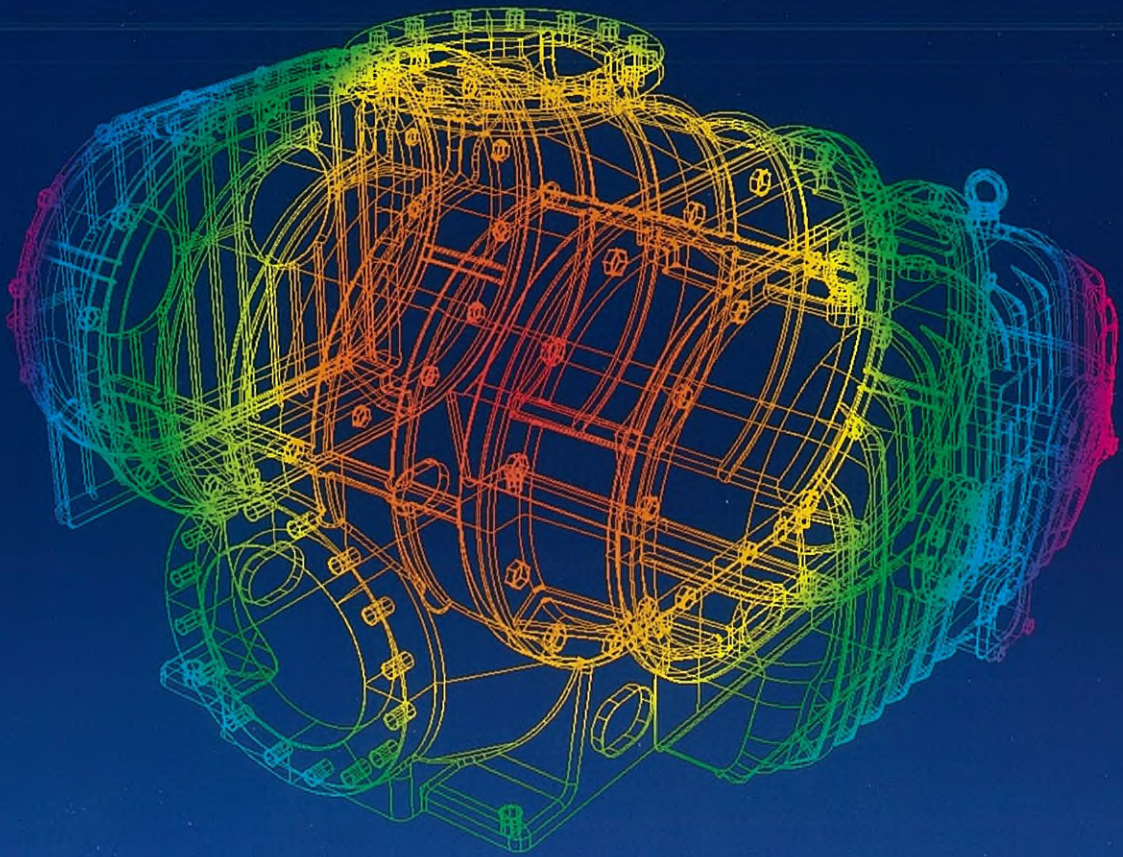


UNOZAWA

**THREE LOBE
ROTARY
BLOWER**



THREE LOBE ROTARY BLOWER

"ARJ" series



UNOZAWA-GUMI IRON WORKS, LTD.

Unozawa "ARJ" Three Lobe Positive Displacement

The Unozawa "ARJ" Three Lobe Positive Displacement Blower are new series roots blowers developed by incorporating Unozawa's extensive experience and technical expertise. This series blower type ARJ employs three lobe rotor, featuring higher performance, lower noise and less vibration. It embodies the essence of Unozawa's highly sophisticated technology. The new series blower have been standardized, with a wide applicable working pressure—ranging from low to high. When used for special gas, a mechanical seal can be provided. When applying the Unozawa back-flow cooling system, single stage vacuum pumps can be used safely up to a vacuum level of -65kPa of suction pressure. Single stage blowers can also be used safely up to 120kPa of discharge pressure.

Application

1. As an air blower:

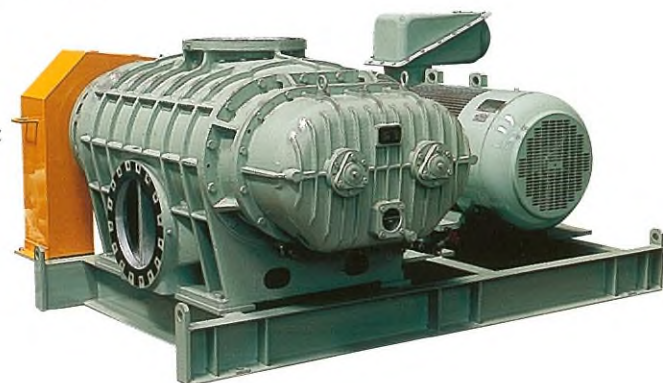
For pneumatic conveyors and the chemical industry; for humidifying and aeration to water treatment and blending and aeration of powder or granular foods, cement, or vinyl.

2. As a gas blower:

For pressurized transportation or circulation of gases in chemical processes. Hydrogen, nitrogen, acetylene, oxygen, kerosene gas, methane, sulfurous acid gas, stack flue gas, city gas, carbonic acid gas, hydrogen sulfide gas, and hydrochloric acid gas.

