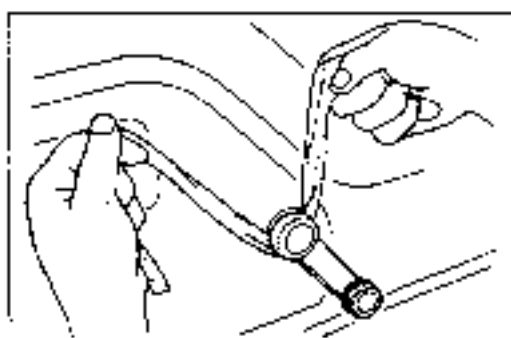


9TGC51-019

- |  |           |   |           |
|--|-----------|---|-----------|
| 1. Regulator handle<br>Removal Note..... | page S-16 | 8. Run channel                                |           |
| 2. Armrest                               |           | 9. Glass guide                                |           |
| 3. Door trim                             |           | 10. Rear door lock assembly                   |           |
| 4. Inner handle                          |           | 11. Rear window regulator<br>Removal Note.... | page S-16 |
| 5. Door screen                           |           | 12. Rear window glass<br>Removal Note.....    | page S-16 |
| 6. Inner weatherstrip                    |           |   |           |
| 7. Outer weatherstrip                    |           |   |           |

# S

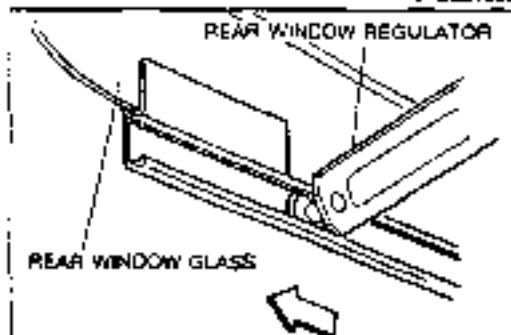
## REAR WINDOW REGULATOR AND GLASS



9TG05A-C20

### Removal note Regulator handle

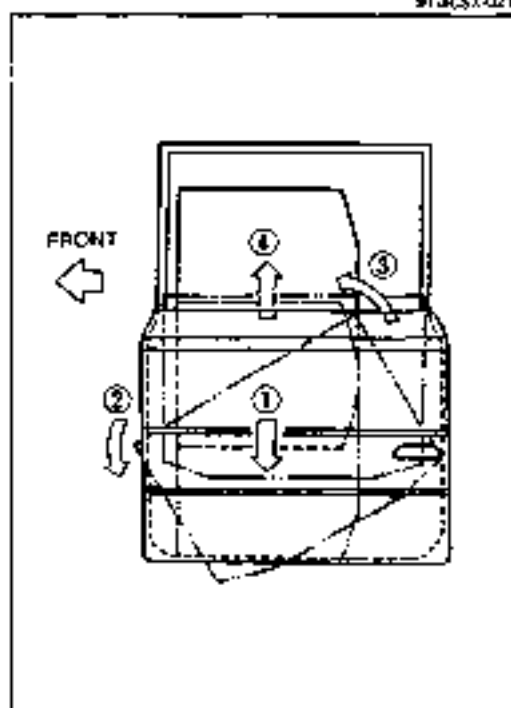
- 1 Remove the regulator handle with a rag as shown in the figure.



9TG05A-C21

### Rear window regulator

- 1 Remove the regulator as shown in the figure.



9TG05A-C22

### Rear window glass

- 1 Remove the glass from the door by moving it in the order shown in the figure.

REAR DOOR LOCK AND OPENER

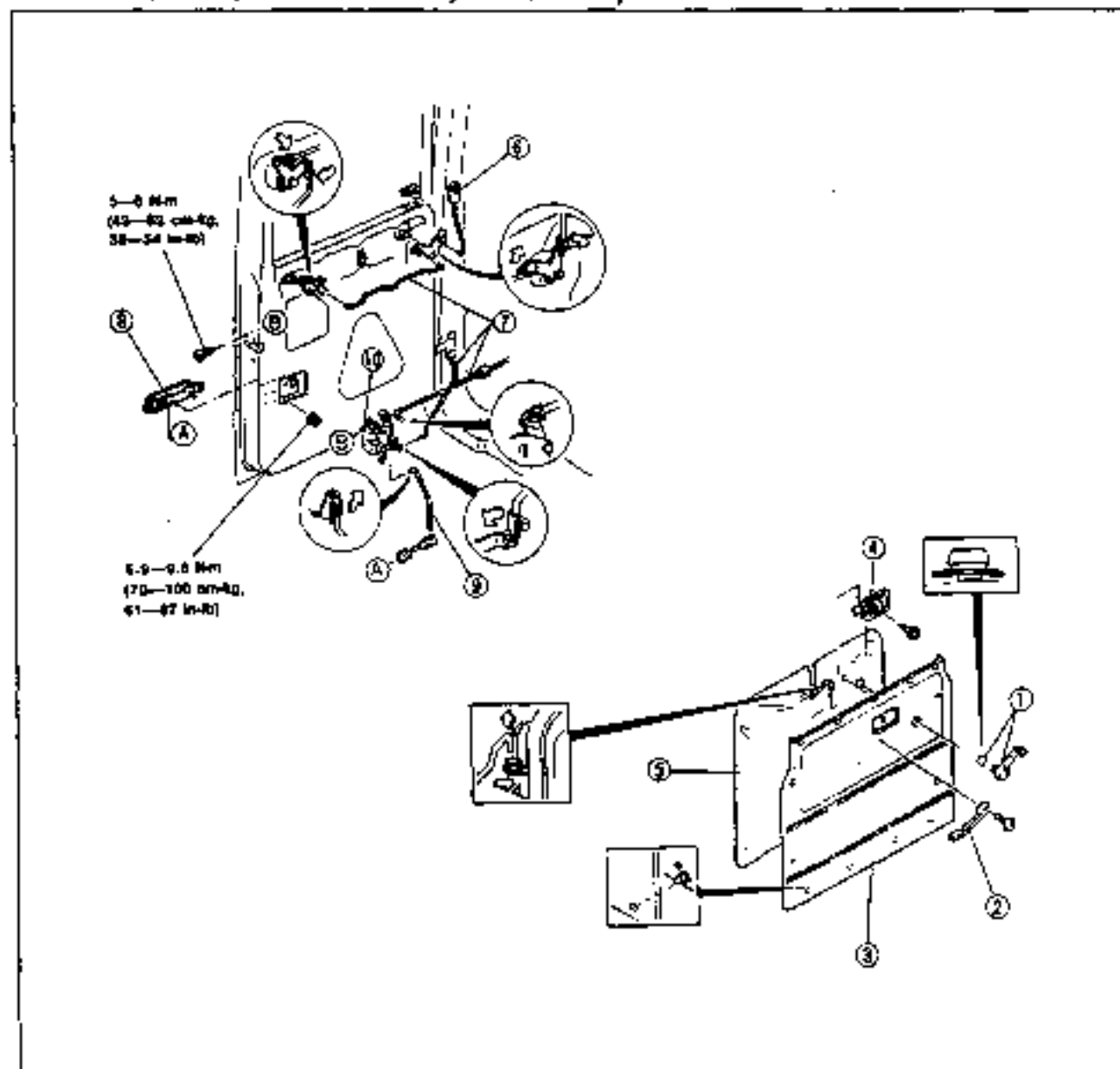
COMPONENTS

Removal / Installation

1. Raise the door glass fully
2. Disconnect the negative battery cable.
3. Remove in the order shown in the figure, referring to **Removal Note**.
4. Install in the reverse order of removal.

Caution

- Remove the door screen carefully so that it may be reused.



9TGG5X-023

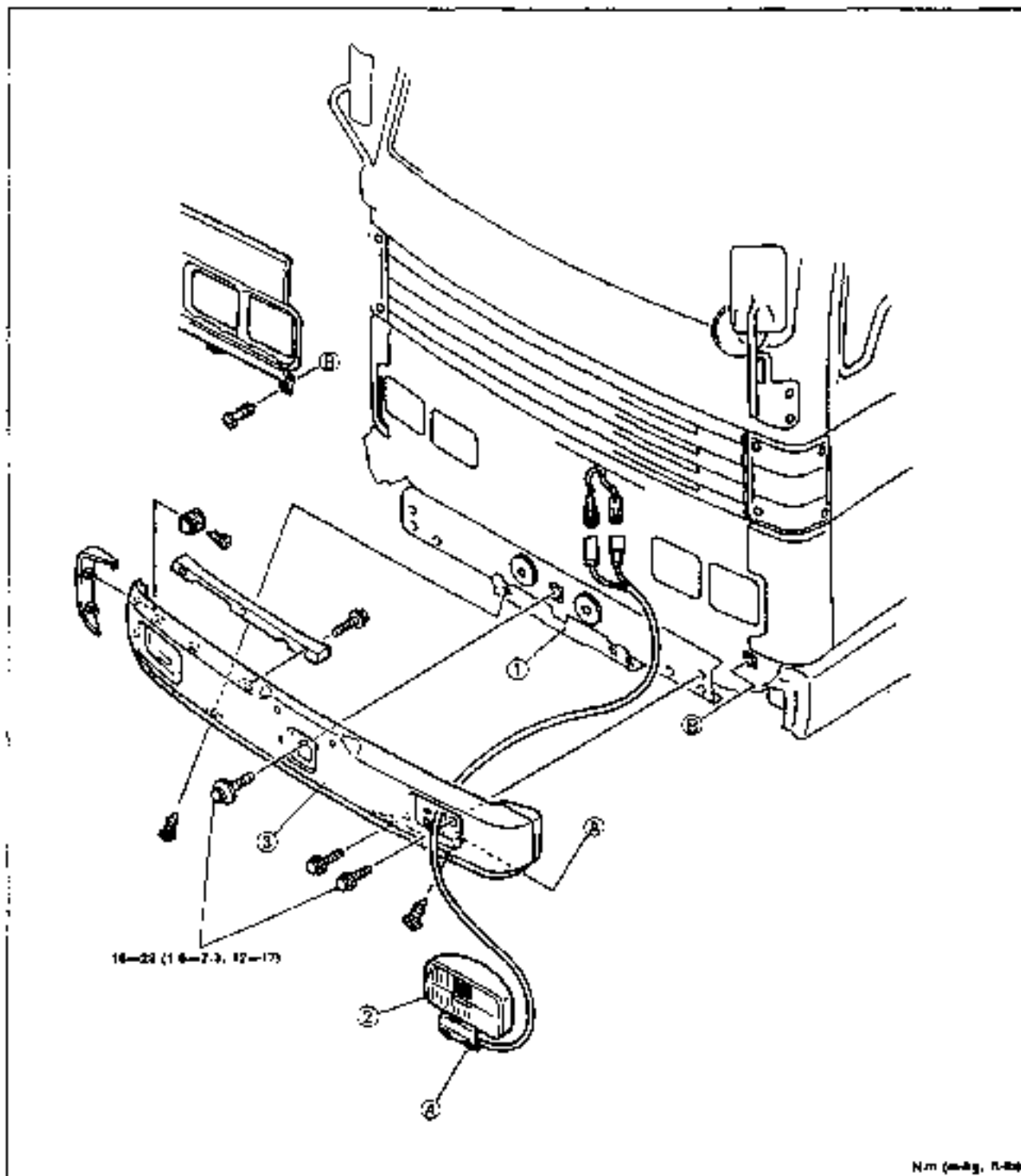
- |  |   |
|--|---|
| <ol style="list-style-type: none"> <li>1. Regulator handle</li> <li>2. Armrest</li> <li>3. Door trim</li> <li>4. Inner handle</li> <li>5. Door screen</li> </ol> | <p>Removal Note..... page S-16</p> <ol style="list-style-type: none"> <li>6. Opener link</li> <li>7. Door lock link 1</li> <li>8. Outer door handle</li> <li>9. Door lock link 2</li> <li>10. Door lock assembly</li> </ol> |
|--|---|

## FRONT BUMPER

## COMPONENTS

## Removal / Installation

1. Disconnect the negative battery cable.
2. Remove in the order shown in the figure.
3. Install in the reverse order of removal.



1. Undercover
2. Fog light

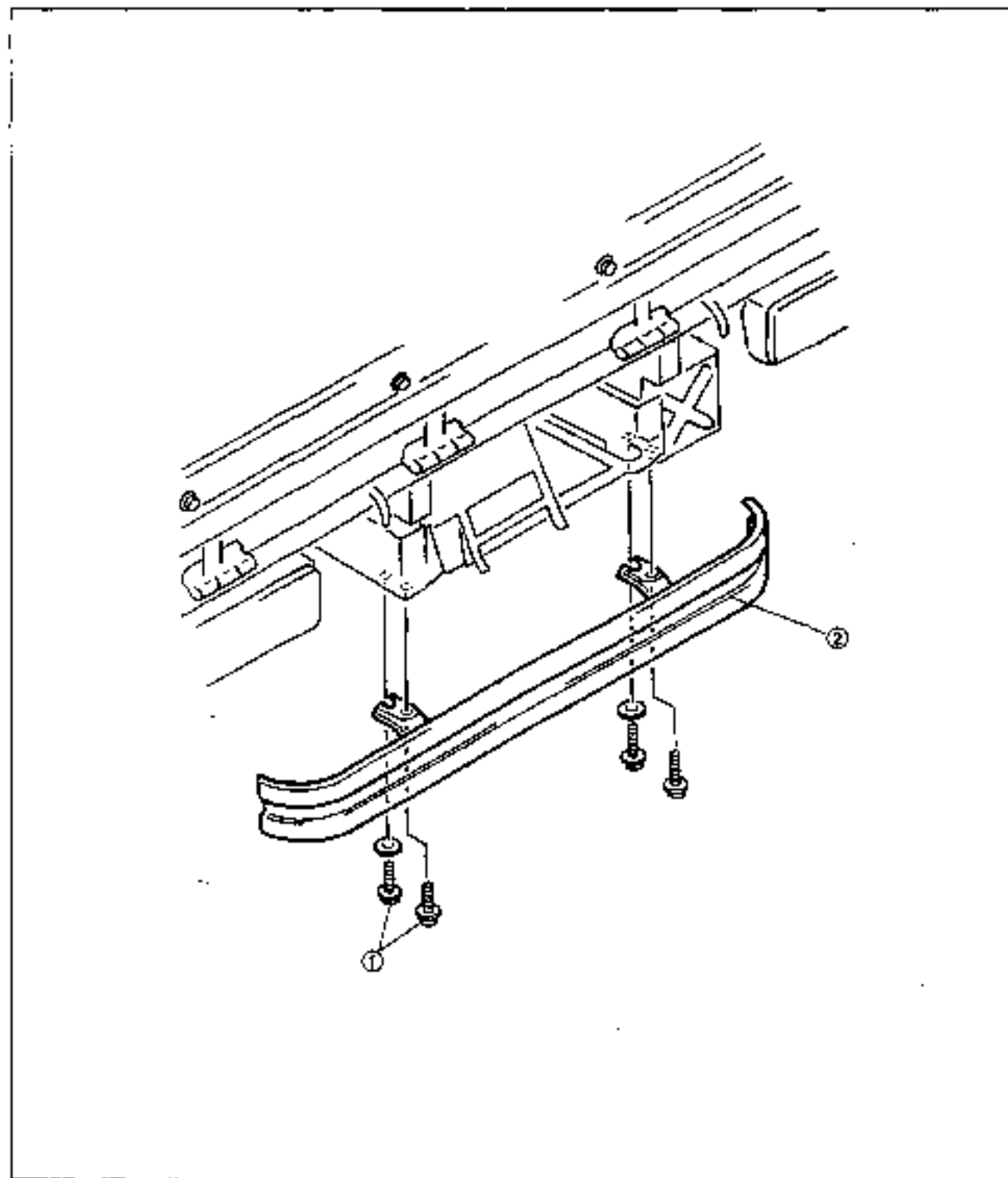
3. Front bumper assembly

## REAR BUMPER

## COMPONENTS

## Removal / Installation

1. Disconnect the negative battery cable
2. Remove in the order shown in the figure.
3. Install in the reverse order of removal.



1. Bolt

2. Rear bumper

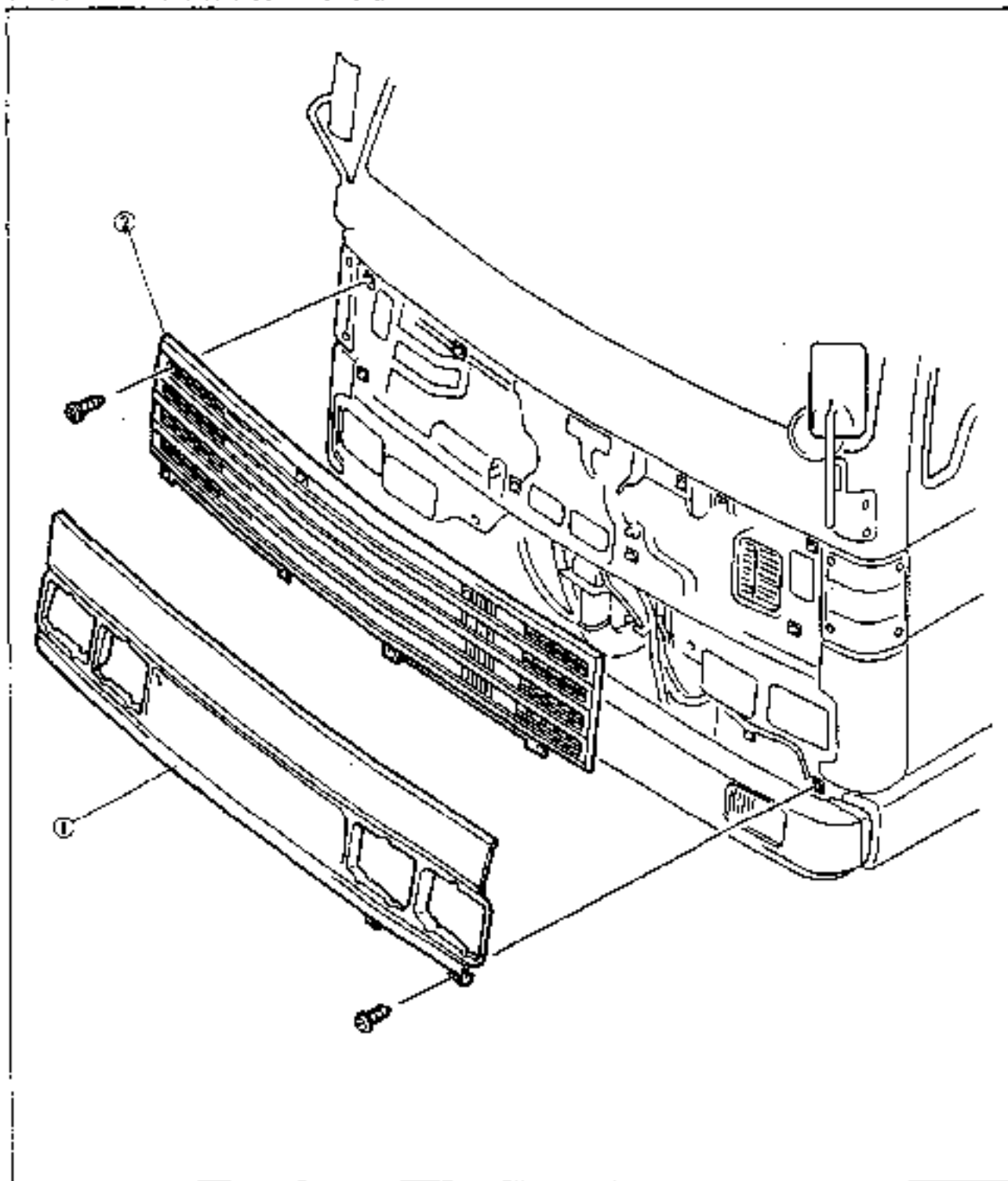
97008X-029

## RADIATOR GRILLE/FRONT GRILLE

## COMPONENTS

## Removal / Installation

1. Disconnect the negative battery cable.
2. Remove in the order shown in the figure.
3. Install in the reverse order of removal.



1. Radiator grille

2. Front grille

9T0053-025

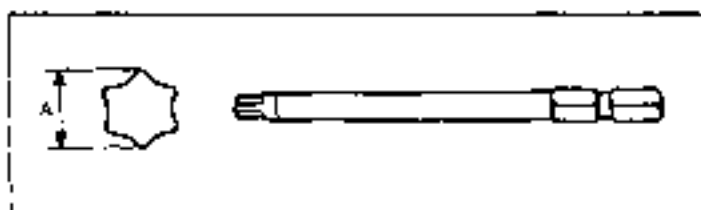
## STEP

## PREPARATION

\*1  
Torx wrench

For removal and installation of step

\*1  
Torx wrench  
specification

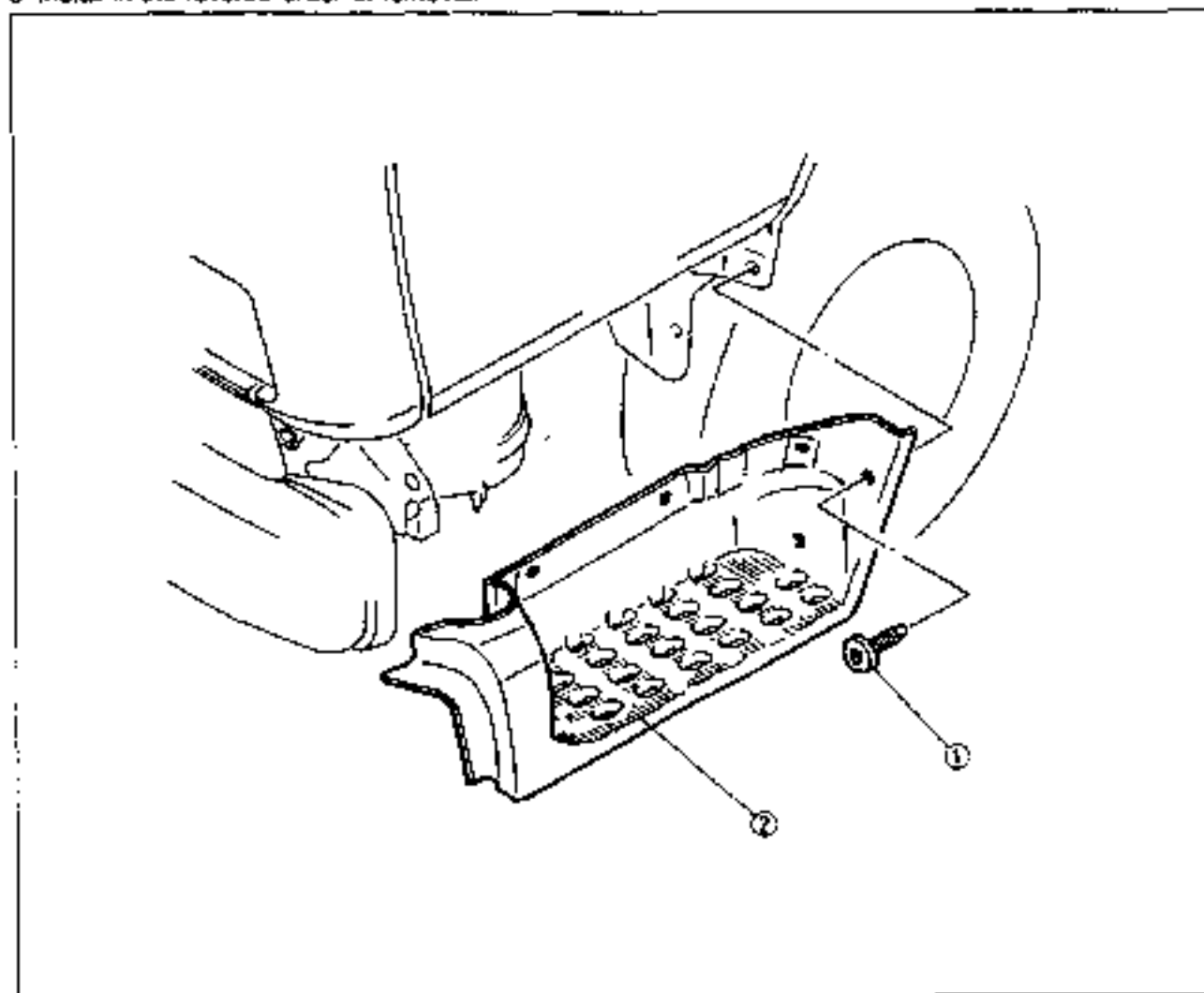


Torx wrench	A
T30	5.5mm (0.22 in)

## STEP

## Removal / Installation

1. Disconnect the negative battery cable.
2. Remove in the order shown in the figure.
3. Install in the reverse order of removal.



1. Torx screw

2 Step

9T3262-02\*

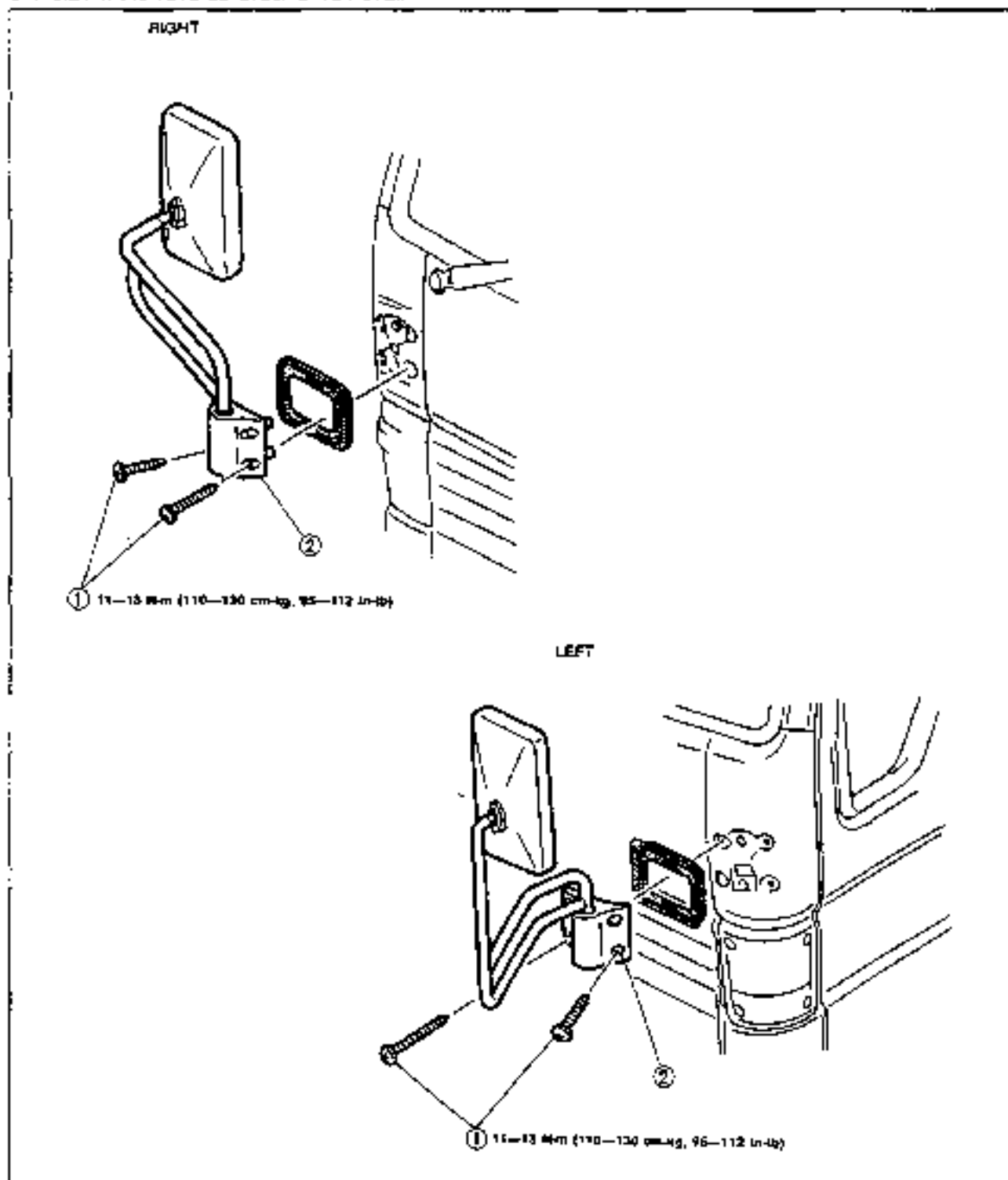


## MIRROR

## MIRROR

## Removal / Installation

1. Disconnect the negative battery cable.
2. Remove in the order shown in the figure.
3. Install in the reverse order of removal.



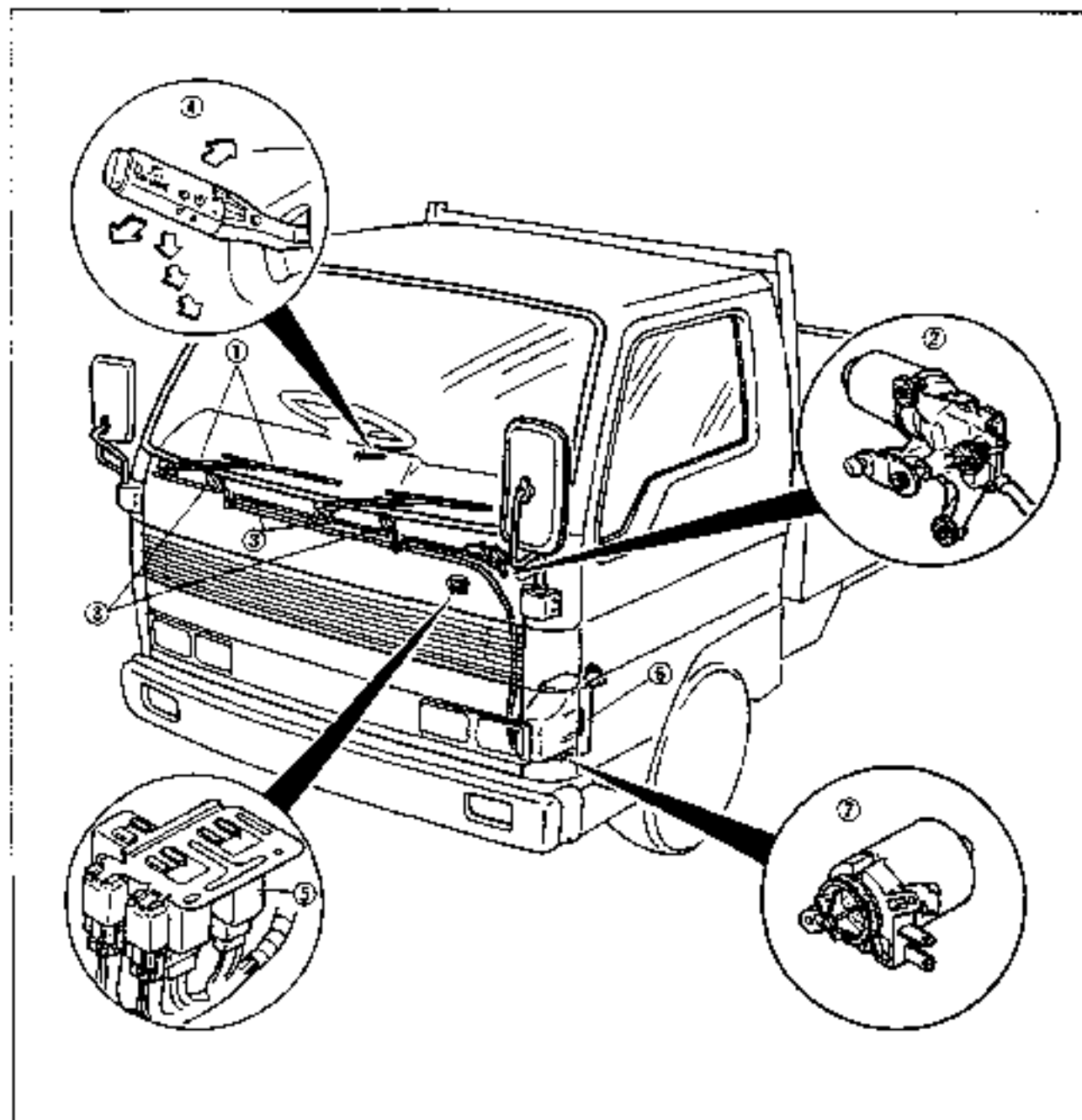
1. Bolt

2. Mirror

97G05X-028

## WINDSHIELD WIPER AND WASHER

## STRUCTURAL VIEW

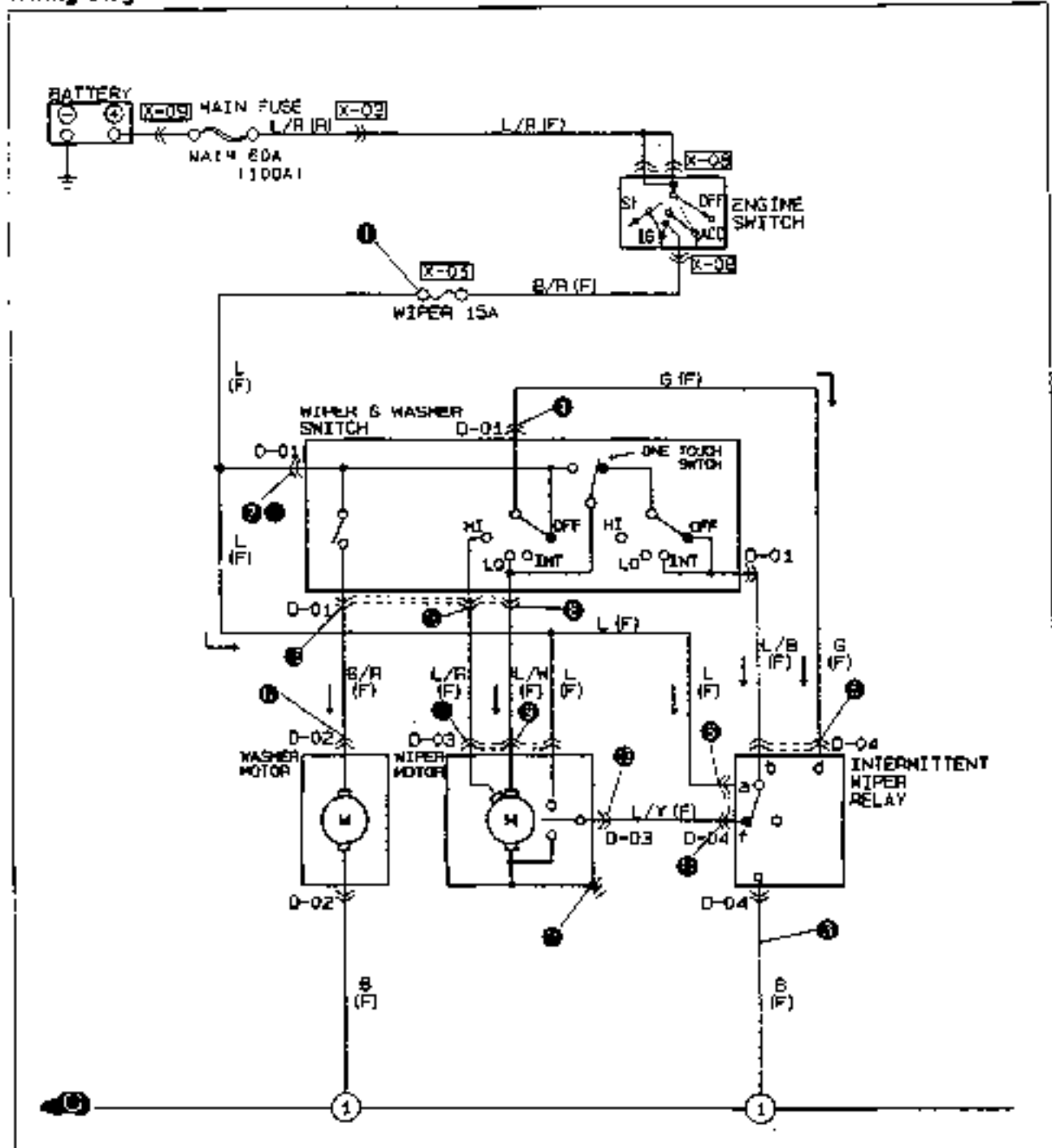


9T003X-029

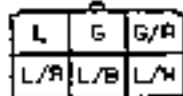
- |  |  |
|--|--|
| 1 Wiper arm and blade<br>Removal / Installation ..... page S-29<br>Adjustment ..... page S-32  | 5. Intermittent wiper relay<br>Inspection ..... page S-34                                |
| 2. Wiper motor and bracket<br>Removal / Installation ..... page S-29<br>Disassembly / Assembly ..... page S-33<br>Inspection ..... page S-33 | 6. Washer tank assembly<br>Removal / Installation ..... page S-29                        |
| 3. Wiper link assembly<br>Removal / Installation ..... page S-30   | 7. Washer motor<br>Removal / Installation ..... page S-29<br>Inspection ..... page S-34  |
| 4. Wiper and washer switch<br>Inspection ..... page S-34   | 8. Washer nozzle<br>Removal / Installation ..... page S-31<br>Adjustment ..... page S-32 |

### TROUBLESHOOTING GUIDE

#### Wiring Diagram



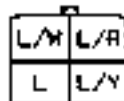
D-01 WIPER & WASHER SWITCH (F)  
RHO



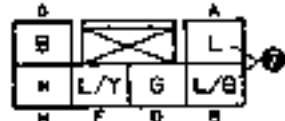
D-02 WASHER MOTOR (F)

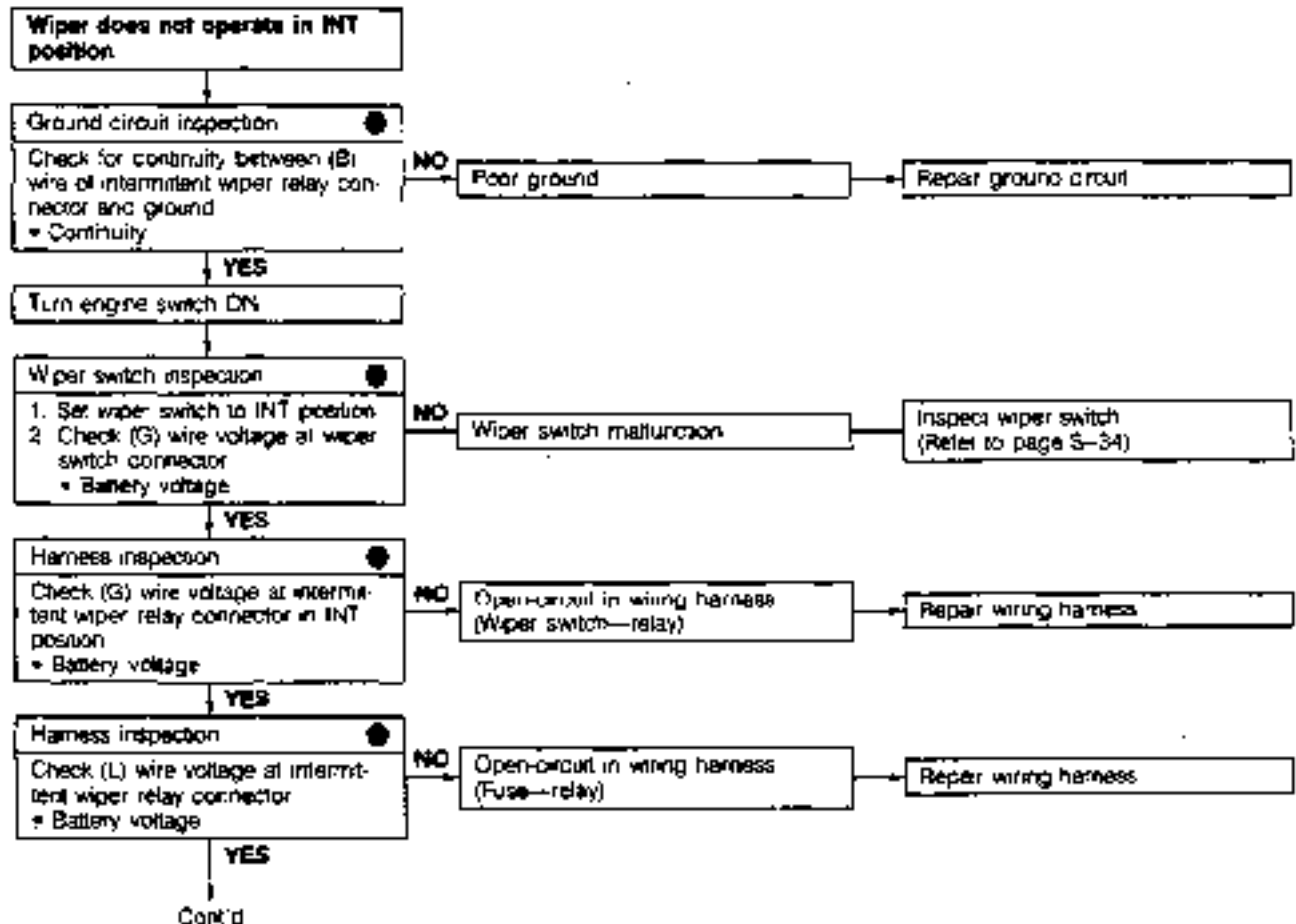
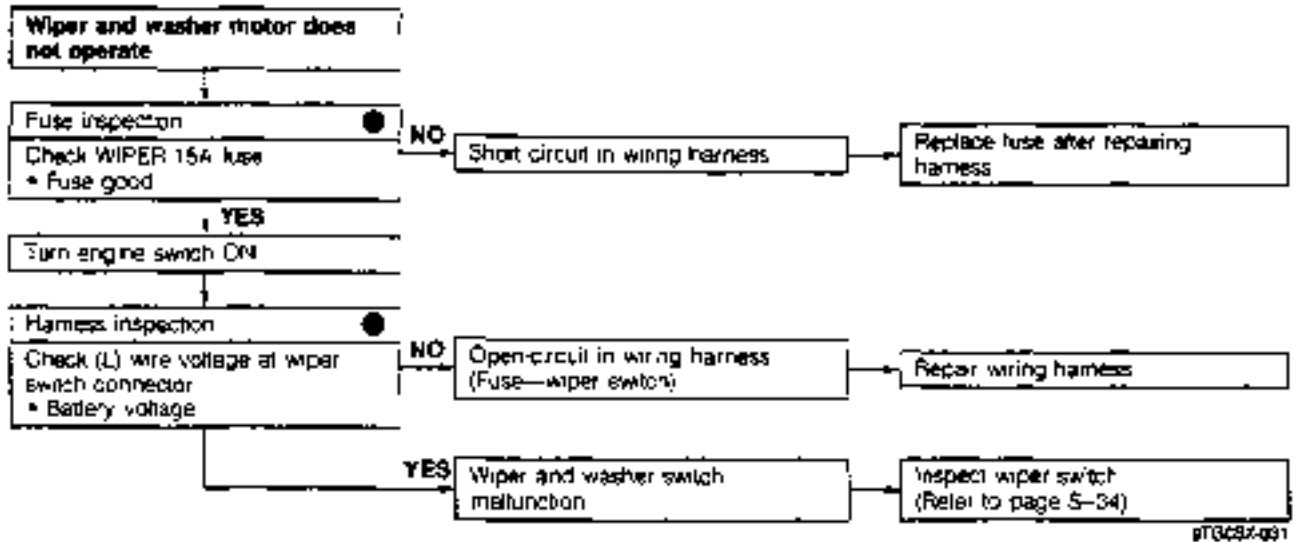


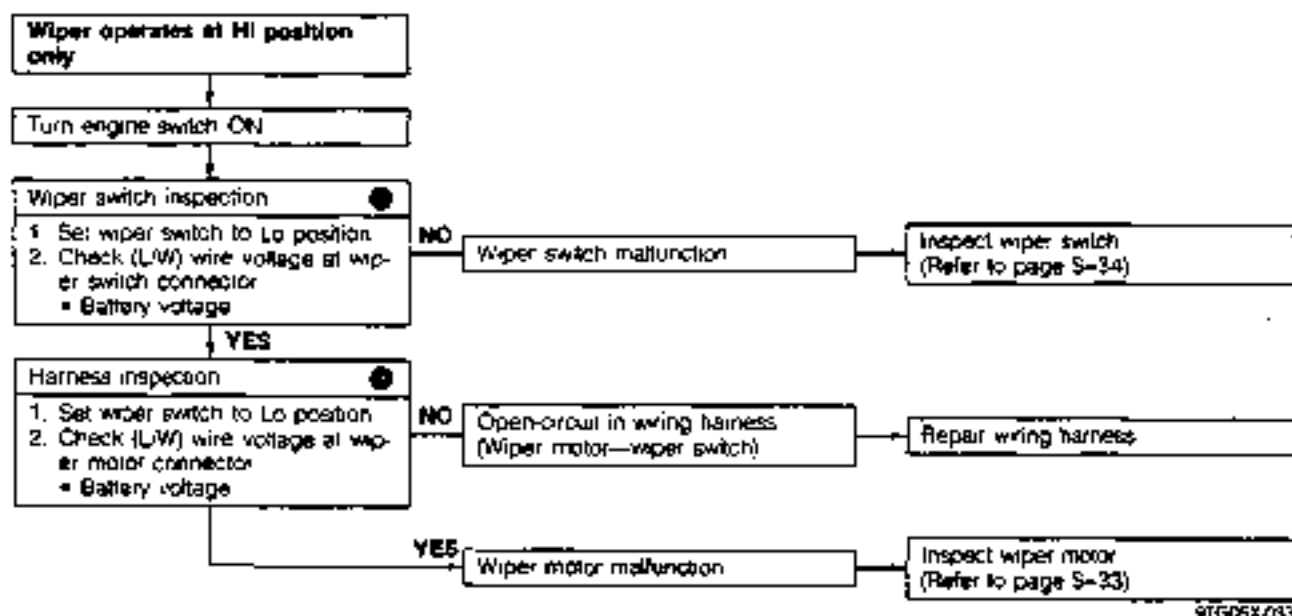
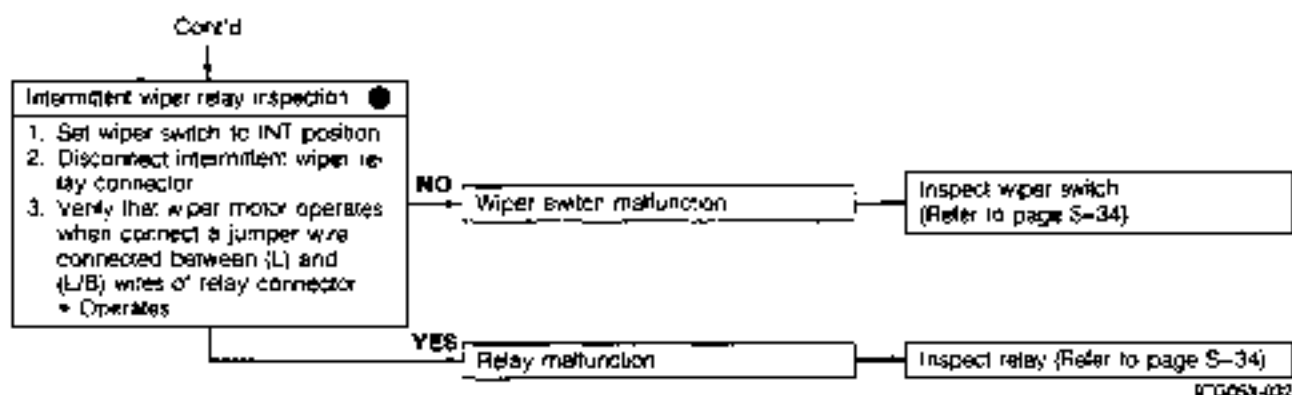
D-03 WIPER MOTOR (F)

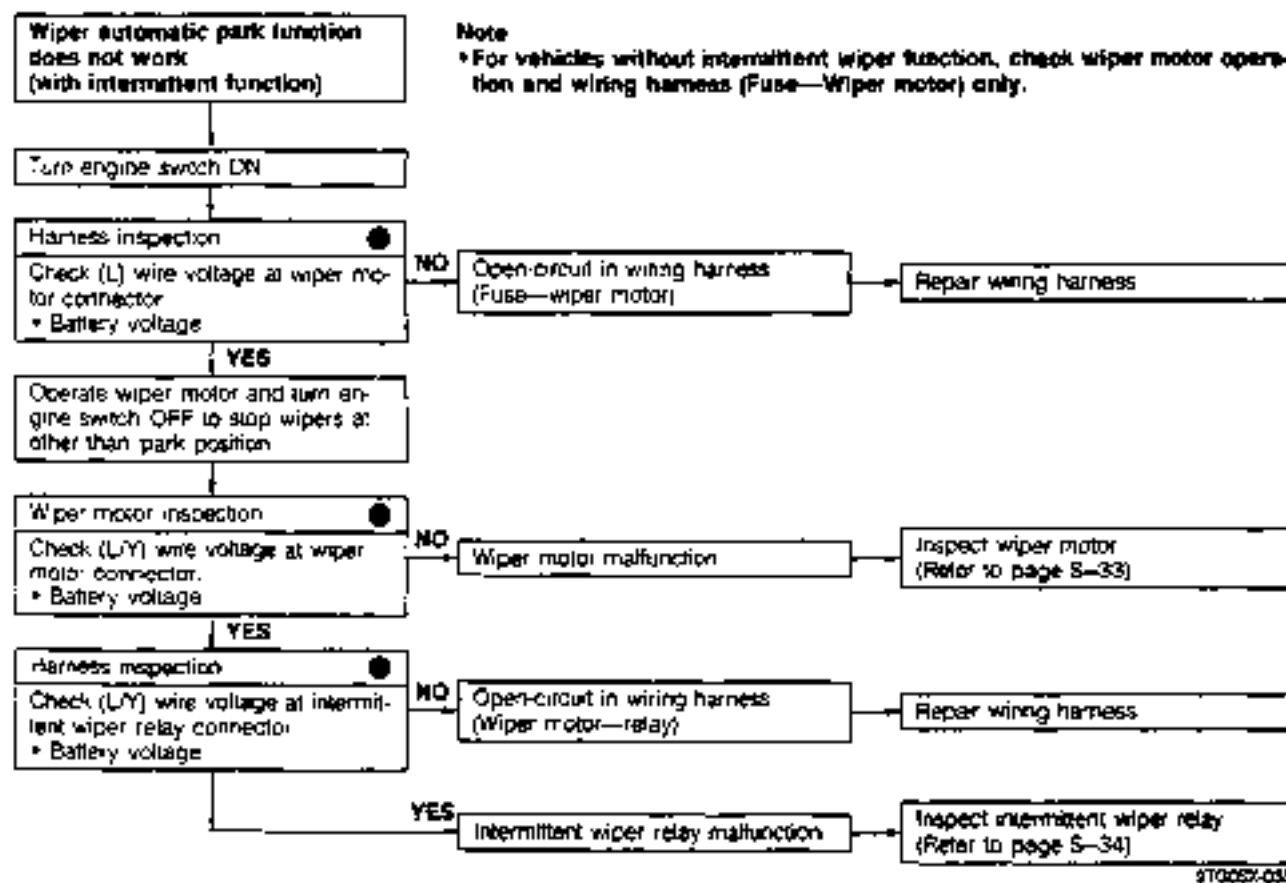
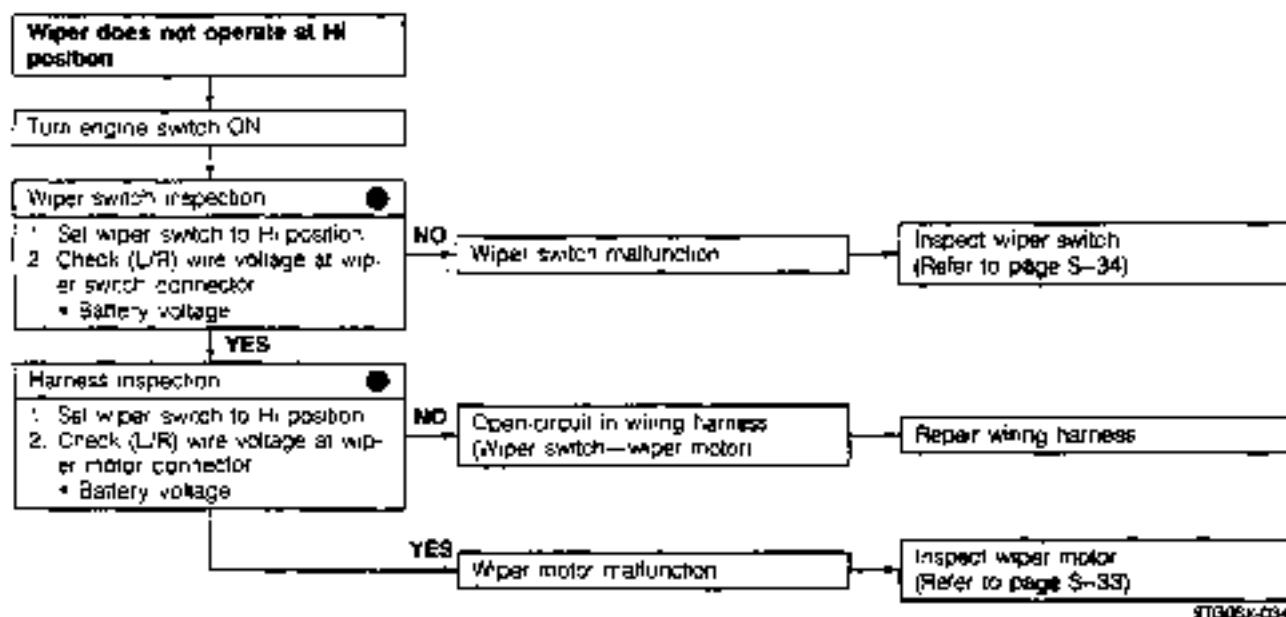


D-04 INTERMITTENT WIPER RELAY (F)





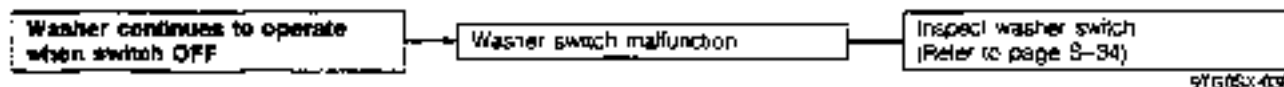
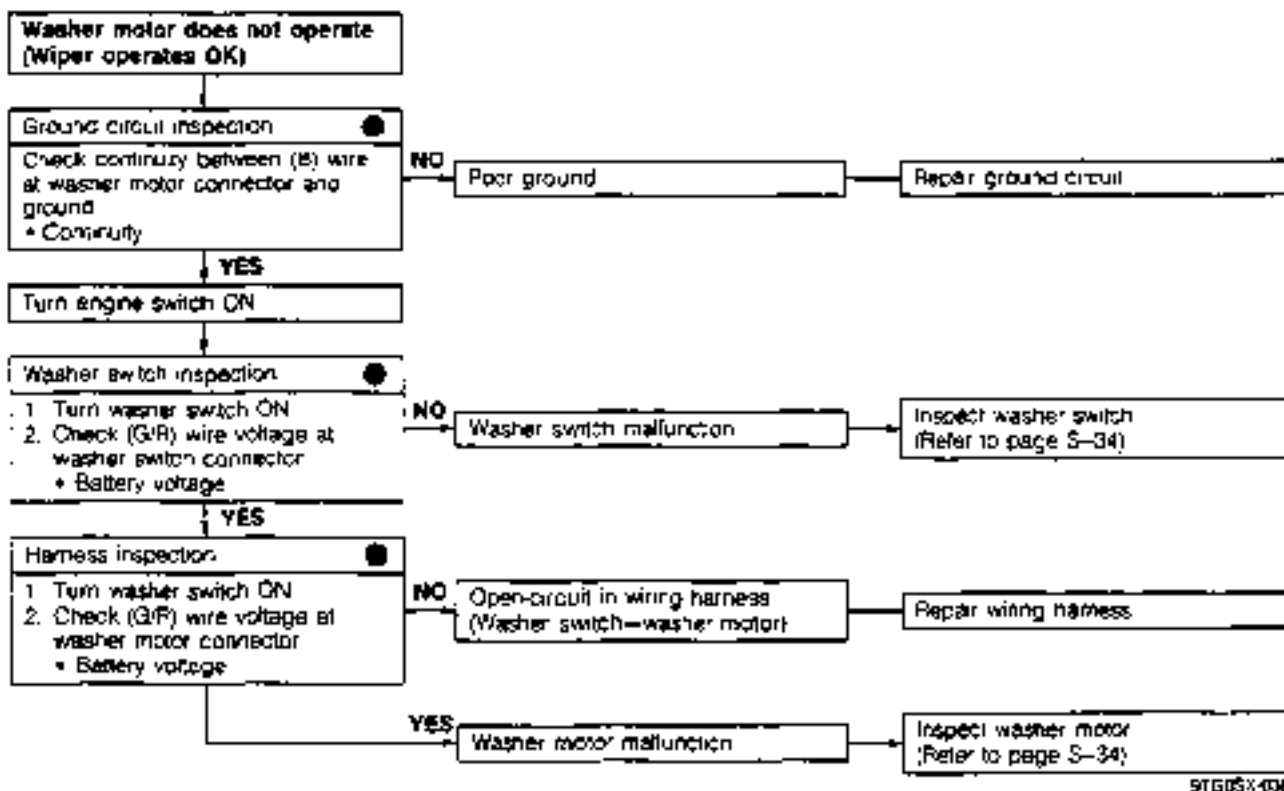
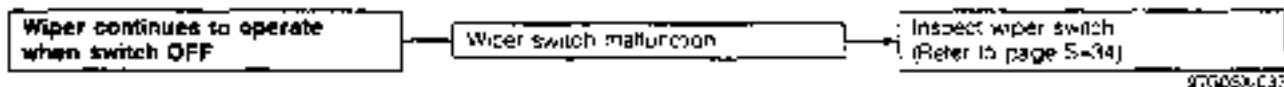




**Note**  
 • For vehicles without intermittent wiper function, check wiper motor operation and wiring harness (Fuse—Wiper motor) only.

# S

## WINDSHIELD WIPER AND WASHER

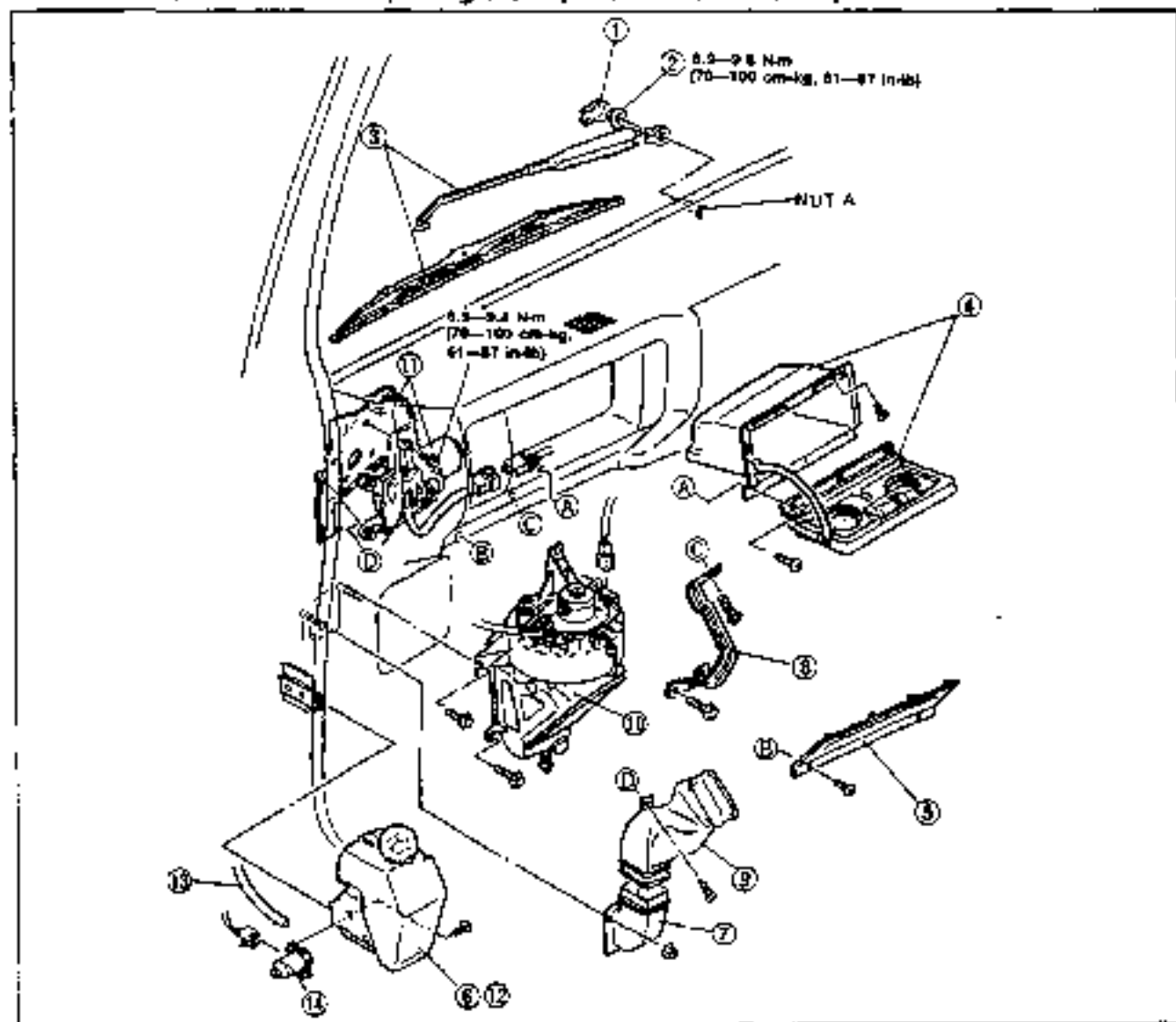


**COMPONENTS****Removal / Installation**

1. Disconnect the negative battery cable.
2. Remove in the order shown in the figure.
3. Install in the reverse order of removal, referring to **Installation Note**.

**Wiper arm and blade, wiper motor, washer motor****Caution**

- Do not remove nut A if replacing the wiper arm and blade only.



97G65X-040

**Wiper arm and blade**

1. Wiper arm cover
2. Nuts
3. Wiper arm and blade  
Adjustment..... page S-32

**Wiper motor**

4. Glove box
5. Lower panel
6. Washer tank assembly
7. Fresh air duct
8. Bracket

## 9. Duct A

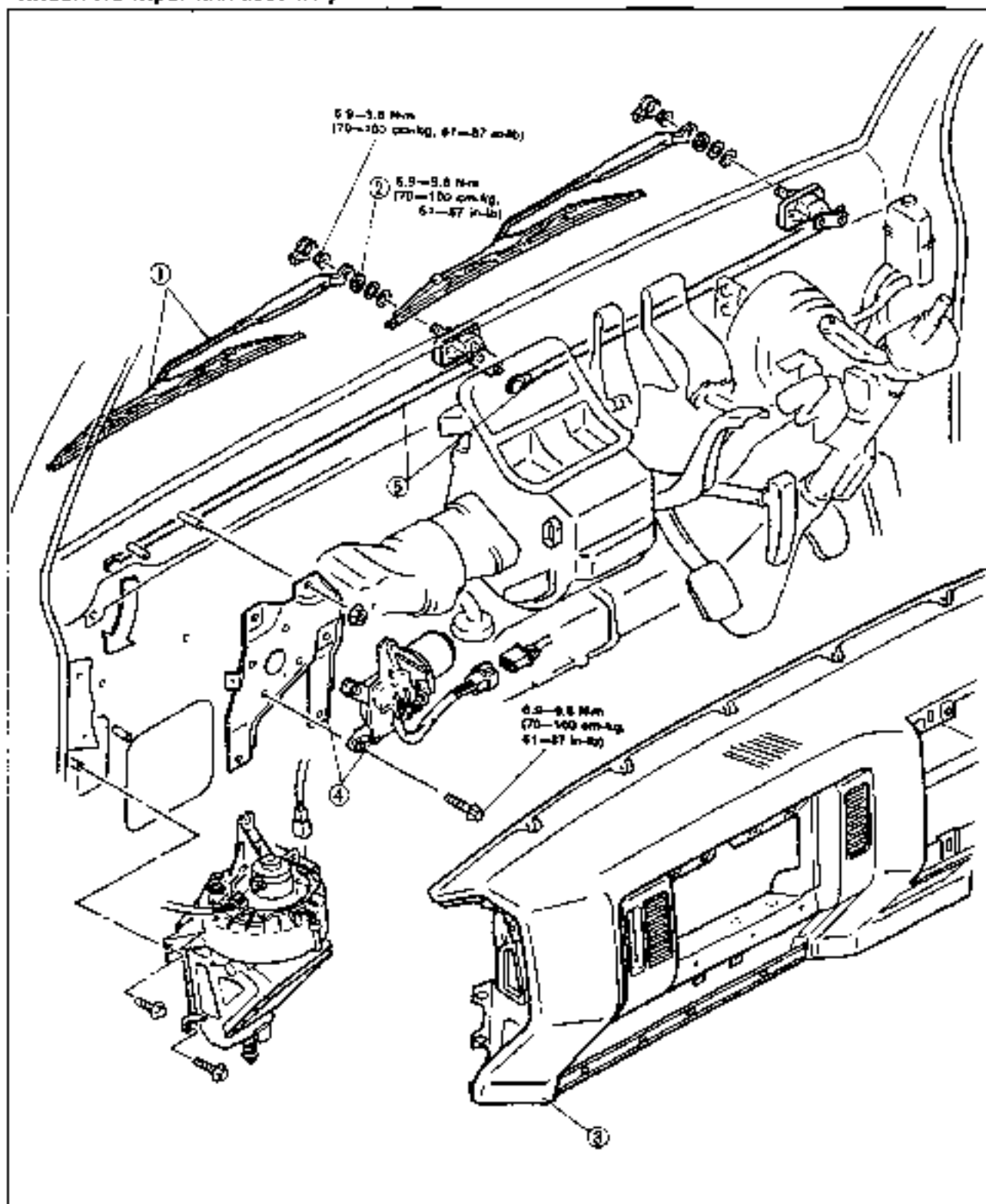
10. Blower unit
11. Wiper motor and bracket  
Installation Note ..... page S-31  
Disassembly / Assembly ..... page S-33  
Inspection ..... page S-33

**Washer motor**

12. Washer tank assembly
13. Washer pipe
14. Washer motor  
Inspection ..... page S-34



## Windshield wiper link assembly

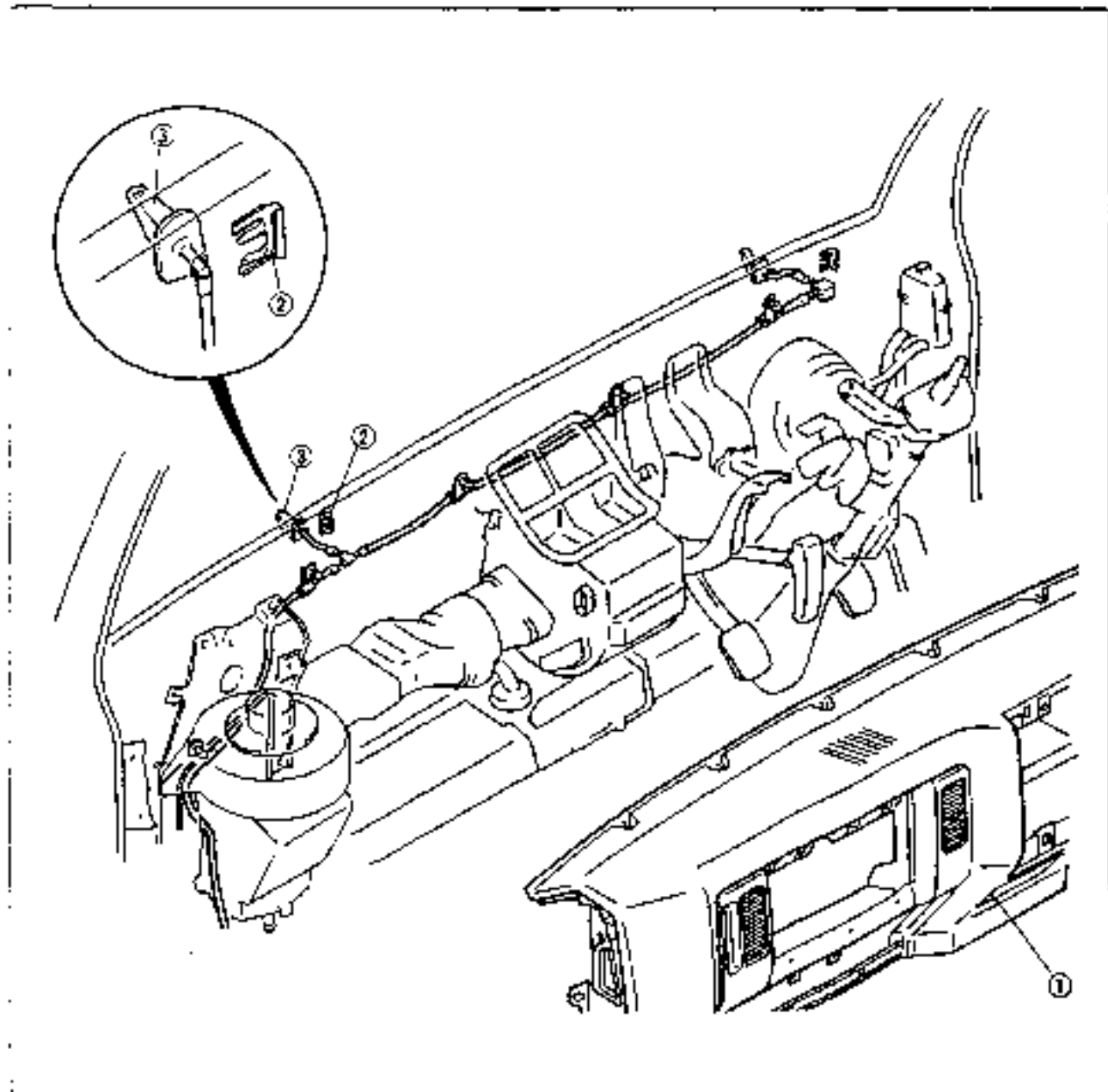


9TGDGX 041

1. Wiper arm and blade  
Adjustment ..... page S-32
2. Nut
3. Instrument panel  
Removal / Installation ..... page S-50

4. Wiper motor and bracket  
Installation Note ..... page S-31  
Disassembly / Assembly ..... page S-33  
Inspection ..... page S-33
5. Windshield wiper link assembly

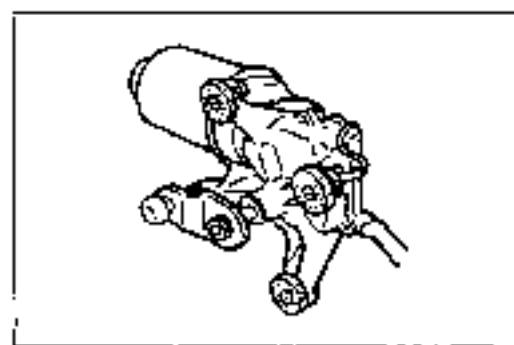
## Washer nozzle



9TG05X-042

1. Instrument panel  
Removal / Installation ..... page S-50
2. Clip

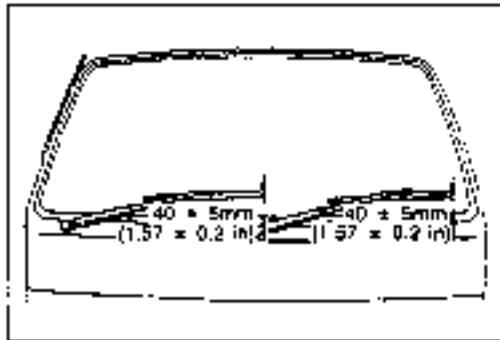
3. Washer nozzle  
Adjustment ..... page S-32



4TG05X-043

**Installation note**  
**Wiper motor and bracket**

1. Align the wiper motor arm as shown in the figure.



STG051-044

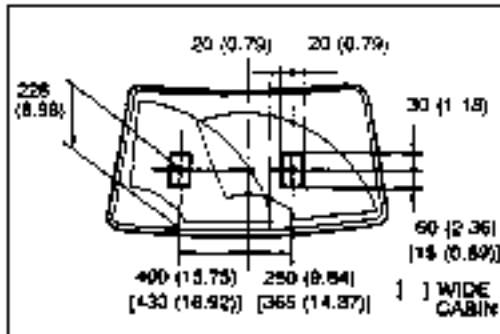
**Adjustment****Wiper arm height**

1. Turn the wiper switch from ON to OFF to set the wiper arm park position.
2. Adjust the arm height as shown in the figure.

**Height:** 40 ± 5mm (1.57 ± 0.2 in)

**Tightening torque:**

9.8—14 Nm (100—140 cm-kg, 67—121 in-lb)



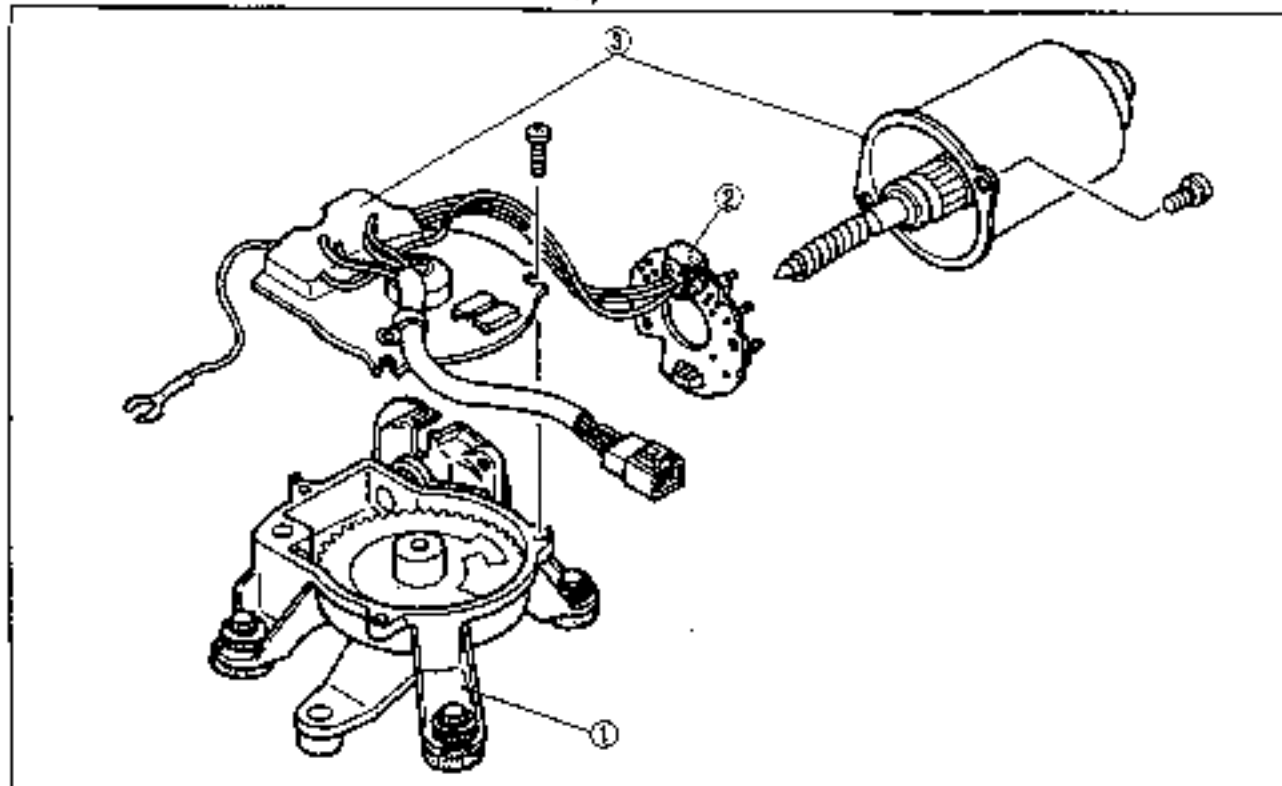
STG051-045

**Washer spray**

1. Insert a needle or similar object into the nozzle hole and move the nozzle to change the direction of spray.

**WIPER MOTOR****Disassembly / Assembly**

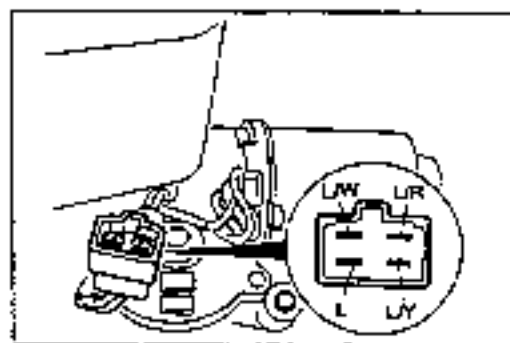
1. Disassemble in the order shown in the figure.
2. Assemble in the reverse order of disassembly.



1. Bracket
2. Brush holder plate

3. Motor assembly

8T065X-049



8T065X-050

**Inspection****Continuity**

1. Remove the blower motor.
2. Disconnect the wiper motor connector.
3. Check continuity between terminals

Terminal	L/R	L/Y	L/W	L
Auto-stop position	○	○	○	
Other position	○	○	○	○

4. If not as specified, replace the wiper motor.

**Operation****Note**

- Connect the negative battery terminal to the motor ground wire if checking out of the vehicle.

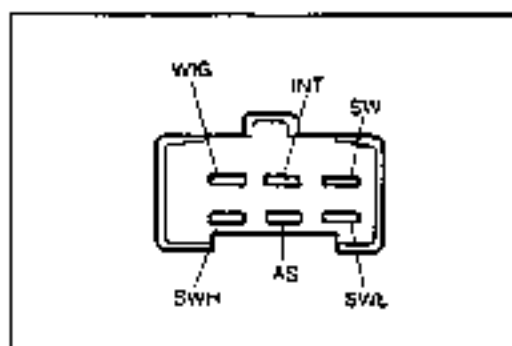
1. Disconnect the wiper motor connector.
2. Verify motor operation when applying 12V to the terminals of the motor connector

12V applied to	Motor operation
(L/W) wire	Rotates at low speed
(L/R) wire	Rotates at high speed

3. If not as specified, replace the wiper motor.

8T065X-048

S-33



9T605X-052

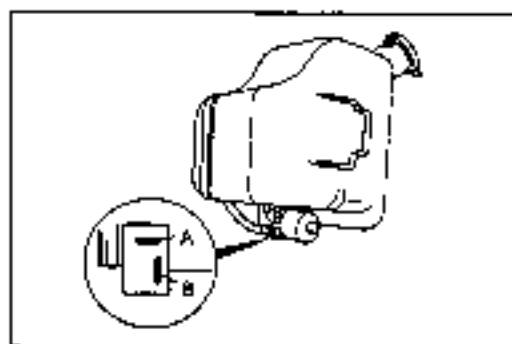
**WIPER AND WASHER SWITCH****Inspection**

1. Check continuity between terminals.

	Wiper	AS	SWL	SWH	WIG	INT	SW
OFF		○	○				
One touch, ON			○		○		
INT		○	○		○	○	
Lo			○		○		
Hi				○	○		
Washer: ON					○		○

○—○. Indicates continuity

2. If not as specified, replace the switch.



9T605X-046

**WASHER MOTOR****Inspection****Continuity**

1. Disconnect the washer motor connector.
2. Check for continuity between terminals of washer motor connector.
3. If not as specified, replace the washer motor.

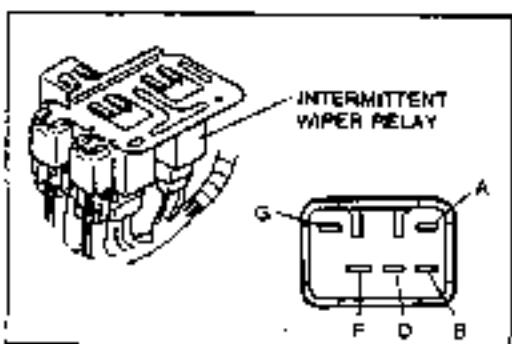
**Operation**

1. Disconnect the washer motor connector.
2. Connect 12V to B terminal and ground A terminal. Verify motor operation.

Terminal	Connection	Motor operation
A	Ground	Operates
B	12V	

3. If not as specified, replace the washer motor.

9T605X-047



9T605X-048

**INTERMITTENT WIPER RELAY****Inspection**

1. Connect a jumper wire between A and D terminals of the relay connector, and connect a voltmeter to B terminal of the relay connector.
2. Turn the engine switch ON and measure the voltage.

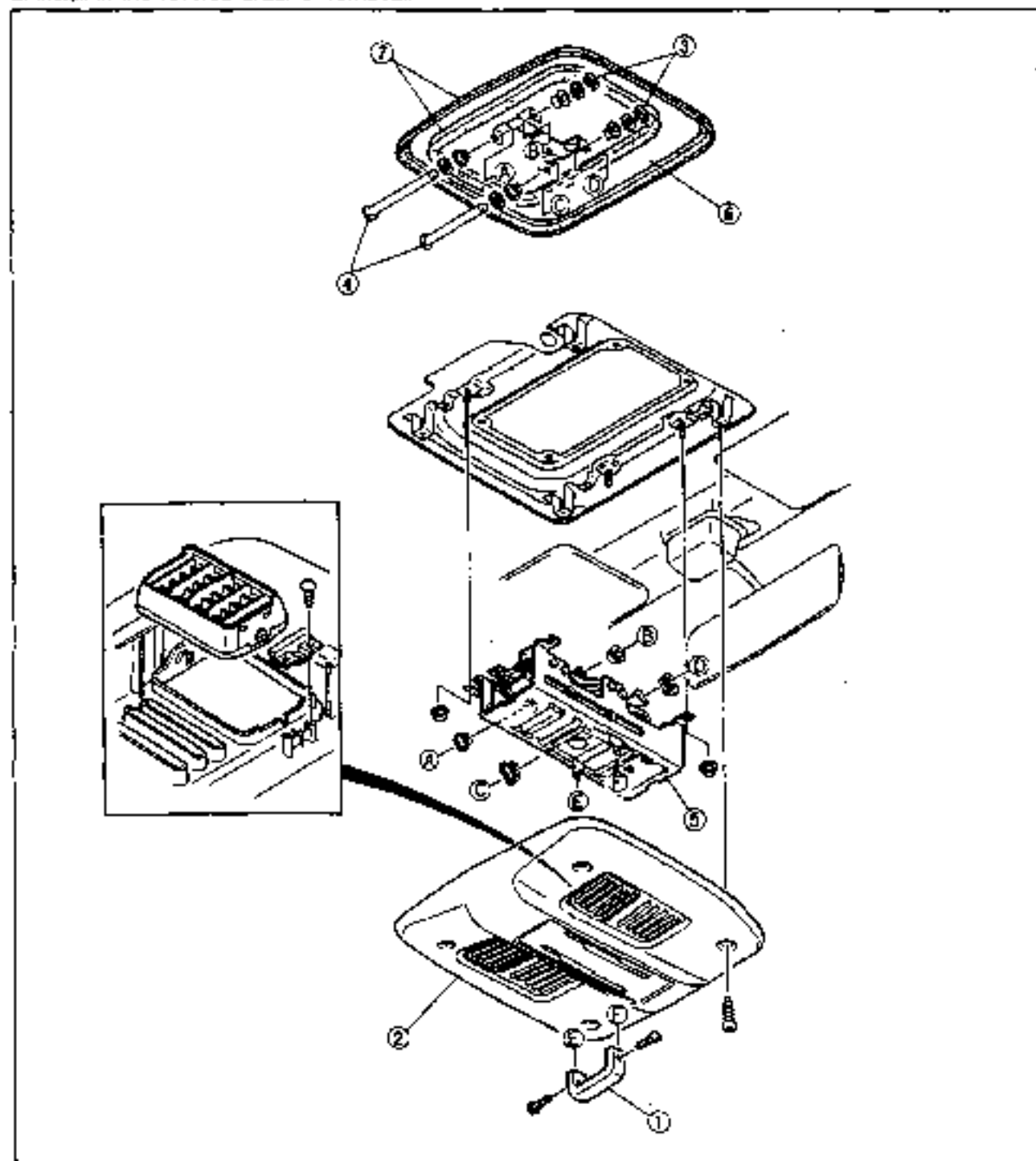
**Voltmeter reading:****Battery voltage 1 time/approx. 5 sec.**

## ROOF VENTILATOR

## COMPONENTS

## Removal / Installation

1. Remove in the order shown in the figure.
2. Install in the reverse order of removal.



1. Lever
2. Ventilator grille
3. Retaining ring
4. Shaft

5. Lever assembly
6. Roof lid assembly
7. Seal rubber

910034-053

## WINDSHIELD

## PREPARATION

## SST

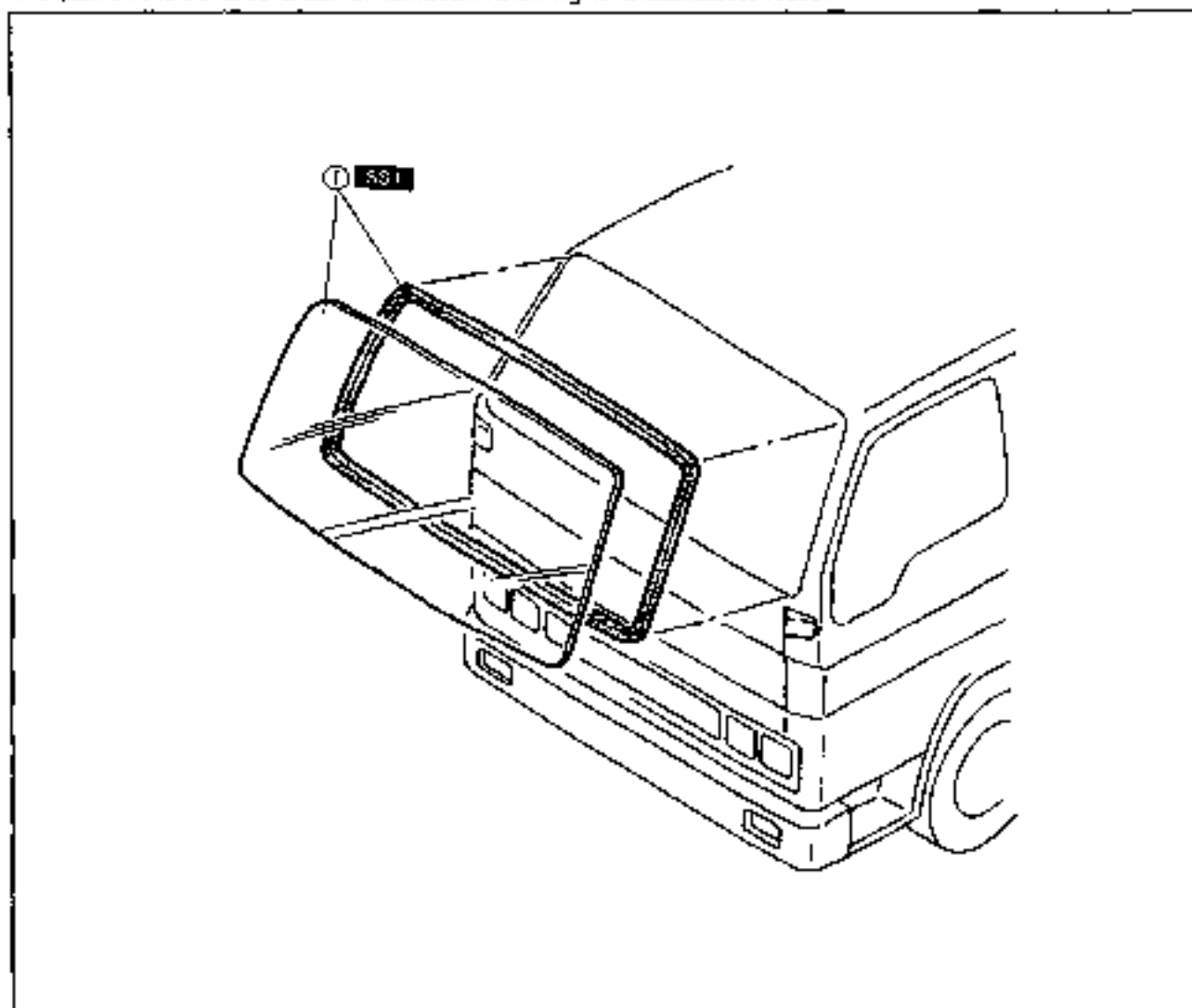
<p>49 0259 066</p> <p>Insert tool windshield</p>		<p>For removal and installation of windshield</p>
--	---	---

9T005x-054

## COMPONENTS

## Removal / Installation

1. Disconnect the negative battery cable.
2. Remove the rearview mirror, wiper arm and blade.
3. Remove in the order shown in the figure, referring to **Removal Note**.
4. Install in the reverse order of removal, referring to **Installation Note**.

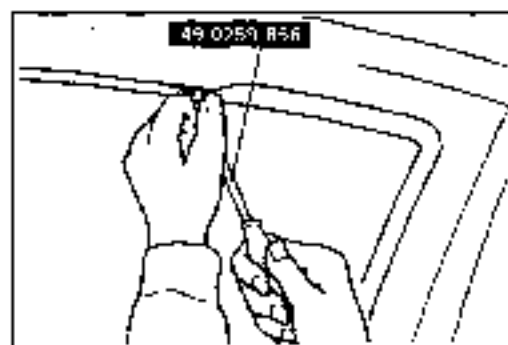


9T005x-065

## 1. Windshield and weatherstrip

Removal Note..... page S-37

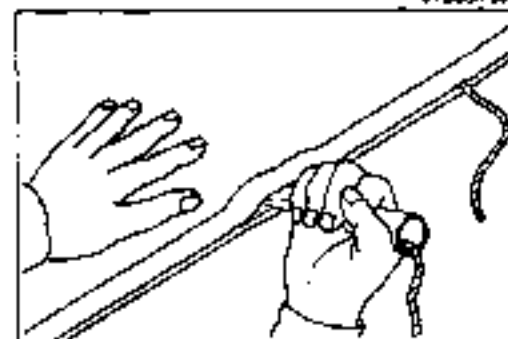
Installation Note..... page S-37



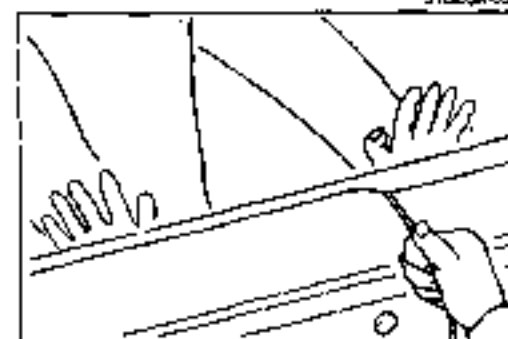
9T005X-056



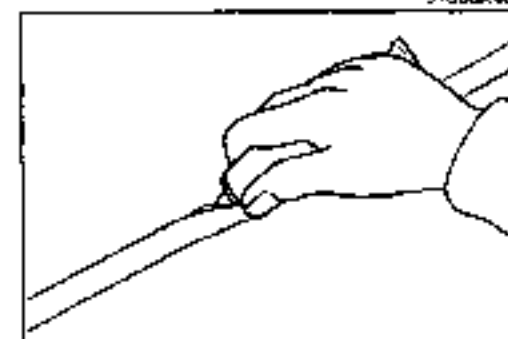
9T005X-057



9T005X-058



9T005X-059



9T005X-060

**Removal note****Windshield and weatherstrip**

1. Pry the weatherstrip outward from within the cabin with SST.
2. Remove the windshield together with the weatherstrip.

**Installation note****Windshield and weatherstrip**

1. Remove the sealant from the body surface.
2. Fit the weatherstrip onto the windshield.

3. Insert heavy string around the weatherstrip.
4. Apply soapy water to ensure smooth installation between the weatherstrip and the body.
5. Locate the glass and weatherstrip squarely in the windshield frame.

**Note**

+ The following operation must be done with a partner.


6. Tap lightly on the outside of the windshield while pulling the string to install the weatherstrip around the entire circumference.
7. Move the glass by hands on the inside and outside of the glass if it is not properly seated.
8. Protect the body around the window frame with masking tape.
9. Fill with sealant between the weatherstrip and body and between the weatherstrip and glass around the entire circumference.



## BACK WINDOW

## PREPARATION

## SST

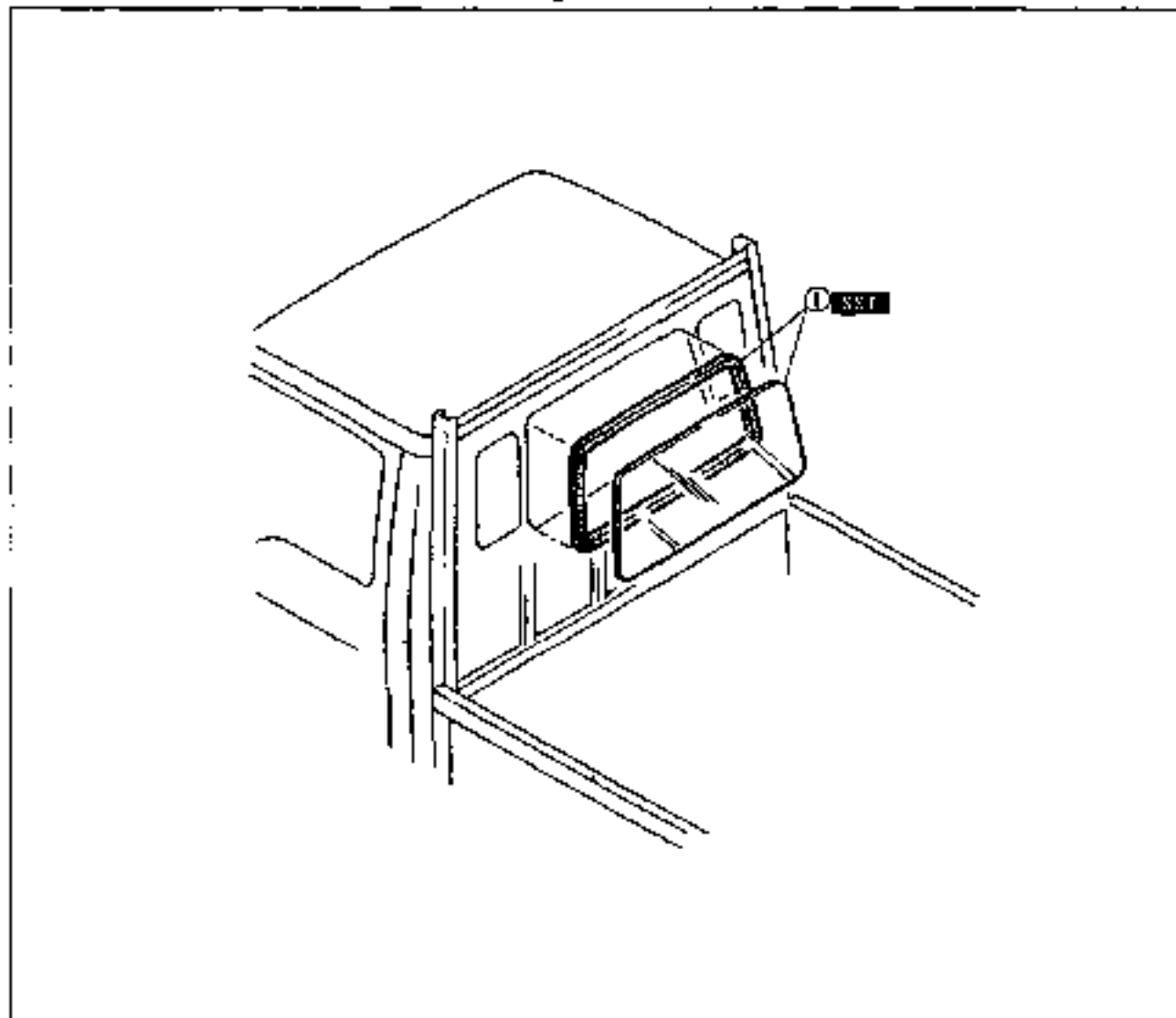
<p>49 0259 B66</p> <p>Insert tool windshield</p> 	<p>For removal and installation of windshield</p>
--	---

9T305X-061

## COMPONENTS

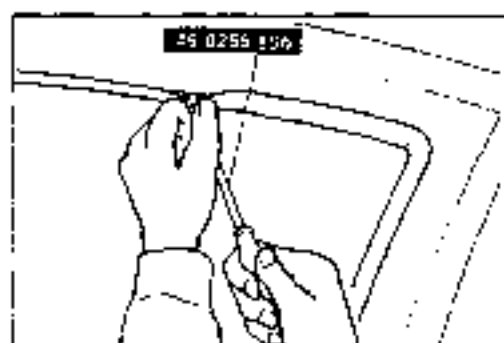
## Removal / Installation

1. Disconnect the negative battery cable.
2. Remove in the order shown in the figure, referring to **Removal Note**.
3. Install in the reverse order of removal, referring to **Installation Note**.



9T605X-062

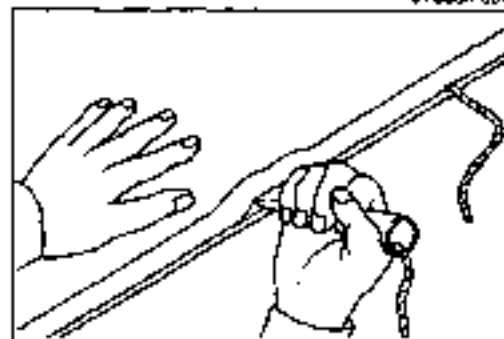
1. Back window and weatherstrip  
 Removal Note ..... page S-39  
 Installation Note ..... page S-39



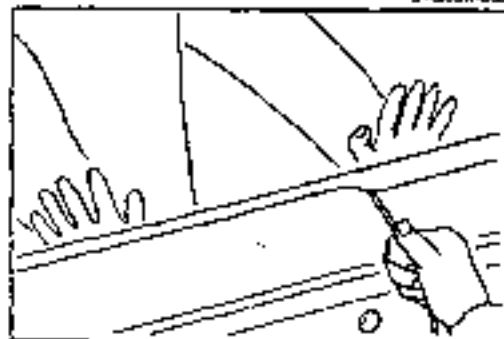
5TG05X-063



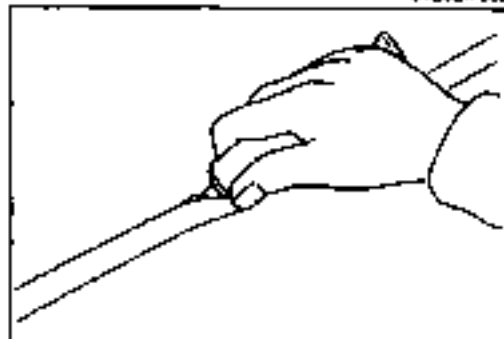
9T203X-064



5TG05X-065



9T005X-066



9T005X-067

**Removal note****Back window and weatherstrip**

1. Pry the weatherstrip outward from within the cabin with SST.
2. Remove the back window together with the weatherstrip.

