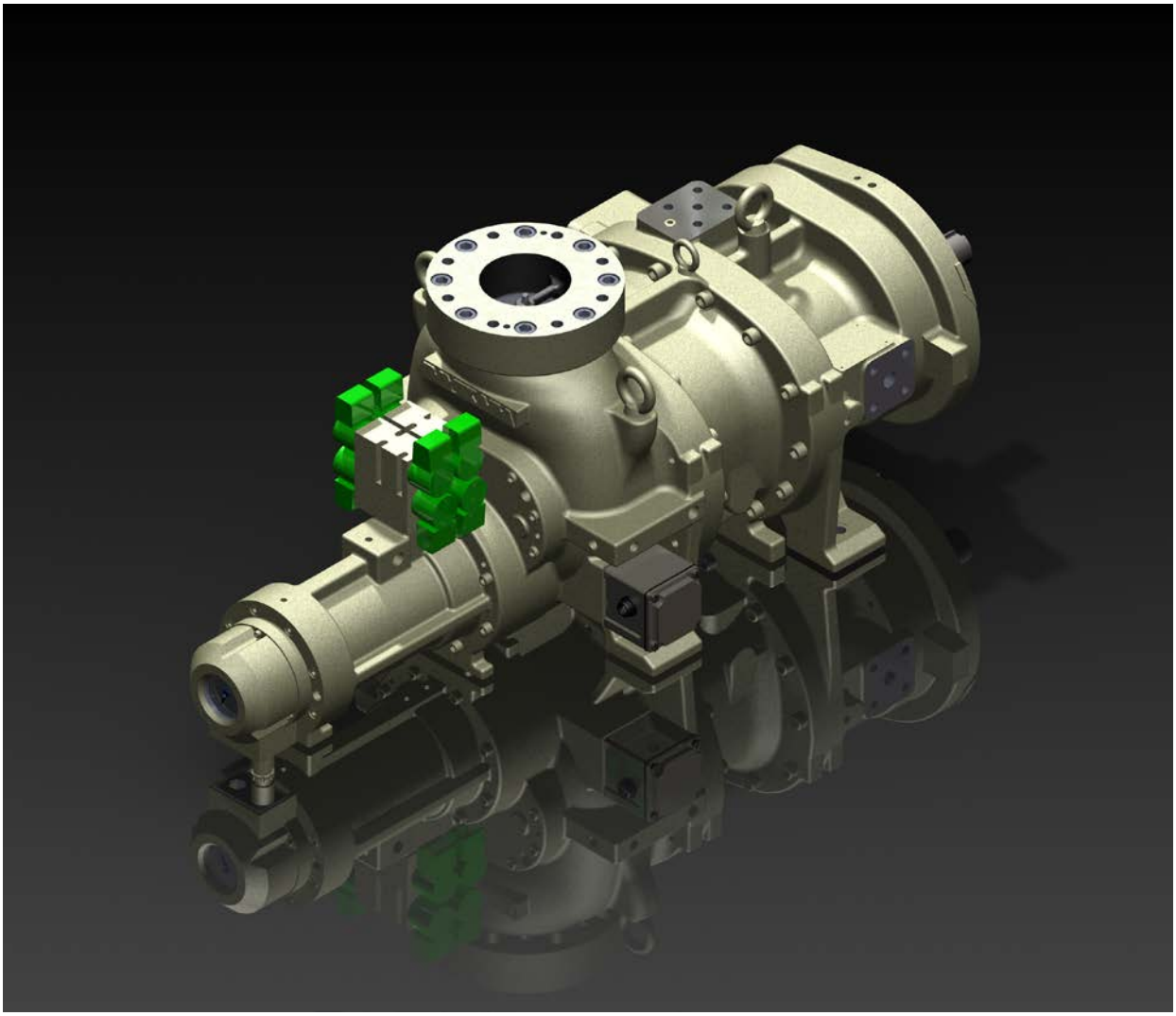
2206B0JE-DA-J-N_2016.03.

MYCOM

Screw Compressor
J-Series Instruction Manual

170JS-V/170JM-V/170JL-V
220JS-V/220JM-V/220JL-V
280JS-V/280JM-V/280JL-V



CAUTION

Before operating, maintaining, or inspecting this product, read the manual thoroughly and fully understand the contents.
Keep the operation manual in a safe, designated place for future reference whenever the need arises.
Specifications of this product are subject to change without prior notice.

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Preface

Thank you for purchasing this MYCOM J-series/screw compressor (hereinafter indicated as "this product").

This instruction manual (hereinafter indicated as "this manual") describes safety information, operational and maintenance procedures in detail for safe and effective use of this product、and applies to the following types.

170JS, 170JM, 170JL, 220JS, 220JM, 220JL, 280JS, 280JM, 280JL

Before installing or using this product, make sure you read this manual.

Keep this manual in a safe place near the product for quick reference.

Revision History

Instruction manual name		Document No.	First edition issue date
J-Series Instruction manual		2206B0JE-DA-J-N_2016.03.	2009.10.01
Revision No.	**Issuance Date**	**Contents of revisions**	**Created/ approved by:**
17J0001	2010.03.15	Corrected editing error of Vi Position Sensor.	Kobayashi
17J0002	2012.01.31	Addition of 220J/280J-series	Kobayashi / Muta
03	2014.03.27	Revision by lubricating method change, other	Muta/ Hirao
04	2014.04.25	Replaced Figure 2-1, changed the unit of motor rotation speed to SI-unit	Ikehara / Muta
05	2014.05.21	Corrected the description shortage of oil filter requirements at Section 3.2.5.3	Ikehara / Kubota
06	**2016.03.04**	**Reflected the design modification. Corrected some wrong writing points and configuration table of the parts.**	**Takenouchi / Kato**

Warranty and Disclaimer

Warranty Clauses

If malfunctions or damages occur under proper usage and conditions following documents such as specifications or instruction manual of this product, or, if MAYEKAWA judges that malfunctions or damages are related to design or manufacture of the product, and if the malfunctions or damages are within the warranty period, we will repair or replace the product without any charges.

The warranty period is “12 months from factory shipment of this product”. If use of this product is governed by any other contracts, they will be given priority.

Disclaimer Clauses (Exclusion of Warranty Clauses)

Please note that we disclaim any responsibility for damage or malfunction to this product, as described in the following items.

- Malfunction or damage of this product caused by natural disaster, or other accidental forces (such as windstorm, intense rainfall, flood, tidal wave, earthquake, land subsidence, thunderbolt, fire, etc.).
- Malfunction, damage, or defect to this product due to abnormal or improper use (such as storing this product outdoors or in locations subject to high temperatures and high humidity, unexpected inspections, tests, operations, and excessive repetition of start-up/stoppage of the product.).
- Malfunction or damage caused by devices or equipment not provided by MAYEKAWA including operation control methods of those devices.
- Malfunction or damage caused by refrigerants, gases, or lubricants not approved for this product.
- Malfunction or damage caused by maintenance or inspection not recommended by MAYEKAWA.
- Malfunction or damage caused by parts that are not MAYEKAWA genuine.
- Malfunction or damage caused by remodeling the product without the approval of MAYEKAWA.
- Direct or indirect production warranty or all other related warranties that arose due to malfunction or damage of this product.

Important Information

Intended Use of This Product

This product is a general-purpose screw compressor intended for refrigeration and cold storage.

Do not use the product for any purposes for which it was not intended or which depart from the specifications. For specifications of this product, refer to “2.3 Compressor Specifications”.

The maintenance items described in this manual should be performed safely and closely following procedures.

Important Information for Safe Use of This Product

Although MAYEKAWA has paid a lot of attention to safety measures for this product, all hazards including potential hazards caused by human errors, or due to environmental conditions can not be anticipated.

There are guidelines that must be observed for operating this product. However, the warnings in this manual and safety labels on the product are not all inclusive. When operating this product, pay extreme caution on personnel safety as well as on items described in this manual.

Important rules for safety work with the product that apply to all workers including managers and supervisors are listed below.

Before using this product, carefully read and fully understand the contents written in this manual and pay attention to safety.

- Operation, maintenance, and inspection of this product should be performed by qualified personnel educated about the fundamentals of the product and trained about hazards involved and measures to avoid danger.
- Do not allow any person other than those educated on the fundamental expertise of the product and trained about hazards involved and measures to avoid dangers to approach the product while it is operating or during maintenance.
- Observe all related federal/national and local codes and regulations.
- To prevent accidents, do not carry out any operation or maintenance other than those described in this manual, or use the product for any unapproved purpose.
- Replace the parts with the MYCOM genuine parts.
- Not only workers but also managers should actively participate safety and health activities in the workplace to prevent accidents.
- When closing or opening valves during work, apply lockout/tagout without failure, to prevent the valves from closing or opening accidentally during the work.

[Lockout] To lock with a key in order to keep people, except the workers involved, from operating the product.

“Lockout” means disconnecting or keeping disconnected machines and devices by locking their energy (power) sources. Lockout is not just simply turning off the power switches to stop the supply of power, but includes immobilizing them with a key or similar device to keep any blocked switches from being operated.

Lockout devices are devices such as keys, covers, and latches, to immobilize switches, valves, opening and closing levers, etc., with a state of being locked.

[Tagout] To prevent any inappropriate work by hanging tag plates indicating “work in progress”.

“Tagout” means to clearly indicate, by hanging tag plates, that a device is in lockout and that operation of the device is prohibited. Tag plates forbidding operation, starting, opening, etc. are warnings clearly stating to not operate energy (power) sources, and are not for stopping blocking devices.

Observe the following precautions when performing maintenance work on electrical control.

- Electrical maintenance of the product must be performed by certified/qualified personnel and only those educated about the electrical control of the product.
- Before servicing or inspecting the electrical equipments or devices, turn "OFF" the motor main power and control power, and perform lockout/tagout to prevent the power from being turned on during work.

Even when the motor main power and control power are turned "OFF", this product may be turned on if the power is supplied from outside the refrigeration system, cold storage, and air conditioning unit. Make sure the power supply on the power source side is shut off, and perform lockout/tagout to prevent the product from being turned on during work.

About This Manual

- This product may be modified without prior notice. Therefore, the appearance of actual machine may differ from the descriptions in this manual. If you have any questions contact your sales offices or service centers.
- This manual is in English. If any other language is required it is the customers responsibility to prepare a manual for safety education and operation instructions.
- This manual is copyrighted. Drawings and technical references including this manual shall not, in whole or part, be copied, photocopied, or reproduced into any electronic medium or machine-readable form without prior permission from MAYEKAWA.
- Photographs or drawings included in this manual may differ from the appearance of actual product.
- If this manual is lost or damaged, immediately place a purchase order to your local sales office or service center for a new manual. Using the product without the manual may result in safety issues.
- If you resell the product, never fail to attach this manual to the product.

Construction of This Manual

Title of section and chapter	Description details
Preface	Describes the outline of this manual and how to read the manual.
Warranty and Disclaimer	Describes clauses and coverage of warranty. Exemption of warranty clauses is described as disclaimer.
Important Information	Describes important information related to this product and this manual.
1. Safety	Describes safety information for the worker, safety rules for this product, and management details regarding work safety required for handling the product.
2. Structure and Specifications of the Compressor	Describes the main components of this product, functional information, specifications, and operating limits.
3. Installation	Describes installation procedure of this product.
4. Compressor and Package Operation	Describes precautions for operating this product.
5. Maintenance and Inspection	Describes sections and period for inspecting, disassembly and assembly of the product.
6. Troubleshooting	Describes troubleshooting methods for the product in case problems occur during operation of the product.
7. Related Documents	Describes documents such as illustrated parts breakdown and parts list.
Appendix	Describes tips for design, manufacturing, and installation of the compressor package.
Contact Information	Describes contact information for our local sales offices or service centers, which are for ordering MYCOM genuine parts.

Table of Contents

7 Related Documents

Appendix 1 Tips for Design, Manufacturing, and Installation of the Compressor Package

Contact Information

1 Safety

1.1 Observation/Prevention

1.1.1 Observance (Do's)

1.1.1.1 Do's on Operation

- Always use the specified controller (CP4) designed for this product.
- This controller protects the compressor utilizing sensor output values.
- Make sure that all necessary safety devices are installed and the control values for machine protection are set correctly.
- Regularly inspect the safety devices and the controller's protective functions. Ensure that they operate properly.
- If the safety devices and the controller's protective functions do not work properly or the machine operates abnormally, stop operation immediately and report the incident to your supervisor. Do not restart the machine until the supervisor determines the machine safety and provides proper instructions for restart.
- If the machine stops due to unknown reasons, immediately inform your supervisor. Do not restart the machine until the supervisor determines the machine safety and provides the proper instructions for restart.
- Some types of refrigerants generate bad smell or toxic gases and cause oxygen deficiency. Make sure to ventilate the working area.
- Some refrigerants and refrigerant oils may be corrosive, decomposable, or toxic. Make sure to obtain the Safety Data Sheets (SDS) of the refrigerants and refrigerant oils and follow their instructions.
- When stopping the compressor for a long time, turn "OFF" the main motor, heater, and control power. Close the suction and discharge side shut-off valves.

1.1.1.2 Do's on Maintenance

- When performing work with at least two or more persons, thoroughly confirm the work procedure and clearly understand each others work before commencement.
- Always turn OFF and lockout /tagout the main motor, control and other devices before troubleshooting, setup, cleaning, maintenance, or inspection of the compressor. Also, make sure that those powers are NOT turned on accidentally during work.
- Always confirm that the pressure inside the package (refrigerating/cold storage/ air conditioning) is atmospheric before troubleshooting, setup, cleaning, maintenance or inspection of the compressor.
- Before troubleshooting, setup, cleaning, servicing or inspection of the compressor, apply lockout/tagout or other equivalent measures to the liquid supply stop valves and valves in the upstream and downstream of any opening so that the valves do not open accidentally during the work.
- Some types of refrigerants generate bad smell or toxic gases and cause oxygen deficiency. Make sure to ventilate the air during work.
- Some refrigerants and refrigerant oils may be corrosive, decomposable, or toxic. Make sure to obtain the Safety Data Sheets (SDS) of the refrigerants and refrigerant oils and follow their instructions.
- After working on the machine, always store the tools used at the specified places and make sure that no tools are left in or around the machine.

1.1.1.3 Do's on Lockout/Tagout after Shutting off the Power

- Prepare lockout/tagout devices for the main breakers of the main motor and control power.
- By applying lockout/tagout after shutting off the power, you can prevent any other personnel from activating the machine (power) inadvertently and protect safety of the personnel working inside the power supply equipment and the package.
- If there are any possibilities of danger during work (especially during cleaning, maintenance, inspection, or troubleshooting), turn "OFF" the main motor and control power, and perform lockout/tagout.
- Before entering the package for troubleshooting, setup, cleaning, or maintenance/inspection, always apply lockout/tagout to the main motor and control power personally.
- Shut off the power and perform lockout/tagout before entering the package. Clearly notify the workers of the necessity of lockout/tagout.
  - It is assumed that workers do not perform lockout/tagout of the main motor and control power before starting work because it is troublesome, and only turn "OFF" the main motor and control power.
  - It is assumed that workers only turn off main motor and control power and do not lockout/tagout the main motor and control power, because they think it is not important.
- After checking that all the work is finished, the worker who applied lockout/tagout must release them.

1.1.1.4 Do's about Personal Protective Gear

- Prepare and use protective gear complying with the area’s safety standards.
- Check the function of each protective gear before use.
- Wear appropriate work cloth and avoid loose clothing.
- Do not wear any neckties or jewelry that can get entangled in the moving or rotating parts. A helmet is recommended to protect your head and hair.
- Do not have anything in your pocket to prevent objects from falling into the machine.

1.1.1.5 Do's about Handling of Hazardous and Toxic Substances

- Obtain Safety Data Sheets (SDS) from manufacturers of hazardous and toxic substances.
- Check the SDS and follow the handling instructions recommended by the manufacturers to handle and store those substances.

1.1.1.6 Do's about Handling Emergency Situation

- Develop an emergency action procedure in accordance with the legal regulations and post it at a safe place.

1.1.1.7 Do's about Waste Oil, Fluid, and Materials

- Disposal of refrigerant and waste oil from the compressor are subject to a number of regulations for environmental protection purposes. Follow the local, state or federal acts and regulations as well as your company's rules, when disposing of such waste oil, fluid and materials.

1.1.1.8 Other Do's

- Keep the floor around the refrigerating, cold storage, and air conditioning packages clean and provide a safety aisle.
- Use only the safety aisle to move around the equipment. Keep the safety aisle free from any tools and cleaning fluid.
- If water or oil is spilled on the compressor or the floor, immediately wipe it off to prevent workers from injury caused by slipping.

1.1.2 Prohibition (Don'ts)

- Do not remove or relocate any safety devices, including electrical interfaces.
- Do not disable any safety devices by short-circuiting or bypassing without any permission.
- Do not leave the compressor unsafe and unattended, by removing the safety cover or some other safety measures.
- Do not touch, clean, or lubricate any part of the compressor especially moving parts when the compressor is operating.
- Do not touch relays or electric systems such as terminal block with bare hands when turning on the power.

1.2 Warnings

To alert workers about possible dangers, the following two measures are always provided with the compressor.

- Warnings described in this manual
- Safety labels affixed on the compressor

1.2.1 Types and Meanings of Warnings

This manual includes the following four types of warnings to be used for hazards during operation or maintenance of the compressor.

Neglecting such warnings may cause accidents, resulting in personal injury or even death. Also, the compressor or its auxiliary equipment may be heavily damaged. Therefore, be sure to always observe the instructions of the warnings.

Table 1-1 Types and Meanings of Warnings in this manual

Warning Type	Meaning
DANGER	Indicates an imminently hazardous situation which, if not avoided, will result in serious injury or death.
WARNING	Indicates a potential hazardous situation which, if not avoided, could result in serious injury or death.
CAUTION	Indicates a potential hazardous situation which, if not avoided, may result in minor or moderate injury.
CAUTION	Indicates a potentially hazardous situation which, if not avoided, may result in property damage.

1.2.2 Safety labels

The following shows the types of safety labels and their positions affixed on the compressor.

Always follow the warnings instructed on the safety label affixed on the compressor.

WARNING

- **Be sure to follow the instructions of the safety labels. Otherwise, danger resulting in personal injury, death, or property damage may arise.**
- **Do not smear, cover, or peel off the safety labels.**
- **If the safety labels are damaged or missing, purchase and affix new labels to their proper positions according to this manual.**

【POINT】

- Inform our service centers of the product name and safety label number when placing a purchase order for safety labels.

■ Types of Safety Labels

Table 1-2 Safety Label

No.	Safety label	Remarks
1		
2		

■ Affixing Positions of Safety Labels

The figure below shows the affixing positions of safety labels.
The numbers in the figure correspond to the ones in Table1-2 Safety Label.

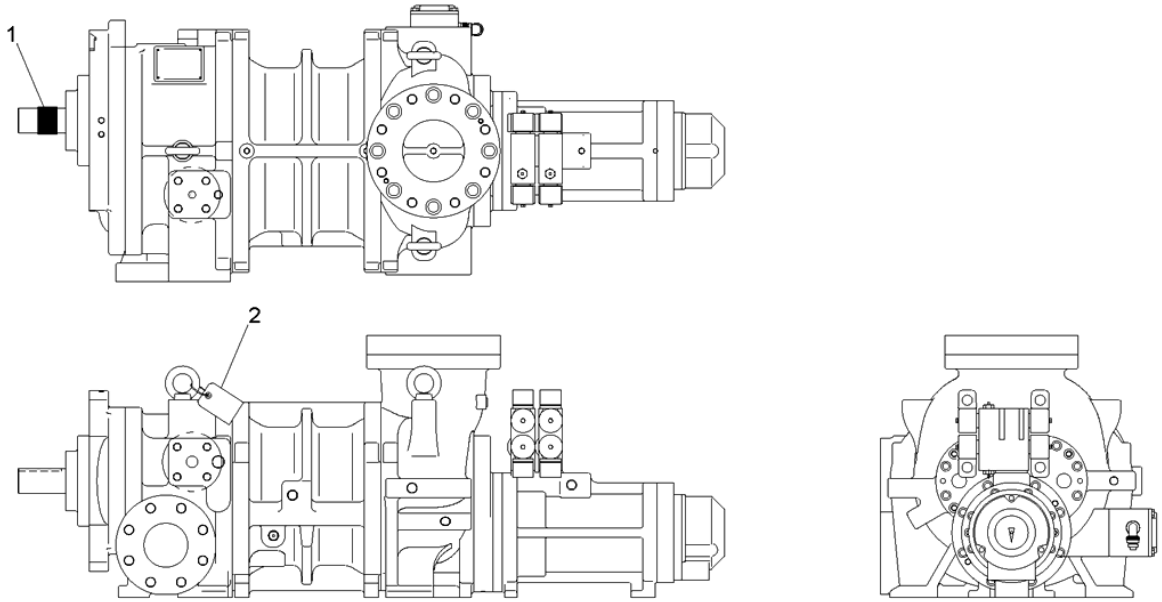


Figure 1-1 Safety Label Locations (170J/220J)

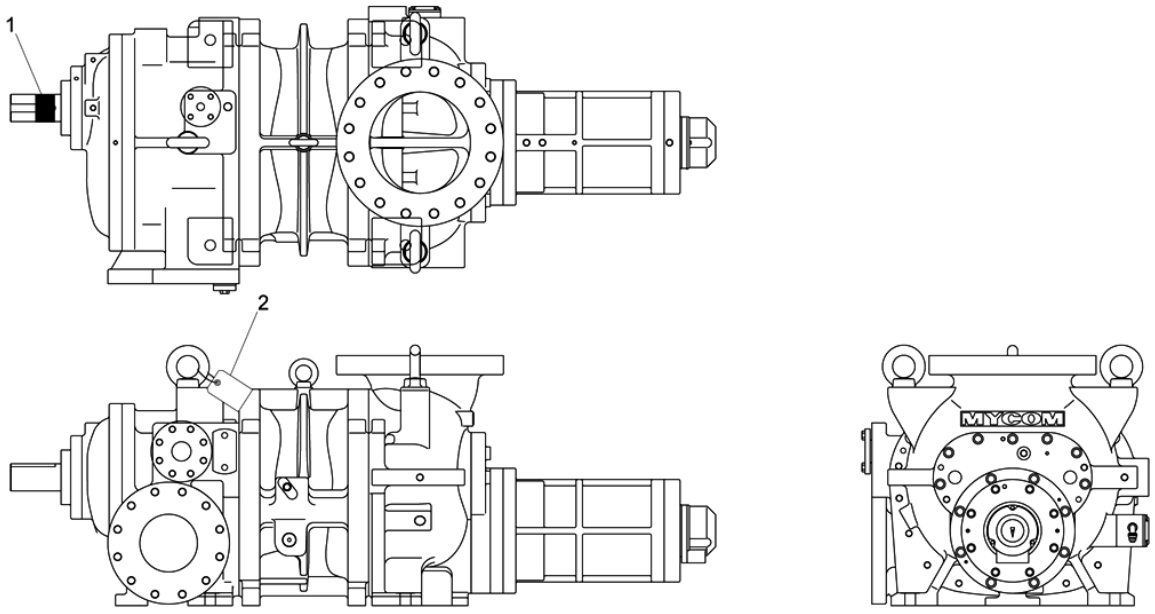


Figure 1-2 Safety Label Locations (280J)

1.3 Residual Risks

The following information is provided on the assumption that this product is operated, inspected, and maintained while being used in general refrigerating, cold storage, and air conditioning packages. Note that all hazardous sources cannot be predicted for the applications mentioned.

Devise appropriate countermeasures for hazardous sources in your systems.

Table 1-3 Hazardous Sources

	Danger source	Predicted hazard	Measures to be taken in operation	Measures to be taken when cleaning, inspecting, and replacing parts
A	Motor and compressor coupling	Entanglement caused by contact	Install coupling covers and prohibit opening Keep away	Shut off and lockout/tagout of motor's main power and control power
B	Motor terminals	Electric shock caused by live wiring contact and electrical leakage	Keep away Do not open terminal box Do not touch terminal box	Shut off and lockout/tagout of motor's main power and control power
C	Compressor suction casing	Frostbite caused by contact Contact with or inhalation of hazardous substances caused by leaking refrigerant, etc.	Keep away and do not touch Wear protective gear Gas leakage detection	Wear protective gear Work under normal temperature
D	Compressor discharge casing	Burn caused by contact Contact with or inhalation of hazardous substances caused by leaking and blowing off refrigerant, etc.	Keep away and do not touch Wear protective gear Sufficient ventilation Gas leakage detection	Wear protective gear Work in temperatures below 40 °C Appropriate refrigerant handling Sufficient ventilation
E	Discharge piping			
F	Lubricating piping and joints			
G	Package unit Solenoid valves/motorized valves on each part	Electric shock caused by live wiring contact and electrical leakage Trapping caused by contact with a drive part	Install terminal protective cover and prohibit opening Keep away and do not touch Wear protective gear	Shut off each breaker, and shut off and lockout/tagout the control power Wear protective gear

	Danger source	Predicted hazard	Measures to be taken in operation	Measures to be taken when cleaning, inspecting, and replacing parts
H	Package unit Electric components of each part (oil heater, protective switch, etc.)	Electric shock caused by live wiring contact and electrical leakage Burn caused by contact	Install terminal protective cover and prohibit opening Keep away and do not touch Wear protective gear	Shut off each breaker, and shut off and lockout/tagout the control power Wear protective gear
I	Package unit Oil drains	Contact with hazard-ous substances caused by leakage and blowoff Burn caused by contacting with high temperature fluid	Sufficient ventilation Keep away and do not touch Wear protective gear	Sufficient ventilation Wear protective gear Work in temperatures below 40 °C
J	Noises	Hearing disabilities caused by noises	Wear protective gear	—

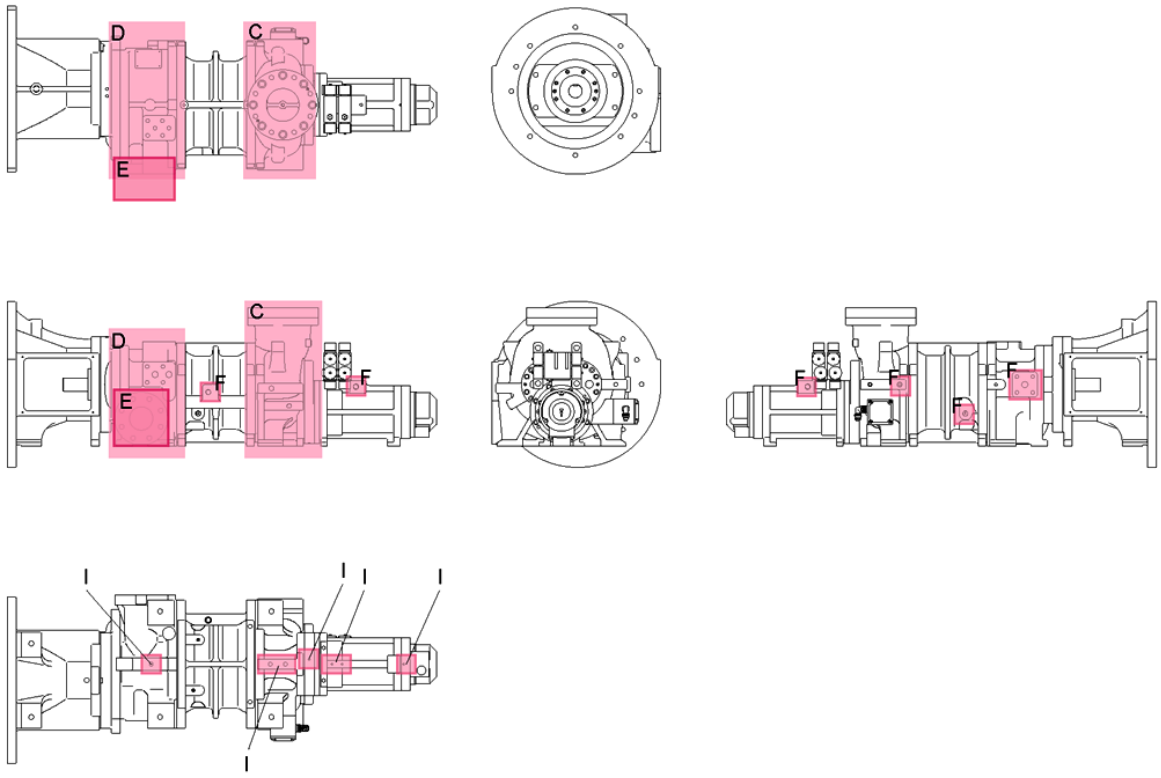


Figure 1-3 Hazardous Sources (170J/220J)

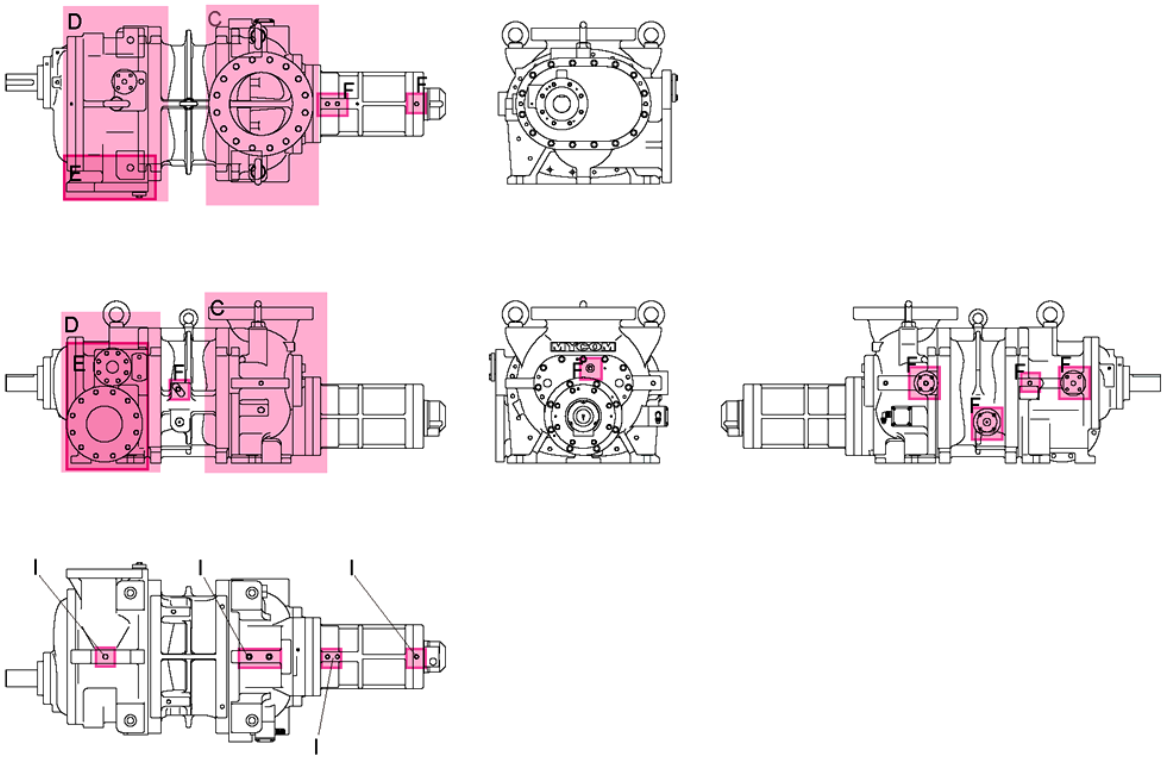


Figure 1-4 Hazardous Sources (280J)

1.4 Safety Devices

For safe use and protection of the compressor, make sure to attach safety devices to the compressor that comply with the regulations and the following descriptions.

Safety devices must be properly and periodically maintained and inspected. It is important to include maintenance and inspection of safety devices in the periodical maintenance/inspection schedule. Make sure to provide users of the compressor with necessary information on types, attachment positions, functions, inspection method of the safety devices.

WARNING

- **Check the safety devices after turning on the power and before operation of the compressor. If they do not operate normally, immediately take measures to replace them.**

1.4.1 Emergency Stop Button

Overview/Function/Purpose

The emergency stop buttons are used to stop the compressor operation immediately if an emergency occurs to the compressor.

Installation Locations

The emergency stop buttons should be installed in the controller on the compressor and in the operating control room

Stop/Reset Methods

To activate and reset the emergency stop buttons, refer to the unit instruction manual.

Inspection Method/Cycle

The emergency stop buttons must be tested before a test run as well as periodically. For details about the inspection procedure and inspection cycle of the emergency stop buttons, refer to the unit instruction manual.

1.4.2 Breakers for the Main Motor Power and Control Power (with Lockout/Tagout Devices)

Overview/Function/Purpose

Turn off the main motor and control power, and if there are any possibilities of danger during work (especially during cleaning, maintenance, inspection, or troubleshooting), lockout/tagout devices must be set up for breakers of the main motor and control powers to prevent injury to workers in case the power is turned on accidentally during work.

Methods of Performing and Releasing Lockout/Tagout

In accordance with the regulations created by Occupational Safety & Health Administration (OSHA) and other authorities, make sure to clearly indicate methods of performing and releasing lockout/tagout and provide users of this compressor with the necessary information.

Inspection Method/Cycle

For inspection procedures and the inspection cycle of the lockout/tagout devices, refer to the unit instruction manual.

1.4.3 Compressor Protection Devices

■ Overview/Function/Purpose

To protect the compressor, the following safety functions of the CP4 controller are used.

■ Protection from High discharge temperature

This function stops the compressor when the discharge temperature exceeds the set value.

A temperature sensor is installed in the oil separator.

■ Protection from High oil temperature

This function stops the compressor when the oil temperature exceeds the set value.

A temperature sensor is installed in the package lubrication piping after the oil cooler.

■ Protection from abnormally High pressure

This function stops the compressor when the discharge pressure abnormally rises due to compressor misoperations or stoppage of cooling water supply to the condenser.

This function prevents explosion of the equipment and components.

A pressure sensor is installed in the oil separator.

■ Protection from abnormally Low suction pressure

This function stops the compressor when the suction pressure is below the set value.

A pressure sensor is installed in the suction piping.

■ Protection from abnormal oil pressure

This function stops the compressor when oil supply is not sufficient, the oil filter is clogged, too much refrigerant in oil, or oil supply pressure difference (from suction pressure) is below the set value. This is to protect the compressor from wear and seizure.

A pressure sensor is installed after the oil filter.

■ Protection from oil filter Differential pressure

This function stops the compressor when the differential pressure between discharge and lubrication pressure is below the set value due to clogging of filters or other reasons.

The discharge and the oil pressure sensors are used.

■ Protection from Low oil level

[Case 1 Differential pressure oil supply system]

This function constantly detects the oil level in the oil separator and stops the compressor when the oil level is below the lower limit.

Oil level sensor is installed in the oil separator.

[Case 2 Forced oil supply system]

When the oil level gets lower and the oil pump takes in the refrigerant gas, the differential pressure between before and after the oil pump decreases. When the differential pressure between before and after the oil pump is less than the specified value, the system will stop the compressor operation.

■ Protection from motor over-current

This function controls the unloader of compressor when current exceeds the set value (upper limit). In some cases, it stops the compressor.

The current value is monitored by the CP4 controller.

■ Sensor positions and settings

Refer to the package instruction manual for the positions and settings of sensors for compressor protection.

Make sure that the set values of the sensors do not exceed the operating limits indicated in Table 2-4 of this manual chapter 2.

■ Inspection Method/Cycle

Compressor protection sensors require operation tests and checking the set values before starting or operating the compressor and must be periodically inspected. For inspection methods and periods, refer to the package instruction manual.

⚠ WARNING

- **Adjust the set values and check operation of the compressor protection functions of the controller and the sensors of the package during test running.**

⚠ CAUTION

- **To test the operation of each sensor used for compressor protection, use devices such as pressure tester to check that alarms and switches operate normally. Do not operate the compressor with all the valves closed, or in any other dangerous conditions.**
- **If oil pressure, abnormal high pressure or, oil filter differential pressure protection functions operate, eliminate the cause before re-starting the compressor.**

2 Structure and Specifications of the Compressor

2.1 Features of the J-Series Screw Compressor

The J-series is a high-performance and sophisticated single-stage screw compressor with the following features: a new rotor profile utilizing MYCOM 's advanced technology (J profile); a variable Vi (internal volume ratio) mechanism that operates with various conditions; the compressor can operate with various types of refrigerants; and high design pressure of 3.5 MPa and flexibility of a wide range of operation conditions in various applications.

■ High Efficiency

The compressor is highly efficient because it utilizes MYCOM 's new "J" rotor profile.

The continuous capacity control system makes operation economical by matching the fluctuation in load.

Efficiency is not affected by variations in operation conditions because of the variable Vi control system.

■ High Reliability

The J-series has extended the operating time without overhaul because of the following features.

A new rotor profile that reduces the bearing load, radial sleeve bearings specially designed with MYCOM 's original technology and special high-load capacity thrust ball bearings.

The J-series achieves an improvement of reliability because the design pressure is higher than the standard model, O-rings are used for sealing between casing and the bellows type mechanical seal are adopted for shaft seal.

■ Easy Packaging due to Integrated Functional Devices

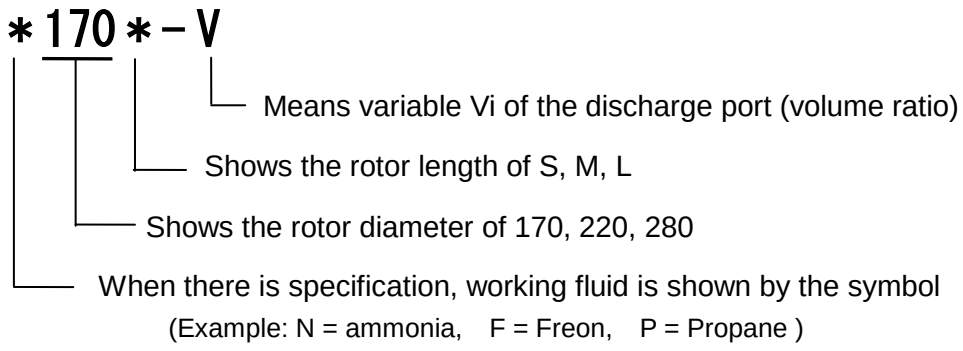
The 170J/220J series has an integrated suction check valve, a mounted hydraulic solenoid valve for capacity control and variable Vi control, and is coupled with flange motors in the standard. These features make packaging design easier.

■ Less Vibration/Noises

The new rotor profile along with other various design considerations have reduced noise and vibrations further.

2.2 Model Designation of the Compressor

The meaning of the type designation stamped on the nameplate of the compressor MODEL column is as follows.



2.3 Compressor Specifications

2.3.1 Specifications

Table 2-1 Specifications of the 170J-Series Compressor

Item			170		
			S	M	L
Refrigerant		–	NH_3, HFC, CO_2, Propane, and Propylene		
Weight		kg	685	715	760
Rotation direction		–	CCW viewed from motor		
Minimum rotation		min^{-1}	1450		
Maximum rotation		min^{-1}	4500		
Allowable maximum input power	@3550 min^{-1}	kW	360		
	@2950 min^{-1}	kW	300		
GD2		kgm^2	0.356	0.446	0.563
Suction flange		–	ANSI #300 5”		
Discharge flange		–	ANSI #300 3”		
Oil supply (discharge side)		–	ANSI #300 1”		
Oil supply (suction side)		–	Rc1/2		
Oil injection oil supply		–	Rc1/2		
Capacity control and Vi control oil supply/drain		–	Oil supply: Rc1/2 Oil drain: Rc1/2		
E port		–	ANSI #300 1”		
I port		–	ANSI #300 3/4”		
Theoretical displacement	@3550 min^{-1}	m^3/h	469	610	793
	@2950 min^{-1}	m^3/h	390	507	659
Capacity control (actual load)		–	25 to 100% (or 30 to 100% in the case of L size)		
Vi control		–	Standard: 2.5 to 5.0		
Design pressure		MPa	3.5		
Suction check valve (integrated)		–	Applicable		
Solenoid valve (integrated)		–	Available but not available for explosion proof		
Flange motor		–	Available but not available for ATEX.		
Oil filter		–	$\beta_{20} \geq 150$ (For more information, refer to Section 3.2.5.3 in this manual Chapter 3)		

Note 1: In this manual unless otherwise noted, pressure units MPa represents the gauge pressure.

Note 2: The connection flanges of the compressor conform to ANSI CLASS 300.

Note 3: The weight excluding the motor spacer is the weight of the compressor.

Table 2-2 Specifications of the 220J-Series Compressor

Item			220		
			S	M	L
Refrigerant		–	NH_3, HFC, CO_2, Propane, and Propylene		
Weight		kg	1255	1315	1385
Rotation direction		–	CCW viewed from motor		
Minimum rotation		min^{-1}	1450		
Maximum rotation		min^{-1}	4500		
Allowable maximum input power	@3550 min^{-1}	kW	750		
	@2950 min^{-1}	kW	625		
GD2		kgm^2	1.312	1.648	2.082
Suction flange		–	ANSI #300 8”		
Discharge flange		–	ANSI #300 5”		
Oil supply (discharge side)		–	ANSI #300 1”		
Oil supply (suction side)		–	Rc3/4		
Oil injection oil supply		–	Rc3/4		
Capacity control and Vi control oil supply/drain		–	Oil supply: Rc1/2 Oil drain: Rc1/2		
E port		–	ANSI #300 1 1/2”		
I port		–	ANSI #300 3/4”		
Theoretical displacement	@3550 min^{-1}	m^3/h	1030	1340	1741
	@2950 min^{-1}	m^3/h	856	1114	1447
Capacity control (actual load)		–	25 to 100% (or 30 to 100% in the case of L size)		
Vi control		–	Standard: 2.5 to 5.0		
Design pressure		MPa	3.5		
Suction check valve (integrated)		–	Applicable		
Solenoid valve (integrated)		–	Available but not available for explosion proof		
Flange motor		–	Available but not available for ATEX.		
Oil filter		–	$\beta_{20} \geq 150$ (For more information, refer to Section 3.2.5.3 in this manual Chapter 3)		

Note 1: In this manual unless otherwise noted, pressure units MPa represents the gauge pressure.

Note 2: The connection flanges of the compressor conform to ANSI CLASS 300.

Note 3: The weight excluding the motor spacer is the weight of the compressor.

Table 2-3 Specifications of the 280J-Series Compressor

Item			280		
			S	M	L
Refrigerant		–	NH_3, HFC, CO_2, Propane, and Propylene		
Weight		kg	2285	2435	2585
Rotation direction		–	CCW viewed from motor		
Minimum rotation		min^{-1}	1450		
Maximum rotation		min^{-1}	3600		
Allowable maximum input power	@3550 min^{-1}	kW	1650		
	@2950 min^{-1}	kW	1375		
GD2		kgm^2	4.887	6.134	7.765
Suction flange		–	ANSI #300 12”		
Discharge flange		–	ANSI #300 8”		
Oil supply (discharge side)		–	ANSI #300 1”		
Oil supply (suction side)		–	ANSI #300 3/4”		
Oil injection oil supply		–	ANSI #300 1 1/4”		
Capacity control and Vi control oil supply/drain		–	Capacity control Increase/Decrease : Rc1/2 on each side Vi control Increase/Decrease : Rc1/2 on each side		
E port		–	ANSI #300 2 1/2”		
I port		–	ANSI #300 1”		
Theoretical displacement	@3550 min^{-1}	m^3/h	2269	2949	3839
	@2950 min^{-1}	m^3/h	1886	2451	3190
Capacity control (actual load)		–	25 to 100% (or 30 to 100% in the case of L size)		
Vi control		–	Standard: 2.5 to 5.0		
Design pressure		MPa	3.5		
Suction check valve (integrated)		–	N/A		
Solenoid valve (integrated)		–	N/A		
Flange motor		–	Non-Available		
Oil filter		–	$\beta_{20} \geq 150$ (For more information, refer to Section 3.2.5.3 in this manual Chapter 3)		

Note 1: In this manual unless otherwise noted, pressure units MPa represents the gauge pressure.

Note 2: The connection flanges of the compressor conform to ANSI CLASS 300.

2.3.2 Operation Limits

Table 2-4 Operation Limits of the J-Series Screw Compressor

Item			Limit value
Maximum discharge pressure		MPa	3.2
Maximum suction pressure		MPa	1.0
Minimum suction pressure		MPa	-0.080
Minimum lubrication pressure		Po: Lubrication pressure, Ps: Suction pressure, Pd: Discharge pressure	
		MPa	(Po - Ps) ≧0.5
	Forced oil supply system	MPa	(Po - Pd) ≧0.05
	Differential pressure oil supply system	MPa	(Pd - Po) ≦ 0.15
Maximum suction temperature		°C	50
Minimum suction temperature		°C	-60
Maximum discharge temperature		°C	100
Maximum lubrication temperature		°C	70 but, when using in the explosion-proof area, it is 55.
Minimum lubrication temperature		°C	20
Maximum rotation speed (M rotor)		min^{-1}	4500 (280J: 3600)
Minimum rotation speed (M rotor)		min^{-1}	1450
Refrigerant		-	NH_3, HFC, CO_2, Propane and Propylene

Note 1: Pressure unit [MPa] in the table 2-4 means gauge pressure.

Note 2: The J-series compressors must be used within the allowable operation range defined in the table 2-4 and next page, Figure2-1.

⚠ DANGER

- **When using J series in the explosion-proof area, use certainly in the condition with the maximum suction temperature of equal to or less than 50 °C, the maximum lubrication temperature of equal to or less than 55 °C (Refer to Note).**
  It is important specifically in the Application limits each clause eyes.

  Note: When exceeding 55 °C, consult us for the further study because the maximum lubrication temperature limitation is related to the atmosphere temperature, too.

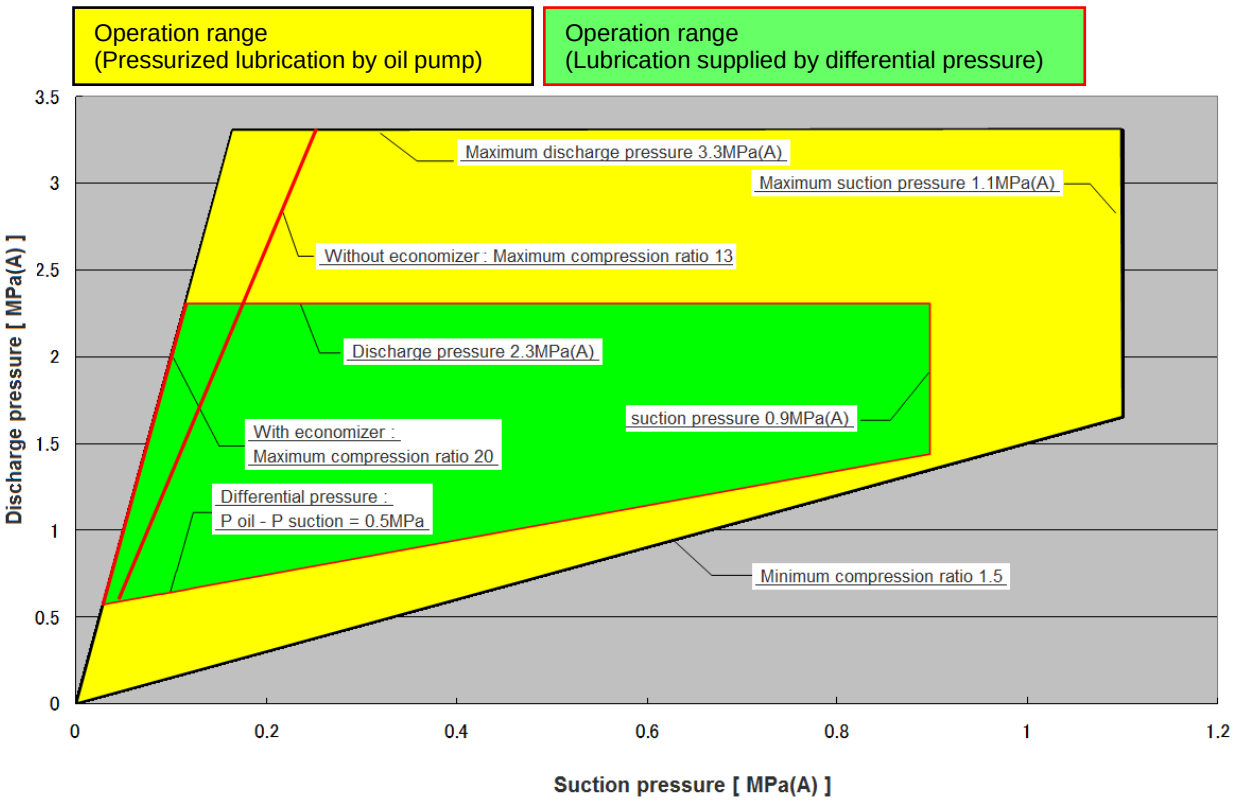


Figure 2-1 Operation Limits Chart

NOTE1: The pressure values in the operation limit chart are absolute values [MPa (A)].

2.3.3 Outer Dimensions

■ **Outer dimensions of the 170J and 220J-series (Standard Specification)**

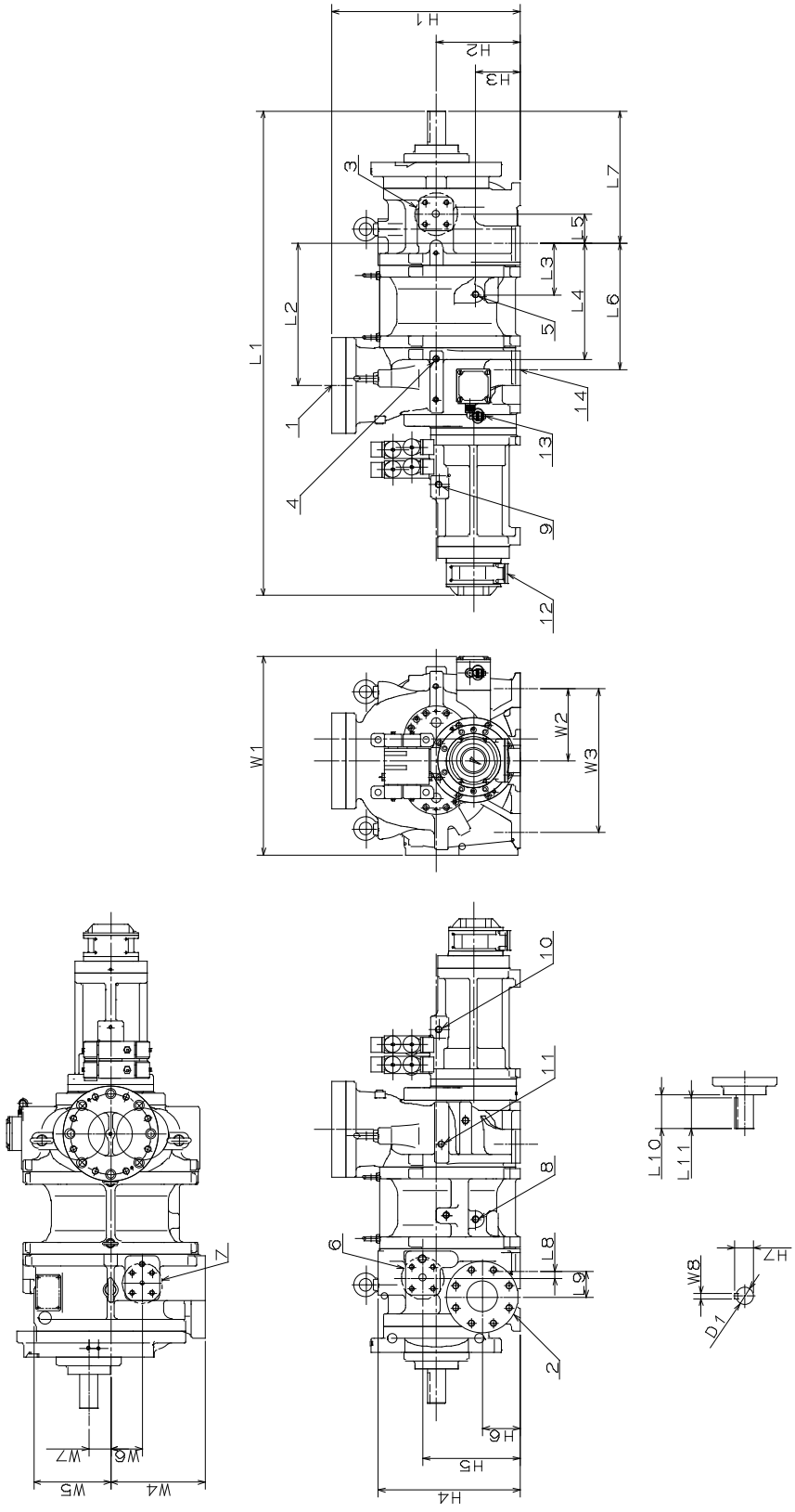


Figure 2-1 Outer Dimensions of the 170J and 220J-Series (Standard Specification)

Table 2-5 170J and 220J-series Outer Dimensions Table (Standard Specification)

Unit(mm)

Item	170J			220J		
	S	M	L	S	M	L
1： Suction	ANSI #300 5" (8-M20)			ANSI #300 8" (12-M22)		
2： Discharge	ANSI #300 3" (8-M20)			ANSI #300 5" (8-M20)		
3： Oil supply (Discharge-side)	ANSI #300 1" (4-M16)			ANSI #300 1" (4-M16)		
4： Oil supply (Suction-side)	Rc1/2			Rc3/4		
5： Oil Injection	Rc1/2			Rc3/4		
6： E-port	ANSI #300 1" (4-M16)			ANSI #300 1 1/2" (4-M20)		
7： I-port	ANSI #300 3/4" (4-M16)			ANSI #300 3/4" (4-M16)		
8： F-injection (Option)	Rc1/2			Rc3/4		
9： Hydraulic cylinder oil supply	Rc1/2					
10：Hydraulic cylinder oil drain	Rc1/2					
11：Hydraulic cylinder oil return	Rc1/2					
12：Unloader indicator connect	PF 3/4					
13：Vi-sensor connect	connector					
14：The leg hole for securing the compressor	4-ϕ19			4-ϕ23		
L1	1358	1413	1485	1680	1752	1845
L2	360	415	487	459	531	624
L3	151			190		
L4	285	340	412	357	429	522
L5	85			132		
L6	315	370	442	395	467	560
L7	385			482		
L8	20			70		
L9	75			105		
L10	100			114		
L11	90			100		
H1	550			700		
H2	245			300		
H3	130			160		
H4	415			520		
H5	285			362		
H6	110			140		
H7	56			71.5		
W1	580			721		
W2	210			240		
W3	420			480		
W4	275			340		
W5	225			285		
W6	92(F rotor side)			86 (M rotor side)		
W7	64			83		
W8	$16^{0}_{-0.043}$			$20^{0}_{-0.052}$		
D1	$52^{+0.012}_{-0.007}$			$67^{+0.012}_{-0.007}$		

■ Outer dimensions of the 170J and 220J-series (Motor Spacer)

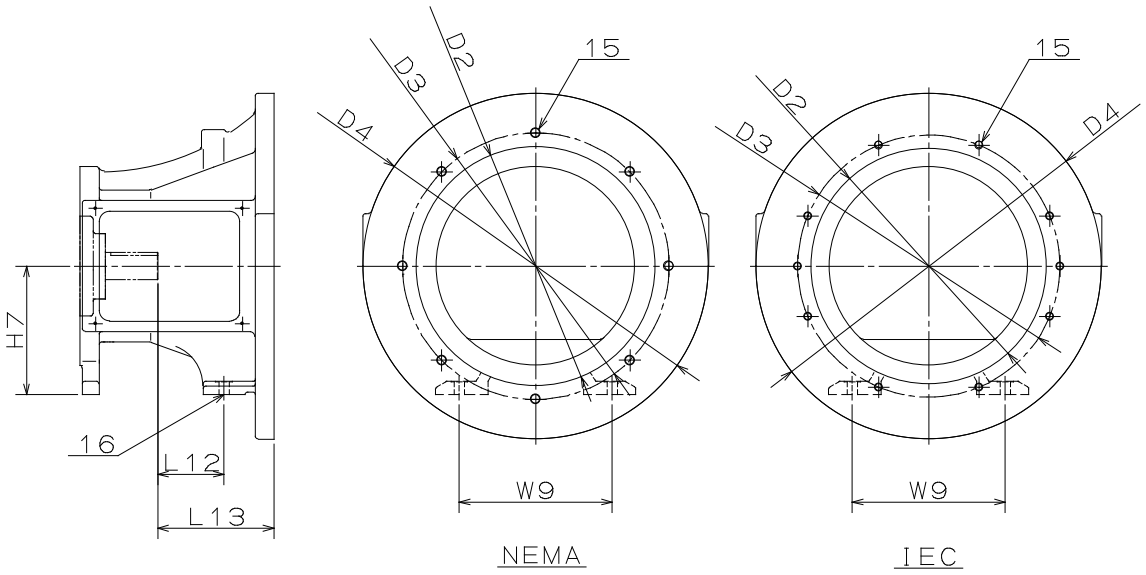


Figure 2-3 Outer Dimensions of the 170J and 220J-Series (Motor Spacer)

Table 2-6 170J and 220J-series Outer Dimensions Table (Motor Spacer)

Unit: mm

Item	170J				220J			
	NEMA		IEC		NEMA		IEC	
	44*D	50*D	FF-500	FF-600	44*D	50*D	FF-600	FF-740
15	8-M20		8-M16	8-M20	8-M20			
16	2-ϕ19				2-ϕ23			
L12	126				140			
L13	221		241		250			
H7	245				300			
W9	292				314			
D2	457.2		450	550	457.2		550	680
D3	508	558.8	500	600	508	558.8	600	740
D4	660				558	810		

■ Outer dimensions of the 170J and 220J-series (Explosion Proof)

