



Components

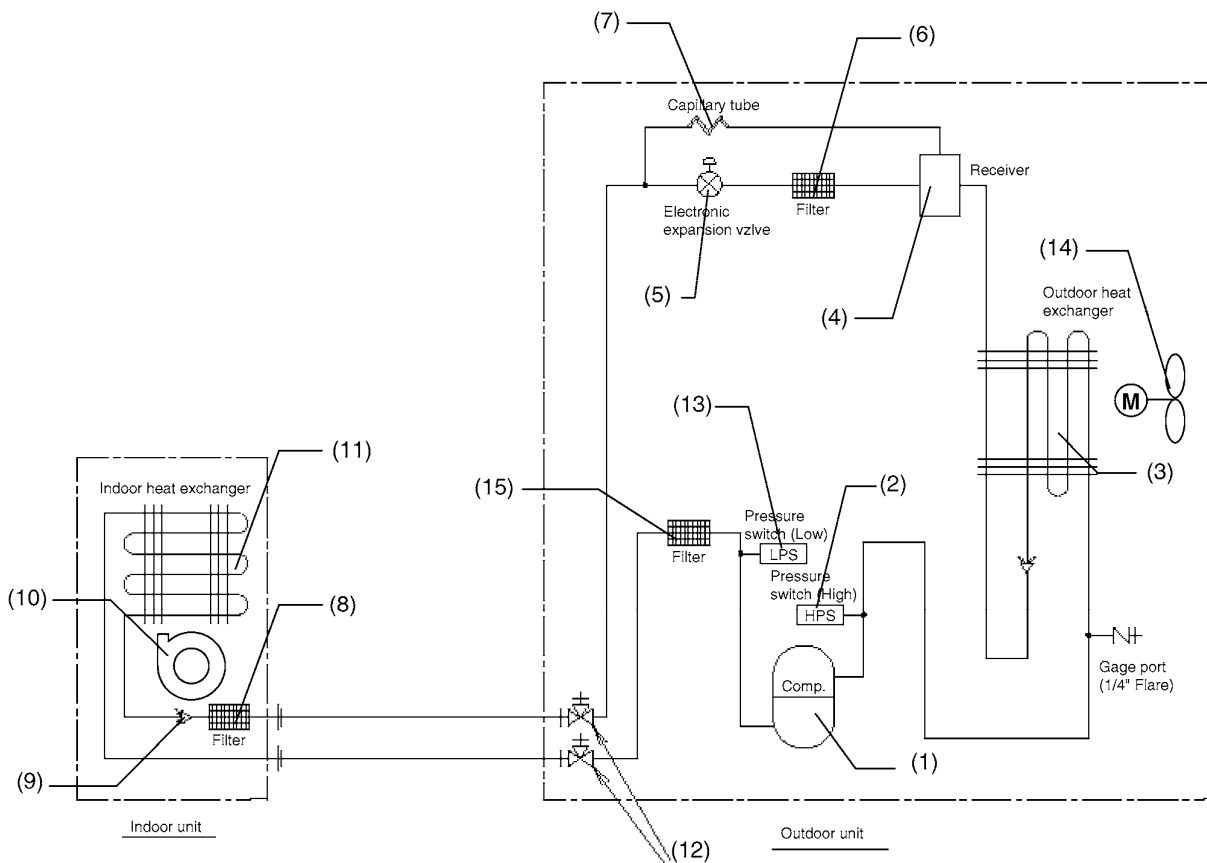
4.1 General description

The air conditioners consist of various parts and components. It is very important for servicemen to understand the structure and functions of each part and component well and to diagnose troubles with the air conditioners.

In this chapter, the parts and components used mainly in the room air conditioners and packaged air conditioners in recent years are explained.

In order to support the reading exercise of piping diagram, this Chapter picks up a product of simple design out of the SkyAir Series prevailing as air conditioners for business use, thus explaining typical components. Referring to the actual single view drawing on the following page of parts with the number corresponding to that shown in the circuit diagram below, get at the outline image of the parts.

