VIGO DRIVE™

RD2 SERIES

Precision Gearhead
Operation Manual

〈Target model code〉

RDS-006E, RDR-006E	RDS-010C, RDR-010C, RDP-010C
RDS-020E, RDR-020E, RDP-020E	RDS-027C, RDR-027C, RDP-027C
RDS-040E, RDR-040E, RDP-040E	RDS-050C, RDR-050C, RDP-050C
RDS-080E, RDR-080E, RDP-080E	RDS-100C, RDR-100C, RDP-100C
RDS-160E, RDR-160E, RDP-160E	RDS-200C, RDR-200C, RDP-200C
RDS-320E, RDR-320E, RDP-320E	RDS-320C, RDR-320C, RDP-320C

Please be sure to read and understand this manual before using the product
The administrator and operator of the product should have access to this manual.
Store this manual at a specified safe place so that it can be referred to when necessary.

Nabtesco Corporation

TMT12002
Date of issue: 2012/xx/xx

Table of Contents

CONTENTS OF MANUAL

This manual consists of the following chapters and references.

Chapter name	Description
IMPORTANT NOTICE	The following are explained: · Intended use of the product · Safety precautions · Notice on the Operation Manual · Disposal of gear reducer · Other important notices
ABOUT THIS MANUAL	The following are explained: · Target readers · Copyright · For losing or damaging the manual
WARRANTY	Warranty of the product is described.
Ch.1 SAFETY	The information on safety is described as "General Precautions". Safety information such as gear reducer installation is described in Chapter 3 and later.
Ch.2 OVERVIEW OF GEAR REDUCER	The name of each part of the gear reducer as well as how to store it described.
Ch.3 PREPARATION	Preparing the environment of gear reducer, preparation of necessary materials, unpacking, and hoisting are described, along with safety precautions.
Ch.4 INSTALLATION	Installation procedure of gear reducer, and precautions to avoid human injuries during installation as well as damage of the gear reducer.
Ch.5 LUBRICANT	The following information on lubricants is described: • Precautions for handling • Recommended brand • Filling volume • Replacing interval and procedure
Ch.6 MAINTENANCE	Precautions for daily maintenance and inspection works on the gear reducer are described.
CUSTOMER SERVICE	Service contact at Nabtesco is described.

IMPORTANT NOTICE

1. Intended Use of Product

The gear reducer is designed and manufactured for reduction of servo motor rotation and torque transmission; do not use the product for any other application.

⚠ WARNING

Do not modify or disassemble the gear reducer, or use the gear reducer out of the range allowable for gear reducer. It may result in human accidents or breakage of the gear reducer.

2. Precautions for Safe Use

Nabtesco cannot predict all the risks, such as, but not limited to, the potential risk remained in this product, risk on human error, or risk caused by surrounding devices.

There are many adherences and prohibitions on the product operation; this manual cannot explain all of the information.

Therefore, operation to this product requires all the necessary safety countermeasures for not only items described in this manual but those possibly anticipated.

For the safe operation of the product, precautions especially important are described below; these shall be applied to all the workers including administrators and supervisors.

The term "operation" in this manual shall mean all the actions relevant to this product through the process of installation, operation, and maintenance.

Ensure to read the manual

Before handling the product, ensure to read this manual and fully understand the contents. The safety precautions in this manual should always be observed.

Allow only qualified personnel for operation

- Personnel who has a basic knowledge on the product
- Personnel who knows the risk of the product as well as the measures to avoid that risk

Observe laws, ordinances, rules and regulations

Ensure to follow laws, ordinances, rules and regulations of the relevant country or government.

Prevent accidents

- To prevent accidents, use the product only for the intended purpose. Avoid installation and maintenance work not specified or recommended in this manual
- When any abnormality should occur, immediately take an adequate action before accidents, serious damage, or wear may be resulted.
- Not only workers but all the members including administrators should try to avoid any accidents positively by taking part of the measures to secure safety and hygiene.

3. Providing risk information to users

If you are going to sell or transfer the product or machinery (attached, incorporated or assembled in any way) to another party, be sure to submit this manual and related document to the person actually use or control the machine (personnel or group in charge) of the new user.

Manufacturers of industrial l machinery should always reflect the precautions on the handling and maintenance work to avoid accidents or malfunction described in this manual in the instruction manual targeted to the user of the machine including the product (gear reducer).

4. Disposal of Gear reducer

In disposing of the product, first drain the lubricant completely. Be sure to observe the laws, acts, codes and regulations of local governments and ask an industrial waste disposal contractor for disposal

5. Other Important Notice

It is prohibited to analyze and use the product by any measure of reverse engineering or other related technology.

ABOUT THIS MANUAL

1. Target user of the manual

This manual is intended for workers who are fluent in English. If this product is going to be operated or serviced by workers who are not fluent in English, the responsibility falls on the customer to provide thorough training on operation and safety.

2. Copyright

3. For losing or damaging the manual

If this manual is lost or damaged, immediately contact to our Customer Service. Operating or servicing the product without this manual may result in accident.

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 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 WARRATIES 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 the 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 the Section (1) above shall be the rest of the initial Warranty Period of the defective Product subjected to such repair/replace.

Chapter 1 SAFETY

The safety precautions are guidelines to avoid human accidents to personnel during the transportation, installation, and maintenance of the gear reducer, as well as to avoid damage to the gear reducer.

1.1. Warning

This manual calls for attention of the operator on the risks and cautions on the product in the following way:

1. Explaining safety obligations and regulations in "Chapter 1 Safety".
2. Describing warning information on this manual

1.2. Type and Meaning of Warnings

The following five types of warnings are used according to the expected hazards during operation and maintenance of the product. Neglecting such safety rules and warnings may cause accidents, resulting in serious injury and/or damage to this product.

⚠ DANGER	Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
⚠ WARNING	Indicates a potential hazardous situation which, if not avoided, could result in serious injury.
⚠ CAUTION	Indicates a potential hazardous situation which, if not avoided, may result in minor or moderate injury.
NOTICE	CAUTION used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.
NOTE	Used to give useful information on the product, as well as to give additional explanation and to avoid operation mistakes.

1.3. General Safety Precautions

Overall precautions are classified into adherence and prohibition.

For precautions at installation and maintenance, be sure to refer to the description of the corresponding chapter

⚠ WARNING

- The transportation, installation, and maintenance should be performed only by personnel who understand the manual.
- If any abnormality or breakage should occur in the gear reducer, do not operate it until a proper countermeasure is prepared.
- For handling of the lubricants, refer to the indications and recommendations in this manual.

⚠ CAUTION

- The work coordinator and/or administrator should not let personnel who have no ample knowledge of the gear reducer work with the gear reducer. It may result in an injury to the operator or damage to the gear reducer.
- Do not put fingers or any foreign object at the opening of the gear reducer. Do not put fingers or any foreign object in the gap between the protection cover and the belt or chain if used at the joint part of drive unit. It may result in serious injuries.
- The gear reducer may be very hot during operation. After the operation, do not touch the gear reducer until it has cooled down. Otherwise it may result in a heat-related injury.

NOTICE

- The tools required for the work should be cleaned up to a specified place after work. Mixing a foreign object such as tools, screws and/or nuts may cause damage to the gear reducer.
- Do not modify or disassemble the gear reducer except for so indicated in this manual. It may result in breakage of the gear reducer.
- Do not apply excessive impact or vibration to the gear reducer. It may cause breakage of the gear reducer.

Chapter 2 OVERVIEW OF GEAR REDUCER

2.1. Name of Each Part

Here is an explanation of the name of each part.

NOTE

The following illustration may not strictly represent the actual appearance of the product ordered.