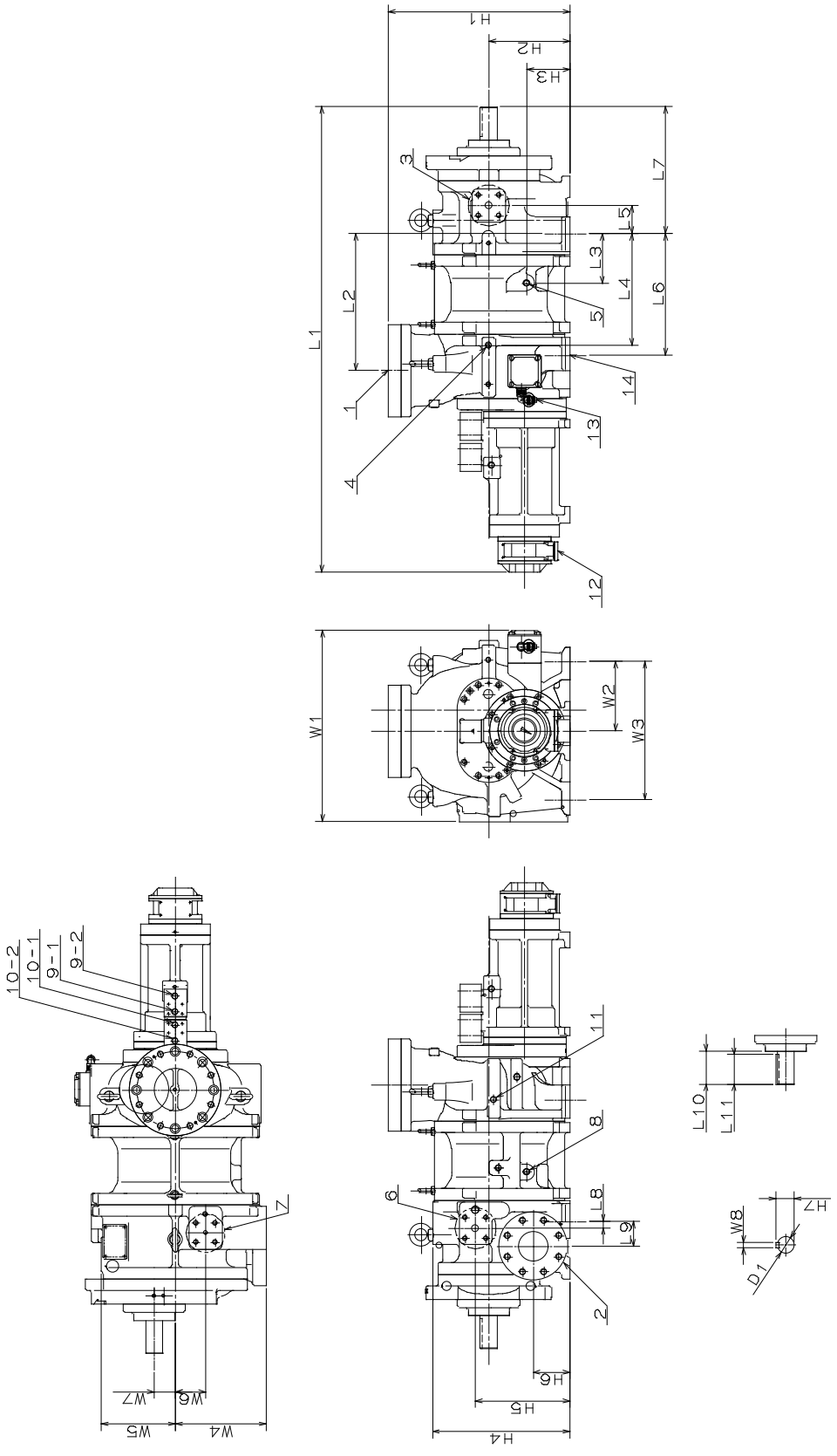


Figure 2-4 Outer Dimensions of the 170J and 220J-Series (Explosion-proof)

Table 2-7 Outer Dimensions of the 170J and 220J-Series (Explosion-proof)

Unit: mm

項目	170J			220J		
	S	M	L	S	M	L
1 : Suction	ANSI #300 5" (8-M20)			ANSI #300 8" (12-M22)		
2 : Discharge	ANSI #300 3" (8-M20)			ANSI #300 5" (8-M20)		
3 : Oil supply (Discharge- side)	ANSI #300 1" (4-M16)			ANSI #300 1" (4-M16)		
4 : Oil supply (Suction-side)	Rc1/2			Rc3/4		
5 : Oil injection	Rc1/2			Rc3/4		
6 : E-port	ANSI #300 1" (4-M16)			ANSI #300 1 1/2" (4-M20)		
7 : I-port	ANSI #300 3/4" (4-M16)			ANSI #300 3/4" (4-M16)		
8 : F-injection (Option)	Rc1/2			Rc3/4		
9-1 : Capacity control increase	Rc1/2					
9-2 : Capacity control decrease	Rc1/2					
10-1 : Vi control increase (L→H)	Rc1/2					
10-2 : Vi control decrease (H→L)	Rc1/2					
11 : Capacity control oil return	Rc1/2					
12 : Unloader indicator connect	PF 3/4					
13 : Vi-sensor connect	connector					
14 : The leg hole for securing the compressor	4-ϕ19			4-ϕ23		
L1	1358	1413	1485	1680	1752	1845
L2	360	415	487	459	531	624
L3	151			190		
L4	285	340	412	357	429	522
L5	85			132		
L6	315	370	442	395	467	560
L7	385			482		
L8	20			70		
L9	75			105		
L10	100			114		
L11	90			100		
H1	550			700		
H2	245			300		
H3	130			160		
H4	415			520		
H5	285			362		
H6	110			140		
H7	56			71.5		
W1	580			721		
W2	210			240		
W3	420			480		
W4	275			340		
W5	225			285		
W6	92(F rotor side)			86 (M rotor side)		
W7	64			83		
W8	$16^{0}_{-0.043}$			$20^{0}_{-0.052}$		
D1	$52^{+0.012}_{-0.007}$			$67^{+0.012}_{-0.007}$		

■ Outer dimensions of the 280J-series

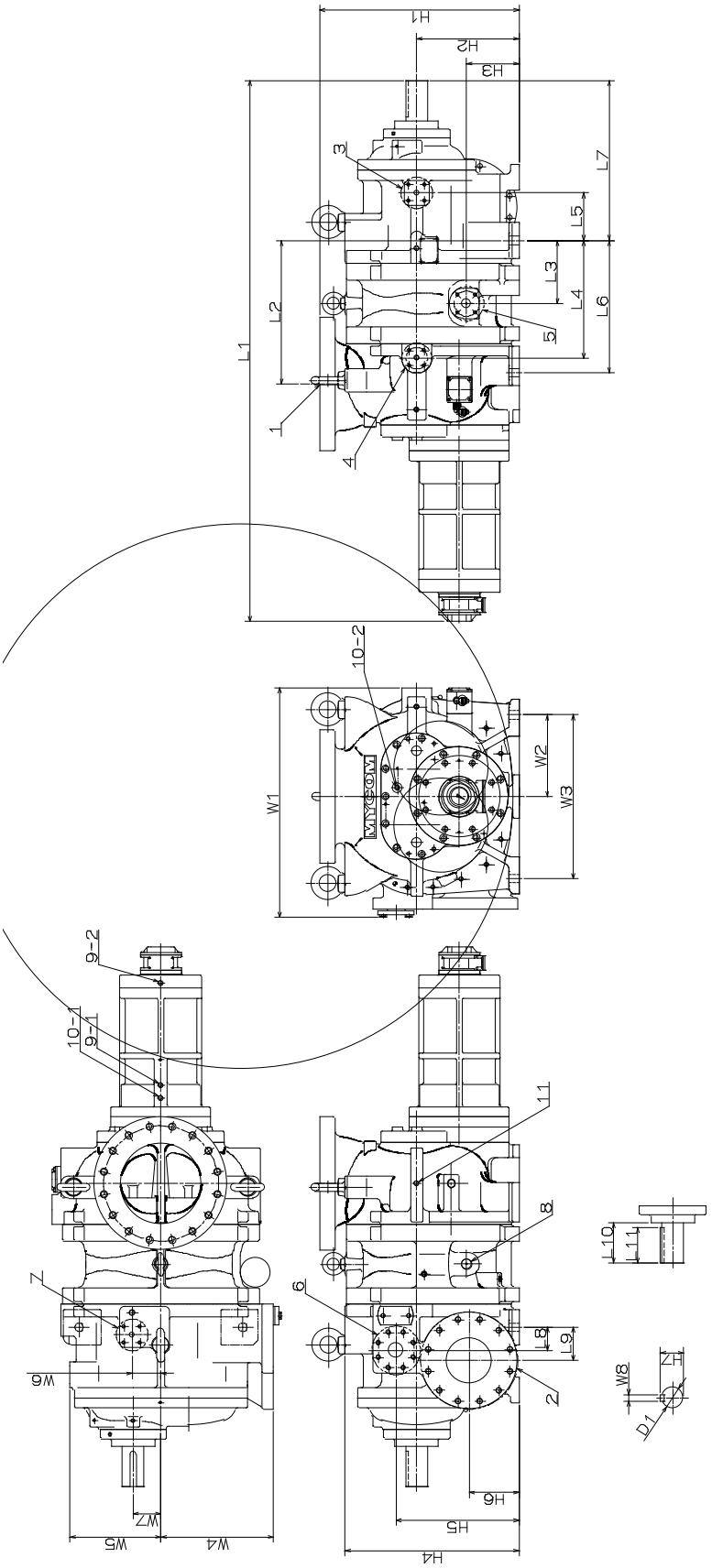


Figure 2-5 Outer Dimensions of the 280J-series

Table 2-8 Outer Dimensions of the 280J-series

Unit: mm

Item	280J		
	S	M	L
1 : Suction	ANSI #300 12" (16-M30)		
2 : Discharge	ANSI #300 8" (12-M22)		
3 : Oil supply (Discharge-side)	ANSI #300 1" (4-M16)		
4 : Oil supply (Suction-side)	ANSI #300 3/4" (4-M16)		
5 : Oil injection	ANSI #300 1 1/4" (4-M16)		
6 : E-port	ANSI #300 2 1/2" (8-M20)		
7 : I-port	ANSI #300 1" (4-M16)		
8 : F-injection (Option)	Rc1 1/4		
9-1 : Capacity control increase	Rc1/2		
9-2 : Capacity control decrease	Rc1/2		
10-1 : Vi control increase (L→H)	Rc1/2		
10-2 : Vi control decrease (H→L)	Rc1/2		
11 : Capacity control oil return	Rc1/2		
12 : Unloader indicator connect	PF 3/4		
13 : Vi-sensor connect	connector		
14 : The leg hole for securing the compressor	4-ϕ33		
L1	2112	2205	2328
L2	562	655	778
L3	247		
L4	460	553	676
L5	186		
L6	517	610	733
L7	624		
L8	90		
L9	130		
L10	158		
L11	140		
H1	780		
H2	400		
H3	205		
H4	680		
H5	481		
H6	195		
H7	90		
W1	896		
W2	320		
W3	640		
W4	440		
W5	355		
W6	112(M rotor side)		
W7	108		
W8	$25^{0}_{-0.052}$		
D1	$85^{+0.011}_{-0.011}$		

2.4 Structure of the Compressor

【POINT】

- For the names and locations of the compressor components, refer to "7.1 Development View and Configuration Table of the Parts" in this manual chapter 7.

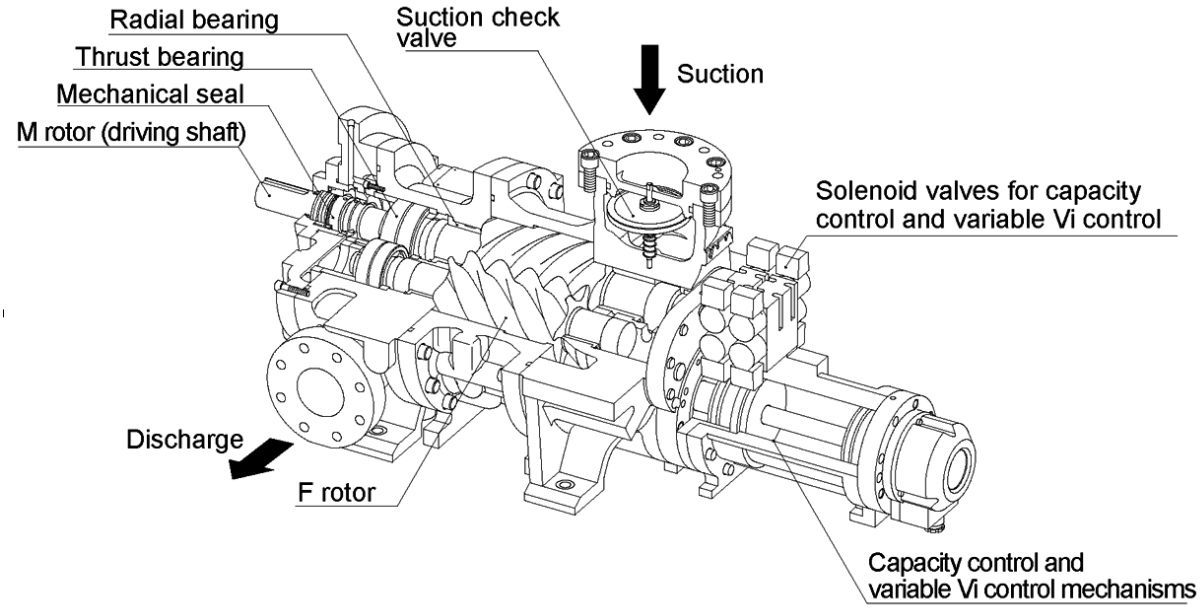


Figure 2-6 Structure of Compressor (170JM-V)

2.4.1 Sectional View

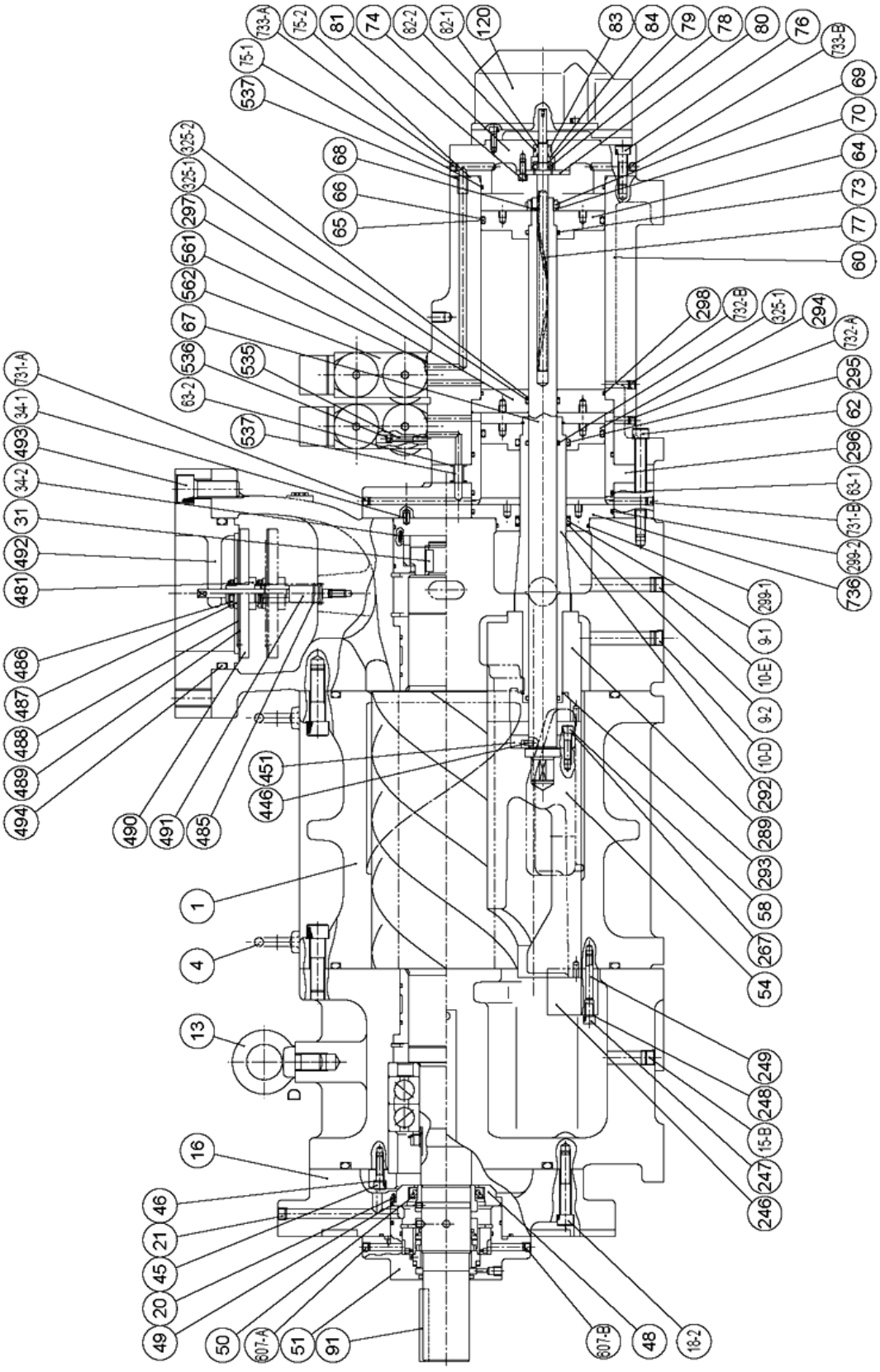


Figure 2-7 Sectional View of the 170J-Series (1/3)

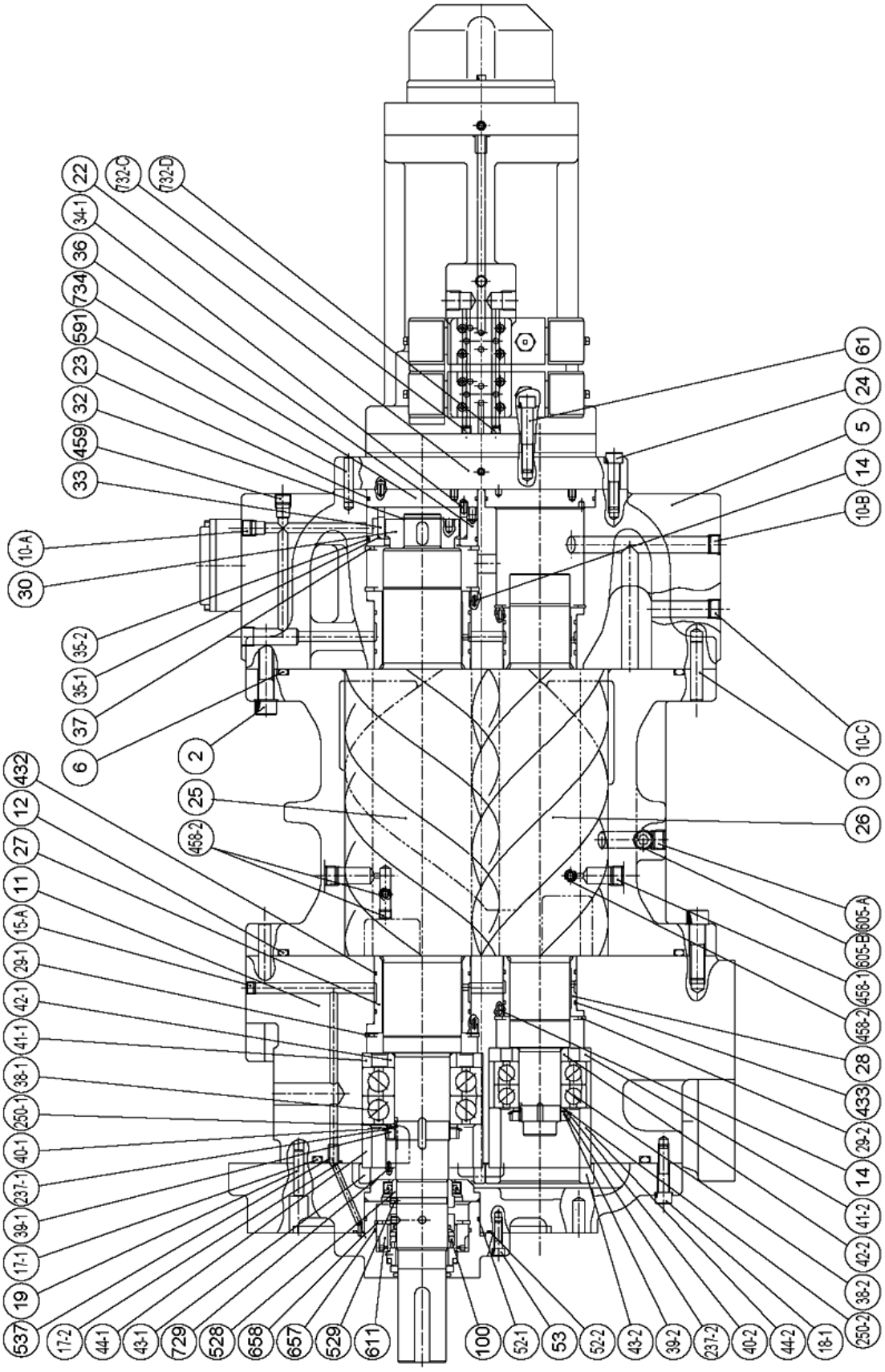


Figure 2-8 Sectional View of the 170J-Series (2/3)

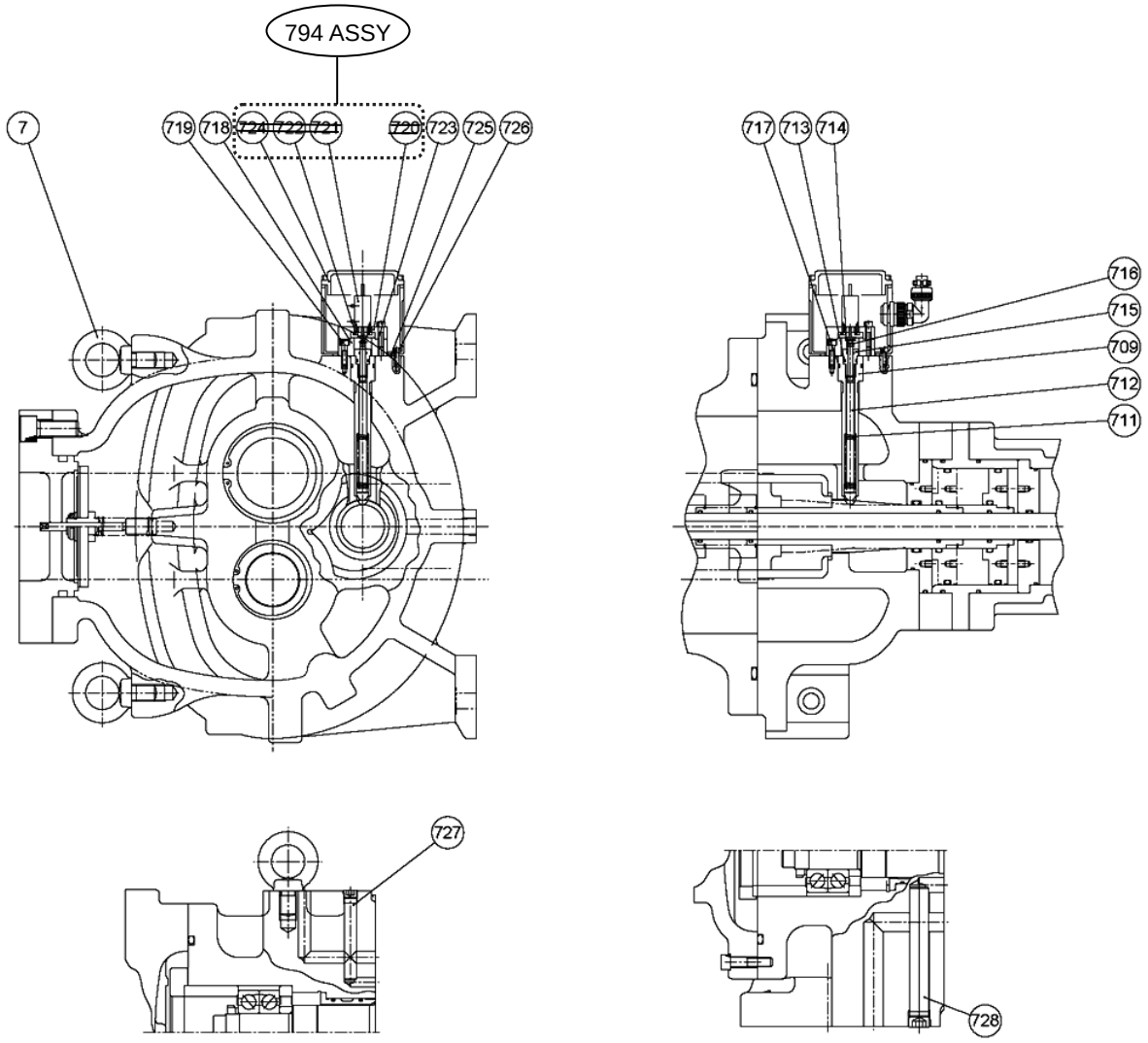


Figure 2-9 Sectional View of the 170J-Series (3/3)

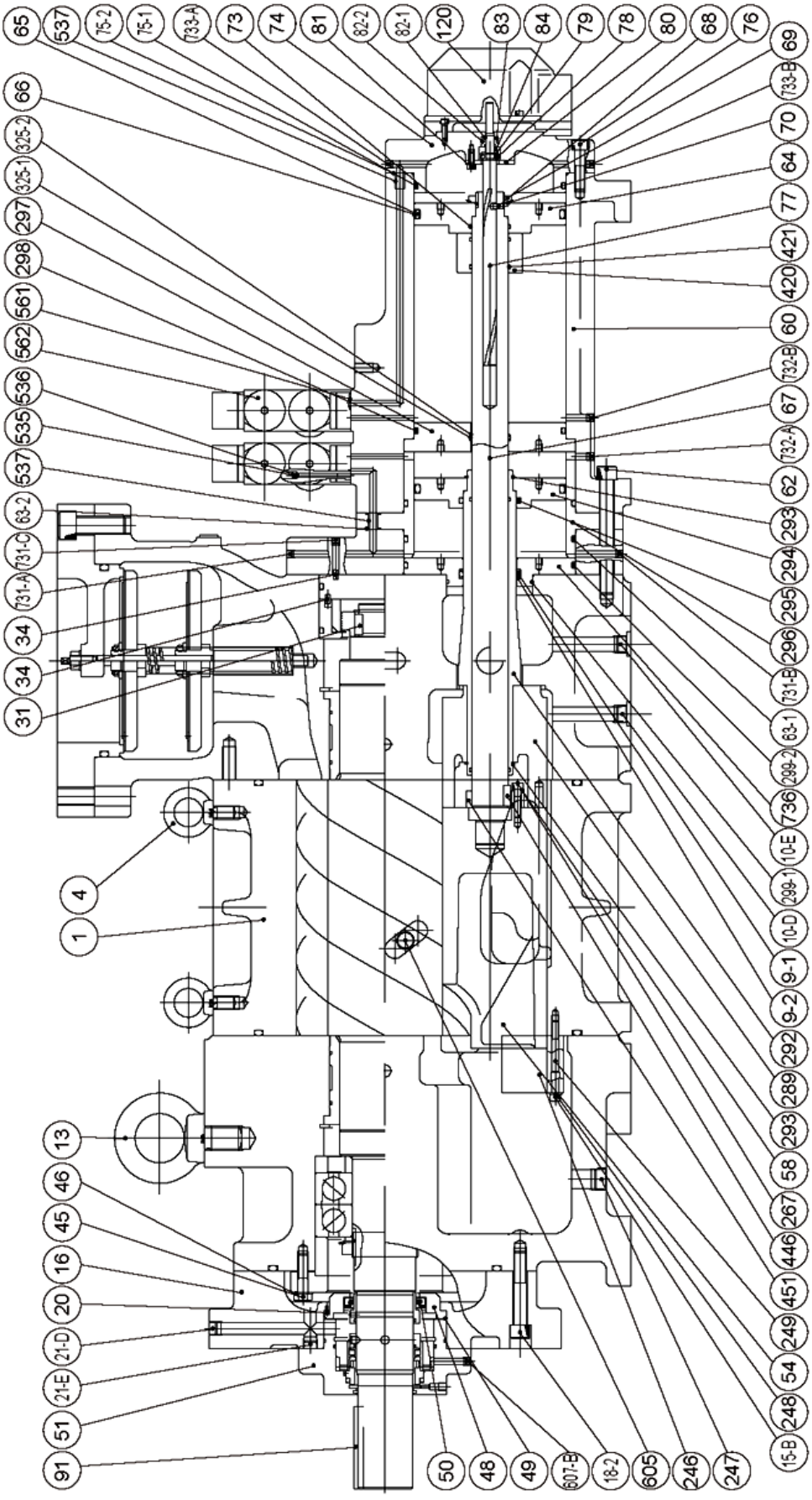


Figure 2-10 Sectional View of the 220J-Series (1/3)

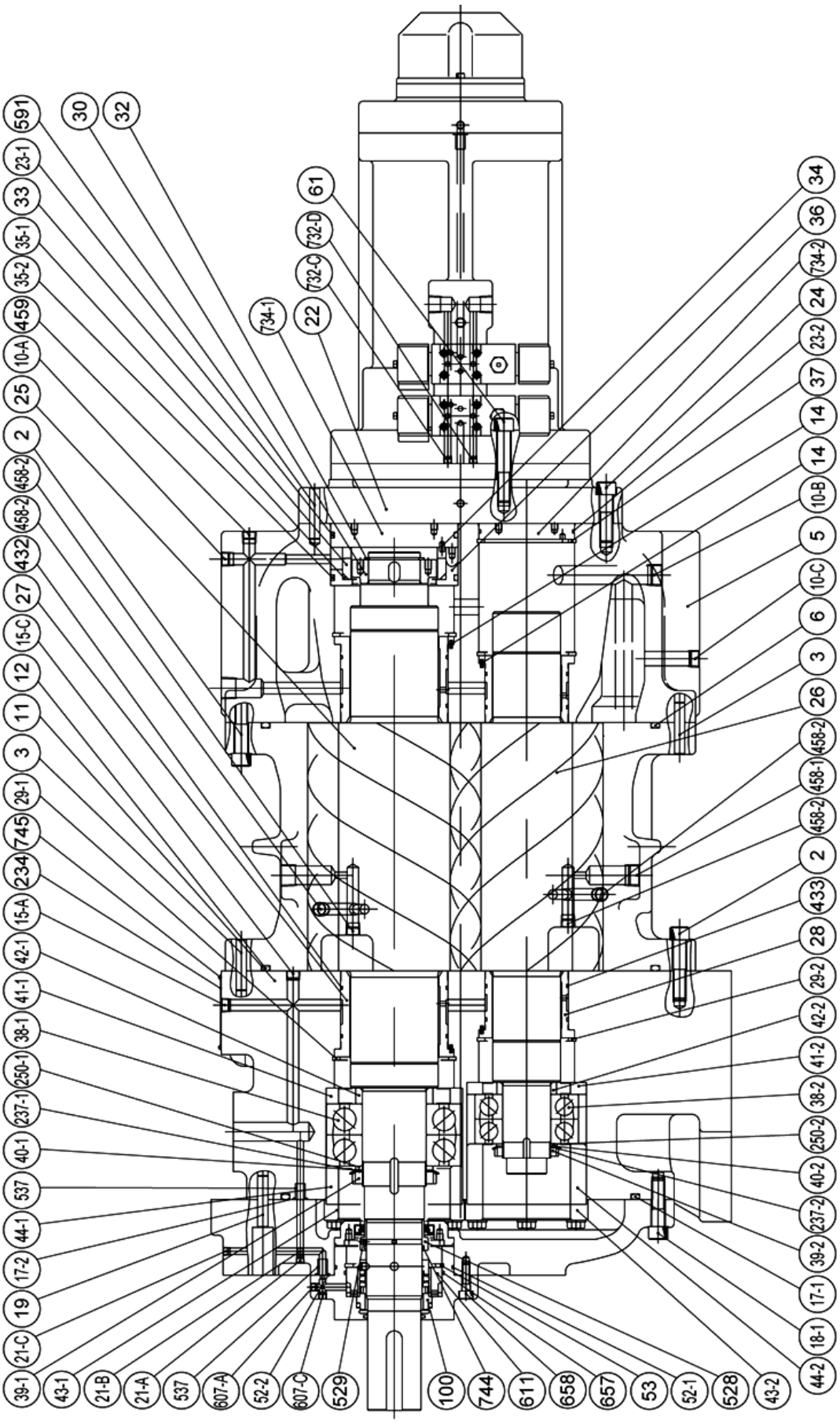


Figure 2-11 Sectional View of the 220J-Series (2/3)

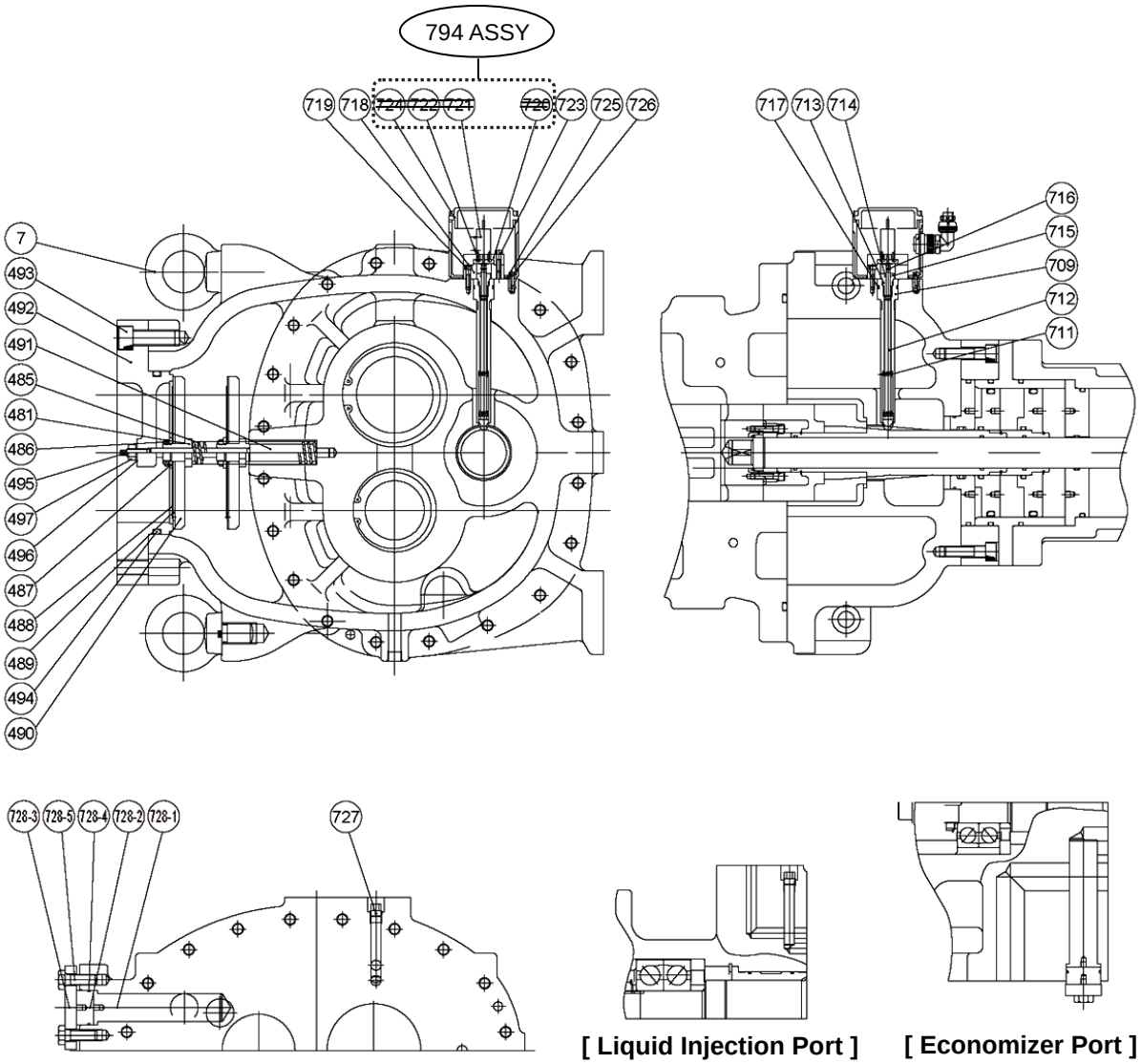


Figure 2-12 Sectional View of the 220J-Series (3/3)

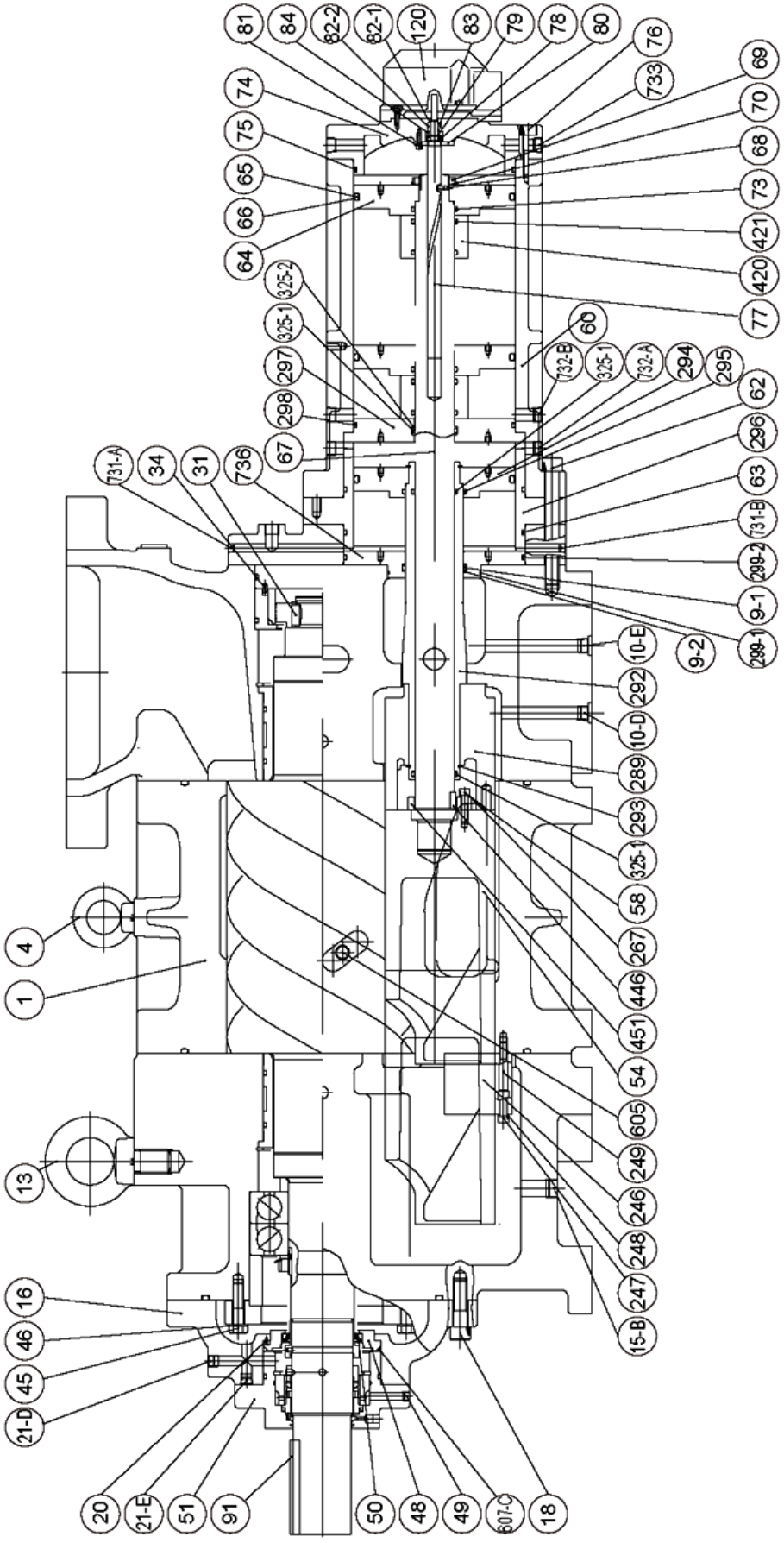


Figure 2-13 Sectional View of the 280J-Series (1/3)

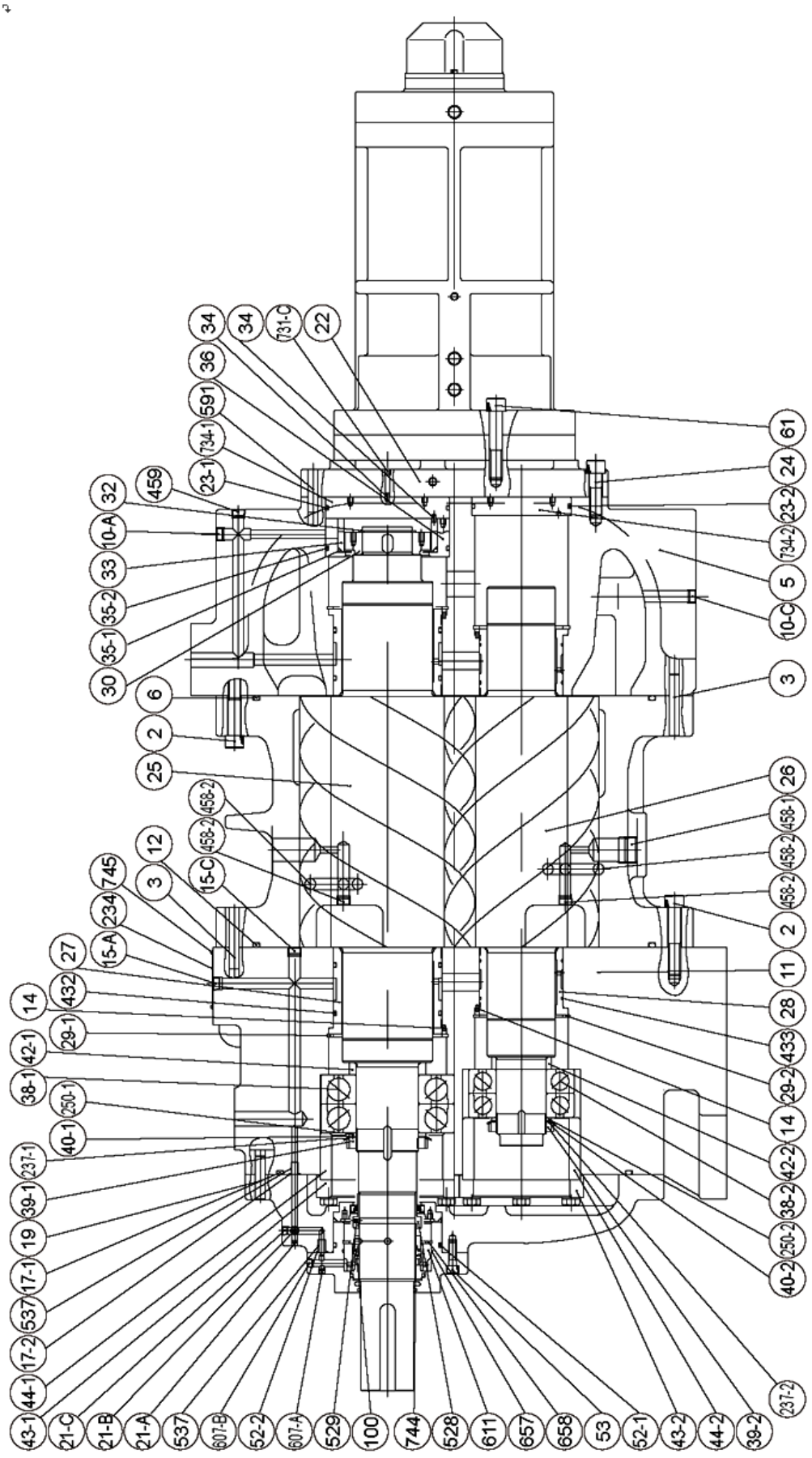


Figure 2-14 Sectional View of the 280J-Series (2/3)

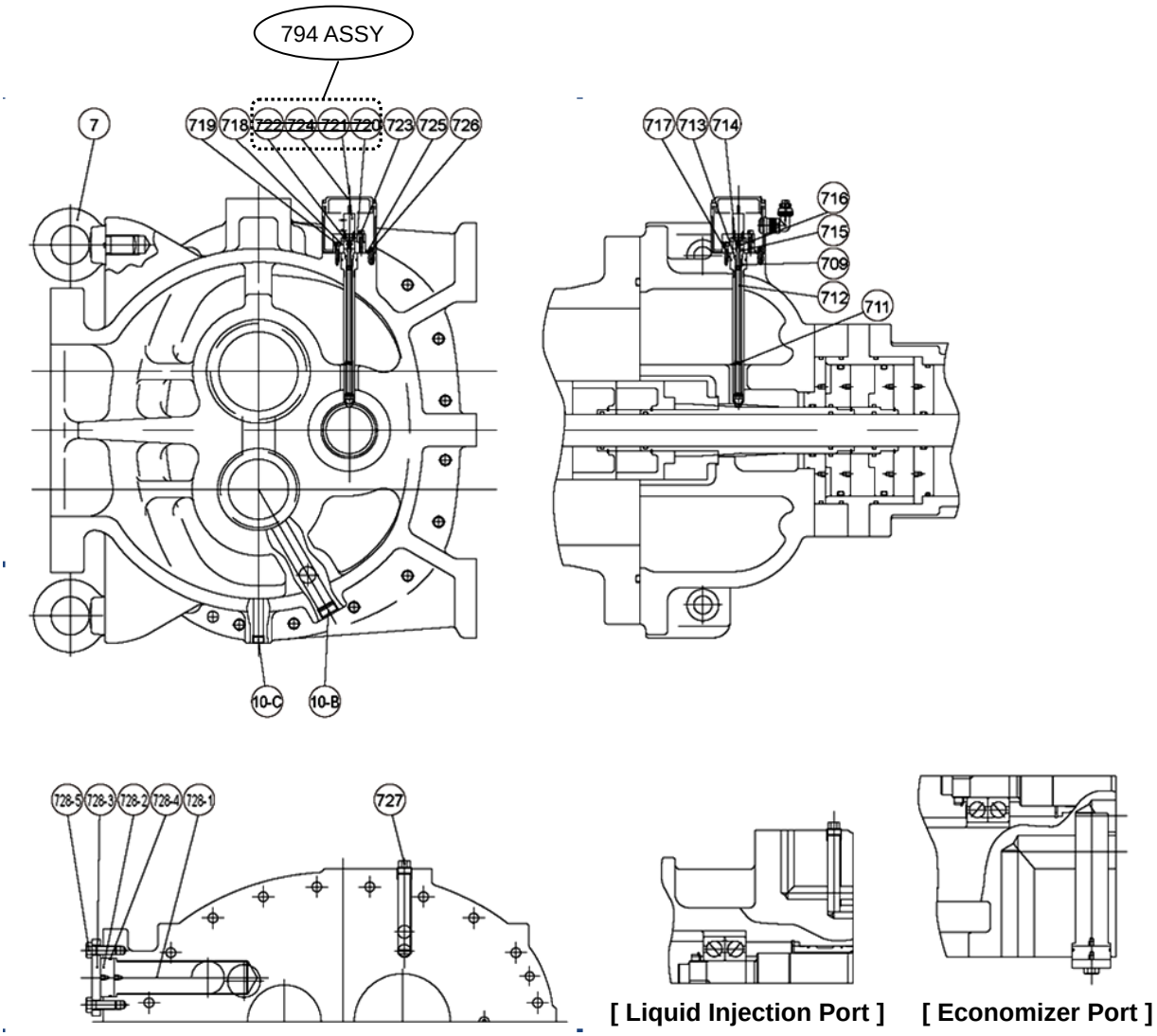


Figure 2-15 Sectional View of the 280J-Series (3/3)

2.5 Mechanisms

2.5.1 Basics of the Screw Compressor

The screw compressor is a positive displacement rotary compressor. It has the features of both the reciprocating and centrifugal compressors.

As shown in Figure 2-16 and Figure 2-17, the refrigerant (gas) is continuously compressed by changing the volume between the casing, male and female meshed screw rotors, which have different profiles.

The rotor with five lobe sections is called the male (M) rotor while the one with six lobe sections is called the female (F) rotor.

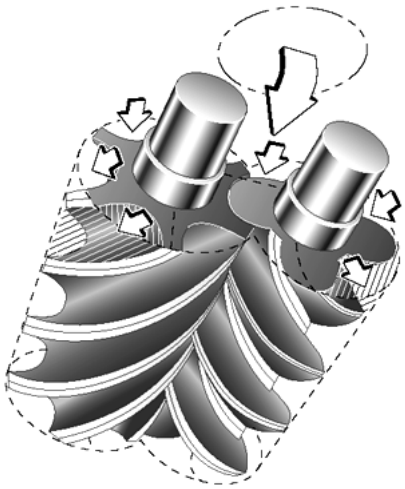


Figure 2-16 Compressor Mechanisms

The compressor is driven by a 2 pole type motor connected to the M rotor shaft and drives the compressor at 2,950 min^{-1} (50Hz) or 3,550 min^{-1} (60Hz).

The 170/220J-series compressor is normally driven by a flange motor and is able to operate continuously at variable rotation speed control when used with a variable speed driver. (The flange motor is not available for the 280J-series.)

The newly developed J profile optimizes the rotor profile and mating, thereby improving the compressor efficiency significantly.

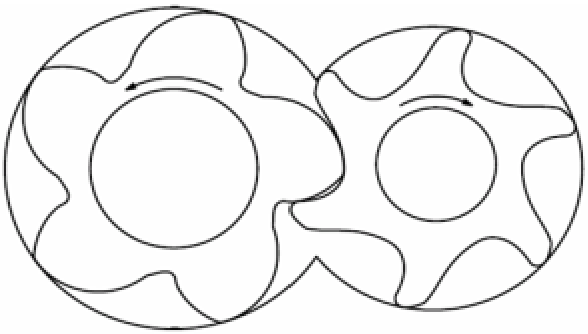
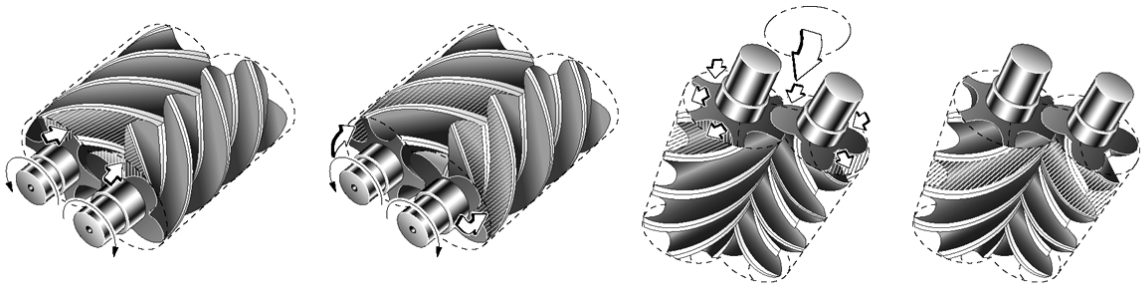


Figure 2-17 J Profile

2.5.2 Suction Process

As show in Figure 2-18, rotors with different lobe profiles that mesh intricately start the suction process. The volume enclosed between the M and F rotor lobes and compressor casing increases from the suction side as the rotors turn. When the volume is at its maximum, the rotors start to trap the gas between the lobes and compressor casing thereby isolating the gas from the suction port.



(1) Start of suction (2) Suction continues (3) Just before suction completion (4) Suction side sealed

Figure 2-18 Suction Process

2.5.3 Compression Process

As the rotors further rotate, the sealing line between them moves toward the discharge side and the volume between the rotor lobes decreases and compresses the trapped gas.（Refer to Figure 2-19)

2.5.4 Discharge Process

The volume between rotor lobes decrease to a predetermined value at the discharge port. As the rotors further rotate, the compressed gas is pushed out from the discharge port to the outlet of the compressor.（Refer to Figure 2-20)

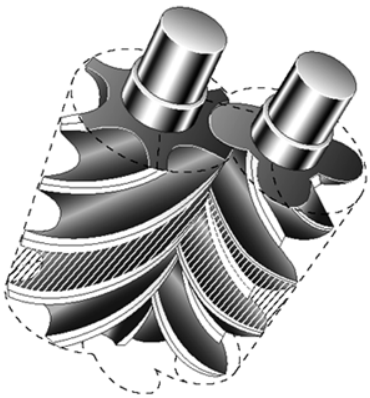


Figure 2-19 Compression Process

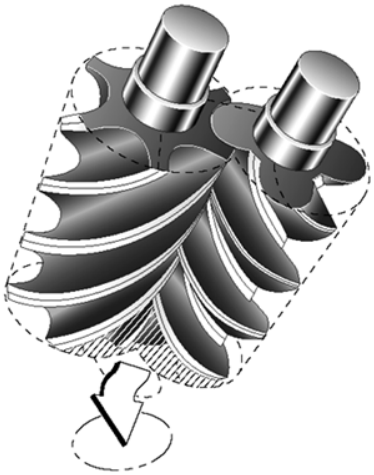


Figure 2-20 Discharge Process

2.6 Oil Flow

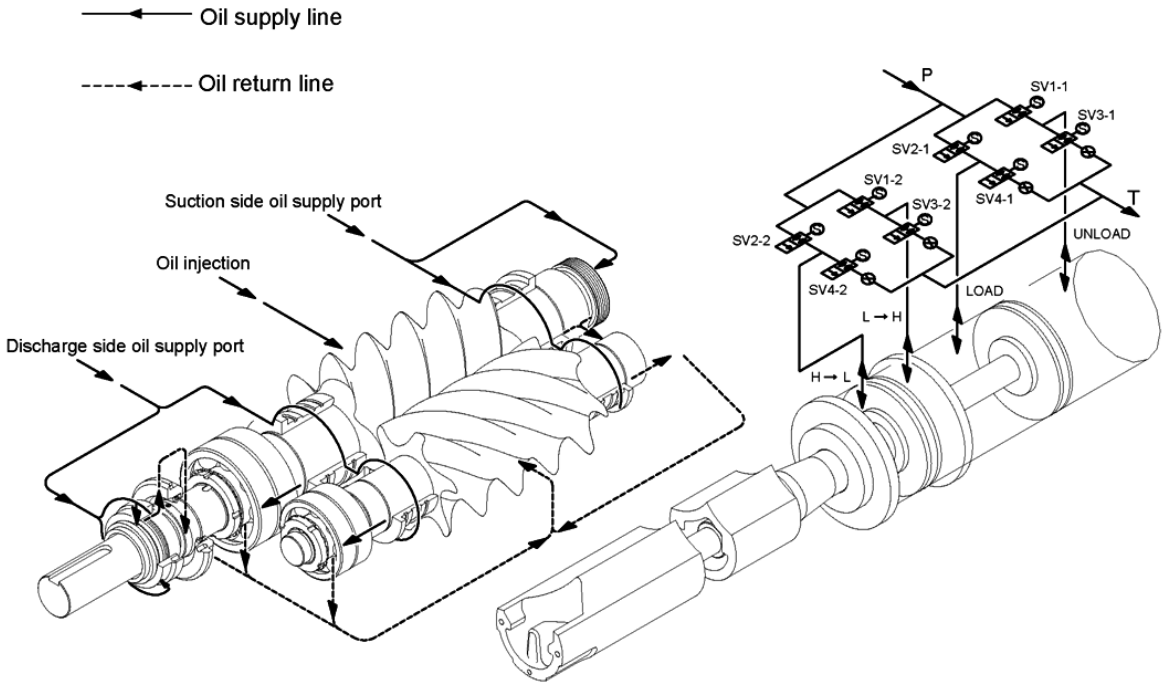


Figure 2-21 Oil Flow (170J/220J-Series)

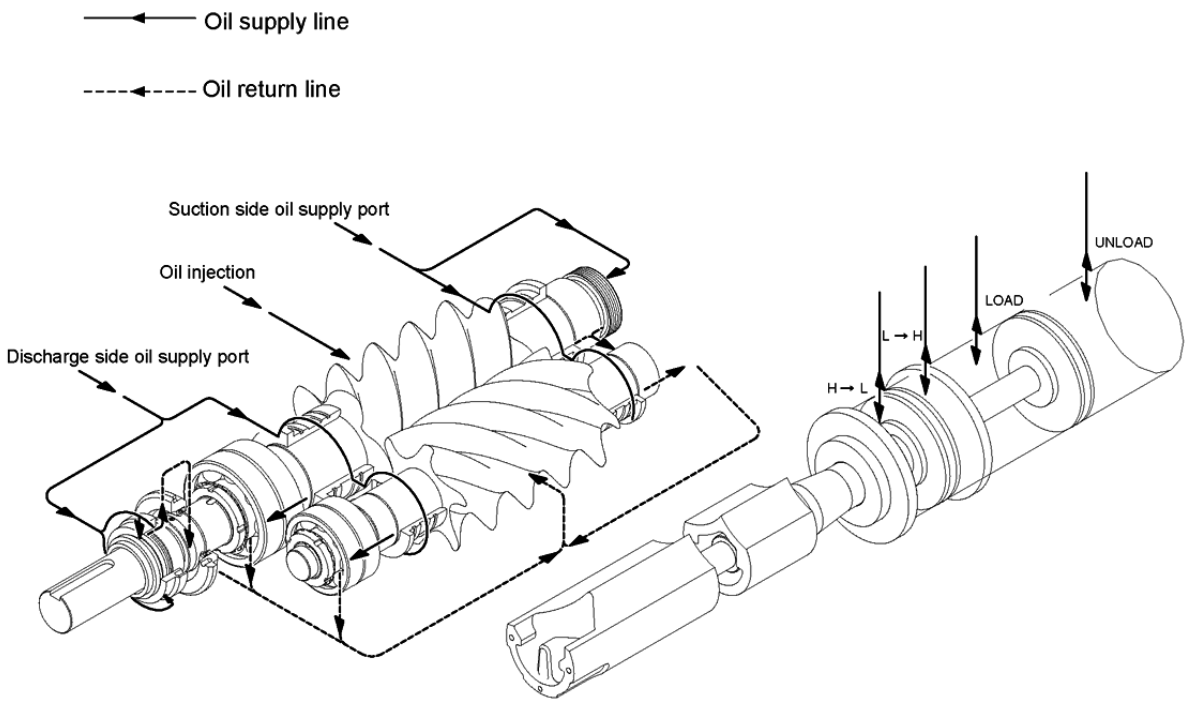


Figure 2-22 Oil Flow (280J-Series)

2.7 Capacity Control Characteristics

The J-series can vary capacity continuously using the slide valve capacity control structure.
This control system offers a wide capacity control range with high efficiency by hydraulic control.

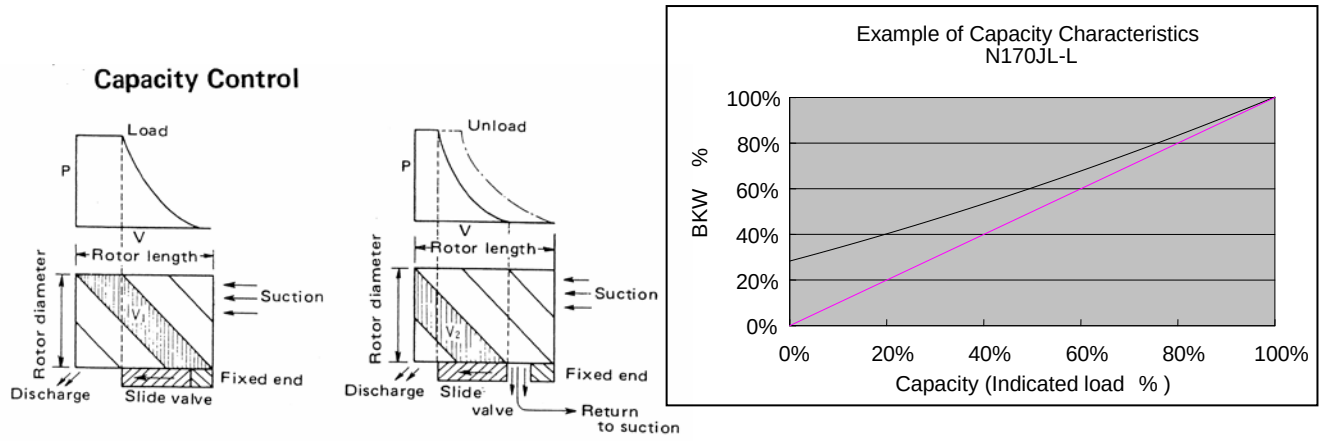


Figure 2-23 Slide Valve Capacity Control Structure and Capacity Control Characteristics

2.8 Variable Vi Control

2.8.1 Vi (Internal Volume Ratio)

For a screw compressor, the volume of refrigerant gas trapped between the M and F rotor lobes decreases while the pressure increases as the rotors turn. When the trapped volume decreases to the designed Vi (internal volume ratio), the volume is exposed to the discharge side and the refrigerant gas is discharged.