3. As a vacuum pump:

Filtration equipment in the chemical industry. Pneumatic conveyors. Ship unloading.



Blower



Advantages

Three lobe rotor blower and vacuum pump:

An ideal air handler usable to satisfy a number of work conditions, the new series low noise system can be used to satisfy wide range of user requirements.

The specifications areas follows :

Blowers :

Suction size : 50~500mm

Suction pressure : Atmospheric pressure

Discharge pressure : ~215kPa

Capacity : 1~480m³/min.

Vacuum pumps :

Suction size : 50~500mm

Suction pressure : ~-65kPa

Discharge pressure : Atmospheric pressure

Capacity : 1~480m³/min.

This catalogue details capacities, noise characteristics. The blower model that meets your needs can be picked up. For external dimensions of units, refer to the "Blower data book"

Low noise less vibration

Due to ideal back-flow caused by the three lobe rotor, pulsations of air discharge from the blower have been greatly reduced. Noise and vibration have also been significantly eliminated.

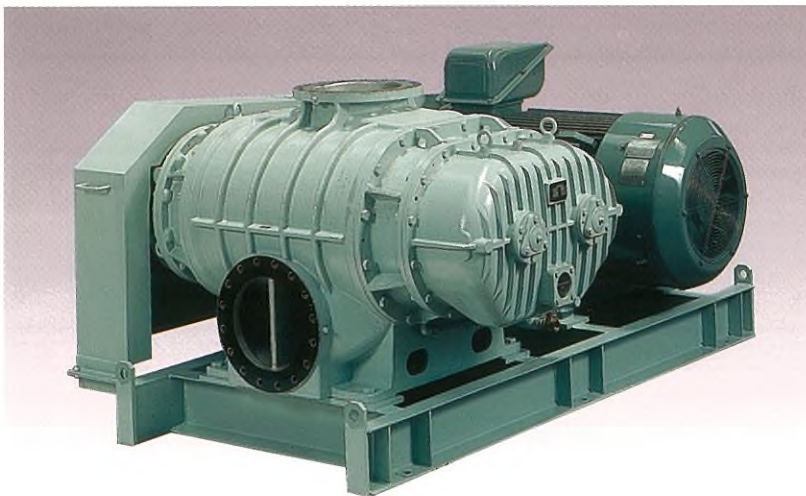
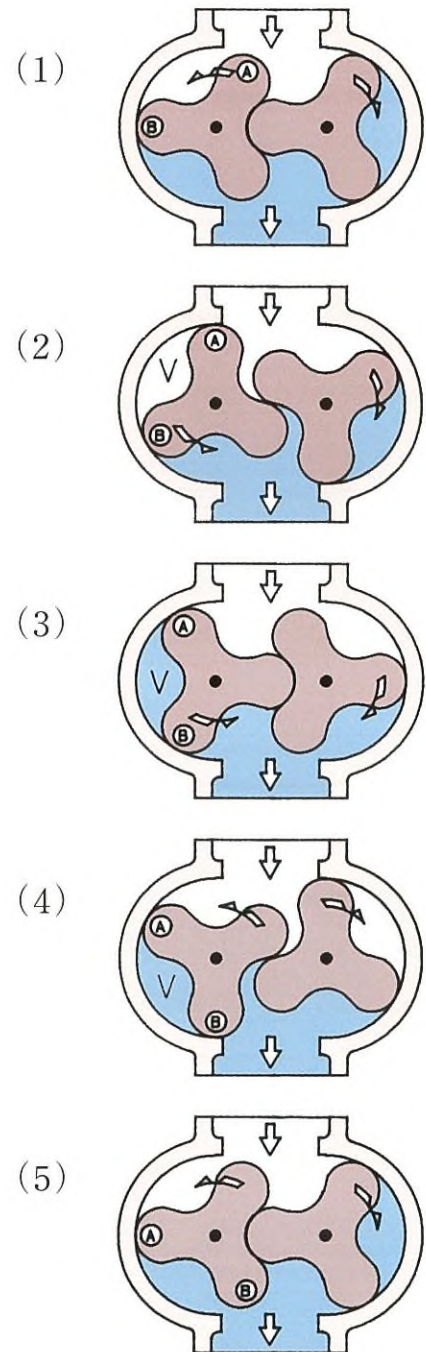
When the back-flow cooling system (page 9) is applied for vacuum pump, it can handle, high temperature gas up to 120°C.