◆ Solid series

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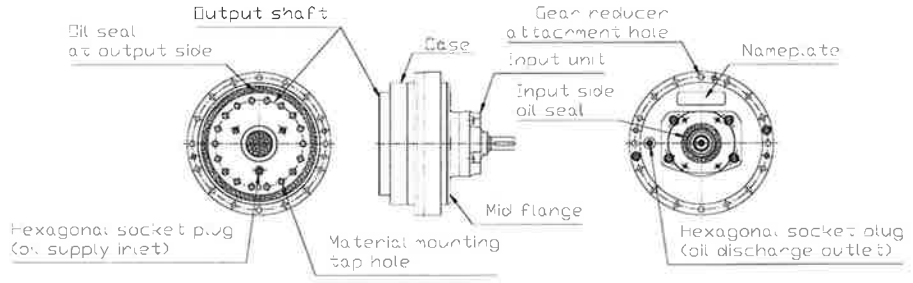

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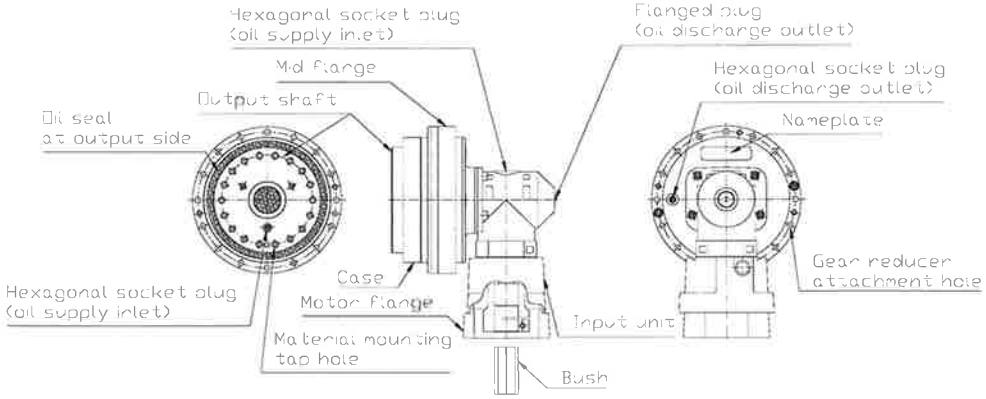

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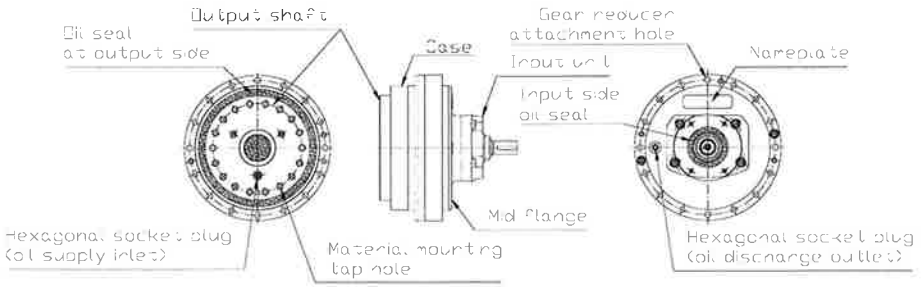
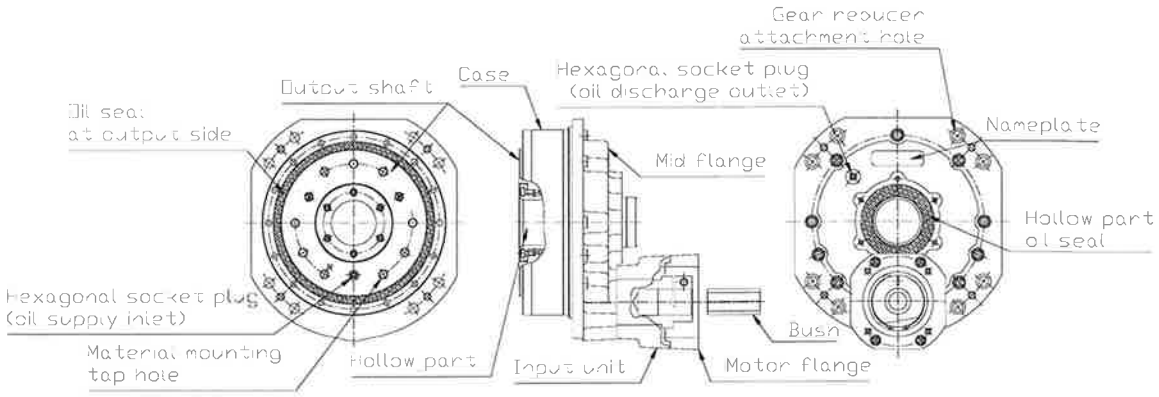


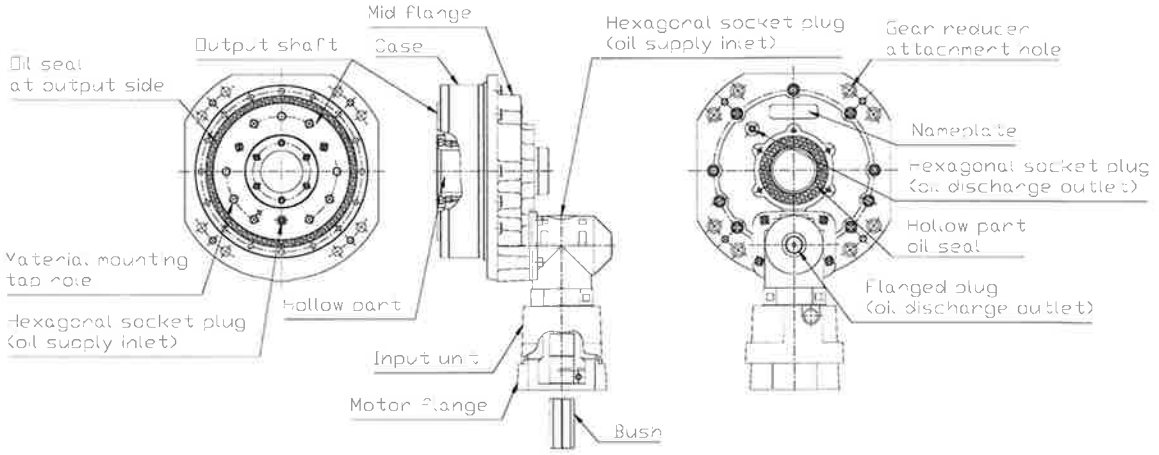
Fig. 2-1

◆ Hollow series

＜Straight input type＞



＜Orthogonal input type＞



＜Pulley input type＞

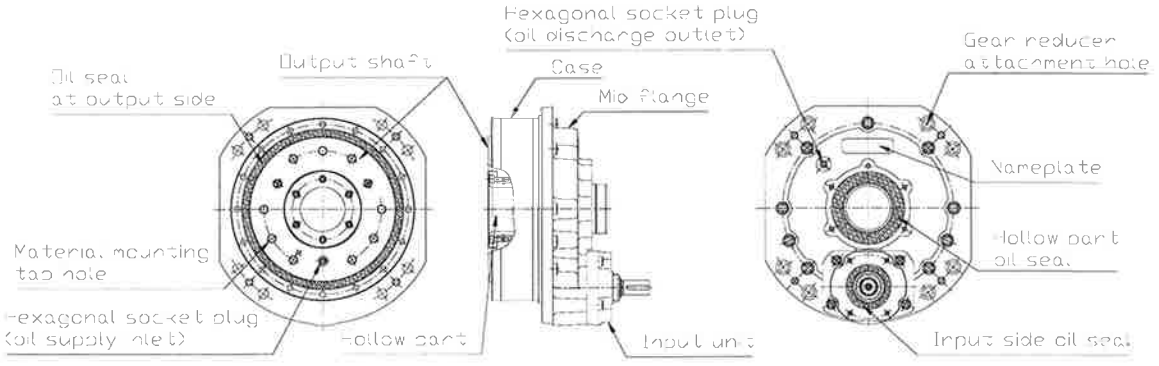


Fig. 2-2

2.2. Storage of Gear reducer

To avoid rust, corrosion, deterioration of seals, or damages on the packages during storage, avoid storage in places such as:

- places where the surrounding temperature is under -10°C or over 40°C
- places of high humidity
- places where dew may condensate or freeze
- outdoor places directly exposed to wind and rain as well as to their influence
- places exposed to corrosive gas and/or dust
- places with unstable flooring
- places under vibration

NOTICE

When storing the gear reducer, follow the same packing condition as before unpacking. Correctly keep the vertical orientation, or the gear reducer may be damaged.

