Table 4-1 Reciprocating compressors

	Advantages	Disadvantages
Open type	(1) Dismantling and inspection are possible. (2) Revolving speed is variable. (3) Engine drive is possible.	(1) Dimensions of units are larger than that of other compressors having the same horsepower. (2) Shaft seal is necessary and there is possibility of gas leakage.
Semi-hermetic type	(1) Dismantling and inspection are possible. (2) No gas leaks from shaft seal (3) Moving parts are not exposed. (4) Running noise is smaller than that of the open type.	(1) Revolving speed is fixed (2) Motor is free from any moisture or dust.
Hermetic type	(1) Compact and light (2) No gas leaks. (3) Moving parts are not exposed. (4) Running noise is low.	(1) Dismantling is impossible when damaged. A whole compressor should be replaced. (2) Motor is free from moisture or dust.

Table 4-2 Lineup of Daikin Compressors

For RAC, small PAC		Capacity [kW]@ASHRAE/T, 60Hz R22	Alternative refrigerants
		1 — 5 — 10	
Swing	DC-Inverter (1cyl.) (2cyl.)	23 ●·····●(Under development) 32 — 45 — 63 ●shows DC-INV model	23, 32: R410A/ R407C 45, 63: R407C/ R410A

For PAC			Capacity [kW]@ASHRAE/T, 60Hz R22	Alternative refrigerants
			5 — 10 — 50	
Scroll	Hi-Eff. Model	Model D	◎shows AC-INV & modulated model ●shows modulated model	R407C
		Model F	●shows DC-INV model	R407C
	Standard Model	Model B	●shows DC & AC-INV model ◎shows AC-INV model	R407C

For Chiller		Capacity [kW], 60Hz R22	Alternative refrigerants
		100 — 500 — 1000 — 3000 4000	
Screw	Semi-Hermetic		R134a/ R407C
Centrifugal	Hermetic		R123

4.2.2 Condenser

The condenser functions to change the state of the refrigerant discharged by the compressor from gas to liquid.

Since the refrigerant vapor discharged by the compressor is high in temperature and pressure, the refrigerant can be condensed easily by outdoor air or water. The heat gained through the evaporator is discharged into outdoors or water by the condenser.

The heat discharged by the condenser is larger than evaporation heat, since the compression heat in the compressor is added to it.

The condenser can be classified into two types according to its cooling method; i.e. water cooled type and air cooled type. Each type is further classified into two types.

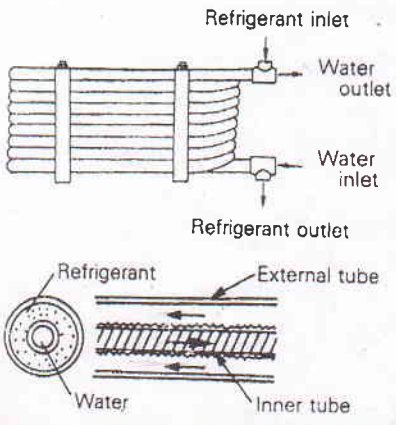
- Water cooled
  - Double tube type..... (1)
  - Shell and tube type..... (2)
- Air cooled
  - Cross fin coil type ..... (3)
  - Wind fin type ..... (4)

(1) Double tube type (Tube-within-a-tube type)

This type is adopted in smaller capacity models of water cooled packaged water chillers and air conditioners. Water flows through the inner tube and the refrigerant flows in the opposite direction between the inner and outer tubes.

The external surface of the inner tube is formed with a spiral groove flute to increase heat exchange coefficient.

Fig.4-20 Double tube type

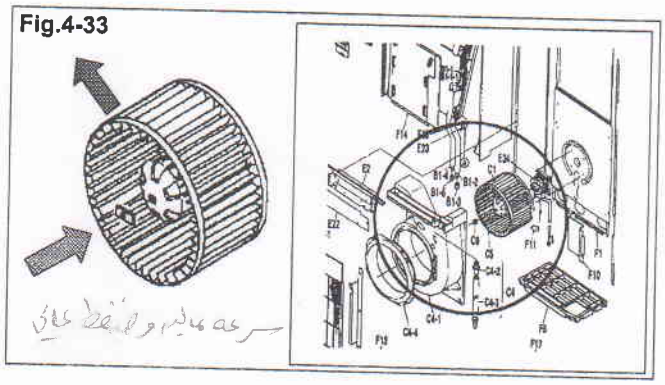


4.2.4 Fan

(1) Sirocco fans

Indoor units make most use of the multi-blade fans, which offers a large static pressure. Therefore, this type of fans is suited for units with high airflow resistance or of duct connection type. Air is sucked in from one side and discharges in the rotating direction. The fans are completely enclosed in the fan housing for use.

