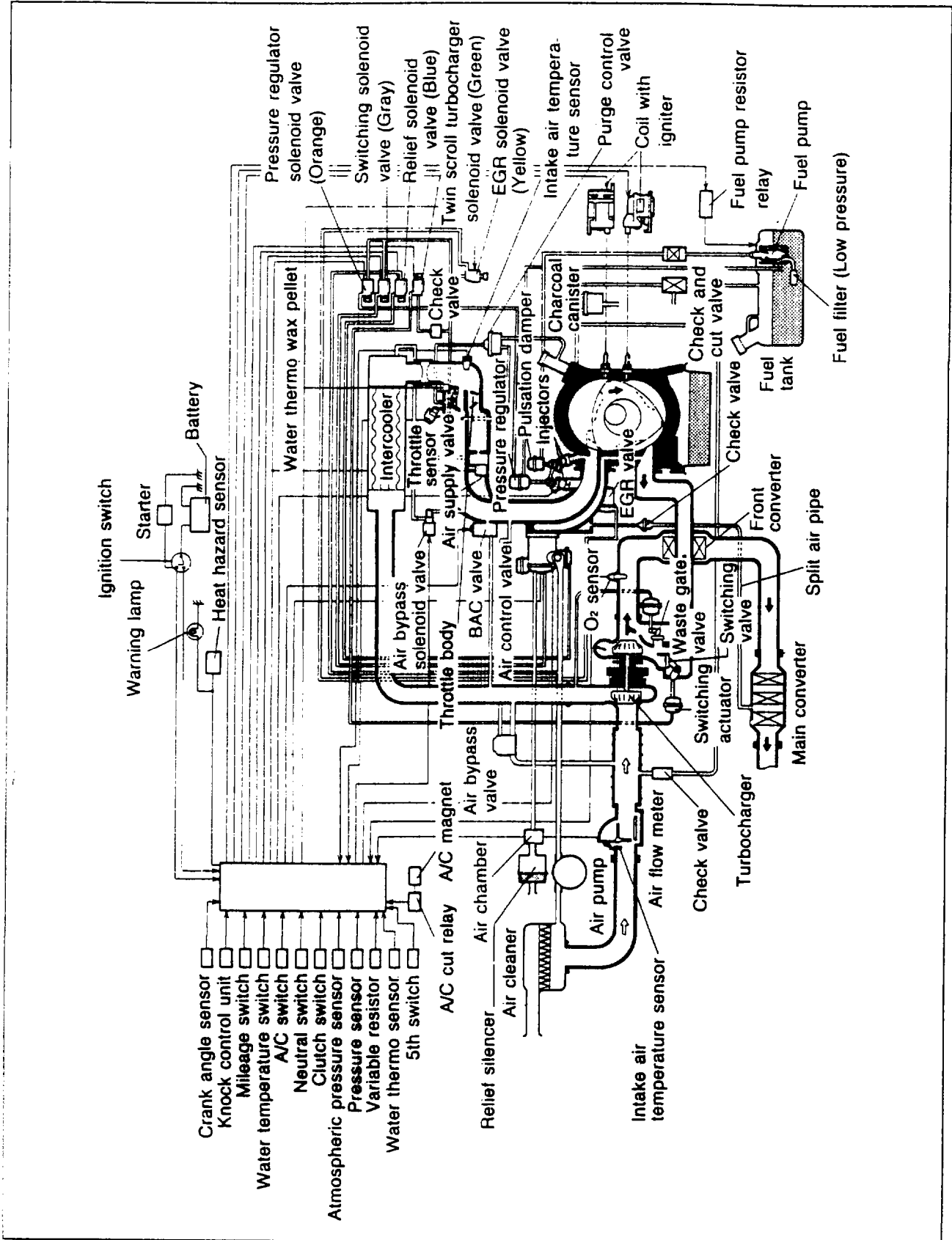


FUEL AND EMISSION CONTROL SYSTEMS (EGI TURBO)

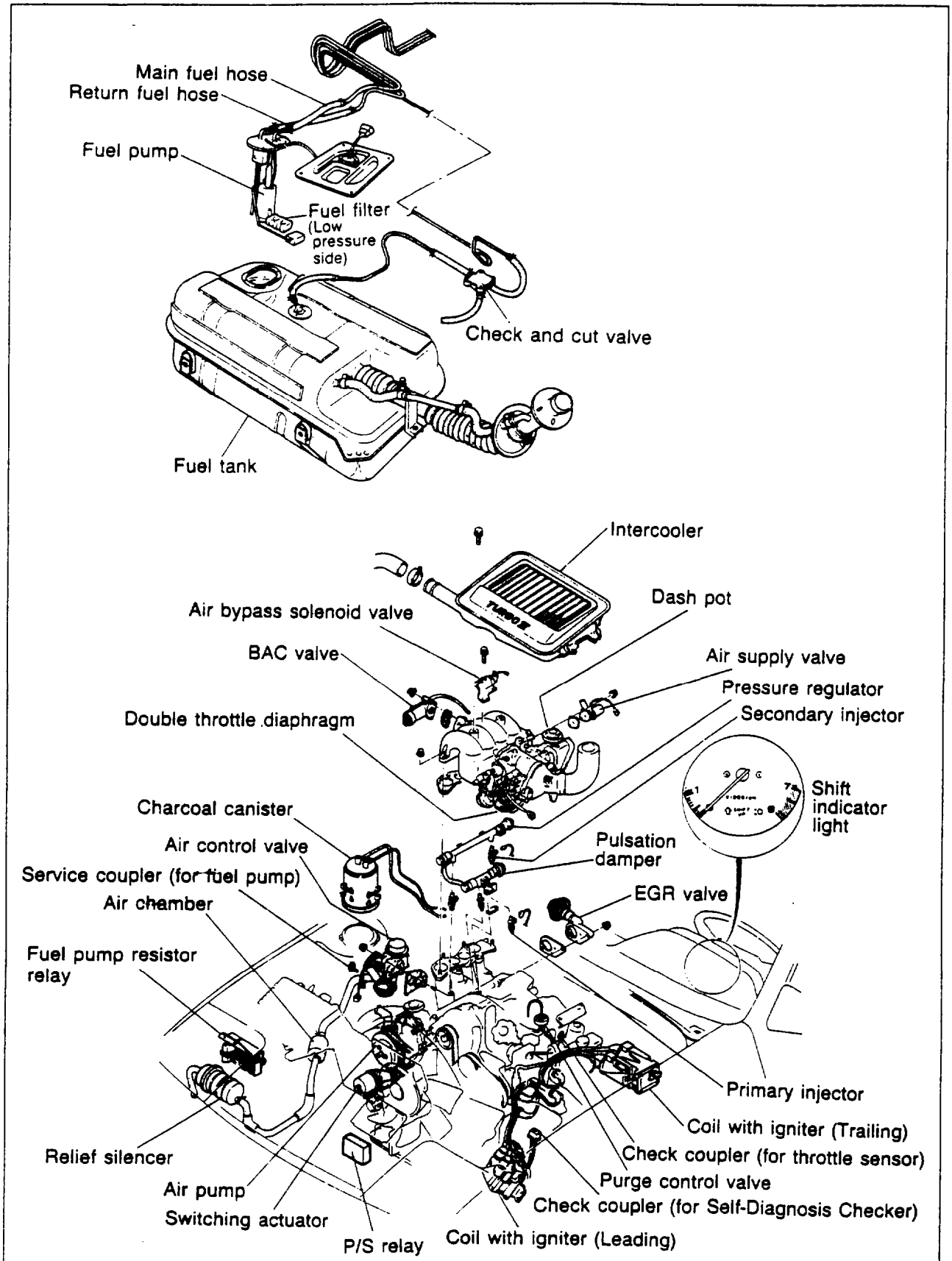
OUTLINE	4B— 2	TWIN-SCROLL TURBOCHARGER	
SYSTEM DIAGRAM.....	4B— 2	CONTROL SYSTEM	4B—53
EMISSION COMPONENTS		TWIN-SCROLL TURBOCHARGER	
LOCATION	4B— 3	CONTROL SYSTEM.....	4B—54
VACUUM HOSE ROUTING		TWIN-SCROLL TURBOCHARGER	
DIAGRAM.....	4B— 5	SOLENOID VALVE	4B—54
COMPONENT DESCRIPTION	4B— 6	SWITCHING ACTUATOR.....	4B—55
SPECIFICATIONS	4B— 9	SWITCHING VALVE	4B—55
TROUBLESHOOTING GUIDE	4B—10	TURBOCHARGER	4B—56
SELF-DIAGNOSIS CHECKER	4B—22	WASTE GATE VALVE.....	4B—56
TROUBLESHOOTING WITH		REMOVAL AND INSTALLATION ...	4B—57
SELF-DIAGNOSIS CHECKER	4B—24	INTAKE AIR SYSTEM	4B—59
CONTROL UNIT	4B—30	AIR FLOW METER.....	4B—59
EMISSION CHECKING PROCEDURE	4B—34	THROTTLE BODY.....	4B—61
SECONDARY AIR INJECTION		ACCELERATOR LINKAGE	4B—64
CONTROL SYSTEM	4B—38	BYPASS AIR CONTROL	
AIR PUMP.....	4B—39	(BAC) SYSTEM	4B—65
AIR PUMP DRIVE BELT.....	4B—39	FUEL SYSTEM	4B—68
CHECK VALVE		HOW TO USE THE MULTI-PRESSURE	
(IN INTAKE MANIFOLD).....	4B—40	TESTER.....	4B—69
CHECK VALVE (INTAKE MANIFOLD		FUEL PRESSURE	4B—69
TO CATALYTIC CONVERTER).....	4B—41	REMOVAL.....	4B—71
AIR CONTROL VALVE.....	4B—41	FUEL PUMP CONTROL SYSTEM..	4B—72
SWITCHING SOLENOID VALVE	4B—43	INJECTOR.....	4B—73
RELIEF SOLENOID VALVE.....	4B—44	EGI MAIN FUSE.....	4B—76
WATER TEMPERATURE SWITCH..	4B—46	MAIN RELAY	4B—76
WATER THERMO SENSOR	4B—46	CIRCUIT OPENING RELAY	4B—76
HEAT HAZARD SENSOR	4B—46	PRESSURE SENSOR.....	4B—77
SPLIT AIR SOLENOID VALVE.....	4B—48	ATMOSPHERIC PRESSURE	
PORT AIR SOLENOID VALVE.....	4B—48	SENSOR.....	4B—77
DECELERATION CONTROL SYSTEM	4B—49	FUEL TANK.....	4B—78
THROTTLE SENSOR	4B—49	FUEL LINE.....	4B—79
ANTI-AFTERBURN VALVE	4B—49	FUEL FILTER.....	4B—79
DASHPOT	4B—50	IDLE SPEED AND IDLE MIXTURE ..	4B—80
AIR BYPASS VALVE.....	4B—50	HOT START ASSIST SYSTEM	4B—83
ELECTRONIC SPARK ADVANCE		EXHAUST GAS RECIRCULATION	
(ESA) CONTROL SYSTEM	4B—51	(EGR) CONTROL SYSTEM	4B—85
CRANK ANGLE SENSOR.....	4B—51	CLOSED LOOP CONTROL SYSTEM	4B—86
KNOCK CONTROL SYSTEM.....	4B—52	SHIFT INDICATOR LIGHT	
		CONTROL SYSTEM	4B—87
		CRANKCASE AND EVAPORATIVE	
		EMISSION CONTROL SYSTEM	4B—88
		SUB-ZERO STARTING ASSIST DEVICE	
		(EXCEPT FOR CALIFORNIA)	4B—90

OUTLINE

SYSTEM DIAGRAM



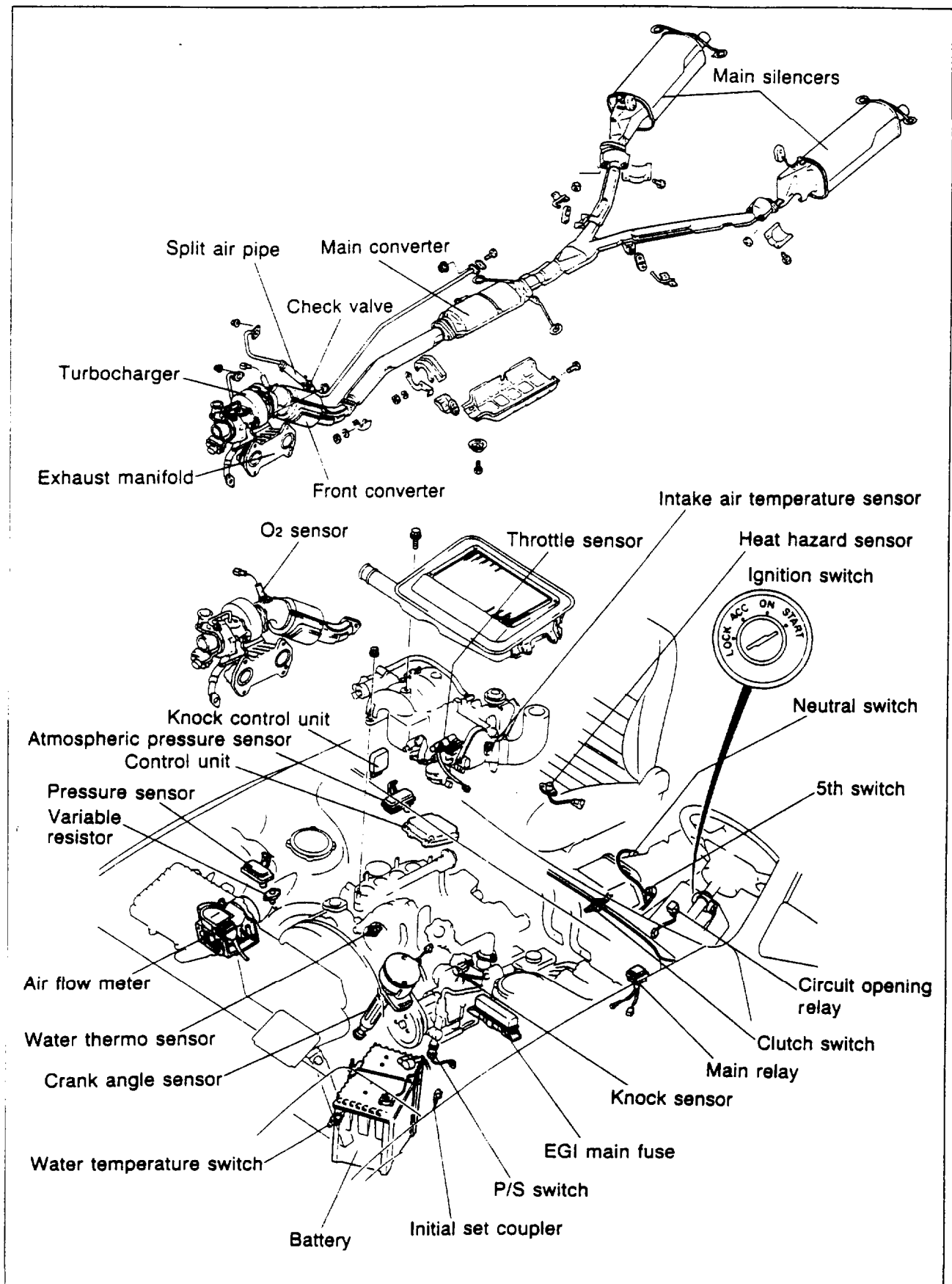
EMISSION COMPONENTS LOCATION
Fuel and Output Devices



77U048-005

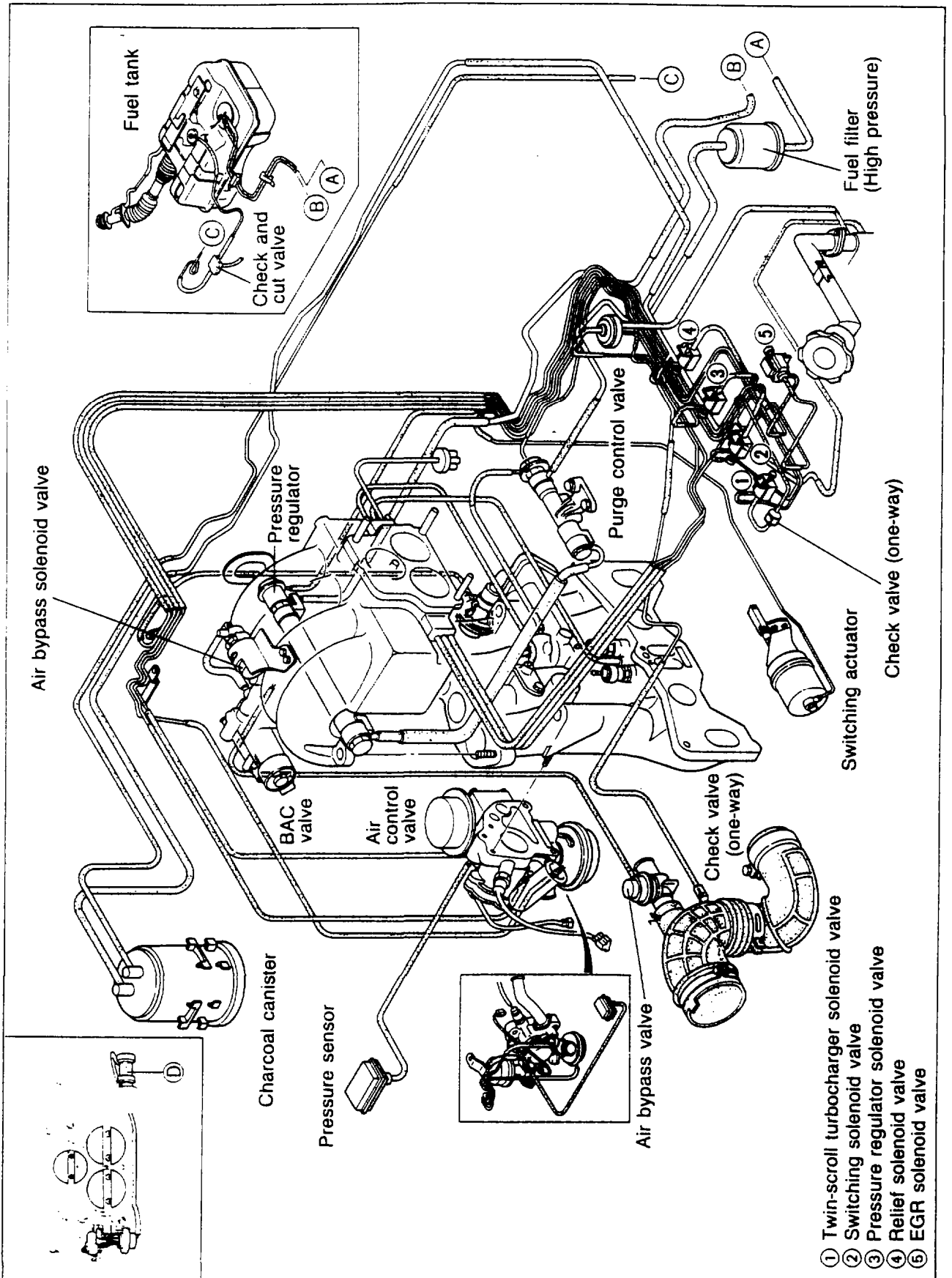
4B OUTLINE

Exhaust and Input Devices



77U04B-006

VACUUM HOSE ROUTING DIAGRAM



- ① Twin-scroll turbocharger solenoid valve
- ② Switching solenoid valve
- ③ Pressure regulator solenoid valve
- ④ Relief solenoid valve
- ⑤ EGR solenoid valve

77U04B-007

4B OUTLINE

COMPONENT DESCRIPTION

Component	Function	Remarks
Anti-afterburn Valve	Supplies fresh air into rear port during deceleration	Included in air control valve
Air Bleed Socket	Supplies fresh air into primary injector hole	
Air Bypass Solenoid Valve	Supplies bypass air into primary intake manifold	Assist of BAC valve during cold condition
Air Bypass Valve	Reduces sound of intake air from turbocharger relieved through air flow meter during deceleration.	
Air cleaner	Filters air into throttle chamber	
Air Control Valve	Directs air to one of three locations: exhaust port, main converter or relief air silencer	Consists of 3 valves: Relief valve Switching valve Anti-afterburn valve
Air Flow Meter	Detects amount of intake air; sends signal to control unit	
Atmospheric Pressure Sensor	Detects atmospheric pressure; sends signal to control unit	
Air Pump	Supplies secondary air to air control valve	
Air Supply Valve	Supplies bypass air into dynamic chamber	During P/S operation During hot starting
Bypass Air Control (BAC) Valve	Supplies bypass air into dynamic chamber	Controlled by duty signal from control unit
Pressure Sensor	Detects intake manifold vacuum; sends signal to control unit	E.G.I. Engine; Boost sensor
Catalytic Converter	Reduces HC, CO and NOx	
Check Valve	Supplies the blowby gas and evaporative emission gas into the turbocharger when the intake manifold vacuum becomes positive pressure	For evaporative emission control system
Charcoal Canister	Stores gas tank fumes when engine stops	Vented to atmosphere through charcoal and filter
Check and cut valve	Controls pressure in fuel tank	
Control Unit	<p>Detects the following:</p> <ol style="list-style-type: none"> 1.Engine speed 2.Amount of intake air 3.Engine coolant temperature 4.Throttle opening 5.Intake manifold vacuum 6.O₂ concentration 7.Radiator coolant temperature 8.Idle mixture 9.In-gear condition 10.Intake air temperature 11.Floor temperature 12.A/C operation 13.Cranking signal 14.Atmospheric pressure 15.Knocking signal 16.Initial set signal 17.Position of transmission gear <p>Controls operation of the following:</p> <ol style="list-style-type: none"> 1.Fuel injection system 2.Ignition control system 3.BAC system 4.Pressure regulator control system 5.Secondary air injection control system 6.Shift indicator light system 7.EGR system 8.Fuel pump control system 9.Twin scroll turbocharger 	<p>Crank angle sensor Air flow meter Water thermo sensor Throttle sensor Pressure sensor Oxygen (O₂) sensor Water temperature switch Variable resistor Neutral switch and clutch switch Intake air temperature sensor Heat hazard sensor A/C switch Starter switch Atmospheric pressure sensor Knock sensor and knock control unit Initial set coupler 5th switch</p>

Component	Function	Remarks
Coil with Igniter	Generates high voltage	Leading; ignite simultaneously Trailing; ignite individually
Crank Angle Sensor	Detects eccentric shaft angle at 30° intervals and front rotor position; sends signal to control unit	
Dashpot	Gradually closes throttle valve during deceleration	
Double Throttle System	Gradually opens the No. 2 secondary throttle valve when No. 1 secondary throttle valve suddenly opens	
Dynamic Chamber	Connects front and rear ports	Primary and secondary separated
EGR Solenoid Valve	Supplies intake manifold vacuum to EGR valve	Yellow
EGR Valve	Supplies exhaust gas into intake manifold	
Fast Idle System	Opens primary throttle valve slightly at idle	Only during cold condition
Fuel Filter	Filters particles from fuel	
Fuel Pump	Provides fuel to injectors	Operates while engine is running Installed in fuel tank
Fuel Pump Resistor Relay	Controls voltage for fuel pump	
Heat Hazard Sensor	Detects floor temperature; sends signal to control unit	Heat hazard sensor turned ON; relieves secondary air
Initial Set Coupler	Sends initial set signal to control unit	During adjustment of idle speed, idle mixture, and knock system; coupler is shorted
Injector	Injects fuel into intermediate housing and secondary intake manifold	Controlled by signals from control unit
Intake Air Temperature Sensor	Detects intake air temperature and temperature into the engine; sends signal to control unit	Located on the air flow meter and air intake pipe Thermistor
Intercooler	Prevents to increase of intake air temperature	Air cooled type
Knock Sensor	Detects engine knock; sends signal to knock control unit	
Mileage Switch	Detects vehicle mileage sends signal to control unit	Above 20,000 miles; mileage switch is ON
Oxygen (O₂) Sensor	Detects O ₂ concentration; sends signal to control unit	Zirconia ceramic and platinum coating
Pressure Regulator	Adjusts fuel pressure supplied to injectors	
Pressure Regulator Control Solenoid Valve	Shuts vacuum passage between dynamic chamber and pressure regulator	Only during hot condition Orange
Pulsation Damper	Absorbs fuel pulsation	
Purge Valve	Regulates evaporative fumes from gas tank and canister to intake manifold	

77U04B-211

4B OUTLINE

Component	Function	Remarks
Relief Solenoid Valve	Controls relief valve	Blue
Shift Indicator Light	Reveals shift condition to driver	
Switching Solenoid Valve	Controls switching valve of the air control valve	Gray
Switching Valve & Actuator	Adjusts the passage area of exhaust gas to turbocharger	
Throttle Body	Controls intake air quantity	
Throttle Sensor	Detects primary throttle valve opening angle; sends signal to control unit	
Turbocharger	Pressurizes intake air utilizing exhaust gas flow	Twin-scroll turbocharger
Twin-Scroll Turbocharger Solenoid Valve	Controls exhaust gas flow area	Green
Variable Resistor	Adjusts air/fuel ratio; sends signal to control unit	Tamper-proof
Waste Gate Valve	Controls amount of exhaust gas bypassing exhaust turbine to control intake air boost pressure	
Water Thermo Sensor	Detects engine coolant temperature; sends signal to control unit	Thermistor
Water Temperature Switch	Detects radiator coolant temperature; sends signal to control unit	

87U04B-002

SPECIFICATIONS

		13B Turbocharged engine	
Idle speed	(rpm)	725—775 (with BAC valve)	
Air cleaner	Element type	Long life dry	
Throttle body	Type	Horizontal-draft (2 stage-3 barrel)	
	Throat diameter	Primary (mm(in))	45 (1.772)
		Secondary (mm(in))	45 (1.772) x 2
Water thermo valve	Operation temp (°C(°F))	58—62 (136.4—143.6) or more	
Dashpot	Adjustment	1.8—3.8 kΩ (Throttle sensor)	
Turbocharger	Type	Water cooled	
	Lubrication	Engine oil	
	Boost pressure	45.2 kPa (0.46 kg/cm ² , 6.56 psi)	
Waste gate valve	Incorporated with turbocharger		
Fuel tank	Capacity (liter (us gal))	63 (16.6)	
Fuel filter	Type	Low pressure	Nylon 6 (164 & 45 mesh)
		High pressure	Filter paper
Pressure regulator	Type	Diaphragm	
	Regulated pressure (kPa (kg/cm ² , lb/in ²))	245.2—255.0 (2.5—2.6, 35.6—37.0)	
Fuel pump	Type	Impeller (intank)	
	Output pressure (kPa (kg/cm ² , lb/in ²))	490—637 (5.0—6.5, 71.1—92.4)	
	Feeding capacity (liter (us gal)/minute)	2.2—3.3 (0.58—0.87)	
Injector (Primary and Secondary)	Drive	Voltage drive	
	Injection volume [cc (cu in)/15 sec.]	133—142 (8.1—8.7)	
Heat hazard sensor	Operation temperature (°C (°F))	105—115 (221—239)	
Main silencer	Capacity (cc (cu in))	12,000 (732) x 2	
Ignition timing		Leading: 5° ATDC Trailing: 20° ATDC (at idle)	
Distribution	Type	Control unit	
Spark advance	Type	Control unit	
Idle up system	A/C (rpm)	800	
Anti-afterburn valve	Operating time (sec)	1.60—2.20	
Exhaust gas recirculation valve	Valve opening vacuum (mmHg (inHg))	Min 50 (1.97)	
Intercooler	Type	Air cooled	

87U04B-003

TROUBLESHOOTING GUIDE

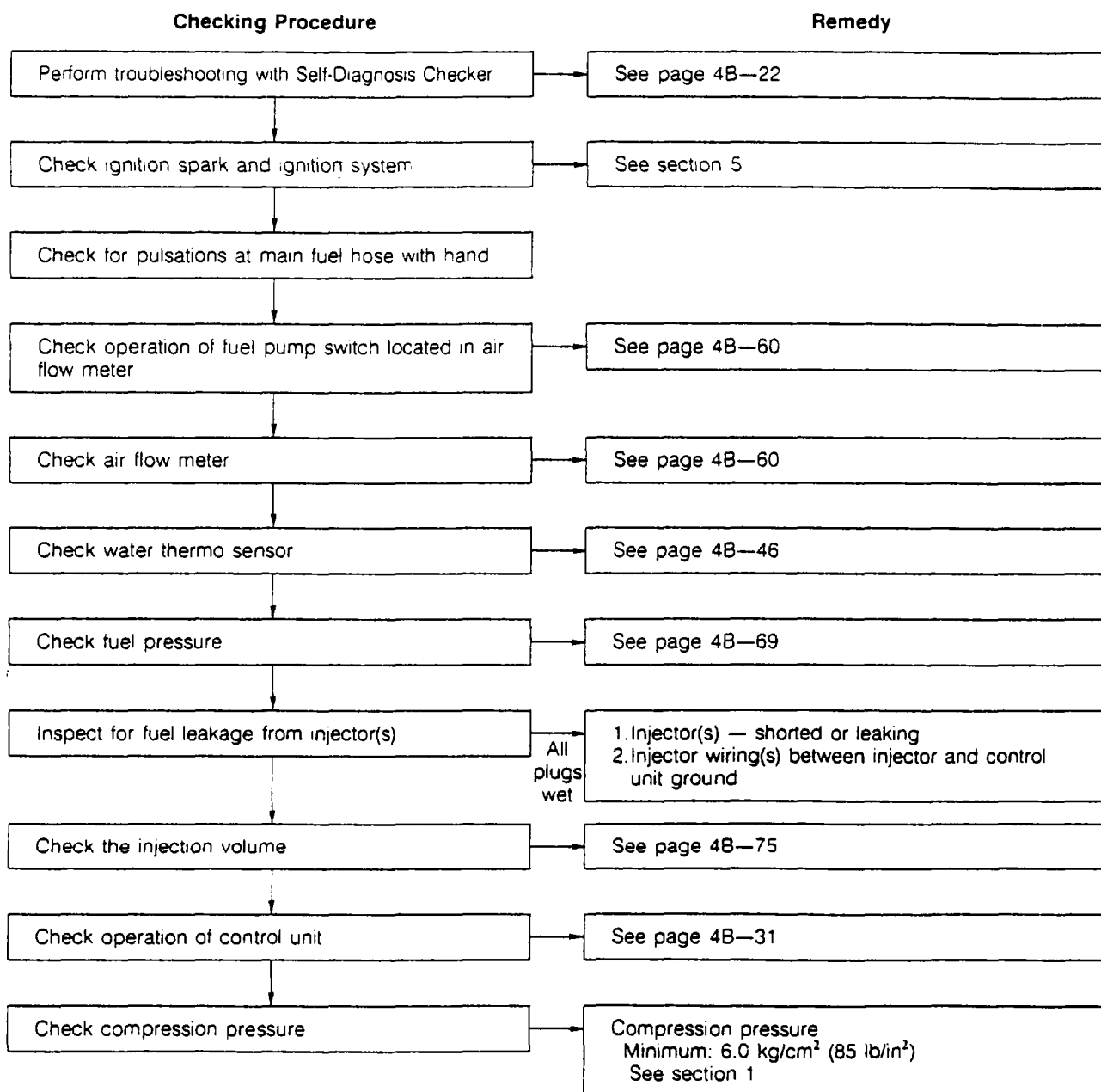
PRELIMINARY CHECKS

When troubleshooting, always first check the below.

1. Main relay
2. Main fuse
3. Circuit opening relay
4. Fuses
5. Connectors
6. Vacuum hoses and air hoses routing

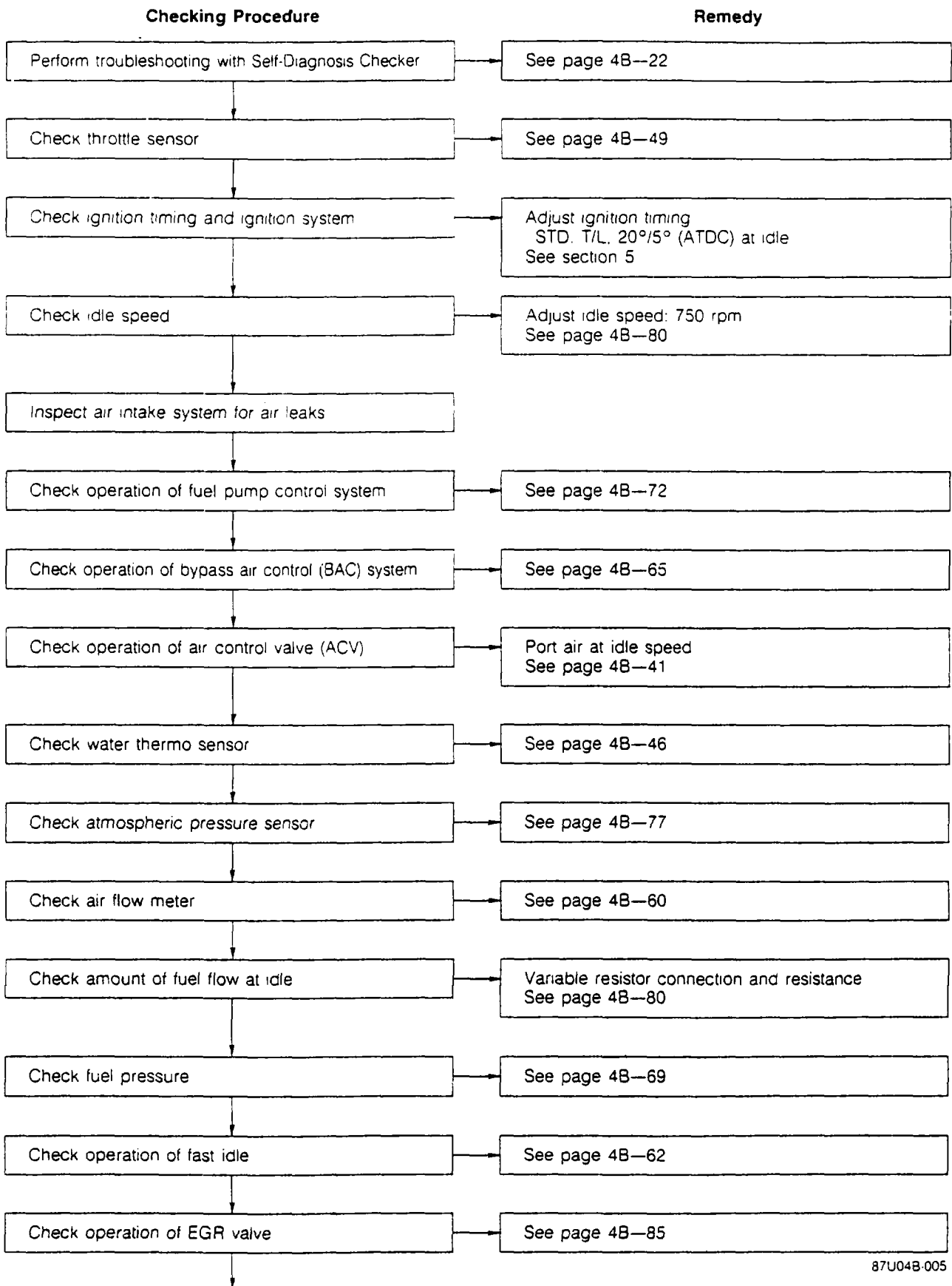
77U04B-050

1. HARD START OR NO START (CRANKS OK)



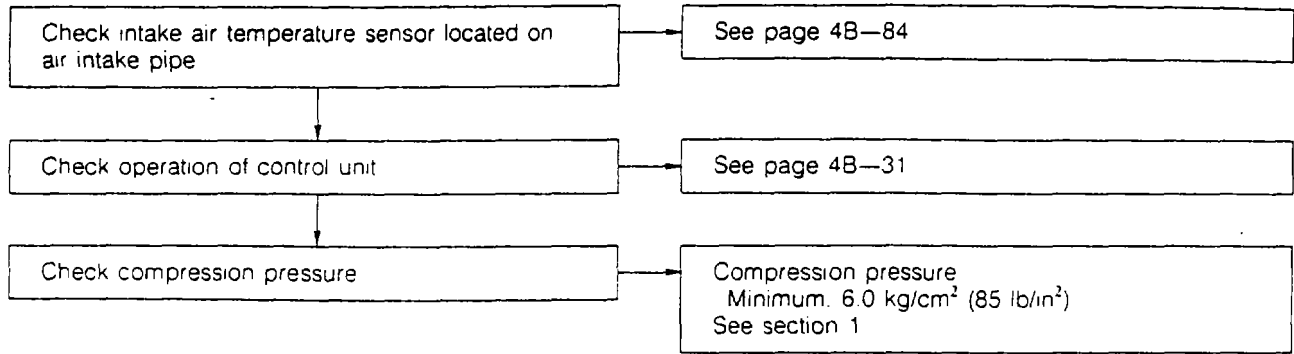
87U04B-004

2. ROUGH IDLE

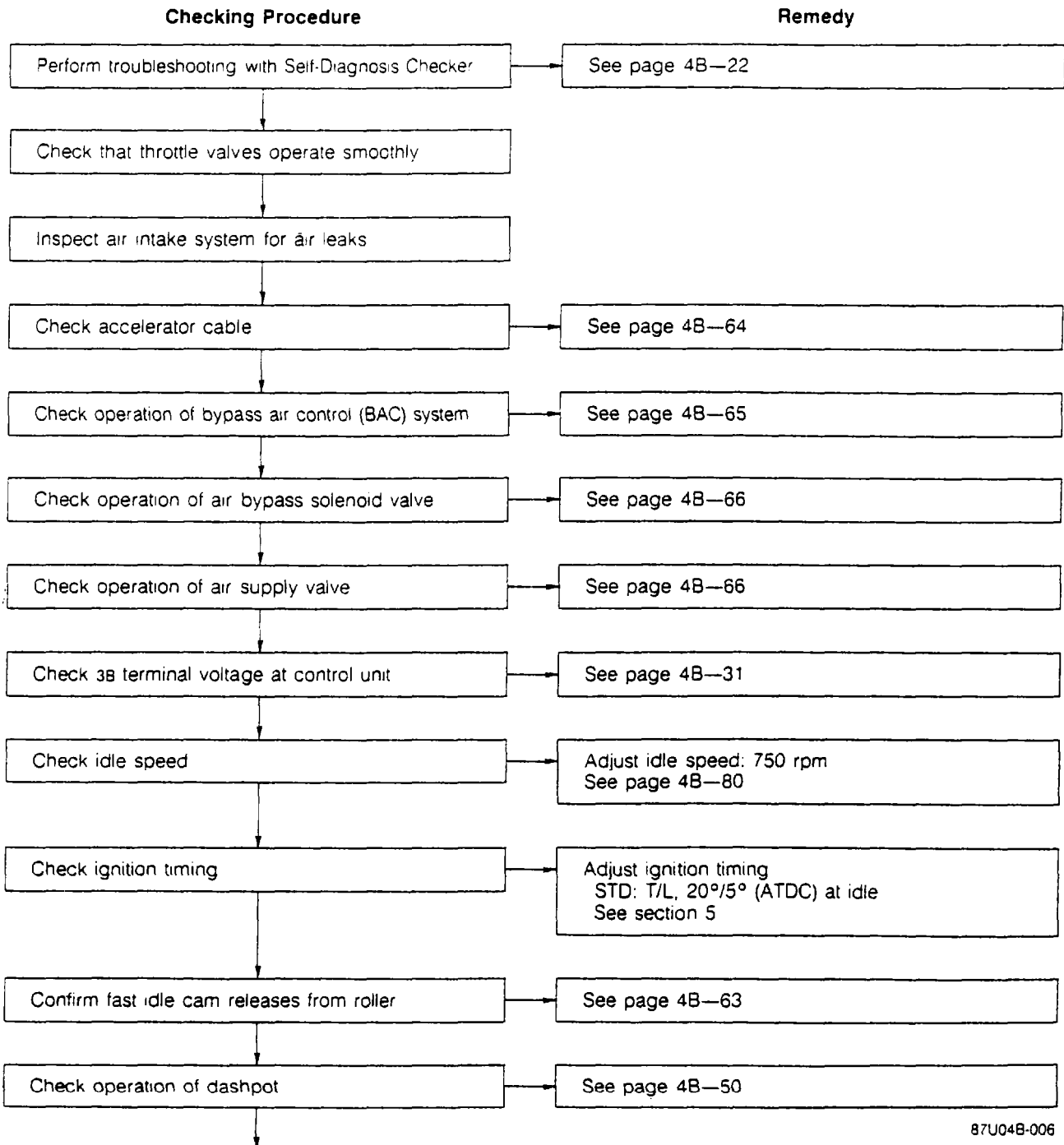


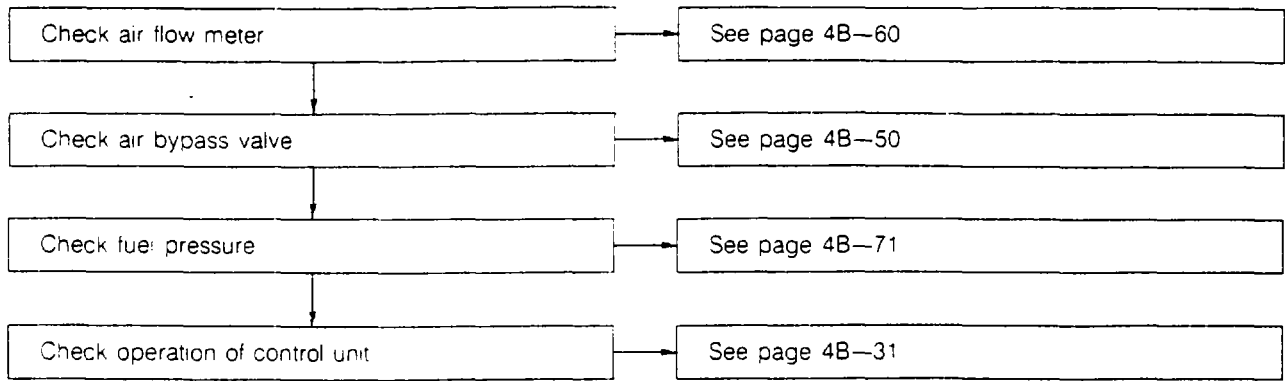
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4B TROUBLESHOOTING GUIDE

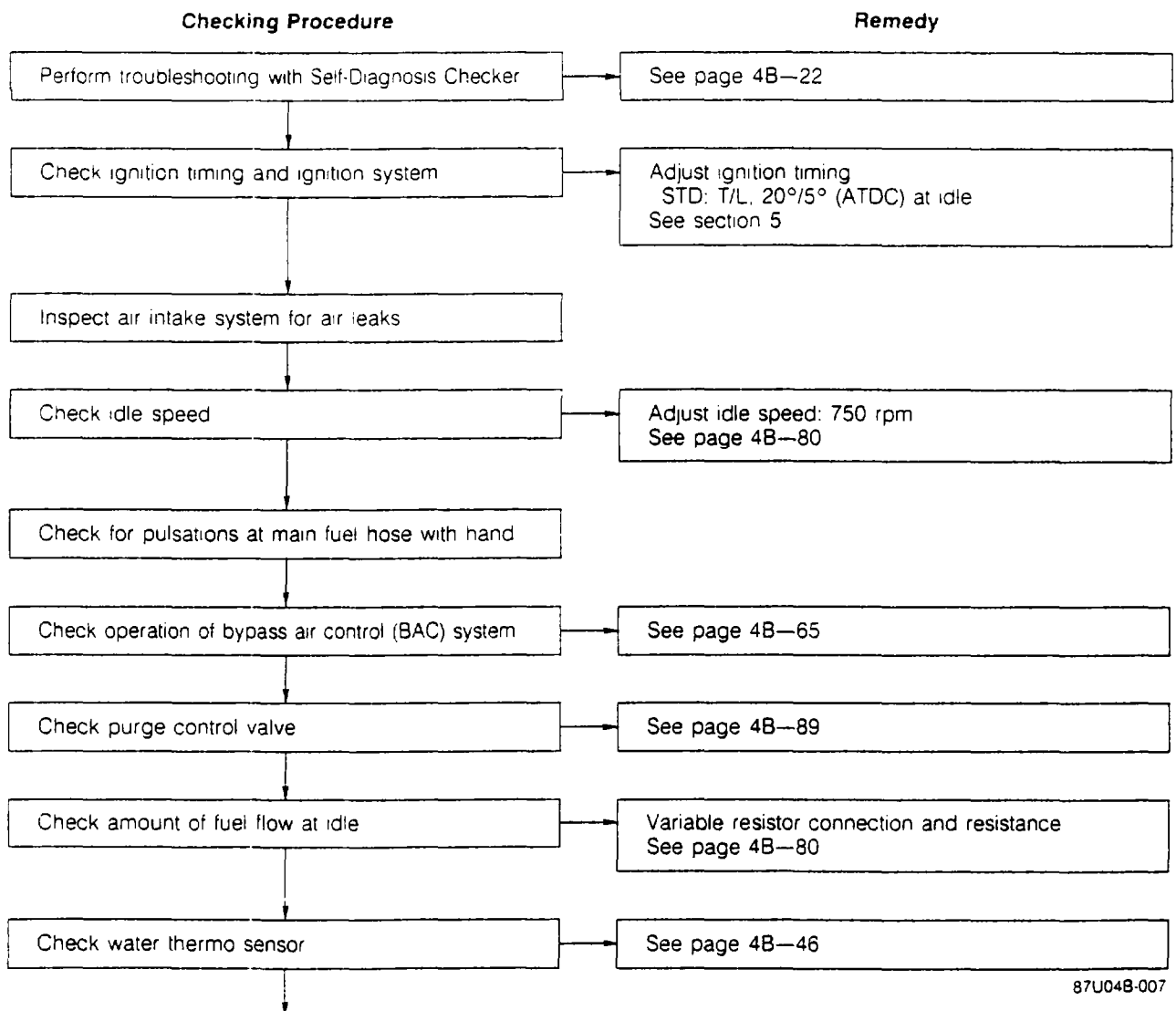


3. HIGH IDLE SPEED AT NORMAL OPERATING TEMPERATURE

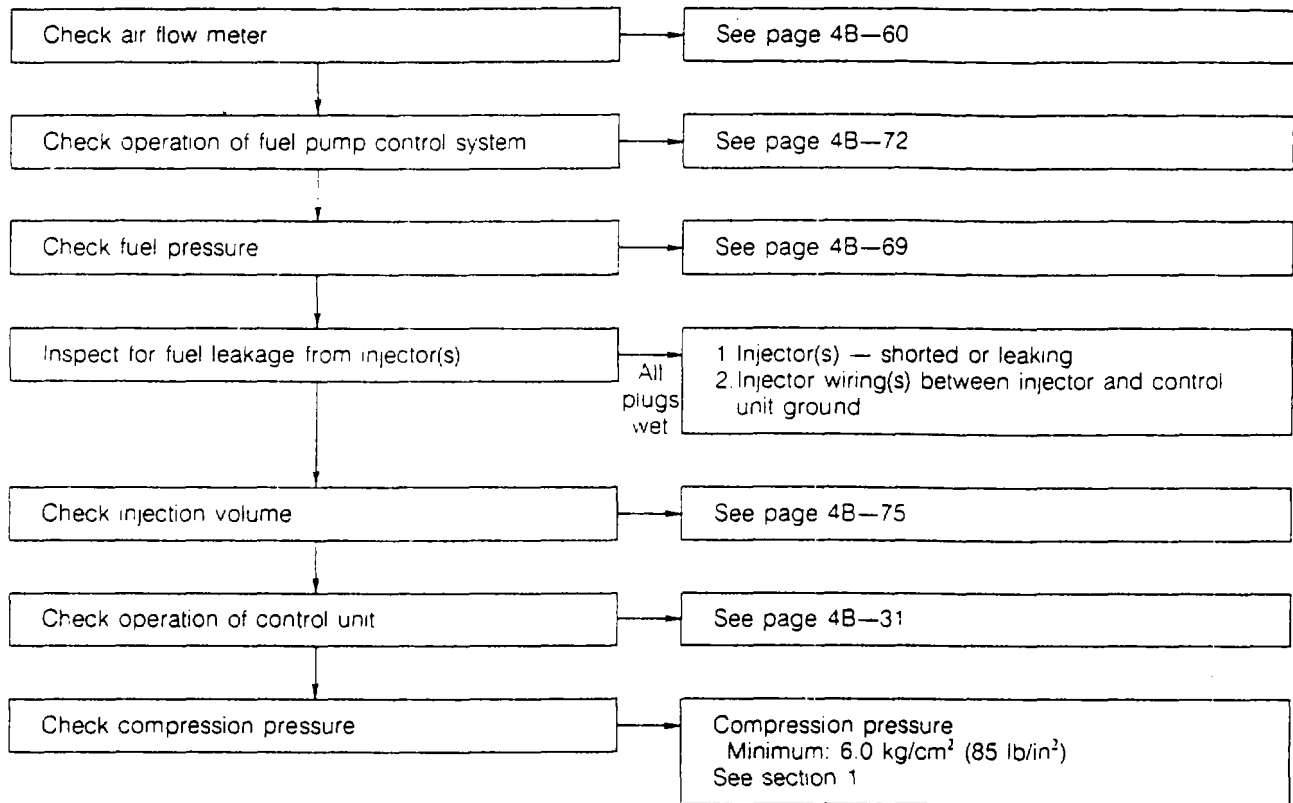




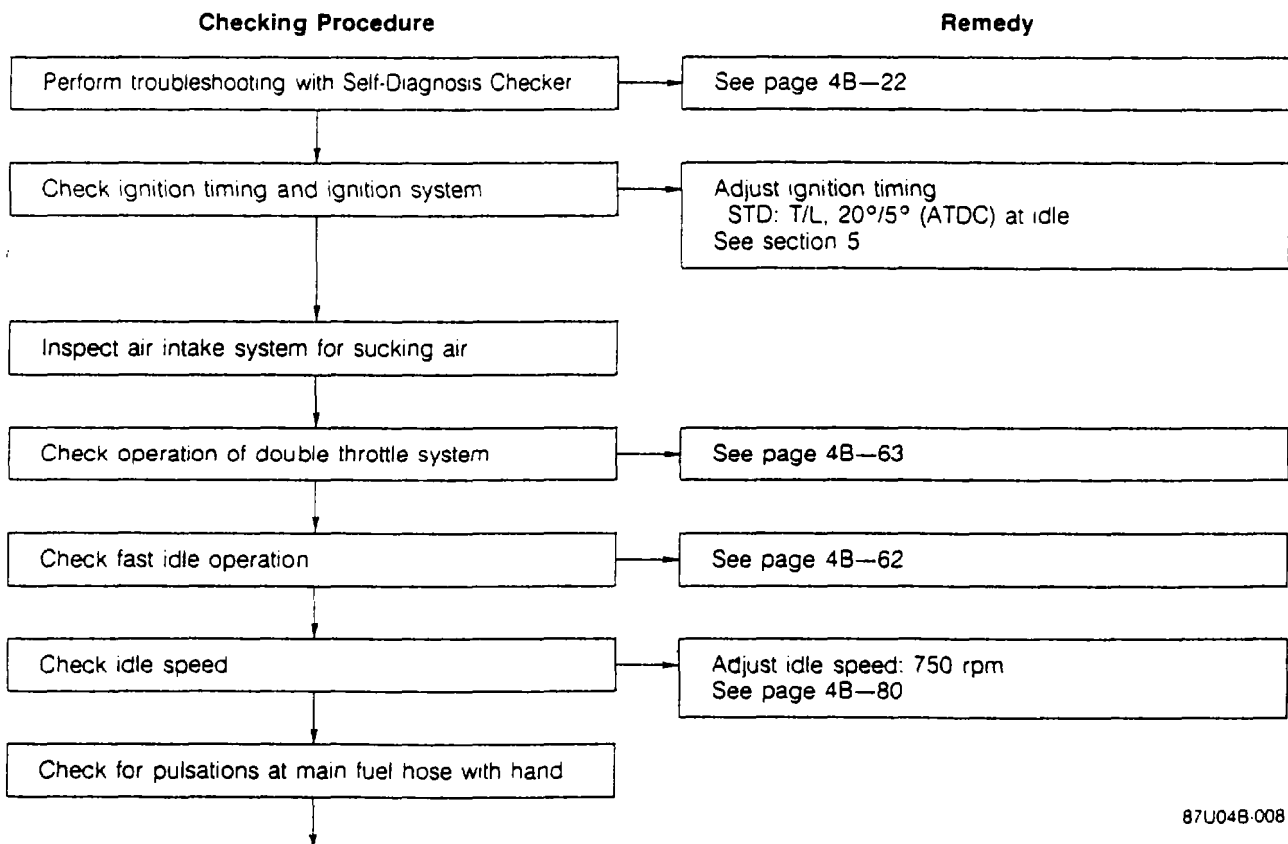
4. ENGINE DOES NOT RUN SMOOTHLY AT NORMAL OPERATING TEMPERATURE



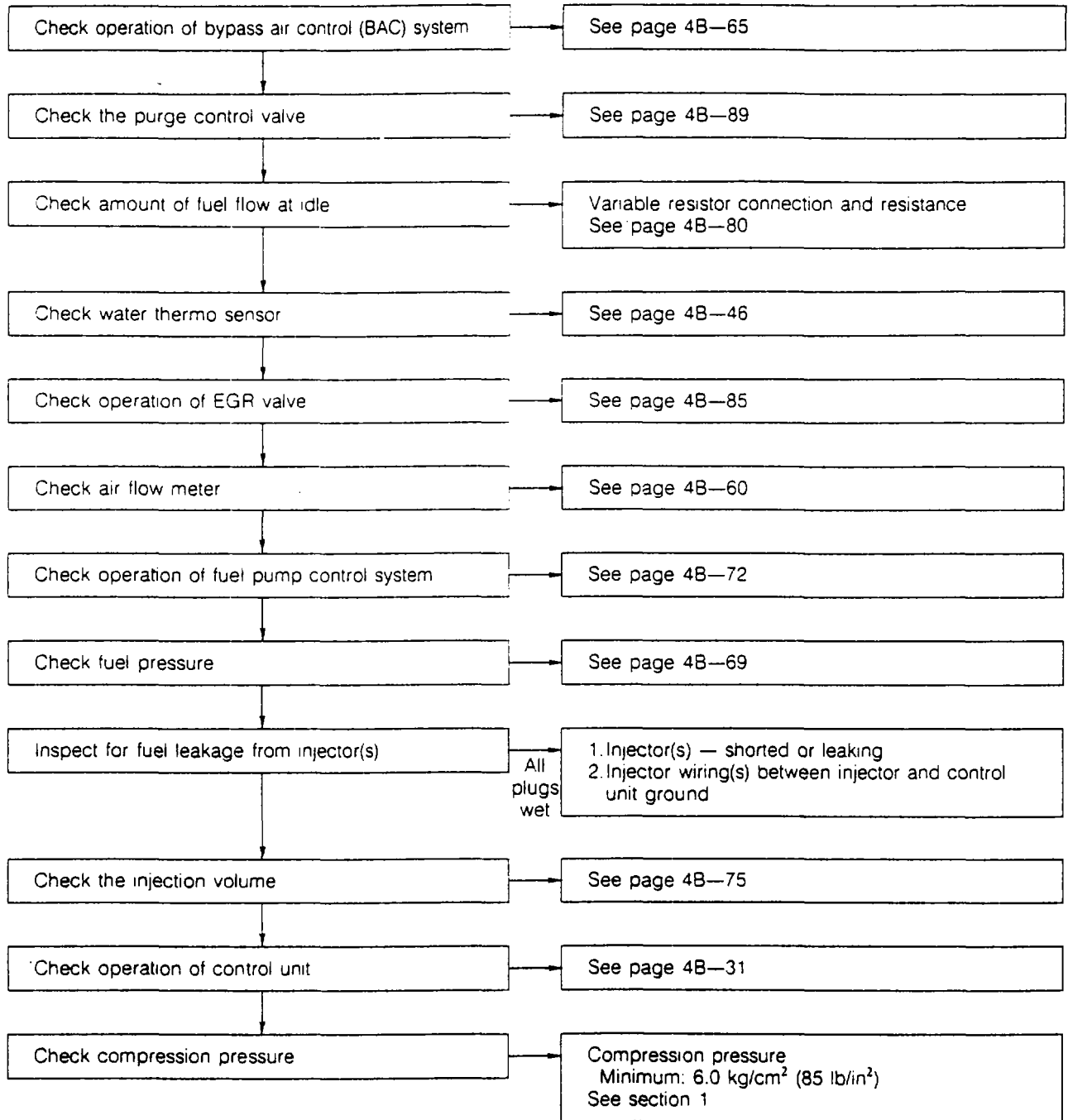
4B TROUBLESHOOTING GUIDE



5. ENGINE DOES NOT RUN SMOOTHLY AT COLD CONDITION

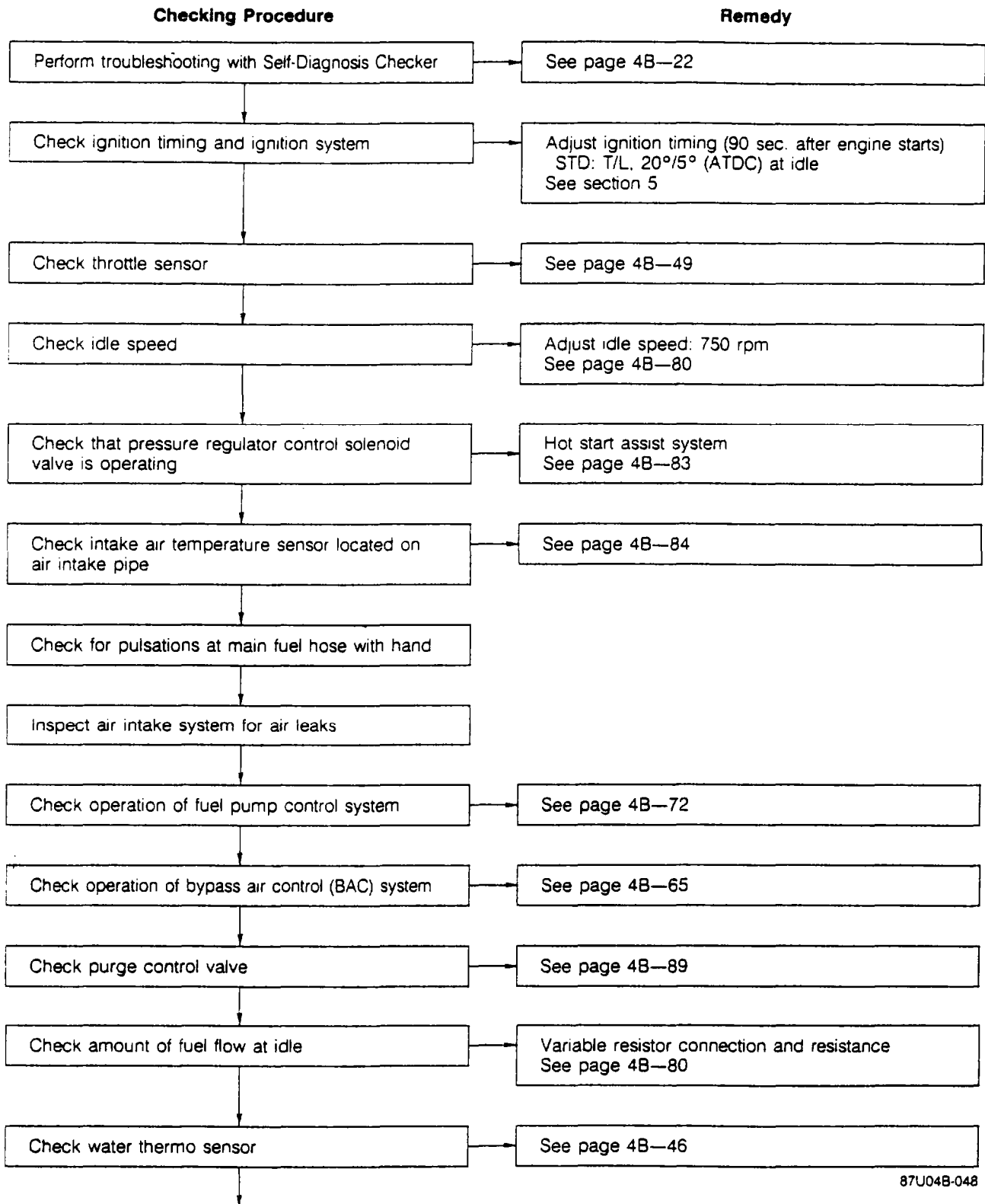


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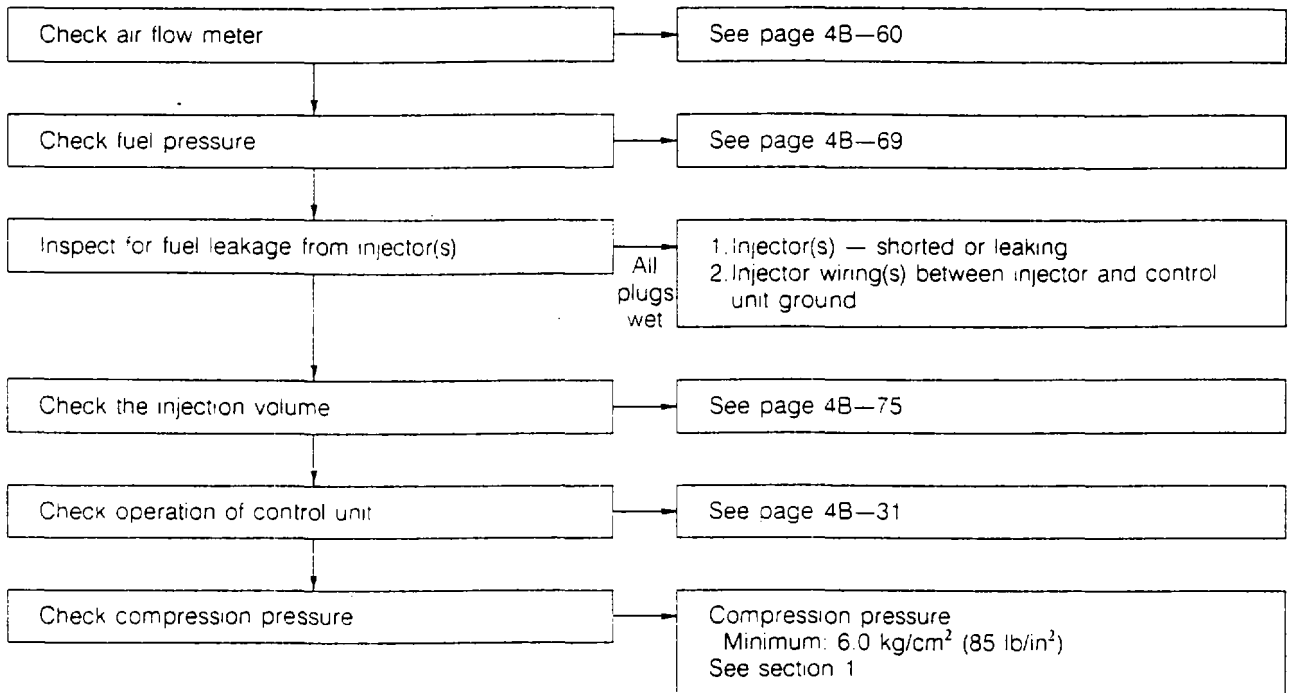