(For the vertical orientation, refer to Fig. 3-2 on p.8.)

NOTE

When the product is used or re-operated after a long-term, check the following:

- That there is no rust or corrosion;
  although the gear reducer has antirust oil applied before shipment, storage for a long period is not expected. Check for rust and take appropriate antirust measures if necessary.
- That seals have not deteriorated
- That lubricant has not leaked;
- That lubricant has not been deteriorated
  Lubricants sealed into the gear reducer deteriorates even without operation. Replace lubricant for approximately 20,000 hours as a standard replacement interval. (Refer to 5.3 in p.24.) The deterioration level may vary depending on the storage condition.

2.3. Lubricants

This product is shipped after the specific lubricant is filled:

Lubricant specified by Nabtesco:

Table 2-1

Brand	VIGOGREASE RE0
Manufacturer	Nabtesco
Temperature range (Surrounding temperature)	-10 to 40°C

Chapter 3 PREPARATION FOR INSTALLATION

⚠ WARNING

- In using the gear reducer to a personal transportation machine, ensure to provide safety equipment enabling to avoid loss in sudden failure of the gearhead for safety. Neglecting to provide safety equipment could result in human accidents due to runaway or drop, as well as in damage of gear reducer.
- In using the gear reducer to an elevating/lowering device, ensure to provide safety equipment enabling to restore loss at sudden failure of the gearhead for safety to prevent drop due to idle operation. Neglecting to provide safety equipment could result in human accidents due to drop of the elevated machines or damage of gear reducer.

NOTICE

If preparation against leakage of the lubricant due to breakage or deterioration is necessary, provide an oil tray as a damage prevention measure.

3.1. Environment

Use the product in the environment as follows:

- where the surrounding temperature range between -10 and 40°C
- humidity is under 85%, with no dew condensation
- under 1000 m above sea level
- good ventilation

Do not install the gear reducer in a place such as:

- places which are exposed to a lot of dust
- outdoor places exposed to wind and rain as well as their influence
- places with an atmosphere of inflammable, explosive, or corrosive gas or near combustible materials
- places that are generating a magnetic field or vibration, which can influence servomotor performance

NOTE

- If the environment specified here cannot be satisfied, consult our Customer Service before starting installation.
- If a special environmental condition is necessary (such as, but not limited to, a case under concentrated alkali or high-pressured steam), consult our Customer Service before starting installation.

3.2. Preparation of Necessary Materials

The installation of the gear reducer requires the following parts and materials. Materials should be provided by the customer or end-user by referring to the tables and lists below.
If you have any questions on screws, disc springs, and washers recommended by us, contact our Customer Service.

◆ Bolts for attaching the gear reducer

<Recommended specification>

Hexagon socket head cap screw	JIS B1176
Strength class	JIS B1051 12.9
Screw	JIS B0205 6g or Class 2

Hexagon socket head cap screw for mounting
Table 3-1

Model	Nominal x pitch (mm)	Required Q'ty	
		Straight, Pulley input type	Orthogonal input type
RD□-006E	M5x0.8	8	7
RD□-020E	M6x1.0	18	15
RD□-040E	M8x1.25	16	13
RD□-080E	M8x1.25	16	13
RD□-160E	M8x1.25	16	13
RD□-320E	M12x1.75	20	17
RD□-010C	M6x1.0	8	8
RD□-027C	M8x1.25	8	8
RD□-050C	M10x1.5	8	8
RD□-100C	M12x1.75	8	8
RD□-200C	M16x2.0	8	8
RD□-320C	M16x2.0	12	12

Hexagon socket head cap screw for material
Table 3-2

Model	Nominal x pitch(mm)	Required Q'ty
RD□-006E	M8x1.25	6
RD□-020E	M10x1.5	6
RD□-040E	M10x1.5	10
RD□-080E	M10x1.5	18
RD□-160E	M10x1.5	20
RD□-320E	M12x1.75	24
RD□-010C	M8x1.25	6
RD□-027C	M8x1.25	8
RD□-050C	M10x1.5	9
RD□-100C	M12x1.75	9
RD□-200C	M16x2.0	9
RD□-320C	M16x2.0	15

◆ Conical spring washer for hexagon socket head cap screw
<Recommended specification>

Name:	Disc spring washer	HEIWA HATSUJO INDUSTRY
Model:	CWD-H- nominal	
Material:	S50C to S70C	
Hardness:	HRC40 to 48	

Table 3-3 (Unit: mm)

Nominal	Inner/Outer dia. of disc spring washer		T	H
	d	D		
5	5.25	8.5	0.6	0.85
6	6.4	10	1	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
16	16.9	24	2.3	2.8

Assemble so that the bolt head faces this side

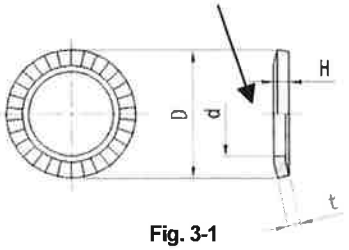


Fig. 3-1

◆ Liquid sealing agent

Liquid sealing agent recommended by Nabtesco

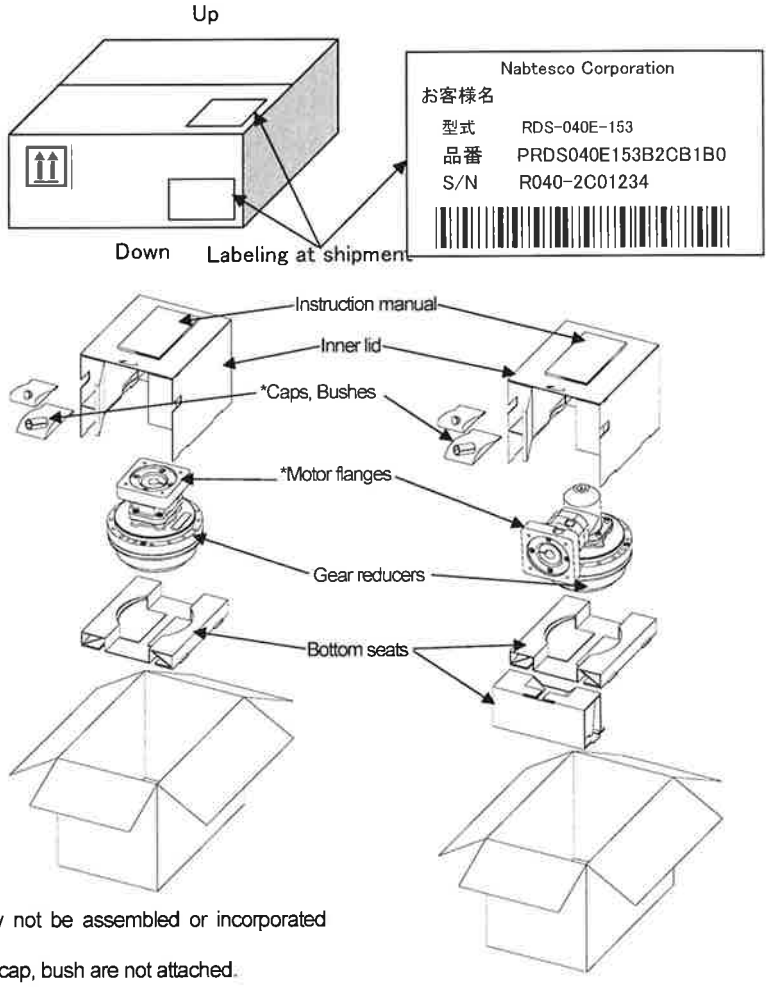
Table 3-4

Name	Manufacturer	Property, application
Three bond 1211	Three bond	・Silicon solvent-less type ・Semi-drying gasket
HERME[N1] SEAL SS-60F	NIPPON Helmetex	・Solvent-less elastic sealant ・Seal of metal contact face (flange face) ・Equivalent to Three bond 1211

NOTICE

When a flange is made of copper or copper alloy, do not use the above-mentioned gasket sealants.
Consult us when you need to assemble the gear reducer to materials of copper or copper alloy.

