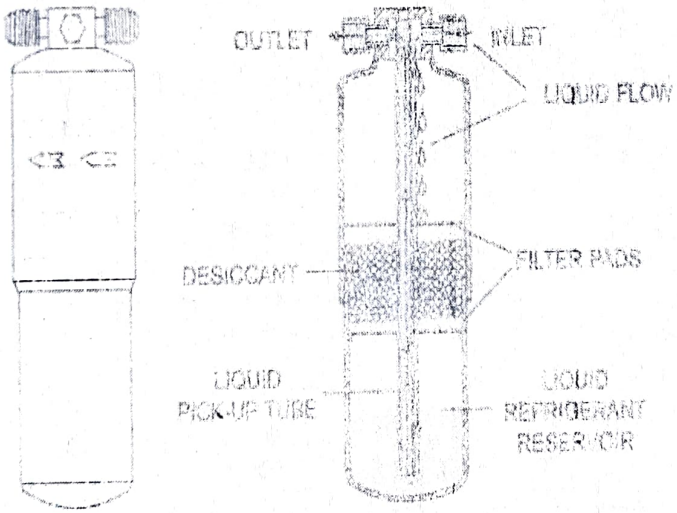
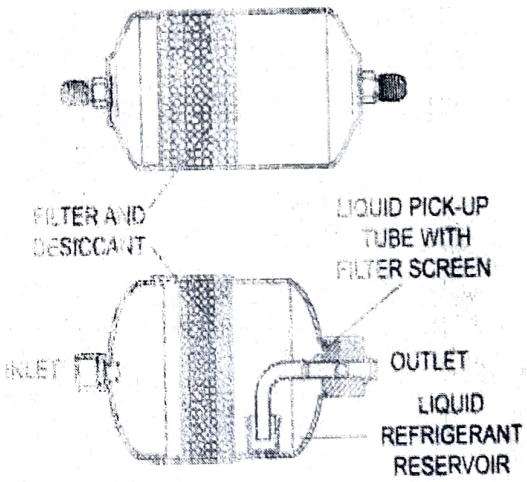
RECEIVER/DRYER

Used on many early systems, the receiver/dryer is a storage tank for the liquid refrigerant from the condenser which flows into the upper portion of the receiver tank containing a bag of desiccant (moisture absorbing material such as silica alumina or silica gel). As the refrigerant flows through an opening in the lower portion of the receiver, it is filtered through a mesh screen attached to a baffle at the bottom of the receiver. The purpose of the desiccant in this assembly is to absorb any moisture present that might enter the system during assembly. These features of the assembly prevent obstruction to the valves or damage to the compressor. Depending on the manufacturer, the receiver/dryer may be known by other names such as filter or dehydrator.Regardless of its name, the function is the same. Included in many receiver/dryers are additional features such as a high-pressure fitting, a pressure relief valve, and a sight glass for determining the state and condition of the refrigerant in the system. It is shown in fig..1

Receiver/Driers are used in standard thermostatic expansion valve (tx valve) systems and are situated between the condenser and the tx valve at the evaporator. note that all upright and some in-line type receiver-driers have liquid pick-up tubes. Some in-line driers do not have pickup tubes and are designed to be mounted vertically. Correct installation to ensure liquid refrigerant flow to the tx valve is critical



