GROUP 24 — HEATERS AND AIR CONDITIONING

SECTION 0 — INDEX

SERVICE BULLETIN REFERENCE

DATE	NUMBER	SUBJECT	CHANGES

SECTION 1 — AIR CONDITIONING

SPECIFICATIONS

Compressor make	Mitsubishi
Model	JHG652
Compressor configuration	2 cylinder in line
Bore x stroke	47,6 x 30 mm (1.874 x 1.181")
Displacement	107 cc (6.53 cu. in)
Valve type	Reed
Oil capacity (refrigerant oil)	250 ml (8.8 fl. oz.)
Compressor Clearances	
Piston to cylinder clearance	0,15 mm (0.006")
Conrod big end bearing clearance	0,05 mm (0.002")
Piston pin to conrod small end clearance	0,02 mm (0.0008")
Piston ring gap	0,25 mm (0.010")
Magnetic Clutch	
Type	Dry single disc magnet
Voltage power consumption	DC 12v, 38w
Condensor location	Forward of radiator yoke
Receiver-strainer-drier	
Type	Cylindrical steel container
Location	Left side splash shield
Refrigerant	
Type	"Refrigerant 12"
Capacity	795g to 908g (1 lb. 11 oz. to 2.0 lbs.)
Evaporator	
Location	In unit (attached to dash panel)
Blower Motor	
Type	Centrifugal single suction sirocco fan (also serves as heater fan)
Voltage, power consumption	DC 12v, 108w
Location	In unit (attached to dash panel)
Stationary cooling performance (Controls set to Maximum cooling)	Reduce 30°C (86°F) ambient air temperature to 11°C (52°F) in 15 minutes with 0.0825 m^3/s (175 C.F.M.) air flow from centre air outlet duct.
Belt deflection	17-20 mm (5/8"-3/4")

SPECIAL TOOLS

Mechanical, Electrical and Refrigeration
- Thermometer test set — 18° to 66°C (0-150°F mercury glass)
- Vacuum Pump (240 volt Dynavac 2R or similar)

Refrigeration
- Safety goggles
- Refrigerant filling ratchet
- Tube bending set
- Weighing scale 18 kg in g graduations (40 lbs in ounce graduations)
- Pipe flare nut torque wrench
- Torch — Refrigerant leak detector (electric or flame)
- Test set and manifolding with tubes
- Gauge refrigerant pressure testing-2000 kPa (290 p.s.i.)
- Gauge refrigerant pressure testing-3500 kPa (500 p.s.i.) (Imperial 461C or similar)

Mechanical and Electrical
- 0-20 Amp. test Ammeter
- Cooling system pressure test set
- Pressure gauge — vacuum testing

Compressor

Connecting rod bolt tool	MB990671
Seal extractor	MB990672
Seal cover aligning tool	MB990679
Valve plate assembly tool	MB990670
Front bearing remover	MB990673
Rear bearing remover	MB990674
Front bearing installer	MB990676
Rear bearing installer	MB990677
Crankshaft installer	MB990675
Piston ring compressor	MB990678
Magnetic clutch hub removal cap screw	M16 x 2,0 x 50 mm

TORQUE SPECFICATIONS

Compressor	
Clutch field coil retaining screws	9,8 Nm (87 lbs. in.)
Clutch hub retaining bolt	19,8 Nm (175 lbs. in.)
Compressor service valve nut	8,3 Nm (73 lbs. in.)
Connecting rod bearing cap retaining bolts	8,7 Nm (77 lbs. in.)
Cylinder head retaining bolts	24,6 Nm (19 lbs./ft.)
Oil filler plug	14,8 Nm (131 lbs. in.)
Front seal cover bolts	9,8 Nm (87 lbs. in.)
Rear bearing plate bolts	10,8 Nm (96 lbs. in.)
Bottom cover retaining bolts	10,8 Nm (96 lbs. in.)
Check valve retaining bolt	24,6 Nm (19 lbs./ft.)
Hose and pipe fittings	
Receiver drier pipes	25,0 Nm (19 lbs./ft.)
Compressor hoses	34,0 Nm (25 lbs./ft.)
Compressor brackets	
M8 bolts	24,5 Nm (18 lbs./ft.)
M10 bolts	46,6 Nm (34 lbs./ft.)

SERVICE DIAGNOSIS

Condition	Possible Cause	Correction
DEFECTIVE MAGNETIC CLUTCH		
CLUTCH FAILS TO ENGAGE	(a) Open circuit in clutch coil. (b) Temperature control switch defective. (c) Blown fuse. (d) Defective thermister.	(a) Replace coil. (b) Replace faulty switch. (c) Rectify cause and replace fuse. (d) Replace thermister.
CLUTCH SLIPS	(a) Oil or dirt between mating surfaces of clutch. (b) Insufficient power supply to field coil.	(a) Clean and recheck operation — replace if necessary. (b) Check voltage at field coil.
KNOCKING NOISE FROM CLUTCH AREA	(a) Faulty clutch centre bearing. (b) Loose clutch assembly attaching bolt.	(a) Replace bearing. (b) Retension bolt — replace if necessary.
DEFECTIVE COMPRESSOR		
COMPRESSOR FAILS TO ROTATE	(a) Loose or broken drive belt. (b) Compressor seized — check to see if compressor can be rotated by hand.	(a) Retension or replace drive belt. (b) Repair or replace.
KNOCKING NOISE FROM COMPRESSOR	(a) Compressor internal components damaged. (b) Excessively overcharged refrigerant in system.	(a) Repair or replace. (b) Release refrigerant until bubbles appear in receiver-drier sight glass — recheck pressures.
COMPRESSOR VIBRATES	(a) Loose compressor drive belt. (b) Loose compressor attaching bolts and/or brackets. (c) Unbalanced compressor clutch or compressor internal components.	(a) Retension drive belt. (b) Retension bolts. (c) Balance or replace faulty components.
DEFECTIVE IDLER PULLEY	(a) Worn bearing. (b) Loose idler pulley attaching bolt. (c) Worn idler pulley vee section.	(a) Replace idler pulley assembly. (b) Retension or replace bolt. (c) Replace idler pulley assembly.
BUBBLES IN RECEIVER-DRIER SIGHT GLASS	(a) Insufficient refrigeration in system. (b) Receiver-drier installed in reverse flow direction. (c) Air in refrigerant circuit.	(a) Charge system with correct amount of refrigerant and test for leaks. (b) Install receiver-drier in correct flow direction. (c) Evacuate and recharge system.
HIGH SUCTION PRESSURE	(a) Expansion valve seized in the open position. (b) Poor contact between expansion valve temperature sensing bulb and suction pipe. (c) System overcharged with refrigerant. (d) Damaged compressor valves or head gasket allowing discharge pressure to enter suction area in compressor. (e) Condensor fins blocked or dirty. Restricted air flow caused by driving lights, badges etc., broken or slipping fan belt, malfunctioning fan clutch.	(a) Clean expansion valve, repair or replace if necessary. (b) Clean temperature sensing bulb and suction pipe — re-insulate and test operation. (c) Release refrigerant until bubbles appear in receiver-drier sight glass — recheck pressures. (d) Replace faulty components and recheck pressures. (e) Clean, repair or replace faulty components.

Condition	Possible Cause	Correction
LOW SUCTION PRESSURE	(a) Insufficient refrigerant in system.	(a) Charge system with correct amount of refrigerant and test for leaks.
	(b) Blocked expansion valve filter.	(b) Clean expansion valve filter, replace receiver-drier — recharge and check system pressures.
	(c) Expansion valve heat sensing bulb or capillary tube gas leak causing expansion valve to fail closed.	(c) Replace expansion valve.
	(d) System over-filled with refrigerant oil.	(d) Discharge system and check compressor oil level.
HIGH DISCHARGE PRESSURE	(a) Excessively overcharged refrigerant in system.	(a) Release refrigerant until bubbles appear in receiver-drier sight glass — recheck pressures.
	(b) Air in refrigerant circuit due to refrigerant circuit being left open to atmosphere and improper evacuation and charging procedures.	(b) Evacuate and recharge system.
	(c) Blockage in high pressure circuit of system due to damaged condenser tubes or restrictions in piping. Can be detected by temperature difference in condensor core, i.e., hot to point of restriction, cool after restriction.	(c) Repair or replace faulty components and recheck pressures.
	(d) System overfilled with refrigerant oil, causing restrictions in expansion valve or receiver-drier.	(d) Discharge system and check compressor oil level. Charge and recheck pressures.
	(e) Restricted air flow through condensor fins, caused by driving lights, badges, blocked or dirty condensor fins. Broken fan belt or slipping fan clutch.	(e) Repair or replace faulty components and recheck pressures.
LOW DISCHARGE PRESSURE	(a) Receiver-drier blocked. Check receiver-drier inlet and outlet pipe temperatures. Variation should not exceed 5°C (41°F).	(a) Replace receiver-drier and recheck pressures.
	(b) Expansion valve filter blocked or moisture frozen in expansion valve.	(b) Clean expansion valve, repair or replace as necessary.
	(c) Expansion valve heat sensing bulb or capillary tube gas leak causing the expansion valve to fail closed.	(c) Replace expansion valve.
	(d) Damaged compressor valves or head gasket allowing discharge pressure to enter suction area.	(d) Replace faulty components and recheck pressures.
INSUFFICIENT AIR VOLUME	(a) Air intake duct blocked by leaves or foreign material obstructing air intake duct.	(a) Clean air intake duct.
	(b) Evaporator coil frozen or frosted.	(b) Check thermister operation — replace if necessary.
	(c) Incorrect blower motor or fan fitted.	(c) Replace with correct air conditioner blower motor and/or fan.
	(d) Blower motor will not operate, possibly due to blown fuse, faulty fan switch, defective blower motor.	(d) Check power supply at blower motor — replace faulty components and recheck operation.

DESCRIPTION AND OPERATION

The air conditioner combines both heating and cooling in one system and also provides fresh air cooling. Controls and cooling air outlets are integral with the instrument panel.

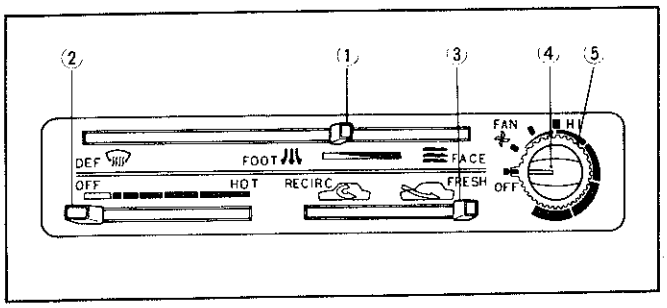


Fig. 1—Control panel

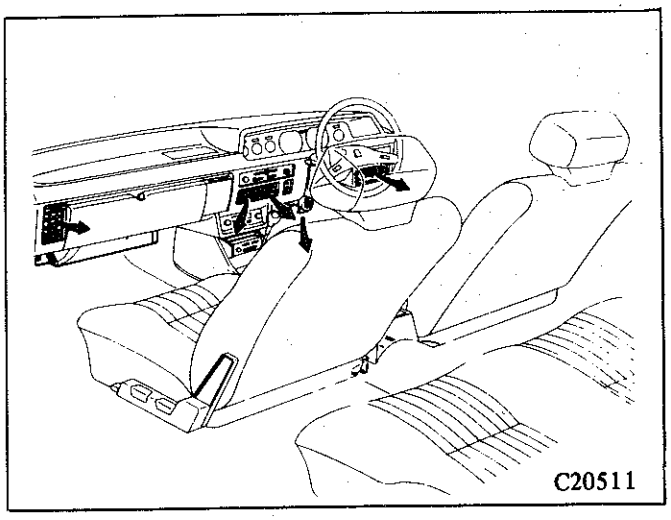


Fig. 2—Air outlets

OPERATION

Controls

(1) Air Flow Lever

The air flow lever has three positions.

DEF — (defrosting or defogging) directs air to the windshield.

FOOT — directs air to the feet.

 — air is directed to the leg area, and to the upper half of the body. Air flow to the upper half of the body is increased as the lever is moved to face. This air is drawn off before heating and is at ambient temperature or cooler if the air conditioner is being used. Air flow to the floor passes through the heater core and may be warmed.

FACE — directs all air flow to the upper half of the body.

(2) Temperature Control Lever

Controls the temperature of heated air. The temperature will rise from ambient as the lever is moved toward HOT.

(3) Fresh/Recirc Lever

Fresh, introduces fresh outside air into the vehicle interior.

Recirc, recirculates interior air.

(4) Fan Switch

The fan switch has three positions, Low, Medium and High, air flow increases as the switch is turned to Hi.

(5) Thermo Switch

The thermo switch is located behind the fan switch. Clockwise rotation turns the air conditioner on. Cooler dehumified air can be obtained by rotating the switch further clockwise.

Circulation of Interior Air

Interior air is drawn in through the entrance to the evaporator by the fan, where it is cooled and dehumidified as it passes through the evaporator. The cooled air is then expelled from the left and right outlet grilles, centre outlet grille and if open, the outlet in the leg area.

Air Directional Vanes

Located in the centre, left and right air outlet grilles are manually adjusted up, down, or to either side to deflect cool air to suit requirements of driver and passengers. The leg area outlet has no provision for changing the direction of air, but has an On/Off control.

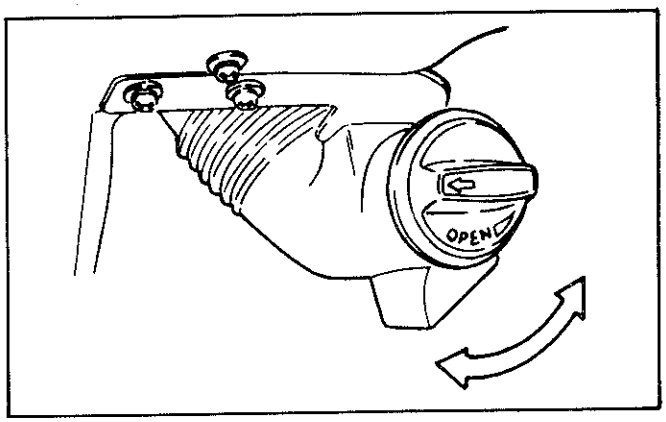


Fig. 3—Leg area outlet

OPERATING INSTRUCTIONS

Fast Cooling

Open vehicle windows, select recirculation and face positions with the control levers. Position fan speed switch to Hi and rotate thermo switch fully clockwise. Open left and right air outlet grilles and leg area outlet and adjust the air directional vanes to direct cooled air to suit occupants requirements.

Drive vehicle for a few minutes to expel warm air, and close all windows when cooled air is felt from the vents.

When less cooling is desired, position the fan switch to a lower speed and re-adjust the thermo switch to desired temperature to suit occupants.

Normal Cooling (Cooling with fresh air)

Select fresh and face positions with the control levers.

Position fan and thermo switch to desired fan speed and temperature to suit occupants comfort.

Adjust air directional vanes to suit occupants requirements.

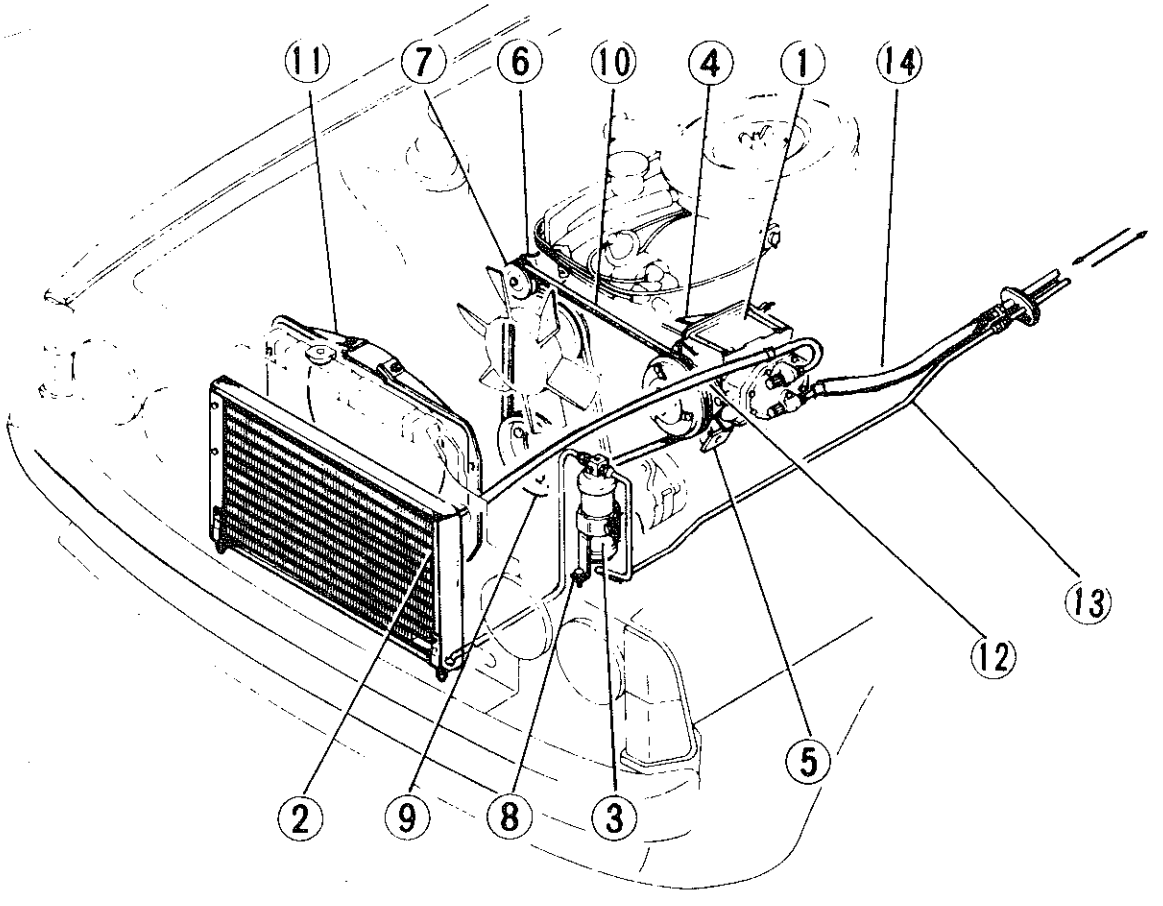
Operation in Traffic

In extremely slow traffic, additional cooling may be required.

When pulling a trailer, when driving through heavy traffic at 16-24 km/h or when pulling up steep hills, **additional engine cooling** may be required. If any or all of these situations are encountered put the transmission in a **lower** gear. At stop lights and other stops, put transmission in **neutral and increase engine speed.** The engine cooling system is protected from any over heating resulting from the air conditioning system by a high pressure cut out switch. This switch is located in the receiver-drier and will cut out the compressor if the air conditioning system is rejecting too much heat from the condensor into the radiator. Heat absorbed by the radiator consequently reduces the ability of the radiator to cool the engine. If this condition occurs at idle, increasing engine speed will provide a greater air flow through the radiator and condensor, thereby improving the ability of the radiator to cool the engine and will create a greater air conditioning effect. When driving, it is normal to hear the air conditioner clutch engage and disengage, and experience minor variations in vehicle speed.

Off-Season Operation

During the "off cooling" season, ensure that the owners operate the air conditioner system for the least five minutes once a week with the controls set to achieve maximum cooling. This will cause the air conditioner compressor to distribute oil to the compressor seal, preventing the seal from drying out and allowing loss of refrigerant.



1. Compressor clutch assembly
2. Condenser assembly
3. Receiver assembly
4. Compressor bracket, upper
5. Compressor bracket, lower
6. Idle pulley bracket
7. Tension pulley
8. Receiver bracket
9. Compressor pulley
10. V belt
11. Shroud assembly
12. Rubber hose (H.P.)
13. Pipe assembly (for liquid)
14. Rubber hose (L.P.)

Fig. 4—Engine compartment components

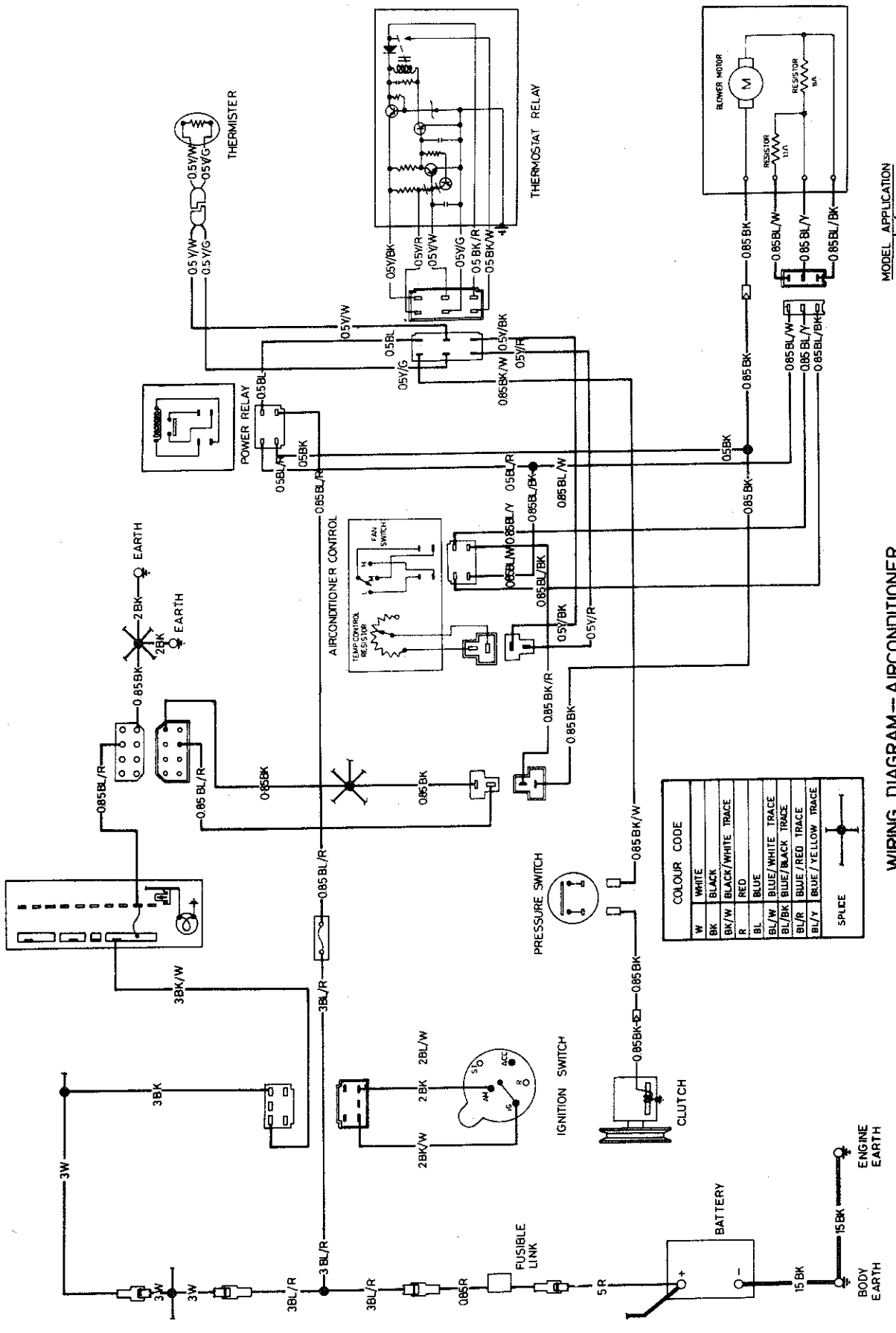


Fig. 5—Wiring diagram air conditioner

REFRIGERANT CIRCUIT

Heat-laden, low pressure refrigerant is drawn into the compressor, where it is compressed and discharged to the condensor as a high pressure gas to be cooled and liquified. Heat from the gaseous refrigerant dissipates through the condensor fins as the condensor is cooled by air and the refrigerant changes from a gas to a liquid.