As described above, for a screw compressor, the Vi (internal volume ratio) indicates the ratio of the volume of sucked refrigerant gas to the compressed minimum volume when the interlobes connect to the discharge outlet port (the volume before discharged).

Vi is shown as follow.

$$Vi = \frac{\text{(Volume of refrigerant gas (after suction) when compression begins)}}{\text{(Volume of refrigerant gas when discharge port opens (end of compression))}}$$

Vi is the ratio of the volume between rotor lobes and casing after completion of suction and the volume when discharge port starts to open. The J-series basically adopts three Vi values of 2.50, 3.50, and 5.0 which are called ‘L port’, ‘M port’, and ‘H port’ respectively.

Vi is expressed as follows with the compression ratio.

$$Vi = \left(\frac{Pd}{Ps}\right)^{\frac{1}{\kappa}} \quad \text{or} \quad Vi^{\kappa} = \frac{Pd}{Ps}$$

As shown above, Vi is related to the specific heat ratio (κ) of the refrigerant gas. Therefore, Vi values vary not only with the compression ratio but also the type of refrigerant gas. The J-series compressors are designed to automatically adjust Vi according to operating conditions using the specified controller (MYPRO-CP IV or succession machine).

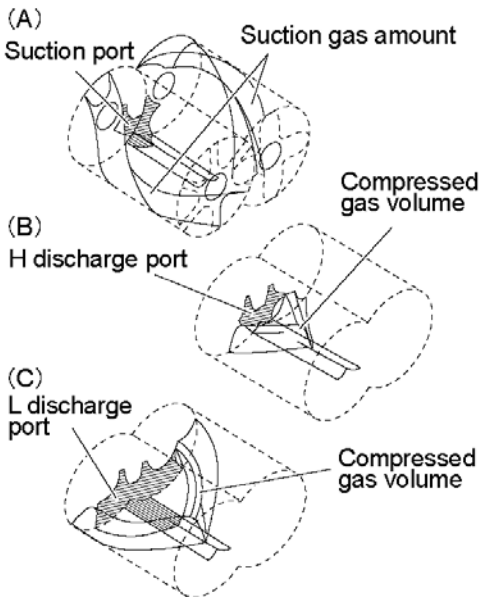


Figure 2-24 Explanation of Vi (Internal Volume Ratio)

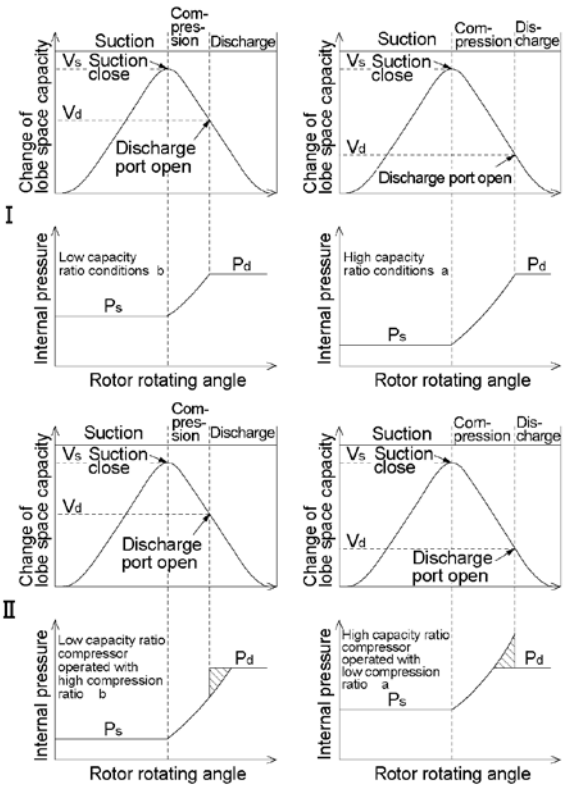


Figure 2-25 Relationship between Vi Settings and Operation Conditions

2.8.2 Reasons for Adjusting Vi According to Operating Conditions

Operating conditions for the compressor differs with applications. The same compressor may be operated under a variety of pressure conditions such as air conditioning, cold storage and freezing. Also, the discharge pressure may vary depending on the type of condenser or climate conditions. Even in the same application, some conditions may vary. For example, a compressor for air conditioning has different operating conditions for the cooling mode and the heating mode. And a compressor for refrigeration may have different operating conditions depending on the storage room temperature. Compressors are always required to operate with maximum efficiency in these varying operating conditions.

For a compressor without a variable Vi mechanism, power is wasted when the fixed Vi does not match the operating conditions (refer to Figure 2-25). For example, if a compressor with a high Vi discharge port (suitable for a high compression ratio) is operated at low compression ratio conditions, the gas between the rotor lobes increases internal pressure to a value higher than the discharge pressure before it is released to the discharge port, this results in extra compression power. On the other hand, if a compressor with a low Vi discharge port is operated at high compression ratio conditions, the gas between the rotor lobes is released to the discharge port before the internal pressure reaches discharge pressure. This results in backflow of the high pressure gas to the discharge side which wastes extra power to push back the backflow gas. These characteristics are inevitable for a fixed Vi screw compressor and become obvious when the discharge port Vi does not match the actual operation conditions.

The J-series has a structure that can vary Vi of the discharge port according to operating conditions, therefore, it provides the advantage of operating at a wide range of conditions with high efficiency.

2.8.3 Details of Variable Vi Mechanism

The J-series varies the Vi by moving the variable Vi slide valve with a hydraulic cylinder thus changing the radial discharge port located in the unloader slide valve.

The Vi is increased when oil is supplied to the Vi increase side of the hydraulic cylinder. The variable Vi slide valve moves towards the discharge side, and the unloader slide valve moves so that the radial discharge port becomes smaller and Vi is increased.

On the other hand, the Vi is decreased when oil is supplied to the Vi decrease side of the hydraulic cylinder and the variable Vi slide valve moves towards the suction side. The radial discharge port becomes large and Vi is decreased.

The position of the variable Vi slide valve can be detected by the Vi position sensor. The J-series can always control Vi to an optimum value with a specified controller according to measured operating conditions (such as suction and discharge pressure).

2.8.3.1 Automatic Variable Vi Mode

In the automatic variable Vi mode, the J-series calculates the optimum Vi from the measured operating pressures using a specified controller and adjusts the hydraulic pressure on the Vi increasing side or the Vi decreasing side of the hydraulic cylinder to move the variable Vi slide valve to a suitable position for the calculated Vi.

Note 1: Basically, the automatic variable Vi control is achieved in three steps, L, M, and H.（Not continuously）

Note 2: Do not frequently vary the Vi automatically. This may lead to deterioration of reliability such as early wear to the related components.

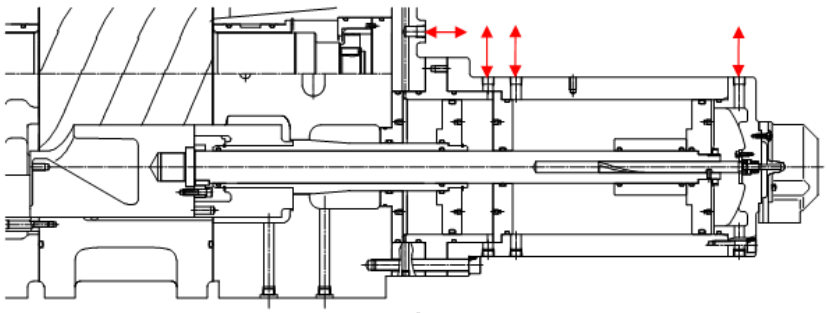


Figure 2-26

2.8.3.2 Fixed Vi Mode

The J-series also allows for fixed Vi if the operating conditions are stable and the automatic variable Vi control is not necessary.

Note, however, a specified controller is required to adjust the variable Vi slide valve to the desired Vi value. It is able to set Vi to the following three ports: L port (Vi=2.5), M port (Vi=3.5), H port (Vi=5.0).

Note 1: For the J-series, a specified controller is always required.

2.8.4 Vi Position Sensor

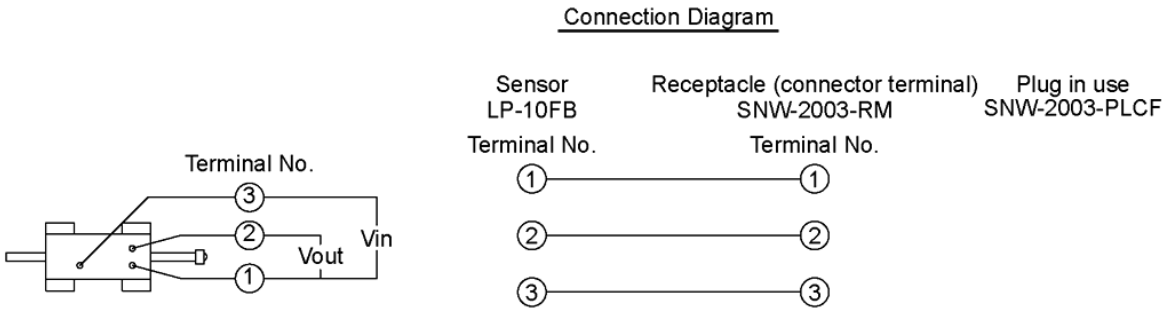


Figure 2-27 Vi Sensor Wiring Diagram

Table 2-9 Relationship between Vi and Vi Sensor Output

Port	Vi	Ratio to full stroke (%)	Resistance (Ω)	Output voltage ratio (%)
L	2.5	0	830	83
M	3.5	56	550	55
H	5.0	100	330	33

Table 2-10 Specifications of the Potentiometer

Item	Specifications
Total resistance	1kΩ ±20%
Rated power	0.3W/50°C
Insulation resistance	100MΩ or more 500V DC
Withstanding voltage	500V AC for 1 minute
Working temperature range	-40—100°C

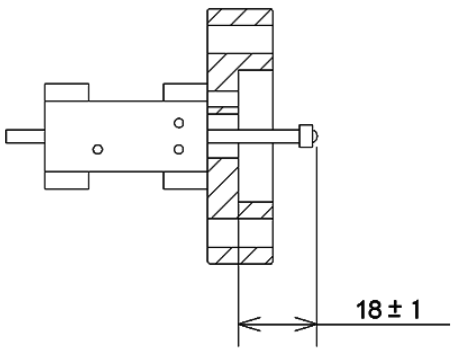


Figure 2-28 Vi Sensor Dimensions

2.9 Solenoid Valve

2.9.1 170J/220J-Series

The 170J/220J-series are provided with solenoid valve assemblies for capacity and variable Vi control.

Table 2-4 Specifications of the Solenoid Valves

Item	Type	
	SBL5B-4BL	SXL6-4BL
Maximum working differential pressure	1.6 MPa	2.1 MPa
Minimum working differential pressure	0.0 MPa	0.0 MPa
Operation fluid	Lubricant (Refrigerant oil)	
Fluid temperature	100°C or less	
Ambient temperature	−20—40°C	
Maximum working pressure	3.5 MPa (see Note 1)	
Maximum working kinematic viscosity	120 mm^2/s. (see Note 2)	
Proof counter pressure (See Note 3)	0.45 MPa (information only)	
Maximum flow rate coefficient (Cv value)	0.33—0.35	
Applicable standard	UL and CSA	CE

Note 1: This pressure represents the gauge pressure.

Note 2: Proper operation is not possible when the kinematic viscosity of the lubricant is over 120 mm^2/s.

Note 3: The proof counter pressure indicates the pressure working against the direction of flow at which the plunger opens automatically. This control can prevent an abnormally high pressure inside the cylinder due to liquid enclosing.

Table 2-12 Specifications of the Coil for SBL5B-4BL

Rated voltage	Lead wire color	Frequency	Effective power	Allowable voltage fluctuation
100V AC	Black	50/60 Hz	11/9 W	±10%
110V AC	Blue			
120V AC				
200V AC	Red			
220V AC	Blue			
240V AC				

Table 2-13 Specifications of the Coil for SXL6-4BL

Rated voltage	Lead wire color	Frequency	Effective power	Allowable voltage fluctuation
110-127 V AC	Blue	50 Hz	12-19 W	+10—−15 %
220-240 V AC			12-15 W	

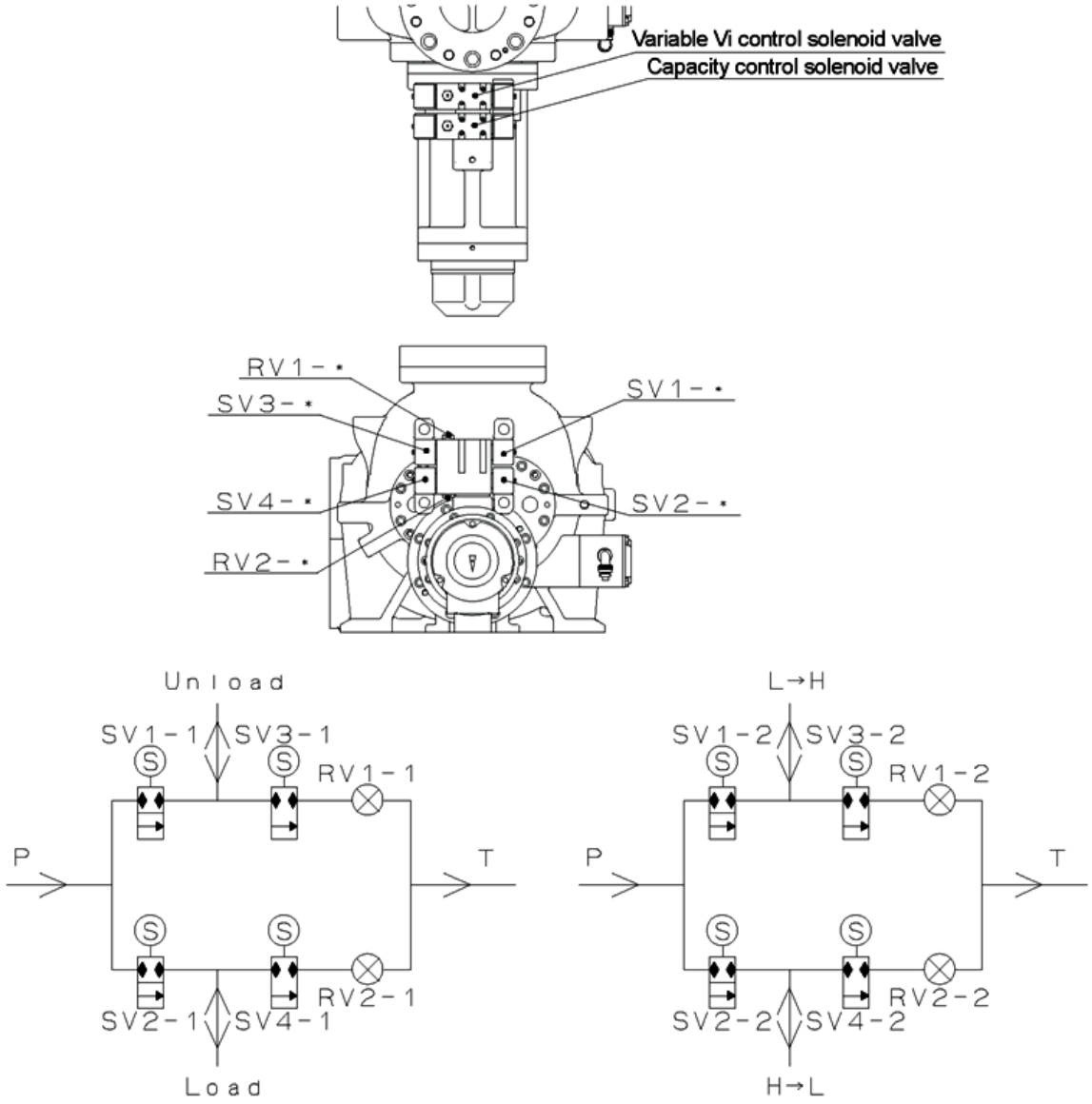


Figure 2-29 Hydraulic Circuit for Solenoid Valve Assembly

Table 2-14 Capacity Control and Variable Vi Control

	SV1-1	SV2-1	SV3-1	SV4-1	RV1-1	RV2-1
Load	Off	On	On	Off	*	-
Unload	On	Off	Off	On	-	*

	SV1-2	SV2-2	SV3-2	SV4-2	RV1-2	RV2-2
H→L	Off	On	On	Off	*	-
L→H	On	Off	Off	On	-	*

Note 1: If it is not possible to adjust capacity or variable Vi control because a hunting occurred and the unloader slide valve or the Vi slide valve move too fast, carry out the appropriate adjustment by decreasing the openings of RV (*) valves.

2.9.2 Explosion Proof for 170J/220J-series, Also 280J-series

The 170J/220J-series with the explosion-proof specification and the 280j-series must prepare solenoid valves for the capacity control and the variable Vi mechanism respectively separately.

The type of solenoid valve can use any type of the poppet type and the spool type. But, because the spool-type solenoid valve is easy to be affected by an foreign substance and the refrigerant gas in lubricating oil, attention is necessary for the system of the dry process vaporizer using the miscible oil.

Table 2-15 Recommended Specifications of the solenoid valves for the J-series

Item	Recommended Specifications
Maximum working differential pressure	1.6 MPa（equal to or more than 70% of the differential pressure between suction and discharge pressure）
Minimum working differential pressure	0.0 MPa
Operation fluid	Lubricant (Refrigerant oil)
Fluid temperature	70 ℃ and over
Ambient temperature	－20～40 ℃
Maximum working pressure	3.5 MPa (See **Note 1**) and over
Maximum working viscosity	120 mm^2/s
Proof counter pressure (See **Note 2**)	0.4～0.6 MPa（U→P）
Maximum Flow rate coefficient (Cv value)	0.53 and over
Minimum Flow rate coefficient (Cv value)	0.10 or less

Note 1:

In this manual unless otherwise noted, pressure units MPa represents the gauge pressure.

Note 2:

Under some operating conditions the pressure in the cylinder may rise. To prevent this abnormally high pressure capacity control system is required, which releases the pressure of U port to P port.

When the poppet-type solenoid valve is added the pressure from the opposite direction of the usual flow direction, it automatically opens its plunger. Use the poppet solenoid valves for 0.4MPa to 0.6MPa.

The spool-type Solenoid valve does not have a backflow problem like the poppet-type solenoid valve. Provide a check valve which has the cracking pressure of 0.4MPa to 0.6MPa between U port and P port (indicated in the figure 2-28).

When the pressure between U port and P port is too big, cylinders may break. Contrarily when the pressure is too small, there may be control failures including the inability to maintain partial loading conditions.

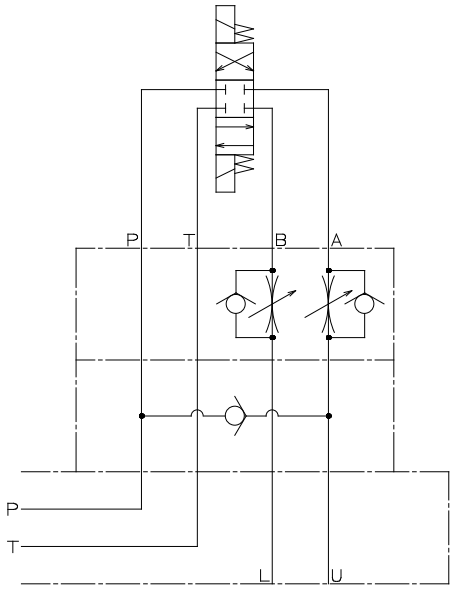


Figure 2-30 Hydraulic Circuit for Spool Type Solenoid Valve

■ Dummy Block

In case of the explosion-proof specification of the 170J and 220J, a dummy-block is installed instead of solenoid valve. When using a dummy-block, it doesn't use a hydraulic cylinder oil supply port, a hydraulic cylinder oil drain port.

3 Installation

3.1 Precautions for Installation

Basically the J-series is delivered as a standard package consisted of the compressor.

Figure 3-1 Appearance of the Package

【POINT】

- This chapter 3 is based on the assumption that the compressor is installed to standard packages for the purpose of refrigeration, cold storage, and air conditioning.
  If the package is not standard and the installation procedure is different from the contents of this manual, prepare an installation procedure manual referring to this chapter and considering safety precautions, before installing the compressor.
  If there are any questions, please contact our local sales offices or service centers.

- Insure that installation is performed by a qualified personal or contracting company. Make sure that the work is performed in compliance with local laws and ordinances.
- Read this chapter and related documents, and fully understand their contents before performing installation.
- Electrical work must be performed only by a qualified worker.
- Do not let anyone to be or enter any part of body under the lifted compressor.

3.2 Installation Work

3.2.1 Unpacking

When unpacking the compressor, make sure that the compressor body is not damaged. Check that there are no abnormalities.

【POINT】

- If there are abnormalities or deficient parts on the compressor, please contact our local sales offices or service centers immediately.
- Unnecessary packaging materials should be discarded according to the laws and ordinances, or your company's rules.

3.2.2 Storage

To store the compressor before installation;

- Store it indoors.
- Seal nitrogen gas in the compressor. (Pressure: approximately 0.15 MPa)

3.2.3 Transfer

⚠ DANGER

- **Dropping of the lifted compressor may cause death or serious injury to the worker. Do not allow anyone to be under the lifted compressor.**

1. To lift the compressor, use lifting equipment with sufficient load for the weight of the compressor and appropriate lifting slings having proof load of more than the weight of compressor.
2. Secure sufficient space for safe lifting.
3. Check the lifting slings before use. Thoroughly check the lifting slings for any problems (such as deformation, knot, wire breakage). Do not start lifting unless the lifting slings are verified that they have no problems. If you cannot make correct evaluation or judgment, entrust an expert to inspect the lifting slings.
4. To lift the compressor, attach the lifting slings to the attached eyebolts using appropriate shackles and hooks. The eyebolts are only used for lifting the compressor. Do not use the eyebolts to lift the compressor with any attached apparatus.

⚠ DANGER

- **The compressor eyebolts must not be used to lift the package. To lift the package, use the lifting chains on the base periphery or other lifting devices provided on the base.**

5. Check the transportation route for any obstacles in consideration of the compressor size.
6. Before lifting, check that the lift hook is located on the vertical line leading from the gravity center of the compressor.
7. Instruct all workers to move from near the work site before lifting.
8. Before lifting the compressor, alert all workers on the site of possible dangers of the lifting process by signal (such as calling at the beginning of the work or making a signal with hand). Remove all nonessential workers from area until lift is complete. Do not lift the compressor unless the signals are completely understood by the all personal working together.

9. Slowly reel up the winch immediately before the compressor is away from the ground.
10. Then, reel up the winch further until the compressor is completely away from the ground and check that the compressor is not inclined. If the compressor is inclined, return the compressor on the ground and correct the inclination by adjusting the lifting slings. Then, restart the lifting operation.
11. Make sure to reel up the compressor slowly. Lifting it too quickly may damage the lifting slings or part of the compressor.
12. After lifting the compressor, check the wire ropes or lift slings. Check that the compressor is held horizontally.
13. When moving the lifted compressor, always use a guiding rope.
14. When moving the compressor, turn away workers from the movement direction and check safety.
15. Do not lift the compressor above any safety passage unless in unavoidable case.
16. Do not put the compressor in a safety passage. Always keep the safety passage free of obstacles.
17. Remove any obstacles before putting down the compressor on the ground. The compressor should not be inclined or unstable.
18. Before putting down the compressor on the ground, announce to the workers around the working area.
19. When lowering the compressor onto two or more blocks, use blocks with the same height so that the compressor is horizontal and stable.
20. Lower the compressor slowly so that it dose not get damaged or collided.

3.2.4 Preparation for Installation

Installation Space

Prepare sufficient working space for easy operation, cleaning, maintenance, and inspection.

Illumination

Prepare lighting for easy operation, cleaning, maintenance, and inspection.

Ventilation

If natural ventilation is insufficient, install ventilation fans according to the regulations.

Piping

Refer to "2.3.2 Outer Dimensions" in this manual chapter 2.

3.2.5 Installation

3.2.5.1 Installation

■ **170J/220J-Series**

The standard 170J/220J-series has a structure coupled with a flange motor. The compressor can only be installed to the motor by connecting with the motor spacer.

For installation of the compressor in the package, the following two cases are assumed: Installing the compressor first (for package manufacturing); Motor and motor spacer are already present on package frame (for compressor maintenance).

The following procedure describes how to install the compressor to the motor spacer for maintenance purposes.

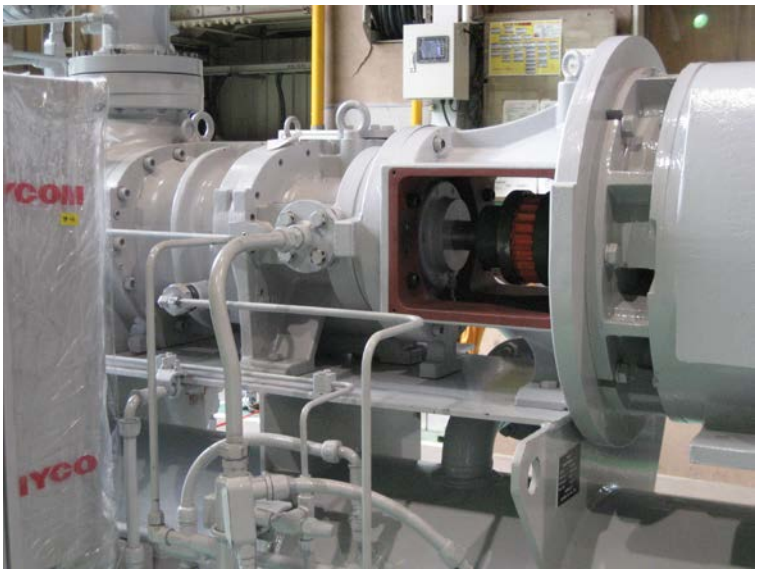


Figure 3-2 Motor Spacer

1. Attach the upper two stud bolts (safety bolts) (M16 × 60) to the bearing cover flange face of the compressor.
2. Lift the compressor horizontally using lifting equipment such as a crane and align the compressor flange to the motor spacer flange by using the stud bolts on the bearing cover as the guide.
3. Insert two hexagon socket head cap screws (M16 × 60) in diagonal positions from the motor spacer side, and tighten them until the flanges are in contact.
4. Apply lubricant (molybdenum disulfide) to the parallel pin (13 dia. × 60) and insert the parallel pin by knocking it with a copper hammer from the motor spacer side.
5. Remove the stud bolts and insert all bolts and tighten them to the specified torque diagonally.
6. Remove the crane used to lift the compressor and check for any gaps between the base of package and the feet of the compressor. If there are any gaps, adjust the compressor height using shims and then fix the compressor to the base with bolts.

【POINT】

- When installing the compressor to the motor spacer, always use stud bolts.
- Do not hammer in the parallel pins while there are gaps between the flanges or the flanges are inclined. Make sure that the flanges are in close contact with each other and are aligned in height before hammering in the parallel pins.
- When there is a gap between a compressor and a base and the compressor is fixed with bolts without adjusting height using liner, deformation may cause misalignment between the compressor and the motor center.
- Other than the compressor accuracy and the deformation stated above there may be misalignment caused by the motor accuracy. It is recommended that couplings used should have the misalignment tolerance of more than 0.2mm.

For the installation of compressor and motor at unit manufacturing, refer to the appendix in this manual.

■ 280J-Series

The 280J-series is not designed to be coupled with a flange motor. Fix the compressor to the package frame, and perform the standard centering operation by using the adjusting bolts in the base on the motor side.

CAUTION
● **Excessive misalignment increases shaft seal leakage and vibration/noise of the compressor. Correct misalignment so that couplings stay in the tolerable range.**

3.2.5.2 Piping

■ Refrigerant Piping

When constructing the refrigerant piping, follow the instructions below.

- The compressor is one of the few equipments with moving components in refrigerating, cold storage, and air conditioning packages. The moving components are adversely affected by foreign substances within the system (scale, dust, spatter). Therefore when constructing the piping, make sure that no such foreign substances enter the piping.
- The compressor is sealed with nitrogen gas before shipment to prevent internal rust. Before removing the flange of the compressor, make sure to purge/bleed the nitrogen gas from the attached valve on the compressor.
- Any moisture in the piping will cause problems when operating the compressor. When constructing the piping, make sure that all components are free of moisture.
- Inappropriate piping construction may cause operating problems such as lubricant not returning to compressor or liquid flowing back to the compressor.
- When constructing the piping to the compressor, use a pipe with the same diameter as the compressor connection port. If the pipe size is smaller than the compressor connecting port, the lubricant or refrigerant flow may be reduced, resulting in operating problems.
- When constructing the piping for the compressor, execute piping supports at appropriate positions so that excessive force is not applied to the compressor flange or connecting port.
- When performing welding work, make sure to disconnect wiring described below. If welding work is performed with wiring connected, the compressor parts may be damaged.
  1) Wirings of the capacity control and potentiometer for Vi changing
  2) Wirings of the solenoid valves for 170J/220J

3.2.5.3 Equipment and Devices for Protection of the Compressor

■ Oil Filter

According to the requirements of the use of the package unit or the standard to apply, install an oil filter of appropriate filtration precision in the lubrication system of the compressor.

In the case of general applications such as closed-cycle refrigeration systems, we recommend to use an oil filter with beta ratio in the range of $\beta_{20} \geq 150$ that conforms to requirements of NAS 1638 class 8 or ISO 4406 17/15/13.

When the package unit requires API 619 4th/5th edition conformity, use an oil filter with beta ratio in the range of $\beta_{10} \geq 200$.

The oil filter may clog just after test operation. We recommend installing two oil filters in parallel. This will enable replacement of either filter during operation.

■ Oil Heater

Install an oil heater in the oil separator to ensure sufficient lubricant temperature before starting the compressor. Make sure to install a protection function (thermostat, etc) to prevent overheating.

■ Suction Strainer

When miscible oil is used, the mesh size of suction strainer should be 200 meshes or more, or when non-miscible oil is used, the mesh size of suction strainer should be 100 meshes or more.

For miscible oil and non-miscible, refer to "4.2 Lubricant (Refrigerant Oil)" in this manual chapter 4.

During test operation, small particles and scale may come from the system. We recommend installing a fine temporally filter or replace with new filters after test operation.

■ Economizer, Liquid Injection Line Filter

When an economizer or liquid injection is used, install a filter of 100µm or finer in the line.

■ Compressor Protection Functions (Safety Device)

The J-series has a specified controller which must be used to protect the compressor with the controller's protection functions.

Figure 3-3 A Specified Controller (example)

In addition, the following sensors are installed in the package to protect the compressor. For further details such as sensor and controller settings, refer to the sensor and controller instruction manual.

- Discharge temperature sensor (protection from abnormally high discharge temperatures)

- Lubrication temperature sensor (protection from abnormally high oil temperatures)
- Discharge pressure sensor (protection from abnormally high discharge pressures)
- Suction pressure sensor (protection from abnormally low suction pressures)
- Oil pressure sensor (protection from abnormal oil pressures)
- Motor input current ammeter (protection from motor overcurrent)

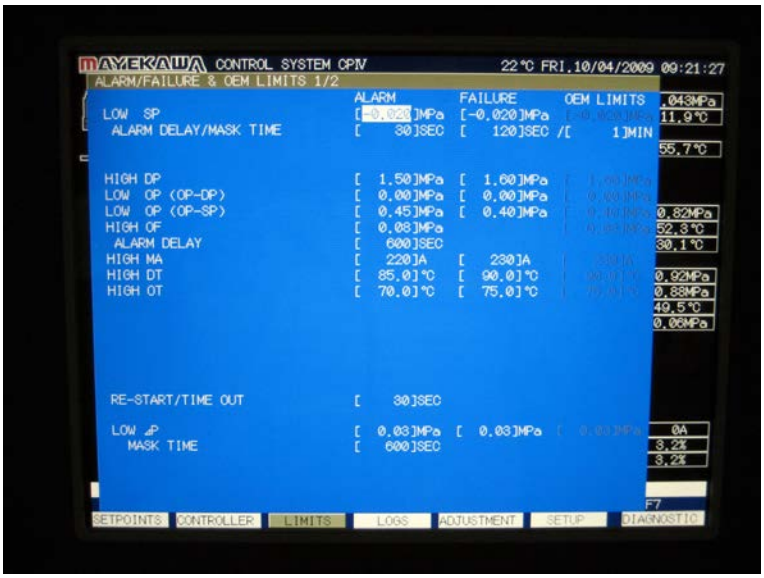


Figure 3-4 Controller Setting Screen (example)

Check the sensors and controller for proper protection function operation during test runs.

3.2.6 Pressure Test (Leak Test)

Perform pressure tests before starting operation. To prevent moisture entering in the package, use nitrogen gas or dry air for the pressure test. Set the test pressure to the design pressure of the package and maintain the pressure for at least 30 minutes while checking the flange connections and fittings for any leaks using leak detector fluid (such as soapy water).

3.2.7 Lubricant (Refrigerant Oil) Charge

CAUTION

- **For the initial charge, always use new oil not exposed to air.**
- **When adding lubricant, make sure that no air or water enters the package.**
- **Store the lubricant in a sealed container placed indoors.**

3.2.7.1 Initial Charge of Lubricant

At initial test operation or after periodical inspection, the compressor's moving parts such as bearings and seals may not have sufficient lubrication. Therefore, charge the compressor with lubricant according to the following procedure.

1. Thoroughly vacuum the compressor and oil separator to 40 Torr. Make sure that the unloader and variable Vi solenoid valves are opened to vacuum the cylinders.
2. Close the oil separator outlet valve in the oil supply line. Also close the oil injection regulating valve.

3. Charge lubricant from the drain valve on the oil cooler (or on the oil filter) through the compressor to the oil separator.
4. When the oil level reaches to the lower limit of the oil level gauge in the oil separator, stop the charging from the oil supply line. (The approximate amount of refrigerant oil charge is the combined capacity of the oil cooler and oil filter plus at least 20 liter).
5. Then charge oil to the specified level from the oil charging valve on oil separator.
6. Start the oil pump and check the oil pump discharge pressure to confirm that the lubricant flows. When possible, check if the oil level on the oil separator lowers.
7. Adjust the differential pressure between the oil pump discharge and the suction pressure. (Specified differential pressure: 0.2±0.05 MPa). Refer to "2.3 Compressor Specifications" in this manual chapter 2.
8. After adjusting the differential pressure, run the oil pump for 2 minutes. After checking that the motor main power is off, turn the compressor driving shaft manually. About 10 turns using a coupling.
9. If lubricant flows through the oil supply line normally after the above works, the initial lubricant charge is completed.

【POINT】

- After the initial charge of lubricant, make sure that the oil cooler and oil filter are filled with lubricant.
- For lubricant to be used, refer to "4.1 Lubricant (Refrigerant Oil)" in this manual chapter 4.
- For the amount of initial lubricant charge, refer to the package instruction manual.

3.2.7.2 Additional Charge of Lubricant Procedure

For additional charge of lubricant during operation the procedures of charging defer depending on the systems and operating conditions therefore follow the procedures described in the instruction manual of the unit.

CAUTION

- **For additional lubricant charge, always use the same brand of oil with the same viscosity grade as that already charged in the package. The use of any other brand or viscosity grade may cause operation problems.**

3.2.8 Charging of Refrigerant

As with the lubricant charge, charging of the refrigerant must be performed carefully so that no moisture or air enters the system.

For further details on refrigerant charging works, refer to the package or refrigeration unit instruction manual.

3.2.9 Check after Installation

Perform the checks after compressor installation according to the check list in the package instruction manual.

3.3 Documents Related to Installation

■ Lifting Positions/Gravity Center Positions/Lifted View

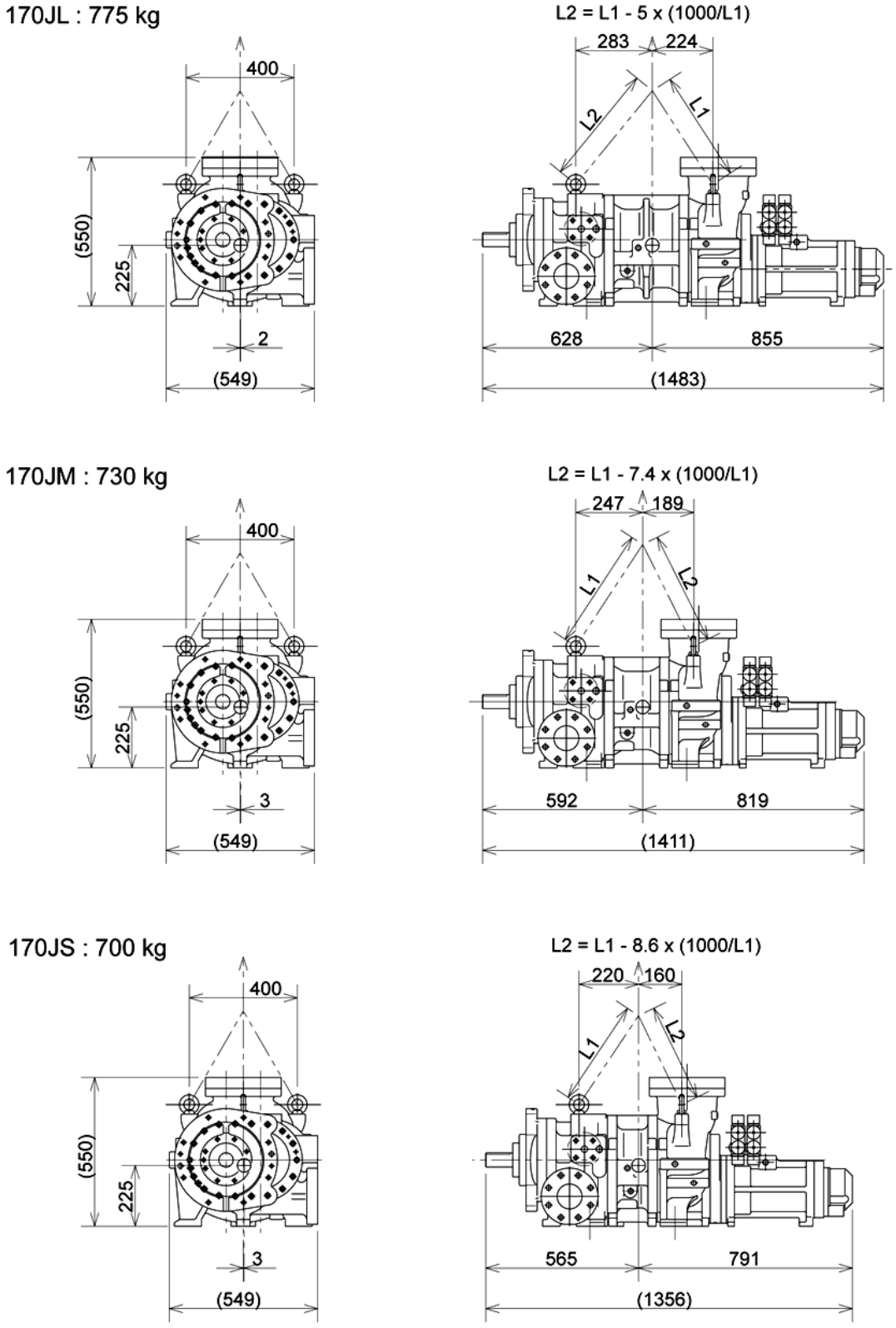


Figure 3-5 Center of Gravity and Lifting Points (170J)

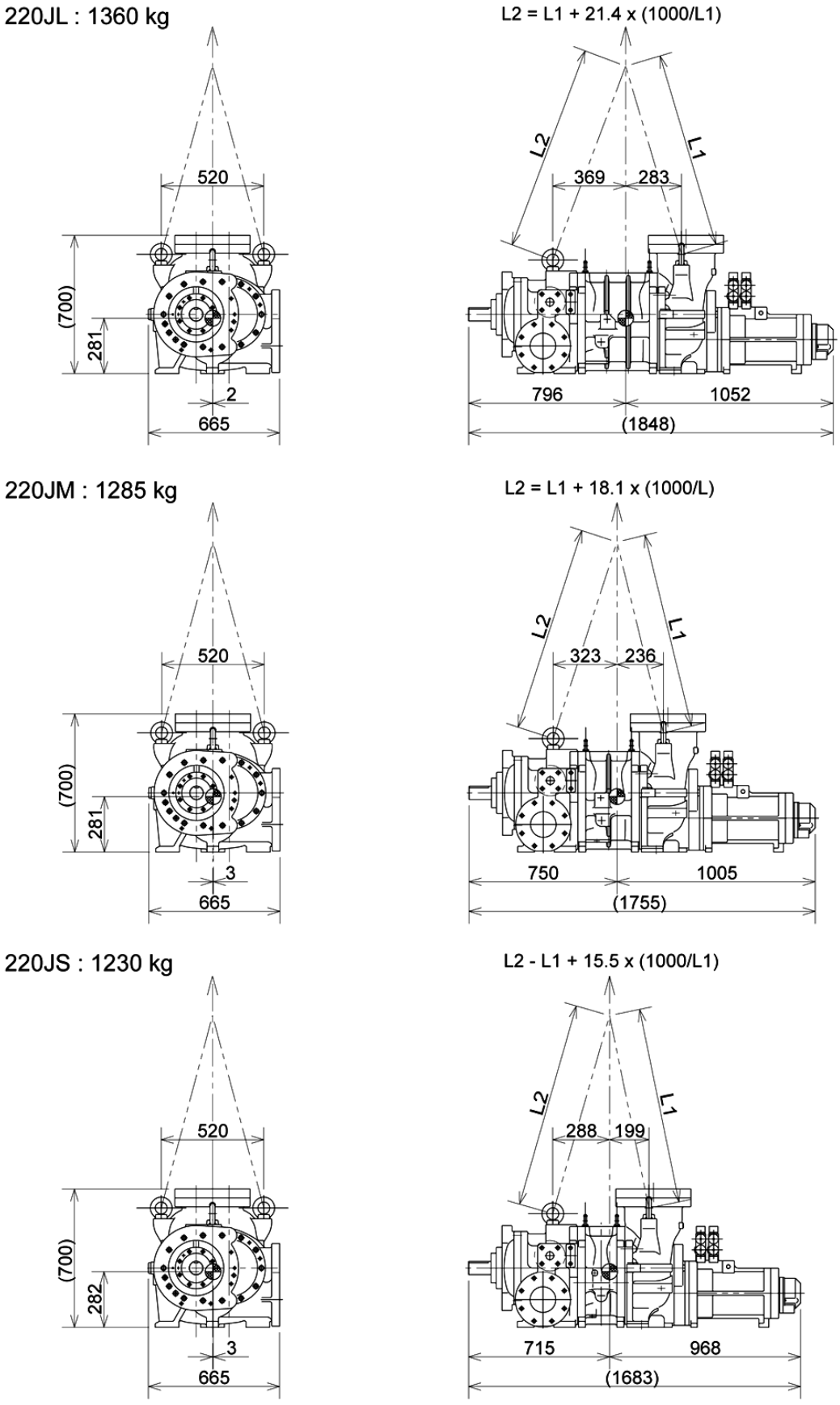


Figure 3-6 Center of Gravity and Lifting Points (220J)

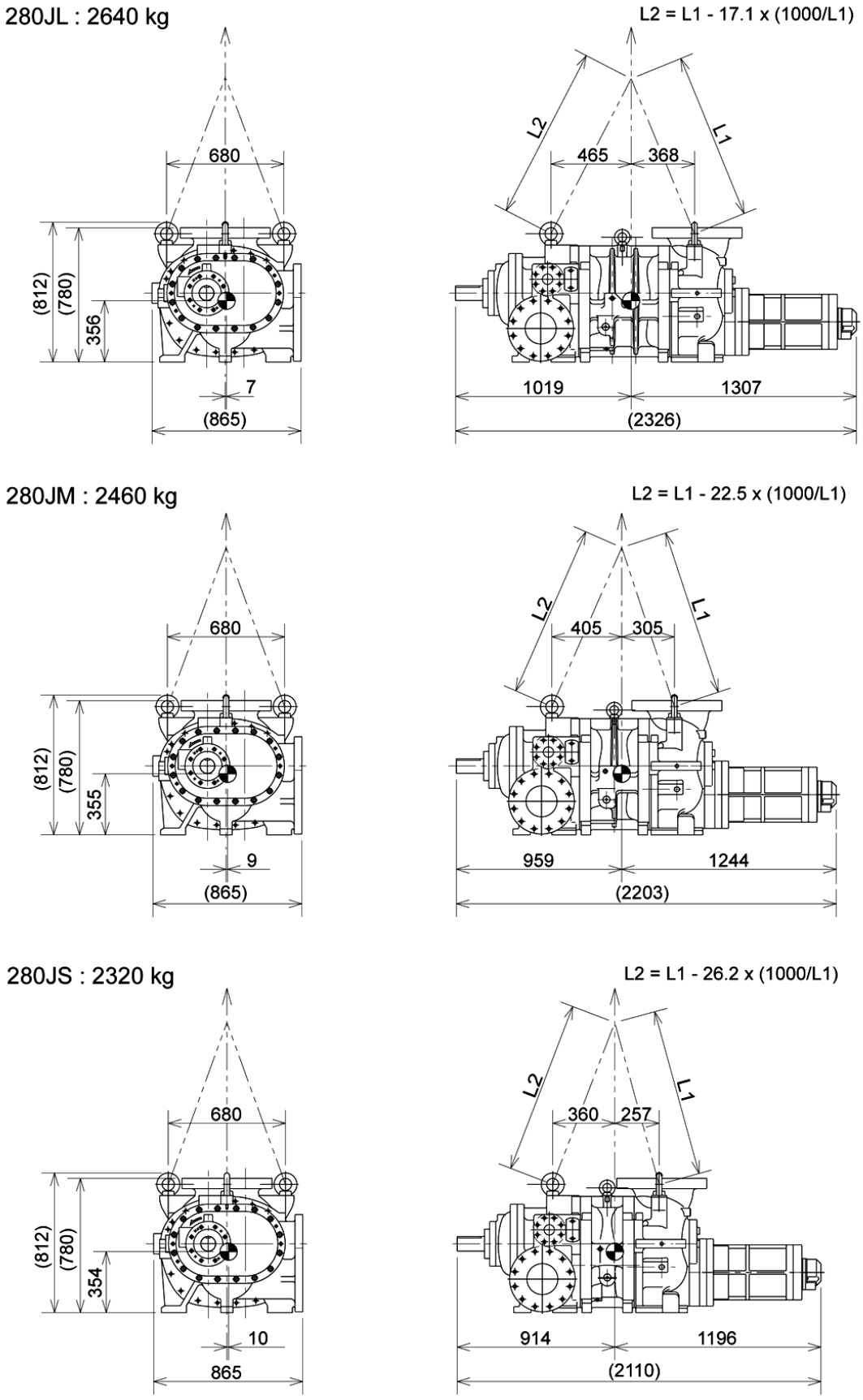


Figure 3-7 Center of Gravity and Lifting Points (280J)

Figure 3-8 Compressor being Lifted

4 Compressor and Package Operation

4.1 Adjustment before Test Operation

The unloader slide valve and variable Vi valve must be set by the controller before test operation.

4.1.1 Adjustment of Unloader Slide Valve and Variable Vi Slide Valve

Before test operation, make sure to perform a set-up that allows the controller to learn unloader slide valve positions from the 0% to 100%(indicated load) and variable Vi valve positions from the 2.5 to 5.0.

CAUTION

- **During the setup, make sure to operate the oil pump only. Turn off the main power for the compressor motor.**
- **During the setup, make sure to keep the internal pressure of the compressor less than 1.5 MPa (gauge pressure).**
- **After the setup operation, equalize pressure by opening the suction stop valve slowly in the package. After opening the suction stop valve, make sure that the motor main power is off and then turn the compressor driving shaft manually.**

1. Close the suction stop valve of the package.
2. Confirm that the internal compressor pressure is less than 1.5MPa (gauge pressure). If the pressure in the compressor is high, setup work of the Vi slide valve becomes difficult to perform accurately.
3. To check the unloader solenoid valve operation, start the oil pump and adjust the pressure.
   Set the oil pump discharge pressure 0.2 MPa (+/-0.05 MPa) higher than the oil pump suction pressure.
4. Using the controller manually, press the increase button of the unloader solenoid valve to increase the load of the unloader slide valve and check if the indicator needle moves toward the 100% point.
5. If the indicator needle moves in the increasing direction, the unloader solenoid valve wiring is correct.
6. If the indicator needle moves reversely or does not move, check the unloader solenoid valve wiring.
7. Next, operate the variable Vi slide valve to the L-Port position using the controller and check the variable Vi slide valve moving direction on the controller display.
8. If the variable Vi slide valve moves to the L-Port direction, the variable Vi solenoid valve wiring is correct. If it does not move or moves in the reverse direction, check the wiring.
9. If the unloader slide valve and variable Vi slide valve move in the correct directions respectively, execute the initial set up mode for the unloader slide valve and the variable Vi slide valve by the controller.
10. The oil pump automatically starts and the unloader slide valve and variable Vi slide valve automatically move in increasing direction and decreasing directions to allow operational position check.

With these steps, the initial adjustment for the unloader slide valve and the variable Vi slide valve is completed.

4.2 Lubricant (Refrigerant Oil)

The selection and management of lubricant (refrigerant oil) has a significant influence to the compressor performance

When selecting and managing lubricant, take the following points into consideration

4.2.1 Precautions for Selecting the Lubricant

- The lubricant must be selected while considering the refrigerant in use, type of evaporator, and operation conditions. Various properties of lubricant must be checked such as solubility with the refrigerant, separability, fluidity at low temperature and thermal stability at high temperature as well as viscosity. We therefore recommend consulting our sales offices or Mayekawa agencies for choice of a specified brand for your system.
- The lubricant supplied to the compressor must have appropriate proper viscosity to lubricate bearings and other mechanical components. The lubricant viscosity must be measured at the oil supply port of the compressor. The viscosity of lubricant is significantly affected by the type of refrigerant and oil. If the refrigerant dissolves in oil (the oil is miscible), the actual viscosity may be substantially lower than the required viscosity for the compressor depending on the operation conditions. If the refrigerant does not dissolve in the oil (the oil is not miscible) and the oil temperature is low, the viscosity may become excessively high. The lubricant must be selected such that it is supplied to the compressor with appropriate viscosity (13 to 40 mm^2/s) in the operating conditions.
- In a system utilizing a screw compressor, the lubricant supplied to the compressor is discharged along with the gas and separated from the refrigerant gas by the oil separator. However, the oil separator cannot separate all the oil from refrigerant gas and a small quantity of the lubricant goes to the condenser. As a results oil also enters the evaporator. Because of the wide operation temperature range of the lubricant, it must have thermal stability at high temperatures, good fluidity at low temperatures as well as high separable performance from refrigerant gas in the oil separator.
- Depending on the refrigerant in use, some lubricants cannot be used. For example, polyolester (POE) cannot be used with ammonia refrigerant.

4.2.2 Recommended Lubricant

When selecting lubricant, not only the refrigerant but also O-rings in use must be considered.
We therefore recommend using the following brands of lubricant for the J-series compressors to prevent any operating problems.

■ Recommended Lubricant for Ammonia Refrigerant

(1) Polyalkylene glycol synthetic oil (PAG): Miscible oil

Type	Brand	Manufacturer	VG	Recommended temperature (°C)
PAG	Freol PN46	JX	46	40-50 **see Note 1**
	RPS52	Kluber	46	40-50 **see Note 1**

(2) Naphthenic base mineral oil: Non-miscible oil

Type	Brand	Manufacturer	VG	Recommended temperature (°C)
M	Suniso 3GS	Sun Oil	32	35-60
	Suniso 4GS		68	50-60
	Gargoyle Arctic 155	Exxon Mobil	32	35-60
	Gargoyle Arctic C Heavy		46	45-60
	Gargoyle Arctic 300		68	55-60
	Capella WF32	Texaco	32	35-60
	Capella WF46		46	45-60
	Capella WF68		68	55-60

(3) Paraffinic base hydrotreated oil (HT): Non-miscible oil

Type	Brand	Manufacturer	VG	Recommended temperature (°C)
HT	CP-1009-32	CPI	32	35-65
	CP-1009-68		68	55-70
	Reflo 46A	Petro Canada	46	45-70
	Reflo 68A		68	55-70
	Reflo XL		68	55-70
	Capella Premium	Texaco	68	55-70
	RHT-68	Kluber	68	55-70

(4) Synthetic oil: Non-miscible oil

Type	Brand	Manufacturer	VG	Recommended temperature (°C)
AB	Acemire 300	Acemire Mayekawa	68	55-70
	Mycold AB68		68	50-70
	CP-4700-32	CPI	32	35-65
	CP-4700-68		68	50-70
	Zerice S 32	Exxon Mobil	32	35-65
	Zerice S 46		46	45-70
	Zerice S 68		68	55-70
	Gold-Cold 300	GoldenWest	68	50-70
	Barrel Freeze 32S	MATSUMURA OIL	32	35-65
	Barrel Freeze 46S		46	45-70
	Barrel Freeze 68S		68	55-70
	Refrigeration oil S4 FR-V 32	Shell	32	35-65
	Refrigeration oil S4 FR-V 46		46	45-70
	Refrigeration oil S4 FR-V 68		68	55-70
PAO+AB	Gargoyle Arctic NH68	Exxon Mobil	68	55-70
	Reflo Synthetic 68A	Petro Canada	68	55-70
PAO	Gargoyle arctic SHC224	Exxon Mobil	32	35-65
	Gargoyle arctic SHC226(E)		68	55-70

■ Lubricant for HFC refrigerants

(1) Polyolester synthetic oil (POE) for R404A, R507A, R410A: Miscible oil

Type	Brand	Manufacturer	VG	Recommended temperature (°C)
POE	Emkarate RL68H	Lubrizol	68	50-55 **see Note 1**
	Suniso SL-68S	Sun oil	68	50-55 **see Note 1**

(2) Polyolester synthetic oil (POE) for R134a: Miscible oil

Type	Brand	Manufacturer	VG	Recommended temperature (°C)
POE	Freol α100	JX	100	50-55 **see Note 1**

Note 1: Using inter-soluble oil, a case to use in liquid injection is excluded as for the recommended viscosity.

CAUTION

- **The lubricants listed above are adaptable to the J-series. We do not recommend using any of them with our other compressors.**

To use any other brand of lubricant not listed above, please contact us.

4.2.3 Change of Lubricant Brand

When changing the brand of lubricant in use, attention must be paid to the following points.

CAUTION

- **The change of lubricant brand may cause problems in operating conditions and the compressor. When changing the lubricant brand in use, make sure to contact us because appropriate steps must be surely followed.**

- Lubricant may contain additives for the purpose of improving lubricating ability and preventing deterioration. The kinds of additives and the additive rate differ depending on the type and brand of lubricant. Therefore, we recommend avoiding the mixed use of different brands of lubricant. If mixed brands of lubricant are used, the different additives in the lubricants may react with each other and cause problems of creating foreign substances.
- If it is necessary to change the brand of lubricant, recover as much oil as possible from the compressor as well as the oil separator, oil cooler, condenser, evaporator and other package and plant components before charging the new lubricant brands.
- When changing brands of lubricants, always confirm advice of change from the lubricant manufacturer. Particularly when changing the brand to a different manufacturer, consult both manufacturers to verify that the brand change will not cause problems.
- When changing the lubricant to another product of the same brand at a different viscosity grade, confirm that the viscosity grade will not cause problems during operation of the compressor.
- Depending on the characteristics of lubricant (miscible or non-miscible), the refrigeration system must adopt different package components and refrigeration flow (e.g. type of evaporator, with or without oil return line). Therefore, miscible lubricant must not be changed to non-miscible lubricant. If you change the lubricant from non-miscible to miscible, select the lubricant paying particular attention to the viscosity. The actual lubricant viscosity supplied to the compressor will lower because the refrigerant dissolves in the lubricant.

4.2.4 Precautions for Handling Lubricant

- For lubricant charging, always use clean oil that has been sealed and stored indoors. Any oil left open to air may absorb moisture and contain dust or foreign substances.
- When charging lubricant, take extreme care not to allow entry of air and moisture.

4.2.4.1 Precautions for Handling Polyalkylene Glycol (PAG)

PAG oil is much more hygroscopic than mineral oils and any moisture mixed in the oil may lead to rust, corrosion and wear within the package. When handling PAG oil, pay special attention to the following points.

- Do not perform oil charging in rainy weather or at a place with high humidity to prevent absorbing moisture.
- Before charging, remove as much moisture as possible from the system by exhausting it with a vacuum pump for a sufficient length of time and leaving the system in vacuum condition overnight.
- Do not open the lid of pale can until just before charging. Once the can is opened, finish the oil charge as quickly as possible. (Finish the charge of a single can of oil within 15 minutes.)
- Cover any gaps between the pale can opening and the charge hose so that foreign substances or moisture cannot enter. A more effective way is to substitute any space inside the pale can with nitrogen gas .
- Always charge all oil from the pale can. Even if some oil remains, do not use it subsequently.
- If any oil drops on a painted surface, wipe it away as soon as possible. Otherwise the paint may come off.

4.2.4.2 Precautions for Handling Polyolester (POE) Oil

This type of oil has high hygroscopicity as polyalkylene glycol, and also exhibits hydrolyzability under high temperature environments. Moisture entry must be avoided. Therefore, special attention must be paid as with PAG when handling POE.

- Finish the charging in as short a time as possible after opening the pale can to minimize exposure to air.
- Make sure that all oil in a pale can is used in a single charging. Any remaining oil must be stored indoors with the can lid closed tightly. Do not attempt to store it for a long time.
- Because POE can hydrolyze, make sure to perform an oil analysis regularly in the package to see if any abnormal conditions are present.

4.3 Precautions for Operation

4.3.1 Prevention of Liquid Return (Liquid Backflow) Operation

Liquid return is a phenomenon where refrigerant liquid (mist) is not completely evaporated within the evaporator and is drawn into the compressor.

Liquid return may cause abnormal vibrations and noises from compressor, foaming of lubricant in the oil separator (too much entry of oil), and poor lubrication of compressor.

To prevent liquid return, appropriately adjust the expansion valve to the evaporator or liquid cooler. In addition, special attention must be paid to the suction pipe line connection way to the system and means of starting up the compressor after a long time of stoppage.

4.3.2 Purging of Non-condensable Gases

Any non-condensable gas in the system may cause the compressor discharge pressure to rise higher than the refrigerant saturation pressure that depends on cooling water temperature of condenser. This is caused by the non-condensable gas staying in the condenser which deteriorates the heat exchange performance.

If the vacuum pumping performed upon initial installation or maintenance is insufficient or the suction pressure is lower than the atmospheric pressure to suck air if the suction pipe had a leak, non-condensable gases accumulate in the condenser.

When a considerable amount of non-condensable gases accumulate in the condenser, the compressor load increases and finally the motor overcurrent alarm may occur.

In such a case, purge any non-condensable gas from the condenser.

⚠ WARNING

- **Some types of refrigerants may have bad smell, toxicity, and/or flammability. In a airtight space such as a machine room, oxygen shortage may occur due to high concentration of the refrigerant gas. Maintain sufficient ventilation while working.**
- **When handling fluorocarbon refrigerants, remember that they are prohibited from being purged into air by law.**

1. When the compressor is stopped, allow the cooling water to flow to the condenser and check that there is no difference in water temperature between the inlet and outlet. If any difference is present between the inlet and outlet water temperatures, keep the cooling water flowing until the temperature difference is eliminated.
2. Measure the pressure of the condenser and compare it with the refrigerant saturation pressure depending on the cooling water temperature.
3. If the condenser pressure is higher than the refrigerant saturation pressure by 0.05 MPa or more, purge any non-condensable gases.

