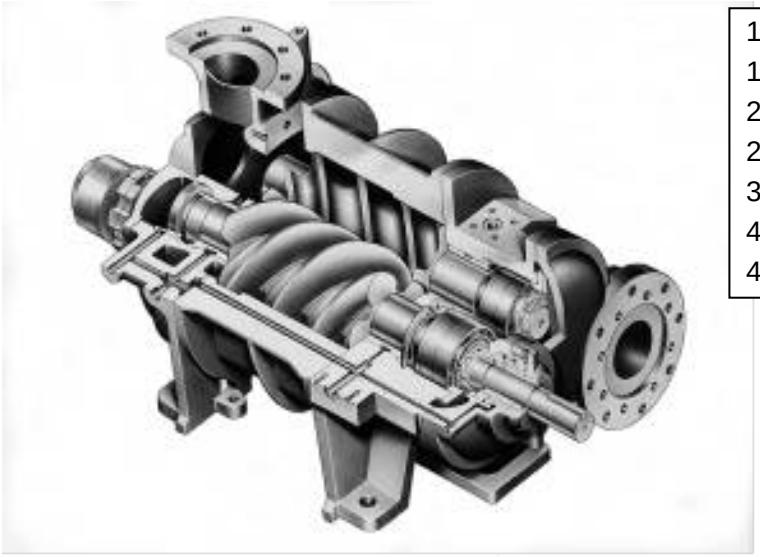
MYCOM

UD-series Screw Compressor Instruction Manual



125SUD/125LUD
160SUD/160MUD/160LUD
200SUD/200MUD/200LUD
250SUD/250MUD/250LUD
320SUD/320MUD/320LUD/320LLUD
400SUD/400MUD/400LUD/400LLUD/
400XLUD

CAUTION

Read this manual carefully and thoroughly before operating, maintaining or inspecting this product. It is important to fully comprehend the contents of this manual. 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.

MYCOM MAYEKAWA MFG. CO., LTD.
3-14-15 Botan Koto-ku, Tokyo 135-8482, Japan

Preface

Thank you for purchasing the MYCOM UD-series/screw compressor (hereinafter referred to as "this product").

This instruction manual (hereinafter referred to as "this manual") describes safety information, operational and detailed maintenance procedures for safe and effective use of this product、It is applicable to the following compressor types

125SUD, 125LUD, 160SUD, 160MUD, 160LUD, 200SUD, 200MUD, 200LUD, 250SUD, 250MUD, 250LUD, 320SUD, 320MUD, 320LUD, 400SUD, 400MUD, 400LUD, 400LLUD, 400XLUD

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

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

Revision History

Title of Instruction Manual		Document No.	Date of Initial Issue
UD series Instruction Manual		2200X2JE-MY-S2-N_2020.09.	September, 2020
Rev. No.	**Issue Date**	**Revision Details**	**Prepared/Approved by**
00	Sep. 03, 2020	Completely revised by re-issuing as electronic version and Document number change	Takita/ Muta

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, MAEKAWA will repair this product or replace parts without any charges.

The warranty period is “12 months from factory shipment of this product”. However, if any separate agreement has been concluded, such an agreement will have the priority in principle.

Disclaimer Clauses (Exclusion of Warranty Clauses)

Please note that we disclaim any responsibility for malfunction and/or damage to this product in case of the following incidents:.

- Malfunction or damage of this product caused by force majeure such as windstorm, intense rainfall, flood, tidal wave, earthquake, land subsidence, thunderbolt, fire, etc.
- Malfunction, damage, or defect to this product due to abuse or misuse such as storing this product outdoors or in hot and humid locations, operation with excessive liquid flow-back and start-and-stop.
- Malfunction or damage caused by devices or equipment not provided by MAYEKAWA including operation control methods of those devices or equipment.
- Malfunction or damage due to operation of this product outside the operation limits as described in this manual.
- Malfunction or damage caused by the usage of refrigerants, gases, and/or lubricants which are not approved by MAYEKAWA for this product as described in this manual.
- Malfunction or damage caused by maintenance or inspection procedures which are not recommended by MAYEKAWA.
- Malfunction or damage caused by parts which are not MAYEKAWA genuine.
- Malfunction or damage caused by parts which are not MAYEKAWA genuine.
- MAEKAWA shall not be liable to buyer for any incidental, indirect, special or consequential damages that buyer may suffer in relation to this product.

Important Information

Intended Use of this Product

This product is a screw compressor intended use for freezing and refrigeration.

Do not use this product for any other purposes for which it is not intended or deviate from the specifications which are described in Chapter 2, Article 2.3 “Compressor Specifications”.

The maintenance service should be performed according to the procedures described in this manual. Always pay attention to perform the works in a safe manner and working environment.

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 followed to ensure proper use of this product. However, the warnings in this manual and safety labels on this product are not all inclusive. When operating the product, pay extreme caution on personnel safety as well as on items described in this manual or required by common safety practice.

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” is a safety procedure to make sure that machines or equipment are property shut off and not able to be started up again by locking the power source to them.

Lockout is not just simply turning off the switches to stop the power supply, but includes immobilizing them with a key or similar device to prevent unauthorized access.

Lockout devices are devices such as keys, covers, and latches, to immobilize and shut-off switches, valves, opening and closing levers, etc.

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

“Tag-out” means to clearly indicate that a device is in lockout and that operation of the device is

prohibited. The sole purpose of the tag plates such as prohibition of operation or commissioning is to warn others that it is prohibited to operate the locked out product. It should always be accompanied by a suitable lockout device to make operation impossible.

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 who have been trained in the potential danger and its avoidance relevant to 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.

During maintenance work, make sure that the power supply on the power source side is shut off and perform lockout/tagout to prevent the product from being accidentally turned on.

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. For each sight of MAYEKAWA, refer to following URL. http://www.mayekawa.com/about/network/
- 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.
- In the event that this product or the compressor package is resold, don’t forget to supply this manual together with the product.

Construction of this Manual

Title of section and chapter	Description details
Preface	Describes the outline of this manual and how to read it.
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.

Title of section and chapter	Description details
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.

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Chapter 1 Safety

1.1 Observation/Prevention

1.1.1 Observance (Do's)

Do’s on Operation

- The controller protects this product based on the sensor output values.
- Make sure that all necessary safety devices are installed and that their control values are set correctly to assure proper and safe operation.
- Inspect the safety devices and the controller's protective functions on a regular base. Ensure that they perform according to the specifications.
- If the safety devices and the controller's protective functions do not work properly or the machine operates abnormally, immediately stop the operation and report the incident to your supervisor. Do not restart the machine until the supervisor determines the machine’s safety and provides proper instructions for a safe restart of the compressor.
- If the machine stops due to unknown reasons, immediately inform your supervisor. Do not restart the machine until the supervisor determines the machine’s safety and provides proper instructions for a safe restart of the compressor.
- Some types of refrigerants are toxic and/or generate bad odors which can cause oxygen deficiency. Make sure to ventilate the working area sufficiently to prevent asphyxiation.
- Some refrigerants and refrigeration compressor oils may be corrosive, decomposable, or toxic. Make sure to obtain their Safety Data Sheets (SDS) and strictly follow the mentioned 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.

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 use the lockout /tag-out procedure for the main motor, control and other devices before troubleshooting, setup, cleaning, maintaining, or inspecting this product. Also, make sure that the power is NOT turned on accidentally during the intervention.
- Always confirm that the pressure inside the packages for freezing, refrigerating and air conditioning is at atmospheric level before troubleshooting, setup, cleaning, maintaining or inspecting this system.
- Before troubleshooting, setup, cleaning, servicing or inspecting this product, apply the lockout / tag-out procedure to the liquid supply stop valves and valves in the upstream and downstream of the compressor so that they do not open accidentally during the work.
- Some types of refrigerants are toxic and/or generate bad odors which can cause oxygen deficiency. Make sure to ventilate the working area sufficiently to prevent asphyxiation.
- Some refrigerants and refrigerant oils may be corrosive, decomposable, or toxic. Make sure to obtain their Safety Data Sheets (SDS) and strictly follow the mentioned instructions.
- After working on the machine, always store the used tools at specified places and make sure that no tools are left in or around the machine.

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

- Prepare lockout / tag-out devices for the main breakers in the power lines to the main motor and control cabinet.
- By applying the lockout/tag-out procedure after turning off the power, you can prevent any other personnel from restoring the power inadvertently. It enhances the safety of the personnel working on the power supply equipment and the package.
- If there are any possibilities of danger during work (especially during cleaning, maintenance, inspection, or troubleshooting), turn the main motor and control power "OFF" and perform a lockout/tag-out procedure.
- Before working on the package for troubleshooting, setup, cleaning, maintenance and/or inspection, it is recommended to always perform a lockout/tag-out procedure to the main motor and control power. It is also recommended to check if the lockout/tag-out procedure has been performed according to good practice.
- Turn off the power and perform lockout/tag-out before working on 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.
- Upon completion of the work, the worker responsible for the lockout/tag-out must remove the lockout/tag-out device.

Do’s about Personal Protective Equipment(PPE)

- Prepare and use personal protective equipment which is in accordance with the area’s safety standards.
- Check the function of each PPE 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 for the protection against head injuries
- Empty your pockets to prevent objects from falling into the machine

Do’s about Handling of Hazardous and Toxic Substances

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

Do’s about the Handling Emergency Situations

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

Do’s about Waste Oil, Fluid, and Materials

- Disposal of refrigerant and waste oil from the compressor are subject to a number of environmental protection regulations. 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.

Other Do's

- Keep the floor around the freezing, refrigeration, and/or air conditioning packages clean and provide a safety aisle.
- Use the safety aisle only to move around the equipment. Keep the safety aisle free under all circumstances to ensure safe passage when required.
- 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 Prohibitions (Don'ts)

- Do not remove or relocate any safety devices, including electrical interfaces.
- Do not disable any safety device 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 activating the power.

1.2 Warnings

To alert workers about possible dangers, the following information is always provided with the compressor.

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

1.2.1 Types and Meanings of Warnings

This manual uses the following four types of warnings to emphasize potential hazards during operation or maintenance of the compressor:

Neglecting the warnings may cause damage to the compressor or its auxiliary equipment. Furthermore, it may lead to accidents, personal injury or even death. Be sure to always take the instructions in this manual into consideration.

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 section shows the different types of safety labels and their positions affixed on the compressor.

Always follow the warnings instructed on the safety label.

WARNING

- **Make sure to follow the instructions mentioned on the safety labels. Failure to do so may result in personal injury, death, or property damage.**
- **Do not smear, cover, or remove the safety labels.**
- **If the safety labels are damaged or missing, purchase new labels and install them onto their proper positions according to this manual.**

【POINT】

- Inform our service centers 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		

1.3 Residual Risks

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

Foresee appropriate countermeasures for hazardous sources applicable to 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	Coupling for motor and compressor	Entanglement caused by contact	Install coupling covers and prohibit opening 1)Avoid contact	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	2)Avoid contact 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.	3)Avoid contact 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.	4)Avoid contact 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	Solenoid valves and motorized valves mounted on compressor unit	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 5)Avoid contact Wear protective gear	Shut off each breaker, and shut off and lockout/tagout the control power Wear protective gear
H	electric components (oil heater, protective switch, etc.) mounted on compressor unit	Electric shock caused by live wiring contact and electrical leakage Burn caused by contact	Install terminal protective cover and prohibit opening 6)Avoid contact Wear protective gear	Shut off each breaker, and shut off and lockout/tagout the control power Wear protective gear Work in temperatures below 40 °C

	Danger source	Predicted hazard	Measures to be taken in operation	Measures to be taken when cleaning, inspecting, and replacing parts
I	Oil drains from compressor unit	Contact with hazard-ous substances caused by leakage and blow off Burn caused by contacting with high temperature fluid	Sufficient ventilation 7)Avoid contact 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	—

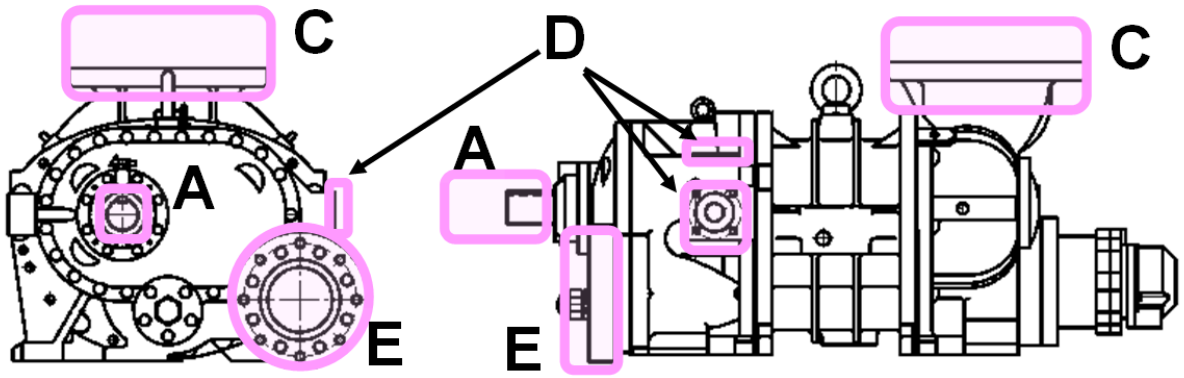


Figure 1-1 Hazardous Sources
(Compressor: V*D type i.e. discharge port facing sideways)

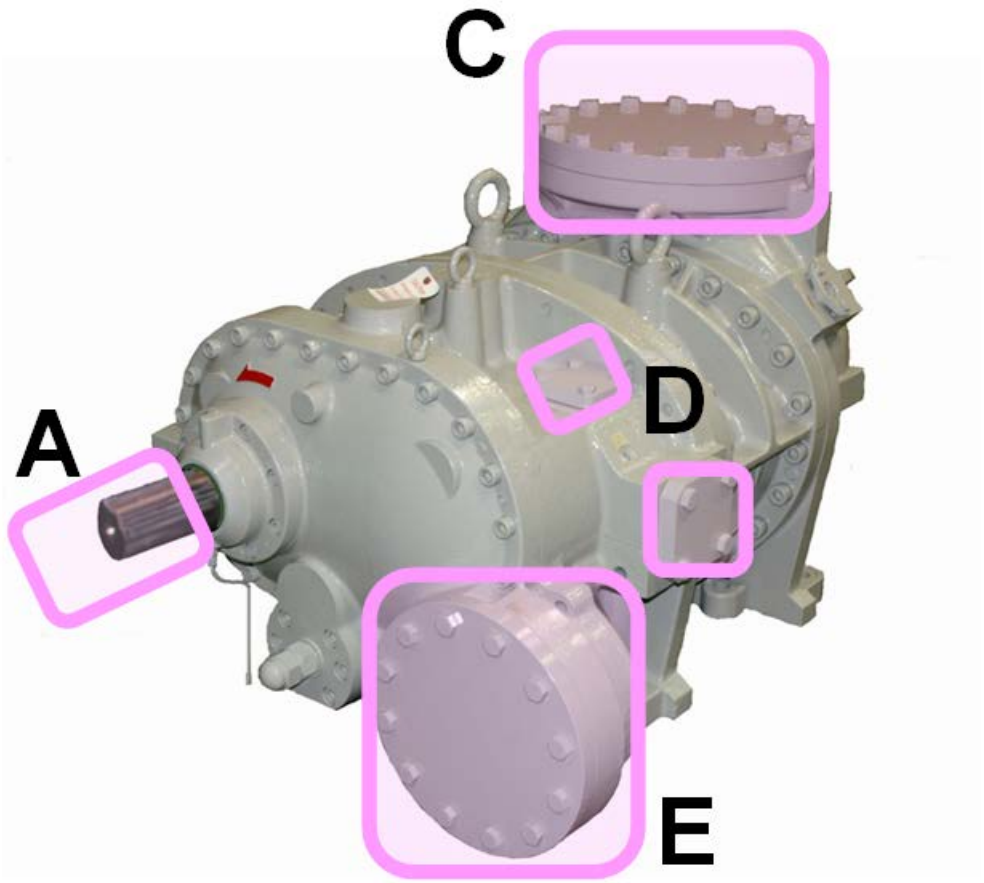


Figure 1-2 Hazardous Sources
(Compressor: V*D type)

1.4 Safety Devices

For safe use and protection of the compressor, make sure to foresee and install 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

- **Please inspect the operation of all safety protection devices before starting the compressor. If any kind of malfunction and/or wrong operation is detected, immediately take measures to resolve the hazardous situation. Operating the compressor with faulty safety devices can lead to dangerous situations for personnel and environment.**

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 activated before commissioning as well as periodically. For details about the inspection procedure and inspection cycle of the emergency stop buttons, please consult 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

Please consult the unit instruction manual for inspection procedures.

1.4.3 Compressor Protection Devices

■ Overview/Function/Purpose

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

■ Protection against 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 against 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 against abnormal High pressure

This function stops the compressor when the discharge pressure abnormally rises due to faulty operation of the compressor or insufficient 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 against abnormal 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 against 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 in the package lubrication piping after the oil filter.

■ Protection against 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 is used.

■ Protection against Low oil level

[Case 1 Differential pressure oil supply system]

This function continuously 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 against motor over-current

When motor current exceeds the set value (upper limit), it stops the compressor..

The current value is monitored by the controller.

■ Sensor positions and settings

Consult the package instruction manual for the positions and sensor settings for compressor protection. Make sure that the set values of the sensors do not exceed the operating limits indicated in Chapter 2, section 2.3.2 and Table 2-6 in this manual.

■ Inspection Method/Cycle

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

⚠ WARNING

- **Adjust and fine-tune the set values of all safety protection devices (controllers and sensors) during the commissioning.**

⚠ CAUTION

- **To test the functionality and operation of each safety device, use appropriate testing tools to ensure that all alarms and switches operate normally. Do not operate the compressor with all valves closed or in any other conditions which will lead to dangerous situations.**
- **It is highly recommended to investigate the cause when the safety protection devices detect low oil pressure, abnormal high discharge pressure or high oil filter differential pressure. The compressor should not be operated as long as the situation has been unresolved.**

Chapter 2 Compressor Specifications and Structure

2.1 Features of UD-series Screw Compressors

MYCOM UD-series Screw is a single-stage screw compressor classified into a rotary displacement pump type, and it consists of the following features.

■ High Efficiency

The UD-series has achieved high efficiency by applying "MYCOM original O-profile screw robes with the minimum leakage".

In addition, the UD-series provides economical operations due to its variable capacity control mechanism, which well follows the load variation.

■ Responding to a Wide Range Condition

In the UD-series compressors, there are six types of rotor lobe diameter, and each rotor has three types of shaft length (320 is 4 types, 400 is 5 types) as a standard specification.

With these features, the UD-series compressor is providing a high versatility that can satisfy a wide range of operation conditions required by different applications at the load side.

■ High Reliability

The UD-series has extended the long span continuous operation without compressor overhauling because of the following features:

Radial sleeve bearings specially designed with MYCOM's original technology, special high-load capacity thrust ball bearings, and a bellows type mechanical seal assembly.

Furthermore, from December 2014 Moriya factory production, the UD-series models have employed the new type unloader indicator assembly with the protection grade IP66 of the dust and water proof, at the same timing, have installed a durable conductive plastic potentiometer as the standard inner component of the indicator.

Because of this improvement, the UD-series has equipped with further high reliability.

■ Less Vibration/Noises

The O-profile rotors 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, which is engraved on the MODEL column of the compressor nameplate, is as follows.

[1]	[2]	[3]	[4]	[5]		[6]	[7]	[8]
F	**200**	**L**	**UD**		**-**	**M**		**E**

[1] Working fluid

NH_3, R134a, R404A, R507A

Propane, propylene, CO2

R407C, R407F, R410A

[2] Rotor diameter

Symbol
125
160
200
250
320
400

[3] Rotor length

Symbol	L/D	Remarks
S	1.10	
M	1.38	No setting for rotor diameter 125
L	1.65	
LL	1.95	Rotor diameter 320, 400
XL	2.20	Rotor diameter 400 only

[4] Discharge direction

Symbol	Discharge direction	Remarks
UD	Sideway	

[5] Short cut rotors

Symbol	Specification
No symbol	Standard
S	Short cut rotors

1) Shortcut rates of 5 %, 7 % and 11 % in principle.

2) It cannot be used at H port.

3) Systems that use Economizer and Sideload have an extremely high risk of reduced capacity.
4) When used with Liquid injection, the capacity may be reduced.
5) The notation for no symbol is left-justified.

[6] Discharge port

Symbol	Supplement
H	Vi = 5.80
M	Vi = 3.65
L	Vi = 2.63
KL	Vi = 2.20
JL	Vi = 2.00
FK	Vi = 1.80

1) KL, JL and FK are special ports.
2) For two-letter symbols,
First letter: Slide valve, second letter : Bearing head port.

[7] Booster specifications

Symbol	Specification
No symbol	Standard
B	Booster specifications

1) The notation for no symbol is left-justified.

[8] Economizer port, Liquid injection port

Symbol	Economizer port	Liquid injection port
No symbol	no port	no port
E	with port	no port
I	no port	with port
X	with port	with port

1) X includes I2 ports. However, No setting for rotor diameter 400.
2) The notation for no symbol is left-justified.

Refrigerant Auxiliary Symbols

In the past, in this series, "2" was added to the model name (left side of "-") for R22 application, but currently not added.

Example: Conventional F200LUD2, Currently F200LUD

2.3 Compressor Specifications

2.3.1 Standard Specifications

Table 2-1 UD-Series 125

Items			125		160			200		
			LUD	SUD	LUD	MUD	SUD	LUD	MUD	SUD
Capacity control (actual load)		%	10 ～ 100							
Direction of rotation		—	CCW seen from the motor							
Theoretical displacement	@ 3550 min^{-1}	m^3/h	356	237	749	624	499	1460	1220	975
	@ 2950 min^{-1}	m^3/h	295	197	622	519	415	1210	1020	810

Table 2-2 UD-Series 250

Items			250			320			
			LUD	MUD	SUD	LLUD	LUD	MUD	SUD
Capacity control (actual load)		%	10 ～ 100						
Direction of rotation		—	CCW seen from the motor						
Theoretical displacement	@ 3550 min^{-1}	m^3/h	2840	2380	1900	6740	5700	4760	3820
	@ 2950 min^{-1}	m^3/h	2360	1980	1580	5600	4740	3960	3170

Table 2-3 UD-Series 400

Items			400				
			XLUD	LLUD	LUD	MUD	SUD
Capacity control (actual load)		%	30 ～ 100	20 ～ 100		10 ～ 100	
Direction of rotation		—	CCW seen from the motor				
Theoretical displacement	@ 3550 min^{-1}	m^3/h	15600	13800	11700	9800	7800
	@ 2950 min^{-1}	m^3/h	12900	11500	9700	8140	6480

2.3.2 Operation Limits

Table 2-4 Operation Limits of UD-series Screw Compressors

Item		Operation Limit
Maximum discharge pressure	MPa	1.96 (Other than 320LL, 400LL, 400XL)
		1.37（320LL,400LL,）
		0.60（400XL）
Maximum suction pressure	MPa	0.59
Minimum suction pressure	MPa	-0.080
Minimum differential pressure between discharge pressure and suction pressure	MPa	0.49
Maximum oil supply pressure	MPa	Forced oil supply
		Pd + 0.39
Minimum oil supply pressure	MPa	Forced oil supply
		Pd + 0.049
Maximum suction temperature	°C	85
Minimum suction temperature	°C	-60
Maximum discharge temperature	°C	90
Maximum oil supply temperature	°C	60
Minimum oil supply temperature	°C	30
Maximum M rotor rotation speed	min^{-1}	4500 (320*UD, 400*UD are 3600)
Minimum M rotor rotation speed	min^{-1}	1450
Applications		NH_3, R134a, R404A, R507A Propane, propylene, CO2 R407C, R407F, R410A, as same as J and gas compressor for other gases

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

Note 2: The oil supply pressure of the capacity control part (control hydraulic pressure of the unloader slide valve), the value of the forced oil supply pressure is applied.

Note 3: When it is required that pressure difference between Pd (discharge pressure) and Ps (suction pressure) should be not greater than 0.49 MPa, oil pump needs to be installed.

If a combination of "NH_3 + compatible oil (PN46)" is used for working fluid (refrigerant) and lubricating oil, oil pump must be installed.

Note 4: Please contact us when using it for gas pressure.

CAUTION

- **If operation at partial load, which is not greater than 30% of the indicated load, is continued for a long time except when starting up the machine, abnormal noises or vibration may be generated. So avoid such operation.**
- **Repeated startup and stop in a short period is harmful not for the startup devices and electric machinery but also for the compressor itself. For information on the start/stop limitations, refer to each instruction manual. Wait at least 15 minutes after stopping the compressor before restarting it.**

2.3.3 Outer Dimensions and Weight

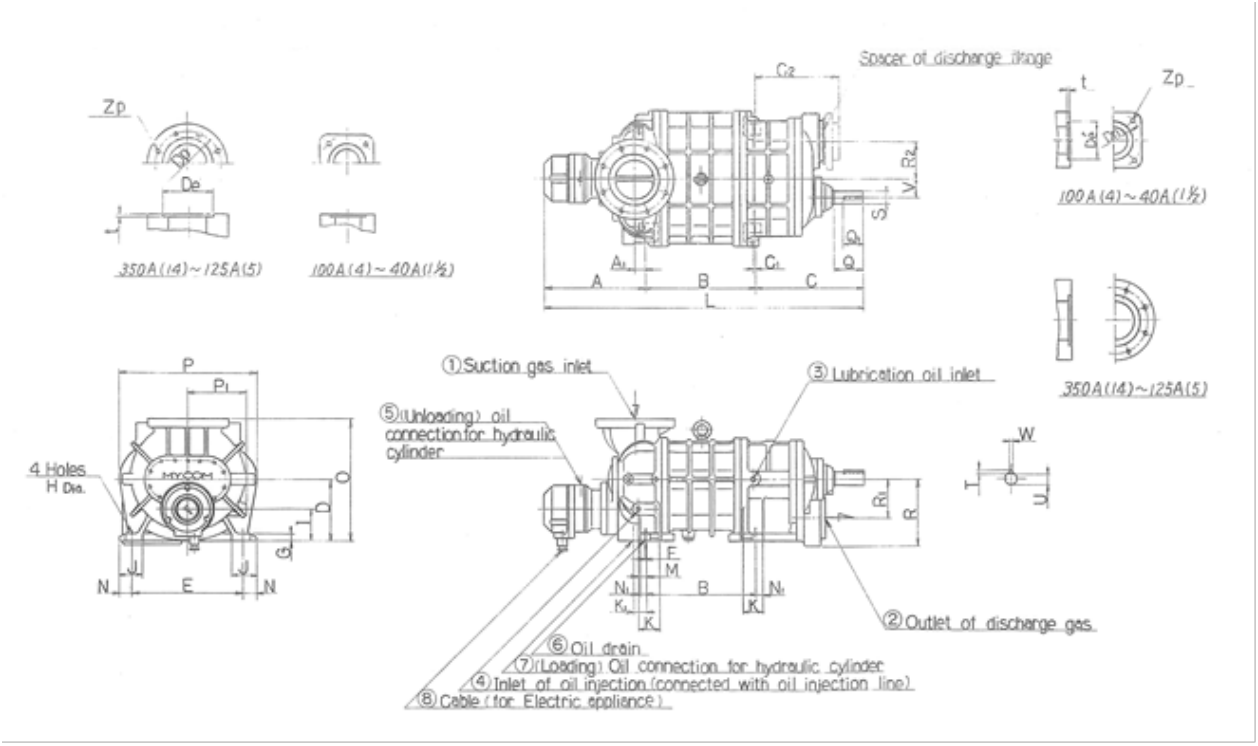


Figure 2-1 Outer Dimensions UD-Series

Table 2-5 Outer Dimensions (1/2)

(mm)

MODEL	A	A1	B	C	C1	C2	D	E	F	G
125SUD	286.5	20	240.5	320	10	236	170	310	10	25
125LUD			310.5							
160SUD	311	40.5	280	360	10	294	210	370	2	25
160MUD	337		325							
160LUD	359		370							
200SUD	337	40.5	363	407	18	300.5	260	460	4.5	30
200MUD	367		420							
200LUD	393		475							
250SUD	397	80.5	430	470	10	366.5	320	580	5	40
250MUD	432		502							
250LUD	472		570							
320SUD	443	45.0	576	600	20	413.8	400	720	10	50
320MUD	491		664							
320LUD	540		751							
400S	595	57.5	1056	456	59	190	550	880	30	70
400M	646		1171							
400L	754		1279							
400LL	754		1401							
400XL										

MODEL	H	I	J	K	K1	L	M	N	N1	O
125SUD	φ19	90	72	75	27	847	5	32	30	335
125LUD						917				
160SUD	φ19	107.5	80	65	43	951	25.5	45	25	410
160MUD						1022				
160LUD						1089				
200SUD	φ23	132	100	95	60.5	1107	17.5	50	30	510
200MUD						1194				

200LUD						1275				
250SUD	φ23	160	110	100	75	1297	33.5	50	30	640
250MUD						1404				
250LUD						1518				
320SUD	φ33	198	155	145	70	1619	-	65	40	780
320MUD						1755				
320LUD						1891				
400S	φ39	294	210	200(S) 304(D)	105	2107	85	90	140	1050
400M						2273				
400L						2489				
400LL						2611				
400XL										

MODEL	P	P1	Q	Q1	R	S	T	U	V	W
125SUD	380	143	100	55	162.5	φ38 0 -0.016	8	33.5	50	10 +0.022 0
125LUD										
160SUD	460	188	100	75	225	φ45 +0.011 -0.005	8	40.5	64	12 +0.027 0
160MUD										
160LUD										
200SUD	560	225	110	90	280	φ55 +0.012 -0.007	100	50	80	15 +0.027 0
200MUD										
200LUD										
250SUD	700	280	110	100	335	φ67 +0.012 -0.007	12	61	100	18 +0.027 0
250MUD										
250LUD										
320SUD	890	P2 351	156	130	436	φ85 ±0.011	16	77	126	24 +0.033 0
320MUD										
320LUD										
400S	1290	590	176	170	550	φ110 ±0.011	18	99	160	32 0 -0.062
400M										
400L										
400LL										
400XL										

MODEL	R1	R2
125SUD	90.5	145
125LUD		
160SUD	130	125
160MUD		
160LUD		
200SUD	143	240
200MUD		
200LUD		
250SUD	186	290
250MUD		
250LUD		
320SUD	240	360
320MUD		
320LUD		
400S	285	
400M		
400L		
400LL		
400XL		

Note) Please refer to the outer dimension drawings for details.

Table 2-6 Weight

（kg）

MODEL	FC300	
	Current weight	Actual weight
125SUD	200	220
125LUD	220	240
160SUD	320	355
160MUD	360	400
160LUD	400	440
200SUD	600	660
200MUD	650	720
200LUD	700	770
250SUD	1060	1170
250MUD	1140	1260
250LUD	1200	1320
320SUD	2030	2240
320MUD	2250	2480
320LUD	2400	2640
320LLUD	3110	3430
400SUD	5310	5520
400MUD	6160	6420
400LUD	7010	7320
400LLUD	7810	8170
400XLUD	-	8880

Note 1：Cast iron casings from 160 to 320*UD were discontinued in 2010.
Note 2：This weight does not include the weight of the flange.

2.4 Compressor Structure and Mechanism

2.4.1 Overview of UD-series Screw Compressor

UD-series Screw Compressors are rotary compressors falling into the category of the positive displacement compressor. The compressor sucks refrigerant gas into a cavity, gradually reduces the volume of the cavity, and discharge the refrigerant as a high-pressure gas. More specifically, a sealed cavity is formed by a casing and a pair of intermeshing rotors (called the male = M and female = F rotors) in the casing. The rotors are different in lead and number of screw lobes. The volume of the sealed cavity gets reduced as the rotors rotate. The gas trapped in the cavity is thus compressed before it is discharged.

In the UD-series, the robe profile of the rotor also adopts an O profile with little leakage to improve compression efficiency. In addition, the UD-series compressors employ O-profile screw lobes for the rotors, which minimize leaks and thus enhance the compression efficiency.

【POINT】

- For names and positions of each part of the compressor, refer to Section 7.1 "Exploded Views, Sectional Views ", and Section 7.2 "Parts Configuration Table" in this manual Chapter 7.

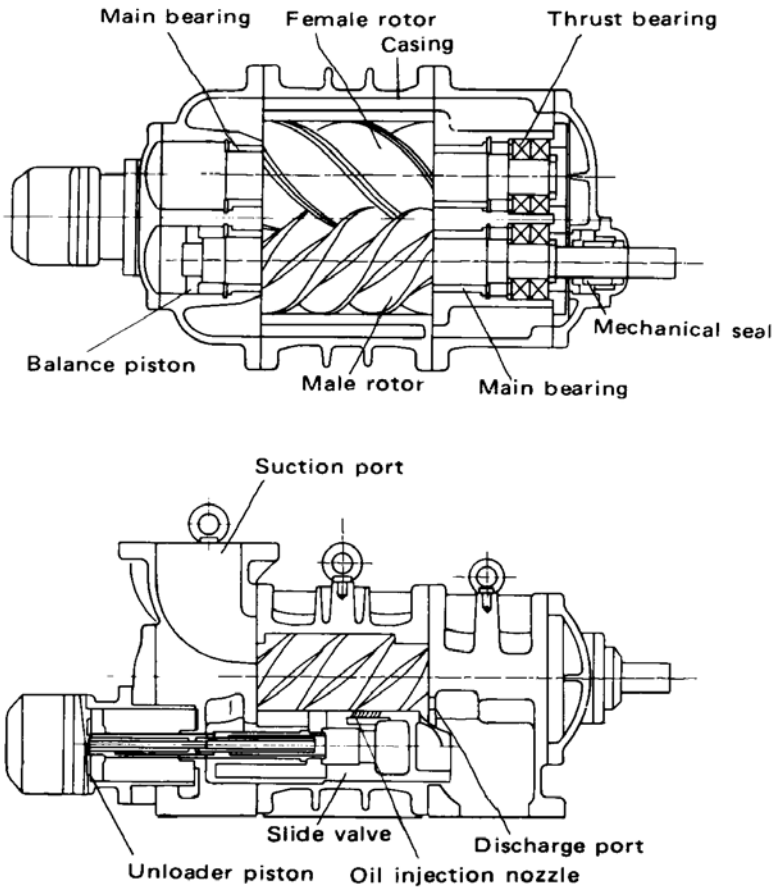


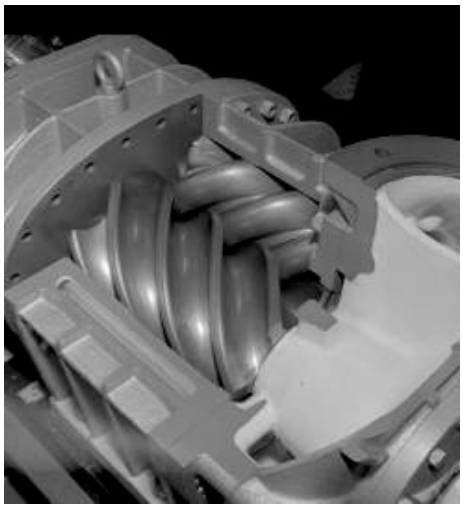
Figure 2-4 Compressor Structure

2.4.2 Refrigerant Gas Compression Mechanism

Inside the main rotor casing, there are the M rotor (number of screw lobes: 4) and F rotor (number of screw lobes: 6), intermeshing and rotating in the opposing directions each other. Together with the rotor casing, these two rotors constitute the essential elements of the compressor for sucking and compressing the refrigerant gas.

The M rotor is directly coupled to a two-phase electric motor and driven at a standard speed of 2950 min^{-1} (with a 50 Hz power supply) or 3600 min^{-1} (with a 60 Hz power supply). If necessary, the speed may be changed using an inverter or a gear set.

One end of each rotor constitutes the gas suction end, while the other end the compressed gas discharge end. While the rotors are rotating over a certain angular range, their suction ends open the suction port; the suction ends close the port while the rotors are rotating over another angular range. This is also true with the discharge ends and the discharge port (see Figure 2-5).



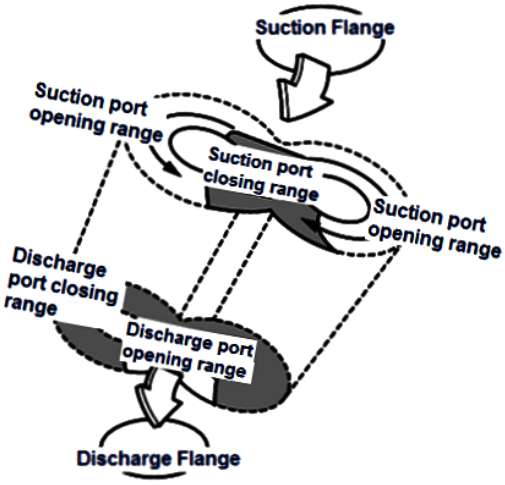
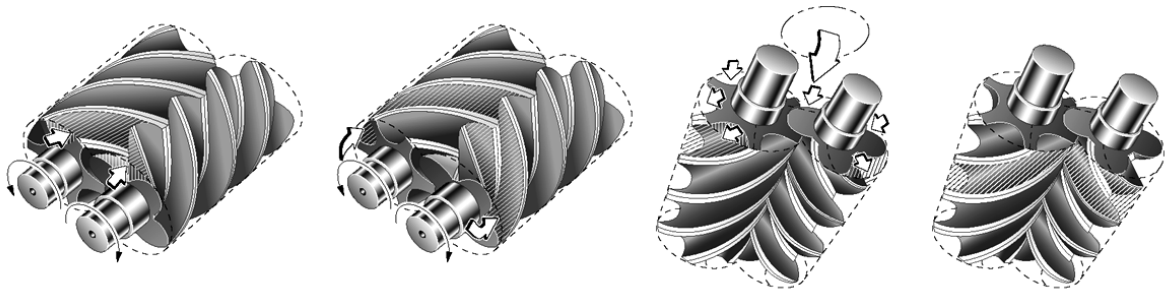


Figure 2-5 Suction and Discharge Port

Gas Suction Phase

As shown in Figure 2-8, the rotors with different tooth profiles are engaged. As the rotors turn, the volume between the M and F rotor tooth profiles and the compressor casing gradually increases starting from the suction side.

As the rotation continues, at a certain point when the volume reaches its maximum, the rotors isolate the gas (volume), which is enclosed by the rotors and the compressor casing, from the suction port and then continues rotation.



(1) Gas Suction Started | **(2) Gas Suction in Progress** | **(3) Gas Suction Phase about to End** | **(4) Suction Port Closed**

Figure 2-6 Gas Suction Phase

Compression Phase

As the rotors rotate further, the volume between the rotor lobes and grooves decreases while the sealing line moves toward the discharge side, which compresses the trapped refrigerant gas.

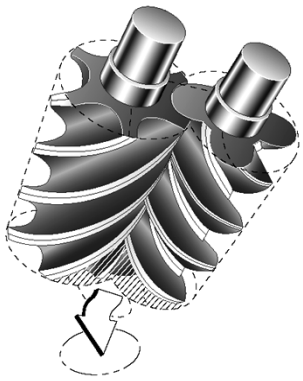


Figure 2-7 Compression Phase

Discharge Phase

The volume between the rotor lobes and grooves decreases to a level predetermined by the discharge port. With the rotations of the rotors, the compressed refrigerant gas is pushed out to the discharge port.

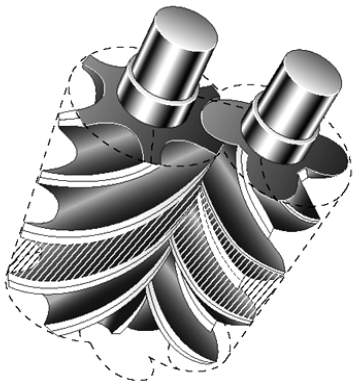


Figure 2-8 Discharge Phase

2.4.3 Internal Volume Ratio Vi

What is the Internal Volume Ratio Vi ?

In the case of reciprocating compressors, the refrigerant compression capacity is controlled by setting the pressure attained by piston displacement to an optimum level for the intended application.

With screw compressors, on the other hand, the compression capacity is controlled by setting the extent to which the volume of the sucked refrigerant gas is to be reduced. In other words, the compression capacity control applied to the screw compressor is a volumetric ratio control.

This volumetric ratio is called the 'internal volume ratio Vi' and defined by the following formula:

$$\mathbf{Vi} = \frac{\textbf{Volume of suction refrigerant gas just before start of compression}}{\textbf{Volume of refrigerant gas just before opening of discharge port}}$$

The Vi value is fixed at 2.63, 3.65, or 5.80 for MYCOM UD-series compressor; compressors with Vi at 2.63 are called the L-port compressors, those with Vi at 3.65 are called the M-port compressors, and those with Vi at 5.80 are called the H-port compressors.

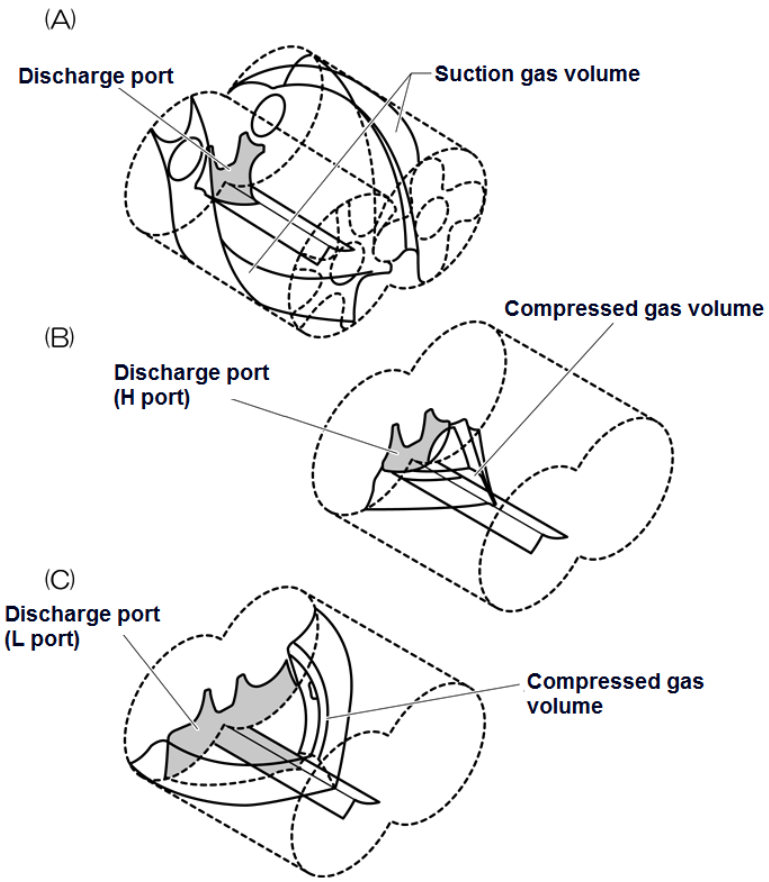


Figure 2-9 Internal Volume Ratio Vi

Why the Vi Needs to Be Chosen?

[1] You ca set the Vi that is suitable for use refrigerant.
Internal volume ratio Vi is expressed as follows with the compression ratio.

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

Pd: discharge pressure, Ps: suction pressure,
κ: ratio of specific heats (a constant specific to each refrigerant).

As seen from the formula, the Vi corresponding to a certain pressure ratio varies with the type of refrigerant gas.

[2] You can operate the compressor most efficiently under varying conditions.

Compressors of the same model will be used for a variety of applications whose load conditions are different, e.g. air conditioning, cold storage, and freezing. The compressor, however, can be operated most efficiently when the Vi is matched with the load condition.

For example, if a conventional M port compressor with the fixed Vi is used for a low compression ratio application (an application with small difference between suction and discharge pressures), a pressure higher than the necessary pressure will be reached before the discharge port opens as shown in the lower right graph of Figure 2-13 in next page. This means that power will be used wastefully for unneeded compression.

Conversely, if the same compressor is used for a high compression-ratio application (an application with large difference between suction and discharge pressures), the discharge port will open before the refrigerant gas pressure has risen to the necessary level. This would cause the refrigerant gas in the outlet piping to flow back through the discharge port as shown in the lower left graph of Figure 2-13 unless the flowing-back gas is overcome by driving the compressor using extra power.

In summary, the greatest benefit provided by properly setting the Vi value is that the rotor driving power (brake horse power) is made optimum for the load. The refrigeration capacity generally changes little even if the Vi is varied. However, the efficiency of the brake horse power becomes the maximum and the loss of power is minimized if the Vi is optimally adjusted.

The performance curves in below Figure 2-12 show the relationship between the refrigeration capacity and the brake horse power. The curves indicated by thick solid lines in the graph represent the brake horse powers most efficient for achieving the specific refrigerating capacities.

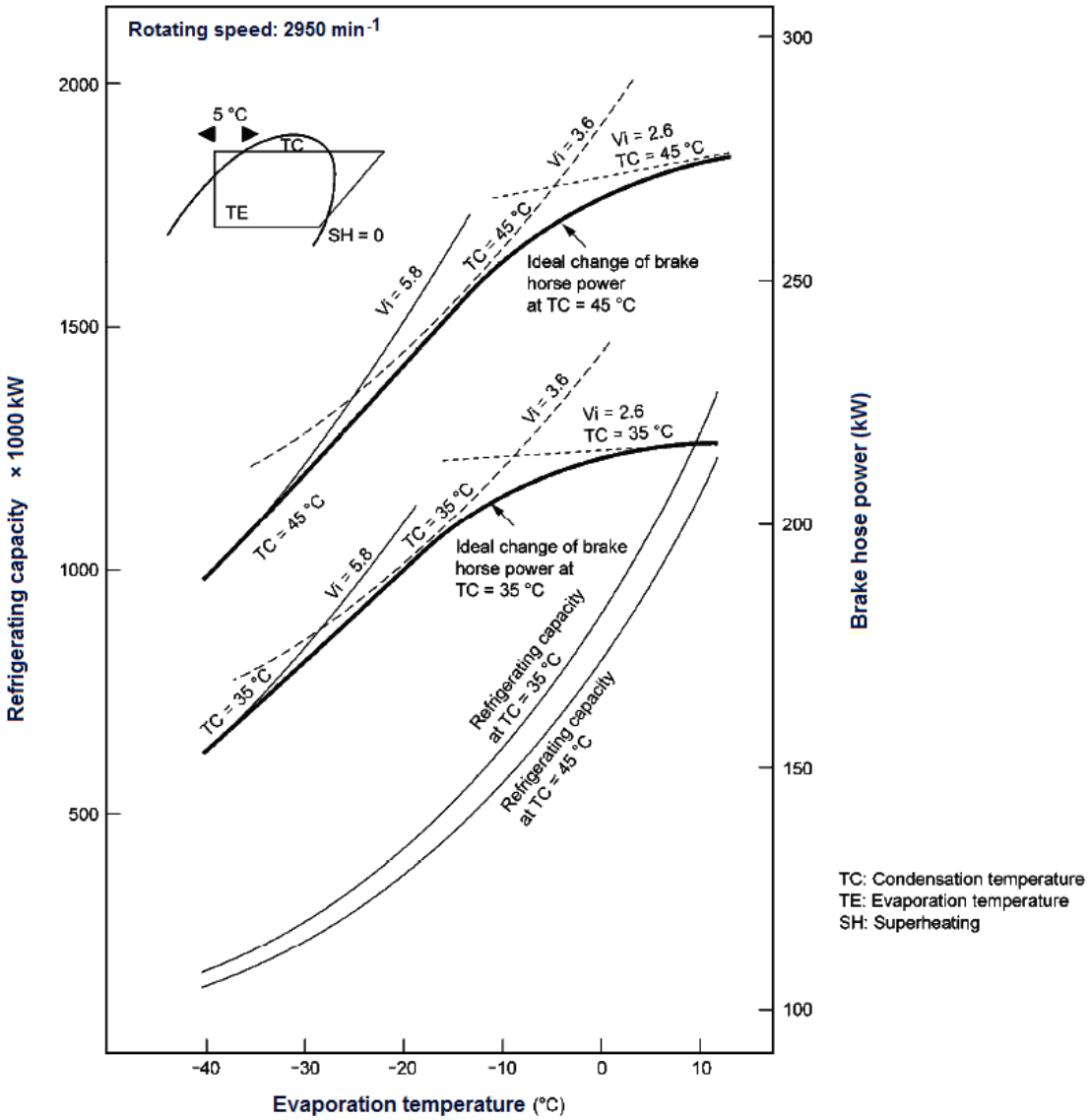
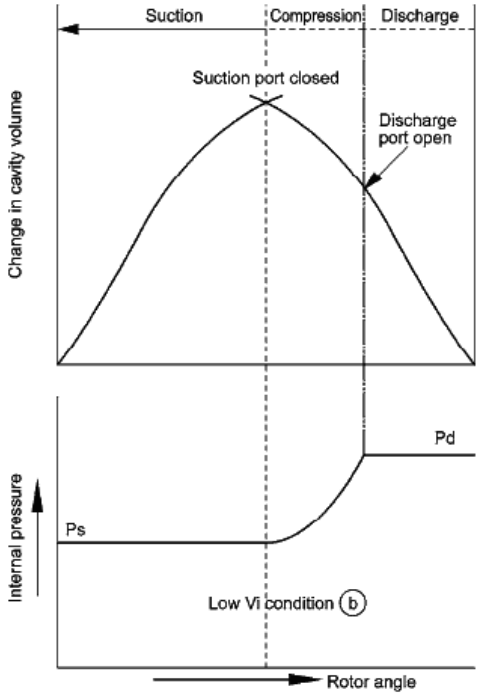
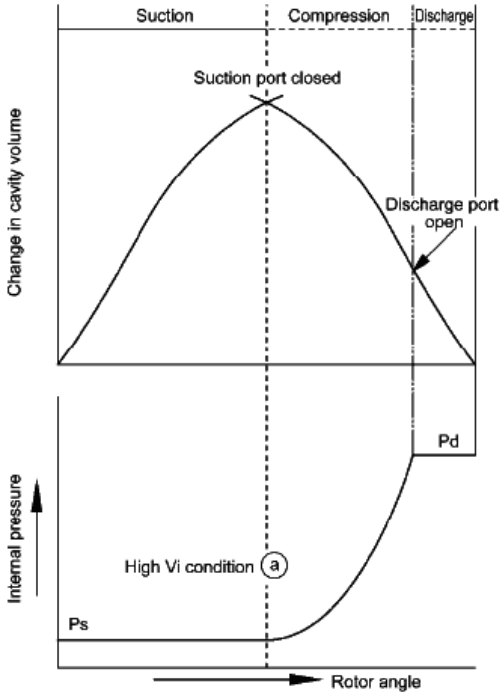


Figure 2-12 Refrigeration Capacity of Screw Compressor

(A) Properly adapted Vi to load condition

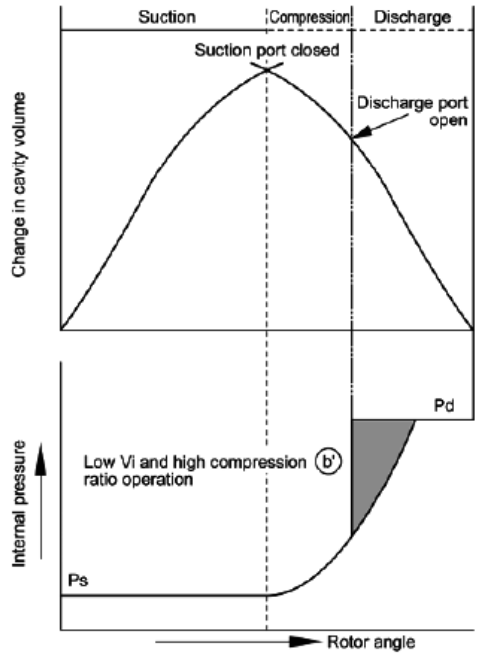


Necessary compression ratio and Vi are both low

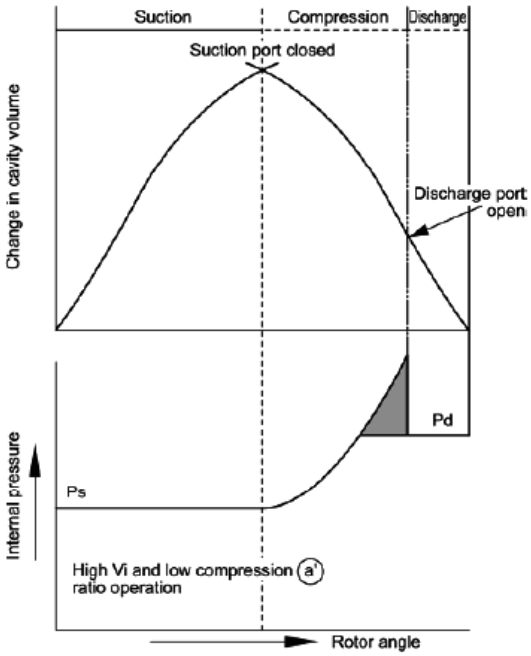


Necessary compression ratio and Vi are both high

(B) Improperly adapted Vi to load condition



Too low Vi compared with necessary compression ratio



Too high Vi compared with necessary compression ratio

Figure 2-13 Proper and Improper Adaptation of Vi to Load Condition

2.4.4 Bearings and Balance Piston

The M rotor and F rotor are supported at their both ends by the side bearings in the suction cover and the main bearings in the bearing head. These bearings use sleeve type white metal lined bearings.

In addition, the thrust bearings located outside the main bearings support the thrust loads working on the rotors, which result from both the rotation of the rotors and the difference in refrigerant gas pressure that takes place during the compression process. For the thrust bearing, UD-series compressors use the angular contact ball bearing.

In particular, because the M rotor is a kind of helical gear and also because the thrust force produced by discharge pressure is larger than that for F rotor. To reduce the load acting on the thrust bearing of the male rotor, a hydraulic piston (balance piston is provided in the suction cover.

2.4.5 Shaft Seal

To prevent refrigerant gas leakage, a reliable mechanical seal assembly is used for the shaft seal of the male rotor, which is the compressor's drive shaft.

Mechanical seal assembly is mainly composed of "rotating ring" installed on the rotor shaft and "stationary ring" installed in the seal cover. Rotating ring rotates with the shaft, and slides each other with the stationary ring while maintaining a micron class gap. The sliding each other place is called as the sliding surface.