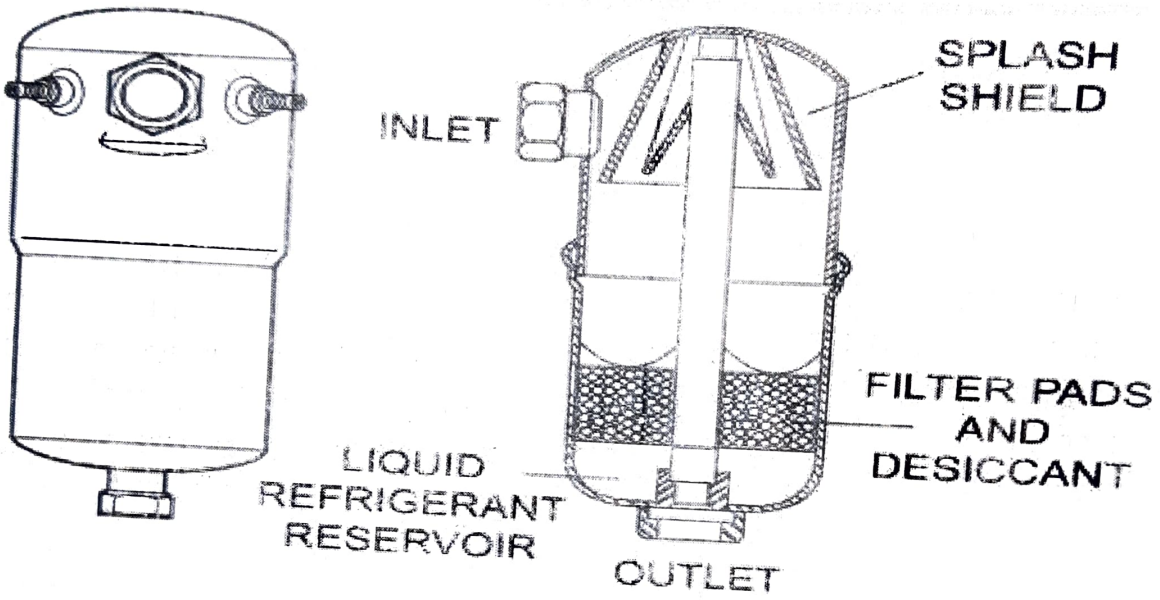
(Fig. 1)Upright Receiver Drier.



In Line Receiver Drier

ACCUMULATOR

Most late-model systems are not equipped with a receiver/dryer; rather, they use an accumulator to accomplish the same thing (Fig 2.). The accumulator is connected into the low side at the outlet of the evaporator. The accumulator also contains a desiccant and is designed to store excess refrigerant and to filter and dry the refrigerant. If liquid refrigerant flows out of the evaporator, it will be collected by and stored in the accumulator. The main purpose of an accumulator is to prevent liquid from entering the compressor.



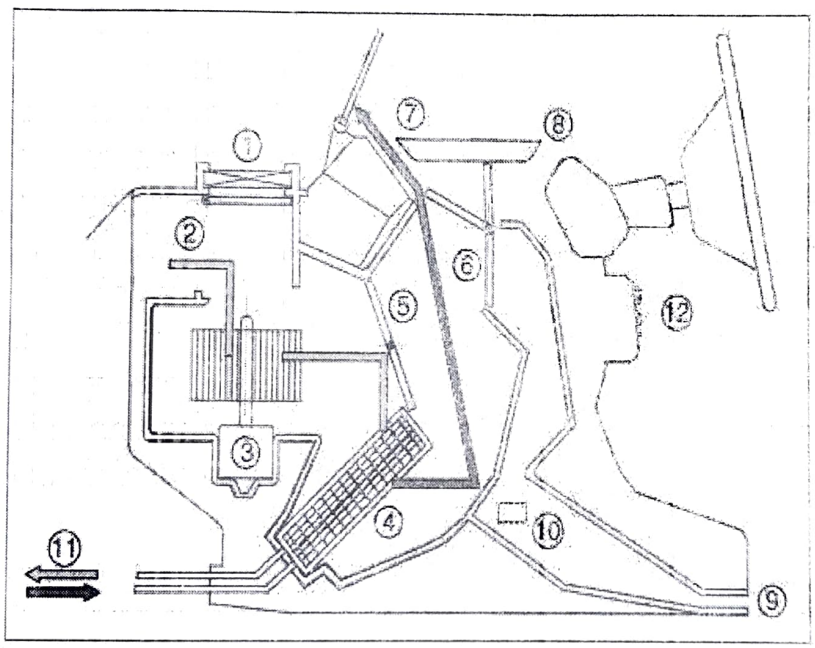
2. Accumulator

DESSICANTS :

