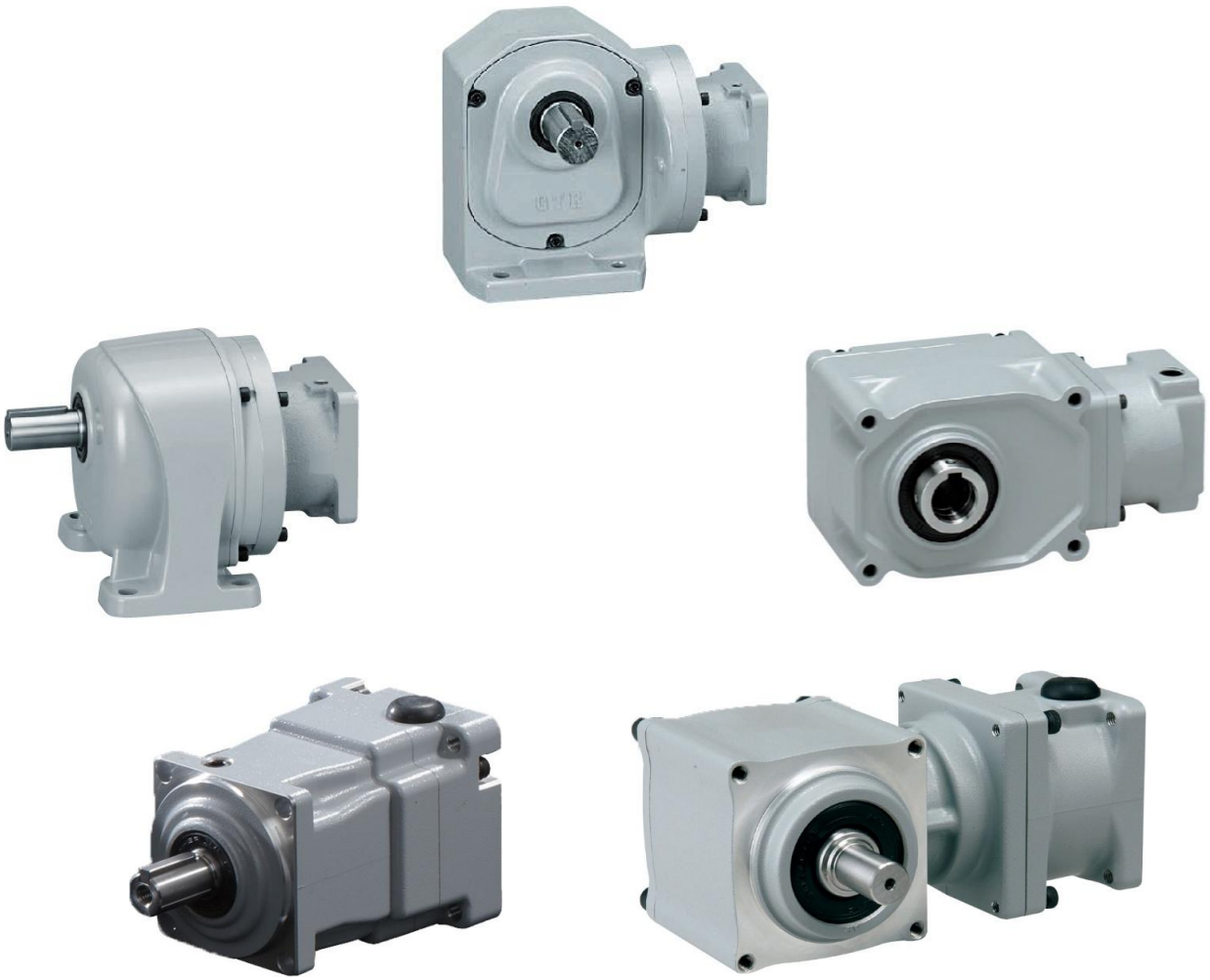
High Precision Gearbox for Servo Motor

Detailed Instruction Manual



- Be sure to read this manual before using the product.
- Provide this manual to the customer who will use the product.
- Be sure to store this manual for reading at any time.

Brother International Corporation

Introduction

Thank you very much for purchasing our product.

Before using the product

- Brother International Corporation accepts no responsibility or liability for any trouble caused by abnormal usage that violates the safety precautions.
- The contents of this manual are subject to change without notice in order to make improvements.
- We have made every possible effort to make the contents of this manual clear. If anything is unclear or hard to understand, please contact us.

Specifications

Check the product specifications on our website.

https://www.BrotherGearmotors.com

Related instruction manuals and software

The instruction manuals and software related to this product are as follows.

The instruction manuals and software can be downloaded from our website or via the QR code.

Title	High Precision Gearbox for Servo Motor Detailed Instruction Manual (This document)	
Summary	A detailed edition of the instruction manual that shows how to use the product and the precautions for safe handling of the product.	
Link to document	Website	QR code
	https://www.brother-usa.com/servo-gearbox-manual	

Title	High Precision Reducer for Servo Motor　Instruction Manual(abridged edition)
Summary	An abridged edition of the instruction manual.
Link to document	Included with the product package

Safety Precautions

- Be sure to read the manual contents carefully in order to understand correct usage of the product before using it.
- The extent of danger/damage expected to occur in the case of improper handling is classified and indicated as levels of “DANGER”, ”WARNING”, and ”CAUTION” in this manual.

  The definitions and indications are as follows.

Description of symbols

DANGER	Cases where it is expected that the degree of danger is extremely high, such that improper handling could cause a dangerous situation which might lead to death or serious injury.
WARNING	Cases where improper handling could cause a dangerous situation which might lead to death or serious injury.
CAUTION	Cases where improper handling could cause a dangerous situation which might lead to a minor or medium degree of injury.

Even items described in “CAUTION” may lead to a serious accident depending on the situation.
Be sure to observe every instruction which deals with important contents.

Description of icons

The icons used in this document stand for the following:

	Nonspecific hazard warning		Nonspecific prohibitions
	Burn injury hazard		Do not disassemble
	Electric shock hazard		Nonspecific obligations
	Fire hazard		Grounding required

DANGER/WARNING/CAUTION

DANGER	
General	
	When using the product for an application that may directly cause injury, such as personnel transportation equipment, provide the equipment with a protective device to ensure safety. Otherwise, there is a risk of accidents with casualties or damage to the equipment due to loss of control or falling.
	When using the product for lifting equipment, provide the equipment with a safety device to prevent falling. Otherwise, there is a risk of accidents with casualties or damage to the equipment.
	Do not use the product in an explosive atmosphere. Otherwise, there is a risk of explosions, ignition, fire, electric shock, injury, or damage to the equipment.
Transportation	
	Never stand under the product when it is lifted for transportation. Otherwise, there is a risk of injury due to falling.
Operation	
	Never approach or touch the product while it is rotating. Otherwise, there is a risk of injury due to entanglement.

WARNING	
General	
	Transportation, installation, piping, wiring, operation, handling, maintenance, and inspection must be performed by personnel having expertise and skills. Otherwise, there is a risk of explosions, ignition, fire, electric shock, injury, or damage to the equipment.
	Do not repair, disassemble, or remodel the product. Otherwise, there is a risk of fire, electric shock, burns, injury, and/or damage to the product.
Operation	
	When operation has stopped due to errors or activated safeguard functions, do not restart operation until the error causes are identified and countermeasures have been taken. Otherwise, there is a risk of fire, electric shock, burns, injury, and/or damage to the product.
	When performing trial operation, fix the product in place and disconnect it from the equipment. Otherwise, there is a risk of injury.

CAUTION	
General	
	Operate the product under the conditions specified in this instruction manual. Otherwise, there is a risk of injury and/or damage to the product.
	Do not expose the product to strong impacts/shocks. Otherwise, there is a risk of failure of the product and/or injury.
	Do not use the product under conditions not specified on the nameplate or in the product specifications. Otherwise, there is a risk of fire, electric shock, injury, and/or damage to the equipment.
	Do not use damaged products. Otherwise, there is a risk of fire, injury, and/or damage to the equipment.
	Do not insert fingers or objects into the opening of the product. Otherwise, there is a risk of fire, electric shock, injury, and/or damage to the equipment.
	Do not remove the nameplate.
	We assume no responsibility for remodeling of the product by the customer, which is out of our warranty coverage.
Transportation	
	The product must be transported correctly in accordance with its weight. Otherwise, there is a risk of injury and/or malfunction.
	Do not overload/overstack the product. Otherwise, there is a risk of injury and/or malfunction.
	Be very cautious during transportation to avoid dropping the product or falling. If the product has an eyebolt, always make sure that there is no looseness before using the eyebolt. However, after installing the product to the machine, never lift the entire machine with an eyebolt. Otherwise, there is a risk of damage to the lifting equipment or injury and/or damage to the equipment due to dropping or falling.
	Before lifting the product, check the product weight on the nameplate, package, drawings, catalogs, etc. and do not lift the product if it exceeds the rated load of the lifting equipment. Otherwise, there is a risk of damage to the bolt or injury and/or damage to the equipment due to dropping or falling.
Installation	
	When handling the product, be careful with its sharp angles/edges. Otherwise, there is a risk of injury.
	Ensure that the product is securely fixed onto the machine. Otherwise, there is a risk of injury and/or damage to the product.
	Do not stand or hang from the product. Otherwise, there is a risk of injury and/or damage to the product.
	Do not place heavy items on the product. Otherwise, there is a risk of damage.
	Do not put any object around the product that may prevent air circulation. Otherwise, there is a risk of abnormal overheating of the product due to restricted cooling, which may result in fire or burns.
	Never put combustible materials around the product. Otherwise, there is a risk of fire.
	Install an oil pan or other preventive device in oil-sensitive machinery such as food machinery, in case of oil leaks due to malfunctions, service life, etc. Otherwise, there is a risk of product defects due to oil leakage.

	Do not touch the key ways on the end of the shaft or the hollow shaft, etc. with bare hands. Otherwise, there is a risk of injury.
	Confirm the rotational direction before connecting with the application. Incorrect rotational direction may result in injury or damage to the equipment.
Operation	
	If an abnormality occurs, immediately stop the operation. Otherwise, there is a risk of fire, electric shock, and/or injury.
	Do not touch the product during operation or for a while after stopping operation, as its surfaces may become very hot. Otherwise, there is a risk of burns.
	Do not touch the rotating parts of the product. Otherwise, there is a risk of injury.
	Make sure that the surface temperature of the reducer does not exceed 90℃. If the surface temperature exceeds 90°C, cool it with an external fan or heat sink to keep it below 90°C. Otherwise, there is a risk of product malfunction and/or damage to the equipment.
	Ensure that the product is securely installed to the machine before operating. Sudden acceleration or deceleration without properly installing the product may cause unexpected movement that could result in injury, product malfunction, and/or damage to the application.
	Ensure that the inertial load does not cause vibration to the output shaft during acceleration or deceleration. Vibration may cause product malfunction and/or damage to the machine.

Contents

1. Inspection upon Unpacking

CAUTION	
	Check that the product is right side up when unpacking. Otherwise, there is a risk of injury.
	Check that the product is as you ordered. Installing the wrong product may result in injury, damage to the equipment, etc.

1.1 Checking the Contents of the Package

Check the following items after unpacking.

