Precision Reduction Gear RV™
Turn Table Gearhead
RS Series
Operation Manual

<Applicable Model>

RS-260A, RS-320A, RS-900A

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.

Nabtesco Corporation

ERD15042A
2016/10/01

Contents

Important Information

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.

WARNING

- 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 product catalog 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

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

Warranty

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 from the initial operation of Customer's equipment incorporating the Product at end user's production line, 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

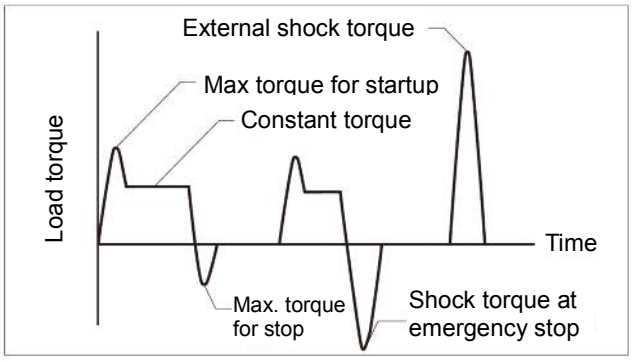
When the machine starts or stops, the load torque to be applied to the reduction gear is larger than the constant-speed load torque due to the effect of the inertia torque of the rotating part. In such a situation, the allowable torque during acceleration/deceleration is referred to as “allowable acceleration/deceleration 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: The reduction gear temperature may exceed 60°C even when the speed is under the allowable speed depending on the operation conditions (duty, load, ambient temperature, etc.). In such a case, use the reduction gear at the speed so that the gear surface temperature is 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” indicated in this manual refers to the “RS series turn table gearhead” 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.

DANGER	Indicates a hazardous situation that, if not avoided, is highly likely to result in death or serious injury.
WARNING	Indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury.
CAUTION	Indicates a potentially hazardous situation that, if not avoided, could result in minor or moderate injury.
Note	Indicates a potentially hazardous situation that, if not avoided, could result in physical damage.

Important 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

- 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.