A desiccant is a hygroscopic substance that induces or sustains a state of dryness (desiccation) in its vicinity. Commonly encountered pre-packaged desiccants are solids that adsorb water. Desiccants for specialized purposes may be in forms other than solid, and may work through other principles, such as chemical bonding of water molecules. They are commonly encountered in foods to retain crispness. Industrially, desiccants are widely used to control the level of water in gas streams. Although some desiccants are chemically inert, many are extremely reactive and require specialized handling techniques. The most common desiccant is silica, an otherwise inert, nontoxic, water-insoluble white solid. Tens of thousands of tons are produced annually for this purpose. Other common desiccants include activated charcoal, calcium sulfate (Drierite), calcium chloride, and molecular sieves (typically, zeolites)

Air Distribution Unit:

The air distribution unit is generally located under the instrument panel of the vehicle.Inside the air distribution unit there is a system of ducts and mixing/directing doors. In addition the unit houses the blower motor, the heater core and for vehicles with an airconditioning system, the evaporator.The filtered incoming air from the intake panel grille is induced by the blower motor and is forced under centrifugal force to the air distribution unit.The air coming from the blower is directed to the different air ducts through the moving doors in the air distribution unit.The temperature is regulated by mixing warm and cold air.The air is then directed to different air outlets/air nozzles and panel vents.There are basically two ways for the ventilation system to take in air: fresh air from the outside and recirculated air from the interior.Therefore the air distribution unit has two air inlets which are alternately closed by a door.



1. Air filtration
2. Air recirculation door
3. Blower motor and centrifugal fan
4. Heat exchanger
5. Temperature blend door
6. Air distribution door
7. Panel vent (not adjustable)
8. Face/head vent (adjustable)
9. Panel vent – rear passengers' foot well
10. Ducting to passenger foot well
11. Flow of coolant
12. Control panel

Fig 4 Air Distribution Unit.

I) Demisting Position:

In the demisting position (Fig.5) the air from outside is moved under force from the blower motor to the temperature blend door which is fully closed. This forces the total volume of air to flow through the heater core where it will be heated and then directed by the top distribution door towards the windscreen and side windows. Note that no air is directed towards the occupants. This allows the maximum volume of air to flow to the windscreen to aid the demisting process. In

Fig.5. the air intake door is fully open allowing external air to flow through to the blower.The blower forces air towards the temperature blend door which is fully closed forcing all the air to flow through the heater core.All the air flows through the heater core and is then directed to the top distribution door where a portion is directed towards the windscreen and side windows and the rest is directed to the foot vents which includes passengers in the rear of the vehicle.

