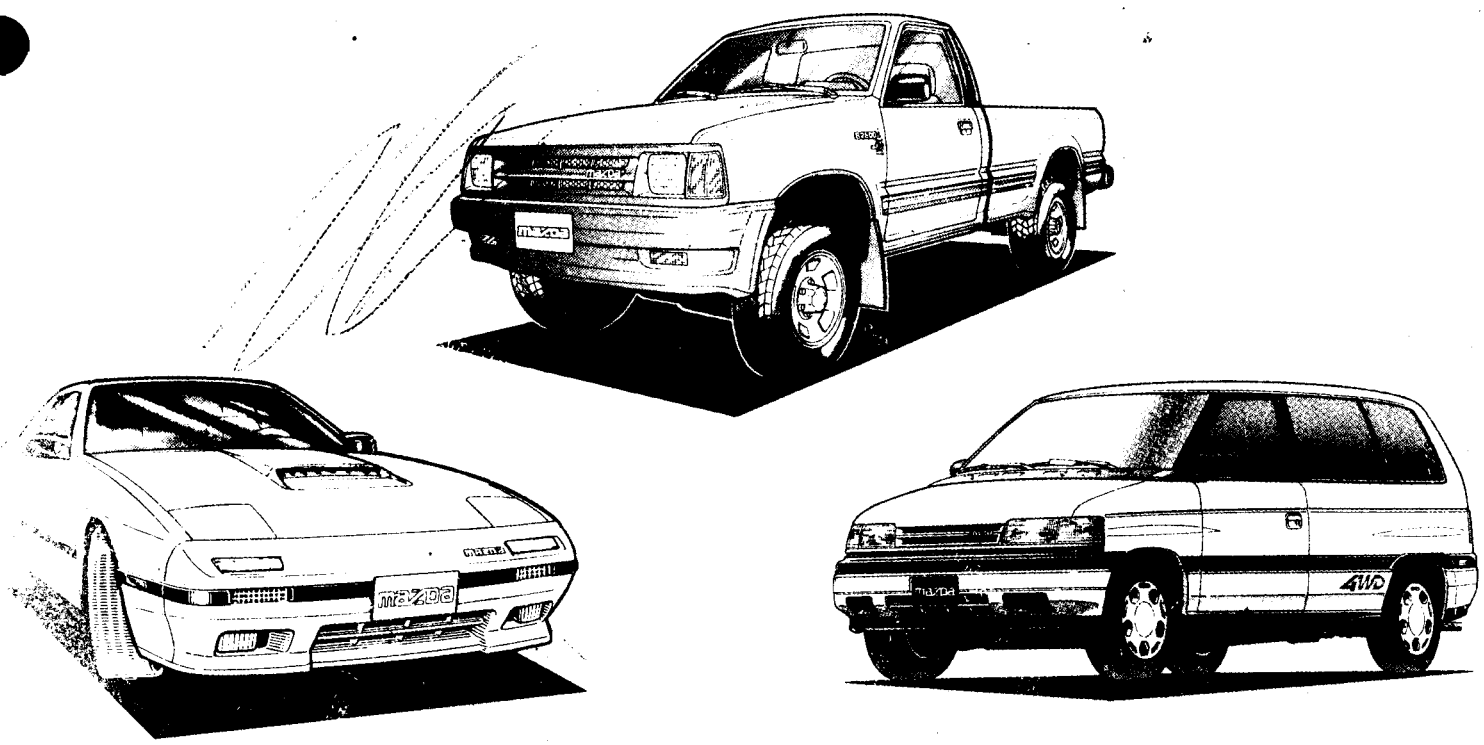
Mazda B-Series RX-7 MPV 4-Wheel Drive

1989 Service Highlights



mazda

RX-7

CONTENTS

ENGINE

97U0CX-501

OUTLINE

OUTLINE OF CONSTRUCTION

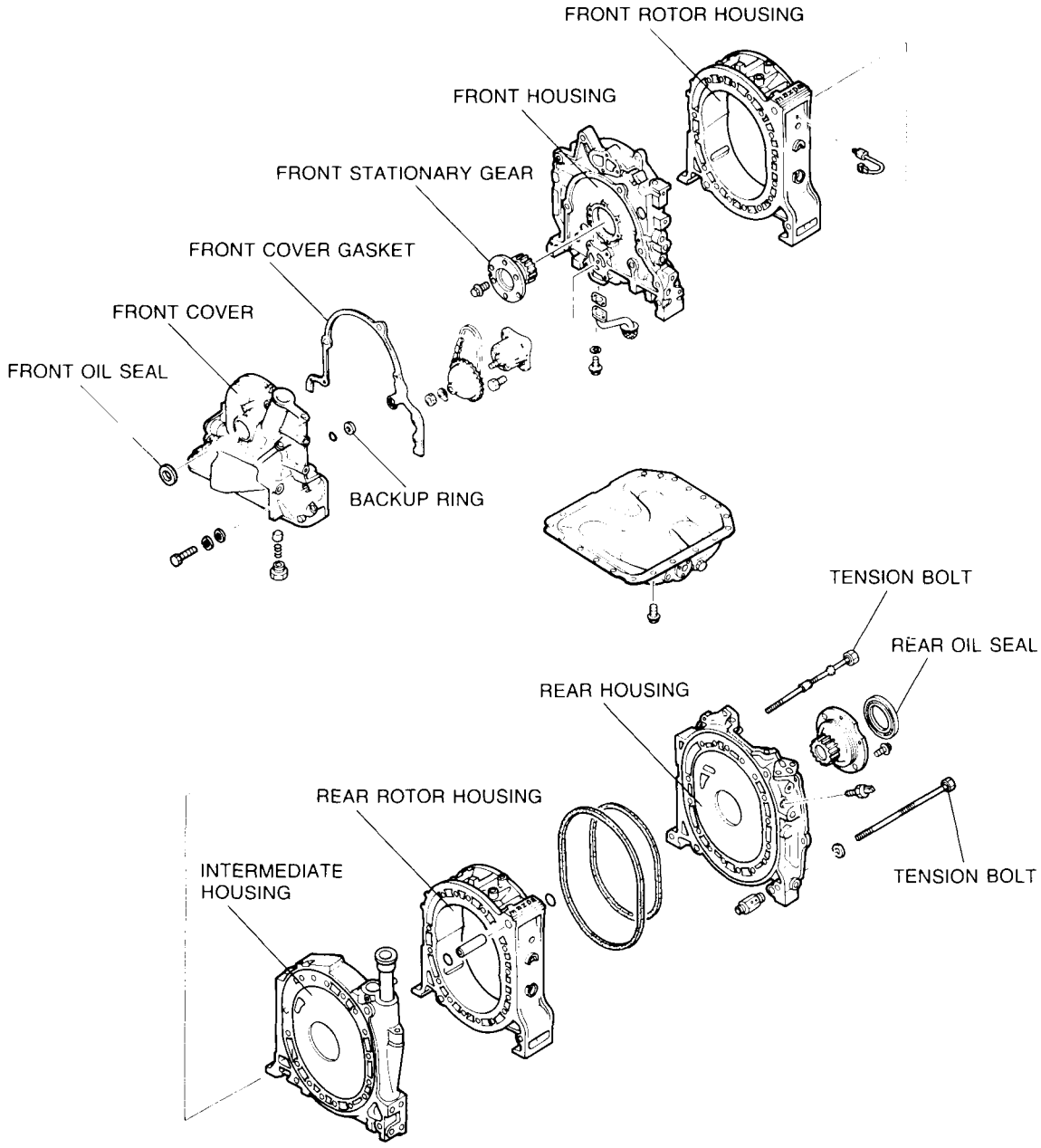
The 13B in the 1989 RX-7 is basically the same as in the previous model but with some modifications for improved engine performance.

Major changes

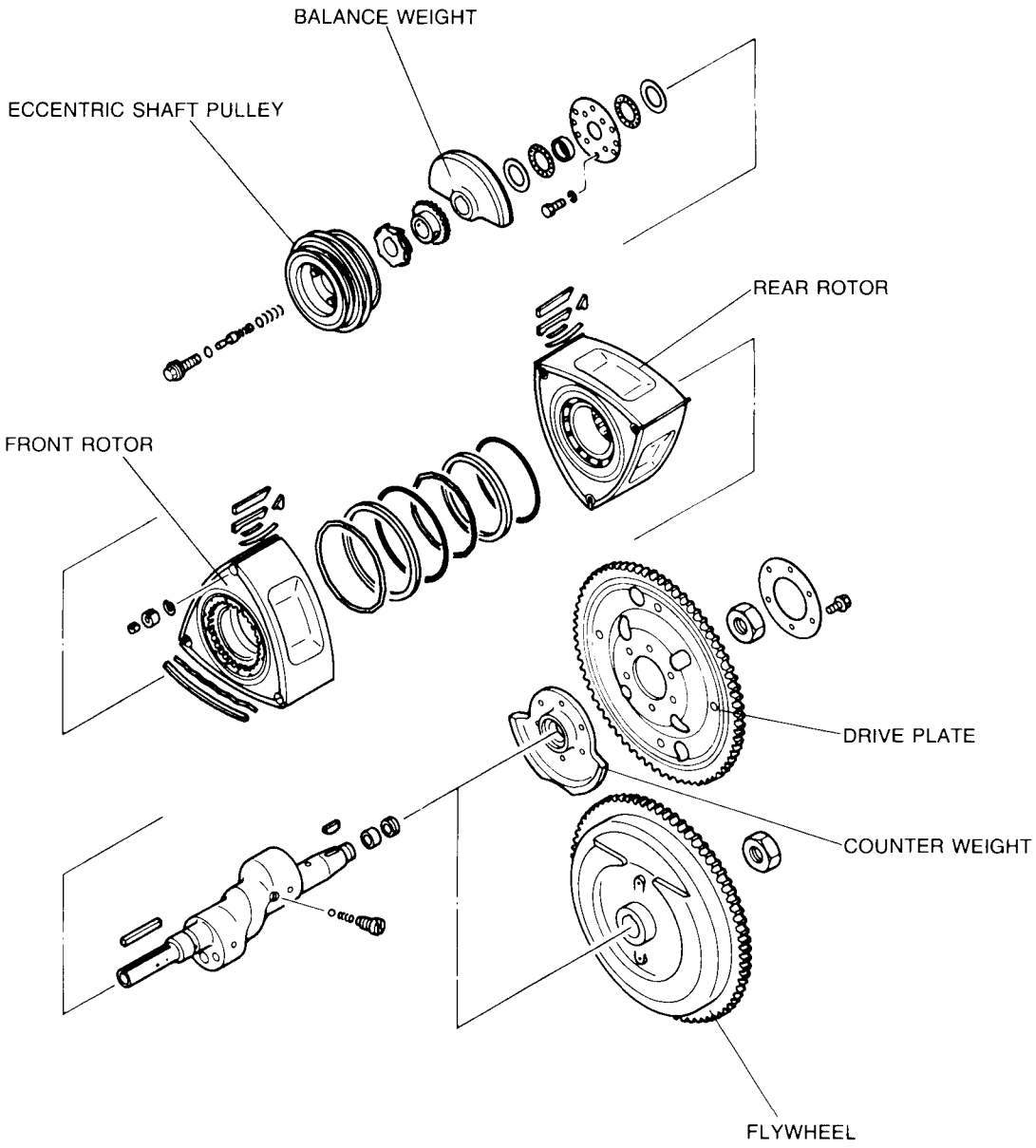
1. Rotor : Lighter, rotor recess shape change to increase compression ratio
2. Tension bolt : Strengthening ribs added
3. Front cover : Shape changed for new metering oil pump
4. Side housings : Inlet port erea enlarged

STRUCTURAL VIEW

HOUSING-RELATED PARTS



97U0CX-502


BALANCE WEIGHT
ECCENTRIC SHAFT PULLEY
REAR ROTOR
FRONT ROTOR
DRIVE PLATE
COUNTER WEIGHT
FLYWHEEL

97U0CX-503

SPECIFICATIONS

Item				Model	Turbo	Non-Turbo
Engine type					Rotary engine	
Displacement				cc (cu in)	654 x 2 (40.0 x 2)	
Number of cylinders and arrangement					2 rotors, longitudinal	
Combustion chamber type					Bathtub	
Compression ratio					9.0:1	9.7:1
Air induction					4-port induction	6-port induction
Port timing	Intake	Open	Primary		45° ATDC	32° ATDC
			Secondary		32° ATDC	
			Auxiliary		—	45° ATDC
		Close	Primary		50° ABDC	40° ABDC
			Secondary		50° ABDC	30° ABDC
			Auxiliary		—	80° ABDC
	Exhaust	Open			75° BBDC	
		Close			48° ATDC	
Fuel supply system					EGI	
Ignition timing (with test connector (Green: 1-pin) grounded)			Trailing		20° ± 2° ATDC (RED)	
			Leading		5° ± 1° ATDC (YELLOW)	
Idle speed (with test connector (Green: 1-pin) grounded)				rpm	750 ± 25	

97U0CX-504

INTERCHANGEABILITY

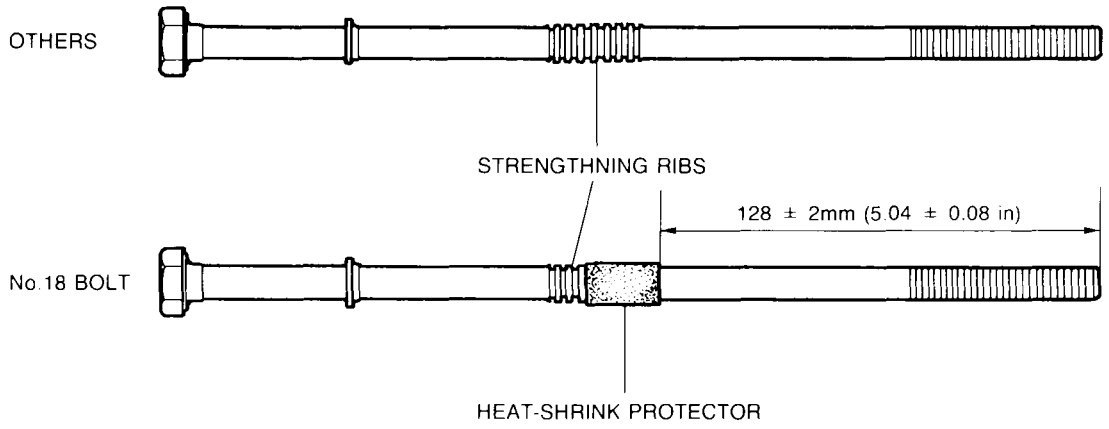
The following chart shows interchangeability of major components of the previous model and the 1989 model

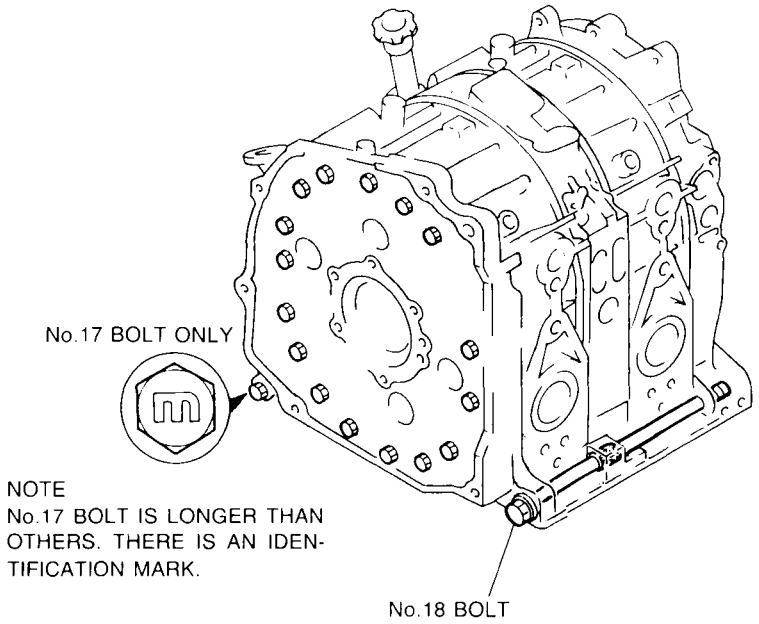
○: Interchangeable X: Not interchangeable

	Part	Interchangeability	Remark
Housing-related parts	Front rotor housing Rear rotor housing	X	• Knock sensor boss added
	Front housing Intermediate housing Rear housing	X	• Inlet port area enlarged
	Inner sealing rubber Outer sealing rubber	○	
	Front cover	X	• Shape changed to incorporate new metering oil pump
	Oil pan	○	
	Tension bolt	X	• Ribs added to center of shank
Rotating-related parts	Eccentric shaft	○	
	Rotor	X	• Weight reduction • Combustion chamber shape changed
	Apex seal	○	
	Side seal	○	
	Corner seal	○	
	Balance weight	X	• Shape changed
	Oil pump drive sprocket	○	
	Eccentric shaft pulley	X	• Shape changed
	Eccentric shaft bypass valve	○	
	Pulley lock bolt	○	
	Flywheel (M/T)	X	• Shape changed • Weight reduction
	Pilot bearing (M/T)	○	
	Counter weight (A/T)	X	• Shape changed • Weight reduction

97UC[illegible]

TENSION BOLT

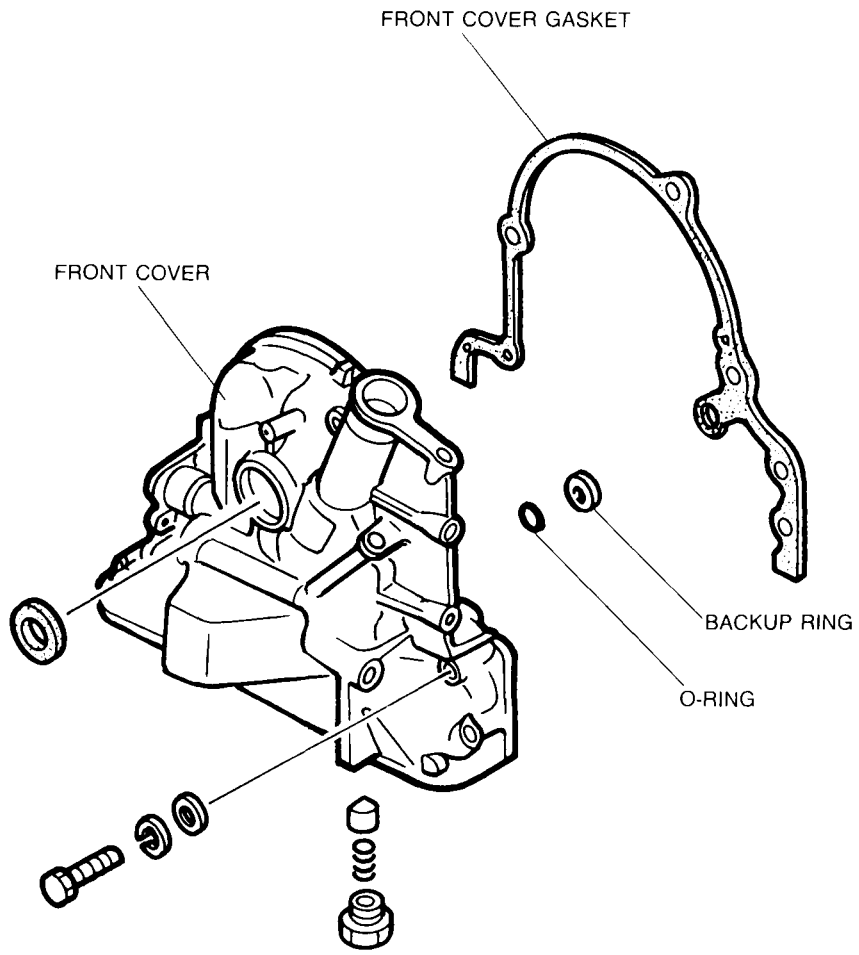




97U0CX-506

The strength of the tension bolts is increased by addition of strengthening ribs in the middle of the shank. The tension bolt installed into the No.18 hole differs from others in that it is not fully enclosed, leading to transmission of engine noise. To reduce this noise, the heat-shrik protector is used on the bolt where it goes through the intermediate housing boss. The No.18 bolt is supplied as an assembly (bolt with washer and protector). If the bolt is reused and the protector is damaged, replace the protector. The protector is easily shrunk with a lighter or match.

FRONT COVER

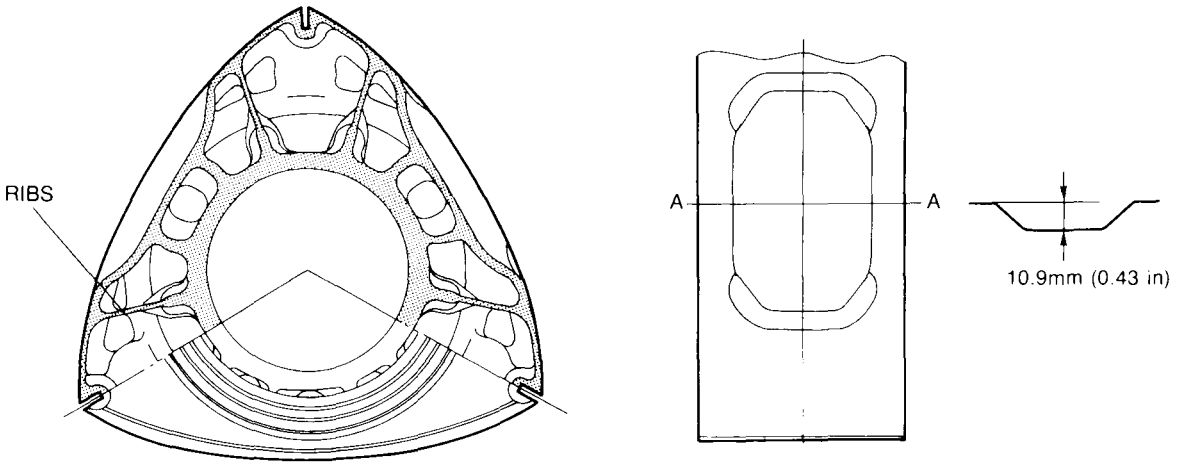


97U0CX-507

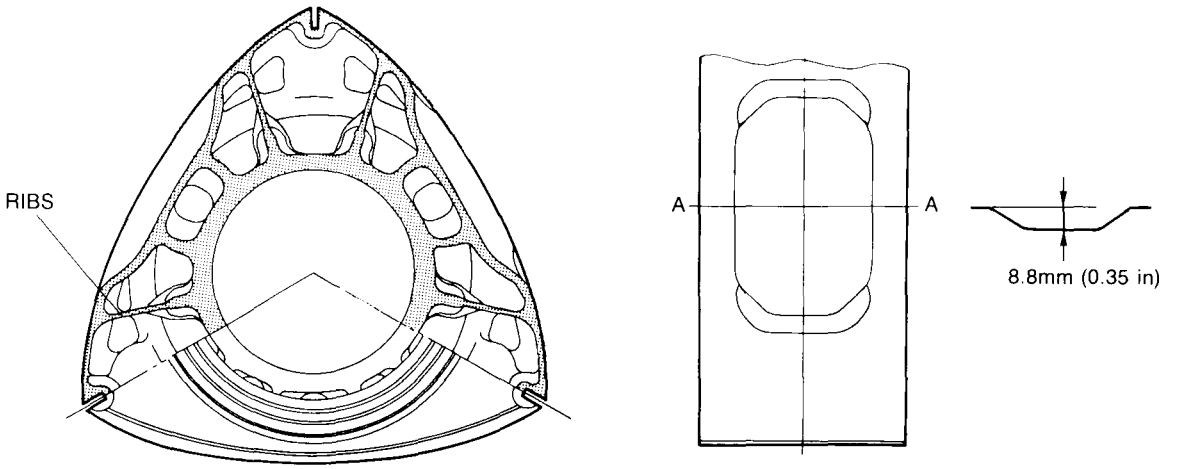
'989 RX-7 front cover is changed to incorporate a new metering oil pump.
added between the front cover and front housing for improved sealing.

ROTOR

TURBO



NON-TURBO



97U0CX-508

The rotor in the 1989 RX-7 is lighter and provides a higher compression ratio (9.0 : 1 for turbo model and 9.7 : 1 for non-turbo model) than the previous engine.
These improvements results in a engine with more power and torque.
The rotor ribs are redesigned for increased strength.
The combustion chamber rotor recess is made more uniform by utilizing a mechanical cutting process.
The rotor for turbo and non-turbo engines are distinguished by the rotor recess shape.

LUBRICATION SYSTEM

97U0DX-501

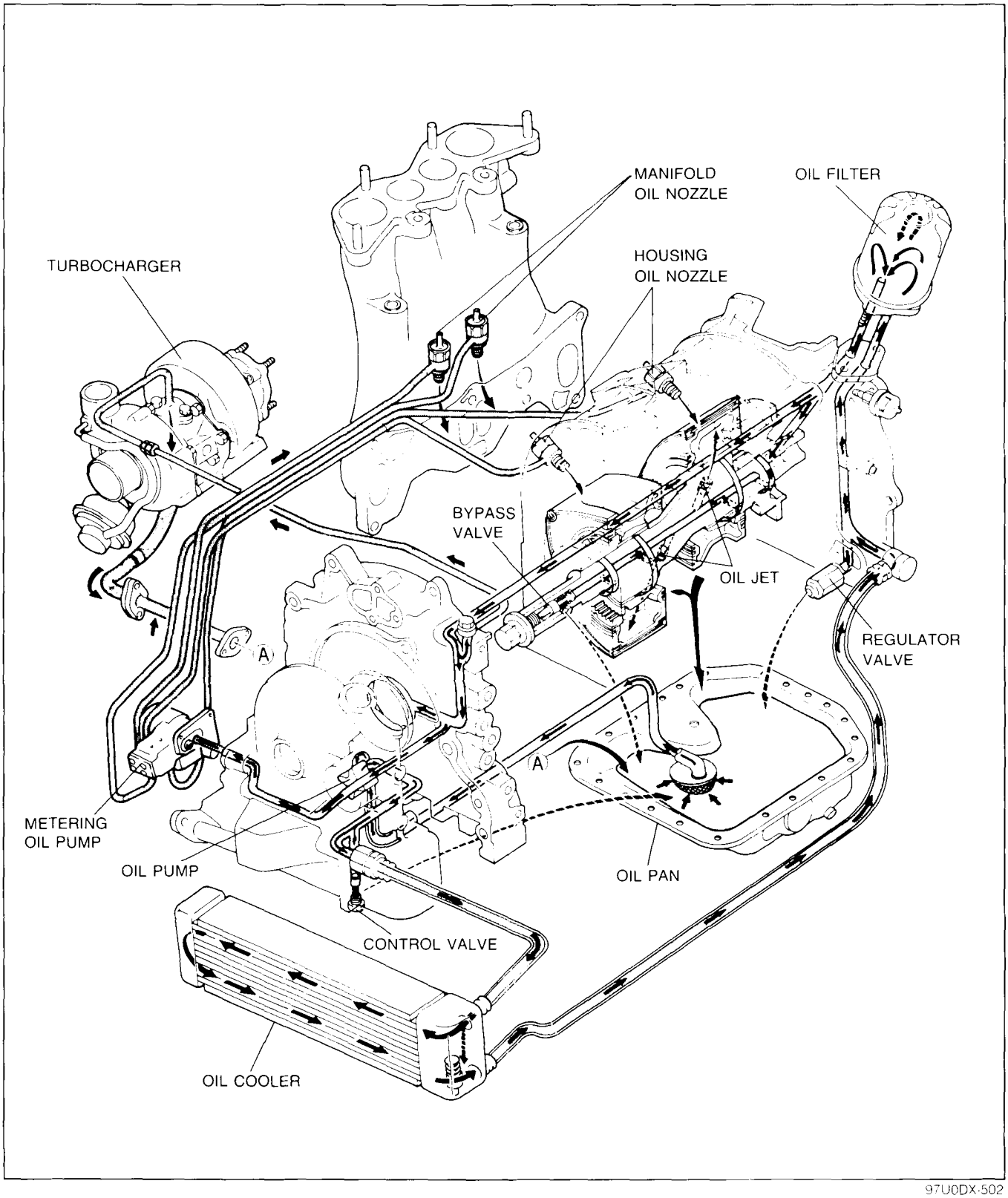
OUTLINE

OUTLINE OF CONSTRUCTION

The lubrication system of the 1989 RX-7 is basically the same as the previous model, but some improvements have been made as described below.

1. A new electronically controlled metering oil pump is adopted instead of the previous mechanical metering oil pump for reduced oil consumption and improved reliability.
2. A small-size oil filter is used and its installation procedure is different.

STRUCTURAL VIEW



97U0DX-502

SPECIFICATIONS

Items			Engine model	Turbo	Non-Turbo
Lubrication system				Force-fed	
Oil pump	Type			Trochoid	
	Number of rotors			2	
	Diameter x width of rotor		mm (in)	50 x 17.5 (1.97 x 0.69)	50 x 12.5 (1.97 x 0.49)
Control valve relief pressure			kPa (kg/cm^2, psi)	1,079 (11.0, 156)	
Oil cooler	Type			Air-cooled, with bypass valve	
	Relief temperature		°C (°F)	60—65 (140—149) or below	
	Relief pressure differential		kPa (kg/cm^2, psi)	349 (3.56, 50) at 60°C (140°F)	
Regulator valve relief pressure			kPa (kg/cm^2, psi)	490 (5.0, 71)	
Oil filter	Type			Full-flow, paper element	
	Relief pressure differential		kPa (kg/cm^2, psi)	98 (1.0, 14)	
Eccentric shaft bypass valve relief temperature			°C (°F)	60 (140) or below	
Oil capacity	Total (dry engine)		liters (US qt, Imp qt)	5.8 (6.1, 5.1)	
	Oil pan		liters (US qt, Imp qt)	4.4 (4.7, 3.9)	
	Oil cooler		liters (US qt, Imp qt)	0.85 (0.90, 0.75)	
	Oil filter liters (US qt, Imp qt)	Factory-installed		0.19 (0.20, 0.17)	
		Service parts		0.17 (0.18, 0.15)	
Engine oil (API service)				"Fuel efficient" SF (Mineral oil only)	

97U0DX-507

INTERCHANGEABILITY

The following chart shows interchangeability of major components of the previous model and the 1989 model.