4.4 Action for Stopping the Compressor for Long Period of Time

Before stopping the compressor for a long time, make sure to perform the following steps.

- Turn off the main motor power.
- Turn off the oil heater power and the control power.
- Close the suction stop valve and discharge stop valve.
- If an economizer or liquid injection is used, close the stop valve located at the compressor inlet.

If the stoppage period is 1 month or longer, perform the following checks every month.

- Measure the package pressure.
- Check for refrigerant leak using a leakage detector.
- Operate the oil pump for 5 minutes. After that, turn the compressor driving shaft manually. (10 turns or more)

When restarting the compressor after a stoppage period of 1 year or longer, check the package for refrigerant leakage and replace the lubricant. Also check the main motor for insulation resistance.

Supply power to the oil heater for at least 1 hour before operation starts. And before starting the operation, confirm that the refrigerant is not condensed in the package by checking the package temperature and pressure (especially the suction pipe).

5 Maintenance and Inspection

5.1 Precautions for Maintenance and Inspection

- Before starting maintenance/inspection work after completely removing the refrigerant from the package, make sure that the main motor, control and power for instruments and valves are turned off and the power off switches are protected from any unauthorized access. In addition, attach a tag to each power off switch informing other workers that the switch must not be turned on. (Lockout/tagout)
- Also when a manual valve is closed, apply appropriate measures so that it cannot be operated by other workers and attach a tag stating that the device must not be opened.
- Before disassembling, inspecting or handling the compressor, fully understand the disassembly/assembly procedure of the compressor. This document does not provide the complete procedures of compressor disassembly and assembly but just instructs the main points in compressor service.
- If you need to perform the complete compressor disassembly/assembly work, consult MYCOM in your region.
- When replacing any parts with the compressor, always use the MYCOM genuine parts. If any unauthentic part is used, unexpected problems may occur.
- Do not modify the compressor or any of its parts without prior permission of Mayekawa. It may cause the compressor to be damaged or disabled from maintaining its normal functions.
- To disassemble the compressor, it must be removed from the package and placed on a work bench. Before removing the compressor from the package, make sure to remove the refrigerant in the package and confirm that the pressure inside the compressor is atmospheric.
- Prior to removing the compressor from the package, check that the high temperature side (discharge side) is cooled down to 40°C or less.
- Perform the compressor disassembly on a rigid and flat work bench.
- When removing the compressor from the package and placing it on the work bench, follow the instructions in Chapter 3, "3.1 Precautions for Installation" and "3.2.3 Transfer".
- Lifting and carrying works for the compressor and package must be performed by a qualified person.
- For compressor disassembly/assembly, use specified tools that are properly functioning.
- When handling heavy parts, exercise extreme caution and use safe auxiliary tools such as safety bolts.
- When carrying a heavy part, use lifting equipment such as crane, or work with one or more workers.
- Before working with other workers, make sure that all workers clearly understand the work procedure.
- When turning on and off the power supplies, take care to avoid any electric shock hazard.
- Any electric works requiring some expert qualifications must be performed by a qualified person.

5.2 Maintenance List

5.2.1 Daily Management

The controller panel installed to the compressor package in standard displays the following items that monitor the compressor operating conditions.

- Suction pressure (MPa)
- Discharge pressure (MPa)
- Lubrication pressure (MPa)
- Oil filter pressure loss (MPa)
- Suction temperature (°C)
- Discharge temperature (°C)
- Oil supply temperature (°C)
- Motor current (A)
- Indicated load of unloader (%)
- Compressor Vi setting (-)
- Suction superheat (°C)
- Discharge superheat (°C)

Note: Unless otherwise noted, the pressure unit MPa represents the gauge pressure in this manual.

These operation data should be recorded in an operating log book on a daily basis. This practice is significantly effective and helpful in finding out any abnormal condition of the compressor and prevents possible compressor failures.

In particular, it is important to confirm the absence of any abnormality between the temperature and pressure correlations related to the refrigerant evaporation and condensation. It is possible to find any abnormal condition in the compressor or the system quickly by monitoring the evaporation and condensation temperature and pressure.

If any compressor/system failure or operating accident occurs, the operating log book will help the cause to be clear and take appropriate measures promptly.

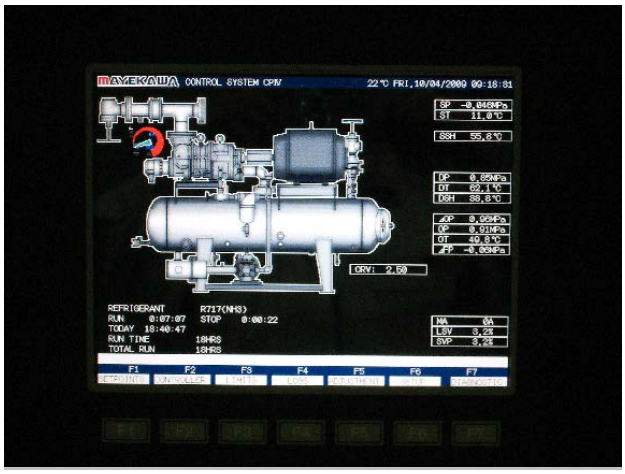


Figure 5-1 Controller Display Screen (Example)

■ Daily inspection items

Based on the operating log, check the following points.

Table 5-1 Daily Inspection Items

Inspection Items			Inspection Contents	Check Items/Actions
Compressor	Operating hours	h	Total operating hours	• Judgment of periodic maintenance timing
	Suction pressure	MPa Note 1	Difference from the set value of evaporation temperature equivalent pressure	• Contamination on the cooling pipe surface • Temperature, flow rate, etc. of the object to be cooled
	Discharge pressure	Mpa	Difference from cooling water temperature equivalent condensing pressure	• Contamination on condenser cooling pipes • Non-condensable gases mixed into the system • Quantity, temperature, etc. of cooling water
	Oil supply pressure	MPa	Difference from discharge pressure	• Whether differential pressure is decreasing • Operation with liquid flow-back • Whether compressor parts are worn
	Oil filter pressure loss	MPa	Pressure difference between oil filter inlet and outlet	• Contamination of lubricant • Clogging of oil filter
	Suction temperature	°C	Whether within upper and lower limits	• Temperature, flow rate, etc. of the object to be cooled
	Degree of superheat for suction	°C	Whether degree of superheat is proper	• Adjust expansion valve • Insufficient refrigerant flow
	Discharge temperature	°C	Whether within upper limit	• Non-condensable gases mixed into the system • Oil supply temperature, insufficient oil supply • Compressor failure
Compressor	Oil supply temperature	°C	Whether within upper and lower limits	• Contamination on cooling pipes of oil cooler
	Capacity control Indicated load	%	Whether operation is normal	• Damage to solenoid valve coil • Improper adjustment of manual control valve of electromagnetic assembly
	Leak from mechanical seal	mL/h	Leak per hour	• Mechanical seal failure
	Variable Vi valve position (L, M, H)		Whether port position is appropriate for operating conditions	• Damaged solenoid valve coil • Position sensor failure
	Noise and vibration		Abnormal noise/vibration	• Compressor failure
Others	Motor current	A	Whether it is higher than the current at test run	• Compressor failure • Motor failure
	Oil level of oil separator	-	Oil level	• Oil loss • Replenish oil
	Fluid level in the receiver	-	Fluid level	• Replenish refrigerant
	Check for refrigerant leak	-	leak or not	• The machine room and the load side facilities

Note 1 : Unless otherwise noted, the pressure unit MPa represents the gauge pressure in this manual.

■ Daily maintenance items

1. Lubrication oil level

When the oil level in the oil separator reaches the lower limit, charge lubricant by referring to the instruction manual of the package/refrigerant system.

2. Replacing Oil Filter

When the differential pressure between oil filter inlet and outlet is beyond pressure specified by the manufacture, replace the oil filter element.

When starting operation, the oil filter differential pressure may increase in a short time.

CAUTION

- **In the case of differential pressure oil supply system, any oil supply differential pressure (Discharge pressure – Oil supply pressure) exceeding over 0.15 MPa may significantly decrease the thrust bearing life. Moreover, the oil filter element may be broken, resulting in compressor damage.**

3. Cleaning Suction Strainer

When the compressor operating hours have exceeded 500 h, inspect the suction strainer and remove the temporary filter for an initial period of operation if it is attached.

At the beginning of operation or just after the periodical maintenance, the differential pressure of the suction strainer may increase in a short time. If the differential pressure increases, inspect and clean the suction strainer.

4. Oil Leak from Mechanical Seal

If there is a lot of oil leak from the mechanical seal, confirm the quantity of the leak per a hour. The table below specifies the allowable leak rate and the upper limit for inspection.

If any damage is found in the mechanical seal during inspection, replace the mechanical seal.

Table 5-2 Guideline for Leak Rate from Mechanical Seal

	170J	220J	280J
Allowable leak rate (mL/h)	≤ 3		≤ 6
Rate at which inspection must be done (mL/h)	≥ 9		≥ 18

Note: The specifications above are just guidelines. They are not guaranteed value.

5. Contamination of Condenser and Oil Cooler Pipes

The degree of clogging and contamination of the cooling pipes of the cooling water side is mostly affected by the cooling water quality.

If the oil temperature and discharge pressure increase gradually in an initial period of operation, inspect and clean the cooling water side of the oil cooler and condenser even when the inspection time has not come.

5.2.2 Periodical inspection

Inspect the following points at specified intervals.

Table 5-3 Periodic Inspection Items

Item	Inspection Interval	Remarks
Pressure sensors	Annually	
Temperature sensors	Annually	
Protective devices and safety valves	Annually.	
Suction strainer	Inspect 500 operating hours after start	If the differential pressure between the front and back of the suction strainer increases, inspect and clean the suction strainer.
	Inspect and clean annually.	
Lubricant	Replace 500 operating hours after start	
	Analyze lubricant at intervals of 6 months.	If the analysis results do not satisfy the management criteria provided in "5.3 Management of Lubricant", in this manual, replace oil.
Oil filter	Replace annually	When the differential pressure between oil filter inlet and outlet is beyond pressure of the manufacture specification, replace the oil filter element.
Cooling water side of oil cooler	Annually	Clean it if it is confirmed to be contaminated heavily.
Cooling water side of condenser	Annually	Clean it if it is confirmed to be contaminated heavily.
Mechanical seal	Annually or every 8,000 operating hours *	To be replaced if any abnormality is found However, in the case that it is difficult to stop the operation not at regular inspection, replace the mechanical seal assembly at every inspection.
Coupling	Annually or every 8,000 operating hours *	

Note*: Inspect the machine per period or operating hours, whichever is shorter.

5.2.3 Guidelines for Compressor Overhaul Frequency

When servicing or overhauling the compressor, follow the instructions and guidelines described below.

The compressor inspection frequency significantly differs depending on the operating conditions, refrigerant in use, type and condition of lubricant, and the system in which the compressor is operated. The table below indicates the overhaul frequency recommended by MYCOM based on the operating conditions of the compressor.

Table 5-4 Standard Package Operation Conditions and Overhaul Frequency Guidelines

• Category of Operating Condition	Application Example	Recommended Overhaul Frequency
Relatively stable operating condition	Cold storage and refrigeration	Every 5 years or 40,000 operating hours
Relatively changing operating condition	Ice maker/chiller	Every 4 years or 30,000 operating hours
Frequently started/stopped, and relatively changing operating conditions	Heat pump	Every 3 years or 20,000 operating hours

Note 1: The above guidelines are only applicable when the compressor is operated within the operation limits which are specified separately. (See "2.3.2 Operation Limits" in this manual.)

Note 2: The above guidelines are only applicable when the compressor undergoes daily and periodical inspections specified separately. (See "5.2.1 Daily Management" in this manual.)

Note 3: Inspect the compressor at the intervals of specified period or operating hours, whichever comes first.

Note 4: The above guidelines do not constitute any warranty.

5.2.4 Replacement Parts of the Compressor in Overhauling

Table 5-5 Overhaul Timings and Replacement Parts (170J)

Part No.	Part Name	Qty.			Inspection Interval		Remarks
					40,000 hours or 5 years	80,000 hours or 10 years	
		170J			30,000 hours or 4 years	60,000 hours or 8 years	
		S	M	L	20,000 hours or 3 years	40,000 hours or 6 years	
93	Suction flange gasket	1			○	○	ANSI#300 5”
96	Discharge flange gasket	1			○	○	ANSI#300 3”
216	Lubrication flange gasket	1			○	○	ANSI#300 1”
251	Electromizer (Economizer) flange gasket	1			○	○	ANSI#300 1”
254	Aquamizer (Liquid injection) flange gasket	1			○	○	ANSI#300 3/4”
6	O-ring	1			○	○	JIS B 2401 P375
9-1	O-ring	1			○	○	JIS B 2401 P52
12	O-ring	1			○	○	JIS B 2401 P375
17-1	O-ring	1			○	○	JIS B 2401 P300
17-2	O-ring	1			○	○	JIS B 2401 P14
23	O-ring	2			○	○	JIS B 2401 G115
35-1	O-ring	1			○	○	JIS B 2401 G90
35-2	O-ring	1			○	○	JIS B 2401 G115
49	O-ring	1			○	○	JIS B 2401 G120
52-1	O-ring	1			○	○	JIS B 2401 G120
52-2	O-ring	1			○	○	JIS B 2401 G145
63-1	O-ring	2			○	○	AS568A-258
63-2	O-ring	2			○	○	JIS B 2401 P14
65	O-ring	2			○	○	JIS B 2401 P130
73	O-ring	1			○	○	JIS B 2401 P32
75-1	O-ring	1			○	○	JIS B 2401 G135
75-2	O-ring	1			○	○	JIS B 2401 P14
82-1	O-ring	2			○	○	JIS B 2401 P10A
82-2	O-ring	1			○	○	JIS B 2401 P16
100-1	O-ring	1			○	○	AS568A-334
100-4	O-ring	1			○	○	AS568A-227
295	O-ring	1			○	○	JIS B 2401 P52
298	O-ring	1			○	○	JIS B 2401 G135
299-1	O-ring	1			○	○	JIS B 2401 G100
299-2	O-ring	1			○	○	AS568A-258
325-1	O-ring	3			○	○	JIS B 2401 P32
421	O-ring	2	2	-	○	○	JIS B 2401 P32
432	O-ring	4			○	○	JIS B 2401 G100
433	O-ring	4			○	○	JIS B 2401 G75
494	O-ring	1			○	○	JIS B 2401 P155
561	O-ring	8			○	○	JIS B 2401 P12
657	O-ring	1			○	○	JIS B 2401 G100
713	O-ring	1			○	○	JIS B 2401 P12
714	O-ring	1			○	○	JIS B 2401 P6
717	O-ring	1			○	○	JIS B 2401 G25

Part No.	Part Name	Qty.			Inspection Interval		Remarks
					40,000 hours or 5 years	80,000 hours or 10 years	
		170J			30,000 hours or 4 years	60,000 hours or 8 years	
		S	M	L	20,000 hours or 3 years	40,000 hours or 6 years	
744	O-ring	1			○	○	JIS B 2401 G55
9-2	Back-up ring for O-ring	2			○	○	SUN-2BP 52
325-2	Back-up ring for O-ring	2			○	○	SUN-2BP 32
66	Teflon cap seal	2			○	○	SUNR-BE-130
50	Oil seal	1			○	○	SA1J 65 85 12
100	Mechanical seal assembly	1			○	○	
38-1	Thrust bearing assembly, M	1			○	○	7312BEAXT7DF
38-2	Thrust bearing assembly, F	1			○	○	7309BEAXT7DF
40-1	Lock washer	1			○	○	AW12
40-2	Lock washer	1			○	○	AW09
46	Conical spring washer	12			○	○	Hexagon socket head cap screw M8
237-1	Torsional slip washer	1			○	○	
237-2	Torsional slip washer	1			○	○	
293	Spiral retaining ring	2			○	○	FRSN-45
489	Valve sheet	1			○	○	
485	Spring, check valve	1			○	○	
711	Spring	1			○	○	
27	Bearing for M rotor	2			○	○	Reusable if not damaged.
28	Bearing for F rotor	2			○	○	Reusable if not damaged.
481	Check valve slider	1			○	○	Reusable if not damaged.
486	Locknut	1			○	○	FU nut FU04SS Reusable if not damaged.
487	Plain washer	1			○	○	JIS B 1256, small dia. M20 Reusable if not damaged.
491	Check valve stem	1			○	○	Reusable if not damaged.
528	Sleeve, oil seal	1			○	○	Reusable if not damaged.
712	Vi position sensor rod	1			○	○	Reusable if not damaged.
30	Balance piston	1				○	To be replaced if there is any damage.
33	Balance piston sleeve	1				○	To be replaced if there is any damage.
29-1	Retaining ring C type - Internal	2				○	JIS B 2804 H120 To be replaced if there is any damage.

Part No.	Part Name	Qty.			Inspection Interval		Remarks
					40,000 hours or 5 years	80,000 hours or 10 years	
		170J			30,000 hours or 4 years	60,000 hours or 8 years	
		S	M	L	20,000 hours or 3 years	40,000 hours or 6 years	
29-2	Retaining ring C type - Internal	2				○	JIS B 2804 H95 To be replaced if there is any damage.
32	Retaining ring C type - External	1				○	JIS B 2804 S40 To be replaced if there is any damage.
37	Retaining ring C type - Internal	1				○	JIS B 2804 H120 To be replaced if there is any damage.
79	Retaining ring C type - External	1				○	JISB2804 S10 To be replaced if there is any damage.
716	Retaining ring E type	1				○	JIS B2804 E snap ring 4 To be replaced if there is any damage
78	Ball bearing	1				○	To be replaced if there is any damage.
39-1	Locknut	1				○	AN12 To be replaced if there is any damage.
39-2	Locknut	1				○	AN09 To be replaced if there is any damage.
69	Locknut	1				○	FU nut FU05SS To be replaced if there is any damage
25	M rotor	1					To be replaced if there is any damage.
26	F rotor	1					To be replaced if there is any damage.
41-1	Thrust bearing outer race spacer, M	1					To be replaced if there is any damage.
41-2	Thrust bearing outer race spacer, F	1					To be replaced if there is any damage.
42-1	Thrust bearing alignment spacer, M	1					To be replaced if there is any damage.

Part No.	Part Name	Qty.			Inspection Interval		Remarks
					40,000 hours or 5 years	80,000 hours or 10 years	
		170J			30,000 hours or 4 years	60,000 hours or 8 years	
		S	M	L	20,000 hours or 3 years	40,000 hours or 6 years	
42-2	Thrust bearing alignment spacer, F	1					To be replaced if there is any damage.
250-1	Thrust washer, M	1					To be replaced if there is any damage.
250-2	Thrust washer, F	1					To be replaced if there is any damage.
31	Balance piston key	1					To be replaced if there is any damage.
91	Shaft key	1					To be replaced if there is any damage.
725	Packing, Vi position sensor box	1					To be replaced if there is any damage.

Note:
Reusable if not damaged: If there is no damage or abnormality in visual inspection, the part can be used continuously.
To be replaced if there is any damage: Replace the part if any damage or abnormality is found in visual inspection.

Table 5-6 Overhaul Timings and Replacement Parts (220J)

Part No.	Part Name	Qty.			Inspection Interval		Remarks
					40,000 hours or 5 years	80,000 hours or 10 years	
		220J			30,000 hours or 4 years	60,000 hours or 8 years	
		S	M	L	20,000 hours or 3 years	40,000 hours or 6 years	
93	Suction flange gasket	1			○	○	ANSI#300 8”
96	Discharge flange gasket	1			○	○	ANSI#300 5”
216	Oil supply flange gasket	1			○	○	ANSI#300 1”
251	Electromizer (Economizer) flange gasket	1			○	○	ANSI#300 1 1/2”
254	Aquamizer (Liquid injection) flange gasket	1			○	○	ANSI#300 3/4”
6	O-ring	1			○	○	JIS B 2401 P450
9-1	O-ring	1			○	○	JIS B 2401 P65
12	O-ring	1			○	○	JIS B 2401 P450
17-1	O-ring	1			○	○	JIS B 2401 P375
17-2	O-ring	1			○	○	JIS B 2401 P14
23-1	O-ring	1			○	○	JIS B 2401 G150
23-2	O-ring	1			○	○	JIS B 2401 G115
35-1	O-ring	1			○	○	JIS B 2401 P120
35-2	O-ring	1			○	○	JIS B 2401 G150
49	O-ring	1			○	○	JIS B 2401 G145
52-1	O-ring	1			○	○	JIS B 2401 G145
52-2	O-ring	1			○	○	JIS B 2401 P14
63-1	O-ring	2			○	○	JIS B 2401 G200
63-2	O-ring	2			○	○	JIS B 2401 P14
65	O-ring	2			○	○	JIS B 2401 P170
73	O-ring	1			○	○	JIS B 2401 P44
75-1	O-ring	1			○	○	JIS B 2401 G175
75-2	O-ring	1			○	○	JIS B 2401 P14
82-1	O-ring	2			○	○	JIS B 2401 P10A
82-2	O-ring	1			○	○	JIS B 2401 P16
100-1	O-ring	1			○	○	AS568A-340
100-4	O-ring	1			○	○	AS568A-148
295	O-ring	1			○	○	JIS B 2401 P65
298	O-ring	1			○	○	JIS B 2401 G175
299-1	O-ring	1			○	○	JIS B 2401 G100
299-2	O-ring	1			○	○	JIS B 2401 G200
325-1	O-ring	3			○	○	JIS B 2401 P44
421	O-ring	2	2	-	○	○	JIS B 2401 P44
432	O-ring	4			○	○	JIS B 2401 G130
433	O-ring	4			○	○	JIS B 2401 G100
494	O-ring	1			○	○	JIS B 2401 P220
561	O-ring	8			○	○	JIS B 2401 P12
657	O-ring	1			○	○	JIS B 2401 G120
713	O-ring	1			○	○	JIS B 2401 P12
714	O-ring	1			○	○	JIS B 2401 P6
717	O-ring	1			○	○	JIS B 2401 G25
728-4	O-ring	1			○	○	JIS B 2401 G45

Part No.	Part Name	Qty.			Inspection Interval		Remarks
					40,000 hours or 5 years	80,000 hours or 10 years	
		220J			30,000 hours or 4 years	60,000 hours or 8 years	
		S	M	L	20,000 hours or 3 years	40,000 hours or 6 years	
744	O-ring	1			○	○	JIS B 2401 G70
9-2	Back-up ring for O-ring	2			○	○	SUN-2BP 65
325-2	Back-up ring for O-ring	2			○	○	SUN-2BP 44
66	Teflon cap seal	2			○	○	SUNR-BE-170
50	Oil seal	1			○	○	SA1J 75 100 13
100	Mechanical seal assembly	1			○	○	
38-1	Thrust bearing assembly, M	1			○	○	7316BEAXT7DF
38-2	Thrust bearing assembly, F	1			○	○	7312BEAXT7DF
40-1	Lock washer	1			○	○	AW16
40-2	Lock washer	1			○	○	AW12
70	Lock washer	1			○	○	AW07
46	Conical spring washer	12			○	○	for Hexagon socket head cap screw M12
237-1	Torsional slip washer	1			○	○	
237-2	Torsional slip washer	1			○	○	
293	Spiral retaining ring	2			○	○	FRSN-56
489	Valve sheet	1			○	○	
485	Spring, check valve	1			○	○	
711	Spring	1			○	○	
27	Bearing for M rotor	2			○	○	Reusable if not damaged.
28	Bearing for F rotor	2			○	○	Reusable if not damaged.
481	Check valve slider	1			○	○	Reusable if not damaged.
486	Locknut	1			○	○	FU nut FU05SS Reusable if not damaged.
487	Plain washer	1			○	○	JIS B 1256, normal, 24 × 44 Reusable if not damaged.
491	Check valve stem	1			○	○	Reusable if not damaged.
528	Sleeve, oil seal	1			○	○	Reusable if not damaged.
712	Vi position sensor rod	1			○	○	Reusable if not damaged.
30	Balance piston	1				○	To be replaced if there is any damage.
33	Balance piston sleeve	1				○	To be replaced if there is any damage.

Part No.	Part Name	Qty.			Inspection Interval		Remarks
					40,000 hours or 5 years	80,000 hours or 10 years	
		220J			30,000 hours or 4 years	60,000 hours or 8 years	
		S	M	L	20,000 hours or 3 years	40,000 hours or 6 years	
29-1	Retaining ring C type - Internal	2				○	JIS B 2804 H150 To be replaced if there is any damage.
29-2	Retaining ring C type - Internal	2				○	JIS B 2804 H120 To be replaced if there is any damage.
32	Retaining ring C type - External	1				○	JIS B 2804 S65 To be replaced if there is any damage.
37	Retaining ring C type - Internal	1				○	JIS B 2804 H120 To be replaced if there is any damage.
79	Retaining ring C type - External	1				○	JISB2804 S10 To be replaced if there is any damage.
716	Retaining ring E type	1				○	JIS B2804 E snap ring 4 To be replaced if there is any damage.
78	Ball bearing	1				○	To be replaced if there is any damage.
39-1	Locknut	1				○	AN16 To be replaced if there is any damage.
39-2	Locknut	1				○	AN12 To be replaced if there is any damage.
69	Locknut	1				○	AN07 To be replaced if there is any damage.
25	M rotor	1					To be replaced if there is any damage.
26	F rotor	1					To be replaced if there is any damage.
41-1	Thrust bearing outer race spacer, M	1					To be replaced if there is any damage.

Part No.	Part Name	Qty.			Inspection Interval		Remarks
					40,000 hours or 5 years	80,000 hours or 10 years	
		220J			30,000 hours or 4 years	60,000 hours or 8 years	
		S	M	L	20,000 hours or 3 years	40,000 hours or 6 years	
41-2	Thrust bearing outer race spacer, F	1					To be replaced if there is any damage.
42-1	Thrust bearing alignment spacer, M	1					To be replaced if there is any damage.
42-2	Thrust bearing alignment spacer, F	1					To be replaced if there is any damage.
250-1	Thrust washer, M rotor	1					To be replaced if there is any damage.
250-2	Thrust washer, F rotor	1					To be replaced if there is any damage.
31	Balance piston key	1					To be replaced if there is any damage.
91	Shaft key	1					To be replaced if there is any damage.
725	Packing, Vi position sensor box	1					To be replaced if there is any damage.

Note:
Reusable if not damaged: If there is no damage or abnormality in visual inspection, the part can be used continuously.
To be replaced if there is any damage: Replace the part if any damage or abnormality is found in visual inspection.

Table 5-7 Overhaul Timings and Replacement Parts (280J)

Part No.	Part Name	Qty.			Inspection Interval		Remarks
					40,000 hours or 5 years	80,000 hours or 10 years	
		280J			30,000 hours or 4 years	60,000 hours or 8 years	
		S	M	L	20,000 hours or 3 years	40,000 hours or 6 years	
93	Suction flange gasket	1			○	○	ANSI#300 12”
96	Discharge flange gasket	1			○	○	ANSI#300 8”
216-1	Oil supply flange gasket (discharge side)	1			○	○	ANSI#300 1”
216-2	Oil supply flange gasket (suction side)	1			○	○	ANSI#300 3/4”
219	Oil supply flange gasket (injection)	1			○	○	ANSI#300 1 1/4”
251	Electromizer (Economizer) flange gasket	1			○	○	ANSI#300 2 1/2”
254	Aquamizer (Liquid injection) flange gasket	1			○	○	ANSI#300 1”
6	O-ring	1			○	○	JIS B 2401 P580
9-1	O-ring	1			○	○	JIS B 2401 P85
12	O-ring	1			○	○	JIS B 2401 P580
17-1	O-ring	1			○	○	JIS B 2401 P480
17-2	O-ring	1			○	○	JIS B 2401 P14
23-1	O-ring	1			○	○	JIS B 2401 G190
23-2	O-ring	1			○	○	JIS B 2401 G150
35-1	O-ring	1			○	○	JIS B 2401 G150
35-2	O-ring	1			○	○	JIS B 2401 G190
49	O-ring	1			○	○	JIS B 2401 G165
52-1	O-ring	1			○	○	JIS B 2401 G165
52-2	O-ring	1			○	○	JIS B 2401 P14
63	O-ring	2			○	○	JIS B 2401 G260
65	O-ring	2			○	○	JIS B 2401 P225
73	O-ring	1			○	○	JIS B 2401 P58
75	O-ring	1			○	○	JIS B 2401 G230
82-1	O-ring	2			○	○	JIS B 2401 P10A
82-2	O-ring	1			○	○	JIS B 2401 P16
100-1	O-ring	1			○	○	JIS B 2401 P110
100-4	O-ring	1			○	○	AS568A-239
295	O-ring	1			○	○	JIS B 2401 P85
298	O-ring	1			○	○	JIS B 2401 G230
299-1	O-ring	1			○	○	JIS B 2401 G135
299-2	O-ring	1			○	○	JIS B 2401 G260
325-1	O-ring	3			○	○	JIS B 2401 P58
421	O-ring	2	2	-	○	○	JIS B 2401 P58
432	O-ring	4			○	○	JIS B 2401 G165
433	O-ring	4			○	○	JIS B 2401 G140
657	O-ring	1			○	○	JIS B 2401 G120
713	O-ring	1			○	○	JIS B 2401 P12
714	O-ring	1			○	○	JIS B 2401 P6
717	O-ring	1			○	○	JIS B 2401 G25
728-4	O-ring	1			○	○	JIS B 2401 G65

Part No.	Part Name	Qty.			Inspection Interval		Remarks
					40,000 hours or 5 years	80,000 hours or 10 years	
		280J			30,000 hours or 4 years	60,000 hours or 8 years	
		S	M	L	20,000 hours or 3 years	40,000 hours or 6 years	
744	O-ring	1			○	○	JIS B 2401 G90
9-2	Back-up ring for O-ring	2			○	○	SUN-2BP 85
325-2	Back-up ring for O-ring	2			○	○	SUN-2BP 58
66	Teflon cap seal	2			○	○	SUNR-BE-225
50	Oil seal	1			○	○	SA1J 95 120 13
100	Mechanical seal assembly	1			○	○	
38-1	Thrust bearing assembly, M	1			○	○	7320BEAXT7DF
38-2	Thrust bearing assembly, F	1			○	○	7316BEAXT7DF
40-1	Lock washer	1			○	○	AW20
40-2	Lock washer	1			○	○	AW16
70	Lock washer	1			○	○	AW09
46	Conical spring washer	12			○	○	Hexagon socket head cap screw M16
237-1	Torsional slip washer	1			○	○	
237-2	Torsional slip washer	1			○	○	
293	Spiral retaining ring	2			○	○	FRSN-75
711	Spring	1			○	○	
27	Bearing for M rotor	2			○	○	Reusable if not damaged.
28	Bearing for F rotor	2			○	○	Reusable if not damaged.
528	Sleeve, oil seal	1			○	○	Reusable if not damaged.
712	Vi position sensor rod	1			○	○	Reusable if not damaged.
30	Balance piston	1				○	To be replaced if there is any damage.
33	Balance piston sleeve	1				○	To be replaced if there is any damage.
29-1	Retaining ring C type - Internal	2				○	JIS B 2804 H190 To be replaced if there is any damage.
29-2	Retaining ring C type - Internal	2				○	JIS B 2804 H150 To be replaced if there is any damage.
32	Retaining ring C type - External	1				○	JIS B 2804 S80 To be replaced if there is any damage.
79	Retaining ring C type - External	1				○	JISB2804 S10 To be replaced if there is any damage .

Part No.	Part Name	Qty.			Inspection Interval		Remarks
					40,000 hours or 5 years	80,000 hours or 10 years	
		280J			30,000 hours or 4 years	60,000 hours or 8 years	
		S	M	L	20,000 hours or 3 years	40,000 hours or 6 years	
716	Retaining ring E type	1				○	JIS B2804 E snap ring 4 To be replaced if there is any damage.
78	Ball bearing	1				○	To be replaced if there is any damage.
39-1	Locknut	1				○	AN20 To be replaced if there is any damage.
39-2	Locknut	1				○	AN16 To be replaced if there is any damage.
69	Locknut	1				○	AN09 To be replaced if there is any damage.
25	M rotor	1					To be replaced if there is any damage.
26	F rotor	1					To be replaced if there is any damage.
42-1	Thrust bearing alignment spacer, M	1					To be replaced if there is any damage.
42-2	Thrust bearing alignment spacer, F	1					To be replaced if there is any damage.
250-1	Thrust washer, M	1					To be replaced if there is any damage.
250-2	Thrust washer, F	1					To be replaced if there is any damage.
31	Balance piston key	1					To be replaced if there is any damage.
91	Shaft key	1					To be replaced if there is any damage.
725	Packing, Vi position sensor box	1					To be replaced if there is any damage.

Note:
Reusable if not damaged: If there is no damage or abnormality in visual inspection, the part can be used continuously.
To be replaced if there is any damage: Replace the part if any damage or abnormality is found in visual inspection.

5.3 Management of Lubricant

5.3.1 Lubricant Management Standard

The lubricant, to which the management standard is applied, is classified as follows:

(1) Synthetic oil: Polyalkylene Glycol (PAG)
(2) Mineral oil: Naphthenic base, Paraffinic base
Synthetic oil: Alkyl benzene (AB), Polyalphaolefin (PAO)
(3) Synthetic oil: Polyolester (POE)

- We recommend analyzing oil by sampling at intervals of 6 months.
- If the oil does not satisfy the management standards below, replace the oil. (This does not apply to water contents in PAG oil)

The evaluation items and standards are as follows. The management standards may be changed without notice.

Table 5-8 Synthetic oil (PAG)

Item	Management Standards
(a) Color	ASTM color standard: 4.0 or less
(b) Total acid number	0.1 mg•KOH/g or less
(c) Kinematic viscosity	Amount of change must be within ±10% from that of the new oil.
(d) Water content	2000 ppm or less **Note 1**
(e) Contamination level	Contamination measured by gravimetric analysis (millipore filter value) is 15 mg/100 mL or less.

Table 5-9 Mineral oil, synthetic oil (AB, PAO)

Item	Management Standards
(a) Color	ASTM color standard: 6.0 or less
(b) Total acid number	0.3 mg•KOH/g or less
(c) Kinematic viscosity	Amount of change must be within ±15% from that of the new oil.
(d) Water content	100 ppm or less **Note 1**
(e) Contamination level	Contamination measured by gravimetric analysis (millipore filter value) is 15 mg/100 mL or less.

Table 5-10 Synthetic Oil (POE)

Item	Management Standards
(a) Color	ASTM color standard: 4.0 or less
(b) Total acid number	0.2 mg•KOH/g or less
(c) Kinematic viscosity	Amount of change must be within ±10% relative to the new oil.
(d) Water content	200 ppm or less
(e) Contamination level	Contamination measured by gravimetric analysis (millipore filter value) is 15 mg/100 mL or less.

Note 1: Lubricant miscible with ammonia has high hygroscopicity and may contain water during sampling.
In addition, ammonia dissolved in the lubricant may be detected as water when it is analyzed, thereby preventing correct measurement of water content. Therefore, the management standards above should be construed as guidelines.

5.3.2 Replacement Interval for Lubricant

5.3.2.1 First system startup

When the system is started up for the first time, the lubricant may get contaminated or deteriorate due to scale inside the piping and vessels. For the first system start up, replace the lubricant 500 hours after operation.

If the results do not meet the management standards for each oil type detailed in tables 5-8 to 5-10, replace the lubricant.

5.3.2.2 During normal operation

Lubricant gradually degrades when used for a long term.

Though, the degradation rate differs depending on the operating conditions, oil type, and any foreign substances or water in the oil.

Sample and analyze the lubricant every 6 months and if the results do not meet the management criteria for each oil type detailed in tables 5-8 to 5-10, replace the lubricant.
However, if the oil filter is clogging frequently or the oil becomes black and opaque, replace the oil after confirming and eliminating the cause.

5.4 Disassembly and Assembly of the Compressor

This chapter describes that the text in parentheses after the part name indicates size, length, etc. Also, these texts indicate size, length, etc in the order of the model shown in the upper left of the illustrated parts breakdown.

5.4.1 Tools for Disassembly and Work Place

⚠ CAUTION

- **For compressor disassembly/assembly work, use specified tools that are properly functioning. Using tools that are worn or damaged or that are inappropriate for the work, can result in injury.**

Prepare tools to be required for the work referring to “7.4 Tools for Disassembly.” It is also recommended to prepare general hand tools, green silicon carbide grinding stone, emery paper(#80-#100), emery paper(over #800), parts cleaning oil, lubrication oil, a lubricator, an oil can for oil sump, waste cloth and so on.

When removing the compressor from the installation flame and doing an overhaul, prepare a large surface plate as the work bench.

To safely perform bolts and plugs removal used in the lower side of the compressor, an exclusive frame for placing the compressor is required. Refer to the article 5.4.5 in this chapter.

Perform the work in a dry place with as little sand and dust as possible, with a sufficiently wide space around there.

5.4.2 Replacement Parts

Prepare MYCOM genuine replacement parts referring to "5.2.4 Replacement Parts of the compressor in overhauling" in this chapter and "7.1 Development View and Configuration Table " in this manual Chapter 7.

Because O-rings and gaskets which are removed for the inspection are easy to be damaged, replace all with new ones.

When purchasing any part, inform its (a) model, (b) serial number, (c) part name, (d) code No. and (e) necessary number to our sales offices or service centers. Especially when the (b) serial number of the compressor is not identified, it will be difficult to decide the required parts because we can not specify the design and manufacturing specifications.

5.4.3 Recovering the Refrigerant

After stopping the compressor package unit, internal pressure is high.
Before disassembling the compressor it is necessary to lower the internal pressure to atmospheric pressure. The following methods are available.

- If there is another compressor package unit connected by bypass piping (or which can be temporarily installed), operate the other compressor and lower the pressure through the bypass piping.
- Operate the refrigerating unit, close the fluid supply master valve, and collect the liquefied gas in the receiver.
- By using a refrigerant recovery machine, recover the liquefied refrigerant in the receiver.

For either of the methods above, prepare a device flow sheet for the work, check the necessary valve operation on the flow sheet and on the device, and specify valve operation and device/tube connection on the flow sheet.
Prepare one flow sheet for the foreman and one for displaying in the work area.
Also, make a refrigerant recovery procedure showing the conditions of the workplace and make sure all workers have read and understand it before starting the work.

WARNING

- **Make sure that all risk assessment checks, including checking the work contents and procedure, are implemented before starting work. Neglecting these checks will lead to an increase in industrial accidents to a level that cannot be ignored.**
- **Perform sufficient ventilation during the work.**

5.4.4 Removing the Compressor

1. Turn off the main motor power.
2. Close the suction stop valve, discharge stop valve, and liquid supply stop valve.
3. Perform refrigerant disposed from the compressor. Maintain sufficient ventilation when working.
4. Open the capacity control solenoid valve and variable Vi solenoid valve manually, and dispose oil and refrigerant inside the cylinder.
5. Turn off the control power.
6. Disconnect the Vi position sensor connector.
7. Remove the coils from the capacity control solenoid valve and variable Vi solenoid valve.

WARNING

- **After turning off the motor main power, control power, and power for the other equipments, always perform lockout/tagout to prevent any inadvertent operation to turn on the equipment.**
- **After closing the suction stop valve, discharge stop valve, and liquid supply stop valve, always perform lockout/tagout to prevent any inadvertent opening of these valves (lockout/tagout).**
- **If there is residual high-pressure gas/refrigerant or oil dissolved in the refrigerant, the gas and oil may blow off when closed valves (components) are opened. This may result in injury such as frostbite and loss of vision. Always check and confirm the pressure in the compressor, before opening any pipe connections and valves.**

8. Disconnect the pipe connections and remove the lug bolts from the compressor base.
9. Pull out the parallel pin between motor spacer and compressor, and remove the bolts.
10. Using lifting equipment, remove the compressor from the motor spacer.
11. Put place the lifting compressor on a work bench like the right photograph.

12. Remove the bottom four hexagon socket head cap screws (M16×60 for 170J, M16×75 for 220J, M20×110 for 280J), which connect the main rotor casing with the bearing head, and the suction cover.

DANGER

- **Make sure that the lifting equipment and wires have sufficient load capacity for the compressor. Otherwise, the compressor may fall, resulting in death or injuries and damage to the compressor. Do not allow anyone to be under the lifted compressor. (Compressor weight: 700 kg for 170JS, 730 kg for 170JM, 775 kgor 170JL, 1270 kg for 220JS, 1330 kg for 220JM, 1400 kg for 220JL, 2300 kg for 280JS, 2450 kg for 280JM, 2600 kg for 280JL)**

5.4.5 Removing Oil from Inside the Compressor

While placing the compressor on the work bench, remove the drain plug at the bottom of the compressor as shown in the figure 5-2 and drain lubricant.

Make sure to reattach the removed plugs to the original positions (to prevent any plug being left detached).

WARNING

- **If there is residual high-pressure gas/refrigerant or high-pressure oil dissolved in refrigerant within the hydraulic cylinder (variable Vi cylinder and capacity control cylinder), the refrigerant gas or oil may blow off when the oil drain plugs are removed. This may result in injury such as frostbite and loss of vision. Therefore always check and confirm the pressure in the hydraulic cylinder, before the oil drain plugs are opened, and wear protective equipments such as goggles and chemical resistant gloves.**

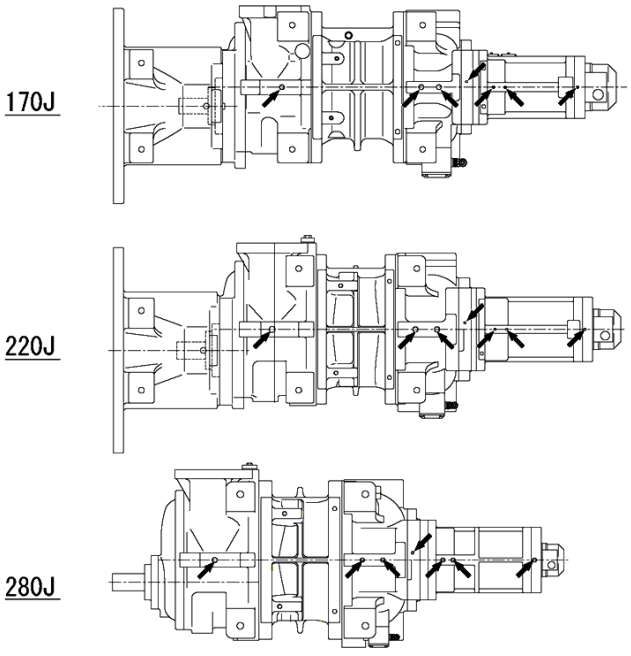
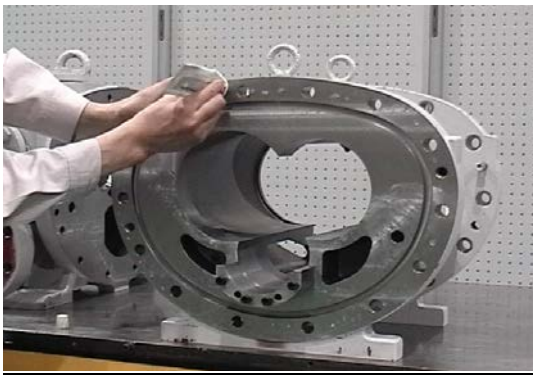


Figure 5-2 Positions of Drain Plugs

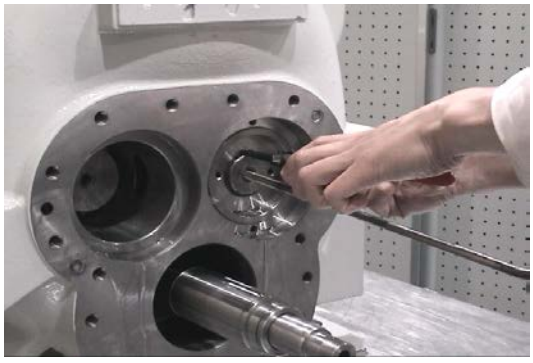
5.4.6 Common Work Items

- When attaching an O-ring, apply a thin coat of silicon grease to it.
- When installing a casing or cover with an O-ring, apply a thin coat of silicon grease to the outer connecting faces of the O-ring groove.



- Clean the removed parts of any contamination and dirt. When storing the parts, take appropriate measures to prevent rust and damage.
- When assembling parts, make sure to lubricate them. (bearing, balance piston, rotor)
- For the parallel pin and locknut threads, apply sticking-preventive lubricants. (molybdenum disulfide, a solid lubricant).

- Before hammering in the parallel pin, tighten the four bolts lightly in diagonal sequence with a wrench.
- Tighten the bolts, locknuts, and plugs, to the specified torque using a torque wrench. (Refer to The Table for Tightening Torques of Bolts and Nuts.)
- For the retaining ring, always use retaining ring pliers that match the size of the stop ring.
-

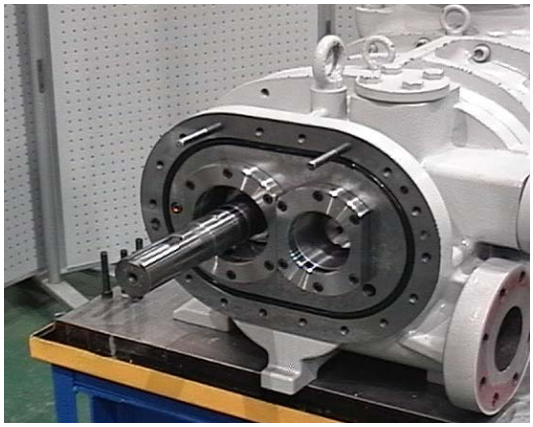


CAUTION

- **When the size of the retaining ring pliers is different, the retaining ring may jump out, causing injuries. Always use retaining ring pliers of appropriate size and wear protective goggles.**

-

- Before disassembly or assembly of the casings and covers, first remove the upper two bolts and attach the stud bolts (safety bolts) to prevent the casing from falling.
-



CAUTION

- Any casing or cover dropped may cause injuries or damage to the compressor. Always attach stud bolts before installing or disassembling the casing or cover.

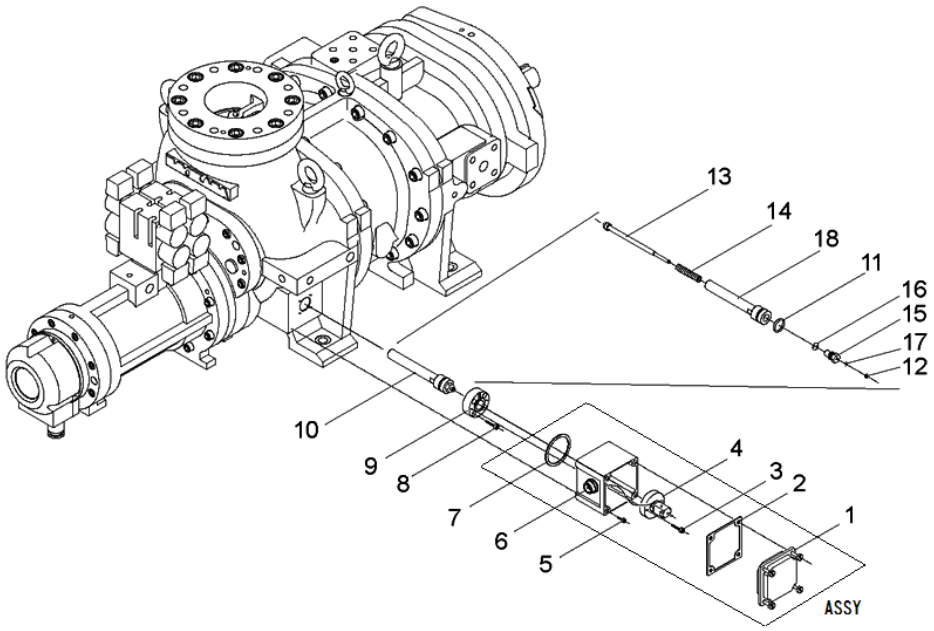
- To disassemble the casing, first loosen all bolts and then remove the parallel pin using two service holes located in diagonal positions.
- Notice that the lock nut for the unloader push rod is harder to screw in because it is high friction locking devices. To assemble the nut, use a locknut wrench.
- Use liquid gasket (for example, HERME SEAL) or silicon grease for the suction adapter tightening bolts.

5.4.7 Vi Position Sensor

【POINT】

- Assemble the Vi position sensor finally after assembling all other parts.

■ **170J/220J/280J**



Order	Description	Part No.
1	Sensor box lid	—
2	Sensor box lid packing	—
3	Hexagon socket head cap screw (M6×25)	723
4	Potentiometer	721
	Vi position sensor support	720
	Hexagon socket head cap screw (M3×10)	722
5	Hexagon socket head cap screw (M5×15)	726
6	Sensor box	724
7	Packing, Vi position sensor box	725
8	Hexagon socket head cap screw (M6×25)	719

Order	Description	Part No.
9	Gland, Vi position sensor rod housing	718
10	Vi position sensor rod housing assembly	—
11	O-ring (G25)	717
12	Retaining ring E type	716
13	Vi position sensor rod	712
14	Spring	711
15	Plug, Vi position sensor rod	715
16	O-ring (P12)	713
17	O-ring (P6)	714
18	Vi position sensor rod housing	709

1. Remove the parts in the order of the numbers shown in the figure.

2. Install the parts in the reverse order of removing.

Note: For the details about the Vi position sensor, separately, refer to the special instruction manual. If the compressor is of explosion-proof, not the replacement of internal parts. For Vi position sensor has been certified..

5.4.7.1 Common Precautions for Removal/Installation

■ **Retaining ring E type/Vi position sensor rod**

⚠ CAUTION

- **The Retaining ring E type may jump out, causing injuries. Make sure to use a Retaining ring E type removing/attaching tool of suitable size and wear protective tools such as protective goggles.**
- **Because the Vi position sensor assembly uses a spring, the Vi position sensor rod may jump out and cause injuries. During and after retaining ring removal, do not direct the Vi position sensor assembly toward anyone.**

5.4.7.2 Precautions for Removal

■ **Sensor box lid**

【POINT】

- The sensor box lid mounting bolts are structured so that they do not drop off from the lid.

■ **Vi position sensor assembly**

1. To remove the Vi position sensor rod housing, turn the Vi position sensor rod plug (No.715) clockwise using a wrench.

5.4.7.3 Precautions for Installation

■ **O-ring**

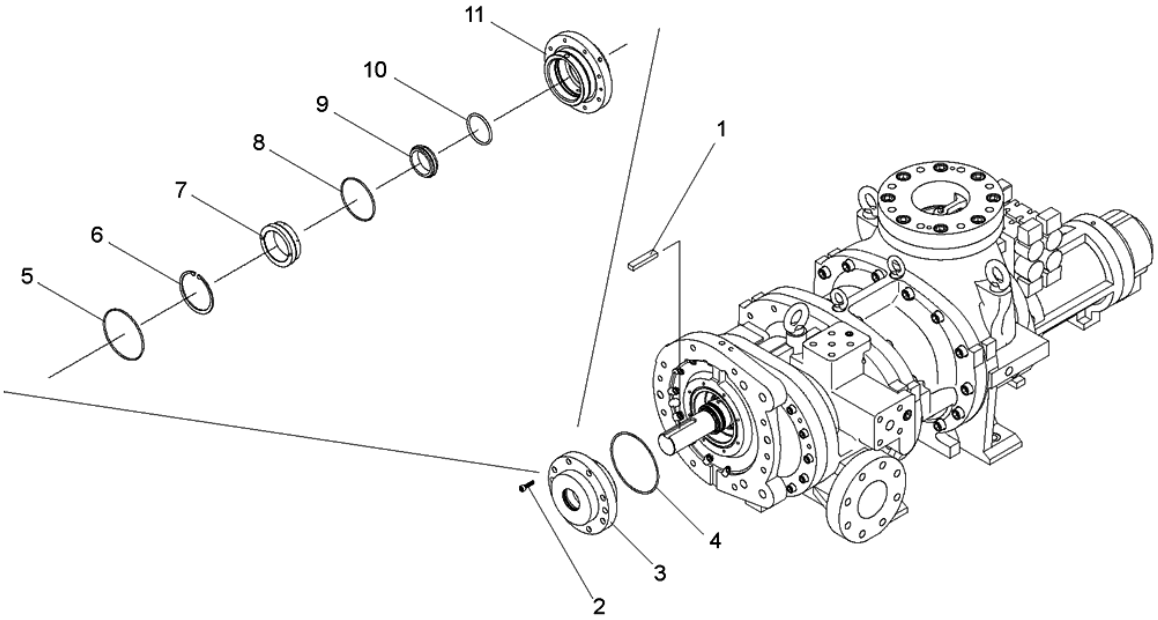
1. Make sure that all necessary O-rings are attached. (In particular, part No. 714)

■ **Vi position sensor rod housing gland**

1. Install the Vi position sensor rod housing gland of the groove facing down.

5.4.8 Seal Cover

■ **170J**



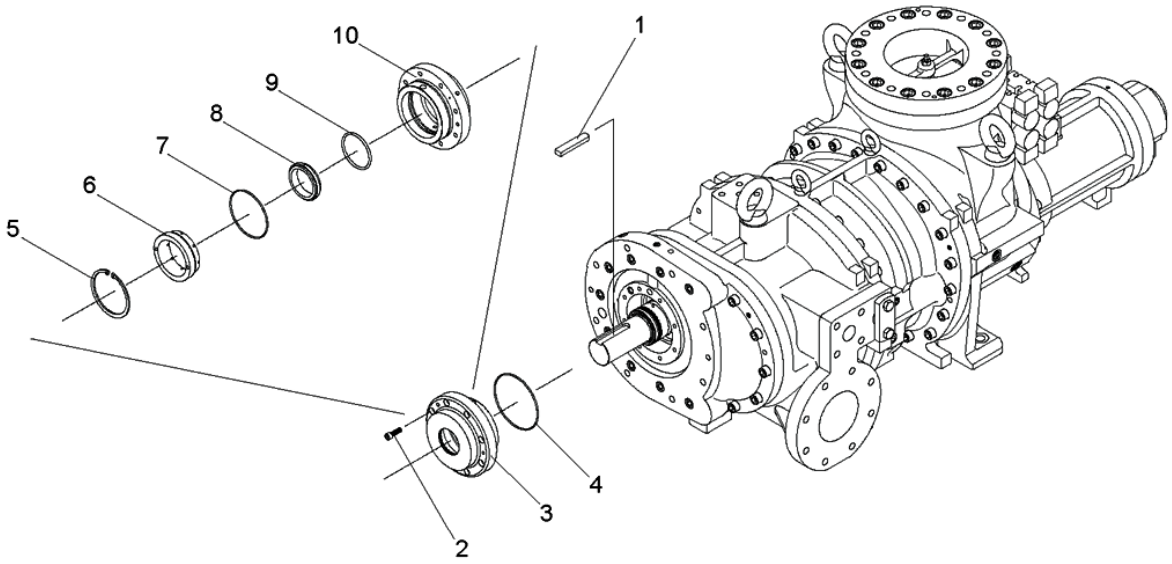
Order	Description	Part No.
1	Shaft key	91
2	Hexagon socket head cap screw (M8×30)	53
3	Seal cover assembly	—
4	O-ring (G120)	52-1
5	O-ring (G145)	52-2
6	Retaining ring C type internal (H100)	658
7	Sleeve, shower flushing	611

Order	Description	Part No.
8	O-ring (G100)	657
9	Mechanical seal assembly Mating ring	100 100-2
10	Mechanical seal assembly O-ring	100 100-1
11	Seal cover	51

1. Remove the parts in the order of numbers shown in the figure.

2. Install the parts in the reverse order of removing.

■ 220J/280J



Order	Description	Part No.
1	Shaft key	91
2	Hexagon socket head cap screw (M10×35/ M12×40)	53
3	Seal cover assembly	—
4	O-ring (G145/G165)	52-1
5	Retaining ring C type internal (H120/ H140)	658
6	Sleeve, shower flushing	611

Order	Description	Part No.
7	O-ring (G120/G140)	657
8	Mechanical seal assembly Mating ring	100 100-2
9	Mechanical seal assembly O-ring	100 100-1
10	Shaft seal cover	51

1. Remove the parts in the order of numbers shown in the figure.

2. Install the parts in the reverse order of removing.

5.4.8.1 Common Precautions for Removal/Installation

■ **Seal cover assembly**

⚠ CAUTION

- **The seal cover assembly weights 7 kg for 170J, 10 kg for 220J, and 17 kg for 280J. The seal cover assembly may fall causing injuries or damage to the compressor. Before starting the removing work, always attach safety bolts (M8).**

CAUTION

- **When removing the seal cover assembly, do not damage the male rotor shaft surface and the mechanical seal mating ring.**

■ **Retaining ring**

⚠ CAUTION

- **The retaining ring may jump out causing injuries. Always use retaining ring pliers of appropriate size and wear protective goggles.**

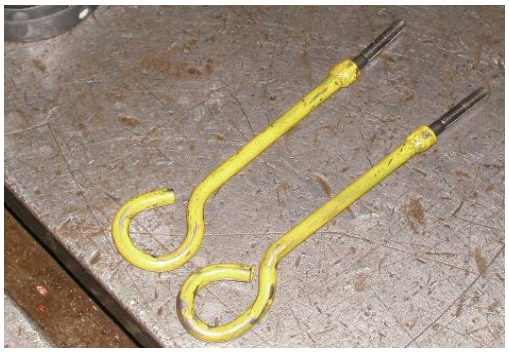
5.4.8.2 Precautions for Removal

■ **Seal cover assembly**

【POINT】

- Prepare an appropriate container to collect any lubricant that may flow out when the seal cover assembly is removed.

