



# Precision Reduction Gear **RV**<sup>TM</sup>

## High Precision Gearhead

### ***RH Series***

## Operation Manual

<Applicable model>

RH-□E

RH-□C

RH-□N

□ above indicates the torque code (number).

For the applicable models, refer to "Model" indicated on the shipping label of the product.

This manual must be thoroughly read and understood before using the product.

Be sure to deliver this operation manual to the system manager and the person in charge of the operation.

Keep this manual in the specified location so that it can be immediately referred to whenever necessary.

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**Contact information**

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# Important Information

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## 1. Intended use of this product

This product was designed and manufactured as a reduction gear that decelerates the rotation of the motor and transmits the rotational torque. Do not use this product for other purposes.



- Do not modify the reduction gear or use it outside its specified range. Failure to do so could cause injury or damage to the reduction gear.
  - The specifications indicated in the specification sheet are based on Nabtesco evaluation methods. This product should only be used after confirming that it is appropriate for the operating conditions of your system. Failure to do so could cause injury or damage to the reduction gear.
- 

## 2. Rules to ensure safe use of this product

It is impossible for Nabtesco Corporation (referred to as “Nabtesco” hereafter) to foresee any potential hazards related to this product and hazards caused by human errors or peripheral devices.

There are also various points that must be observed and operations that are prohibited in relation to the use of this product, but it is also impossible to note all of them in this manual.

For this reason, it is necessary to take appropriate safety measures when operating this product, in addition to the points noted in this manual.

The particularly important information for safe handling of this product is noted below. This information applies to all workers involved, including the manager and supervisor of this product.

The “procedures” referred to in this manual indicate all the acts performed on this product during transportation, installation, operation, and maintenance/inspection.

### **Be sure to read this manual**

Before using this product, thoroughly read this manual and understand all the content of this manual. Also, observe the safety precautions described in this manual.

### **Conditions for workers**

- The worker must have a fundamental knowledge of this product
- The worker must be aware of the potential hazards of this product and have adequate knowledge to avoid hazardous situations
- The worker must be able to take appropriate measures to avoid hazardous situations

**Observe the relevant laws, regulations, ordinances, and bylaws.**

Observe the relevant laws, regulations, ordinances, and bylaws enacted by the related countries and local governments.

**Prevention of accidents**

- To prevent accidents, do not perform any procedures not noted in this manual. Also, do not use this product for any purposes other than those noted at the beginning of this manual.
- If any abnormalities are found, take appropriate measures immediately to prevent any accidents, serious injury, or damage.
- Everyone, including workers and supervisors, must voluntarily take measures to ensure safety and well-being, as this can prevent accidents.

**3. Sharing of hazard information with users**

When selling or transferring this product embedded in a device, etc., hand this manual to the person who actually uses or manages the device (the person/group in charge). Or, add the necessary information concerning handling and maintenance procedures for preventing the accidents and failures described in this manual to the contents of the operation manual of the device.

**4. Product disposal**

When disposing of this product, drain the lubricant completely and handle it according to the ordinances of the local government and entrust the disposal to an industrial waste disposal specialist.

**5. Other important notes**

It is strictly prohibited to reverse-engineer the internal parts of this product.

# About This Manual

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## 1. Users of this manual

This manual is intended for native speakers of English. If this product is operated by non-native speakers of English, the customer is responsible for conducting safety training and giving operation instructions to those workers.

## 2. Copyrights

The copyright for this manual belongs to Nabtesco Corporation. Unauthorized reprinting, reproduction, copying, or translation of this manual in whole or in part is strictly prohibited.

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# Warranty

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1. In the case where Nabtesco confirms that a defect of the Product was caused due to Nabtesco's design or manufacture within the Warranty Period of the Product, Nabtesco shall repair or replace such defective Product at its cost. The Warranty Period shall be from the delivery of the Product by Nabtesco or its distributor to you ("Customer") until the end of one (1) year thereafter, or the end of two thousand (2,000) hours running of the Product installed into Customer's equipment, whichever comes earlier.
  
2. Unless otherwise expressly agreed between the parties in writing, the warranty obligations for the Product shall be limited to the repair or replacement set forth herein. **OTHER THAN AS PROVIDED HEREIN, THERE ARE NO WARRANTIES ON THE PRODUCT, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.**
  
3. The warranty obligation under Section 1 above shall not apply if:
  - a) the defect was caused due to the use of the Product deviated from the Specifications or the working conditions provided by Nabtesco;
  - b) the defect was caused due to exposure to foreign substances or contamination (dirt, sand, etc.)
  - c) lubricant or spare part other than the ones recommended by Nabtesco was used in the Product;
  - d) the Product was used in an unusual environment (such as high temperature, high humidity, a lot of dust, corrosive/volatile/inflammable gas, pressurized/depressurized air, under water/liquid or others except for those expressly stated in the Specifications);
  - e) the Product was disassembled, re-assembled, repaired or modified by anyone other than Nabtesco;
  - f) the defect was caused due to the equipment into which the Product was installed;
  - g) the defect was caused due to an accident such as fire, earthquake, lightning, flood or others; or
  - h) the defect was due to any cause other than the design or manufacturing of the Product.
  
4. The warranty period for the repaired/replaced Product/part under Section 1 above shall be the rest of the initial Warranty Period of the defective Product subjected to such repair/replace.

# Glossary

## Rated service life

The lifetime resulting from the operation with the rated torque and the rated output speed is referred to as the “rated service life”.

## Allowable acceleration/deceleration torque

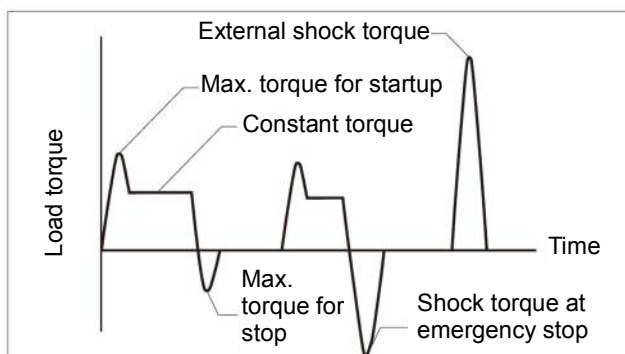
When the machine starts or stops, the load torque to be applied to the reduction gear is larger than the constant-speed load torque due to the effect of the inertia torque of the rotating part. In such a situation, the allowable torque during acceleration/deceleration is referred to as “allowable acceleration/deceleration torque”.

Note: Be careful that the load torque, which is applied at startup and stop, does not exceed the allowable acceleration/deceleration torque.

## Momentary maximum allowable torque

A large torque may be applied to the reduction gear due to execution of emergency stop or by an external shock. In such a situation, the allowable value of the momentary applied torque is referred to as “momentary maximum allowable torque”.

Note: Be careful that the momentary excessive torque does not exceed the momentary maximum allowable torque.



## Allowable output speed

The allowable value for the reduction gear’s output speed during operation without a load is referred to as the “allowable output speed”.

Note: Depending on the conditions of use (duty ratio, load, ambient temperature), the reduction gear surface temperature may exceed 60°C even when the speed is under the allowable output speed. In such a case, either take cooling measures or use the reduction gear at a speed that keeps the surface temperature at 60°C or lower.

## Allowable moment and maximum thrust load

The external load moment or thrust load may be applied to the reduction gear during normal operation. The allowable values at this time are referred to as “allowable moment” and “maximum thrust load” respectively.

Note 1: The above specification values are noted in the catalog or separately provided specification sheet.

Note 2: The “reduction gear” described in this manual indicates the precision gearhead RH series of the product.



## Chapter 1 About safety

The safety precautions noted in this chapter should be used as guidelines to prevent injury of workers who perform transportation, installation, operation, and maintenance of this product, as well as damage to the product.






### 1.1. About warnings

This manual alerts workers to hazardous situations and precautions related to this product in the following manner:

1. Safety regulations are described in Chapter 1 “About safety” in this manual
2. Warning statements are noted in this manual

### 1.2. Type and indication of warning

Warnings for potential hazards during operation are given according to the following four categories in this manual. If you fail to observe these warning statements, it could result in lethal injury or serious damage and malfunction of the product.

 <b>DANGER</b>	Indicates a hazardous situation that, if not avoided, is highly likely to result in death or serious injury.
 <b>WARNING</b>	Indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury.
 <b>CAUTION</b>	Indicates a potentially hazardous situation that, if not avoided, could result in minor or moderate injury.
 <b>Note</b>	Indicates a potentially hazardous situation that, if not avoided, could result in physical damage.
 <b>Important</b>	Provides important information for correct use of this product, as well as supplemental explanation for the main body of the text or other information that helps to prevent erroneous operation.

### 1.3. General precautions

This section describes general precautions for safe use of this product. For precautions concerning transportation, installation, operation, maintenance, and inspection, be sure to confirm the contents of the relevant chapter.

---

**! WARNING**

- Do not modify or disassemble the reduction gear in a manner not described in this manual. Failure to do so could cause injury or damage to the reduction gear.
  - Transportation, installation, operation, maintenance, and inspection of the reduction gear must be performed by personnel who fully understand this manual. The person in charge of the operation and manager of the reduction gear must not allow anyone without an understanding of the contents of this manual to operate it. Failure to do so could cause injury or damage to the reduction gear.
  - Do not put your fingers or any object into the opening of the reduction gear. If a belt or chain is used for connection of the drive sections, do not put your fingers or any object into the clearance of the protective cover, etc., as it could cause injury.
  - If any abnormalities or damage to the reduction gear are found, stop the operation immediately. Incorrect motion could cause injury.
- 

**! CAUTION**

- The reduction gear could become extremely hot during operation. After stopping the operation, never touch the reduction gear until it is completely cooled. Touching the reduction gear could cause burns.
  - Handle the lubricant according to the instructions given in this manual. Failure to do so could impair your health.
- 

**Note**

- This reduction gear may not be filled with lubricant, depending on the customer's specifications. For such product, fill it with an appropriate amount of Nabtesco-recommended lubricant before use. Failure to do so could cause damage to the reduction gear.
  - Return the tools and other necessary items to the specified location after use. If a tool, bolt, nut, or other foreign object is trapped in the system, it could cause damage to the reduction gear.
  - Avoid excessive impact or vibration of the reduction gear. Failure to do so could cause damage to the reduction gear.
-

## Chapter 2 Product overview

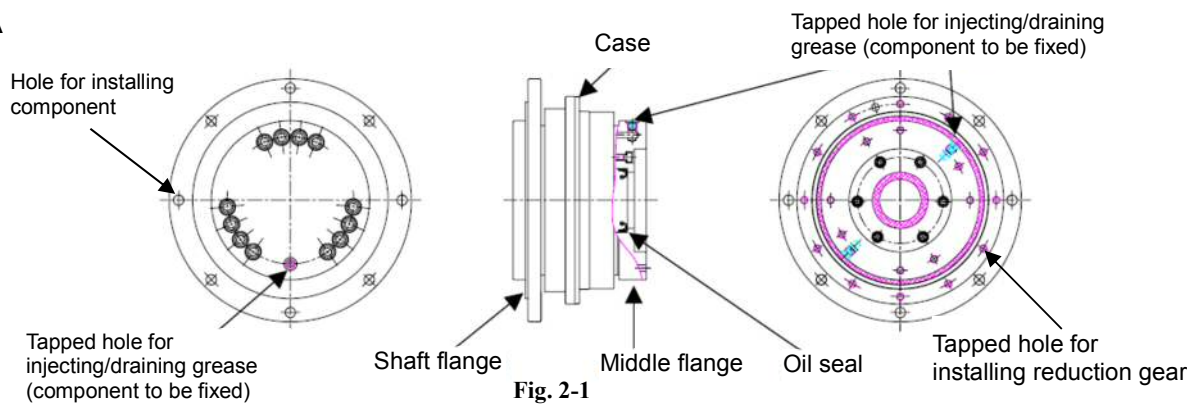
This chapter describes an overview of this product.

### 2.1. Name of each section

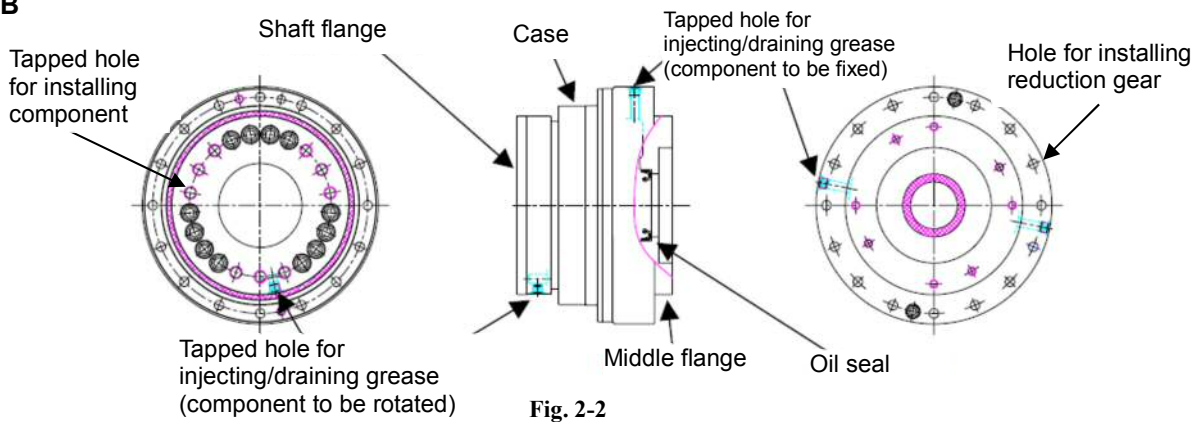
This section provides an explanation of the name of each section.

- If the shape of the actual section differs from the illustration below, refer to the separately provided “Outer dimensions” drawings and specification sheet.