(1) RS-260A

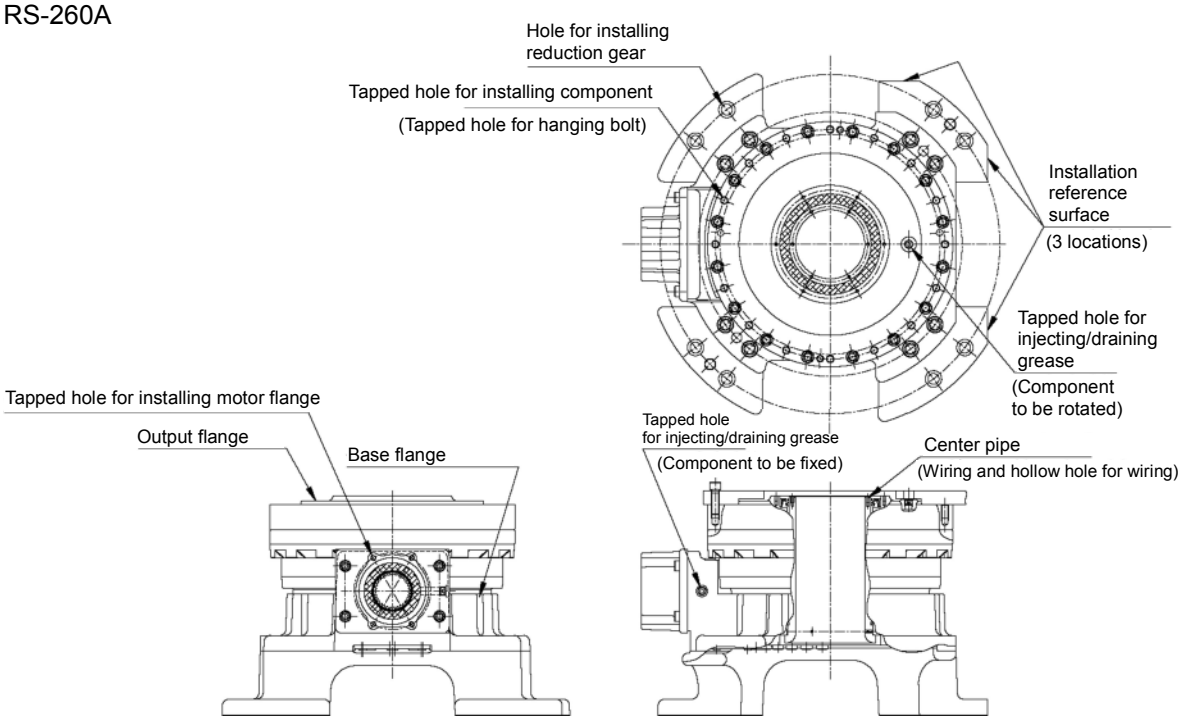


Fig. 2-1

(2) RS-320A

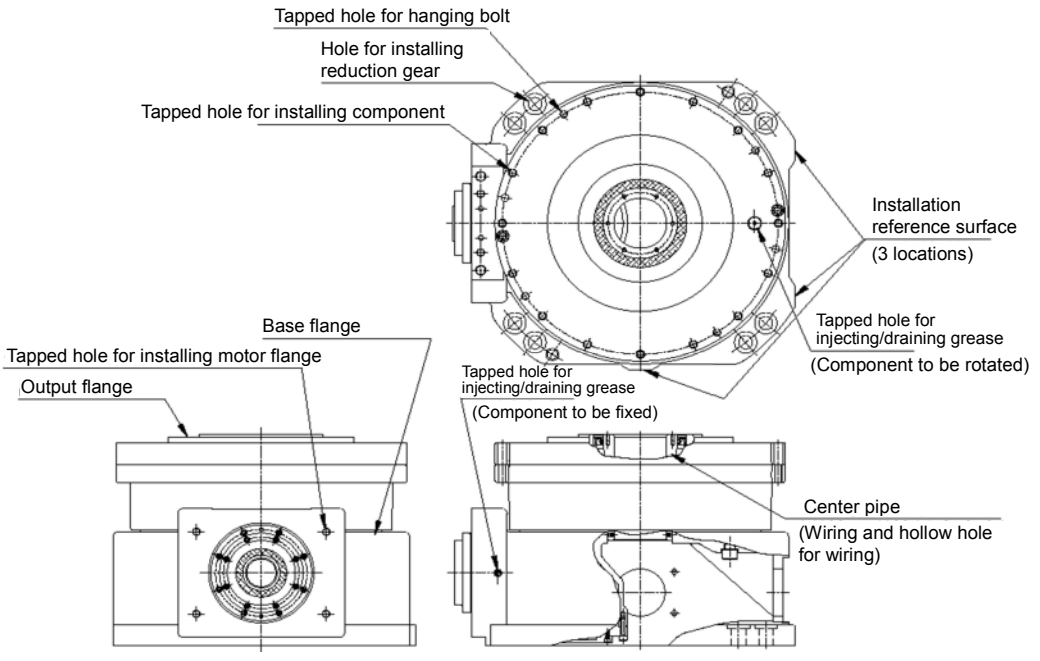


Fig. 2-2

(3) RS-900A

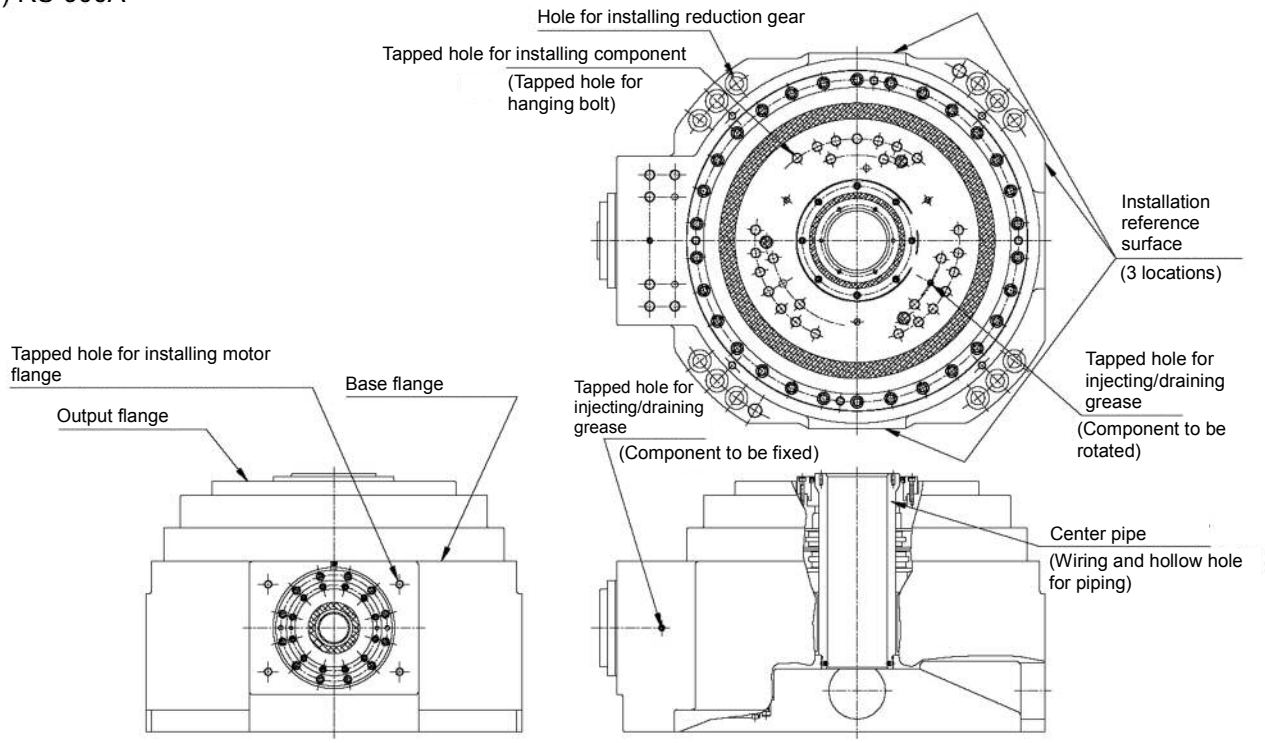


Fig. 2-3

Important

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

2.2. Lubricant

- The specified lubricant is filled before shipping.
- When replacing the lubricant, be sure to use the Nabtesco-specified lubricant. For purchase of the lubricant, contact our service representative.
- Do not mix it with other lubricants.

Table 2-1

Model	RS-260A	RS-320A, RS-900A
Brand specified by Nabtesco	VIGOGREASE* RE0	Molywhite RE No. 00
Operating temperature range (ambient temperature)	-10 to 40°C	-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.

Chapter 3 Transportation and Storage of Product

This chapter describes the transportation and storage of this product.

3.1. Transportation

- Refer to the weights of the reduction gears listed in Table 3-1 and transport the product in an appropriate way.
- 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 the reduction gear too high.
- Avoid excessive impact or vibration of the reduction gear.

Table 3-1

Model	Weight (kg)
RS-260A	165
RS-320A	290
RS-900A	480

WARNING

- 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

- The weight shown in Table 3-1 indicates the weight of the reduction gear only. The weight of the packing box, motor flange, input spline, etc. is not included.
- The actual weight of the reduction gear may slightly differ from that listed in the above table, depending on the specifications.

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℃.
- 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

WARNING

- 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 or rotary 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.

DANGER

- When the reduction gear is used for human transportation equipment or rotary 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℃.
- 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

When operating the reduction gear in a location where there is a lot of dust or particles, or where machine oil or water, etc. can enter, attach the protective cover to protect the oil seal on the output shaft. (When attaching the protective cover, use the tapped holes on the center pipe.)

CAUTION

- Be sure that no load is applied to the center pipe when attaching the protective cover. The oil seals for the output shaft may be deformed, which could eventually cause leakage of the lubricant.
- If the reduction gear is operated without the protective cover under the above conditions, lubricant may leak from the oil seal on the output shaft.

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 and materials are required for installing this product. Check the components/materials and prepare them at each customer's site.
- 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 components on the fixed side and the rotation side, which have been designed and manufactured either based on the catalog or based on separately provided "Outer dimensions" drawings and a specification sheet.