For example, the Balance Bellow Single Seal which is currently used as standard seal, employs a stationary ring (mating ring) made of special cast steel, a rotating ring made from carbon, and O-rings for the packing.

2.4.6 Capacity Control

The unloader slide valve, which is activated hydraulically via the unloader cylinder and the unloader piston, automatically carries out capacity control (suction gas amount control) of each UD-series compressor.

The unloader indicator assembly is connected to the unloader cylinder via the indicator cam, allowing the indicator to indicate the positions of the unloader slide valve. The indicator cam has a spiral groove, in which the guide pin implanted in the unloader slide valve push rod is movably inserted. As this pin and cam combination converts a linear displacement of the unloader slide valve into an angular displacement, the pointer of the indicator indicates the position of the slide valve.

In addition to the visual reading of the position of the unloader slide valve, the unloader indicator assembly can also provide the following electric signals for output to external devices: ON/OFF signals produced by the cam mechanism contacts and resistance signals produced by a potentiometer. Mechanisms

2.4.7 Oil Supply Route

Depending on applications, the UD-series compressors use either of the following types of oil supply system.

- **Forced oil supply system:**

  This system uses pump-pressurized oil for both the lubrication and capacity control purposes.

- **Differential pressure oil supply system:**

  This system supplies lubrication oil under the effect of the differential pressure, but uses pump pressurized oil as the capacity control oil and as the lubrication oil during startup of the compressor.

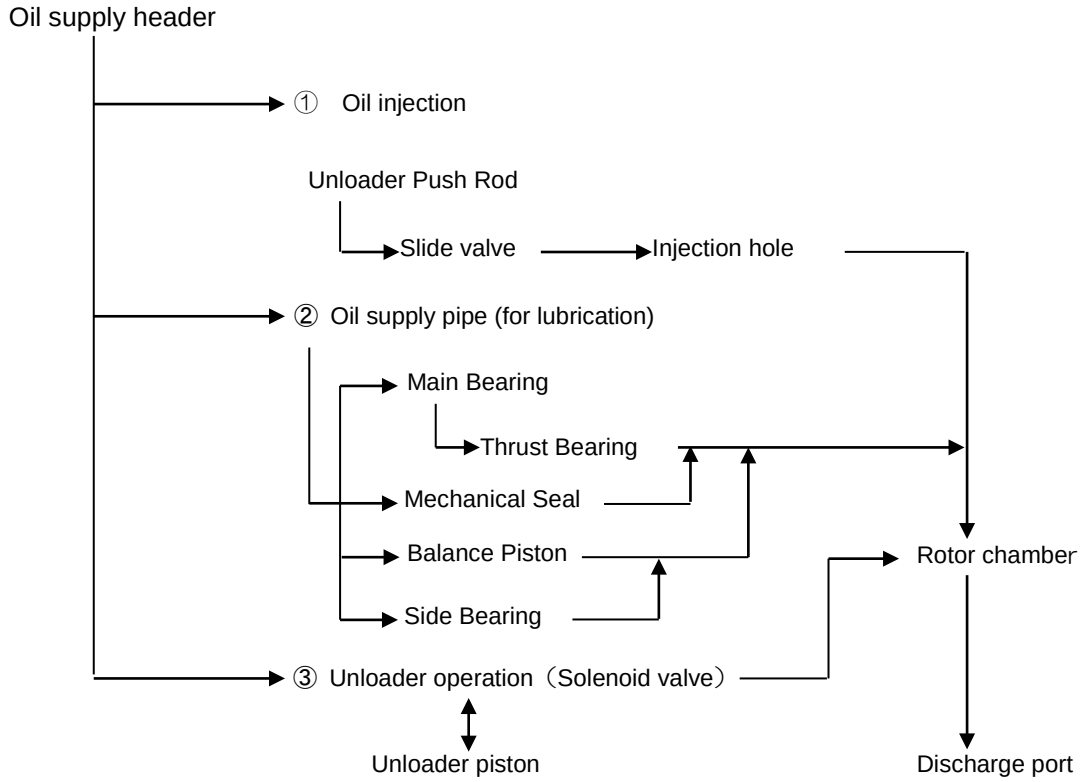


Figure 2-14 Oil Supply Route of Forced Oil Supply System

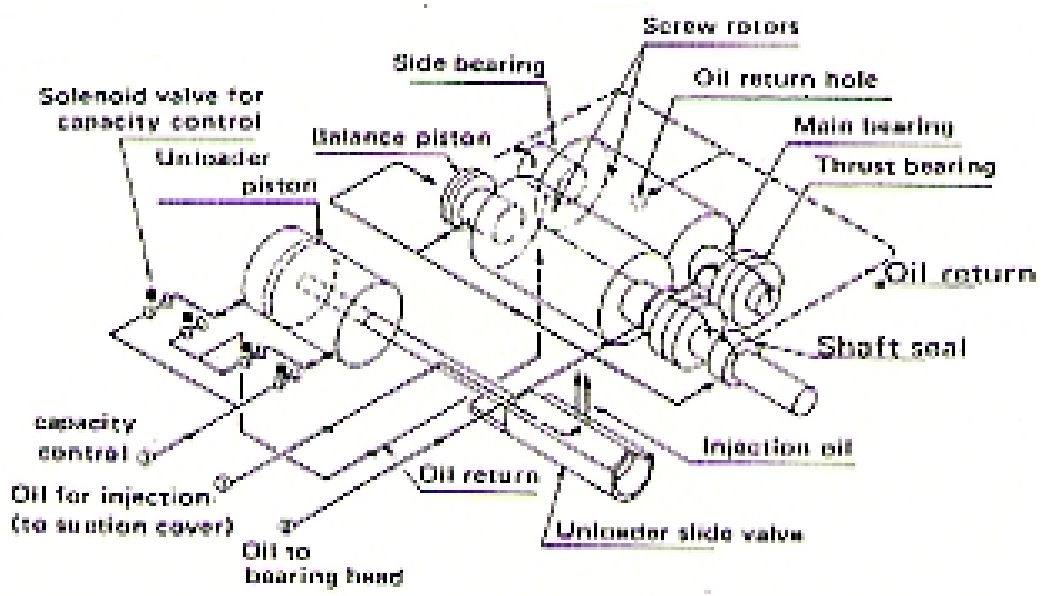


Figure 2-15 Lubricating oil flow inside the compressor

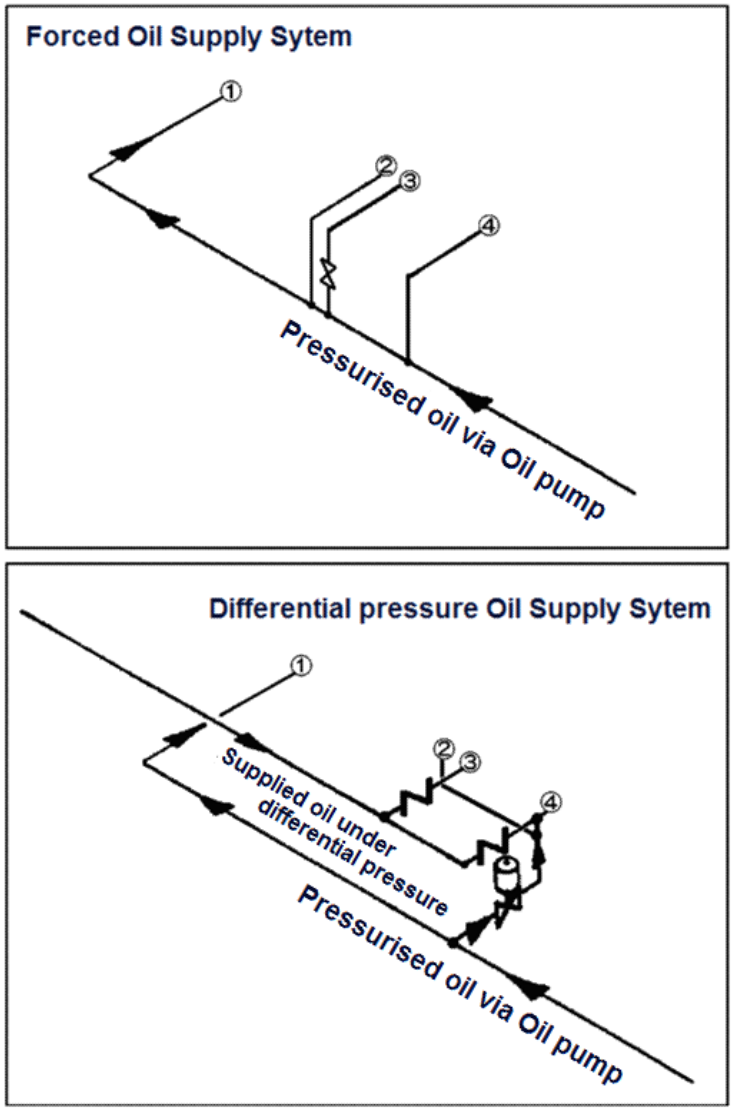


Figure 2-16 Oil Supply Route

Chapter 3 Installation

3.1 General Installation Precautions

【POINT】

- This chapter (Installation) assumes that the compressor is installed to a standard refrigeration / cold storage package unit.
  If the unit you are actually using is not the standard type refrigeration/cold storage package unit, prepare a proper installation manual by referring to the description in this chapter and paying due consideration to safety, before installing the compressor.
  If there are any questions, please contact our local sales offices or service centers.

- In some cases, it may be required that installation is performed by qualified personnel. Make sure that the work is performed by qualified personnel in compliance with local laws, ordinances and other regulations/requirements.
- Before installing the compressor, please read this chapter and related documents attentively and fully understand their contents.
- Electrical works should be performed only by electrical engineers.

3.2 Installation Works

3.2.1 Unpacking

Confirm whether a compressor does not have abnormality including the damage.

【POINT】

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

3.2.2 Storage

Perform the followings to store the compressor before installation.

- Store it indoors.
- Infuse nitrogen gas into the compressor and seal it. (Pressure: Approximately 0.15 Mpa)

3.2.3 Transportation

DANGER

- **Dropping of the lifted compressor may cause death or serious injury. Do not stand under the lifted compressor.**

1. At first, mass and dimensions of the compressor should be confirmed referring to Section 2.3.1 "Standard Specifications" and Section 2.3.3 "Outer Dimensions" in this manual Chapter 2.

For lifting the compressor within the safety limit, use lifting equipment and tools appropriate for the mass of the compressor.

2. Secure sufficient space for safe lifting.

3. Always check the wire ropes before using them. Thoroughly check the wire ropes for problems such as kinks, knots and broken strands. Do not perform lifting before confirming the safety of the wire ropes. If you cannot make a correct evaluation or judgment, entrust an expert to check.

4. To lift the compressor, attach the wire ropes to the appended eye bolts by using appropriate shackles and hooks.
Use the eye bolts only for lifting the compressor. Do not use the eye bolts when lifting the compressor together with additive equipment.

DANGER

- **The compressor eye bolts must not be used for lifting the package unit. To lift the unit, use the lifting chains provided around the base or other lifting means provided on the base.**

5. Check path of compressor installation to make sure it is free of obstacles in consideration of the compressor size.

6. Before lifting, check that the hook is located above the gravity center of the compressor.

7. Direct all the workers to stay clear of the work site before lifting.

8. Before lifting the compressor, alert all workers in area of dangers during lifting process by signal (such as calling at the beginning of the work or making a signal by hand). Do not lift the compressor unless the signals (such as calling out or hand signals) are completely understood by the workers at site.

9. Slowly wind up the wire ropes until immediately before the compressor leaves the ground.

10. Then, wind up the wire ropes a little further until the compressor is slightly up away from the ground. Check that the compressor is not tilted. If the compressor is tilted, return the compressor to the ground and correct the tilt by adjusting the wire ropes. After that, restart the lifting operation.

11. Be sure to lift up the compressor slowly. If it is lifted rapidly, it may damage the lifting tools such as wire ropes or a part of the compressor.

12. When the lifting work starts, observe to see if wire ropes and lifting tools are normal. Be sure that the compressor is not tilted.

13. When moving the lifted compressor, always use guiding ropes.

14. When moving the compressor, turn away workers from the movement direction and check safety.

15. Do not lift the compressor above the safety passage unless absolutely necessary.

16. Do not lower the compressor on the safety passage. Always keep the safety passage free of obstacles.

17. Remove any obstacles before lowering the compressor onto the ground. The compressor should not be tilted or unstable.

18. Before lowering the compressor, announce to the workers around the working area in advance.

19. When lowering the compressor onto two or more blocks, align the tops of blocks so that the compressor becomes stable horizontally on them.

20. Slowly lower the lifted compressor so that it is not damaged by shock.

3.2.4 Preparation for Installation

■ Installation Space

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

■ Illumination

Prepare illumination devices which allow easy operation, cleaning, maintenance, and inspection.

■ Ventilation

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

■ Connecting Port of Compressor

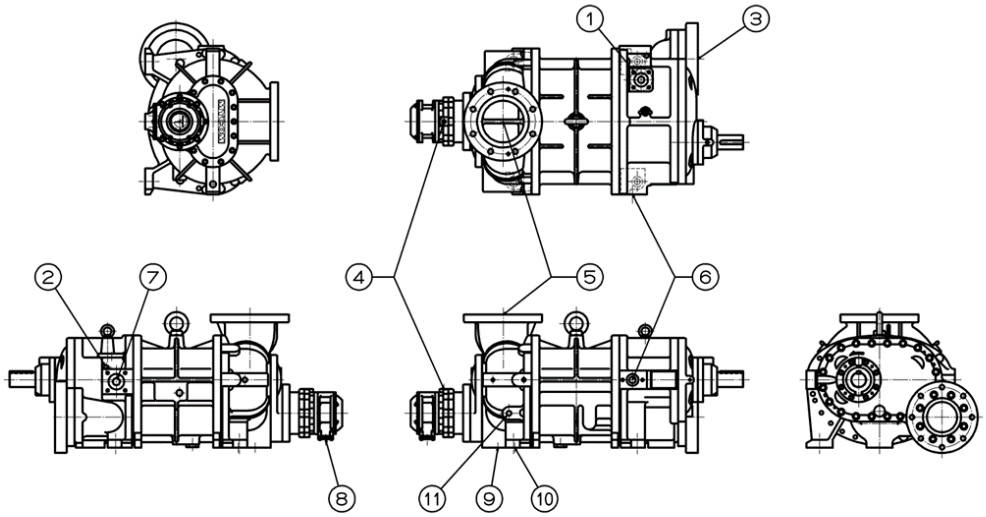


Table 3-1 Connecting Port of Compressor (125 – 320, Cast iron case)

Note 1：Cast iron casings from 160 to 320*UD were discontinued in 2010.

No.	Item	Rotor diameter				
		125	160	200	250	320
1	Connecting port for liquid injection1	MYK 10A	MYK 20A	MYK 25A	MYK 32A	MYK 50A
2	Connecting port for liquid injection2	Rc 1/4	Rc 3/8	Rc 1/2	Rc 1/2	Rc 3/4
3	Discharge gas outlet	MYK 65CD	MYK 100CD	MYK 125CD	MYK 150CD	MYK 200CD
4	Unloader control（Decrease）	Rc 1/4	Rc 1/4	Rc 3/8	Rc 3/8	Rc 3/8
5	Suction gas inlet	MYK 100A	MYK 125A	MYK 150A	MYK 250A	MYK 350A
6	Lubricating oil main supply port（journal）	Rc 3/8	Rc 1/2	MYK 20A	MYK 25A	MYK 40A
7	Economizer connecting port	MYK 15A	MYK 25A	MYK 32A	MYK 50A	MYK 80A
8	Control wiring connector for indicator	2-PF 3/4	2-PF 3/4	2-PF 3/4	2-PF 3/4	2-PF 3/4
9	Unloader control（Increase）	Rc 1/4	Rc 3/8	Rc 3/8	Rc 1/2	Rc 1/2
10	Oil drain port	Rc 3/8	Rc 3/8	Rc 1/2	Rc 1/2	Rc 1/2
11	Oil injection port	Rc 3/8	Rc 3/8	Rc 1/2	Rc 1/2	MYK 25A

Please check the figure for details.

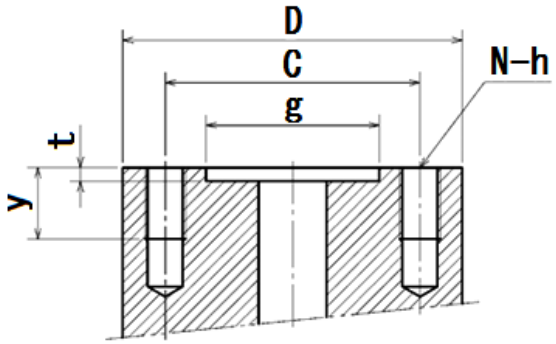


Figure 3-2 Dimensions of the MYK Flange Joint Part (Compressor)

	D	t	φg	φC	N-h	y
10A	56	4.5	37	61	2-M12×P1.75	18
15A	50	4.5	37	68	2-M12×P1.75	18
20A	110	4.5	45	76	2-M12×P1.75	18
□ 25A	91	4.5	52	83	4-M12×P1.75	18
□ 32A	98	4.5	60	95	4-M12×P1.75	18
□ 40A	108	4.5	68	108	4-M12×P1.75	22
□ 50A	120	4.5	84	116	4-M16×P2	24
□ 65CD	144	4.5	85	144	4-M16×P2	27
□ 80A	160	4.5	119	158	4-M20×P2.5	30
□ 100A	192	4.5	144	190	4-M22×P2.5	30
□ 100CD	190	4.5	111	190	4-M22×P2.5	33
125A	270	5	174	230	8-M20×P2.5	27
125CD	274	5	146	230	8-M20×P2.5	25
150A	300	5	199	248	8-M22×P2.5	30
150CD	298	5	176	248	8-M22×P2.5	35
200CD	392	5	234	330	12-M20×P2.5	40
250A	435	5	331	375	12-M24×P3	34
350A	540	5	422	480	16-M24×P3	40

Table 3-2 Connecting Port of Compressor (125 – 320, Cast steel case)

No.	Item	Rotor diameter				
		125	160	200	250	320
1	Connecting port for liquid injection 1					
2	Connecting port for liquid injection 2					
3	Discharge gas outlet（type D）	ANSI #300 3”	ANSI #300 3”	ANSI #300 5”	ANSI #300 6”	ANSI #300 8”
4	Unloader control（decrease）	NPT 1/4	NPT 1/4	NPT 3/8	NPT 3/8	NPT 3/8
5	Suction gas inlet	ANSI #300 4”	ANSI #300 5”	ANSI #300 6”	ANSI #300 10”	ANSI #300 14”
6	Lubricating oil main supply port（journal）	NPT 3/8	ANSI #300 1/2”	ANSI #300 3/4”	ANSI #300 1”	ANSI #300 1 1/2”
7	Economizer connecting port				ANSI #300 1 1/2”	
8	Control wiring connector for indicator	2-PF 3/4	2-PF 3/4	2-PF 3/4	2-PF 3/4	2-PF 3/4
9	Unloader control（increase）	NPT 1/4	NPT 3/8	NPT 3/8	NPT 1/2	NPT 1/2
10	Oil drain port	NPT 3/8	NPT 3/8	NPT 1/2	NPT 1/2	NPT 1/2
11	Oil injection port	NPT 3/8	NPT 3/8	ANSI #300 1/2”	ANSI #300 1/2”	ANSI #300 1”

・Please contact us for the blank size.

・It may differ from the above table. Please check the figure for details.

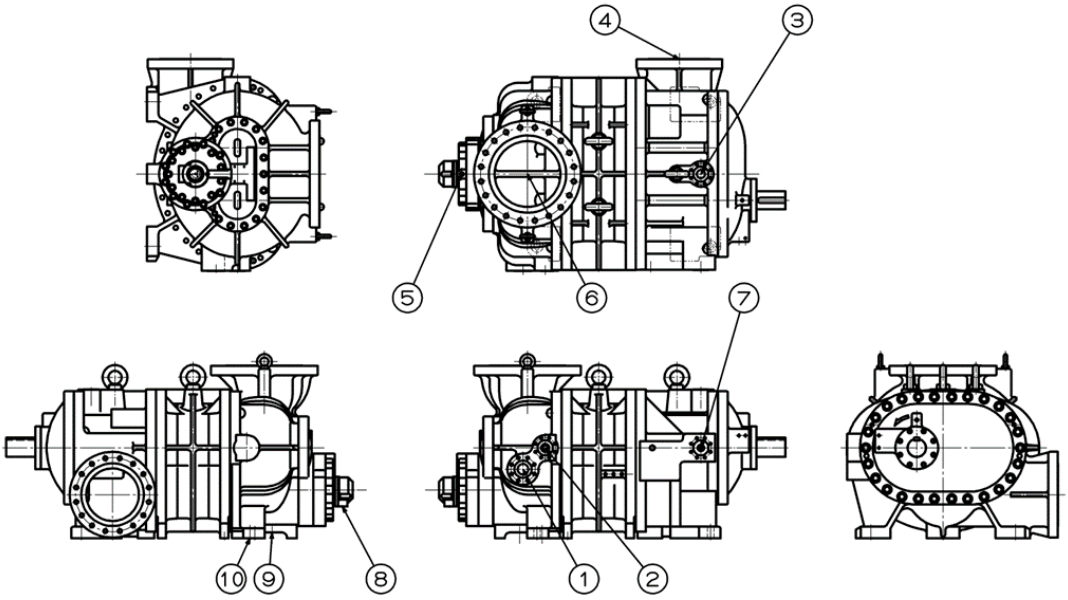


Table 3-3 Connecting Port of Compressor (400)

No.	Item	Size
1	Oil injection port	ANSI #300 2 1/2”
2	Lubricating oil main supply port（Side, Balance piston）	ANSI #300 2”
3	Lubricating oil main supply port（TPTB）	ANSI #300 2”
4	Discharge gas outlet	ANSI #300 12”
5	Unloader control（Decrease）	NPT 3/4
6	Suction gas inlet	ANSI #300 16”
7	Lubricating oil main supply port（Main, Seal）	ANSI #300 2”
8	Control wiring connector for indicator	2-PF 3/4
9	Unloader control（Increase）	NPT 3/4
10	Oil drain port	ANSI #300 1”

3.2.5 Installation

Placement

Check that the surface of the package unit, where the compressor is to be installed, is even and horizontal. If it is uneven and non-horizontal, tightening the bolts may lead to compressor deformation, which may prevent normal operation.

Shaft Alignment between the Compressor and Driving Machine

DANGER

- **Turn off the main power and control power of the driving machine before shaft alignment work between the compressor and the driving machine. Be careful so that the power of instruments does not turn on during shaft alignment work. If the power turns on during shaft alignment work, the driving machine starts moving and there is a risk of being entangled with the rotating shaft.**
- **At the time of turning ON/OFF each electric power breaker, make sure to prevent electric shock.**

CAUTION

- **For shaft alignment work between the compressor and driving machine, use designated tools in normal condition. If a worn or damaged tool or a tool unsuitable for the work is used, there is a risk of being injured.**

In the case shaft alignment between this product and the driving machine, be sure that the deviations within the range shown in the Table 3-4. However, if alignment tolerance of the driving machine side is more stringent than Table 3-4, please adjust to the request within the allowable value of the driving machine side.

Table 3–4 Tolerance of Misalignment

	Tolerance
Offset	6/100 mm
Angularity	3/100 mm (reference: Φ100 mm)

The Figure 3-3 and 3-4 show how to measure offset and angularity when performing the centering of the shafts of the driving machine and this product using a dedicated hub, a dial gauge and a magnet stand.

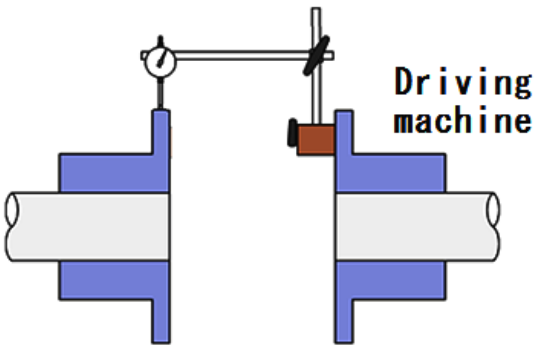


Figure 3-3 Measurement of Offset

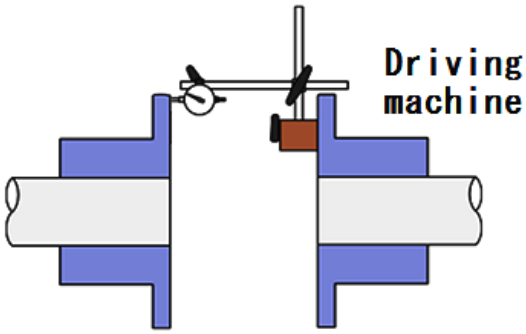


Figure 3-4 Measurement of Angularity

Piping Connection

■ Refrigerant Piping

Observe the following when connecting the refrigerant piping to the compressor.

- The compressor is one of the few devices installed within the package unit that have moving components. These moving components are adversely affected by foreign substances within the system (scale, dust, spatter, etc.). Therefore, when connecting the piping, do not allow any of such foreign substances to enter inside.
- Some compressors (mainly those for export) are charged with nitrogen gas to prevent rust. Be sure to release the pressure before starting piping work.
- Be sure not to allow moisture to enter the piping. There is a high probability that it will cause trouble after the start of operation. Be sure to assemble piping when it is dry.
- Improper piping may cause operating problems such as oil not returning to the compressor or liquid flow-backs.
- When connecting the piping to the compressor, use piping that is the same size as the compressor connection port. If the pipe size of the piping is smaller than the compressor connection port, the flow of lubricating oil or refrigerant will be obstructed leading to problems.
- Do not let the mass of the piping connected to the compressor applied onto flanges or joints. Be sure to prepare proper supports for piping.

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 be clogged just after commissioning. We recommend installing two oil filters in parallel. This will enable replacement of either filter during operation.

■ Oil Heater for Oil Separator

To preserve the temperature of the lubricating oil before starting the compressor, install an oil heater on the oil separator. Make sure to install a protection function (thermostat, or like) to prevent overheating.

■ Suction Strainer

When inter-soluble oil is used, the mesh size of suction strainer should be not less than 200 meshes. When non-miscible oil is used, it should be not less than 100 meshes.

For details about inter-soluble and non-inter-soluble oils, see Section 4.1 "Lubricating Oil (Refrigerant Oil)" in this manual.

During the commissioning, small particles and scale may come from the system. We recommend installing a finer filter temporarily.

■ Compressor Protective Devices (Safety Devices)

To protect the compressor, install the necessary protective devices as described in Section 1.4.3 "Compressor Protective Devices" in this manual.

3.2.6 Airtightness Test

Perform an airtightness test on the package unit before starting commissioning. To prevent water entry in the package unit, use nitrogen gas or dry air for the airtightness test.

3.2.7 Vacuuming

CAUTION

- **Do not turn the compressor rotor shaft during vacuuming.**

Vacuuming involves discharging the air in the unit before the refrigerant and oil are charged in the unit. Always use a vacuum pump when vacuuming.

3.2.8 Lubricating Oil Charge

CAUTION

- **TO select the lubricating oil to be used, refer to Section 4. "Lubricating Oil (Refrigerant Oil)" in this manual.**
- **When refilling lubricating oil, ensure that it is clean and does not contain foreign matters.**
- **Be careful that air and water are not mixed in when refilling.**
- **To ensure that the lubricating oil does not absorb air moisture, keep it indoors in an airtight container until use.**

Initial Charge of Lubricating Oil

Depending on the package unit configuration and operating condition, specify the procedure, method and amount of the initial charge of lubricating oil, and make sure to provide users of this product with such information.

In determining the procedure and work procedure, please care oil is to be filled in the oil filter and oil cooler always.

Additional Charge of Lubricating Oil

Specify the procedure of the additional filling of lubricating oil based on the configuration of the package unit, and make sure to provide users of this product with the information.

3.2.9 Charge of Refrigerant

Depending on the use working fluid and equipment configuration of your package unit, specify the work procedure that considered safety enough, and conduct the refrigerant initial filling work accordingly.

In addition, specify the procedure of the additional filling of refrigerant, make sure to provide users of this product with the information.

3.2.10 Checkout after Installation

Depending on the package unit to which this product is installed, formulate the necessary confirmation items and methods for package unit after installation and conduct them accordingly before the commissioning. In addition, make sure to record and keep the results of your confirmation.

Chapter 4 Compressor and Package Unit Operation

4.1 Lubricating Oil (Refrigerant Oil)

Selecting and managing lubricating oil (refrigerant oil) is very significant to keep the compressor in a good operating condition.

Take the following notes when selecting and managing lubricating oil.

4.1.1 Precautions for Selecting the Lubricating Oil

- Selection of the lubricating oil should depend on the type of the refrigerant, the type of the evaporator used with the compressor, and the conditions under which the compressor is operated. Also to be considered when selecting lubricating oil are the properties of the oil that include not only the viscosity but also such characteristics as solubility in refrigerant, separability from refrigerant, low temperature fluidity, high temperature thermal stability, etc. We therefore recommend contacting our sales offices or service centers for choice of a specified brand for your system.
- Lubricating oil used for compressors must have a viscosity appropriate for lubricating the bearings and other components in the compressors. The viscosity to be considered in this case should be the viscosity the oil shows at the oil inlet of the compressor. The viscosity of the lubricating oil significantly changes depending on the type of the refrigerant used in combination with the oil. If the refrigerant dissolves in the oil (or the oil and refrigerant are compatible), the viscosity of the oil drops to a level remarkably below the level required for operation of the compressor under some operating conditions. On the contrary, if the refrigerant does not dissolve in the oil (or the oil and refrigerant are incompatible), the viscosity may become too high when the supply oil temperature is low. For this reason, the lubricating oil must be selected such that it is supplied to the compressor with an appropriate viscosity (kinematic viscosity of 13 - 40 mm^2/s) in the operating state.
- In a refrigeration system using a screw compressor, the lubricating oil supplied to compressor is discharged together with the compressed refrigerant gas and separated from the refrigerant by an oil separator. However, the oil cannot be separated completely in the oil separator, so very small part of the oil enters the condenser and can remain there. Part of the oil can also enter the evaporator. For this reason, the lubricating oil must be thermally stable under high temperatures, be separable from the refrigerant gas, and maintain adequate fluidity under low temperatures.
- Note that some lubricating oils are incompatible with a certain type of refrigerant.
  The caution below is an example case that is required especially attention.

CAUTION
● **Be careful since polyolester synthetic oil (POE) cannot be used with ammonia refrigerant.**

4.1.2 Change of Lubricating Oil Brand

CAUTION

- **The change of lubricating oil brand may cause problems in operating conditions and the compressor. When changing the lubricating oil brand in use, make sure to contact us because appropriate steps must be surely followed.**
- **Package unit composition differs depending on the characteristics of lubricating oil (compatible/incompatible with refrigerant).**
  As a general rule, changing compatible oil to incompatible oil or vice versa is not allowed.

- Lubricating oil contains various additives to fulfill necessary lubricating conditions. Types of additives and their mixing ratio depend on each oil brand. We, therefore, recommend to avoid mixed use of different brands of lubricating oil. If mixed brands of lubricating oil are used, the different additives in the lubricating oil may react with each other and produce foreign substances like slurry.
- If it is necessary to change the brand of lubricating oil, collect as much as oil as possible from the compressor as well as from the condenser, evaporator, and all other refrigerating unit components before charging the new lubricating oil. After 100 to 200 hours of operation, replace the oil again.
- If lubricating oil manufacturers differ, contact both of them and inquire whether the changing is appropriate. The same confirmation is required for changing the brand even if it is of the same manufacturer.
- There is no problem in changing the viscosity level within the same brand. However, make sure that the viscosity grade will not cause problems during operation. (Example : SUNISO 3GS→SUNISO 4GS)

4.1.3 Precautions for Handling lubricating Oil

- When refilling lubricating oil, ensure that it is clean and does not contain foreign matters.
- Be careful that air and water are not mixed in when refilling.
- To ensure that the lubricating oil does not absorb air moisture, keep it indoors in an airtight container until use.

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 pail (oil container) 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 pail opening and the charge hose so that foreign substances or moisture cannot enter. A more effective way is to substitute any space inside the pail with nitrogen gas .
- Always charge all oil from the pail. 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.

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 pail to minimize exposure to air.
- Make sure that all oil in a pail 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.

4.1.4 Lubricating Oil Control Criteria

Lubricating oils that are controlled by the criteria are classified into the following categories:

(1) Synthetic oils: Polyalkylene glycols (PAG)
(2) Mineral oils: Naphthenic base oils and paraffinic base oils
(3) Synthetic oils: Alkylbenzene (AB) and Polyalphaolefine (PAO)
(4) Synthetic oils: Polyolesters (POE)

- **Oil sampling and analysis is recommended every six months.**
- **If the following control criteria are not satisfied, replace the oil.**
  - ◆ Note that the water content of PAG shall be excluded from the above oil replacement criteria. Refer to the Note *1 in the table below.

The analysis items and the criteria are shown in the following tables. Please note that these control criteria may be changed without notice.

Table 4-3 Synthetic Oil (PAG)

Item	Criteria
(a) Color phase	ASTM color scale: 4.0 or less
(b) Total acid number (TAN)	0.1 mg KOH/g or less
(c) Kinematic viscosity	Within ±10 % from that of fresh oil
(d) Water content	2000 mass ppm or less **Note1**
(e) Degree of contamination	Degree of contamination measured by mass method (Millipore value) shall be 15 mg/100 mL or less

Table 4-4 Mineral Oil and Synthetic Oil (AB, PAO)

Item	Criteria
(a) Color phase	ASTM color scale: 6.0 or less
(b) Total acid number (TAN)	0.3 mg KOH/g or less
(c) Kinematic viscosity	Within ±15 % from that of fresh oil
(d) Water content	100 mass ppm or less
(e) Degree of contamination	Degree of contamination measured by mass method (Millipore value) shall be 15 mg/100 mL or less

Table 4-5 Synthetic Oil (POE)

Item	Criteria
(a) Color phase	ASTM color scale: 4.0 or less
(b) Total acid number (TAN)	0.2 mg KOH/g or less

(c) Kinematic viscosity	Within ±10 % from that of fresh oil
(d) Water content	200 mass ppm or less
(e) Degree of contamination	Degree of contamination measured by mass method (Millipore value) shall be 15 mg/100 mL or less

Note 1: Synthetic oils (compatible with ammonia) are so highly hygroscopic that they can absorb moisture at the time of sampling. In addition, the ammonia content they have absorbed may be detected as the water content at the time of the analysis, making it difficult to precisely measure the water content. Thus, use the criterion value only as a reference.

4.1.5 Lubricating Oil Replacement Timing

After Starting the Initial Operation

As the oil can easily be contaminated and degraded relatively quickly during the initial operation due to scales and deposits remaining in piping and vessels, be sure to sample and analyze the oil after 500 hours of operation.

If it is found as a result of the analysis that the criteria given in Tables 4-3 to 4-5 are not satisfied, the oil must be replaced.

During Normal Operation

Lubricating oils will degrade gradually as the system is operated over time.

The rate of degradation depends on the operating condition, type of oil and amount of foreign matters and moisture contained in the oil. The lubricating oil must be sampled and analyzed every six months. If it is found as a result of the analysis that the control criteria given in Tables 4-3 to 4-5 are not satisfied, the oil must be replaced.

If the oil filters are frequently clogged or the oil color quickly becomes darker and unclear, replace the oil after removing the cause of the problem.

4.2 Precautions for Operation

If the package unit is used in the refrigeration cycle, please keep in mind the contents of this section in particular.

4.2.1 Prevention of Liquid Flow-back Operation

Liquid flow-back is a phenomenon where refrigerant that did not completely evaporate with the gas reaches the compressor. Liquid flow-back may cause insufficient lubrication of the compressor, abnormal vibrations and noises, and abnormal foaming of lubricating oil (too much oil loss).

To prevent liquid flow-back, appropriately adjust the expansion valve to the evaporator and/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.

4.2.2 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.

4.3 When Stopping the Compressor for a Long Time

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

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

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

- Operate the oil pump for 10 seconds per week.
  After that, rotate the compressor shaft (10 rotations or more).
- Measure the system pressure once per month.
- Check for refrigerant leak once per month.

When restarting the compressor after an operation stop period of 1 year or longer, check the system for refrigerant leak and analyze the lubricating oil. If it is found as a result of the analysis that the control criteria given in Section 4.3.1 Tables 4-3 to 4-5 are not satisfied, the oil must be replaced.

Also check the motor insulation resistance.

Supply power to the oil heater at least 1 day before operation start. Before starting the operation, confirm that the refrigerant is not condensed in the package by checking the package temperature and pressure.

Chapter 5 Maintenance and Inspection

5.1 Precautions for Maintenance and Inspection

When reading this Section, also refer to Section 1.1 in this manual Chapter 1.

DANGER

- **When entering the machine room for maintenance services, ensure that sufficient ventilation has been started and measure the oxygen concentration so that there is no risk of oxygen deficiency. The ventilation must be continued steadily until the work is completed.**
- **For performing the inspection work, be sure to prepare safety shoes, protective glasses, gas mask and other proper protective equipment and do not fail to use them whenever they are required.**
- **After stopping the machine and before working on a periodic inspection or overhaul, be sure to shut off the main motor power, control power, and other power to each equipment and valve. After they are shut off, be sure to make the switches inoperable by others. Also, be sure to attach notification tags to prohibit operation (lock-out/tag-out).**
- **When any manual stop valve has been closed, be sure to make the valve inoperable by others and put a notification tag to prohibit the operation (tag-out).**
- **When the compressor is to be overhauled, check that the internal pressure of this product is at the atmospheric pressure before starting the work.**
- **When using lifting devices, e.g. a crane, etc. and/or lifting tools, ensure that they can sufficiently withstand the load.**
- **When lifting a heavy load object, do not allow anyone's body to put under it.**
- **The work to turn each power supply ON/OFF or operate a lifting unit must be exclusively performed by qualified personnel.**
- **When using electric tools, ensure that they are properly managed in accordance with each instruction manual. Especially before using and while using, be sure to follow the care instructions on the safety of each instruction manual.**

WARNING

- **Be sure to use only MYCOM genuine parts for replacement. Using parts that are not genuine can cause damage to this product or other devices during operation.**
- **Do not convert or modify this product or its components without prior permission from MAYEKAWA. Otherwise, it can lead to an unexpected accident.**
- **Exercise sufficient care for handling a heavy load, and use such a lifting device as a crane or work with an adequate number of personnel commensurate with the magnitude of the weight. Also, be sure to use stud bolts (safety retention bolts) and other support tools for the work. Neglecting the above warning can lead to low back pain of the worker or injury due to dropping of the parts.**
- **If two or more people are to work together, be sure to clearly define the work procedures to share a common understanding among all workers before performing the work.**
- **Not only the work to turn each power supply ON/OFF or operate a lifting device, but also any type of work requiring qualification must be exclusively performed by qualified personnel.**

CAUTION

- **When checking the operation data of units and executing other daily maintenance services, pay particular attention to avoid touching the area heated to a high temperature causing skin burns or inadvertently moving the handle of a valve leading to an erroneous operation.**
- **In the disassembly/inspection workplace, secure a sufficient space for temporary storage of the removed parts and tools, replacement parts, and for the disassembling work as well as safety passages, and then put up necessary off-limit signs.**
- **In the workplace, secure a sufficient space and refrain from putting tools directly on the floor or from haphazardly laying wires.**
- **Keep the floor clean all the time. Leaving the floor smeared with oil and the like causes it to be slippery and may result in the fall and injury of personnel. Thus, do not leave it but wipe it off right away.**
- **Make sure that the temperature of the high temperature sections such as bearing head and discharge lines has been cooled down to normal ambient temperature, before working on them.**
- **When disassembling and reassembling the compressor, use the specified tools properly. Before starting to use those tools, gain the full understanding of their characteristics and the method for use.**
- **During the maintenance service, keep the tools clean all the time. Using those tools smeared with oil increases the risk of slip and fall, leading to an injury. Also during the service, there is a risk of foreign matters intruding inside the compressor to cause its damage.**
- **Parts are slippery with oil. Fully watch out for the risk of any object falling down. Pay attention to any parts falling down, which could lead to personal injury.**

CAUTION

- **Before disassembly, inspections, and handling of the compressor, sufficiently understand the disassembly and assembly procedures.**
  This manual is not intended to provide complete disassembly and assembly procedures for the compressor. Instead, it describes only the important points in relation to the maintenance service of the compressor.
- **If complete disassembly and assembly of the compressor are required, please contact your nearest sales office or service center of MAYEKAWA.**
- **When removing a part, be careful not to damage it.**
- **Place the removed parts on a clean workbench in an orderly manner.**
- **For cleaning parts, use kerosene and/or machine parts cleaner.**
- **Washed parts shall be dried by compressed air or wiped up using clean cloth. Do not use synthetic textiles or woolen textiles to prevent fibers from attaching the parts.**
- **When separating the assembled compressor casings, sometimes it is difficult to separate them due to the gasket stuck. In such a case, never hammer in a screw driver or flat chisel into the gap. Screw jack bolts using the screw holes to separate the casing each other. When some gap is observed between them, use a scraper to remove one side of the gasket from the surface.**
- **Removed bolts from each part should be classified into each used section to prevent confusion.**

5.2 Maintenance and Inspection List

5.2.1 Daily Management

For the purpose of daily maintenance, check the items listed in Table 5-1 "Daily Inspection Items" and record the results.

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.

Table 5-1 Daily Inspection Items

Inspection item			Inspection details	Checkpoints and actions
Compressor	Operating hours	hr.	Total operating hours	• Judgment of periodic maintenance timing
	Suction pressure	MPa	Difference from the set value of evaporation temperature equivalent pressure	• Contamination in the evaporator • 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 the lubricant • Clogged of oil filter
	Suction temperature	°C	Whether within upper and lower limits	• Temperature, flow rate, etc. of the object to be cooled
	Degree of suction superheat	°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
	Oil supply temperature	°C	Whether within upper and lower limits	• Contamination on cooling pipes of oil cooler
	Operation check of Slide valve	%	Whether operation is normal	• Damage to solenoid valve coil • Adjustability of manual control(needle) valve for Solenoid valve assembly
	Leak from mechanical seal	mL/h	Leak per hour	• Damage to mechanical seal assembly
	Noise and vibration	-	Abnormal noise/vibration	• Compressor failure

Table 5-1 Daily Inspection Item (continued)

Inspection item			Inspection details	Checkpoints and actions
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(Cold storage etc)

■ 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 compressor package.

2. Replacing Oil Filter
When the differential pressure between oil filter inlet and outlet is higher than specified by the manufacture, replace the oil filter element. The oil filter differential pressure may increase for a short time during startup.

3. Cleaning of Suction Strainer
After 500 h of operation inspect the suction strainer. Also remove the temporary filter(suction cloth bag) if it was supplied with the package.
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 significant increase of oil leak from the mechanical seal, confirm the rate of the leakage per 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 Reference values for Leak Rate from Mechanical Seal

	Model of UD-series					
	125	**160**	**200**	**250**	**320**	**400**
Acceptable leakage amount (mL/h)	≤ 3	≤ 3	≤ 3	≤ 3	≤ 6	≤ 12
Inspection is required (mL/h)	≥ 9	≥ 9	≥ 9	≥ 9	≥ 18	≤ 36

Note: The specifications above are just for reference. They are not guaranteed values.

5. Contamination of Condenser and Oil Cooler Tubes.
The degree of clogging and contamination of the cooling tubes 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 Periodic Inspection

Inspect the following points at specified intervals.

Table 5-3 Periodic Inspection Items

Item	Inspection interval	Remarks
Pressure sensors	Annually	
Temperature sensors	Annually	
Protection devices and safety valves	Annually	
Suction strainer	Inspection after the first 500h of operation	If the differential pressure between the front and back of the suction strainer increses, inspect and clean the suction strainer
	Inspect and clean annually	
Lubricant	Replace after the first 500h of operation	If the analysis results do not satisfy the management criteria provided in" 4.1.4 Management of Lubricant, in this manual, replace oil.
	Analyze lubricant at intervals of 6 months	
Oil filter	Replace annually	Replace the filter element if the pressure difference between the inlet and outlet ports of the oil filter exceeds 0.1 MPa.
Cooling water side of oil cooler	Annually	Clean the oil cooler if it is confirmed that it is heavily contaminated.
Cooling water side of condenser	Annually	Clean the oil cooler if it is confirmed that it is heavily contaminated.
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 comes first..

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 Operaion Conditions and Overhaul Frequency Guidelines

Application	Recommended Overhaul Frequency	Remarks
Cold storage and refrigeraion	40,000 hours or 5 years	Relatively stable operating condition
Ice maker/Chiller	30,000 hours or 4 years	
Heat pump/Gas Compressor	20,000 hours or 3 years	

Note 1: The above guidelines are only applicable when the compressor is operated within the operation limits which are specified separately. (See Chapter 2, Section 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 ofspecified period or operating hours, whichever comes first.

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

5.3 Compressor Disassembly Preparation

Although screw compressors are very reliable machines, it is still necessary to perform overhaul to inspect internal parts after a certain period of operation.

This chapter 5 explains the essential points of disassembly methods, where to inspect on parts, and reassembly procedure.

In principle, compressor overhaul that require complete disassembly should be performed in the maintenance factory. If you must do the overhaul work at the installation site due to unavoidable reasons, use the methods described in the following paragraphs.

However, please note that regular overhaul work requires removal of the compressor from the base frame. And then, the compressor should be placed on a work bench which has properly size area to disassembling the compressor.

When moving the compressor from the unit base to the workbench, be sure to follow the instructions given in Chapter 3, Section 3.1 "General Installation Precautions" and Section 3.2.3 "Transportation" of this manual.

Carefully read this manual and fully understand the details before starting to work.

Note that some parts name given in the text of this manual is followed by a number enclosed in square brackets [ ], which indicates the part identification number given in assembly sectional views or parts configuration table.

5.3.1 Disassembly Tools and Workplace

Prepare all the required tools as mentioned in “ 7.8 Tools for Disassembly" in this manual Chapter 7.

It is also recommended to prepare general hand tools, green silicon carbide grinding stone, emery paper (#80 - #100), empty paper (#400 to #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 for an overhaul, foresee enough space on the workbench to perform the task.

To safely reach the bolts and plugs used on the lower side of the compressor, place the compressor on an additional frame. Consult article 5.3.5 in this chapter for more information.

Perform the work in a dry place with as little sand, dust or any other contamination as possible.

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5.3.2 Replacement Parts

Prepare the MYCOM genuine parts for replacement.

Parts listed in Table 5-5, we recommend to be replaced on the occasion of each compressor overhaul.

For each part size and code No. of each compressor model, refer to Section 7.2 "Parts Configuration Table" in this manual Chapter 7.

When ordering parts, be sure to inform the (a) model name, (b) serial number, (c) part name, (d) code No. and (e) quantity required, to our sales offices or service centers.

In particular, if the serial number (b) is unknown, the details of the applicable design and manufacturing specifications cannot be identified, and thus it becomes difficult to choose correct parts.

Table 5-5 Replacement Parts of UD-series Compressor Overhauling

P/N	Part Name	Remarks	Q'ty.					
			125	160	200	250	320	400
6	Gasket, Suction Cover		1	1	1	1	1	1
9	O-ring, Suction Cover		1	1	1	1	1	1
12	Gasket, Bearing Head		1	1	1	1	1	1
17	Bearing Cover Gasket		1	1	1	1	1	1
23	Gasket, Balance Piston Cover		1	1	1	1	1	1
27	Main Bearing	with O-ring	2	2	2	2	2	2
28	Side Bearing	with O-ring	2	2	2	2	2	2
30	Balance Piston	To be replaced if any abnormality is found.	1	1	1	1	1	1
33	Balance Piston Sleeve		1	1	1	1	1	1
35	O-ring, Balance Piston Sleeve		1	1	1	1	1	1
38	Thrust Bearing		2	2	2	2	2	2
39	Lock Nut	To be replaced if any abnormality is found.	2	2	2	2	2	2
40	Lock Washer		2	2	2	2	2	2
49	O-ring, Oil Seal Retainer		1	1	1	1	1	-
50	Oil Seal		1	1	1	1	1	-
52	Gasket, Seal Cover		1	1	1	1	1	-
63	O-ring, Unloader Cylinder		1	1	1	1	1	1
65	O-ring, Unloader Piston		1	1	1	1	1	1
66	Cap Seal		1	1	1	1	1	1
68	Guide Pin (Grooved Pin)	To be replaced if any abnormality is found.	1	1	1	1	1	1
69	Lock Nut, Unloader Piston	To be replaced if any abnormality is found.	1	1	1	1	1	1
70	Lock Washer, Unloader Piston		1	1	1	1	1	1
73	O-ring, Unloader Push Rod		1	1	1	1	1	1
75	O-ring, Unloader Cover		1	1	1	1	1	1
78	Ball Bearing, Unloader Cylinder Cam	#6000	1	1	1	1	1	1
79	Retaining ring C type External	CE-EX10 (S10)	1	1	1	1	1	1

82	V-ring, Unloader Cylinder Cam		1	1	1	1	1	1
93	Gasket, Suction Flange		1	1	1	1	1	1
96	Gasket, Discharge Flange (1)		1	1	1	1	1	1
100	Mechanical Seal Assembly	BBS-E as standard	1	1	1	1	1	1
125	Micro Switch	To be replaced if any abnormality is found.	2	2	2	2	2	2
129	Potentiometer	To be replaced if any abnormality is found.	1	1	1	1	1	1
150	O-ring, Thrust Bearing Gland 320	for 320V*D	-	-	-	-	2	2
216	Gasket, Lubricating Oil Inlet Flange	Journal inlet	-	-	1	1	1	1
219	Gasket, Oil Injection Inlet Flange	for 320V*D	-	-	-	-	1	1
236	Gasket, Discharge Flange Spacer	for Sideways discharge type	1	1	1	1	1	1
237	Torsional Slip Washer		2	2	2	2	2	2
255	Gasket, Liquid Injection Inlet Flange		1	1	1	1	1	1
325	O-ring, Unloader Push Rod	JIS B 2401 P46	2	2	2	2	-	2
432	O-ring, Main Bearing		4	4	4	4	4	4
433	O-ring, Side Bearing		4	4	4	4	4	4
674	O-ring, Seal Cover		-	-	-	-	-	1
701	Backup Ring		1	1	1	1	1	-
744	O-ring, Sleeve for Oil seal		-	1	1	1	-	-

5.3.3 Refrigerant Gas Recovery

At the time the compressor operation is stopped, the pressure inside the compressor is still high. As such, it is necessary to drop the pressure down to the atmospheric pressure before starting the disassembly process. To do this, there are the following methods for example. Perform your recovery work in an appropriate manner considering site conditions, requirements of regulatory laws and regulations.

- Use the bypass valve to release the high pressure gas in the unit into the low pressure side.
- If there is an adjacent compressor to which a bypass line is connected from this compressor, run the adjacent compressor to drop the internal pressure of this compressor through the bypass line.
- Operate the refrigerating system and close the supply source valve to turn the gas into liquid, and recover the liquid at the receiver.
- Use a refrigerant recovery machine to recover the liquid at the receiver.

In using either method, prepare a working flow sheet of the system beforehand. Check the valves to be controlled during the recovery work, according to the method to be used, by comparing them with the ones in the flow sheet, and clearly note the valves to be operated, other connected devices, and tubes on the flow sheet.

Two flow sheets must be prepared: one at the foreman and the other for posting in the workplace.

In addition, prepare a work procedure document for the refrigerant recovery work to reflect the actual conditions of the workplace, and sufficiently share the work details among all the coworkers through checking and confirmation before actually starting the work.

WARNING

- **Before the work, be sure to check and communicate the work details and procedure among all coworkers, and carry out hazard prediction activities based on the information shared. Neglecting to do this will increase the risk of on-the-job accidents and injuries to a considerable level.**
- **All the valves that have been opened or closed during the work must be prevented from accidental operation through proper lock-out and tag-out procedures.**

5.3.4 Removal of Connections to the Unit

DANGER

- **If high-pressure refrigerant gas or refrigerant-mixed lubricating oil remains inside the compressor, a gas and oil under pressure will gush out as soon as a sealed part is opened and cause injury to the operator such as frostbite or loss of eyesight. Be sure the check that there is no residual pressure before disconnecting any pipe joint.**
- **Before opening the sealed part, make sure to reconfirm that ventilation of the workplace is appropriate.**
- **Wear the appropriate preventive gear before opening the sealed part.**

【POINT】

When oil lines are removed from the compressor, any residual oil in the pipe can flow out. To be prepared for this, either check the amount of oil outflow by slightly loosening the pipe joint or drain the oil from the oil temperature gauge at the oil supply header before removing the pipe.

As the unloader cylinder is filled with oil, have an oil pan ready to catch the oil when the pipe is disconnected. An empty 18-liter can for lubricating oil is suitable as the oil pan.

For easy reconnection, disconnected electric wires should be properly marked for identification. Any wrong reconnection may result in a startup failure or inability to operate the capacity control mechanism.

When removing the compressor from the mounting base frame, the following parts must be disconnected beforehand in numeric order.

(1) Coupling to connect the compressor to the driving machine;
(2) Suction piping of the compressor.
If the suction strainer is directly connected to the compressor, also remove the strainer;
(3) Discharge piping of the compressor;
(4) Oil supply piping to the compressor (Journal oil inlet port);
(5) Oil supply piping to the side bearing of compressor F rotor side;
(6) Liquid injection (Aquamizer) 1 piping to the compressor;
(7) Liquid injection (Aquamizer) 2 piping to the compressor;
(8) Economizer (Electromizer) piping to the compressor
(9) Oil injection piping to the compressor
(10) Oil piping connection 2 for the capacity control (unload)
(11) Oil piping connection 1 for the capacity control (load)
(12) Electric wiring for capacity control operation (In some cases, the unloader indicator assembly may be removed without removing the wiring.
(13) Compressor mounting bolts (foot bolts); and

After performing work of (1) to (13), the openings of the flanges and screwed connections on the compressor should be prevented from entering foreign matters inside the compressor, by using cover flanges and plugs.