1. Using eyebolts (M8), remove the seal cover.



■ **Shower flushing sleeve**

1. Using eyebolts (M8), remove the shower flashing sleeve.

■ **Mechanical seal assembly (mating ring)**

1. Remove the mechanical seal mating ring from the seal cover.

5.4.8.3 Precautions for Installation

■ O-ring

1. Make sure that all necessary O-rings are all attached.

■ Mechanical seal assembly (mating ring)

1. Attach the mating ring to the seal cover.

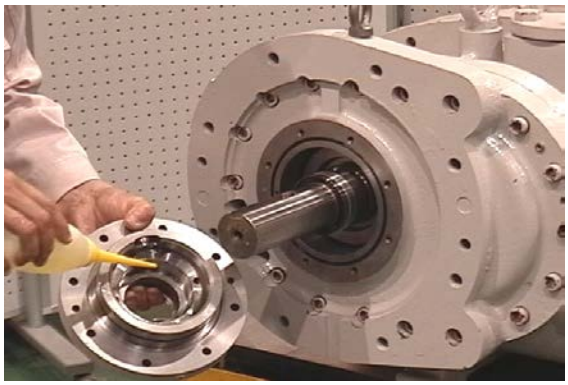
■ Shower flushing sleeve

1. Using eyebolts (M8), install the shower flashing sleeve.

■ Seal cover assembly

1. Lubricate the seal ring of the male rotor shaft with lubricant.

2. Lubricate the mating ring of the seal cover assembly with lubricant.

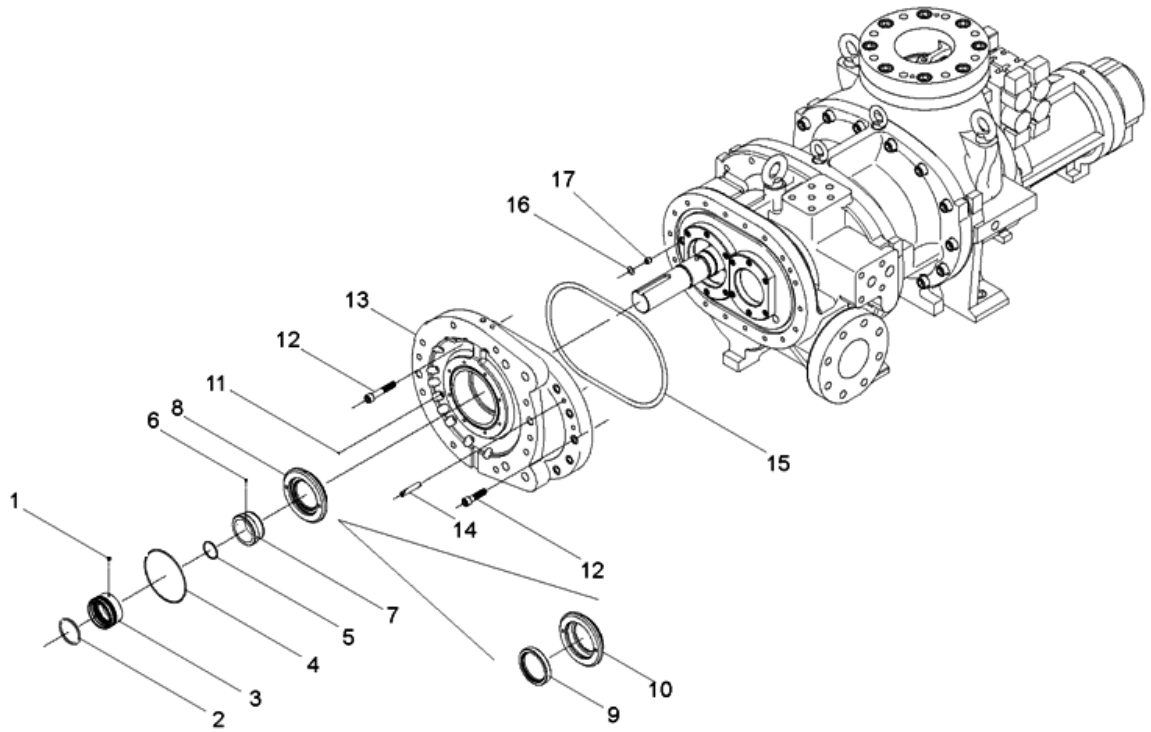


■ Shaft key

1. Check for damages. If anything wrong is found, replace the key.

5.4.9 Bearing Cover

■ **170J/220J/280J**



Order	Description	Part No.
1	Mechanical seal assembly	100
	Hexagon socket set screw	100-5
2	Mechanical seal assembly	100
	O-ring	100-4
3	Mechanical seal assembly	100
	Rotating ring	100-3
4	O-ring (G120/G145/G165)	49
5	O-ring (G55/G70/G90)	744
6	Hexagon socket set screw (M6×8)	529
7	Sleeve, oil seal	528
8	Retainer for oil seal	—

Order	Description	Part No.
9	Oil seal	50
10	Retainer for oil seal	48
11	Spring pin (3 dia.×8/3 dia.×10/3 dia.×10)	20
12	Hexagon socket head cap screw (280J: M20×50)	18
	Hexagon socket head cap screw (M12×50/M16×60)	18-1
	Hexagon socket head cap screw (M12×70/M16×90)	18-2
13	Bearing cover	16
14	Parallel pin (10 dia. ×55/13 dia. ×65/16 dia. ×70)	19
15	O-ring (P300/P375/P480)	17-1
16	O-ring (P14)	17-2
	Bush, P14 type O-ring	537

1. Remove the parts in the order of the numbers shown in the figure.

2. Install the parts in the reverse order of removing.

5.4.9.1 Common Precautions for Removal/Installation

■ **Bearing cover**

⚠ CAUTION

- **If the lifting equipment and lifting slings in use do not have sufficient loading capacity, the bearing cover may fall causing injuries and damage to the compressor. Before starting the lifting work, always check that the lifting equipment and lifting slings have sufficient loading capacity. Do not allow anyone to be under the lifted bearing cover. (Bearing cover weight: 47 kg for 170J, 74 kg for 220J, 82 kg for 280J)**

CAUTION

- **Do not damage the male rotor shaft surface, when removing/installing the bearing cover.**

5.4.9.2 Precautions for Removal

■ **Mechanical seal assembly (rotating ring)**

CAUTION

- **Loosen the hexagon socket set screw for at least more than 5 turns and remove mechanical seal assembly from the male rotor shaft. If the hexagon socket set screw is not turned and loosened for 5 turns or more, the male rotor shaft surface may be damaged.**

■ **Oil seal sleeve/retainer for oil seal**

CAUTION

- **Loosen the hexagon socket set screw for at least more than 2 turns and remove the oil seal sleeve from male rotor shaft. If the hexagon socket set screw is not turned and loosened for 2 turns or more, the male rotor shaft surface may be damaged.**

1. Loosen the hexagon socket set screw for oil seal sleeve at least 2 turns or more.
2. Attach eyebolts (M8) to the retainer for an oil seal, remove the retainer and oil seal sleeve as an assembly.
3. Using a flat screwdriver and a hammer, remove the oil seal from the retainer.

【POINT】

- The spring pin (3 dia. x 8/3 dia. x 10) attached to the bearing cover may not be pulled out during a regular service.

■ Bearing cover

1. Remove the two upper hexagon socket head cap screws (M12×50, M12×70, and M20×70) and attach safety bolts.
2. Remove the rest of the hexagon socket head cap screws (M12×70, M12×50, and M20×70).
3. To pull out the parallel pins, insert hexagon socket head cap screws (M12 and M20) into the service holes and tighten the hexagon socket head cap screws so that the gap between the bearing cover and the bearing head expands in parallel.

【POINT】

- Even though screwing the forcing bolts evenly, when the gap between bearing cover and bearing head does not open parallel and parallel pins are fixed unevenly, use a plastic hammer to adjust the gap evenly.
- If the parallel pins are not pulled out, use a slide hammer.

4. Using the lifting equipment, remove the bearing cover.

5.4.9.3 Precautions for Installation

■ O-ring (P300/P375/P480)

1. After disassembly, replace the existing O-rings with new ones.

■ Oil seal

1. With the lip of the oil seal facing down, set the oil seal on the retainer for oil seal.
2. Using an appropriate tool such as a plastic block, insert the oil seal fully into the retainer for oil seal by tapping.

■ Oil seal sleeve/oil seal/retainer for oil seal

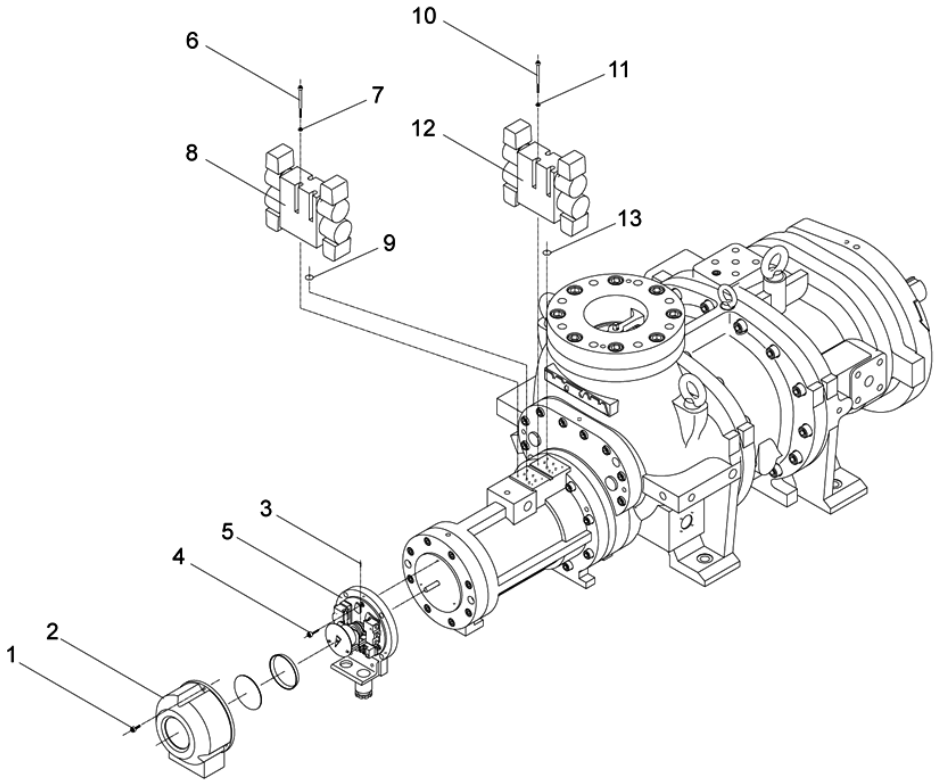
1. Lubricate the oil seal sleeve with lubricant.
2. Insert the oil seal sleeve into the retainer for oil seal.
3. Attach eyebolts (M8) to the retainer for oil seal and install both the retainer and the oil seal sleeve as an assembly into the bearing cover.
4. When installing the retainer for oil seal assembly into the bearing cover, face the cutout of retainer upward and align the cutout of retainer to the spring pin on the bearing cover.

■ Mechanical seal assembly

1. Install the mechanical seal ring by aligning the hexagon socket set screw positions and the drilled holes of the male rotor shaft.

5.4.10 Unloader Indicator/Capacity Control Solenoid Valve

■ **170J/220J**



Order	Description	Part No.
1	Assembly, unloader indicator	120
2		
3		
4		
5		
6	Hexagon socket head cap screw (M5×75)	535
7	Spring lock washer	536

Order	Description	Part No.
8	Capacity control / variable Vi solenoid valve	562
	or Solenoid valve dummy block	
9	O-ring	561
10	Hexagon socket head cap screw (M5×75)	535
11	Spring lock washer	536
12	Capacity control / variable Vi solenoid valve	562
13	O-ring	561

1. Remove the parts in the order of the numbers shown in the figure.

2. Install the parts in the reverse order of removing.

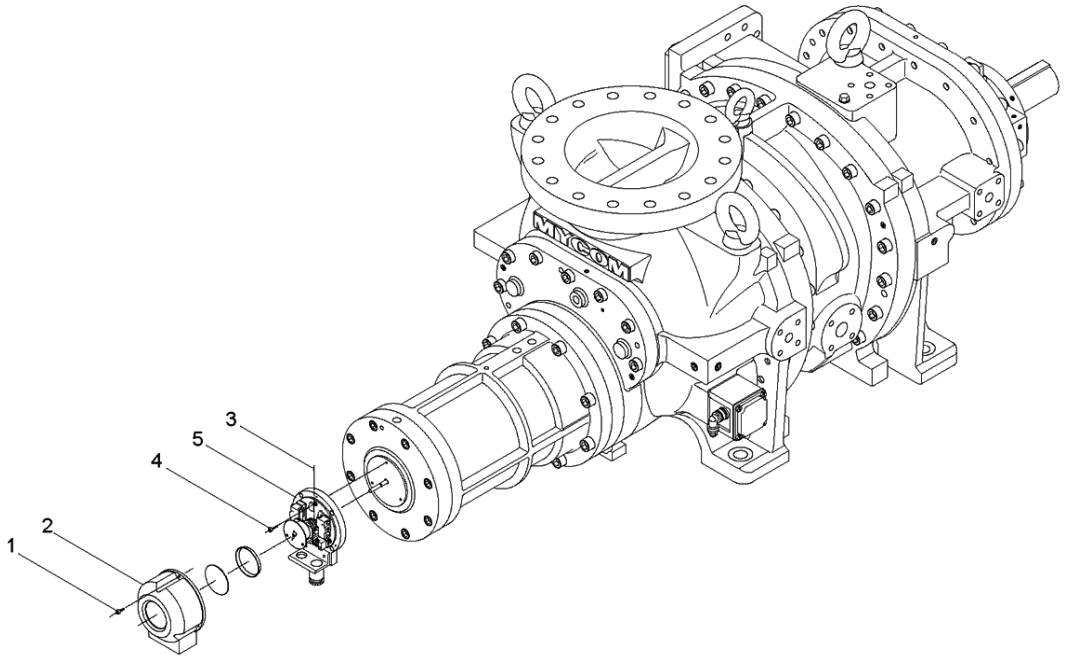
【POINT】

- Make sure to remove all drain plugs and don't cover the outlet of oil and the inlet of oil for hydraulic cylinder before removing the solenoid valve.

NOTE:

According to the design modification notification as of January 2014, J series unloader indicators have all changed to explosion-proof type which is newly designed. For details of this new unloader indicators refer to their instruction manual provided separately.

■ **280J**



Order					Description	Part No.
1	2	3	4	5	Unloader indicator assembly	120

1. Remove the parts in the order of the numbers shown in the figure.

2. Install the parts in the reverse order of removing.

5.4.10.1 Precautions for Removal

■ **Capacity control solenoid valve/variable Vi solenoid valve**

WARNING

- **If there is residual high-pressure gas/refrigerant or high-pressure oil dissolved in refrigerant within the variable Vi cylinder and the capacity control cylinder, the refrigerant gas or oil may blow off when the capacity control solenoid valve and the variable Vi cylinder are removed. This may result in injury such as frostbite and loss of vision. Therefore always check that all plugs are opened, before the capacity control solenoid valve and the variable Vi cylinder are removed.**

5.4.10.2 Precautions for Installation

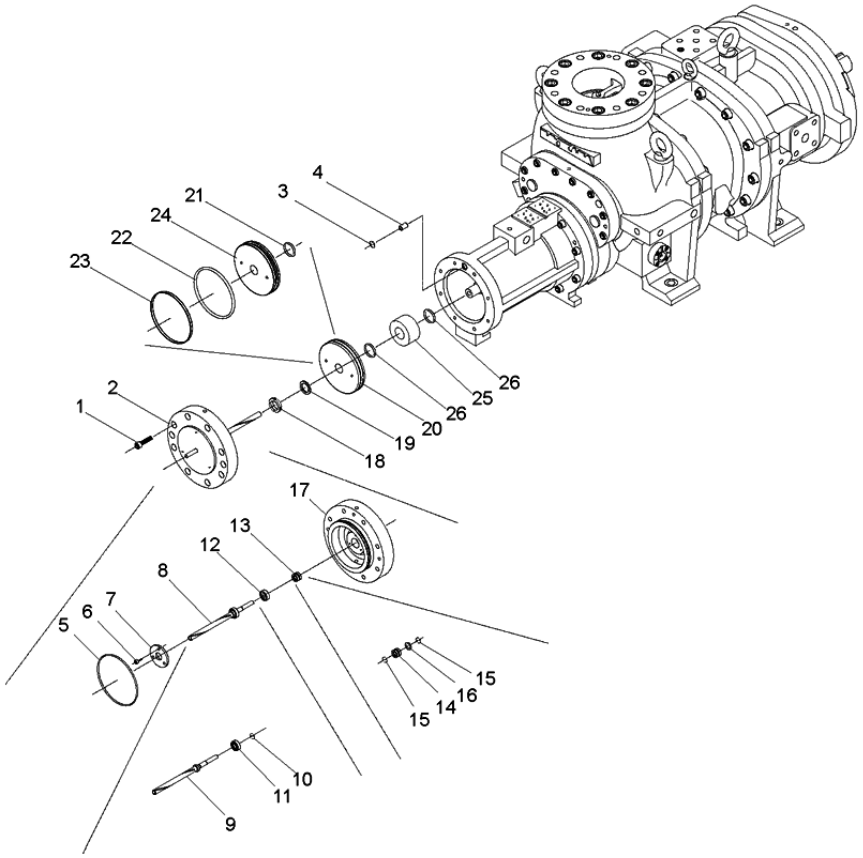
■ **Capacity control solenoid valve/variable Vi solenoid valve**

【POINT】

- Install the capacity control solenoid valve and variable Vi solenoid valve, after assembling all other parts of the unloader cylinder and the variable Vi cylinder.

5.4.11 Unloader Cover

■ **170J/220J**



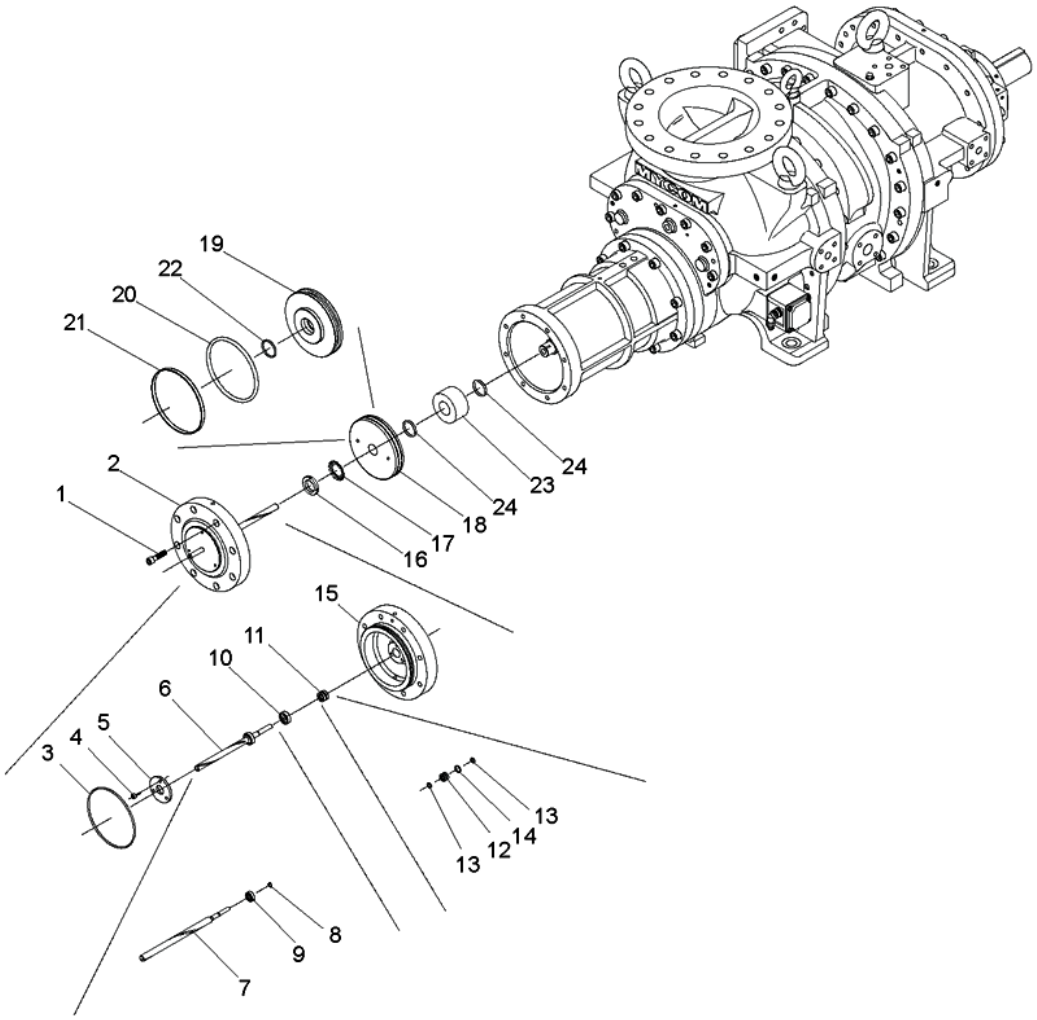
Order	Description	Part No.
1	Hexagon socket head cap screw (M10×40/M12×50)	76
2	Unloader cover assembly	—
3	O-ring (P14)	75-2
4	Bush, P14 type O-ring	537
5	O-ring (G135/G175)	75-1
6	Hexagon socket head cap screw (M6×15)	81
7	Bearing gland	80
8	Unloader indicator cam assembly	—
9	Unloader indicator cam	77
10	Retaining ring C type external (S10)	79
11	Ball bearing	78
12	Spacer, unloader cover	84
13	Retainer assembly, O-ring	—

Order	Description	Part No.
14	Retainer, O-ring	83
15	O-ring (P10A)	82-1
16	O-ring (P16)	82-2
17	Unloader cover	74
18	Locknut (FU05SS/AN07)	69
19	Plain washer (170J)/ Lock washer (AW07) (220J)	70
20	Unloader piston assembly	—
21	O-ring (P32/P44)	73
22	Teflon cap seal (SUNR-BE-130/SUNR-BE-170)	66
23	O-ring (P130/P170)	65
24	Unloader piston	64
25	Unloader spacer	420
26	O-ring (P32/P44)	421

1. Remove the parts in the order of the numbers shown in the figure.

2. Install the parts in the reverse order of removing.

■ 280J



Order	Description	Part No.
1	Hexagon socket head cap screw (M16×60)	76
2	Unloader cover assembly	—
3	O-ring (G230) (280J)	75
4	Hexagon socket head cap screw (M6×15)	81
5	Bearing gland	80
6	Unloader indicator cam assembly	—
7	Unloader indicator cam	77
8	Retaining ring C type external (S10)	79
9	Ball bearing	78
10	Spacer, unloader cover	84
11	Retainer assembly, O-ring	—
12	Retainer, O-ring	83

Order	Description	Part No.
13	O-ring (P10A)	82-1
14	O-ring (P16)	82-2
15	Unloader cover	74
16	Locknut (AN09)	69
17	Lock washer (AW09)	70
18	Unloader piston assembly	—
19	Unloader piston	64
20	O-ring (P225)	65
21	Teflon cap seal (SUNR-BE-225)	66
22	O-ring (P58)	73
23	Unloader spacer	420
24	O-ring (P58)	421

1. Remove the parts in the order of the numbers shown in the figure.

2. Install the parts in the reverse order of removing.

5.4.11.1 Common Precautions for Removal/Installation

■ **Unloader cover assembly**

CAUTION
● **Pull out /Install the unloader cover assembly horizontally.** **The unloader indicator cam may be damaged if handled inappropriately.**

■ **Retaining ring**

CAUTION
● **The retaining ring may jump out, causing injuries. Always use retaining ring pliers of appropriate size and wear protective goggles.**

■ **Unloader piston**

CAUTION
● **The 170JS, 170JM, 220JS, 220JM, 280JS, and 280JM have an unloader spacer installed at the back of unloader piston. Therefore, remove the unloader spacer form the unloader push rod after removing the unloader piston, when disassembling the 170JS, 170JM, 220JS, 220JM, 280JS, and 280JM.** ● **Therefore, install the unloader spacer to the unloader push rod before installing the unloader piston, when assembling the 170JS, 170JM, 220JS, 220JM, 280JS, and 280JM.**

5.4.11.2 Precautions for Removal

■ **Unloader cover assembly**

【POINT】

- The unloader indicator cam is assembled in the unloader cover assembly. The unloader indicator cam is fitted on the internal surface of the unloader slide valve push rod and rotated by the pin of the push rod as guide.

1. Insert hexagon socket head cap screws (M10, for 170J) or eye bolts (M8, for 220J/280J) in the service holes and tighten the screws evenly to expand the gap between the flange faces of unloader cylinder and unloader cover.
2. Hold the hexagon socket head cap screws (M10, for 170J) or eye bolts (M8, for 220J/280J), pull out the unloader cover horizontally and remove.

■ O-ring (P10A)

1. If the O-ring remains on the unloader cover, remove it by using an appropriate tool (2—3 mm dia. wire with a flat point).

■ Locknut (FU nut) (only for 170J)

【POINT】

- The FU nut has a high friction locking device. Turn the FU nut with a locknut wrench until it is loosened.

■ Unloader piston

1. Using eyebolts (M8), remove the unloader piston from the unloader push rod.

5.4.11.3 Precautions for Installation

■ Unloader piston

1. Attach the O-ring (P130/P170/P225) to the unloader piston.

2. Attach the Teflon cap seal to the outside of the O-ring.

3. Using eyebolts (M8), put the unloader piston into the unloader cylinder and install the unloader piston to the unloader push rod.

■ O-ring (P130/P170/P225)

【POINT】

- Do not apply silicon grease to the O-ring (P130/P170/P225) of the unloader piston.

■ Teflon cap seal

【POINT】

- Attach the Teflon cap seal to cover the outside of the O-ring. Make sure both sides of the Teflon cap seal do not stick out of the O-ring groove on the unloader piston.

■ Push rod

【POINT】

- Pull the push rod towards yourself so that the push rod can be inserted into the internal face of the unloader piston, before inserting the unloader piston into the unloader cylinder.

■ O-ring (P10A)

1. Assemble the O-ring (P10A) to the inside of the O-ring retainer in advance.

■ O-ring retainer

1. Attach two O-rings (P10A) to the inner face of the O-ring retainer and one O-ring (P16) to the outer face, and install the O-ring retainer to the unloader cover.

■ Unloader cover spacer

1. Install the unloader cover spacer to the unloader cover with the flat face to the atmosphere side.

■ Unloader indicator cam assembly

1. Install the ball bearing to the cam shaft, with the surface with stamped letters (mfg codes) of the ball bearing facing the suction cover side.

2. Attach the retaining ring C type external (S10).

3. Install the unloader indicator cam with the ball bearing to the unloader cover.

■ Bearing gland

1. Install the bearing gland so that it contacts the ball bearing of the unloader indicator cam.

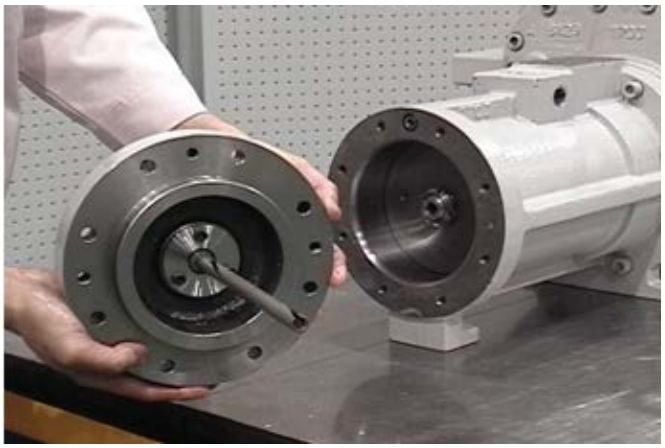
■ Locknut (FU nut) (only for 170J)

【POINT】

- The FU nut has a high friction locking device. Turn the FU nut with a locknut wrench when tightening the FU nut.

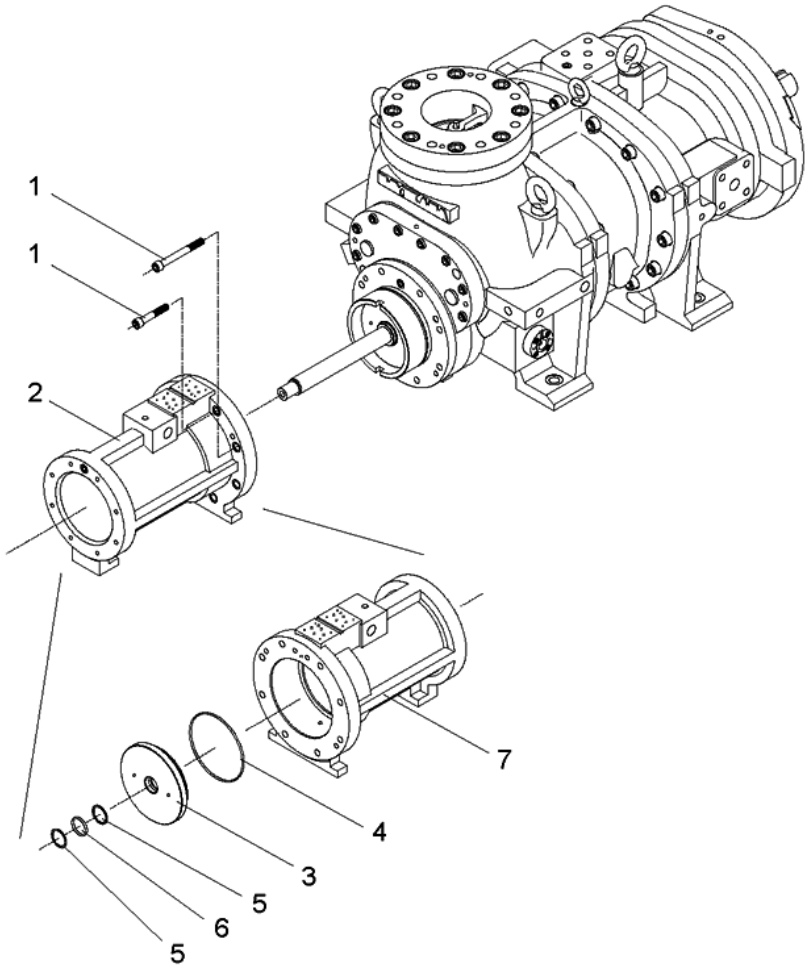
■ Unloader cover assembly

1. The unloader indicator cam groove opening must face upwards, when installing into the unloader slide valve push rod pin.
2. Install the unloader assembly to the unloader cylinder with the diagonal service holes of the unloader cover horizontal, and with one of the three tap holes for unloader indicator assembly above the horizontal service holes.
3. Check that the cam rotates smoothly by moving the unloader cover assembly back and forth horizontally.



5.4.12 Unloader Cylinder

■ **170J/220J/280J**



Order	Description	Part No.
1	Hexagon socket head cap screw (M12×70/M16×90/M20×110)	61
	Hexagon socket head cap screw (M12×110/ M16×140/ M20×170)	62
2	Unloader cylinder assembly	—
3	Partition plate, unloader cylinder	297

Order	Description	Part No.
4	O-ring (G135/G175/G230)	298
5	Back-up ring for O-ring (SUN-2BP 32/ SUN-2BP 44/ SUN-2BP 58)	325-2
6	O-ring (P32/P44/P58)	325-1
7	Unloader cylinder	60

1. Remove the parts in the order of the numbers shown in the figure.

2. Install the parts in the reverse order of removing.

5.4.12.1 Common Precautions for Removal/Installation

■ **Unloader cylinder assembly**

CAUTION

- **If the lifting equipment and lifting slings in use do not have sufficient loading capacity, the unloader cylinder assembly may fall causing injuries and damage to the compressor.**
  Before starting the lifting work, always check that the lifting equipment and lifting slings have sufficient loading capacity. Do not allow anyone to be under the lifted unloader cylinder assembly.
  (Unloader cylinder assembly weight: 30 kg for 170J, 60 kg for 220J, 90 kg for 280J)

5.4.12.2 Precautions for Removal

■ **Unloader cylinder assembly**

1. Remove the plastic caps from the eyebolt holes and service holes.
2. Attach eyebolt (M12) in eyebolt hole.
3. Remove the two upper hexagon socket head cap screws (M12×70/M16×90/M20×110) and attach stud bolts for safety.
4. Remove the hexagon socket head cap screws (M12×110/ M16×140/ M20×170).
5. Insert the hexagon socket head cap screws (M12) into the service holes and tighten the hexagon socket head cap screws evenly.
6. After the fitted part of the unloader cylinder and balance piston cover is separated, pull the unloader cylinder assembly horizontally towards yourself to remove the unloader cylinder assembly from the unloader slide valve push rod.
7. Lift and carry the unloader cylinder with lifting equipment by using the attached eyebolt (M12) on the unloader cylinder.

【POINT】

- Push the unloader slide valve push rod into the inner part of unloader cylinder using eyebolts (M8) attached to the unloader piston, before removing the unloader cylinder.

CAUTION

- **Pull the unloader cylinder straight and horizontally not to damage the unloader slide valve push rod.**

■ **Unloader cylinder partition plate**

1. Using eyebolts (M8), remove the unloader cylinder partition plate.

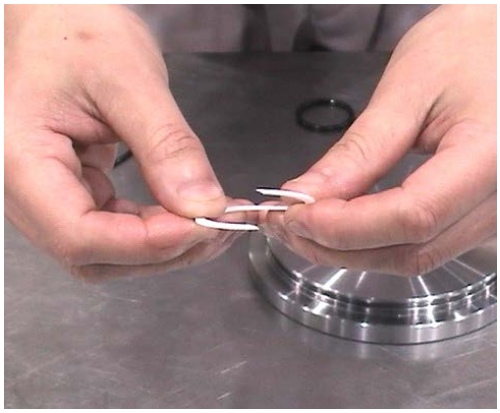
5.4.12.3 Precautions for Installation

■ O-ring

1. Make sure that all necessary O-rings are attached.

■ Back-up ring for O-ring

1. Attach the back-up rings to the unloader cylinder partition plate while paying appropriate attention to the direction of the bias cut surface.
Ensure that the joint of back-up ring mates, and that the O-ring fits between the two back-up rings.



■ Unloader cylinder partition plate

1. Install unloader cylinder partition plate to the unloader cylinder with the projection side facing out towards the atmosphere.

【POINT】

- Do not jam the O-ring between the unloader cylinder partition plate and the unloader cylinder.

■ Unloader cylinder assembly

CAUTION

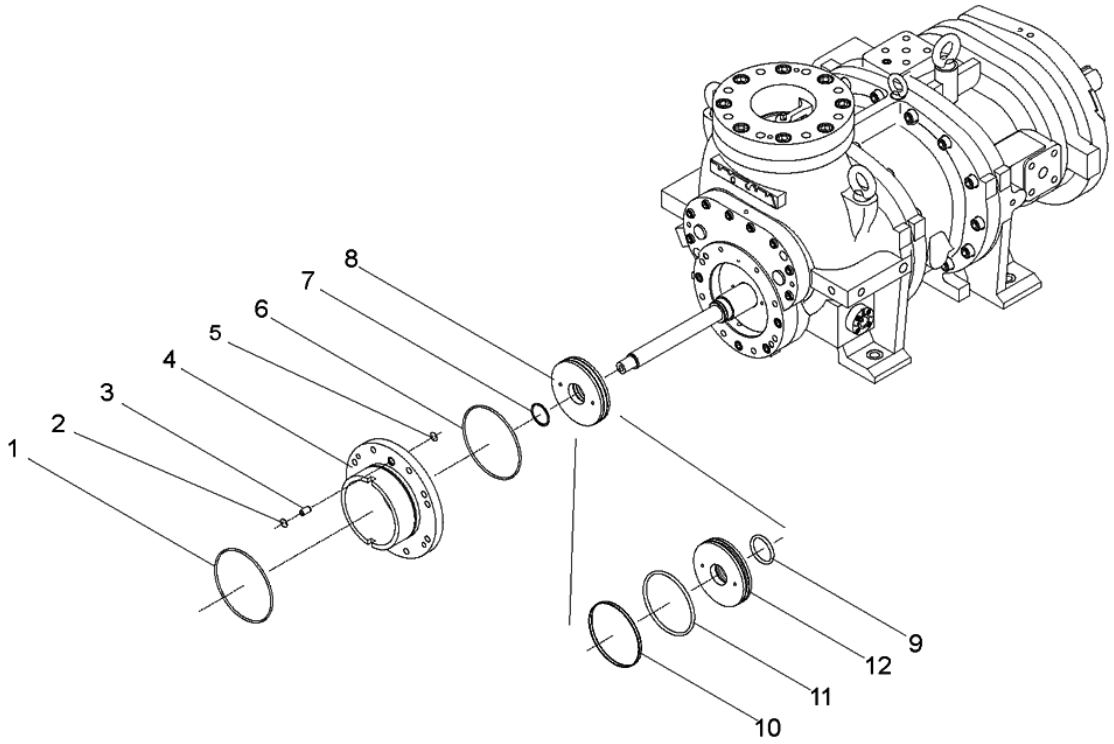
- **For 220J/280J, check the two plugs (R1/8) (732-C, 732-D) installed to the Vi cylinder side flange face of the unloader cylinder.**

■ Hexagon socket head cap screw

1. For the upper two bolts, the size is M12×70 for 170J, M16×90 for 220J, or M20×110 for 280J. Other screws are of M12×110 for 170J, M160×140 for 220J, M20×170 for 280J.
Pay attention to the size difference.

5.4.13 Vi Cylinder

■ **170J/220J**



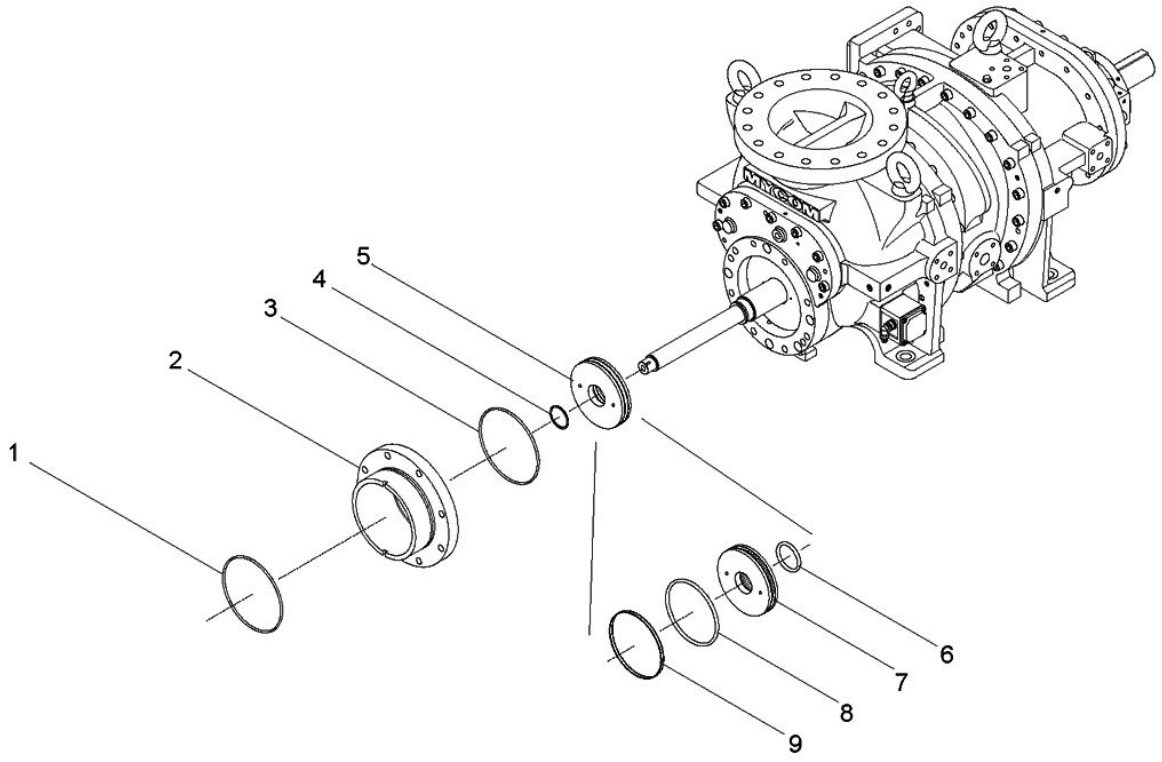
Order	Description	Part No.
1	O-ring (WG36/G200)	63-1
2	O-ring (P14)	63-2
3	Bush, P14 type O-ring	537
4	Cylinder, Vi	296
5	O-ring (P14)	63-2
6	O-ring (WG36/G200)	63-1

Order	Description	Part No.
7	Spiral retaining ring (FRSN-45/FRSN-56)	293
8	Vi piston assembly	—
9	O-ring (P52/P65)	295
10	Teflon cap seal (SUNR-BE-130/SUNR-BE-170)	66
11	O-ring (P130/P170)	65
12	Piston, Vi	294

1. Remove the parts in the order of the numbers shown in the figure.

2. Install the parts in the reverse order of removing.

■ 280J



Order	Description	Part No.
1	O-ring (G260)	63
2	Cylinder, Vi	296
3	O-ring (G260)	63
4	Spiral retaining ring (FRSN-75)	293
5	Vi piston assembly	—

Order	Description	Part No.
6	O-ring (P85)	295
7	Piston, Vi	294
8	O-ring (P225)	65
9	Teflon cap seal (SUNR-BE-225)	66
—	—	—

1. Remove the parts in the order of the numbers shown in the figure.

2. Install the parts in the reverse order of removing.

5.4.13.1 Common Precautions for Removal/Installation

■ **Spiral retaining ring**

⚠ CAUTION

- **Do not extend the spiral retaining ring excessively in the circumferential direction. It may cause injuries if extended excessively in the circumferential direction.**

5.4.13.2 Precautions for Removal

■ **Vi cylinder**

1. Attach the hexagon socket head cap screws (M12 for 170J, M8 for 220J/280J) into the service holes of the Vi cylinder and tighten them evenly to separate the Vi cylinder from the balance piston cover in parallel.
2. After the O-ring part of the Vi cylinder is pulled out, remove the Vi cylinder from the Vi piston by holding the hexagon socket head cap screws (M12 for 170J, M8 for 220J/280J) used as service bolts.

■ **Spiral retaining ring**

【POINT】

- Do not attempt to extend the spiral retaining ring excessively in the axis direction. The ring will be distorted and can't reuse it.

■ **Vi piston assembly**

1. Using eyebolts, remove the Vi piston assembly from the Vi push rod.

5.4.13.3 Precautions for Installation

■ **Spiral retaining ring**

【POINT】

- If the spiral retaining ring is distorted, replace it with new one.

■ **O-ring (P130/P170/P225)**

【POINT】

- Do not apply silicon grease to the O-ring (P130/P170/P225) of the Vi piston.

■ **Teflon cap seal**

【POINT】

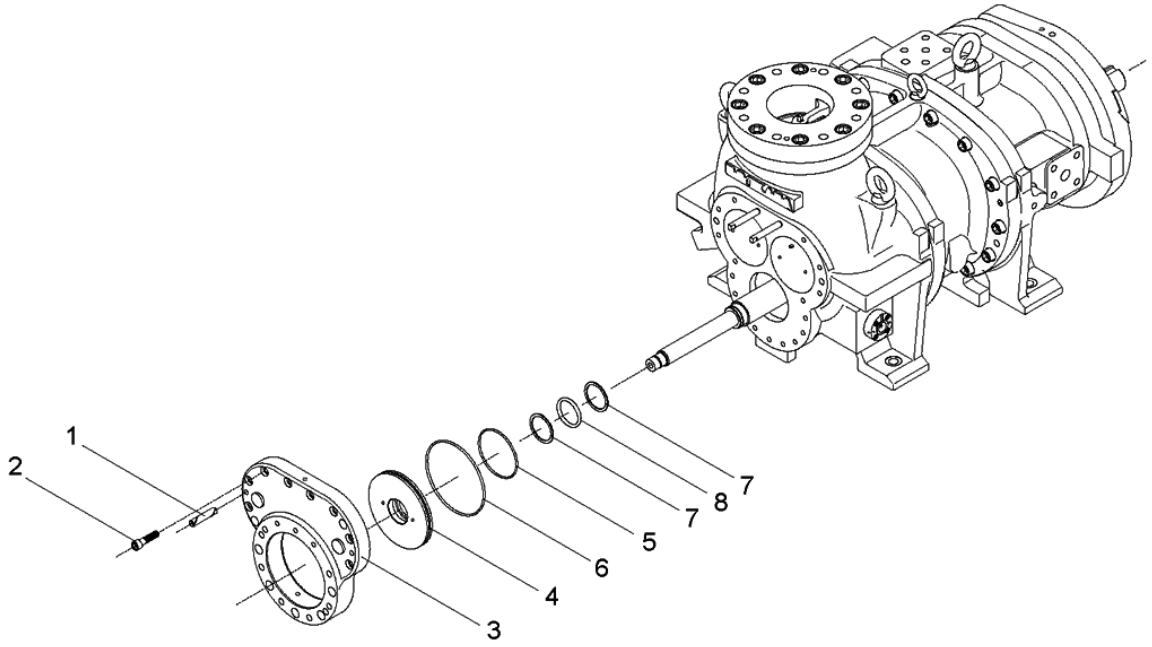
- Attach the Teflon cap seal to cover the outside of the O-ring. Make sure both sides of the Teflon cap seal do not stick out of the O-ring groove on the unloader piston.

■ **Vi cylinder**

1. Lubricate the inner face of Vi cylinder with lubricant.
2. Install the Vi cylinder to the Vi piston and push the Vi cylinder into the balance piston cover.

5.4.14 Balance Piston Cover

■ **170J/220J/280J**



Order	Description	Part No.	Order	Description	Part No.
1	Parallel pin (10 dia.×55/16 dia.×55/16 dia.×70)	591	5	O-ring (G100/G100/G135)	299-1
2	Hexagon socket head cap screw (M12×50/ M16×60/ M20×70)	24	6	O-ring (WG36/G200/G260)	299-2
3	Balance piston cover	22	7	Back-up ring for O-ring	9-2
4	Partition plate, suction cover	736	8	O-ring (P52/P65/P85)	9-1

1. Remove the parts in the order of the numbers shown in the figure.

2. Install the parts in the reverse order of removing.

5.4.14.1 Common Precautions for Removal/Installation

■ **Balance piston cover**

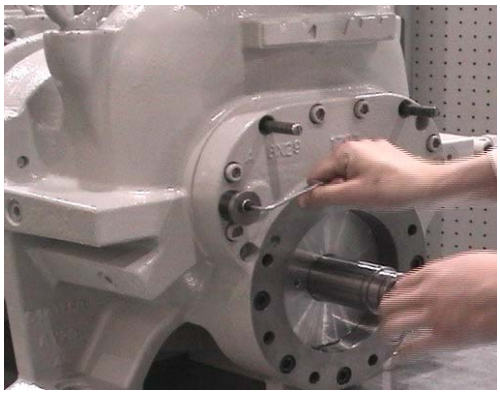
CAUTION

- **The balance piston cover may fall causing injuries or damage to the compressor. Before starting the removing work, always attach stud bolts (M12×75) for safety. (Balance piston cover weight: 17 kg for 170J, 33 kg for 220J, 48 kg for 280J)**

5.4.14.2 Precautions for Removal

■ **Balance piston cover**

1. Remove the two upper hexagon socket head cap screws (M12×50/M16×60/M20×70) and attach safety bolts.
2. Use the slide hammer and remove the parallel pin.
3. After pulling out the parallel pin, loosen the rest of the hexagon socket head cap screws and remove the balance piston cover.



■ **Suction cover partition plate**

1. Using eyebolts (M8), remove the suction cover partition plate.

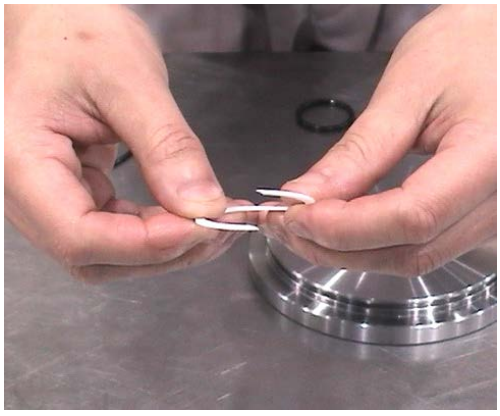
5.4.14.3 Precautions for Installation

■ **O-ring**

1. Make sure that all necessary O-rings are attached.

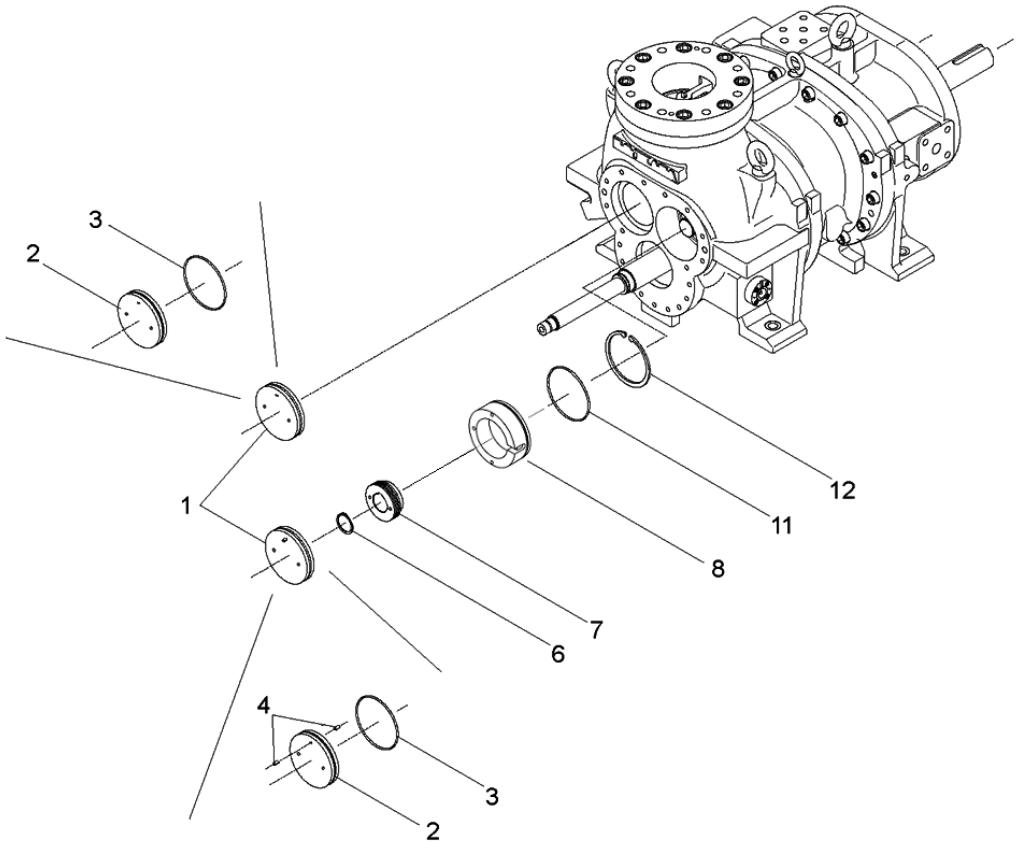
■ **Back-up ring for O-ring**

1. Attach the back-up rings to the suction cover partition plate while paying appropriate attention to the direction of the bias cut surface. Ensure that the joint of backup ring mates, and the O-ring fits between the two back-up rings.



5.4.15 Suction Cover

■ **170J**



Order	Description	Part No.
1	Inner cover assembly, balance piston cover	—
2	Inner cover, balance piston cover	734
3	O-ring (G115)	23
4	Spring pin (6 dia.×12)	34-1
6	Retaining ring C type external (S40)	32

Order	Description	Part No.
7	Balance piston	30
8	Sleeve, balance piston	33
11	O-ring (G115)	35-2
12	Retaining ring C type internal (H120)	37

1. Remove the parts in the order of the numbers shown in the figure.
2. Install the parts in the reverse order of removing.

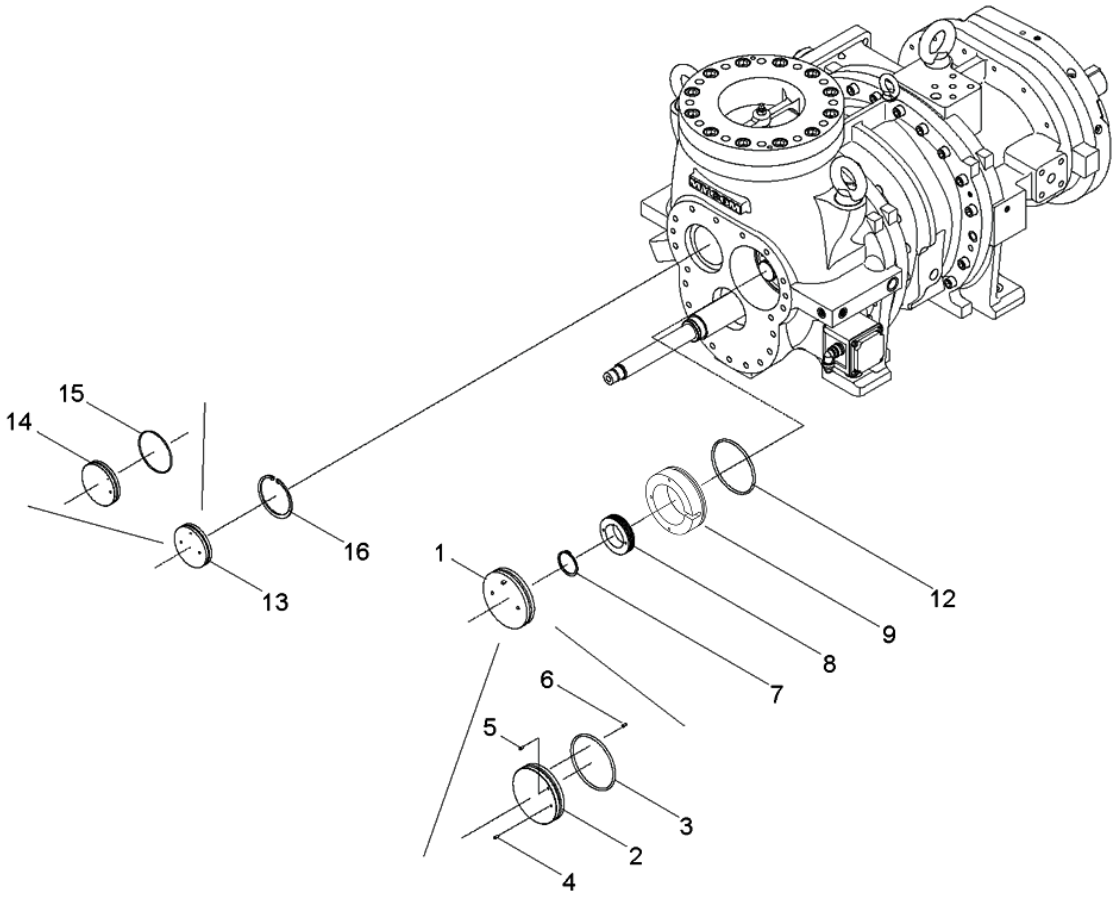
Note:

According to the design modification notification as of April 9, 2012, J series balance piston related parts have been changed including the integration of balance piston sleeve and its housing. Accordingly the parts indicated with double strikethrough on the parts list on this page and the following page have been discontinued.

As for the serial number and other detailed information of the compressor applied for this design modification refer to the clause 7.4 design modification information (No.C0956-02) in the chapter 7.

If you require information about the suction cover (balance piston) before this design modification, refer to the instruction manual(No.2202B0-JJ-DA-J-N_2012.01.).

■ 220J/280J



Order	Description	Part No.
1	Inner cover M assembly, balance piston cover	—
2	Inner cover M, balance piston cover	734-1
3	O-ring (G150/G190)	23-1
4	Spring pin (6 dia.×12)	34
6	Spring pin (6 dia.×12)	34
7	Retaining ring C type external (S65/S80)	32
8	Balance piston	30

Order	Description	Part No.
9	Sleeve, balance piston	33
12	O-ring (G150/G190)	35-2
13	Inner cover F assembly, balance piston cover	—
14	Inner cover F, balance piston cover	734-2
15	O-ring (G115/G150)	23-2
16	Retaining ring C type internal (H120/None)	37

1. Remove the parts in the order of the numbers shown in the figure.

2. Install the parts in the reverse order of removing.

5.4.15.1 Common Precautions for Removal/Installation

■ **Retaining ring**

⚠ CAUTION

- **The retaining ring may jump out, causing injuries. Always use retaining ring pliers of appropriate size and wear protective goggles.**

5.4.15.2 Preparation for Suction Adapter Removal

1. Loosen the hexagon socket head cap screw (No. 493: M20×50 for 170J, M22×60 for 220J) while the suction cover and the main rotor casing are assembled, because it is difficult to hold by hand the suction cover separately while loosening the hexagon socket head cap screw.

【POINT】

- Preparation for suction adapter removal is not required for 280J.

5.4.15.3 Precautions for Removal

■ **Balance piston cover inner cover**

1. Using eyebolts (M8), remove the balance piston cover inner cover.

【POINT】

- For 170J, the balance piston cover inner covers on the male rotor side and the female rotor side are the same. But that on the male rotor side is attached with the spring pins. It is not necessary to remove these spring pins from the balance piston cover inner cover.

■ **Balance piston**

1. Using eyebolts (M8), remove the balance piston with the balance piston sleeve.

■ **Balance piston sleeve**

1. Using eyebolts (M8), remove the balance piston sleeve.

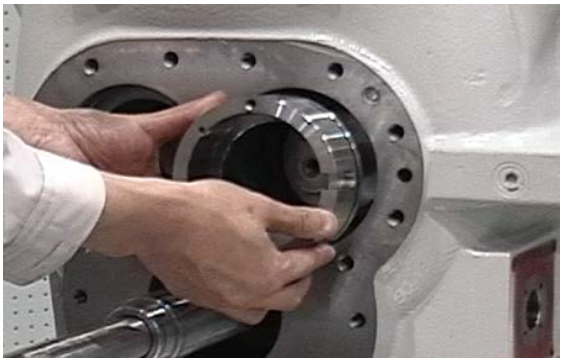
5.4.15.4 Precautions for Installation

■ O-ring

1. Make sure that all necessary O-rings are attached.

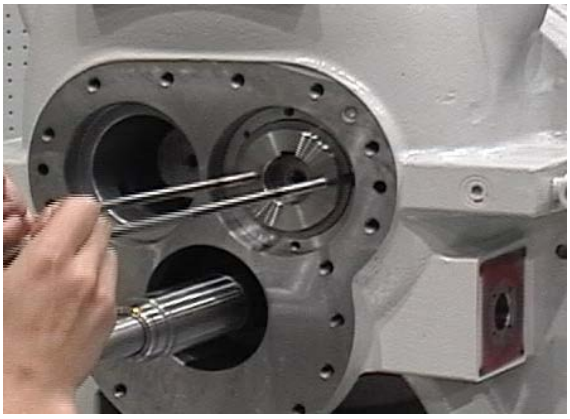
■ Balance piston sleeve

1. The large cutout of the balance piston sleeve must face the right side when installing into the suction cover. Align the large cutout with the oil supplied port on the right side of the suction cover.