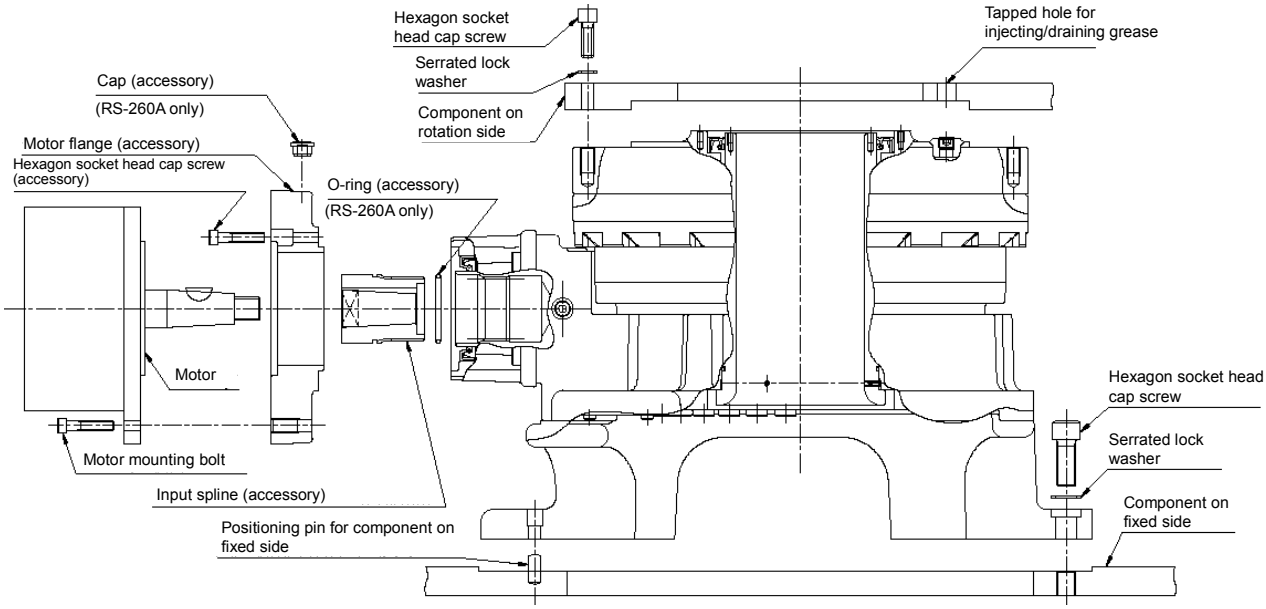


Fig. 4-1

Important

- 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.

- **(Component on fixed side)**

- Prepare the installation component on the fixed side to be used for the base flange of the reduction gear.

CAUTION

- Confirm that the design of the prepared component on the fixed side conforms to the size and quantity of the mounting bolts for the base flange indicated in the catalog and in the separately provided "Outer dimensions" drawings and specification sheet.
- Use the positioning pin or positioning plate when aligning the component on the fixed side with the reduction gear.

- **(Component on rotation side)**

Prepare the installation component on the rotation side to be attached to the output shaft of the reduction gear.

CAUTION

- Confirm that the design of the prepared component on the rotation side conforms to the size and quantity of the mounting bolts for the output flange indicated in the catalog and in the separately provided "Outer dimensions" drawings and specification sheet.
- When preparing the component on the rotation side, 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

- Refer to the size and quantity of the bolts listed in Table 4-1 and Table 4-2.
- 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	6g

Component on fixed side

Table 4-1

Model	Nominal size × pitch (mm)	Required Qty.
RS-260A	M16 × 2.0	8
RS-320A	M20 × 2.5	8
RS-900A	M20 × 2.5	12

Component on rotation side

Table 4-2

Model	Nominal size × pitch (mm)	Required Qty.
RS-260A	M12 × 1.75	16
RS-320A	M12 × 1.75	16
RS-900A	M16 × 2.0	27

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 symbol: CDW-H,
CDW-L (Only for M5)
Material: S50C to S70C
Hardness: HRC40 to 48

Table 4-3 (Unit: mm)

Nominal size	ID and OD of Belleville spring washer		t	H
	ød	øD		
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
20	20.9	30	2.8	3.55

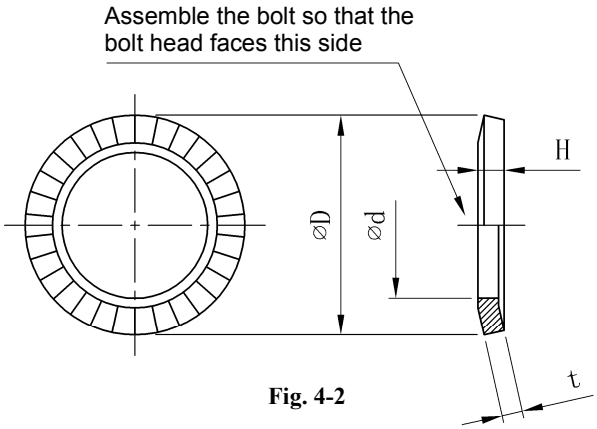


Fig. 4-2

Important

- When using any equivalent washer, pay particular attention to its outside diameter (ø D) and to the strength of the spring washer.

4.2.4. Liquid sealant

When using a liquid sealant to seal the sections between the reduction gear and the motor flange and between the motor flange and the motor installation surface, prepare one of the following liquid sealants recommended by Nabtesco.

Table 4-4

Name	Manufacturer	Characteristics and applications
ThreeBond 1211	ThreeBond	• Silicone-based, solventless type • Semi-dry gasket
HermeSeal SS-60F	Nihon Hermetics Co.	• One-part, non-solvent elastic sealant • Metal contact surface (flange surface) seal • Any product basically equivalent to ThreeBond 1211
Loctite 515	Henkel	• Anaerobic flange sealant • Metal contact surface (flange surface) seal

Note

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

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.

⚠ CAUTION

- 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 the customer's device and the reduction gear.

Note

- If it is left upside down, it could cause damage to the reduction gear. (Refer to Fig. 4-3 for the direction.)

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 contents

- Check the shipping label to confirm that it matches the product you have ordered.
- Confirm that the contents of the packing box match the items in the illustration below when unpacking.
- The packing material may differ depending on the product. The following illustration should only be referred to as an example.

