SECTION ET

ENGINE TUNE-UP

CONTENTS

EMISSION CONTROL DEVICES

System name	Device \ Engine Model	L28					
	Destination	U.S.A.				Canada	
		Non-California		California			
	Transmission	M/T	A/T	M/T	A/T	M/T	A/T
Engine Proper	Cylinder head exhaust port liner	X	X	X	X	X	X
B.C.D.D.	With altitude corrector	–	–	X	X	–	–
	Without altitude corrector	X	X	–	–	X	X
	Inhibitor switch	–	X	–	X	–	X
	Speed detecting switch	X	–	X	–	X	–
Ignition System	IC Ignition Unit, Distributor (Pick-up coil type)	X	X	X	X	X	X
	V.D.V. (Vacuum delay valve – Spark timing)	–	–	X	X	X	X
E.G.R. System	E.G.R. control valve	X	X	X	X	X	X
	B.P.T. valve	X	X	X	X	–	–
	T.V.V. (Thermal vacuum valve-E.G.R.)	X	X	X	X	X	X
	V.D.V. (Vacuum delay valve – E.G.R.)	–	–	X	X	–	–
Catalytic Converter System	Catalytic converter	–	–	X	X	–	–
Others	Dash pot	X	–	X	–	–	–
	Carbon canister	X	X	X	X	X	X
	Fuel check valve (with vacuum relief valve)	X	X	X	X	X	X
	P.C.V. valve	X	X	X	X	X	X

Remarks:

X : Available
– : Not available

M/T : Manual transmission
A/T : Automatic transmission
B.C.D.D. : Boost controlled deceleration device
E.G.R. : Exhaust gas recirculation
B.P.T. : Back pressure transducer
P.C.V. : Positive crankcase ventilation

BASIC MECHANICAL SYSTEM

ADJUSTING INTAKE AND EXHAUST VALVE CLEARANCE

Note: Valve clearance adjustment cannot be made while engine is in operation.

1. Start engine and warm up engine until water temperature indicator points to the middle of gauge, then stop engine.
2. Remove valve rocker cover.
3. Loosen pivot lock nut, using Pivot Adjuster ST10640001, and turn valve rocker pivot until specified value is obtained.

Tighten pivot lock nut securely after adjustment, and recheck clearance.

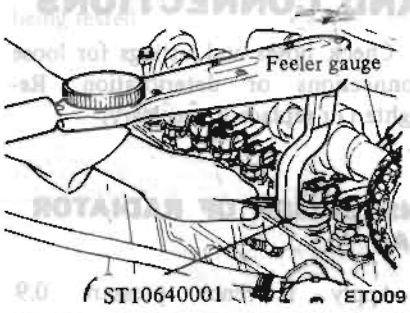

Fig. ET-1 Adjusting Valve Clearance

Valve clearance

Unit: mm (in)

Hot	Intake	0.25 (0.010)
	Exhaust	0.30 (0.012)

Ⓣ Tightening torque:
Pivot lock nut
5.0 to 6.0 kg-m
(36 to 43 ft-lb)

Order of valve clearance adjustments is as follows:

Note: When turning crankshaft with starter, remove high tension cable from ignition coil, then turn it.

(1) Set so that high point of No. 1 cam lobe points above. See Fig. ET-2.
- Exhaust valve ① of No. 1 cylinder
- Intake valve ③ of No. 2 cylinder
- Exhaust valve ⑦ and intake valve ⑧ of No. 4 cylinder
- Exhaust valve ⑨ of No. 5 cylinder
- Intake valve ⑪ of No. 6 cylinder

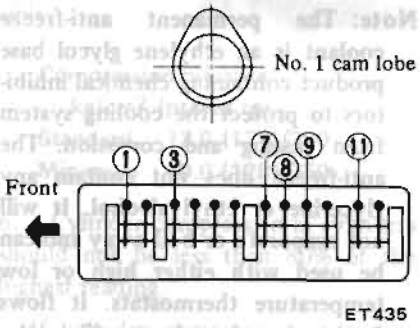

Fig. ET-2 Sequence of Adjusting Valve Clearance

(2) Set so that high point of No. 1 cam lobe points down. See Fig. ET-3.
- Intake valve ② of No. 1 cylinder
- Exhaust valve ④ of No. 2 cylinder
- Intake valve ⑤ and exhaust valve ⑥ of No. 3 cylinder
- Intake valve ⑩ of No. 5 cylinder
- Exhaust valve ⑫ of No. 6 cylinder

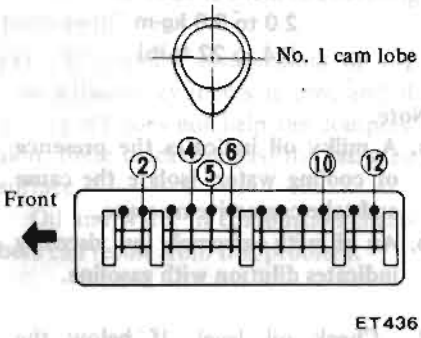

Fig. ET-3 Sequence of Adjusting Valve Clearance

CHECKING AND ADJUSTING DRIVE BELTS

1. Check for cracks or damage. Replace if necessary.
2. Normal drive belt deflection is shown in figure below, when moderate force is applied midway between pulleys.

Force: 10 kg (22 lb)

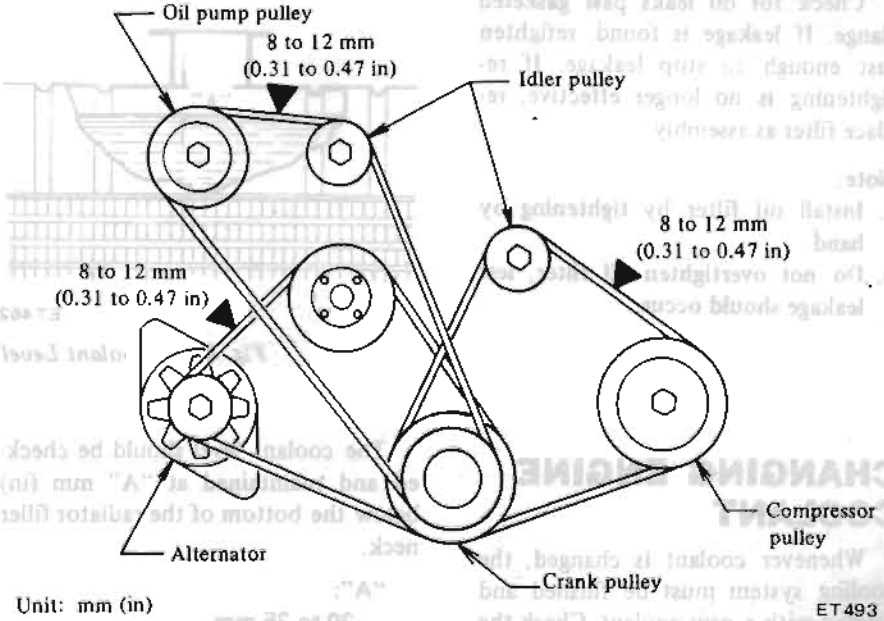

Fig. ET-4 Checking Drive Belt for Deflection

CHANGING ENGINE OIL

1. Check if oil is diluted with water or gasoline. Drain and refill oil if necessary.

Ⓣ Tightening torque:
Oil pan drain plug
2.0 to 3.0 kg-m
(14 to 22 ft-lb)

Note:
a. A milky oil indicates the presence of cooling water. Isolate the cause and take corrective measure.
b. An oil with extremely low viscosity indicates dilution with gasoline.