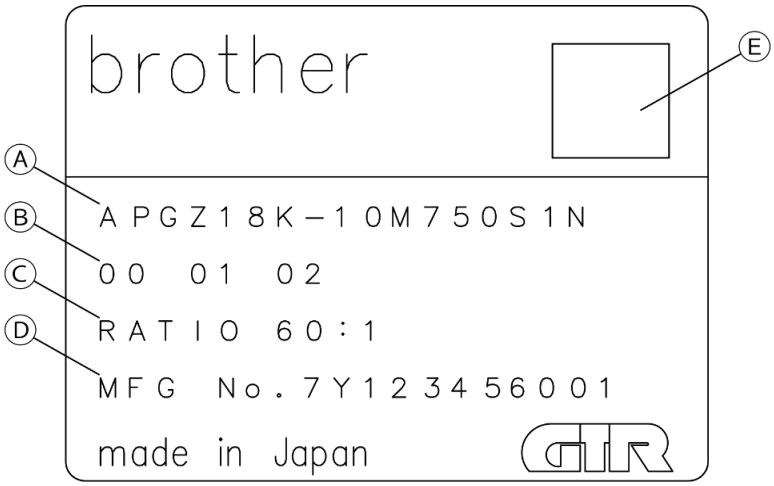
If there are any defects, or if you have any questions, please contact your nearest service office immediately.

- Does the information on the nameplate completely match your order?
- Is there any damage caused during transportation?
- Are there any loose screws, bolts, or other fastening parts?
- If an accessories list is included in the package, do the accessories match the descriptions in the accessories list?

1.2 How to Read the Nameplate

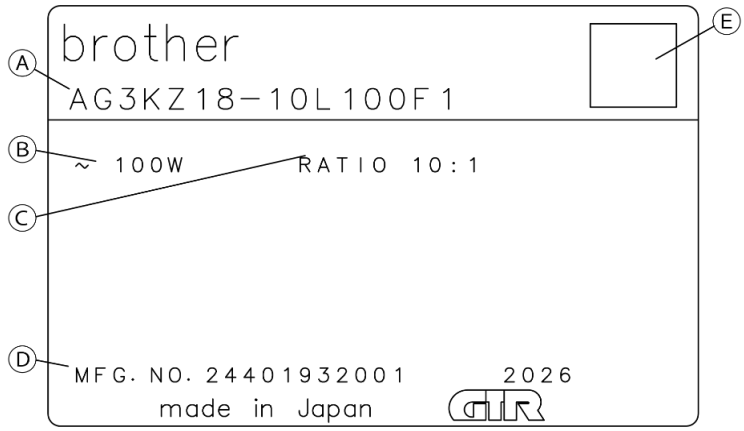
Typical examples of nameplates are shown below.

APG/AFC types



Ⓐ Part Number
Ⓑ Option code
Ⓒ Reduction ratio
Ⓓ Manufacturing number (MFG No.)
Ⓔ QR code (internal control code)

AG3/AH2/AF3 types



Ⓐ Part Number
Ⓑ Power
Ⓒ Reduction ratio
Ⓓ Manufacturing number (MFG No.)
Ⓔ QR code (internal control code)

- For the meaning of each type code, refer to "Part Number".
- When inquiring, please inform us of the part number/manufacturing number.

1.3 Part Number

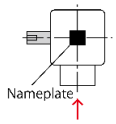
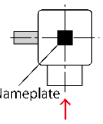
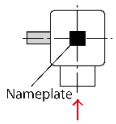
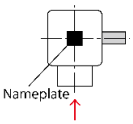
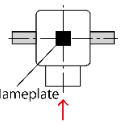
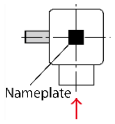
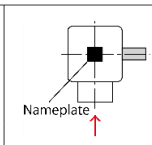
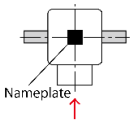
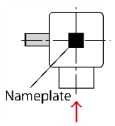
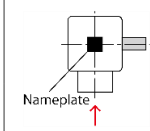
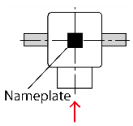
Below is information on type codes. Check that the part number is as you ordered.

①	②	③	④	⑤	
Type	Mount	Motor Type	Frame Size	Shaft Type	—
AH2	L	Z	22	R	—

①Shaft Type		②Mount	
APG	Concentric Parallel Shaft (Planetary Type)	Blank	Compact Flange Mount
AFC	Concentric Right Angle Shaft		
AG3	Parallel Shaft	L	Foot Mount
		F	Flange Mount
		K	Small Flange Mount
AH2	Right Angle Shaft	L	Foot Mount
AF3	Concentric Right Angle Shaft	S	Flange Mount
		F	

③Motor Type	④Frame Size	
High Precision Reducer for Servo Motor	□□	Output Shaft Diameter

①②	⑤Shaft Type (Parallel Shaft Type)	
APG	K	Output shaft with key and shaft end tapped
	J	Straight shaft
AG3L AG3F AG3K	Blank	

①②	⑤Shaft Type (Right Angle Shaft Type			
	Hollow Bore	Solid Shaft		
AFC	S (With a key way)	 Output shaft on the left side when viewed from the input shaft side (↑) (with a key)	 Output shaft on the left side when viewed from the input shaft side (↑) (without a key)	—
AH2L	—	 Output shaft on the left side when viewed from the input shaft side (↑)	 Output shaft on the right side when viewed from the input shaft side (↑)	 Output shaft on both sides when viewed from the input shaft side (↑)
AF3S	Blank	—		
AF3F	—	1 arc min and 3 arc min specification	 Output shaft on the left side when viewed from the input shaft side (↑)	 Output shaft on the right side when viewed from the input shaft side (↑)	 Output shaft on both sides when viewed from the input shaft side (↑)
		Low backlash specification	 Output shaft on the left side when viewed from the input shaft side (↑)	 Output shaft on the right side when viewed from the input shaft side (↑)	 Output shaft on both sides when viewed from the input shaft side (↑)

	⑥	⑦	⑧	⑨	⑩	⑪	⑫
—	Reduction ratio	Precision	Power	Flange Type for Servo Motor Mounting	Protection Rating	Auxiliary Code	Option Code
—	30	L	200	S1		X	B3

⑥Reduction Ratio	
3～240	1/3～1/240

①	⑦Precision	
APG	M	Backlash 3 arc min
	Q	Backlash 15 arc min
AFC	M	Backlash 3 arc min
	L	Backlash 30 arc min
AG3	L	Low backlash specification
AH2	L	Low backlash specification
AF3	H	Backlash 1 arc min
	M	Backlash 3 arc min
	L	Low backlash specification

⑧Power	
100	100W Class
150	150W Class
200	200W Class
400	400W Class
600	600W Class
750	750W Class
1000	1000W Class
1500	1500W Class
2000	2000W Class
3000	3000W Class

⑪Auxiliary Code	
Blank	Standard Specification
X	Special Specification Code

①	⑩IP Protection Rating	
APG	N	IP44 Class
	W	IP65 Class
AFC	Blank	
AG3		
AH2		
AF3		

⑧	⑨Flange Type for Servo Motor Mounting
100～750	S1, S3, F1, F2, etc.
1000～3000	K13, K22, KAA, KBA, etc.

* The type code changes according to the motor that can be mounted. For details, refer to our homepage or catalog.

2. Transportation

DANGER	
	Never stand under the product when it is lifted for transportation. Otherwise, there is a risk of injury due to falling.

CAUTION	
	Be very cautious when transporting to avoid dropping the product or any situation that may cause a fall. If the product has an eyebolt, always make sure that there is no looseness before using the eyebolt. However, after installing the product to the machine, never lift the entire machine with an eyebolt. Otherwise, there is a risk of damage to the lifting equipment or injury and/or damage to the equipment due to dropping or falling.
	Before lifting the product, check the product weight on the nameplate, package, drawings, catalogs, etc. and do not lift the product if it exceeds the rated load of the lifting equipment. Otherwise, there is a risk of damage to the bolt or injury and/or damage to the equipment due to dropping or falling.
	If the package is a wooden box, transport it with belts. Otherwise, there is a risk of injury and/or damage to the product.

3. Installation

The installation quality affects the service life of the product, so pay attention to the following items.

CAUTION	
	Do not stand or hang from the product. Otherwise, there is a risk of injury and/or damage to the product.
	Do not place heavy items on the product. Otherwise, there is a risk of damage.
	Do not put any object around the product that may prevent air circulation. Otherwise, there is a risk of abnormal overheating of the product due to restricted cooling, which may result in fire or burns.
	Never put combustible materials around the product. Otherwise, there is a risk of fire.
	Install an oil pan or other preventive device in oil-sensitive machinery such as food machinery, in case of oil leaks due to malfunctions, service life, etc. Otherwise, there is a risk of product defects due to oil leakage.
	Do not touch the key ways on the end of the shaft or the hollow shaft, etc. with bare hands. Otherwise, there is a risk of injury.
	The vibration applied from the product installation surface or the outside should be less than the specified value.

3.1 Installation Location

Ambient temperature	0°C to 40°C
Ambient humidity	85% RH max. (no condensation)
Altitude	1,000 m max.
Vibration resistance	0.5 G max.
Atmosphere	Well-ventilated place free from corrosive gas, explosive gas, vapor, chemicals, etc. Well-ventilated place with no dust No direct exposure to rain or water No direct exposure to sunlight

3.2 Installation Orientation

All models adopt a grease lubrication method and can therefore be installed in any orientation.

3.3 Installation Procedure

3.3.1 Foot Mount/Flange Mount

- Fasten the product to a vibration-free, machined, flat surface using four bolts.
- Make sure the flatness of the mounting surface is 0.1 mm or below.

Important: If the foundation is improper or the mounting surface is not flat enough, vibration may occur during operation and the service life of the reducer may be shortened.

3.3.2 Installation Fixing Bolts

For the bolt size and the tightening torque, refer to the following tables.

AG3/AH2/AF3 types

(Reference value)

Mounting hole [mm]	Bolt size	Strength classification (JIS B 1051)	Tightening torque [N•m]
9	M8	4.8	13
11	M10	4.8	25
13	M12	4.8	44
15	M14	4.8	69
18	M16	4.8	108
22	M20	6.8	294

APG/AFC types

(Reference value)

Mounting hole [mm]	Bolt size	Strength classification (JIS B 1051)	Tightening torque [N•m]
5.5	M5	10.9	8.3
6.5	M6	10.9	14.2
9	M8	10.9	29.4
11	M10	10.9	65.8

4. Motor Mounting

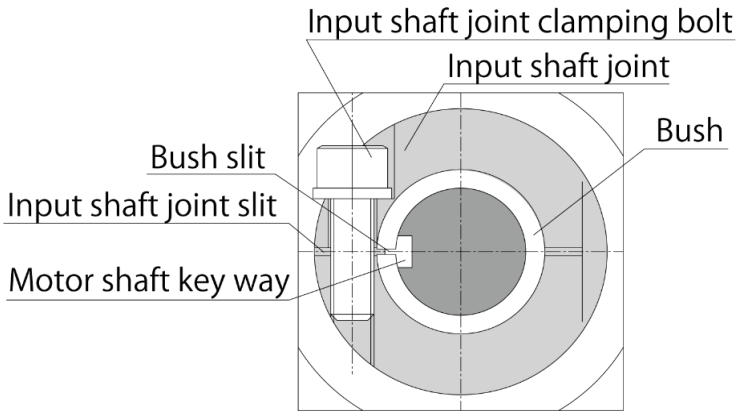
4.1 Motor Mounting Procedure

4.1.1 APG type

Step 1. Turn the input shaft joint and align the input shaft joint clamping bolt head to the wrench hole for input shaft joint clamping on top of the flange.

