IWAKI PUMPS

IWAKI Screw Pump

NFA-T

Instruction Manual (Asia Edition)

⚠ Read this manual before use of product

Thank you for purchasing Iwaki Screw Pumps NFA-T Series.

This instruction manual is divided into "Safety instructions", "Outline", "Installation", "Operation", and "Maintenance", providing the instructions on how to handle and operate the pumps.

To take full advantage of the screw pump functions for efficient use of this product for a long time, read through this instruction manual before use to understand each section fully and use this product properly.

Contents

Please ensure that the end user keeps this instruction manual. After reading this instruction manual, please keep it handy such as when using this product for future reference.

If you have questions, please contact us or your nearest distributor.

Important Instructions

For the Safe and
Correct Handling of the Pump

- "Safety Instruction" section deals with important details about handling of the product. Before use, read this section carefully for the prevention of personal injury or property damage.
- Observe the instructions accompanied with "WARNING" or "CAUTION" in this manual. These instructions are very important for protecting users from dangerous situations.
- The symbols on this instruction manual have the following meanings:

⚠ **WARNING**	**Nonobservance or misapplication of "Warning" sections could lead to a serious accident which may result in death.**
⚠ **CAUTION**	**Nonobservance or misapplication of "Caution" sections could lead to personal injury or property damage.**

Types of Symbols


Indicates that "Warning" or "Caution" must be exercised. Inside this triangle, a concrete and practical image provided as a warning or caution message is depicted.


Indicates a prohibited action or procedure. Inside or near this circle, a concrete and practical image of the activity to be avoided is depicted.


Indicates an important action or procedure which must be performed or carried out without fail. Failure to follow the instructions herein can lead to malfunction or damage to the pump.

⚠ Export Restrictions

Technical information contained in this instruction manual might be treated as controlled technology in your countries, due to agreements in international regime for export control. Please be reminded that export license/permission could be required when this manual is provided, due to export control regulations of your country.

Safety instructions

⚠WARNING

- **Turn off power before service**
  Risk of electrical shock. Be sure to turn off power to stop the pump and related devices before service is performed.


Turning off power

- **Wear protective clothing**
  Always wear protective clothing such as an eye protection, chemical resistant gloves, a mask and a face shield during disassembly, assembly or maintenance work.


Wear protective gear

- **Use strong ropes (chains) for lifting up the pump**
  Keep away from the pump while it is lifted up for installation. Serious injury may result if lifting ropes (chains) break. Observe the maximum weight of the rope (chains).

- **Use eye bolts**
  Chain the pump via eye bolts to lift it up. Otherwise the pump may accidentally fall down, resulting in serious injury.

- **Stay out from under suspended loads**
  Risk of personal injury. Keep away from the pump while it is lifted up.


Prohibited

- **Be sure to turn off all the related power supplies prior to any inspection/maintenance and installation works (motor fan cover).**
  Working on the pump with power ON, any rotating part may catch the hand, finger, hair, or clothes, and it may result in serious injury.


Prohibited

- **Do not get access to the pump inlet/outlet in operation**
  Risk of personal injury. A rotating parts may catch the finger or hand.


Prohibited

- **Do not modify the product**
  Alterations to the product carries a high degree of risk. It is not the manufacturer's responsibility for any failure or injury resulting from alterations to the pump.


No Remodeling

Safety instructions

⚠ CAUTION

- **Qualified personnel only**
  This product should be handled or operated by qualified personnel with a full understanding. Any person not familiar with the product should not take part in the operation or maintenance of the pump.


Prohibited

- **Do not use the pump in any condition other than its intended purpose**
  The use of the pump in any conditions other than those clearly specified may result in failure or injury. Use this product in specified conditions only.


Prohibited

- **Use specified power only**
  Do not apply power other than that specified on the nameplate. Otherwise, failure or fire may result. Ensure the pump is properly grounded.


Prohibited

- **Ventilation**
  Fumes or vapours can be hazardous with certain solutions. Ensure proper ventilation at the operation site.

- **Spill precautions**
  Fumes or vapours can be hazardous with certain solutions. Ensure proper ventilation at the operation site.

- **Do not run pump dry**
  Do not run pump dry (operation without liquid). Friction heat builds up during dry running operation and damages internal parts. If the pump is operated with a suction side valve closed or without priming, the pump runs dry.


Prohibited

- **Do not operate the pump in a flammable atmosphere**
  Do not place explosive or flammable material near the pump.


Fire ban

- **Do not stand on the pump**
  Do not use the pump as a platform. Injury or damage may result when the pump turns over.


Prohibited

- **Do not close a discharge line during operation**
  Risk of damage to the pump/plumbing. An pressure that builds up internally may exceed the allowable pressure of the pump/plumbing in a short time.


Prohibited

- **Do not close a suction line during operation**
  Risk of damage to the pump/plumbing. An vacuum pressure that builds up internally may cause cavitation in a short time.


Prohibited

- **Unpacking**
  Be careful not to be injured by a nail or so when removing the crate from the pump.


Caution

Safety instructions

⚠ CAUTION

- **Do not touch the pump or pipe with bare hands**
  Risk of burning. The surface temperature of the pump or pipe rises high along with liquid temperature in or right after operation.


Do not touch

- **Observe the maximum operating pressure of the pump**
  See the standard specification item on page 7 for the rated maximum pressure at each pump type.


Caution

- **Grounding**
  Risk of electrical shock! Always properly ground the pump. Conform to local electric codes.


Grounding

- **Install an earth leakage breaker**
  An electrical failure of the pump may adversely affect other devices on the same line. Purchase and install an earth leakage breaker separately.


Electrical shock

- **Do not install/store the pump:**
  - In a flammable/explosive/corrosive atmosphere.
  - In a dusty/humid environment.
  - Where ambient temperature can exceed 0-40ºC.
  - In direct sunlight or wind & rain (except outdoor-use models).
  - In a mechanical vibration


Prohibited

- **Non-freezing**
  Frozen liquid may damage the pump and piping. Drain liquid before leaving it for a long time or use measures to prevent liquid from freezing in winter.


Caution

- **Starting**
  The pump doesn't have an ON-OFF switch. The pump starts as a power cable is plugged in.

- **Pumps with casters**
  The pump doesn't have an ON-OFF switch. The pump starts as a power cable is plugged in.

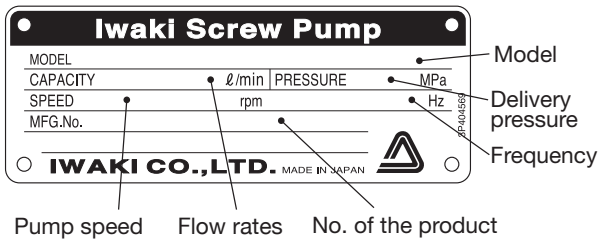

Caution

- **Foreign matter**
  When foreign matters enter the pump, turn off power at once and remove them. Using the pump with foreign matters may result in failure.

- **Disposal of the product**
  Dispose of any used or damaged product in accordance with local rules and regulations. If necessary, consult a licensed industrial waste disposal company.

Outline

1. Unpacking inspection



Once you have unpacked this product, check the following:

1 Check if the delivery is correct.
Check if the specifications (e.g. model, capacity, delivery pressure, pump speed, voltage) specified on the nameplate correspond to the ordered product.

2 Check if the delivery was damaged or deformed during the transport.

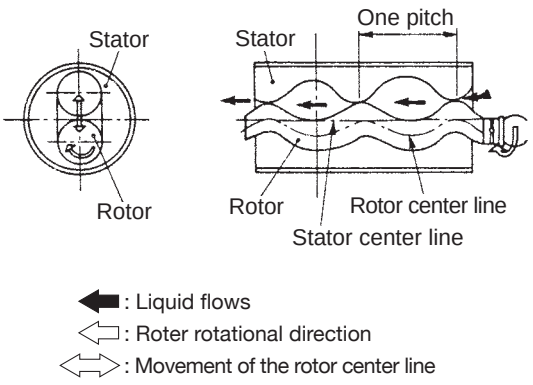
3 Check for loose or disconnected bolts.

* If any problem or inconsistency is found, contact your distributor.

2. Product overview

Iwaki Screw Pumps NFA-T Series is a type of rotary displacement pumps, which are single-shaft screw pumps ideal for transferring viscous, slurry, and fibrous liquids as well as liquids that contain solids.

★Since the pump can deliver liquid in proportion to its speed, it excels in transferring a constant amount of liquid. Additionally, it adjusts the pump speed to allow easy control of the flow rate. It can transfer liquid smoothly without pulsation, stirring, or foaming so that it can be used in a wide range of water treatment applications including chemical plants, water treatment plants, and sewage treatment plants.



■Operating principle

The pump part consists of the rotor (its cross-section forming a circular single-threaded male screw) and the synthetic rubber stator (its cross-section forming a rectangular cavity resembling a double-threaded female screw).

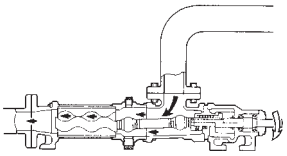
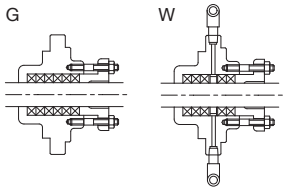
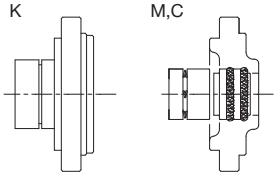
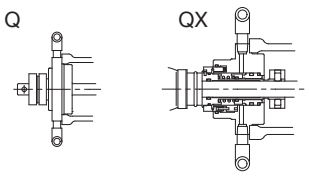
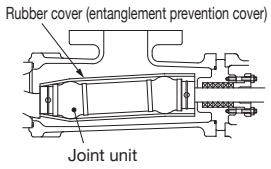
This engagement of the rotor with the stator forms a certain volume of sealed air gap. This air gap is sequentially shifted by rotations of the rotor, thus transferring liquid.

3. Standard specifications

Model	★Capacity		Maximum delivery pressure	Required power (a single stage)	Maximum allowable particle size (mm)
	*1. Theoretical capacity	*2. Maximum capacity			
NFA-T20	1.35ℓ	19ℓ/min	Single stage: 0.6MPa Two stage: 1.2MPa 2NFA-T100 only 1.0MPa	0.2 to 0.75kW	4
NFA-T32	3.4ℓ	40ℓ/min		0.4 to 1.5kW	5.5
NFA-T50	10ℓ	98ℓ/min		0.4 to 2.2kW	7.5
NFA-T65	25ℓ	220ℓ/min		0.75 to 5.5kW	10
NFA-T80	49ℓ	380ℓ/min		1.5 to 7.5kW	12.5
NFA-T100	90ℓ	620ℓ/min		2.2 to 11kW	18
NFA-T125	220ℓ	1300ℓ/min	Single stage: 0.6MPa Two stage: 1.2MPa	5.5 to 22kW	24
NFA-T150	420ℓ	2150ℓ/min		7.5 to 30kW	30

★*1. Theoretical capacity: Indicates the pump capacity when the rotor rotates 100 times.
★*2. Maximum capacity: The value that is obtained when pumping fresh water at a pressure of 0.2MPa and the maximum pump speed.
★This value is obtained under a certain condition (pumping fresh water at ambient temperature) using our test equipment and is based on operation data with the pump positioned to maintain a flooded suction system. Use it as reference.

4. Basic configuration

		Code	Shape	Application
Standard flange type JIS 10K equivalent Flange type		No Code		For liquids that have mobility. When transferring highly viscous, cake-like materials, NFN Series is used. Please contact us separately.
Shaft seal (sealing type)	Gland packing seal (standard) Water filled gland packing seal (High functional F and S types only)	G W		A device intended to minimize leaking from the inside of the pump. For highly viscous (approximately below 10,000 mPa•s), light slurries. W: Injects water forcibly into the shaft and onto the packing sliding surface to prevent clogging and wear-induced heat.
	Mechanical seal (standard) K: External porous ultra-hard x ultra-soft M: Internal carbon x ceramic C: Internal porous ultra-hard x ultra-soft	K M C		A device intended to mechanically control leaking from the inside of the pump. K : For coagulable liquids and fibrous slurries. M: For low viscosity liquids and liquids without slurries. C : For low viscosity slurries.
	Quenching mechanical seal Double mechanical seal	Q QX		When transferring liquid with poor lubricating properties such as coagulable liquids, prevents forcible lubrication and leaking on the sealing surfaces. QX: Used when it is impossible to lubricate and cool the sealing surfaces, or when it is impossible to discharge liquid out into the atmosphere as it is poisonous.
Entanglement prevention type		P		When long fibrous foreign materials are mixed with handled liquid. Attach the synthetic rubber cover to prevent fibers from getting entangled with the joints and clogging of the pump.

・For the available combinations, refer to the section of "5. Identification codes" on pages 8 and 9.
・When transferring a highly viscous liquid having a viscosity greater than 100,000 mPa·s as well as cake-like materials that are almost non-fluidal, or when a four-stage high pressure pump (maximum pressure of 2.0 MPa) is required, a different series, NFN screw pumps will be used. Please contact us separately.

5. Identification codes

■High-functional type

2	NFA - T	65	F	N	4	G	P	X	-	37	B	16	X
①	②	③	④	⑤	⑥	⑦	⑧	⑨		⑩	⑪	⑫	⑬

Asterisks (*) indicate

① **Number of stages (maximum allowable delivery pressure)**
No code : Single-stage (0.6 MPa) NFA-T20 to T150 (for pump sizes greater than 125A, max. 0.5 MPa)
2: Two-stage (1.2 MPa) 2NFA-T20 to T125 (for pump sizes greater than 100A, max. 1.0 MPa)

② **Model: NFA-T Series (standard round flange type)**

③ **Nominal diameter (suction inlet/delivery outlet diameters)**
20 : Rc3/4 32 : Rc 1 1/4 50 : 50A 65 : 65A 80 : 80A
100 : 100A 125 : 125A 150 : 150A
Pump sizes 20A and 32A are connected using Rc screws. For flange connections, loose flanges for 20A and 32A are available respectively (optional).

④ **Identification code for high-functional types**
Pump body materials F:FC S:SCS13 *X: Others
A side cover (a sight glass) is fitted to T50 or greater models. T65 or greater models are combined with a two-segment pump body (with a stator spacer).

⑤ **Stator materials** N: NBR (nitrile rubber) *V: FKM (fluoro rubber)
*H: CSM (hypalon) *X: Other materials

⑥ **Rotor materials** 1: SKS 2: SKS+HCr 4: SUS304+HCr
*5: SKD *6: SKD+HCr *9: Other materials

⑦ **Shaft seal** G: gland packing/PTFE (teflon) impregnated carbon fiber (Note 1)
K: External mechanical seal (unit type) porous ultra-hard x ultra-soft
*M: Internal mechanical seal (standalone type) carbon x ceramic (Note 2)
*C: Internal mechanical seal (standalone type) porous ultra-hard x ultra-soft (Note 2)
*W: Water filled gland packing seal
*Q: Quenching mechanical seal (K type only)
*X: Other shaft seals
Note 1: A shaft sleeve is fitted to T50 or greater models.
Note 2: Not fitted to NFA-T125/T150 models or 2NFA-T100/T125 models.

⑧ **Special specifications** No code : Standard
P: With an entanglement prevention cover

⑨ **Custom specifications related to the pump body** No code: With a standalone universal joint + rod
*X: Other special specifications (e.g. with a pulse oscillator)

⑩ **Motor output**

02: 0.2kW	04: 0.4kW	07: 0.75kW	15: 1.5kW	22: 2.2kW
37: 3.7kW	55: 5.5kW	75: 7.5kW	110: 11kW	150: 15kW
185: 18.5kW	220: 22kW	300: 30kW		

⑪ **Drive type** B : Sumitomo's Beier Variator (BHHMNA, 1/2 geared GHHBMA)
M: 4-pole generic motor S: 6-pole generic motor
R : Ring corn (NRXM) F: inverter motor, `*1/3 geared GM-DZ
V : Yasukawa's VS motor *D: DISCO Speed Variator
*G: Geared motor (Mitsubishi's GM-D, others) *N: Other stepless speed variators
*X : Other drives

⑫ **Drive system** 10 to 99: Motor mounted belt drive/The numbers represent the pump speed codes.
(Numbers ending with an odd number correspond to 50Hz specifications; numbers ending with an even number correspond to 60Hz specifications)
*C: Direct drive coupling *X: Other drive systems

⑬ **Others** No code: Standard *X: Custom specifications except for the pump body (e.g. with a custom cover)

■Low-cost types

2 NFA - T 65 C N 4 M P X - 37 B 16 X
① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬

Asterisks (*) indicate

① **Number of stages (maximum allowable delivery pressure)**
No code : Single-stage (0.6MPa) NFA-T20 to T100
2: Two-stage (1.2MPa) 2NFA-T20 to T80

② **Model: NFA-T Series (standard round flange type)**

③ **Nominal diameter (suction inlet/delivery outlet diameters)**
20: Rc3/4 32: Rc11/4 50: 50A 65: 65A 80: 80A 100: 100A
Pump sizes 20A and 32A are connected using Rc screws. For flange connections, loose flanges for 20A and 32A are available respectively (optional).

④ **Identification code for low-cost types**
Pump body materials C:FC U:SCS13 *X: Others
For single-stage types, no specifications are available to provide a side cover and a stator spacer. With a non-segmented pump body
A side cover (a sight glass) is fitted to the 2NFA-T50 or greater models. 2NFA-T65 or greater models are combined with a two-segment pump body (with a stator spacer).

⑤ **Stator materials** N: NBR (nitrile rubber) *V: FKM (fluoro rubber)
*H: CSM (hypalon) *X: Other materials

⑥ **Rotor materials** 1: SKS 2: SKS+HCr 4: SUS304+HCr
*5: SKD *6: SKD+HCr *9: Other materials

⑦ **Shaft seal** G: gland packing/PTFE (teflon) impregnated carbon fiber (Note 1)
*K: External mechanical seal (unit type) porous ultra-hard x ultra-soft
M: Internal mechanical seal (standalone type) carbon x ceramic
C: Internal mechanical seal (standalone type) porous ultra-hard x ultra-soft
*Q: Quenching mechanical seal (K type only)
*X: Other shaft seals
Note 1: Without a shaft sleeve

⑧ **Special specifications** No code : Standard
P: With an entanglement prevention cover

⑨ **Custom specifications related to the pump body** No code: With a joint unit
*X: Other special specifications (e.g. with a pulse oscillator)

⑩ **Motor output** 02: 0.2kW 04: 0.4kW 07: 0.75kW 15: 1.5kW
22: 2.2kW 37: 3.7kW 55: 5.5kW 75: 7.5kW

⑪ **Drive type** B: Sumitomo's Beier Variator (BHHMNA, 1/2 geared GHHBMA)
M: 4-pole generic motor S: 6-pole generic motor
R: Ring corn (NRXM) F: inverter motor, *1/3 geared GM-DZ
V: Yasukawa's VS motor *D: DISCO Speed Variator
*G: Geared motor (Mitsubishi's GM-D, others) *N: Other stepless speed variators
*X: Other drives

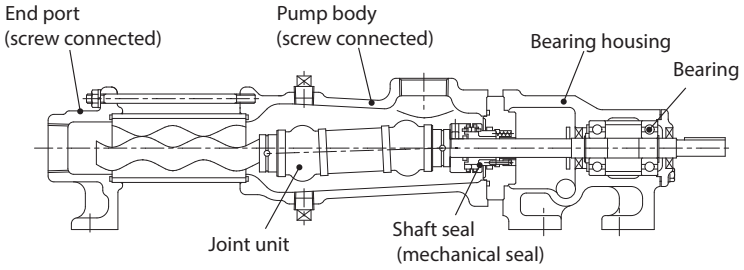
⑫ **Drive system** 10 to 99: Motor mounted belt drive/The numbers represent the pump speed codes.
(Numbers ending with an odd number correspond to 50Hz specifications; numbers ending with an even number correspond to 60Hz specifications)
*C: Direct drive coupling *X: Other drive systems

⑬ **Others** No code: Standard *X: Custom specifications except for the pump body (e.g. with a custom cover)

6. Names and structures of the main parts

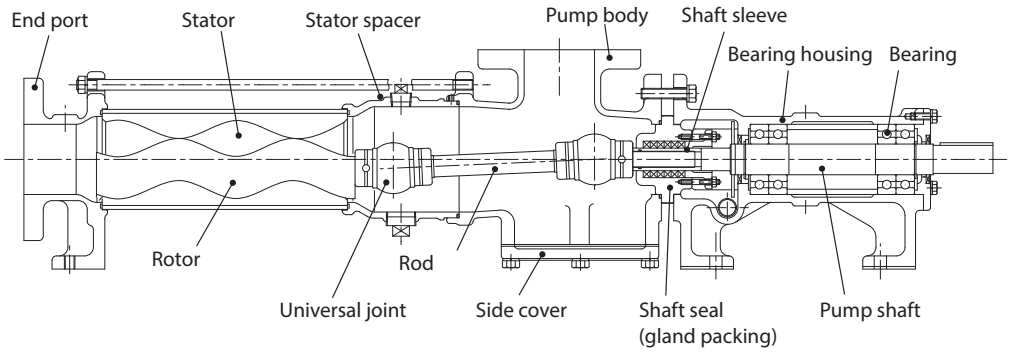
■NFA-T20/T32 and 2NFA-T20/T32 models

The diagram shows the NFA-T32C/U models' K type with a mechanical seal.