2. Check oil level. If below the specified level, raise it up to the H level.

Engine oil capacity:
With oil filter
4.5 liters
(4¾ US qt, 4 Imp qt)
Without oil filter
4.0 liters
(4¼ US qt, 3½ Imp qt)

REPLACING OIL FILTER

The oil filter is a cartridge type and can be removed using Oil Filter Wrench ST19320000.

Check for oil leaks past gasketed flange. If leakage is found, retighten just enough to stop leakage. If retightening is no longer effective, replace filter as assembly.

Note:
a. Install oil filter by tightening by hand.
b. Do not overtighten oil filter, lest leakage should occur.

CHANGING ENGINE COOLANT

Whenever coolant is changed, the cooling system must be flushed and refilled with a new coolant. Check the coolant level.

See instructions attached to the anti-freeze container for mixing ratio of anti-freeze to water.

Cooling water capacity

Unit: ℓ (US qt, Imp qt)

With coolant reservoir	10.5 (11⅛, 9¼)
Without coolant reservoir	9.7 (10¼, 8½)

Note: The permanent anti-freeze coolant is an ethylene glycol base product containing chemical inhibitors to protect the cooling system from rusting and corrosion. The anti-freeze does not contain any glycerine or ethyl alcohol. It will not evaporate or boil away and can be used with either high or low temperature thermostats. It flows freely, transfers heat efficiently, and will not clog the passages in the cooling system. The anti-freeze must not be mixed with other product. This coolant can be used throughout the seasons of the year.

COOLANT LEVEL

- Without coolant reservoir.

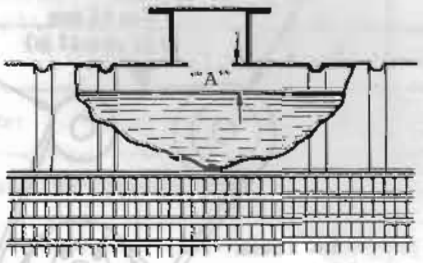

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Fig. ET-5 Coolant Level

The coolant level should be checked and maintained at "A" mm (in) below the bottom of the radiator filler neck.

"A":
20 to 35 mm
(0.79 to 1.38 in)

- With coolant reservoir.

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Fig. ET-6 Coolant Level

Check the amount of coolant in the reservoir tank. If the coolant level is below the MIN. level, remove the reservoir tank filler cap and add enough coolant to reach MAX. level.

CHECKING COOLING SYSTEM, HOSES AND CONNECTIONS

Check hoses and fittings for loose connections or deterioration. Retighten or replace if necessary.

INSPECTION OF RADIATOR CAP

Apply reference pressure 0.9 kg/cm² (13 psi) to radiator cap by means of a cap tester to see if it is satisfactory. Replace cap assembly if necessary.


ET012

Fig. ET-7 Testing Radiator Cap

COOLING SYSTEM PRESSURE TEST

With radiator cap removed, apply reference pressure 1.6 kg/cm² (23 psi) to the cooling system by means of a tester to detect any leakage.

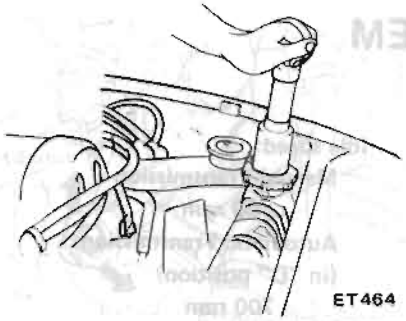


Fig. ET-8 Cooling System Pressure Test

CHECKING ENGINE COMPRESSION

1. Warm up engine until water temperature indicator points to the middle of gauge.
2. Disconnect all spark plugs.
3. Disconnect cold start valve and all injector connectors.
4. Properly attach a compression tester to spark plug hole in cylinder being tested.

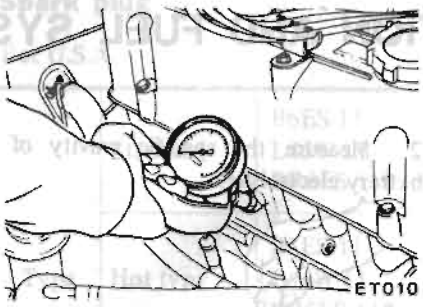


Fig. ET-9 Testing Compression Pressure

5. Crank engine as quickly as possible.

Compression pressure: kg/cm² (psi)/at rpm	
Standard	12.0 (171)/350
Minimum	9.0 (128)/350

6. Cylinder compression in cylinders should not be less than 80% of the highest reading.

If cylinder compression in one or more cylinders is low, pour a small quantity of engine oil into cylinders through the spark plug holes and retest compression.

(1) If adding oil helps the compression pressure, the chances are that piston rings are worn or damaged.

(2) If pressure stays low, the likelihood is that valve is sticking or seating improperly.

(3) If cylinder compression in any two adjacent cylinders is low, and if adding oil does not help the compression, there is leakage past the gasketed surface.

Oil and water in combustion chambers can result from this problem.

IGNITION AND FUEL SYSTEM

CHECKING BATTERY

1. Remove six vent plugs and check electrolyte level in each battery cell. If necessary, pour distilled water.

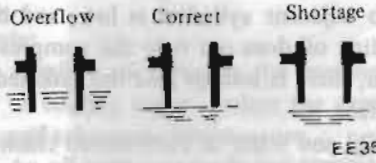


Fig. ET-10 Checking Electrolyte Level

2. Measure the specific gravity of battery electrolyte.

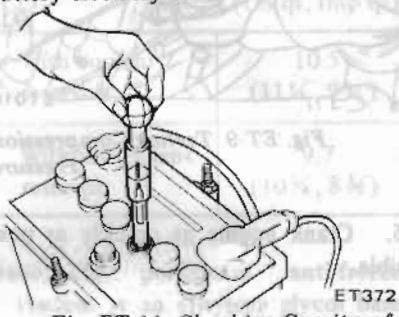


Fig. ET-11 Checking Gravity of Battery Electrolyte

	Permissible value	Full charge value [at 20°C (68°F)]
Frigid climates	Over 1.22	1.28
Other climates	Over 1.20	1.26

Note:

a. Clean top of battery and terminals with a solution of baking soda and water. Rinse off and dry with compressed air. Top of battery must be clean to prevent current leakage between terminals and from positive terminal to hold-down clamp.
b. In addition to current leakage, prolonged accumulation of acid and dirt on top of battery may cause blistering of the material covering connector straps and corrosion of straps.
c. After tightening terminals, coat them with petrolatum (vaseline) to protect them from corrosion.

CAUTION:

a. If it becomes necessary to start the engine with a booster battery and jumper cables, the booster battery voltage must not exceed 12 volts, or the control unit of the fuel injection system and other electric components will be damaged.
b. If the battery cables are disconnected, they should be tightly clamped to the battery terminals to secure a good contact.

CHECKING AND ADJUSTING IGNITION TIMING

Note:

a. On air conditioner equipped models, inspections should be carried out while the air conditioner is "OFF".
b. On automatic transmission models, inspections should be carried out while shift lever is in "D" position.

WARNING:
When selector lever is shifted to "D" position, apply parking brake and block both front and rear wheels with chocks.

1. Warm up engine until water temperature indicator points to the middle of gauge.
2. Race engine two or three times under no-load, then run engine for one minute at idling.
3. Check idle speed.

Idle speed:
Manual Transmission
800 rpm
Automatic Transmission
(in "D" position)
700 rpm

If necessary, adjust idle speed to the specified rpm by turning idle speed adjusting screw attached to throttle chamber.