**Installation note****Back window and weatherstrip**

1. Remove the sealant from the body surface.
2. Fit the weatherstrip onto the back window.

3. Insert heavy string around the weatherstrip.
4. Apply soapy water to ensure smooth installation between the weatherstrip and the body.
5. Locate the glass and weatherstrip squarely in the window frame.

**Note**

+ The following operation must be done by the partner.

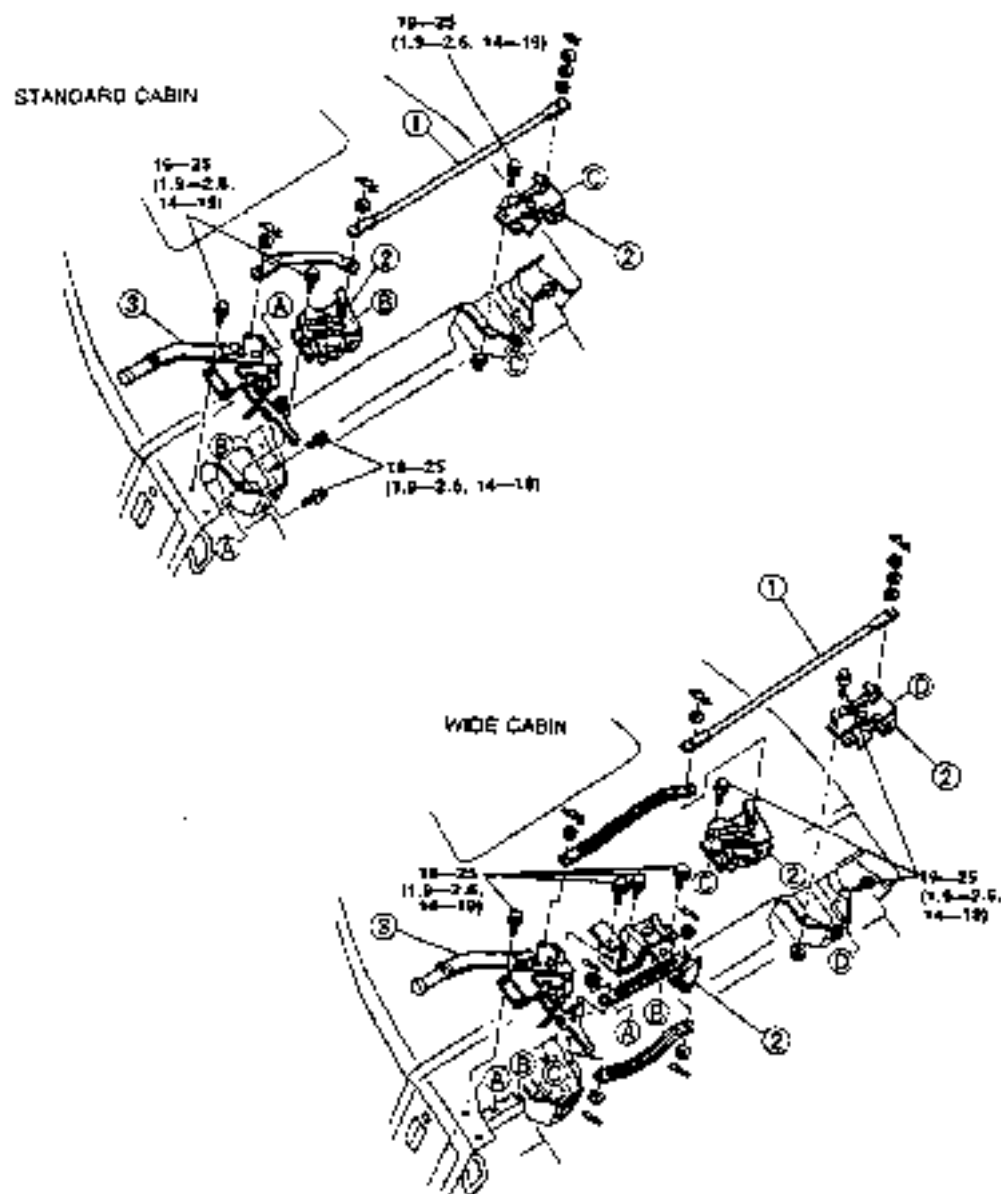
6. Tap lightly on the outside of the back window while pulling the string to install the weatherstrip around the entire circumference.
7. Move the glass by hands on the inside and the outside of the glass if it is not properly seated.
8. Protect the body around the window frame with masking tape.
9. Fill with sealant between the weatherstrip and body and between the weatherstrip and glass around the entire circumference.

## TILT LOCK SYSTEM

## COMPONENTS

## Removal / Installation

1. Disconnect the negative battery cable.
2. Tilt the cabin and verify that it is securely locked in position.
3. Remove in the order shown in the figure.
4. Install in the reverse order of removal.

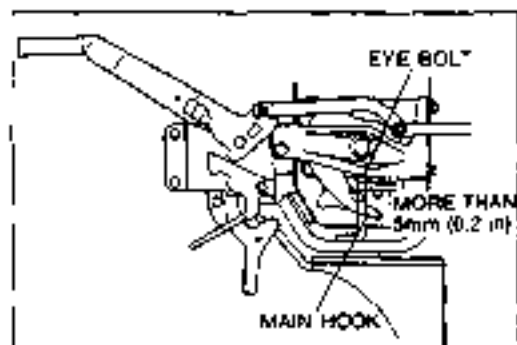


444 (mkg. 11-96)

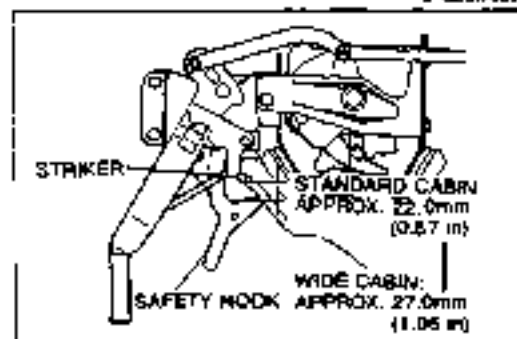
97F05X-001

1. Rod
2. Hook assembly

3. Lock lever assembly



STGCS-069



QTR08-002

**Inspection**

1. Lower the cabin and measure the clearance between the main hook and eye bolt

**Clearance: 5mm (0.2 in) min.**

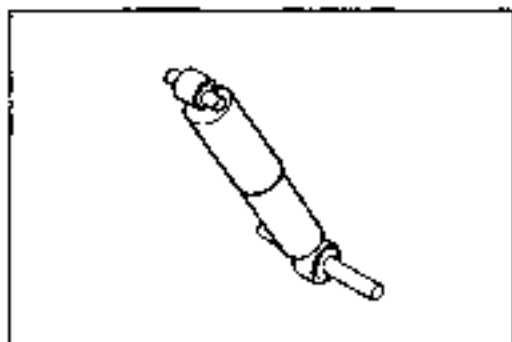
2. Verify that when the main hook is completely locked, the clearance between safety hook and striker is as specified.

**Clearance:**

**Wide cabin approx. 27.0mm (1.06 in)**

**Standard cabin approx. 22.0mm (0.87 in)**

3. If clearance is not within specification, check for a worn main hook or worn eye bolt, and check the lock installation



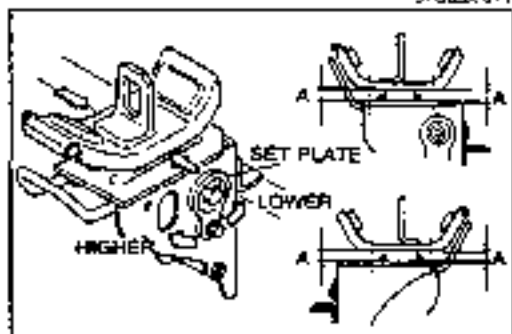
9TG05X-071

## CABIN MOUNT

## DAMPER

## Inspection (On-vehicle)

1. Verify that there is no oil leakage from the damper.  
Replace the damper if it is leaking.



9TG05X-072

## CABIN MOUNT (With rear cabin damper)

## Inspection (On-vehicle)

1. Check for heights A as shown in the figure.

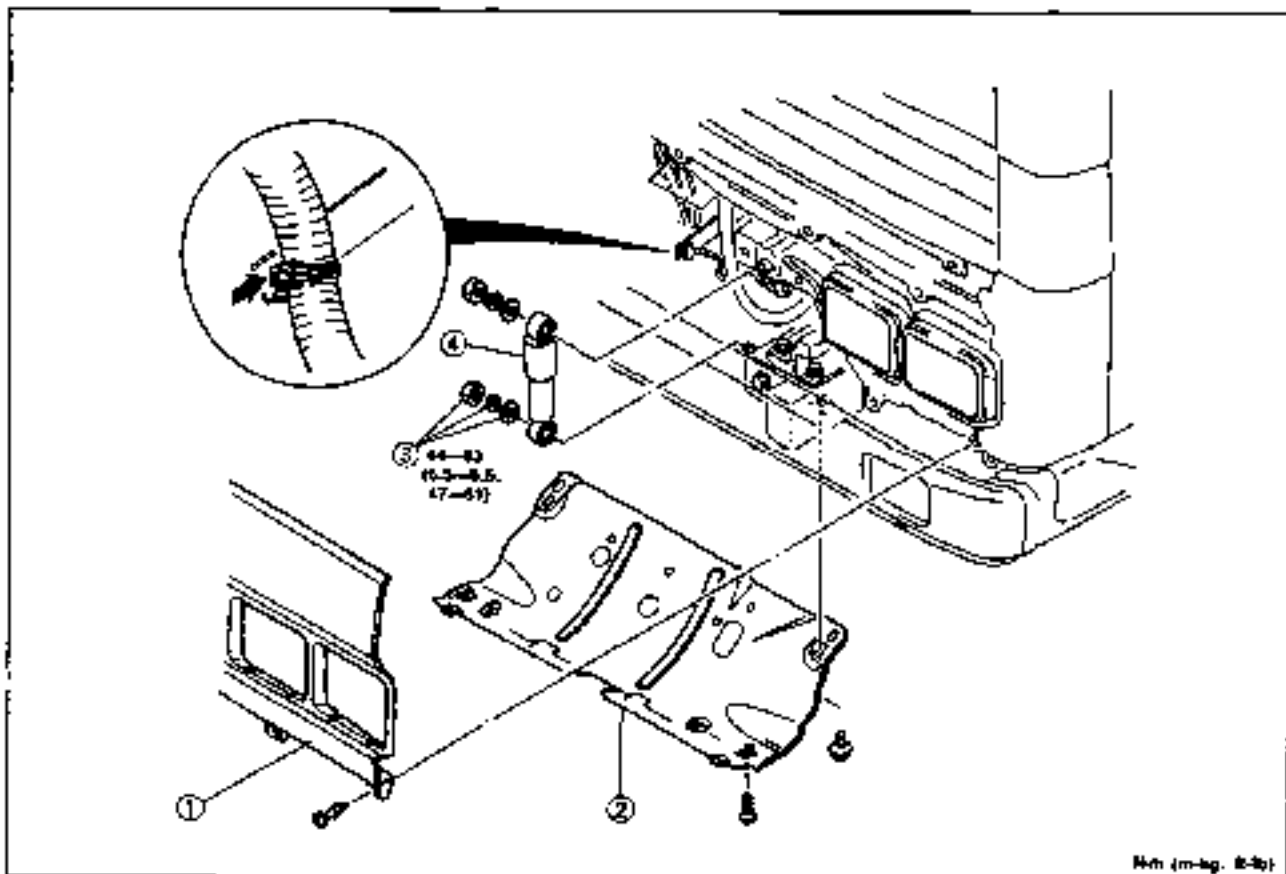
## Height:

- |                |                         |                              |
|----------------|-------------------------|------------------------------|
| Wide cabin     | $43.0 \pm 1.0\text{mm}$ | $(1.69 \pm 0.04 \text{ in})$ |
| Standard cabin | $26.4 \pm 1.0\text{mm}$ | $(1.04 \pm 0.04 \text{ in})$ |

## Caution

- Loosen the damper mounting bolts when adjusting
2. Adjust the height by moving the set plate if not as specified.

## FRONT CABIN DAMPER



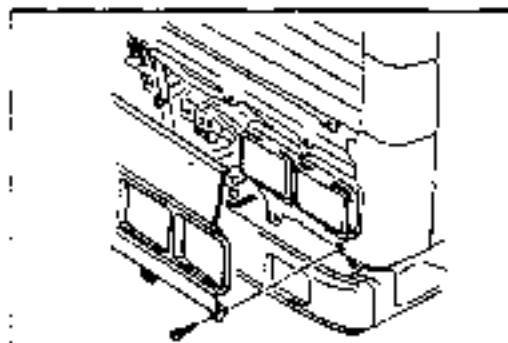
9TG05X-073

9TG05X-073

1. Radiator grille
2. Undercover

3. Nut, lock washer, washer
4. Front cabin damper

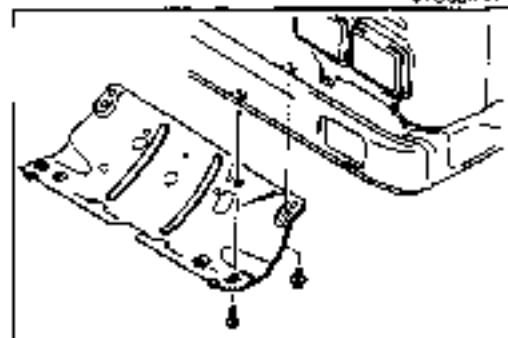
Inspection (On-vehicle)..... page S-42



9TG05X-074

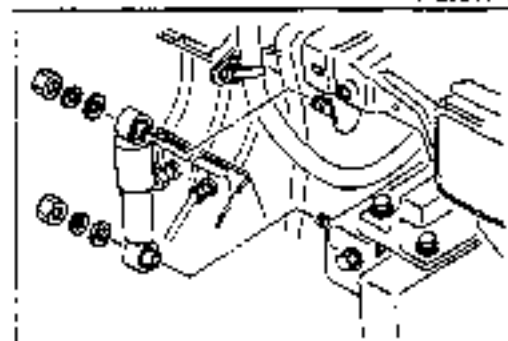
**Removal**

1. Remove the radiator grille.



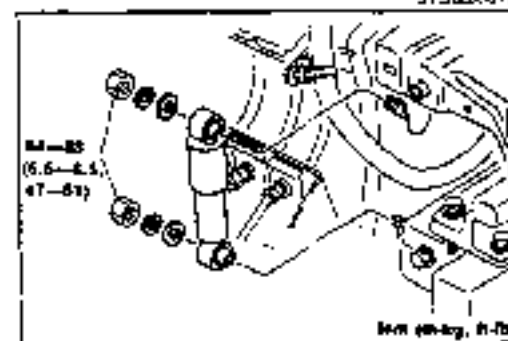
9TG05X-075

2. Remove the undercover



9TG05X-076

3. Remove the nuts and front cabin damper.



9TG05X-077

**Installation**

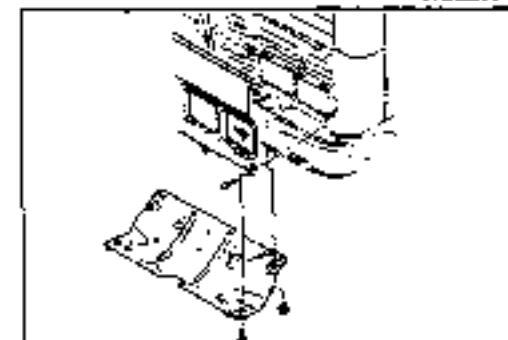
1. Install the damper between the frame and cabin.
2. Install nuts and tighten to the specified torque.

**Tightening torque:**

64—83 Nm (6.5—8.5 m·kg, 47—61 ft·lb)

64—83  
(6.5—8.5  
47—61)

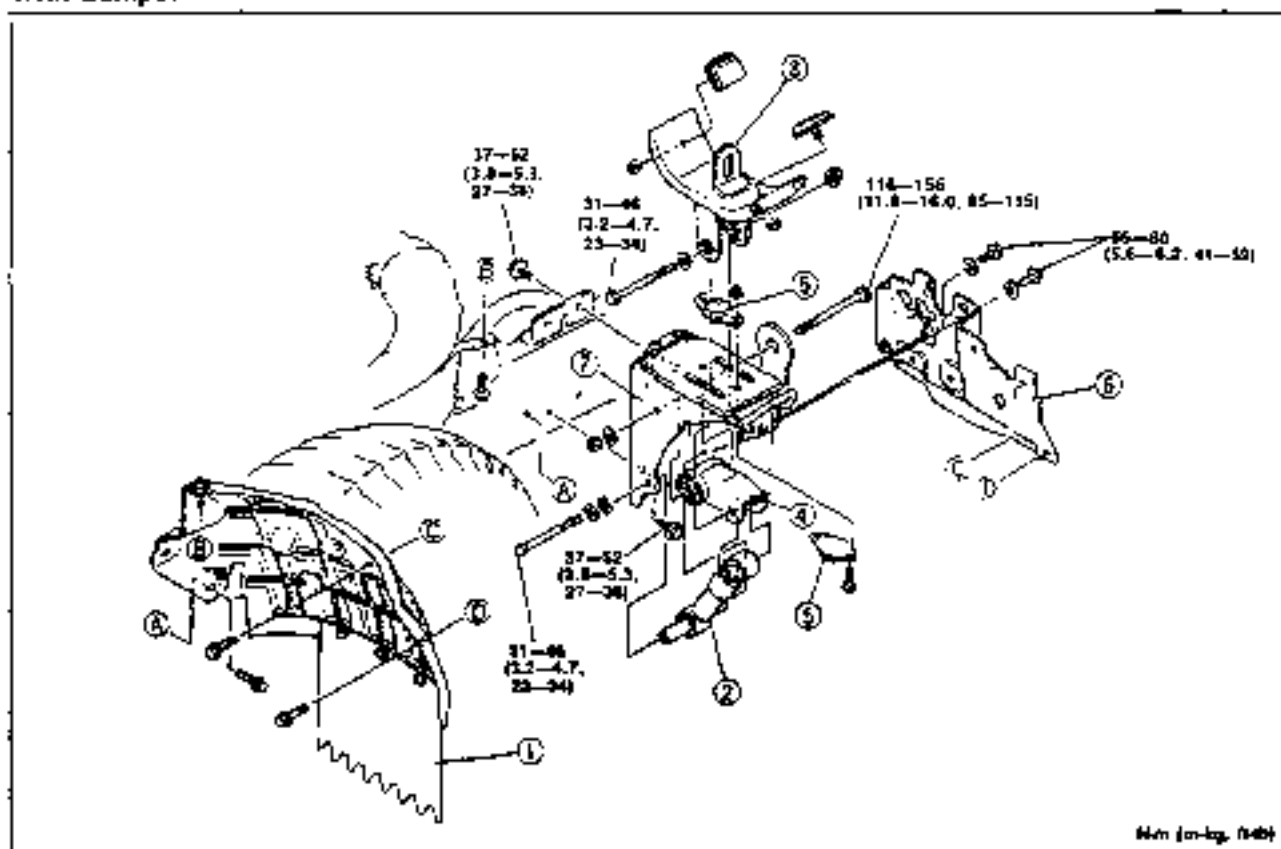
3. Install the undercover and radiator grille.



9TG05X-078

## REAR CABIN MOUNT

With damper



1. Mud guard and flap

2. Rear cabin damper

Inspection (On-vehicle) ..... page S-42

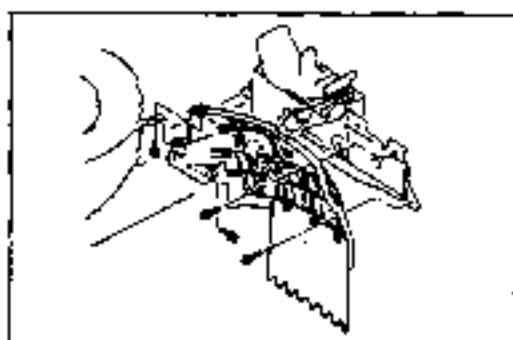
3. Wedge

4. Arm assembly

5. Stopper rubber

6. Front flap bracket

7. Cabin mount bracket



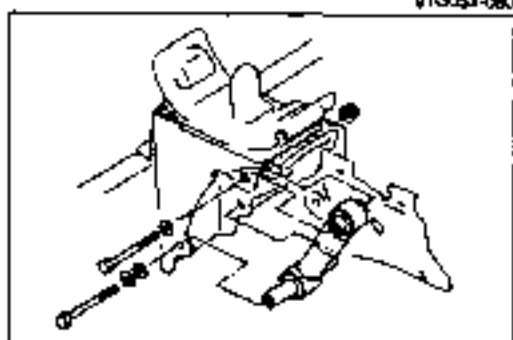
9TG03r-080

## Removal

## Caution

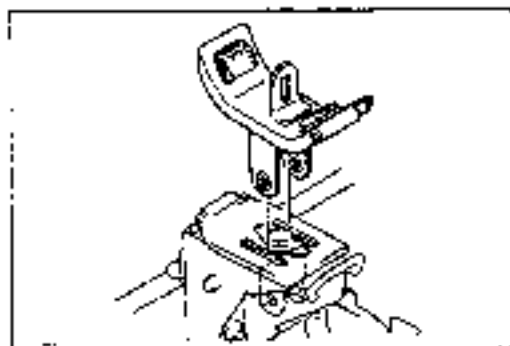
- Securely lock the cabin when raised.
- Disconnect the negative battery cable.

1. Remove the mud guard flap.



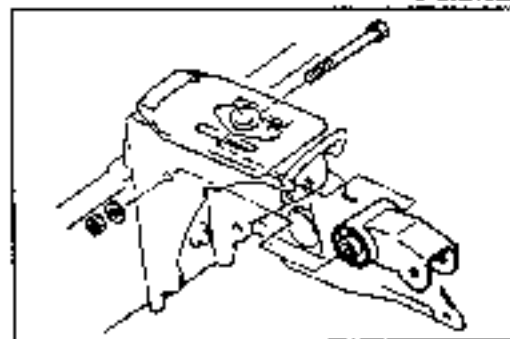
9TG05X-091

2. Remove the damper mounting bolts and damper.



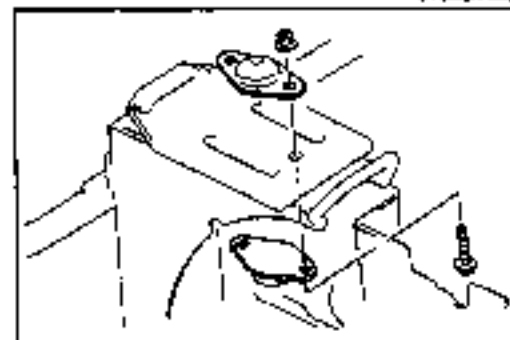
BTG05X-082

3. Remove the wedge



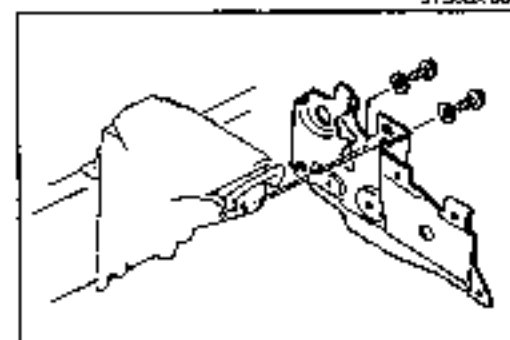
BTG05X-083

4. Remove the arm mounting bolts and arm.



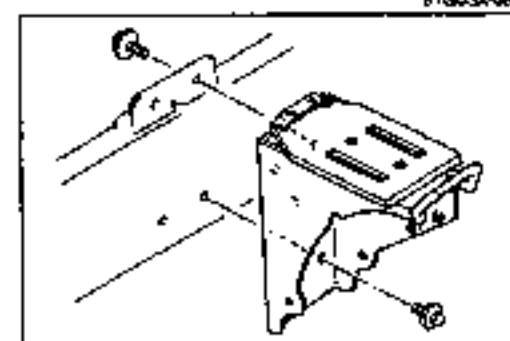
BTG05X-084

5. Remove the nuts and stopper rubber.



BTG05X-085

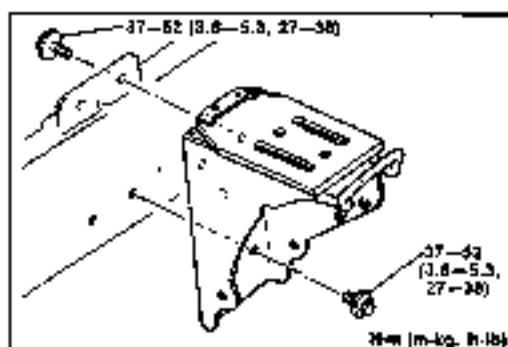
6. Remove the front flap bracket.



BTG05X-086

7. Remove the cabin mount bracket.

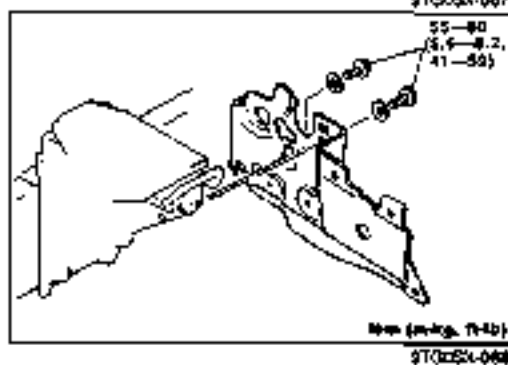


**Installation**

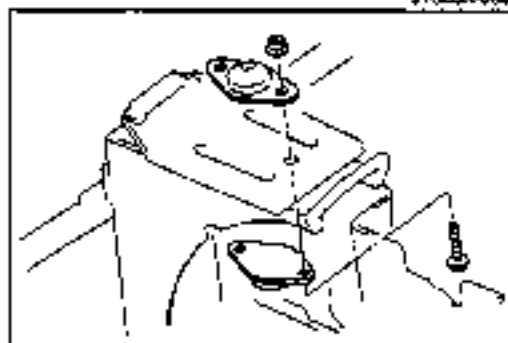
1. Install the cabin mount bracket.

**Tightening torque:**

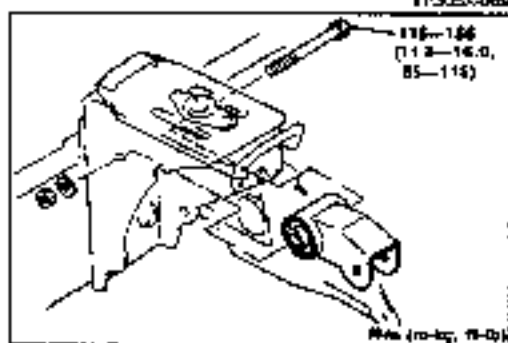
37-52 N·m (3.8-5.3 m·kg, 27-38 ft·lb)



2. Install the front flap bracket.



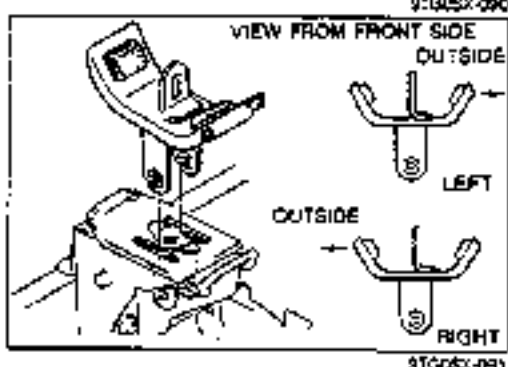
3. Install the stopper rubber.



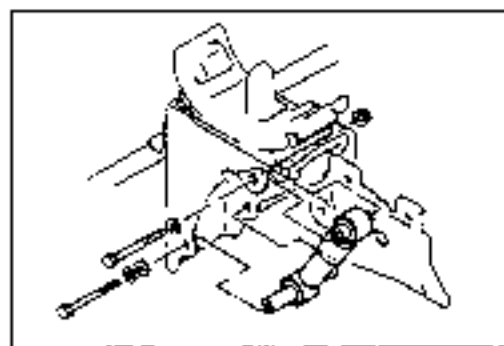
4. Install the arm and bolt.

**Tightening torque:**

116-156 N·m (11.8-16.0 m·kg, 85-115 ft·lb)



5. Install the wedge as shown in the figure.

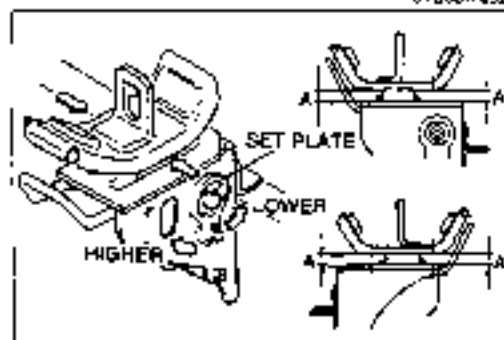


81G05K-092

6. Install the damper and loosely tighten the bolts.
7. Check for heights A as shown in the figure.  
(Refer to page S-42.)
8. Adjust the height by moving the set plate if not as specified.
9. Tighten the bolt with specified torque.

**Tightening torque:**

**31—46 N·m (3.2—4.7 m·kg, 23—34 ft·lb)**



9TG05K-004

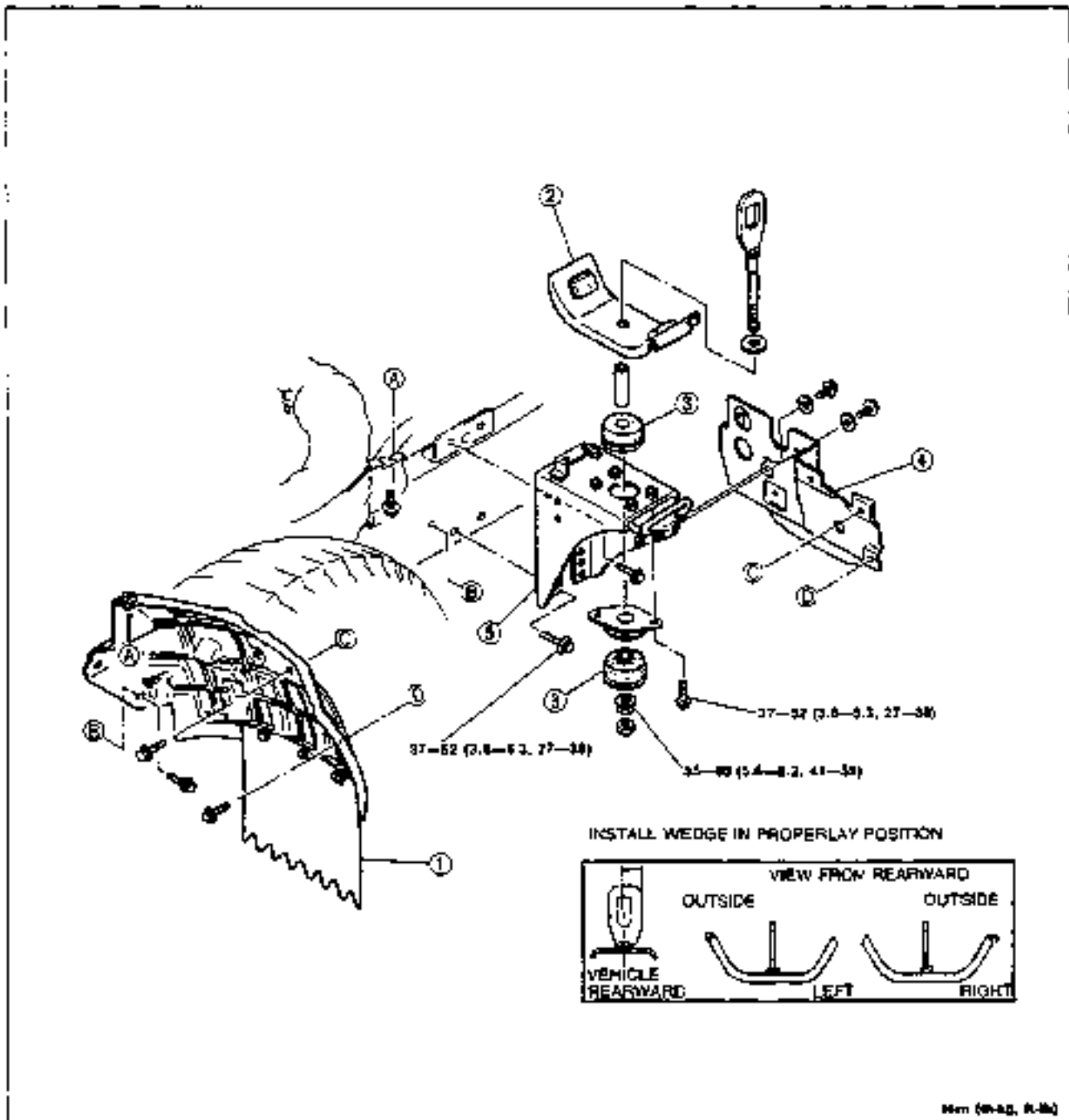
10. Install the mud guard flap.

### REAR CABIN MOUNT Without Damper Removal / Installation

#### Caution

- Securely lock the cabin while raised.

1. Disconnect the negative battery cable.
2. Remove in the order shown in the figure.
3. Install in the reverse order of removal.

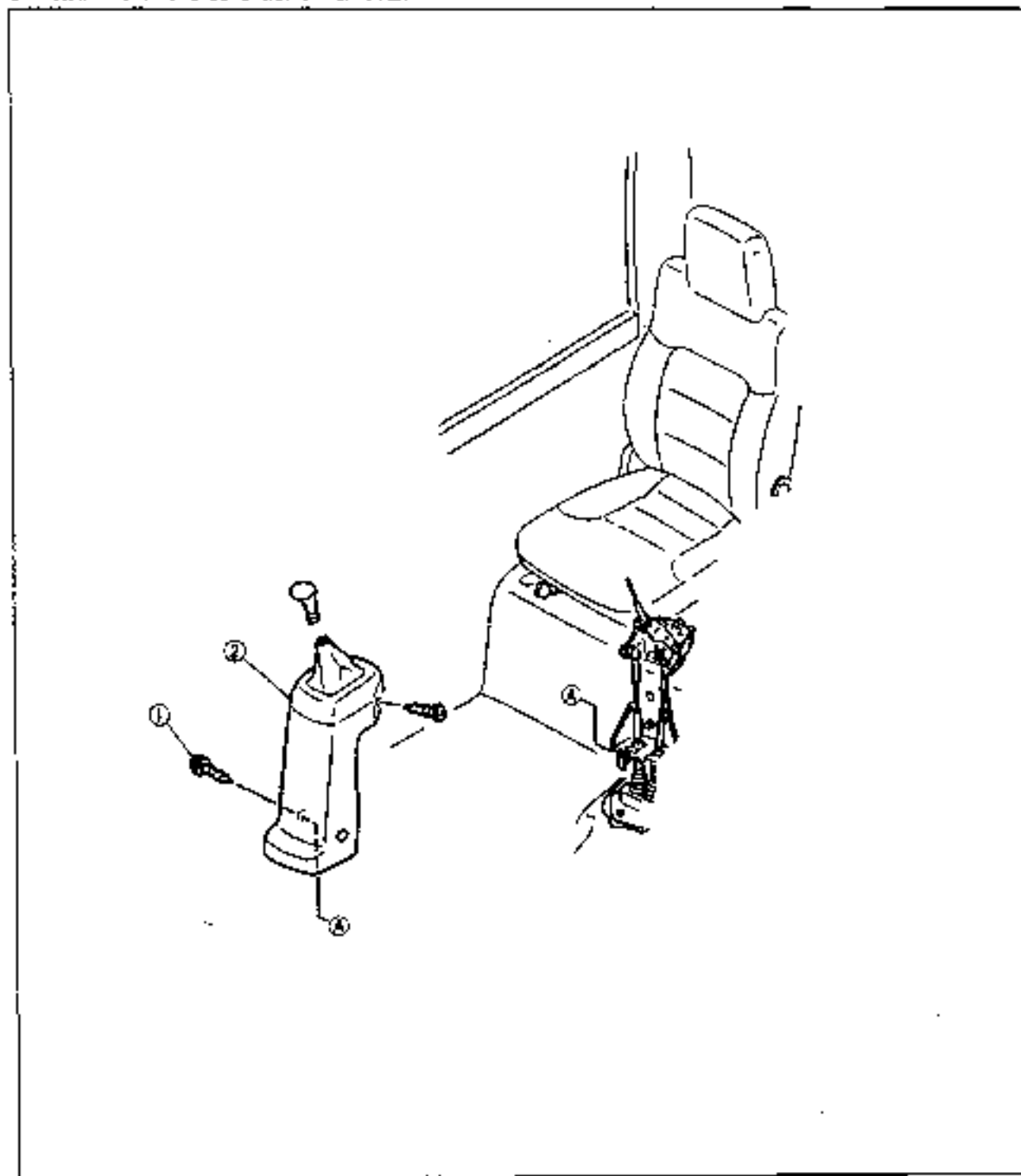


1. Mud guard and flap
2. Wedge
3. Bushing

4. Front flap bracket
5. Rear cabin bracket

**CONSOLE****COMPONENTS****Removal / Installation**

1. Remove in the order shown in the figure.
2. Install in the reverse order of removal.



9TFC6X-003

**Console**

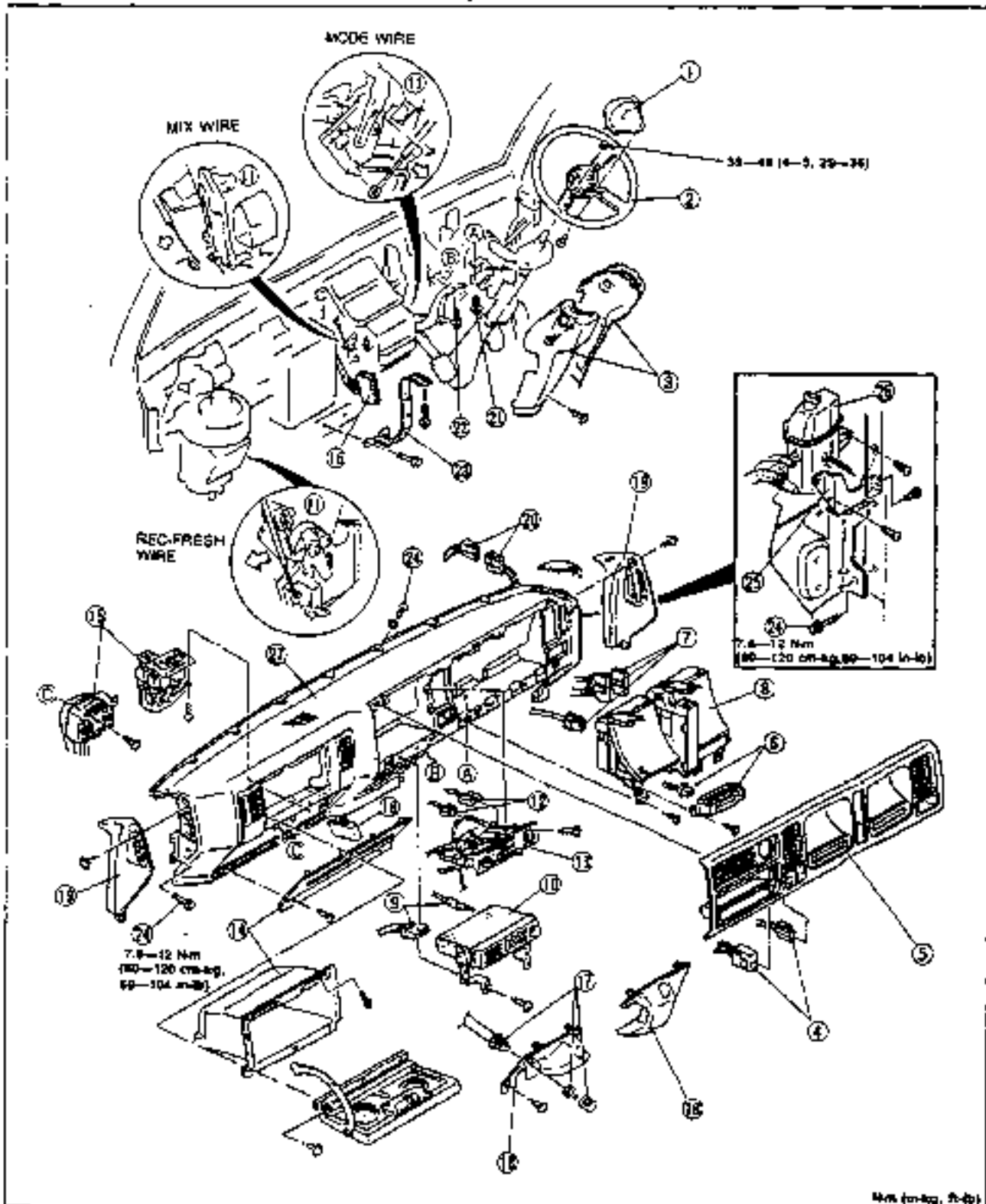
1. Screws
2. Console

## INSTRUMENT PANEL

## COMPONENTS

## Removal / Installation

1. Disconnect the negative battery cable.
2. Remove in the order shown in the figure, referring to **Removal Note**.
3. Install in the reverse order of removal, referring to **Installation Note**.

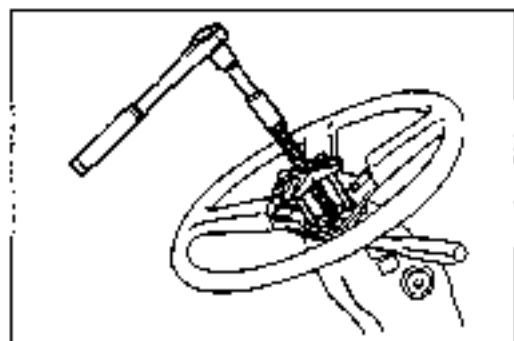


MVA (cm-kg, ft-lb)

BT005X-087

- |  |  |
|--|--|
| <ul style="list-style-type: none"> <li>1. Horn cover</li> <li>2. Steering wheel<br/>Removal Note . . . . . page S-51<br/>Installation Note . . . . . page S-52</li> <li>3. Steering column cover</li> <li>4. Connectors<br/>(fog light switch, exhaust heating switch)</li> <li>5. Instrument cluster panel</li> <li>6. Clock</li> <li>7. Connector (meter), speedometer cable</li> <li>8. Instrument cluster (meter)</li> <li>9. Connector (audio), antenna feeder</li> <li>10. Audio</li> <li>11. Heater control wire<br/>Removal Note . . . . . page S-51<br/>Installation Note . . . . . page S-52</li> <li>12. Connector (heater control unit)</li> </ul> | <ul style="list-style-type: none"> <li>13. Heater control unit</li> <li>14. Lower panel, glove box</li> <li>15. Fuse box, relay assembly</li> <li>16. Connector<br/>(for instrument panel harness: 21-pin)</li> <li>17. Idling knob, cable</li> <li>18. Lower panel</li> <li>19. Side panel</li> <li>20. Connector (brake fluid level sensor)</li> <li>21. Steering bracket mounting bolt</li> <li>22. Parking brake bracket mounting bolt</li> <li>23. Bracket</li> <li>24. Instrument panel mounting bolt<br/>Installation Note . . . . . page S-51</li> <li>25. Brake reserve tank bracket</li> <li>26. Brake reserve tank</li> <li>27. Instrument panel</li> </ul> |
|--|--|

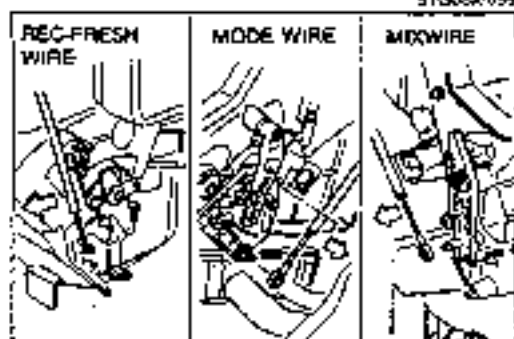
9TG05X-099



9TG05X-099

**Removal note**  
**Steering wheel**

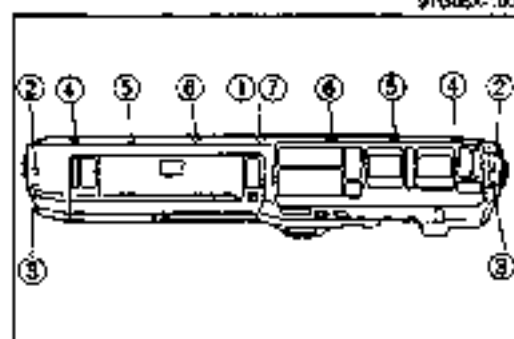
1. Remove the steering wheel with a steering wheel puller.



9TG05X-100

**Heater control wire**

1. Disconnect the REC-FRESH wire from the blower unit door link.
2. Disconnect the MODE and MIX wires from the heater unit door links.



9TG05X-101

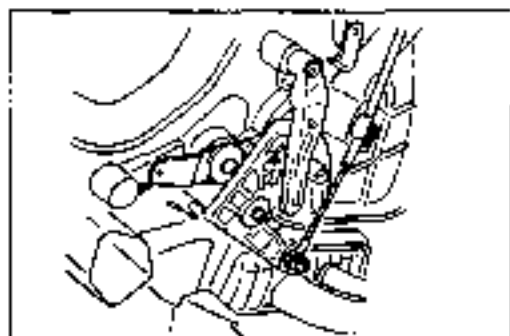
**Installation note**  
**Instrument panel mounting bolt**

1. Tighten the instrument panel mounting bolts in the order shown in the figure.

**Heater control wire****Caution**

- Connect the heater control wires to the correct positions.
- Do not bend or twist the wires when installing.
- After installation, move the lever to verify that the wire is securely attached.

9TG09X-102



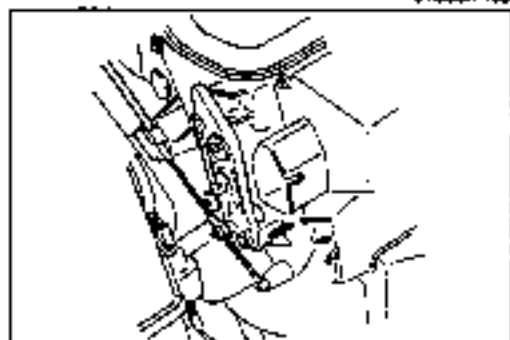
9TG09X-103

**MODE wire****Adjustment**

1. Set the MODE lever to DEF position.
2. Set the MODE door link to DEF position as shown in the figure, and connect the wire.
3. Clamp the wire.

**Caution**

- After installation, move the MODE lever to verify that it moves the full stroke from DEF to VENT.



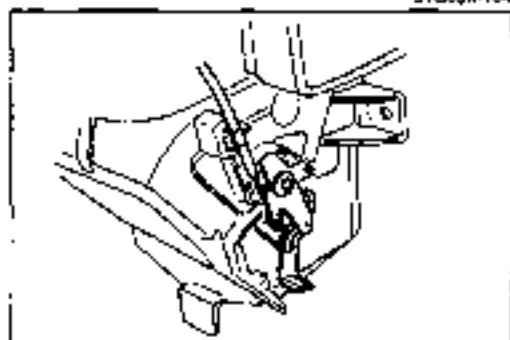
9TG09X-104

**MIX wire****Adjustment**

1. Set the MIX lever to maximum hot position.
2. Set the MIX door link to maximum hot position as shown in the figure, and connect the wire.
3. Clamp the wire.

**Caution**

- After installation, move the MIX lever to verify that it moves the full stroke from HOT to COLD.



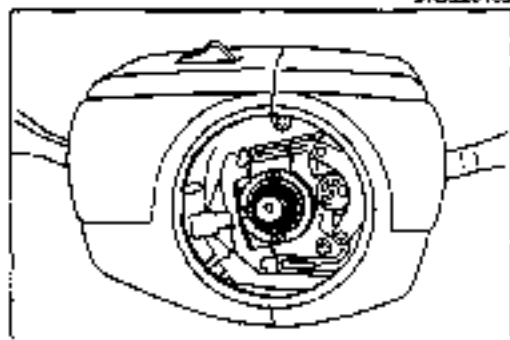
9TG09X-105

**REC-FRESH wire****Adjustment**

1. Set the REC-FRESH lever to REC position.
2. Set the REC-FRESH door link to REC position as shown in the figure, and connect the wire.
3. Clamp the wire.

**Caution**

- After installation, move the REC-FRESH lever to verify that it moves the full stroke from REC to FRESH.



9TG09X-106

**Steering wheel**

1. Set the cancel cam as shown in the figure.

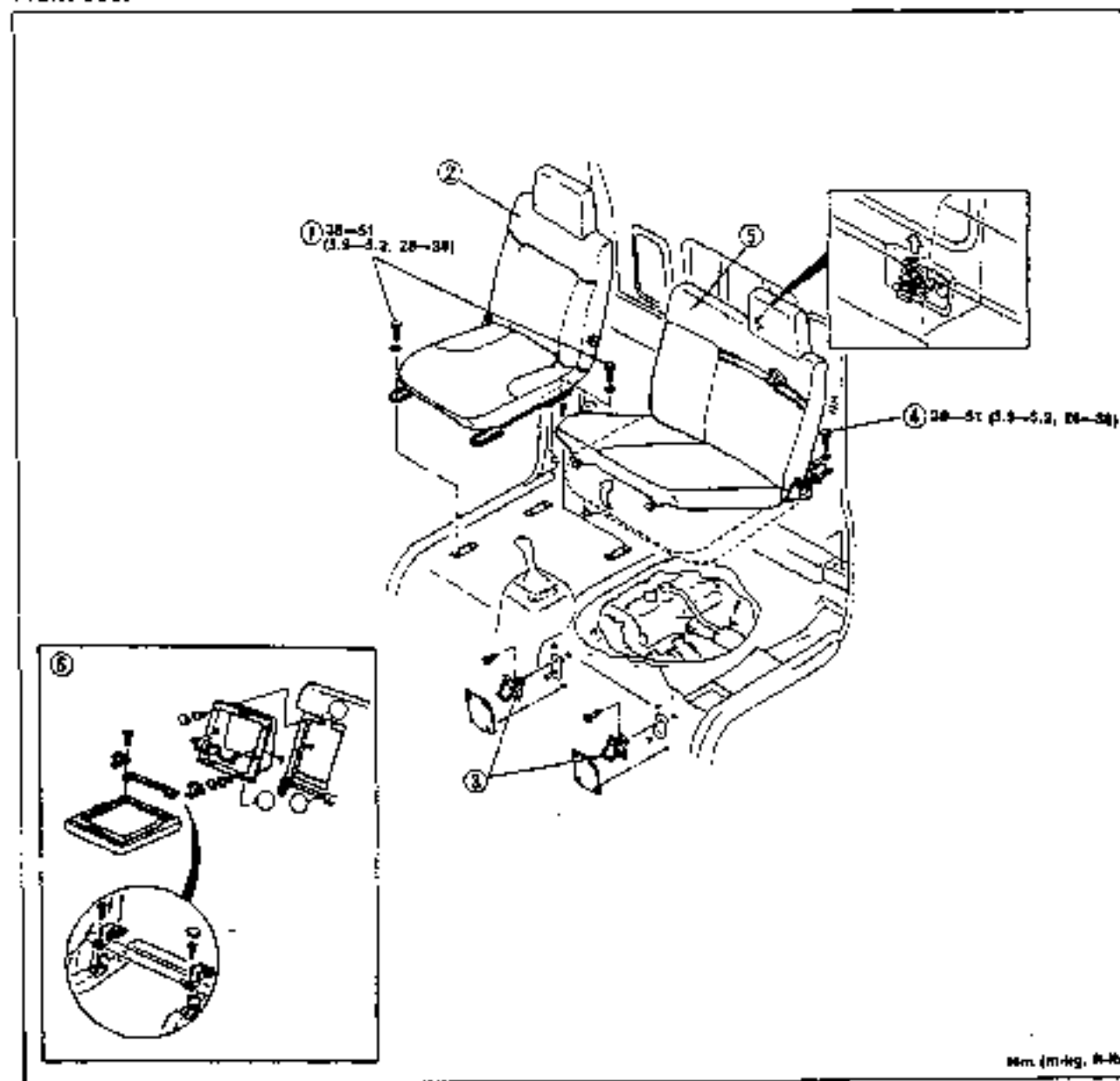
## SEAT

## SEAT

## Removal / Installation

1. Disconnect the negative battery cable.
2. Remove in the order shown in the figure.
3. Install in the reverse order of removal referring to **Installation Note**.

## Front seat



Rev. (m-kg, 8-01)

6TR050-004

## Driver seat

1. Seat mounting bolt
  2. Driver seat
- Installation Note  
..... page S-54  
Disassembly /  
Assembly..... page S-55

## Passenger seat

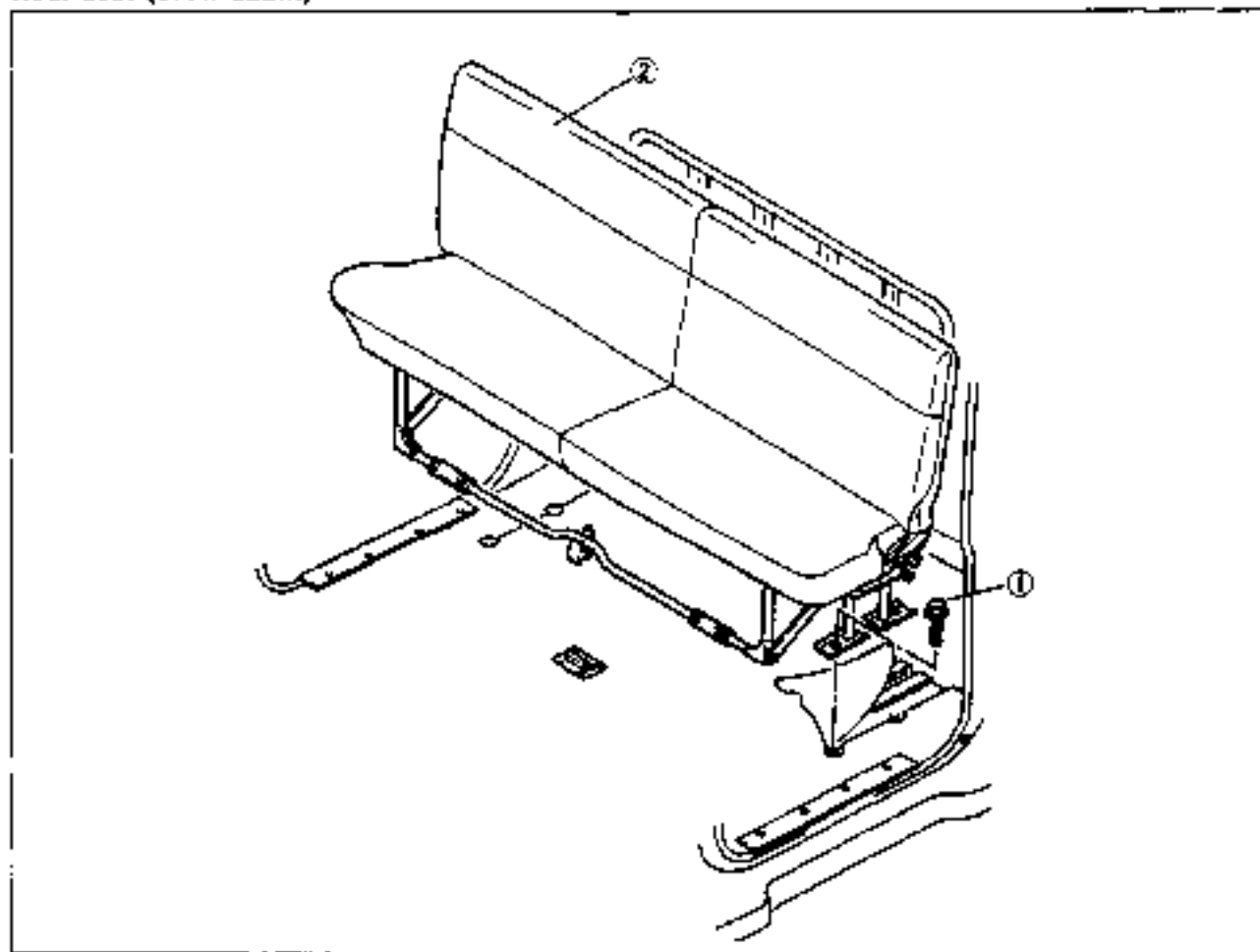
3. Shutter lever
  4. Mounting bolt
  5. Passenger seat
- Installation Note  
..... page S-54  
Disassembly /Assembly  
..... page S-56, 57

## Seatback tray

6. Seatback tray



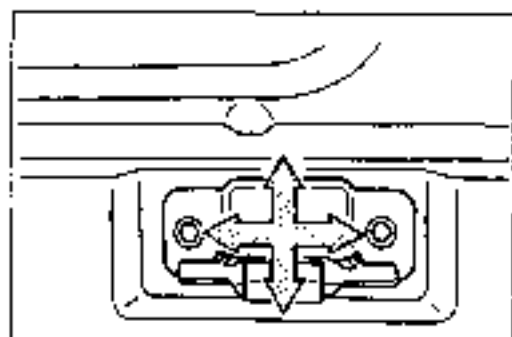
## Rear seat (Crew cabin)



9TGD5X-108

1. Mounting bolt

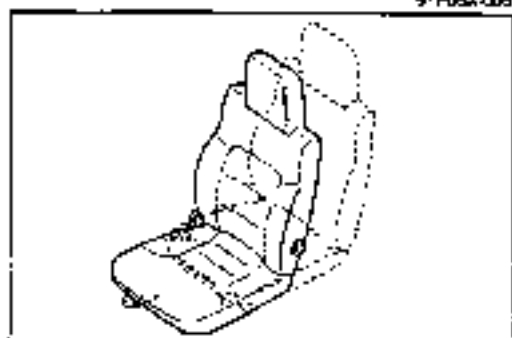
2. Rear seat



9TFO5X-006

**Installation note****Passenger seat**

1. Verify that the seatback lock is securely locked after installation.
2. Adjust the seatback striker if necessary.



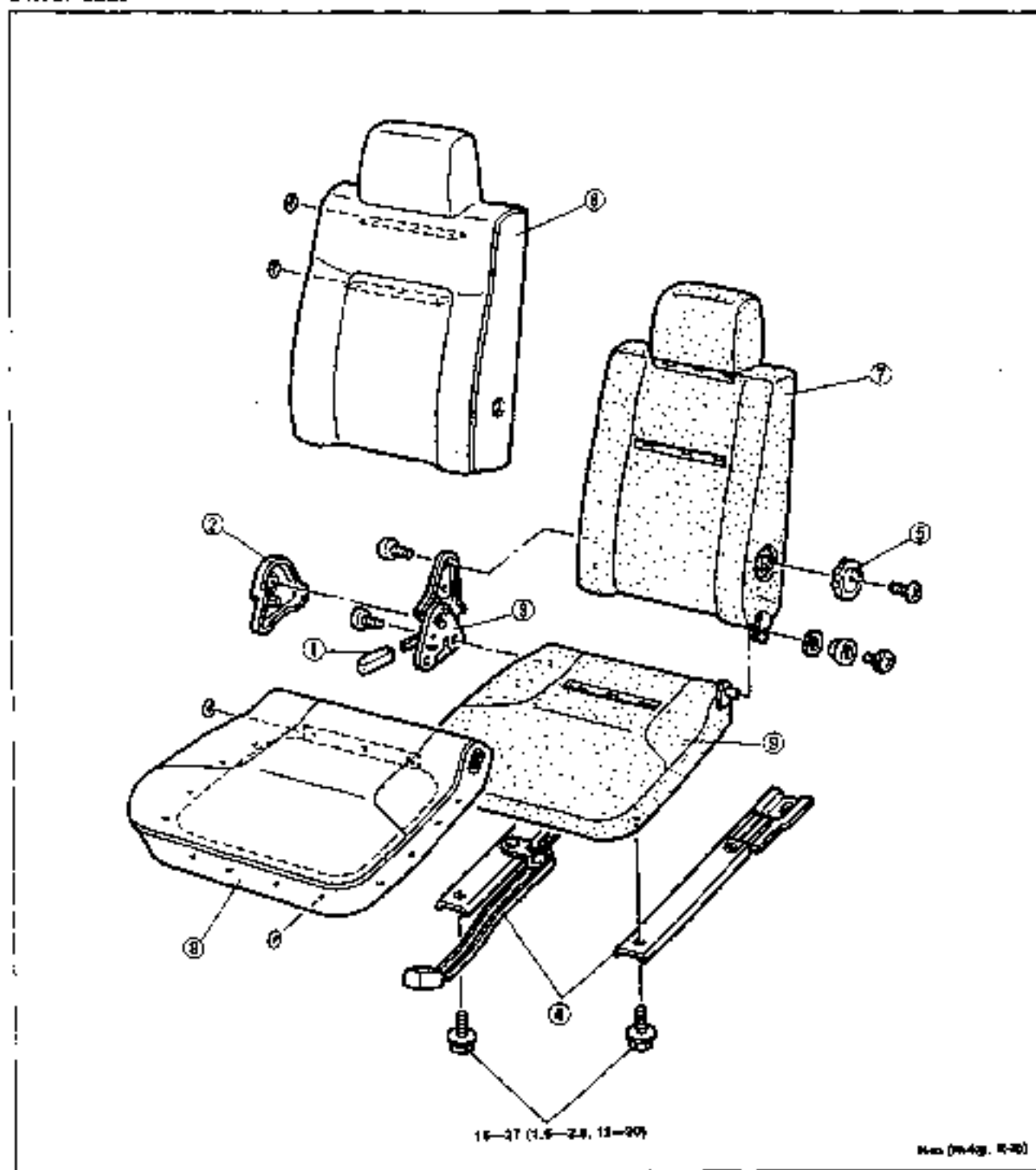
9TGD5X-110

**Driver seat**

1. Verify that the seat slides smoothly.

**Disassembly / Assembly**

1. Disassemble in the order shown in the figure, referring to **Disassembly Note**.
2. Assemble in the reverse order of disassembly.

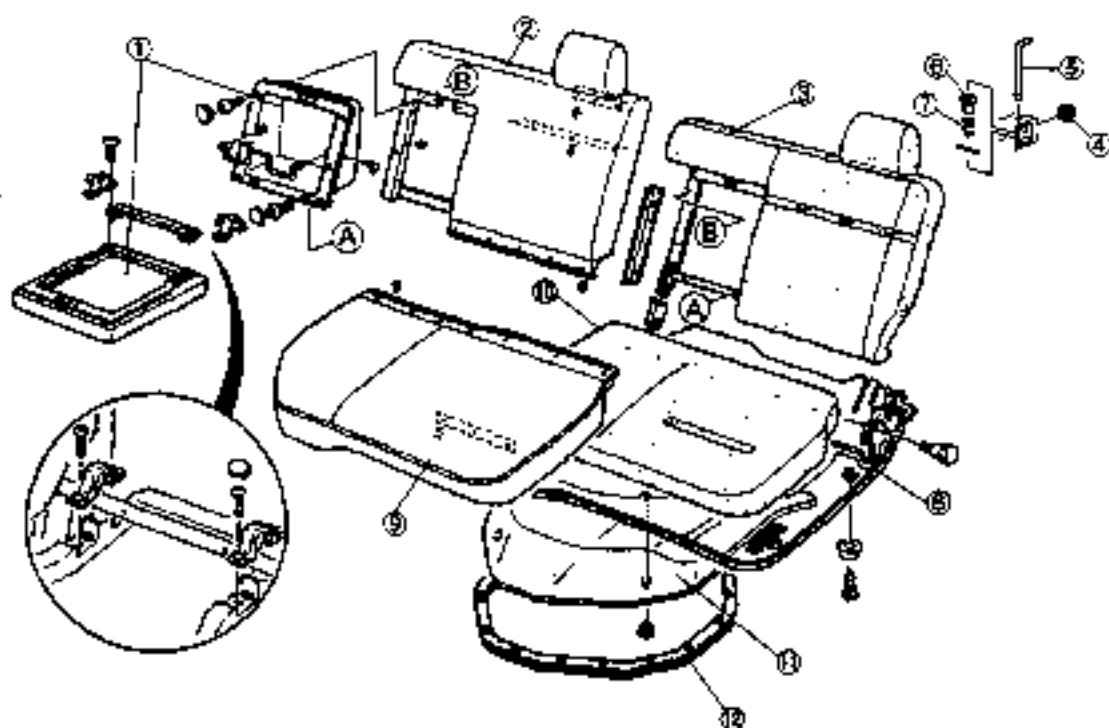
**Driver seat**

Rev. (Rev. 4/99, 11-20)

9TGGGX-111

- |                        |                      |
|------------------------|----------------------|
| 1. Knuckle knob        | 6. Seatback trim     |
| 2. Knuckle cover       | 7. Seatback cushion  |
| 3. Reclining knuckle   | 8. Seat cushion trim |
| 4. Adjuster            | 9. Seat cushion      |
| 5. Lumbar support dial |                      |

## Passenger seat (with seatback tray)



9TF053-005

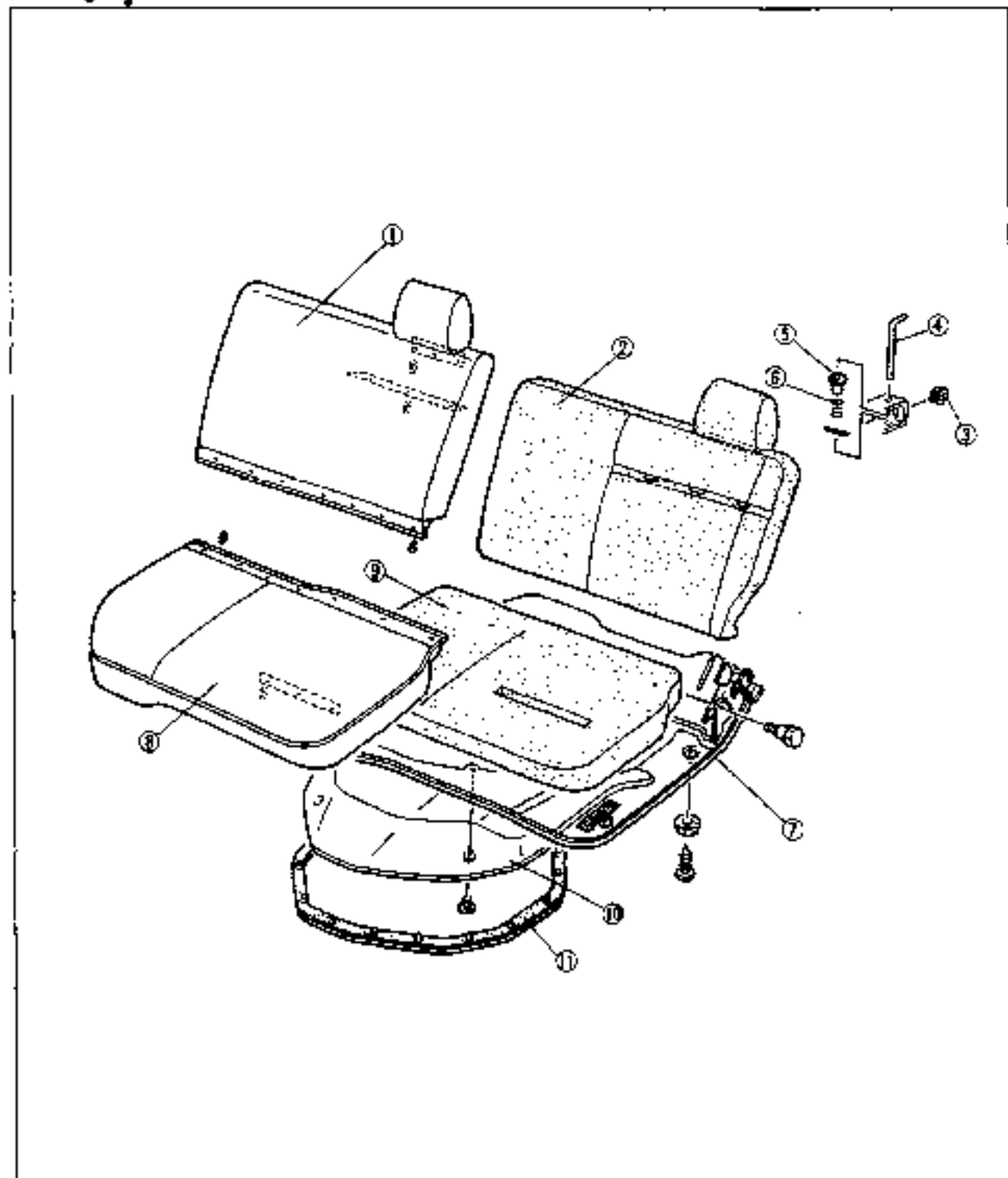
1. Seatback tray
2. Front seatback trim
3. Front seatback cushion
4. Rubber
5. Lock pin
6. Bushing
7. Spring

8. Plate
9. Front seat trim
10. Front seat cushion
- \*1. Insulator

Disassembly Note..... page S-58

12. Rubber seal
- Disassembly Note..... page S-58

## Passenger seat



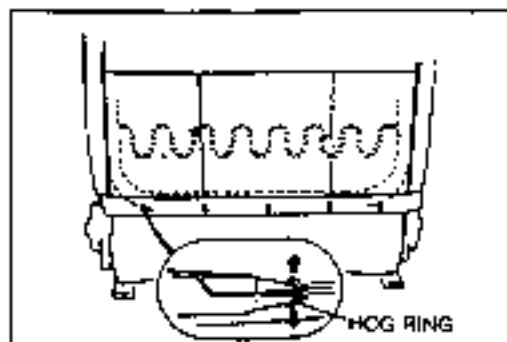
97P03X-007

1. Front seatback trim
2. Front seatback cushion
3. Rubber
4. Lock pin
5. Bushing
6. Spring
7. Plate

8. Front seat trim
9. Front seat cushion
10. Insulator

Disassembly Note ... page S-56

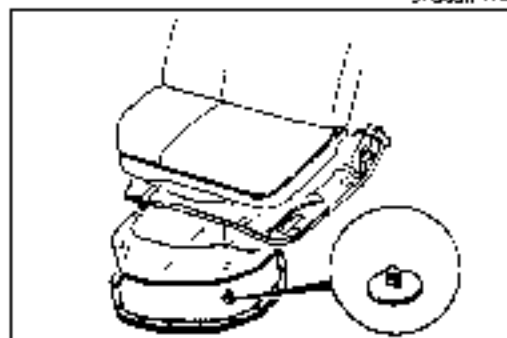
11. Rubber seal  
Disassembly Note..... page S-58



9TG05X-114

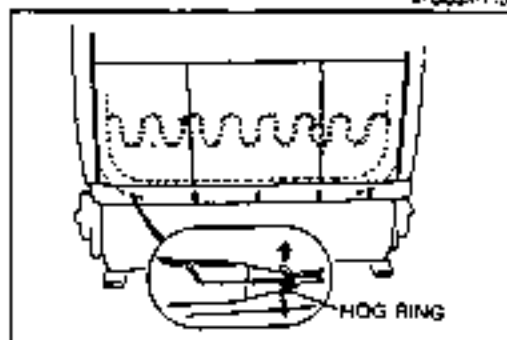
**Disassembly note****Insulator**

1. Remove the hog rings from the seatback and seat cushion
2. Remove the seat cushion cover



9TG05X-115

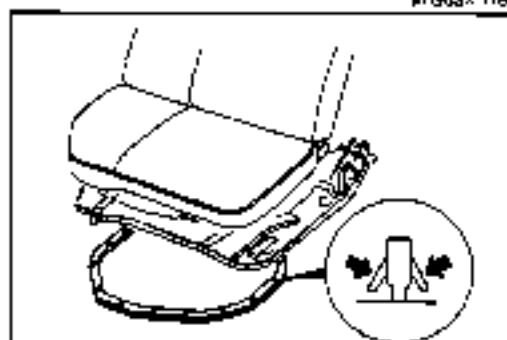
3. Remove the fasteners and insulator



9TG05X-116

**Rubber seal**

1. Remove the hog rings from the seatback and seat cushion.
2. Remove the seat cushion cover.



9TG05X-117

3. Remove the rubber seal fasteners as shown in the figure.

## SEAT BELT

## SEAT BELT

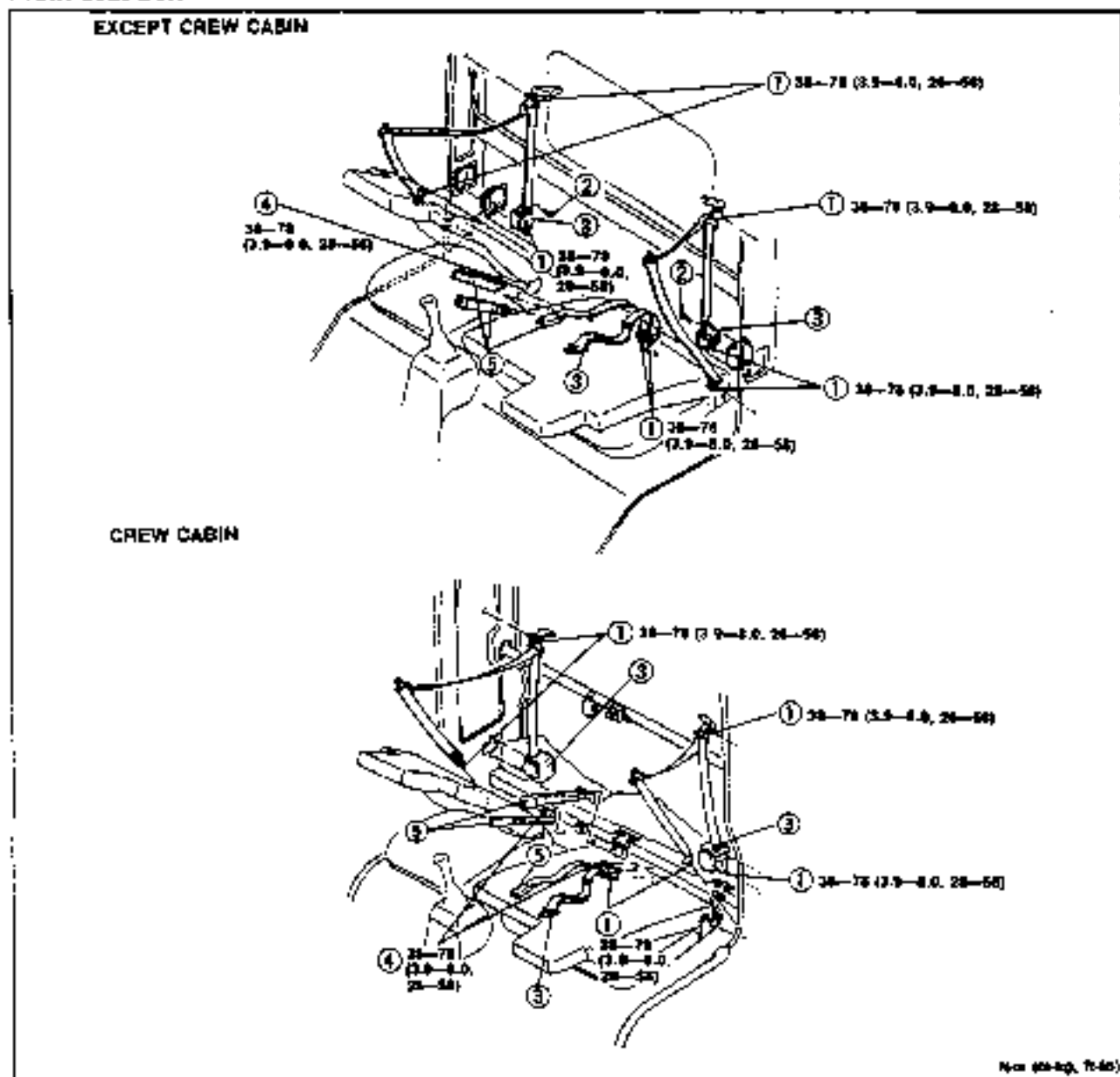
## Removal / Installation

1. Disconnect the negative battery cable.
2. Remove in the order shown in the figure
3. Install in the reverse order of removal.

## Caution

- Do not disassemble the buckle and retractor assembly.

## Front seat belt



New 900-kg, 70-kg)

97005X-119

## Front seat belt

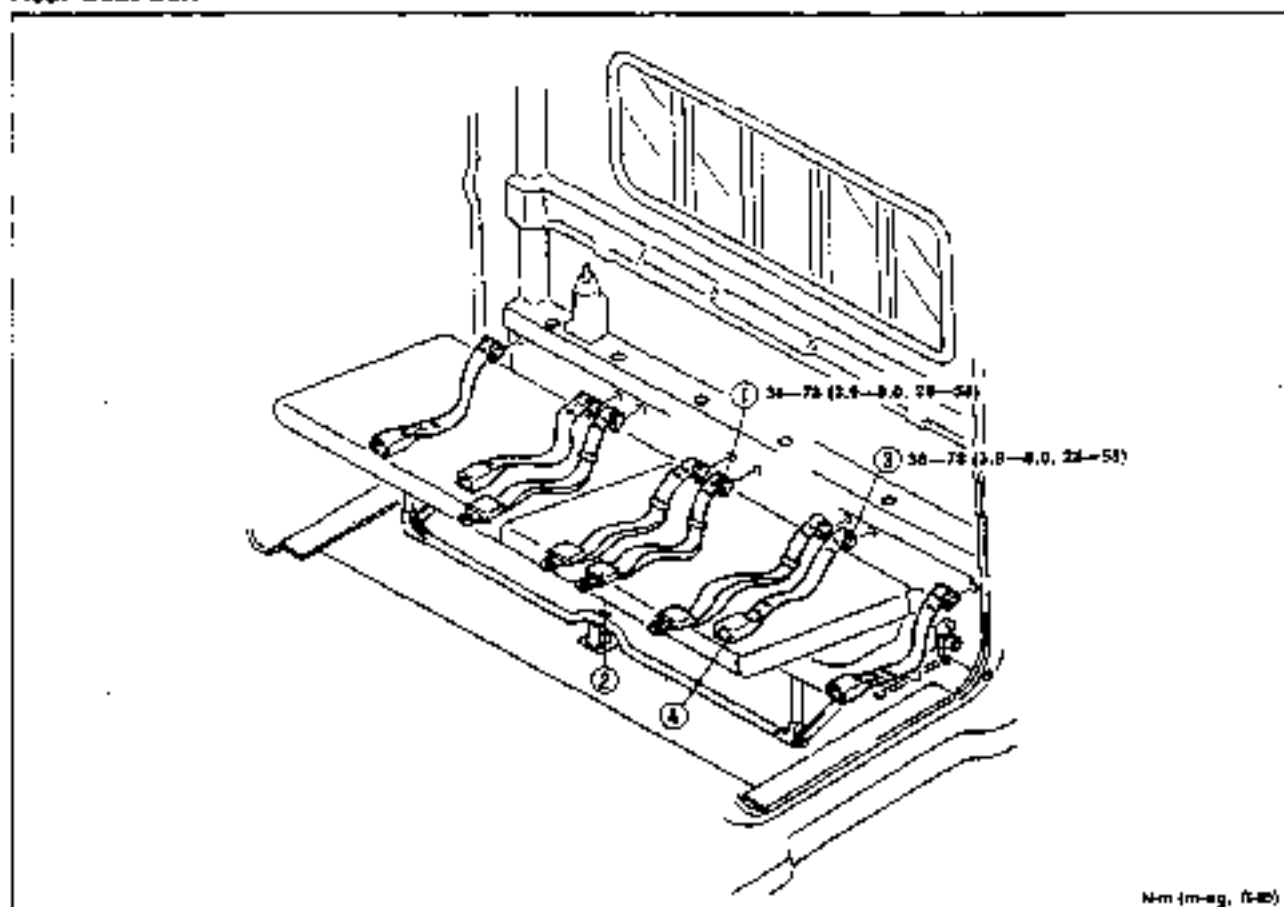
1. Bolt
2. Screw
3. Front seat belt

## Buckle

4. Bolt
5. Buckle

Inspection..... page S-60

## Rear seat belt



Nm (m·kg, ft·lb)

97G05X-11B

## Rear seat belt

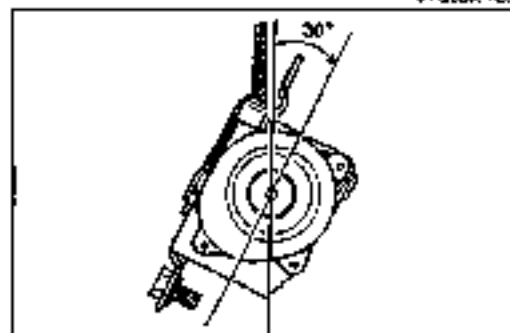
1. Bolt
2. Rear seat belt

## Buckle

3. Bolt
4. Buckle



97G05X-120



97G05X-121

## Inspection

## Emergency locking retractor (ELR)

1. Verify that the belt can be pulled out smoothly and that it moves smoothly when worn.
2. Verify that the retractor locks when quickly pulling the belt.

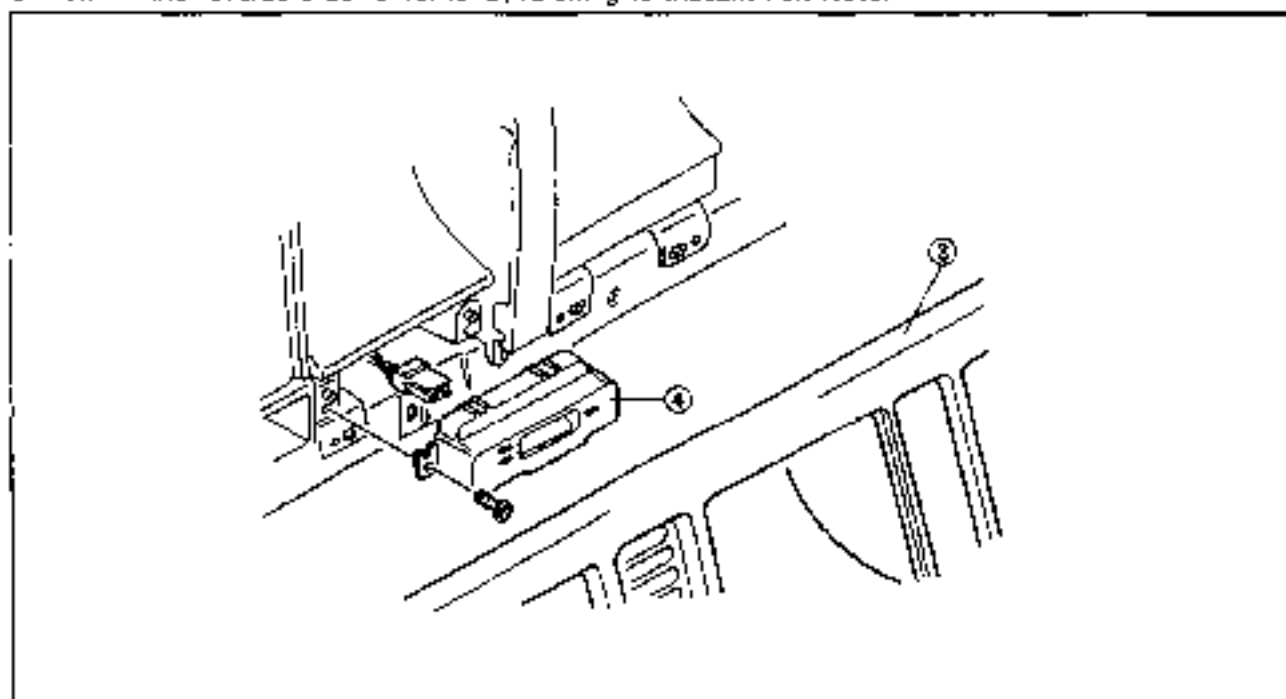
3. Remove the retractor.
4. Hold the retractor as it is installed.
5. Slowly incline the retractor while pulling out the belt.
6. Verify that the retractor locks at **Approx. 30 degrees** inclination.

## CLOCK

## CLOCK

## Removal / Installation

1. Disconnect the negative battery cable.
2. Remove in the order shown in the figure, referring to **Removal Note**.
3. Install in the reverse order of removal, referring to **Installation Note**.



9TG06X-122

1. Steering column

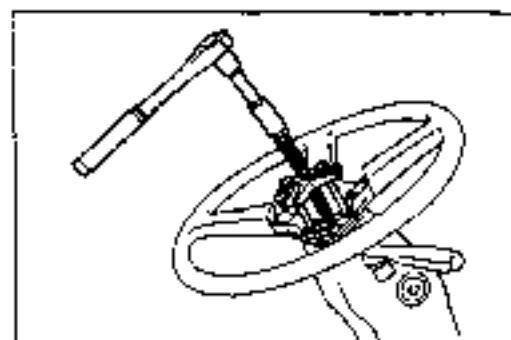
2. Steering wheel

Removal Note..... page S-61

Installation Note..... page S-61

3. Instrument cluster panel

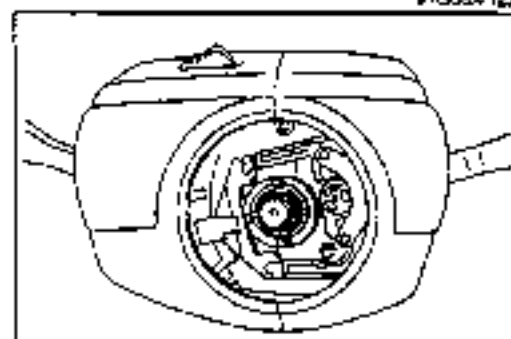
4. Clock



9TG06X-123

Removal note  
Steering wheel

1. Remove the steering wheel with a steering wheel puller.



9TG06X-124

Installation note  
Steering wheel

1. Set the cancel cam as shown in the figure.



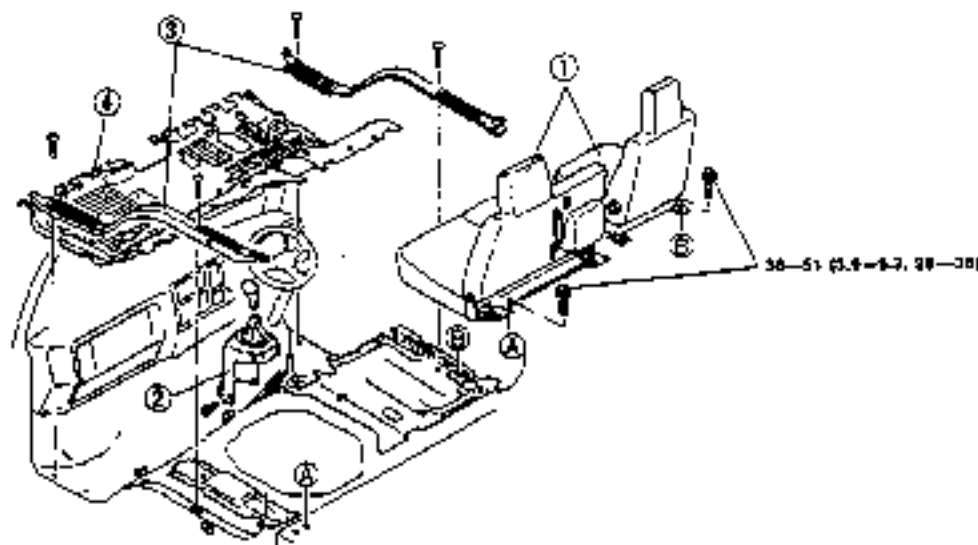
## FLOORMAT

## COMPONENTS

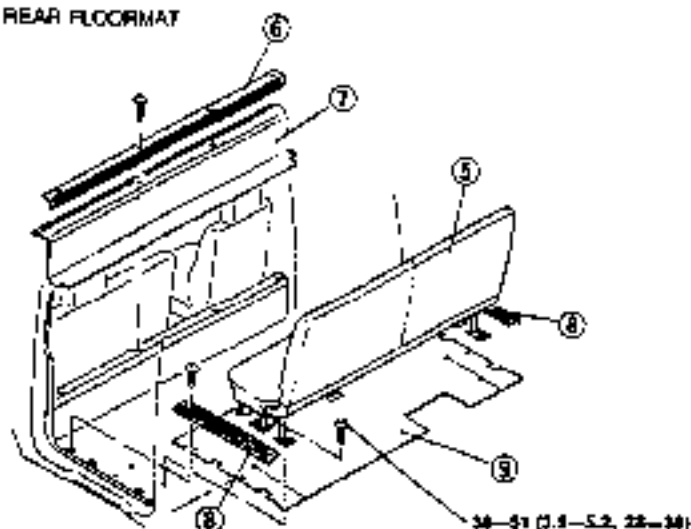
## Removal / Installation

1. Disconnect the negative battery cable
2. Remove in the order shown in the figure.
3. Install in the reverse order of removal.