Principle

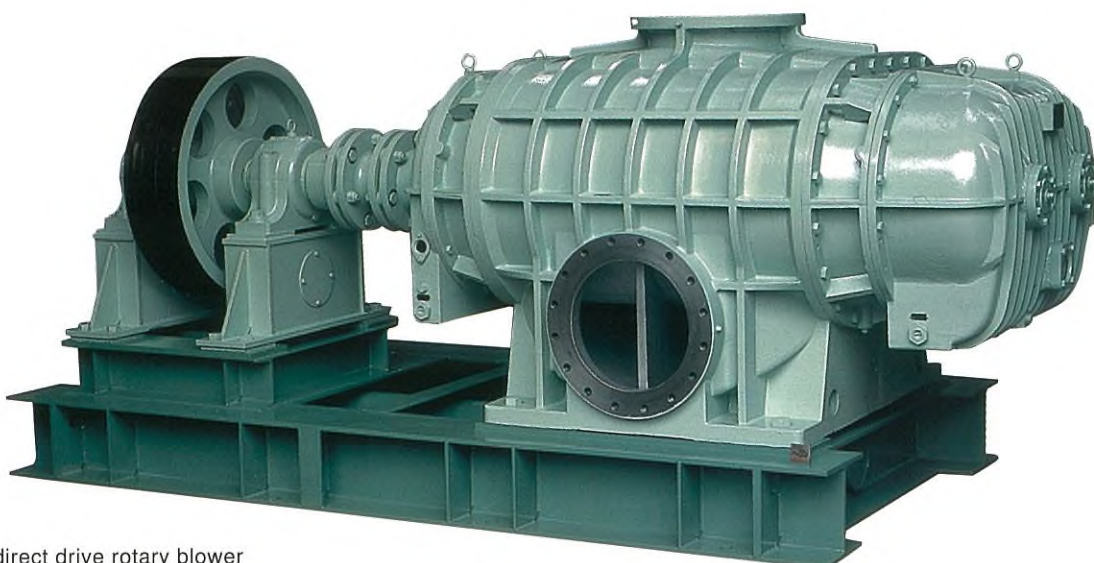
Pair of rotors turn in opposite directions inside the casing, maintaining a precision clearance between the side wall of the casing and the two rotors. Gas flows into the blower as the lobe end of each rotor passes the suction port. And gas is transferred from the suction side to the discharge side.

It is then discharged, forced towards the high-pressure side. Gas at the suction side is caught in volume "V" surrounded by rotor tips (A), (B) and the casing in process as shown in illustrations (1) and (2) at right, and after step (3), (4) and (5), is discharged.

With three lobes, this process is repeated six times per one rotation and constant volume of gas proportional to the number of revolutions are discharged.



V-belt drive rotary blower



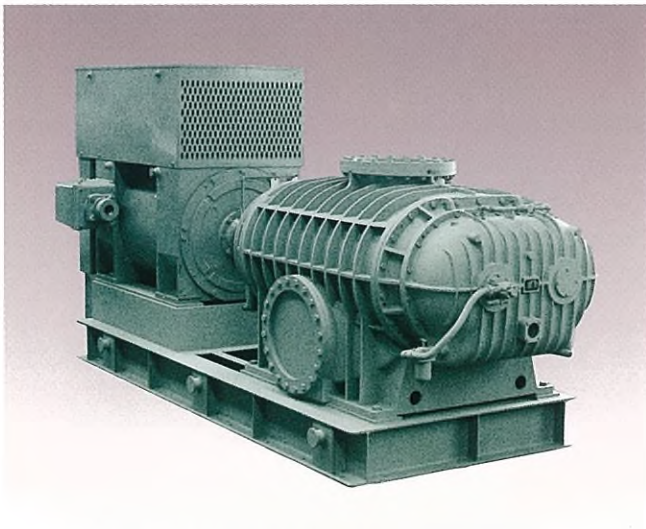
V-belt indirect drive rotary blower

Advantage of the three lobe rotor

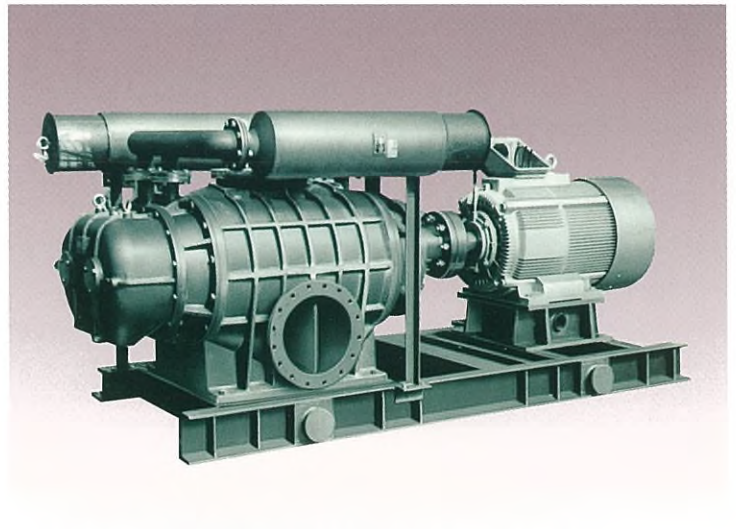
Compression takes when the rotor's lobe end faces the discharge port and high pressure gas at the discharge side flow back into the casing.

The main cause of blower noise lies in this pulsation of pressure that accompanies the back-flow compression. In case of the three lobe rotor, the cycle of pulsation is $\frac{2}{3}$ that of the two lobe rotor.