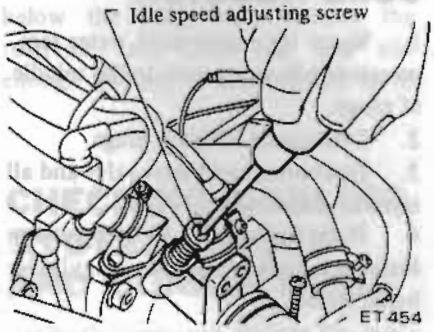


Fig. ET-12 Adjusting Idle RPM

4. Check ignition timing with a timing light.

Ignition timing:
Manual Transmission
10° B.T.D.C./800 rpm
Automatic Transmission
(in "D" position)
10° B.T.D.C./700 rpm

This operation need not be carried out at 1,000 km (600 mile) service.

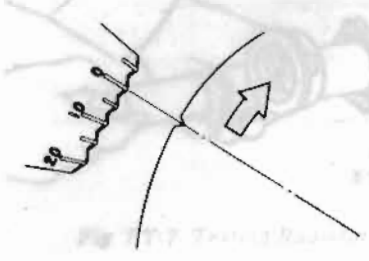


Fig. ET-13 Ignition Timing Indicator

If necessary, adjust ignition timing by turning distributor after loosening bolt which secures distributor.

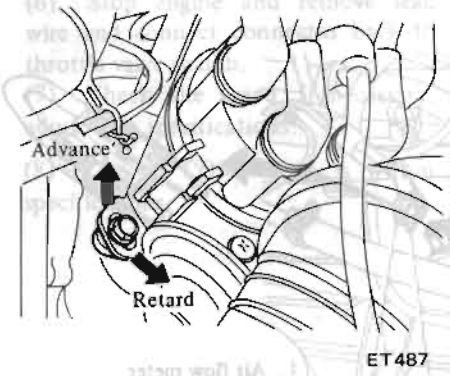


Fig. ET-14 Adjusting Ignition Timing

CHECKING AND REPLACING SPARK PLUGS

1. Clean plugs in a sand blast cleaner. Inspect each spark plug. Make sure that they are of the specified heat range and type.
2. Inspect insulator for cracks or chips. Check both center and ground electrodes.
3. If they are excessively worn, replace with new spark plugs.
4. Check spark plug gap with plug gap gauge. If not specified value, adjust by bending the ground electrode.

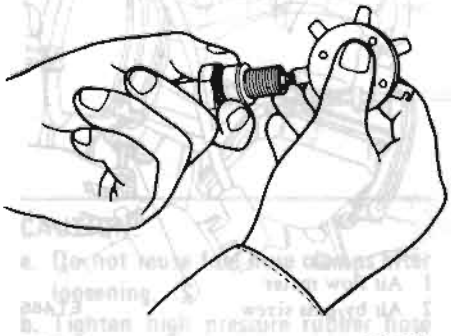


Fig. ET-15 Checking Spark Plug Gap

Spark plug

For U.S.A.

Type	Standard	B6ES-11 L45W-11 BR6ES-11*
	Hot type	B5ES-11 L46W-11 BR5ES-11*
	Cold type	B7ES-11 L44W-11 BR7ES-11*
Plug gap mm (in)		1.0 to 1.1 (0.039 to 0.043)

*: Option

For Canada

Type	Standard	BR6ES-11
	Hot type	BR5ES-11
	Cold type	BR7ES-11
Plug gap mm (in)		1.0 to 1.1 (0.039 to 0.043)

Ⓣ **Tightening torque:**
Spark plug
1.5 to 2.0 kg-m
(11 to 14 ft-lb)

CHECKING IGNITION WIRING

Use an ohmmeter to check resistance on high tension cables.

1. Disconnect high tension cables from spark plugs and remove distributor cap.

Note: Do not remove cables from cap.

2. Connect the ohmmeter between cable terminal on the spark plug side and the corresponding electrode inside cap.
3. If the resistance is more than 30,000 ohms, remove cable from cap and check the cable resistance only. If resistance is still more than 30,000 ohms, replace cable assembly.

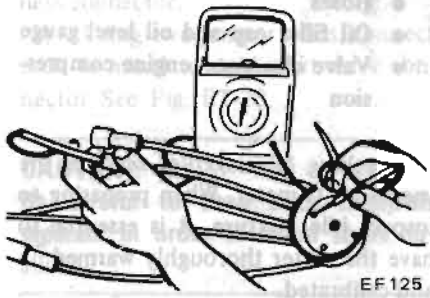


Fig. ET-16 Checking High Tension Cable

CHECKING AND ADJUSTING IDLE RPM AND MIXTURE RATIO

WARNING:
- a. On automatic transmission models, checks should be performed with the lever shifted to the "D" position. Be sure to engage parking brake and to lock both front and rear wheels with wheel chocks.
- b. Depress brake pedal while accelerating the engine to prevent forward surge of car.
- c. After the adjustment has been made, shift the lever to the "N" or "P" position and remove wheel chocks.

CAUTION:
Before disconnecting and connecting EFI component parts harness connectors, ensure that ignition switch is in "OFF" position.

Note:
- a. On air conditioner equipped models, inspection should be carried out while air conditioner is "OFF".
- b. When checking idle mixture ratio (CO percentage), make sure that the following parts are in good order.
  - Battery
  - Ignition system
  - Engine oil and coolant levels

- Fuses
- EFI component parts
- EFI harness connectors
- Hoses
- Oil filler cap and oil level gauge
- Valve clearance, engine compression

Checking idle mixture requires the use of a CO-meter. When preparing to inspect idle mixture, it is essential to have the meter thoroughly warmed up and calibrated.

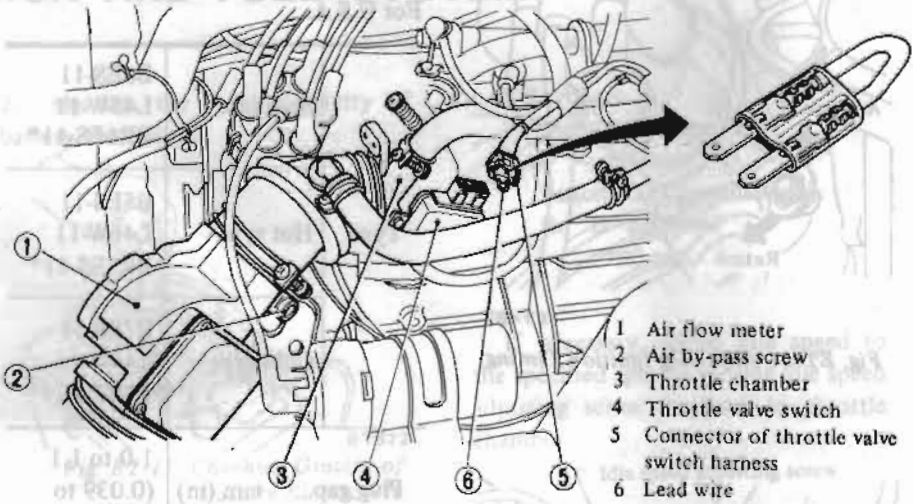
1. Warm up engine until water temperature indicator points to the middle of gauge. The procedure to warm up engine is not specifically recommended. Either driving car or operating engine at no load will be good.
2. Make sure that water temperature indicator points to the middle. Further keep engine running at about 2,000 rpm for about 2 minutes without applying load to engine in order to stabilize engine condition. Engine hood should be open.
3. Run engine for about 5 minutes at idling speed.
4. During this 5 minutes, adjust idle speed and ignition timing, referring to Checking and Adjusting Ignition Timing.
5. At about 5 minutes after engine is run, check CO percentage with CO meter.

Idle "CO" %:
California models
0.5% or lower
Non-California models
1.0% or lower

6. If specified idle CO percentage is not obtained, repeat procedures as described in steps 2, 3 and 4 above. Checking idle CO in step 5 can be carried out right after step 4.

If specified idle CO percentage is not obtained, adjust it as described below in the last resort.