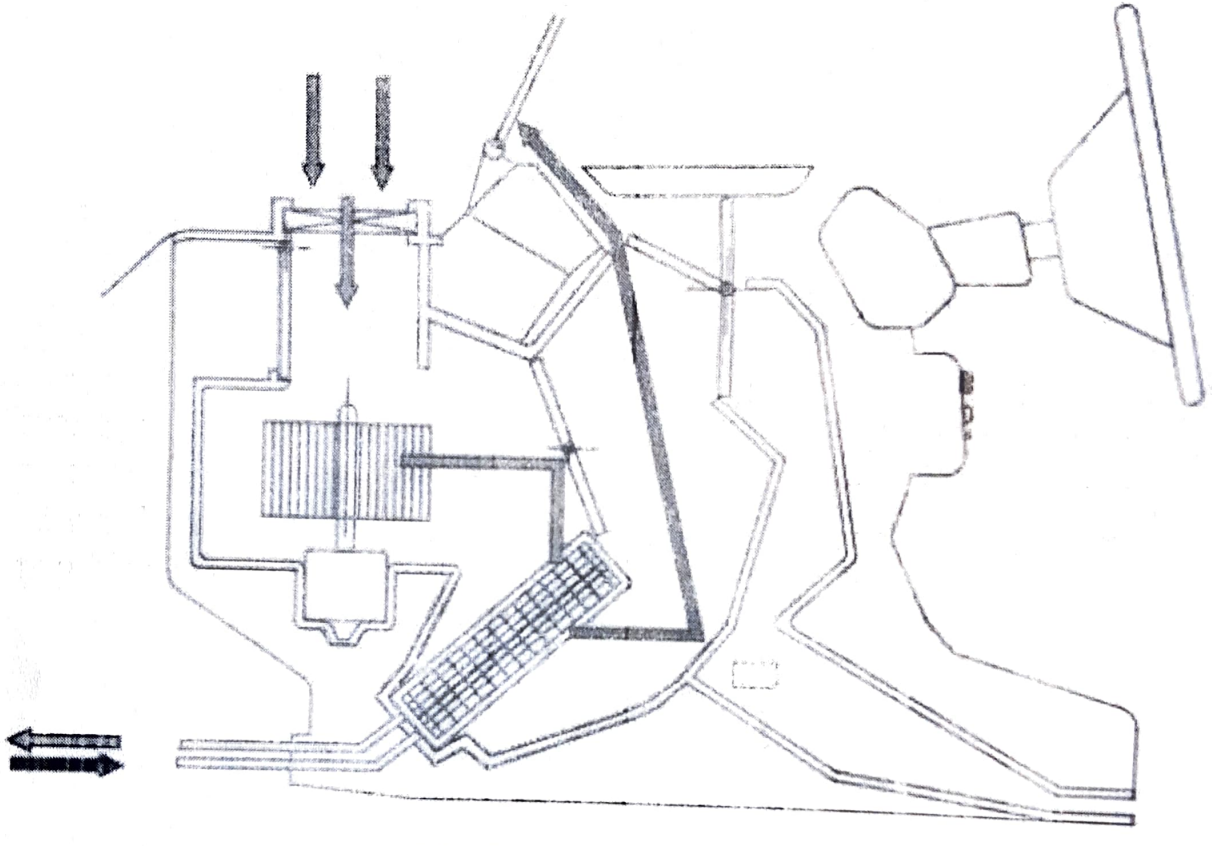


Fig.5 Demistiting.

II) Face and Foot:

The air intake door is fully open allowing air to flow through to the blower. The blower forces air towards the temperature blend door.The blend door directs a volume of air towards the heater core and the rest towards the distribution door allowing air to flow to the face vents. The air going through the heater core is then directed towards the back of the blend door andthen the distribution door,where it is distributed by the feet vents (Fig.6).here will be a temperature difference between the face vent and feet vent of approximately 7°C.This is due to humans feeling comfortable with their feet being warmer than their head in cold conditions

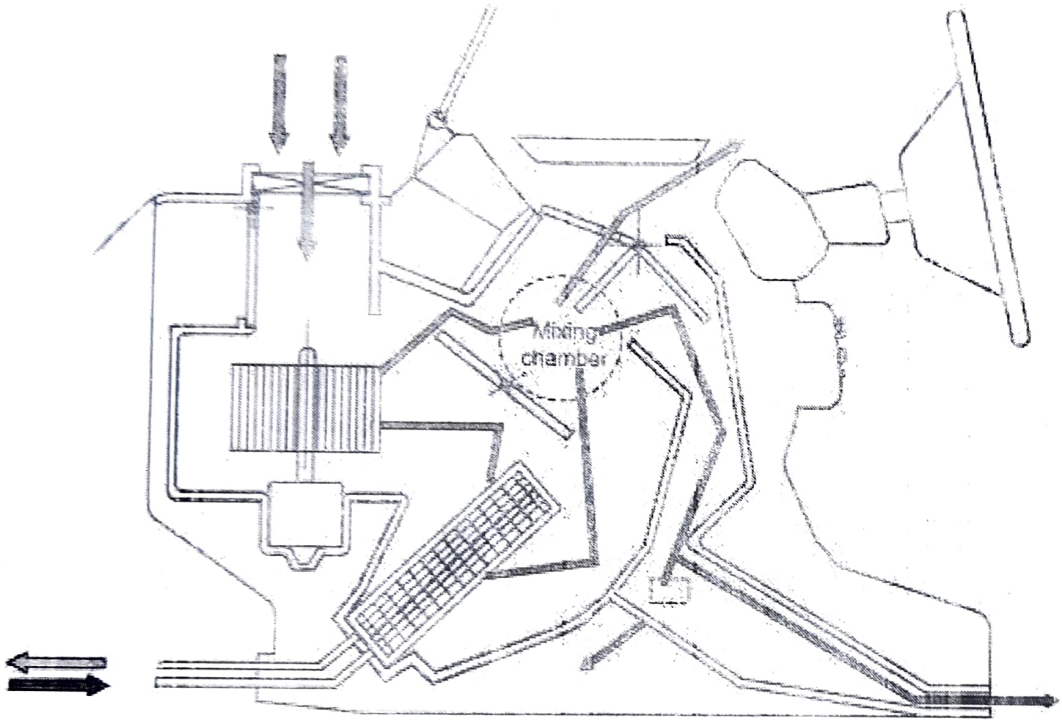
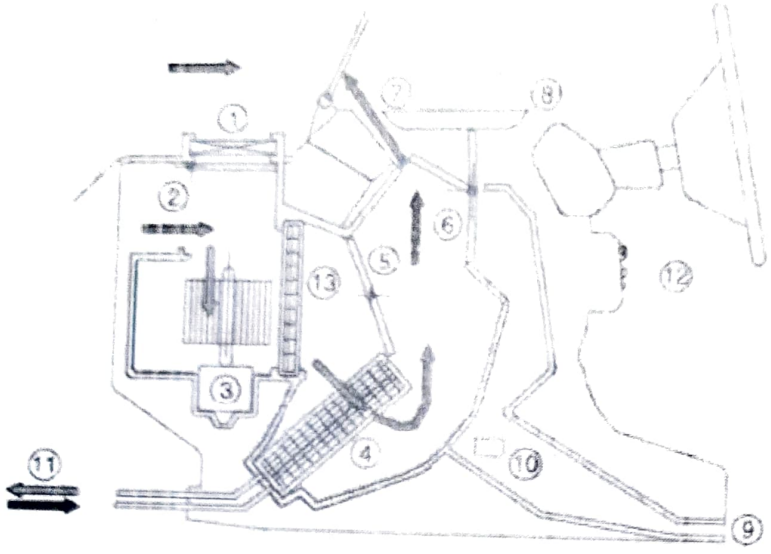