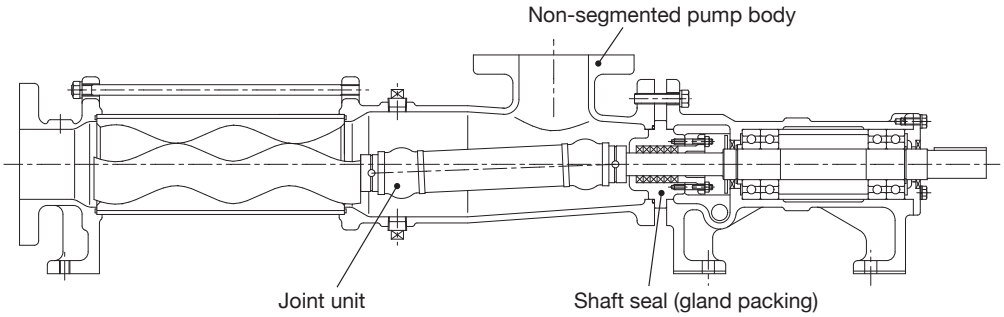
■NFA-T50 to T100 F and S models, 2NFA-T50 to T80 F and S models (high-functional types)

The diagram shows the NFA-T80 gland packing type.



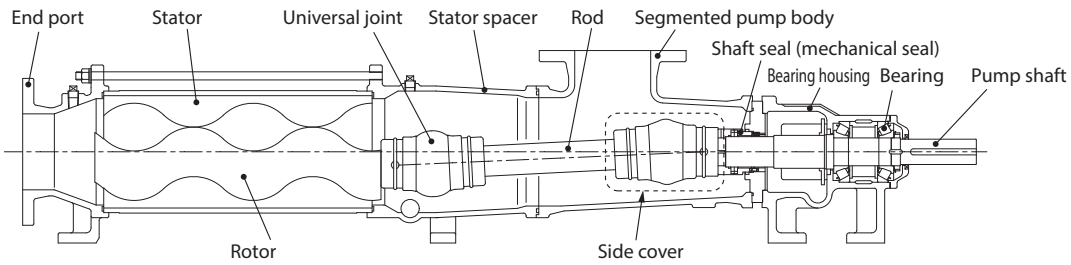
■NFA-T50 to T100 C and U models, 2NFA-T50 to T80 C and U models (low-cost types)

The diagram shows the NFA-T80 gland packing type.



■NFA-T125/T150 models, and 2NFA-T100/T125 F and S models (high-functional types)

The diagram shows the NFA-T150 mechanical seal type.



End port

It is the pump delivery outlet. When rotating the rotor in the reverse direction (counterclockwise when viewed from the end port), liquid flows in the opposite direction, and then the end port serves as the suction inlet (Refer to "Commissioning procedure", Section 4 on page 23).

The pipework connection surface is JIS10K flange equivalent. NFA-T20/T32 pumps are connected using Rc screws (taper screws for JIS pipes). If you prefer flange connections for T20/T32 pumps, loose flanges for 20A/32A are available respectively (optional).

Stator

It is a component that forms the screw pump's pump chamber, with its synthetic rubber cross-section forming a rectangular cavity resembling a double-threaded female screw (standard rubber material: NBR).★It is a consumable component. It should be replaced if it is worn or the flow rate decrease as it is blemished.

Rotor

It is an important pumping component to be combined with the stator, with its metal cross-section forming a circular single-threaded eccentric male screw (standard materials: SKS and SUS304). ★It is a consumable component. It should be replaced if it is worn or the flow rate decrease as it is blemished.

Universal joint

It is a universal joint that converts rotary motion of the drive into eccentric rotary motion. There are two types of joints available. The first one is used in a component unit intended to eccentrically rotate the rotor via a universal joint by fitting a rod (for high-functional types).

The other is a joint unit (for low-cost types) integrated with the rod.

Rod

It is a universal joint component for high-functional types. It connects two standalone universal joints.

Pump body

It is a component to which a pipework flange is fitted to suction liquid.

High-functional T65 to T150 models are combined with a two-segment pump body, for which a stator spacer is fitted between the pump body and the stator. A side cover is also fitted.

Low-cost types are fitted with a non-segmented pump body and without a stator spacer or side cover.

Pump shaft

It is a component intended to transmit power from the drive to pump body.

Stator spacer (high-functional types/pump sizes greater than 65A)

It is a component provided with a fitting for priming and draining water and is located on the side of the stator, which is a part of the pump body divided into two segments. To only replace the rotor and stator, remove the stator spacer without removing the pipes and pump body on the suction side for easy dismantling and assembly.

Side cover (high-functional types/pump sizes greater than 65A)

When inspecting the inside of the pump, the inside of the pump body can be checked by removing the side cover without removing the pump and pipes. High-functional T50 or greater models are fitted with a side cover.

Low-cost types are not fitted with a side cover.

Bearing housing

It houses a bearing that supports the pump shaft.

Bearing

There are two types of bearings available depending on the model: a ball bearing and a spherical roller bearing. A ball bearing is fitted to pump sizes from 20A to 100A. A spherical roller bearing is fitted to pump sizes 125A/150A and the 2NFA-T100 model.

Shaft seal

It is a device that prevents and restricts liquid inside the pump body from leaking out. Depending on the application, either a mechanical seal type or gland packing seal type can be selected.

Shaft sleeve (gland packing dedicated component)

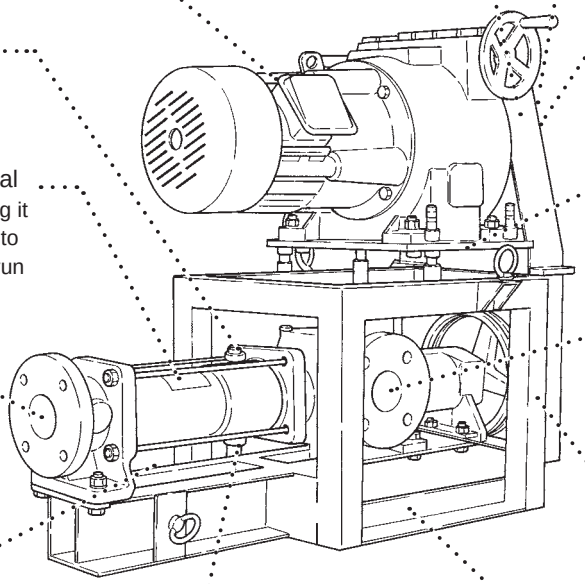
It is fitted as a standard component to high-functional pump sizes greater than 50A. This shaft sleeve can be fitted to the packing sliding parts of the pump shaft (main shaft). Maintenance can easily be performed without needing to dismantle the main shaft and bearing parts.

7. Main parts and labels

The diagram shows an example of a model fitted with a motor-mounted V-belt drive and Beier stepless speed variator.

⚠ WARNING

- **Do not remove or mount the cover during operation.**
  Do not operate the pump with the cover removed. Otherwise, this may cause you to get caught in rotating components (e.g. the V-belt, fan, shaft, coupling), suffering injuries. Mount the cover back to its original position after adjustment and inspection. Additionally, keep things such as a waste cloth that can get caught easily away from the pump.



Belt cover
The cover to prevent hands and other things from getting caught in the V-belt. Do not insert fingers or hands through the gap.

Arrow seal "→" indicating direction: cover top
Indicates the rotational direction of the pump. Be sure to rotate the pump in the arrow indicating direction.

Motor (driving source)
Use the supply voltage specified on the nameplate for the motor.

"Rotational direction" caution seal
Indicates the liquid flow direction in relation to the rotational direction of the motor.

Priming water inlet
Prime water from the priming water inlet before operation, and then run the pump.

MT (motor) base
Intended to move the motor mount and V-belt up and down when adjusting tension.

"No dry running" caution seal
Running the pump without filling it with liquid may cause damage to the inside of the pump. Never run the pump dry.

Suction inlet (delivery outlet)
When rotating the rotor in the reverse direction, the inlet serves as the delivery outlet.

Delivery outlet (suction inlet)
When rotating the rotor in the reverse direction, the outlet serves as the suction inlet.

Base stand
Supporting poles of the motor mount. Use the hoisting holes and base eye bolts when performing hoisting work.

Specifications specified on the nameplate
Be sure to operate the pump at the supply voltage within the range specified on the nameplate, as well as within the pump specification limits.

Drain outlet
A liquid delivery outlet used when performing internal inspection, dismantling and so on. Drain liquid directly into a container instead of doing so onto the ground or floor surface, and then dispose of it in accordance with the applicable laws and regulations.

Base
The structure and shape of the base may vary across the model. When installing the pump, fix it on a solid base surface.

⚠ CAUTION

When caring for this product, squeeze a damp soft cloth very tightly and wipe this product with it. Use a mild detergent to clean stubborn stains and wipe this product dry with a cloth thoroughly. Do not use a solvent to wipe the nameplate, labels, or pump body.

⚠ CAUTION

For your safety, turn off the main power before caring for this product. Do not wet or splash liquid over the motor parts (the terminal box and fan cover) or the wiring parts. Otherwise, this may cause a short circuit or electrical shock.

8. Handling instructions

1 Use the pump within the planned scope of capacity and pressure.

2 Do not run the pump dry.

⚠ CAUTION

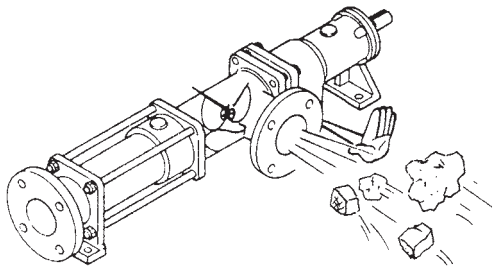
Among the components for the NFA-T model, the rotor, stator, and mechanical seal slide and rotate in close contact with each other. These sliding parts are water lubricated and cooled with liquid. If the pump is run dry, however, water is gone, and frictional heat is generated in the sliding parts, which causes the materials to generate heat. This may cause damage to the pump. If the rotor and stator are burnt out, they will no longer be able to supply liquid. Additionally, if the mechanical seal is damaged, liquid leaks out, making it impossible to shut it off. Running the pump dry for only a few seconds is strictly unacceptable.

3 Be sure to prime the pump before operation.

This pump is self-priming. But still, priming is still required. Be sure to prime the pump until it is filled completely with water before operation. If the pump is run without being filled with liquid, it causes the pump to run dry, and the rotor, stator, and shaft seal parts are burnt out. This may cause damage to the pump.

Be sure to prime the pump (with fresh water or transfer liquid) before operation, such as when using the pump for the first time after installation, or after dismantling and repairing. Additionally, if the pump is run with the suction side valve closed, it causes the pump to run dry. Absolutely avoid this. Be sure to fully open the valves before start running the pump.

* Should the pump be run dry, turn off the main power and let the pump rest for some time. (Do not fill liquid into the pump immediately after operation. Let the pump rest. If the pump is immediately cooled off, cracks may form in the components.) Then, perform inspection.



4 Prevent large solids from getting mixed with transfer liquid.

If large solids and foreign materials are mixed, this may cause premature wear or damage to the stator or rotor, or damage to the joints. For transferable solid sizes, refer to the maximum allowable particle sizes specified in the table in "3. Standard specifications" on page 7.

* Note that the degree of wear varies depending on the hardness, shape, and mixing volume of solids. For further information, please contact us.

5 Instructions for starting and stopping the pump

When starting and stopping the pump, note the following to prevent a water hammer (fluid hammer) (*1). Especially, much caution is required in case of a long delivery pipe.

① When starting the pump

After priming the pump, be sure to open the suction side valve as well as the delivery side valve, and then turn on the main power to start running the pump.

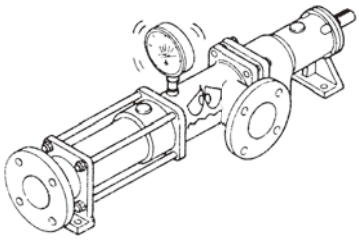
② When bringing the pump to a stop

After bringing the pump to a stop, be sure to close the valves.

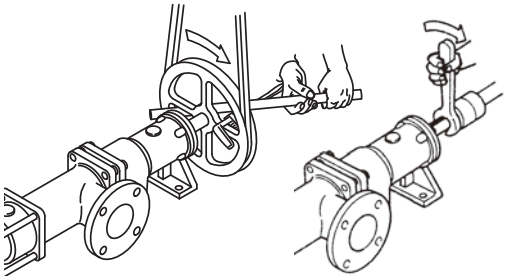
⚠ CAUTION

Never close the delivery side valve during operation. Otherwise, this may block the liquid flow path, causing the pump and/or pipework to rupture and liquid to scatter. This may even cause damage to the motor and other devices.

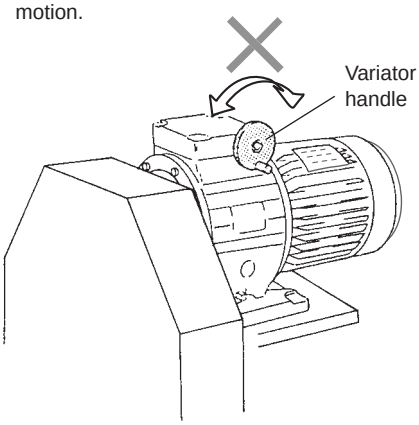
Term explanation*1 A phenomenon in which a pressure surge or wave is caused by fluid pressure changes inside the pipework when a fluid in motion is forced to stop suddenly by suddenly closing a valve, etc, generating impact sound and/or vibration. Additionally, much caution is required as this may cause damage to the pipework and/or pump, or water leaks.



Use a metal stick to tuck the pulley into a pipe wrench, and then turn the pulley.



Do not turn the variator handle
while the pump is not in motion.



6 Mount a pressure gauge and compound gauge (for monitoring)

Mount a pressure gauge and compound gauge to monitor daily operating conditions of the pump. Violent swings of the gauge needles signal a warning sign that air is being sucked or cavitation (*2) is occurring. Check if the degree of vacuum is appropriate and liquid is being delivered correctly.

7 Adherence of the rotor with the stator

The rotor and stator slide and rotate in close contact with each other. They adhere together when they are not in motion and may not start even if the main power is turned on. Especially, in case of new ones, or depending on the type of rotor and stator that are combined, they may adhere tightly together. They can adhere together only for a short period of time. Check the rotor and stator for adherence by manually turning the V-pulley before starting or restarting operation.

If they are adhering together, prime the pump, and then shift their respective phase positions of the rotor and stator by turning the V-pulley or pump shaft to disengage their adherence. Remove the belt or coupling cover, and then perform the immediately aforementioned action using an arm material (e.g. a metal stick), spanner, or chain wrench.

⚠ WARNING

Be sure to turn off the main power before performing inspection. Otherwise, hands or fingers may get caught, suffering injuries.
Additionally, be careful not to insert fingers and so on when turning the pump shaft or V-pulley.

8 With a stepless speed variator

Do not turn the handle forcibly while the pump is not in motion. Change the pump speed after starting the pump or during operation.

⚠ CAUTION

If the handle is turned while the pump is not in motion, this may cause damage to the variator gear and so on.
Additionally, if you stop pump operation for an extended period of time, return the position of the variator scale to "Min" before bringing it to a stop.

9 V-pulley and coupling centering adjustment

Centering is adjusted prior to shipping. But still, verify the centering condition of the pump and motor before using this product. Poor centering or fixing may cause abnormal vibration or sound (Refer to "Periodic inspection", Section 9 on page 34).

10 ON/OFF operation

Frequent ON/OFF operation imposes an excessive load on the pump joint components. This greatly affects the service life of the components. Avoid such operation as much as possible.

Term explanation*2. A phenomenon in which vapor cavities (bubbles or voids) are formed in a liquid due to a negative pressure inside the pump, which deteriorates pump performance and produces vibration and noise, imposing adverse effects such as erosion on components.

Installation

Installation

1. Installation instructions

The following are the instructions for the mounting location including pipework and wiring.

⚠WARNING

● Be careful with turnover or fall of the pump when transporting and mounting it.
When delivering the pump to its mounting location and mounting it, handle it with care to prevent bumping it against something or dragging it. Especially, you must not let it fall. Additionally, when hoisting the pump, use the mount carrying it, eye bolts, or hoisting holes.


Requirement

● Ensure proper ventilation when mounting the pump indoors.
When handling odorous or toxic liquid, we recommend that equipment be provided for adequate ventilation.


Caution

● The main power should be handled only by a dedicated personnel.
Only the dedicated personnel should perform electric work or handle the main power. Failure to observe this may cause personal injuries or property damage.


Requirement

● Do not apply a pipework load to the pump.
When connecting the pipework, be careful not to apply a pipework load directly to the pump. Besure to support and fix the pipework in place to prevent the pump part or base from being deformed or distorted.


Prohibition

● Do not climb onto the pump.
If you climb onto the pump or use it as a stand, you may get hurt in a slip, trip, or fall. Never climb onto the pump.


Prohibition

・Install the pump according to the pump drawing and specifications.

・Check if the indicated model and capacity of the pump correspond to those specified in the design drawing.

・Regarding the installation location and pipework layout, provide margins in the pump installation space to prevent fitting the pump forcibly in a tight space.

2. Installation location

Mount the pump in a location where the pump will not be damaged or deformed by the surrounding environment and condition of the installation location.

Observe the following conditions for the installation location:

- ○ A location that is not flooded even in case of an accident or disaster
- ○ A location that is convenient for water supply and drainage
- ○ A location that is not likely to become frozen in winter
- ○ A location with RH of 35 to 85% (a location that has low humidity and is well ventilated)
- ○ A location that is not subject to water leaks and dry (except for outdoor specifications)
- ○ A location in a clean atmosphere
- ○ A location with ambient temperature of 0 to 40˚C
- ○ A location that is not likely to be exposed to water droplets (for outdoor applications)
- ○ A location that is not subject to vibration

3. Mounting

When mounting the pump, ensure that no adverse effects will be imposed on buildings, works, construction materials and so on, or will not be suffered by those performing the mounting tasks. Additionally, to ensure smooth and easy operation and prolonged use of the pump without malfunction, consider the following points in planning and performing the mounting tasks:

3-1. Mounting location

1 Provide enough workspace for mounting and maintenance.
2 Mount the pump on a flat and solid floor or base surface where it will not be twisted or subject to vibration.
3 Mount the pump in a location where there will be no flooding due to heave rain.
4 Provide space for equipment to allow transport and relocation of the pump.
5 We recommend that a protection wall be provided in case liquid leaks from the pump.