(1) Turn ignition switch to "OFF" position.
(2) Disconnect throttle valve switch harness connector.
(3) Connect a lead wire, shown in Fig. ET-17, between terminals No. 24 and No. 30 of throttle valve switch harness connector.



1 Air flow meter
2 Air by-pass screw
3 Throttle chamber
4 Throttle valve switch
5 Connector of throttle valve switch harness
6 Lead wire

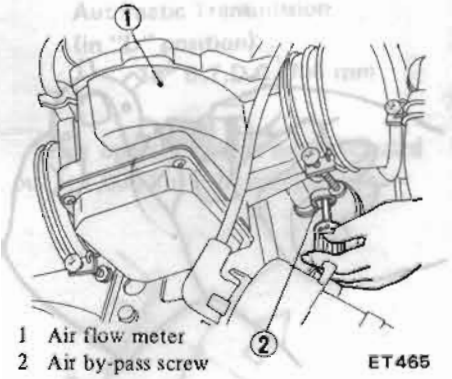
ET503

Fig. ET-17 Idle Mixture Ratio Adjustment

Note:
a. **The idle mixture ratio of EFI car is set so lean that "CO"% remains almost unchanged when adjustment is made under normal condition. Therefore, when adjusting idle mixture ratio, to distinguish variation in "CO"%, a full enrichment must be temporarily given to idle mixture setting to make it richer.**
b. **Make lead wire as follows:**
Use flat plate terminals 3 mm (0.12 in) wide, 0.8 mm (0.031 in) thick as male terminals. Place flat plate terminals parallel with each other and keep distance between inside faces 2 mm (0.08 in). Solder lead wire to each terminal and wrap insulation tape around soldered portion.

(4) Warm up engine sufficiently, race engine two on three times under no-load, then run engine for one minute at idling speed.
(5) Adjust "CO"% to altitude at measured point by turning air by-pass screw on air flow meter.

Altitude	Idle CO % (full enrichment)
0 to 600 m (0 to 2,000 ft)	3.3%
600 to 1,200 m (2,000 to 4,000 ft)	4.7%
1,200 to 1,800 m (4,000 to 6,000 ft)	5.7%
Above 1,800 m (6,000 ft)	6.7%



1 Air flow meter
2 Air by-pass screw

ET465

Fig. ET-18 Adjusting "CO"%

Note:
a. **Air by-pass screw:**
Turning counterclockwise – Leaner
Turning clockwise – Richer
b. **When adjusting "CO"%, remove blind plug from air by-pass screw. After adjustment, install the plug on air flow meter.**

(6) Stop engine and remove lead wire and connect connector back to throttle valve switch.
(7) Check idle speed. If necessary, adjust it to specifications.
(8) Check "CO%" if it is within specifications.

CHECKING FUEL LINES

Check fuel line for leaks, particularly around connection of fuel pipe and fuel hose.

Retighten loose connections and replace any damaged or deformed parts.

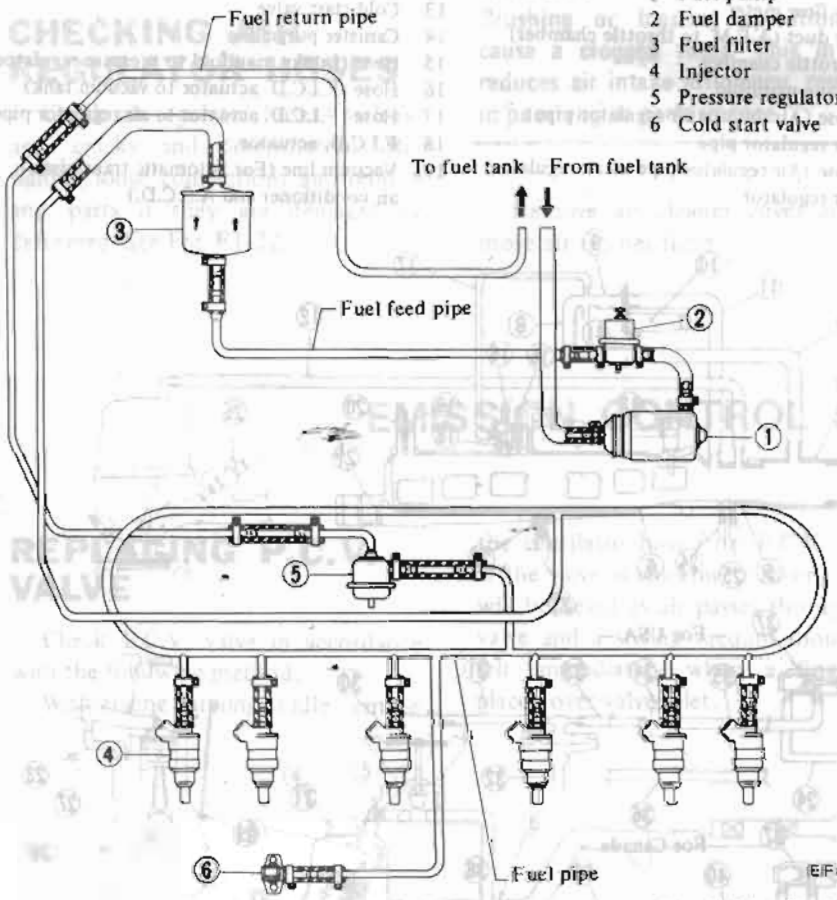


Fig. ET-19 Fuel Line

CAUTION:
a. Do not reuse fuel hose clamps after loosening.
b. Tighten high pressure rubber hose clamp so that clamp end is 3 mm (0.12 in) from hose end or screw position (wider than other portions of clamp) is flush with hose end. Tightening torque specifications are the same for all rubber hose clamps.

Tightening torque of fuel hose clamps:
0.10 to 0.15 kg-m
(0.7 to 1.1 ft-lb)

REPLACING FUEL FILTER

The fuel filter is designed especially for use with the EFI system. It should be replaced as an assembly.

1. Follow the procedure below to decrease fuel pressure to zero.

CAUTION:
Before disconnecting fuel hose, release fuel pressure from fuel line to avoid danger.

(1) Disconnect ground cable from battery.
(2) Disconnect cold start valve harness connector.
(3) Using two jumper wires, connect each terminal to cold start valve connector. See Fig. ET-20.

CAUTION:
Be careful to keep both terminals separate in order to avoid short circuit.

(4) Release pressure in fuel system by connecting other terminals of jumper wires to battery positive and negative terminals for a few seconds.

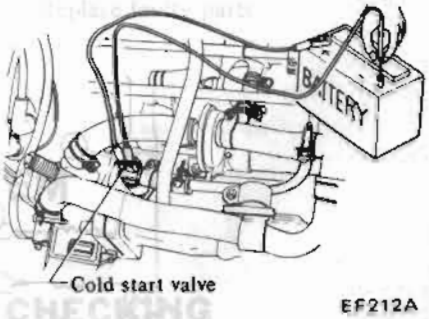


Fig. ET-20 Releasing Pressure in Fuel System

2. Unfasten clamps securing fuel hoses to the outlet and inlet sides of fuel filter, and disconnect fuel hoses.

Note: Be careful not to spill fuel over engine compartment. Place a rag to absorb fuel.

3. Loosen bolt securing fuel filter to bracket, and remove fuel filter.

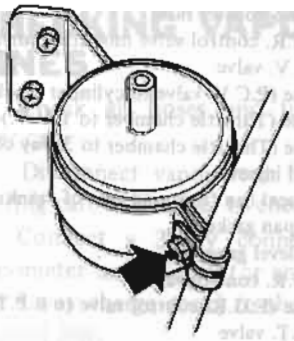


Fig. ET-21 Fuel Filter

4. To install fuel filter, reverse the order of removal.

CAUTION:

a. Do not reuse fuel hose clamps after loosening.

b. Tighten high pressure rubber hose clamp so that clamp end is 3 mm (0.12 in) from hose end or screw position (wider than other portions of clamp) is flush with hose end. Tightening torque specifications are the same for all rubber hose clamps.