Step 2. Wipe rust-preventive agent, oil, etc., off the input shaft joint guide part and the motor output shaft.

Step 3. Insert the motor into the reducer body.
When a bush is provided, align the position of the bush slit with that of the input shaft joint slit as shown in the following figure.
Additionally, when a key way is provided in the motor shaft, align the position of the bush slit with the key way.
For a reducer of IP65 specifications, before inserting the motor into the reducer body,
put a sheet gasket (accessory) between the reducer flange and the motor.



Step 4. Fasten the motor and the reducer flange part with a motor mounting bolt.
Refer to [Table 1] for the tightening torque value.

Step 5. Tighten the input shaft joint clamping bolt to the specified tightening torque.
Refer to [Table 2] for the tightening torque value.

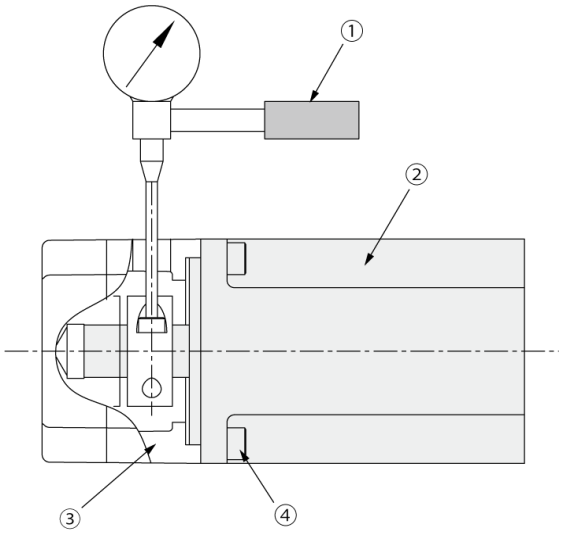
Step 6. Mount the rubber cap (accessory) to the wrench hole for input shaft joint clamping.

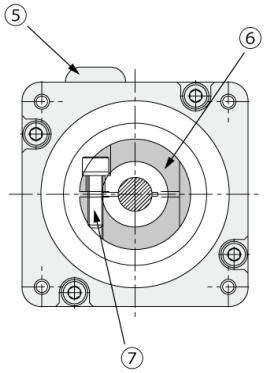
[Table 1] Tightening torque for motor mounting bolt (Reference value)

Bolt size	M3	M4	M5	M6	M8
Tightening torque [N•m]	1.6	4.4	8.3	14.2	29.4
Strength classification (JIS B 1051)	10.9	10.9	10.9	10.9	10.9

[Table 2] Tightening torque for input shaft joint clamping bolt (Reference value)

Power class	100W 150W 200W 400W	600W 750W	1000W 1500W 2000W 3000W
Bolt size	M4	M5	M8
Tightening torque [N•m]	5.1	9	35





① Torque wrench
② Motor
③ Flange
④ Motor mounting bolt
⑤ Wrench hole for input shaft joint clamping (Rubber cap - accessory)
⑥ Input shaft joint
⑦ Input shaft joint clamping bolt

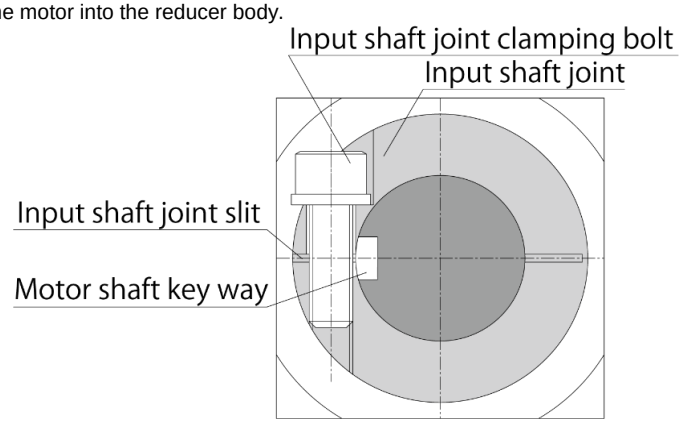
CAUTION: Do not tighten the input shaft joint clamping bolt while the motor shaft is not inserted into the input shaft joint. Otherwise, there is a risk of damage to the input shaft.

4.1.2 AFC type

Step 1. Turn the input shaft joint and align the input shaft joint clamping bolt head to the wrench hole for input shaft joint clamping on top of the flange.

Step 2. Wipe rust-preventive agent, oil, etc., off the input shaft joint guide part and the motor output shaft.

Step 3. Insert the motor into the reducer body.



Step 4. Fasten the motor and the reducer flange part with a motor mounting bolt.
Refer to [Table 3] for the tightening torque value.

Step 5. Tighten the input shaft joint clamping bolt to the specified tightening torque.
Refer to [Table 4] for the tightening torque value.

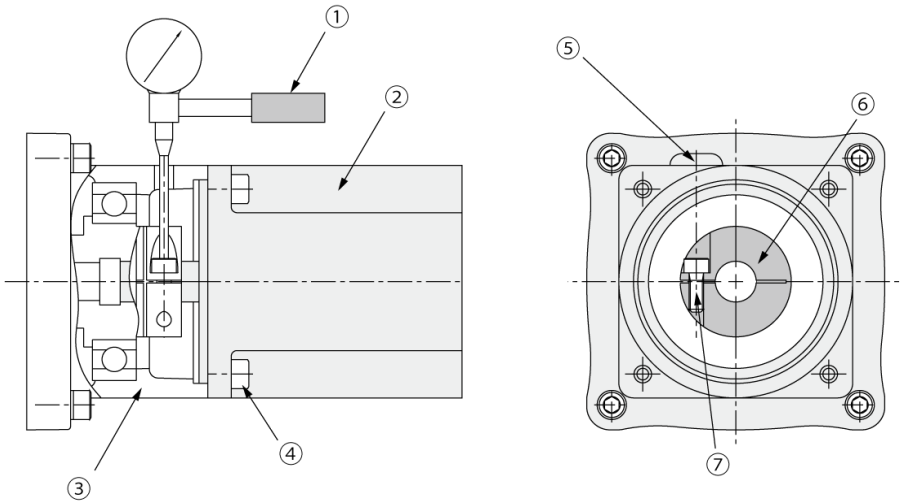
Step 6. Mount the rubber cap (accessory) to the wrench hole for input shaft joint clamping.

[Table 3] Tightening torque for motor mounting bolt (Reference value)

Bolt size	M3	M4	M5	M6	M8
Tightening torque [N•m]	1.6	4.4	8.3	14.2	29.4
Strength classification (JIS B 1051)	10.9	10.9	10.9	10.9	10.9

[Table 4] Tightening torque for input shaft joint clamping bolt (Reference value)

Power class	100W 200W 400W	750W	1000W 2000W 3000W
Bolt size	M4	M5	M8
Tightening torque [N•m]	5.1	9	35



① Torque wrench
② Motor
③ Flange
④ Motor mounting bolt
⑤ Wrench hole for input shaft joint clamping (Rubber cap - accessory)
⑥ Input shaft joint
⑦ Input shaft joint clamping bolt

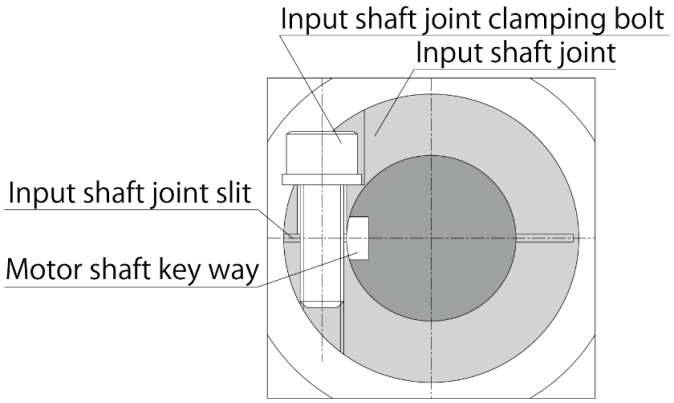
CAUTION: Do not tighten the input shaft joint clamping bolt while the motor shaft is not inserted into the input shaft joint. Otherwise, there is a risk of damage to the input shaft.

4.1.3 AG3/AH2/AF3 types

Step 1. Turn the input shaft joint and align the input shaft joint clamping bolt head to the wrench hole for input shaft joint clamping on top of the flange.

Step 2. Wipe rust-preventive agent, oil, etc., off the input shaft joint guide part and the motor output shaft.

Step 3. Insert the motor into the reducer body.



Step 4. Fasten the motor and the reducer flange part with a motor mounting bolt.
Refer to [Table 5] for the tightening torque value.

Step 5. Tighten the input shaft joint clamping bolt to the specified tightening torque.
Refer to [Table 6] for the tightening torque value.

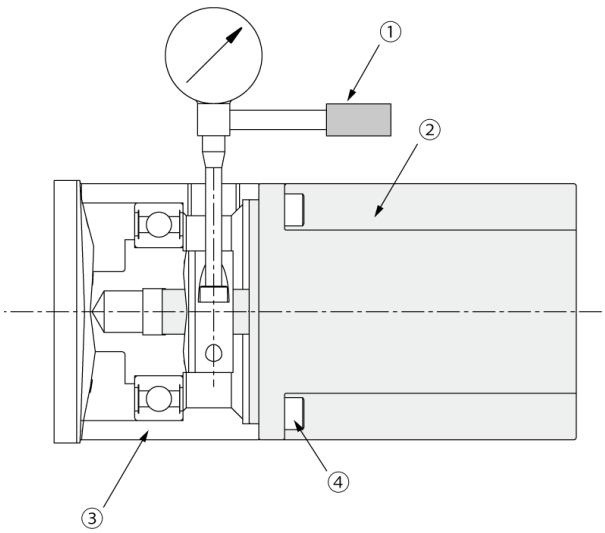
Step 6. Mount the accessory cap screw (rubber bush) to the wrench hole for input shaft joint clamping.

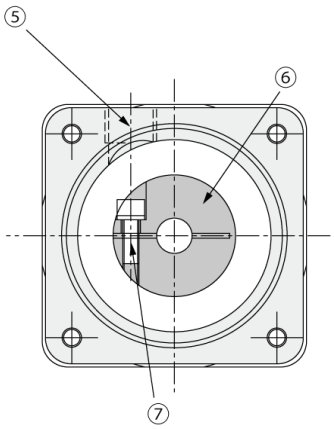
[Table 5] Tightening torque for motor mounting bolt (Reference value)

Bolt size	M3	M4	M5	M6	M8
Tightening torque [N•m]	1.6	4.4	8.3	14.2	29.4
Strength classification (JIS B 1051)	10.9	10.9	10.9	10.9	10.9

[Table 6] Tightening torque for input shaft joint clamping bolt (Reference value)

Power class	100W 200W 400W	750W	1000W 2000W
Bolt size	M5	M6	M8
Tightening torque [N•m]	8.3	12.7	29.4





① Torque wrench
② Motor
③ Flange
④ Motor mounting bolt
⑤ Wrench hole for input shaft joint clamping
(Cap screw (rubber cap) - accessory)
⑥ Input shaft joint
⑦ Input shaft joint clamping bolt

CAUTION: Do not tighten the input shaft joint clamping bolt while the motor shaft is not inserted into the input shaft joint.
Otherwise, there is a risk of damage to the input shaft.