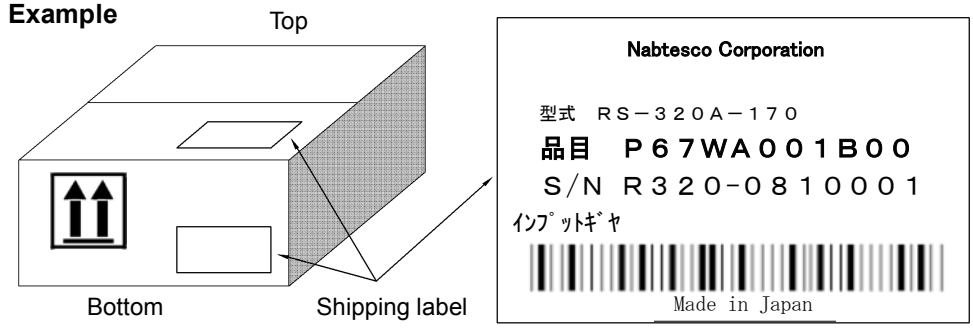


Fig. 4-3

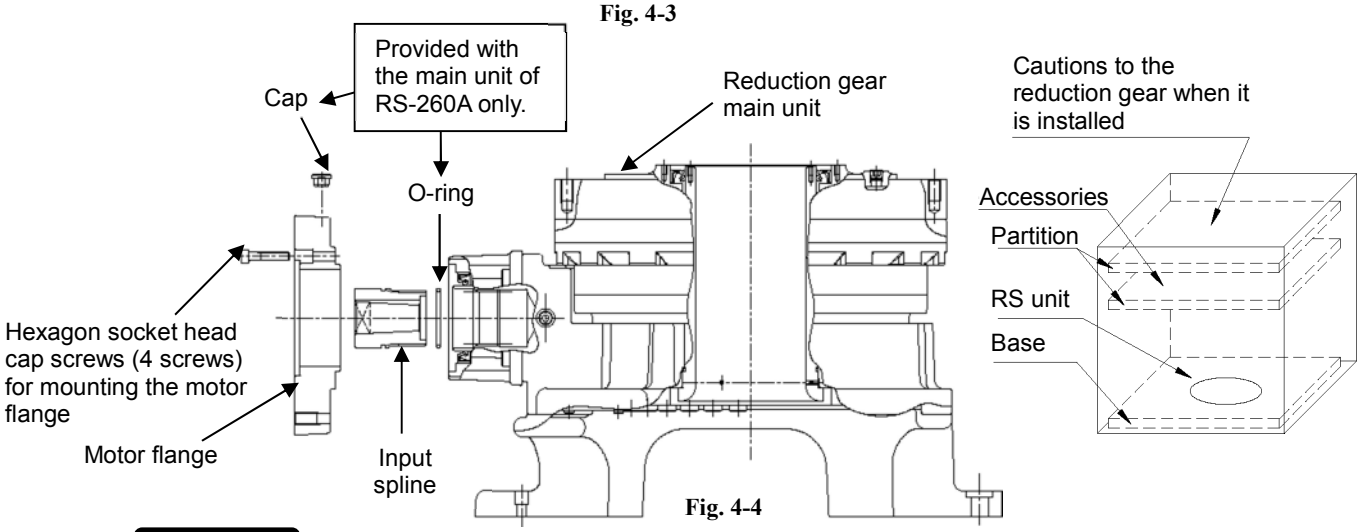


Fig. 4-4

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. (The model and serial number indicated on the label may be used.)
- The contents of the packing box and shape of the reduction gear may differ from the illustration above depending on the ordered specifications. The motor flange and input spline may not be included in the packing box.

4.3.2. Label indication

A label is attached to the main unit of this product.

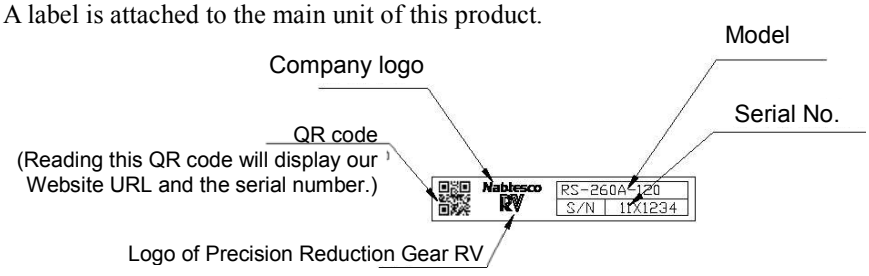


Fig. 4-5

4.4. Lifting of this product

- When lifting the product, use the tap holes for the hanging bolts or for installing component shown in Fig. 2-1 to 2-3.
- When using tapped holes for component attachment to lift the product, check the load capacity of the lifter and determine the number of tapped holes required.
- Refer to Table 3-1 for the product weight.
- 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.

Table 4-5

Model	Hanging bolt Nominal size × pitch (mm)
RS-260A	M12 × 1.75
RS-320A	M12 × 1.75
RS-900A	M16 × 2.0

WARNING

- 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.

CAUTION

- Be sure that no load is applied to the center pipe or spline hole on the input unit when lifting. The reduction gear could be damaged and the components could fall down, which may cause injury to the workers. In addition, the oil seals on the output and/or input sides may become 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.
- The center pipe at the center of the reduction unit is not designed to support a load. Do not use the reduction gear in any way that applies a load to the center pipe. The oil seals may become deformed, which could eventually cause leakage of the lubricant.

5.1. Installation position

- When installing the reduction gear in the horizontal shaft position, do not position the input shaft (motor) upward. (Install the reduction gear with the input shaft facing left, right, or down.)

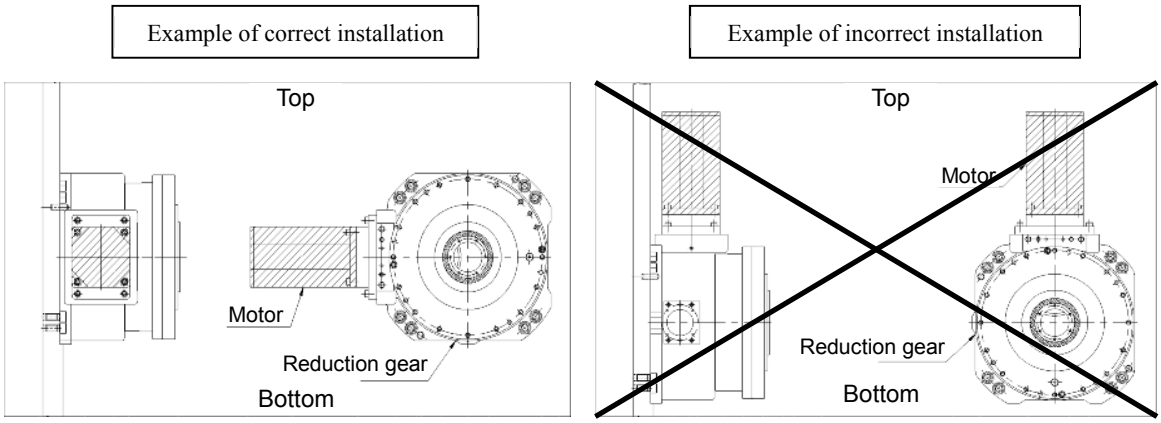


Fig. 5-1

- For the RS-260A, do not attach the reduction gear to the ceiling.