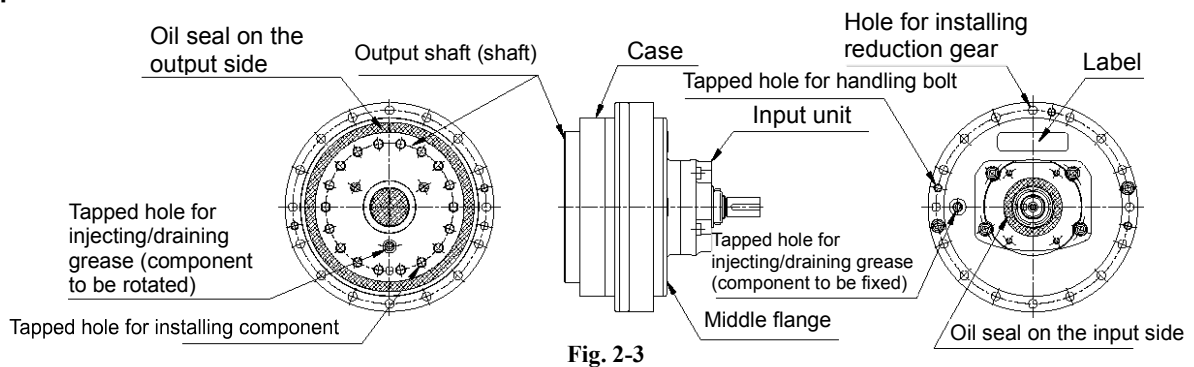
#### Type A



#### Type B



#### Type C



**Type D**

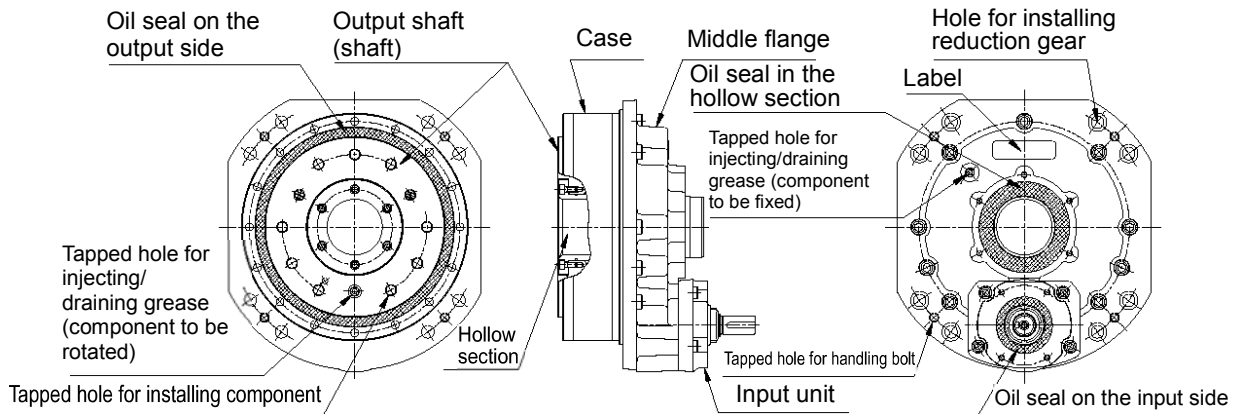


Fig. 2-4

**Type E**

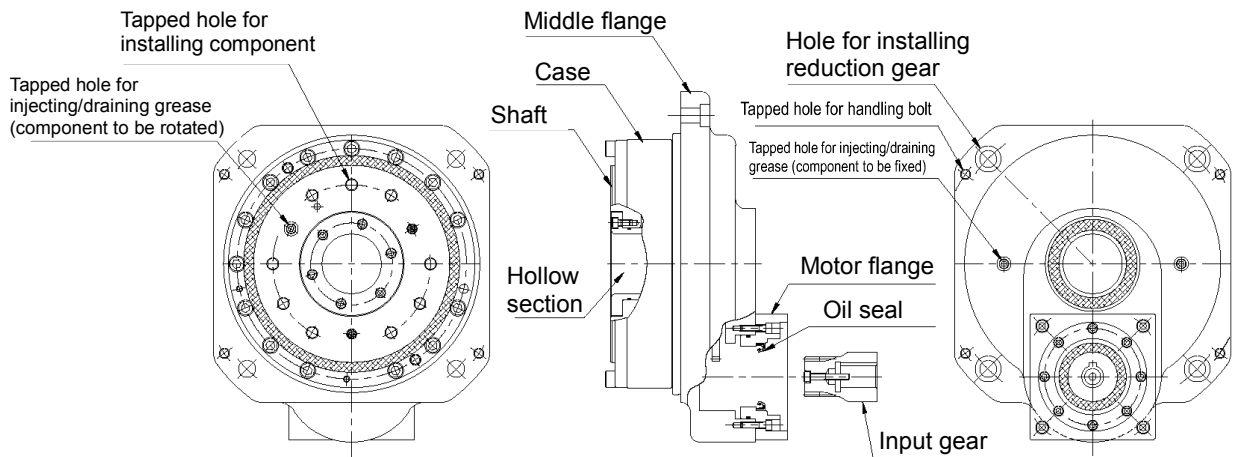


Fig. 2-5

**Type F**

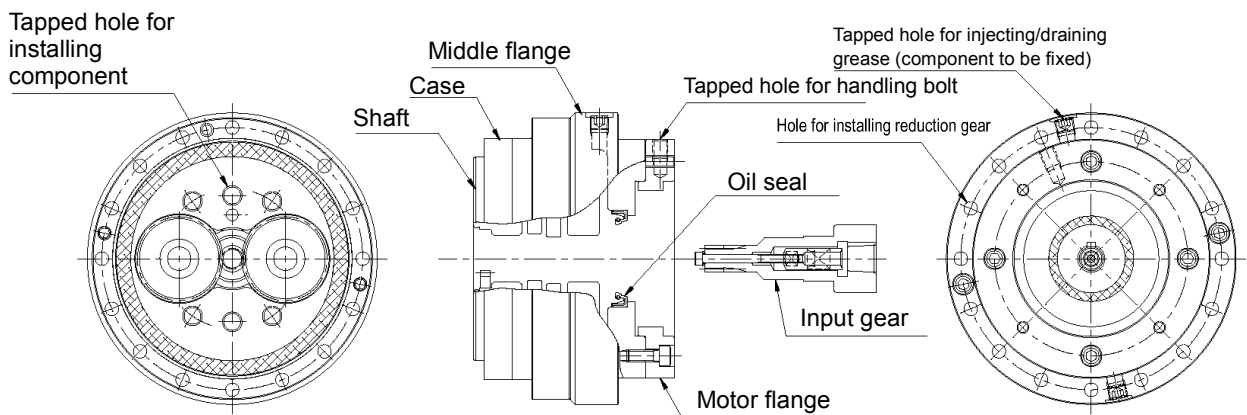


Fig. 2-6

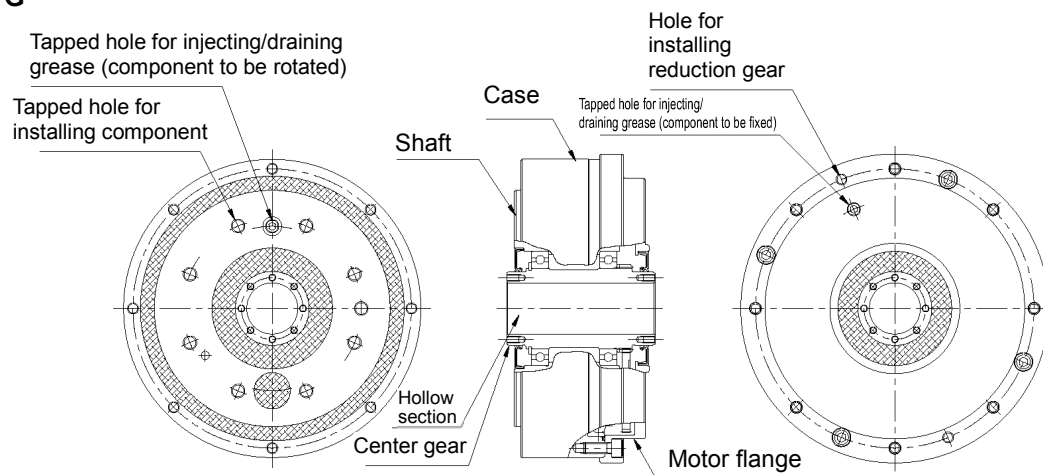
**Type G**

Fig. 2-7

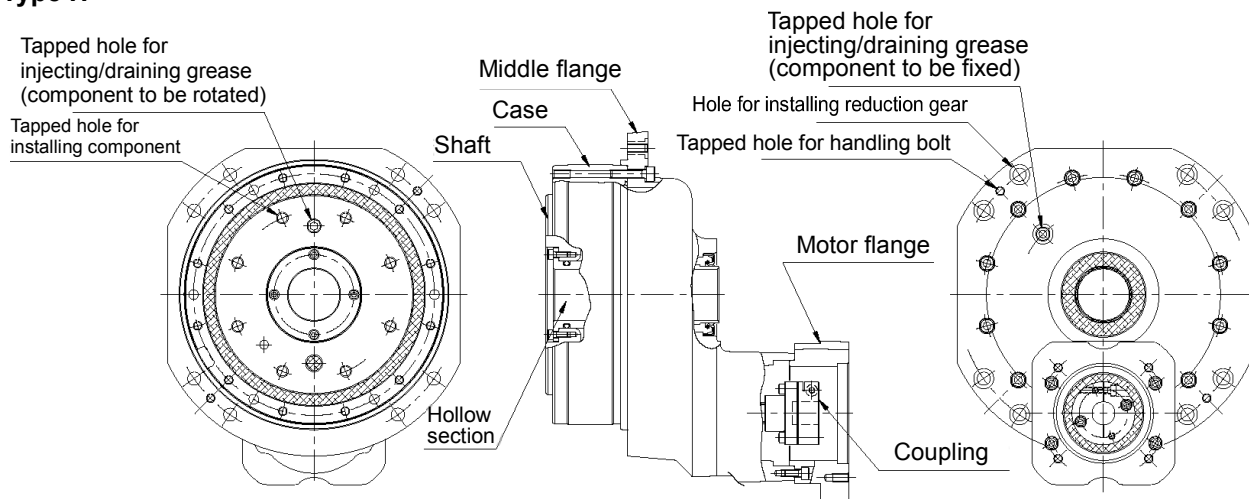
**Type H**

Fig. 2-8

**Important**

- The shape of the reduction gear may differ from the illustration depending on the ordered specifications.

## Chapter 3 Transportation and storage of product

This chapter describes the transportation and storage of this product.

### 3.1. Transportation

- Transport the product in an appropriate manner according to the weights indicated in the separately provided “Outer dimensions” drawings and specifications.
- If the reduction gear needs to be lifted after unpacking, also refer to “4.4 Lifting of this product”.
- Do not stack the packing boxes containing this product too high.
- Avoid excessive impact or vibration of the reduction gear.



- 
- If the packing boxes containing the reduction gear are stacked too high during transportation, they may collapse and fall down, causing injury or damage to the reduction gear.
- 

#### Note

- 
- Applying excessive impact or vibration to the reduction gear could cause damage to the reduction gear.
- 

#### Important

- 
- Each weight listed in the separately provided “Outer dimensions” drawings and specification sheet, indicates the weight of the reduction gear only. It does not include the weight of the packing box or optional parts, etc.
-

### 3.2. Storage

To avoid rust, corrosion, or deterioration of the sealing material, etc., and collapse of stored packing boxes, store the product in the following location.

- Location where the ambient temperature is between -10°C to 40°C.
- Location where the humidity is less than 85% and no condensation occurs
- Location that is not directly affected by wind and rain
- Location that is free from combustible/volatile/corrosive gas or dust.
- Stable location that is free from any danger of collapse
- Location with little vibration



- 
- When storing the reduction gears, do not stack too many packing boxes. They may collapse and fall down, causing injury or damage to the reduction gear.
- 

#### Note

- 
- Store the reduction gear under the same conditions as those before unpacking. If it is left upside down, it could cause damage to the reduction gear.
  - Although the reduction gear is coated with rust prevention oil before shipping, it is not designed for long-term storage. If it is stored for a long period, check the condition of the reduction gear periodically and perform rust prevention treatment as necessary. If rust occurs, it could cause the leakage of lubricant or premature damage to the reduction gear.
  - If the reduction gear is used or operated after it has not been used for a long period of time, confirm that it is free from rust or corrosion and that the sealing material is free from deformation or cracks beforehand. If the reduction gear is used without checking these points, it could cause the leakage of lubricant or premature damage to the reduction gear.
-

## Chapter 4 Preparations for installation

This chapter describes the preparation for installing this product.

Before designing the equipment, take care regarding the following precautions.

- When the reduction gear is used for human transportation equipment, install an effective safety unit as a fail-safe mechanism, in case of an unexpected failure in the reduction gear.
- When the reduction gear is used for elevating equipment, install an effective safety unit for preventing falls caused by idle running as a fail-safe mechanism, in case of an unexpected failure in the reduction gear.
- Install an oil receiver, etc., to prevent damage in case of lubricant leakage due to a failure or lifetime expiration.
- As this product may have residual rust prevention agent coated on it before shipping, wipe it off as necessary.



- When the reduction gear is used for human transportation equipment, install an effective safety unit as a fail-safe mechanism, in case of an unexpected failure in the reduction gear. If you fail to install it, it could cause injury in case the equipment goes out of control or falls off.
- When the reduction gear is used for elevating equipment, install an effective safety unit for preventing falls caused by idle running as a fail-safe mechanism, in case of an unexpected failure in the reduction gear. If you fail to install it, it could cause injury in case the elevating unit falls off.

### 4.1. Installation environment

Use this product under the following environment:

- Location where the ambient temperature is between -10°C to 40°C.
- Location where the humidity is less than 85% and no condensation occurs
- Location where the altitude is less than 1,000 m
- Well-ventilated location

Do not install the reduction gear at the following locations.

- Location where a lot of dust is collected
- Outdoors that can be directly affected by wind and rain
- Location near the environment that contains combustible/explosive/corrosive gases and flammable materials
- Location where the magnetic fields or vibration occur

#### Important

- If the required installation environment cannot be established/met, contact us in advance.
- When using this product under special conditions (clean room, equipment for food, medical equipment, concentrated alkali, high-pressure steam, etc.), contact our service representative in advance.



## 4.2. Preparation of required components

- The following components (e.g., bolts) and materials are required for installing this product. The customer is required to prepare them by referring to the separately provided “Outer dimensions” drawings and specification sheet.
- If the shape of the actual section differs from the illustration below, refer to the separately provided “Outer dimensions” drawings and specification sheet.
- Prepare the case installation component and shaft installation component that have been designed and manufactured based on the separately provided “Outer dimensions” drawings and specification sheet.

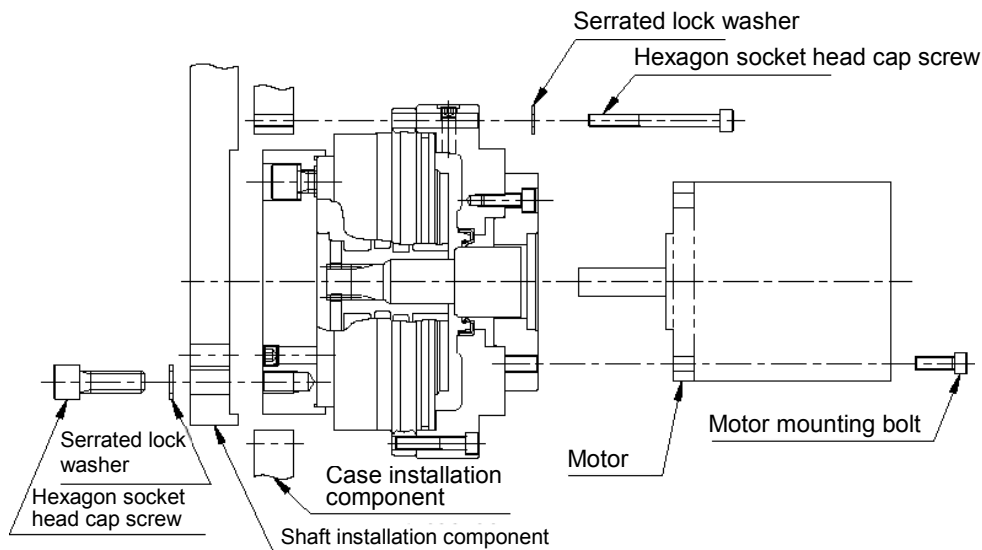


Fig. 4-1 “Example: Type B (Fig. 2-2)”

### Important

- For type F (Fig. 2-6), which is structured in such a way that the lubricant cannot be sealed inside, prepare the shaft installation component that has been designed and manufactured based on the separately provided “Outer dimensions” drawings, specification sheet, and catalogs for the N and E series.
- The actual components may differ from the required components shown in the above illustration, depending on the customer’s equipment.