○: Interchangeable X: Not interchangeable

Part	Interchangeability	Remark
Oil pump	○	Oil pump unchanged Baffle plate for turbo model eliminated
Metering oil pump	X	Shape changed
Oil filter	○	Small-size filter used
Manifold oil nozzle	○	Shape changed
Housing oil nozzle	○	Shape changed
Oil cooler	○	

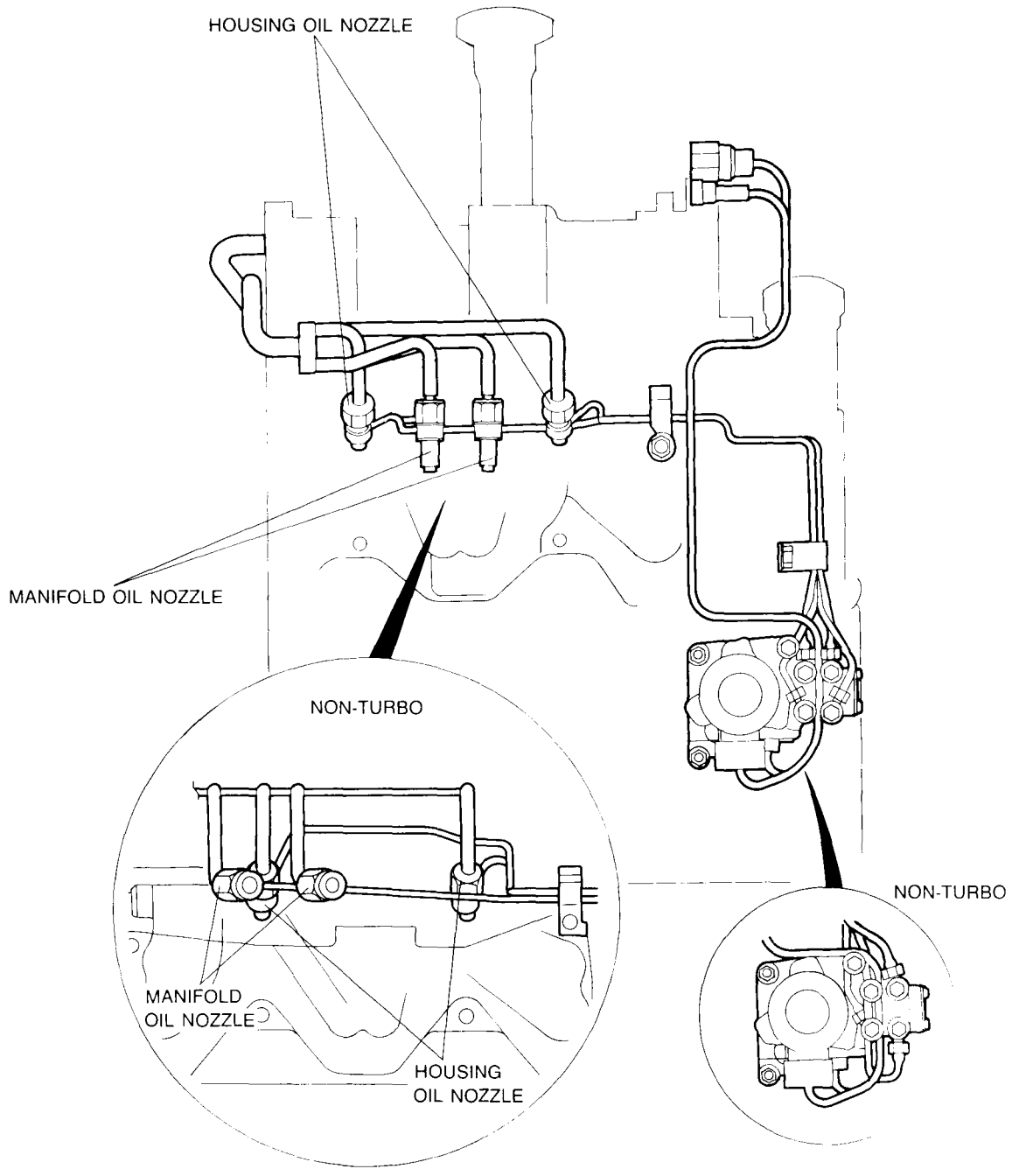
97U0DX-503

METERING OIL PUMP

OUTLINE

An electronically controlled metering oil pump is used instead of the previously used mechanical metering oil pump for reduced oil consumption. This new metering oil pump is controlled by the engine control unit. The ECU bases it calculation of engine oil needs on the input from various sensors.
It then sends a pulse signal to control the oil discharge amount according to engine speed, engine coolant temperature and intake air amount (load condition).
The same metering oil pump is used for turbo and non-turbo engines, but the oil nozzle plumbing is different.

TURBO



97U0DX-504

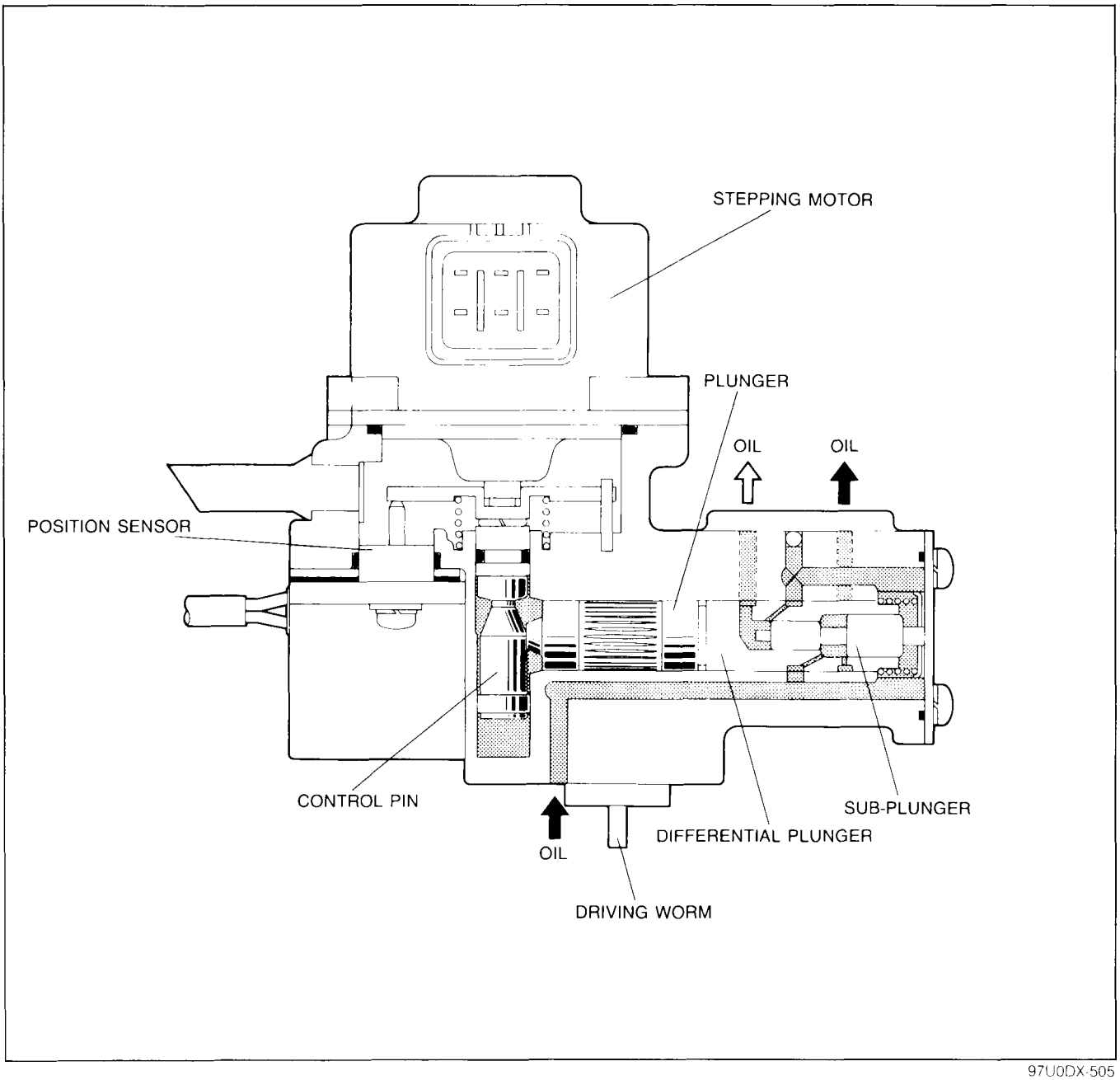
OPERATION

The oil discharge mechanism in the new electronically controlled metering oil pump is the same as that in the previous mechanical metering oil pump. The plunger and differential plunger are driven through the driving worm, which is driven by the eccentric shaft.

The oil discharge amount is controlled by movement of the control pin.

The plunger rides against the taper of the control pin. As the pin moves up or down, the plunger stroke changes to control the oil discharge amount.

Stepping motor operation is monitored by the position sensor, which results in the engine control unit setting the optimum oil discharge for all driving conditions.



97U0DX-505

FAIL-SAFE FUNCTION

If the engine control unit senses a malfunction of the stepping motor or position sensor, fail-safe function takes place.

The engine control unit fixes the control pin to its lowest compensation step, and oil is discharged in proportion to engine speed only without any load compensation.

The vehicle can be driven normally as long as the oil injection needs are within the lowest compensation step range.

If the oil injection needs exceed the lowest compensation step range, fuel injection is restricted to limit the engine speed and resultant oil injection requirements.

SERVICE POINT

OIL FILTER

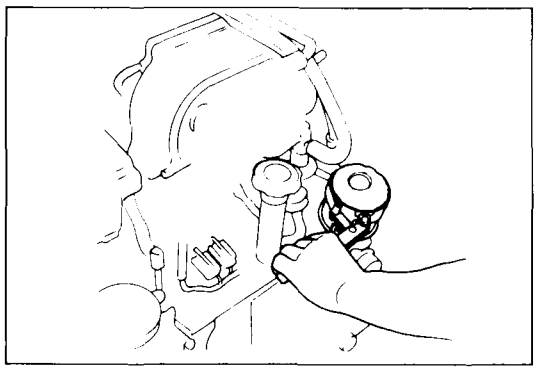
The 1989 RX-7 has a small-size oil filter. The factory-installed oil filter differs from the service parts oil filter. The service oil filter is the same as that used for the Mazda 323 B-series engine.

Oil filter capacity

liters (US qt, Imp qt)

Factory installed	0.19 (0.20, 0.17)
Service part	0.17 (0.18, 0.15)

97U0DX-508



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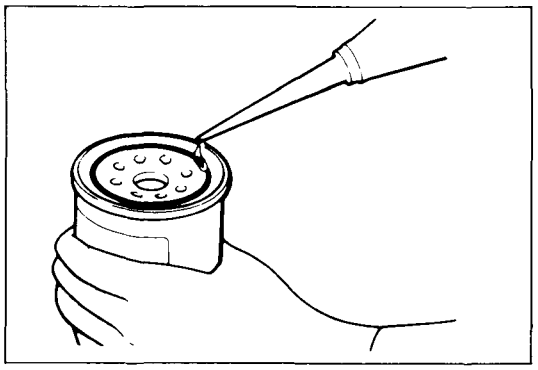


97U0DX-510

Replacement

1. Remove the oil filter with a suitable wrench.
2. Use a clean rag to wipe clean the mounting surface on the engine.
3. Apply a small amount of clean engine oil to the rubber seal of the new filter.
4. Hand tighten the oil filter until the rubber seal contacts the base, and then tighten the filter an additional 1-1/6 turn with a wrench.
5. Start the engine and inspect for leaks around the filter seal.
6. Check the oil level and add oil as necessary.

COOLING SYSTEM

97U0EX-501

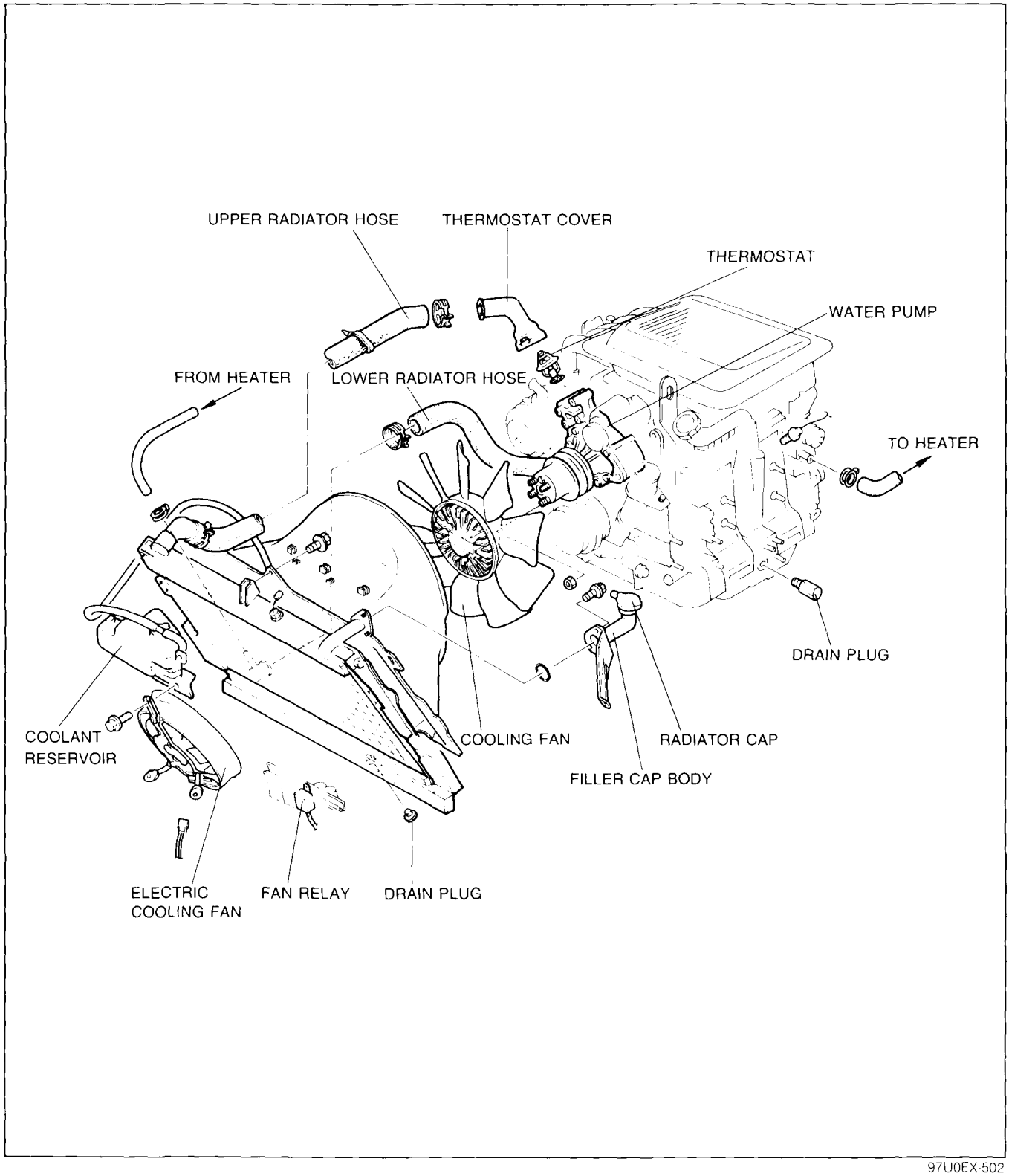
OUTLINE

OUTLINE OF CONSTRUCTION

The cooling system of the 1989 RX-7 is basically the same as the previous model but certain improvements have been made as described below.

1. The number of cooling fan blades is increased from 8 to 10 for improved cooling performance.
2. In conjunction with the cooling fan modification, the shape of the water pump is changed for improved rigidity.
3. A new radiator with a filler cap body is adopted for improved serviceability.
4. In conjunction with the radiator modification, the thermostat cover and thermostat gasket shapes are changed.

STRUCTURAL VIEW



97U0EX-502

SPECIFICATIONS

Item		Engine model	Turbo	Non-Turbo
Cooling method			Water-cooled, forced circulation	
Coolant capacity	With heater	liters (US qt, Imp qt)	8.7 (9.2, 7.7)	7.3 (7.7, 6.4)
Water pump	Type		Centrifugal	
	Pulley ratio (speed)		1:1.22	
Thermostat	Type		Wax, bottom bypass	
	Opening temperature	°C (°F)	80.5—83.5 (177—182)	
	Full open temperature	°C (°F)	95 (203)	
	Full open lift	mm (in)	8—10 (0.31—0.39)	
Radiator	Type		Corrugated fin	
Filler cap	Relief pressure	kPa (kg/cm^2, psi)	74—103 (0.75—1.05, 11—15)	
Cooling fan	Type		Thermo-modulated	
	Number of blades		10	
	Outer diameter	mm (in)	390 (15.35)	
Electric cooling fan	Type		Electrical	
	Capacity	W	90	
	Number of blades		5	
	Outer diameter	mm (in)	255 (10.04)	

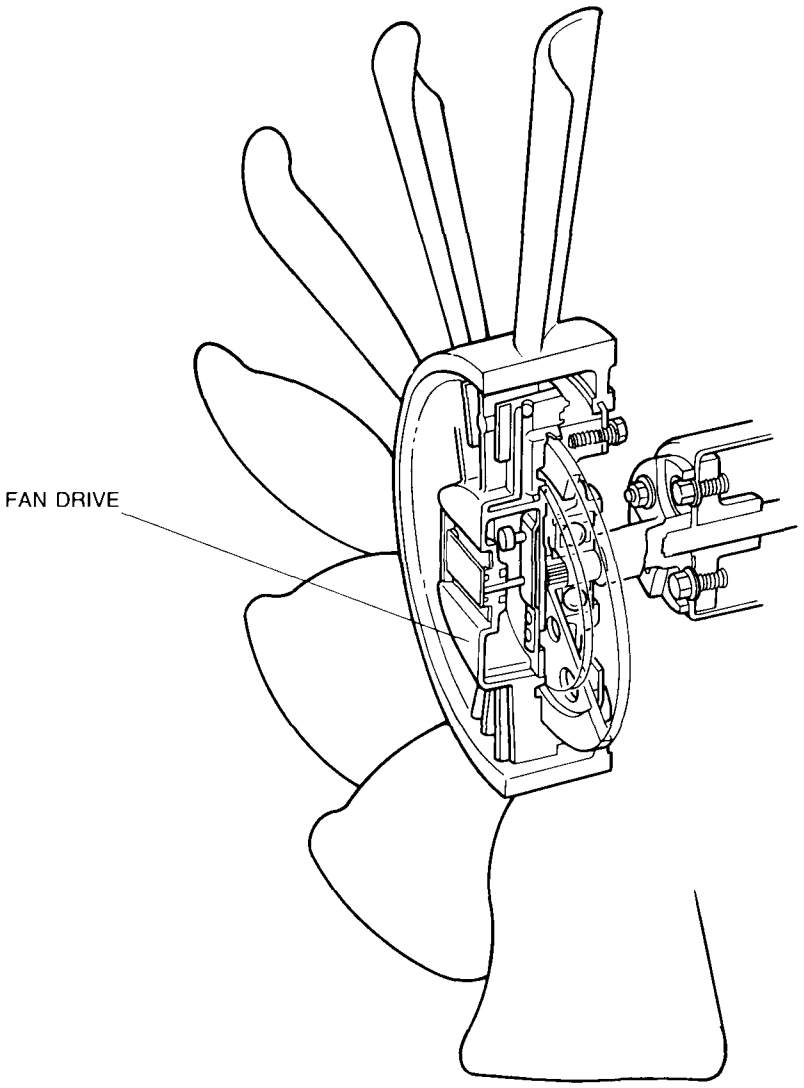
INTERCHANGEABILITY

The following chart shows the major components interchangeability between the previous model and 1989 model.

O: Interchangeable X: Not interchangeable

Parts	Interchangeability	Remark
Water pump	X	Shape changed
Thermostat	X	Rubber gasket used
Radiator	X	Shape changed
Radiator cap	○	
Cooling fan	X	Blade number increased
Electric cooling fan	○	

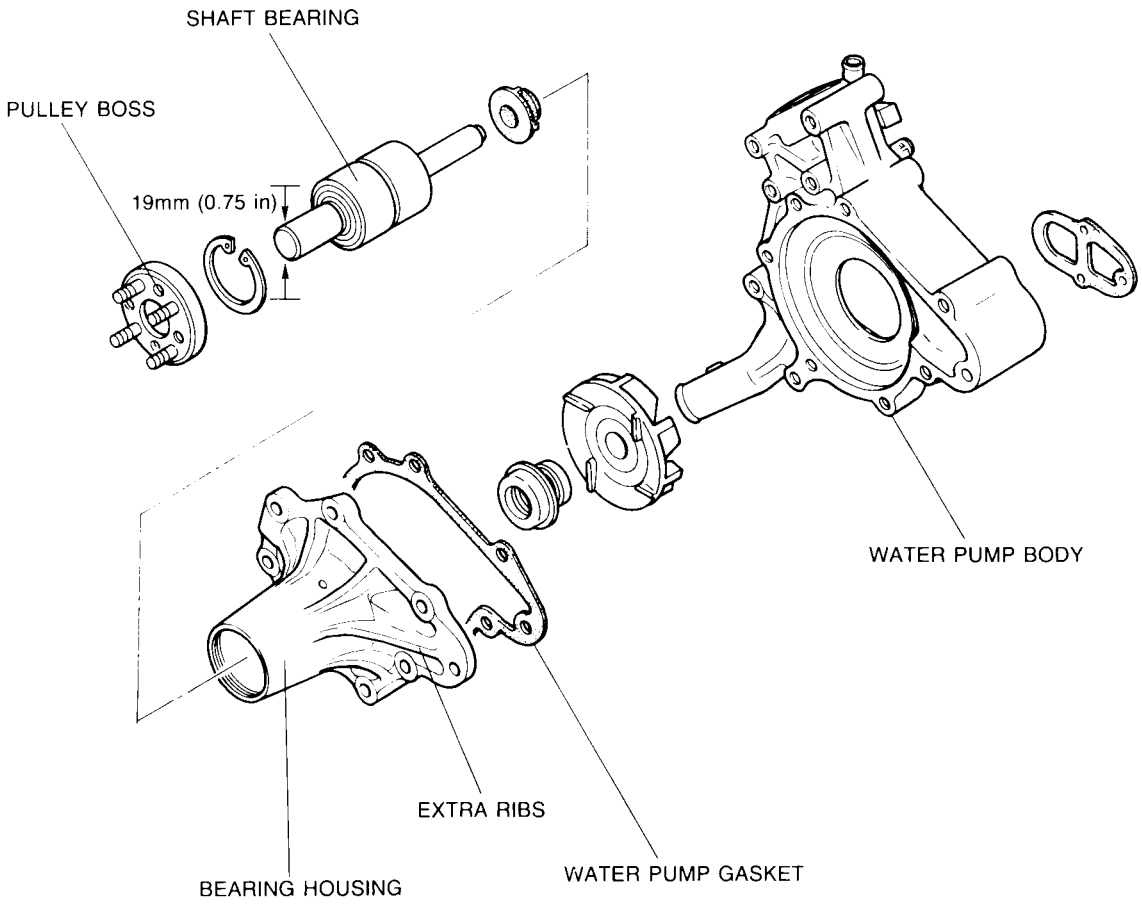
COOLING FAN



97U0EX-504

The thermomodulate cooling fan used in the 1989 RX-7 has 10 blades and a single bearing instead of 8 blades and double bearing of the previous model, which result in improved cooling performance. The cooling fan drive characteristics is the same as the previous model but the fan-drive is not interchangeable because the water pump shaft bearing mounting diameter is larger.

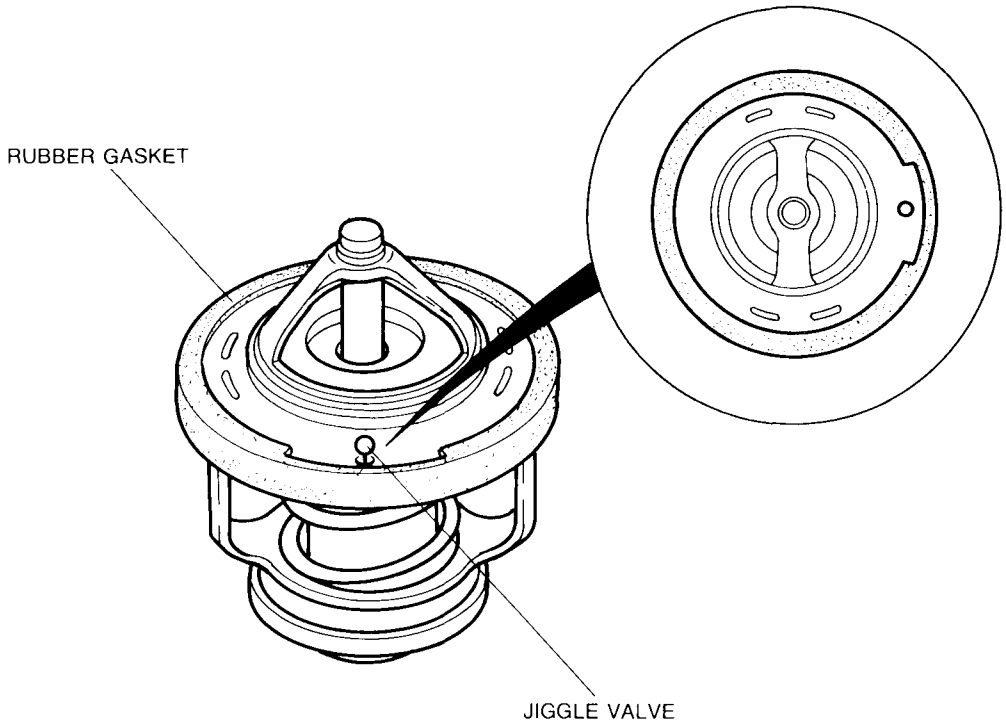
WATER PUMP



97U0EX-505

- Water pump shape is changed to incorporate the new cooling fan and thermostat.
- Bearing housing : Extra ribs are used for improved rigidity.
- Water pump gasket : The shape is changed because of the bearing housing change.
- Shaft bearing and pulley boss : The shaft bearing shaft outer diameter and pulley boss inner diameter are increased to incorporate the new cooling fan.
- Water pump body : The body shape is changed to incorporate the new thermostat and cover. The water thermoswitch for automatic transmission and Turbo models is in the pump body.
- Internal parts are interchangeable with the previous RX-7.

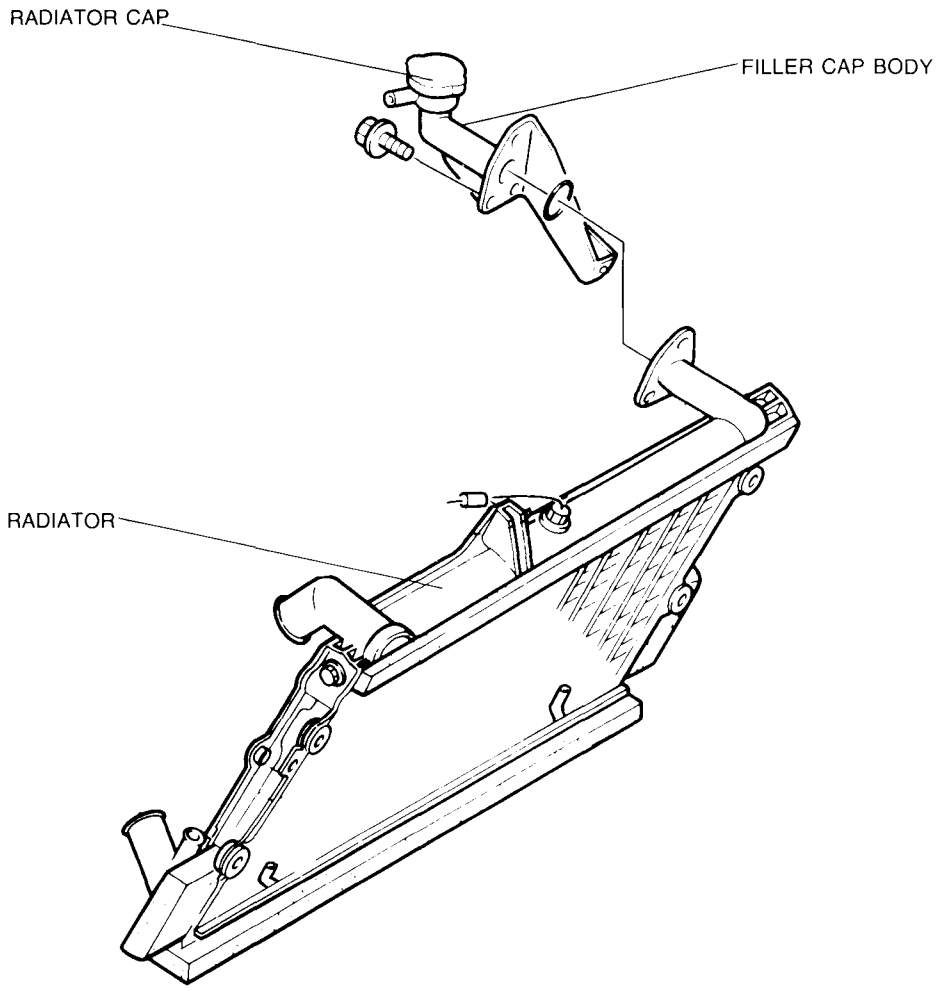
THERMOSTAT



JT90EX 506

A new thermostat with a rubber gasket is used for improved serviceability. The opening temperature is the same as the previous model. The outer diameter is decreased from 54mm (2.13 in) to 52mm (2.05 in) for use with the rubber gasket.
Assemble the rubber gasket with the notch positioned around the jiggle valve.

RADIATOR



97U0EX-507

...e of the radiator core is decreased (width 561.8mm (22.12 in) x height 415mm (16.34 in) x thickness ... 98 in)) because of the cooling fan improvements. The radiator has a filler cap body for improved ...ability. By moving the radiator cap from the middle of the radiator to the filler cap body, the need ... bleeder plug and the filler cap at the thermostat cover is eliminated. Coolant replacement is done ...ary.