Fig.4-1 R71KU



Components name

- | | |
|---|--|
| (1) Compressor | (8) Filter (Refrigerant) |
| (2) High pressure switch | (9) Distributor |
| (3) Condenser (Outdoor unit heat exchanger) | (10) Indoor unit fan (Centrifugal) |
| (4) Receiver | (11) Evaporator (Indoor unit heat exchanger) |
| (5) Electronic expansion valve | (12) Stop valve (Service vail) |
| (6) Filter (Refrigerant) | (13) Low pressure switch |
| (7) Capillary tube | (14) Outdoor fan (Propeller) |
| | (15) Filter (Refrigerant) |

SkyAir (Cooling only)

Fig.4-2 FVY71L

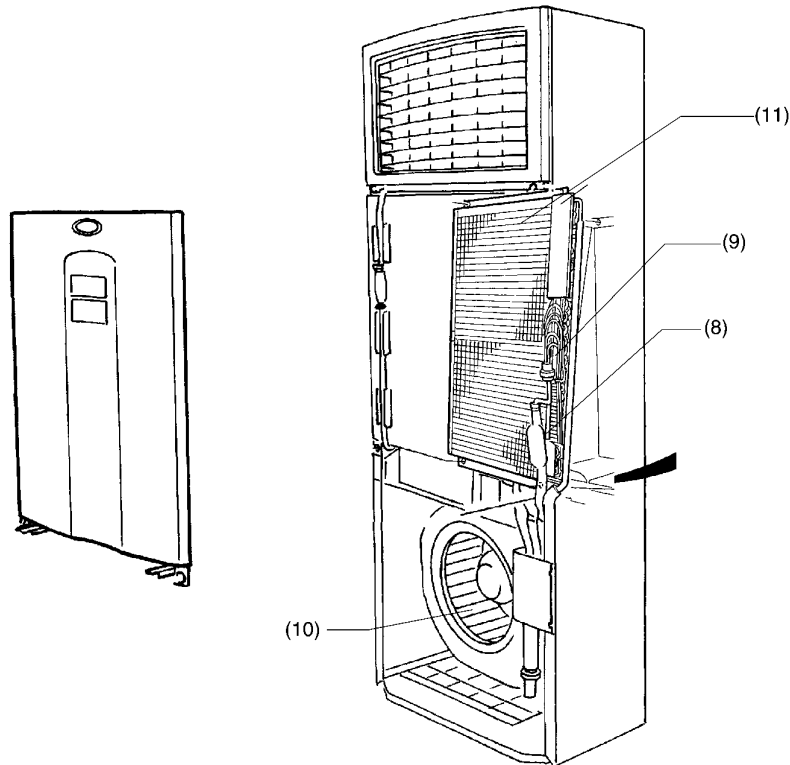
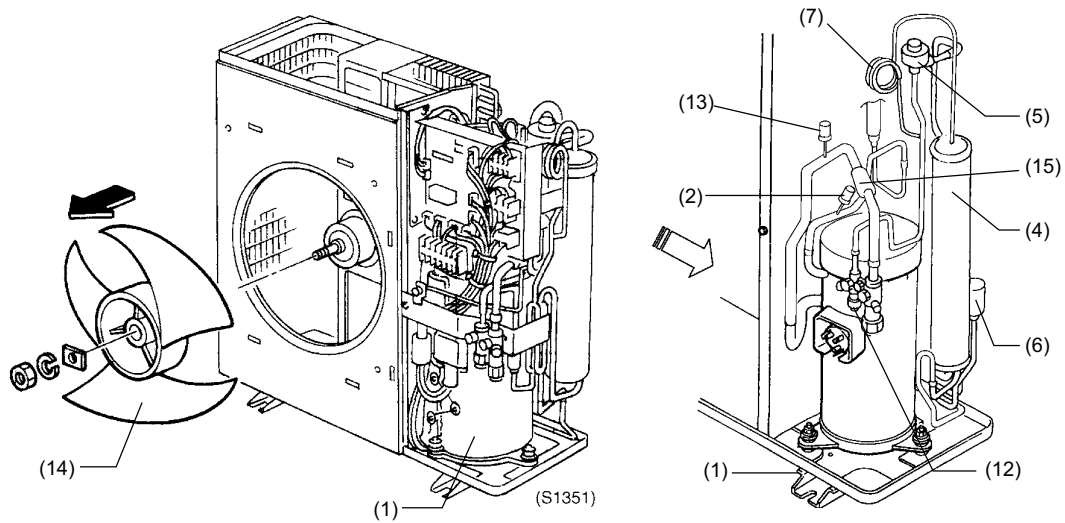


Fig.4-3 R71KU



Air conditioners have a variety of functional parts except for four components such as compressor, condenser, expansion valve, and evaporator. It is certainly practical for you to understand the structure and functions of the parts when you do many different types of services.