5. Connection with Application

CAUTION	
	If the product is connected to a load, pay attention to centering, belt tension, pulley parallelism, etc. For belt tension, adjust the belt tension properly. For direct coupling, align the shaft core of the product rotating shaft with that of the application. Also, before operation, be sure to fasten the tightening bolts of the pulley and the coupling. Otherwise, there is a risk of injury or damage to the equipment due to scattering of fragments.
	Provide a cover, etc. to prevent the rotating parts from being touched. Otherwise, there is a risk of injury.

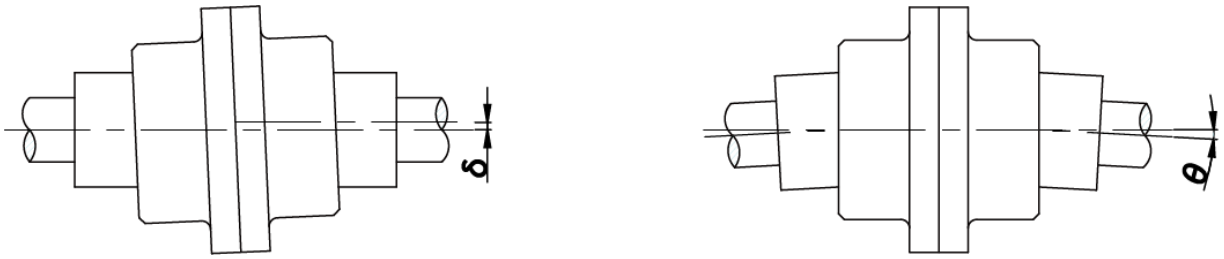
5.1 Mounting Transmission Part

- H7 fit is recommended when mounting a connector (coupling, sprocket, pulley, gear, etc.) on the rotating shaft.
- When assembling the connector, be sure to use the designated key material.

5.1.1 For direct coupling

Align the shaft core of the product rotating shaft with that of the application.

Example of gear coupling



- The displacement δ or θ differs depending on the type of coupling; keep it within the allowable value of the coupling manufacturer.

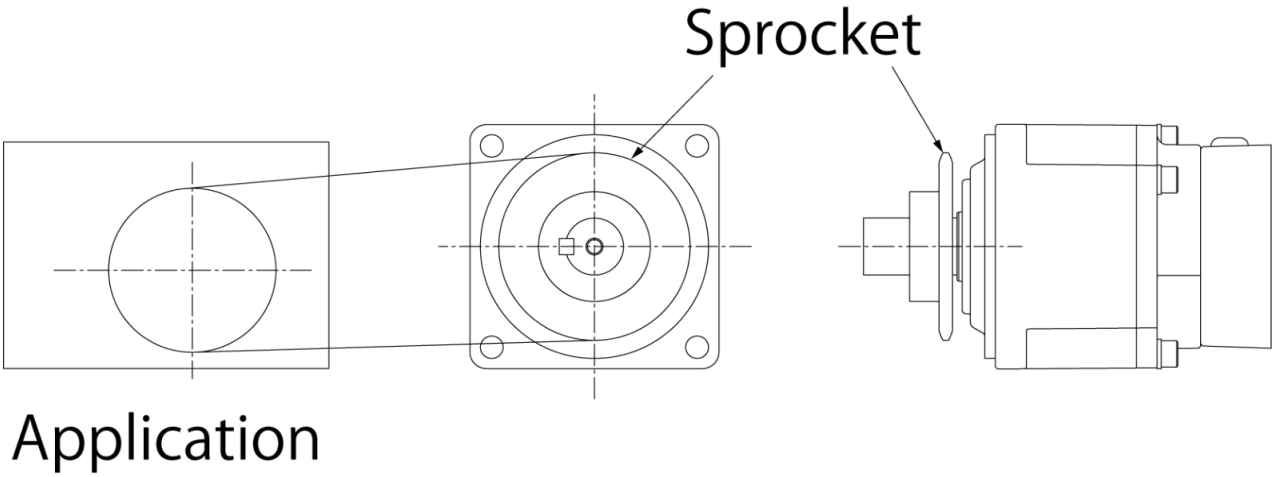
Reference: For chain couplings: δ = 2% of roller chain pitch, θ = within 1°

5.1.2 For chain, belt, gear engagement, etc.

- Place the shaft core of the product rotating shaft in parallel with that of the application.
- The chain or belt tension and the gear engagement must be perpendicular to the shaft core.
- If the load acts on the end of the rotating shaft, excessive force will be applied to the rotating shaft, causing the case to split, etc. Put the sprocket, pulley, gear, etc. up to the base of the shaft so that the load point is as close to the product as possible.
- Excessive belt tension will damage the bearing.
- Excessive chain tension will damage the bearing. Very loose tension will generate large impact force upon startup, adversely affecting the product and the application, so make proper adjustments.

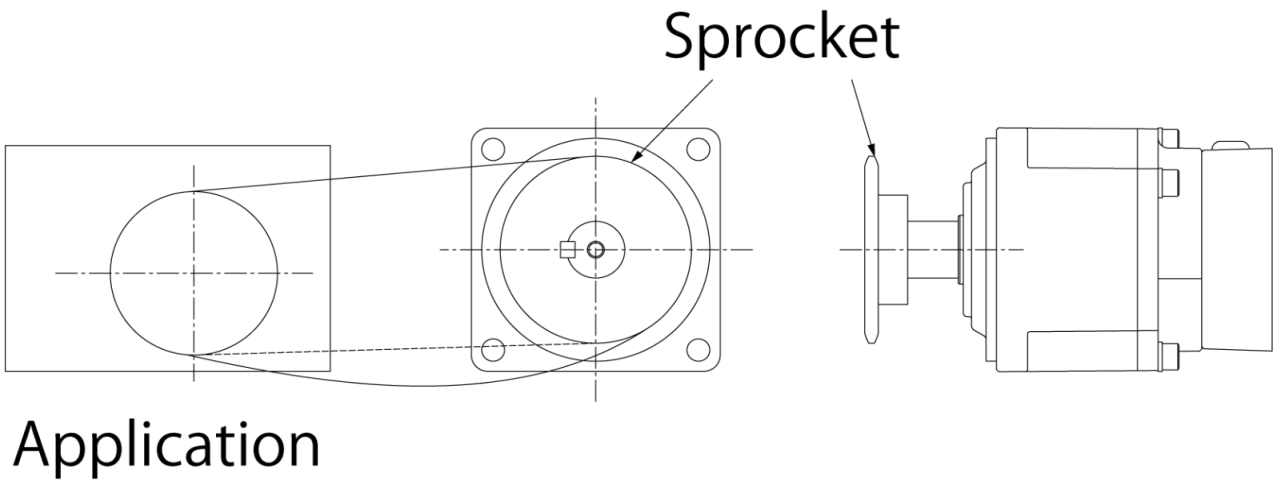
Proper usage

- The tension of the belt/chain is appropriate.
- The position of the pulley/sprocket is appropriate.



Improper usage

- Chain too loose
- Reverse orientation of the sprocket and the load point at the shaft end

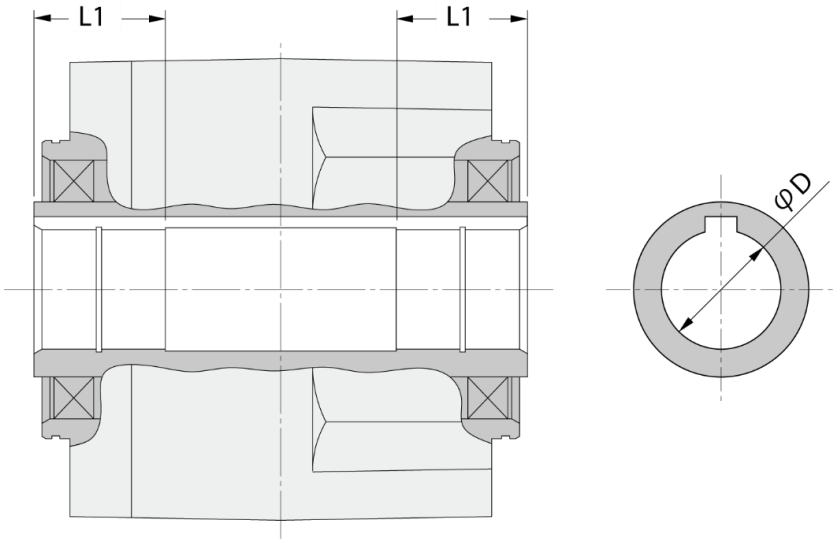


5.2 Mounting and Removing Hollow Bore

5.2.1 Driven shaft length/driven shaft key length

- Arrange the driven shaft to reach both ends of the L1 area. However, allow for some margin for the spacer dimensions required during “Removal from hollow bore”.
- Set the length of the key to at least 1.5 times hole diameter D of the hollow bore.

  In addition, adjust the key insertion position so that at least 1/2 of the overall length of the key is engaged with L1. Engagement on both sides of the two L1 areas is not required.



5.2.2 Mounting on driven shaft

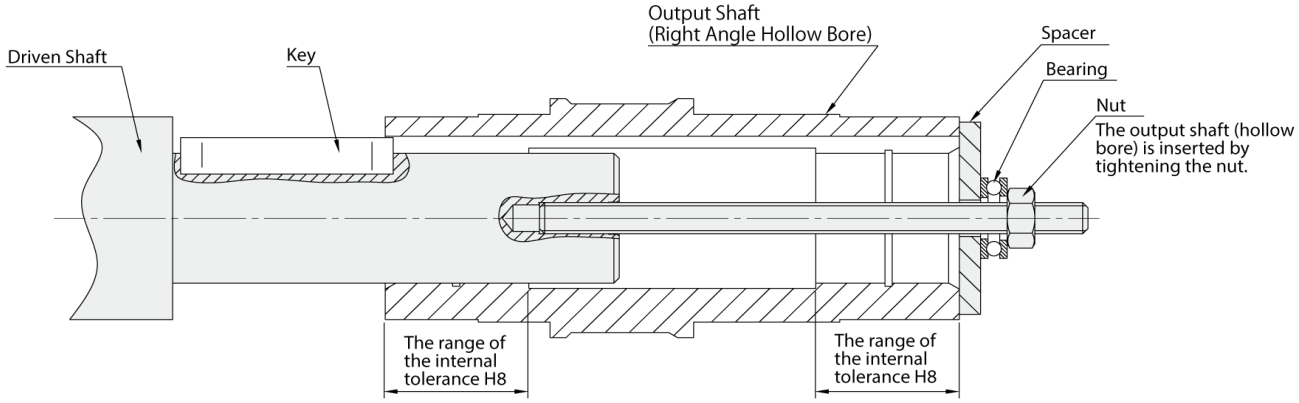
- Apply an anti-seizing agent (molybdenum disulfide, etc.) suitable for the usage environment to the surface of the driven shaft and the internal diameter of the hollow bore, and then insert the reducer into the driven shaft.
- The internal diameter of the hollow bore is designed to have a tolerance of H8.