FRONT FLOORMAT



REAR FLOORMAT



Met (m-1g, 1-1b)

97F05X-008

## Front floormat

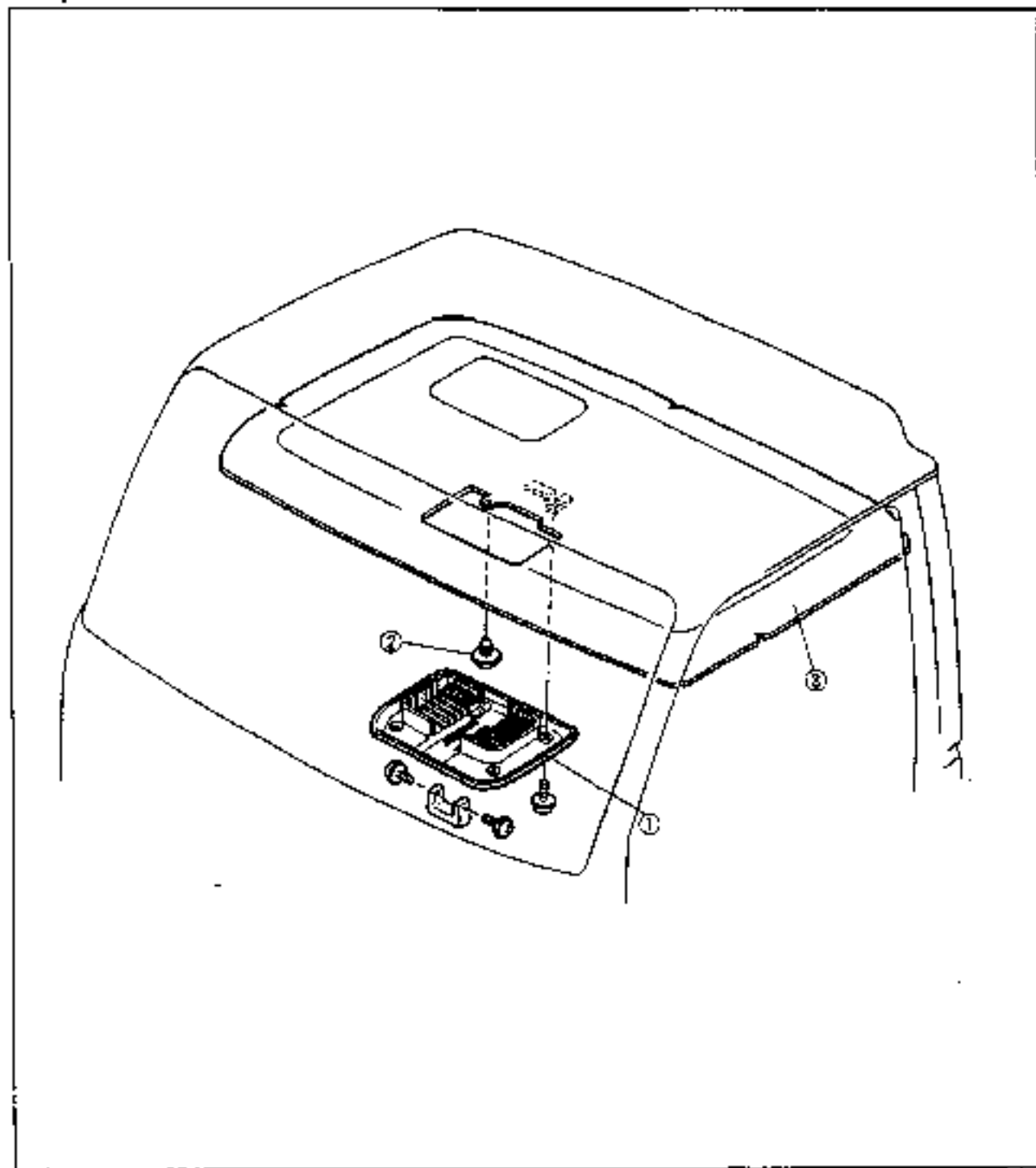
1. Front seat  
Removal / Installation ..... page S-53
2. Console  
Removal / Installation ..... page S-49
3. Scuff plate
4. Front floormat

## Rear floormat

5. Rear seat  
Removal / Installation ..... page S-54
6. Brim plate
7. Back plate mat
8. Mat side plate
9. Rear floormat

**HEADLINER****HEADLINER****Removal**

1. Disconnect the negative battery cable.
2. Remove in the order shown in the figure

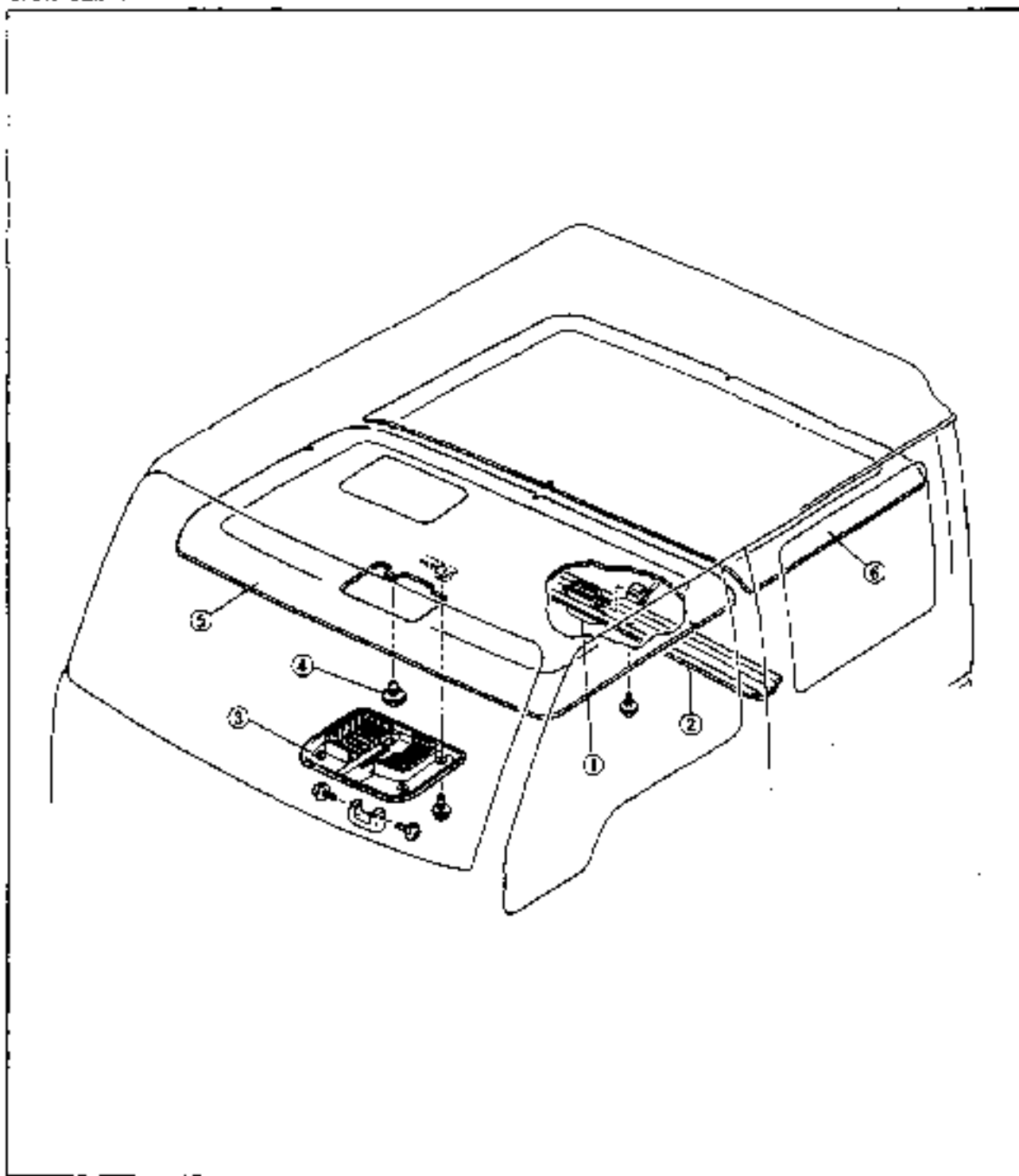
**Except crew cabin**

1. Roof ventilator grille
2. Fastener

3. Headliner  
Installation..... page S-65

97C05A-136

## Crew cabin



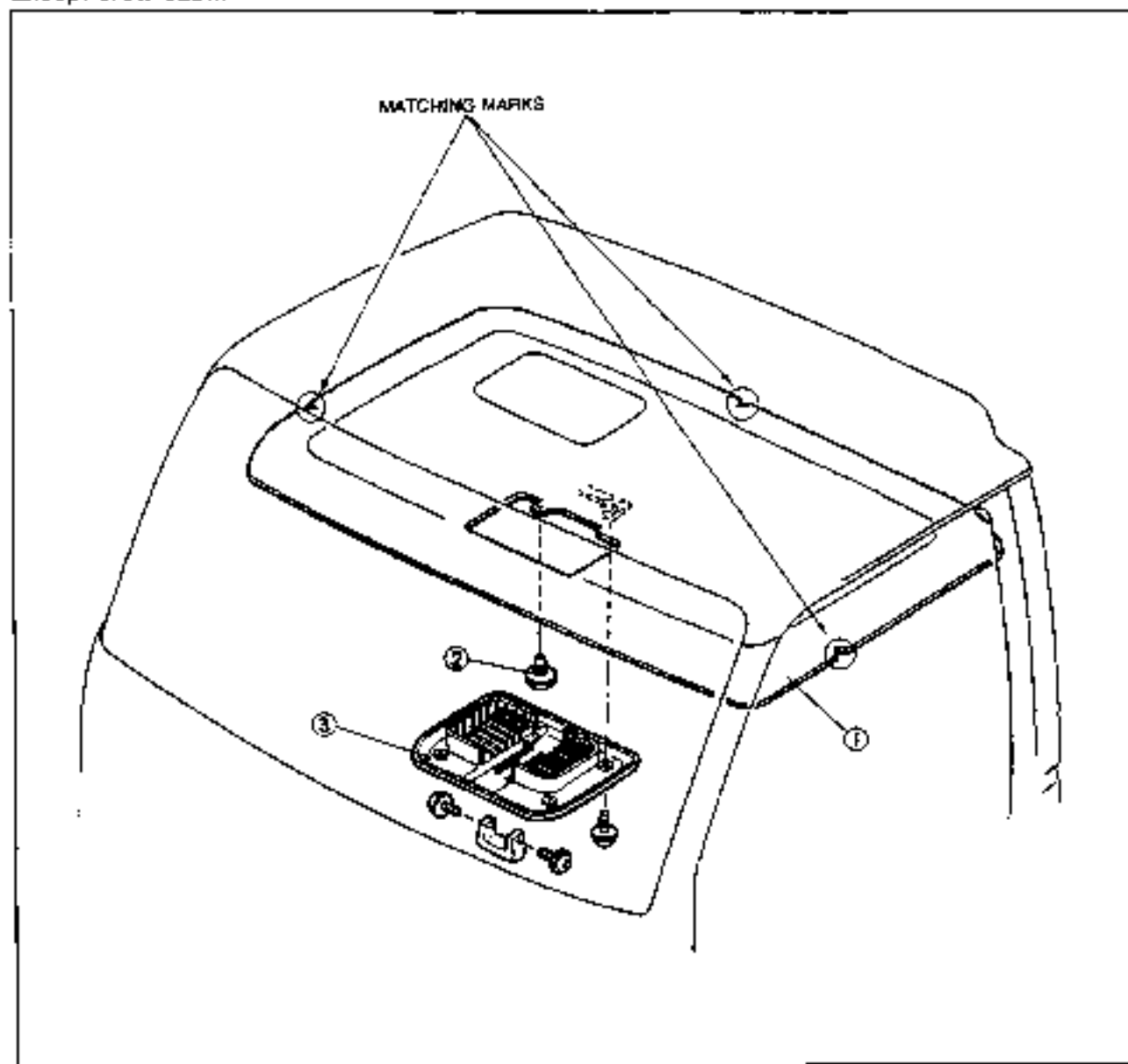
97005X 1/27

1. Rear interior lamp  
Service ..... Section T
2. Roof reinforcement
- Front headliner**
3. Roof ventilator grille
4. Fastener
5. Front headliner  
Installation ..... page S-66

- Rear headliner**
6. Rear headliner  
Installation ..... page S-66

**Installation**

1. Install in the reverse order of removal, referring to **Installation Note**.

**Except crew cabin**

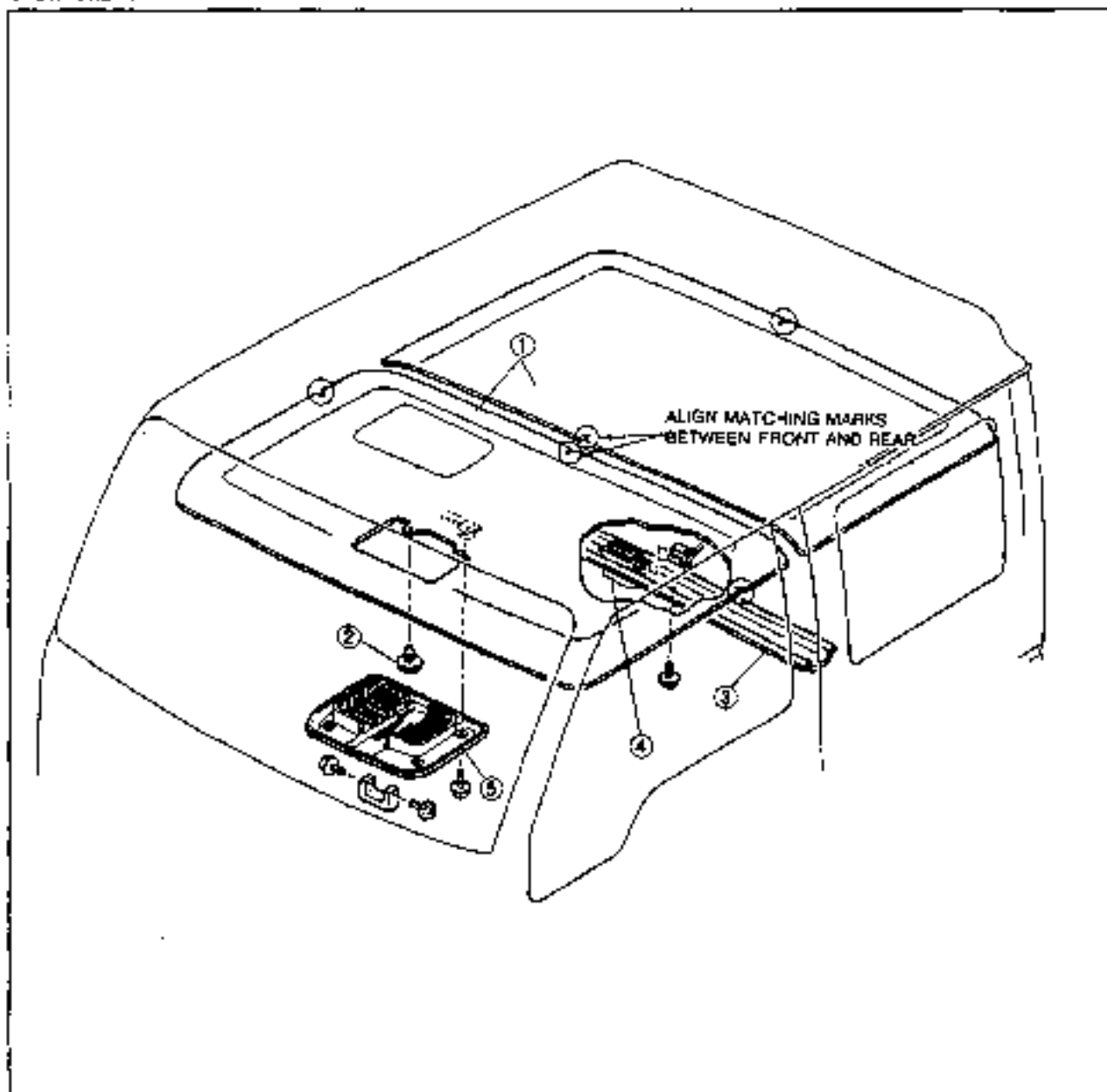
1. Headliner

Installation Note ..... page S-67

2. Fastener

3. Roof ventilator grille

## Crew cabin



P1603-129

1. Headliner  
Installation Note ..... page S-67
2. Fastener

3. Roof reinforcement  
4. Rear interior lamp  
5. Roof ventilator grille

STANDARD CABIN

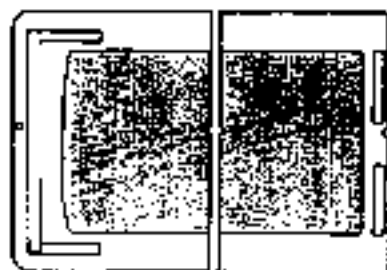


9T3356:30

WIDE CABIN



CREW CABIN (STANDARD)

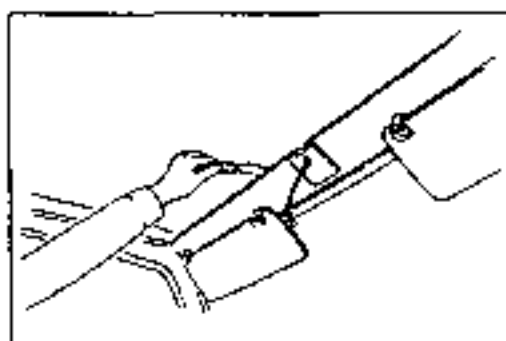


CREW CABIN (WIDE)

**Installation note****Headliner**

1. Remove the protective sheet (shaded area) from the headliner.

2. Push the headliner into place with a flat tool.



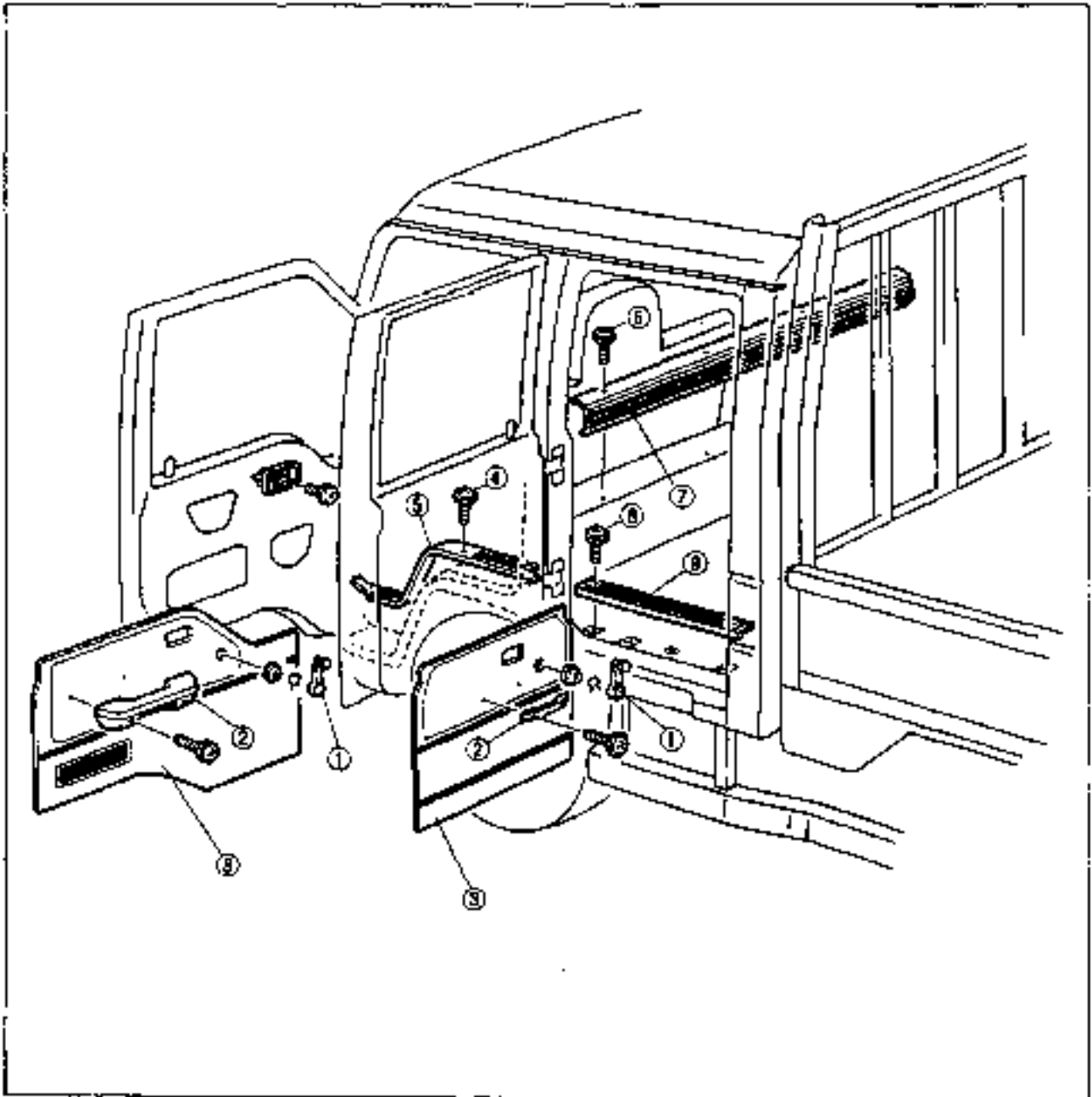
9T3356:131

## TRIM

## COMPONENTS

## Removal / Installation

1. Disconnect the negative battery cable.
2. Remove in the order shown in the figure, referring to **Removal Note**.
3. Install in the reverse order of removal.



91GJ5K-132

**Door trim**

1. Regulator handle  
Removal Note..... page S-11
2. Armrest
3. Door trim

**Scuff plate**

4. Screw
5. Scuff plate

**Brimplate (crew cabin)**

6. Screw
7. Brimplate

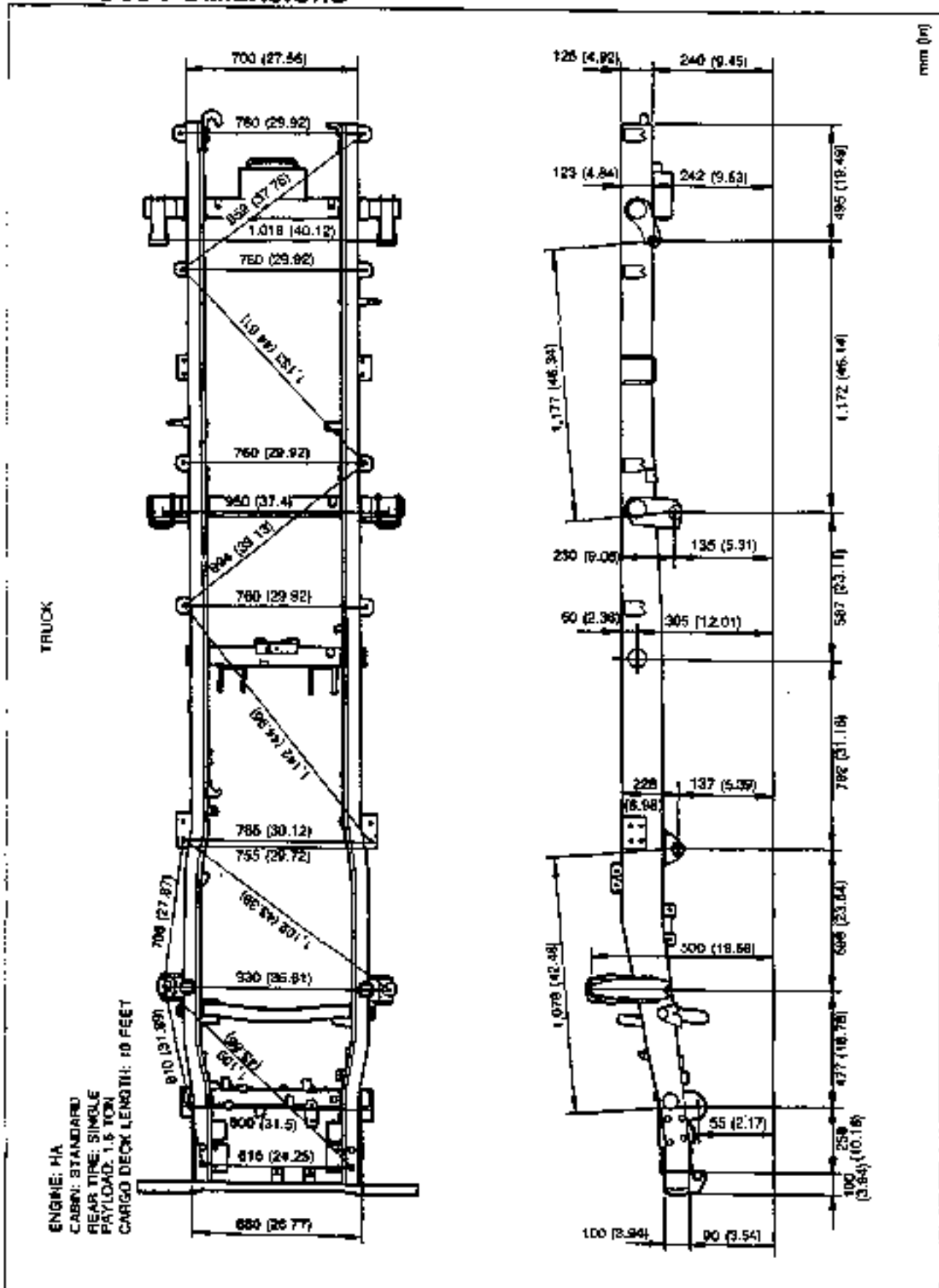
**Mat side plate (crew cabin)**

8. Screw
9. Mat side plate

# UNDERBODY DIMENSIONS

S

## UNDERBODY DIMENSIONS





## UNDERBODY DIMENSIONS

TRUCK OR CHEW CABIN

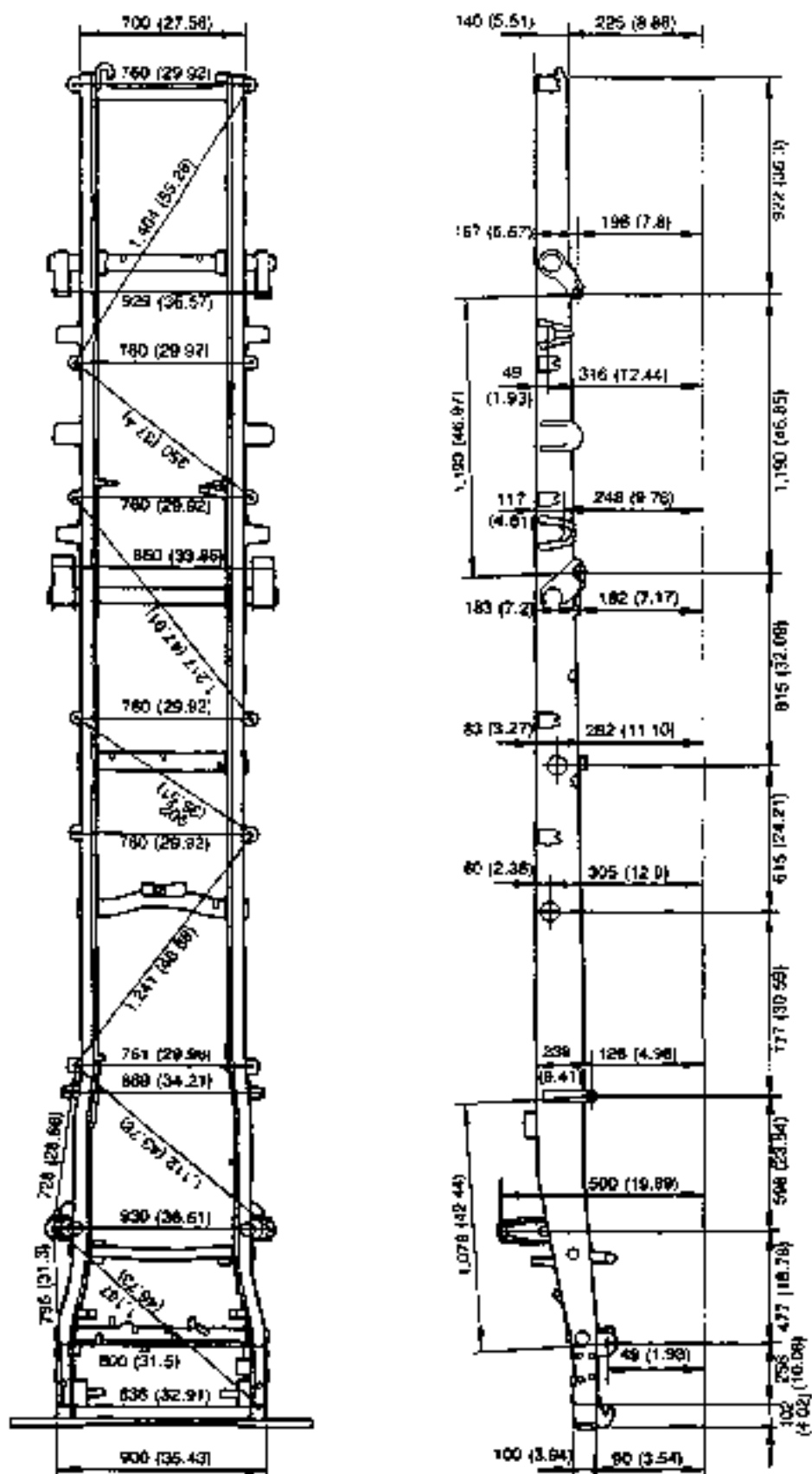
ENGINE: 3L

CABIN: WIDE, CREW STANDARD

REAR TIRE: DOUBLE

PAY LOAD: 2.75 TON, 3 TON, OR 4 TON

CARGO DECK LENGTH: 14 FEET



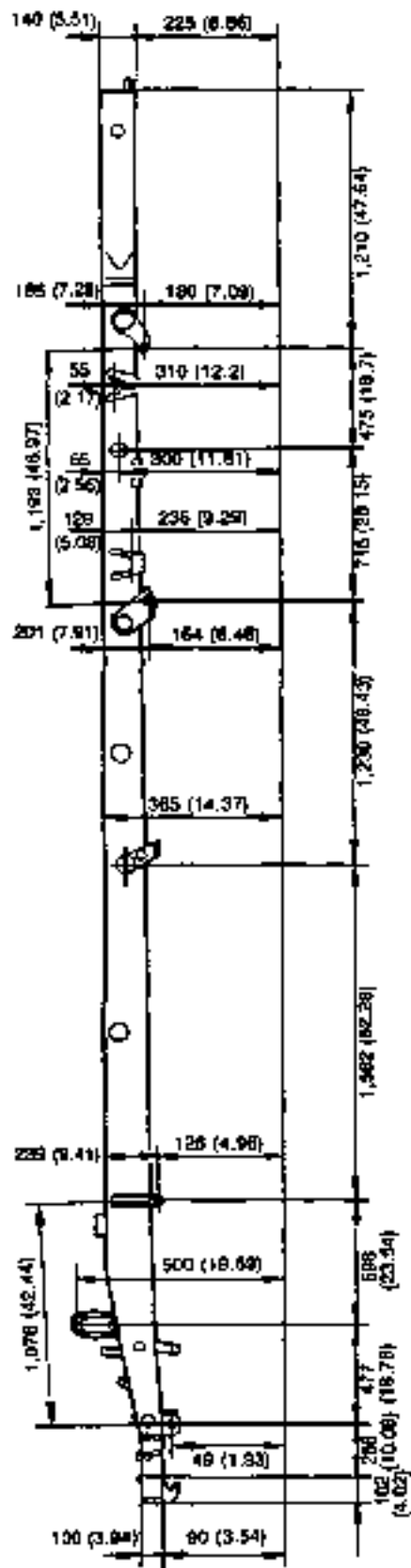
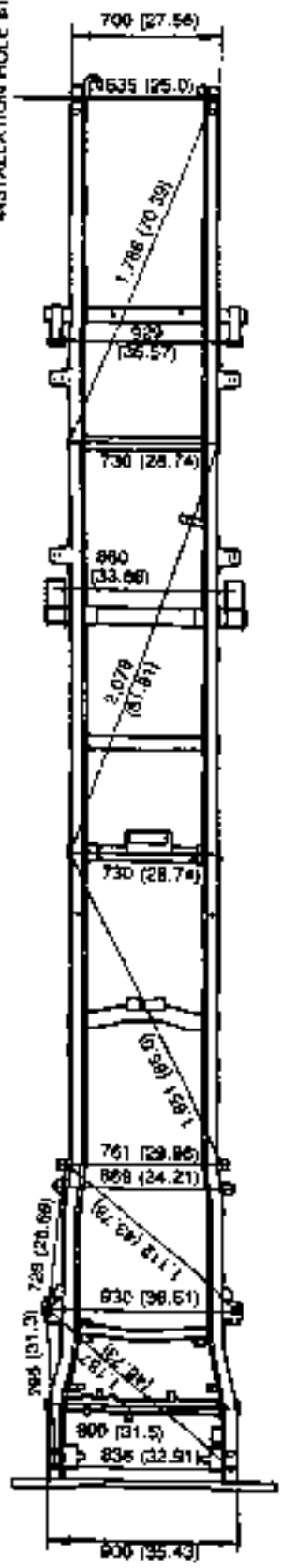
# UNDERBODY DIMENSIONS

S

TRUCK

ENGINE: 8L  
 CABIN: WIDE  
 REAR TIRE: DOUBLE  
 PAYLOAD: 4,100W  
 CARGO DECK LENGTH: 17 FEET

REAR BUMPER  
 INSTALLATION HOLE #13.7



mm (in)

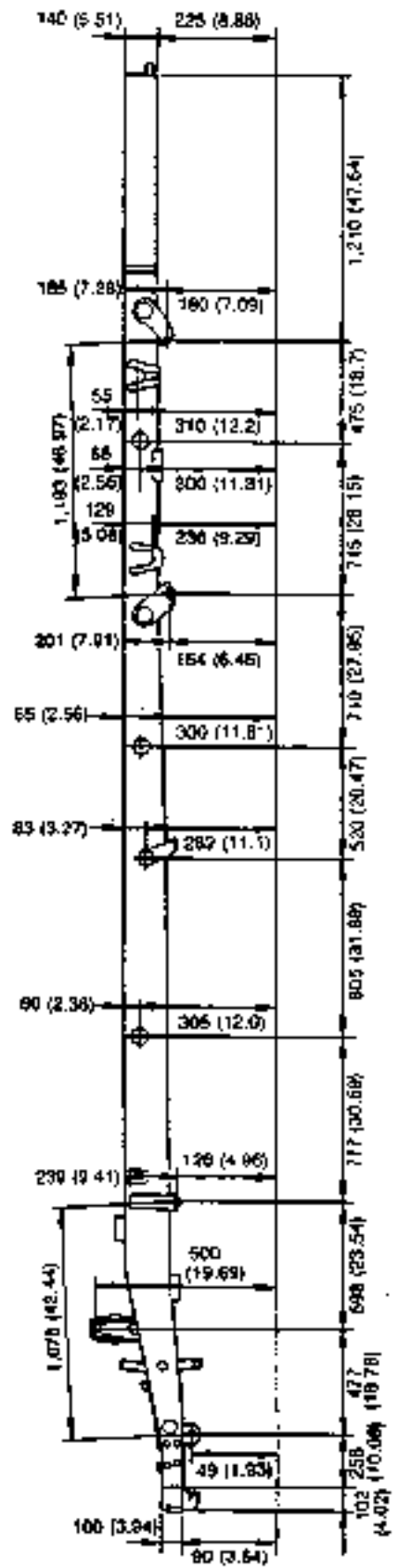
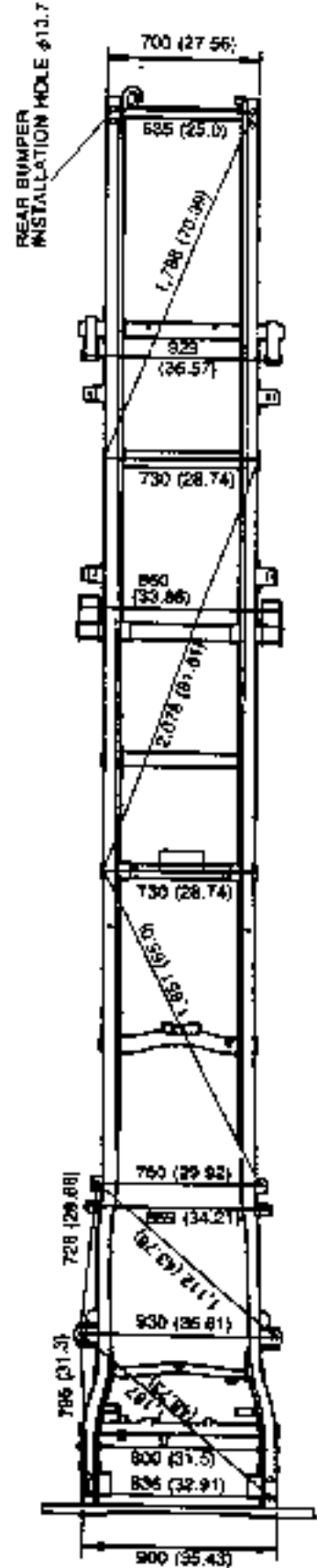


# UNDERBODY DIMENSIONS

S

TRUCK

ENGINE: 1P  
 CABIN: WIDE  
 REAR TIRE: DOUBLE  
 PAYLOAD: 4 TON  
 CARGO DECK LENGTH: 17 FEET



mm (in)

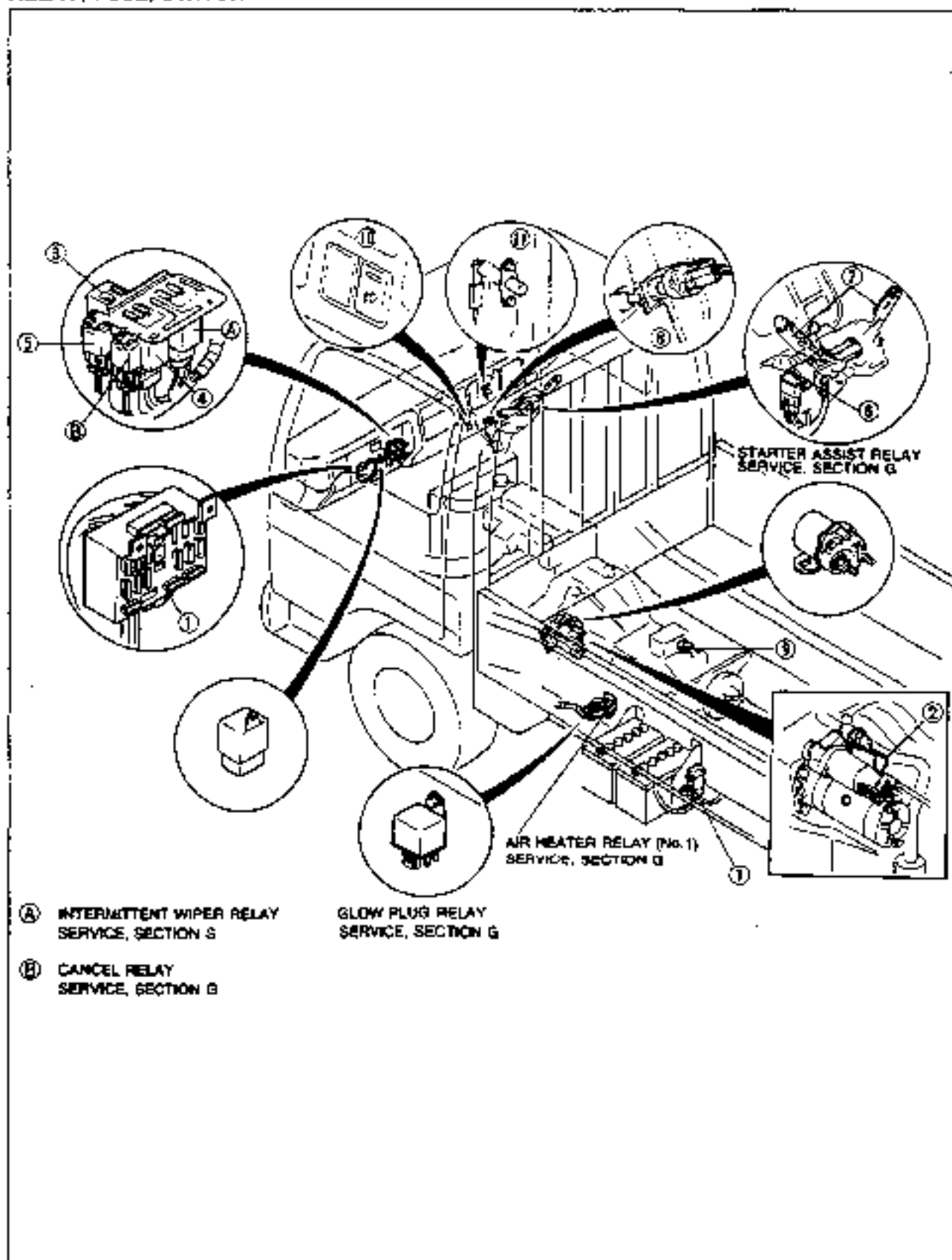


## BODY ELECTRICAL SYSTEM

<b>INDEX</b> .....	T- 2	<b>WARNING SYSTEM</b> .....	T-47
<b>TROUBLESHOOTING GUIDE</b> .....	T- 8	STRUCTURAL VIEW .....	T-47
<b>OUTLINE</b> .....	T-10	TROUBLESHOOTING .....	T-48
<b>FUSE</b> .....	T-12	WARNING AND INDICATOR LAMP ..	T-58
DESCRIPTION .....	T-12	OIL PRESSURE SWITCH .....	T-58
FUSES .....	T-12	COOLANT WARNING UNIT .....	T-59
<b>RELAY</b> .....	T-14	OIL BYPASS ALARM SWITCH .....	T-59
STRUCTURAL VIEW .....	T-14	BRAKE FLUID LEVEL SENSOR .....	T-60
STOPLIGHT CHECKER RELAY .....	T-15	PARKING BRAKE SWITCH .....	T-60
FLASHER UNIT .....	T-15	WARNING BUZZER .....	T-61
<b>SWITCHES</b> .....	T-16	OIL LEVEL SENSOR .....	T-61
STRUCTURAL VIEW .....	T-16	SEDIMENTOR SENSOR .....	T-62
ENGINE SWITCH .....	T-17	COOLANT LEVEL SENSOR .....	T-62
COMBINATION SWITCH .....	T-18	<b>INSTRUMENT CLUSTER (METER)</b> .....	T-63
<b>EXTERIOR LIGHTING SYSTEM</b> .....	T-20	PREPARATION .....	T-63
STRUCTURAL VIEW .....	T-20	STRUCTURAL VIEW .....	T-63
SPECIFICATIONS .....	T-21	TROUBLESHOOTING .....	T-64
AIMING .....	T-22	INSTRUMENT CLUSTER (METER) .....	T-68
TROUBLESHOOTING .....	T-23	WATER THERMOSENSOR .....	T-71
HEADLIGHT .....	T-36	FUEL GAUGE SENDER UNIT .....	T-71
FRONT COMBINATION LIGHT .....	T-37	PICKUP SENSOR .....	T-72
FOG LIGHT .....	T-38	<b>HORN</b> .....	T-73
REAR COMBINATION LIGHT .....	T-39	HORN .....	T-73
BACK-UP LIGHT .....	T-40	HORN RELAY .....	T-73
LICENSE PLATE LIGHT .....	T-41	<b>BACKING WARNING HORN</b> .....	T-74
STOPLIGHT SWITCH .....	T-41	BACKING WARNING HORN .....	T-74
BACK-UP LIGHT SWITCH .....	T-41	<b>AUDIO</b> .....	T-75
FOG LIGHT SWITCH .....	T-42	STRUCTURAL VIEW .....	T-75
<b>INTERIOR LIGHTING SYSTEM</b> .....	T-42	SPECIFICATIONS .....	T-76
STRUCTURAL VIEW .....	T-42	DESCRIPTIONS .....	T-76
SPECIFICATIONS .....	T-42	TROUBLESHOOTING .....	T-78
TROUBLESHOOTING .....	T-43	AUDIO UNIT .....	T-88
INTERIOR LAMP .....	T-45	SPEAKER .....	T-89
DOOR SWITCH .....	T-45	ANTENNA FEEDER .....	T-91

## INDEX

## RELAY, FUSE, SWITCH

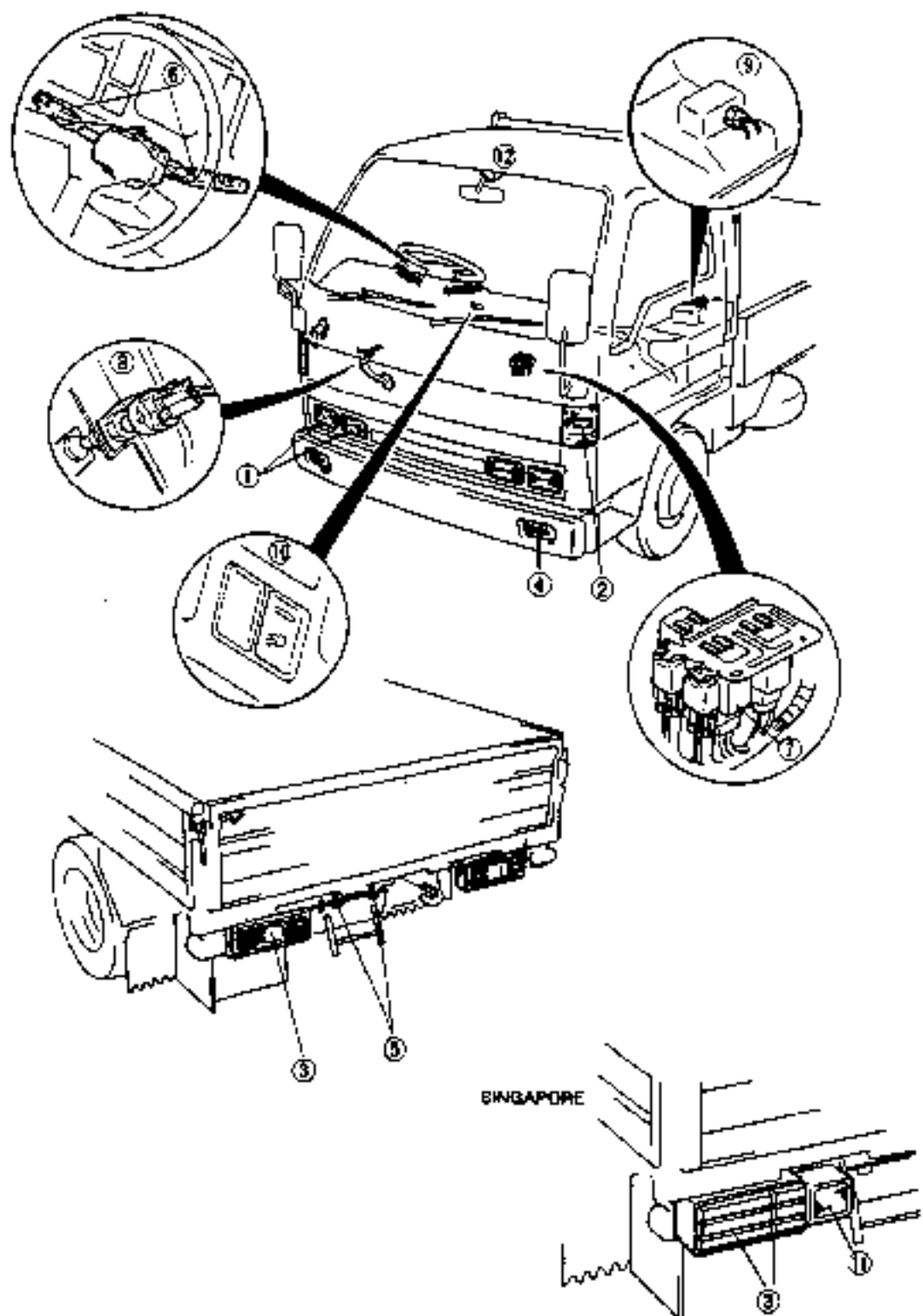


- 
- |                              |               |  |
|------------------------------|---------------|--|
| 1. Fuses, main fuses         |               |  |
| Removal / Installation ..... | page T-13     |  |
| 2. Fusible link              |               |  |
| Removal / Installation ..... | page T-13     |  |
| 3. Stoplight checker relay   |               |  |
| Inspection .....             | page T-15, 60 |  |
| 4. Flasher unit              |               |  |
| Inspection .....             | page T-15     |  |
| 5. Horn relay                |               |  |
| Inspection .....             | page T-73     |  |
| 6. Engine switch             |               |  |
| Inspection .....             | page T-17     |  |
| Removal / Installation ..... | page T-17     |  |
| 7. Combination switch        |               |  |
| Removal / Installation ..... | page T-18     |  |
| Disassembly / Assembly ..... | page T-18     |  |
| Inspection .....             | page T-19     |  |
| 8. Stoplight switch          |               |  |
| Inspection .....             | page T-41     |  |
| 9. Back-up light switch      |               |  |
| Inspection .....             | page T-41     |  |
| 10. Fog light switch         |               |  |
| Inspection .....             | page T-42     |  |
| 11. Door switch              |               |  |
| Inspection .....             | page T-46     |  |

9TFC1X-002

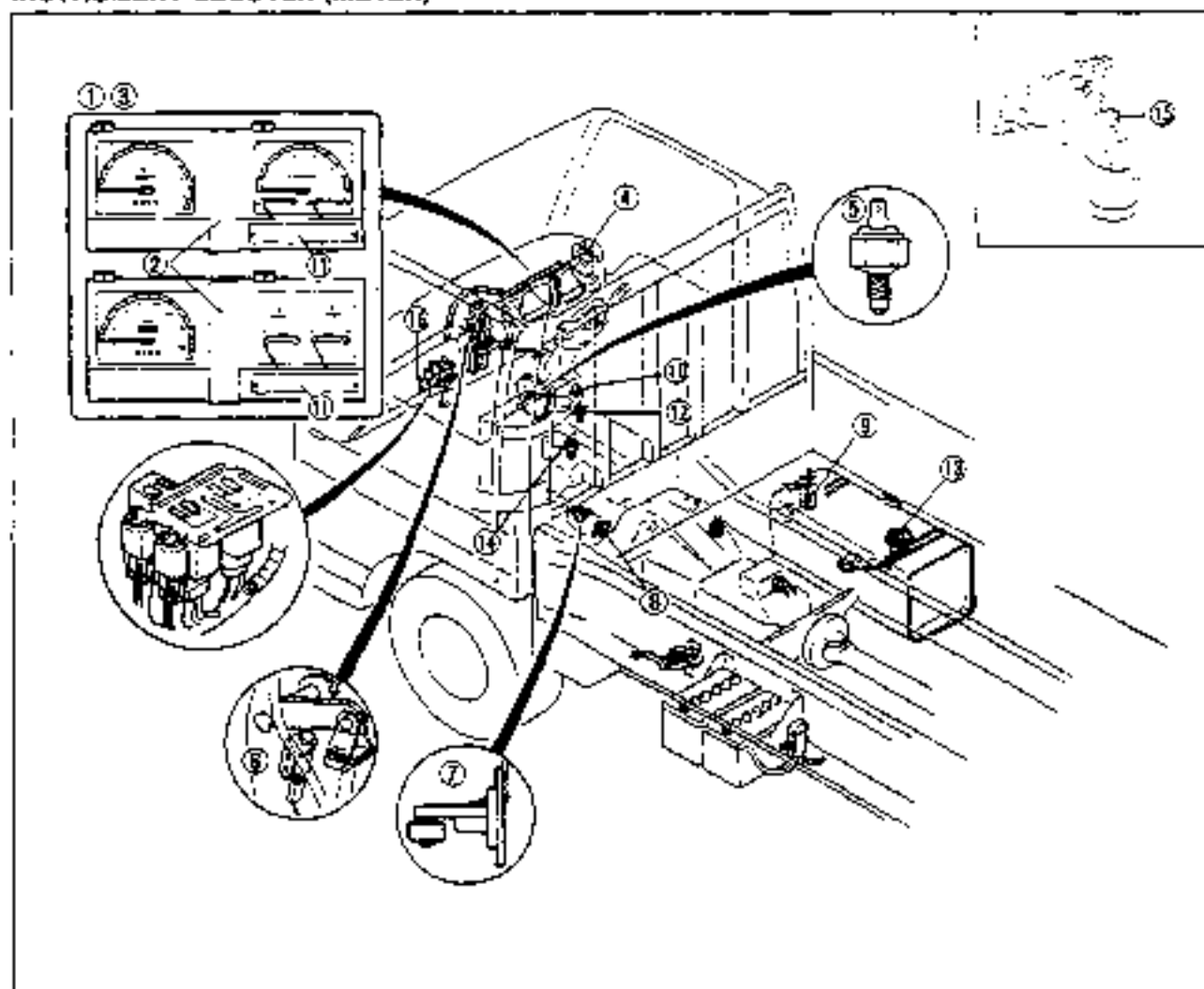


## EXTERIOR LIGHT, INTERIOR LAMP



- |                                  |      |      |  |
|----------------------------------|------|------|--|
| 1. Headlight                     |      |      |  |
| Aiming .....                     | page | T-22 |  |
| Troubleshooting .....            | page | T-23 |  |
| Removal / Installation .....     | page | T-36 |  |
| 2. Front combination light       |      |      |  |
| Removal / Inspection /           |      |      |  |
| Installation .....               | page | T-37 |  |
| 1) Turn and hazard warning light |      |      |  |
| Troubleshooting .....            | page | T-25 |  |
| Removal / Inspection /           |      |      |  |
| Installation .....               | page | T-37 |  |
| 2) Small light control system    |      |      |  |
| Troubleshooting .....            | page | T-26 |  |
| Removal / Inspection /           |      |      |  |
| Installation .....               | page | T-37 |  |
| 3. Rear combination light        |      |      |  |
| Removal / Inspection /           |      |      |  |
| Installation .....               | page | T-39 |  |
| 1) Turn and hazard warning light |      |      |  |
| Troubleshooting .....            | page | T-25 |  |
| Removal / Inspection /           |      |      |  |
| Installation .....               | page | T-39 |  |
| 2) Small light control system    |      |      |  |
| Troubleshooting .....            | page | T-26 |  |
| Removal / Inspection /           |      |      |  |
| Installation .....               | page | T-39 |  |
| 3) Back-up light                 |      |      |  |
| Troubleshooting .....            | page | T-30 |  |
| Removal / Inspection /           |      |      |  |
| Installation .....               | page | T-39 |  |
| 4) Stoplight                     |      |      |  |
| Troubleshooting .....            | page | T-32 |  |
| Removal / Inspection /           |      |      |  |
| Installation .....               | page | T-39 |  |
| 4. Fog light                     |      |      |  |
| Troubleshooting .....            | page | T-34 |  |
| Removal / Inspection /           |      |      |  |
| Installation .....               | page | T-38 |  |
| 5. License plate light           |      |      |  |
| Troubleshooting .....            | page | T-28 |  |
| Removal / Inspection /           |      |      |  |
| Installation .....               | page | T-41 |  |
| 6. Combination switch            |      |      |  |
| Removal / Installation .....     | page | T-18 |  |
| Disassembly / Assembly .....     | page | T-18 |  |
| Inspection .....                 | page | T-19 |  |
| 7. Flasher unit                  |      |      |  |
| Inspection .....                 | page | T-15 |  |
| 8. Stoplight switch              |      |      |  |
| Inspection .....                 | page | T-41 |  |
| 9. Back-up light switch          |      |      |  |
| Inspection .....                 | page | T-41 |  |
| 10. Fog light switch             |      |      |  |
| Inspection .....                 | page | T-42 |  |
| 11. Back-up light                |      |      |  |
| Troubleshooting .....            | page | T-30 |  |
| Removal / Inspection /           |      |      |  |
| Installation .....               | page | T-40 |  |
| 12. Interior lamp                |      |      |  |
| Troubleshooting .....            | page | T-43 |  |
| Removal / Inspection /           |      |      |  |
| Installation .....               | page | T-46 |  |

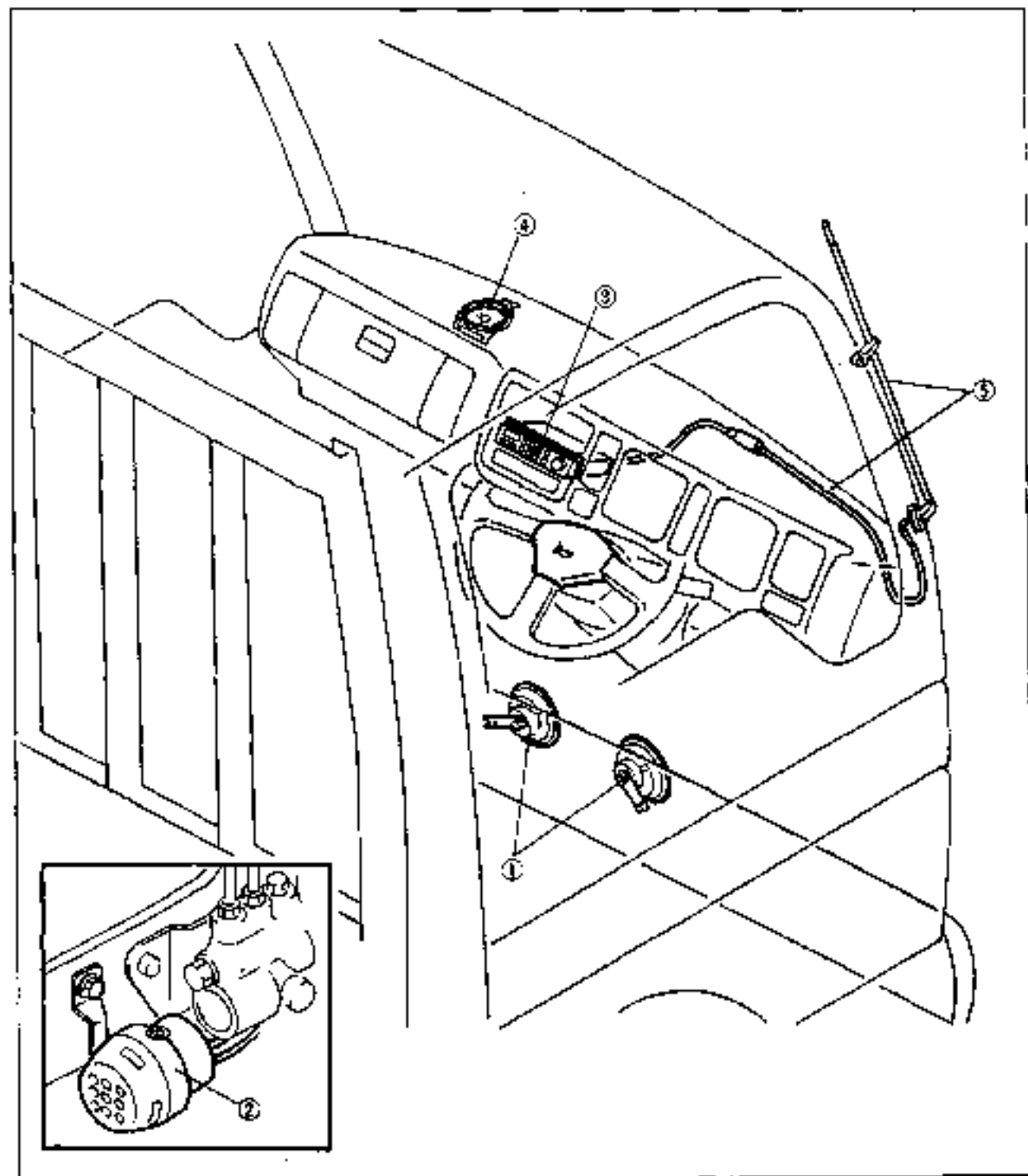
## INSTRUMENT CLUSTER (METER)



57-P01X-003

- |                               |           |  |  |
|-------------------------------|-----------|--|--|
| 1. Instrument cluster (Meter) |           |  |  |
| Troubleshooting .....         | page T-64 |  |  |
| Removal / Installation .....  | page T-68 |  |  |
| Disassembly / Assembly .....  | page T-69 |  |  |
| Inspection .....              | page T-70 |  |  |
| 2. Warning lamp               |           |  |  |
| Troubleshooting .....         | page T-48 |  |  |
| Inspection .....              | page T-58 |  |  |
| 3. Warning buzzer             |           |  |  |
| Troubleshooting .....         | page T-57 |  |  |
| Removal / Installation .....  | page T-68 |  |  |
| Inspection .....              | page T-61 |  |  |
| 4. Brake fluid level sensor   |           |  |  |
| Inspection .....              | page T-60 |  |  |
| Removal / Installation .....  | page T-60 |  |  |
| 5. Vacuum switch              |           |  |  |
| Troubleshooting .....         | page T-56 |  |  |
| 6. Parking brake switch       |           |  |  |
| Inspection .....              | page T-60 |  |  |
| 7. Oil level sensor           |           |  |  |
| Removal / Installation .....  | page T-61 |  |  |
| Inspection .....              | page T-61 |  |  |
| 8. Oil pressure switch        |           |  |  |
| Inspection .....              | page T-58 |  |  |
| 9. Sedimentor sensor          |           |  |  |
| Inspection .....              | page T-62 |  |  |
| 10. Coolant level sensor      |           |  |  |
| Inspection .....              | page T-62 |  |  |
| 11. Indicator lamp            |           |  |  |
| Inspection .....              | page T-58 |  |  |
| 12. Water thermosensor        |           |  |  |
| Removal / Installation .....  | page T-71 |  |  |
| Inspection .....              | page T-71 |  |  |
| 13. Fuel gauge sender unit    |           |  |  |
| Removal / Installation .....  | page T-71 |  |  |
| Inspection .....              | page T-71 |  |  |
| 14. Pickup sensor             |           |  |  |
| Inspection .....              | page T-72 |  |  |
| 15. Oil bypass alarm switch   |           |  |  |
| Inspection .....              | page T-59 |  |  |
| 16. Coolant warning unit      |           |  |  |
| Inspection .....              | page T-59 |  |  |

## OTHERS



9TPTX-004

- |                              |           |  |  |
|------------------------------|-----------|--|--|
| 1. Horn                      |           |  |  |
| Removal / Installation ..... | page T-73 |  |  |
| 2. Backing warning horn      |           |  |  |
| Removal / Installation ..... | page T-74 |  |  |
| Inspection .....             | page T-74 |  |  |
| 3. Audio unit                |           |  |  |
| Troubleshooting .....        | page T-78 |  |  |
| Removal / Installation ..... | page T-88 |  |  |
| 4. Speaker                   |           |  |  |
| Troubleshooting .....        | page T-78 |  |  |
| Removal / Installation ..... | page T-89 |  |  |
| Inspection .....             | page T-90 |  |  |
| 5. Antenna feeder            |           |  |  |
| Troubleshooting .....        | page T-78 |  |  |
| Removal / Installation ..... | page T-91 |  |  |
| Inspection .....             | page T-91 |  |  |

## TROUBLESHOOTING GUIDE

System	Symptom	Reference page
Exterior lighting system	Headlights do not operate (High or low)	T-24
	One headlight does not operate	T-24
	Headlights do not change high/low beam	T-24
	Turn function does not operate	T-25
	One side turn function does not operate	T-27
	Hazard warning function does not operate (Turn function normal)	T-27
	Turn signal flashes rapidly	T-27
	Small lights do not operate (Small lights, Tail light, License plate light, Position light)	T-29
	Back-up lights do not operate	T-31
	One back-up light does not operate	T-31
	Stoplights do not operate	T-33
	One stoplight does not operate	T-33
	Fog lights do not operate	T-35
	One fog light does not operate	T-35
Interior lighting system	Interior lamp does not operate (Switch: ON position)	T-44
	Interior lamp does not operate (Switch: Door position)	T-44
	Interior lamp stays ON (Switch: Door position)	T-44
Warning system	Brake warning lamp comes ON after engine started	T-49
	Brake warning lamp does not operate parking brake set	T-49
	Brake warning lamp does not operate when brake fluid level below MIN	T-50
	Alternator warning lamp comes ON after engine started	T-50
	Alternator warning lamp does not operate when engine switch ON	T-50
	Oil pressure warning lamp comes ON after engine started	T-51
	Oil pressure warning lamp does not come ON when oil level below L (Diesel)	T-52
	Stoplight warning lamp comes ON after engine started	T-52
	Stoplight warning lamp does not operate when stoplight failed	T-53
	Sedimentor warning lamp comes ON with buzzer after engine started	T-54
	Sedimentor warning lamp and buzzer do not operate when water level high	T-55
	Sedimentor warning lamp comes ON without buzzer after engine started	T-55
	Vacuum warning lamp comes ON with buzzer after engine started	T-56
	Vacuum warning lamp comes ON without buzzer after engine started	T-56
Warning buzzer sounds	T-57	

System	Symptom	Reference page
Instrument cluster (Meter)	Speedometer does not operate or indication incorrect	T-65
	Tachometer does not operate	T-65
	Water temperature gauge does not operate	T-66
	Fuel gauge does not operate	T-67
Audio system	<b>AM RADIO</b>	
	No sound	T-79
	Bad sound quality	T-79
	Noise	T-80
	No display of frequency. Preset memory canceled	T-81
	<b>AM/FM RADIO</b>	
	No sound	T-82
	Bad sound quality	T-83
	Noise	T-84
	Tuning does not stop/Auto-memory does not operate	T-84
	No display of frequency. Preset memory canceled	T-85

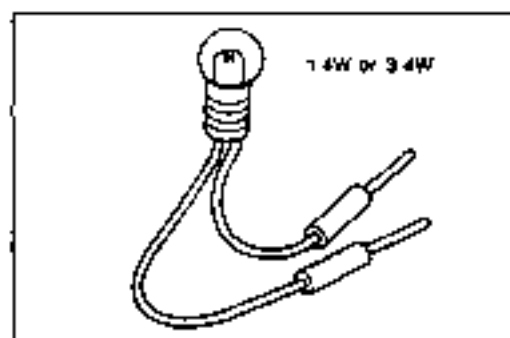
97FDX006

## OUTLINE

## HOW TO USE THIS SECTION

Understanding will be easier if this section is used in conjunction with the **WIRING DIAGRAMS**.

9M-017-008



68C154-002

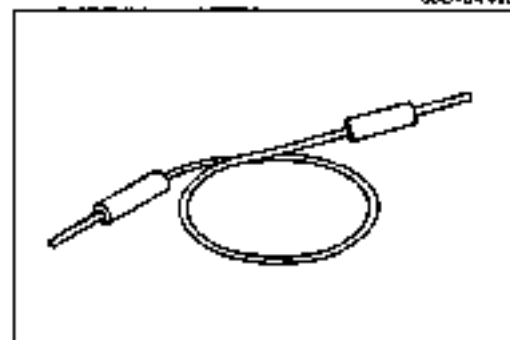
## ELECTRICAL TROUBLESHOOTING TOOLS

## Test Light

The test light, as shown in the figure, uses a 12V bulb. The two leads should be connected to probes. The test light is used for simple voltage checks and to check for open circuits.

## Caution

- When checking the control unit, never use a bulb over 3.4W.



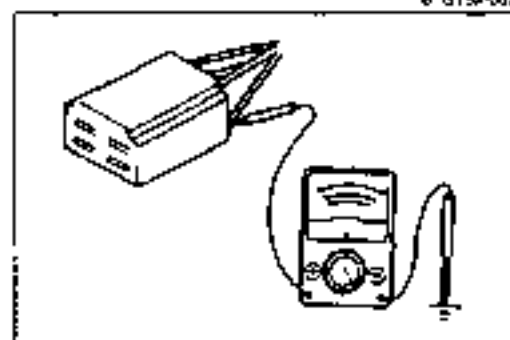
61G154-002

## Jumper Wire

The jumper wire is used for testing by short-circuiting switch terminals and for verifying the condition of ground connections.

## Caution

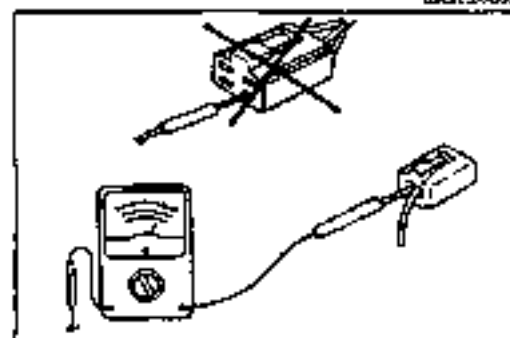
- Do not connect the jumper wire between a power source line and body ground because this may cause burning or other damage to harnesses or electronic components.



68C154-009

## Voltmeter

The DC voltmeter is used for measuring circuit voltage. A voltmeter with a range of 15V or more is used by connecting the positive (+) probe (red lead) to the point where voltage is to be measured, and the negative (-) probe (black lead) to the body ground.



62C154-006

## Ohmmeter

The ohmmeter is used to measure the resistance between two points in a circuit, and is also used to check for continuity and diagnosis of short circuits.

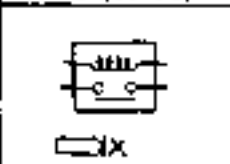
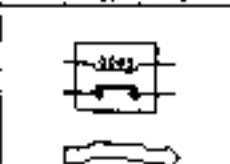
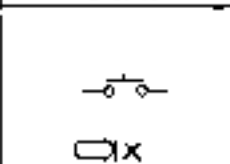

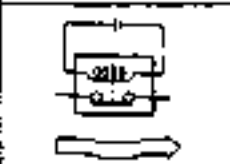
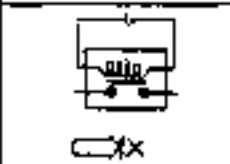

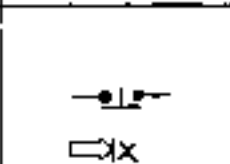
## Caution

- Do not attempt to connect the ohmmeter to any circuit to which voltage is applied because this may burn or otherwise damage the ohmmeter.


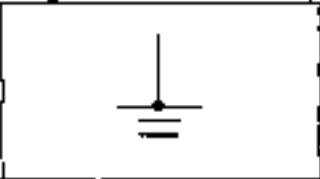
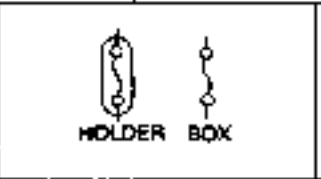
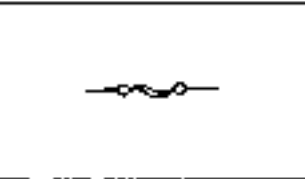
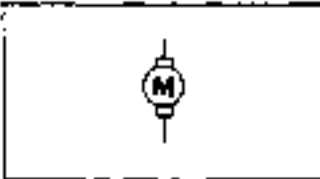
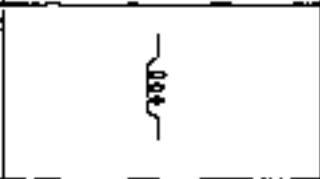

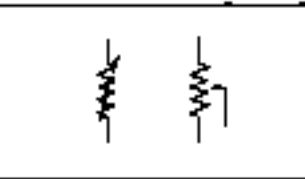
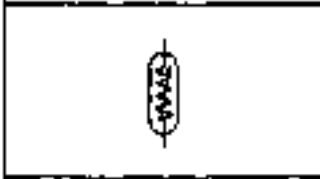

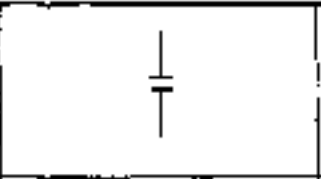
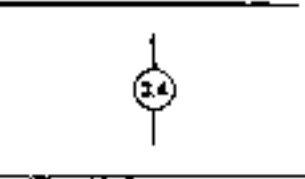

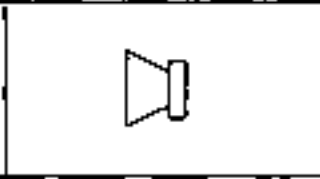

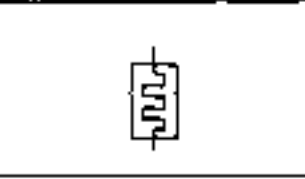
**ELECTRICAL SYMBOLS**

**Switches and Relays**

There is an NC (normally closed) and NO (normally open) indication for switches and relays which shows when no change of operation conditions has occurred

	Relay		Switch	
	NO type relay	NC type relay	NO switch	NC switch
Not in operation (No power supply)	 STOP	 FLOW	 STOP	 FLOW
In operation (Power supply)	 FLOW	 STOP	 FLOW	 STOP

**Other Electrical Symbols**

			
BATTERY	BODY GROUND	FUSE	FUSIBLE LINK
			
MOTOR	COIL, SOLENOID	RESISTOR	VARIABLE RESISTOR
			
THERMISTER	DIODE	CONDENSER	LIGHT
			
TRANSISTOR	SPEAKER	CIGARETTE LIGHTER	HEATER

89G15K-009



## FUSE

## DESCRIPTION

The main fuse block is behind the battery. The fuse box is behind the lower panel. The fuses are color-coded by average rating.

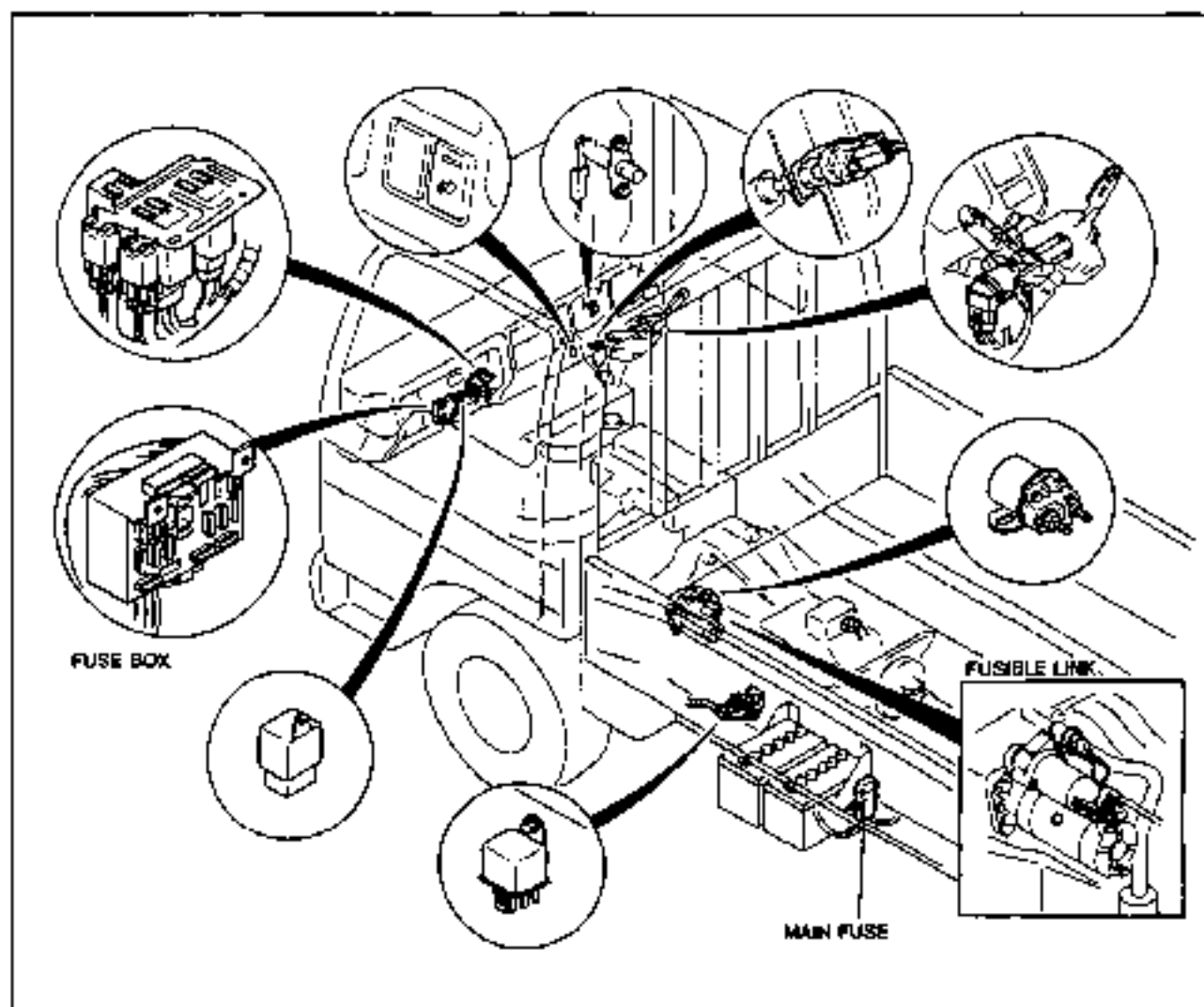
9T337X-009

## FUSES

## Specifications

## Main fuse block

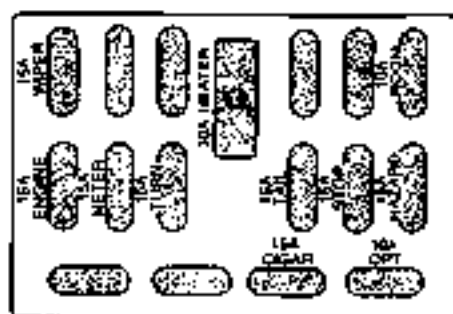
Fuse	Housing color	Protected circuit
MAIN 100A	Blue	Glow plug, Engine switch, Alternator. Circuits protected in fuse box.
MAIN 80A	Yellow	Engine switch, Alternator, Air heater. Circuits protected in fuse box.
HEAD 30A	Pink	Alternator, headlight.
WORKING LAMP 30A	Pink	Working lamp.



9T337X-005

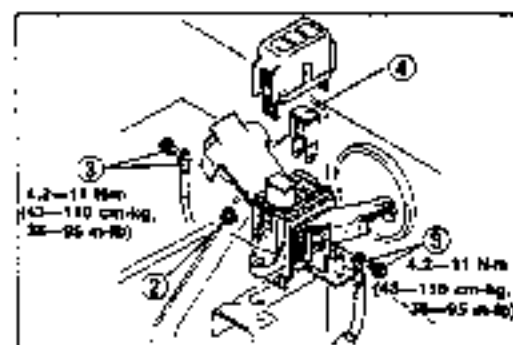
Fuse box

Fuse	Color	Protected circuit
WIPE 15A	Blue	Wiper and washer system
HEATER 30A	Green	Heater
ROOM 10A	Red	Interior lamp system, Radio
ENGINE 15A	Blue	Air heater system, QSS system
METER 15A	Blue	Back-up light, Instrument cluster (meter), Exhaust brake system, Exhaust heating system, Fuel cut solenoid
TURN 15A	Blue	Turn lights
TAIL 15A	Blue	Instrument panel control, Taillights, License plate lights, Fog lights, Combination lights
STOP 15A	Blue	Horn, Stoplights
HAZARD 15A	Blue	Hazard lights
CIGAR 15A	Blue	Radio, Cigar lighter
OPT 10A	Red	—

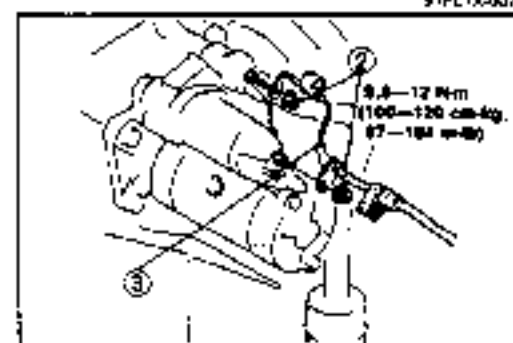


Fusible link: Circuit protected QSS or air heater system

9T00TK-017



9T00TK-007



9T00TK-010

Removal / Installation

Main fuse

1. Disconnect the negative battery cable.
2. Remove the main fuse box attaching nuts.
3. Remove the bolts and wiring harness from the main fuse box.
4. Pull out the MAIN 100A or MAIN 60A fuse from the main fuse box.
5. Install the reverse order of removal.

Tightening torque:

MAIN 100A, MAIN 60A fuse

4.2-11 Nm (43-110 cm-kg, 38-95 in-lb)

Fusible link

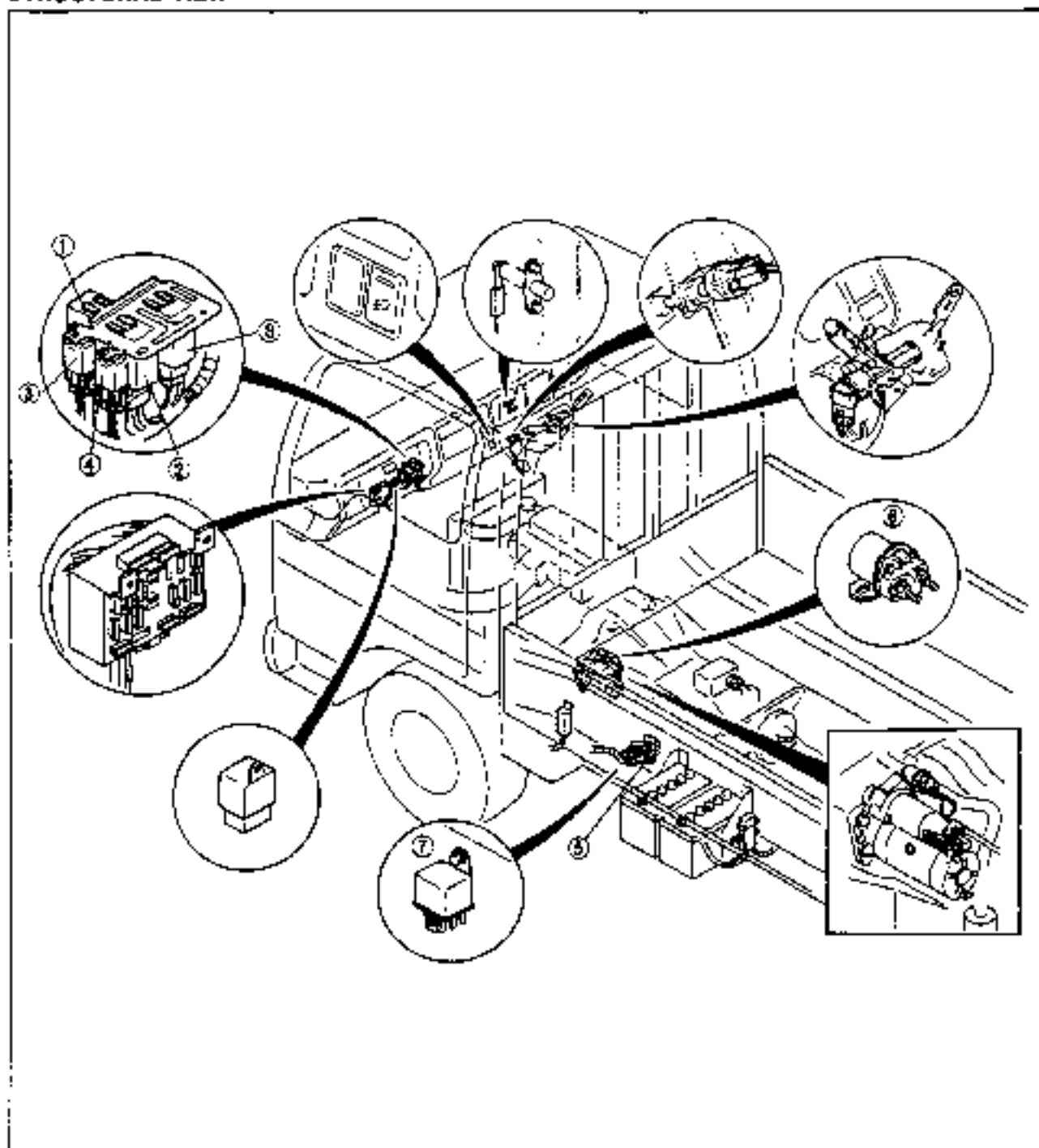
1. Disconnect the negative battery cable.
2. Remove the nuts.
3. Remove the fusible link from the stator.
4. Install in the reverse order of removal.

Tightening torque:

9.8-12 Nm (100-120 cm-kg, 87-104 in-lb)

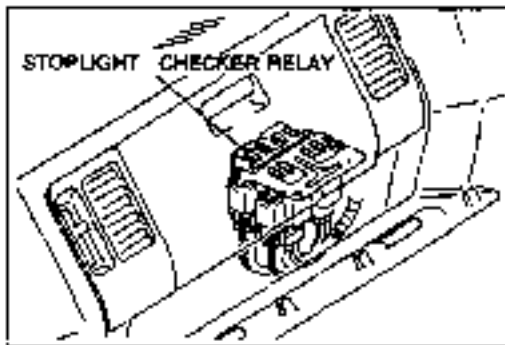
## RELAY

## STRUCTURAL VIEW

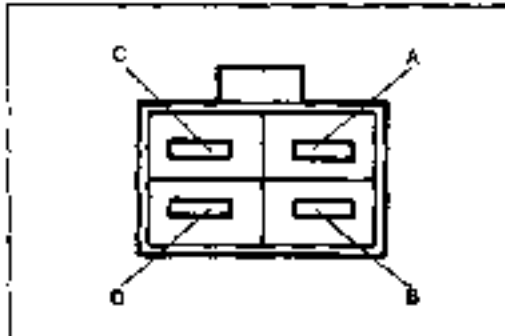


57F3TX 008

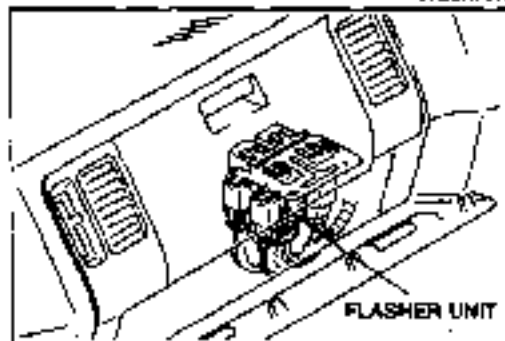
- |                            |               |                             |           |
|----------------------------|---------------|-----------------------------|-----------|
| 1. Stoplight checker relay |               | 5. Air heater relay         |           |
| Inspection.....            | page T-15, 60 | Service.....                | Section G |
| 2. Flasher unit            |               | E Assist relay              |           |
| Inspection.....            | page T-15     | Service.....                | Section G |
| 3. Horn relay              |               | 7 Glow plug relay           |           |
| Inspection.....            | page T-73     | Service.....                | Section G |
| 4. Cancel relay            |               | B. Intermittent wiper relay |           |
| Service.....               | Section G     | Service.....                | Section S |



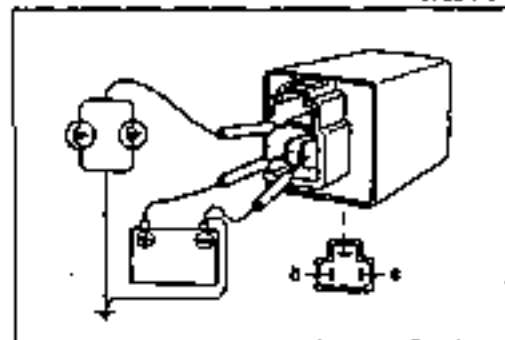
9T337X-015



9T337X-016



9T607X-017



**STOPLIGHT CHECKER RELAY**

**Inspection**

1. Check continuity between terminals of the stoplight checker relay.

**Note**

- Set the tester to  $\times 1,000\Omega$  range.

Terminal		Continuity	Terminal		Continuity
+	-		+	-	
A	B	○	B	A	○
A	C	X	C	A	○
A	D	○	D	A	○
B	C	X	C	B	○
B	D	○	D	B	○
C	D	○	D	C	X

2. Replace the relay if not as specified.

**FLASHER UNIT**

**Inspection**

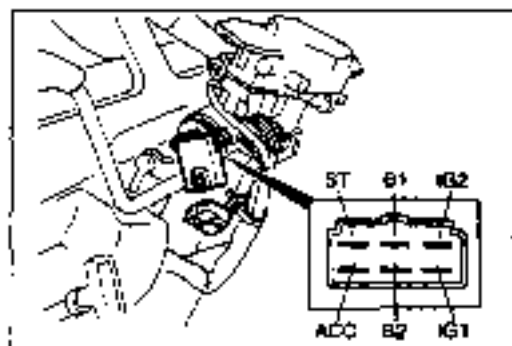
1. Connect 12V to terminal b and ground terminal e.
2. Connect the test lamp between terminal l and a ground, and verify that the test lamp glows.

**Caution**

- Apply the battery voltage to terminals properly.

3. Replace the flasher unit if not as specified.





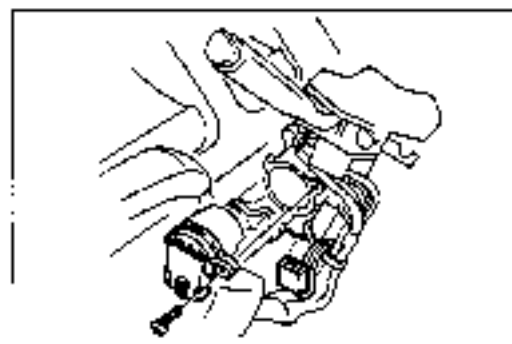
9TGT4-013

**ENGINE SWITCH****Inspection**

1. Check continuity between terminals of the engine switch.

Engine switch	B1	B2	ACC	IG1	IG2	ST
OFF						
ACC	○		○			
ON	○		○	○		
STA	○	○		○		
	○	○				○

2. Replace the engine switch if not as specified.



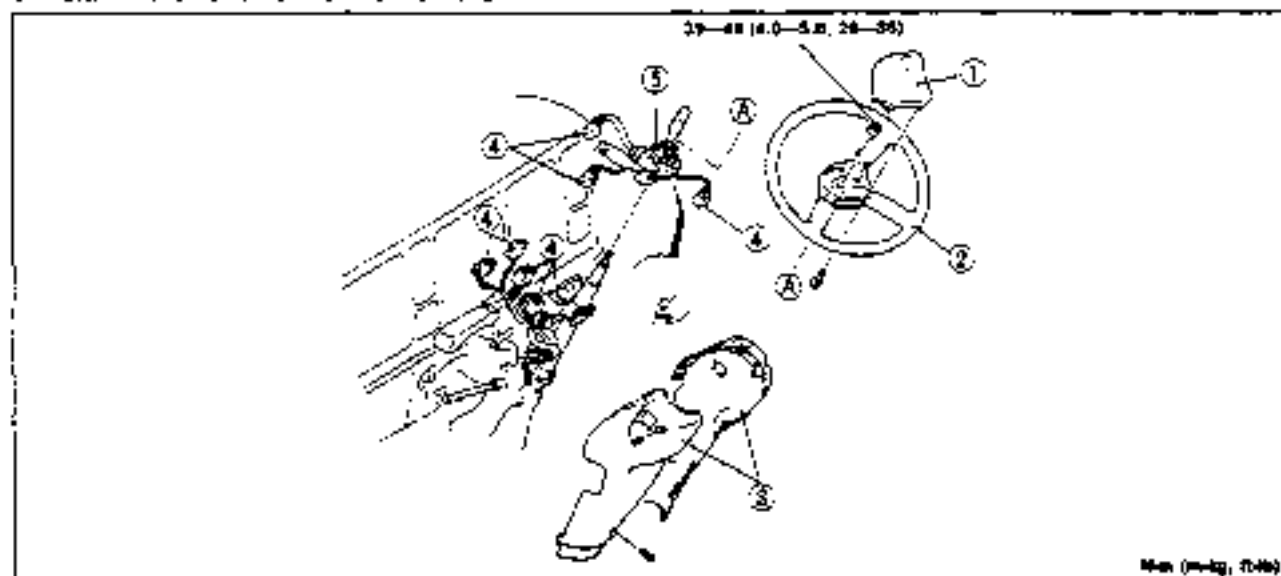
9TGT4-020

**Removal / Installation**

1. Disconnect the negative battery cable.
2. Remove the steering column cover.
3. Disconnect the engine switch connector.
4. Remove the engine switch.
5. Install in the reverse order of removal.

**COMBINATION SWITCH****Removal / Installation**

1. Disconnect the negative battery cable.
2. Remove in the order shown in the figure
3. Install in the reverse order of removal

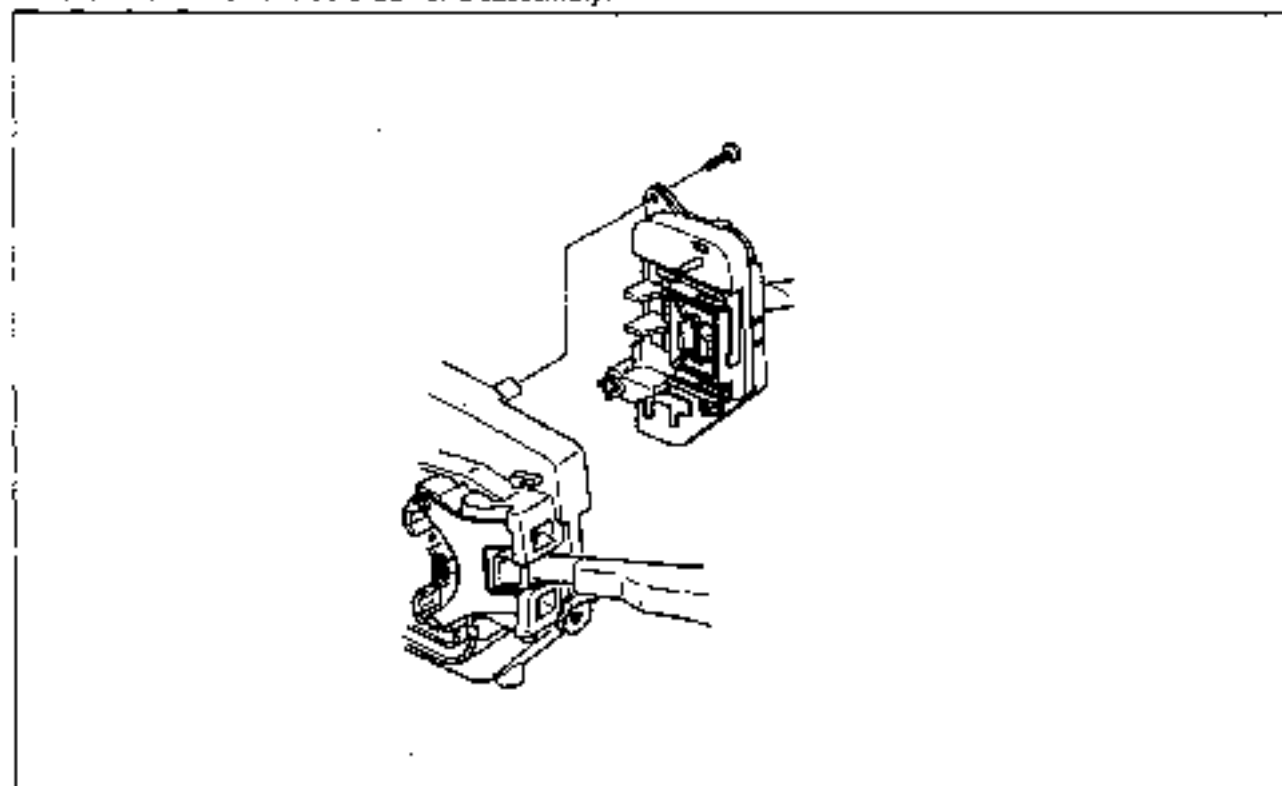


1. Horn cap
2. Steering
3. Steering column cover
4. Connector (Combination switch)

5. Combination switch  
 Disassembly / Assembly ..... page T-18  
 Inspector ..... page T-19

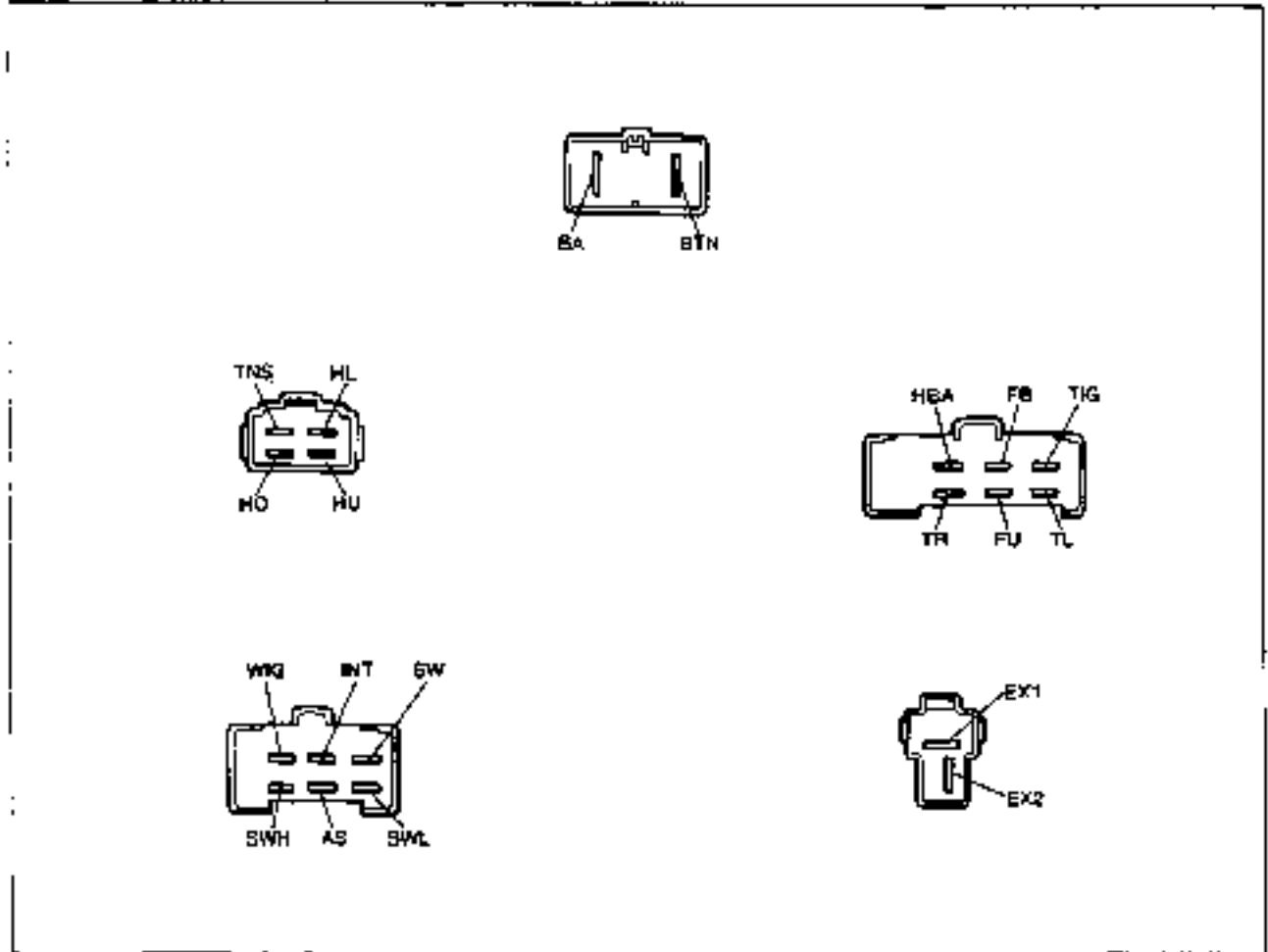
**Disassembly / Assembly**

1. Remove the light switch unit.
2. Assemble in the reverse order of disassembly.



**Inspection**

1. Check continuity between terminals of the combination switch.



97C07X-022

**Light switch**

Light switch		BTN	TNS	BA	HL	HU
OFF						
	Passing			○	○	○
Small light		○	○			
	Passing	○	○	○	○	○
ON	Low	○	○	○	○	
	high	○	○	○	○	○
	Passing	○	○	○	○	○

**Turn and hazard warning switch**

Hazard	Turn	FU	TL	TR	TIG	HGA	FB
OFF	Right	○	○	○	○	○	○
	Neutral				○	○	○
	Left	○	○	○	○	○	○
ON	—	○	○	○		○	○

**Wiper and washer switch**

Wiper	AS	SWL	SWH	WIG	INT	SW
OFF						
	One touch ON		○	○		
INT	○	○		○	○	
Low		○	○	○		
High			○	○		
Washer ON				○	○	○

**Exhaust brake switch**

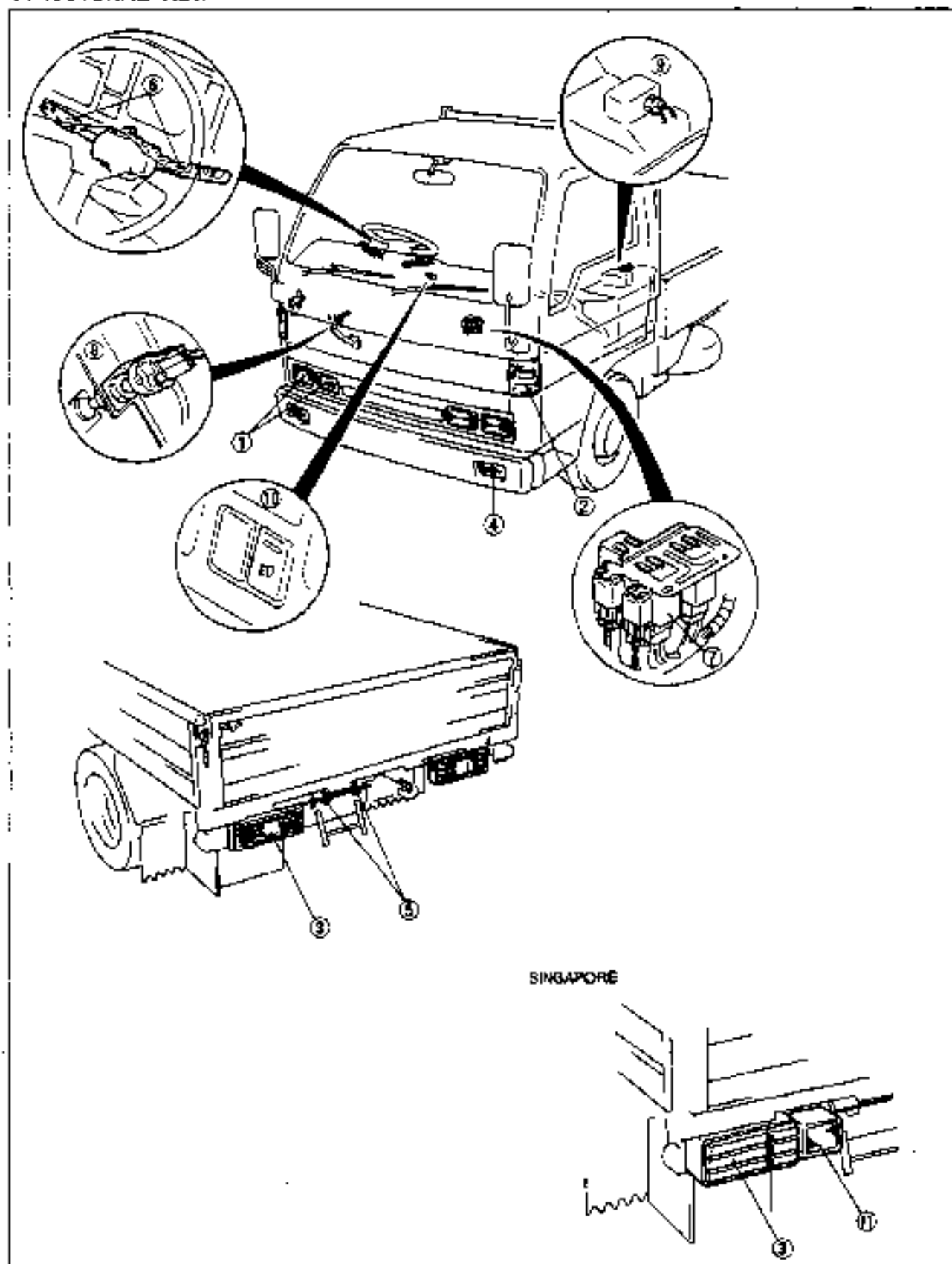
Exhaust brake switch	EX1	EX2
OFF		
ON	○	○

○—○ Indicates continuity



## EXTERIOR LIGHTING SYSTEM

## STRUCTURAL VIEW



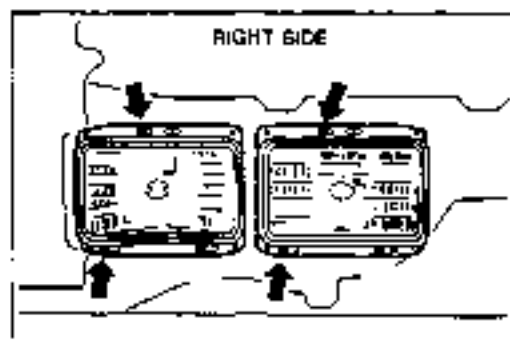
1. Headlight					
Aiming.....	page	T-22			
Troubleshooting .....	page	T-23			
Removal / Installation .....	page	T-36			
2. Front combination light:					
Removal / Inspection /					
Installation.....	page	T-37			
1) Turn and hazard warning light					
Troubleshooting .....	page	T-25			
Removal / Inspection /					
Installation.....	page	T-37			
2) Small light control system					
Troubleshooting .....	page	T-28			
Removal / Inspection /					
Installation.....	page	T-37			
3. Rear combination light					
Removal / Inspection /					
Installation.....	page	T-39			
1) Turn and hazard warning light					
Troubleshooting .....	page	T-25			
Removal / Inspection /					
Installation.....	page	T-39			
2) Small light control system					
Troubleshooting .....	page	T-28			
Removal / Inspection /					
Installation.....	page	T-39			
3) Back-up light					
Troubleshooting .....	page	T-30			
Removal / Inspection /					
Installation.....	page	T-39			
4) Stoplight					
Troubleshooting .....	page	T-32			
Removal / Inspection /					
Installation.....	page	T-39			
4. Fog light					
Troubleshooting .....	page	T-34			
Removal / Inspection /					
Installation.....	page	T-38			
5. License plate light					
Troubleshooting .....	page	T-28			
Removal / Inspection /					
Installation.....	page	T-41			
6. Combination switch					
Removal / Installation .....	page	T-18			
Disassembly / Assembly .....	page	T-18			
Inspection.....	page	T-19			
7. Flasher unit					
Inspection.....	page	T-15			
8. Stoplight switch					
Inspection.....	page	T-41			
9. Back-up light switch					
Inspection.....	page	T-41			
10. Fog light switch					
Inspection.....	page	T-42			
*1. Back-up light					
Troubleshooting .....	page	T-30			
Removal / Inspection /					
Installation.....	page	T-40			

97601X-028

**SPECIFICATIONS**

Light		Bulb (W)		Remarks
		RHD	Australia	
Headlight	Inside	50	45	
	Outside	40/60	45/60	
Front combination light	Position light	5		
	Turn and hazard warning light	21		
Rear combination light	Tailight	5		SINGAPORE Turn and hazard warning light: 27W Stoplight: 27W Tailight: 8W Back-up light: 23W
	Stoplight	21		
	Turn and hazard warning light	21		
	Back-up light	21		
License plate light		7.5		
Fog light		35		