This Chapter explains on the basis of actual piping circuit diagram the structure, types, and functions of the components used in the piping. At present, the Split-type air conditioners are prevailing, among which the Daikin SkyAir Series is the most popular in the field. Therefore, a simple circuit diagram in the SkyAir Series is illustrated below.



■ Cooling only

Fig.4-4 R35~60G

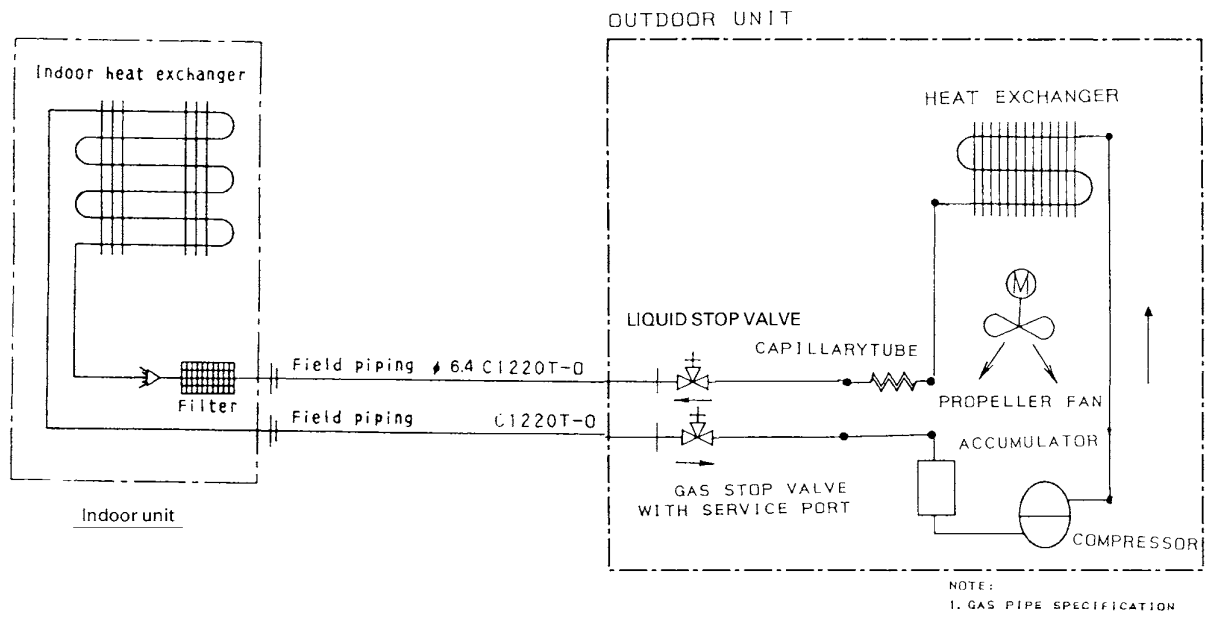
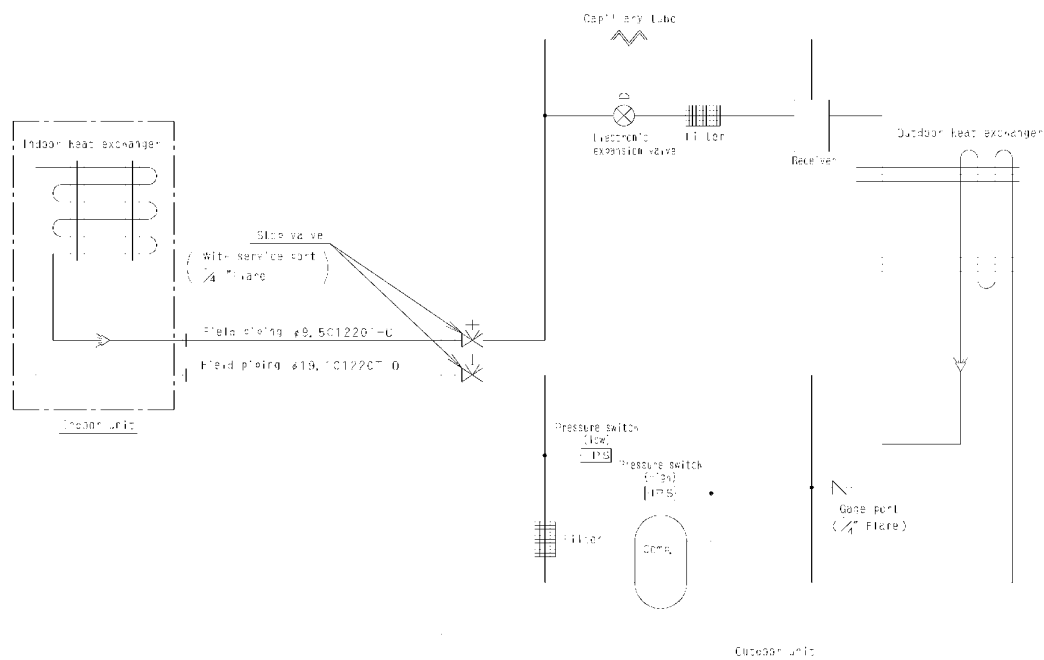