  When no impact is imposed under uniform load, the recommended tolerance for the driven shaft is h7.

  If impact load is imposed or radial load is high, tighten the fit.
- If the fit is tight, insert the hollow bore output shaft by tapping its end face with a plastic hammer.

  In this case, be sure not to hit the casing. Make a jig as shown in the diagram below to insert the shaft smoothly.
- It is recommended to arrange the length of the driven shaft and the detent key so as to reach the range of the internal diameter tolerance H8 on the fixing side.
- It is recommended to adjust the axial runout of the driven shaft to 0.05 mm or less at the end of the shaft.

  If the axial runout increases during operation, it may adversely affect the product.



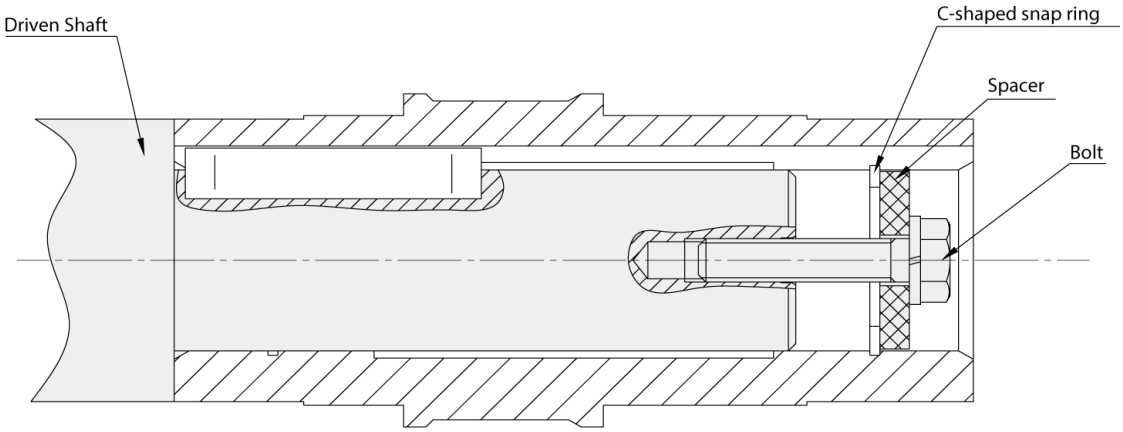
The customer is asked to prepare spacers, nuts, bolts, key material, and bearings.

5.2.3 Fixing to driven shaft

When the driven shaft is stepped

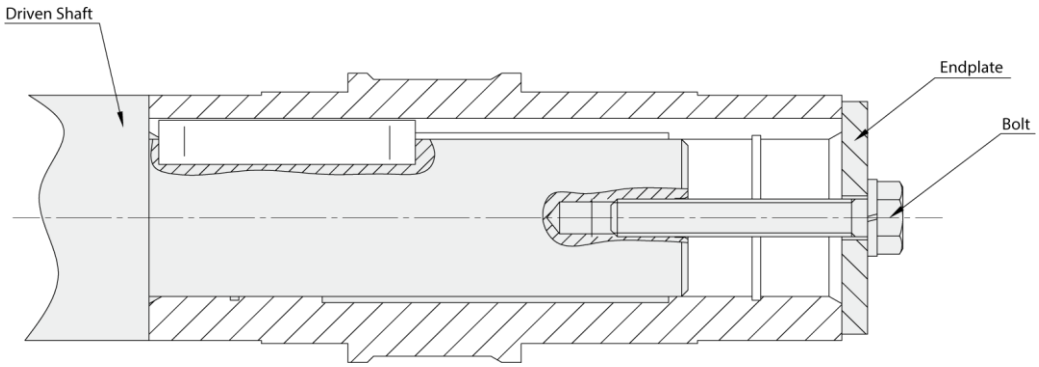
Fixing using a spacer and a C-type retaining ring

Important: Note that the C-type retaining ring may deform if the bolt is tightened excessively.



The customer is asked to prepare the spacer, bolts, and C-type retaining ring.

Fixing using an endplate



The customer is asked to prepare the endplate and bolts.

When the driven shaft is not stepped

Fixing using a spacer and a C-type retaining ring

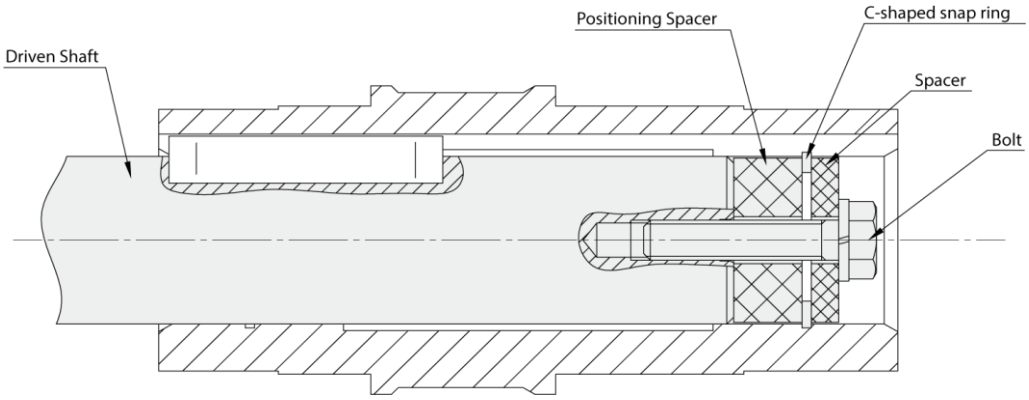
Important: Be sure to allow a gap between the outer diameter of the spacer and the internal diameter of the hollow bore.

If the fit is tight or the outer diameter of the spacer is inaccurate, the axial runout of the driven shaft and hollow bore may increase.

Use a positioning spacer to position the product. This is not required if the length of the driven shaft is secured in advance.

In addition, attaching a positioning spacer makes it possible to remove the shaft smoothly from the hollow bore.

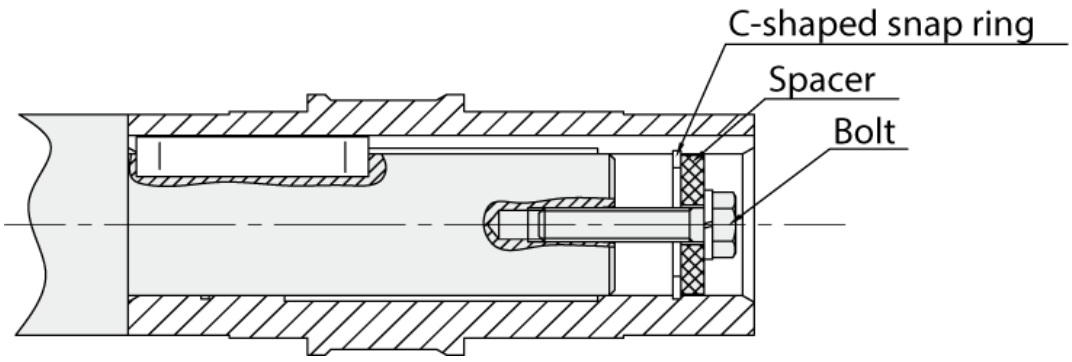
For removal from the hollow bore, refer to "Removal from hollow bore".



The customer is asked to prepare the spacer, positioning spacer, bolts, and C-type retaining ring.

Recommended sizes for the driven shaft fixing parts

Design the tightening of hollow bore types for general applications by referring to the dimensions shown in the following table to ensure strength.



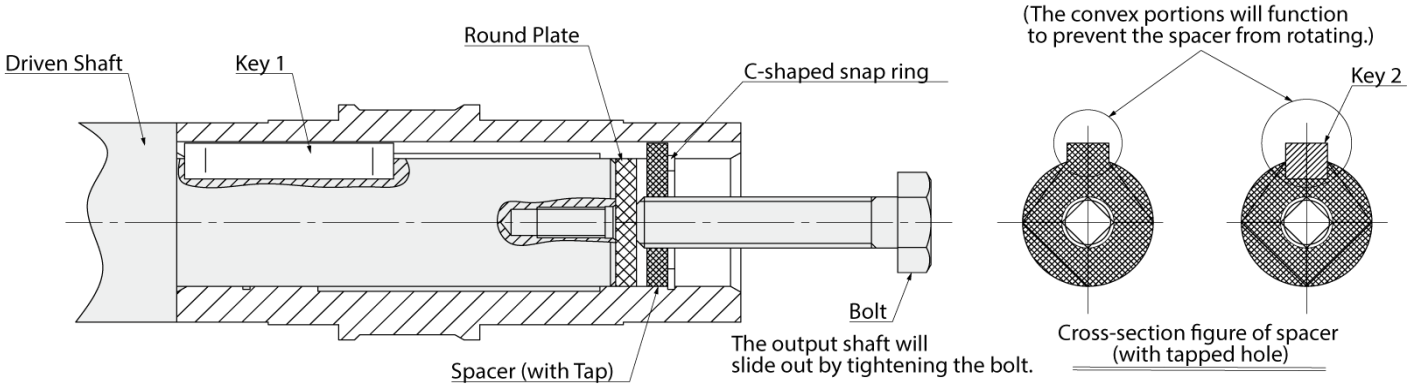
Internal diameter of hollow bore [mm]	Bolt size	Spacer dimension [mm]			Nominal size of C-type retaining ring for hole
		Outer diameter	Internal diameter	Width	
φ20	M6	φ19.5	φ7	3	20
φ25	M6	φ24.5	φ7	4	25
φ30	M8	φ29.5	φ9	5	30
φ35	M10	φ34.5	φ11	5	35
φ45	M10	φ44.5	φ11	5	45
φ50	M12	φ49.5	φ13	6	50
φ55	M12	φ54.5	φ13	6	55

5.2.4 Removal from hollow bore

Take care not to impose unnecessary force between the casing and the hollow bore when removing the driven shaft.

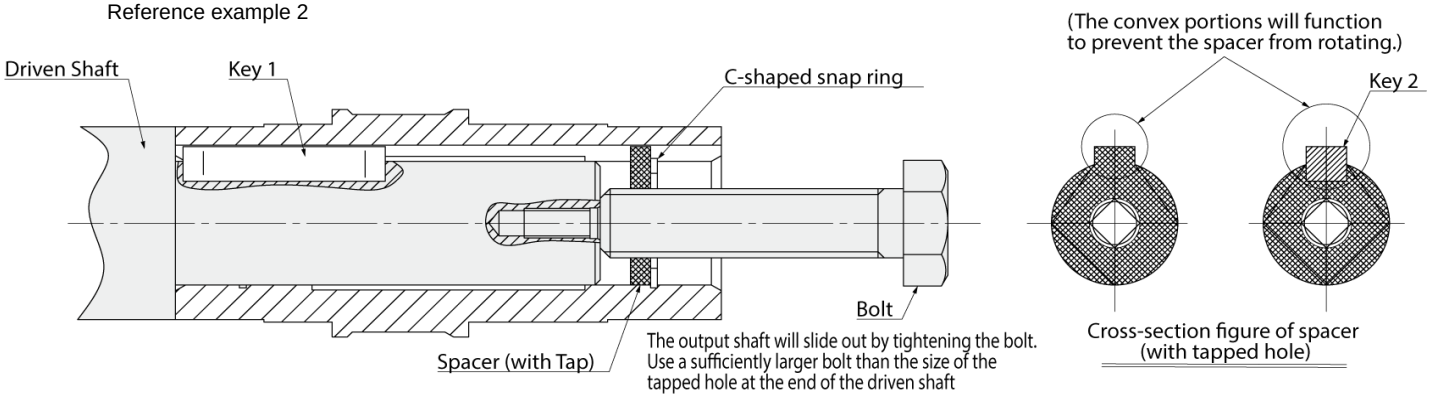
Make and use a jig as shown in the figure below to remove the shaft smoothly.