### 4.2.1. Installation components

The customer is required to prepare the following components used for incorporating the reduction gear into the customer's equipment.

- **Case installation component**

- Prepare the case installation component for the reduction gear.



- 
- Confirm that the design of the prepared case installation component conforms to the size and quantity of the case mounting bolts indicated in the separately provided "Outer dimensions" drawings and specification sheet.
  - When preparing the case installation component, take extra care not to cover the tapped holes for injecting/draining grease. If the tapped holes are covered, it will be difficult to replace the lubricant.
- 

- **Shaft installation component**

- Prepare the shaft installation component for the output shaft of the reduction gear.
- Confirm that the component is structured so that the lubricant can be sealed with an O-ring or liquid sealant.
- Confirm that the tapped hole for injecting/draining grease is accessible in the shaft installation component. It will be necessary for replacing the lubricant after installing the reduction gear.



- 
- Confirm that the design of the prepared shaft installation component conforms to the size and quantity of the shaft mounting bolts indicated in the separately provided "Outer dimensions" drawings and specification sheet.
  - When preparing the shaft installation component, take extra care not to cover the tapped holes for injecting/draining grease. If the tapped holes are covered, it will be difficult to replace the lubricant.
-

### 4.2.2. Reduction gear mounting bolts

- Prepare bolts according to the size and quantity of the case installation bolts and shaft installation bolts indicated in the separately provided “Outer dimensions” drawings and specification sheet.
- Select the appropriate bolt length based on the mounting dimensions of the components prepared by the customer and the reduction gear.
- Prepare the following bolts recommended by Nabtesco:

Hexagon socket head cap screw	JIS B 1176: 2006
Strength class	JIS B 1051: 2000 12.9
Thread	JIS B 0209: 2001 6 g

### 4.2.3. Serrated lock washer for hexagon socket head cap screw

Prepare the following serrated lock washer for a hexagon socket head cap screw recommended by Nabtesco:

Name	Belleville spring washer (made by Heiwa Hatsujyo Industry Co., Ltd.)
Corporation	CDW-H,
symbol:	CDW-L (Only for M5)
Material:	S50C to S70C
Hardness:	HR40 to 48

Table 4-1

(Unit: mm)

Nominal size	ID and OD of Belleville spring washer		t	H
	$\varnothing d$	$\varnothing D$		
5	5.25	8.5	0.6	0.85
6	6.4	10	1.0	1.25
8	8.4	13	1.2	1.55
10	10.6	16	1.5	1.9
12	12.6	18	1.8	2.2
14	14.6	21	2.0	2.5
16	16.9	24	2.3	2.8
18	18.9	27	2.6	3.15
20	20.9	30	2.8	3.55

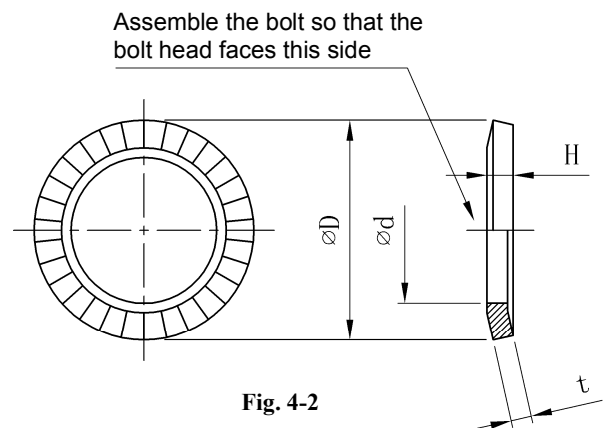


Fig. 4-2

#### Important

- When using any equivalent washer, select it with special care given to its outside diameter ( $\varnothing D$ ).

#### 4.2.4. O-ring

If the reduction gear is shaped in a way that its shaft side is not hermetically sealed (refer to Fig. 2-6), it is necessary to seal the shaft mounting surface. Use the O-rings indicated in the separately provided “Outer dimensions” drawings and specification sheet. If there is no indication, select the size of the O-ring appropriate for the surface to be sealed. If an O-ring cannot be used due to the structure, seal the section using a liquid sealant, etc.

**Note**

- If it is difficult to purchase any of the O-rings described in the “Outer dimensions” drawings and specification sheet, select an O-ring based on the design standard of each manufacturer by referring to the dimensions listed above. Failure to do so could cause the leakage of lubricant.

#### 4.2.5. Liquid sealant

When sealing the shaft mounting surface of the reduction gear and shaft installation component using liquid sealants, prepare the following liquid sealants recommended by Nabtesco.

**Table 4-2**

Name	Manufacturer	Characteristics and applications
ThreeBond 1211	ThreeBond	<ul style="list-style-type: none"> <li>• Silicone-based, solventless type</li> <li>• Semi-dry gasket</li> </ul>
HermeSeal SS-60F	Nihon Hermetics Co.	<ul style="list-style-type: none"> <li>• One-part, non-solvent elastic sealant</li> <li>• Metal contact surface (flange surface) seal</li> <li>• Any product basically equivalent to ThreeBond 1211</li> </ul>
Loctite 515	Henkel	<ul style="list-style-type: none"> <li>• Anaerobic flange sealant</li> <li>• Metal contact surface (flange surface) seal</li> </ul>

**Note**

- Do not use the above liquid sealants if the component of the customer’s device is made of copper or copper alloy.

#### 4.2.6. Lubricant

- **For products in which the lubricant is filled**
  - The lubricant described in the “Outer dimensions” drawings is filled before shipping. If there is no indication in the “Outer dimensions” drawings, contact our service representative.
- **For products in which the lubricant is not filled**
  - Be sure to prepare the Nabtesco-specified lubricant. For purchase of the lubricant, contact our service representative.
  - Do not mix it with other lubricants.

**Table 4-3**

Brand specified by Nabtesco	VIGOGREASE* RE0
Operating temperature range (ambient temperature)	-10 to 40°C

\* VIGOGREASE is registered trademark of Nabtesco Corporation.

#### Note

- In order to take advantage of the performance of this product, use the Nabtesco-specified lubricant. Using other types of lubricant could cause deterioration of performance and premature damage.
- Mixing with other lubricants could cause deterioration of performance, generation of abnormal noise, and premature damage.

#### 4.2.7. Plug for tapped hole for injecting/draining grease

Prepare plugs for tapped holes for injecting/draining grease used for the motor mounting flange and shaft installation component. Also prepare seal tapes and other necessary items.

### 4.3. Unpacking

Check the following points when unpacking.

- Before using this product, check the contents of the packing box and confirm that all the ordered items are included.
- Check the top and bottom direction of the packing box and unpack it.



- When transporting the reduction gear, take extra care so that it will not fall down or topple over. It could cause injury to the workers or damage to the reduction gear.
- Before using this product, check the contents of the packing box and confirm that all the ordered items are included. If an incorrect part is installed, it could cause injury to the workers or damage to the customer's device and the reduction gear.

#### Note

- If it is left upside down, it could cause damage to the reduction gear.
- For type F (Fig. 2-6), the internal parts of the reduction gear remain exposed when unpacking. Take extra care so that no foreign matter adheres to the reduction gear when it is installed in the customer's equipment and filled with lubricant. If foreign matter adheres, it may lead to deterioration of reduction gear performance and also to deterioration of durability or premature damage.

#### Important

- The reduction gear is coated with rust prevention oil before shipping. Therefore, if it is used as it is, the rust prevention oil could ooze from the bolt hole or flange mating face during operation. In addition, the rust prevention oil makes the reduction gear slippery. Wipe it off as necessary before use.

#### 4.3.1. Checking the shipping label

Check the shipping label to confirm that it matches the product you have ordered.

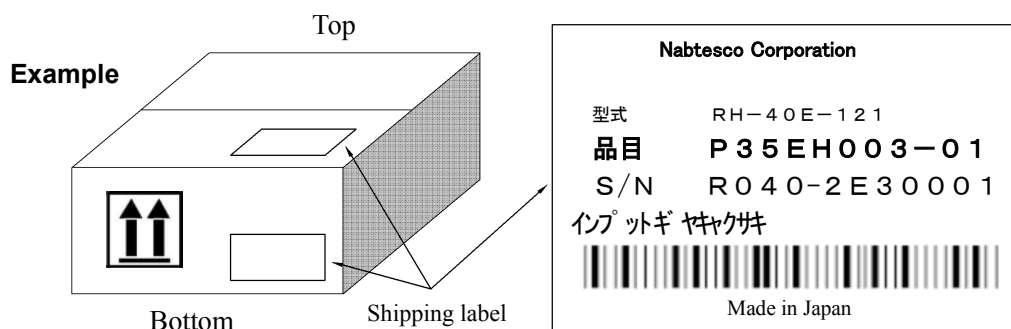


Fig. 4-3

#### Important

- When inquiring about this product, the model, parts name, and S/N (serial number) indicated on the shipping label are needed. Write them down when unpacking and keep them for cases in which they are needed.

### 4.3.2. Checking the contents

When unpacking, check the contents of the packing box and confirm that all the necessary components are included.

Note: The packing material may differ depending on the product. The following illustration should only be referred to as an example.

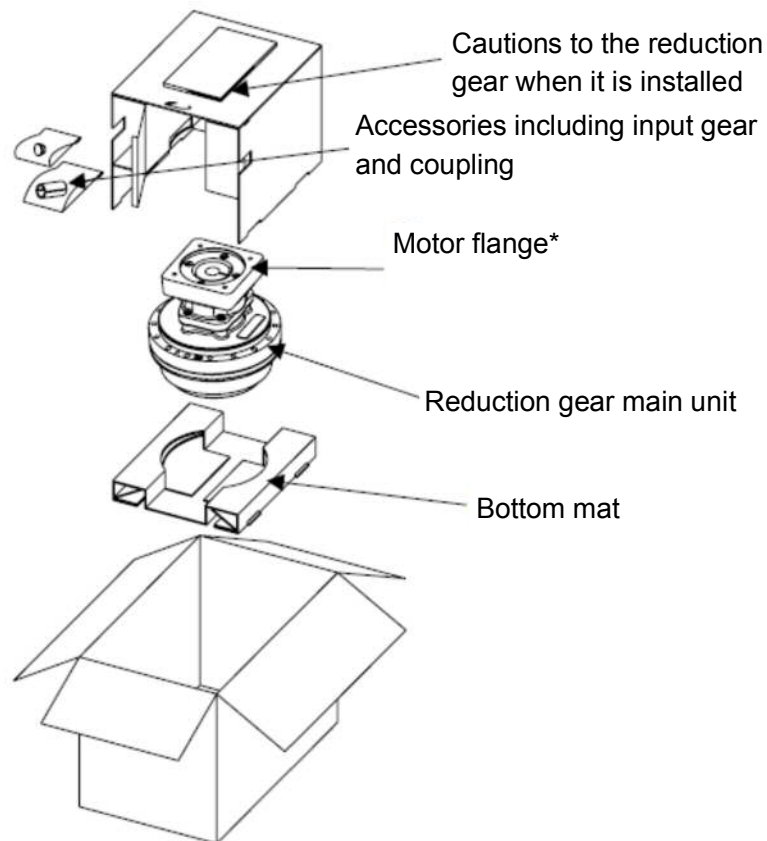


Fig. 4-4

\* The motor flange may be provided as an accessory. Check the accessories according to the separately provided "Outer dimensions" drawings and specification sheet.

#### Important

- The contents of the packing box and shape of the reduction gear may differ from the illustration above depending on the ordered specifications. Check the accessories according to the separately provided "Outer dimensions" drawings and specification sheet.

#### 4.4. Lifting of this product

- When lifting the product, use the tap holes for the hanging bolts described in the separately provided “Outer dimensions” drawings and specifications.
- Do not enter the area under the reduction gear when lifting the reduction gear.
- When lifting the reduction gear, be sure to use a lifter that can withstand the weight of the reduction gear.
- For the weight of each product, refer to the separately provided “Outer dimensions” drawings and specification sheet.



- 
- Do not enter the area under the reduction gear when lifting the reduction gear. If the reduction gear falls down, it could cause injury.
  - When lifting the reduction gear, be sure to use a lifter that can withstand the weight of the reduction gear. Otherwise, the lifter will be damaged, and the reduction gear could fall down and topple over, which may result in injury.
- 

#### Note

- 
- For types D, E, and H (Figs. 2-4, 2-5, and 2-8) described in the section of “2.1. Name of each section”, the hollow section at the center of the reduction gear main unit is not structured to support the load. Be sure that no load is applied to the hollow section when lifting. Otherwise, it could cause injury to the workers, damage or fall of the reduction gear, or leakage of the lubricant. In addition, the oil seals for the hollow section may be deformed, which could eventually cause leakage of the lubricant.
-



## Chapter 5 Installation

This chapter describes the installation of this product.

Before installation, take care regarding the following precautions.

- Do not stand on top of the reduction gear or put anything on it.
- Be sure to install the reduction gear with the correct orientation.

### Note

- Standing on top of the reduction gear or putting something on it could cause damage to the reduction gear.
- Installing the reduction gear with an incorrect orientation could cause damage to the customer's device and the reduction gear.

### 5.1. Bolt tightening torque

- Use the Nabtesco-recommended bolts for installing the reduction gear and tighten them with the specified tightening torque.
- Use the serrated lock washer for hexagon socket head cap screw to prevent the bolt from loosening and protect the bolt seat surface from flaws.

(Reference: “4.2.2 Reduction gear mounting bolts” and “4.2.3 Serrated lock washer for hexagon socket head cap screw”)

The following are the bolt tightening torques specified by Nabtesco. Be sure to check the following when tightening the bolts.

**Table 5-1**

Nominal size × pitch (mm)	Tightening torque * (Nm)	Tightening force (N)
M5 × 0.8	9.01 ±0.49	9,310
M6 × 1.0	15.6 ±0.78	13,180
M8 × 1.25	37.2 ±1.86	23,960
M10 × 1.5	73.5 ±3.43	38,080
M12 × 1.75	129 ±6.37	55,100
M14 × 2.0	205 ±10.2	75,860
M16 × 2.0	319 ±15.9	103,410
M18 × 2.5	441 ±22.0	126,720
M20 × 2.5	493 ±24.6	132,170

\* The tightening torque values listed are for steel or cast iron material.

### Important

- If aluminum material or stainless-steel bolt is used, limit the tightening torque. When tightening the bolt with the limited torque, confirm that there is no strength problem by taking the transmission torque and load moment into due consideration.

## 5.2. Installation work

**Important**

- The installation procedure may differ from the contents of this manual, depending on the shape of the components designed by the customer.