Fig.4-5 R71KU





■ Heat pump

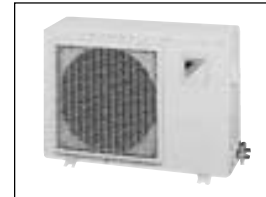
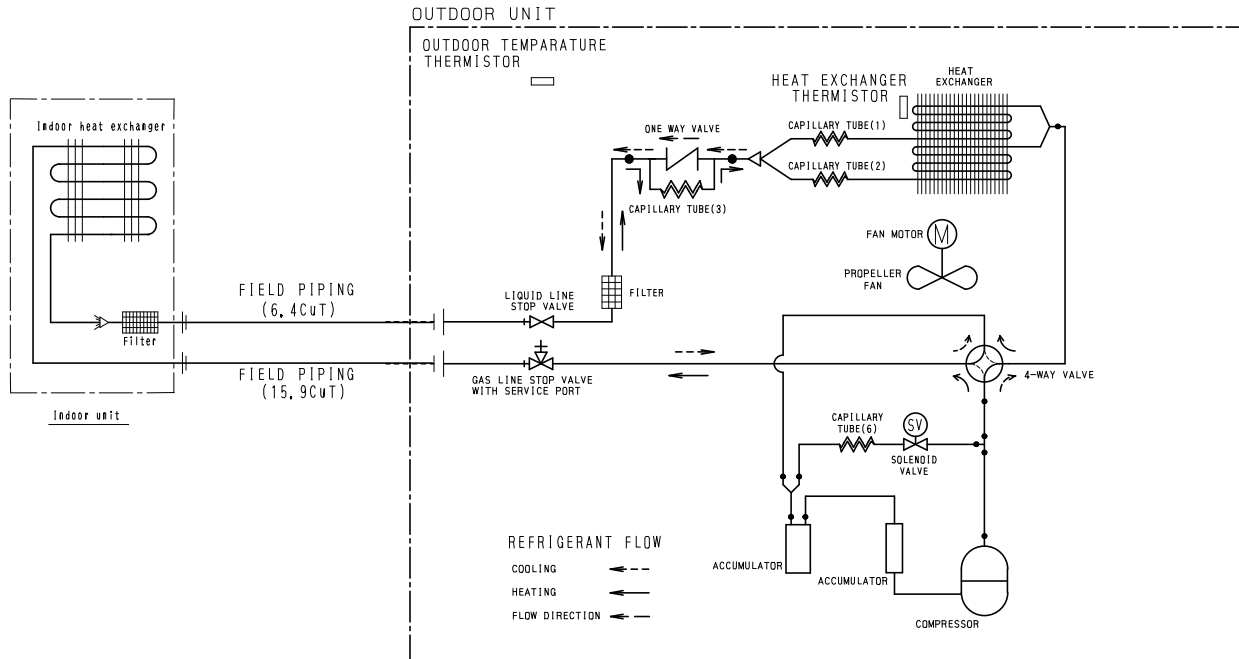
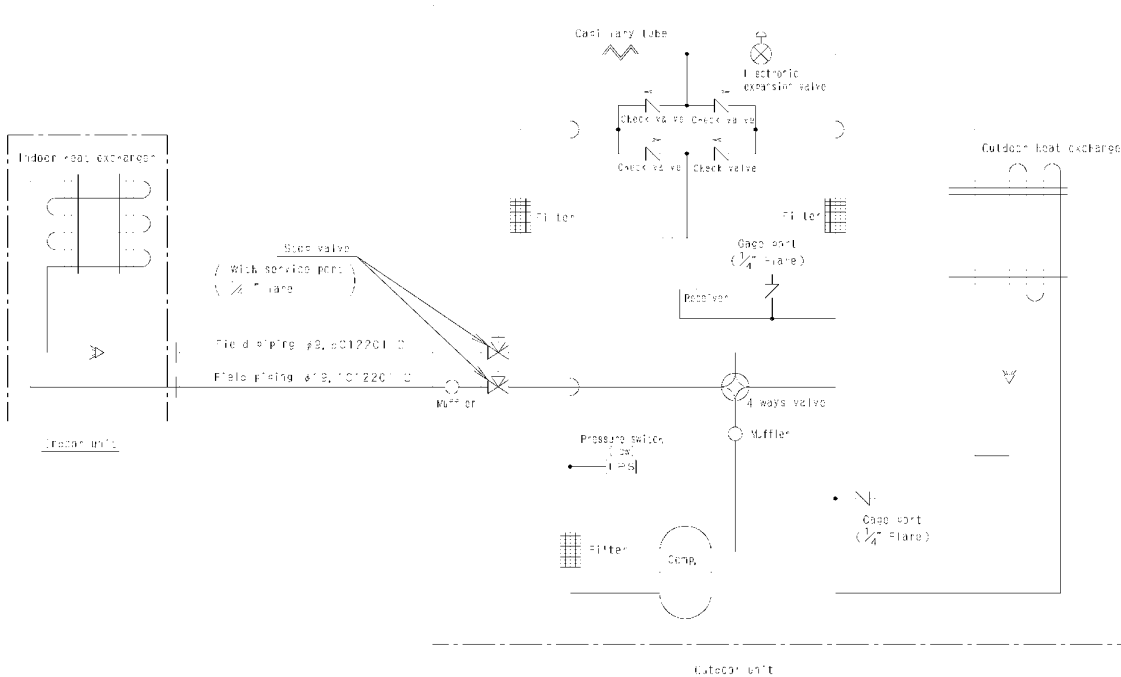