5.3.5 Removal of the Compressor from Base Frame

WARNING

- **The work to lift up or move the compressor must be performed by a qualified operator. If the work is done by an unqualified operator, it may result in a dropping accident.**
- **Never try to perform disassembly or assembly while the compressor is lifted in the air. The main body or some part of the compressor can drop down on people below.**

【POINT】

As the suction piping is located immediately above the compressor, lift up or partially remove the piping such that it will not interfere with the lifting device.
After lifting up the compressor, place it on a special stand to remove hexagon head cap screws around the bottom flange part. Instead of using the special stand, you can use the temporally stand which has same height as the workbench, i.e., place the leg part of the suction cover on the workbench and place the leg part of bearing head on the temporally stand as shown in Figure 5-1.

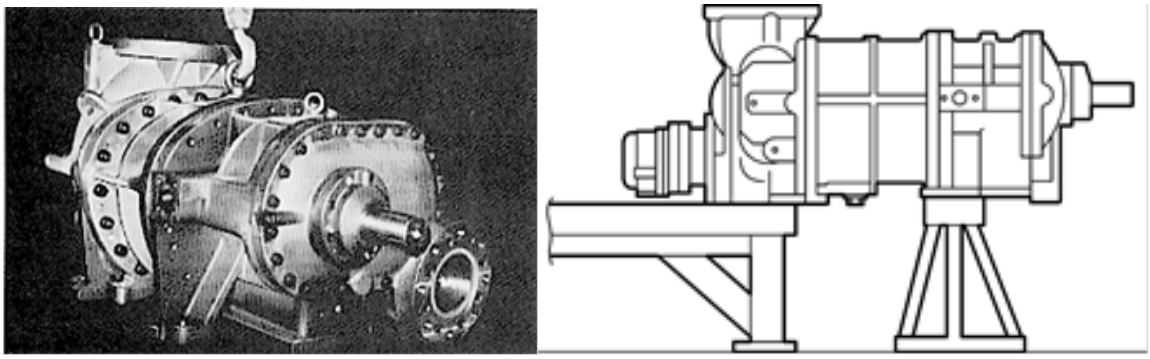
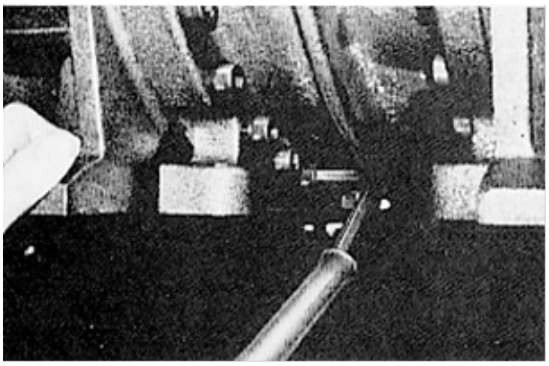


Figure 5-1 In case of using temporary stand



a) Place the compressor on the special stand or use a temporary stand as shown in Figure 5-2.
Then remove 6 to 8 hexagon head cap screws around the bottom flange part tightened rotor casing [1] to suction cover [5] / bearing head [11].
Note: After placing the compressor on the workbench, it is impossible to remove these lower bolts.

b) Remove the compressor onto the workbench. How to place the compressor on the workbench varies according to the compressor models described below;

Since the outer part of the discharge port flange extending downward from the leg plane of the suction cover and bearing head, place the compressor with the flange part outside of the workbench edge (see Figure 5-2 in next page).

Alternatively, place wooden blocks high enough to provide the flange with clearance from the workbench surface below the legs of the suction cover and bearing head and lower the compressor on the wooden blocks as shown in below picture to the right.

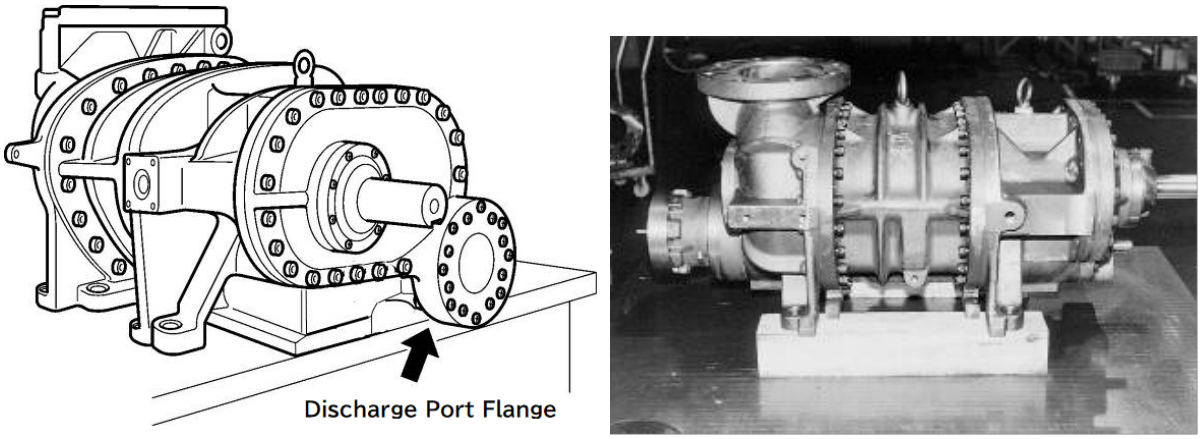


Figure 5-2

5.3.6 Compressor Disassembly Order

The disassembly order of the UD/G-series compressor is general as described below.

Generally UD/G-series compressors are disassembled in the order described below. But this order is just an example and the actual order may differ according to individual situations.

Depending on the situation, please complete the work in a safe and appropriate procedure.

a) Unloader indicator block
   (n some cases, the unloader indicator assembly may be removed without removing the wiring.)
b) Mechanical seal block
c) Unloader cover block
d) Unloader cylinder and Balance piston cover
e) Balance piston block
f) Bearing cover
g) Suction cover and Side bearings
h) Thrust bearing block
i) Rotor and Main rotor casing
j) Unloader Slide Valve
k) Bearing head and Main bearing

5.4 Disassembly and Inspection

5.4.1 Unloader Indicator Block

The UD/G-series unloader indicator has been changed to the new type indicator (right picture) with the protection grade IP66 by improving the performance of the dust and water proof from December 2014 Moriya factory production.

This new indicator IND-052WP and IND-062WP are nearly same to the traditional indicator in the following items: outer dimensions, mounting method to the compressor, signal output of the loaded capacity 0 % to 100 % by using a potentiometer, and contact output function by using micro-switches.

Major changes (improvements) are described in Table 5-6.

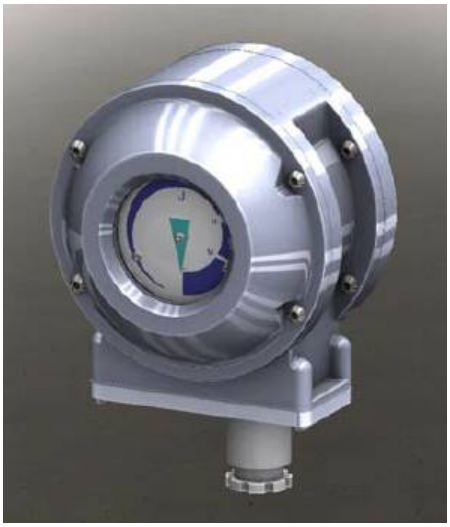


Table 5-6 Difference of Unloader Indicator between old type and new type

Item	Traditional type	New type
Dust and water proof	Equivalent to protection grade IP20	Protection grade IP66
Quantity of housing parts	2	4
Potentiometer	Wire wound type	Conductive plastic
Micro-switch	Wiring is screwed.	Wiring is connected with connector
Terminal block	6P terminals	7P terminals

For more details of the new type indicator IND-052WP, refer to the another dedicated instruction manual “2200TYJJ-DA-S11-N-2016.11 Unloader indicator IND-05”.
As the transition period after change of the unloader indicator, the traditional type indicator is described as the target.

Disassembly

■ **In the Case of Removing the Wiring only**

When removing the wiring of the unloader indicator upon removing the compressor, it is necessary to remove the cover as the indicator has a terminal block for the wiring. Perform the work according to the following procedure, and after removing the wires, attach the cover to them for protection.

a) By removing the three hexagon socket head cap screws [147] that are used to fasten the indicator cover [146], the cover can be removed.
b) The indicator cover will be removed with the glass [141] and spacer [142] attached. While the glass and spacer are glued, be careful not to drop these as they may be separated from the cover.
c) Remove the wiring. Be careful not to lose the phillips screws [133] of the terminal block [132].

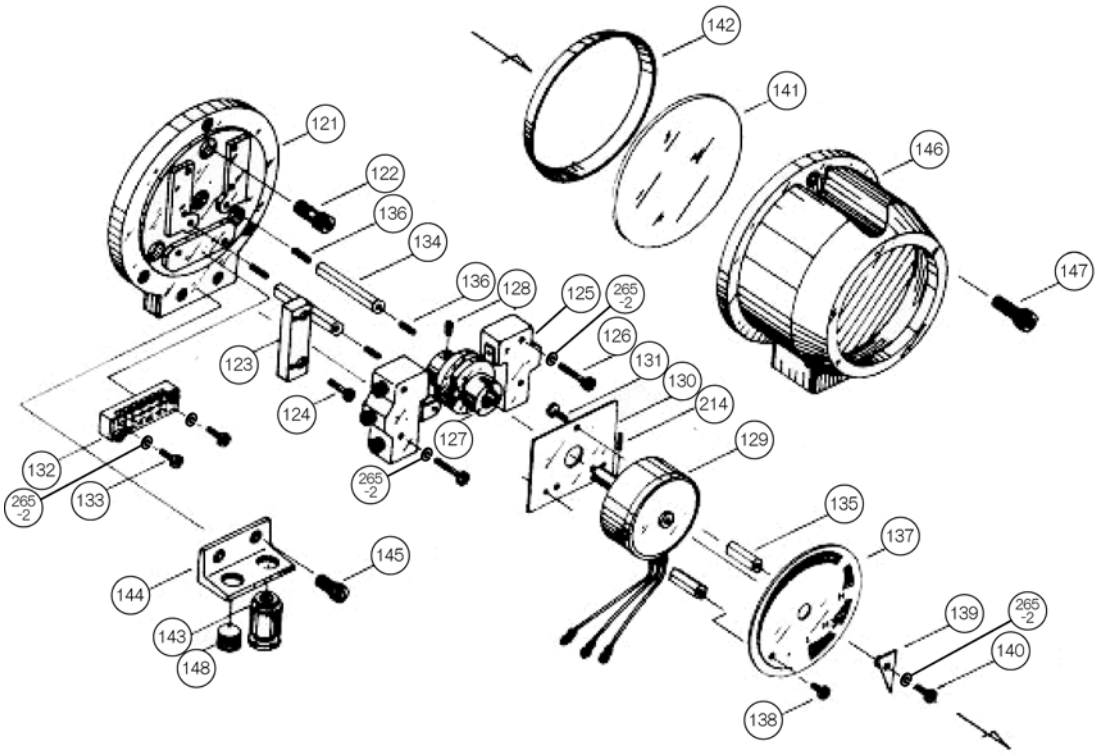
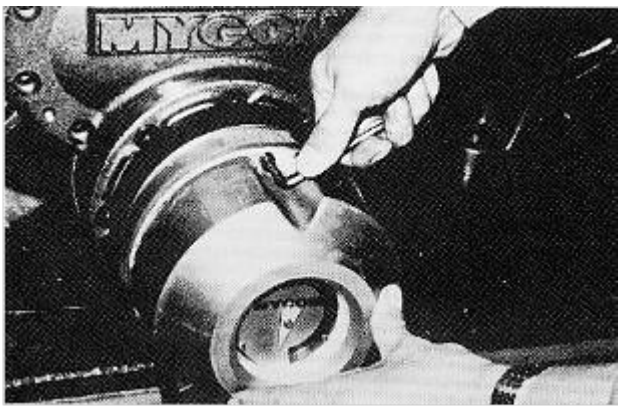


Figure 5-3 Traditional Standard type Unloader Indicator Assembly

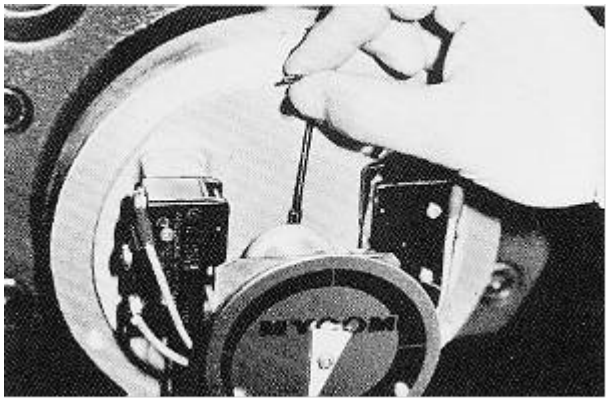


Removal of the Indicator Cover

■ **For Further Disassembly (In the case of Removing as Unloader Indicator Assembly)**

As the indicator is an assembly to be removed as a whole, no further disassembly should be made unless the purpose of the disassembly is to disassemble this part.

a) As a result of the previous disassembly process, the micro switch base plate [121], which is mounting the potentiometer [129], micro switches [125], and micro switch cam [127], can be removed.
b) Unscrew and remove three hexagon socket head cap screws [122].
c) Loosen the set screw [128] of the micro switch cam.
d) After that, the assembly can be removed by pulling it in the axial direction.

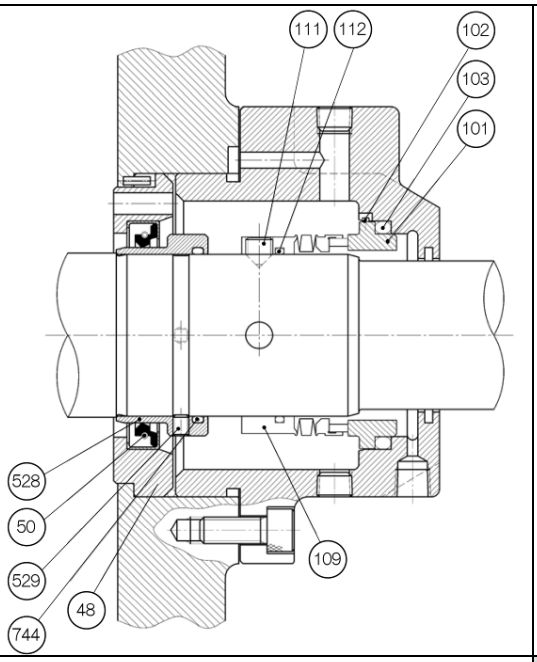


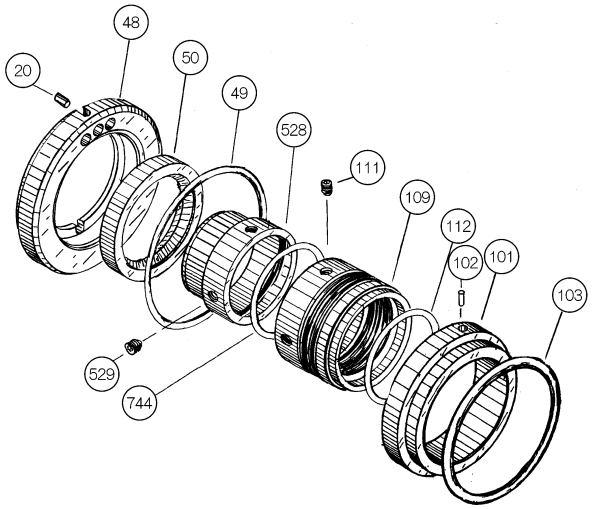
Loosen the Set Screw of the Micro Switch Cam

Inspection

The inspection procedure is described in the "Reassembly" section of this chapter, as it is often the case that the unloader indicator block is removed as an assembly and later inspected and adjusted after the overhauled compressor is reassembled and installed on the mounting base. Refer to Section 5.5.12 "Unloader Indicator" for details.

5.4.2 Shaft Seal Block (125～320)





Mechanical Seal assembly

P/N		Part Name	
101	100	Mating ring	Stationary rings
102		Insert lock pin	
103		O-ring	
109		Seal collar	Rotating rings
111		Seal collar set screw	
112		O-ring	
528 **Note**		Oil seal sleeve	
529 **Note**		Set screw for oil seal sleeve	
744 **Note**		O-ring	
48		Retainer, oil seal	
49		O-ring	
50		Oil seal	
20		Spring pin	

Note: [528], [529], [744] are not used to 125,160 models.

Figure 5-4 Details of BBSE-type Mechanical Seal Assembly and Related Parts

Disassembly

a) Of the eight hexagon socket head cap screws [53] securing the seal cover [51], remove six bolts leaving two diagonally opposite bolts.

b) Loosen the remaining two screws alternately and evenly, a little at a time. When the screws are loosened to some extent, the seal cover will be pushed by the spring force of the seal to create a gap under the cover. The gap will not be created if the gasket is sticking to both surfaces. In this case, free the cover by screwing M8 eye bolts into the jacking screw threads on the seal cover to separate it.

c) As the oil inside will flow out through the gap, be ready to receive the oil with a container.

d) Pull out the seal cover in the direction of the rotor shaft axis. Inside the cover, there is the mating ring fitted with the O-ring. In this, carefully remove the seal cover for the mating ring not to be damaged by touching the shaft.

e) Remove the O-ring [49] between the seal cover and oil seal retainer [48].

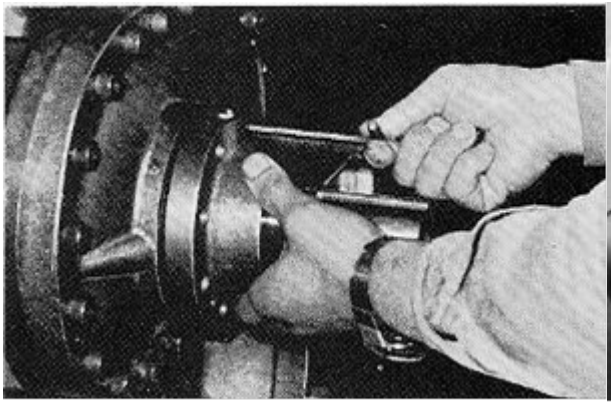
f) After the seal cover has been removed, wipe clean the shaft and then check its surface. If any flaw is found, use a fine sandpaper to smoothen the surface. This correction is intended to prevent possible damage of the internal O-ring when the mechanical seal is pulled out.

g) Loosen the set screws [111] securing the seal collar [109] about three turns. Do not remove the set screws completely. Loosen them such that their ends are retracted from the surface of the seal collar. These two screws are located 90° apart from each other.

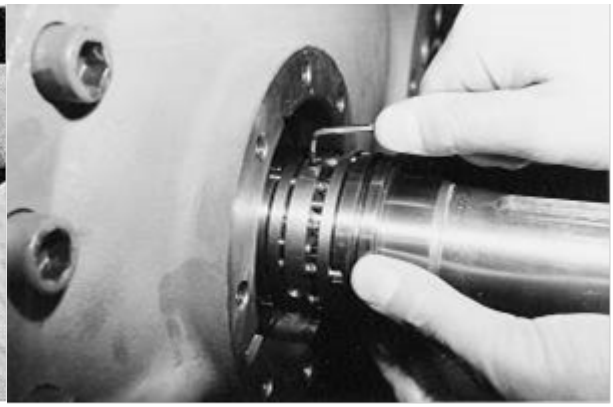
h) Pull out the mechanical seal assembly by holding the seal collar with your fingertips. While removing the assembly, make sure that the ends of the set screws do not touch the shaft surface. Any scratch on the shaft will cause leakage.

i) Pull out the oil seal sleeve [528] after removing the two set screws [744] (except for 125,160 type).

j) Screw two M8 eye bolts into the jacking screw holes in the seal retainer and pull out the seal retainer while keeping it in the right angle with the shaft.



Removing the seal cover



Loosen the set screw of the seal collar

Inspection

a) Although it is instructed that the mechanical seal must be replaced after abnormality is found in the inspection, only visually checking the sliding surface may be insufficient in determining any abnormality. It is thus recommended to always replace it with a new one, similarly to the case of O-rings and gaskets, if the inspection is done in such a way.
However, even if the assembly is to be replaced without exception, it is still necessary to visually check the condition of the sliding surface between the mating ring and the seal collar. If any unevenness or flaw is observed on the sliding surface, analyze the condition to determine whether it is due to aging, overheating, or other reasons in order to take necessary corrective actions.

b) Replace the O-rings every time the mechanical seal assembly is inspected because they normally swell and deform over time.

c) Check the wear of the oil seal sleeve in the area it rubs against the oil seal lip.
If wear is evident, replace both the oil seal [50] and oil seal sleeve [528] with new parts. Since the oil seal is made of a special material, only genuine oil seals must be used for the replacement.

Information on the O-ring [744] for the oil seal sleeve

In March 2010, the design of O-ring [744] was changed on the inner circumference of the oil seal sleeve.

5.4.3 Shaft Seal (400)

UD models use the double balanced mechanical seal assembly as the shaft seal.

According to the system applications and working fluids (refrigerants), UD applies an appropriate one from appropriate three types of mechanical seal assemblies, i.e., BOD (balanced, O-ring, double) type, BBD (balanced, bellows, double) type, and BBDE (balanced, bellows, double, E* made) type.

These mechanical seals are compatible to each other.

For disassembly and assembly work of these mechanical seals, a qualified trained personnel and special tools are required. For details, contact us.

Disassembly

After removing the hexagon socket head cap screws [53] and seal cover [51], disassemble in the order of the colored number shown in Figure 5-5/5-6/5-7.

Inspection

Although it is instructed that the mechanical seal assembly must be replaced after abnormality is found in the inspection, only visually checking the sliding surface may be insufficient in determining any abnormality. It is thus recommended to always replace it with a new one, similarly to the case of O-rings and gaskets, if the inspection is done in such a way.

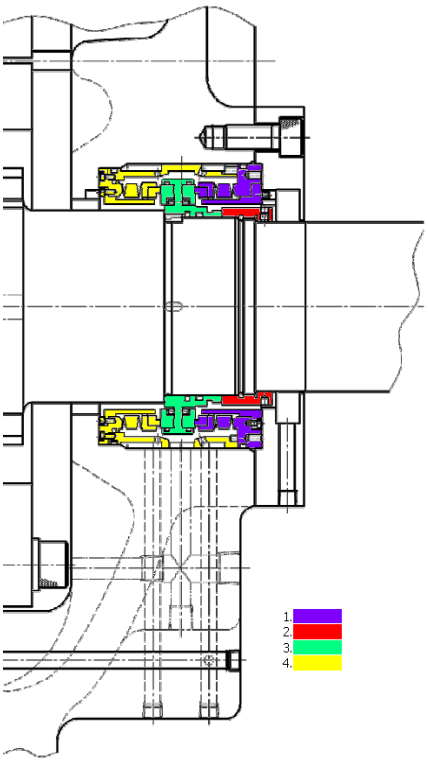


Figure 5-5 BOD type Seal

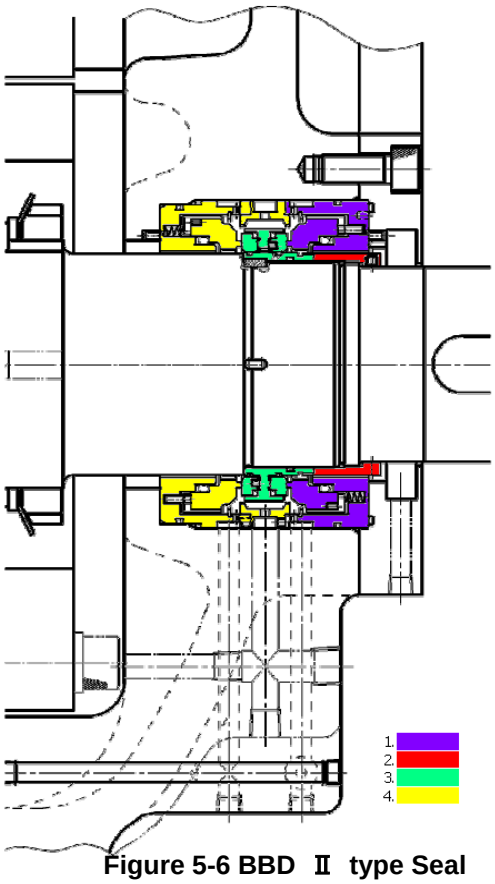


Figure 5-6 BBD Ⅱ type Seal

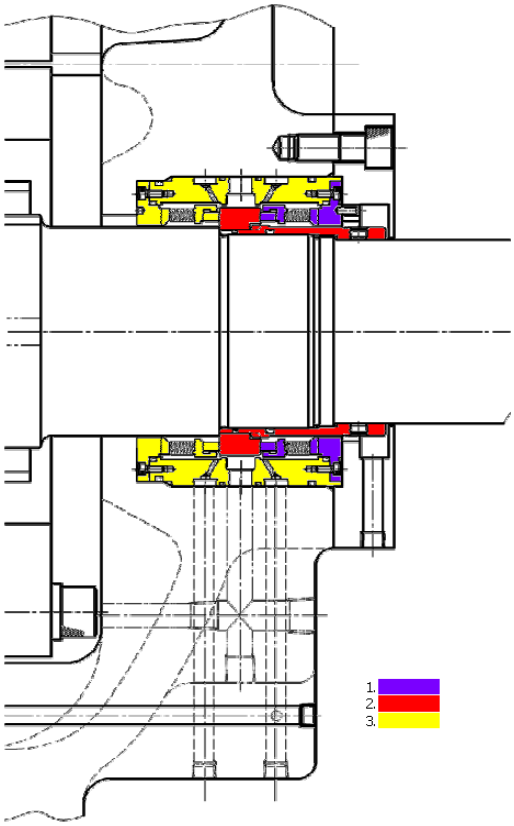


Figure 5-7 BBDE type Seal

5.4.4 Unloader Cover

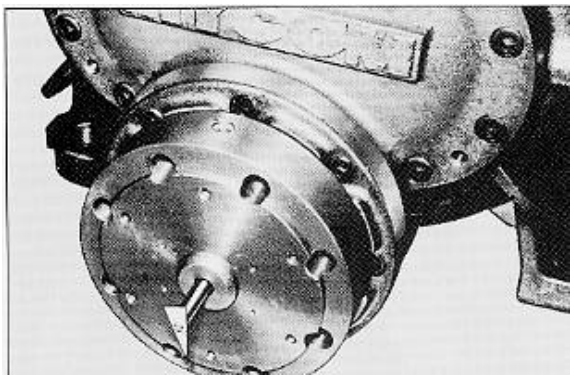
The unloader cover [74] is mounted with the indicator cam [77] which converts the linear motion of the unloader slide valve to a rotational motion, and their mounting parts.
The indicator cam is supported by the ball bearing [78] and fixed to the cover with a bearing gland [80].
To make it airtight, the V-ring [82], spring [83], and spring retainer [84] are also attached.
The indicator cam has a spiral groove of 340° to cover the moving range of the unloader slide valve. The indicator cam shaft is rotated being pushed by the guide pin [68] on the top end of the unloader push rod [67].

Disassembly

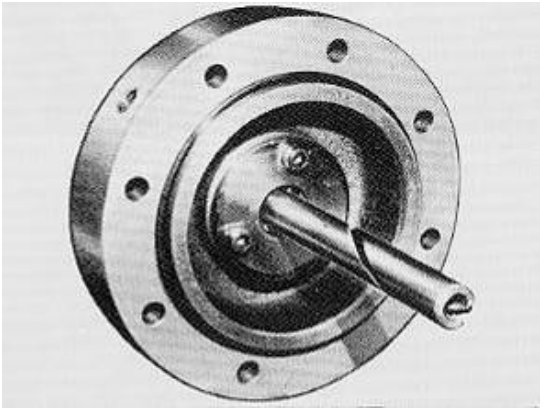
a) Unscrew and remove the unloader cover mounting hexagon socket head cap screws [76].

b) Pull the cover out in the direction parallel to the axis of the push rod in the unloader cylinder.
Carefully pull it straight, because if the unloader cover is pulled sideways, the shaft of the indicator cam may be bent.

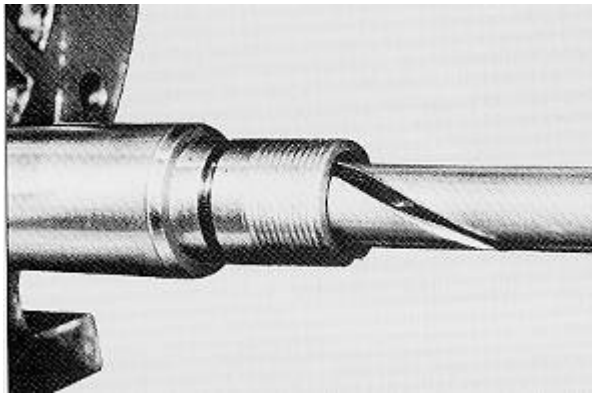
c) If the indicator cam will not move normally, check the groove of the indicator cam, bearing, and guide pin. The disassembly sequence is as follows:
   c-1) As the bearing gland [80], which fixes the indicator cam in place, is secured by three hexagon socket head cap screws [81] on the cylinder side of the unloader cover, unscrew and remove these bolts.
   c-2) Then, the indicator cam can be pulled out with the ball bearing [78] and the snap ring (retaining ring) [79] attached to the shaft.
   c-3) Inside the unloader cover, the spring retainer [84], spring [83], and then V-ring [82] are assembled in this order. Because the V-ring is tightly engaged with the bore of the unloader cover, the lip of the V-ring will be damaged when it is once removed, making it unusable again. Therefore, be sure to replace it with a new one once it is disassembled.



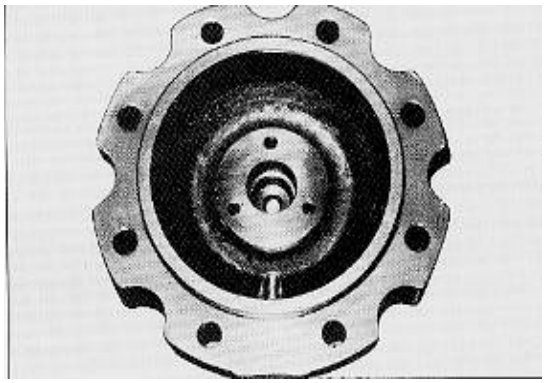
Unloader Cover



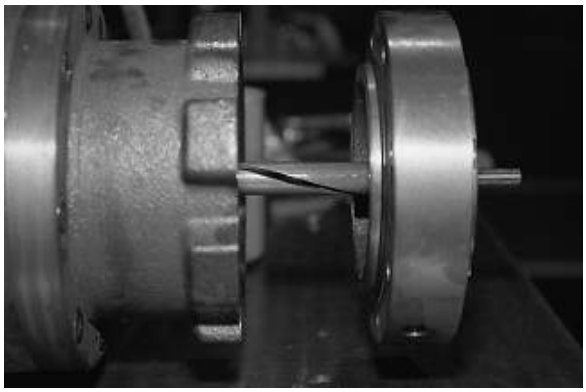
Unloader Cover Mounting Parts



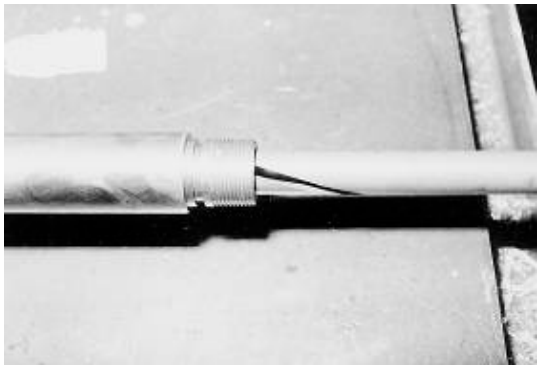
Indicator Cam and Pushrod



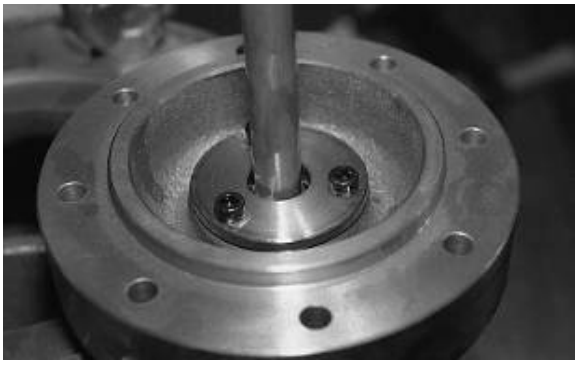
Unloader Cover



Removing the Unloader Cover



Unloader Push Rod and Indicator Cam



Unloader Cover

Inspection

a) Check the packing of the indicator cam shaft for any flaw. If the refrigerant leaks without any flaw observed in this part, it should be due to a defect of the V-ring or installing the V-ring without sufficient oil.
   In this case, replace the V-ring.
b) Check the spiral groove of the indicator cam. If an abnormal flaw or wear is observed, replace it with a new one.

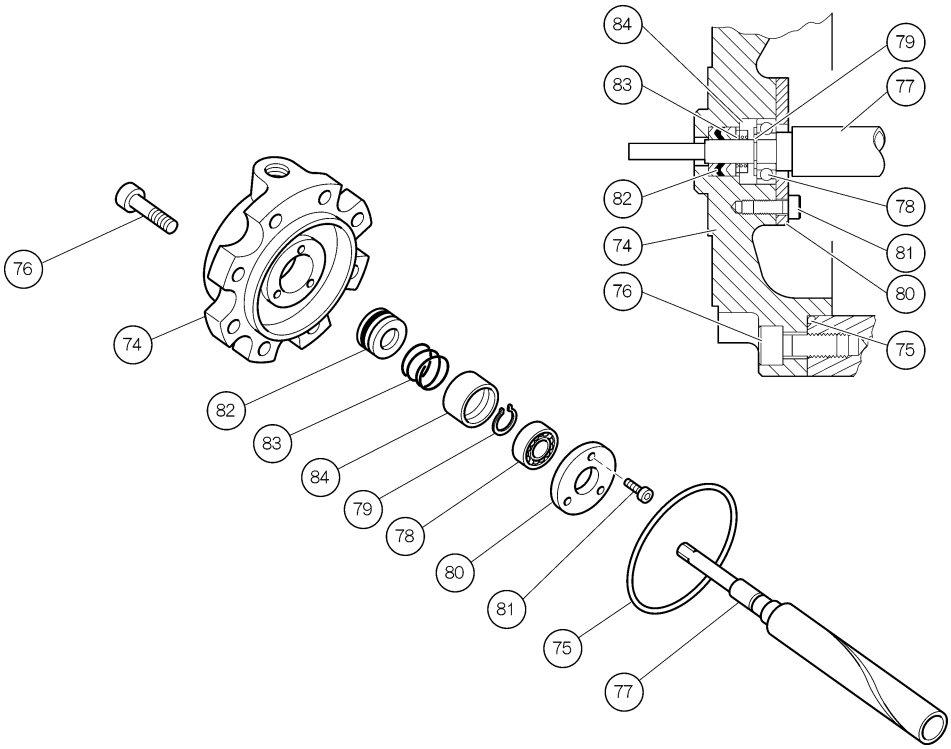


Figure 5-8 Unloader Cover Block(125～320 Type)

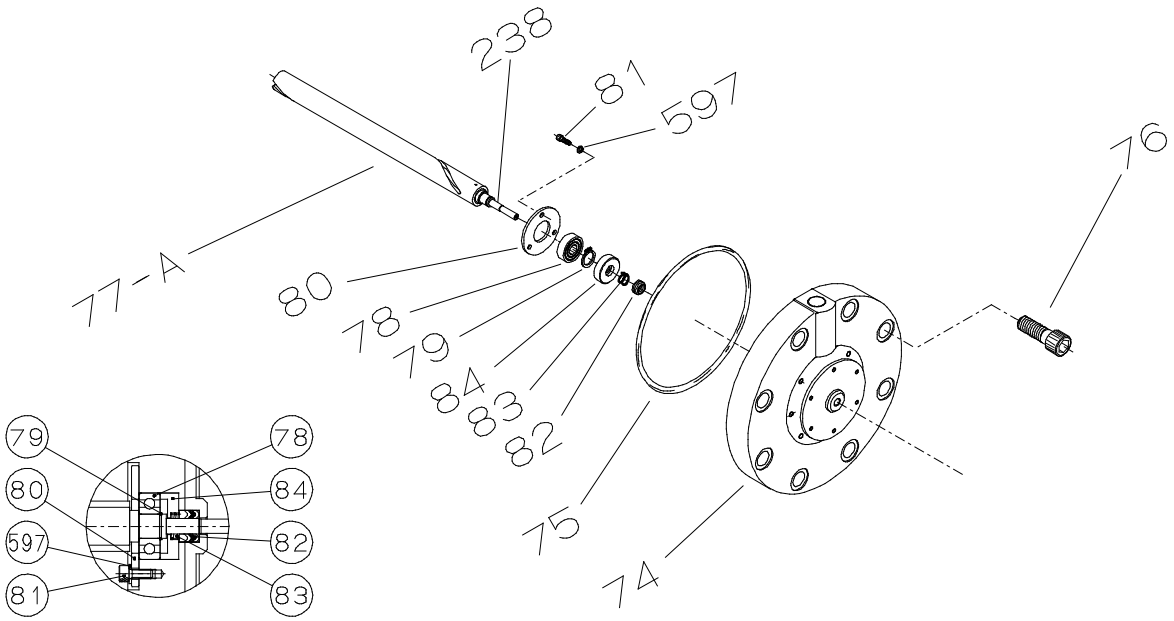
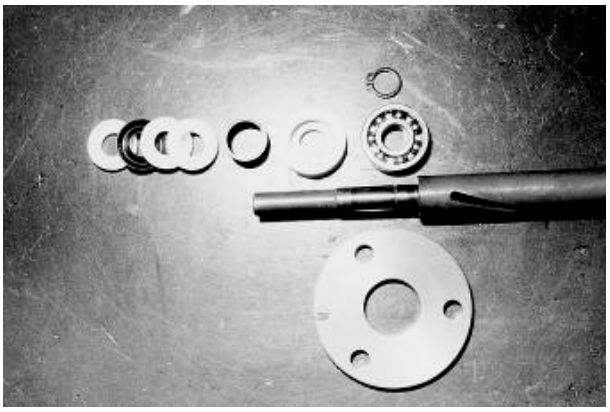
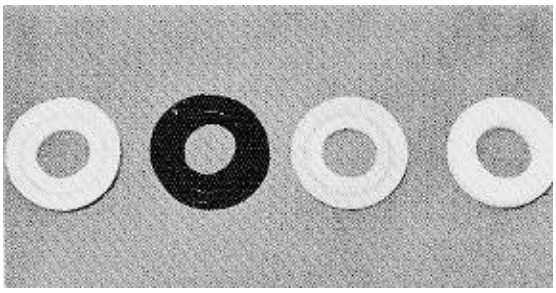


Figure 5-9 Unloader Cover Block (400 Type)



Shaft seal parts of indicator cam



Teflon V ring

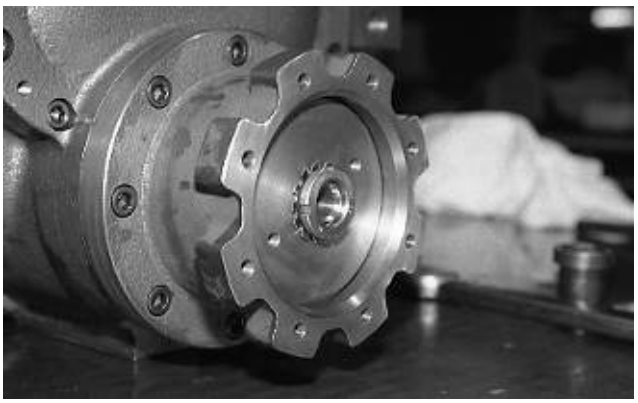
5.4.5 Unloader Piston and Unloader Cylinder

Disassembly

a) Screw the eyebolts of the disassembly tool into the two screw holes on the unloader piston, and move the unloader piston to the unloader indicator side to the full load (100 % load) position. Bend back the claw lock washer for locking the lock nut that secures the unloader piston to the push rod.

b) Use a lock nut wrench “sold separately” to loosen the lock nut “part number 69”.

c) Use the eyebolt again to pull the unloader piston out of the push rod.



Bend back the claw lock washer for locking

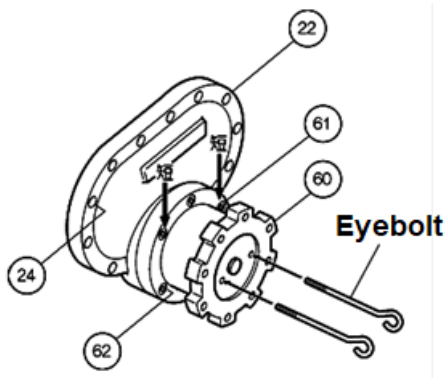


Figure 5-10 Remove Unloader Piston

d) The unloader cylinder is assembled to the balance piston cover with two short hexagon socket head bolts (part number 61) and to the suction cover with six long hexagon socket head bolts (part number 62).

e) Remove the tightening bolts on the balance piston cover. Place a container to receive the oil coming out from inside, and pull the entire cover toward you to separate the unloader cylinder and balance piston cover from the suction cover.

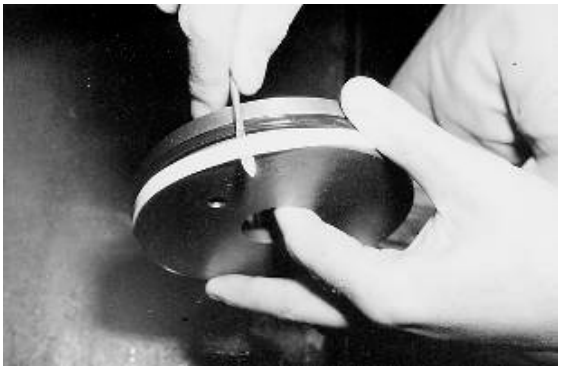
Inspection

a) Be sure to replace the cap seal (part number 66) and “O” ring (part number 65) that are installed on the outer circumference of the unloader piston.

b) If the inner surface of the unloader cylinder is scratched, remove it with fine sandpaper (#400

or more) and wash the surface thoroughly.

c） Replace the "O" ring (part number 73) on the unloader piston mating part of the unloader pushrod.



Inspection of cap seal

Unloader Push Rod "O" Ring

5.4.6 Removal of Bearing Cover

If it is less than 320, the discharge flange is in an asymmetrical position, so the left and right balance is poor in terms of weight, so remove it carefully.

WARNING

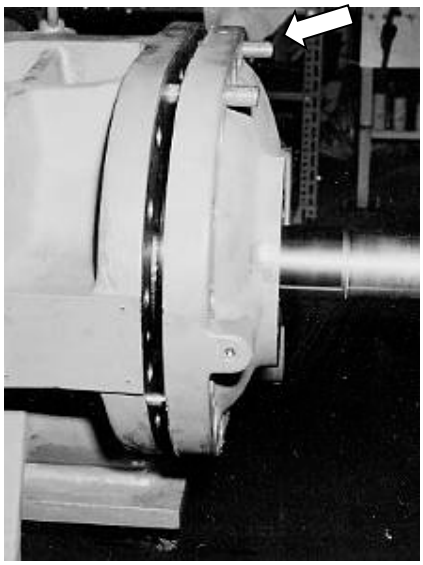
- **Make sure to take sufficient care to handle the heavy objects, and make better use of a crane or chain block, etc., if necessary.**
  Dropping heavy objects may cause a large damage to workers and goods

Disassembly

a) Among the bolts "Part No. 18-1 and 18-2" tightening the bearing cover, replace the two bolts at the upper position without head "safety bolts" and remove all other bolts.

b) There are two screw holes for the service holes at the 2 o'clock and 8 o'clock positions on the bearing cover. "A vinyl cap is attached at the time of shipment."。After placing a container for receiving oil under the bearing cover, attach two removed bolts to the screw holes and screw them in alternately to widen the gap with the bearing head on average. When there is a gap, the oil inside will flow out.

c) If the gap is further widened, the cover will come off from the positioning pin near the service hole.For 200, 250 and 320 models, eye bolt screws are machined on the upper side of the flange on the bearing cover. The product is heavy. Hang it with a lifting slings to remove it.



Safety Bolt

Removing bearing cover bolt

Inspection

Make sure that the positioning pin is not bent (it might bend when removing the cover).

5.4.7 Thrust Bearings

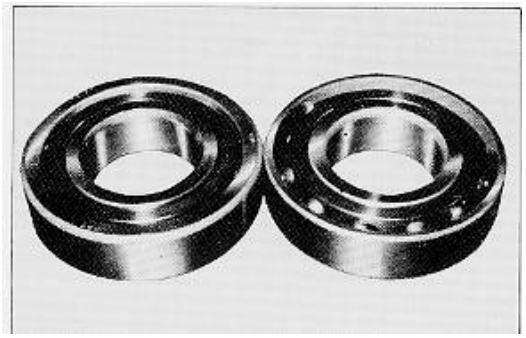
Thrust bearings “part number 38” are an important component in the performance of screw compressors.

Improper installation of this part may cause malfunction. Pay attention to disassembly and assembly, and work carefully.

This thrust bearing is a face-to-face combination angular contact ball bearing and uses a special retainer.

The outer ring is a clearance fit with the bearing head and is designed to receive only thrust load.

Not only does this bearing support the thrust load, it also serves to maintain precise the end clearance between the rotor end face and the bearing head discharge end face.



Thrust bearing (1 set)

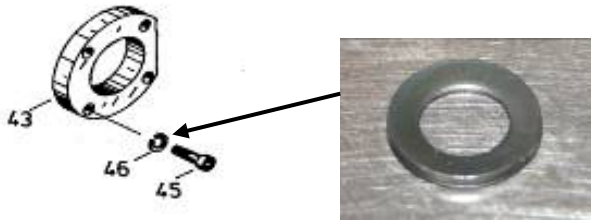
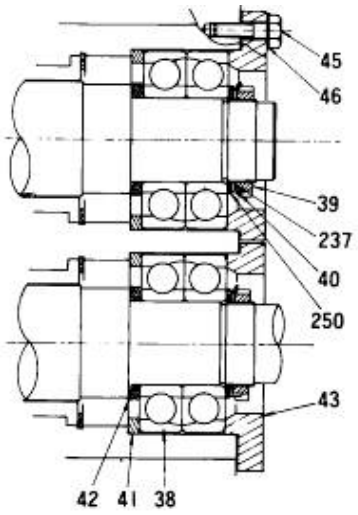


Figure 5-11 Conical Spring Washer



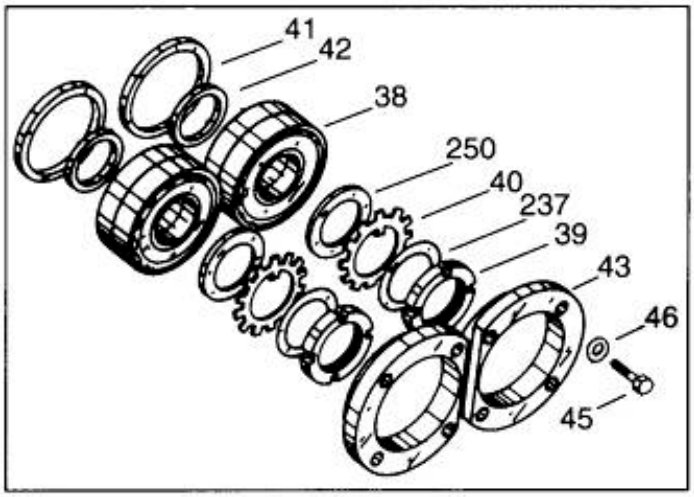


Figure 5-12 Development view of the 125-250 thrust bearing
* 250 does not have thrust bearing outer race spacer (41).

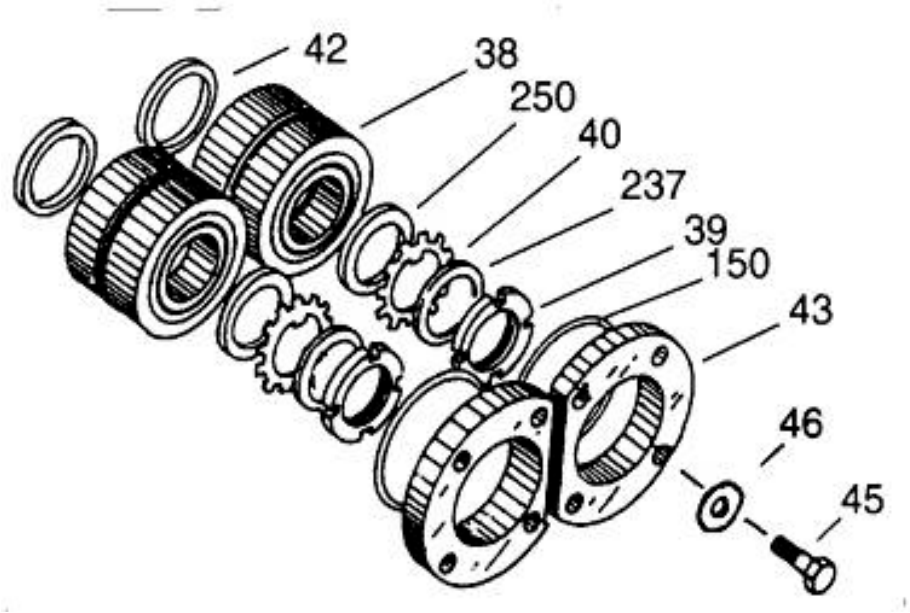


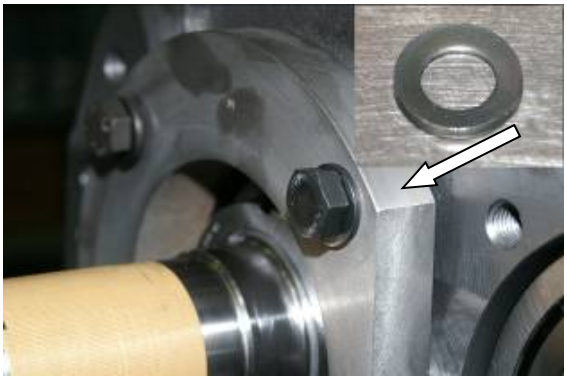
Figure 5-13 Development view of the 320 Thrust Bearing

Disassembly

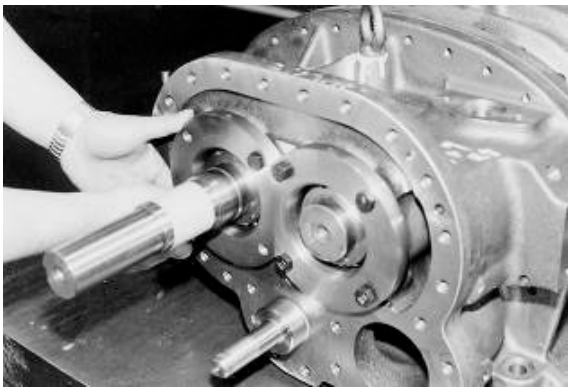
“For 125, 160, 200, 250, 320”

a) Remove the hexagon head screw “part number 45” that tightens the thrust bearing gland “part number 43”.

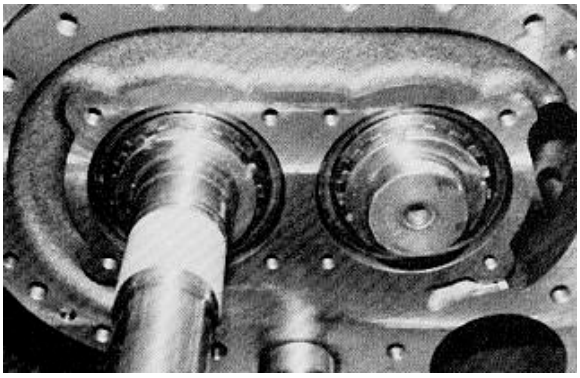
Be careful not to lose the disc spring lock washer “part number 46” when removing the bolt, as it will come off at the same time.



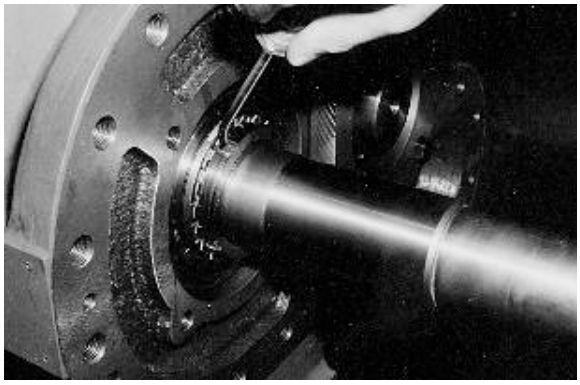
Removal of Thrust Bearing Gland



Removal of Thrust Bearing Gland



After removing the Thrust Bearing Gland

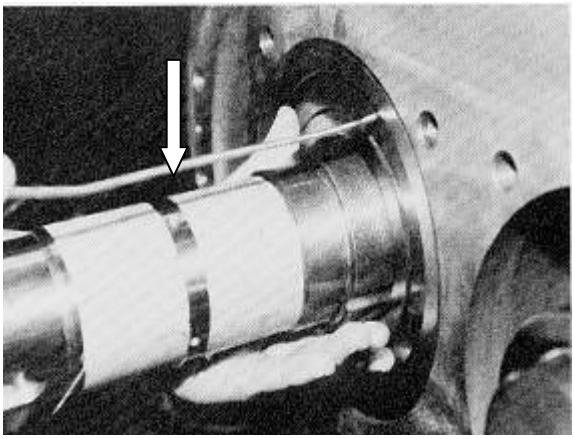


Bend back of the lock washer

b) Bend back of the lock washer “part number 40” for the lock nut “part number 39” that secures the innerring of the thrust bearing to the shaft, and then loosen the lock nut.

c) Store the torsional slip washer “part number 237” between the locknut and lockwasher carefully so that you do not bend it.

Also store the thrust washer “part number 250” located between the lock washer and the bearing.