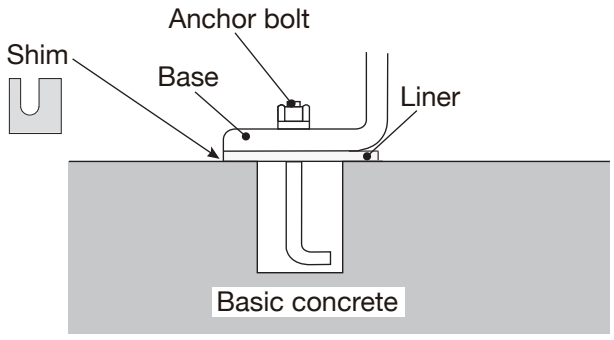
3-2. Mounting location

Consider the following points before choosing the location to mount the pump:
1 Mount the pump as close to the liquid supply tank as possible.
2 If the liquid level on the suction side is lower than on the suction inlet of the pump, the pump self-priming height is 9 m (approximately). But still, be sure to provide marginal space when mounting the pump.
Note: The pump self-priming capacity varies, depending on the pipework conditions such as the liquid quality, specific gravity, liquid temperature, and suction pipe length. For further information, please contact us.

* For more information about the pipework (suction and delivery), refer to "4. Pipework" on page 18.
The "Pipework" section provides the basic layout and instructions as examples to explain pipework.

3-3. Basic work

1 Check if the surface is level with a level, and then tighten the pump base part firmly with the anchor bolt.
2 If there is a gap between the base and base surface, adjust the gap with shims.
3 Be sure that the base surface on which the pump is mounted is larger than the pump base.
4 Refer to the diagram below for mounting the base onto the basic concrete.



<< Example of a basic work outline >>

①Place the pump on the basic concrete, and then insert a liner between the base and base surface to create a gap through which cement mortar is poured in.
②Insert the anchor bolt into the pump base in advance, and then fit the nut with three threads of the bolt showing on the outside of it, allowing it to hang from the bolt hole.
③Place a level on the pump base to check if the surface is level, and then pour cement mortar into the anchor bolt hole. Let it dry for several days, waiting for it to reach sufficient strength.
④Once it has sufficient strength, remove the liner, check if the surface is level again, and then tighten the nut of the anchor bolt. If there is a gap, insert shims to adjust the gap.

4. Pipework

· Foreign materials such as sand, scales, and welding scum may enter the pipe while working on the pipework. If they enter the pump, this may cause damage to the pump components or malfunction. Be sure to blow them out of the pipework before connecting the pump. Especially, be careful not to leave adhesive drips, crumbs from sealing materials, screws and nuts where they are.

· Pipework supports

· Provide supports (pipework supports and metal fittings guides) to prevent a pipework load from being directly applied to the pump.

· If a load is applied, the pump mount or base surface will be distorted, possibly causing adverse effects such as extreme increase of vibration.

· Follow the instructions for pipework to lay the pipes.

<< Instructions about pipework >>

1 Be sure to remove foreign materials inside the pipework with an air blower or brush before operation.

2 Connect the pipework in such a way that the pump is not subject to excessive force. Additionally, support the delivery pipe in such a way that the pump is not subject to thermal stress and vibration of the pipework.

3 If applicable, consider and plan a pipework layout in which the pipework is positioned to maintain a flooded suction system, make the pipes as straight as possible, and minimize bent portions. Additionally, select long elbows or bend pipes having a curvature radius as large as possible for pipe bending materials.

4 Mount a pressure gauge near the pump delivery outlet and a compound gauge on the suction inlet side to monitor the delivery pressure on a daily basis.

5 Take extra care with the suction pipe to prevent air leaks (Perform a leak test after having completed laying the pipes).

6 When handling highly viscous, toxic liquid difficult to maintain and inspect or liquid that becomes solid, provide a flushing pipe in addition to the liquid supply line. Additionally, we recommend that a flushing pipe be provided for the purpose of inspection and maintenance of the pump.

7 When handling precipitated slurry liquid, avoid laying pipes in such a way that a U-shaped portion is formed along the way as such portion can easily become clogged. Additionally, when planning the pipe diameter, calculate the precipitation speed in the mother liquid and ensure the flow velocity is faster than the calculated precipitation speed. However, determine the pipe diameter so that the delivery pressure is maintained below the value specified on the nameplate.

8 Provide a gate valve (to shut off liquid) on the delivery and suction sides for inspection and maintenance purposes. Additionally, although a drain plug is fitted to the pump body, we recommend that a drain valve be installed at the bottom of the suction side pipe.

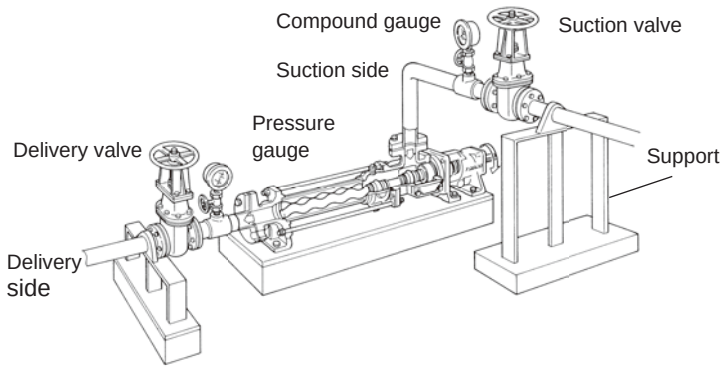
9 A horizontally oriented pump body suction inlet

When using the pump as a self-priming pump, provide a rising pipe (e.g. a reverse U-shaped pipe or inclined upwards) so that liquid stays inside the pump body.

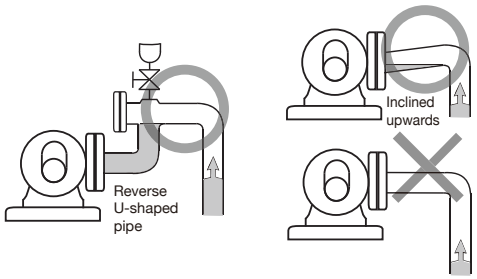
10 Precipitated or non water soluble liquid may stay inside the pipework and/or pump due to the specific gravity, particle size, and hardness of slurries, which may cause clogging, shaft seal leaks, or premature wear of the rotor and stator. Much caution is required.

<Wiring reference example>

*The diagram shows a reference example in which the motor is directly connected, with the suction inlet inclined upwards in a flooded suction system, to ensure that the motor rotation is positive.



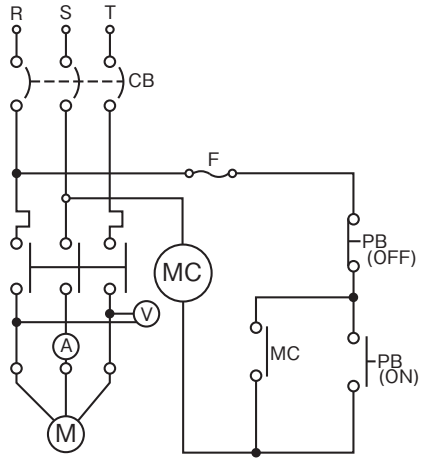
*< A suction lift system >



5. Wiring

Use a proper wiring tool, follow the electrical equipment technical standards, indoor wiring regulations, and motor instruction manual, and observe the following points to perform wiring.

Wiring example (a three-phase motor)



A : Ammeter
V : Voltmeter
M : Motor
F : Fuse
CB : Circuit breaker
MC : Electromagnetic switch
PB : Push button

①Select an electromagnetic switch that correspond to the pump motor specifications (e.g. voltage and capacity).
②Do not mount an electromagnetic switch, remote switch and so on onto the pump base and so on.
③Be sure to install an ammeter to check the operating conditions of the pump.
④For outdoor use, waterproof this product.
⑤Be sure to earth this product.
⑥Confirm the rotational direction before wiring.
Read the motor instruction manual carefully, and then perform wiring so that the motor rotates in the same direction as the one indicated by the arrow seal attached to the pump.
Prime the pump before actually operating the pump to check the conditions. For more information, refer to Section 4on page 23.

Especially when the motor is fitted with a speed variator or a coupling is directly connected, it may rotate in the opposite direction from the one indicated by the arrow seal even if it is wired according to the diagram on the left. If the rotational direction is reversed, replace two of the three phases.

■ Inverter motor drive

- Select the same manufacturer for the motor and inverter.
- Due to the difference (starting torque) based on inverter models, you need to select the type of inverter that has constant torque characteristics and is capable of withstanding larger starting torque than the specified one.
- Use the inverter by combining with a constant torque motor.
  As a general-purpose motor lowers continuous operating torque in the low frequency range continuous operating torque needs to be controlled.
- If the pump does not start, we recommend that torque boost be increased or the parameter be switched to magnetic flux vector control and so on. Additionally, if current exceeds its specified range in the low speed range, decrease torque boost or switch the parameter to magnetic flux vector control and so on.

Operation

Operation

1. Before operation

Be sure to read this section for safe handling of the pump.

⚠ WARNING

●Handling the pump and main power

The management supervisor or authorized person should operate/manage the pump and handle the main power.

●Do not remove or mount the cover during operation.

Do not operate the pump with the cover removed. Otherwise, this may cause you to get caught in rotating components (e.g. the V-belt, fan, shaft, coupling), suffering injuries. Mount the cover back to its original position after adjustment and inspection. Additionally, do not insert fingers or hands into the cover, and keep things such as a waste cloth that can get caught easily away from it.

●Do not touch,or insert hands or fingers.

Do not touch the shaft that is rotating during operation. Otherwise, this may cause injuries.
Much caution is required when performing inspection tasks such as retightening the gland packings.

Do not touch

⚠ CAUTION

●Do not run the pump dry.

This pump has the metallic rotor slide and rotate inside the synthetic rubber stator. If the pump is run dry, frictional heat is generated in the stator and rotor, which burns them out, making them no longer usable (Running the pump dry for only a few seconds is strictly unacceptable).

Prohibition

●Prime the pump before operation

Be sure to prime the pump and ensure that the pump body is filled with liquid before operation, such as when using the pump for the first time after installing or repairing it.

●For drives, refer to their own instruction manuals.

2. Commissioning

Be sure to make a trial run and inspect each part, such as when using the pump for the first time after installation, or when putting the pump into operation again after dismantling or maintenance.

■Operation preparation

Inspect the following before operation. Additionally, be sure to turn off the main power before performing inspection.

1 Check the shaft for accurate centering. Centering is adjusted when shipping out of the factory. But still, verify the centering condition before operation (Refer to "Periodic inspection", Section 9 on page 34).

2 Check if the supply voltage corresponds to the value specified on the motor nameplate and this product is correctly wired by inspecting the circuit with a tester (Refer to the "5. Wiring" section on page 19, as well as the drive and inverter instruction manuals).

VS motor drive: Check if wiring is performed exactly according to the designated wiring diagram.
he VS controller, snap-in module, VS operator and so on are not able to operate properly if they are not wired correctly. Additionally, this may burn out this product.

Inverter motor drive: Check if it is wired correctly.

3 Check if the liquid supply tank or tank is filled with liquid. Check if pipework is performed correctly.

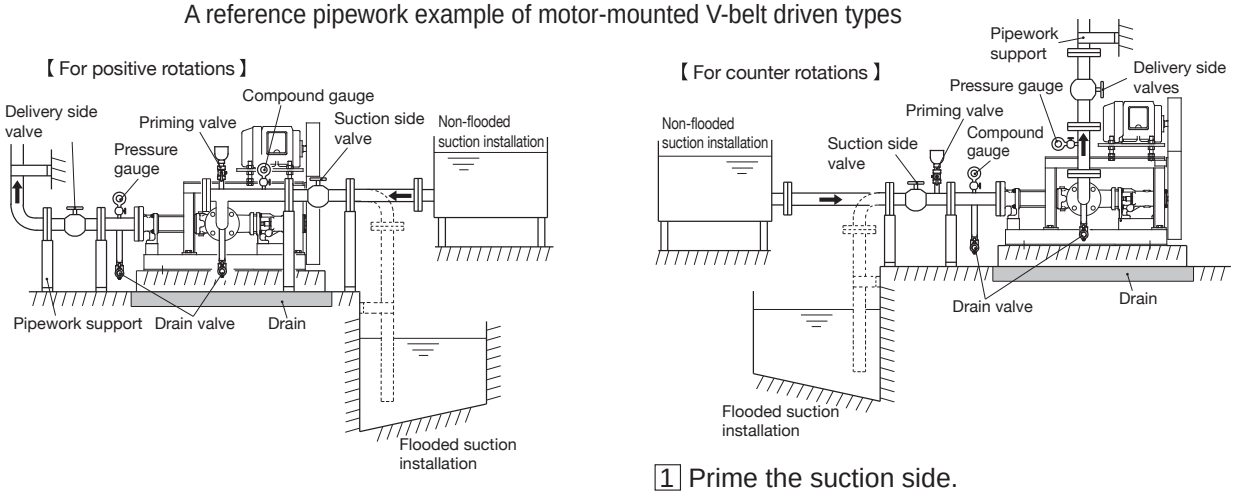
4 Check the rotor and stator for adherence.

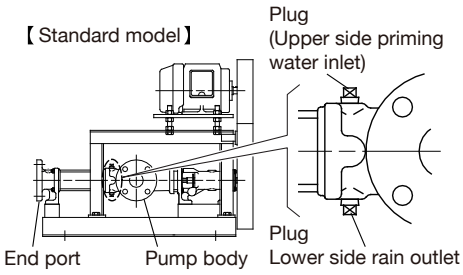
Check the rotor and stator for adherence by manually turning the V-pulley, such as when using the pump for the first time after installation, or after dismantling or inspection. Especially, in case of new or unused ones, or depending on the type of rotor and stator that are combined, they may adhere tightly together. They can adhere together only for a short period of time. If the start button is repeatedly pressed when the pump does not start due to their adherence, excessive force will be imposed on the motor and pump, causing damage to them. Much caution is required. If the rotor and stator adhere together, prime the pump, and then rotate the V-pulley or coupling part 1/2 to 1 turn to disengage their adherence (Refer to "8. Handling instructions", Section 7 on page 14).

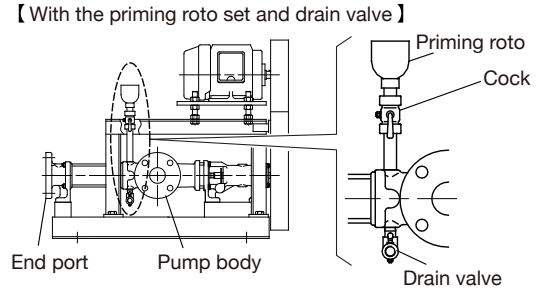
■Commissioning procedure

Make a trial run using fresh water. Additionally, if fresh water cannot be used, use real liquid.
follow the instructions below to start a trial run, such as when operating the pump for the first time after installation, after replacing the rotor and stator, after flushing the pipework and/or pump, or after draining liquid.

A reference pipework example of motor-mounted V-belt driven types







*The priming roto set and drain valve are special accessories. We will make these accessories upon request.

1 Prime the suction side.

Prime the pump body before starting the pump (When counter-rotating the pump, prime the end port).

- A flooded suction system
  Disconnect the plug on the top of the pump (or open the water cock with a priming roto), and then fill the pump completely with water.
- A flooded suction system
  Provide a rising pipe, disconnect the plug on the top of the pump (or open the water cock with a priming roto), and then fill the pump completely with water.

2 Prime the pump, and then reconnect the plug.

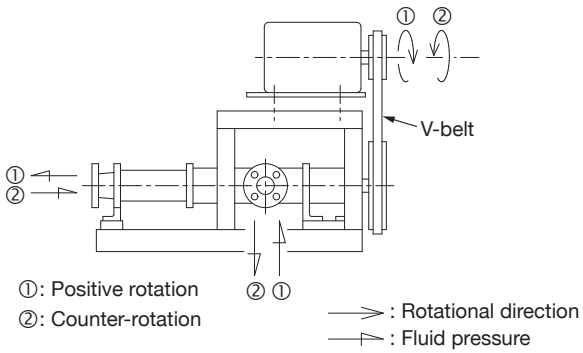
Re-tape the disconnected plug with new sealing tape before reconnecting it.
If a priming roto is fitted, open the water cock fully.

3 Check if the valves open and close properly.

Suction and delivery side valves.....Fully open
Priming rote cock, drain valve.....Fully open

⚠CAUTION

Do not operate the pump with the suction and delivery side valves (e.g. a gate valve) fully closed. Otherwise, liquid cannot be supplied, causing the pump to run dry or blocking the flow path. This may cause the pressure to keep increasing inside the pump, liquid to scatter, and damage to the pump. Open these valves fully.



4 Check if the rotational direction is correct.

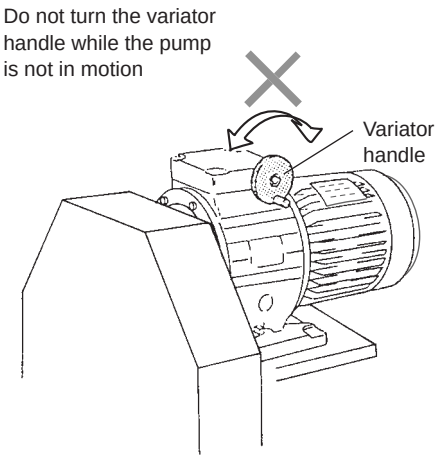
Confirm that the pump is filled with liquid, and then instantaneously start the motor to check if the motor rotates in the same direction as the one indicated by the arrow seal " ". The seal is attached to the top of the belt cover (or the bearing shell).

If the motor rotational direction cannot be reversed or liquid cannot be filled in, disconnect the pump from the drive (or remove the V-belt) to check if the drive alone can make the motor rotate in the same direction as the one indicated by the arrow seal.

If you wish the motor to rotate in the opposite direction from the one indicated by the arrow, please contact us.

5 Start the pump, and check its operating conditions.

Check for abnormal noise or vibration. In case of violent vibration, stop operation, and then refer to the next section, "3. Operating instructions" to inspect each part.



6 Adjust the flow rate.

If the pump is fitted with an inverter motor or stepless speed variator, adjust the flow rate to the specified rate.

⚠ CAUTION

In case of a stepless speed variator, turn the variator handle to change speeds. Do not turn the variator handle while the pump is not in motion. Additionally, when bringing the pump to a stop, return the rotation value to "Min" before turning "OFF".

7 With a water filled shaft seal (Q/W) type

Check if liquid is filled properly from the water inlet (Refer to the "Water filled (quenching) shaft seal" on page 29).

3.Operating instructions

Once you have completed precommissioning check-ups and preparations and have started the trial run of the pump, observe the following points to check the operating conditions.
Stop operation immediately in case of an error, and then read the "1. Troubleshooting" section on pages 31 and 32 to troubleshoot the error. Additionally, if it is difficult to troubleshoot the error, please contact us.