FUEL AND EMISSION CONTROL SYSTEMS (NON-TURBO)

97U0F1 501

OUTLINE

OUTLINE OF CONSTRUCTION

Development Concepts

The development concepts for the new model are as follows:

1. Increased horsepower
2. Improved performance
3. Improved fuel economy
4. Improved serviceability

Areas of Improvement

Development concepts / Improved parts	Increased horsepower	Improved performance	Improved fuel economy	Improved serviceability
Airflow meter (Linear type)	X	○	X	X
Mixing plate (Primary fuel injection)	○	○	○	X
Variable dynamic effect intake (VDI) system	○	X	X	X
Throttle-idle-position auto-adjusting system	X	X	X	
Lean best-idle control system (Variable resistor eliminated)	X	X	○	○
Spark advance feedback system	X	○	X	X

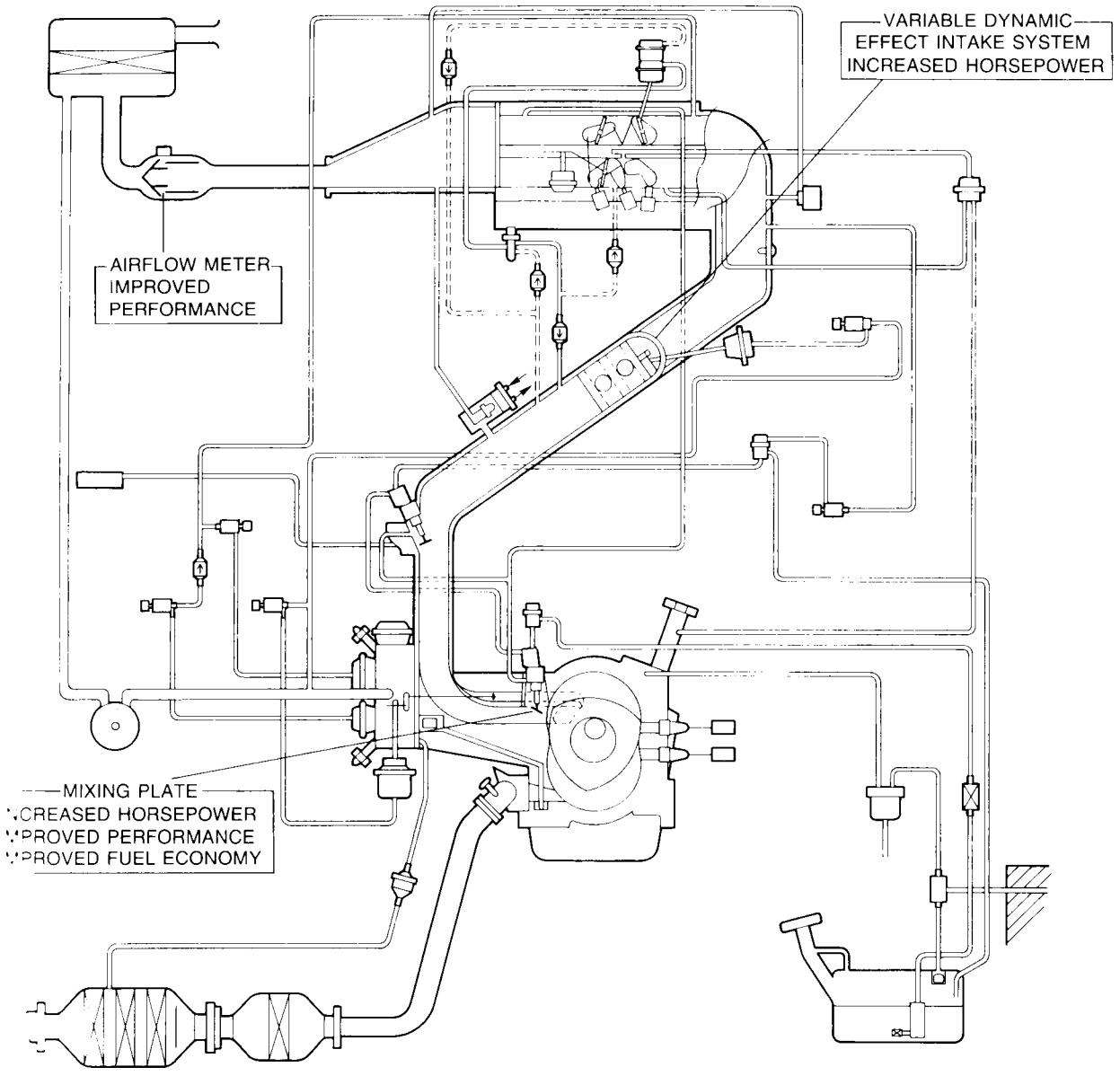
○: Related X: Non-related

97U0F1-502

System Construction

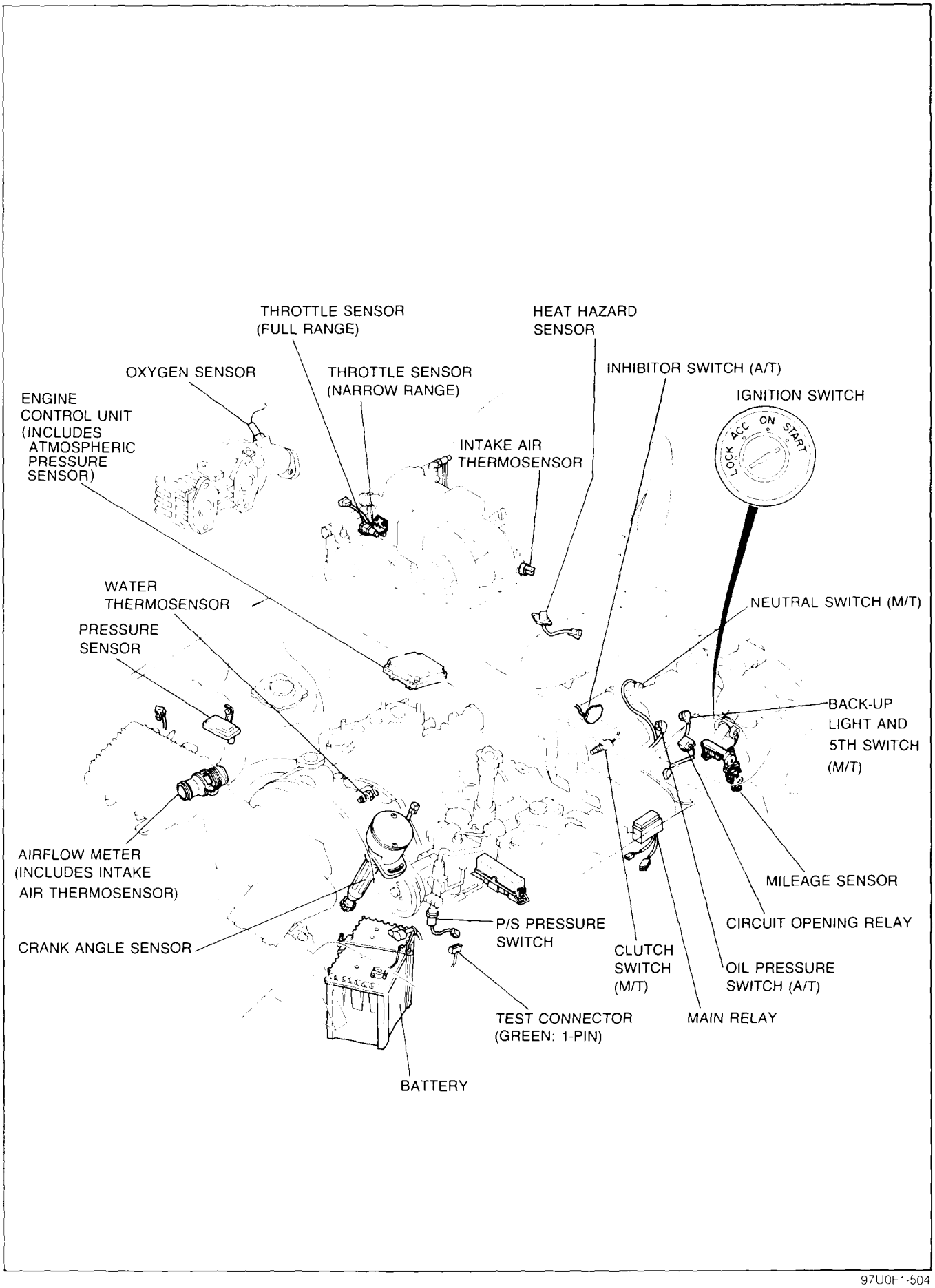
ENGINE CONTROL UNIT

- THROTTLE-IDLE-POSITION AUTO-ADJUSTING SYSTEM IMPROVED SERVICEABILITY
- SPARK ADVANCE FEEDBACK SYSTEM IMPROVED PERFORMANCE
- LEAN BEST-IDLE CONTROL SYSTEM IMPROVED FUEL ECONOMY IMPROVED SERVICEABILITY



97U0F1-503

EMISSION CONTROL SCHEMATIC DIAGRAM
Input Devices



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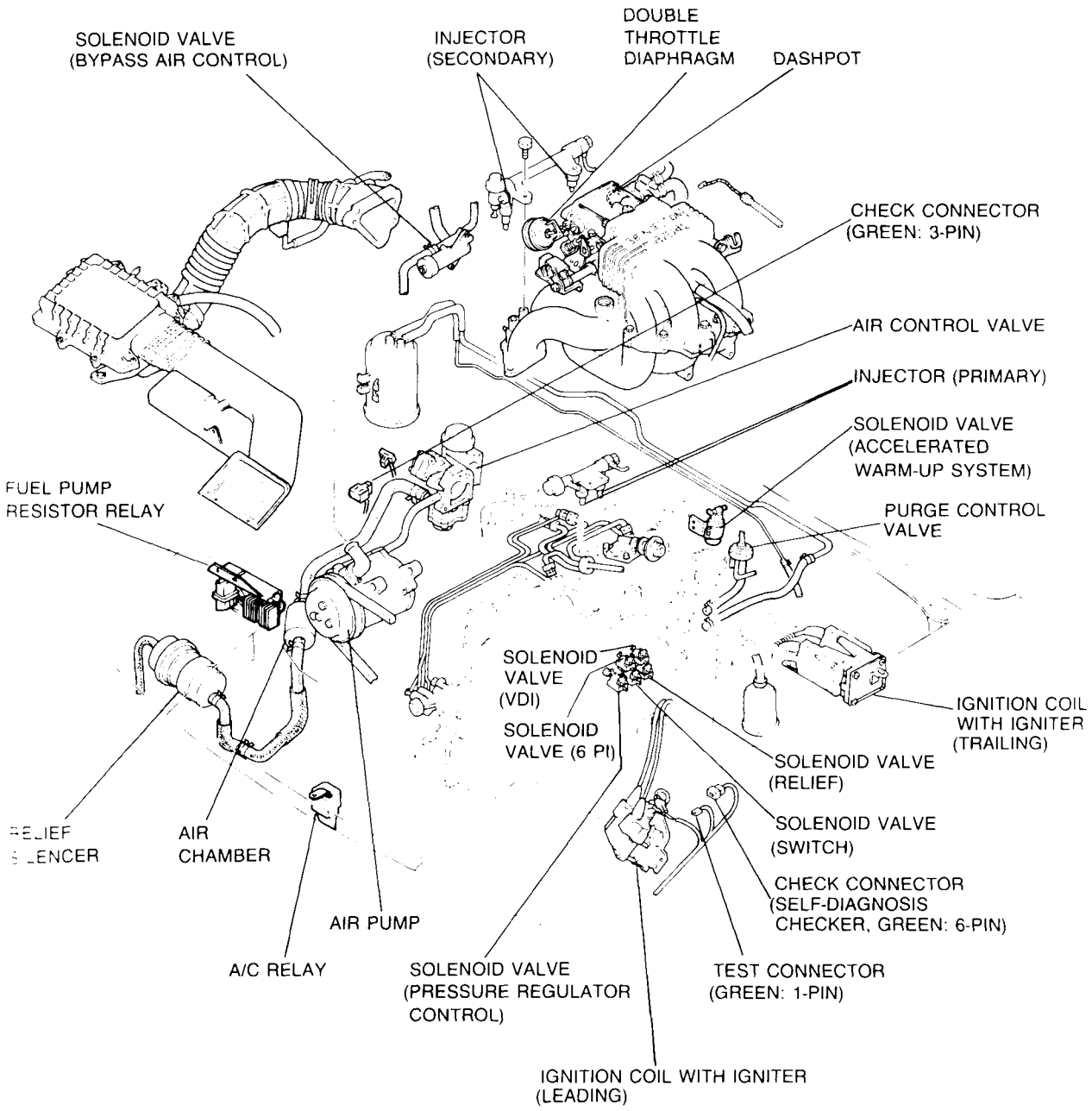
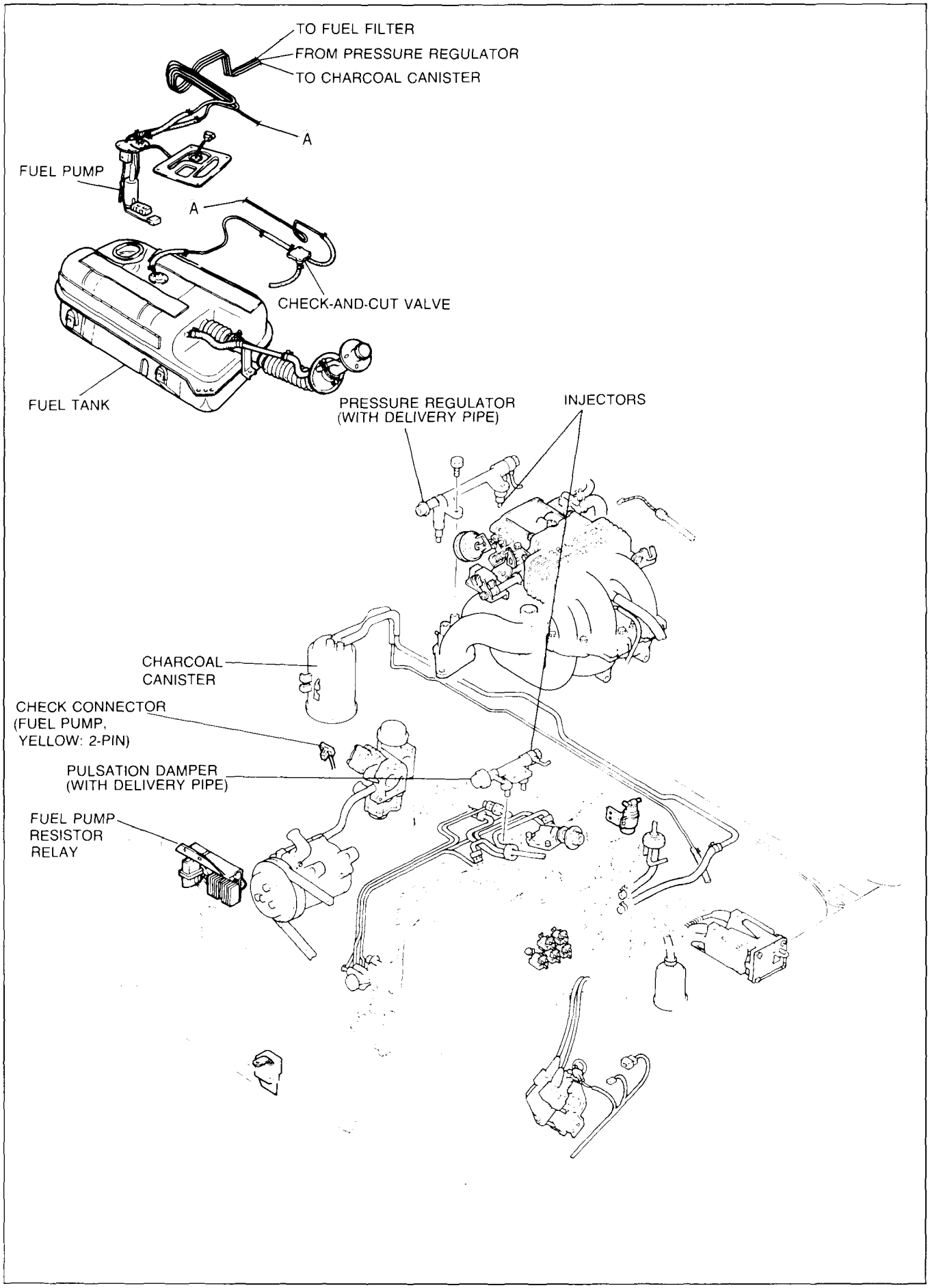
Output Devices



ABLE DYNAMIC EFFECT INTAKE
PORT INDUCTION

Fuel Devices



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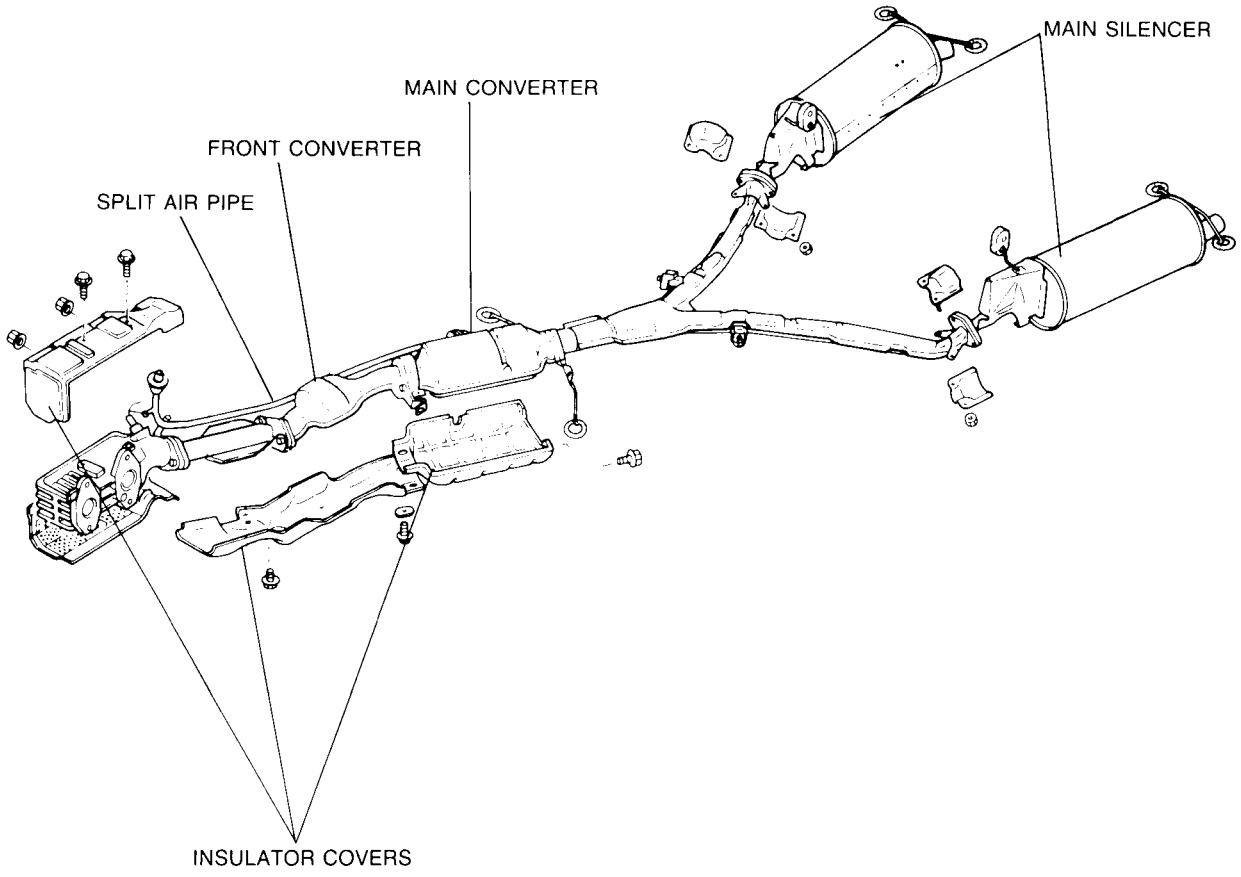
Exhaust Devices



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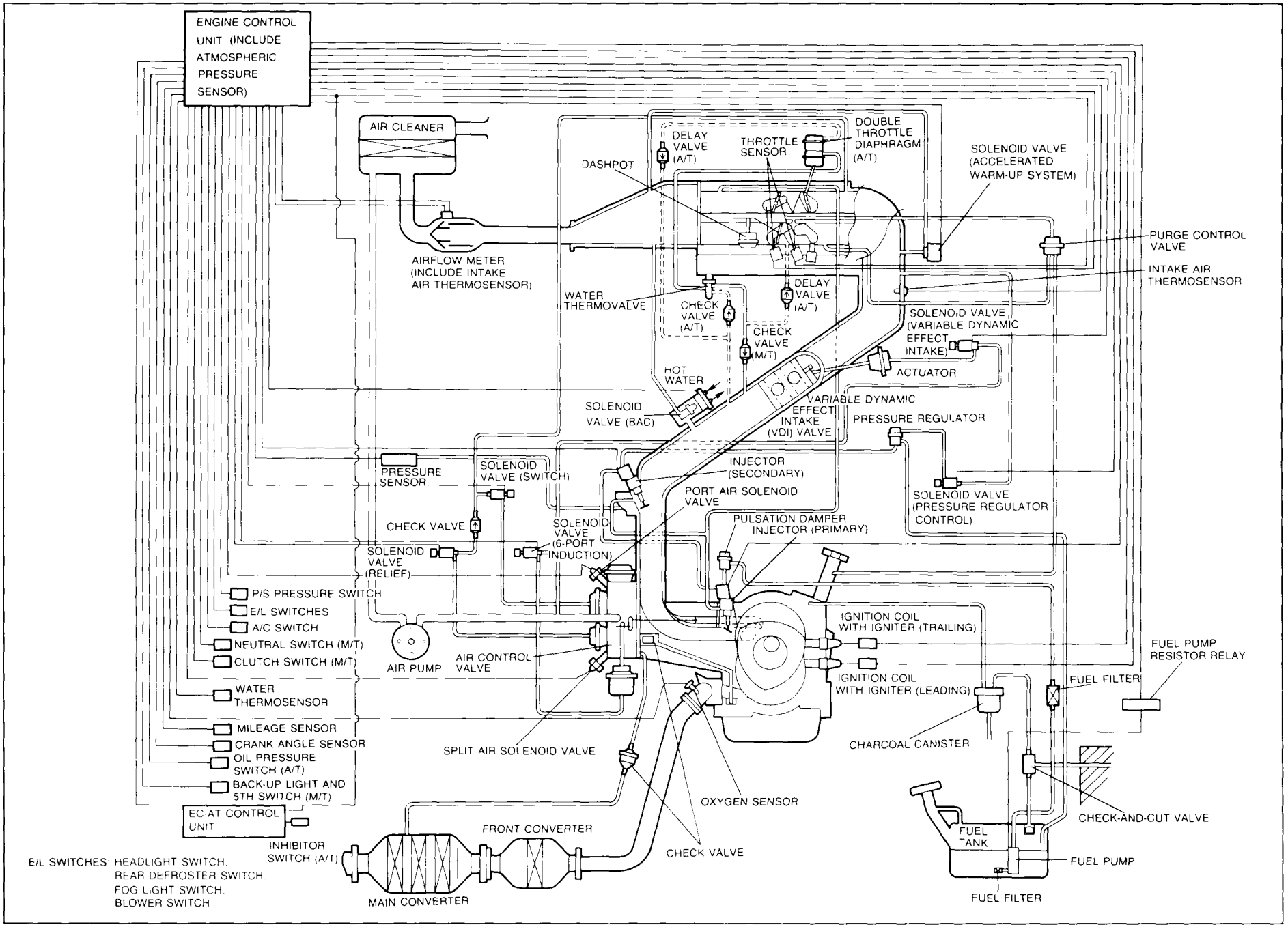
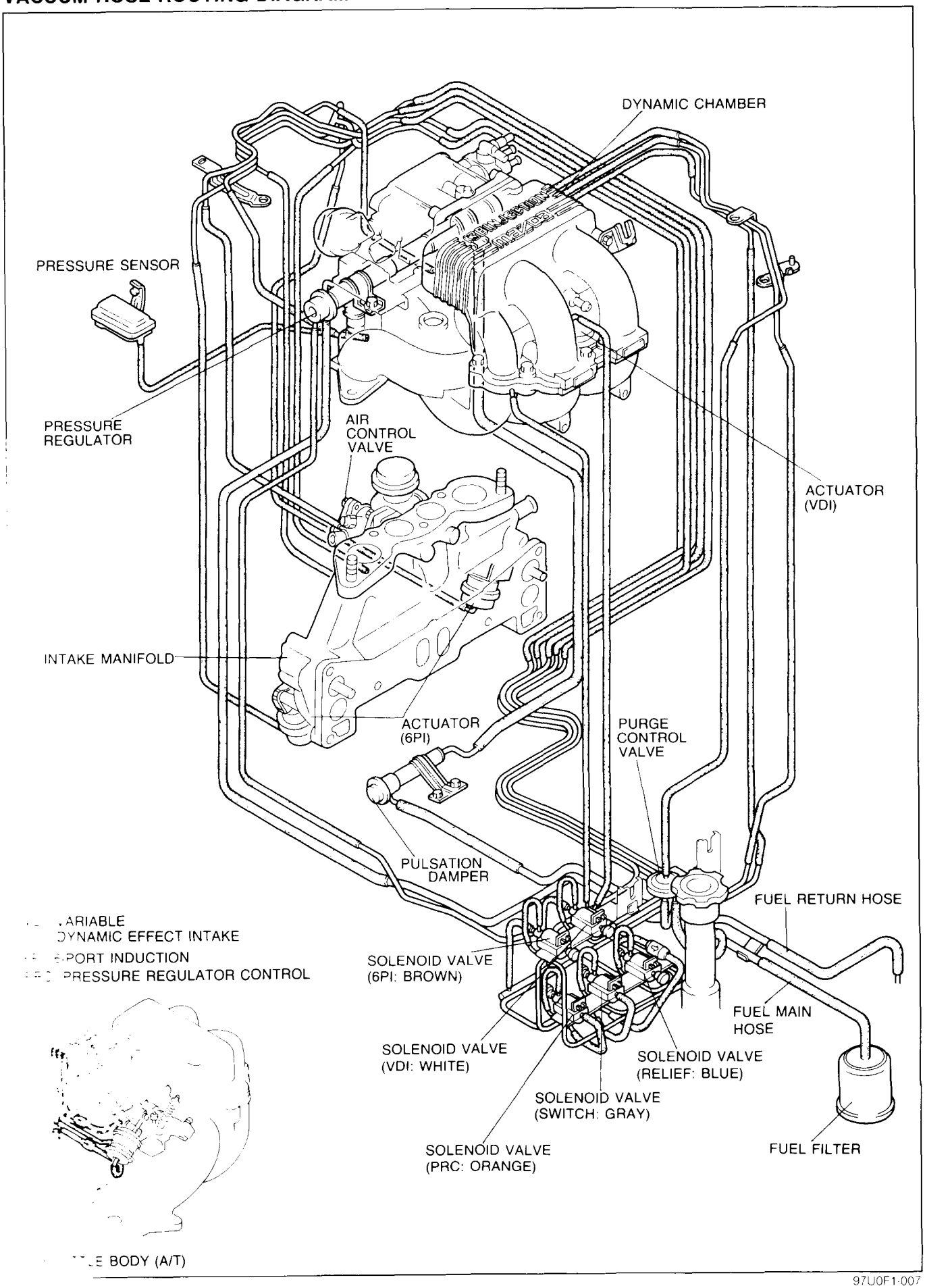
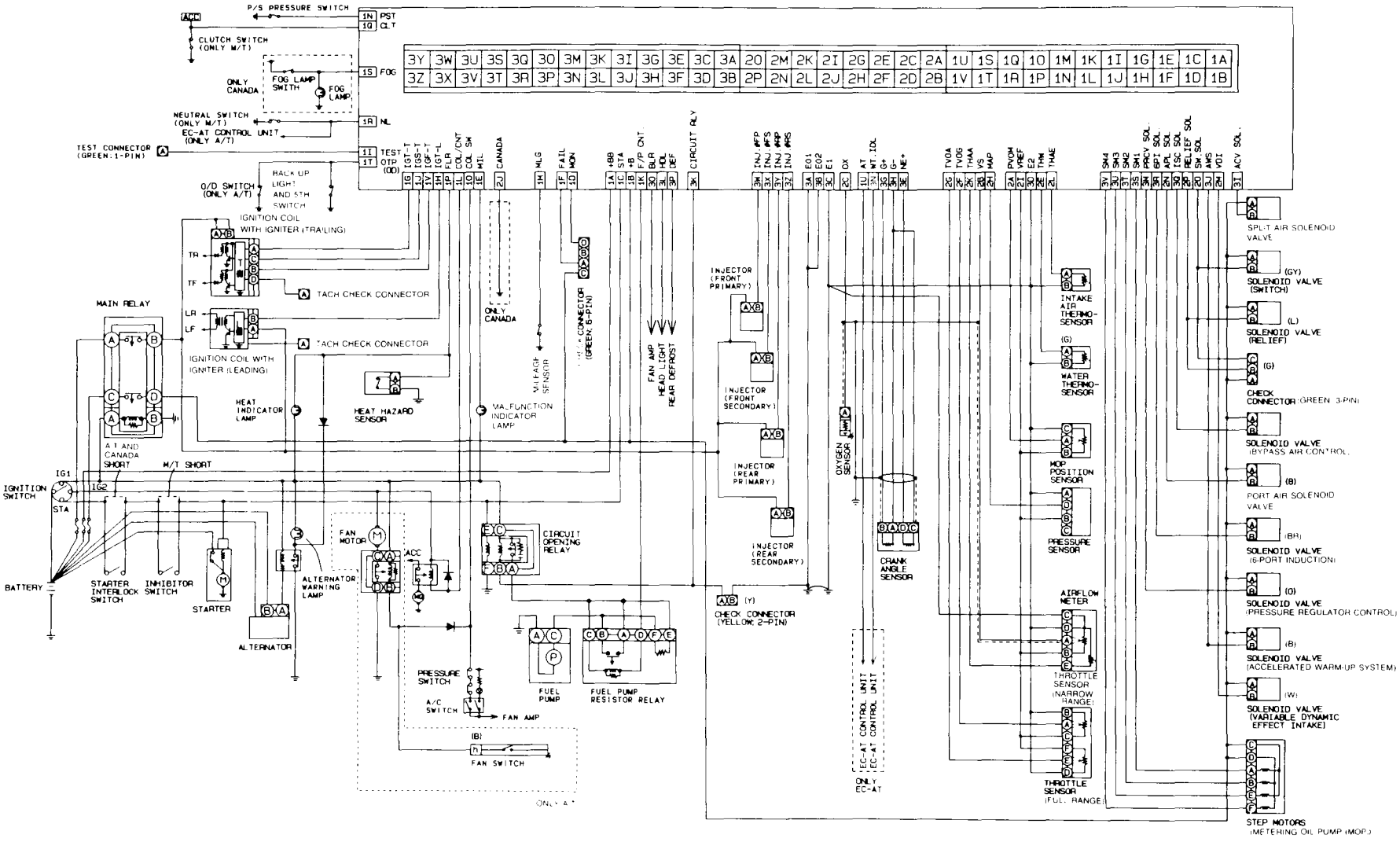

ENGINE CONTROL UNIT (INCLUDE ATMOSPHERIC PRESSURE SENSOR)
AIR CLEANER
DELAY VALVE (A/T)
THROTTLE SENSOR
DOUBLE THROTTLE DIAPHRAGM (A/T)
SOLENOID VALVE (ACCELERATED WARM-UP SYSTEM)
DASHPOT
PURGE CONTROL VALVE
INTAKE AIR THERMOSENSOR
AIRFLOW METER (INCLUDE INTAKE AIR THERMOSENSOR)
WATER THERMOVALVE
CHECK VALVE (A/T)
DELAY VALVE (A/T)
CHECK VALVE (M/T)
SOLENOID VALVE (VARIABLE DYNAMIC EFFECT INTAKE)
ACTUATOR
HOT WATER
SOLENOID VALVE (BAC)
VARIABLE DYNAMIC EFFECT INTAKE (VDI) VALVE
PRESSURE REGULATOR
PRESSURE SENSOR
SOLENOID VALVE (SWITCH)
INJECTOR (SECONDARY)
PORT AIR SOLENOID VALVE
SOLENOID VALVE (PRESSURE REGULATOR CONTROL)
CHECK VALVE
SOLENOID VALVE (6-PORT INDUCTION)
PULSATION DAMPER INJECTOR (PRIMARY)
SOLENOID VALVE (RELIEF)
P/S PRESSURE SWITCH
E/L SWITCHES
A/C SWITCH
NEUTRAL SWITCH (M/T)
CLUTCH SWITCH (M/T)
IGNITION COIL WITH IGNITER (TRAILING)
FUEL PUMP RESISTOR RELAY
AIR PUMP
AIR CONTROL VALVE
IGNITION COIL WITH IGNITER (LEADING)
FUEL FILTER
WATER THERMOSENSOR
CHARCOAL CANISTER
MILEAGE SENSOR
CRANK ANGLE SENSOR
OIL PRESSURE SWITCH (A/T)
SPLIT AIR SOLENOID VALVE
BACK-UP LIGHT AND 5TH SWITCH (M/T)
OXYGEN SENSOR
CHECK-AND-CUT VALVE
EC-AT CONTROL UNIT
FRONT CONVERTER
FUEL TANK
INHIBITOR SWITCH (A/T)
CHECK VALVE
FUEL PUMP
E/L SWITCHES: HEADLIGHT SWITCH, REAR DEFROSTER SWITCH, FOG LIGHT SWITCH, BLOWER SWITCH
MAIN CONVERTER
FUEL FILTER
97UOF1-508

VACUUM HOSE ROUTING DIAGRAM



97U0F1-007


P/S PRESSURE SWITCH
ACC
CLUTCH SWITCH (ONLY M/T)
ONLY CANADA
FOG LAMP SWITH
FOG LAMP
NEUTRAL SWITCH (ONLY M/T)
EC-AT CONTROL UNIT (ONLY A/T)
TEST CONNECTOR (GREEN: 1-PIN)
O/D SWITCH (ONLY A/T)
BACK UP LIGHT AND 5TH SWITCH
IGNITION COIL WITH IGNITER (TRAILING)
TACH CHECK CONNECTOR
IGNITION COIL WITH IGNITER (LEADING)
MAIN RELAY
HEAT INDICATOR LAMP
HEAT HAZARD SENSOR
MALFUNCTION INDICATOR LAMP
MILEAGE SENSOR
ONLY CANADA
FAN AMP
HEAD LIGHT
REAR DEFOST
CIRCUIT RLY
INJECTOR (FRONT PRIMARY)
INJECTOR (FRONT SECONDARY)
INJECTOR (REAR PRIMARY)
INJECTOR (REAR SECONDARY)
OXYGEN SENSOR
CRANK ANGLE SENSOR
CHECK CONNECTOR (YELLOW, 2-PIN)
EC-AT CONTROL UNIT
ONLY EC-AT
INTAKE AIR THERMO-SENSOR
WATER THERMO-SENSOR
MOP POSITION SENSOR
PRESSURE SENSOR
AIRFLOW METER
THROTTLE SENSOR (NARROW RANGE)
THROTTLE SENSOR (FULL RANGE)
SPLIT AIR SOLENOID VALVE
SOLENOID VALVE (SWITCH)
SOLENOID VALVE (RELIEF)
CHECK CONNECTOR (GREEN, 3-PIN)
SOLENOID VALVE (BYPASS AIR CONTROL)
PORT AIR SOLENOID VALVE
SOLENOID VALVE (6-PORT INDUCTION)
SOLENOID VALVE (PRESSURE REGULATOR CONTROL)
SOLENOID VALVE (ACCELERATED WARM-UP SYSTEM)
SOLENOID VALVE (VARIABLE DYNAMIC EFFECT INTAKE)
STEP MOTORS (METERING OIL PUMP (MOP))
IGNITION SWITCH
BATTERY
STARTER INTERLOCK SWITCH
INHIBITOR SWITCH
STARTER
ALTERNATOR
ALTERNATOR WARNING LAMP
FAN MOTOR
CIRCUIT OPENING RELAY
PRESSURE SWITCH
A/C SWITCH
FAN SWITCH
FUEL PUMP
FUEL PUMP RESISTOR RELAY
A/T AND CANADA SHORT
M/T SHORT