Fig.6 Foot and Face

The air intake is fully open to allow air to flow through the blower. The blower forces air towards the temperature blend door and depending on its position it will direct air straight to the top distribution door and the face vents or it will direct a portion of the air towards the heater core to raise the temperature of the interior and improve the comfort levels of the occupants. The interior temperature is generally controlled by the occupants via the control panel.This selection offers the occupants fresh outside air straight to the head which is beneficial in hot weather conditions removing heat from the occupants by convection. This increases the occupants' comfort, especially if perspiring, allowing the latent heat of evaporation to remove sweat producing rapid cooling,relative humidity permitting.

III) Defrost:



1. Air filtration
2. Air recirculation door
3. Blower motor and centrifugal fan
4. Heat exchanger
5. Temperature blend door
6. Air distribution door
7. Panel vent (not adjustable)
8. Face/Head vent (adjustable)
9. Panel vent – rear passengers' foot well
10. Ducting to passenger foot well
11. Flow of coolant
12. Control panel
13. Evaporator (models with A/C)

Fig.7

It is system with A/C (including evaporator) Fig 7. illustrates the position of the evaporator in the heating and ventilation system. All air passes through the evaporator irrespective of whether the system is operating. When the A/C system is running the evaporator temperature is approximately 2–6°C (°F). This causes the temperature of the air to reduce and moisture in the air to condense producing water droplets on the evaporator's surface. This reduces the moisture content (dehumidifying) of the air and also helps to remove dirt particles (purifying) suspended in the air stream. The water covers the surface of the evaporator trapping dirt particles and eventually dripping off the surface on to a drain tray which directs the water to the outside of the vehicle.

Temperature control systems:

Temperature control systems for air conditioners usually are connected with heater controls. Most heater and air conditioning systems use the same plenum chamber for air distribution. Three types of air-conditioning controls are used: manual/semiautomatic and automatic.

Manual/Semiautomatic Temperature Controls :

Aircondition manual/semiautomatic temperature controls (MTC and SATC) operate in a manner similar to heater controls. Depending on the control setting, doors are opened and closed to direct airflow. The amount of cooling is controlled manually through the use of control settings and blower speed.