87U04B-009

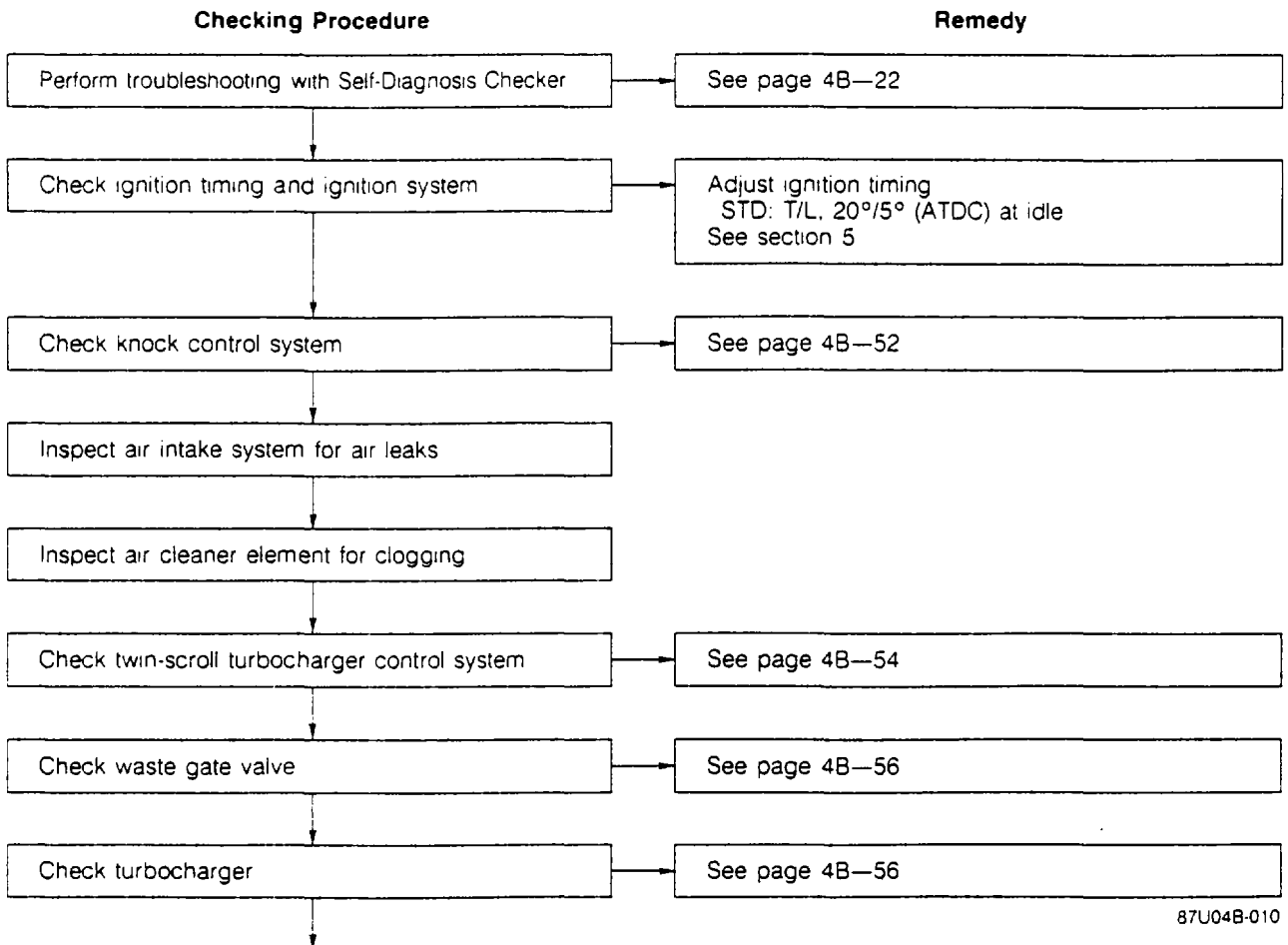
6. ENGINE DOES NOT RUN SMOOTHLY AT HOT CONDITION



87U04B-048

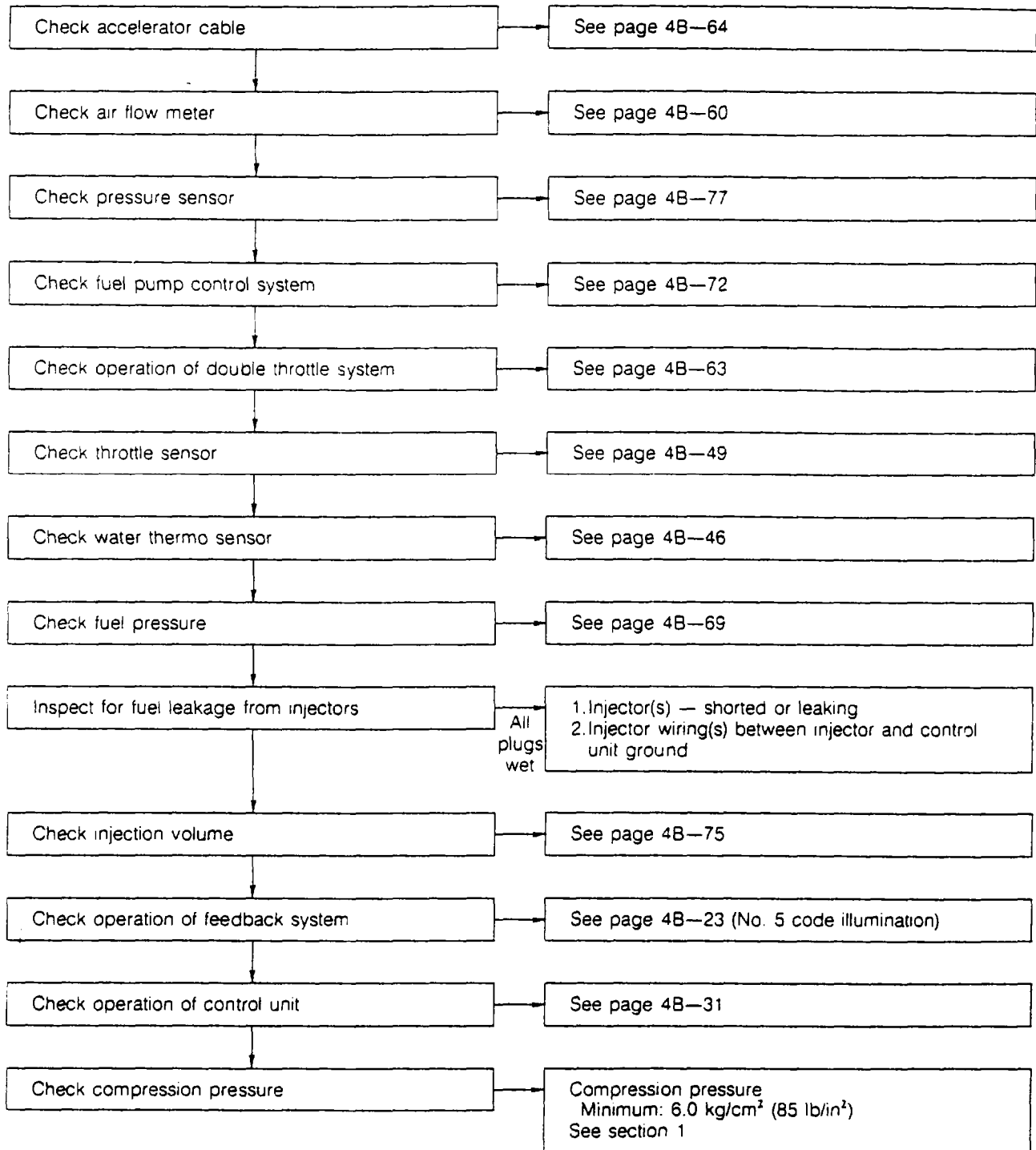


7. LACK OF POWER



87U04B-010

4B TROUBLESHOOTING GUIDE



87U04B-011

8. POOR ACCELERATION OR HESITATION

Refer to "LACK OF POWER"

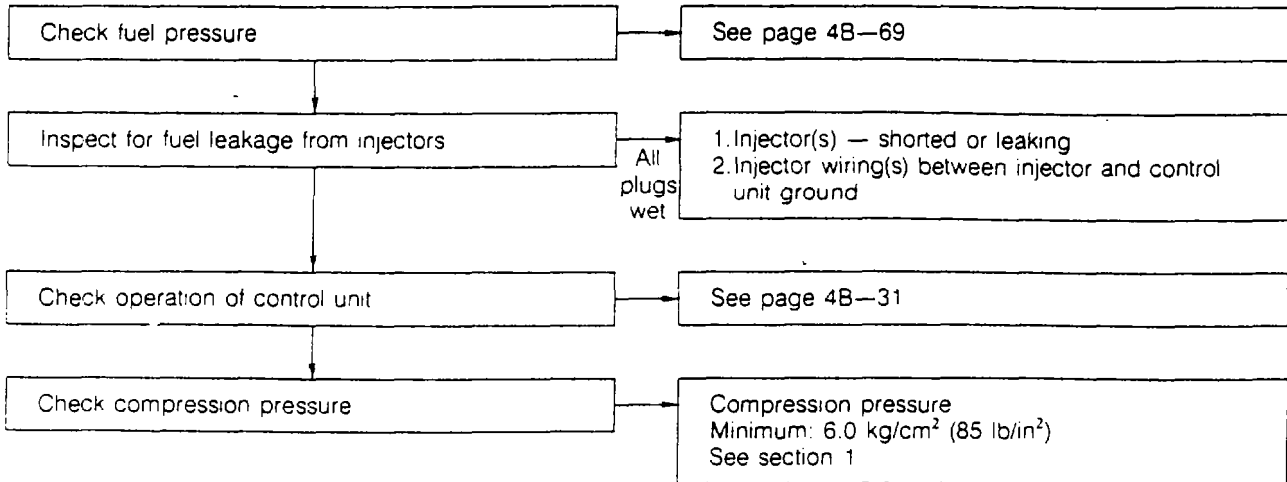
67U04X-036

9. AFTERBURN

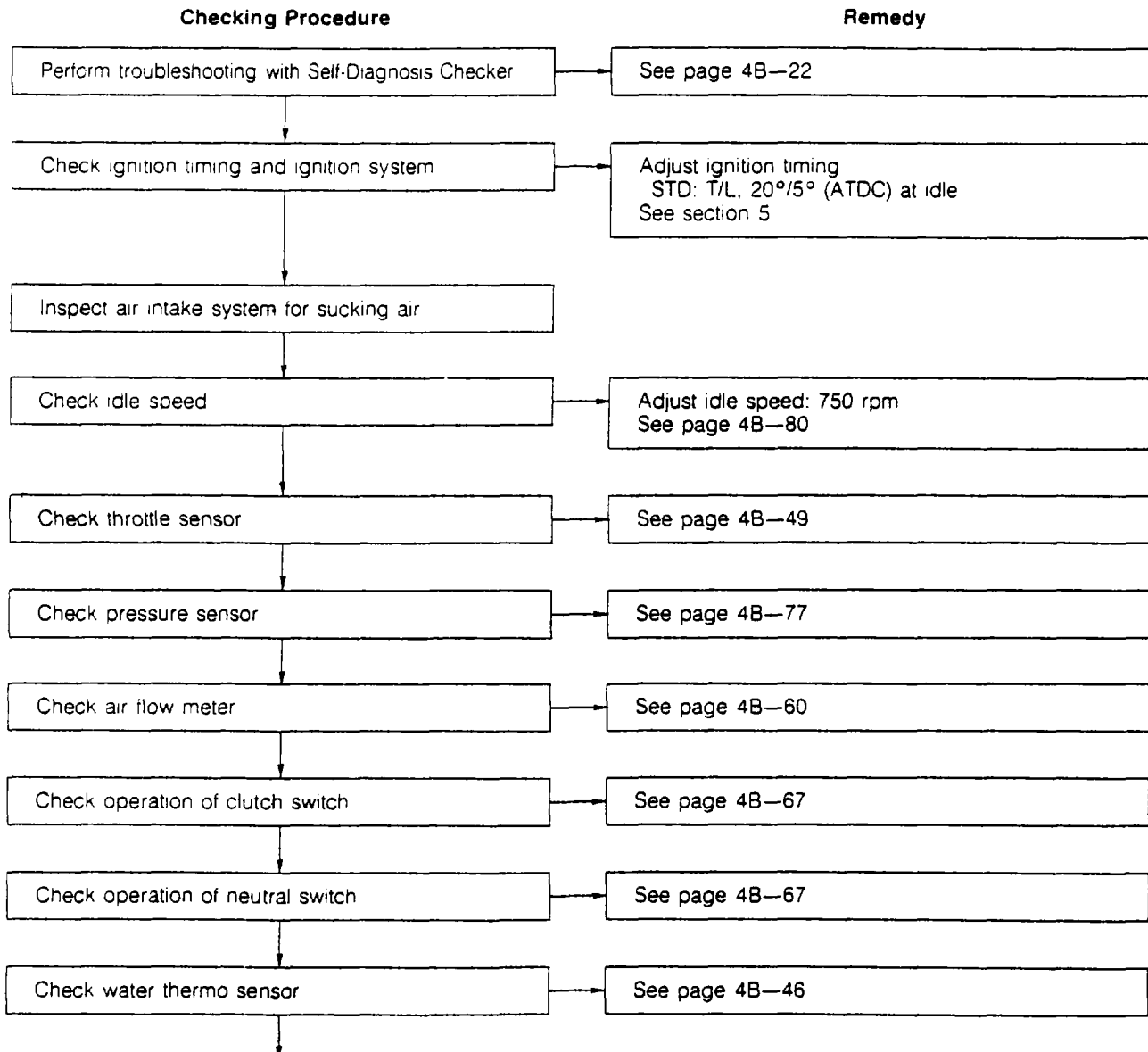
Checking Procedure	Remedy
Perform troubleshooting with Self-Diagnosis Checker	See page 4B-22
Check ignition timing and ignition system	Adjust ignition timing STD: T/L, 20°/5° (ATDC) at idle See section 5
Inspect air intake system for air leaks	
Check idle speed	Adjust idle speed: 750 rpm See page 4B-80
Check throttle sensor	See page 4B-49
Check pressure sensor	See page 4B-77
Check water thermo sensor	See page 4B-46
Check operation of air control valve (ACV)	Port air at idle speed See page 4B-41
Check operation of dashpot	See page 4B-50
Check that anti-afterburn valve (AAV) is operating	See page 4B-49
Check operation of bypass air control (BAC) system	See page 4B-65
Check fuel pump control system	See page 4B-72
Check air flow meter	See page 4B-60
Check amount of fuel flow at idle	Variable resistor connection and resistance See page 4B-80
Check operation of EGR valve	See page 4B-85

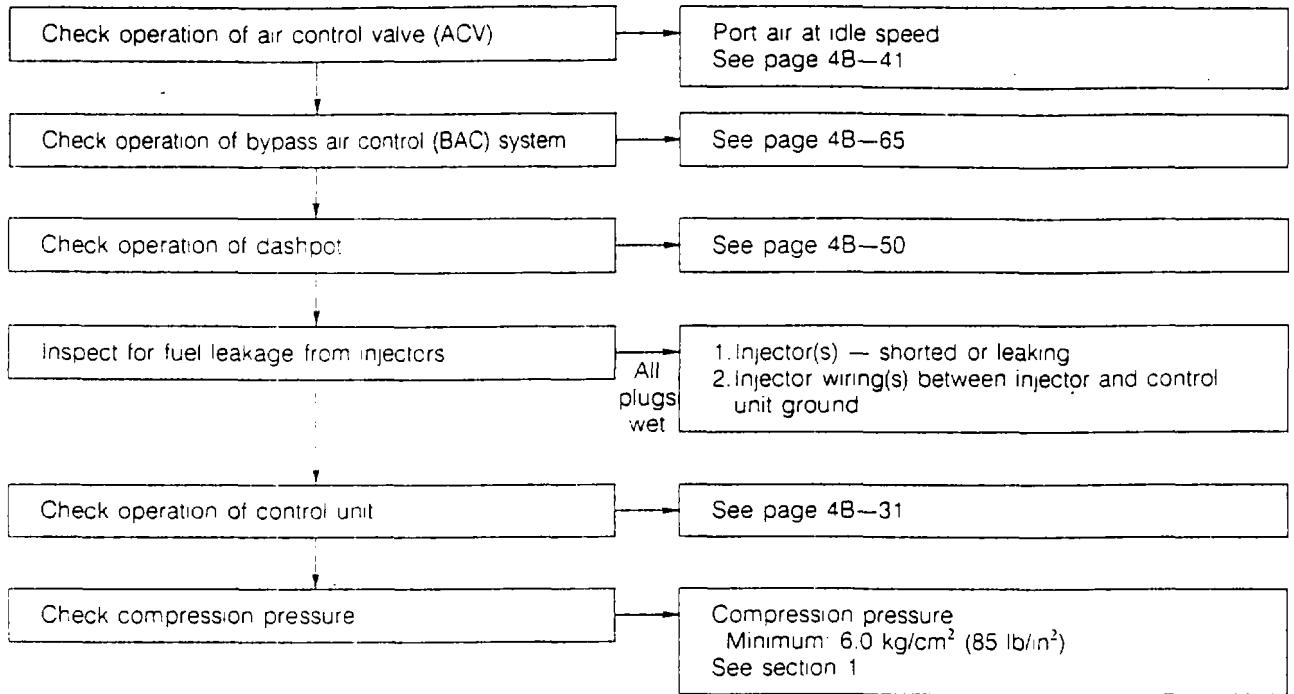
87U04B-012

4B TROUBLESHOOTING GUIDE

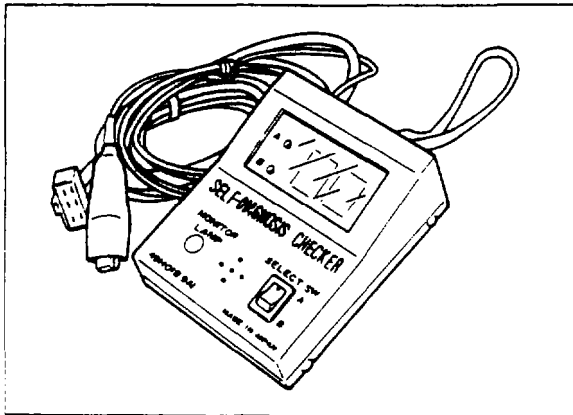


10. RUNS ROUGH ON DECELERATION

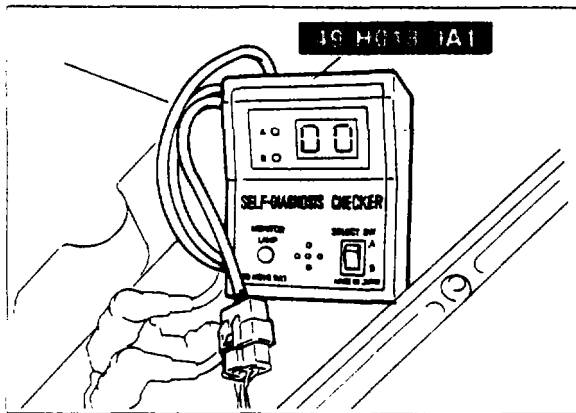




4B SELF-DIAGNOSIS CHECKER



67G04B-740



87U04B-014

SELF-DIAGNOSIS CHECKER

Self-Diagnosis Checker (49 H018 9A1)

Self-Diagnosis Checker (49 H018 9A1) can be used to detect (via the control unit check terminal) problems with each sensor and damaged wiring, poor contact or short circuits between the sensors and the control unit.

The code numbers are shown in the table below.

INSPECTION

1. Warm up the engine to normal operating temperature.
2. Connect **Self-Diagnosis Checker (49 H018 9A1)** to the check connector as shown.
3. Turn the select switch to "B" on **Self-Diagnosis Checker**.
4. Check for code number indication.
5. If a code number is indicated, check for the cause of the problem (Refer to 4B—24).

Note

The Self-Diagnosis Checker buzzer will sound for approx. 3 seconds after the ignition switch is turned ON.

Code No.	Location problem	Fail safe function
01	Crank angle sensor	—
02	Air flow meter	Maintains basic signal at preset value
03	Water thermo sensor	Maintains constant 80°C (176°F) command
04	Intake air temperature sensor (air flow meter)	Maintains constant 20°C (68°F) command
05	Oxygen (O ₂) sensor	Stops feedback correction
06	Throttle sensor	Maintains constant 100% (approx. 18°) command
07	Pressure sensor	Maintains constant 26.3 kPa (0.27 kg/cm ² , 3.82 psi) command
09	Atmospheric pressure sensor	Maintains constant command of sea-level pressure
12	Coil with igniter (trailing side)	Stops operation of ignition system (only trailing side)
15	Intake air temperature sensor (intake air pipe)	Maintains constant 20°C (68°F) command

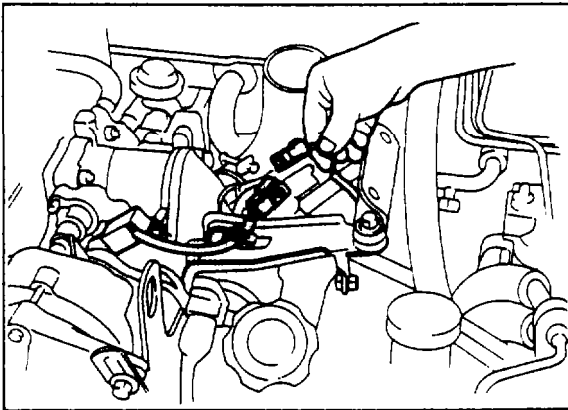
87U04B-015

MONITOR LAMP (FEEDBACK SYSTEM)

Lamp flashes to indicate O₂ sensor signal.

Monitor Lamp	Air/Fuel Ratio
ON	Too rich
Flashes ON and OFF	Best
OFF	Too lean

67G04B-742



67G04B-743

OPERATION OF FEEDBACK SYSTEM

Inspection

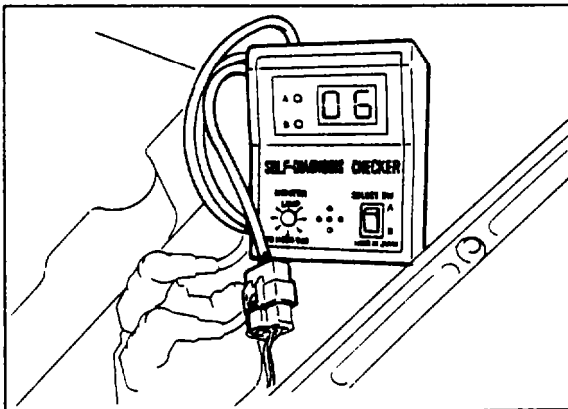
Step 1

Before checking the O₂ sensor, disconnect the neutral switch connector.

1. Warm up the engine, and stop it.
2. Remove the intercooler.
3. Disconnect the throttle sensor connector.
4. Install the intercooler in the reverse order of removal.
5. Start the engine and check the Self-Diagnosis Checker.

Code number: 06

Monitor lamp: ON



67G04B-744

Step 2

6. Check that the monitor lamp starts to flash within 10 seconds after increasing the engine speed to between 1,500 and 2,000 rpm.

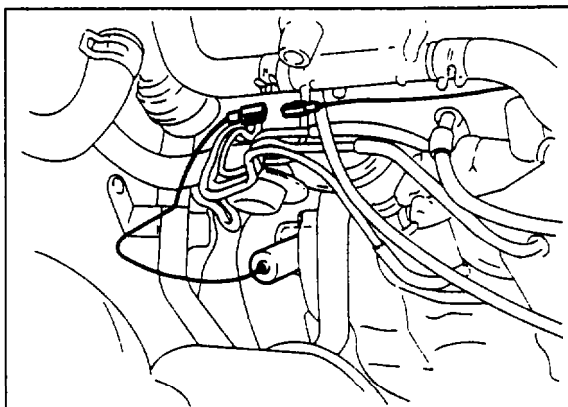
Code number: 06

Monitor lamp: Flashes ON and OFF

Step 3

7. Check that the number of flashes is within specification.

**Specification: more than 8 times/10 seconds
(at 1,500—2,000 rpm)**



67G04B-745

Step 4

8. Hold the engine speed at 1,750 rpm and disconnect the O₂ sensor connector. Check that the code number and lamp change as follows.

Code number: 05

Monitor lamp: OFF

9. If the Self-Diagnosis Checker shows other than the above, the control unit is faulty.
10. Replace the control unit.

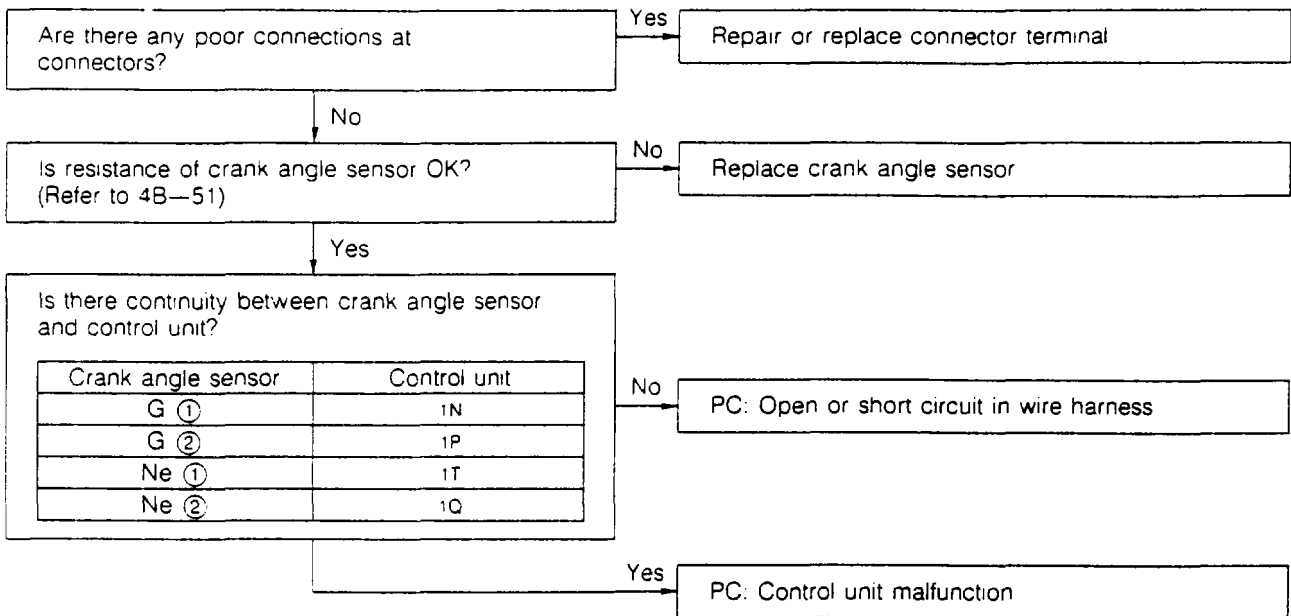
4B TROUBLESHOOTING WITH SELF-DIAGNOSIS CHECKER

TROUBLESHOOTING WITH SELF-DIAGNOSIS CHECKER

If code a number is illuminated on the Self-Diagnosis Checker, check the following chart along with the wiring diagram (Section 50).

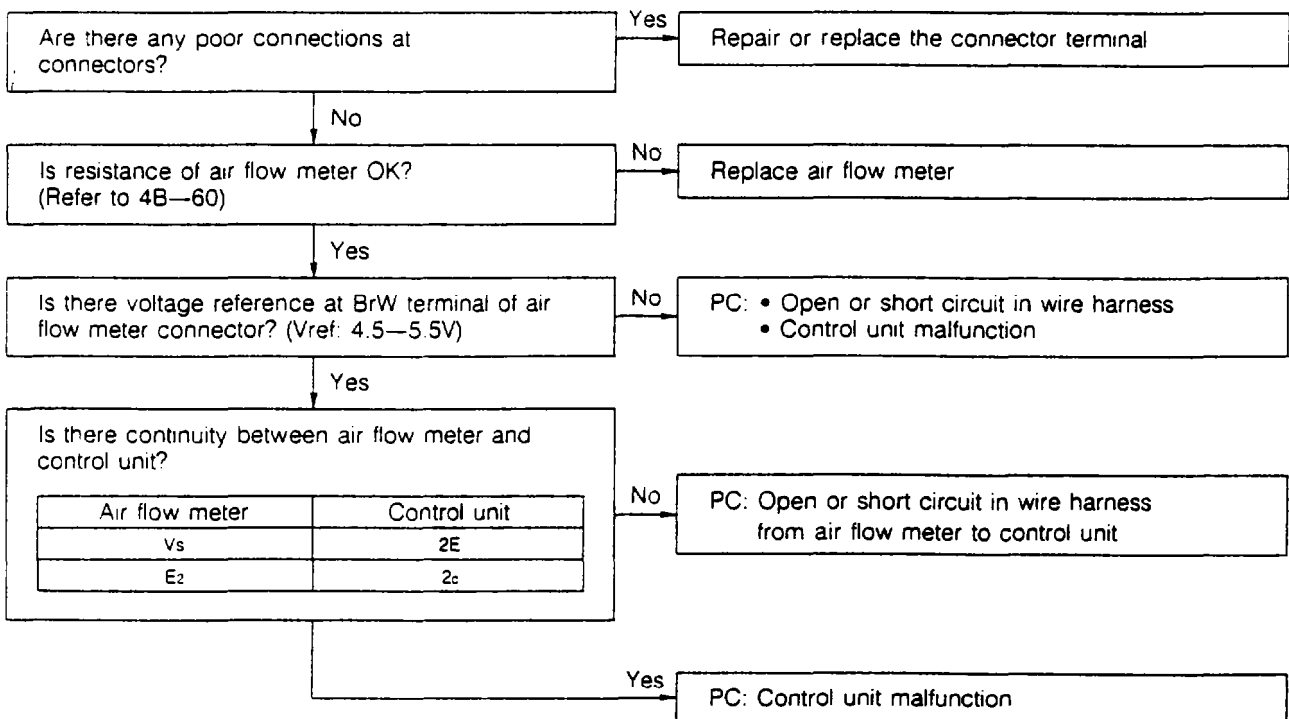
87U048-016

No. 01 code illumination



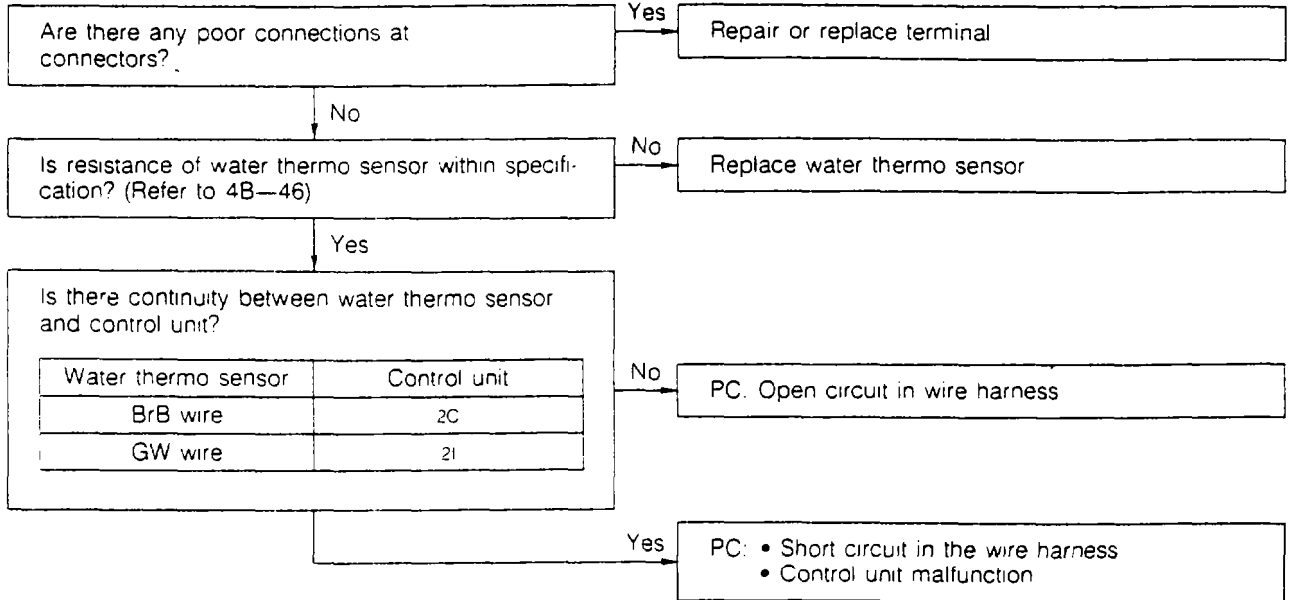
77U048-063p

No. 02 code illumination



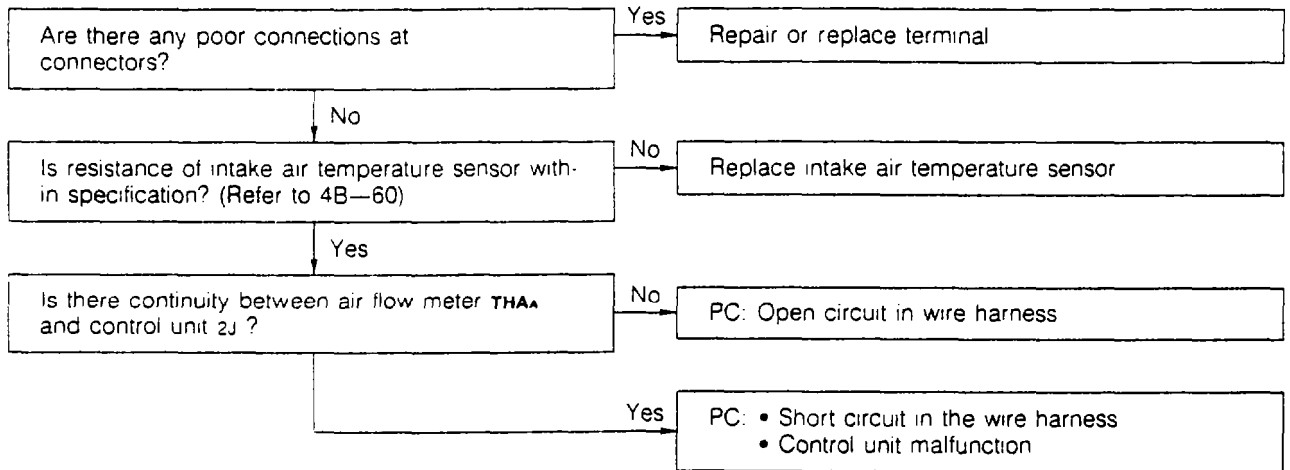
77U048-064p

No. 03 code illumination



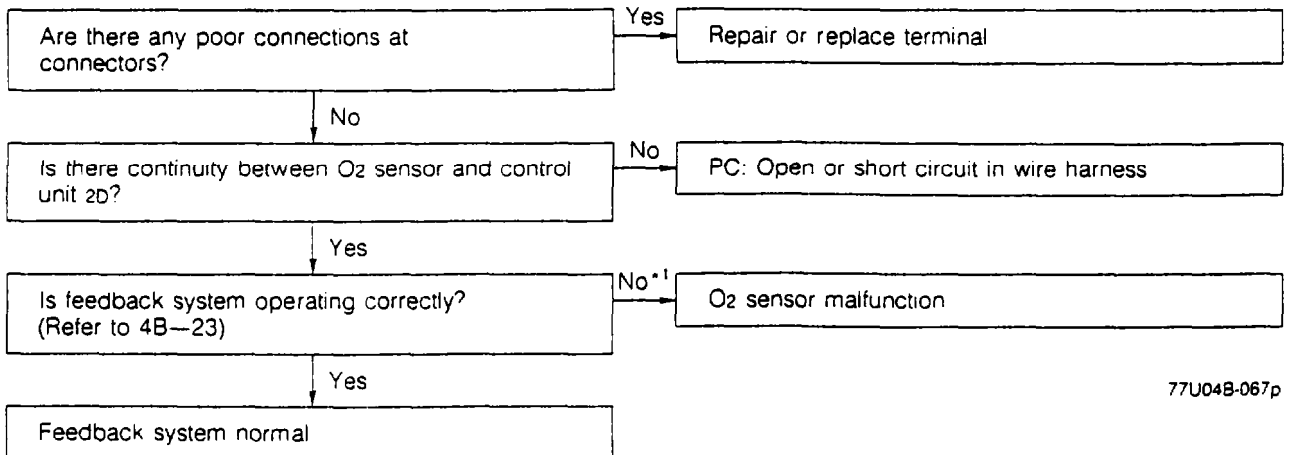
77U04B-065p

No. 04 code illumination



77U04B-066p

No. 05 code illumination

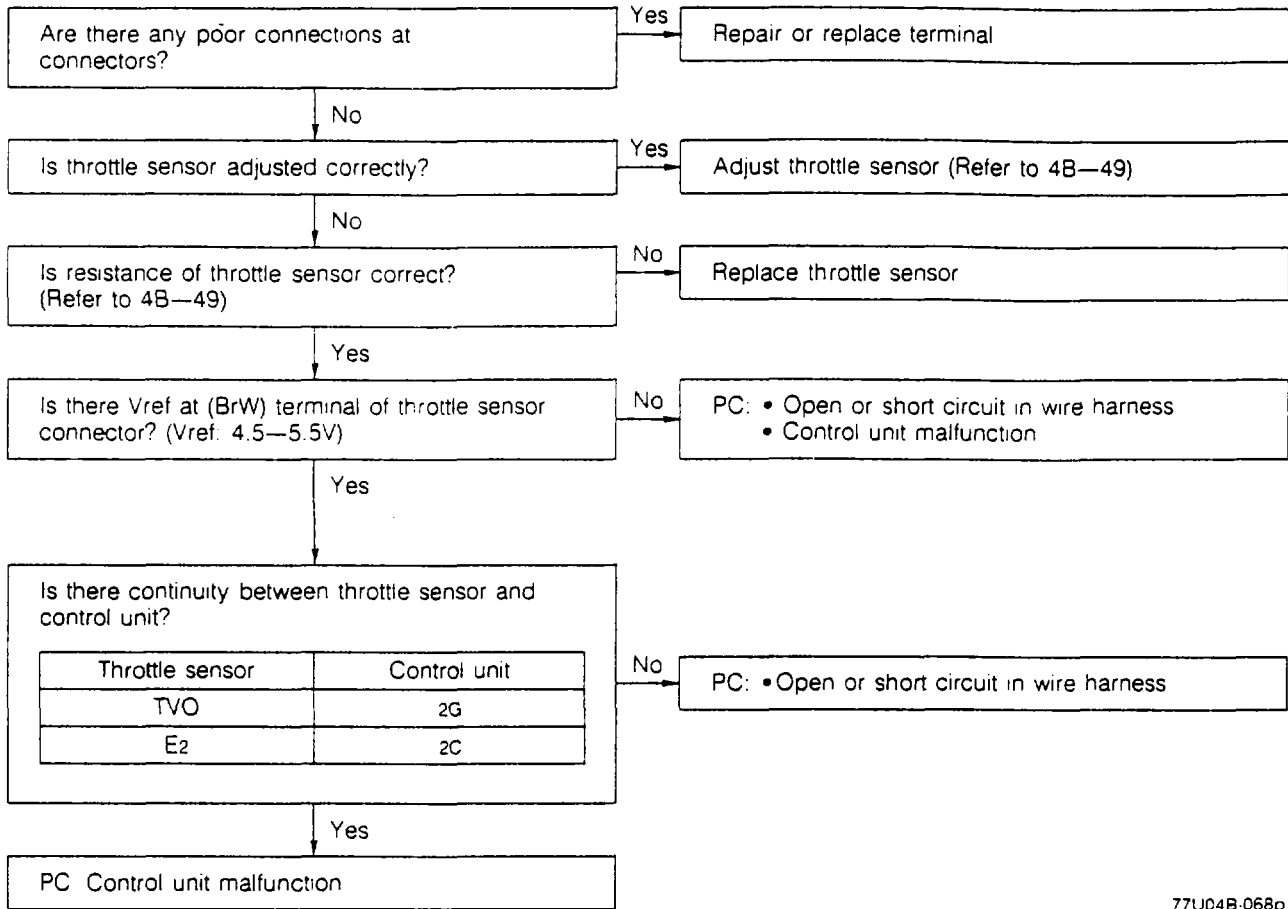


77U04B-067p

*1; Do not perform step 2 or step 3 on page 4B-23.

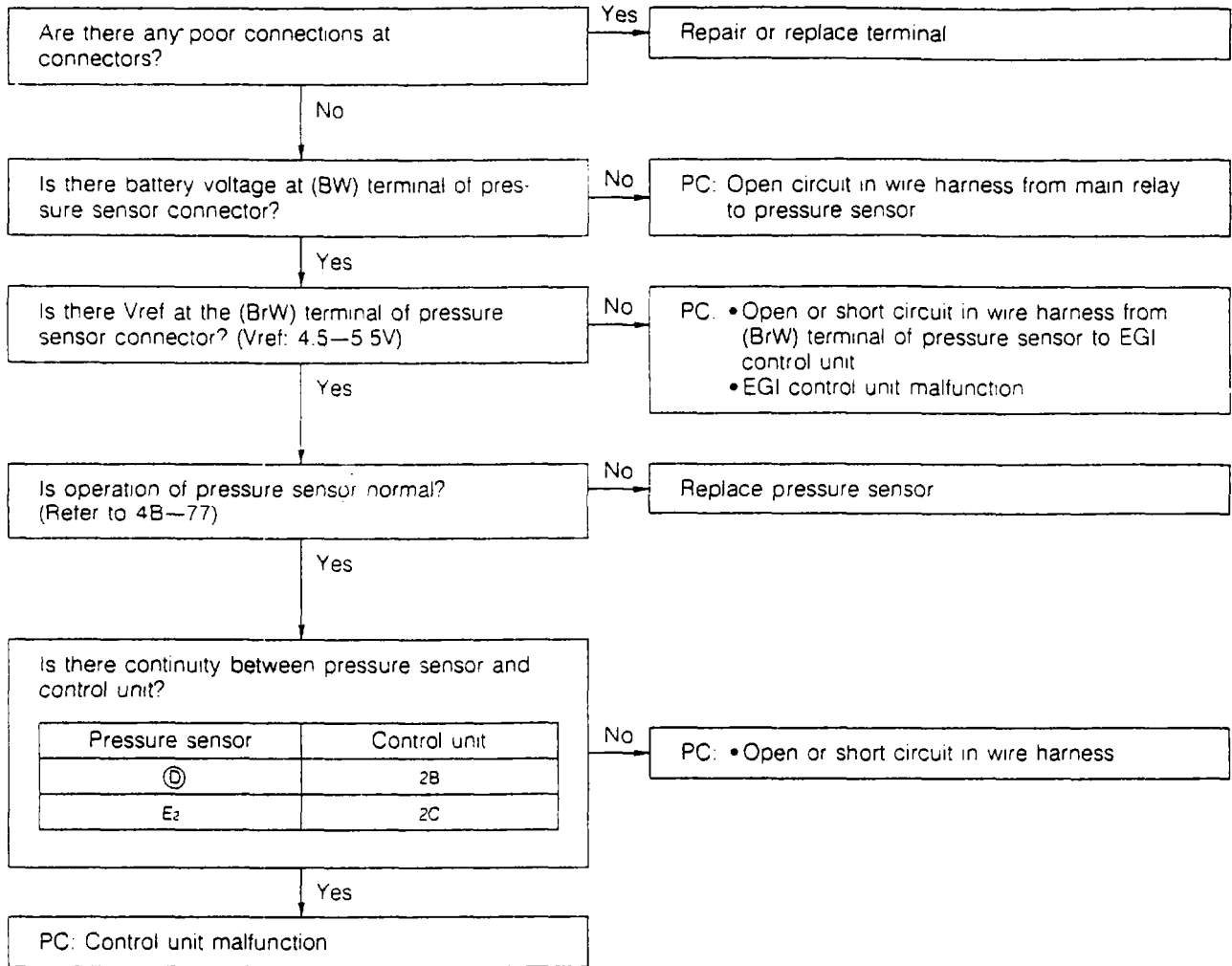
4B TROUBLESHOOTING WITH SELF-DIAGNOSIS CHECKER

No. 06 code illumination



77U04B-068p

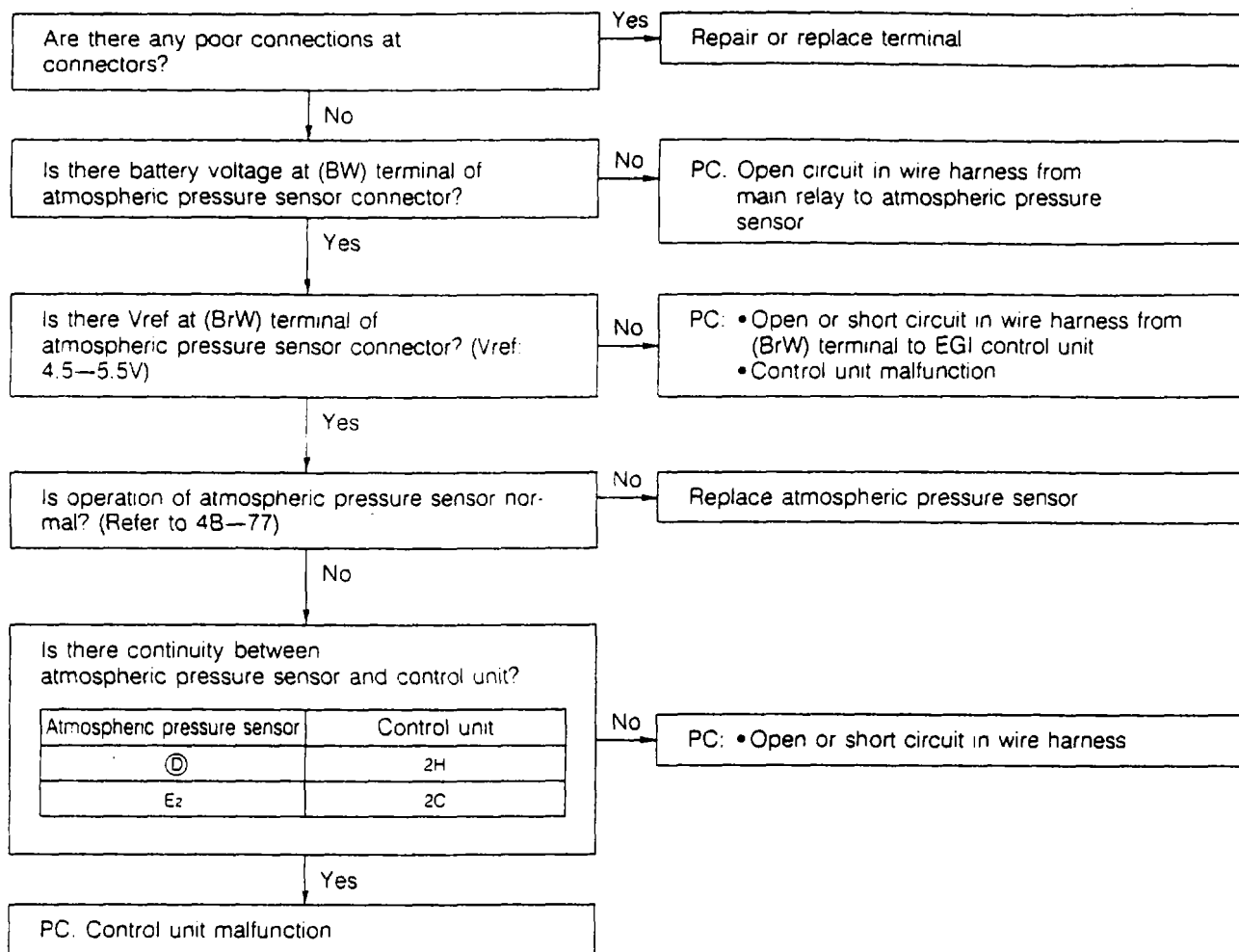
No. 07 code illumination



77U04B-069D

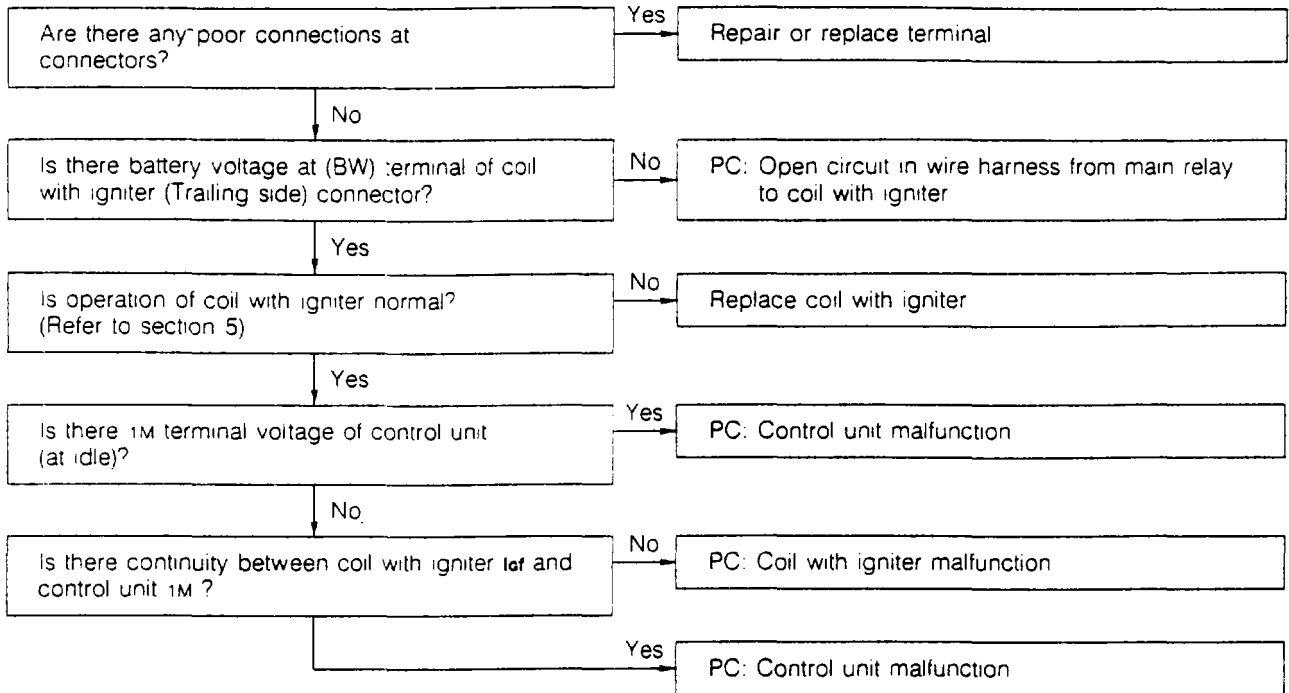
4B TROUBLESHOOTING WITH SELF-DIAGNOSIS CHECKER

No. 09 code illumination



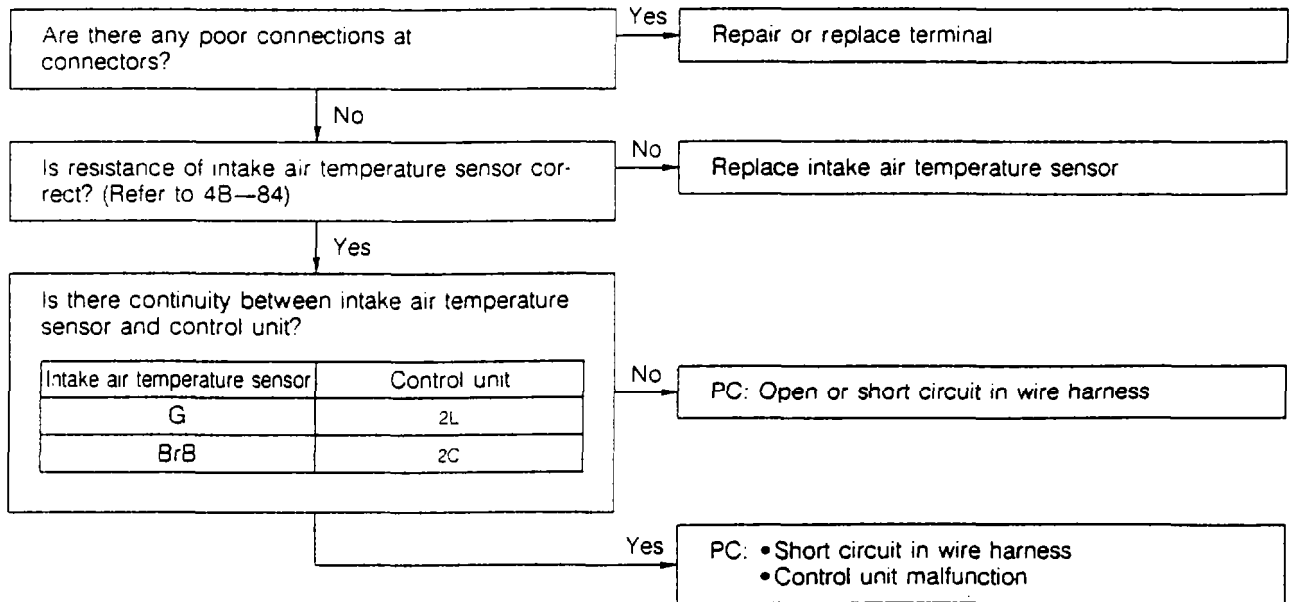
77U04B-070p

No. 12 code illumination



77U04B-116

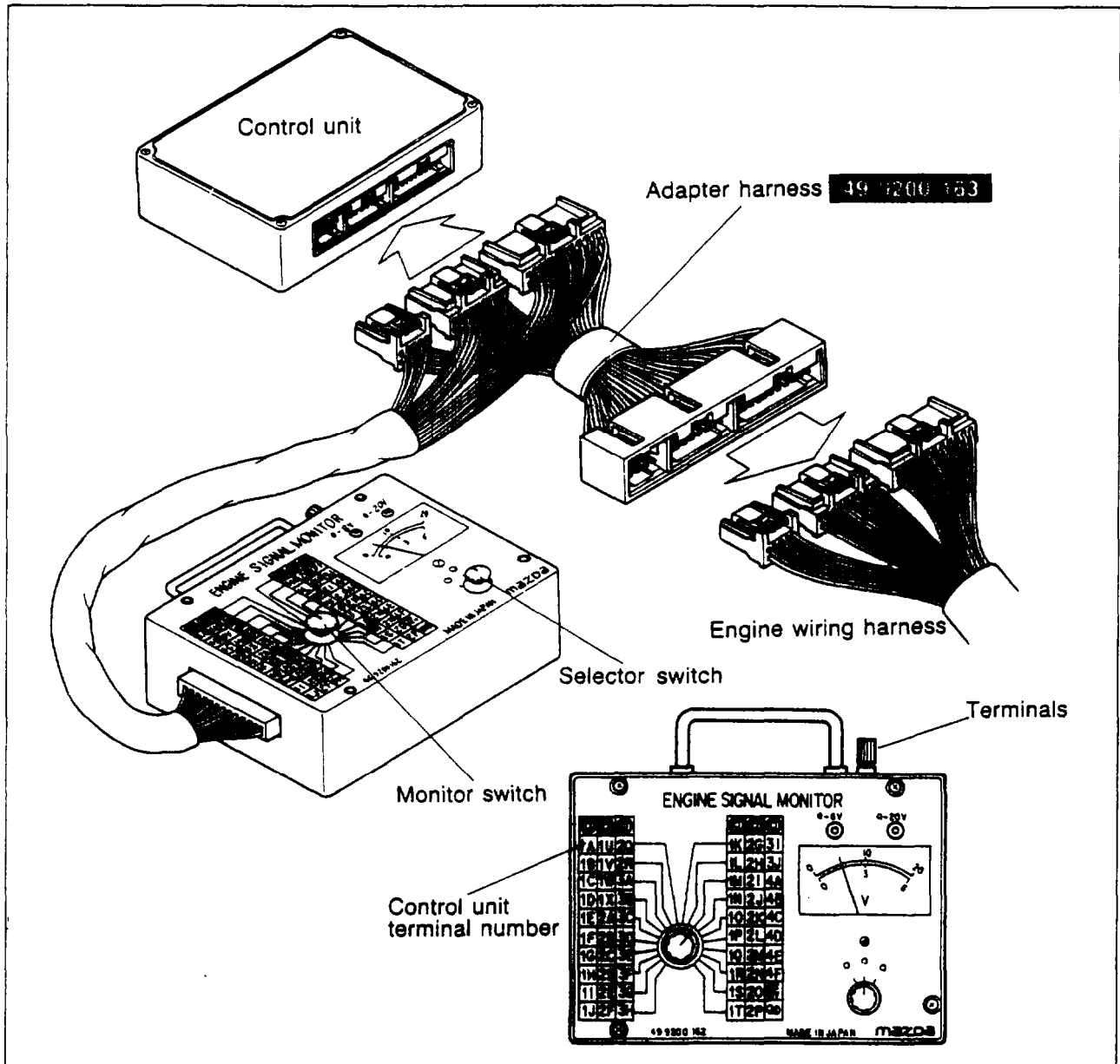
No. 15 code illumination



77U04B-072p

CONTROL UNIT

ENGINE SIGNAL MONITOR (49 9200 162) AND ADAPTER (49 9200 163)



87U04B-017

The **Engine Signal Monitor** (49 9200 162) has been developed to check the EGI control unit terminal voltage. This monitor easily inspects the terminal voltage by setting the monitor switch.

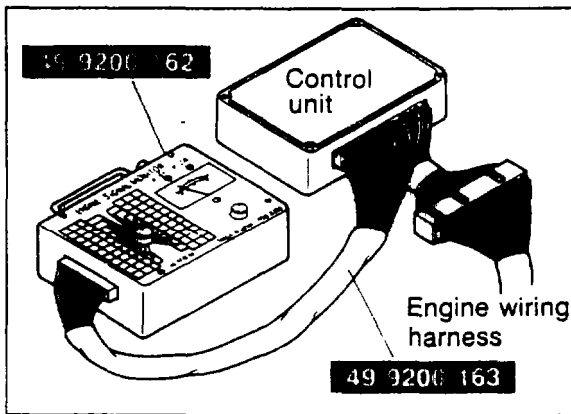
How to Use The Engine Signal Monitor

1. Connect the **Engine Signal Monitor** (49 9200 162) between the control unit and the engine harness using the **adapter** (49 9200 163).
2. Turn the selector switch and monitor switch to select the terminal number.
3. Check the terminal voltage.

Caution

Do not apply voltage to terminals.

77U04B-231



67U04X-197

INSPECTION

1. Connect **engine signal monitor** (49 9200 162) and **adapter** (49 9200 163) as shown in the figure.
2. Turn the ignition switch ON, and check the voltage of the terminals.

Caution

- a. Before checking the control unit, warm up the engine to normal operating temperature.
- b. If the proper voltage is not indicated on the voltmeter, check all wiring, connections and finally, check that component.