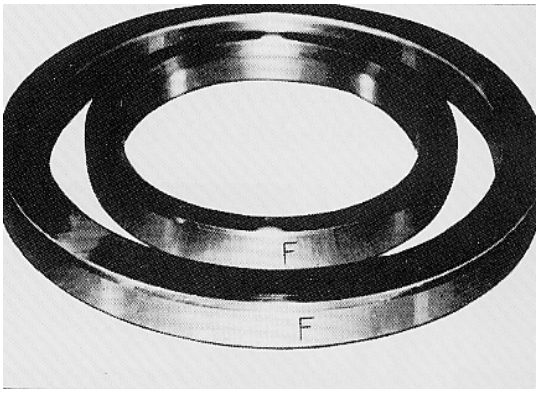
Pulling out the Thrust bearing

Thrust bearing (1 set)

d） The thrust bearing inner ring and rotor shaft have a clearance fit. Prepare a slightly bent wire tip with a diameter (φ) of 2 to 3mm flattened, insert it between the outer ring of the bearing and the retainer, hook it, and pull it out toward you “see arrow ⇨.

e） Remove the thrust adjustment washers “part number 42” and thrust bearing spacer “part number 41” on the inside “some models do not have a spacer”.

Place the removed adjustment washer and spacer separately for the M rotor and F rotor （There is a engrave indicating the rotor used. If the assembly position is mistaken during reassembly, the end clearance between the discharge end surface and the bearing head end surface will not be maintained correctly, resulting in performance degradation and seizure of the end surface.)



The Marking of Thrust bearing outer race spacer and alignment spacer

№	Part name	125～200	250	320
38	Thrust Bearing	2 sets	2 sets	2 sets
39	Lock Nut	2	2	2
40	Lock Washer	2	2	2
41	Spacer,Thrust Bearing Outer Race	2	—	—
42	Spacer,Thrust Bearing Alignment	2	2	2
43	Thrust Bearing Gland	2	2	2
45	Hexagon Head Bolt	2	8	8
46	Disk Spring Washer, Lock Washer	2	8	8
150	O-ring	—	—	8
237	Torsional Slip Washer	2	2	8
250	Thrust Washer	2	2	8

Inspection

a) After thoroughly cleaning the thrust bearings, remove the cleaning solution with compressed air. First, make sure that the surface of the ball is evenly shiny and that there are no scratches or flaking.
   Next, inspect the corners of the retainer (thrust bearing retainer) ball hole for blisters and wear.
   In either case, replace the bearing set.

b) Hold one of the bearings in your hand and rotate the outer ring by hand with the inner ring facing downward. (Make sure the inside of the combination is facing down). If the rotation is not smooth and it is uneven or hooked, it is caused by dust or scratchesIn that case, check again and wash or replace the bearing set if necessary.

Tilting pad thrust bearing (TPTB, 400*UD)

Disassembly

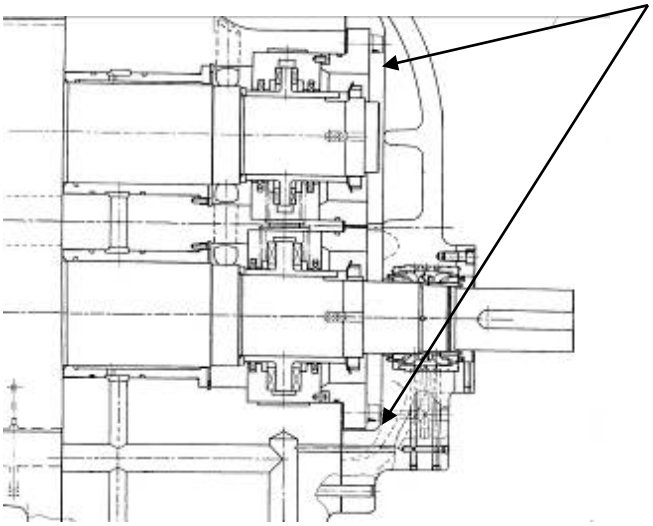
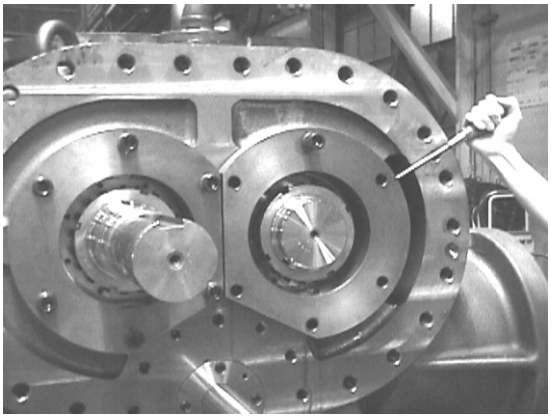


Figure 5-14 TPTB

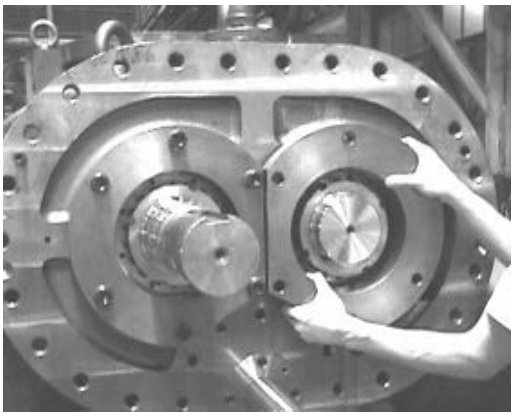
Thrust Bearing Gland



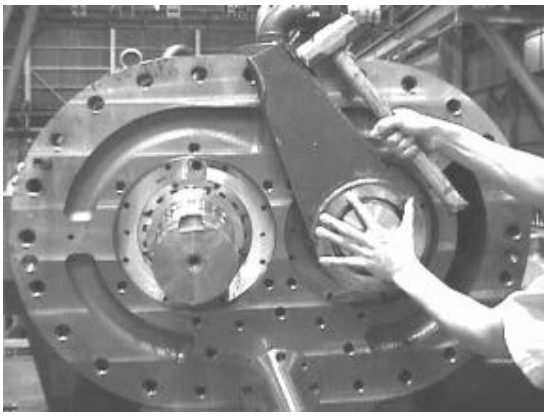
Thrust Bearing Gland (1)

a) Loosen the hexagon socket head cap screw and insert the lifting eye bolt into the bolt hole on the upper part of the thrust bearing gland.

b) Lift up the thrust bearing gland, remove the bolt, and insert the safety bolt on top of the thrust bearing gland. Pull out the thrust bearing gland using a flathead screwdriver. Remove the thrust bearing gland and pull out the other thrust bearing gland in the same way.



Thrust Bearing Gland (2)

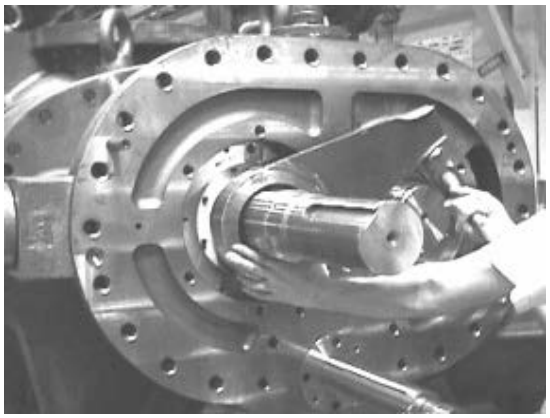


Lock Nut (1)

(The photograph used is 400 VMD) VMD and MUD have different points.

TPTB assembly

a) Use the lock nut wrench of the special disassembly tool to loosen the lock nut and remove the lock nut and lock washer.



Lock nut (2)

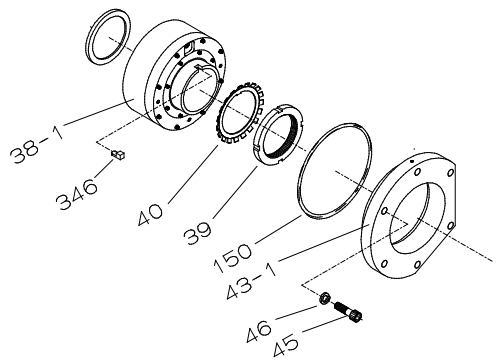
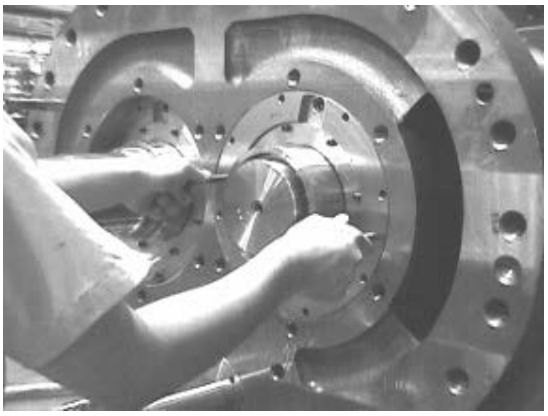
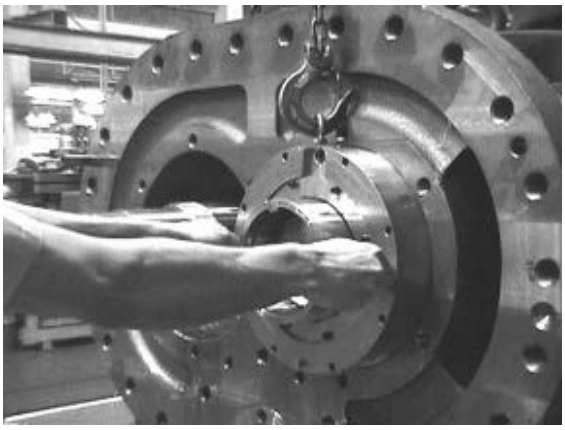


Figure 5-15 Development View of the Thrust Bearing

b) Remove the key on the shaft and store it in a safe place.
c) Insert two eye bolts into the bolt holes on the tilting pad thrust bearings and pull out the tilting pad thrust bearings until the bolt holes on the top of the bearings are visible axially.
d) Insert the lifting bolt into the hole on the tilting pad thrust bearing and lift it. Pull out the tilting pad thrust bearing from the bearing box.

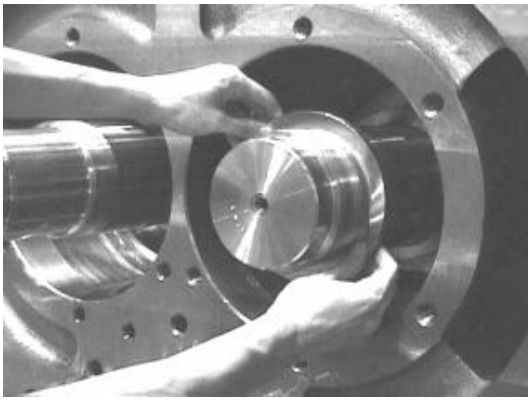


Thrust Bearing (1)

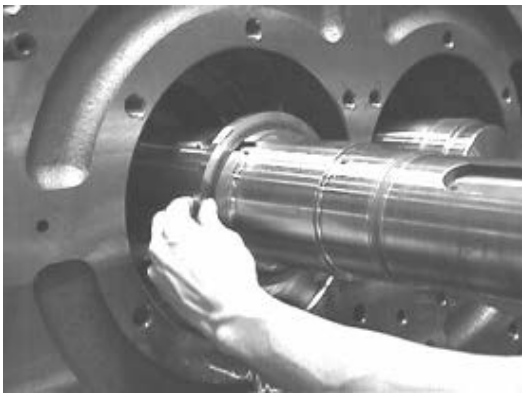


Thrust Bearing (2)

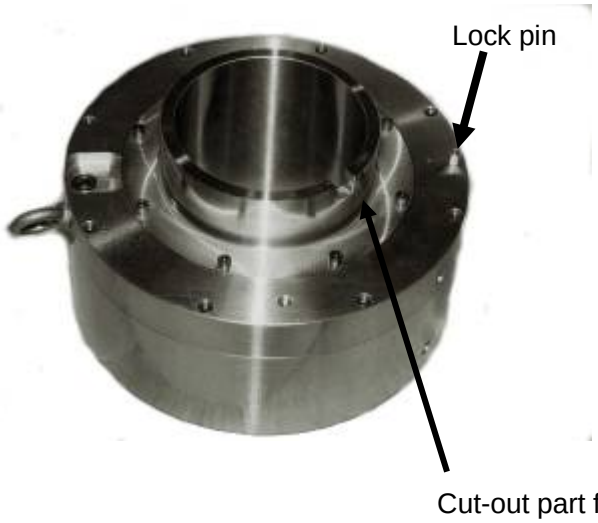
e) Remove the thrust bearing alignment spacers from the rotor.



Thrust bearing alignment spacer（1）



Thrust bearing alignment spacer（2）



Tilting pad thrust bearing (TPTB)

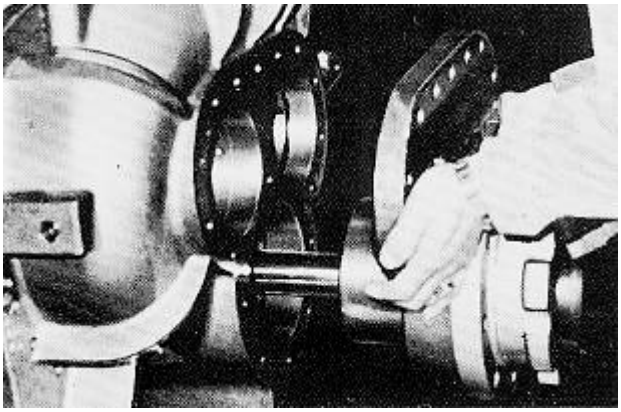
5.4.8 Balance Piston Cover

The balance piston cover (part number 22) can be easily reassembled by removing it together with the unloader cylinder as described in Section 5.4.5 “Unloader piston and cylinder”. Pay attention to the following points when removing only the balance piston cover after removing the unloader cylinder.

Disassembly

a) Loosen all the hexagon socket head cap screws (part number 24) by 3 to 4 turns, screw the eyebolts into the screw holes of the balance piston cover, and remove the cover gasket (part number 23) which is in close contact.

b) In this condition, oil accumulated in the balance piston and side bearing section of the suction cover is discharged. Once the oil has been drained, remove all other bolts leaving one of the upper bolts. While pressing the cover by hand and remove the remaining bolts from the suction cover without damaging the gasket.



Removing the Balance Piston Cover

5.4.9 Balance Piston

The screw compressor is structurally of the two rotors M and F, and the M rotor rotates 1.5 times more than the F rotor because the thrust caused by the drive revolution of the M rotor and the thrust caused by the difference in the gas pressure are applied. If the same thrust bearing is used, the life of the M rotor side will be shortened remarkably. Therefore, a piston is installed at the tip of the M rotor to apply hydraulic pressure in the direction to cancel the thrust load.
This is the balance piston (part number 30).
The balance piston rotates with a narrow clearance from the balance piston sleeve (part number 33).

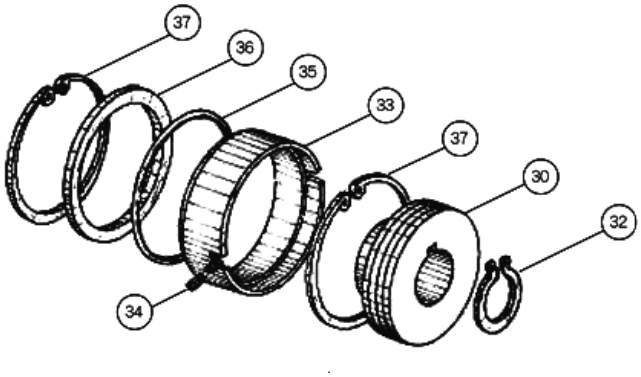
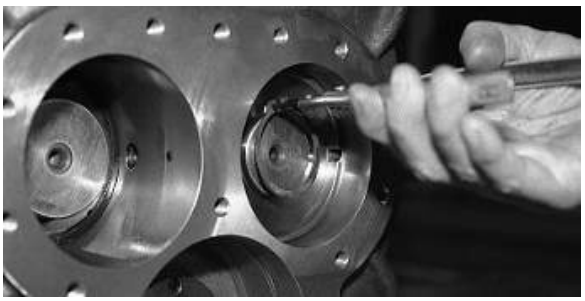


Figure 5-16 Development view of the Balance Piston

Disassembly

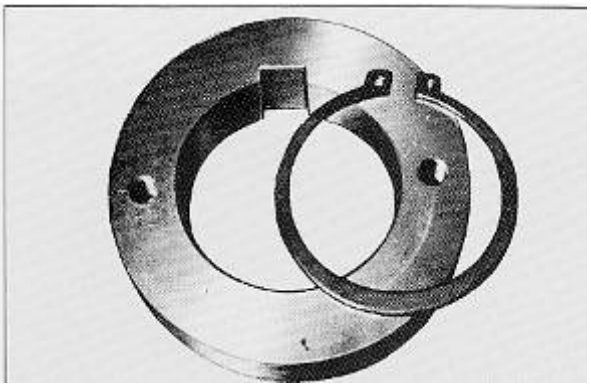
Disassembly of balance piston and balance piston sleeve

a) Remove the stop ring (part number 37) that secures the balance piston (part number 30) to the shaft with the stop ring pliers.
b) Screw the accessory eye bolt into the balance piston and pull it out parallel to the axis.
The rotor shaft remains with the balance piston key (part number 31) embedded, but does not need to be removed.



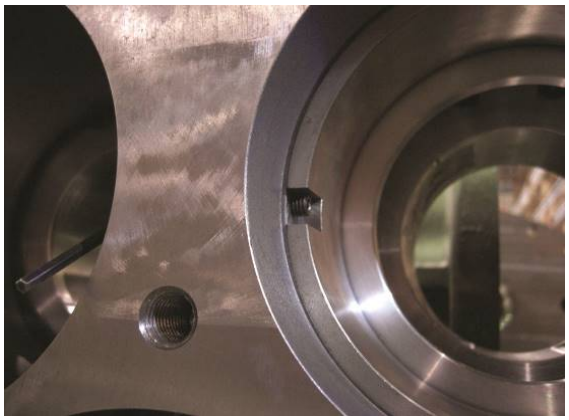
Removing Balance Piston retaining ring

Pull out the Balance Piston



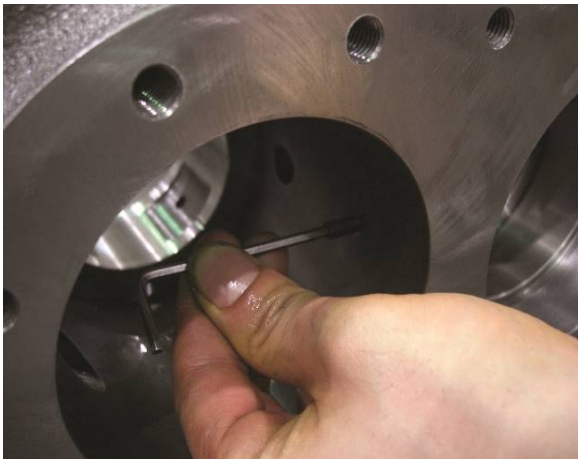
Balance piston

c) The balance piston sleeve is not attached to 125.
There are two types of locking methods for 160 and above depending on the model.
Type 1: How to fasten the cut out part of the balance piston sleeve with a screw
(160 ~ 250 *** type)
Type 2: Drive the spring pin into the sleeve and fit it into the groove of the suction cover
(320, 400 *** type)

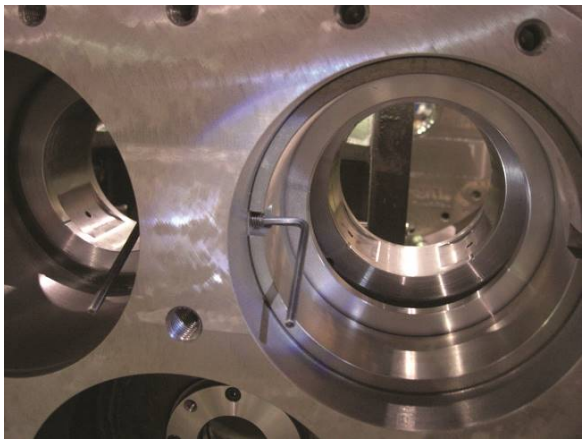


Type 1: Balance Piston Sleeve
Hexagon Socket Set Screw

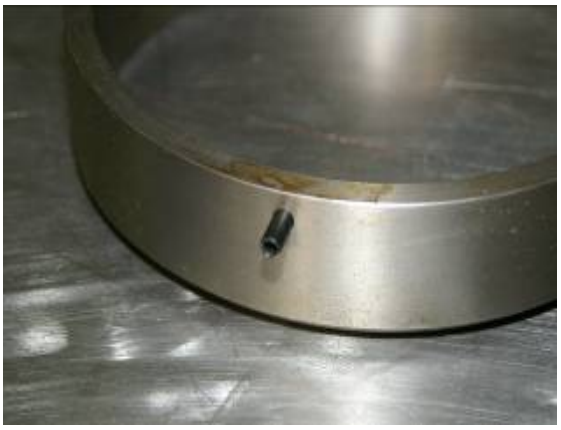
Type 2 (groove part): Balance Piston Sleeve
Hexagon Socket Set Screw (320, 400 type)



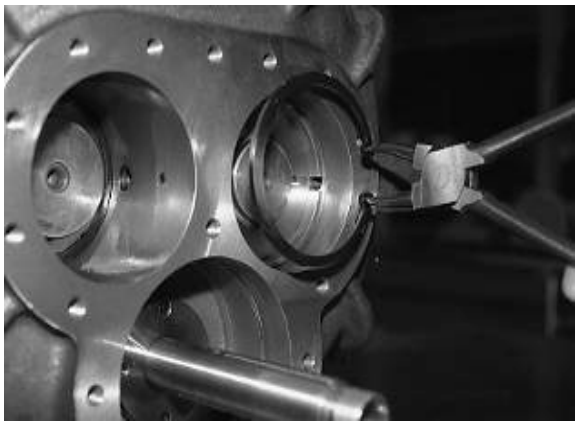
Loosening Balance Piston Sleeve
Hexagon Socket Set Screw 1



Loosening Balance Piston Sleeve
Hexagon Socket Set Screw 2



Balance piston sleeve locking spring pin(320，400Type)



Removing the Retaining ring for the balance piston sleeve

d) The balance piston sleeve (part number 33) has a cutout and is fixed by matching two hexagon socket set screws to the screw holes on the suction cover side. Pull out the M side or loosen the F side and let the head part of the M side into it.
e) Remove the stop ring of the balance piston sleeve with Type 2 as it is.
f) Remove the balance piston sleeve. The sleeve is a clearance fit so it can be pulled out easily.
g) Remove the "O" ring (part number 35) and the "O" ring spacer inside the sleeve.
h) If you plan to remove the side bearings, also remove the stop ring (part number 37) inside.

Inspection for Balance Piston and Balance Piston Sleeve

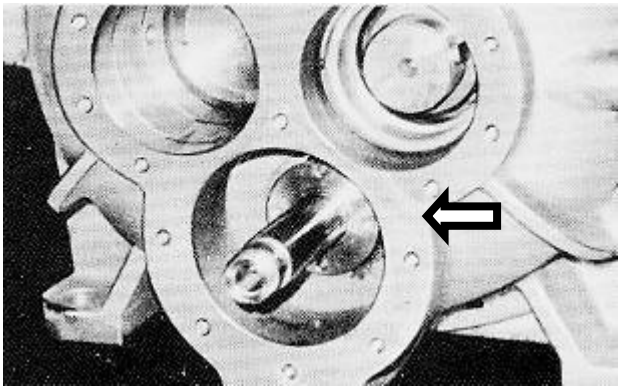
There is a mark of wear on the inner surface of the balance piston sleeve, but this is normal because the clearance between the balance piston and piston sleeve is smaller than the clearance between the rotor shaft and bearing.

A large gap is provided on the outer circumference of the balance piston sleeve to prevent the bearing load from being applied to the balance piston, so further wear does not progress.

However, if the side bearings are severely worn, the balancing piston will also be worn. Check carefully.

Be sure to replace the "O" ring. The "O" ring serves to match the gap with the outer circumference of the balance piston sleeve with the core of the balance piston due to its elasticity.

5.4.10 Oil Injection Pipe



Oil injection pipe insertion part

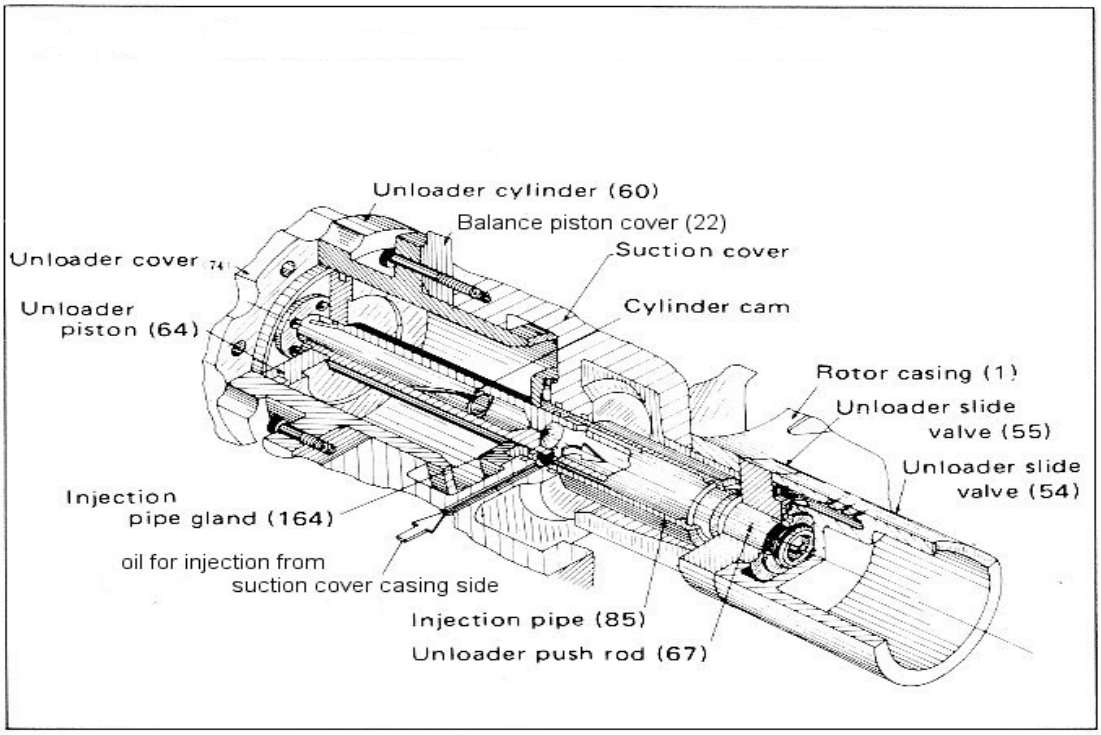


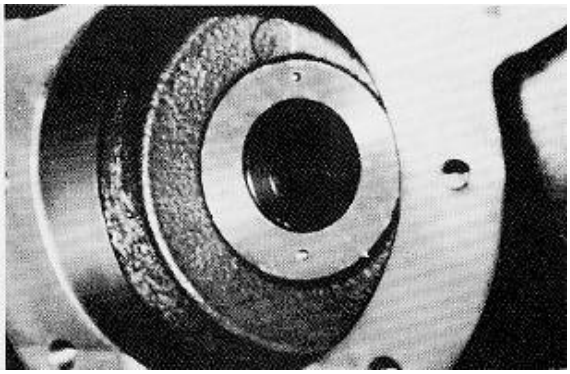
Figure 5-17 Development view of the Oil Injection Pipe section

The unloader push rod protrudes from the location where the unloader cylinder of the suction cover is removed, and the injection pipe is attached to the outer periphery of the unloader push rod. Relaying the unloader push rod and slide valve from the suction cover, injection oil is supplied to the rotor meshing part.

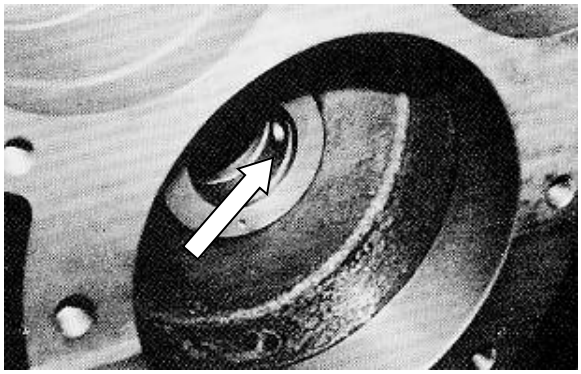
Disassembly

a) Remove the hexagon socket head cap screws (part number 166) that tighten the oil injection pipe retainer (part number 164).
b) The oil injection pipe retainer has two screw holes for pull out. Use the eyebolt to pull it out parallel to the unloader push rod. Since it is sealed with four "O" rings, so it needs a little force.

c) The oil injection pipe retainer and the oil injection pipe (part number 85) are connected by spring pins so they can be pulled out at the same time.



Oil injection pipe retainer



Oil hole for oil injection

Inspection

a) Replace the "O" ring. It is installed in two places inside the oil injection pipe.

b) Also replace the “O” ring (part number 9) which is in the hole for the oil injection pipe in the center of the suction cover.（Arrow indication）

5.4.11 Suction Cover and Side Bearing

Disassembly

a）Remove all bolts that attach the suction cover to the rotor casing.

b）Tighten the two removed bolts to the screw holes for the removal bolts on the rotor casing side, and alternately screw in little by little to widen the clearance between the suction cover and rotor casing. If not screwed evenly, the positioning pin will be bent. Remove the gasket when there is a small gap. At this time, remove the gasket so that it is on the suction cover side.

c）Then screw in the bolts alternately to widen the gap and remove the positioning pin. Then, lift the suction cover with a crane to separate the rotor shaft and unloader pushrod assembled on the suction cover side from the suction cover. Slide it parallel to the rotor axis on the work bench to separate it from the rotor casing. Move the suction cover while pushing the rotor back into the rotor casing so that the rotor does not fall out at this time.

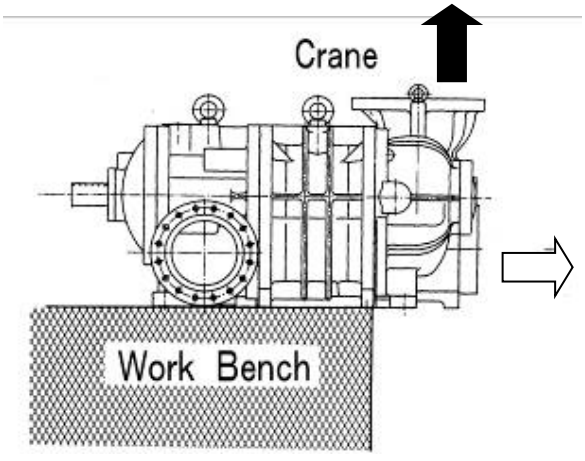
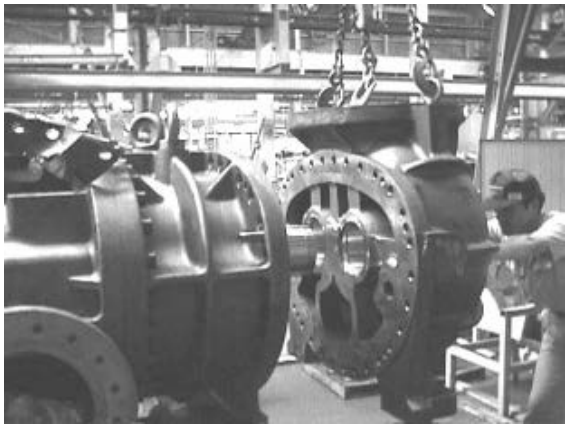


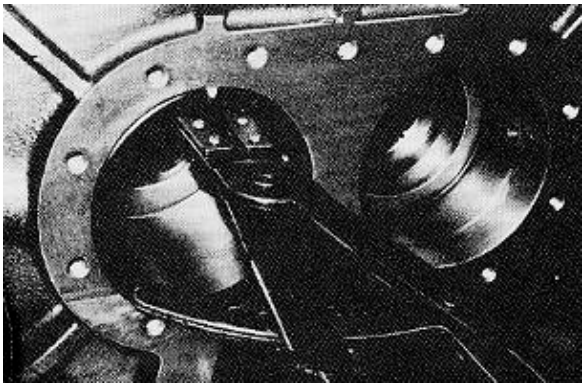
Figure 5-18 Removal of Suction cover



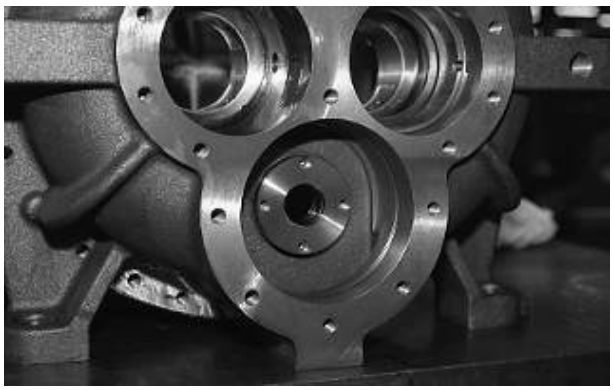
Removal of Suction cover (400UD)

d) Once the suction cover has been separated, for 320 and 400, remove the hexagon socket head cap screws (part number 166) at the section where the unloader push rod was incorporated and remove the "O" ring retainer (part number 326). Replace the “O” ring inside the “O” ring retainer and the “O” ring (part number 9, 325) inside the suction cover.

e) Remove the stop ring (part number 29) to remove the side bearings (part number 28). Then push the side bearings out from the rotor side. If the fitting is hard, do not hit the bearing directly, but use a copper, aluminum or plastic wire. The side bearings have clearance fits due to machining tolerances. Replace the "O" ring (part number 433) on the outer circumference of the bearing.



Removing of Retaining Ring for Side Bearing



Unloader push rod “O” ring retainer

Inspection

a) Inspect the unloader push rod (part number 67). Replace the rod if it is deformed or the sliding part on the outer circumference is abnormal. Be sure to replace the “O” ring (part number 73) on the unloader piston fitting.

b) Check if foreign matter is embedded in the inner sliding surface of the side bearings and the dimensional accuracy. Judging from the result of the inspection, replace the side bearing if necessary.

5.4.12 Rotor and Rotor Casing

Disassembly

WARNING

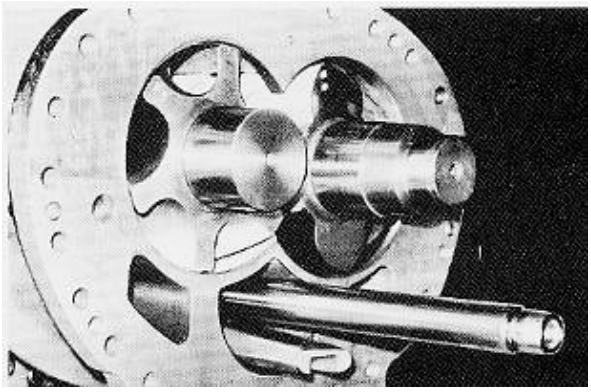
- **The rotor is a heavy object, so use a crane or chain block while working with care.**

a) Hook the hemp rope or nylon belt at the position where the rotor was pulled out halfway through the casing, and then lift the rotor while pulling it out. Avoid using wire rope as it will damage the rotor.
You can pull out from either the M rotor or the F rotor. When pulling out from the F rotor, turn the rotor counterclockwise and it will come out from the rotor casing. When about two-thirds out, hang a belt around the outer circumference, make it feel like lift up, and pull out the rest. Be careful not to scratch the inner diameter of the rotor casing with the tip of the shaft when pulling it out.

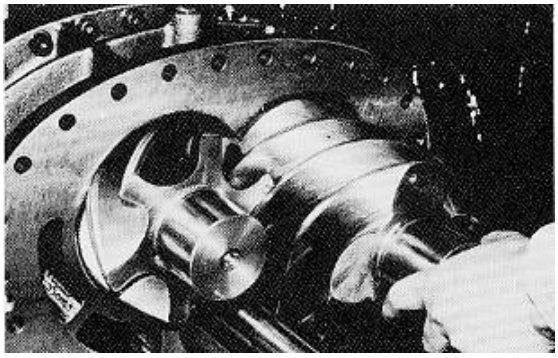
b) Please support the shaft by V block (wooden) etc. so that the outer circumference of the rotor

does not touch the floor.

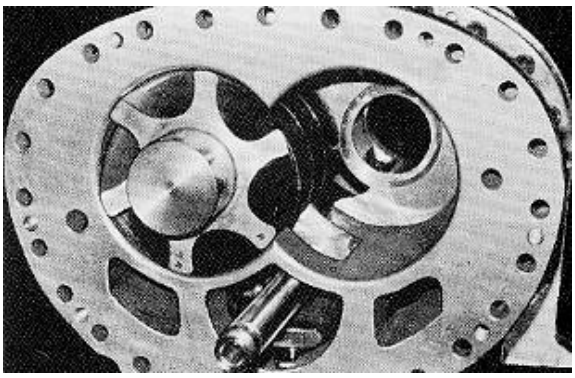
c）Take out the other rotor in the same way as in a) and support the shaft with a V block (wooden) and hold it.



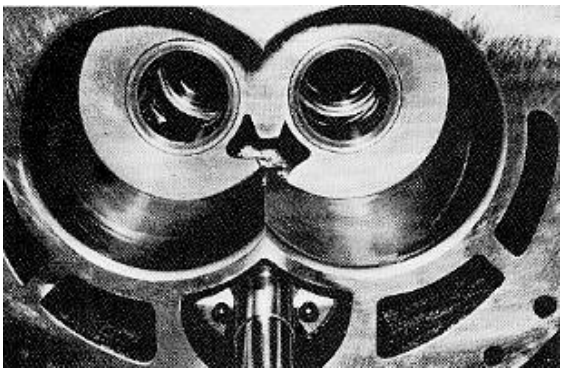
After removing the suction cover



Pull out the M rotor



After pull out the M rotor



Rotor casing and Bearing Head

Inspection

a）Inspect the surface of the rotor's bearing part and the surface of the mechanical seal section where the "O" ring touches, and make sure that there are no scratches.

b）Check the rotor for robe contact and outer diameter for wear or damage. Abnormalities rarely occur in normal use. If it is damaged, foreign matter may have been sucked in. The suction gas filter or the oil filter must be checked.

c） Check the sliding surfaces of the unloader slide valve and rotor casing.

d） Check the surface of the rotor inserting part of the rotor casing. Normally, the rotor and the inner diameter surface of the rotor casing do not contact, so it is normal that nothing changes. If there is any sign of contact with the rotor, there is an abnormality in the rotor shaft and bearing relation. If the outer diameter of the rotor wears about 0.3 % of the diameter, the refrigeration capacity will start to decrease.

e）Contact us if you need to repair the mechanical seal.

5.4.13 Bearing Head and Main Bearing

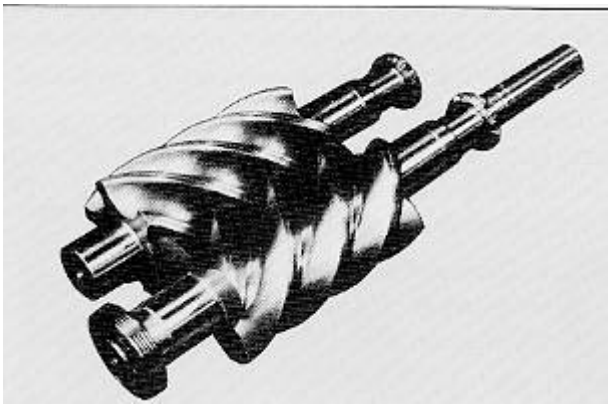
On the side where the rotor of the bearing head (part number 11) is installed, a gas discharge port that is determined by the operating conditions of the compressor is machined. This discharge port affects the performance of the compressor. The bearing head also has a bearing that supports the discharge side of the rotor. There is a difference in the shape of the discharge part between UD type and G type.

Disassembly

a） Bearing heads and rotor casings do not normally need to be separated.
Pull out all the hexagon socket head cap screws (part number 2) that tighten the casing and bearing head, and drive the parallel pin (part number 3) into the rotor casing side.

b) Screw the bolt (part number 2) into the screw hole on the casing side and push it in.

c) The main bearing can be removed by pulling out the stop ring (part number 29) from the bearing cover side of the bearing head with the stop ring pliers and pressing the main bearing. If the fitting is hard, do not hit the bearing directly, but use a copper, aluminum or plastic wire. Replace the "O" ring (part number 432) on the outer circumference of the bearing.



M rotor and F rotor

Inspection

You should always inspect them according to the following procedure.

a) Visually inspect the bearing surface of the main bearing (part number 27) fixed to the bearing head to ensure that there is no abnormality.
If it is abnormal, replace it with a new one.

b) Visually inspect the bearing surface of the discharge port on the rotor side to make sure there are no abnormalities.
If it is severely damaged, the end clearance adjustment may not be correct. Garbage contained in the gas may cause scratchesVisually inspect the contact surface between the casing and the slide valve to make sure there are no abnormalities..

c) Visually inspect the contact surface between the casing and the slide valve to make sure there are no abnormalities.

5.4.14 Unloader Slide Valve and Guide Block

The guide block consists of a guide block stem (part number 88), a guide block (part number 87), and two "O" rings. The guide block meshes with the slot in the bottom of the slide valve.

The length of this unloader slide valve assembly varies depending on the compressor model.

The unloader slide valve assembly consists of a slide valve body (part number 54, 55) consisting of two parts, four hexagon socket head cap screws (part number 58) and an unloader push rod (part number 67).

The unloader push rod and unloader slide valve (2) are fixed with a lock nut (part number 69) and a lock washer (part number 70).

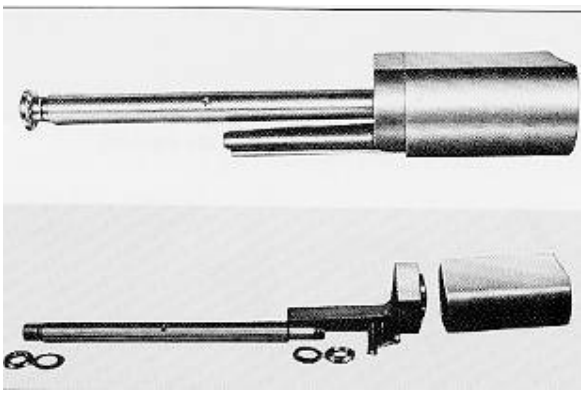
Disassembly

a) Remove the unloader slide valve assembly from the casing. It is not necessary to disassembly the unloader slide valve assembly except when replacing the unloader pushrod.
b) To replace this rod, remove the hexagon socket head cap screws (part number 58) and remove the unloader slide valve (2) (part number 55).
c) Loosen the lock nut, remove the lock washer, and pull out the push rod from the unloader slide valve body.
d) To remove the guide block, remove the guide block stem (part number 88) from the bottom of the casing. Removal of the guide block stem is necessary if a refrigerant leak is found near the stem hole.

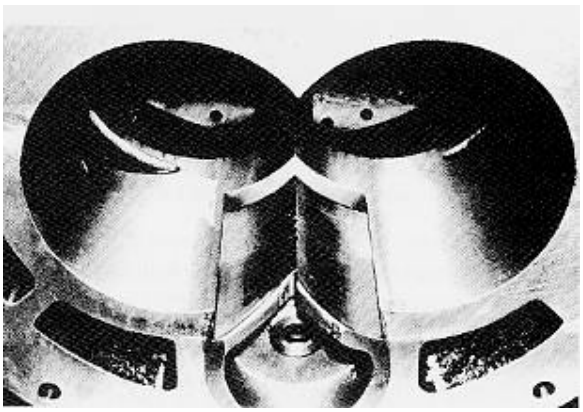
Inspection

Inspect them according to the following procedure.

a) Check the sliding surface and gap between the guide block and slide valve.
b) Inspect the grooved pin at the end of the unloader push rod and replace it if scratched or worn.



Unloader slide valve assemblies (upper)、Disassembled parts (lower)



Rotor casing and unloader slide valve

List of O-rings used

No.	Install position	125	160	200	250	320	400
9	Suction Cover	P42(2)	P42(2)	G55(2)	G60(2)	P58(1)	G95(1)
35	Balance Piston Sleeve	-	G95(1)	P120(1)	P150(1)	G190(1)	G240(1)
49	Seal Retainer	G85(1)	G90(1)	G115(1)	G135(1)	G160(1)	G160(1)
59	Oil Injection Pipe	P30(2)	P30(2)	P40(2)	P46(2)	P32(1)	-
63	Unloader Cylinder	G95(1)	G125(1)	G150(1)	G190(1)	G240(1)	G300(1)
65	Unloader Piston	P75(1)	P100(1)	P125(1)	P155(1)	P200(1)	P265(1)
73	Unloader Push Rod	P21(1)	P21(1)	G30(1)	G35(1)	P44(1)	G45(1)
75	Unloader Cover	G85(1)	G110(1)	G135(1)	G170(1)	G210(1)	G270(1)
86	Oil Injection Pipe					G30(1)	-
89	Guide Block	P12(2)	P16(2)	P20(2)	P20(2)	P24(2)	-
150	Thrust Bearing Gland Spacer					G220(2)	G290(2)
325	"O" ring retainer						P70(2)
432	Main Bearing		G85(4)	G22☆(4)	G135(4)	G165(4)	G200(4)
433	Side Bearing		G85(4)	G22☆(4)	G135(4)	G165(4)	G200(4)
674	Seal Cover						G39☆(1)

() indicates the Q'ty. ☆: JIS W1516 No mark: JIS B2401

5.5 Reassembly

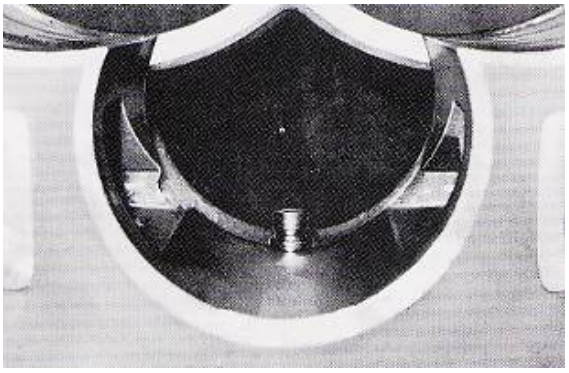
CAUTION

- **Be sure to use only MYCOM genuine parts for replacement. Using parts that are not genuine can cause damage to this product or other devices during operation.**

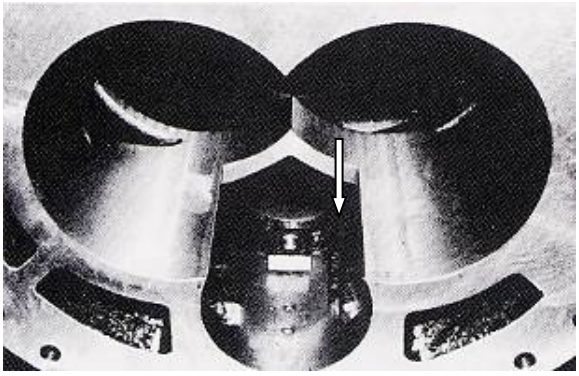
Reassembly of the compressor will be carried out after inspection, repair of parts and confirmation of parts to be replaced. Assembly is mostly carried out in the reverse order of disassembly. Before starting the assembly work, clean the assembly parts, tools, and workbenches and prepare them to apply new compressor oil to the assembly parts.

5.5.1 Unloader Slide Valve and Guide Block (125-320)

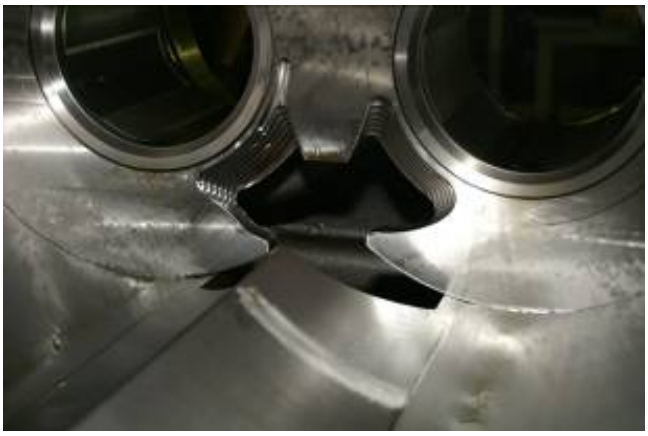
a) Install the guide block in the casing and replace and tighten the guide block stem.



Guide block stem inside the casing



Slide Valve and Guide Block



400UD slide valve and bearing head

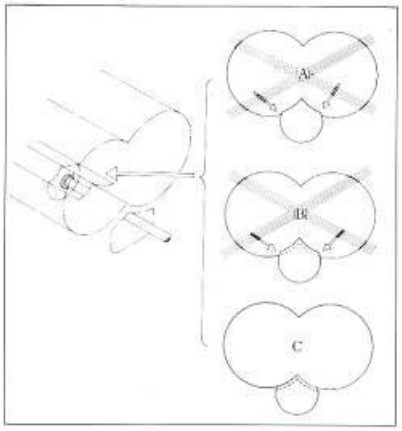
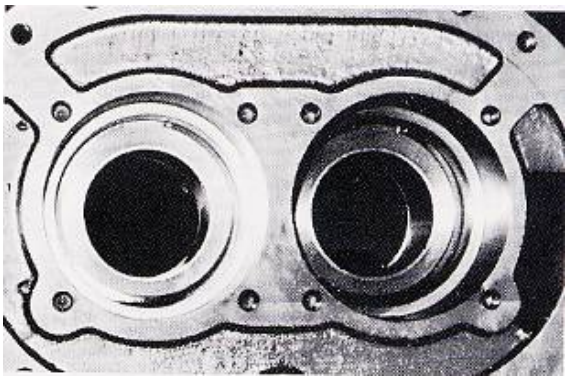


Figure 5-19 Adjustment of Slide Value

b) Insert the slide valve into the casing, making sure the groove of the slide valve is aligned with the guide block. After insertion, move the slide valve back and forth to check the overall movement.

c) Set it to the C position (see Figure. 5-19).
Do not twist the slide valve as shown in A in the figure.
This happens if the guide block is not installed properly.
In the figure, B carefully checks the rotor casing and slide valve.
Sharpen or polish the bottom of the slide valve so that it becomes the condition of (C)

5.5.2 Bearing Head and Main bearing



Setting Main Bearing

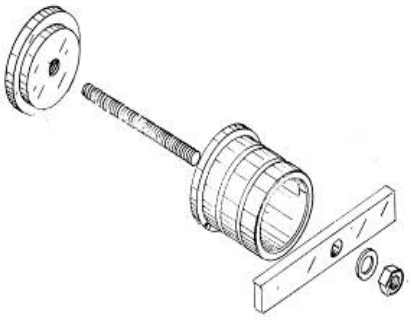


Figure 5-20 Bearing pull-in too

a) The main bearing is a clearance fit. Align the notch of the main bearing with the spring pin (part number 14) of the bearing head and drive with a wooden hammer. If it slips or is not properly aligned, remove it and try again. If necessary, use a tool like a hydraulic jack. Attach the "O" ring (part number 432) of the outer circumference properly.

Cut-out part of the main bearing

b） Cut the bearing head gasket along the inner edge (important for thrust adjustment). Bearing head gaskets are asymmetrical, so check if they are in the correct position.

c） Insert the parallel pin through the flange before tightening the hexagon socket head cap screw (part number 2).

5.5.3 Rotor

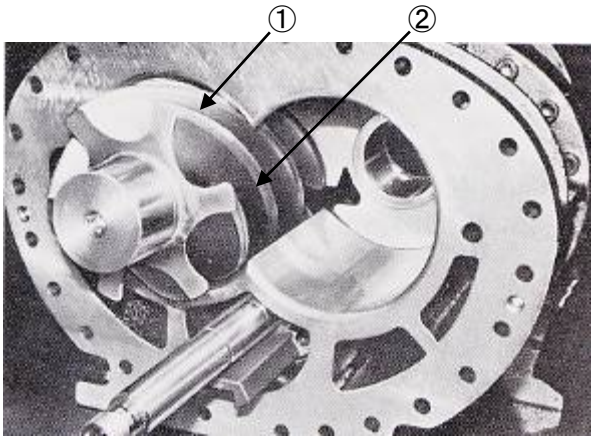
Mating Mark on the M Rotor

Mating Mark on the F Rotor

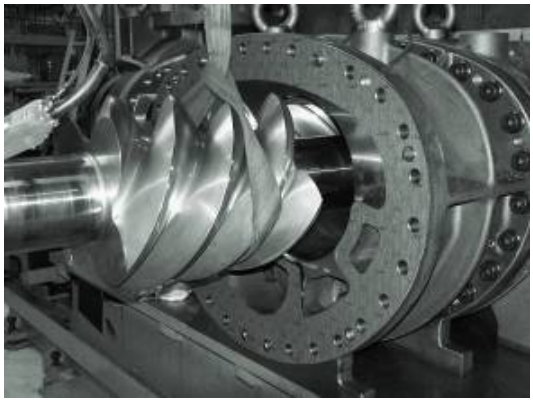
a） First, apply oil to the bearing head side shaft of the F rotor, and also apply oil to the inside of the main bearing.

Install from F rotor to rotor casing. Use a crane or chain block to hang the center of the rotor, balance the front and back, and install half of the rotor in the rotor casing, then remove the hanging belt and push the rotor in.（If the robe of both rotors can be correctly mesh as in steps b) and c), the M rotor may be installed first.)

The rotor robes have robe mark (engraved) on both the discharge side and suction side. In that case, even if you install the M rotor first, you can check the combined engraving of the robes.



Install the F Rotor(200S)


Install the M Rotor (400M)

b）Of the robes of the F rotor, check the position of the groove between the robes of the robe tip marks ① and ②.

c）Combine the teeth of the M rotor robe tip mark ① with the groove between the robes of the F rotor robe tip mark ① and ②. While rotating the M rotor, install it to the middle of the rotor casing, remove the hanging belt, and push it in.

NOTE) Be sure to observe these combinations, as changing the robe combination may change the position of the robe contact or the clearance between the robes and may cause the vibration and the noise during operation.