The refrigerant then passes through the receiver-drier as a high pressure liquid where moisture and foreign substances are removed before it enters the expansion valve.

At this point the high pressure liquid refrigerant is turned into a mixture of low pressure, low temperature, liquid and gas by the expansion valve as it enters the evaporator. The atomised refrigerant absorbs heat from the vehicle interior via the evaporator and the refrigerant converts to a gas.

The refrigerant gas is then drawn into the suction side of the compressor where it is recycled through the refrigerant circuit as previously described.

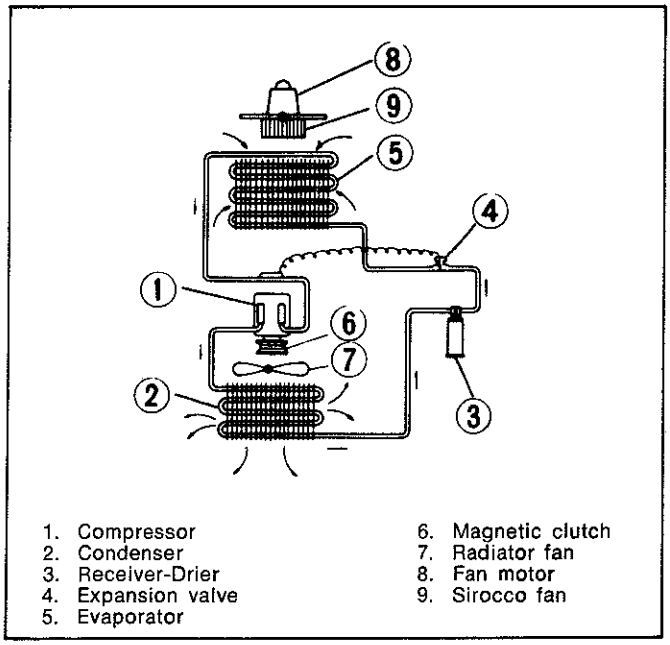


Fig. 6—Refrigerant circuit

COMPRESSOR

The compressor is a two cylinder, reciprocating piston, in line type compressor.

Its purpose is to draw low pressure, vapourised refrigerant from the evaporator, compress the refrigerant and pump it to the condesor, where the high pressure vapour is cooled and re-converted to a liquid.

Operation

On the **Downstroke** of the piston, vapourised refrigerant is drawn into the compressor from the evaporator through the suction check valve, into the suction manifold, then into the compressor cylinder via the suction reed valve.

On the **Upstroke,** the refrigerant is compressed and forced through the discharge reed valve, into the discharge manifold and then to the condenser, via the discharge check valve to be cooled and re-converted to a liquid.

Compressor Clutch

The compressor clutch is a magnetic type clutch, energised by an electric current. Its function is to engage and disengage the compressor as required to supply refrigerant to the evaporator. The clutch pulley when not engaged, rotates at a speed compatible with engine R.P.M.

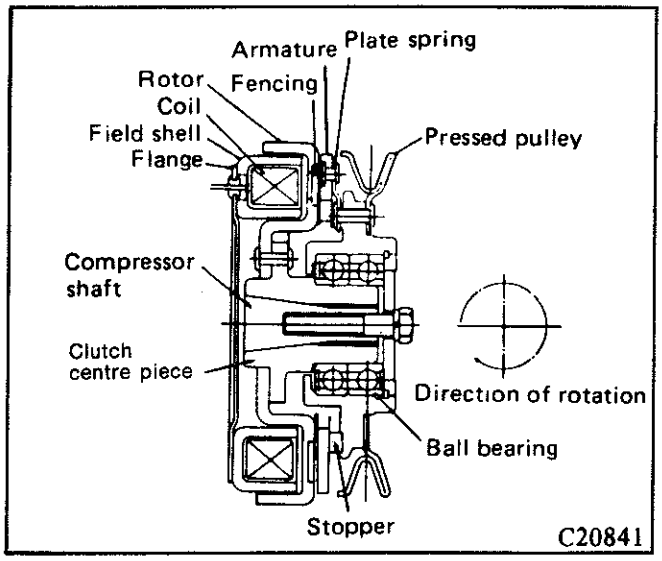


Fig. 7—Magnetic clutch

CONDENSOR

The condensor receives super-heated high pressure refrigerant vapour. The air passing between the fins, being cooler than the refrigerant, readily receives the heat from the vapour, thereby permitting the latent heat to be given off, the refrigerant then re-converts to a liquid.

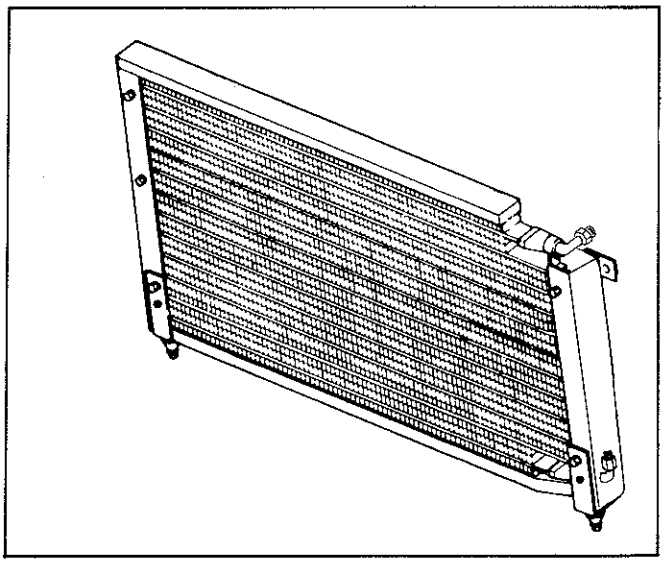


Fig. 8—Condensor

RECEIVER - DRIER

The receiver-drier is situated in the high pressure circuit between the condensor and expansion valve. Its purpose is to serve as a refrigerant reservoir and to remove moisture and foreign substances from the refrigerant. Any moisture present in the refrigerant may not only corrode metal surfaces in the refrigerant circuit, but also cause malfunctioning of the expansion valve, due to expansion valve frosting and subsequent blockage.

A sight glass is installed in the top of the receiver-drier to moniter the flow and condition of the refrigerant.

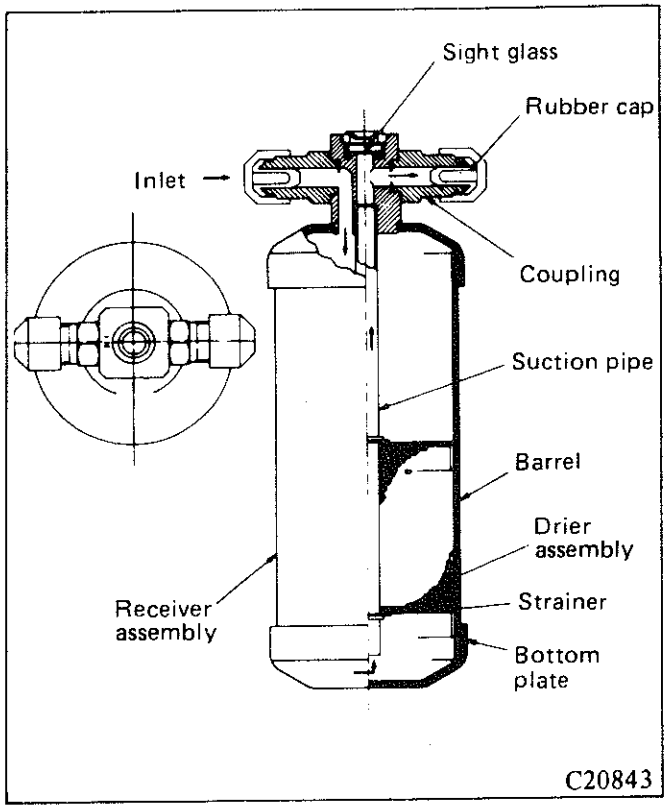


Fig. 9—Receiver-drier

HIGH PRESSURE CUT-OUT SWITCH

The high pressure cut-out switch is a pressure-temperature sensitive valve, located in the top section of the receiver-drier and is provided to prevent the engine from over-heating as a result of the air conditioner operation. Its function is to cut the electrical power supply to the compressor magnetic clutch if the pressure or temperature of the high pressure liquid refrigerant exceeds the following pressure or temperature.

Operating Pressure and Temperature

	Pressure	Temperature
OFF	1,961 ± 49 kPa (284.5 ± 7.1 p.s.i.)	Approx. 74°C (165.2°F)
ON	1,471 ± 98 kPa (213.4 ± 14.2 p.s.i.)	Approx. 62°C (143.6°F)

EXPANSION VALVE

The "Thermostatic" expansion valve is mounted at the high pressure inlet side of the evaporator. It controls the flow of liquid refrigerant from the receiver-drier to the evaporator and converts the high pressure liquid refrigerant into a low pressure atomised spray by sudden expansion across the valve.

A heat sensitive bulb located at the outlet side of the evaporator, senses the temperature of the suction line and through the action of a capillary tube connected to the diaphragm of the expansion valve opens and closes the orifice control valve, regulating the refrigerant flow. An increase in temperature will open the valve, allowing more refrigerant into the evaporator. A decrease in temperature will close the valve, restricting the flow of refrigerant to the evaporator.

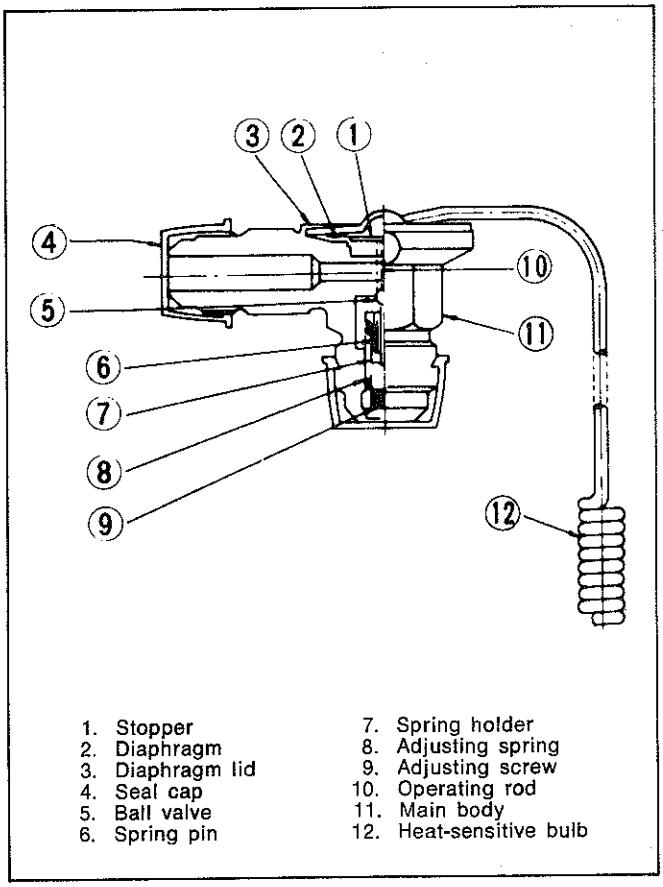


Fig. 10—Construction of expansion valve

EVAPORATOR

The evaporator receives high pressure atomised refrigerant from the expansion valve. The refrigerant is exposed to low pressure inside the evaporator, where it boils and absorbs heat from the tubes and fins of the evaporator leaving them very cold. Air is forced over the evaporator by the fan where it gives up heat and is then routed into the vehicle via the air outlet ducts.

THERMISTER

The function of the thermister is to maintain the vehicle interior temperature at the required level.

The thermister is an electronic type thermostat which senses cool air temperature at the outlet of the evaporator and controls the On-Off current supply to the compressor magnetic clutch. A variable temperature setting is achieved by adjusting the temperature control thermo switch, located behind the control panel fan switch.

COMPRESSOR DRIVE BELT

Satisfactory performance of the air conditioning system is dependent upon drive belt condition and tension. If the proper tensions are not maintained, belt slippage will greatly reduce air conditioning performance and drive belt life. To avoid such adverse effects, the following service procedure should be followed:

(1) Ensure that only the special air conditioning drive belt is used.

(2) Any belt that has operated for a minimum of half an hour is considered to be 'used' and must be adjusted to give the specified deflection at centre of longest run.

(3) Measure drive belt tension at regular service intervals and adjust as necessary.

(4) On all "new belt" installations, tension the belt as outlined below, retension the belt after initial settling-in, i.e. after half an hour of operation.

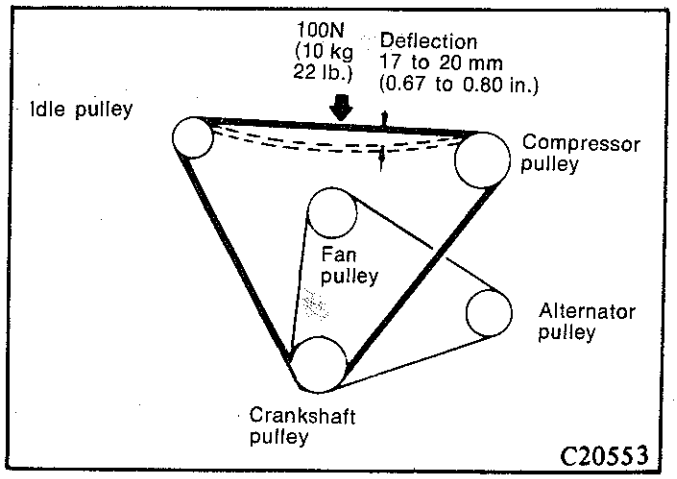


Fig. 11—Drive belt tension

NOTE: Should the compressor drive belt be found rolled over, check for misalignment or damaged mounting brackets, also check that the drive pulleys are correctly aligned. Remedy any misalignment, where necessary. Check also for a non-uniform V-section drive belt.

SAFETY PRECAUTIONS

The refrigerant used is colourless in both the liquid and vapour state and, as the boiling point is —30°C (21.7°F) below zero at normal atmospheric pressure, it will revert to a vapour immediately upon release, **FREEZING ANYTHING IT CONTACTS. DO NOT ALLOW ANY BODY EXPOSURE TO CONTACT THE VAPOUR — PARICULARLY THE EYES — AS PERMANENT BLINDNESS RESULTS DUE TO "FROSTBITE" — ALWAYS WEAR SAFETY GOGGLES AND GLOVES.**

Also keep a bottle of **STERILE** mineral oil and a **WEAK** solution of **BORIC** acid handy when servicing the refrigeration components.

CAUTION: DO NOT heat any part of container containing refrigerant above 52°C (125°F). Do not weld or steam clean on or adjacent to the refrigeration system components.

DO NOT allow the refrigerant vapours to be consumed by flame as this will convert the vapour INTO A POISONOUS GAS. DO NOT inhale the fumes from the leak detector.

Do not allow the refrigerant to contact bright metal surfaces, as corrosion damage will occur.

Work in a well ventilated area taking care to discharge any vapours into the exhausting system. Although the refrigerant vapours are not normally poisonous, they are heavy, thus causing the air to be displaced, which can cause suffocation.

FIRST AID

Eyes

(1) Add a few drops of mineral oil to wash out and absorb the refrigerant.

(2) Wash the eyes with the **weak boric acid** solution.

(3) Obtain a **doctor's aid** and **examination immediately,** even if relief is obtained.

TUBES AND FITTINGS

NOTE: The following precautions must be observed. The system must be completely discharged before opening any fitting or connection in the refrigeration system. Open fittings with caution even after the system has been discharged. If any pressure is noticed as a fitting is loosened, allow trapped pressure to bleed off very slowly.

Kinks in the refrigerant tubing or sharp bends in the refrigerant hose lines will greatly reduce the capacity of the entire system. High pressures are produced in the system when it is operating. Extreme care must be exercised to make sure that all connections are pressure tight. Dirt and moisture can enter the system when it is opened for repair or replacement of lines or components. Use a suitable tube bending tool when bending the refrigerant lines to avoid kinking. Never attempt to rebend formed lines to fit. Use the correct line for the installation you are servicing. A good rule for the flexible hose lines is to keep the radius of all bends at least 10 times the diameter of the hose. Sharper bends will reduce the flow of refrigerant. The flexible hose lines should be routed so that they are at least 76 mm (3") from the exhaust manifold. It is good practice to inspect all flexible hose lines at least once a year to make sure they are in good condition, and properly routed.

Fittings must be in good condition. The slightest burr or foreign material may cause a leak. Fittings **must** be coated with refrigerant oil to allow the connections to seat squarely and to be tightened evenly to the proper torque. Fittings which are not oiled with refrigerant oil are almost **sure** to leak.

The use of proper wrenches when making connections is very important. Improper wrenches or improper use of wrenches can damage the fittings. Always use two wrenches when loosening or tightening tube fittings to prevent distorting of lines and components.

The internal parts of the refrigeration system will remain in a state of chemical stability as long as pure moisture free Refrigerant 12 and refrigeration oil is used. Abnormal amounts of **dirt, moisture or air** can upset the chemical stability and **cause operational troubles** or even **serious damage** if present in more than minute quantities. When it is necessary to open the refrigeration system, have everything you will need to service the system ready so that the system will not be left open any longer than necessary. Cap or plug all lines and fittings as soon as they are opened to prevent the entrance of dirt and moisture.

NOTE: Do not use corks or cotton waste as these could cause blockage or malfunction in the system.

All lines and components in parts stock should be capped or sealed until they are ready to be used. All tools, including the refrigerant dispensing manifold, the gauge set manifold and test hoses, should be kept clean and dry.

The special refrigeration oil supplied for the system is as clean and dry as it is possible to make it. Only refrigeration oil should be used in the system or on the fittings and lines. The oil container should be kept tightly capped until it is ready for use, and then tighten cap again after use to prevent entrance of dirt and moisture. Refrigerant oil will quickly absorb any moisture with which it comes in contact.

TEST GAUGE MANIFOLD SET

The gauge manifold set is an indispensable test and diagnosis instrument. The gauge manifold set has a compound suction gauge (low pressure), blue in colour and a discharge gauge (high pressure), red in colour. The hoses are also colour coded to distinguish the correct hose and gauge application.

The Suction Gauge (low pressure)—at the left side of the manifold is calibrated to register 0-102 kPa (0-30" Hg) of vacuum and 0-2000 kPa (0-290 p.s.i.). This gauge is connected to the compressor suction (inlet) check valve on the cylinder head. When the **BLUE** hose is connected to the suction check valve at the compressor, the hose fitting will depress the Schraeder valve inside the check valve to allow vacuum or pressure to register on the gauge.

The Discharge Gauge (high pressure)—at the right side of the manifold is calibrated to register 0-3500 kPa (0-500 p.s.i.). This gauge is connected to the compressor discharge check valve on the cylinder head. When the **RED** hose is connected to the discharge check valve at the compressor, the hose fitting will depress the Schraeder valve inside the check valve to allow pressure to register on the gauge.

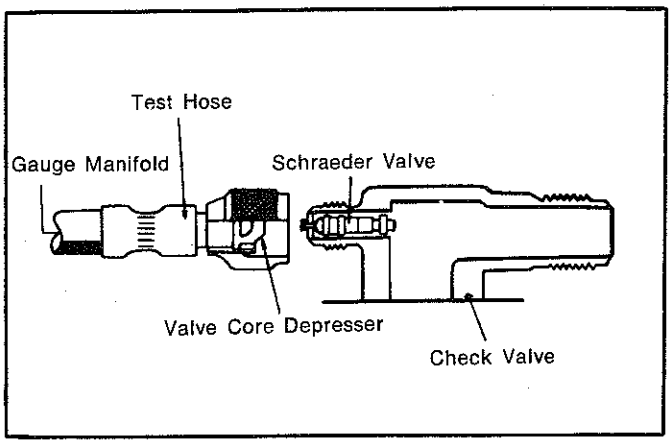


Fig. 12—Compressor check valve and test hose

Centre Manifold Outlet — provides the necessary connection for a long service hose used when discharging the system, using a vacuum pump to "pull a vacuum" before charging the system, and for connecting the supply of refrigerant when charging the system.

Manifold Gauge Valves — should be closed when connecting the gauge set manifold to the service ports of the compressor.

The suction gauge valve at the left is opened to provide a passage between the suction gauge and the centre manifold outlet. The discharge gauge valve at the right is opened to provide a passage between the discharge pressure gauge and the centre manifold outlet.

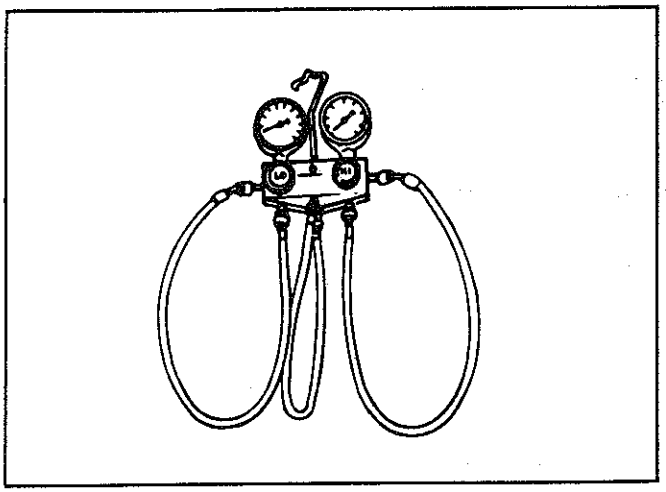


Fig. 13—Gauge manifold and charging hoses

SYSTEM PRESSURE TEST

Engine not running

(1) Connect a gauge manifold set to the compressor check valves—high pressure gauge hose to the discharge valve and low pressure gauge hose to the suction valve.