Terminal	Input	Output	Connection to	Voltage (after warming up)		Remark
				Ignition switch: ON	Idle	
1A		○	Self-Diagnosis Checker	Ignition switch OFF → ON for 3 sec. below 5V, after 3sec. approx. 12V		with Self-Diagnosis Checker
1B		○	Self-Diagnosis Checker	Ignition switch OFF → ON for 3 sec. below 5V after 3 sec. approx. 12V		with Self-Diagnosis Checker
1C		○	Air bypass solenoid valve	Approx. 12V		
1D		○	Self-Diagnosis Checker (Monitor lamp)	Ignition switch OFF → ON for 3 sec. below 5V after 3 sec. approx. 12V		with Self-Diagnosis Checker
1E	○		A/C switch	below 2.5V (A/C: ON), approx. 12V (A/C: OFF)		Blower motor ON
1F		○	A/C main relay	approx. 12V (A/C: OFF)		Blower motor ON
1G	○		Neutral switch	below 1.5V (in neutral), approx. 12V (others)		
1H	○		Water temperature switch	below 1.5V (water temperature: above 17°C (62.6°F))		
1I	○		5th switch	below 1.5V; (Others), approx. 12V (5th gear)		
1J	○		Initial set coupler	approx. 4—7V (Initial set coupler: OFF), below 1.5V (Initial set coupler: ON)		
1K		○	Shift indicator light	below 1.5V	approx. 12V	
1L	○		Clutch switch	below 1.5V (clutch pedal; released) approx. 12V (clutch pedal; depressed)		
1M	○		Coil with igniter (Trailing) IGf-T	below 2V		*1
1N	○		Crank angle sensor G ①	below 1.0V		G
1O	○		Mileage switch	approx. 12V (below 20,000 miles), below 1.5V (above 20,000 miles)		
1P	○		Crank angle sensor G ②	below 1.0V		B
1Q	○		Crank angle sensor Ne ②	below 1.0V		W
1R	○		Knock control unit	3—5V		
1S		○	Port air solenoid valve	approx. 12V		Mileage switch ON: below 2.5V
1T	○		Crank angle sensor Ne ①	below 1.0V		R

87U048-018

4B CONTROL UNIT

Terminal	Input	Output	Connection to	Voltage (after warming up)		Remark
				Ignition switch: ON	Idle	
1U		○	Coil with igniter (Trailing) IGs-T (Select signal)	approx. 4.4V	approx. 2.2V	
1V		○	Coil with igniter (Leading) IGT-L (Ignition timing signal)	0V	approx. 0.8V	
1W	○		Heat hazard sensor	below 1.5V	approx. 12V	Floor Temp.: below 110°C (230°F)
1X		○	Coil with igniter (Trailing) IGT-T (Ignition timing signal)	0V	approx. 0.8V	
2A		○	V ref	4.5—5.5V		
2B	○		Pressure sensor	2.3—2.7V		Disconnect vacuum hose
2C	—	—	Ground	0V		
2D	○		O ₂ sensor	below 1.0V		Acceleration: 0.5—1.0 V Deceleration: 0—0.4 V
2E	○		Air flow meter (Vs)	approx. 4V	2.5—3.5V	
2F	○		Variable resistor	1—4V (varies according to the variable resistor adjustment)		
2G	○		Throttle sensor (TVO)	approx. 1V (throttle sensor adjusted properly)		
2H	○		Atmospheric pressure sensor	3.5—4.5V (at sea level) 2.5—3.5V (at 2,000 m (6,500 ft))		
2I	○		Water thermo sensor	approx. 0.4—1.8V		Warm engine
2J	○		Air flow meter (intake air temperature sensor)	2—3V at 20°C (68°F)		
2K		○	Twin-scroll turbocharger solenoid valve	below 2.0V		above 2,700 rpm: approx. 12V
2L	○		Intake air temperature sen- sor (inlet air pipe)	1—2V at 80°C (176°F)		
2M		○	Pressure regulator control solenoid valve	below 2.0V	approx. 12V	Cranking: below 2.0V
2N		○	EGR solenoid valve	approx. 12V		
2O		○	Switching solenoid valve	approx. 12V (throttle sensor is adjusted properly)	approx. 12V	
2P		○	Relief solenoid valve	below 2V (throttle sen- sor is adjusted properly)	below 2.0V	
2Q		○	Bypass air control (BAC) valve	8—12V Engine signal monitor green and red light flash		
2R	—	—	Ground	0V		
3A	—	—	Ground	0V		
3B	○		Starter switch	below 1.5V		approx. 10V (at cranking)
3C		○	Injector (Rear primary)	approx. 12V	approx. 12V* ¹	

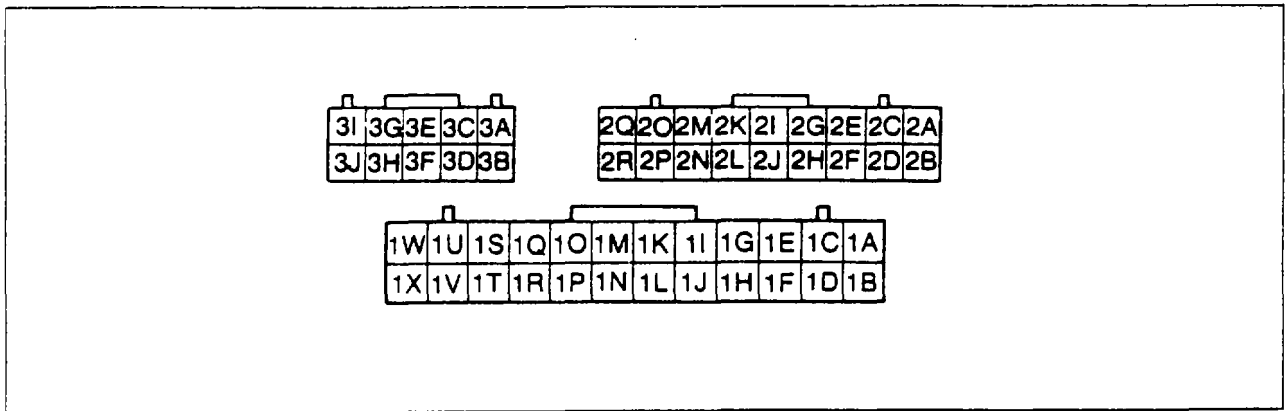
87U048-019

Terminal	Input	Output	Connection to	Voltage (after warming up)		Remark
				Ignition switch: ON	Idle	
3D		○	Fuel pump resistor relay	approx. 12V	below 2.0V	
3E		○	Injector (Front primary)	approx. 12V	approx. 12V* ¹	
3F		○	Injector (Rear secondary)	approx. 12V		
3G	—	—	Ground	0V		
3H		○	Injector (Front secondary)	approx. 12V		
3I	—	—	Main relay	approx. 12V		
3J	○		Battery	approx. 12V		

*¹ Engine signal monitor green and red light flash

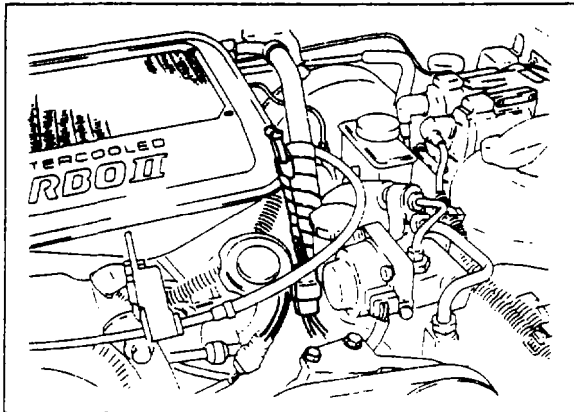
87U04B-020

Control unit connector (Control unit side)



77U04B-076

4B EMISSION CHECKING PROCEDURE

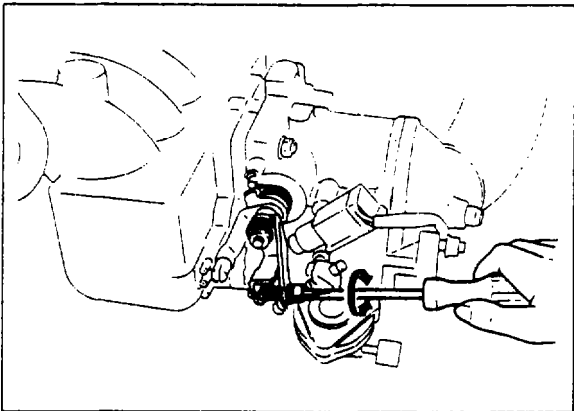


67U04X-007

EMISSION CHECKING PROCEDURE

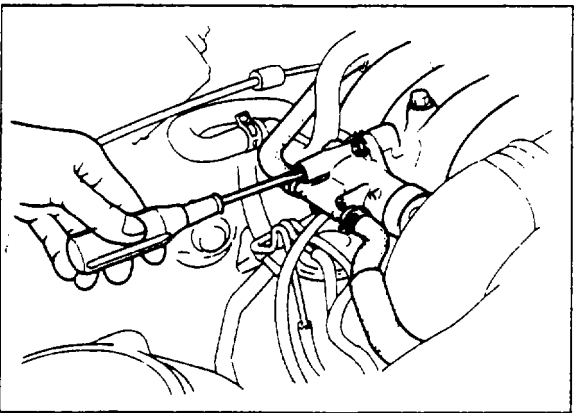
INSPECTION OF THROTTLE SENSOR

1. Warm up the engine, then turn it off.
2. Connect the **checker lamp** (49 F018 001) to the check connector (Green).
3. Turn the ignition switch on and check whether one of the lamps illuminates.



77U04B-077

4. If both lamps illuminate or neither does, turn the throttle sensor adjusting screw until only one of the lamps illuminates.
 - a) If both lamps illuminate, turn the adjusting screw clockwise.
 - b) If both lamps do not illuminate, turn the adjusting screw counterclockwise.



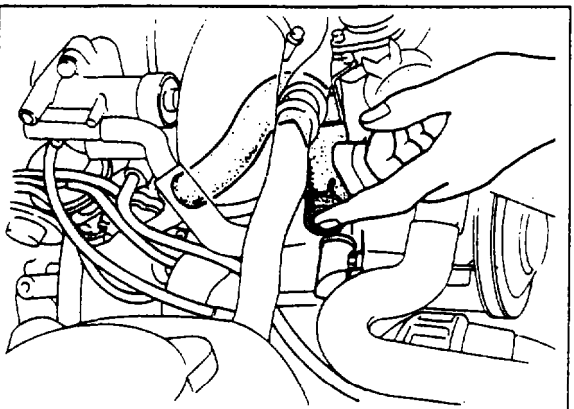
77U04B-078p

INSPECTION OF IDLE SPEED

5. Connect a tachometer to the engine.
6. Connect a jumper wire to the terminals of the initial set coupler.
7. Start the engine and adjust the idle speed. (Refer to 4B—80)
8. After adjusting, disconnect the jumper wire from the initial set coupler.

Note

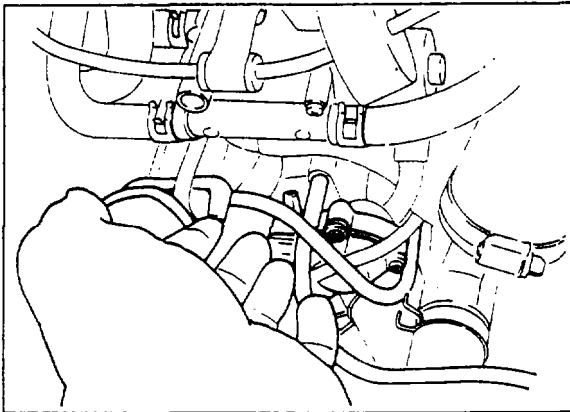
Failure to use a jumper wire at the initial set coupler will result in a misadjustment.



67U04X-010

INSPECTION OF ANTI-AFTERBURN VALVE

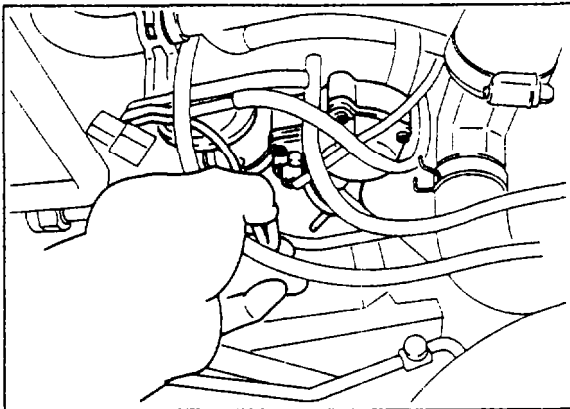
9. Disconnect the air hose (air pump—air control valve) at the air pump and place a finger over the air hose opening.
10. Increase the engine speed to **3,000 rpm**, and then decrease the engine speed rapidly.
11. Check that air is sucked into the air hose for a few seconds while decelerating.
12. Reconnect the air hose to the air pump.



77U04B-079

INSPECTION OF SWITCHING SOLENOID VALVE

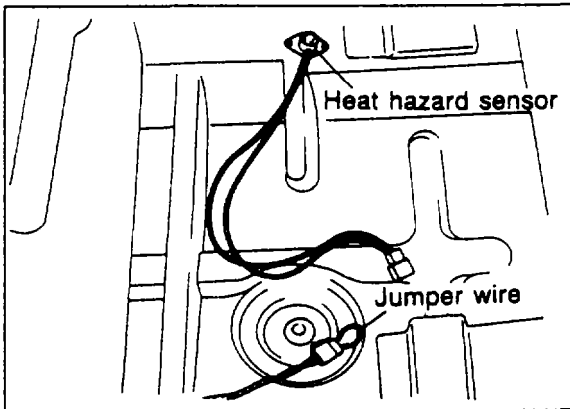
13. Disconnect the vacuum hose (switching solenoid valve to air control valve) at the air control valve.
14. Place a finger over the port opening and check that air is sucked into the port at idle.
15. Gradually increase the engine speed and check that air is not sucked into the port when the engine speed is above **4,200 rpm**.
16. Check that air is sucked into the port during deceleration.
17. Reconnect the vacuum hose.



77U04B-080

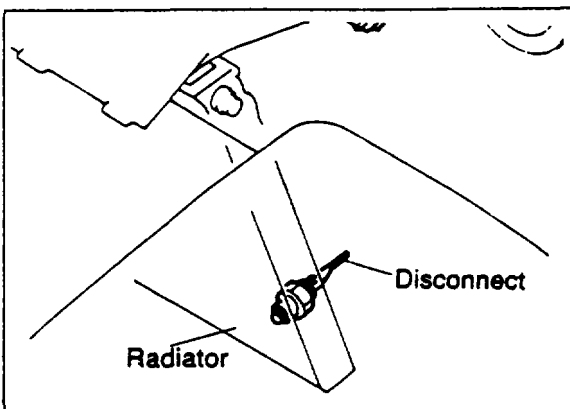
INSPECTION OF RELIEF SOLENOID VALVE

18. Disconnect the vacuum hose (relief solenoid valve to air control valve) at the air control valve.
19. Place a finger over the port opening and check that air does not flow from the port at idle.
20. Gradually increase the engine speed and check that the air does flow from the port when the engine speed is above **3,850 rpm**.
21. Check that air does not flow from the port during deceleration.



77U04B-081

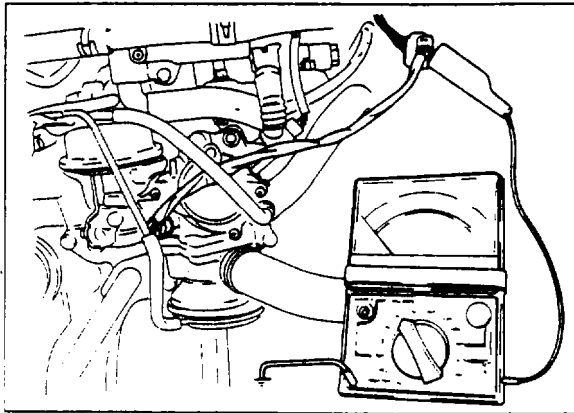
22. Disconnect the heat hazard sensor connector and connect a jumper wire to both terminals in the connector.
23. Check that the air flows from the port opening at any engine speed.
24. Disconnect the jumper wire from both terminals in the connector and connect the heat hazard sensor connector.



77U04B-082

25. Stop the engine and disconnect the water temperature switch connector at the radiator.
26. Start the engine and gradually increase the engine speed. Check that air flows from the port opening when the engine speed is over **1,000—1,200 rpm**.
27. Reconnect the vacuum hose to the relief solenoid valve.
28. Stop the engine and reconnect the water temperature switch connector.

4B EMISSION CHECKING PROCEDURE



87U04B-021

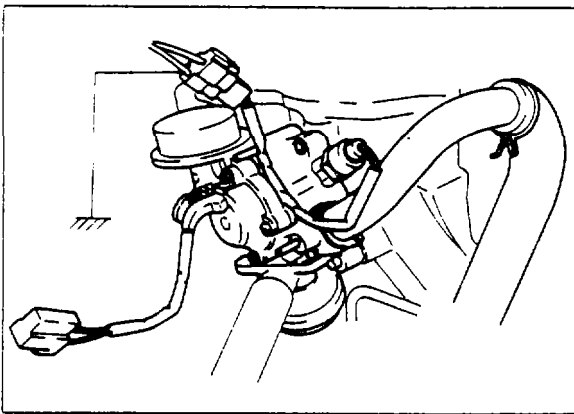
INSPECTION OF SPLIT AIR SOLENOID VALVE

29. Turn the ignition switch ON.
30. Connect the voltmeter to the split air solenoid valve (BW) terminal and ground.
31. Shift into 5th gear and check the voltmeter reading.

5th gear: below 2.5V

Others: approx. 12V

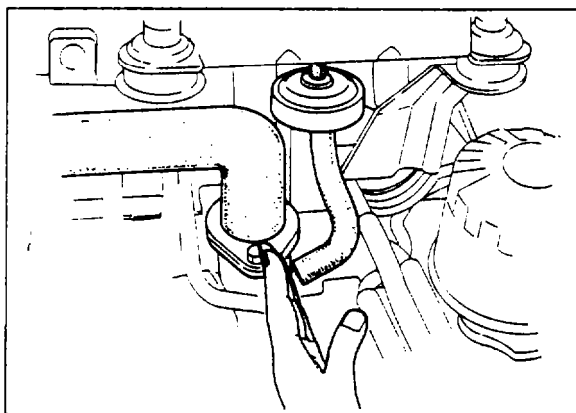
32. Disconnect the voltmeter.



77U04B-084

INSPECTION OF PORT AIR SOLENOID VALVE

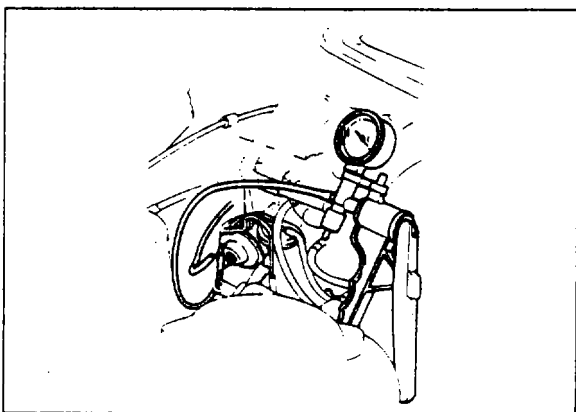
33. Connect a jumper wire to the port air solenoid valve (BR) terminal and ground.
34. Check for an operating sound of the solenoid valve when the jumper wire is connected to ground.
35. Disconnect the jumper wire and start the engine.



77U04B-085

INSPECTION OF PURGE VALVE

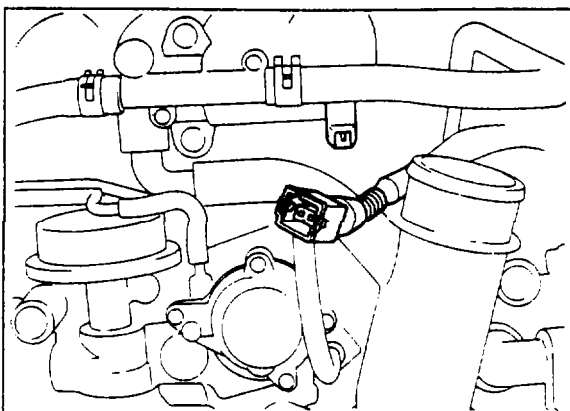
36. Disconnect the hose (purge valve—oil filler pipe) from the oil filler pipe.
37. Place a finger over the port of the hose opening.
38. Increase the engine speed to **2,000 rpm** and check that the air is sucked into the port.
39. Reconnect the hose to the purge valve.



77U04B-086

INSPECTION OF EGR VALVE

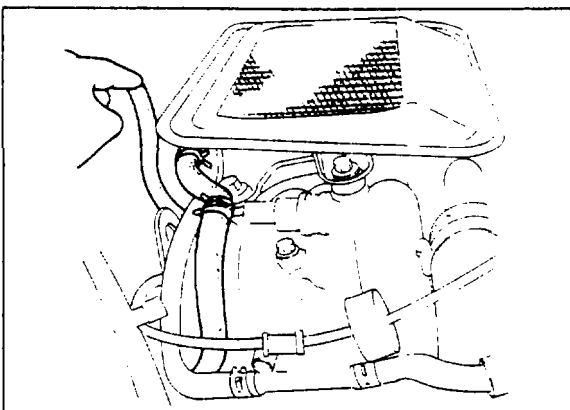
40. Disconnect the vacuum hose (EGR solenoid valve to EGR valve) at the EGR valve.
41. Connect the vacuum pump tester to the EGR valve.
42. Apply **100 mmHg (3.9 inHg)** vacuum and check that the engine speed decreases.
43. Disconnect the vacuum pump tester and reconnect the vacuum hose.



87U04B-046

INSPECTION OF BAC VALVE

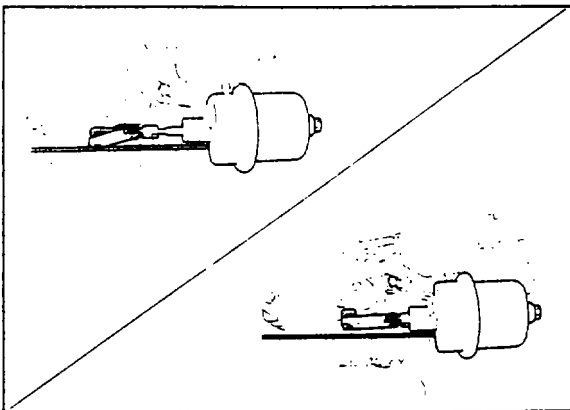
44. Connect a jumper wire to both terminals of initial set coupler, disconnect the BAC valve connector.
45. Check that the engine speed decreases.
46. Reconnect the BAC valve connector and disconnect the jumper wire from the initial set coupler.



77U04B-088

INSPECTION OF AIR SUPPLY VALVE

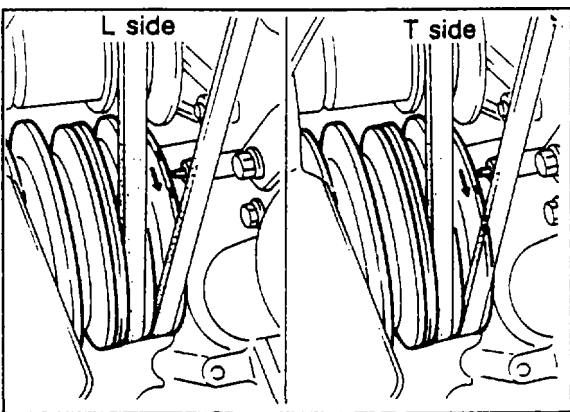
47. Disconnect the air hose (intercooler to dynamic chamber) at the intercooler.
48. Place a finger over the port opening and check that the air is not sucked into the port opening.
49. Turn the steering wheel either to the right or left, and check that the air is sucked into the port opening.
50. Reconnect the air hose.



77U04B-089

INSPECTION OF TWIN-SCROLL TURBOCHARGER CONTROL SYSTEM

51. Check that the rod returns when engine speed increases at above 2,700 rpm.
52. Decrease engine speed and check that the rod moves.



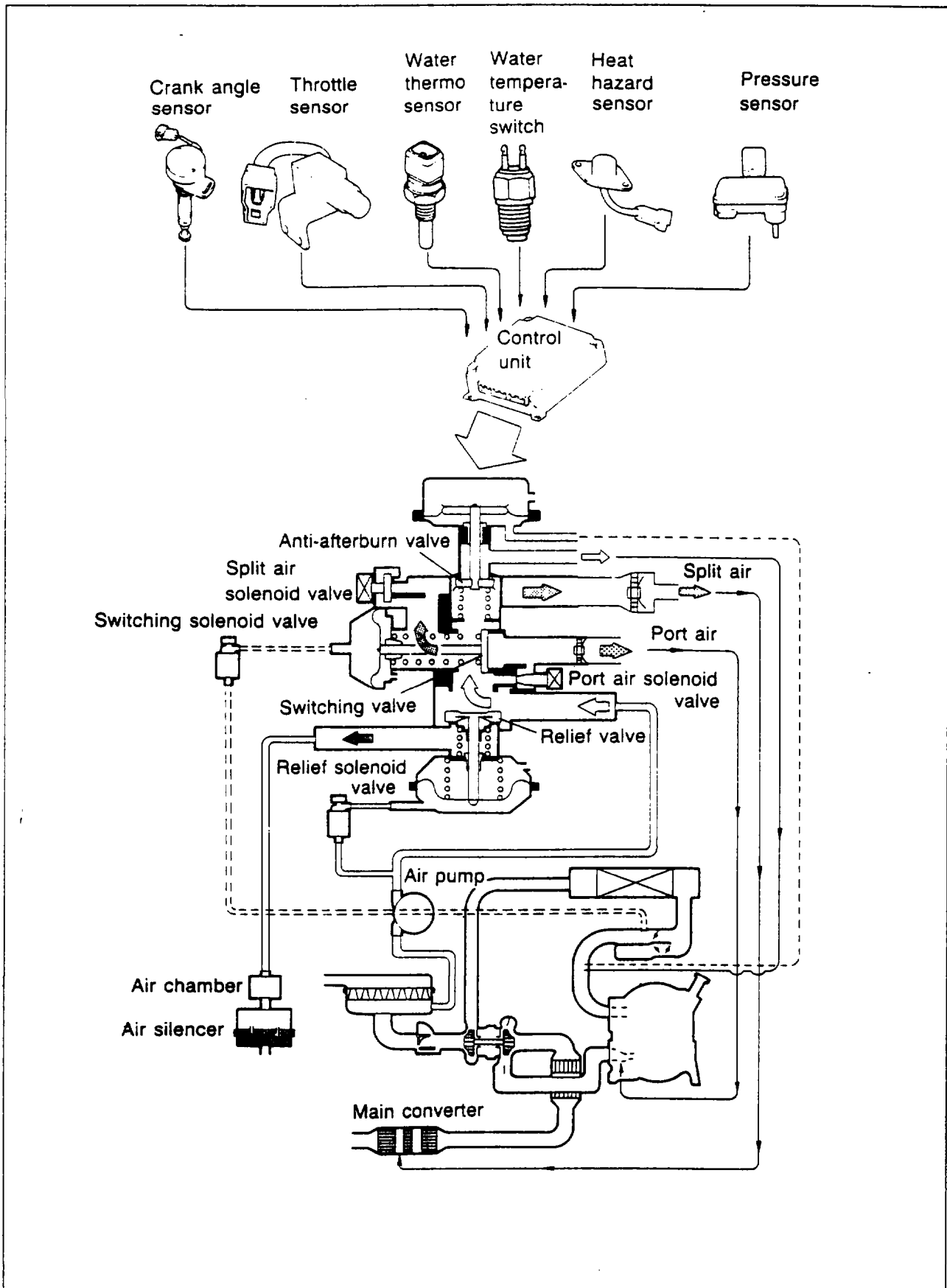
77U04B-499

INSPECTION OF KNOCK CONTROL SYSTEM

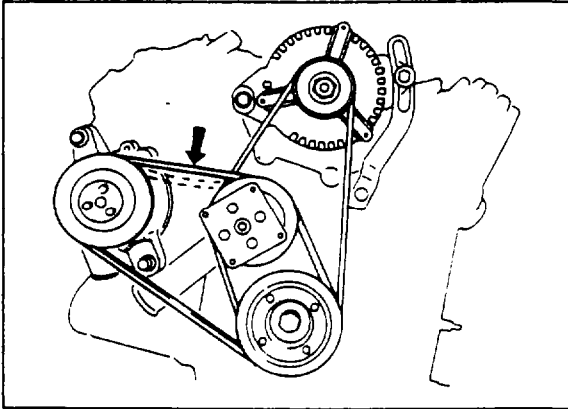
53. Connect a timing light to the "L-1" high tension lead.
54. Tap the engine hanger lightly with a plastic hammer and make sure that the ignition timing does not move.
55. Connect a jumper wire to the initial set coupler.
56. Tap the engine hanger lightly with a plastic hammer and make sure that the ignition timing retards.
57. Disconnect the jumper wire, timing light and tachometer.
58. Perform the same test for the trailing side.
59. Stop the engine.

4B SECONDARY AIR INJECTION CONTROL SYSTEM

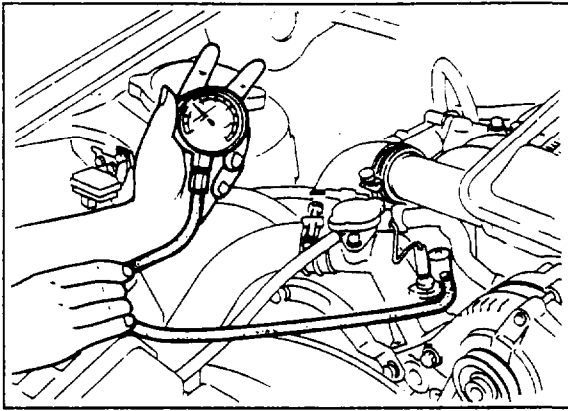
SECONDARY AIR INJECTION CONTROL SYSTEM



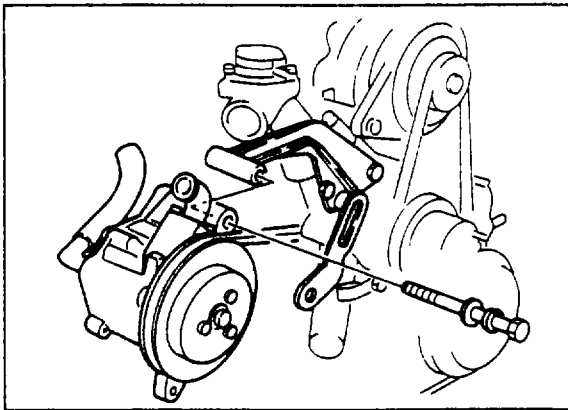
77U04B-092



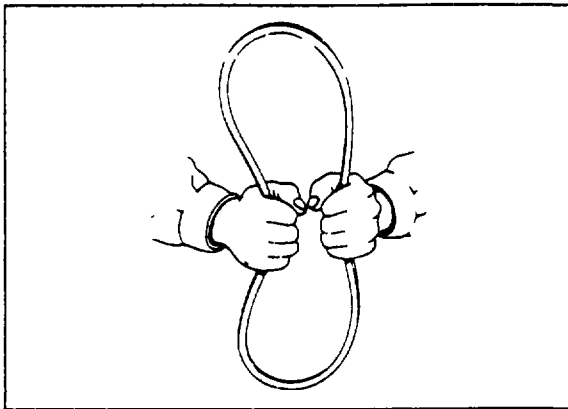
67U04X-042



87U04B-022



67U04X-044



67U04X-045

AIR PUMP Inspection

1. Warm up the engine to normal operating temperature.
2. Check the hoses and connections for leaks.
3. Check the air pump for noise.
4. Check the air pump drive belt tension.
5. Adjust, repair or replace, if necessary.
6. Disconnect the air hose (air pump—air control valve) at the air control valve.
7. Connect the **air pump gauge set** (49 2113 010B) to the air hose.
8. Connect a tachometer to the engine.
9. Start the engine and run it at idle.
10. Observe the pressure reading.
11. Replace the pump, if necessary.

**Pressure: 11.8 kPa
(0.12 kg/cm², 1.7 psi) at idle**

Removal

1. Disconnect the air hose.
2. Remove the air pump strap bolt.
3. Remove the air pump mounting bolt.
4. Remove the air pump drive belt and remove the air pump.

Installation

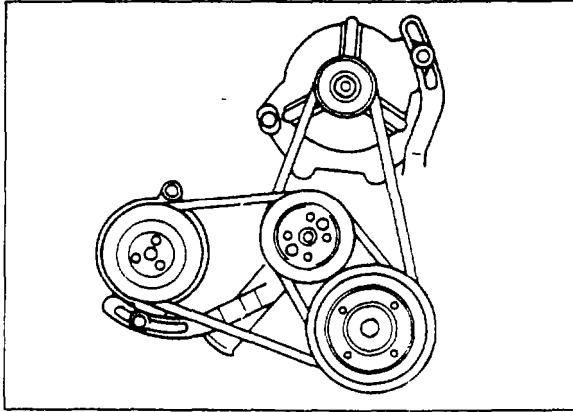
Install the air pump in the reverse order of removal and adjust the drive belt tension.

AIR PUMP DRIVE BELT

Inspection

1. Check the drive belt for cracks, deterioration or oil contamination, replace if necessary.
2. If the belt is noisy, check for loose or misaligned pulleys.

4B SECONDARY AIR INJECTION CONTROL SYSTEM



77U04B-093

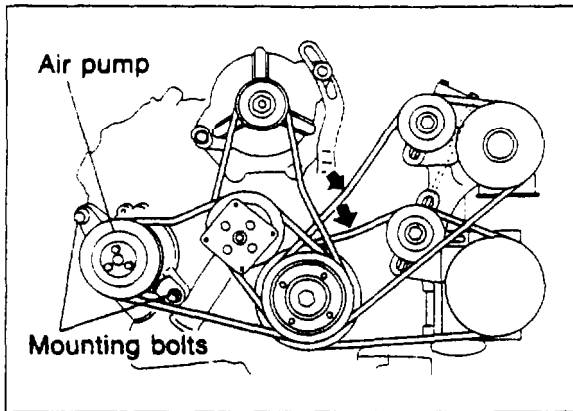
Adjustment

1. Loosen the air pump strap bolt and mounting bolt.
2. Move the air pump closer to, or away from the engine until the correct belt tension is obtained.

Belt tension:

8—10 mm (0.31—0.39 in)
when pressed at 98.1 N (10 kg, 22 lb)

3. Tighten the bolts.



77U04B-215

Removal

1. Loosen the A/C and P/S pulley drive belts (if equipped).
2. Loosen the air pump strap and mounting bolts, and move the air pump to remove the drive belt.

Installation

1. Install a new belt and adjust the belt tension (Refer to "Adjustment").
2. Install the other drive belts and adjust the belt tension.

Belt tension:

6—8 mm (0.24—0.32 in) — A/C
11—13 mm (0.43—0.51 in) — P/S
when pressed at 98.1 N (10 kg, 22 lb)

CHECK VALVE (IN INTAKE MANIFOLD)

Inspection

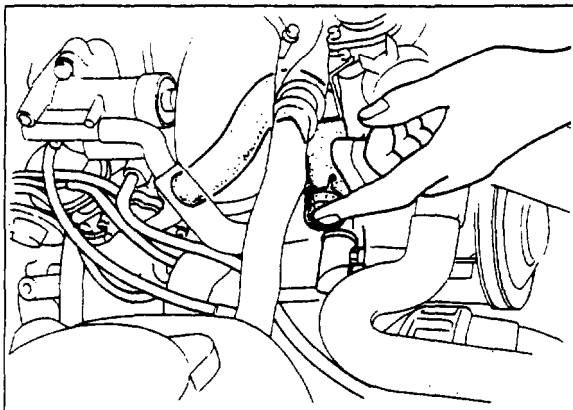
1. Disconnect the air hose (air pump to air control valve) at the air pump.
2. Connect a tachometer to the engine.
3. Start the engine and disconnect the connector from the switching solenoid valve.
4. Increase the engine speed to **1,500 rpm** and check for exhaust gas leakage at the air inlet fitting on the air control valve.
5. Replace the check valve, if there is exhaust gas leakage.

Removal

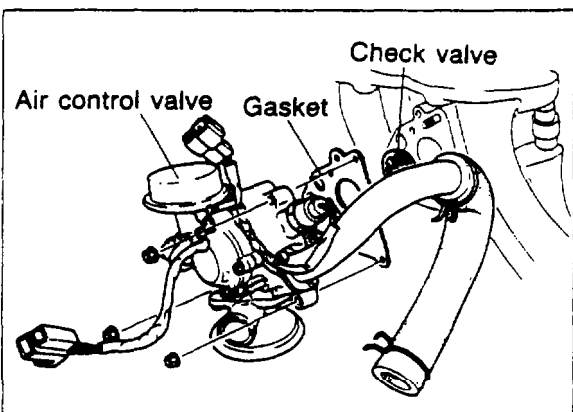
1. Remove the air control valve. (Refer to 4B—42)
2. Remove the gasket and check valve.

Installation

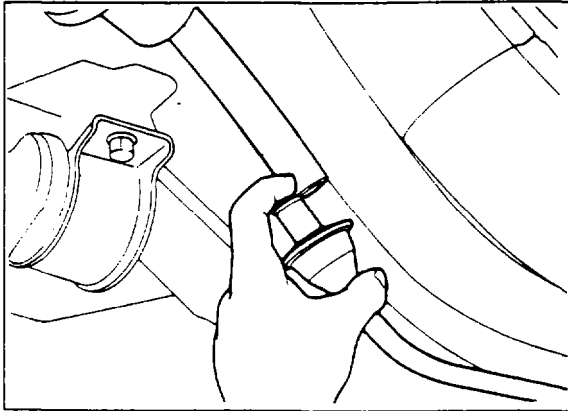
Install the check valve in the reverse order of removal.



77U04B-109



77U04B-110p

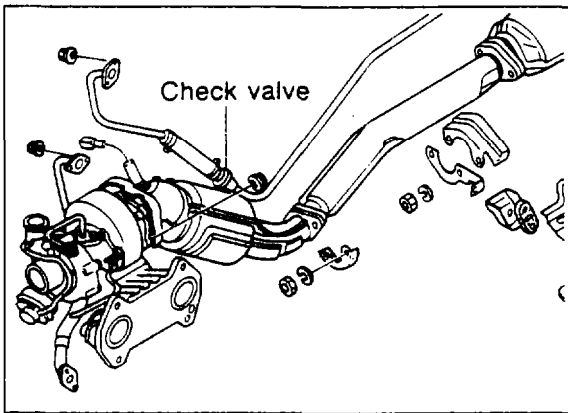


77U04B-095

CHECK VALVE (INTAKE MANIFOLD TO CATALYTIC CONVERTER)

Inspection

1. Disconnect the air hose (intake manifold to check valve) at the check valve.
2. Connect a tachometer to the engine.
3. Start the engine.
4. Place a finger over the check valve opening.
5. Increase the engine speed to **1,500 rpm** and check for exhaust gas leakage from the check valve opening.
6. Replace the check valve, if there is exhaust gas leakage.



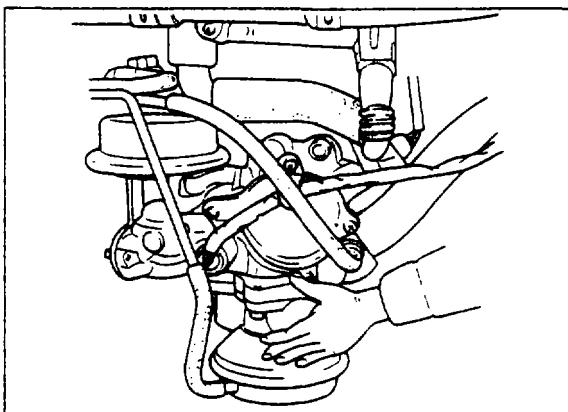
67U04X-051

Removal

1. Unfasten the clip and disconnect the air hose from the check valve.
2. Remove the split air pipe attaching bolts and remove the air pipe assembly.

Installation

Install the check valve and air pipe assembly in the reverse order of removal.



77U04B-219

AIR CONTROL VALVE

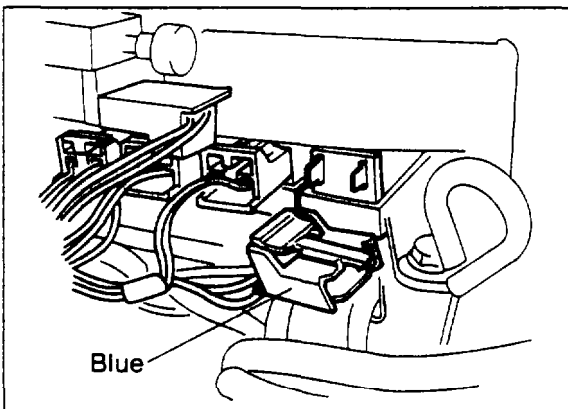
Inspection

1. Warm up the engine to normal operating temperature.
2. Connect a tachometer to the engine.

Note

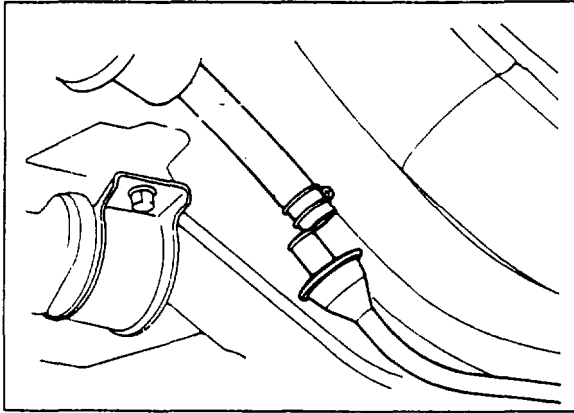
Only for vehicles equipped with ABS, disconnect the air hose and vacuum hose of the air bypass valve from the turbocharger and plug the hoses before disconnecting the air hose (air silencer to air control valve) at the air control valve.

3. Disconnect the air hose (air silencer to air control valve) at the air control valve.
4. Place a finger over the air control valve outlet.
5. Slowly increase the engine speed and check that air begins to flow out at **3,750 rpm**.
6. Run the engine at idle.
7. Disconnect the relief solenoid valve connector.
8. Check that air flows out at **1,200 rpm** or more.
9. Reconnect the solenoid valve connector.



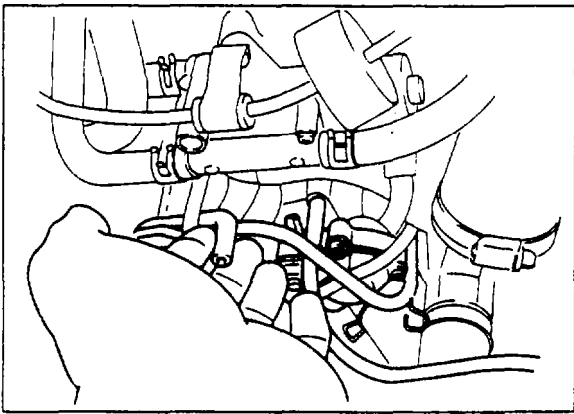
77U04B-220

4B SECONDARY AIR INJECTION CONTROL SYSTEM



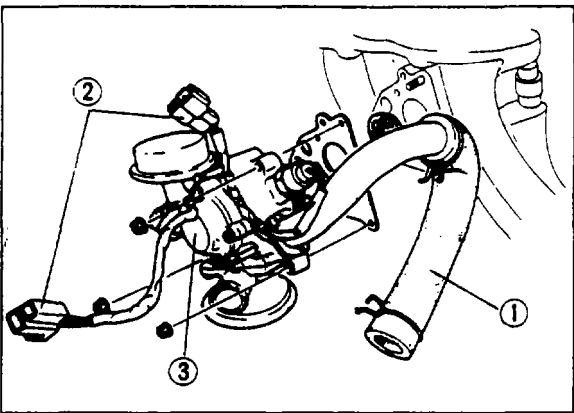
77U04B-098

10. Disconnect the split air hose (intake manifold to check valve) at the check valve.
11. Place a finger over the port opening.



77U04B-099

12. Disconnect the vacuum hose (switching solenoid valve to air control valve) at the air control valve.
13. Check that air flows out of the split air hose.
14. Reconnect the vacuum hose and split air hose.
15. Replace the air control valve, if necessary.



67U04X-056

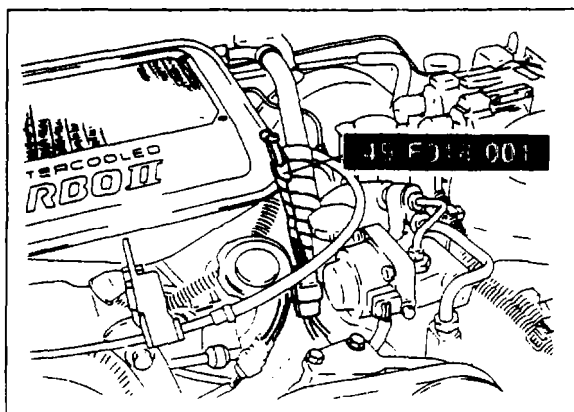
Removal

Remove the parts in the sequence as shown in the figure.

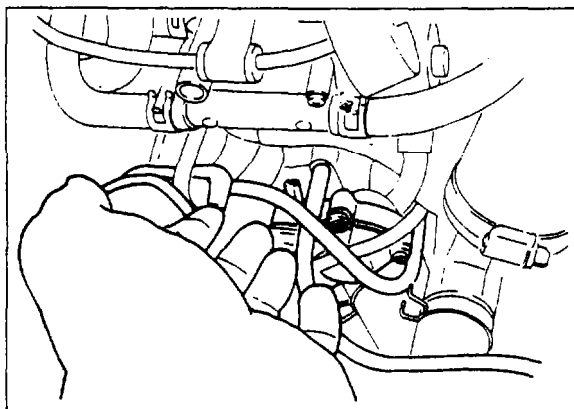
- 1 Air hose.
- 2 Split air solenoid valve and port air solenoid valve connector.
- 3 Air control valve.

Installation

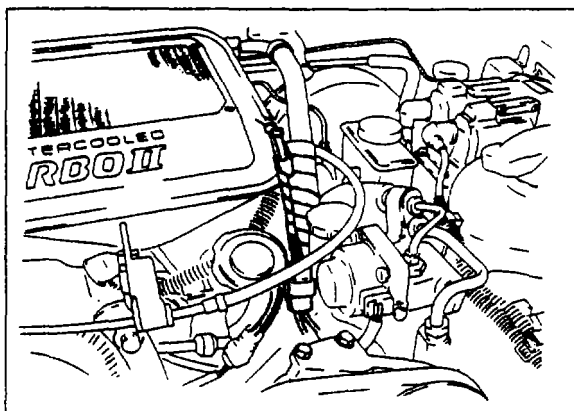
Install the air control valve in the reverse order of removal.



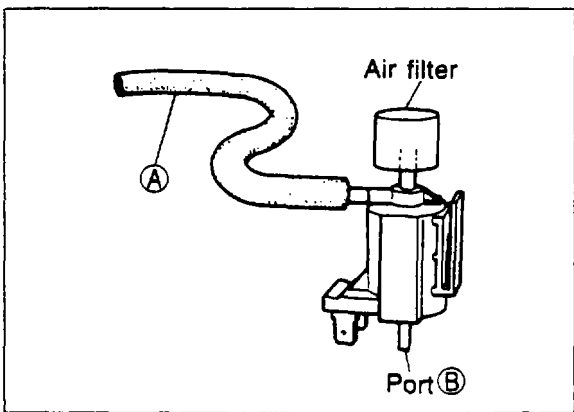
77U04B-100



77U04B-101



77U04B-216



67U04X-059

SWITCHING SOLENOID VALVE

Inspection

Signal

1. Warm up the engine and run it at idle.
2. Connect a tachometer to the engine.
3. Connect the **checker lamp** (49 F018 001) to the check connector (Green).
4. Disconnect the vacuum hose (switching solenoid valve to air control valve) at the air control valve.
5. Place a finger over the port opening.

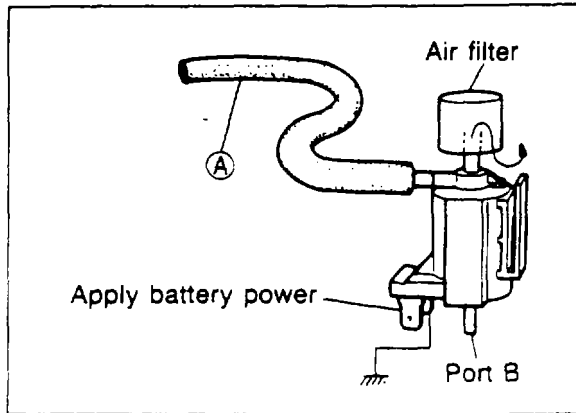
6. Check that **checker lamp** (49 F018 001) illuminates (red lamp) and for suction at the port.

Engine condition	Checker lamp illumination	Sucking air	Remark
Idle	Red lamp does not illuminate	Yes	
Deceleration			
Above 4,200 rpm	Red lamp illuminates	No	Increase engine speed
Acceleration	Red lamp illuminates	No	

Switching solenoid valve

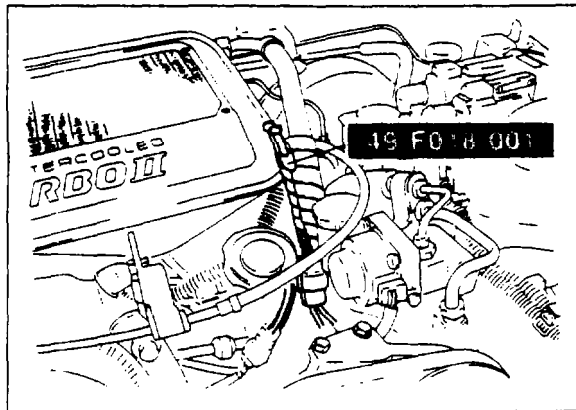
1. Disconnect the vacuum hoses from the switching solenoid valve.
2. Blow through the solenoid valve from port (A). Check that air passes through the valve and flows from port (B).

4B SECONDARY AIR INJECTION CONTROL SYSTEM



67U04X-060

3. Disconnect the solenoid valve connector and connect 12V and ground to the terminals on the solenoid valve.
4. Blow through the solenoid valve from port (A). Check that air passes through the valve and flows from the air filter.



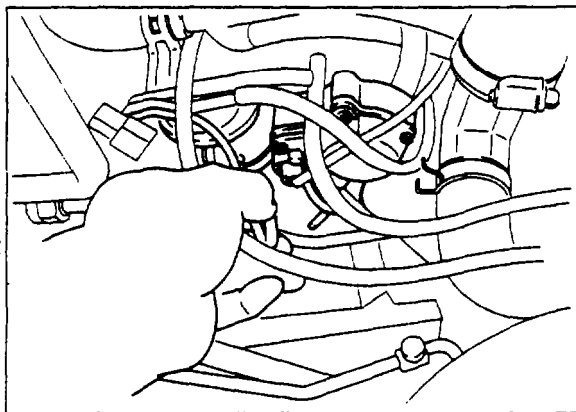
77U04B-103

RELIEF SOLENOID VALVE

Inspection

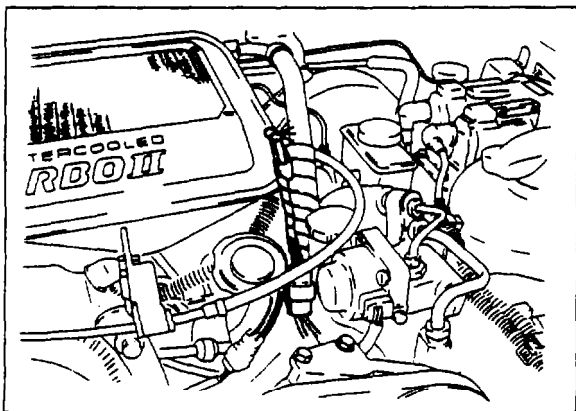
Signal

1. Warm up the engine and run it at idle.
2. Connect a tachometer to the engine.
3. Connect the **checker lamp** (49 F018 001) to the check connector (Green).



77U04B-104

4. Disconnect the vacuum hose (relief solenoid valve to air control valve) at the air control valve.
5. Place a finger over the port opening.



77U04B-217

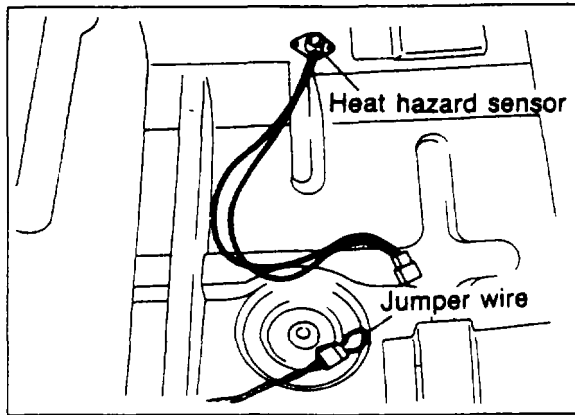
6. Check that **checker lamp** (49 F018 001) illuminates (Green lamp) and that air flows from the port opening.

Engine condition	Checker lamp illumination	Flowing air	Remark
Idle	Green lamp illuminates	No	
Deceleration			
Above 3,750 rpm	Green lamp does not illuminate	Yes	Gradually increase engine speed

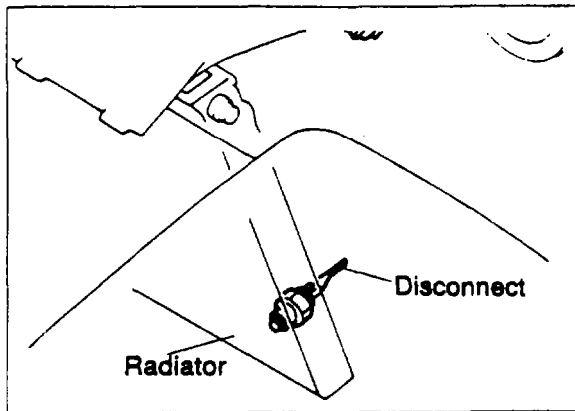
Note

The checker lamp sometimes turns OFF at approx. 1,200 rpm. It is normal.

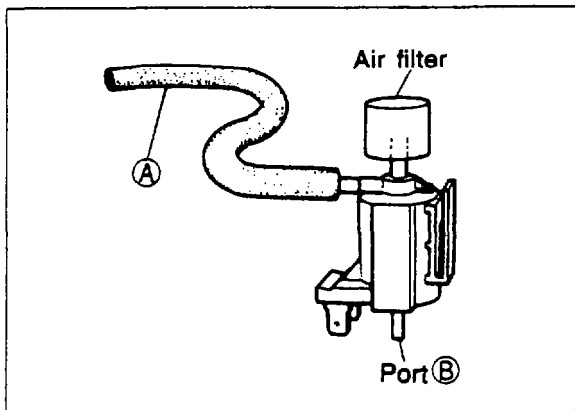
SECONDARY AIR INJECTION CONTROL SYSTEM 4B



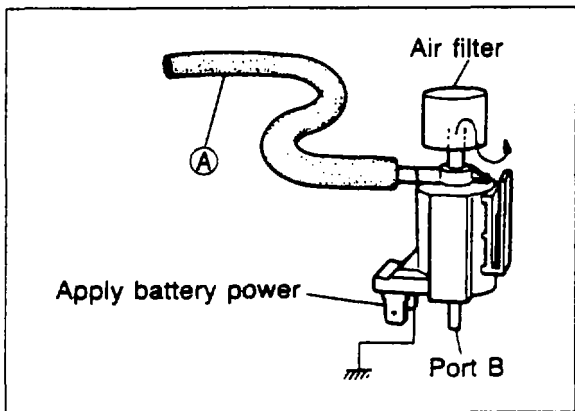
77U04B-106



77U04B-218



77U04B-108



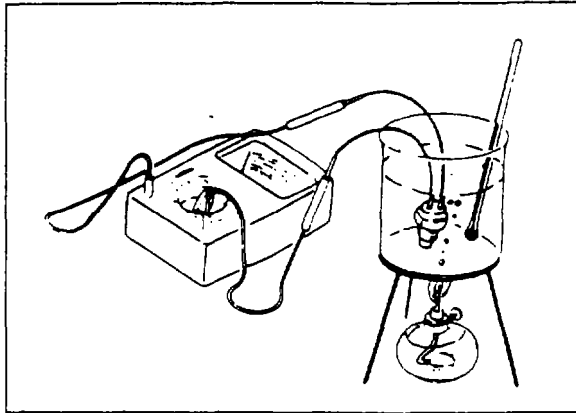
67U04X-060

7. Disconnect the heat hazard sensor connector, and connect a jumper wire to the terminals in the connector.
8. Check that the Green lamp does not illuminate and the air flows from the port opening at any engine speed.
9. Disconnect the jumper wire and reconnect the heat hazard sensor.
10. Stop the engine and disconnect the water temperature switch connector at the radiator.
11. Start the engine and gradually increase the rpm. Check that the Green lamp does not illuminate and that air flows from the port opening when the engine speed is **over 1,000—1,200 rpm.**

Relief solenoid valve

1. Disconnect the vacuum hoses from the relief solenoid valve.
2. Blow through the solenoid valve from port (A). Check that air passes through the valve and flows from port (B).
3. Disconnect the solenoid valve connector and connect 12V and ground to the terminals on the solenoid valve.
4. Blow through the solenoid valve from port (A). Check that air passes through the valve and flows from the air filter.

4B SECONDARY AIR INJECTION CONTROL SYSTEM



67U04X-069

WATER TEMPERATURE SWITCH

Removal

Remove the water temperature switch from the radiator.

Installation

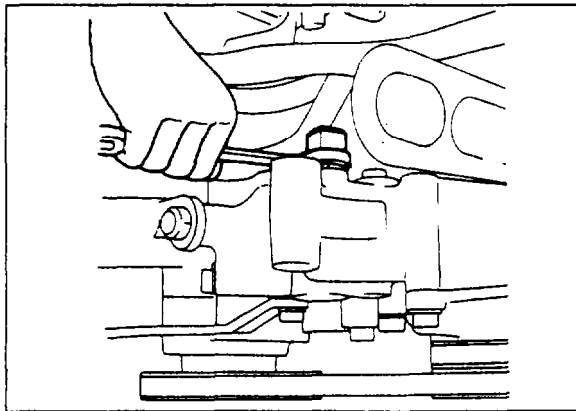
Install in the reverse order of removal.

Inspection

1. Place the water temperature switch in water with a thermometer and heat the water gradually.
2. Check the temperature at which continuity exists between the terminals.

Specified temperature: 15—19°C (59—66.2°F)

3. Replace the switch, if necessary.



67U04X-070

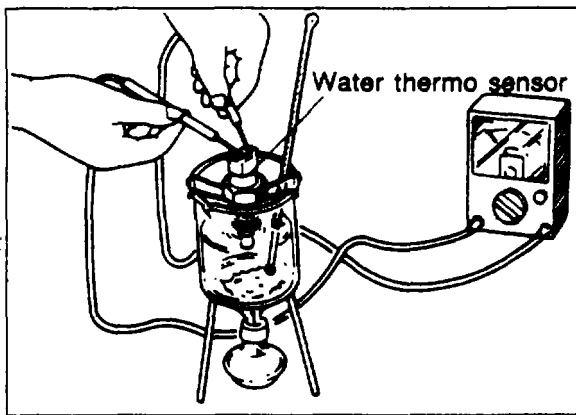
WATER THERMO SENSOR

Removal

1. Disconnect the water thermo sensor connector.
2. Remove the sensor from the water pump.

Installation

Install in the reverse order of removal.



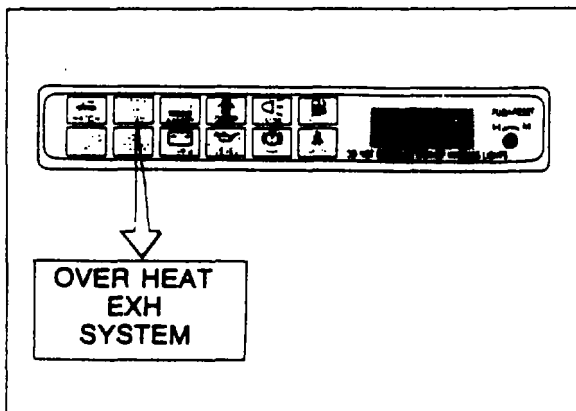
67U04X-071

Inspection

1. Place the water thermo sensor in water with a thermometer and heat the water gradually.
2. Check the resistance of the sensor using a circuit tester.