Reference example 1



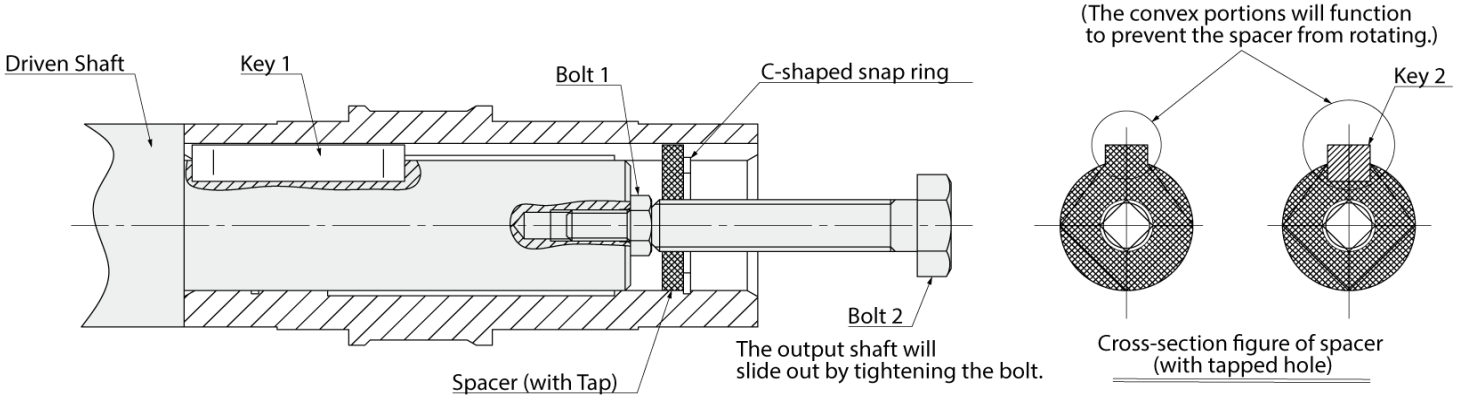
Please prepare a spacer, a round plate, a bolt, a retaining ring, and a key yourself.

Reference example 2



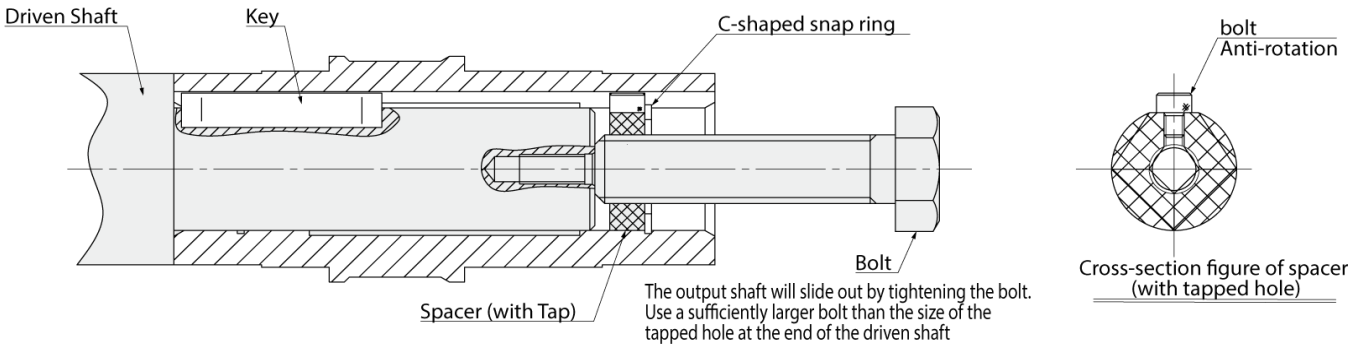
Please prepare a spacer, a bolt, a C-shaped Retaining Ring, and a key material yourself.

Reference example 3



Please prepare a spacer, a bolt, a C-shaped Retaining Ring, and a key material yourself.

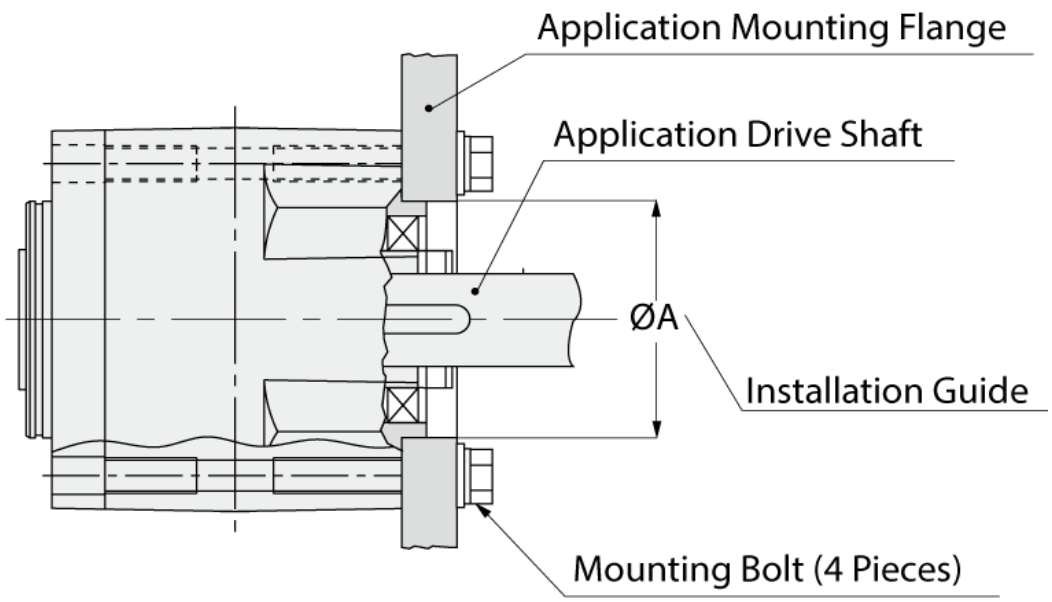
Reference example 4



Please prepare a spacer, a bolt, a C-shaped Retaining Ring, and a key material yourself.

5.3 Flange Mount

- When mounting directly on the application installation flange surface, be sure to perform centering.
  Misalignment at the center may cause motor seizing or bearing damage.
- If the product has an installation guide, use four mounting bolts and mount as shown in the following figure.
  The dimensional tolerance for ØA for the installation guide is h7.

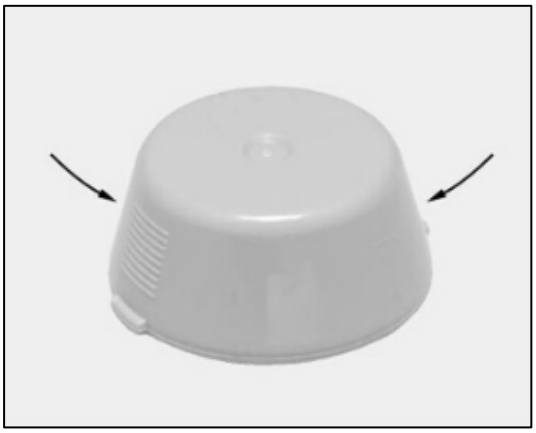


5.4 Mounting and Removing Safety Cap

After mounting the application driven shaft, mount the accessory safety cap.

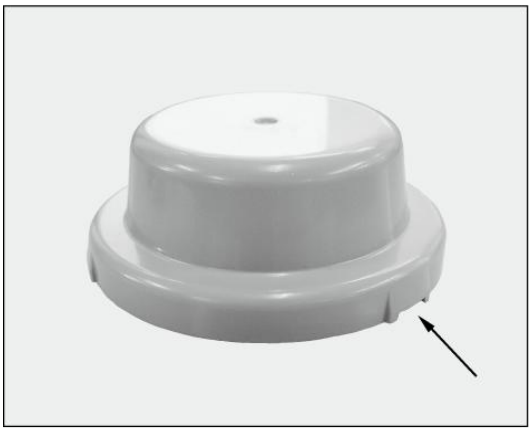
5.4.1 AF3 type 100 W

Mount and remove the safety cap by lightly pushing the part indicated by the arrow.
Do not push hard. Otherwise, there is a risk of damage.



5.4.2 AF3 type other than 100 W

Insert a tapered bar, etc. into the three gaps on the side face of the safety cap to remove the safety cap.
Wrap the tip of the bar in cloth, etc. to prevent the safety cap from being damaged.

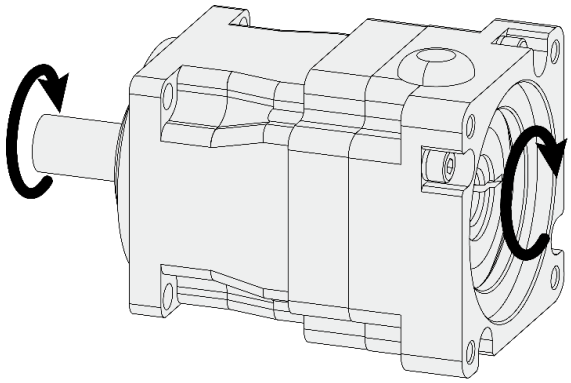


6. Rotational Direction

CAUTION	
	Confirm the rotational direction before connecting with the application. Incorrect rotational direction may result in injury or damage to the equipment.