1	Check if the pump supplies liquid properly (Inspect the condition during operation and at regular intervals). ①Check the liquid surface and discharging conditions on the suction side. ②Check the suction and delivery pressures with a pressure gauge to confirm that the vales are within the specified limits (Refer to the values specified on the nameplate). ・If the flow rate and delivery pressure suddenly decrease during operation, inspect the rotor and stator. ・If they increase extremely, bring the pump to an immediate stop, and then check the discharge side line for clogging.
2	Check for abnormal noise or vibration. ・When handling fresh water or transfer liquid with no lubricating properties, the stator part may make creaking sounds. But this is not a sign of abnormal behavior.
3	Check if the temperature at the stator and bearing shell part is too high. ①After starting the pump, keep touching the stator with a hand for a while to check if the temperature is getting excessively too high. ②Check if the surface temperature of the bearing shell part is within ambient temperature plus 40°C.
4	Check for leaking from the shaft seal part (Refer to "Criteria for the standard leak rate of leak" on page 35). ① Gland packing (G) types When starting operation Liquids with no friction properties .....At the beginning of operation, the leak rate varies until the packings start fitting into the system. Continue with this break-in operation, and then retighten the packing. Liquids with friction properties .....Retighten the packings immediately after starting operation. If the leak rate is considerably high, or leaking does not stop even after retightening, replace the packings. ② For mechanical seal (K/C/M) types, leaking signals a sign of abnormal behavior, refer to "Example of cause of defects in mechanical seal" on page 36 and troubleshoot it. Initial leaking .....When starting operation, a somewhat greater leak rate than usual is observed, but it gradually stops with time as the sealing surface starts fitting into the system. If leaking continues for more than one day, please contact us.
5	Check if liquid leaks or air is being sucked from the joints of each pump part. ・If leaking is detected, retighten the connections. Even a small gap can suck in a large amount of air, lowering the flow rate.

4. Operation

If no problems are found with the trial run, put the pump into full operation. Additionally, do not forget to observe the points mentioned in "3. Operating instructions" above even during operation for daily monitoring, to maintain proper operating conditions.
Bring the pump to an immediate stop if you sense something is wrong. Read the "1. Troubleshooting" section on pages 31 and 32 to troubleshoot the error. Additionally, if it is difficult to troubleshoot the error, please contact us.

5. Shutdown/restart instructions

■ Instructions for shutting down and stopping operation

1	If liquid is likely to become frozen	・In the cold season, freezing may cause damage to the pump body and pipework. Drain liquid completely from the pump body and pipework when finishing pump operation. Or, take measures to keep the pump and pipework warm.
2	If liquid becomes solid or precipitated	・In case that liquid becomes solid or precipitated before restarting the pump, perform flushing every time you finish pump operation to flush out liquid inside the pump and pipework.
3	If operation is stopped for an extended period of time 1.Stator 2.Rotor 3.Inside of the pump 4.V-belt	・If operation is stopped for an extended period of time, the rotor and stator adhere together, which may disallow the pump to restart. Remove the stator, flush the inside, and then store it in a dark cold location in a tightly sealed state. *The performance of the stator (rubber materials) may be deteriorated if stored for an extended period of time. It is recommended that it be used within three years. ・If it is made of iron (SKS materials), apply an anti-corrosive agent (e.g. grease) after drying it to prevent rust, and then store it in a vinyl plastic bag and so on. ・A stainless rotor requires no anti-corrosion treatment but should be wrapped up with cushioning material and stored in a vinyl plastic bag and so on. ・Drain liquid completely out from the inside of the pump, and then keep the drain plug opened. ・If you drain liquid out by disconnecting the plug while the pump is not in motion, be sure to re-tape the disconnected plug with new sealing tape before reconnecting it. Even a small gap can suck in a large amount of air, causing leaking or disallowing liquid supply. ・For V-belt driven types, loosen or remove the belt, and then store it carefully to prevent deterioration. Additionally, if you remove the belt, do not coil the belt into a multitiered spiral to prevent the tendency to bend in certain patterns, or store it in a tightly bent state.

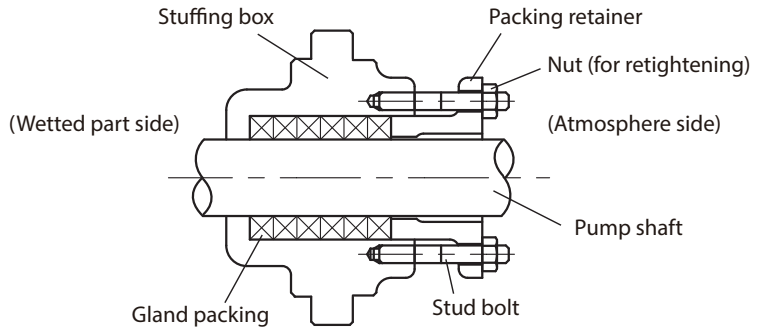
■ Instructions for restarting operation

1	To resume operation after it was stopped, be careful not to run the pump dry.	・When restarting operation, be sure to prime the pump body (for counter-rotation, the end port side) with water or real liquid before starting the pump.
2	Turn the pump shaft with a belt wrench and so on to disengage adherence of the rotor with the stator before restarting.	・While shutting down and stopping operation for an extended period of time, the rotor and stator may adhere together as they are in close contact with each other. Especially, when handling viscous or adherent liquid, or in case of new ones, they may adhere tightly together, preventing the pump from starting. If such occurs, temporarily remove the cover, and then turn the shaft to disengage adherence of the rotor with the stator. (Refer to "8. Handling instructions", Section 7 on page 14). ⚠ WARNING Be sure to turn off the main power before performing a task. Additionally, if someone accidentally turn on the main power while performing a task, this may lead to personal injuries. Put up the "During Operation" sign near the power switch especially in noisy places or places with poor visibility to let everyone know a task is in process.

6. How to handle a shaft seal

6-1. Gland packing seal

The gland packing seal is a shaft seal that stuffs the packing inside a stuffing box and presses it with a packing retainer to seal it with the pump shaft and packing inner diameter surface. The device prevents leaking from the inside of the pump, and lubricates and cools the sliding surface with transfer liquid while minimizing the leak rate.



■ Handling instructions

1 Carefully fit and tighten·the gland packings.

he fitting conditions of the gland packings increases or decreases the service life of this product by several times. Carefully replace and retighten the gland packings.

2 Use good judgment to replace the packings.

Treat the gland packings as consumable components in terms of its functionality. The service life of a packing significantly varies depending on conditions such as the type of liquid in use and delivery pressure. Good judgment is required in determining when to replace the packing.

■ Operating instructions

- The tightening force of the packings gradually decreases as it starts to fit into the system after starting the pump. Retighten them immediately after starting operation.
- Do not reduce the leak rate to zero during operation. Operate the pump while allowing a small amount of leak.
- If you keep operating the pump for a long time even while leaks are exceeding the standard leak rate, a leak path is formed in the packings, which cannot prevent stopping leaks even if the packing is retightened. Retighten the packings early to adjust the leak rate on a daily basis.
- If the packings are tightened until there are no tightening margins, replace them with new ones.
  *For the outline of removing and fitting packings, refer to the "Removing and fitting packings for gland packing seal [G/W] types" section on page 43.
- Tightening timing

  1) Liquids with no friction properties

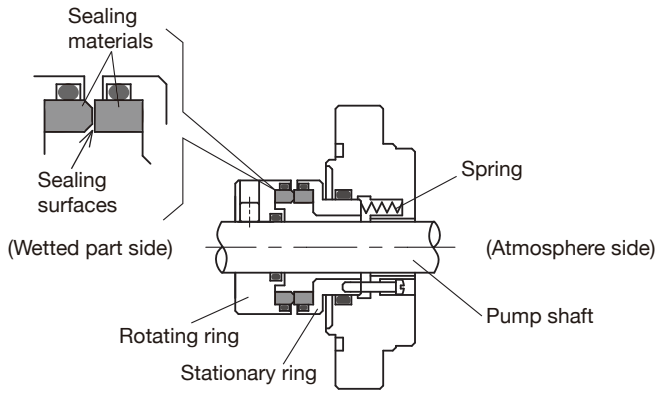
  At the beginning of operation, no leaks may occur, or rather a somewhat greater leak rate than usual may be observed, depending on the tightening condition. Refer to the "Adjusting the tightening level of the gland packing" and " Break-in operation" sections on page 35, and then tighten the packing in such a way that the leak rate corresponds to the standard leak rate.

  2) Liquids with friction properties

  When handling liquid with friction properties such as slurry liquids, tighten the packings immediately after starting operation in such a way that the leak rate corresponds to the standard leak rate.

6-2. Mechanical seal

A mechanical seal is a device, consisting of a rotating ring and stationary ring, each having a sealing surface, which is pressed by a spring with sufficient force to allow the rings to slide in close contact with each other. This helps to minimize liquid leaking (prevent burnout by allowing a tiny amount of leak to lubricate the respective sealing surfaces of the rings).



Reference: Mechanical seal (K type) structural drawing

■ Handling instructions

1 Handle with care in order not to apply impact to the mechanical seal.

A mechanical seal is a precision mechanical component. Operating conditions and handling procedures greatly affect the service life of the component. Much caution is required in order not to apply impact to it. Especially, you must not let it fall.

2 Do not run the pump dry.

If the pump is run dry, the sealing surfaces of the mechanical seal can no longer water lubricated. This results in the surfaces coming in contact with each other in a dry state. Heat is generated, burnout occurs, and cracks are formed, causing leaking and damage to the pump. Much caution is required.

3 Clean the sealing and sliding surfaces carefully while preventing scratching them.

Do not scratch the sealing surfaces and/or O-ring fitted parts. Additionally, much caution is required in order to prevent foreign material contamination on the sealing surfaces (Even a minor scratch or a small amount of dirt can cause leaking). When replacing the mechanical seal, you also need to modify and clean the O-ring contact surface of the pump shaft.

- Check for scratches, nicks, corrosion and so on.
- If burrs and/or foreign materials adhere to the surfaces, remove them with sand paper and so on, and then wipe them with a clean, soft waste cloth.
- Anti-rust oil is applied to an unopened mechanical seal. Wipe the oil off completely with benzene or alcohol when fitting to the pump. Do not apply a lubricant thereafter.

4 When handling liquid that becomes solid or precipitated, perform flushing with clean water when you finish pump operation every day.

Keep the wet ends clean to prevent deposits from entering the sealing surfaces and O-ring fitted parts, and then restart operation or store the seal. If slurries enter these areas, the sealing surfaces open, causing leaking.

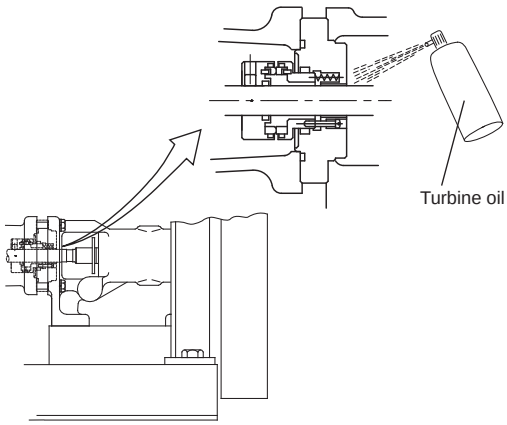
5 Recommended stock of spare seals

If leaking occurs from the mechanical seal, we recommend spare seal(s) be kept on hand for quick recovery work.

■ Operating instructions

● Initial leaking

At the beginning of operation, a leak may occur from the mechanical seal. This initial leaking gradually decreases with time as the sealing surface starts fitting into the system. If leaking continues in large quantities or for an extended period of time (more than one day), please contact us.



● Mechanical squeal noise

The mechanical seal may generate mechanical squeal noise (metallic sounds) while being operated by transfer liquid.

This noise is largely due to a lack of lubrication on the sealing surfaces and may stop as the mechanical seal starts fitting to the system after having operated for some time. To stop the noise manually, spray a lubricant such as kerosene and turbine oil that does not adversely affect the O-ring through the gap between the pump shaft and mechanical seal. It helps to lubricate the sealing surfaces, stopping mechanical squeal noise. If the squeal noise does not stop, please contact us.

● Liquid mixed with non water soluble metal powders

This type of liquid may be precipitated inside the pump and/or pipework gradually, depending on the pipework layout. If such deposits enter the sealing surfaces of the mechanical seal, this may cause leaking. Perform flushing with clean water when you finish pump operation every time you finish pump operation to keep it clean. Additionally, we recommend that the inside of the liquid supply tank ad pipework be inspected and cleaned at regular intervals. Bent portions are especially subject to clogging. Much caution is required.

● Liquid that becomes crystallized

crystallized particles may be extracted from the gap between the pump shaft and mechanical seal. This is because the mechanical seal by its nature lubricates the sealing surfaces with transfer liquid. Water evaporates from the sealing surfaces, while crystallized particles contained in water does not evaporate and is gradually precipitated inside the mechanical seal until they are eventually extracted externally. If such particles adhere to the sealing surfaces, the surfaces open, causing leaking.

⚠ CAUTION

The mechanical seal may not be an appropriate shaft seal, depending on the properties of liquid handled. Make a careful selection of liquid, especially when the property or composition is unknown. Additionally, the mechanical seal may not be able to demonstrate its sealing performance fully, depending on the pipework layout. For further information, please contact us.

6-3. Water filled (quenching) shaft seal

A water filled shaft seal is used for liquids that easily form scales such as coagulable liquids and fibrous slurries. By forcibly filling liquid, it prevents scale forming and burnout, and controls leaking. A pump with a water filled (quenching) shaft seal requires constant water filling during operation. Refer to the following to fill water.

1 Water filled gland packing seal (W) type

1. Filing liquid : Fresh water
2. Filling volume : 0.2 to 1ℓ/min
3. Filling pressure : Pump suction pressure +0.01 to 0.03MPa

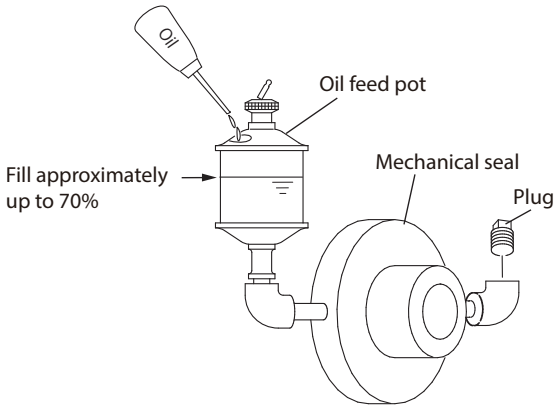
2 Quenching mechanical seal (Q) type

1. Filing liquid : Fresh water or low viscosity oil
2. Filling volume : 1 to 3ℓ/min
3. Filling pressure : Less than 0.03MPa (If the value exceeds 0.03MPa, this may cause filling liquid leaks.)

3 Oil feed pot mechanical seal (QX) type

It is a mechanical seal with an oil pot in which the quenching mechanical seal (Q) type is oil sealed. It is recommended for places where no water supply facilities are available or it is difficult to fill liquid.

1. Sealing liquid : Low viscosity oil (Our choice of oil: Idemitsu Daphne Turbine Oil 32)
2. Sealing volume : Feed oil into the oil pot and fill approximately up to 70%.
3 Oil replacement : Leaks below the allowable limits occur from the mechanical seal. This may cause sealing oil to become cloudy. Cloudy oil poses no problem. But still, if it is too dirty with impurities such as dirt, replace oil. Additionally, we recommend that oil be replaced approximately once a year even if it is only cloudy.



≪ Handling outline ≫

Disconnect the plug, and then feed oil into the oil pot. If oil flows from the pot, tighten the plug and feed oil into the pot. Fill up to 70% (Refill the pot before it has completely run out of oil).

6-4. Double mechanical seal

It is an integrated double mechanical seal, which has two pairs of stationary rings and rotating rings fitted to a single mechanical seal, as compared to a single mechanical seal (fitted with one pair of a stationary ring and a rotating ring).

≪ Application ≫

It is used when a single seal alone cannot lubricate and cool the sealing surfaces in a most appropriate manner. It mainly handles liquids with poor lubricating properties such as high density slurries or liquids that cannot be leaked externally however tiny the amount is.

≪ Handling outline ≫

Replacement procedure: Refer to "Double mechanical seal [QX] type" on page 47.

Dismantling instructions: The structure is complex. We recommend that you avoid dismantling the seal if applicable and replace the entire unit. For further information, please contact us.

Maintenance

1. Troubleshooting

If you sense something wrong, bring the pump to an immediate stop and investigate the cause.
If you are still unsure of the cause or corrective action, consult your dealer.

Phenomenon \ Cause	No power.	Mismatched power voltage. Or, incorrect wiring.	Foreign materials bitten.	Locked due to too high liquid supply temperature and too small stator inner diameter.	Incompatible stator materials ➡ stator swelling ➡ adherence	Slurry and viscous liquid over-transferred beyond the pump capacity.	Liquid frozen.	Adherence of the rotor with the stator.	V-belt loosened.	liquid easy to solidify.	Liquid easy to be precipitated and separated.	High-temperature rotor in use at temperature below the specified value.	Air being sucked through the suction pipe connections.	Loosely tightened gland packing(s).	Suction valve closed, or dry running due to the lowering of the liquid level.	Remedy
The pump does not start.	○	○	○	○	○	○	○	◎	○	○	○					Fully open the suction valve. Or, consider upgrading the pump.
The pump starts but does not deliver liquid.									○			○	○	○	◎	Retighten or replace the gland packing.
Low flow rate.		○			○	○			○			○	○	○		Seal the pipework connections securely.
Motor overloaded.			◎	○	◎	○	○	○		○	○					Control the designated temperature. Preheat the stator.
Vibrations too violent, and noise too loud.			◎						○						○	Be sure to flush the inside of the pump after bringing it to a stop.
Leak rate from the shaft seal part too high.														◎		Prevent liquid from solidifying.
The motor stops suddenly.			○	○	◎	○	○			○	○					Give the V-belt sufficient tension.
Delivery pressure is becoming lower.									○			○	○	○	○	Turn the stator and rotor manually to check if they rotate. (Turn the shaft to pull the stator and rotor apart.)
Flow rates decrease early.			◎							○		○	○			Perform deicing. Drain liquid after bringing the pump to a stop.
The stator and rotor are worn out prematurely.			○		○	◎				○	○	○	◎			Raise the pump capacity, or change the pipework conditions.
Fluctuations observed in flow rates.		○				○			○			○				Change the stator materials.
Excessive heat generated in the pump.		◎		○	○	○										Lower the temperature to supply liquid. Or, switch to a high-temperature rotor.
Oil leaking from the speed variator.																Remove foreign materials. Replace components if they are damaged.
																Adjust the voltage. Or, perform wiring again.
																Turn on the main power.

◎ indicates correlation that occurs with a high degree of frequency. Please consult us for replacing the components marked with *.

(continued)

Phenomenon / Cause	Defective oil seal on the speed variator side.	The rotor and stator are burnt out incurred by dry running.	Damaged bearing.	Inaccurate shaft alignment. Or, the damaged shaft.	Poor installation.	Faster pump speed.	The delivery pipe is closed, blocking the path.	Defective mechanical seal parts.	The suction lift is too high, causing cavitation.	Slower pump speed.	Delivery pressure is higher than the specified value.	The suction side pipe is clogged.	The rotational direction of the pump is reversed.	Damaged universal joint(s).	Rotor or stator wear.	Overtightened gland packing(s)	Remedy
The pump does not start.																	
The pump starts but does not deliver liquid.		○			○		○					○	○	○	○		
Low flow rate.								○	○	○	◎	○			◎		
Motor overloaded.		○				○	◎				○						
Vibrations too violent, and noise too loud.		◎	○	○	◎	○	○	○	○		◎	○		◎	○		
Leak rate from the shaft seal part too high.			○	○				◎									
The motor stops suddenly.		○					○										
Delivery pressure is becoming lower.								○	○	○		○			◎		
Flow rates decrease early.							○		○			○			◎		
The stator and rotor are worn out prematurely.						○	○				○				○		
Fluctuations observed in flow rates.									○						○		
Excessive heat generated in the pump.		○									○					○	
Oil leaking from the speed variator.	○																
Remedy / Cause	Replace it.*	Replace the rotor and the stator.	Replace it.*	Perform inspection and adjustment. Or, replace the shaft.	Perform inspection and adjustment.	Lower the pump speed.	Clean the inside of the pipework to remove foreign materials.	Replace it.*	Lower the suction lift. Or, reduce pipework resistance.	Raise the pump speed.	Reconsider the pipework conditions, or consider upgrading the pump.	Clean the inside of the pipework to remove the objects that cause clogging.	Have the pump rotate in the correct direction.	Replace it.	Replace it. Consider performing surface treatment of the rotor.	Readjust it.	