97601X-028



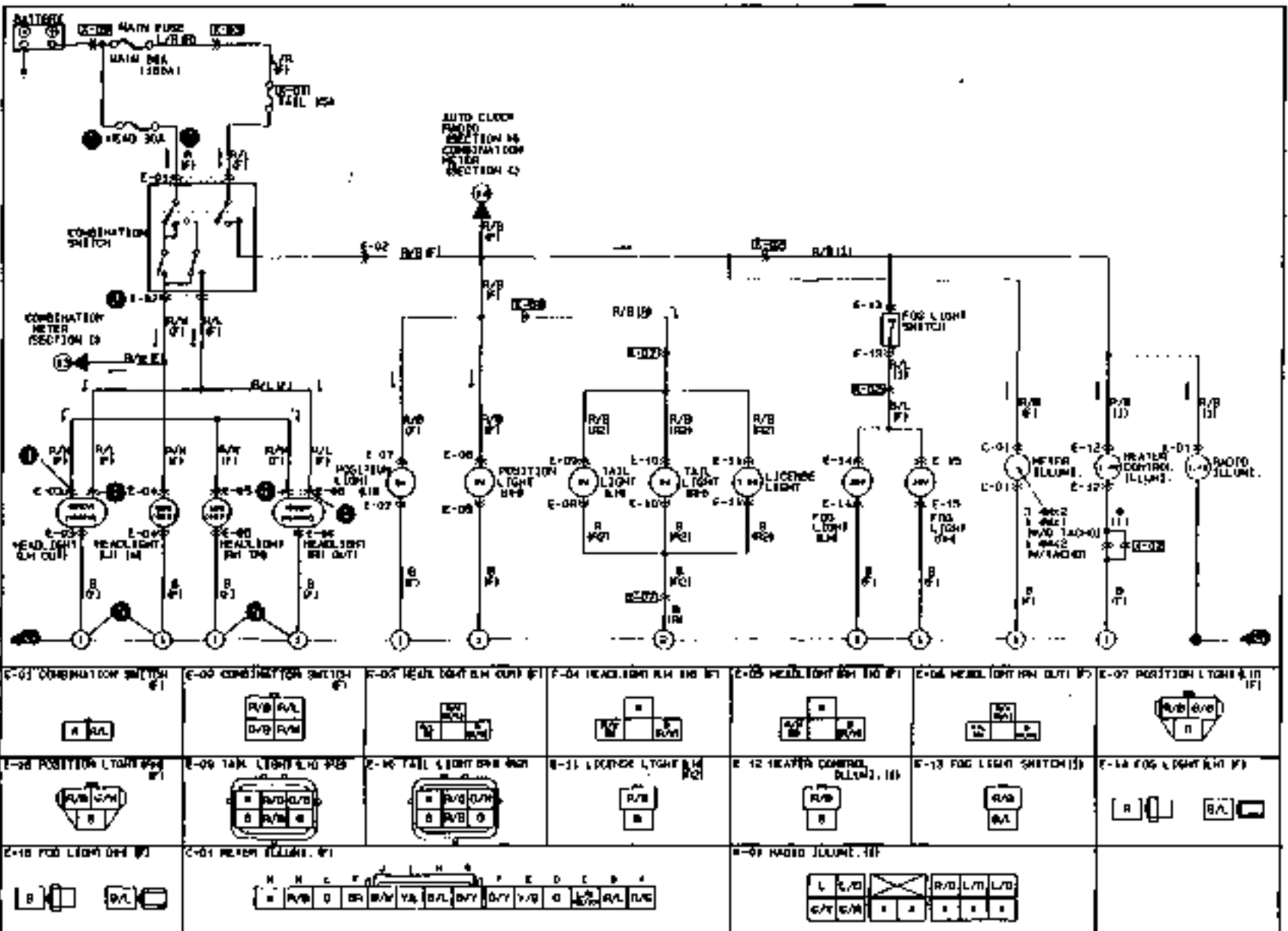
0T3C7X 027

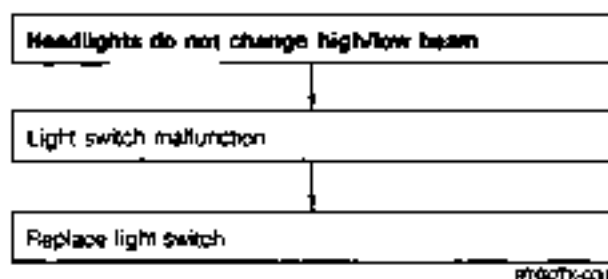
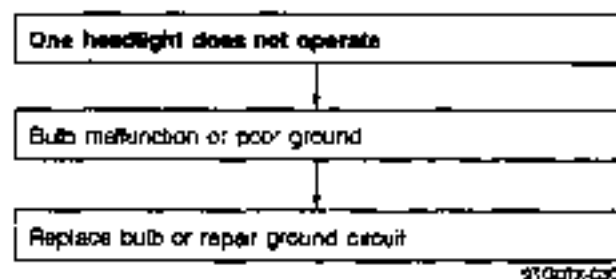
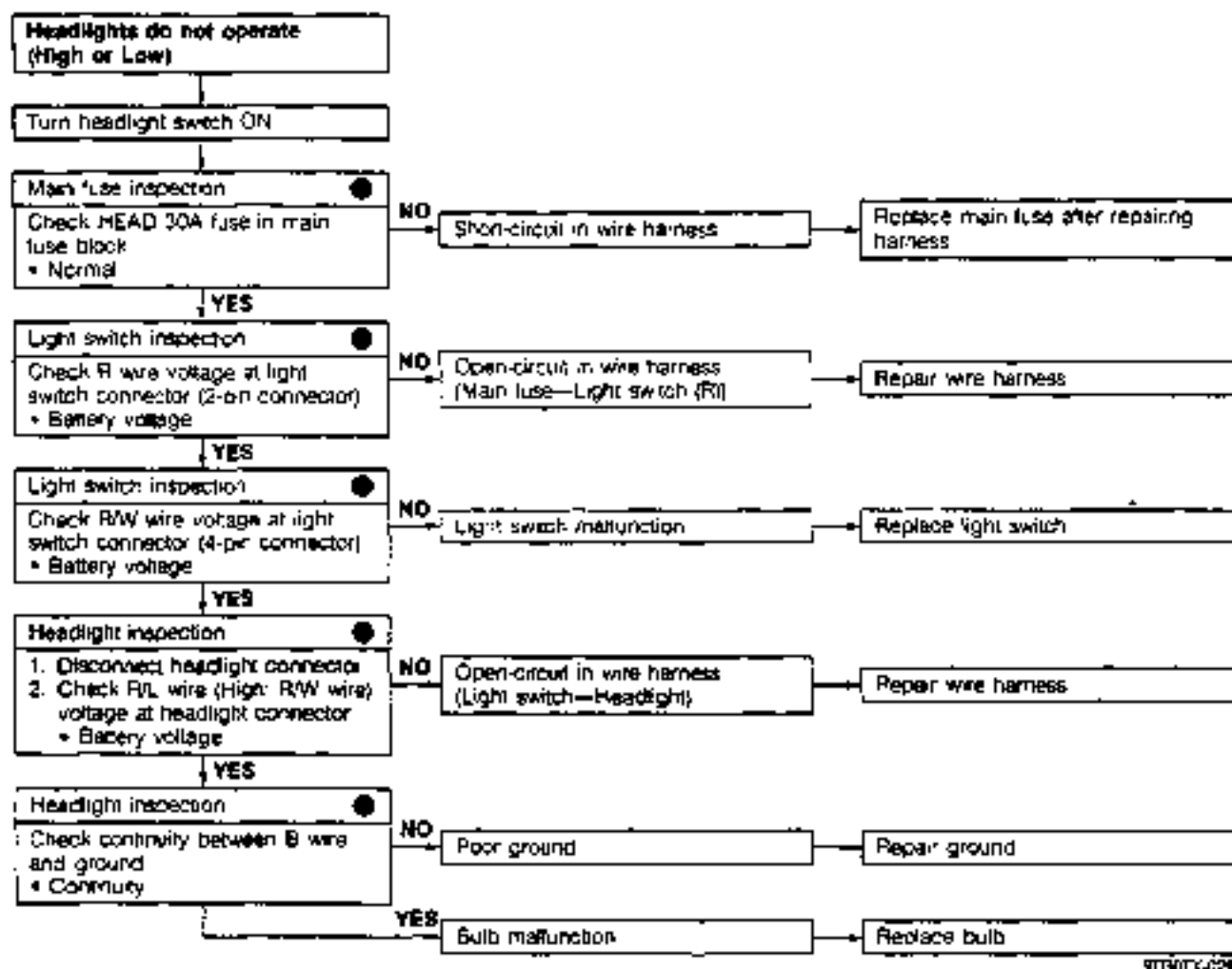
**AIMING**

1. Adjust the tire air pressures to specification.
2. Position the unloaded vehicle on a flat, level surface.
3. Adjust the headlights to meet local vehicle regulations.  
To adjust, turn the adjusting screws

# EXTERIOR LIGHTING SYSTEM

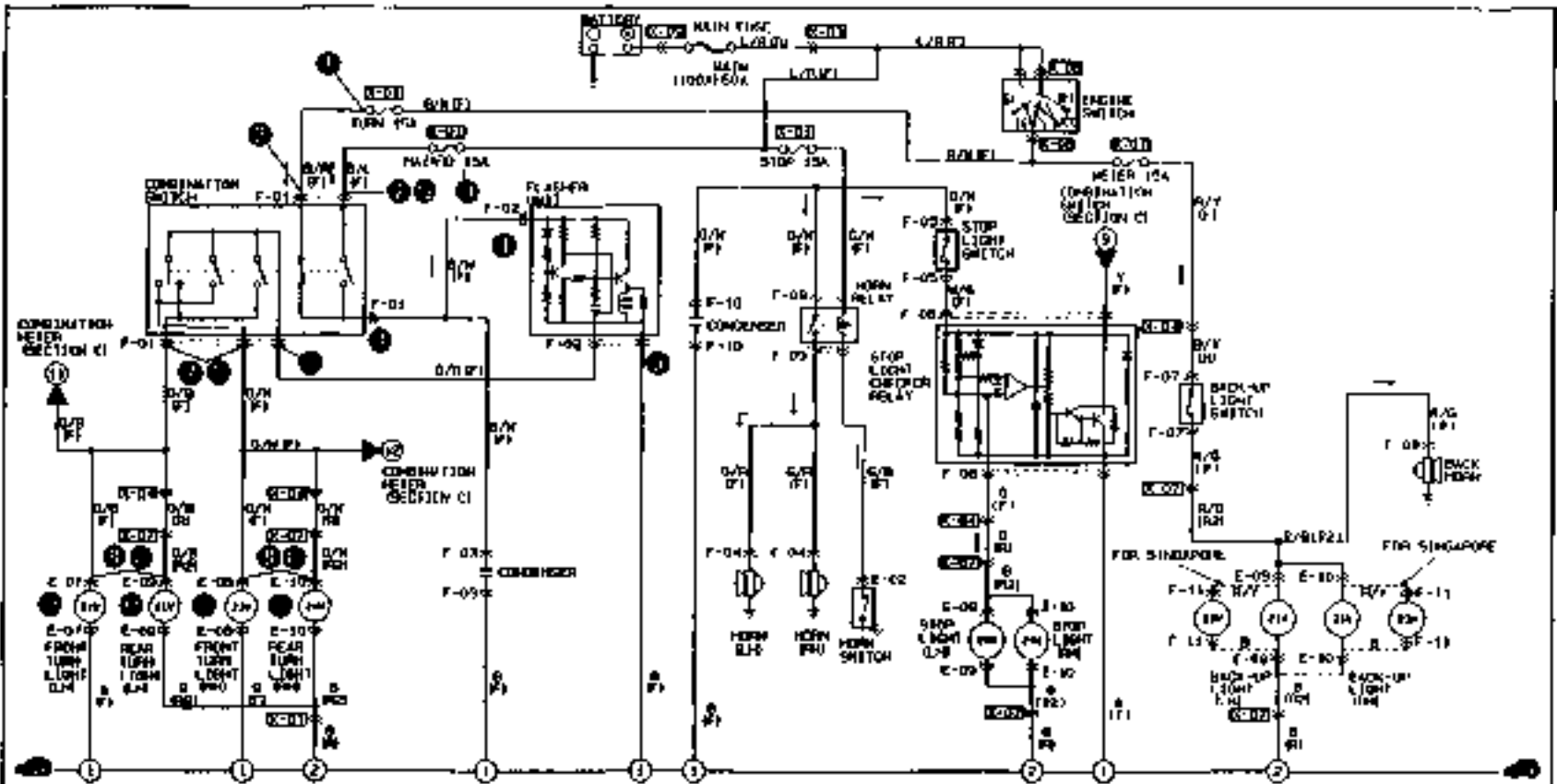
## TROUBLESHOOTING Headlights Wiring diagram





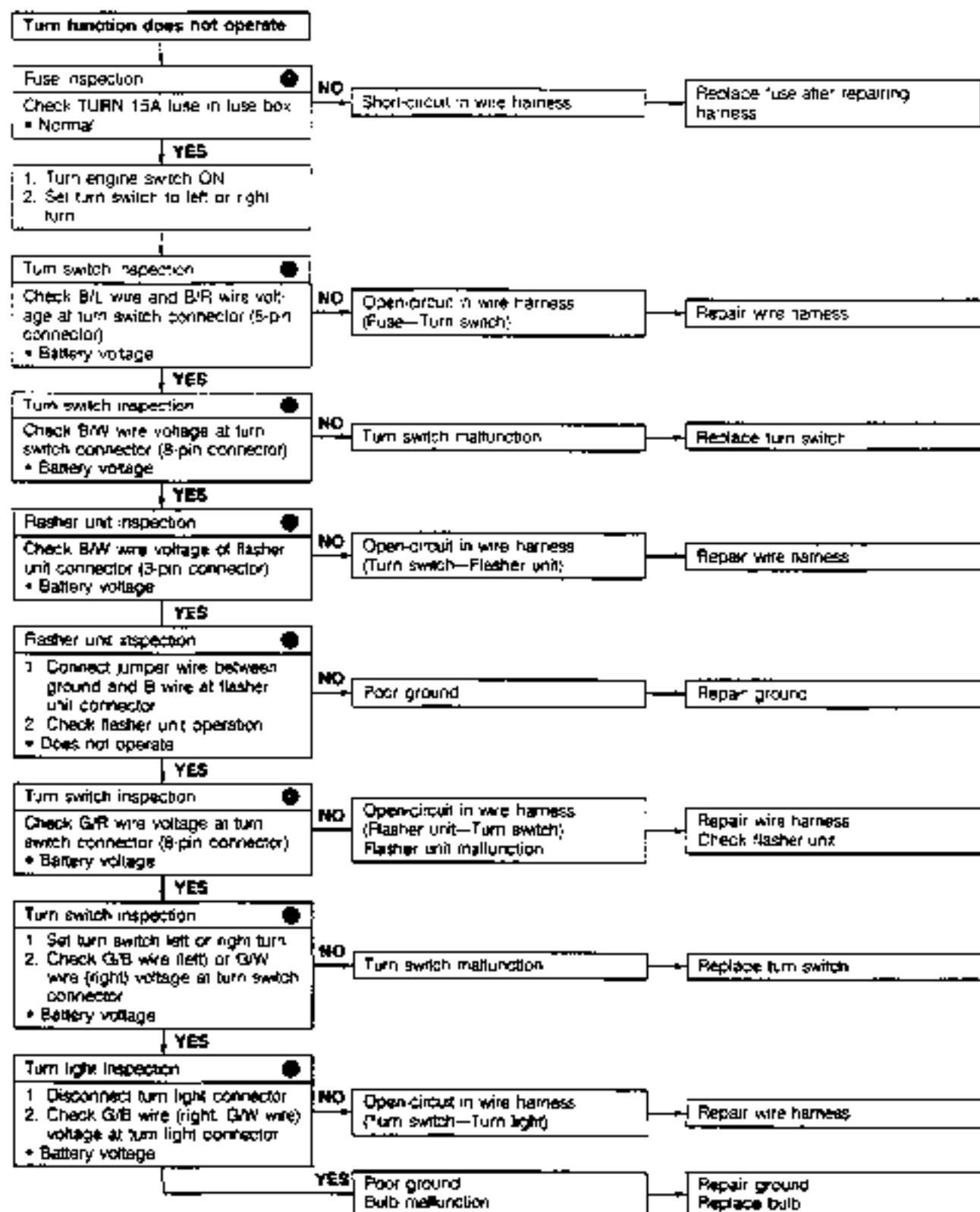
# EXTERIOR LIGHTING SYSTEM

## Turn and Hazard Warning Light Wiring Diagram

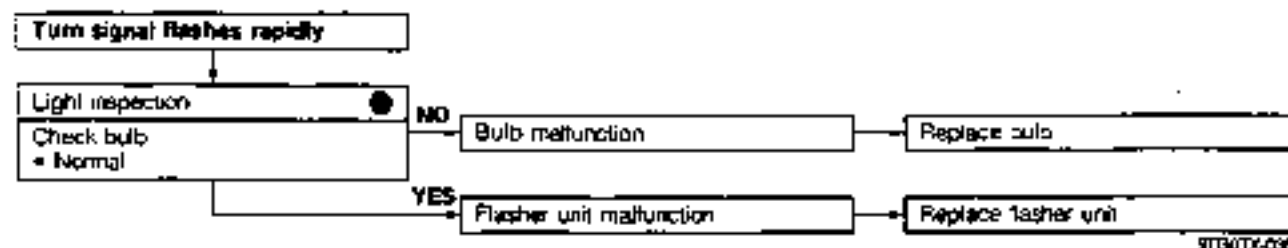
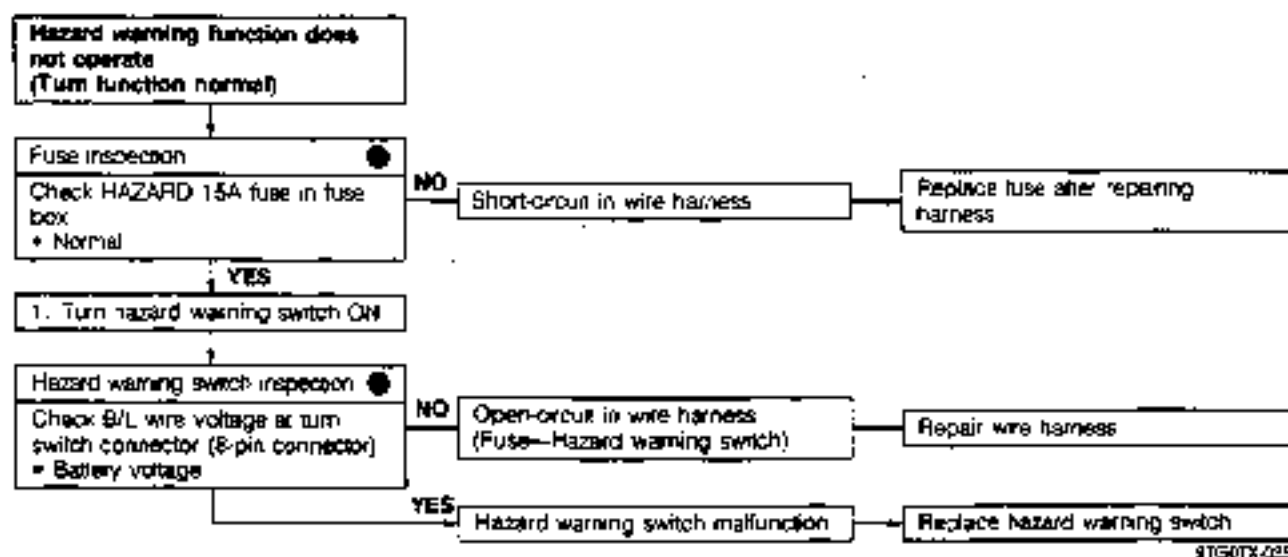
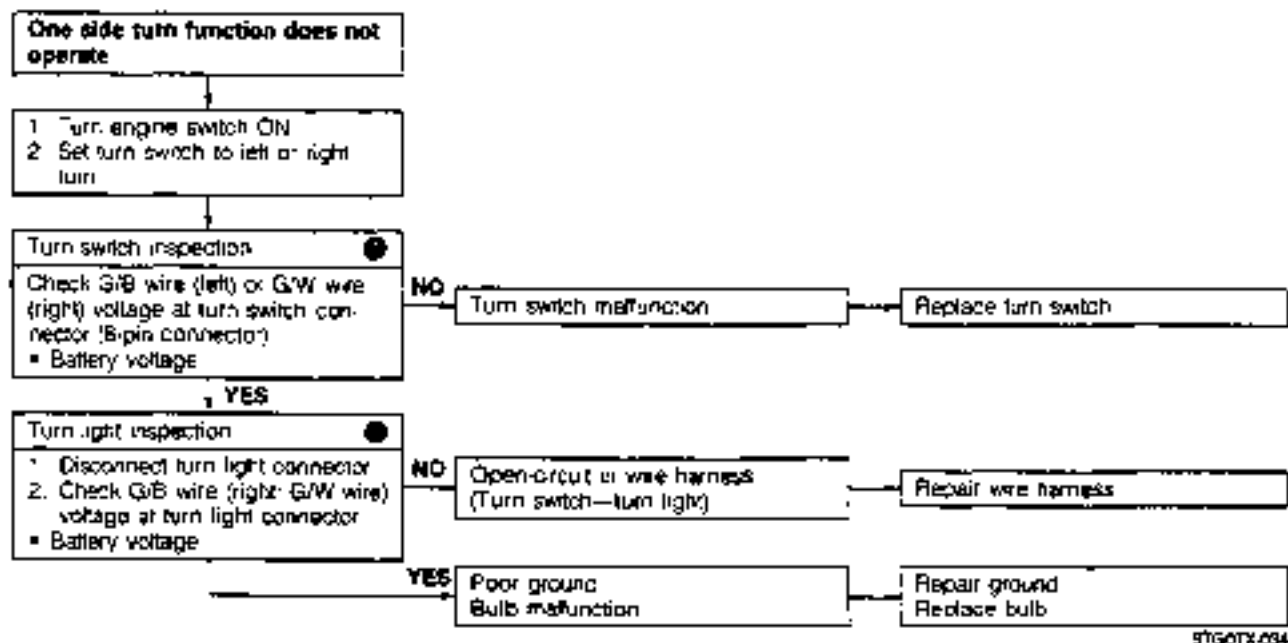


<b>F-01 COMBINATION SWITCH (F)</b> 	<b>F-02 FLASHER UNIT (F)</b> 	<b>F-03 CONDENSER (F)</b> 	<b>F-04 HORN (F)</b> 	<b>F-05 STOP LIGHT SWITCH (F)</b> 	<b>F-06 STOP LIGHT RELAY (F)</b> 	<b>F-07 BACK UP LIGHT SWITCH (F)</b> 
<b>F-08 BACK HORN (F)</b> 	<b>F-09 HORN RELAY (F)</b> 	<b>F-10 CONDENSER (F)</b> 	<b>F-11 BACK-UP LIGHT FOR SINGAPORE (F)</b> 	<b>E-02 HORN SWITCH (F)</b> 	<b>E-03 FRONT TURN LIGHT (F)</b> 	<b>E-04 FRONT TURN LIGHT (F)</b> 
<b>E-05 REAR COMBINATION LIGHT (R/L, R/R)</b> 	<b>E-10 REAR COMBINATION LIGHT (R/L, R/R)</b> 					

NOTE: F-1 NOT USED

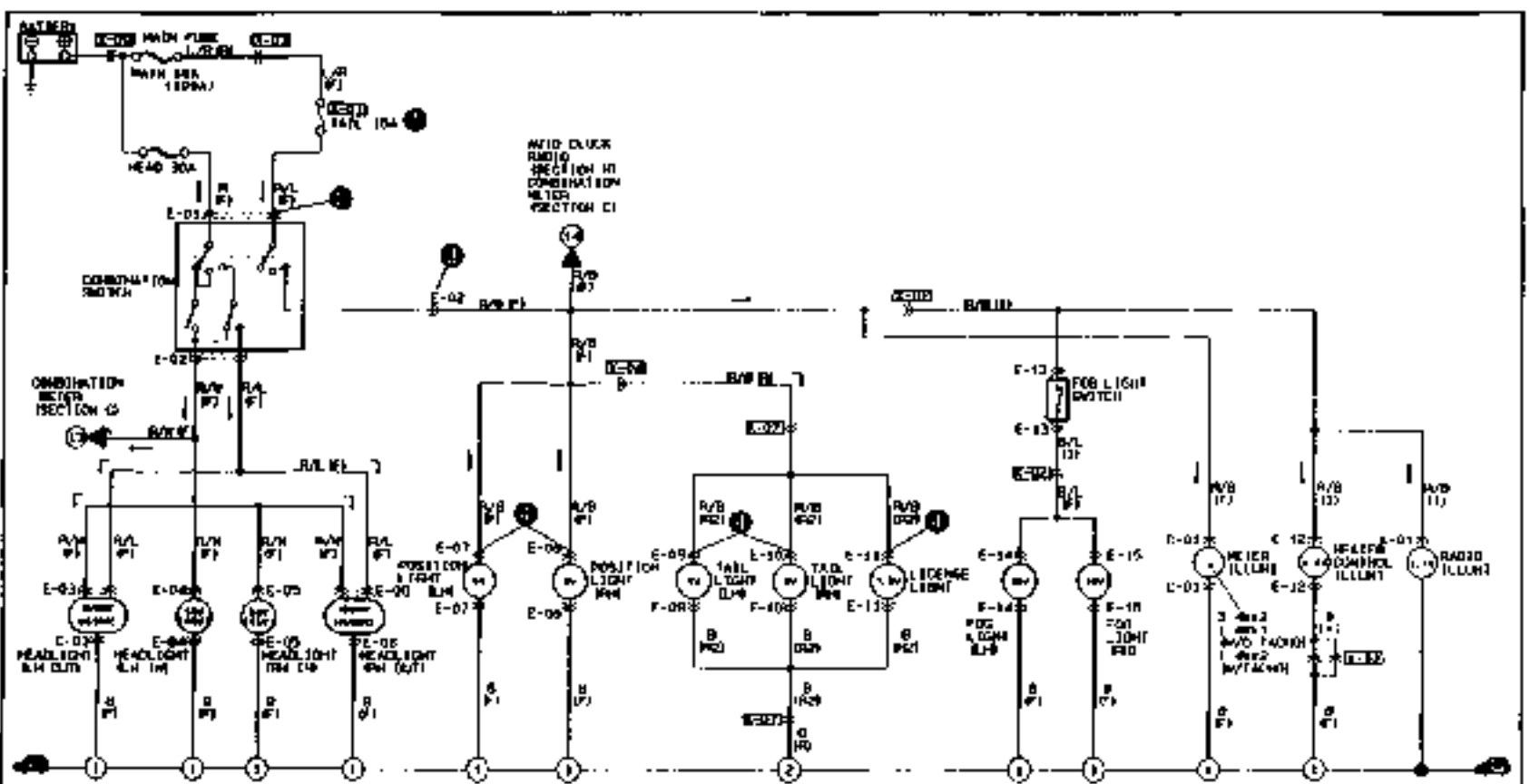


9F507X-033



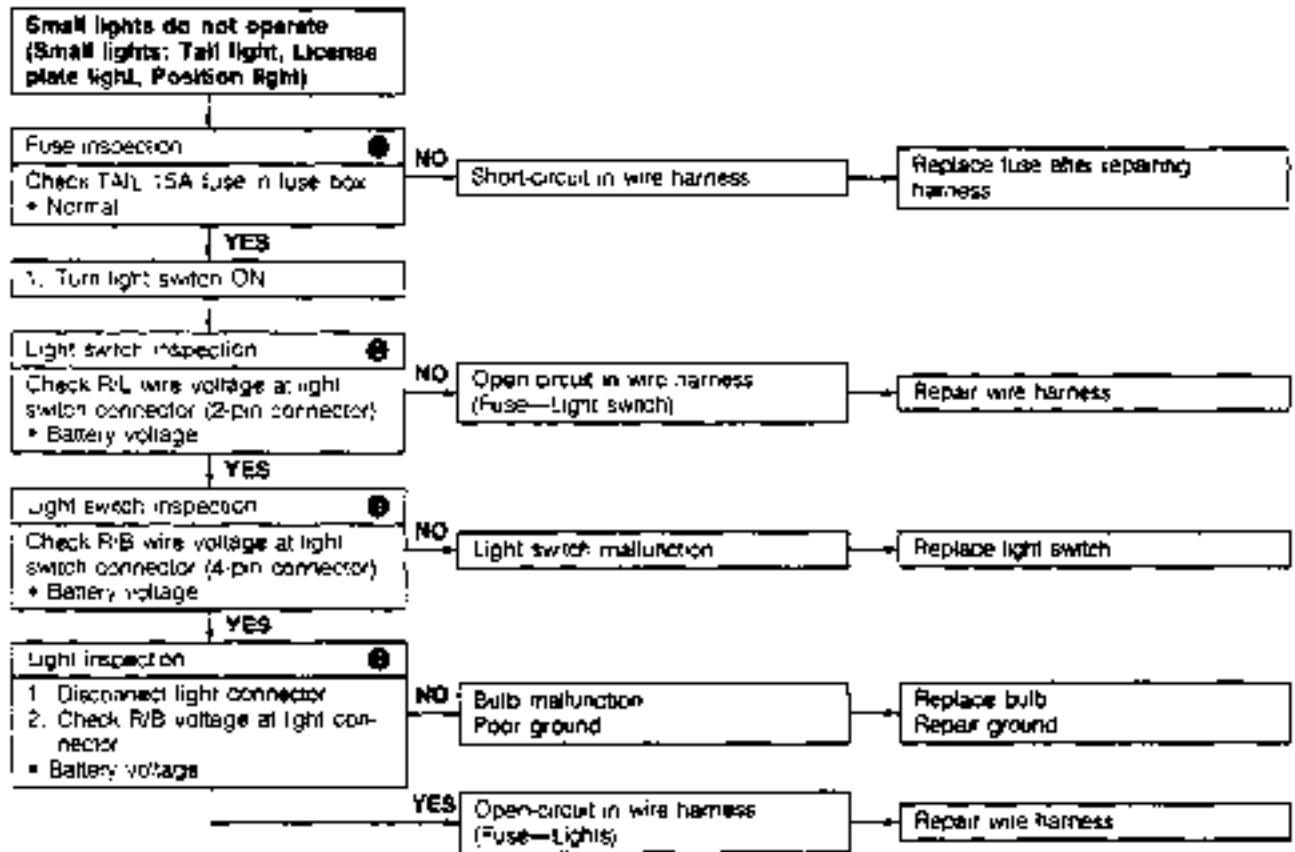


Small Light Control System  
Wiring diagram



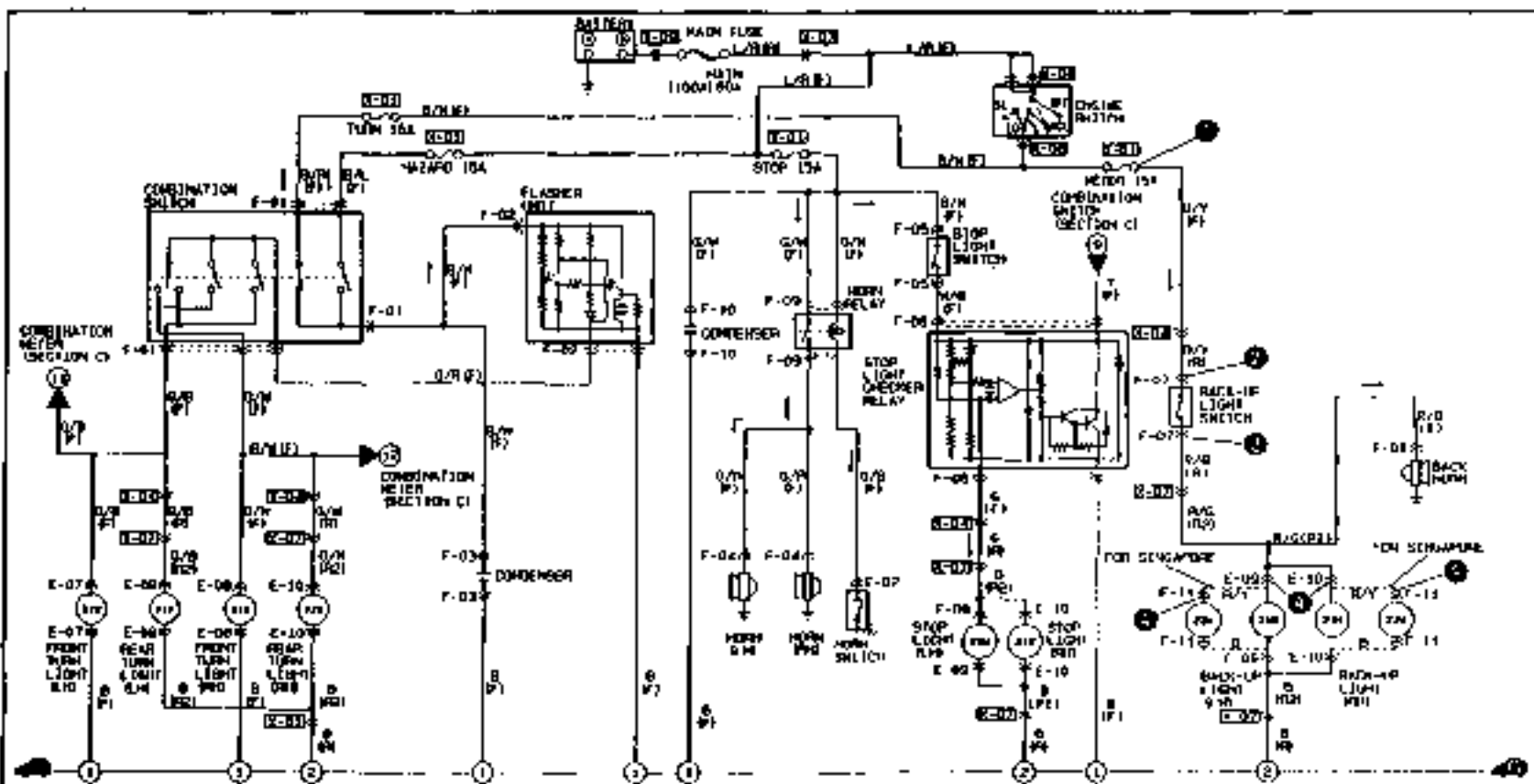
<p>E-01 COMBINATION SWITCH (P)</p>	<p>E-02 COMBINATION SWITCH (P)</p>	<p>E-03 HEADLIGHT RELAY (P)</p>	<p>E-04 HEADLIGHT RELAY (P)</p>	<p>E-05 HEADLIGHT RELAY (P)</p>	<p>E-06 HEADLIGHT RELAY (P)</p>	<p>E-07 POSITION LIGHT RELAY (P)</p>
<p>E-08 POSITION LIGHT RELAY (P)</p>	<p>E-09 TAIL LIGHT RELAY (P)</p>	<p>E-10 TAIL LIGHT RELAY (P)</p>	<p>E-11 LICENSE LIGHT RELAY (P)</p>	<p>E-12 HEADLAMP DIMMER RELAY (P)</p>	<p>E-13 FOG LIGHT SWITCH (P)</p>	<p>E-14 FOG LIGHT SWITCH (P)</p>
<p>E-15 FOG LIGHT SWITCH (P)</p>	<p>E-01 METER ILLUMINATION (P)</p>					<p>E-16 RADIO ILLUMINATION (P)</p>

NOTE: R - 100 WATT



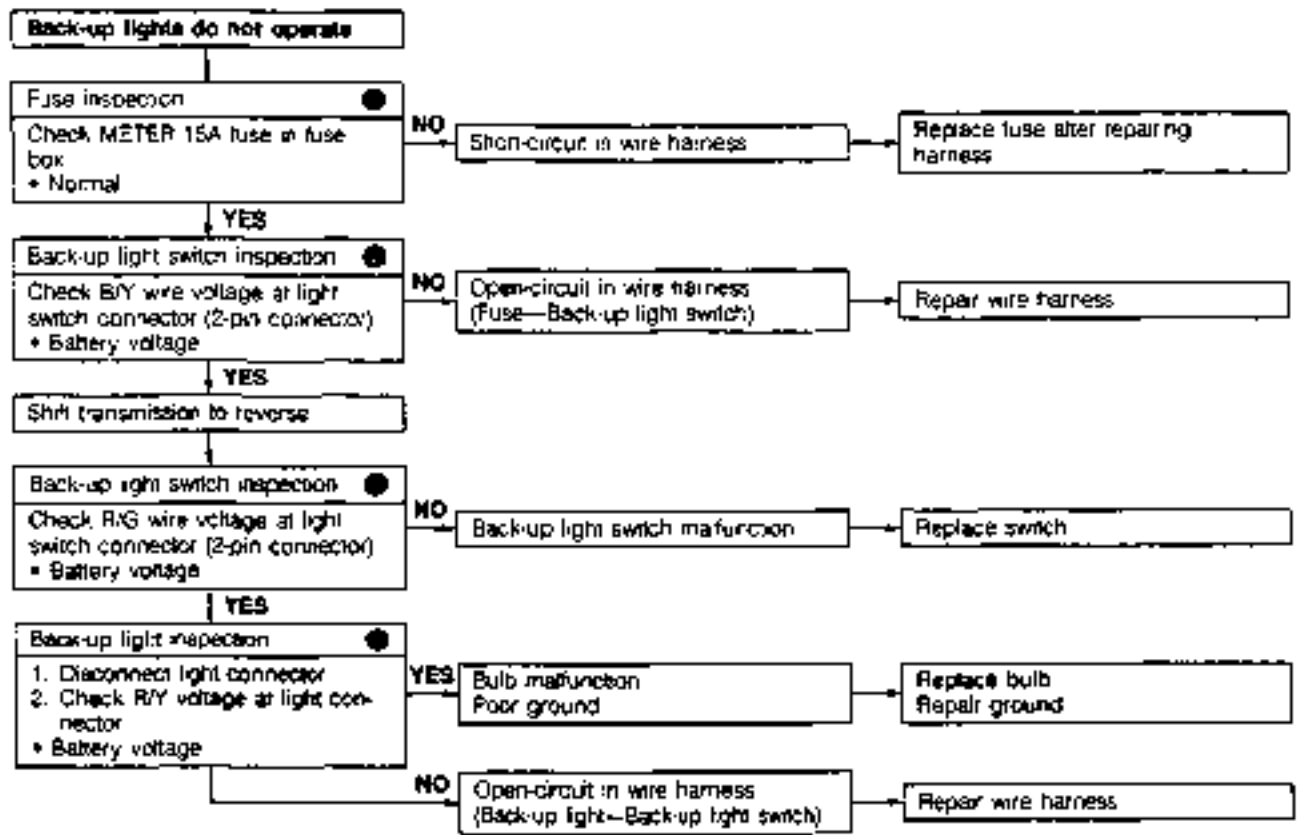
9T007X-03M

Back-up Light  
Wiring diagram

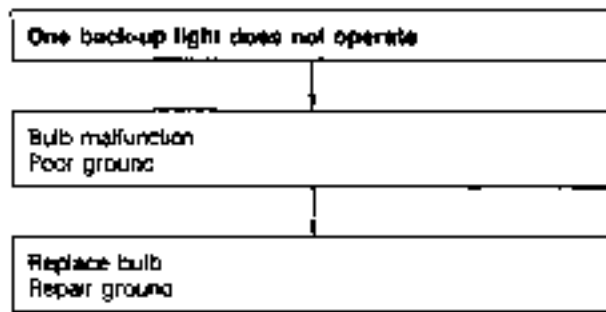


F-01 COMBINATION METER SECTION (F)	F-02 FLASHER UNIT (F)	F-03 CONDENSER (F)	F-04 HORN (F)	F-05 STOP LIGHT CHECKER RELAY (F)	F-06 STOP LIGHT SWITCH (F)	F-07 BACK-UP LIGHT SWITCH (F)
F-08 BACK-UP LIGHT (F)	F-09 HORN RELAY (F)	F-10 CONDENSER (F)	F-11 BACK-UP LIGHT FOR SINGAPORE (F)	E-02 HORN SWITCH (F)	E-07 FRONT TURN LIGHT (E)	E-08 FRONT TURN LIGHT (E)
E-09 REAR COMBINATION LIGHT (E)	E-10 REAR COMBINATION LIGHT (E)					

NOTE: --- NOT USED

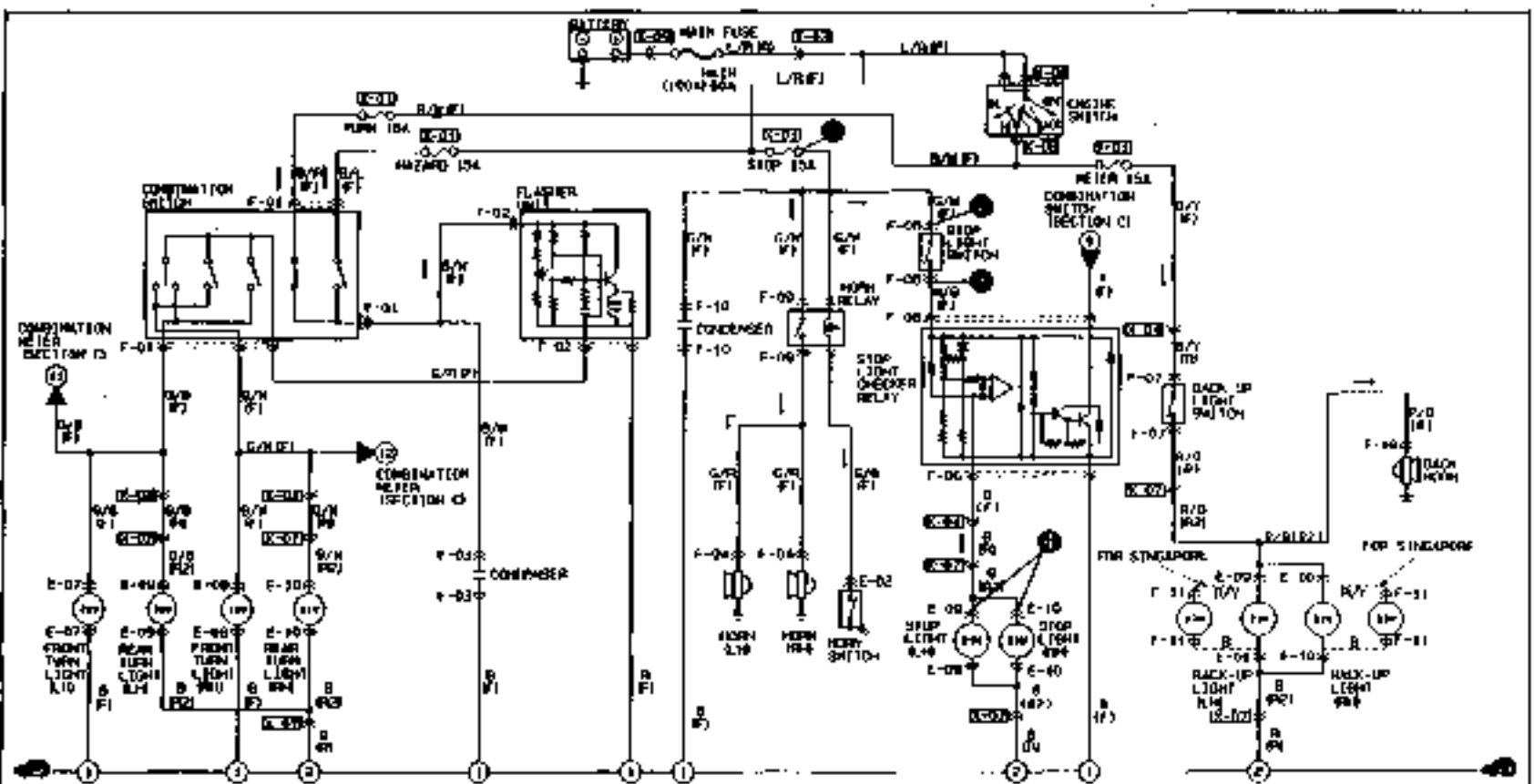


9T607A-040



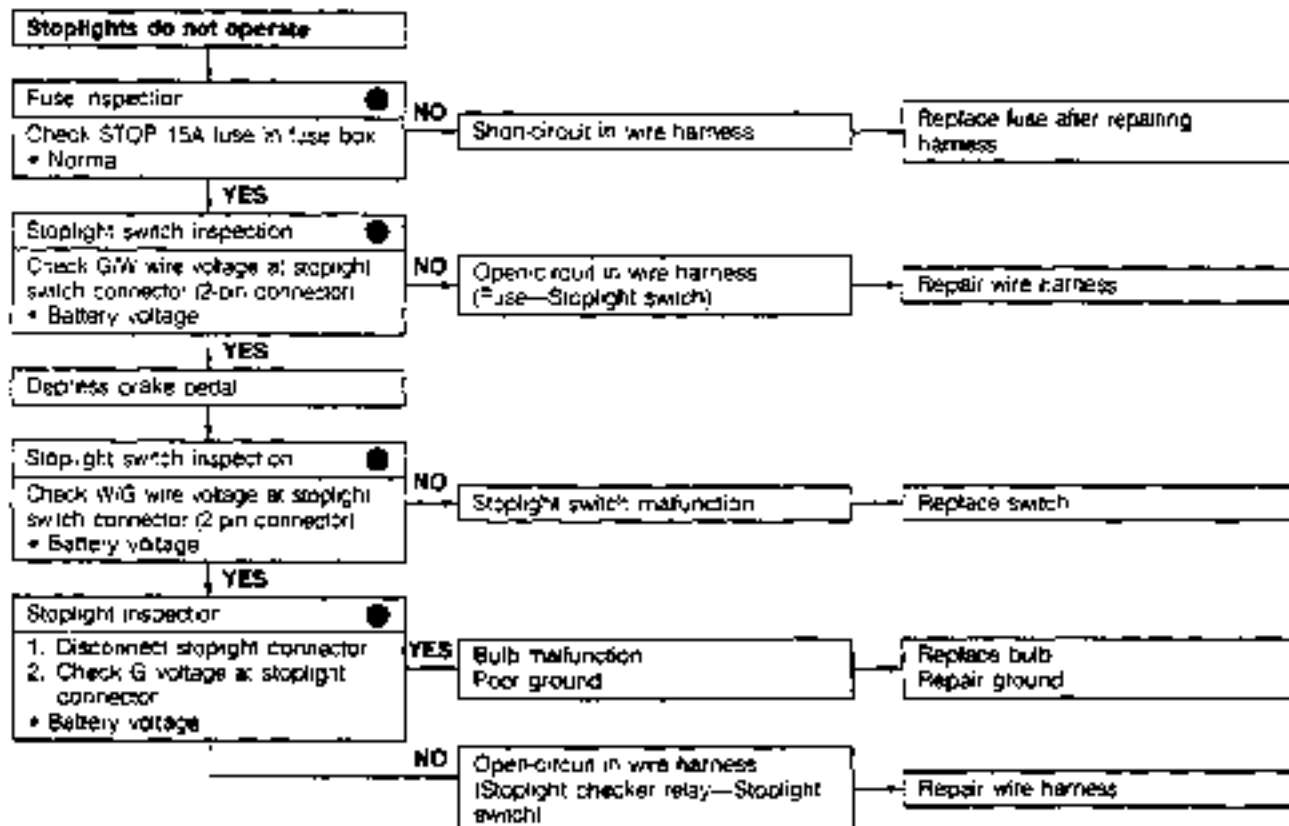
9T607A-041

Stoplight  
Wiring Diagram

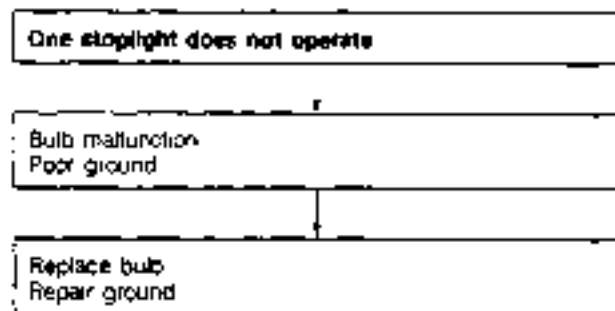


<p>F-01 COMBINATION SWITCH (F)</p>	<p>F-02 FLASHER UNIT (F)</p>	<p>F-03 CONDENSER (F)</p>	<p>F-04 HORN (F)</p>	<p>F-05 STOP LIGHT SWITCH (F)</p>	<p>F-06 STOP LIGHT CHECKER RELAY (F)</p>	<p>F-07 BACK UP LIGHT SWITCH (F)</p>
<p>F-08 BACK HORN (F)</p>	<p>F-09 HORN RELAY (F)</p>	<p>F-10 CONDENSER (F)</p>	<p>F-11 BACK-UP LIGHT FOR SINGAPORE (F)</p>	<p>E-02 HORN SWITCH (F)</p>	<p>E-07 FRONT TURN LIGHT (F)</p>	<p>E-08 FRONT TURN LIGHT (F)</p>
<p>E-09 REAR COMBINATION LIGHT (F)</p>	<p>E-10 REAR COMBINATION LIGHT (F)</p>					

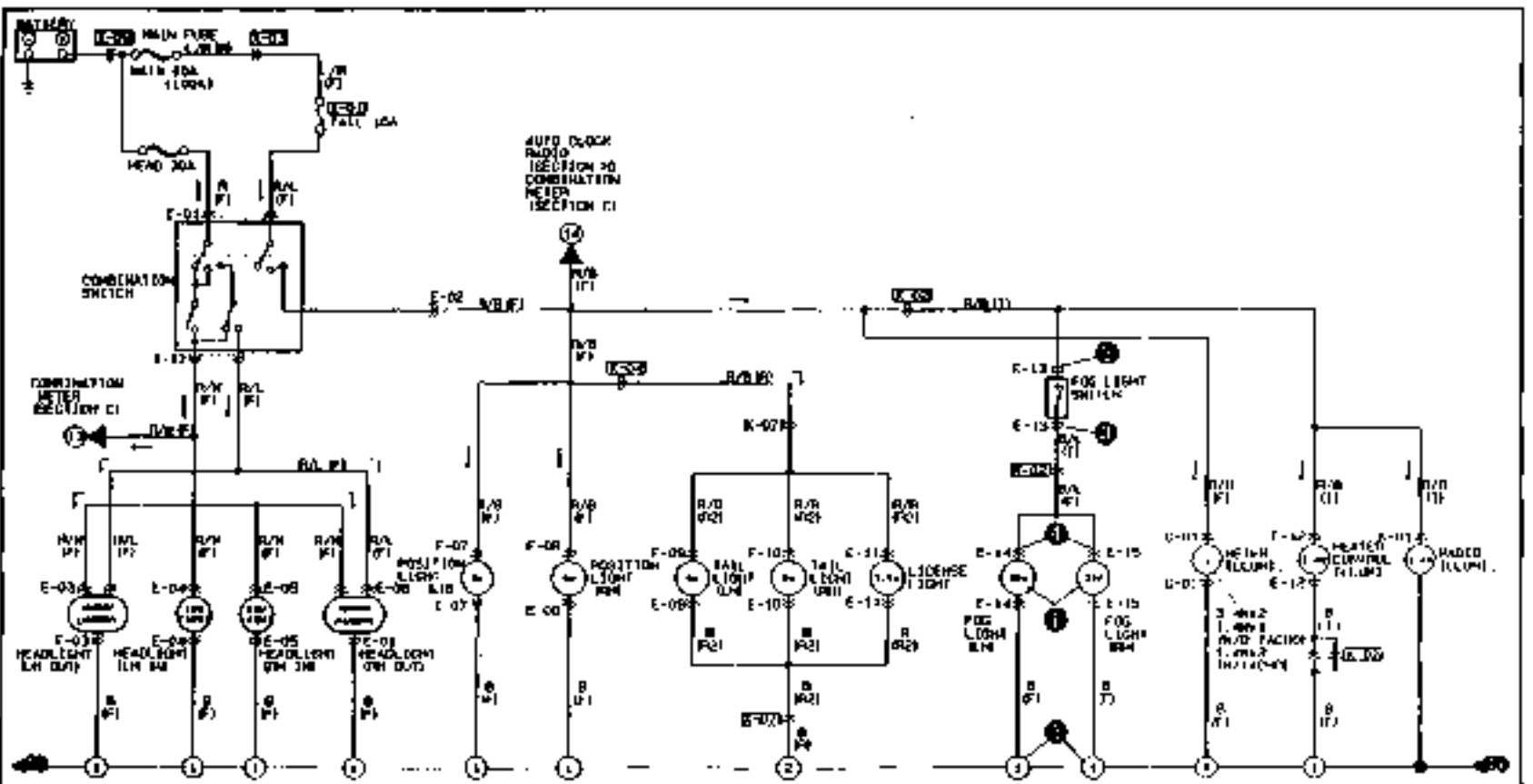
NOTE: B... NOT USED



9T90TX-043

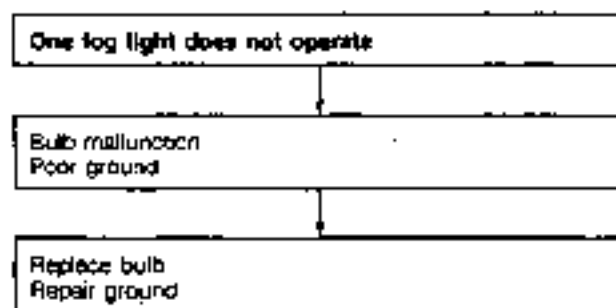
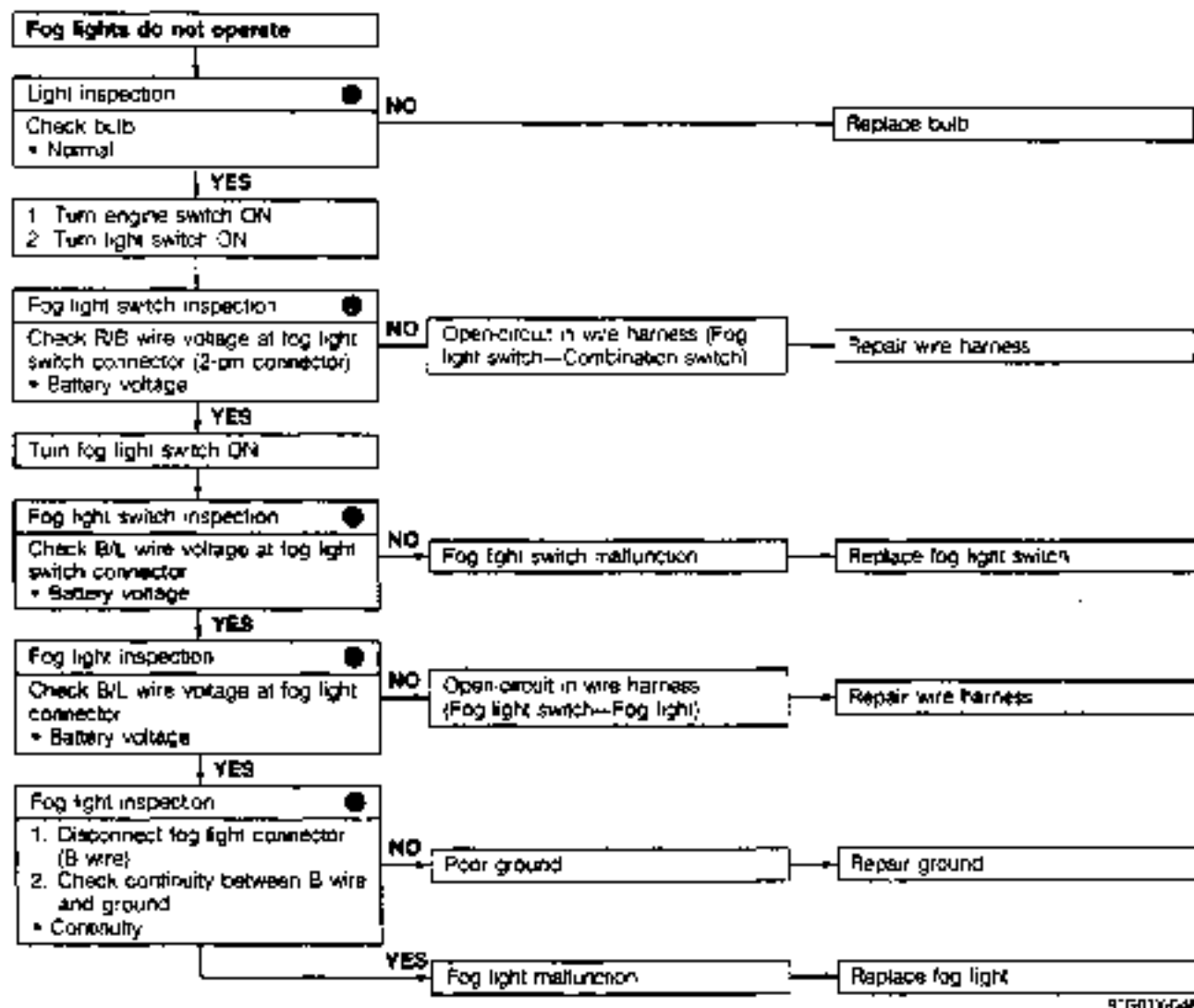


9T90TX-044



E-03 COMBINATION SWITCH (F)	E-04 COMBINATION SWITCH (F)	E-05 HEADLIGHT LH (F)	E-06 HEADLIGHT RH (F)	E-07 HEADLIGHT LH (F)	E-08 HEADLIGHT RH (F)	E-09 POSITION LIGHT (F)
E-07 POSITION LIGHT (F)	E-08 TAIL LIGHT (F)	E-10 TAIL LIGHT (F)	E-11 LICENSE LIGHT (F)	E-12 HEATER CONTROL (F)	E-13 FOG LIGHT SWITCH (F)	E-14 POSITION LIGHT (F)
E-10 FOG LIGHT (F)	E-01 METER (F)					

NOTE: ... NOT USED

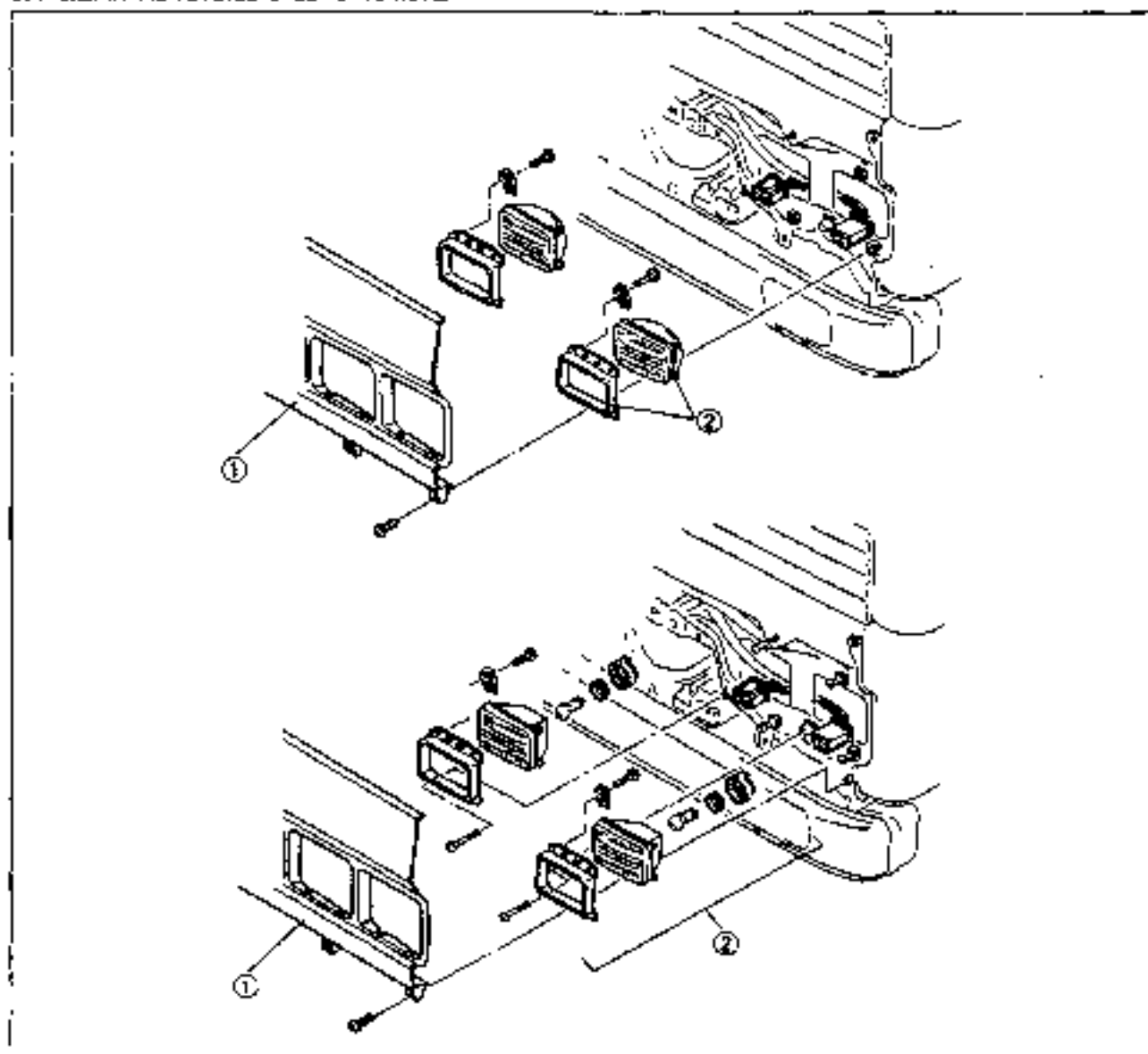




## HEADLIGHT

## Removal / Installation

1. Disconnect the negative battery cable.
2. Remove in the order shown in the figure, referring to **Removal Note**
3. Install in the reverse order of removal

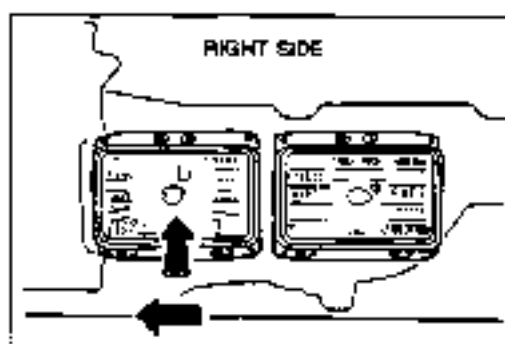


9T007X-048

1. Radiator grille

2. Headlight

Removal Note..... page T-36



9T007X-046

## Removal note

## Headlight

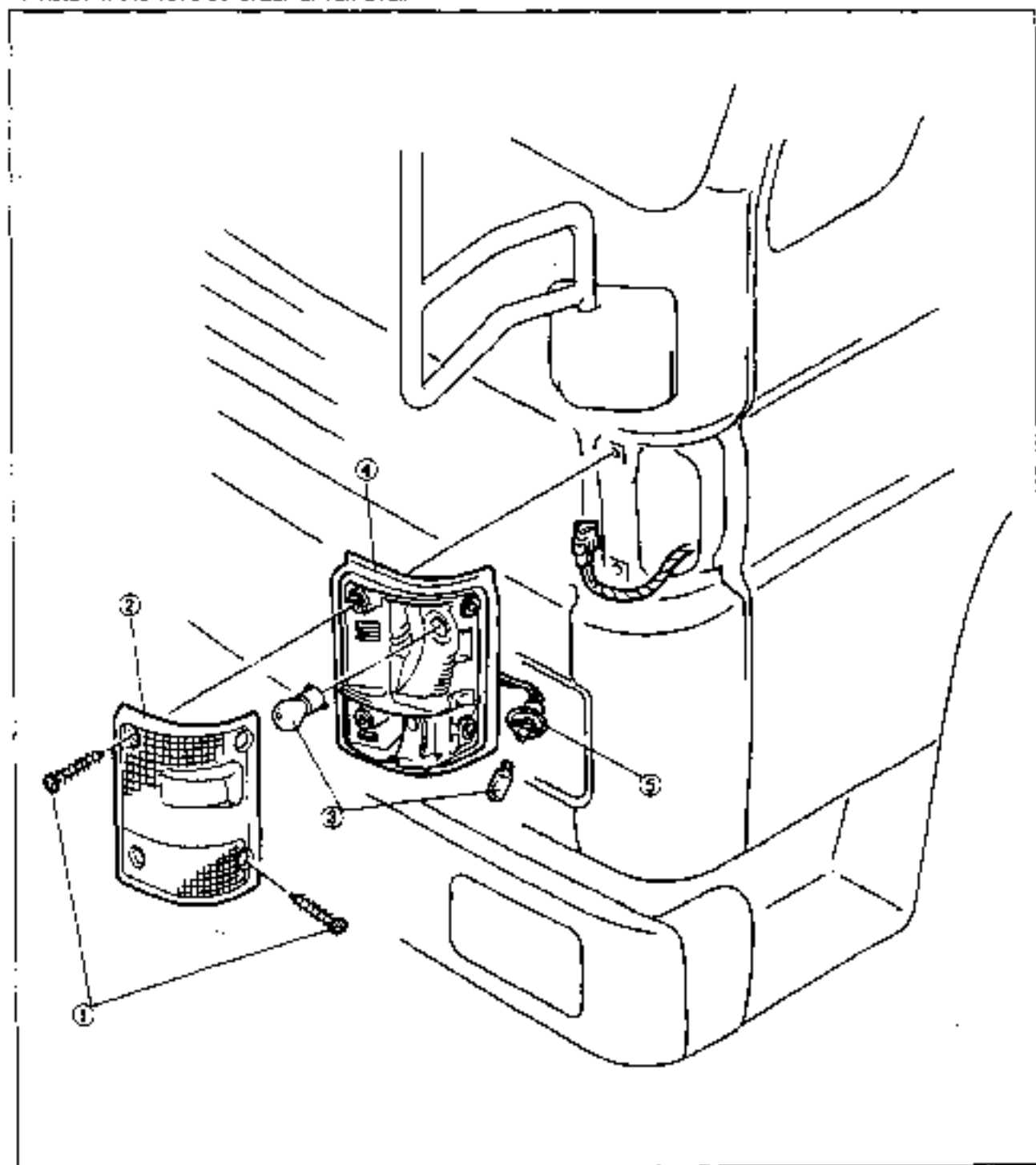
1. To remove, push the headlight and slide it to right or left.

Right headlight: Slide to left

Left headlight : Slide to right

**FRONT COMBINATION LIGHT****Removal / Inspection / Installation**

1. Disconnect the negative battery cable.
2. Remove in the order shown in the figure
3. Inspect all parts and repair or replace as necessary
4. Install in the reverse order of removal.



1. Screws
2. Lens
3. Bulb

4. Housing
5. Socket

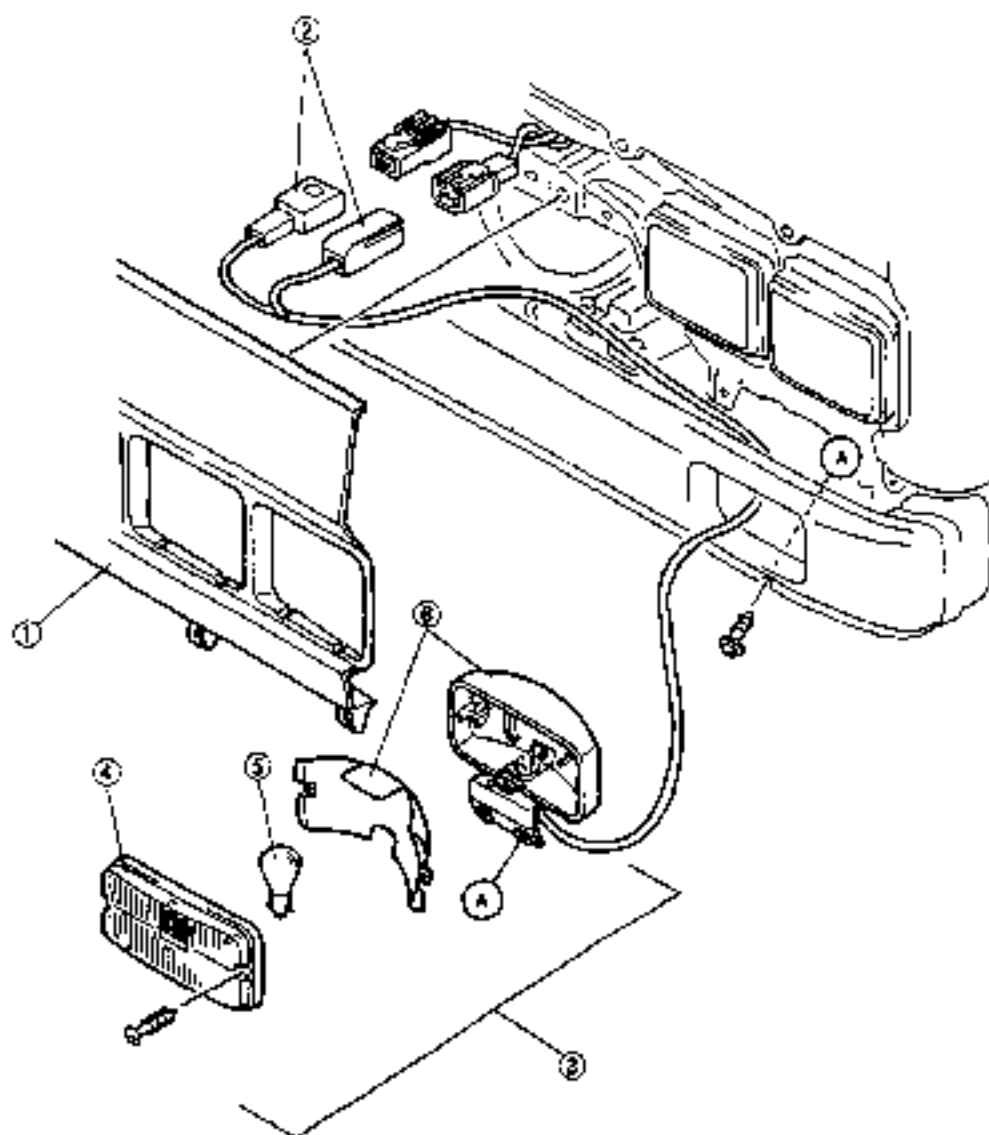
Inspect for failure and poor contact

9T907M-050

## FOG LIGHT

## Removal / Inspection / Installation

1. Disconnect the negative battery cable.
2. Remove in the order shown in the figure
3. Inspect all parts and repair or replace as necessary.
4. Install in the reverse order of removal



1. Radiator grille
2. Connector
3. Fog light assembly
4. Lens

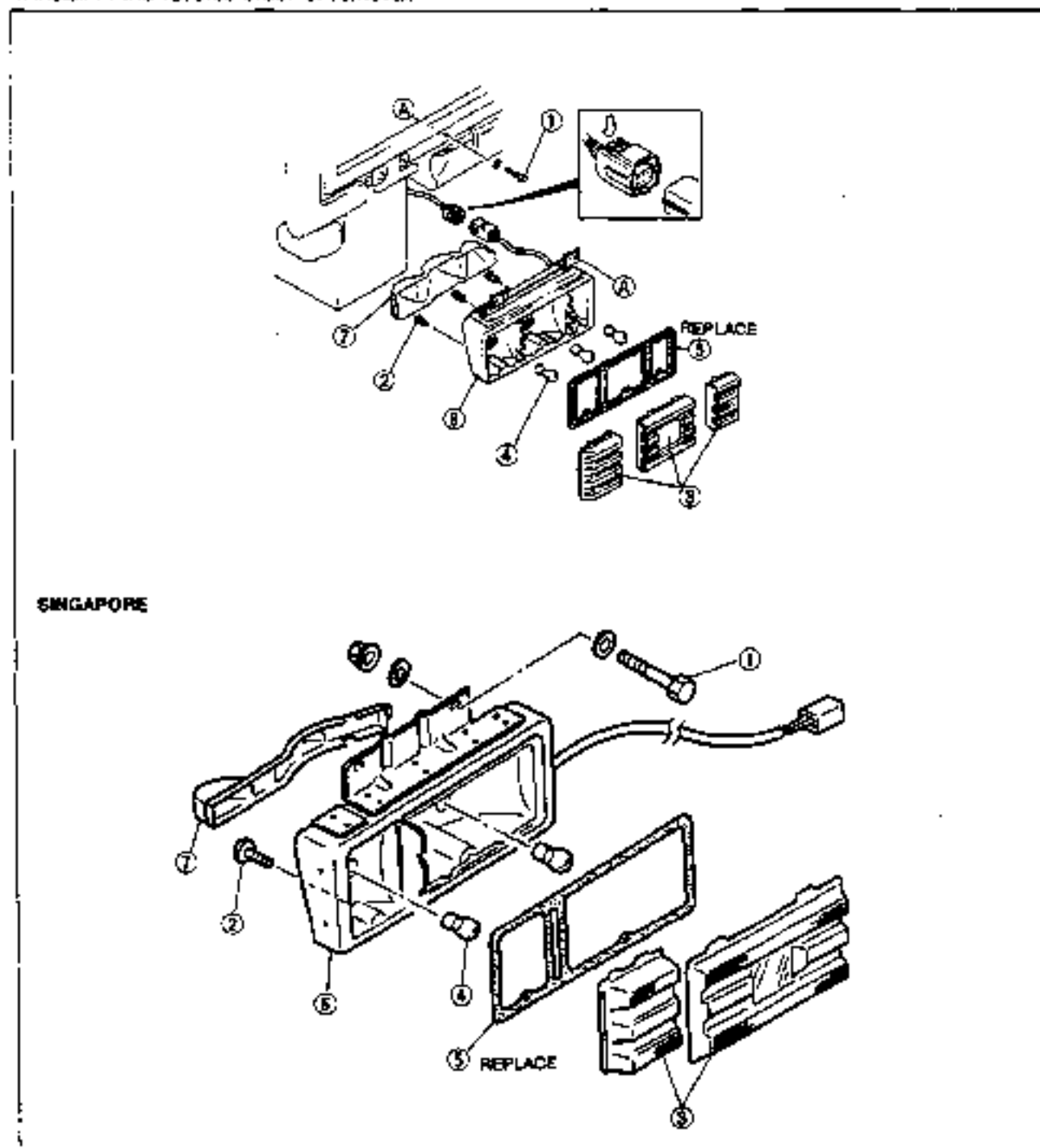
5. Bulb  
Inspect for failure and poor contact
6. Fog light body assembly

97307X-051

## REAR COMBINATION LIGHT

### Removal / Inspection / Installation

1. Disconnect the negative battery cable
2. Remove in the order shown in the figure.
3. Inspect all parts and repair or replace as necessary.
4. Install in the reverse order of removal.



1. Bolts
2. Screws
3. Lens

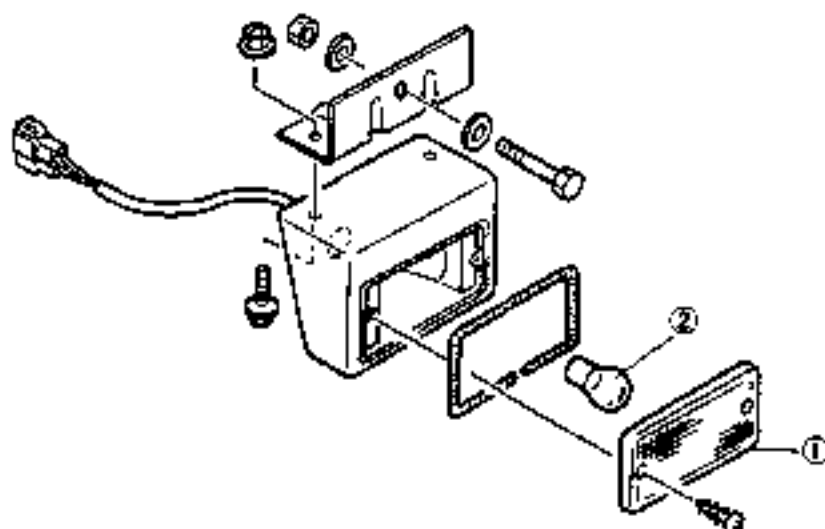
4. Bulb  
Inspect for failure and poor contact
5. Gasket
6. Housing
7. Cover

97P07X-013

**BACK-UP LIGHT****Removal / Inspection / Installation**

1. Disconnect the negative battery cable.
2. Remove in the order shown in the figure.
3. Inspect all parts and repair or replace as necessary.
4. Install in the reverse order of removal.

SINGAPORE



9T60TX-053

1. Lens

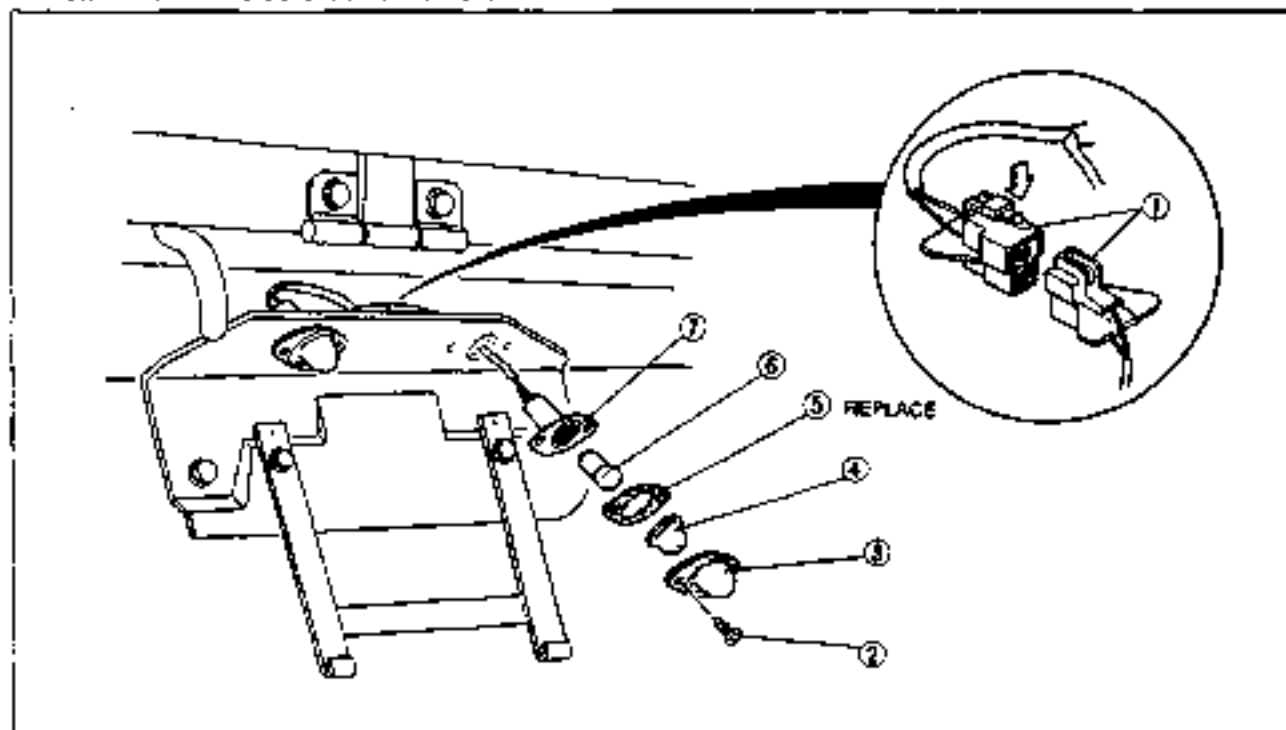
2. Bulb

Inspect for failure and poor contact

**LICENSE PLATE LIGHT**

**Removal / Inspection / Installation**

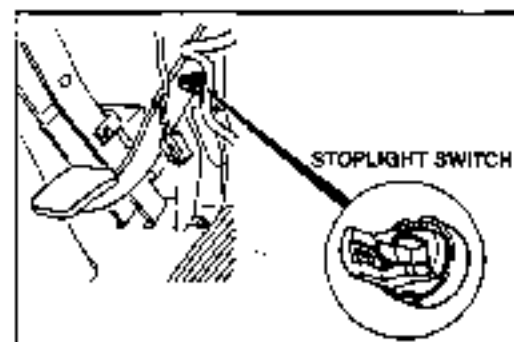
1. Disconnect the negative battery cable.
2. Remove in the order shown in the figure.
3. Inspect all parts and repair or replace as necessary.
4. Install in the reverse order of removal.



9T60TX-064

1. Connector
2. Screws
3. Cover
4. Lens

5. Gasket
6. Bulb  
Inspect for failure and poor contact
7. Socket



9T60TX-056

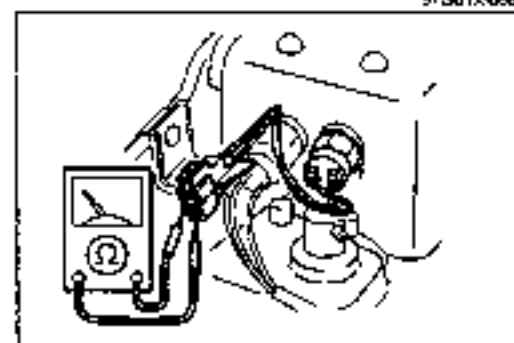
**STOPLIGHT SWITCH**

**Inspection**

1. Disconnect the stoplight switch connector.
2. Check continuity of the stoplight switch.

Brake pedal	Continuity
Depressed	Yes
Released	No

3. Replace the stoplight switch, if not as specified.



9T60TX-056

**BACK-UP LIGHT SWITCH**

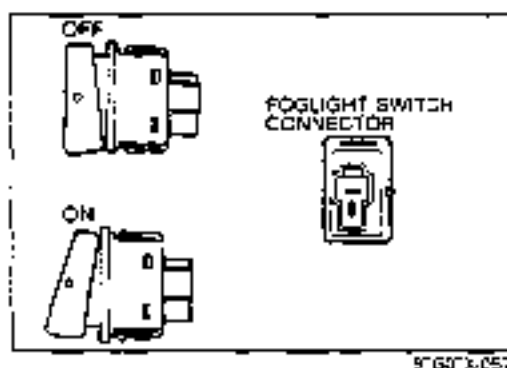
**Inspection**

1. Disconnect the backup light switch connector.
2. Check continuity of the back-up light switch.

Transmission	Continuity
Reverse	Yes
Other gears	No

3. Replace the back-up light switch, if not as specified.

# T EXTERIOR LIGHTING SYSTEM/INTERIOR LIGHTING SYSTEM



## FOG LIGHT SWITCH

### Inspection

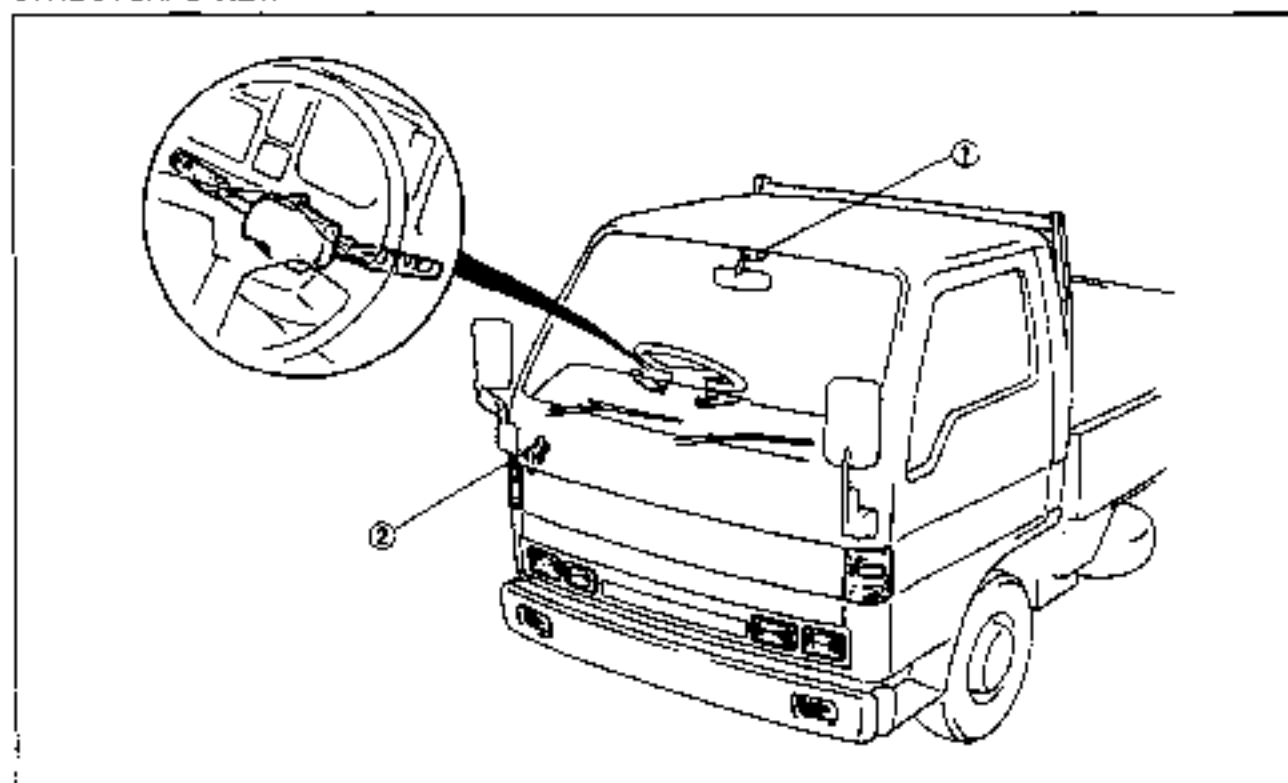
1. Remove the fog light switch.
2. Disconnect the fog light switch connector.
3. Check continuity of the fog light switch.

Switch	Continuity
ON	Yes
OFF	No

4. Replace the fog light switch if not as specified.

## INTERIOR LIGHTING SYSTEM

### STRUCTURAL VIEW



97G07X-058

1. Interior lamp  
 Troubleshooting ..... page T-43  
 Removal / Inspection /  
 Installation ..... page T-46

2. Door switch  
 Inspection ..... page T-46

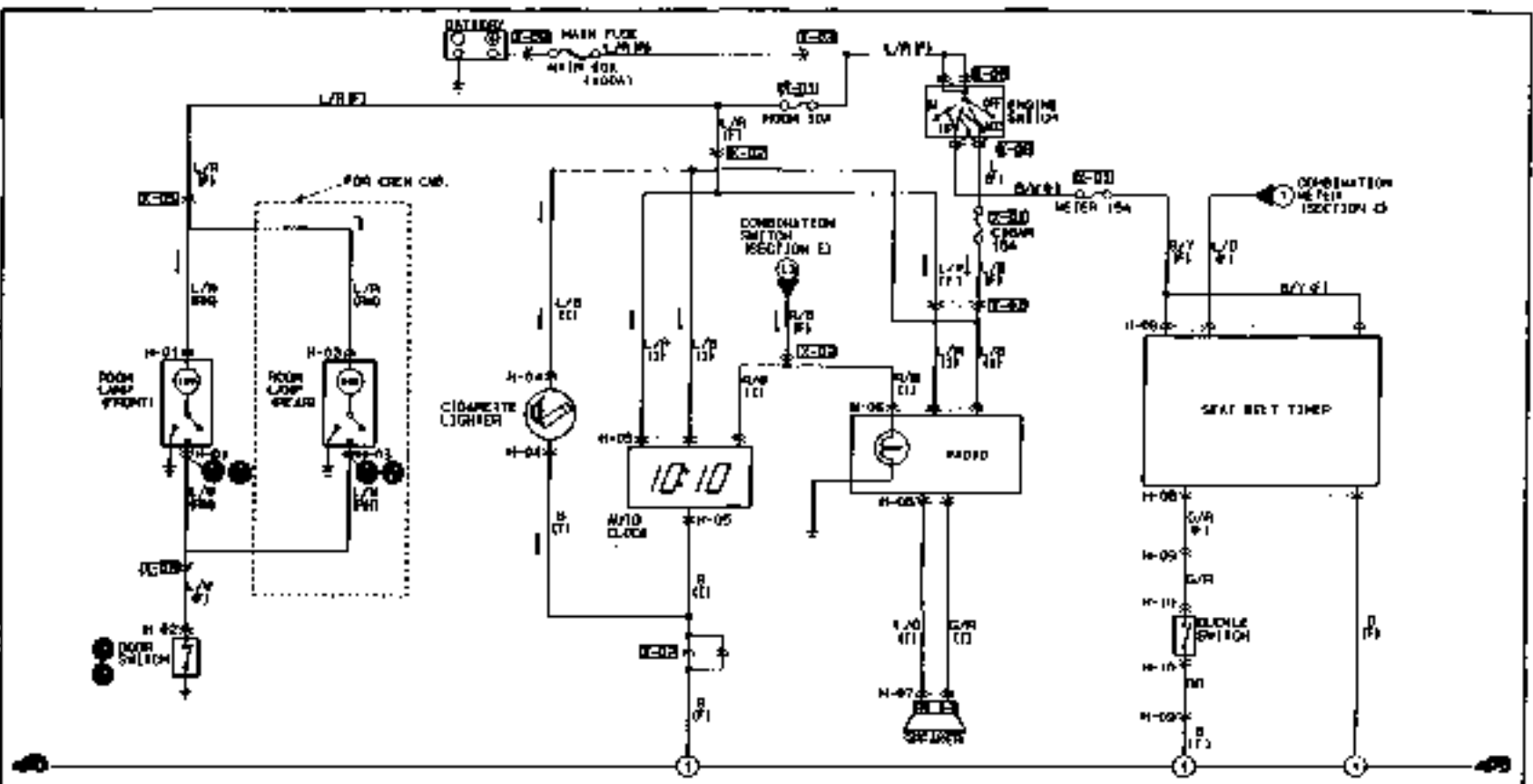
## SPECIFICATIONS

Lamp	Bulb (W)	Remark
Interior lamp	10	Front interior lamp
	10	Rear interior lamp (Crew Cab.)

97G07X-059

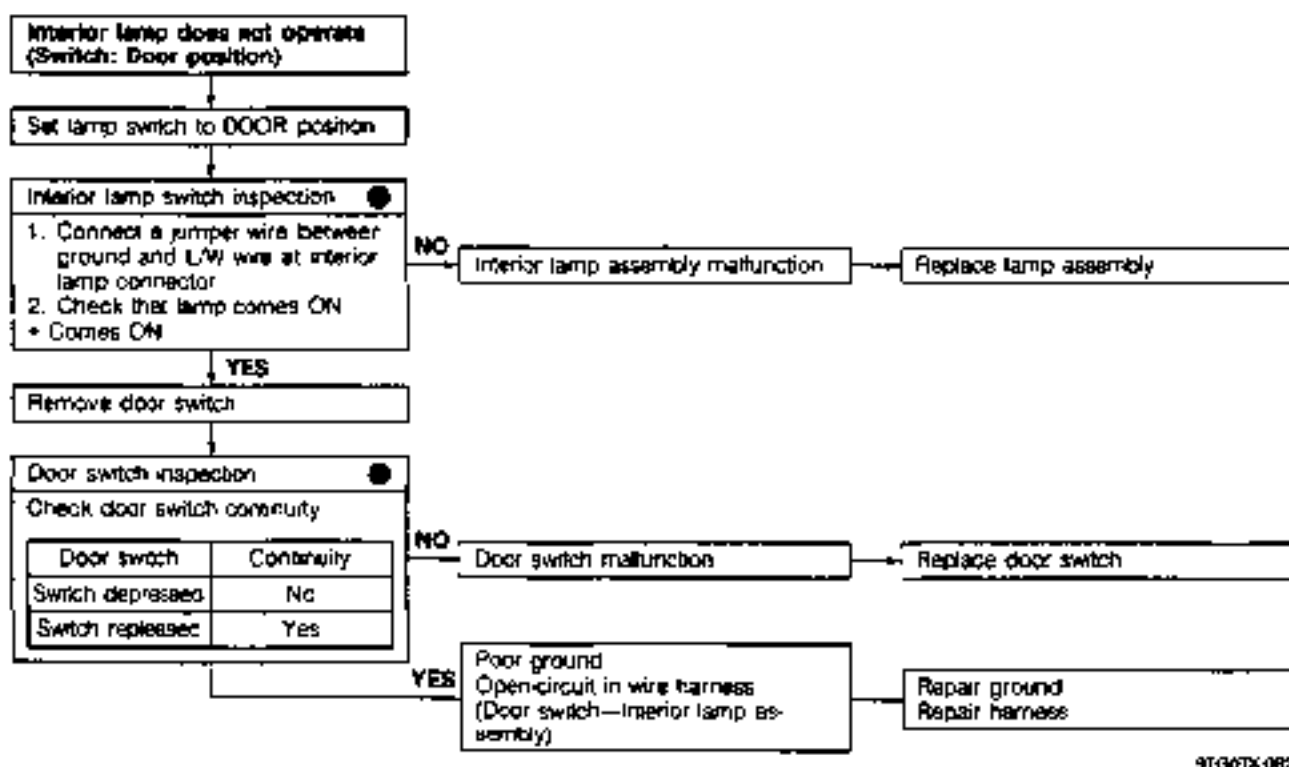
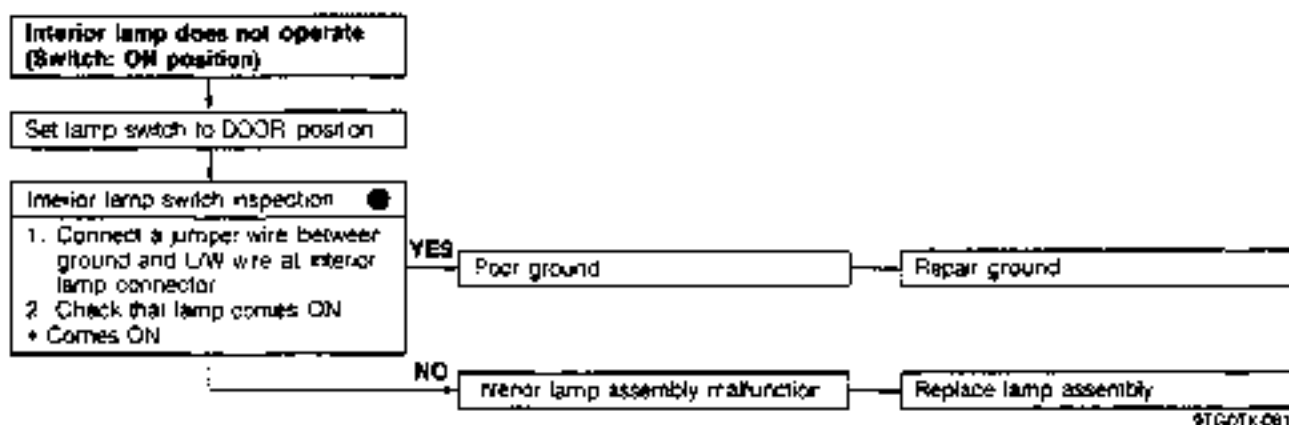
# INTERIOR LIGHTING SYSTEM

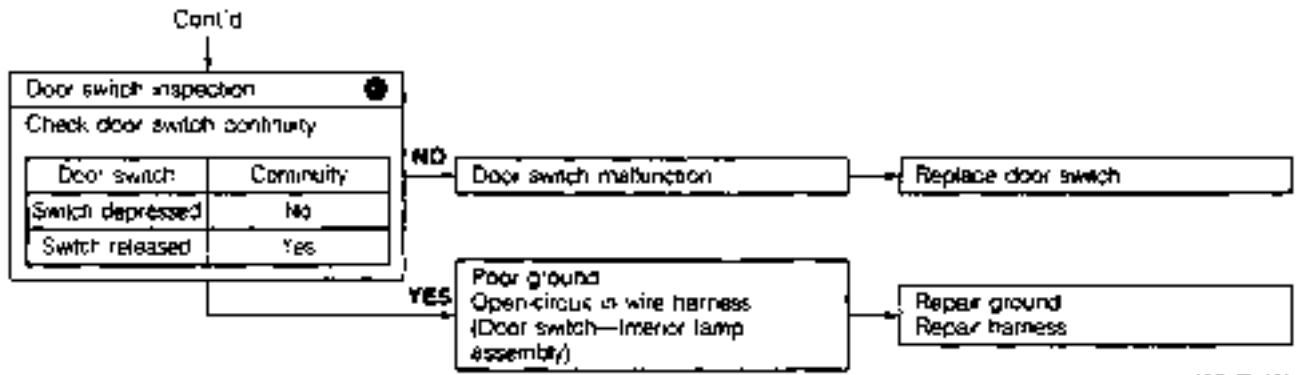
## TROUBLESHOOTING Interior Lamp Wiring diagram



H-01 ROOM LAMP FRONT 	H-02 ROOM LAMP REAR 	H-03 ROOM LAMP REAR 	H-04 CIGARETTE LIGHTER 	H-05 AUTO CLOCK 	H-06 RADIO 
H-07 BREAKER 	H-09 SEAT BELT TIMER 	H-10 BUCKLE SWITCH 	H-10 BUCKLE SWITCH 		



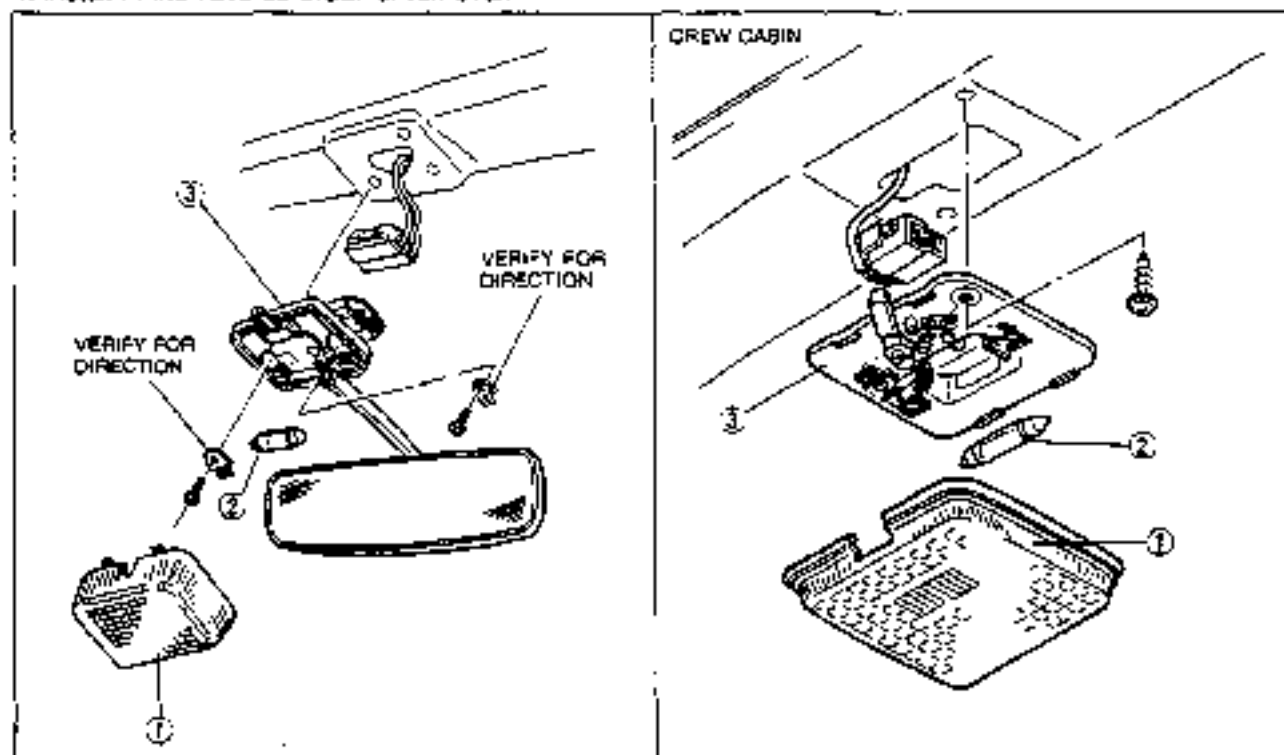




97G07X-003

**INTERIOR LAMP****Removal / Inspection / Installation**

1. Disconnect the negative battery cable.
2. Remove in the order shown in the figure.
3. Inspect all parts and repair or replace as necessary.
4. Install in the reverse order of removal.