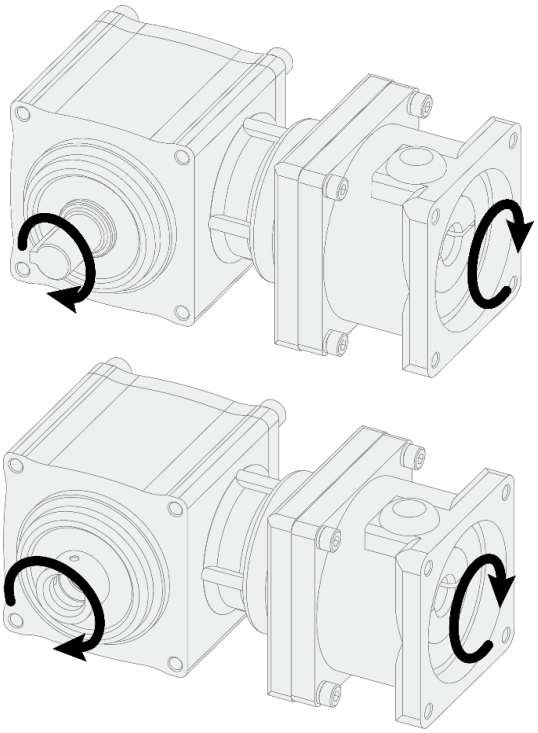
The relationship between the rotational direction of the input shaft and that of the output shaft is as follows:

6.1 APG Type

Motor power class	Reduction ratio
100W	1/3, 1/5, 1/10, 1/15, 1/20, 1/30, 1/40, 1/50, 1/60, 1/100
150W	1/3, 1/5, 1/10, 1/15, 1/20, 1/30, 1/40, 1/50, 1/60
200W	1/3, 1/5, 1/10, 1/15, 1/20, 1/30, 1/40, 1/50, 1/60, 1/100
400W	1/3, 1/5, 1/10, 1/15, 1/20, 1/30, 1/40, 1/50, 1/60, 1/100
600W	1/3, 1/5, 1/10, 1/15, 1/20, 1/30, 1/40, 1/50, 1/60
750W	1/3, 1/5, 1/10, 1/15, 1/20, 1/30, 1/40, 1/50, 1/60
1000W	1/3, 1/5, 1/10, 1/15, 1/20, 1/30, 1/40, 1/50
1500W	1/3, 1/5, 1/10, 1/15, 1/20, 1/30
2000W	1/3, 1/5, 1/10, 1/15, 1/20
3000W	1/3, 1/5, 1/10
Rotational direction of output shaft	

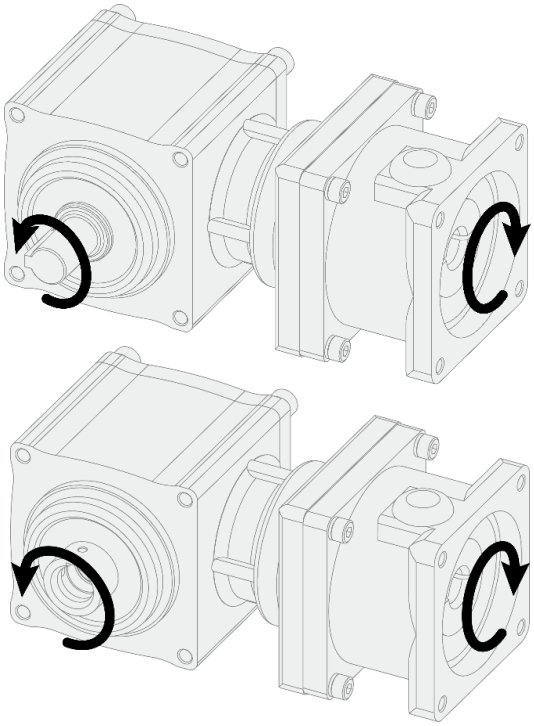
*The rotational direction of the APG type output shaft is the same as that of the motor input for all reduction ratios.

6.2 AFC Type

Motor power class	Reduction ratio
100W	1/7.5, 1/10*
200W	1/5, 1/7.5, *1/10
400W	1/3, 1/5, 1/7.5, *1/10
750W	1/3, 1/5, 1/7.5, *1/10
1000W	1/3, 1/5, 1/7.5, *1/10
2000W	1/3, 1/5, 1/7.5, 1/10
3000W	1/3, 1/5
Rotational direction of output shaft	

*For the frame size (output shaft diameter) of the 1/10 reduction ratio, see the following table.

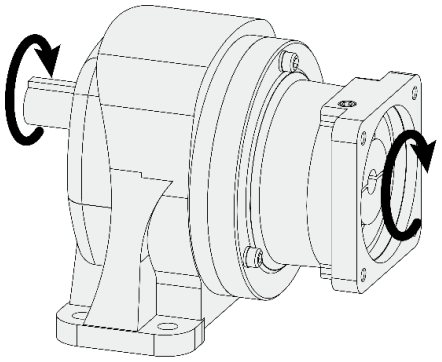
Motor power class	Frame size (output shaft diameter)
100W	Φ12
200W	Φ15
400W	Φ18
750W	Φ22
1000W	Φ28

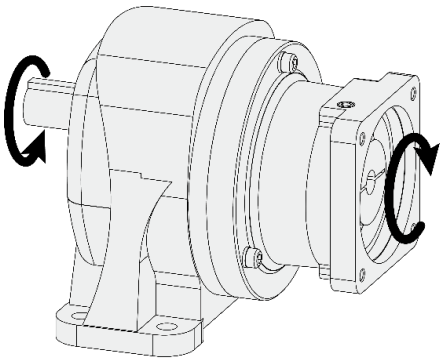
Motor power class	Reduction ratio
100W	1/10*, 1/12, 1/15, 1/20, 1/25, 1/30, 1/40, 1/50, 1/60
200W	* 1/10, 1/12, 1/15, 1/20, 1/25, 1/30, 1/40, 1/50, 1/60
400W	* 1/10, 1/12, 1/15, 1/20, 1/25, 1/30, 1/40, 1/50, 1/60
750W	* 1/10, 1/12, 1/15, 1/20, 1/25, 1/30, 1/40, 1/50, 1/60
1000W	* 1/10, 1/12, 1/15, 1/20, 1/25, 1/30
2000W	-
3000W	-
Rotational direction of output shaft	

*For the frame size (output shaft diameter) of the 1/10 reduction ratio, see the following table.

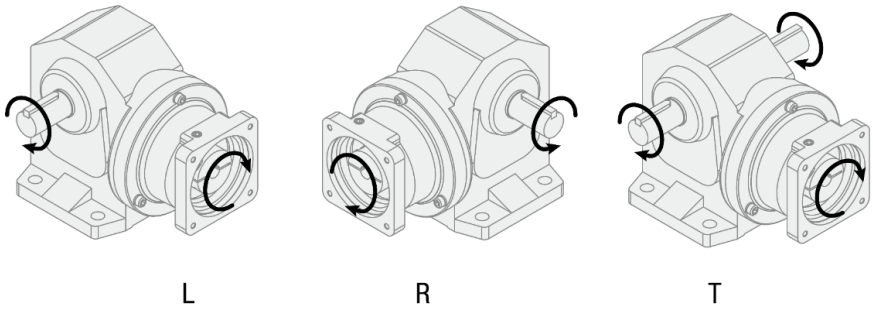
Motor power class	Frame size (output shaft diameter)
100W	Φ15
200W	Φ18
400W	Φ22
750W	Φ28
1000W	Φ32

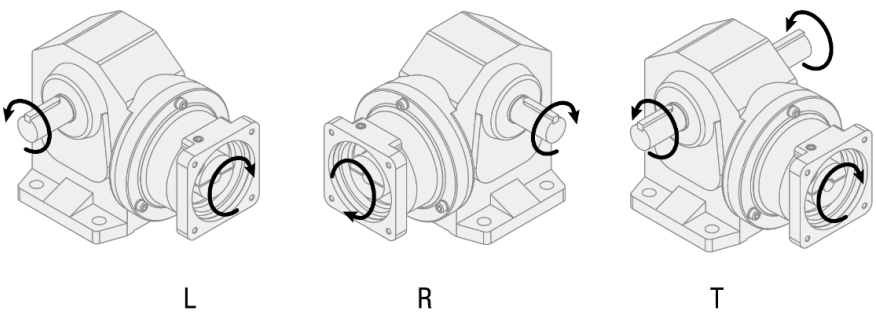
6.3 AG3 Type

Motor power class	Reduction ratio
100W	1/5, 1/10, 1/15, 1/20, 1/25, 1/30, 1/40, 1/50
200W	1/5, 1/10, 1/15, 1/20, 1/25, 1/30
400W	1/5, 1/10, 1/15, 1/20, 1/25, 1/30
750W	1/5, 1/10, 1/15, 1/20, 1/25, 1/30
2000W	1/5, 1/10, 1/15, 1/20, 1/25, 1/30
Rotational direction of output shaft	

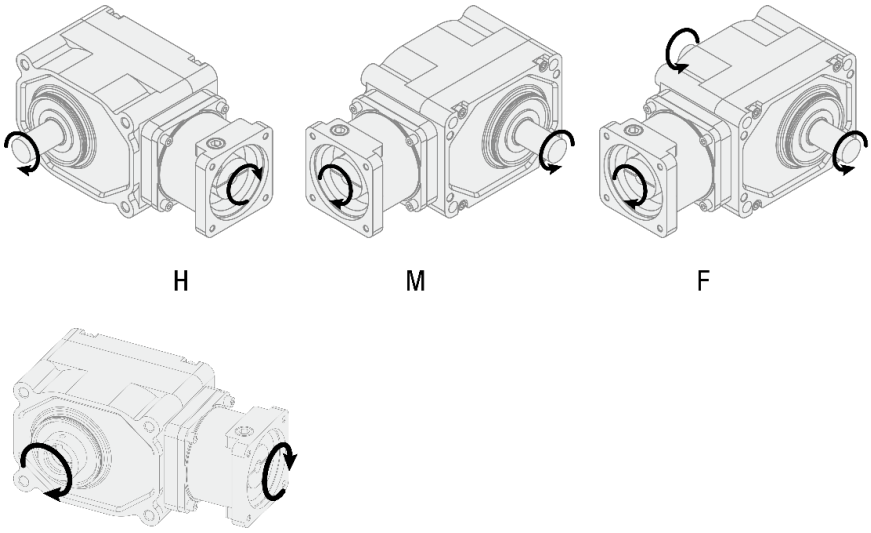
Motor power class	Reduction ratio
100W	1/60, 1/80, 1,100, 1/120, 1/160, 1/200
200W	1/40, 1/50, 1/60, 1/80, 1,100, 1/120, 1/160, 1/200
400W	1/40, 1/50, 1/60, 1/80, 1,100, 1/120, 1/160, 1/200
750W	1/40, 1/50, 1/60, 1/80, 1,100, 1/120, 1/160, 1/200
2000W	1/40, 1/50, 1/60, 1/80, 1,100, 1/120, 1/160, 1/200
Rotational direction of output shaft	

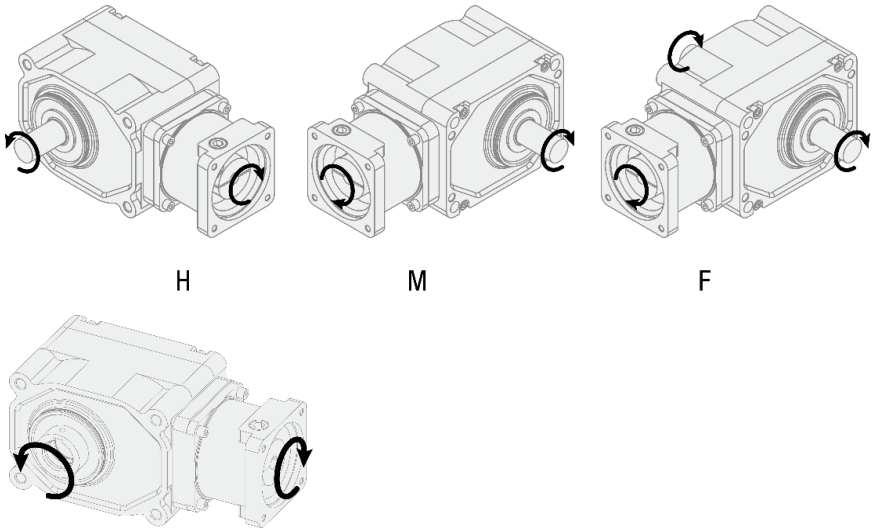
6.4 AH2 Type

Motor power class	Reduction ratio
100W	1/5, 1/10, 1/15, 1/20, 1/25, 1/30, 1/40, 1/50, 1/60
200W	1/5, 1/10, 1/15, 1/20, 1/25, 1/30, 1/40, 1/50, 1/60
400W	1/5, 1/10, 1/15, 1/20, 1/25, 1/30, 1/40, 1/50, 1/60
750W	1/5, 1/10, 1/15, 1/20, 1/25, 1/30, 1/40, 1/50, 1/60
2000W	1/5, 1/10, 1/15, 1/20, 1/25, 1/30
Rotational direction of output shaft	