### 5.2.1. Installing the reduction gear

The following describes the installation of the reduction gear.

- The reduction gear is coated with rust prevention oil before shipping. Wipe off the rust prevention oil as necessary during installation. In particular, do not fail to wipe off the rust prevention oil from the mounting surface.
- When you order the motor flange mounting type, the product may be delivered with a motor flange already mounted. In such a case, it may not be possible to install the product in the customer's equipment as is, depending on the installation method and tools to be used (Fig. 5-1). Check the condition of your equipment and install the product using the correct procedure.

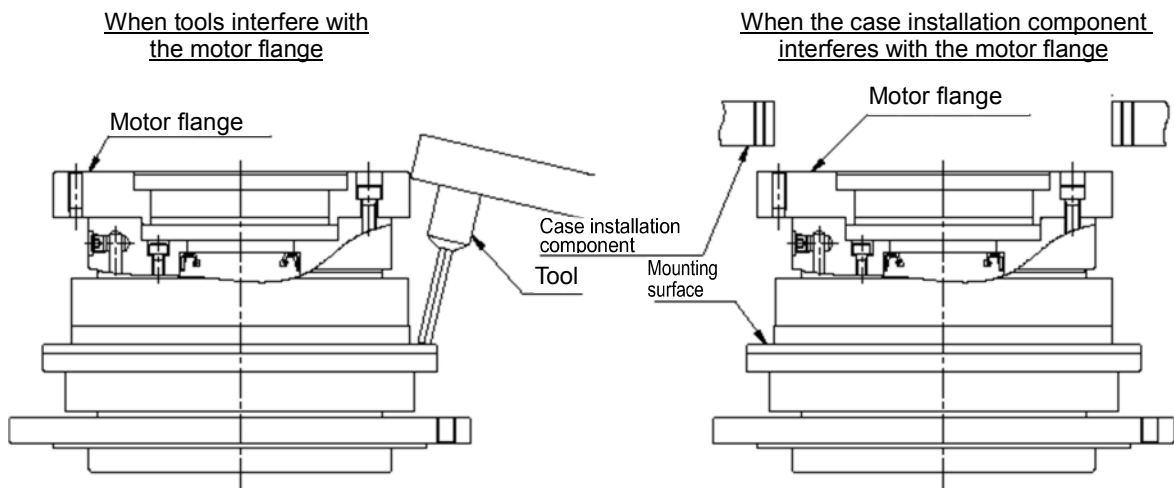
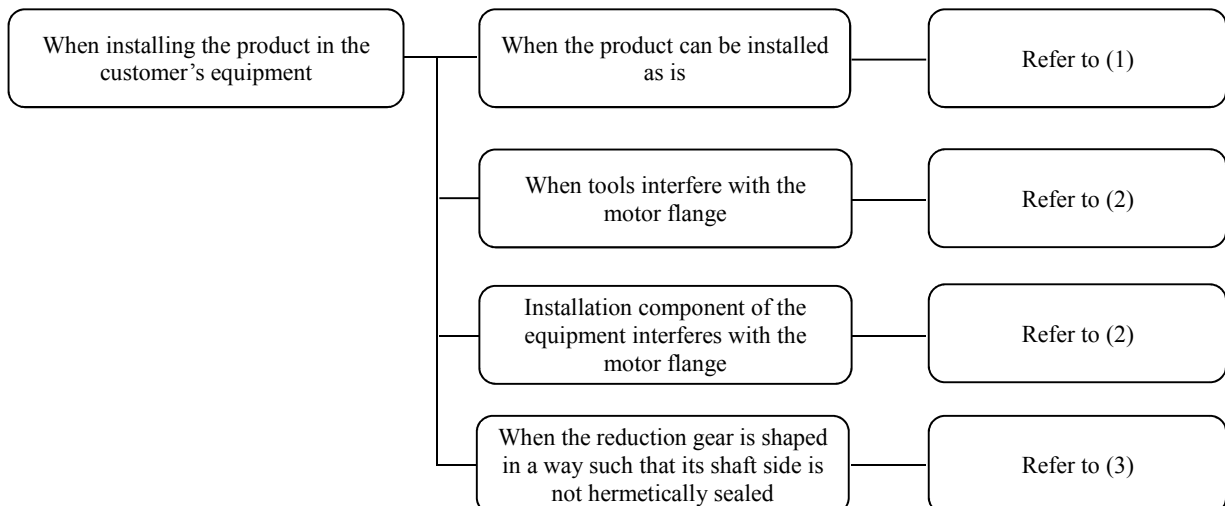


Fig. 5-1



**(1) When the product can be installed as is**

Perform steps 1 to 4 by taking care regarding the following precautions.

- Step 1**
- Align the mounting holes (or tapped holes) of the reduction gear with the positions of the tapped holes for the case installation component, and then attach the reduction gear to the specified position.
  - Confirm that the centering shaft of the reduction gear (case section) is correctly fitted into the centering hole of the case installation component.
  - Check that there is no foreign matter adhering to the mounting surface.

**Note**

- If there is foreign matter adhering to the mounting surface, the mounting surface of the reduction gear may be deformed, which could cause deterioration of performance, such as abnormal noise and torque irregularity and durability.
- The shape of the reduction gear may differ from the illustration depending on the ordered specifications.

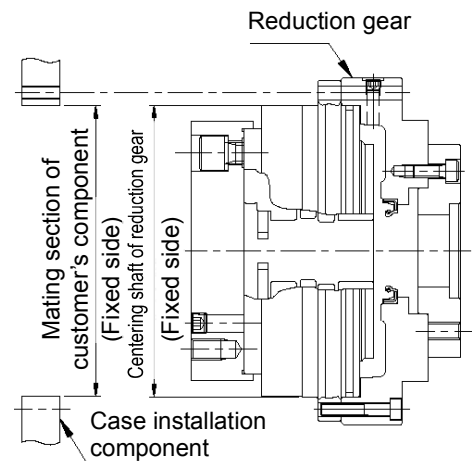


Fig. 5-2

- Step 2**
- Fit the serrated lock washer for the hexagon socket head cap screw through the hexagon socket head cap screw.  
(Reference: Fig. 4-2 in “4.2.3 Serrated lock washer for hexagon socket head cap screw”)
- Step 3**
- Tighten the hexagon socket head cap screws equally with the specified bolt tightening torque.  
(Reference: Table 5-1 in “5.1 Bolt tightening torque”)

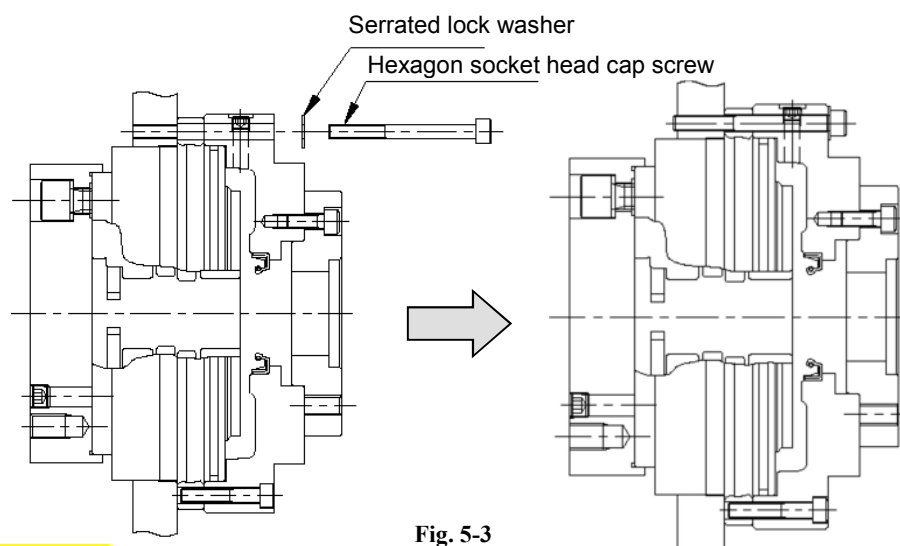


Fig. 5-3

**CAUTION**

- If the hexagon socket head cap screws are not tightened with the specified torque, the reduction gear does not deliver the designed performance. In addition, it could cause injury and damage to the customer's device and the reduction gear.

- Step 4**
- Attach the shaft installation component to the reduction gear.
  - Confirm that the centering shaft of the reduction gear is correctly fitted into the centering hole of the shaft installation component.
  - Check that there is no foreign matter adhering to the mounting surface.
  - Using the reduction gear mounting bolt and serrated lock washer for hexagon socket head cap screw, fix the shaft installation component to the reduction gear.
  - Be sure to tighten the hexagon socket head cap screws with the specified tightening torque.
- (Reference: “4.2.2. Reduction gear mounting bolts”, “4.2.3. Serrated lock washer for hexagon socket head cap screw”, and “5.1. Bolt tightening torque”)

### CAUTION

- If the hexagon socket head cap screws are not tightened with the specified torque, the reduction gear does not deliver the designed performance. In addition, it could cause injury and damage to the customer's device and the reduction gear.

### Note

- If there is foreign matter adhering to the mounting surface, the mounting surface of the reduction gear may be deformed, which could cause deterioration of performance, such as abnormal noise and torque irregularity and durability.
- When installing the installation component, take extra care not to cover the tapped holes for injecting/drainng grease. If the tapped holes are covered, it will be difficult to replace the lubricant.

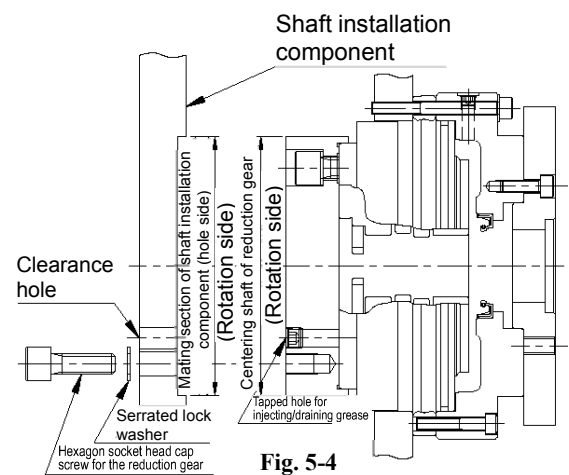


Fig. 5-4

## (2) When the product cannot be installed with the motor flange already mounted

Perform steps 1 to 5 by taking care regarding the following precautions.

- Step 1**
- Loosen the hexagon socket head cap screws securing the motor flange, and then remove the motor flange from the reduction gear.
  - As the hexagon socket head cap screws will be reused when assembling, store them in a safe place.

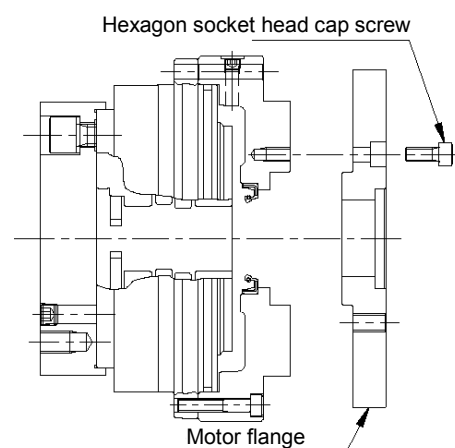


Fig. 5-5

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**Note**

- A liquid sealant may have been used in the area between the motor flange and reduction gear main unit (middle flange). Due to the effect of the liquid sealant, it may not be possible to remove the motor flange easily only by removing the screws. In such a case, make a cut in the coating on the bonded surface using a cutter knife, etc., while taking care not to scratch the coating. Then, lightly tap the motor flange using a tool such as plastic hammer, and then remove the motor flange from the reduction gear main unit. Applying excessive load could scratch the reduction gear or motor flange, and eventually cause damage.
- 

- Step 2**
- With the motor flange removed, incorporate the reduction gear into the customer's equipment according to steps 1 to 3 in "(1) When the product can be installed as is".
- Step 3**
- If necessary, wipe off the grease adhering to the mounting surface of the motor flange and the reduction gear, and then use a liquid sealant on this surface.  
(Reference: Table 4-2 in "4.2.5 Liquid sealant")
  - Take extra care so that the liquid sealant will not leak into the reduction gear.
  - Take extra care so that the liquid sealant will not leak into the mounting bolt section.
  - For the detailed coating procedure, follow the instructions given by the manufacturer of the sealant to be used.

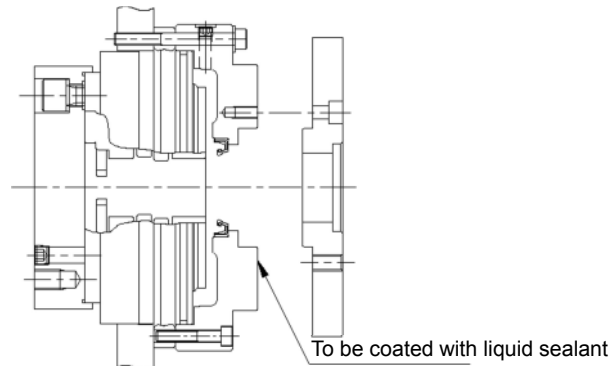


Fig. 5-6

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**Note**

- If the leaking liquid sealant is mixed into the reduction gear, it could cause deterioration of performance, such as abnormal noise, vibration, and torque irregularity. Also, if the liquid sealant adheres to the lip of the oil seal, it could cause leakage of the lubricant.
  - If it leaks into the mounting bolt section, it could deteriorate the bolt tightening force, and eventually result in deterioration of the transmission torque.
-

- Step 4**
- Align the mating part of the motor flange with that of the reduction gear. Then, closely attach the motor flange to the reduction gear while adjusting the position of the motor flange fixing hole.
  - Confirm that the centering shaft of the motor flange is correctly fitted into the centering hole of the reduction gear.
  - Check that there is no foreign matter adhering to the mounting surface.
  - Make sure that the matching surface of the motor flange and the matching surface of the reduction gear are in close contact. If either of them is tilting or there is a gap, remove the motor flange and perform step 4 again.

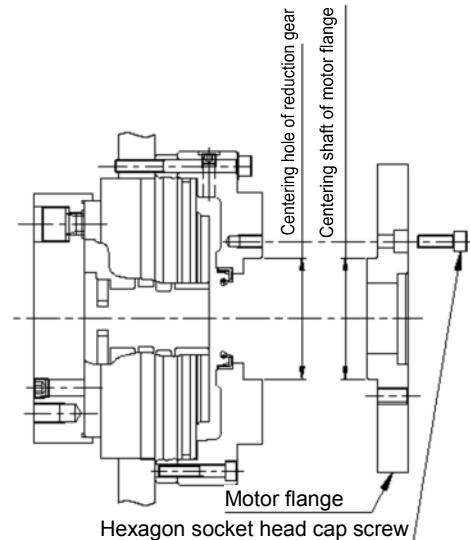


Fig. 5-7

- Use the stored hexagon socket head cap screws, which have been removed in step 1 for “(2) When the product cannot be installed with the motor flange already mounted”.
- Using the hexagon socket head cap screw, fix the motor flange and reduction gear.
- Be sure to tighten the hexagon socket head cap screws with the specified tightening torque. (Reference: “4.2.2. Reduction gear mounting bolts” and “5.1. Bolt tightening torque”)

### CAUTION

- If the hexagon socket head cap screws are not tightened with the specified torque, the reduction gear does not deliver the designed performance. In addition, it could cause injury and damage to the customer’s device and the reduction gear.