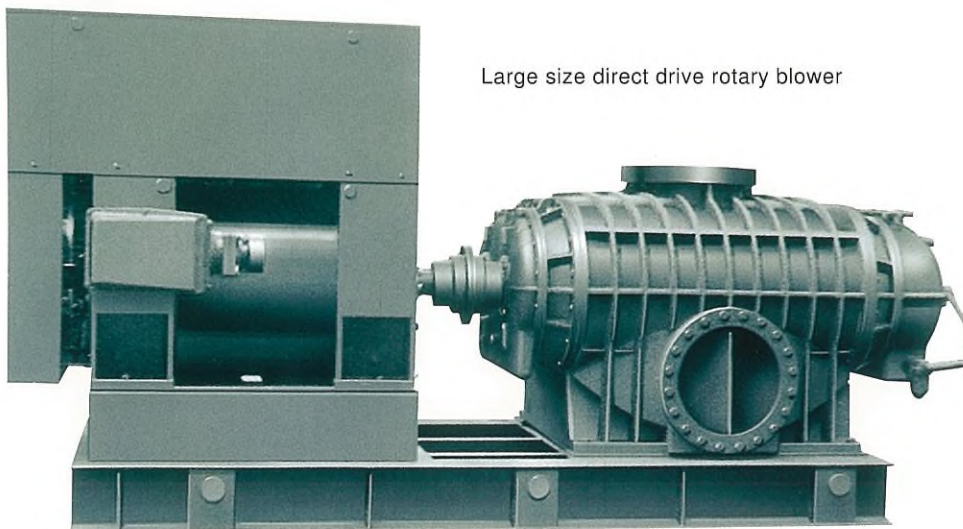
The pressure peak value also reduces. In addition, since the three lobe rotor is of specially designed construction so as to minimize the range of pulsation, pulsation at the discharge port have been conspicuously reduced, compared with the two lobe rotor. Consequently, the back-flow compression of blower is done smoothly noise level greatly lowered.



Large size direct drive rotary blower



Direct drive vacuum pump with back-flow cooling system



Large size direct drive rotary blower

Construction

● Rotor

The three lobe rotor made of cast iron or ductile cast iron has good quality subjected to high precision machining. The inside clearances are precision matched and optimum efficiency is guaranteed.

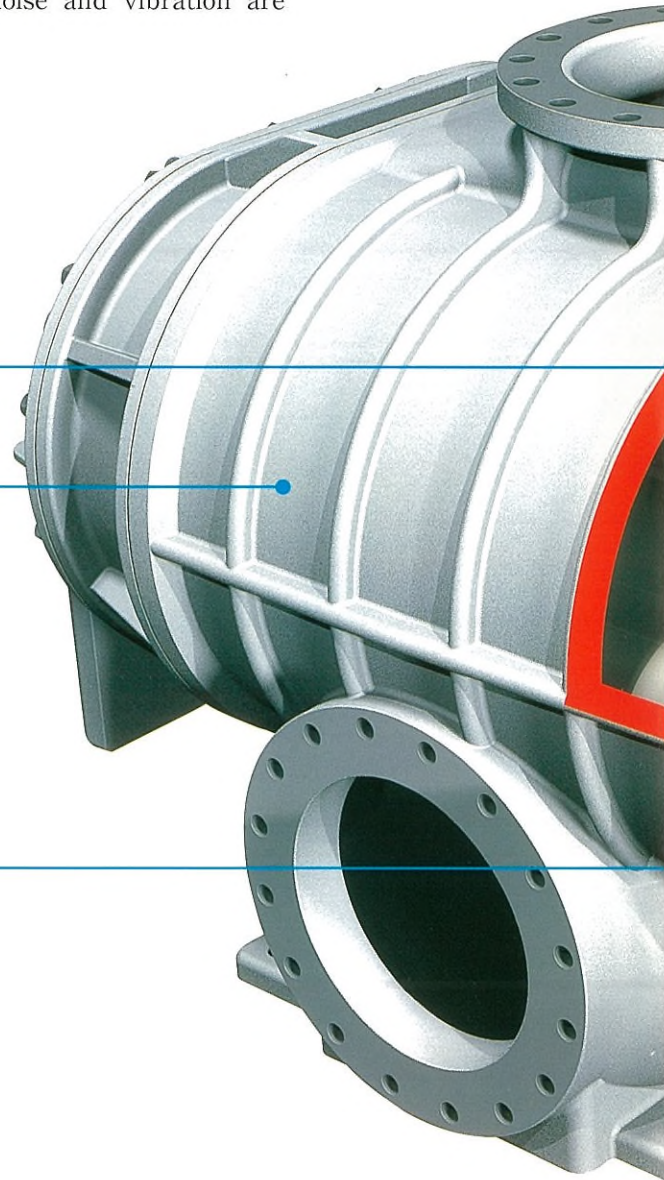
In addition, as it is perfectly balanced by means dynamic balancing machine, noise and vibration are minimized.

● Casing

The casing made of cast iron, consisting of the upper suction and the lower horizontal discharge sections, ensures sufficient strength and durability.

● Side cover

The side cover functions as an intermediate chamber between the casing and oil cavity for the bearing/gear. As the side cover has seal system, it prevents lubricating oil from leaking into the casing.