◎ indicates correlation that occurs with a high degree of frequency. Please consult us for replacing the components marked with *.

2. Maintenance and inspection

⚠WARNING

● Wear protective clothing.
When handling hazardous materials or liquid with unknown properties, be sure to wear protective clothing such as safety gloves and glasses before performing a repair or inspection task.


Wear protection

● Turn off the main power before performing a task.
Be sure to turn off the main power before performing a maintenance task. Additionally, put up the "During Operation" sign to prevent turning on the power switch accidentally and let everyone know a task is in process. If someone accidentally turn on the main power while performing a task, this may lead to personal injuries. Workers should exercise caution.


Turning off power

● Remove and mount the cover after the pump has been brought to a stop.
Never remove or mount the cover during operation. Otherwise, this may cause you to get caught in rotating components (e.g. the V-belt, shaft, coupling), suffering injuries. Mount the cover back to its original position after adjustment and inspection. Additionally, keep things such as a waste cloth that can get caught easily away from the pump.


Caution

⚠CAUTION

● Do not touch this product with bear hands.
When handling high temperature liquid, note that the surface temperature of the pump and/or pipework is high. Never touch this product with bear hands during operation or immediately after operation is stopped.

2-1. Daily inspection

1 Check if the pump is operating smoothly without any abnormal sound or vibration.

2 Inspect the liquid level and suction pressure of the liquid supply tank to check if they are within the normal range.

3 Compare the values of the delivery pressure, current, and pump speed during operation with those specified on the pump and motor nameplates, and then check the operating conditions to ensure that these values are within their respective rated ranges or specification limits. Additionally, check the pump's surroundings for abnormal conditions.

*Note that the indicated level of a pressure gauge is proportional to the specific gravity of the handled liquid. Additionally, open the gauge cocks of a pressure gauge and compound gauge for measurement and close them after measurement. If you leave them open all the time, this may cause these gauges to behave erratically or become damaged due to pressure surges such as a water hammer (fluid hammer) incurred as a result of it.

4 Inspect the shaft seal. For gland packing types, check the leak rate and adjust the tightening level. Refer to the "Adjusting the tightening level of gland packings" and " Break-in operation" sections on page 35.

2-2. Periodic inspection

1 If a spare pump is available, operate it once in a while so that it is ready for operation any time.
Check if leaking is occurring from the spare pump before operation. If leaking is detected, never try to operate it.

2 Check if the specified values of the delivery pressure, pump speed, and motor supply voltage remain unchanged while operating the pump. If significant changes are observed, refer to the "1. Troubleshooting" section on pages 31 and 32 to troubleshoot the error.

3 Check the rotor and stator for scratches, wear or corrosion on their surfaces (once a year or every 8000 hours).
Plan and consider keeping spare parts on hand before the parts currently in use are no longer usable in any way.

4 Check the oil level of the speed variator (whether oil is filled up to the midpoint when the pump is not in motion).

・For oil lubricated types with an oil inlet, check the oil level approximately at 500 hours after starting operation, and then approximately at every 2000 hours. If lubricant deterioration is significant, replace the oil early.

・For grease lubricated types, refilling is not required, but still, overhauling approximately at every 20000 hours helps to ensure a longer service life. For further information, read the motor instruction manual.

5 Check the mounting bolts for looseness.

6 Check the V-belt for looseness.

If the V-belt is overstretched or severed, this adversely affects operation. Check the belt for looseness and adjust it if it is loosened at regular intervals. Maintain the desired belt tension level all the time (for raising and lowering the motorbase).

7 Refilling and replacing bearing grease (every two years): For NFA-T125/T150 models and 2NAF-T100/T125 models with a spherical roller bearing, replace the grease.

8 Inspecting the oil seal: An oil seal has a finite service life. Using it for an extended period of time lowers its sealing effect. Replace the oil seal approximately at every one to three years for operation under normal conditions, or approximately every year for operation under severe conditions such as operation with high temperature liquid or continuous operation, or for operation requiring a clean operating environment.

9 Centering level for V-belt driven types/types to which a coupling is directly connected

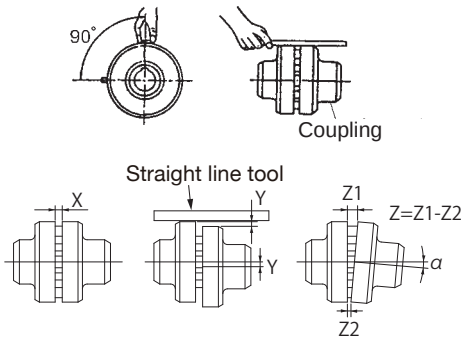
・Keep in mind the coupling and centering accuracy of the V-belt and coupling (parallelism and eccentricity).

・Check the accuracy with a straight line tool.

(a) Types directly connected to the motor

Place a straight line tool on the upper end of the coupling, and then check the accuracy at two points approximately 90° apart.

If a gap is created between the motor and base, measure the gap with a feeler and insert shims to adjust it.

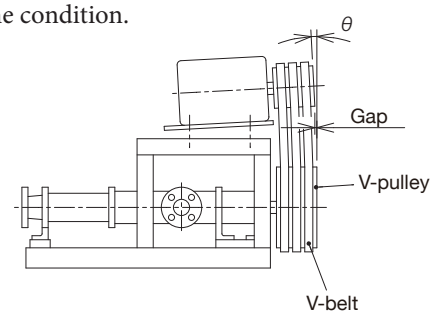


Pump model	Axial displacement X (mm)	Eccentricity Y (mm)	Eccentric angle α (min)	Displacement Z (mm)
NFA-T20/T32 2NFA-T20	±0.5	Less than 0.3	Less than 1°	----------
NFA-T50 2NFA-T32	±0.7			
NFA-T65 2NFA-T50	±1.0	Less than 0.5	Less than 30'	Less than 0.7
NFA-T80 2NFA-T65			Less than 25'	
NFA-T100 2NFA-T80		Less than 0.7		Less than 0.8
NFA-T125 2NFA-T100		Less than 1		Less than 0.9
NFA-T150			Less than 20'	

(b) Belt driven types

Improper parallelism and eccentricity of the V-pulley causes uneven belt wear, lowering durability.

Maintain the values below the values specified below. Place a straight line tool between the two pulleys and check the condition.



・Maintain the parallelism tolerance and eccentricity of the V-pulley to θ ≤ 20'.

<Centering level for belt driven types>

Gap Up to 1m: ±1mm

More than 1m $\pm \frac{\text{Distance between shafts (mm)}}{1000}$

2-3. Inspecting the shaft seal

2-3-1. Inspecting the gland packing seal

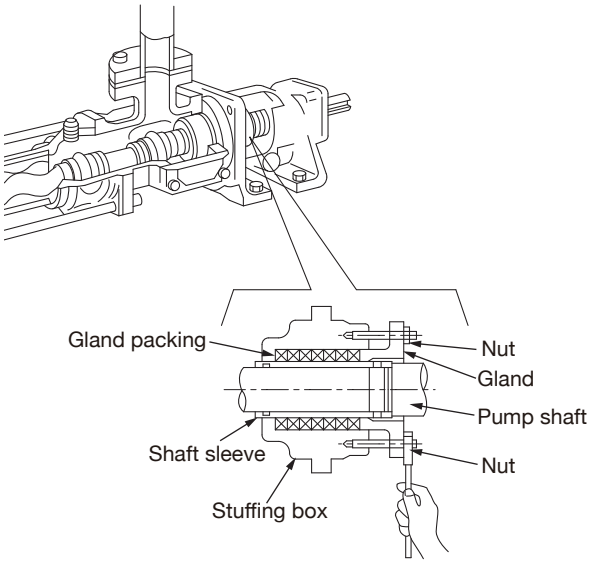
Loosely tightened or worn packings cause frequent leaking. Alternatively, excessively tightened packings cause heat generation, increasing the load on the motor and shortening the packing service life. For this reason, retighten the packings as part of daily inspection tasks while operating the pump.

■ Adjusting the tightening level of gland packings

Retighten the packings when the leak rate exceeds the standard leak rate. When the leak rate exceeds the standard leak rate even if the packings are retightened, replace the packing (Refer to the "Replacing the shaft seal" section on page 43).

●Criteria for the standard leak rate (standard item: #5210 packing)

Model	During initial operation	During stable operation
NFA-T20・32, 2NFA-T20	16cc/min	5cc/min
NFA-T50, 2NFA-T32	16cc/min	5cc/min
NFA-T65, 2NFA-T50	22cc/min	7cc/min
NFA-T80, 2NFA-T65	26cc/min	9cc/min
NFA-T100, 2NFA-T80	32cc/min	11cc/min
NFA-T120, 2NFA-T100	61cc/min	20cc/min
NFA-T150, 2NFA-T125	76cc/min	25cc/min



Criteria for fresh water

2cc/min : Leaking at a rate of one drop every three seconds

20cc/min : Leaking from stringlike dropping to dripping.

<< Break-in operation (approx. 30 min.) >>

Once new packings have been fitted, start break-in operation to adjust the leak rate.

①Refer to the section "2. Commissioning" on page 21 to start the pump. After the pump has been started, perform initial operation for 15 to 20 minutes, and then refer to "Criteira for the standard leak rate" to check the gland leak rate as well as for heat generation or abnormal sound.

②Immediately after starting operation, operate the pump while allowing liquid to leak from the inside of the pump, alternately turn the tightening nuts by approximately 30° to 40° degrees to tighten them to a snug tight condition, and then adjust the tightening level repeatedly to prevent excessive tightening until the leak rate reaches the standard leak rate.

(Note) Retighten the nuts so that the leak rate does not become zero during operation.

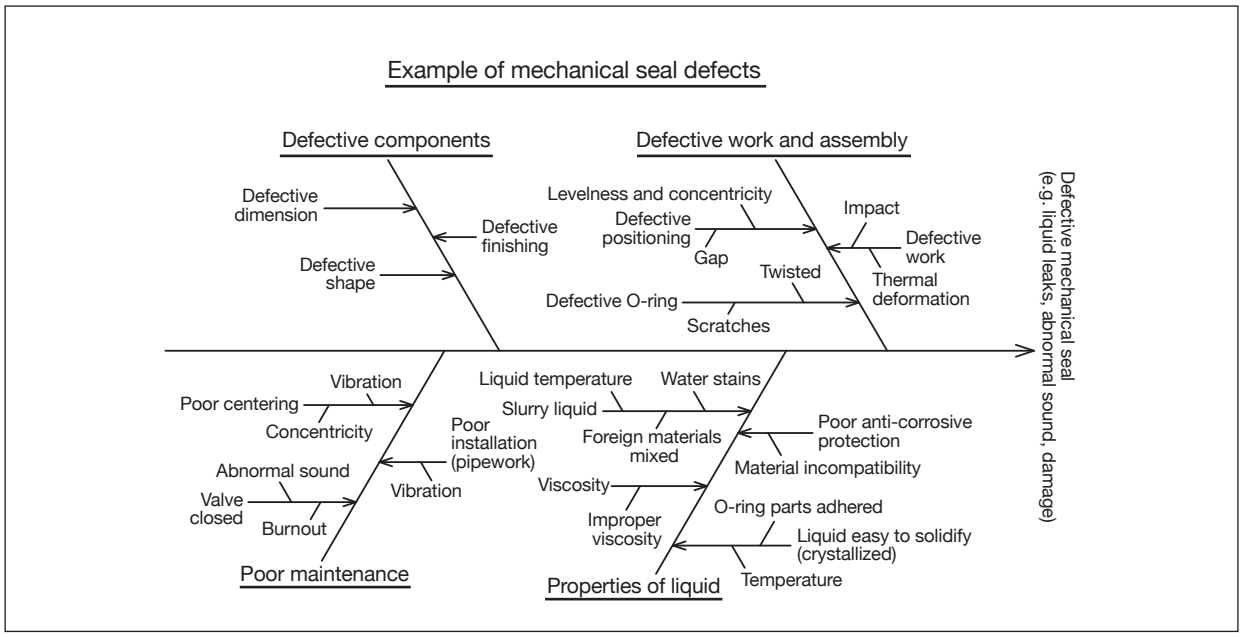
③Touch the stuffing box with a hand. Loosen the nuts if the temperature is extremely high.

(Note) Excessively tightened packings cause excessive wear on the sliding surface. Tighten the nuts several times to ensure gradual tightening instead of tightening them all the way at once. Additionally, alternately tighten the nuts with uniform force to prevent uneven tightening.

④Once adjustment has been completed during break-in operation and operation has become stable after starting, tighten the nuts in such as way that the gland does not become loosened.

2-3-2. Inspecting the mechanical seal

If leaking occurs frequently, bring the pump to a stop, and then perform inspection and flushing. If leaking continues to occur, we recommend that the mechanical seal be replaced with new one. A mechanical seal with coarse sealing surfaces and/or streaky wear marks requires needs to be replaced. For mechanical seal replacement, consult your dealer or us.



3. Afterparts

If you continuously operate the pump for an extended period of time, you need to have sufficient spare parts on hand. Especially, we recommend that consumable components always be kept on hand.

Inform us of the following items when ordering parts:

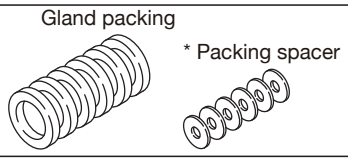
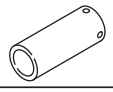
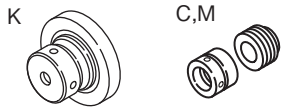
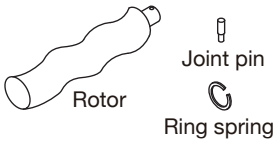
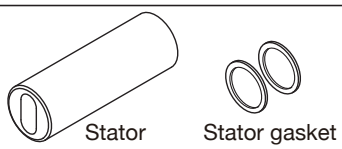
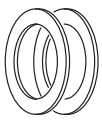
① Part names and numbers (Refer to the table below.)

② Pump model number and manufacturing number (Refer to the pump nameplate.)

③ If an approved drawing has been submitted to your company, inform us of its drawing number.

Storing spare parts: Store them in a location (indoors) that is not subject to wind, rain or dust, has low humidity, and is well ventilated. Do not stack parts on top of one another. Choose a stable location that is not subject to the dangers of falling objects.

List of consumable components

Components No.	Name of components	Details	Quantity	Notes
26 14-2 (14-3)	Gland packing (packing spacer)		One set	* Fitted only to high-functional types, NFA-T20/T32/T125/T150 models or 2NFA-T20F/T100/T125 models.
29 18-2	Shaft sleeve		1	For gland packing types, High-functional NFA-T50 model Only the above types.
32 14	Mechanical seal		One set	High-functional types An O-ring fitted only to NFA-T125/T150 models or 2NFA-T100/T125 models.
63 11	Rotor set		One set	With a joint pin and ring spring Joint pins and ring springs for NFA-T125/T150 models or 2NFA-T100/T125 models to be ordered separately.
64 5	Stator set		One set	With a stator gasket (Each component can be ordered individually.)
52 7-2	O-ring (for a stator spacer)		1	
33 14-4	O-ring (for a shaft seal)		1	
30 18-3	O-ring (for a shaft sleeve)		1	For gland packing types,
65 4	Stator gasket		2	

○Part No. Upper line: NFA-T20 to T100 and 2NFA-T20 to T80
Lower line: NFA-T125/T150 or 2NFA-T100/T125

○The joint unit or universal joint is not a consumable component. But still, we recommend that they be kept on hand as spare components.

* Spare stator: The performance of the stator (rubber materials) may be deteriorated if stored for an extended period of time. It is recommended that it be used within three years. This also applies to other rubber components (O-ring and gaskets).

4. Dismantling and assembly

To dismantle and assemble the pump accordingly, such as when replacing consumable components, observe the safety instructions (those related to personal safety) and do so properly and safely.

⚠ WARNING

● Turn off the main power before performing a task.

Be sure to turn off the main power before dismantling and assembling the pump. Additionally, put up the "During Operation" sign to prevent turning on the power switch accidentally and let everyone know a task is in process. If someone accidentally turn on the main power while performing a task, this may lead to personal injuries. Workers should exercise caution.

Turning off power

● Wear protective clothing.

Handled liquid still remains inside the pipework and/pr pump parts.
Some hazardous materials, liquids with unknown properties, or handled liquids could be harmful to your eyes and skin. Be sure to wear protective clothing (e.g. safety gloves and glasses) before performing a repair or inspection task.

Wear protection

● Remove and mount the cover after the pump has been brought to a stop.

Never remove or mount the cover during operation. Otherwise, this may cause you to get caught in rotating components (e.g. the V-belt, chain, shaft, coupling), suffering injuries. Mount the cover back to its original position after dismantling and assembly. Additionally, keep things such as a waste cloth that can get caught easily away from the pump.

● Be careful not to get caught.

Make thorough preparations for dismantling and assembly tasks to prevent hands or fingers from getting caught between the rotor and stator, or between heavy components.

Do not touch

⚠ CAUTION

● Persons knowledgeable about pumps should handle and/or work on the pump.

Persons fully knowledgeable about and familiar with handling pumps should handle and/or work on the pump. Do not allow persons who are not to work on the pump.

Prohibition

● Do not climb onto the pump.

If you climb onto the pump or use it as a stand, you may get hurt in a slip, trip, or fall. Never climb onto the pump.

Prohibition

● Use an appropriate tool.

Damaged or deteriorated tools can be very dangerous to use. Use appropriate or specialized tools.

● For a base with casters, lock the caster wheels.

For a base with casters, be sure to lock the caster wheels. Otherwise, it moves or overturns, causing personal injuries.

■ Operating instructions

* Refer to the "5. Names and structures of the main parts" on pages 48 through 52 to dismantle and assemble the pump. Special tools and jigs necessary for dismantling and assembly are available as options. Order them separately.

  For drives, refer to their own instruction manuals.

- Be sure not to scratch the joint unit, or rubber cover, O-ring, and gaskets for use with the universal joint.
- When assembling the pump, be sure to mount the ring spring back to its original position. Be careful not to allow the O-ring and/or gaskets to slip off, drop off or bite.
- Especially when working on a large model, to ensure safe work, hoist components to be dismantled and assembled with a crane and so and support them on a mount (e.g. blocks) to perform the task reasonably and safely.
- Using glycerin or soapy water makes it easy to insert (or remove) the stator.
- Re-tape the disconnected plug with new sealing tape before reconnecting it.

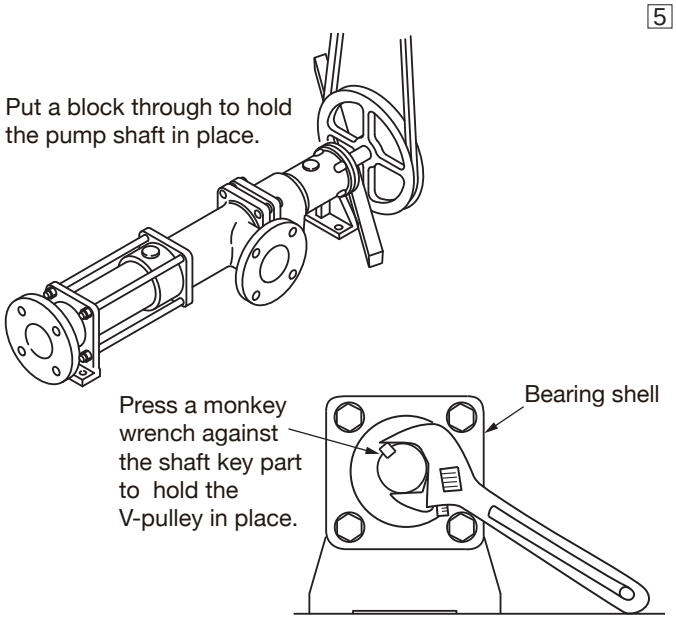
4-1. Dismantling preparations

1 Turn off the main power, and then bring the pump to a stop.

2 Run water from the flushing pipe to flush liquid out from the pump. Flush the pump thoroughly.

3 Close the suction and delivery side valves, disconnect the drain plug (located at the bottom of either the stator spacer or pump body), and then drain the liquid from the pump. For a pump with a side cover, inspect the condition inside the pump body.