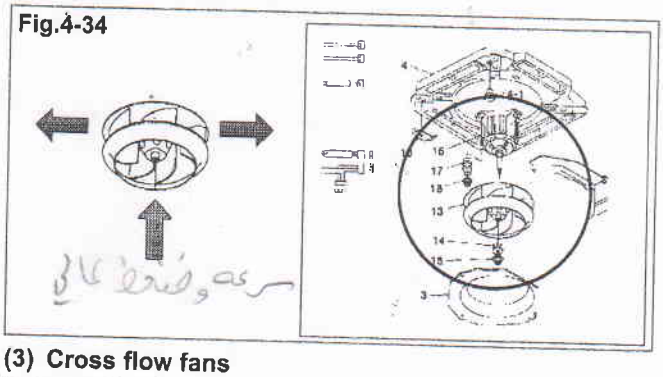
Fig.4-33



(2) Turbo fans

The turbo fans are used for the ceiling recessed cassette type of multi-flow units, which suck air from the bottom and discharge to the periphery. This type of fans requires no particular housing and is configured with heat exchanger coil around.

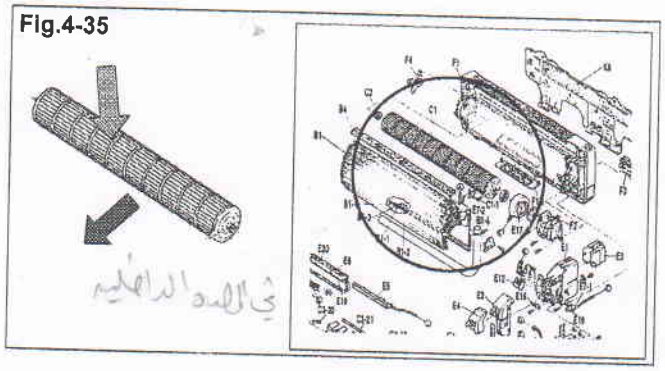
Fig.4-34



(3) Cross flow fans

The cross flow fans are dedicated for wall-mounted type of indoor units and have a long, narrow structure. Air is sucked in from one side with higher resistance and discharged to the other side with lower resistance. This type of fans cannot provide a large static pressure, thus disabling the duct connection.

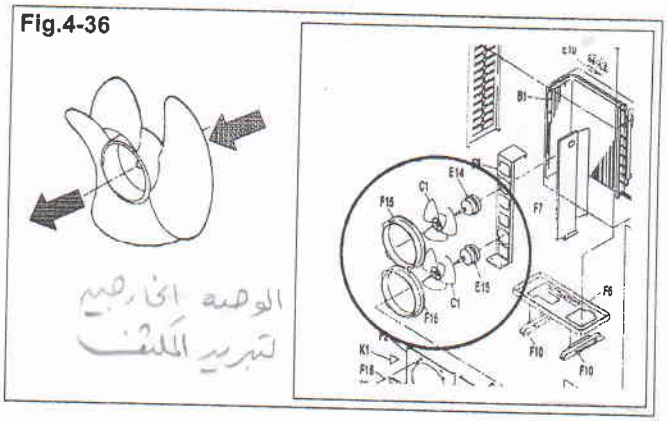
Fig.4-35



(4) Propeller fans

The propeller fans are in the most common use for outdoor units and called axial flow fans as well. Air is sucked in and discharged in the direction of the rotary shaft. This type of fans provide a small static pressure, while enables the connection of simple ducts when outdoor units are installed in the balcony.

Fig.4-36



4.2.5 Metering devices

The functions of the metering devices are to regulate the flow of high-pressure liquid refrigerant from the liquid line into the evaporator and to maintain a pressure differential between the high and low pressure sides of the system in order to permit the refrigerant to vaporize under the desired low pressure in the evaporator and at the same time to be condensed at a high pressure in the condenser.

There are six basic types of refrigerant flow controls as shown below. Almost all recent room air conditioners and packaged air conditioners adopt the capillary tube or the thermostatic expansion valve. So these types are explained below.

- Hand expansion valve
- Automatic expansion valve
- Thermostatic expansion valve
- Capillary tube
- Low pressure float
- High pressure float

(1) Capillary tube

The simplest one of all metering devices is the capillary tube, which is shown in Fig.4-37. This is nothing more than a deliberate restriction in the liquid line. Because of its small tube size, it creates a considerable pressure drop. The diameter and length of the capillary tube are determined experimentally by capacity of the refrigeration unit, operation conditions and refrigerant charged volume.

This type of the metering device is generally used only in small equipment with fairly constant loads, such as room air conditioners and small sized packaged air conditioners.

The advantages and disadvantages of the capillary tube are as follows:

1. Low cost compared with expansion valve
2. Simple structure...difficult to be damaged
3. When the compressor stops, high and low pressure are equalized soon.