### Note

- If there is foreign matter adhering to the mounting surface, the mounting surface of the reduction gear may be deformed, which could cause deterioration of performance, such as abnormal noise and torque irregularity and durability.

- Step 5**
- Incorporate the reduction gear into the customer’s equipment according to step 4 in “(1) When the product can be installed as is”.

### (3) When the reduction gear is shaped in a way its shaft side is not hermetically sealed

- Only for type F (Fig. 2-6), perform steps 1 to 3 by taking care regarding the following precautions. For other types, proceed to “5.2.2 Installing the input gear”

- Step 1**
- When the shaft mounting surface of the reduction gear is provided with an O-ring groove, attach an O-ring.
  - If the product does not feature an O-ring groove, prepare a groove on the customer's component, or seal the area with a liquid sealant. If an O-ring cannot be used due to the structure, seal the section using a liquid sealant, etc.
- (Reference: “4.2.4 O-ring”)

#### Note

- For the product with an O-ring groove, use the O-rings indicated in the separately provided “Outer dimensions” drawings and specification sheet. If there is no indication, select the size of the O-ring appropriate for the surface to be sealed.

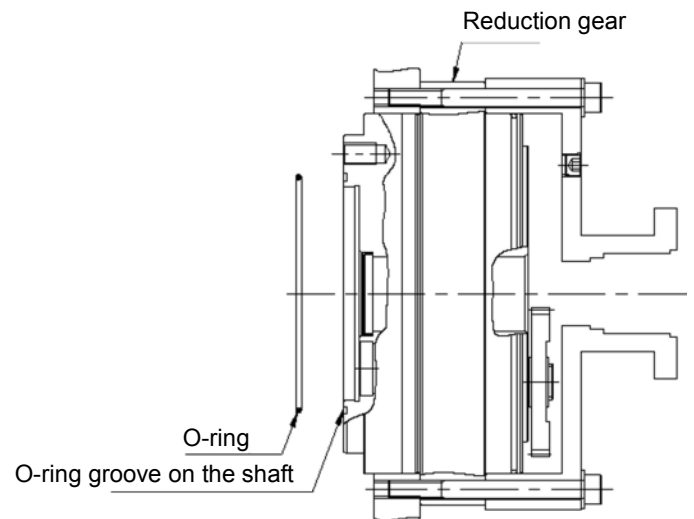



Fig. 5-8

#### ● When sealing with a liquid sealant

- When sealing the section with a liquid sealant, coat the liquid sealant onto the  area on the shaft mounting surface. For the coating area, refer to the illustration on the right.
- Apply coating seamlessly in the coating area.
- Take extra care so that the liquid sealant will not leak into the reduction gear or mounting bolt section.
- For the detailed coating procedure, follow the instructions given by the manufacturer of the sealant to be used.

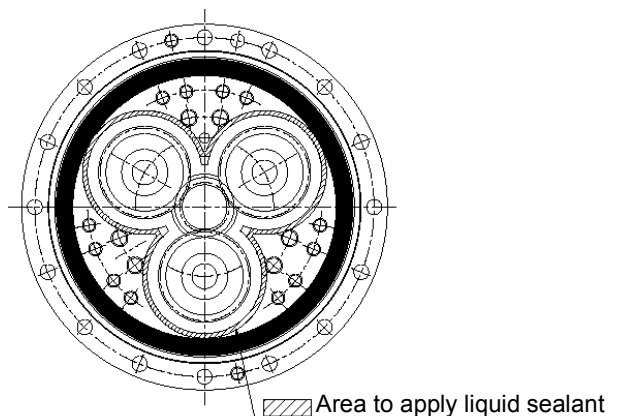


Fig. 5-9

(Reference: “4.2.5 Liquid sealant”)

#### Note

- If a coating is not applied at some points within the coating range, it could cause leakage of the lubricant.
- If the leaking liquid sealant is mixed into the reduction gear, it could cause deterioration of performance, such as abnormal noise, vibration, and torque irregularity. Also, if the liquid sealant adheres to the lip of the oil seal, it could cause leakage of the lubricant.
- If it leaks into the shaft mounting bolt section, it could deteriorate the bolt tightening force, and eventually result in deterioration of the transmission torque.

- **When sealing the section with an O-ring by preparing an O-ring groove on the customer's component**

- Fit an O-ring into the groove.
- Align the mounting holes of the shaft installation component with the positions of the tapped holes of the reduction gear (shaft section), and then attach the shaft installation component to the reduction gear.
- Take extra care so that the O-ring is not caught by the mounting surface.
- Confirm that the centering shaft of the reduction gear (shaft section) is correctly fitted into the centering location of the shaft mounting flange.
- Check that there is no foreign matter adhering to the mounting surface.

**Note**

- If the O-ring is caught by the mounting surface, it could cause leakage of the lubricant.
- If there is foreign matter adhering to the mounting surface, the mounting surface of the reduction gear may be deformed. This could cause deterioration of performance, such as abnormal noise and torque irregularity, as well as reduced durability.
- The shape of the shaft installation component may differ from the illustration above, depending on the customer's equipment or shape of the reduction gear.

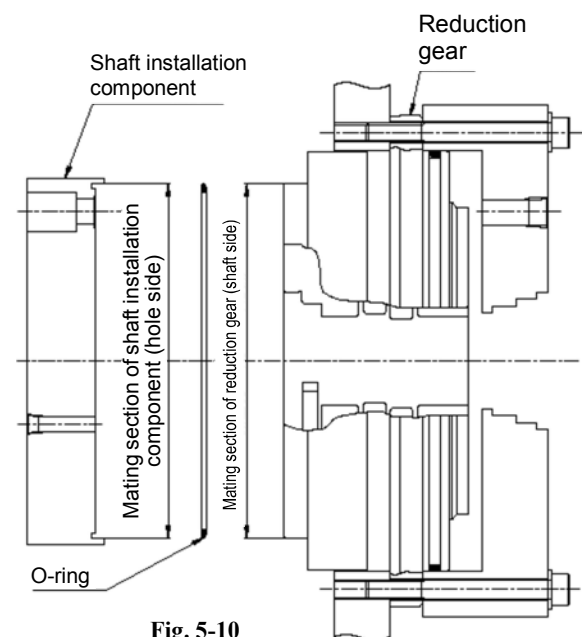


Fig. 5-10



- Step 2**
- Using the hexagon socket head cap screw and serrated lock washer for hexagon socket head cap screw, or high-torque seal washer, fix the shaft installation component to the reduction gear.
  - Be sure to tighten the hexagon socket head cap screws with the specified tightening torque.

(Reference: “4.2.2. Reduction gear mounting bolts”, “4.2.3. Serrated lock washer for hexagon socket head cap screw”, and “5.1. Bolt tightening torque”)

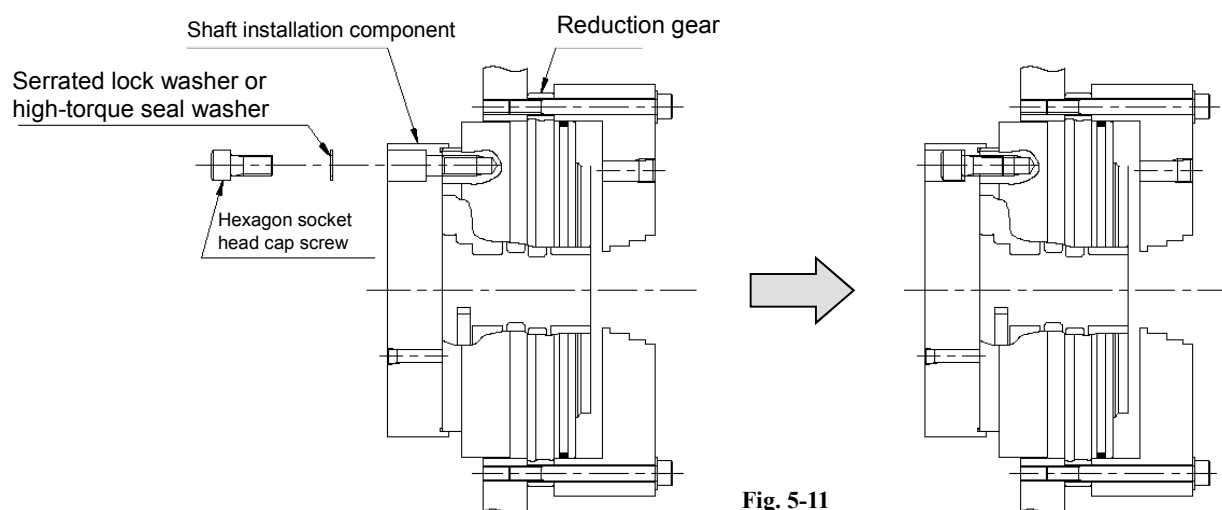


Fig. 5-11

### CAUTION

- If the hexagon socket head cap screws are not tightened with the specified torque, the reduction gear does not deliver the designed performance. In addition, it could cause injury and damage to the customer's device and the reduction gear.

## 5.2.2. Installing the input gear

### • For straight shafts (attached to motor shaft tip)

The following is an example when fixing the input gear to the motor shaft using a bolt.

Perform steps 1 to 3 by taking care regarding the following precautions.

- Avoid impact to the motor shaft when attaching the input gear.
- The outer diameters of the bolt head and seal washer should be smaller than the root circle diameter of the input gear.

### Note

- Avoid impact to the motor shaft when attaching the input gear, as it could damage the motor.
- If the outer diameters of the bolt head and seal washer are larger than the root circle diameter of the input gear, the bolt and seal washer will interfere with the spur gear, and therefore, the gear cannot be installed or could be damaged.

**Step 1** • Attach a key to the motor shaft.

**Step 2** • Attach the input gear to the motor shaft.

- Check that there is no foreign matter adhering to the mounting surface.

**Note**

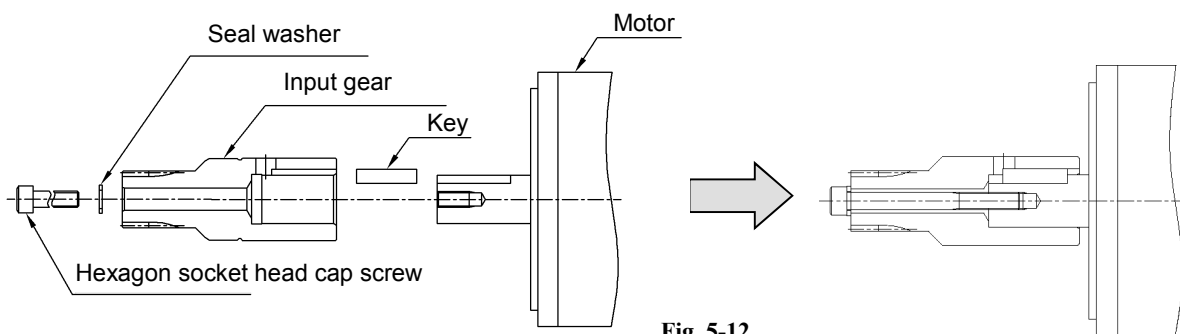
- If there is foreign matter adhering to the mounting surface, appropriate installation accuracy cannot be obtained. It could cause deterioration of performance, such as abnormal noise and vibration, and also lead to damage of the motor.

**Step 3** • Fix the input gear to the motor shaft using a hexagon socket head cap screw.

- Using a thread-locking sealant for screws, lock the hexagon socket head cap screw.

**Important**

- If necessary, seal the area with a seal washer, etc. Otherwise, it could cause the leakage of lubricant.
- Check the depths of the input spline hole and motor shaft screw before selecting an appropriate size and length of the hexagon socket head cap screw.

**Fig. 5-12**

- **For straight shafts (attached to motor shaft base)**

The following is an example when fixing the input gear to the motor shaft using a set screw.

Perform steps 1 to 3 by taking care regarding the following precautions.

- Avoid impact to the motor shaft when attaching the input gear.

**Note**

- Avoid impact to the motor shaft when attaching the input gear, as it could damage the motor.

**Step 1** • Attach a key to the motor shaft.

**Step 2** • Attach the input gear to the motor shaft.  
• Check that there is no foreign matter adhering to the mounting surface.

**Note**

- If there is foreign matter adhering to the mounting surface, appropriate installation accuracy cannot be obtained. It could cause deterioration of performance, such as abnormal noise and vibration, and also lead to damage of the motor.

**Step 3** • Tighten the input gear and motor shaft using a set screw.  
• Using a thread-locking sealant for screws, lock the set screw.

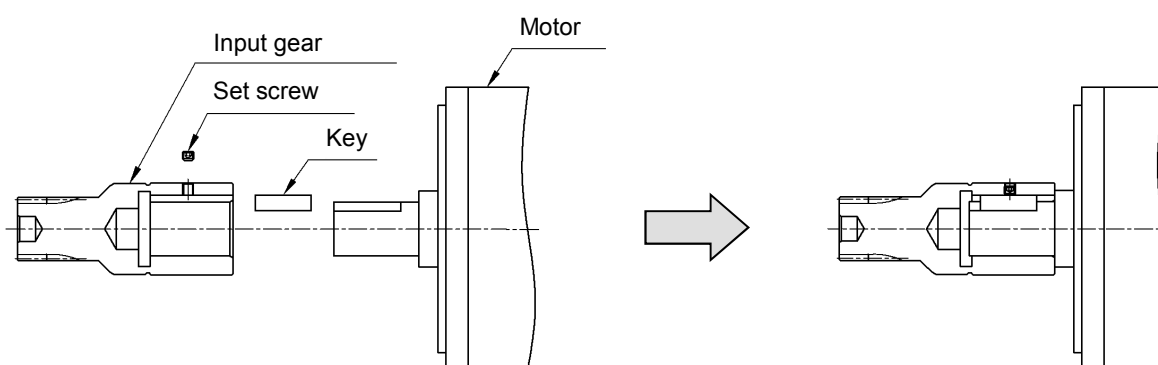


Fig. 5-13

**Note**

- If a thread-locking sealant is not used for the set screw, a clearance will be generated in the keyway, which could cause deterioration of performance, such as abnormal noise and vibration, and also lead to damage of the motor.

- **For tapered shafts**

The following is an example when fixing the input gear to the motor shaft using a draw bolt and a hexagon nut.

Perform steps 1 to 4 by taking care regarding the following precautions.

- Avoid impact to the motor shaft when attaching the input gear.
- The outer diameters of the hexagon nut and seal washer should be smaller than the root circle diameter of the input gear.

**Note**

- Avoid impact to the motor shaft when attaching the input gear, as it could damage the motor.
- If the outer diameters of the hexagon nut and seal washer are larger than the diameter of the teeth bottom of the input gear, the hexagon nut and seal washer will interfere with the spur gear, and therefore, the gear cannot be installed or could be damaged.

**Step 1** • Attach the draw bolt to the motor shaft.

**Step 2** • Attach the Woodruff key to the motor shaft.  
• Check that there is no foreign matter adhering to the mounting surface.