Fig.4-6 RY50GAV1A



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Fig.4-7 RY100KU



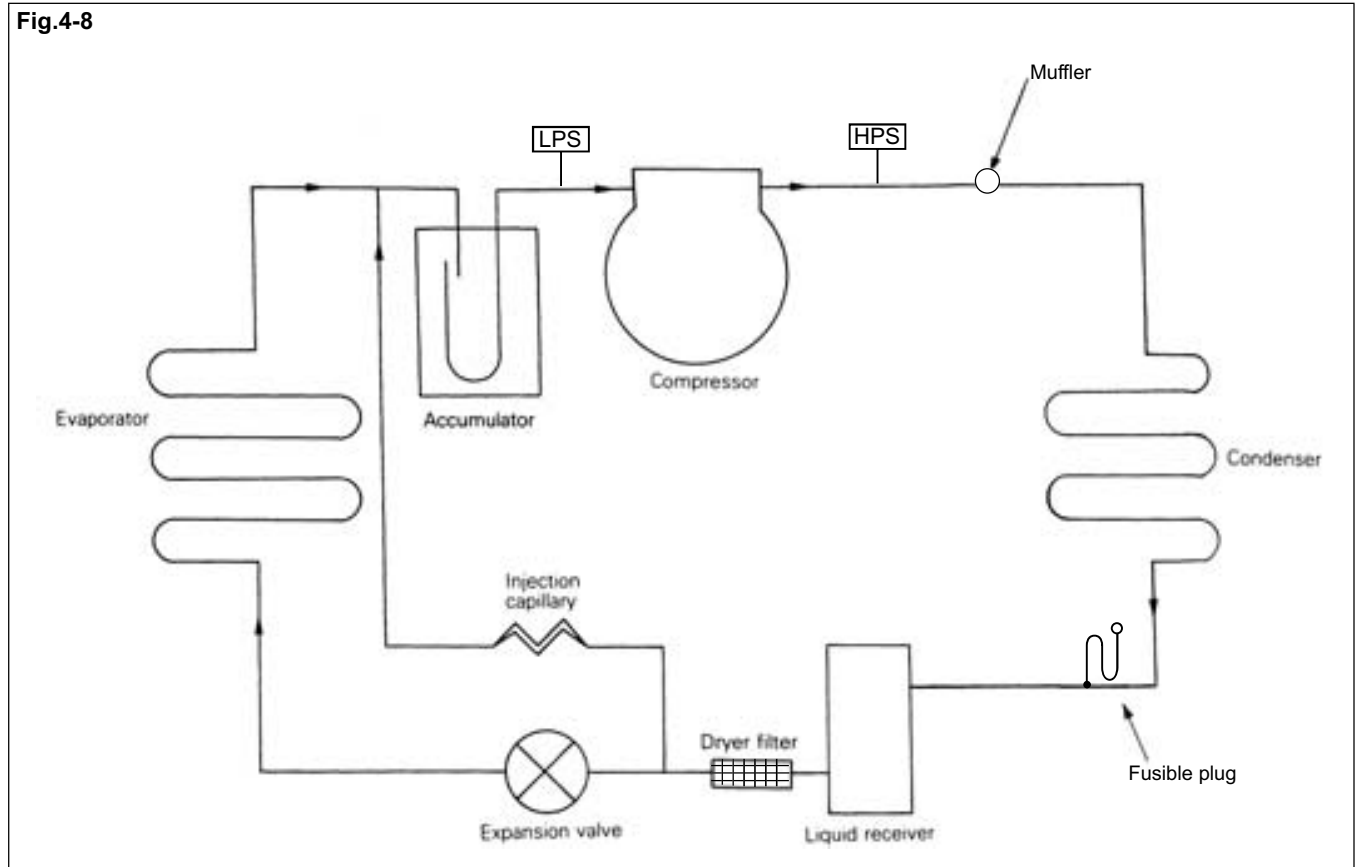
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Here, main components are schematically illustrated for better comprehension. In the succeeding pages, this schematic figure sometimes can be seen on the booth explaining each