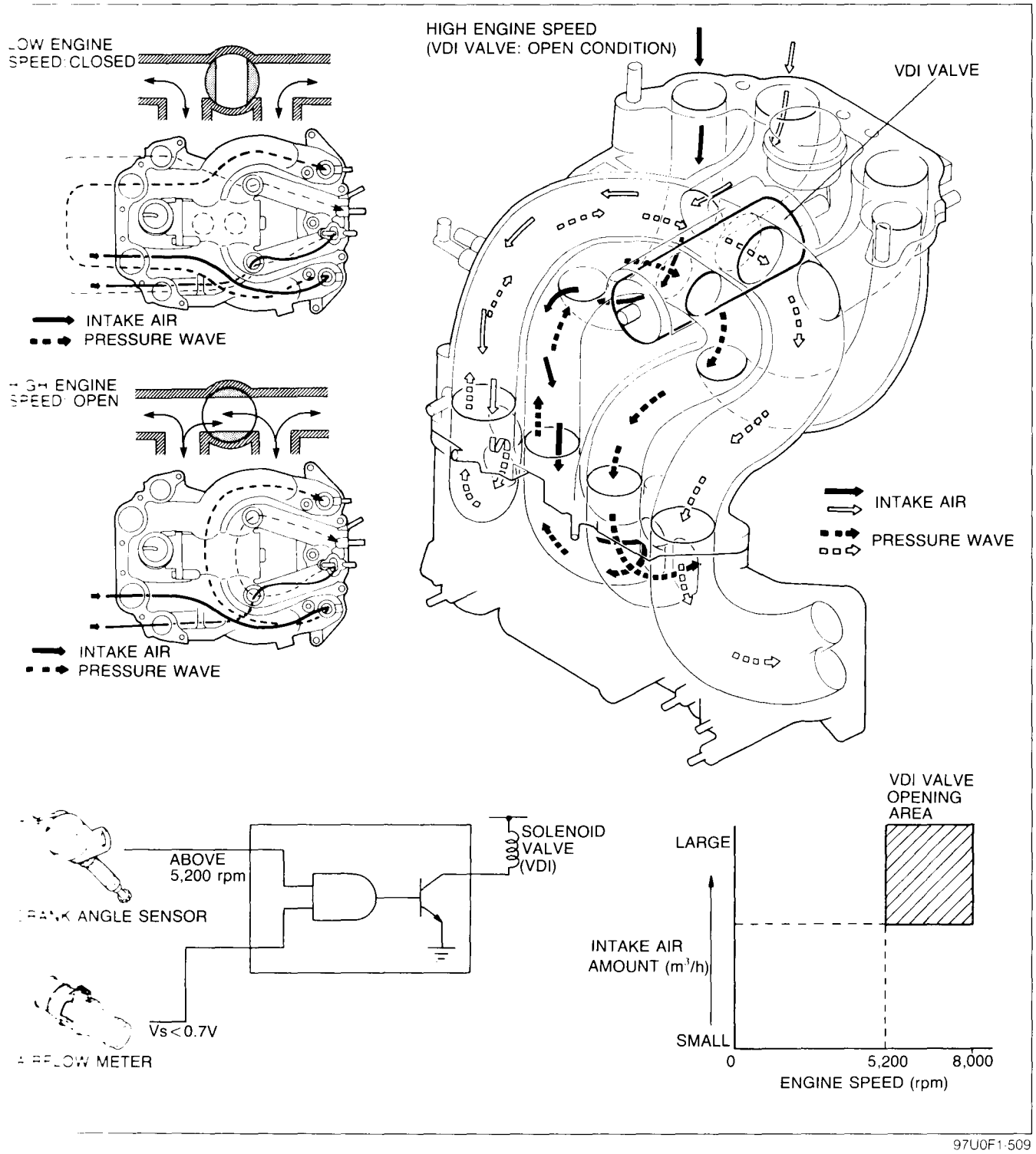
SPECIFICATIONS

Item			Model: 13B EGI engine
Idle speed (Test connector (green: 1-pin) grounded)		rpm	750 ± 25 (for A/T...N Range)
Air cleaner	Element type		Long life wet
	Type		Horizontal — draft (2 stage — 3 barrel)
Throttle body	Throat diameter	Primary mm (in)	45 (1.772)
		Secondary mm (in)	45 (1.772) x 2
	Water thermovalve	Operation temp. °C (°F)	M/T: 67—77 (153—171) or more A/T: 60—70 (140—158) or more
Dashpot	Adjustment speed	rpm	2,700—3,100
Fuel tank	Capacity liters (US gal, Imp gal)		70 (18.5, 15.4)
Fuel filter	Low pressure		Nylon 6 (164 and 45 mesh)
	High pressure		Filter paper
Pressure regulator	Type		Diaphragm
	Regulated pressure kPa (kg/cm^2, psi)		235—275 (2.4—2.8, 34.1—39.8)
Fuel pump	Type		Impeller (intank)
	Outlet pressure kPa (kg/cm^2, psi)		441—588 (4.5—6.0, 64.0—85.3)
Injector (Primary and Secondary)	Drive		Voltage drive
	Injection volume cc (cu in)/15 sec.		111—118 (6.8—7.2)
Heat hazard sensor	Operation temperature	°C (°F)	105—115 (221—239)
Main silencer	Capacity	cc (cu in)	M/T: 10,300 (628.3) x 2, A/T: 12,000 (732) x 2
Ignition timing (Test connector (green: 1-pin) grounded)			Leading: 5° ± 1° ATDC Trailing : 20° ± 2° ATDC
Distribution	Type		Engine control unit
Spark advance	Type		Engine control unit
Idle-up system	A/C	rpm	M/T: 875 A/T: 800
	"D" range	rpm	750 (at warm engine)
Bypass air control system			Linear solenoid
Anti-afterburn valve	Operation time	sec.	M/T: 1.60—2.20 A/T: 0.52—0.92

97U0F1511

VARIABLE DYNAMIC EFFECT INTAKE (VDI) SYSTEM

This system consists of the VDI valve, solenoid valve, and actuator. The VDI valve is built into the exten mani-fold. Operation of this system is as shown below.



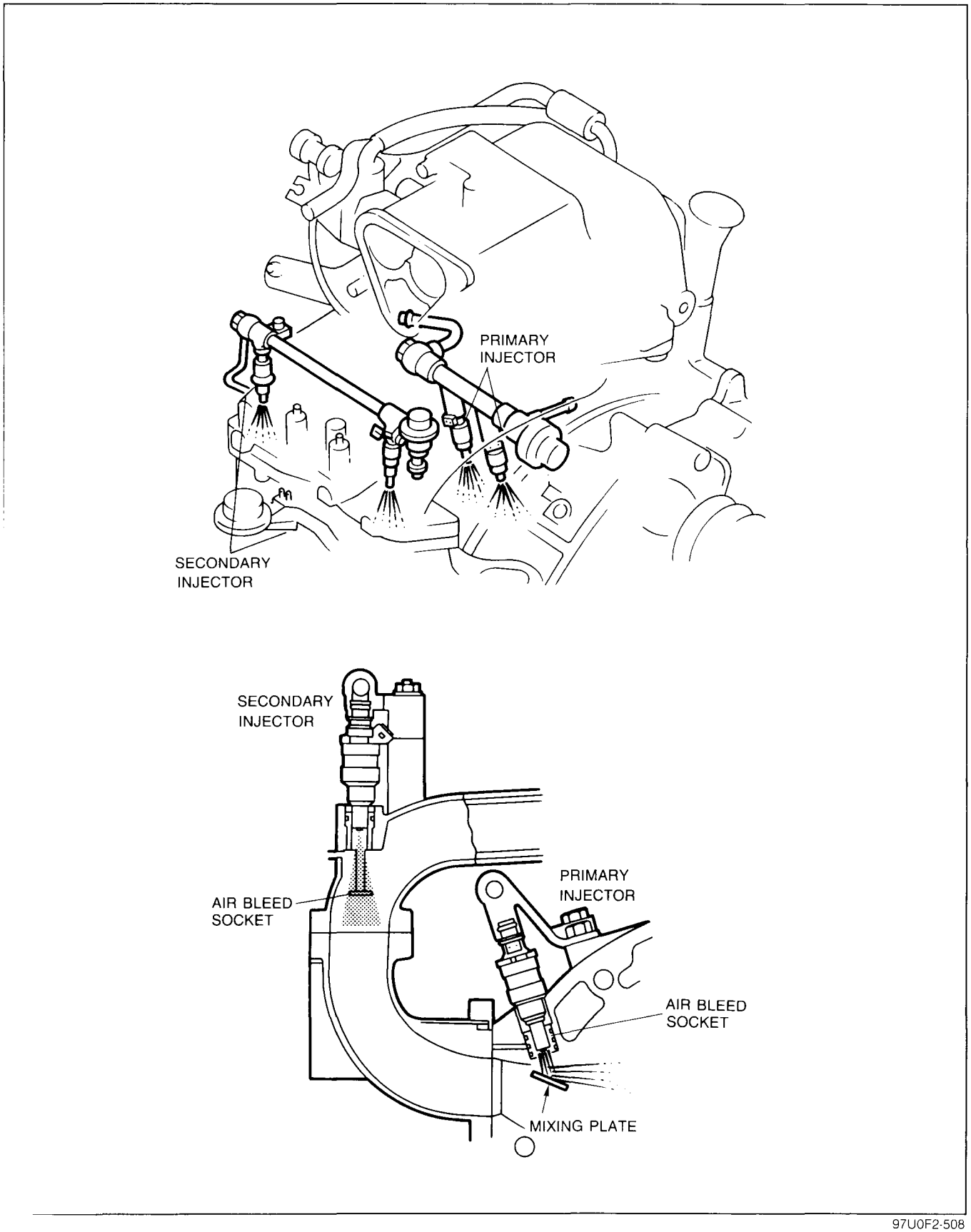
97U0F1-509

During engine operation, when intake air flows to a port closed by the rotor a pressure wave is created. This pressure wave then goes toward the open intake port, compressing the intake air along the way. At low engine speed, the VDI valve is closed, causing the pressure wave path to be long. At high engine speed, the VDI valve opens and the pressure wave quickly pressurizes the intake air through the shortened path. Thus, air is forced into the combustion chamber at all engine speeds.

Some pressurization is induced at the time of the opening of the intake port, when the high-pressure exhaust gas remaining in the working chamber generates strong pressure waves that rush into the intake manifold.

FUEL SYSTEM

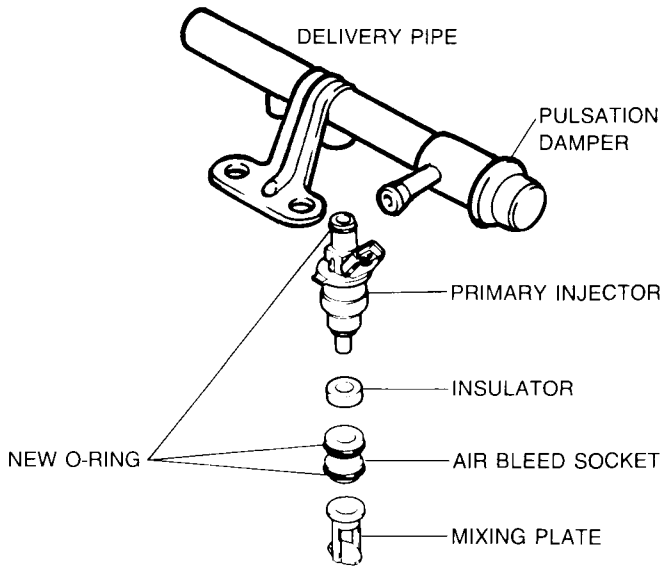
MIXING PLATE

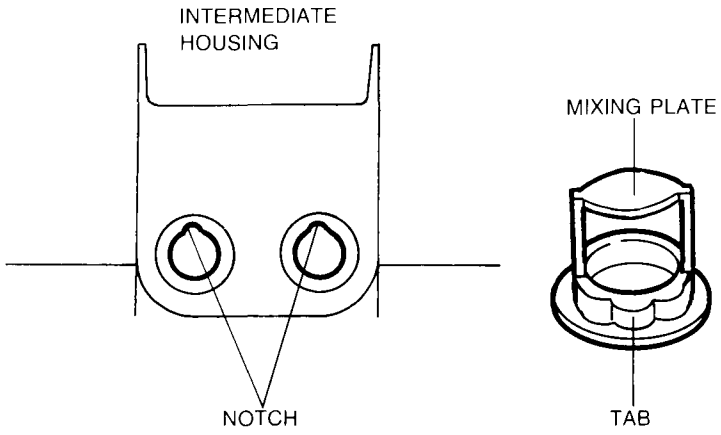


97U0F2-508

ng plate is installed at the tip of primary injector to direct the primary fuel injection fuel directly into
ake air port.

SERVICE POINT



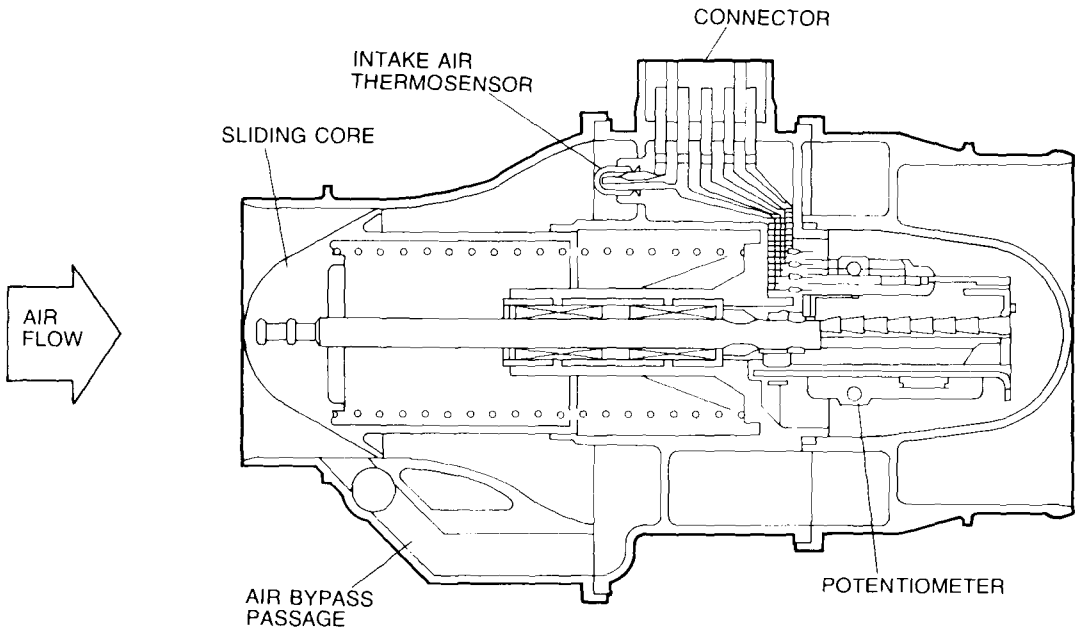


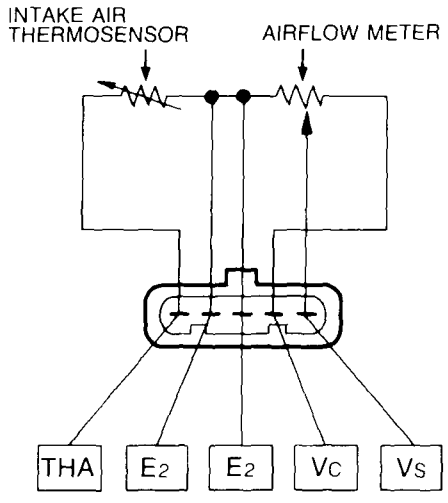
97U0F2-509

The primary injector is installed noting the following:
1. Install the parts in the order shown in the figure.
2. Use a new insulator and O-rings.
3. Align the tabs of the mixing plate with the notches in the intermediate housing.

CONTROL SYSTEM

AIRFLOW METER



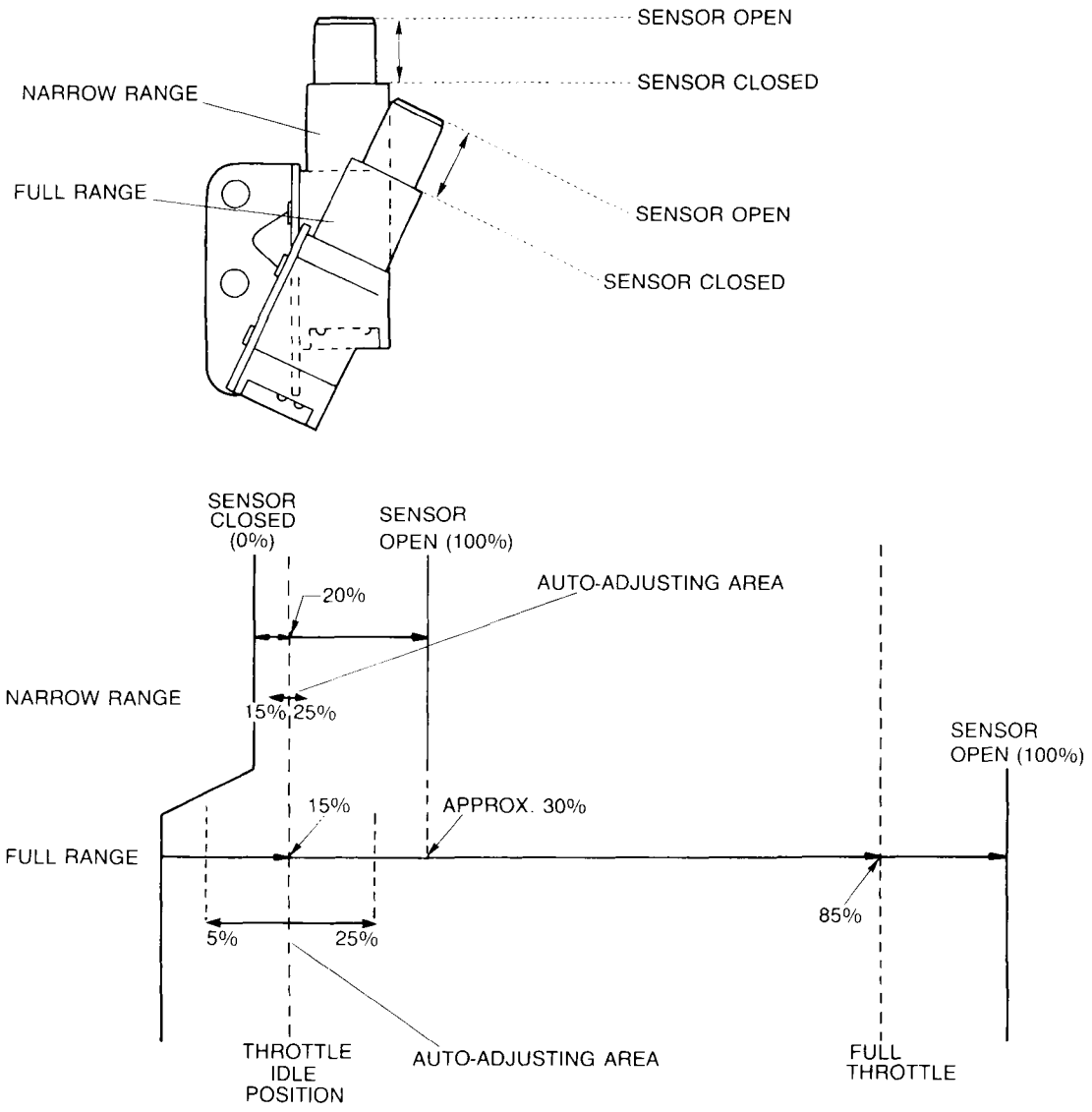


97U0F2-513

...eter is changed from a vane type to a linear type. The sliding core moves parallel to the airflow

...gn, there is little air damping and low air resistance as a result of the streamlined shape.

THROTTLE-IDLE-POSITION AUTO-ADJUSTING SYSTEM

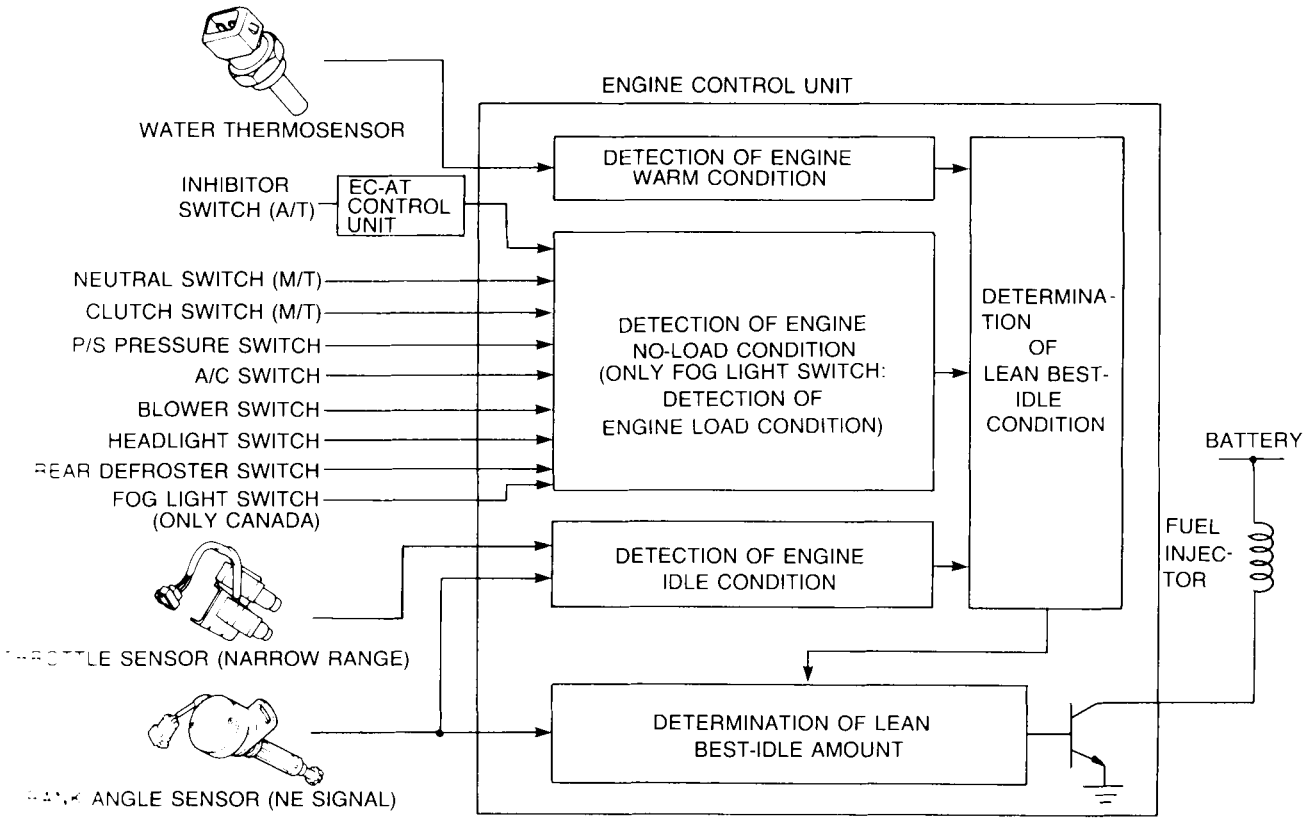


97U0F2-514

Newly developed throttle-idle-position auto-adjusting system is incorporated within the engine control unit. This system automatically compensates for certain variations in the output signal of the throttle sensors. For example, the narrow range throttle sensor is set to output a signal of 20% of full-open. With the throttle idle-position auto-adjusting system, the engine control unit will compensate for actual output values of 15%—25%. If the output is less than 15% or more than 25% at idle, the engine control unit fixes the value at 15% and 25% respectively for fail-safe operation.

Operation for the full range sensor is the same. The sensor is set to register a 15% signal at idle, and the engine control unit compensates within the range from 5%—25%. If over or under the signal is fixed at 5% and 25% respectively for fail-safe operation.

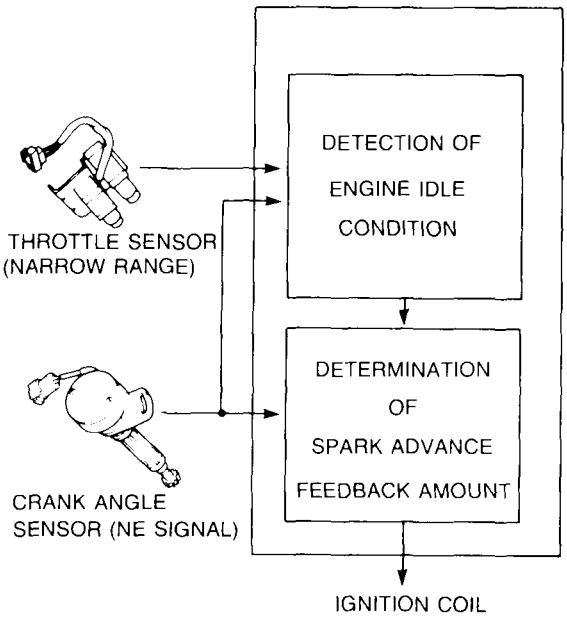
LEAN BEST-IDLE CONTROL SYSTEM

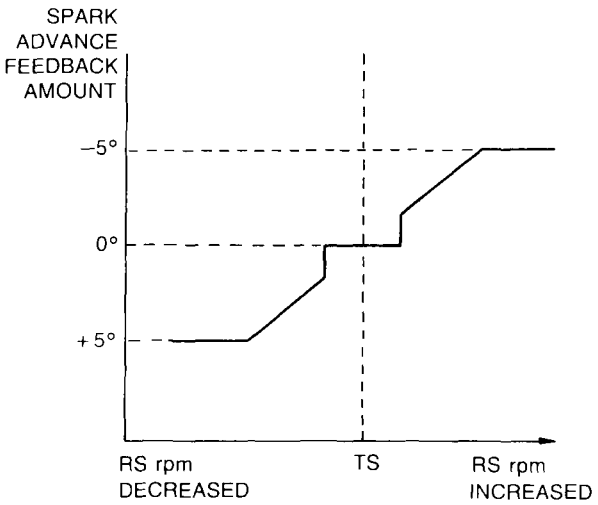


97U0F2-515

...ced fuel consumption and reduced exhaust emissions at idle, the lean best-idle control system is ... With this system, the engine control unit sets fuel injection at idle to the leanest amount possible ...sing lean misfire and rough idle.

SPARK ADVANCE FEEDBACK SYSTEM (ENGINE AT IDLE)



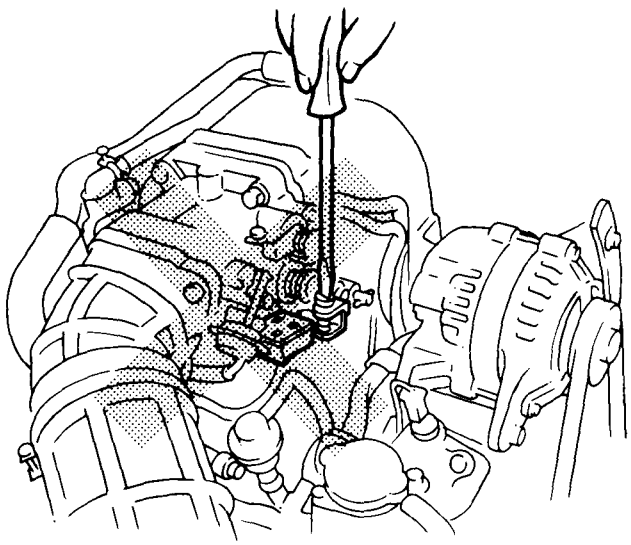


TS: TARGET ENGINE SPEED
RS: REAL ENGINE SPEED

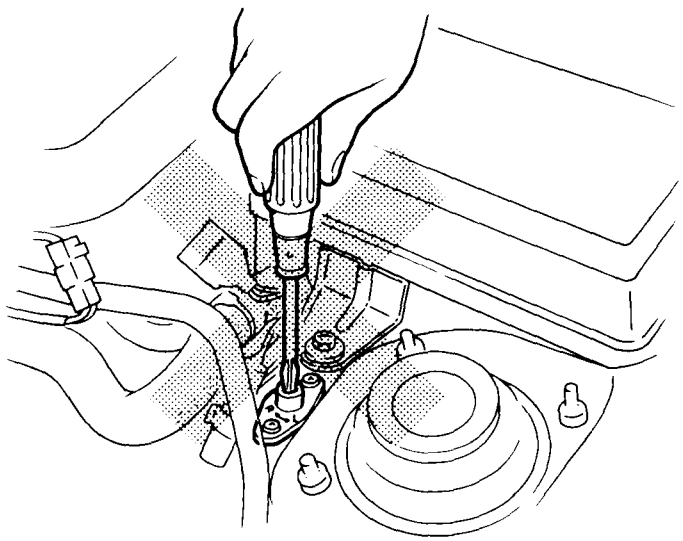
97U0F2-516

To prevent rough idle caused by incorrect idle speeds, the spark advance feedback system controls the spark advance. The engine control unit judges the engine speed (real speed: RS) and then adjusts the ignition timing to obtain the preprogrammed target speed (TS).

THROTTLE SENSOR ADJUSTMENT



IDLE MIXTURE ADJUSTMENT



[illegible] adjustment: Not usually necessary unless throttle sensor unit is replaced. Throttle-idle-position auto-adjusting system automatically compensates.

[illegible] adjustment : Not necessary because of lean best-idle control system. (Variable resistor eliminated.)

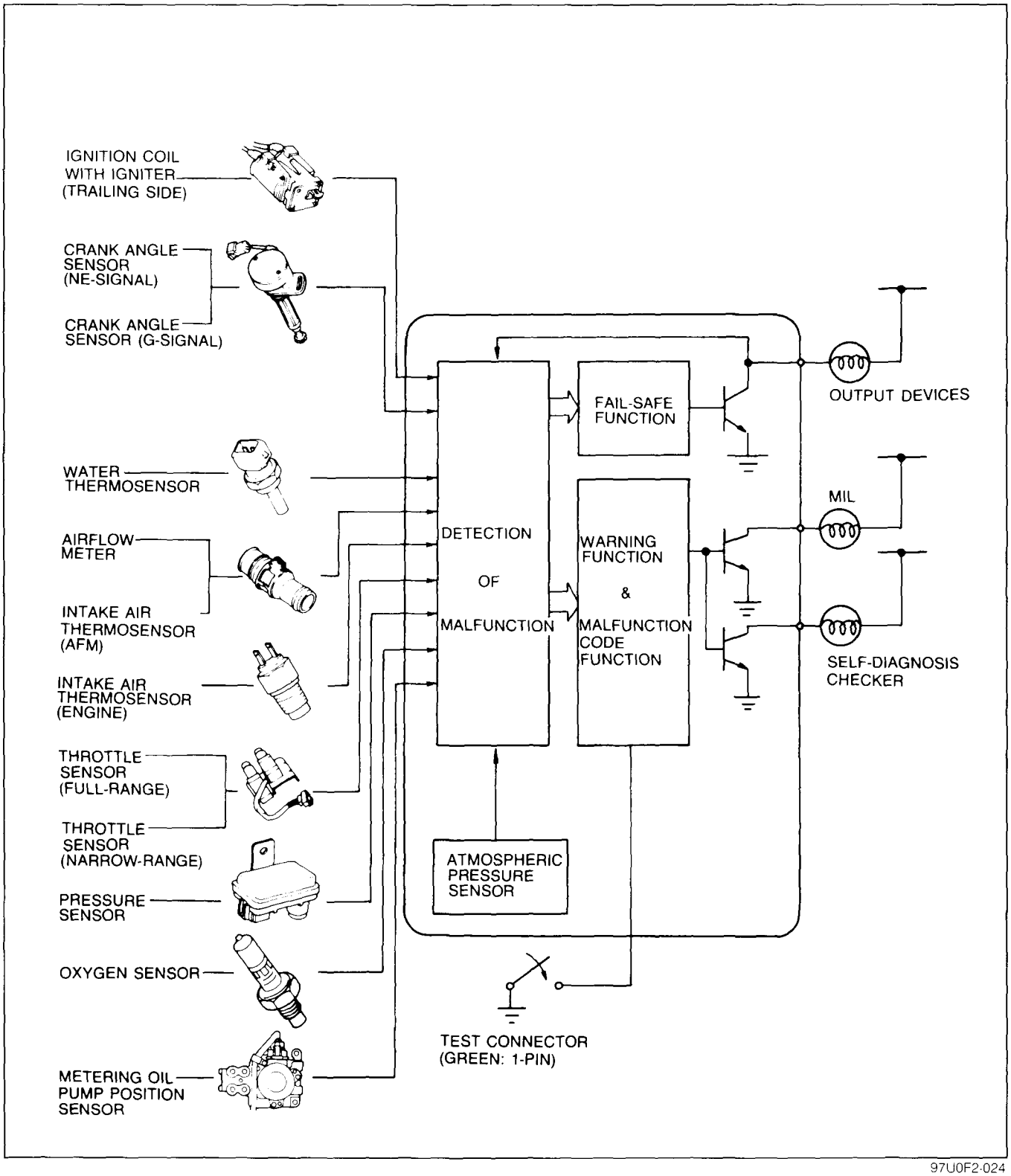
SELF-DIAGNOSIS FUNCTION

DESCRIPTION

When troubles are suspected in the main input devices or output devices, check for the cause with the **SST**. Failures of individual input and output devices are indicated and retrieved from the control unit as malfunction code numbers.