**Note**

- If there is foreign matter adhering to the mounting surface, appropriate installation accuracy cannot be obtained. It could cause deterioration of performance, such as abnormal noise and vibration, and also lead to damage of the motor.

**Step 3** • Attach the input gear to the motor shaft.

**Step 4** • Tighten the hexagon nut into the draw bolt.  
• Using a double nut and thread-locking agent, etc., lock the hexagon nut.

**Important**

- If necessary, seal the area with a seal washer, etc. Otherwise, it could cause the leakage of lubricant.

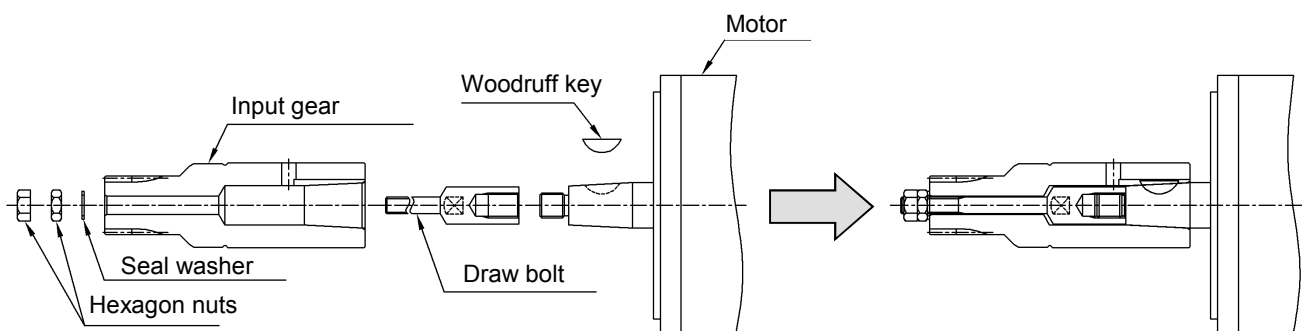


Fig. 5-14

- **When no straight shaft key is provided**

- **For the wedge-type frictional coupling**

The following is an example when fixing the input gear to the motor shaft using a wedge-type frictional coupling.

Perform steps 1 to 5 by taking care regarding the following precautions.

- Avoid impact to the motor shaft when attaching the input gear.
- Check that there is no foreign matter adhering to the mounting surface.
- When attaching the wedge-type frictional coupling, apply the lubricant onto it.
- For the lubricant, use the one that does not contain molybdenum antifriction agent.

**Note**

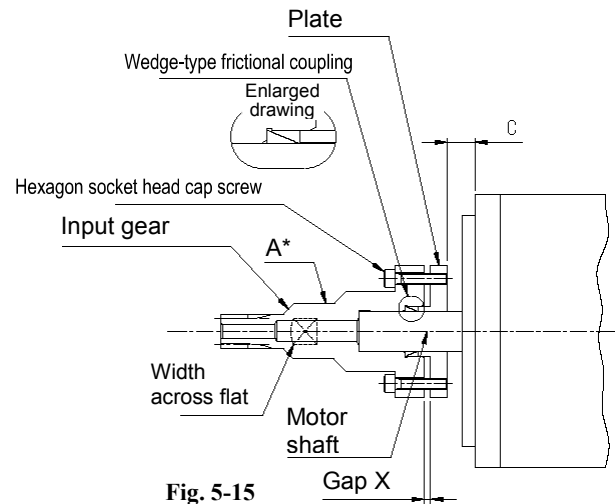
- Avoid impact to the motor shaft when attaching the input gear, as it could damage the motor.
- If there is foreign matter adhering to the mounting surface, appropriate installation accuracy cannot be obtained. It could cause deterioration of performance, such as abnormal noise and vibration, and also lead to damage of the motor.
- The transmission torque of the wedge-type frictional coupling varies depending on the motor shaft diameter. Due to this, the momentary maximum allowable torque or allowable acceleration/deceleration torque may not be ensured.

- Step 1** • Assemble the wedge-type frictional coupling into the input gear as shown in Fig. 5-15.
- Step 2** • Assemble the plate into the input gear, and then temporarily secure it with the hexagon socket head cap screws.
- Step 3** • Press the hole base of the input gear onto the edge of the motor shaft completely. (During assembly, the input gear should slide slightly.)
- Step 4** • Tighten the hexagon socket head cap screws in a diagonal order with the specified tightening torque. After tightening, check that the gap X is equal at each point along the circumference. (Reference: Table 5-1 in “5.1 Bolt tightening torque”)
- Check dimensions C to see if the input gear has been assembled as in the specified dimensions. For dimensions C, refer to “Outer dimensions” drawing.



- If the hexagon socket head cap screws are not tightened with the specified torque, the reduction gear does not deliver the designed performance. In addition, it could cause injury and damage to the customer’s device and the reduction gear.

- Step 5** • Check for deviation during rotation at position A of the input gear. If the deviation is within 50  $\mu\text{m}$ , the procedure is completed.
- Step 6** • If the deviation of the input gear exceeds 50  $\mu\text{m}$ , loosen the hexagon socket head cap screws and perform adjustment by repeating step 2 and the subsequent steps.



• **For the clamp coupling**

The following is an example for fixing the motor shaft using the coupling whose one end is the spline type and other end is the side clamp type (Type H in “2.1 Name of each section”).

Perform steps 1 to 4 by taking care regarding the following precautions.

- Step 1** • The coupling is stored in the packing box.
- Check that the grease (PYRONOC UNIVERSAL N-6B) is coated onto the spline.

**Note**

- If the coupling is assembled without greasing the spline, it could cause abnormal wear of the spline.
- Do not disassemble the coupling.

- Step 2** • Wipe the exterior of the motor shaft and the clamping surface with a clean cloth.

**Note**

- If there is foreign matter or grease adhering to the exterior of the motor shaft and interior of the clamping surface for the coupling, proper tightening force cannot be obtained.

- Step 3**
- Insert the coupling into the motor shaft until the partition plate inside the coupling contacts the tip of the motor shaft. Although the coupling can be inserted smoothly at first, a large friction is generated at the end (for a few millimeters).
  - Do not forcibly insert the motor shaft.

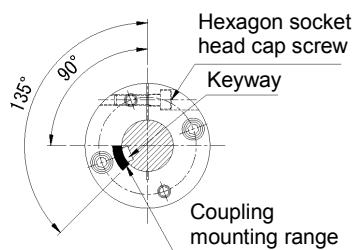


Fig. 5-16

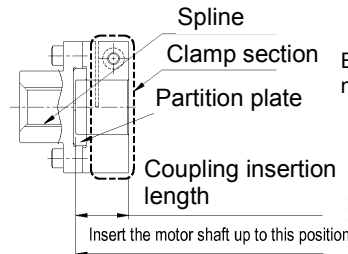


Fig. 5-17

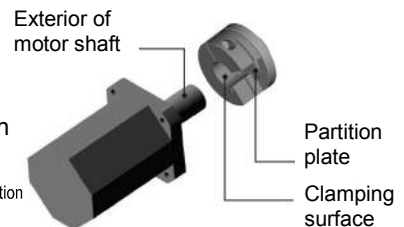


Fig. 5-18

**Note**

- For the motor shaft provided with a keyway, remove the key and align the center phase of the keyway of the motor shaft with the position indicated in Fig. 5-16 (with reference to the bolt) within the mounting range of the coupling. Otherwise, proper tightening force cannot be obtained.
- If the motor shaft is forcibly inserted, it could damage the coupling and motor.
- If the motor shaft is not in contact with the partition plate, it could damage the reduction gear. (Refer to Fig. 5-17)

- Step 4**
- Confirm that the tip of the motor shaft is in contact with the partition plate, and then tighten the hexagon socket head cap screws with the specified tightening torque (refer to Fig. 5-16).

Table 5-2

Coupling external diameter (mm)	φ 44	φ 56	φ 68	φ 82	φ 94	φ 126
Bolt size	M4	M5	M6	M8	M8	M10
Tightening torque (N·m)	3.4 ± 0.17	7 ± 0.35	14 ± 0.7	30 ± 1.5	30 ± 1.5	60 ± 3.0
Coupling insertion length (mm)	18.5	23.5	27.5	33.5	38.5	43.5

**Note**

- For a taper motor shaft, an adapter with taper inner and straight outer is provided. After attaching this adapter, perform the above steps.

### 5.2.3. Installing the motor

Perform steps 1 to 4 by taking care regarding the following precautions.

Note: For the reduction gear that is not filled with lubricant, steps 1 and 2 are not necessary.

- Step 1**
- Remove the cap and plastic sheets from the reduction gear. If the reduction gear is not vertical during the procedure, remove the cap and plastic sheets before installing the equipment or motor flange.

#### Note

- If the above procedure is performed while the reduction gear is set horizontally, it could cause leakage of the lubricant.
- When the cap or plastic sheets are removed, the inside of the reduction gear is exposed to the air. Take extra care so that no foreign matter adheres to the reduction gear before it is installed in the customer's equipment. If foreign matter adheres, it may lead to deterioration of reduction gear performance and also to deterioration of durability or premature damage.

In case of cap

- ◆ A cap is attached to the insertion slot of the input gear before shipping in order to prevent the lubricant filled in the reduction gear from leaking.

As shown on the right, remove the cap upward to prevent the lubricant from leaking from the reduction gear.

If the reduction gear is not vertical, the lubricant will leak out when the cap is removed.

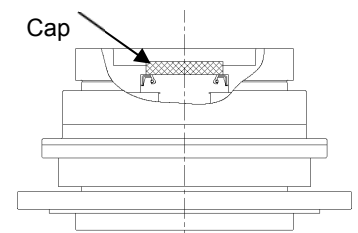


Fig. 5-19


#### Note

- When removing the cap using a screwdriver, etc., take extra care to prevent any scratches or dents on the components.

In case of plastic sheets

- ◆ Plastic sheets are attached to the edge of the flange before shipping in order to prevent the lubricant filled in the reduction gear from leaking. As shown on the right, remove the plastic sheets while the reduction gear is horizontal.

If it is not horizontal, the lubricant will leak out when the plastic sheets are removed.

After removing the plastic sheets, be sure to completely wipe off the lubricant adhering to the area indicated with .

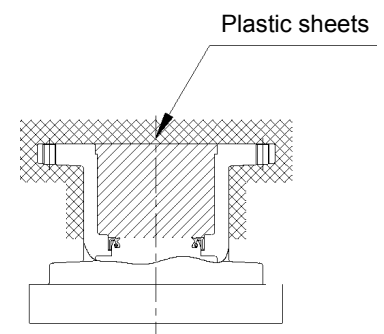
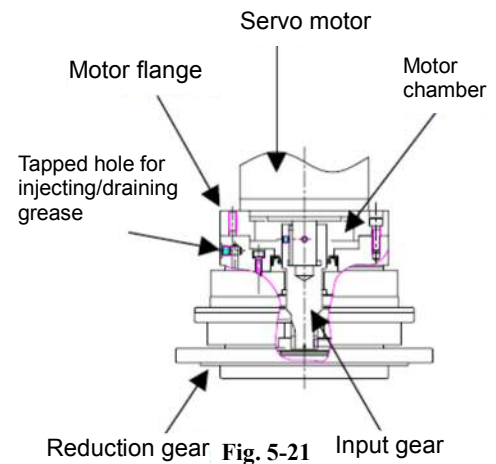


Fig. 5-20



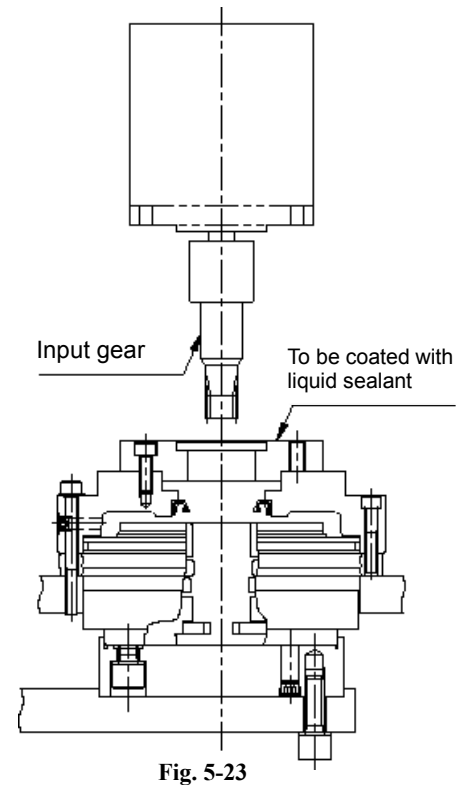
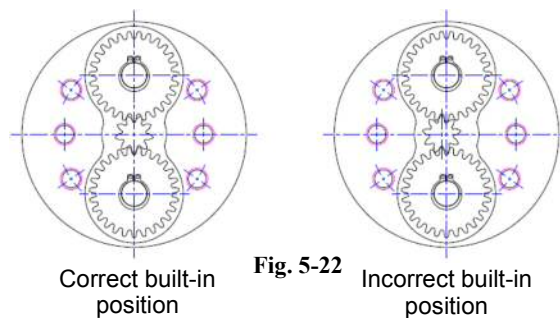
- Step 2**
- When inserting the input gear, release the tapped hole for injecting/draining grease so that the internal pressure will not rise. After inserting the input gear, close the tapped hole for injecting/draining grease. (For a hexagon socket head cap plug, use seal tape)
  - When inserting the motor, if the lubricant leaks from the reduction gear into the motor chamber through the oil seals, remove the input gear and wipe off the leaking lubricant with a clean cloth.



#### Note

- If you fail to perform step 2, the internal pressure of the reduction gear increases while inserting the motor. If the reduction gear is operated under this condition and the temperature of the reduction gear increases, the internal pressure of the reduction gear exceeds the allowable pressure range of the oil seals, which could cause the leakage of the lubricant.

- Step 3**
- Install the input gear on to the motor shaft, and then directly insert the motor into the reduction gear. At this point, make sure that the motor flange and the motor surface are in close contact without any tilt.
  - Do not forcibly press down on the motor.
  - Take extra care so that the gear section of the input gear does not scratch the lip surface of the oil seal.
  - Take extra care so that no scratch will be made on the gear section due to interference between the input gear and spur gear.
  - For the product with two spur gears, insert the motor so that the input gear is in the correct position as illustrated in Fig. 5-22 “Correct built-in position”. Then, confirm that the motor and flange surface are closely attached with each other without any tilt. If there is a clearance between the motor and motor flange surface, the motor could be in an incorrect position as illustrated in Fig. 5-22 “Incorrect built-in position”. Do not tighten the bolt to eliminate the clearance.



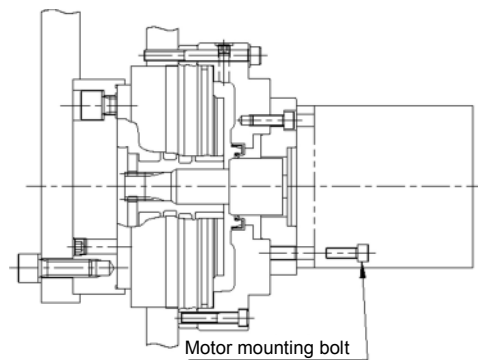
#### Note

- If the motor is forcibly pressed down, it could damage the input gear, spur gear, and motor.
- If the gear section of the input gear scratches the lip surface of the oil seal, it could cause leakage of the lubricant.
- If the gear section is scratched due to interference between the input gear and spur gear, it could cause abnormal noise.