● Bearing

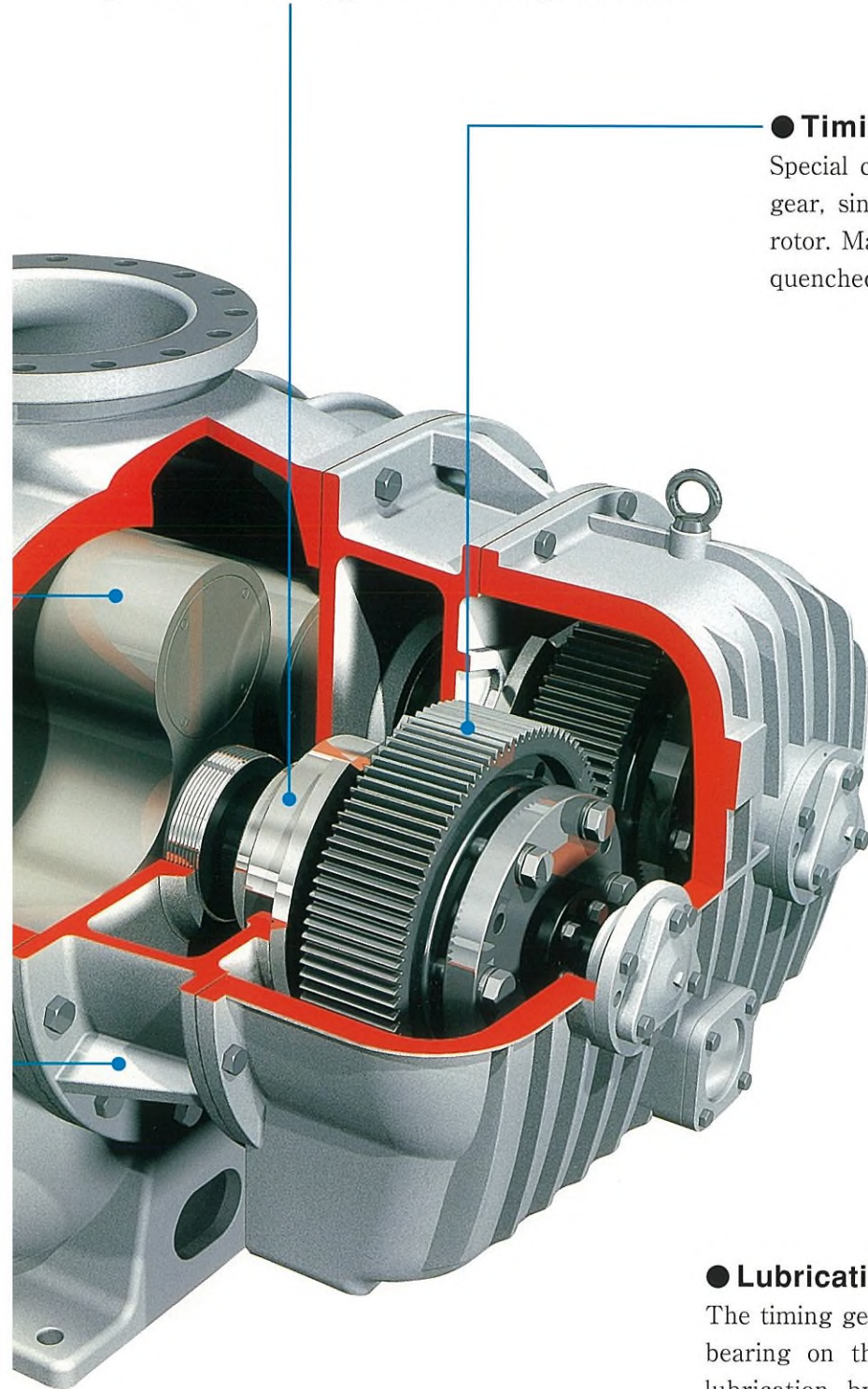
The bearing are high precision bearings with a load capacity suited for working conditions. Stable performance and long service life are guaranteed.

● Timing gear

Special considerations have been given to the timing gear, since it is as important part of blower as the rotor. Made of chrome molybdenum steel, carbonized, quenched and ground, it is excellent in durability.

● Lubrication

The timing gear, the bearing on the gear side and the bearing on the drive side are subjected to splash lubrication by oil bath. In order to ensure ideal lubrication, oil is used throughout. Depending upon service conditions, a cooling water path can be attached to each of the oil cavity on the drive and the gear sides, in order to prevent oil temperature from rising, or prevent oil itself from deterioration.



Shaft Sealing

“ARJ” blowers are available with many types of standard shaft sealing. The type of blower shaft sealing is selected according to the gas handled. When handling a special kind of gas, a mechanical seal is provided—either single or double mechanical seal can be used. Available types of shaft sealing and their general uses are as follows:

1. Standard types:

The standard type for blower mainly suitable for blower that handles air.

Seal position A	Oil seal
Seal position B	Labyrinth seal
Seal position C	Labyrinth seal

2. One-mechanical seal type:

Provided with one mechanical seal on the shaft. Suitable for sealing the shaft when gases that should not be leaked into air are handled—N₂, H₂, Ar, CO, CO₂ and other non-solvent gases; and also coke oven gas, city gas, digested gas, etc.

This type is available with either of two systems of “Ka” and “Kb” at seal position “A” according to working pressure and the water content of those gas being handled.

	Type “Ka”	Type “Kb”
Seal position A	Single mechanical seal	Double mechanical seal
Seal position B	Oil seal or Labyrinth seal	Oil seal or Labyrinth seal
Seal position C	Labyrinth seal	Labyrinth seal