NOTE: Ensure both valves of the gauge manifold are closed before connecting hoses — do not over-tighten hose connections.

(2) Purge air from the gauge hoses as follows:

(a) Open suction gauge valve momentarily then close it.

(b) Open discharge gauge valve momentarily then close it.

If the vehicle has been parked and the air conditioning not operating, gauge pressure should be normal for temperature of the system. Refer to the **Temperature Pressure Relationship Chart.**

If no pressure is indicated on the gauge it means that the system is empty, due to a leak. It will be necessary to evacuate, charge with a sweep-test charge, locate and correct the leak, purge the test charge, replace the drier, vacuum the system and charge the system with the proper amount of Refrigerant 12.

DISCHARGING THE SYSTEM

(1) Clean compressor suction and discharge check valves and remove the dust caps.

(2) Connect a gauge manifold set to the check valves—high pressure gauge hose tc the discharge valve and low pressure gauge hose to the suction valve.

NOTE: Ensure both valves of the gauge manifold set are closed before attaching the hoses.

(3) Insert the end of the charging hose into a clean plastic bottle or suitable transparent container.

(4) Open the high pressure valve slowly and allow the R12 refrigerant to escape into the bottle. Maintain a discharge slow enough to allow a little or no oil to escape into the bottle.

NOTE: The R12 refrigerant will vapourize as soon as it is exposed to the atmosphere inside the bottle, so there will be no visible evidence of the volume of discharge.

(5) After all the refrigerant has been discharged, gauge pressures will read zero. Open the low pressure gauge valve to release any refrigerant trapped at the suction side of the system.

(6) Close both high and low pressure gauge valves and remove the gauge manifold set from the compressor.

TEMPERATURE-PRESSURE RELATIONSHIP CHART (FOR REFRIGERANT 12)

Temp. °C	Temp. °F	Press. kPa	Press. PSI	Temp. °C	Temp. °F	Press. kPa	Press. PSI	Temp. °C	Temp. °F	Press. kPa	Press. PSI	Temp. °C	Temp. °F	Press. kPa	Press. PSI
—17.8	(0)	63	(9.2)	1.7	(35)	225	(32.6)	15.6	(60)	398	(57.7)	29.4	(85)	633	(91.8)	43.3	(110)	940	(136.4)
—16.7	(2)	69	(10.2)	2.2	(36)	230	(33.4)	16.1	(61)	406	(58.9)	30.0	(86)	643	(93.3)	43.9	(111)	954	(138.4)
—15.6	(4)	77	(11.2)	2.8	(37)	236	(34.3)	16.7	(62)	414	(60.1)	30.6	(87)	653	(94.7)	44.4	(112)	969	(140.5)
—14.4	(6)	83	(12.0)	3.3	(38)	243	(35.2)	17.2	(63)	423	(61.3)	31.3	(88)	665	(96.5)	45.0	(113)	983	(142.6)
—13.3	(8)	93	(13.5)	3.9	(39)	249	(36.1)	17.8	(64)	431	(62.5)	31.7	(89)	677	(98.2)	45.6	(114)	998	(144.7)
—12.2	(10)	101	(14.6)	4.4	(40)	255	(37.0)	18.3	(65)	440	(63.8)	32.2	(90)	688	(99.8)	46.1	(115)	1012	(146.8)
—11.1	(12)	109	(15.8)	5.0	(41)	261	(37.9)	18.9	(66)	448	(65.0)	32.8	(91)	697	(101.5)	46.7	(116)	1027	(148.9)
—10.0	(14)	118	(17.1)	5.6	(42)	268	(38.9)	19.4	(67)	457	(66.3)	33.3	(92)	711	(103.1)	47.2	(117)	1042	(151.1)
—8.9	(16)	127	(18.4)	6.1	(43)	274	(39.8)	20.0	(68)	466	(67.6)	33.9	(93)	723	(104.8)	47.8	(118)	1056	(153.2)
—7.8	(18)	136	(19.7)	6.7	(44)	281	(40.7)	20.6	(69)	475	(68.9)	34.4	(94)	734	(106.5)	48.3	(119)	1017	(155.4)
—6.7	(20)	145	(21.0)	7.2	(45)	287	(41.7)	21.1	(70)	484	(70.2)	35.0	(95)	747	(108.3)	48.9	(120)	1087	(157.7)
—6.1	(21)	150	(21.7)	7.8	(46)	294	(42.7)	21.7	(71)	493	(71.5)	35.6	(96)	758	(110.0)	49.4	(121)	1102	(159.9)
—5.6	(22)	154	(22.4)	8.3	(47)	300	(43.6)	22.2	(72)	503	(72.9)	36.1	(97)	770	(111.7)	50.0	(122)	1111	(161.2)
—5.0	(23)	160	(23.2)	8.9	(48)	308	(44.7)	22.8	(73)	512	(74.2)	36.7	(98)	783	(113.5)	50.6	(123)	1133	(164.4)
—4.4	(24)	165	(23.9)	9.4	(49)	315	(45.7)	23.3	(74)	521	(75.6)	37.2	(99)	795	(115.3)	51.1	(124)	1149	(166.7)
—3.9	(25)	170	(24.6)	10.0	(50)	322	(46.7)	23.9	(75)	531	(77.0)	37.8	(100)	808	(117.2)	51.7	(125)	1166	(169.1)
—3.3	(26)	175	(25.4)	10.6	(51)	328	(47.7)	24.4	(76)	541	(78.4)	38.3	(101)	820	(119.0)	52.2	(126)	1182	(171.4)
—2.8	(27)	180	(26.1)	11.1	(52)	336	(48.8)	25.0	(77)	550	(79.8)	38.9	(102)	834	(120.9)	52.8	(127)	1198	(173.8)
—2.2	(28)	185	(26.9)	11.7	(53)	344	(49.9)	25.6	(78)	561	(81.3)	39.4	(103)	846	(122.7)	53.3	(128)	1215	(176.2)
—1.7	(29)	191	(27.7)	12.2	(54)	352	(51.0)	26.1	(79)	570	(82.7)	40.0	(104)	859	(124.6)	53.9	(129)	1231	(178.6)
—1.1	(30)	196	(28.5)	12.8	(55)	362	(52.5)	26.7	(80)	581	(84.2)	40.6	(105)	873	(126.6)	54.4	(130)	1248	(181.0)
—0.6	(31)	202	(29.3)	13.3	(56)	367	(53.2)	27.2	(81)	591	(85.7)	41.1	(106)	886	(128.5)	55.0	(131)	1265	(183.5)
0.0	(32)	207	(30.1)	13.9	(57)	374	(54.3)	27.8	(82)	601	(87.2)	41.7	(107)	899	(130.4)	55.6	(132)	1282	(185.9)
0.6	(33)	213	(30.9)	14.4	(58)	382	(55.4)	28.3	(83)	612	(88.7)	42.2	(108)	913	(132.4)	56.1	(133)	1300	(188.5)
1.1	(34)	218	(31.7)	15.0	(59)	390	(56.6)	28.9	(84)	622	(90.2)	42.8	(109)	927	(134.4)	56.7	(134)	1317	(191.0)

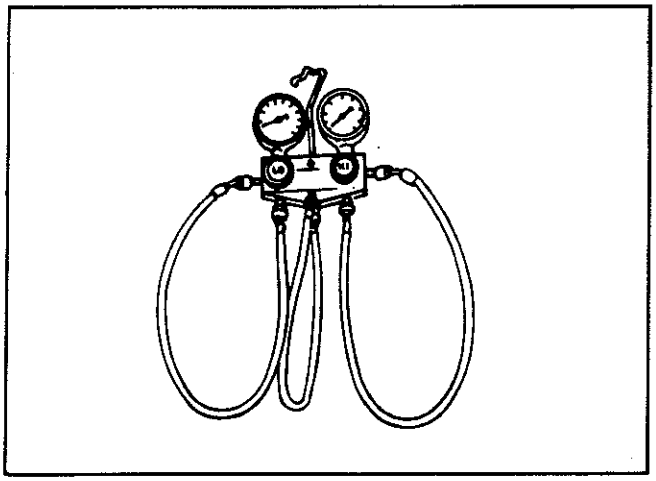


Fig. 14—Gauge manifold and charging hoses

OIL LEVEL

When a new or replacement compressor is installed, the compressor contains 250 ml (8.8 fl. oz.) of a special wax-free refrigerant oil. While the air conditioning system is in operation, the oil is carried through the entire system by the refrigerant. Some of this oil will be trapped and retained in various parts of the system. Consequently, once the system has been in operation, the amount of oil left in the compressor will always be less than the original charge. The compressor oil level should be checked as a matter of routine, whenever the refrigerant has been released from the system.

Checking oil level

(1) Discharge air conditioning system as previously described.

(2) Remove the combined filler/drain plug at the upper side of the compressor crankcase.

(3) Insert the oil gauge (refer Fig. 15) in the filler port until the gauge touches the bottom of the crankcase. The correct oil level should be between points A and B on the oil gauge. If the oil level is below point B, add refrigerant oil to the correct level. (Never use engine oil as a subsitute for refrigerant oil).

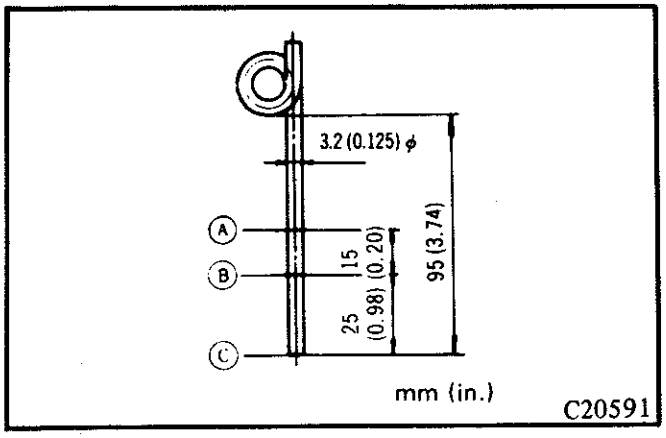


Fig. 15—Oil gauge (for compressor in horizontal position)

NOTE: If the unit has been operated without refrigerant, compressor oil will be pumped into the evporator, receiver and condensor and the oil gauge reading will be low. If this situation occurs, charge the unit with the correct amount of R12 refrigerant and run the air conditioning system for 5 minutes, discharge and recheck the oil level.

EVACUATING THE SYSTEM

Whenever the system has been opened to atmosphere, it is absolutely essential that the system be swept with refrigerant and evacuated to remove all the air and the moisture. If any appreciable amount of air remains in the system when it is charged, the trapped air will concentrate near the top of the condensor and cause abnormally high discharge pressure. Air in the system will reduce the condensers's ability to condense the refrigerant gas and supply adequate liquid refrigerant to the evaporator. To evacuate the system, proceed as follows:—

(1) Clean compressor suction and discharge check valves and remove dust caps.

(2) Connect a gauge manifold set to the check valves, —high pressure gauge hose to discharge valve and low pressure gauge hose to suction valve.

NOTE: Ensure both valves of the gauge manifold are closed before attaching hoses.

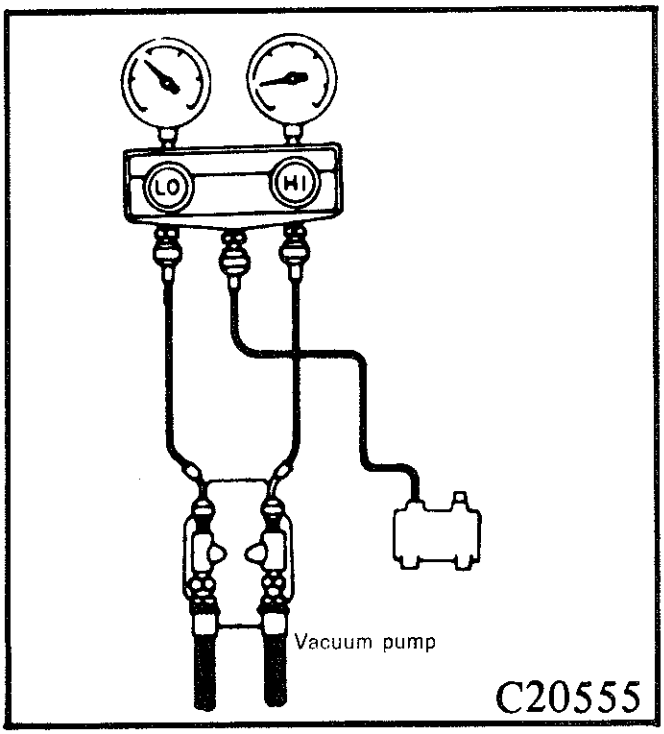


Fig. 16—Evacuation

(3) Check to ensure that there is no internal pressure in the system. If there is internal pressure present. it should be relieved — as described in "Discharging The System" — Refer page 12.

(4) Connect a vacuum pump to the charging hose of the manifold gauge set and open both high and low pressure gauge valves.

(5) Operate the vacuum pump until the low pressure gauge registers at least 660 mm Hg (26" Hg) of vacuum. If the system is tight and vacuum pump is in good condition, vacuum will go as low as 760 mm Hg (30" Hg).

NOTE: If a vacuum reading is unobtainable within 2 minutes, the air conditioning system has a large leak. Recharge the system, test and repair the leak.

(6) Allow the vacuum pump to operate with the low pressure gauge registering at least 660 mm Hg (26" Hg) of vacuum for a minimum period of 5 minutes.

(7) Close both guage manifold valves, turn off vacuum pump and check for loss of vacuum for a further 5 minutes.

(8) If no vacuum leaks occur, continue evacuation for a further 30 minutes.

(9) At the completion of evacuation, turn off the vacuum pump and disconnect the charging hose from the vacuum pump. The system is now ready for charging.

CHARGING THE SYSTEM

Since the refrigeration system is completely sealed, refrigerant level will not be low unless there is a leak in the system or the system has been discharged for repairs.

Before adding refrigerant where the cause of low level is not known, the entire system should be checked for leaks.

Assuming no leaks are present, or leaks have been repaired, proceed with charging of the system.

Charging an empty system

(1) Connect a gauge manifold set to the compressor check valves — high pressure gauge hose to discharge valve and low pressure gauge hose to suction valve.

NOTE: Ensure both valves of the gauge manifold are closed before connecting hoses — do not overtighten hose connections.

(2) Connect a cylinder of R12 refrigerant to the gauge manifold centre charging hose.

(3) Place the refrigerant cylinder on an accurate scale so that the amount of refrigerant can be weighed.

(4) Open the refrigerant cylinder valve and loosen the gauge manifold end of the charging hose to purge air from the hose. Re-tighten the hose connection and repeat the procedure to purge air from the suction and discharge hoses, by opening the respective gauge manifold valve and loosen the hose connection at the compressor. Tighten connections and close gauge manifold valves as soon as air is purged.

(5) With the vehicle windows open and engine hood up, operate the engine at approximately 1,100 r.p.m.

(6) Set controls to achieve maximum air conditioning and the fan speed on high.

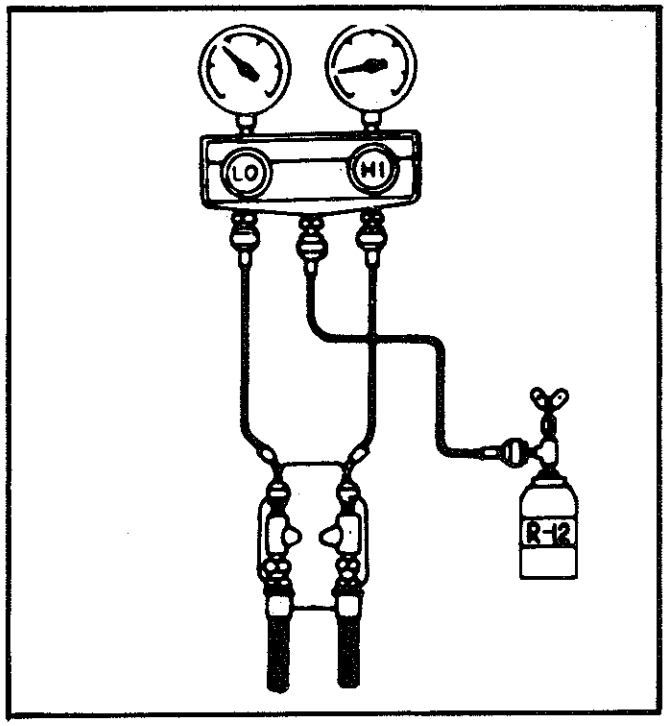


Fig. 17—Charging the system

(7) Slowly open the low pressure gauge manifold valve, to allow refrigerant to enter the system through the **suction** side of the compressor. Meter the flow of refrigerant by adjusting the gauge manifold valve so that the pressure registered at the low pressure gauge does not exceed 345 kPa (50 p.s.i.).

CAUTION: Ensure that the refrigerant cylinder is in an upright position when charging the system in this manner; to prevent liquid refrigerant being charged into the system through the suction port of the compressor. Liquid refrigerant entering the suction side of the compressor can damage the internal components of the compressor.

(8) Charge the system with 795g (1 lb. 11 oz.) of refrigerant. Add a further 115g (4 oz.) of refrigerant after foaming ceases at the receiver drier sight glass.

CAUTION: Do not charge the system with any more than the maximum of 1022g (2 lb. 4 oz.) of refrigerant. Too much refrigerant in the system can cause abnormally high discharge pressures.

(9) At the completion of charging, close the suction gauge manifold valve, refrigerant cylinder valve and disconnect the gauge manifold charging hose from the refrigerant cylinder.

(10) Disconnect the high and low pressure manifold gauge hoses from the compressor and install protective caps.

(11) Check entire system for leaks.

NOTE: When removing hoses from the compressor, disconnect the hose connections as quickly as possible to prevent loss of refrigerant.

Partial charging of system

(1) Connect gauge manifold set as previously described in "Charging an empty system" and follow steps 1 to 7.

(2) Add refrigerant R12 until foaming ceases at the receiver-drier sight glass and then add an additional 115 g (4 oz.) of refrigerant.

(3) Proceed with steps 9 to 11 as previously described.

REFRIGERANT LEVEL

The system must be operated at high fan speed, with vehicle doors and windows open, when this test is made, and when adding to the charge. The sight glass is an integral part of the receiver drier. The outlet line (liquid) from the condenser must be attached to the connection marked "IN". The word "IN" is stamped on the top face of the inlet connection. If the receiver-drier is reversed and the lines are connected incorrectly, the system must be purged, the lines reversed and the system recharged.

Set the engine speed to 1150 r.p.m. Block the air flow across the condenser to raise the discharge pressure to 1550-1725 kPa (225-250 p.s.i.), and check the sight glass for foam. There should be no foam. If sight glass is clear, remove the air restriction from the condenser and allow the discharge pressure to return to normal.

If the foam shows in the sight glass under the preceding conditions. it indicates the system is low on refrigerant.

The proper amount of refrigerant required to complete a full charge may be added to the system as follows:

Maintaining the discharge pressure at 1550-1725 kPa (225 to 250 p.s.i.) add refrigerant gas through the suction side of the system until foam is cleared from sight glass, then add exactly 115 g (4 ozs.) of refrigerant.

PERFORMANCE TEST

Humidity (the amount of moisture in the air) has an important bearing on the temperature of the air delivered to the vehicle's interior. This is true of all air conditioned systems whether in the home, office or vehicle. It is important to understand the effect humidity has on the performance of the system. When humidity is high, the evaporator has to perform a double duty. It must lower the air temperature and the temperature of the moisture carried in the air. Condensing the moisture in the air transfers a great deal of heat energy into the evaporator fins and tubing. This reduces the amount of heat the evaporator can absorb from the air. In other words high humidity greatly reduces the evaporator's ability to lower the temperature of the air delivered to the vehicle interior.

Evaportor capacity used to reduce the amount of moisture in the air is not wasted. Wringing some of the moisture out of the air entering the vehicle adds materially to the comfort of the passengers. However, an owner may expect too much from his air conditioning system on humid days. A performance test is the best way to determine whether or not the system is performing up to standard.

Prior to conducting the "Performance Test", the vehicle air conditioning system must be fully charged and leak tested.

The "Performance Test" cannot be carried out satisfactorily if ambient shade temperatures exceed 40°C (104°F), as unreliable results may be obtained.

Stationary Performance Test

(1) Place the vehicle in a shaded area with all windows and doors closed.

(2) With the aid of a tachometer, set the engine speed to 1150 r.p.m. by adjusting the carburettor idle speed adjustment screw.

(3) Disconnect the magnetic clutch feed wire at the compressor and permanently engage the clutch with the aid of a jumper lead connected to the positive battery terminal and clutch feed wire.

(4) Set the control panel Temperature Control lever to OFF position, Air Flow lever to Face and Recirc./Fresh lever to Recirc. position.

(5) Open all face level air outlet grilles and set the air direction vanes to ensure that there is no deflection of the air flow. Close the Lap Cooler outlet.

(6) Set the Fan Switch to "HI" and temperature control Thermo Switch to maximum cooling.

(7) Insert a "Dry Bulb" thermometer into the centre air outlet grille to record the outlet grille air temperature.

(8) Operate the air conditioner in the above operating conditions, taking note of the centre air outlet grille temperature.

Sedan air outlet grille temperatures should reduce to 11°C (52°F) for ambient shade temperatures up to 30°C (86°F), and 15°C (59°F) or below for ambient shade temperatures up to 40°C (104°F) in 15 minutes.

Station Wagon air outlet grille temperatures may be up to 5°C (41°F) warmer than Sedan temperatures after 15 minutes due to larger interior air volumes requiring cooling.

If the vehicles centre air outlet grille temperature is above the test temperatures, conduct a pressure test of the system and refer to the Service Diagnosis section for possible causes of low performance.

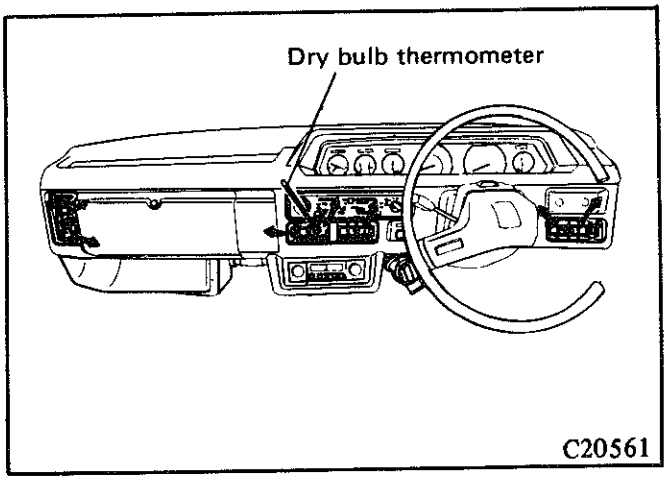


Fig. 18—Performance test

TESTING THE SYSTEM FOR LEAKS

Connect a manifold gauge set as described in **System Pressure Test** taking note of the gauge pressures.