- Step 4**
- Using the hexagon socket head cap screw, fix the motor to the motor mounting flange.
  - Confirm that the centering shaft of the motor is correctly fitted into the centering hole of the motor mounting flange.
  - Check that there is no foreign matter adhering to the mounting surface.

**Note**

- If there is foreign matter adhering to the mounting surface, appropriate installation accuracy cannot be obtained. It could cause deterioration of performance, such as abnormal noise and vibration, and also lead to premature damage of the motor.

**Fig. 5-24**

- \* There are various ways to install the motor, depending on the shape of the reduction gear or customer's equipment.  
For the installation methods other than the above examples, check the "Outer dimensions" drawings and specification sheet.  
If anything is unclear, contact our service representative.

## Chapter 6 Filling the Lubricant

This chapter describes the filling of lubricant.

**Note:** For the reduction gear already filled with lubricant, perform the procedure described in this chapter only for replacing the lubricant.

Before filling the lubricant, take care regarding the following precautions.

- If the product is not filled with lubricant, fill it with an appropriate amount of Nabtesco-recommended lubricant before use.
- When pneumatic pressure is used for filling the lubricant, set the pressure below 0.03 MPa.
- Be sure to leave a space about 10% of the total volume to be filled with the lubricant.

### Note

- If the internal pressure of the reduction gear increases, oil seals could fall off or lubricant could leak.
- If overfilled, the temperature increases during operation and the internal pressure also increases. As a result, oil seals could fall off or lubricant could leak.
- If the lubricant is not filled sufficiently, it could lead to premature damage of the reduction gear.

### 6.1. Precautions when handling the lubricant

This section describes the precautions when handling lubricants.

### CAUTION

- Before handling the lubricant, read the precautions described on the container of the lubricant and use it correctly. Improper use could impair your health.
- Wear protective goggles to protect your eyes from the lubricant. If it gets into your eyes, it could cause inflammation.
- Wear rubber gloves to protect your skin from the lubricant. If it touches your skin, it could cause inflammation.
- Do not eat or put the lubricant into your mouth. If it gets into your mouth, it could cause diarrhea or vomiting.

### Important

- If anything is unclear, refer to the Safety Data Sheet. If it is not available, contact our service representative.

### **Emergency remedy**

- If the lubricant gets into your eyes, rinse your eyes with clean water for 15 minutes and consult a physician.
- If the lubricant contacts the skin, wipe it off completely and thoroughly rinse the affected area with water and soap.
- If the lubricant is inhaled, move to a fresh air location and cover your body with a blanket to keep yourself warm and calm. Then, consult a physician.
- If the lubricant is swallowed, do not force yourself to vomit and consult a physician.


### **Disposal of waste grease and container**

- It is required by law to dispose of the grease and container in the specified manner. Dispose of the grease and container appropriately according to the law.
- If anything is unclear, check the disposal precautions described in the Safety Data Sheet or contact our service representative.





### **Storage**

- To prevent particles and moisture from being mixed into the container, seal it tightly.
- Keep it away from the direct sunlight, fire, and heat sources, and store it in a cool and dark place.

## 6.2. Reduction gear mounting direction and amount of lubricant

The amount of grease the reduction gear requires will differ according to the orientation in which the gear is installed. The target range for filling the lubricant (the  areas in the diagram) inside the reduction gear for each mounting direction is indicated below. Set the amount of lubricant according to the customer's installation environment based on this information.

### 6.2.1. Horizontal shaft installation

The target range (the  areas in the diagram) when the reduction gear is installed in the horizontal shaft is indicated in Fig. 6-1. The amount does not include the space on the motor mounting side (the  areas in the diagram). Therefore, if there is a blank space, also fill the space. Leave a space about 10% of the total volume of the internal capacity of the reduction gear (the  areas in the diagram) and the space on the motor mounting side (the  areas in the diagram). Be sure to fill the amount of lubricant described in the separately provided "Outer dimensions" drawings. If there is no indication in the "Outer dimensions" drawings, contact our service representative individually.

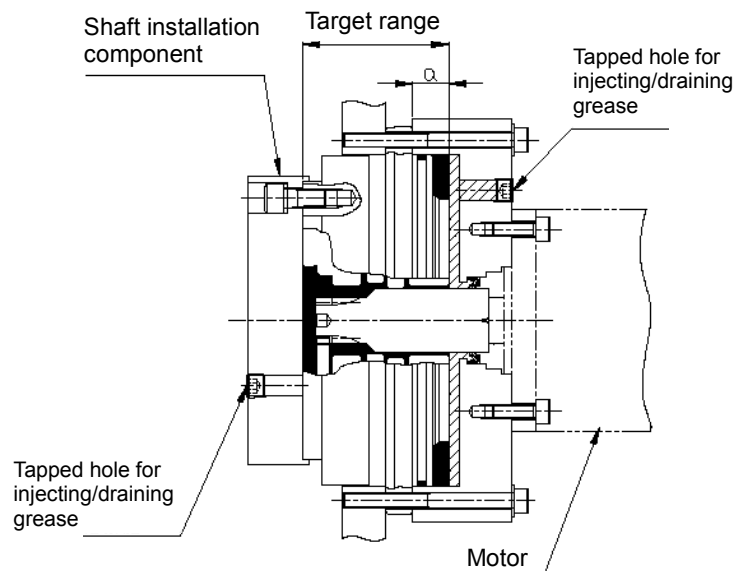






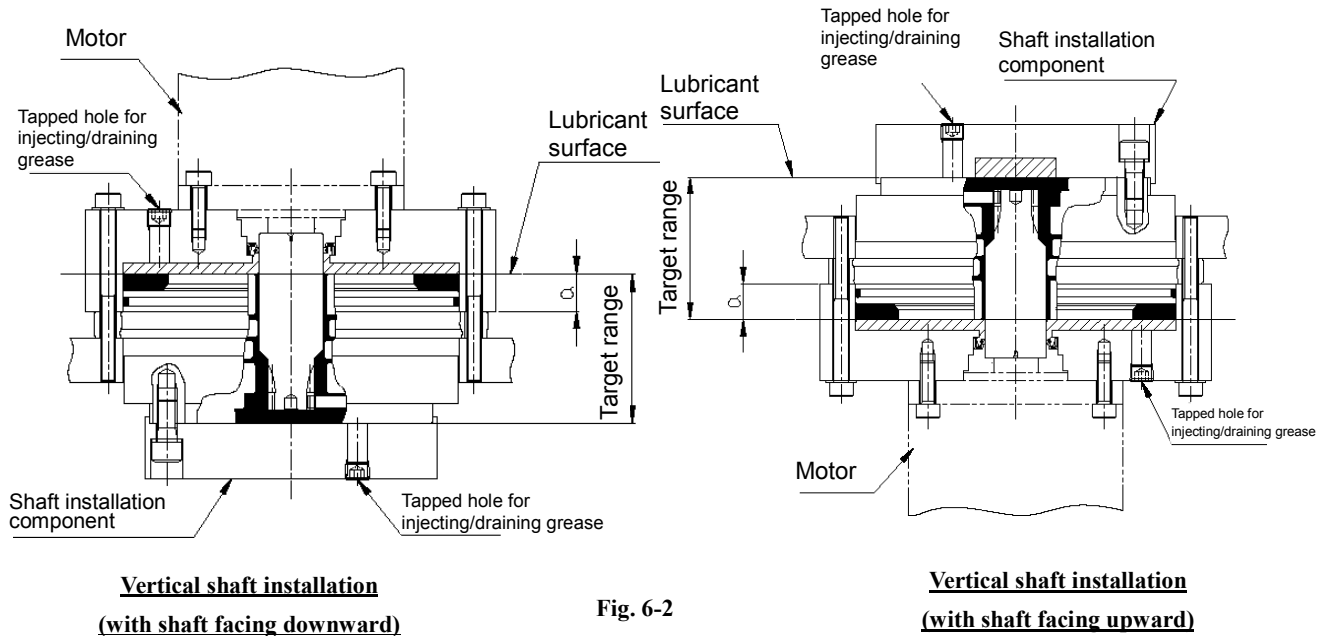
Fig. 6-1

#### Note

- Be sure to leave a space about 10% of the total volume. If overfilled, the temperature increases during operation and the internal pressure also increases. As a result, oil seals could fall off or lubricant could leak.
- If the lubricant is not filled sufficiently, it could lead to premature damage of the reduction gear.
- The shape of the reduction gear may differ from the illustration in Fig. 6-1 above, depending on the ordered specifications. For details on the shape, refer to the separately provided "Outer dimensions" drawings and specification sheet.

### 6.2.2. Vertical shaft installation

The target range for filling the lubricant (the  areas in the diagram) inside the reduction gear when the reduction gear is installed in the vertical shaft is indicated below. The amount does not include the space (the  areas in the diagram) on the motor mounting side. Therefore, if there is a blank space, also fill the space. Leave a space about 10% of the total volume of the internal capacity of the reduction gear (the  areas in the diagram) and the space on the motor mounting side (the  areas in the diagram). Be sure to fill the amount of lubricant described in the separately provided “Outer dimensions” drawings. If there is no indication in the “Outer dimensions” drawings, contact our service representative individually.



#### Note

- Be sure to leave a space about 10% of the total volume. If overfilled, the temperature increases during operation and the internal pressure also increases. As a result, oil seals could fall off or lubricant could leak.
- If the lubricant is not filled sufficiently, it could lead to premature damage of the reduction gear.
- The shape of the reduction gear may differ from the illustration in Fig. 6-2 above, depending on the ordered specifications. For details on the shape, refer to the separately provided “Outer dimensions” drawings and specification sheet.

### 6.3. Lubricant filling procedure

This section describes how to fill the lubricant.

If the product is not filled with lubricant, perform steps 1 to 7 by taking care regarding the following precautions.

- When handling the lubricant, be sure to wear protective goggles and rubber gloves.



- If the lubricant gets in your eyes or touches your skin, it could cause inflammation.

- Step 1**
- Remove both of the plugs for tapped holes for injecting/draining grease, and attach a grease nipple, etc., and then attach the injector. (Reference: Fig. 6-3.)

#### Important

- If the injector is attached with the supply side down, air is less likely to accumulate in the reduction gear, which facilitates the lubricant filling procedure.

- Step 2**
- Fill the specified lubricant using the injector.
  - When filling the lubricant, be sure to remove the plug for tapped hole for injecting/draining grease on the drain side.
  - When pneumatic pressure is used for filling the lubricant, set the pressure below 0.03 MPa.

#### Note

- If you fail to remove the plug for tapped hole for injecting/draining grease on the drain side, the internal pressure increases. As a result, oil seals could fall off or the oil seal lip could be reversed.
- If the internal pressure of the reduction gear increases, oil seals could fall off or lubricant could leak.
- The shape of the reduction gear may differ from the illustration in Fig. 6-3, depending on the ordered specifications. For details on the shape, refer to the separately provided "Outer dimensions" drawings and specification sheet.

- Step 3**
- If the lubricant overflows from the tapped hole for injecting/draining grease on the drain side during filling, temporarily stop the filling.

- Step 4**
- Remove the injector from the grease nipple and plug the tapped holes for injecting/draining grease on both the greasing and drain sides.



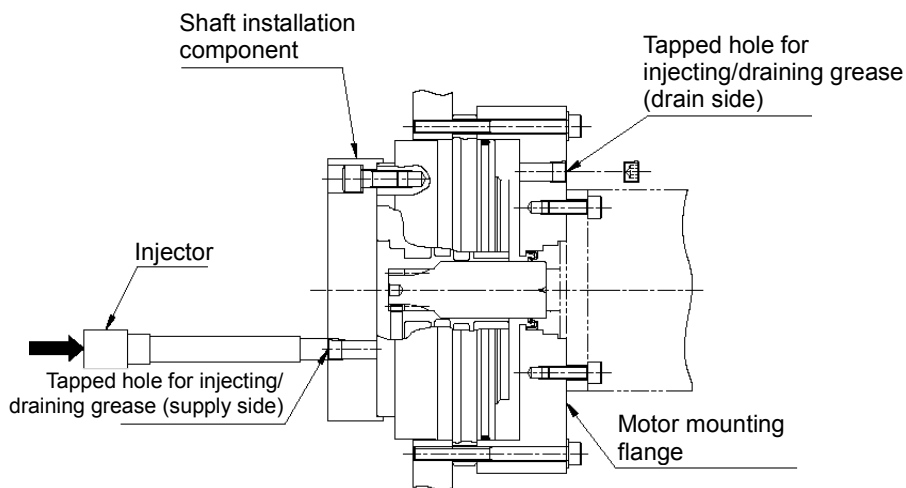
**Step 5** • Rotate the output shaft of the reduction gear by 1 or 2 turns.



- Do not use the motor to rotate the output shaft of the reduction gear for safety, if possible. If the motor is used by necessity, run the motor at a low speed and never touch the rotation section. Otherwise, you could be caught by the rotation section, which will result in serious injury.

**Step 6** • Repeat steps 1 to 5 until the lubricant is filled up to the specified level.

- Step 7** • After filling the lubricant up to the specified level, wipe the lubricant off from the tapped holes for injecting/draining grease and then install the plugs removed in step 1 after sealing them with a seal tape, etc.
- If the customer's component is flush with the tapped holes for injecting/draining grease, tighten it so that the plugs will not protrude from the edge surface.



**Horizontal shaft installation**

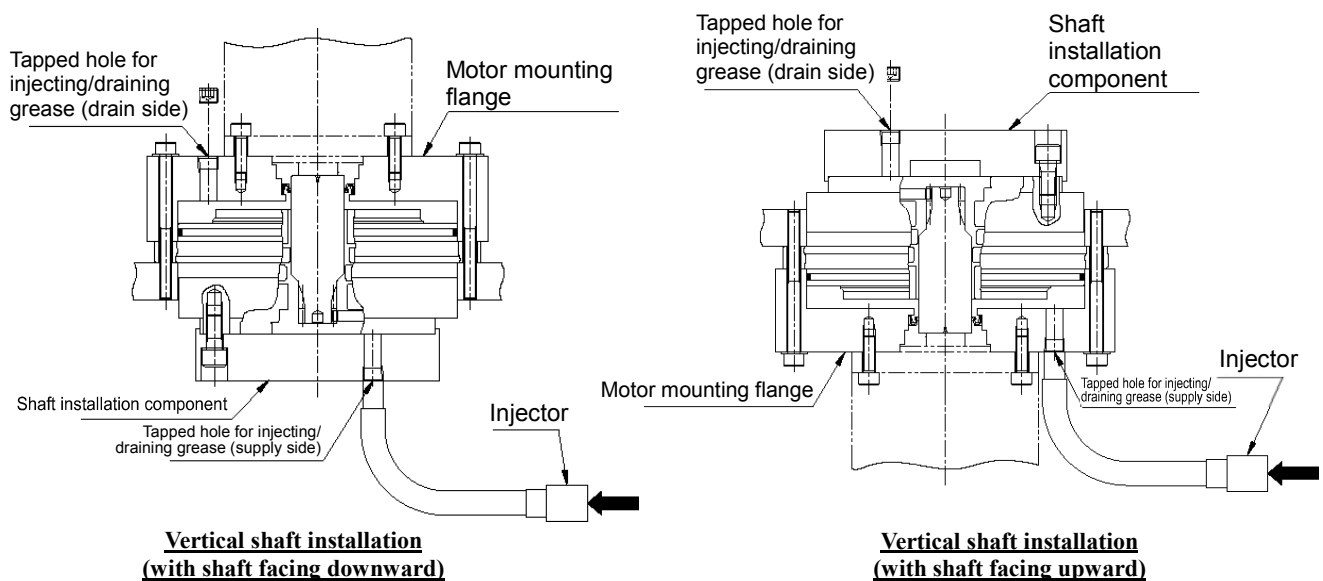


Fig. 6-3

## Chapter 7 Operation

This chapter describes the operation of the product.