CAUTION

- If the input shaft side is oriented upward, lubrication of some parts may be adversely affected. This could cause damage to the reduction gear.

5.2. Bolt tightening torque

- Use the Nabtesco-recommended bolts for installing the reduction gear and tighten them with the specified tightening torque.

  (Reference: “4.2.2. Reduction gear mounting bolts”)

- 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: “4.2.3 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
M20 × 2.5	493 ± 22.0	132,170

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

Important

- If aluminum or stainless-steel is used for the bolt, 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.

5.3. 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.

5.3.1. Installing the reduction gear

The following describes the installation of the reduction gear.

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

- 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 and the bolt seat surface.
- Use the installation reference surface of the reduction gear or a positioning pin when aligning the component on the fixed side with the reduction gear.

Step 1

- Align the installation reference surface of the component on the fixed side with that of the reduction gear. Then use a reamer to drill a positioning pin hole for the reduction gear and the component on the fixed side. After that, tap the taper pin.
- Align the mounting holes of the reduction gear with the positions of the tapped holes for the component on the fixed side. Then attach the reduction gear to the specified position.
- Check that there is no foreign matter adhering to the mounting surface.
- Using the hexagon socket head cap screw and serrated lock washer for a hexagon socket head cap screw, tighten each component.
- Tighten the hexagon socket head cap screws equally with the specified bolt tightening torque. (For the bolt tightening torque, refer to Table 5-1.)

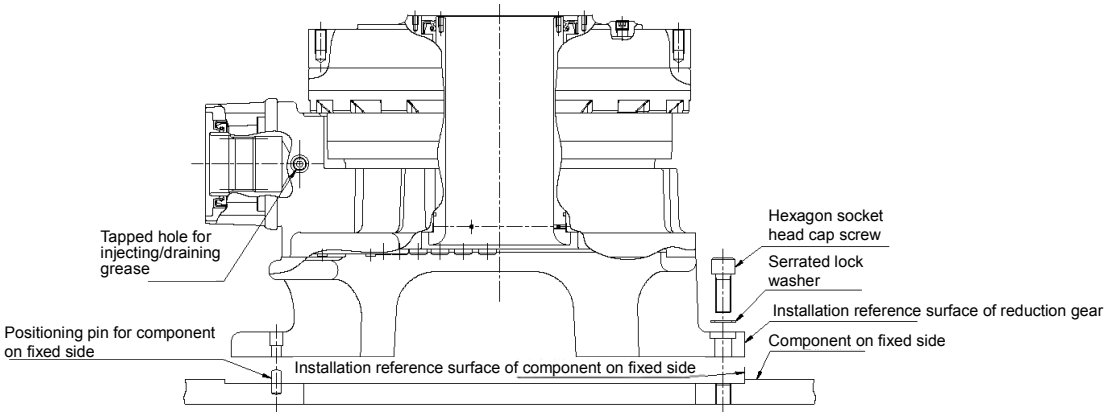


Fig. 5-2

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 component on the fixed side, 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.

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 2

- Align the tapped holes of the reduction gear with the positions of the mounting holes for the component on the rotation side. Then attach the reduction gear to the specified position.
- Confirm that the centering shaft of the reduction gear is correctly fitted into the centering hole of the component on the rotation side.
- Check that there is no foreign matter adhering to the mounting surface.
- Using the hexagon socket head cap screw and serrated lock washer for a hexagon socket head cap screw, tighten each component.
- Tighten the hexagon socket head cap screws equally with the specified bolt tightening torque. (For the bolt tightening torque, refer to Table 5-1.)

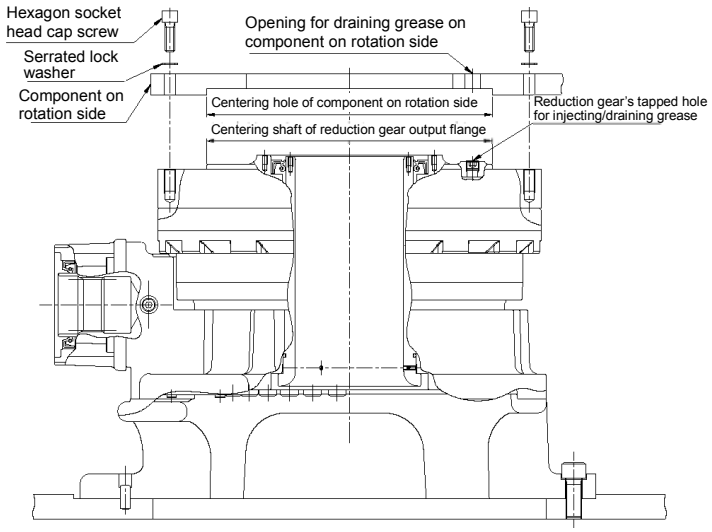


Fig. 5-3

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 component on the rotation side, 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.

⚠ 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 3

- Align the mating part of the motor flange with that of the reduction gear. Then, while checking the bolt holes for securing the mating parts, attach the motor flange to the reduction gear.
- 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.
- For the RS-260A, insert the cap provided with the reduction gear into the side of the motor flange.