3. Four-mechanical seal “B” type:

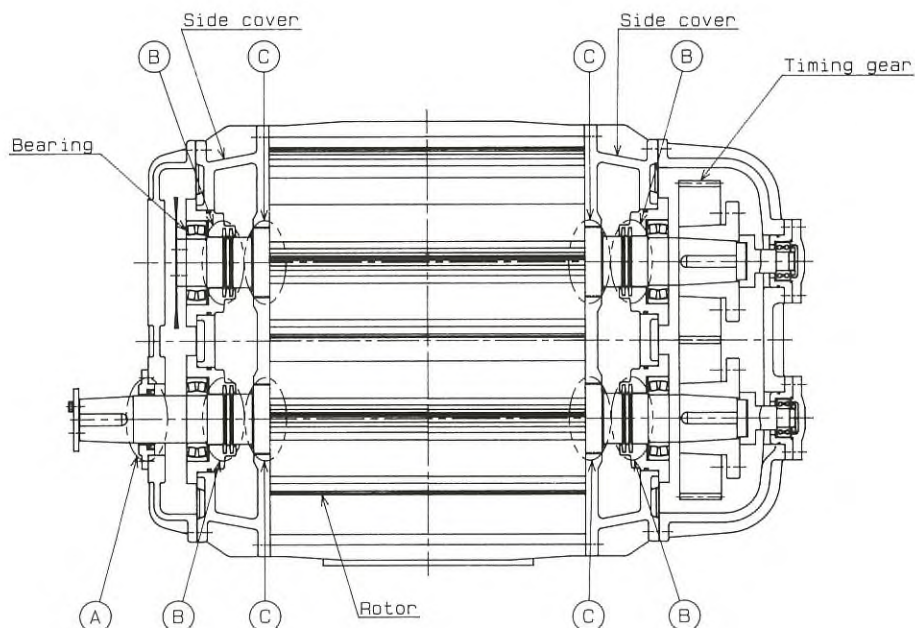
Mechanical seals are provided at four points on the back of the bearing. Used for sealing the shaft when handling solvent gases. This type is available with either single mechanical seals or double mechanical seals according to the constituents of the gas being handled.

	Type “Ba”	Type “Bb”
Seal position A	Oil seal	Oil seal
Seal position B	Single mechanical seal	Double mechanical seal
Seal position C	Labyrinth seal	Labyrinth seal

4. Four-mechanical seal “I” type:

Mechanical seals are provided at four position of the rotor shaft. Handled gas is completely separated from the bearing.

	Type “Ia”	Type “Ib”
Seal position A	Oil seal	Oil seal
Seal position B	Labyrinth seal	Labyrinth seal
Seal position C	Single mechanical seal	Double mechanical seal



Material construction

The Standard material construction

Casing & covers : Cast iron (FC250)

Rotor : Ductile cast iron (FCD450) or
cast iron (FC250)

Shaft : Carbon steel (S45C)

Timing gear : Chromium Molybdenum
steel (SCM420H)

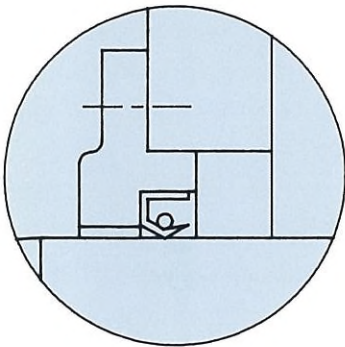
“O” ring·Lip seal : NBR

Special material construction

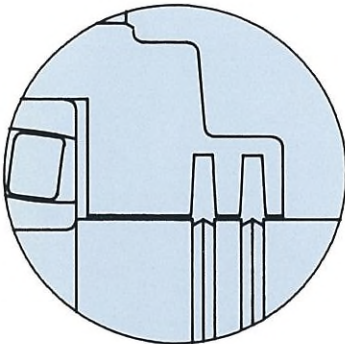
Stainless cast steel (SCS13, SCS14 Duplex
stainless steel) Ductile cast iron, Cast
steel, Plating.

Blowers with the special high design
pressure are available.

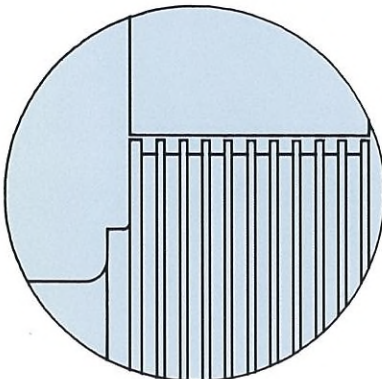
Detail of the standard shaft seal



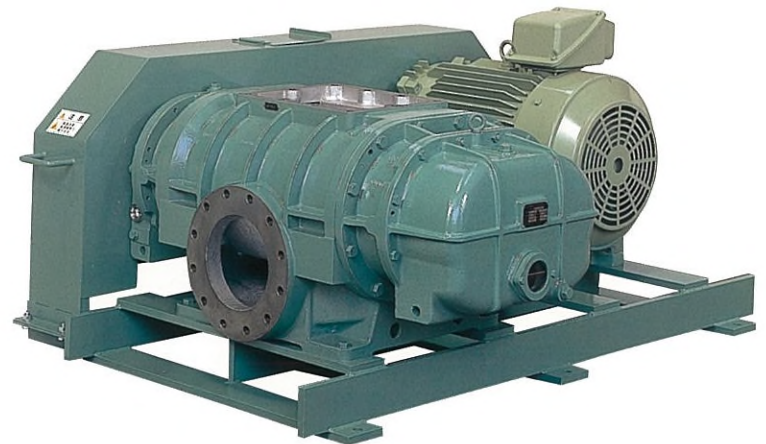
Seal position A
(Oil seal)



Seal position B
(Labyrinth seal)



Seal position C
(Labyrinth seal)



Back-flow Cooling System

The Unozawa Back-flow Cooling System was developed by incorporating Unozawa's extensive experience, outstanding achievements and technical expertise in the area of rotary blowers and vacuum pump—a background of many years of accumulated experience. Back-flow ingeniously utilizes the working principles of a rotary vacuum pump (blower) to reduce discharge temperature, thereby providing many conspicuous advantages noted below,

1. High temperature gases can be handled:

Usually when the temperature of the suction gas is high, it is generally cooled down to approx. 40°C by using a pre-cooler. When using Unozawa back-flow cooling, however, high temperature gas can be handled without cooling it. Although allowable temperature differs depending on working conditions, even gas at 120°C can safely be handled.