Automatic Temperature Control :

An automatic or electronic temperature control system maintains a specific temperature automatically inside the passenger compartment. To maintain a selected temperature, heat sensors send signals to a computer unit that controls compressor, heater valve, blower, and plenum door operation. A typical electronic control system might contain a coolant temperature sensor, in-car temperature sensor outside temperature sensor, highside temperature switch, low-side temperature switch, low-pressure switch, vehicle speed sensor, throttle position sensor, sunload sensor, and power steering cutout switch.

The control panel is found in the instrument panel at a convenient location for
both driver and front-seat passenger access. Three types of control panels may be found: manual, push-button, or touch pad. All serve the same purpose. They provide operator input control for the air-conditioning and heating system. Some control panels have features that other panels do not have, such as provisions to display in-car and outside air temperature in degrees.

Vehicle Operation Mode :

The signal to activate the air-conditioning system comes from the occupant(s). Activation is completed by the onboard Electronic Control Unit (ECU).The ECU has a number of inputs which send electronic signals based on sensed conditions. e.g. temperatures, pressures, speeds, positions. Based on this information the ECU will either activate or deactivate (if already operating) the system.If the system does not activate then a fault in the form of a code will be stored in the computer and on some systems a light will be activated to tell the driver a fault exists with the system.Advanced systems may use telematics to send a signal to a call centre who will advise the customer of the required action.i.e. urgency on visiting a

dealership. Activation of the air-conditioning system is achieved under some of the following conditions:

1) The outside air temperature is above 9°C.
2) The engine has been running for more than 5 seconds.
3) The temperature of the evaporator is above 4°C (no ice forming over the surface).
4) The engine coolant temperature is approximately between 40°C and 105°C.
5) The vehicle is not rapidly accelerating or the engine is under high load (overtaking etc.).
6) The air-conditioning activation button has been selected and the interior fan is on.
7) The sensors in the air-conditioning system have acknowledged that the system is under pressure assuming that a quantity of refrigerant exists inside the system and that it has not leaked out to the atmosphere (sensed by either pressure switches or sensors).
8) No fault codes exist in the ECU.

Cool-down performance:

Cooldown Test This test is carried out to obtain the cabin temperature variation under steady state operation of the air conditioning system.

- Additinal Vehicle Preparation
- Sensors, such as thermocouples for recording temperatures at nose levels of all occupant seating positions shall be fitted with recording instrutnents having an accuracy of +1oC.
- After the above preparation, the vehicle shall be parked under sunlight, in an open area free from structures which may cast shadows on any part of the vehicle.
- The vehicle shall be positioned facing the sun in such a way to ensure maximum solar load through windscreen and side window during the entire one hour of soaking.
- All the doors and windows of the vehicle shall be shut and the fresh air valve (if provided) shall be closed.
- The vehicle shall be left undisturbed in this position for a minimum duration of one hour and this period shall be considered as the soaking period.

- After the soaking period, the testing personnel shall enter the vehicle. The total number of occupants during the test shall be not less than two in case of M1 and three for M2 and in no case exceed the maximum seating capacity of the vehicle.
- While entering the vehicle, care shall be taken for the following:
  I. Occupants shall enter one at a time and each one shall enter quickly and shut the door behind him/her immediately.
  II. Not more than one door of the vehicle shall be opened at one time during entry.
- Initial record -After all the occupants are inside the vehicle, the initial temperatures at all the occupants nose levels shall be recorded
- Running - The vehicle shall be started and immediately the air conditioning system shall be switched on at its maximum capacity as at 3.6 to 3.8. The vehicle shall be driven for one hour at a steady speed of 60 km/h with gear ratio chosen] so as to run the compressor at 50 to 80 percent of maximum speed. The start of the test period shall be considered at that instant when the last of the controls is operated to begin the air conditioning system.
- Interim Record -During the one hour run, the temperatures at all the occupants nose levels shall be recorded at intervals not exceeding 5 minutes maximum. The lower limit for the sampling time shall be decided based on the sensitivity and response of the temperature measuring sensor and the capability of the recording equipment.
- Cabin Temyeruture Variation- The average of all nose level temperatures shall be taken and plotted against time.