■ Balance piston

1. Install the balance piston onto the shaft by aligning the keyway to the key on the male rotor shaft

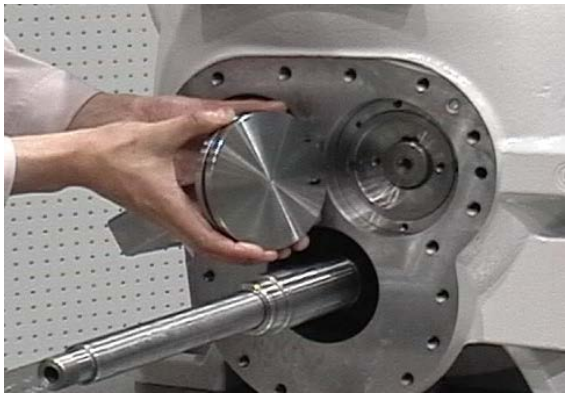


■ Spring pin

1. Check for wear and damages. If anything wrong is found, replace with new spring pin.

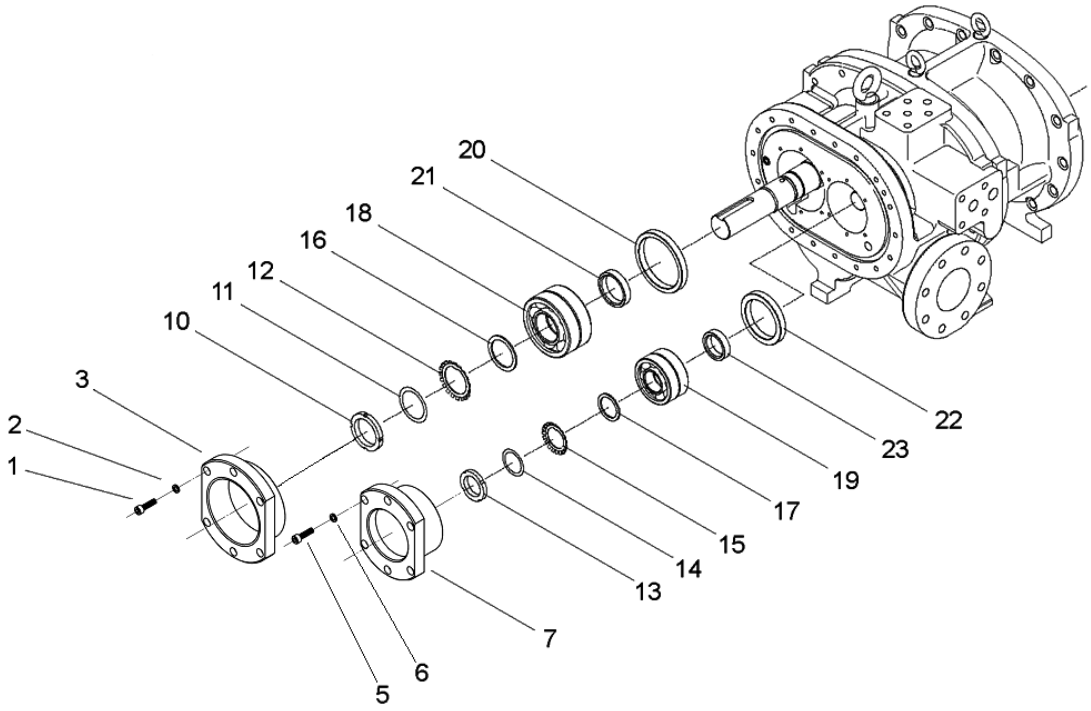
■ Balance piston cover inner cover (male rotor side)

1. Install the balance piston inner cover into the suction cover aligning the spring pin (6 dia.×12) the cutout on the detent hole of the balance piston sleeve



5.4.16 Thrust Bearings

■ **170J**



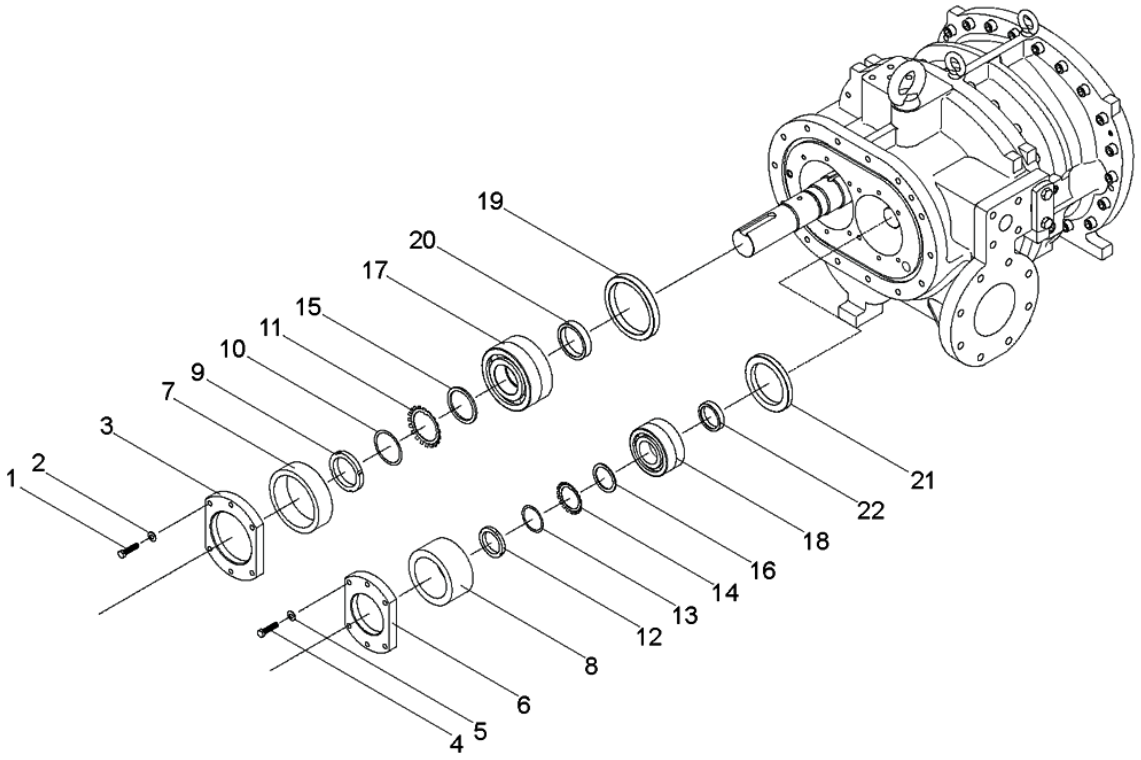
Order	Description	Part No.
1	Hexagon socket head cap screw (M8×30)	45
2	Spring lock washer	46
3	Thrust bearing gland, male rotor	43-1
5	Hexagon socket head cap screw (M8×30)	45
6	Conical spring washer	46
7	Thrust bearing gland, female rotor	43-2
10	Locknut (AN12)	39-1
11	Torsional slip washer (160)	237-1
12	Lock washer (AW12)	40-1
13	Locknut (AN09)	39-2
14	Torsional slip washer (125)	237-2

Order	Description	Part No.
15	Lock washer (AW09)	40-2
16	Thrust washer, male rotor	250-1
17	Thrust washer, female rotor	250-2
18	Thrust bearing assembly, male rotor	38-1
19	Thrust bearing assembly, female rotor	38-2
20	Thrust bearing outer race spacer, male rotor	41-1
21	Thrust bearing alignment spacer, male rotor	42-1
22	Thrust bearing outer race spacer, female rotor	41-2
23	Thrust bearing alignment spacer, female rotor	42-2
22	Thrust bearing outer race spacer, female rotor	41-2

1. Remove the parts in the order of the numbers shown in the figure.

2. Install the parts in the reverse order of removing.

■ 220J/280J



Order	Description	Part No.
1	Hexagon head screw (M12×50/ M16×65)	45
2	Spring lock washer	46
3	Thrust bearing gland, male rotor	43-1
4	Hexagon head screw (M12×50/ M16×65)	45
5	Conical spring washer	46
6	Thrust bearing gland, female rotor	43-2
9	Locknut (AN16/AN20)	39-1
10	Torsional slip washer	237-1
11	Lock washer (AW16/AW20)	40-1
12	Locknut (AN12/AN16)	39-2

Order	Description	Part No.
13	Torsional slip washer	237-2
14	Lock washer (AW12/AW16)	40-2
15	Thrust washer, male rotor	250-1
16	Thrust washer, female rotor	250-2
17	Thrust bearing assembly, male rotor	38-1
18	Thrust bearing assembly, female rotor	38-2
19	Thrust bearing outer race spacer, male rotor (only for 220J)	41-1
20	Thrust bearing alignment spacer, male rotor	42-1
21	Thrust bearing outer race spacer, female rotor (only for 220J)	41-2
22	Thrust bearing alignment spacer, female rotor	42-2

1. Remove the parts in the order of the numbers shown in the figure.

2. Install the parts in the reverse order of removing.

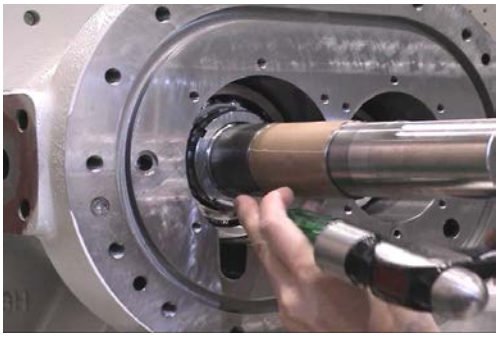
5.4.16.1 Precautions for Removal

■ Thrust bearing gland

1. Protect the part of the male rotor where the mechanical seal is installed from being damaged by using a curing tape.

■ Locknuts M and F / torsional slip washers / lock washers M and F

1. Using a screwdriver, bend back the claw of the lock washer.



■ Thrust bearing assembly for male rotor / thrust bearing assembly for female rotor

【POINT】

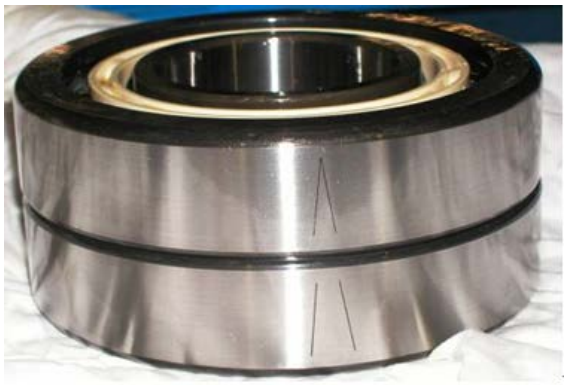
- If the thrust bearings cannot be removed by hand, use the thrust bearing pulling tool. Take care not to damage the inner and outer rings, balls and retainers of the thrust bearings.

5.4.16.2 Precautions for Installation

■ Thrust bearing

【POINT】

- When replacing the thrust bearings, regarding the direction of thrust bearing assembly, there may or may not be a V-shaped mark for assembly on the outer side of the bearing. Follow the instructions below accordingly.



1. If there is a V-shaped mark for assembly on the outer side of the thrust bearing, assemble with the pointed end of the mark on the inner side of the machine due to a slight directional difference that affects end clearance adjustment.

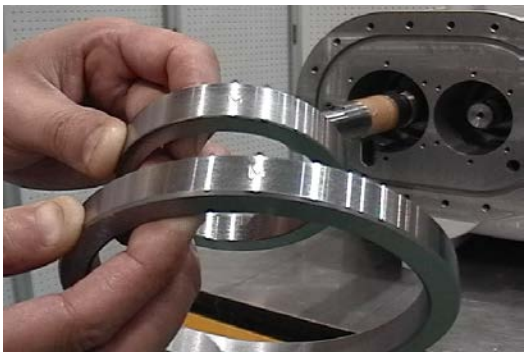
If there is no V-shaped mark, assembly direction does not affect end clearance adjustment. However, to clarify the difference between the inner side and outer side of the machine, after assembling with the bearing number engravings on the outer side, make a V-shaped mark using blue whetstone on the machine's inner side of the bearing..

□

■ Thrust bearing outer race spacers M and F (only for 170J/220J) / thrust bearing alignment spacers M and F

【POINT】

- The thrust bearing outer race spacers and thrust bearing alignment spacers have a stamped mark of M or F.



1. When installing the thrust bearing outer race spacers and thrust bearing alignment spacers, direct the upper side of the stamped letter toward the machine.

■ Locknuts M and F / torsional slip washers / lock washers M and F

【POINT】

- If the locknut is tightly fastened and the rotor is not able to rotate, it secures no end clearance and the thrust bearing will be damaged.
- If no end clearance is secured, do not tighten the locknut further and replace the thrust bearing alignment spacer or insert a shim of appropriate thickness between the thrust bearing alignment spacer and the inner race of the thrust bearing to secure appropriate end clearance.
- For further details, refer to “5.4.20 Adjustment of End Clearance” in this manual chapter 5.

1. Align the lock washer claw to the locknut groove and bend the lock washer claw using a screwdriver.

■ Thrust bearing gland for male rotor (170J)

1. Facing the cast out part of the thrust bearing gland for male rotor down, attach it to the oil drain groove of the bearing head.

■ Hexagon head screw (M8×30/M12×50/M16×65)/conical spring washer (M8/M12/M16)

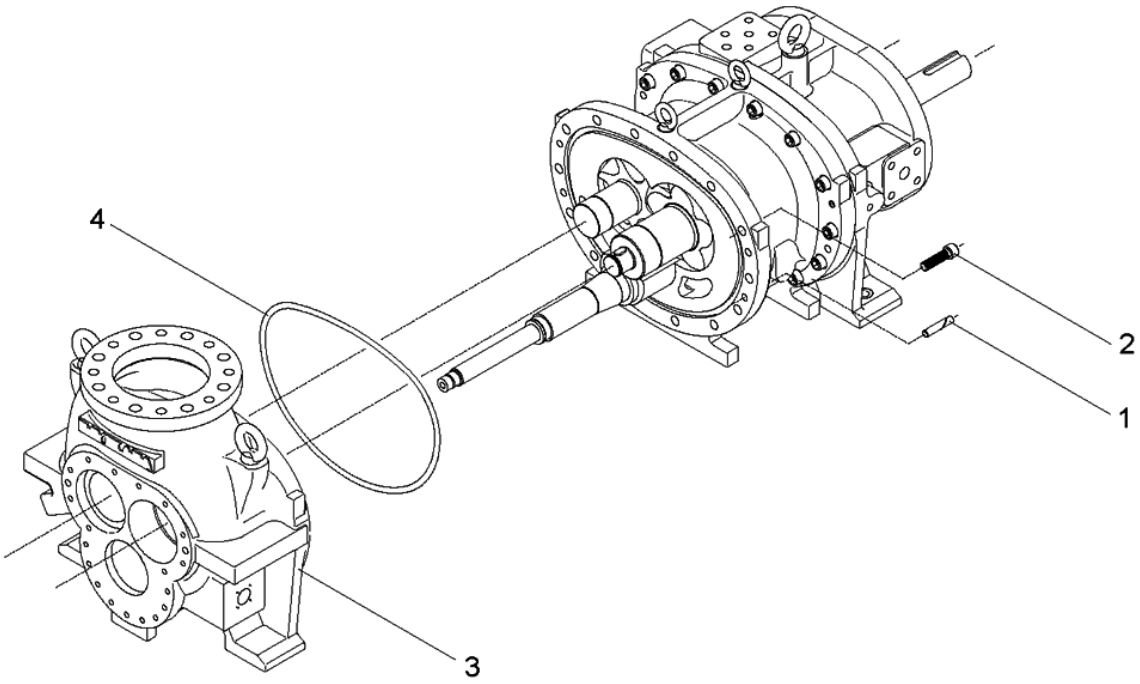
1. The conical spring washer must be attached after adjustment of end clearance.

2. Tighten the hexagon socket head cap screw (M8×30/M12×50/M16×65) evenly and lightly using a wrench.

3. For further details, refer to "5.4.20 Adjustment of End Clearance".

5.4.17 Separation of Suction Cover and Main Rotor Casing

■ **170J/220J/280J**



Order	Description	Part No.
1	Parallel pin (13 dia.×65/13 dia.×65/16 dia.×110)	3
2	Hexagon socket head cap screw (M16×60/M16×75/M20×110)	2

Order	Description	Part No.
3	Suction cover	5
4	O-ring (P375/P450/P580)	6

1. Remove the parts in the order of the numbers shown in the figure.

2. Install the parts in the reverse order of removing.

5.4.17.1 Common precautions for Removal/Installation

■ **Suction cover**

⚠ CAUTION

- **If the lifting equipment and lifting slings in use do not have sufficient loading capacity, the suction cover may fall causing injuries and damage to the compressor. Before starting the lifting work, always check that the lifting equipment and lifting slings have sufficient loading capacity. Do not allow anyone to be under the suction cover.**
  (Suction cover weight: 142 kg for 170J, 270kg for 220J, 280kg for 280J)

5.4.17.2 Precautions for Removal

■ **Suction cover**

1. Using appropriate tools, remove the parallel pin.
2. Insert bolts into the service holes, tighten the bolts, and separate the suction cover and the main rotor casing flange face evenly.
3. Pull out the suction cover being careful not to damage the push rod.

【POINT】

- Before separating the suction cover from the main rotor casing, loosen the suction adapter fixing bolts (M20×50 for 170J, M22×60 for 220J) on the suction cover.
- When separating the suction cover from the main rotor casing, do not remove the suction cover with the rotors.
- If it is difficult to separate the suction cover from the main rotor casing, lift the main rotor casing slightly using a crowbar while removing the suction cover.

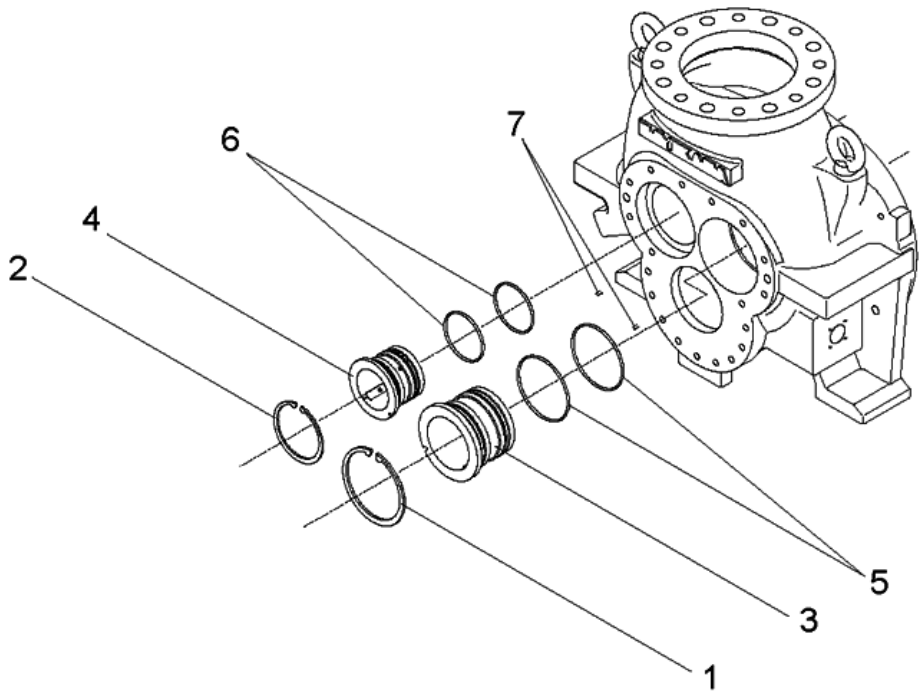
5.4.17.3 Precautions for Installation

■ **O-ring (P375/P450/P580)**

1. After disassembly, replace the existing O-rings with new ones.

5.4.18 Suction Cover

■ **170J/220J/280J**



Order	Description	Part No.
1	Retaining ring C type internal (H120/H150/H190)	29-1
2	Retaining ring C type internal (H95/H120/H150)	29-2
3	Bearing, male rotor	27
4	Bearing, female rotor	28

Order	Description	Part No.
5	O-ring (G100/G130/G165)	432
6	O-ring (G75/G100/G100)	433
7	Spring pin (4 dia.×10)	14

1. Remove the parts in the order of the numbers shown in the figure.

2. Install the parts in the reverse order of removing.

5.4.18.1 Common Precautions for Removal/Installation

■ **Retaining ring**

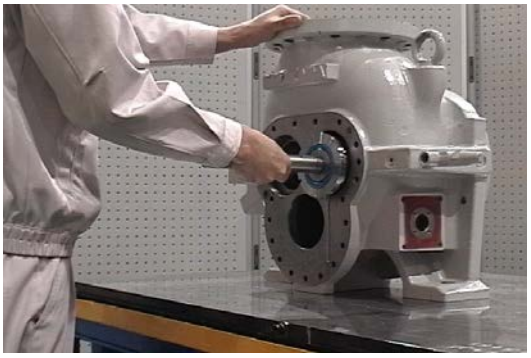
⚠ CAUTION

- **The retaining ring may jump out, causing injuries. Always use retaining ring pliers of appropriate size and wear protective goggles.**

5.4.18.2 Precautions for Removal

■ Bearing

1. Remove the bearing using the radial bearing installing tool.



5.4.18.3 Precautions for Installation

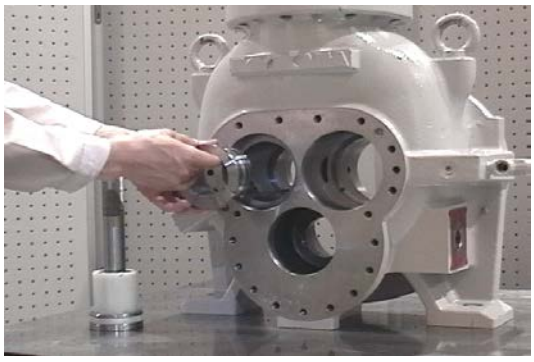
■ Spring pin

1. Check for wear and damages. If anything wrong is found, replace with new spring pin.

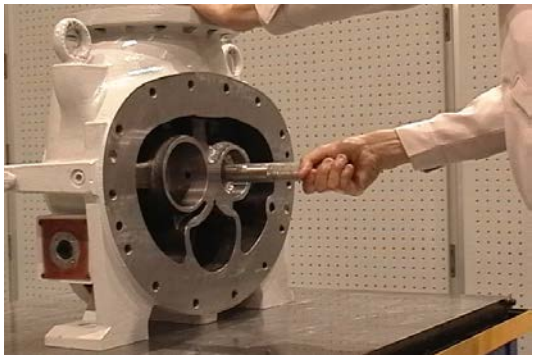
■ Bearing

1. Lubricate the bearing face on the suction cover with lubricant.

2. Insert the guide to the spring pin (4 dia.×10) and align the cutout of the bearing to the guide.

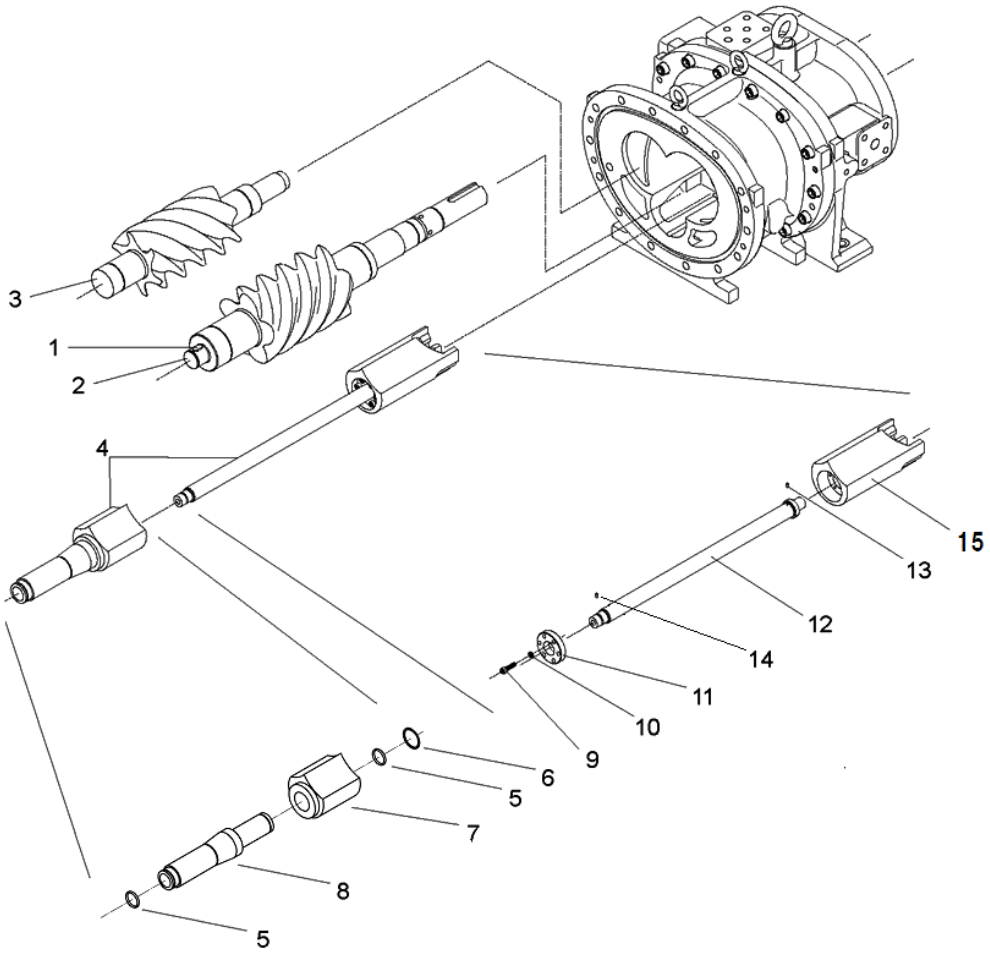


3. Install the bearing using the radial bearing installing tool.



5.4.19 Rotors

■ **170J/220J/280J**



Order	Description	Part No.
1	Key for balance piston	31
2	Male rotor	25
3	Female rotor	26
4	Unloader slide valve assembly and slide valve assembly, Vi	—
5	O-ring (P32)	325-1
6	Spiral retaining ring	293
7	Slide valve, Vi	289
8	Push rod, Vi	292

Order	Description	Part No.
9	Hexagon socket head cap screw (M8×30/M8×35/M10×40)	58
10	Spring lock washer (M8/M8/M10)	267
11	Gland, push rod for unloader slide valve	451
12	Unloader push rod	67
13	Grooved pin / Key, Push rod for unloader slide valve	446
14	Guide pin	68
15	Unloader slide valve	54

1. Remove the parts in the order of the numbers shown in the figure.

2. Install the parts in the reverse order of removing.

5.4.19.1 Common Precautions for Removal/Installation

■ **Male rotor and female rotor**

⚠ CAUTION

Weight of rotor alone (kg)									
	170JS	170JM	170JL	220JS	220JM	220JL	280JS	280JM	280JL
M rotor	37	44	52	88	104	124	194	228	272
F rotor	19	23	28	46	55	67	101	121	148

- **If lifted inappropriately, it may cause injuries. When lifting the male rotor or female rotor use the lifting equipment, and make sure to adopt an appropriate method such as using lifting slings.**
- **If the lifting equipment and lifting slings in use do not have sufficient loading capacity, the male rotor or female rotor may fall causing injuries and damage to the compressor. Before starting the lifting work, always check that the lifting equipment and lifting slings have sufficient loading capacity. Do not allow anyone to be under the lifted male rotor or female rotor.**

CAUTION

- **Do not damage the rotor, the casing, or the bearing when pulling out /installing the rotors. Suspend the rotors and pull them out horizontally.**

5.4.19.2 Precautions for Removal

■ **Unloader slide valve assembly and Vi slide valve assembly**

⚠ CAUTION

Weight of Unloader slide valve assembly (kg)									
	170JS	170JM	170JL	220JS	220JM	220JL	280JS	280JM	280JL
Unloader slide valve	10	12	13	22	24	27	47	52	59
Slide valve, Vi	7	7.5	7.8	12.2	12.7	13.3	26	27	29

- **If lifted inappropriately, it may cause injuries.**
  If it is difficult to lift them by hand, use appropriate lifting equipment.

5.4.19.3 Precautions for Installation

■ Unloader push rod

1. Install the unloader push rod (Part No. 67) into the unloader slide valve (Part No. 54) with the grooved pin (Part No. 446) facing upward.

■ Push rod gland for unloader slide valve

1. When installing the push rod gland for unloader slide valve (No. 451) into the unloader slide valve (No. 54), align the cutout of the push rod gland with the grooved pin (No. 446) in the unloader slide valve push rod.

■ Male rotor and female rotor

1. Inspect the rotors for dents or scratches.

2. Using lifting slings, lift the female rotor horizontally and maintain the horizontal equilibrium.

3. Install the female rotor into the main rotor casing.

4. Using lifting slings, lift the male rotor horizontally and maintaining the horizontal equilibrium.

5. Engage the male rotor to the female rotor and push them into the main rotor casing.

【POINT】

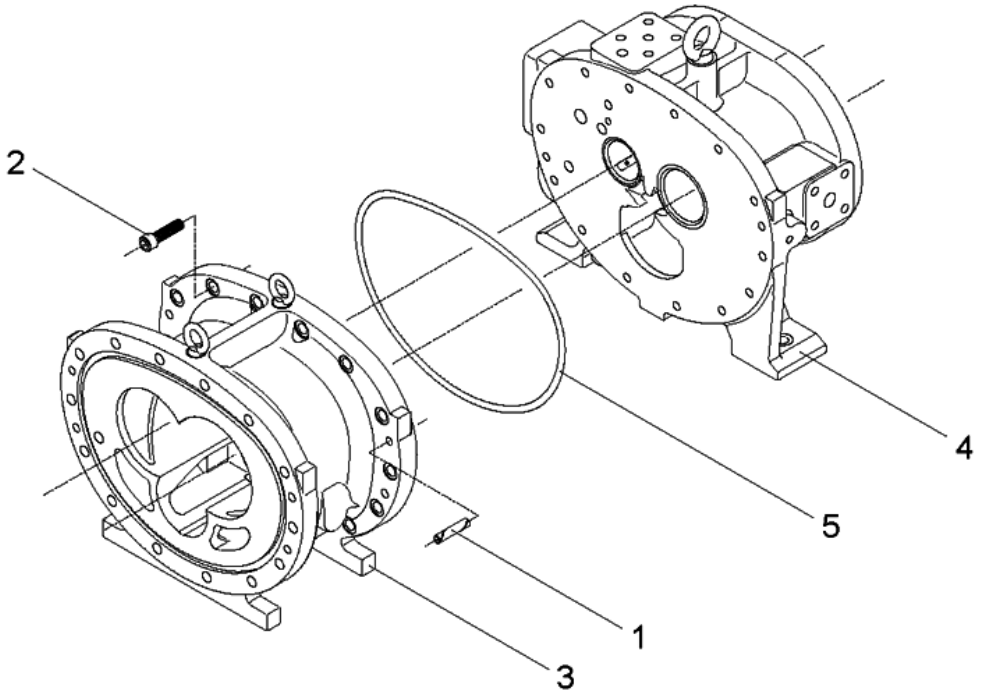
- The male rotor and female rotor can be engaged at any orientation.

■ Key for balance piston

1. Check for wear and damages. If anything wrong is found, replace the key.

5.4.20 Separation of Bearing Head and Main Rotor Casing

■ **170J/220J/280J**



Order	Description	Part No.
1	Parallel pin (13 dia.×65/16 dia.×65/16 dia.×110)	3
2	Hexagon socket head cap screw (M16×60/ M16×75/ M20×110)	2
3	Main rotor casing	1

Order	Description	Part No.
4	Bearing head	11
5	O-ring (P375/P450/P580)	12

1. Remove the parts in the order of the numbers shown in the figure.

2. Install the parts in the reverse order of removing.

5.4.20.1 Precautions for Removal

1. Remove the parallel pin using an appropriate tool.
2. Insert bolts into the service holes, tighten the bolts, and separate the bearing head and the main rotor casing flange face evenly.

5.4.20.2 Lifting of Bearing Head

CAUTION

- **Make sure that the lifting equipment and wires have sufficient loading capacity for the compressor. Otherwise, the bearing head may fall, resulting in injuries and damage to the compressor. Before lifting the compressor, always check that the lifting equipment and wires have sufficient loading capacity. Do not allow anyone to be under the lifted bearing head. (Bearing head weight: 168 kg for 170J, 270 kg for 220J, 520 kg for 280J)**

1. Using the one eyebolt (M20/M30/M36) on the top of the bearing head, lift and carry the bearing head with lifting equipment.

5.4.20.3 Lifting of Main Rotor Casing

CAUTION

Weight of main rotor casing (kg)								
170JS	170JM	170JL	220JS	220JM	220JL	280JS	280JM	280JL
101	107	132	165	200	250	405	490	590

- **Make sure that the lifting equipment and wires have sufficient loading capacity for the compressor. Otherwise, the main rotor casing may fall, resulting in injuries and damage to the compressor. Before lifting the compressor, always check that the lifting equipment and wires have sufficient loading capacity. Do not allow anyone to be under the lifted main rotor casing.**

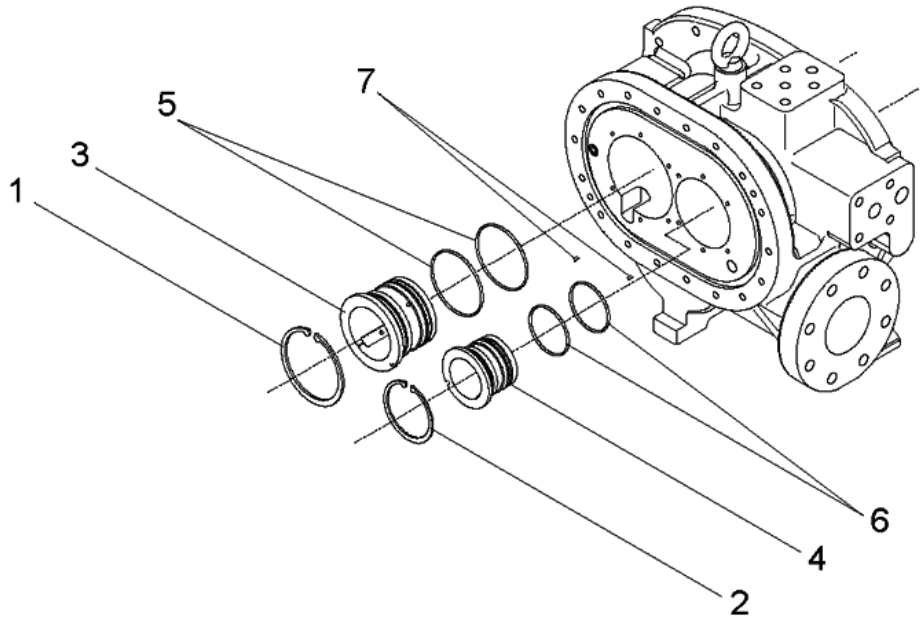
1. Using the two eyebolts (M12 2 places/M16 2 places/M24 1 place) on the top of the main rotor casing, lift and carry the main rotor casing with lifting equipment.

5.4.20.4 Precautions for Installation

■ O-ring (P375/P450/P580)

1. After disassembly, replace the existing O-rings with new ones.

5.4.21 Bearing Head



Order	Description	Part No.
1	Retaining ring C type internal (H120/H150/H190)	29-1
2	Retaining ring C type internal (H95/H120/H150)	29-2
3	Bearing, male rotor	27
4	Bearing, female rotor	28

Order	Description	Part No.
4	Bearing, female rotor	28
5	O-ring (G100/G150/G100)	432
6	O-ring (G75/G165/G130)	433
7	Spring pin (4 dia.×10)	14

1. Remove the parts in the order of the numbers shown in the figure.

2. Install the parts in the reverse order of removing.

5.4.21.1 Common Precautions for Removal/Installation

■ **Retaining ring**

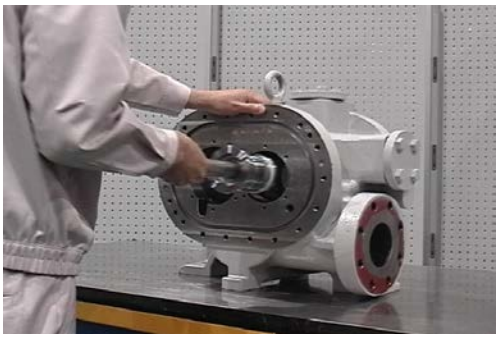
⚠ CAUTION

- **The retaining ring may jump out, causing injuries. Always use retaining ring pliers of appropriate size and wear protective goggles.**

5.4.21.2 Precautions for Removal

■ Bearing

1. Remove the bearing using the radial bearing installing tool.



5.4.21.3 Precautions for Installation

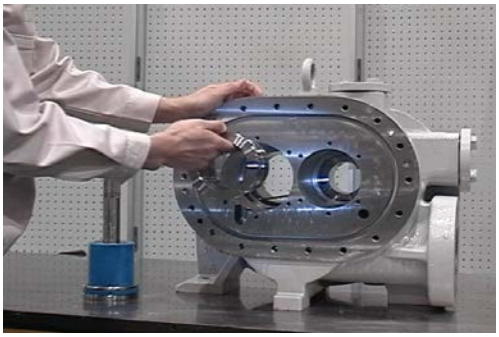
■ Spring pin

1. Check for wear and damages. If anything wrong is found, replace with new spring pin.

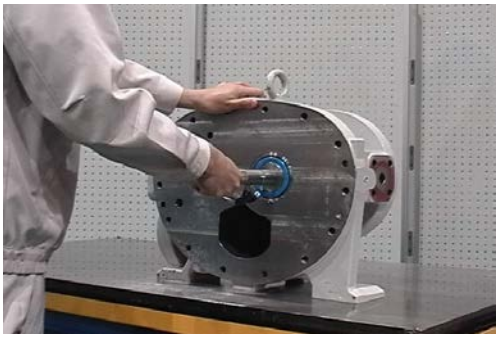
■ Bearing

1. Lubricate the bearing face of the bearing head with lubricant.

2. Insert the guide to the spring pin (4 dia.×10) and align the cutout of the bearing to the guide.

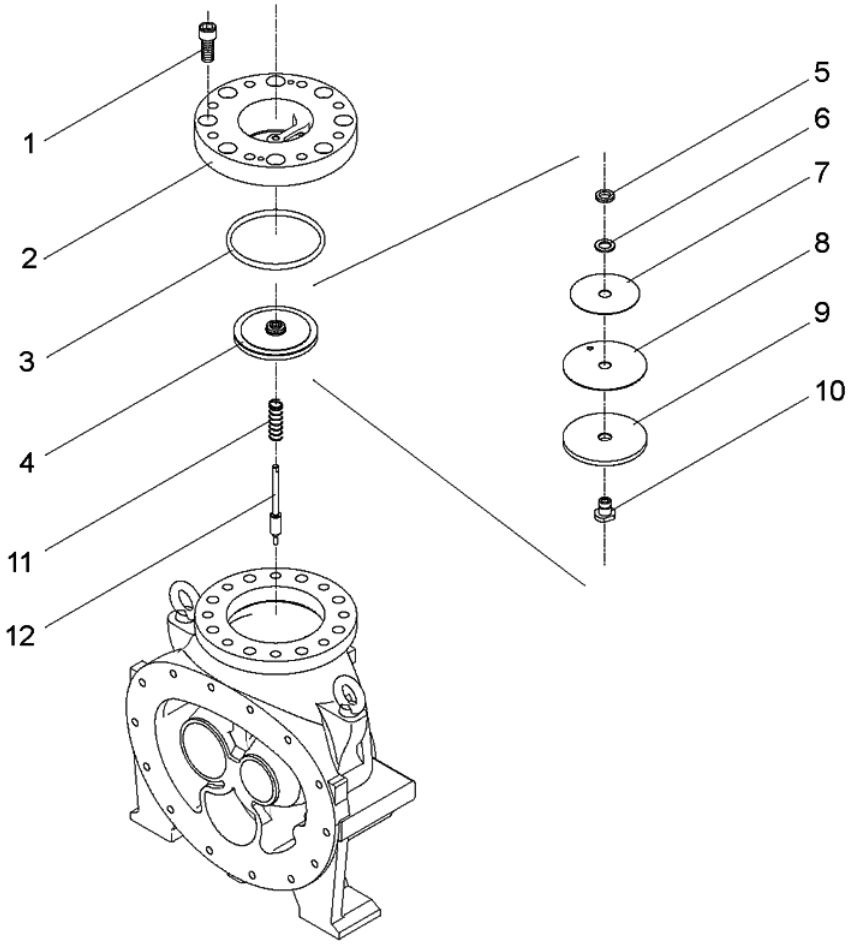


3. Install the bearing using the radial bearing installing tool.



5.4.22 Suction Adapter (except for 280J)

■ **170J**

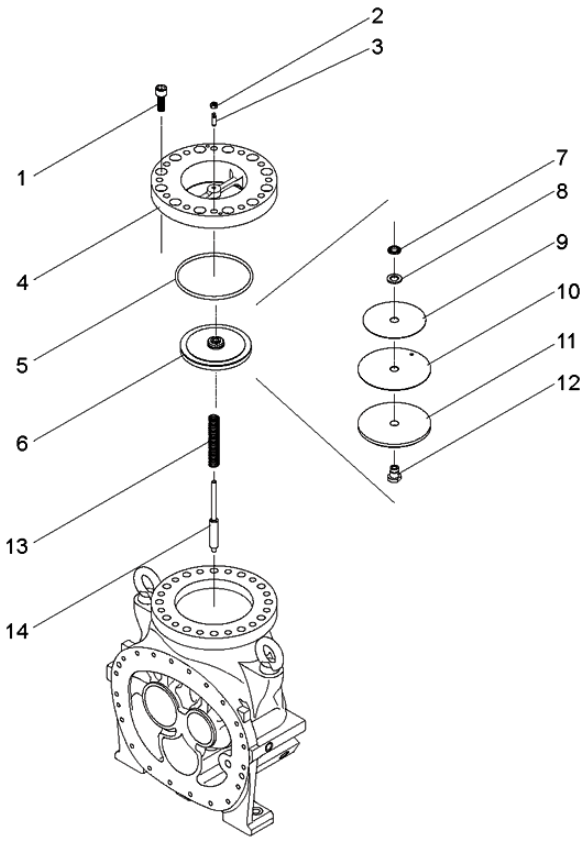


Order	Description	Part No.	Order	Description	Part No.
1	Hexagon socket head cap screw (M20×50)	493	7	Sheet stopper	488
2	Suction adapter	492	8	Valve sheet	489
3	O-ring (P155)	494	9	Valve disc	490
4	Valve disc assembly	—	10	Check valve slider	481
5	FU nut (FU04SS)	486	11	Spring, check valve	485
6	Plain washer	487	12	Check valve stem	491

1. Remove the parts in the order of the numbers shown in the figure.

2. Install the parts in the reverse order of removing.

■ **220J**



Order	Description	Part No.	Order	Description	Part No.
1	Hexagon socket head cap screw (M22×60)	493	8	Plain washer	487
2	Plain washer	496	9	Sheet stopper	488
3	Check valve stem gland	495	10	Valve sheet	489
4	Suction adapter	492	11	Valve disc	490
5	O-ring (P220)	494	12	Check valve slider	481
6	Valve disc assembly	—	13	Spring, check valve	485
7	FU nut (FU05SS)	486	14	Check valve stem	491

1. Remove the parts in the order of the numbers shown in the figure.

2. Install the parts in the reverse order of removing.

5.4.22.1 Common Precautions for Removal/Installation

CAUTION

- **The suction adapter weights 14 kg for 170J and 26 kg for 220J. If lifted inappropriately, it may cause injuries. If it is difficult to lift the suction adapter by hands, use lifting equipment.**

5.4.22.2 Precautions for Removal

■ Hexagon socket head cap screw (M20×50/M22×60)

1. Before separating the suction cover from the main rotor casing, loosen the hexagon socket head cap screws (No. 493: M20×50/M22×60).

■ Suction adapter

1. Using eyebolts (M8), remove the suction adapter.

■ FU nut

【POINT】

- The FU nut has a high friction locking device. Turn the FU nut with a locknut wrench until it is loosened.

5.4.22.3 Precautions for Installation

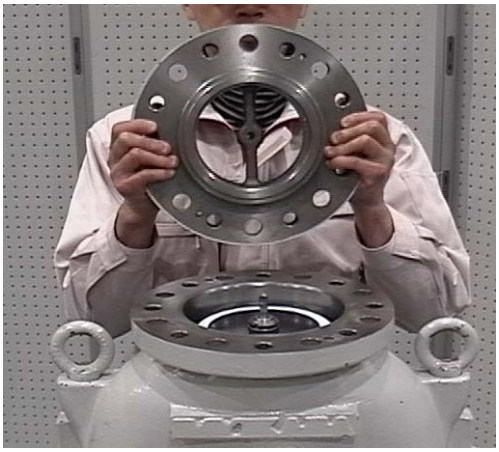
■ FU nut

【POINT】

- The FU nut has a high friction locking device. Turn the FU nut with a locknut wrench when tightening the FU nut.

■ Suction adapter

1. Install the suction adapter into the suction cover so that the adapter plate stem supporting the check valve stem orients in the thrust direction.



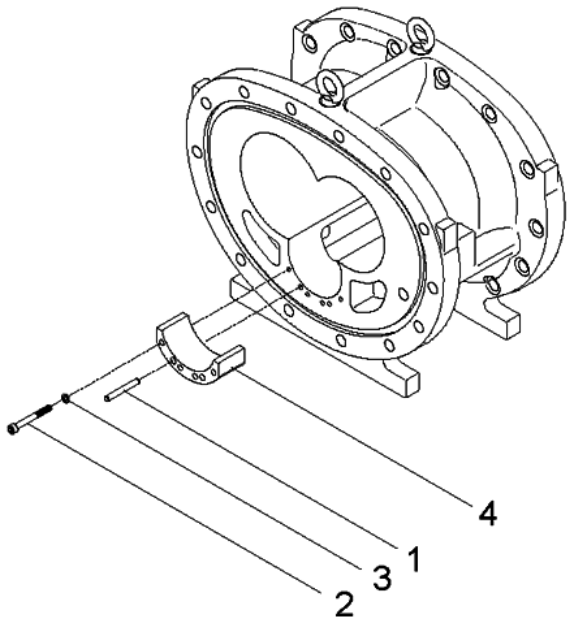
■ Hexagon socket head cap screw (M20×50/M22×60)

1. Apply liquid gasket to the suction adapter tightening bolts. (This is to prevent water entry and freezing. Silicon grease is allowable.)

2. Install the bolts to the suction cover and tighten them lightly with a wrench.

3. After connecting the suction cover and the main rotor casing securely, tighten the hexagon socket head cap screws (M20×50/M22×60) on the suction cover to the specified torque.

5.4.23 Unloader Slide Valve Guide



Order	Description	Part No.	Order	Description	Part No.
1	Parallel pin (8 dia.×60/8 dia.×80/13 dia.×100)	249	3	Spring lock washer	248
2	Hexagon socket head cap screw (M8×70/M8×90/M10×110)	247	4	Guide, unloader slide valve	246

1. Remove the parts in the order of the numbers shown in the figure.

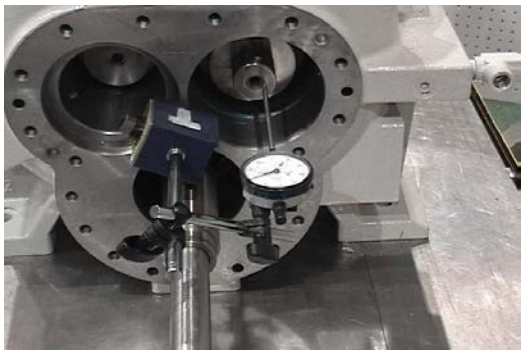
2. Install the parts in the reverse order of removing.

CAUTION

- **For periodic inspection, do not remove the unloader slide valve guide.**

5.4.24 Adjustment of End Clearance

1. Rotate the male rotor clockwise several turns.
2. Press the end face of male rotor on a suction side securely.
3. Attach the point of a dial gauge on the suction cover side end face of the male rotor.
4. Reset the dial gauge scale to 0.
5. Using a torque wrench, tighten the hexagon socket head cap screws (M8×30/M12×50/M16×65) for thrust gland diagonally little by little and finally tighten them to the specified torque.
6. Check if the dial gauge reading falls in the specified range.



Specified range: 0.04 - 0.06 (170J)
0.06 – 0.08 (220J)
0.10 – 0.14 (280J)

(1) When the end clearance is smaller than the specified value

To deal with this, insert shim material (thrust adjustment liner) of required thickness (difference in thickness from the specified value) between the thrust bearing alignment spacer【42】and thrust bearing inner race.

* The thrust adjustment liner is not shown in the development view, but available from us. Place an order together with a model name.

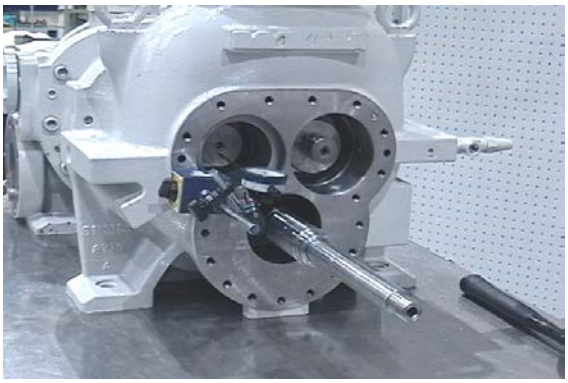
Also, in case of 170 J and the 220 J series, using a highly accurate surface grinding machine or asking professional service vendors to grind, grind the surface of thrust bearing outer race spacer【41】by the difference from the specified value.
This method doesn't apply to the 280 J series which isn't using a thrust bearing outer race spacer.

After grinding the flat surface, measure the whole circumference of the saucer by using a micrometer, and check that the thickness is even.

(2) When the end clearance is larger than the specified value

As the end clearance is excessive, remove shim material (thrust adjustment liner) of a thickness equal to the difference between the measured value and the specified value if the shim material is used between thrust bearing alignment spacer and thrust bearing inner race.
Or if the shim material is not used between thrust bearing alignment spacer and thrust bearing inner race, or even if used but insufficient thickness, grind the surface of thrust bearing alignment spacer【42】by the difference between the measured value and the specified value or ask professional service vendors to do so.
After grinding the flat surface, measure the whole circumference of the spacer by using a micrometer, and check that the thickness is even.

7. Rotate the male rotor counterclockwise several turns.



8. Press the end face of female rotor on suction side securely**.**
9. **Attach the point of a dial gauge to the suction cover-side end face of the female rotor.**
10. **Reset the dial gauge scale to 0.**
11. **Using a torque wrench, tighten the hexagon socket head cap screws (M8×30/M12×50/M16×65) for thrust gland diagonally lit**tle by little and finally tighten them to the specified torque.
12. Check if the dial gauge reads the specified range.

Specified range : 0.04 - 0.06 (170J)
0.06 - 0.08 (220J)
0.10 - 0.14 (280J)

(1) When the end clearance is smaller than the specified value

To deal with this, insert shim material (thrust adjustment liner) of required thickness (difference in thickness from the specified value) between the thrust bearing alignment spacer【42】and thrust bearing inner race.

* The thrust adjustment liner is not shown in the development view, but available from us. Place an order together with a model name.

Also, in case of 170 J and the 220 J series, using a highly accurate surface grinding machine or asking professional service vendors to grind, grind the surface of thrust bearing outer race spacer【41】by the difference from the specified value. This method doesn't apply to the 280 J series which isn't using a thrust bearing outer race spacer.

After grinding the flat surface, measure the whole circumference of the saucer by using a micrometer, and check that the thickness is even.

(2) When the end clearance is larger than the specified value

As the end clearance is excessive, remove shim material (thrust adjustment liner) of a thickness equal to the difference between the measured value and the specified value if the shim material is used between thrust bearing alignment spacer and thrust bearing inner race.
Or if the shim material is not used between thrust bearing alignment spacer and thrust bearing inner race, or even if used but insufficient thickness, grind the surface of thrust bearing alignment spacer【42】by the difference between the measured value and the specified value or ask professional service vendors to do so. This method applies to the 170J series and 220J series.
After grinding the flat surface, measure the whole circumference of the spacer by using a micrometer, and check that the thickness is even.

13. After finishing end clearance adjustment, remove one of the hexagon socket head cap screw (M8×30/M12×50/M16×65) of the thrust bearing gland for the male rotor, attach a spring lock washer to the hexagon socket head cap screw, and then reattach and tighten the hexagon socket head cap screw to the specified torque.
14. Repeat this work for all hexagon socket head cap screws (M8×30/M12×50/M16×65) of the thrust bearing gland for the male rotor in a star pattern.
15. Perform the same operation to the hexagon socket head cap screws (M8×30/M12×50/M16×65) of the thrust bearing gland for the female rotor.

5.4.25 Inspection for Runout Male Rotor Shaft

1. Mount a dial gauge on the bearing head flange face and attach the point to the seal portion of the male rotor.
2. Check the runout of the seal portion of male rotor shaft by rotating it.

Specification: 0.03/turn or less

CAUTION

- **If the measured runout is larger than specified, some foreign matters may be jammed between the parts, the locknut tightening torque may be excessive, or the accuracy of parallelism deviation for the thrust adjustment spacer is not satisfactory.**
  Disassemble the parts and inspect the thrust adjustment spacer, thrust spacer, thrust bearing, and locknut to eliminate any possible causes. Do not tighten the locknut fully in one cycle. Tighten it evenly several times while changing the combination of engagement between tightening tool claw and locknut groove.

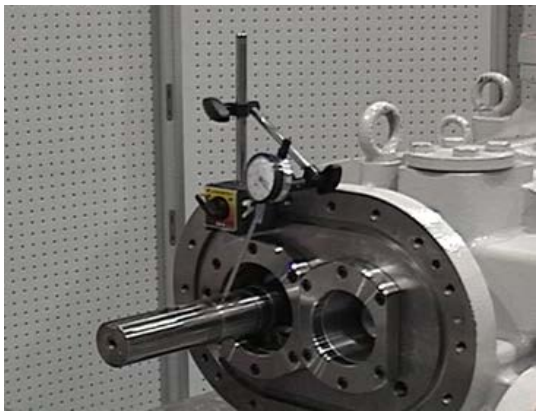
5.4.26 Inspection for Runout of Seal Cover Mount Face (Bearing Cover)

1. Mount a dial gauge to the shaft of the male rotor and attach the point on the flange face of bearing cover.
2. Check the runout of the seal cover mount face for the bearing cover by rotating the male rotor shaft.

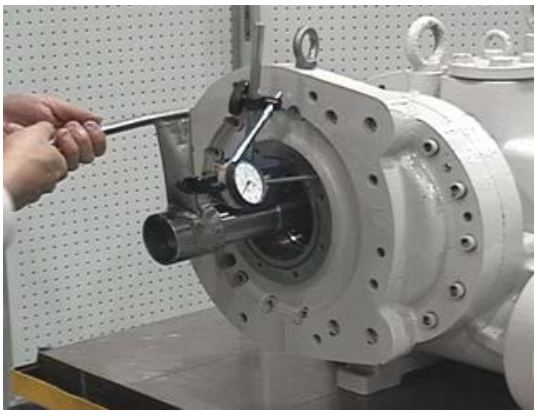
Specification: 0.05/turn or less

CAUTION

- **If the measured runout is larger than specified, some foreign matters may be jammed between the parts, or the locknut tightening torque may be excessive, or the accuracy of parallelism deviation for the thrust adjustment spacer is not satisfactory.**
  Disassemble the parts and inspect the thrust adjustment spacer, thrust spacer, thrust bearing, and locknut to eliminate any possible causes. Do not tighten the locknut fully in one cycle. Tighten it evenly several times while changing the combination of engagement between tightening tool claw and locknut groove.



Check the runout of the male rotor shaft



Check the runout of the seal cover mount face

6 Troubleshooting

Table 6-1 Troubleshooting

	Trouble	Direct causes	Factors	Actions
01	Compressor not starting	Power source is off.	Most cases are due to neglect to turn power source on after inspection.	Prevent by checking using a check sheet, and by pointing and calling.
		Main motor malfunction	Most cases are due to overload protection circuit.	Refer to the motor instruction manual as well for other causes and actions.
		Capacity control of 0% undetected by unloader indicator	Malfunction of micro-switch	Replace micro-switch.
		Capacity control hydraulic circuit defect	Maladjustment of oil controller valve (decreased too much)	Readjust.
			Leak or clogging in pipes and solenoid valves	Remove factors. Check oil contamination level and replace pipes and solenoid valves.
		Unconfirmed hydraulic pressure	Malfunction in hydraulic pressure protection device, pressure sensor, relays, etc.	Identify malfunctioning devices, examine their causes, and take measures. Then, replace malfunctioning devices.
			Clogging in connecting pipes	Remove clogging. Check oil contamination level and replace oil as necessary.
		Unconfirmed cooling water circulation	Malfunction in devices such as cooling water pumps and related circuits	Identify malfunctioning devices, examine their causes, and take measures. Then, replace malfunctioning devices.
			Clogging in circulation routes	Remove clogging.
		Malfunction in magnets, relays, etc., in compressor start circuit	Aging degradation	Replace with new devices.
			Bad installation environment	Replace ventilation fans, etc, if malfunctioning. Improve temperature, humidity, and ventilation for installation site.
02	Compressor stops immediately after startup.	Low pressure protection circuit activated	Insufficient refrigerant circulation volume • Insufficient refrigerant amount • Insufficient refrigerant supply • Heat exchange failure at heat exchanger	For insufficient refrigerant amount, check for and stop leak, and then replenish refrigerant. * Be aware of moisture contamination in the system.
				For insufficient supply, inspect expansion valves and supplying strainers, and then take necessary measures. Also, inspect devices and parameters (setting values) for expansion value aperture adjustment device, and then take necessary measures.

	Trouble	Direct causes	Factors	Actions
02	Compressor stops immediately after startup.	Low pressure protection circuit activated	Insufficient refrigerant circulation volume	If any heat exchange failures as typified by poor defrost performance, investigate the cause and take measures.
				For malfunction in pressure adjustment valve operation, replace pressure adjustment valve, or remove the cause.
			Malfunction of low pressure protection device, pressure sensor, relays, etc.	Identify malfunctioning devices, examine their causes, and take measures. Then, replace malfunctioning devices.
		Motor overload	In many cases, motor overload that occurs just after startup is caused by the motor, not by the refrigeration cycle. Refer to the motor instruction manual.	
03	Abnormally low pressure (low suction pressure)	Refer to the direct causes “Low pressure protection circuit activated” in item 2.	Same as on the left	Same as on the left
04	Low oil-supply pressure	Clogging in oil filter element * Big difference in outlet/inlet pressures	Contamination of lubricant	Remove clogging. Check oil contamination level and change lubricant as necessary.
			Defect inside compressor	Check oil contamination level. After vibration noise diagnosis, overhaul compressor as necessary.
		Insufficient oil amount in oil separator	Malfunctioning oil heater, excessive refrigerant dissolution during stoppage, and oil carried away during startup.	Inspect oil heater. Inspect relays, etc., on related circuits. Replace parts as necessary.
			Insufficient oil return caused by insufficient refrigerant circulation	Resolve insufficient refrigerant circulation, and then return oil from load side heat exchanger. * Replenish lubricant temporarily.
			Troubles such as clogging in oil return circuit	Remove any causes of trouble to restore.
			Extensive oil leak	Inspect machine room and around compressor and take measures. Inspect for presence of oil floating in cooling water system. If there is any oil floating, check for oil leak in oil cooler heat transmission tube, and take measures.
				For damage in pipes, etc., caused by excessive vibration, take vibration reduction measures (including sympathetic vibration measures).

	Trouble	Direct causes	Factors	Actions
04	Low oil-supply pressure	Defect in hydraulic pressure detection feature.	Malfunction in hydraulic pressure protection device, pressure sensor, relays, etc.	Identify malfunctioning devices, examine their causes, and take measures. Then, replace malfunctioning devices.
			Clogging in connecting pipes	Remove clogging. Check oil contamination level and replace oil as necessary.
05	Abnormally high pressure (abnormal discharge pressure)	Heat exchange failure at condenser (heat exchanger)	Contaminated and blocked heat trans-mission tubes, fins, etc.	Clean and wash them. Use solvent to clean depending on contamination.
			Malfunction of fan motor, thermo-switch, water spray bars, cooling water pumps, etc. (including waterfall)	Identify malfunctioning devices, examine their causes, and take measures. Then, replace malfunctioning devices.
			Flow volume adjustment fault for cooling water, brine, etc.	If valve is manually adjusted, readjust it. If an automatic control valve (including wax valve) is used, examine its cause and take measures.
			Other insufficient circulation volume problems of cooling water, etc.	Inspect for clogging and contamination of circulation route filters, and take measures. Inspect for leak in circulation routes, and take measures. Inspect water supply routes and construction, and take measures. If frozen, improve by insulation or heating.
			Poor performance in heat exchanger	If the trouble is caused by change in operating conditions, re-examine the conditions to improve. If the trouble is caused by change in installation environment, improve the environment if possible. For both cases, if it is difficult to improve, add more heat exchangers or increase their sizes.
		Uncondensed gas in the system	Leak on low pressure side * Cases of erosion of compressor's suction thermometer protection pipe have also been confirmed.	Inspect for leak, and take necessary measures. Then, air purge the heat exchanger.