Water temperature	Resistance
-20°C (-4°F)	16.2 ± 1.62 kΩ
20°C (68°F)	2.45 ± 0.24 kΩ
80°C (176°F)	0.32 ± 0.032 kΩ

3. Replace the sensor, if necessary.



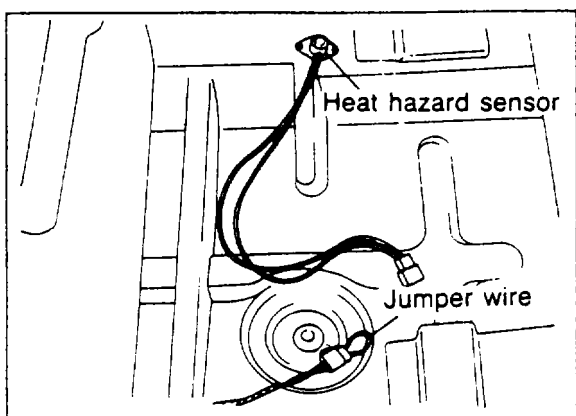
67U04X-072

HEAT HAZARD SENSOR

Inspection

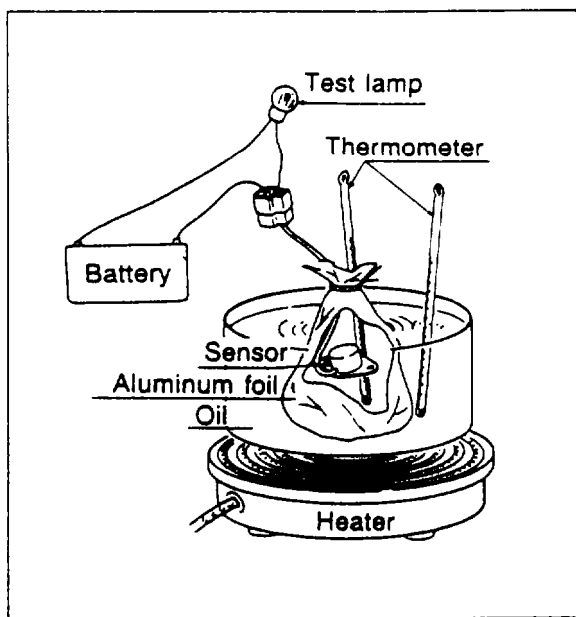
Warning system

1. Turn the ignition switch ON. Check that the heat hazard warning light comes on.
2. Start the engine and the warning light should go off.



67U04X 073

3. Disconnect the heat hazard sensor connector.
4. Check that the heat hazard warning light comes on when a jumper wire is connected to the terminals of the sensor connector.



67U04X-074

Heat hazard sensor Removal

1. Remove right seat.
2. Lift up the floor mat.
3. Disconnect the heat hazard sensor connector and remove the sensor connector.

Installation

Install in the reverse order of removal.

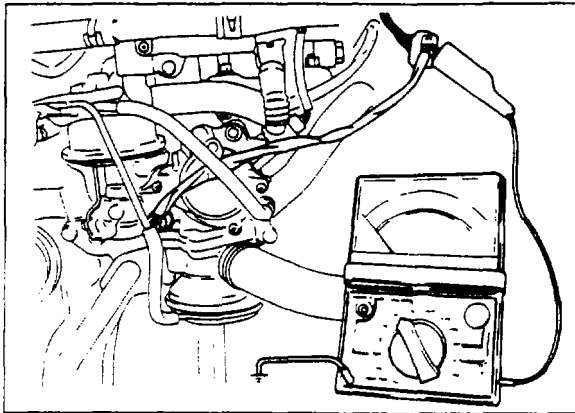
Inspection

1. Wrap the sensor and thermometer with aluminum foil to prevent oil penetration and place it in a container of oil.
2. Connect a test lamp and battery power to the terminals of the sensor connector.
3. Gradually heat the oil.
The test lamp should come on when the temperature in the aluminum foil reaches **105—115°C (221—239°F)**.
4. Replace the sensor if necessary.

Note

Do not heat the oil to more than 150°C (302°F).

4B SECONDARY AIR INJECTION CONTROL SYSTEM



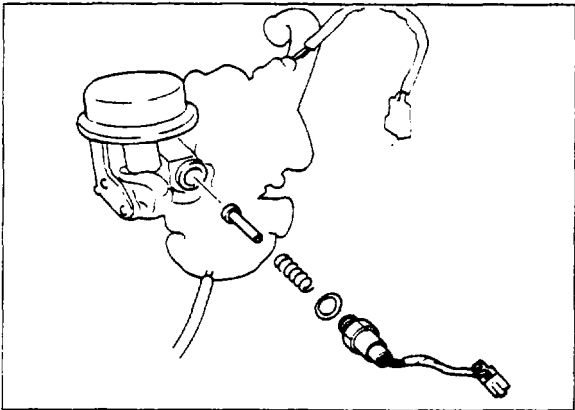
87U04B-023

SPLIT AIR SOLENOID VALVE

Inspection Signal

1. Connect a voltmeter to the split air solenoid valve (BW) terminal and ground.
2. Turn the ignition switch on.
3. Shift into 5th gear and observe the voltmeter reading.

Voltmeter reading
5th gear: below 2.5V
Others: approx. 12V



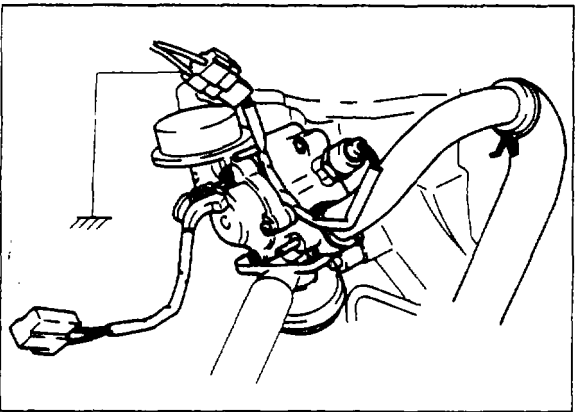
67U04X-077

Removal

1. Disconnect the split air solenoid valve connector.
2. Remove the solenoid valve.

Installation

Install in the reverse order of removal.



77U04B-112

PORT AIR SOLENOID VALVE

Inspection

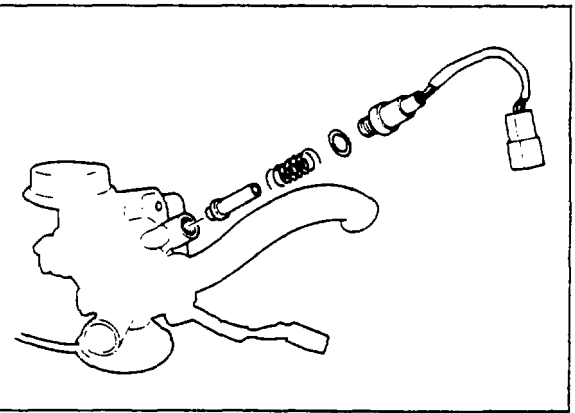
1. Connect a jumper wire to the port air solenoid valve (BR) terminal and ground.
2. Turn the ignition switch on.
3. Check for operating sound of the solenoid valve.

Removal

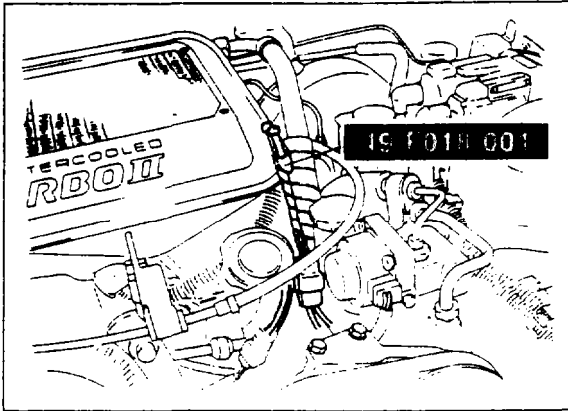
1. Disconnect the port air solenoid valve connector.
2. Remove the solenoid valve.

Installation

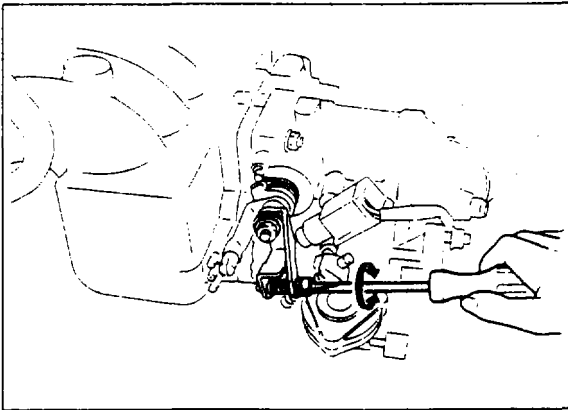
Install in the reverse order of removal.



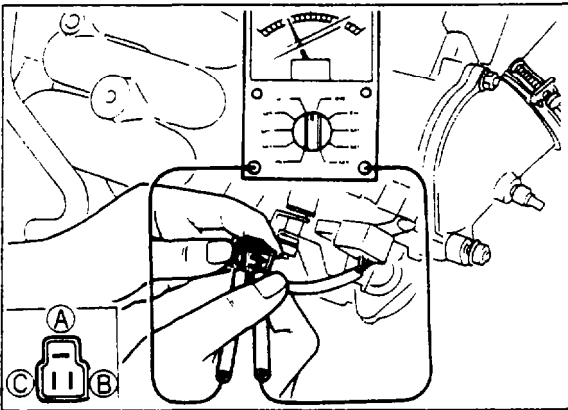
67U04X-080



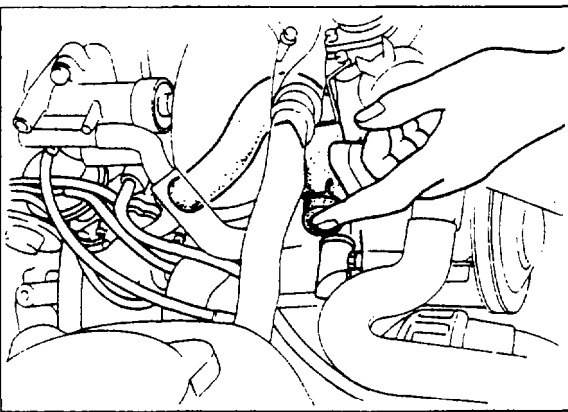
67U04X-082



77U04B-113



77U04B-114p



67U04X-085

DECELERATION CONTROL SYSTEM

THROTTLE SENSOR

Adjustment

1. Warm up the engine, then stop it.
2. Connect the **checker lamp** (49 F018 001) to the check connector (Green).
3. Turn the ignition switch on and check whether one of the lamps illuminates.
4. If both lamps illuminate or if neither does, turn the throttle sensor adjust screw until one of the lamps illuminates.
 - a) If both lamps illuminate turn the adjust screw clockwise.
 - b) If both lamps do not illuminate turn the adjust screw counterclockwise.

Note

Do not use excessive pressure on the screw; this may cause incorrect adjustment.

Inspection

1. Remove the intercooler. (Refer to 4B—61)
2. Disconnect the throttle sensor connector.
3. Connect a circuit tester between (A) terminal and (B) terminal of the sensor as shown.
4. Open the throttle valve and observe the sensor resistance.

Throttle opening

Idle position: approx. 1 kΩ

Full open: approx. 5 ± 1 kΩ

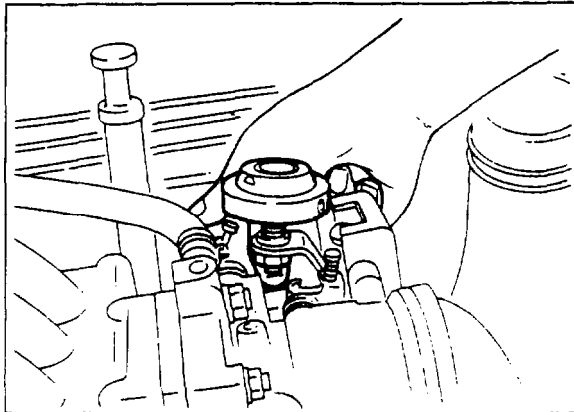
5. Reconnect the connector and install the intercooler in reverse order of removal.

ANTI-AFTERBURN VALVE

Inspection

1. Warm up the engine and run it at idle.
2. Disconnect the air hose (air control valve to air pump) at the air pump.
3. Place a finger over the air hose opening.
4. Check that air is not sucked into the air hose at idle.
5. Increase the engine speed to over **3,000 rpm**, then decrease the engine speed **rapidly**.
6. Check that air is sucked into the air hose for a few seconds while decelerating.
7. Replace the air control valve, if necessary.

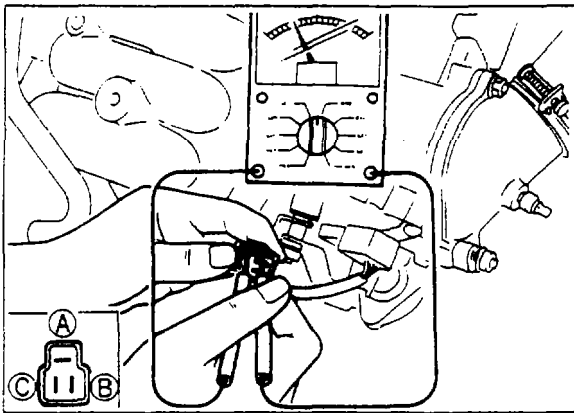
4B DECELERATION CONTROL SYSTEM



77U04B-115p

DASHPOT Inspection

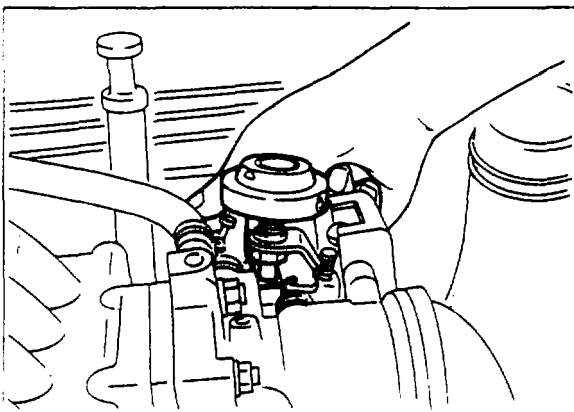
- 1 Remove the intercooler. (Refer to 4B—61)
- 2 Open the throttle valve fully, then push the dashpot rod with a finger and check that the rod goes into the dashpot slowly.
- 3 Release the rod and check that it comes out quickly.
- 4 Replace it, if necessary.
- 5 Install the intercooler in reverse order of removal.



77U04B-116p

Adjustment

- 1 Warm up the engine to the normal operating temperature and stop it.
- 2 Remove the intercooler. (Refer to 4B—61)
- 3 Disconnect the throttle sensor connector and connect the circuit tester between (A) terminal and (B) terminal of the sensor.

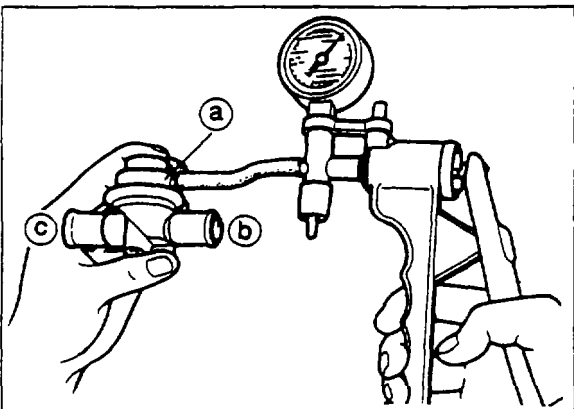


77U04B-117

- 4 Check the resistance when the dashpot rod separates from the lever.

Resistance: 1.8—3.8 k Ω

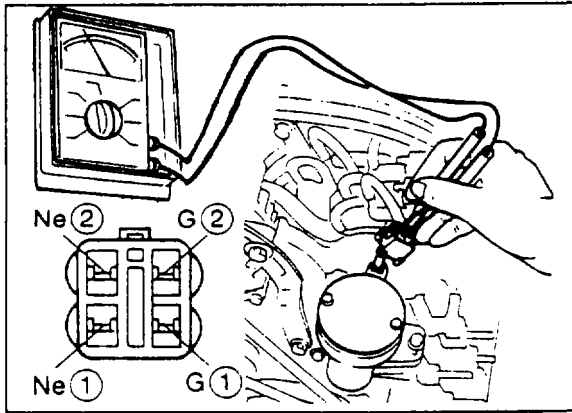
- 5 Loosen the lock nut and adjust by turning the dashpot, if necessary.
- 6 Install the intercooler in the reverse order of removal.



77U04B-118

AIR BYPASS VALVE Inspection

- 1 Remove the air bypass valve.
- 2 Connect a vacuum pump tester to the port (a) of the valve shown in the figure.
- 3 Apply vacuum and check that the air flows through the valve from port (b) port (c) at **300 mmHg (11.8 inHg)** the vacuum.
- 4 Replace it, if necessary.



77U04B-119

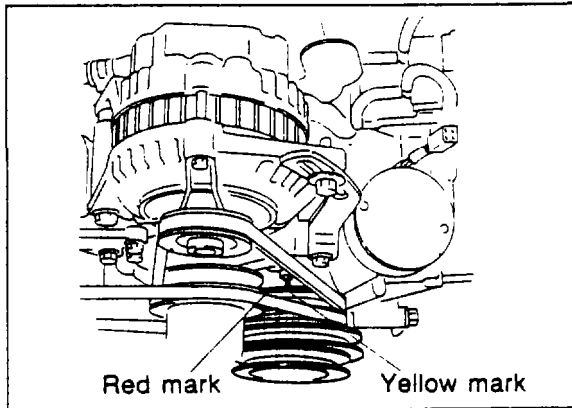
ELECTRONIC SPARK ADVANCE (ESA) CONTROL SYSTEM

CRANK ANGLE SENSOR

Inspection

1. Disconnect the crank angle sensor connector.
2. Connect a circuit tester to the terminals of the crank angle sensor connector.
3. Check the resistance of the following.

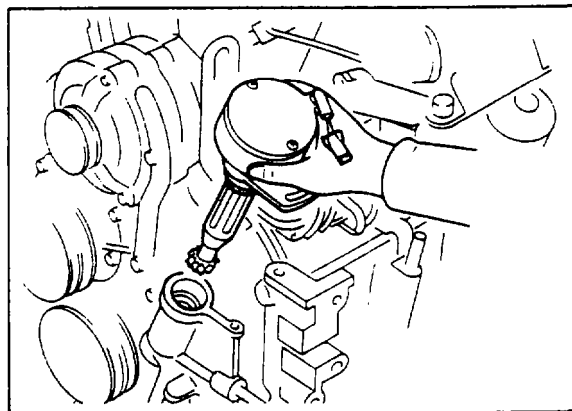
Terminal	Resistance
G ① (G) — G ② (B)	110—210 Ω
Ne ① (R) — Ne ② (W)	110—210 Ω



87U04X-089

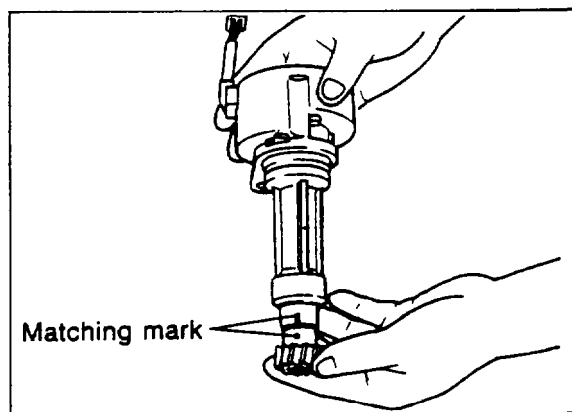
Removal

1. Set the eccentric shaft pulley to the leading mark (Yellow mark) by turning the pulley.



87U04B-049

2. Disconnect the crank angle sensor connector.
3. Remove the blind cap and the lock bolt.
4. Remove the sensor.



87U04B-024

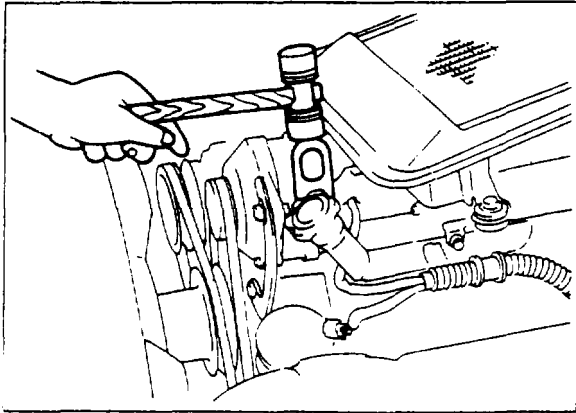
Installation

1. Align the matching mark on the crank angle sensor housing and driven gear.
2. Check that the eccentric shaft pulley is set to the leading mark (Yellow mark).
3. Install the sensor and lock bolt.
4. Check the ignition timing. (Refer to section 5)
5. Tighten the lock bolt.

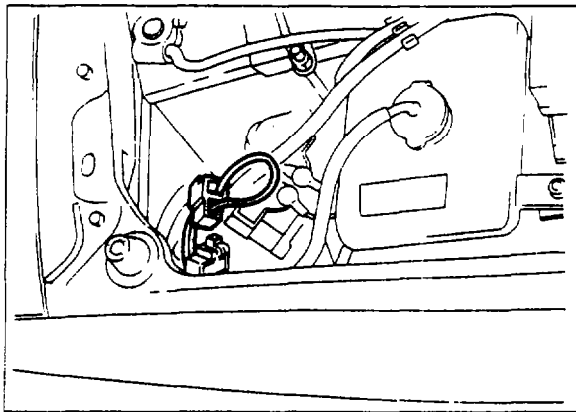
**Tightening torque: 7.8—10.8 N·m
(0.8—1.1 m·kg, 5.8—8.0 ft·lb)**

6. Install a new blind cap.

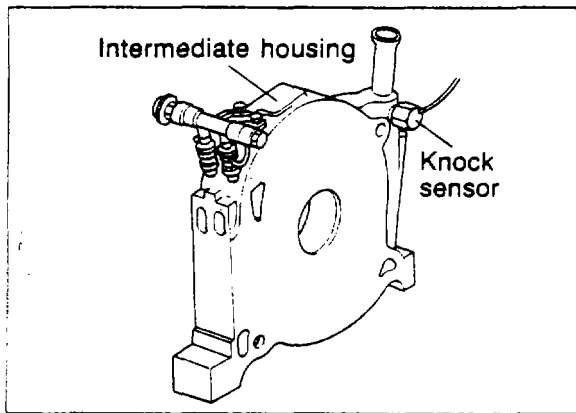
4B ELECTRONIC SPARK ADVANCE (ESA) CONTROL SYSTEM



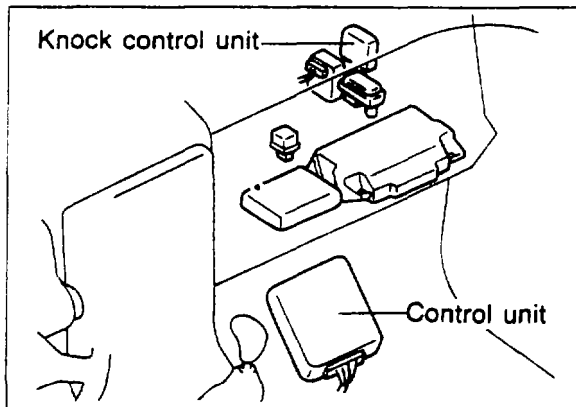
77U04B-120



77U04B-121



77U04B-122a



77U04B-123

KNOCK CONTROL SYSTEM

Inspection

1. Warm up the engine and run it at idle.
2. Tap the engine hanger lightly with a plastic hammer and make sure that the ignition timing does not move.

3. Connect a jumper wire to the initial set coupler terminal.
4. Tap the engine hanger lightly with a plastic hammer and make sure that the ignition timing retards.
5. Disconnect the jumper wire from the initial set coupler.

Removal of Knock Sensor

1. Disconnect the knock sensor connector.
2. Remove the throttle chamber. (Refer to 4B—61)
3. Remove the knock sensor.

Installation of Knock Sensor

Install in the reverse order of removal.

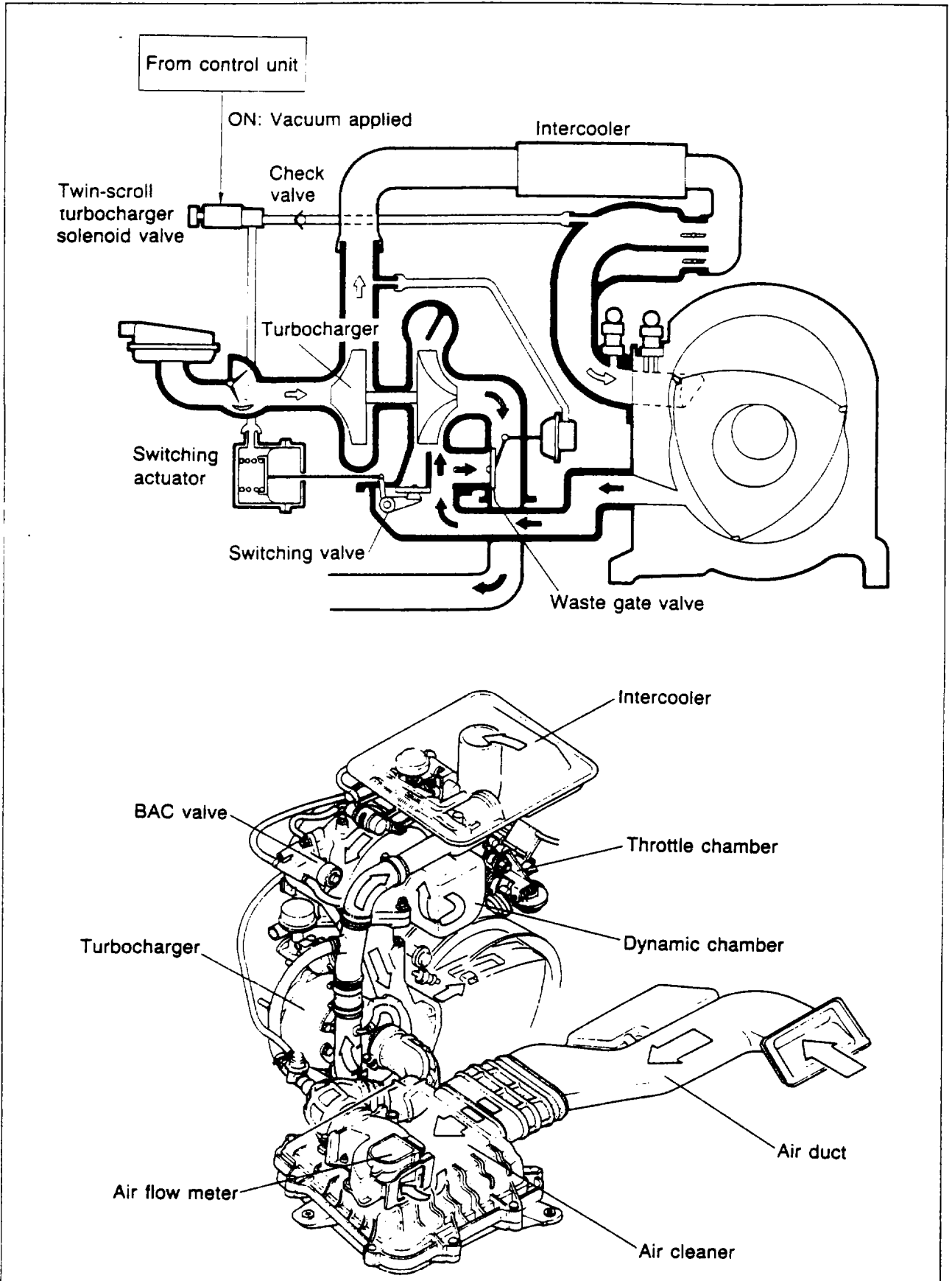
Removal of Knock Control Unit

1. Remove the front scuff plate (right side) and front side trim (right side).
2. Disconnect the knock control unit connector.
3. Remove the knock control unit.

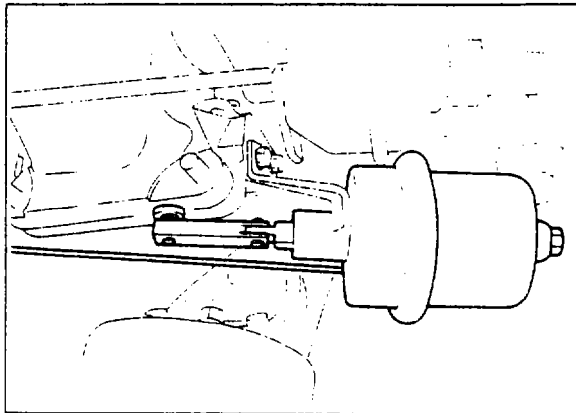
Installation of Knock Control Unit

Install in the reverse order of removal.

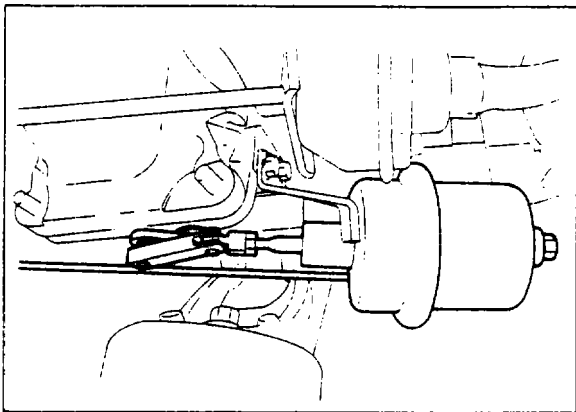
TWIN-SCROLL TURBOCHARGER CONTROL SYSTEM



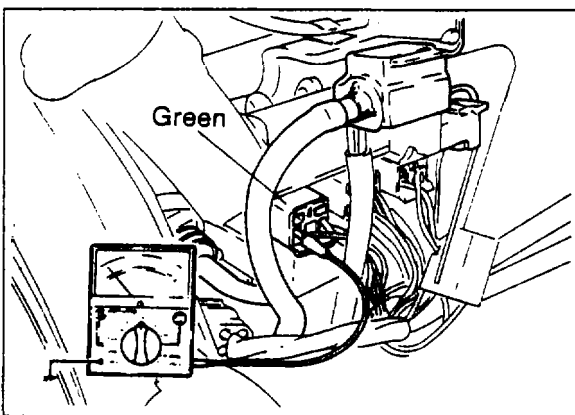
4B TWIN-SCROLL TURBOCHARGER CONTROL SYSTEM



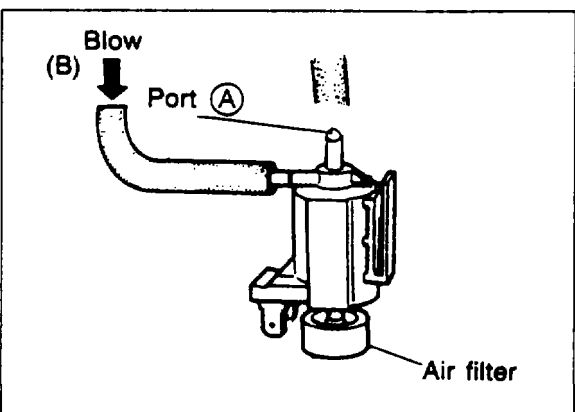
77U04B-222



77U04B-223



77U04B-127



77U04B-128

TWIN-SCROLL TURBOCHARGER CONTROL SYSTEM

Inspection

1. Warm up the engine to normal operating temperature.
2. Stop the engine.
3. Check that the rod moves in when the engine is restarted.

Note

When checking on a vehicle with ABS, move the air hose (air control valve—relief air silencer) toward the engine to view the rod.

4. Disconnect the twin-scroll turbocharger solenoid valve connector (Green).
5. Check that the rod returns.
6. Reconnect the solenoid valve connector.
7. Increase the engine speed and check that the rod starts to move at **above 2,700 rpm**.

TWIN-SCROLL TURBOCHARGER SOLENOID VALVE

Signal

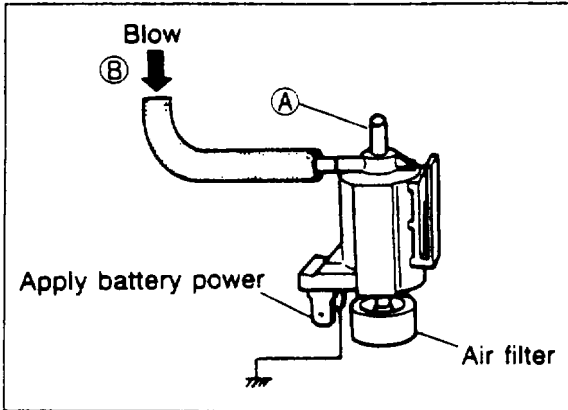
1. Warm up the engine to normal operating temperature.
2. Connect the voltmeter to the (LB) terminal of the twin-scroll turbocharger solenoid valve.
3. Increase the engine speed and check the voltmeter reading.

Voltmeter reading;

below 2,700 rpm; below 2.0V
above 2,700 rpm; approx. 12V

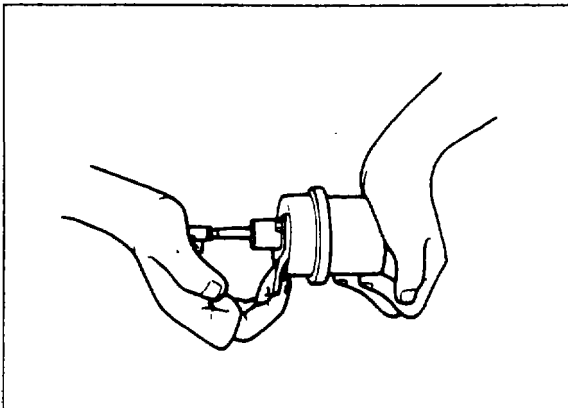
Twin-scroll turbocharger solenoid valve

1. Disconnect the vacuum hose from the twin-scroll turbocharger solenoid valve.
2. Blow through the solenoid valve from the port (B). Check that air passes through the valve and flows from the air filter.



67U04X 068

3. Disconnect the solenoid valve connector and connect 12V and ground to the terminals of the solenoid valve.
4. Blow through the solenoid valve from port (B). Check that air passes through the valve and flows from port (A).

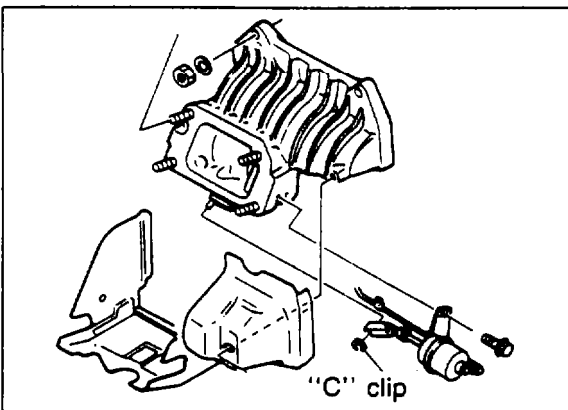


77U04B-129

SWITCHING ACTUATOR

Inspection

1. Remove the switching actuator.
2. Check that the rod moves smoothly when pushing it.
3. Block the vacuum port and check that air does not leak and the rod is held in.



77U04B-130

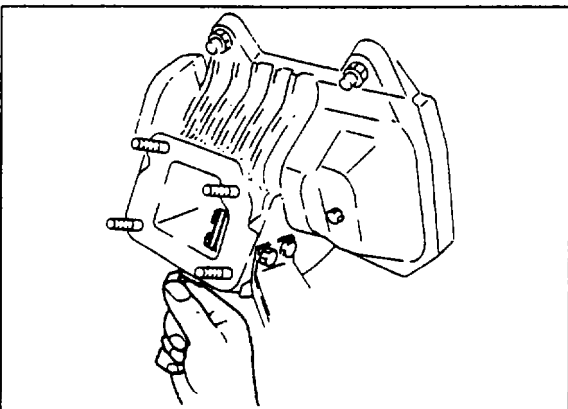
Removal And Installation

Removal

1. Raise the vehicle and support it with safety stands.
2. Remove the "C" clip.
3. Remove the attaching bolt.
4. Remove the switching actuator.

Installation

Install in the reverse order of removal.



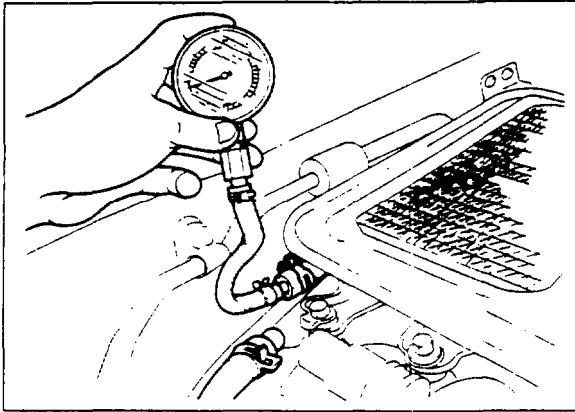
77U04B-131

SWITCHING VALVE

Inspection

1. Remove "C" clip and disconnect the switching actuator rod from the switching valve.
2. Check that the switching valve moves smoothly.

4B TWIN-SCROLL TURBOCHARGER CONTROL SYSTEM



87U04B-025

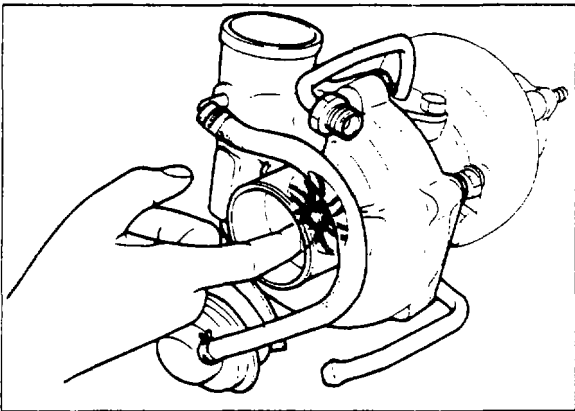
TURBOCHARGER

Boost Pressure

1. Disconnect the air hose (intercooler to air bypass solenoid valve) at the intercooler.
2. Connect the pressure gauge as shown.
3. Warm up the engine.
4. Check the boost pressure as the engine speed suddenly increases.

Specification

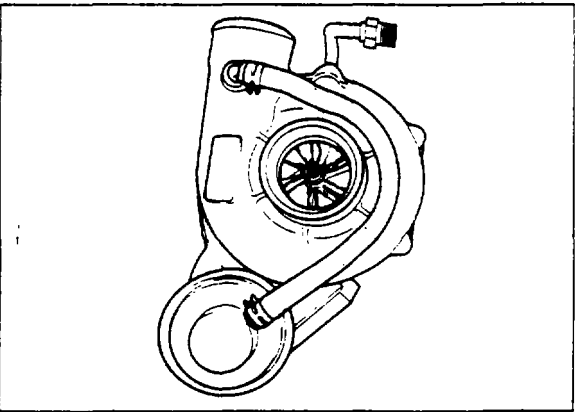
approx. 4,000 rpm: boost begins
above approx. 5,000 rpm: above 4.8 kPa
(0.049 kg/cm², 0.7 psi)



77U04B-133

Inspection of Turbine Rotor Assembly

1. Allow the engine to cool.
2. Remove the air funnel.
3. Check that the rotor assembly turns smoothly.
4. If there is excessive load or noise, replace the turbocharger.



77U04B-217

Inspection of Compressor Wheel Deflection

1. Allow the engine to cool.
2. Remove the air funnel.
3. Check if the turbine wheel touches the compressor housing.
4. If the turbine wheel touches the housing, replace the turbocharger.

WASTE GATE VALVE

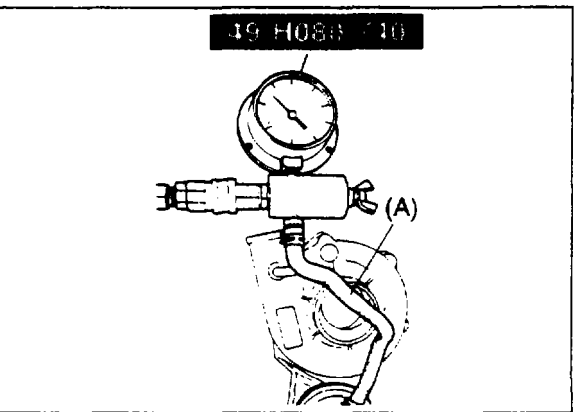
1. Allow the engine to cool.
2. Disconnect the air hose (A) and attach the **pressure tester** (49 H080 740) as shown.
3. Adjust the compressed air pressure to **68.7 kPa (0.7 kg/cm², 10 psi)**.
4. Check that the rod moves when applying and releasing air pressure.

Caution

Do not apply compressed air higher than 98 kPa (1.0 kg/cm², 14 psi)

Note

Before inspection of waste gate valve operation, mark a reference line on the rod with white paint.

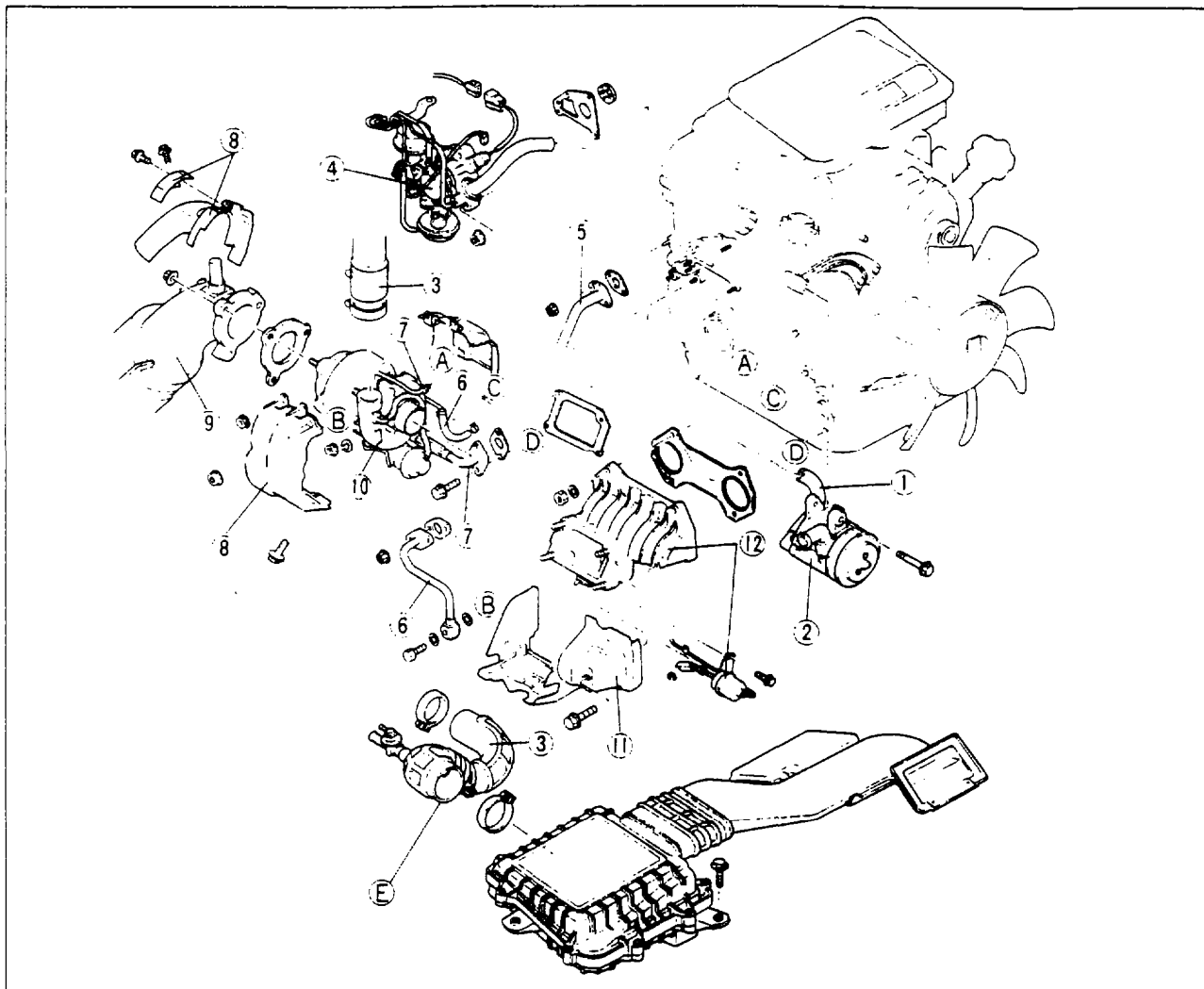


87U04B-026

REMOVAL AND INSTALLATION

Removal

1. Remove the lower cover and drain the engine coolant from the radiator.
2. Remove in the sequence shown in the figure.



77U04B-224

- | | |
|------------------------------|--|
| 1. Air hoses | 7. Oil pipes |
| 2. Air pump | 8. Insulator covers (Bolts: 4 Nuts: 4) |
| 3. Air funnel and air hose | 9. Front converter |
| 4. Air control valve | 10. Turbocharger |
| 5. Split air pipe | 11. Insulator covers |
| 6. Water hose and water pipe | 12. Exhaust manifold and actuator |

Note

87U04B-027

Before removing the air pump, loosen air hose (E) from the air flow meter to remove the air pump easily.

Installation

Install in the reverse order of removal. When installing the turbocharger, tighten to the specified torque.

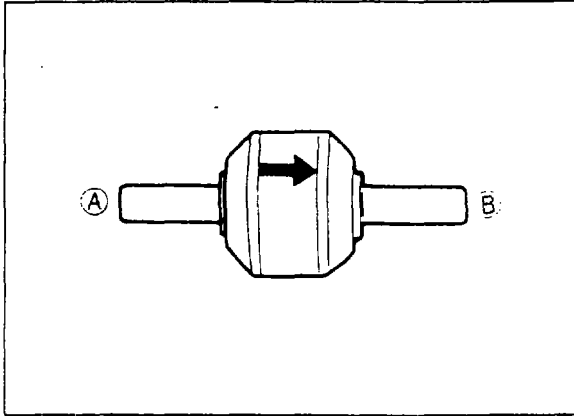
Tightening torque

- Turbocharger; 44.1—53.9 N·m (4.5—5.5 m·kg, 33—39 ft·lb)
- Exhaust manifold; 31.4—46.1 N·m (3.2—4.7 m·kg, 24—33 ft·lb)
- Front converter; 44.1—53.9 N·m (4.5—5.5 m·kg, 33—39 ft·lb)

Note

After tightening the turbocharger retaining nuts to the specified torque, crimp the edges of the retainer plate against the nuts to prevent loosening.

4B TWIN-SCROLL TURBOCHARGER CONTROL SYSTEM

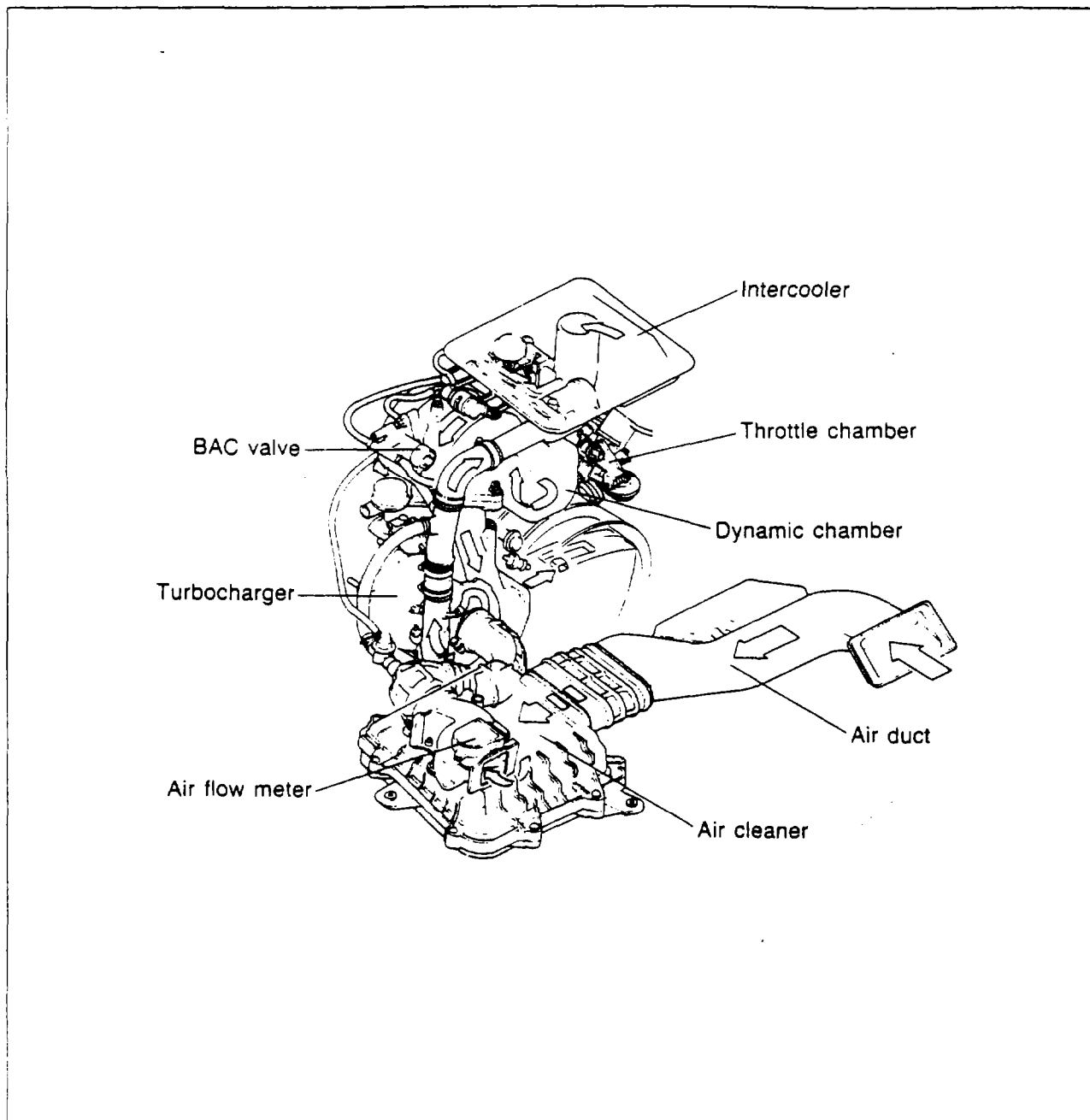


67U04X-109

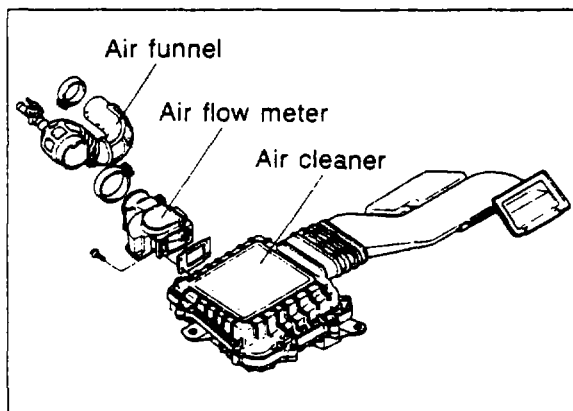
Check valve

1. Remove the check valve.
2. Blow through (A) and check that air flows from (B).
3. Blow through (B) and check that air does not flow from (A).

INTAKE AIR SYSTEM



67U04X-092



77U04B-138

AIR FLOW METER

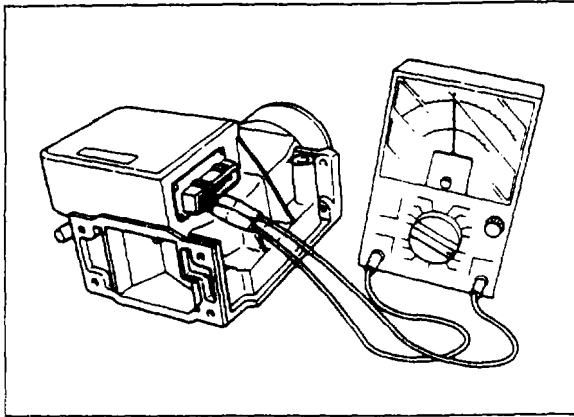
Removal

1. Disconnect the connector from the air flow meter.
2. Remove the air flow meter attaching bolts and remove the air cleaner.
3. Loosen the air funnel band and remove the air flow meter.

Installation

Install in the reverse order of removal.

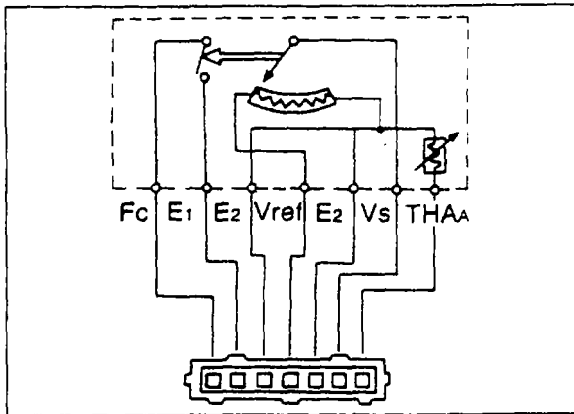
4B INTAKE AIR SYSTEM



77U04B-139

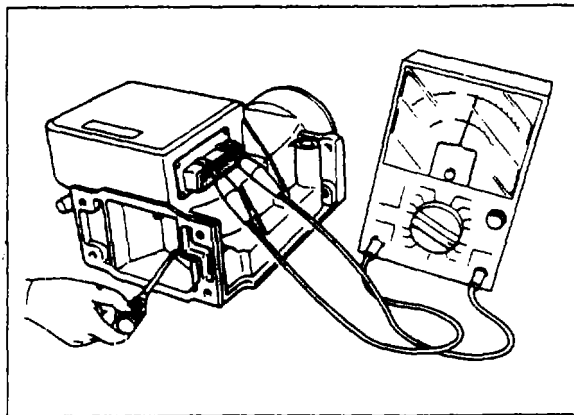
Inspection

1. Check the air flow meter body for cracks or damage.
2. Check that the measuring plate opens smoothly.
3. Check the resistance of the terminals using a circuit tester.



77U04B-140

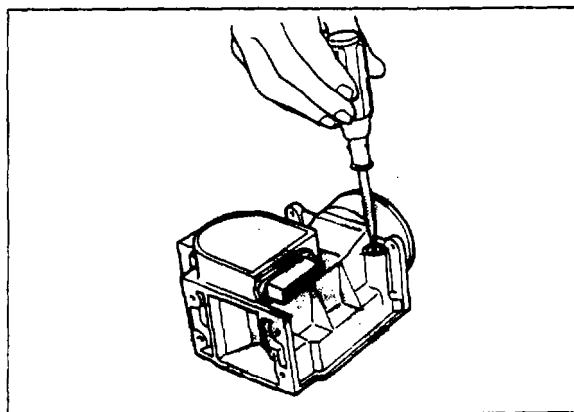
Terminal	Resistance (Ω)	
$E_2 \leftrightarrow V_s$	200—600	
$E_2 \leftrightarrow V_{ref}$	200—400	
$E_2 \leftrightarrow THA$ (Intake air temperature sensor)	-20°C (-4°F)	10,000—20,000
	0°C (32°F)	4,000—7,000
	20°C (68°F)	2,000—3,000
	40°C (104°F)	900—1,300
	60°C (140°F)	400—700
$E_1 \leftrightarrow F_c$	∞	



77U04B-141

4. Press open the measuring plate. Measure the resistance between E_1 and F_c (fuel pump switch) and between E_2 and V_s .

Terminal \ Condition	Measuring plate	
	Fully closed	Fully open
$E_1 \leftrightarrow F_c$	∞	0
$E_2 \leftrightarrow V_s$	200—600	20—1,000



77U04B-142

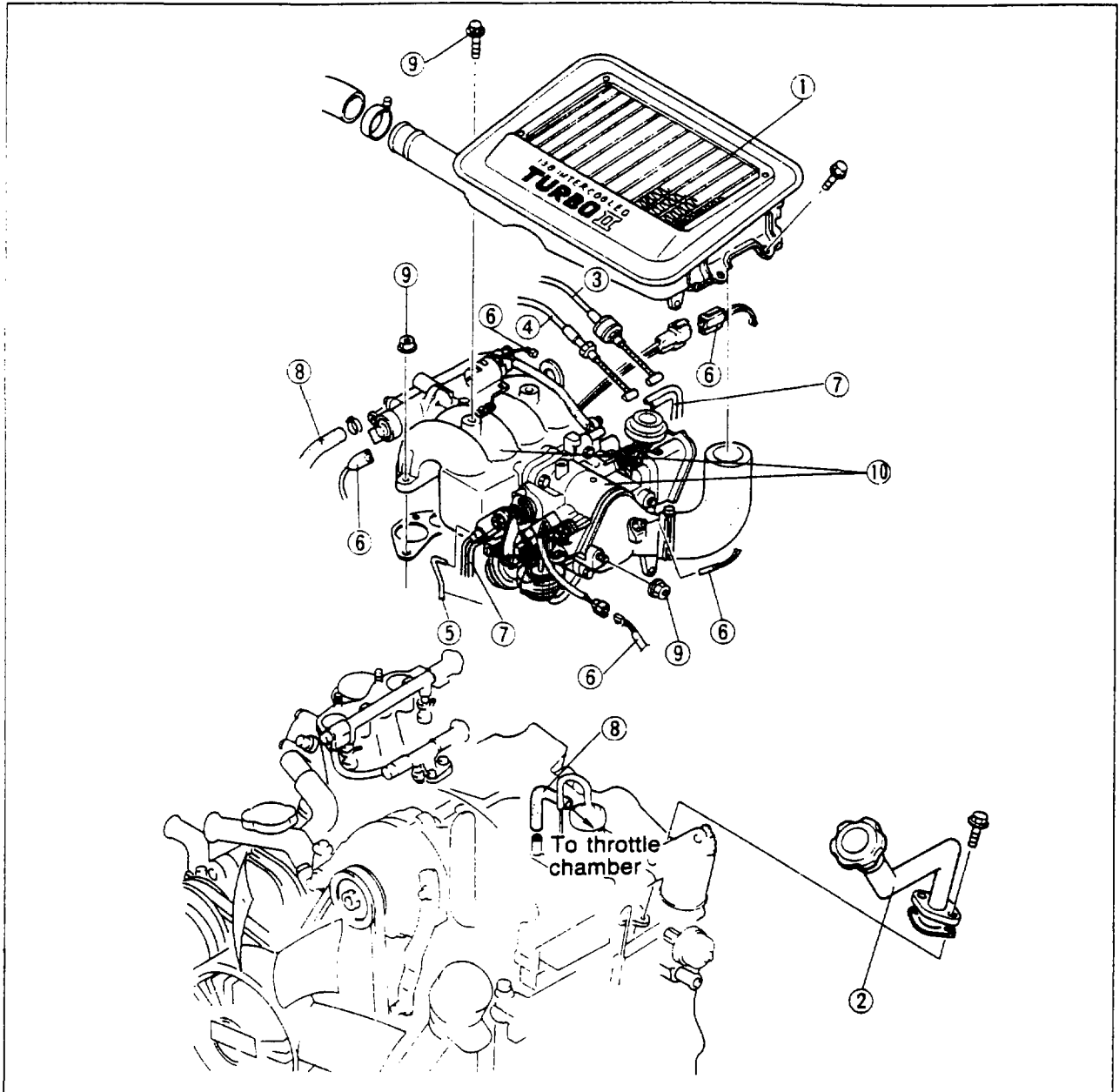
Precaution

The air bypass adjust screw is pre-set and sealed at the factory and must not be tampered with.

THROTTLE BODY

Removal

1. Drain the engine coolant from the radiator.
2. Remove in the sequence shown in the figure.



87U04B-028

- | | |
|---------------------------------------|---------------------------------------|
| 1. Intercooler | 7. Vacuum tubes |
| 2. Oil filler pipe | 8. Water hoses |
| 3. Accelerator cable | 9. Nuts and bolts |
| 4. Cruise control cable (if equipped) | 10. Throttle body and dynamic chamber |
| 5. Metering oil pump connecting rod | |
| 6. Connectors | |

Caution

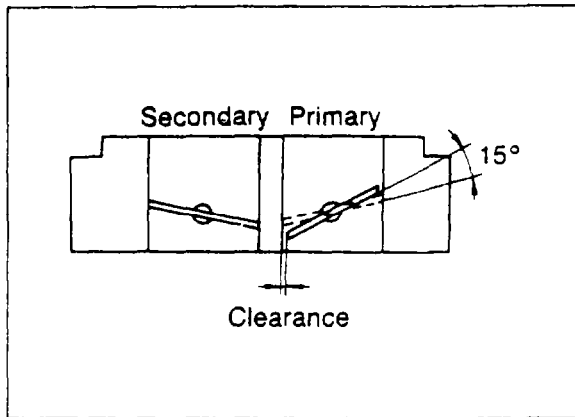
Cover the intake manifold opening with a clean cloth to prevent dust or dirt from entering after the throttle body and dynamic chamber are removed.

Installation

Install in the reverse order of removal.

87U04B-029

4B INTAKE AIR SYSTEM



77U04B-145

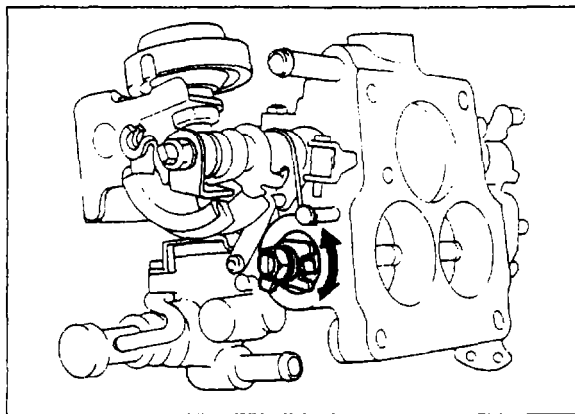
Inspection

No. 1 secondary throttle valve

1. Check the clearance between the primary throttle valve and the wall of the throttle bore when the No. 1 secondary throttle valve starts to open.