3.3. Unpacking



*Motor flanges and bushes may not be assembled or incorporated depending on the model.
For the pulley type, motor flange, cap, bush are not attached.

Fig. 3-2

- **Confirmation of contents**

In opening the package, check the followings:

Table 3-5

Check parameter	Check procedure	Check standard
Package contents	Visual check	Compare with description in this manual (See Fig.3-2, P.8)
Outer package	Visual check	Flaw, damage
Bolt	Check by touch	Looseness

- **Labeling**

For inquiries, be ready to provide product information such as (model code, speed ratio code, as well as the serial No. (S/N No.). The nameplate is sealed on the gear reducer body.

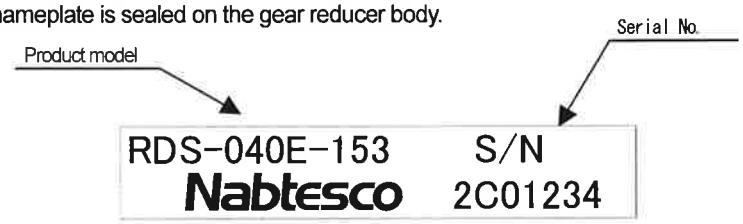


Fig. 3-3

⚠ CAUTION

- In transporting the gear reducer, handle it with ample care to avoid drops or falls. Otherwise it may result in injuries of the operator or damage to the gear reducer.
- Before use of the product, be sure to inspect the package contents to check if the ordered contents are included. If the wrong product are mistakenly installed or assembled, the gear reducer may be damaged.

NOTICE

- Before unpacking, confirm the top and the bottom of the package. Opening the package with the wrong orientation could result in damage in the gear reducer. (For correct orientation, refer to Fig. 3-2 in p.8.)
- The gear reducer is shipped with the anti-rust oil applied; the antirust oil may seep from the screw hole or flange joint surface during operation, and the product may be slippery. Wipe off the antirust oil before operation.

NOTE

- The illustrations in this manual do not necessarily represent the specifically ordered contents or the exact gear reducer.
- In hoisting the gear reducer, refer to Chapter 3, Section 4, and "Hoisting Gear reducer" in p.11.

3.4. Hoisting Gear reducer

In hoisting the gear reducer, ensure to use the following threads:

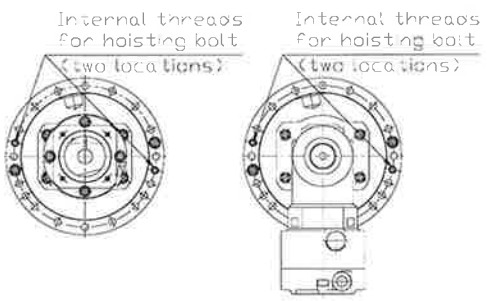
Thread size/Solid series

Table 3-6

Model	Thread size	Q'ty	Mass (kg)		
			Straight ※1	Orthogonal *1	Pulley
RD□-006E	M5	2	4 - 15	5 - 16	-
RD□-020E	M6	2	5 - 16	6 - 18	5
RD□-040E	M8	3	18 - 29	21 - 32	17
RD□-080E	M8	3	22 - 34	25 - 37	21
RD□-160E	M10	2	41 - 58	56 - 72	39
RD□-320E	M12	2	66 - 83	81 - 97	64

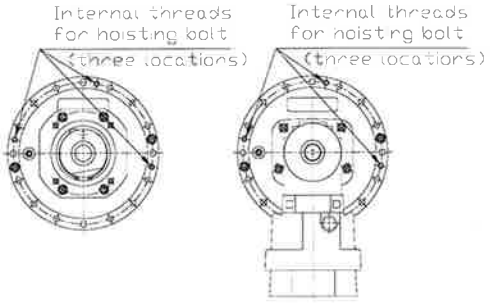
*1 : Depends on coupling inner diameter and motor flange of the input unit.

<For RD□-006E・020E・160E・320E>



Straight, pulley: Input type　Orthogonal input type

<For RD□-040E・080E>



Straight, pulley　Input type　Orthogonal type

Fig. 3-4

*Select the hoisting tool by referring to the dimensional outline in catalogs.

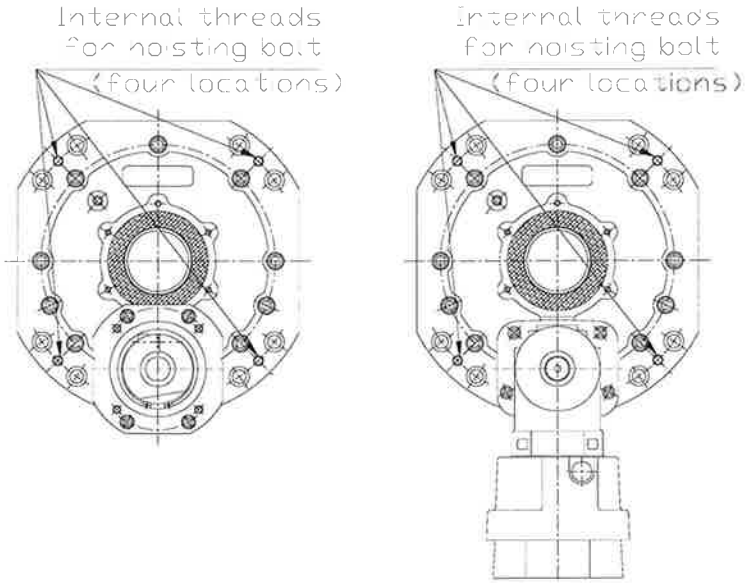
Hoisting bolt size/Hollow series

Table 3-7

Model	Thread size	Q'ty	Mass (kg)		
			Straight *1	Orthogonal *1	Pulley
RD□-010C	-	-	6 - 18	8 - 19	7
RD□-027C	M6	4	9 - 20	10 - 22	9
RD□-050C	M8	4	30 - 31	33 - 45	29
RD□-100C	M10	4	37 - 49	40 - 52	37
RD□-200C	M12	4	85 - 101	99 - 116	83
RD□-320C	M12	4	141 - 158	155 - 171	139

*1 : Depends on coupling inner diameter and motor flange of the input unit.

<For RD□-027C・050C・100C・200C・320C>



Straight, Pulley Input type

Orthogonal input type

Fig. 3-5

*Select the hoisting tool by referring to the dimensional outline in catalogs.

⚠ WARNING

- When hoisting the gear reducer for transportation or installation, be sure to stay out from under the load.
- Use a hoisting tool robust enough to endure the mass of gear reducer. Otherwise the tool may be damaged and/or drop the gear reducer.

NOTICE

For the hollow series, the hollow part at the center is not designed to accept excessive load. Do not apply excessive load to the hollow shaft in hoisting, or it may result in injuries of operators, and in damage or drop of the gear reducer.

Chapter 4 INSTALLATION

This chapter describes installation of the gear reducer.

⚠ WARNING

- In hoisting the gear reducer for transportation or installation, be sure to stay out from under the load.
- Use a hoisting tool robust enough to endure the mass of the gear reducer. Otherwise the tool may be damaged or may drop the gear reducer.

⚠ CAUTION

Be sure to tighten the hexagon socket head cap screw(s) for mounting gear reducer (See Table 3-1 in p.7) and the hexagon socket head cap screw(s) for mounting components (See Table 3-2 in p.7) to the specified tightening torque and use the specified quantity. Tightening/attaching by not following the specification does not only decrease the performance of gear reducer but also risks injuries of the operator, damage of the users' machine as well as damage of the gear reducer itself.

NOTICE

- Do not step onto or put heavy objects on the gear reducer. It may result in damage to the gear reducer.
- When installing the gear reducer, be sure to confirm that there is no foreign object between the gear reducer and the installation surface. Any foreign objects may deform the installed surface, causing installation problems.
- Be sure to install the gear reducer with the correct orientation. Wrong orientation may result in damage to the gear reducer as well as to the customer's machine.

NOTE

The gear reducer has antirust oil applied before shipping at the unpainted part. Wipe off the antirust oil before operation as necessary.