If the pressures are normal — (refer Temperature Pressure Relationship Chart — Page 24 - 1 - 12), proceed with testing for leaks.

If no pressure is indicated on the manifold gauge set, it means that the system is empty, possibly due to a leak. It will be necessary to evacuate, charge the system with a sweep — test charge, locate and correct the leak, purge the test charge, replace the receiver-drier, evacuate and charge the system with the correct amount of refrigerant.

Sweep Test Charge

Repairs and component replacement must be completed before charging with the sweep test charge. The purpose of the sweep test is to pressurise the system so that a leak test can be made.

Testing

Check the entire system for refrigerant leaks using a Halide gas leak detector, Propane torch or Electric leak detector. The use of an Electric leak detector is recommended, due to toxic Phosgene gas being produced when the refrigerant gas contacts the flame of a Propane or Halide gas leak detector.

Perform the leak test in a wind free area, such as a garage or workshop.

Due to the refrigerant gas being heavier than air, it is good practice to place the test probe of the leak detector directly below the point being checked. Move the test probe slowly to allow the refrigerant to saturate the test probe element.

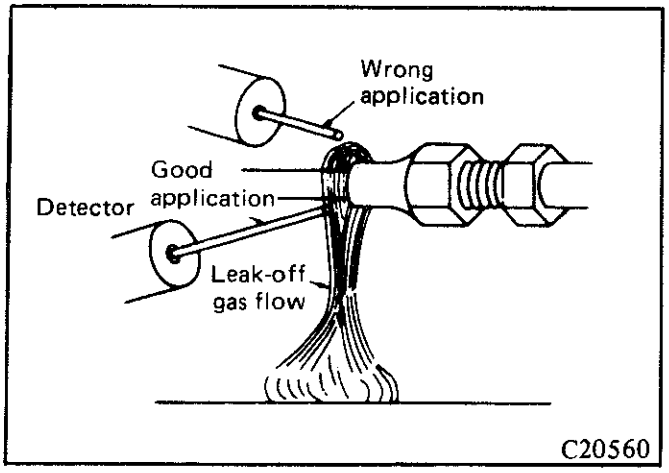


Fig. 19—Gas Leak Test

The high pressure refrigerant circuit should be tested for gas leaks during operation. Areas which are dangerous or hard to test during operation (including areas around the compressor and condensor) should be tested immediately after shut down.

The low pressure refrigerant circuit should be tested during shut down, after the refrigerant pressure has equalised.

CONDENSER INSPECTION

Inspect the condenser fins for obstructions or foreign matter. Clean if necessary. Any obstructions to the free flow of air across the condenser, will decrease heat dissipation from the condenser, decrease the efficiency of the condenser and, in turn, decrease the evaporator's efficiency. The conditions result in increasing the discharge pressure and horsepower load on the engine.

Inspect the condenser for bent or damaged fins. The bent fins on the condenser deflect air flow across the bent portions, decreasing the condenser area.

At extremely high temperatures overheating may be experienced if the vehicle is equipped with an insect screen and is travelling at a high speed or is towing a heavily laden trailer or caravan. First check fan belt tension and then if necessary remove insect screen.

CONDENSER REPLACEMENT

Where the condenser is required to be removed for any reason, the air conditioning refrigerant must be first discharged as previously detailed.

The condenser is mounted forward of the radiator core and is secured by two bolts to the radiator support.

Removal

(1) Discharge the refrigerant as previously detailed.

(2) Remove the front grille.

(3) Disconnect the refrigerant hose and pipe flare nuts at the condenser and cap all openings with plastic caps. (Do not use cloth, etc.)

(4) Remove the hood lock stay.

(5) Remove the condenser mounting bolts, raise the condenser to disengage the locating pins at the bottom of the condenser and at the same time withdraw the condenser from the vehicle.

Installation

Installation is a reversal of the above procedure, ensuring that the hose and pipe flare nuts are tightened to the specified torque and refrigerant oil applied to all flares and flare nuts prior to assembly.

RECEIVER-DRIER REPLACEMENT

Removal

(1) Discharge the refrigerant as previously detailed.

(2) Disconnect the receiver-drier inlet and outlet pipe flare nuts.

(3) Disconnect the high pressure cut-out switch wiring loom.

(4) Remove the clamping bolts of the receiver-drier mounting bracket and withdraw the receiver-drier.

NOTE: Immediately after removal of the receiver-drier ensure that plastic caps are fitted to all pipes and fittings (do not use cloth, etc.).

CAUTION: Replacement receiver-drier units must be sealed while in storage. The drier used in these units is so hungry for moisture that it can saturate quickly upon exposure to the atmosphere. When installing a drier, have all tools and supplies ready for quick reassembly to avoid keeping the system open any longer than necessary.

Installation

Installation is a reversal of the above procedure, ensuring that pipe flares are lubricated with refrigerant oil and flare nuts are tightenend to the specified torque. Ensure that the receiver-drier is connected with the **inlet side to the condenser pipe.**

CAUTION: Do not reverse the receiver-drier connections.

EVAPORATOR ASSEMBLY

Removal

Engine Compartment:

(1) Disconnect the negative battery terminal.

(2) Discharge the refrigerant from the system, refer "Discharging The System" section.

(3) Disconnect the evaporator suction hose and liquid pipe connections at the dash panel and cap all fittings to prevent entrance of dirt and moisture.

NOTE: Use two spanners to loosen each connection to prevent damaging the evaporator pipes.

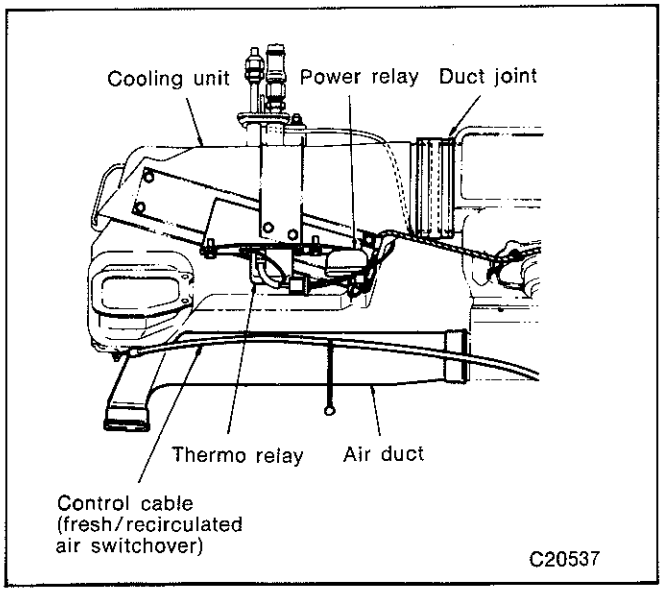


Fig. 20—Removing evaporator unit

Vehicle Interior:

(1) Remove the glove box and parcel tray.

(2) Remove the left hand air duct.

(3) Disconnect the recirculation/fresh air cable clip at the evaporator and disconnect the cable.

(4) Disconnect the thermostat relay, power relay and thermister wiring loom connectors.

(5) Loosen the evaporator to heater connecting duct band and slide the connecting duct toward the heater.

(6) Remove the evaporator upper and lower mounting bracket screws and remove the evaporator assembly.

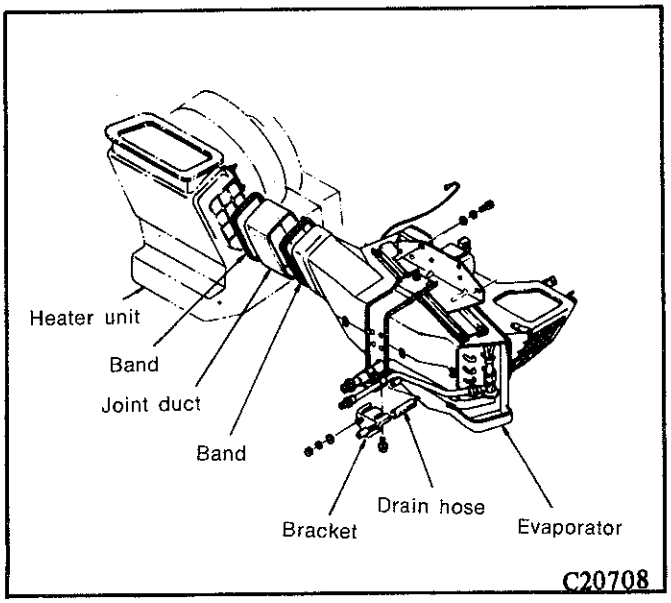


Fig. 21—Installing evaporator unit

Installation

Install by reversing the removal procedure, taking note of the following:

(1) When connecting hose and pipe connections, apply refrigerant oil to flares and flare nuts.

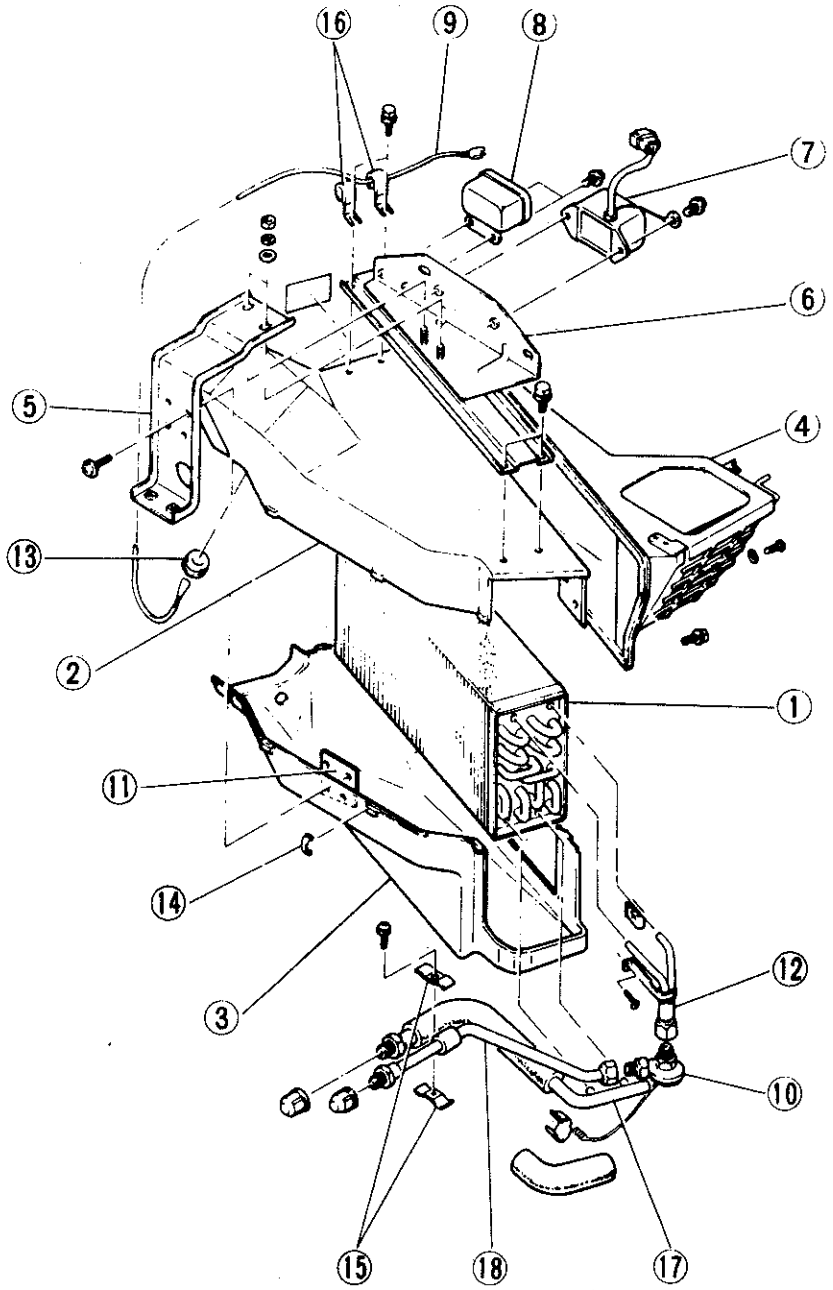
NOTE: On early vehicles, copper washers were fitted at the hose and pipe connectors — replace if damaged.

(2) Tighten connections to specified torque.

(3) Check operation and adjustment of fresh/recirculation control lever and door.

(4) Ensure air ducts are correctly fitted to prevent air leaks.

(5) Charge system with refrigerant and check for leaks — refer "Charging The System" section.



1. Evaporator coil
2. Evaporator housing (upper)
3. Evaporator housing (lower)
4. Duct assembly
5. Evaporator bracket (B)
6. Evaporator bracket (A)
7. Thermo relay assembly
8. Power relay assembly
9. Thermistor
10. Expansion valve
11. Plate
12. Pipe assembly
13. Grommet
14. Clip
15. Clamp
16. Clamp
17. Header assembly (for low pressure)
18. Pipe assembly (for liquid)

Fig. 22—Components of evaporator assembly

Disassembly

(1) Remove the clamp securing the evaporator pipes to the lower evaporator bracket (B).

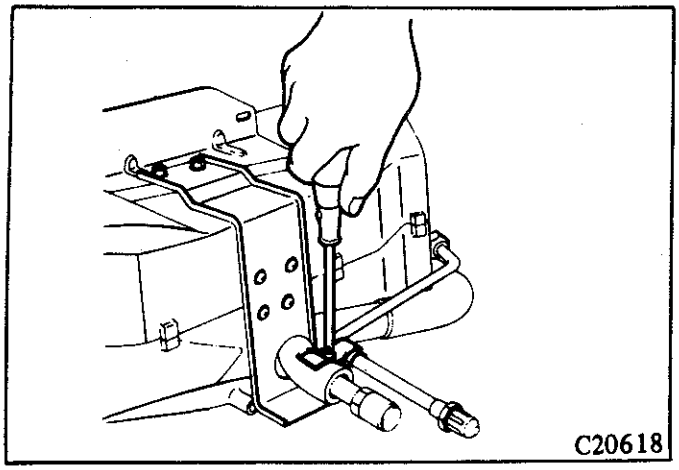


Fig. 23—Removing pipe clamp

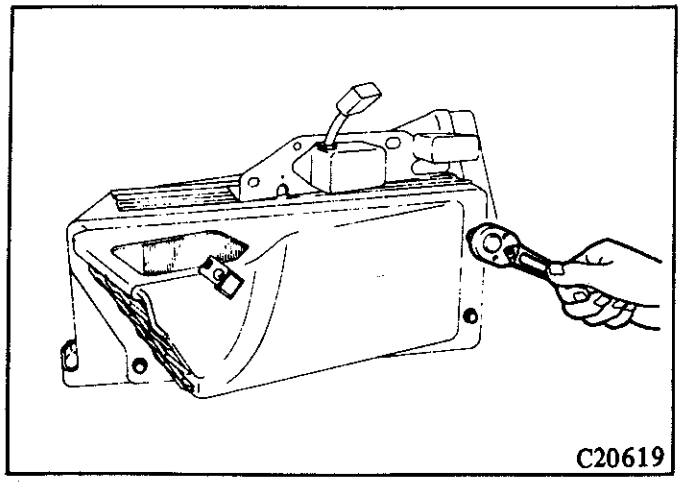


Fig. 24—Removing duct assembly screws

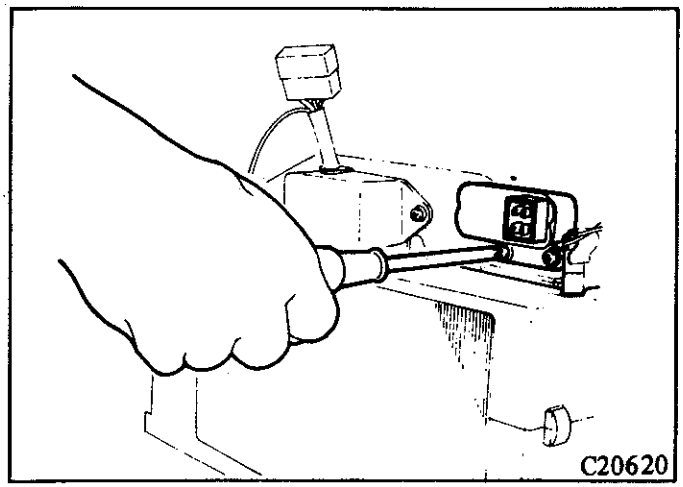


Fig. 25—Removing power relay assembly

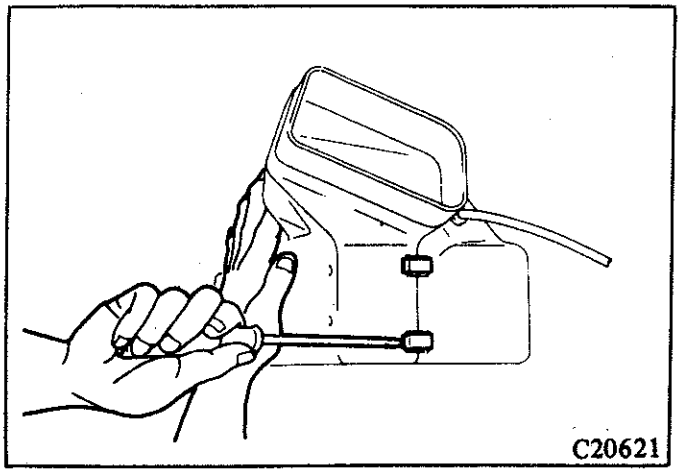


Fig. 26—Removing clips

(2) Remove bracket (B) from the evaporator housing.

(3) Remove the duct assembly attaching screws and remove the duct assembly.

(4) Remove the power relay and thermo relay assemblies.

(5) Remove bracket (A) from the evaporator housing.

(6) Remove the upper evaporator housing attaching screws and clips and then remove the upper housing.

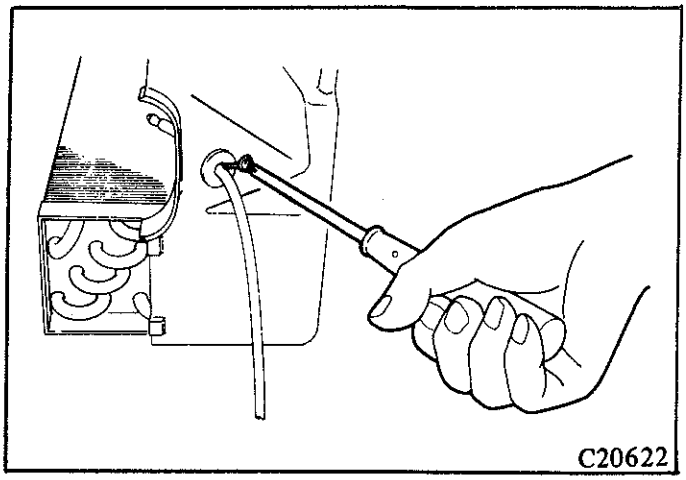


Fig. 27—Removing thermister

(7) Remove the thermister attaching screw and remove the thermister together with the grommet from the lower evaporator housing.

(8) Remove the evaporator coil from the lower evaporator housing.

(9) Remove the expansion valve.

Reassembly

Reassemble by reversing the disassembly procedure.

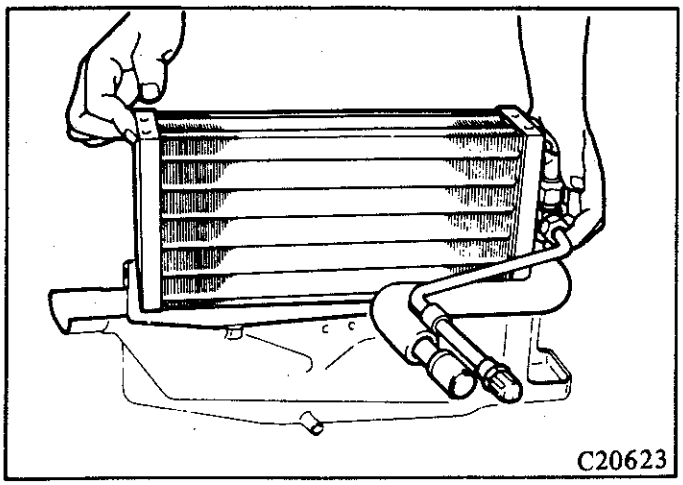


Fig. 28—Removing evaporator coil

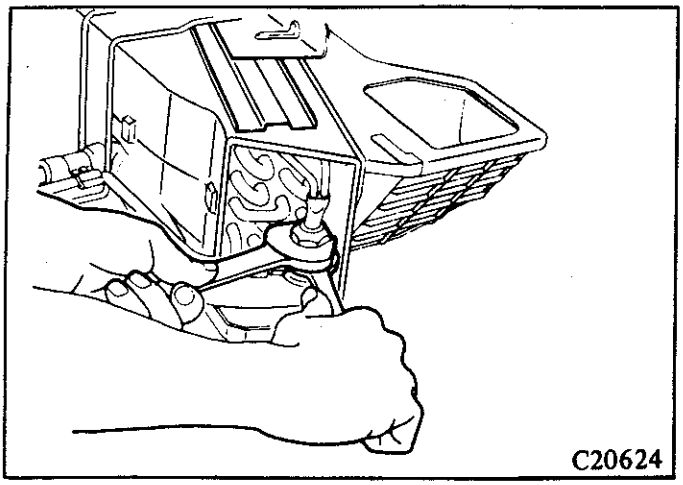


Fig. 29—Removing expansion valve

COMPRESSOR REPLACEMENT

Removal

(1) Clean compressor suction and discharge valves and remove dust caps from service ports.

(2) Connect a gauge manifold set to the service ports — high pressure gauge hose to discharge port and low pressure gauge hose to the suction port.

NOTE: Ensure both valves of the gauge manifold are closed before connecting hoses.

(3) If the gauges indicate any pressure, the compressor will be safe to operate. Operate the compressor until the low pressure gauge indicates approximately 51 mm Hg (2" Hg) of vacuum.

NOTE: Operating the compressor in this manner will return most of the refrigeration oil to the compressor.

(4) Stop the engine and discharge the system as previously described.

(5) Disconnect the negative battery terminal and remove the gauge manifold suction and discharge hoses from the compressor service ports. **Fit plugs or covers to the hose fittings immediately they are disconnected, to prevent entry of dirt and contaminants.**

(6) Inspect compressor oil level as previously described.

(7) Loosen the drive belt tension and disconnect the magnetic clutch control wire.

(8) Remove compressor to lower mounting bracket attaching bolts.

(9) Remove bolts attaching upper mounting bracket to timing cover and engine block and remove compressor with upper mounting bracket attached.

(10) Place compressor on a work bench and remove the upper mounting bracket to compressor bolts.

(11) Remove the compressor crakshaft to clutch pulley attaching bolt.