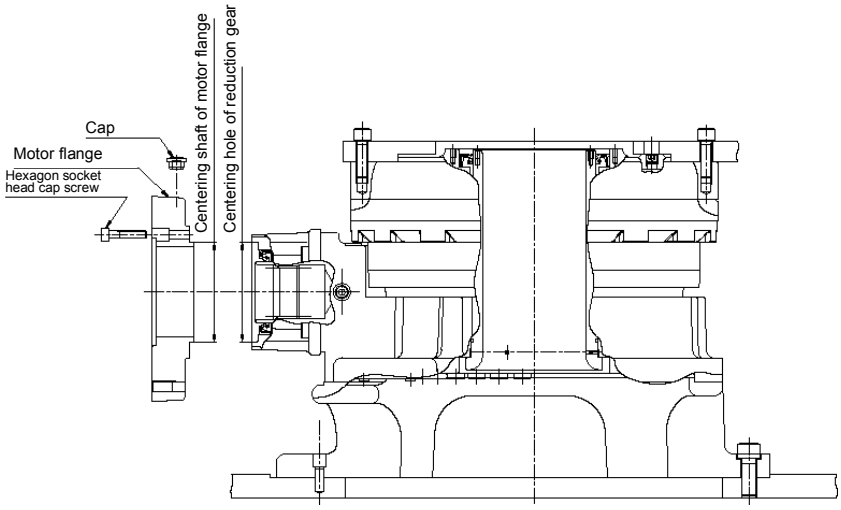


Fig. 5-4

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 4

- Using the provided hexagon socket head cap screw, install the motor flange on the reduction gear.
- Tighten the provided hexagon socket head cap screws equally with the specified bolt tightening torque. (For the bolt tightening torque, refer to Table 5-1.)

Table 5-2

Hexagon socket head cap screw for motor flange (accessory)

Model	Hexagon socket head cap screw	Qty.
RS-260A	M8×35	4
RS-320A	M12×45	4
RS-900A	M12×45	4

⚠ 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

- The motor flange mounting bolts are provided with this product.

5.3.2. Installing the input spline

- **For straight shaft (with a key and tap)**

The following is an example when fixing the input spline to the motor shaft using a hexagon socket head cap screw.

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

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

Note

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

Step 1
- Attach the key (4) to the motor shaft.

Step 2
- Attach the input spline (1) 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 spline retainer (2) to the motor shaft using the hexagon socket head cap screw (3).
- Using a thread-locking sealant for screws, lock the hexagon socket head cap screw (3).

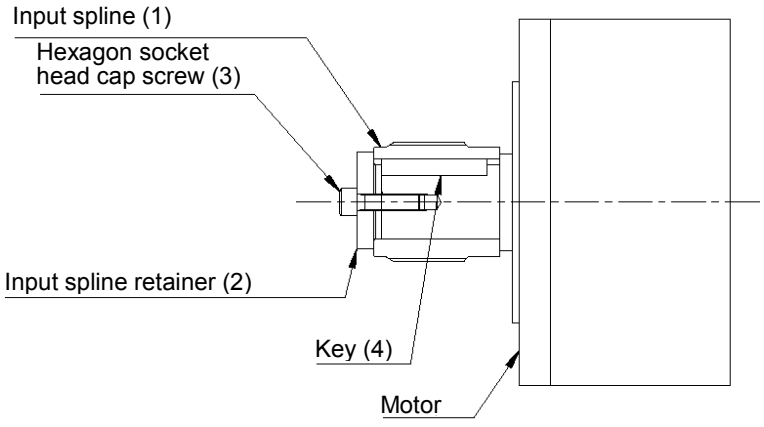


Fig. 5-5

Important

- Check the depths of the input spline retainer hole and motor shaft screw hole before selecting an appropriate size and length of the hexagon socket head cap screw.

● For straight shaft (with a key and set screw)

The following is an example when fixing the input spline 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 spline.

Note

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

Step 1
- Attach the key (3) to the motor shaft.

Step 2
- Attach the input spline (1) 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 spline (1) to the motor shaft using the set screw (2).
- Using a thread-locking sealant for screws, lock the set screw (2).

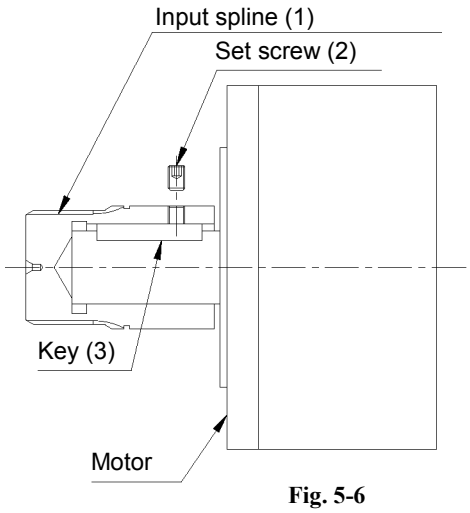


Fig. 5-6

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 of fixing the input spline to the motor shaft using a washer and a hexagon nut.

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

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

Note

- Avoid impact to the motor shaft when attaching the input spline, as it could damage the motor.
- If the outer diameters of the hexagon nut and washer are larger than the root circle diameter of the input spline, the hexagon nut and washer will interfere with the input shaft. This may prevent the spline from being installed or it may damage the input shaft.

Step 1
- Attach the Woodruff key (4) to the motor shaft.

Step 2
- Attach the input spline (1) 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
- Place the washer (2) into the motor shaft, and then tighten the hexagon nut (3).
- Using a thread-locking sealant for the screws, lock the hexagon nut (3).
- For the shape shown in Fig. 5-8, use the washer (2) and hexagon nut (3) with outer diameters of øA or smaller. (For øA, refer to the separately provided “Outer dimensions” drawings and specification sheet.)

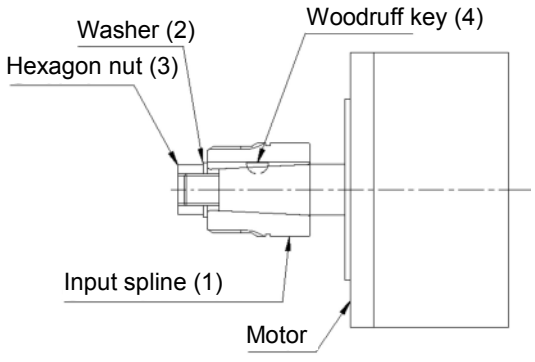


Fig. 5-7

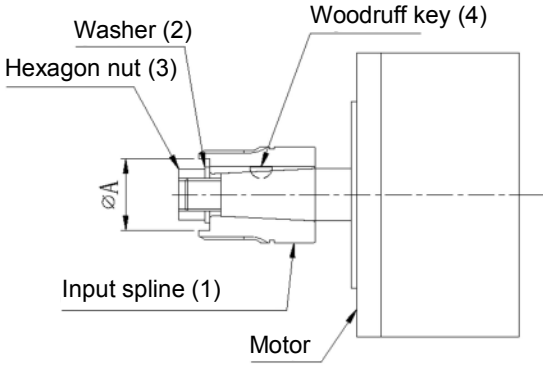


Fig. 5-8

● When no straight shaft key is provided

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

Perform steps 1 to 6 by taking care regarding the following precautions.