Tightening torque of fuel hose clamps:

0.10 to 0.15 kg-m (0.7 to 1.1 ft-lb)

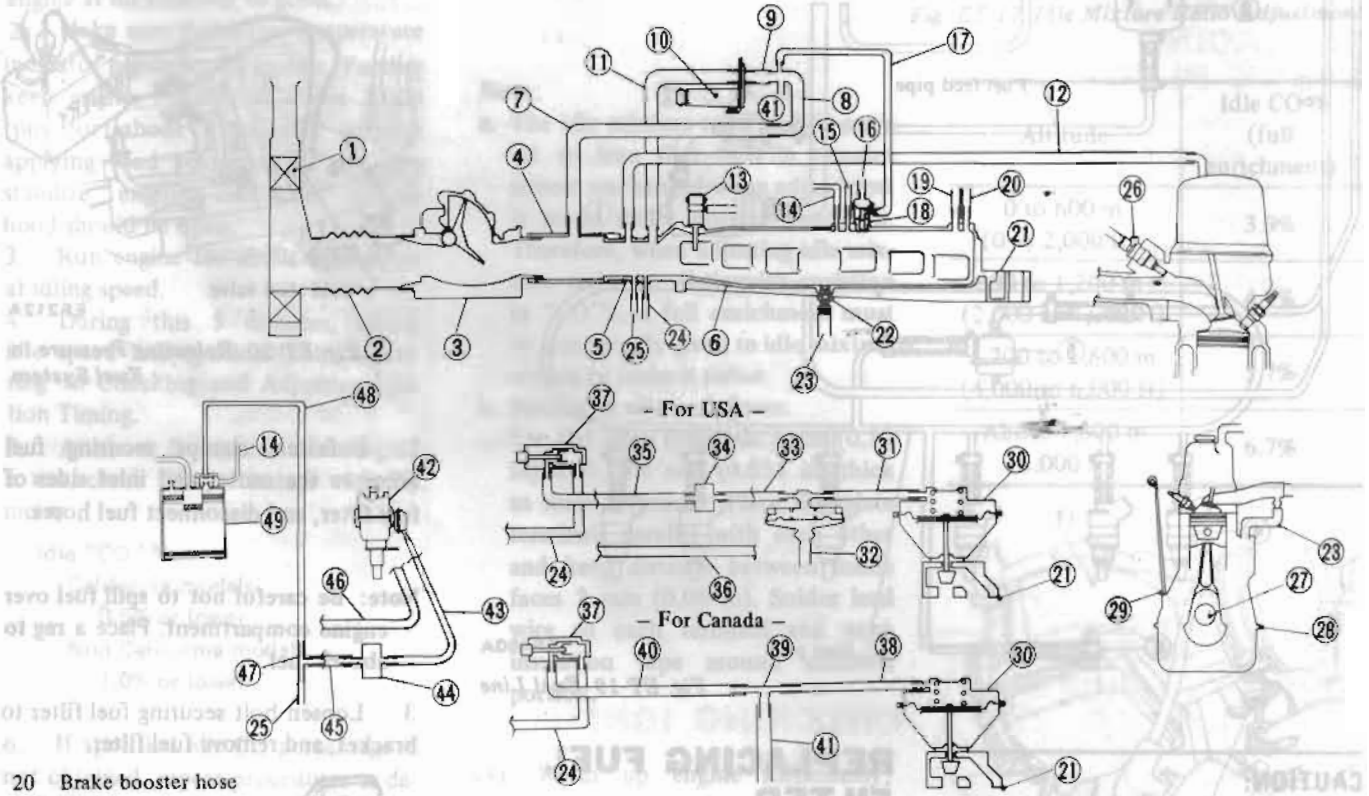
CHECKING AIR LEAKAGE IN AIR INTAKE SYSTEM

Make sure that even a slight air leak does not occur.

When inspecting the EFI system, pay particular attention to hose connections, dipstick, oil filler cap, etc. for any indication of air leaks.

Note: The air flow meter used in the EFI system directly measures the quantity of intake air to permit the supply of the optimum fuel quantity for each cylinder.

1 Air cleaner filter
2 Air duct (Air cleaner to A.F.M.)
3 Air flow meter
4 Air duct (A.F.M. to throttle chamber)
5 Throttle chamber
6 Intake manifold
7 Hose (Air duct to air regulator pipe)
8 Air regulator pipe
9 Hose (Air regulator pipe to air regulator)
10 Air regulator
11 Hose (Air regulator to throttle chamber)
12 Hose (Throttle chamber to rocker cover)
13 Cold start valve
14 Canister purge line
15 Hose (Intake manifold to pressure regulator)
16 Hose (F.I.C.D. actuator to vacuum tank)
17 Hose (F.I.C.D. actuator to air regulator pipe)
18 F.I.C.D. actuator
19 Vacuum line (For automatic transmission, air conditioner and A.S.C.D.)



20 Brake booster hose
21 E.G.R. control valve mounting surface
22 P.C.V. valve
23 Hose (P.C.V. valve to cylinder block)
24 Hose (Throttle chamber to T.V.V.)
25 Hose (Throttle chamber to 3-way connector)
26 Fuel injector
27 Oil seal (on front and rear of crankshaft)
28 Oil pan gasket
29 Oil level gauge
30 E.G.R. control valve
31 Hose (E.G.R. control valve to B.P.T. valve) } For U.S.A.
32 B.P.T. valve
33 Hose (B.P.T. valve to V.D.V.) } California models
34 V.D.V.
35 Hose (V.D.V. to T.V.V.)
36 Hose (B.P.T. valve to T.V.V.) – Non-California models except Canada
37 Thermal vacuum valve
38 Hose (E.G.R. control valve to 3-way connector) } Canada models
39 3-way connector
40 Hose (3-way connector to T.V.V.)
41 Hose (3-way connector to air regulator pipe)
42 Distributor
43 Hose (Distributor to V.D.V.) } California and Canada models
44 V.D.V.
45 Hose (V.D.V. to 3-way connector)
46 Hose (Distributor to 3-way connector) – Non-California models except Canada
47 3-way connector
48 Hose (3-way connector to canister)
49 Canister

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Fig. ET-22 Checking Air Leakage in Air Intake System

CHECKING VACUUM FITTING TUBES AND CONNECTIONS

Check fittings and hoses for loose connections or damage. Retighten loose parts or replace parts that are not suitable for further use. See Fig. ET-22.

CHECKING AIR REGULATOR HOSES

Check air regulator hoses for leakage, cracks and deterioration. Retighten loose connections and replace any parts if they are demaged or deformed. See Fig. ET-22.

REPLACING AIR CLEANER FILTER

Note: The viscous paper type air cleaner filter does not require any cleaning operation between renewals.

CAUTION:
Brushing or blasting operation can cause a clogged filter. This in turn reduces air intake efficiency, resulting in poor engine performance.

Remove air cleaner cover and remove air cleaner filter.

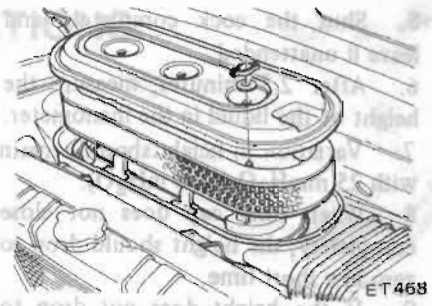


Fig. ET-23 Air Cleaner Filter

CHECKING CABLE HARNESS AND CONNECTORS

Check harness connectors for correct insertion and harness connector terminals for deformation or rust.