component or equipment. This figure effectively affects to let you notice the location of the component in relation to the other component's locations.

Fig.4-8





4.2 Main components

All of the unitally air conditioners consist of four main components, a compressor, a condenser, an evaporator and a refrigerant controller.

Firstly functions and kinds of four main components will be explained below.

4.2.1 Compressor

The compressor performs as a pump to circulate the refrigerant in the refrigeration circuit. The low temperature and low pressure refrigerant vapor evaporates through the evaporator and is compressed to the pressure at which the refrigerant vapor can be easily liquefied in the condenser.

(1) Classifications by compression methods

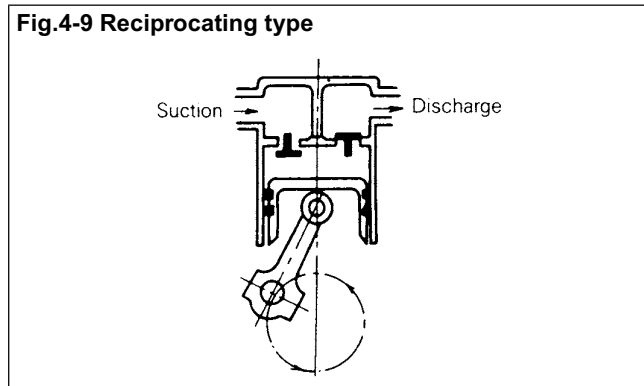
Compressors are largely classified by compression methods; i.e., volumetric compression and centrifugal compression, and when these types are classified furthermore, they are as shown below.

- Volumetric compression
 - Reciprocating type
 - Single stage compression
 - Two stage compression
 - Rotary type
 - Rolling piston
 - Sliding vane
 - Swing
 - Scroll type
 - Screw type
- Centrifugal compression
 - Single stage compression
 - Multi-stage compression

1) Reciprocating compressors

The reciprocating compressors consist of cylinders, pistons and valves.

Compression is performed by reciprocating movements of the piston in the cylinder. The valve controls gas in and out of the cylinder. (See Fig.4-9)



2) Rotary compressors

The rotary compressors are available in two types, rolling piston and sliding vane types.

The compression theory of the rolling piston type is that the rotating piston which is also called rotor rotates in contact

with the contour of the cylinder and a fixed blade compresses the refrigerant. (See Fig.4-10)

Compression method of the sliding vane type is that several blades rotate with the rotary piston in contact with the contour of the cylinder, compressing the refrigerant. (See Fig.4-11)

Compared with the reciprocating compressors, the rotary compressors are compact, simple in construction and consist of fewer parts. In addition, the rotary compressors excel in coefficient of performance and efficiency. However, accuracy and antiabrasion are required for machining the contacting parts. For the time being, the rolling piston type has been a major type of rotary, but in recent year, new rotary of swing type has been developed and gradually expands the share of rotary comps.