### 7.1. Checking before operation

After installing this product in the customer's device, check the following points before starting operation.

- The lubricant is filled correctly.
- Components are fixed with each other correctly.
- The mounting bolts are tightened securely.
- The rotation section rotates in the desired direction.

### 7.2. Running-in operation

We recommend that the running-in operation is performed.

#### Important

- Abnormal noise or torque irregularity may occur during operation, depending on the characteristics of the lubricant. There is no problem with the quality when the symptom disappears after the running-in operation is performed for 30 minutes or more (until the surface temperature of the reduction gear body reaches around 50°C).
- During the running-in operation, check the items in Table 8-1 on page 36.

### 7.3. Precautions for operation

Once the pre-operation checks and running-in operation are completed, operate the device safely by observing the following precautions.

#### WARNING

- Keep away from the rotation section during operation of the device or until it is completely stopped. Otherwise, you could be caught by the rotation section, which will result in serious injury.
- If any abnormalities, such as abnormal noise or excessive vibration are found, stop the operation immediately. Do not start the operation before the cause of the error is identified and corrective measures are taken. Incorrect motion could cause injury.

#### CAUTION

- The reduction gear could become extremely hot during operation. After stopping the operation, never touch the reduction gear until it is completely cooled. Touching the reduction gear could cause burns.
- Do not operate the reduction gear under a condition that exceeds the allowable acceleration/deceleration torque, allowable moment, and allowable output speed. It could cause injury to the workers or damage to the reduction gear.

#### Note

- Operate the reduction gear while the surface temperature is below 60°C. Failure to do so could cause premature damage.
- When the reduction gear is used with the surface temperature within 40 to 60°C, refer to "8.3.1 Replacement period of lubricant".

## Chapter 8 Maintenance and Inspection

This chapter describes how to perform maintenance and inspection.

### 8.1. Precautions on maintenance



- Keep away from the rotation section during maintenance/inspection of the device currently in operation. Otherwise, you could be caught by the rotation section, which will result in serious injury.
- If any abnormalities, such as abnormal noise or excessive vibration are found, stop the operation immediately. Do not start the operation before the cause of the error is identified and corrective measures are taken. Incorrect motion could cause injury.



- The reduction gear could become extremely hot during operation. After stopping the operation, never touch the reduction gear until it is completely cooled. Touching the reduction gear could cause burns.

When performing maintenance, observe the following precautions and ensure safety.

- Wear appropriate clothing and protective gear, including the protective goggles, gloves, and safety shoes.
- Organize the surrounding area and ensure safety to prevent secondary accidents.
- To maintain the condition in which the device is completely stopped, turn OFF the power to the customer's device and take extra care so that the power will not be turned ON by accident.

### 8.2. Daily inspection

Check the following items every day before starting the operation.

**Table 8 - 1**

Inspection item	Description
Noise	Check for abnormal noise or sudden change of noise.
Vibration	Check for excessive vibration or any sudden change. *
Surface temperature	Check for an excessively hot surface of the reduction gear (normally below 60°C) or any sudden change.
Bolts	Check for looseness of each mounting bolt.
Leakage of lubricant	Check for leakage of lubricant from the mating face or oil seal section in the vicinity of the reduction gear.


Note: Check for vibration remotely in a distance from the rotation section such as connection components.



- If it is necessary to access the device for inspection while the device is in operation, cover the rotation section. Otherwise, you could be caught by the rotation section, which will result in serious injury.

### 8.3. Lubricant replacement

#### 8.3.1. Lubricant replacement time

When this product is operated filled with an appropriate amount of lubricant, the standard lubricant replacement time due to lubricant degradation is 20,000 hours. However, when operation involves a reduction gear surface temperature above 40°C (the  area in the right diagram), the state of the lubricant should be checked in advance and the grease replaced earlier as necessary. For the lubricants specified by Nabtesco, refer to “4.2.6 Lubricant”.

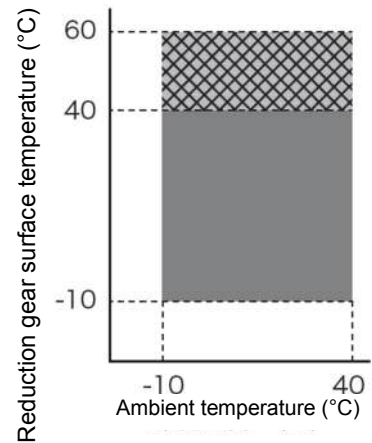


Fig. 8-1

#### 8.3.2. Lubricant replacement procedure

This section describes how to replace lubricants.

Perform steps 1 to 7 by taking care regarding the following precautions.

- When handling the lubricant, be sure to wear protective goggles and rubber gloves.



- When replacing the lubricant, turn OFF the power source (e.g., power supply) and execute lock-out/tag-out so that the power will not be turned ON by accident. Otherwise, you could be caught by the rotation section, which will result in injury.



- If the lubricant gets in your eyes or touches your skin, it could cause inflammation.
- When the safety cover near the reduction gear has been removed for replacement/maintenance of lubricant, be sure to return them to their original positions after the procedure.

#### Note

- If the lubricant is overfilled, there is a possibility of high internal pressure and that an oil seal could fall off, the lip could be reversed, or lubricant could leak. If the lubricant is insufficient, a lubrication failure could occur and the reduction gear could be damaged.
- If the lubricant is not filled sufficiently, it could lead to premature damage of the reduction gear.
- The shape of the reduction gear may differ from the illustration in Fig. 8-2, depending on the ordered specifications. For details on the shape, refer to the separately provided “Outer dimensions” drawings and specification sheet.

- Step 1** • Rotate the output shaft of the reduction gear so that the tapped holes for injecting/draining grease are positioned diagonally.  
(When rotating the output shaft using electric power, do not approach the equipment and reduction gear. When rotating the output shaft without using electric power, perform step 2 first.)
- Step 2** • Turn OFF the power to the device and confirm that the device is completely stopped.
- Step 3** • Remove both of the plugs for the tapped holes for injecting/draining grease, and drain the lubricant from the upper tapped hole for injecting/draining grease.
- Check the amount of drained lubricant by catching it with a container, etc., in order to control the same amount of lubricant to be drained and filled.
  - Always drain the lubricant while the reduction gear is cool.

 **CAUTION**

- If a tapped hole for injecting/draining grease is unplugged while the reduction gear is still hot, high-temperature lubricant sprays out, which could cause burns.

- Step 4** • Attach a grease nipple, etc. to the tapped hole for injecting/draining grease and then attach the injector. (Refer to Fig. 8-2)
- Step 5** • Using the injector or the like, fill the lubricant through the tapped hole for injecting/draining grease on the supply side.
- When filling the lubricant, be sure to remove the plug for tapped hole for injecting/draining grease on the drain side.
  - When pneumatic pressure is used for filling the lubricant, set the pressure below 0.03 MPa.

**Note**

- If you fail to remove the plug for tapped hole for injecting/draining grease on the drain side, the internal pressure increases. As a result, oil seals could fall off or the oil seal lip could be reversed.
- If the internal pressure of the reduction gear increases, oil seals could fall off or lubricant could leak.

- Step 6** • Inject the lubricant until it overflows from the tapped hole for injecting/draining grease on the drain side.
- Step 7** • Remove the injector from the grease nipple and plug the tapped holes for injecting/draining grease on both the greasing and drain sides.
- Step 8** • Rotate the output shaft of the reduction gear by 1 or 2 turns.



- Do not use the motor to rotate the output shaft of the reduction gear for safety, if possible. If the motor is used by necessity, run the motor at a low speed and never touch the rotation section. Otherwise, you could be caught by the rotation section, which will result in serious injury.

**Step 9** • Repeat steps 3 to 8 until the reduction gear is filled with the same amount of lubricant as that was drained.

- Step 10** • It is recommended that the inside of the reduction gear is flushed so that the lubricant can be replaced more efficiently.
- Remove the injector from the tapped hole on the supply side, and attach a hexagon socket head cap plug to the tapped hole on the drain side. Calculate the output shaft conversion and set the motor rotation speed so that the output shaft rotation speed is 5 to 10 rpm. Then, rotate the motor for about one minute.

**Important**

- Set the rotation speed based on the output shaft conversion by taking the customer's operation conditions into account.

**Step 11** • Perform steps 2 and 3 again.

- Step 12** • Attach the plugs removed in step 2 above to the tapped holes for injecting/draining grease. Replace with new seal tape.
- If the customer's component is flush with the tapped holes for injecting/draining grease, tighten it so that the plugs will not protrude from the edge surface.

**Step 13** • Wipe off the lubricant adhering to the surrounding completely.

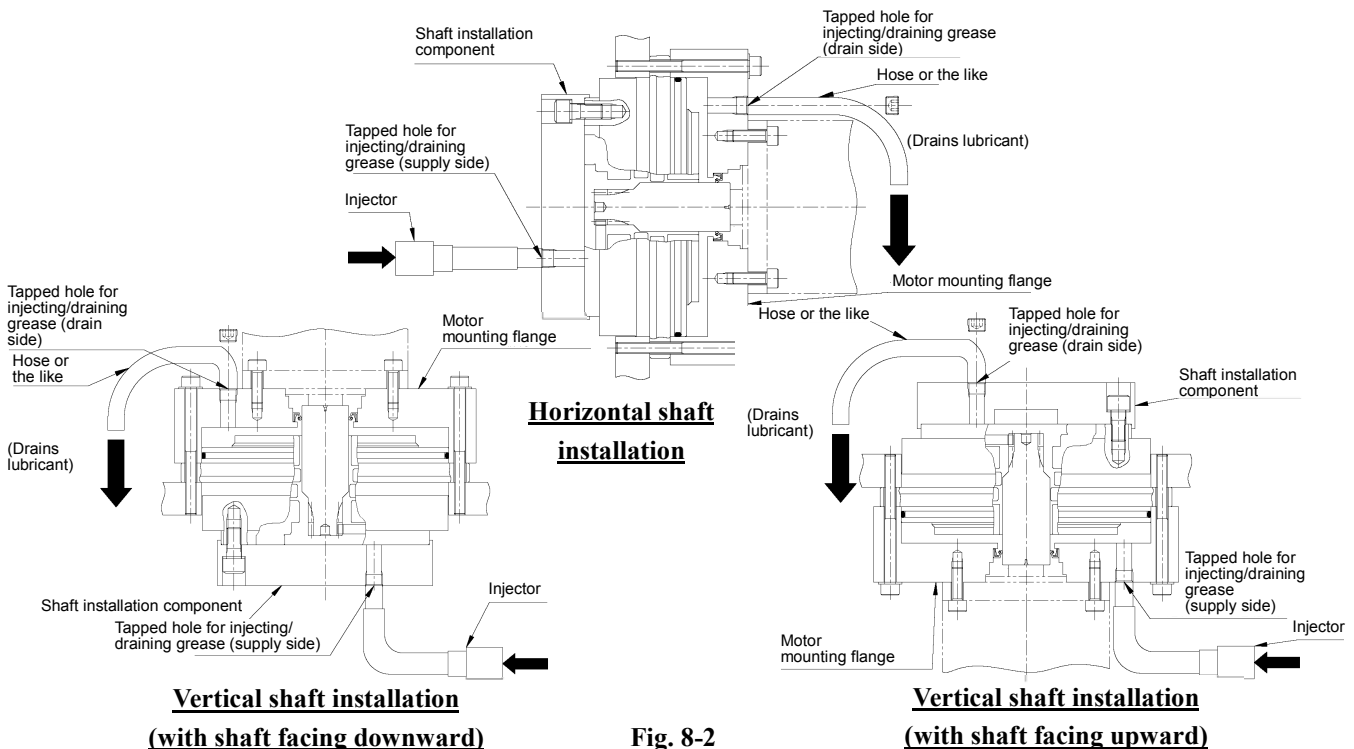


Fig. 8-2

## 8.4. Troubleshooting checksheet

Check the following items in the case of trouble like abnormal noise, vibration, or malfunctions. When it is not possible to resolve an abnormality even after verifying the corresponding checkpoint, obtain a “Reduction Gear Investigation Request Sheet” from our Website, fill in the necessary information, and contact us via the agent where you bought the device.

<http://precision.nabtesco.com/documents/request.html>

### ● The trouble started immediately after installation of the reduction gear

Check column	Item
	Make sure the equipment’s drive section (the motor side or the reduction gear output surface side) is not interfering with another component.
	Make sure the equipment is not under a greater than expected load (torque, moment load, thrust load).
	Make sure the required number of bolts are tightened uniformly with the specified tightening torque.
	Make sure the reduction gear, motor, or your company’s components are not installed at a slant.
	Make sure the specified amount of Nabtesco-specified lubricant has been added.
	Make sure there are no problems with the motor’s parameter settings.
	Make sure there are no components resonating in unity.
	Make sure the input gear is appropriately installed on the motor.
	Make sure there is no damage to the surface of the input gear teeth.
	Make sure the input gear specifications (precision, number of teeth, module, shift coefficient, dimensions of each part) are correct.
	Make sure the flange and other components are designed and manufactured with the correct tolerances.

### ● The trouble started during operation

Check column	Item
	Make sure the equipment has not been in operation longer than the calculated service life.
	Make sure the surface temperature of the reduction gear is not higher than normal during operation.
	Make sure the operation conditions have not been changed.
	Make sure there are no loose or missing bolts.
	Make sure the equipment is not under a greater than expected load (torque, moment load, thrust load).
	Make sure the equipment’s drive section is not interfering with another component.
	Make sure an oil leak is not causing a drop in the amount of lubricant.
	Make sure there are no external contaminants in the gear, such as moisture or metal powder.
	Make sure no lubricant other than that specified is being used.

When the reduction gear is embedded in the customer’s equipment, create your own troubleshooting checksheet based on the above checkpoints.

## Contact information

For any inquiries and requests for services related to this product, contact our service representative using the following contact information.

In such a case, please inform us of the model, parts code, and S/N (serial number) indicated on the shipping label for the packing box.



<http://precision.nabtesco.com/>

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