Note

The control unit constantly checks for malfunction of the input devices. It checks for malfunction of output devices only during a 3-second period after the ignition switch has been turned ON while the test connector is grounded.

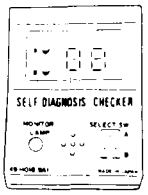


97U0F2-024

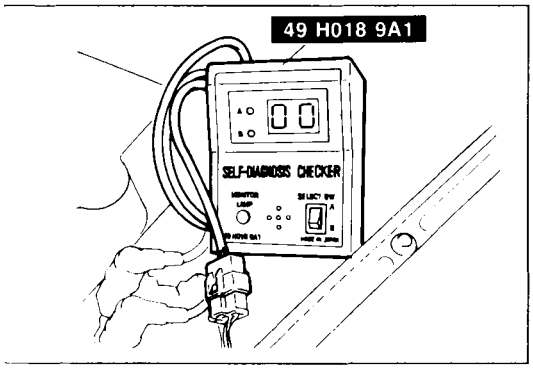
MALFUNCTION CODE NUMBER
SST

49 H018 9A1

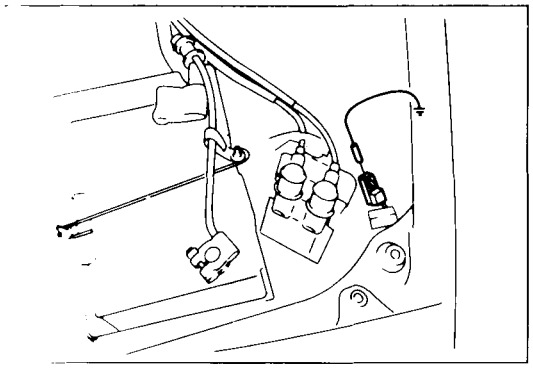
Self-Diagnosis Checker



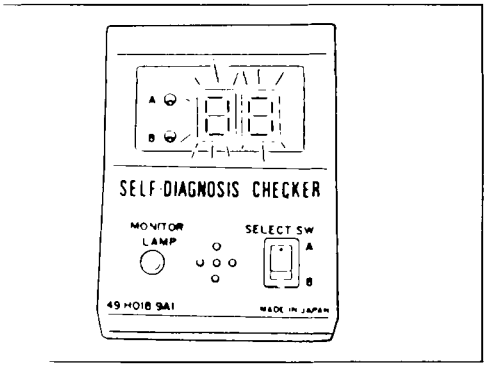
97U0F1-512



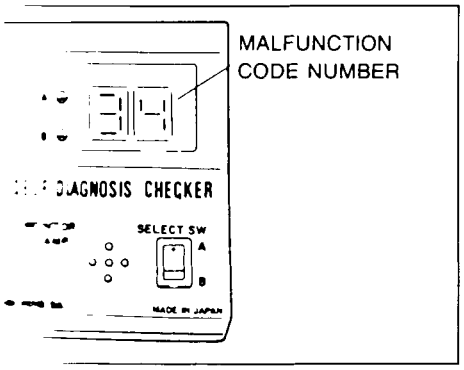
97U0F1-513



97U0F2-027



97U0F1-514



97U0F1-510

Inspection Procedure

1. Warm up the engine to normal operating temperature and stop it.
2. Connect the **SST** to the check connector (Green: 6-pin) and the negative battery terminal.
   Set the select switch to position **A**.
3. Connect a jumper wire between the test connector (Green: 1-pin) and a body ground.
4. Turn the ignition switch ON.
5. Check that **88** flashes on the digital display and the buzzer sounds for **3 sec.** after turning the ignition switch ON.
6. If **88** does not flash, check the check connector wiring.
7. If **88** flashes and the buzzer sounds continuously for more than **20 sec.**, check for a short circuit between the engine control unit (1F) terminal and check connector (Green: 6-pin). And check the engine control unit (3X) and (3Z) terminal voltage. Replace the engine control unit if necessary and perform Step 4 again.
8. Check for any malfunction code numbers.
9. Start the engine and check for further malfunction code numbers.
10. If a malfunction code number is indicated, check for the cause of the problem.

Note
Cancel the malfunction code numbers by performing the after-repair procedure following repairs.

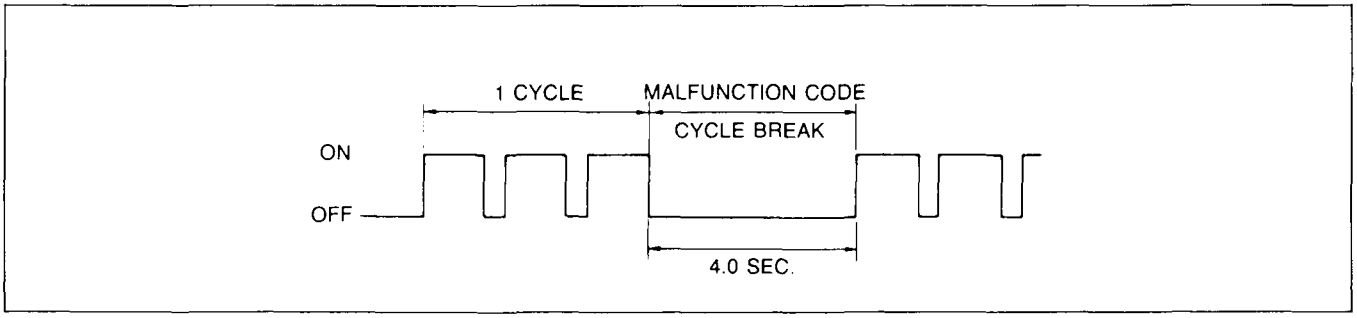
Principle of code cycle

Malfunction codes are determined as below by use of the MIL and Self-Diagnosis Checker.

97U0F1-515

1. Malfunction code cycle break

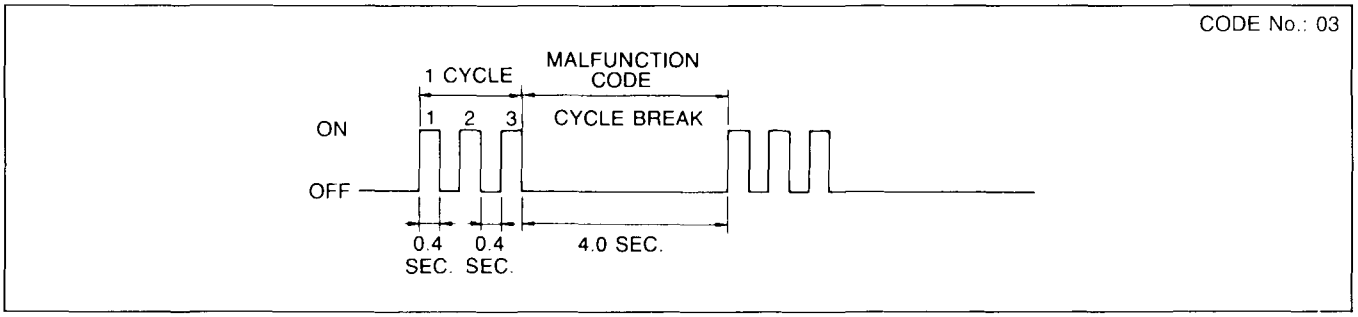
The time between malfunction code cycles is 4.0 sec. (the time the MIL and checker buzzer are off).



9MU0F1-543

2. Second digit of malfunction code (ones position)

The digit in the ones position of the malfunction code represents the number of times the MIL and buzzer are on 0.4 sec. during one cycle.

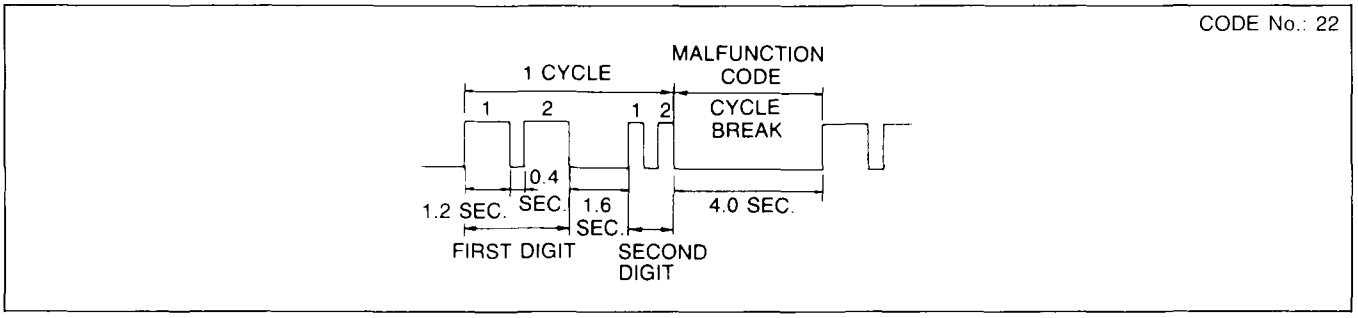


89U04X-565

3. First digit of malfunction code (tens position)

The digit in the tens position of the malfunction code represents the number of times the MIL and buzzer are on 1.2 sec. during one cycle.

The MIL and buzzer are off for 1.6 sec. between the long and short pulses.



89U04X-566

Code number

Caution

a) If there is more than one failure present, the lowest number malfunction code is displayed first, the subsequent malfunction codes appear in order.

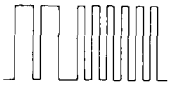
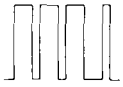
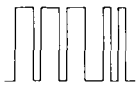
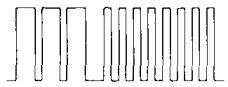
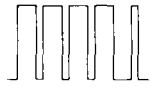
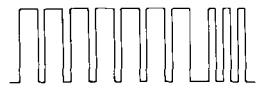
b) After repairing all failures, turn the ignition switch OFF, disconnect the negative battery cable, at least 5 seconds to erase the malfunction code memory.

Input devices

Code No.	Input devices	Malfunction	Fail-safe function	Output signal pattern (Self-Diagnosis Checker or MIL)
0[illegible]	Ignition coil with igniter (Trailing side)	Malfunction of spark plug, broken wire, short circuit	Trailing-side ignition pulse cut	
[illegible]2	Crank angle sensor (Ne signal)	Broken wire, short circuit	Fuel injection and ignition cut	
[illegible]	Crank angle sensor (G signal)	Broken wire, short circuit	Fuel injection and ignition cut	
[illegible]	Airflow meter (AFM)	Broken wire, short circuit	Basic fuel injection amount and ignition timing fixed	
[illegible]	Water thermosensor	Broken wire, short circuit	Coolant temp. input fixed at 80°C (176°F)	
[illegible]	Intake air thermosensor (AFM)	Broken wire, short circuit	Intake air temp. input fixed at 20°C (68°F)	
[illegible]	Intake air thermosensor (Engine)	Broken wire, short circuit	Intake air temp. input fixed at 20°C (68°F)	
[illegible]	Throttle sensor (Full range)	Broken wire, short circuit	Throttle valve opening angle input signal fixed at 20% open	
[illegible]	Pressure sensor (Intake manifold pressure)	Broken wire, short circuit	Intake manifold pressure input signal fixed at 760 mmHg (29.9 inHg)	
[illegible]	Atmospheric pressure sensor (ATP) (Built in ECU)	Malfunctioning ECU	Atmospheric pressure input signal fixed at 760 mmHg (29.9 inHg)	
[illegible]	Oxygen sensor	Oxygen sensor output remains below 0.55V 80 sec. after F/B system operation begining	Feedback system canceled (For EGI)	
[illegible]	Feedback system	Oxygen sensor output remains 0.55V [illegible]0 sec. after F/B system operation begining	Feedback system canceled (For EGI)	
[illegible]	Throttle sensor (Narrow range)	Broken wire, short circuit	Throttle valve opening angle input signal fixed at full open	
[illegible]	Metering oil pump position sensor	Broken wire, short circuit	MOP fixed smallest open Basic fuel injection amount and ignition timing fixed	
[illegible]	Metering oil pump (MOP)	Malfunctioning MOP, step motors, broken wire, short circuit, or malfunctioning ECU	MOP fixed smallest open Basic fuel injection amount and ignition timing fixed	
[illegible]	Metering oil pump (MOP)	Malfunctioning MOP, step motors, broken wire, short circuit, malfunctioning ECU, alternator or battery	Basic fuel injection amount and ignition timing fixed	

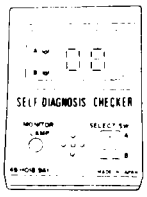
97U0F1-516

Output devices

Code No.	Output devices	Output signal pattern (Self-Diagnosis Checker or MIL)
25	Solenoid valve (Pressure regulator control (PRC))	
26	Step motor (Metering oil pump)	
30	Split air solenoid valve	
31	Solenoid valve (Relief)	
32	Solenoid valve (Switch)	
33	Port air solenoid valve	
34	Solenoid valve (Bypass air control)	
38	Solenoid valve (Accelerated warm-up system (AWS))	
40	Solenoid valve (6-port induction)	
41	Solenoid valve (Variable dynamic effect intake (VDI))	
51	Fuel pump resistor relay	
71	Injector (Front secondary)	
73	Injector (Rear secondary)	

97U0F1-517

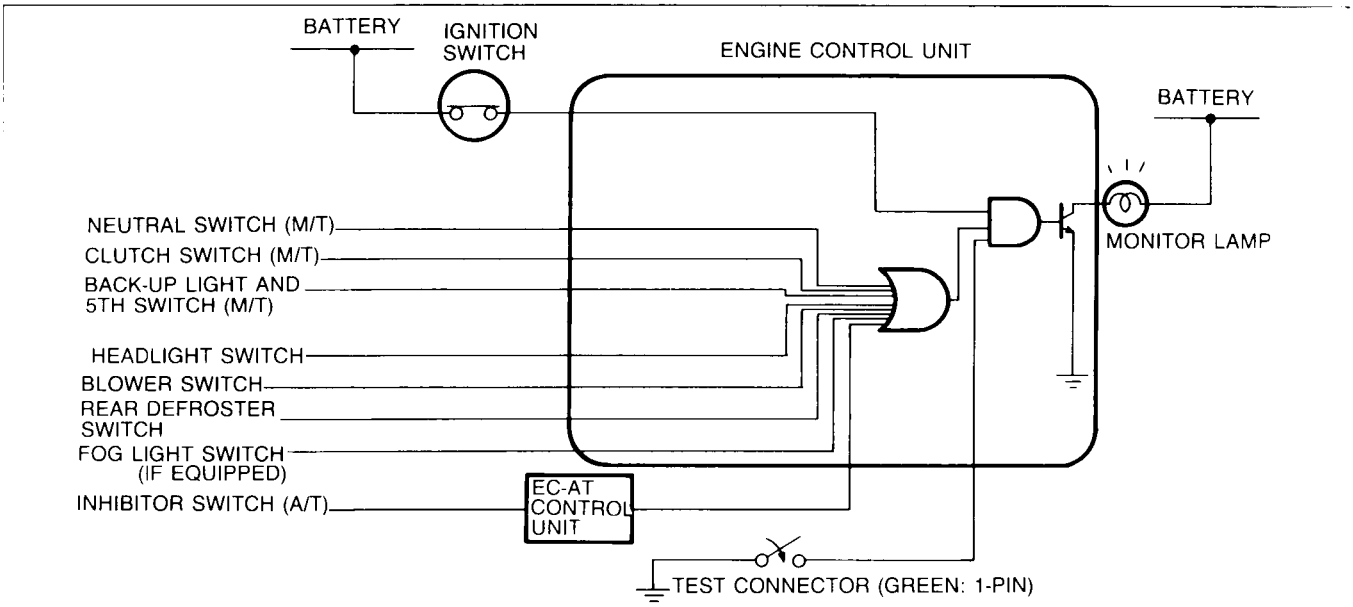
SWITCH MONITOR FUNCTION
Preparation
SST

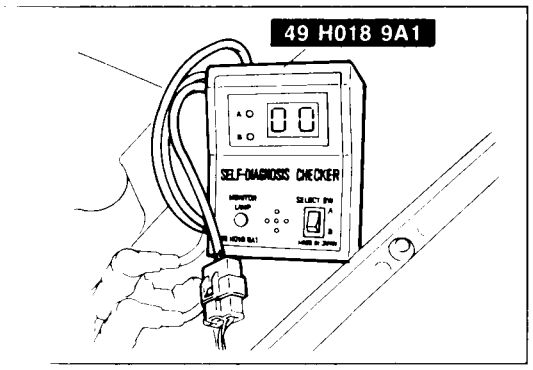
49 H018 9A1 Self-Diagnosis Checker	

97U0F2-064

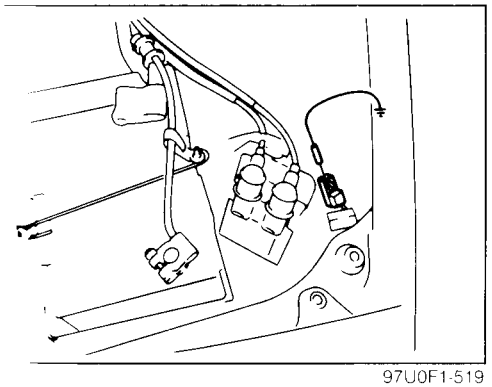
Individual switches can be monitored by the **SST**.

Note
The test connector must be grounded and the ignition switch ON (engine stopped).





97U0F2-066



97U0F1-519

Inspection Procedure

1. Warm up the engine to normal operating temperature a : stop it.
2. Connect the **SST** to the check connector (Green: 6-pin) a : the negative battery terminal.
3. Connect a jumper wire between the test connector (Gr : 1-pin) and a ground.
4. Turn the ignition switch ON, then check that the mo : lamp illuminates when each switch is made to functio : cording to the function table.

Caution
a) When any one of the switches are activated, the monitor lamp will be on.
b) Do not start the engine.

Function Table

Switch	Self-Diagnosis Checker (Monitor lamp) Lamp-ON	Lamp-OFF	Possible cause (When incorrect)
Neutral switch (M/T)	Shift transmission to 1, 2, 3 or 4	Neutral position	• Neutral switch malfunction • Open circuit between neutral switch and ECU 1R terminal, neutral switch and ground
Back-up light and 5th switch (M/T)	Shift transmission 5th gear	Neutral position	• Back-up light and 5th switch malfunction • Open circuit between Back-up light and 5th switch and ECU 1T terminal, overdrive and ground
Clutch switch (M/T)	Pedal depressed	Pedal released	• Clutch switch malfunction • Open circuit between clutch switch and ECU 1Q terminal, clutch switch and ground, clutch switch and ACC circuit
Inhibitor switch (A/T)	Except N and P range	N and P range	• Inhibitor switch malfunction • EC-AT control unit malfunction • Open circuit between EC-AT control unit and ECU.
Headlight switch	Switch ON	Switch OFF	• Headlight switch malfunction • Open circuit between headlight switch and ECU 3L terminal, headlight switch and battery line
Blower switch	Switch ON (At any fan speed OK)	Switch OFF	• Blower switch malfunction • Heater relay malfunction • Heater control unit malfunction • Open circuit between heater control unit and ECU 3O terminal
Rear defroster switch	Switch ON	Switch OFF	• Rear defroster switch malfunction • Open circuit between rear defroster switch and ECU 3P terminal, rear defroster switch and ground
Fog light switch (If equipped)	Switch ON (Only equip fog light)	Switch OFF	• Fog light switch malfunction • Open circuit between fog light switch and ECU 1S terminal, fog light switch and battery

97U0F1-520

FUEL AND EMISSION CONTROL SYSTEMS (TURBO)

97U0F2-501

OUTLINE

OUTLINE OF CONSTRUCTION

Development Concepts

The development concepts for the new model are as follows:

1. Increased horsepower
2. Improved performance
3. Improved fuel economy
4. Improved serviceability

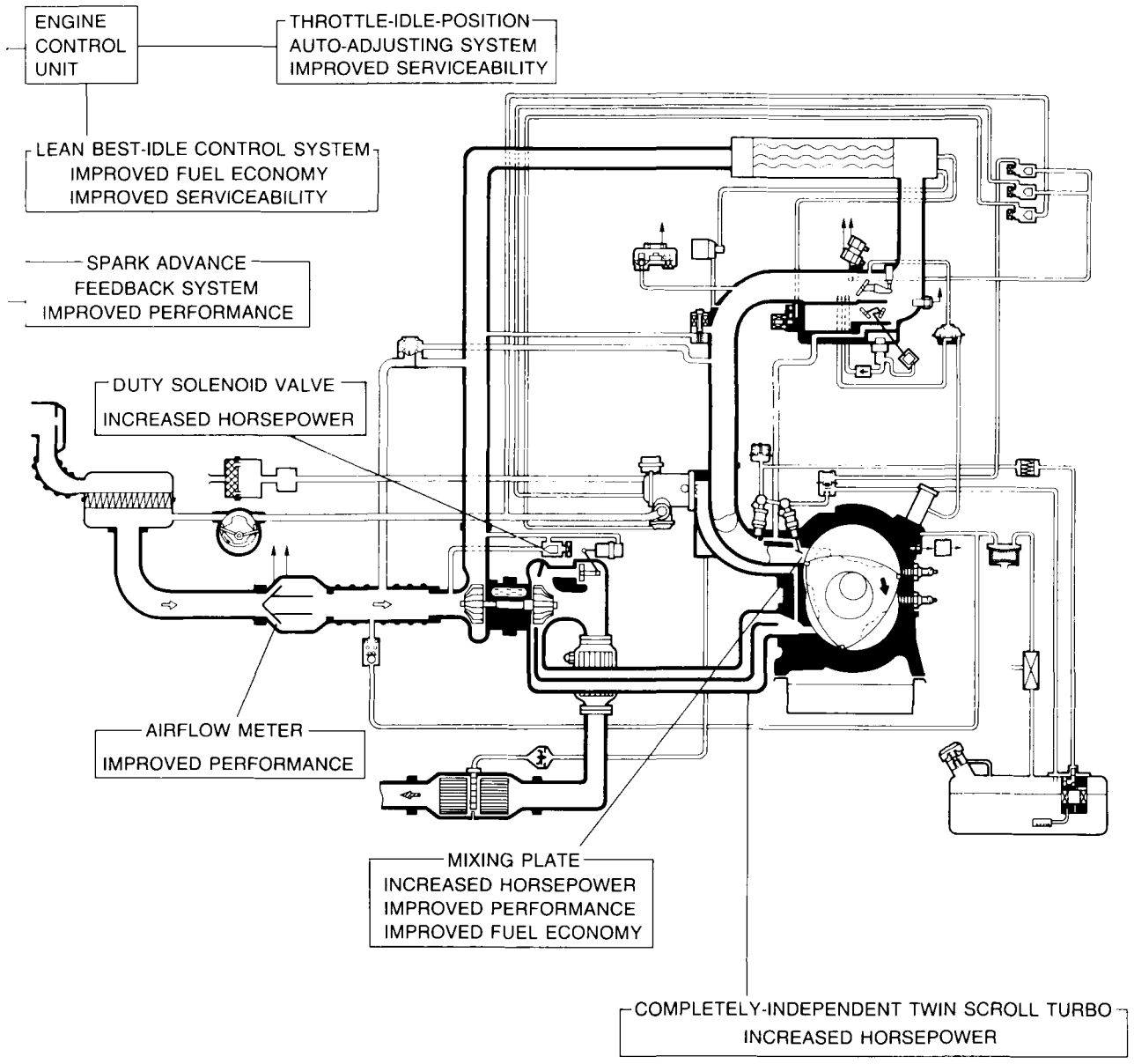
Areas of Improvement

Development concepts / Improved parts	Increased horsepower	Improved performance	Improved fuel economy	Improved serviceability
Airflow meter (Linear type)	X	○	X	X
Mixing plate (Primary fuel injection)	○	○	○	X
Completely-independent twin scroll turbo	○	X	X	X
Duty solenoid valve (Turbo boost pressure control system)	○	X	X	X
Throttle-idle-position auto-adjusting system	X	X	X	○
Lean best-idle control system (Variable resistor eliminated)	X	X	○	○
Spark advance feedback system	X	○	X	X

○: Related X: Non-related

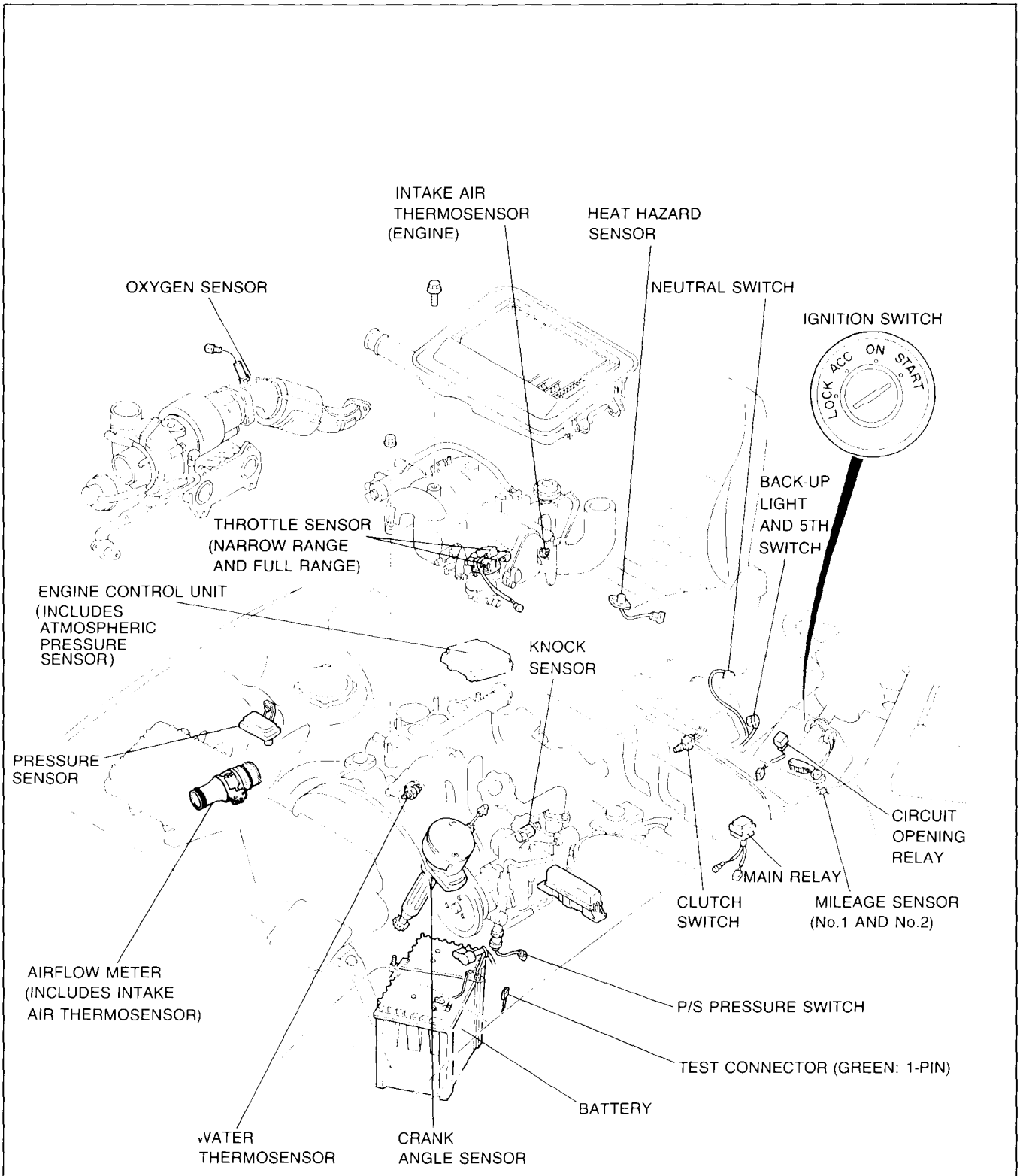
97U0F2-502

System construction

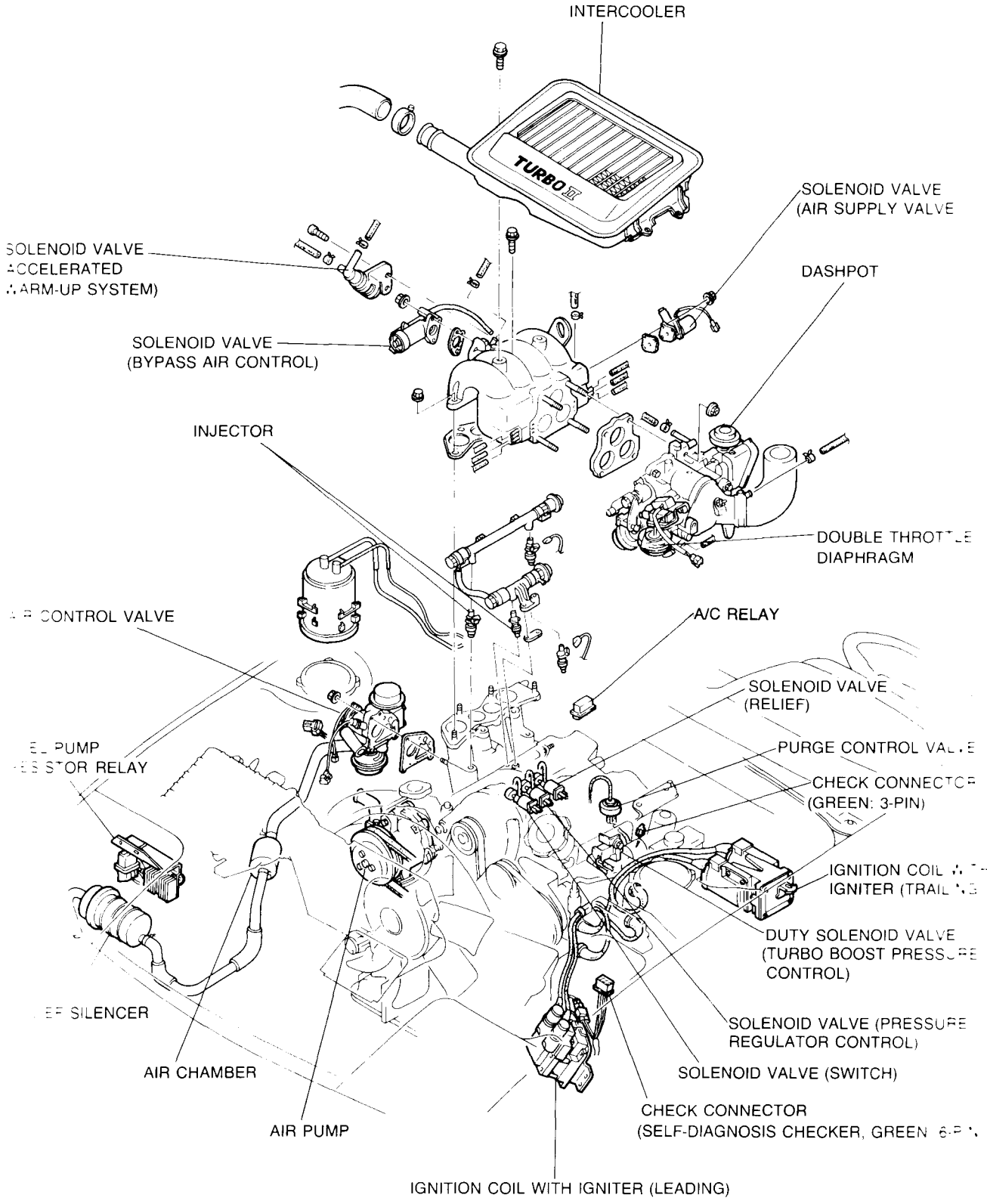


97U0F2-503

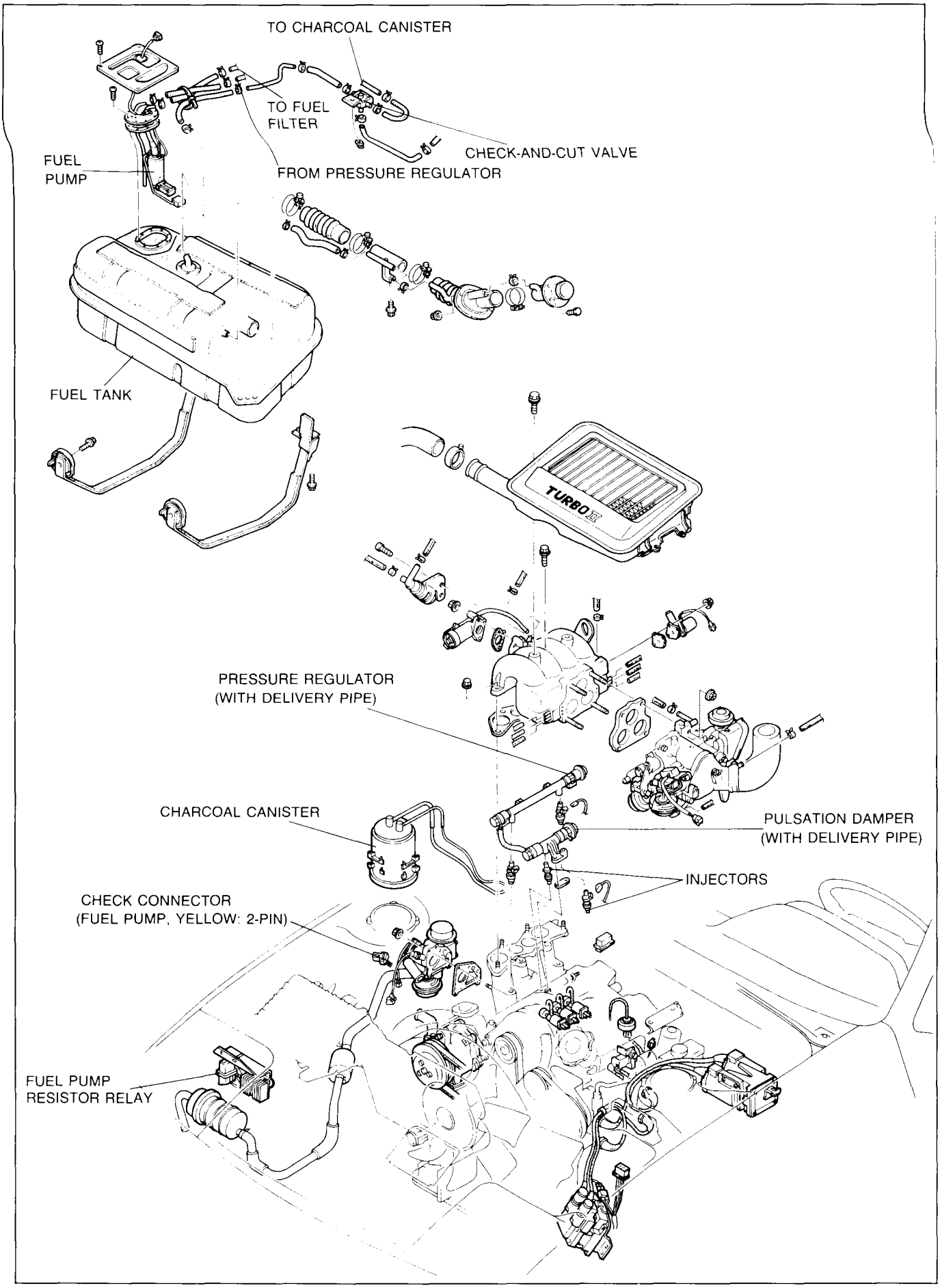
EMISSION CONTROL SCHEMATIC DIAGRAM
Input Devices