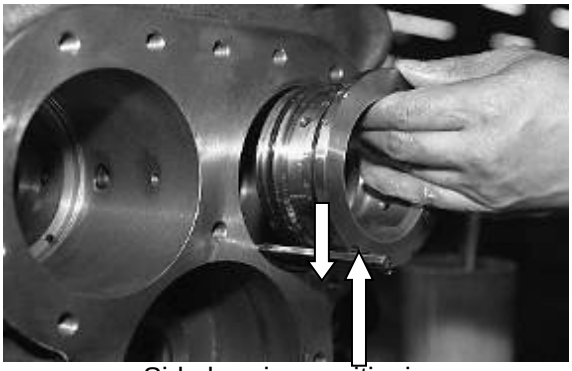
d）After assembling the rotor to the casing, apply oil to the robe surface

e）Do not turn the rotor as the outer circumference of the rotor touches the casing. Turning it can damage the edges of the robes.

5.5.4 Suction Cover, Side Bearing and Oil Injection Pipe

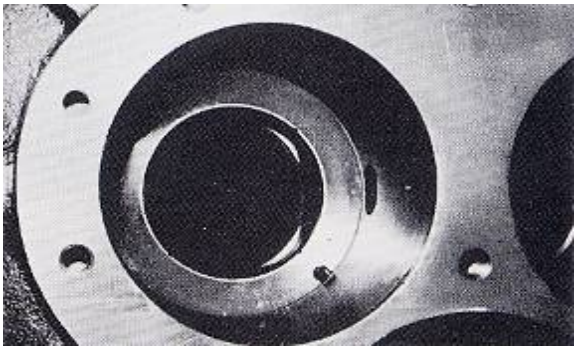
a）Install the side bearings in the suction cover in the same way as the main bearings are installed in the bearing head. Be careful not to forget to assemble the "O" ring (part number 433) of the outside diameter of the side bearing. The fitting between the bearing and the bearing hole of the suction cover is a clearance fit as in the case of the main bearing. If the fit is strong, be sure to hit it with a pad instead of hitting the bearing directly. In addition, to ensure that the positioning spring pin (part number 8) and the cut out of the side bearing are aligned when assembled, attaching the guide rod to the pin makes the work easier. The side bearing has a clearance fit in the suction cover hole. Always ensure that the spring pins (part number 8) of the side bearings fit into the cutouts in the bearings.

* The arrow above indicates that if the guide rod position shifts during pushing, re-install it.

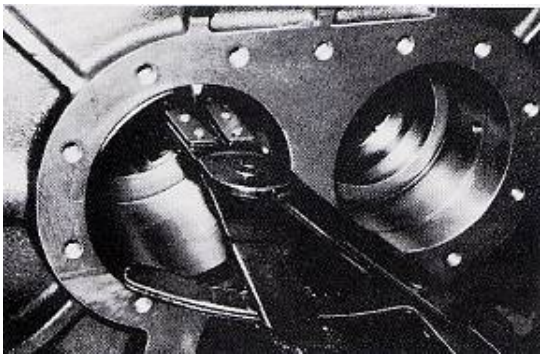


Side bearing positioning

Setting Bearing



Spring pin of Side Bearing



Setting Retaining Ring of Side Bearing

b) After checking that the positioning spring pins and side bearings are in the correct position, secure the side bearings with the stop ring.

c) The oil injection pipe and the pipe retainer are fitted with a pin. This part is installed in the suction cover. Apply oil to the "O" ring, push it in, and secure with bolts.

Note: There is an oil hole position on the right side when viewed from the unloader cylinder side. Align the O mark on the right side pipe retainer. Lubricate the "O" ring of the oil injection pipe sufficiently.

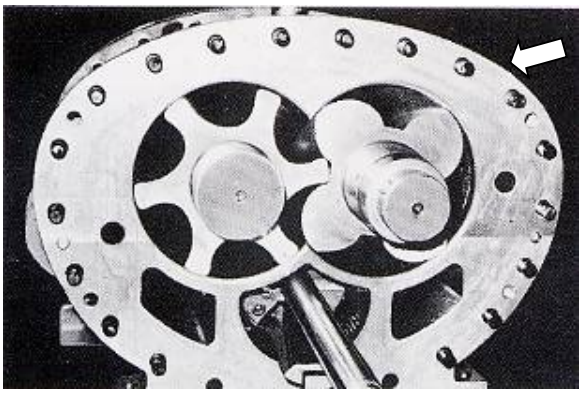
d) Keep the unloader slide valve in the full load position. Apply oil to the gasket and attach it to the rotor casing side. Insert some bolts to prevent it from sliding. Pull the positioning pin toward the rotor casing side. The gasket of the suction cover is asymmetric. Check that it is properly fitted. Lubricate the side bearings sufficiently.

For 320 type and 400 type, attach the "O" ring retainer (part number 326) that holds the unloader push rod to the suction cover. Don't forget to attach the "O" ring in the hole on the suction cover body side.

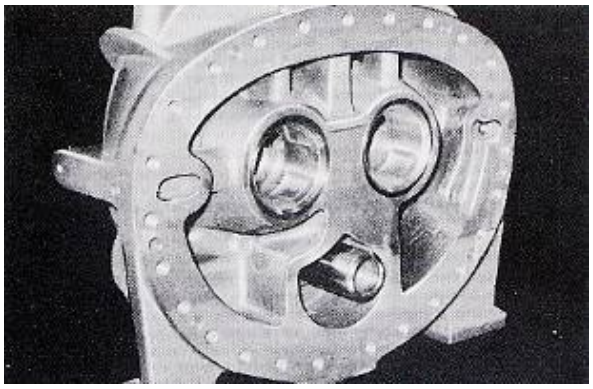
e) Slide the suction cover over the rotor shaft to align it.

First place the unloader slide valve in the full load position. Combine the tip of the unloader pushrod into the oil injection pipe of the suction cover and the unloader pushrod into the injection pipe. Be careful not to damage the "O" ring of the injection pipe with the unloader push rod.

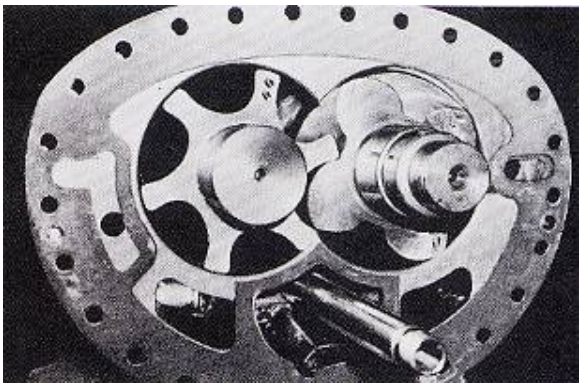
f) Lift the suction cover with a crane and slide it on the workbench. First, combine the unloader pushrod with the "O" ring retainer of the suction cover. Next, combine the rotor shaft and side bearings, and push the suction cover parallel to the shaft core to combine it with the rotor casing.



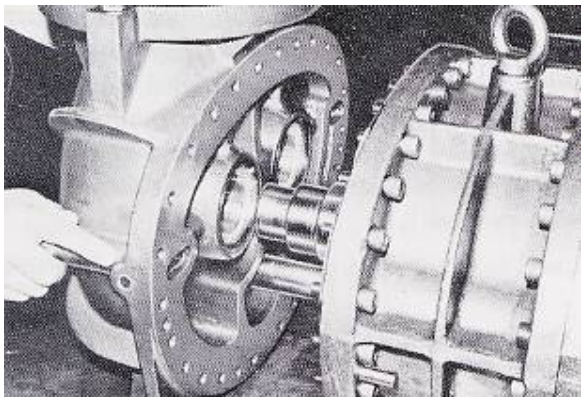
Suction cover tightening bolts



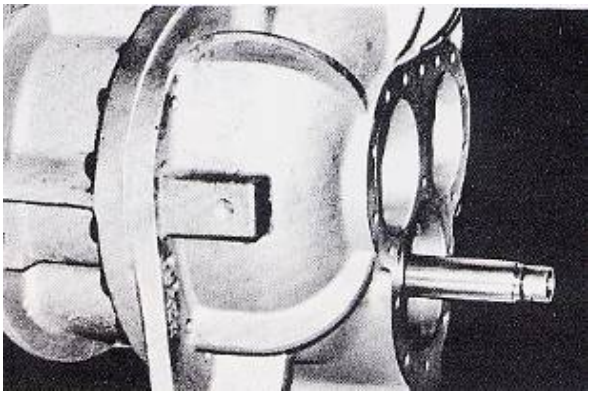
Inside of suction cover



Suction Cover Gasket left-right asymmetric



Install Suction Cover (125-320)



Fitting the unloader push rod

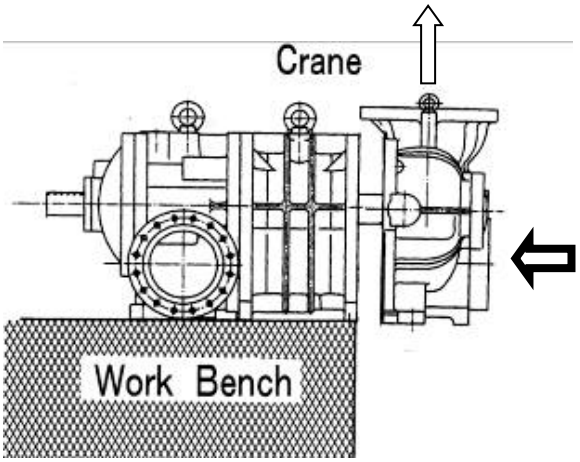
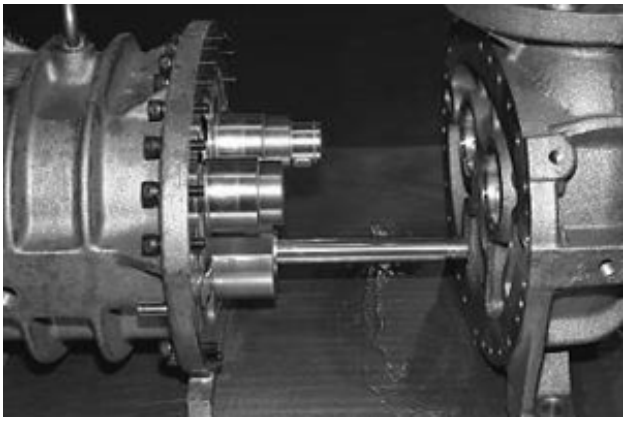


Figure 5-21 Setting Suction Cover

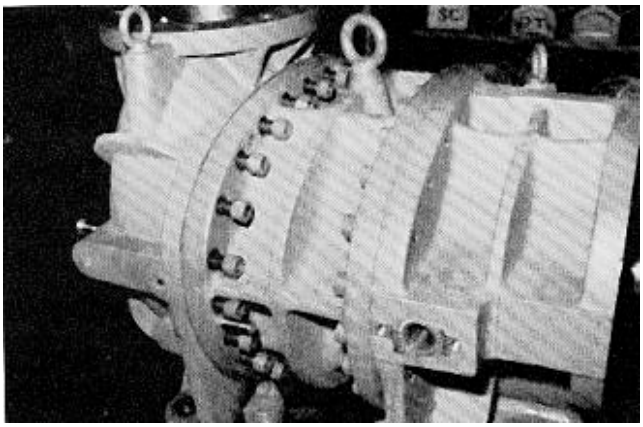


On the surface plate with suction cover assembled

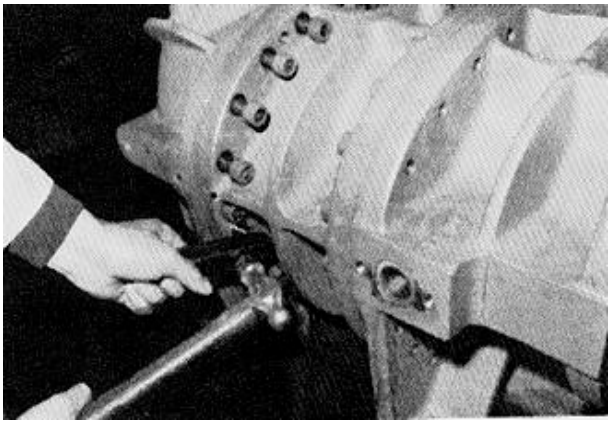
Use a crane to assemble the suction cover

For large models, it is difficult to slide the suction cover on the work bench during the above work, so place the rotor casing side on the end of the work table and hang the suction cover with a crane to combine. In such a case, use a chain block or the like so that the vertical adjustment can be made. For the 320 and 400 tys, slide on the surface plate and first combine the unloader push rod with the "O" ring retainer on the suction cover. Then combine the rotor shaft and side bearings by pushing them parallel to the combined shaft core.
Also, when assembling the rotor bearings on the side bearings, be careful not to damage the inside of the side bearings at the end of the rotor shaft.

g) Drive the positioning pin. Tighten the bolt to the specified torque. When the tip of the rotor is aligned with the bearing, move it parallel to the rotor shaft and assemble it.

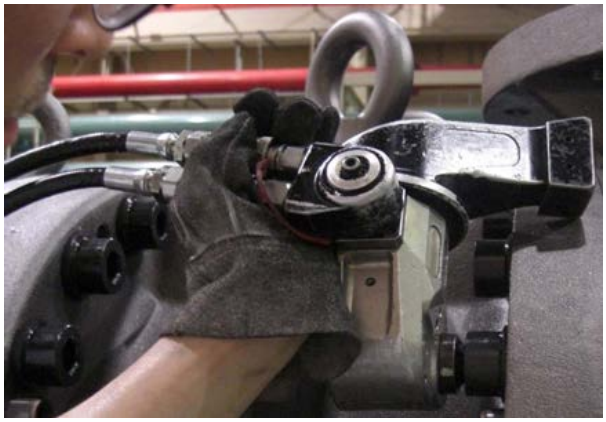


Setting Completed

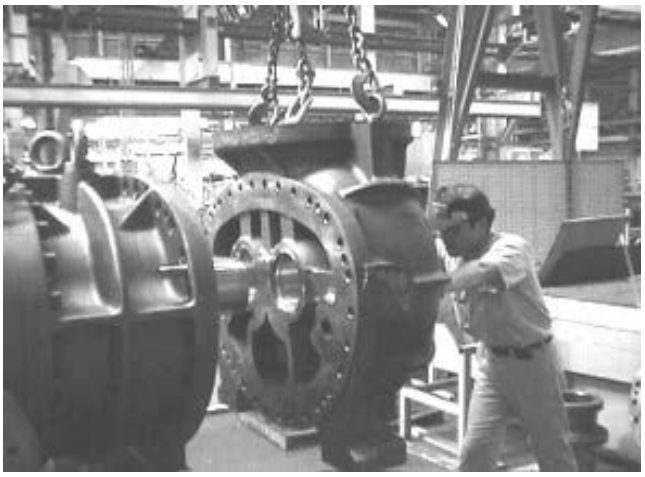


Drive in the parallel pins by using a hammar

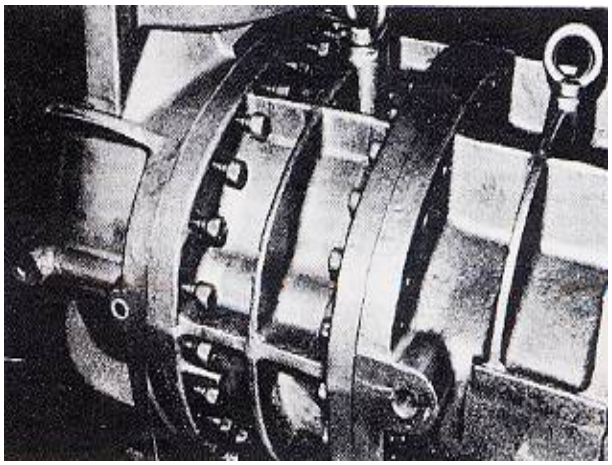
Use of a bolt tightening torque wrench



Using a hydraulic torque wrench (for large machines)



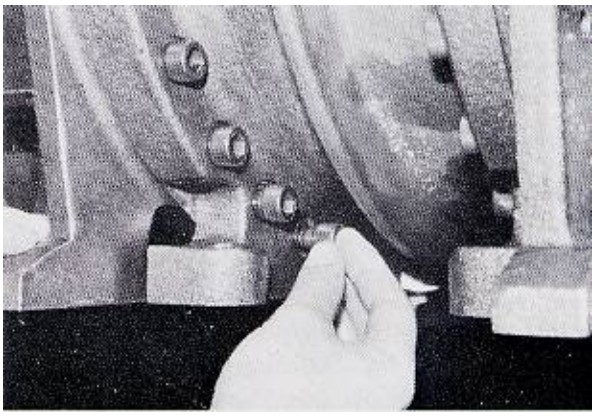
Setting of Suction Cover（400UD）



Completion of suction cover setting

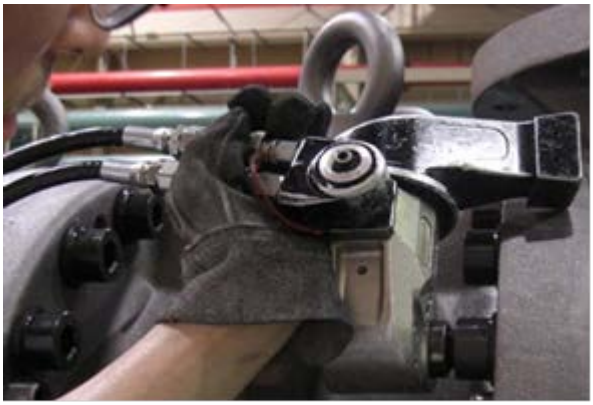
Precautions when tightening the bolts at the lower part of the rotor casing with a screw compressor

The lower part of the rotor casing of the screw compressor is fixed to the bearing head and the suction cover with bolts, but do not attempt to hang the rotor casing and tighten this bolt. Securely fix the suction cover feet and bearing heads to the frame or stand, and then tighten them. The method is to place two stands of the same height under the casing at the proper distance. If the casing is not installed correctly, the casing may fall during the tightening operation.



Tightening the bolts at the bottom of the rotor casing

Tightening the upper bolt



Bolt tightening with a hydraulic wrench (320-400UD)

i） Check the movement of the unloader slide valve, and check that the M rotor shaft can be turned by hand.

5.5.5 Balance Piston Sleeve

a） Install the balance piston part into the suction cover as follows.

The 125 has no built-in balance piston sleeve.

First, install the stop ring (part number 37).

Next, install the "O" ring spacer (part number 36), "O" ring (part number 35), balance piston sleeve (part number 33), and stop ring in that order. Finally, the stop ring to be assembled is pushed outward by the "O" ring of the balance piston sleeve, so it enters the groove while pushing it in.

When operating the above work, locking the balance piston sleeve from rotating by using following method.

■Type1 （160～250SUD/MUD/LUD/SG/MG/LG/LLG）

Screw the hexagon socket set screw (Part No. 34) into the suction cover from the M rotor side, and attach the hexagon socket set screw from the F rotor side.

■Type2 （320SUD/MUD/LUD/SU/MU/LU）

Fit the pin on the outer diameter of the balance piston sleeve into the groove on the suction cover.

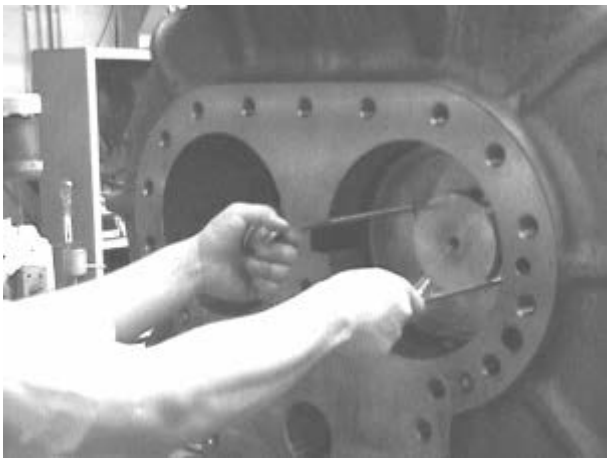
b） Assemble the balance piston sleeve (part number 33).
Make sure that the shaped edge side of the outer periphery of the balanced piston sleeve is on the "O" ring side and the side with the locking cut out is on the outside. Align the cut out position with the hexagon socket set screw.

c) Assemble the stop ring (part number 37) for fixing the balance piston sleeve.

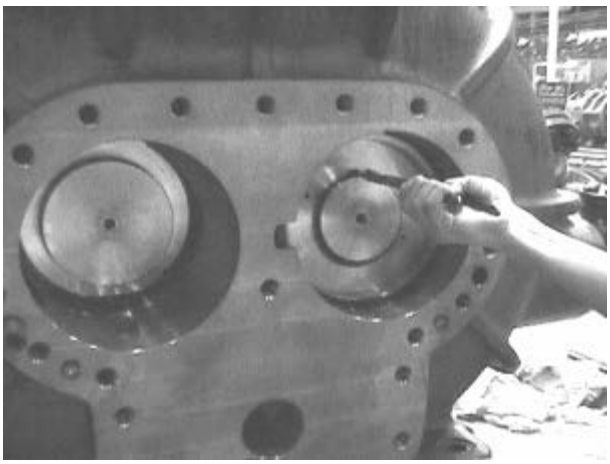
d) Tighten the hexagon socket set screw until the head protrudes from the hole. Tighten the other screw from the F rotor side.

e) Screw the eyebolt into the balance piston, aligning it with the key and keyway of the M rotor and insert it.

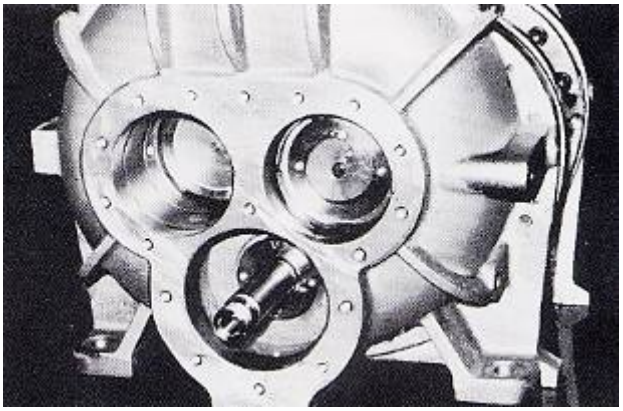
f) Assemble the stop ring (part number 32) to fix the balance piston.



Install Balance Piston

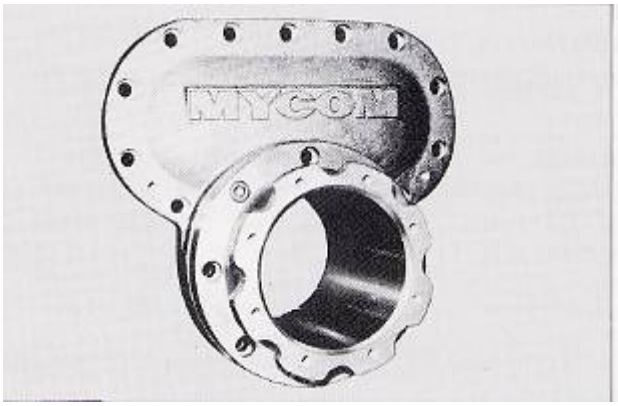


Install Retaining Ring(400VMD)



Completed Setting of Balance Piston

5.5.6 Balance Piston Cover



Balance piston cover and unloader cylinder

When reassembling, if the balance piston cover and unloader cylinder are joined in advance and then attached to the suction cover, the unloader push rod and unloader piston can be easily adjusted. Remember to attach the "O" ring (part number 63). (See unloader piston and unloader cylinder section). This part is only a cover, so there is no failure.

5.5.7 Thrust Bearing Block

a) Position the thrust bearing spacer (part number 41) and thrust adjusting washer (part number 42) so that they are correctly on the M rotor and F rotor sides. This is very important for clearance on the rotor discharge side. (See Figure. 5-23)
b) Keep the gap between the thrust bearing spacer and the thrust adjusting washer clean. Residues and dust affect the end clearance.
c) Position the thrust bearing so that the apex of the V stamped on the bearing is on the rotor side.
d) Then attach the lock washer (part number 40), tighten the lock nut for the bearing (part number 39), and fix the inner ring to the thrust bearing on the shaft.

V mark on thrust bearing

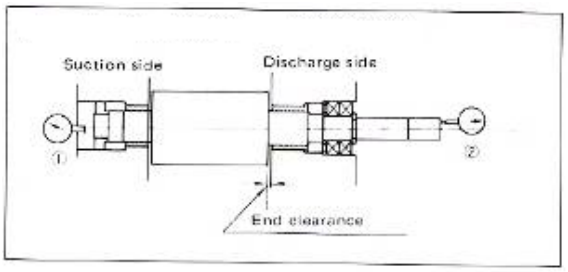
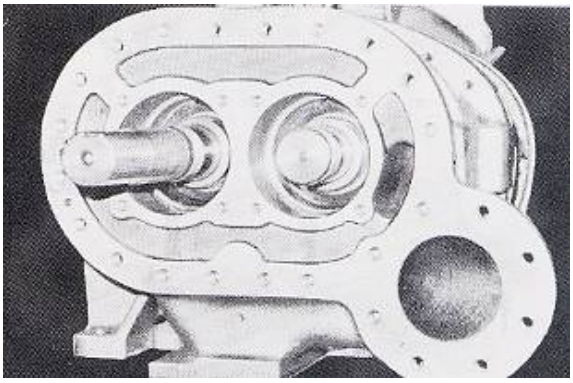
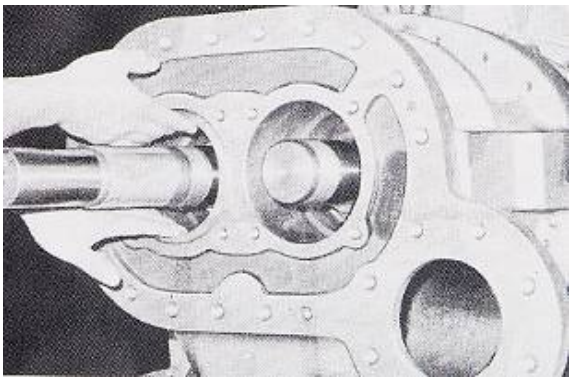


Figure 5-22 Adjustment of thrust bearing

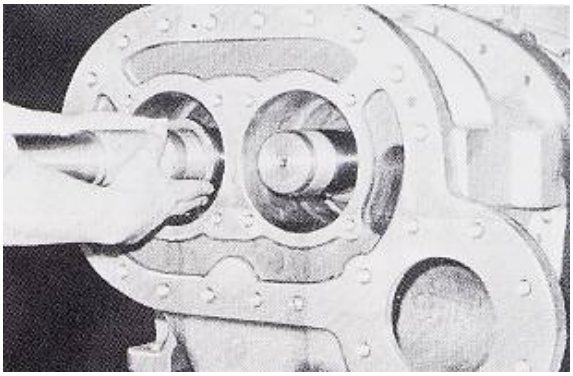


Clearance of thrust bearing

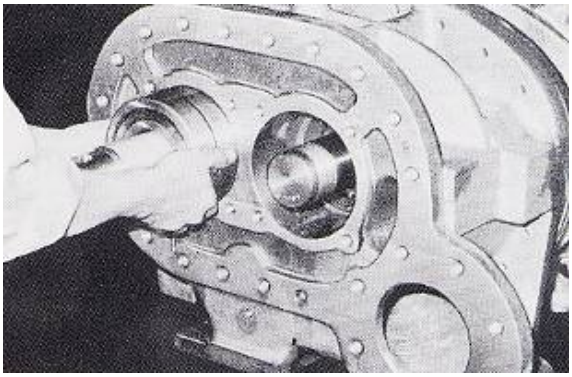


Install Thrust Bearing Spacer

e) At this time, measure and confirm the end clearance of the rotor. The tolerances must fall within the following ranges: Use the methods described below to measure the end clearance.



Install the Thrust Bearing Alignment spacer

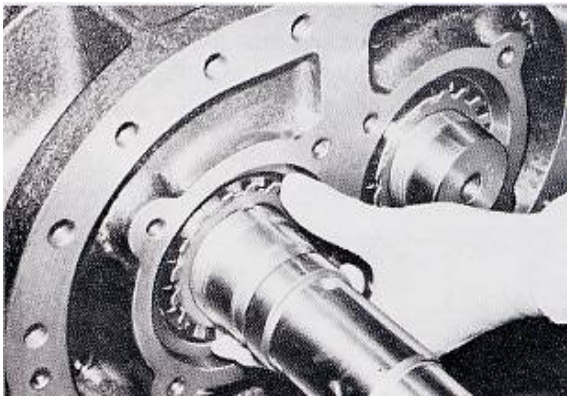


Bearing assembly

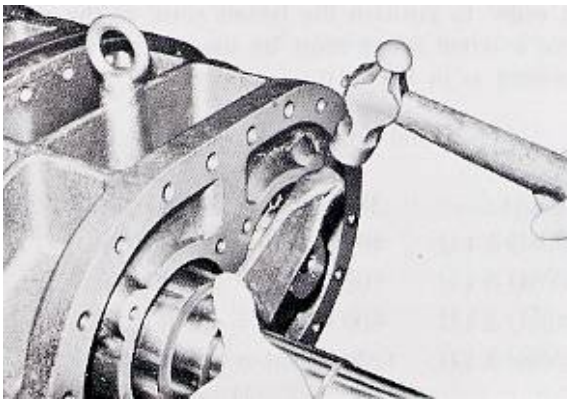
Table 7 End clearance

Model	For single stage (high stage)				
	S	M	L	LL	XL
125	0.03～0.05			-	-
160	0.04～0.06			-	-
200	0.05～0.07			-	-
250	0.08～0.11			-	-
320	0.17～0.21	0.20～0.24	0.23～0.27	0.26～0.30	-
400	0.24～0.30			-	-
Model	For booster (low stage)				
	S	M	L	LL	XL
160	0.20～0.22	0.22～0.24	0.24～0.26	-	-
200	0.26～0.30	0.28～0.32	0.31～0.35	-	-
250	0.40～0.44	0.45～0.49	0.50～0.54	0.55～0.59	-
320	0.70～0.76	0.73～0.79	0.77～0.83	0.81～0.87	-
400	0.70～0.80	0.75～0.85	0.80～0.90	0.85～0.95	0.90～1.00

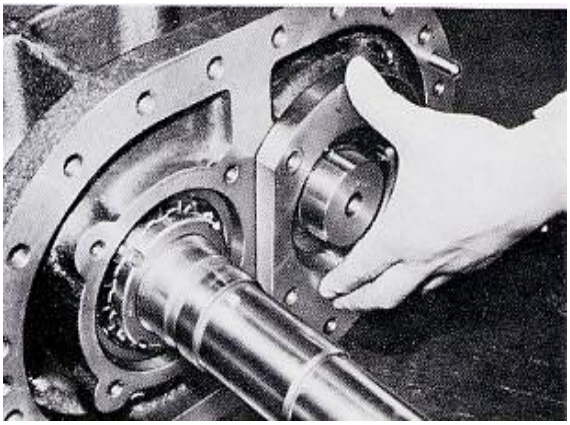
Unit: mm



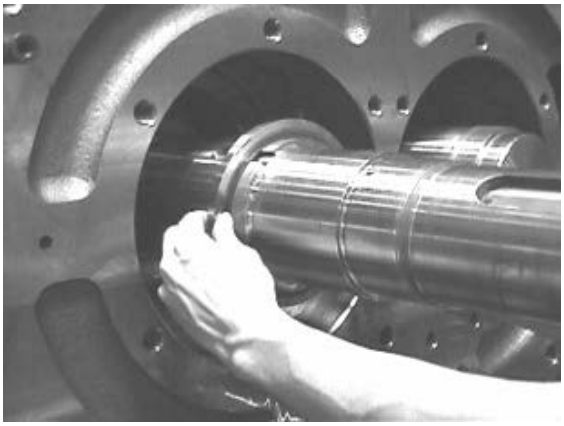
Install the Lock Washer



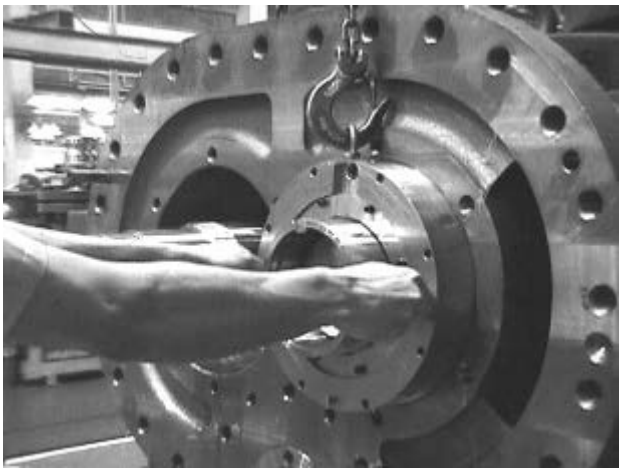
Tighten the Lock Nut



Install the Thrust Bearing Gland



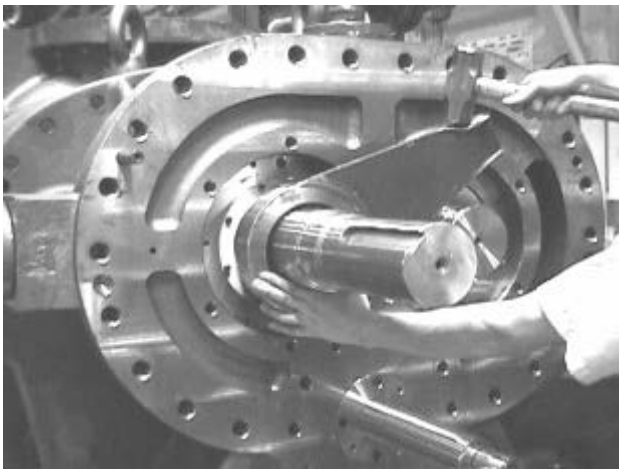
（400*UD）Setting Thrust Bearing Alignment Spacer



（400*UD）Setting Bearing

* For the 400 UD, insert the thrust bearing key in the direction of the shaft key. Install the lock washer and lock nut and tighten the lock nut using the lock nut spanner.

f) With the inner ring of the thrust bearing on the shaft fixed, push the rotor toward the discharge side. Use a screwdriver to pull out the bearing part of the lock nut (see Figure 5-23). Place the gauge set on the suction side of the shaft and set the needle to zero.



(400) Tightening Lock Nut

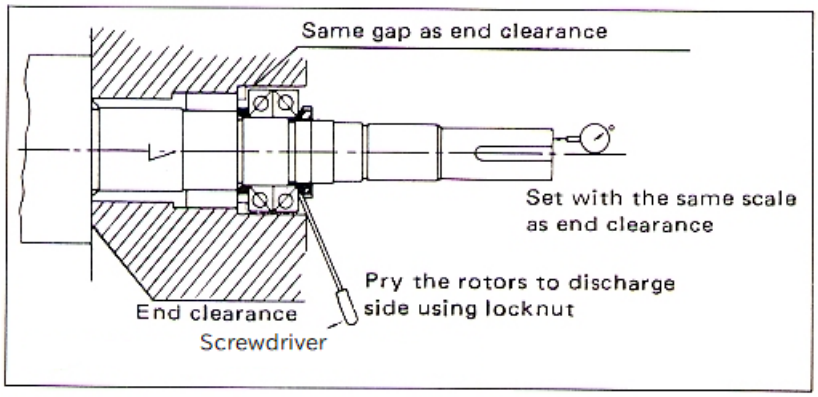
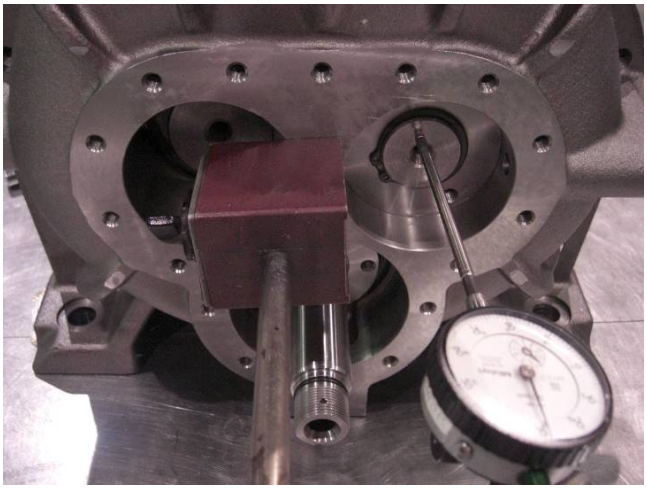


Figure 5-23 Thrust adjustment

g) Set the end clearance of the F rotor in the same way. Note that the screwdriver is pushed in as shown in Figure 5-23 to position the F-rotor on the discharge side.
h) Install the thrust bearing gland and tightening bolt. Tighten the bolts with the torque values shown in the table "Tightening torque".



End Clearance Adjustment

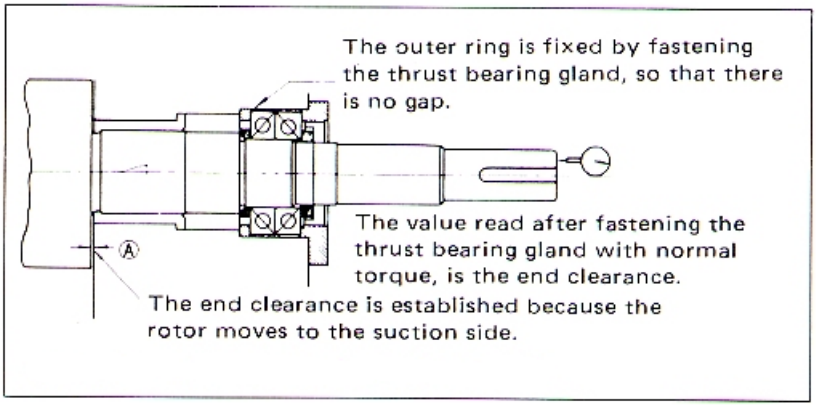
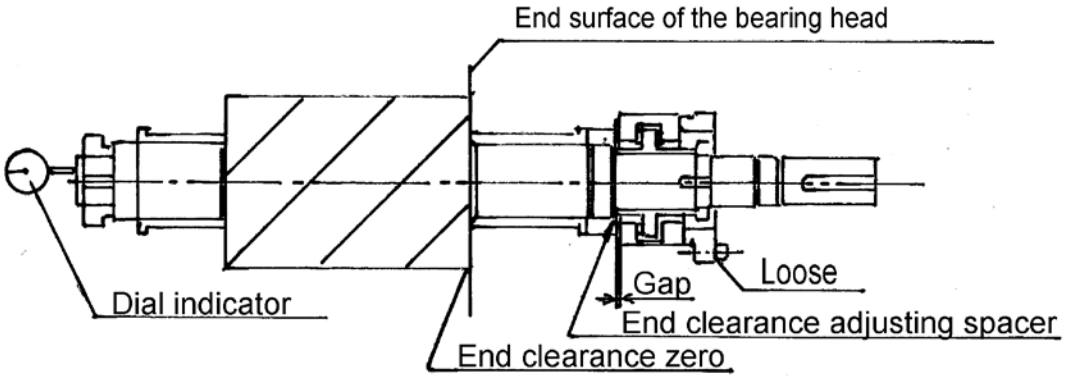


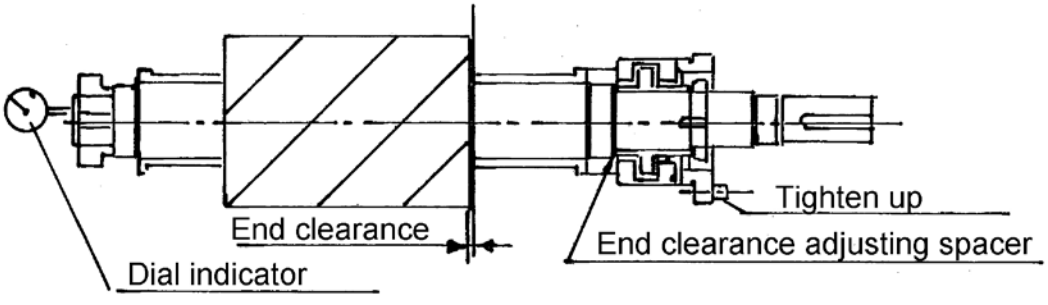
Figure 5-24 End Clearance adjustment (II)

Tightening torque

Model	N・m	Kg・cm	Ft・lb
125	30	300	21.70
160	40	400	28.93
200	50	500	36.17
250	60	600	43.40
320	120	1200	86.78
400	90	900	65.10



a) End clearance zero condition



b) Completion of the end clearance

Figure 5-25

i) How to adjust if the end clearance is outside the specified value

(1) If the end clearance is greater than the specified value, if the clearance measured from the discharge side of the bearing head at the end of the rotor is too large, the thrust bearing must be tightened with a lock nut to narrow the end clearance.

Method 1: If the end clearance (A) (Figure. 5-24) is too large, sharpen the thrust bearing alignment spacer to make it the same thickness as the difference between the measurement result and the specified value. Perform this work with a precise surface grinder. Measure the thickness of the washer around the entire circumference with a micrometer to make sure it is parallel. This adjustment method is available for all models.

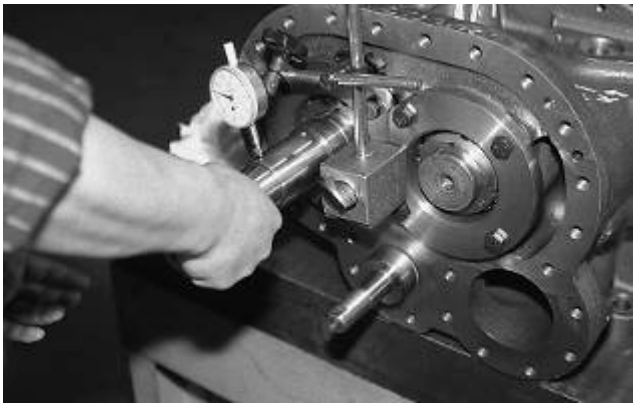
Method 2: Insert a shim material of appropriate thickness between the thrust bearing spacer (partnumber 41) and the outer ring of the bearing.

The thickness of the shim material is the difference between the measured value and the specified value. Do not use brass or copper shim material as it will corrode if the refrigerant is ammonia.

(2) If the end clearance is smaller than the specified value, that is, if the rotor does not turn after tightening the tightening bolts, the thrust adjustment washer (part number 42) is not thick enough or the thrust bearing spacer is too thick. For this adjustment, insert a shim material of appropriate thickness between the thrust bearing alignment spacer (part number 42) and the inner ring of the thrust bearing, or replace the thrust bearing alignment spacer.

If the thrust bearing spacer (part number 41) is too thick, it must be ground. After adjustment by the above method, measure several times to check whether the end clearance is appropriate.

j) Turn the M rotor shaft by hand and check if it rotates smoothly.



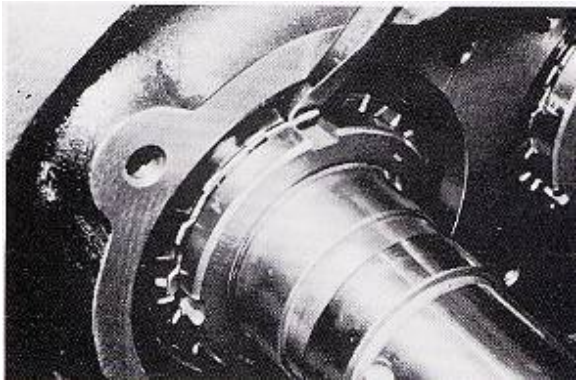
Inspection of axial runout

k) Use the dial gauge to check for radial runout at the M rotors indicated point. The maximum allowable runout width is 0.03 mm. Swing may be caused by mismatch between the washer and the spacer, and it is necessary to check again whether the V mark is set correctly. Even if the end clearance is specified value, disassemble and adjustment of the thrust bearing spacer (part number 41) is important to maintain long life and high performance. If there is dust

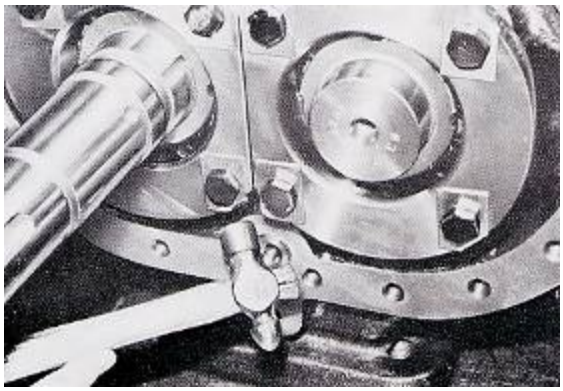
between the parts, the vibration value will increase.

l) When the adjustment is completed, the thrust bearing is completely tightened.
Note: (125-320 type)
(1) Use new lock washers.
(2) Set a torsional slip washer between the lock nut and lock washer.
(3) Be careful not to break the claws of the lock washer.

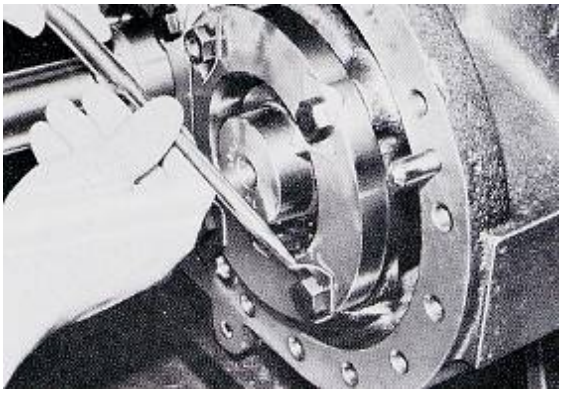
m) After confirming the tightening, finally bend the lock washer and the locking claw of thethrust bearing gland.



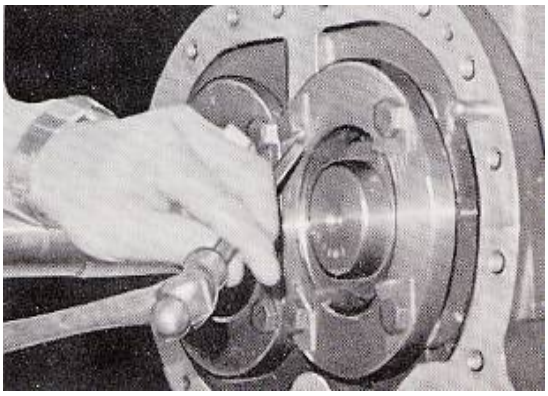
Bending the claw of Lock washer



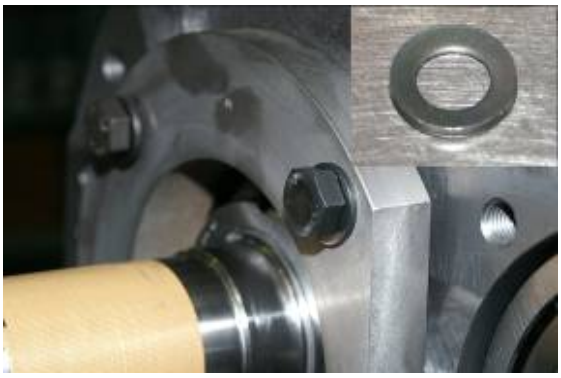
Bending of out side of claw washer



Bending inside of lock washer



Bend the claw firmly



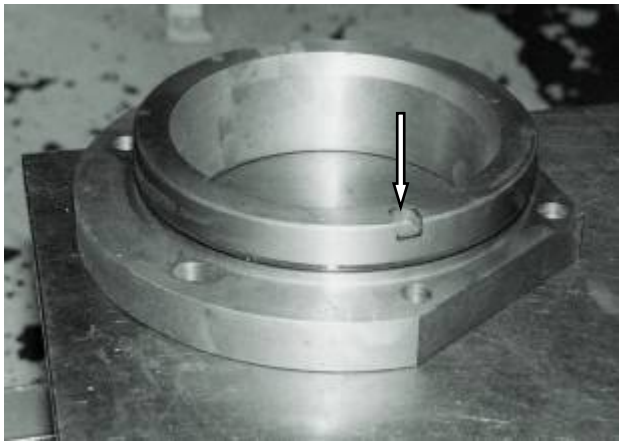
Spring Washer

n） For the 400 type, the inner ring of the tilting pad has a locking key. After inserting the tilting pad assembly, install the key in the keyway of the inner ring, and align the tilting pad with the stepped side of the key.

o) After attaching the lock key to the shaft, install the lock washer and lock nut, and fix the inner ring of the tilting pad to the shaft with the lock key.

p) A lock pin is also built into the outer ring of the tilting pad, and there is also a cutout for the lock pin on the side of the thrust bearing gland. Install the tilting pad while checking that the cutout on the outer ring is aligned with the locking pin.

q) Install the spring washer and tighten the hexagon socket head cap screws (type 400) on the thrust bearing gland until the specified torque is reached.



The thrust bearing gland has a cutout for the lock key.

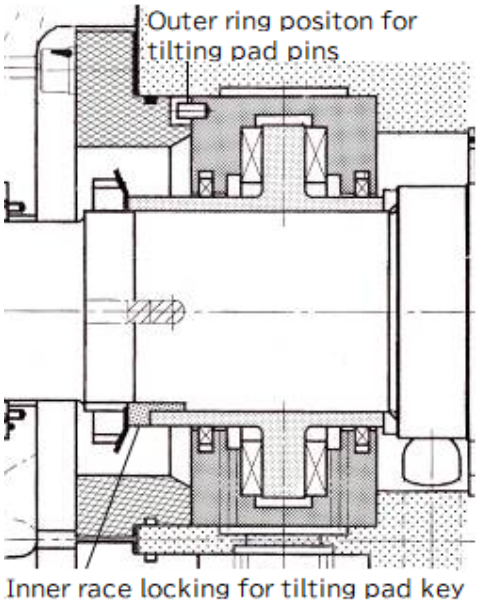
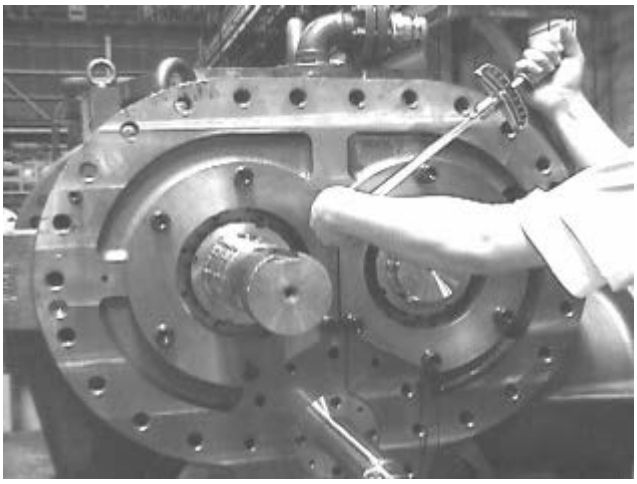


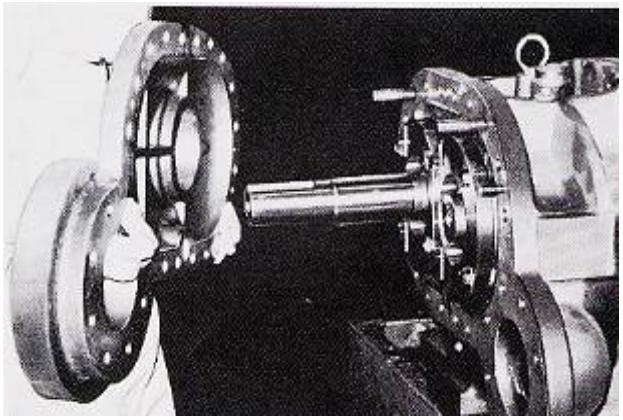
Figure 5-26 Cross section of TPTB



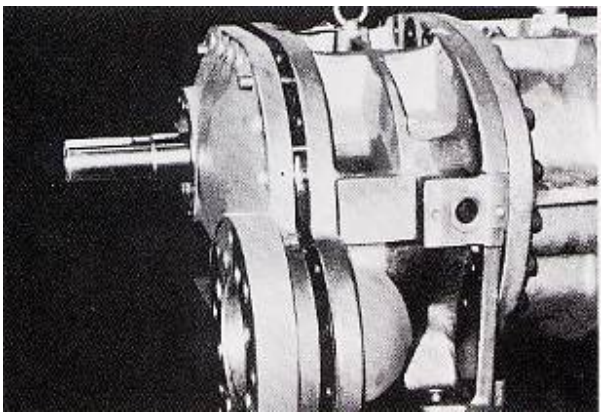
400*UD Tightening of thrust bearing gland with hexagon socket head cap screw

5.5.8 Bearing Cover

Screw a long safety bolt into the bearing head and press the gasket and the bearing cover, taking care not to damage the mechanical seal. Adjust the parallel pin (part number 19) while taking care to keep it parallel, and press the bearing cover against the bearing head.
Tighten the two hexagon socket head bolts on the diagonal, making sure that the bearing covers are parallel. After the whole surface of the bearing cover contacts the bearing head, fix the remaining hexagon socket head cap screws.



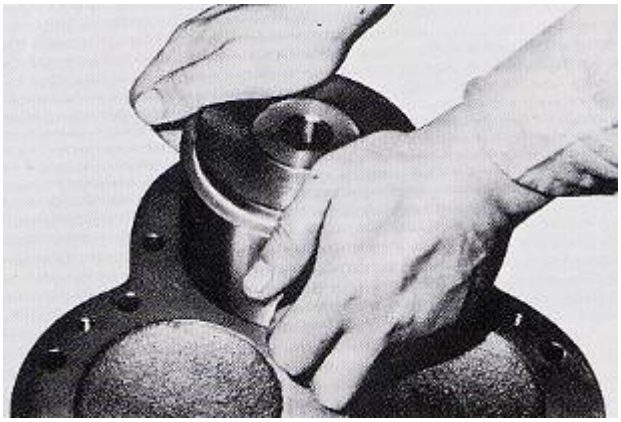
Setting the bearing cover



Setting the bearing cover

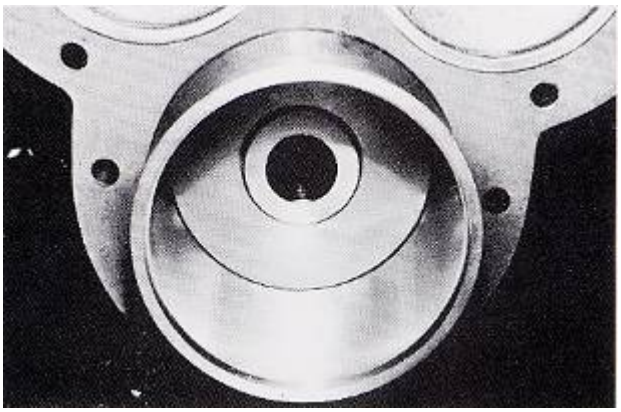
5.5.9 Unloader Piston and Unloader Cylinder

a) Inside the unloader cylinder [60] is an unloader piston [64] around which the cap seal [66] and O-ring [65] are fitted. The unloader piston is assembled to the unloader push rod [67], which operates the unloader slide valve, with the lock nut [69].
Unloader cylinder is secured to the balance piston cover [22] with two short hexagon head cap screws 61] and to the suction cover with six log hexagon head cap screws [62].