- Avoid impact to the motor shaft when attaching the input spline.
- Check that there is no foreign matter adhering to the mounting surface.
- When attaching the wedge-type frictional coupling, coat 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 spline, 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 (3) into the input spline (1) as shown in Fig. 5-9.

Step 2 • Assemble the plate (2) into the input spline (1), and then temporarily secure it with the hexagon socket head cap screws (4).

Step 3 • Press the hole base of the input spline (1) onto the edge of the motor shaft completely. (During assembly, the input gear slightly slides.)

Step 4 • Tighten the hexagon socket head cap screws (4) with the recommended tightening torque. After tightening, check that the gap X is equal at any point along the circumference. (Reference: Table 5-1 in “5.2 Bolt tightening torque”)

• Check dimensions C to see if the input spline (1) has been assembled as in the specified dimensions. For dimensions C, refer to “Outer dimensions”drawing.

⚠ 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 5 • Check for deviation during rotation at position A of the input spline (1). If the deviation is within 50 µm, the procedure is completed.

Step 6 • If the deviation of the input spline (1) exceeds 50 µm, loosen the hexagon socket head cap screws (4) and then perform adjustment by repeating step 2 and subsequent steps.

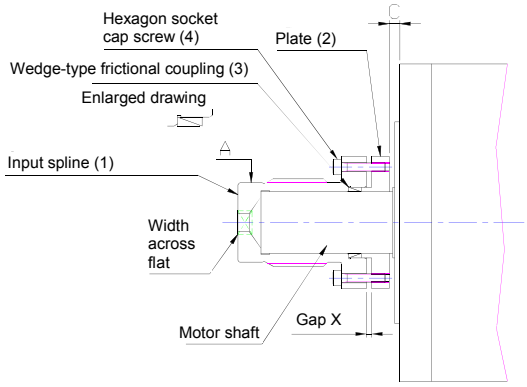


Fig. 5-9

5.3.3. Installing the motor

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

Step 1 • Check that the lubricant (PYRONOC UNIVERSAL N-6B) is coated onto the inside of the spline on the input unit. (Do not wipe off the lubricant.)

• For the RS-260A, assemble the O-ring provided with the main unit into the input spline.

Note

- Use the O-ring that is provided with the reduction gear main unit.

Step 2 • Install the input spline on to the motor, 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.

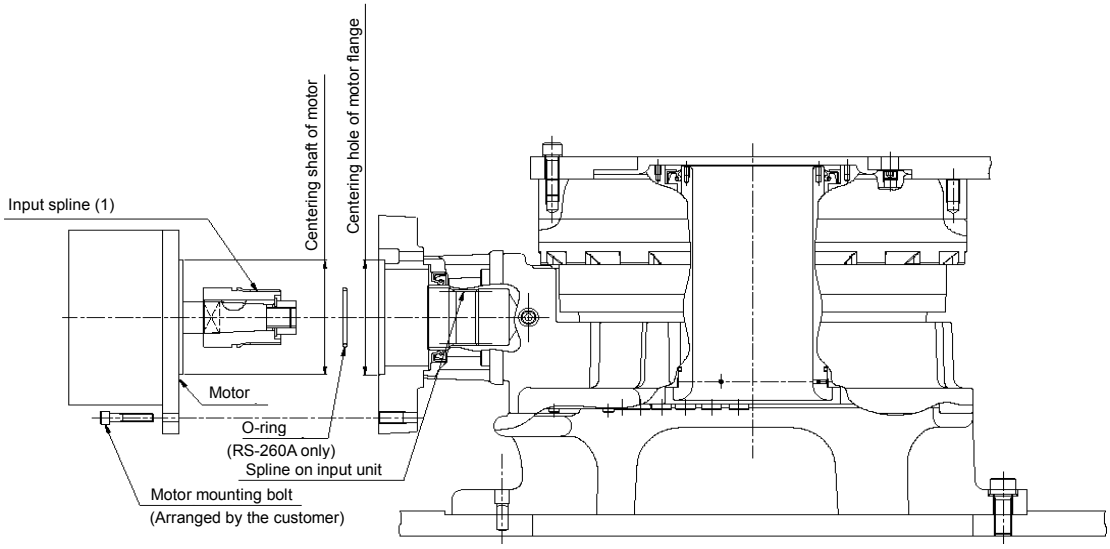


Fig. 5-10

Note

- If the motor is forcibly pressed down, it could damage the input spline, and motor.
- If the lubricant is not applied to the inside of the spline on the input unit, the spline may be worn or damaged.

Step 3

- Using the hexagon socket head cap screw, fix the motor to the motor flange.
- Confirm that the centering part of the motor flange and that of the motor are correctly fitted.
- Check that there is no foreign matter adhering to the mounting surface.

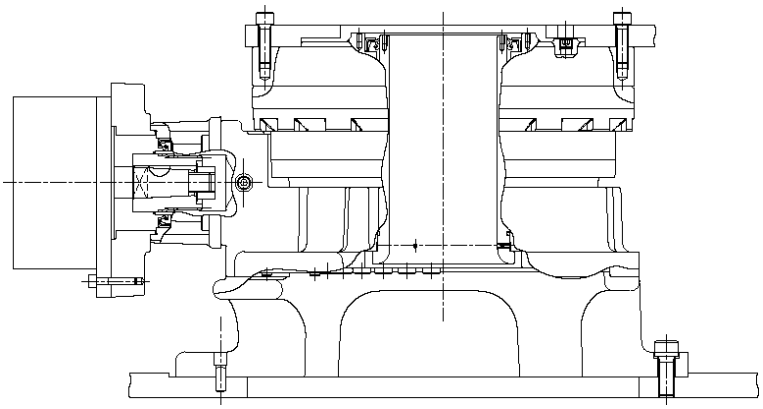


Fig. 5-11

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.
- Tighten the motor mounting bolt using the tightening torque specified by the motor manufacturer.

Chapter 6 Operation

This chapter describes the operation of the product.

6.1. Checking before operation

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

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

6.2. 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 7-1.

6.3. 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 “7.4.1 Replacement period of lubricant”.