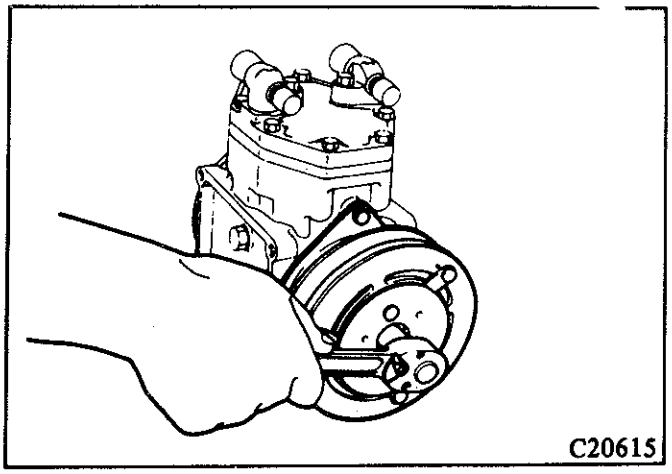


Fig. 30—Removing clutch pulley attaching bolt

(12) Insert an M16 x 2,0 x 50 mm cap screw into the threaded portion of the hub assembly and screw the cap screw in to draw the hub off the crankshaft taper.

CAUTION: Do not hammer the shaft or pulley to assist removal.

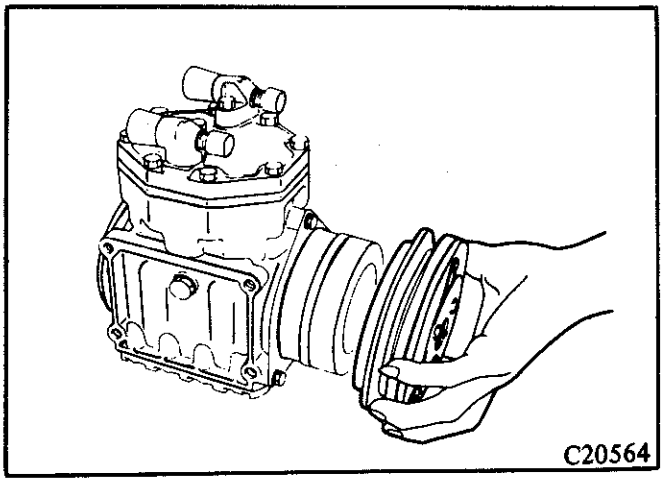


Fig. 31—Removing clutch assembly

(13) Remove the clutch field coil support and drive key from the crankshaft.

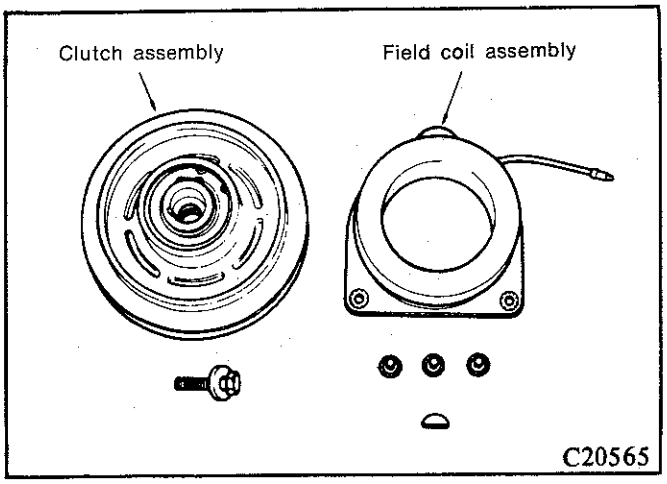


Fig. 32—Components of magnetic clutch assembly

Installation

(1) Position the magnetic clutch field coil support onto the compressor. Install and tighten attaching screws to specified torque.

(2) Carefully position the clutch hub drive key into the crankshaft keyway.

(3) Position the clutch assembly onto the compressor crankshaft, carefully aligning the keyway as the clutch is installed. Install the clutch attaching bolt and washer. Tighten bolt to specified torque.

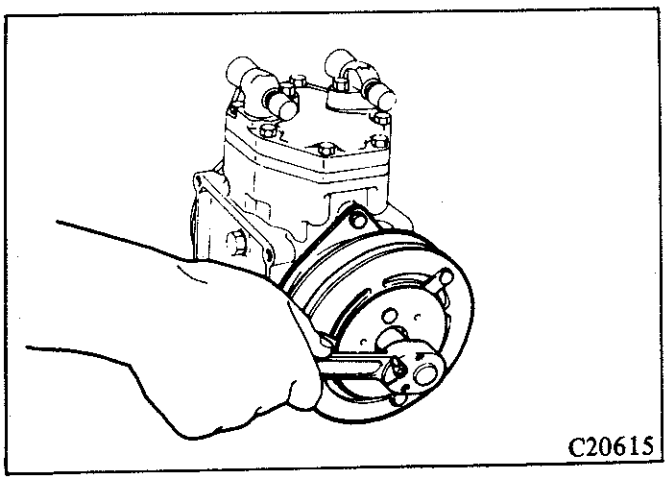


Fig. 33—Tightening clutch attaching bolt.

(4) Install upper mounting bracket to compressor (tighten bolts finger tight).

(5) Position the compressor on the engine and install the mounting bolts. Tighten bolts evenly to specified torque.

CAUTION: When replacing the compressor assembly, the crankshaft should be rotated by hand at least two complete revolutions to clear oil accumulation from the compressor head before the clutch is energised to avoid damaging the compressor reed valves.

(6) Install the compressor drive belt and adjust the drive belt tension.

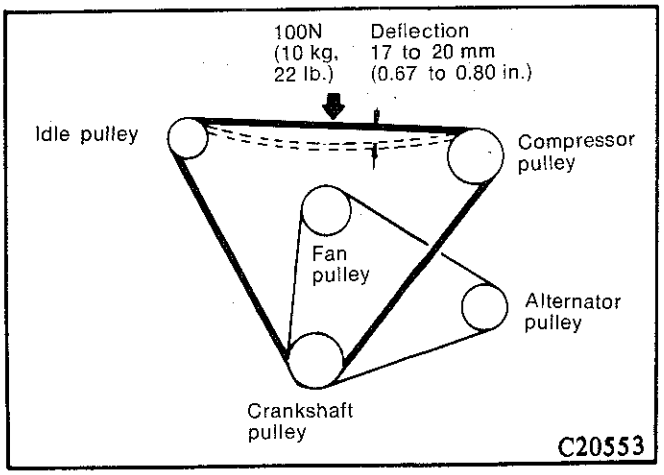


Fig. 34—Drive belt tension

(7) Apply refrigerant oil to all hose connections and connect hoses. Tighten to specified torque.

NOTE: On early model units, copper washers were fitted at hose connection seats. If the copper washer seats are in a satisfactory condition, they can carefully be re-used. Replace if necessary. Also ensure that the utmost care and cleanliness is attained when making all connections.

(8) Connect magnetic clutch control wire. Check compressor oil level as previously described. Maintain oil level at the exact level indicated on the dipstick prior to removal of the compressor.

(9) Charge and check the refrigerant system as previously described.

COMPRESSOR OVERHAUL

Precautions prior to Disassembly

(1) The refrigerant oil used in the compressor is carried through the entire system by the refrigerant. Some of this oil will be trapped and retained in the system when the refrigerant is discharged for testing or unit replacement. If the compressor is to be removed for replacement, measure the refrigerant oil level in the compressor before the compressor is removed from the vehicle, so that the same oil level can be established when the replacement compressor is installed on the vehicle. Too much refrigerant oil in the system can cause abnormal operating pressures and reduce the performance of the entire system.

(2) Complete disassembly and assembly of the compressor must be performed with the compressor removed from the vehicle.

Precautions at Disassembly

(1) Pressure within the compressor must be completely discharged before attempting to perform any repair service to the compressor.

(2) Cleanliness is of the utmost importance, clean tools, work bench and a clean dust free environment are essential to prevent contamination of the compressor and associated components.

(3) Use only air drying cleaning fluids, such as Trichlor-Ethylene or Shell X55 solvent.

NOTE: Inflammable cleaning fluids should not be used in a confined area.

(4) When cleaning compressor components, ensure that oil galleries, tapped holes, corners and pockets etc., are carefully cleaned.

(5) Use lint free cleaning cloths and dry components with compressed air.

(6) Store components in a dry, dust-free environment.

Precautions at Assembly

(1) All contact surfaces must be liberally coated with clean refrigerant oil. Refrigerant oil must be kept in a sealed container until ready for use to prevent entrance of moisture and dirt.

(2) Never use engine oil as a substitute for refrigerant oil.

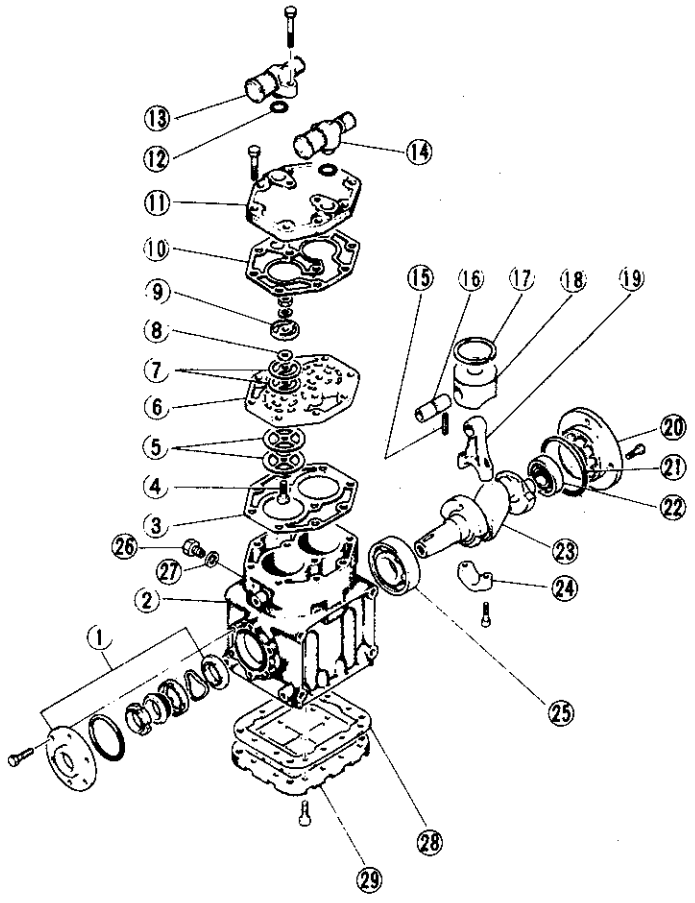
(3) Ensure that the components to be installed are clean.

(4) Gaskets, seals, "O" rings, etc., must be replaced with new components.

(5) Old gasket materials must be completely removed.

(6) Check to ensure that the piston, crankshaft and associated moving components rotate or move freely when fitting each component.

(7) Tighten nuts and bolts to the specified torque and correct tightening sequence.



1. Shaft seal assembly
2. Crankcase
3. Valve plate gasket
4. Machine screw, special
5. Suction valve
6. Valve plate
7. Discharge valve
8. Valve disc
9. Retainer
10. Cylinder head gasket
11. Cylinder head
12. O ring
13. Check valve (discharge)
14. Check valve (suction)
15. Spring pin
16. Piston pin
17. Compression ring
18. Piston
19. Connecting rod
20. Rear bearing housing
21. O ring
22. Rear bearing
23. Crankshaft
24. Rod cap
25. Front bearing
26. Combined filler and drain port plug
27. O ring
28. Bottom cover gasket
29. Bottom cover

Fig. 35—Components of compressor

Removal

(1) Remove the compressor assembly as described in Compressor Replacement.

(2) Place the cleaned compressor assembly upright on the bench.

Disassembly

(1) Remove the compressor magnetic clutch hub to crankshaft attaching bolt.

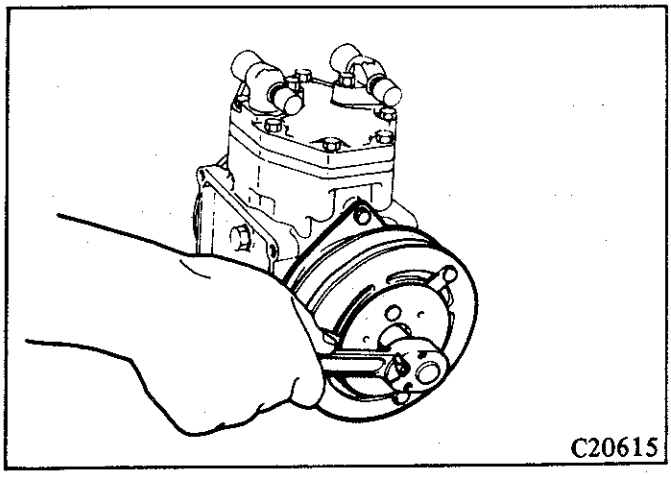


Fig. 36—Removing clutch pulley attaching bolt

(2) Screw an M16 x 2,0 x 50 mm cap screw into the threaded portion of the clutch hub assembly and screw the cap screw in to draw the hub off the crankshaft taper.

CAUTION: Do not hammer the shaft or pulley to assist removal.

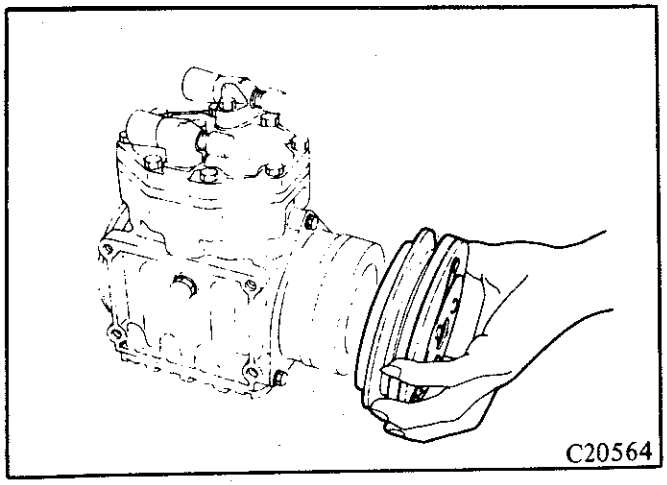


Fig. 37—Removing clutch assembly

(3) Remove the clutch field coil support and drive key from the crankshaft.

(4) Remove the combined filler drain plug and drain the refrigerant oil.

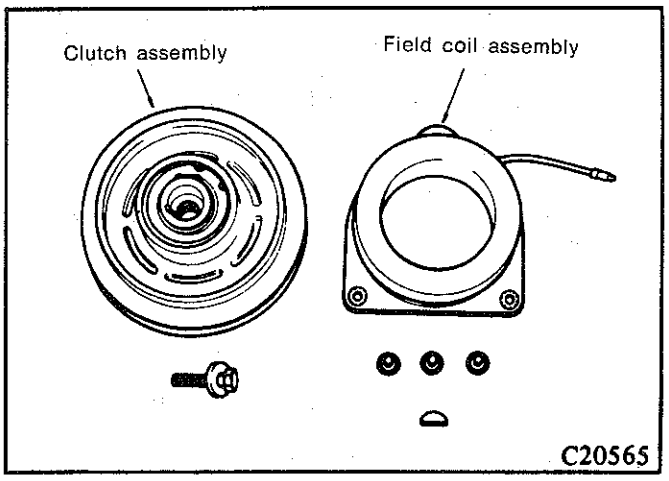


Fig. 38—Components of magnetic clutch assembly

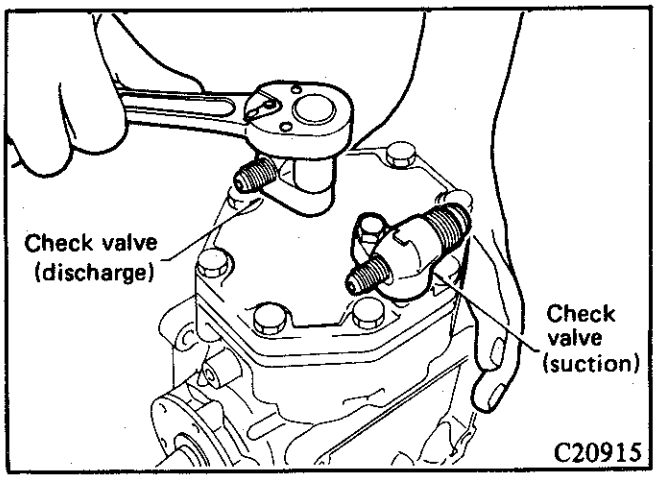


Fig. 39—Removing check valves

(5) Remove the check valve attaching bolts.

(6) Remove the cylinder head bolts in a diagonal sequence and remove the cylinder head.

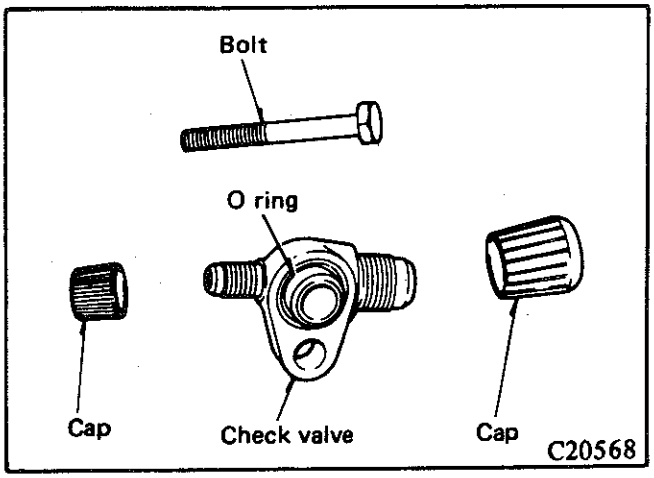


Fig. 40—Components of check valve

NOTE: If the cylinder head is found to be seized onto the compressor, replace two of the cylinder head bolts diagonally opposite each other finger tight and back off two full turns. The cylinder head can then be carefully driven off with the aid of a screwdriver or punch and a plastic hammer applied to the cut out section in the cylinder head — refer Fig. 42. Care must be taken to prevent damaging the cylinder head or valve plate assembly.

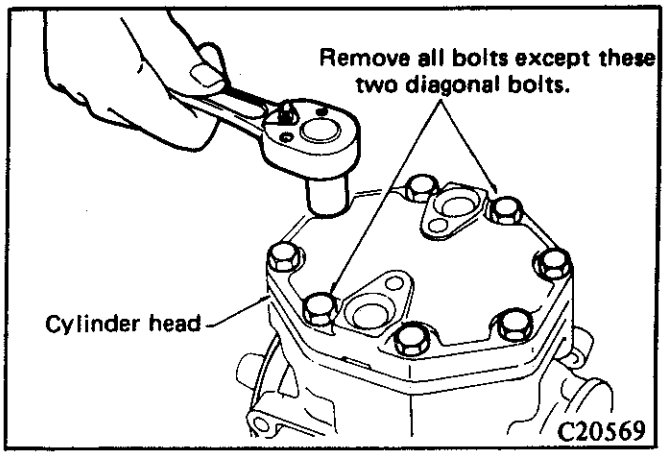


Fig. 41—Removing cylinder head bolts

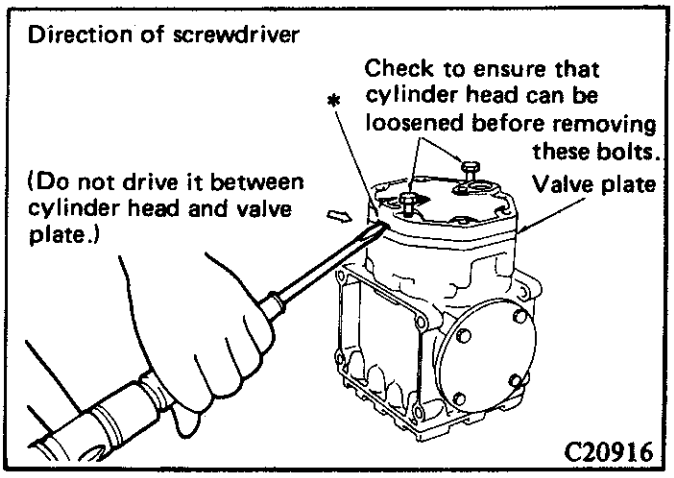


Fig. 42—Removing cylinder head

(7) Remove the valve plate assembly.

NOTE: If the valve plate is seized onto the compressor, apply the same method of removal as the cylinder head.

(8) Invert the compressor and remove the crankcase bottom cover bolts.

NOTE: If the crankcase bottom cover is found to be seized to the crankcase — strike the bottom cover with a plastic hammer.

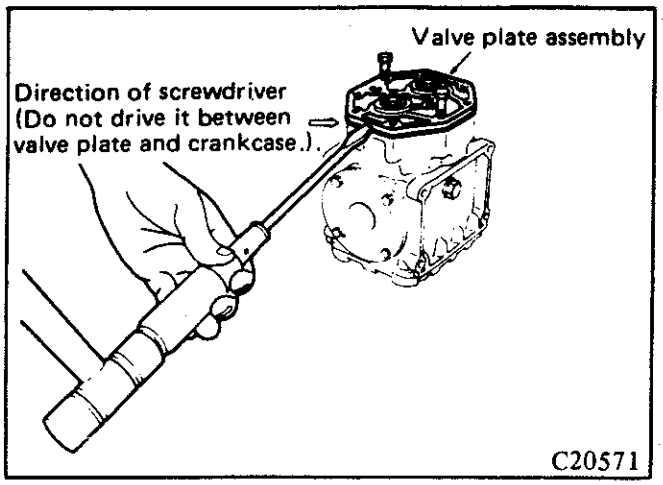


Fig. 43—Removing valve plate assembly

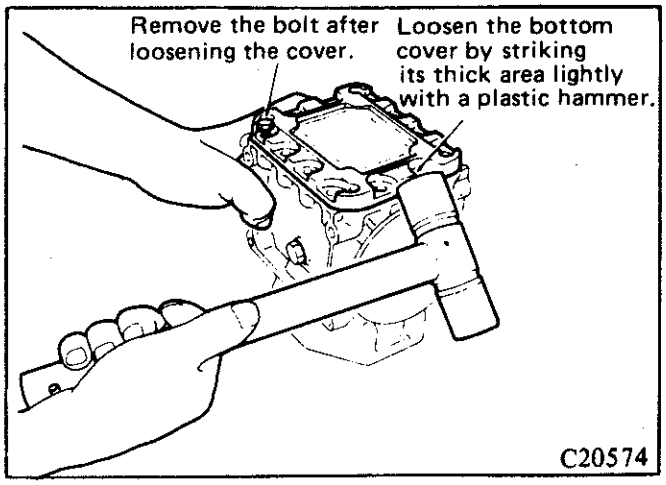


Fig. 44—Removing bottom cover

(9) With the aid of a suitable punch, mark the connecting rod and cap with the appropriate cylinder number to enable correct assembly of connecting rod and cap during re-fitment.