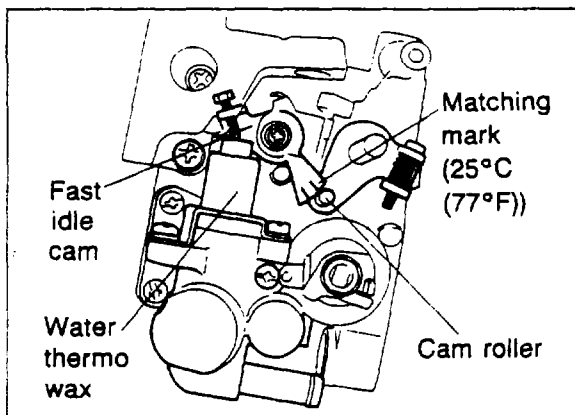
Standard clearance:

1.1—1.7 mm (0.04—0.07 in)



77U04B-146

2. If the clearance is not within the specification, bend the tab until the proper clearance is obtained.

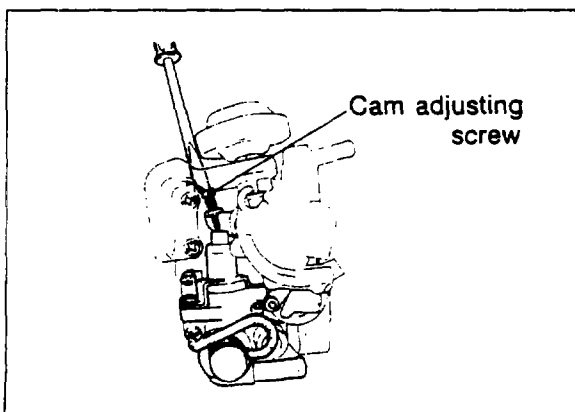


87U04B-030

Fast idle operation

For this operation to be checked, the vehicle and throttle body must be at **25°C (77°F)**.

1. Check that the matching mark on the fast idle cam is aligned with the center of the cam roller.

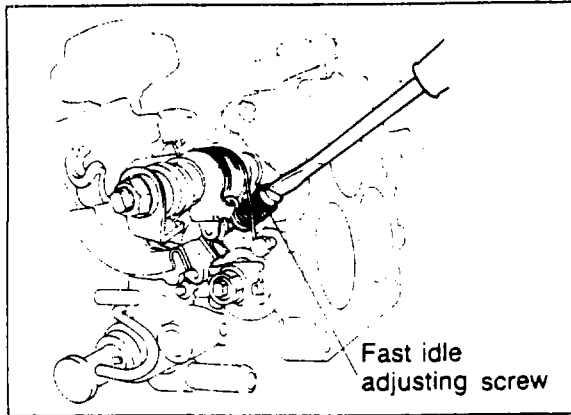


67U04X-101

2. If the matching mark and the center of the cam roller do not align, turn the cam adjusting screw until proper alignment is obtained.

Note

Fast idle adjustment is unnecessary unless it has been tampered with.

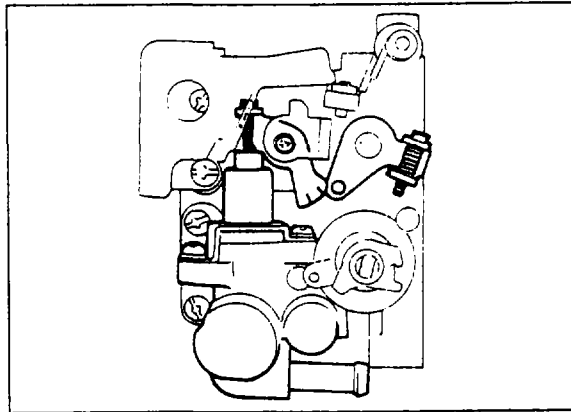


67U04X-102

3. With the matching mark aligned, check the clearance between the primary throttle valve and the wall of the throttle bore.

Standard clearance:
0.4—0.5 mm (0.016—0.02 in)

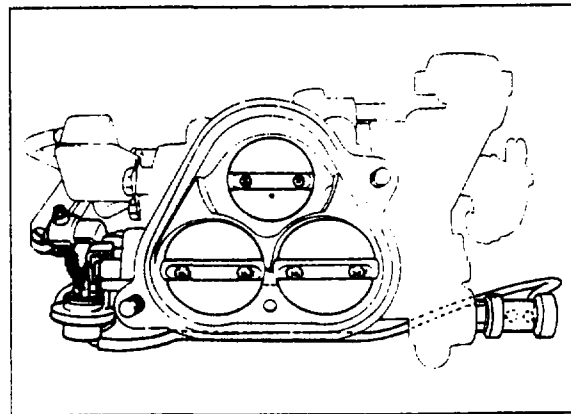
4. To adjust, turn the fast idle adjusting screw, if necessary.



67U04X-103

On Vehicle

1. Warm up the engine to operating temperature.
2. Check that the wax rod extends outward fully and the idle cam separates from the roller.



77U04B-147

Double throttle valve

Check that the No. 2 secondary throttle valve and linkage moves smoothly when the primary throttle valve is fully opened.

Water thermo valve

Removal

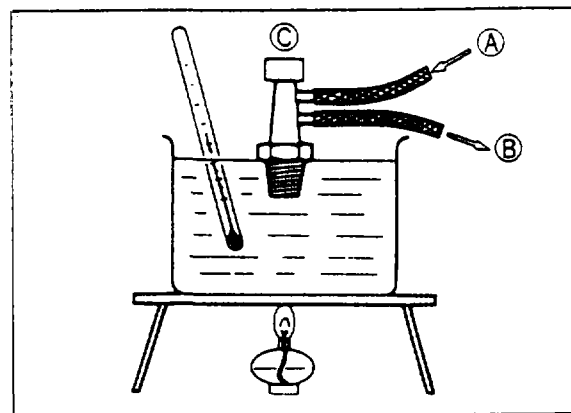
Remove the water thermo valve from the throttle body.

Installation

Install in the reverse order of removal.

Inspection

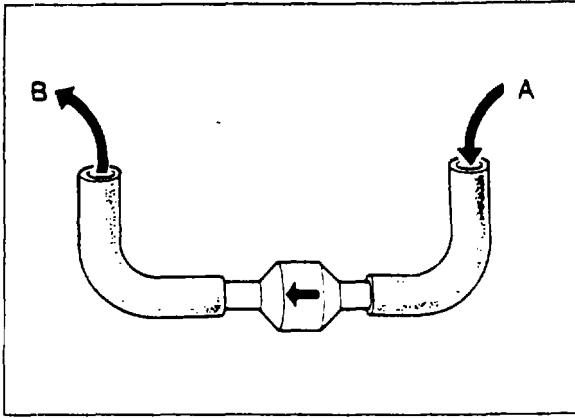
1. Immerse the water thermo valve in a container.
2. Heat the water gradually and observe the temperature.
3. Blow through port (A) and check the thermo valve operation.



87U04B-031

Water temperature	Air passes
Below 60°C (140°F)	From (A) to (B)
Above 60°C (140°F)	From (A) to (C)

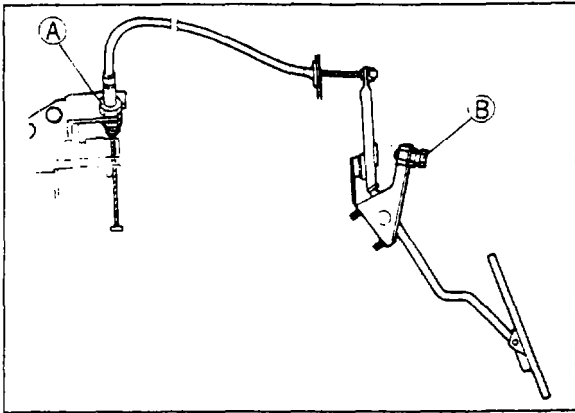
4B INTAKE AIR SYSTEM



77U04B-196

Check valve

1. Remove the check valve.
2. Blow through (A) and check that air flows from (B).
3. Blow through (B) and check that air does not flow from (A).



77U04B-148

ACCELERATOR LINKAGE

Adjustment

1. Check the free play of the cable at the throttle chamber.

Free play: 1—3 mm (0.04—0.12 in)

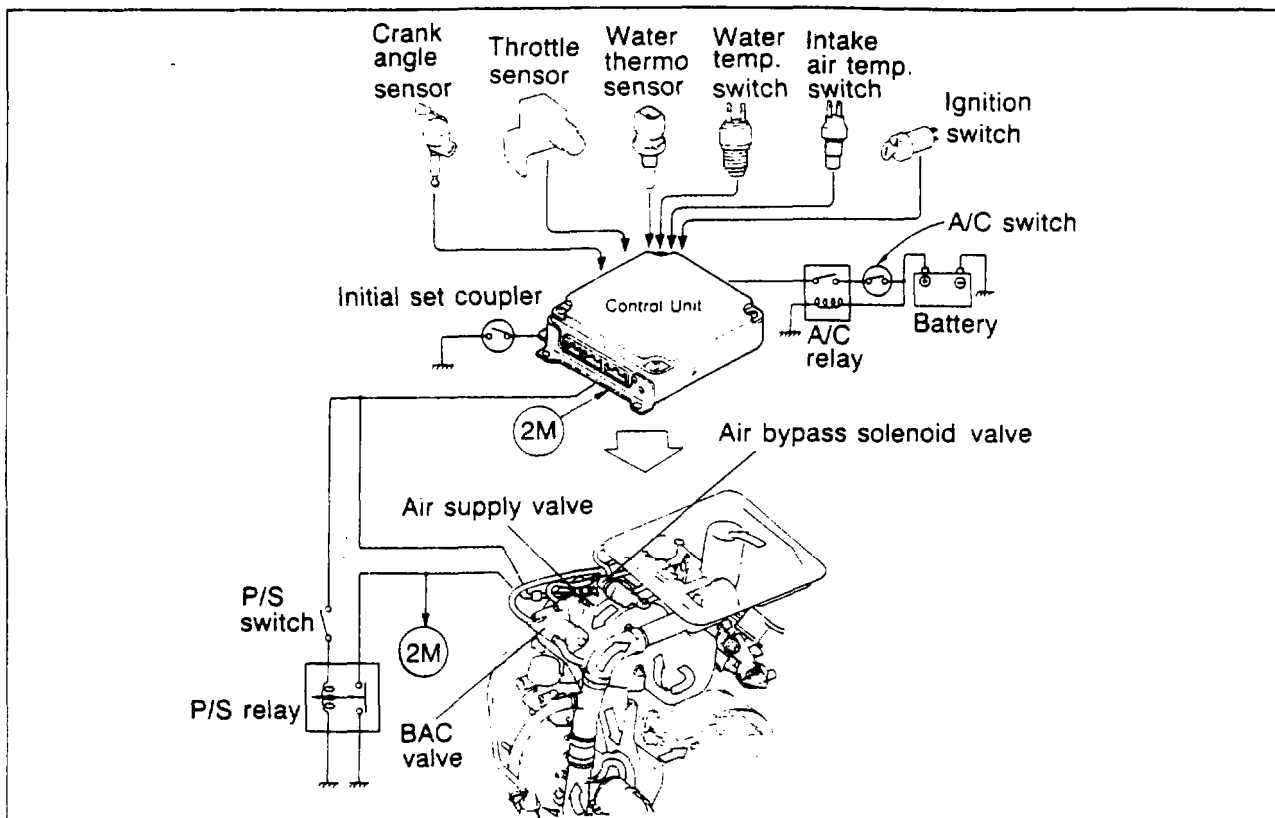
2. Adjust with nut (A), if not within specifications.

Caution

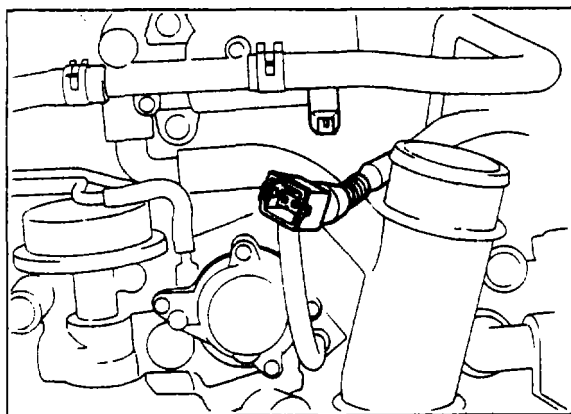
Check first that the fast idle operation is fully cancelled.

3. Check that the throttle valves are fully opened with the accelerator pedal fully depressed.
4. Adjust stopper bolt (B), if necessary.

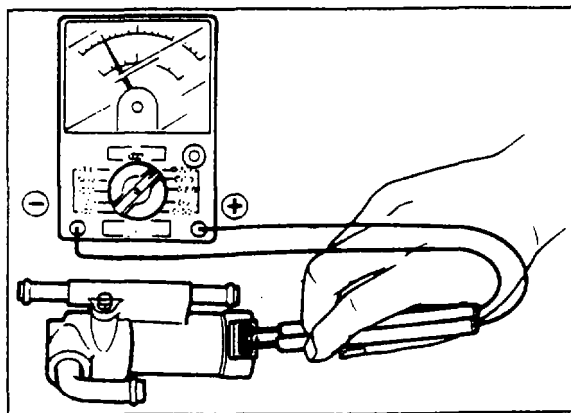
BYPASS AIR CONTROL (BAC) SYSTEM



67U04X-121



87U04B-047



67U04X-123

BAC SYSTEM Inspection

Note

Connect a jumper wire to both terminals of the initial set coupler

1. Warm up the engine and run it at idle.
2. Connect a tachometer to the engine.
3. Disconnect the BAC valve connector.
4. Check that the engine speed decreases.
5. Reconnect the BAC valve connector.

Removal

1. Drain the engine coolant.
2. Disconnect the air hose and water hoses from the valve.
3. Remove the BAC valve attaching nuts.
4. Remove the BAC valve.

Installation

Install in the reverse order of removal.

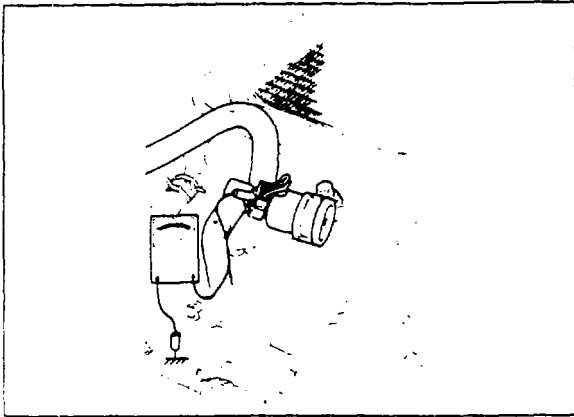
BAC VALVE Inspection

1. Disconnect the BAC valve connector.
2. Check the valve resistance using a circuit tester.

Resistance: 10.7—12.3 Ω

3. Apply 12V and a ground to the terminals of the BAC valve.
4. The valve should click when voltage is applied.
5. Replace the valve, if necessary.

4B BYPASS AIR CONTROL (BAC) SYSTEM



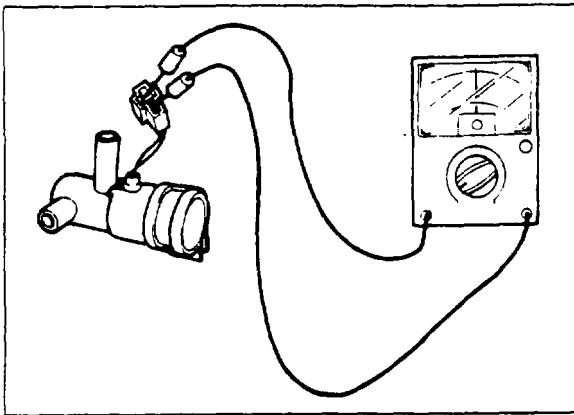
67U04X-124

AIR BYPASS SOLENOID VALVE

Inspection

Signal

1. Disconnect the water thermo sensor connector.
2. Connect a resistor ($2\text{ k}\Omega$) to the terminals of the sensor connector.
3. Connect a voltmeter to the (BrY) terminal of the air bypass solenoid valve connector and ground.
4. Start the engine and check the following:
 - For 17 seconds after engine starts.
Voltmeter reading is 0V.
 - After 17 seconds.
Voltmeter reading is 12V.



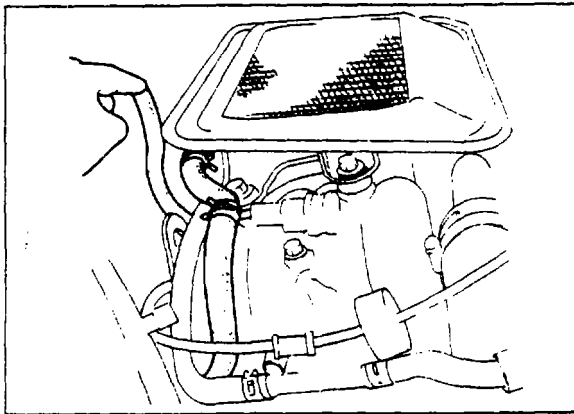
67U04X-125

Air bypass solenoid valve

1. Disconnect the air bypass solenoid valve connector.
2. Check the solenoid valve resistance using a circuit tester.

Resistance: $16.2\text{--}19.8\ \Omega$

3. Replace the solenoid valve, if necessary.



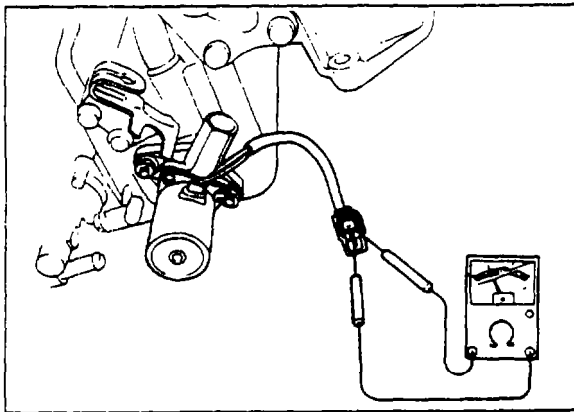
77U04B-151

AIR SUPPLY VALVE

Inspection

Signal

1. Warm up the engine and run it at idle.
2. Disconnect the air hose (intercooler to dynamic chamber) at the intercooler.
3. Place a finger over the port opening and check that the air is not sucked into the port opening.
4. Turn the steering wheel either to the right or left, and check that the air is sucked into the port opening.



77U04B-152

Air supply valve

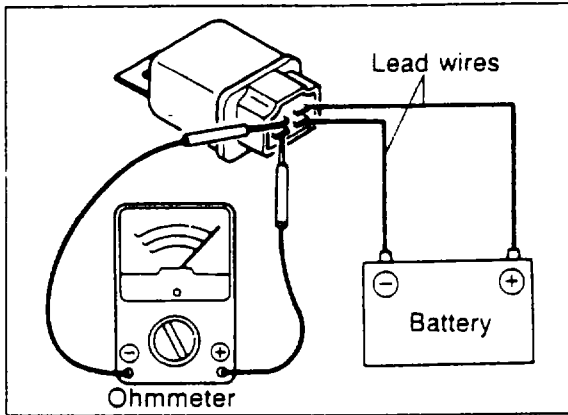
1. Disconnect the air supply valve connector.
2. Check the air supply valve resistance using a circuit tester.

Resistance: $16.2\text{--}19.8\ \Omega$

3. Replace the air supply valve, if necessary.

Caution

Do not tamper with the adjust screw.



77U04B-200

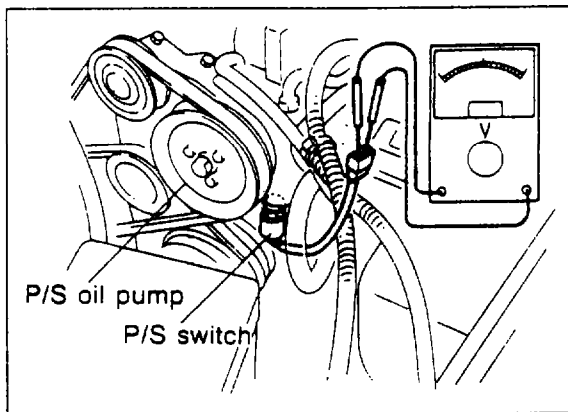
POWER STEERING RELAY

Inspection

1. Apply 12V and ground (12V to (A) terminal and ground to (B) terminal), and check that there is continuity at terminals (C) and (D) using a circuit tester.

Operation	12V Not applied	12V Applied
Terminals (C) - (D)	No continuity	Continuity

2. Replace the relay, if necessary.



67U04X-127

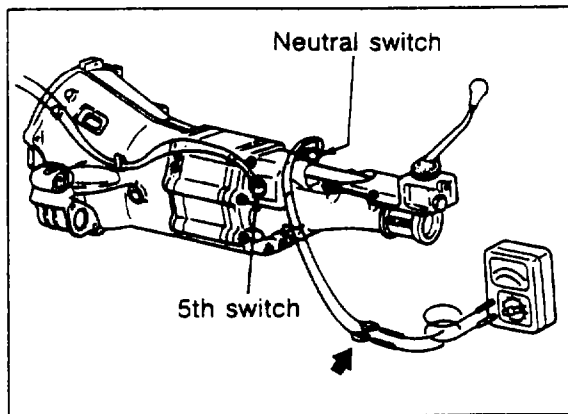
POWER STEERING SWITCH

Inspection

1. Start the engine and run it at idle.
2. Disconnect the P/S switch connector.
3. Connect a circuit tester to the switch.
4. Turn the steering wheel either to the right or left, and check the continuity.

Steering wheel	Continuity
Turn	Yes
Straight ahead	No

5. Replace the switch, if necessary.



77U04B-197

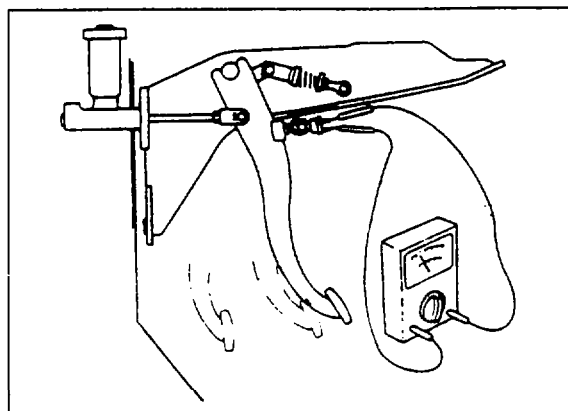
NEUTRAL SWITCH

Inspection

1. Disconnect the neutral switch connector.
2. Connect a circuit tester to the switch.
3. Check the continuity.

Transmission	Continuity
In neutral	Yes
In other ranges	No

4. Replace the switch, if necessary.



77U04B-198

CLUTCH SWITCH

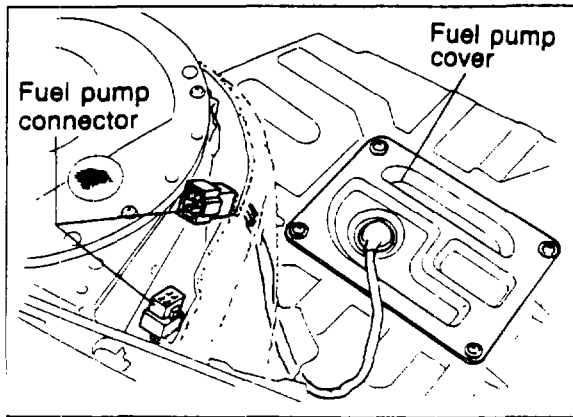
Inspection

1. Disconnect the clutch switch connector.
2. Connect a circuit tester to the switch.
3. Check the continuity.

Pedal	Continuity
Depressed	Yes
Released	No

4. Replace the switch, if necessary.

4B FUEL SYSTEM



77U04B-220

FUEL SYSTEM

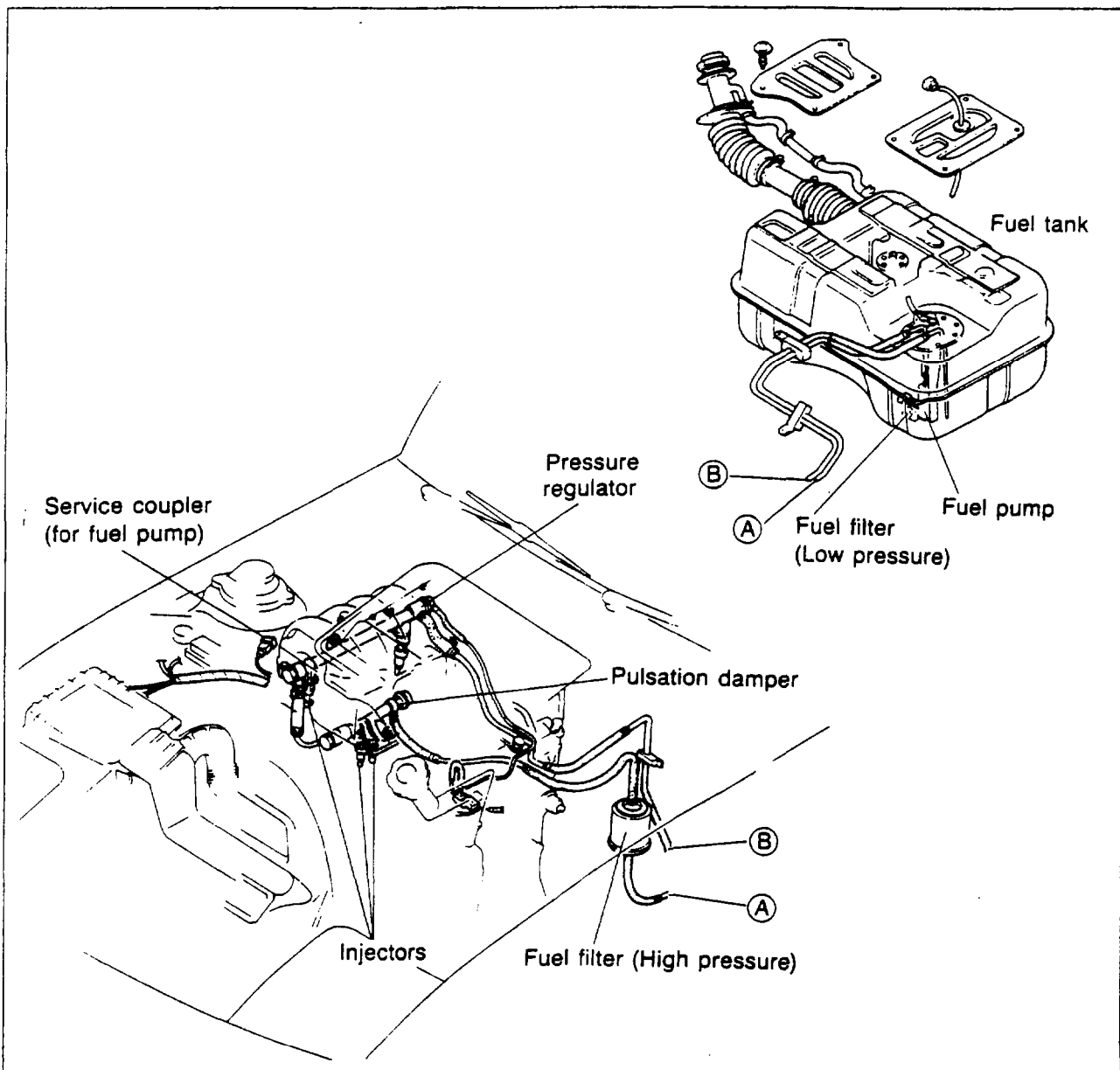
FUEL PRESSURE RELEASE AND SERVICING FUEL SYSTEM

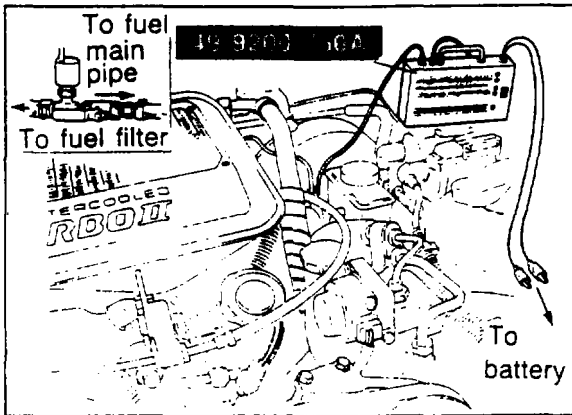
Fuel in the fuel lines remains under high pressure even when the engine is not running.

a) Before disconnecting fuel line, release fuel pressure from fuel line to eliminate possibly causing injury and a fire.

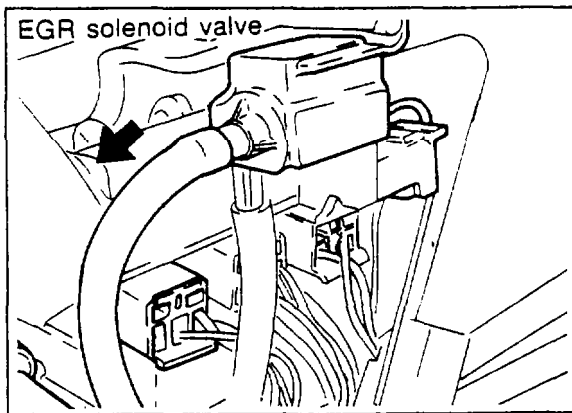
1. Start the engine.
2. Disconnect the fuel pump connector with engine running.
3. After stalling the engine, turn the ignition switch OFF.

b) Use a rag to protect from fuel spraying out when disconnecting the hose and plug the hoses after removal.

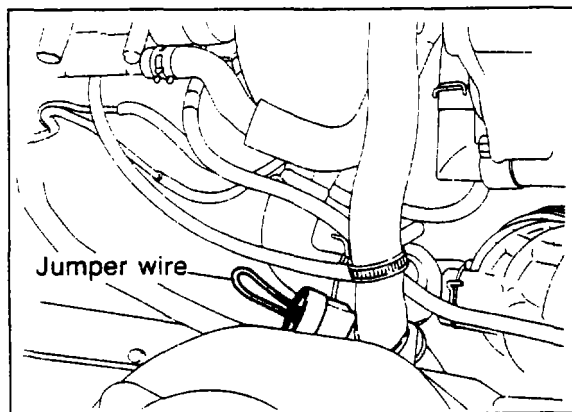




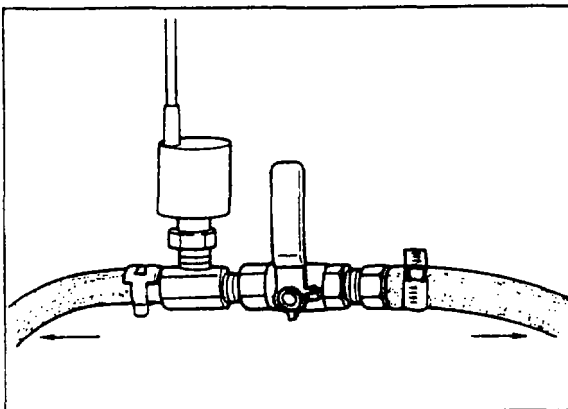
87U04B-032



67G04B-774



67G04B-775



67G04B-776

HOW TO USE THE MULTI-PRESSURE TESTER

When inspecting the fuel pressure, use the Multi-pressure tester (49 9200 750A).

Warning

Before connecting the multi-pressure tester (49 9200 750A), release the fuel pressure from the fuel line to eliminate possibly causing injury or a fire. (Refer to 4B-68)

1. Disconnect the negative battery terminal.
2. Disconnect the fuel main hose from the fuel main pipe.
3. Connect a **Multi-Pressure Tester (49 9200 750A) Adapter** between fuel main hose and fuel main pipe.

Caution

Do not reverse the adapter connection.

4. Disconnect the vacuum hose from the EGR solenoid valve, and connect the **Multi-Pressure Tester (49 9200 750A) Vacuum Hose** using three-way joint.
5. Connect the negative battery terminal.
6. Connect the **Multi-Pressure Tester (49 9200 750A) Wires** to the battery.
7. Connect the terminals of the check connector (yellow connector) with a jumper wire. Turn on the ignition switch to operate the fuel pump.
8. Check for fuel leaks.
9. Check the fuel pressure after checking fuel leakage.

Caution

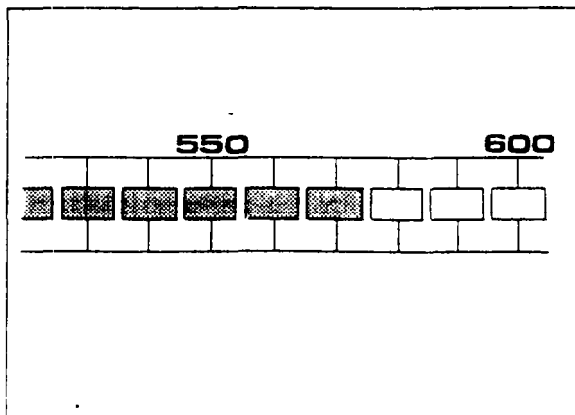
Afer checking fuel leakage, turn off the ignition switch and disconnect the jumper wire from the check connector.

FUEL PRESSURE

Fuel Pump

1. Connect the terminals of the check connector (yellow connector) with a jumper wire.
Turn on the ignition switch to operate the fuel pump.
2. Move the lever on the adapter as shown in the figure.

4B FUEL SYSTEM

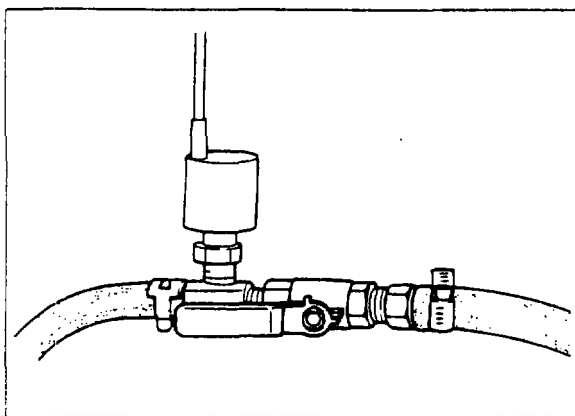


67G04B-777

3. Check the fuel pump pressure.

**Fuel pump pressure: 490—637 kPa
(5.0—6.5 kg/cm², 71.1—92.4 psi)**

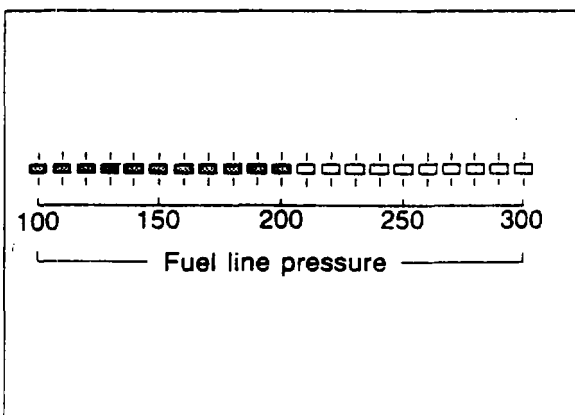
4. If it is not within specified value, check the wiring harness and main relay.
When these are normal, replace the fuel pump.
5. After checking fuel pump pressure, turn OFF the ignition switch and disconnect the jumper wire from the check connector.



67G04B-778

Fuel Line

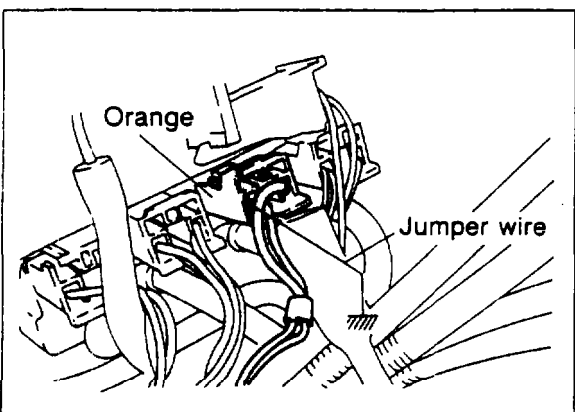
1. Warm up the engine to the normal operating temperature and run it at idle.
2. Move the lever on the adapter as shown in the figure.



87U04B-033

3. Check the fuel line pressure

**Fuel line pressure: Approx. 196 kPa
(2.0 kg/cm², 28.4 psi)**

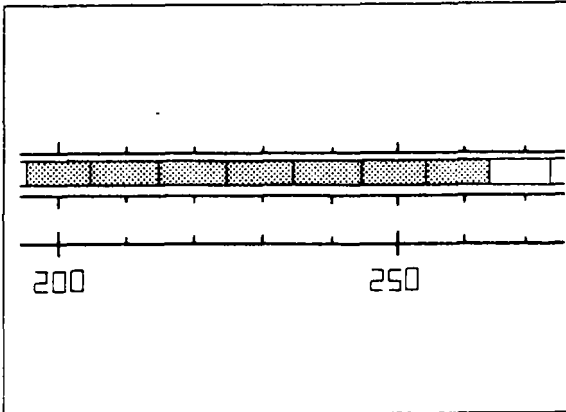


67G04B-780

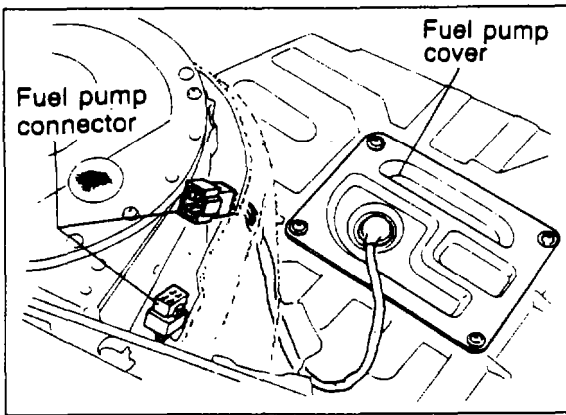
4. Connect a jumper wire to the pressure regulator control solenoid valve, and check the fuel line pressure again.

**Fuel line pressure: 235—275 kPa
(2.4—2.8 kg/cm², 34.1—39.8 psi)**

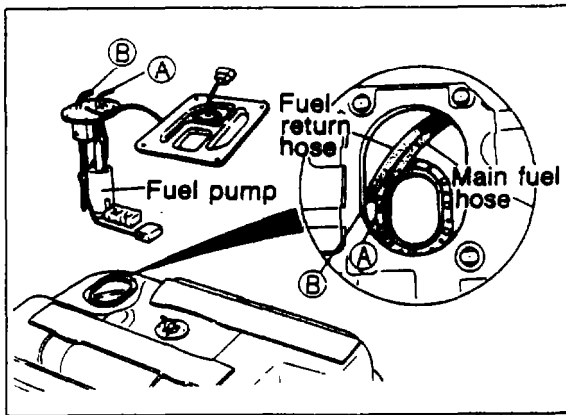
5. If it is not within specified value, check the wiring harness and pressure regulator solenoid valve, when these are normal, replace the pressure regulator.



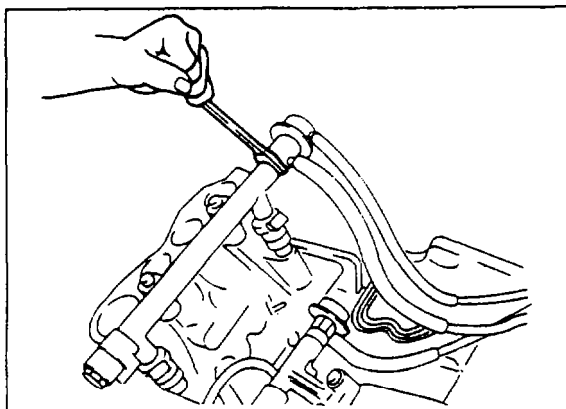
67G04B-781



87U04B-034



67G04B-783



87U04B-035

Injection pressure

When the trouble is poor acceleration or hesitation, check the injection pressure.

1. Run the vehicle and measure the injection pressure on the **Multi-Pressure Tester**.

Fuel pressure (Injection pressure)

Approx. 235—275 kPa

(2.4—2.8 kg/cm², 34.1—39.8 psi)

2. If the injection pressure is lower than specifications, check the following points.
 - a) Fuel pump outlet pressure.
 - b) Fuel filter clog.
3. If the injection pressure is higher than specifications, check the following points.
 - a) Fuel return pipe clog.
 - b) Fuel line pressure.

REMOVAL

Warning

Before removing the fuel pump and pressure regulator, release the fuel pressure from the fuel line to eliminate possibly causing injury or a fire. (Refer to 4B—68)

Fuel Pump

1. Lift up the rear mat.
2. Remove fuel pump cover.
3. Disconnect the fuel pump connector.
4. Disconnect the fuel main hose and the fuel return hose.
5. Remove the fuel pump screws.
6. Remove the fuel pump from the fuel tank.

Installation

Install in the reverse order of removal.

Pressure Regulator

1. Remove the throttle body and dynamic chamber. (Refer to page 4B—61)
2. Disconnect the vacuum hose and fuel return hose from the pressure regulator.
3. Remove the pressure regulator.

Warning

- a) Cover the hose with a cloth as a small amount of fuel will come out when it is disconnected.
- b) Plug the fuel hoses to prevent leakage.

Installation

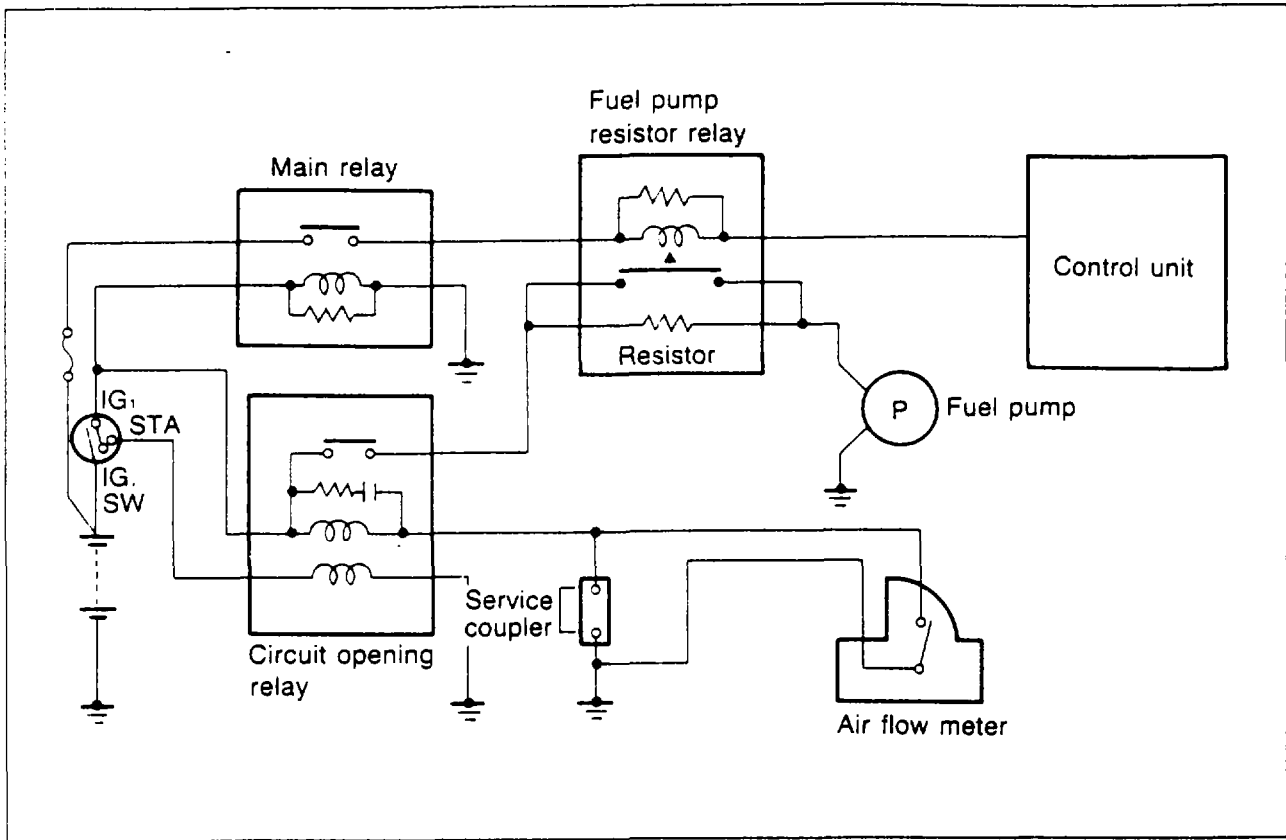
Install in the reverse order of removal.

Caution

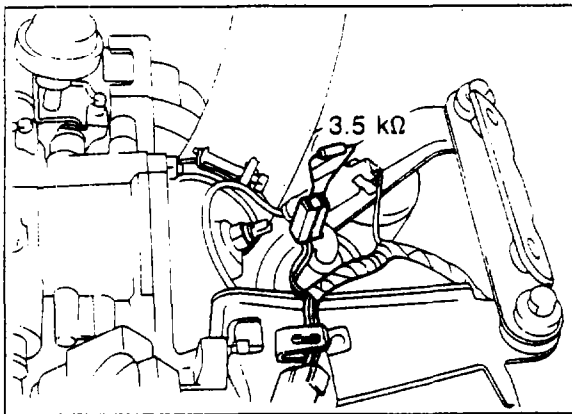
Check for fuel leaks after installing the pressure regulator.

4B FUEL SYSTEM

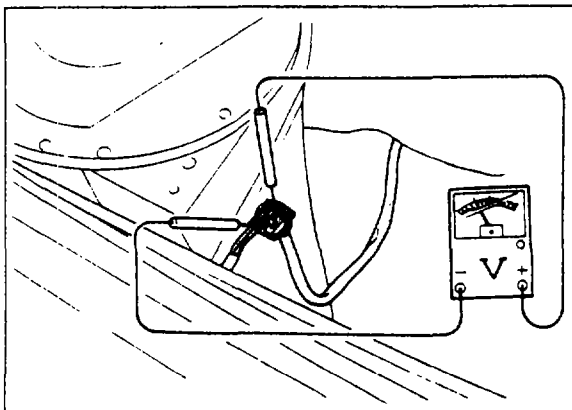
FUEL PUMP CONTROL SYSTEM



77U04B-155



77U04B-156



77U04B-157

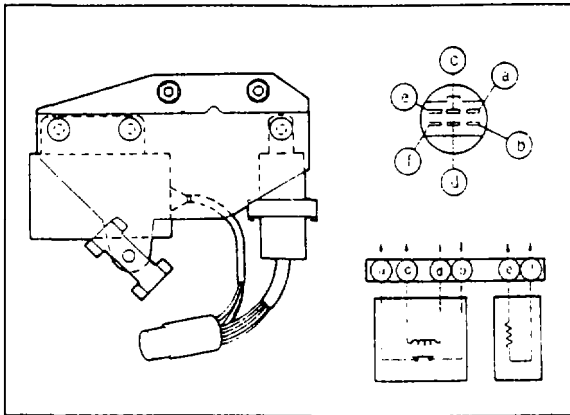
Inspection Signal

1. Remove the intercooler.
2. Disconnect the intake air temperature sensor connector and connect a resistance ($3.5 \text{ k}\Omega$) to the terminals of the sensor connector.
3. Install the intercooler.
4. Connect a voltmeter between (B) terminal and (Bu) terminal of the fuel pump connector.
5. Warm up the engine and stop it.

6. Restart the engine and check the voltage.

Color	B — Bu [V]
After starting for approx. 50 sec	approx. 12
after above	approx. 9

7. Check the fuel pump resistor relay, 3D terminal of control unit, engine wiring harness and connectors, if necessary.



77U04B '58

Fuel pump resistor relay

1. Remove the air cleaner and air flow meter.
2. Disconnect the fuel pump resistor relay connector.
3. Check the resistance.

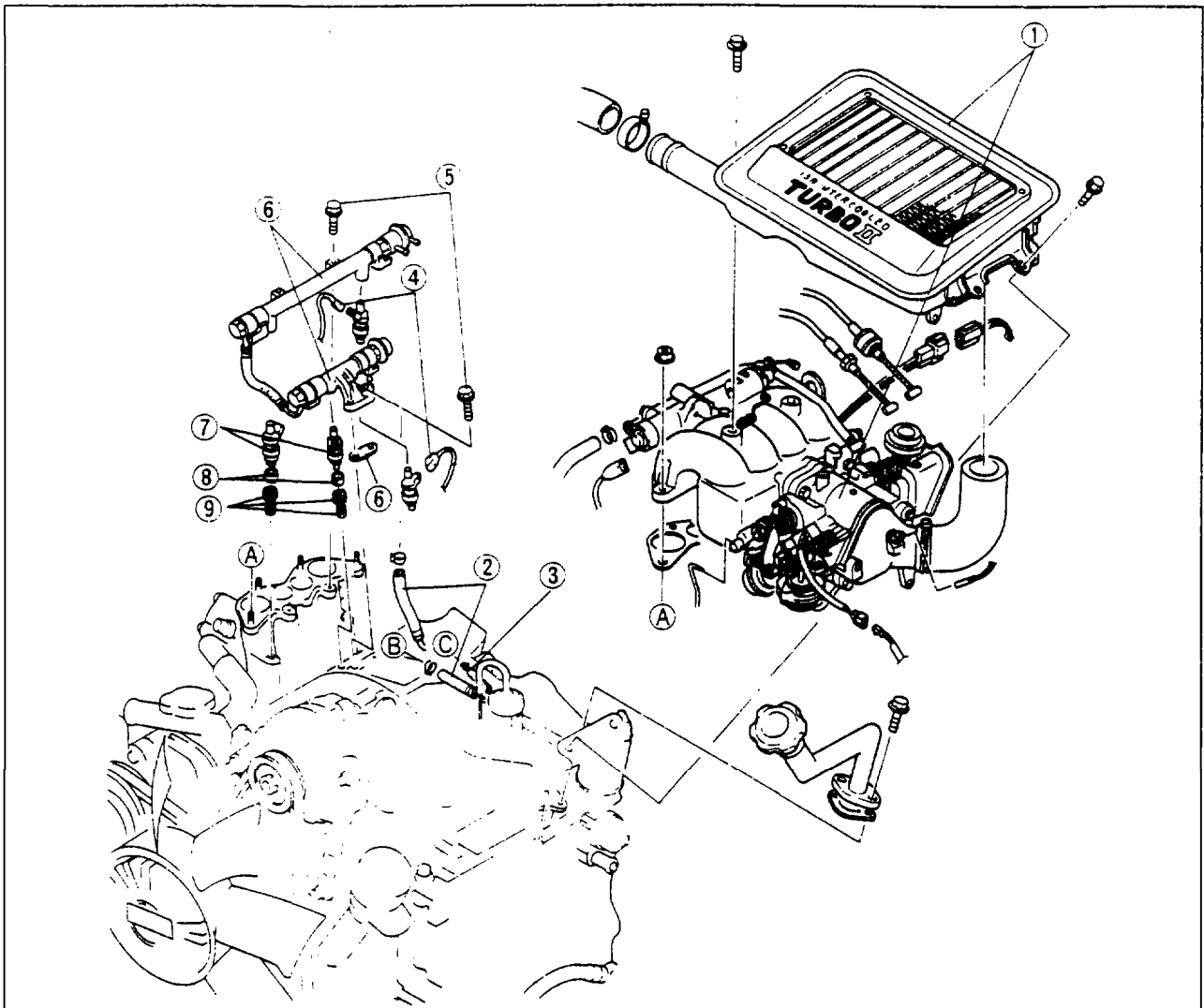
Resistance: a—b 0 Ω
 c—d 68—92 Ω
 e—f 0.64 Ω

4. Replace, if necessary

INJECTOR

Removal

Before performing the following procedures, release the fuel pressure from the fuel line to eliminate possibly causing injury or a fire. (Refer to 4B—68)

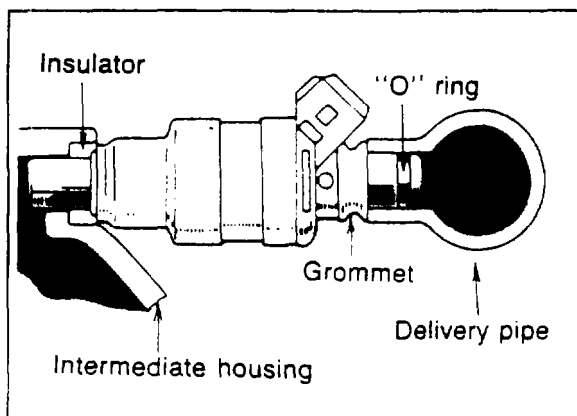


Remove the parts in the sequence shown in the figure.

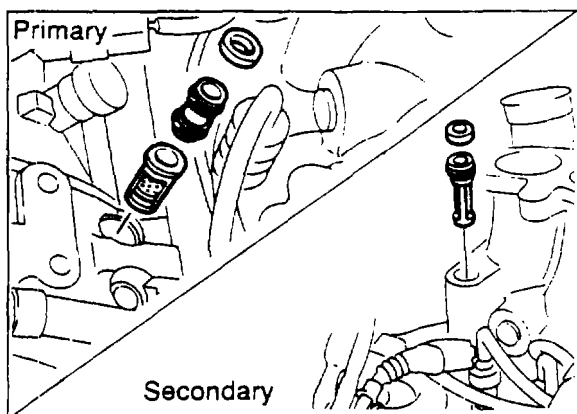
87U04B-036

- | | | |
|---|---------------------------------|------------------------|
| 1. Intercooler, throttle body and dynamic chamber (Refer to page 4B—61) | 3. Vacuum hose | 8. Injector insulators |
| 2. Fuel main hose and fuel return hose | 4. Connectors | 9. Air bleed sockets |
| | 5. Attaching bolts | |
| | 6. Delivery pipes and insulator | |
| | 7. Injectors | |

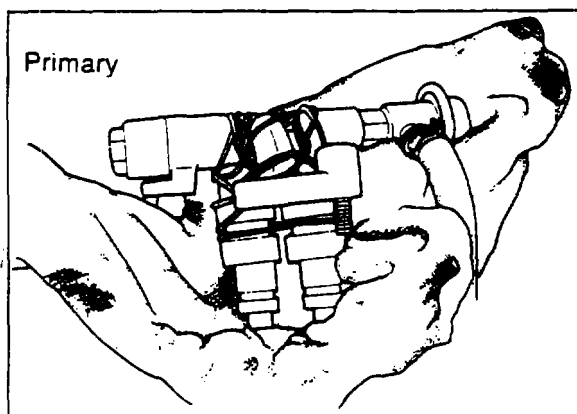
4B FUEL SYSTEM



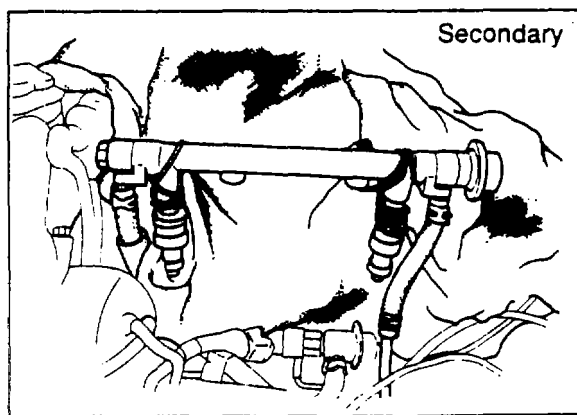
77U04B-163p



87U04B-037



77U04B-165p



77U04B-166p

Installation

Install the injectors in the reverse order of removal.

Caution

- Do not misinstall the air bleed sockets when installing.
- Replace "O" rings with new ones when installing. Use a lubricant and be careful not to damage the "O" rings during installation.

- Check for leaks with fuel pressure applied (Refer to 4B—69) before installing the dynamic chamber and throttle body.

Inspection

Warning

Before performing the following procedures, release the fuel pressure from the fuel line to reduce possibility of injury or fire. (Refer to 4B—68)

Fuel injection leakage test

- Affix the injectors to the delivery pipe with wire.

Caution

Affix the injectors firmly to the delivery pipe so no movement of the injectors is possible.

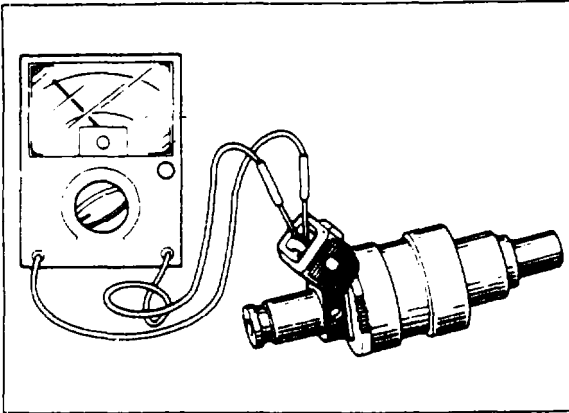
Warning

Be extremely careful when working with fuel. Always work away from sparks or open flames.

- Connect the terminals of the fuel pump check connector with a jumper wire (Refer to 4B—69). Turn on the ignition switch.
- Check that fuel does not leak from the injector nozzles.

Note

After 5 minutes a very slight amount of fuel leakage from the injector is acceptable.

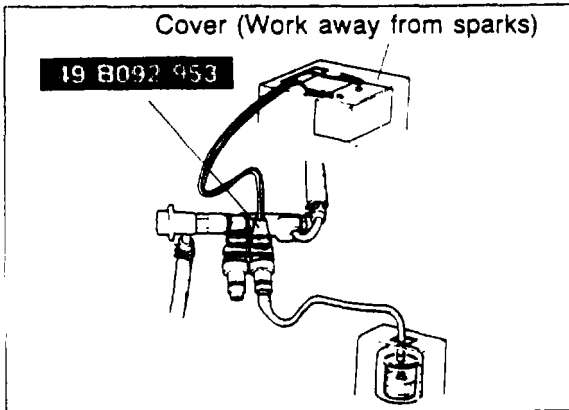


87U04B-038

Resistance

Check the resistance of the injector using a circuit tester.

Resistance: 12—16 Ω



87U04B-039

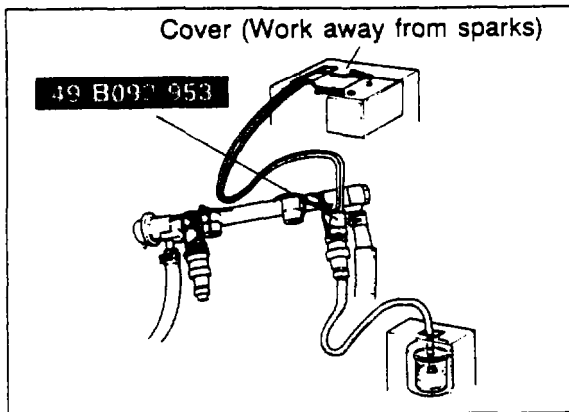
Injection volume test

1. Affix the injectors to the delivery pipes with wire.
2. Connect the terminals of the fuel pump check connector with a jumper wire (Refer to 4B—69). Turn on the ignition switch.
3. Connect the **injector checker** (49 B092 953) to the battery and injector.
4. Check the injection volume with a graduated container.

Volume: 133—142 cc (8.1—8.7 cu in)/15 sec.

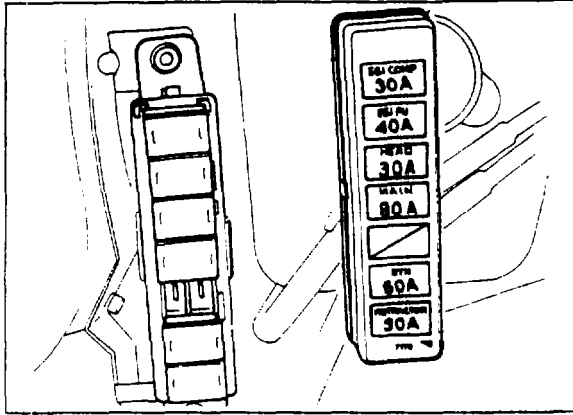
Warning

Be extremely careful when working with fuel. Always work away from sparks or open flames.