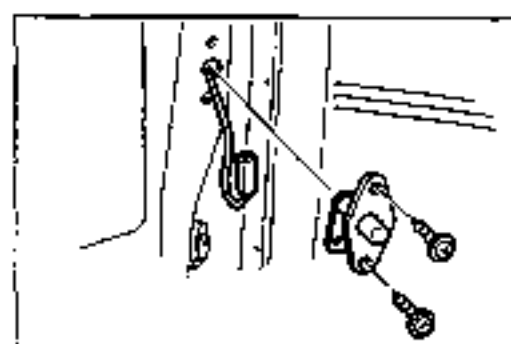


2T507X-054

1. Lens
2. Bulb

3. Interior lamp assembly

Inspect for failure and poor contact



2T507X-065

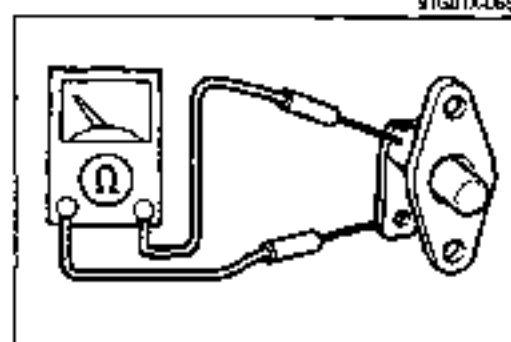
**DOOR SWITCH  
Inspection**

1. Remove the door switch

2. Check continuity of the door switch.

Switch	Continuity
Switch depressed	No
Switch released	Yes

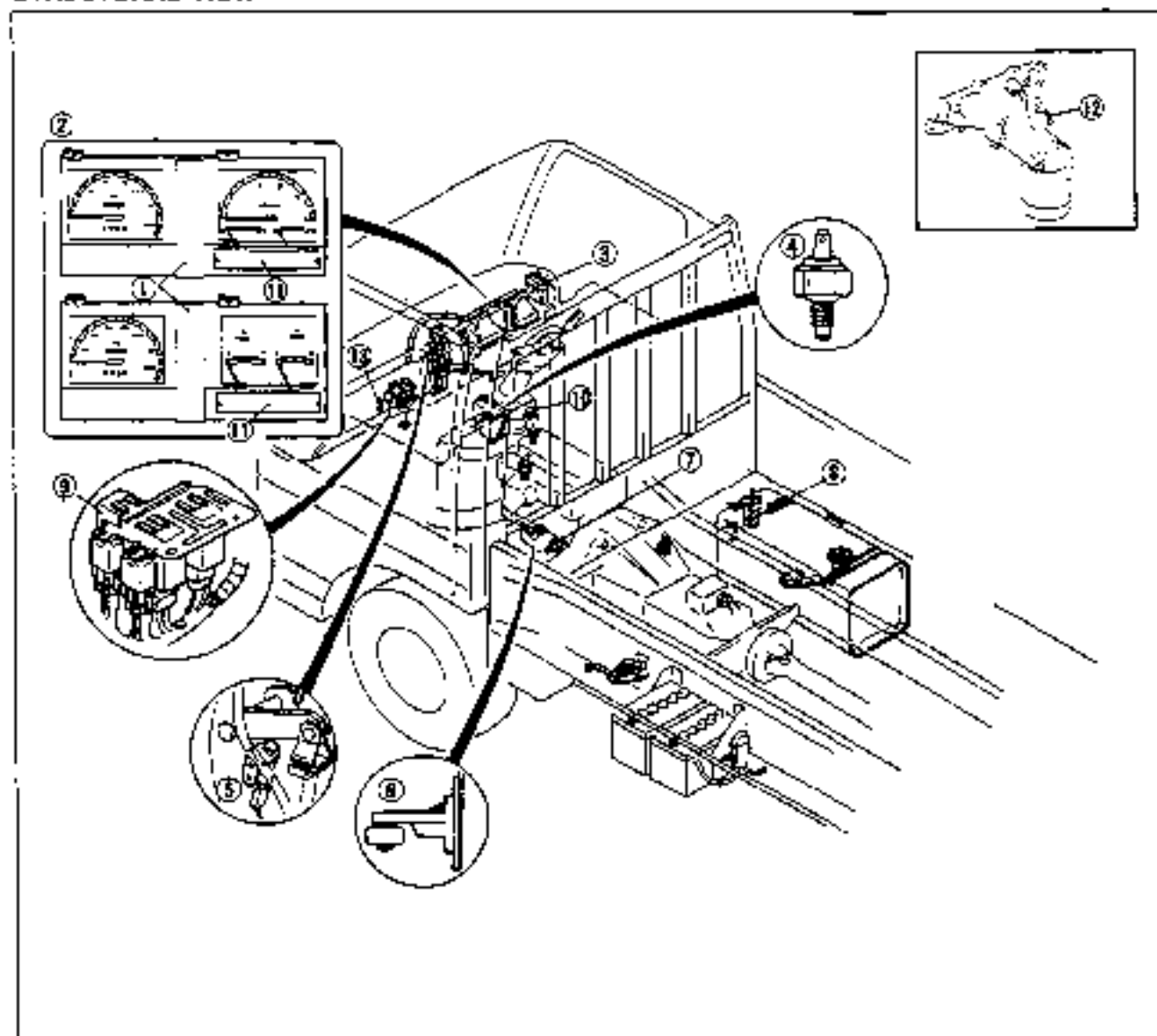
3. Replace the door switch if not as specified



2T507X-066

WARNING SYSTEM

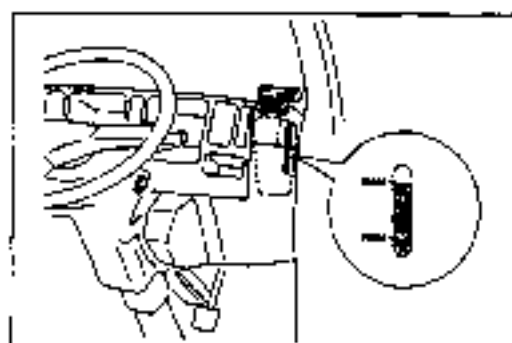
STRUCTURAL VIEW



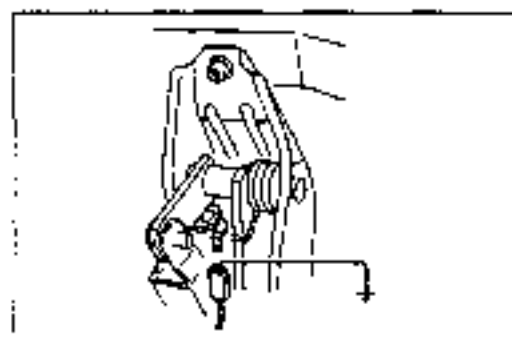
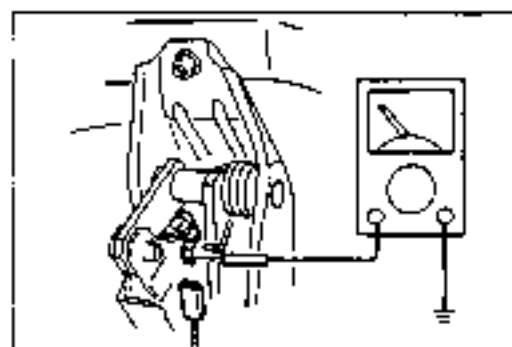
8TR0TK011

1. Warning lamp		7. Oil pressure switch	
Troubleshooting .....	page T-48	Inspection .....	page T-58
Inspection .....	page T-58	8. Sedimentor sensor	
2. Warning buzzer		Inspection .....	page T-62
Troubleshooting .....	page T-57	9. Stoplight checker relay	
Removal / Installation .....	page T-69	Inspection .....	page T-60
Inspection .....	page T-61	10. Coolant level sensor	
3. Brake fluid level sensor		Inspection .....	page T-62
Inspection .....	page T-60	11. Indicator lamp	
Removal / Installation .....	page T-60	Inspection .....	page T-58
4. Vacuum switch		Inspection .....	page T-62
Troubleshooting .....	page T-56	12. Oil bypass alarm switch	
5. Parking brake switch		Inspection .....	page T-59
Inspection .....	page T-60	13. Coolant warning unit	
6. Oil level sensor		Inspection .....	page T-59
Removal / Installation .....	page T-61		
Inspection .....	page T-61		

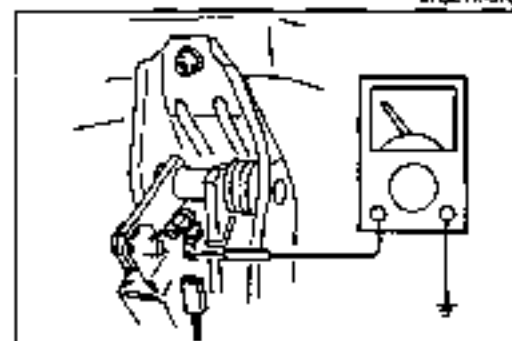




87GcTk-c03

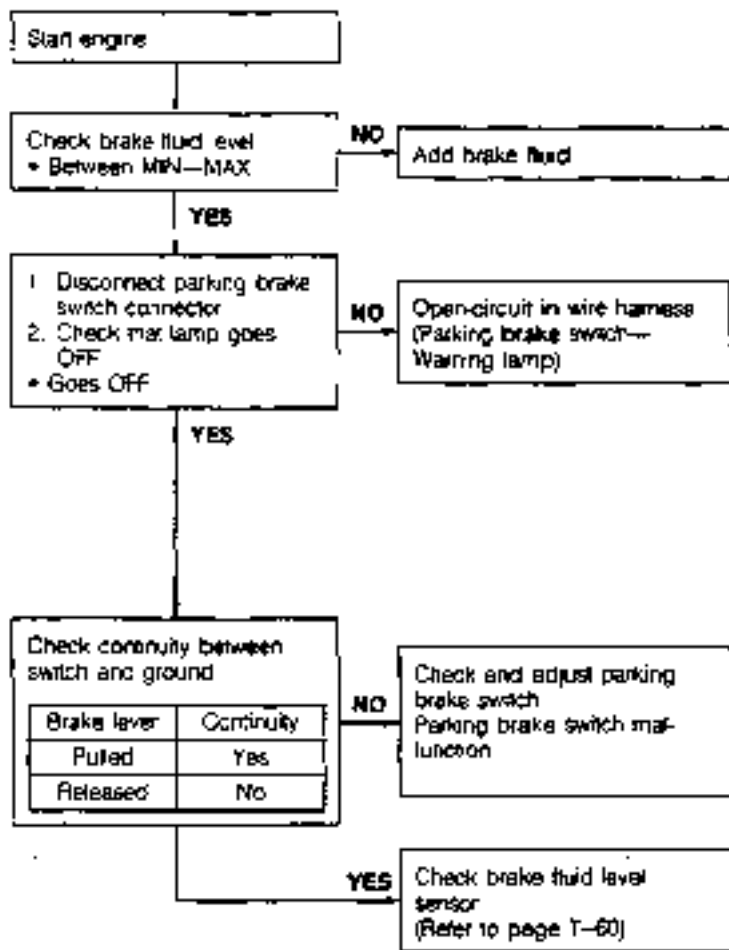


87GcTk-c04

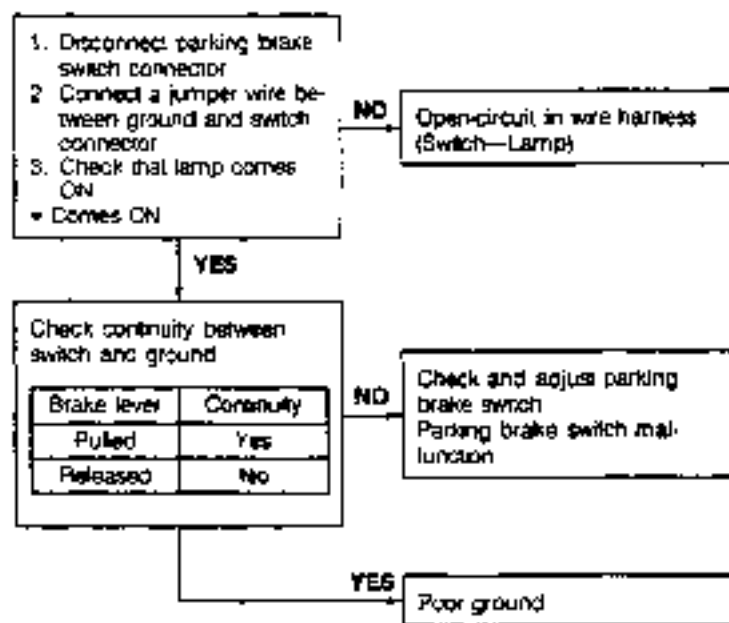


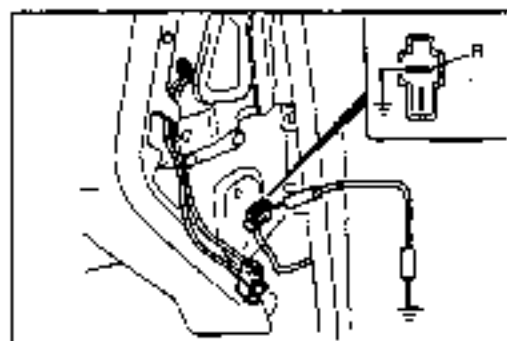
## Brake warning lamp

**Brake warning lamp comes ON after engine started**

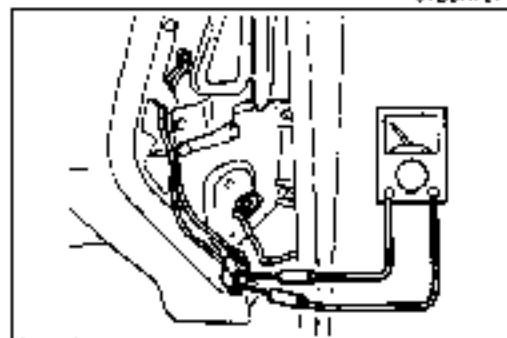


**Brake warning lamp does not operate parking brake set**





9TGD7X-071



**Brake warning lamp does not operate when brake fluid level below MIN**

1. Disconnect brake fluid level sensor connector
  2. Connect a jumper wire between R wire at sensor connector and ground
  3. Check that lamp comes ON
- Comes ON

**NO** Open-circuit in wire harness (Sensor—Lamp)

**YES**

Check continuity of brake fluid level sensor

Brake fluid	Continuity
Below MIN	Yes
Above MIN	No

**NO** Brake fluid level sensor malfunction

**YES** Poor ground

### Alternator warning lamp

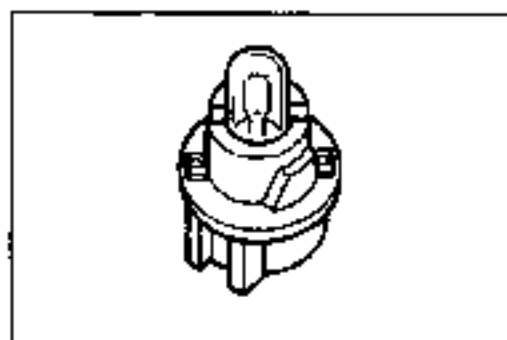
**Alternator warning lamp comes ON after engine started**

Check alternator output voltage (Refer to Section G):

- Normal

**NO** Alternator malfunction

**YES** Short-circuit in wire harness (Alternator—Lamp)



**Alternator warning lamp does not operate when engine switch ON**

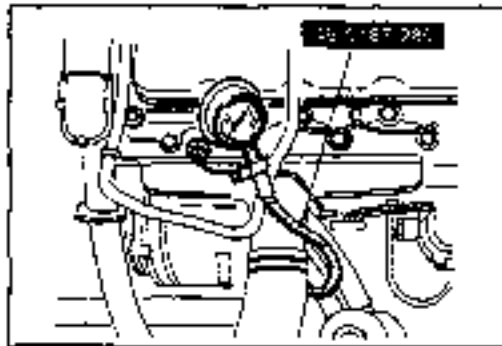
Check if bulb burned

- Normal

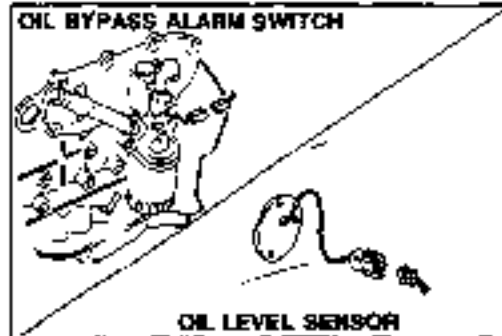
**NO** Replace bulb

**YES** Open-circuit in wire harness (Alternator—Lamp)

9TGD7X-072

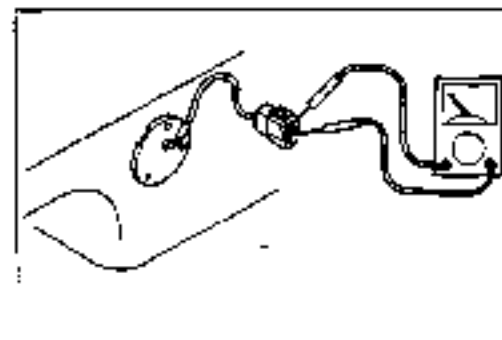
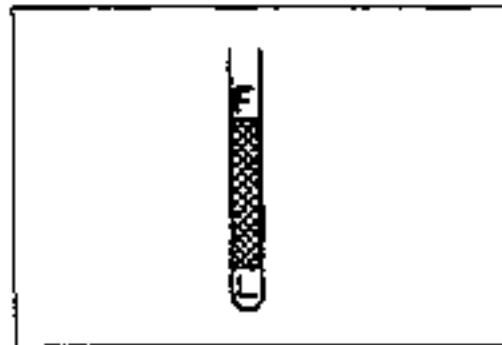


9TF07X-012



OIL BYPASS ALARM SWITCH

OIL LEVEL SENSOR



9TG07X-074

Oil pressure warning lamp

Oil pressure warning lamp comes ON after engine started

Set pressure gauge to engine

Start engine

1. Disconnect oil bypass alarm switch and oil level sensor connectors
2. Check that lamp goes OFF
- Goes OFF

NO Short-circuit in wire harness (Switch—Lamp or sensor—Lamp)

YES

Connect oil bypass alarm switch connector

Check engine oil level  
• Between L—F

NO Add engine oil

YES

Check continuity of oil level sensor

Oil level	Continuity
Below L	Yes
Above L	No

NO Oil level sensor malfunction

**Caution**  
• Check oil level sensor continuity after warm-up the engine.

YES

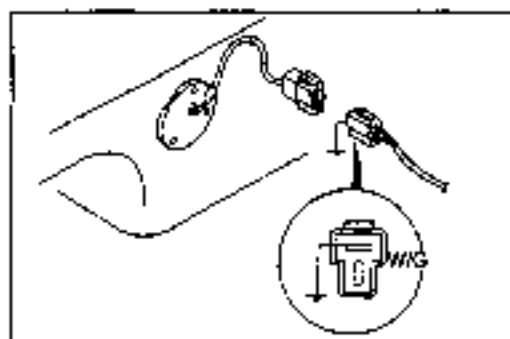
Check oil pressure (Refer to Section D)

NO Check oil pump (Refer to Section D)

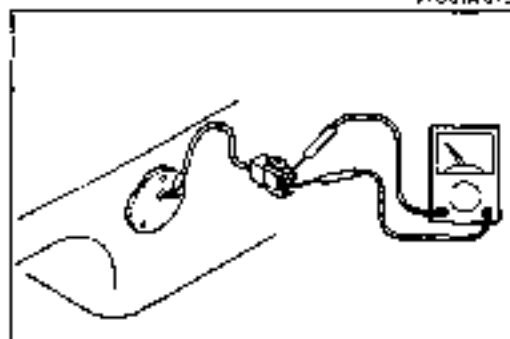
YES Check oil pressure switch (Refer to page T-56)  
Check oil bypass alarm switch (Refer to page T-58)



## WARNING SYSTEM



9T60TX-075



Oil pressure warning lamp does not come ON when oil level below L (Diesel)

**Caution**

- Check oil level sensor continuity after warm-up the engine.

1. Disconnect oil level sensor connector
  2. Connect a jumper wire between WIG wire at sensor connector and ground
  3. Check that lamp comes ON
- Comes ON

NO  
Open-circuit in wire harness (Sensor—Lamp)

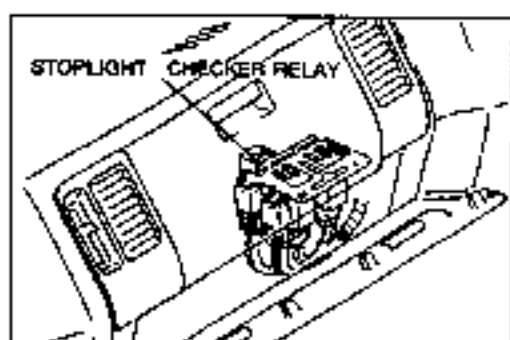
YES

Check continuity of oil level sensor

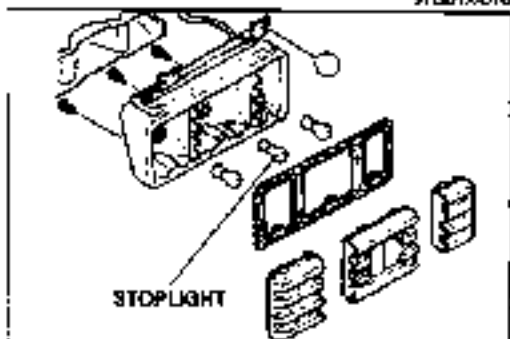
Oil level	Continuity
Below L	Yes
Above L	No

NO  
Oil level sensor malfunction

YES  
Poor ground



9T60TX-078

**Stoplight warning lamp**

Stoplight warning lamp comes ON after engine started

1. Disconnect stoplight checker relay connector
  2. Check that lamp goes OFF
- Goes OFF

NO  
Short-circuit in wire harness (Relay—Lamp)

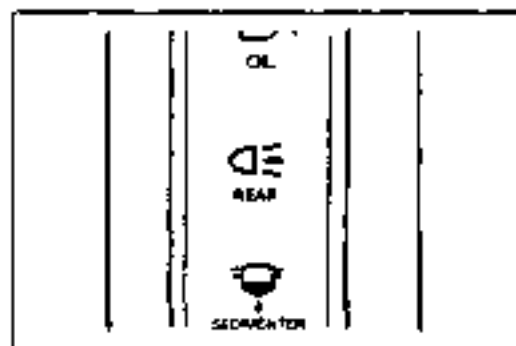
YES

Check if stoplight burned

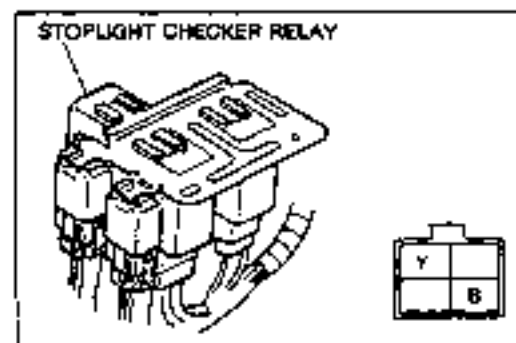
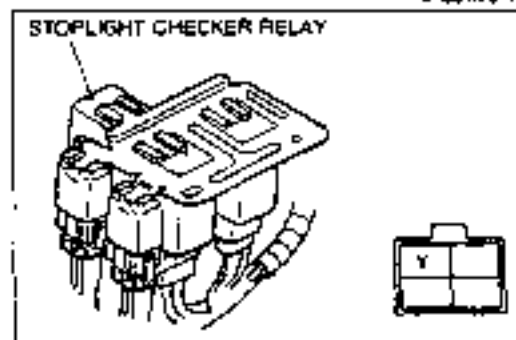
- Normal

NO  
Replace stoplight

YES  
Check stoplight checker relay (Refer to page T-60)



W001x-077



Stoplight warning lamp does not operate when stoplight failed

Check that lamp comes ON while engine switch ON  
• Comes ON

NO

Bulb burned

YES

Disconnect stoplight checker relay connector, and ground Y wire at relay connector

1. Start engine  
2. Check that lamp comes ON  
• Comes ON

NO

Open-circuit in wire harness (Relay—Lamp)

YES

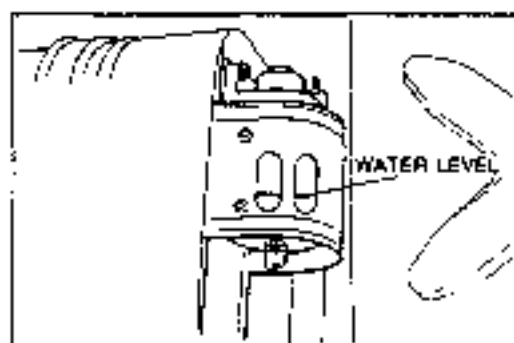
1. Connect a jumper wire between Y wire and B wire at relay connector  
2. Check that lamp comes ON  
• Comes ON

NO

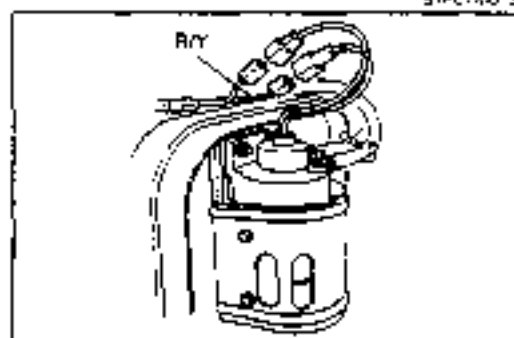
Poor ground

YES

Check stoplight checker relay (Refer to page T-60)



B1FC7X013



## Sedimentor warning lamp

Sedimentor warning lamp comes ON with buzzer after engine started

Check sedimentor water level  
• Water level high

NO

Drain water  
(Refer to Section F1, F2, F3)

YES

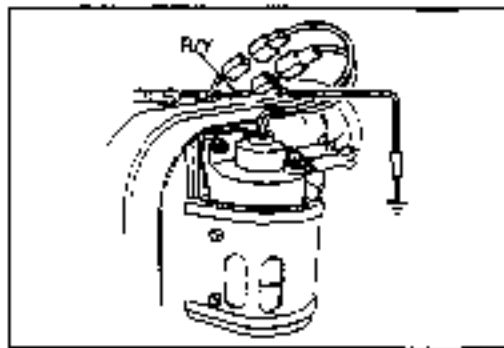
1. Disconnect sedimentor sensor connector (R/Y wire)
  2. Check that lamp goes OFF and buzzer stops
- Lamp goes OFF and buzzer stops

NO

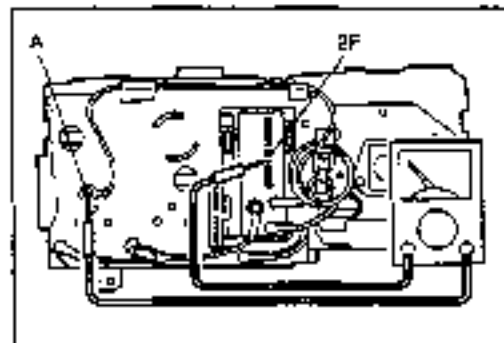
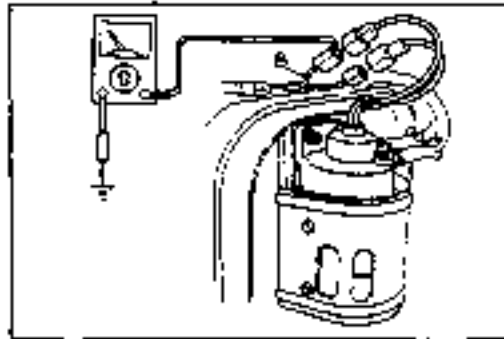
Short-circuit in wire harness  
(R/Y wire—Instrument cluster)

YES

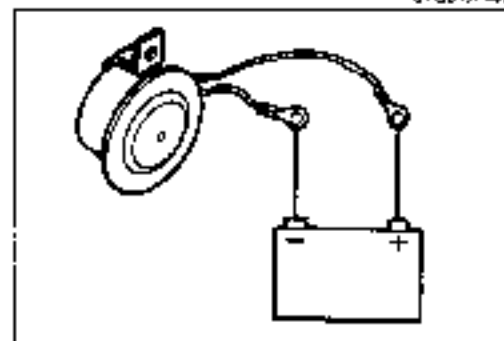
Check sedimentor sensor  
(Refer to page T-62)



8T60Tx-081



8T60Tx-082



**Sedimentor warning lamp and buzzer do not operate when water level high**

- 1 Disconnect sedimentor sensor connector (R/Y wire)
- 2 Connect a jumper wire between R/Y wire at sensor connector and ground
- 3 Check that lamp comes ON and buzzer sounds
  - Lamp comes ON and buzzer sounds

NO  
Open-circuit in wire harness (R/Y wire—Instrument cluster)

YES  
Check continuity between B wire at sensor connector and ground  
• Continuity

NO  
Poor ground

YES  
Check sedimentor sensor (Refer to page T-62)

**Sedimentor warning lamp comes ON without buzzer after engine started**

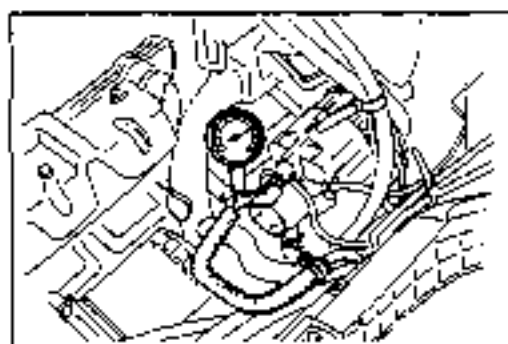
Check continuity between 2F terminal at instrument cluster and buzzer A terminal as shown in the figure  
• Continuity

NO  
Instrument cluster malfunction

YES  
Check buzzer operation (Refer to page T-61)  
• Normal

NO  
Buzzer malfunction

YES  
Short-circuit in instrument cluster



9TFC7X.013

### Vacuum warning lamp

Vacuum warning lamp comes ON with buzzer after engine started

Connect vacuum gauge between vacuum pump and vacuum tank

Start engine

Check vacuum  
 • Specified vacuum  
 -440 mmHg  
 (-17.32 inHg)/1,500 rpm  
 -580 mmHg  
 (-22.83 inHg)/3,000 rpm  
 max. -700 mmHg  
 (-27.58 inHg) or more

NO

Check vacuum pump  
 (Refer to Section P)  
 Vacuum leakage from  
 vacuum hose

YES

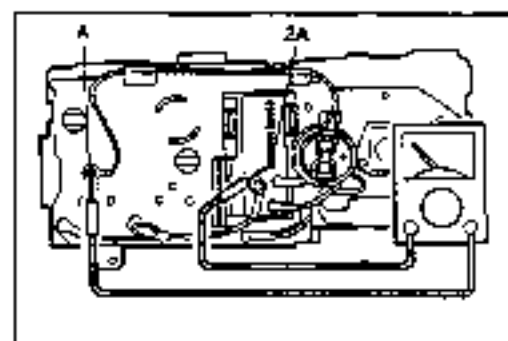
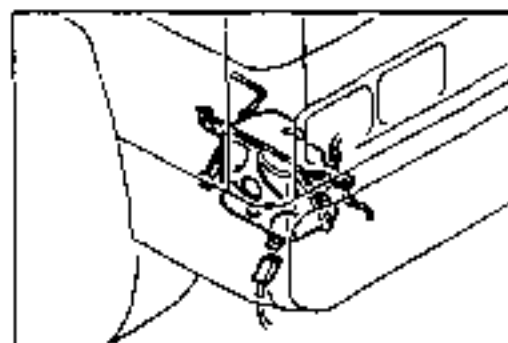
1. Disconnect vacuum switch  
 connector  
 2. Check that lamp goes  
 OFF and buzzer stops  
 • Goes OFF and buzzer  
 stops

YES

Vacuum switch malfunction

NO

Short-circuit in wire harness  
 (Vacuum switch—Instrument  
 cluster)



9TGG7X.084

Vacuum warning lamp comes ON without buzzer after engine started

Check continuity between 2A  
 terminal at instrument cluster  
 and buzzer A terminal as  
 shown in the figure  
 • Continuity

NO

Instrument cluster malfunction

YES

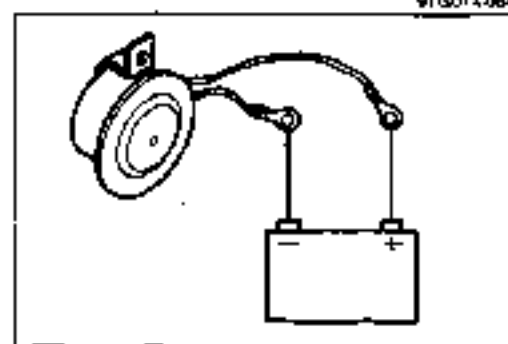
Check buzzer operation  
 (Refer to page T-51)  
 • Normal

NO

Buzzer malfunction

YES

Short-circuit in instrument  
 cluster



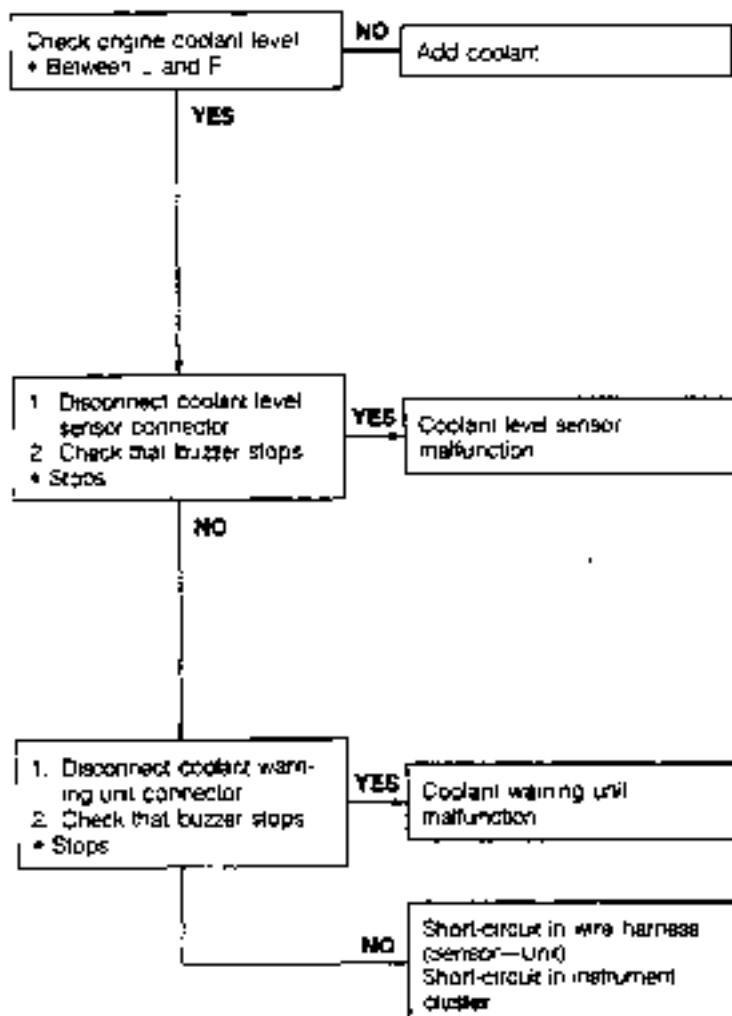
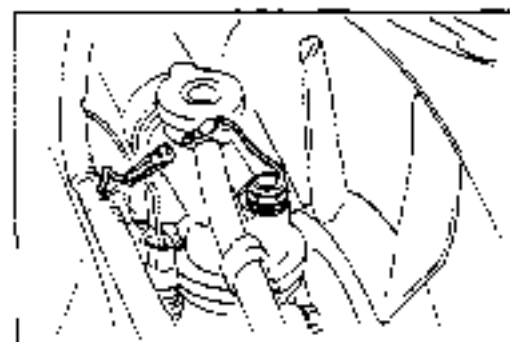
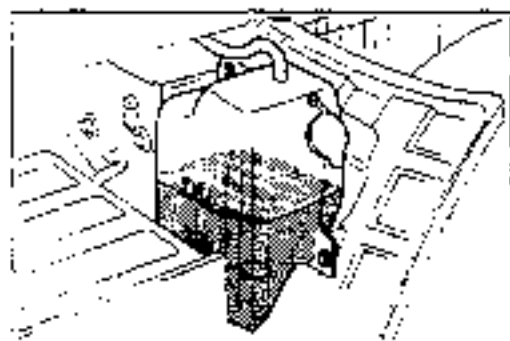
## Warning buzzer

Warning buzzer sounds

### Note

- If vacuum warning lamp comes ON with buzzer operation, refer to page T-55 for troubleshooting.
- If sedimentor warning lamp comes ON with buzzer operation, refer to page T-54 for troubleshooting.

9T30TX-085



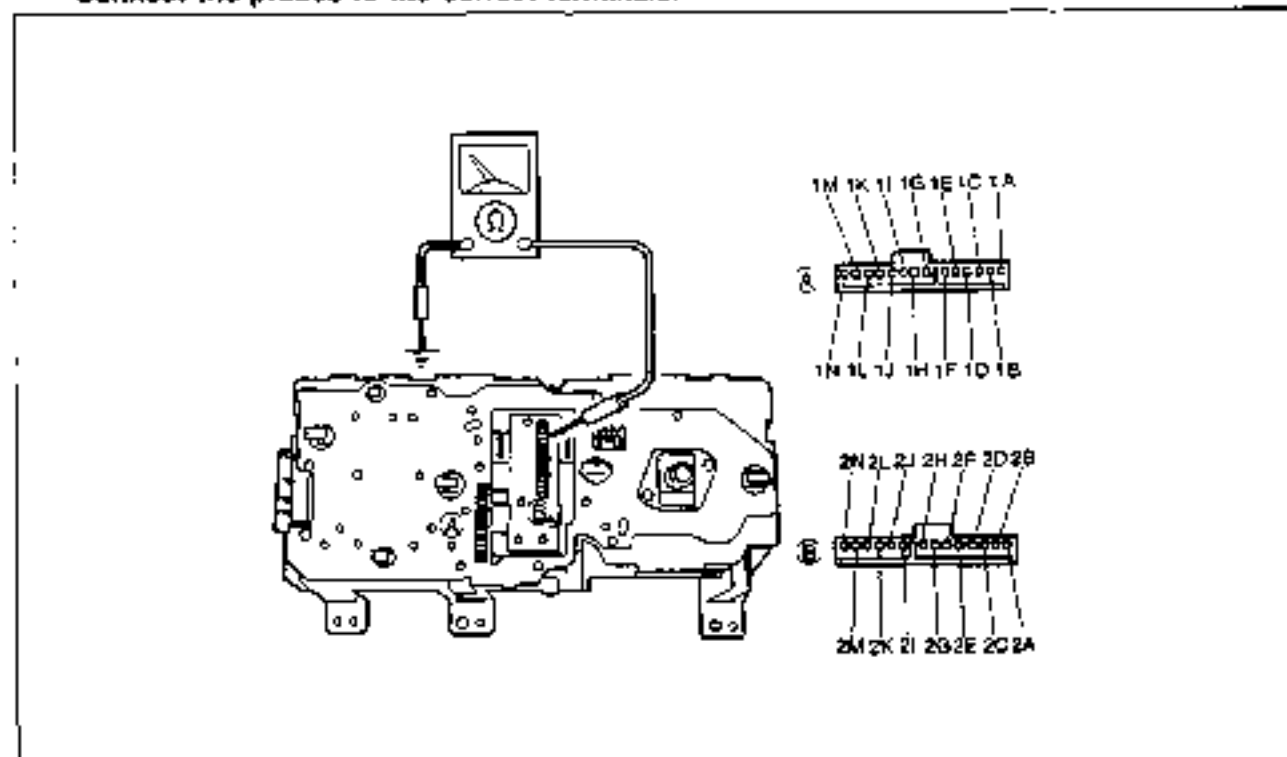
## WARNING AND INDICATOR LAMP

## Inspection

1. Check continuity with an ohmmeter.

## Caution

- Connect the probes to the correct terminals.



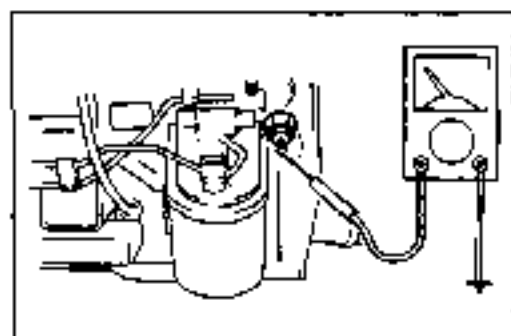
97F01X-015

## Warning lamp

Lamp	Ohmmeter connection to		
	+ probe	- probe	
Sedimentor warning	2F	2L	
Stoplight warning (REAR)	2H		
Oil pressure warning	Pressure		2J
	Oil level		2I
	Bypass alarm		
Alternator warning (CHARGE)	2G		
Brake warning	2K		
Vacuum warning	2A		1G

## Indicator lamp

Lamp	Ohmmeter connection to		
	+ probe	- probe	
ECONO indicator	1A	1G	
High beam indicator (BEAM)	1L	1J	
Glow indicator	1F	1G	
Air heater indicator (GI QW)	1F		
Exhaust brake indicator	1C	1C	
Turn indicator	Left	2N	2D
	Right	2M	



97G01X-088

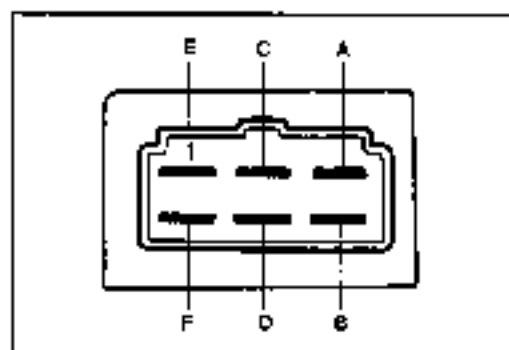
## OIL PRESSURE SWITCH

## Inspection

1. Disconnect the oil pressure switch connector.
2. Check continuity of the switch.

Engine condition	Continuity
Stopped	Yes
Running	No

3. Replace the oil pressure switch if not as specified.



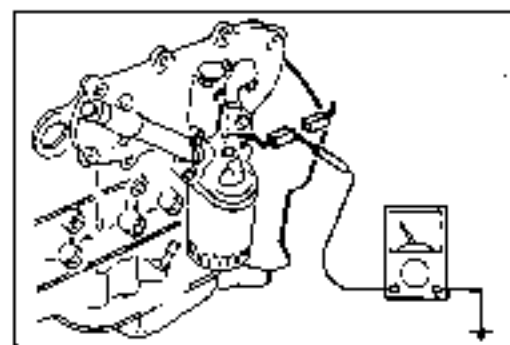
9T607X-171

## COOLANT WARNING UNIT

### Inspection

1. Check the voltage (except terminals D and F) or continuity (only terminals D and F).

Terminal	Connection to	Test condition	Specification
A	Warning buzzer	Engine switch: ON (Disconnected coolant level sensor connector)	Battery voltage
B	Engine switch	Engine switch: ON	Battery Voltage
C	—	—	—
D	Coolant level sensor	Cooling system in normal	∞
		Others	∞
E	—	—	—
F	Ground	Constant	∞



9T601X-172

## OIL BYPASS ALARM SWITCH

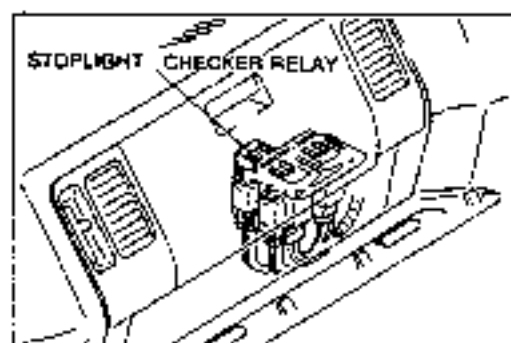
### Inspection

1. Disconnect the oil bypass alarm switch connector.
2. Check continuity between the switch and ground.

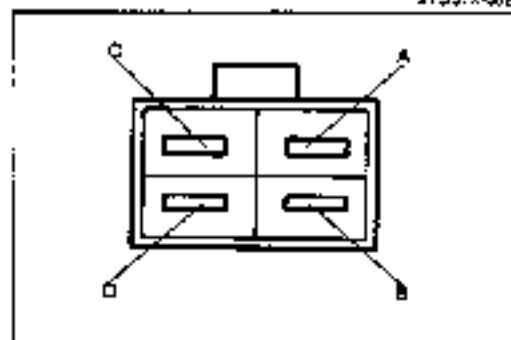
**Continuity: No continuity**

3. If there is continuity, check lubrication system for clogged.
4. Replace the oil bypass alarm switch if the lubrication system is normal.

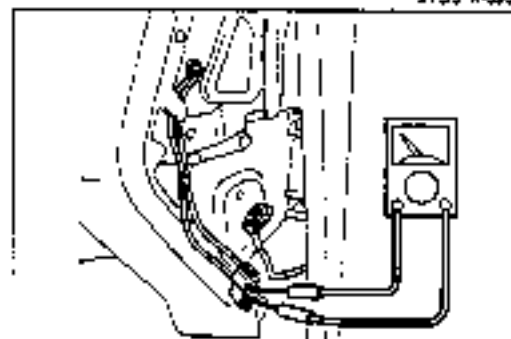




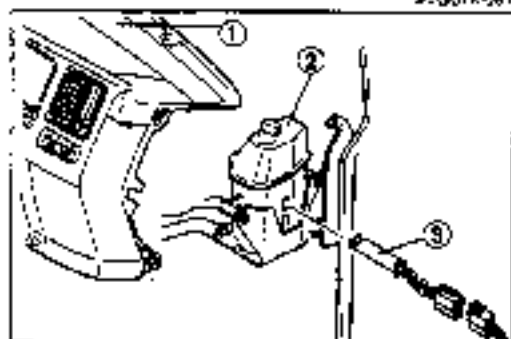
9T30TX-089



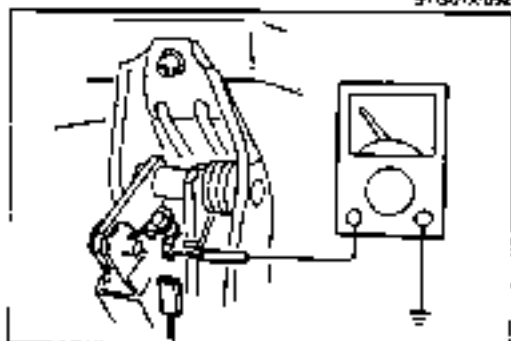
9T30TX-090



9T60TX-081



9T60TX-092



9T60TX-093

**STOPLIGHT CHECKER RELAY****Inspection**

1. Check continuity between terminal of the stoplight checker relay

**Note**

- Set the tester to x1,000Ω range.

Terminal		Continuity	Terminal		Continuity
+	-		+	-	
A	B	○	B	A	○
A	C	X	C	A	○
A	D	○	D	A	○
B	C	X	C	B	○
B	D	○	D	B	○
C	D	○	D	C	X

2. Replace the relay if not as specified.

**BRAKE FLUID LEVEL SENSOR****Inspection**

1. Check continuity of the brake fluid sensor.

Brake fluid level	Continuity
Below MIN	Yes
Above MIN	No

2. Replace brake fluid sensor if not as specified.

**Removal / Installation**

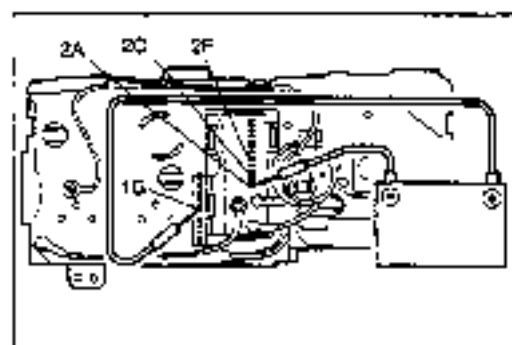
1. Remove the instrument panel. (Refer to Section S.)
2. Remove the brake reserve tank.
3. Remove the brake fluid level sensor.
4. Install in the reverse order of removal.

**PARKING BRAKE SWITCH****Inspection**

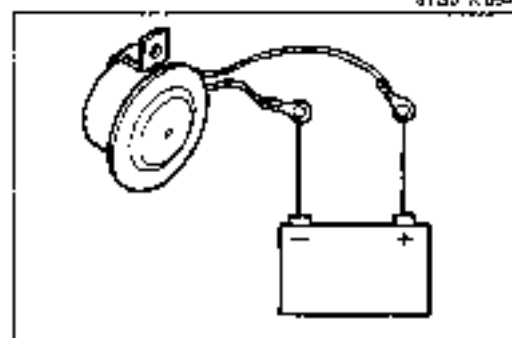
1. Disconnect the parking brake switch connector.
2. Check continuity between the parking brake switch and ground.

Brake lever	Continuity
Pulled	Yes
Released	No

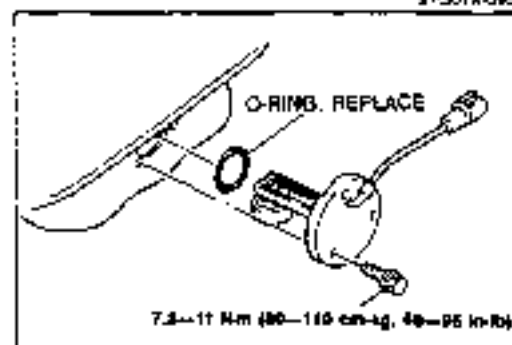
3. Replace the parking brake switch if not as specified.



9T507X-094

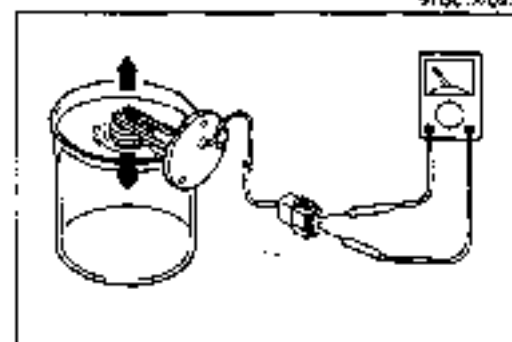


9T507X-095



7.8—11 Nm (90—110 cm-kg, 69—95 in-lb)

9T607X-097



9T607X-098

**WARNING BUZZER**

**Inspection**

1. Connect the battery to instrument cluster as shown below, and verify that the buzzer sounds

Battery connection to		Buzzer	Remark
12V	Ground		
1G	2A	Sounds	Vacuum warning
	2F		Sedimentor warning
	2C		Coolant level warning

2. If the buzzer does not operate, remove it and apply 12V to the buzzer. Verify that the buzzer sounds.
3. If the buzzer does not sound, replace it.
4. If the buzzer sounds, replace the meter printed.

**OIL LEVEL SENSOR**

**Removal / Installation**

1. Drain the engine oil.
2. Remove the bolts.
3. Remove the oil level sensor
4. Install in the reverse order of removal.

**Tightening torque:**

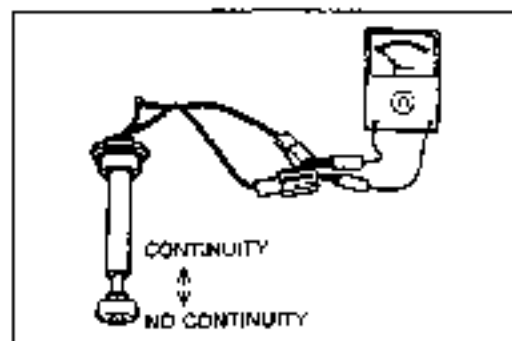
7.8—11 Nm (90—110 cm-kg, 69—95 in-lb)

**Inspection**

1. Place the oil level sensor and a thermometer in a container of water.
2. Gradually heat the water.
3. Check for continuity of the sensor

Float	Continuity
Up	No
Down	Yes

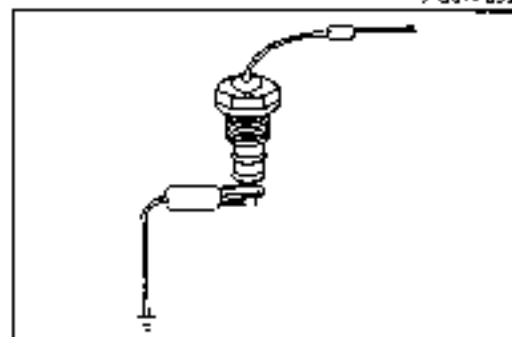
4. Replace the oil level sensor, if not as specified.



9TGTX-096

**SEDIMENTOR SENSOR****Inspection**

1. Remove the sedimentor sensor from the sedimentor.
2. Connect an ohmmeter to the sedimentor sensor.
3. Verify that there is continuity when the float is up.
4. Replace the sedimentor sensor if not as specified.



9TGTX-101


**COOLANT LEVEL SENSOR****Inspection**

1. Remove the level sensor and reconnect the connector.
2. With the sensor not grounded to the body, start the engine.
3. After checking that the warning lamp illuminates, ground the threaded part of the sensor.
4. If the warning lamp remains illuminated, the sensor is normal. If it does not, the sensor is faulty and should be replaced.

INSTRUMENT CLUSTER (METER)

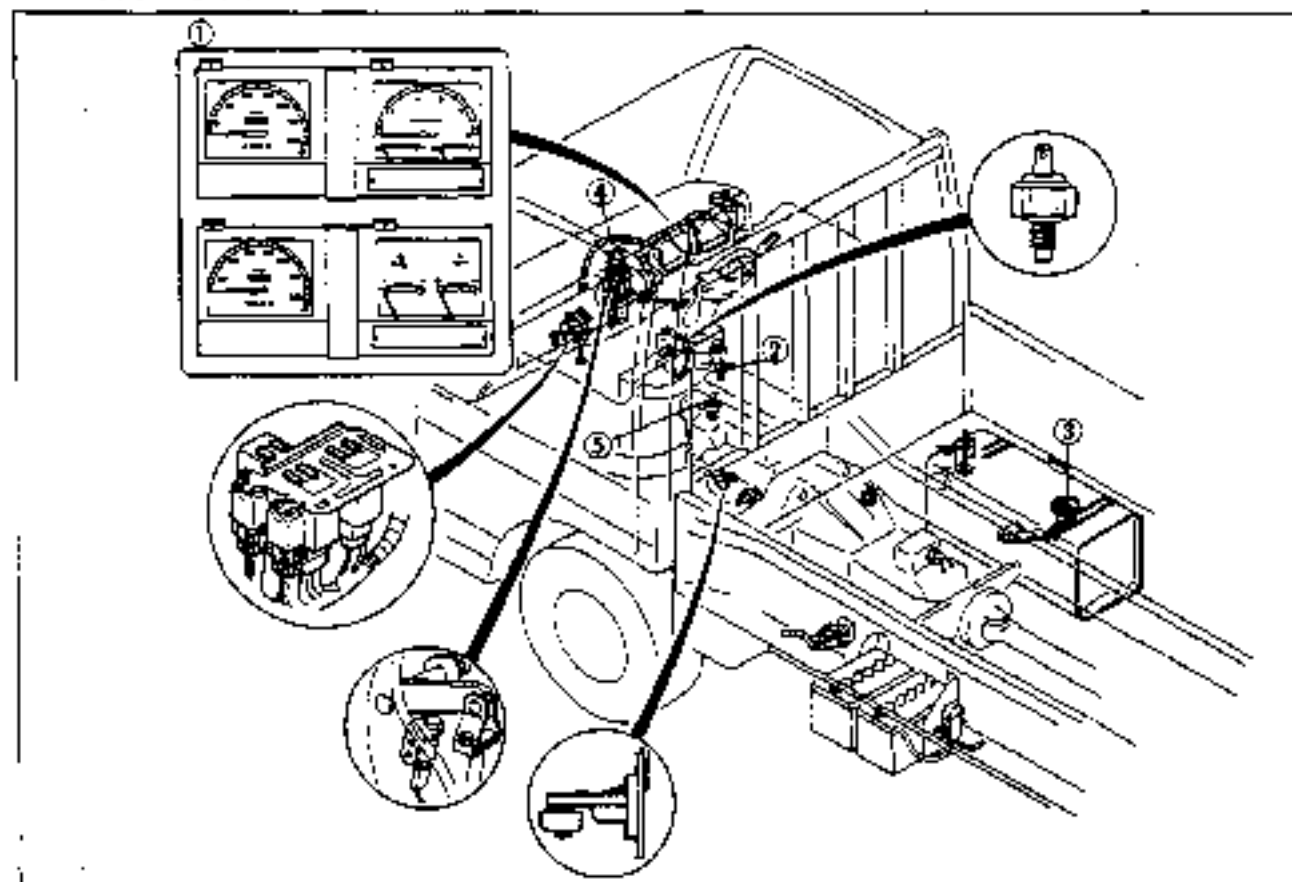
PREPARATION

SST

49 0839 285		For inspection of fuel gauge and water temperature gauge
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9TGD07X-10D

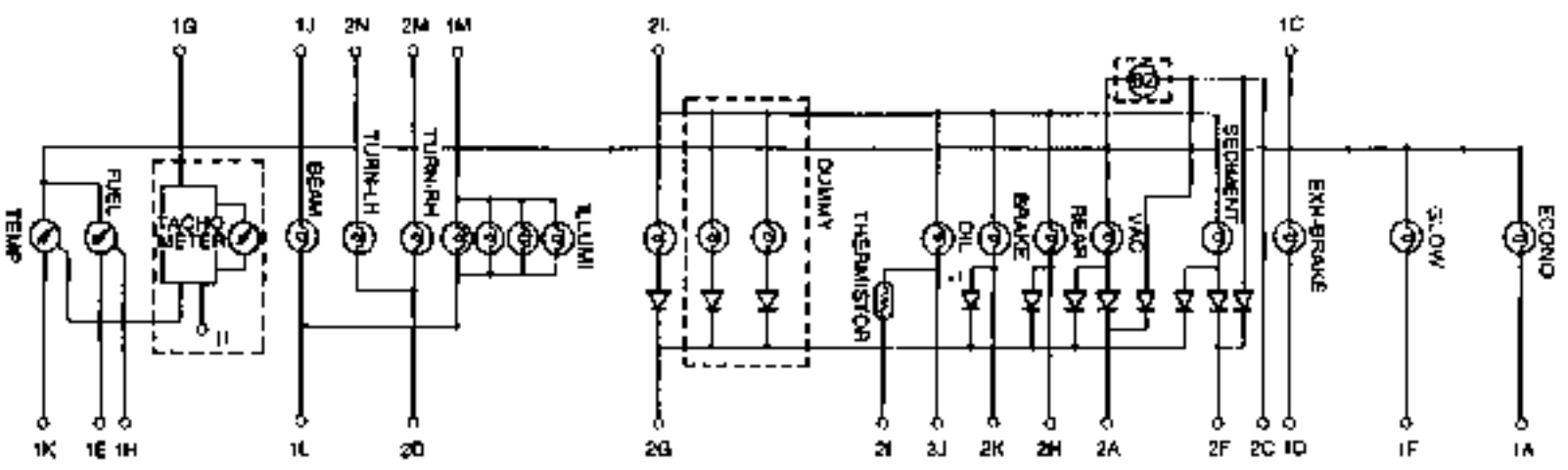
STRUCTURAL VIEW



9TGD07X-10A

1. Instrument cluster (meter)		5) Warning and indicator lamp	
Removal / Installation	page T-68	Troubleshooting	page T-48
Disassembly / Assembly	page T-69	Inspection	page T-58
1) Speedometer		6) Odometer	
Troubleshooting	page T-65	7) Trip meter	
Inspection	page T-70	2. Water thermosensor	
2) Tachometer		Removal / Installation	page T-71
Troubleshooting	page T-65	Inspection	page T-71
Inspection	page T-70	3. Fuel gauge sender unit	
3) Water temperature gauge		Removal / Installation	page T-71
Troubleshooting	page T-66	Inspection	page T-71
Inspection	page T-70	4. Speedometer cable	
4) Fuel gauge		Removal / Installation	page T-68
Troubleshooting	page T-67	5. Pickup sensor	
Inspection	page T-70	Inspection	page T-72

### TROUBLESHOOTING Wiring Diagram

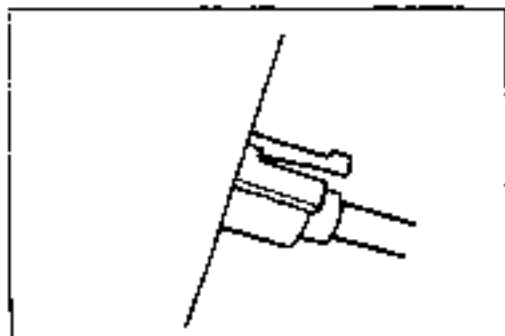


TERMINAL	CONNECTION TO	TERMINAL	CONNECTION TO
1A	SUB-MISSION SWITCH	2A	VACUUM SWITCH
1B		2B	
1C	FUSE	2C	COOLANT WARNING UNIT
1D	EXHAUST BRAKE SWITCH	2D	GROUND
1E	FUEL GAUGE SENDER UNIT	2E	
1F	OSS CONTROL UNIT AIR HEATER CONTROL UNIT	2F	ALTERNATOR
1H	GROUND	2H	STOPLIGHT CHECKER RELAY
1I	PICK-UP SENSOR	2I	OIL LEVEL SENSOR OIL BYPASS ALARM SWITCH
1J	COMBINATION SWITCH	2J	OIL PRESSURE SWITCH
1K	WATER THERMOSENSOR	2K	BRAKE FLUID LEVEL SENSOR PARKING BRAKE SWITCH
1L	GROUND	2L	FUSE
1M	COMBINATION SWITCH	2M	COMBINATION SWITCH
1N		2N	COMBINATION SWITCH

\*\* AUSTRALIA

**Speedometer does not operate or indication incorrect**

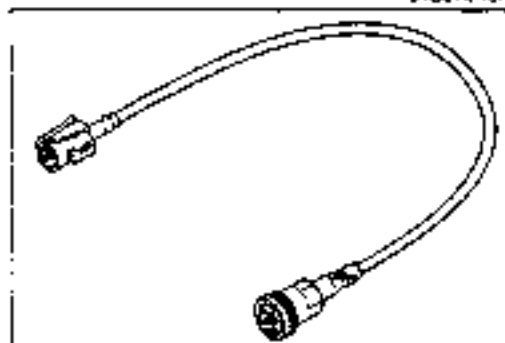
9T60TX-106



9T60TX-107

**Step 1**

1. Verify that the speedometer cable is properly connected.



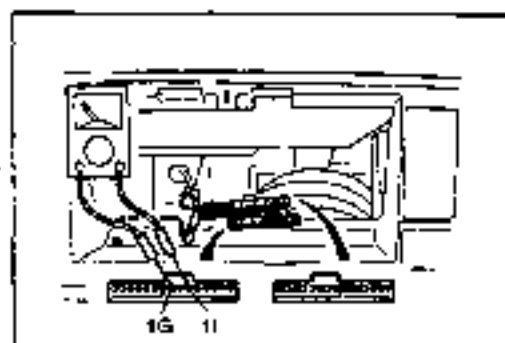
9T60TX-108

**Step 2**

1. Disconnect the speedometer cable from the instrument cluster and transmission case.
2. Verify that the cable and gear spine easily when turned by hand.
3. If the cable or gear is stiff, replace the speedometer cable or gear.
4. If the speedometer cable and gear are OK, replace the speedometer.

**Tachometer does not operate**

9T60TX-109



9T60TX-110

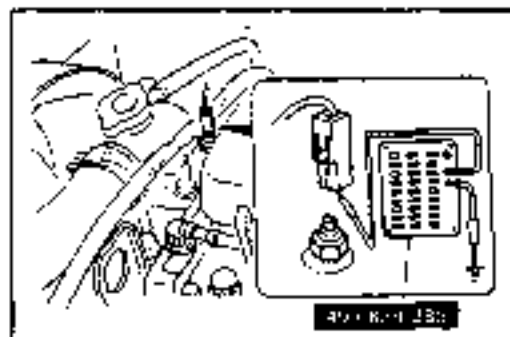
1. Remove the instrument cluster.
2. Connect a test tachometer between terminals 1G and 1I of the harness side connector.
3. Start the engine.
4. Check that the test tachometer indicates engine speed.

Indicates rpm	Action
Yes	Replace tachometer
No	Repair wire harness (Instrument cluster—Pickup sensor)

# T INSTRUMENT CLUSTER (METER)

## Water temperature gauge does not operate

9T307X-1-1



9T307X-1-2

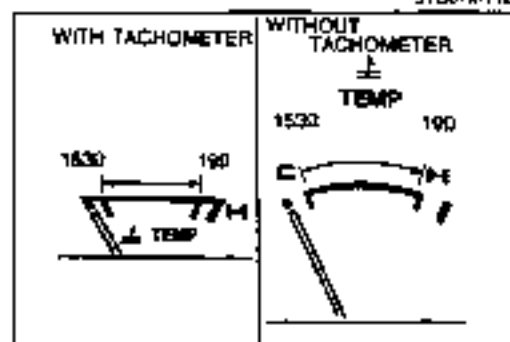
### Step 1

1. Disconnect the connector from the water thermosensor.
2. Connect the red lead of the SST to the connector, and the black lead to a body ground.
3. Set the SST to the resistance values shown in the figure.
4. Turn the engine switch ON and check that the needle indicates the correct values.

Gauge displays correct	Action
Yes	Replace water thermosensor
No	Go to Step 2

### Caution

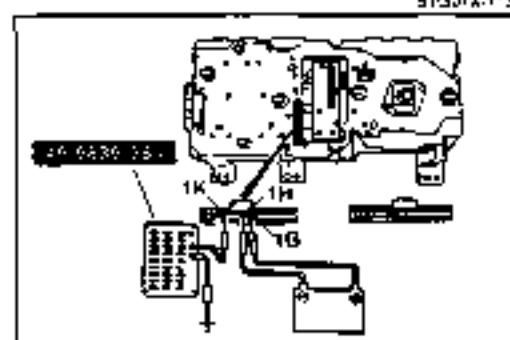
- Continue the above checks for at the least two minutes each to correctly judge the condition.
- The allowable indication error is twice the width of the needle.



9T307X-1-3

### Step 2

1. Remove the instrument cluster.
2. Apply 12V to terminal 1G and ground terminal 1H.
3. Connect the red lead of the SST to terminal 1K and the black lead to a negative battery terminal.



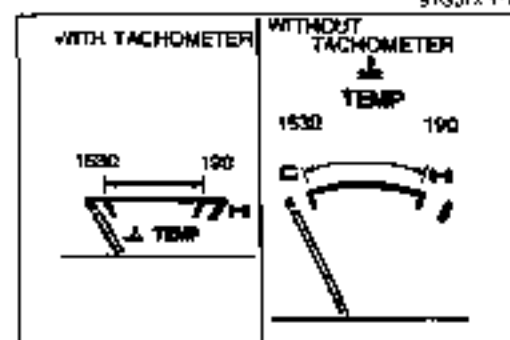
9T307X-1-4

4. Set the SST to the resistance values shown in the figure.
5. Verify that the needle indicates the correct values.

Indicates correct	Action
Yes	Repair wire harness (Instrument cluster—Water thermosensor)
No	Replace water temperature gauge

### Caution

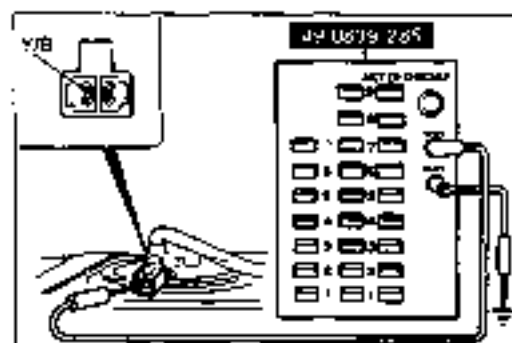
- Continue the above checks for at least two minutes each to correctly judge the condition.
- The allowable indication error is twice the width of the needle.



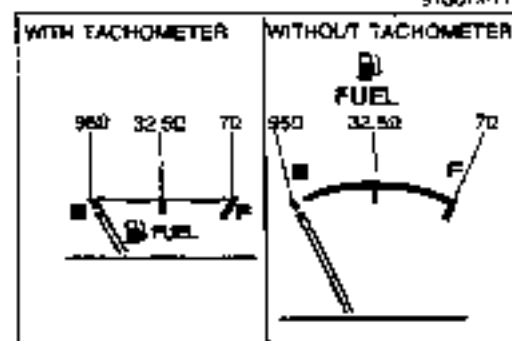
9T307X-1-5

## Fuel gauge does not operate

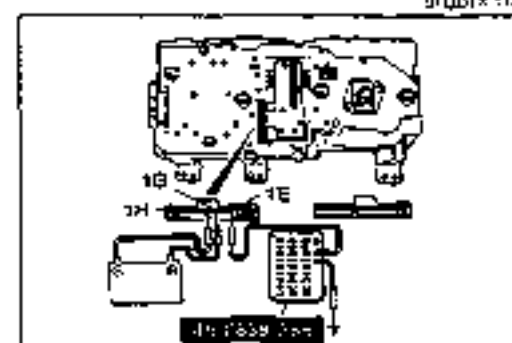
DT3C7X-118



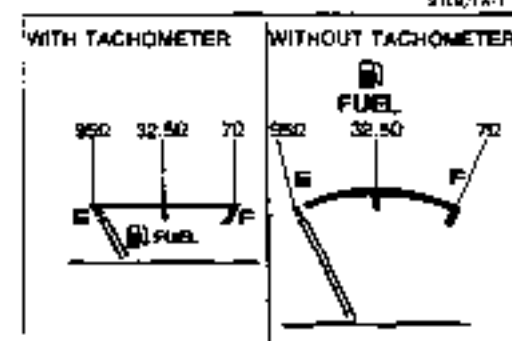
9TGC7X-117



9TGC7X-118



9TGC7X-119



9TGC7X-120

### Step 1

1. Disconnect the connector from fuel gauge sender unit.
2. Connect the red lead of the **SST** to the terminal-wire (Y/B) and the black lead to a body ground.

3. Set the **SST** to the resistance values shown in the figure.
4. Turn the engine switch ON, and verify that the needle indicates the correct values.

Indicates correct	Action
Yes	Replace fuel gauge sender unit (in fuel tank)
No	Go to Step 2

### Caution

- Continue the above checks for at least two minutes each to correctly judge the condition.
- The allowable indication error is twice the width of the needle.

### Step 2

1. Remove the instrument cluster.
2. Apply 12V to terminal 1G and ground terminal 1H.
3. Connect the red lead of the **SST** to terminal 1E and the black lead to a negative battery terminal.
4. Set the **SST** to the resistance values shown in the figure.
5. Verify that the needle indicates the correct values.

Indicates correct	Action
Yes	Repair wire harness (Instrument cluster—fuel gauge sender unit)
No	Replace fuel gauge sender unit

### Caution

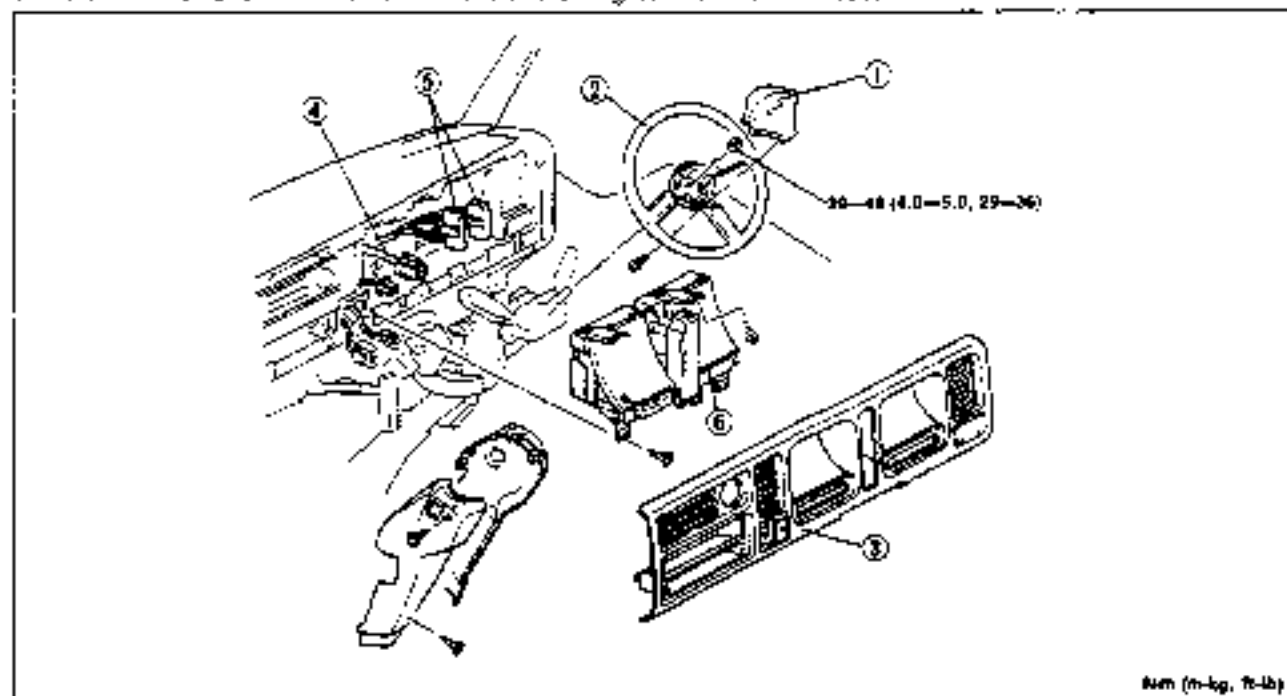
- Continue the above checks for at least two minutes each to correctly judge the condition.
- The allowable indication error is twice the width of the needle.



## INSTRUMENT CLUSTER (METER)

## Removal / Installation

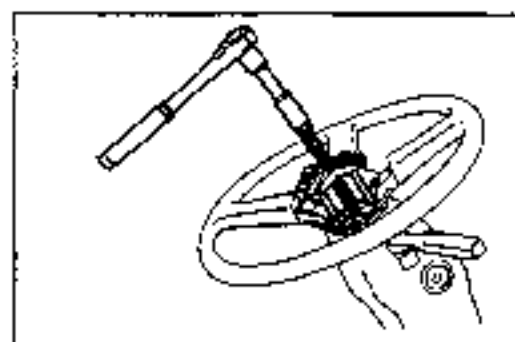
1. Disconnect the negative battery cable.
2. Remove in the order shown in the figure, referring to **Removal Note**.
3. Install in the reverse order of removal, referring to **Installation Note**.



Item (m-kg, ft-lb)

5T6CTX-121

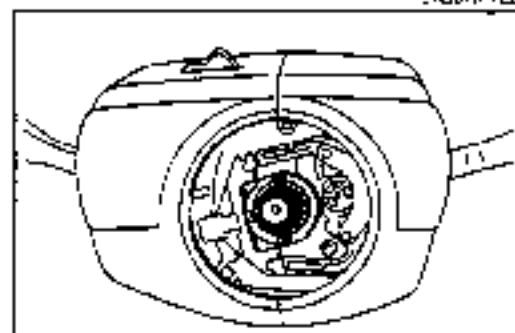
- |                                   |  |
|-----------------------------------|--|
| 1. Steering column                | 5. Connector                           |
| 2. Steering wheel                 | 6. Instrument cluster (meter)          |
| Removal Note ..... page T-68      | Troubleshooting ..... page T-64        |
| Installation Note ..... page T-68 | Disassembly / Assembly ..... page T-69 |
| 3. Meter panel                    | Inspection ..... page T-70             |
| 4. Speedometer cable              |  |



5T6G07X-122

**Removal note****Steering wheel**

1. Remove the steering wheel with a steering wheel puller.



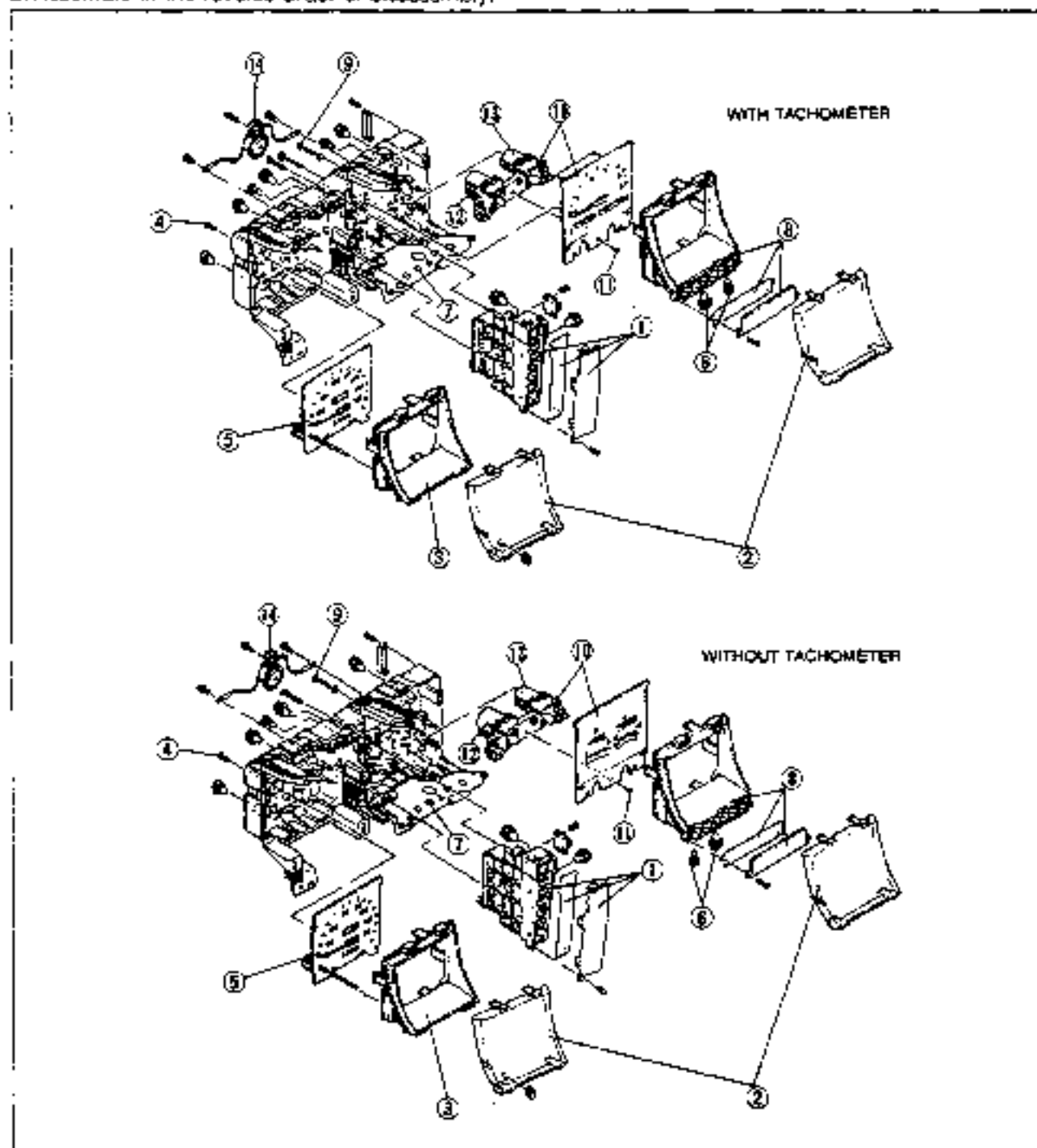
5T6G07X-123

**Installation note****Steering wheel**

1. Set the cancel cam as shown in the figure.

### Disassembly / Assembly

1. Disassemble in the order shown in the figure.
2. Assemble in the reverse order of disassembly.



9T007X-124

1. Warning lamp assembly  
Inspection..... page T-58
2. Cover
3. Meter hood
- Speedometer**
4. Screws
5. Speedometer  
Inspection..... page T-70

- Tachometer/gauge ass'y**
6. Bulbs
7. Meter printed circuit
8. Indicator lamp assembly  
Inspection..... page T-58
9. Screws
10. Tachometer/gauge assembly  
Inspection..... page T-70

11. Screws
12. Fuel gauge  
Inspection..... page T-70
13. Water temperature gauge  
Inspection..... page T-70
- Warning buzzer**
14. Warning buzzer  
Inspection..... page T-61

Standard indication (rpm)	Allowable range (rpm)
1 000	800—1 060
2 000	1 970—2 150
3 000	3 000—3 180
4 000	4 000—4 240
5 000	5 000—5 300
6 000	6 000—6 360
7 000	7 000—7 420

STC00T4-125

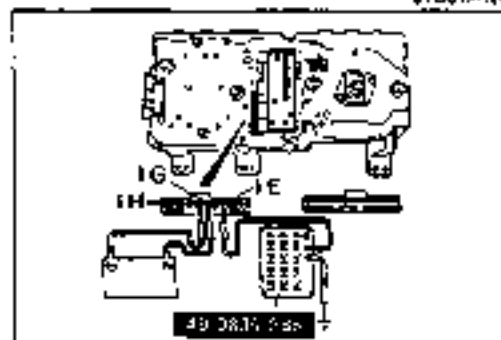
## km/h

Standard indication	Allowable range
40	40—43
80	80—84

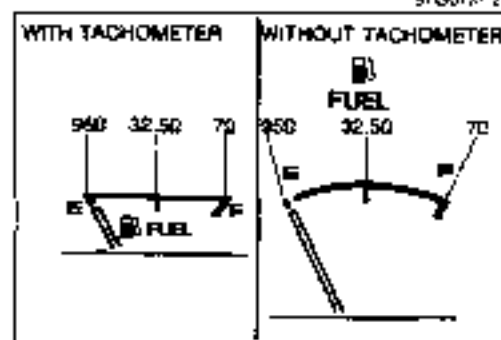
## mph

Standard indication	Allowable range
20	20—22
50	50—53
80	80—84

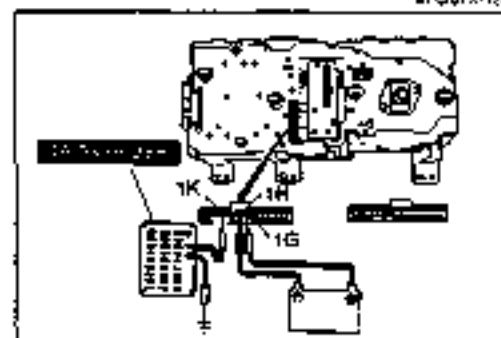
STC00T4-126



STC00T4-127



STC00T4-128



STC00T4-129

## Inspection

## Tachometer

1. Connect a test tachometer to the engine, and start the engine.
2. Check the tachometer for allowable indication error. Replace if necessary.

## Caution

- When removing or installing the tachometer, do not drop it or subject it to sharp shocks.

## Speedometer

1. Using a speedometer tester, check the speedometer for allowable indication error and check the operation of the odometer. Replace if necessary.
2. Check the speedometer for fluctuation and/or abnormal noise.

## Caution

- If significant fluctuation occurs or the speedometer does not move at all, remove the speedometer cable. If it is normal, replace the speedometer assembly.
- Tire wear and improper inflation will increase speedometer error.

## Fuel gauge

1. Remove the instrument cluster.
2. Apply 12V to terminal 1G and ground terminal 1H.
3. Connect the red lead of the SST to terminal 1E and the black lead to a negative battery terminal.

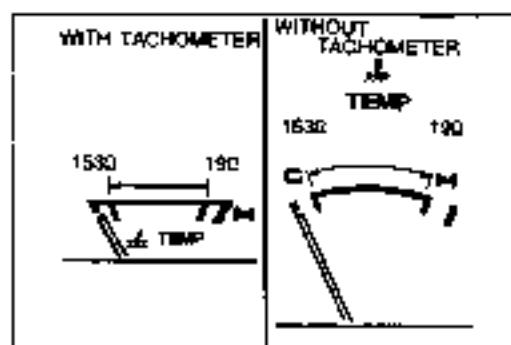
4. Set the SST to the resistance values shown in the figure.
5. Verify that the needle indicates the correct values.

## Caution

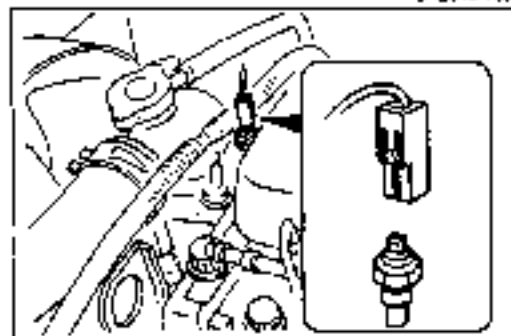
- Continue the above checks for at least two minutes each to correctly judge the condition.
- The allowable indication error is twice the width of the needle.

## Water Temperature Gauge

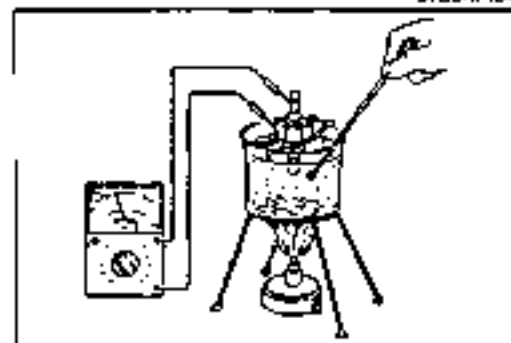
1. Remove the instrument cluster.
2. Apply 12V to terminal 1G and ground terminal 1H.
3. Connect the red lead of the SST to terminal 1K and the black lead to a negative battery terminal.



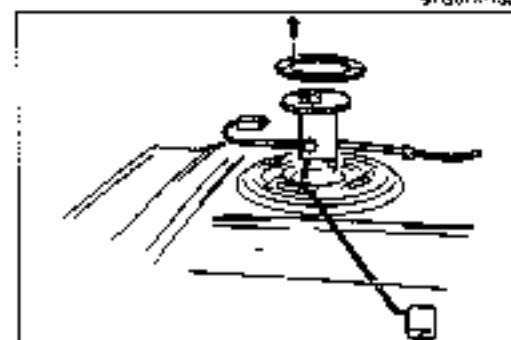
9TG07X-130



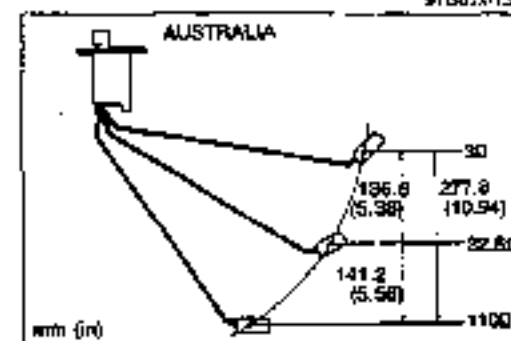
9TG07X-131



9TG07X-132



9TG07X-133



9TG07X-134

4. Set the **SST** to the resistance values shown in the figure.
5. Turn the engine switch **ON**, and verify that the needle indicates the correct values

### Caution

- Continue the above checks for at least two minutes each to correctly judge the condition.
- The allowable indication error is twice the width of the needle.

## WATER THERMOSENSOR

### Removal / Installation

1. Disconnect the connector from the water thermosensor.
2. Remove the sensor
3. Install in the reverse order of removal.

### Inspection

1. Place the water thermosensor and a thermometer in water, and gradually heat the water.
2. Measure the resistance of the sensor with an ohmmeter.

**Resistance: 190—280Ω at 50°C (122°F)**

3. Replace the water thermosensor if not as specified.

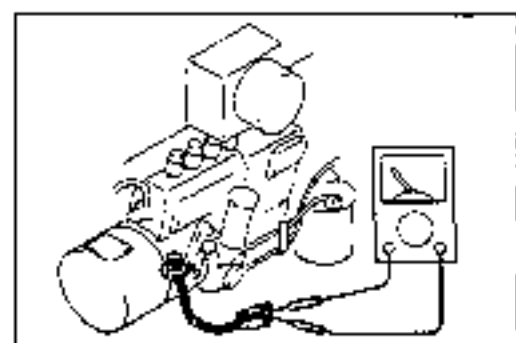
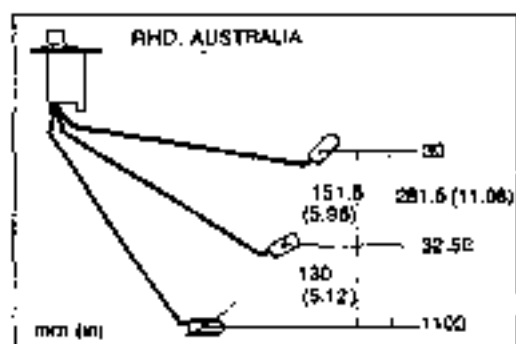
## FUEL GAUGE SENDER UNIT

### Removal / Installation

1. Disconnect the connector from the fuel gauge sender unit.
2. Remove the screws and remove the fuel gauge sender unit from the fuel tank.
3. Install in the reverse order of removal.

### Inspection

1. Connect an ohmmeter between the terminals of the fuel gauge sender unit.
2. Measure the resistance while slowly moving the unit from point E to point F.
3. Replace the fuel gauge sender unit if not as specified.



91G07X-136

**PICKUP SENSOR****Inspection**

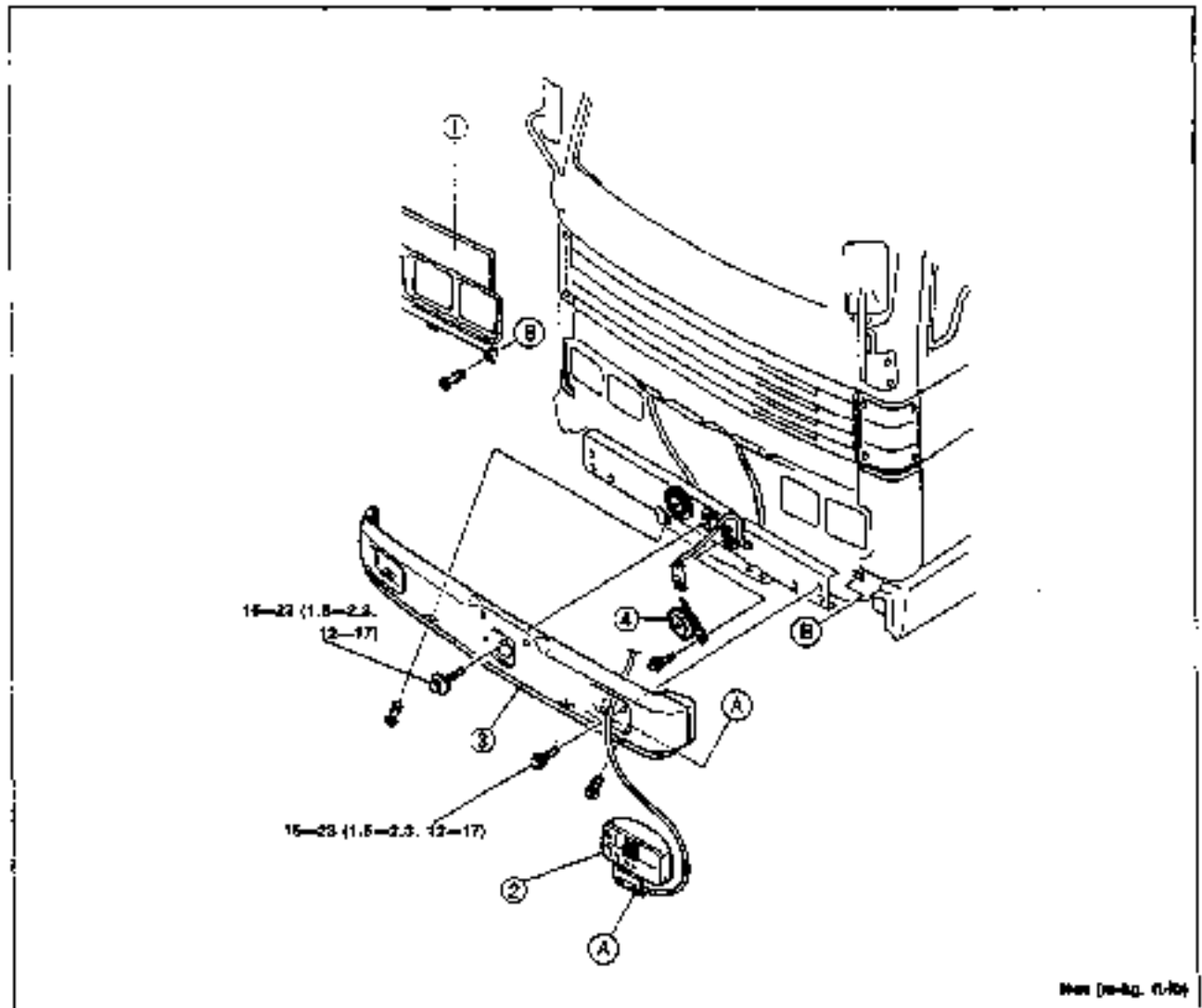
1. Disconnect the pickup sensor connector.
2. Check for continuity with an ohmmeter.
3. Replace the pickup sensor if there is no continuity.

## HORN

## HORN

## Removal / Installation

1. Remove in the order shown in the figure.
2. Install in the reverse order of removal.



Horn (Fig. T-38)

9T60TX-136

1. Radiator grille

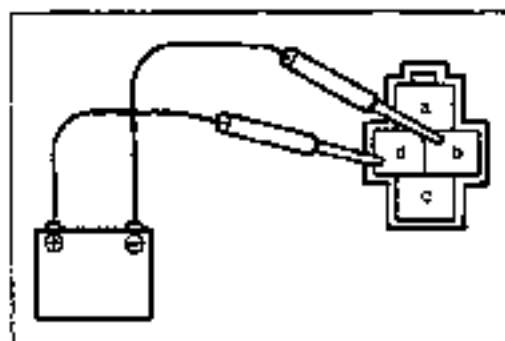
2. Fog light

Removal / Inspection /

Installation ..... page T-38

3. Front bumper

4. Horn



9T60TX-137

## HORN RELAY

## Inspection

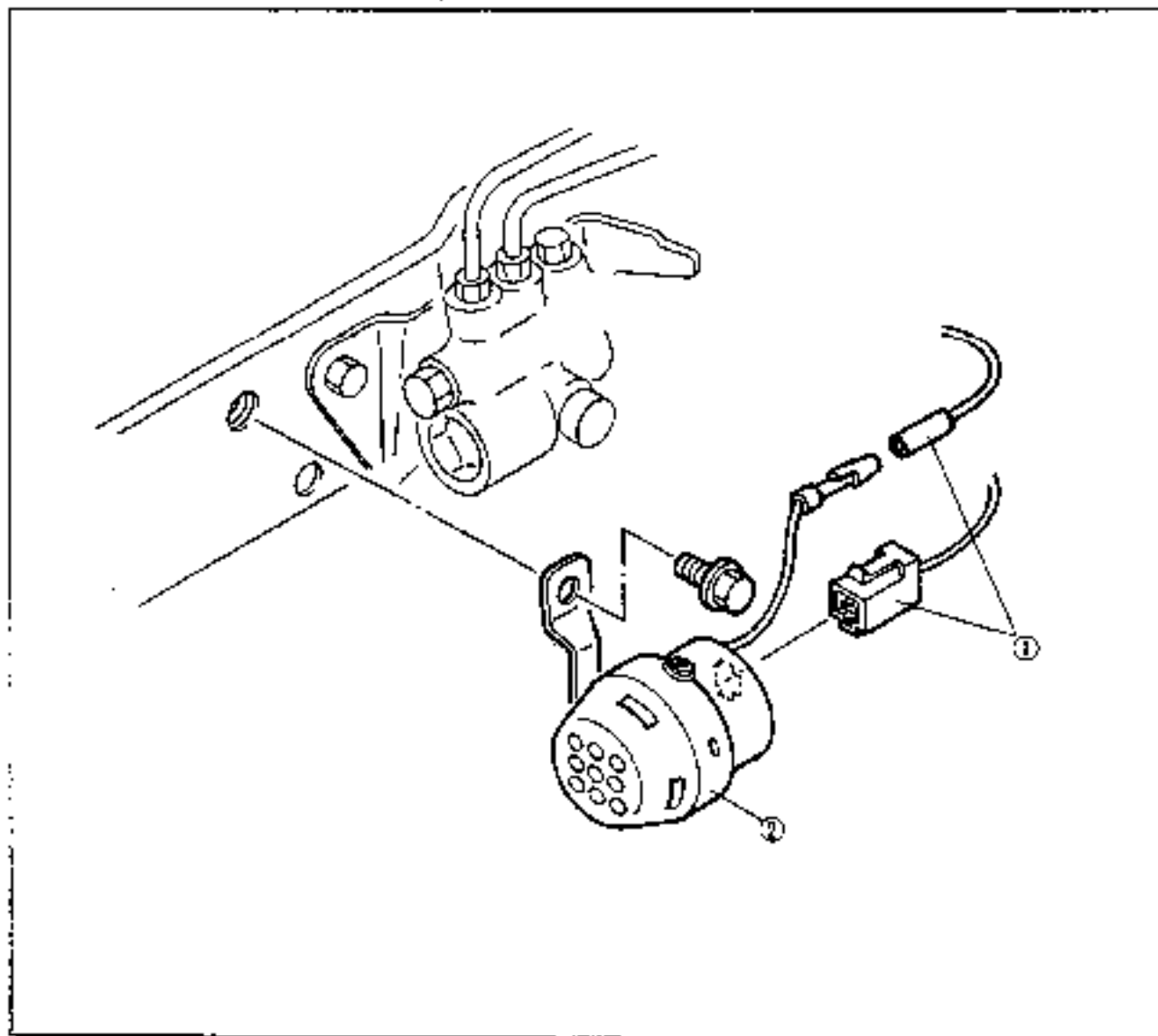
1. Apply 12V to D terminal and ground B terminal, and check continuity between A and C terminals.
2. Replace horn relay if not as specified.