2. Can be used at a higher pressure ratio:

When using a vacuum pump or blower at a high-pressure ratio, discharge gas temperatures rise due to the compression heat. When using the back-flow cooling system, however, a vacuum pump or blower can be used with a high compression ratio. Thus, the service range can be expanded greatly.

In the case of single stage vacuum pumps, safe operation can be ensured up to -65kPa of suction pressure.

In the case of single stage blowers, safety can be ensured up to 120kPa discharge pressure.

3. No cooling water required for lubricant:

When employing the back-flow cooling system, no lubricating oil cooling water is required when suction temperature stands at room temperature: No cooling water is required even when using a vacuum of up to -65kPa.

4. No seal water required:

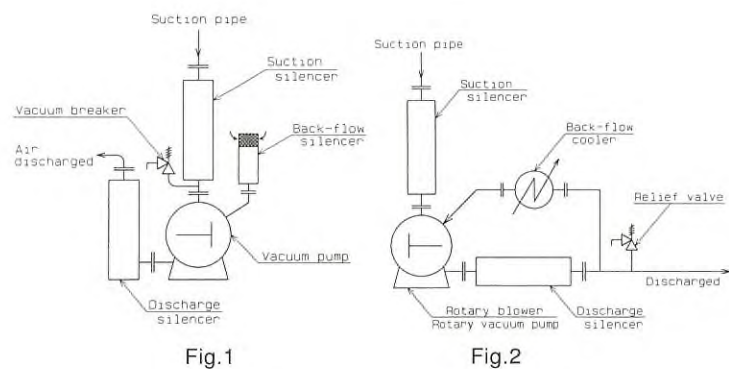
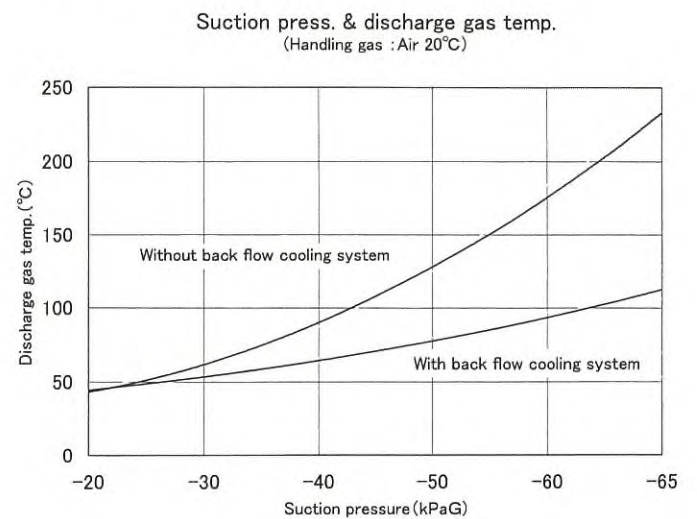
In the case of vacuum pumps, they can be run without using any inside seal water even at a high vacuum, so they are quite convenient when water or drainage is not easily accessible.

5. Open air can be used for Back-flow cooling:

When employing the back-flow cooling for vacuum pumps, open air shall be introduced as cooling air and compression should be made with atmospheric. Simply, the open air shall be provided with a back-flow intake silencer. (Fig. 1)

6. Can be applied for the special gas handled:

When the blower or vacuum pump handles special gas, the exhaust gas shall be cooled by heat exchanger and can be used as back-flow cooling gas. (Fig. 2)