87U04B-040

4B FUEL SYSTEM

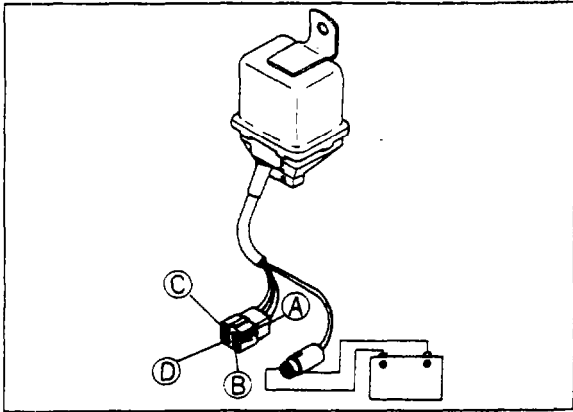


87U04B-041

EGI MAIN FUSE

Inspection

1. Check the EGI main fuses.
2. Replace fuses, if necessary.



77U04B-171

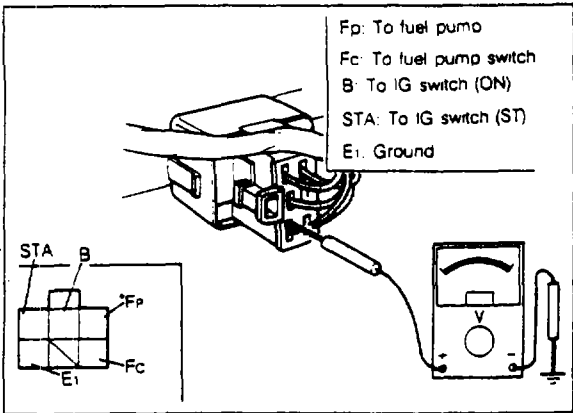
MAIN RELAY

Inspection

1. Check for a "clicking" sound of the main relay by turning the ignition switch ON and OFF.
2. Apply 12V and ground the 2-prong connector of the main relay.
3. Check continuity of the terminals using an ohmmeter.

Operation	12V Not applied	12V Applied
Terminals		
Ⓐ - Ⓑ	No continuity	Continuity
Ⓒ - Ⓓ		

4. Replace the main relay, if necessary.



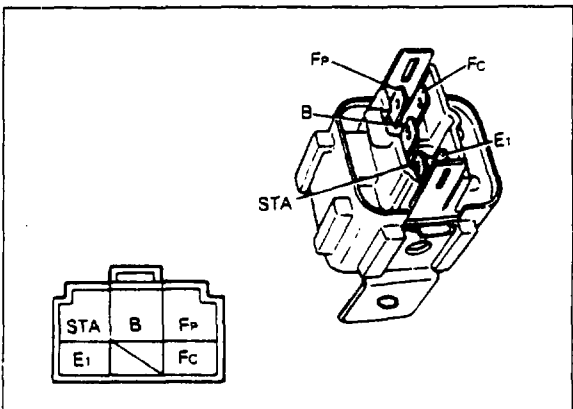
66U04A-323

CIRCUIT OPENING RELAY

Inspection of Terminal Voltage

1. Check voltage between each terminal and ground by using a voltmeter.

Condition	Fp	Fc	B	STA	E1
IG SW: ON	0V	12V	12V	0V	0V
Measuring plate: open	12V	0V	12V	0V	0V
IG SW: ST	12V	0V	12V	12V	0V



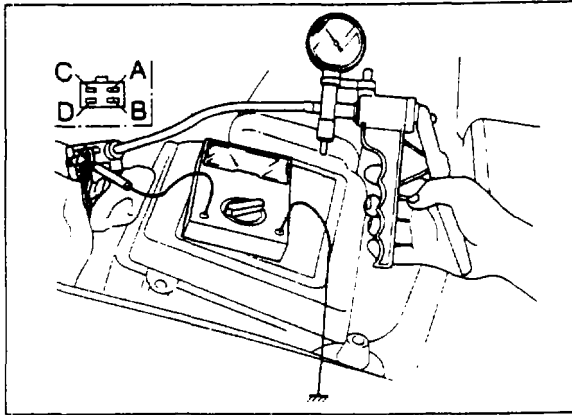
66U04A-325

Inspection of Resistance

1. Check the resistance between the terminals by using an ohmmeter.

Between terminals	Resistance (Ω)
STA ↔ E1	15-30
B ↔ Fc	80-150
B ↔ Fp	∞

2. If the resistance is not within specification, replace the circuit opening relay.



77U04B-172

PRESSURE SENSOR

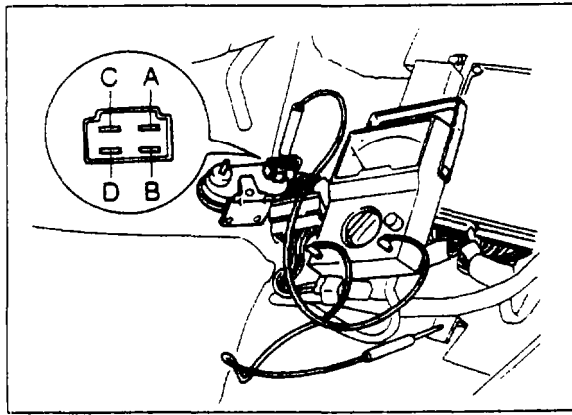
Inspection

1. Disconnect the vacuum hose from pressure sensor.
2. Connect a voltmeter to the pressure sensor (D) terminal.
3. Apply 100 mmHg (3.9 inHg) of vacuum to the pressure sensor using a vacuum pump tester.
4. Turn on the ignition switch and check the voltmeter reading.

Voltage:

2.0—2.5V at 100 mmHg (3.9 inHg)

5. Replace the sensor, if necessary.



67U04X-154

ATMOSPHERIC PRESSURE SENSOR

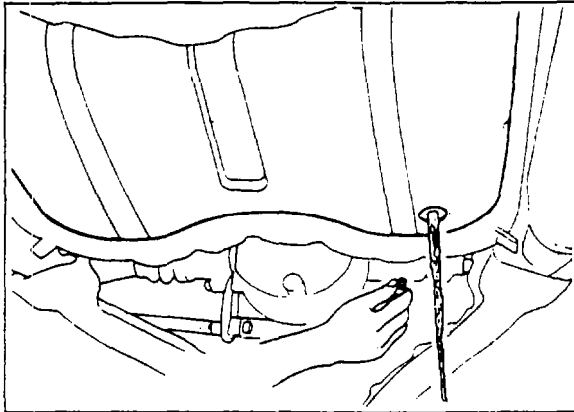
Inspection

1. Connect a voltmeter to the atmospheric pressure sensor (D) terminal.
2. Turn the ignition switch on and take a voltage reading.

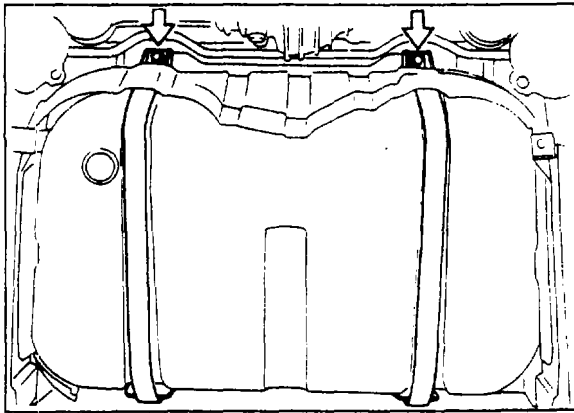
Voltage: 3.5—4.5V at sea level

**2.5—3.5V at high altitude
[2,000m (6,500 ft)]**

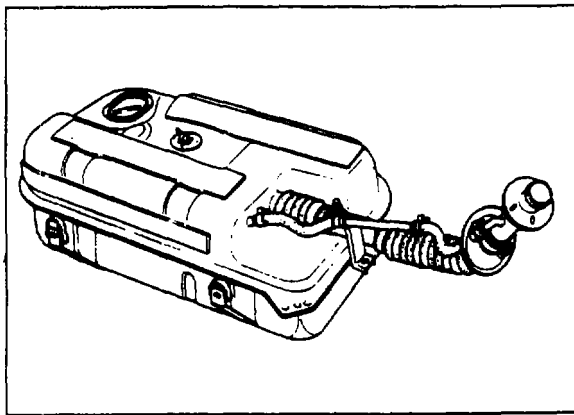
3. Replace the sensor, if necessary.



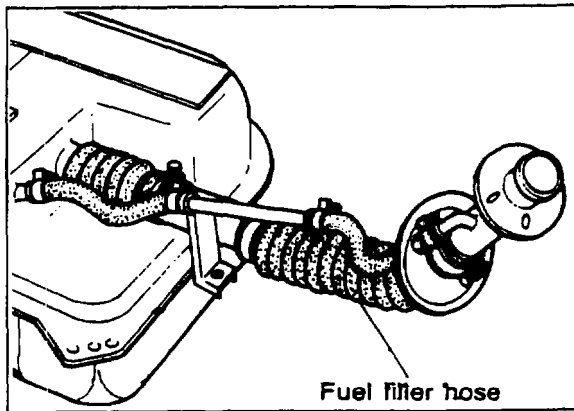
87U04B-042



67U04X-156



67U04X-157



Fuel filler hose

67U04X-158

FUEL TANK Removal

Warning

Before performing the following procedures, release the fuel pressure from the fuel line to reduce possibility of injury or fire. (Refer to 4B—68)

1. Drain the fuel tank.
2. Remove the fuel pump (Refer to 4B—71).
3. Disconnect the fuel filler hose from the fuel tank.
4. Raise the rear of the vehicle and support it with stands.
5. Remove the fuel tank protectors.
6. Disconnect the evaporation hoses from the fuel tank.
7. Remove the fixing band attaching bolts.
8. Remove the fuel tank.

Note

When removing the fuel tank, keep sparks, cigarettes and open flames away.

Inspection

1. Check the fuel tank for cracks and corrosion.
2. If any defect is found, repair or replace the tank.

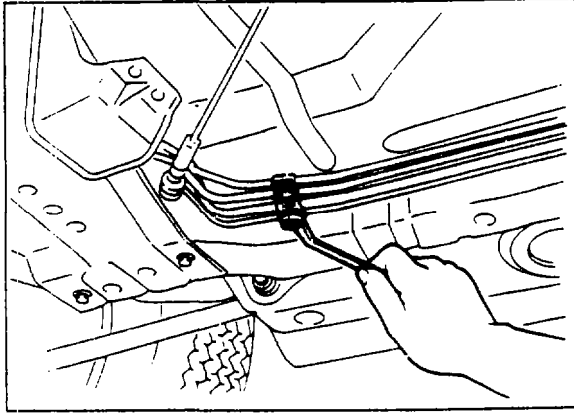
Warning

Before repairing, clean the fuel tank thoroughly with steam to sufficiently remove all explosive gas.

Installation

Install the fuel tank in the reverse order of removal.

1. Push the fuel main hose, fuel return hose and evaporation hoses onto the fuel tank fittings **at least 25 mm (1.0 in)**.
2. Push the fuel filler hoses onto the fuel tank pipe and filler pipe **at least 40 mm (1.6 in)**.

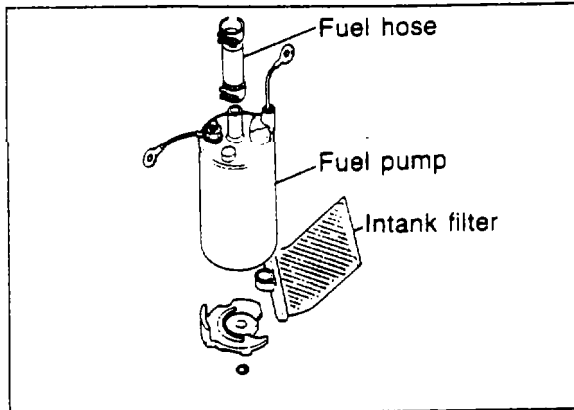


67U04X-159

FUEL LINE

Inspection

1. Check the fuel lines for leaks and tighten the fuel line connections, if necessary.
2. Drain the fuel tank and blow out the fuel lines with compressed air if an excessive amount of dirt or water is found.
3. Push the fuel hose onto the fuel pipe **at least 30—35 mm (1.2—1.4 in)**.



87U04B-043

FUEL FILTER

(LOW PRESSURE SIDE)

Replacement

Warning

Before performing the following procedures, release the fuel pressure from the fuel line to reduce possibility of injury or fire. (Refer to 4B—68)

1. Remove the fuel pump (Refer to 4B—71).
2. Remove the rubber boot and clip.
3. Remove the filter and install a new filter.

Note

Always use new clips and filter.

(HIGH PRESSURE SIDE)

Replacement

Warning

Before performing the following procedures, release the fuel pressure from the fuel line to reduce possibility of injury or fire. (Refer to 4B—68)

The fuel filter is to be replaced at intervals as outlined in the maintenance schedule.

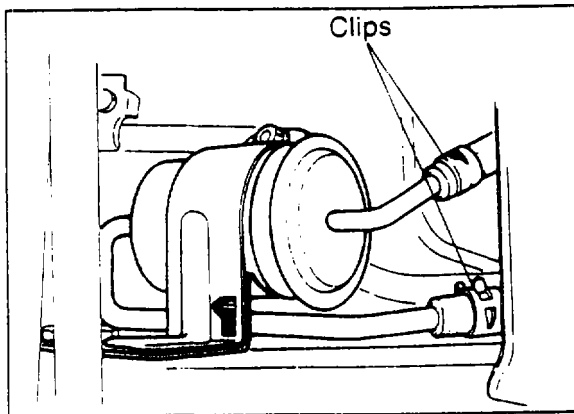
1. Raise the front of the vehicle and support it with safety stands.
2. Loosen the clips at both ends of the filter and disconnect the fuel hoses.
3. Remove the fuel filter with the bracket.
4. Install a new filter and connect the fuel hoses.

Warning

Always work away from sparks or open flames.

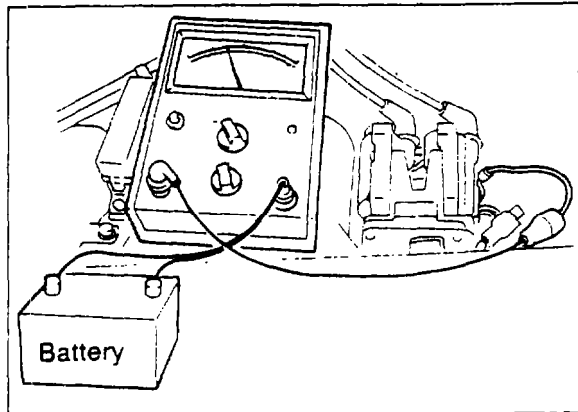
Note

When installing the filter, push the fuel hoses fully onto the fuel filter and secure the hoses with clips.

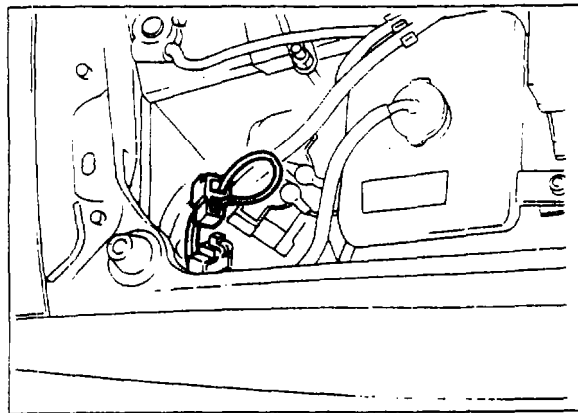


77U04B-175p

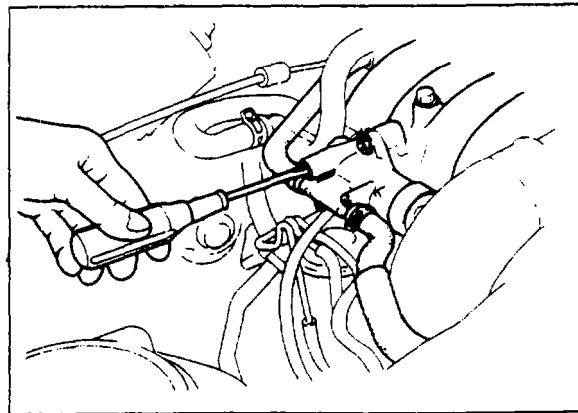
4B IDLE SPEED AND IDLE MIXTURE



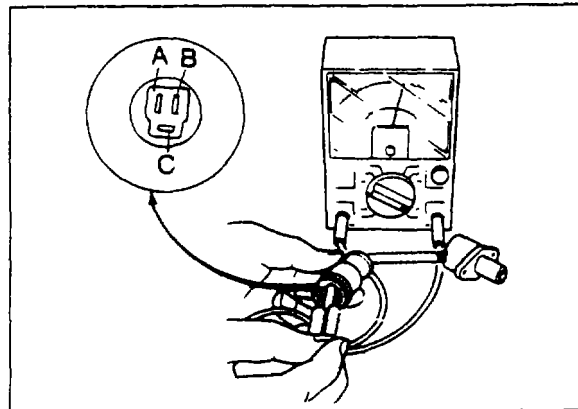
77U04B-176



77U04B-199



77U04B-177p



IDLE SPEED AND IDLE MIXTURE

Note

- To check or adjust idle speed and idle mixture, connect a tachometer to the check coupler at the trailing side coil with igniter.
- If the tachometer does not function correctly on the trailing side coil with igniter, reconnect to the leading side coil with igniter (Black coupler).
- If using an inductive (Secondary pick up) type tachometer, connect it only at the trailing side high tension leads. If connected on the leading side coil with igniter, it will function incorrectly.

IDLE SPEED

Before checking or adjusting the idle speed, follow these directions.

- Switch off all accessories.
- Connect a tachometer to the engine.
- Warm up the engine to normal operating temperature.
- Connect a jumper wire to the initial set coupler.

1. Check and adjust the throttle sensor. (Refer to 4B—49)
2. Remove the blind cap from the BAC valve and adjust the idle speed by turning the air adjust screw.

Idle speed: 725—775 rpm

3. Install the blind cap and disconnect the jumper wire from the initial set coupler.

Caution

Make certain the jumper wire is removed.

IDLE MIXTURE

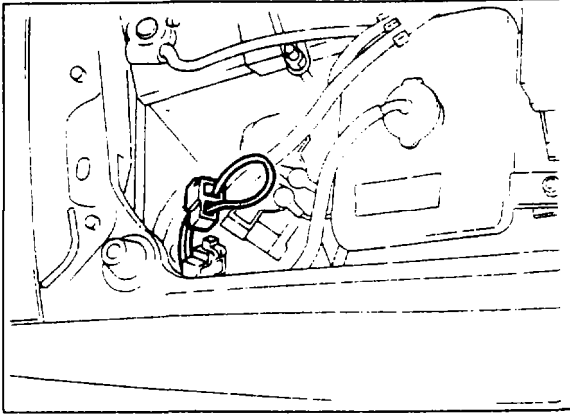
Variable Resistor Inspection

1. Disconnect the variable resistor connector.
2. Check the resistance of the variable resistor using a circuit tester.

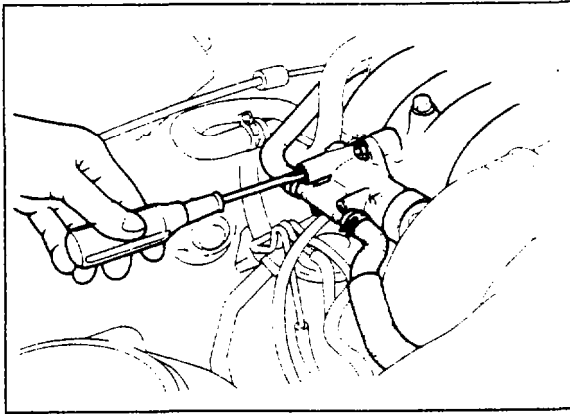
Resistance

- A — C: 0.5—4.5 k Ω
- B — C: 0.5—4.5 k Ω

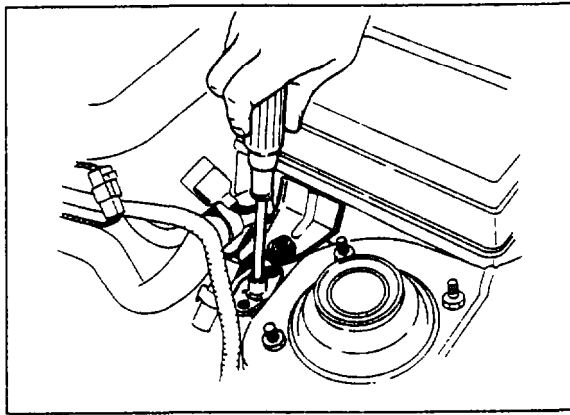
3. Replace the resistor, if necessary.
4. Adjust the idle mixture.



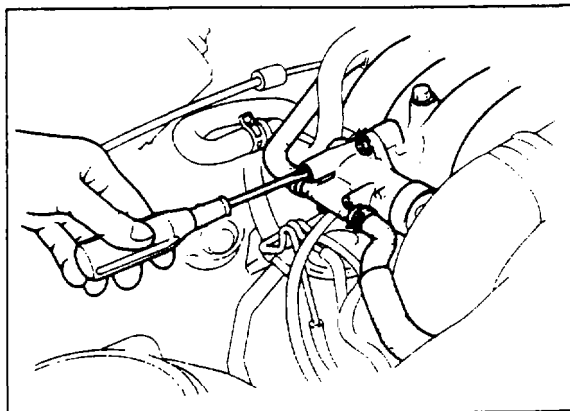
77U04B-178



77U04B-179a



67U04X-166



67U04X-167

Adjustment of Idle Mixture

Note

Usually idle mixture adjustment is unnecessary. Idle mixture adjustment should be performed only when the variable resistor or the engine is replaced.

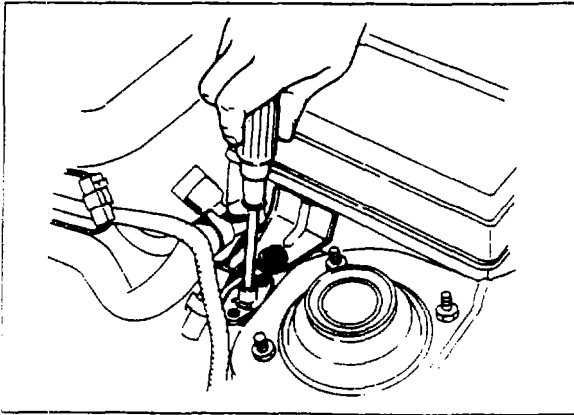
Before adjusting the idle mixture, follow these directions.

- Switch off all accessories.
 - Connect a tachometer to the engine.
 - Warm up the engine to normal operating temperature.
 - Connect a jumper wire to the initial set coupler
1. Check and adjust the throttle sensor. (Refer to 4B—49)
 2. Remove the blind cap from the BAC valve and adjust the idle speed to **750 rpm** by turning the air adjust screw.

3. Set the idle speed to the highest rpm by turning the variable resistor.

4. Reset the idle speed to **750 rpm** by turning the air adjust screw.

4B IDLE SPEED AND IDLE MIXTURE

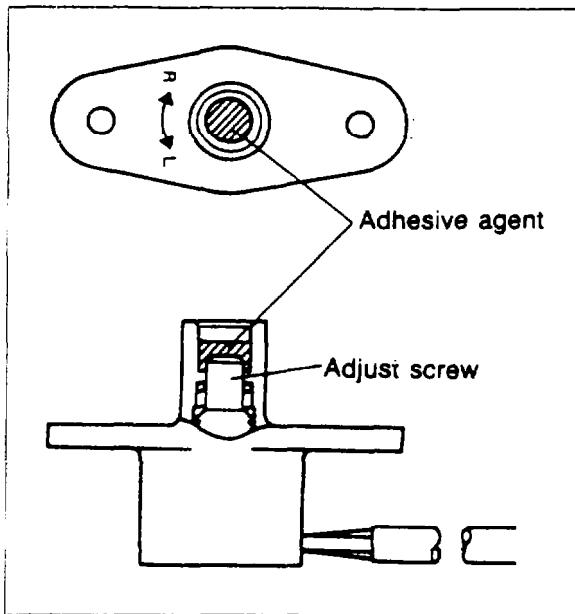


77U04B 180

- 5 Turn the variable resistor **counterclockwise** until the idle speed becomes **730 rpm**, and then turn it **clockwise** to reset the speed to **750 rpm**.
- 6 Install the blind cap and disconnect the jumper wire.

Caution

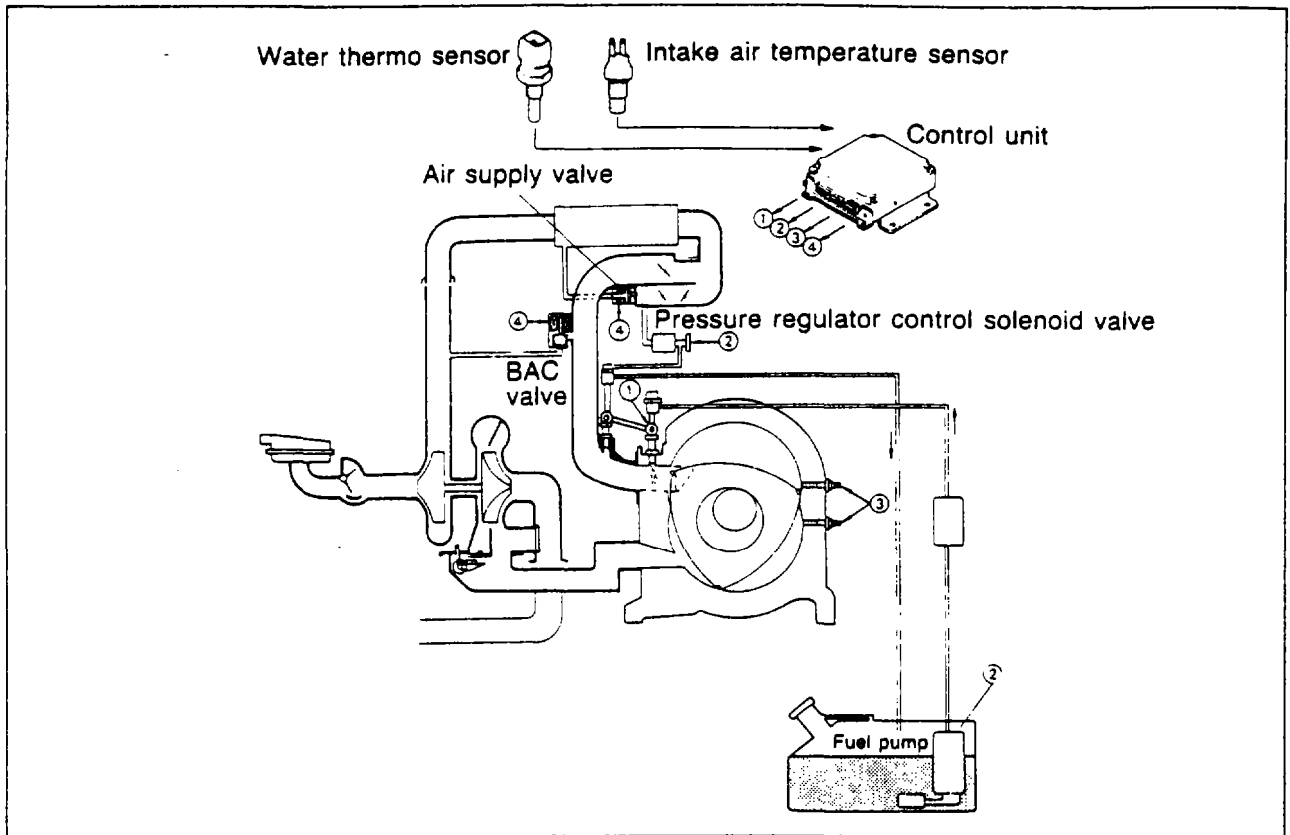
Make certain the jumper wire is removed.



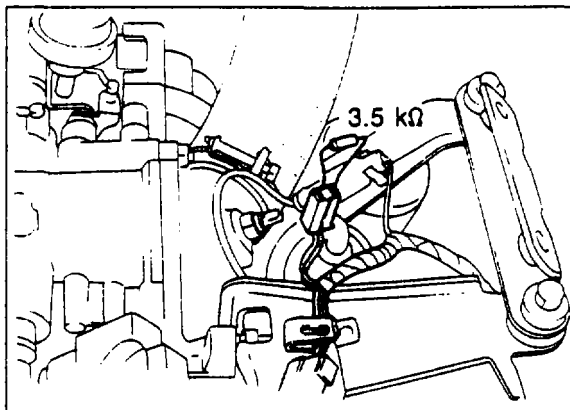
67U04X 169

- 7 Plug the head of the adjust screw with **adhesive agent** (P/N N304 23 795).

HOT START ASSIST SYSTEM



77U04B-181



77U04B-182

ON VEHICLE INSPECTION

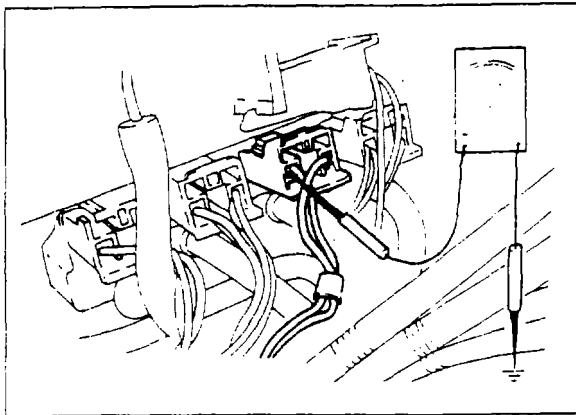
1. Warm up the engine to the normal operating temperature and stop it.
2. Remove the intercooler.
3. Disconnect the intake air temperature sensor connector.
4. Connect a resistor (**3.5 kΩ**) to the sensor connector.

	Engine speed
After starting, for 50 sec	850 rpm
After 50 sec	750 rpm

77U04B-183

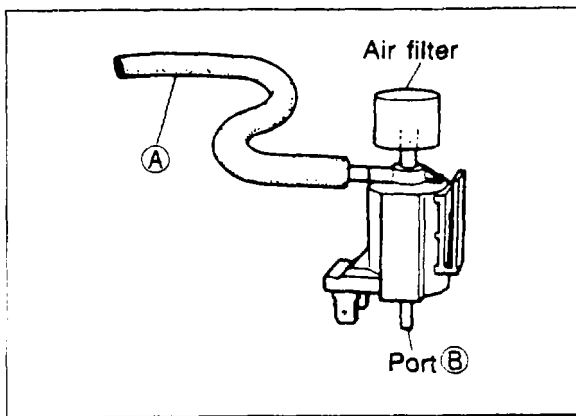
6. Connect a tachometer to the engine.
7. Start the engine and check the engine speed as shown in the chart.

4B HOT START ASSIST SYSTEM



77U04B-184

8. Stop the engine and connect the voltmeter to the pressure regulator control solenoid valve as shown in the figure.
9. Start the engine and check the following:
 - For 50 seconds after engine is started, below 2.0V.
 - After 50 seconds, approx. 12V.

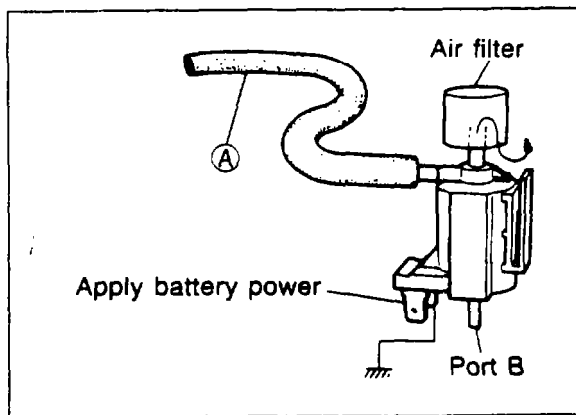


67U04X-174

PRESSURE REGULATOR CONTROL SOLENOID VALVE

Inspection

1. Disconnect the vacuum hose from the solenoid valve and vacuum pipe.
2. Blow through the valve from vacuum hose (A).
3. Check that air passes through the valve and flows from port (B).



67U04X-175

4. Disconnect the solenoid valve connector.
5. Connect 12V and a ground to the terminals of the valve.
6. Blow through the valve from the vacuum hose (A).
7. Check that air passes through the valve and flows from the air filter.

INTAKE AIR TEMPERATURE SENSOR (INTAKE AIR PIPE)

Removal

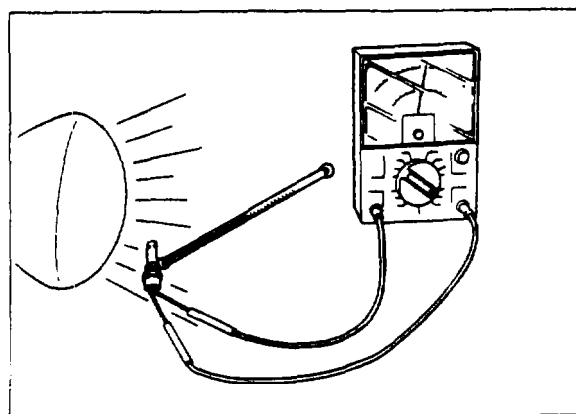
Remove the intake air temperature sensor from the inlet air pipe.

Installation

Install in the reverse order of removal.

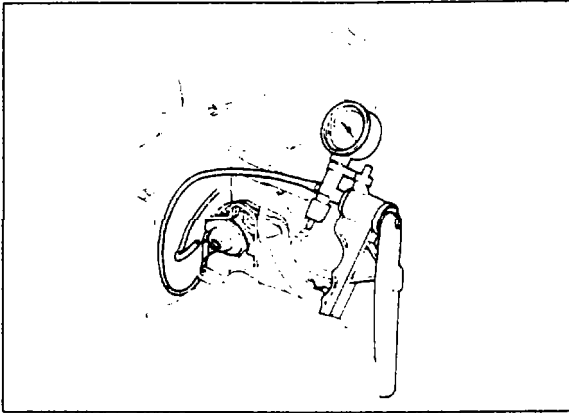
Inspection

1. Connect an ohmmeter to the sensor terminals.
2. Check the resistance of the sensor.



77U04B-185

Temperature	Resistance
20°C (68°F)	41.5 ± 4.15 kΩ
50°C (122°F)	11.85 ± 1.19 kΩ
85°C (185°F)	3.5 ± 0.35 kΩ

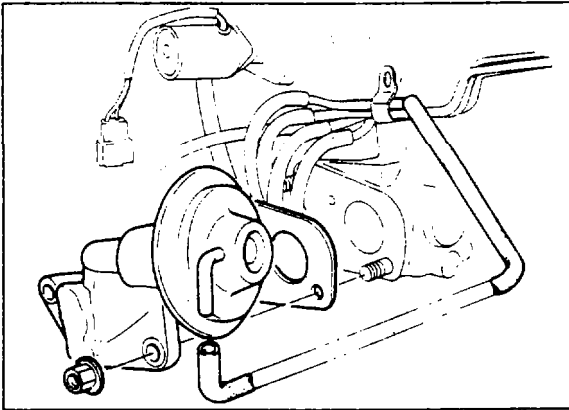


77U04B-186

EXHAUST GAS RECIRCULATION (EGR) CONTROL SYSTEM

EGR Valve Inspection

1. Warm up the engine and run it at idle.
2. Disconnect the vacuum hose from the EGR valve and connect a vacuum pump tester to the EGR valve.
3. Apply **100 mmHg (3.9 inHg)** vacuum.
4. Check that the engine speed decreases.



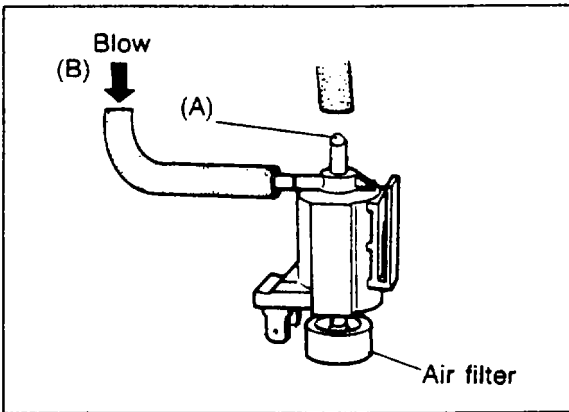
77U04B-187

Removal

1. Disconnect the vacuum hose from the EGR valve.
2. Remove the EGR valve.

Installation

Install in the reverse order of removal.

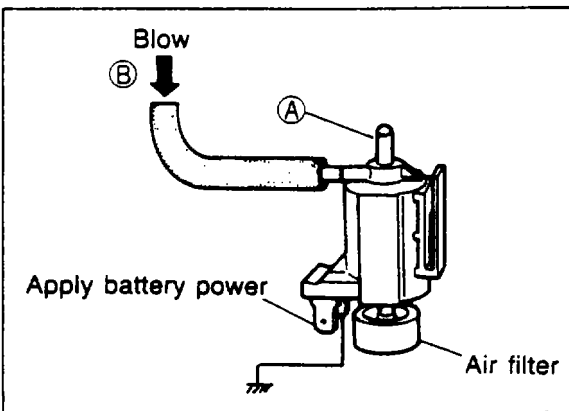


67U04X-179

EGR SOLENOID VALVE

Inspection

1. Disconnect the vacuum hose from the EGR solenoid valve.
2. Blow through the valve from port (B). Check that air passes through the valve and flows from the air filter.



67U04X-180

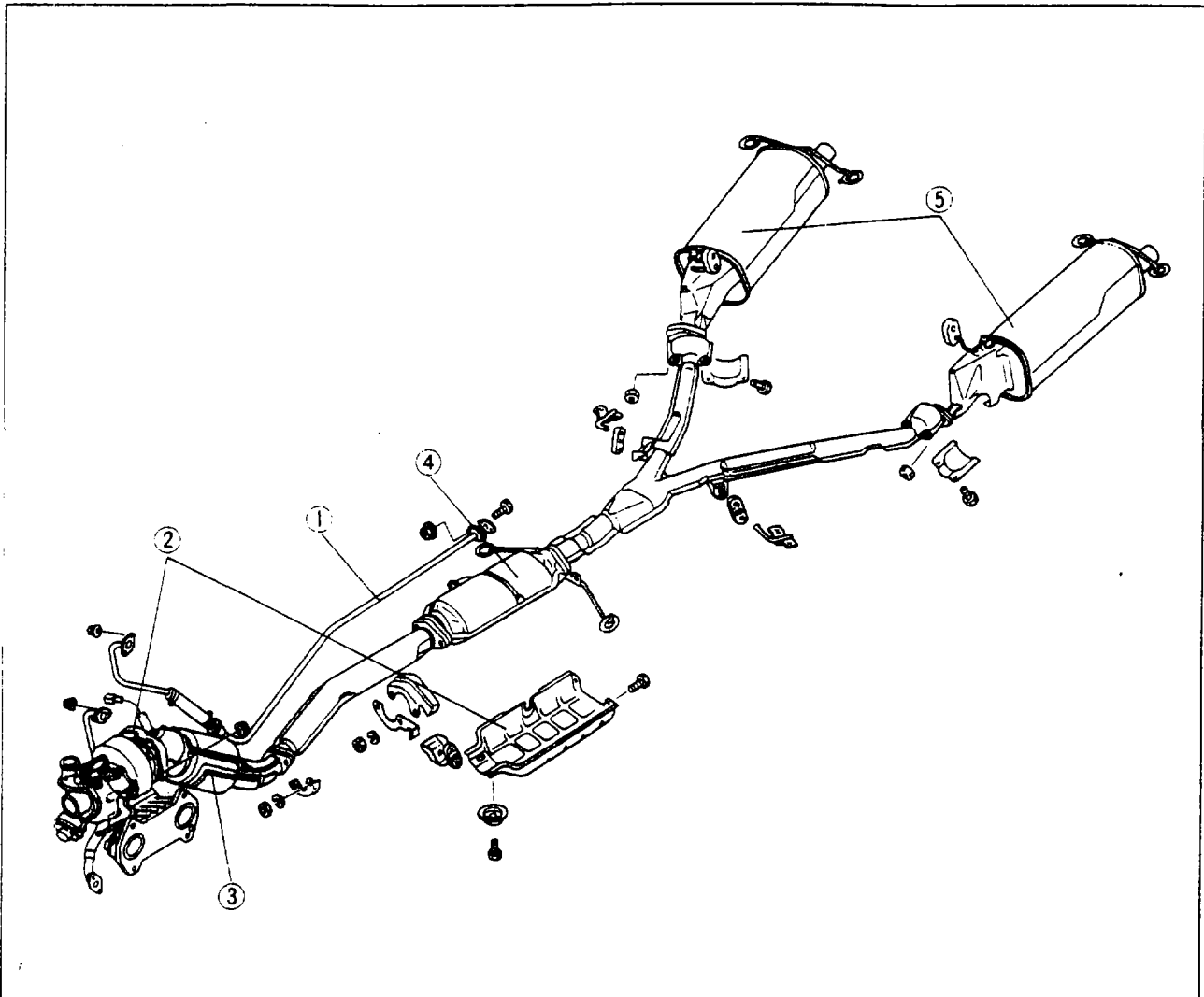
3. Disconnect the EGR solenoid valve connector and connect 12V and a ground to the terminals of the valve.
4. Blow through the valve from port (B). Check that air passes through the valve and flows from port (A).

4B CLOSED LOOP CONTROL SYSTEM

CLOSED LOOP CONTROL SYSTEM

Removal

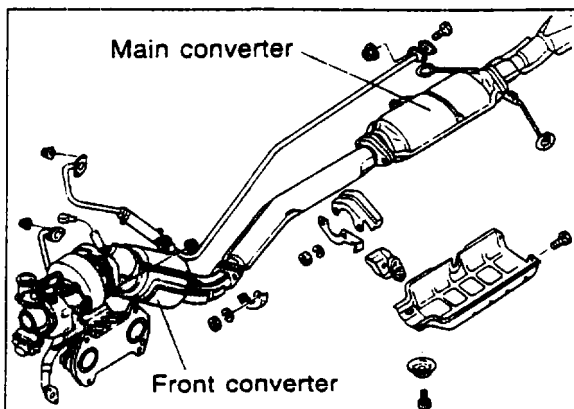
Remove in the sequence shown in the figure.



77U04B-224

1. Split air pipe
2. Insulator covers
3. Front converter

4. Main converter
5. Main silencer



77U04B-189

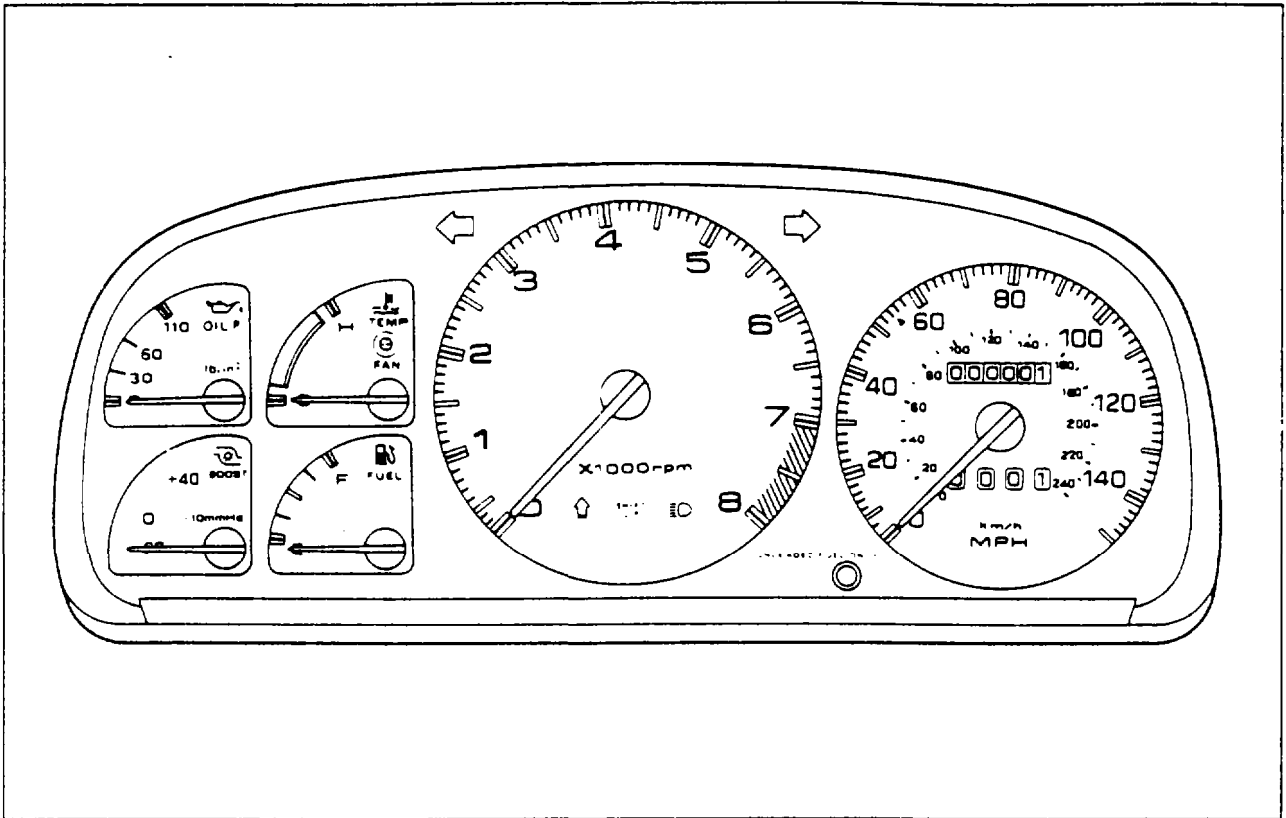
Inspection

1. Visually inspect the front converter and main converter for cracks or damage.
2. Check the front converter and main converter connections for tightness.
3. Start the engine and run it at idle.
4. Check for exhaust gas leakage from the front converter and main converter connections.

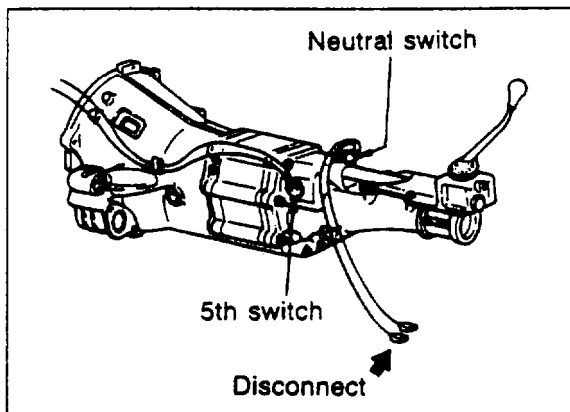
Installation

Install in the reverse order of removal.

SHIFT INDICATOR LIGHT CONTROL SYSTEM



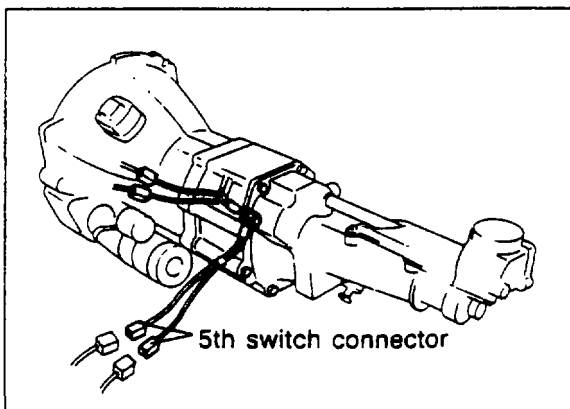
67U04X-188



77U04B-190

SHIFT INDICATOR LIGHT Inspection

1. Warm up the engine and then turn it off.
2. Disconnect the neutral switch connector.
3. Start the engine and increase the engine speed to **above 2,600 rpm**.
4. Check that the shift indicator light comes on.
5. Stop the engine.

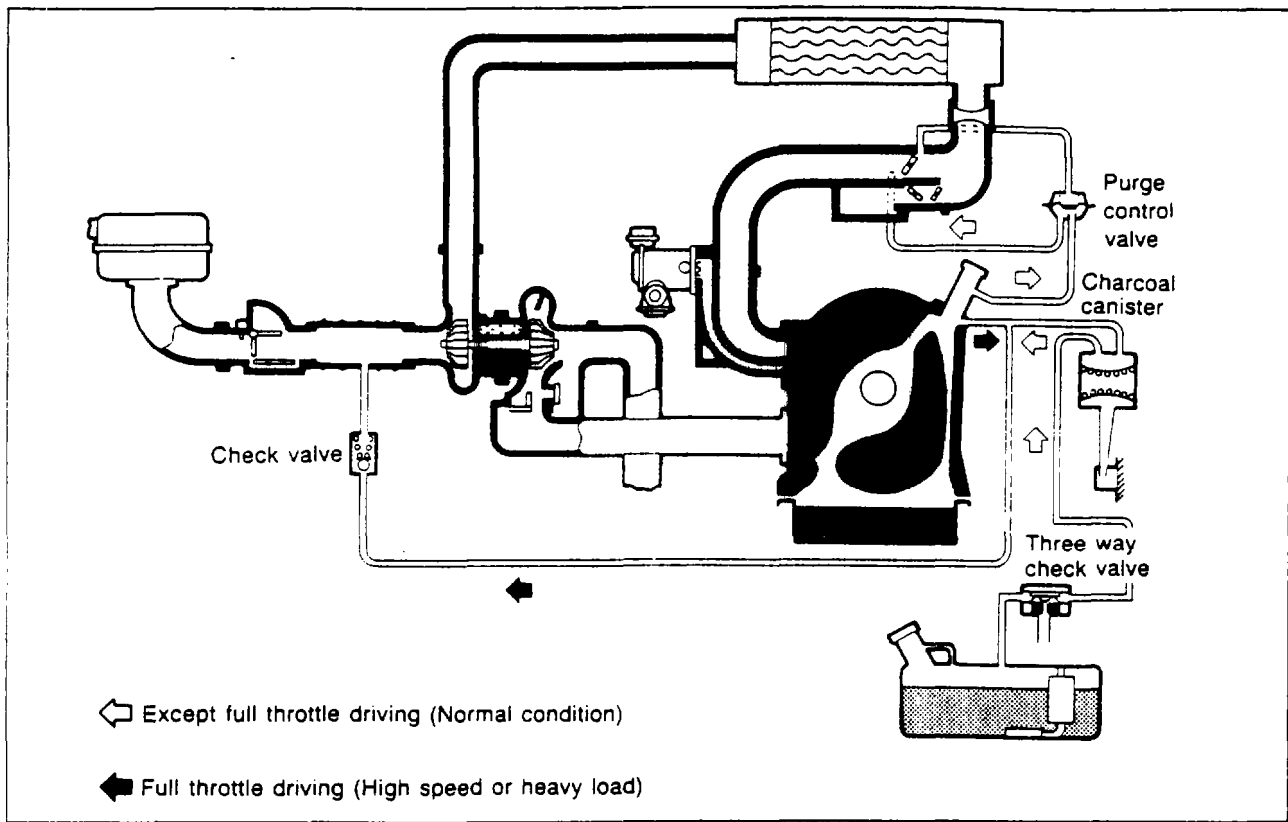


67U04X-190

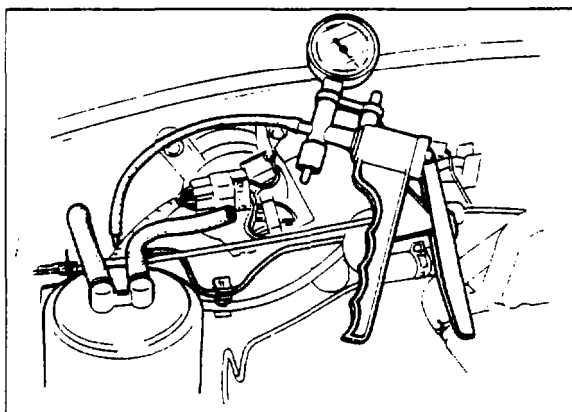
6. Disconnect the 5th gear switch connector.
7. Start the engine and increase the engine speed to **above 2,600 rpm**.
8. Check that the shift indicator light does not come on.

4B CRANKCASE AND EVAPORATIVE EMISSION CONTROL SYSTEM

CRANKCASE AND EVAPORATIVE EMISSION CONTROL SYSTEM



77U04B-191



77U04B-192

EVAPORATIVE LINE

Inspection

1. Disconnect the ventilation hose from the canister and connect a vacuum pump tester to the ventilation hose.
2. Operate the vacuum pump tester and make sure no vacuum is held.
3. If vacuum is held, check the three-way check valve and evaporation pipe for blockage.

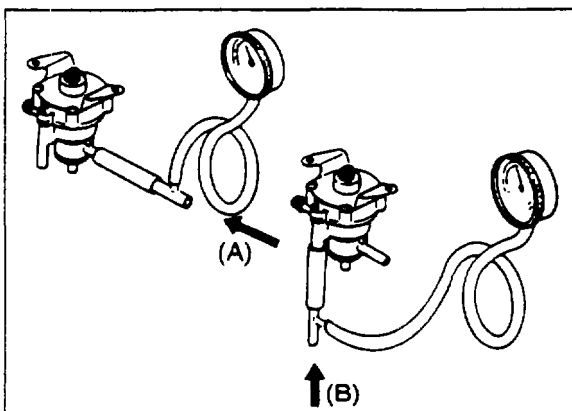
CHECK AND CUT VALVE

Inspection

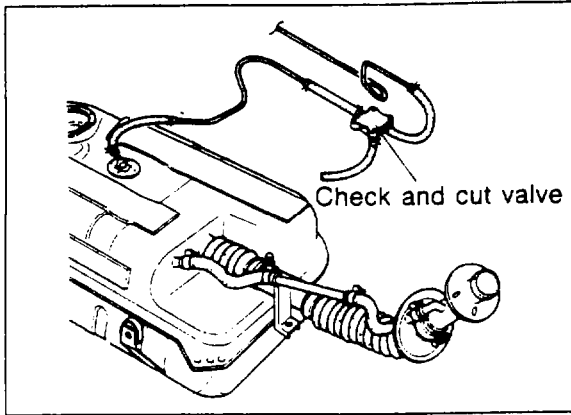
1. Remove the check and cut valve.
2. Connect a pressure gauge to the passage from the fuel tank.
3. Blow through the valve from (A) and check that the valve opens at a pressure of 0.98—4.9 kPa (0.01—0.05 kg/cm², 0.14—0.71 psi).
4. Remove the pressure gauge and connect it to the passage to atmosphere.
5. Blow through the valve from (B) and check that the valve opens at a pressure of 5.39—6.87 kPa (0.055—0.07 kg/cm², 0.78—1.00 psi).

Note

The test should be performed with the valve held horizontally. Otherwise the check balls in the valve will close the passages.



87U04B-044



37U04B-045

Removal

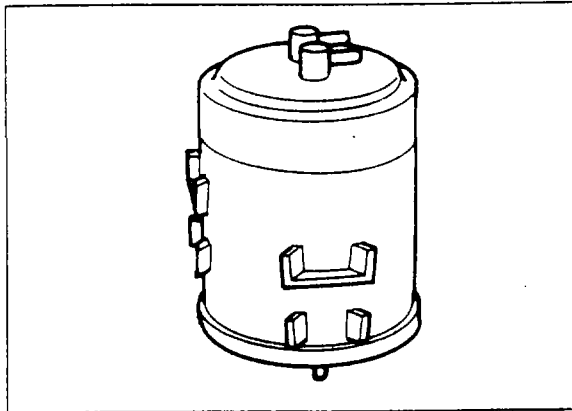
1. Raise the rear of the vehicle and support it with safety stands.
2. Unfasten the hose bands and disconnect the evaporative hoses from the check and cut valve.
3. Remove the valve.

Installation

Install in the reverse order of removal noting the hose positions.

Caution

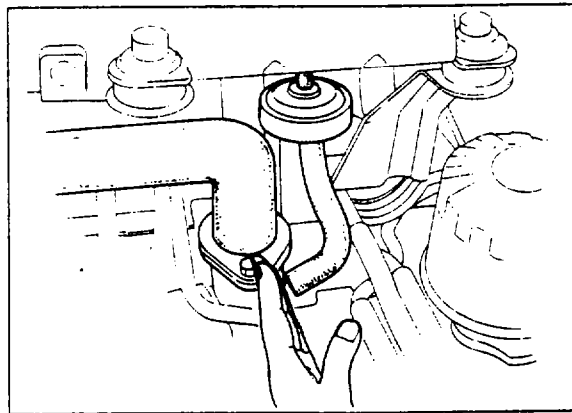
- a) When installing the check and cut valve, fully push the evaporative hoses onto the valve and secure the hoses with bands.
- b) When connecting the hoses to the valve, note the direction of the valve fittings.



67U04X-195

CHARCOAL CANISTER

Visually check the canister for leakage or damage.

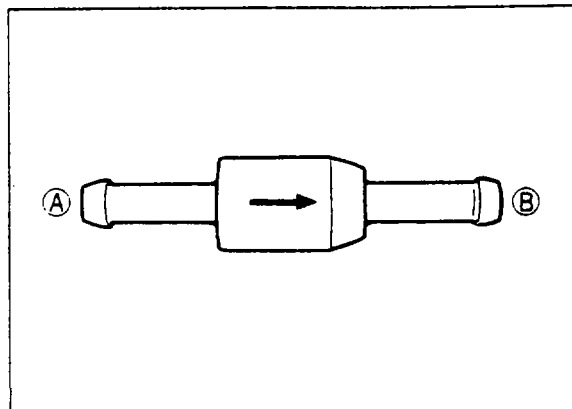


67U04X-196

PURGE CONTROL VALVE

Inspection

1. Disconnect the hose (purge control valve to oil filler pipe) from the purge control valve.
2. Start the engine and run it at idle.
3. Place a finger on the port opening and check that air is not drawn into the port.
4. Increase the engine speed to **2,000 rpm** and air should be drawn into the port.
5. Replace the valve, if necessary.



77U04B-193

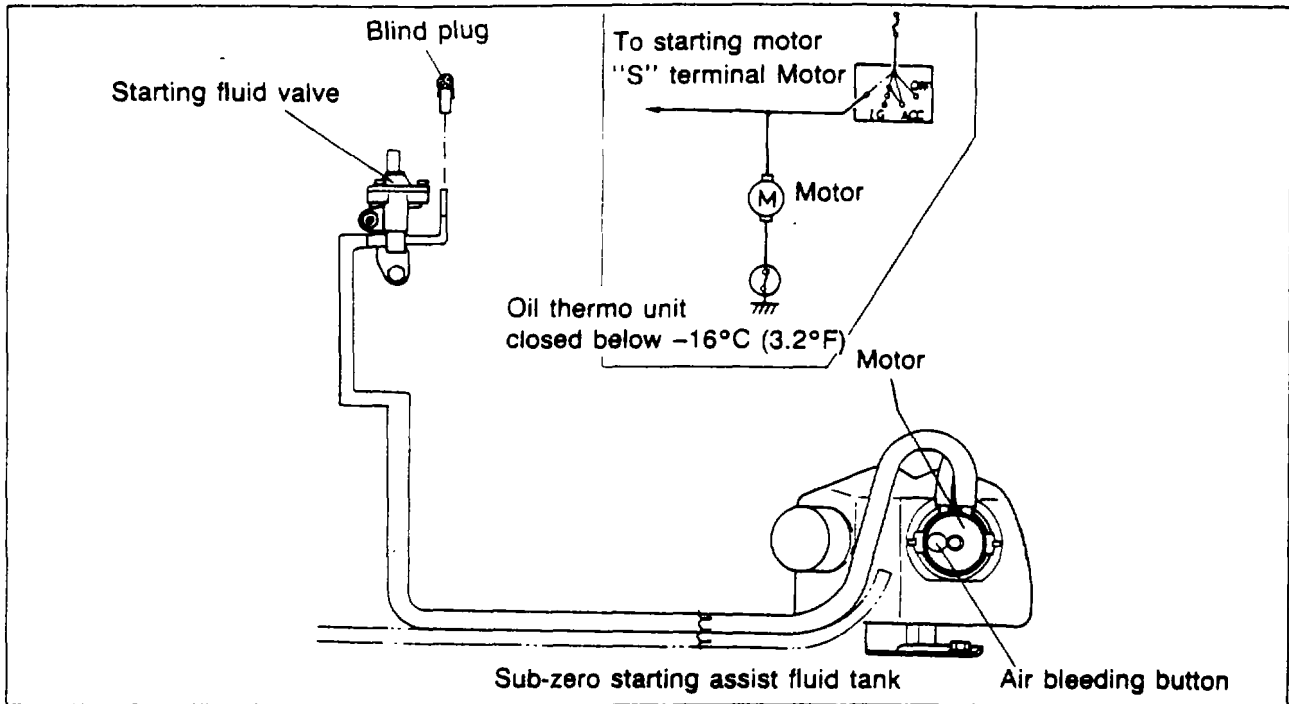
CHECK VALVE

Inspection

1. Remove the check valve.
2. Blow through the check valve from port **(A)**, and check that the air comes out of port **(B)**.
3. Blow through the check valve from port **(B)**, and check that the air does not come out of port **(A)**.