## BACKING WARNING HORN

## BACKING WARNING HORN

## Removal / Installation

1. Remove in the order shown in the figure.
2. Install in the reverse order of removal.

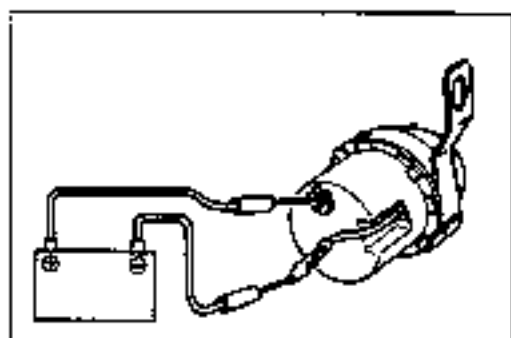


9700TX-138

1. Connector

2. Backing warning horn

Inspection ..... page T-74



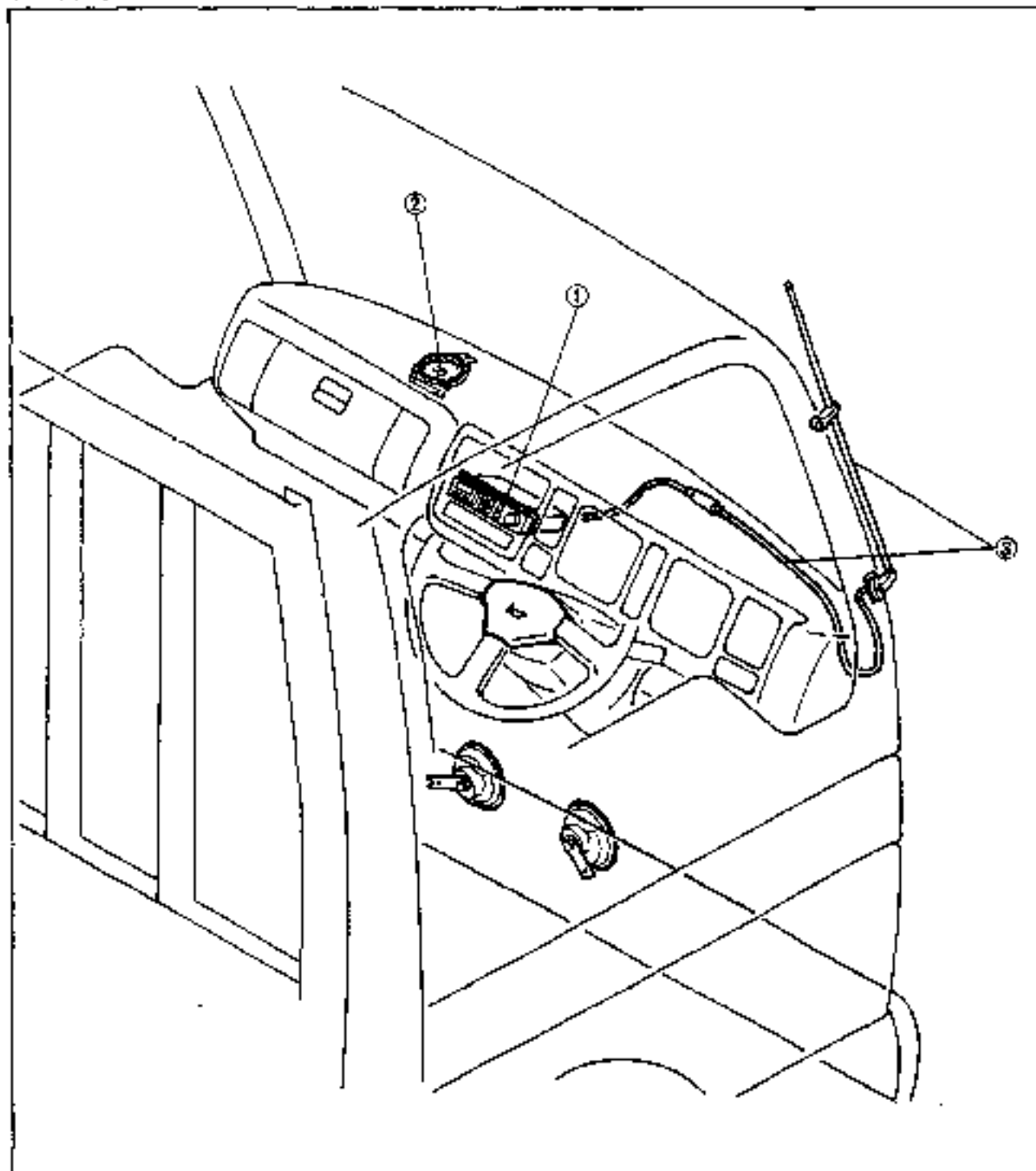
9700TX-138

**Inspection**

1. Disconnect the connector from the backing warning horn.
2. Connect the battery to the backing warning horn as shown in the figure.
3. Verify that the horn operates.
4. Replace the backing warning horn if not as specified.

## AUDIO

## STRUCTURAL VIEW



91P01x-010

1. Audio unit  
 Troubleshooting ..... page T-78  
 Removal / Installation ..... page T-88
2. Speaker  
 Troubleshooting ..... page T-78  
 Removal / Installation ..... page T-89  
 Inspection ..... page T-90

3. Antenna feeder  
 Troubleshooting ..... page T-78  
 Removal / Installation ..... page T-91  
 Inspection ..... page T-91



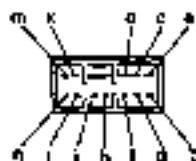
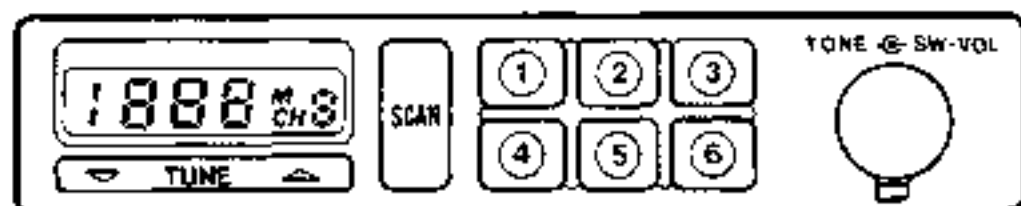
## SPECIFICATIONS

		AM radio	AM/FM radio	Remark	
Frequency band	AM (kHz)	531 ~ 1 602	531 ~ 1 602		
	FM (MHz)	—	87.9 ~ 107.9		
Band step	AM (kHz)	9	9		
	FM (kHz)	—	100		
Amplifier output		5W x 2	25W x 2		
Function of Radio	Memory	AM	⊙	⊙	
		FM	—	⊙	
	Seek function		⊙ (up and down)	⊙ (up and down)	
	Scan function		⊙ (up only)	—	
Auto-memory		—	⊙		
Dark current (mA)		Max 3	Max 3		

9TGT0107

## DESCRIPTIONS

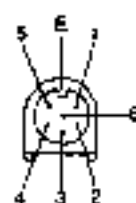
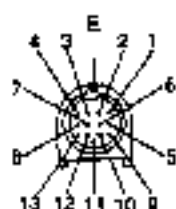
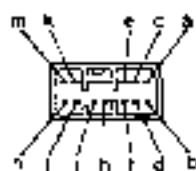
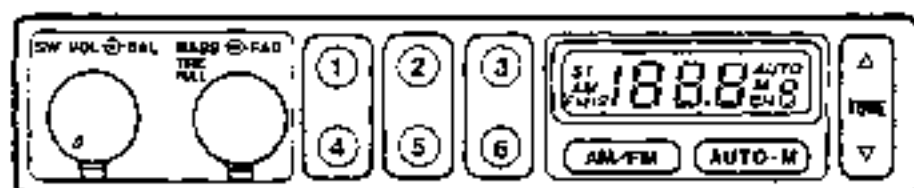
## AM Radio



a	(+) 13.2V (ACC)
b	
c	
d	
e	
f	
h	
i	
k	SPEAKER (+)
l	SPEAKER (-)
m	SPEAKER (+)
n	SPEAKER (-)

9TGT01142

AM/FM Radio

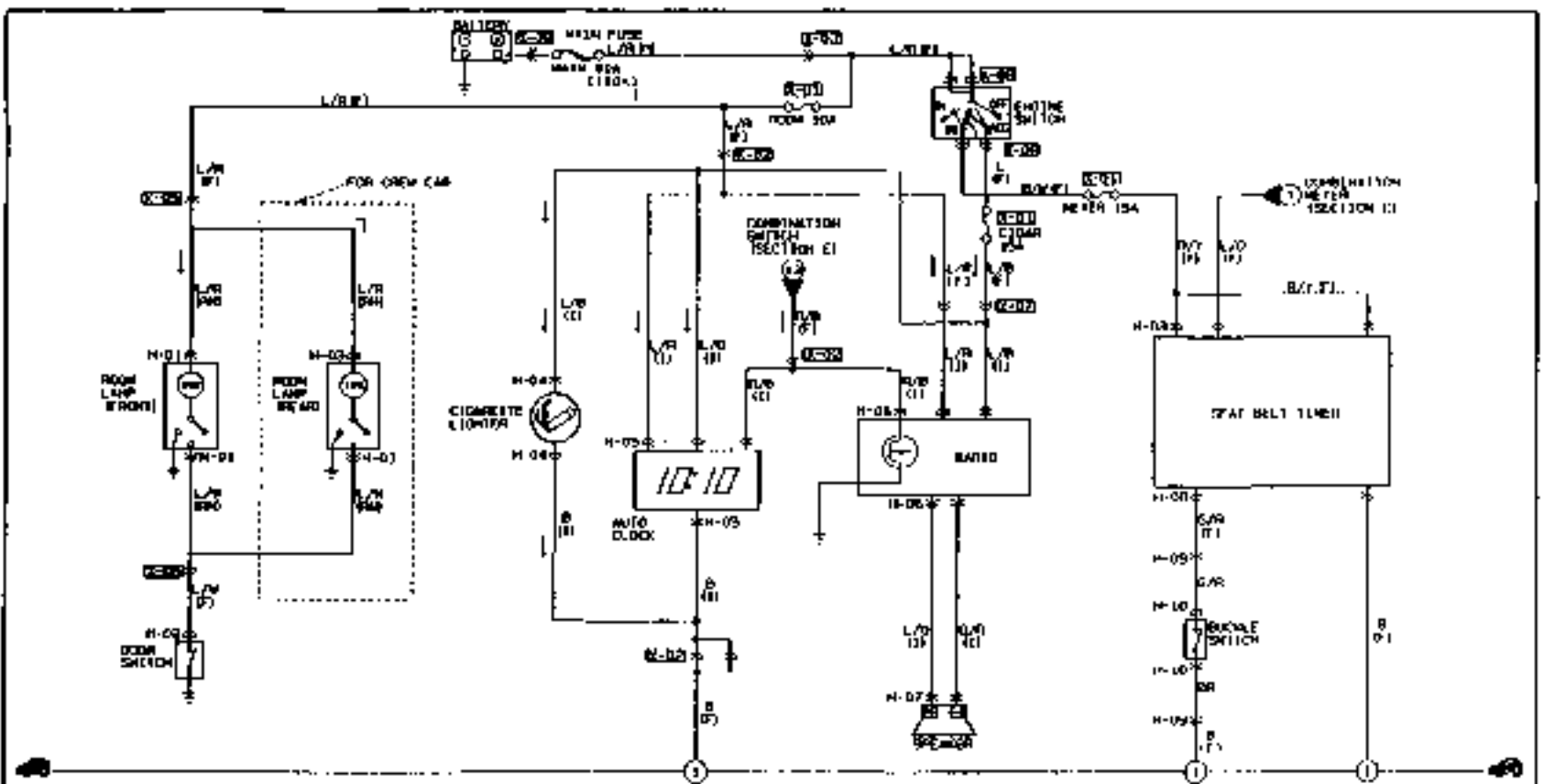


a	(+) 13.2V (ACC)
b	
c	BACK-UP
d	
e	ILLUMINATION
1	
h	
j	
k	SPEAKER (+)
l	SPEAKER (-)
m	SPEAKER (+)
n	SPEAKER (-)

1	OUTPUT (+)
2	INPUT (-)
3	OUTPUT (+)
4	INPUT (+)
5	SIGNAL GROUND
6	ILLUMINATION
7	(+) 13.2V (ACC)
8	BATTERY
9	SYSTEM ON
10	SYSTEM OFF (DECK)
11	SYSTEM OFF (AUX)
12	
13	SYSTEM MUTE
E	GROUND

1	OUTPUT (+)
2	(+) 13.2V CONTROL POWER
3	OUTPUT (+)
4	OUTPUT (-)
5	OUTPUT (-)
6	GROUND
E	SHIELD GROUND

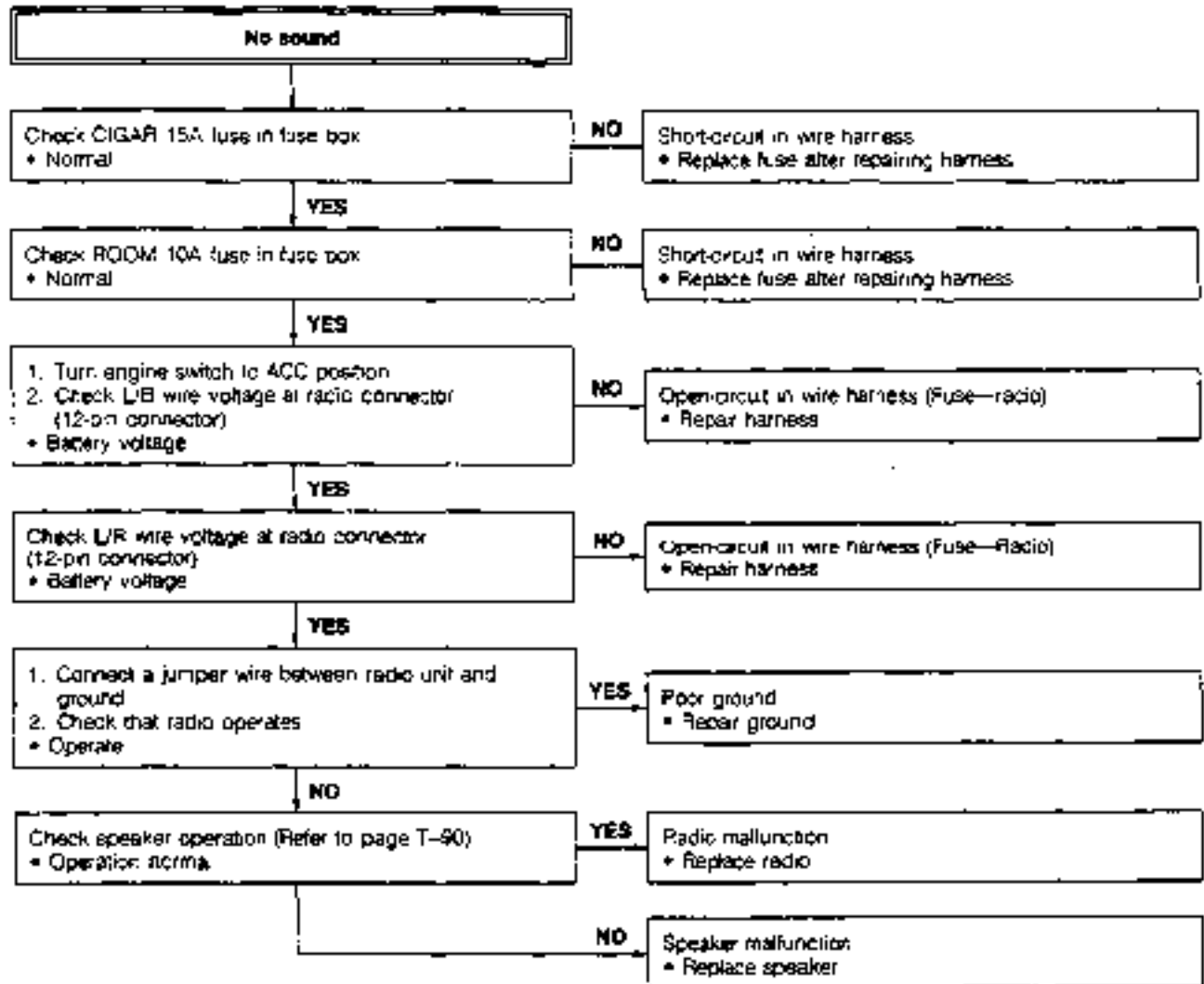
TROUBLESHOOTING  
Wiring Diagram



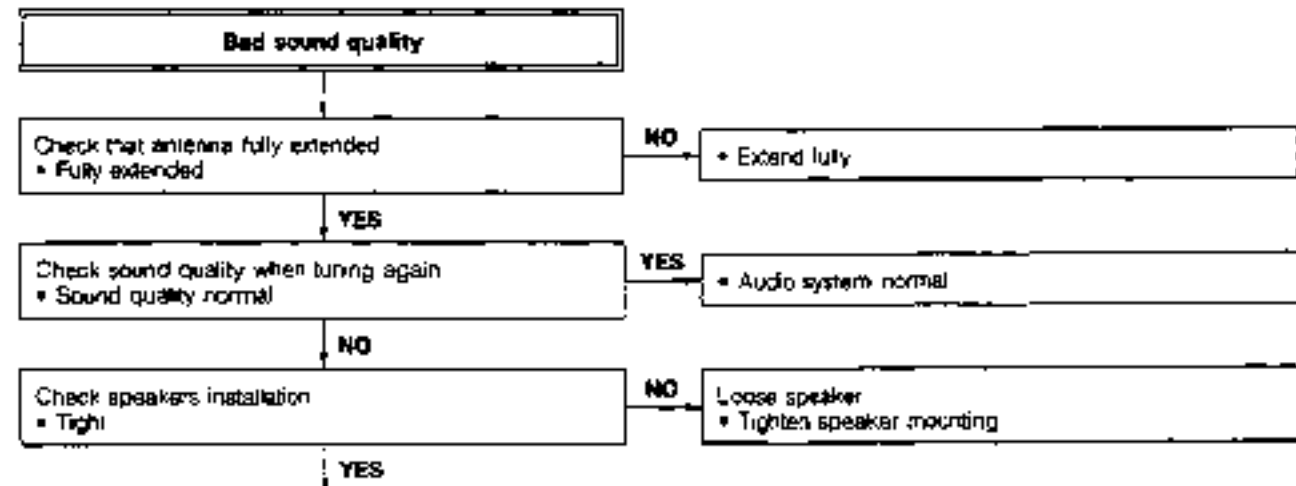
H-01 ROOM LAMP (FRONT) (F)	H-02 ROOM LAMP (BACK) (F)	H-03 DOOR SWITCH (F)	H-04 CIGARETTE LIGHTER (F)	H-05 AUTO D. BOX (F)	H-06 RADIO (B)
H-07 SPEAKER (B)	H-08 SEAT BELT TUMBLER (B)	H-09 BUZZER SWITCH COMB. (B)	H-10 BUZZER SWITCH (B)		

NOTE: W-100-1000

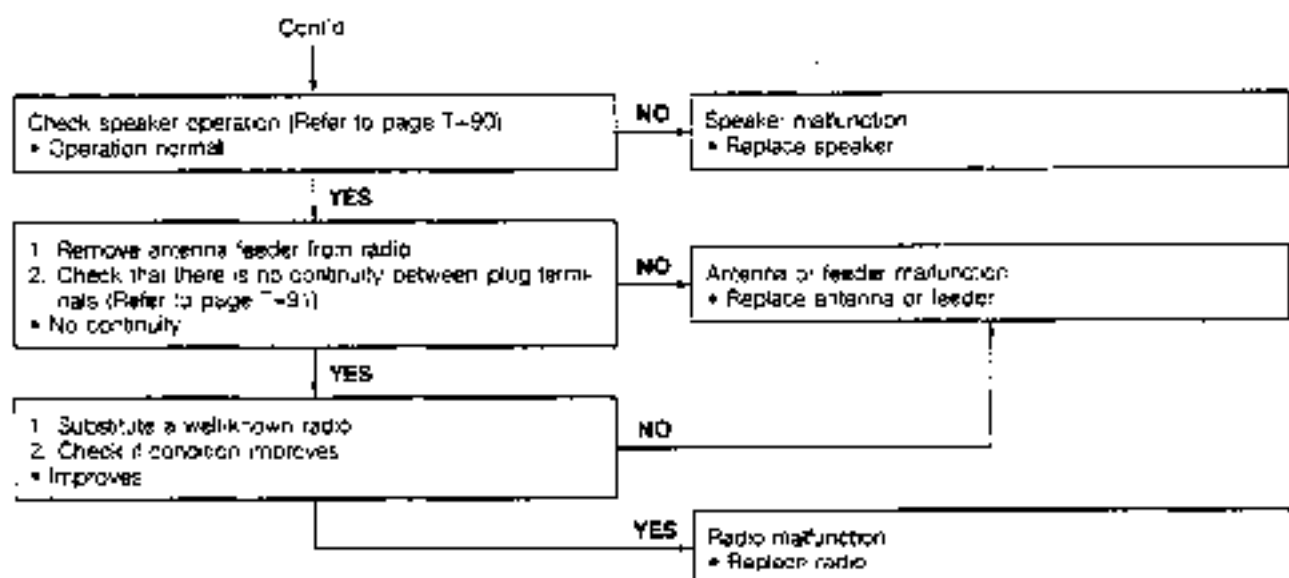
**AM Radio**



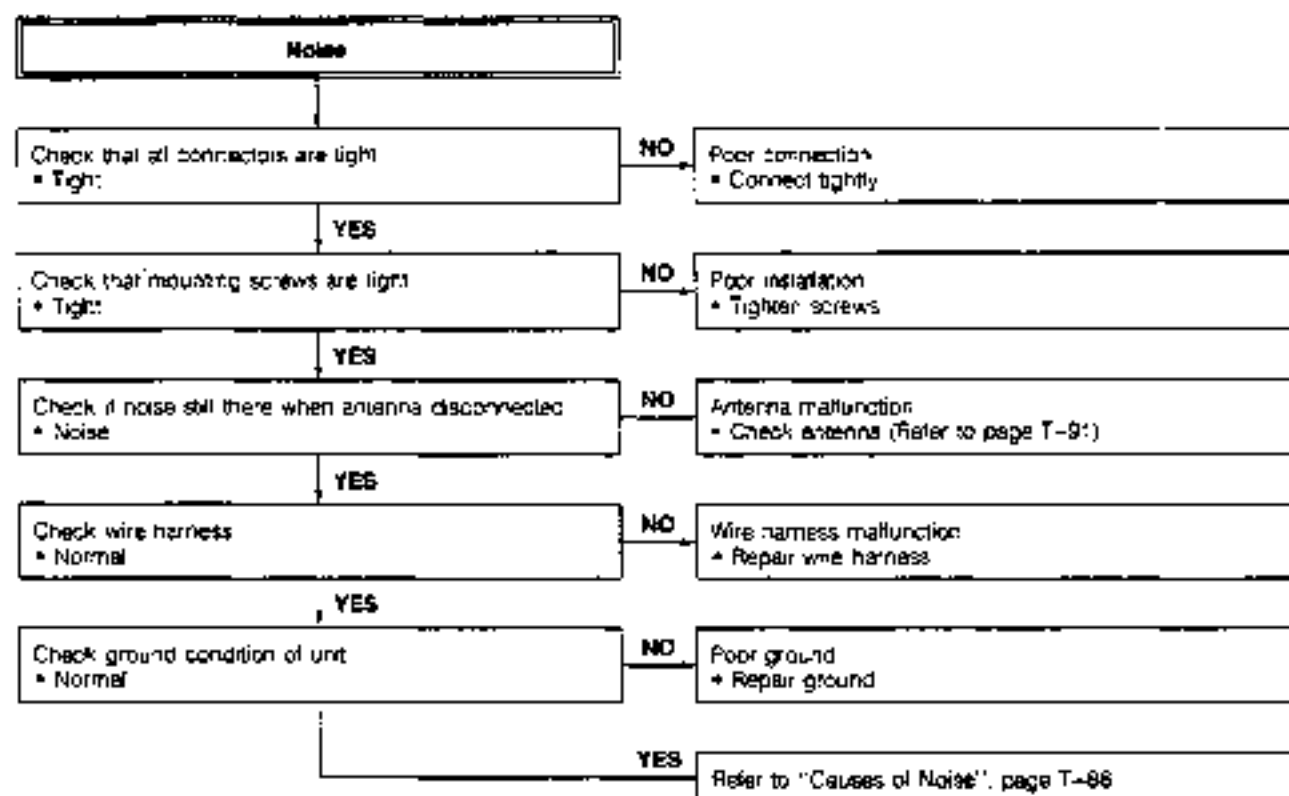
BTFR01X-018



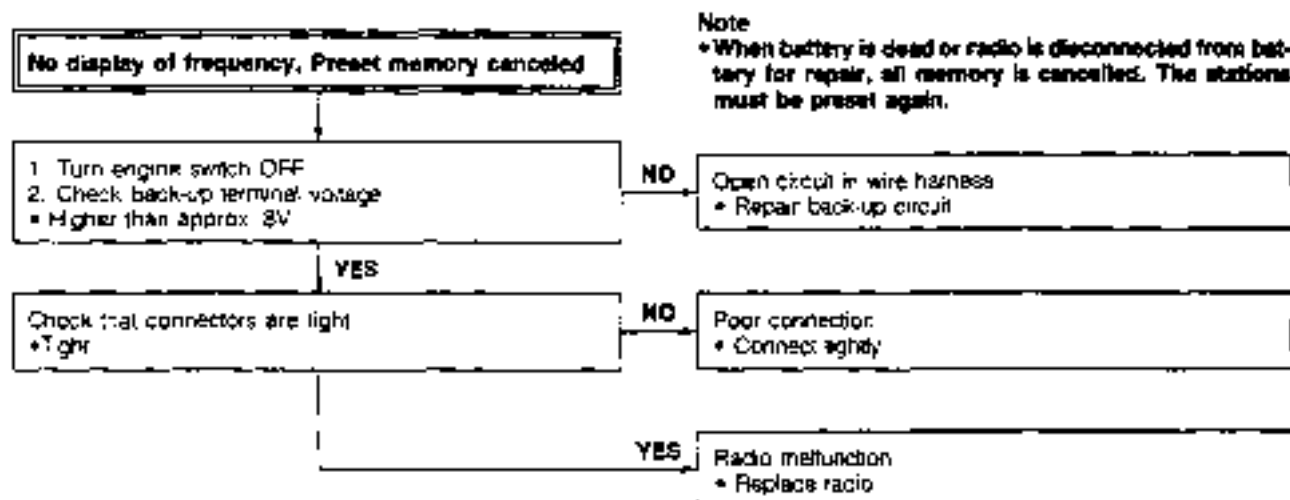
Cont'd



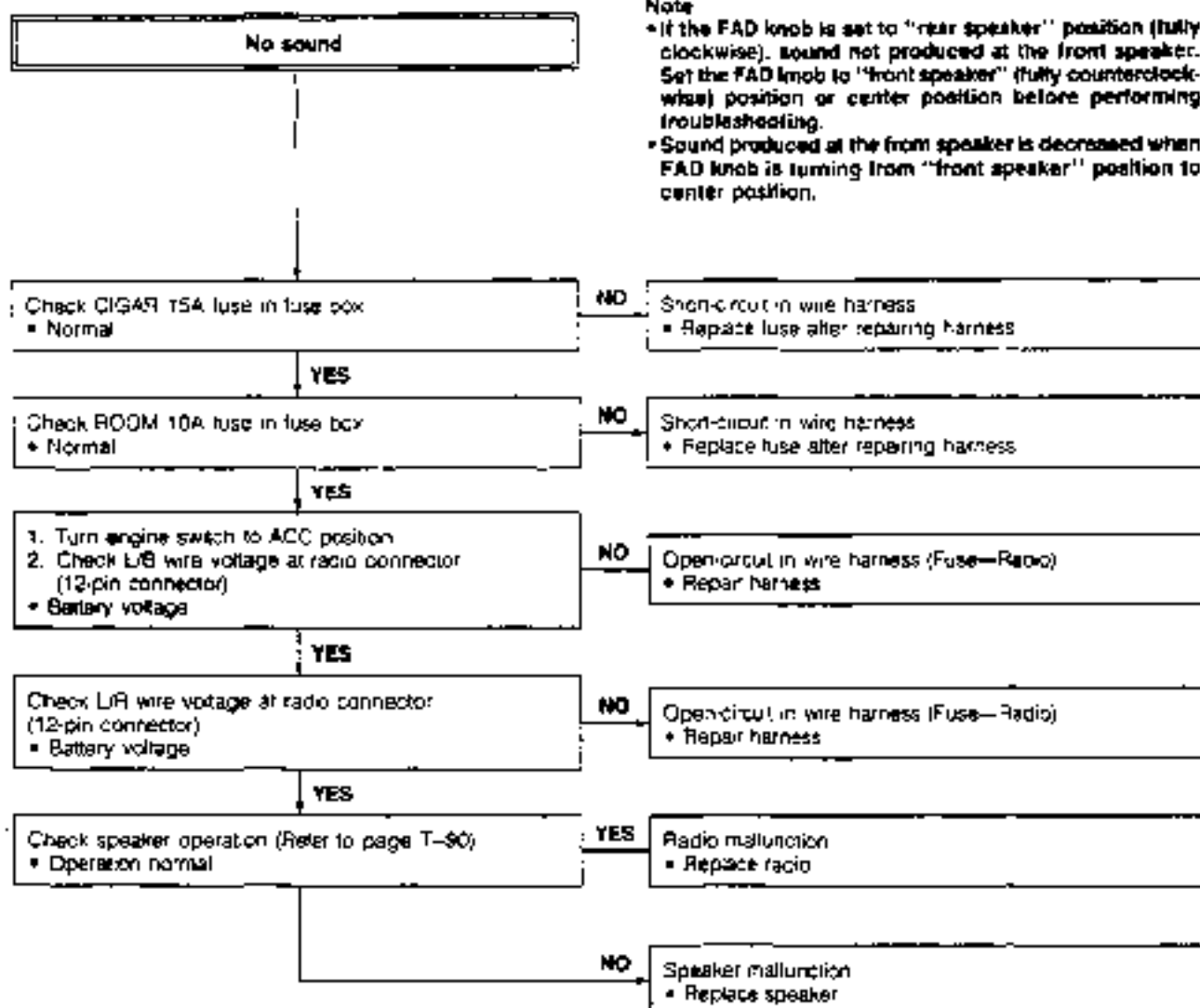
9T-07X-019



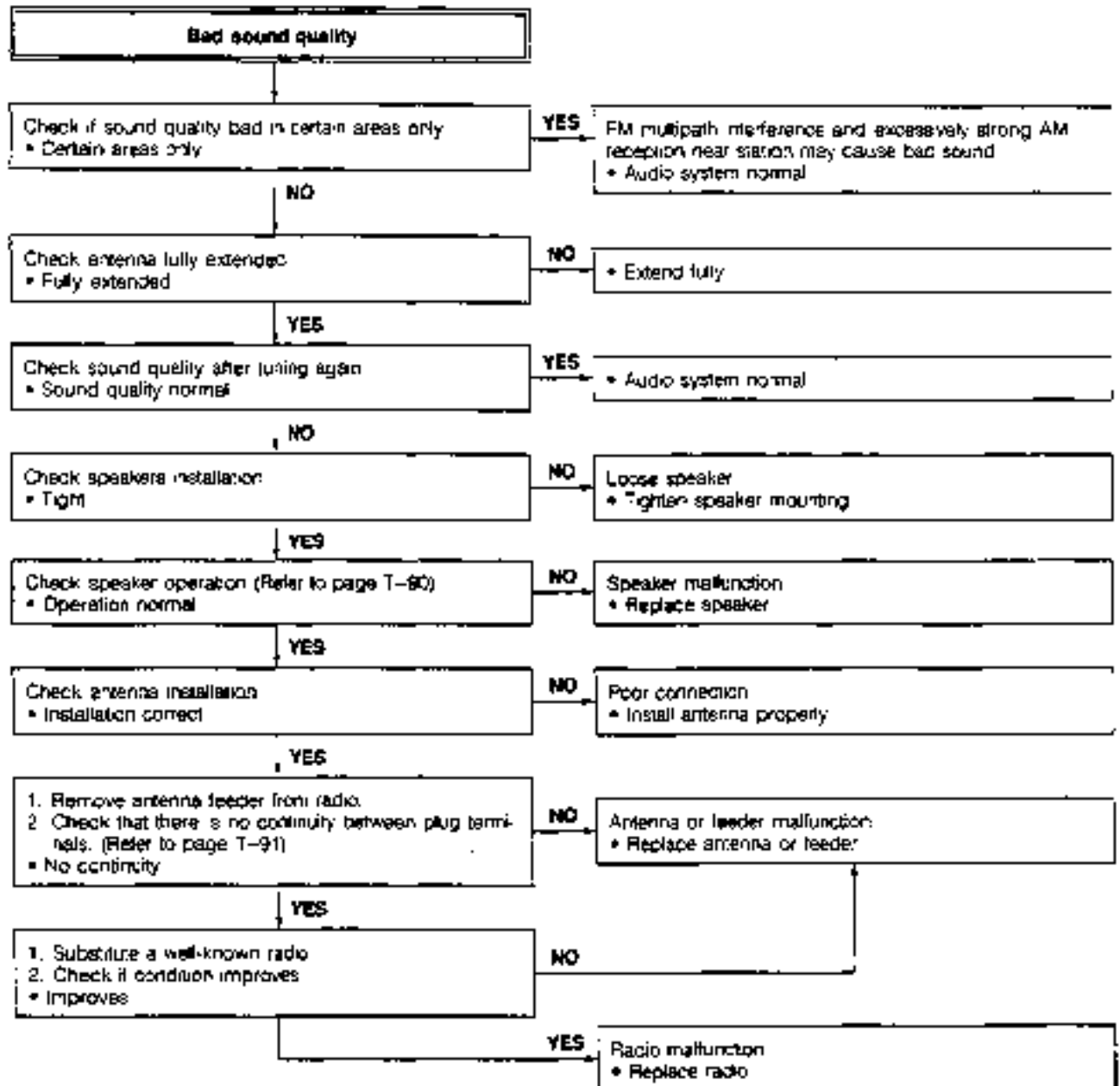
9TRGX-020



## AM/FM Radio

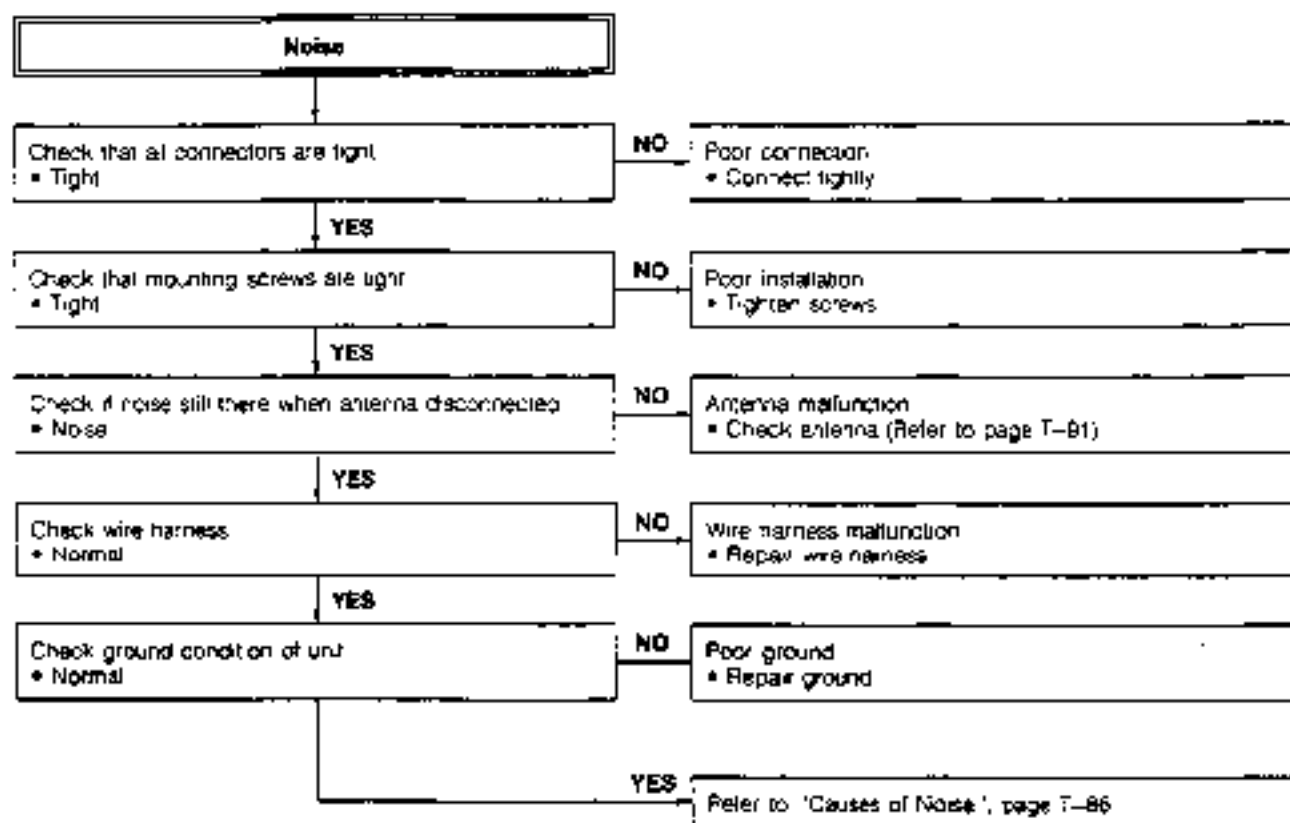


B\*607x-011

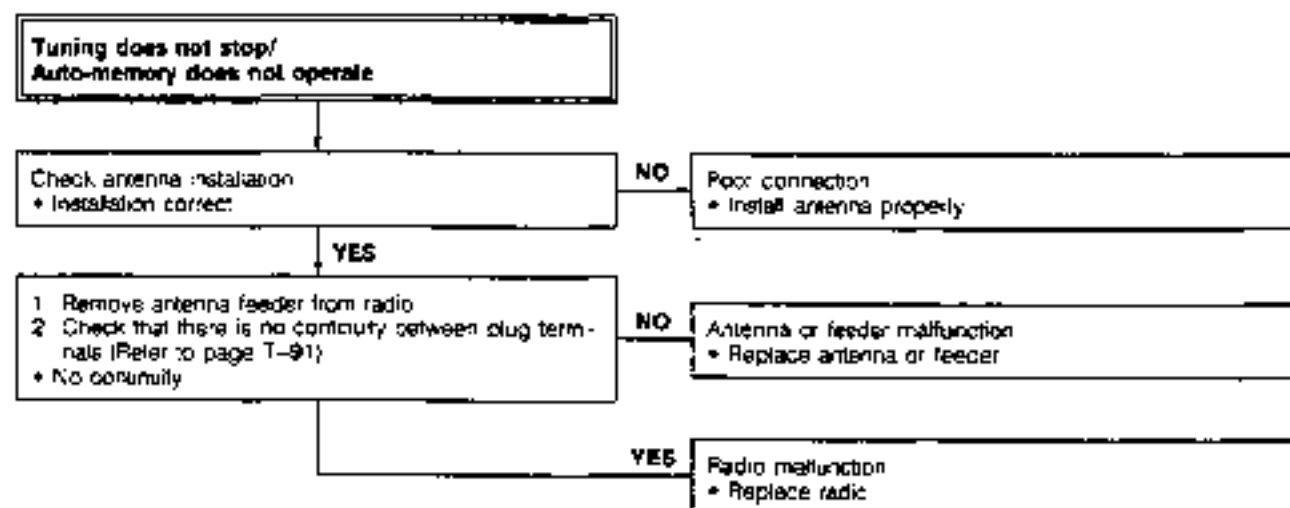


97P07X.029

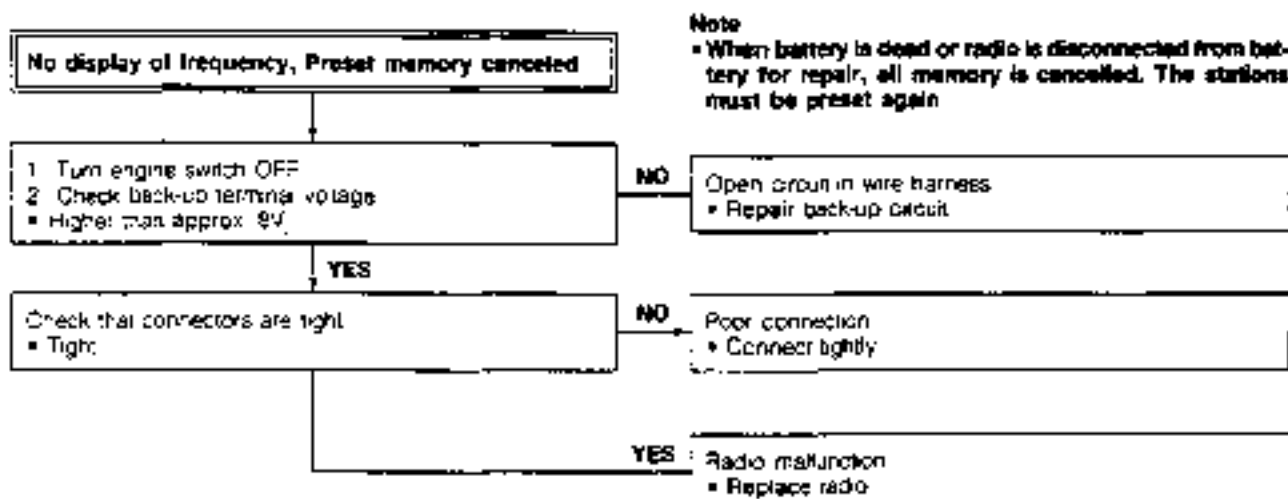




BTR074-023



BTR074-024



BTG07-154

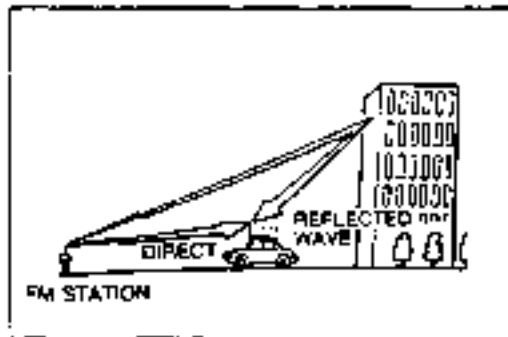
### Causes of Noise

When the radio receives a signal from a station, there may be some noise interference. The cause could be

1. Defective audio system
2. The vehicle itself inducts noise. (called outside noise.)
3. Noise from other cars or neon signs, for example (ambience noise)

Since ambience noise is a temporary occurrence, this section does not deal with it. For noise problems, first, the cause of the noise must be determined through troubleshooting guide. Once it has been determined, refer to the suppression chart to find the proper procedure for eliminating the noise.

9TGTX-162

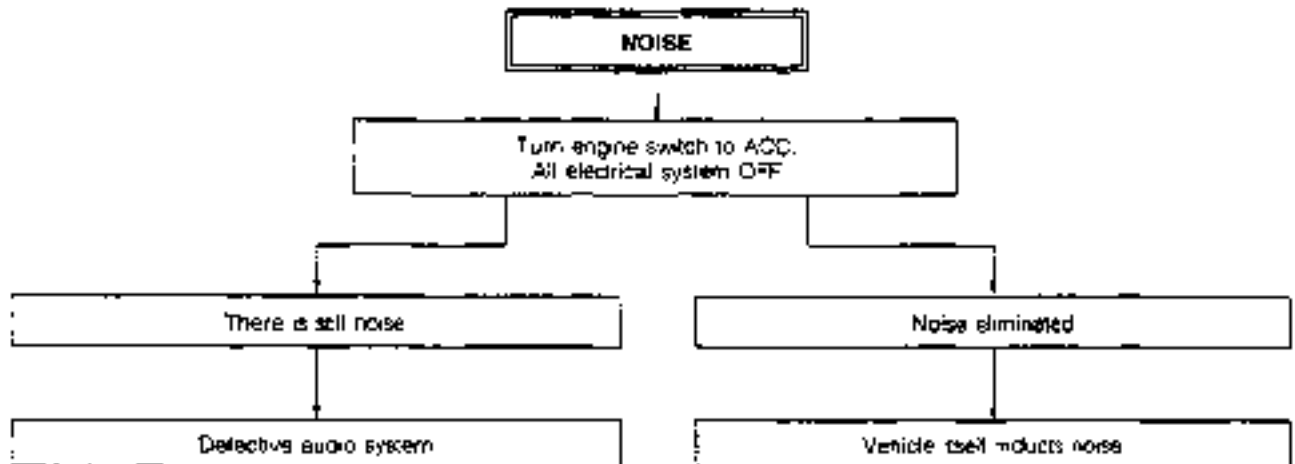


93U154-079

### FM multipath

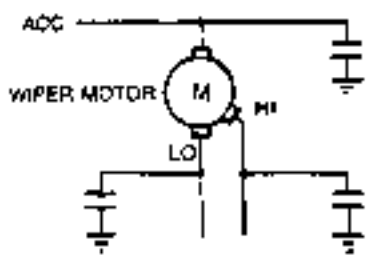
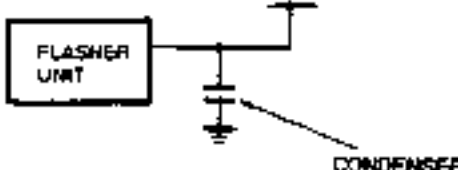
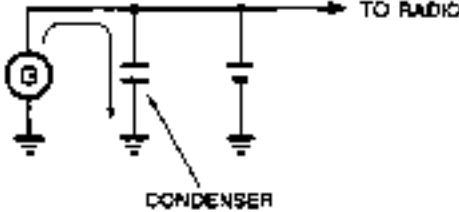
FM waves can cause a problem called multipath receiving. This happens when the radio picks up a direct wave and reflected wave at the same time. This results in a "Dead Spot" or distorted sound.

### Troubleshooting



9TGTX-163

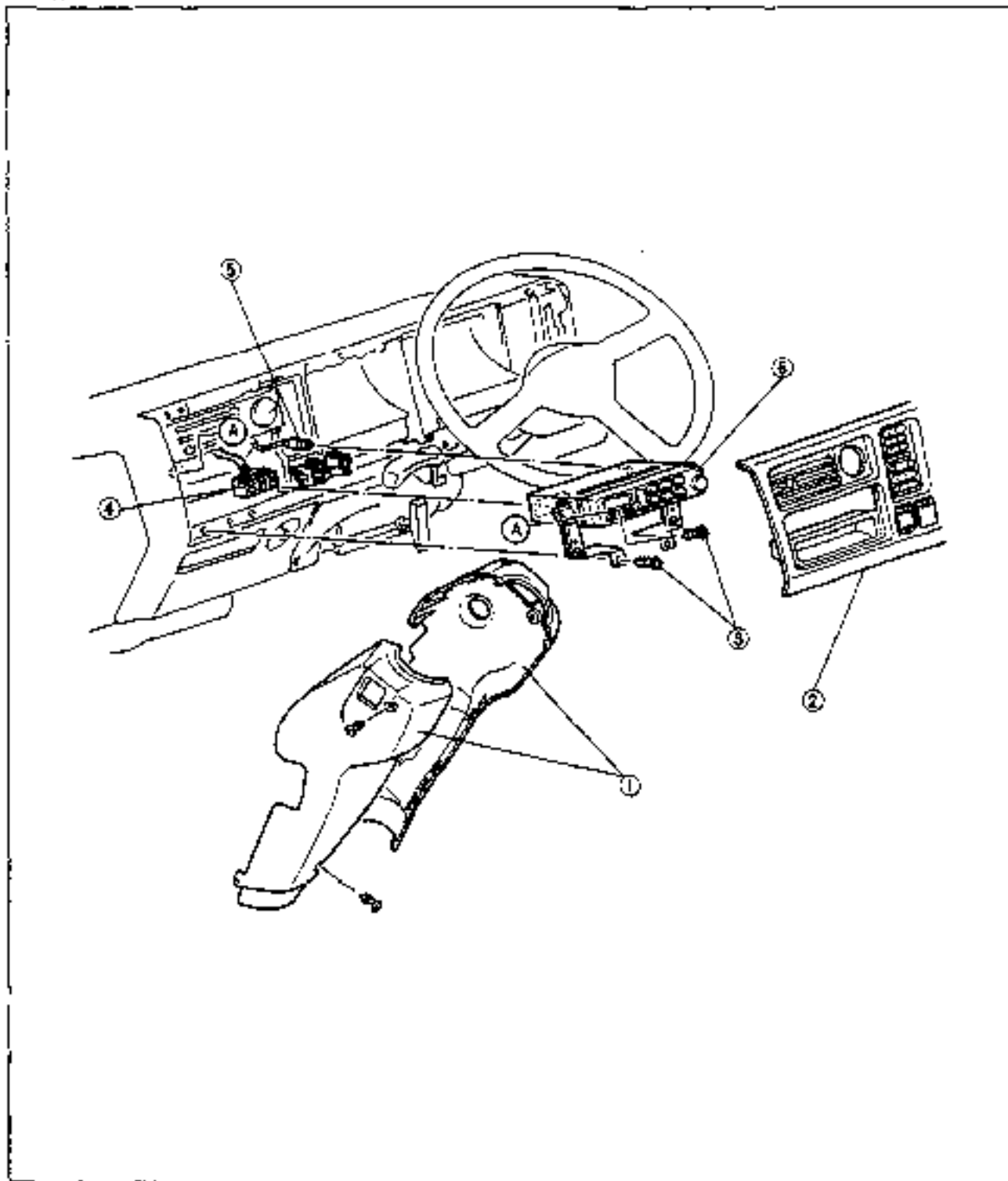
## Noise Suppression Chart

Cause	Remedy
Motor noise (Wiper, washer, for example)	<p>1. Check grounding. 2. Install condensers to motor circuit</p> 
Turn signal noise	<p>Connect condenser to power line of flasher unit</p>  <p><b>Note</b> • Condenser should be placed near flasher unit.</p>
Alternator noise	<p>Connect condenser near alternator.</p> 

31501X-104

**AUDIO UNIT****Removal / Installation**

1. Remove in the order shown in the figure.
2. Install in the reverse order of removal.



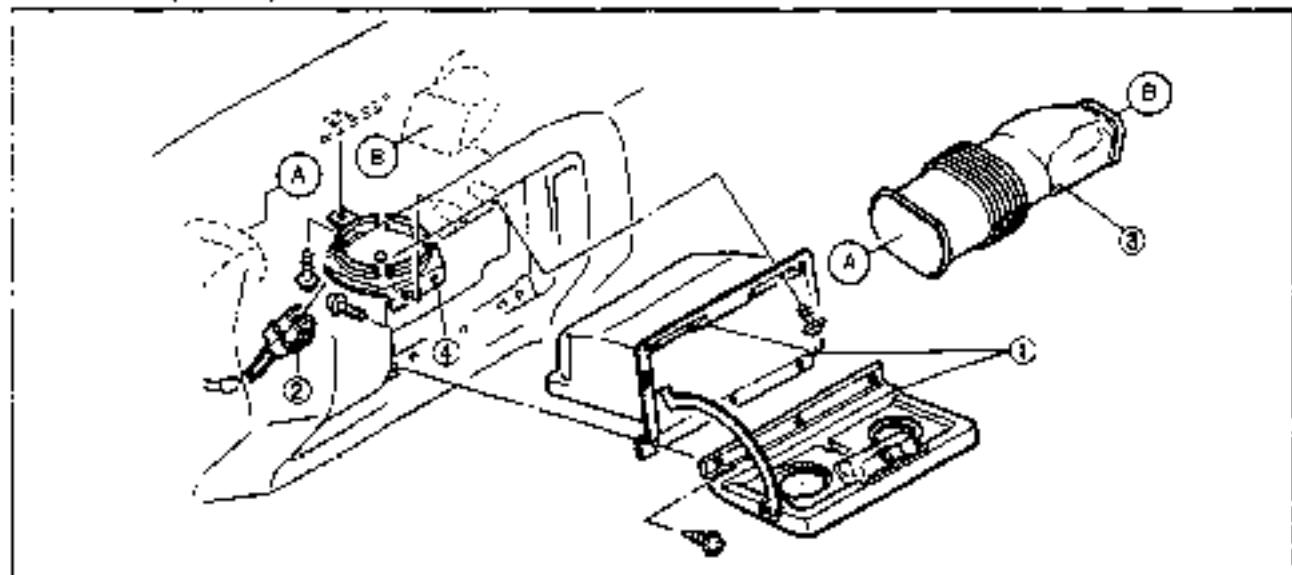
91F07A-025

1. Steering column cover
2. Meter panel
3. Screws
4. Connectors

5. Antenna feeder  
Removal / Installation ..... page T-91  
Inspection ..... page T-91
6. Audio unit/Radio

**SPEAKER****Removal / Installation**

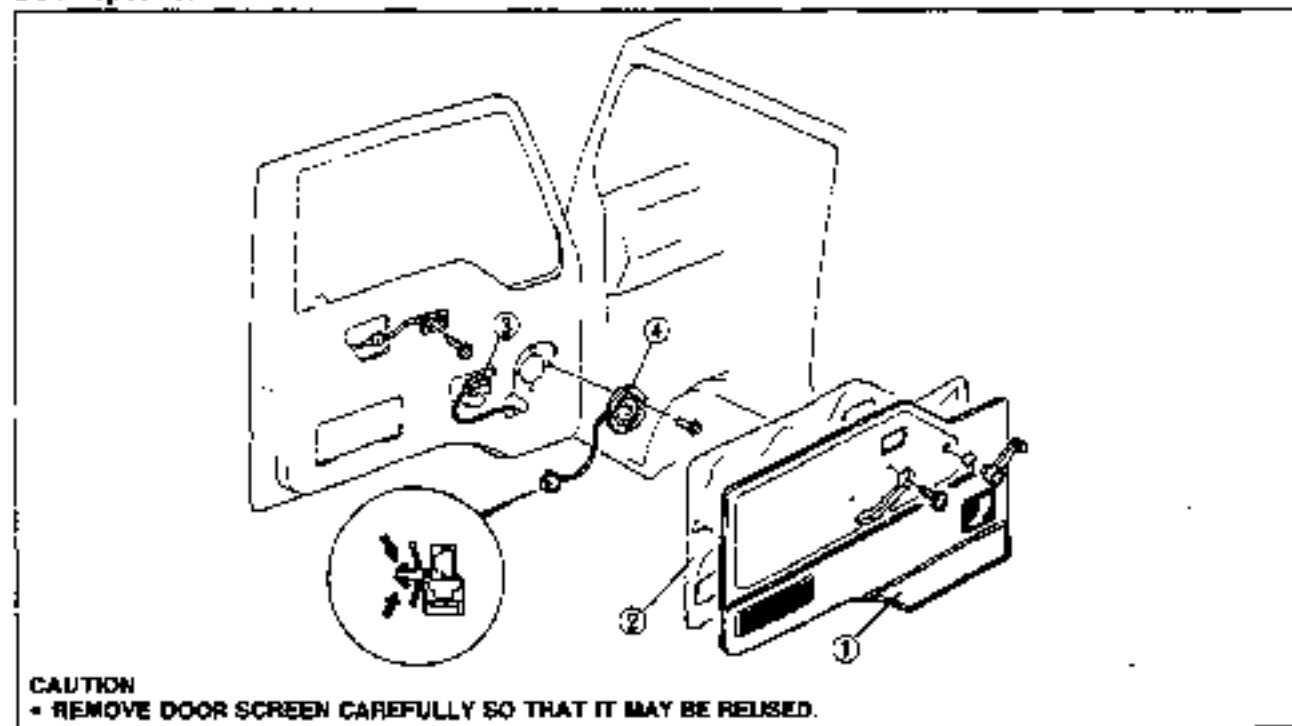
1. Remove in the order shown in the figure
2. Install in the reverse order of removal

**Instrument panel speaker**

97P07X-326

1. Glove box
2. Connectors
3. Duct

4. Speaker  
Inspection ..... page T-90

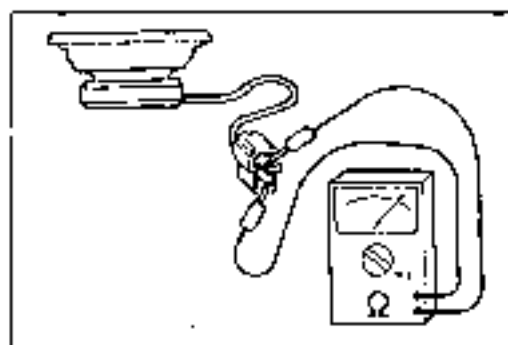
**Door speaker**

**CAUTION**  
 • REMOVE DOOR SCREEN CAREFULLY SO THAT IT MAY BE REUSED.

97P07X-027

1. Door trim
2. Door screen
3. Connectors

4. Speaker  
Inspection ..... page T-90



BT06F01-168

**Inspection****Caution**

- Use an ohmmeter at x1Ω range.

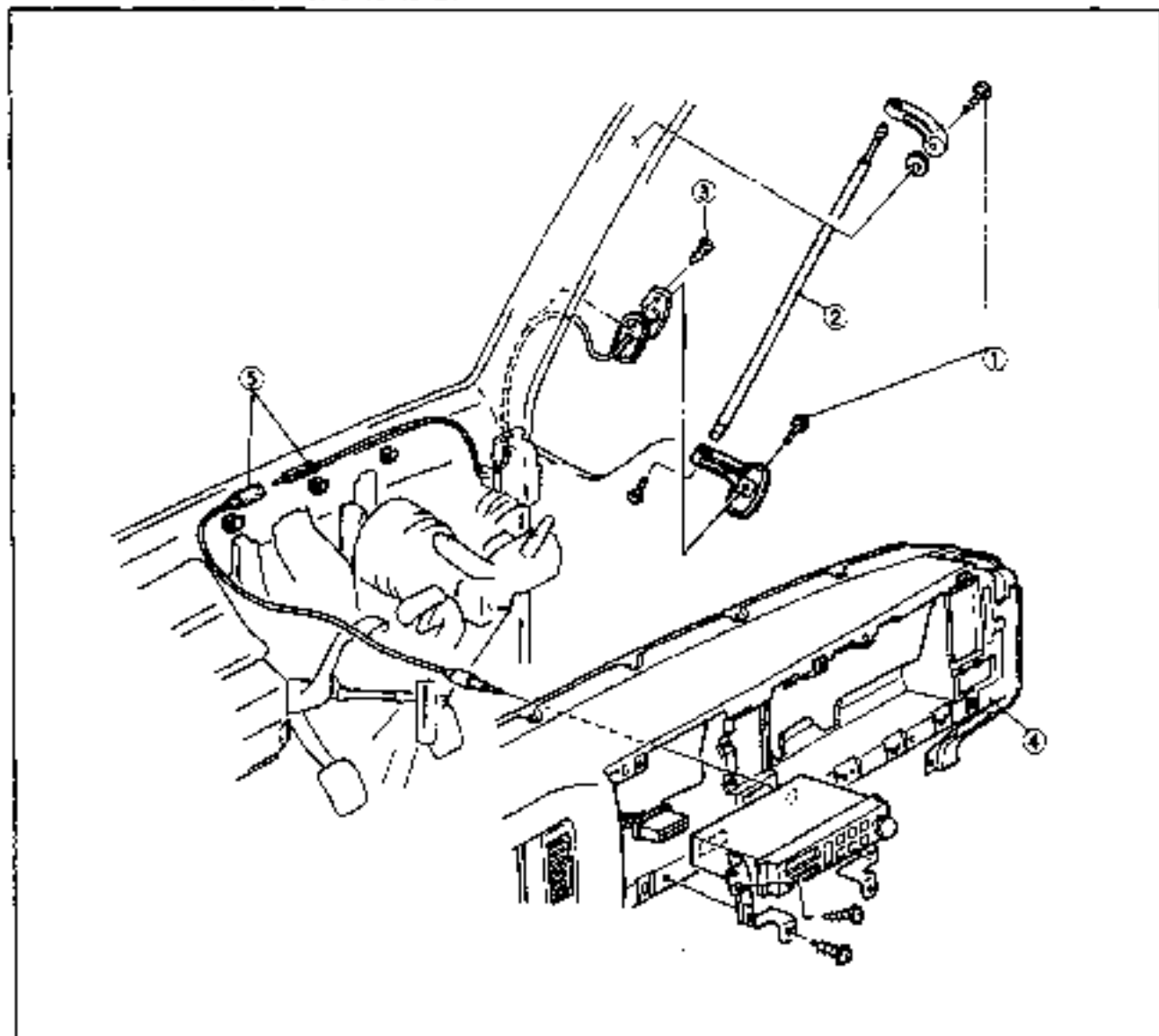
1. Check for resistance of the speaker.

**Resistance: 4Ω**

2. Verify that the speaker clicks when the ohmmeter is connected to the speaker terminal
3. Replace the speaker if not as specified.

**ANTENNA FEEDER****Removal / Installation**

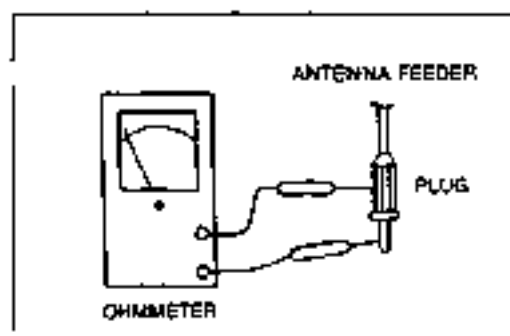
1. Remove in the order shown in the figure.
2. Install in the reverse order of removal.



DTF0TX-625

1. Screws
2. Antenna
3. Screws

4. Instrument panel  
Service..... Section S
5. Antenna feeder  
Inspection..... page T-91



2T0CTX-170

**Inspection**

1. Check that there is no continuity between the plug terminals.
2. Replace the antenna feeder if not as specified.

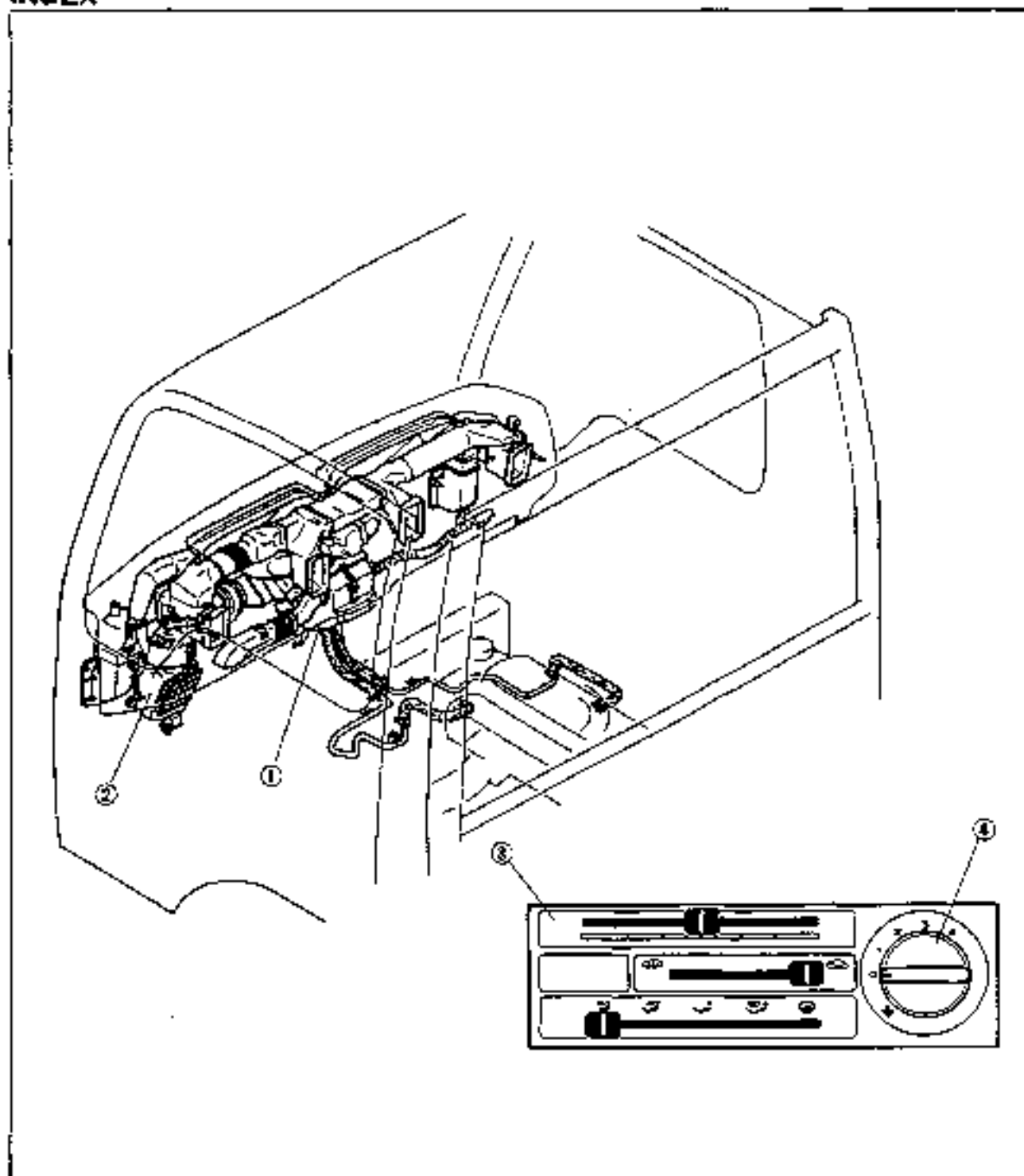


# HEATER AND AIR CONDITIONER SYSTEM

<b>INDEX</b> .....	<b>U- 2</b>
<b>TROUBLESHOOTING</b> .....	<b>U- 3</b>
TROUBLESHOOTING GUIDE .....	<b>U- 3</b>
WIRING DIAGRAM .....	<b>U- 3</b>
<b>FRONT HEATER</b> .....	<b>U- 7</b>
STRUCTURAL VIEW .....	<b>U- 7</b>
FRONT HEATER UNIT .....	<b>U- 8</b>
FRONT BLOWER UNIT .....	<b>U-10</b>
HEATER CONTROL UNIT .....	<b>U-13</b>

9T36L01.001

## INDEX



BT09L01-002

- |                             |           |                             |           |
|-----------------------------|-----------|-----------------------------|-----------|
| 1. Front heater unit        |           | 3. Heater control unit      |           |
| Removal / Installation..... | page U- 8 | Removal / Installation..... | page U-13 |
| Disassembly / Assembly..... | page U- 9 | Disassembly / Assembly..... | page U-16 |
| Inspection.....             | page U- 9 |                             |           |
| 2. Front blower unit        |           | 4. Fan switch               |           |
| Removal / Installation..... | page U-10 | Inspection.....             | page U-16 |
| Disassembly / Assembly..... | page U-12 |                             |           |
| Inspection.....             | page U-12 |                             |           |

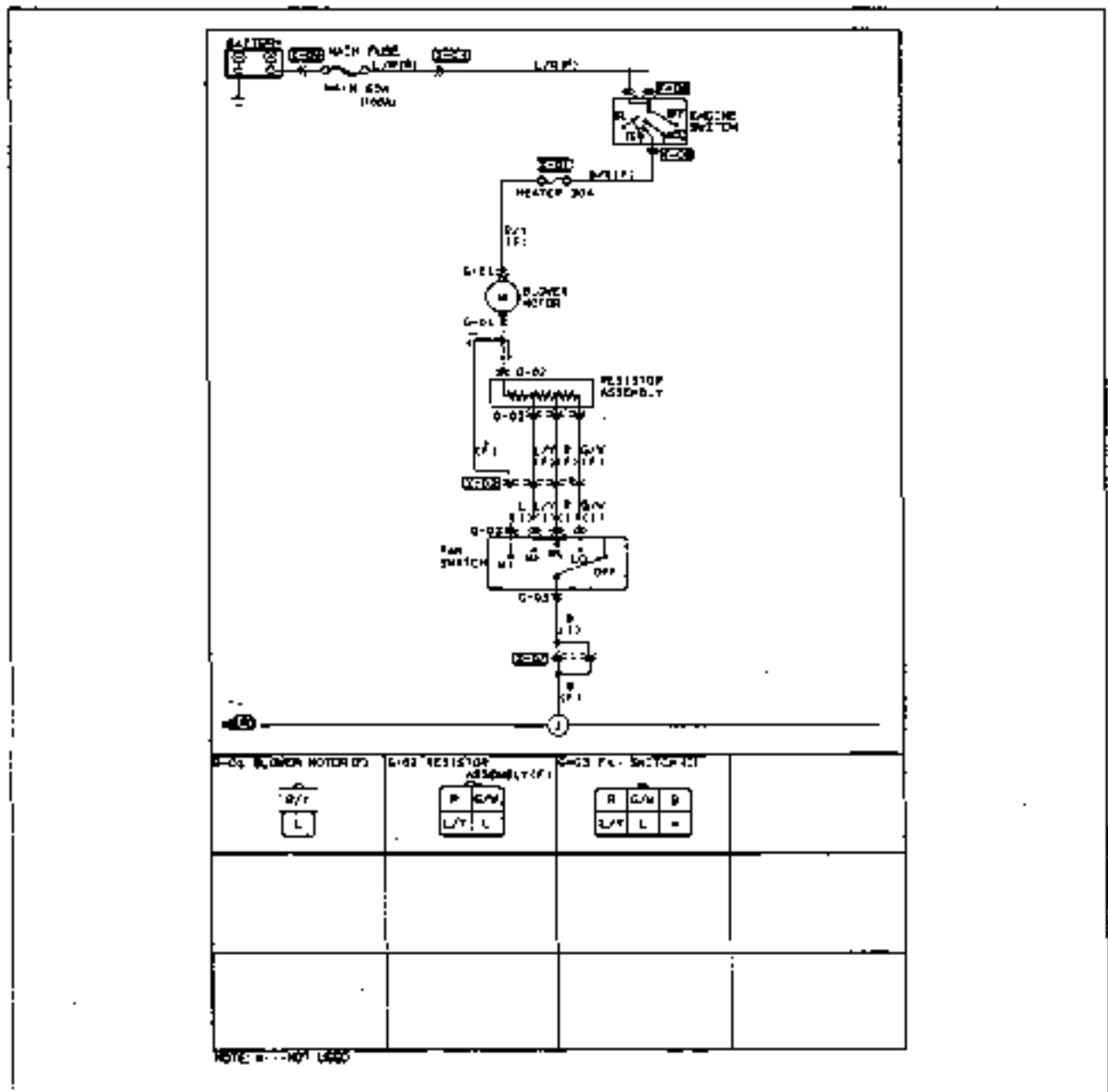
## TROUBLESHOOTING

### TROUBLESHOOTING GUIDE

System	Symptom	Reference page
Front heater	Blower motor operates if fan switch is OFF	U-4
	Blower motor does not operate if fan switch is "1" position	U-4
	Blower motor does not operate if fan switch is "2" position	U-4
	Blower motor does not operate if fan switch is "3" position	U-5
	Blower motor does not operate if fan switch is "4" position	U-5
	Blower motor does not operate	U-5
	Mode control does not operate	U-6
	Air temperature does not change	U-6

STG01X-001

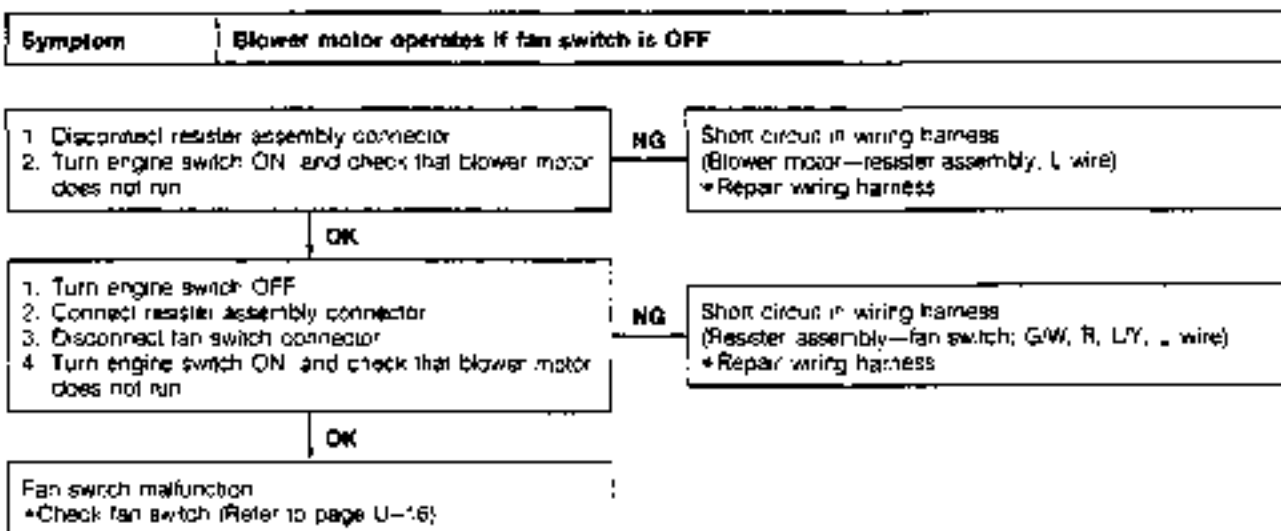
### WIRING DIAGRAM



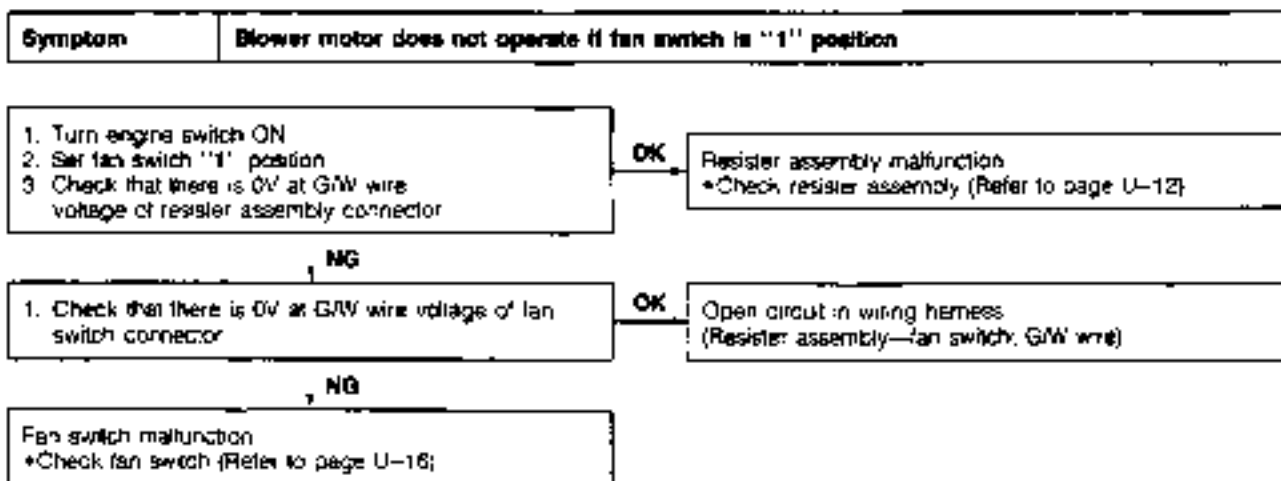
STG01X-001

# U

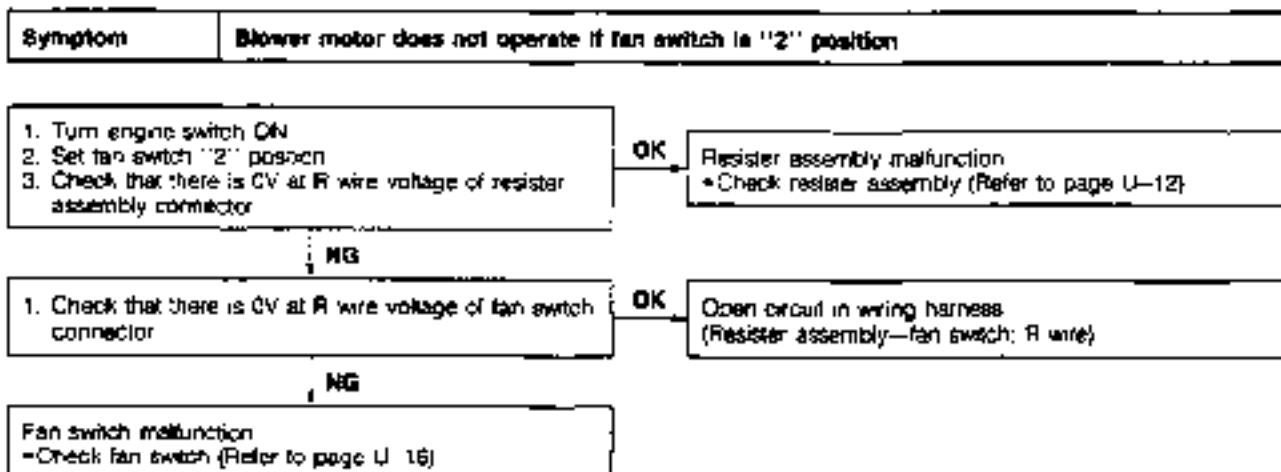
## TROUBLESHOOTING



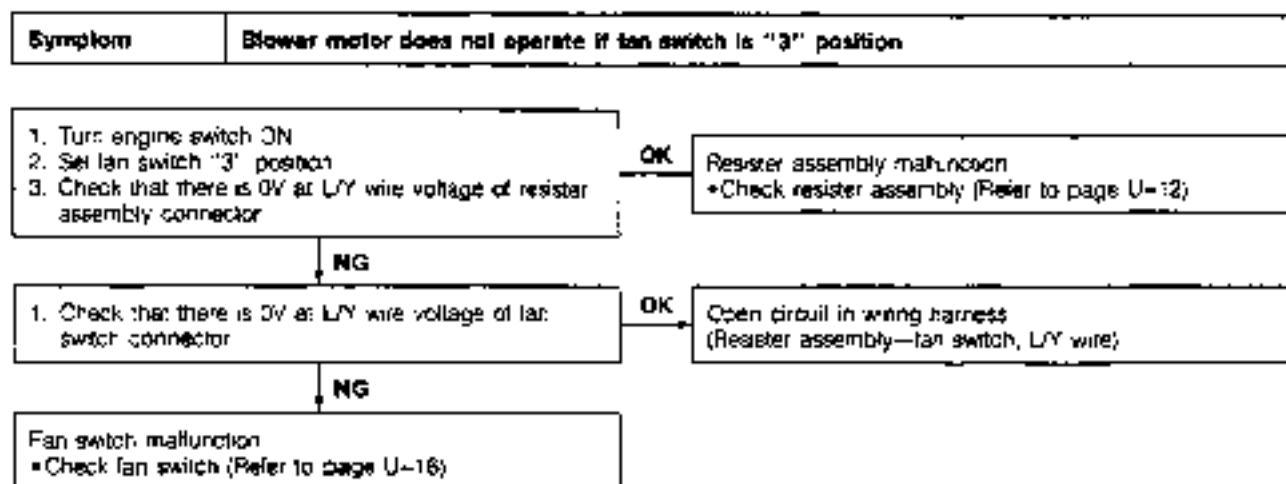
9T90UX-005



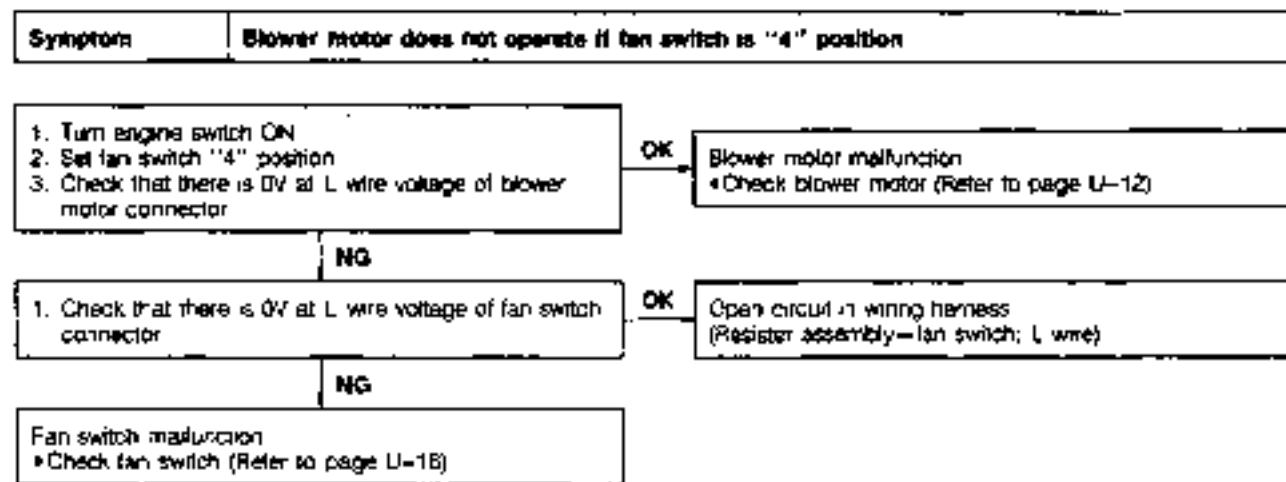
9T90UX-006



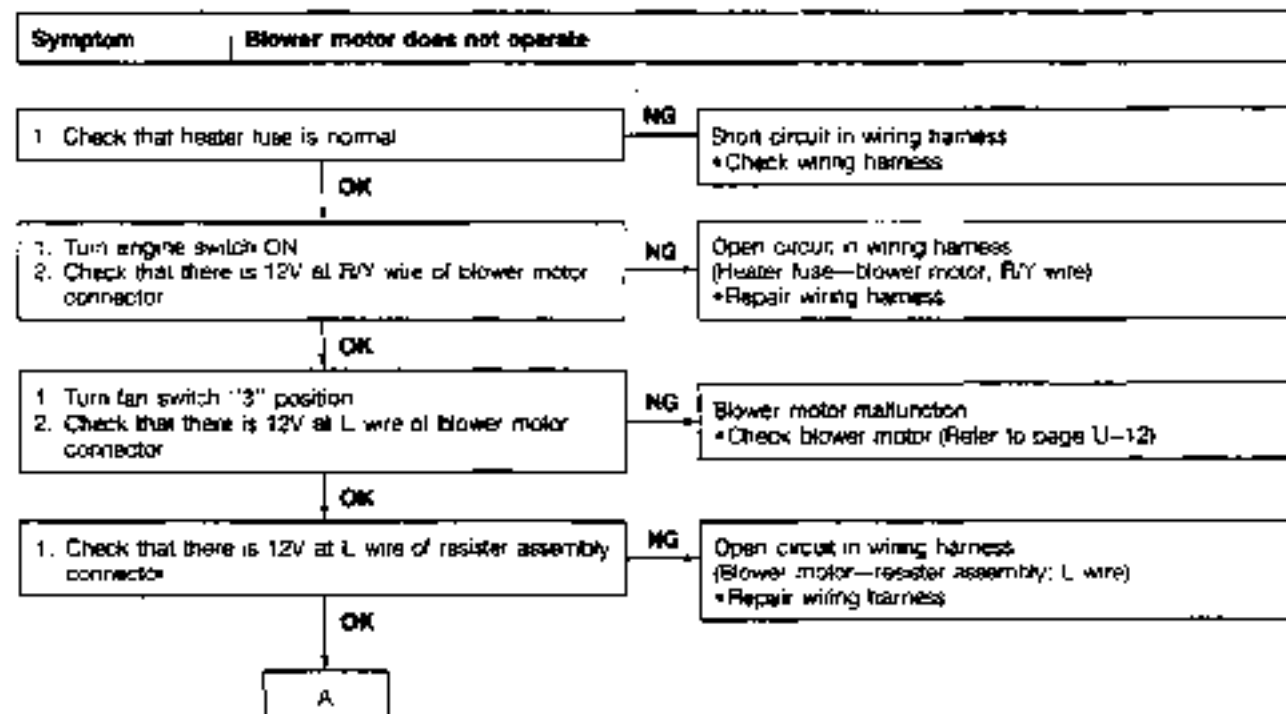
9T90UX-007

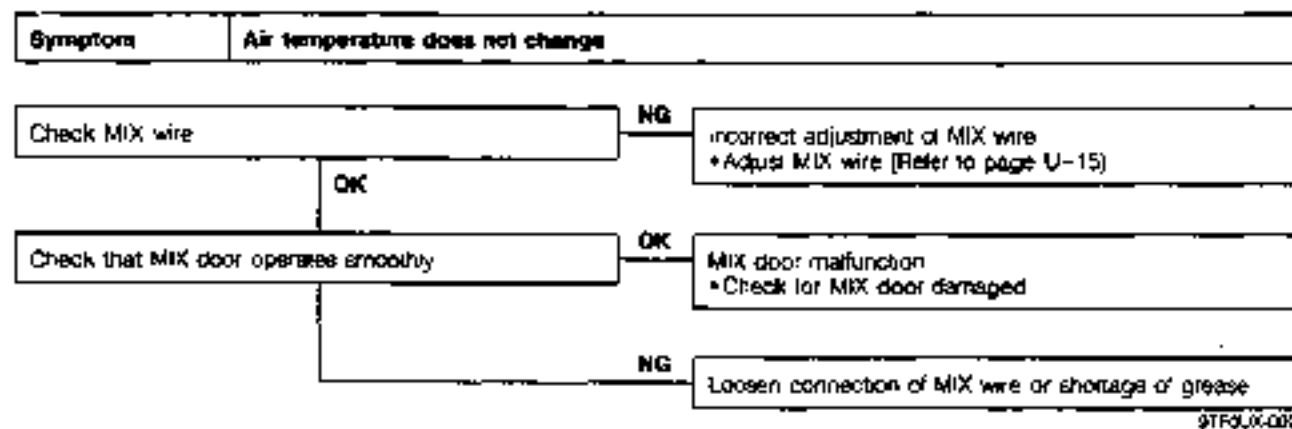
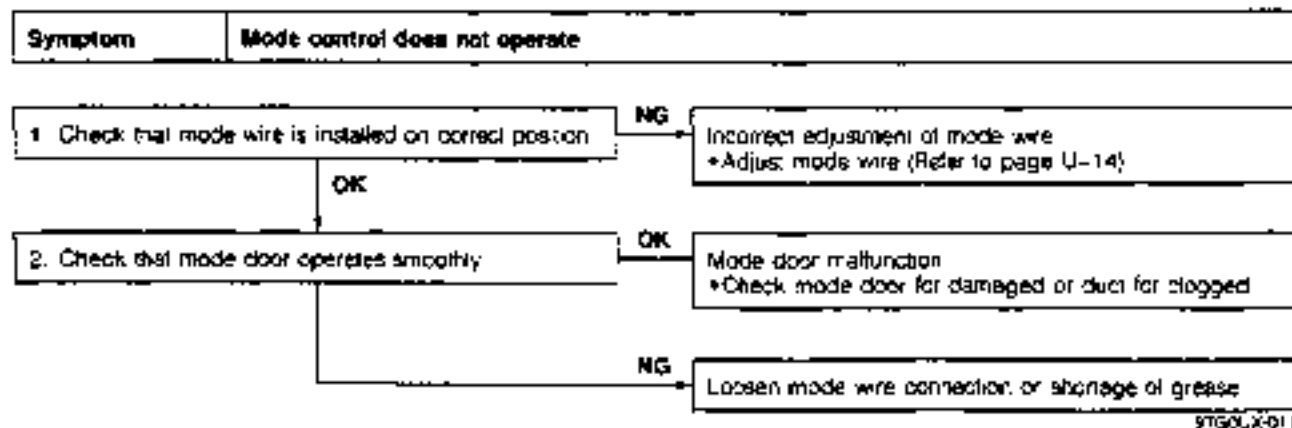
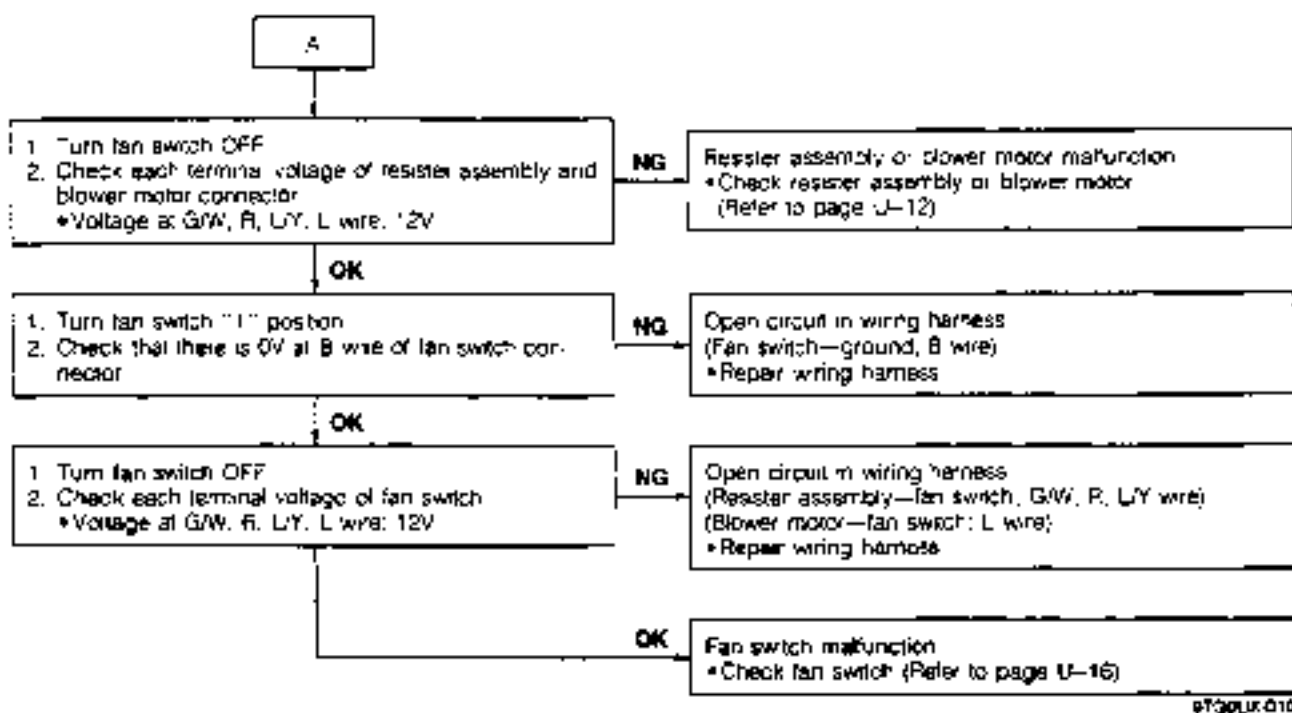


9T60UX-008



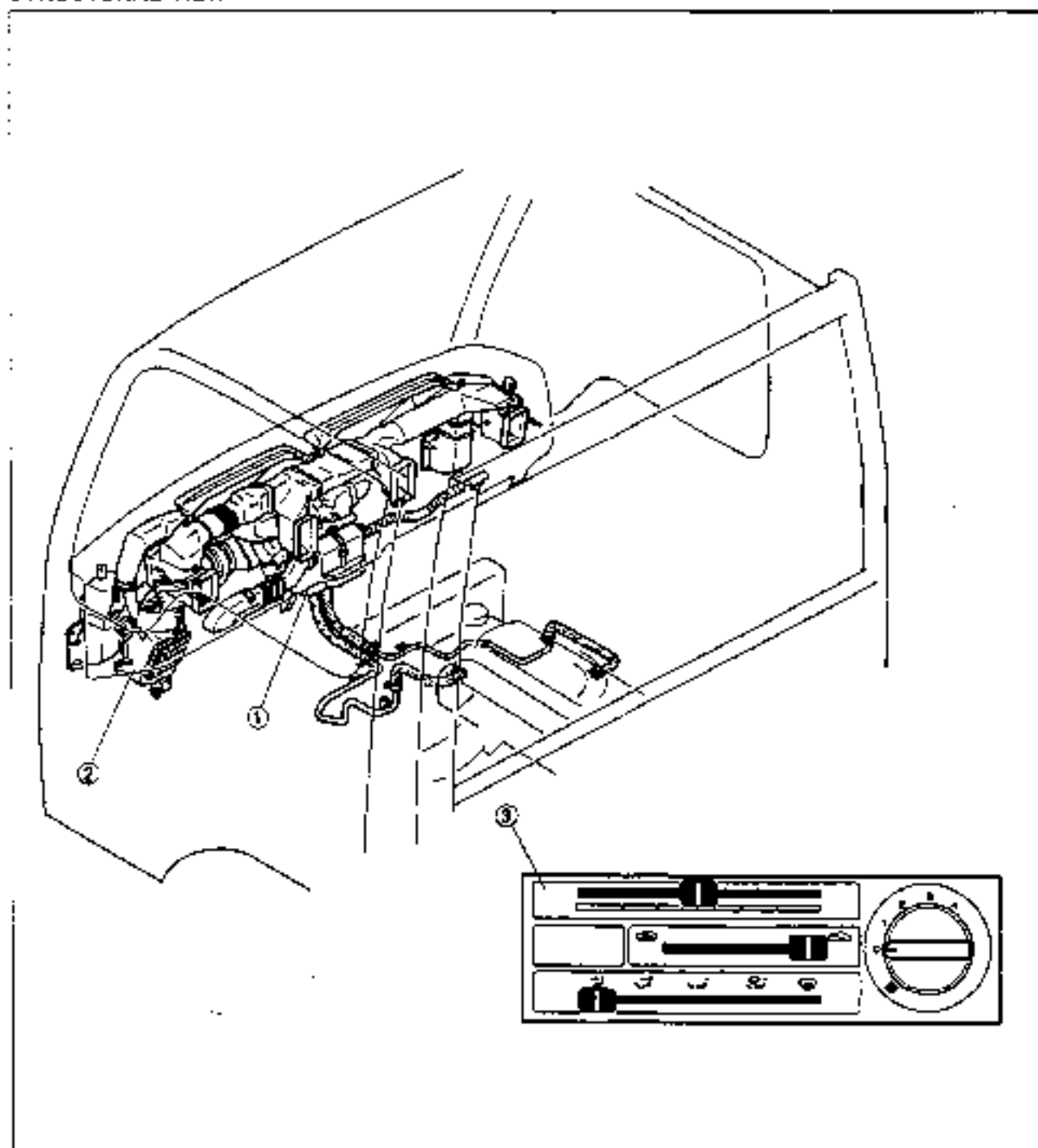
8T60UX-009





## FRONT HEATER

## STRUCTURAL VIEW



970001-013

- |                             |           |                             |           |
|-----------------------------|-----------|-----------------------------|-----------|
| 1. Front heater unit        |           | 3. Heater control unit      |           |
| Removal / Installation..... | page U- 8 | Removal / Installation..... | page U-13 |
| Disassembly / Assembly..... | page U- 9 | Disassembly / Assembly..... | page U-16 |
| Inspection.....             | page U- 9 | Inspection.....             | page U-16 |
| 2. Front blower unit        |           |                             |           |
| Removal / Installation..... | page U-10 |                             |           |
| Disassembly / Assembly..... | page U-12 |                             |           |
| Inspection.....             | page U-12 |                             |           |

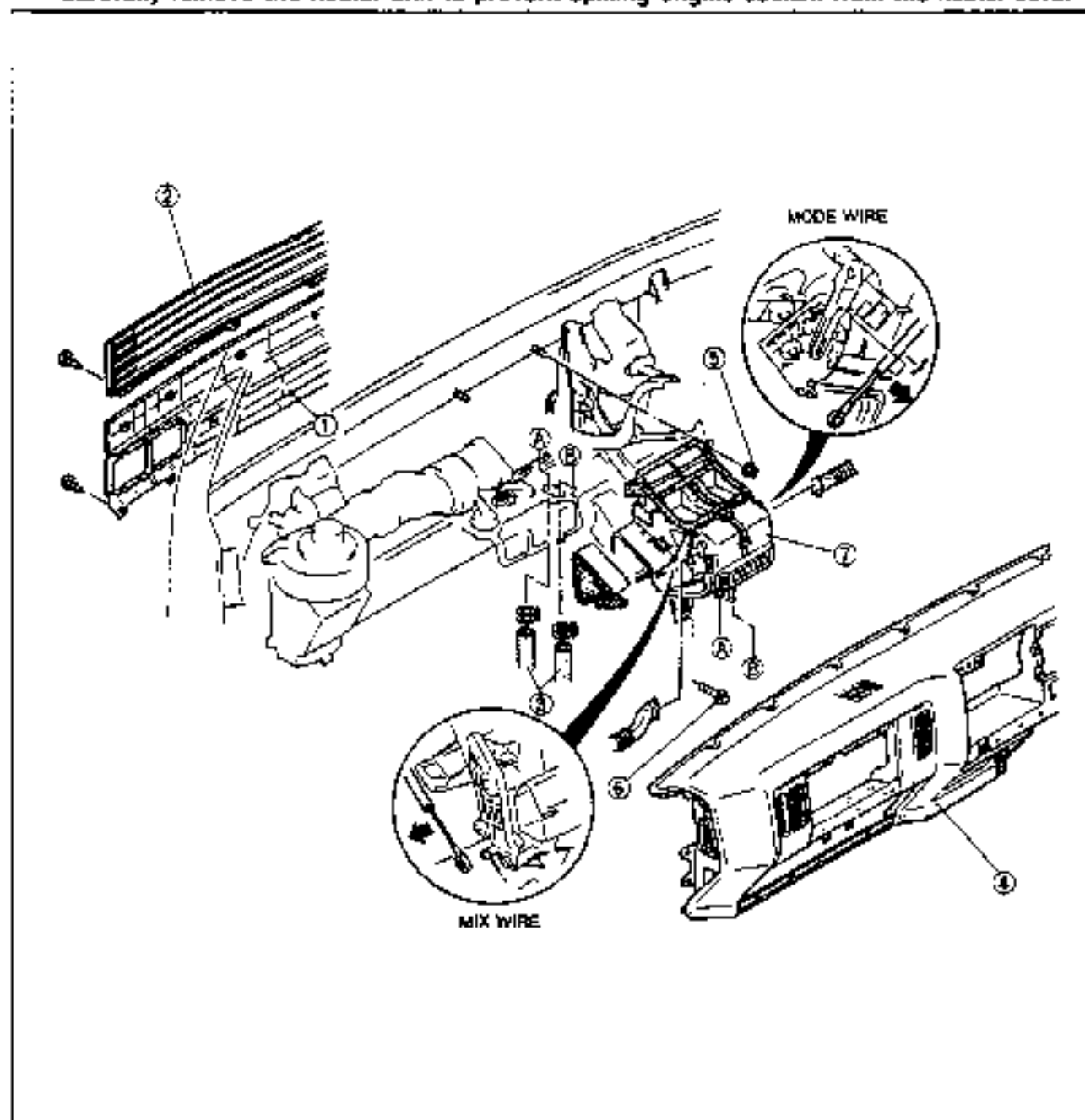
## FRONT HEATER UNIT

## Removal / Installation

1. Disconnect the negative battery cable.
2. Drain the engine coolant.
3. Remove in the order shown in the figure.
4. Install in the reverse order of removal.