4.1. List of Specified Tightening Torque

The following list shows the tightening torque specified by Nabtesco. Be sure to refer to this table during installation.

- **Installing gear reducer to the customer's machine**

Table 4-1

Nominal x Pitch (mm)	Tightening torque※(N-m)	Tightening force (N)
M 5×0.8	9.01±0.49	9,310
M 6×1.0	15.6±0.78	13,180
M 8×1.25	37.2±1.86	23,960
M10×1.5	73.5±3.43	38,080
M12×1.75	129±6.37	55,360
M16×2.0	319±15.9	103,410

* The above shows the tightening torque when the base material is steel and cast iron. For materials such as aluminum, or when stainless screws are used, the tightening torque should be adequately controlled.
For special materials, torque transmission should be taken into consideration during design.

- **Installing motor flange to input unit**

Table 4-2

Nominal x Pitch (mm)	M6x1.0	M8x1.25	M12x1.75
Tightening torque (N-m)	12.1±0.61	29.4±1.47	102±5.10

- **In installing servo motor to motor flange**

Refer to the tightening torque specified by the manufacturer of the servo motor.

- **For coupling clamping bolts**

Table 4-3

Model	Input type	Input unit code	Nominal x Pitch (mm)	Tightening torque (N-m)
RD□006E・RD□020E RD□010C・RD□027C	Straight	B0(Inner dia. Φ14)	M6x1.0	15.6±0.78
		B1(Inner dia.Φ24)		
	Orthogonal	C0(Inner dia.Φ14)		
		C1(Inner dia.Φ24)		
RD□040E・RD□080E RD□050C・RD□100C	Straight	B2(Inner dia.Φ24)	M10x1.5	73.5±3.43
		B3(Inner dia.Φ35)		
	Orthogonal	C2(Inner dia.Φ24)		
		C3(Inner dia.Φ35)	M8x1.25	37.2±1.86
RD□160E・RD□320E RD□200C・RD□320C	Straight	B4(Inner dia.Φ28)	M12x1.75	129±6.37
		B5(Inner dia.Φ42)	M10x1.5	73.5±3.43
	Orthogonal	C4(Inner dia.Φ28)	M12x1.75	129±6.37
		C5(Inner dia.Φ42)	M10x1.5	73.5±3.43

4.2. Outline of Installation

NOTE

Before work, prepare the following parts and materials necessary for the installation.
(Refer to 3.2 on p. 6)

- Hexagon socket head cap screw for installation of gear reducer (See 3.2.in p.6)
- Conical spring washer for hexagon socket head cap screw (See 3.2. in p.6)
- Hexagonal cap head screw for mounting servo motor
- Liquid sealing agent (See 3.2. in p.8)
- Torque wrench (See 4.1. in p.12)

When the customer requests the gear reducer with motor flange, the delivery is given with the motor flange attached. This sometimes may disable the installation work with the delivered condition depending on the installation method or a jig to use (see Fig. 4-1). Ensure to check which condition your machines are for a correct work.

When tool and motor flange have interference

When the installation part of machine and motor flange have interference

*When the mounting face of input unit side is used for the solid series

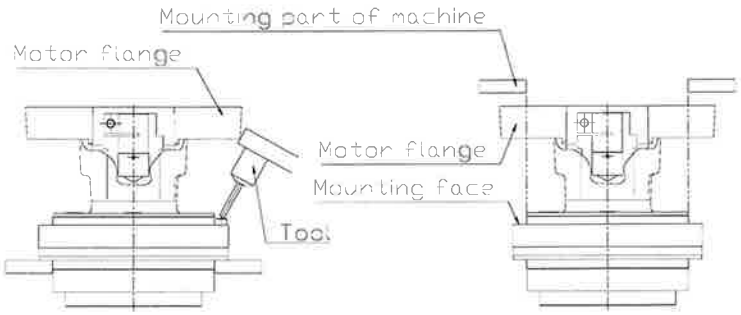
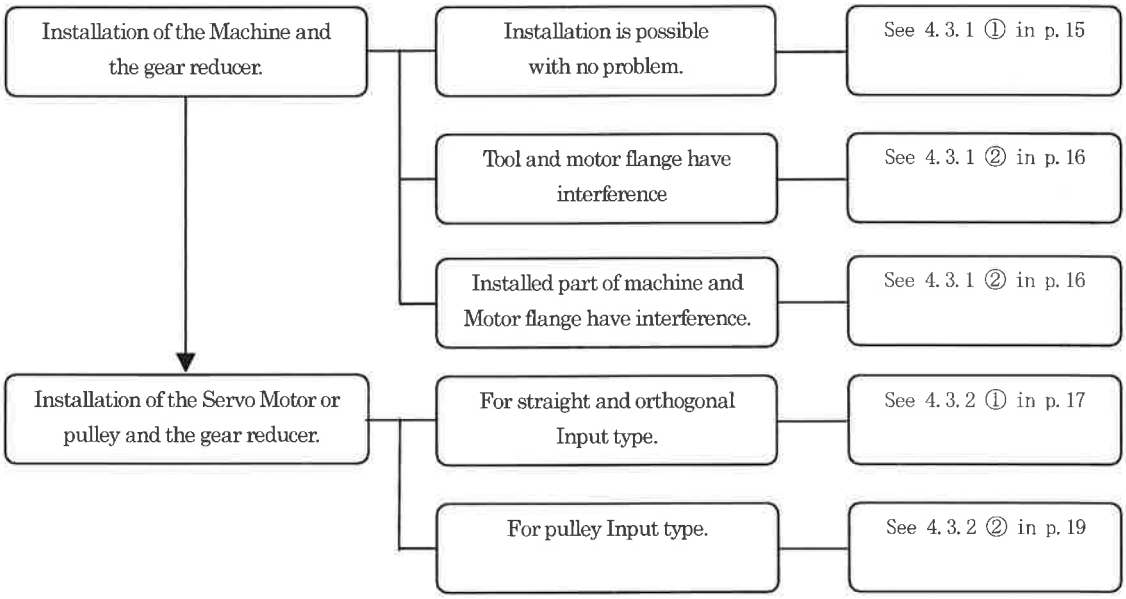


Fig. 4-1



4.3. Installation Work

4.3.1. Installing machines with the gear reducer

⚠ WARNING

Do not place any obstacle that blocks ventilation around the gear reducer. Any obstacle may prevent cooling, causing heat-related injuries or fire due to excessive heat.

NOTICE

For the hollow series, do not apply excessive load to the hollow shaft since the hollow part at the center is not designed to accept excessive load. Otherwise the oil seal for the hollow shaft may deform, causing lubricant leakage. (Refer to Fig. 2-2 on p.4.)

NOTE

Antirust oil has been applied to the gear reducer at the factory. To keep optimum transmission torque, wipe off the antirust oil on the installing surface before installation.

①When installation is possible just as delivered

Step 1 Align the mounting hole of reducer (or tap) with the tap of customer's material, to attach the reducer to the specified position.

Step 2 Insert the disc spring washer for hexagon socket screw to the hexagon socket screw.
(For assembly direction of the spring washer, see Fig. 3-1 in p.7)

Step 3 Evenly tighten the hexagon socket screw with the specified bolt tightening torque.
(For bolt tightening torque, see Table 4-1 in p.12)

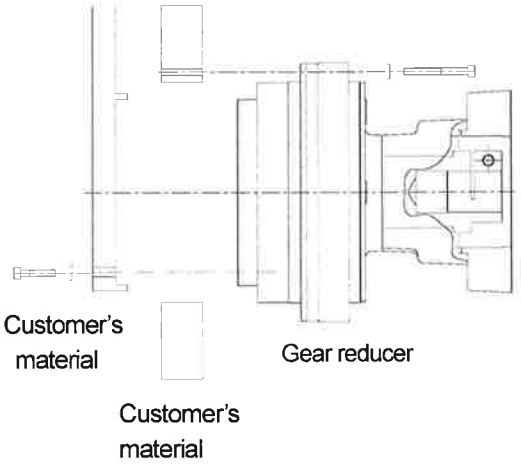


Fig. 4-2

②When installation requires removal of motor flange

Step 1 Loosen four hexagon socket screws fixing the motor flange, to remove the motor flange from the gear reducer.