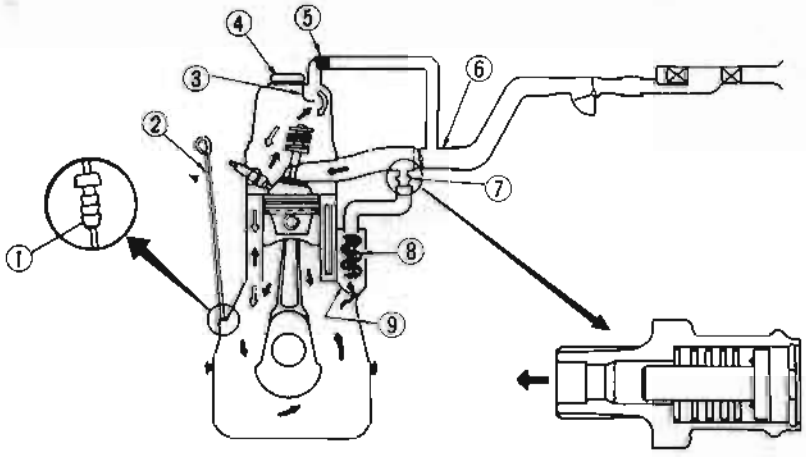
Replace faulty parts.

EMISSION CONTROL SYSTEM

REPLACING P.C.V. VALVE

Check P.C.V. valve in accordance with the following method.

With engine running at idle, remove the ventilator hose from P.C.V. valve. If the valve is working, a hissing noise will be heard as air passes through the valve and a strong vacuum should be felt immediately when a finger is placed over valve inlet.



⇨ Fresh air
➡ Blow-by gas

1 Seal rubber
2 Oil level gauge
3 Baffle plate
4 Oil filler cap
5 Flame arrester
6 Throttle chamber
7 P.C.V. valve
8 Steel net
9 Baffle plate

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Fig. ET-24 Crankcase Emission Control System

CHECKING VENTILATION HOSES

1. Check hoses and hose connections for leaks.
2. Disconnect all hoses and clean with compressed air.

If any hose cannot be free of obstructions, replace.

Ensure that flame arrester is surely inserted in hose between throttle chamber and rocker cover.

CHECKING VAPOR LINES

1. Check all hoses and fuel tank filler cap.
2. Disconnect vapor vent line connecting carbon canister to check valve.
3. Connect a 3-way connector, a manometer and a cock (or an equivalent 3-way charge cock) to the end of the vent line.
4. Supply fresh air into the vapor vent line through the cock little by little until pressure becomes 400 mmH_2O (15.75 inH_2O).

5. Shut the cock completely and leave it unattended.
6. After 2.5 minutes, measure the height of the liquid in the manometer.
7. Variation in height should remain with 25 mmH_2O (0.98 inH_2O).
8. When filler cap does not close completely, the height should drop to zero in a short time.
9. If the height does not drop to zero in a short time when filler cap is removed, it is the cause of a stuffy hose.

Note:
In case the vent line is stuffy, the breathing in fuel tank is not thoroughly made, thus causing insufficient delivery of fuel to engine or vapor lock. It must, therefore, be repaired or replaced.

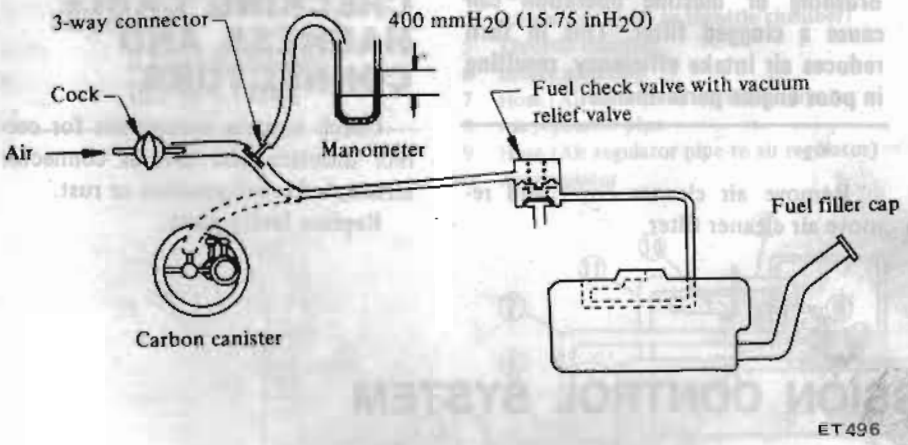


Fig. ET-25 Checking Evaporative Emission Control System

REPLACING CARBON CANISTER FILTER

Check for a contaminated filter.

Remove canister tray and remove filter at bottom of canister.

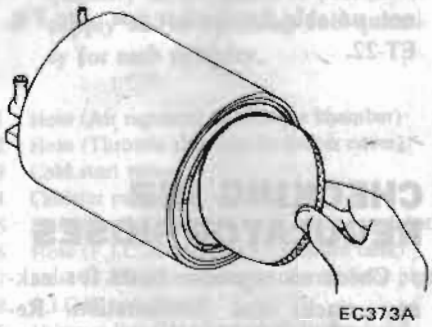


Fig. ET-26 Replacing Carbon Canister Filter

Note:
Sealant has been applied to contact surface of canister and canister tray. When removing canister tray, pull it off while twisting.
When reinstalling canister tray, apply sealant to contact surface of canister and canister tray.

SERVICE DATA AND SPECIFICATIONS

INSPECTION AND ADJUSTMENT

BASIC MECHANICAL SYSTEM

Valve clearance			
Hot	Intake	mm (in)	0.25 (0.010)
	Exhaust	mm (in)	0.30 (0.012)
Drive belt deflection			
Fan, Air conditioner compressor, and Power steering oil pump		mm (in)	8 to 12 (0.31 to 0.47)
Applied pressed force		kg (lb)	10 (22)
Engine oil capacity			
With oil filter		liters (US qt, Imp qt)	4.5 (4 ¾, 4)
Without oil filter		liters (US qt, Imp qt)	4.0 (4 ¼, 3 ½)
Cooling water capacity			
With coolant reservoir		liters (US qt, Imp qt)	10.5 (11 ⅛, 9 ¼)
Without coolant reservoir		liters (US qt, Imp qt)	9.7 (10 ¼, 8 ½)
Radiator cap relief pressure		kg/cm^2 (psi)	0.9 (13)
Cooling system leakage testing pressure		kg/cm^2 (psi)	1.6 (23)
Compression pressure		kg/cm^2 (psi)/rpm	
Standard			12.0 (171)/350
Minimum			9.0 (128)/350

IGNITION AND FUEL SYSTEM

Battery electrolyte gravity at 20°C (68°F)

Frigid climates	1.28
Other climates	1.26

Spark plug

	Type			Plug gap mm (in)
	Standard	Hot type	Cold type	
For U.S.A.	B6ES-11 L45W-11 BR6ES-11*	B5ES-11 L46W-11 BR5ES-11*	B7ES-11 L44W-11 BR7ES-11*	1.0 to 1.1 (0.039 to 0.043)
For Canada	BR6ES-11	BR5ES-11	BR7ES-11	

*Option

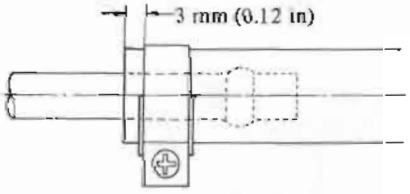
Ignition timing and idling speed

Manual transmission	degree/rpm	10° B.T.D.C./800
Automatic transmission (in "D" position)	degree/rpm	10° B.T.D.C./700
"CO" % at idling speed		
California models	%	0.5 or lower
Non-California models	%	1.0 or lower

TIGHTENING TORQUE

Pivot lock nut	kg-m (ft-lb)	5.0 to 6.0 (36 to 43)
Spark plug	kg-m (ft-lb)	1.5 to 2.0 (11 to 14)
Fuel hose clamp	kg-m (ft-lb)	0.10 to 0.15 (0.7 to 1.1)

Note: Fuel hose clamping position



EF336A

TROUBLE DIAGNOSES AND CORRECTIONS

Condition	Probable cause	Corrective action
CANNOT CRANK ENGINE OR SLOW CRANKING	Improper grade oil.	Replace with proper grade oil.
	Partially discharged battery.	Charge battery.
	Malfunctioning battery.	Replace.
	Loose fan belt.	Adjust.
	Trouble in charging system.	Inspect.
	Wiring connection trouble in starting circuit.	Correct.
	Malfunctioning ignition switch.	Repair or replace.
	Malfunctioning starting motor.	Repair or replace.