## Caution

- Carefully remove the heater unit to prevent spilling engine coolant from the heater core.



2700U-01-4

1. Radiator grille
2. Front grille
3. Water hose
4. Instrument panel

Service..... Section S

5. Nuts
6. Bolts
7. Front heater unit

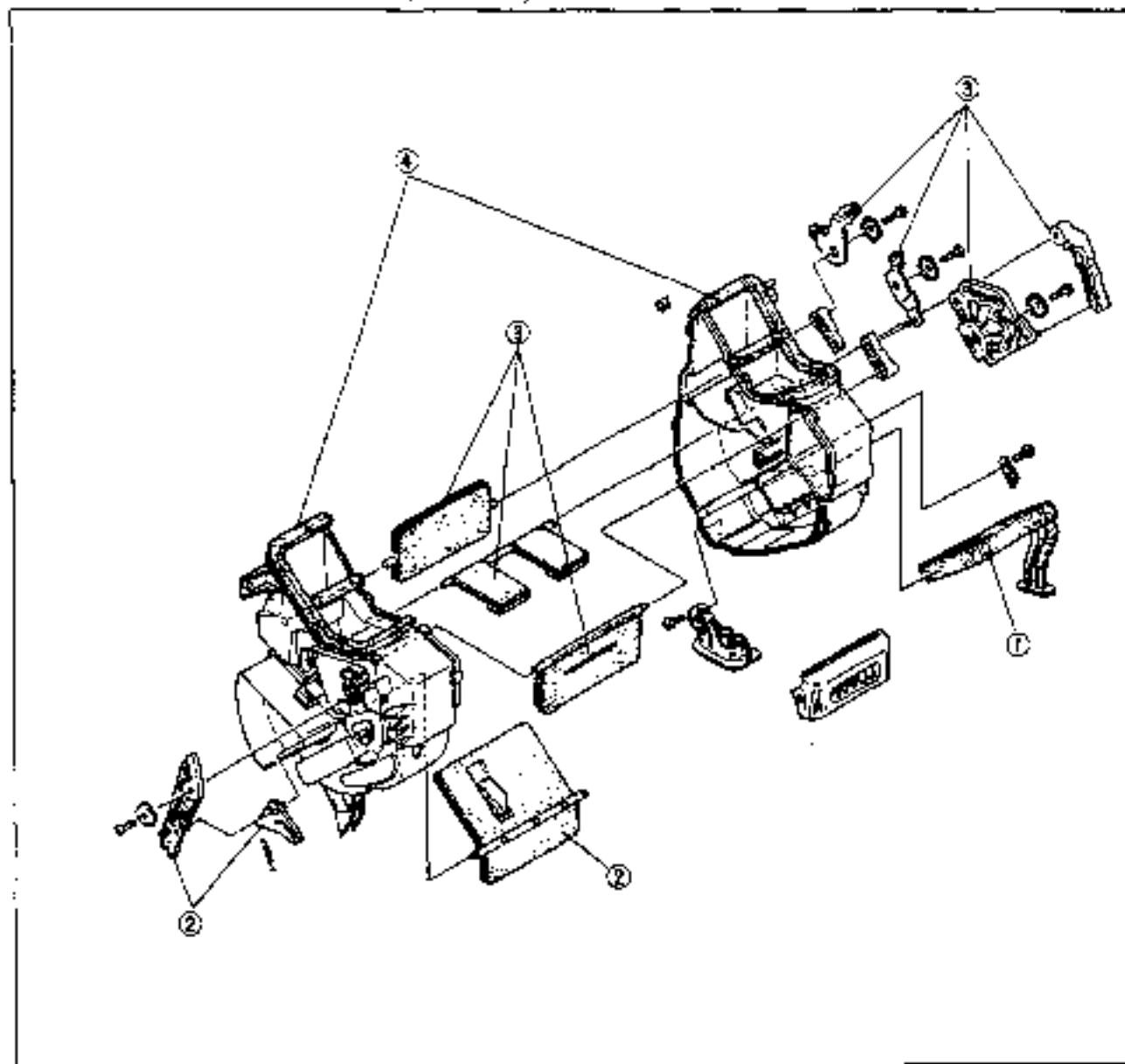
Disassembly / Assembly..... page U- 9

Inspector..... page U- 9



**Disassembly / Assembly**

1. Disassemble in the order shown in the figure.
2. Assemble in the reverse order of disassembly.



9T62L07-016

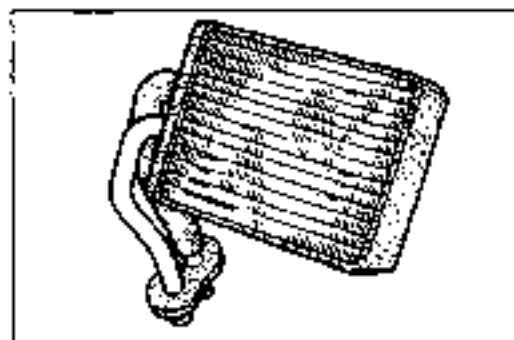
1. Heater core

Inspection ..... page U- 9

2. MIX door assembly

3. MODE door assembly

4. Heater unit case



9T62L07-016

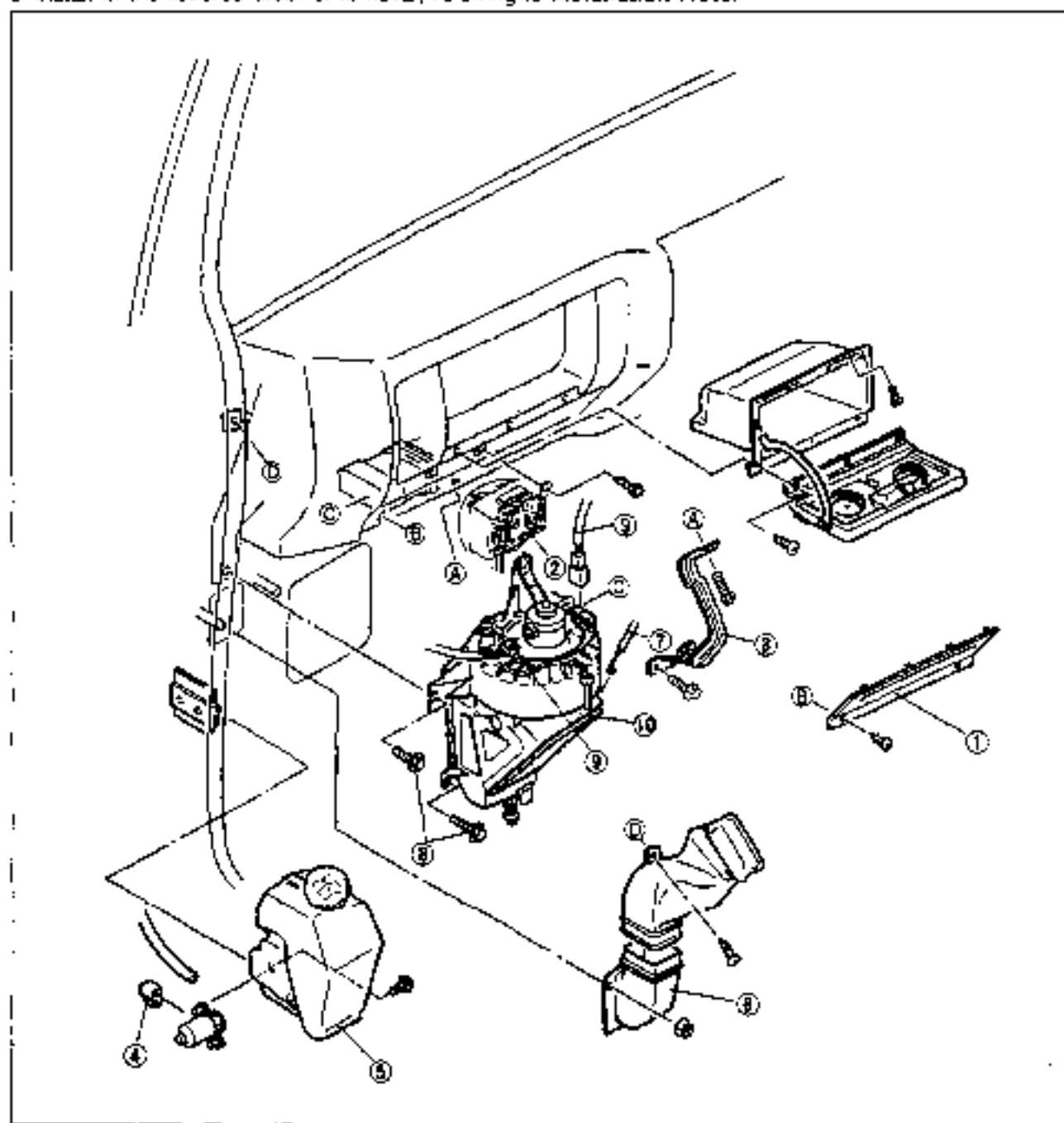
**Inspection****Heater core**

1. Check the heater core fins for blockage.
2. If the fins are clogged, clean them.
3. Check the fittings for cracks or damage.
4. Replace the heater core if necessary.

## FRONT BLOWER UNIT

## Remove / Installation

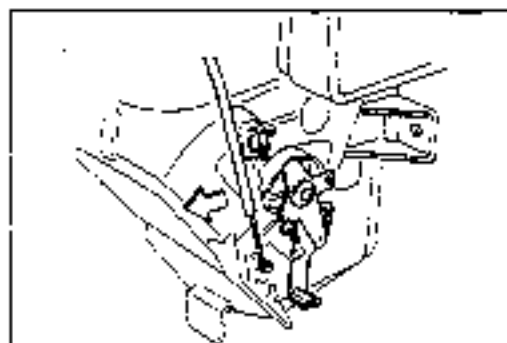
1. Disconnect the negative battery cable.
2. Remove in the order shown in the figure, referring to **Removal Note**.
3. Install in the reverse order of removal, referring to **Installation Note**.



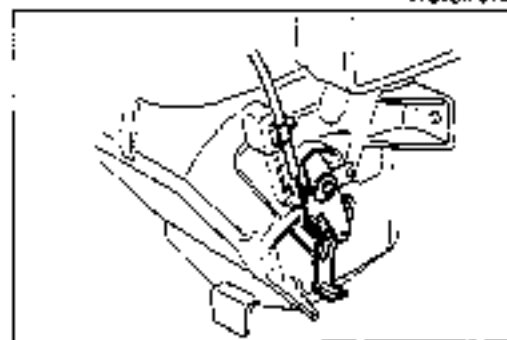
9TQ0100-017

1. Lower panel
2. Fuse box
3. Bracket
4. Washer motor connector
5. Washer tank
6. Natural duct

7. REC-FRESH wire  
Removal Note ..... page U-11  
Installation Note ..... page U-11
8. Bolts
9. Connector
10. Front blower unit  
Disassembly / Assembly ..... page U-12  
Inspection..... page U-12

**Removal note  
REC-FRESH wire**

1. Disconnect the REC-FRESH wire from the door link.

**Installation note  
REC-FRESH wire**

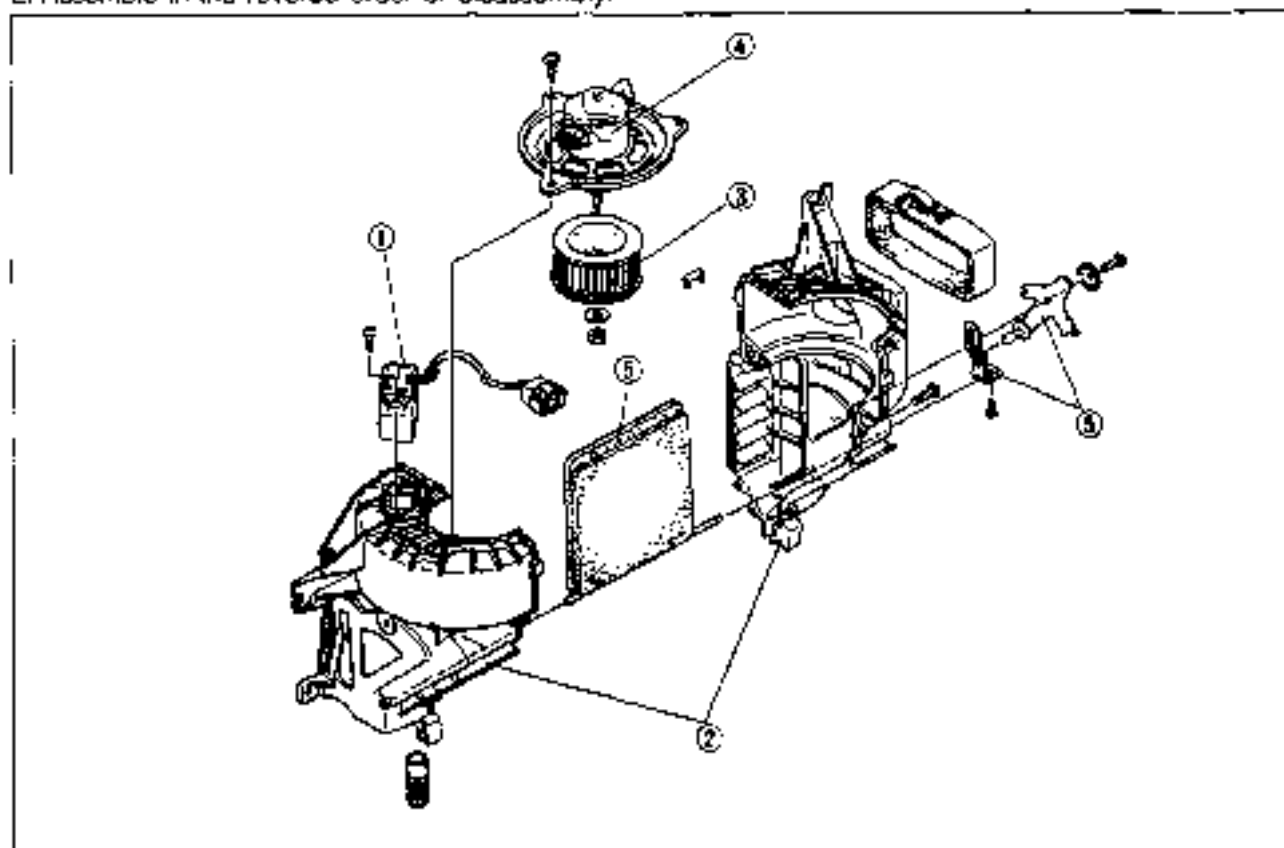
1. Set the REC-FRESH lever to REC position.
2. Set the REC-FRESH door link to REC position as shown in the figure, and connect the wire.
3. Clamp the wire.

**Caution**

- After installation, move the REC-FRESH lever to be sure the wire is securely attached, and that it moves the full stroke from REC to FRESH.

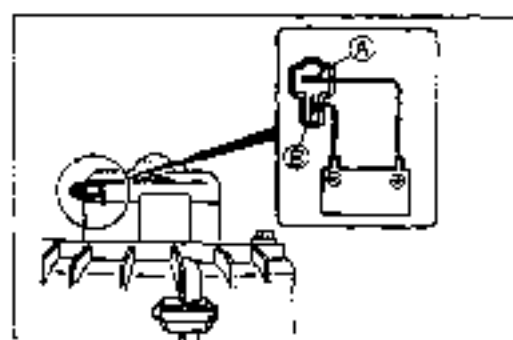
**Disassembly / Assembly**

1. Disassemble in the order shown in the figure.
2. Assemble in the reverse order of disassembly.



9T60J1-020

- |  |   |                            |
|--|---|----------------------------|
| 1. Resistor assembly<br>Inspection ..... page U-12 | 3. Blower fan                                 | 5. REC-FRESH door assembly |
| 2. Blower unit case                                | 4. Blower motor<br>Inspection ..... page U-12 |                            |

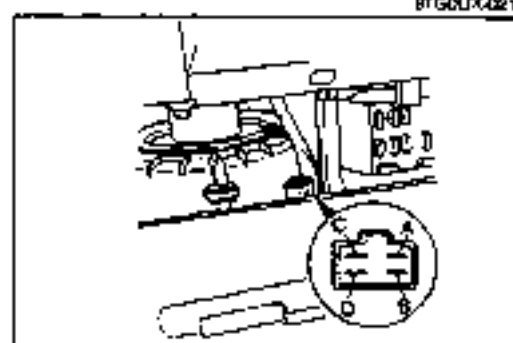


9T60L1-021

**Inspection****Blower motor**

1. Remove the glove box.
2. Disconnect the blower motor connector.
3. Apply 12V to A terminal and ground B terminal. Check that the motor operates.

Terminal	Apply voltage	Motor condition
A	12V	Operate
B	Ground	



9T60L1-022

**Resistor assembly**

1. Remove the glove box.
2. Disconnect the resistor assembly connector.
3. Check for continuity between terminals.

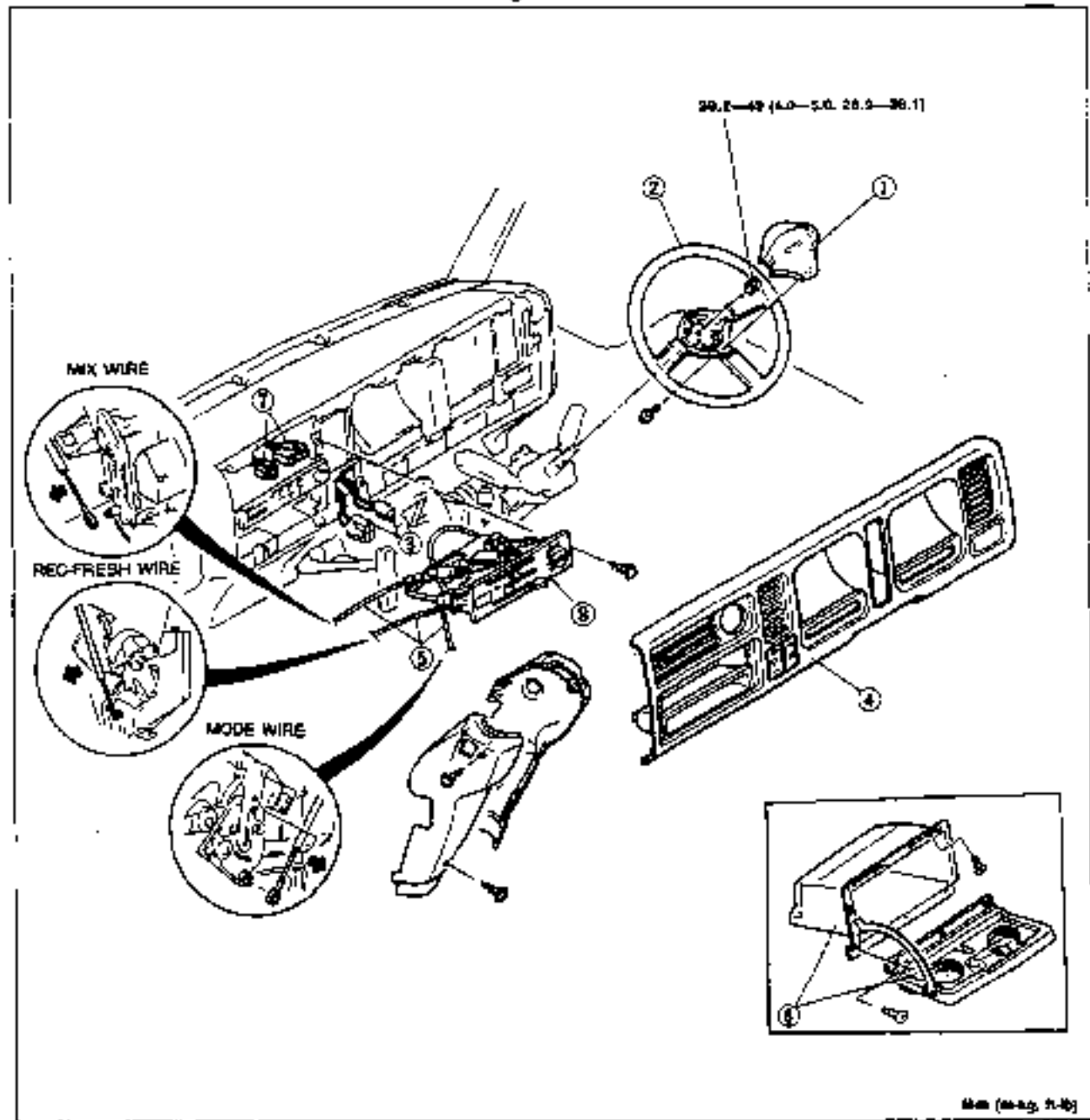
A	B	C	D
○	○		
○		○	
○			○

○—○: Indicates continuity

4. If not as specified, replace the resistor assembly.

**HEATER CONTROL UNIT****Removal / Installation**

- 1 Disconnect the negative battery cable
- 2 Remove in the order shown in the figure referring to **Removal Note**.
- 3 Install in the reverse order of removal referring to **Installation Note**.



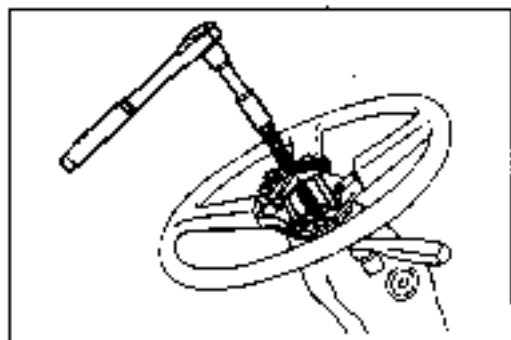
444 (8-89, 9-89)

9730U-023

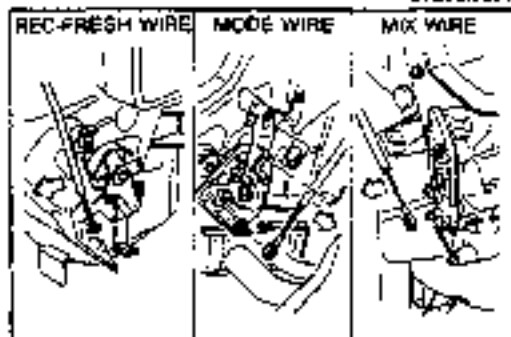
- |  |           |
|--|-----------|
| 1. Steering column                     |           |
| 2. Steering wheel                      |           |
| Removal Note .....                     | page U-14 |
| Installation Note.....                 | page U-15 |
| 3. Connector                           |           |
| 4. Meter panel                         |           |
| 5. Heater control wire                 |           |
| Removal Note .....                     | page U-14 |
| Installation Note.....                 | page U-14 |
| 6. Groove box                          |           |
| 7. Connector (for heater control unit) |           |
| 8. Heater control unit                 |           |
| Disassembly / Assembly.....            | page U-18 |
| Inspection.....                        | page U-16 |

# U

## FRONT HEATER



9T02LX-024



9T30LX-025

### Removal note Steering wheel

1. Remove the steering wheel with a steering wheel puller.

### Heater control wire

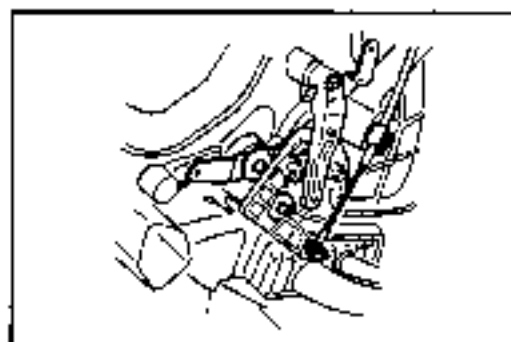
1. Disconnect the REC-FRESH wire from the blower unit door link.
2. Disconnect the MODE wire and MIX wire from the heater unit door links.

### Installation note Heater control wire

#### Caution

- Connect the heater control wires to the correct position.
- Do not bend and twist the wires when installing.
- After installation, move the lever to be sure that the wire is securely attached.

9T00LX-026



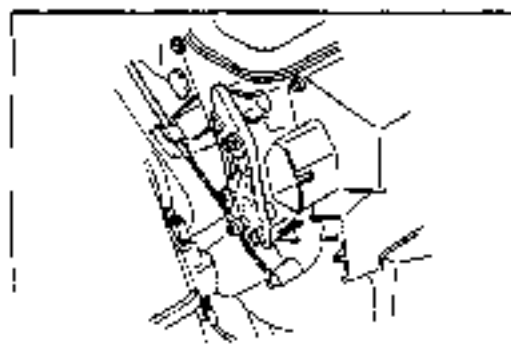
9T60LX-027

### MODE wire Adjustment

1. Set the MODE lever to DEF position
2. Set the MODE door link to DEF position as shown in the figure, and connect the wire.
3. Clamp the wire.

#### Caution

- After installation, move the MODE lever to be sure that it moves the full stroke from DEF to VENT.



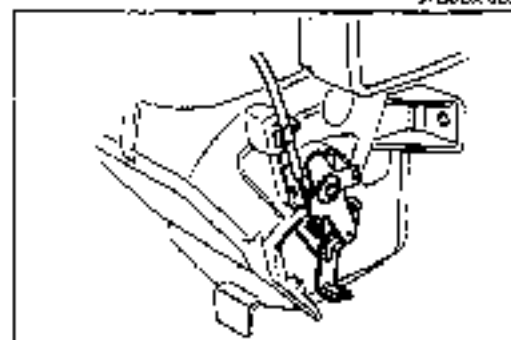
9T50LX-026

**MIX wire****Adjustment**

1. Set the MIX lever to MAX-HOT position.
2. Set the MIX door link to MAX-HOT position as shown in the figure, and connect the wire
3. Clamp the wire.

**Caution**

- After installation, move the MIX lever to be sure that it moves the full stroke from HOT to COLD.



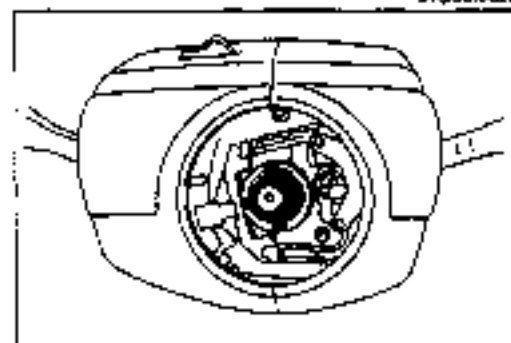
9T50LX-026

**REC-FRESH wire****Adjustment**

1. Set the REC-FRESH lever to REC position.
2. Set the REC-FRESH door link to REC position as shown in the figure, and connect the wire
3. Clamp the wire.

**Caution**

- After installation, move the REC-FRESH lever to be sure that it moves the full stroke from REC to FRESH.



9T50LX-030

**Steering wheel**

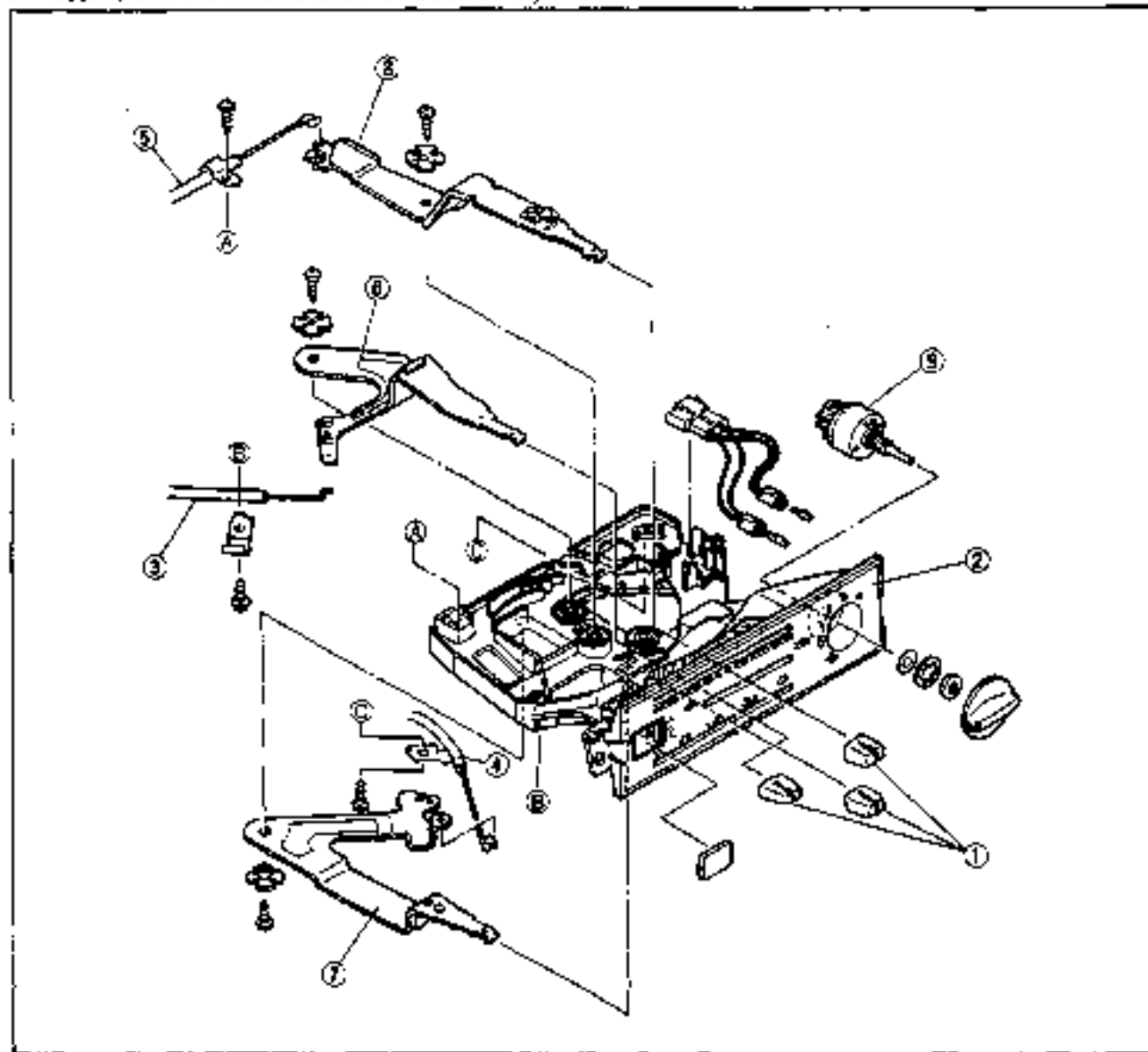
1. Set the cancel cam as shown in the figure.

# U

## FRONT HEATER

### Disassembly / Assembly

1. Disassemble in the order shown in the figure.
2. Assemble in the reverse order of disassembly.



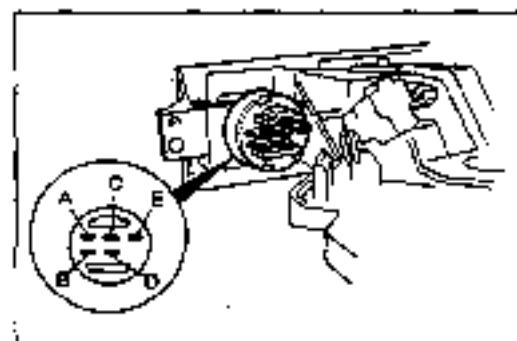
9TGDJX-031

1. Knob
2. Switch body
3. REC-FRESH wire
4. MODE wire

5. MIX wire
6. REC-FRESH lever
7. MODE lever

8. MIX lever
9. Fan switch

Inspection ..... page U-16



9TGDJX-032

### Inspection

#### Fan switch

1. Check for continuity between the terminals.

Switch position	A	B	C	D	E
OFF					
1			○		○
2	○				○
3		○			○
4				○	○

○—○ Indicates continuity



## TECHNICAL DATA

A. MEASUREMENTS.....	TD- 2
B. ENGINE.....	TD- 3
D. LUBRICATION SYSTEM.....	TD- 8
E. COOLING SYSTEM.....	TD- 9
F. FUEL AND EMISSION CONTROL SYSTEM (HA, SL, SL TURBOCHARGED, TF ENGINES) .....	TD-10
G. ENGINE ELECTRICAL SYSTEM (HA, SL, SL TURBOCHARGED, TF ENGINES) .....	TD-10
H. CLUTCH.....	TD-11
J. TRANSMISSION .....	TD-12
L. PROPELLER SHAFT .....	TD-13
M. FRONT AND REAR AXLES.....	TD-13
N. STEERING .....	TD-14
P. BRAKING SYSTEM.....	TD-15
Q. WHEELS AND TIRES.....	TD-16
R. SUSPENSION .....	TD-17
S. BODY .....	TD-19
T. BODY ELECTRICAL SYSTEM .....	TD-19

9TFTDX-001

## A. MEASUREMENTS

## General Models (RHD)

Item		Specifications					
Engine		FA	SL	SL TURBO	SL		
Body		Truck			Crew cab		
Cabin		Standard	Wide				
Cargo deck length (feet)		10	14	17	14		
Cargo deck height/ Rear tire		High/Single	High/Double				
Payload (ton)		1.5	2.0	3.0	4.0	2.75	
Overall length	mm (in)	4,740 (155.61)	4,800 (157.48)	6,010 (197.16)	6,915 (226.84)	6,010 (197.16)	
Overall width	mm (in)	1,990 (78.35)	2,015 (79.33)	2,015 (79.33)	2,200 (86.61)	2,015 (79.33)	
Overall height	mm (in)	1,990 (78.35)	2,155 (84.84)	2,180 (85.82)	2,195 (86.42)	2,155 (84.84)	
Wheelbase	mm (in)	2,505 (98.62)	2,510 (98.81)	3,335 (131.30)	3,940 (155.12)	3,335 (131.30)	
Track	Front	mm (in)	1,410 (55.51)	1,650 (64.96)	1,650 (64.96)	1,655 (65.16)	1,650 (64.96)
	Rear	mm (in)	1,405 (55.31)	1,470 (57.87)	1,470 (57.87)	1,495 (58.86)	1,495 (58.86)

## Australia Models

Item		Specifications						
Engine		SL		TF	SL TURBO		TF	
Body		Truck	Crew cab	Truck			Crew cab	
Cabin		Wide						
Cargo deck length (feet)		10	14		17	14	17	14
Cargo deck height/ Rear tire		High/Double						
Payload (ton)		2.0	3.0	2.75	4.0		3.5	
Overall length	mm (in)	4,860 (160.48)	5,890 (193.89)	5,890 (193.89)	5,890 (193.89)	6,790 (222.75)	5,890 (193.89)	5,890 (193.89)
Overall width	mm (in)	1,990 (78.35)	1,990 (78.35)	2,015 (79.33)	1,990 (78.35)	1,990 (78.35)	1,990 (78.35)	1,990 (78.35)
Overall height	mm (in)	2,095 (82.48)	2,225 (87.60)	2,205 (86.81)	2,255 (88.74)	2,255 (88.74)	2,255 (88.74)	2,255 (88.74)
Wheelbase	mm (in)	2,510 (98.82)	3,335 (131.30)	3,335 (131.30)	3,335 (131.30)	3,490 (137.40)	3,335 (131.30)	3,335 (131.30)
Track	Front	mm (in)	1,650 (64.96)	1,650 (64.96)	1,650 (64.96)	1,655 (65.16)	1,655 (65.16)	1,655 (65.16)
	Rear	mm (in)	1,470 (57.87)	1,470 (57.87)	1,470 (57.87)	1,495 (58.86)	1,495 (58.86)	1,495 (58.86)

B. ENGINE

Item	Engine		HA	SL		TF
				Non-Turbo	Turbo	
Type	Diesel, 4-cycle					
Cylinder arrangement and number	In-line, 4-cylinders					
Type of combustion chamber	Pre-combustion chamber		Piston head			
Valve system	OHV, gear-driven					
Bore x stroke	mm (in)		95.0 x 105.0 (3.74 x 4.13)	100.0 x 110.0 (3.94 x 4.33)		105.5 x 115.0 (4.15 x 4.53)
Total piston displacement	cc (cu in)		2,977 (181.60)	3,455 (210.75)		4,021 (245.28)
Compression ratio			21.0 : 1	18.0 : 1	17.0 : 1	18.0 : 1
Compression pressure kPa (kg/cm <sup>2</sup> , psi)-rpm	Standard		2,943 (30.0, 427)—200	2,943 (30.0, 427)—300	2,551 (26.0, 370)—320	2,943 (30.0, 427)—270
	Minimum		2,649 (27.0, 384)—200	2,649 (27.0, 384)—300	2,256 (23.0, 327)—320	2,649 (27.0, 384)—270
	Variation between cylinders		294 (3.0, 43) max.			
Valve timing	IN	Open BTDC	17°	19°		18°
		Close ABDC	47°	47°		45°
	EX	Open BBDC	51°	52°		49°
		Close ATDC	13°	14°		17°
Valve clearance (Engine cold)	mm (in)	IN	0.30 (0.012)			
		EX	0.30 (0.012)	0.35 (0.014)	0.40 (0.016)	
<b>Cylinder head</b>						
Distortion	mm (in)		0.10 (0.004) max. [Longitudinal direction 0.25 (0.010) max.] [Manifold contact surface 0.10 (0.004) max.]			
<b>Valve and valve guide</b>						
Valve head diameter	mm (in)	IN	44.9—45.4 (1.768—1.776)	45.4—45.6 (1.787—1.795)		46.9—47.1 (1.846—1.854)
		EX	37.4—37.6 (1.472—1.480)	38.2—38.4 (1.504—1.512)		40.9—41.1 (1.610—1.618)
Valve head margin thickness	mm (in)	IN	1.0 (0.039) min.			
		EX	1.0 (0.039) min.	1.2 (0.047) min.	1.5 (0.059) min.	
Valve face angle			IN 45°			
			EX 30°			
Valve length	mm (in)	IN	Standard	114.6 (4.512)		119.7 (4.713)
			Minimum	114.1 (4.492)		119.2 (4.693)
	EX	Standard	114.6 (4.512)	114.5 (4.508)		119.3 (4.697)
		Minimum	114.1 (4.492)	114.0 (4.488)		118.8 (4.677)
Valve stem diameter	mm (in)	IN	8.955—8.980 (0.3526—0.3535)	8.965—8.980 (0.3530—0.3535)		
		EX	8.935—8.960 (0.3518—0.3523)	8.945—8.960 (0.3522—0.3528)		
Guide inner diameter	mm (in)	IN	9.018—9.033 (0.3550—0.3556)			
		EX	9.018—9.033 (0.3550—0.3556)			
Valve stem-to-guide clearance	mm (in)	IN	0.038—0.078 (0.0015—0.0031)	0.038—0.068 (0.0015—0.0027)		
		EX	0.058—0.098 (0.0023—0.0039)	0.058—0.068 (0.0023—0.0035)		
		Maximum	0.127 (0.0050)			
Guide projection (Height "A")	mm (in)	IN	15.2—15.4 (0.598—0.608)			14.2—14.4 (0.559—0.567)
		EX	15.2—15.4 (0.598—0.608)			14.2—14.4 (0.559—0.567)
<b>Valve seat</b>						
Seat angle			IN 45°			
			EX 30°			

Item	Engine				SA		TF	
	mm (in)	IN	HA	SL				
				Non-Turbo	Turbo			
Seal contact width		IN	2.0 (0.079)	1.7 (0.067)				
		EX	2.0 (0.079)	1.7 (0.067)				
Seat sinking (measure valve protruding length) mm (in)	IN	Standard		48.05 (1.892)	48.40 (1.906)			
		Maximum		49.55 (1.951)	49.90 (1.965)			
	EX	Standard	48.05 (1.892)	47.95 (1.888)	48.40 (1.906)			
		Maximum	49.55 (1.951)	49.45 (1.947)	49.90 (1.965)			
<b>Valve spring</b>								
Free length mm (in)	IN	Outer	Standard	55.7 (2.193)	53.1 (2.091)		58.5 (2.343)	
			Minimum	54.7 (2.154)	52.1 (2.051)		58.5 (2.303)	
		Inner	Standard	44.1 (1.736)	46.6 (1.835)		51.4 (2.024)	
			Minimum	43.1 (1.697)	45.6 (1.795)		50.4 (1.984)	
	EX	Outer	Standard	55.7 (2.193)	53.1 (2.091)	56.7 (2.230)	58.5 (2.343)	
			Minimum	54.7 (2.154)	52.1 (2.051)	55.7 (2.189)	58.5 (2.303)	
		Inner	Standard	44.1 (1.736)	46.6 (1.835)	49.4 (1.945)	51.4 (2.024)	
			Minimum	43.1 (1.697)	45.6 (1.795)	48.4 (1.906)	50.4 (1.984)	
Out-of-square mm (in)	IN	Outer	1.37 (0.0539) max.	1.65 (0.0728) max.		2.07 (0.0815) max.		
		Inner	1.25 (0.0492) max.	1.63 (0.0642) max.		1.79 (0.0705) max.		
	EX	Outer	1.37 (0.0539) max.	1.85 (0.0728) max.	1.96 (0.0772) max.	2.07 (0.0815) max.		
		Inner	1.25 (0.0492) max.	1.63 (0.0642) max.	1.72 (0.0677) max.	1.79 (0.0705) max.		
Setting load/height N (kg, lb)/mm (in)	IN	Outer	318—336 (32.4—34.2 71.3—75.2) 40.3 (1.59)		236—262 (24.1—26.7, 53.0—58.7)/40.3 (1.59)		303—342 (30.9—34.9 68.0—76.8) 41.9 (1.65)	
			Inner	119—133 (12.1—13.3, 26.6—29.3) 37.8 (1.49)		149—165 (15.2—16.8, 33.4—37.0)/37.8 (1.49)		191—216 (19.5—22.0, 42.9—48.4) 39.4 (1.55)
		EX		Outer	318—336 (32.4—34.2, 71.3—75.2) 40.3 (1.59)		236—262 (24.1—26.7, 53.0—58.7) 40.3 (1.59)	228—291 (23.2—25.6, 51.0—56.3) 40.3 (1.59)
			Inner		119—133 (12.1—13.3, 26.6—29.3) 37.8 (1.49)		149—165 (15.2—16.8, 33.4—37.0) 37.8 (1.49)	159—175 (16.2—17.5, 35.6—39.2) 37.8 (1.49)
	<b>Camshaft</b>							
	Camlobe height mm (in)	IN	Standard	42.590 (1.6764)	44.116 (1.7368)		48.415 (1.9061)	
			Minimum	42.080 (1.6567)	43.616 (1.7172)		47.915 (1.8864)	
		EX	Standard	42.590 (1.6764)	44.116 (1.7368)		48.547 (1.9113)	
Minimum			42.080 (1.6567)	43.616 (1.7172)		48.047 (1.8916)		
Journal diameter mm (in)	No.1	51.810—51.940 (2.0437—2.0449)		58.410—58.440 (2.2996—2.3008)				
	No.2	51.660—51.690 (2.0339—2.0350)		58.160—58.190 (2.2896—2.2909)				
	No.3	51.410—51.440 (2.0240—2.0252)		57.910—57.940 (2.2799—2.2811)				
	No.4	51.160—51.190 (2.0142—2.0154)		57.660—57.690 (2.2701—2.2713)				
Cylinder block camshaft bore diameter mm (in)	No.1	52.000—52.030 (2.0472—2.0484)		58.500—58.530 (2.3031—2.3043)				
	No.2	51.750—51.780 (2.0374—2.0386)		58.250—58.280 (2.2933—2.2945)				
	No.3	51.500—51.530 (2.0276—2.0287)		58.000—58.030 (2.2835—2.2846)				
	No.4	51.250—51.280 (2.0177—2.0189)		57.750—57.780 (2.2736—2.2748)				

# TECHNICAL DATA

# TD

Item		Engine	HA	SL		TF
				Non-Turbo	Turbo	
Camshaft bearing oil clearance	mm (in)	Standard	0.06—0.12 (0.0024—0.0047)			
		Maximum	0.145 (0.0057)			
Camshaft runout	mm (in)	0.08 (0.0031) max.				
Camshaft end play	mm (in)	Standard	0.02—0.18 (0.0008—0.0071)			
		Maximum	0.30 (0.012)			
<b>Rocker arm and rocker arm shaft</b>						
Rocker arm inner diameter	mm (in)	15.876—15.896 (0.6250—0.6258)	19.000—19.021 (0.7480—0.7489)	23.300—23.021 (0.9055—0.9063)	21.000—21.027 (0.8268—0.8276)	
Rocker arm shaft diameter	mm (in)	15.835—15.850 (0.6234—0.6244)	18.959—18.960 (0.7464—0.7472)	22.958—22.960 (0.9039—0.9047)	20.959—20.980 (0.8252—0.8260)	
Rocker arm-to-shaft clearance	mm (in)	Standard	0.016—0.061 (0.0006—0.0024)			
		Maximum	0.07 (0.003)			
<b>Tapet</b>						
Tapet outer diameter	mm (in)	14.218—14.233 (0.5598—0.5604)				15.518—15.533 (0.6109—0.6115)
Cylinder block tappet bore diameter	mm (in)	14.266—14.319 (0.5626—0.5637)				15.566—15.619 (0.6137—0.6149)
Tapet-to-cylinder block clearance	mm (in)	Standard	0.055—0.101 (0.0022—0.0040)			
		Maximum	0.15 (0.006)			
<b>Push rod</b>						
Push rod runout	mm (in)	0.40 (0.016) max.				
<b>Cylinder block</b>						
Distortion	mm (in)	0.10 (0.004) max. [Longitudinal direction 0.25 (0.010) max.]				
Cylinder inner bore diameter	mm (in)	A	98.500—98.526 (3.8779—3.8780)	103.500—103.513 (4.0748—4.0753)	109.000—109.013 (4.2913—4.2918)	
		B		103.513—103.525 (4.0753—4.0758)	109.013—109.026 (4.2918—4.2924)	
Cylinder inner outer diameter	mm (in)	A	98.530—98.580 (3.8791—3.8811)	103.474—103.487 (4.0738—4.0743)	108.974—108.987 (4.2903—4.2908)	
		B		103.487—103.500 (4.0743—4.0748)	108.987—109.000 (4.2908—4.2913)	
Cylinder block-to-cylinder inner clearance	mm (in)	-0.004—0.060 (-0.0002—0.0031)		0.013—0.039 (0.0005—0.0015)		
Liner protrusion above cylinder block	mm (in)	-0.101—0 (-0.0040—0)		0—0.09 (0—0.0035)		
Cylinder liner inner diameter	mm (in)	Y	95.025—95.060 (3.7411—3.7421)	100.013—100.026 (3.9375—3.9380)	105.516—105.533 (4.1542—4.1548)	
		Z		100.000—100.013 (3.9371—3.9375)	105.499—105.516 (4.1535—4.1542)	
Cylinder liner taper and out-of-round	mm (in)	0.03 (0.0012) max.				
<b>Piston</b>						
Piston diameter (Measured at 90° to pin bore axis at point H from the bottom of the piston)	mm (in)	Y	94.967—94.993 (3.7389—3.7399)	99.950—99.963 (3.9350—3.9355) H = 27.0 (1.063)	105.445—105.458 (4.1514—4.1519) H = 27.0 (1.063)	
		Z		99.937—99.950 (3.9345—3.9350) H = 27.0 (1.063)	105.432—105.445 (4.1509—4.1514) H = 27.0 (1.063)	
Piston-to-cylinder liner clearance	mm (in)	0.032—0.063 (0.0013—0.0033)		0.050—0.078 (0.0020—0.0030)		
Piston pin bore diameter	mm (in)	29.998—30.008 (1.1809—1.1814)		33.996—34.008 (1.3384—1.3389)		
<b>Piston ring</b>						
Thickness	mm (in)	Top	2.363—2.383 (0.0930—0.0938)	2.470—2.490 (0.0972—0.0980)		
		Second	2.363—2.383 (0.0930—0.0938)	1.970—1.990 (0.0776—0.0783)		
		Oil	4.743—4.763 (0.1867—0.1875)	4.470—4.490 (0.1760—0.1768)		

Item	Engine	HA	SL		TF		
			Non-Turbo	Turbo			
End gap measured in cylinder	mm (in)	Top	0.40—0.60 (0.016—0.024)	0.30—0.40 (0.012—0.016)	0.30—0.45 (0.012—0.018)	0.30—0.40 (0.012—0.016)	
		Second	0.40—0.60 (0.016—0.024)	0.40—0.55 (0.016—0.022)	0.30—0.50 (0.012—0.020)	0.40—0.55 (0.016—0.022)	
		Oil	0.40—0.60 (0.016—0.024)	0.20—0.40 (0.008—0.016)	0.30—0.50 (0.012—0.020)	0.20—0.40 (0.008—0.016)	
		Maximum	0.5 (0.059)				
Ring groove width in piston	mm (in)	Top	2.423—2.543 (0.0956—0.1001)	2.550—2.570 (0.1004—0.1012)		2.663—2.683 (0.1048—0.1056)	
		Second	2.423—2.443 (0.0954—0.0962)	2.030—2.050 (0.0799—0.0807)			
		Oil	4.793—4.813 (0.1887—0.1895)	4.520—4.540 (0.1780—0.1787)			
Piston ring-to-ring land clearance	mm (in)	Top	0.05—0.10 (0.0020—0.0074)	0.06—0.10 (0.0024—0.0039)	0.173—0.213 (0.0068—0.0084)		
		Second	0.04—0.08 (0.0016—0.0031)				
		Oil	0.05—0.07 (0.0012—0.0028)				
		Maximum	0.30 (0.012)				
<b>Piston pin</b>							
Diameter	mm (in)	29.994—30.000 (1.1809—1.1811)	33.893—34.000 (1.3339—1.3396)		34.983—35.000 (1.3777—1.3780)		
Connecting rod-to-piston pin clearance	mm (in)	0.012—0.039 (0.0005—0.0015)	0.012—0.040 (0.0005—0.0016)				
Piston-to-piston pin clearance	mm (in)	-0.004—0.014 (-0.0002—0.0006)	-0.004—0.015 (-0.0002—0.0006)				
<b>Connecting rod</b>							
Length (Center to center)	mm (in)	178.000—178.050 (7.0079—7.0098)			183.500—183.550 (7.2244—7.2264)		
Bending	mm (in)	0.06 (0.0020) max./100 (3.94)	0.10 (0.0039) max./100 (3.94)				
Small end bore (Bush inner diameter)	mm (in)	30.012—30.033 (1.1816—1.1824)	34.012—34.033 (1.3389—1.3396)		35.012—35.033 (1.3784—1.3792)		
Big end bore	mm (in)	64.833—64.846 (2.5525—2.5530)			68.100—68.113 (2.6811—2.6816)		
Big end width	mm (in)	34.521—34.621 (1.3591—1.3830)			37.000—37.100 (1.4567—1.4606)		
Connecting rod side clearance	mm (in)	Standard	0.239—0.330 (0.0094—0.0130)	0.239—0.379 (0.0094—0.0149)		0.200—0.400 (0.0079—0.0157)	
		Maximum	0.40 (0.016)			0.50 (0.020)	
<b>Crankshaft</b>							
Crankshaft runout	mm (in)	0.05 (0.0020) max.					
Main journal diameter	mm (in)	Standard size	75.805—75.825 (2.9844—2.9652)		No. 1, 2, 4, 5: 78.980—79.000 (3.1094—3.1102) No. 3: 78.954—78.974 (3.1084—3.1092)		
			75.561—75.571 (2.9744—2.9752)		No. 1, 2, 4, 5: 78.726—78.748 (3.0994—3.1002) No. 3: 78.700—78.720 (3.0984—3.0992)		
			75.297—75.317 (2.9644—2.9652)		No. 1, 2, 4, 5: 78.472—78.482 (3.0894—3.0902) No. 3: 78.448—78.466 (3.0884—3.0892)		
		0.254 (0.0100) undersize					
		0.508 (0.0200) undersize					

# TECHNICAL DATA

# TD

Item		Engine	HA	SL		TF
				Non-Turbo	Turbo	
Main journal diameter mm (in)	0.762 (0.0300) undersize		75.042—75.063 (2.9544—2.9552)		No. 1, 2, 4, 5: 75.216—75.238 (3.0794—3.0902) No. 3: 75.192—75.212 (3.0764—3.0792)	
Main journal taper	mm (in)		0.00E (0.00024) max.			
Main journal out-of-round	mm (in)		0.003 (0.00012) max.			
Crankpin journal diameter mm (in)	Standard size		61.112—61.125 (2.4060—2.4065)		63.567—64.000 (2.5192—2.5197)	
	0.254 (0.0100) undersize		60.858—60.971 (2.3960—2.3965)		63.753—63.746 (2.5092—2.5097)	
	0.508 (0.0200) undersize		60.604—60.617 (2.3860—2.3865)		63.479—63.492 (2.4992—2.4997)	
	0.762 (0.0300) undersize		60.350—60.363 (2.3760—2.3765)		63.225—63.238 (2.4892—2.4897)	
Crankpin taper	mm (in)		0.006 (0.00024) max.			
Crankpin out-of-round	mm (in)		0.003 (0.00012) max.			
<b>Main bearing</b>						
Main journal bearing oil clearance mm (in)	Standard		0.058—0.092 (0.0023—0.0036)		No. 1, 2, 4, 5: 0.058—0.092 (0.0023—0.0036) No. 3: 0.064—0.118 (0.0023—0.0045)	
	Maximum		0.12 (0.005)		No. 1, 2, 4, 5: 0.12 (0.005) No. 3: 0.15 (0.006)	
Available undersize bearing	mm (in)		0.254 (0.0100), 0.508 (0.0200), 0.762 (0.0300)			
<b>Crankpin bearing</b>						
Crankpin bearing oil clearance mm (in)	Standard		0.038—0.074 (0.0015—0.0029)		0.040—0.075 (0.0016—0.0030)	
	Maximum		0.10 (0.004)			
Available undersize bearing	mm (in)		0.254 (0.0100), 0.508 (0.0200), 0.762 (0.0300)			
<b>Thrust bearing</b>						
Crankshaft end play mm (in)	Standard		0.14—0.35 (0.0055—0.0154)			
	Maximum		0.40 (0.016)			
Bearing width mm (in)	Standard size		2.275—2.325 (0.0896—0.0915)			
	0.178 (0.0070) oversize		2.453—2.503 (0.0966—0.0985)			
<b>Timing gear</b>						
Timing gear backlash mm (in)	Standard		0.06—0.19 (0.0024—0.0071)			
	Maximum		0.30 (0.012)			
Idler gear end play	mm (in)		0.05—0.19 (0.0020—0.0071)			
Idler gear bush inner diameter	mm (in)		44.009—44.334 (1.7326—1.7336)			
Idler gear spindle outer diameter	mm (in)		43.950—43.975 (1.7303—1.7313)			
Bush-to-spindle clearance mm (in)	Standard		0.034—0.084 (0.0013—0.0033)			
	Maximum		0.75 (0.029)			

## D. LUBRICATION SYSTEM

Item		Engine	HA	SL	TF		
Lubrication method		Forced					
<b>Oil pump</b>							
Type		Positive displacement gear					
Regulating pressure		kPa (kg/cm <sup>2</sup> , psi)	608—667 (6.2—6.8, 88—97)				
Oil pressure		kPa (kg/cm <sup>2</sup> , psi)—3,800 rpm	373 (3.8, 54) min				
Rotor tooth to body clearance		mm (in)	Standard				
			0.10—0.19 (0.0039—0.0075)				
Side clearance		mm (in)	Standard				
			0.04—0.09 (0.0015—0.0035)				
			Maximum				
			0.15 (0.0059)				
<b>Oil filter</b>							
Type		Full-flow paper element					
Relief pressure differential		kPa (kg/cm <sup>2</sup> , psi)	76—119 (0.8—1.2, 11—17)				
Regulating pressure		kPa (kg/cm <sup>2</sup> , psi)	—				
			608—667 (6.2—6.8, 88—97)				
<b>Oil bypass filter</b>							
Type		Paper element					
<b>Oil cooler</b>							
Type		Water cooled					
<b>Oil pressure switch</b>							
Activation pressure		kPa (kg/cm <sup>2</sup> , psi)	20—39 (0.2—0.4, 2.8—5.7)				
<b>Engine oil</b>							
Capacity		liters (US qt, imp qt)	Total (dry engine)		8.5 (9.3, 7.7)	9.3 (9.8, 8.2)	
			Oil pan		6.5 (6.9, 5.7)	7.0 (7.4, 6.2)	
			Oil filter		1.0 (1.06, 0.88)		
			Oil bypass filter		0.6 (0.63, 0.53)		
Grade		API Service CC					
Viscosity number		Above 40°C (104°F)		SAE 40			
		0°C—40°C (32°F—104°F)		SAE 30			
		—10°C—25°C (14°F—77°F)		SAE 20W-20			
		—25°C—30°C (—13°F—86°F)		SAE 15W-30			
		Below —20°C (—4°F)		SAE 5W-30			



E. COOLING SYSTEM

Item	Engine	HA	SL		TF	
			Non-Turbo	Turbo		
Cooling method			Water-cooled, forced circulation			
<b>Water pump</b>						
Type			Centrifugal			
Impeller diameter	mm (in)		80 (3.15)			
Number of impeller blades			6			
Water seal type			Unifac mechanical seal			
<b>Thermostat</b>						
Type			Wax			
Start to open	°C (°F)		60.5—83.5 (177—182)			
Full open	°C (°F)		95 (203)			
Leak	mm (in)		Ø 5 (0.33) min			
<b>Radiator</b>						
Type			Corrugated fin			
Cap valve opening pressure	kPa (kg/cm <sup>2</sup> , psi)		74—103 (0.75—1.05, 11—15)			
Cooling system checking pressure	kPa (kg/cm <sup>2</sup> , psi)		88 (0.9, 13)			
<b>Cooling fan</b>						
Type			Thermo modulated			
Number of blades			4x2:6, 4x4:10			
Outer diameter	mm (in)		4x2: 410 (16.1), 4x4: 390 (15.4)		420 (16.5)	
<b>Coolant</b>						
Capacity	liters (US qt., Imp qt.)	With heater core	13.5 (14.3, 11.9)			
		Without heater core	12.5 (13.2, 11.0)			
Antifreeze solution	Protection	Mixture percentage (volume) %		Specific gravity of mixture at 20°C (68°F)		
		Water	Solution			
		Above -16°C (3°F)	85		35	1.054
		Above -26°C (-15°F)	55		45	1.066
Above -40°C (-40°F)	45	55	1.078			

## F. FUEL AND EMISSION CONTROL SYSTEM (HA, SL, SL TURBOCHARGED, TF ENGINES)

Items		Engine	HA	SL	SL Turbocharged	TF
Idle speed		rpm	600—650	620—670	660—710	620—700
Injection pump	Type		VE type		PE-A type	
	Injection timing	°BTEC	3	12	13	11
	Cam lift	mm	2.2		8	
	Plunger diameter	mm (in)	10.0 (0.39)		9.0 (0.35)	9.5 (0.37)
Delivery valve diameter		mm (in)	5.0 (0.195)		6.0 (0.23)	
Injection nozzle	Type		Throttle type		Hole type	
	Injection holes quantity		1	5	4	
	Injection hole diameter	mm (in)	1 (0.039)	0.27 (0.011)	0.34 (0.013)	0.31 (0.012)
	Injection pressure	kPa (kg/cm <sup>2</sup> , ps)	13.2—13.7 (1.35—1.40, 1.92—1.99)	16.7—17.2 (1.70—1.75, 2.42—2.49)		19.6—20.1 (2.00—2.05, 2.92—2.99)
Fuel tank capacity		liters (US gal, imp gal)	100 (26.4, 22.0), 100 + 70 (26.4 + 18.5, 22.0 - 18.4)			
Fuel filter type			Paper element			
Air cleaner type			Paper element			

## G. ENGINE ELECTRICAL SYSTEM (HA, SL, SL TURBOCHARGED, TF ENGINES)

Item		Engine	HA	SL		TF
				Non-Turbo	Turbo	
Voltage			12V, negative ground			
Battery	Type and capacity (20-hour rate)		55E26R: 60Ah x 2		75D26R: 65Ah x 2	
Alternator	Type		Alternating			
	Output	V-A	12-50			
	Regulator type		IC regulator			
Starter	Type		Electromagnetic push-in type			
	Output	V-kW	12-2.7			
Glow plug	Type		Sheathed type			
	Voltage	V	10.5	—		
	Ampere	A	16.5			
Air heater	Voltage	V	1*			
	Capacity	A-kWh	190-2.1			

H. CLUTCH

Item	Engine type	HA	SL	SL Turbo	TF
Operation method		Hydraulic			
Clutch pedal	Type	Suspended			
	Pedal ratio	5.6			
	Full stroke	mm (in)	153 (6.02)		
	Height	mm (in)	188—193 (7.40—7.60)		
	Free play	mm (in)	5—11 (0.02—0.11)		
	Disengagement height	mm (in)	65 (2.56)		
Clutch cover	Type	Diaphragm spring			
	Set load	N (kg, lb)	5,248 (535, 1,177)	6,229 (635, 1,397)	7,652 (780, 1,716)
Clutch disc	Type	Single dry plate			
	Diameter	Outer	mm (in)	260 (10.24)	275 (10.83)
		Inner	mm (in)	170 (6.69)	180 (7.09)
	Runout	mm (in)	1.0 (0.04)		
	Wear limit	mm (in)	0.3 (0.01)		
Master cylinder	Inner diameter	mm (in)	15.87 (0.62)		
Release cylinder	Inner diameter	mm (in)	22.22 (0.87)		
Flywheel	Runout	mm (in)	0.2 (0.008)		
Vacuum power assist	Type	Vacuum booster			
	Size	mm (in)	114.3 (4.5)		

## J. TRANSMISSION

Item	Engine type	HA SL	SL Turbo	TF
Change lever position			Floor shift	
Gear ratio	1st	5.833	5.853	5.478
	2nd	2.855	2.954	3.075
	3rd	1.851	1.661	1.637
	4th	1.000	1.000	1.000
	5th	0.800	0.783	0.794
	Reverse	5.372	5.318	5.197
Sub-transmission gear ratio (if equipped)	Power	—	1.000	1.000
	Economy	—	0.812	0.804
Specified oil		AP Service GL-4 or GL-5 SAE 75W-90		
Capacity	liters (US qt, Imp qt)	3.5 (3.7, 3.1)	4.2 (4.4, 3.7) .. without sub-transmission 4.5 (4.8, 4.0) .. with sub-transmission	3.5 (3.7, 3.1) without sub-transmission 3.3 (3.5, 2.9) .. with sub-transmission
<b>Mainshaft</b>				
Rundr. limit	mm (in)	0.035 (0.0014)		
<b>Synchronizer ring</b>				
Clearance between ring and flank surface of gear	mm (in)	Standard	1.3 (0.051)	
		Limit	1.0 (0.039)	
<b>Shift fork</b>				
Clearance between fork and sleeve	mm (in)	Standard	0.380—0.528 (0.0150—0.0208)	
		Limit	0.8 (0.0315)	
Clearance between fork and change lever	mm (in)	Standard	0.2—0.4 (0.0079—0.0157)	
		Limit	0.8 (0.0315)	
<b>Bearing end play</b>				
Mainshaft front		0—0.1 (0—0.004)	0—0.1 (0—0.004)	0—0.1 (0—0.004)
Mainshaft rear		0—0.1 (0—0.004)	0—0.1 (0—0.004)	0—0.1 (0—0.004)
Countershaft front		—	0.005—0.055 (0.0002—0.002)	—
Countershaft rear		0.01—0.05 (0.0004—0.0019)	—	0.01—0.05 (0.0004—0.0019)
Sub-transmission front		—	0—0.1 (0—0.004)	—
Sub-transmission rear		0—0.1 (0—0.004)	—	0—0.1 (0—0.004)

L. PROPELLER SHAFT

Item	Engine type	HA, SL	SL Turbo, TF
Max. permissible runout	mm (in)	0.5 (0.0197)	
Starting torque of the universal	Nm (cm-kg, in-lb)	0.49—1.37 (5—14 4.34—12.15)	
Adjustment snap ring	mm (in)	1.45 (0.057), 1.48 (0.058), 1.50 (0.059), 1.54 (0.061), 1.57 (0.062), 1.60 (0.063), 1.63 (0.064)	2.00 (0.079), 2.03 (0.080), 2.06 (0.081), 2.08 (0.082), 2.12 (0.083), 2.15 (0.085), 2.18 (0.086), 2.21 (0.087), 2.24 (0.088)

M. FRONT AND REAR AXLES

Item	Engine type	HA	SL	SL Turbo	TF			
<b>Front axle</b>								
Wheel bearing preload	Nm (cm-kg, in-lb)	0.11—0.29 (1.1—3.0, 0.85—2.60)						
Clearance between king-pin and bush	mm (in)	0.01—0.04 (0.0004—0.0016)						
Clearance between front axle and steering knuckle	mm (in)	0.20—0.35 (0.008—0.014)						
Kingpin bearing preload	N (kg, lb)	—						
Adjustment shim	mm (in)	0.35 (0.014),	0.5 (0.020),	0.6 (0.024),	0.7 (0.028)			
<b>Rear axle</b>								
Wheel bearing preload	Nm (cm-kg, in-lb)	0.11—0.29 (1.1—3.0, 0.85—2.60)						
<b>Driving and Differential</b>								
Type	Ratio type							
Final gear ratio	10 ft	Sid. cab	Truck	1.5t	5.857	—	—	—
	10 ft	Wide cab.	Truck	2t	—	5.857	—	—
	14 ft	Wide cab	Truck	3t	—	6.142	—	—
	14 ft	Wide cab	Truck	4t	—	—	6.571	6.833
	14 ft	Sid. cab	Crew cab.	2.75t	—	6.142	—	—
	14 ft	Wide cab	Crew cab.	3.5t	—	—	—	6.833
	17 ft	Wide cab.	Truck	4t	—	—	6.571	6.833

Item		Engine type	HA, SL	SL Turbo, TF
Specified oil			API Service GL-5	
-18°C (0°F) or below			SAE 80W	
-18°C (0°F) or above			SAE 90	
Capacity	liters (US qt, Imp qt)		2.6 (2.7, 2.3)	3.6 (3.8, 3.2)
Pinion height	mm (in)		0 ± 0.025 (0 ± 0.001)	
Adjustment shim	mm (in)		0.10 (0.004), 0.15 (0.006)	
Drive pinion bearing preload	Nm (cm·kg, in·lb)		0.8—1.6 (8—16, 7—14)	2.6—3.4 (27—35, 23—30)
Side bearing preload (Case spread)	mm (in)		279.42—279.50 (11.001—11.004)	289.92—290.000 (11.414—11.417)
Backlash of ring gear and drive pinion	mm (in)	Standard	0.25—0.27 (0.0098—0.011)	
		Max. allowable variation	0.11 (0.0043)	

## N. STEERING

Item		Gear type	Manual	Power
Shaft type			Regular type	
Shaft joint type		Non-tilt steering	1-joint	
		Tilt steering	2-joints	
Wheel diameter	mm (in)		430 (16.9)	
Lock to lock turns			3.6 or 4.2	3.9, 4.2 or 4.5
Range of up/down movement (Telescopic steering)	mm (in)		30 (1.18) (At steering wheel center position)	
Amount of tilt	mm (in)		50 (1.97) (At steering wheel center position)	
Free play of steering wheel	mm (in)		0—40 (0—1.57)	
Steering wheel operation force	kg (lb)		25 (55) or less (With wheels and tires on the ground)	4 (8.8) or less
Steering gear	Type		Ball nut	
	Gear ratio		28—33	22.6
	Backlash	mm (in)	0.25 (0.010) (Backlash between worm gear and sector shaft)	
	Worm bearing preload	kg (lb)	0.7—1.1 (1.5—2.4)	0.6—0.8 (1.3—1.8)
Oil	Type		API Service GL-4, SAE 90	ATF M2C33F or DEXRON-II
	Capacity	liters (US qt, Imp qt)	0.94 (0.99, 0.83)	2.0 (2.11, 1.76)

P. BRAKING SYSTEM

Item		Engine type	HA	SL, SL TURBO	TF	
Brake pedal	Type		Suspended			
	Pedal lever ratio		4.5			
	Maximum stroke	mm (in)	149.2 (5.87)			
	Pedal height	mm (in)	226 - 231 (8.90 - 9.09)			
	Pedal play	mm (in)	9 - 11 (0.35 - 0.43)			
	Pedal-to-floor clearance	mm (in)	50 (1.99) min.			
Master cylinder	Type		Tandem			
	Cylinder inner diameter	mm (in)	26.8 (1.06)			
	Reservoir capacity	cc (cu in)	162 (11.1)			
	Push-rod-to-piston clearance	mm (in)	0 (0)			
Front brake (Drum)	Type		2-leading			
	Wheel cylinder inner diameter	mm (in)	28.5 (1.12)			
	Lining dimension		Refer to next page			
	Lining thickness limit	mm (in)	1.0 (0.04)			
	Drum inner diameter	Standard		Refer to next page		
		Limit		Refer to next page		
Shoe clearance adjustment			Turn the adjuster in the reverse direction from locked position 5 notches			
Rear brake (Drum)	Type		Dual 2-leading			
	Wheel cylinder inner diameter	mm (in)	25.4 (1.00)			
	Lining dimension		Refer to next page			
	Lining thickness limit	mm (in)	1.0 (0.04)			
	Drum inner diameter	Standard		Refer to next page		
		Limit		Refer to next page		
Shoe clearance adjustment			Turn the adjuster in the reverse direction from locked position 5 notches			
Power brake unit	Type		Tandem diaphragm			
	Diameter	mm (in)	(a) 188 - 215 (7.4 - 8.5) (b) 213 - 240 (8.4 - 9.4)			
	Fluid pressure per reading force kPa (kg/cm <sup>2</sup> , psi)/N (kg, lb)	Vacuum 0 mmHg		(a) 587 (7.0, 100)/196 (20, 44) (b) 589 (8.0, 85)/196 (20, 44)		
		Vacuum 500 mmHg		(a) 5,180 (63, 686)/196 (20, 44) (b) 6,278 (64, 910)/196 (20, 44)		
Parking brake	Type		Center brake			
	Operating type		Stick type			
	Lever ratio		5.125			
	Lever stroke	Maximum		20 notches		
		When pulled at 294 N (30 kg, 66 lb)		7 - 13 notches		
	Lining dimensions (Length x width x thickness)	mm (in)	190.6 x 35.0 x 3.6 (7.5 x 1.38 x 0.14)			
	Lining thickness limit	mm (in)	1.0 (0.04)			
	Drum inner diameter	Standard		190 (7.48)		
Limit			181 (7.52)			
Shoe clearance adjustment			Turn the adjuster in the reverse direction from locked position 6 - 7 notches			
Auxiliary brake system			Exhaust brake system			
Rear braking force control device			*Load-sensing G-valve (LSGV)			
Brake fluid			FHWSS 116, DOT 3, SAE J1703			

(a): Payload 1,500 kg and 2,000 kg  
 (b): Except payload 1,500 kg and 2,000 kg

## Lining and Drum Dimensions

Engine	Body type	Rear wheel	Item	Front brake		Rear brake				
				Lining dimensions mm (in) (Length x width x thickness)		Drum inner diameter mm (in)		Lining dimensions mm (in) (Length x width x thickness)		Drum inner diameter mm (in)
				Std.	Limit	Std.	Limit	Std.	Limit	
HA	10 feet cargo deck	Single	293.1x60x5.6 (11.53x2.36x0.26)	300 (11.81)	301 (11.85)	229.3x75.0x8.0 (9.02x2.95x0.24)	228.6 (9.00)	229.6 (9.04)		
SL			307.0x75.0x8.0 (12.09x2.95x0.31)			307.0x75.0x8.0 (12.09x2.95x0.31)				
SL	14 feet cargo deck	Dual	307.0x80.0x8.0 (12.09x3.14x0.31)	320 (12.60)	321 (12.64)	307.0x80.0x8.0 (12.09x3.14x0.31)	320 (12.60)	321 (12.64)		
SL TURBO	14 and 17 feet cargo deck		334.9x110.0x10.5 (13.18x4.33x0.41)			334.9x110.0x10.5 (13.18x4.33x0.41)				
*F										

## Q. WHEELS AND TIRES

## Single tire

Specifications		Wheel			Tire	
		Size	Offset mm (in)	Diameter of pitch circle mm (in)	Size	Tire pressure kPa (kg/cm <sup>2</sup> , psi)
3.0L	Front	5.50Fx15	30 (1.18)	184.15 (7.25)	7.00-15-10	392 (4.00, 55)
	Rear					417 (4.25, 60)

## Dual tires

Specifications		Wheel			Tire		
		Size	Offset mm (in)	Diameter of pitch circle mm (in)	Size	Tire pressure kPa (kg/cm <sup>2</sup> , psi)	
2,000 kg	3.5L	Front	4.50Ex16	108 (4.252)	203.2 (8)	6.50-16-10	491 (5.00, 71)
			5.50Fx16	115 (4.528)		6.50R16-10	540 (5.50, 78)
		Rear	4.50Ex16	108 (4.252)		6.50-16-8	417 (4.25, 60)
			5.50Fx16	115 (4.528)		6.50-16-10	441 (4.50, 64)
2,750 kg	3.5L	Front	5.50Fx16	115 (4.528)	203.2 (8)	7.00-16-10	466 (4.75, 68)
						7.00-16-12	466 (4.75, 68)
						7.00R16-10	441 (4.50, 64)
		Rear				7.00-16-10	491 (5.00, 71)
						7.00-16-12	515 (5.25, 75)
						7.00R16-10	640 (5.50, 78)
3,000 kg	3.5L	Front	5.50Fx16	115 (4.528)	203.2 (8)	7.00-16-10	515 (5.25, 75)
						7.00-16-12	540 (5.50, 78)
						7.00R16-10	515 (5.25, 75)
		Rear				7.00-16-10	491 (5.00, 71)
						7.00-16-12	515 (5.25, 75)
						7.00R16-10	515 (5.25, 75)
3,500 kg	4.0L	Front	6.00GSx16	127 (5)	222.25 (8.75)	7.50-16-12	441 (4.50, 64)
						7.50R16-12	441 (4.50, 64)
		Rear				7.50-16-12	540 (5.50, 78)
						7.50R16-12	589 (6.00, 85)
4,000 kg	3.5L 4.0L	14 feet body	6.00GSx16	127 (5)	222.25 (8.75)	7.50-16-12	564 (5.75, 82)
						7.50R16-12	638 (6.50, 93)
	17 feet body	Front				7.50-16-10	515 (5.25, 75)
						7.50-16-12	564 (5.75, 82)
		Rear	7.50R16-12	638 (6.50, 93)			



**Wheels and Tires**

Item		Specifications
Wheel runout	Horizontal	mm (in)
	Vertical	mm (in)
Maximum unbalance (at rim edge)		g (oz)
Remaining tread limit	Ordinary tires	mm (in)
	Snow tires	

**R. SUSPENSION**

Item		Specifications
<b>Front Suspension</b>		
Suspension type		Leaf spring
Spring	Type	Semielliptic leaf spring
	Dimension	See next page
Shock absorber type		Cylindrical double-acting
<b>Rear Suspension</b>		
Suspension type		Leaf spring
Spring	Type	Semielliptic leaf spring
	Dimension	See next page
Shock absorber type		Cylindrical double-acting

**Wheel Alignment (<sup>1</sup>Unladen condition)**

Item	Body		
	Cargo deck	Truck	Truck and Crew cab
	Cabin type	10 feet	14, 17 feet
		Standard cabin	Wide cabin
<b>Front wheel alignment</b>			
Total toe-in	mm (in)	0-3 (0-0.12)	+
	degree	0°-0.3°	+
Camber		0°40' ± 30'	+
Caster		2°50' ± 20'	+
King-pin angle		7°00'	+
Maximum steering angle	Inner	38° ± 2°	42° ± 2°
	Outer	29° ± 2°	31° ± 2°
<b>Rear wheel alignment</b>			
Total toe-in	mm (in)	0 (0)	+
	degree	0°00'	+
Camber		0°00'	+

<sup>1</sup> Fuel tank full, radiator coolant and engine oil at specified level, and spare tire, jack and tools in designated position.

## Leaf Spring Dimensions (Refer to page R-6 for Spring Applications)

## Front leaf spring

	Front spring dimensions			Front spring dimensions	
	Length x Width x Thickness	mm (in)		Length x Width x Thickness	mm (in)
A	1,367 x 70 x 7	(53.8 x 2.8 x 0.28)	C	1,367 x 70 x 7	(53.8 x 2.8 x 0.28)
	1,145 x 70 x 7	(45.1 x 2.8 x 0.28)		1,146 x 70 x 8	(45.1 x 2.8 x 0.31)
	960 x 70 x 8	(38.2 x 2.8 x 0.31)		1,090 x 70 x 8	(42.6 x 2.8 x 0.31)
	690 x 70 x 8	(27.2 x 2.8 x 0.31)		784 x 70 x 8	(30.9 x 2.8 x 0.31)
	520 x 70 x 8	(20.5 x 2.8 x 0.31)		584 x 70 x 8	(23.0 x 2.8 x 0.31)
	340 x 70 x 8	(13.4 x 2.8 x 0.31)		384 x 70 x 8	(15.1 x 2.8 x 0.31)
	200 x 70 x 7	(7.9 x 2.8 x 0.25)		208 x 70 x 8	(8.2 x 2.8 x 0.31)
B	1,367 x 70 x 7	(53.8 x 2.8 x 0.28)	D	1,374 x 70 x 8	(54.1 x 2.8 x 0.31)
	1,156 x 70 x 8	(45.5 x 2.8 x 0.31)		1,150 x 70 x 8	(45.3 x 2.8 x 0.31)
	784 x 70 x 8	(30.9 x 2.8 x 0.31)		815 x 70 x 8	(32.2 x 2.8 x 0.31)
	584 x 70 x 8	(23.0 x 2.8 x 0.31)		668 x 70 x 8	(26.3 x 2.8 x 0.31)
	384 x 70 x 8	(15.1 x 2.8 x 0.31)		518 x 70 x 8	(20.4 x 2.8 x 0.31)
				368 x 70 x 8	(14.5 x 2.8 x 0.31)
				260 x 70 x 7	(10.2 x 2.8 x 0.28)
		160 x 70 x 7	(6.3 x 2.8 x 0.28)		

## Rear leaf spring

	Rear spring dimensions: Length x Width x Thickness mm (in)			
	Main		Auxiliary	
E	1,498 x 70 x 9	(59.0 x 2.8 x 0.35)		
	1,246 x 70 x 9	(49.1 x 2.8 x 0.35)		
	970 x 70 x 9	(38.2 x 2.8 x 0.35)		
	830 x 70 x 10	(32.7 x 2.8 x 0.39)		
	700 x 70 x 10	(27.6 x 2.8 x 0.39)		
	570 x 70 x 11	(22.4 x 2.8 x 0.43)		
	410 x 70 x 11	(16.1 x 2.8 x 0.43)		
260 x 70 x 11	(10.2 x 2.8 x 0.43)			
F	1,506 x 70 x 10	(59.3 x 2.8 x 0.39)	950 x 70 x 12	(37.4 x 2.8 x 0.47)
	1,248 x 70 x 10	(49.1 x 2.8 x 0.39)	900 x 70 x 12	(35.4 x 2.8 x 0.47)
	880 x 70 x 10	(34.6 x 2.8 x 0.39)	900 x 70 x 12	(35.4 x 2.8 x 0.47)
	660 x 70 x 11	(26.0 x 2.8 x 0.43)	650 x 70 x 13	(33.5 x 2.8 x 0.51)
	380 x 70 x 11	(15.0 x 2.8 x 0.43)		
G	1,506 x 70 x 10	(59.3 x 2.8 x 0.39)	950 x 70 x 12	(37.4 x 2.8 x 0.47)
	1,253 x 70 x 10	(49.3 x 2.8 x 0.39)	900 x 70 x 12	(35.4 x 2.8 x 0.47)
	880 x 70 x 10	(34.6 x 2.8 x 0.39)	900 x 70 x 12	(35.4 x 2.8 x 0.47)
	660 x 70 x 11	(26.0 x 2.8 x 0.43)	650 x 70 x 13	(33.5 x 2.8 x 0.51)
	380 x 70 x 11	(15.0 x 2.8 x 0.43)		
H	1,506 x 70 x 10	(59.3 x 2.8 x 0.39)	950 x 70 x 12	(37.4 x 2.8 x 0.47)
	1,253 x 70 x 10	(49.3 x 2.8 x 0.39)	900 x 70 x 12	(35.4 x 2.8 x 0.47)
	880 x 70 x 10	(34.6 x 2.8 x 0.39)	900 x 70 x 12	(35.4 x 2.8 x 0.47)
	660 x 70 x 11	(26.0 x 2.8 x 0.43)	650 x 70 x 13	(33.5 x 2.8 x 0.51)
	380 x 70 x 11	(15.0 x 2.8 x 0.43)		
I	1,506 x 70 x 10	(59.3 x 2.8 x 0.39)	950 x 70 x 13	(37.4 x 2.8 x 0.51)
	1,248 x 70 x 10	(49.1 x 2.8 x 0.39)	900 x 70 x 13	(35.4 x 2.8 x 0.51)
	840 x 70 x 10	(37.0 x 2.8 x 0.39)	900 x 70 x 13	(35.4 x 2.8 x 0.51)
	760 x 70 x 11	(30.0 x 2.8 x 0.43)	650 x 70 x 13	(33.5 x 2.8 x 0.51)
	520 x 70 x 11	(20.5 x 2.8 x 0.43)		
	300 x 70 x 11	(11.8 x 2.8 x 0.43)		

S. BODY

Item	Cabin type	Standard	Wide
<b>Tilt lock</b>			
Clearance between main hook and eye bolt	mm (in)	5 (0.20) min	
Clearance between safety hook and stiker	mm (in)	Approx. 22.0 (0.87)	Approx. 27.0 (1.06)
<b>Cabin mount</b>			
Clearance between wedge and cabin mount bracket	mm (in)	26.4 ± 1.0 (1.04 ± 0.04)	43.0 ± 1.0 (1.69 ± 0.04)

T. BODY ELECTRICAL SYSTEM

Item		Specification (W)		
		RHD 12V	AUSTRALIA 12V	SINGAPORE 12V
Headlights	Outside	40/60	45/60	40/60
	Inside	50	45	50
Turn signal lights	Front	21		
	Rear	21	21	27
Tail lights		5	5	6
License plate lights		7.5		
Stoplights		21	21	27
Back-up lights		21	21	23
Interior lights		10		
Fog lights (if equipped)		35		
<b>Indicator and warning lights</b>				
Hazard		1.4 × 2		
Turn signals		1.4 × 2		
High beam		3.4		
Rear		2		
Brake		1.4		
Econo		1.4		
Glow		1.4		
Charge		2		
Oil		1.4		
Sediment		2		
Vac		1.4		
Exhaust brake		1.4		

## SPECIAL TOOLS

GENERAL INFORMATION .....	ST- 2
ENGINE .....	ST- 3
CLUTCH AND TRANSMISSION .....	ST- 5
DIFFERENTIAL .....	ST- 6
FRONT AND REAR AXLES.....	ST- 8
BRAKING SYSTEM.....	ST- 8
STEERING AND SUSPENSION.....	ST- 8
CHECKER AND OTHER EQUIPMENT.....	ST-10

9175.TX-001

**GENERAL INFORMATION**

The letters A and B in the priority column indicate the degree of importance of each tool.

A...Indispensable

The tools ranked A in this list are indispensable for performing operations satisfactorily, easily, safely, and efficiently. It is, therefore, advisable that all service shops have these tools.

B....Selective

The tools in this list are not as necessary as tools ranked A, but all service shops should have these tools to perform repairs more easily and more efficiently.

**Note**









- **When ordering tool sets that consist of several tools, check the List in the Parts Catalogue to make sure that some tools are not duplicated in other sets you may already have. If they are, instead of ordering the set, order only those new tools that are needed.**






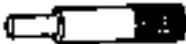
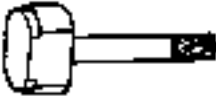

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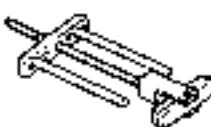


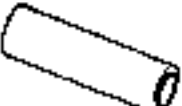



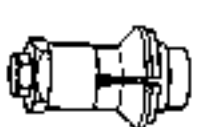
## SPECIAL TOOLS




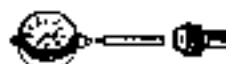



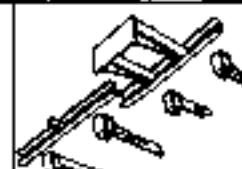
# ST

### ENGINE (HA, SL, TF, AM)

TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 0727 000 Engine crane	B	
49 0636 000B Transmission lifter	B	
49 0107 680A Engine stand	A	
49 0636 007 Body	A	
49 1701 009 Bolt (HA)	A	
49 W065 006 Attachment set (SL, TF)	A	
49 0636 100A Arm, valve spring lifter	A	
49 0107 222A Pivot	A	



TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 L012 0A0 Installer set, valve seal & valve guide	A	
49 0636 165A Remover & installer, valve guide (HA)	A	
49 0107 451A Remover & installer, valve guide (SL, TF)	A	
49 0223 067 Remover & installer, piston pin (HA)	B	
49 B043 002 Installer, bearing (S.)	B	
49 0636 040 Piston pin installer (TF)	B	
49 1363 015 Replacer, cylinder liner (HA)	A	
49 W065 015 Replacer, cylinder liner (SL)	A	

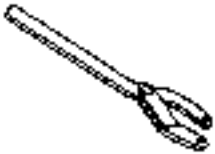
TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 W010 1A0 Remover set, cylinder liner (TF)	A	
49 V101 06GA Brake, ring gear (HA, SL)	A	
49 S501 062 Collar (HA)	A	
49 W065 062 Collar (SL)	A	
49 W011 103 Brake, ring gear (TF)	A	
49 W011 101 Installer, oil seal (TF)	A	
49 SE01 157 Extractor (HA)	A	
49 0558 210 Oil seal installer and centering tool (HA)	A	

TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 W011 102 Installer, oil seal (TF)	A	
49 1456 010 Adapter set, compression gauge (HA)	A	
49 W065 010 Adapter compression gauge (SL, TF)	A	
49 9140 074 Cam lift, measuring device (HA)	A	
49 9200 145 Radiator cap tester adapter set	A	
49 0727 575 Pulver, socket joint	B	
49 S120 170 Remover, valve seal	A	
49 W017 3A0 Supporter set	B	




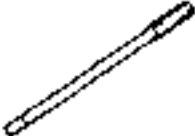
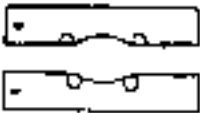
## SPECIAL TOOLS




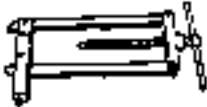

# ST

TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
48 SE01 310 Centering tool, clutch disc	A	
49 G03C 797 Handle (TF)	A	



TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 S120 710 Holder, coupling frange	A	
—	—	—


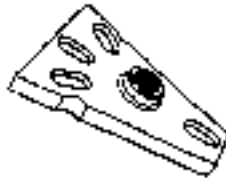
### CLUTCH AND TRANSMISSION

TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 0600 330 Installer, bearing	A	
49 0727 415 Installer main shaft front & rear bearing	A	
49 0223 630B Puller, rear axle shaft	B	
49 0852 350 Guide, shift fork assy	A	
49 F026 103 Puller, wheel hub	A	






TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 W017 101 Remover, clutch hub	A	
49 0839 425C Puller set, bearing	A	
49 W501 445 Holder, synchronizer ring	B	
49 0600 620B Puller main drive shaft bearing	A	
49 0500 330 Installer, transmis- sion bearing	A	

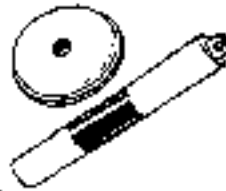






TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 F015 002 Installer, water seal	A	
49 H025 001 Bearing, installer	A	

TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 1285 071 Puller, bearing	A	
49 3501 631A Attachment, rear shaft puller	B	







## DIFFERENTIAL

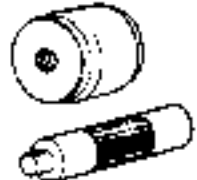
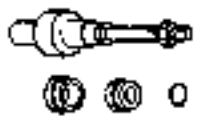




TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 MD05 581 Hanger, differential carrier	A	
49 0259 720 Wrench, side bearing adjust nut	B	
49 F027 0A1 Installer set, bearing	A	
49 U027 003 Installer, oil seal (W type)	A	
49 S231 626 Support block (Y type)	A	

TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 W033 1A0 Installer set, bearing	A	
49 W027 003 Installer, bearing (Y type)	A	
49 G033 107 Installer, dust cover	B	
49 F027 007 Attachment, ø72 (W type)	A	
49 F401 300B Installer set, bearing	A	


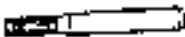
# SPECIAL TOOLS


# ST

TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 H033 101 Remover, bearing (W type)	A	
49 Q552 087 Installer, camshaft bush (W type)	A	
49 G030 785 Installer of seal	A	
49 0710 520 Puller, bearing	A	
49 W000 105 Installer, oil seal (Y type)	A	
49 0727 570 Gauge body, pinion height adjust	A	


TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 W027 040 Installer set, oil seal (W type)	A	
49 1363 565 Pinion model	A	
49 0305 555 Gauge block (W type)	A	
49 W027 004 Gauge block (W type)	A	
49 1316 555 Gauge block (Y type)	A	
49 Y001 555 Gauge block (Y type)	A	


## FRONT AND REAR AXLES

TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 W033 106 Wrench, locknut	A	
49 1316 600 Guide, king pin	A	




TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 1316 610 Puffer & installer, king pin bush	A	
-	-	-




## BRAKING SYSTEM

TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 F043 001 Adjust gauge	A	

TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 0259 7708 Wrench, flare nut	A	



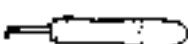



## STEERING AND SUSPENSION







TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 0160 5108 Attachment, preload measuring	B	
49 1232 670A Gauge set, power steering	A	
49 H002 671 Adapter	A	

TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 W032 302 Adapter	A	
49 W032 2A0 Remover set, bearing	A	
49 F017 1A0 Universal wrench	A	




# SPECIAL TOOLS



# ST

TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 W038 040 Replacer set, rubber push	A	
49 W023 785 Installer, dust boot	A	
48 0208 701A Boot air out tool	B	
49 C559 505A Adapter, caster camber gauge	A	
49 H032 327 Installer, bearing and oil seal	A	
49 F403 331 Body	A	

TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 W023 585A Adjust wrench	A	
49 FT01 361 Remover bearing	A	
49 H025 003 Bearing installer	A	
49 G032 3A1 Join hose	A	
48 G032 316 Adapter	A	
49 F027 005 Attachment for bearing ø62	A	

## TESTER AND OTHERS

TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 0259 966 Inserting tool, window glass	B	
49 0639 285 Checker, fuel and thermometer	A	
46 6200 020 Tension gauge, V-ribbed belt	B	

TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 H08D 740 Pressure tester	A	
49 0187 260 Gauge, oil pressure	B	
—	—	—

# PARTS INDEX

## A

ACCELERATOR CABLE (HA ENGINE) .....	F1-22
ACCELERATOR CABLE (SL, SL TURBO ENGINE) .....	F2-40
ACCELERATOR CABLE (TF ENGINE) .....	F3-28
ACCELERATOR PEDAL (HA ENGINE) .....	F1-22
ACCELERATOR PEDAL (SL, SL TURBO ENGINE) .....	F2-40
ACCELERATOR PEDAL (TF ENGINE) .....	F3-28
ACCELERATOR SWITCH (SL, SL TURBO ENGINE) .....	F2-53
ACCELERATOR SWITCH (TF ENGINE) .....	F3-42
AIR CLEANER (HA ENGINE) .....	F1-11
AIR CLEANER (SL, SL TURBO ENGINE) .....	F2-18
AIR CLEANER (TF ENGINE) .....	F3-15
AIR HEATER .....	G-20
AIR HEATER CONTROL UNIT .....	G-19
AIR HEATER RELAY .....	G-20
ALTERNATOR .....	G-6
ANTENNA FEEDER .....	T-91
AUDIO UNIT .....	T-88

## B

BACKING WARNING HORN .....	T-74
BACK WINDOW .....	S-38
BACK-UP LIGHT SWITCH .....	T-41
BACK-UP LIGHT (SINGAPORE) .....	T-40
BATTERY .....	G-5
BRAKE FLUID .....	P-8
BRAKE FLUID LEVEL SENSOR .....	T-60
BRAKE PEDAL .....	P-10

## C

CANCEL RELAY (SL, SL TURBO ENGINE) .....	F2-52
CANCEL RELAY (TF ENGINE) .....	F3-41
CENTER BRAKE .....	P-40
CLOCK .....	S-61
CLUTCH DISC .....	H-18
CLUTCH FLUID .....	H-4
CLUTCH MASTER CYLINDER .....	H-8
CLUTCH PEDAL .....	H-5
CLUTCH RELEASE CYLINDER .....	H-15
CLUTCH SWITCH (SL, SL TURBO ENGINE) .....	F2-54
CLUTCH SWITCH (TF ENGINE) .....	F3-43
COMBINATION SWITCH .....	T-18
CONSOLE .....	S-49
COOLANT LEVEL SENSOR .....	T-62
COOLANT WARNING UNIT .....	T-59
COOLING FAN .....	E-12
CYLINDER HEAD GASKET .....	B-21

## D

DIFFERENTIAL .....	M-20
DIFFERENTIAL OIL .....	M-23
DOOR SWITCH .....	T-46
DRIVE BELT (ALTERNATOR) .....	B-6, 9
DRIVE BELT (COOLING FAN) .....	B-9
DRIVE BELT (POWER STEERING) .....	N-46
DRIVE BELT (P/S) .....	B-9

## E

ENGINE .....	B-33
CAMSHAFT .....	B-85
CONNECTING ROD .....	B-83
CRANKSHAFT .....	B-84
CYLINDER BLOCK .....	B-80
CYLINDER HEAD .....	B-76
IDLER GEAR .....	B-87
PISTON .....	B-81
ROCKER ARM ASSEMBLY .....	B-79
TAPPET .....	B-87
VALVE MECHANISM .....	B-76
ENGINE COOLANT .....	E-6
ENGINE OIL .....	D-7
ENGINE SWITCH .....	T-17
EXHAUST BRAKE SWITCH (SL, SL TURBO ENGINE) .....	F2-55
EXHAUST BRAKE SWITCH (TF ENGINE) .....	F3-44
EXHAUST BRAKE UNIT (SL, SL TURBO ENGINE) .....	F2-49
EXHAUST BRAKE UNIT (TF ENGINE) .....	F3-38
EXHAUST DEVICE (HA ENGINE) .....	F1-26
EXHAUST DEVICE (SL, SL TURBO ENGINE) .....	F2-45
EXHAUST DEVICE (TF ENGINE) .....	F3-33
EXHAUST HEATING CONTROL UNIT (SL, SL TURBO ENGINE) .....	F2-48
EXHAUST HEATING CONTROL UNIT (TF ENGINE) .....	F3-37
EXHAUST HEATING SWITCH (SL, SL TURBO ENGINE) .....	F2-53
EXHAUST HEATING SWITCH (TF ENGINE) .....	F3-42

## F

FLASHER UNIT .....	T-15
FLOORMAT .....	S-62
FLYWHEEL .....	H-18
FOG LIGHT .....	T-38
FOG LIGHT SWITCH .....	T-42
FRESH AIR DUCT (HA ENGINE) .....	F1-11
FRESH AIR DUCT (SL, SL TURBO ENGINE) .....	F2-18
FRESH AIR DUCT (TF ENGINE) .....	F3-15

# PARTS INDEX

FRONT AXLE (4x2) .....	M- 4
STEERING KNUCKLE .....	M-10
WHEEL HUB .....	M- 6
FRONT BLOWER UNIT .....	U-10
FRONT BRAKE (DRUM) .....	P-27
BRAKE DRUM .....	P-28
BRAKE SHOE .....	P-28
WHEEL CYLINDER .....	P-28
FRONT BUMPER .....	S-18
FRONT CABIN DAMPER .....	S-42
FRONT COMBINATION LIGHT .....	T-37
FRONT DOOR .....	S- 8
FRONT DOOR GLASS .....	S-10
FRONT DOOR LOCK AND OPENER .....	S-12
FRONT FENDER PANEL .....	S- 7
FRONT GRILLE .....	S-20
FRONT HEATER UNIT .....	U- 8
FRONT OIL SEAL .....	B-28
FRONT SUSPENSION (LEAF SPRING) .....	R-12
FRONT LEAF SPRING .....	R-14
FRONT SHOCK ABSORBER .....	R-13
FRONT WINDOW REGULATOR .....	S-10
FUEL CUT SOLENOID VALVE (HA ENGINE) .....	F1-23
FUEL FILTER (HA ENGINE) .....	F1-17
FUEL FILTER (SL, SL TURBO ENGINE) .....	F2-35
FUEL FILTER (TF ENGINE) .....	F3-23
FUEL GAUGE SENDER UNIT .....	T-71
FUEL STOP CABLE (SL, SL TURBO ENGINE) .....	F2-41
FUEL STOP CABLE (TF ENGINE) .....	F3-29
FUEL TANK (HA ENGINE) .....	F1-13
FUEL TANK (SL, SL TURBO ENGINE) .....	F2-29
FUEL TANK (TF ENGINE) .....	F3-17
FUSE BOX .....	T-13
FUSIBLE LINK .....	T-13

## G

GLOW INDICATOR LAMP .....	G-21
GLOW PLUG .....	G-24
GLOW PLUG RELAY .....	G-25

## H

HEADLIGHT .....	T-36
HEADLINER .....	S-63
HEATER CONTROL UNIT .....	U-13
HORN .....	T-73
HORN RELAY .....	T-73

## I

IDLING CABLE (HA ENGINE) .....	F1-24
IDLING CABLE (SL, SL TURBO ENGINE) .....	F2-43

IDLING CABLE (TF ENGINE) .....	F3-31
IDLING KNOB (HA ENGINE) .....	F1-24
IDLING KNOB (SL, SL TURBO ENGINE) .....	F2-43
IDLING KNOB (TF ENGINE) .....	F3-31
INDICATOR LAMP .....	T-58
INJECTION NOZZLE (HA ENGINE) .....	F1-19
INJECTION NOZZLE (SL, SL TURBO ENGINE) .....	F2-37
INJECTION NOZZLE (TF ENGINE) .....	F3-25
INJECTION PUMP (HA ENGINE) .....	F1-14
INJECTION PUMP (SL, SL TURBO ENGINE) .....	F2-30
INJECTION PUMP (TF ENGINE) .....	F3-18
INSTRUMENT CLUSTER (METER) .....	T-68
INSTRUMENT PANEL .....	S-50
INTAKE MANIFOLD (HA ENGINE) .....	F1-11
INTAKE MANIFOLD (SL ENGINE) .....	F2-18
INTAKE MANIFOLD (TF ENGINE) .....	F3-15
INTAKE SHUTTER VALVE ACTUATOR (SL, SL TURBO ENGINE) .....	F2-51
INTAKE SHUTTER VALVE ACTUATOR (TF ENGINE) .....	F3-40
INTAKE SHUTTER VALVE (SL, SL TURBO ENGINE) .....	F2-18, 51
INTAKE SHUTTER VALVE (TF ENGINE) .....	F3-15, 40
INTERCOOLER .....	F2-27
INTERIOR LAMP .....	T-46
INTERMITTENT WIPER RELAY .....	S-34

## L

LICENSE PLATE LIGHT .....	T-41
LOAD-SENSING G-VALVE (LSGV) .....	P-25

## M

MAGNETIC VALVE (SL, SL TURBO ENGINE) .....	F2-50
MAGNETIC VALVE (TF ENGINE) .....	F3-39
MAIN FUSE .....	T-13
MASTER CYLINDER .....	P-12
MIRROR .....	S-22

## N

NEUTRAL SWITCH (SL, SL TURBO ENGINE) .....	F2-54
NEUTRAL SWITCH (TF ENGINE) .....	F3-43

## O

OIL BYPASS ALARM SWITCH .....	T-59
OIL BYPASS FILTER .....	D- 8
OIL COOLER .....	D- 9

# PARTS INDEX

OIL FILTER .....	J- 8
OIL LEVEL SENSOR .....	T-81
OIL PAN.....	D-11
OIL PRESSURE SWITCH .....	T-58
OIL PUMP .....	C-14
O/L PUMP (POWER STEERING) .....	N-37

## P

PARKING BRAKE CABLE.....	F-39
PARKING BRAKE LEVER .....	P-37
PARKING BRAKE SWITCH.....	T-60
PICKUP SENSOR.....	T-72
POWER BRAKE UNIT.....	F-15
POWER STEERING FLUID.....	N-24
PROPELLER SHAFT .....	L- 3

## Q

QUICK START SYSTEM (QSS) CONTROL UNIT .....	G-23
--	------

## R

RADIATOR.....	E- 9
RADIATOR CAP.....	E- 8
RADIATOR GRILLE .....	S-20
REAR AXLE .....	M-15
AXLE SHAFT.....	M-16
WHEEL HUB .....	M-16
REAR BRAKE (DRUM) .....	P-32
BRAKE DRUM.....	F-33
BRAKE SHOE.....	P-33
WHEEL CYLINDER.....	F-33
REAR BUMPER.....	S-19
REAR CABIN MOUNT (WITH DAMPER).....	S-44
REAR CABIN MOUNT (WITHOUT DAMPER).....	S-48
REAR COMBINATION LIGHT .....	T-39
REAR DOOR .....	S-13
REAR DOOR LOCK AND OPENER .....	S-17
REAR OIL SEAL.....	B-31
REAR SUSPENSION (LEAF SPRING).....	R-17
REAR LEAF SPRING.....	R-19
REAR SHOCK ABSORBER.....	R-18
REAR WINDOW GLASS.....	S-15
REAR WINDOW REGULATOR.....	S-15
ROOF VENTILATOR.....	S-35

## S

SEAT.....	S-53
SEAT BELT.....	S-59
SEDIMENTOR SENSOR.....	T-62
SEDIMENTOR SENSOR (HA ENGINE).....	F1-16

SEDIMENTOR SENSOR (SL, SL TURBO ENGINE).....	F2-34
SEDIMENTOR SENSOR (TF ENGINE).....	F3-22
SEDIMENTOR (HA ENGINE).....	F1-16
SEDIMENTOR (SL, SL TURBO ENGINE).....	F2-34
SEDIMENTOR (TF ENGINE).....	F3-22
SHIFT MECHANISM (SUB-TRANSMISSION).....	J1-49, J2-49
SHIFT MECHANISM (WSM-R).....	J1-47
SHIFT MECHANISM (Z5M-R) .....	J2-47
SOLENOID VALVE (INTAKE SHUTTER VALVE).....	F2-52, F3-41
SPEAKER.....	T-89
STARTER.....	G-11
STEERING COLUMN.....	N-11, 27
STEERING GEAR AND LINKAGE (MANUAL STEERING) .....	N-15
STEERING GEAR AND LINKAGE (POWER STEERING).....	N-28
STEERING SHAFT (MANUAL STEERING).....	N-12
STEERING WHEEL.....	N-11, 27
STEP .....	S-21
STOPLIGHT CHECKER REALY .....	T-15, 60
STOPLIGHT SWITCH.....	T-41

## T

THERMOSTAT .....	E-10
TILT LOCK.....	S-40
TRANSMISSION OIL (WSM-R) .....	J1-13
TRANSMISSION OIL (Z5M-R) .....	J2-13
TRANSMISSION (WSM-R).....	J1-14
TRANSMISSION (Z5M-R).....	J2-14
TRIM.....	S-68
TURBOCHARGER .....	F2-21

## V

VACUUM POWER ASSIST.....	H-14
VACUUM PUMP.....	F-22

## W

WARNING BUZZER.....	T-61
WARNING LAMP.....	T-58
WASHER MOTOR .....	S-29, 34
WASHER NOZZLE.....	S-31
WATER PUMP.....	E-11
WATER THERMOSENSOR (AIR HEATER SYSTEM).....	G-21
WATER THERMOSENSOR (FOR WATER TEMPERATURE GAUGE).....	T-71
WATER THERMOSENSOR (QSS).....	G-25
WHEELS AND TIRES.....	Q- 4
WINDSHIELD.....	S-36



## PARTS INDEX

WINDSHIELD WIPER LINK.....	S-30
WIPER AND WASHER SWITCH.....	S-34
WIPER ARM AND BLADE.....	S-29, 32
WIPER MOTOR.....	S-29, 33

## WIRING DIAGRAM

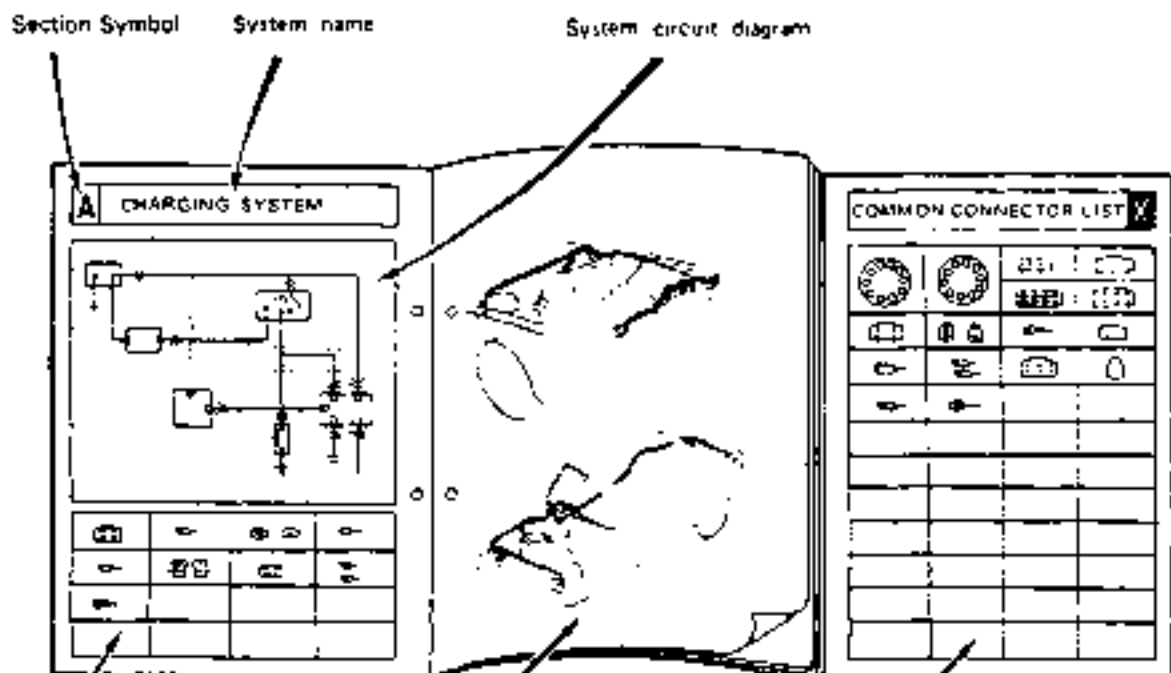
- HOW TO USE THIS WIRING DIAGRAM..... Z-2
- SYMBOLS IN THIS WIRING DIAGRAM..... Z-5
- PARTS INDEX..... Z-7(P1)
- GROUND CIRCUIT..... Z-8(JC)
- ELECTRICAL WIRING SCHEMATIC..... Z-9(W)
- STARTING SYSTEM..... Z-10(A)
- SUB STARTING SYSTEM..... Z-10(A)
- CHARGING SYSTEM..... Z-10(A)
- For HA
- QUICK START SYSTEM (QSS)..... Z-12(B-1)
- FUEL CUT SOLENOID..... Z-12(B-1)
- For SL, SL Turbo, TF
- AIR HEATER CONTROL SYSTEM..... Z-14(B-2)
- EXHAUST CONTROLLED HEATING SYSTEM..... Z-14(B-2)
- METERS & WARNING LAMPS..... Z-16(C)
- WIPER & WASHER..... Z-18(D)
- HEADLIGHTS..... Z-20(E)
- TAIL LIGHTS..... Z-20(E)
- POSITION LIGHTS..... Z-20(E)
- LICENSE LIGHTS..... Z-20(E)
- FOG LIGHTS..... Z-20(E)
- ILLUMINATION LAMPS..... Z-20(E)
- TURN & HAZARD FLASHER LIGHTS..... Z-22(F)
- BACK-UP LIGHTS..... Z-22(F)
- STOP LIGHTS..... Z-22(F)
- HORN..... Z-22(F)
- BACK HORN..... Z-22(F)
- HEATER..... Z-24(G)
- ROOM LAMPS..... Z-26(H)
- CIGARETTE LIGHTER..... Z-26(H)
- AUTO CLOCK..... Z-26(H)
- COMMON CONNECTOR LIST..... Z-28(X)
- PARTS LOCATION..... Z-29(PA)

## HOW TO USE THIS WIRING DIAGRAM

The complete electrical system is divided into charging system, ignition system, etc.