NOTICE

Liquid sealing agent is applied between the motor flange and gear reducer (mid flange).
Because of this agent, sometimes the motor flange cannot be easily removed only by removing the bolt; when this happens, cut the coating of contact part using a cutter knife (do not damage the coating too much), lightly hit the motor flange by a plastic hammer, and remove the motor flange from the gear reducer. Giving excessive force may damage the gear reducer or the motor flange.

NOTE

Hexagon socket screws are used for assembly later; store them carefully.

Step 2 With the motor flange removed, attach the gear reducer to the customer's equipment by referring to steps 1 to 3 of "1. When installation is possible just as delivered (p.15).

Step 3 Wipe off the oil on the mounting face of motor flange and input unit, and apply the liquid sealing agent on this face (see Table 3-4 in p.8).

Step 4 Match the fit part of motor flange and the input unit, and tightly contact the motor flange to the input unit by checking the fixing bolt hole.

NOTE

Ensure that the edge faces of motor flange and of input unit are tightly contacted each other. If slant or gap may be found, remove the motor flange once, and repeat the step 4 again.

Step 5 Attach the motor flange to the input unit.
Use the same hexagon socket screw as that has been removed and stored in step 1 in "4.3.1 2. When installation requires removal of motor flange".
(For bolt tightening torque, see Table 4-2 in p.13.)

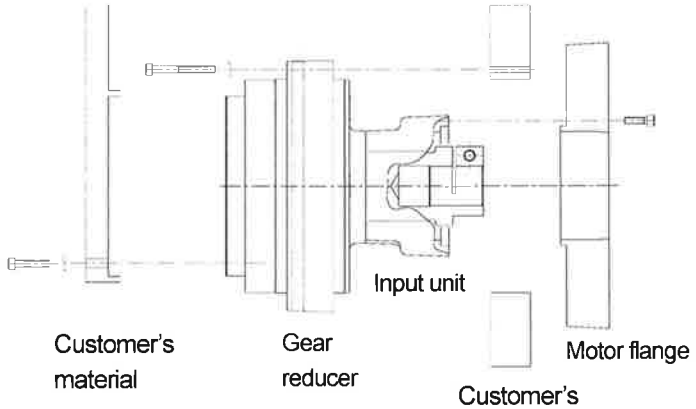


Fig. 4-3

4.3.2. Installing servo motor, pulley, and gear reducer

For straight and orthogonal input unit type, installation of servo motor to the gear reducer (input side) is explained here.
For pulley input unit, installation of pulley to the gear reducer (input side) is explained here

①For Straight, Orthogonal input types

Step 1 Wipe off the outer diameter face of the servo motor shaft and the clamping surface of the coupling by a rag.
(Check that the clamping bolt of the coupling is not tightened)
In using a bush, wipe off the inner/outer faces of the bush by a rag.

NOTE

- Before starting the installation, ensure there is no flaw on the inner diameter of coupling, bush, or motor.
- Ensure there is no foreign substance or oil content on the circumferential face of servo motor shaft, clamping surface of coupling, and inner/outer faces of bush.

Step 2 In using the bush, insert the bush into the coupling, and align the position of clamping bolt of the coupling with the position of motor flange hole.
(For positioning of bush and coupling, see 4-4.)

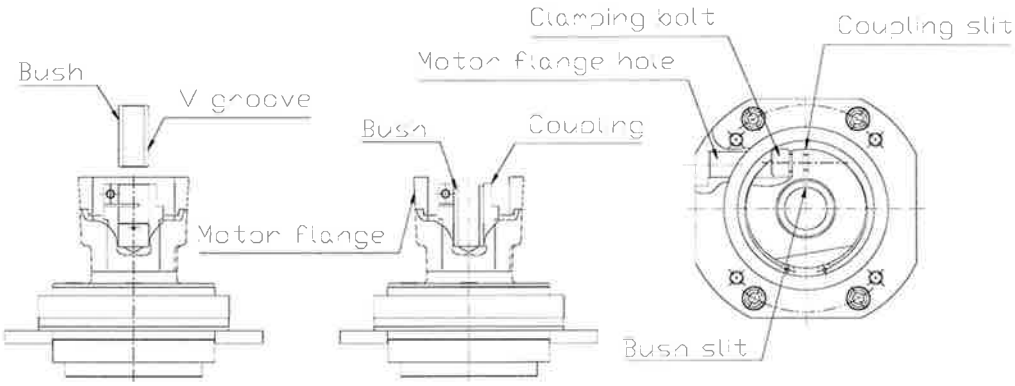


Fig. 4-4

NOTE

- In inserting the bush, adjust the slit orientation to that of coupling slit. If the orientation of bush slit is out of the coupling slit, successful tightening force cannot be obtained.
- Bush with V groove on the outer circumference should have the V groove at the end (reducer side). Wrong orientation may prevent successful tightening force.

Step 3 Wipe off the oil on the mounting face of motor flange and servo motor, and apply the liquid sealing agent on this face (See Table 3-4 in p.8).

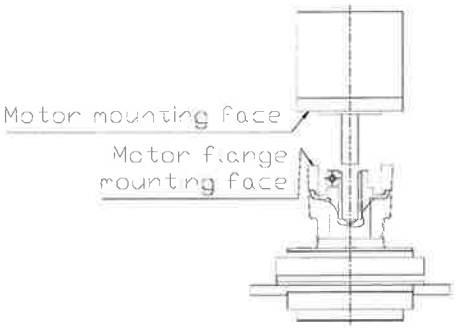


Fig. 4-5

NOTICE

Inserting servo motor forcibly to the gear reducer may cause damage or failure of servo motor or gear reducer.

Step 4 Fit the fit part of motor flange, and insert the servo motor straight.
When there is a key groove in motor shaft, first adjust the position of key groove of motor shaft and the coupling slit so that they face opposite side each other (See Fig. 4-6), and insert the motor.

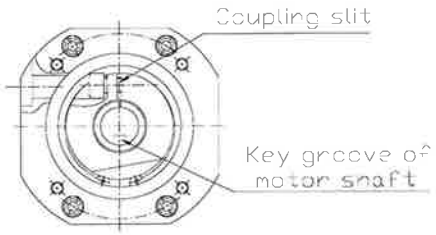


Fig. 4-6

NOTICE

Ensure that the edge faces of motor flange and of input unit are tightly contacted each other. If slant or gap may be found, remove the motor flange once, and repeat the step 4 again.

NOTE

Set the optimum positioning of the key groove and the coupling slit to the servo motor shaft as indicated in this manual. Wrong positioning may prevent successful tightening.

Step 5 Tighten the servo motor to the motor flange by bolt.
Check the bolt tightening torque specified by the servo motor manufacturer.

Step 6 Tighten the clamping bolt of coupling with the specified bolt tightening torque (See Table 4-3 in p.13).

NOTICE

Ensure to perform Step 5 before starting step 6. Wrong order may cause damage or failure of servo motor or gear reducer.

Step 7 Insert the cap at the motor flange hole.

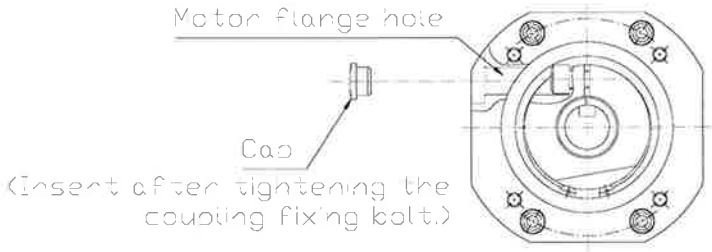


Fig. 4-7

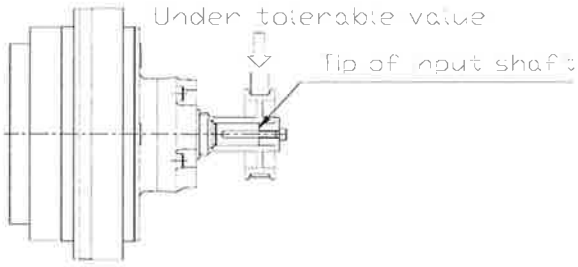
②For Pulley input type

Pulley is mounted using tap screws at key groove and the end face at the input shaft of gear reducer or set screws.