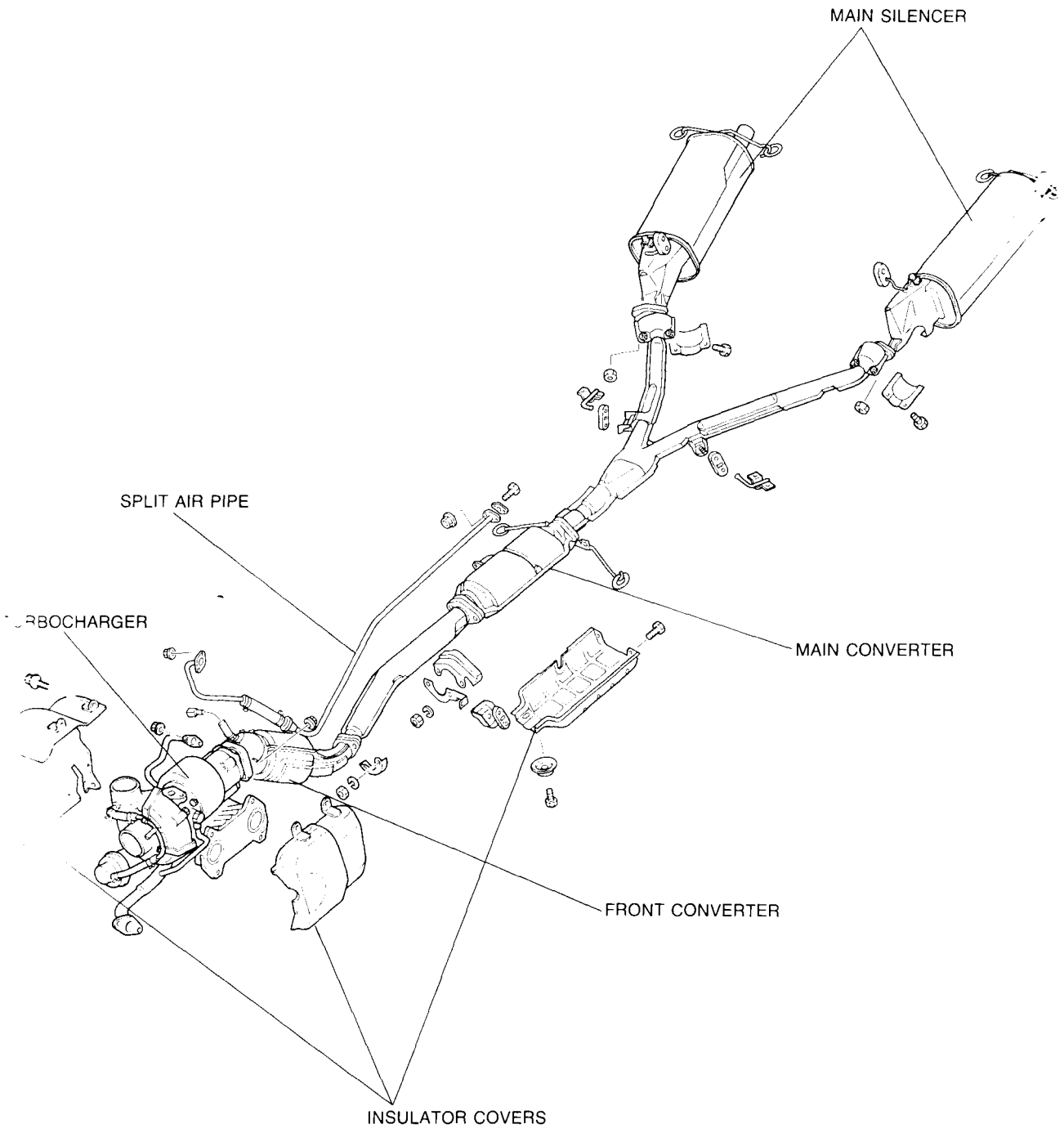
97U0F2-504

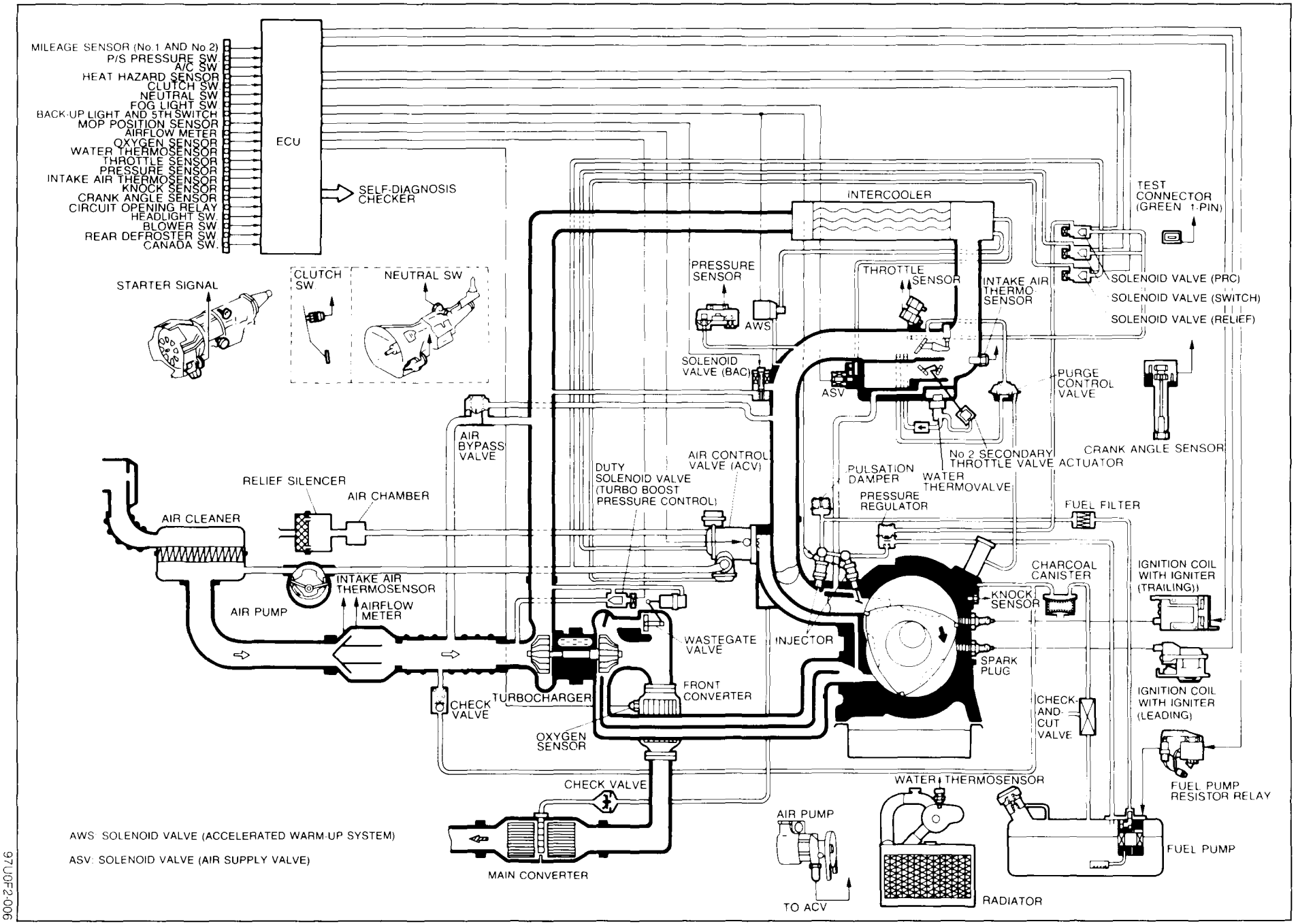

INTERCOOLER
TURBO
SOLENOID VALVE
(AIR SUPPLY VALVE
SOLENOID VALVE
ACCELERATED
ARM-UP SYSTEM)
DASHPOT
SOLENOID VALVE
(BYPASS AIR CONTROL)
INJECTOR
DOUBLE THROTTLE
DIAPHRAGM
CONTROL VALVE
A/C RELAY
SOLENOID VALVE
(RELIEF)
PUMP
STOR RELAY
PURGE CONTROL VALVE
CHECK CONNECTOR
(GREEN: 3-PIN)
IGNITION COIL
IGNITER (TRAIL
DUTY SOLENOID VALVE
(TURBO BOOST PRESSURE
CONTROL)
SILENCER
SOLENOID VALVE (PRESSURE
REGULATOR CONTROL)
AIR CHAMBER
SOLENOID VALVE (SWITCH)
CHECK CONNECTOR
(SELF-DIAGNOSIS CHECKER, GREEN 6-P
AIR PUMP
IGNITION COIL WITH IGNITER (LEADING)

Fuel Devices

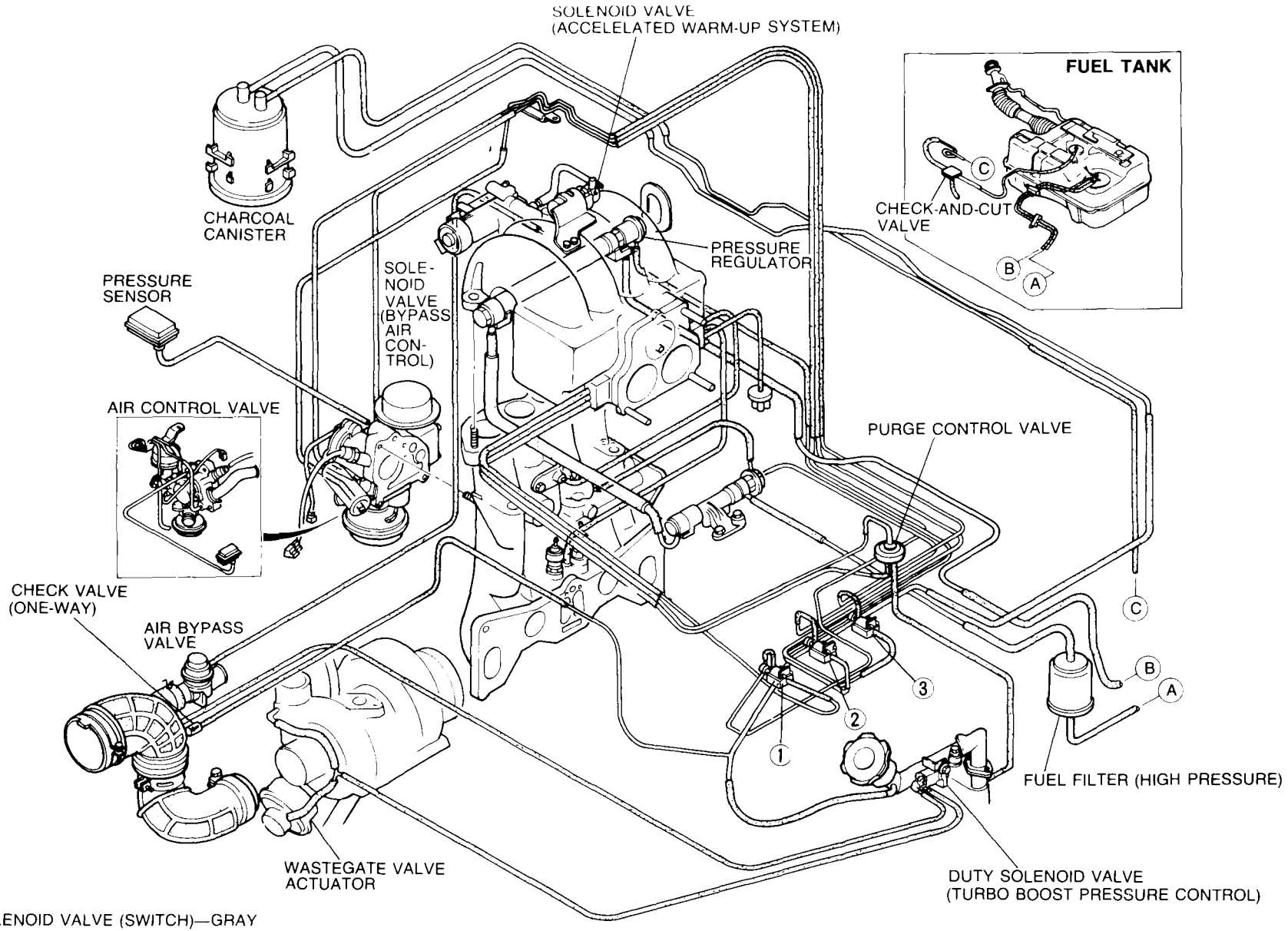


97U0F2-506


MAIN SILENCER
SPLIT AIR PIPE
RBOCHARGER
MAIN CONVERTER
FRONT CONVERTER
INSULATOR COVERS


MILEAGE SENSOR (No.1 AND No.2)
P/S PRESSURE SW.
A/C SW.
HEAT HAZARD SENSOR
CLUTCH SW.
NEUTRAL SW.
FOG LIGHT SW.
BACK-UP LIGHT AND 5TH SWITCH
MOP POSITION SENSOR
AIRFLOW METER
OXYGEN SENSOR
WATER THERMOSENSOR
THROTTLE SENSOR
PRESSURE SENSOR
INTAKE AIR THERMOSENSOR
KNOCK SENSOR
CRANK ANGLE SENSOR
CIRCUIT OPENING RELAY
HEADLIGHT SW.
BLOWER SW.
REAR DEFROSTER SW.
CANADA SW.
ECU
SELF-DIAGNOSIS CHECKER
STARTER SIGNAL
CLUTCH SW.
NEUTRAL SW
INTERCOOLER
TEST CONNECTOR (GREEN 1-PIN)
PRESSURE SENSOR
THROTTLE SENSOR
INTAKE AIR THERMO SENSOR
SOLENOID VALVE (PRC)
SOLENOID VALVE (SWITCH)
SOLENOID VALVE (RELIEF)
AWS
SOLENOID VALVE (BAC)
ASV
PURGE CONTROL VALVE
CRANK ANGLE SENSOR
No.2 SECONDARY THROTTLE VALVE ACTUATOR
AIR BYPASS VALVE
AIR CONTROL VALVE (ACV)
DUTY SOLENOID VALVE (TURBO BOOST PRESSURE CONTROL)
PULSATION DAMPER
WATER THERMOVALVE
PRESSURE REGULATOR
FUEL FILTER
RELIEF SILENCER
AIR CHAMBER
AIR CLEANER
CHARCOAL CANISTER
IGNITION COIL WITH IGNITER (TRAILING)
KNOCK SENSOR
INTAKE AIR THERMOSENSOR
AIRFLOW METER
AIR PUMP
WASTEGATE VALVE
INJECTOR
SPARK PLUG
FRONT CONVERTER
CHECK VALVE
TURBOCHARGER
CHECK-AND-CUT VALVE
IGNITION COIL WITH IGNITER (LEADING)
OXYGEN SENSOR
CHECK VALVE
WATER THERMOSENSOR
FUEL PUMP RESISTOR RELAY
AIR PUMP
FUEL PUMP
MAIN CONVERTER
TO ACV
RADIATOR
AWS: SOLENOID VALVE (ACCELERATED WARM-UP SYSTEM)
ASV: SOLENOID VALVE (AIR SUPPLY VALVE)

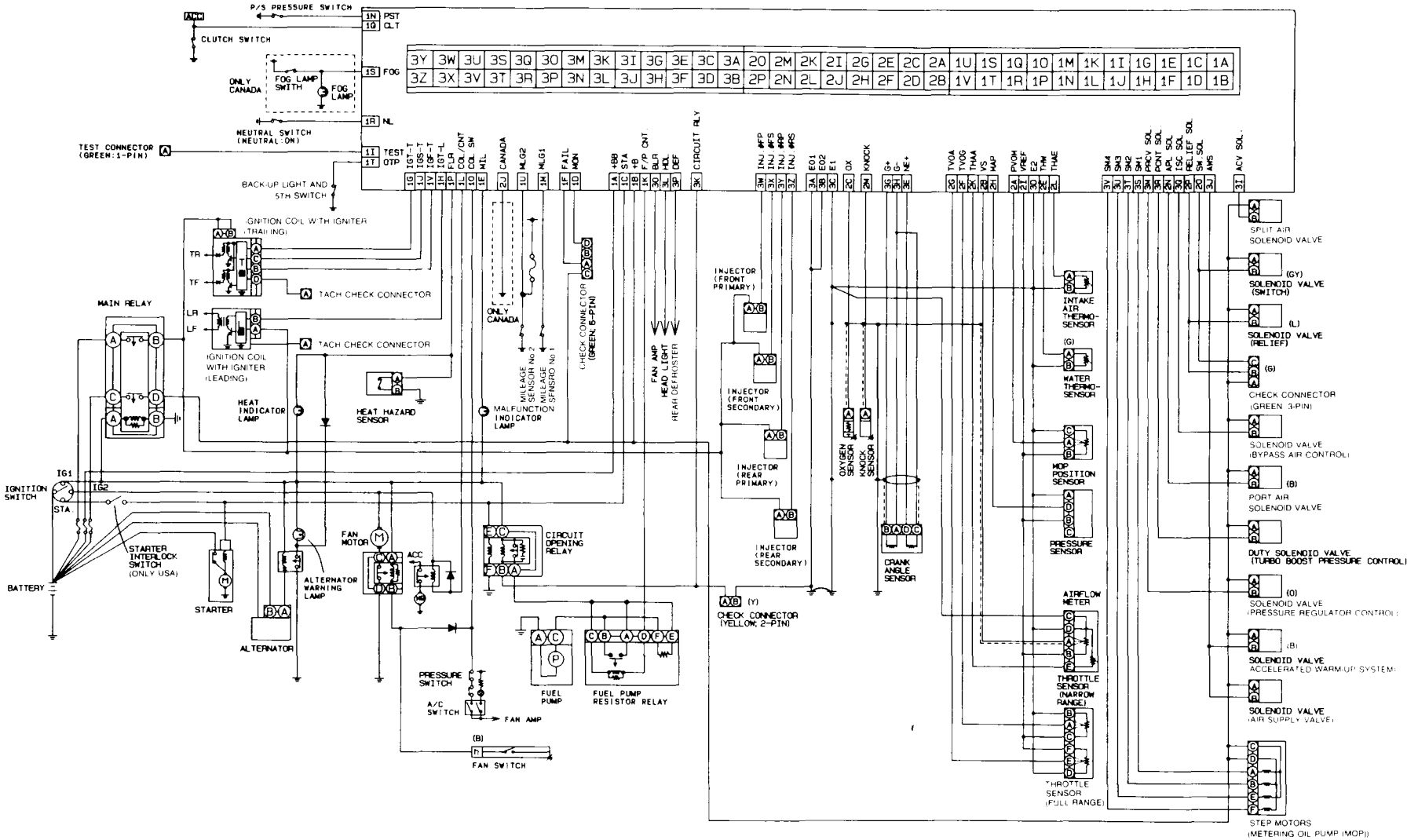
97U0F2-006



(1) SOLENOID VALVE (SWITCH)—GRAY

(2) SOLENOID VALVE (PRESSURE REGULATOR CONTROL)—ORANGE

(3) SOLENOID VALVE (RELIEF)—BLUE


P/S PRESSURE SWITCH
CLUTCH SWITCH
ONLY CANADA
FOG LAMP SWITH
FOG LAMP
NEUTRAL SWITCH (NEUTRAL: ON)
TEST CONNECTOR (GREEN: 1-PIN)
BACK-UP LIGHT AND 5TH SWITCH
IGNITION COIL WITH IGNITER (TRAILING)
TACH CHECK CONNECTOR
IGNITION COIL WITH IGNITER (LEADING)
MAIN RELAY
HEAT INDICATOR LAMP
HEAT HAZARD SENSOR
MALFUNCTION INDICATOR LAMP
MILEAGE SENSOR No.2
MILEAGE SENSOR No.1
CHECK CONNECTOR (GREEN: 6-PIN)
FAN AMP
HEAD LIGHT REAR DEFOGGER
CIRCUIT RLY
IGNITION SWITCH
STARTER INTERLOCK SWITCH (ONLY USA)
BATTERY
STARTER
ALTERNATOR
ALTERNATOR WARNING LAMP
FAN MOTOR
ACC
CIRCUIT OPENING RELAY
PRESSURE SWITCH
A/C SWITCH
FAN SWITCH
FUEL PUMP
FUEL PUMP RESISTOR RELAY
INJECTOR (FRONT PRIMARY)
INJECTOR (FRONT SECONDARY)
INJECTOR (REAR PRIMARY)
INJECTOR (REAR SECONDARY)
CHECK CONNECTOR (YELLOW: 2-PIN)
OXYGEN SENSOR
KNOCK SENSOR
CRANK ANGLE SENSOR
INTAKE AIR THERMO-SENSOR
WATER THERMO-SENSOR
MOP POSITION SENSOR
PRESSURE SENSOR
AIRFLOW METER
THROTTLE SENSOR (NARROW RANGE)
THROTTLE SENSOR (FULL RANGE)
SPLIT AIR SOLENOID VALVE
SOLENOID VALVE (SWITCH)
SOLENOID VALVE (RELIEF)
CHECK CONNECTOR (GREEN 3-PIN)
SOLENOID VALVE (BYPASS AIR CONTROL)
PORT AIR SOLENOID VALVE
DUTY SOLENOID VALVE (TURBO BOOST PRESSURE CONTROL)
SOLENOID VALVE (PRESSURE REGULATOR CONTROL)
SOLENOID VALVE ACCELERATED WARM-UP SYSTEM)
SOLENOID VALVE (AIR SUPPLY VALVE)
STEP MOTORS (METERING OIL PUMP (MOP))

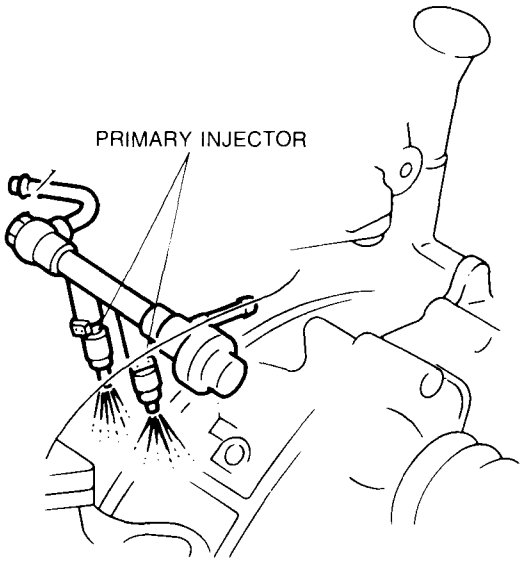
SPECIFICATIONS

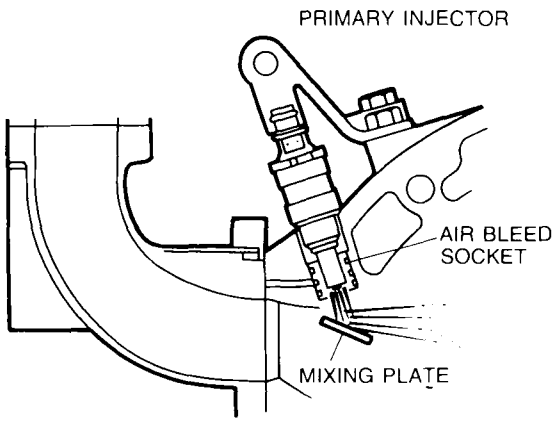
Item			Model: 13B Turbocharged engine
Idle speed (Test connector (green: 1-pin) grounded)		rpm	750 ± 25
Air cleaner	Element type		Long life wet
	Type		Horizontal draft (2 stage-3 barrel)
Throttle body	Throat diameter	Primary mm (in)	45 (1.772)
		Secondary mm (in)	45 (1.772) x 2
	Water thermovalve	Operation temp. °C (°F)	55—65 (131—149) or more
Dashpot	Adjustment (Throttle sensor (narrow range) resistance Ⓐ—Ⓑ)	kΩ	1.8—3.8
Turbocharger	Type		Water cooled
	Boost pressure	kPa (kg/cm², psi)	57.0 (0.58, 8.25)
	Lubrication		Engine oil
Waste gate valve			Incorporated with turbocharger
Fuel tank	Capacity	liters (US gal, Imp gal)	70 (18.5, 15.4)
Fuel filter	Type	Low pressure	Nylon 6 (164 & 45 mesh)
		High pressure	Filter paper
Pressure regulator	Type		Diaphragm
	Regulated pressure	kPa (kg/cm², psi)	235—275 (2.4—2.8, 34.1—39.8)
Fuel pump	Type		Impeller (in-tank)
	Output pressure	kPa (kg/cm², psi)	490—637 (5.0—6.5, 71.1—92.4)
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 (Test connector (green: 1-pin) grounded)			Leading: 5° ± 1° ATDC Trailing: 20° ± 2° ATDC
Distribution	Type		Engine control unit
Spark advance	Type		Engine control unit
Idle up system	A/C	rpm	800
Anti-afterburn valve	Operation time	sec	1.60—2.20
Intercooler	Type		Air cooled

97U0F2 519

FUEL SYSTEM

MIXING PLATE

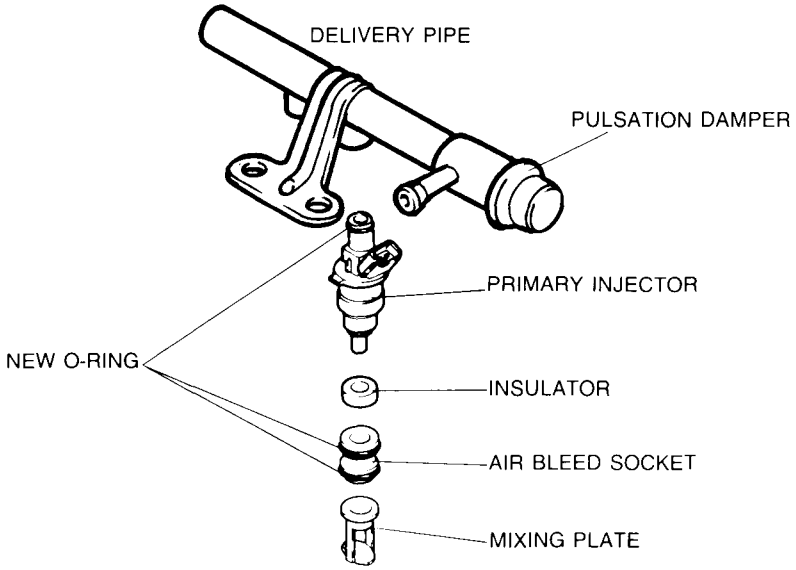


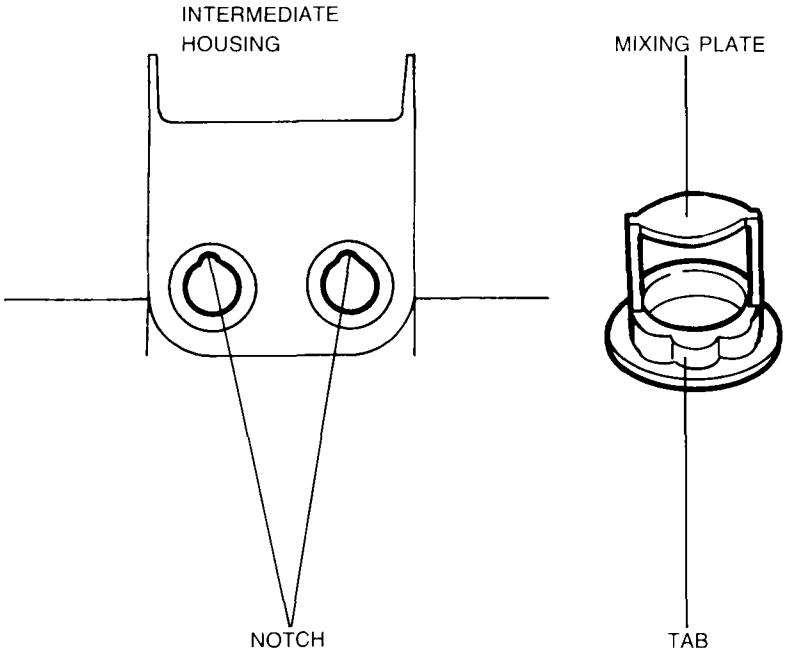


97U0F2-508

A mixing plate is installed at the tip of primary injector to direct the primary fuel injection fuel directly into the intake air port.