	Trouble	Direct causes	Factors	Actions
05	Abnormally high pressure (abnormal discharge pressure)	Excessive refrigerant charge	In some cases, without enough investigation of other causes for insufficient cooling, insufficient refrig-erant amount was considered to be the cause, and refrigerant was charged repeatedly.	Adjust refrigerant to proper amount.
			Insufficient capacity of heat exchanger	If the trouble is caused by change in operating conditions, re-examine the conditions to improve. If it is difficult to improve, add more heat exchangers or increase their sizes.
		Defect in discharge pressure detection feature	Malfunction in abnormal high pressure protection device, pressure sensor, relays, etc.	Identify malfunctioning devices, examine their causes, and take measures. Then, replace malfunctioning devices.
			Liquid stoppage, etc., by clogging in connecting pipes	Remove clogging. Check oil contamination level and replace oil as necessary.
		Closed outlet stop valve for oil separator	Neglected to restore after closing. Human error	Open valve or stop immediately. Make sure to perform tagout during valve operation. Make sure to perform a valve check before starting compressor.
06	Abnormally high discharge temperature	Overheating during operation	Insufficient refriger-ant circulation	Refer to Factors of item 02.
			Heat load on load side is higher than design value.	Inspect the situation on load side (loading volume, opening and closing of doors, etc.), and take necessary measures.
			Malfunction in low pressure protection device, pressure sensor, relays, etc.	Identify malfunctioning devices, examine their causes, and take measures. Then, replace malfunctioning devices.
		Non-condensable gases in the system	Leak on low pressure side	Inspect for leak, and take necessary measures. Then, air purge the heat exchanger.

	Trouble	Direct causes	Factors	Actions
06	Abnormally high discharge temperature	High supply oil temperature	Heat exchange fault in oil cooler	For water-cooling types, refer to “Heat exchange failure at condenser (heat exchanger)” in item 05. For liquid cooling type, inspect liquid supply expansion valve, temperature sensor, related relays, wiring, terminals, etc., and take measures.
			Failure in oil temperature increase protection feature	Inspect temperature protection device, temperature sensor, related relays, wiring, terminals, etc., and take measures.
		Defect in discharge temperature detection and protection features	Malfunction in temperature protec-tion device, temperature sensor, relays, etc.	Identify malfunctioning devices, examine their causes, and take measures. Then, replace malfunctioning devices.
		Insufficient supply oil	Refer to item 04, “Low hydraulic pressure (low oil-supply pres-sure)”.	Same as on the left
07	Leak from mechanical seal	Initial leak after replacement until sliding surfaces fit together	This happens because of the specific operating conditions of the compressor and unsteadiness in bearing pressure condition of processed sliding surfaces following replacement.	For initial leak, amount of leak might increase temporarily. However, it will gradually decrease, so check that the amount of leak does not increase continuously. Period of initial leak might differ according to design and operating conditions. 200 hours can be a rough guide.
		Damaged sliding surfaces due to excessive heat of sliding surfaces	Most cases are due to excessive repetition of startup/stoppage. * For a standard device, more than 4 times per hour is considered too many.	If heat load is below the device’s design conditions, re-examine operating conditions. Set the control settings to fewer startup/stoppage times.
				For capacity control malfunctions, see item 10, “Capacity control malfunction”.
			A lot of refrigerant mixed into the lubricant, resulting in decreased viscosity.	For liquid backflow operation, remove the causes. For malfunction of oil heater and other devices on control circuit, replace them.
			Overheat operation	Refer to Factor “Insufficient refrigerant circulation volume” in item 02.
			High supply oil temperature	Refer to the Direct cause “High supply oil temperature” in item 06.

	Trouble	Direct causes	Factors	Actions
07	Leak from mechanical seal	Long stoppage period (no oil film on sliding surfaces)	Due to user's specific conditions, such as heat load being intermittent.	If stoppage period becomes more than one week, manually operate oil pump as well as turn rotor axis of compressor, or equip external seal portion with oil pot.
		Deteriorated parts	Hardened O-ring	For aging degradation, replace O-ring. For other unique causes, the same factors and actions described in "Damaged sliding surfaces due to excessive heat of sliding surfaces" can be applied.
			Swelled O-ring * Occurs in excessive refrigerant dissolution oil	For liquid backflow operation, remove the causes. For malfunction of oil heater and other devices on control circuit, replace them.
			Deteriorated seal ring or mating ring	For aging degradation, replace parts. For other unique causes, the same factors and actions described in "Damaged sliding surfaces due to excessive heat of sliding surfaces" can be applied.
		Incompatibility between operating conditions (working temperature ranges, refrigerant, etc.) and lubricant	Inappropriate lubricant or change in operating conditions since installation of device	Re-examine operating conditions if possible. If not, refer to Chapter 4.1, "Lubricant (Refrigerant Oil)", and select lubricant again and replace all amount of current lubricant with new type.
		Bad contact condition of sliding surfaces	Foreign matter attached to sliding surfaces due to contamination of lubricant	Exchange all lubricant. Equip oil supply line with bypass filter.
			Faulty parts attachment Human error	Overhaul compressor to replace parts, and reassemble it. Check using assembly check sheet.
08	Squeaking sound from mechanical seal part	During initial period after replacement until sliding surfaces fit together, squeaking sound caused by contact of sliding surfaces might be heard.	Sliding surfaces are high in hardness as well as in density, so it takes a while for them to fit together.	Squeaking itself does not cause leak from or functional deterioration of seal. Squeaking normally subsides after few dozens of hours, but it could continue in rare cases. →In this case, contact our service centers.

	Trouble	Direct causes	Factors	Actions
09	Faulty indication of capacity control position	Imprecision in compressor indicator	Loose screws for indicator	Manually tighten screws to the 0% indication position of compressor capacity control.
		Imprecision in controller capacity control indicator	Worn groove of compressor indicator cam	Most cases are due to prolonged partial load operation. In this case, replace indicator cam. * Indicator cam that is currently manufactured has reinforced groove.
			Worn guide pin (dowel pin) of compressor push rod	Guide pin of compressor push rod is currently reinforced as well. However, if only indicator cam has reinforced groove, wear of guide pin might occur. Replace push rod.
			Malfunction in potentiometer	If cased by aging degradation or prolonged partial load operation, replace potentiometer. If cased by excessive vibration of compressor, take vibration reduction measures, and then replace parts.
			Maladjustment of zero and span adjustment for E/E positioner	Readjust it.
			Malfunction of E/E positioner or its indicator	For aging degradation, replace E/E positioner. For unique causes such as surge current, remove the causes or take measures.
			Loose terminals or faulty wiring	For loose terminals, tighten them. For faulty wiring, replace it.
10	Capacity control malfunction	Refer to each factor in “Imprecision in controller capacity control indicator” above.	Same as on the left	Same as on the left
		Undetected 100% or 0% by indicator	Malfunction of micro-switch	Replace micro-switch.
		Malfunction of solenoid (modular) valves or related relays, etc. for capacity control	Most cases are due to coil burnout.	For aging degradation, replace parts. For water leakage, etc., remove the cause and replace parts. Refer to the solenoid valve instruction manual for details.
		Internal leakage of solenoid (modular) valves for capacity control	Liquid trapped, etc. inside unloader cylinder due to temperature increases	If caused by prolonged low load operation, improve by re-examining the operation method. Install a capacity control hydraulic line with an in-line check valve (internal reversal-stoppage valve) and an oil bypass line.

	Trouble	Direct causes	Factors	Actions
10	Capacity control malfunction	Capacity control hydraulic line defect	Maladjustment of oil controller valve	Readjust it.
			Leak and clogging in solenoid valve gland and oil pipes	Remove factors. Check oil contamination level and replace oil as necessary.
		Unloader piston not moving (This is one factor of a defect of the capacity control hydraulic line, but described separately.)	Damaged cap seal for unloader piston	Check oil contamination level and replace oil as necessary. Replace O-ring, cap seal, etc.
			Pinched cap seal	Replace O-ring, cap seal, etc.
			Worn cap seal	Check oil contamination level and replace oil as necessary. Replace O-ring, cap seal, etc.
			Refrigerant gas retention in unloader cylinder	Stop compressor. Operate oil pump and repeat loading and unloading to purge refrigerant gas from cylinder. For liquid backflow operation, remove the causes. For malfunction of oil heater and other devices on control circuit, replace them.
11	Abnormal vibration and/or noise of compressor	Insufficient axis adjustment with motor side	If vibration value is higher in the axial direction, this might be the cause.	Readjust the shaft-center. If abnormal vibration and noise frequently occur in monocock unit, hot alignment (perform rated operation of compressor once to increase its temperature and readjust before the temperature decreases) is recommended.
		Large runout in Male rotor axis	Uneven tightening for thrust bearing glands	If loose locknuts exist and no other fault is found in parts such as thrust bearing, tighten locknuts evenly.
			Loose thrust bearing	Forgetting to bend lock washer claw or wear of thrust bearing rolling element (ball) can be considered. →Check for any defects in thrust bearings. If there are any defects, replace it. Then perform end clearance adjustment as well as axis contact check, and reassemble it.
			Imprecision in dynamic balance of rotors	Inspection only at site is impossible. However, if no other causes for abnormal vibration are found, and if on-site overhaul has been repeatedly performed, this might be the factor. Overhaul compressor at an institution such at MAYEKAWA Moriya Factory with dynamic balance measurement/ adjustment equipment.

	Trouble	Direct causes	Factors	Actions
11	Abnormal vibration and/or noise of compressor	Oil hammer	Continuous low load operation at below 30% of capacity control	During low load operation, lubricant is poorly discharged. Because of this, the amount of oil that remains inside rotor mesh increases and oil becomes condensed. →Avoid continuous low load operation. * Especially for light gas liquids (such for He and NH_3),10 minutes low load operation has a negative effect. For liquid types such as fluorocarbons, operations of more than 30 minutes are not recommended.
		Liquid backflow during startup * Initial abnormal noises are conspicuous. →If this phenomenon happens, in many cases, compressor (stack and thrust bearing for rotor and casing) gets instantly damaged. This phenomenon may also have an impact on continued operation.	When compressor is stopped, refrigerant is liquefied and remains in upstream piping.	This is due to various factors such as a leak inside the liquid supply solenoid valve on load side, insufficient heat exchange (refrigerant evaporation) in heat exchanger, or trapping caused by wrong piping in piping route. →Identify the causes (more than one may exist), and take measures. Then, perform an overhaul of the compressor.
		Liquid backflow during operation * Frosting on suction side is conspicuous. * In many cases, the phenomenon is often “mist-back” (suction of moist steam) rather than liquid backflow. * To prevent this phenomenon, gas-liquid separator (accumulator) can be installed.	Opening for liquid supply expansion valve is too large.	For temperature type expansion valve, inspect temperature sensitive cylinder and capillary tube. Take measures if any defects are found. For incompatible orifice due to the change in operating conditions, replace orifice.
				For electronic expansion valve, inspect devices on expansion valve opening control devices (circuit) such as temperature sensor, converter, controller (over-heating regulator). If any defects are found, replace the faulty devices. As with temperature type expansion valve, for incompatible orifice due to the change in operating conditions, replace orifice.

	Trouble	Direct causes	Factors	Actions
11	Abnormal vibration and/or noise of compressor	* Refer to Factor “Insufficient refrigerant circulation volume” in item 02 as well.	Rapid change from unloaded operation to full load operation	Set control parameters so that rapid change will not occur. Or, re-adjust opening of oil controller valve on capacity control increase side towards the decrease side.
			Expansion valve opening control cannot keep up with rapid changes in heat load on load side.	Avoid rapid changes in heat load that exceed set response ranges of the heat exchanger (evaporator) on load side and expansion valve. For details, refer to the instruction manual related to devices/control on load side.
			Heat exchange failure (insufficient exchange) of heat exchanger on load side: defrost-related	For frosting (icing), defrost manually. Reduce defrost interval setting. For malfunction of devices specific to defrosting methods, remove the cause and replace them. For blocked piping routing specific to defrosting methods, remove the cause and take measures. Especially for hot gas defrost type, fully understand the unit operation manual related to devices/control on load side.
		Liquid backflow during operation	Heat exchange failure (insufficient exchange) of heat exchanger on load side: load side conditions	Improve the environment if heat exchanger is excessively loaded and impacts ventilation. * Make sure that the flow of heating medium for heat exchanger on load side is stable.
			Heat exchange failure (insufficient exchange) of heat exchanger on load side: heat exchanger conditions	Inspect for blockade around heat transmission tube and malfunctioning fans. If any, take measures.
		Foreign substances contaminating compressor	Contamination of welding spatter, etc., from upstream side	Inspect suction strainer and oil filter. If any problems to element, replace it. Overhaul compressor. Collect foreign substances and objects. Identify the source and take measures.
			Neglect of collecting tools and rags during overhaul	

	Trouble	Direct causes	Factors	Actions
11	Abnormal vibration and/or noise of compressor	Damage to thrust bearing	Aging degradation (exceeded appropriate time for replacement)	Appropriate time for replacement will differ due to operating conditions (if low pressure or intermediate pressure is high, life of thrust bearing becomes shorter) and oil management conditions. However, if used under standard refrigerating usage based on steady continuous operation, inspect and replace it after 40000 hours or within 5 years. For details, refer to chapter 5.2.3 in this manual.
			Liquid backflow operation	Refer to the Direct causes “Liquid backflow during startup” and “Liquid backflow during operation” above in this item.
			Contamination of foreign substances	Refer to the Direct cause “Foreign substances contaminating compressor” above.
			Excessive thrust stress other than above • High suction pressure exceeding op-erating conditions	Re-examine operating conditions and improve them if possible. If it is difficult to improve, re-examine maintenance interval management.
			Faulty assembly * Lock nuts tightened insufficiently, lock washer tab not bended, rotation stopper not set to thrust bearing gland, gland not assembled, etc.	Tighten lock nuts by using specified torque. Be sure to record data on the assembly check sheet to prevent omission of work steps.
		Sympathetic vibration	This phenomenon occurs when vibra-tion approaches the natural frequency of the whole vibration system for the machinery, including piping and support.	In many cases, this occurs due to change in installation environment such as change in piping circuit or additional installation of devices in the machine room, and changes in oil levels. →If sympathetic vibration is suspected, contact our sales offices or service centers.

7 Related Documents

7.1 Development View and Configuration Table of the Parts

■ **Development View and Configuration Table (170J)**

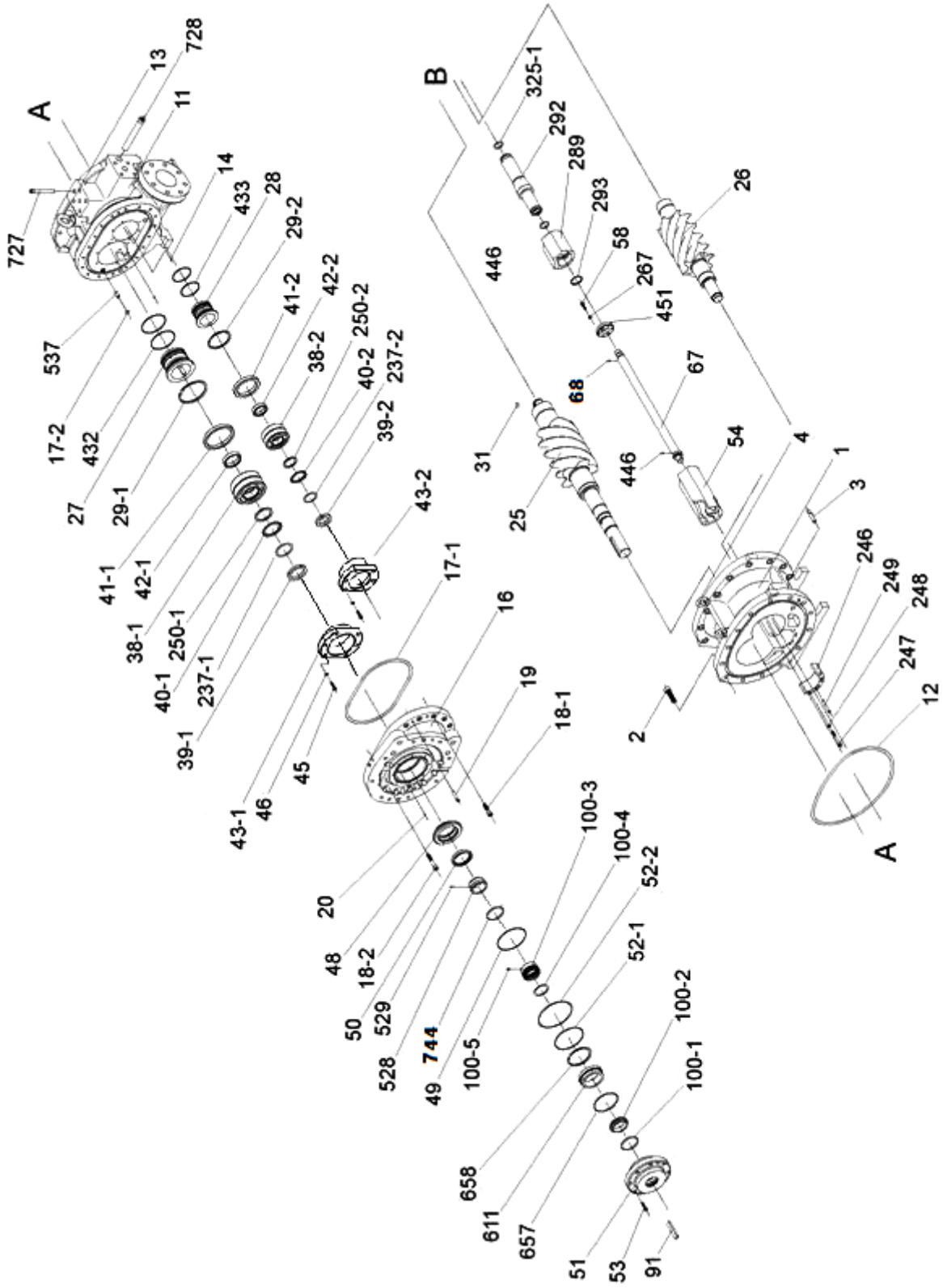


Figure 7-1 Development View of 170J (1/2)

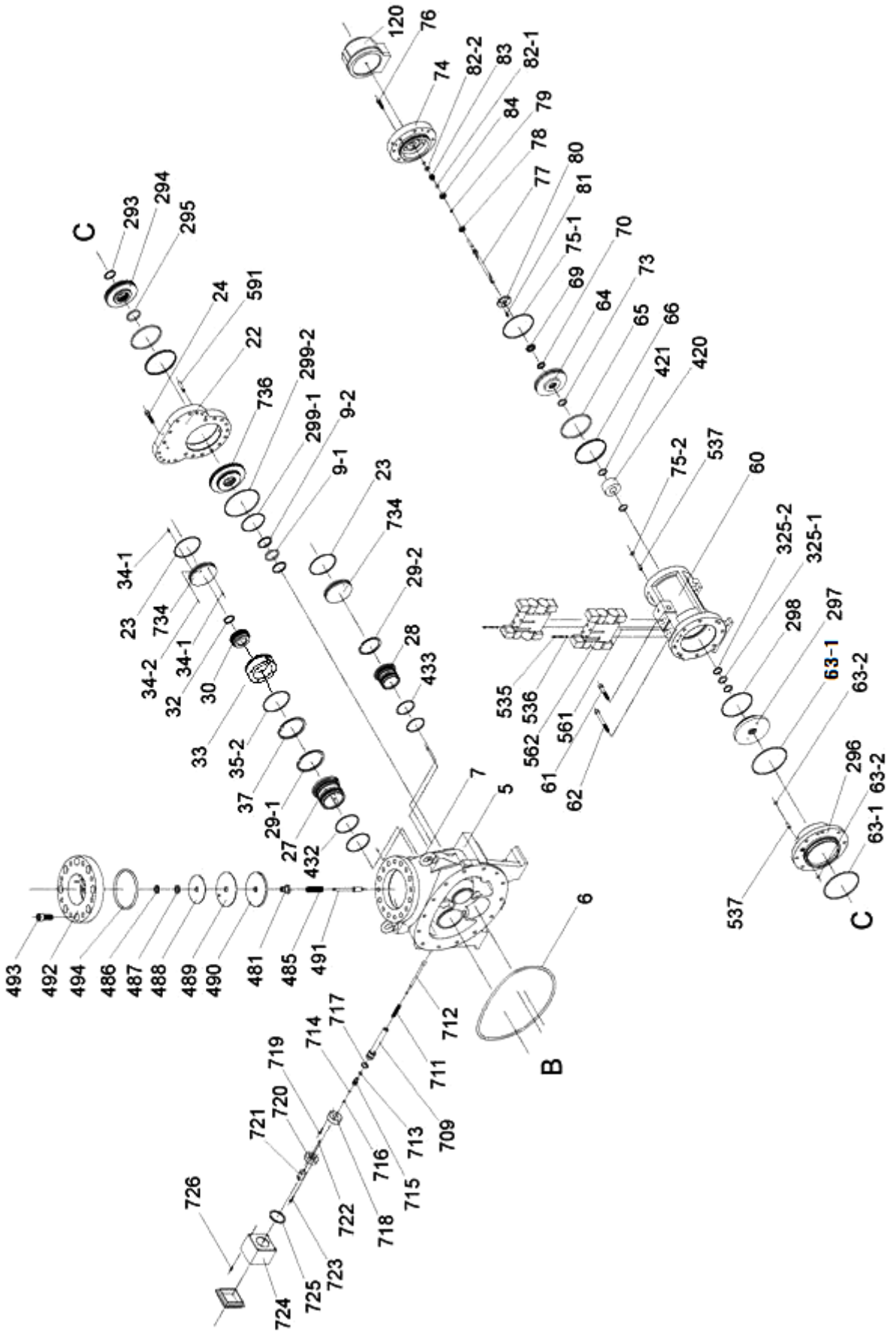


Figure 7-2 Development View of 170J (2/2)

Table 7-1 Configuration table of the parts of 170J

Part No.	Part name	170J Type, etc.	Part code No.		Quantity/unit		
			Standard	Explosion proof for Propane	S	M	L
1	Main rotor casing S				1	—	—
	Main rotor casing M				—	1	—
	Main rotor casing L				—	—	1
2	Hexagon socket head cap screw	M16×60	NB35416-060		28		
3	Parallel pin	13 dia.x65 with female thread	NE2313-065A		4		
4	Eyebolt	M12	NB600-12		2		
5	Suction cover				1		
6	O-ring	JIS B 2401 P375	PAH80-375	PC11-375	1		
7	Eyebolt	M20	NB600-20		2		
9-1	O-ring	JIS B 2401 P52	PAH80-052	PC11-052	1		
9-2	Back-up ring for O-ring	SUN-2BP 52	CS66400-J170		2		
10-A	Plug	R3/8	NF06-010		1		
10-B	Plug	R1/2	NF06-015		1		
10-C	Plug	R1/2	NF06-015		1		
10-D	Plug	R3/8	NF06-010		1		
10-E	Plug	R3/8	NF06-010		1		
11	Bearing head				1		
12	O-ring	JIS B 2401 P375	PAH80-375	PC11-375	1		
13	Eyebolt	M20	NB600-20		1		
14	Spring pin	4 dia.×10	NE3204-010		4		
15-A	Plug	R1/4	NF06-008		1		
15-B	Plug	R3/8	NF06-010		1		
15-C	Plug	R3/8	NF06-010		1		
16	Bearing cover				1		
17-1	O-ring	JIS B 2401 P300	PAH80-300	PC11-300	1		
17-2	O-ring	JIS B 2401 P14	PAH80-014	PC11-014	1		
18-1	Hexagon socket head cap screw	M12×50	NB35412-050		5		
18-2	Hexagon socket head cap screw	M12×70	NB35412-070		13		
19	Parallel pin	10 dia.×55 with female thread	NE2310-055A		2		
20	Spring pin	3 dia.×8	NE3203-008		1		
21	Plug	R1/4	NF06-008		1		
22	Balance piston cover				1		
23	O-ring	JIS B 2401 G115	PAH81-115	PC11-115	2		
24	Hexagon socket head cap screw	M12×50	NB35412-050		13		
25	Male rotor S				1	—	—
	Male rotor M				—	1	—
	Male rotor L				—	—	1
26	Female rotor S				1	—	—
	Female rotor M				—	1	—
	Female rotor L				—	—	1
27	Bearing, male rotor	Sleeve bearing	CS02700-J170M		2		
28	Bearing, female rotor	Sleeve bearing	CS02700-J170F		2		
29-1	Retaining ring C type internal	JIS B 2804 (H120)	NG11-120		2		
29-2	Retaining ring C type internal	JIS B 2804 (H95)	NG11-095		2		
30	Balance piston		CS03000-J170		1		
31	Key for balance piston				1		
32	Retaining ring C type external	JIS B 2804 (S40)	NG12-040		1		
33	Sleeve, balance piston		CS03300-J170		1		
34-1	Spring pin	6 dia.×12	NE3206-012		2		
35-2	O-ring	JIS B 2401 G115	PAH81-115	PC12-115	1		
37	Retaining ring C type internal	JIS B 2804 (H120)	NG11-120		1		
38-1	Thrust bearing assembly, male rotor	7312BEAXT7DF	CS03800-J170M		1		
38-2	Thrust bearing assembly, female rotor	7309BEAXT7DF	CS03800-J170F		1		
39-1	Locknut	AN12	NG31-012		1		

Part No.	Part name	170J Type, etc.	Part code No.		Quantity/unit		
			Standard	Explosion proof for Propane	S	M	L
39-2	Locknut	AN09	NG31-009		1		
40-1	Lock washer	AW12	NG32-012		1		
40-2	Lock washer	AW09	NG32-009		1		
41-1	Thrust bearing outer race spacer, male rotor		CS04100-J170M		1		
41-2	Thrust bearing outer race spacer, female rotor		CS04100-J170F		1		
42-1	Thrust bearing alignment spacer, male rotor		CS04200-J170M		1		
42-2	Thrust bearing alignment spacer, female rotor		CS04200-J170F		1		
43-1	Thrust bearing gland, male rotor		CS04300-J170M		1		
43-2	Thrust bearing gland, female rotor		CS04300-J170F		1		
45	Hexagon socket head cap screw	M8×30	NB35408-030		12		
46	Conical spring washer	Hexagon head screw M8	ND330-08		12		
48	Retainer for oil seal		CS04800-J170		1		
49	O-ring	JIS B 2401 G120	PAH81-120	PC12-120	1		
50	Oil seal	SA1J 65 85 12	CS05010-200VD		1		
51	Seal cover				1		
52-1	O-ring	JIS B 2401 G120	PAH81-120	PC12-120	1		
52-2	O-ring	JIS B 2401 G145	PAH81-145	PC12-145	1		
53	Hexagon socket head cap screw	M8×30	NB35408-030		8		
54	Unloader slide valve S				1	—	—
	Unloader slide valve M				—	1	—
	Unloader slide valve L				—	—	1
58	Hexagon socket head cap screw	M8×30	NB35408-030		6		
60	Unloader cylinder				1		
61	Hexagon socket head cap screw	M12×70	NB35412-070		2		
62	Hexagon socket head cap screw	M12×110	NB35412-110		6		
63-1	O-ring	AS568A-258	PAH82-258	PC62-036	2		
63-2	O-ring	JIS B2401 P14	PAH80-014	PC11-014	2		
64	Unloader piston		CS06400-J170		1		
65	O-ring	JIS B2401 P130	PAH80-130	PC11-130	2		
66	Teflon cap seal	SUNR-BE-130	CS06600-J170		2		
67	Push rod, unloader slide valve		CS06700-J170		1		
68	Guide pin	PH01NG 3×8 BK	CS06809-03		1		
69	Locknut	FU nut FU05SS	NG42-05		1		
70	Plain washer	Small, product grade A, 24×39			1		
73	O-ring	JIS B2401 P32	PAH80-032	PC11-032	1		
74	Unloader cover				1		
75-1	O-ring	JIS B2401 G135	PAH81-135	PC12-135	1		
75-2	O-ring	JIS B2401 P14	PAH80-014	PC11-014	1		
76	Hexagon socket head cap screw	M10×40	NB35410-040		8		
77	Unloader indicator cam S		CS07700-J170S		1	—	—
	Unloader indicator cam M		CS07700-J170M		—	1	—
	Unloader indicator cam L		CS07700-J170L		—	—	1
78	Ball bearing	#6000	CS07800-200		1		
79	Retaining ring C type external	JISB2804 (S10)	NG12-010		1		
80	Bearing gland		CS08000-200		1		
81	Hexagon socket head cap screw	M6×15	NB35406-015		3		
82-1	O-ring	JIS B2401 P10A	PAH80-010A	PC11-010A	2		
82-2	O-ring	JIS B2401 P16	PAH80-016	PC11-016	1		
83	Retainer, O-ring		CS08300-170J		1		
84	Spacer, unloader cover		CS08400-J170		1		
91	Shaft key		CS09100-J170		1		
100	Mechanical seal assembly (including 100-1 to 100-5)		CS10002-J170		1		
100-1	O-ring	AS568A-334	PAH82-334	PC61-037	1		

Part No.	Part name	170J Type, etc.	Part code No.		Quantity/unit		
			Standard	Explosion proof for Propane	S	M	L
100-2	Mating ring				1		
100-3	Rotating ring				1		
100-4	O-ring	AS568A-227	PAH82-227	PC61-005	1		
100-5	Hexagon socket set screw	M8×9			1		
120	Assembly, unloader indicator				1		
137	Dial plate, unloader indicator		CS13700-J170		1		
234	Name plate				1		
237-1	Torsional slip washer M		CS23700-160		1		
237-2	Torsional slip washer F		CS23700-125		1		
246	Guide, unloader slide valve				1		
247	Hexagon socket head cap screw	M8×70	NB35408-070		4		
248	Spring lock washer	Hexagon socket head cap screw M8	ND330-08		4		
249	Parallel pin	8 dia.×60	NE2008-060		2		
250-1	Thrust washer, male rotor		CS25000-160		1		
250-2	Thrust washer, female rotor		CS25000-125		1		
267	Spring lock washer	Hexagon socket head cap screw M8	ND330-08		6		
289	Slide valve S, Vi				1	—	—
	Slide valve M, Vi				—	1	—
	Slide valve L, Vi				—	—	1
292	Push rod S, Vi				1	—	—
	Push rod M, Vi				—	1	—
	Push rod L, Vi				—	—	1
293	Spiral retaining ring	FRSN-45	NGFR-45		2		
294	Piston, Vi		CS29400-J170		1		
295	O-ring	JIS B2401 P52	PAH80-052	PC11-052	1		
296	Cylinder, Vi				1		
297	Partition plate, unloader cylinder		CS29700-J170		1		
298	O-ring	JIS B2401 G135	PAH81-135	PC12-135	1		
299-1	O-ring	JIS B2401 G100	PAH81-100	PC12-100	1		
299-2	O-ring	AS568A-258	PAH82-258	PC62-036	1		
325-1	O-ring	JIS B2401 P32	PAH80-032	PC11-032	3		
325-2	Back-up ring for O-ring	SUN-2BP 32	PBP21-032		2		
396-1	Liner M for thrust adjustment	160*** (Service part)					
396-2	Liner F for thrust adjustment	125*** (Service part)					
420	Unloader spacer S		CS42000-J170S		1	—	—
	Unloader spacer M		CS42000-J170M		—	1	—
421	O-ring	JIS B2401 P32	PAH80-032	PC11-032	2		—
432	O-ring	JIS B2401 G100	PAH81-100	PC12-100	4		
433	O-ring	JIS B2401 G75	PAH81-075	PC12-075	4		
446	Grooved pin	PY01ND 5×10 BK			1		
451	Push rod gland for unloader slide valve		CS45100-J170		1		
458-1	Plug	R1/2	NF06-015		1		
458-2	Plug	R1/4	NF06-008		4		
459	Plug	R3/8	NF06-010		1		
481	Check valve slider		CS48100-J170		1		
485	Spring, check valve	O.D 23, wire diameter 1.8 Free length 95	CS48500-J170		1		
486	Locknut	FU nut FU04SS	NG42-04		1		
487	Plain washer	JIS B 1256, small dia. M20			1		
488	Sheet stopper		CS48800-J170		1		
489	Valve sheet		CS48900-J170		1		
490	Valve disc		CS49000-J170		1		
491	Check valve stem		CS49100-J170		1		
492	Suction adapter				1		
493	Hexagon socket head cap screw	M20×50	NB35420-050		8		

Part No.	Part name	170J Type, etc.	Part code No.		Quantity/unit		
			Standard	Explosion proof for Propane	S	M	L
494	O-ring	JIS B2401 P155	PAH80-155	PC11-155	1		
528	Sleeve, oil seal				1		
529	Hexagon socket set screw	M6×8	NA83606-008		2		
535	Hexagon socket head cap screw	M5×75	NB35405-075		8		
536	Spring lock washer	Hexagon socket head cap screw M5	ND330-05		8		
537	Bush, P14 type O-ring		CS53700-J170		3		
561	O-ring	JISB2401 P12	PAH80-012	PC11-012	8		
562	Capacity control / variable Vi solenoid valve	SBL5B-4BL (UL,CSA)	KK425-1/-2/-3	—	2		
		SXL6-4BL (CE)		—			
	Dummy block, solenoid valve	with bushing	—				
591	Parallel pin	10 dia.×55 with female thread	NE2310-055A		2		
605-A	Plug	R1/2	NF06-015		1		
605-B	Plug	R1/2	NF06-015		1		
607-A	Plug	R1/8	NF06-004		1		
607-B	Plug	R1/8	NF06-004		1		
611	Sleeve, shower flashing		CS61100-J170		1		
657	O-ring	JIS B2401 G100	PAH81-100	PC12-100	1		
658	Retaining ring C type internal	JIS B2804 (H100)	NG11-100		1		
709	Vi position sensor rod housing		CS70900-J170		1		
711	Spring	O.D 13, wire diameter 1.6 Free length 100	CS71100-J170		1		
712	Vi position sensor rod		CS71200-J170		1		
713	O-ring	JIS B2401 P12	PAH80-012	PC11-012	1		
714	O-ring	JIS B2401 P6	PAH80-006	PC11-006	1		
715	Plug, Vi position sensor rod		CS71500-J170		1		
716	Retaining ring E type	JIS B2804 E snap ring 4	NG13-004		1		
717	O-ring	JIS B2401 G25	PAH81-025	PC12-025	1		
718	Gland, Vi position sensor rod housing		CS71800-J170		1		
719	Hexagon socket head cap screw	M6×25	NB35406-025		4		
720	Vi position sensor support		CS72000-J170		1		
721	Potentiometer	Midori Precisions LP-10FB	CS12907-J1701	-	1		
722	Hexagon socket head cap screw	M3×10	NB35403-010	-	2		
723	Hexagon socket head cap screw	M6×25	NB35406-025	-	2		
724	Vi position sensor box			-	1		
725	Packing, Sensor box			-	1		
726	Hexagon socket head cap screw	M5×15	NB35405-015		4		
794	Vi position sensor assembly		CS72100-J170		1		
728	E plug		CS72800-J170		1		
731-A	Plug	R1/8	NF06-004		1		
731-B	Plug	R1/8	NF06-004		1		
732-A	Plug	R1/8	NF06-004		1		
732-B	Plug	R1/8	NF06-004		1		
732-C	Plug	R1/8	NF06-004		1		
732-D	Plug	R1/8	NF06-004		1		
733-A	Plug	R1/8	NF06-004		1		
733-B	Plug	R1/8	NF06-004		1		
734	Inner cover, balance piston cover		CS73400-J170		2		
736	Partition plate, suction cover		CS73600-J170		1		
744	O-ring	JIS B2401 G55	PAH81-055	PC12-055	1		
745	Rivet	3 dia.×6			4		
235-1	Motor spacer	For NEMA 44*D	CS23502-J170NEMA44		1		
	Motor spacer	For NEMA 50*D	CS23502-J170NEMA50				

Part No.	Part name	170J Type, etc.	Part code No.		Quantity/unit		
			Standard	Explosion proof for Propane	S	M	L
	Motor spacer	For IEC FF-500	CS23502-J170IEC50				
	Motor spacer	For IEC FF-600	CS23502-J170IEC60				
235-2	Plate, motor spacer		CS23510-J170		2		
235-3	Hexagon socket head cap screw	M6×15	NB35406-015		8		
739	Hexagon socket head cap screw	M16×60	NB35416-060		8		
740	Parallel pin	13 dia.×65 with female thread	NE2313-065A		2		

CAUTION

- **As for the part code of the O-ring, the material of the standard specification is HNBR and the material of the explosion-proof for propane specification is FKM.**
  For O-rings material other than HNBR or FKM, the part code No. are differ depending on the material.
  For customers using O-rings other than the standard material, contact MYCOM before purchasing the O-ring.

■ Development View and Configuration Table (220J)

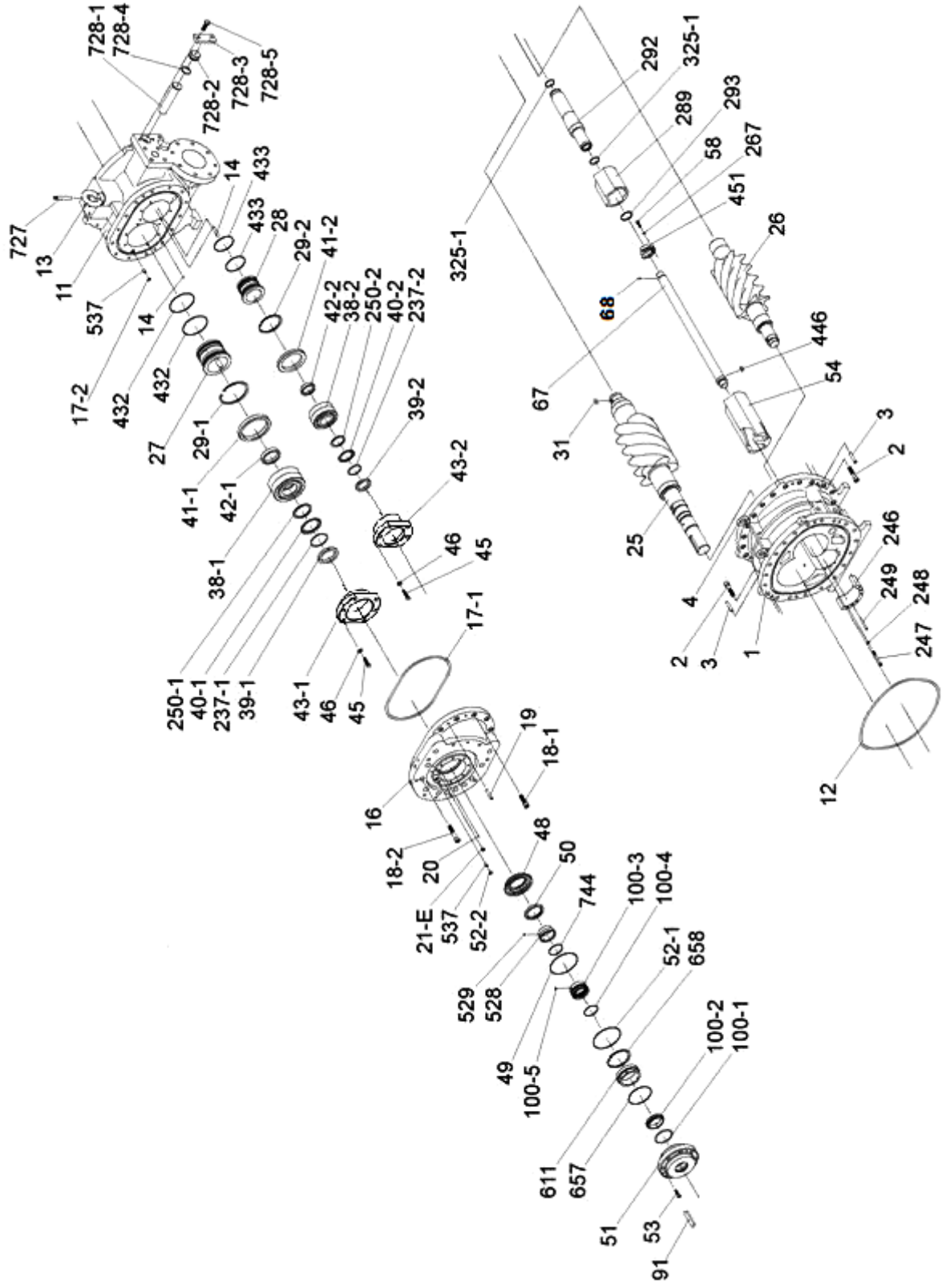


Figure7-3 Development View of 220J (1/2)

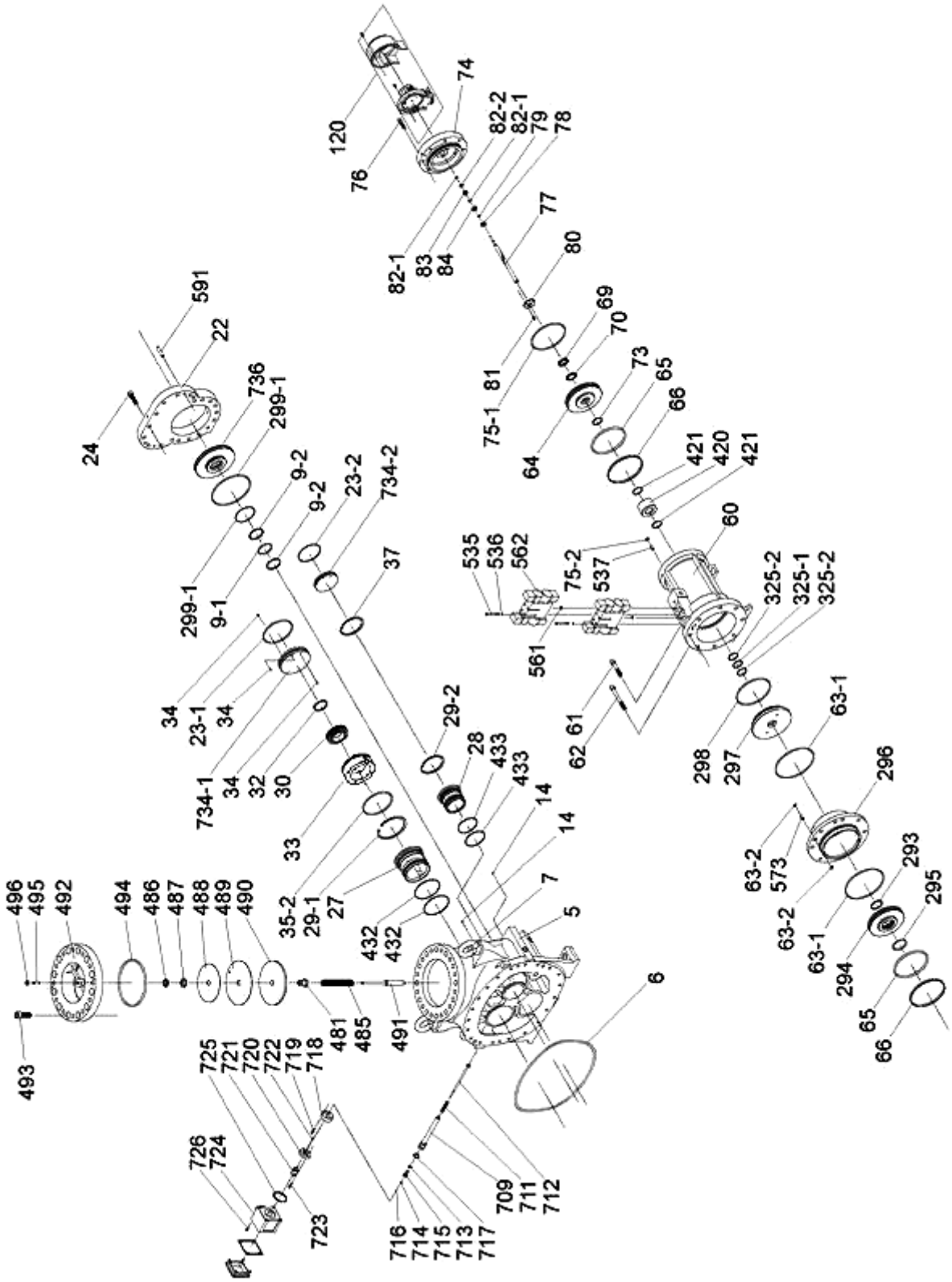


Figure7-4Development View of 220J (2/2)

Table 7-2 Configuration table of the parts of 220J

Part No.	Part name	220J Type, etc.	Part code No.		Quantity/unit		
			Standard	Explosion proof for Propane	S	M	L
1	Main rotor casing S				1	—	—
	Main rotor casing M				—	1	—
	Main rotor casing L				—	—	1
2	Hexagon socket head cap screw	M16×75	NB35416-075		40		
3	Parallel pin	13 dia.x65 with female thread	NE2313-065A		4		
4	Eyebolt	M16	NB600-16		2		
5	Suction cover				1		
6	O-ring	JIS B 2401 P450	PAH80-450	PC11-450	1		
7	Eyebolt	M30	NB600-30		2		
9-1	O-ring	JIS B 2401 P65	PAH80-065	PC11-065	1		
9-2	Back-up ring for O-ring	SUN-2BP 65	PBP21-065		2		
10-A	Plug	R3/8	NF06-010		1		
10-B	Plug	R3/4	NF06-020		1		
10-C	Plug	R1/2	NF06-015		1		
10-D	Plug	R1/2	NF06-015		1		
10-E	Plug	R1/2	NF06-015		1		
11	Bearing head				1		
12	O-ring	JIS B 2401 P450	PAH80-450	PC11-450	1		
13	Eyebolt	M30	NB600-30		1		
14	Spring pin	4 dia.×10	NE3204-010		4		
15-A	Plug	R3/8	NF06-010		1		
15-B	Plug	R3/4	NF06-020		1		
15-C	Plug	R3/8	NF06-010		1		
15-D	Plug	R3/8	NF06-010		1		
16	Bearing cover				1		
17-1	O-ring	JIS B 2401 P375	PAH80-375	PC11-375	1		
17-2	O-ring	JIS B 2401 P14	PAH80-014	PC11-014	1		
18-1	Hexagon socket head cap screw	M16×60	NB35416-060		5		
18-2	Hexagon socket head cap screw	M16×90	NB35416-090		9		
19	Parallel pin	13 dia.×65 with female thread	NE2313-065A		2		
20	Spring pin	3 dia.×10	NE3203-010		1		
21-A	Plug	R1/8	NF06-004		1		
21-B	Plug	R1/8	NF06-004		1		
21-C	Plug	R1/8	NF06-004		1		
21-D	Plug	R3/8	NF06-010		1		
21-E	Plug	R3/8	NF06-010		1		
22	Balance piston cover				1		
23-1	O-ring	JIS B 2401 G150	PAH81-150		1		
23-2	O-ring	JIS B 2401 G115	PAH81-115		1		
24	Hexagon socket head cap screw	M16×60	NB35416-060		13		
25	Male rotor S				1	—	—
	Male rotor M				—	1	—
	Male rotor L				—	—	1
26	Female rotor S				1	—	—
	Female rotor M				—	1	—
	Female rotor L				—	—	1
27	Bearing, male rotor	Sleeve bearing	CS02700-J220M		2		
28	Bearing, female rotor	Sleeve bearing	CS02700-J170M		2		
29-1	Retaining ring C type internal	JIS B 2804 (H150)	NG11-150		2		
29-2	Retaining ring C type internal	JIS B 2804 (H120)	NG11-120		2		
30	Balance piston	200*UD	CS03000-J220		1		
31	Key for balance piston	200***	CS03100-200		1		
32	Retaining ring C type external	JIS B 2804 (S65)	NG12-065		1		
33	Sleeve, balance piston		CS03300-J220		1		
34	Spring pin	6 dia.×12	NE3206-012		2		
35-2	O-ring	JIS B 2401 G150	PAH81-150	PC12-150	1		

Part No.	Part name	220J Type, etc.	Part code No.		Quantity/unit		
			Standard	Explosion proof for Propane	S	M	L
37	Retaining ring C type internal	JIS B 2804 (H120)	NG11-120		1		
38-1	Thrust bearing assembly, male rotor	7316BEAXT7DF	CS03800-J220M		1		
38-2	Thrust bearing assembly, female rotor	7312BEAXT7DF	CS03800-J170M		1		
39-1	Locknut	AN16	NG31-016		1		
39-2	Locknut	AN12	NG31-012		1		
40-1	Lock washer	AW16	NG32-016		1		
40-2	Lock washer	AW12	NG32-012		1		
41-1	Thrust bearing outer race spacer, male rotor		CS04100-J220M		1		
41-2	Thrust bearing outer race spacer, female rotor		CS04100-J220F		1		
42-1	Thrust bearing alignment spacer, male rotor		CS04200-J220M		1		
42-2	Thrust bearing alignment spacer, female rotor	Spacer, alignment male rotor for 170J*	CS04200-J170M		1		
43-1	Thrust bearing gland, male rotor		CS04300-J220M		1		
43-2	Thrust bearing gland, female rotor		CS04300-J220F		1		
45	Hexagon head screw	M12×50	NB111012-050		12		
46	Conical spring washer	Hexagon head screw M12	ND320-012		12		
48	Retainer for oil seal		CS04800-J220		1		
49	O-ring	JIS B 2401 G145	PAH81-145	PC12-145	1		
50	Oil seal	SA1J 75 100 13	CS05010-250VD		1		
51	Seal cover				1		
52-1	O-ring	JIS B 2401 G145	PAH81-145	PC12-145	1		
52-2	O-ring	JIS B 2401 P14	PAH80-014	PC11-014	1		
53	Hexagon socket head cap screw	M10×35	NB35410-035		8		
54	Unloader slide valve S				1	—	—
	Unloader slide valve M				—	1	—
	Unloader slide valve L				—	—	1
58	Hexagon socket head cap screw	M8×35	NB35408-035		9		
60	Unloader cylinder				1		
61	Hexagon socket head cap screw	M16×90	NB35416-090		2		
62	Hexagon socket head cap screw	M16×140	NB35416-140		6		
63-1	O-ring	JIS B2401 G200	PAH81-200	PC12-200	2		
63-2	O-ring	JIS B2401 P14	PAH80-014	PC11-014	2		
64	Unloader piston		CS06400-J220		1		
65	O-ring	JIS B2401 P170	PAH80-170	PC11-170	2		
66	Teflon cap seal	SUNR-BE-170	CS06600-J220		2		
67	Push rod, unloader slide valve		CS06700-J220		1		
68	Guide pin	PH01NG 5×12 BK	NE2505-012		1		
69	Locknut	AN07	NG31-007		1		
70	Lock washer	AW07	NG32-007		1		
73	O-ring	JIS B2401 P44	PAH80-044	PC11-044	1		
74	Unloader cover				1		
75-1	O-ring	JIS B2401 G175	PAH81-175	PC12-175	1		
75-2	O-ring	JIS B2401 P14	PAH80-014	PC11-014	1		
76	Hexagon socket head cap screw	M12×50	NB35412-050		8		
77	Unloader indicator cam S		CS07700-J220S		1	—	—
	Unloader indicator cam M		CS07700-J220M		—	1	—
	Unloader indicator cam L		CS07700-J220L		—	—	1
78	Ball bearing	#6000	CS07800-200		1		
79	Retaining ring C type external	JISB2804 (S10)	NG12-010		1		
80	Bearing gland		CS08000-200		1		
81	Hexagon socket head cap screw	M6×15	NB35406-015		3		
82-1	O-ring	JIS B2401 P10A	PAH80-010A	PC11-010A	2		
82-2	O-ring	JIS B2401 P16	PAH80-016	PC11-016	1		
83	Retainer, O-ring		CS8300-170J		1		

Part No.	Part name	220J Type, etc.	Part code No.		Quantity/unit		
			Standard	Explosion proof for Propane	S	M	L
84	Spacer, unloader cover		CS08400-J170		1		
91	Shaft key		CS09100-J220		1		
100	Mechanical seal assembly (including 100-1 to 100-5)		CS10002-250EBS		1		
100-1	O-ring	AS568A-340	PAH82-340	PC62-043	1		
100-2	Mating ring				1		
100-3	Rotating ring				1		
100-4	O-ring	AS568A-148	PAH82-148	PC56-148	1		
100-5	Hexagon socket set screw	M8×9			1		
120	Assembly, unloader indicator				1		
137	Dial plate, unloader indicator		CS13700-J170		1		
234	Name plate				1		
237-1	Torsional slip washer M		CS23700-J220M		1		
237-2	Torsional slip washer F		CS23700-160		1		
246	Guide, unloader slide valve				1		
247	Hexagon socket head cap screw	M8×90	NB35408-090		4		
248	Spring lock washer	Hexagon socket head cap screw M8	ND330-08		4		
249	Parallel pin	8 dia.×80	NE2008-080		2		
250-1	Thrust washer, male rotor		CS25000-J220		1		
250-2	Thrust washer, female rotor		CS25000-160		1		
267	Spring lock washer	Hexagon socket head cap screw M8	ND330-08		9		
289	Slide valve S, Vi				1	—	—
	Slide valve M, Vi				—	1	—
	Slide valve L, Vi				—	—	1
292	Push rod S, Vi		CS29200-J220S		1	—	—
	Push rod M, Vi		CS29200-J220M		—	1	—
	Push rod L, Vi		CS29200-J220L		—	—	1
293	Spiral retaining ring	FRSN-56	NGFR-56		2		
294	Piston, Vi		CS29400-J220		1		
295	O-ring	JIS B2401 P65	PAH80-065	PC11-065	1		
296	Cylinder, Vi				1		
297	Partition plate, unloader cylinder		CS29700-J220		1		
298	O-ring	JIS B2401 G175	PAH81-175	PC12-175	1		
299-1	O-ring	JIS B2401 G100	PAH81-100	PC12-100	1		
299-2	O-ring	JIS B2401 G200	PAH81-200	PC12-200	1		
325-1	O-ring	JIS B2401 P44	PAH80-044	PC11-044	3		
325-2	Back-up ring for O-ring	SUN-2BP 44	PBP21-044		2		
396-1	Liner M for thrust adjustment	(Service part)					
396-2	Liner F for thrust adjustment	160*** (Service part)					
420	Unloader spacer S		CS42000-J220S		1	—	—
	Unloader spacer M		CS42000-J220M		—	1	—
421	O-ring	JIS B2401 P44	PAH80-044	PC11-044	2		—
432	O-ring	JIS B2401 G130	PAH81-130	PC12-130	4		
433	O-ring	JIS B2401 G100	PAH81-100	PC12-100	4		
446	Key, push rod for unloader slide valve	200*** Key for balance piston	CS03100-200		1		
451	Push rod gland for unloader slide valve		CS45100-J220		1		
458-1	Plug	R3/4	NF06-020		1		
458-2	Plug	R3/8	NF06-010		4		
459	Plug	R3/8	NF06-010		1		
481	Check valve slider		CS48100-J220		1		
485	Spring, check valve	O.D 32, wire diameter 2.6 Free length 250	CS48500-J220		1		
486	Locknut	FU nut FU05SS	NG42-05		1		
487	Plain washer	JIS B 1256, normal, product grade C, M24	ND110-24		1		
488	Sheet stopper		CS48800-J220		1		

Part No.	Part name	220J Type, etc.	Part code No.		Quantity/unit		
			Standard	Explosion proof for Propane	S	M	L
489	Valve sheet		CS48900-J220		1		
490	Valve disc		CS49000-J220		1		
491	Check valve stem		CS49100-J220		1		
492	Suction adapter				1		
493	Hexagon socket head cap screw	M22×60	NB35422-060		12		
494	O-ring	JIS B2401 P220	PAH80-220	PC11-220	1		
495	Check valve stem gland		CS49500-J220		1		
496	Plain washer	JIS B1256, normal M12			1		
497	Hexagon nut	M12	NC30-12		1		
528	Sleeve, oil seal	250***	CS52800-250VD		1		
529	Hexagon socket set screw	M6×8	NA83606-008		2		
535	Hexagon socket head cap screw	M5×75	NB35405-075		8		
536	Spring lock washer	Hexagon socket head cap screw M5	ND330-05		8		
537	Bush, P14 type O-ring		CS53700-J170		4		
561	O-ring	JISB2401 P12	PAH80-012	PC11-012	8		
562	Capacity control / variable Vi solenoid valve	SBL5B-4BL (UL,CSA)	KK425-1/2/3	—	2		
		SXL6-4BL (CE)		—			
	Dummy block, solenoid valve	with bushing	—				
591	Parallel pin	16 dia.×55 with female thread	NE2313-065A		2		
605	Plug	R1/2	NF06-015		1		
607-A	Plug	R1/8	NF06-004		1		
607-B	Plug	R1/8	NF06-004		1		
607-C	Plug	R1/8	NF06-004		1		
611	Sleeve, shower flashing		CS61100-J220		1		
657	O-ring	JIS B2401 G120	PAH81-120	PC12-120	1		
658	Retaining ring C type internal	JIS B2804 (H120)	NG11-120		1		
709	Vi position sensor rod housing		CS70900-J220		1		
711	Spring	O.D 13, wire diameter 1.6 Free length 100	CS71100-J170		1		
712	Vi position sensor rod		CS71200-J220		1		
713	O-ring	JIS B2401 P12	PAH80-012	PC11-012	1		
714	O-ring	JIS B2401 P6	PAH80-006	PC11-006	1		
715	Plug, Vi position sensor rod		CS71500-J170		1		
716	Retaining ring E type	JIS B2804 E snap ring 4	NG13-004		1		
717	O-ring	JIS B2401 G25	PAH81-025	PC12-025	1		
718	Gland, Vi position sensor rod housing		CS71800-J170		1		
719	Hexagon socket head cap screw	M6×25	NB35406-025		4		
720	Vi position sensor support		CS72000-J170	-	1		
721	Potentiometer	Midori Precisions LP-10FB	CS12907-J1701	-	1		
722	Hexagon socket head cap screw	M3×10	NB35403-010	-	2		
723	Hexagon socket head cap screw	M6×25	NB35406-025	-	2		
724	Vi position sensor box			-	1		
725	Packing, Sensor box			-	1		
726	Hexagon socket head cap screw	M5×15	NB35405-015		4		
794	Vi position sensor assembly		CS72100-J170		1		
728-1	E plug		CS72810-J220		1		
728-2	E plug gland		CS72820-J220		1		
728-3	E plug flange		CS72830-J220		1		
728-4	O-ring	JIS B2401 G45	PAH81-045	PC12-045	1		
728-5	Hexagon head screw	M16×45	NB111016-045		2		
731-A	Plug	R1/8	NF06-004		1		
731-B	Plug	R1/8	NF06-004		1		
732-A	Plug	R1/8	NF06-004		1		
732-B	Plug	R1/8	NF06-004		1		
732-C	Plug	R1/8	NF06-004		1		

Part No.	Part name	220J Type, etc.	Part code No.		Quantity/unit		
			Standard	Explosion proof for Propane	S	M	L
732-D	Plug	R1/8	NF06-004		1		
733-A	Plug	R1/8	NF06-004		1		
733-B	Plug	R1/8	NF06-004		1		
734-1	Inner cover M, balance piston cover		CS73400-J280F		2		
734-2	Inner cover F, balance piston cover	Inner cover, balance piston cover for 170J*	CS73400-J170		1		
736	Partition plate, suction cover		CS73600-J220		1		
744	O-ring	JIS B2401 G70	PAH81-070	PC12-070	1		
745	Rivet	3 dia.×6			4		
235-1	Motor spacer	For NEMA 44*D	CS23502-J220NEMA44		1		
	Motor spacer	For NEMA 50*D	CS23502-J220NEMA50				
	Motor spacer	For IEC FF-600	CS23502-J220IEC60				
	Motor spacer	For IEC FF-740	CS23502-J220IEC74				
235-2	Plate, motor spacer		CS23510-J170		2		
235-3	Hexagon socket head cap screw	M6×15	NB35406-015		8		
739	Hexagon socket head cap screw	M16×60	NB35416-060		8		
740	Parallel pin	13 dia.×65 with female thread	NE2313-065A		2		

CAUTION

- **As for the part code of the O-ring, the material of the standard specification is HNBR and the material of the explosion-proof for propane specification is FKM.**
  For O-rings material other than HNBR or FKM, the part code No. are differ depending on the material.
  For customers using O-rings other than the standard material, contact MYCOM before purchasing the O-ring.

