

Air Conditioning Mechanism and Function

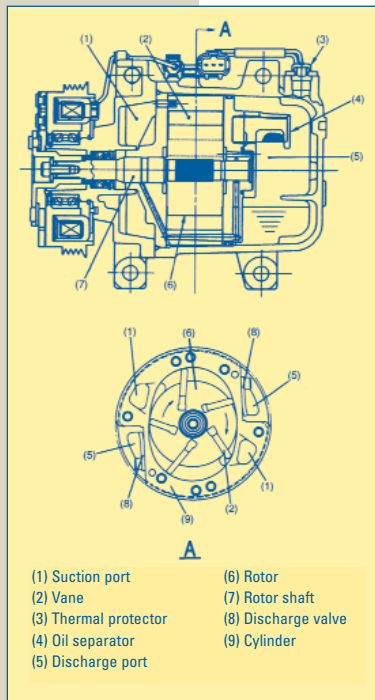
Air Conditioning Cycle

The refrigerant flows in the standard pattern — through the compressor, condenser, receiver drier and evaporator, then back to the compressor.

The refrigerant flow through the evaporator coil is controlled by an internally equalized expansion valve, located inside the evaporator case.

The compressor clutch switches OFF and ON to maintain the evaporator temperature within a specified range. When the evaporator coil temperature falls below a specified point, the thermo control amplifier interrupts the compressor operation by disengaging the compressor clutch. When the evaporator coil temperature rises above the specification, the thermo control amplifier allows compressor operation.

The air conditioning system is protected against excessively high or low pressures by the dual switch, located on the receiver/drier. If the system pressure rises above, or falls below the specifications, the dual switch opens to interrupt compressor operation.



Compressor

The vane rotor type compressor turns around the center axis of the elliptical cylinder, and the vanes, with their ends in contact with the inside wall of the cylinder, move up and down the rotor grooves. The vanes are positioned around the rotor, equally spaced from one another.

Both sides of the cylinder are sealed by side blocks. The space, enclosed by the neighboring vanes, two side blocks, outer circumference of the rotor and inside wall of the cylinder, becomes smaller as the rotor turns, thereby compressing the refrigerant gas.

When the end of a vane sliding on the inside wall of the cylinder goes past the suction port, the vane closes the suction port. The compression stroke begins at that position. When the gas ahead of the vane is compressed and discharged through the discharge valve, the next vane is already on the suction stroke.

Suction and compression of the gas are separately performed in this manner, so the compressed gas left behind in the discharge port never returns to the suction port. Since no suction valve is required, there is no loss caused by a suction valve. A high pressure trigger valve is installed on the rear head to apply a pressure to the back plane of the vane.

Trigger Valve

The trigger valve ensures that the vanes move out smoothly under all condition and minimize the noise that may be produced if the vanes strike the cylinder when the compressor is first started.

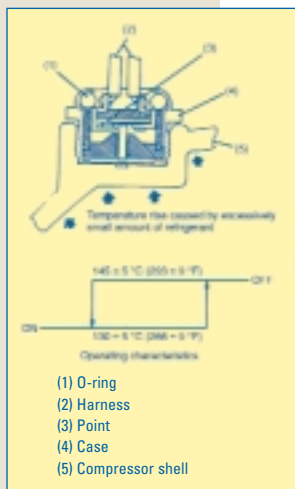
Immediately after the compressor begins rotating and starts compression, the trigger valve introduces high pressure side pressure to the back plane of the vanes, causing the vanes to move out.

When normal compression begins and discharge pressure rises, the trigger valve closes.

When the compressor is stopped, the pressure in the compressor is held constant, as the valves are kept in the opened position by the springs.

When the compressor is restarted, the high pressure side trigger valve is moved to the opened state, applying high pressure side pressure directly to the back plane of the vanes, causing the vanes to move out.

When the compressor is in regular operation, high pressure side pressure rises enough to overcome the spring pressure, the valve closes, and centrifugal force causes the vanes to move out.

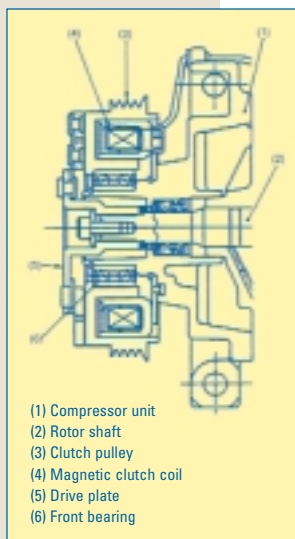


Compressor Saving Sensor

The compressor saving sensor, mounted on the surface of the compressor case, forces the compressor to the OFF state when the refrigerant temperature rises or the compressor case surface temperature becomes abnormally high due to poor lubrication. When the compressor case surface temperature falls, the compressor restarts.

Magnet Clutch

The magnet clutch is built into the compressor shaft and transmits the engine power to the compressor unit. When current flows through the magnet clutch coil, the drive plate is attracted so that the pulley and compressor shaft rotate as a unit. When the compressor is not in use, the pulley alone rotates freely.