Fig.4-10 Rolling piston type

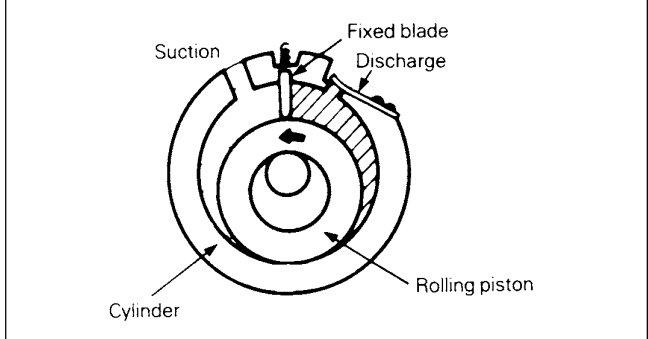


Fig.4-11 Sliding vane type

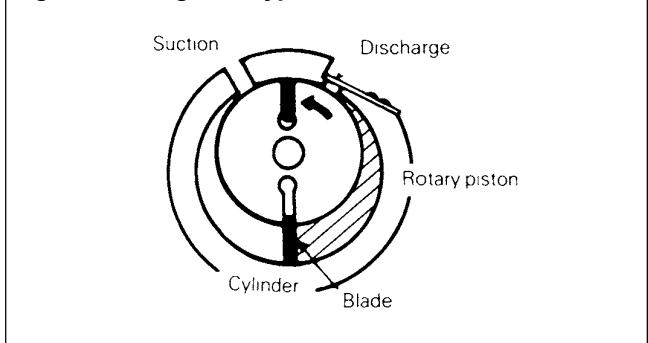
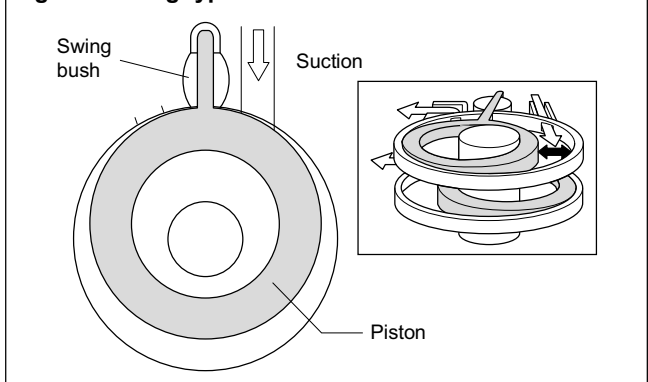
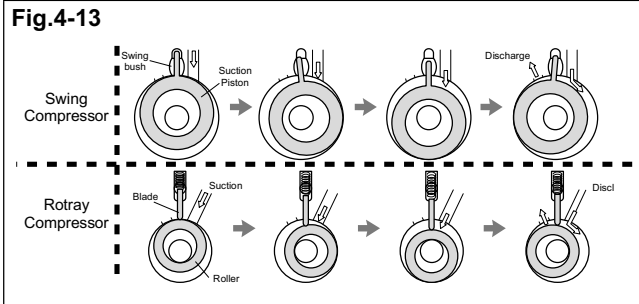


Fig.4-12 Swing type



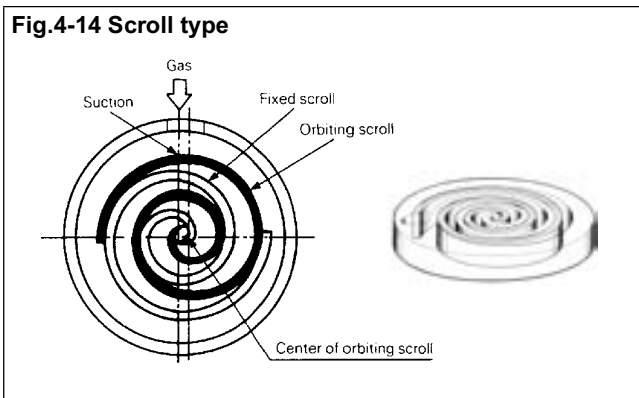


The Swing Rotary Compressor has an integrated blade and piston, thus producing no blowing-through loss from high pressure to low pressure and standing the high-pressure compression ratio. (See Fig. 4-12, 4-13)



3) Scroll compressors

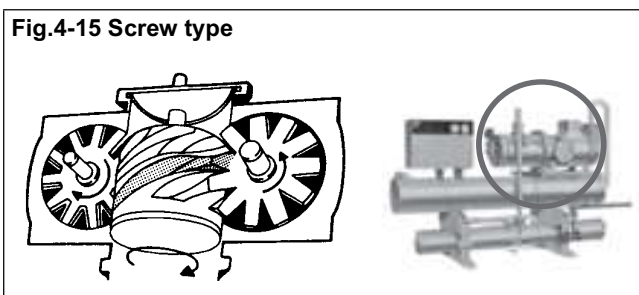
As shown in Fig.4-14, the scroll compressors consist of two scrolls, and one is fixed and the other revolves in orbit. The gaseous refrigerant is drawn in from the circumference of the scrolls and compressed in the space reduced by the surrounded scrolls and discharged from the discharge port at the center.