4 Disconnect the pipes connected to the end port and pump body.
*To only replace the stator and rotor of a pump with a stator spacer, you can do so by simply removing the pipes on the end port side without removing the pipes on the pump body side.

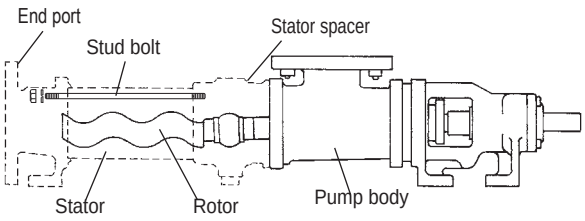


5 Hold the pump shaft in place to prevent it from rotating.
Remove the belt cover, and then put an arm (e.g. a block) through the V-pulley to hold the pump shaft in place to prevent it from co-rotating.

For types to which a coupling is directly connected, remove the cover, and then hold the V-pulley in place by either pressing a monkey wrench against the shaft key part or hold the coupling outer rim with a pipe wrench and so on. Wrap a waste cloth around the pump shaft and key for protection to prevent scratching them.

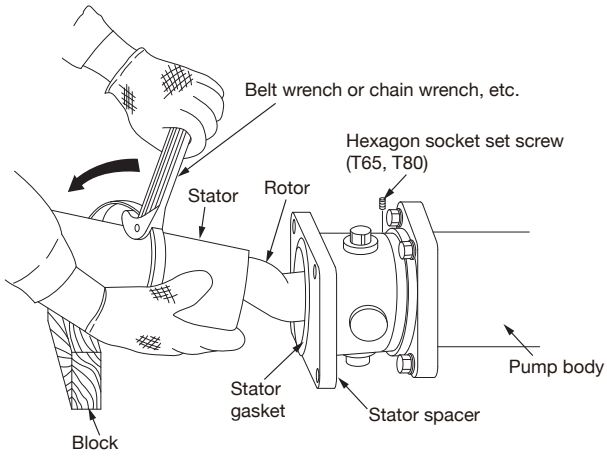
4-2. Replacing the rotor and stator

■ Dismantling procedure



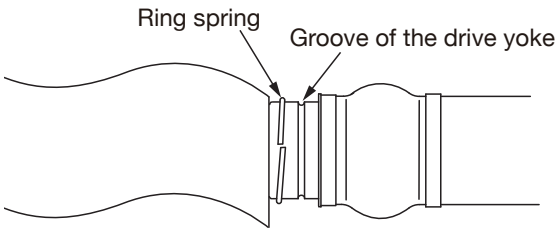
1 Remove the mounting bolt for the base from the end port.

2 Remove the nuts (x4) for the stud bolt and spring washers (x4), and then remove the stud bolt.

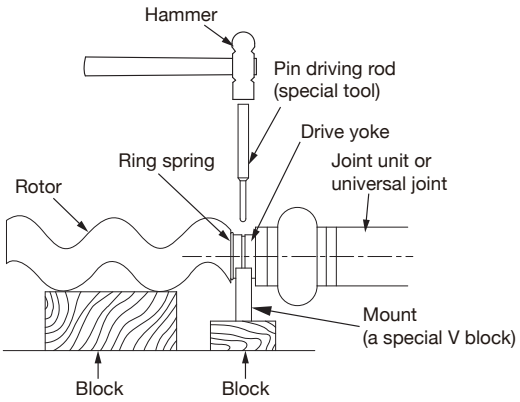


3 Disconnect the stator from the rotor.
Hold the pump shaft in place, and then pull out the stator by turning it in the direction which is counterclockwise when viewed from the end port side (For large models, use a pipe wrench, chain wrench and so on to pull the stator out).

4 Pull out the stator gaskets (x 2), and then remove the stator spacer (or the pump body).
Remove the mounting bolts (x4) or loosen the hexagon socket set screw (x1) in advance.



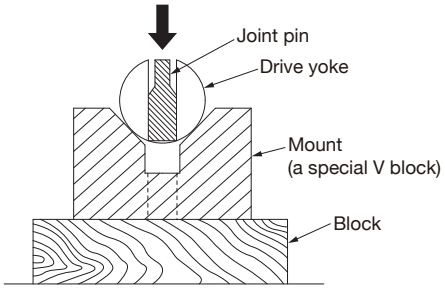
5 Use a pair of snap ring pliers to pull the ring spring from the drive yoke part of the joint unit or universal joint.



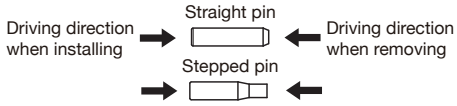
6 Set a mount (a special V block) or block below the drive yoke part and rotor screw parts, and then align the joint unit or universal joint parallel to the rotor.
Place the mount firmly below the drive yoke part.

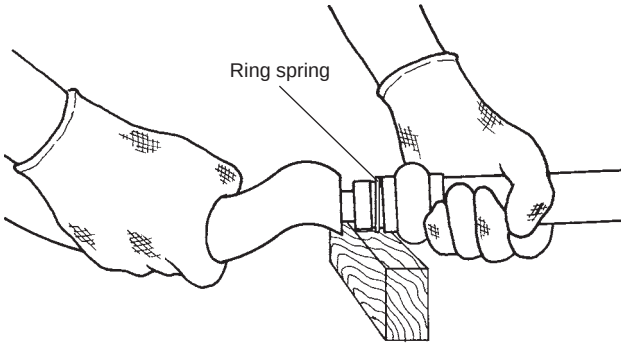
⚠ CAUTION

If you drive the joint pin with these components placed on the mount unstably or incompletely, this may cause damage to these components due to impact and/or recoil. Place these components stably and securely before driving the joint pin.



7 Drive the joint pin connecting the rotor to the joint part in the arrow pointing direction with a pin driving rod (special tool). Depending on the type of model, a straight pin or stepped pin is provided as the joint pin. Be careful about the driving direction.





8 Pull out the rotor straight and slowly towards you. If it is difficult to do so, apply a permeable lubricant to the connections, and then swing the rotor sideways to pull it out.

9 Carefully check the removed rotor, stator, O-ring, and gaskets for scratches on the surface and inside. If remarkable wear, corrosion, or deterioration is found, replace them with new ones.

■ Assembly instructions

For assembly, reverse the dismantling procedure.

1 Prepare a new rotor. Connect it to the joint unit or universal unit, and then drive the joint pin. After driving the joint pin, insert the ring spring securely into the groove of the drive yoke.
* Have the ring spring ready by the side of the groove of the drive yoke.
* Similarly to the section that explains the rotor dismantling procedure, place the mount below the groove of the drive yoke, and then drive the joint pin.

2 Fit the pump body and stator spacer.
Remember to fit the O-ring. Ensure that it does not bite. Otherwise, this causes leaking. Be sure to check it.

3 Fit the stator gaskets to the stator spacer or pump body.

4 Prepare a new stator. Hold the pump shaft in place, align the stator with the rotor screw, and then push in the stator by turning it in the direction which is clockwise when viewed from the end port side.

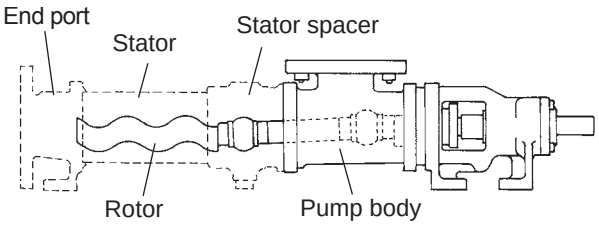
* When doing so, be careful not to allow the stator gaskets to drop off or protrude from the groove of the pump body. Applying fluorine grease to the stator gaskets helps to reduce drop off. If they are easy to protrude or drop off, apply some to them in advance.

5 Fit the stud bolt to the stator spacer or pump body.

6 Fit the end port.
After inserting the stator gaskets into the groove of the end port, insert the four stud bolts into the mounting holes of the end port, fit the spring washers and nuts, and then tighten them uniformly diagonally.

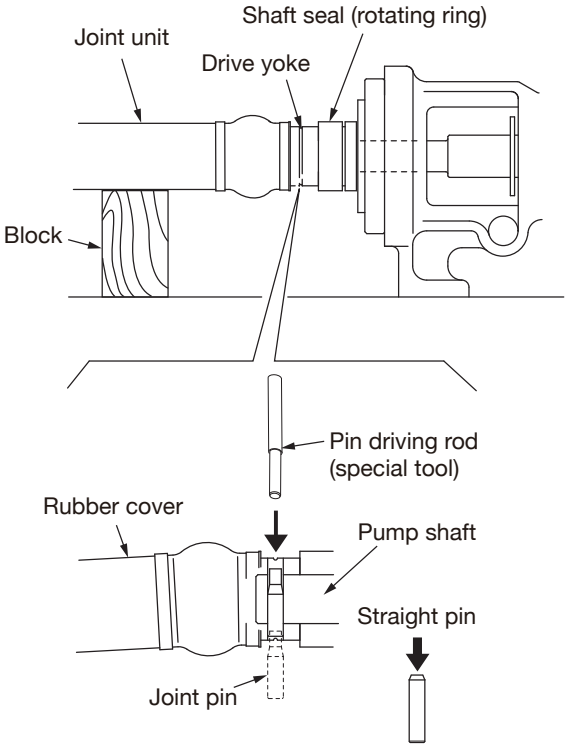
4-3. Replacing the joint unit and universal joint

■ Dismantling procedure



1 Refer to the "Replacing the rotor and stator" section on page 40 to remove the stator spacer (or the pump body).

2 Remove the pump body and rotor.



3 Remove the joint unit or universal joint from the pump shaft.
Place a mount (e.g. a block) before removing it.

⚠ CAUTION

When driving the joint pin, be careful not to accidentally hit or scratch the joint unit or rubber cover.

* Depending on the type of model, a straight pin or stepped pin is provided as the joint pin. Be careful about the driving direction.

Models with a universal joint

For high-functional pumps, they are combined with universal joints (x 2) and a rod. Dismantle and assemble these pumps in the same way as those combined with a joint unit.

4 Inspect the removed joint unit or universal joint. If they are damaged or their rubber covers are scratched or show a sign of deterioration, replace them with new ones.

■ Assembly instructions

For assembly, reverse the dismantling procedure.

Remark: Do not use a rubber cover which is scratched or shows a sign of deterioration. A damaged rubber cover may cause grease inside to ooze out.

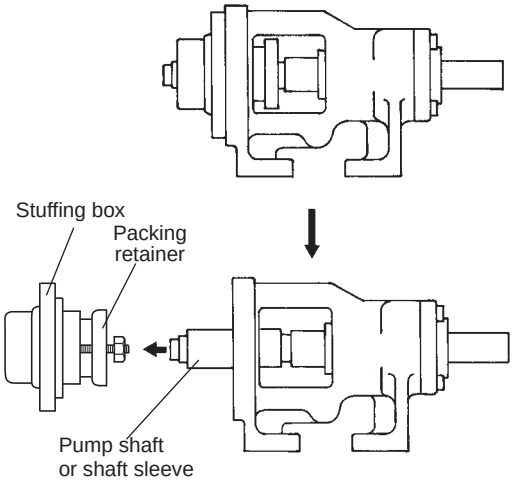
4-4. Replacing the shaft seal

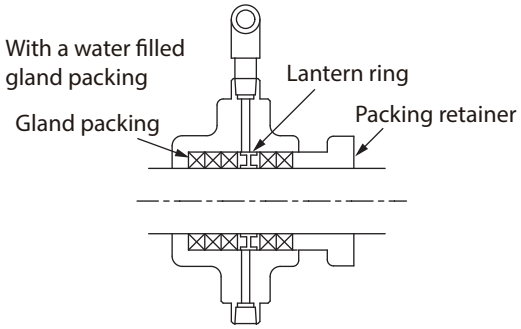
1 Refer to steps 1 through 4 of the dismantling procedure in the "Replacing the rotor and stator" section on page 40 to remove the pump body.

2 Drive the joint pin connecting the pump shaft to the joint unit or universal joint, and then pull out the rotor (with the universal joint).

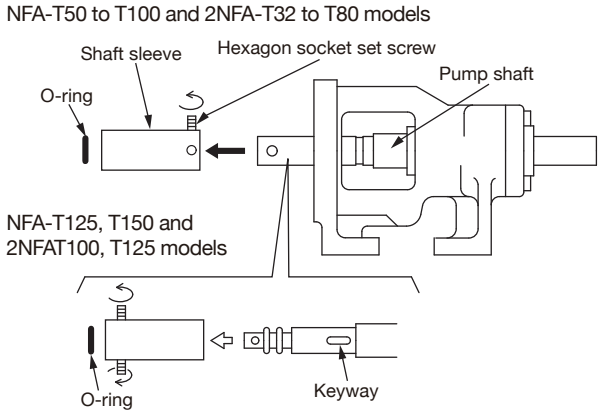
4-4-1. Removing and fitting packings of gland packing seal [G and W] types

Replacing the gland packings: When a large amount of liquid leaks even if the packing is retightened, replace the packings with new ones.





【With a shaft sleeve】



■ Dismantling procedure (excerpted)

1 Loosen the nuts (x2) securing the packing retainer, and then pull out the stuffing box along with the packing retainer.

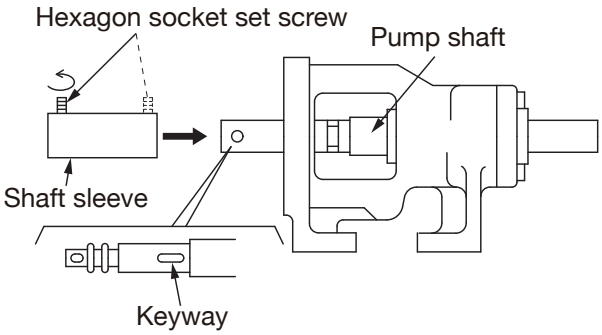
2 Remove the packing retainer, and then pull out the old packings inside the stuffing box.

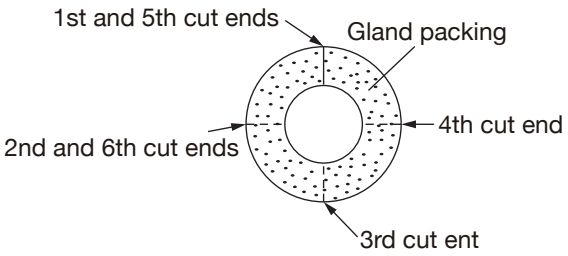
Pull out the rings carefully with a flat head screwdriver and so on, one at a time, to prevent scratching the inner surface of the stuffing box.

* For the W type (water filled gland type), a (metal) lantern ring is inserted between the packings. Carefully pull out the lantern ring to prevent scratching it.

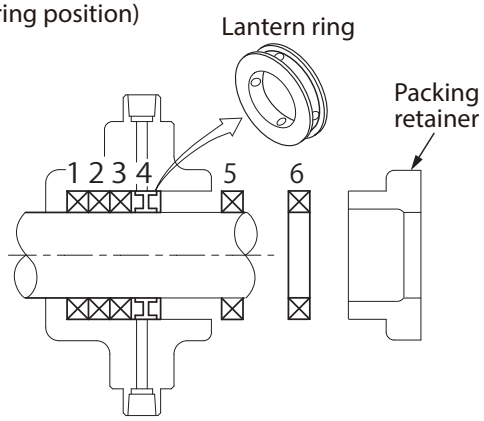
3 Once all the rings have been pulled out, flush the inside of the stuffing box or pump shaft, or the sliding surface of the shaft sleeve thoroughly. Check the sliding surface for wear or scratches. If it is remarkably worn out or scratched, replace the shaft sleeve with new one.

4 When replacing the shaft sleeve (if fitted)
Loosen the two hexagon socket set screws securing the shaft sleeve, and pull out the shaft sleeve. When pulling out the O-ring inside, be careful not to scratch it.





Water filled gland packing
(lantern ring position)



■ Assembly instructions (fitting)

For assembly, reverse the dismantling (pulling out) procedure.

1 With a shaft sleeve

① Prepare a new shaft sleeve. Fit the O-ring and lightly apply grease and so on inside in advance.

② Align the key of the pump shaft with the keyway of the shaft sleeve, and then insert the key.

③ Push the shaft sleeve into the pump shaft until it touches the far end of the pump shaft, and then fix it firmly with hexagon socket set screws (x2).

Note) The position of hexagon socket set screws for NFA-T125/T150 models and 2NFA-T100/T125 models is on the tip end side.

2 Fit gland packings (6 sheets per set). Prepare new packings. Set rings inside the stuffing box one at a time, carefully settle them uniformly, and then fit them.

* Shift the cut ends of the packings by 90° when inserting them.

* For NFA-T20/T32/T125/T150 F and S models and 2NFA-T20/T100/T125 F and S models, packings are paired with packing spacers. Fit in the order of a packing spacer and gland packing per ring.

3 Water filled gland packings (F/S types)
Be careful with the mounting position (4th position) of the lantern ring (5 sheets of packings + one lantern ring) to prevent blocking the water inlet.

4 Once you have fitted the gland packings, fit the packing retainer to the stuffing box, and then insert the pump shaft (or the shaft sleeve) of the bearing shell. Put a round bar through the stuffing box in advance. Push and turn the packings along the bearing outer rim to make it easy to insert them into the pump shaft, and then insert them in such a way that the positions of the left and right stud bolts are parallel.

5 Tighten the packing retainer temporarily with nuts (x2). Once inserted, tighten the packings thoroughly and uniformly, and then settle them inside the stuffing box. Then, loosen them again to tighten them to the extent you can retighten them with fingers.

6 Connect the joint unit to the pump shaft. Fit the ring spring to the groove of the drive yoke before connecting.

7 Fit the O-ring to the stuffing box side (or insert it into the groove securely), and then fit the pump body.

8 Fit the O-ring to the stator spacer side (or the groove), fit them to the pump body, and then fix them with hexagon bolts (x4) and spring washers (x4), or with a hexagon socket set screw.

9 Refer to the assembly instructions in the "Replacing the rotor and stator" section on page 41 and assemble the pump.

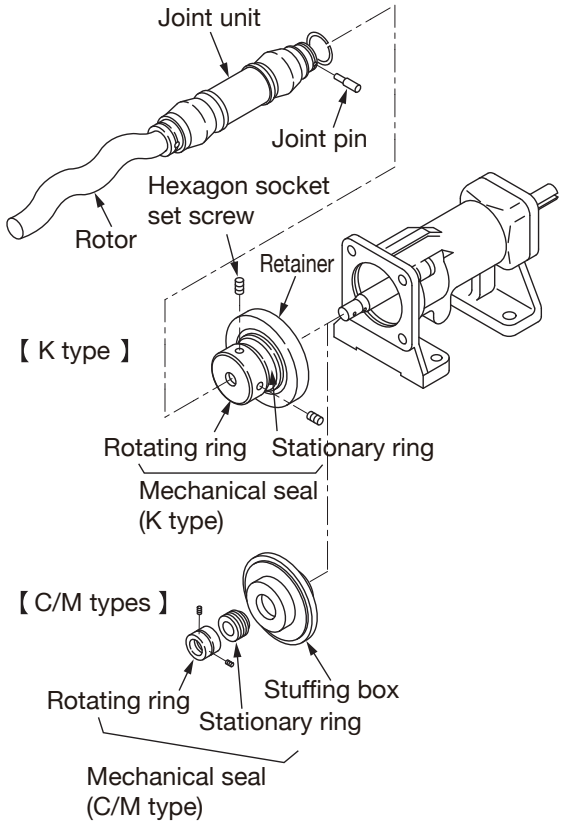
10 Retighten the gland packings.

