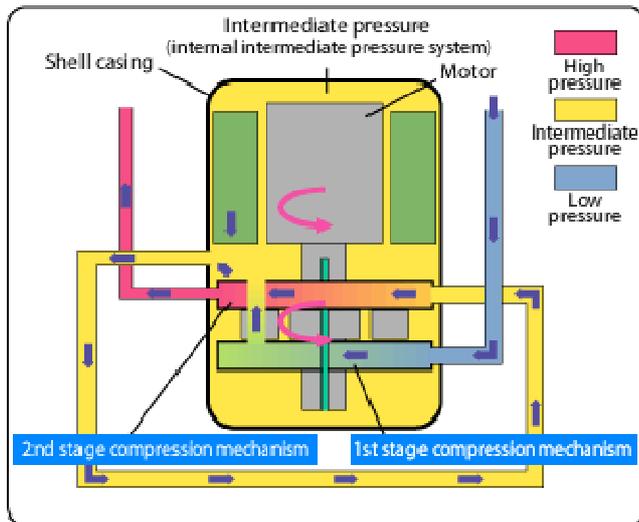


## Features of SANYO CO<sub>2</sub> rotary 2-stage compression CO<sub>2</sub> compressor



### Resistant to high working pressure

Internal intermediate pressure structure  
11 MPa shell design pressure (more than 13 MPa with an internal high-pressure shell)

### Resistant to large pressure difference

2-stage compression mechanism

### Increased efficiency

2-stage compression mechanism  
Optimized dimensions of compression mechanism  
High-efficiency DC motor incorporated

### Compact size and light weight

Internal intermediate pressure structure  
11 MPa shell design pressure (more than 13 MPa with an internal high-pressure shell)

### Minimized noise and vibration levels

2-stage compression mechanism

Two characteristics are yielded by CO<sub>2</sub> natural refrigerant: High working pressure and high differential pressure. These pressure levels are 4 to 10 times higher than with HFC refrigerants.

For this reason, the following factors must be taken into account in the development of CO<sub>2</sub> compressors:

- Resistant to high working pressure
- Reliable sliding parts and components
- Improved efficiency
- Lighter weight

What SANYO did to translate these factors into reality is to divide the compression of the CO<sub>2</sub> refrigerant into two stages so that the inside of the shell is at the intermediate pressure, and the result was the world's first rotary 2-stage compression CO<sub>2</sub> compressor. The figure above shows the structure of SANYO rotary 2-stage compressor and flow of the refrigerant through the compressor. The low-pressure suction gas is introduced into the first-stage compression mechanism at the bottom where it is compressed to the intermediate pressure, after which it is discharged inside the shell. The gas is then introduced through the pipe outside the shell into the second-stage compression mechanism at the top, where it is further compressed, after which it is discharged to the refrigeration cycle.

### Features

- Resistant to high working pressure : The internal intermediate pressure structure makes it easy to design the shell.
- Resistant to large pressure difference : The 2-stage compression makes it possible to disperse the differential pressure and compression load.

- Increased efficiency :

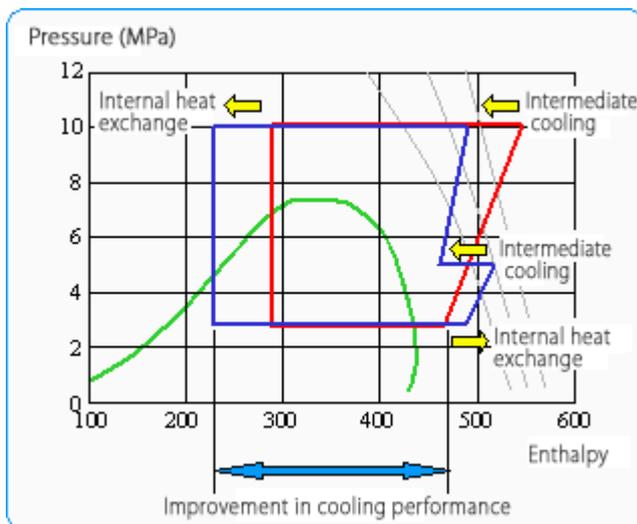
Leakage is reduced by the 2-stage compression, the dimensions of the compression mechanism are optimized, and a high-efficiency DC brushless motor is incorporated.
- Compact size and light weight :

The shell has thinner walls due to the internal intermediate pressure structure, and a compact concentrated winding motor is provided.
- Minimized noise and vibration levels :

Equalization of a torque on that of twin rotary compressor is achieved thanks to the compression mechanism's 2-cylinder structure in which the two cylinders face each other at 180 degrees.
- Just right for hot water heaters in cold climates :

The internal intermediate pressure structure enables discharging at a higher temperature than with regular rotary compressors. Users can select the volume ratio (displacement volume ratio between the first and second stages) that suits the intended application, which makes the compressors just right for use in winter and for water heaters in cold climates.

## Application in refrigeration cycles of CO<sub>2</sub> rotary 2-stage compression system



When the transcritical CO<sub>2</sub> refrigeration cycle is applied in refrigerator and freezer equipment, the theoretical efficiency (COP) is said to be generally lower than that of HFC. An effective way to offset this is to employ: 1) an internal heat exchanger, and 2) an intermediate cooler.

### ■ Internal heat exchanger

The cooling performance is enhanced by exchanging the heat between the evaporator outlet pipe and gas cooler outlet pipe.

### ■ Intermediate cooling

When the CO<sub>2</sub> is compressed in the single stage, the discharge temperature reaches quite a high level. Since intermediate cooling is enabled by the rotary 2-stage compression mechanism, it is possible to reduce the discharge temperature significantly.

In this way, rotary 2-stage compression CO<sub>2</sub> compressors can offer useful solutions even in the refrigeration and freezing fields where compressors have had a poor track record to date.