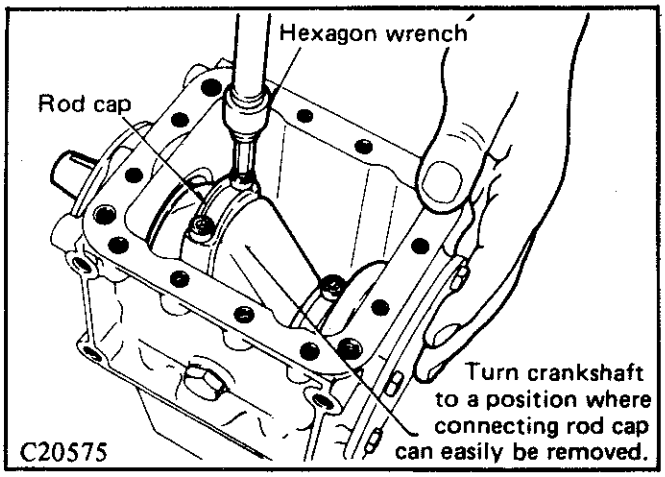


Fig. 45—Removing connecting rod cap

(10) Remove the connecting rod bolts with the aid of special tool (MB990671) and remove the connecting rod cap.

(11) With the aid of a wooden hammer handle push the piston and rod assembly out through the top of the cylinder.

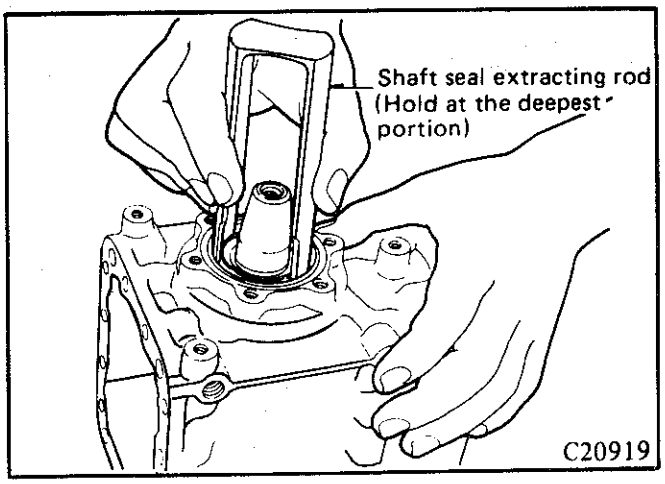


Fig. 46—Removing shaft seal assembly

NOTE: Prior to removing the piston and rod assemblies, remove any ridge that may be at the top section of the cylinder bore.

(12) Remove the crankshaft front seal cover bolts and remove the cover. With the aid of special tool (MB990672) remove the front seal.

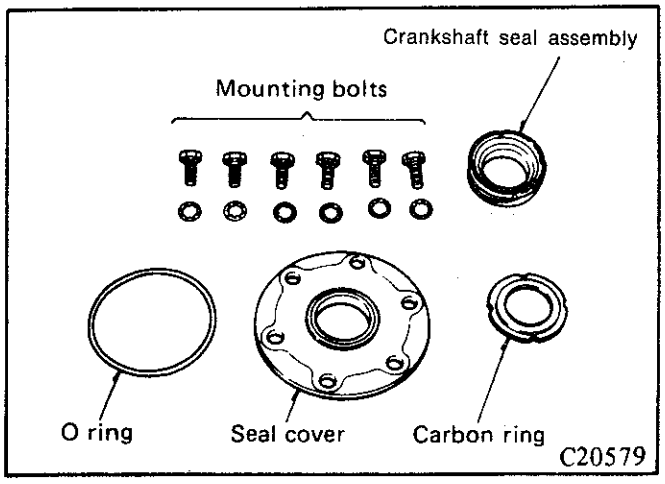


Fig. 47—Components of crankshaft seal assembly

(13) Remove the rear bearing housing attaching bolts and drive the housing out of the crankcase by striking the end of the crankshaft with a plastic hammer.

(14) Remove the crankshaft assembly with bearings attached.

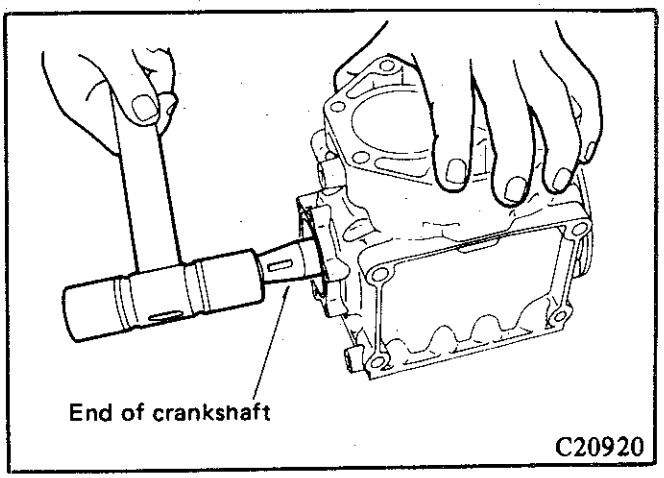


Fig. 48—Extracting crankshaft

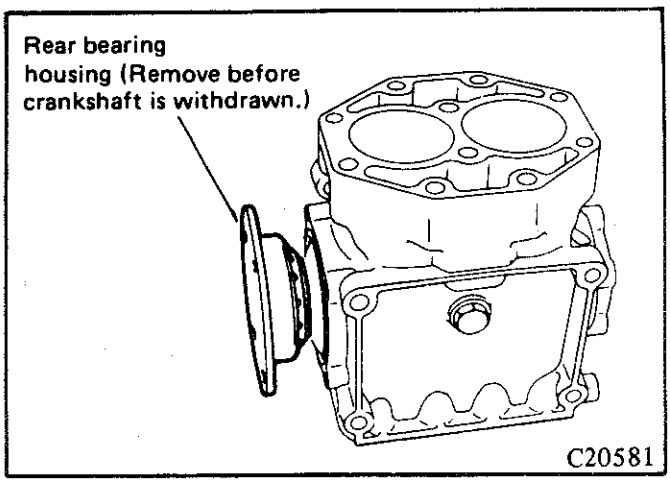


Fig. 49—Withdrawing rear bearing housing

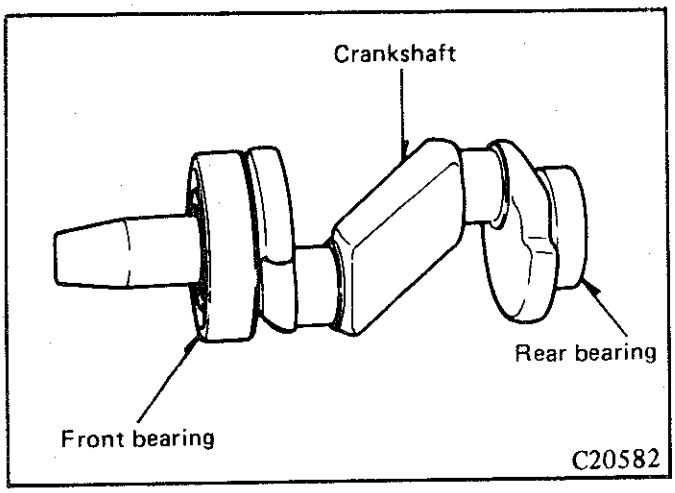


Fig. 50—Crankshaft

(15) Remove the front and rear bearings from the crankshaft with special tools (MB990673 front bearing and MB990674 rear bearing).

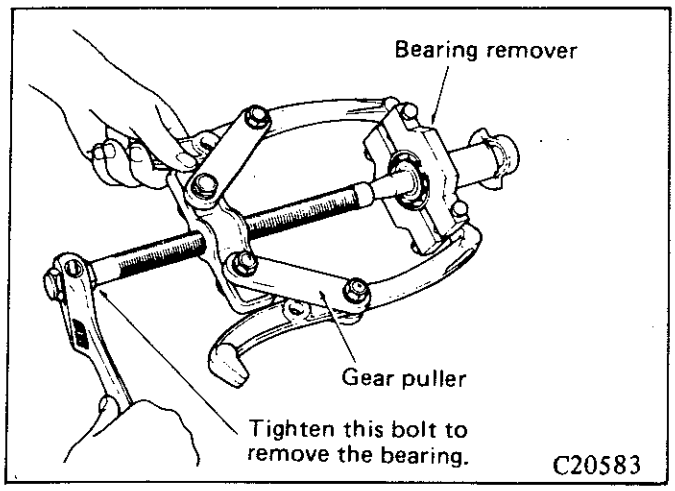


Fig. 51—Removing bearings

CLEANING AND INSPECTION

(1) Clean all components for inspection with Trichlor-Ethylene or Shell X55 solvent. Dry components with compressed air.

NOTE: Inflammable cleaning fluids should not be used in a confined area.

(2) Remove the piston ring from the piston and insert the piston and connecting rod assembly in the respective cylinder upside down. Measure the piston thrust skirt to cylinder clearance with a feeler gauge at the lower section of the cylinder. Inspect the piston for seizure, nicks, cracks, ring land and skirt wear. Replace any faulty components. (Maximum piston to cylinder clearance is 0,15 mm (0.006")).

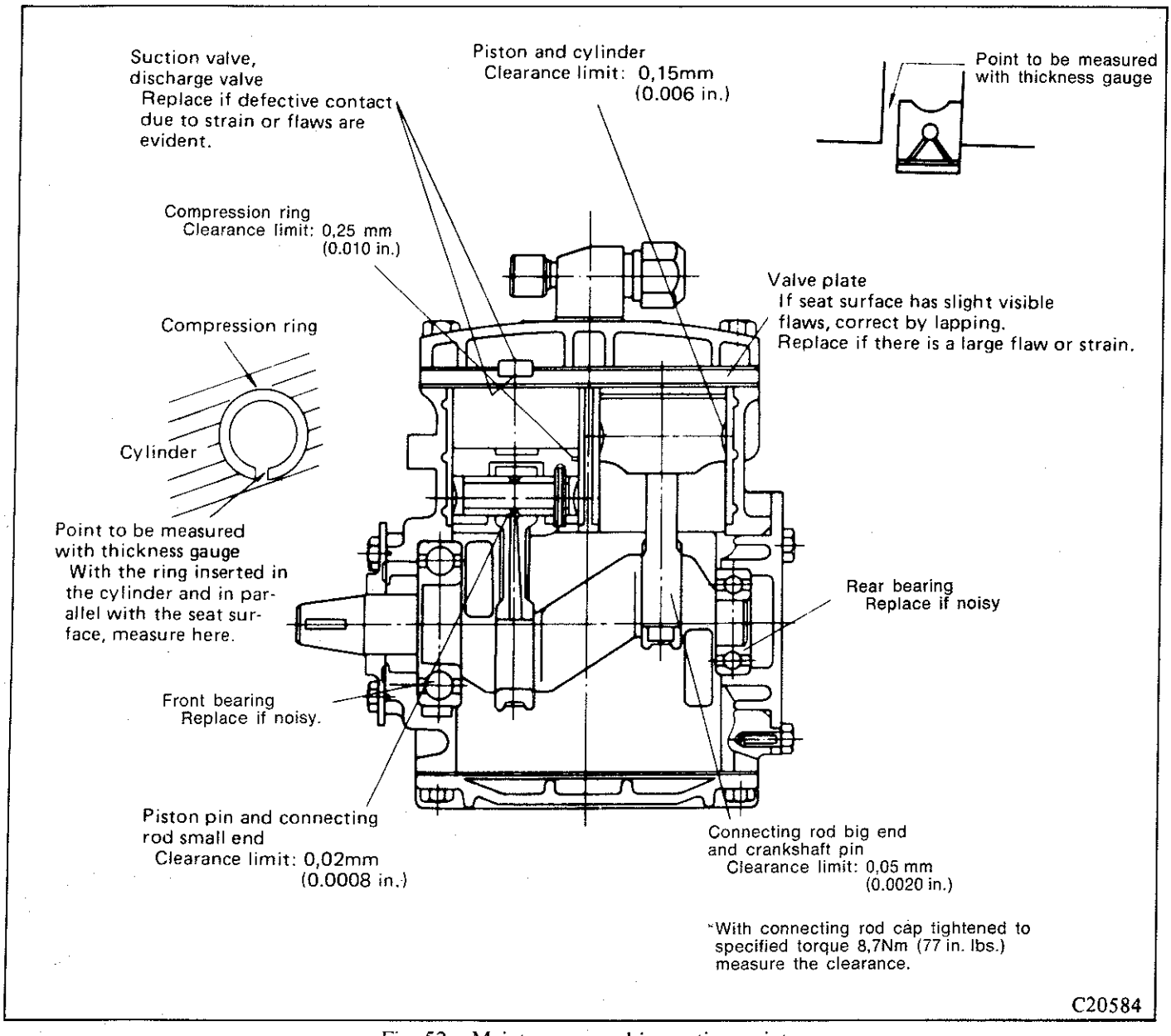


Fig. 52—Maintenance and inspection points

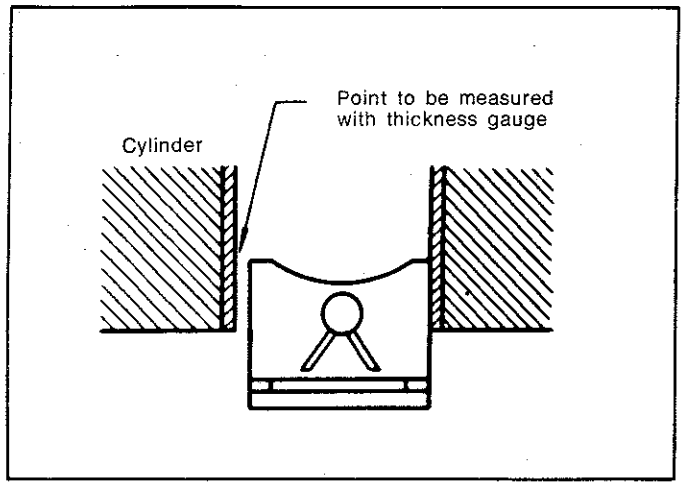


Fig. 53—Measuring clearance between piston and cylinder

(3) Disassemble the piston from the connecting rod and inspect the piston pin, piston pin bore and connecting rod small end.

(a) Measure two diameters intersecting at right angles at the centre of the piston pin.

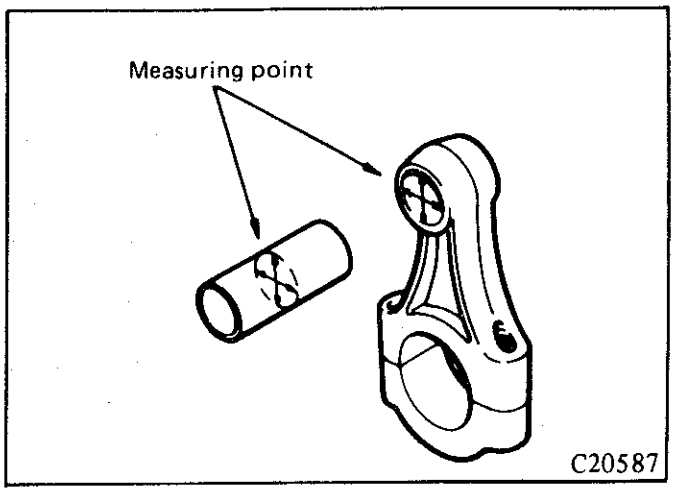


Fig. 54—Measuring piston pin-to-connecting rod small end clearance

(b) Measure two connecting rod small end inside diameters intersecting at right angles.

(c) If the clearance exceeds 0,02 mm (0.008"), replace the piston pin.

(d) If the centre of the piston pin is worn to 14,19 mm (0.5586"), replace the piston pin.

(e) If the connecting rod small end is worn to 14,21 mm (0.5594"), replace the connecting rod.

(4) Fit the connecting rod big end cap and tighten the big end bolts to 8,7 Nm (77 lbs. in.).

(a) Measure the big end bore diameter of the connecting rod.

(b) Measure the crankshaft journal and subtract the crankshaft journal dimension from the connecting rod big end dimension.

(c) If the clearance exceeds 0,05 mm (0.002") replace the connecting rod.

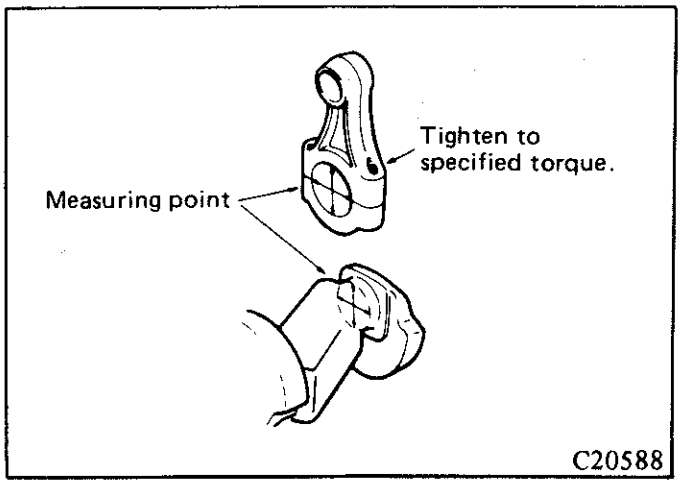


Fig. 55—Measuring points

(5) Insert the piston ring into the respective cylinder and push the ring into the cylinder with an inverted piston, to measure the ring gap at the upper worn section of the cylinder bore. If the ring gap exceeds 0,25 mm (0.010") replace the piston rings.

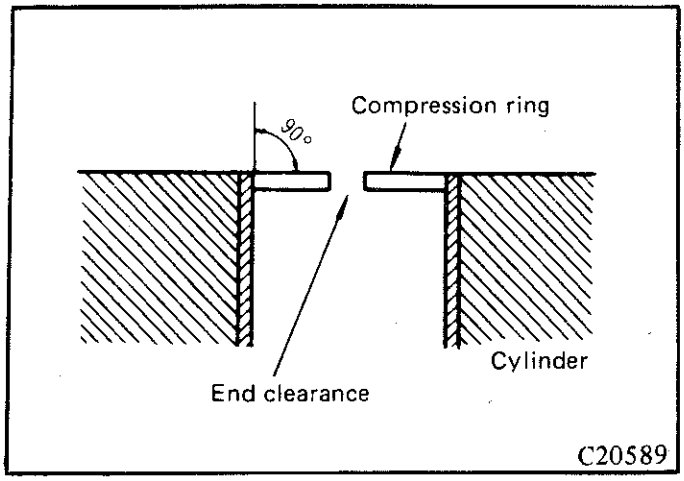


Fig. 56—Measuring compression ring

(6) With the aid of special tool (MB990670), dismantle the valve plate assembly and visually inspect the valve plate, suction and discharge valves.

(7) Inspect the crankshaft front and rear bearings for looseness and roughness when the bearings are rotated. Replace if necessary.

(8) Do not attempt to disassemble the crankshaft seal assembly unless the seal shows signs of leakage. A disassembled crankshaft seal assembly should not be re-used. Replacement of individual parts of the crankshaft seal assembly could result in leaks. If the crankshaft seal shows

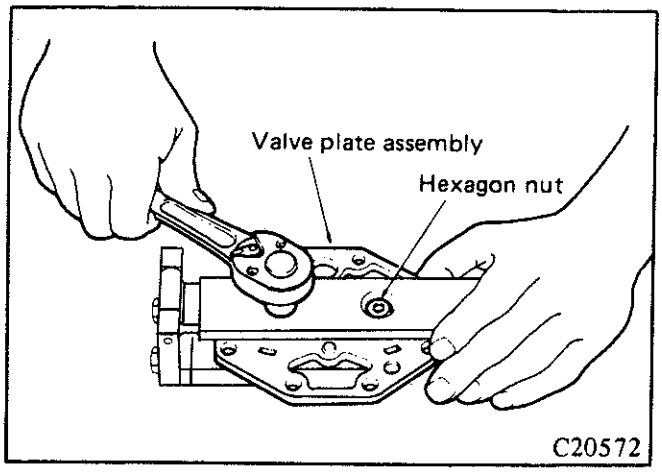


Fig. 57—Minor disassembly of valve plate assembly

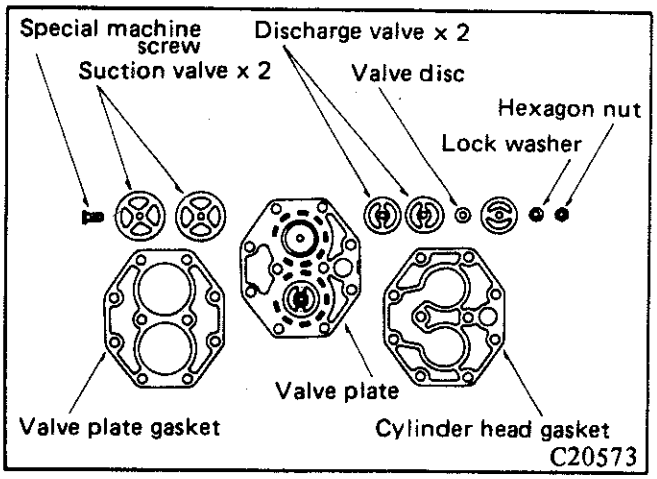


Fig. 58—Components of valve plate assembly

The following parts should be replaced with new ones at each assembly.