SERVICE POINT

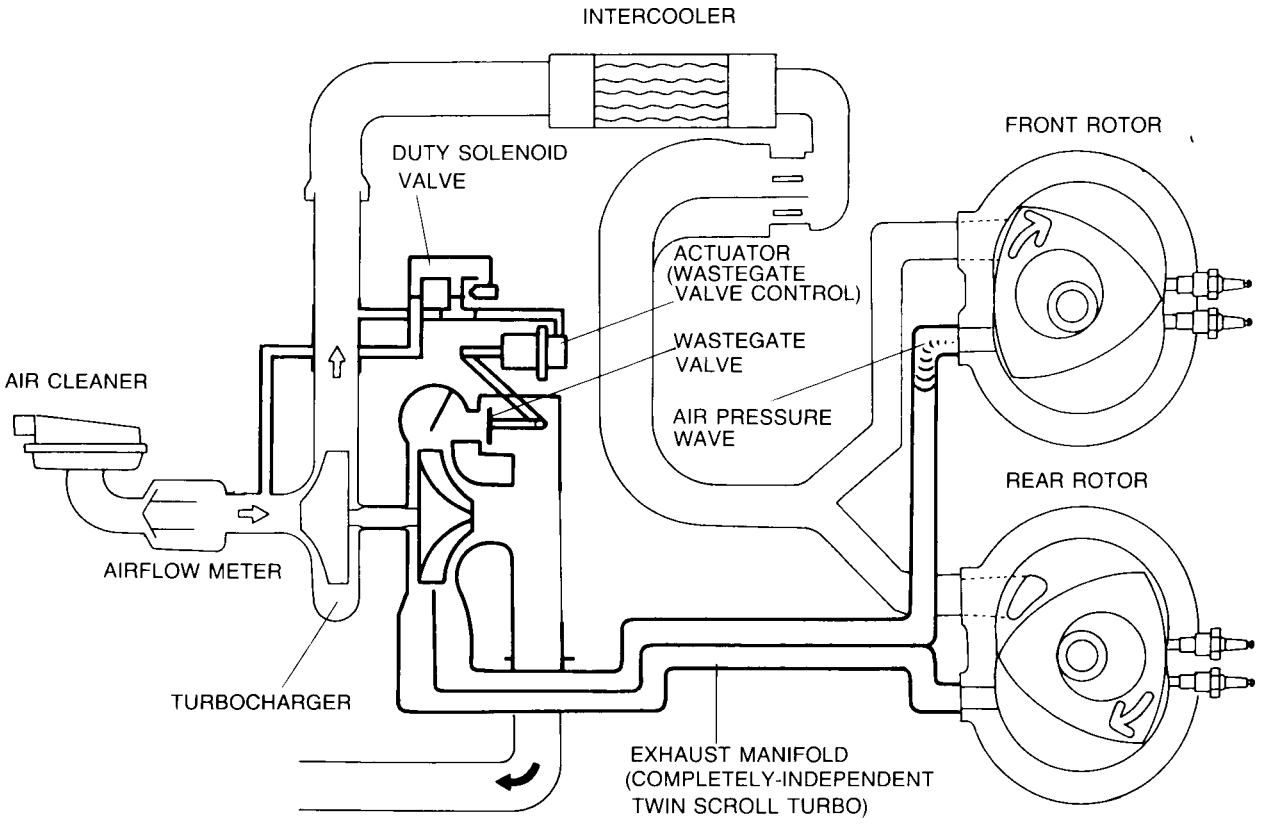




mary injector is installed noting the following:
the parts in the order shown in the figure.
a new insulator and O-rings.
the tabs of the mixing plate with the notches in the intermediate housing.

TURBOCHARGER CONTROL SYSTEM

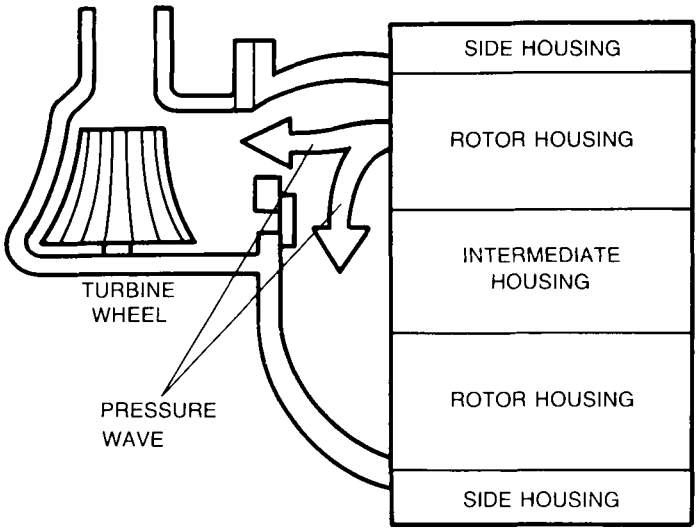
SYSTEM CONSTRUCTION



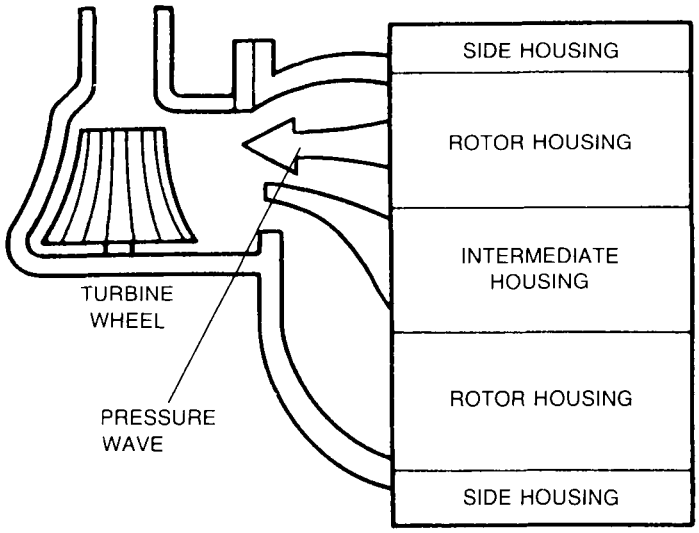
97U0F2-510

Two newly developed systems are employed to increase engine horsepower, a newly designed **completely-independent twin scroll turbo** and a precise **turbo boost pressure control system**.

PREVIOUS OPEN-TYPE



COMPLETELY-INDEPENDENT TYPE

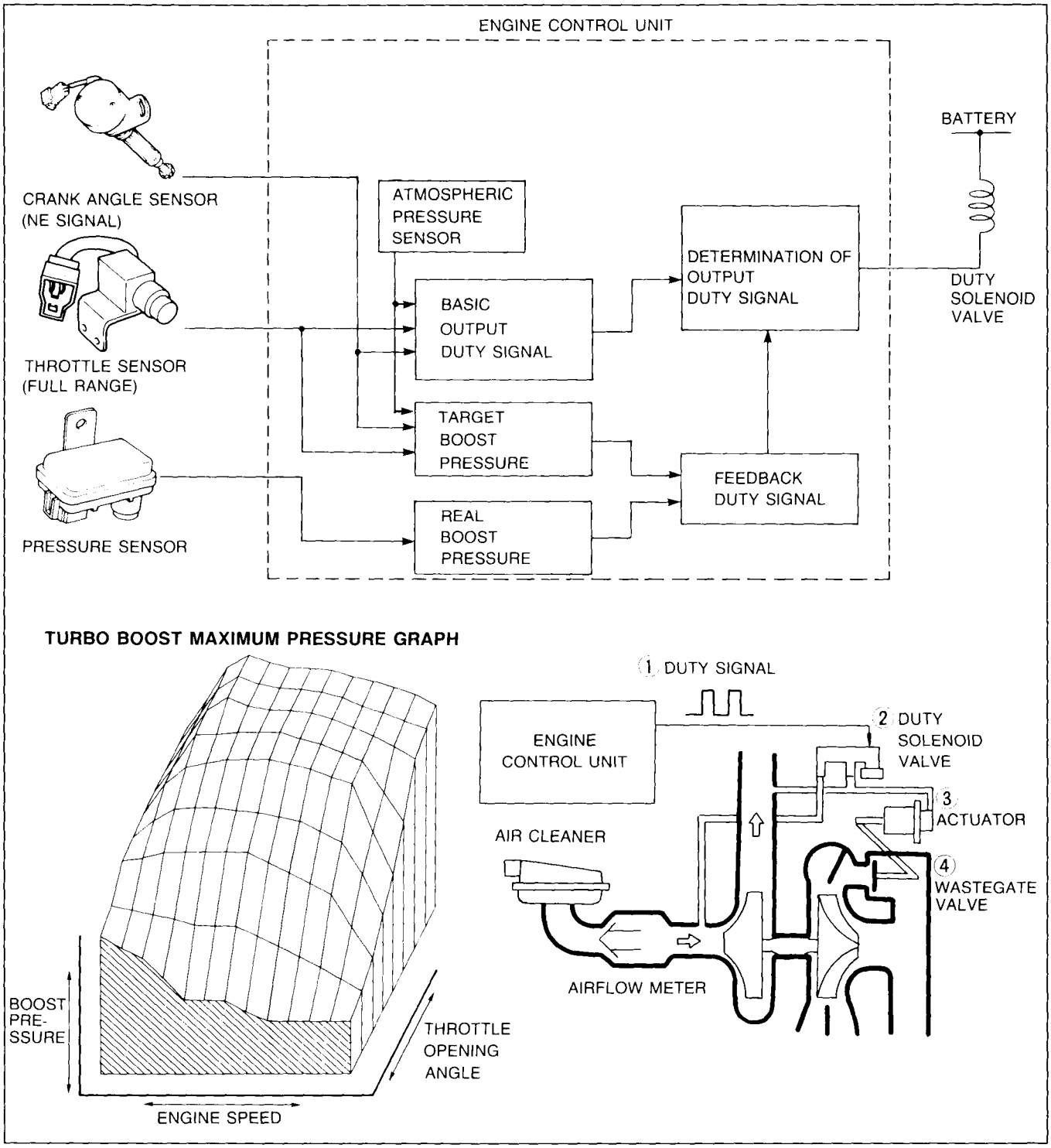


97U0F2-5

completely-independent twin scroll turbo improves horsepower by utilizing more fully the inherent
aves created by the escaping exhaust gases. It does this by isolating the gas flow of the front
otors as it is directed straight toward the turbine wheel. The pressure waves are thus used rather
ed to mix with the exhaust gases of the opposite rotor.

TURBO BOOST PRESSURE CONTROL SYSTEM

This system controls the turbocharger maximum boost pressure by the duty signal from the engine control unit.

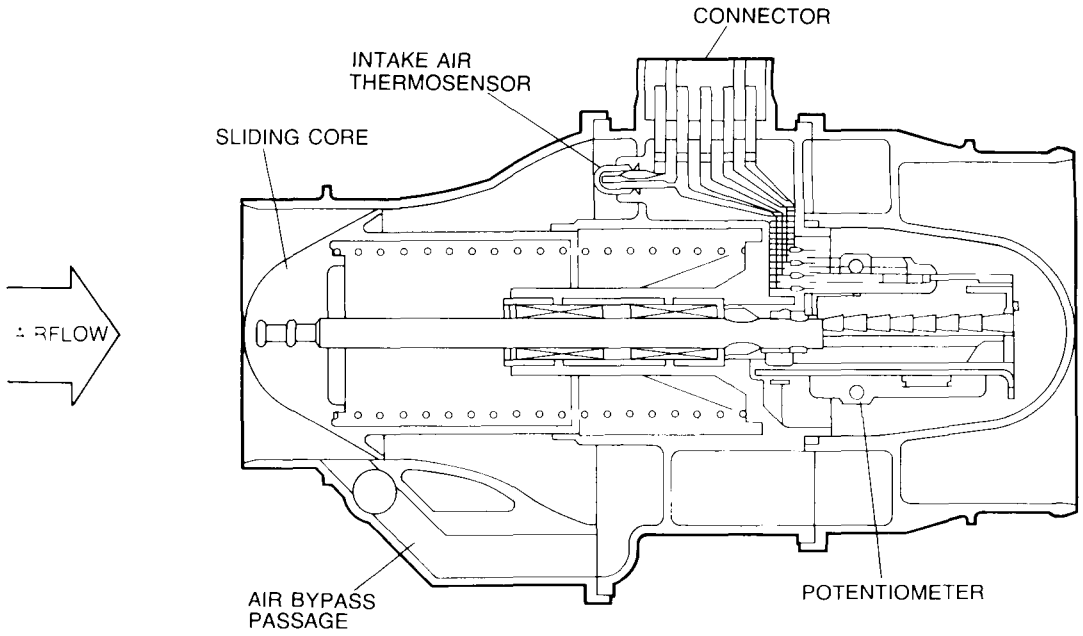


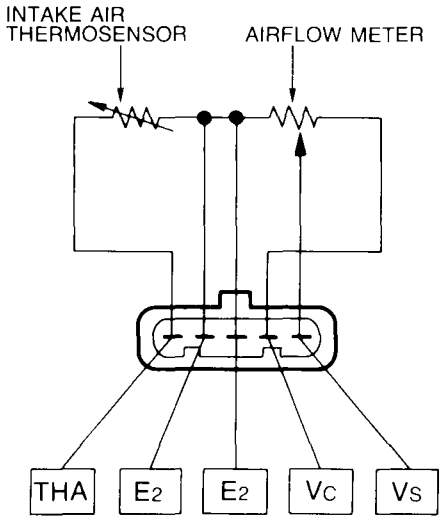
97U0F2-512

Operation

1. The duty signal from engine control unit is varied from 5% to 95% based on information from the full range throttle sensor and the crank angle sensor (Ne signal). The output duty signal is determine within the engine control unit by the basic output duty signal, and feedback duty signal.
2. The duty signal is sent to the duty solenoid valve from the engine control unit.
3. As the duty increases, the duty solenoid valve opening increases, and the pressure air acting on the actuator decreases.
4. The wastegate valve then closes, and the turbo boost pressure increases.
   The engine control unit contains the data to set the turbo boost maximum pressure as shown in the graph. The boost pressure is basically determined by the throttle opening angle and engine speed.

AIRFLOW METER



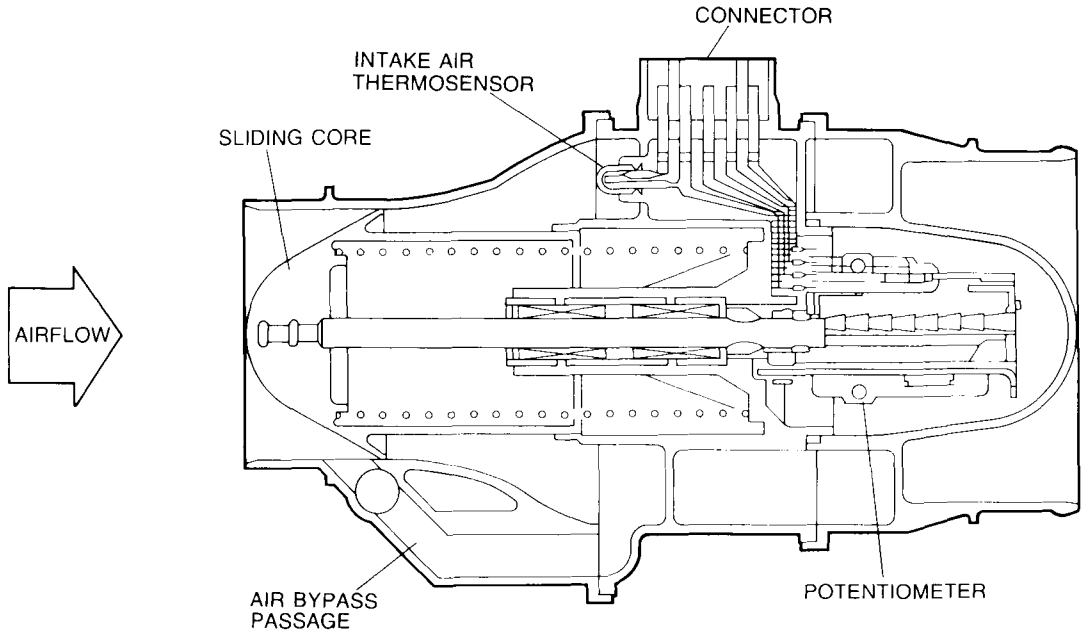


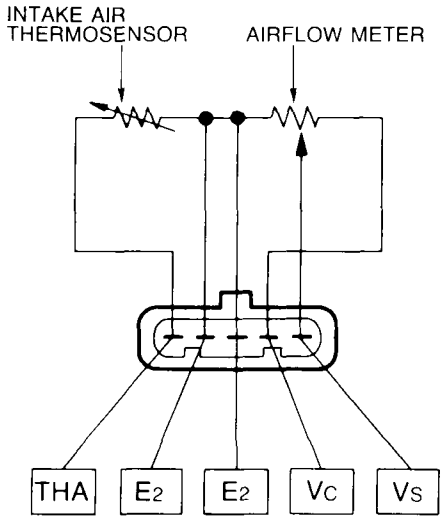
...eter is changed from a vane type to a linear type. The sliding core moves parallel to the a...

...there is little air damping and low air resistance as a result of the streamlined shape

CONTROL SYSTEM

AIRFLOW METER

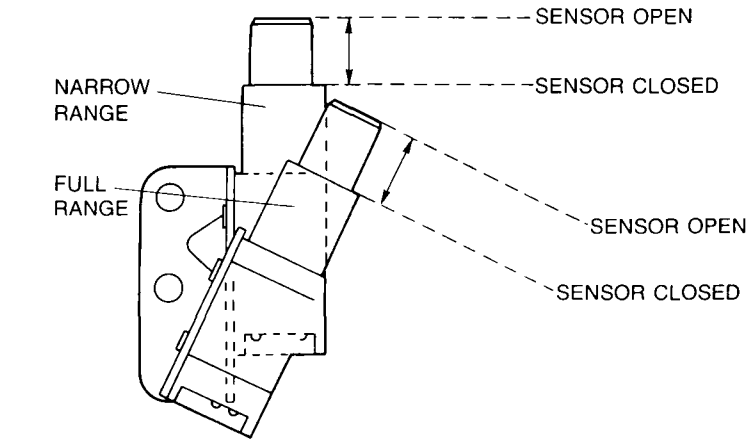


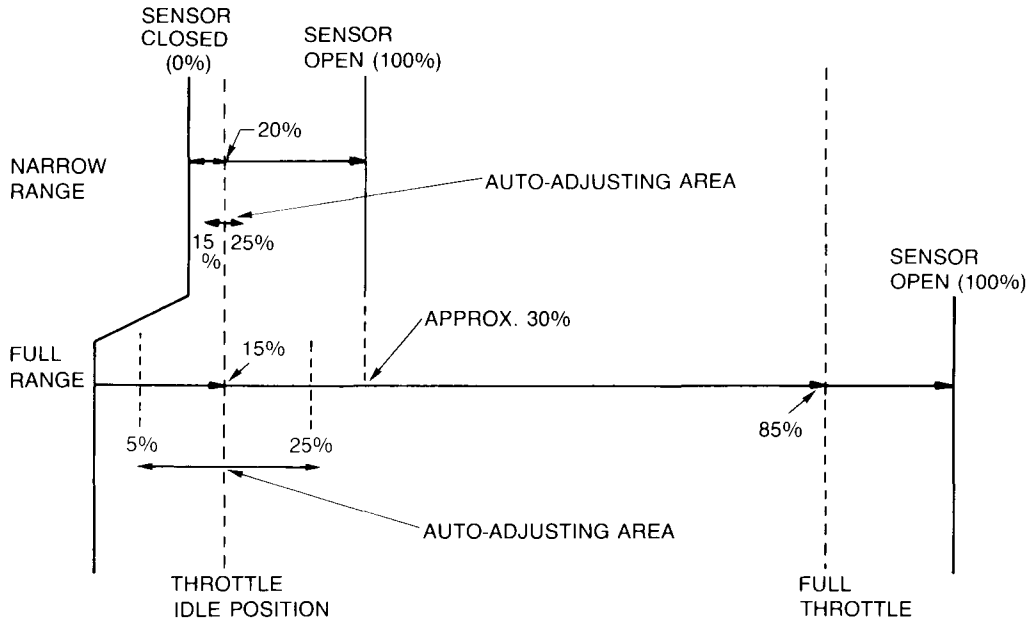


meter is changed from a vane type to a linear type. The sliding core moves parallel to the a

esign, there is little air damping and low air resistance as a result of the streamlined shape

THROTTLE-IDLE-POSITION AUTO-ADJUSTING SYSTEM



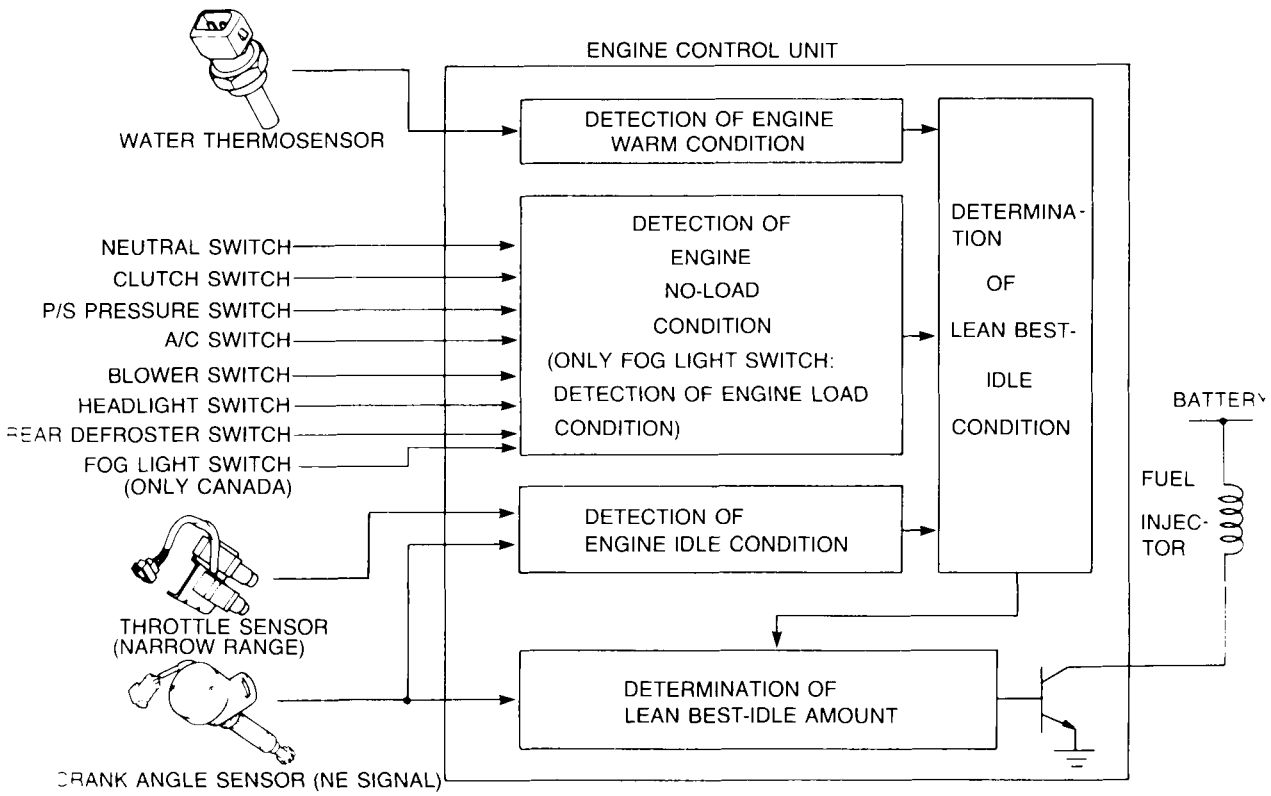


97U0F2-514

A newly developed throttle-idle-position auto-adjusting system is incorporated within the engine control unit. This system automatically compensates for certain variations in the output signal of the throttle sensors. At idle, the narrow range throttle sensor is set to output a signal of 20% of full-open. With the throttle idle position auto adjusting system, the engine control unit will compensate for actual output values of 15%—25%. If the output is less than 15% or more than 25% at idle, the engine control unit fixes the value at 15% and 25% respectively for fail-safe operation.

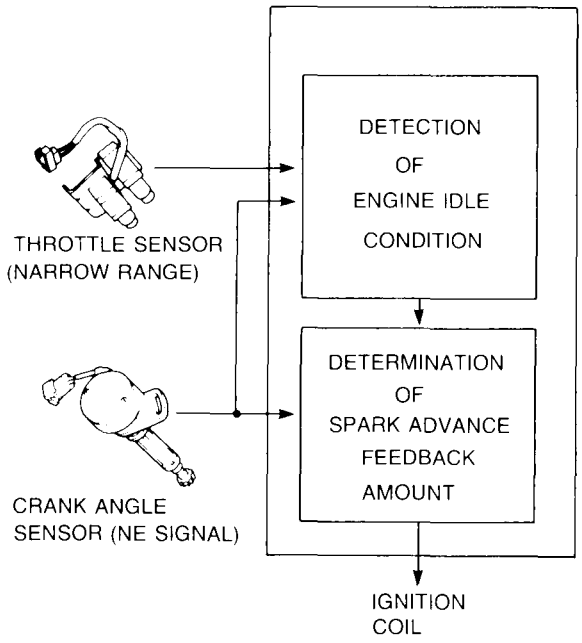
Operation for the full range sensor is the same. The sensor is set to register a 15% signal at idle, and the engine control unit compensates within the range from 5%—25%. If over or under the signal is fixed at 5% and 25% respectively for fail-safe operation.

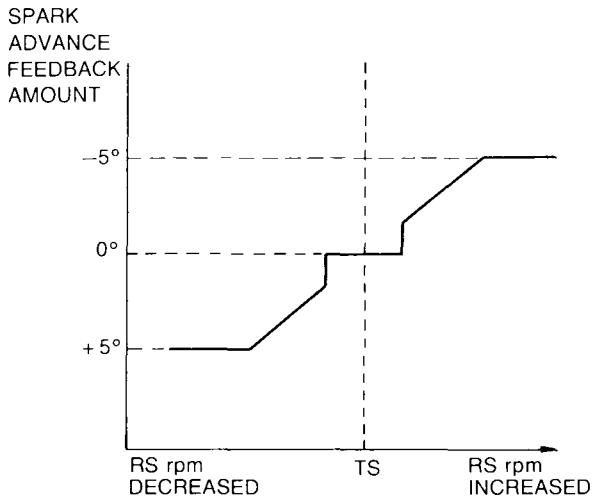
LEAN BEST-IDLE CONTROL SYSTEM



...ced fuel consumption and reduced exhaust emissions at idle, the lean best-idle control system ... With this system, the engine control unit sets fuel injection at idle to the leanest amount poss... ...ing lean misfire and rough idle.

SPARK ADVANCE FEEDBACK SYSTEM (ENGINE AT IDLE)



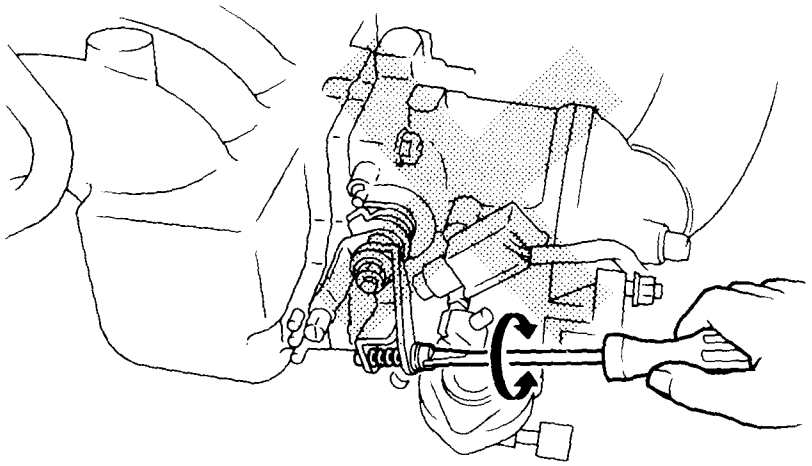


TS: TARGET ENGINE SPEED
RS: REAL ENGINE SPEED

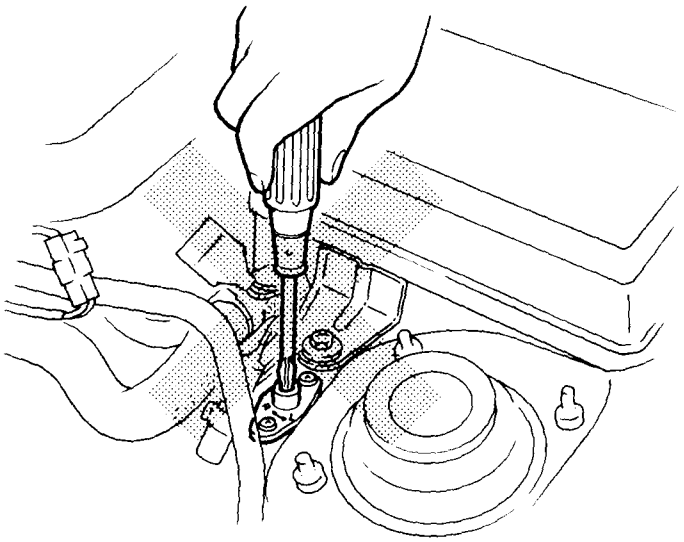
97U0F2-516

To prevent rough idle caused by incorrect idle speeds, the spark advance feedback system controls the spark advance. The engine control unit judges the engine speed (real speed: RS) and then adjusts the ignition timing to obtain the preprogrammed target speed (TS).

THROTTLE SENSOR ADJUSTMENT



IDLE MIXTURE ADJUSTMENT



·· e sensor adjustment	:	Not usually necessary unless throttle sensor unit is replaced. Throttle-idle-pos·t c·· auto-adjusting system automatically compensates.
·· xture adjustment	:	Not necessary because of lean best-idle control system. (Variable res s·· eliminated.)

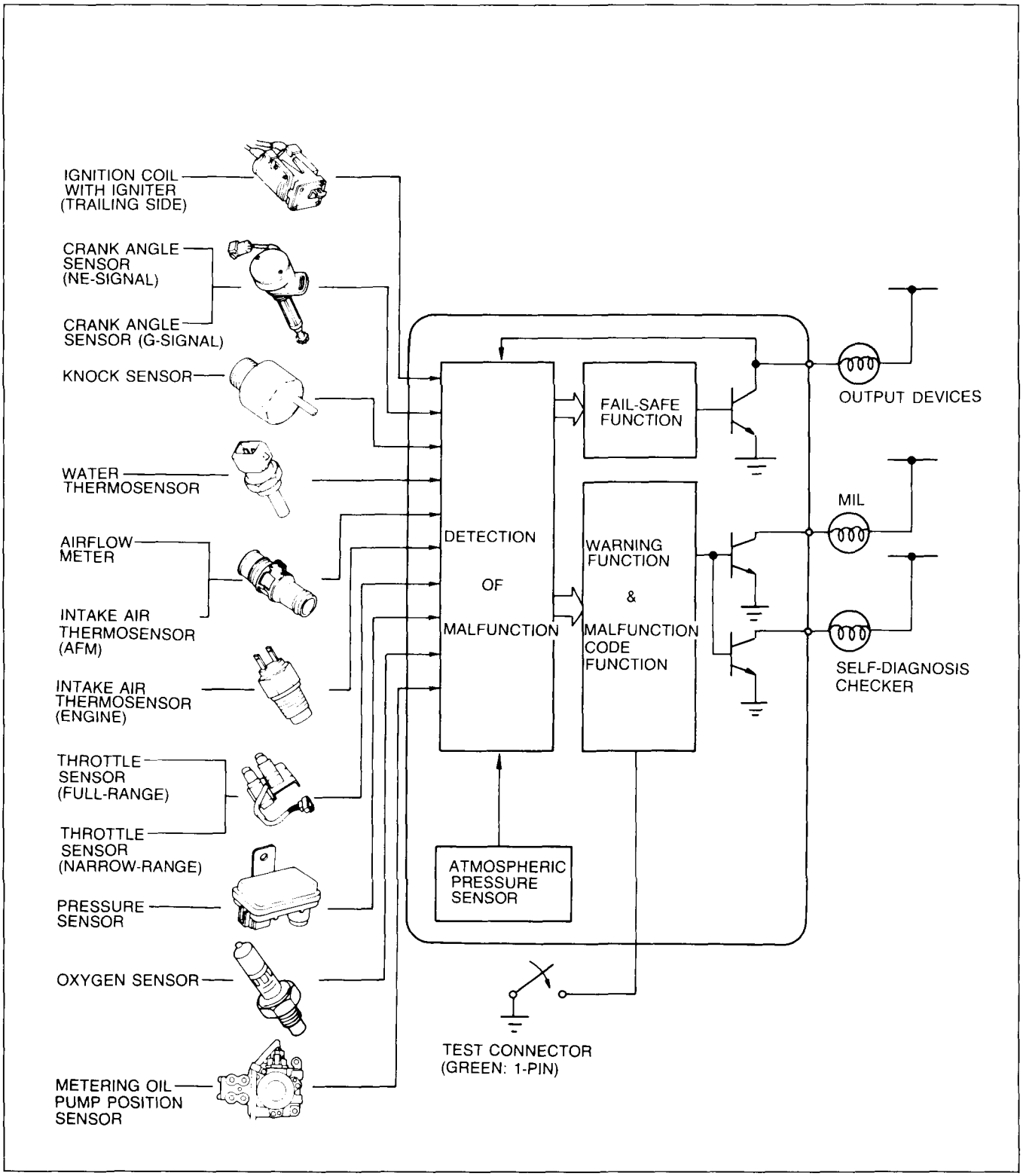
SELF-DIAGNOSIS FUNCTION

DESCRIPTION

When troubles are suspected in the main input devices or output devices, check for the cause with the **SST**. Failures of individual input and output devices are indicated and retrieved from the control unit as malfunction code numbers.