4) Single screw compressors

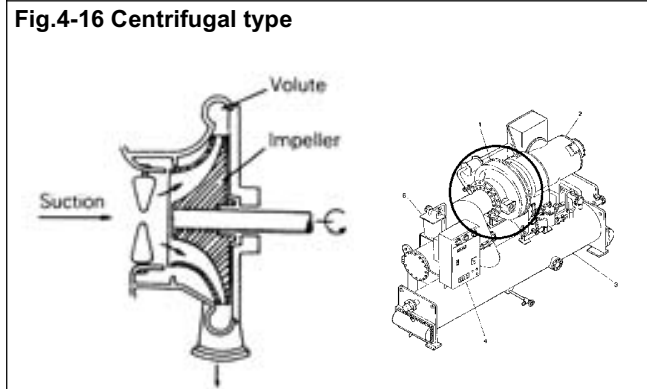
The screw compressors consist of rotors having male and female gears and compresses the refrigerant by engaging one screw rotor and two gate rotors. Like the reciprocating compressors, the compression process of the screw compressors has three steps, suction, compression and discharge.

To minimize gas flow resistance, the gas is sucked toward the shaft direction, compressed and discharged.(See Fig. 4-15)



5) Centrifugal compressors

The centrifugal compressors consist of impeller and volute. The impeller is rotated approximately at 10,000rpm. Such centrifugal force changes the gaseous refrigerant into speed energy, which is converted into pressure energy for compression. (See Fig. 4-16)



(2) Classifications of compressors by structure

When the compressors are classified by structure, they are as shown below.

- Open type {
 - Single stage
 - Two stage

- Hermetic type {
 - Semi-hermetic type {
 - Single stage
 - Two stage
 - Hermetic type

1) Open type compressors (Fig.4-17)

The open type compressors are driven by external power by means of V belts or direct connection couplings. Therefore, one end of the drive shaft sticks out of the compressor housing. To prevent gas from leaking through gap between the compressor housing and the drive shaft, specific part called shaft seal is equipped.

Furthermore, they are easily dismantled for inspection and services, and worn or damaged parts can be replaced easily. They are mainly used for low temperature applications.

Fig.4-17 Open type



2) Semi-hermetic type compressors (Fig.4-18)

The compressor and the motor are connected and housed in the same housing. The cover of each part is tightened by bolts. No shaft seal is required, because no gas leakage occurs.

Fig.4-18 Semi-hermetic type

Reciprocating



Screw



3) Hermetic type compressors (Fig.4-19)

The compressor and the motor are connected and housed in the same housing, which is hermetically sealed by welding. Compared with the semi-hermetic compressors, the hermetic type compressors excel in air tightness. Comparatively small size reciprocating compressors and rotary compressors are in most cases of the hermetic type. In this type, however, if the compressors are out of order, it is necessary to replace whole compressors.

Fig.4-19 Hermetic type

Reciprocating

Scroll



4) Compound type compressors

The compound type compressors have the high pressure stage and the low pressure stage in a single compressor. Compared with the two stage compression method in which separate compressors are used for high and low pressure stages respectively, they are simple in structure, light, and require small installation area and low initial costs. They are used for low temperature applications.



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 |
|--------------------|-----------------------------|----------------------------------|--|
| Swing | DC-Inverter (1cyl.) (2cyl.) | | 23, 32: R410A/ R407C 45, 63: R407C/ R410A |
| | | | |
| For PAC | | Capacity [kW]@ASHRAE/T, 60Hz R22 | Alternative refrigerants |
| Scroll | Hi-Eff. Model | | R407C |
| | Standard Model | | R407C |
| | | | R407C |
| For Chiller | | Capacity [kW], 60Hz R22 | Alternative refrigerants |
| Screw | Semi-Hermetic | | R134a/ R407C |
| Centrifugal | Hermetic | | R123 |