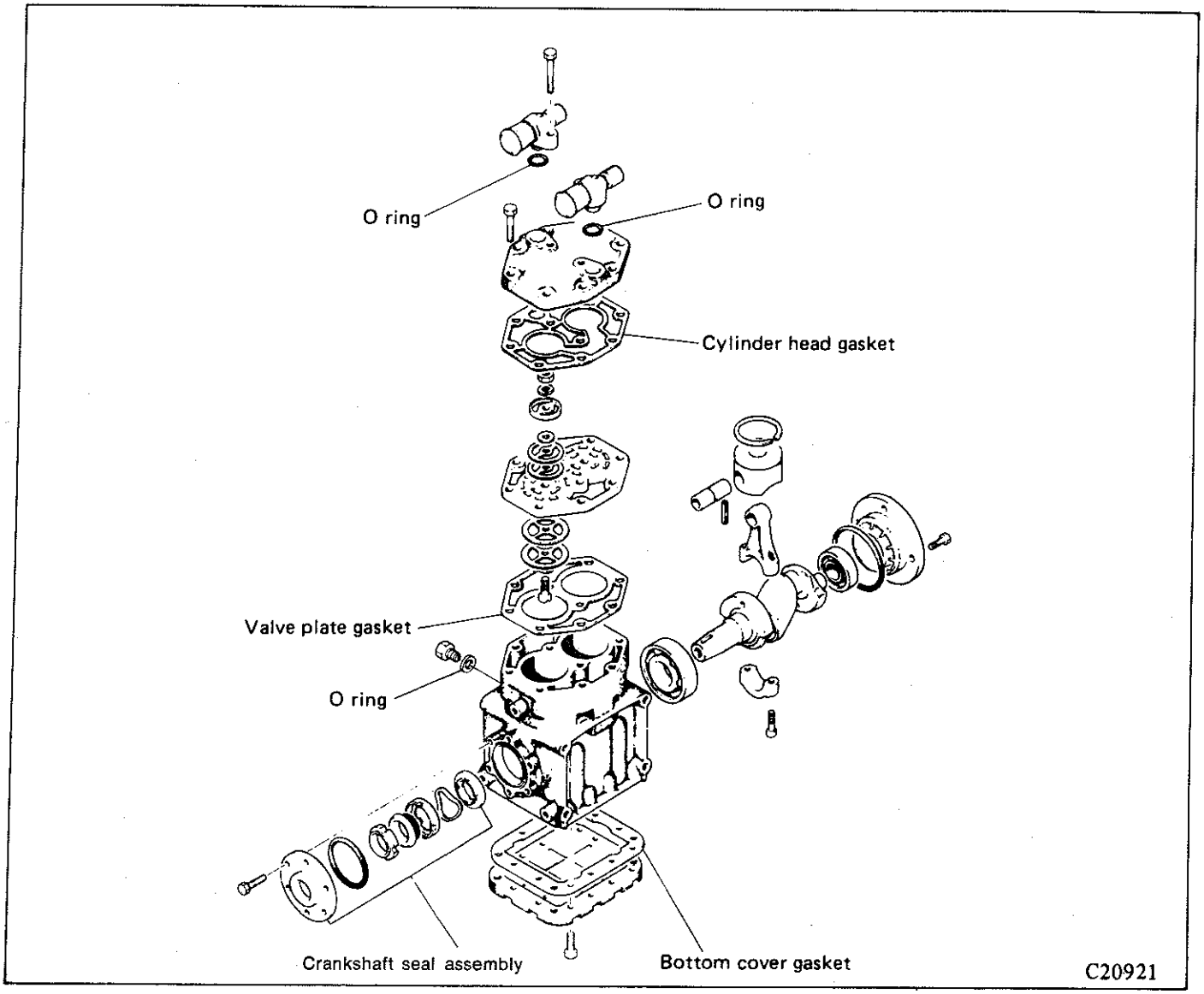


Fig. 59—Expendables

ASSEMBLY

NOTE: When assembling the compressor, lubricate bearings, pistons, crankshaft, cylinders and all internal components with refrigerant oil. Do not use engine oil as a substitute.

(1) With the aid of special tools (MB990675 and MB990677), fit the rear bearing onto the crankshaft.

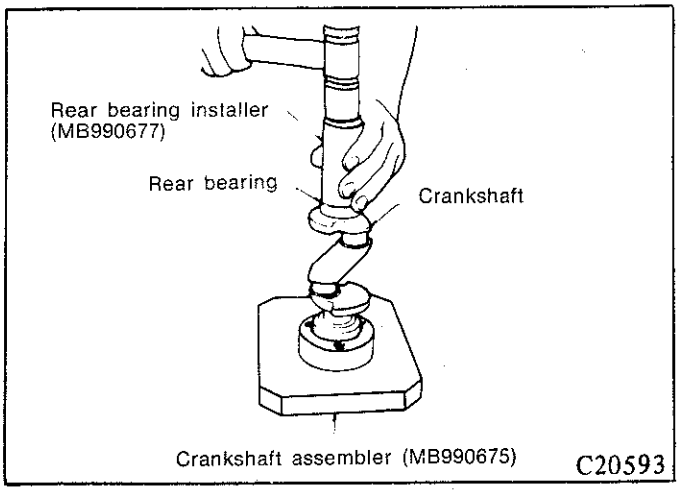


Fig. 60—Fitting the rear bearing

(2) Install the front crankshaft bearing into the crankcase with special tools (MB990675 and MB990676).

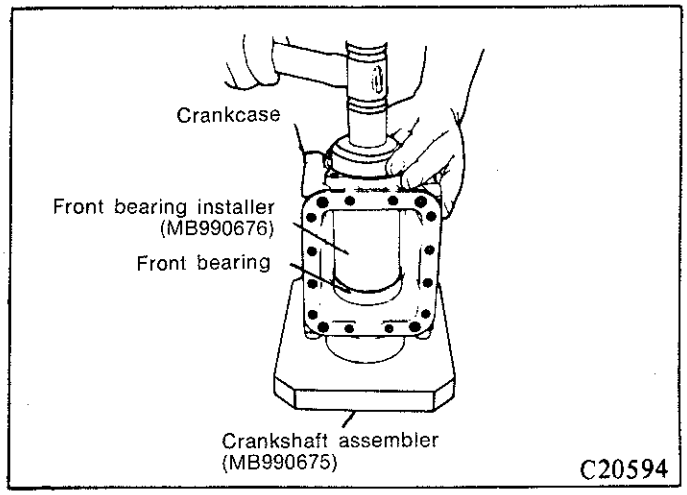


Fig. 61—Fitting front bearing

(3) Insert the crankshaft into the front bearing in the crankcase and install the crankshaft with special tool (MB990676).

(4) Install a new "O" ring in the rear bearing housing and install the rear bearing housing into the crankcase.

Insert two bearing housing bolts diagonally opposite each other as guides for the bearing housing and strike the ribbed section of the housing lightly with a plastic hammer until the housing is fitted in place. Install the rear bearing housing attaching bolts and tighten to specified torque.

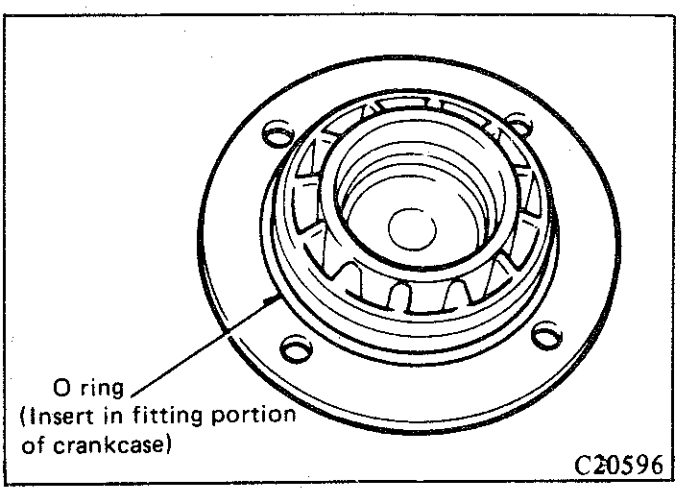


Fig. 62—Inserting "O" ring

NOTE: Ensure that the crankshaft rotates freely after the bearing housing has been installed.

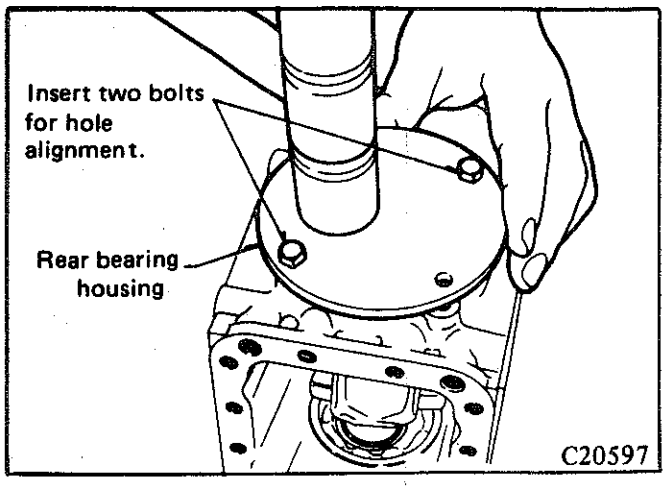


Fig. 63—Installing rear bearing housing

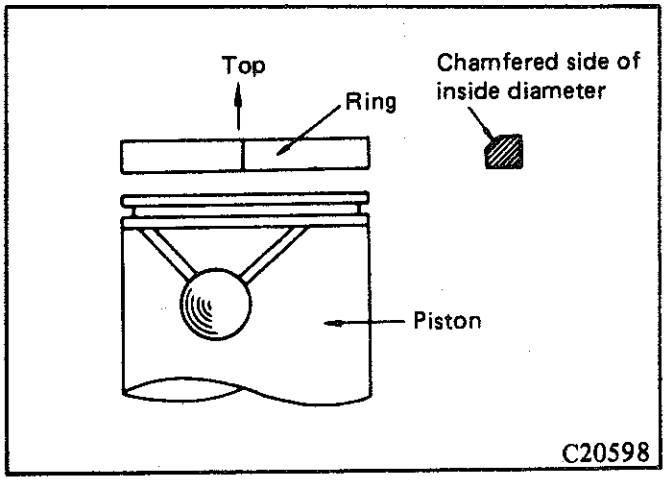


Fig. 64—Compression ring

(5) Fit the compression ring on to the piston, ensuring that the chamfer on the inside of the compression ring faces up and the gap is placed away from the thrust side of the piston.

(6) Install the piston and connecting rod assembly into the cylinder bore with the aid of a ring compressor or special tool (MB990678).

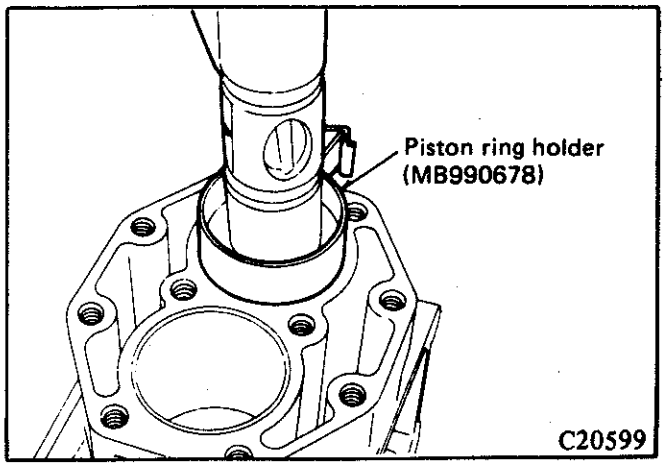


Fig. 65—Inserting piston and connecting rod assembly

(7) Align the connecting rod cap and connecting rod mating punch marks and install the connecting rod cap and bolts. Tighten bolts to specified torque.

NOTE: Perform this work on one cylinder at a time, and ensure that the crankshaft rotates freely before proceeding to the next cylinder.
When the piston and connecting rod assemblies are installed, the piston pin, locking roll pins must face each other.

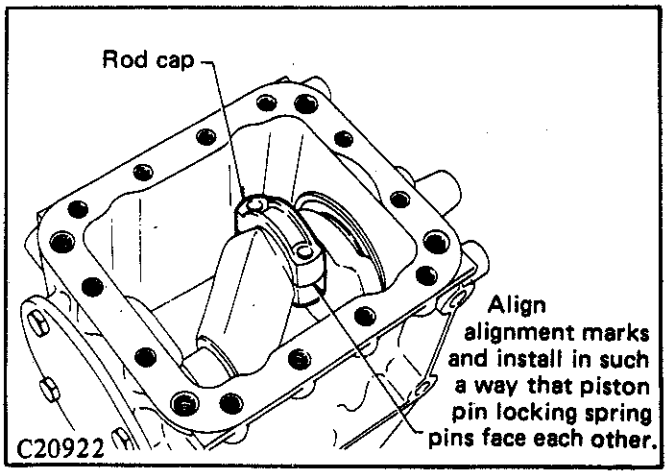


Fig. 66—Installing connecting rod cap

(8) Install the crankcase bottom cover with a new gasket and tighten bolts to specified torque in the correct sequence — refer Fig. 67.

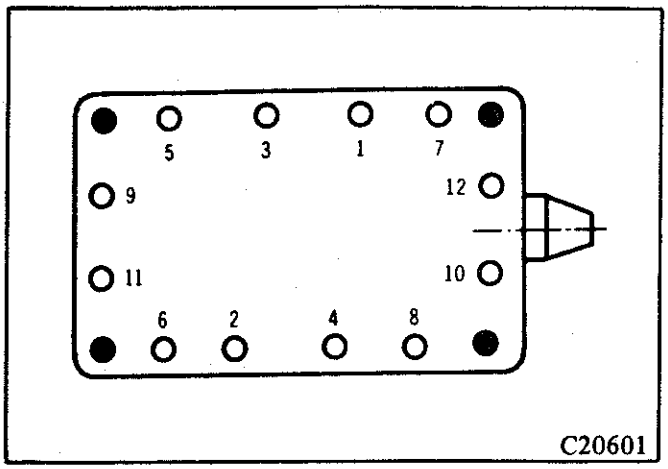


Fig. 67—Tightening sequence

(9) Assemble the valve plate as shown in Fig. 68. Install the discharge and suction valves as shown in Fig. 69.

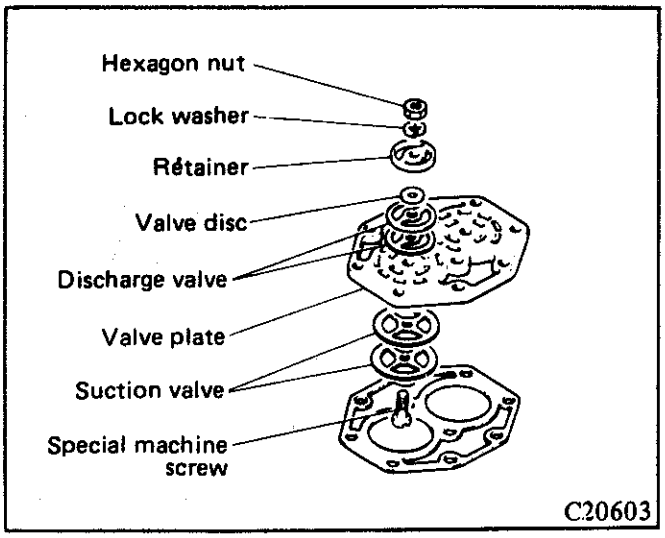


Fig. 68—Valve assembly

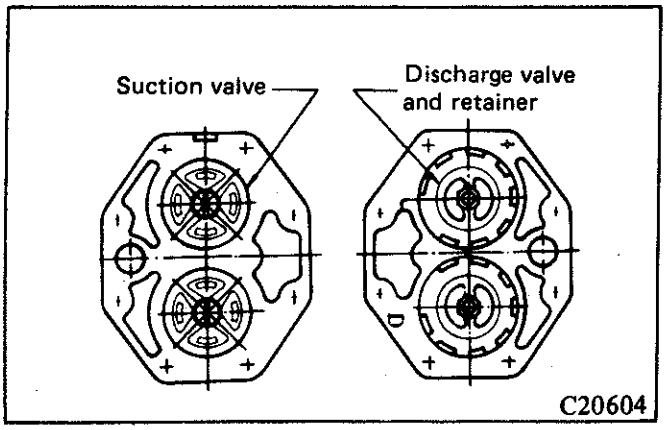


Fig. 69—Discharge valve, retainer and suction valve mounting positions

(10) With the aid of special tool (MB990670) tighten the valve assembly nut to the specified torque, check the clearance between the valve and valve plate. (Valve to valve plate clearance — 0,04 mm (0.0016".)

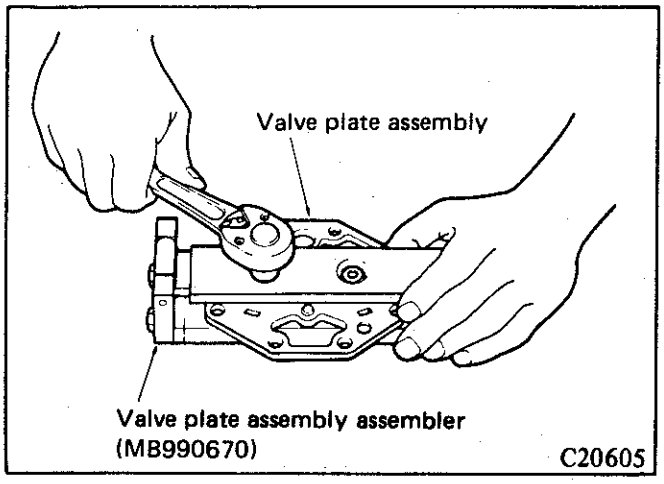


Fig. 70—Assembling valve plate assembly

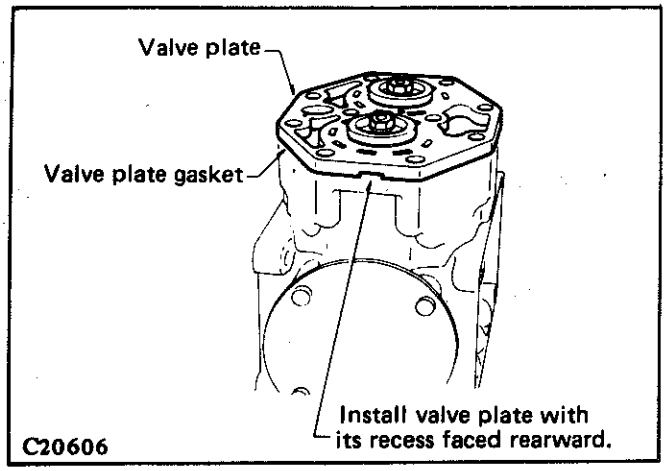


Fig. 71—Installing valve plate assembly

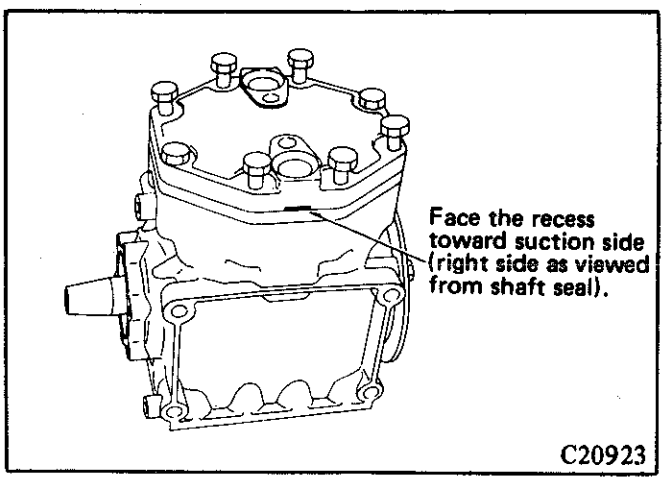


Fig. 72—Installing cylinder head

(11) Install the valve plate with a new gasket on to the compressor, ensuring that the recess in the valve plate assembly faces rearward and the valve plate discharge valves face up.

(12) Install the cylinder head with a new gasket, ensuring that the recess in the cylinder head faces the suction side. Tighten bolts to specified torque in the correct sequence — refer Fig. 74.

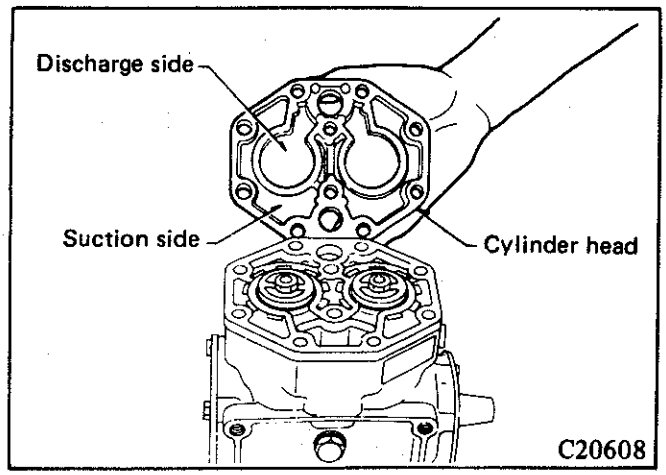


Fig. 73—Cylinder head

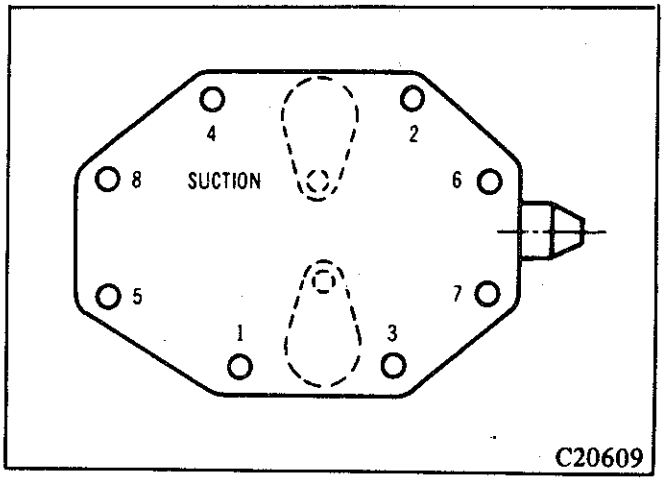


Fig. 74—Tightening sequence

(13) Install the suction and discharge check valves with new "O" rings, tighten bolts to specified torque.

NOTE: Ensure that the Schraeder valve connections face the front.

(14) Immerse the crankshaft seal assembly in refrigerant oil and install the seal onto the crankshaft.

(15) Install a new "O" ring in the front groove of the crankcase.