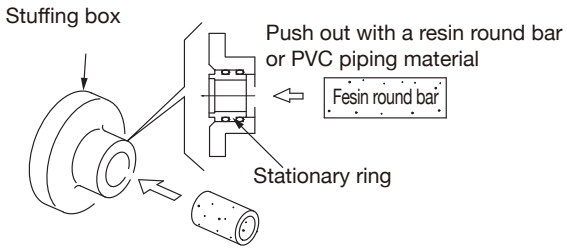
* Refer to the "Adjusting the tightening level of gland packings" on page 35 to retighten the packings during break-in operation.

4-4-2. Mechanical seal [K/C/M] types

■ Dismantling and assembly instructions

- A mechanical seal is a precision mechanical component. Do not apply impact to it.
- After dismantling, perform inspection and flushing carefully, and then remove foreign materials and/or adhered substances.
- Clean the sealing surface and check for foreign materials and so on again before assembly. If oil is adhered, remove it completely before assembly.
- Assemble the seal carefully to prevent adhering hand oil marks or fingerprints.





■ Dismantling procedure

1 Refer to the "Replacing the rotor and stator" section on page 40 to remove the pump body.

2 Drive the joint pin connecting the pump shaft to the joint unit or universal joint, and then pull out the rotor (with the universal joint).

3 Loosen the hexagon socket set screws (x2) on the mechanical rotating ring, and then pull the pump shaft.

* NFA-T125/T150 models and 2NFA-T100/T125 models are fitted with a stop pin (inside). Simply pull it out.

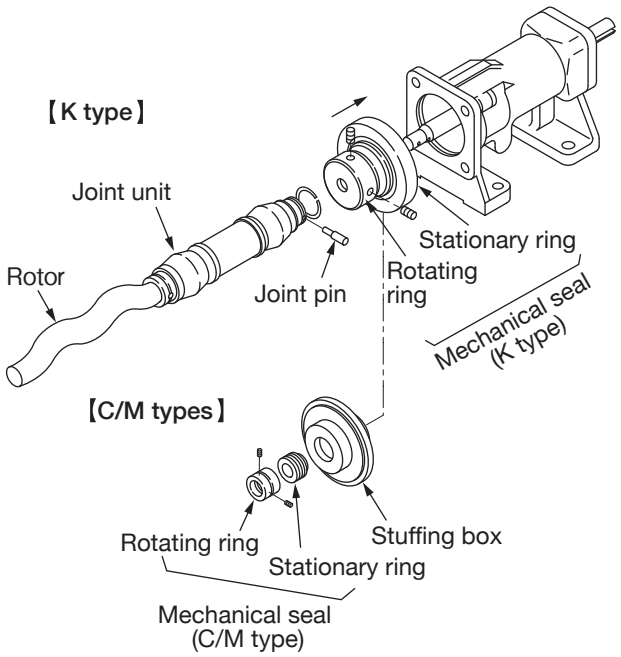
4 Pull out the stationary ring (along with the retainer or stuffing box) slowly and carefully.

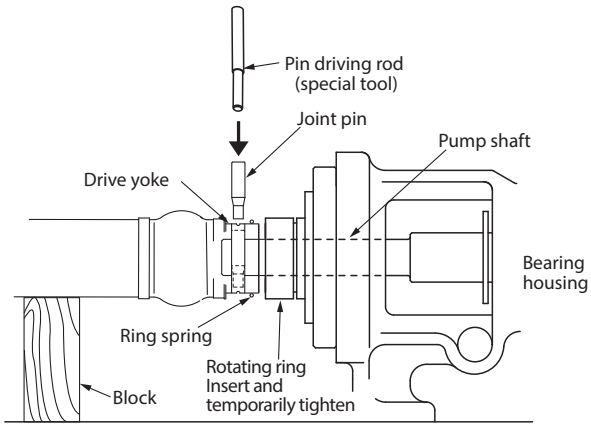
* For C and M types, pull out the stationary ring from inside the stuffing box.

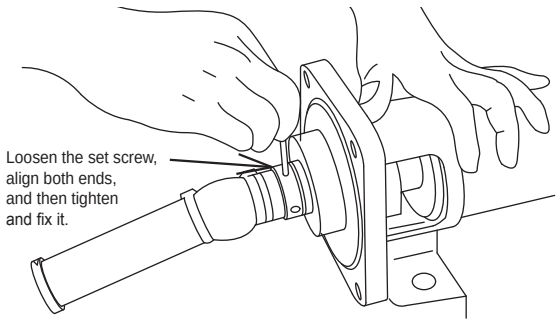
Push out the stationary ring from the back of the stuffing box with a resin round bar or PVC piping material having a flat end small enough to fit into the hole.

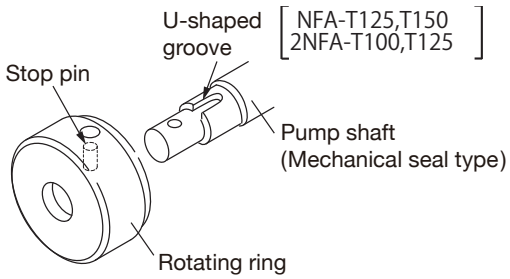
5 After pulling out the stationary ring, clean the area into which the pump shaft is inserted. Especially when the O-ring contact surface is rusted and scratched, repair the surface carefully with fine sandpaper.

* If uneven areas are found on the contact surface during the repair due to corrosion and so on, replace the pump shaft with new one.









■ Assembly instructions

For assembly, reverse the dismantling procedure.

1 Clean the sliding surfaces of the rotating and stationary rings and apply fresh water to the sliding surfaces and O-ring parts.

2 Insert the stationary ring (integrated with a retainer) into the pump shaft.

For C and M types, insert the stationary ring into the stuffing box in advance.

Note) When inserting the stationary ring into the stuffing box, place a clean, soft waste cloth over the O-ring sliding surface to prevent scratching it, and then push the stationary ring straight into the stuffing box. If you forcibly push in the skewed stationary ring, this may cause damage to the stationary ring.

3 Insert the rotating ring into the pump shaft, and then fit the joint unit (or the universal joint).

● NFA-T20 to T100 and 2NFA-T20 to T80 models

① Tighten and temporarily fix a hexagon socket set screw (at one position) while keeping the rotating ring pressed against the bearing housing.

② Align the joint unit with the pin driving hole of the pump shaft, drive the joint pin, and then insert the ring spring into the groove of the drive yoke.

③ Loosen the temporarily fixed hexagon socket set screw, and then retighten and fix it completely (at two locations).

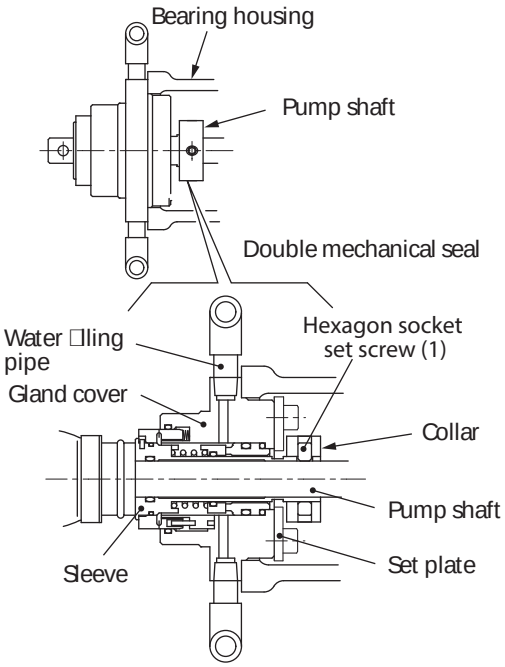
Note) When driving the joint pin, be careful not to accidentally hit the mechanical seal, joint unit or rubber cover.

●NFA-T125/T150 models and 2NFA-T100/T125 models

① Align the position of the stop pin inside the rotating ring with the U-shaped groove of the pump shaft, press it against the bearing housing side, and then fit the universal joint to the pump shaft.

② Align the position of the joint pin with the hole, drive the joint pin, and then insert the ring spring into the groove of the drive yoke.

4-4-3. Double mechanical seal [QX] types



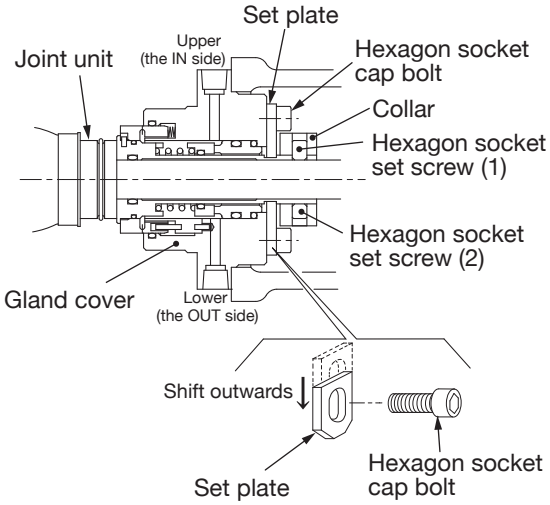
■ Dismantling procedure

1 Loosen the hexagon socket set screws (x 2).
Loosen the hexagon socket set screws (1) (x 2) securing the sleeve of the mechanical seal and pump shaft.

* If a set plate is fitted, insert it into the groove of the sleeve before loosening the screws.

2 Pull out the mechanical seal set from the pump shaft.

3 Clean the removed mechanical seal and other components, and then check for scratches, wear and the like on the sliding surface. If remarkable wear or defect is found, replace them with new ones.



■ Assembly instructions

1 Fit the water filling pipe to the new mechanical seal in advance. Wrap a sufficient amount of sealing tape around the pipe, and then fit the pipe to the water inlet of the gland cover (the IN and OUT sides).

2 Insert the mechanical seal into the pump shaft.
Fit it in such a way that the water inlet is vertically positioned.

3 Fit the joint unit or universal joint to the pump shaft. Refer to the "Replacing the joint unit and universal joint" section on page 42 to fit it.

4 Align the position of the pin driving hole, and then drive the joint pin with a driving rod to fit it.

5 Fix the collar of the mechanical seal to the sleeve. Tighten and fix the hexagon socket set screws (2) (x 2).

6 Fix the collar of the mechanical seal to the pump shaft. Tighten and fix the hexagon socket set screws (1) (x 2).

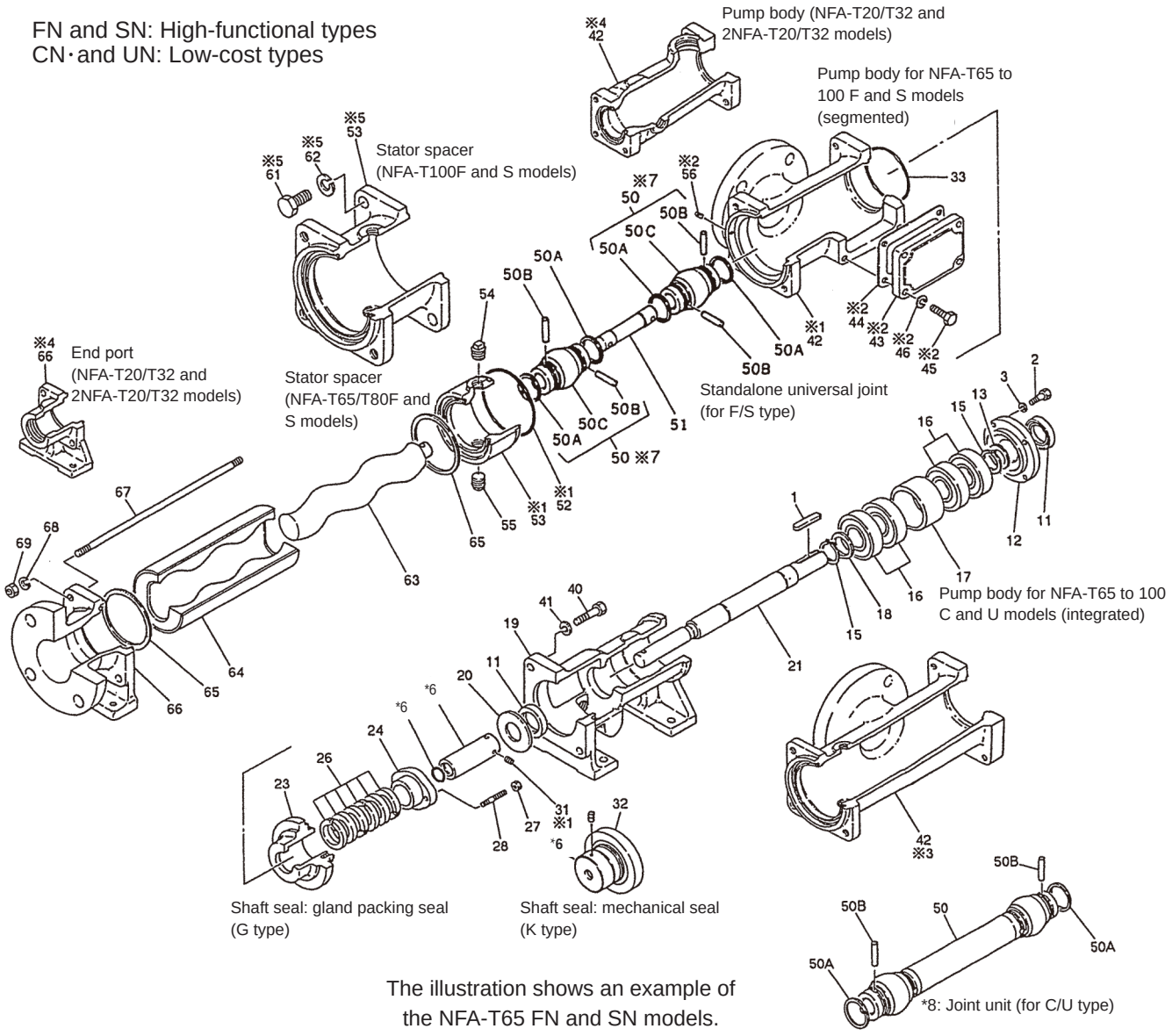
7 Shift the set place outwards. Loosen the hexagon socket set screws (x 2), remove the set place (for registration) from the groove of the sleeve, and then fix the screws. Or, remove and store the screws. (End of assembly)

5. Names and structures of the main parts

For easy explanation of each part and structure, all the components are shown when removed from the pump in the illustration. Dismantle the pump within the scope specified in the "4. Dismantling and assembly" section on page 38.

■ NFA-T20 to T100 FN and SN models
2NFA-T20 to T80 FN/SN and CN/UN models

FN and SN: High-functional types
CN・and UN: Low-cost types



The illustration shows an example of the NFA-T65 FN and SN models.

*1. Stator spacer (screw fixed): For high-functional types. Fitted as a standard component to high-functional pump sizes 65A and 80A.

*2. With a side cover: For high-functional types. Fitted to pump sizes greater than 50A.

*3. Pump body (integrated): For low-cost types. Single stage (sizes from 20A to 100A), Two stage (sizes from 20A to 50A only)

*4. Pump body (screw connected): Only NFA-T20/T32 and 2NFA-T20/T32 models are connected using Rc screws.

*5. Stator spacer (bolt connected): For high-functional types. Pump sizes greater than 100A are bolt connected.

*6. With a shaft sleeve: Fitted as a standard component to high-functional gland packing pumps.

*7. Standalone universal joint: For high-functional types.

*8. Joint unit: For low-cost types. Single stage pumps only. *7 and *8 can be replaced with custom-made items.

■ NFA-T20 to T100 (a single stage)

No.	Name	Quantity	Material Note 1				Model					
			FN	CN	SN	UN	NFA-T20	NFA-T32	NFA-T50	NFA-T65	NFA-T80	NFA-T100
1	Key	1	S45C				5×5×35L, with one round end and one square end	5×5×35L, with one round end and one square end	6×6×40L, with one round end and one square end	8×7×50L	10×8×60L	10×8×70L
2	Hexagon bolt	4	Steel				M6×20L	M6×20L	M6×20L	M6×25L	M8×25L	M10×25L
3	Spring washer	4	Steel				M6	M6	M6	M6	M8	M10
11	Oil seal	2	NBR				VC17355	VC17355	VC20405	VC30505	VC35555	VC40625
12	Bearing cover	1					FC250	FC250	ADC12	FC200	FC200	FC200
13	Bearing cover gasket	1	NBR									
15	Retainer ring	2	SWRH				S-17	S-17	S-20	S-30	S-35	S-40
16	Bearing						6303ZZ (x2)	6303ZZ (x4)	6304ZZ (x4)	6306ZZ (x4)	6307ZZ (x4)	6308ZZ (x4)
17	Bearing spacer	1										
18	Spacer	1										
19	Bearing housing	1	FC250									
20	Slinger	1	NBR									
21	Pump shaft	1	S45C		SUS304							
23	Stuffing box Note 2	1	FC250		SCS13							
24	Packing retainer Note 2	1	FC250		SCS13							
25	Packing spacer Note 2 Note 4	1 set	PTFE	–	PTFE	–						
26	Gland packing Note 2	1 set	PTFE (teflon) impregnated carbon fiber									
27	Hexagon nut Note 2	2	Stainless steel				M6	M6	M6	M6	M6	M6
28	Stud bolt Note 2	2	SUS 304 equivalent				6×40 12/14	6×40 12/14	6×44 12/13	6×44 12/13	6×44 12/23	6×44 12/23
29	Shaft sleeve Note 2, Note 4	1	S45C	–	SUS304	–						
30	O-ring Note 2, Note 4	1	NBR	–	NBR	–			P-16	P-22	P-26	P-32
31	Hexagon socket set screw Note 2, Note 4	2	Stainless steel	–	Stainless steel	–			65	6×5	6×5	6×5
32	Mechanical seal Note 3	1	Super hard metal alloy									
33	O-ring	1	NBR				G-60	G-60	G-60	G-80	G-80	G-100
40	Hexagon bolt	4	Steel				M8×45L	M8×45L	M8×50L	M10×55L	M12×60L	M16×60L
41	Spring washer	4	Steel				M8	M8	M8	M10	M12	M16
42	Pump body	1	FC250		SCS13							
43	Side cover Note 4	1	FC250	–	SUS304	–						
44	Side cover gasket, Note 4	1	NBR	–	NBR	–						
45	Hexagon bolt Note 4		Steel	–	Steel	–			M8×25L (x4)	M10×35L (x4)	M10×35L (x6)	M10×35L (x6)
46	Spring washer, Note 4		Steel	–	Steel	–			M8 (x4)	M10 (x4)	M10 (x6)	M10 (x6)
50	Joint unit Note 5	1	–	S45C NBR	–	SUS304 NBR						
50C	Standalone universal joint Note 6	2	S45C NBR	–	SUS316 NBR	–						
50A	Ring spring Note 7	2	SUS316 Note 8									
50B	Joint pin Note 7	2	SUS316 Note 8									
51	Rod Note 6	1	S45C	–	SUS304	–						
52	O-ring Note 6	1	NBR	–	NBR	–				G-105	G-125	G-145
53	Stator spacer Note 6	1	FC250	–	SCS13	–						
54	Plug	1	SUS 304 equivalent				10A	10A	10A	15A	15A	15A
55	Plug	1	SUS 304 equivalent				10A	10A	10A	15A	25A	25A
56	Hexagon socket set screw Note 6	1	Stainless steel	–	Stainless steel	–				4×6L	4×6L	
61	Hexagon bolt Note 6	4	Steel	–	Steel	–						M16×40L
62	Spring washer Note 6	4	Steel	–	Steel	–						M6
63	Rotor	1	Metal alloy		SUS304							
64	Stator	1	NBR									
65	Stator gasket	2	NBR									
66	End port	1	FC250		SCS13		Rc3/4 (female screw)	Rc 1 1/4 (female screw)	JIS 10K 50A	JIS 10K 65A	JIS 10K 80A	JIS 10K 100A
67	Stud bolt	4	SS400				6×115 10/10	8×145 15/15	8×220 18/18	10×340 20/20	12×460 23/23	16×380 20/20
68	Spring washer	4	Steel				M6	M8	M8	M10	M12	M16
69	Hexagon nut	4	Steel				M6	M8	M8	M10	M12	M16

Note 1. FN: High-functional cast iron types CN: Low-cost cast iron types SN: High-functional stainless types
UN: Low-cost stainless types

Note 2. Gland packing seal types only
Note 3. Mechanical seal types only
Note 4. For high-functional and gland packing types
Note 5. For low-cost types
Note 6. For high-functional types
Note 7. For high-functional types and standalone universal joints, quantity is 4.
Note 8. Material for 2NFA-T20/T32 low-cost types is SUS304.