4B SUB-ZERO STARTING ASSIST DEVICE (EXCEPT FOR CALIFORNIA)

SUB-ZERO STARTING ASSIST DEVICE (EXCEPT FOR CALIFORNIA)

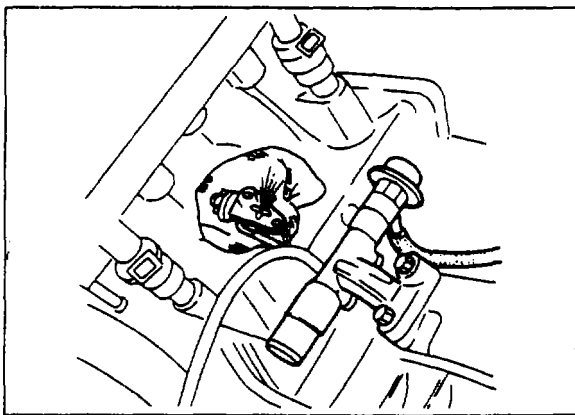


67U04X-181

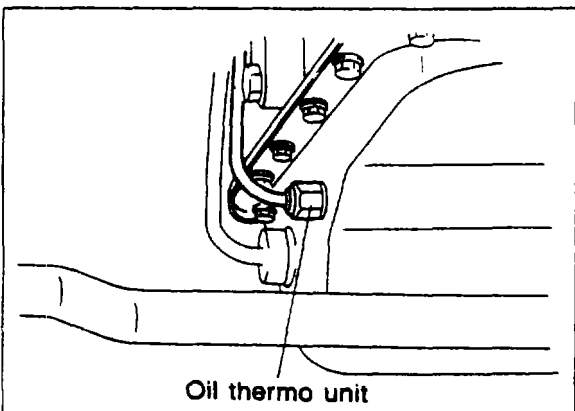
SUB-ZERO STARTING ASSIST DEVICE

Inspection

1. Check that there is sufficient starting assist fluid in the tank, and add if necessary.
2. Disconnect the Ⓢ terminal connector from the starter.
3. Remove the starting fluid valve from the intake manifold.
4. Turn the ignition key to the "START" position and check that no starting assist fluid is ejected from the valve.
[Ambient temperature: **above -20 — -12°C (-4°F — 10.4°F)**]
5. Disconnect the oil thermo unit connector on the oil pan and ground the connector.
6. Turn the ignition key to the "START" position. Push the air bleed button on the tank and check that starting assist fluid is ejected from the valve.



67U04X-182



67U04X-183

SUB-ZERO STARTING ASSIST FLUID

The mixture of the starting assist fluid should be **90%** high quality ethylene glycol antifreeze solution and **10%** water.

OIL THERMO UNIT

Check the oil thermo unit continuity using a circuit tester.

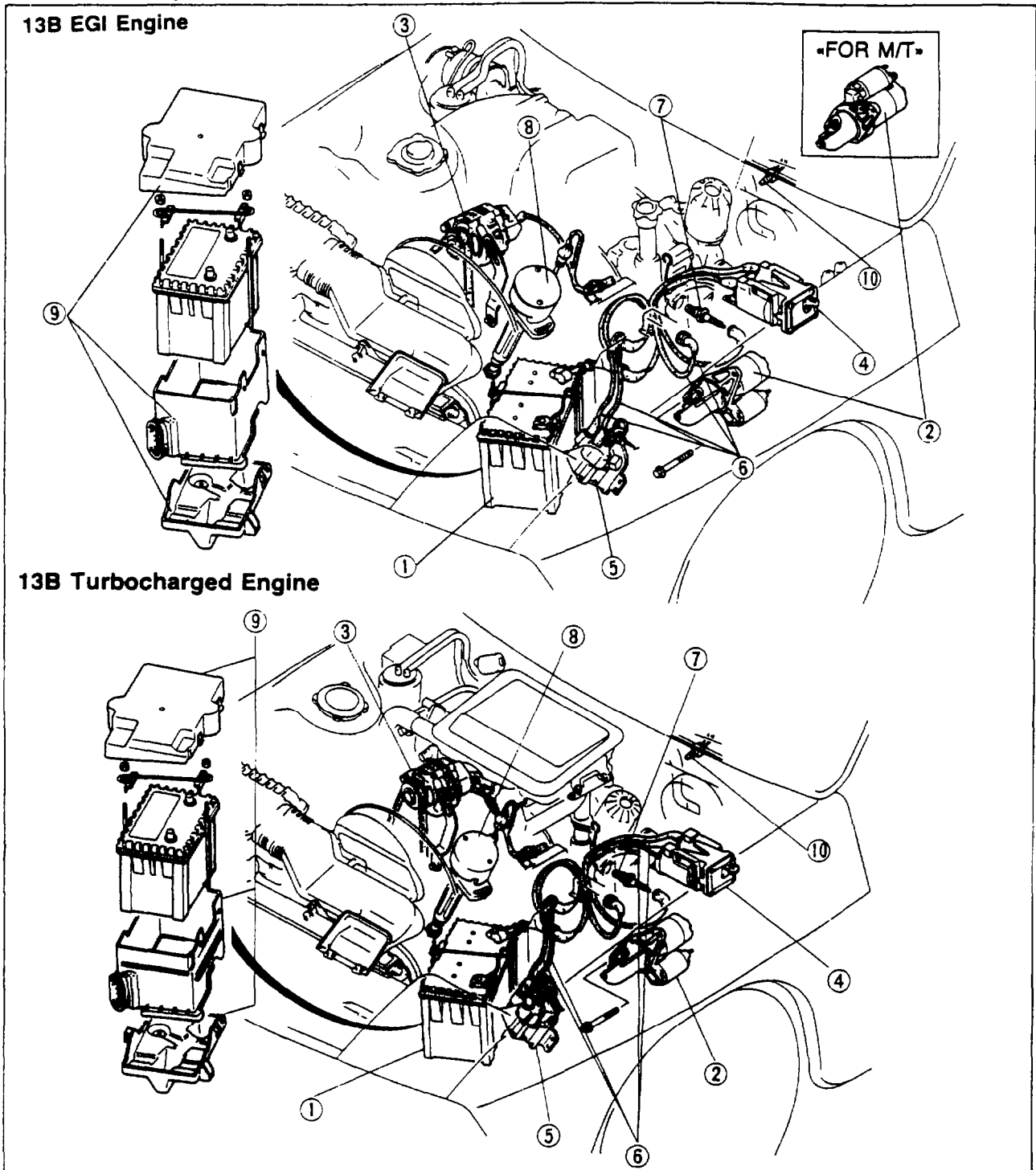
Ambient temperature	Continuity
Below -16°C (3.2°F)	Yes
Above -16°C (3.2°F)	No

ENGINE ELECTRICAL SYSTEM

OUTLINE	5— 2
STRUCTURAL VIEW	5— 2
SPECIFICATIONS	5— 3
TROUBLESHOOTING GUIDE	5— 4
BATTERY	5— 5
INSPECTION	5— 5
RECHARGING	5— 5
ALTERNATOR	5— 6
CHARGING SYSTEM	5— 6
ON-VEHICLE INSPECTION	5— 7
REMOVAL	5—12
DISASSEMBLY	5—12
INSPECTION	5—15
ASSEMBLY	5—18
INSTALLATION	5—19
STARTER	5—20
STARTING SYSTEM	5—20
ON-VEHICLE INSPECTION	5—20
REMOVAL	5—21
INSTALLATION	5—21
DISASSEMBLY	5—21
INSPECTION	5—24
ASSEMBLY	5—28
CHECKING OPERATION	5—29
STARTER INTERLOCK SYSTEM	5—30
INTERLOCK SWITCH	5—30
SPARK PLUGS	5—31
REMOVAL AND INSTALLATION	5—31
INSPECTION	5—31
HIGH-TENSION LEADS	5—31
INSPECTION	5—31
COIL WITH IGNITER	5—32
INSPECTION	5—32
ADJUSTMENT OF IGNITION TIMING	5—35

OUTLINE

STRUCTURAL VIEW



77U05X-030

- 1. Battery
- 2. Starter motor
- 3. Alternator
- 4. Coil with igniter (Trailing side)
- 5. Coil with igniter (Leading side)

- 6. High-tension leads
- 7. Spark plugs
- 8. Crank angle sensor
- 9. Battery cover
- 10. Interlock switch

SPECIFICATIONS

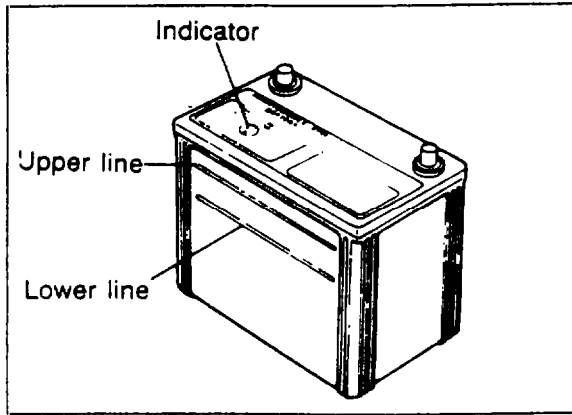
		13B EGI Engine		13B Turbocharged Engine	
		M/T	A/T	M/T	
Voltage (V)		12, Negative ground			
Battery	Type and capacity (20—hour rate) (Maintenance free)	50D20L : 50AH 65D23L : 55AH (65D23L : Coldproof area)			
Ignition system	Distribution	Control Unit			
	Spark timing	Leading: 5° ATDC Trailing: 20° ATDC at idle (A/T, N range)			
	Spark advance	Control unit			
	Spark plug	Type	Trailing : NGK SD11A Leading ; NGK SD10A		
	Plug gap (mm (in))	2.0 (0.08)			
Alternator	Output (V—A)	12—70			
	Regulated voltage (V)	14.4—15.0 (with temperature—gradient characteristics)			
	Output test (at hot)	Voltage (V)	13.5		
		Current (A)	Min 55		
		Speed (rpm)	2,500		
	Brush length	Standard (mm (in))	16.5 (0.650)		
Wear limit (mm (in))		8.0 (0.315)			
Starter	Type	Coaxial reduction			
	Output (KW)	1.2	2.0	1.2	
	Output(No load)	Voltage (V)	11.0		
		Current (A)	Max. 90		
		Speed (rpm)	Min. 3,000		
	Brush length	Standard (mm (in))	17.5 (0.689)		
		Wear limit (mm (in))	10.0 (0.394)		

87U05X-001

5 TROUBLESHOOTING GUIDE

TROUBLESHOOTING GUIDE

Problem	Possible cause	Remedy	Page
Starter does not turn at all, or its turning speed is too slow to start the engine.	Battery and related parts Poor contact of battery terminals Poor grounding of negative cable Voltage drop caused by discharged battery Insufficient voltage caused by battery malfunction	Clean and tighten Clean and repair Recharge Replace	5— 5 — 5— 5 5— 5
	Ignition switch and related parts Poor contact of ignition switch Loose ignition switch wiring or connector Broken wire between ignition switch and magnetic switch	Replace Repair Repair or replace	Section 15 5—25
	Magnetic switch and related parts Loose wiring and/or connectors Burnt magnetic switch contact plate or improper contact Broken wire in magnetic switch pull-in coil Broken wire in magnetic switch holding coil	Repair Replace Replace Replace	5—25 5—25 5—25 5—25
	Starter Poor contact of brushes Fatigued brush spring Commutator malfunction Grounded armature Worn parts Interlock switch malfunction	Adjust contact or replace Replace Repair or Replace Replace Replace Replace	5—27 5—27 5—24, 25 — — 5—30
Starting problem	Insufficient battery capacity Malfunction of spark plug(s) Loose positive terminal Malfunction of coil with igniter	Recharge Clean, adjust or replace Tighten Replace	5— 5 5—31 — 5—32, 33, 34
	Starter turns but pinion gear does not mesh with ring gear	Starter Tip of overrunning clutch pinion is worn Weakened overrunning clutch drive spring Worn overrunning clutch Improper sliding of spline Worn bushing Worn ring gear	Replace Replace Replace Adjust contact and repair, or replace Replace Replace
Starter turns continuously (does not stop)	Magnetic switch Sticking contact plate of magnetic switch Layer shorting coil of magnetic switch Ignition switch does not return	Replace Replace Replace	5—25 5—25 Section 15
Misfiring	Dirty or damaged spark plug(s) Malfunction of wiring, or open circuit Malfunction of coil with igniter	Clean or replace Repair or Replace Replace	5—31 5—31 5—32, 33, 34
Discharging of battery	Alternator Loose V belt Grounded or broken stator coil Broken rotor coil Poor contact of brush and slip ring Malfunction of rectifier Malfunction of IC regulator	Adjust Replace Replace Clean, repair or replace Replace Replace	5—19 5—15 5—15 5—16 5—16, 17 —
	Battery and related parts Insufficient or unsuitable battery electrolyte Malfunction of battery electrode (internal short-circuit) Poor contact of battery terminal(s) Excessive electric load	Adjust Replace Clean and tighten Check power consumption and short circuit	5—5 5—5 5—5 —
Overcharging of battery	IC regulator malfunction	Replace	—
	Operating at extremely high temperature	Repair	—



67U05X-005

BATTERY

INSPECTION

Indicator Sign

1. Remove the battery cover.
2. Check that the indicator sign is blue.
3. If the blue indicator sign is not visible, check that the electrolyte level lies between the upper and lower lines.
4. If low, add distilled water, being careful not to overfill.
5. If the electrolyte level is acceptable and yet the blue indicator sign is not visible, the battery must be recharged.

Terminal and cable

1. Check the tightness of the terminals to ensure good electrical connections. Clean the terminals and coat them with grease.
2. Inspect for corroded or frayed battery cables.
3. Check the rubber protector on the positive terminal for proper coverage.

67U05X-006

Temperature [°C (°F)]	Specific gravity of electrolyte
-40 (-40)	1.322
-30 (-22)	1.315
-20 (- 4)	1.308
-10 (14)	1.301
0 (32)	1.294
10 (50)	1.287
20 (68)	1.280
30 (86)	1.273
40 (104)	1.266
50 (122)	1.259
60 (140)	1.252

Charged rate : 100%

87U05X-002

RECHARGING

Battery	Slow charge (A)	Quick charge (A)
50D20L	Under 5	Max. 20
65D23L	Under 5.5	

Quick Charging

Remove the battery from the vehicle and remove all the vent caps to perform a quick charge.

Slow Charging

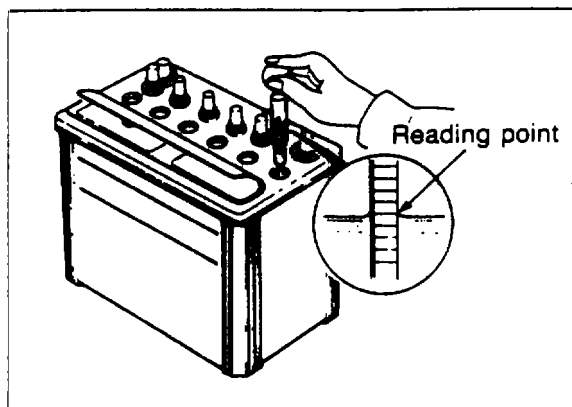
It is not necessary to remove the vent caps to perform a slow charge.

Warning

- a) Before performing maintenance or recharging the battery, turn off all accessories and stop the engine.
- b) The negative cable must be removed first and installed last.

Note

- a) If the indicator sign does not turn blue even after being charged, measure the specific gravity with a hydrometer. If the specific gravity is under 1.230, charge once more.
- b) If the indicator sign does not turn blue when the specific gravity is normal, the indicator could be defective.

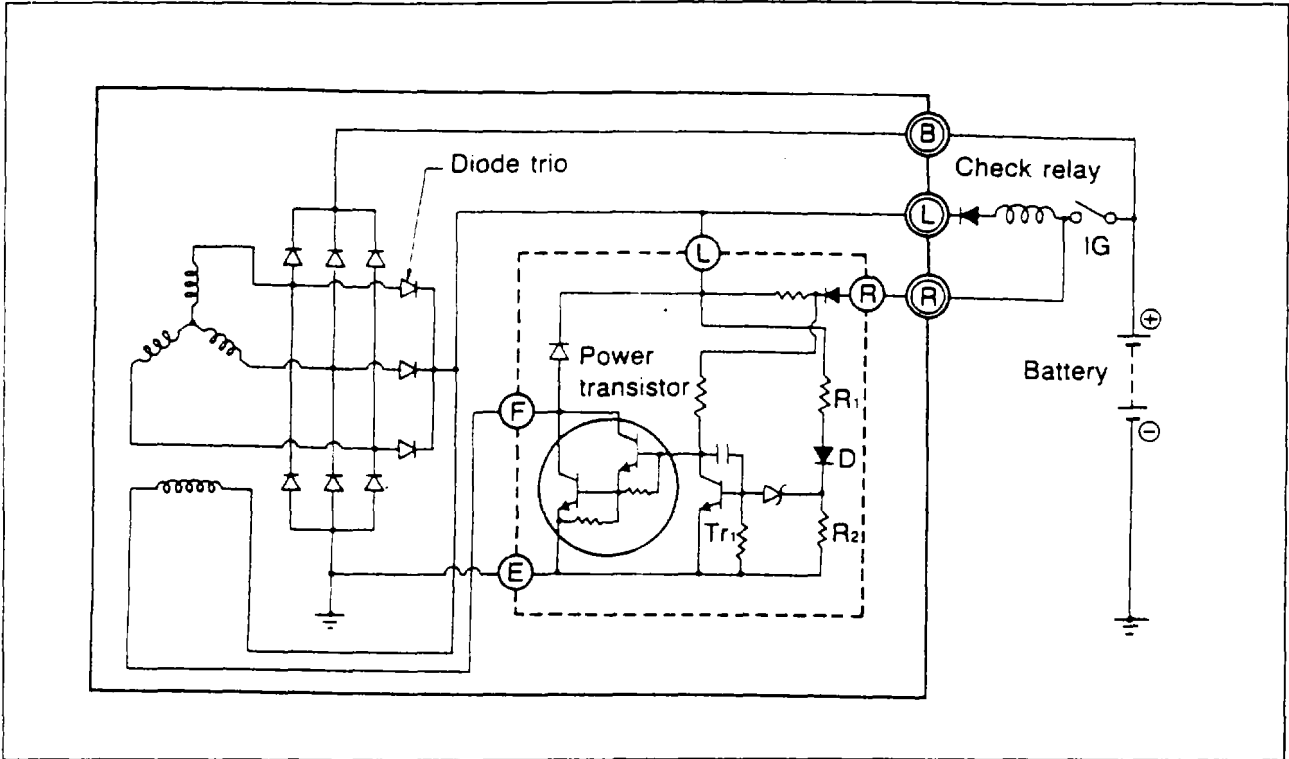


67U05X-008

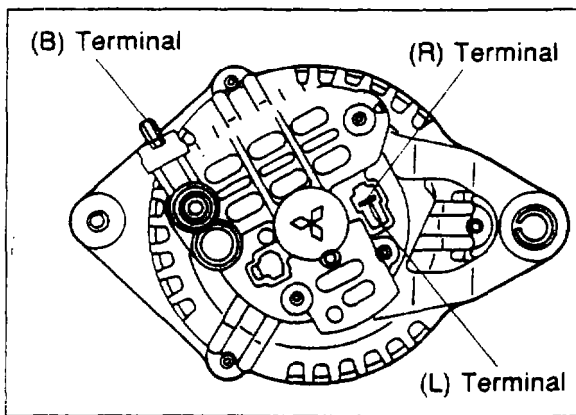
5 ALTERNATOR

ALTERNATOR

CHARGING SYSTEM



67U05X-009



77U05X-031

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 present at the alternator (B) terminal.
- Do not ground the (L) terminal while the engine is running.
- Do not start the engine while the coupler is disconnected from the (L) and (R) terminals.

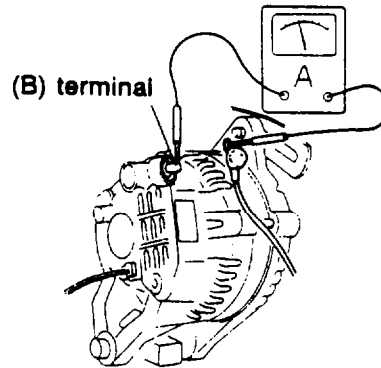
ON-VEHICLE INSPECTION Battery Discharges.

TEST 1: Output current inspection (Load condition)

1. Disconnect the battery \ominus terminal.
2. Disconnect the wire connected to the alternator (B) terminal, and connect an ammeter (**60A or more**) between the wire and the terminal.
3. Reconnect the battery \ominus terminal.
4. Turn all headlights and accessories on, and depress the brake pedal.
5. Start the engine and read indication at **2,500—3,000 rpm** engine speed.

Caution

Do not ground the (B) terminal.



87U05X 003

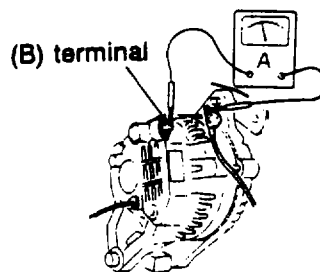
Max 55A or less

55A or more

Alternator normal

TEST 2: Output current inspection (No-load condition)

1. Turn all electric loads off and release the brake pedal.
2. Charge the battery until the charging rate indication becomes **less than 5A**, or replace the battery with a fully charged one. Then read the ammeter indication at approx **2,500 engine rpm**.



87U05X-004

Less than 5A

More than 5A

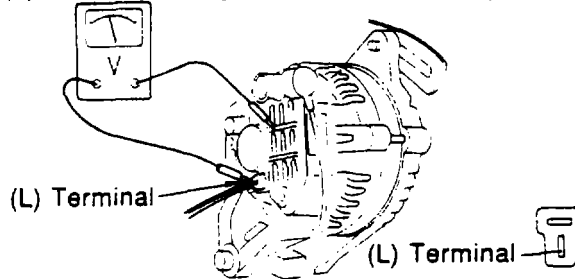
Go to TEST 4

Go to TEST 3

5 ALTERNATOR

TEST 3: Regulated voltage inspection

1. Stop the engine and disconnect the battery \ominus terminal.
2. Reconnect the alternator (B) terminal.
3. Reconnect the battery \ominus terminal and then restart the engine.
4. Measure the (L) terminal voltage at **about 2,500 rpm** using a voltmeter.



87U05X-005

14.4V—15.0 V
(At 20°C, 68°F)

Less than 14.4 V or more than 15.0 V
(At 20°C, 68°F)

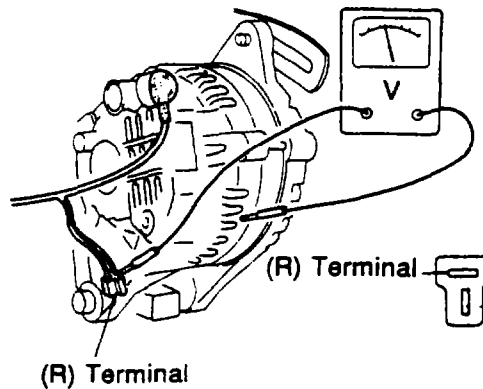
- Poor connection between (B) terminal and battery positive cable (Go to TEST 4)
- Poor connection of battery negative cable (Go to TEST 4)

Poor connection between 2-prong (R,L) connector and the battery positive cable (Go to TEST 3)

Problem in the stator coil or diodes
(Refer to page 5—15, 16 or 17)

TEST 4: IC regulator power source inspection

1. Turn the ignition switch OFF.
2. Disconnect the (R) connector from the alternator terminal.
3. Turn the ignition switch on and measure the (R) terminal voltage at the connector.



87U05X-006

Battery voltage

Go to TEST 5

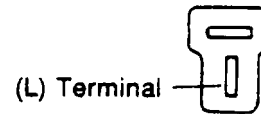
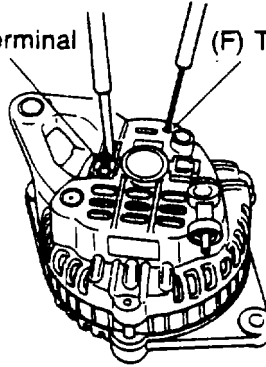
Less than battery voltage

Problem in wiring harness

TEST 5: Rotor coil inspection

1. Turn the ignition switch off.
2. Disconnect the battery \ominus terminal.
3. Disconnect the (B) terminal from the alternator.
4. Measure the resistance between the alternator (L) and (F) terminals at the alternator, using an ohmmeter.

(L) Terminal (F) Terminal



87U05X-007

2.0—4.0 Ω

Other than 2.0—4.0 Ω

Rotate pulley and inspect resistance between alternator (L) and (F) terminals again

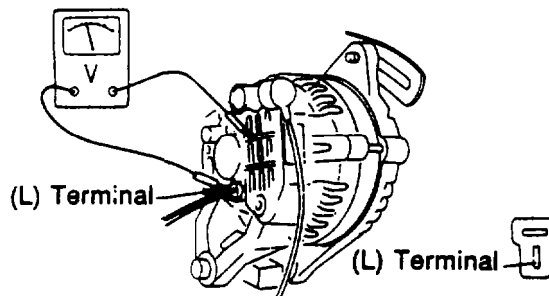
2.0—4.0 Ω

Other than 2.0—4.0 Ω

Problem in rotor coil or brush.
(Refer to page 5—15)

TEST 6: Alternator (L) terminal voltage inspection

1. Connect the (B) connector to the alternator.
2. Reconnect the battery \ominus terminal.
3. Turn the ignition switch on.
4. Measure the alternator (L) terminal voltage using a voltmeter.



87U05X-008

1—3 V

Alternator normal

Over 3 V

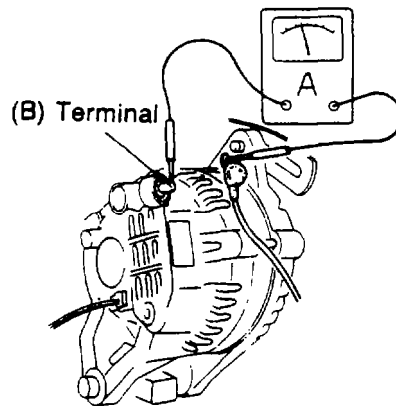
Problem in IC regulator or rotor coil
(Refer to page 5—16, 17)

5 ALTERNATOR

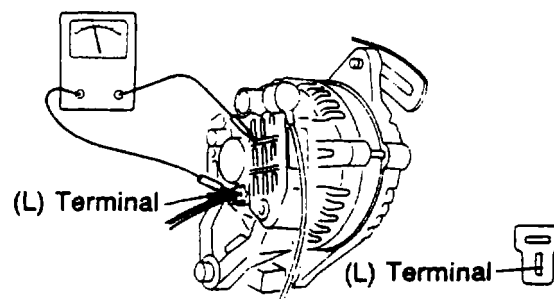
Battery Overcharge Problem

TEST 1: Output voltage inspection

1. Turn all electric loads off.
2. Disconnect the battery \ominus terminal.
3. Disconnect the wire connected to the alternator (B) terminal, and connect an ammeter (**60A or more**) between the wire and the terminal.
4. Reconnect the battery \ominus terminal.
5. Charge the battery until the charging rate becomes **less than 5A**, or replace the battery with a fully charged one. Run the engine at approx **2,500 rpm**, and then read the meter, if it indicates less than 5A, go to TEST 5 and TEST 6.



6. If (B) terminal is less than 5A, measure the (L) terminal voltage at **about 2,500 rpm**.



87U05X-009

More than 15.0 V
(At 20°C, 68°F)

Problem in alternator

14.4—15.0 V
(At 20°C, 68°F)

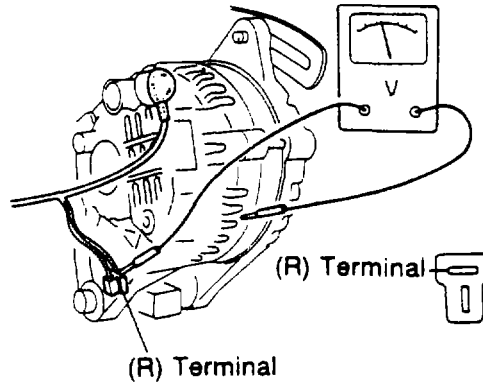
Alternator OK

If the battery discharges, perform TEST 2 and TEST 3.

77U05X-035

TEST 2: IC regulator power source inspection

1. Turn the ignition switch OFF.
2. Disconnect the (R) connector from the alternator.
3. Turn the ignition switch on and measure the (R) terminal voltage at the connector.
4. Reconnect the (R) connector.



63U05X-011

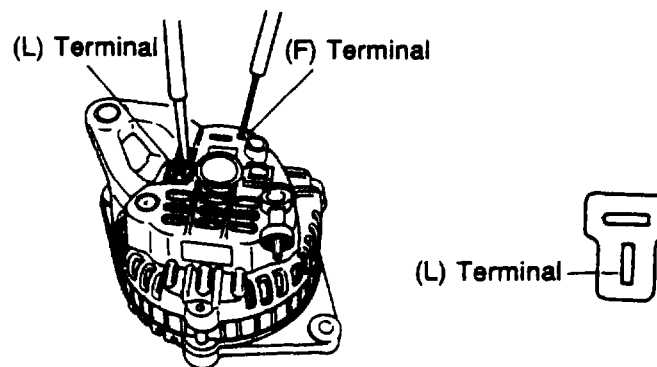
Battery voltage

Less than battery voltage

Problem in wiring harness

TEST 3: Rotor coil inspection

1. Turn the ignition switch off.
2. Disconnect the battery \ominus terminal.
3. Disconnect the (B) terminal from the alternator.
4. Measure the resistance between the alternator's (L) and (F) terminals.



87U05X-010

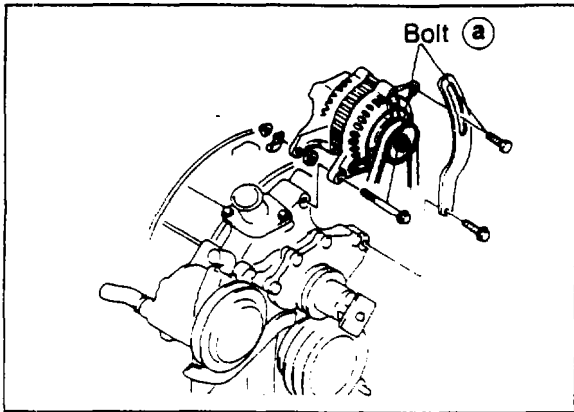
2.0—4.0 Ω

Other than 2.0—4.0 Ω

Problem in IC regulator
(Refer to page 5—16, 17)

Problem in rotor coil or brush
(Refer to page 5—15)

5 ALTERNATOR

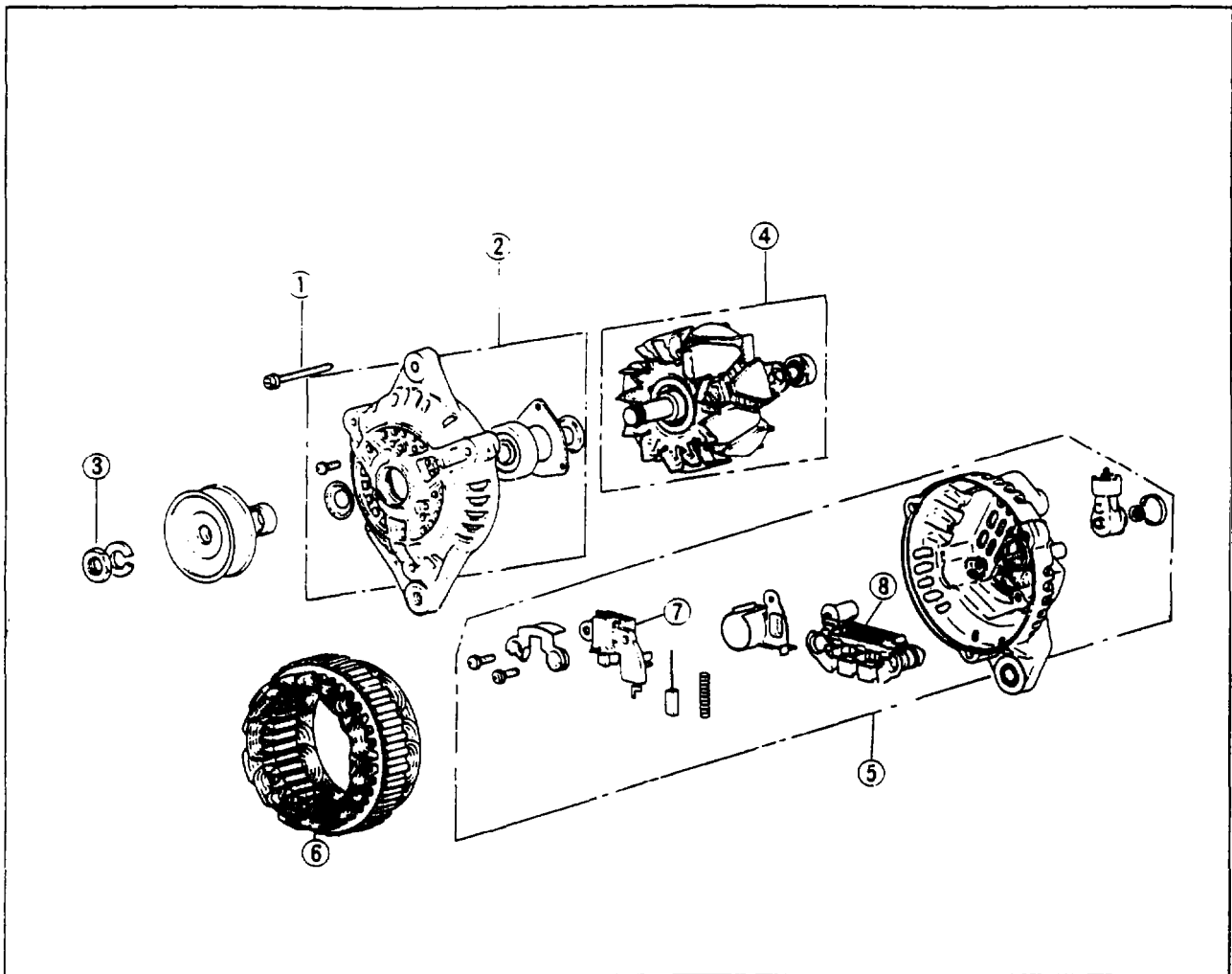


67U05X-011

REMOVAL

1. Disconnect the negative battery terminal.
2. Disconnect the wire and connector from the alternator.
3. Remove bolts (a).
4. Remove the following parts.
 - (1) V-belt.
 - (2) Alternator.

DISASSEMBLY

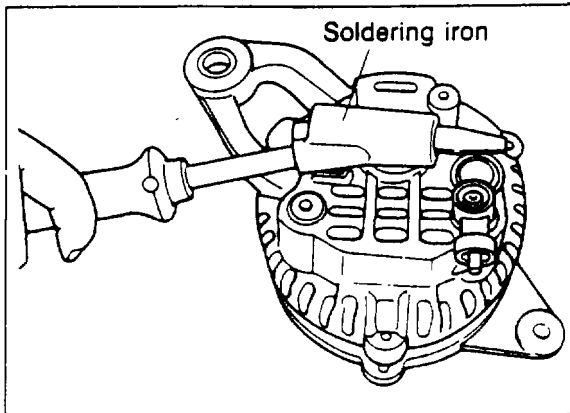


87U05X-011

1. Bolt
2. Front bracket assembly
3. Lock nut and washer

4. Rotor and fan
5. Rear bracket assembly
6. Stator

7. Brush holder assembly
8. Rectifier and IC regulator

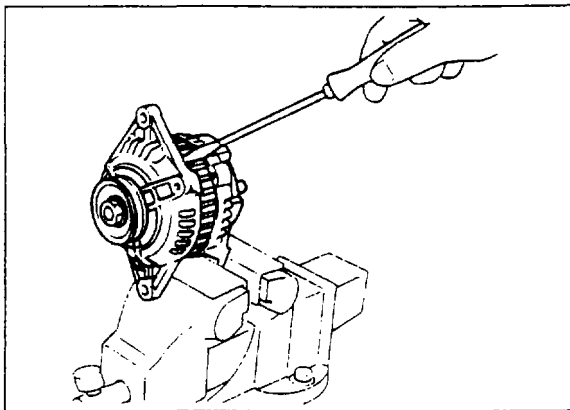


87U05X-012

Place a soldering iron (200W class) on the bearing box for **3 or 4 minutes** to heat to about **50 — 60°C (122 — 140°F)**.

Note

If the bearing box is not heated, the bearing cannot be pulled out, because the rear bearing and rear bracket fit together very tightly.



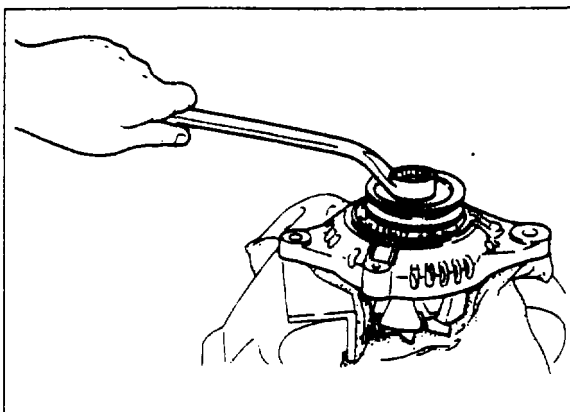
67U05X-014

Front Bracket and Rotor

1. Remove the three bolts, and insert a flat-tip screwdriver between the stator core and front bracket and separate them.

Note

Be careful not to force the screwdriver in too far, because the stator may be scratched.

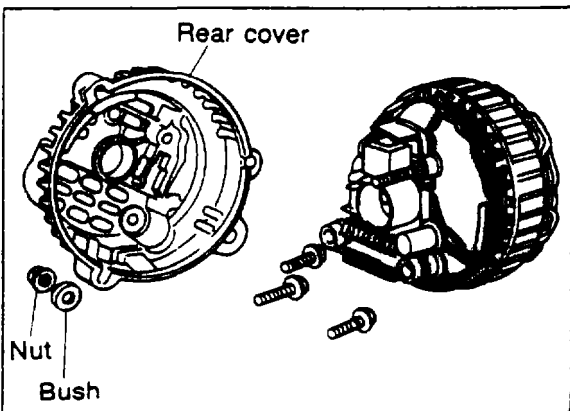


87U05X-013

2. Remove the lock nut, and remove the pulley, rotor and front bracket.

Tightening torque:

58.8—73.5 N·m
(6—7.5 m·kg, 44—54 ft·lb)

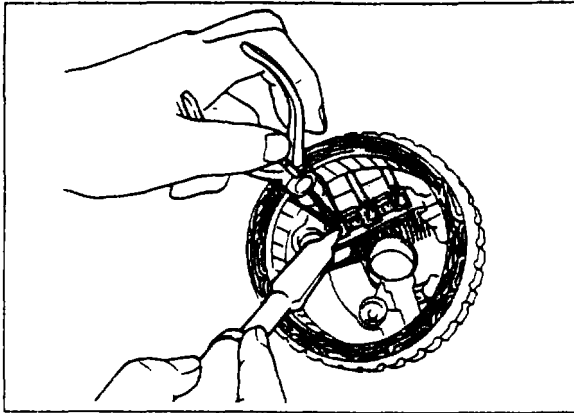


67U05X-016

Rear Bracket and Stator

1. Remove the following parts.
 - (1) The nut of the B terminal.
 - (2) Insulation bushing.
 - (3) Rectifier holding screws.
 - (4) Brush holder holding screw.

5 ALTERNATOR

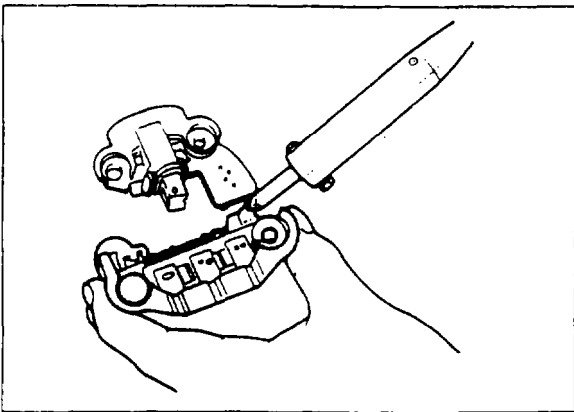


67U05X-017

2. Use a soldering iron to remove the solder from the rectifier and the stator lead.

Caution

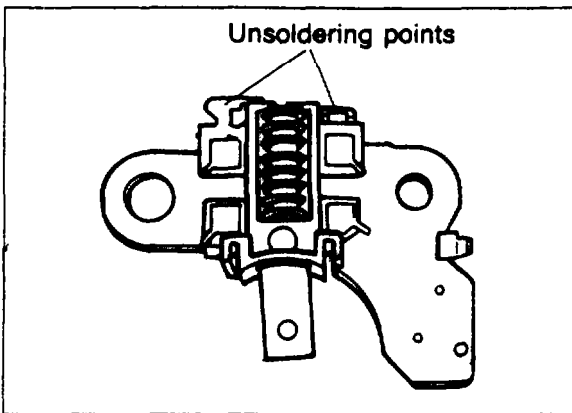
Disconnect quickly, use the soldering iron no more than about 5 seconds, because the rectifier may be damaged if it is overheated.



67U05X-018

IC Regulator and Rectifier

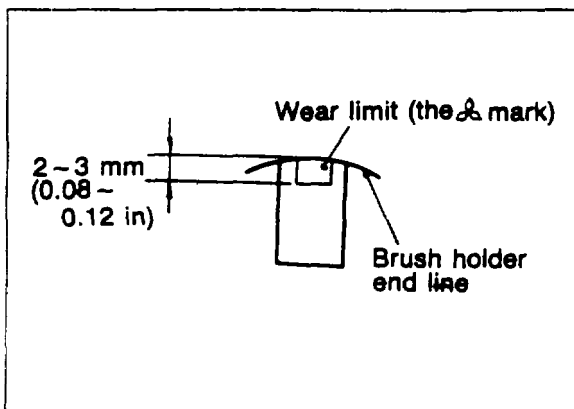
Use a soldering iron to remove the IC regulator from the rectifier.



67U05X-019

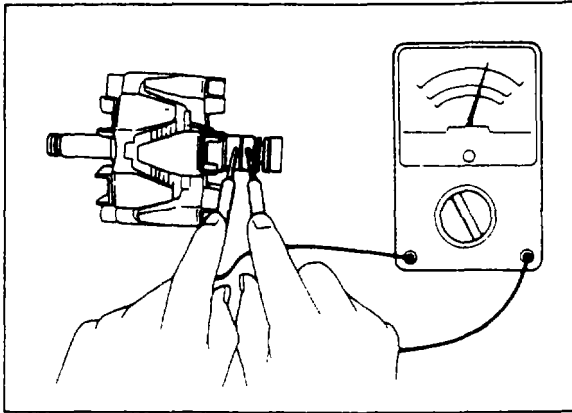
Brush

1. Remove the solder from the pigtail, then remove the brush.

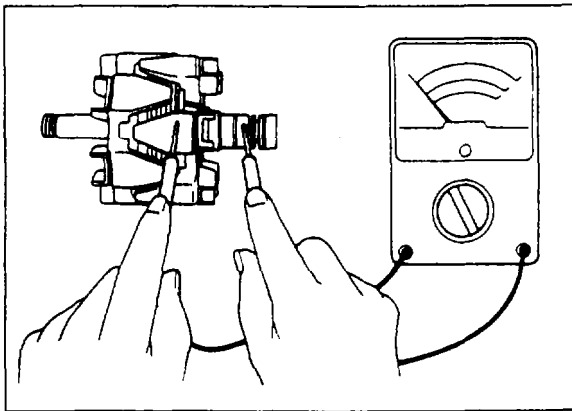


67U05X-020

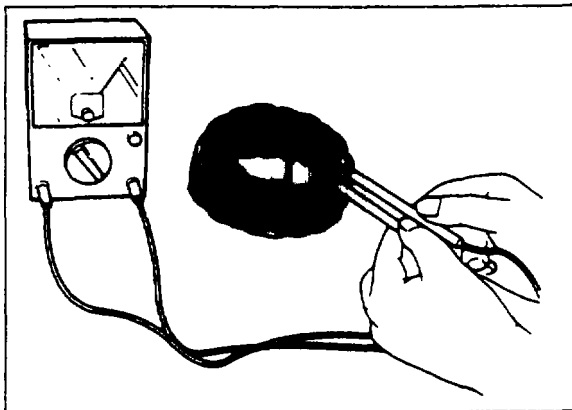
2. When soldering the brush, solder the pigtail so that the wear limit line of the brush projects **2 or 3 mm (0.08—0.12 in)** out from the end of the brush holder.



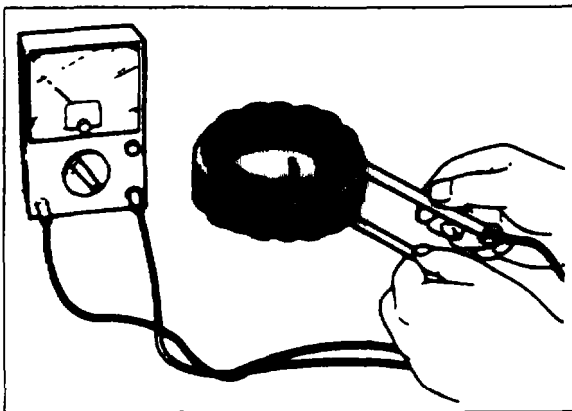
87U05X-014



67U05X-022



67U05X-023



67U05X-024

INSPECTION

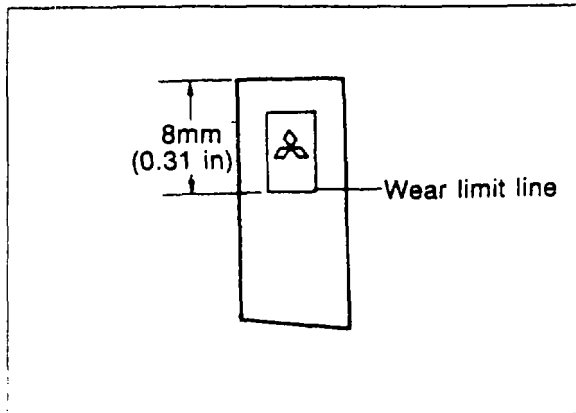
Rotor

1. Wiring damage
Check the resistance between the slip rings by using a circuit tester. It should be **2.0—4.0 Ω** . Replace the rotor if it is not within this range.
2. Ground of rotor coil
Check for continuity between the slip ring and the core by using a circuit tester. Replace the rotor if there is continuity.
3. Slip ring surface
If the slip ring surface is rough, use a lathe or fine sandpaper to repair it.

Stator

1. Wiring damage
Check for continuity between the stator coil leads by using a circuit tester. Replace the stator if there is no continuity.
2. Ground of stator
Check for continuity between the stator leads and the core by using a circuit tester. Replace the stator if there is continuity.

5 ALTERNATOR

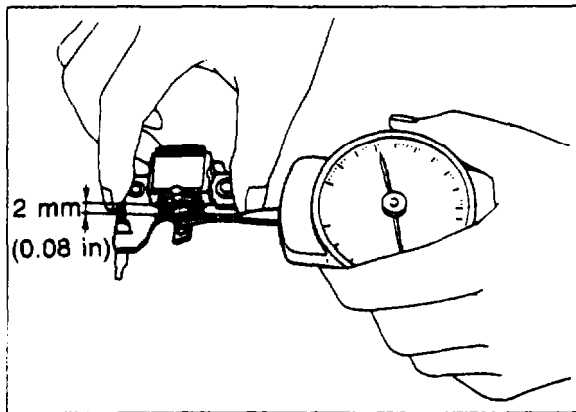


87U05X-015

Brush

Replace the brush if it is worn almost to or beyond the limit.

Length: 8 mm (0.31 in) min.



87U05X-016

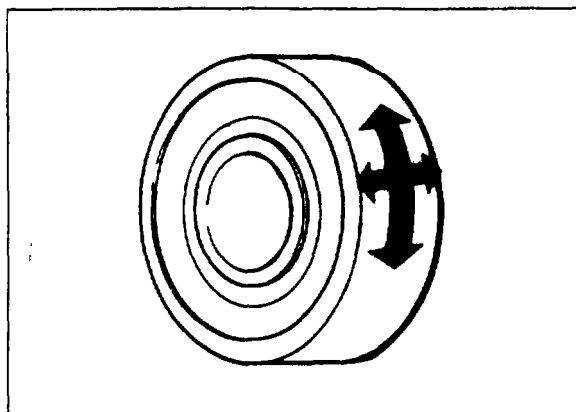
Brush spring

Measure the force of the brush spring by using a spring pressure gauge. Replace the spring if the force is less than **2.0 N (210g, 0.46 lb)**.

Note

a) For a new brush the force is **2.9 — 4.3 N (300 — 440g, 0.66 — 0.97 lb)**.

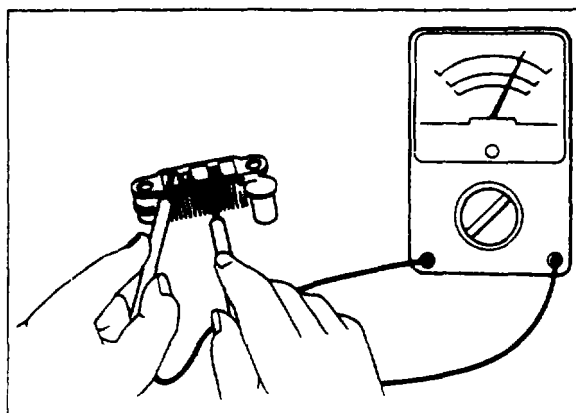
b) When making the measurement, use the spring pressure gauge to push the brush into the brush holder until the tip projects **2 mm (0.08 in)**, read the force at that time.



67U05X-027

Bearing

Check for abnormal noise, looseness, binding, etc. Replace the bearing if there is any abnormality.

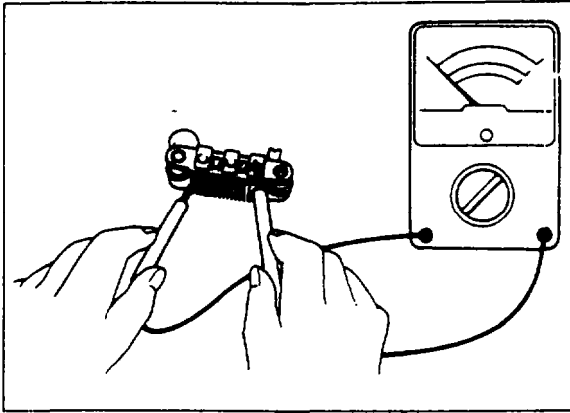


67U05X-028

Rectifier

1. Positive diode

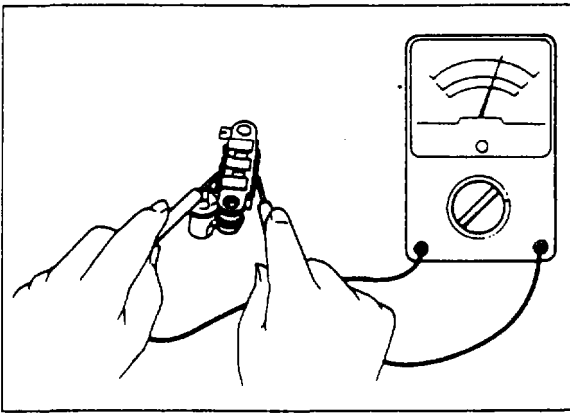
Check for continuity between the diode lead and the heat sink at the positive side by using a circuit tester. There should be continuity only in the direction from the diode lead to the heat sink.



67U05X-029

2. Negative diode

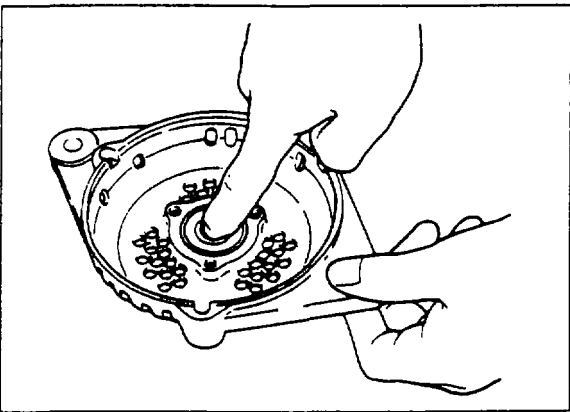
Check for continuity between the diode lead and the heat sink at the negative side using a circuit tester. There should be continuity only in the direction from the heat sink to the diode.



67U05X-030

3. Diode trio

Check for continuity using a circuit tester. There should be continuity in one direction only.



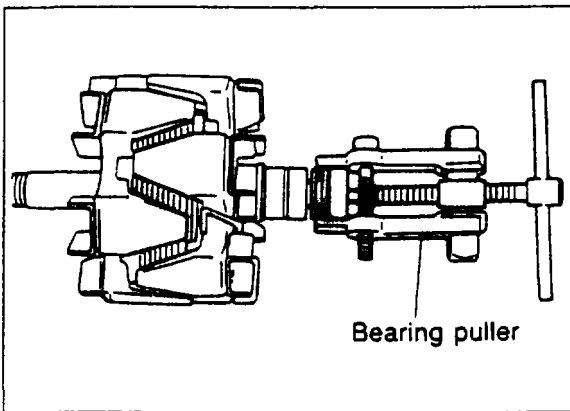
67U05X-031

Front bearing

Check for abnormal noise, looseness, binding, etc. Replace the bearing if there is any problem.

Note

Use a hand press or "S" vice to remove it.



67U05X-032

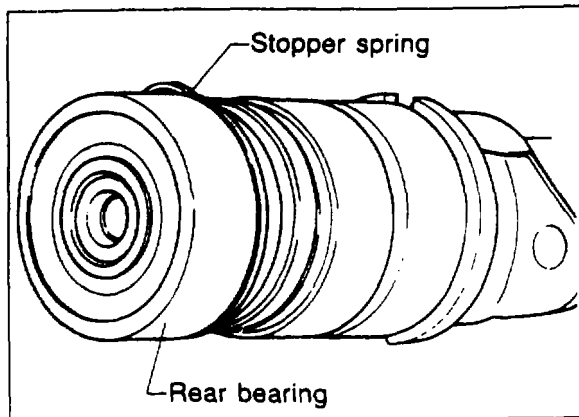
Rear bearing

Check for abnormal noise, looseness, binding, etc. Replace the bearing if there is any problem.

Note

Use a bearing puller to remove it.

5 ALTERNATOR



67U05X-033

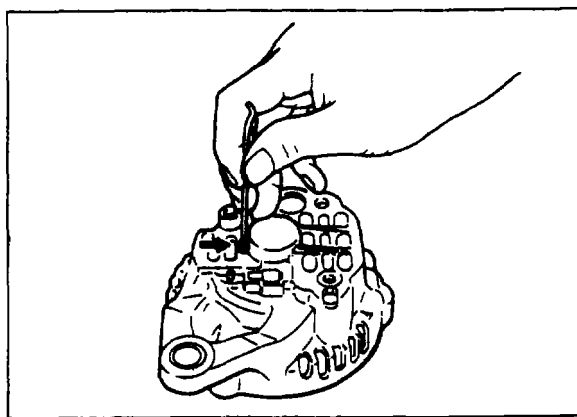
ASSEMBLY

Assembly is in the reverse order of disassembly. There are no lubrication points.

1. Fit the stopper spring into the eccentric groove of the rear bearing circumference. The protruding part of the spring should be fit into the deepest groove. Note that, for easy recognition, the edge of the deepest groove is chamfered.

Note

By fitting the stopper spring in this way, the amount of spring protruding from the groove is lessened, so that assembly becomes easier. In addition, no strain is exerted upon the spring and thus its stopping effect is greater.



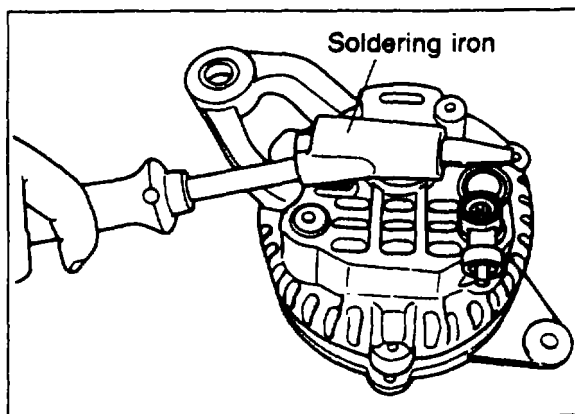
67U05X-034

2. Brush lifting

Before assembly, push the brush into the brush holder and pass a wire ($\phi 2$ mm, 40—50 mm ($\phi 0.08$ in, 1.6—2.0 in)) through the hole shown in the figure to secure the brush in position.

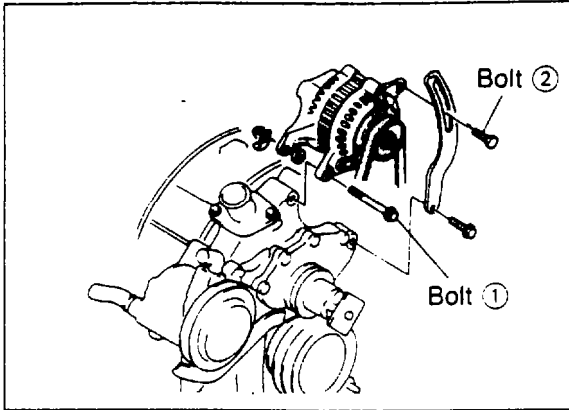
Note

Be sure to pull the wire out after the assembly is completed.

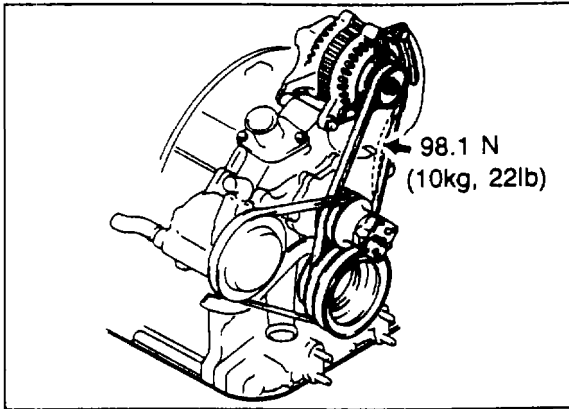


77U05X-036

3. When the rear bearing is pressed into the rear bracket, heat the bracket before pressing it in.
4. After assembly is completed, rotate the pulley manually and check that the rotor turns easily.



87U05X-017



67U05X-034

INSTALLATION

1. Install in the reverse order of removal.

Tightening torque

Bolts ① ; 37.3—52.0 N·m
(3.8—5.3 m·kg, 28—38 ft·lb)

Bolts ② ; 18.6—25.5 N·m
(1.9—2.6 m·kg, 14—18 ft·lb)

2. Adjust the tension of the V-belt.

Deflection

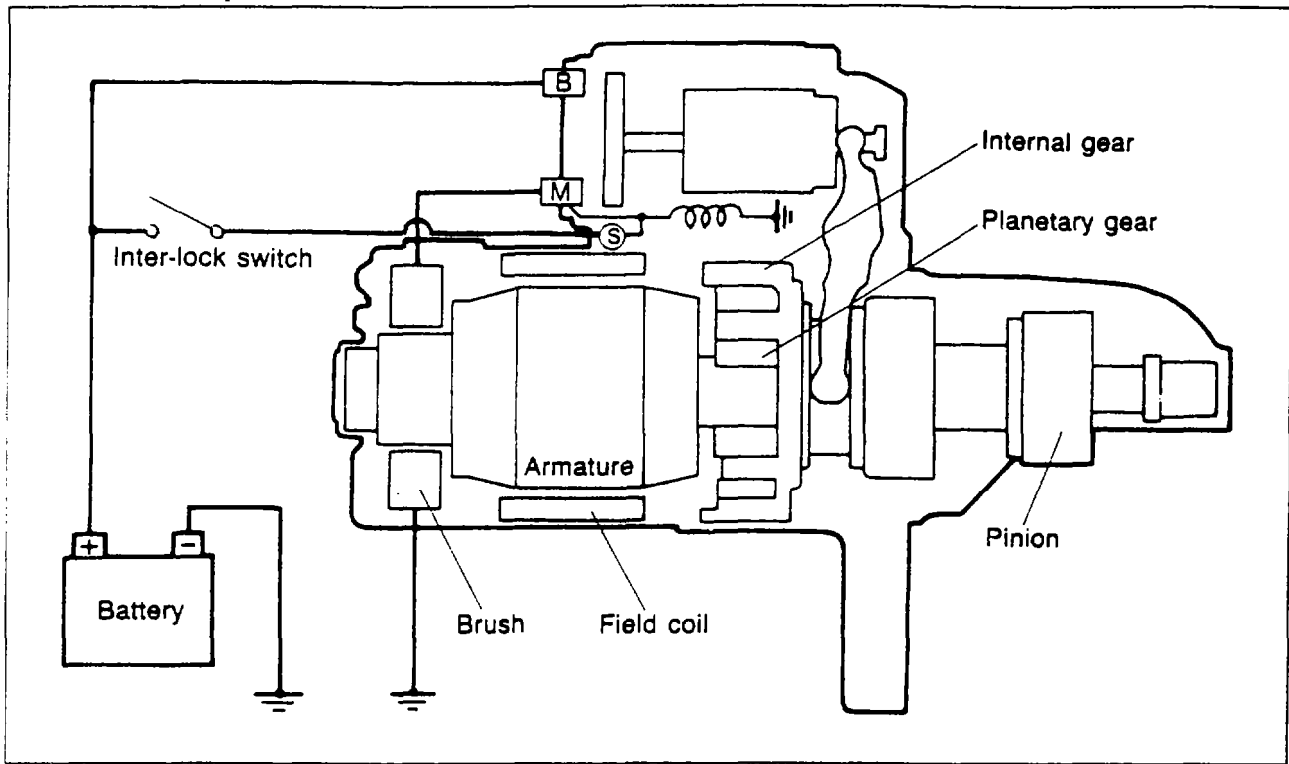
New belt: 12—15 mm (0.472—0.591 in)

Used belt: 14—17 mm (0.551—0.669 in)

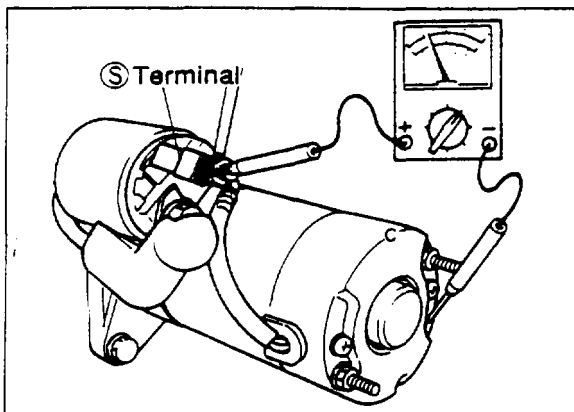
5 STARTER

STARTER

STARTING SYSTEM



67U05X-038



67U05X-039

ON-VEHICLE INSPECTION

Before this inspection, measure the specific gravity of the battery, and check that the battery is at or near full-charge.