NOTICE

Design so that the moment load applied to the end edge of gear reducer input shaft is within the allowable value range. Load more than the allowable range may cause damage in the gear reducer as well as in your equipment.
*For the calculation direction of moment load, refer to the catalog in Nabtesco.

〈Example of pulley assembly〉



Moment load/Allowable value

Table 4-4

Model code	Speed rate code	Rated moment (N-m)	Allowable moment (N-m)
RDP-020E	081	38	38
RDP-040E	057	78	122
RDP-080E	081		133
RDP-160E	066	158	295
RDP-320E	081		417
RDP-010C	108	38	38
RDP-027C	100		40
RDP-050C	109	78	90
RDP-100C	101		134
RDP-200C	106	158	230
RDP-320C	161		215

4.4. Trial Run after Installation

After installing the gear reducer to the customer machine, operate the machine safely according to the following precautions.

⚠ WARNING

Never approach the rotating part during machine operation. Person(s) may be caught by the rotating part, causing fatal accident.

⚠ CAUTION

- Do not put fingers or any foreign object at the opening of the gear reducer. It may result in injuries to the operator and/or damage to the gear reducer.
- The gear reducer may become hot during operation. Do not touch the gear reducer until it has cooled down.
- Immediately stop operation when abnormal noise or large vibration occurs; operators may be injured.
- Do not operate the gear reducer under conditions that exceed the allowable torque to start/stop the gear, allowable moment, or allowable output count. It may cause injuries to operators and damage to the gear reducer.
- Use the gear reducer under the operation condition where the surface temperature is 60°C or less.

● Output rotation speed

Set the maximum output rotation speed and maximum rotation speed during operation for the servo motor as follows.

Maximum output rotation count of servo motor (highest rotation count in use) ÷ actual speed ratio ≦ Tolerable maximum output rotation count of gear reducer

◆ Solid, Hollow series

Table 4-5

Model code	Actual speed reducing rate	Rated output rotation count (r.p.m.	Allowable output rotation		
			Straight input (r.p.m.)	Orthogonal input (r.p.m.)	Pulley input (r.p.m.)
RD□-006E	31	30	100	100	-
	43		81	81	-
	53.5		65	65	-
	79		44	44	-
	103		34	34	-
RD□-020E	41	15	75	75	-
	57		61	61	-
	81		43	43	43
	105		33	33	-
	121		29	29	-
	161		22	22	-
RD□-040E	41	15	70	70	-
	57		53	53	53
	81		37	37	-
	105		29	29	-
	121		25	25	-
	153		20	20	-

Model code	Actual speed reducing rate	Rated output rotation count (r.p.m.)	Allowable output rotation		
			Straight input (r.p.m.)	Orthogonal input (r.p.m.)	Pulley input (r.p.m.)
RD□-080E	41	15	70	70	-
	57		53	53	-
	81		37	37	37
	101		30	30	-
	121		25	25	-
	153		20	20	
RD□-160E	66	15	30	30	30
	81		25	25	-
	101		20	20	-
	121		17	17	-
	145		14	14	-
	171		12	12	-
RD□-320E	66	15	30	30	-
	81		25	25	25
	101		20	20	-
	121		17	17	-
	141		14	14	-
	185		11	11	-
RD□-010C	81	15	43	43	-
	108		32	32	32
	153		23	23	-
	189		19	19	-
	243		14	14	-
RD□-027C	99.82	15	35	35	35
	141.68		25	25	-
	184		19	19	-
	233.45		15	15	-
RD□-050C	109	15	28	28	28
	152.6		20	20	-
	196.2		15	15	-
	239.8		13	13	-
RD□-100C	100.5	15	30	30	30
	150		20	20	-
	210		14	14	-
	258		12	12	-
RD□-200C	105.83	15	19	19	19
	155.96		13	13	-
	206.09		10	10	-
	245.08		8	8	-
RD□-320C	115	15	17	17	-
	157		13	13	13
	207		10	10	-
	253		8	8	-

※ Allowable rotation count may be limited by heat depending on the operation ratio.

Chapter 5 LUBRICANT

This chapter describes lubricants. Provide at least a description of this chapter in the instructions for the customer's machine.

⚠ WARNING

In replacing the lubricants, turn OFF the power source such as power supply, and perform lockout or tagout to prevent the machine from suddenly starting up. Otherwise entanglement with the rotation part may cause serious human accidents.

⚠ CAUTION

- The gear reducer may be hot during operation. Do not touch the gear reducer until it is cooled down.
- When the safety cover of or around the gear reducer is detached due to lubricant replacement or maintenance work, return the cover and attach it to the original location afterwards.

NOTICE

- The gear reducer has been filled with lubricant at the factory. Adding excessive amounts of lubricant may cause overheating and lubricant leakage.
- Ensure to use the specified lubricants. Use of lubricants other than specified or the mixed use with the lubricant other than specified could result in damage or failure of gear reducer.

5.1. Precautions when Handling Lubricants

Precautions when handling lubricants are as follows:

- Before handling lubricants, be sure to read the precautions described on the case/bottle of each lubricant for correct use. Wrong usage may cause fatal accident.
- Be sure to wear protective goggles in order to prevent lubricant from entering into your eyes. Contact with eyes may cause inflammation.
- Be sure to wear rubber gloves to prevent lubrication from contacting your skin. Contact with skin may cause inflammation.
- Do not eat or put lubricant into your mouth; it may cause diarrhea or vomiting.
- For detailed information, refer to Material Safety Data Sheet of lubricant.
  Ask to the Material Safety Data Sheet from our Customer Service or the purchaser of the lubricant.

Emergent measure:

- If lubricant comes into contact with eyes, flush for 15 minutes with clean water and seek medical treatment.
- If lubricant comes into contact with skin, wash affected area with water and soap.
- If lubricant is swallowed, do not induce vomiting and seek medical treatment immediately.

Disposal of waste oil and container:

- Proper disposal is required by law and ordinances. Follow local law and ordinances.
- If you are unsure of local law or ordinances, check the precautions for disposal on the Product Safety Data Sheet, or consult with the sales shop of lubricants for proper process.

Storage

- To avoid any foreign object or water from becoming mixed in, seal the lubricant after use.
- Avoid direct sun light, keep away from fire or heat sources, and store in a cool and dark place.

5.2. Type of Lubricant and Filling volume

Lubricant specified by Nabtesco

Table 5-1

Brand	VIGOGREASE RE0
Manufacturer	Nabtesco
Temperature range (Surrounding temperature)	-10 to 40°C

NOTE

Using a lubricant other than specified by Nabtesco, consult our Customer Service beforehand.

Filling volume lubricant/Solid series

Table 5-2

Model	Mass (g)			
	Straight input type	Orthogonal input type		Pulley input type
		Main body	Orthogonal input part	
RD□-006E	141	167	23	-
RD□-020E	219	229	23	243
RD□-040E	358	390	51	371
RD□-080E	492	498	51	507
RD□-160E	1042	1188	581	1113
RD□-320E	1770	1961	581	1859

Filling volume lubricant/Hollow series

Table 5-3

Model	Mass (g)			
	Straight input type	Orthogonal input type		Pulley input type
		Main body	Orthogonal input part	
RD□-010C	262	288	23	263
RD□-027C	443	469	23	446
RD□-050C	726	760	51	743
RD□-100C	938	968	51	950
RD□-200C	2294	2432	581	2359
RD□-320C	4563	4705	581	4647

5.3. Replacing Lubricant

5.3.1. Replacement interval

When operating the gear reducer that has an adequate volume of lubricant, **the standard Replacement interval** is 20,000 running hours.

If the lubricant is contaminated or the gear reducer is used in high temperature condition (over 40°C), check for deterioration and contamination of the lubricant to determine the replacement interval.