6.4. Servomotor

● Output torque

Set the maximum output torque and maximum operating torque for the servomotor as follows.
Servomotor maximum output torque (maximum operating torque) × Actual reduction ratio × 0.8 (Efficiency) ≤ Reduction gear allowable acceleration/deceleration torque

● Output speed

Set the maximum output speed and maximum operating speed for the servomotor as follows.
Servomotor maximum output speed (maximum operating speed) / Actual reduction ratio ≤ Reduction gear allowable output speed

◆ RS Series rating table

Table 6-1

Model	Actual reduction ratio	Rated torque	Allowable acceleration/deceleration torque	Momentary maximum allowable torque	Allowable output speed
RS-260A	120	2,548 Nm (260 kgfm)	6,370 Nm (650 kgfm)	12,740 Nm (1,300 kgfm)	21.5 rpm
RS-320A	170	3,136 Nm (320 kgfm)	7,840 Nm (800 kgfm)	15,680 Nm (1,600 kgfm)	20 rpm
RS-900A	193.6	8,820 Nm (900 kgfm)	17,640 Nm (1,800 kgfm)	35,280 Nm (3,600 kgfm)	10 rpm
	240				

Note: Depending on the operating rate, the allowable speed may be limited by heat.

Chapter 7 Maintenance and Inspection

This chapter describes how to perform maintenance and inspection.

7.1. Precautions on maintenance

WARNING

- 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.

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.

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.

7.2. Daily inspection

Check the following items every day before starting the operation.

Table 7-1

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.

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

WARNING

- 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.

7.3. 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.

7.4. Lubricant replacement

7.4.1. 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 “2.2 Lubricant”.

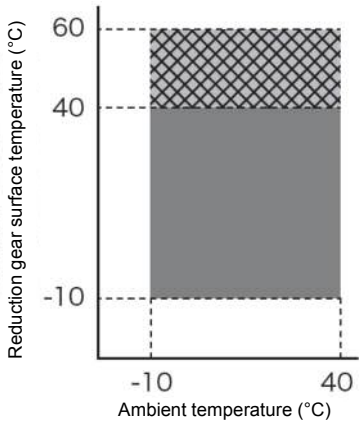


Fig. 7-1

7.4.2. Preparation

- Lubricant
  For the RS-260A, prepare as much VIGOGREASE RE0 as needed, and for the RS-320A and RS-900A prepare as much Molywhite RE00 as needed, according to the number of units. (For the amount of lubricant, refer to Table 7-2.)
- Seal tape
- Tightening tool
  Prepare the tightening tool based on Table 7-3.

Amount of specified lubricant

Table 7-2

Model	Required amount	
	cc	(kg)
RS-260A	3,900	(3.5)
RS-320A	5,200	(4.5)
RS-900A	17,000	(14.8)

Plug size and tightening torque

Table 7-3

Frame number	Grease drainage side	Grease injection side
RS-260A	Hexagon socket head cap plug GM-1/4 Tightening torque 29.4 ± 4.9 (Nm)	Hexagon socket head cap plug GM-1/4 Tightening torque 29.4 ± 4.9 (Nm)
RS-320A	Hexagon socket flange head screw plug GFO-M10 Tightening torque 19.6 ± 0.98 (Nm)	Hexagon socket head cap plug GM-1/8 Tightening torque 12.3 ± 2.45 (Nm)
RS-900A	Hexagon socket head cap plug GM-1/8 Tightening torque 12.3 ± 2.45 (Nm)	

7.4.3. Lubricant replacement procedure

This section describes how to replace lubricants.

Perform steps 1 to 11 by taking care regarding the following precautions.

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

WARNING

- 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.

CAUTION

- 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.

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.
- Always drain the lubricant while the reduction gear is cool.
- 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.

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. 7-2)

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 the 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 the 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.

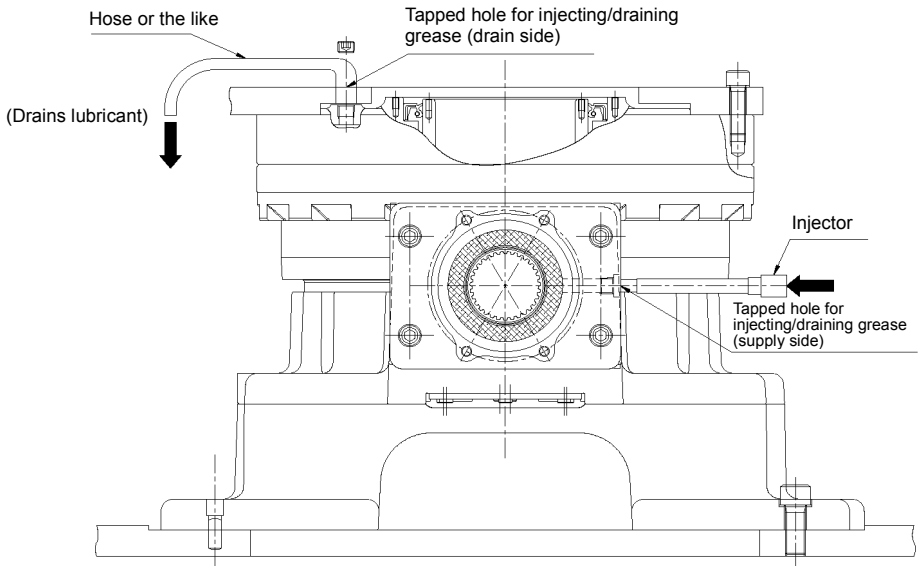


Fig. 7-2

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.

WARNING

- 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 4 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.
- When flushing the inside of the reduction gear, remove the injector from the tapped hole on the supply side, and insert a hexagon socket head cap plug into the tapped hole on the drain side. (Reference: Table 7-3 “Plug size and tightening torque”)
- Calculate the output shaft conversion and set the servomotor rotation speed so that the output shaft rotation speed is 5 to 10 rpm. Then, rotate the motor for about one minute.
- Perform **steps 1 to 9** again.

Important

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

Step 11
- Attach the hexagon socket head cap plugs and other parts removed in step 2 above to the tapped holes for injecting/draining grease with the specified tightening torque. (Reference: Table 7-3 “Plug size and tightening torque”)
- 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. However, tighten the hexagon socket head cap plug GM-1/8 to a maximum tightening torque of 14.75 (Nm).

Step 12
- Wipe off the lubricant adhering to the surrounding completely.

7.5. 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 spline is appropriately installed on the motor.
	Make sure there is no damage to the surface of the input spline teeth.
	Make sure the input spline 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 inquires 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.

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