(Trouble-shooting procedure on starting circuit)
Switch on the starting motor with head lights "ON".

When head lights go off or dim considerably,

a. Check battery.
b. Check connection and cable.
c. Check starting motor.

When head lights stay bright,

a. Check wiring connection between battery and starting motor.
b. Check ignition switch.
c. Check starting motor.

ENGINE WILL CRANK NORMALLY BUT WILL NOT START

In this case, the following trouble causes may exist, but in many cases ignition system or fuel system is in trouble.

Ignition system in trouble
Fuel system in trouble
Valve mechanism does not work properly
Low compression

(Trouble-shooting procedure)

Check spark plug firstly by following procedure.
Disconnect high tension cable from one spark plug and hold it about 10 mm (0.39 in) from the engine metal part and crank the engine.

Good spark occurs.

a. Check spark plug.
b. Check ignition timing.
c. Check fuel system.
d. Check revolution trigger signal.
e. Check cylinder compression.

No spark occurs.

Very high current.

Check the current flow in primary circuit.
Inspect primary circuit for short.
Check distributor pick-up coil operation.
Check IC ignition system.

Condition	Probable cause	Corrective action
	Low or no current.	Check for loose terminal or disconnection in primary circuit. Check for burned points.
Ignition system in trouble	Malfunctioning distributor pick-up coil.	Replace.
	Improper air gap.	Adjust.
	Leak at rotor cap and rotor.	Clean or replace.
	Malfunctioning spark plug.	Clean, adjust plug gap or replace.
	Improper ignition timing.	Adjust.
	Malfunctioning ignition coil.	Replace.
	Disconnection of high tension cable.	Replace.
	Loose connection or disconnection in primary circuit.	Repair or replace.
	Irregular revolution trigger pulse.	Replace IC ignition unit.
	Malfunctioning IC ignition unit.	Replace.
ENGINE CRANKS NORMALLY BUT WILL NOT START		
Fuel system malfunction	Lack of fuel.	Supply.
	Damaged electronic fuel injection harness or relay.	Replace.
	Malfunctioning fuel pump (Listen to operating sound).	Replace.
	Damaged control unit.	Replace.
	Seized injector (Listen to operating sound).	Replace.
	Seized cold start valve.	Replace.
	Malfunctioning air flow meter.	Replace.
	Damaged water temp. sensor.	Replace.
	Malfunctioning pressure regulator.	Replace.
	Dirty fuel filter.	Replace.
	Dirty or clogged fuel pipe.	Clean.
	Clogged fuel tank breather pipe.	Repair and clean.
Low compression	Incorrect spark plug tightening or damaged gasket.	Tighten to normal torque or replace gasket.
	Improper grade engine oil or low viscosity.	Replace with proper grade oil.
	Incorrect valve clearance.	Adjust.
	Compression leak from valve seat.	Lap valves.
	Sticky valve stem.	Correct or replace valve and valve guide.
	Weak or damaged valve springs.	Replace valve springs.
	Compression leak at cylinder head gasket.	Replace gasket.

For inspection procedures for electronic fuel injection system components, refer to Engine Fuel section.

Condition	Probable cause	Corrective action
Low compression	Sticking or defective piston ring.	Replace piston rings.
	Worn piston ring or cylinder.	Overhaul engine.
	(Trouble shooting procedure) Pour the engine oil from plug hole, and then measure cylinder compression.	
	Compression increases.	Trouble in cylinder or piston ring.
	Compression does not change.	Compression leaks from valve, cylinder head or head gasket.
UNSTABLE ENGINE IDLING		
Ignition system	Incorrect idle adjustment	Adjust.
	Malfunctioning ignition system (spark plug, high tension cable, distributor, IC ignition unit, ignition coil, etc.)	Replace.
	Incorrect basic ignition timing.	Adjust.
Engine mechanical system in trouble	Loose manifold and cylinder head bolts.	Retighten bolts.
	Incorrect valve clearance.	Adjust.
Fuel system malfunction	Clogged air cleaner filter.	Replace filter.
	Damaged manifold gaskets.	Replace gasket.
	Intake air leakage at following points: Dipstick Oil filler cap Blow-by hoses Intake air duct–air flow meter to throttle chamber, etc.	Repair or replace.
	Damaged electronic fuel injection harness.	Replace.
	Seized injector (Listen to operating sound).	Replace.
	Malfunctioning air regulator (During warm-up driving only)	Replace.
	Damaged control unit.	Replace.
	Damaged water and air temp. sensor.	Replace.
	Malfunctioning throttle valve switch.	Repair or replace.
	Irregular fuel pressure.	Replace pressure regulator.
		For inspection procedures for electronic fuel injection system components, refer to Engine Fuel Section.
Others	Malfunctioning E.G.R. control system.	Clean or replace.
HIGH ENGINE IDLE SPEED	Dragged accelerator linkage.	Check and correct accelerator linkage.
	Malfunctioning B.C.D.D. system.	If engine idling speed rises above 1,800 to 2,000 rpm, the cause may be a malfunctioning B.C.D.D. system. Check B.C.D.D. system. Repair or replace if necessary.
	Malfunctioning air regulator.	Replace. For inspection procedures for air regulator, refer to Engine Fuel section.

Condition	Probable cause	Corrective action
HIGH ENGINE IDLE SPEED	Incorrect adjustment of idle speed adjusting screw.	Correct.
	Throttle valve is opened excessively at idle.	Replace throttle chamber.
	Malfunctioning F.I.C.D.	Replace.
ENGINE POWER NOT UP TO NORMAL		
Low compression		Previously mentioned.
Ignition system in trouble	Incorrect ignition timing.	Adjust.
	Malfunctioning spark plugs.	Clean, adjust or replace plugs.
	Malfunctioning distributor pick-up coil.	Replace.
ENGINE POWER BELOW NORMAL		
Fuel system malfunction	Throttle valve does not open fully.	Adjust.
	Damaged electronic fuel injection harness.	Replace.
	Seized injector (Listen to operating sound).	Replace.
	Malfunctioning air flow meter.	Replace.
	Malfunctioning throttle valve switch.	Repair or replace.
		For inspection procedures for electronic fuel injection system components, refer to Engine Fuel Section.
	Irregular fuel pressure.	Replace pressure regulator if necessary.
	Clogged fuel pipe.	Replace if necessary.
	Dirty or clogged fuel filter.	Replace.
	Fuel pump will not work properly.	Replace.
Air intake system malfunction	Clogged air cleaner filter.	Replace filter.
	Air leaking from manifold gasket.	Replace gasket.
	Intake air leakage at following points: Dipstick Oil filler cap Blow-by hoses Intake air duct–air flow meter to throttle chamber etc.	Repair or replace.
Overheating	Insufficient coolant.	Replenish.
	Loose fan belt.	Adjust fan belt.
	Worn or damaged fan belt.	Replace.
	Malfunctioning thermostat.	Replace.
	Malfunctioning water pump.	Replace.
	Clogged or leaky radiator.	Flush, repair or replace.
	Malfunctioning radiator filler cap.	Replace.
	Air in cooling system.	Retighten each part of cooling system.
	Improper engine oil grade.	Replace with proper grade oil.
	Incorrect ignition timing.	Adjust.
	Malfunctioning thermal vacuum valve (for E.G.R. system).	Replace.