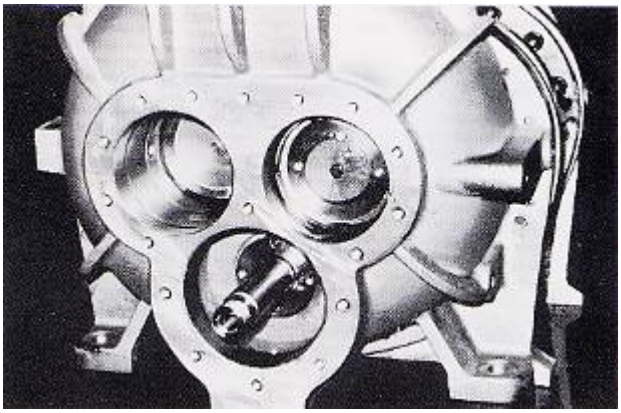


Push the piston into the unloader cylinder

b) Make sure the cap seal is in the correct position. Push the unloader push rod to the end (no load position), pull out the unloader piston, and assemble the unloader cylinder and balance piston cover to the suction cover.

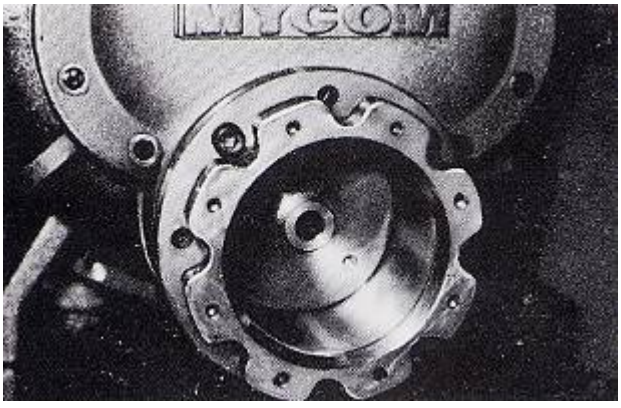


View of suction cover where unloader cylinder, balance piston cover, unloader piston are fitted



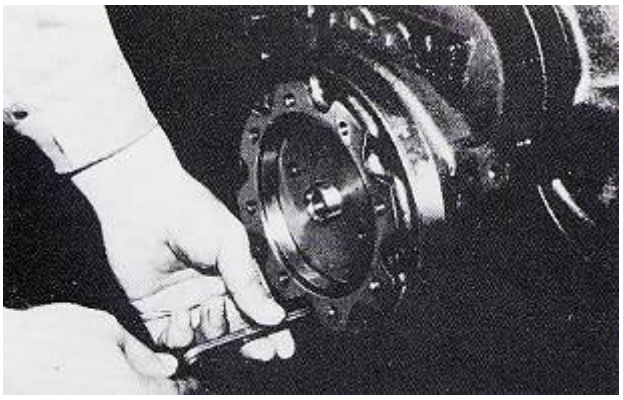
Positioning unloader push rod on the suction cover side

c) Push the unloader piston inward by hand, push it into the unloader push rod, and lightly screw in the lock nut. Pull out the unloader piston toward you and remove the lock nut.
d) Install the lock washer and fix the lock nut completely. Then bend the claw of the lock washer.

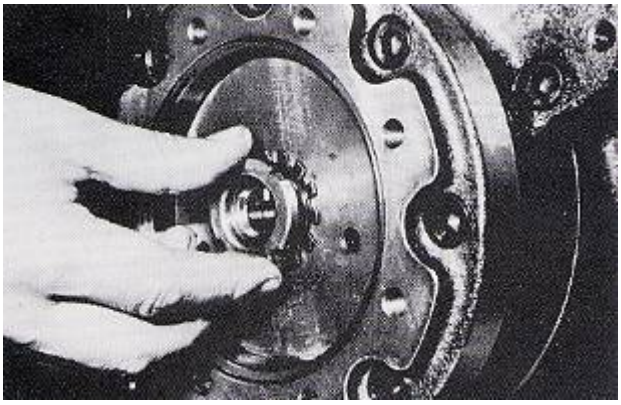


Setting of Piston and Push Rod

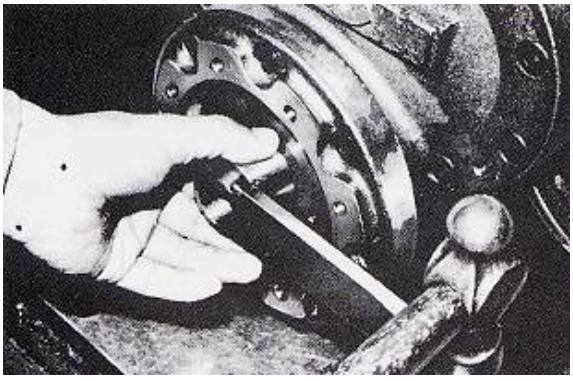
e) Screw two eye bolts into the unloader piston to check if the piston and slide valve are working properly.
f) Keep the unloader piston in the no-load position.



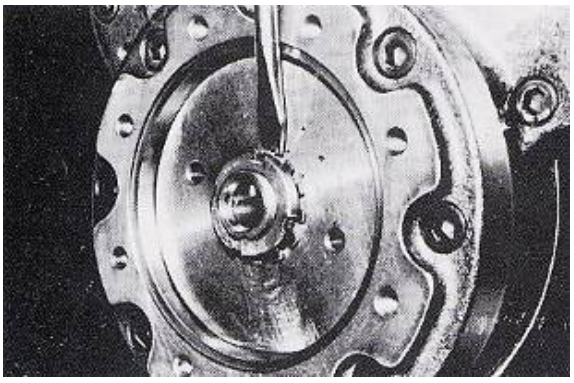
Setting the cylinder and balance piston cover



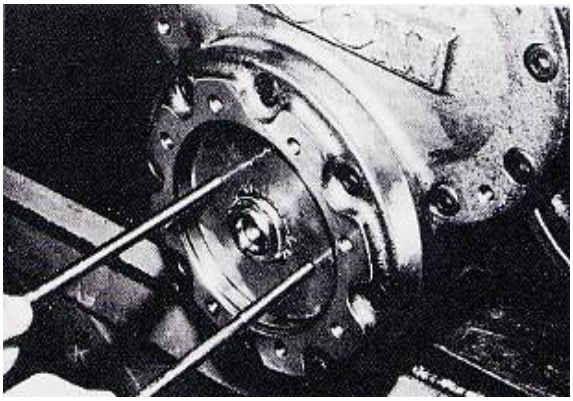
Setting Lock Washer and Lock Nut



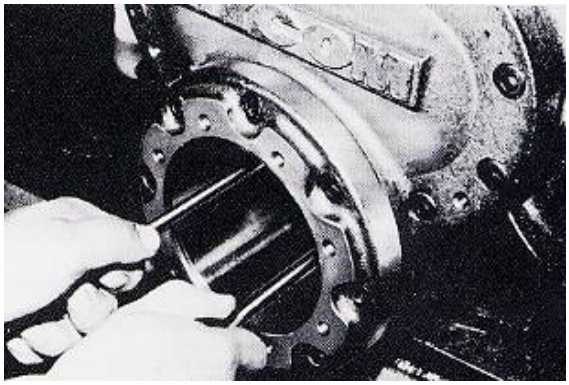
Tigten the Lock Nut to the specified torque



Bend the claws of the lock washer



Confirm operation with eyebolts



Full unloaded position (push to the end)

5.5.10 Unloader Cover

When disassembling the indicator cam shaft sealing part of the unloader cover, refer to the development view in Figure 5-27,5-28 and assemble according to the following installation procedure.

a) Assemble the ball bearing to the shaft of the indicator cam. When pushing the bearing into the

shaft, push the inner ring of the bearing. Otherwise, the bearing may be damaged. Push into the stepped part of the indicator cam and use the stop ring to prevent it from coming off. If the outer diameter of the indicator cam is larger than the inner diameter of the bearing retainer, install the bearing retainer before installing the bearing.

b) Install the oiled V-ring on the unloader cover. One ring of the V-ring set is made of rubber for better sealing. Insert the tip of the V part of the V ring into the unloader cover.

c) Assemble the spring and spring retainer. Insert the indicator camshaft assembled in a) into the V-ring and tighten the ball bearing to the unloader cover with the bearing retainer.

d) Make sure that the cylindrical cam rotates smoothly, and then attach the "O" ring (part number 75) to the unloader cover.

e) With the unloader push rod in the unloaded position, align the groove of the indicator cam with the pin of the push rod and push in the unloader cover to assemble. Tighten the unloader cover with the oil port for unloader operation facing up and tighten it with the hexagon socket head cap screw to fix it.

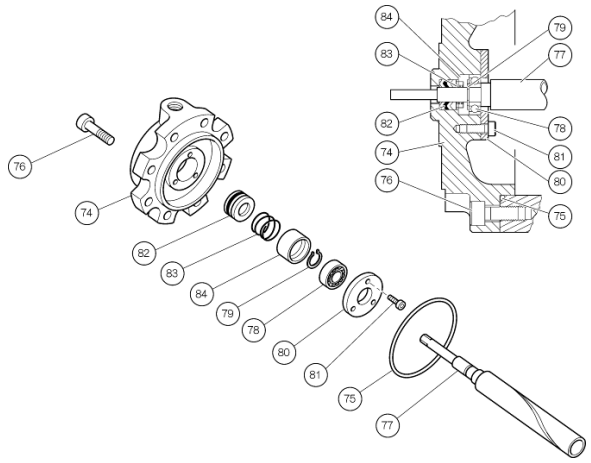


Figure 5-27 Development view of the Unloader cover

№	Part name	Q'ty
74	Unloader Cover	1
75	"O" ring	1
76	Hexagon socket head cap screw	8
77	Unloader indicator cam	1
78	Ball Bearing	1
79	Retaining Ring	1
80	Thrust Bearing Gland Spacer	1
81	Hexagon Socket Head Cap Screw	3
82	V ring	1set
83	Spring	1
84	Spring Retainer	1
597	Spring Washer (type 400)	3

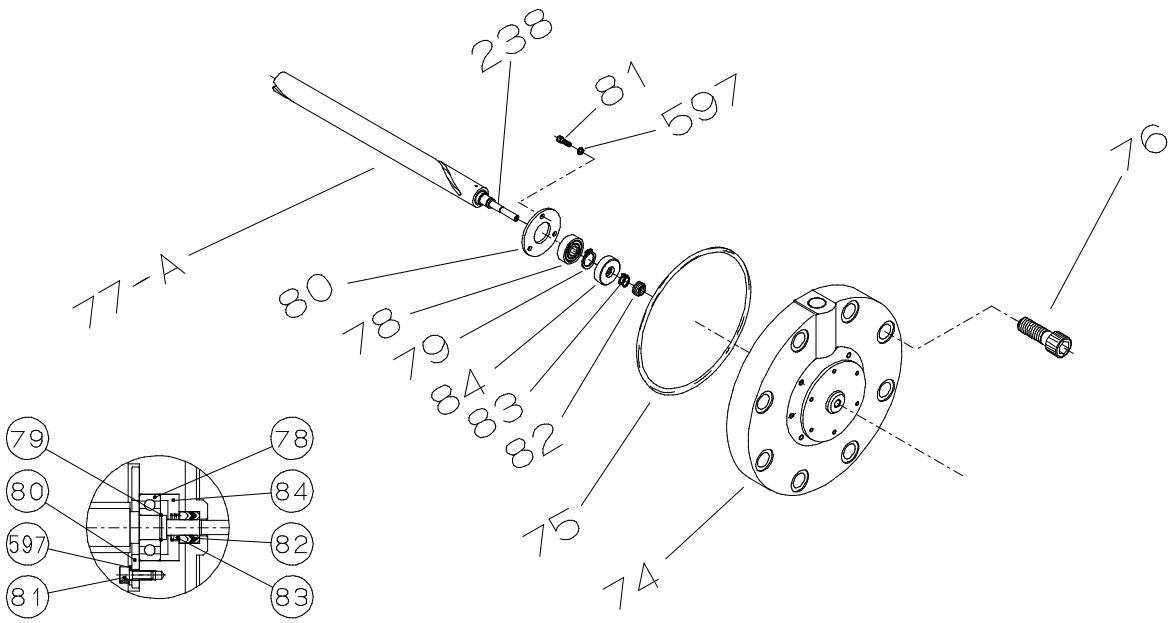
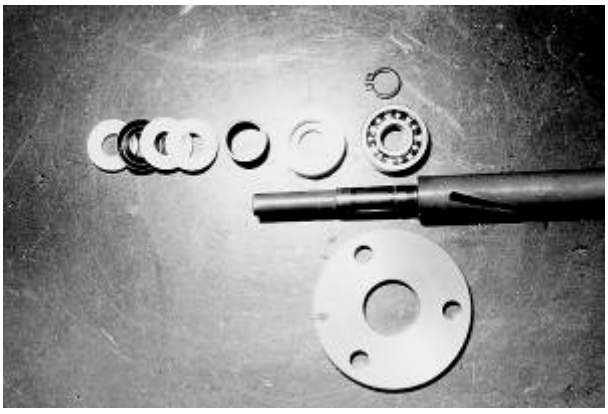
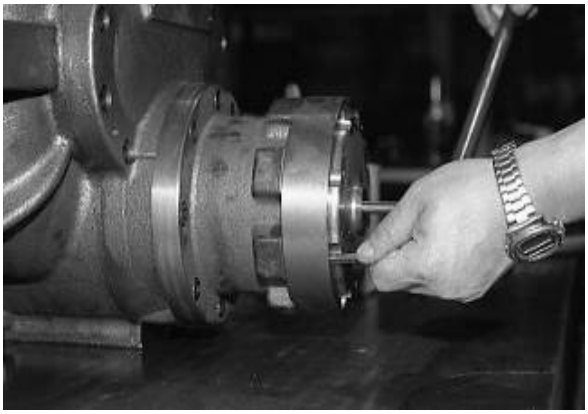


Figure 5-28 Development view of the Unloader cover (400 type)



Indicator CAM Mounting parts

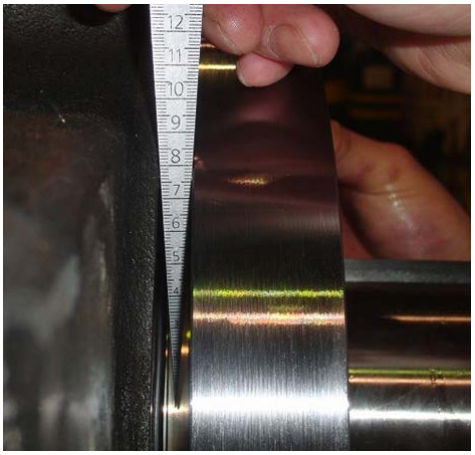


Setting Unloader Cover

5.5.11 Shaft Seal Block

The assembly procedure of the shaft seal block is the reverse sequence described in Section 5.4.3 as shown in the order of the colored number of each sectional view drawing.

Disassembly and assembly works of this block especially require qualified trained personnel and special tools. For details contact us.

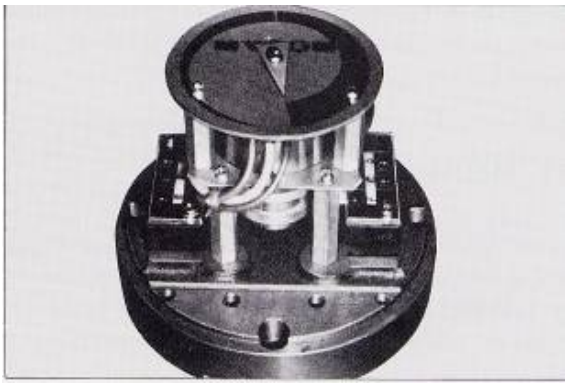


Note that to confirm the sliding surface pressure of the mechanical seal is proper or not, measure the clearance between the surfaces of the seal cover gasket and the bearing cover flange. This clearance is called " fastening margin of the seal", it should be measured by using a taper gauge. The proper value guide line (reference) of this " fastening margin of the seal" is; 3 mm as BOD type seal, 5 mm as BBDⅡ type seal, and 6 mm as BBDE type seal.

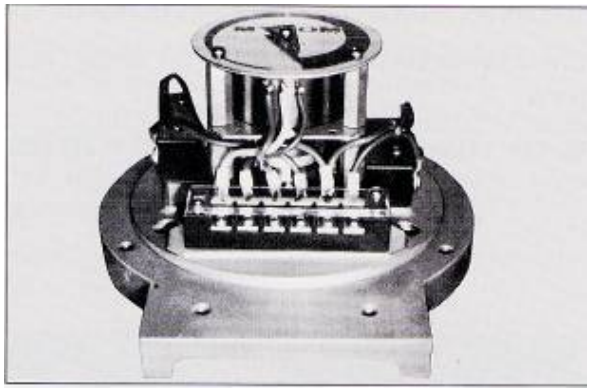
5.5.12 Disassembly and Assembly of the Unloader Indicator

The indicator of the automatic control system consists of a potentiometer, a macro switch and a cam.

(1) IND-02	125＊＊＊
(2) 160～400 Type	160＊＊＊～400＊＊＊



125 type unloader indicator



160-400 type unloader indicator

The 125 type components are as follows

Potentiometer	For feedback of slide valve position
Micro-switch	For slide valve no-load (0 %) position signal
Micro-switch	For signals at slide valve full load (100 %) position
Cam	For micro-switch

The components of 160-400 type and above are as follows

The numbers in the table below indicate the number of pieces, and (1) indicates that one of them should be used.

Parts	Automatic standard operation	Special specifications (1)	Special specifications (2)	Special specifications (3) 3 micro switches specifications
Potentiometer（For feedback of slide valve position）	1	1	1	1
Micro-switch（For slide valve no-load (0 %) position signal）	1	1	1	1

Micro-switch（For signals at slide valve full load (100 %) position）	1		(1)	
Micro-switch（Slide valve partial load position signal, for 50 % load）		1	(1)	
Micro-switch（Slide valve partial load position signal, for special specifications）				2
Micro-switch Cam（For 0-100 % operation）	1			
Micro-switch Cam（For 0-50 % or 50-100 % operation）			1	1
Micro-switch Cam（For special operation）				1

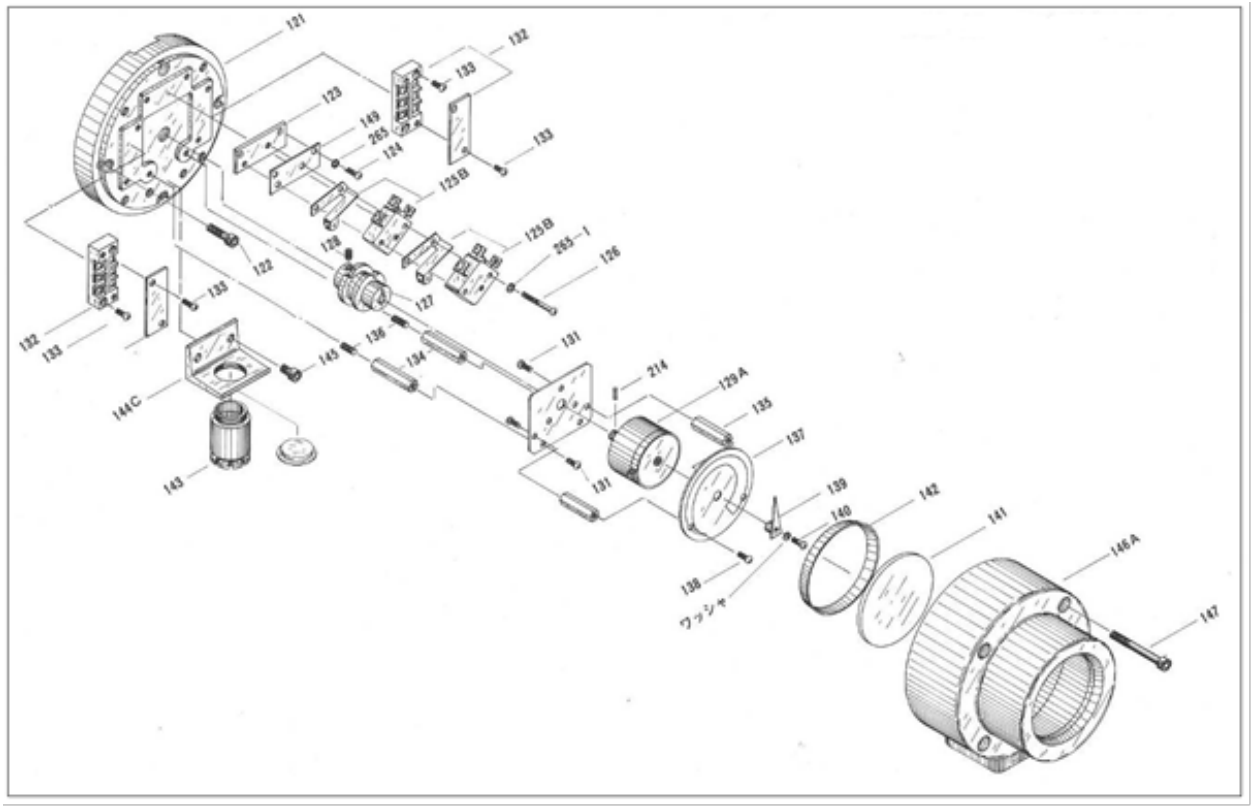


Figure 5-29　Development View of the Unloader Indicator(125 type)

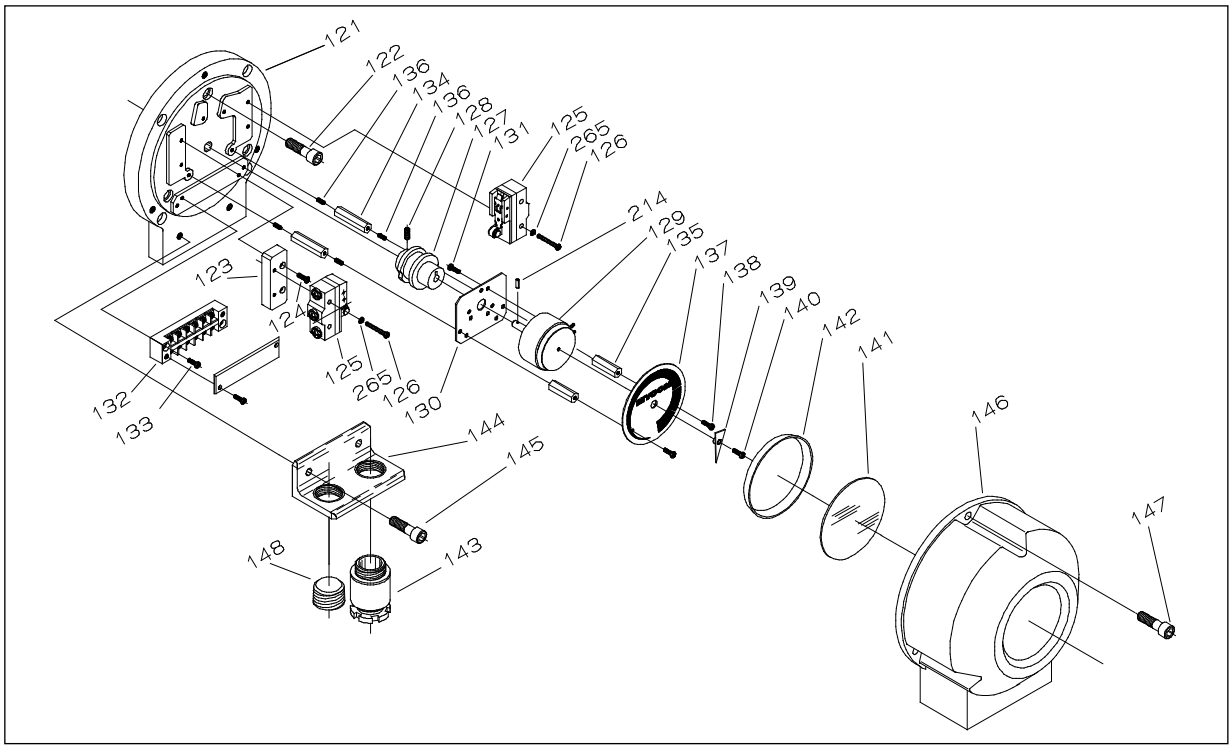


Figure 5-30 Development View of the Unloader Indicator(160～400 type)

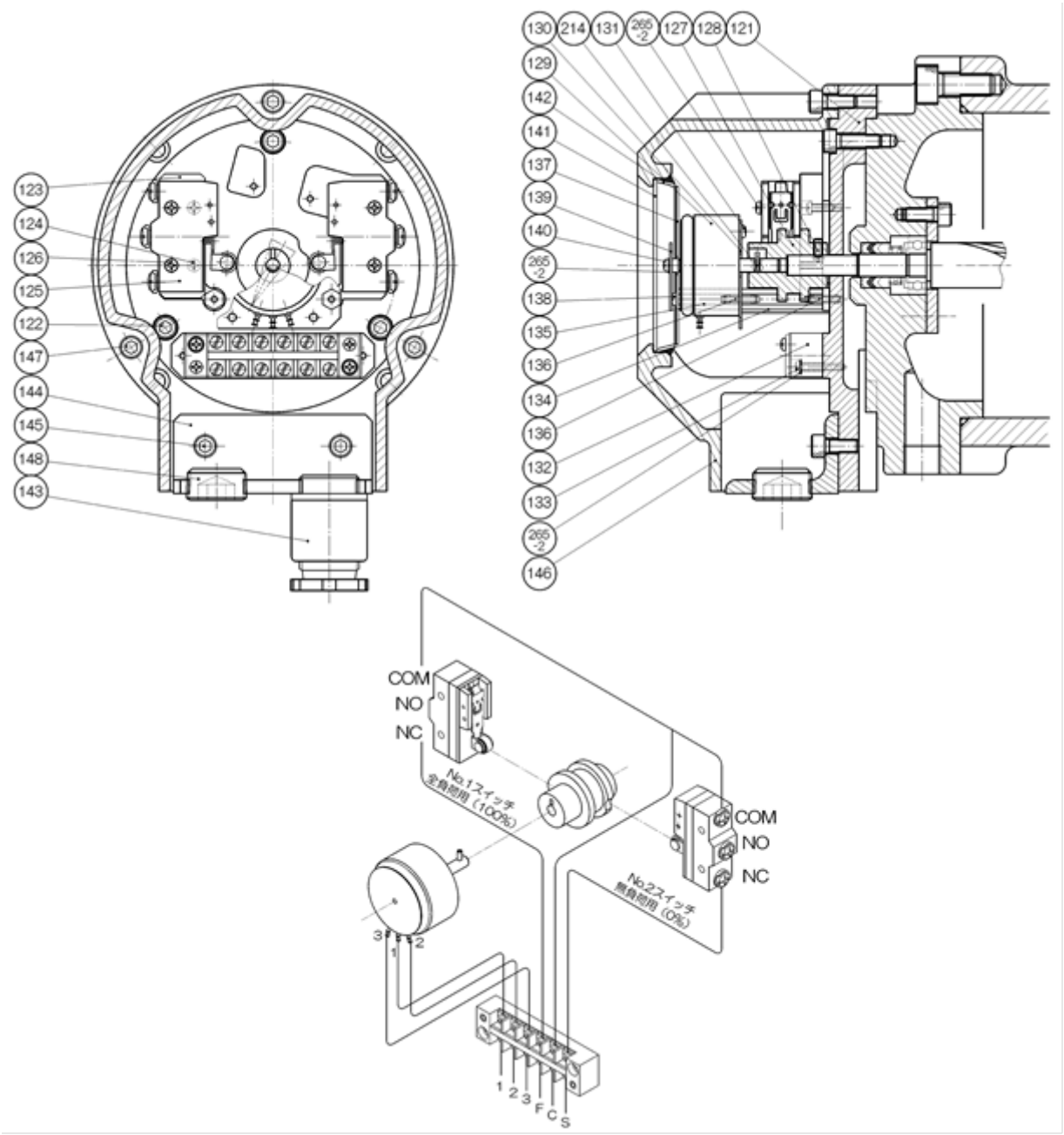


Figure 5-31 Sectional View of UD-series Unloader Indicator
(Traditional standard type)

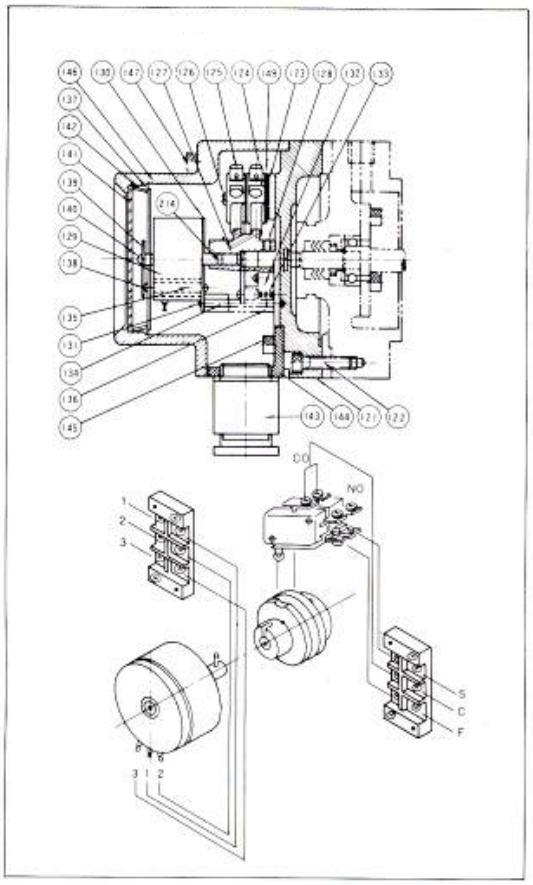


Figure 5-32 Unloder Indicator for 125LUD

Component Parts of the Unloader Indicator (The number in () is the 125 type)

P/N	Part Name	Q'ty	P/N	Part Name	Q'ty	P/N	Part Name	Q'ty
121	Micro-switch base plate	1	131	Phillips Screw	3(4)	141	Indicator glass	1
122	Hexagon socket head cap screw	3	132	Terminal block	1	142	Indicator glass spacer	1
123	Micro-switch setting plate	1	133	Phillips Screw	2	143	Indicator glass spacer	1
124	Phillips Screw	1	134	Dial plate support [2]	2	144	Bracket	1
125	Micro-switch	2	135	Dial plate support [1]	2	145	Hexagon socket head cap screw	2
126	Phillips Screw	4(2)	136	Hexagon socket set screw	4(2)	146	Unloader indicator cover (2)	1
127	Micro-switch cam	1	137	Dial	1	147	Hexagon socket head cap screw	3
128	Hexagon socket set screw	1	138	Phillips Screw	2	148	Plug	1
129	Potentiometer	1	139	Indicator needle	1	214	Spring pin	1
130	Potentiometer mounting plate	1	140	Phillips Screw	2(1)	265-2	Spring washer	7

Disassembly

a) Remove the Phillips screw (part number 140) that fixes the indicator pointer (part number 139) to the shaft.
b) Remove the Phillips screw (part number 138) that fixes the dial plate (part number 137) to the dial plate support.
c) A potentiometer mounting plate (part number 130) is installed between the dial support [1] (part number 134) and the dial support [2] (part number 135). Fix the dial support [1] and loosen it by turning the dial support [2] counterclockwise to remove the support [2].
d) Remove the two right and left supports and remove the potentiometer (part number 129) while it is attached to the mounting plate.
e) The potentiometer is attached to the mounting plate with three Phillips screws.
f) The micro-switch (part number 125) is fixed with two long Phillips screws (part number 126). The micro switch can be removed by loosening these screws.
g) The right side of the micro-switch is for the no load (0 %) position signal, and the left side is for the full load (100 %) position signal. On the left side, the cam on the outside of the actuating cam is used, and a micro switch setting plate (part number 123) under the micro switch is fixed to the micro switch base plate with a Phillips screw (part number 124).
h) Other parts can also be removed by removing the tightening screws.

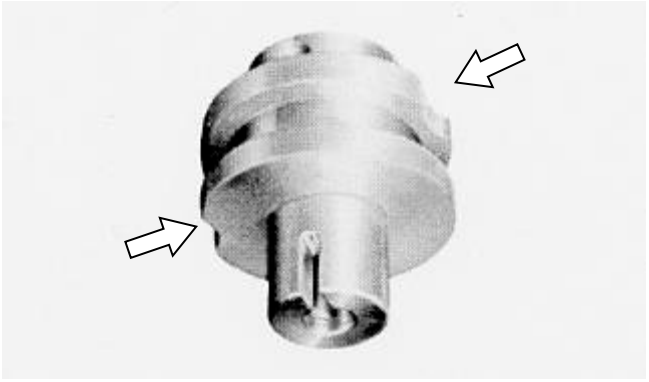
Inspection

a) Mainly check the operation of the contacts of electrical parts. Since the potentiometer is a full rotation type, check that the resistance value changes smoothly throughout the full revolution. If the surrounding environment is bad (in a corrosive gas atmosphere, in a place with a lot of water, or in a place with strong vibration), the internal resistance wire may be defective due to corrosion or wear. So it needs to be inspected.
b) Check the operation of the microswitch contacts using a tester. Also check the rotation of the microswitch roller.
c) Inspect the cam for contact wear and damage.

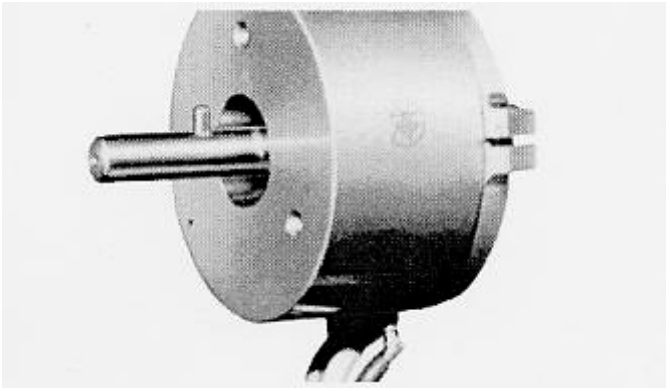
Reassembly / Adjustment

The procedure is completely reverse to the disassembly, but adjustment after assembly is important. These adjustments are made after the microswitch base plate is attached to the unloader cover.

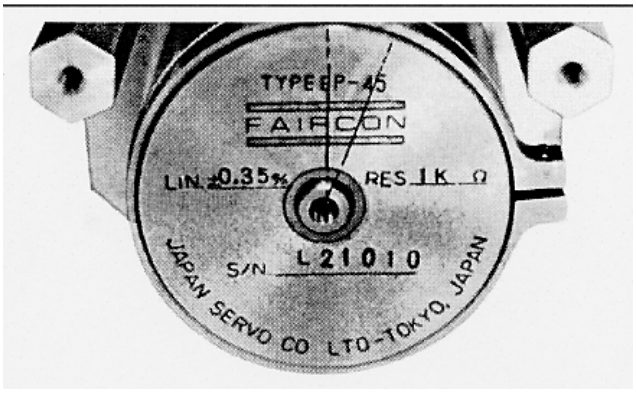
a) Since the unloader cover was assembled with the unloader slide valve position (unloader piston) in the unloaded position, the unloader indicator cam is in the unloaded position. Therefore, use the hexagon socket set screw (part number 128) of the micro-switch cam to fix it to the set hole on the shaft of the unloader indicator cam. Since the position is unloaded as described above, align the operation rod (roller) of the micro switch with the recess of the (inner) cam on the unloader cover side of the micro switch cam (see arrow ⇨) to fix the micro switch.
b) To assemble the potentiometer, a spring pin is inserted into a part of the shaft of the potentiometer. Align that pin with the key groove (cut-out part) of the micro switch cam and fix it with the dial plate support [2] (part number 135).



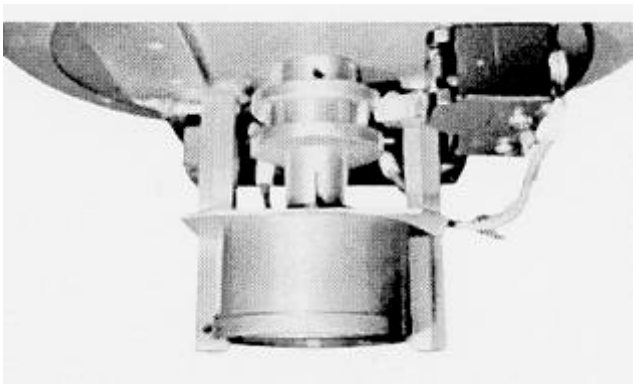
Micro-switch cam



Potentiometer



Potentiometer positioning mark



1 micro switch

c) Fix the dial with the indicator needle aligned to the no-load position. The full-loadmicroswitch will eventually pneumatically move the unloader piston to the full-load position and adjust it to operate with the mounting screw.

d) After completing the operation test, connect the electrical wires as they were.

Chapter 6 Troubleshooting

Table 6-1 Troubleshooting

	Trouble	Direct causes	Factors	Actions
01	Compressor does not start up	Power source is off.	Power source not turned on after inspection.	Prevent oversight by checking a check sheet after inspection.
		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 flow control valve (decreased too much)	Readjust.
			Leak or clogging in pipes and solenoid valves	Remove factors. Check oil contamination level and replace oil if necessary.
		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 if 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 (switch) activated	Insufficient refrigerant circulation volume • Insufficient refrigerant amount • Insufficient refrigerant supply • Heat exchange failure at heat exchanger	For insufficient refrigerant amount, check the system and stop leak, and then recharge refrigerant. * Be cautious about moisture contamination in the system.
				For insufficient supply, inspect expansion valves and liquid supply strainers, and then take necessary measures. Also, inspect devices and parameters (setting values) for expansion value aperture (opening) 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 regulating valve operation, replace pressure regulating 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, thus resulting in oil carry over during startup.	Inspect oil heater. Inspect relays, etc., on related circuits. And replace parts as needed.
			Insufficient oil return caused by insufficient refrigerant circulation	Resolve insufficient volume of refrigerant circulation, and then return oil from load side heat exchanger. * Charge 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 exchanger 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 divices.	Malfunction in hydraulic pressure protection device(switch), pressure sensor, relays, etc.	Identify malfunctioning devices, examine their causes, and take measures. Then, replace malfunctioning devices.
			Clogging in the tubing for oil pressure protection switch.	Remove clogging. Check oil contamination level and replace oil as necessary.
05	Abnormal high pressure (abnormal discharge pressure)	Heat exchange failure at condenser (heat exchanger)	Contaminated and blocked heat exchanger 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 shortage or out of water)	Identify malfunctioning devices, examine their causes, and take measures. Then, replace malfunctioning devices.
			Flow volume adjustment failure of cooling water, brine, etc.	If regulating valve is manually adjusted, readjust it. If an automatic control valve (including wax valve) is used, examine its cause and take measures.
			Other causes of insufficient circulation volume of cooling water, etc.	Inspect for clogging and contamination of filters for circulation route filters, and take measures as needed. Inspect for leak in circulation routes, and take measures if any. Inspect water supply routes and systems, and take measures as needed. If frozen, resolve by better insulation or heating.
			Shortage in capacity of 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 exchanger or increase their sizes.
		Uncondensed gas in the system	Intake air to low pressure side through pinholes, cracks, corrosions and other defective areas.	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	Repetitive refrigerant charge by mistaking insufficient cooking as a lack of refrigerant in the system.	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 the size.
		Defect in discharge pressure detection feature	Malfunction in abnormal high pressure protection device(switch), pressure sensor, relays, etc.	Identify malfunctioning devices, examine their causes, and take measures. Then, replace malfunctioning devices.
			Liquid stoppage, etc, by clogging in the tubing for high pressure protection switch.	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 system 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	Intake air to 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 oil supply temperature	Heat exchange failure in oil cooler	For water-cooled oil cooling, refer to “Heat exchange failure at condenser (heat exchanger)” in item 05. For liquid-injection oil cooling, inspect liquid supply expansion valve, temperature sensor, related relays, wiring, terminals, etc., and take necessary measures.
			Failure in oil temperature increase protection feature	Inspect temperature protection device (switch), temperature sensor, related relays, wiring, terminals, etc., and take measures.
		Defect in discharge temperature detection and protection devices	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 mating surface(seal and shaft) fit each other.	Initial wear stage of mating surface.	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 compressor start/stop. *Under normal operating condition, more than 4 times /h is considered as excessive.	If heat load is below the design operating conditions, re-examine the conditions and set the control settings to fewer start/stop 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 manually turn compressor rotor shaft, or equip external seal portion with oil pot.
		Deteriorated parts	Hardened O-ring	For aging degradation, replace O-ring. For other specific causes, the same factors and actions described above of "Damaged sliding surface due to excessive heat of sliding surface" 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 specific causes, the same factors and actions described above of "Damaged sliding surfaces due to excessive heat of sliding surface" can be applied.
		Incompatibility between operating conditions (working temperature ranges, refrigerant, etc.) and lubricant	Inappropriate lubricant or change in operating conditions since installation of compressor.	Re-examine operating conditions if possible. If not, refer to Chapter 4.1, "Lubricant (Refrigerant Oil)", and re-select lubricant and replace all amount of current lubricant with new type.
		Inappropriate contact conditions 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 surface fits each other, squeaking sound caused by contact of sliding surfaces might be heard.	Sliding surfaces is high in hardness as well as in density, so it takes a while for them to fit each other.	Squeaking itself does not cause seal leak 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 dowel pin.
			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 point 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 unloader solenoid 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 unloader solenoid valves for capacity control	Expanded oil and refrigerant liquid trapped 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 flow 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 does not move. (A defect of the capacity control hydraulic line is one of the causes, 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 flow-back 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 alignment between compressor shaft and motor shaft	If vibration value is higher in the axial direction, insufficient alignment might be the cause.	Realign the shaft-center. If abnormal vibration and noise frequently occur in monocoque unit, hot alignment is recommended. (operate compressor at design conditions once to increase shaft temperature and realign before the temperature decreases).
		Large axial runout of Male rotor	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 axial runout check, and reassemble it.
			Imprecision in dynamic balance of rotors	If no other causes for abnormal vibration are found, and if on-site overhaul has been repeatedly performed, imprecision in rotor dynamic balance might be the cause of abnormal noise and vibration. If this is the case, overhaul and inspect compressor where rotor dynamic balance measurerment and adjustment is feasible.

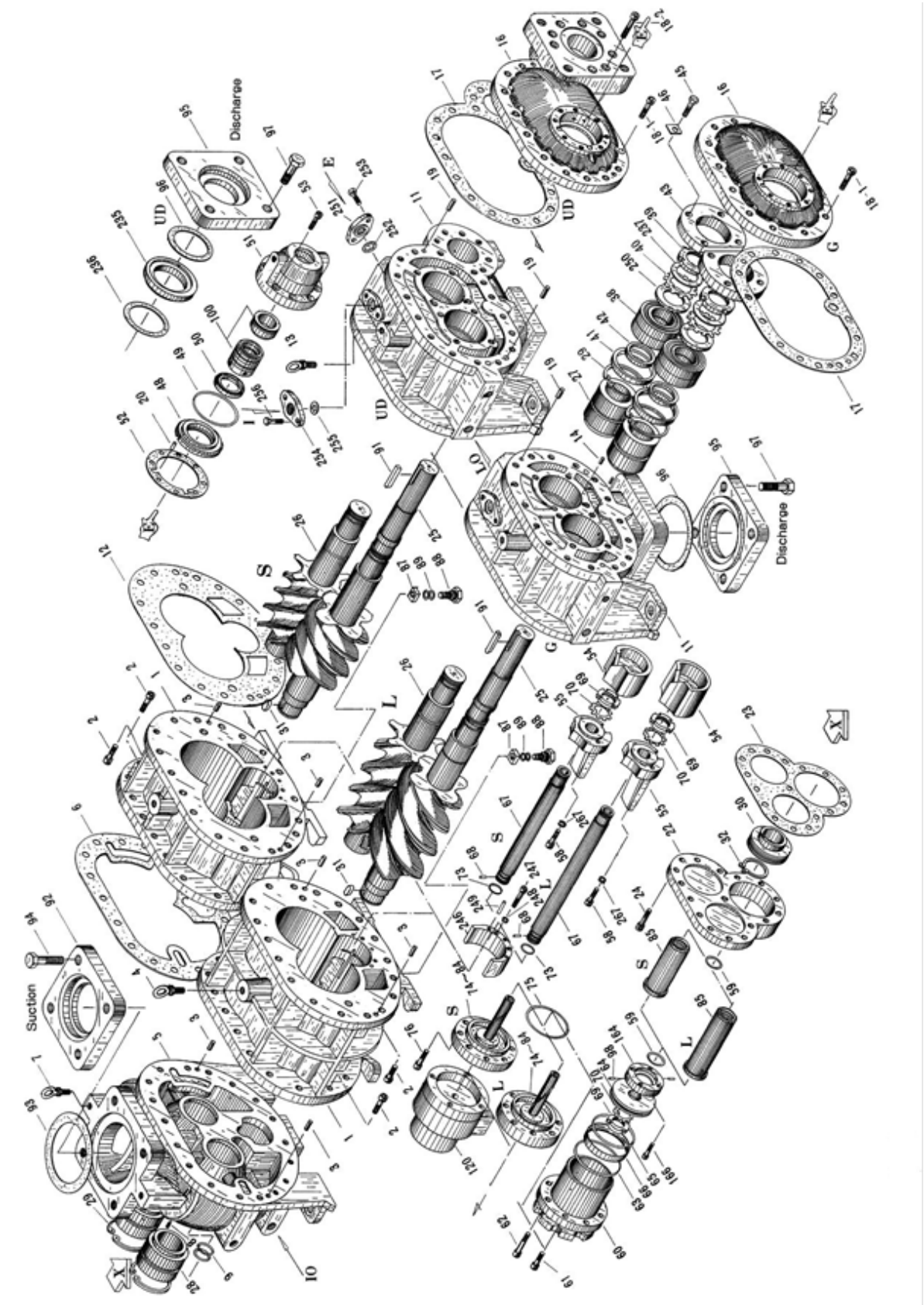
	Trouble	Direct causes	Factors	Actions
11	Abnormal vibration and/or noise of compressor	Oil hammer	Continuous low load operation at below 30 % of capacity control	During low load operation, lubricant is poorly discharged. Because of this, the amount of oil that remains inside rotor mesh increases and oil becomes compressed. →Avoid continuous low load operation. * Especially for light gas such as He and NH3, 10 minutes low load operation has a negative effect. For fluorocarbons, low load operations of more than 30 minutes are not recommended
		Liquid flow-back during startup * Initial abnormal noises are conspicuous. →If this phenomenon happens, in some cases, compressor gets instantly damaged.	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 liquid 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 flow-back during operation * Frosting on suction side is conspicuous. * In many cases, the phenomenon is often “mist-back” (suction of moist steam) rather than liquid flow-back. * To prevent this phenomenon, gas-liquid separator (accumulator) can be installed. * Refer to Factor “Insufficient refrigerant circulation volume” in item 02 as well.	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.
			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.

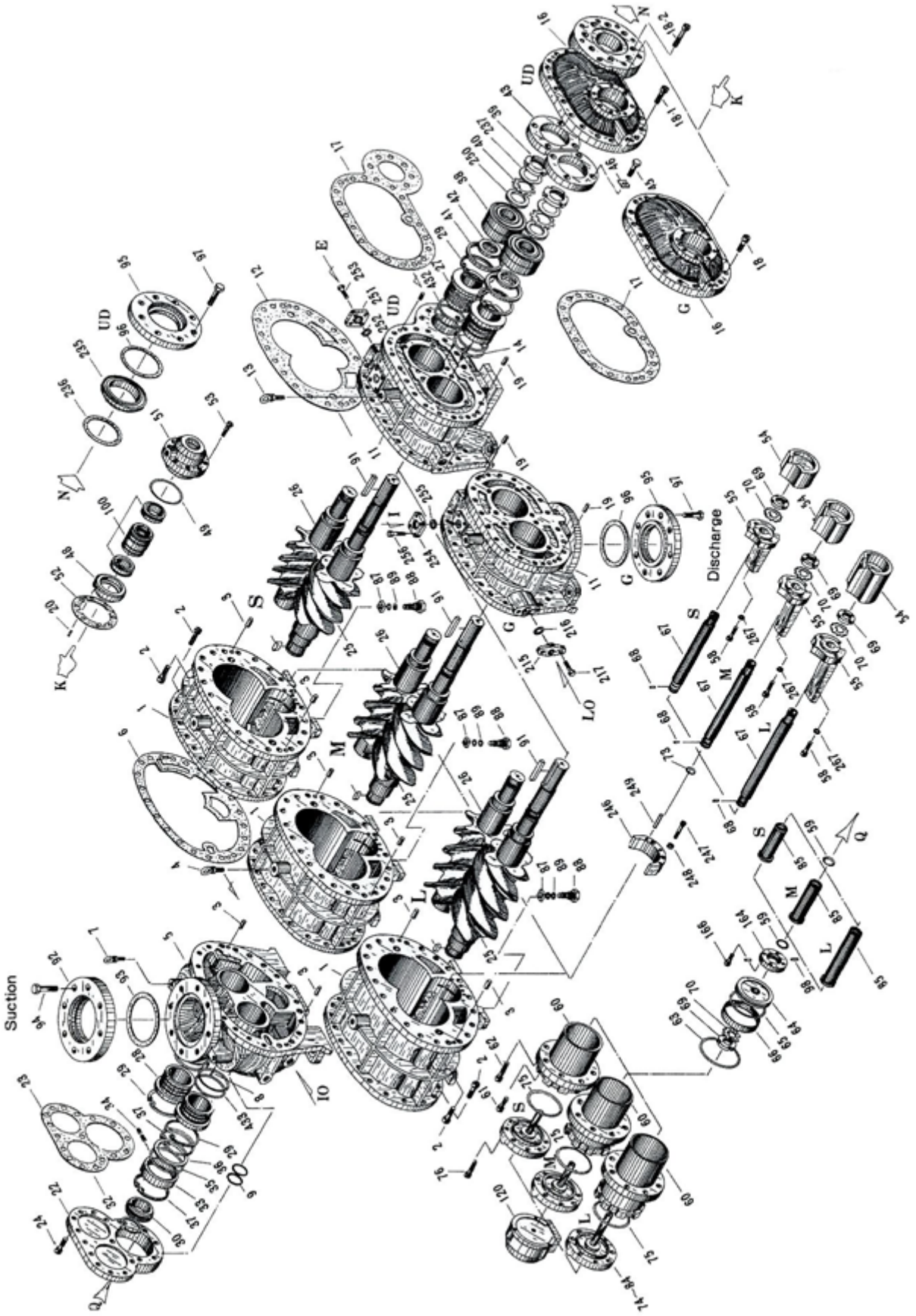
	Trouble	Direct causes	Factors	Actions
11	Abnormal vibration and/or noise of compressor		Expansion valve opening control cannot keep up with rapid changes in heat load on load side.	Avoid rapid changes in heat load.
			Shortage in heat exchanger capacity on load side due to an insufficient defrosting.	For frosting (icing), defrost manually. Reduce setting of defrosting interval. For malfunction of devices specific to defrosting methods, remove the cause and replace them. For blocked piping route specific to defrosting methods, remove the cause and take measures. * Especially for hot gas defrost, refer to the instruction manual related to devices/control on load side.
		Liquid flow-back during operation	Shortage in heat exchanger capacity on load side due to load side conditions	Improve the environment if cooling ventilation is blocked by excessive loads around heater exchanger. * Make sure to maintain sufficient air flow for heat exchanger on load side.
			Shortage in heat exchanger capacity on load side due to the failure of heat exchanger.	Inspect for blockage of heat exchanger tubes and malfunction of fans of heat exchanger. If any, take measures.
		Foreign substances entering into compressor	Entering 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	
		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 normal operating conditions based on steady and 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 flow-back during startup” and “Liquid flow-back during operation” above in this item.

	Trouble	Direct causes	Factors	Actions
11	Abnormal vibration and/or noise of compressor		Entering of foreign substances	Refer to the Direct cause “Foreign substances entering into compressor” above.
			Excessive thrust stress High suction pressure exceeding operating 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, 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 the natural frequency of piping or support approaches to vibration of compressor.	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.