■ Development View and Configuration Table (280J)

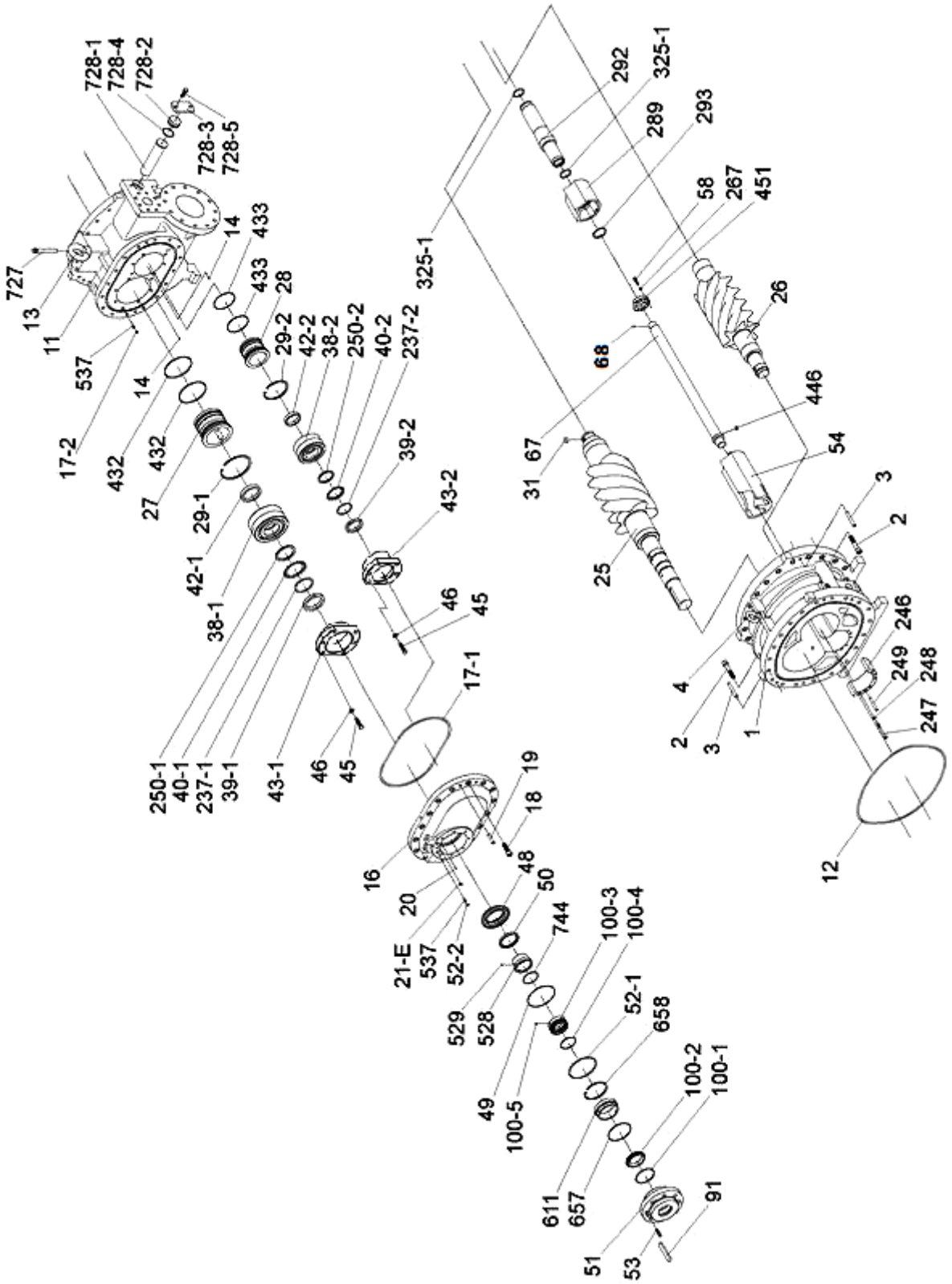


Figure7-5 Development View of 280J (1/2)

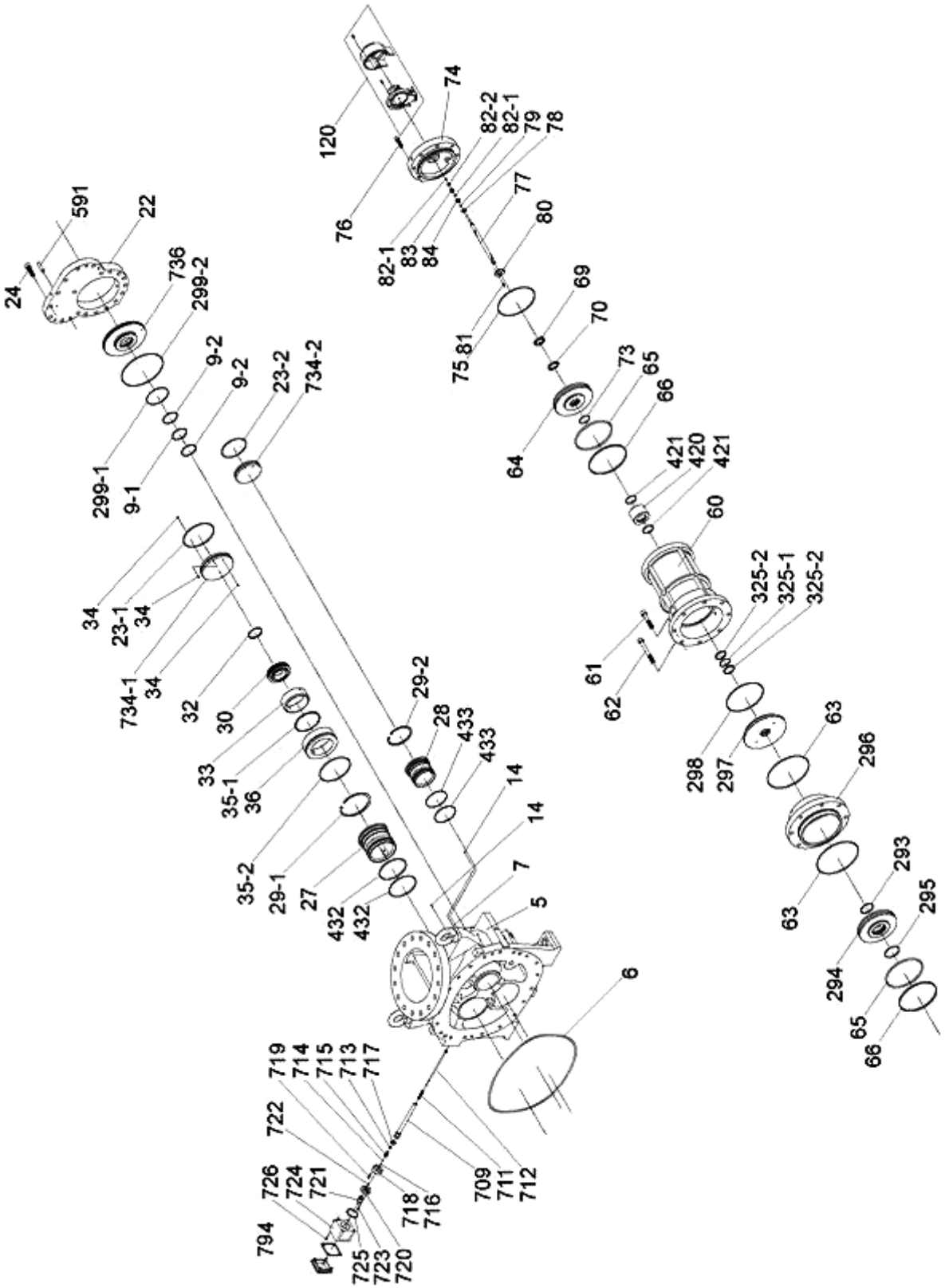


Figure7-6Development View of 280J (2/2)

Table 7-3 Configuration table of the parts of 280J

Part No.	Part name	280J Type, etc.	Part code No.		Quantity/unit		
			Standard	Explosion proof for Propane	S	M	L
1	Main rotor casing S				1	—	—
	Main rotor casing M				—	1	—
	Main rotor casing L				—	—	1
2	Hexagon socket head cap screw	M20×110	NB35420-110		40		
3	Parallel pin	16 dia. ×110 with female thread	NE2316-110A		4		
4	Eyebolt	M24	NB600-24		1		
5	Suction cover				1		
6	O-ring	JIS B 2401 P580	PAH80-580	PC11-580	1		
7	Eyebolt	M36	NB600-36		2		
9-1	O-ring	JIS B 2401 P85	PAH80-085	PC11-085	1		
9-2	Back-up ring for O-ring	SUN-2BP 85	PBP21-085		2		
10-A	Plug	R1/2	NF06-015		1		
10-B	Plug	R3/4	NF06-020		1		
10-C	Plug	R1/2	NF06-015		1		
10-D	Plug	R1/2	NF06-015		1		
10-E	Plug	R1/2	NF06-015		1		
11	Bearing head				1		
12	O-ring	JIS B 2401 P580	PAH80-580	PC11-580	1		
13	Eyebolt	M36	NB600-36		1		
14	Spring pin	4 dia.×10	NE3204-010		4		
15-A	Plug	R1/2	NF06-015		1		
15-B	Plug	R3/4	NF06-020		1		
15-C	Plug	R1/2	NF06-015		1		
15-D	Plug	R3/4	NF06-020		1		
16	Bearing cover				1		
17-1	O-ring	JIS B 2401 P480	PAH80-480	PC11-480	1		
17-2	O-ring	JIS B 2401 P14	PAH80-014	PC11-014	1		
18	Hexagon socket head cap screw	M20×70	NB35420-070		16		
19	Dowel pin	16 dia. ×70 with female thread	NE2316-070		2		
20	Spring pin	3 dia.×10	NE3203-010		1		
21-A	Plug	R1/8	NF06-004		1		
21-B	Plug	R1/4	NF06-008		1		
21-C	Plug	R1/4	NF06-008		1		
21-D	Plug	R3/8	NF06-010		1		
21-E	Plug	R3/8	NF06-010		1		
22	Balance piston cover				1		
23-1	O-ring	JIS B 2401 G190	PAH81-190	PC12-190	1		
23-2	O-ring	JIS B 2401 G150	PAH81-150	PC12-150	1		
24	Hexagon socket head cap screw	M20×70	NB35416-070		13		
25	Male rotor S				1	—	—
	Male rotor M				—	1	—
	Male rotor L				—	—	1
26	Female rotor S				1	—	—
	Female rotor M				—	1	—
	Female rotor L				—	—	1
27	Bearing, male rotor	Sleeve bearing	CS02700-J280M		2		
28	Bearing, female rotor	Sleeve bearing	CS02700-J220M		2		
29-1	Retaining ring C type internal	JIS B 2804 (H190)	NG11-190		2		
29-2	Retaining ring C type internal	JIS B 2804 (H150)	NG11-150		2		
30	Balance piston		CS03000-J280		1		
31	Key for balance piston	250***	CS03100-250		1		
32	Retaining ring C type external	JIS B 2804 (S80)	NG12-080		1		
33	Sleeve, balance piston		CS03300-J280		1		
34	Spring pin	6 dia.×12	NE3206-012		2		
35-2	O-ring	JIS B 2401 G190	PAH81-190	PC12-190	1		

Part No.	Part name	280J Type, etc.	Part code No.		Quantity/unit		
			Standard	Explosion proof for Propane	S	M	L
38-1	Thrust bearing assembly, male rotor	7320BEAXT7DF	CS03800-J280M		1		
38-2	Thrust bearing assembly, female rotor	7316BEAXT7DF	CS03800-J220M		1		
39-1	Locknut	AN20	NG31-020		1		
39-2	Locknut	AN16	NG31-016		1		
40-1	Lock washer	AW20	NG32-020		1		
40-2	Lock washer	AW16	NG32-016		1		
42-1	Thrust bearing alignment spacer, male rotor		CS04200-J280M		1		
42-2	Thrust bearing alignment spacer, female rotor		CS04200-J220M		1		
43-1	Thrust bearing gland, male rotor		CS04300-J280M		1		
43-2	Thrust bearing gland, female rotor		CS04300-J280F		1		
45	Hexagon head screw	M16×65	NB111016-065		12		
46	Conical spring washer	Hexagon head screw M16	ND320-016		12		
48	Retainer for oil seal		CS04800-J280		1		
49	O-ring	JIS B 2401 G165	PAH81-165	PC12-165	1		
50	Oil seal	SA1J 95 120 13	CS05010-320VD		1		
51	Seal cover				1		
52-1	O-ring	JIS B 2401 G165	PAH81-165	PC12-165	1		
52-2	O-ring	JIS B 2401 P14	PAH80-014	PC11-014	1		
53	Hexagon socket head cap screw	M12×40	NB35412-040		8		
54	Unloader slide valve S				1	—	—
	Unloader slide valve M				—	1	—
	Unloader slide valve L				—	—	1
58	Hexagon socket head cap screw	M10×40	NB35410-040		9		
60	Unloader cylinder				1		
61	Hexagon socket head cap screw	M20×110	NB35420-110		2		
62	Hexagon socket head cap screw	M20×170	NB35420-170		6		
63	O-ring	JIS B2401 G260	PAH81-260	PC12-260	2		
64	Unloader piston		CS06400-J280		1		
65	O-ring	JIS B2401 P225	PAH80-225	PC11-225	2		
66	Teflon cap seal	SUNR-BE-225	CS06600-J280		2		
67	Push rod, unloader slide valve		CS06700-J280		1		
68	Guide pin	PH01NG 6×16 BK	NE2506-016		1		
69	Locknut	AN09	NG31-009		1		
70	Lock washer	AW09	NG32-009		1		
73	O-ring	JIS B2401 P58	PAH80-058	PC11-058	1		
74	Unloader cover				1		
75	O-ring	JIS B2401 G230	PAH81-230	PC12-230	1		
76	Hexagon socket head cap screw	M16×60	NB35416-060		8		
77	Unloader indicator cam S		CS07700-J280S		1	—	—
	Unloader indicator cam M		CS07700-J280M		—	1	—
	Unloader indicator cam L		CS07700-J280L		—	—	1
78	Ball bearing	#6000	CS07800-200		1		
79	Retaining ring C type external	JISB2804 (S10)	NG12-010		1		
80	Bearing gland		CS08000-200		1		
81	Hexagon socket head cap screw	M6×15	NB35406-015		3		
82-1	O-ring	JIS B2401 P10A	PAH80-010A	PC11-010A	2		
82-2	O-ring	JIS B2401 P16	PAH80-016	PC11-016	1		
83	Retainer, O-ring		CS08300-200HE		1		
84	Spacer, unloader cover		CS08400-J170		1		
91	Shaft key		CS09100-J280		1		
100	Mechanical seal assembly (including 100-1 to 100-5)		CS10002-320EBS		1		
100-1	O-ring	JIS B2401 P110	PAH80-110	PC11-110	1		
100-2	Mating ring				1		

Part No.	Part name	280J Type, etc.	Part code No.		Quantity/unit		
			Standard	Explosion proof for Propane	S	M	L
100-3	Rotating ring				1		
100-4	O-ring	AS568A-239	PAH82-239	PC62-017	1		
100-5	Hexagon socket set screw	M8×9			1		
120	Assembly, unloader indicator				1		
137	Dial plate, unloader indicator		CS13700-J170		1		
234	Name plate				1		
237-1	Torsional slip washer M		CS23700-J280M		1		
237-2	Torsional slip washer F		CS23700-J220M		1		
246	Guide, unloader slide valve				1		
247	Hexagon socket head cap screw	M10×110	NB35410-110		4		
248	Spring lock washer	Hexagon socket head cap screw M10	ND330-10		4		
249	Parallel pin	13 dia.×100	NE2013-100		2		
250-1	Thrust washer, male rotor		CS25000-J280		1		
250-2	Thrust washer, female rotor		CS25000-J220		1		
267	Spring lock washer	Hexagon socket head cap screw M10	ND330-10		9		
289	Slide valve S, Vi				1	—	—
	Slide valve M, Vi				—	1	—
	Slide valve L, Vi				—	—	1
292	Push rod S, Vi		CS29200-J280S		1	—	—
	Push rod M, Vi		CS29200-J280M		—	1	—
	Push rod L, Vi		CS29200-J280L		—	—	1
293	Spiral retaining ring	FRSN-75	NGFR-75		2		
294	Piston, Vi		CS29400-J280		1		
295	O-ring	JIS B2401 P85	PAH80-085	PC11-085	1		
296	Cylinder, Vi				1		
297	Partition plate, unloader cylinder		CS29700-J280		1		
298	O-ring	JIS B2401 G230	PAH81-230	PC12-230	1		
299-1	O-ring	JIS B2401 G135	PAH81-135	PC12-135	1		
299-2	O-ring	JIS B2401 G260	PAH81-260	PC12-260	1		
325-1	O-ring	JIS B2401 P58	PAH80-058	PC11-058	3		
325-2	Back-up ring for O-ring	SUN-2BP 58	PBP21-058		2		
396-1	Liner M for thrust adjustment	(Service part)					
396-2	Liner F for thrust adjustment	(Service part)					
420	Unloader spacer S		CS42000-J280S		1	—	—
	Unloader spacer M		CS42000-J280M		—	1	—
421	O-ring	JIS B2401 P58	PAH80-058	PC11-058	2		—
432	O-ring	JIS B2401 G165	PAH81-165	PC12-165	4		
433	O-ring	JIS B2401 G130	PAH81-130	PC12-130	4		
446	Key, push rod for unloader slide valve	200*** Key for balance piston	CS03100-200		1		
451	Push rod gland for unloader slide valve		CS45100-J280		1		
458-2	Plug	R1/2	NF06-015		2		
459	Plug	R1/2	NF06-015		1		
528	Sleeve, oil seal	320***	CS52800-320VD		1		
529	Hexagon socket set screw	M6×8	NA83606-008		2		
537	Bush, P14 type O-ring		CS53700-J170		2		
591	Parallel pin	16 dia.×70 with female thread	NE2316-070A		2		
605	Plug	R1/2	NF06-015		1		
607-A	Plug	R1/8	NF06-004		1		
607-B	Plug	R1/4	NF06-008		1		
607-C	Plug	R1/4	NF06-008		1		
611	Sleeve, shower flashing				1		
657	O-ring	JIS B2401 G140	PAH81-140	PC12-140	1		

Part No.	Part name	280J Type, etc.	Part code No.		Quantity/unit		
			Standard	Explosion proof for Propane	S	M	L
658	Retaining ring	JIS B2804 H140	NG11-140		1		
709	Vi position sensor rod housing		CS70900-J280		1		
711	Spring	O.D 13, wire diameter 1.6 Free length 100	CS71100-J170		1		
712	Vi position sensor rod		CS71200-J280		1		
713	O-ring	JIS B2401 P12	PAH80-012	PC11-012	1		
714	O-ring	JIS B2401 P6	PAH80-006	PC11-006	1		
715	Plug, Vi position sensor rod		CS71500-J170		1		
716	Retaining ring	JIS B2804 E snap ring 4	NG13-004		1		
717	O-ring	JIS B2401 G25	PAH81-025	PC12-025	1		
718	Gland, Vi position sensor rod housing		CS71800-J170		1		
719	Hexagon socket head cap screw	M6×25	NB35406-025		4		
720	Vi position sensor support		CS72000-J170	-	1		
721	Potentiometer	Midori Precisions LP-10FB	CS12907-J1701	-	1		
722	Hexagon socket head cap screw	M3×10	NB35403-010	-	2		
723	Hexagon socket head cap screw	M6×25	NB35406-025	-	2		
724	Vi position sensor box			-	1		
725	Packing, Sensor box			-	1		
726	Hexagon socket head cap screw	M5×15	NB35405-015		4		
794	Vi position sensor assembly		CS72100-J170		1		
728-1	E plug		CS72810-J280		1		
728-2	E plug gland		CS72820-J280		1		
728-3	E plug flange		CS72830-J280		1		
728-4	O-ring	JIS B2401 G65	PAH81-065	PC12-065	1		
728-5	Hexagon head screw	M16×45	NB111016-045		2		
731-A	Plug	R1/4	NF06-008		1		
731-B	Plug	R1/4	NF06-008		1		
731-C	Plug	R1/8	NF06-004		1		
732-A	Plug	R1/2	NF06-015		1		
732-B	Plug	R1/2	NF06-015		1		
733	Plug	R1/2	NF06-015		1		
734-1	Inner cover M, balance piston cover		CS73400-J280M		1		
734-2	Inner cover F, balance piston cover	Inner cover, balance piston cover for 220J*	CS73400-J280F		1		
736	Partition plate, suction cover		CS73600-J280		1		
744	O-ring	JIS B2401 G90	PAH81-090	PC12-090	1		
745	Rivet	3 dia.×6			4		

CAUTION

- **As for the part code of the O-ring, the material of the standard specification is HNBR and the material of the explosion-proof for propane specification is FKM.**
  For O-rings material other than HNBR or FKM, the part code No. are differ depending on the material.
  For customers using O-rings other than the standard material, contact MYCOM before purchasing the O-ring.

7.2 List of Tightening Torques for Bolts and Nuts

Table 7-4 List of Tightening Torques

■ Hexagon socket head cap screw (170J)

Part No.	Tightening point	Tightening torque N·m (kgf·cm)	Qty.	Remarks
2	Suction cover Bearing head	130(1300)	28	Hexagon socket head cap screw M16×60
18-1	Bearing cover	52(520)	5	Hexagon socket head cap screw M12×50
18-2	Bearing cover	52(520)	13	Hexagon socket head cap screw M12×70
24	Balance piston cover	52(520)	13	Hexagon socket head cap screw M12×50
45	Bearing gland	20(200)	12	Hexagon socket head cap screw M8×30
53	Shaft seal cover	15(150)	8	Hexagon socket head cap screw M8×30
58	Gland, push rod for unloader slide valve	25(250)	6	Hexagon socket head cap screw M8×30
61	Unloader cylinder	52(520)	2	Hexagon socket head cap screw M12×70
62	Unloader cylinder	52(520)	6	Hexagon socket head cap screw M12×110
76	Unloader cover	30(300)	8	Hexagon socket head cap screw M10×40
81	Bearing gland	10(100)	3	Hexagon socket head cap screw M6×15
247	Slide valve guide	25(250)	4	Hexagon socket head cap screw M8×70
493	Suction adapter	260(2600)	8	Hexagon socket head cap screw M20×50
535	Solenoid valve, capacity control and variable Vi solenoid valve or Dummy block, solenoid valve	6(60)	8	Hexagon socket head cap screw M5×75
719	Vi position sensor rod housing gland	10(100)	4	Hexagon socket head cap screw M6×25

■ Hexagon socket head cap screw /Hexagon head screw (220J)

Part No.	Tightening point	Tightening torque N·m (kgf·cm)	Qty.	Remarks
2	Suction cover Bearing head	130(1300)	40	Hexagon socket head cap screw M16×75
18-1	Bearing cover	130(1300)	5	Hexagon socket head cap screw M16×60
18-2	Bearing cover	130(1300)	9	Hexagon socket head cap screw M16×90
24	Balance piston cover	130(1300)	13	Hexagon socket head cap screw M16×60
45	Bearing gland	50(500)	12	Hexagon head screw M12×50
53	Shaft seal cover	30(300)	8	Hexagon socket head cap screw M10×35
58	Gland, push rod for unloader slide valve	25(250)	9	Hexagon socket head cap screw M8×35
61	Unloader cylinder	130(1300)	2	Hexagon socket head cap screw M16×90
62	Unloader cylinder	130(1300)	6	Hexagon socket head cap screw M16×140
76	Unloader cover	52(520)	8	Hexagon socket head cap screw M12×50
81	Bearing gland	10(100)	3	Hexagon socket head cap screw M6×15
247	Slide valve guide	25(250)	4	Hexagon socket head cap screw M8×90
493	Suction adapter	360(3600)	8	Hexagon socket head cap screw M22×60
535	Solenoid valve, capacity control / variable Vi solenoid valve or Dummy block, solenoid valve	6(60)	8	Hexagon socket head cap screw M5×75
719	Vi position sensor rod housing gland	10(100)	4	Hexagon socket head cap screw M6×25
728-5	E plug flange	110(1100)	2	Hexagon head screw M16×45

■ Hexagon socket head cap screw /Hexagon head screw (280J)

Part No.	Tightening point	Tightening torque N·m (kgf·cm)	Qty.	Remarks
2	Suction cover Bearing head	260(2600)	40	Hexagon socket head cap screw M20×110
18	Bearing cover	260(2600)	16	Hexagon socket head cap screw M20×70
24	Balance piston cover	260(2600)	13	Hexagon socket head cap screw M20×70
45	Bearing gland	60(600)	12	Hexagon head screw M16×65
53	Shaft seal cover	52(520)	8	Hexagon socket head cap screw M12×40
58	Gland, push rod for unloader slide valve	50(500)	9	Hexagon socket head cap screw M10×40
61	Unloader cylinder	260(2600)	2	Hexagon socket head cap screw M20×110
62	Unloader cylinder	260(2600)	6	Hexagon socket head cap screw M20×170
76	Unloader cover	130(1300)	8	Hexagon socket head cap screw M16×60
81	Bearing gland	10(100)	3	Hexagon socket head cap screw M6×15
247	Slide valve guide	50(500)	4	Hexagon socket head cap screw M10×110
719	Vi position sensor rod housing gland	10(100)	4	Hexagon socket head cap screw M6×25
723	Vi position sensor support	10(100)	2	Hexagon socket head cap screw M6×25
726	Vi position sensor box	6(60)	4	Hexagon socket head cap screw M5×15
728-5	E plug flange	110(1100)	2	Hexagon head screw M16×45

■ Connection flange

Tightening point	Tightening torque N·m (kgf·cm)	Qty.	Remarks
ANSI#300 3/4”	110(1100)	4	Hexagon head screw M16×45
ANSI#300 1”	110(1100)	4	Hexagon head screw M16×45
ANSI#300 1 1/4”	110(1100)	4	Hexagon head screw M16×45
ANSI#300 1 1/2”	140(1400)	4	Hexagon head screw M20×55
ANSI#300 2 1/2”	140(1400)	8	Hexagon head screw M20×65
ANSI#300 3”	140(1400)	8	Hexagon head screw M20×65
ANSI#300 5”	140(1400)	8	Hexagon head screw M20×65
ANSI#300 8”	240(2400)	12	Hexagon head screw M22×80
ANSI#300 12”	300(3000)	16	Hexagon head screw M30×100

■ Hexagon socket taper screw plug

Size	Tightening torque N·m (kgf·cm)
R1/8	15(150)
R1/4	25(250)
R3/8	50(500)
R1/2	60(600)
R3/4	140(1400)
R1	180(1800)
R1 1/4	220(2200)
R1 1/2	240(2400)

■ Lock Nut/FU Nut (170J/220J/280J)

Part No.		Tightening point	Tightening torque N·m (kgf·cm)	Qty.	Remarks
170J	39-1	Thrust bearing assembly, male rotor	410(4100)	1	Locknut AN12
	39-2	Thrust bearing assembly, female rotor	200(2000)	1	Locknut AN09
	69	Unloader piston	80(800)	1	FU nut FU05SS
	486	Valve disc	50(500)	1	FU nut FU04SS
220J	39-1	Thrust bearing assembly, male rotor	980(9800)	1	Locknut AN16
	39-2	Thrust bearing assembly, female rotor	410(4100)	1	Locknut AN12
	69	Unloader piston	80(800)	1	Locknut AN07
	486	Valve disc	80(800)	1	FU nut FU05SS
280J	39-1	Thrust bearing assembly, male rotor	1900(19000)	1	Locknut AN20
	39-2	Thrust bearing assembly, female rotor	980(9800)	1	Locknut AN16
	69	Unloader piston	170(1700)	1	Locknut AN09

Note 1: On June 14, 2010, the "Lock Nut Tightening Angle Range Control Standard" has been introduced to our compressor manufacturing division, to control the specified tightening torque for rotor shaft lock nuts (【39-1】【39-2】 in tables above) as follows. Accordingly, the tightening angle range is now added to the rotor shaft lock nut tightening procedure in this manual.

■ Tightening Angle Range of Lock Nuts for Rotors

a) After tightening the lock nut by hand, further tighten the lock nut by using a lock nut wrench until the rotor starts to turn. Take care not to over-tighten.
b) Put a mark on the lock nut at the right side edge of the rotor groove where the stopper tongue of the lock washer fits in, as shown in Figure 7-9.
c) From this marking position, tighten the lock nut in such a way that rotation can be stopped within the tightening angle range shown in Table 7-3. When measuring the angle, use an angle gauge which is set to the diameter of rotor shaft.

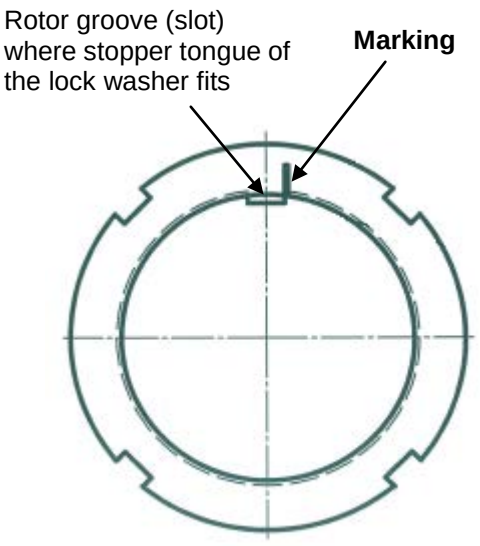


Figure 7-9 Position where mark is put

Table 7-5 Tightening Angles Specified for Lock Nuts of Rotor

	Model	Angle range
First time tightening	170J & 220J & F rotor of 280J	30°to 40°
	M rotor of 280J	25°to 35°
Second time tightening	170J & 220J & F rotor of 280J	20°to 30°
	M rotor of 280J	15°to 25°

* When tightening lock nut, tightening start position differs between the first time tightening and the tightening for the second time or after. Therefore, angle ranges are specified also for the second time tightening.

7.3 List of Tools for Disassembly

■ Special Tool

Table7-6 List of Special Tools

Tool name	Code No.	Qty.			Remarks
		170J*	220J*	280J*	
Locknut wrench (AN09 J)	SAS1139-09J	1	-	-	Size 09, long
Locknut wrench (AN12 J)	SAS1139-12J	1	1	-	Size 12, long
Locknut wrench (AN16 J)	SAS1139-16J	-	1	1	Size 16, long
Locknut wrench (AN20 J)	SAS1139-20J	-	-	1	Size 20, long
Radial bearing installing tool, 65 dia. J	SAS116-065J	1	-	-	
Radial bearing installing tool, 85 dia. J	SAS116-085J	1	1	-	
Radial bearing installing tool, 110 dia. J	SAS116-110J	-	1	1	
Radial bearing installing tool, 145 dia. J	SAS116-145J	-	-	1	
Slide hammer for J series	SAS130	1	1	1	
Magnet for solenoid valve	EAI-90178	1	1	-	

■ Standard Tool

Table7-7 List of Standard Tools

Tool name	Code No.	Qty.			Remarks
		170J*	220J*	280J*	
Ratchet wrench (1/4")		1			
Screwdriver		1			Screwdriver for slotted-head screws
Philip's screwdriver		1			Screwdriver for cross recessed head screws
Eyebolt (M8)		1 set			2 pcs. in 1 set
Retaining ring pliers (medium size)		1			for external
Retaining ring pliers (large size)		1			for internal
Hexagon socket screw keys		1 each			Width across flats: 2.5, 3, 4, 5, 6 mm 8, 10, 14, 17 mm
INHEX socket, width across flats 6 mm		1	1	-	Hexagon socket head cap screw M8
INHEX socket, width across flats 8 mm		-	1	1	Hexagon socket head cap screw M10
INHEX socket, width across flats 10 mm		1	1	1	Hexagon socket head cap screw M12
INHEX socket, width across flats 14 mm		1	1	1	Hexagon socket head cap screw M16
INHEX socket, width across flats 17 mm		1	1	1	Hexagon socket head cap screw M20, M22
Torque wrench		1			Maximum torque: 100 Nm
Torque wrench		1			Maximum torque: 280 Nm
Torque wrench		-	1	-	Maximum torque: 420 Nm
Adjustable angle wrench		1			250mm
Socket for locknut (FU04)		1	-	-	FUT#04 (for FU04)
Socket for locknut (FU05)		1	1	-	FUT#05 (for FU05)
Socket for locknut (FU07)		-	1	-	FUT#07 (for FU07)
Socket for locknut (FU09)		-	-	1	FUT#09 (for FU09)
Socket wrench 13 mm		1	1	-	
Socket wrench 18 mm		1	-	1	

Note: There standard tools mean tools generally sold on the market.

Appendix 1 Tips for Design, Manufacturing, and Installation of the Compressor Package

The J-series screw compressor is delivered as a package in standard. The appendix describes points to be considered when designing or manufacturing the package or installing the compressor package.

Appendix 1.1 Precautions for Design of the Compressor Package

■ Working Limits of the Compressor

Understand and adhere to the instructions in “2.3 Operation Limits” in this manual chapter 2, so that the package is designed within the specified operating limits.

The following points are important for the compressor to operate within the operating limits.

- Regulate the minimum differential pressure for lubrication within the specifications.
  For life time of thrust bearing, sufficient lubrication.
- Ensure appropriate flow rate of the lubricant (appropriate pipe diameter) for lubricating and cooling bearings and seals and discharge gas.

■ Compressor Protection Function

When placing the compressor into a new or an existing system, always use the specified controller to control and protect the compressor.

Set the following control values for compressor protection in consideration of the compressor operating limits.

(1) Protection from abnormal high pressure

(2) Protection from abnormal low suction pressure

(3) Protection from low supply oil pressure

(4) Protection from high supply oil temperature

(5) Protection from high discharge temperature

(6) Protection from overcurrent

In addition, install safety valves to pressure vessels such as oil separator, condenser, and evaporator.

■ Operating Control

The specified controller (CP4) for the compressor incorporates the following operational controls that allow the package to operate smoothly and safely.

1) Start-up preparation control

The following controls are performed before the compressor is started up.

- The capacity control slide valve of the compressor is checked to see if it is at the minimum load position.
- The compressor is lubricated before start-up.

2) Operating control

In normal operation state, the following operational controls are performed.

- The compressor capacity is controlled according to the load so that the predetermined temperature or pressure is constant.
- The compressor stops automatically when the operating conditions reach the set points.
- Vi is controlled according to the compressor operating conditions.

3) Control for compressor stop

The following controls are performed before the compressor is stopped.

- The capacity control slide valve of the compressor is set to the minimum position before it is stopped.
  (Alternatively, the compressor is stopped with the capacity control slide valve is in the low load position and the capacity control slide valve is set to the 0% position after it is stopped.)

■ Motor

The 170J/220J-series is intended for a flange motor in standard.

It is applied for the following standards and frames.

170J	220J
• NEMA 44*D, 55*D • IEC FF-500, FF-600	• NEMA 44*D, 50*D • IEC FF-600, FF-740

■ Oil Separator

The oil separator is required to separate and hold compressor lubricant oil, therefore take the following points into consideration during design.

1) Oil separation performance

Design the oil separator so that the quantity of oil carried away from the oil separator is below 10 ppm. Consider the gravitational sedimentation method and the types of filter to use.

2) Amount of lubricant held

The amount of lubricant held in the oil separator must at least be more than 1.5 times the supply lubricant flow rate per minute.

3) Attachment of oil level gauge

To manage the lubricant level, an oil level gauges that shows both the upper and lower level limit must be provided.

4) Installation of oil heater

An oil heater must be installed at the bottom of the oil separator with appropriate temperature settings to prevent excessive viscosity increase of lubricant, condensation of refrigerant, and refrigerant dissolving in lubricant at start up.

If the package is for use in cold regions or the lubricant dissolves excessively in the refrigerant, the oil separator must be thermally insulated.

5) Sufficient stiffness

If a horizontal type of oil separator with the compressor and motor mounted on top is adopted, the oil separator must be sufficiently rigidly designed.

CAUTION

- **The oil separator must have sufficient rigid structure so that no misalignment trouble occurs to the compressor and motor during operation due to the oil separator heat stress or deformation due to pressure.**

■ Oil Cooler

The oil cooler must have adequate capacity to sufficiently dissipate heat from the oil.

The oil cooler must be designed with minimum pressure loss.

Some of oil cooler types are: 1. water cooling, 2.Thermosyphon, 3. direct expansion.

CAUTION

- **Large pressure loss may lead to insufficient supply of lubricant. In other cases, lubrication problems may occur inside the compressor due to the vaporized refrigerant gas from the lubricant (refrigerant gas that may have dissolved (or mixed) in the lubricant.)**

Instead of using a shell and tube or plate and frame oil cooler, oil may be cooled by supplying liquid refrigerant to the compressor (liquid injection system). In this case, liquid injection flow rate must be controlled so that the discharge superheat is maintained at an appropriate temperature.

CAUTION

- **Notice that excessive liquid injection may cause the lubricant in the oil separator to foam, resulting in excessive oil carried away from oil separator and insufficient lubrication to the compressor components.**
  In other cases, refrigerant solution in lubricant may reduce the lubricant viscosity.

■ Oil Pipe Installation

The J-series requires the following three oil lines: lubrication, oil injection, and unloader/variable Vi system oil lines.

1) Lubrication oil line

For the lubrication system, an inlet port of ANSI #300 1” (common in J-series) is provided on the bearing head and another inlet port of Rc1/2 (170J), Rc3/4 (220J), or ANSI #300 3/4” (280J) is also provided on the suction cover.

Because the J-series uses hydrodynamic bearings, it requires pre-lubrication before start-up. Therefore, a pre-lubrication pump must be installed. Note, the supply lubricant line located upstream of the pre-lubrication pump must be installed with a check valve.

2) Oil injection oil line

For oil injection, an inlet port of Rc1/2 (170J), Rc3/4 (220J), or ANSI #300 1 1/4” (280J) is provided on the male rotor side of the main rotor casing and should be used in normal cases. (In some cases when the discharge temperature is higher than limit temperature, the female rotor side injection port may be used at the same time.)

The oil injection line must be installed with a check valve to prevent reversed flow.

3) Oil line for the Unloader, Vi cylinder

For 170J/220J-series, an Rc1/2 port (interchangeable with NPT1/2) for oil supply to the unloader and Vi cylinder is provided on the male rotor side of the unloader cylinder. The oil outlet port for the unloader and Vi cylinder is an Rc1/2 port on the female rotor side.

For 280J-series, connect between the ports (4 places) with corresponding ports of the solenoid valve.

Make sure that the oil line is connected to the suction line located upstream of the suction flange which is integrated with suction check valve.

Oil Pump

When using booster to make minimum differential oil pressure (the differential pressure between oil supply pressure and suction pressure) should be more than 0.5MPa, an oil pump which can refill all oil volume should be provided.

Under high pressure conditions; discharge pressure is more than 2.2Mpa or suction pressure is more than 0.8MPa, to make thrust bearing service life longer, an oil pump which can refill all oil volume should be provided.

The oil pump is also required for lubrication before start-up and to move capacity control slide valve and the variable Vi slide valve when the compressor is stopped.

The oil pump must be installed after the oil filter.

Oil Filter

To eliminate contaminants in the lubricant, an oil filter (main filter) must be installed in the oil line.

According to the requirements of the use of the package unit or the standard to apply, install an oil filter of appropriate filtration precision in the lubrication system of the compressor.

In the case of general applications such as closed-cycle refrigeration systems, we recommend to use an oil filter with beta ratio in the range of $\beta_{20} \geq 150$ that conforms to requirements of NAS 1638 class 8 or ISO 4406 17/15/13.

When the package unit requires API 619 4th/5th edition conformity, use an oil filter with beta ratio in the range of $\beta_{10} \geq 200$.

CAUTION

- **Any contaminants in the lubricant may cause damage to important components such as bearings and shaft seal.**

Economizer Piping

To install economizer piping, follow the instructions below.

1) When an economizer is used, the E plug (728) must be removed. Refer to Sectional View 3/3.

2) For 170J-series, remove the blind flange for the economizer (ANSI #300 1") to access the E plug. The E plug head is exposed and a tool (socket, size 18) can be fitted to the head of the E plug. Use a wrench to remove the E plug.

   For 220J/280J-series, first remove the E plug flange (728-3). Then remove the E plug gland (728-2) and the E plug in this order by using the eye bolt (M8).

3) For 170J-series, insert a R3/4 hexagon socket headless tapered pipe plug after removing the E plug.
   The plug must be a metric taper screw plug. (Do not use a NPT plug.) After attaching the R3/4 plug, apply anticorrosive paint to the plug head and the counter bore. Applying grease additionally is more effective for rust proofing.

   For 220J/280J-series, reattach the E plug flange and the E plug gland after removing the E plug.

4) To connect the pipe for the economizer port, use ANSI #300 flanges. The flange size is 1B for 170J, 1 1/2B for 220J, and 2 1/2B for 280J.

5) While installing the pipes, take sufficient care not to allow any contamination such as spatters to remain in the piping and enter the compressor.

■ Liquid Injection Piping

To install liquid injection piping, follow the instructions below.

1) To connect the pipe for the liquid injection port, use ANSI #300 flanges. The flange size is 3/4B for 170J/220J and 1B for 280J.

2) While installing the pipes, take sufficient care not to allow any contamination such as spatters to remain in the piping and enter the compressor.

■ Suction Piping

For 170J/220J-series, before connecting the suction pipes, apply grease or liquid gasket (such as HERME SEAL) to the counter bores, bolt heads, holes of the hexagon socket head cap screws (493) fastening the suction adapter (492) to prevent rust and freeze up.

Make sure that the suction check valve located below the compressor suction flange is not subjected to excessive force or damaged during installation of the suction pipe.

CAUTION

- **If no rustproof and freezing-proof coating is applied to the hexagon socket head cap screws fastening the suction adapter, the suction flange and bolts may be damaged.**

■ Miscellaneous

1) Suction/discharge check valve

The 170J-220J-series integrates a suction check valve.

For the discharge side, a separate discharge check valve must be installed at the outlet of the oil separator.

CAUTION

- **When two or more compressors are installed with a single oil separator, check valves must be installed in each discharge pipes between the compressors and the oil separator.**

2) Suction strainer

To prevent foreign substances from entering the compressor, a suction gas strainer must be installed in the suction line of the compressor.

Equal to or more than 100 meshes (equal to or more than 200 meshes when using a dry process evaporator) are recommended for the suction gas strainer.

Appendix 1.2 Tips for Compressor Package Manufacturing

■ Piping arrangements, Vessel

Any foreign substances in the lubricant will affect lubrication of the compressor bearings and mechanical seal, resulting in compressor failures. To prevent such problems, components such as oil separators, oil coolers, oil filters and suction gas strainers must be cleaned to remove all foreign substances. The main pipes must be cleaned by shot blast or pickling before installation.
In particular, the lubricant piping from the oil filter to the compressor port and the suction piping after the suction gas strainer to the compressor suction must be thoroughly cleaned.

Appendix 1.3 Tips for Compressor Package Installation

■ Installation of Compressor and Motor to the package

For coupling the 170J/220J-series compressor with the flange motor and fastening them to the compressor base, follow the instructions below.

1. Remove any adhesive matters such as paint from the motor spacer side flange face of the compressor bearing cover using a scraper and brass wire brush, and clean the face with a solvent (such as kerosine). Check the flange face for damage. Rectify any scratches and damage.

2. Clean the compressor side flange face of the motor spacer using a solvent.

3. Place the compressor on a working table. Make sure to prepare sleepers with a height of 120 mm or more to use as the compressor base because the motor side flange diameter is bigger than the compressor side flange diameter.

4. Attach two safety bolts (M16×60) to the upper two bolt holes on the flange face of the bearing cover motor spacer side.

5. Lift the motor spacer with lifting equipment such as a crane and move it horizontally to align with the compressor side flange face of the compressor bearing cover flange face using the safety bolts on the bearing cover as the guides.

6. From the motor spacer side, insert two hexagon socket head cap screws (M16×20) at diagonal positions and lightly tighten them by wrench evenly so that no gap is present between the flange faces.

7. Apply lubricant (for example, molybdenum disulfide) to the parallel pin (13 dia. × 60) and insert it by knocking with a copper hammer from the motor spacer side.

8. Remove the safety bolts and insert the remaining bolts from the motor spacer side, then tighten all bolts to the specified torque in a star pattern.

9. Lift the compressor with motor spacer using lifting equipment such as a crane hooking on the three eyebolts on the compressor, place it on the compressor base of the package, and fix the motor spacer and compressor feet to the compressor base with bolts.

10. Lift the motor using lifting equipment such as a crane, put the spigot of the motor in the recess of motor spacer, and fit the motor flange face and the motor spacer flange face.

11. Insert two bolts at the diagonal positions from the motor side, and tighten them evenly so that no gap is present between the flange faces.

12. Insert the remaining bolts and tighten all bolts to the specified torque.

13. Remove the crane and finally tighten the two bolts on the counter-load side motor feet.

14. If there is any gap between the motor feet and the motor base, adjust the height by inserting shims before tightening the bolts.

With these steps, the coupling of flange motor and compressor and fastening them to the compressor base is finished.

CAUTION
● **If there is any gap left between the base and the motor feet, the compressor and motor spacer can be strained, which may lead not only to abnormal noises and vibrations but also damage to the bearing or leak from the mechanical seal.**

When the compressor is the 280J-series or when the compressor and the motor are coupled without a motor spacer, the four feet of the compressor and motor must be firmly fastened to the compressor and motor bases.

In this case, the couplings of the motor and the compressor must be aligned. (For detailed procedure, refer to the package instruction manual.)

■ Suction Gas Line Piping

When installing the suction piping to the compressor package, provide pipe supports at appropriate positions so that the compressor suction flange is not subject to excessive loads.

CAUTION
● **Any excessive loads to the compressor from the piping may cause compressor casing deformation, resulting in mechanical problems.**

■ Foundation for Compressor Package

The compressor package must be mounted on a solid floor or foundation. The package must be firmly fixed to the foundation with anchor bolts after leveling and aligning.

CAUTION
● **If the package is mounted on a floor or foundation without sufficient reinforcement, abnormal vibrations may occur from the compressor and/or the package.**

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MAYEKAWA PHILIPPINES CORP. (GENARAL SANTOS OFFICE)	ROOM 4, LEAH DAPROZA BUILDING FISCAL DAPROZA AVENUE GENERAL SANTOS CITY 9500, PHILIPPINES	TEL: (63) 83-552-3282 FAX: (63) 83-301-2698
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MAYEKAWA (TAIWAN) CO., LTD. (CHEMICAL DEPARTMENT)	1F., NO.2, SHIN JANN ROAD, CHIEN CHEN DIST., KAOHSIUNG, TAIWAN 80672, ROC	TEL: (886) 7-812-7709 FAX: (886) 7-812-9019
MAYEKAWA (TAIWAN) CO., LTD. (TAIPEI HEAD OFFICE)	8F, NO, 421, SUNG-SHAN ROAD, TAIPEI, TAIWAN 11083, REP. OF CHINA	TEL: (886) 2-2727-9711 FAX: (886) 2-2759-8484
MAYEKAWA (TAIWAN) CO., LTD. (TAICHUNG BRANCH)	NO. 80-2, SEC.3, HUANJUNG RD., TAICHUNG, TAIWAN, 40755, REP. OF CHINA	TEL: (886) 4-2251-4128 FAX: (886) 4-2251-4129
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MAYEKAWA CHINA MFG.CO., LTD. (GUANGZHOU BRANCH)	RM.1205, TIANLHEFULI BUSINESS MANSION, No.4, HUA TING RD, GUANGZHOU, 510610, CHINA	TEL: (86) 20-8527-6161 FAX: (86) 20-8527-6165
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MAYEKAWA CHINA MFG. CO., LTD. (DALIAN BRANCH)	RM.A13-5, No.1 BUILDING, AREA A , WUCAI CITY, DALIAN ECO-TECH DEVELOPMENT ZONE, 116100, DALIAN, P. R. CHINA	TEL: (86) 411-8753-9620 FAX: (86)411-8757-9620
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MAYEKAWA (THAILAND) CO., LTD. (TRANG BRANCH)	1/7 TRANG-PALIAN RD., MUANG, TRANG 92000, THALAND	TEL: (66) 75-224-784 FAX: (66) 75-224-351
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MYCOM KOREA CO., LTD. (HEAD OFFICE)	2F, 345, CHEONGRA-RO , YONGSAN-KU, SEOUL, 140-710, REP.OF KOREA	TEL: (82) 2-796-1766 FAX: (82) 2-798-7715

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MYCOM KOREA CO., LTD. (BUSAN BRANCH)	5F, 26, JUNGANG-DAERO, JUNG-GU, BUSAN 600-714, REP.OF KOREA	TEL: (82) 51-242-3737 FAX: (82) 51-243-8542
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MAYEKAWA ARGENTINA S.A. (BUENOS AIRES OFFICE)	DR. JOSE VALENTIN GOMEZ 151, LOT42, HAEDO-PARTIDO DE MORON, BUENOS AIRES, CP B1706FMA, ARGENTINA	TEL: (54) 11-4609-2000 FAX: (54) 11-4628-1511
MAYEKAWA ARGENTINA S.A. (PUERTO MADRYN OFFICE)	OFICINA PTO. MADRYN LEOPOLDO LUGONES 45 (U9129KDA)-PUERTO MADRYN PCIA DE CHUBUT REPUBLICA ARGENTINA	TEL: (54) 2965-475414 FAX: (54) 2965-475414
MYCOM PERU S.A.C.	CALLE LUIS PASTEUR 1490, LINCE, LIMA, PERU	TEL: (51) 1-205-5400 FAX: (51) 1-222-1543
MAYEKAWA CHILE S.A.C.el. (SANTIAGO OFFICE)	CORDILLERA No.331, MODULO D14, FLEX CENTER, PUERTO VESPUCIO, QUILICURA, SANTIAGO, CHILE	TEL: (56) 9-7791-8211 FAX: (56) 2-7778-4416
MAYEKAWA CHILE S.A.C.el. (CONCEPCION OFFICE)	ANIBAL PINTO No.215, OFICINA 403, CONCEPCION, CHILE	TEL: (56) 41-223547 FAX: (56) 41-212443
MAYEKAWA CHILE S.A.C.el. (PUERTO MONTT OFFICE)	BERNARDINO 1057 MODULO 6, PARQUE INDUSTRIAL SAN ANDRES PUERTO MONTT, CHILE	TEL: (56) 65-257570 FAX: (56) 65-288073
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MAYEKAWA COLOMBIA S.A.S	TRANSVERSAL 93 NO.53-48 INTERIOR 37, PAQUE INDUSTRIAL EL DORADO, BOGOTA, COLOMBIA	TEL: (57) 1-430-9980 TEL: (57) 1-224-3028 FAX: (57) 1-437-0988
MAYEKAWA COLOMBIA S.A.S. (MEDELLIN OFFICE)	DIRECCION CR 43B No. 8 SUR 10 OFICINA 404 EDF. OVIEDO MEDELLIN, COLOMBIA	TEL: (57) 4-313-4343 FAX: (57) 4-313-4343
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MAYEKAWA DO BRASIL LTDA. (BAHIA BRANCH)	RUA DR. JOSE PEROBA, 275 - SALA 902 EDIFICIO METROPOLIS - BAIRRO STIEPE, SALVADOR – BA,CEP:41770-235, BRASIL	TEL: (55) 71-3341-0737 FAX: —
MAYEKAWA DO BRASIL EQIPAMENTOS INDUSTRIAIS LTDA. (CHAPECO BRANCH)	AV. NEREU RAMOS, 75D, SALA 503A, EDIFICIO CENTRO PROFISSIONAL CEP:89801-023 C.P.:177 CHAPECO-SC, BRASIL	TEL: (55) 49-3324-6881 FAX: (55) 49-3322-4241
MAYEKAWA DO BRASIL EQIPAMENTOS INDUSTRIAIS LTDA. (CUIABA BRANCH)	AVENIDA ISSAC POVOAS, 586 – SALA 502 EDIFICIO WALL STREET CENTRO CUIABA-MT, CEP 78055-560, BRASIL	TEL: (55) 65-3364-4724 FAX: —
MAYEKAWA DO BRASIL EQIPAMENTOS INDUSTRIAIS LTDA. (CURITIBA BRANCH)	RUA XV DE NOVEMBRO, 2175 6 ANDAR SALA 30 SHOPPING CELLI CEP:83005-000 SAO JOSE DOS PINHAIS-PR, BRASIL	TEL: (55) 41-3383-1518 FAX: (55) 41-3383-1987

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MAYEKAWA DO BRASIL EQIPAMENTOS INDUSTRIAIS LTDA. (OESTE PAULISTA BRANCH)	RUA. FRANCISCO GIGLIOTTI,444-SALA 14 SANTA CANDIDA-SAO JOSE DO RIO PRETO-SP CEP 15091-280,BRASIL	TEL: (55) 17-3227-0235 FAX: (55) 17-3227-3120
MAYEKAWA DO BRASIL EQIPAMENTOS INDUSTRIAIS LTDA. (RECIFE BRANCH)	RUA AGENOR LOPES, 292 SALA 305 CEP:51021-110 BOA VIAGEM RECIFE-PE, BRASIL	TEL: (55) 81-3342-7670 FAX: —
MAYEKAWA DO BRASIL EQIPAMENTOS INDUSTRIAIS LTDA. (RIO GRANDE DO SUL BRANCH)	RUA MUCK, 298 – SALA 601 EDIFICIO SANTA HELENA CEP:92010-250 CANOAS-RS, BRASIL	TEL: (55) 51-3429-1860 FAX: (55) 51-3477-5212
MAYEKAWA DO BRASIL EQIPAMENTOS INDUSTRIAIS (CASCAVEL BRANCH)	RUA.EMILIANO AFONSO SILVA,569 MARIA LUIZA-JARDIM ITAMARATI-CASCAVEL-PR CEP:85819-768 BRASIL	TEL : - FAX : -
MAYEKAWA DO BRASIL EQIPAMENTOS INDUSTRIAIS (CEARA BRANCH)	AV.CAMINHO DO SOL,3007-AP 300-BLOCO 7 COND.ENCOSTA DAS-PORTO DAS DUNAS AQUIRAZ-CE CEP:61700-976 BRASIL	TEL : - FAX : -
MAYEKAWA DO BRASIL EQIPAMENTOS INDUSTRIAIS LTDA (BELO HORIZONTE BRANCH)	RUA.TAMBORIL,1099-CONCORDIA-B ELO HORIZONTE-MG CEP:31130-310 BRASIL	TEL: — FAX: —
MAYEKAWA DO BRASIL EQIPAMENTOS INDUSTRIAIS LTDA. (LINHARES BRANCH)	AV. GOVERNADOR CARLOS LINDENBERG, 873/107 CENTRO CEP:29900-020 LINHARES-ES, BRASIL	TEL: (55)27-3264-1930 FAX: —
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MAYEKAWA DO BRASIL EQIPAMENTOS INDUSTRIAIS LTDA. (RIO DE JANEIRO BRANCH)	AV.LUIZ CARLOS PRESTES, 350-SALA 313-EDIFICIO BARRA TRADE II, BARRA DA TIJUCA, RIO DE JANEIRO-RJ CEP:22775-055, BRASIL	TEL: (55) 21-2431-3600 FAX: (55) 21-2430-8882
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MYCOM VENEZUELA SALES & SERVICE, C.A. (BARCELONA OFFICE)	AV. MUNICIPAL DE PTO. LA CRUZ, EDIF. LOCAL NRO.57, PLANTA ALTA, MUNICIPIO SOTILLO, PUERTO LA CRUZ, VENEZUELA	TEL: (58) 261-765-1059
MYCOM CHEMICAL PROCESS CORP. DE VENEZUELA S.A.	CALLE 148,CENTRO EMPRESARIAL SAN FRANCISCO NIVEL 1 LOCAL 5 Y 6, ZONA INDUSTRIAL IIETAPA,SAN FRANCISCO EDO.ZUILIA, VENEZUELA	TEL: (58) 261-418-1760 FAX: -
MAYEKAWA DE MEXICO, S.A. DE C.V. (CUERNAVACA OFFICE)	AV.DE LOS 50MTS.NO.381, CIVAC. JIUTEPEC MORELOS, C.P.62578, MEXICO	TEL: (52) 77-73-19-0925 FAX: (52) 77-73-20-5762
MAYEKAWA DE MEXICO, S.A. DE C.V. (MEXICO CITY OFFICE)	AV.COYOACAN #945 COL .DEL VALLE DEL. BENITO JUAREZ C.P.03100, MEXICO, D.F. MEXICO	TEL: (52) 55-5062-0870 FAX: (52) 55-5062-0898
MAYEKAWA DE MEXICO, S.A. DE C.V. (GUADALAJARA OFFICE)	SANTA MARIA No.3086, COL. VALLARTA SAN LUCAS GUADALAJARA, JALISCO, C.P.44690, MEXICO	TEL: (52) 3336-15-5765 FAX: (52) 3336-15-1307
MAYEKAWA DE MEXICO, S.A. DE C.V. (MONTERREY OFFICE)	AV.CHAPULTEPEC NO.2233 OTE. FRACC, BUENOS AIRES MONTERREY N.L. C.P.64800, MEXICO	TEL: (52) 81-8347-3085 FAX: (52) 81-8347-5830
MAYEKAWA DE MEXICO, S.A. DE C.V. (HERMOSILLO OFFICE)	CALLE FRAY TORIBIO DE BENAVENTE #38 COL. LOS ARCOS CD. HERMOSILLO, SONORA, C.P.83250, MEXICO	TEL: (52) 662-216-2047 FAX: (52) 662-216-2047
MAYEKAWA DE MEXICO, S.A. DE C.V. (IRAPUATO OFFICE)	CALLE AGUSTIN ZARAGOZA NO.219 LOCAL-2 COL.DEPORTIVA, C.P.36612, IRAPUATO, GTO. MEXICO	TEL: (52) 462-624-9353 FAX: (52) 462-624-9264
MAYEKAWA DE MEXICO, S.A. DE C.V. (CULIACAN OFFICE)	AV. NICOLAS BRAVO 1572, LOCAL 1 COL.MORELOS CULIACAN, SINALOA, C.P.80170, MEXICO	TEL: (52) 66-7715-4199 FAX: (52) 66-7715-4150
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