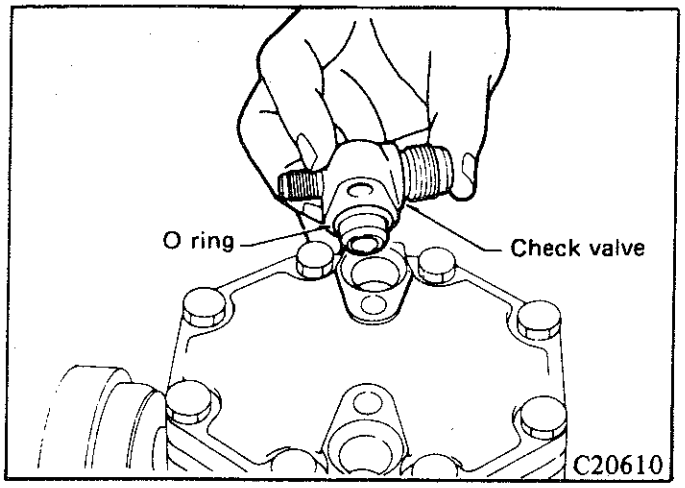


Fig. 75—Check valve

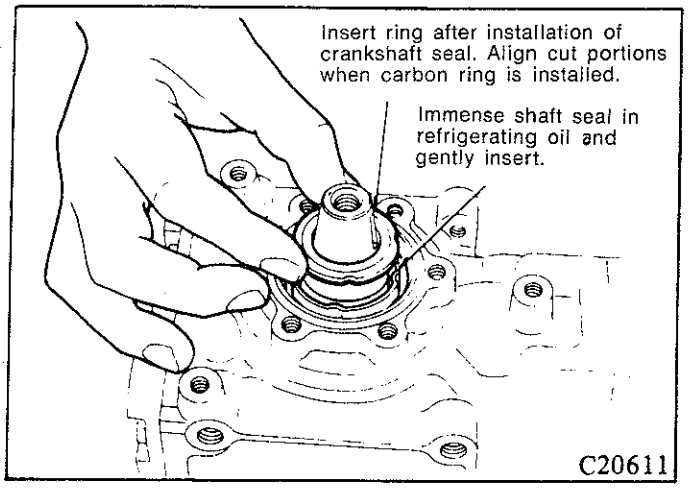


Fig. 76—Installing crankshaft seal assembly

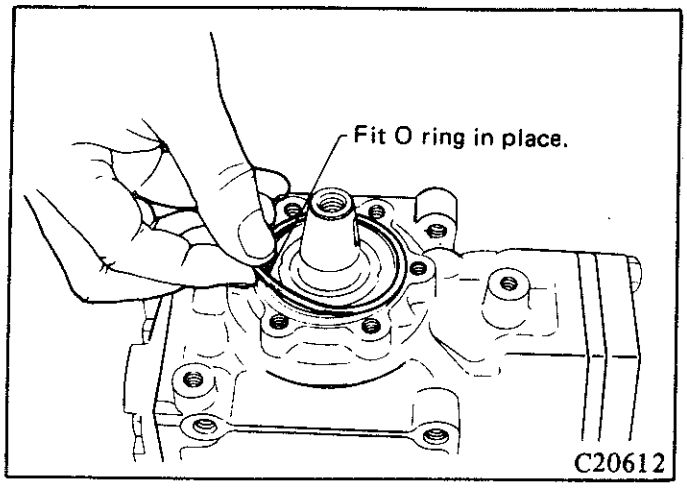


Fig. 77—Installing "O" ring

(16) Install the front crankshaft seal cover, carefully aligning the seal with special tool (MB990679). Install the front seal cover attaching bolts and tighten two of the bolts diagonally opposite each other to the specified torque. Tighten remaining bolts to the specified torque.

(17) Install the magnetic clutch field coil assembly and tighten bolts to specified torque.

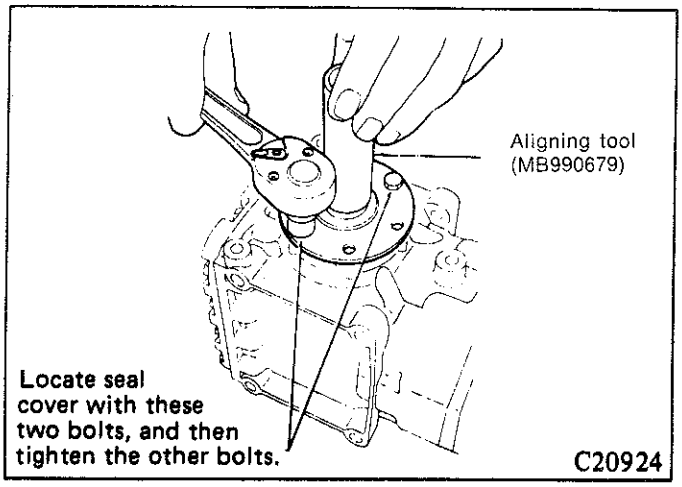


Fig. 78—Installing seal cover

(18) Fit the crankshaft key and install the magnetic clutch assembly. Tighten the magnetic clutch attaching bolt to the specified torque and check to ensure that the crankshaft rotates smoothly by hand.

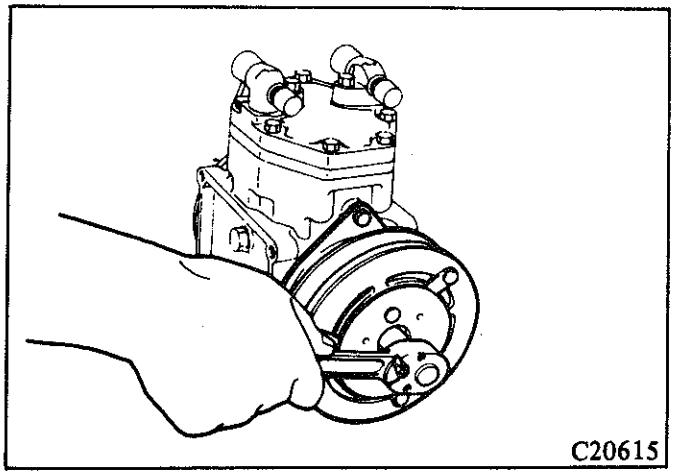


Fig. 79—Tightening clutch pulley attaching bolt

(19) Fill the crankcase with the specified amount of oil and install the filler plug with a new "O" ring. Tighten filler plug to specified torque.

(20) Charge the compressor with refrigerant gas to a pressure of 98 kPa (14.2 psi), raise the gas pressure with dry nitrogen to a pressure of 785 kPa (113.6 psi) and check for leaks with a leak detector. Fit protective caps to suction and discharge check valves.

(21) If the compressor is to be stored, evacuate the compressor and charge with dry nitrogen to a pressure of 49 kPa (7 psi) to prevent moisture contamination.

SECTION 2 — HEATER

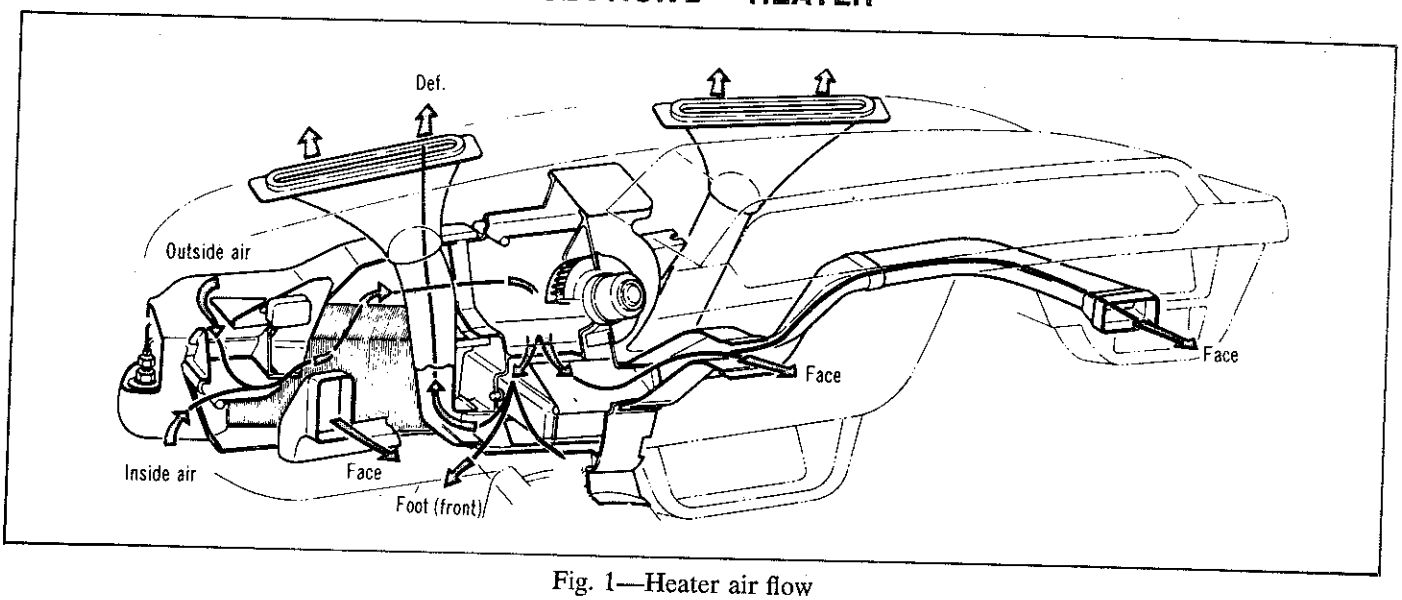


Fig. 1—Heater air flow

GENERAL INFORMATION

A fresh air heater is fitted as standard equipment to all models, its features include demisting, face level and floor level heating. Fresh or recirculated air is used to supply the heater and air flow is controlled by a three speed fan. The unit is adjusted on assembly and normally requires no attention. However, if adjustment is found to be necessary, the following procedure should be adopted.

SELECTOR LEVER ASSEMBLY

Adjustment

Air Selector Cable

(1) Position the selector in the RECIRC position.
(2) Remove the clip securing the outer cable to the heater assembly and position the flap lever in the down position.
(3) Install the clip onto the outer cable and check the operation of the cable, readjust if necessary.

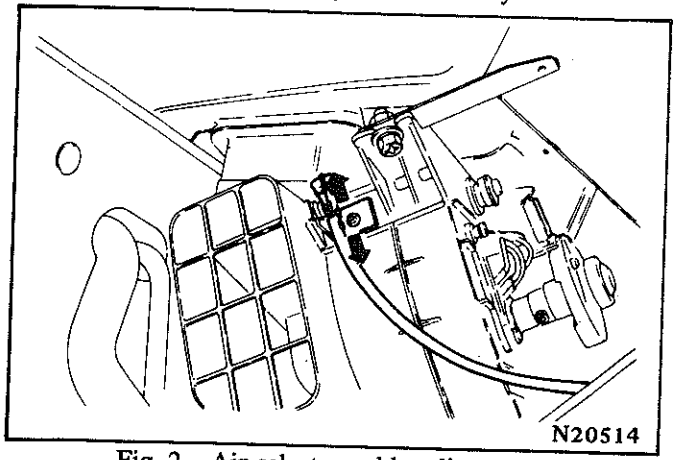


Fig. 2—Air selector cable adjustment

Heat Control Cable

(1) Position the selector lever in the OFF position.
(2) Remove the clip securing the outer cable to the heater assembly and position the water valve lever in the off position.
(3) Install the clip onto the outer cable and check the operation of the cable, ensuring the valve is fully closed when the control lever is in the OFF position, readjust if necessary.

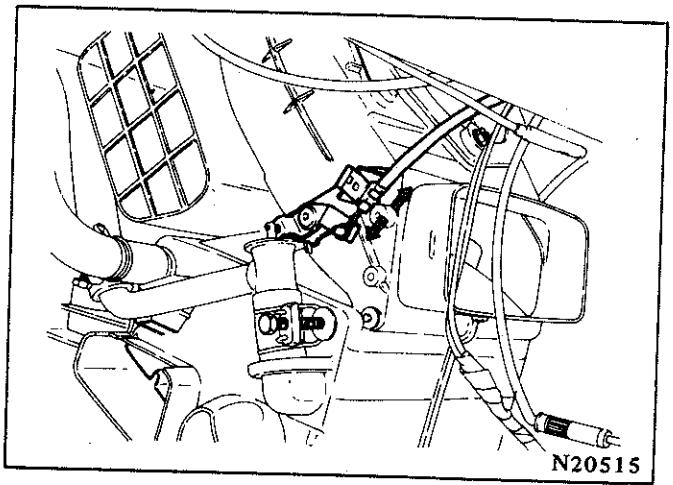


Fig. 3—Heat control cable adjustment

Air Control Cable

(1) Position the selector lever in the DEF position.
(2) Remove the clip securing the cable to the heater assembly and move the lever to the up position.
(3) Install the clip onto the outer cable.
(4) Move the selector lever to the HEAT position and check to ensure there are no air leaks to the demisting vents.

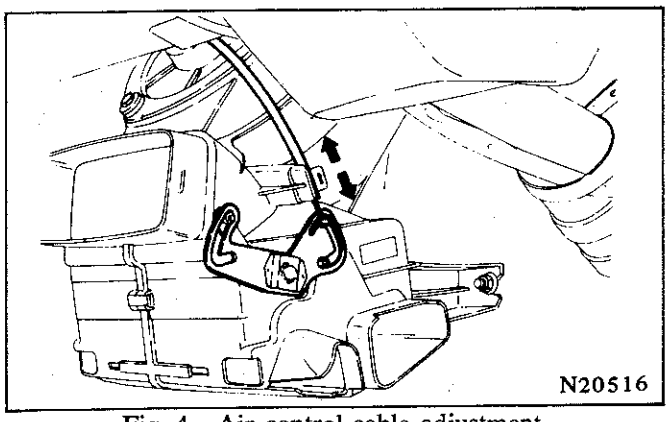


Fig. 4—Air control cable adjustment

Removal

(1) Remove the instrument panel centre panel as described in Group 23.

(2) Disconnect the heater control cables at the heater assembly.

(3) Remove the screws securing the selector lever assembly and remove the selector lever and cable assembly.

Installation

Install by reversing removal procedure and adjust control cables as previously described.

HEATER ASSEMBLY

Removal

(1) Disconnect the battery negative (ground) terminal.

(2) Drain the engine coolant.

(3) Remove the parcel tray, glove box, floor console (if fitted) and centre panel as described in Group 23.

(4) Remove the demisting tubes from the heater assembly.

(5) Disconnect the control cables and electrical connectors from the heater assembly.

(6) Remove the centre vent duct and the water hoses.

(7) Remove the top mounting bolts and the lower mounting nuts and remove the heater assembly.

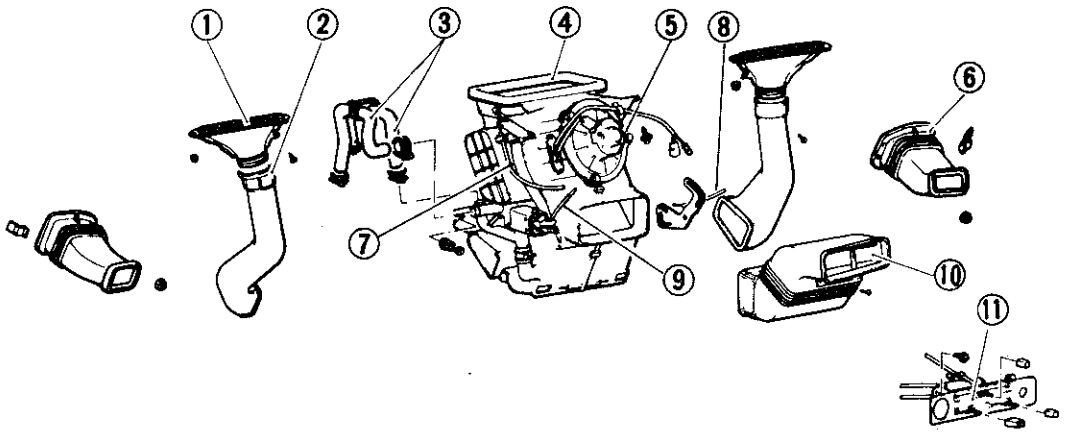
Installation

Install by reversing removal procedure noting the following:

(1) Install the water hoses fully onto the water valve and tighten the clamps securely.

(2) When filling the cooling system, run the engine with the water valve open (heat ON position), to allow all air to be expelled from the cooling system.

(3) Adjust the heater control cables as previously described.



1 Demist vent duct
2 Demist tube
3 Water hose
4 Heater assembly
5 Blower motor
6 Face vent duct
7 Air selector cable
8 Air control cable
9 Heat control cable
10 Centre vent duct
11 Selector lever assembly

Fig. 5—Heater assembly components

Disassembly

(1) Disconnect the blower motor wiring.
(2) Remove the motor retaining screws and remove the motor assembly, resistor and wiring assembly.
(3) Remove the water tap to heater core hose.
(4) Disconnect the air selector flap positioning spring from the heater housing.
(5) Remove the heater housing halve retaining clips and separate the housing halves.
(6) Remove the heater core and air control flap.
(7) If necessary the water tap, air selector flap and face ventilator flap can be removed.

Assembly

Assemble by reversing disassembly procedure.

BLOWER MOTOR

Removal

(1) Remove the instrument cluster hood by raising it slightly to release the retaining clips and then pulling it forward.

NOTE: When removing the hood use care not to damage the clock or trip meter reset knob and shafts.

(2) Remove the instrument cluster retaining screws and pull the cluster forward far enough to disconnect the speedometer cable and wiring connectors, remove the cluster.
(3) Disconnect the electrical wiring to the blower motor.
(4) Remove the screws securing the motor to the heater housing and remove the motor assembly.
(5) Remove the fan from the motor shaft by removing the fan retaining nut.

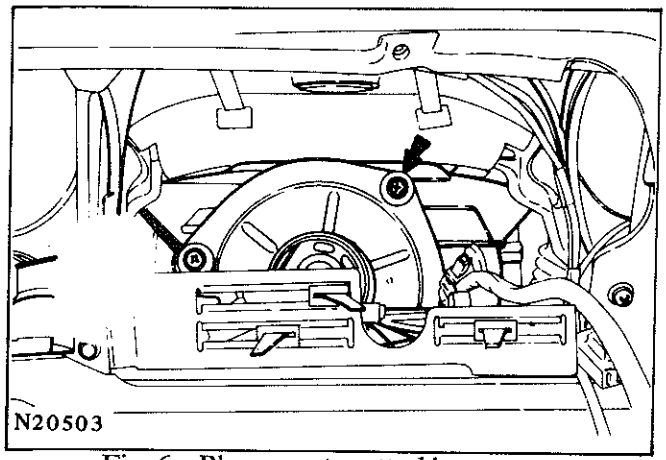


Fig. 6—Blower motor attaching screws

(6) Remove the motor mounting plate nuts and remove the mounting plate.
(7) Remove the motor through bolts and separate the motor housing.

Inspection

Check the brushes, comutator and bushings for wear or damage. Replace any faulty components. If the comutator is only slightly defective, it can be turned on a lathe.

Installation

Install by reversing removal procedure.

DEMISTER VENT DUCT

Removal

(1) Remove the glove box upper retaining screws and loosen the lower retaining screws, remove the glove box.
(2) Remove the instrument cluster hood and instrument cluster as previously described under Blower Motor.
(3) Remove the demist tube from the duct.
(4) Remove the screws retaining the duct and remove the duct.
(5) Install by reversing removal procedure.

FACE VENT DUCTS

Removal

(1) If the left hand duct is to be removed, remove the glove box as previously described and then remove the duct by removing the retaining nuts.
(2) If the right hand duct is to be removed, remove the screws retaining instrument corner panel and remove the panel. Remove the duct by removing the retaining nuts.
(3) Install by reversing removal procedure.

OUTLET DUCTS (Sedan)

Removal

(1) Remove the outlet garnish by prying it out with a screw driver, use care not to damage the painted surface.
(2) Remove the "C" pillar internal trim and remove the screws retaining the duct to the "C" pillar.
(3) Remove the screws retaining the duct under the external garnish vent and withdraw the duct through the inside of the "C" pillar from the luggage compartment.

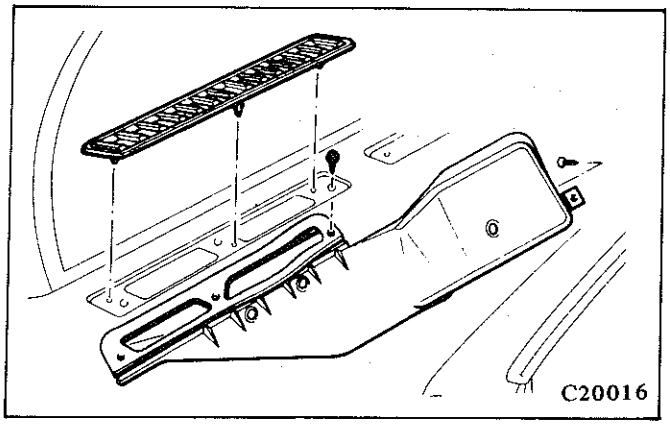


Fig. 7—Removing "C" pillar outlet duct

OUTLET DUCTS (Station Wagon)

Removal

Open the rear tailgate and remove the screws retaining the duct to the rear quarter panel, withdraw the duct.

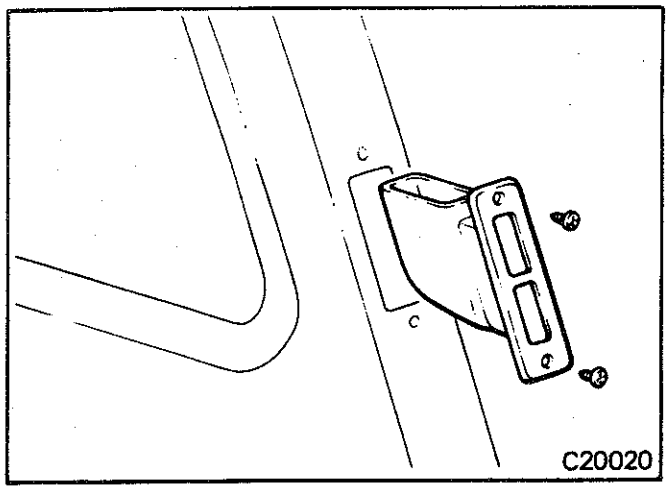


Fig. 8—Removing rear quarter panel duct

OUTLET DUCTS (Two Door Models)

Removal

(1) Remove the outlet garnish by prying it out with a screw driver using care to avoid damage to painted surfaces.

(2) Remove the rear seat cushion and squab.

(3) Unclip the rear edge of the rear pillar trim from under the rear window rubber. Remove the screws along the bottom of the trim and remove it from the vehicle.

(4) Loosen the bolt that retains the air outlet duct and remove the duct.

Installation

Install by reversing the removal procedure taking note of the following:

(1) Attach the pawl of the ventilator duct to the quarter trim and after confirming that the duct is properly installed, tighten the screw clamping the duct into place (refer Fig. 9).

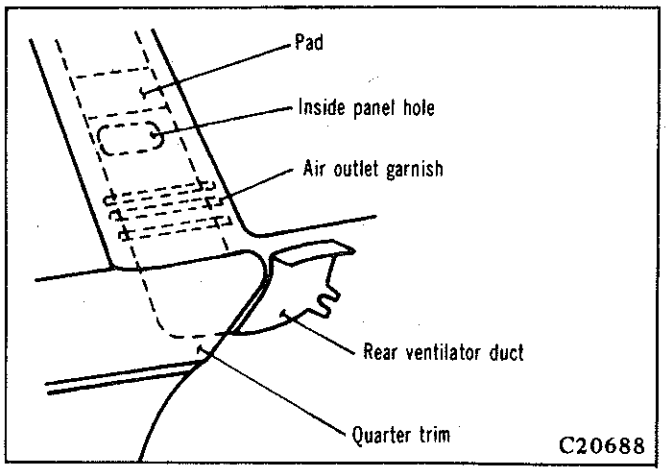


Fig. 9—Installing the duct and panel

(2) Insert the pad through the opening in the rear roof panel and into the duct ensuring that the pad does not protrude out of the duct.