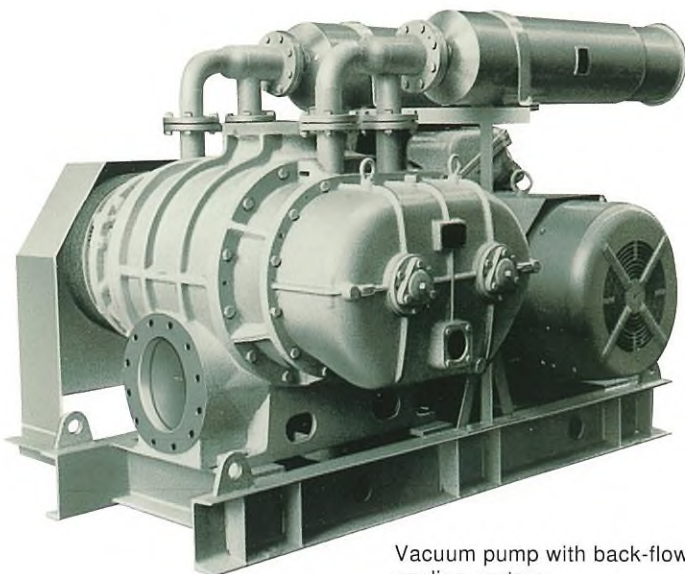
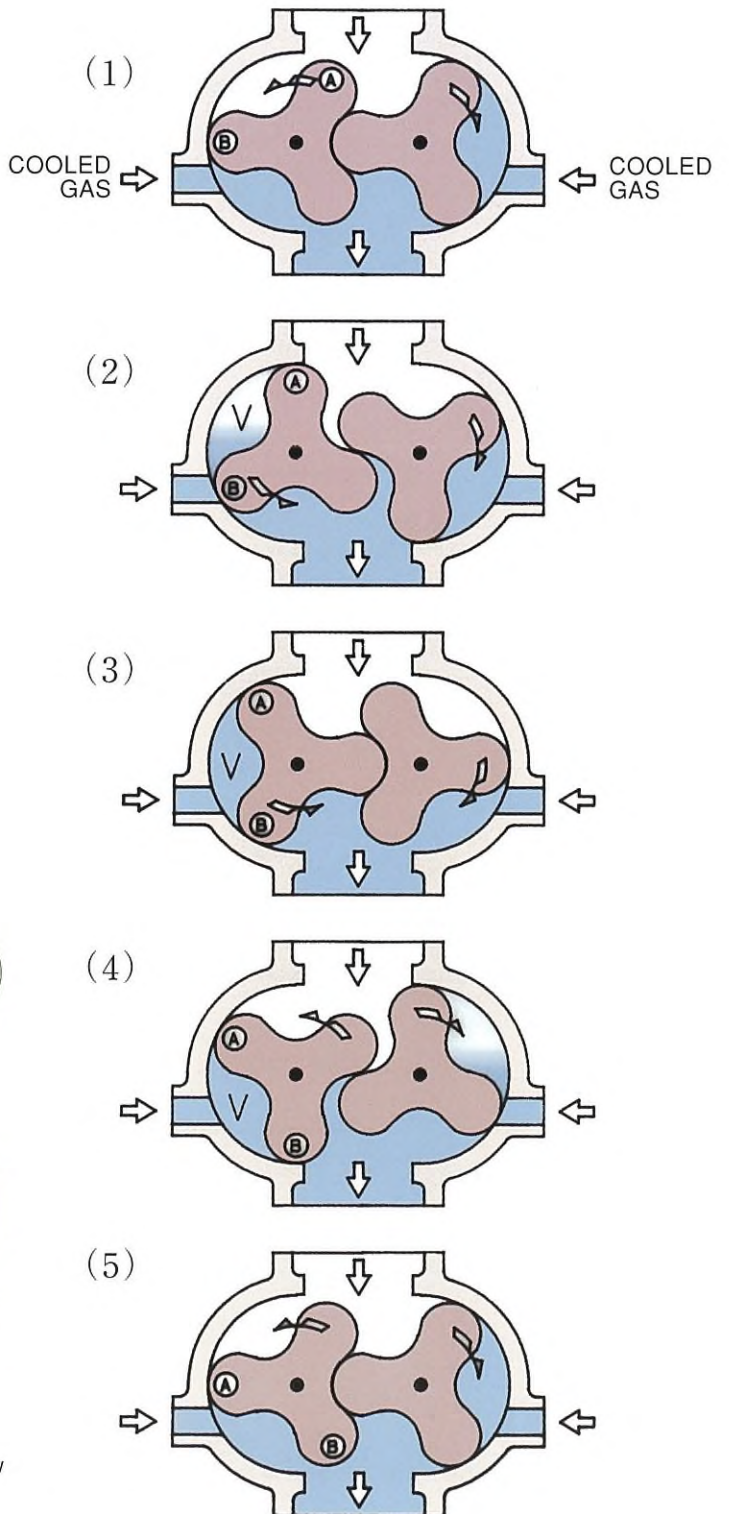


Principle of Operation

What are operating principles of a vacuum pump with back-flow cooling system?

The rotor turns in the sequence of (1) to (5). The light section of the drawing indicates the vacuum (suction pressure), while the dark section indicates the discharge pressure. The left side rotor indicates back-flow cooling system function.

- (1) The rotor tips A and B are positioned to catch suction gas in volume "V" (moving volume).
- (2) The rotor has completely caught suction gas in volume "V" and cooled gas whose pressure is the same as the discharge pressure has to flow back.
- (3) Furthermore, as the rotor turns, the cooled gas continues to flow into volume "V", causing the pressure in volume "V" to approximate that of the discharge pressure.
- (4) The pressure in volume "V" nearly equals the discharge pressure in the discharge port.
- (5) The volume "V" comes in direct contact to discharge pressure part and the gas shall be pushed in the discharge port area.



Vacuum pump with back-flow cooling system



Unozawa Products

- ① Rotary blower (Roots type)
- ② Rotary vacuum pump (Roots type)
- ③ Dry Vacuum pump
- ④ Mechanical booster
- ⑤ Water ring Vacuum pump
- ⑥ Reciprocating Vacuum pump
- ⑦ Pneumatic conveyor
- ⑧ Deaerator

Inquiries

When inquiring about Unozawa three lobe rotary blowers, please furnish the following information.

- 1.Application: Water aeration, pneumatic conveying, filter, intra-furnace air blowing, etc...
- 2.Specification: Capacity, suction and discharge conditions (Temperature, pressure)
- 3.Type of gas: Name of gas, gas constant, corrosiveness, character and quantity of liquid contained.
- 4.Conditions for installation: Whether indoors or outdoors, ambient temperature, condition of dust, etc...
- 5.Drive: Type, rpm and frequency of motor to be used.
- 6.Accessories, spare parts: Required or not
- 7.Color of paint:

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