Chapter 7 Related Documents

7.1 Exploded Views, Sectional Views

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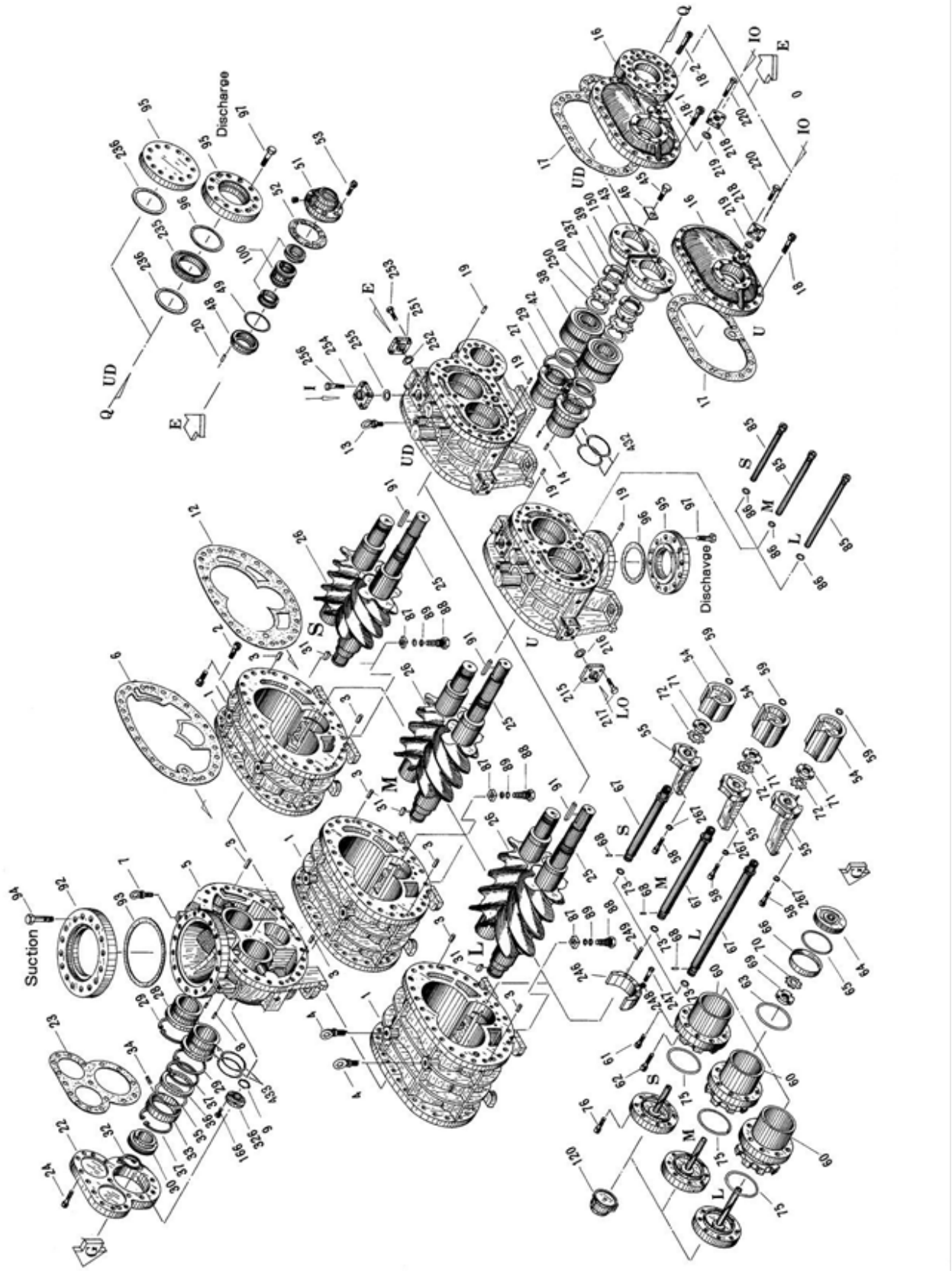
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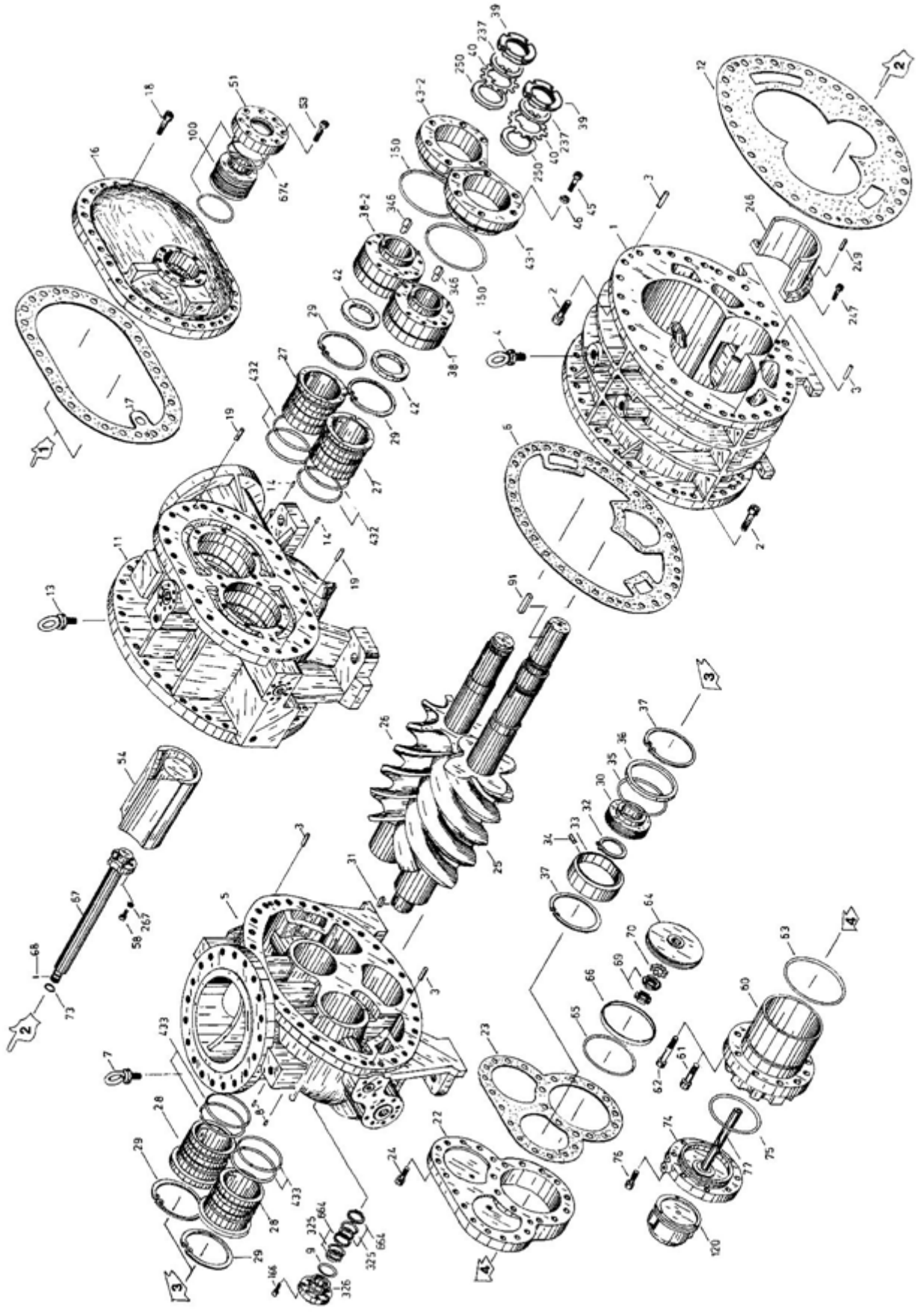

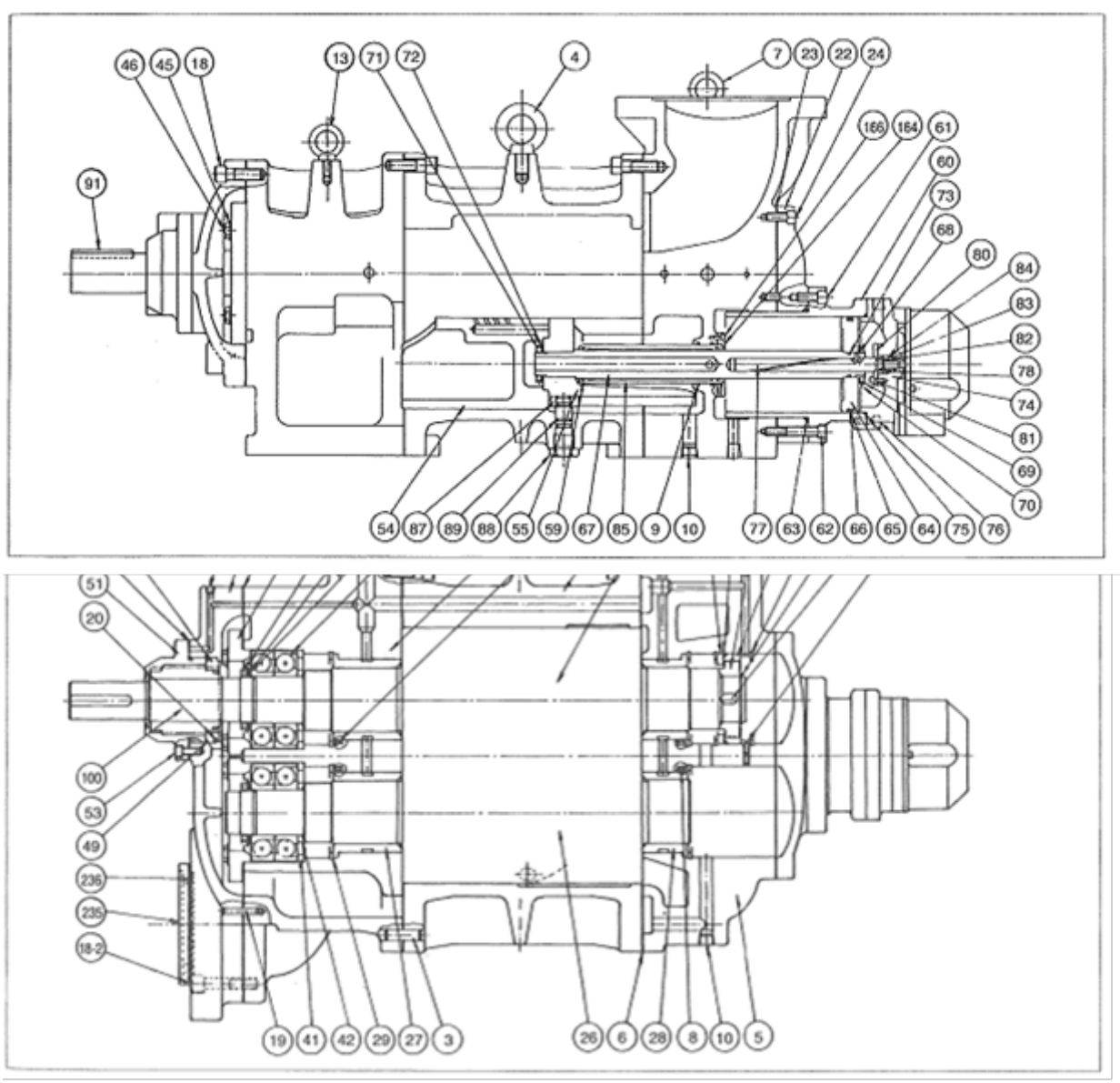
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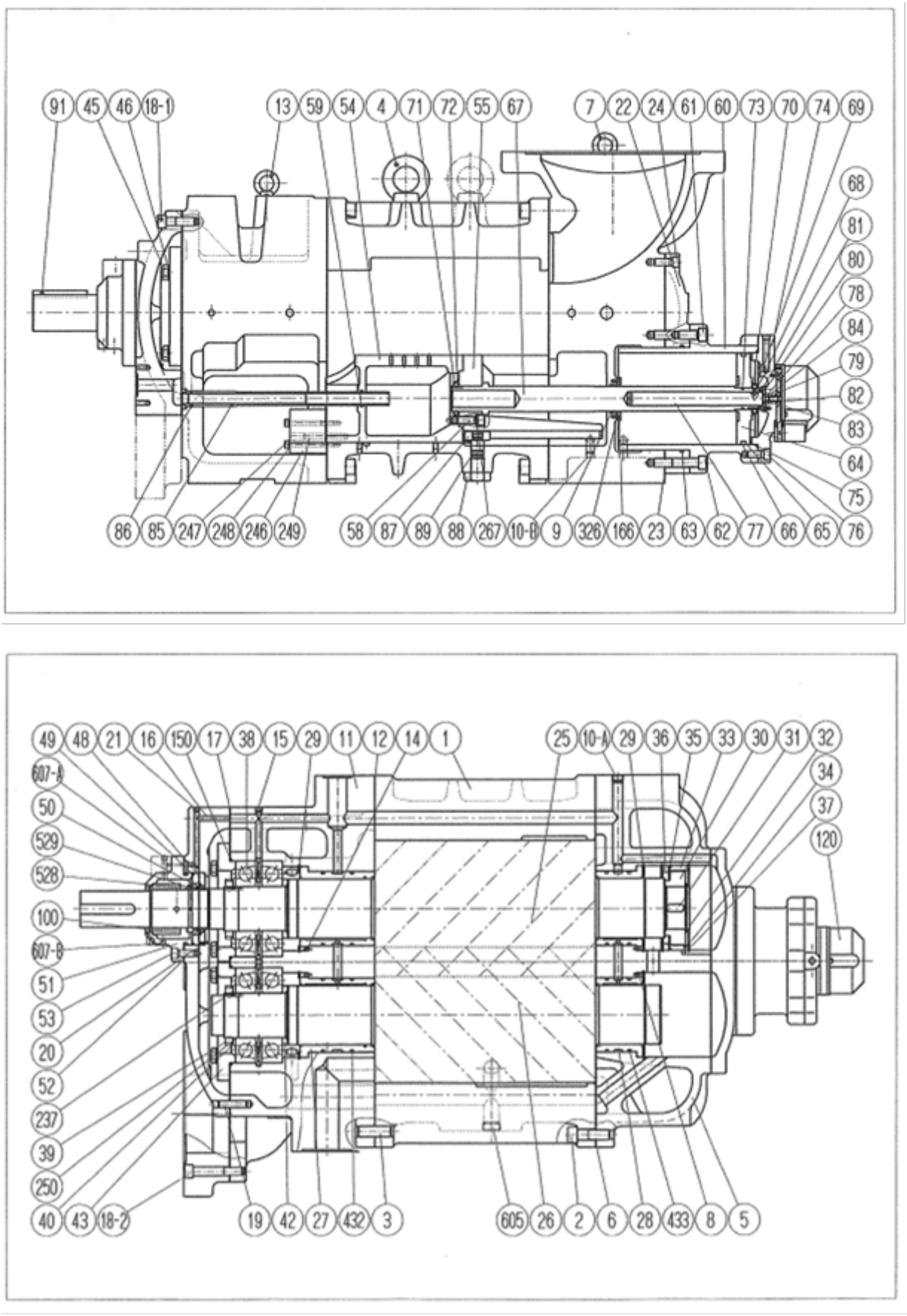


Figure 7-6 Sectional View (320*UD model)

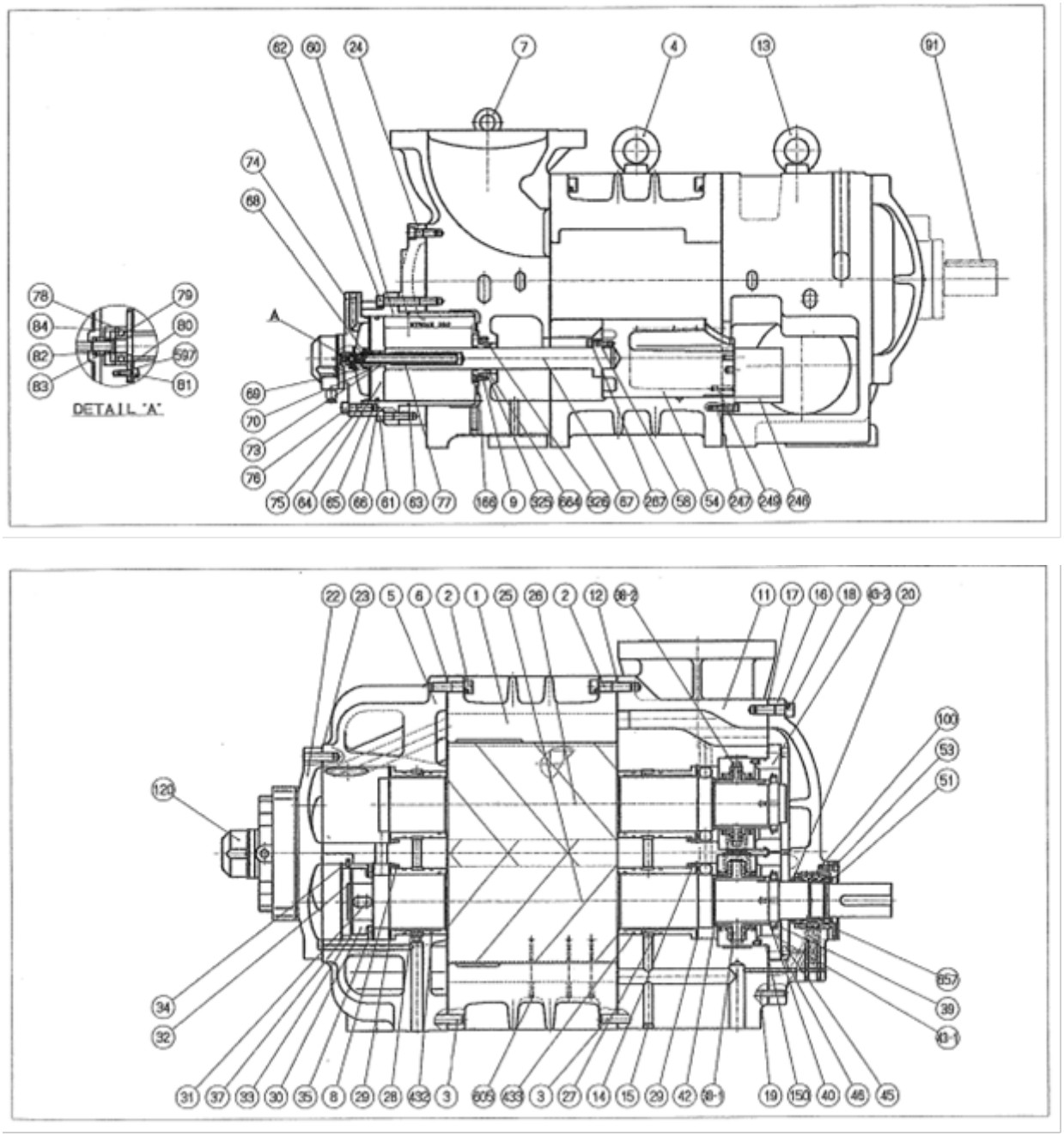


Figure 7-7 Sectional View (400*UD model)

7.2 Parts Configuration Table

Table 7-1 Parts Configuration Table of 125*UD models

P/N		Part Name	Code No.	Remarks	Q'ty.
1		Main Rotor Casing	CS00100-125S	125S**	1 (S**)
1		Main Rotor Casing	CS00100-125L	125L**	1 (L**)
2		Hexagon Socket Head Cap Screw	NB35414-040	M14×40	36
3		Alignment Pin	NE2016-040	φ16×40	4
4		Eye Bolt	NB600-16	M16	1
5		Suction Cover	CS00500-125D	125***	1
6		Gasket, Suction Cover	CS00600-125N	125***	1
7		Eye Bolt	NB600-12	M12	2
8		Spring Pin	NE3204-010	φ4×10	2
9		O-ring	PA11-042	JISB2401 1A P42	2
10	A	Plug	NF06-008	R1/4	1
10	B	Plug	NF06-008	R1/4	1
10	C	Plug	NF06-010	R3/8	1
10	D	Plug	NF06-010	R3/8	1
11	H	Bearing Head	CS01100-125DH	125***	1 (*UD)
11	M	Bearing Head	CS01100-125DM	125***	1 (*UD)
11	L	Bearing Head	CS01100-125DL	125***	1 (*UD)
12		Gasket, Bearing Head	CS01200-125N	125***	1
13		Eye Bolt	NB600-12	M12	1
14		Spring Pin	NE3204-010	φ4×10	2
16		Bearing Cover	CS01600-125D	125***	1 (*UD)
17		Gasket, Bearing Cover	CS01700-125DN	125***	1 (*UD)
18	1	Hexagon Socket Head Cap Screw	NB35412-030	M12×30	13 (*UD)
18	2	Hexagon Socket Head Cap Screw	NB35412-075	M12×75	8 (*UD)
19		Alignment Pin	NE2013-032	φ13×32	2
20		Spring Pin	NE3203-008	φ3×8	1
22		Balance Piston Cover	CS02200-125	125***	1
23		Gasket, Balance Piston Cover	CS02300-125N	125***	1
24		Hexagon Socket Head Cap Screw	NB35408-025	M8×25	11
25		Male Rotor	CS02520-125S	125S**	1 (S**)
26		Female Rotor			
25		Male Rotor	CS02520-125L	125L**	1 (L**)
26		Female Rotor			
27		Main Bearing	CS02700-125	125***	
28		Side Bearing	CS02800-125	125***	2
29		Retaining Ring	NG11-080	H80	2
30		Balance Piston	CS03000-125	125***	4
31		Key, Balance Piston	CS03100-125	125***	1
32		Retaining Ring	NG12-040	S40	1
38		Thrust Bearing	CS03800-125P	125*** 7209B PPS	1
38		Ductile retainer	CS03800-125	125***7209A	2
39		Lock Nut	NG31-009	AN09	2
40		Lock Washer	NG32-009	AW09	2
41		Spacer, Thrust Bearing Outer Race	CS04100-125	125***	2
42		Spacer, Thrust Bearing Alignment	CS04200-125	125***	2
43		Thrust Bearing Gland	CS04300-125D	125***	2
43		Thrust Bearing Gland	CS04300-125U	125LU	2 (LU)

P/N		Part Name	Code No.	Remarks	Q'ty.
45		Hexagon Head Bolt	NB111008-025	M8×25	8
46		Spring Washer	ND320-008	M8	8
48		Retainer, Oil Seal	CS04800-125	125***	1
49		O-ring	PA12-085	JISB2401 1A G85	1
50		Oil Seal	CS05000-125D	125***	1
50		Oil Seal	CS05000-125HE	HE125	1 (HE)
51		Seal Cover	CS051000-125BBS	125***	1
51	H E	Seal Cover	CS05100-125HE	125*** (HE)	1
52		Gasket, Seal Cover	CS05200-125N	125***	1
53		Hexagon Socket Head Cap Screw	NB35406-020	M6×20	8
54	L	Unloader Slide Valve (1) L-port	CS05400-125SDL	125S**	1 (S**)
54	M	Unloader Slide Valve (1) M-port	CS05400-125SDM	125S**	1 (S**)
54	H	Unloader Slide Valve (1) H-port	CS05400-125SDH	125S**	1 (S**)
54	L	Unloader Slide Valve (1) L-port	CS05400-125LDL	125L**	1 (L**)
54	M	Unloader Slide Valve (1) M-port	CS05400-125LDM	125L**	1 (L**)
54	H	Unloader Slide Valve (1) H-port	CS05400-125LDH	125L**	1 (L**)
55		Unloader Slide Valve (2)	-	125L**	1 (L**)
58		Hexagon Socket Head Cap Screw	NB35406-025	M6×25	4
59		O-ring	PA11-030	JISB2401 1A P30	2
60		Unloader Cylinder	CS06000-125L	125***	1
61		Hexagon Socket Head Cap Screw	NB35408-025	M8×25	2
62		Hexagon Socket Head Cap Screw	NB35408-065	M8×65	6
63		O-ring	PA12-095	JISB2401 1A G95	1
64		Unloader Piston	CS06400-125D	125***	1
65		O-ring	PA11-075	JISB2401 1A P75	1
66		Cap Seal	CS06600-125	CAP-3BE75	1
67		Unloader Push Rod	CS0671-CS	125S**	1 (S**)
67		Unloader Push Rod	CS0671-CL	125L**	1 (L**)
68		Guide Pin	NE2503-008	φ3×8	1
69		Lock Nut	NG31-005	AN05	2
70		Unloader Cover	NG32-005	AW05	2
73		O-ring	PA11-021	JISB2401 1A P21	1
74		Unloader Cylinder Cover	CS07400-125	125***	1
75		O-ring	PA12-085	JISB2401 1A G85	1
76		Hexagon Socket Head Cap Screw	NB35406-030	M6×30	8
77		Indicator Cam	CS07700-125S	125S**	1 (S**)
77		Indicator Cam	CS07700-125L	125L**	1 (L**)
78		Ball Bearing	CS07800-200	#6000	1
79		Stop Ring	NG12-010	S10	1
80		Bearing Gland	CS08000-200	200***	1
81		Hexagon Socket Head Cap Screw	NB35406-015	M6×15	3
82		V-ring	CS08200-200B	NBR	1
82		V-ring	CS08200-200V	FPM	1
83		Spring	CS08300-200	200***	1
84		Retainer, Indicator Cam Spring	CS08400-200	200***	1
85		Oil Injection Pipe	CS08500-125SD	125S**	1 (S**)
85		Oil Injection Pipe	CS08500-160SD	125L&160S	1 (L**)
87		Guide Block	CS08700-125	125***	1
88		Stem, Guide Block			
89		O-ring	PA11-012	JISB2401 1A P12	2
91		Shaft Key	CS09100-125	125***	1

P/N		Part Name	Code No.	Remarks	Q'ty.
92		Suction Cover Flange MYK100A without hole	CS71400-P100	MYK100A(4") Male	1
93		Gasket, Suction Flange	CR72000-100N	MYK100A	1
94		Hexagon Head Bolt	NB12022-055	M22×55	4
95		Discharge Cover Flange MYK65CD	CS71400-P065CD	MYK65CD Male	1 (*UD)
96		Gasket, Discharge Flange	CS72000-065N	MYK65A	1 (*UD)
97		Hexagon Head Bolt for MYK65CD Flange	NB12016-045	M16×45	4 (*UD)
97		Hexagon Head Bolt for MYK65A Flange	-	M16×70	4 (*UD)
98		Spring Pin	NE3203-014	φ3×14	2
100		Mechanical Seal Assembly (BOS-T1)	CS10000-125BT	BOS-T1	1
100		Mechanical Seal Assembly (BBSE)	CS10002-125EBS	BBS-E	1
100		Mechanical Seal Assembly (UV4)	CS10009-125-F70	UV4	1
100		Mechanical Seal Assembly (BBS3)	CS10001-125BBS	BBS3	1
100		Mechanical Seal Assembly (BOS)	CS10000-125BT-F70	BOS	1
100		Mechanical Seal Assembly (BBS3)	CS10001-125BBS	BBS3	1
120		Unloader Indicator Assembly	CS12000-125F	125, 0-100 %	1
120		Unloader Indicator Assembly	CS12000-125H	125, 0-50 %	1
125		Micro Switch Set	CS12501-IND0203	125,1612 shared right	1
127		Micro Switch Cam	CS12700－125F	125, 0-100 %	1
127		Micro Switch Cam	CS12700-125H	125, 0-50 %	1
129		Potentiometer	CS1299-E10	200-1K with lead wire	1
129		Conductive Potentiometer	CS12919-E10	200-1K with lead wire	1
164		Pipe Gland, Oil Injection	CS16400-160	160***	1
166		Hexagon Socket Head Cap Screw	NB35405-012	M5×12	2
235		Spacer, Discharge Flange	FX101-125		1
236		Gasket, Discharge Flange Spacer	CS23600-125N		1
237		Torsional Slip Washer	CS23700-125	125***	2
246		Guide, Unloader Slide Valve	CS24600-125	125***	1
247		Hexagon Socket Head Cap Screw	NB35406-045	M6×45	3
248		Spring Washer, Hexagon Head Cap Screw	ND330-06	M6	3
249		Alignment Pin	NE2006-035	φ6×35	2
250		Thrust Washer	CS25000-125	125***	2
251		Flange (for Electromizer)	CR74000-015	MYK15A(1/2")	1
252		Gasket, Flange (for Electromizer)	CR72000-015N		1
253		Hexagon Head Bolt	NB111012-035	M12×30	2
253		Hexagon Head Bolt	NB111012-030	M12×30	2
254		Flange (for Aquamizer)	CR74000-010	MYK10A(3/8")	1
255		Gasket, Flange (for Aquamizer)	CR72000-010N		1
256		Hexagon Head Bolt	NB111012-030	M12×30	2
267		Spring Washer, Hexagon Head Cap Screw	ND330-06	M6	4
605		Plug	NF06-015	R1/2	1
607		Plug	NF06-004	R1/8	1
715		Blind Plate for Electromizer	CS71500-010	10A	1
715		Blind Plate for Aquamizer	CS71500-010	10A	1

CAUTION

- **The part code of the O-ring is the one assigned to NBR which is standard material. When the material of the O-ring is other than NBR, a different part code is used for each material.**
  If you are using O-rings made from other than the standard material, please contact MAYEKAWA when placing an order.

CAUTION

- **The Code No. of parts shown in parentheses below is applied to the product until the end of November, 2014:**
  (P/N 120 Unloader Indicator Assembly, P/N 125 Micro-Switch, P/N 129 Potentiometer)
- **For the Code No. of new type indicator part, refer to the separately dedicated Instruction manual for it.**

Table 7-2 Parts Configuration Table of 160*UD models

P/N		Part Name	Code No.	Remarks	Q'ty.
1		Main Rotor Casing	CS00100-160S	160S**	1 (S**)
1		Main Rotor Casing	CS00100-160M	160M**	1 (M**)
1		Main Rotor Casing	CS00100-160L	160L**	1 (L**)
2		Hexagon Socket Head Cap Screw	NB35412-040	M12×40	52
3		Alignment Pin	NE2013-040	φ13×40	4
4		Eye Bolt	NB600-16	M16	1
5		Suction Cover	CS00500-160D	160***	1
6		Gasket, Suction Cover	CS00600-160N	160***	1
7		Eye Bolt	NB600-12	M12	2
8		Spring Pin	NE3204-010	φ4×10	2
9		O-ring	PA11-042	JISB2401 1A P42	2
10	A	Plug	NF06-004	R1/8	1
10	B	Plug	NF06-008	R1/4	1
10	C	Plug	NF06-008	R1/4	1
11	H	Bearing Head	CS01100-160DH	160***	1 (*UD)
11	M	Bearing Head	CS01100-160DM	160***	1 (*UD)
11	L	Bearing Head	CS01100-160DL	160***	1 (*UD)
12		Gasket, Bearing Head	CS01200-160N	160***	1
13		Eye Bolt	NB600-12	M12	1
14		Spring Pin	NE3204-010	φ4×10	2
15		Plug	NF06-008	R1/4	1
16		Bearing Cover	CS01600-160D	160***	1 (*UD)
17		Gasket, Bearing Cover	CS01700-160DN	160***	1 (*UD)
18	1	Hexagon Socket Head Cap Screw	NB35412-040	M12×40	17 (*UD)
18	2	Hexagon Socket Head Cap Screw	NB35412-080	M12×80	7 (*UD)
19		Alignment Pin	NE2010-040	φ10×40	2
20		Spring Pin	NE3203-010	φ3×10	1
22		Balance Piston Cover	CS02200-160	160S/L	1
23		Gasket, Balance Piston Cover	CS02300-160N	160L**	1
24		Hexagon Socket Head Cap Screw	NB35410-025	M10×25	11
25		Male Rotor	CS02520-160S	160S*	1 (S**)
26		Female Rotor		160S*	
25		Male Rotor	CS02520-160M	160M*	1 (M**)
26		Female Rotor	-	160M*	1 (M**)
25		Male Rotor	CS02520-160L	160L*	1 (L**)
26		Female Rotor	-	160L*	1 (L**)
27		Main bearing	CSH02700-160	Overseas	2
			CS02700-160N	Domestic	2
28		Side Bearing	CSH02800-160	Overseas	2
			CS02800-160N	Domestic	2
29		Stop Ring	NG11-102	H102	4
30		Balance Piston	CS03000-160	160***	1
30		Balance Piston for high temperatures	CS03000-160H	160*** DH	1
31		Key, Balance Piston	CS03100-160	160***	1
32		Stop Ring	NG12-050	S50	1
33		Sleeve, Balance Piston	CS03300-160	160***	1
33		Sleeve, Balance Piston for high temperatures	CS03300-160H	160*** DH	1
34		Set Screw	NA83606-015	M6×15	2

P/N		Part Name	Code No.	Remarks	Q'ty.
35		O-ring	PA12-095	JISB2401 1A G95	1
36		Spacer	CS03600-160	160***	1
37		Stop Ring	NG11-102	H102	2
38		Thrust Bearing	CS03800-160P	7212B	2
38		Ductile retainer	CSC3800-160	NFA	2
			CS03800-160N7	NTN	2
39		Lock Nut	NG31-012	AN12	2
40		Lock Washer	NG32-012	AW12	2
41		Spacer, Thrust Bearing Outer Race	CS04100-160	160***	2
42		Spacer, Thrust Bearing Alignment	CS04200-160	160***	2
43		Thrust Bearing Gland	CS04300-160	160***	2
45		Hexagon Head Bolt	NB111010-030	M10×30	8
46		Conical Spring Washer	ND150-010	160***	8
46		Lock Washer Set (old , plate type)	CS0469-D	160*** 8ps/set	-
48		Retainer, Oil Seal	CS04800-160	160***	1
49		O-ring	PA12-090	JISB2401 1A G90	1
50		Oil Seal	CS05000-160VD	SA1 Ⅰ 55	1
51	H E	Seal Cover	CS051000-160BBS	160***BBS	1
51		Seal Cover	CS05100-160HE	160*** (HE)	1
52		Gasket, Seal Cover	CS05200-160N	160***	1
53		Hexagon Socket Head Cap Screw	NB35408-025	M8×25	8
54	L	Unloader Slide Valve (1) L Port	CS05400-160SDL	160S**	1 (S**)
54	M	Unloader Slide Valve (1) M Port	CS05400-160SDM	160S**	1 (S**)
54	H	Unloader Slide Valve (1) H Port	CS05400-160SDH	160S**	1 (S**)
54	L	Unloader Slide Valve (1) L Port	CS05400-160MDL	160M**	1 (M**)
54	M	Unloader Slide Valve (1) M Port	CS05400-160MDM	160M**	1 (M**)
54	H	Unloader Slide Valve (1) H Port	CS05400-160MDH	160M**	1 (M**)
54	L	Unloader Slide Valve (1) L Port	CS05400-160LDL	160L**	1 (L**)
54	M	Unloader Slide Valve (1) M Port	CS05400-160LDM	160L**	1 (L**)
54	H	Unloader Slide Valve (1) H Port	CS05400-160LDH	160L**	1 (L**)
55		Unloader Slide Valve (2)	-	160S**	1 (S**)
55		Unloader Slide Valve (2)	-	160M**	1 (M**)
55		Unloader Slide Valve (2)	-	160L**	1 (L**)
58		Hexagon Socket Head Cap Screw	NB35408-025	M8×25	4
59		O-ring	PA11-030	JISB2401 1A P30	2
60		Unloader Cylinder	CS06000-160S	160S**	1 (S**)
60		Unloader Cylinder	CS06000-160M	160M**	1 (M**)
60		Unloader Cylinder	CS06000-160L	160L**	1 (L**)
61		Hexagon Socket Head Cap Screw	NB35410-025	M10×25	2
62		Hexagon Socket Head Cap Screw	NB35410-065	M10×65	6
63		O-ring	PA12-125	JISB2401 1A G125	1
64		Unloader Piston	CS06400-160D	160***	1
65		O-ring	PA11-100	JISB2401 1A P100	1
66		Cap Seal	CS06600-160	CAP-3BE100	1
67		Push Rod, Unloader Slide Valve	CS0671-DS	160S**	1 (S**)
67		Push Rod, Unloader Slide Valve	CS0671-DM	160M**	1 (M**)
67		Push Rod, Unloader Slide Valve	CS0671-DL	160L**	1 (L**)

P/N		Part Name	Code No.	Remarks	Q'ty.
68		Guide Pin	NE2503-008	φ3×8	1
69		Lock Nut	NG31-005	AN05	2
70		Lock Washer	NG32-005	AW05	2
73		O-ring	PA11-021	JISB2401 1A P21	1
74		Unloader Cylinder Cover	CS07400-160	160***	1
75		O-ring	PA12-110	JISB2401 1A G110	1
76		Hexagon Socket Head Cap Screw	NB35408-025	M8×25	8
77		Indicator Cam	CS07700-160S	160S**	1 (S**)
77		Indicator Cam	CS07700-160M	160M**	1 (M**)
77		Indicator Cam	CS07700-160L	160L**	1 (L**)
78		Ball Bearing	CS07800-200	#6000	1
79		Stop Ring	NG12-010	S10	1
80		Bearing Gland	CS08000-200	200***	1
81		Hexagon Socket Head Cap Screw	NB35406-015	M6×15	3
82		V-ring	CS08200-200B	20×10×12	1
83		Spring	CS08300-200	200***	1
84		Retainer, Indicator Cam Spring	CS08400-200	200***	1
85		Oil Injection Pipe	CS08500-160SD	160S**	1 (S**)
85		Oil Injection Pipe	CS08500-160MD	160M**	1 (M**)
85		Oil Injection Pipe	CS08500-160LD	160L**	1 (L**)
87		Guide Block	CS08700-160	160***	1
88		Stem, Guide Block		160***	1
89		O-ring	PA11-016	JISB2401 1A P16	2
91		Shaft Key	CS09100-160	160***	1
92		Suction Cover Flange without hole	CS71400-P125	MYK125A Male	1
93		Gasket, Suction Flange	CR72000-125N	MYK125A	1
94		Hexagon Head Bolt	NB12020-055	M20×55	8
95		Discharge Cover Flange	CS71400-P100CD	MYK100CD Male	1 (*UD)
96		Gasket, Discharge Flange	CR72000-100N	MYK100A	1
97		Hexagon Head Bolt	NB12022-055	M22×55	4
97		Hexagon Head Bolt	NB12022-080	M22×80	4
98		Spring Pin	NE3203-014	φ3×14	2
100		Mechanical Seal Assembly (BOS)	CS10000-160BT-F70	160V** BOS Type	1
100		Mechanical Seal Assembly (BBSE)	CS10002-160EBS	BBS-E	1
100		Mechanical Seal Assembly (UV4)	CS10009-160-F70	UV4	1
100		Mechanical Seal Assembly (BBS3)	CS10001-160BBS	BBS3	1
120		Unloader Indicator Assembly (With dial)	CS120-IND062WP-UP	200, 0-100 %	1
120		Unloader Indicator Assembly (No dial)	CS120-INDO62WP	200, 0-50 %	1
125		Micro Switch	CS12501-IND06P	200*** Z15GW	2
129		Potentiometer 200-1k	CS12900-IND06P	with lead wire	1
129		Conductive Potentiometer 200-1k	CS12919-E10	with lead wire	1
137		Indicator Dial	CS13700-200		1
164		Pipe Gland, Oil Injection	CS16400-160	160***	1
166		Hexagon Socket Head Cap Screw	NB35405-012	M5×12	2
235		Spacer, Discharge Flange	FX101-160		1
236		Gasket, Discharge Flange Spacer	CS23600-160N		1

P/N		Part Name	Code No.	Remarks	Q'ty.
237		Torsional Slip Washer	CS23700-160	160***	2
247		Hexagon Socket Head Cap Screw	NB35406-060	M6×60	4
248	1	Spring Washer for Hexagon Head Cap Screw	ND330-06	M6	4
249	2	Alignment Pin	NE2006-050	φ6×50	2
250		Thrust Washer	CS25000-160	160***	2
252		Gasket, Flange for Electromizer	CR72000-025N	MYK25A	1
253		Hexagon Head Bolt	NB111012-035	M12×35	4
255		Gasket, Flange for Aquamizer	CR72000-020N		1
256		Hexagon Head Bolt	NB111012-035	M12×35	2
267		Spring Washer for Hexagon Head Cap Screw	ND330-08	M8	4
432	A	O-ring	PA12-085	JISB2401 1A G85	4
433	B	O-ring	PA12-085	JISB2401 1A G85	4
605	A	Plug	NF06-015	R1/2	1
607	B	Plug	NF06-004	R1/8	1
715		Blind Plate for Aquamizer	CS71500-020	20A	1

CAUTION

- **The part code of the O-ring is the one assigned to NBR which is standard material. When the material of the O-ring is other than NBR, a different part code is used for each material.**
  If you are using O-rings made from other than the standard material, please contact MAYEKAWA when placing an order.

CAUTION

- **The Code No. of parts shown in parentheses below is applied to the product until the end of November, 2014:**
  (P/N 120 Unloader Indicator Assembly, P/N 125 Micro-Switch, P/N 129 Potentiometer)
- **For the Code No. of new type indicator part, refer to the separately dedicated Instruction manual for it.**

Table 7-3 Parts Configuration Table of 200*UD models

P/N		Part Name	Code No.	Remarks	Q'ty.
1		Main Rotor Casing	CS00100-200S	200S**	1 (S**)
1		Main Rotor Casing	CS00100-200M	200M**	1 (M**)
1		Main Rotor Casing	CS00100-200L	200L**	1 (L**)
2		Hexagon Socket Head Cap Screw	NB35416-050	M16X50	50
3		Alignment Pin	NE2016-055	φ16X55	4
4		Eye Bolt	NB600-20	M20	1
5		Suction Cover	CS00500-200D	200***	1
6		Gasket, Suction Cover	CS00600-200N	200***	1
7		Eye Bolt	NB600-12	M12	2
8		Spring Pin	NE3206-012	φ6×12	2
9		O-ring	PA12-055	JISB2401 1A G55	2
10	A	Plug	NF06-010	R3/8	1
10	B	Plug	NF06-008	R1/4	1
10	C	Plug	NF06-015	R1/2	1
10	D	Plug	NF06-015	R1/2	1
11	H	Bearing Head	CS01100-200DH	200***	1 (*UD)
11	M	Bearing Head	CS01100-200DM	200***	1 (*UD)
11	L	Bearing Head	CS01100-200DL	200***	1 (*UD)
12		Gasket, Bearing Head	CS01200-200N	200***	1
13		Eye Bolt	NB600-12	M12	1
14		Spring Pin	NE3206-012	φ6x12	2
16		Bearing Cover	CS01600-200D	200***	1 (*UD)
17		Gasket, Bearing Cover	CS01700-200DN	200***	1 (*UD)
18	1	Hexagon Socket Head Cap Screw	NB35416-050	M16X50	17(*UD)
18	2	Hexagon Socket Head Cap Screw	NB35416-075	M16X75	8 (*UD)
19		Alignment Pin	NE2010-050	φ10x50	2
20		Spring Pin	NE3203-010	φ3×10	1
21		Plug	NF06-010	R3/8	1
22		Balance Piston Cover	CS02200-200	200***	1
23		Gasket, Balance Piston Cover	CS02300-200N	200***	1
24		Hexagon Socket Head Cap Screw	NB35412-030	M12X30	11
25		Male Rotor	CS02520-200S	200S*	1 (S**)
26		Female Rotor			
25		Male Rotor	CS02520-200M	200M*	1 (M**)
26		Female Rotor	-	200M*	
25		Male Rotor	CS02520-200L	200L*	1 (L**)
26		Female Rotor	-	200L*	
27		Main Bearing	CSH02700-200	Overseas	
			CS02700-200N	Domestic	
28		Side Bearing	CSH02800-200	Overseas	
			CS02800-200N	Domestic	
29		Stop Ring	NG11-130	H130	4
30		Balance Piston	CS03000-200	200***	1
30		Balance Piston for high temperatures	CS03000-200H	200*** DH	1
31		Key, Balance Piston	CS03100-200	200***	1
32		Stop Ring	NG12-065	S65	1
33		Sleeve, Balance Piston	CS03300-200	200***	1
33		Sleeve, Balance Piston for high temperatures	CS03300-200H	200*** DH	1

P/N		Part Name	Code No.	Remarks	Q'ty.
34		Set Screw	NA83608-015	M8X15	2
35		O-ring	PA11-120	JISB2401 1A P120	1
36		Spacer	CS03600-200	200***	1
37		Stop Ring	NG11-130	H130	2
38		Thrust Bearing	CS03800-200P	7313PPS	2
38		Ductile retainer	CS03800-200	NSK type	
			CS03800-200N	NTN type	
39		Lock Nut	NG31-013	AN13	2
40		Lock Washer	NG32-013	AW13	2
41		Spacer, Thrust Bearing Outer Race	CS04100-200	200***	2
42		Spacer, Thrust Bearing Alignment	CS04200-200	200***	2
43		Thrust Bearing Gland	CS04300-200	200***	2
45		Hexagon Head Bolt	NB111012-035	M12X35	8
46		Conical Spring Washer	ND150-012	M12	8
46		Lock Washer Set (old , plate type)	CS0469-E	200*** 8ps/set	-
48		Retainer, Oil Seal	CS04800-200VDS	200V** BOS TYPE	1
49		O-ring	PA12-115	JISB2401 1A G115	1
50		Oil Seal	CS05010-200VD	SA1J 65X85X12	1
51		Seal Cover	CS05100-200BBS	200***	1
51		Seal Cover	CS05100-200UV4	200***	1
51	H E	Seal Cover	CS05100-200HE	200*** (HE)	1
52		Gasket, Seal Cover	CS05200-200N	200***	1
53		Hexagon Socket Head Cap Screw	NB35410-025	M10X25	8
54	L	Unloader Slide Valve (L Port)	CS05400-200SDL	200S**	1 (S**)
54	M	Unloader Slide Valve (M Port)	CS05400-200SDM	200S**	1 (S**)
54	H	Unloader Slide Valve (H Port)	CS05400-200SDH	200S**	1 (S**)
54	L	Unloader Slide Valve (L Port)	CS05400-200MDL	200M**	1 (M**)
54	M	Unloader Slide Valve (M Port)	CS05400-200MDM	200M**	1 (M**)
54	H	Unloader Slide Valve (H Port)	CS05400-200MDH	200M**	1 (M**)
54	L	Unloader Slide Valve (L Port)	CS05400-200LDL	200L**	1 (L**)
54	M	Unloader Slide Valve (M Port)	CS05400-200LDM	200L**	1 (L**)
54	H	Unloader Slide Valve (H Port)	CS05400-200LDH	200L**	1 (L**)
55		Unloader Slide Valve	-	200S**	1 (S**)
55		Unloader Slide Valve	-	200M**	1 (M**)
55		Unloader Slide Valve	-	200L**	1 (L**)
58		Hexagon Socket Head Cap Screw	NB35410-030	M10X30	4
59		O-ring	PA11-040	JISB2401 1A P40	2
60		Unloader Cylinder	CS06000-200S	200S**	1 (S**)
60		Unloader Cylinder	CS06000-200M	200M**	1 (M**)
60		Unloader Cylinder	CS06000-200L	200L**	1 (L**)
61		Hexagon Socket Head Cap Screw	NB35412-030	M12X30	2
62		Hexagon Socket Head Cap Screw	NB35412-075	M12X75	6
63		O-ring	PA12-150	JISB2401 1A G150	1
64		Unloader Piston	CS06400-200D	200***	1
65		O-ring	PA11-125	JISB2401 1A P125	1
66		Cap Seal	CS06600-200-1	CAP-3BE125	1
67		Push Rod, Unloader Slide Valve	CS0671-ES	200S**	1 (S**)
67		Push Rod, Unloader Slide Valve	CS0671-EM	200M**	1 (M**)
67		Push Rod, Unloader Slide Valve	CS0671-EL	200L**	1 (L**)

P/N		Part Name	Code No.	Remarks	Q'ty.
68		Guide Pin	NE2505-012	φ5X12	1
69		Lock Nut	NG31-007	AN07	2
70		Lock Washer	NG32-007	AW07	2
73		O-ring	PA12-030	JISB2401 1A G30	1
74		Unloader Cylinder Cover	CS07400-200	200***	1
75		O-ring	PA12-135	JISB2401 1A G135	1
76		Hexagon Socket Head Cap Screw	NB35410-025	M10X25	8
77		Indicator Cam	CS07700-200S	200S**	1 (S**)
77		Indicator Cam	CS07700-200M	200M**	1 (M**)
77		Indicator Cam	CS07700-200L	200L**	1 (L**)
78		Ball Bearing	CS07800-200	#6000	1
79		Stop Ring	NG12-010	S10	1
80		Bearing Gland	CS08000-200	200***	1
81		Hexagon Socket Head Cap Screw	NB35406-015	M6×15	3
82		V-ring, Indicator Cam	CS08200-200B	VH10 NBR	1
82		V-ring, Indicator Cam	CS08200-200V	VH10 FPM	1
83		Spring	CS08300-200	200***	1
84		Retainer, Indicator Cam Spring	CS08400-200	200***	1
85		Oil Injection Pipe	CS08500-200SD	200S**	1 (S**)
85		Oil Injection Pipe	CS08500-200MD	200M**	1 (M**)
85		Oil Injection Pipe	CS08500-200LD	200L**	1 (L**)
87		Guide Block	CS08700-200	200***	1
88		Stem, Guide Block			
89		O-ring	PA11-020	JISB2401 1A P20	2
91		Shaft Key	CS09100-200	200***	1
92		Suction Cover Flange without hole	CS71400-P150	MYK150A(6") Male	1
93		Gasket, Suction Flange	CR72000-150N	MYK150A	1
94		Hexagon Head Bolt	NB12022-055	M22X55	8
95		Discharge Cover Flange	CS71400-P125CD	MYK125CD Male	1 (*UD)
96		Gasket, Discharge Flange	CR72000-125N	MYK125A	1
97		Hexagon Head Bolt	NB12020-055	M20X55	8
97		Hexagon Head Bolt	NB12020-070	M20X70	8 (*UD)
98		Spring Pin	NE3203-016	φ3×16	2
100		Mechanical Seal Assembly (BOS-E1)	CS10000-200BE	BOS-E1	1
100		Mechanical Seal Assembly (BBSE)	CS10002-200EBS	BBS-E	1
100		Mechanical Seal Assembly (UV4)	CS10009-200-F70	UV4	1
100		Mechanical Seal Assembly (BBS3)	CS10001-200BBS	BBS3	1
120		Unloader Indicator Assembly (With dial)	CS120-IND062WP-UP	200, 0-100 %	1
120		Unloader Indicator Assembly (No dial)	CS120-IND062WP	200, 0-50 %	1
125		Micro Switch	CS12501-IND06P	200*** Z15GW	2
129		Potentiometer 200-1k	CS12900-IND06P	with lead wire	1
129		Conductive Potentiometer 200-1k	CS12919-E10	with lead wire	1
137		Indicator Dial	CS13700-200		1
164		Retainer, Oil Injection Pipe	CS16400-200	200***	1
166		Hexagon Socket Head Cap Screw	NB35405-012	M5×12	2
167		Plug	NF06-015	R1/2	1

P/N		Part Name	Code No.	Remarks	Q'ty.
216		Gasket, Lubrication Oil Supply Flange	CR72000-020N	MYK20A	1
217		Hexagon Head Bolt	NB111012-035	M12X35	4
235		Spacer, Discharge Flange	FX101-200		1
236		Gasket, Discharge Flange Spacer	CS23600-200N		1
237		Torsional Slip Washer	CS23700-200	200***	2
246		Guide, Unloader Slide Valve	CS24600-200	200***	1
247		Hexagon Socket Head Cap Screw	NB35408-070	M8X70	3
248		Spring Washer for Hexagon Head Cap Screw	ND330-08	M8	3
249		Alignment Pin	NE2008-060	φ8X60	2
250	1	Thrust Washer	CS25000-200	200***	2
252	3	Gasket, Flange for Electromizer	CR72000-032N	MYK32A	1
253		Hexagon Head Bolt	NB111012-040	M12X40	4
255		Gasket, Flange for Aquamizer	CR72000-025N	MYK25A	1
256		Hexagon Head Bolt	NB111012-035	M12X35	4
267		Spring Washer for Hexagon Head Cap Screw	ND330-10	M10	4
432		O-ring	PA62-022	JIS W1516 1A G22	4
433		O-ring	PA62-022	JIS W1516 1A G22	4
528		Sleeve, Oil Seal	CS52809-200VD	200V**	1
529	A	Set Screw	NA83606-008	M6X8	2
605	B	Plug	NF06-020	R3/4	1
607	A	Plug	NF06-004	R1/8	1
715	B	Blind Plate for Lubrication Oil Supply	CS71500-020	20A	1
715		Blind Plate for Electromizer	CS71500-032	32A	1
744		O-ring	PA12-060	JISB2401 1A G60	1

CAUTION

- **The part code of the O-ring is the one assigned to NBR which is standard material. When the material of the O-ring is other than NBR, a different part code is used for each material.**
  If you are using O-rings made from other than the standard material, please contact MAYEKAWA when placing an order.

CAUTION

- **The Code No. of parts shown in parentheses below is applied to the product until the end of November, 2014:**
  (P/N 120 Unloader Indicator Assembly, P/N 125 Micro-Switch, P/N 129 Potentiometer)
- **For the Code No. of new type indicator part, refer to the separately dedicated Instruction manual for it.**

【POINT】

The sizes of O-ring No.432-2 and No.432-2 have been changed to G130 from G135 in October 2012 as a design change.