■ 2NFA-T20 to T80 (two stage)

No.	Name	Quantity	Material Note 1				Model				
			FN	CN	SN	UN	2NFA-T20	2NFA-T32	2NFA-T50	2NFA-T65	2NFA-T80
1	Key	1	S45C				5×5×35L	6×6×40L	8×7×50L	10×8×60L	10×8×70L
2	Hexagon bolt	4	Steel				M6×20L	M6×20L	M6×25L	M8×25L	M10×25L
3	Spring washer	4	Steel				M6	M6	M6	M8	M10
11	Oil seal	2	NBR				VC17355	VC20405	VC30305	VC35555	VC40625
12	Bearing cover	1					FC250	ADC12	FC200	FC200	FC200
13	Bearing cover gasket	1	NBR								
15	Retainer ring	2	SWRH				S-17	S-20	S-30	S-35	S-40
16	Bearing						6303ZZ (x2)	6304ZZ (x4)	6306ZZ (x4)	6307ZZ (x4)	6308ZZ (x4)
17	Bearing spacer	1									
18	Spacer	1									
19	Bearing housing	1	FC250								
20	Slinger	1	NBR								
21	Pump shaft	1	S45C		SUS304						
23	Stuffing box Note 2	1	FC250		SCS13						
24	Packing retainer Note 2	1	FC250		SCS13						
25	Packing spacer Note 2, Note 4	1set	PTFE	–	PTFE	–					
26	Gland packing Note 2, Note 4	1 set	PTFE (teflon) impregnated carbon fiber								
27	Hexagon nut Note 2	2	Stainless steel				M6	M6	M6	M6	M6
28	Stud bolt Note 2	2	SUS 304 equivalent				6×40 12/14	6×44 12/23	6×44 12/13	6×44 12/13	6×44 12/23
29	Shaft sleeve Note 2, Note 4	1	S45C		SUS304						
30	O-ring Note 2, Note 4	1	NBR					P-16	P-22	P-26	P-32
31	Hexagon socket set screw Note 2, Note 4	2	Stainless steel					65	6×5	6×5	6×5
32	Mechanical seal Note 3	1	Super hard metal alloy								
33	O-ring	1	NBR				G-60	G-60	G-80	G-80	G-100
40	Hexagon bolt	4	Steel				M8×45L	M8×50L	M10×55L	M12×60L	M16×60L
41	Spring washer	4	Steel				M8	M8	M10	M12	M16
42	Pump body	1	FC250		SCS13						
43	Side cover	1	FC250		SUS304						
44	Side cover gasket	1	NBR								
45	Hexagon bolt		Steel						M10×35L (x4)	M10×35L (x4)	M10×35L (x6)
46	Spring washer		Steel						M10 (x4)	M10 (x4)	M10 (x6)
50	Joint unit Note 7	1	S45C/NBR		SUS304/NBR						
50C	Standalone universal joint Note 8	2	S45C NBR		SUS316/NBR						
50A	Ring spring Note 6	2	SUS316 Note 9								
50B	Joint pin Note 6	2	SUS316 Note 9								
51	Rod Note 4	1	S45C		SUS304						
52	O-ring Note 4	1	NBR							G-125	G-125
53	Stator spacer Note 4	1	FC250		SCS13						
54	Plug	1	SUS 304 equivalent				10A	10A	15A	15A	15A
55	Plug	1	SUS 304 equivalent				10A	10A	15A	25A	25A
56	Hexagon socket set screw Note 4	1	Stainless steel							4×6L	4×6L
63	Rotor	1	Metal alloy		SUS304						
64	Stator	1	NBR								
65	Stator gasket	2	NBR								
66	End port	1	FC250		SCS13		Rc3/4	Rc 1 1/4	JIS 10K 50A	JIS 10K 65A	JIS 10K 80A
67	Stud bolt	4	SS400				6×210 10/10	8×265 15/15	8×395 15/15	10×650 20/20	12×750 20/20
68	Spring washer	4	Steel				M6	M8	M8	M10	M12
69	Hexagon nut	4	Steel				M6	M8	M8	M10	M12

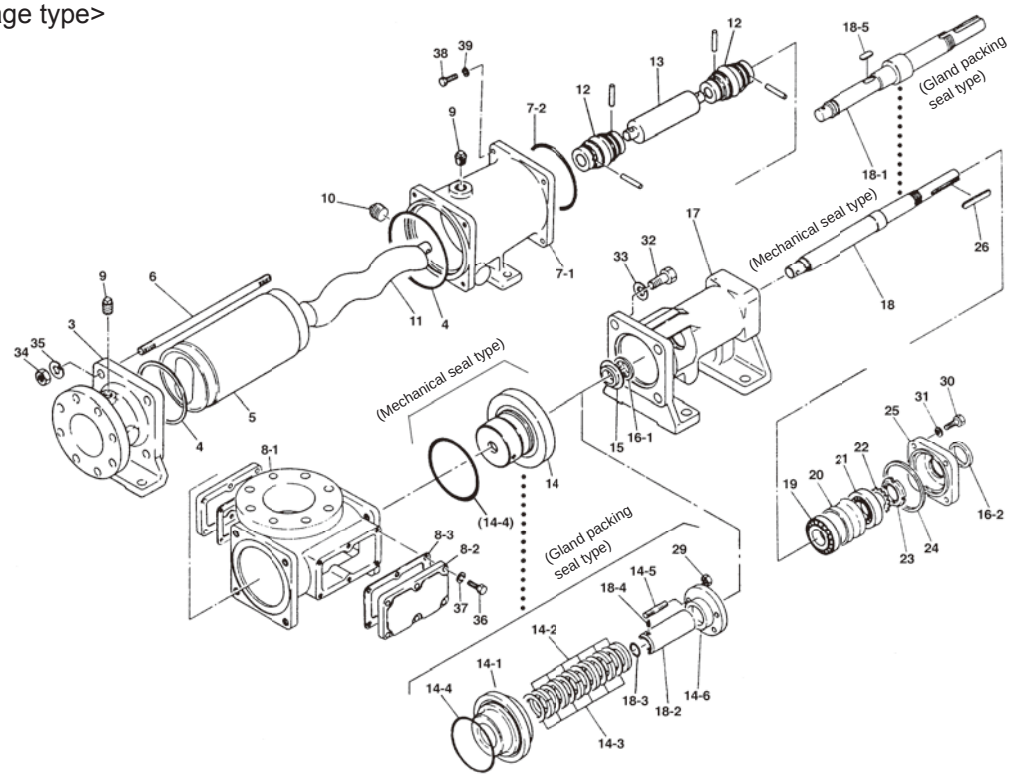
Note 1. FN: High-functional cast iron types CN: Low-cost cast iron types SN: High-functional stainless types
UN: Low-cost stainless types

Note 2. Gland packing seal types only
Note 3. Mechanical seal types only
Note 4. For high-functional and gland packing types
Note 5. For low-cost types
Note 6. For high-functional types and standalone universal joints, quantity is 4.
Note 7. For high-functional types
Note 8. For low-cost types
Note 9. Material for 2NFA-T20/T32 low-cost types is SUS304.

■ NFA-T125/T150F N and SN models

For easy explanation of each part and structure, all the components are shown when removed from the pump in the illustration. Dismantle the pump within the scope specified in the "4. Dismantling and assembly" section on page 38.

<Single stage type>



No.	Name	Quantity	Material		Model	
			FN	SN	NFA-T125	NFA-T150
3	End port	1	FC250	SCS13	JIS 10K 125A equivalent	JIS 10K 150A equivalent
4	Stator gasket	2	NBR			
5	Stator	1	NBR			
6	Stud bolt	4	SS400		M16	M16
7-1	Stator spacer	1	FC250	SCS13		
7-2	O-ring	1	NBR		G170	G230
8-1	Pump body	1	FC250	SCS13		
8-2	Side cover	2	FC250	SUS304		
8-3	Side cover gasket	2	NBR			
9	Plug	2	SUS 304 equivalent		15A	15A
10	Plug	1	SUS 304 equivalent		25A	25A
11	Rotor	1	Metal alloy	SUS304		
12	Universal joint	2 sets	S45C NBR	SUS316 NBR		
13	Rod	1	S45C	SUS304		
14	Mechanical seal Note 1	1	Super hard metal alloy NBR			
14-1	Stuffing box Note 2	1	FC250	SCS13		
14-2	Gland packing Note 2	1 sets	PTFE (teflon) impregnated carbon fiber			
14-3	Packing spacer Note 2	1 sets	PTFE			
14-4	O-ring Note 2	1	NBR		G130	G170
14-5	Stud bolt Note 2	4	SUS 304 equivalent		M10	M10
14-6	Packing retainer Note 2	1	FC250	SCS13		
15	Slinger	1	NBR			
16-1	Oil seal	1	NBR		φ60×φ82×6t	φ68×φ90×7t
16-2	Oil seal	1	NBR		φ45×φ62×7t	φ50×φ68×7t
17	Bearing housing	1	FC250			

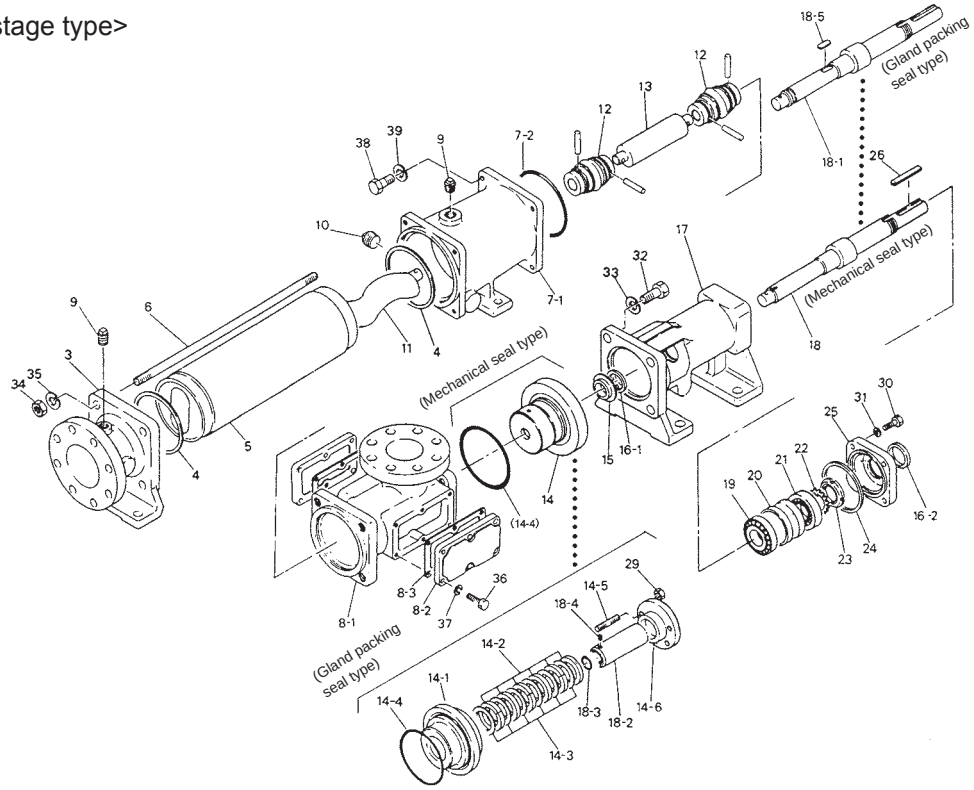
No.	Name	Quantity	Material		Model	
			FN	SN	NFA-T125	NFA-T150
18	Pump shaft Note 1	1	S45C	SUS304		
18-1	Pump shaft Note 2	1	S45C	SUS304		
18-2	Shaft sleeve Note 2	1	S45C	SUS304		
18-3	O-ring Note 2	1	NBR		P41	G55
18-4	Hexagon socket set screw Note 2	2	Stainless steel		M8×8L	M8×8L
18-5	Key Note 2	1	S45C		10×8×31.5L, with two round ends	15×10×50L, with two round ends
19	Bearing	1			4T-30310 D	4T-30311 D
20	Bearing spacer	1	FC250			
21	Bearing	1			4T-30310 D	4T-30311 D
22	Bearing washer	1			AW10	AW11
23	Bearing nut	1			AN10	AN11
24	Bearing cover gasket	1	NBR			
25	Bearing cover	1	FC250			
26	Key	1	S45C		12×8×100L, with one round end and one square end	12×8×130L, with one round end and one square end
29	Hexagon nut Note 2	4	Steel		M10	M10
30	Hexagon bolt	4	Steel		M12×45L	M12×35L
31	Spring washer	4	Steel		M12	M12
32	Hexagon bolt	4	Steel		M16×75L	M16×75L
33	Spring washer	4	Steel		M16	M16
34	Hexagon nut	4	Steel		M16	M16
35	Spring washer	4	Steel		M16	M16
36	Hexagon bolt	12	Steel		M10×35L	M12×35L
37	Spring washer	12	Steel		M10	M12
38	Hexagon bolt	4	Steel		M16×50L	M16×50L
39	Spring washer	4	Steel		M16	M16

Note 1. Mechanical seal types only Note 2. Gland packing seal types only

■ 2NFA-T100/T125 FN and SN models

For easy explanation of each part and structure, all the components are shown when removed from the pump in the illustration. Dismantle the pump within the scope specified in the "4. Dismantling and assembly" section on page 38.

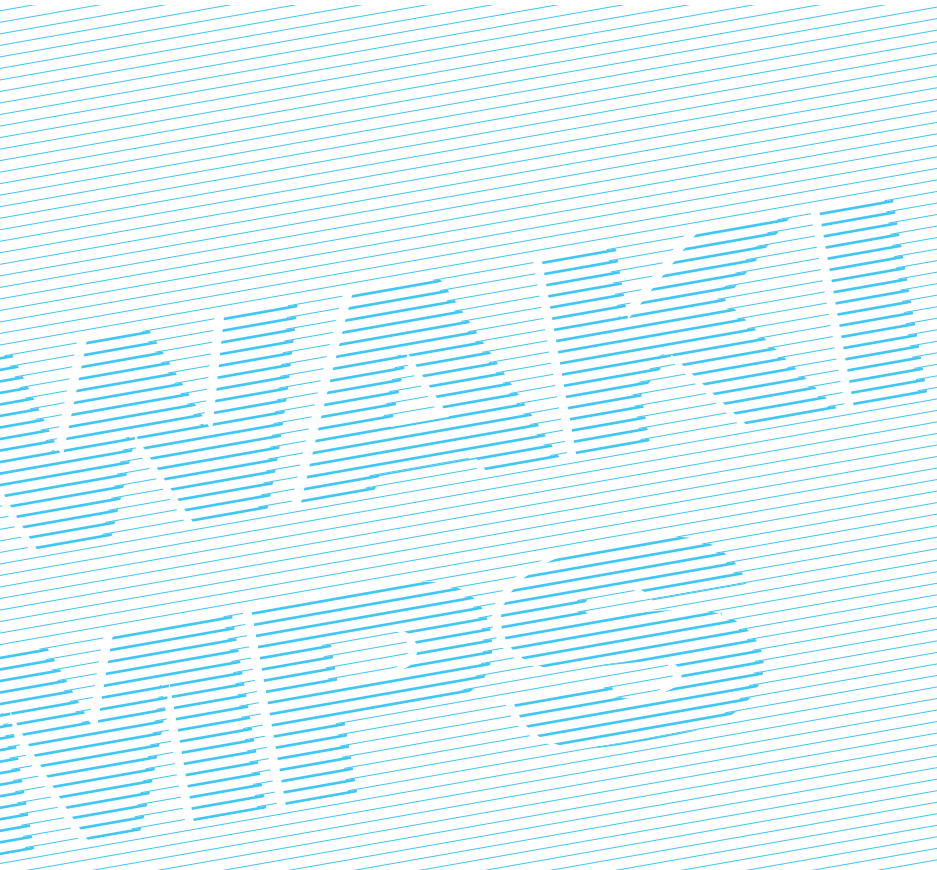
<Two stage type>



No.	Name	Quantity	Material		Model	
			FN	SN	NFA-T125	NFA-T150
3	End port	1	FC250	SCS13	JIS 10K 100A equivalent	JIS 10K 125A equivalent
4	Stator gasket	2	NBR			
5	Stator	2	NBR			
6	Stud bolt	4	SS400		M16	M20
7-1	Stator spacer	1	FC250	SCS13		
7-2	O-ring	1	NBR		G170	G210
8-1	Pump body	1	FC250	SCS13		
8-2	Side cover	2	FC250	SUS304		
8-3	Side cover gasket	2	NBR			
9	Plug	2	SUS 304 equivalent		15A	15A
10	Plug	1	SUS 304 equivalent		15A	25A
11	Rotor	1	Metal alloy			
12	Universal joint	2 sets	S45C-NBR	SUS316-NBR		
13	Rod	1	S45C	SUS304		
14	Mechanical seal Note 1	1	Super hard metal alloy NBR			
14-1	Stuffing box Note 2	1	FC250	SCS13		
14-2	Gland packing Note 2	1 sets	PTFE (teflon) impregnated carbon fiber			
14-3	Packing spacer Note 2	1 sets	PTFE			
14-4	O-ring Note 2	1	NBR		G130	G170
14-5	Stud bolt Note 2	4	SUS 304 equivalent		M10	M10
14-6	Packing retainer Note 2	1	FC250	SCS13		
15	Slinger	1	NBR			
16-1	Oil seal	1	NBR		φ68×φ82×6t	φ68×φ90×7t
16-2	Oil seal	1	NBR		φ45×φ62×7t	φ50×φ68×7t
17	Bearing housing	1	FC250			

No.	Name	Quantity	Material		Model	
			FN	SN	NFA-T125	NFA-T150
18	Pump shaft Note 1	1	S45C	SUS304		
18-1	Pump shaft Note 2	1	S45C	SUS304		
18-2	Shaft sleeve Note 2	1	S45C	SUS304		
18-3	O-ring Note 2	1	NBR		P41	G55
18-4	Hexagon socket set screw Note 2	2	Stainless steel		M8×8L	M8×8L
18-5	Key Note 2	1	S45C		10×8×31.5L, with two round ends	15×10×50L, with two round ends
19	Bearing	1			4T-30310 D	4T-30311 D
20	Bearing spacer	1	FC250			
21	Bearing	1			4T-30310 D	4T-30311 D
22	Bearing washer	1			AW10	AW11
23	Bearing nut	1			AN10	AN11
24	Bearing cover gasket	1	NBR			
25	Bearing cover	1	FC250			
26	Key	1	S45C		12×8×100L, with one round end and one square end	12×8×130L, with one round end and one square end
29	Hexagon nut Note 2	4	Steel		M10	M10
30	Hexagon bolt	4	Steel		M12×45L	M12×35L
31	Spring washer	4	Steel		M12	M12
32	Hexagon bolt	4	Steel		M16×75L	M16×75L
33	Spring washer	4	Steel		M16	M16
34	Hexagon nut	4	Steel		M16	M16
35	Spring washer	4	Steel		M16	M16
36	Hexagon bolt	12	Steel		M10×35L	M12×35L
37	Spring washer	12	Steel		M10	M12
38	Hexagon bolt	4	Steel		M16×50L	M16×50L
39	Spring washer	4	Steel		M16	M16

Note 1. Mechanical seal types only Note 2. Gland packing seal types only



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