5.3.2. Preparation

- Lubricant
  Prepare necessary volume of VIGOGREASE RE0 according to the model and quantity.
  (For filling in volume of lubricant, refer to Table 5-2 and Table 5-3 in p.23)
- Sealing tape
- Tightening tool
  Prepare by referring to Table 5-4 below.

Table 5-4

<table>
<tr><th>Model</th><th>Oil supply inlet
Oil supply inlet A</th><th>Oil discharge outlet
Oil discharge outlet A</th><th>Oil supply inlet B</th><th>Oil discharge outlet B</th></tr>
<tr><td>006E</td><td rowspan="2">hexagon socket head cap screw M6
Seal washer
Tightening torque ·
12.1±0.61(N · m)</td><td rowspan="12">Hexagon socket screw plug
GM-1/8
Tightening torque
12.3±2.45(N · m)</td><td rowspan="2">Hexagon socket screw plug
GM-1/8
Tightening torque
8.0±1.0(N · m)</td><td rowspan="2">Hexagon socket flange head screw cap
GFO-M14
Tightening torque
39.2±1.96(N · m)</td></tr>
<tr><td>020E</td></tr>
<tr><td>010C</td><td rowspan="10">Hexagon socket screw plug
GM-1/8
Tightening torque
12.3±2.45(N · m)</td></tr>
<tr><td>027C</td></tr>
<tr><td>040E</td></tr>
<tr><td>080E</td></tr>
<tr><td>050C</td></tr>
<tr><td>100C</td></tr>
<tr><td>160E</td><td rowspan="4">Hexagon socket screw plug
GM-1/8
Tightening torque
12.3±2.45(N · m)</td><td rowspan="4">Hexagon socket flange head screw cap
GFO-M18
Tightening torque
78.4±3.92(N · m)</td></tr>
<tr><td>320E</td></tr>
<tr><td>200C</td></tr>
<tr><td>320C</td></tr>
</table>

5.3.3. Replacement procedure

Replacement procedure depends on the type; straight, pulley input, or orthogonal input.
For each type, ensure correct work by referring to the step below:

⚠ CAUTION

Be sure to wear protective goggles and rubber gloves.

NOTICE

The discharged lubricant should be received by a container. Check the discharged volume and control so that the discharged volume is the same with the filling volume.
Filling lubricants too much causes high internal pressure, resulting in leakage of lubricant or damage in oil seal. On the other hand, too short of lubricant may cause poor lubrication, resulting in damage in the gear reducer.

- **For straight, pulley input type**

Step 1 Rotate the output shaft of reducer so that the oil supply inlet is diagonal to the oil discharge outlet and the oil supply inlet faces downward, and the oil discharge outlet faces upward.

Step 2 Remove the hexagonal socket plugs at the oil discharge outlet. Prepare grease nipples and mount grease gun.

Step 3 Using the grease gun, fill the specified volume of lubricant from the oil supply inlet (See 5.2. in p.23).

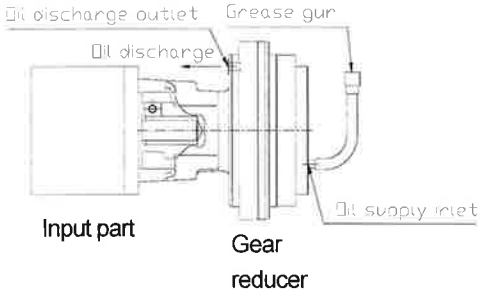


Fig. 5-1

Step 4 Perform flushing inside the gear reducer.
Remove the grease gun at the oil supply inlet, and attach hexagonal socket plug at the oil discharge outlet (See Table 5-4 in p.24).
Perform output shaft conversion, and set the servo motor rotation count so that the output shaft rotation count is 5 to 10 rpm. Operate the machine for approximately 1 minute in this state.

NOTE

For rotation count setting, use the output shaft conversion and consider using condition of the customer.

Step 5 Open the oil discharge output again. Remove the hexagonal socket plug at the oil discharge outlet.

Step 6 Using the grease gun, fill the specified volume of lubricant from the oil supply inlet (See 5.2. in p.23).

Step 7 Mount the hexagonal socket plug at the oil discharge outlet. Replace the seal tape to a new one.

Step 8 Wipe off the lubricant adhered to the surroundings clearly.

- **For orthogonal input type**

Step 1 Rotate the output shaft of gear reducer, so that the oil supply inlet A is diagonal to the oil discharge outlet A and the oil supply inlet A faces downward, and the oil discharge outlet A faces upward.

Step 2 Remove hexagonal socket plugs at oil supply inlet A, B, and oil discharge outlet A. Also remove the flange screws of oil discharge outlet B (See Fig. 2-1, Fig. 2-2 in p.3,4). Prepare grease nipples and mount the grease gun at oil supply inlet A and B.

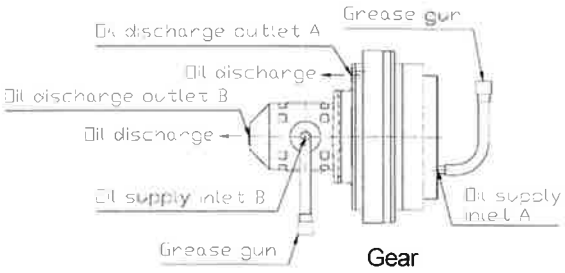


Fig. 5-2

NOTE

Gear reducer body and the orthogonal input part are separated inside. Supply oil to the body of gear reducer from oil supply inlet A and oil discharge outlet A, whereas supply oil to the orthogonal input part from oil supply inlet B and oil discharge outlet B.

〈Oil supply to gear reducer〉

Step 3 By referring to steps 2 to 5 in "For straight, pulley input type", fill new lubricant to the main body of gear reducer.

Step 4 Mount the hexagonal socket plug (bolt tightening torque: 12.3±2.45 N-m) to the oil supply inlet A and oil discharge outlet A. (See Fig. 2-1 and Fig. 202 in p.3,4). Replace the seal tape with a new one.

〈Oil supply to orthogonal input part〉

Step 5 By referring to steps 2 to 5 in "For straight, pulley input type", fill new lubricant to the main body of gear reducer.

Step 6 Mount the hexagonal socket plug (bolt tightening torque: 12.3±2.45 N-m) to the oil supply inlet B, and mount the flange screw to oil discharge outlet B. (See Fig. 2-1 and Fig. 202 in p.3,4). Replace the seal tape with a new one.

Step 7 Wipe off the lubricant adhered to the surroundings clearly.

Chapter 6 MAINTENANCE

6.1. Precautions for Maintenance Work

⚠ WARNING

Do not perform maintenance or inspection work during operation of the machine. Any person may be caught by rotating parts which can cause a fatal accident.

⚠ CAUTION

- Do not put fingers or any foreign object near the opening of gear reducer. This may result in injuries to the operator and/or damage to the gear reducer.
- The gear reducer may be very hot during operation. After operating, do not touch the gear reducer until it has cooled down.
- If any abnormality or breakage should occur in the gear reducer, do not operate it until a cause of the abnormality is identified and proper countermeasure is prepared.
- Do not operate the gear reducer under conditions that exceed the allowable torque to start/stop the gear, allowable moment, or allowable output count. It may cause injuries to operators and damage to the gear reducer.

During maintenance, follow the precautions below for safety.

- Wear appropriate clothing and appropriate protective equipment (protective goggles, protective gloves, and protective footwear).
- Clean the surroundings to ensure a safe environment in order to avoid any secondary disaster.
- Start the maintenance work with the machine completely stopped and with the power OFF. Take care not to allow the power to be mistakenly turned ON during work.

6.2. Daily Inspection

Before starting the daily work, check the following:

Daily inspection check sheet
Table 6-1

Parameter	Inspection	Description
Noise	Listen	No abnormal noise. No sudden change in sound.
Vibration	Touch	No abnormally large vibration. No sudden change in vibration.
Surface temperature	Use thermometer	No abnormally high temperature on surface of gear reducer (under 60°C). No sudden change in temperature.
Bolt	Visual check	No loosening of mounting screws.
Lubricant leakage	Visual check	No leakage from joint surface and oil sealing part around the gear reducer