Table 7-4 Parts Configuration Table of 250*UD models

P/N		Part Name	Code No.	Remarks	Q'ty.
1		Main Rotor Casing	CS00100-250S	250S**	1 (S**)
1		Main Rotor Casing	CS00100-250M	250M**	1 (M**)
1		Main Rotor Casing	CS00100-250L	250L**	1 (L**)
2		Hexagon Socket Head Cap Screw	NB35420-060	M20X60	44
3		Alignment Pin	NE2016-070	φ16X70	4
4		Eye Bolt	NB600-24	M24	1
5		Suction Cover	CS00500-250D	250***	1
6		Gasket, Suction Cover	CS00600-250N	250***	1
7		Eye Bolt	NB600-12	M12	2
8		Spring Pin	NE3206-012	φ6×12	2
9		O-ring	PA12-060	JISB2401 1A G60	2
10	A	Plug	NF06-010	R3/8	1
10	B	Plug	NF06-008	R1/4	1
10	C	Plug	NF06-020	R3/4	1
10	D	Plug	NF06-015	R1/2	1
11	H	Bearing Head	CS01100-250DH	250***	1 (*UD)
11	M	Bearing Head	CS01100-250DM	250***	1 (*UD)
11	L	Bearing Head	CS01100-250DL	250***	1 (*UD)
12		Gasket, Bearing Head	CS01200-250N	250***	1
13		Eye Bolt	NB600-12	M12	1
14		Spring Pin	NE3206-012	φ6x12	2
16		Bearing Cover	CS01600-250D	250***	1 (*UD)
17		Gasket, Bearing Cover	CS01700-250DN	250***	1 (*UD)
18	1	Hexagon Socket Head Cap Screw	NB35416-050	M16X50	20(*UD)
18	2	Hexagon Socket Head Cap Screw	NB35416-090	M16X90	8 (*UD)
19		Alignment Pin	NE2010-050	φ10x50	2
20		Spring Pin	NE3203-010	φ3×10	1
21		Plug	NF06-010	R3/8	1
22		Balance Piston Cover	CS02200-250	250V**	1
23		Gasket, Balance Piston Cover	CS02300-250N	250***	1
24		Hexagon Socket Head Cap Screw	NB35412-030	M12X30	11
25		Male Rotor	CS02520-250S	250S	1 (S**)
26		Female Rotor		250S	1 (S**)
25		Male Rotor	CS02520-250M	250M	1 (M**)
26		Female Rotor	-	250M	1 (M**)
25		Male Rotor	CS02520-250L	250L	1 (L**)
26		Female Rotor	-	250L	1 (L**)
27		Main Bearing (O-ring type)	CSH02700-250	Overseas	2
			CS02700-250N	Domestic	
28		Side Bearing (O-ring type)	CSH02800-250	Overseas	2
			CS02800-250N	Domestic	
29		Stop Ring	NG11-160	H160	4
30		Balance Piston	CS03000-250	250***	1
31		Key, Balance Piston	CS03100-250	250***	1
32		Stop Ring	NG12-080	S80	1
33		Sleeve, Balance Piston	CS03300-250	250***	1

P/N		Part Name	Code No.	Remarks	Q'ty.
34		Set Screw	NA83608-020	M8X20	2
35		O-ring	PA11-150	JISB2401 1A P150	1
36		Spacer	CS03600-250	250***	1
37		Stop Ring	NG11-160	H160	2
38		Thrust Bearing	CS03800-250P	7317PPS	2
38		Ductile retainer	CS03800-250	NSK	
39		Lock Nut	NG31-017	AN17	2
40		Lock Washer	NG32-017	AW17	2
42		Spacer, Thrust Bearing Alignment1	CS04200-250	250***	2
43		Thrust Bearing Gland	CS04300-250S	250***	2
45		Hexagon Head Bolt	NB111016-045	M16X45	8
46		Conical Spring Washer	ND150-016	M16	8
46		Lock Washer Set (old , plate type)	CS0469-F	250*** 8ps/set	-
48		Retainer, Oil Seal	CS04800-250VD	250V** BBS Ⅲ BBSE BOS	1
48		Retainer, Oil Seal	CS04800-250	250*** UV-4 BBS Ⅰ He	-
49		O-ring	PA12-135	JISB2401 1A G135	1
50		Oil Seal	CS05010-250VD	SA1J 75X100X13	1
51	H E	Seal Cover	CS051000-250BBS	250***	1
51		Seal Cover	CS5100-250UV4	250***(UV4)	
51		Seal Cover	CS05100-250HE	250*** (HE)	1
52		Gasket, Seal Cover	CS05200-250N	250***	1
53	L	Hexagon Socket Head Cap Screw	NB35412-030	M12X30	8
54	M	Unloader Slide Valve (L Port)	CS05400-250SDL	250S**	1 (S**)
54	H	Unloader Slide Valve (M Port)	CS05400-250SDM	250S**	1 (S**)
54	L	Unloader Slide Valve (H Port)	CS05400-250SDH	250S**	1 (S**)
54	M	Unloader Slide Valve (L Port)	CS05400-250MDL	250M**	1 (M**)
54	H	Unloader Slide Valve (M Port)	CS05400-250MDM	250M**	1 (M**)
54	L	Unloader Slide Valve (H Port)	CS05400-250MDH	250M**	1 (M**)
54	M	Unloader Slide Valve (L Port)	CS05400-250LDL	250L**	1 (L**)
54	H	Unloader Slide Valve (M Port)	CS05400-250LDM	250L**	1 (L**)
54	H	Unloader Slide Valve (H Port)	CS05400-250LDH	250L**	1 (L**)
55		Unloader Slide Valve	-	250S**	1 (S**)
55		Unloader Slide Valve	-	250M**	1 (M**)
55		Unloader Slide Valve	-	250L**	1 (L**)
58		Hexagon Socket Head Cap Screw	NB35412-040	M12X40	4
59		O-ring	PA11-046	JISB2401 1A P46	2
60		Unloader Cylinder	CS06000-250S	250S**	1 (S**)
60		Unloader Cylinder	CS06000-250M	250M**	1 (M**)
60		Unloader Cylinder	CS06000-250L	250L**	1 (L**)
61		Hexagon Socket Head Cap Screw	NB35416-040	M16X40	2
62		Hexagon Socket Head Cap Screw	NB35416-090	M16X90	6
63		O-ring	PA12-190	JISB2401 1A G190	1
64		Unloader Piston	CS06400-250D	250***	1
65		O-ring	PA11-155	JISB2401 1A P155	1
66		Cap Seal	CS06600-250	BE155	1
67		Push Rod, Unloader Slide Valve	CS0671-FS	250S**	1 (S**)
67		Push Rod, Unloader Slide Valve	CS0671-FM	250M**	1 (M**)

P/N		Part Name	Code No.	Remarks	Q'ty.
67		Push Rod, Unloader Slide Valve	CS0671-FL	250L**	1 (L**)
68		Guide Pin	NE2505-012	φ5X12	1
69		Lock Nut	NG31-008	AN08	2
70		Lock Washer	NG32-008	AW08	2
73		O-ring	PA12-035	JISB2401 1A G35	1
74		Unloader Cylinder Cover	CS07400-250S	250***	1
75		O-ring	PA12-170	JISB2401 1A G170	1
76		Hexagon Socket Head Cap Screw	NB35412-030	M12X30	8
77		Indicator Cam	CS07700-250S	250S**	1 (S**)
77		Indicator Cam	CS07700-250M	250M**	1 (M**)
77		Indicator Cam	CS07700-250L	250L**	1 (L**)
78		Ball Bearing	CS07800-200	#6000	1
79		Stop Ring	NG12-010	S10	1
80		Bearing Gland	CS08000-200	200***	1
81		Hexagon Socket Head Cap Screw	NB35406-015	M6×15	3
82		V-ring	CS08200-200B	VH10 NBR	1
82		V-ring	CS08200-200V	VH1- FPM	1
83		Spring	CS08300-200	200***	1
84		Retainer, Indicator Cam Spring	CS08400-200	200***	1
85		Oil Injection Pipe	CS08500-250SD	250S**	1 (S**)
85		Oil Injection Pipe	CS08500-250MD	250M**	1 (M**)
85		Oil Injection Pipe	CS08500-250LD	250L**	1 (L**)
87		Guide Block	CS08700-250	250***	1
88		Stem, Guide Block			
89		O-ring	PA11-020	JISB2401 1A P20	2
91		Shaft Key	CS09100-250	250***	1
92		Suction Cover Flange without hole	CS71400-P250	MYK250A Male	1
93		Gasket,Suction Flange	CS09300-250N	MYK250A	1
94		Hexagon Head Bolt	NB12024-065	M24X65	12
95		Discharge Cover Flange	CS71400-P150CD	MYK150CD Male	1 (*UD)
96		Gasket, Discharge Flange	CR72000-150N	MYK150A	1
97		Hexagon Head Bolt	NB12022-055	M22X55	8
97		Hexagon Head Bolt	NB12022-085	M22X85	8 (*UD)
98		Spring Pin	NE3203-012	φ3×12	2
100		Mechanical Seal Assembly (BOS)	CS10000-250BE	250V** BOS Type	1
100		Mechanical Seal Assembly (BBSE)	CS10002-250EBS	BBS-E	1
100		Mechanical Seal Assembly (UV4)	CS10009-250-F70	UV4	
100		Mechanical Seal Assembly (BBS3)	CS10001-250BBS	BBS3	1
120		Unloader Indicator Assembly (With dial)	CS120-IND062WP-UP		1
120		Unloader Indicator Assembly (No dial)	CS120-IND062WP	200, 0-50 %	1
125		Micro Switch	CS12501-IND06P	200*** Z15GW	2
129		Potentiometer 200-1k	CS12900-IND06P	with lead wire	1
129		Conductive Potentiometer 200-1k	CS12919-E10	with lead wire	1
164		Retainer, Oil Injection Pipe	CS16400-250	250***	1
166		Hexagon Socket Head Cap Screw	NB35405-012	M5X12	2
215	1	Flange ~~with hole~~, Lubrication Oil Supply	CR74000-025	MYK25A Male	1

P/N		Part Name	Code No.	Remarks	Q'ty.
216	2	Gasket, Lubrication Oil Supply Flange	CR72000-025N	MYK25A	1
217	3	Hexagon Head Bolt	NB111012-035	M12X35	4
235		Spacer, Discharge Flange	FX101-250	250***	1 (*UD)
236		Gasket, Discharge Flange Spacer	CS23600-250N	250***	1 (*UD)
237		Torsional Slip Washer	CS23700-250	250***	2
246		Guide, Unloader Slide Valve	CS24600-250	250***	1
247		Hexagon Socket Head Cap Screw	NB35408-090	M8X90	4
248		Spring Washer for Hexagon Head Cap Screw	ND330-08	M8	4
249		Alignment Pin	NE2008-080	φ8X80	2
250		Thrust Washer	CS25000-250	250***	2
251		Flange for Electromizer	CS71400-050	MYK50A Male	1
252		Gasket, Flange for Electromizer	CR72000-050N	MYK50A	1
253		Hexagon Head Bolt	NB111016-045	M16X45	4
255		Gasket, Flange for Aquamizer	CR72000-032N	MYK32A	1
256	A	Hexagon Head Bolt	NB111012-040	M12X40	4
267	B	Spring Washer fro Hexagon Head Cap Screw	ND330-12	M12	4
432	A	O-ring	PA12-130	JISB2401 1A G130	4
433	B	O-ring	PA12-130	JISB2401 1A G130	4
528		Sleeve, Oil Seal	CS52809-250VD	250V**	1
529		Set Screw	NA83606-008	M6X8	2
605		Plug	NF06-025	R 1"	1
607	A	Plug	NF06-008	R1/4	1
607	B	Plug	NF06-008	R1/4	1
715		Blind Plate for Aquamizer	CS71500-032	32A	1
744		O-ring	PA12-070	JISB2401 1A G70	1

CAUTION

- **The part code of the O-ring is the one assigned to NBR which is standard material. When the material of the O-ring is other than NBR, a different part code is used for each material.**
  If you are using O-rings made from other than the standard material, please contact MAYEKAWA when placing an order.

CAUTION

- **The Code No. of parts shown in parentheses below is applied to the product until the end of November, 2014:**
  (P/N 120 Unloader Indicator Assembly, P/N 125 Micro-Switch, P/N 129 Potentiometer)
- **For the Code No. of new type indicator part, refer to the separately dedicated Instruction manual for it.**

Table 7-5 Parts Configuration Table of 320*UD models

P/N		Part Name	Code No.	Remarks	Q'ty.
1		Main Rotor Casing	CS00100-320S	320S**	1(SUD)
1		Main Rotor Casing	CS00100-320M	320M**	1(MUD)
1		Main Rotor Casing	CS00100-320L	320L**	1(LUD)
1		Main Rotor Casing	CS00100-320LL	320LL**	1 (LLUD)
2		Hexagon Socket Head Cap Screw	NB35424-080	M24x80	52
3		Alignment Pin	NE2025-080	φ25x80	4
4		Eye Bolt	NB600-30	M30	2
5		Suction Cover	CS00500-320U	320*** LLUD is excluded	1
5		Suction Cover	CS00500-320LL	320LL**	1 (LLUD)
6		Gasket, Suction Cover	CS00600-320N	320***	1
7		Eye Bolt	NB600-16	M16	2
-	A	Plain Washer, Eye Bolt	ND710-016	M16×30	4
8	B	Spring Pin	NE3206-018	φ6×18	2
9	C	O-ring	PA11-058	JISB2401 1A P58	1
10	D	Plug	NF06-015	R1/2	1
10	H	Plug	NF06-020	R3/4	1
11	H	Bearing Head	CS01100-320DH	320***	1 (*UD)
11	M	Bearing Head	CS01100-320DM	320***	1 (*UD)
11	L	Bearing Head	CS01100-320DL	320***	1 (*UD)
12		Gasket, Bearing Head	CS01200-320N	320***	1
13		Eye Bolt	NB600-16	M16	1
-		Plain Washer, Eye Bolt	ND710-016	M16×30	2
14		Spring Pin	NE3206-018	φ6x18	2
15		Plug	NF06-008	R1/4	3
16		Bearing Cover	CS01600-320D	320***	1 (*UD)
17	1	Gasket, Bearing Cover	CS01700-320DN	320***	1 (*UD)
18		Hexagon Socket Head Cap Screw	NB35420-070	M20x70	20(*UD)
18		Hexagon Socket Head Cap Screw	NB35420-120	M20x120	14(*UD)
19		Alignment Pin	NE2016-070	φ16x70	2
20		Spring Pin	NE3203-016	φ3×16	1
21		Plug	NF06-010	R3/8	1
22		Balance Piston Cover	CS02200-320	320***	1
23		Gasket, Balance Piston Cover	CS02300-320N	320***	1
24		Hexagon Socket Head Cap Screw	NB35416-045	M16x45	11
25		Male Rotor	CS02520-320S	320S** O-profile	1(SUD)
26		Female Rotor			
25		Male Rotor	CS02520-320M	320M** O-profile	1(MUD)
26		Female Rotor			
25		Male Rotor	CS02520-320L	320L** O-profile	1(LUD)
26		Female Rotor			
25		Male Rotor	-	320LL** O-profile	1 (LLUD)
26		Female Rotor			
27		Main Bearing	CS02700-320N	320*** O-ring type	"2 (*UD) 4 (LLUD)
28		Side Bearing	CS02800-320N	320*** O-ring type	2 (*UD)
29		Stop Ring	NG11-200	H200	4

P/N		Part Name	Code No.	Remarks	Q'ty.
30		Balance Piston	CS03000-320	320***	1
31		Key, Balance Piston	CS03100-320	320***	1
32		Stop Ring	NG12-100	S100	1
33		Sleeve, Balance Piston	CS03300-320	320***	1
34		Spring Pin	NE3206-014	φ6x14	1
35		O-ring	PA12-190	JISB2401 1A G190	1
36		Spacer	CS03600-320	320***	1
37		Stop Ring	NG11-200	H200	2
38		Thrust Bearing	CS03800-320	7321A	2
39		Lock Nut	NG31-021	AN21	2
40		Lock Washer	NG32-021	AW21	2
42		Spacer, Thrust Bearing Alignment	CS04200-320	320***	2
43		Thrust Bearing Gland	CS04300-320	320***	2
45		Hexagon Head Bolt	NB15520-055	M20X55	8
46		Lock Washer	ND150-020	320***	8
46	H E	Lock Washer Set (old , plate type)	CS0469-G	320*** 8p s /set	-
48		Retainer, Oil Seal	CS04800-320VDS	320V** BBSⅢ BBSE BOS	1
48		Retainer, Oil Seal	CS04800-320	320*** UV-4 BBS Ⅰ He	-
49	L	O-ring	PA12-160	JISB2401 1A G160	1
50	M	Oil Seal	CS05010-320VD	SA1J95X120X13	1
51	H	Seal Cover	CS051000-320BBS	320***	1
51		Seal Cover	CS051000-320UV4	320*** (UV4)	1
51	L	Seal Cover	CS05100-320HE	320*** (HE)	-
52	M	Gasket, Seal Cover	CS05200-320N	320***	1
53	H	Hexagon Socket Head Cap Screw	NB35416-040	M16X40	8
54,55	L	Unloader Slide Valve Assembly L Port	CS05400-320SDL	320S**	1 (SUD)
54,55	M	Unloader Slide Valve Assembly M Port	CS05400-320SDM	320S**	1 (SUD)
54,55	H	Unloader Slide Valve Assembly H Port	CS05400-320SDH	320S**	1 (SUD)
54,55	L	Unloader Slide Valve Assembly L Port	CS05400-320MDL	320M**	1 (MUD)
54,55	M	Unloader Slide Valve Assembly M Port	CS05400-320MDM	320M**	1 (MUD)
54,55	H	Unloader Slide Valve Assembly H Port	CS05400-320MDH	320M**	1 (MUD)
54,55	L	Unloader Slide Valve Assembly L Port	CS05400-320LDL	320L**	1 (LUD)
54,55	M	Unloader Slide Valve Assembly M Port	CS05400-320LDM	320L**	1 (LUD)
54,55	H	Unloader Slide Valve Assembly H Port	CS05400-320LDH	320L**	1 (LUD)
54,55	L	Unloader Slide Valve Assembly L Port	CS05404-320LLDL		
54,55	M	Unloader Slide Valve Assembly M Port	CS05404-320LLDM		
54,55	H	Unloader Slide Valve Assembly L Port	CS05404-320LLDH		
54, 55		Unloader Slide Valve Assembly L Port	CS05404-320LLUL	320LL**	1 (LLUD)
54, 55		Unloader Slide Valve Assembly M Port	CS05404-320LLUM	320LL**	1 (LLUD)
54, 55		Unloader Slide Valve Assembly H Port	CS05404-320LLUH	320LL**	1 (LLUD)

P/N		Part Name	Code No.	Remarks	Q'ty.
58		Hexagon Socket Head Cap Screw	NB35416-050	M16X50	4
59		O-ring	PA11-032	JISB2401 1A P32	1
60		Unloader Cylinder	CS06000-320S	320S**	1 (SUD)
60		Unloader Cylinder	CS06000-320M	320M**	1 (MUD)
60		Unloader Cylinder	CS06000-320L	320L**	1 (LUD)
60		Unloader Cylinder	CS06000-320LL	320LL**	1 (LLUD)
61		Hexagon Socket Head Cap Screw	NB35420-050	M20X50	2
62		Hexagon Socket Head Cap Screw	NB35420-110	M20X110	6
63		O-ring	PA12-240	JISB2401 1A G240	1
64		Unloader Piston	CS06400-320S	320***	1
65		O-ring	PA11-200	JISB2401 1A P200	1
66		Cap Seal	CS06600-320	CAP-3BE200	1
67		Push Rod, Unloader Slide Valve	CS0670-GS	320S**	1 (SUD)
67		Push Rod, Unloader Slide Valve	CS0670-GM	320M**	1 (MUD)
67		Push Rod, Unloader Slide Valve	CS0670-GL	320L**	1 (LUD)
67		Push Rod, Unloader Slide Valve	CS06709-320LL	320LL**	1 (LLUD)
68		Guide Pin	NE2506-016	φ6x16	1
69		Lock Nut	NG31-010	AN10	1
70		Lock Washer	NG32-010	AW10	1
71		Lock Nut	NG31-012	AN12	1
72		Lock Washer	NG32-012	AW12	1
73		O-ring	PA11-044	JISB2401 1A P44	1
74		Unloader Cylinder Cover	CS07400-320	320***	1
75		O-ring	PA12-210	JISB2401 1A G210	1
76		Hexagon Socket Head Cap Screw	NB35416-040	M16X40	8
77		Indicator Cam	CS07700-320S	320S**	1 (SUD)
77		Indicator Cam	CS07700-320M	320M**	1 (MUD)
77		Indicator Cam	CS07700-320L	320L**	1 (LUD)
77		Indicator Cam	CS07700-320LL	320LL**	1 (LLUD)
78		Ball Bearing	CS07800-200	#6000	1
79		Stop Ring	NG12-010	S10	1
80		Bearing Gland	CS08000-200	200L**	1
81		Hexagon Socket Head Cap Screw	NB35406-015	M6×15	3
82		V-ring	CS08200-200B	VH10 NBR	1
82		V-ring	CS08200-200V	VH10 FPM	-
83		Spring	CS08300-200	200L**	1
84		Retainer, Indicator Cam Spring	CS08400-200	200L**	1
85		Oil Injection Pipe	CS08500-320SU	320S**	1 (SUD)
85		Oil Injection Pipe	CS08500-320MU	320M**	1 (MUD)
85		Oil Injection Pipe	CS08500-320LU	320L**	1 (L*UD)
86		O-ring	PA12-030	JISB2401 1A G30	1
87, 88		Guide Block Assembly	CS08700-320	320***	1
89		O-ring	PA11-024	JISB2401 1A P24	2
91		Shaft Key	CS09100-320	320***	1
92		Suction Flange without hole	CS71400-P350	MYK350A(14") Male	1
93		Gasket, Suction Flange	CS09300-320N	MYK350A	1

P/N		Part Name	Code No.	Remarks	Q'ty.
94		Hexagon Head Bolt	NB12024-075	M24X75	16
95		Discharge Cover Flange	CS71400-P200CD	MYK200CD Male	1 (*UD)
96		Gasket, Discharge Flange	CR72000-200N	MYK200A	1
97		Hexagon Head Bolt	NB12020-055	M20X55	12
97		Hexagon Head Bolt	NB12020-075	M20X75	12
100		Mechanical Seal Assembly (BOS)	CS10000-320BE	320V** BOS Type	1
100		Mechanical Seal Assembly (BBSE)	CS10002-320EBS	BBS-E	-
100		Mechanical Seal Assembly (UV4)	CS10009-320-F70	UV4	1
100		Mechanical Seal Assembly (BBS3)	CS10001-320BBS	BBS3 Type	-
120	1	Unloader Indicator Assembly (With dial)	CS120-IND062WP-UP	200, 0-100 %	1
120	2	Unloader Indicator Assembly (No dial)	CS120-IND062WP	200, 0-50 %	-
125	3	Micro Switch	CS12501-IND06P	200*** Z15GW	2
129		Potentiometer 200-1k	CS12900-IND006P	with lead wire	1
129		Conductive Potentiometer 200-1k	CS12919-E10	with lead wire	1
137		Indicator dial 200S/L	CS13700-200		
150		O-ring	PA12-220	JISB2401 1A G220	2
166		Hexagon Socket Head Cap Screw	NB35405-010	M5×10	4
167		Plug	NF06-015	R1/2	1
215		Flange, Lubrication Oil Supply	CS71400-040	MYK40A(1 1/2") Male	1
216		Gasket, Lubrication Oil Supply Flange	CR72000-040N	MYK40A	1
217		Hexagon Head Bolt	NB15512-040	M12X40	4
218		Flange, Injection Oil Supply	CR74000-025	MYK25A(1") Male	1
219		Gasket, Injection Oil Supply Flange	CR72000-025N	MYK25A	1
220		Hexagon Head Bolt	NB15512-035	M12X35	4
230	A	Plug	NF06-020	R3/4	1
235	B	Spacer, Discharge Flange	-		1(*UD)
236	A	Gasket, Discharge Flange Spacer	CS23600-320N	320***	1(*UD)
237	B	Torsional Slip Washer	CS23700-320	320***	2
246		Guide, Unloader Slide Valve	CS24600-320	320***	1
247		Hexagon Socket Head Cap Screw	NB35410-110	M10X110	4
248		Spring Washer	ND330-10	M10	4
249	A	Alignment Pin	NE2013-100	φ13x100	2
250	B	Thrust Washer	CS25000-320	320***	2
251		Flange (for Electromizer)	CS71400-080	MYK80A(3") Male	1
252		Gasket, Flange (for Electromizer)	CR72000-080N	MYK80A	1
253		Hexagon Head Bolt	NB111020-055	M20X55	4
254		Flange (for Aquamizer)	CS71400-050	MYK50A(2") Male	1
255		Gasket, Flange (for Aquamizer)	CR72000-050N	MYK50A	1
256		Hexagon Head Bolt	NB111016-045	M16X45	4
267		Spring Washer, Hexagon Socket Head Cap Screw	ND330-16	M16	4
326		Gland, O-ring	CS32600-320		1
528		Sleeve, Oil Seal	CS52800-320VD	320V**	-
528		Sleeve, Oil Seal with O-ring	CS52809-320VD	320V**	1
529		Set Screw	NA83606-008	M6X8	2
744		O-ring	PA12-090	JISB2401 1A G90	1

CAUTION

- **The part code of the O-ring is the one assigned to NBR which is standard material. When the material of the O-ring is other than NBR, a different part code is used for each material.**
  If you are using O-rings made from other than the standard material, please contact MAYEKAWA when placing an order.

CAUTION

- **The Code No. of parts shown in parentheses below is applied to the product until the end of November, 2014:**
  (P/N 120 Unloader Indicator Assembly, P/N 125 Micro-Switch, P/N 129 Potentiometer)
- **For the Code No. of new type indicator part, refer to the separately dedicated Instruction manual for it.**

Table 7-6 Parts Configuration Table of 400*UD models

P/N		Part Name	Code No.	Remarks	Q'ty.
1		Main Rotor Casing	CS00107-400S	400S**	1 (SUD)
1		Main Rotor Casing	CS00107-400M	400M**	1 (MUD)
1		Main Rotor Casing	CS00107-400L	400L**	1 (LUD)
1		Main Rotor Casing	CS00107-400LL	400LL**	1(LLUD)
1		Main Rotor Casing	CS00107-400XL	400XL**	1(XLUD)
2		Hexagon Socket Head Cap Screw with Flange	NB35930-110	M30x110	60
3		Alignment Pin	NE2330-100A	JISB1359 φ30x100	4
4		Eye Bolt	NB600-42	M42	2
5		Suction Cover	CS00500-400	400***	1
6		Gasket, Suction Cover	CS00600-4032CN	4032**C	1
7		Eye Bolt	NB600-24	M24	2
8		Spring Pin	NE3208-025	φ8×25	2
9		O-ring	PA12-095	JISB2401 1A G95	1
11		Bearing Head	CS01100-400	400*UD	1
12		Gasket, Bearing Head	CS01200-400	400V**	1
13		Eye Bolt	NB600-42	M42	1
14		Spring Pin	NE3208-025	φ8×25	2
15	A	Plug	NF062-N008	NPT 1"	1
15	B	Plug	NF062-N010	NPT 1 1/4"	1
15	C	Plug	NF062-N006	NPT 3/4"	1
16		Bearing Cover	CS01607-400D	400*UD	1
17		Gasket, Bearing Cover	CS01700-400UD	400*UD	1
18		Hexagon Socket Head Cap Screw with Flange	NB35930-100	M30x100	26
19		Alignment Pin	NE2320-100A	JISB1359 φ20x100	2
20		Spring Pin	NB3203-016	φ3×16	1
21	A	Plug	NF062-N002	NPT1/4	4
21	B	Plug	NF062-N003	NPT3/8	2
21	C	Plug	NF062-N004	NPT1/2	1
22		Balance Piston Cover	CS02200-400	400***	1
23		Gasket, Balance Piston Cover	CS02300-400UD	400***	1
24		Hexagon Socket Head Cap Screw	NB35424-070	M24x70	15
25		Male Rotor	CS02500-400S	400S**	1 (SUD)
26		Female Rotor			
25		Male Rotor	CS02500-400M	400M**	1 (MUD)
26		Female Rotor			
25		Male Rotor	CS02500-400L	400L**	1 (LUD)
26		Female Rotor			
25		Male Rotor	-	400LL**	1(LLUD)
26		Female Rotor			
25		Male Rotor	-	400XL**	1(XLUD)
26		Female Rotor			
27		Main Bearing	CS02700-400	400*** NBR	2
27		Main Bearing	CS0270-QB	400*** FPM	2
28		Side Bearing	CS02800-400	400*** NBR	2
28		Side Bearing	CS0280-QB	400*** FPM	2

P/N		Part Name	Code No.	Remarks	Q'ty.
29		Stop Ring	NG11-250	H250	4
30		Balance Piston	CS03000-400	400V**	1
31		Key, Balance Piston	CS03100-400	400V**	1
32		Stop Ring	NG12-120	S120	1
33		Sleeve, Balance Piston	CS03300-400	400V**	1
34		Spring Pin	NE3210-025	φ10x25	1
35		O-ring	PA12-240	JISB2401 1A G240	1
36		Spacer	CS03600-400	400V**	1
37		Stop Ring	NG11-250	H250	2
38		Thrust Bearing	CS03800-T400M	400*** M	1
38		Thrust Bearing	CS03800-T400F	400*** F	1
39		Lock Nut	NG311-028	AN28	2
40		Lock Washer	NG32-028X	AW28X	2
42		Spacer, Thrust Bearing Alignment	CS04200-400	400***	2
43		Thrust Bearing Gland	CS04300-400M	400***	1
43		Thrust Bearing Gland	CS04300-400F	400***	1
45		Hexagon Socket Head Cap Screw	NN35420-075	M20X75	12
46		Spring Washer, Hexagon Socket Head Cap Screw	ND330-20	M20	12
51		Seal Cover	CS05100-400	400***	1
53		Hexagon Socket Head Cap Screw	NB35416-040	M16X40	8
54		Unloader Slide Valve (L Port)	CS05400-400SDL	400S**	1 (SUD)
54		Unloader Slide Valve (M Port)	CS05400-400SDM	400S**	1 (SUD)
54		Unloader Slide Valve (H Port)	CS05400-400SDH	400S**	1 (SUD)
54		Unloader Slide Valve (L Port)	CS05400-400MDL	400M**	1 (MUD)
54		Unloader Slide Valve (M Port)	CS05400-400MDM	400M**	1 (MUD)
54		Unloader Slide Valve (L Port)	CS05400-400LDL	400L**	1 (LUD)
54		Unloader Slide Valve (M Port)	CS05400-400LDM	400L**	1 (LUD)
54		Unloader Slide Valve (H Port)	CS05400-400LDH	400L**	1 (LUD)
54		Unloader Slide Valve (L Port)	CS05400-400LLDL	400LL**	1(LLUD)
54		Unloader Slide Valve (M Port)	CS05400-400LLDM	400LL**	1(LLUD)
54		Unloader Slide Valve (L Port)	-	400XL**	1(XLUD)
54		Unloader Slide Valve (M Port)	-	400XL**	1(XLUD)
58		Hexagon Socket Head Cap Screw	NB35416-055	M16X55	7
60		Unloader Cylinder	CS06000-400SD	400S**	1 (SUD)
60		Unloader Cylinder	CS06000-400MD	400M**	1 (MUD)
60		Unloader Cylinder	CS06000-400LD	400L**	1 (LUD)
60		Unloader Cylinder	CS06000-400LLD	400LL**	1(LLUD)
61		Hexagon Socket Head Cap Screw	NB35424-085	M24X85	2
62		Hexagon Socket Head Cap Screw	NB35424-180	M24X180	9
63		O-ring	PA12-300	JISB2401 1A G300	1
64		Unloader Piston	CS06400-400D	400***	1
65		O-ring	PA11-265	JISB2401 1A P265	1
66		Cap Seal	CS06600-400UD	CAP-3BE265	1
67		Push Rod, Unloader Slide Valve	CS0671-QS	400S***	1 (SUD)
67		Push Rod, Unloader Slide Valve	CS0671-QM	400M***	1 (MUD)
67		Push Rod, Unloader Slide Valve	CS0671-QL	400L***	1 (LUD)
67		Push Rod, Unloader Slide Valve	CS06700-400LLD	400LL**	1(LLUD)
67		Push Rod, Unloader Slide Valve	CS06700-400XLD	400XL**	1(XLUD)

P/N		Part Name	Code No.	Remarks	Q'ty.
68		Guide Pin	NE2506-016	φ6x16	1
69		Lock Nut	NG31-010	AN10	2
70		Lock Washer	NG32-010	AW10	1
73		O-ring	PA12-045	JISB2401 1A G45	1
74		Unloader Cylinder Cover	CS07400-400	400***	1
75		O-ring	PA12-270	JISB2401 1A G270	1
76		Hexagon Socket Head Cap Screw	NB35424-080	M24X80	11
77		Indicator Cam	CS07700-400SD	400S**	1 (SUD)
77		Indicator Cam	CS07700-400MD	400M**	1 (MUD)
77		Indicator Cam	CS07700-400LD	400L**	1 (LUD)
77		Indicator Cam	CS07700-400LLD	400LL**, 400XL**	1(LLUD)
78		Ball Bearing	CS07800-400	#6302	1
79		Stop Ring	NG12-015	S15	1
80		Bearing Gland	CS08000-400	400V**	1
81		Hexagon Socket Head Cap Screw	NB35406-015	M6×15	3
82		V-ring	CS08200-200B	VH10 NBR	1
82		V-ring	CS08200-200V	VH10 FPM	-
83		Spring	CS08300-200	200L**	1
84		Retainer, Indicator Cam Spring	CS08400-400	400V**	1
91		Shaft Key	CS09100-400	400***	1
93		Gasket, Suction Flange	PL300-400	ANSI#300 16" 400A	1
94		Stud Bolt & Nut	NBU611/4-7UNC	1 1/4" -7UNC X 165mm	20
			NCU1511/4-7UNC	1 1/4" -7UNC	20
96		Gasket, Discharge Flange	PL300-300	ANSI#300 12"	1
97		Stud Bolt & Nut	NBU611/8-7UNC	1 1/8" -7UNC X 150mm	16
			NCU1511/8-7UNC	1. 1／8-7UC	16
100		Mechanical Seal Assembly	CS10000-400	400*** BOD	1
	B	Mechanical Seal Assembly	-	400*** BBDE	1
120		Unloader Indicator Assembly (With dial)	CS120-IND062WP-UP	200, 0-100 %	1
120		Unloader Indicator Assembly (No dial)	CS120-IND062WP		
125		Micro Switch	CS12501-IND06P	200*** Z15GW	2
129		Potentiometer 200-1k	CS12900-IND06P	with lead wire	1
129		Conductive Potentiometer 200-1k	CS12919-E10	with lead wire	1
137		Indicator dial 200S/L	CS13700-200		
150		O-ring	PA12-290	JISB2401 1A G290	2
166		Hexagon Socket Head Cap Screw	NB35412-025	M12×25	4
215	1	Flange, Lubrication Oil Supply for Main Journal	CZA01-300C02B	ANSI#300 2"	1
215	2	Flange, Lubrication Oil Supply for Side Journal	CZA01-300C02B	ANSI#300 2"	1
215	3	Flange, Lubrication Oil Supply for TPTB	CZA01-300C02B	ANSI#300 2"	1
216	1	Gasket, Lubrication Oil Supply for Main Journal	PL300-050	ANSI#300 2"	1
216	2	Gasket, Lubrication Oil Supply for Side Journal	PL300-050	ANSI#300 2"	1
216	3	Gasket, Lubrication Oil Supply for TPTB	PL300-050	ANSI#300 2"	1
217	1	Stud Bolt & Nut	NBU605/8-11UNC	5/8-11UNC X 75 mm	8
			NCU1505/8-11UNC	5/8-11UNC	8

P/N		Part Name	Code No.	Remarks	Q'ty.
217	2	Stud Bolt & Nut	NBU605/8-11UNC	5/8-11UNC X 75 mm	8
			NCU1505/8-11UNC	5/8-11UNC	8
217	3	Stud Bolt & Nut	NBU605/8-11UNC	5/8-11UNC X 75 mm	8
			NCU1505/8-11UNC	5/8-11UNC	8
218		Flange, Injection Oil Supply	CZA01-300C0204B	ANSI#300 2-1/2" 65A	1
219		Gasket, Injection Oil Supply	PL300-065	ANSI#300 2-1/2"	1
220		Stud Bolt & Nut	NBU603/4-10UNC	3/4-10UNC X 90 mm	8
			NCU1505/8-11UNC	3/4-10UNC	8
221		Flange, Injection Oil Supply	-	ANSI#300 1"	1
222		Gasket, Injection Oil Supply	PL300-025	ANSI#300 1"	1
223		Stud Bolt & Nut	NBU605/8-11UNC	5/8-11UNC X 75 mm	4
			NCU1505/8-11UNC	5/8-11UNC	4
237		Gasket, Injection Oil Supply	CS23700-400	400***	2
246		Stud Bolt & Nut	CS24600-400	400***	1
247		Hexagon Socket Head Cap Screw	NB35416-075	M16X75	8
249		Alignment Pin	NE2016-055	JISB1359 φ16×55	2
250		Gasket, Loading oil connection for hydraulic cylinder	CS25000-400	400***	2
267		Spring Washer, Hexagon Socket Head Cap Screw	ND330-16	M16	7
325		O-ring	PA11-070	JISB2401 1A P70	2
326		Gland, O-ring	CS32600-400	400V**	1
346		Key, Thrust Bearing TP	CS34600-400	400***	2
432		O-ring	PA12-200	JISB2401 1A G200	4
433		O-ring	PA12-200	JISB2401 1A G200	4
597		Spring Washer	ND320-006	M6	3
605		Plug	NF062-N003	NPT3/8	3
664		Backup Ring	PBP21-070	SUN-2BP-70-T2	4
674		O-ring for BOD Seal	PA62-039	JISW1516 1A G39	1
999	1	Drain Flange	CZA01-300C01B	ANSI#300 1"	1
999	2	Gasket, Drain Flange	PL300-025	ANSI#300 1"	1
999	3	Stud Bolt & Nut	NBU605/8-11UNC	5/8-11UNC X 76 mm	4
			NCU1505/8-11UNC	5/8-11UNC	4

CAUTION

- **The part code of the O-ring is the one assigned to NBR which is standard material. When the material of the O-ring is other than NBR, a different part code is used for each material.**
  If you are using O-rings made from other than the standard material, please contact MAYEKAWA when placing an order.

CAUTION

- **The Code No. of parts shown in parentheses below is applied to the product until the end of November, 2014:**
  (P/N 120 Unloader Indicator Assembly, P/N 125 Micro-Switch, P/N 129 Potentiometer)
- **For the Code No. of new type indicator part, refer to the separately dedicated Instruction manual for it.**

7.3 Maintenance Data

Table 7-7 End clearance

Model	For single stage (high stage)				
	S	M	L	LL	XL
125	0.03～0.05			-	-
160	0.04～0.06			-	-
200	0.05～0.07			-	-
250	0.08～0.11			-	-
320	0.17～0.21	0.20～0.24	0.23～0.27	0.26～0.30	-
400	0.24～0.30			-	-
Model	For booster (low stage)				
	S	M	L	LL	XL
160	0.20～0.22	0.22～0.24	0.24～0.26	-	-
200	0.26～0.30	0.28～0.32	0.31～0.35	-	-
250	0.40～0.44	0.45～0.49	0.50～0.54	0.55～0.59	-
320	0.70～0.76	0.73～0.79	0.77～0.83	0.81～0.87	-
400	0.70～0.80	0.75～0.85	0.80～0.90	0.85～0.95	0.90～1.00

Unit: mm

Table 7-8 Mechanical Seal Model（Part№：100）

125	BBSE	BOS-T1	BBSⅢ
160		BOS-T1	BBSⅢ
200		BOS-E1	BBSⅢ
250		BOS-E1	BBSⅢ
320		BOS-E1	BBSⅢ
400	BBDE	BOD	BBDⅡ

Table 7-9 Hexagon Socket Head Cap Screw Tightening Torque

Size	N/m	kgf・cm
M4	2.8	28
M5	6	60
M6	10	100
M8	25	250
M10	50	500
M12	90	900
M14	140	1400
M16	240	2400
M20	450	4500
M24	750	7500

Table 7-10 Thrust Bearing Gland Tightening Torque

Part No.45

Model	Bolt Size	N・m	kgf・cm
125	M8 x 25	30	300
160	M10 x 30	40	400
200	M12 x 35	50	500
250	M16 x 45	60	600
320	M20 x 55	120	1200
400	M20 x 75	90	900

Table 7-11 Lock Nut Tightening Torque

	Standard		Maximum	
	N・m	kgf・cm	N・m	kgf・cm
AN 05	28	280	35	350
AN 06	49	490	61	610
AN 07	79	790	99	990
AN 08	90	900	113	1,130
AN 09	206	2,060	258	2,580
AN 10	238	2,380	297	2,970
AN 11	312	3,120	390	3,900
AN 12	408	4,080	510	5,100
AN 13	522	5,220	653	6,530
AN 14	656	6,560	820	8,200
AN 15	810	8,100	1,012	10,120
AN 16	984	9,840	1,230	12,300
AN 17	1,186	11,860	1,483	14,830
AN 18	1,413	14,130	1,766	17,660
AN 19	1,164	16,640	2,080	20,800
AN 20	1,876	18,760	2,345	23,450
AN 21	2,259	22,590	2,824	28,240

Table 7-12 Retaining Ring

№	Location	125	160	200	250	320	400
29	Main Bearing	CE-IN80 (H80) (2)	CE-IN102 (H102) (2)	CE-IN130 (H130) (2)	CE-IN160 (H160) (2)	CE-IN200 (H200) (2)	CE-IN250 (H250) (2)
29	Side Bearing	CE-IN80 (H80) (2)	CE-IN102 (H102) (2)	CE-IN130 (H130) (2)	CE-IN160 (H160) (2)	CE-IN200 (H200) (2)	CE-IN250 (H250) (2)
32	Balance Piston	CE-EX40 (S40) (1)	CE-EX50 (S50) (1)	CE-EX65 (S65) (1)	CE-EX80 (S80) (1)	CE-EX100 (S100) (1)	CE-EX120 (S120) (1)
37	Balance Piston Sleeve	-	CE-IN102 (H102) (2)	CE-IN130 (H130) (2)	CE-IN160 (H160) (2)	CE-IN200 (H200) (2)	CE-IN250 (H250) (2)
79	Indicator CAM	CE-EX10 (S10) (1)	CE-EX10 (S10) (1)	CE-EX10 (S10) (1)	CE-EX10 (S10) (1)	CE-EX10 (S10) (1)	CE-EX15 (S15) (1)

Table 7-13 Lock Nut

№	Location	125	160	200	250	320	400
39	Thrust Bearing	AN09 (2)	AN12 (2)	AN13 (2)	AN17 (2)	AN21 (2)	AN28 (2)
69	Unloader Push Rod	AN05 (2)	AN05 (2)	AN07 (2)	AN08 (2)	AN10 (1)	AN10 (2)

7.4 Lock Nuts

Table 7-14 Lock Nut Used and Each Tightening Torque

P/N	Location	Nominal Designation of Lock Nut（Qty） Tightening Torque N·m					
		125	160	200	250	320	400
39	Thrust Bearing Standard/Maximum	AN09(2) 206/258	AN12 (2) 408/510	AN13 (2) 522/653	AN17 (2) 1186/1483	AN21 (2) 2259/2824	AN28(2) 5347/6683
69	Unloader Piston	AN05(2) 28/35	AN05 (1) 80	AN07 (1) 120	AN08 (1) 140	AN10 (1) 180	AN10(2) 180

When tightening a lock nut, if it is difficult to use a torque wrench, manage the tightening torque of the lock nut controlling the tightening angle range as explained below.

■ Distortion correction of slip washers and lock washers

a) Tighten the lock nut by hand.
b) Use a lock nut wrench and tighten until the rotor turns.
c) Use a lock nut wrench and a hammer, hit twice lightly.
d) Use a lock nut wrench and a hammer, loosen the lock nut.

■ 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 7-8.
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 7-15.
When measuring the angle, use an angle gauge which is set to the diameter of rotor shaft.

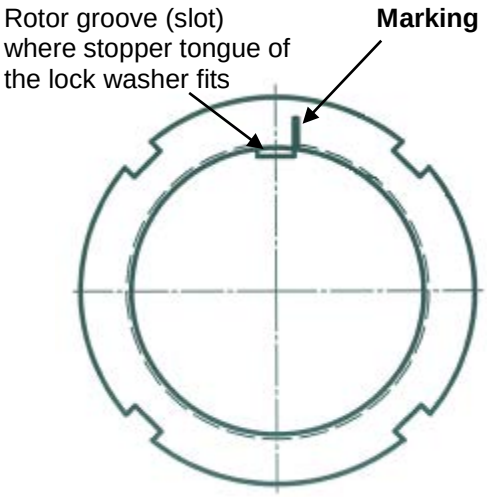
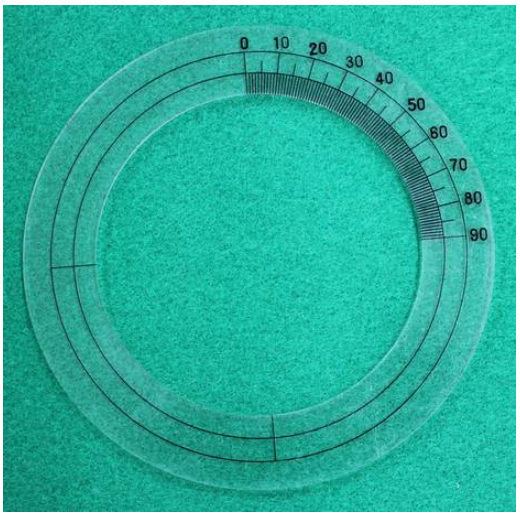


Figure 7-8 Position where mark is put

Table 7-15 Tightening Angles Specified for Lock Nuts of Rotor

Model	Angle range
125** - 400**	15° to 30°



Angle gauge (example)

7.5 Thrust Bearing Gland

Standard tightening torque of thrust bearing gland bolt and its tightening method

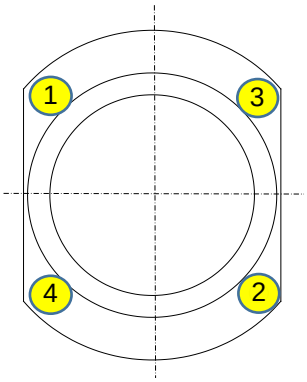
1. Introduction

Thrust bearing gland bolts for screw compressors are a very important task in assembling precision thrust bearings.
In this work, excessive tightening or partial tightening exceeding the specified torque may affect the bearing life, so be sure to use the specified torque and tightening method below.

Table 7-16 Specified tightening torque and tightening method

STEP	Working procedure	Specified tightening torque (%)	Tightening torque at each STEP (N·m)				
			160	200	250	320	400
			4-M10	4-M12	4-M16	4-M20	6-M20
1	First, tighten all bolts by hand. (①→②→③→④)	0	0	0	0	0	0
2	Next, temporarily tighten diagonally and uniformly with a snug torque (25 % x specified torque). (①→②→③→④)	25	10	13	15	30	23
3	Next, tighten uniformly diagonally with 50 % x specified torque. (①→②→③→④)	50	20	25	30	60	45
4	Next, tighten uniformly diagonally with 50 % x specified torque. (①→②→③→④)	100	40	50	60	120	90

Note 1) STEP1 and STEP2 in this procedure are intended to ensure that the bolt seating surface is securely and uniformly contacted with the object to be fastened without any gaps, thereby preventing one-sided tightening.
Note 2) STEP3 and STEP4 in this procedure are intended to fix the outer ring of the bearing, which is the object to be fastened, with uniform tightening.
Note 3) When tightening bolts, always use a torque wrench. If using a ratchet type torque wrench, be careful not to overtighten.



7.6 O-rings Used

Table 7-17 List of O-ring Materials Used for Screw Compressor (excluding mechanical seal)

Working fluid		O-ring material
Working Fluid	Ammonia	NBR
	H Hydrofluorocarbon (HFC)	
	CO_2 *Note	HNBR
	R23 Propane Propylene Natural gas City gas Helium	FKM

∗ Note: Select FKM if you suspect that gases other than CO_2 or impurities are mixed in.

Table 7-18 List of O-rings Used

P/N	Location	125	160	200	250	320	400
9	Suction Cover	P42(2)	P42(2)	G55(2)	G60(2)	P58(1)	G95(1)
35	Balance Piston Sleeve	-	G95(1)	P120(1)	P150(1)	G190(1)	G240(1)
49	Seal Retainer	G85(1)	G90(1)	G115(1)	G135(1)	G160(1)	G160(1)
59	Oil Injection Pipe	P30(2)	P30(2)	P40(2)	P46(2)	P32(1)	-
63	Unloader Cylinder	G95(1)	G125(1)	G150(1)	G190(1)	G240(1)	G300(1)
65	Unloader Piston	P75(1)	P100(1)	P125(1)	P155(1)	P200(1)	P265(1)
73	Unloader Push Rod	P21(1)	P21(1)	G30(1)	G35(1)	P44(1)	G45(1)
75	Unloader Cylinder Cover	G85(1)	G110(1)	G135(1)	G170(1)	G210(1)	G270(1)
86	Oil Injection Pipe	-	-	-	-	G30(1)	-
89	Guide Block	P12(2)	P16(2)	P20(2)	P20(2)	P24(2)	-
150	Thrust Bearing Gland	-	-	-	-	G220(2)	G290(2)
325	O-ring Gland	-	-	-	-	-	P70(2)
432	Main Bearing	-	G85(4)	G22☆(4)	G135(4)	G165(4)	G200(4)
433	Side Bearing	-	G85(4)	G22☆(4)	G135(4)	G165(4)	G200(4)
674	Seal Cover	-	-	-	-	-	G39☆(1)

7.7 Gaskets Used

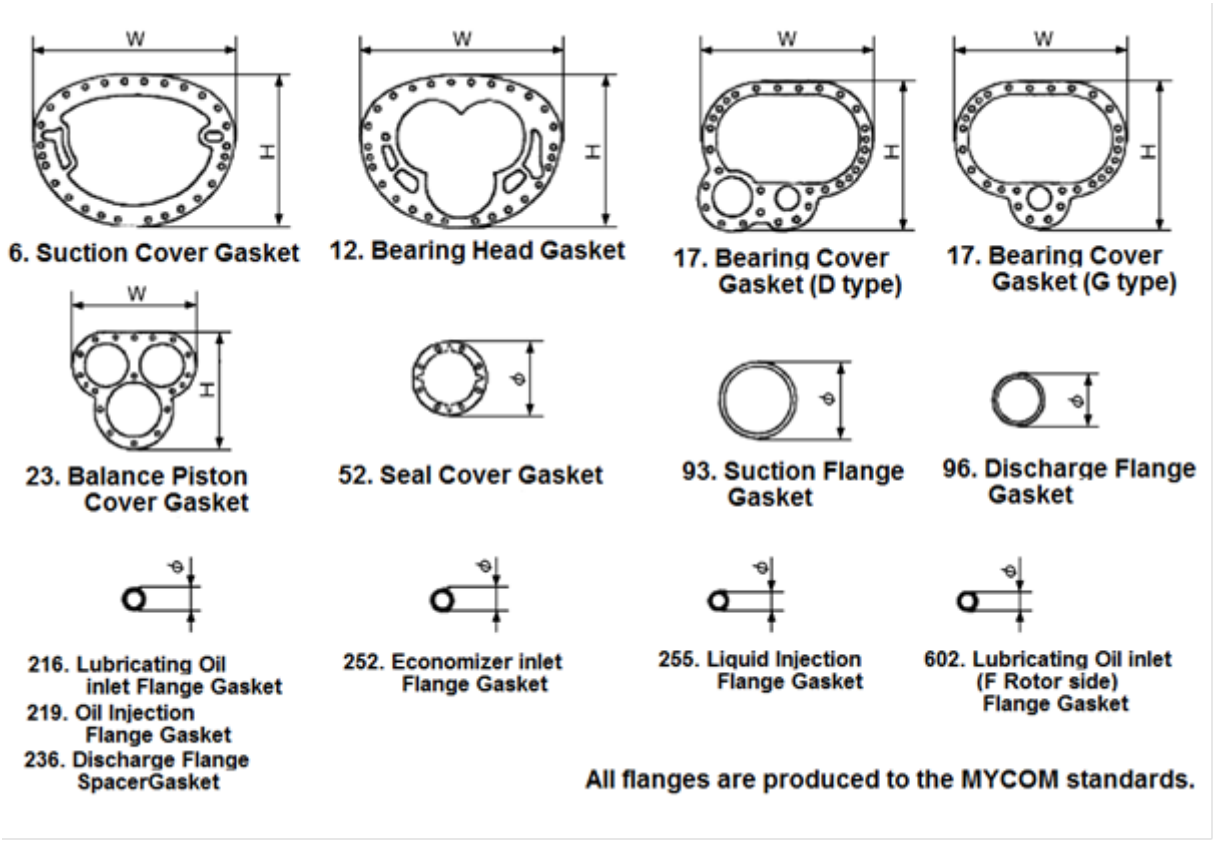


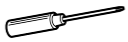
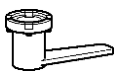
Figure 7-9 Gaskets Used

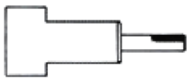
Table 7-19 Gasket Size (mm)

P/N	Location		160	200	250	320
6	Suction Cover	H	354	420	525	660
		W	460	560	700	880
12	Bearing Head	H	345	420	525	660
		W	460	560	700	880
17	Bearing Cover (D: Sideways discharge)	H	338	414	505	641
		W	397	591	709	887
17	Bearing Cover (G: Downward discharge)	H	332.5	380	463	—
		W	388	480	580	—
23	Balance Piston Cover	H	270	333	340	517
		W	283	350	420	532
52	Seal Cover	Φ	140	170	200	250
93	Suction Flange	Φ	173 (125A)	198 (150A)	325 (250A)	421 (350A)
96	Discharge Flange	Φ	143 (100A)	173 (125A)	198 (150A)	250 (200A)
216	Lubricating Oil inlet Flange	Φ	—	44 (20A)	51 (25A)	67 (40A)
219	Oil Injection Flange	Φ	—	—	—	51 (25A)
236	Discharge Flange Spacer	Φ	110 (100CD)	146 (125CD)	176 (150CD)	233 (200CD)
252	Economizer Flange	Φ	51 (25A)	59 (32A)	83 (50A)	118 (80A)
255	Liquid injection Flange	Φ	44 (20A)	51 (25A)	59 (32A)	83 (50A)
602	Lubricating Oil (for F Rotor side Bearing) inlet Flange	Φ	—	—	—	44 (20A)

7.8 Tools for Disassembly

Table 7-20 List of Tools for Disassembly (example)

Tool name	Illustration	size, etc.;		Code No.
Ratchet wrench		1/4”		SG261-08
Adjustable wrench		250 mm		SG231-250
Screwdriver		Phillips	75 mm	SG112-075
			125 mm	SG112-125
Screwdriver		Flat blade	75 mm	SG111-075
			125 mm	SG111-125
Snap ring pliers		External	ST-1	SG311-01
			ST-2N	SG311-02N
			ST-3	SG311-03
Snap ring pliers		Internal	RT-4	SG312-04
			RT-5	—
Eye bolt		M8×200 two-peace-set		UHT0016
Allen wrench key		Across flats	2 mm	SG241-02
			3 mm	SG241-03
			4 mm	SG241-04
			5 mm	SG241-05
			6 mm	SG241-06
			8 mm	SG241-08
			10 mm	SG241-10
			12 mm	SG241-12
			14 mm	SG241-14
			17 mm	SG241-17
			19 mm	SG241-19
			22 mm	SG241-22
Lock nut wrench		AN-05		SAS111-05
		AN-07		SAS111-07
		AN-08		SAS111-08
		AN-10		SAS111-10
		AN-12		SAS111-12
		AN-13		SAS111-13
		AN-17		SAS111-17

Tool name	Illustration	size, etc.;	Code No.
		AN-21	SAS111-21
Torque wrench for assembly		5-25 N·m	-
		20-100 N·m	SG132-0900
		60-420 N·m	SG132-4200
Assembly and Disassembly Tool, Main/Side Bearing		160	CS70300-160
		200	CS70300-200
		250	CS70300-250
		320	CS70300-320

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