A. If the magnetic switch doesn't function during starting

With the ignition switch at the start position, measure the voltage between the S terminal and ground. If the measured value is 8V or more, there is a starter malfunction; if it is less than 8V, there is a malfunction in the wiring.

Caution

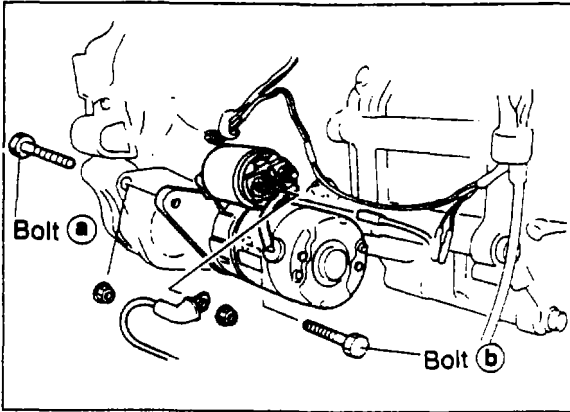
If the magnetic switch is excessively hot, it may not function even though the voltage is 8V or more.

B. If the starter won't crank, or if the cranking speed is slow

The problem may be a malfunction of the starter or in the wiring

Note

The cranking speed is greatly affected by the viscosity of the engine oil.



87U05X-018

REMOVAL

1. Disconnect the negative battery terminal
2. Disconnect the wiring from the starter.
3. Remove bolts (a) and (b).
4. Remove the starter.

INSTALLATION

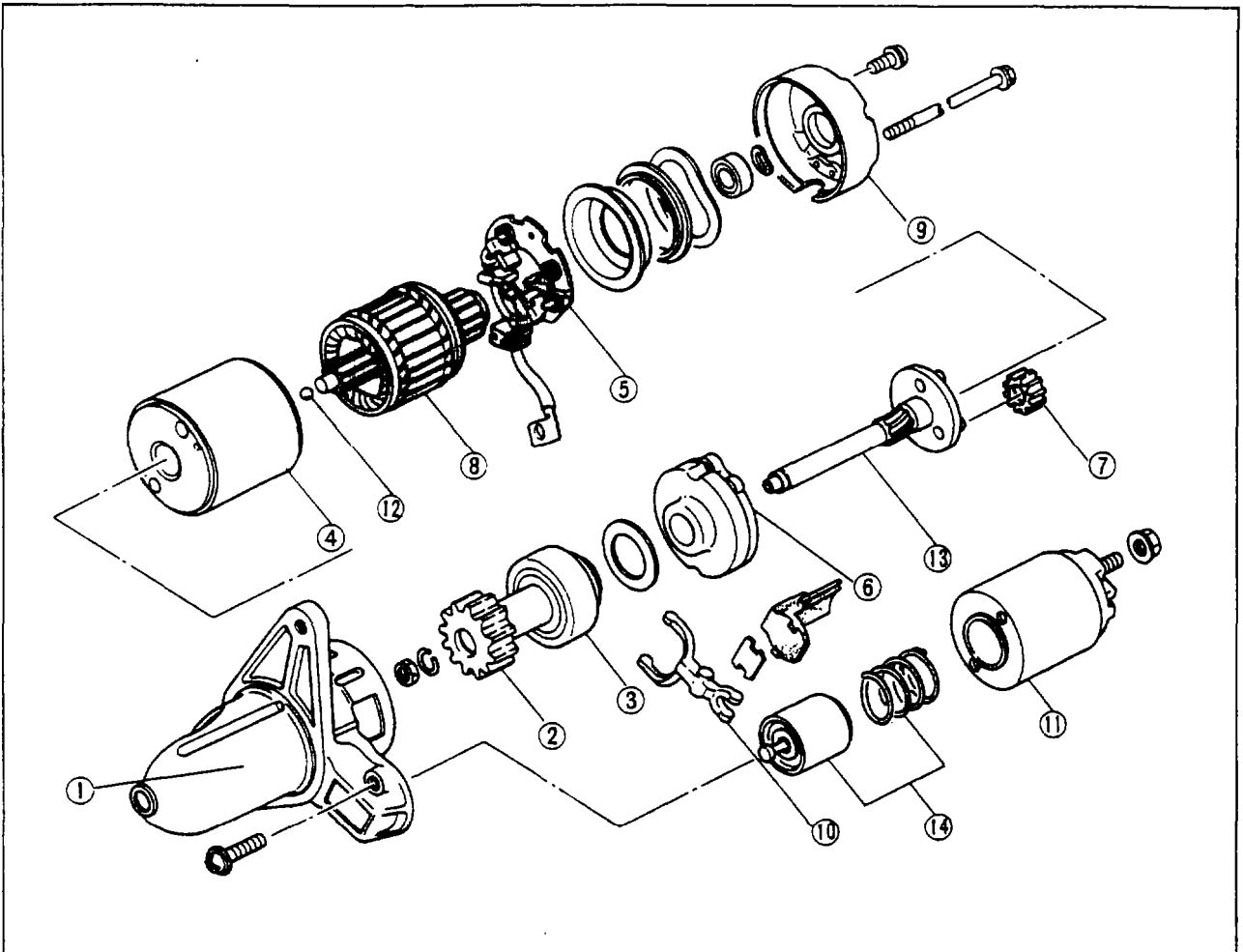
Install in the reverse order of removal.

Tightening torque

Bolts (a) and (b); 31.4—46.1 N·m
(3.2—4.7 m·kg, 24—33 ft·lb)

B terminal; 9.8—11.7 N·m
(1.0—1.2 m·kg, 8 ft·lb)

DISASSEMBLY



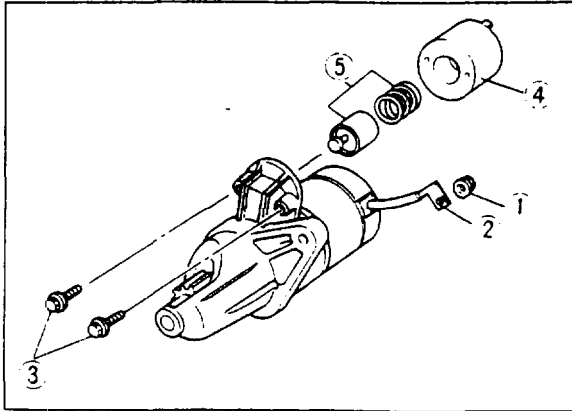
67U05X-038

- | | | |
|------------------------------|-------------------|------------------------|
| 1. Drive housing front cover | 6. Internal gear | 11. Magnetic switch |
| 2. Drive pinion | 7. Planetary gear | 12. Ball |
| 3. Overrunning clutch | 8. Armature | 13. Gear shaft |
| 4. Yoke assembly | 9. Rear housing | 14. Plunger and spring |
| 5. Brush holder assembly | 10. Lever | |

Caution

Do not strike the yoke with a hammer, drop it or put it in a vice when disassembling the starter.

5 STARTER

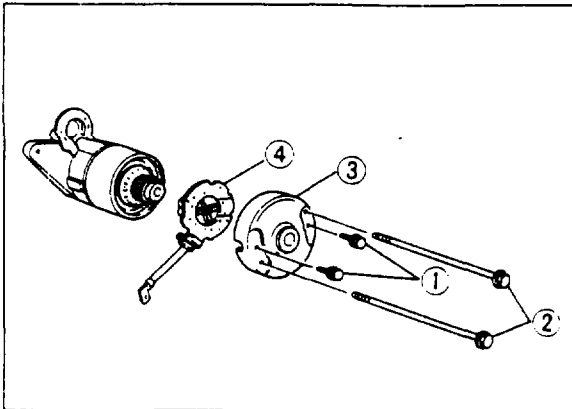


67U05X-039

Magnetic Switch

Remove the following parts.

- (1) The nut for the switch (M) terminal.
- (2) Wire.
- (3) Switch installation screws.
- (4) Magnetic switch.
- (5) Plunger and plunger spring.



77U05X-037

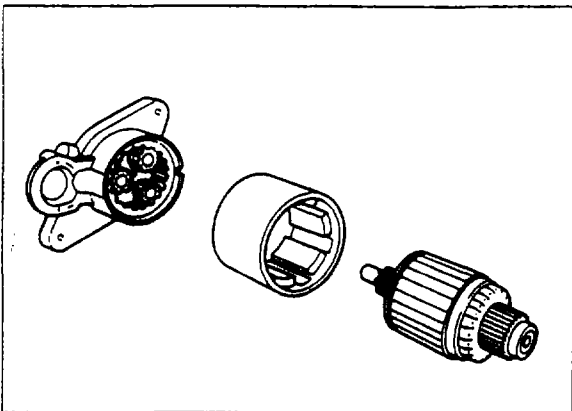
Rear Bracket and Brush Holder

Remove the following parts.

- (1) Brush holder installation screws.
- (2) Through bolts.
- (3) Rear bracket.
- (4) Brush holder.

Note

Put an aligning mark on the yoke and rear bracket before removing the rear bracket.



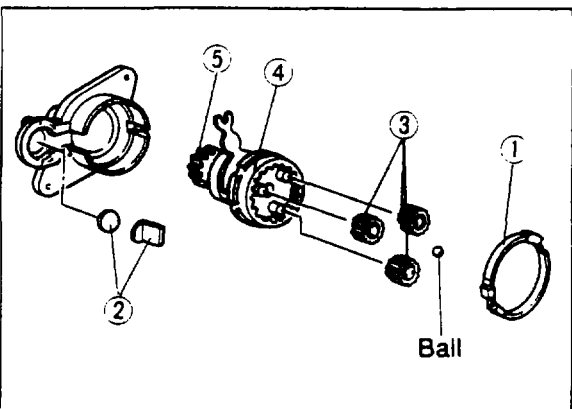
67U05X-041

Yoke and Armature

Remove the armature and yoke.

Note

Put an aligning mark on the yoke and front bracket before removing the front bracket.



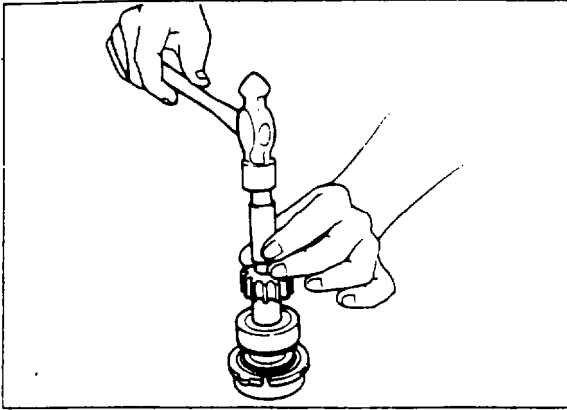
67U05X-042

Overrunning Clutch, Planetary Gears and Internal Gear. Remove the following parts:

- (1) Gasket.
- (2) Plate.
- (3) Planetary gears.
- (4) Internal gear.
- (5) Overrunning clutch.

Note

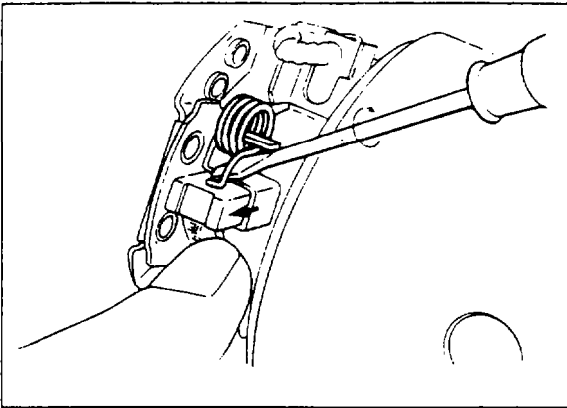
Do not lose the ball.



67U05X 046

Stopper of the Overrunning Clutch

Remove the stopper of the overrunning clutch using a pipe, and then remove the ring and overrunning clutch.

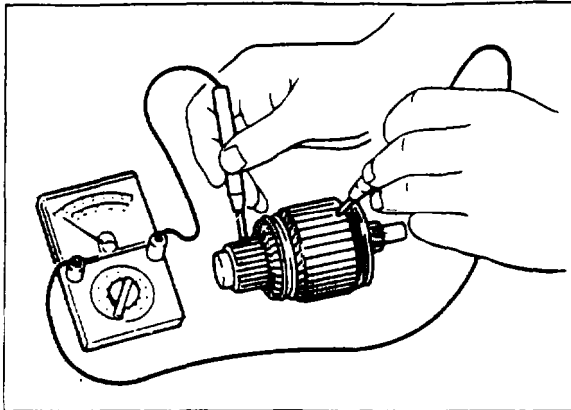


67U05X-047

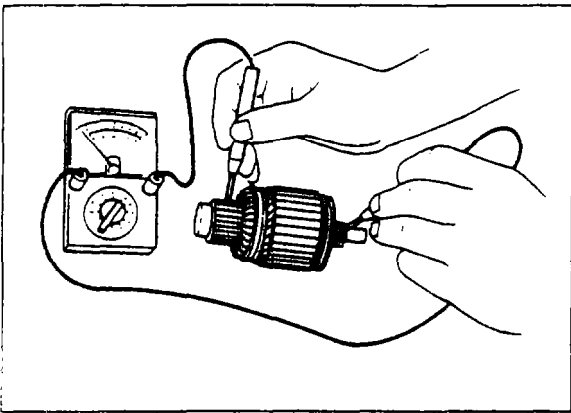
Brush and Brush Holder

Remove the brush from the brush holder using a flat-tip screwdriver.

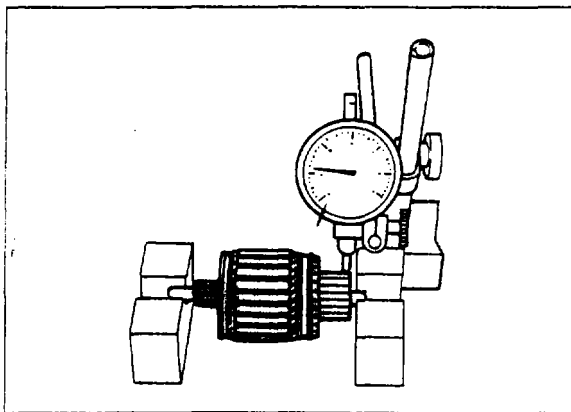
5 STARTER



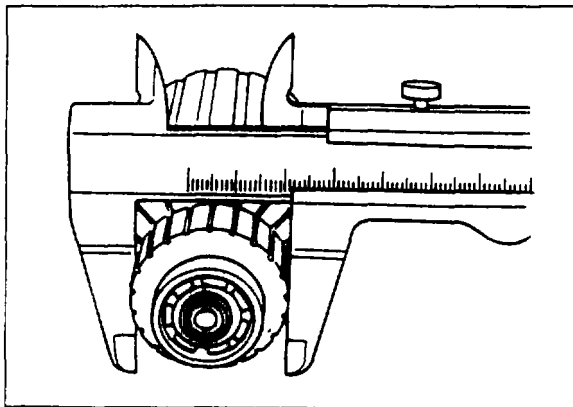
67U05X-048



67U05X-049



87U05X-019



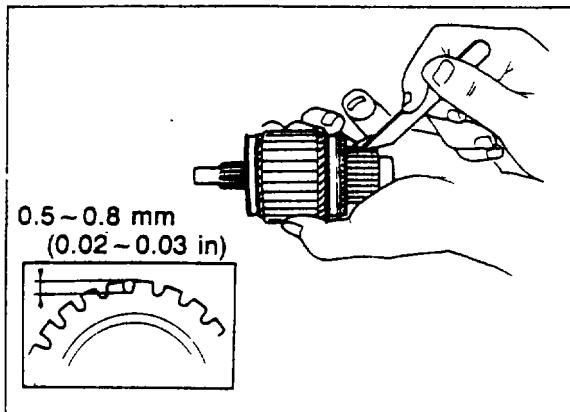
67U05X-051

INSPECTION

Armature

1. Ground of armature coil
Check for continuity between the commutator and the core using a circuit tester. Replace the armature if there is continuity.
2. Insulation of armature coil
Check for continuity between the commutator and the shaft using a circuit tester. Replace the armature if there is continuity.
3. Runout of commutator
Place the armature on V blocks, and measure the runout using a dial gauge. If the runout is **more than 0.1 mm (0.004 in)**, repair it using a lathe, or replace the armature.

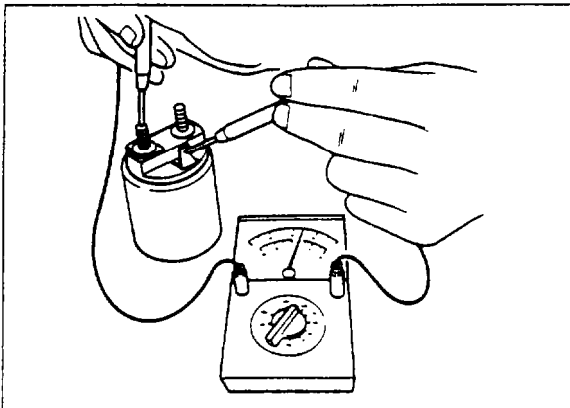
Note
Replace only when the outer diameter of the commutator is less than 28.4 mm (1.12 in) or runout of the commutator cannot be repaired to 0.05 mm (0.002 in).
4. Outer diameter of commutator
Replace the armature if the outer diameter of the commutator is less than **28.4 mm (1.12 in)**.
5. Roughness of commutator surface
Repair using a lathe or fine sandpaper if it is rough; wipe it with a rag if it is dirty.



67U05X-052

6. Segments

Undercut by **0.5—0.8 mm (0.020—0.03 in)** if the depth of the mold between segments is **less than 0.2 mm (0.008 in)**.

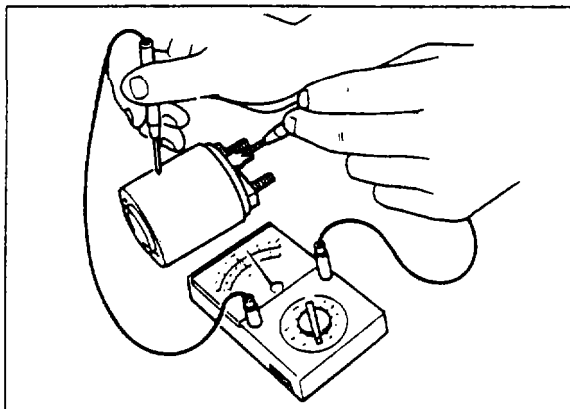


67U05X-053

Magnetic Switch

1. Wiring damage (S terminal — M terminal).

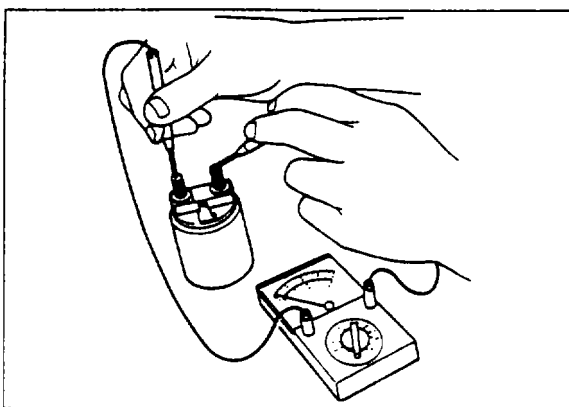
Check for continuity between the S terminal and the M terminal using a circuit tester. Replace the magnetic switch if there is no continuity.



67U05X-054

2. Wiring damage (S terminal — body)

Check for continuity between S terminal and body using a circuit tester. Replace the magnetic switch if there is no continuity.

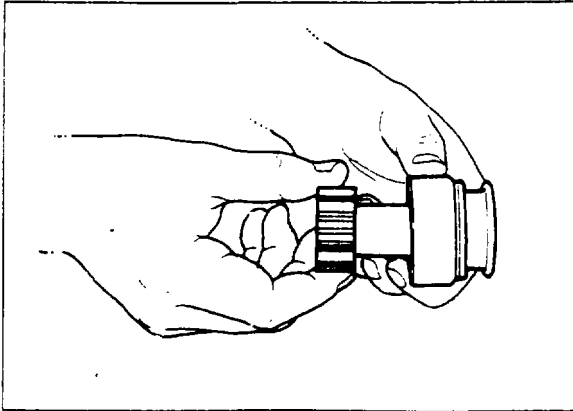


67U05X-055

3. Ground of magnetic switch

Check for continuity between M and B terminals using a circuit tester. Replace the magnetic switch if there is continuity.

5 STARTER



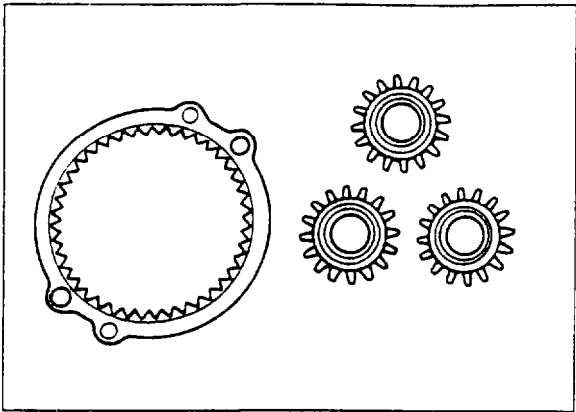
77U05X-038

Overrunning Clutch

Turn the pinion shaft by hand while holding the overrunning clutch.
Replace the overrunning clutch if the pinion turns in both directions or in neither direction.

Note

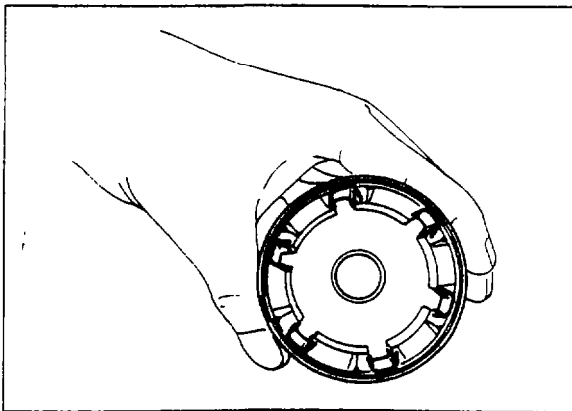
Do not wash the overrunning clutch with solvent, as the overrunning clutch is packed with grease.



67U05X-057

Internal Gear and Planetary Gears

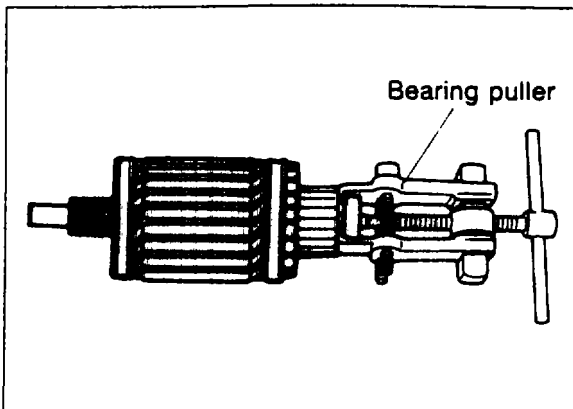
1. Internal gear
Check for wear or damage. Replace if necessary.
2. Planetary gears
Check for wear or damage. Replace if necessary.



67U05X-058

Yoke

Check for damage, replace if necessary.



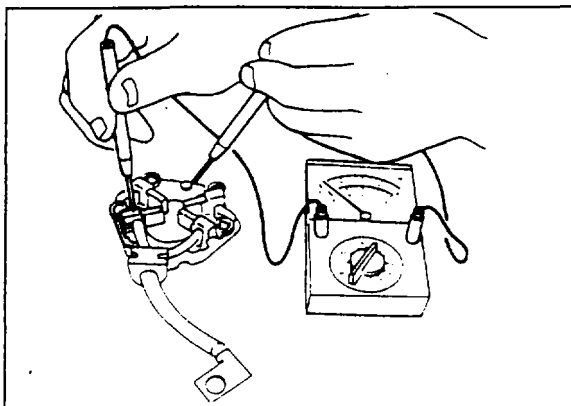
67U05X-059

Bearing

Check for abnormal noise, looseness, binding, etc.
Replace the bearing if there is any problem.

Note

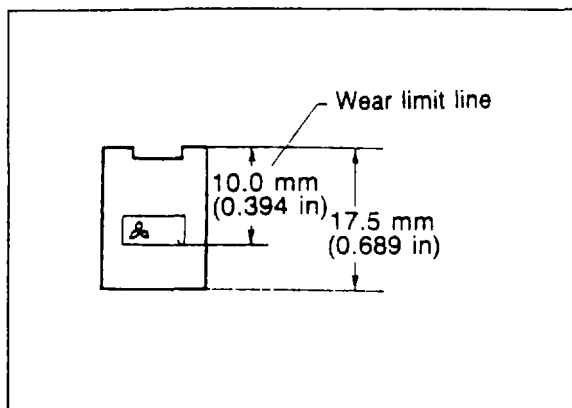
Use a bearing puller to remove the bearings.



67U05X-060

Brush and Brush Holder

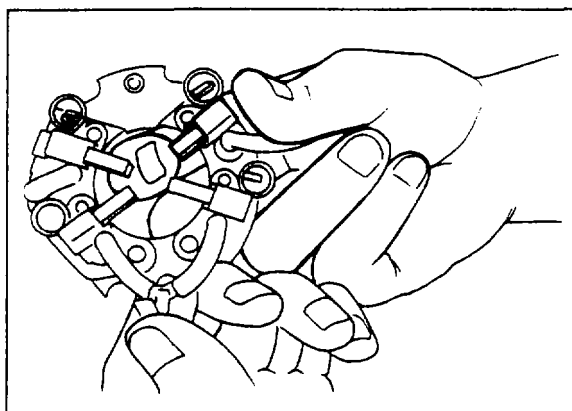
1. Insulation of brush holder
Check for continuity between the insulated brush and the plate using a circuit tester. Replace the brush holder if there is continuity.



67U05X-061

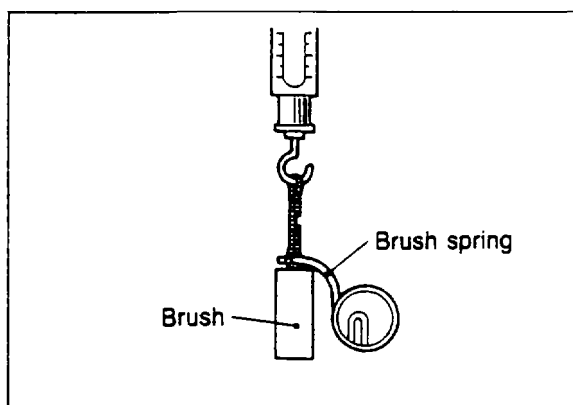
2. Brush
Replace the brushes if the brushes are worn beyond the wear limit, or if the wear is near the limit.

Wear limit; 10.0 mm (0.394 in)
New brush; 17.5 mm (0.689 in)



67U05X-062

3. Brush holder
Check that the brush slides smoothly inside the brush holder.



87U05X-020

4. Brush spring
Check the force of the brush spring using a spring balance. Replace the brush spring if the force is **less than 6.9 N (700g, 1.54 lb)**.

Note

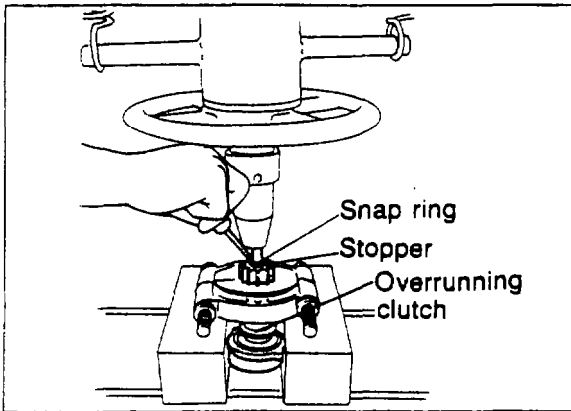
- a) The force is to be measured at the moment the brush spring separates from the brush.
- b) The force must be 14–23 N (1.4–2.4 kg, 3.1–5.2 lb) for a new brush spring.

5 STARTER

ASSEMBLY

Assemble in the reverse order of disassembly.
During assembly lubricate the following points.

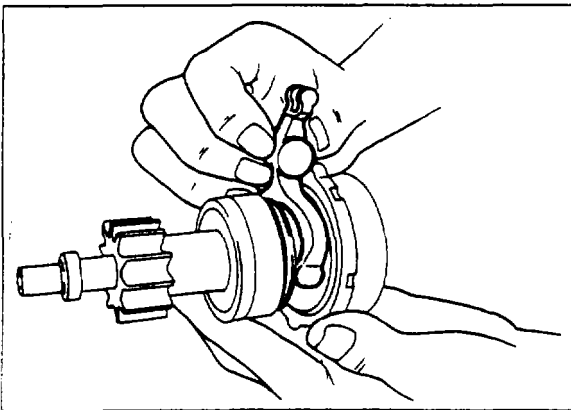
1. Gear of armature shaft.
2. Internal gear and planetary gears.
3. Plunger circumference.
4. Lever.
5. Ball.
6. Gear shaft spline.
7. Front bracket bushing.



67U05X-065

Installation of Overrunning Clutch

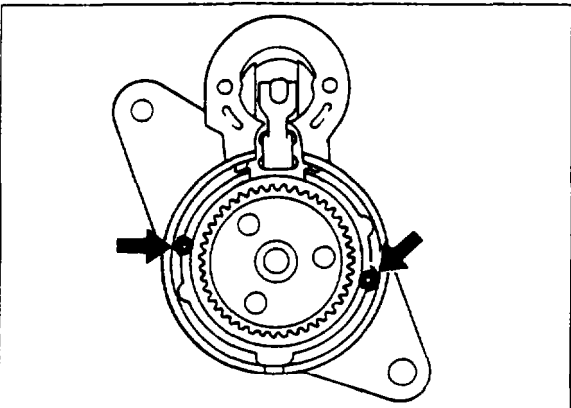
- 1 Install the overrunning clutch, stopper, and the snap ring on the armature shaft.
- 2 Set the stopper and the snap ring shown in the figure.



67U05X-066

Installation of lever

Be sure the lever faces in the correct direction.

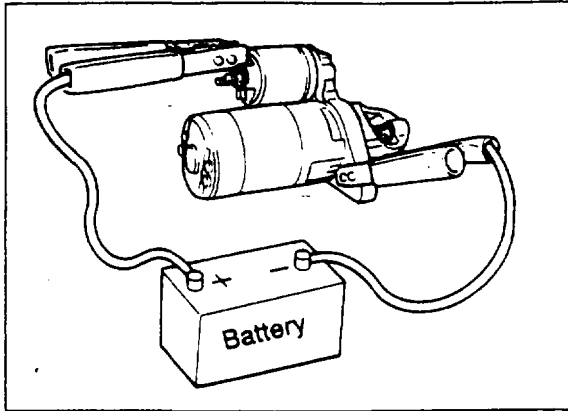


67U05X-067

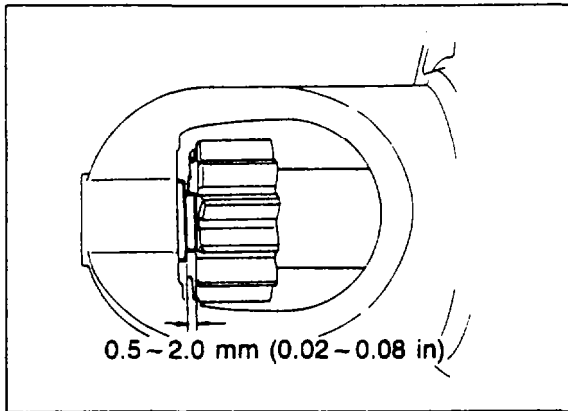
Installation of Brush Holder

Install the brush holder while carefully checking the position of the through bolt.

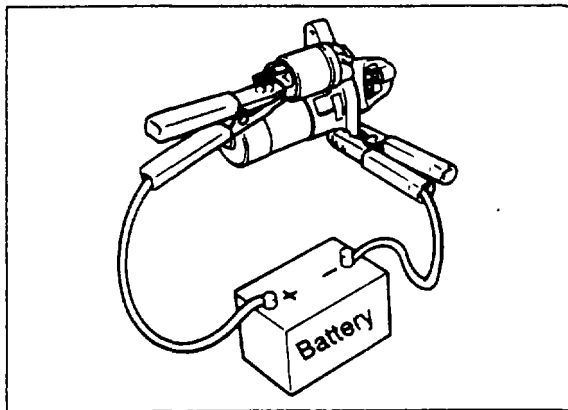
67U05X-064



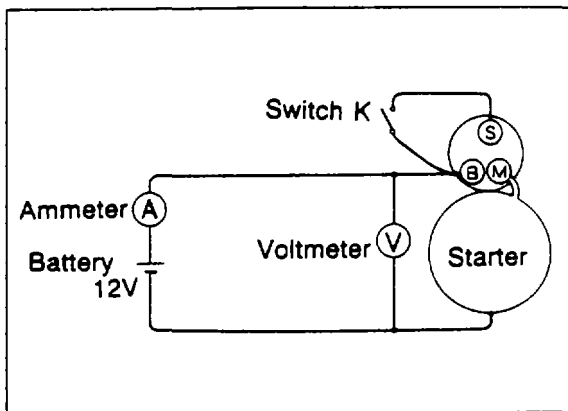
67U05X-068



67U05X-069



67U05X-070



77U05X-038

CHECKING OPERATION

Magnetic Switch

Make the following tests.

Pull-out test

1. Check that the pinion is pulled out when the battery power is applied between the (S) terminal and the body.

2. Measure the pinion gap while the pinion is pulled out.

Standard: 0.5—2.0 mm (0.02—0.08 in)

3. Adjust the pinion gap with an adjustment washer (drive housing front cover—magnetic switch) if it is not within standard value.

Return test

1. Disconnect the wire from the (M) terminal, and then connect the battery between the (M) terminal and the body, as shown in the figure.
2. Pull out the overrunning clutch with a flat-tip screwdriver, and then check that the overrunning clutch returns to its original position when released.

No-Load Test

1. Form a test circuit with a voltmeter and an ammeter.

Note

Use wires as thick as possible and tighten each terminal fully.

2. Close switch "K" to run the starter until its speed rises about 3,000 rpm (gear shaft rpm). Check the following values:

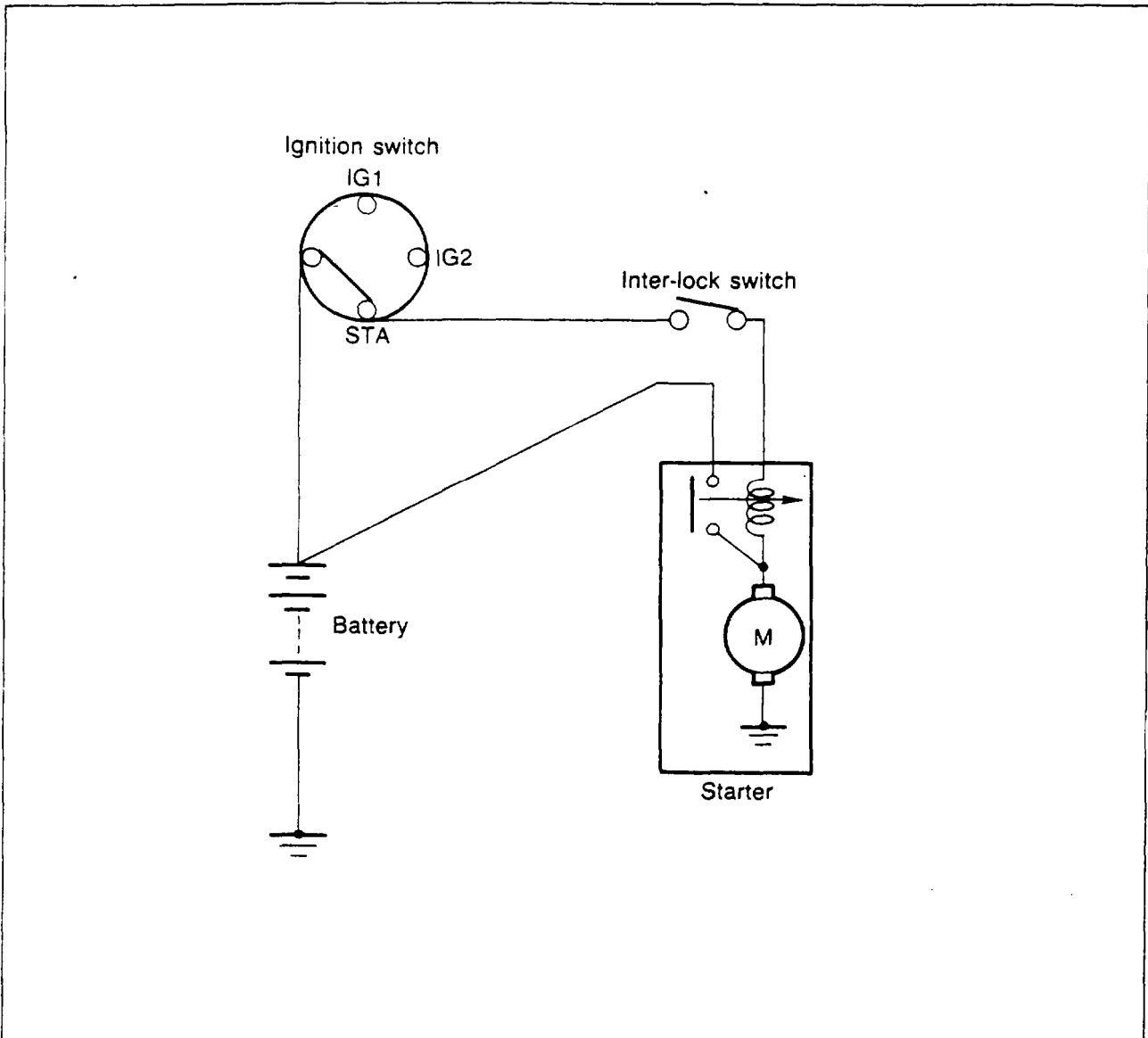
Battery voltage: 11.0V

Current: 90A and less

3. If any abnormality is noted, check it according to "INSPECTION".

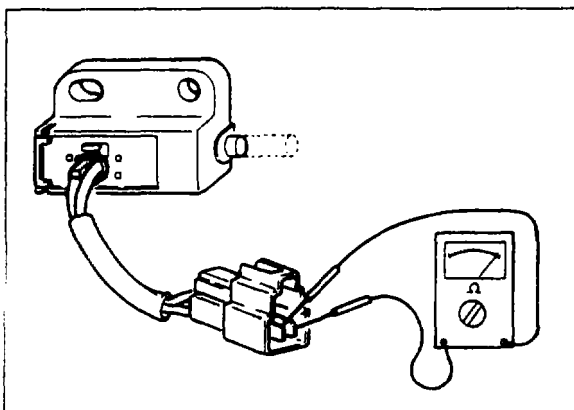
5 STARTER INTERLOCK SYSTEM (ONLY FOR M/T)

STARTER INTERLOCK SYSTEM (ONLY FOR M/T)



77U05X-039

This system is similar to that of the inhibitor switch on an A/T vehicle. If the clutch pedal is not depressed during starting, battery power will not be supplied to the starter and it will not operate.



77U05X-016

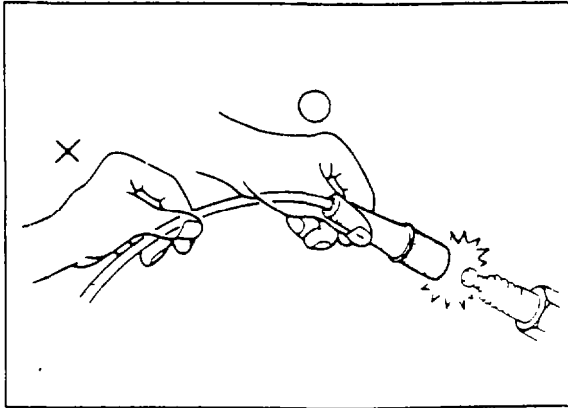
INTERLOCK SWITCH

Inspection

1. Disconnect the interlock switch connector.
2. Connect a circuit tester to the switch.
3. Check the continuity.

Pedal	Continuity
Depressed	Yes
Released	No

4. Replace the switch, if necessary.



87U05X-021

SPARK PLUGS

REMOVAL AND INSTALLATION

Note the following points:

1. When the high-tension lead is to be pulled off, be sure to pull the boot itself, and not the wire.
2. Tighten the spark plugs to the specified torque.

Spark plug tightening torque:

12.7—17.7 N·m

(1.3—1.8 m·kg, 10—13 ft·lb)

INSPECTION

Check the following points. Replace the spark plug if a problem is found.

1. Damaged insulation
2. Worn electrodes
3. Carbon deposits

If cleaning is necessary, use a wire brush. Clean the upper insulator also.

4. Damaged gasket

Plug gap: 2.0 mm (0.08 in)

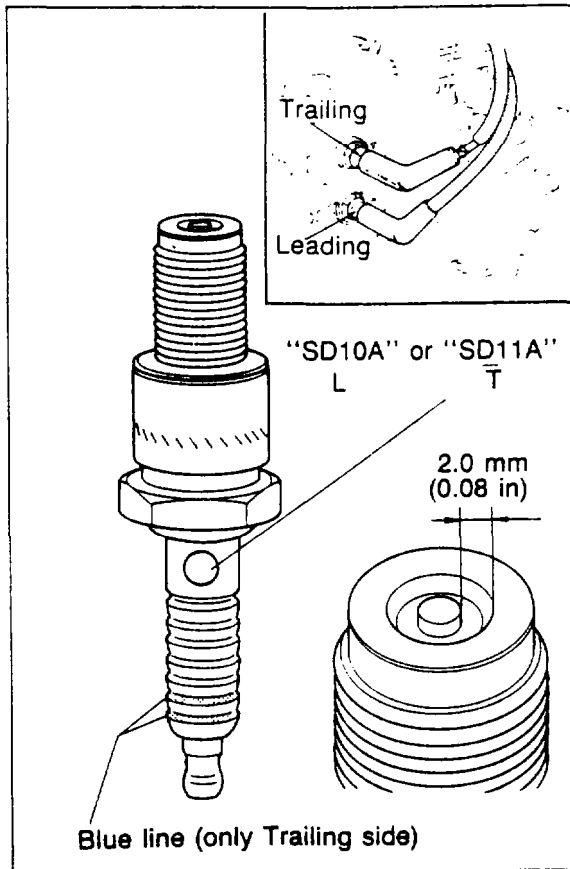
Note

Don't use a plug cleaner because cleaning sand may be lodged in the plug.

	NGK	Identification line
Trailing	SD 11A	Blue line
Leading	SD 10A	—

Caution

Install the correct type spark plug after confirming the identification mark. Never misinstall the spark plug.



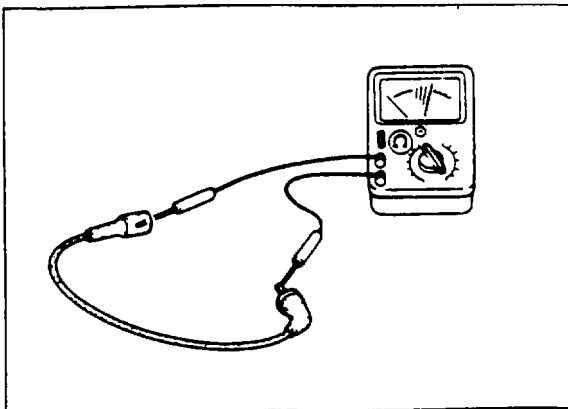
87U05X-022

HIGH-TENSION LEADS

INSPECTION

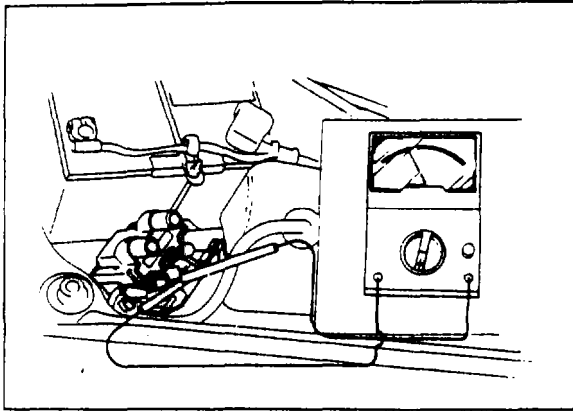
Use a tester to measure the resistance.

Resistance: 16 kΩ per 1 m (3.28 ft)

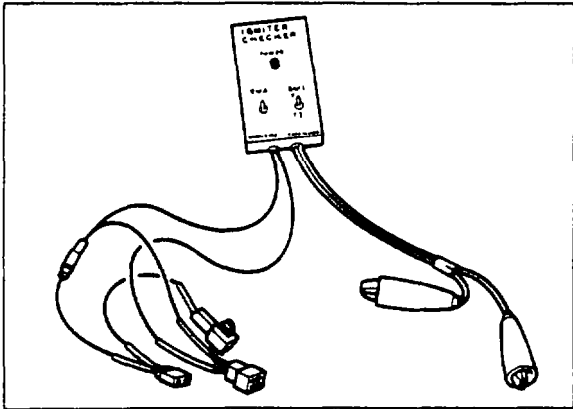


67U05X-074

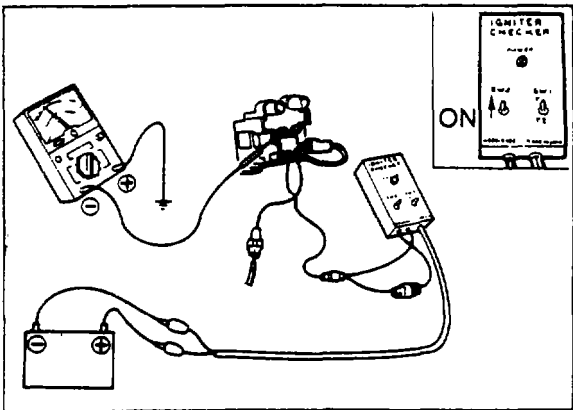
5 COIL WITH IGNITER



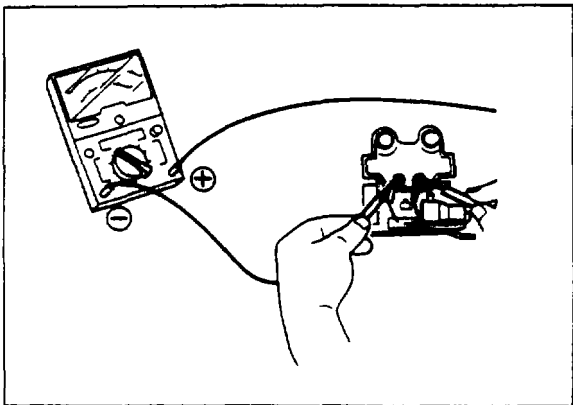
77U05X-017



87U05X-023



57G05X-026



87U05X-024

COIL WITH IGNITER

INSPECTION

Before this inspection, check the specific gravity of the battery, and that it is at or near full charge.

Note:

Igniter Checker is used for inspection of the igniter.

Leading Side Igniter

1. Disconnect the 2-prong connector, and connect the voltmeter in series with the (BY) wire terminals.
2. Turn the ignition switch ON.
3. Check that the voltage is **approx. 12V**.

Caution

- a) Do not misconnect the ohmmeter leads. They should be connected as follows:
 - + lead to ground
 - lead to (B) wire
- b) Disconnect the negative battery cable before removing the (B) wire from the coil with igniter, or damage will result.
- c) Do not disconnect the (Br) wire from the coil

4. Turn the ignition switch OFF, and disconnect the voltmeter and negative battery cable.
5. Connect **Igniter Checker** (49 F018 002) between the 2-prong connectors.
6. Disconnect the (B) wire from the coil with igniter.
7. Reconnect the negative battery cable.
8. Connect an ohmmeter between (B) wire and ground.
9. Turn the ignition switch ON.
10. Push up the "SW2" switch on the igniter checker while observing the ohmmeter. The pointer needle on the ohmmeter should jump up to the **approx. 1/3rd scale on the X1 scale** and then return.
11. Replace the igniter, if necessary.

Warning:

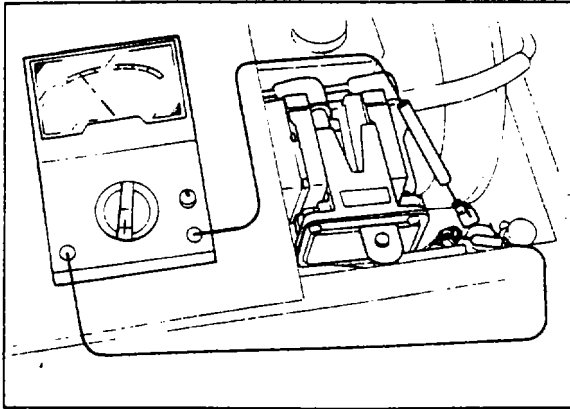
While checking the coil with igniter as outlined above, the high-tension leads must remain connected to the coil. If the high-tension leads are disconnected, high voltage ignition sparks may occur.

Coil

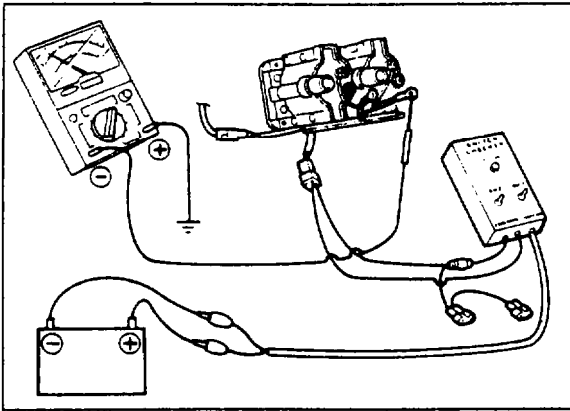
1. Disconnect the negative battery cable.
2. Connect the ohmmeter as shown in the figure.
3. Check the resistance of the coil.

Resistance: below 1 Ω

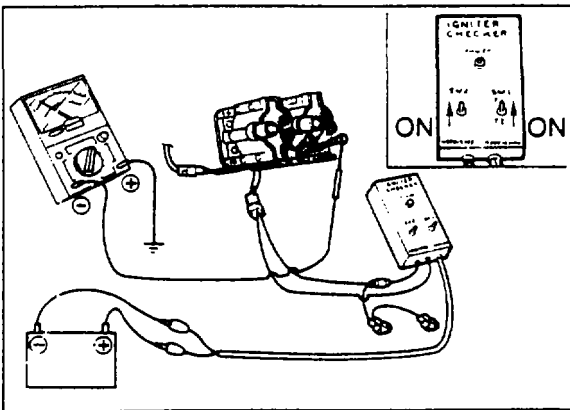
4. Replace the coil, if necessary.



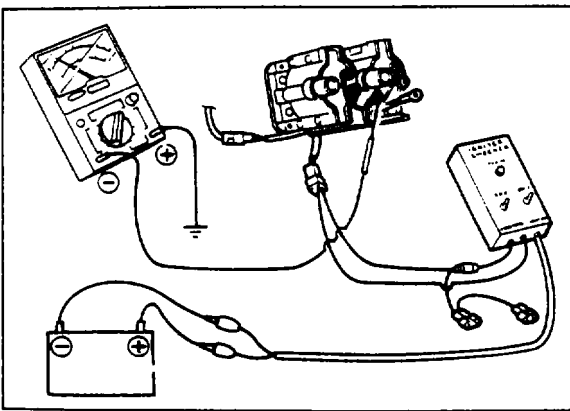
87U05X-025



67U05X-080



57G05X-028



67U05X-082

Trailing Side Igniter

1. Disconnect the 2-prong connector, and connect the voltmeter in series with one side of the 2-prong connectors.
2. Turn the ignition switch ON.
3. Check that the voltage is **approx. 12V**.

Caution

a) **Do not misconnect the ohmmeter leads.**

They should be connected as follows:

+ lead to ground

- lead to (B) wire

b) **Disconnect the negative battery cable before removing the (B) or (L) wires from the coil with igniter, or damage will result.**

c) **Do not disconnect the (Br) wires from the coils.**

4. Turn the ignition switch OFF, and disconnect the voltmeter and negative battery cable.

5. Reconnect the 2-prong connector.

6. Disconnect the 4-prong connector, and connect **Igniter Checker** (49 F018 002) to the 4-prong connector of the coil with igniter.

7. Disconnect the (B) and (L) wires from the coil with igniter.

8. Reconnect the negative battery cable.

9. Connect an ohmmeter between (B) wire and ground.

10. Turn the ignition switch ON.

11. Set the "SW1" switch of the igniter checker to the "T1" position. While observing the ohmmeter, push up the "SW2" switch and the ohmmeter pointer needle should jump up to **approx. 1/3rd scale on the X1 scale** and then return.

12. Turn the ignition switch OFF, and disconnect the ohmmeter.

13. Connect the ohmmeter between (L) wire and ground.

Caution

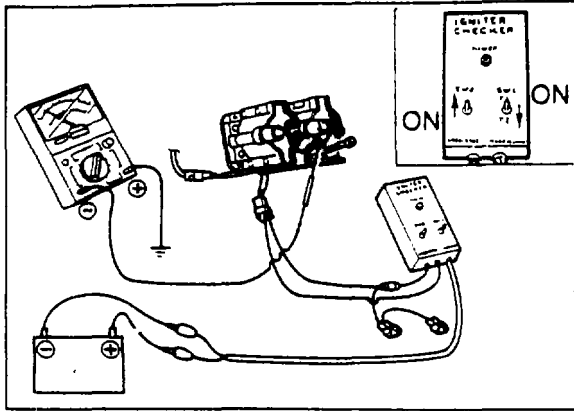
Do not misconnect the ohmmeter leads.

They should be connected as follows:

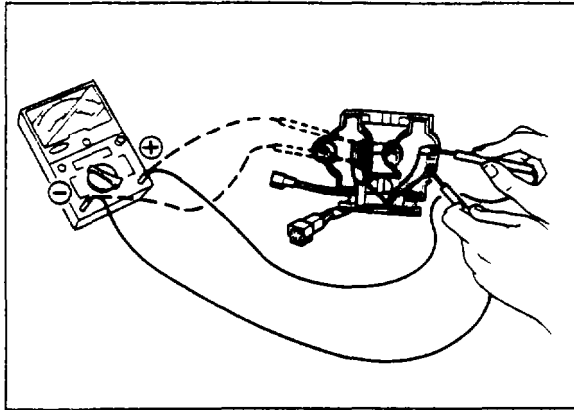
+ lead to ground

- lead to (L) wire

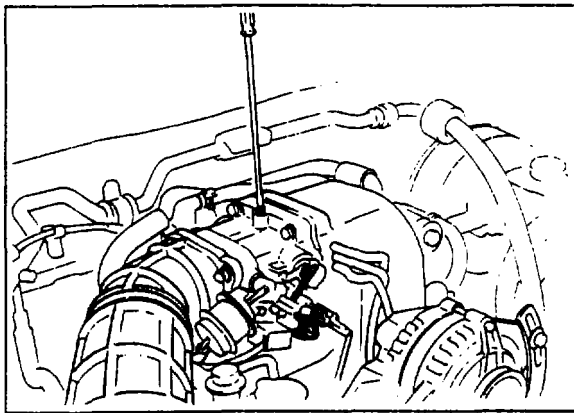
5 COIL WITH IGNITER



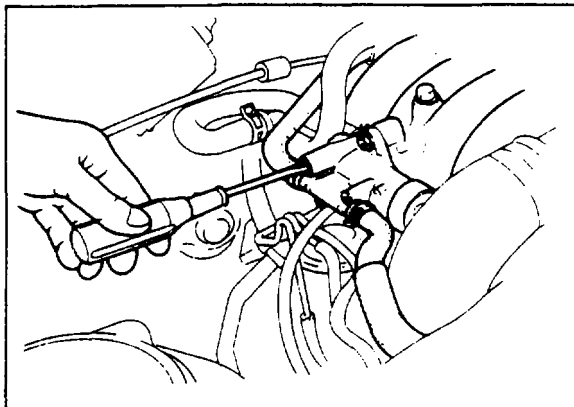
57G05X-029



87U05X-026



87U05X-027



87U05X-081

- 14 Turn the ignition switch ON.
- 15 Set the "SW1" switch of the igniter checker to the "T2" position.
While observing the ohmmeter, push up the "SW2" switch and the ohmmeter pointer needle should jump up to **approx. 1/3rd scale on the X1 scale** and then return.
- 16 Replace the igniter, if necessary.

Warning:

While checking the coil with igniter as outlined above, the high-tension leads must remain connected to the coil. If the high-tension leads are disconnected, high voltage ignition sparks may occur.

Coil

1. Disconnect the negative battery cable.
2. Connect the ohmmeter as shown in the figure.
3. Check the resistance of the coil.

Resistance: below 1 Ω

4. Replace the coil, if necessary.

ADJUSTMENT OF IGNITION TIMING

Warning

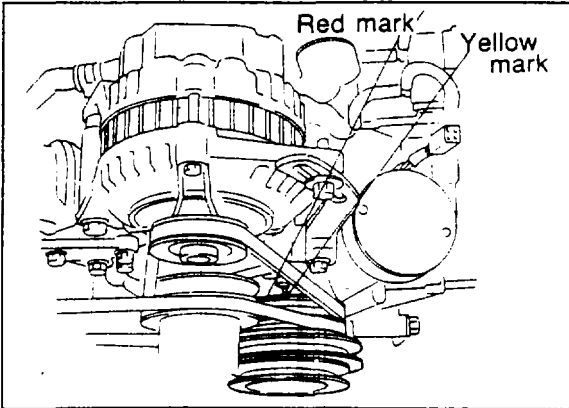
When inspecting and adjusting the ignition timing, keep hands, clothing, hair and tools away from the P/S drive belt.

Note

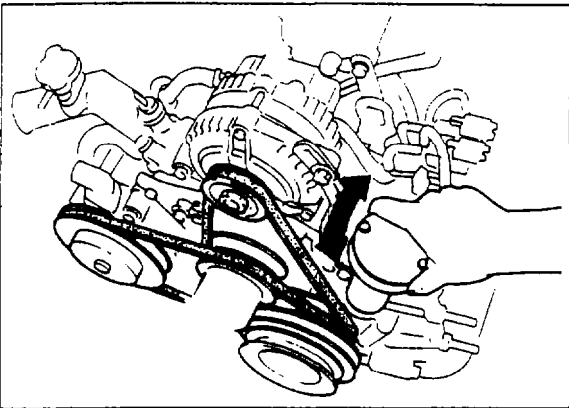
Self powered timing lights might not function. Use a vehicle-battery-powered timing light for checking ignition timing.

Initial

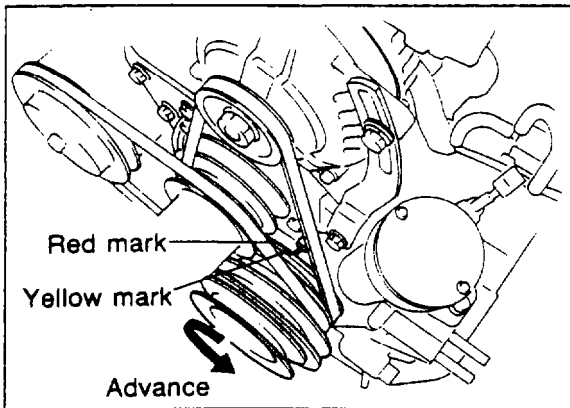
1. Run the engine until it is at operating temperature.
2. Turn all electric loads OFF.
3. Connect a tachometer.
4. Check the idle speed. Set to the specified idle speed if necessary. (Refer to Section 4A and 4B)
5. Connect a timing light to the "L-1" high-tension lead.



67U05X-082



87U05X-028



67U05X-084

6. Check that the marks on the pulley and indicator pin are aligned.

Ignition timing;

- Leading 5° ATDC (Yellow mark)
- Trailing 20° ATDC (Red mark)

7. If they aren't aligned, remove the blind cap and loosen the crank angle sensor installation bolt and turn it to make the adjustment.
8. Check the trailing side with the same procedure as the leading side.
9. Install a new blind cap.

Advance

1. Connect a timing light to the "L-1" high-tension lead.
2. Increase the engine speed and check that the ignition timing advances.
3. Disconnect the timing light.

Note

When decelerating, the ignition timing will drop to a certain point and stay momentarily, and then return to normal.