Note

The control unit constantly checks for malfunction of the input devices. It checks for malfunction of output devices only during a 3-second period after the ignition switch has been turned ON while the test connector is grounded.

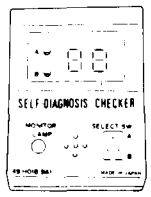


97U0F2-024

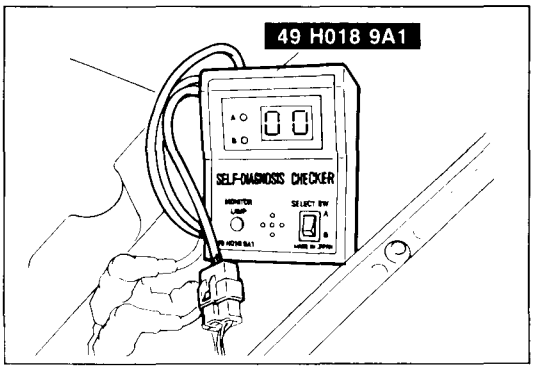
MALFUNCTION CODE NUMBER
SST

49 H018 9A1

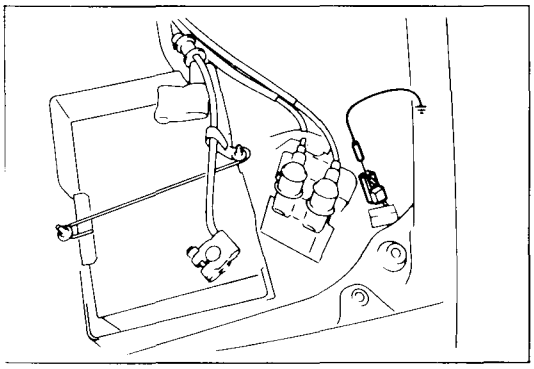
Self-Diagnosis Checker



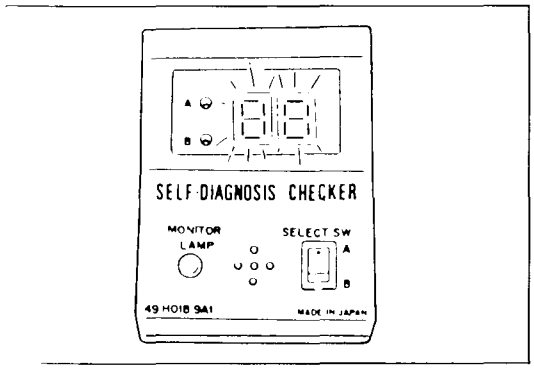
97U0F2-520



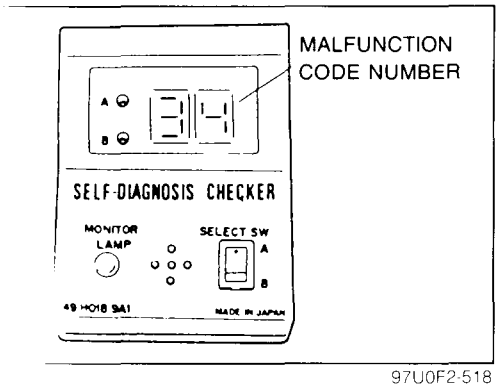
97U0F2-521



97J0F2-027



97U0F2-522



97U0F2-518

Inspection Procedure

1. Warm up the engine to normal operating temperature and stop it.
2. Connect the **SST** to the check connector (Green: 6-pin) and the negative battery terminal.
   Set the select switch to position **A**.
3. Connect a jumper wire between the test connector (Green: 1-pin) and a body ground.
4. Turn the ignition switch ON.
5. Check that **88** flashes on the digital display and the buzzer sounds for **3 sec.** after turning the ignition switch ON.
6. If **88** does not flash, check the check connector wiring.
7. If **88** flashes and the buzzer sounds continuously for more than **20 sec.**, check for a short circuit between the engine control unit (1F) terminal and check connector (Green: 6-pin). And check the engine control unit (3X) and (3Z) terminal voltage. Replace the engine control unit if necessary and perform Step 4 again.
8. Check for any malfunction code numbers.
9. Start the engine and check for further malfunction code numbers.
10. If a malfunction code number is indicated, check for the cause of the problem.

Note
Cancel the malfunction code numbers by performing the after-repair procedure following repairs.

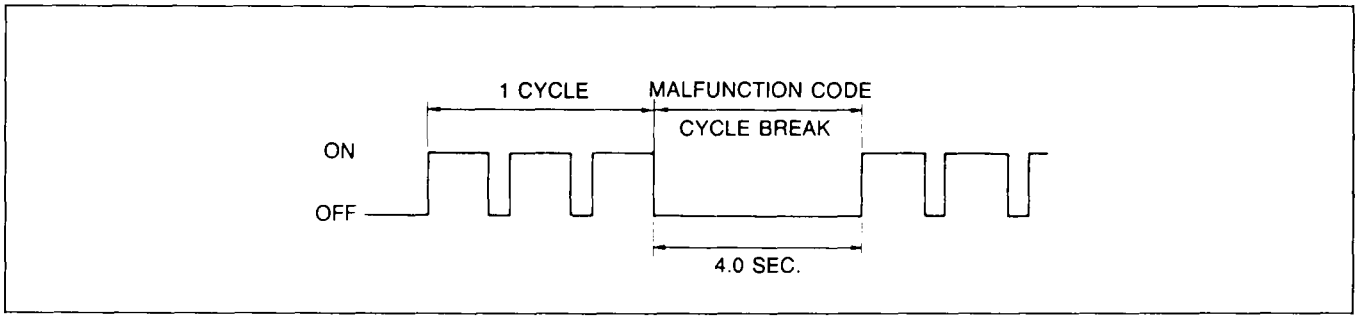
Principle of code cycle

Malfunction codes are determined as below by use of the MIL and Self-Diagnosis Checker.

97U0F2-523

1. Malfunction code cycle break

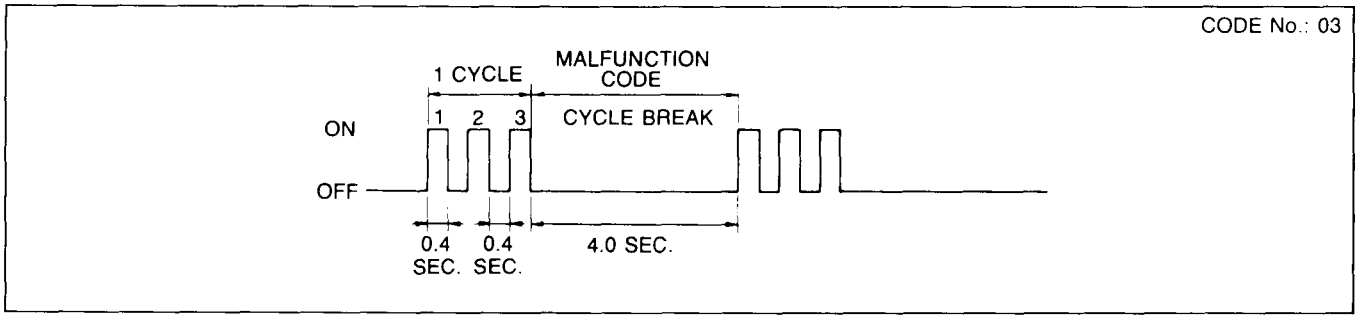
The time between malfunction code cycles is 4.0 sec. (the time the MIL and checker buzzer are off).



9MU0F1-543

2. Second digit of malfunction code (ones position)

The digit in the ones position of the malfunction code represents the number of times the MIL and buzzer are on 0.4 sec. during one cycle.

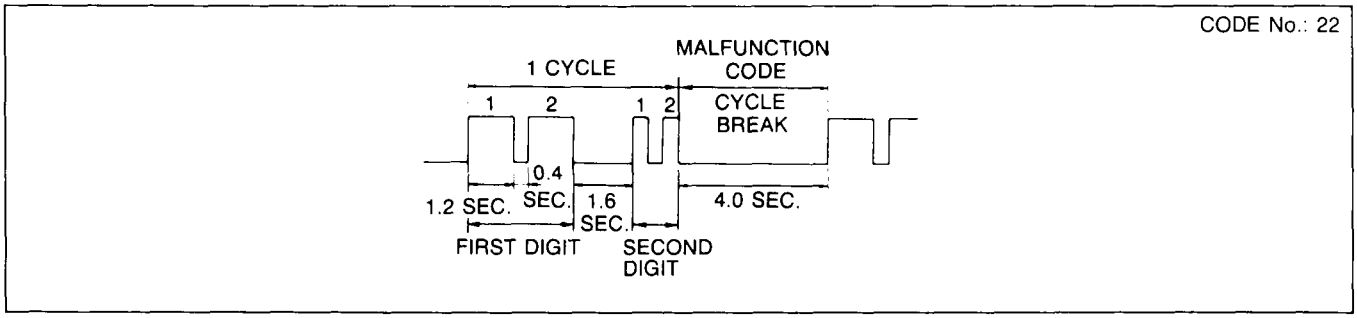


89U04X-565

3. First digit of malfunction code (tens position)

The digit in the tens position of the malfunction code represents the number of times the MIL and buzzer are on 1.2 sec. during one cycle.

The MIL and buzzer are off for 1.6 sec. between the long and short pulses.



89U04X-566

Code number

Caution

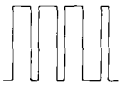
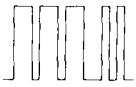
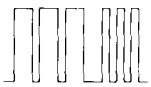
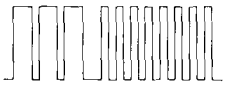
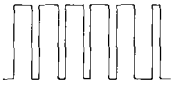
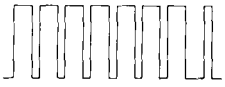
a) If there is more than one failure present, the lowest number malfunction code is displayed first, the subsequent malfunction codes appear in order.

b) After repairing all failures, turn the ignition switch OFF, disconnect the negative battery cable, and depress the brake pedal for at least 5 seconds to erase the malfunction code memory.

Input devices

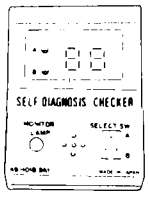
Code No.	Input devices	Malfunction	Fail-safe function	Output signal pattern (Self-Diagnosis Checker or MIL)
01	Ignition coil with igniter (Trailing side)	Malfunction of spark plug, broken wire, short circuit	Trailing-side ignition pulse cut	
02	Crank angle sensor (Ne signal)	Broken wire, short circuit	Fuel injection and ignition cut	
03	Crank angle sensor (G signal)	Broken wire, short circuit	Fuel injection and ignition cut	
05	Knock sensor	Broken wire, short circuit	Ignition timing fixed	
08	Airflow meter (AFM)	Broken wire, short circuit	Basic fuel injection amount and ignition timing fixed	
09	Water thermosensor	Broken wire, short circuit	Coolant temp. input fixed at 80°C (176°F)	
10	Intake air thermosensor (AFM)	Broken wire, short circuit	Intake air temp. input fixed at 20°C (68°F)	
	·· ar thermo- ·· Engine)	Broken wire, short circuit	Intake air temp. input fixed at 20°C (68°F)	
	·· sensor (Full range)	Broken wire, short circuit	Throttle valve opening angle input signal fixed at 20% open	
13	Pressure sensor (Intake manifold pressure)	Broken wire, short circuit	Intake manifold pressure input signal fixed at 760 mmHg (29.9 inHg)	
14	Atmospheric pressure sensor (ATP) (Built in ECU)	Malfunctioning ECU	Atmospheric pressure input signal fixed at 760 mmHg (29.9 inHg)	
15	Oxygen sensor	Oxygen sensor output remains below 0.55V 80 sec. after F/B system operation begining	Feedback system canceled (For EGI)	
17	Feedback system	Oxygen sensor output remains 0.55V 10 sec. after F/B system operation begining	Feedback system canceled (For EGI)	
18	Throttle sensor (Narrow range)	Broken wire, short circuit	Throttle valve opening angle input signal fixed at full open	
	Metering oil pump position sensor	Broken wire, short circuit	MOP fixed smallest open Basic fuel injection amount and ignition timing fixed	
	Metering oil pump (MOP)	Malfunctioning MOP, step motors, broken wire, short circuit, or malfunctioning ECU	MOP fixed smallest open Basic fuel injection amount and ignition timing fixed	
	Metering oil pump (MOP)	Malfunctioning MOP, step motors, broken wire, short circuit, malfunctioning ECU, alternator or battery	Basic fuel injection amount and ignition timing fixed	

Output devices

Code No.	Output devices	Output signal pattern (Self-Diagnosis Checker or MIL)
25	Solenoid valve (Pressure regulator control (PRC))	
26	Step motor (Metering oil pump)	
30	Split air solenoid valve	
31	Solenoid valve (Relief)	
32	Solenoid valve (Switch)	
33	Port air solenoid valve	
34	Solenoid valve (Bypass air control)	
38	Solenoid valve (Accelerated warm-up system (AWS) and air supply valve (ASV))	
42	Duty solenoid valve (Turbo boost pressure control)	
51	Fuel pump resistor relay	
71	Injector (Front secondary)	
73	Injector (Rear secondary)	

97U0F2-525

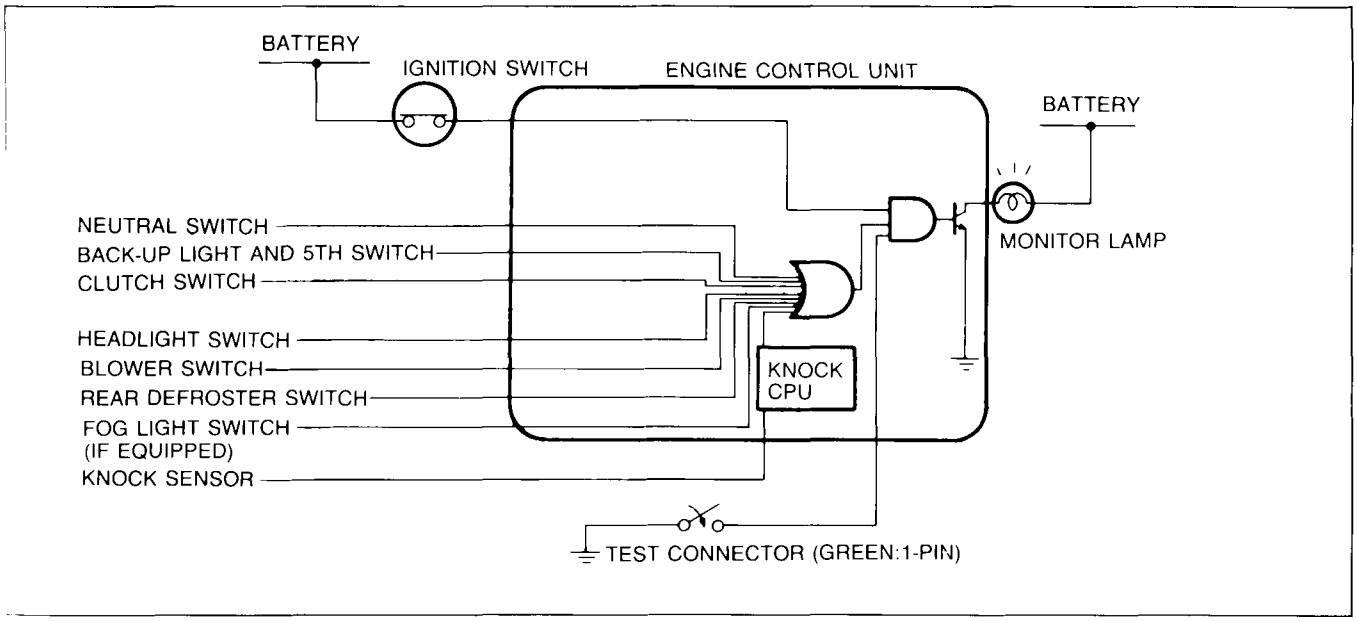
SWITCH MONITOR FUNCTION
Preparation
SST

49 H018 9A1 Self-Diagnosis Checker	

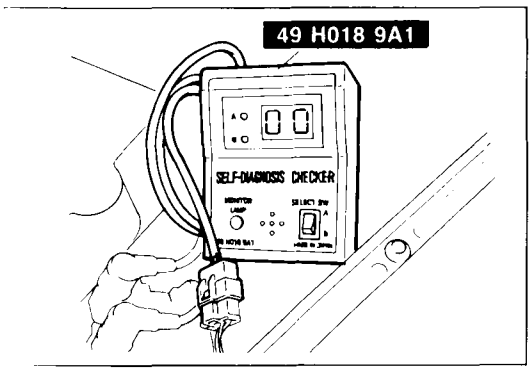
97U0F2 064

Individual switches can be monitored by the **SST**.

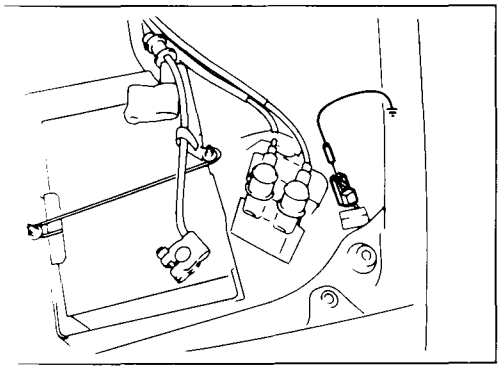
Note
The test connector must be grounded and the ignition switch ON (engine stopped).



97U0F2-065



97U0F2-066



97U0F2-526

Inspection Procedure

1. Warm up the engine to normal operating temperature and stop it.
2. Connect the **SST** to the check connector (Green: 6-pin) and the negative battery terminal.
3. Connect a jumper wire between the test connector (Green: 1-pin) and a ground.
4. Turn the ignition switch ON, then check that the monitor lamp illuminates when each switch is made to function according to the function table.

Caution
a) When any one of the switches are activated, the monitor lamp will be on.
b) Do not start the engine.

Function Table

Switch	Self-Diagnosis Checker (Monitor lamp) Lamp-ON	Lamp-OFF	Possible cause (When incorrect)
Neutral switch	Shift transmission to 1, 2, 3 or 4	Neutral position	• Neutral switch malfunction • Open circuit between neutral switch and ECU 1R terminal, neutral switch and ground
Back-up light and 5th switch	Shift transmission 5th gear	Neutral position	• Back-up light and 5th switch malfunction • Open circuit between back-up light and 5th switch and ECU 1T terminal, overdrive and ground
Clutch switch	Pedal depressed	Pedal released	• Clutch switch malfunction • Open circuit between clutch switch and ECU 1Q terminal, clutch switch and ground, clutch switch and ACC circuit
Headlight switch	Switch ON	Switch OFF	• Headlight switch malfunction • Open circuit between headlight switch and ECU 3L terminal, headlight switch and battery line
Blower switch	Switch ON (At any fan speed OK)	Switch OFF	• Blower switch malfunction • Heater relay malfunction • Heater control unit malfunction • Open circuit between heater control unit and ECU 3O terminal
Rear defroster switch	Switch ON	Switch OFF	• Rear defroster switch malfunction • Open circuit between rear defroster switch and ECU 3P terminal, rear defroster switch and ground
Fog light switch (If equipped)	Switch ON (Only equip fog light)	Switch OFF	• Fog light switch malfunction • Open circuit between fog light switch and ECU 1S terminal, fog light switch and battery
Knock sensor	While knocking: Lamp ON 0.5 sec. (IGN switch ON: hit engine hanger with hammer)	Others	• Knock sensor malfunction • Open circuit between knock sensor and ECU 2M terminal

97U0F2-068

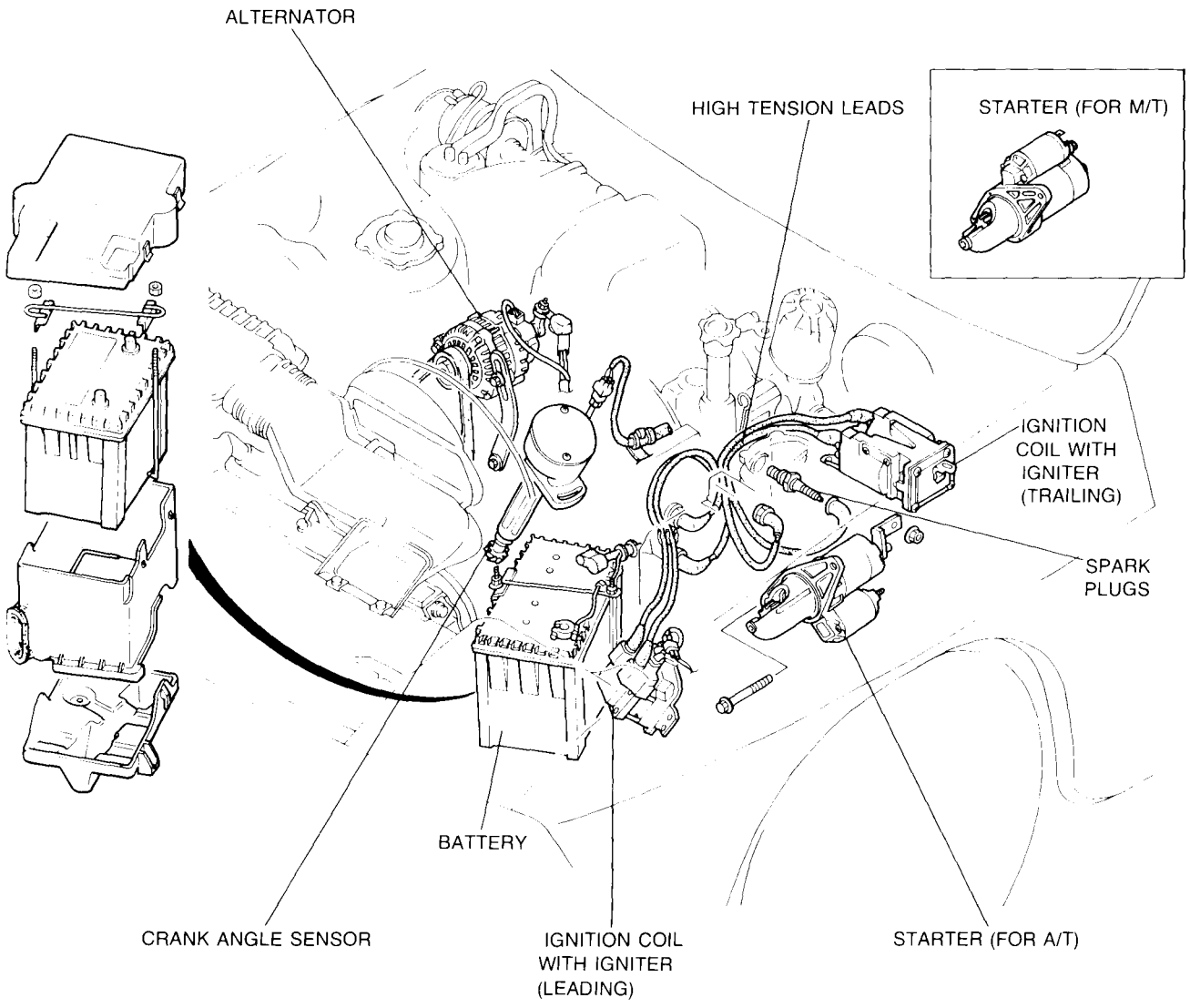
ENGINE ELECTRICAL SYSTEM

97U0GX-501

OUTLINE

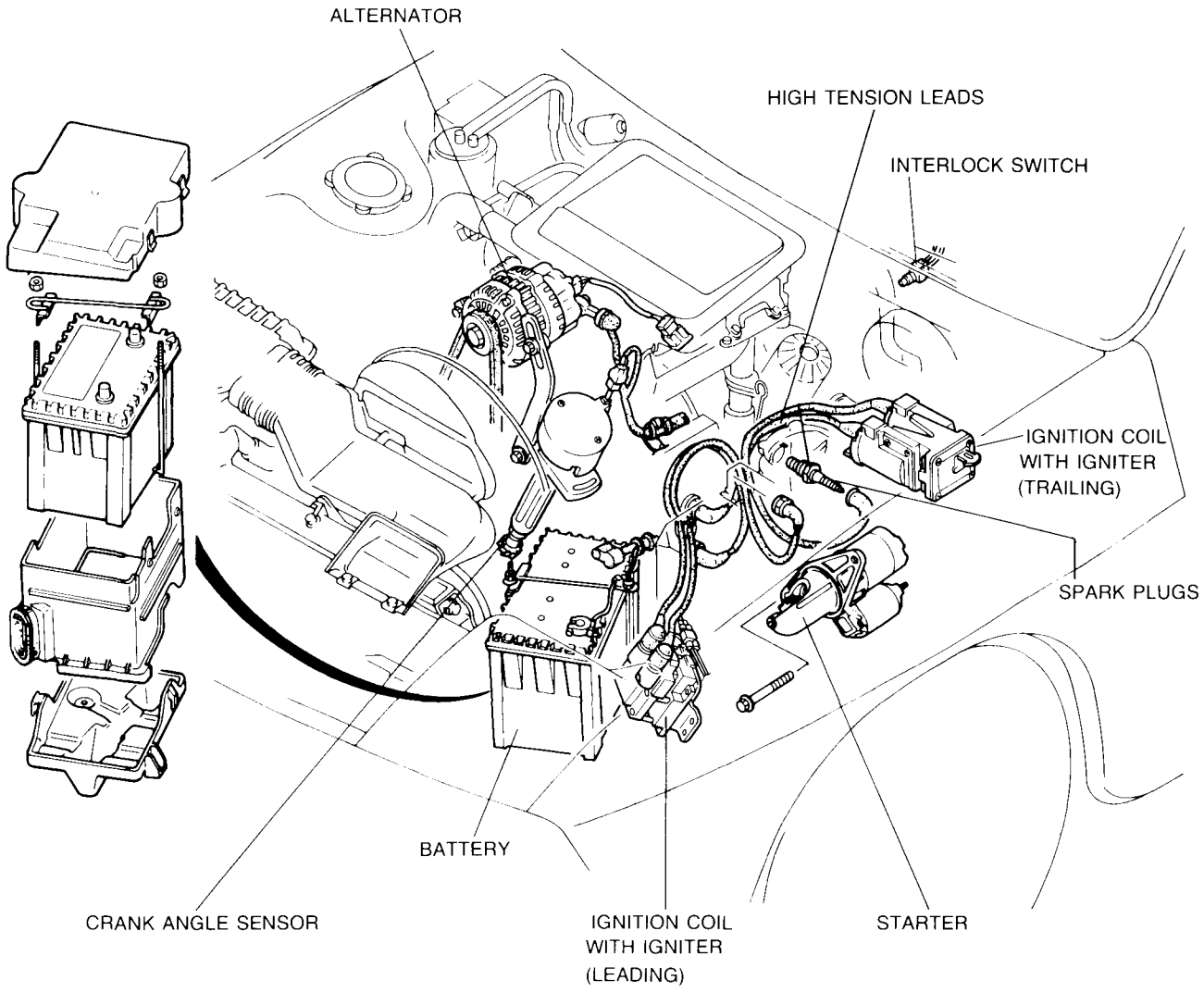
STRUCTURAL VIEW

NON TURBO



97U0GX-502

TURBO



97U0GX-503

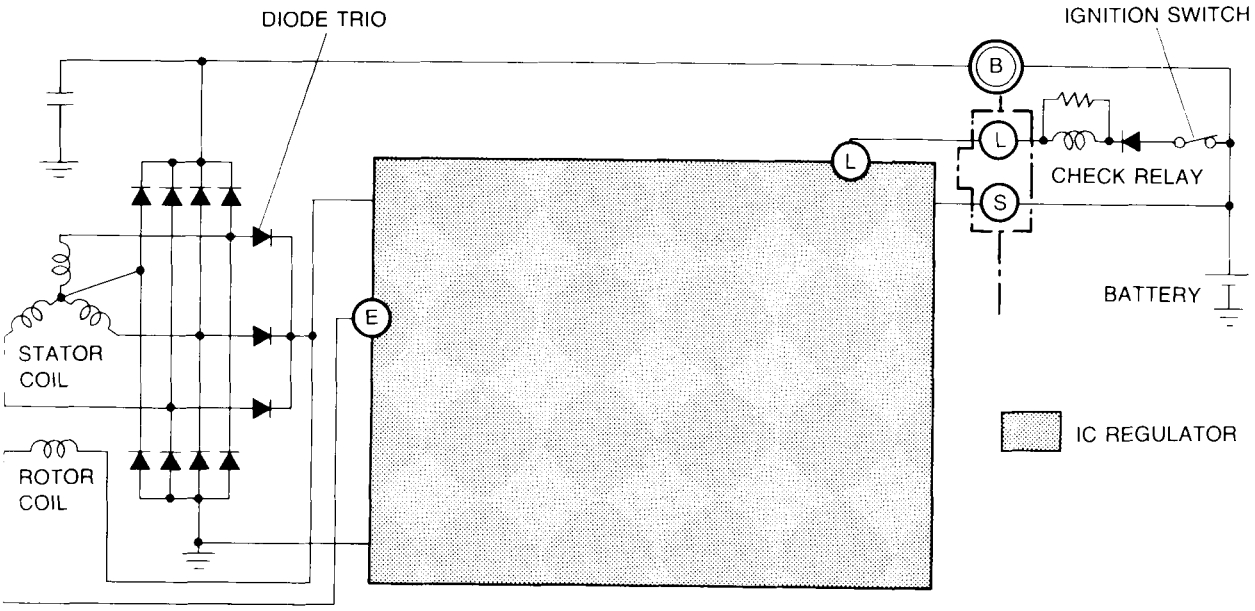
SPECIFICATIONS

Item				Engine models	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)				55D23L: 60 AH 65D23L: 55 AH (Coldproof area)		
Ignition system	Distribution				Control Unit		
	Spark timing (Test connector grounded)				Leading: 5° ± 1° ATDC Trailing: 20° ± 2° ATDC at idle (A/T: N range)		
	Spark advance				Control unit		
	Spark plug	Type			Trailing ; NGK BUR9EQ Leading ; NGK BUR7EQ		
		Plug gap	mm (in)		1.4 (0.056)		
Alternator	Output			V-A	12-80		
	Regulated voltage			V	14.1—14.7 (with temperature—gradient characteristics)		
	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)		

97U0GX-003

ALTERNATOR

CHARGING SYSTEM



detect and control the real battery voltage, the sensing for charging rate is changed to a battery voltage sensing type insted of an IC regulator sensing type.