Each system is shown on both the right and left pages as described below.

When reading the wiring diagram, the following should be noted:

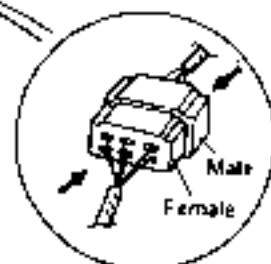
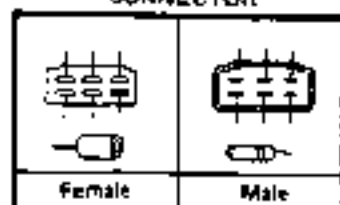


- Connector diagram identifies the exclusive applicable connectors for the circuit.

- Right page illustrates the actual location of each connector and the routing diagram of the harness.

- The last page, "Section X", illustrates common connectors related to each system.

## CONNECTOR



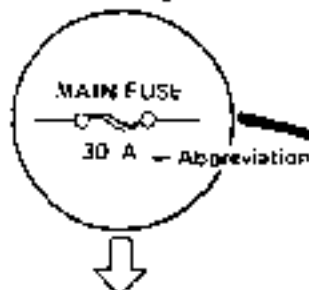
View of connector

**WIRING COLOR CODE**

Wiring color code is indicated with alphabetical letter(s). The first letter indicates the basic color of the wire, and second letter (if any) indicates the color of the stripe.

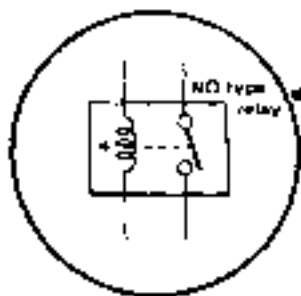
CODE	COLOR	CODE	COLOR
B	Black	LG	Light green
BR	Brown	O	Orange
G	Green	R	Red
L	Blue	Y	Yellow
LB	Light blue	W	White

The same main fuse and fuses are indicated on each page.

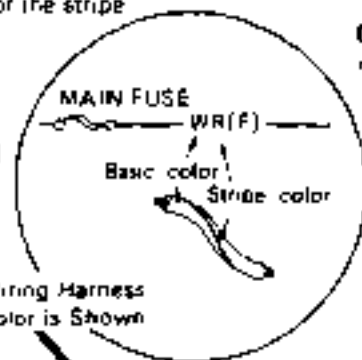


**ABBREVIATIONS USED IN THIS BOOKLET**

Abbr	Term	Abbr	Term
S	Start	A	Ampere
IGN	Ignition	W	Watt
ACC	Accessory	R	Resistance
AS	Auto stop	Tr	Transistor
INT	Intermittent	M	Motor
SW	Switch	SW	Switch
M	Middle	Sq	Square per millimeter
H	High	EC-AT	Electrically Automatic Transaxle
RH	Right hand	MT	Manual transaxle
LH	Left hand	NO	Normal opened
FR	Front right	NC	Normal closed
FL	Front left	A/C	Air Conditioner
RR	Rear right	AT	Automatic Transaxle
RL	Rear left		
V	Volt		
PS	Power Steering		

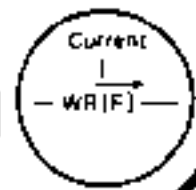


The relays and switches are identified as NC (normal closed), or NO (normal opened), to indicate their normal positions when they are not in operation.

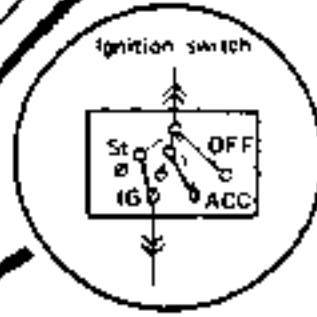
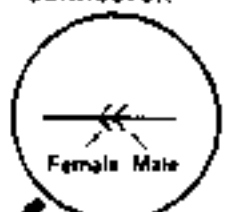


Wiring Harness Color is Shown

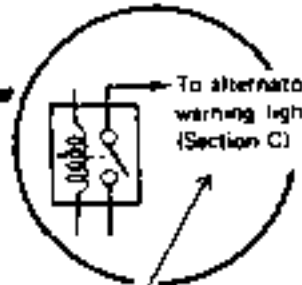
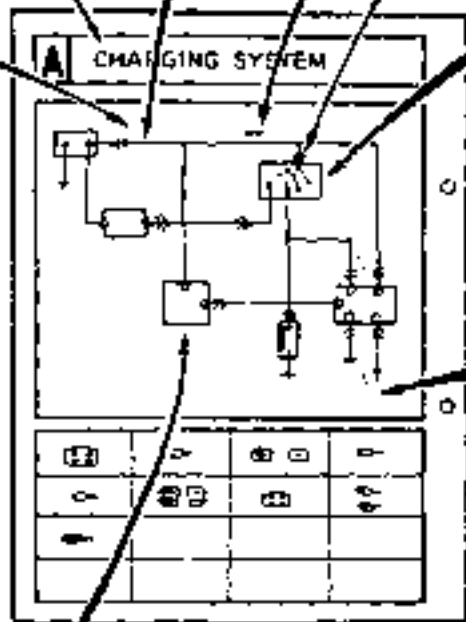
Direction of current is shown by the arrow



**CONNECTOR**



Circuit is shown with the ignition switch OFF.



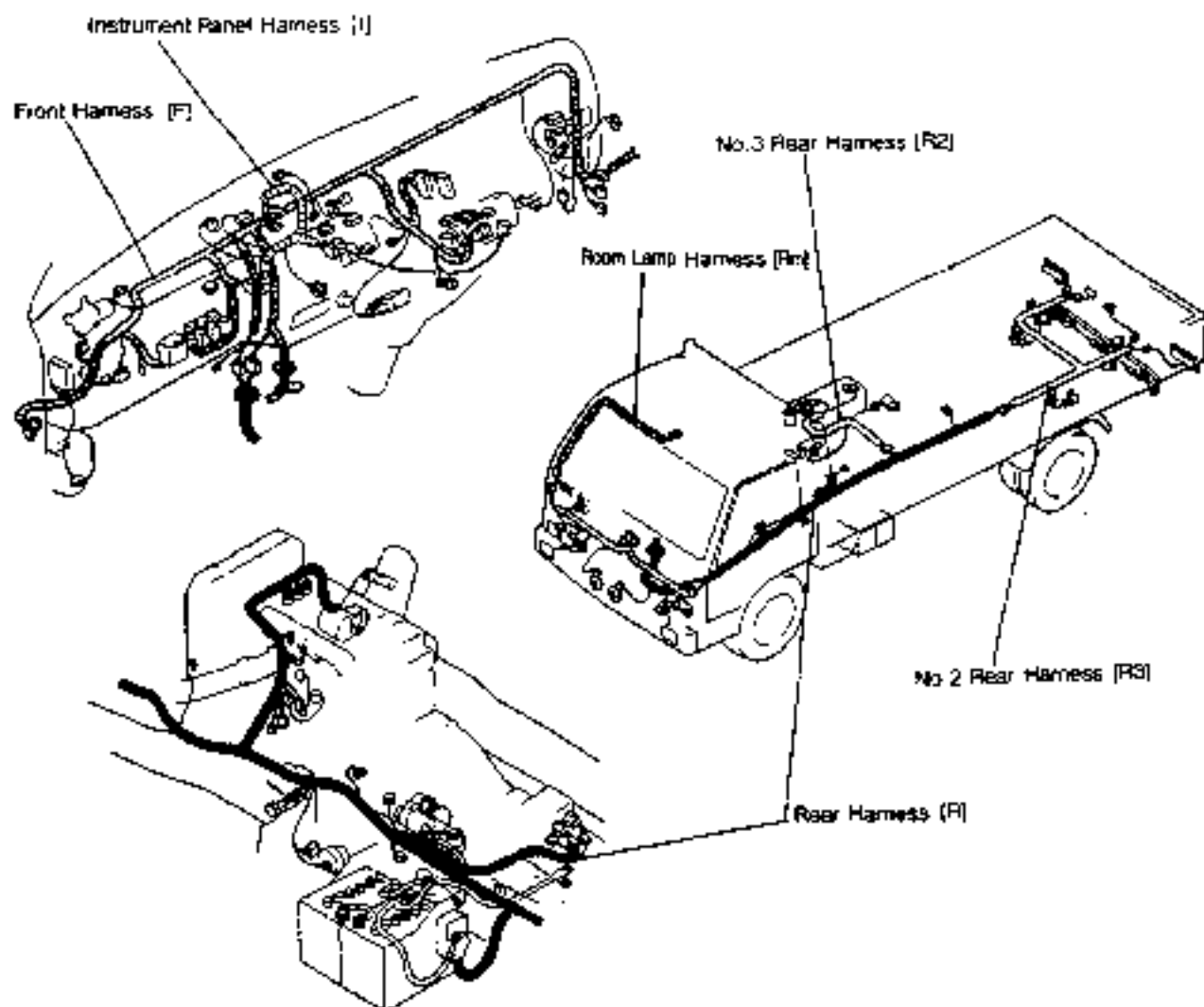
Legend in the parenthesis ( ) indicates the reference section.

	Relay		Switch	
	NO type relay	NC type relay	NO switch	NC switch
Not in operation				
In operation				

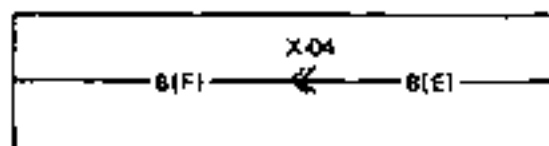
## HARNESS SYMBOLS

Each harness is distinguished by a symbol to indicate which harness it is.

DESCRIPTION OF HARNESS	SYMBOLS	DESCRIPTION OF HARNESS	SYMBOLS
Front Harness	(F)	No.3 Rear Harness	(R3)
Instrument Panel Harness	(I)		
Rear Harness	(R)		
Room Lamp Harness	(Rm)		
No.2 Rear Harness	(R2)		



## EXAMPLE OF CIRCUIT DIAGRAM



- It is seen from the above that the male-side black line of the X-04 shows the engine harness and the female-side black line shows the front harness.
- It is seen from the above that the X-04 connector is a connector connecting the engine and the front harness.

## EXAMPLE OF CONNECTOR

C-03 Fuel Tank Unit (R)


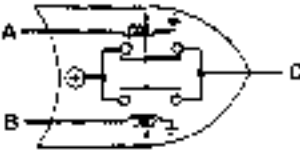

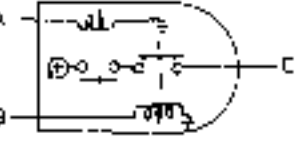
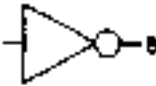
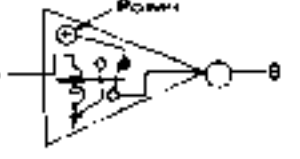
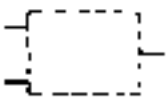
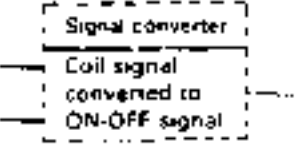


- This sign (+) means "empty" - Not used.
- It is seen from the above that this connector (C-03) is in the rear harness.


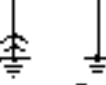





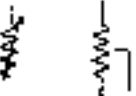



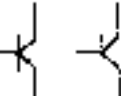
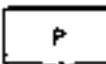







**SYMBOLS IN THIS WIRING DIAGRAM**

**LOGICAL SYMBOLS**

The logical symbols are of four kinds: OR, AND, INV (Inverter), PROCESS.  
The circuit operation can be easily read by understanding these symbols.

<p>OR</p> 	<p>In case of input to either A or B, an output comes out from C. When A and B are OFF (0V), C is OFF (0V). When either A or B is ON (12V), C is ON (12V). This is shown in the relay circuit on the right.</p>	
<p>AND</p> 	<p>In case of input to both A and B an output comes out from C. When A and B are ON (12V), C is ON (12V). When either A or B is OFF (0V), C is OFF (0V). This is shown in the relay circuit on the right.</p>	
<p>INV. (Inverter)</p> 	<p>In case of input to A, B is grounded. When A is OFF (0V), B is ON (12V). When A is ON (12V), B is OFF (0V). This is shown in the relay circuit on the right.</p>	
	<p>PROCESS makes a simplified representation of complicated functions of the circuit. Functions mainly used: 1. Detection of signals 2. Conversion of signals The process of the full transistor ignition control unit is as shown at the right.</p>	

**GRAPHIC SYMBOLS**

				
<p>Battery</p>	<p>Ground</p>	<p>Fuse</p>	<p>Main Fuse</p>	<p>Motor</p>
				
<p>Coil solenoid</p>	<p>Resistance</p>	<p>Variable resistance</p>	<p>Thermister</p>	<p>Diode</p>
				
<p>Condenser</p>	<p>Transistor</p>	<p>Pump</p>	<p>Lamp</p>	<p>Horn</p>
				
<p>Speaker</p>	<p>Cigarette lighter</p>	<p>Heater</p>	<p>Illuminated Diode</p>	<p>Zener Diode</p>

# WIRING DIAGRAM

Z

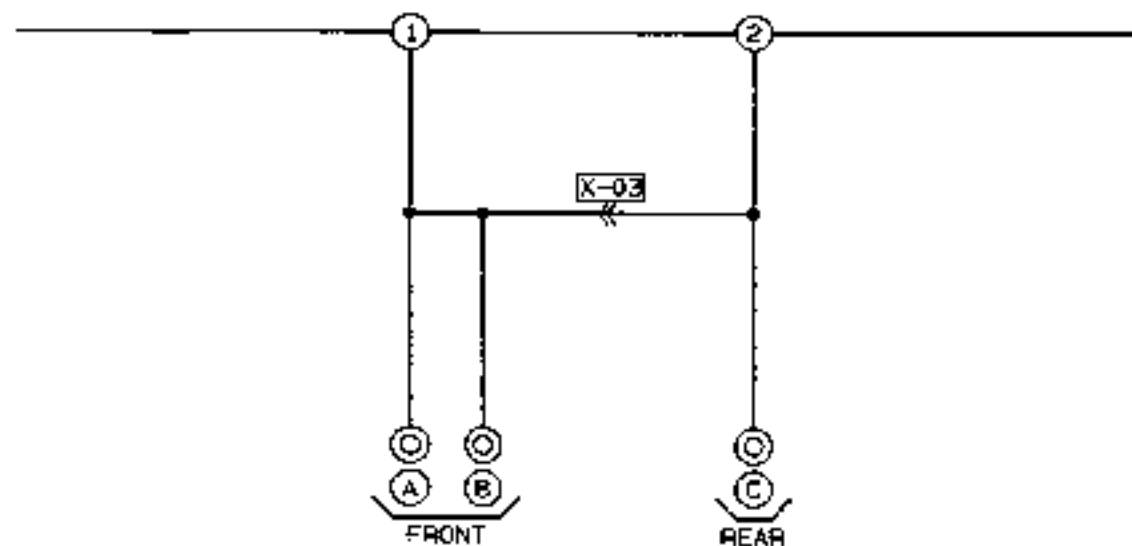
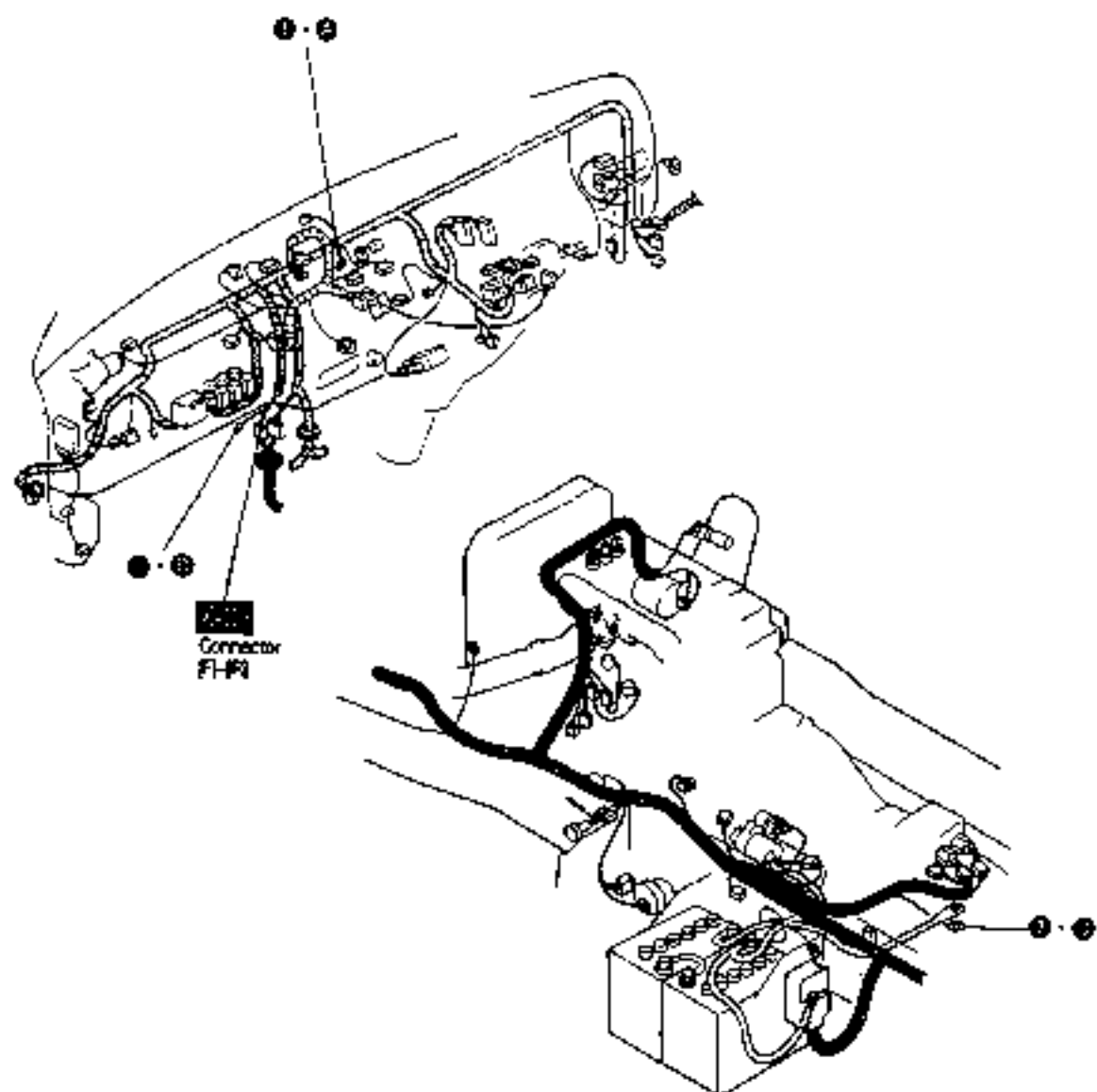
## PARTS INDEX

PI

PARTS NAME	SECTION	PARTS NAME	SECTION
① Accelerator Switch	B-2	① Neutral Switch	A, B-2
Air Heater Control Unit	B-2	② Oil Bypass Switch	C
Air Heater	B-2	Oil Level Sensor	C
Air Heater Relay	B-2	Oil Pressure Switch	C
Alternator With Regulator	A	③ P/E Select Switch	C
Auto Clock	H	PTO Switch	C
② Back Horn	F	Parking Brake Switch	C
Back-up Light Switch	F	Pick Up Sensor	C
Back-up Light	F	Position Light	E
Battery	A-H	④ QSS Control Unit	B-1
Blower Motor	G	⑤ Radio	H
Brake Fluid Level Switch	C	Rear Turn Light	F
③ Cancel Relay	B-2	Resistor Assembly	B
Cigarette Lighter	H	Road Lamp	H
Clutch Switch	B-2	⑥ Sedimentor Level Sensor	C
Condenser	F	Solenoid Valve	B-2
Combination Meter	C	Speaker	H
Combination Switch	E, F	Starting Motor	A
Coolant Level Sensor	C	Stop Light Checker Relay	F
Coolant Level Unit	C	Stop Light Switch	F
④ Door Switch	H	Stop Light	F
⑦ Engine Switch	A-H	Sub Mission Switch	C
Exhaust Brake Switch	B-2	Sub Starting Switch	A
Exhaust Heating Switch	B-2	⑧ Tail Light	E
Exhaust Heating Control Unit	B-2	⑨ Vacuum Switch	C
⑤ Fan Switch	G	⑩ Washer Motor	D
Flasher Unit	F	Water Thermo Switch	B-1
Fog Light Switch	E	Water Thermo Sensor	B-2, C
Front Turn Light	F	Wiper & Washer Switch	D
Fuel Cut Solenoid Valve	B-1	Wiper Motor	D
Fuel Tank Gauge Unit	C		
Fusible Link	A		
⑥ Glow Plug Relay	B-2		
Glow Plug	B-2		
① Headlight	E		
Horn Relay	F		
Horn Switch	F		
Horn	F		
⑪ Illumination Lamps	E		
Heater Control Illum.			
Meter Illum.			
Radio Illum.			
Intermittent Wiper Relay	D		
⑫ License Light	E		
⑬ Magnetic Valve	B-2		
Main Fuse	A-H		

JC

## ■ GROUND CIRCUIT

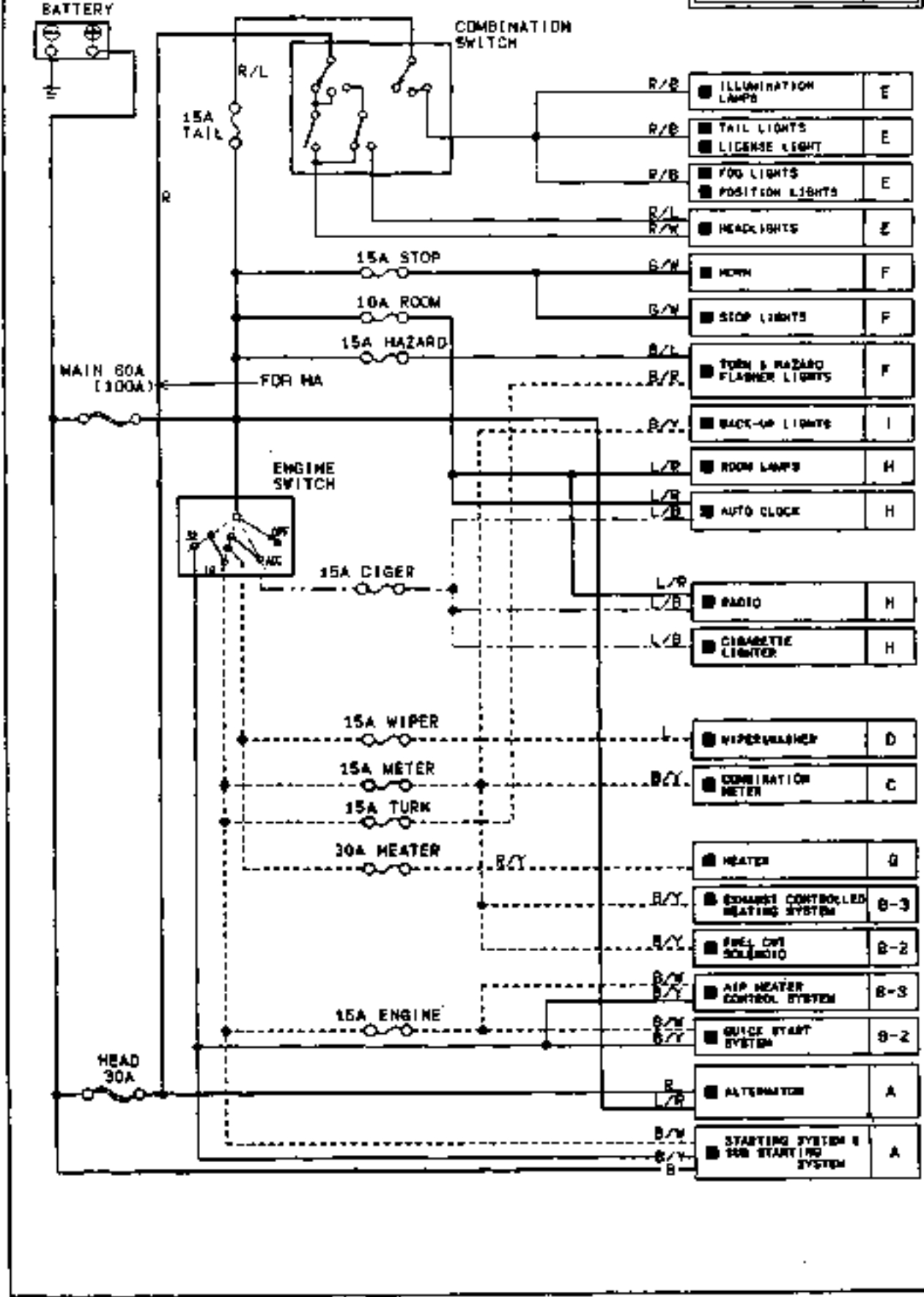




W ■ ELECTRICAL WIRING SCHEMATIC

--- Green (Left Battery)  
 --- Green (Right Battery)  
 --- Green (ACC Terminal of Green Battery)  
 --- Blue

SYSTEM CIRCUIT SECTION

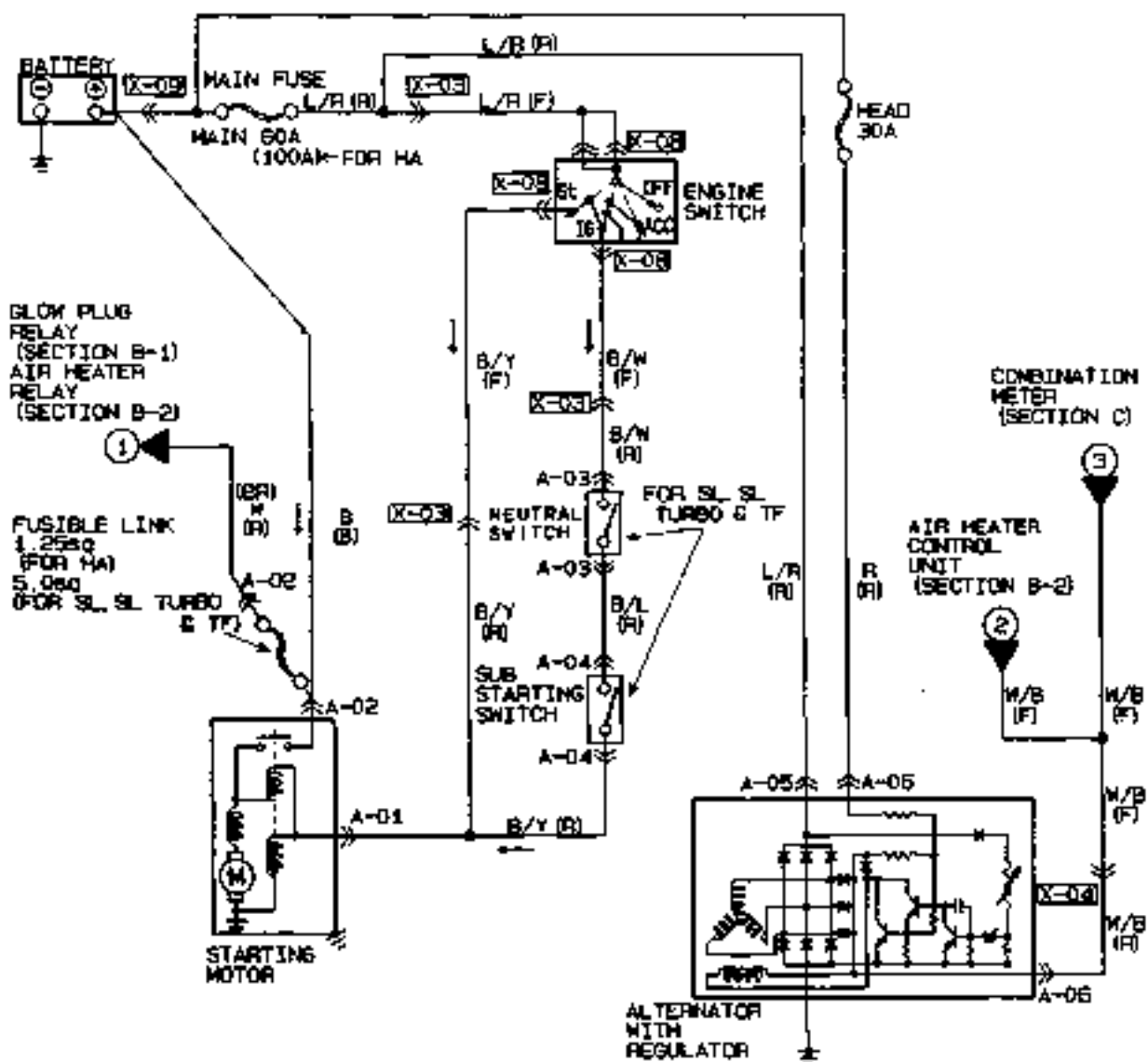


WIRING DIAGRAM

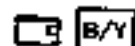
A

■ STARTING SYSTEM ■ SUB STARTING SYSTEM  
 ■ CHARGING SYSTEM

( ): FOR SL SL TURBO & TF



A-01 STARTING MOTOR (R)



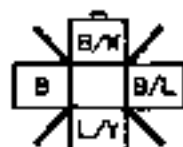
A-02 STARTING MOTOR (B) & FUSIBLE LINK (R)  
 FUSIBLE LINK 1.25A (FOR HA)



FUSIBLE LINK 5.0A (FOR SL SL TURBO & TF)



A-03 NEUTRAL SWITCH (R)  
 (FOR SL SL TURBO & TF)



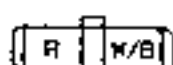
A-04 SUB STARTING SWITCH (R)



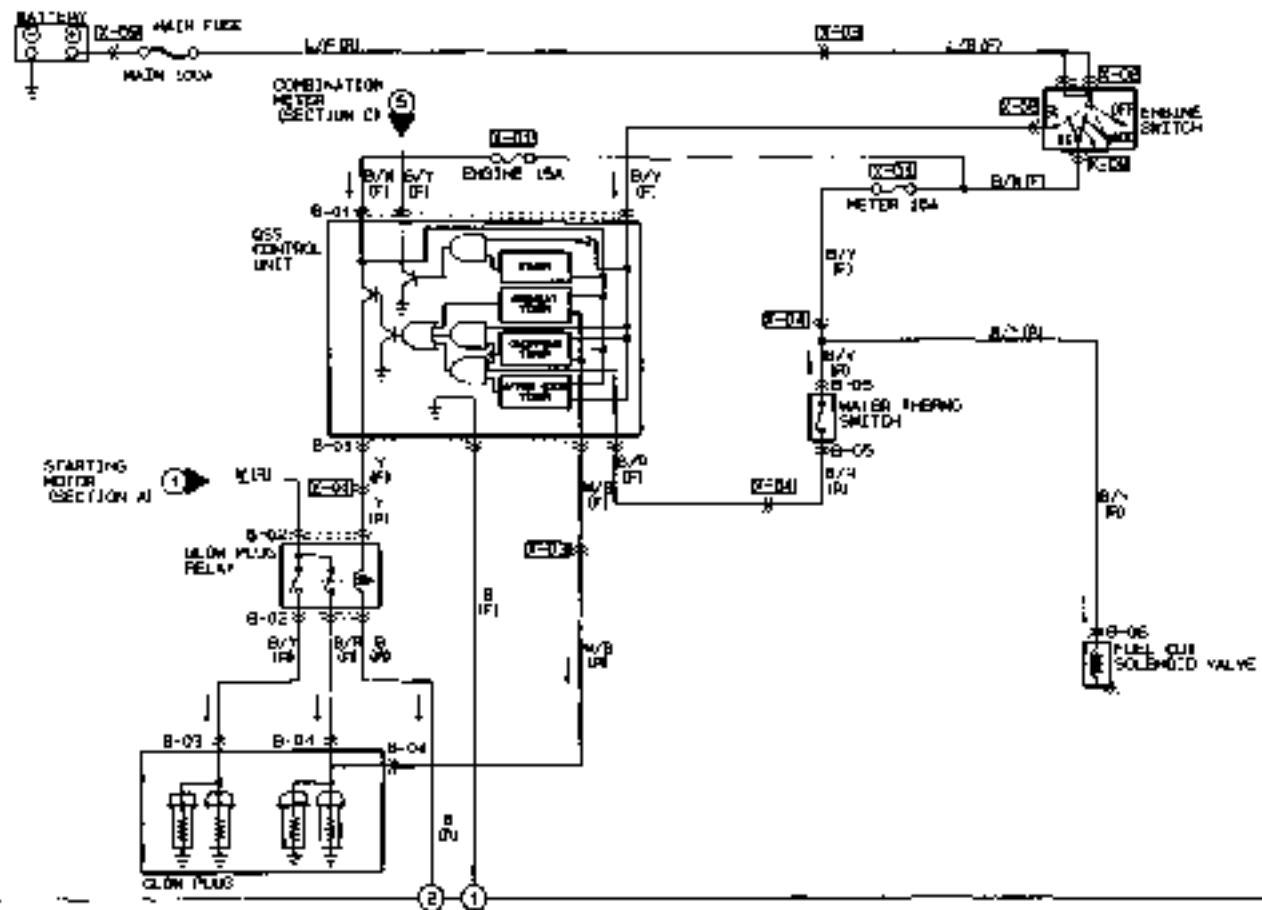
A-05 ALTERNATOR WITH REGULATOR (R)



A-06 ALTERNATOR WITH REGULATOR (R)

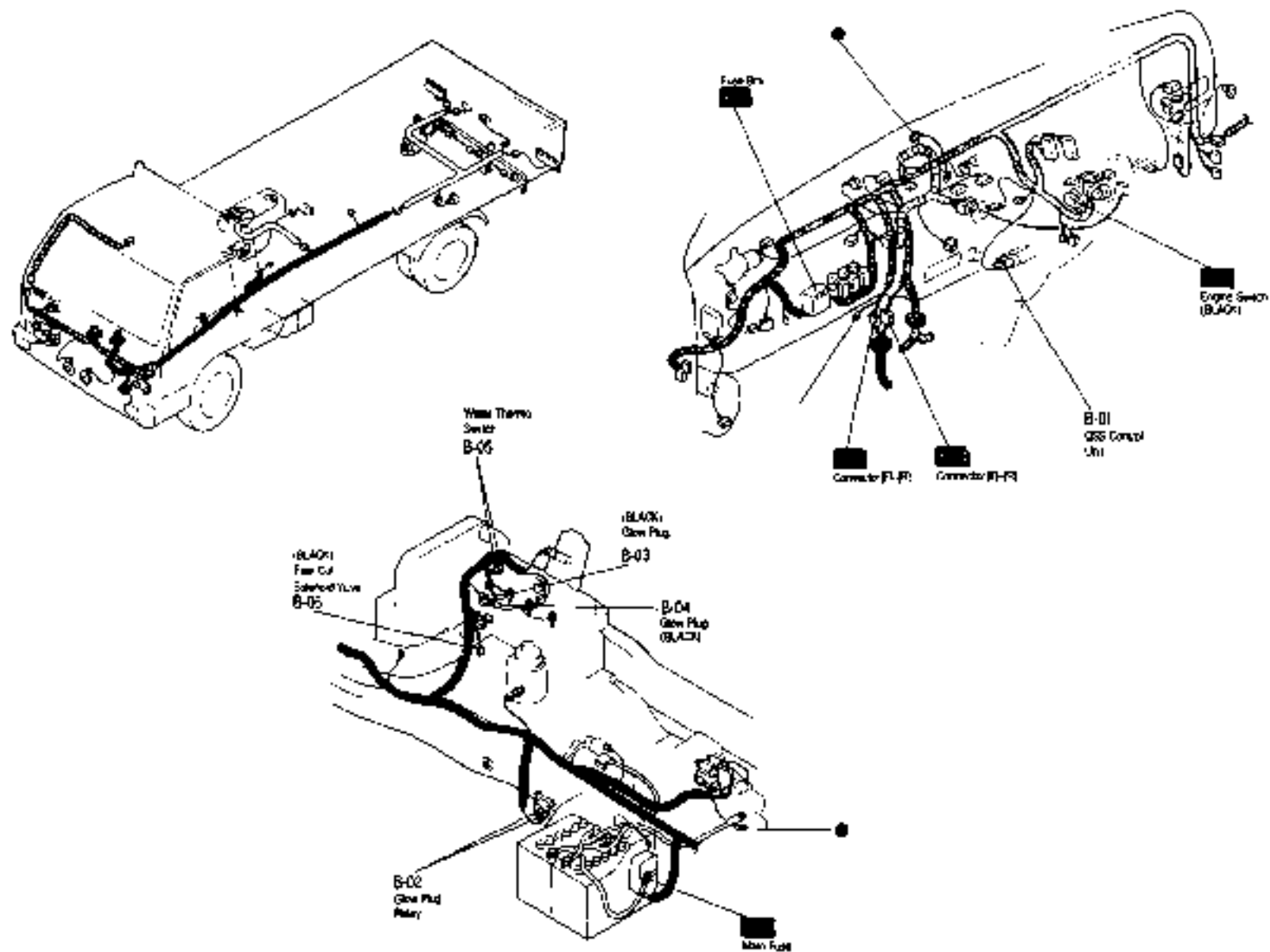




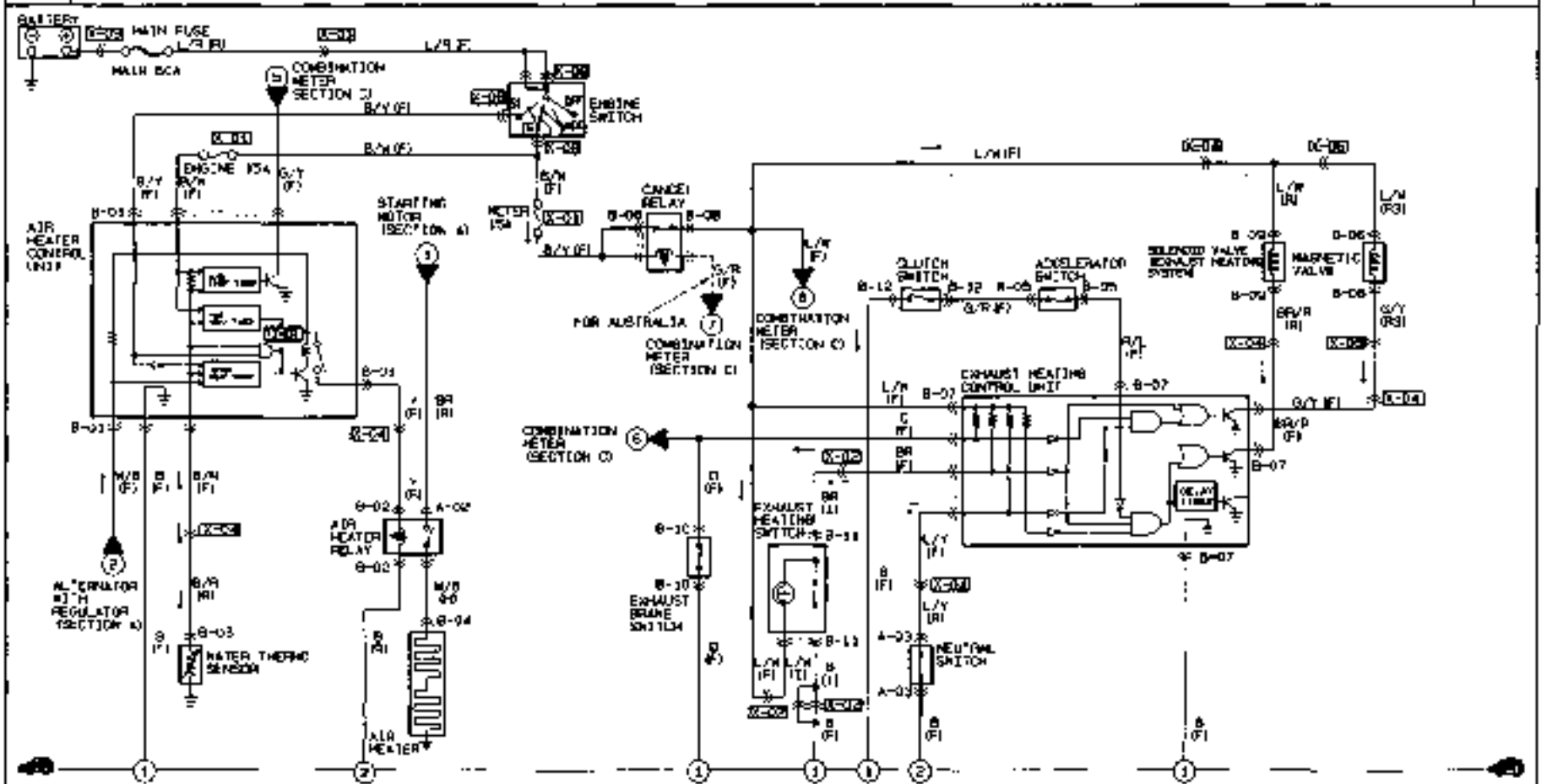


<p>B-01 GSS CONTROL UNIT (P)</p>	<p>B-02 GLOW PLUG RELAY (P)</p>	<p>B-03 GLOW PLUG (N)</p>	<p>B-04 GLOW PLUG (N)</p>	<p>B-05 WATER THERMO SWITCH (N)</p>	<p>B-06 FUEL CUT SOLENOID VALVE (N)</p>

NOTE: W - NOT USED



B-2 FOR SL, SL TURBO & TF ■ AIR HEATER CONTROL SYSTEM ■ EXHAUST CONTROLLED HEATING SYSTEM ■ B-2



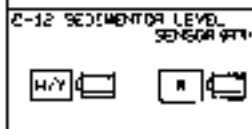
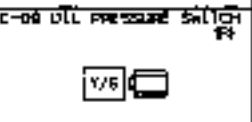
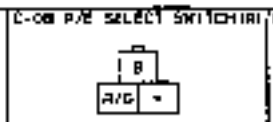
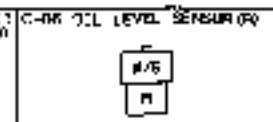
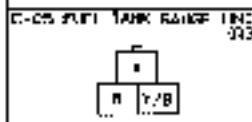
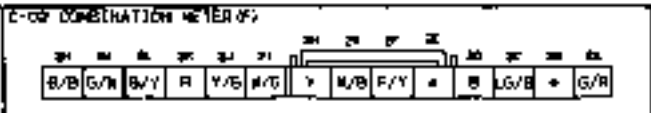
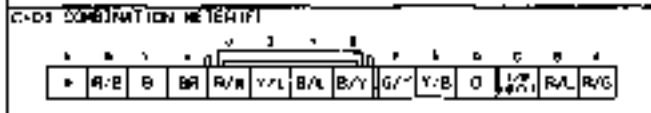
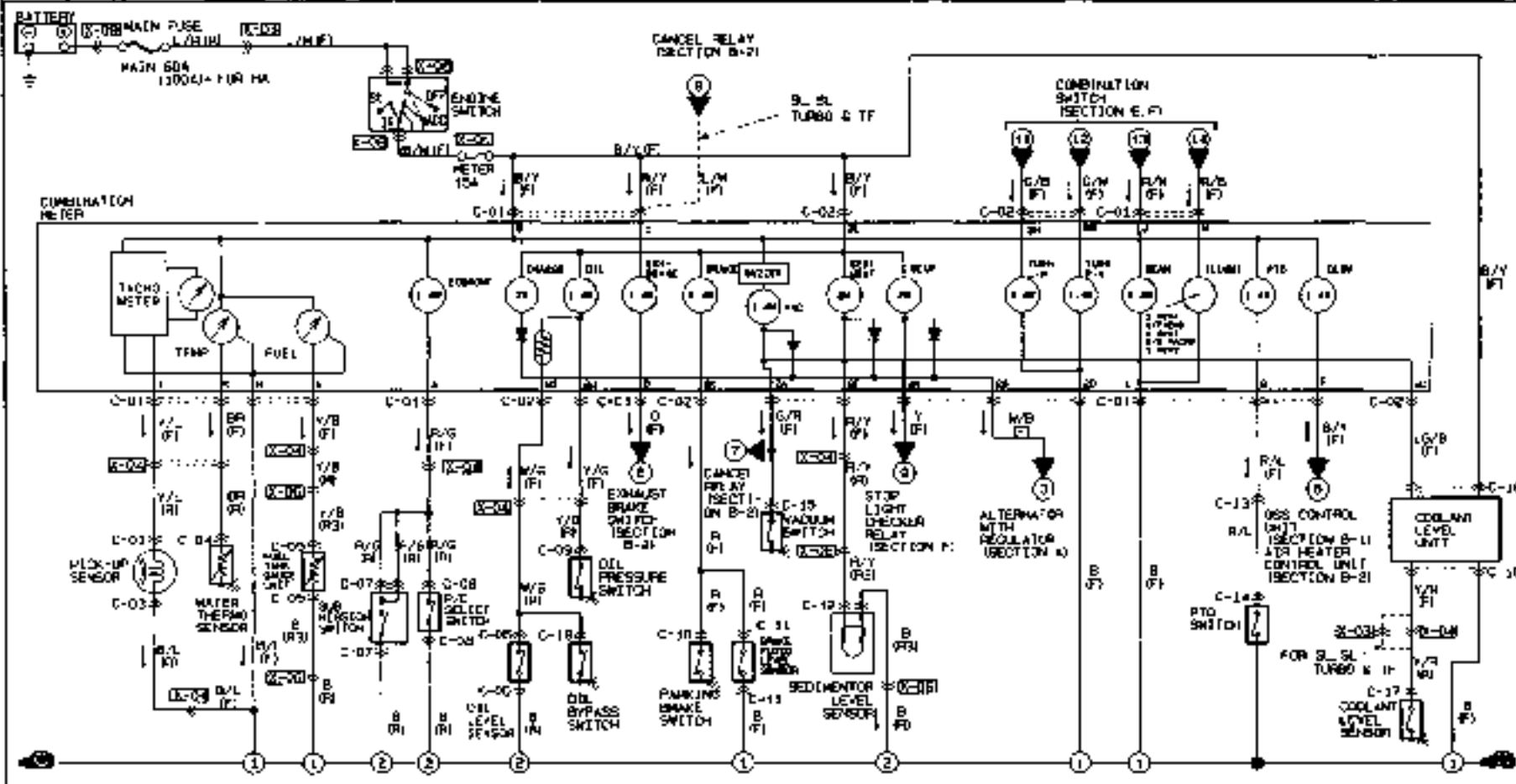
<p>B-01 AIR HEATER CONTROL UNIT (F)</p>	<p>B-02 AIR HEATER RELAY (R)</p>	<p>B-03 WATER THERMO SENSOR (R)</p>	<p>B-04 AIR HEATER (R)</p>	<p>B-05 ACCELERATOR SWITCH (F)</p>	<p>B-06 MAGNETIC VALVE (R)</p>	<p>B-07 EXHAUST HEATING CONTROL UNIT (F)</p>
<p>B-08 CANCEL RELAY (F)</p>	<p>B-09 SOLENOID VALVE EXHAUST HEATING SYSTEM (R)</p>	<p>B-10 EXHAUST BRAKE SWITCH (F)</p>	<p>B-11 EXHAUST HEATING SWITCH (L)</p>	<p>B-12 CLUTCH SWITCH (F)</p>	<p>A-03 NEUTRAL SWITCH (R)</p>	
<p>A-02 STARTING MOTOR (R) &amp; FUSIBLE LINK (R)</p>		<p>FUSIBLE LINK 5.0A (R)</p>		<p>NOTE: --- NOT USED</p>		

NOTE: --- NOT USED

1 : FOR OPEN CAB.

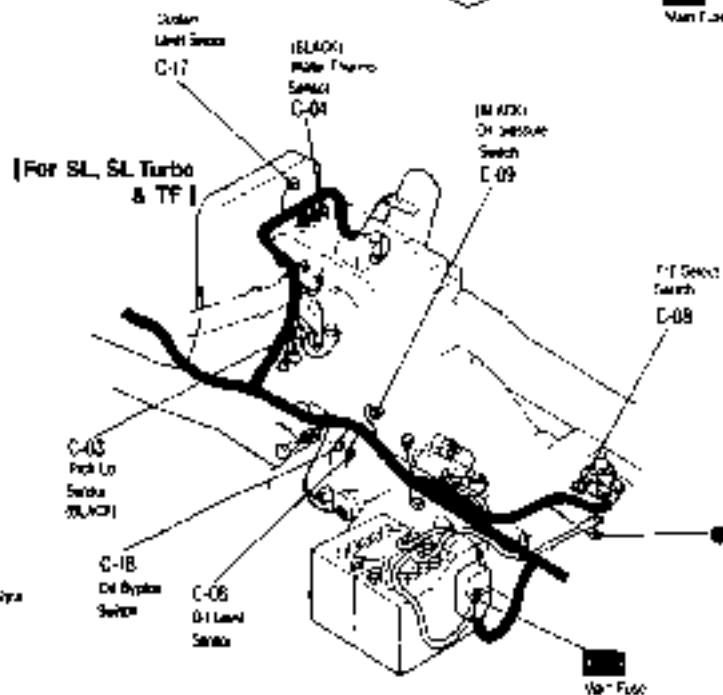
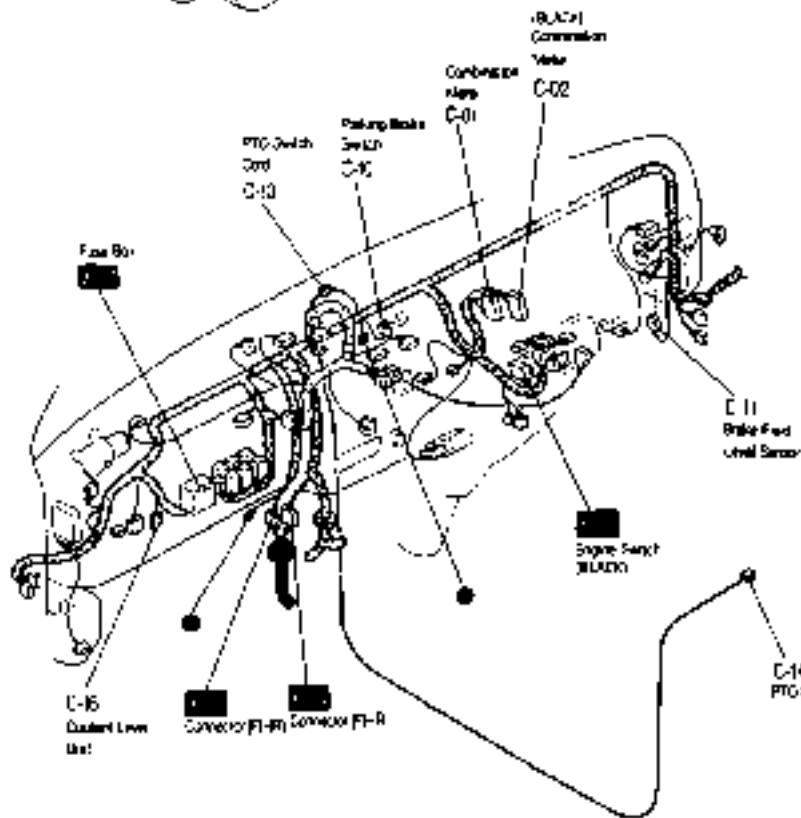
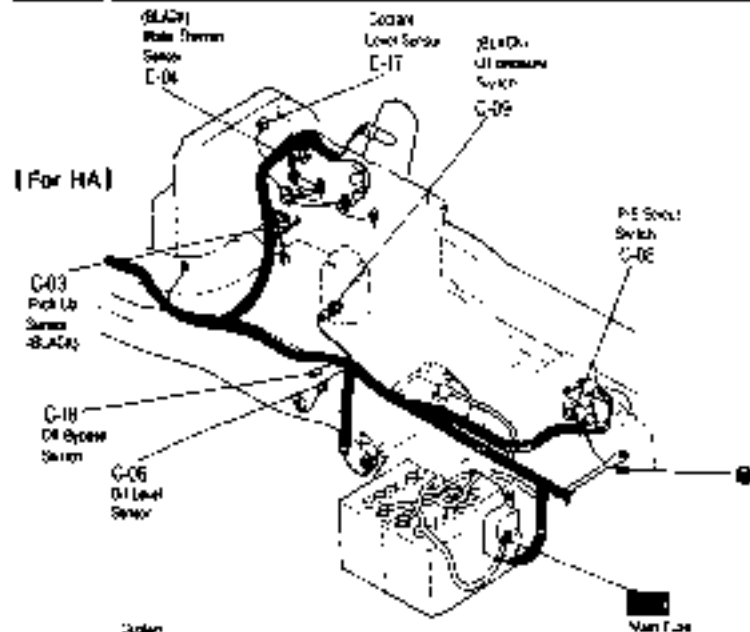
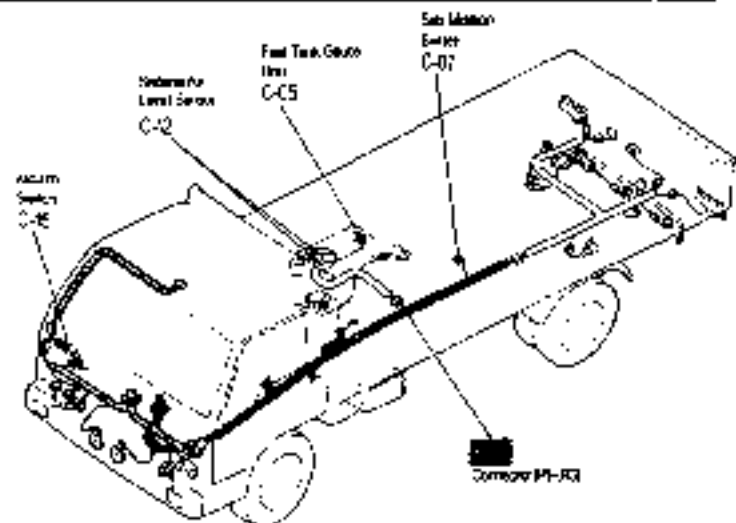


C • METER & WARNING LAMPS

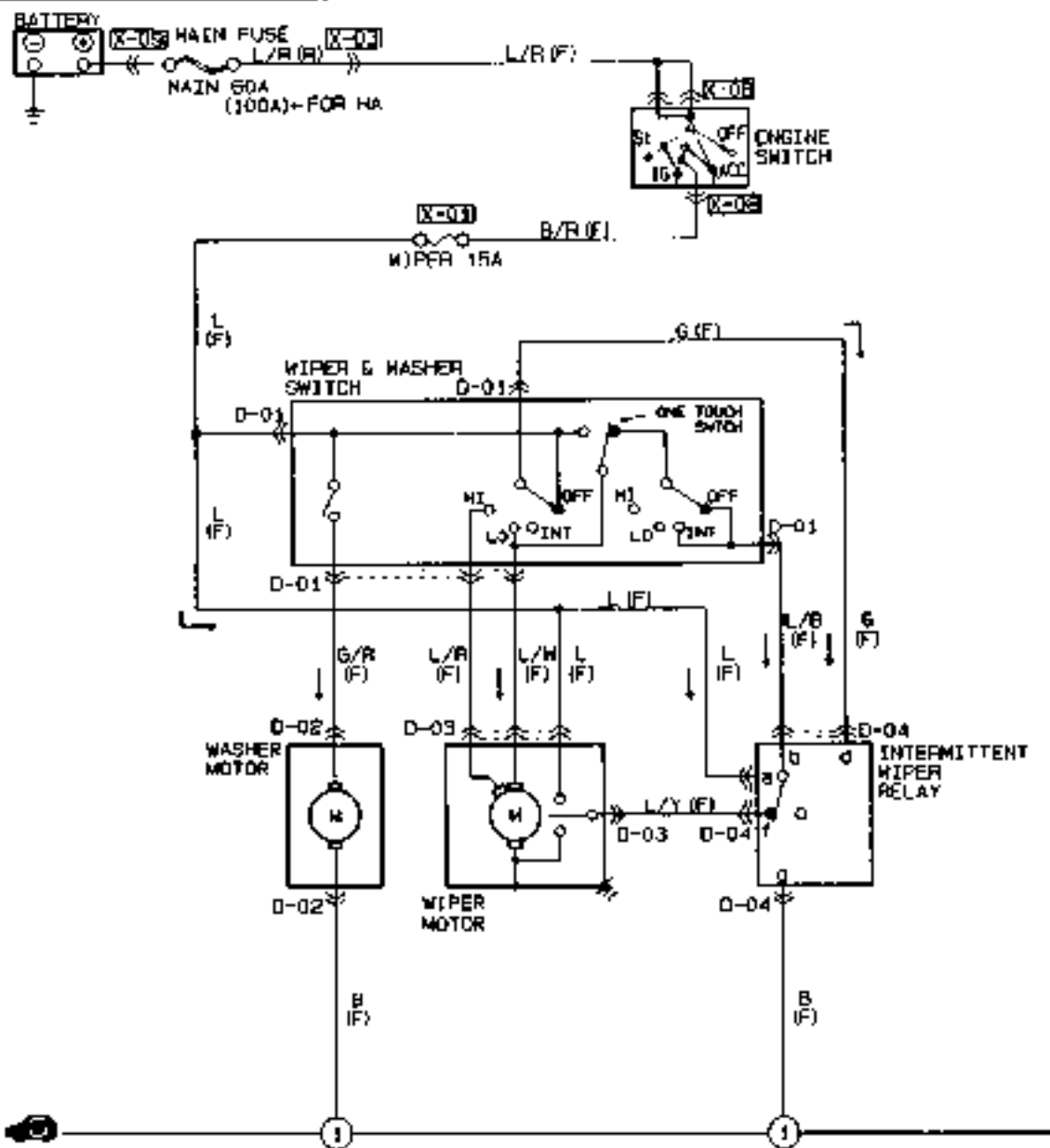


NOTE: R - NOT USED  
Y - 16





D ■ WIPER & WASHER



D-01 WIPER & WASHER SWITCH (F)

L	G	G/R
L/R	L/B	L/W

D-02 WASHER MOTOR (F)

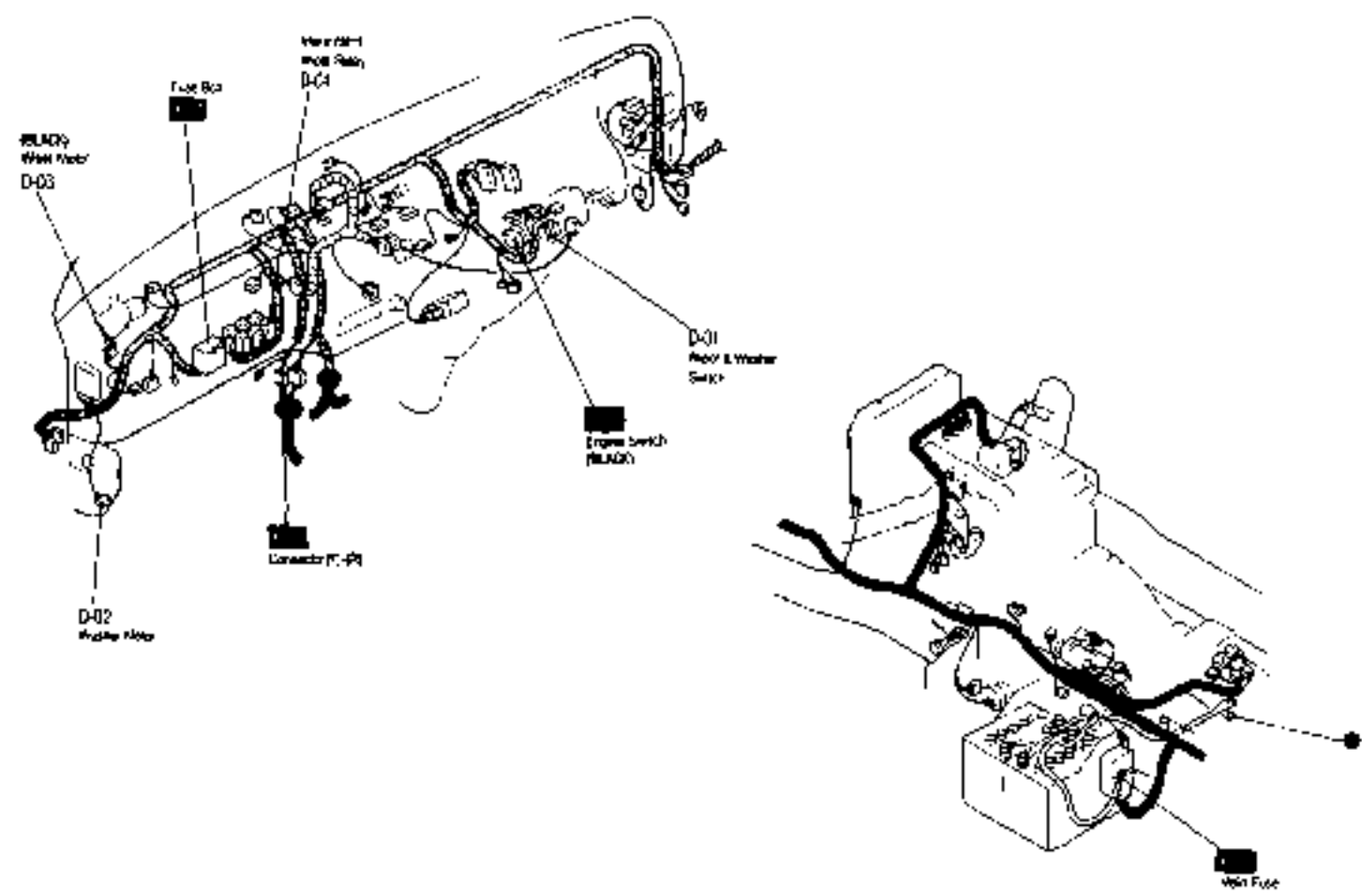
B
B/R

D-03 WIPER MOTOR (F)

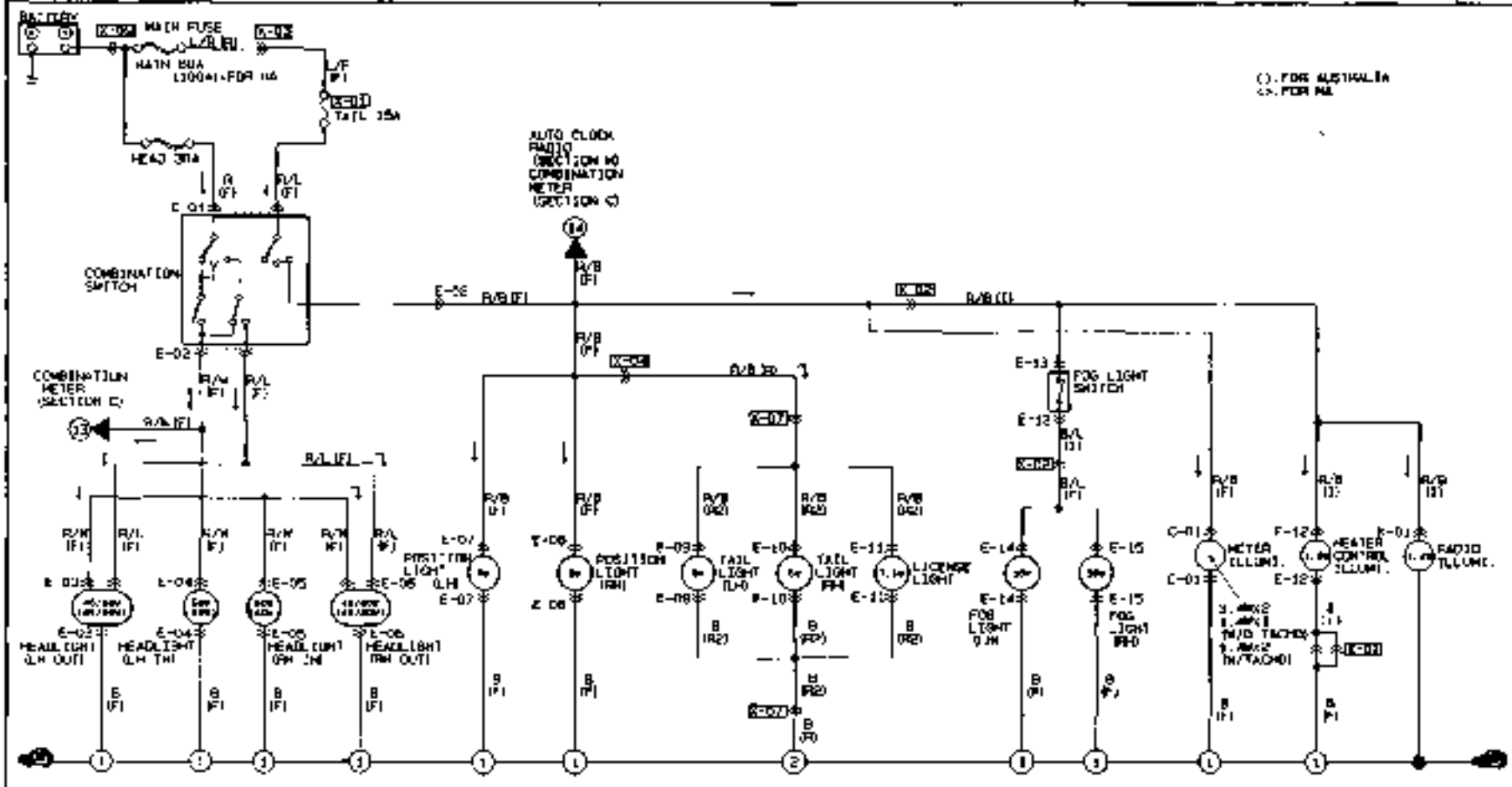
L/N	L/R
L	L/Y

D-04 INTERMITTENT WIPER RELAY (F)

B		A	
H	L	L	L
H	L/Y	G	L/B
H	F	G	B



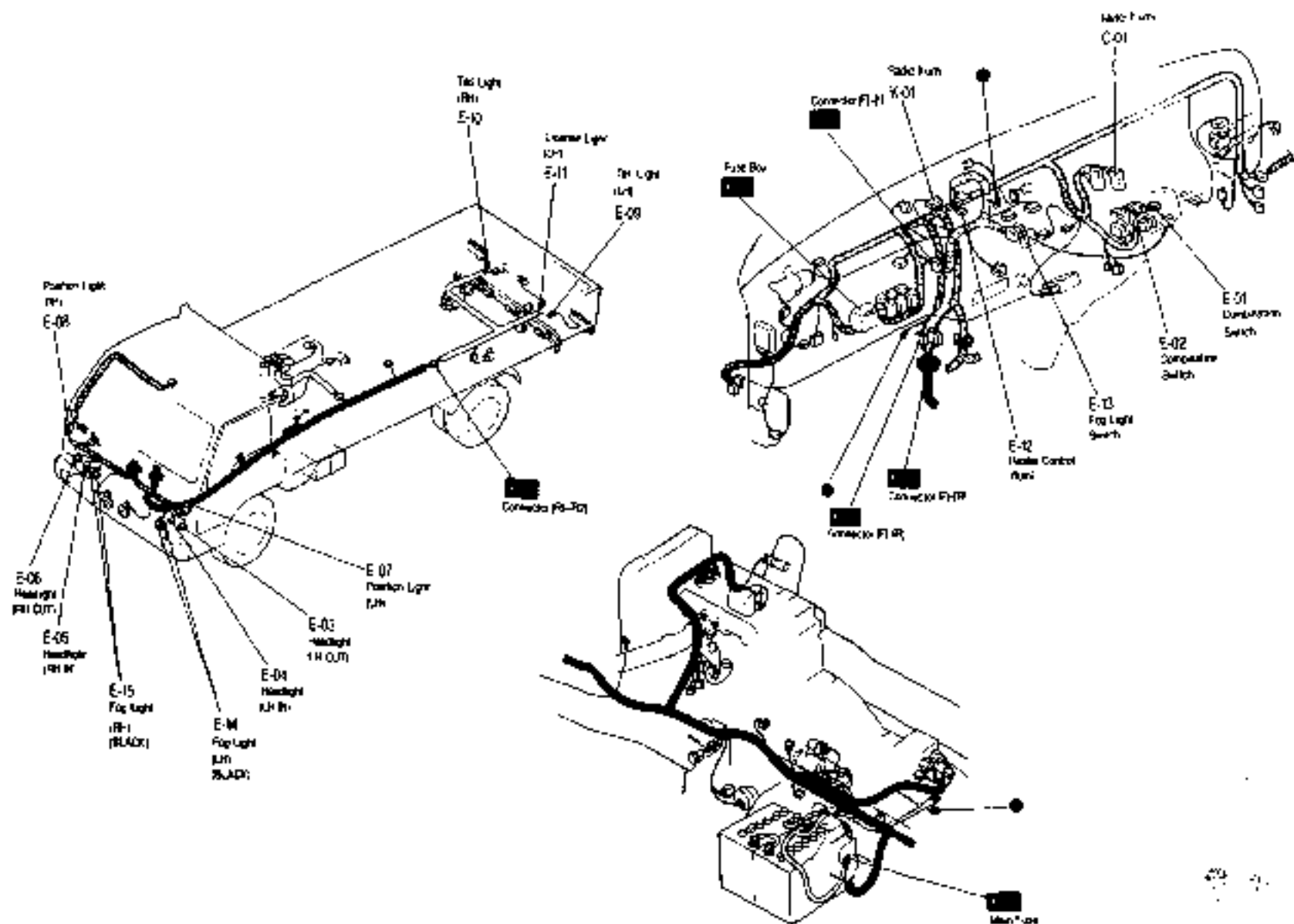
E HEADLIGHTS • POSITION LIGHTS • TAIL LIGHTS • LICENSE LIGHT • FOG LIGHTS • ILLUMINATION LAMPS



(C) FOR AUSTRALIA  
(S) FOR N.E.

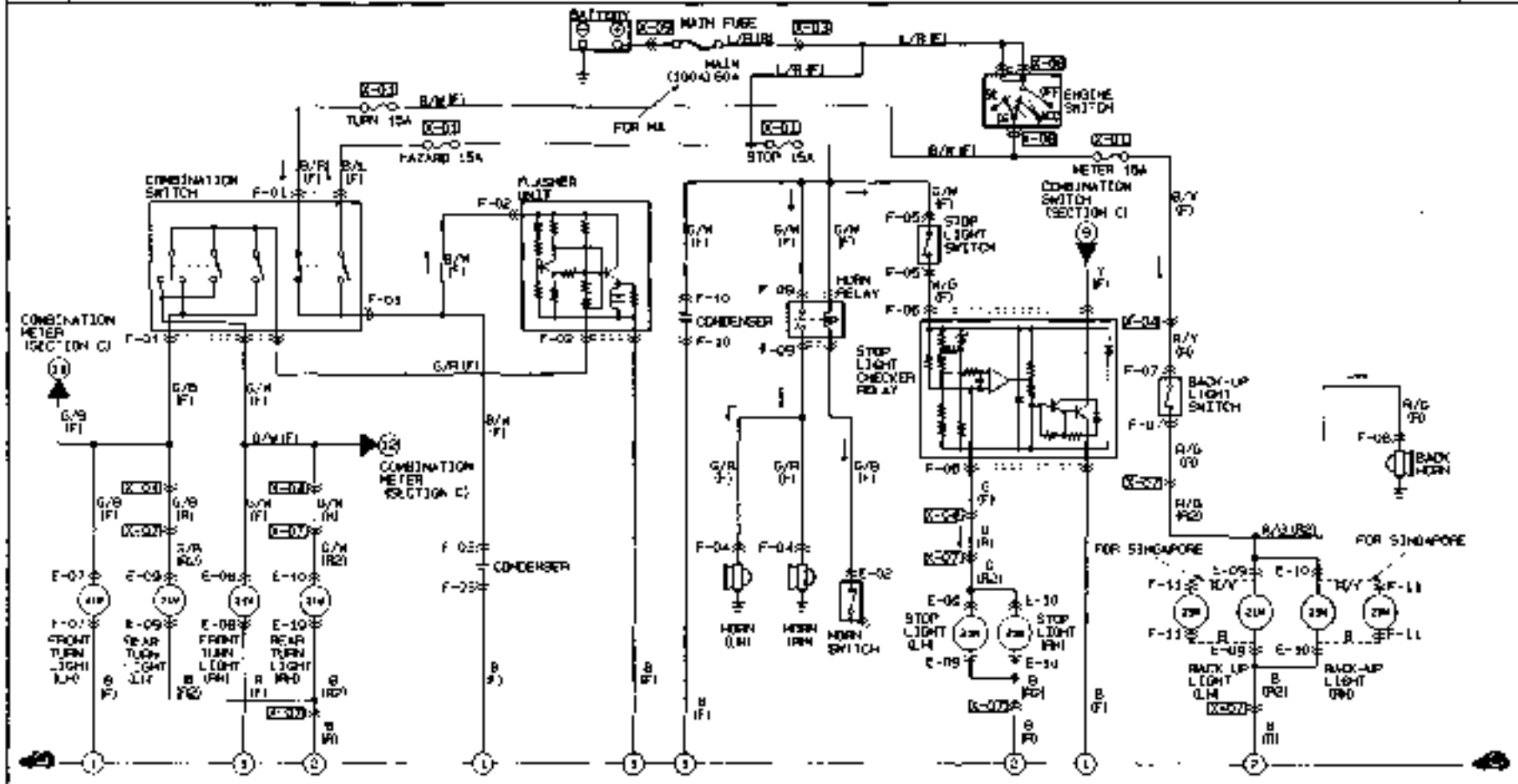
E-01 COMBINATION SWITCH (F1)	E-02 COMBINATION SWITCH (F1)	E-03 HEADLIGHT LH OUT (F1)	E-04 HEADLIGHT LH INT (F1)	E-05 HEADLIGHT RH INT (F1)	E-06 HEADLIGHT RH OUT (F1)	E-07 POSITION LIGHT LH (F1)
E-08 POSITION LIGHT RH (F1)	E-09 TAIL LIGHT LH (R2)	E-10 TAIL LIGHT RH (R2)	E-11 LICENSE LIGHT LH (R2)	E-12 HEATER CONTROL ILLUM. (L1)	E-13 FOG LIGHT SWITCH (D)	E-14 FOG LIGHT LH (F1)
E-15 FOG LIGHT RH (F1)	E-01 METER ILLUM. (F1)		E-05 RADIO ILLUM. (C1)			

NOTE: --- NOT USED



409

F ■ TURN & HAZARD FLASHER LIGHTS ■ BACK-UP LIGHTS ■ STOP LIGHTS ■ HORN ■ BACK HORN

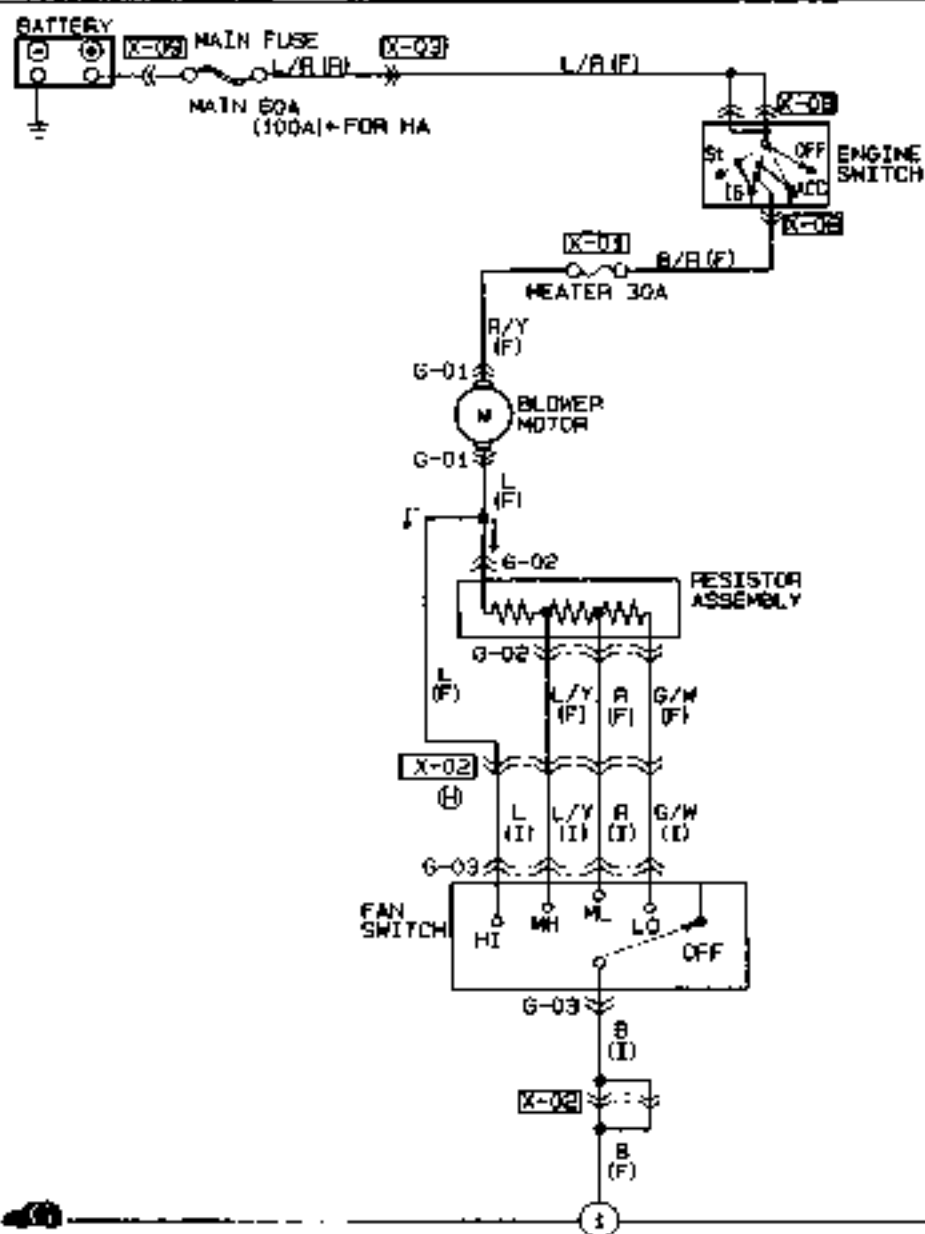


<p>F-01 COMBINATION SWITCH (F1)</p>	<p>F-02 FLASHER UNIT (F1)</p>	<p>F-03 CONDENSER (F1)</p>	<p>F-04 HORN (F1)</p>	<p>F-05 STOP LIGHT SWITCH (F1)</p>	<p>F-06 STOP LIGHT CHECKER RELAY (F1)</p>	<p>F-07 BACK-UP LIGHT SWITCH (F1)</p>
<p>F-08 BACK HORN (E2)</p>	<p>F-09 HORN RELAY (F1)</p>	<p>F-10 CONDENSER (F1)</p>	<p>F-11 BACK-UP LIGHT FOR SINGAPORE</p>	<p>E-02 HORN SWITCH (F1)</p>	<p>E-07 FRONT TURN LIGHT (E1) (F1)</p>	<p>E-08 FRONT TURN LIGHT (E1) (E1)</p>
<p>E-09 REAR COMBINATION LIGHT (E1) (E2)</p>	<p>E-10 REAR COMBINATION LIGHT (E1) (E2)</p>					

NOTE: NOT USED



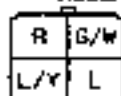
## G ■ HEATER



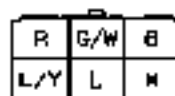
G-01 BLOWER MOTOR (F)



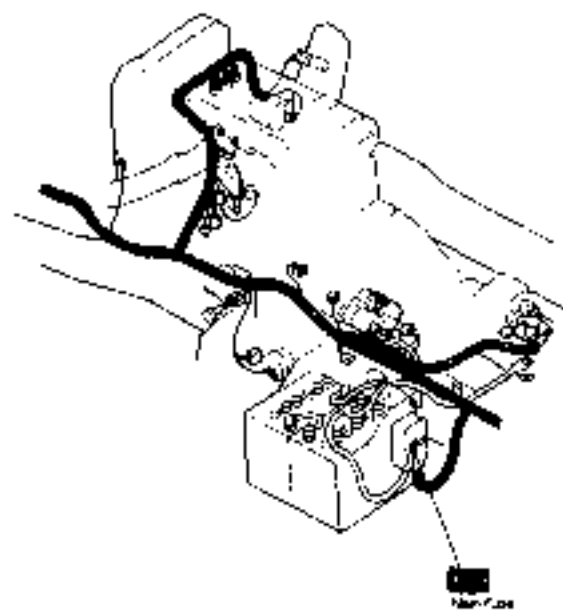
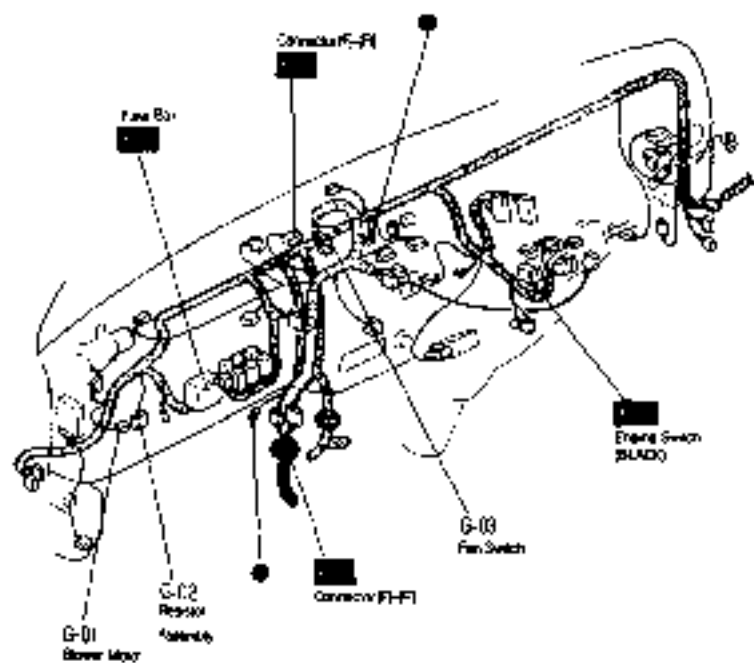
G-02 RESISTOR ASSEMBLY (F)

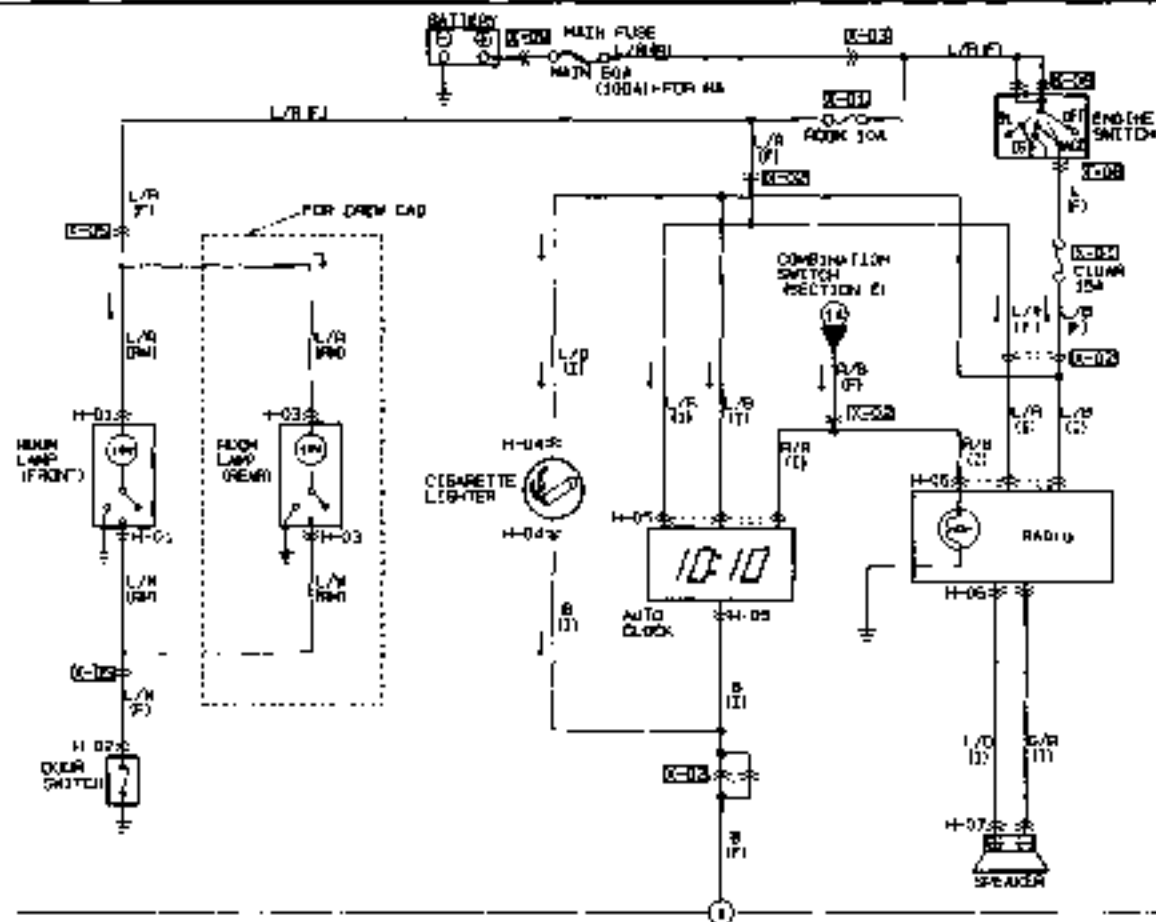


G-03 FAN SWITCH (I)









H-01 ROOM LAMP (FRONT) (RM) H-02 DOOR SWITCH (F)



H-03 ROOM LAMP (REAR) (RM)



H-04 CIGARETTE LIGHTER



H-05 AUTO CLOCK (C)



H-06 RADIO (R)



H-07 SPEAKER (S)

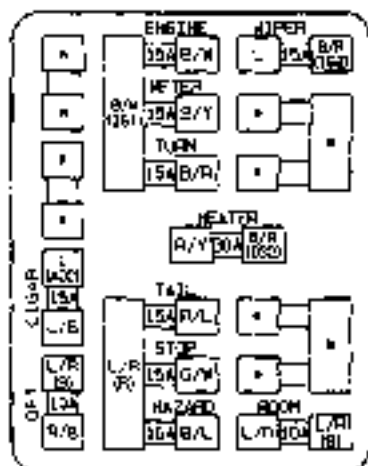


WIRING DIAGRAM

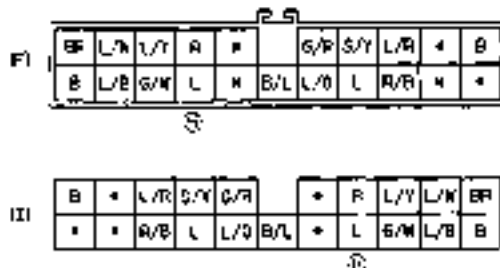
COMMON CONNECTOR LIST I: FOR SL, SL TURBO & IT

X

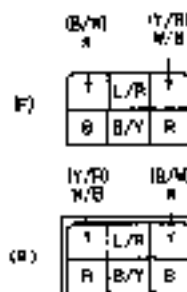
X-01 FUSE BOX (FI)



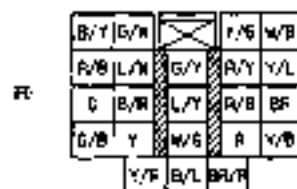
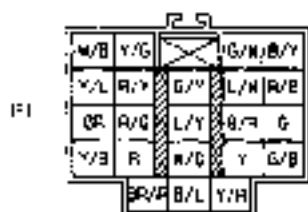
X-02 CONNECTOR BETWEEN FRONT (FI) AND INSTRUMENT PANEL HARNESS (II)



X-03 CONNECTOR BETWEEN FRONT (F) AND REAR HARNESS (R)



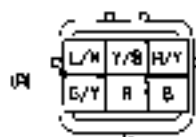
X-04 CONNECTOR BETWEEN FRONT (F) AND REAR HARNESS (R)



X-05 CONNECTOR BETWEEN FRONT (F) AND REAR HARNESS (R)



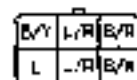
X-06 CONNECTOR BETWEEN REAR HARNESS (R) AND NO. 3 REAR HARNESS (R3)



X-07 CONNECTOR BETWEEN REAR HARNESS (R) AND NO. 2 REAR HARNESS (R2)



X-08 ENGINE SWITCH (F)



X-09 MAIN FUSE (B) (INSIDE)