Condenser

The condenser is composed of tubes and heat-radiating fins. The high-temperature and high-pressure gaseous refrigerant discharged from the compressor is cooled down and turned into a liquid state in the condenser. The condenser is cooled by the ambient air delivered by the cooling fan.

The heat from the hot refrigerant radiates to the ambient air when the high-temperature gaseous refrigerant passes through the condenser tubes.

Receiver/Drier

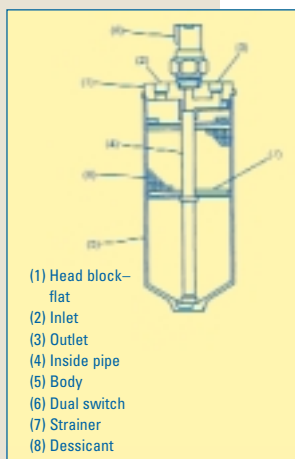
The amount of refrigerant circulating through the air conditioning system varies as the heat load changes. The receiver/drier helps the system adapt to these changes. Other functions of the receiver/drier include:

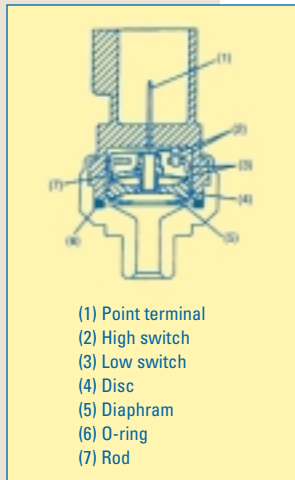
- Remove bubbles from the condensed refrigerant so that only liquid refrigerant is delivered to the expansion valve.
- Remove moisture from the refrigerant.
- Remove foreign substances from the refrigerant.
- It permits a visual inspection of the amount of refrigerant in the system, via the sight glass.

The receiver/drier consists of a strainer to remove foreign substances, a desiccant to absorb moisture from the refrigerant and a sight glass to check the amount of refrigerant.

Dual Switch

The dual switch is located in the high-pressure line of the refrigerant cycle. It consists of a diaphragm which receives pressure, diaphragm springs, pins and contact points. Two types of contact points are used. The first type activates if the internal pressure is low or when it is too high.





The second set of contact points control the operation of the condenser fan. The dual switch:

- Prevents system operation when there is low system pressure (due to an absence of refrigerant).
- Protects the system from an abnormal refrigerant pressure rise (during high pressure operation).

During abnormal low pressure operation, all dual switch contacts are open (OFF), because the tension of the diaphragm springs is greater than the refrigerant pressure. The low pressure switch opens if system pressure falls below approximately 25.5 psi.

If the refrigerant pressure is abnormally high (above approximately 398 psi), the diaphragm spring is inverted. The high pressure switch is opened (OFF) and the low pressure switch is closed (ON).

Evaporator

An airstream produced by the blower motor passes through the evaporator cooling fins and tubes. This air is warmer than the refrigerant and gives up its heat to the fins, tubes and then the refrigerant itself. As the low pressure refrigerant moves through the evaporator, heat given up by the air passing through the evaporator causes the refrigerant to begin to boil. By the time the refrigerant has passed through the evaporator, it has become a vapor.

As the heat is absorbed by the boiling refrigerant, the fins and tubes turn cold and in turn cool the air passing over them. Moisture contained in the air condenses to water drops as it passes around the cooling tubes and fins of the evaporator. Water and dirt are then discharged outside the vehicle through the drain hose.

The operation of the evaporator is as follows:

- Misty, low pressure refrigerant (very close to liquid form) passes through the expansion valve, and enters the lower tubes of the evaporator, where it soaks up heat from the passenger compartment.
- The refrigerant boils and evaporates quickly, due to the rapid heat exchange.
- The refrigerant is then pushed upward by the force of the bubble generated during the exchange of heat, and passes into the upper tubes as it evaporates into a gas.
- When the refrigerant reaches the upper evaporator tank, it is in a thoroughly vaporized form.

The evaporator has a single tank, and its surface has been given the following treatments:

- Rustproof
- Waterproof
- Moldproof.

Expansion Valve

The expansion valve is attached to the evaporator inlet and outlet pipes. It converts high pressure liquid refrigerant from the liquid tank to misty, low pressure refrigerant, and delivers it to the evaporator.

Because it is at low pressure and temperature, the liquid refrigerant evaporates in the evaporator, removing heat from the passenger compartment. The expansion valve automatically controls the flow rate of refrigerant to obtain the necessary cooling ability required by the fluctuating heat load.

The refrigerant temperature is sensed by the sensing element installed at the low pressure refrigerant passage in the expansion valve, and the flow rate of the refrigerant is controlled by changing the lift of the valve ball at the high pressure side.

If the heat load of the air conditioning system increases, the refrigerant temperature at the evaporator outlet rises. This increases the pressure P1 around the temperature sensing area. As pressure P1 becomes higher than the resultant force of the evaporator outlet (low pressure side), pressure P2 and the spring force F ($P1 > P2 + F$), the diaphragm is pressed down, opening the valve ball connected to the diaphragm to increase the flow of refrigerant.

If the heat load decreases, an action contrary to the one just described takes place, closing the valve to decrease the flow of refrigerant.