Condition	Probable cause	Corrective action
Overcooling	Malfunctioning thermostat.	Replace.
Others	Improper octane fuel.	Replace with specified octane fuel.
	Improper tire pressure.	Inflate to specified pressure.
	Dragging brake.	Adjust.
	Clutch slipping.	Adjust.
NOISY ENGINE		
Car knocking	Overloaded engine.	Use right gear in driving.
	Carbon knocking.	Disassemble cylinder head and remove carbon.
	Timing knocking.	Adjust ignition timing.
	Fuel knocking.	Use specified octane fuel.
	Preignition (misusing of spark plug).	Use specified spark plug.
Mechanical knocking		
Crankshaft bearing knocking.	This strong dull noise increases when engine is accelerated. To locate the place, cause a misfire on each cylinder. If the noise stops by the misfire, this cylinder generates the noise.	This is caused by worn or damaged bearings, or unevenly worn crankshaft. Renew bearings and adjust or change crankshaft. Check lubrication system.
Connecting rod bearing knocking.	This is a little higher-pitched noise than the crankshaft knocking, and also increases when engine is accelerated. Cause a misfire on each cylinder and if the noise diminishes almost completely, this crankshaft bearing generates the noise.	Same as the case of crankshaft bearings.
Piston and cylinder noise.	When you hear an overlapping metallic noise which increases its magnitude with the revolution of engine and which decreases as engine is warmed up, this noise is caused by piston and cylinder. To locate the place, cause a misfire on each cylinder.	This may cause an abnormal wearing of cylinder and lower compression which in turn will cause a lower out-put power and excessive consumption of oil. Overhaul engine.
Piston pin noise.	This noise is heared at each highest and lowest dead end of piston. To locate the place, cause a misfire on each cylinder.	This may cause a wear on piston pin, or piston pin hole. Renew piston and piston pin assembly.
Water pump noise.	This noise may be caused by worn or damaged bearings, or by the uneven surface of sliding parts.	Replace water pump with a new one.
Others.	An improper adjustment of valve clearance.	Adjust.
	Noise of timing chain.	Adjust the tension of chain.
	An excessive end-play on crankshaft.	Disassemble engine and renew main bearing.

Condition	Probable cause	Corrective action
Others.	**Note: This noise will be heared when clutch is disengaged.**	
	Wear on clutch pilot bushing.	Renew bushing and adjust drive shaft.
	Note: This noise will be heard when clutch is disengaged.	
ABNORMAL COMBUSTION (backfire, after fire run-on etc.)		
Improper ignition timing	Improper ignition timing.	Adjust ignition timing.
	Improper heat range of spark plugs.	Use specified spark plugs.
Fuel stem malfunction	Intake air leakage at following points: Dipstick Oil filler cap Blow-by hoses Intake air duct–air flow meter to throttle chamber etc.	Repair or replace.
	Damaged electronic fuel injection harness.	Replace.
	Damaged control unit.	Replace.
	Malfunctioning air flow meter.	Replace.
	Damaged water temp. sensor.	Replace.
		For inspection procedures for electronic fuel injection system components, refer to Engine Fuel Section.
Defective cylinder head, etc.	Improperly adjusted valve clearance.	Adjust.
	Excess carbon in combustion chamber.	Remove head and get rid of carbon.
	Damaged valve spring (backfire, after fire).	Replace it with a new one.
Others		Check for loose vacuum hoses. Replace if necessary.
	Malfunctioning E.G.R. control system.	Replace.
EXCESSIVE OIL CONSUMPTION		
Oil leakage	Loose oil drain plug.	Tighten it.
	Loose or damaged oil pan gasket.	Renew gasket or tighten it.
	Loose or damaged chain cover gasket.	Renew gasket or tighten it.
	Damaged oil seal in front and rear of crankshaft.	Renew oil seal.
	Loose or damaged rocker cover gasket.	Renew gasket or tighten it (but not too much).
	Improper tightening of oil filter.	Renew gasket and tighten it with the proper torque.
	Loose or damaged oil pressure switch.	Renew oil pressure switch or tighten it.

Condition	Probable cause	Corrective action
Excessive oil consumption	Cylinder and piston wear.	Overhaul cylinder and renew piston.
	Improper location of piston ring or reversely assembled piston ring.	Remount piston rings.
	Damaged piston rings.	Renew rings.
		Repair or renew piston and cylinder.
	Worn piston ring groove and ring.	Renew piston and piston ring.
	Fatigue of valve oil seal lip.	Replace seal lip with a new one.
	Worn valve stem.	Renew valve or guide.
Others	Inadequate quality of engine oil.	Use the designated oil.
	Engine overheat.	Previously mentioned.
POOR FUEL ECONOMY		
Ignition system		
See the explanation of the power decrease		
Others	Exceeding idling revolution.	Adjust it to the designated rpm.
		Repair or tighten the connection of fuel pipes.
Emission control system	Malfunctioning E.G.R. control system.	Replace.
Fuel system malfunction	Fuel leakage.	Repair or replace.
	Damaged electronic fuel injection harness.	Replace.
	Damaged control unit.	Replace.
	Malfunctioning air flow meter.	Replace.
	Damaged air temperature sensor.	Replace.
	Malfunctioning throttle valve switch.	Replace.
		For inspection procedures for electronic fuel injection system components, refer to Engine Fuel Section.
	Fuel leakage at injector or cold start valve.	Replace damaged part.
	Fuel leakage at rubber fuel hose.	Repair or replace.
	Irregular fuel pressure.	Replace pressure regulator if necessary.
TROUBLE IN OTHER FUNCTIONS		
Decreased oil pressure	Inadequate oil quality.	Use the designated oil.
	Overheat.	Previously mentioned.
	Malfunctioning oil pump regulator valve.	Disassemble oil pump and repair or renew it.
	Functional deterioration of oil pump.	Repair or replace it with a new one.
	Blocked oil filter.	Renew it.

Condition	Probable cause	Corrective action
Decreased oil pressure	Increased clearance in various sliding parts.	Disassemble and replace the worn parts with new ones.
	Blocked oil strainer.	Clean it.
	Malfunctioning oil gauge pressure switch.	Replace it with a new one.
Excessive wear on the sliding parts	Oil pressure decreases.	Previously mentioned.
	Damaged quality or contamination	Change the oil with proper one and element.
	Air leakage from air intake duct	Repair or replace.
	Damaged air cleaner.	Change element.
	Overheat or overcool.	Previously mentioned.
	Improper fuel mixture.	Check the fuel system.
Scuffing of sliding parts	Decrease of oil pressure.	Previously mentioned.
	Insufficient clearances.	Readjust to the designated clearances.
	Overheat.	Previously mentioned.
	Improper fuel mixture.	Check the fuel system.

SPECIAL SERVICE TOOLS

Tool number & tool name	Kent-Moore No. / Reference page or Fig. No.	Tool number & tool name	Kent-Moore No. / Reference page or Fig. No.
ST10640001 Pivot adjuster	J 25615-01 / Fig. ET-1	ST19320000 Oil filter wrench	J 25664 / Page ET-4