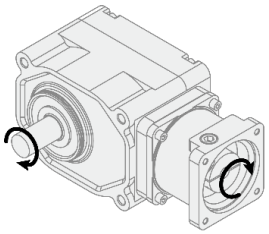
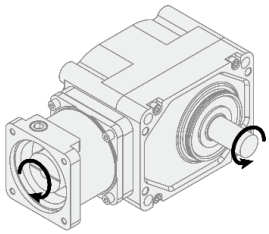
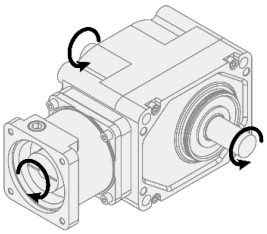
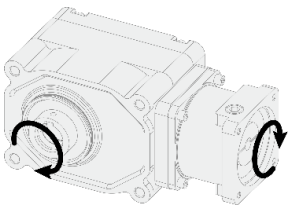
Motor power class	Reduction ratio
100W	1/80, 1,100, 1/120, 1/160, 1/200, 1/240
200W	1/80, 1,100, 1/120, 1/160, 1/200, 1/240
400W	1/80, 1,100, 1/120, 1/160, 1/200, 1/240
750W	1/80, 1,100, 1/120, 1/160, 1/200, 1/240
2000W	1/40, 1/50, 1/60, 1/80, 1/100, 1/120, 1/160, 1/200, 1/240
Rotational direction of output shaft	

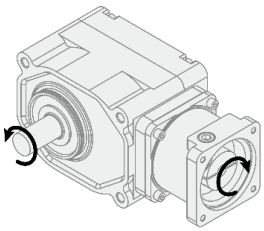
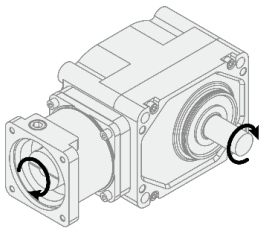
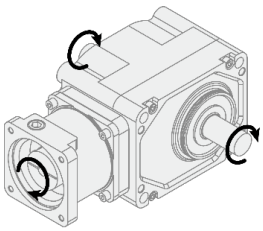
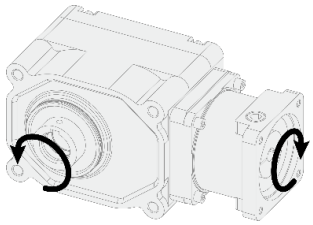
6.5 AF3 Type (backlash 1 arc min/3 arc min specification)

Motor power class	Reduction ratio
100W	1/75, 1/90, 1/120
200W	1/10, 1/15, 1/20, 1/25, 1/30, 1/40, 1/50, 1/60
400W	1/10, 1/15, 1/20, 1/25, 1/30, 1/40, 1/50, 1/60
750W	1/10, 1/15, 1/20, 1/25, 1/30, 1/40, 1/50, 1/60
1000W	1/10, 1/20, 1/30, 1/40, 1/50, 1/60
2000W	1/10, 1/20, 1/30, 1/40, 1/50, 1/60
Rotational direction of output shaft	

Motor power class	Reduction ratio
100W	1/10, 1/15, 1/20, 1/25, 1/30, 1/40, 1/50, 1/60
200W	1/75, 1/90, 1/120, 1/150, 1/180
400W	1/75, 1/90, 1/120, 1/150, 1/180
750W	1/75, 1/90, 1/120, 1/150, 1/180
1000W	-
2000W	-
Rotational direction of output shaft	

6.6 AF3 Type (low backlash)

Motor power class	Reduction ratio
100W	1/10, 1/15, 1/20, 1/25, 1/30, 1/40, 1/50, 1/60
200W	1/10, 1/15, 1/20, 1/25, 1/30, 1/40, 1/50, 1/60
400W	1/5, 1/7.5, 1/10, 1/12, 1/15, 1/20, 1/25, 1/30, 1/40, 1/50, 1/60
750W	1/5, 1/7.5, 1/10, 1/12, 1/15, 1/20, 1/25, 1/30, 1/40, 1/50, 1/60
2000W	1/5, 1/7.5, 1/10, 1/12, 1/15, 1/20, 1/25, 1/30, 1/40, 1/50, 1/60
Rotational direction of output shaft	 H  M  F 

Motor power class	Reduction ratio
100W	1/80, 1/100, 1/120, 1/160, 1/200, 1/240
200W	1/80, 1/100, 1/120, 1/160, 1/200, 1/240
400W	1/80, 1/100, 1/120, 1/160, 1/200, 1/240
750W	1/80, 1/100, 1/120, 1/160, 1/200, 1/240
2000W	-
Rotational direction of output shaft	 H  M  F 

7. Wiring

CAUTION	
	Confirm the rotational direction before connecting with the application. Incorrect rotational direction may result in injury or damage to the equipment.

8. Operation

DANGER	
	Never approach or touch the product while it is rotating. Otherwise, there is a risk of injury due to entanglement.

CAUTION	
	If an abnormality occurs, immediately stop the operation. Otherwise, there is a risk of fire, electric shock, and/or injury.
	Do not touch the product during operation or for a while after stopping operation, as its surfaces may become very hot. Otherwise, there is a risk of burns.
	Do not apply load exceeding the rated load during operation. Otherwise, there is a risk of injury or damage to the equipment.

8.1 Check Before Operation

Check the following items before operation.

- The product is correctly connected to the application.
- The product is correctly installed.

8.2 Check During Trial Operation

Check the following items during trial operation.

- Before connection with the application, turn on the switch for one to two seconds without load and check the rotational direction.
- First, perform running-in without load. If there is no abnormality, increase the load gradually and enter full-load operation.

8.3 Check in Operational Conditions

Refer to the contents of "Inspection" and check the operational conditions.

CAUTION: If there is any abnormality, stop operation immediately. Otherwise, there is a risk of fire, electric shock, burns, injury, and/or damage to the product.

Do not re-start operation until the causes of the abnormality are determined and countermeasures are taken.

Reference: For diagnosis should an abnormality occur, refer to "Troubleshooting", etc.

9. Maintenance/Inspection/Disposal

9.1 Maintenance

- All models use a grease lubrication system; they do not need grease replacement/replenishment.
- The product is designed for 10,000 hours of operation.
- Though the oil seals, etc. should prevent grease leakage, it is highly recommended to apply protection such as oil pans just in case.

  Oil leakage may cause product failure. (There is a risk of grease leakage during product failure or at the end of product life.)
- The service life of oil seals varies depending on the conditions of use, so that replacement may be required even before the 10,000 hours of usage.

  Note that the replacement must be performed at our factory.
- The precision (backlash) life varies depending on the conditions of use.

9.2 Inspection

DANGER	
	Never approach or touch the product while it is rotating. Otherwise, there is a risk of injury due to entanglement.
	When performing inspections of the gear surface conditions with equipment stopped, be sure to stop the drive/driven parts' rotation. Otherwise, there is a risk of entanglement in the gears and/or injury.
	When entering the product during a stop to perform inspection, be sure to stop the drive/driven parts' rotation; also, cool the product interior thoroughly and keep it constantly ventilated while working. In addition, while performing inspection, place safety check personnel outside and confirm safety with workers at all times. Be fully aware that the product interior is slippery due to lubrication oil and take reliable safety measures. Otherwise, there is a risk of injury.
	Do not operate the product with the safety cover removed after inspection. Otherwise, there is a risk of injury due to entanglement.

WARNING	
	When operation has stopped due to errors or activated safeguard functions, do not restart operation until the error causes are identified and countermeasures have been taken. Otherwise, there is a risk of fire, electric shock, burns, injury, and/or damage to the product.

CAUTION	
General	
	Do not touch the product during operation or for a while after stopping operation, as its surfaces may become very hot. Otherwise, there is a risk of burns.

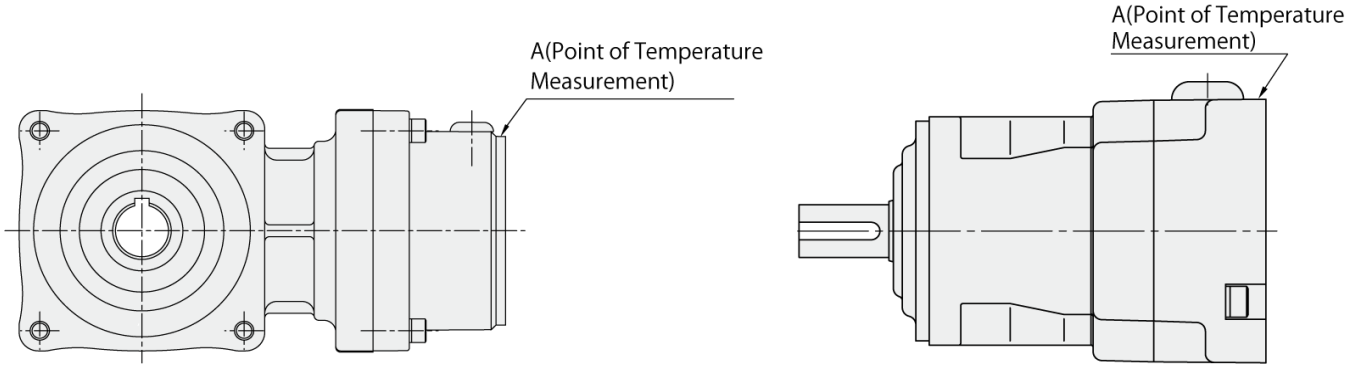
Based on 8 hours/day operation.

Perform periodic inspections according to the inspection interval guidelines.

(Determine the optimal timing for inspections based on the conditions and usage environment.)

Inspection item	Inspection interval guidelines	Inspection contents
Noise	2 to 3 days	No abnormal noise (rattling, periodic noise) No increase from the normal level Reference: Apply a listening rod to the bearing part to check for abnormal noise
Vibration	2 to 3 days	No abnormal vibration No increase from the normal level
Surface temperature	2 to 3 days	At or below 90℃ No rapid increase or decrease from the normal temperatures
Grease leakage	2 to 3 days	No leakage from the oil seals or case joint parts
Installation	6 months	No loose screws mounting the product onto the application
Connection with Application	6 months	No loose connection between the product and its load
		Chain and belt tension
		No core displacement

* Take care to maintain the surface temperature (area A) at or below 90°C.
If the surface temperature exceeds 90°C, cool it with an external fan or heat sink to keep it below 90°C.



9.3 Disposal

CAUTION	
	When disposing of the product, dispose of it as general industrial waste. Follow applicable local laws and regulations and take appropriate disposal measures.

10. Troubleshooting

10.1 Problems and Countermeasures

If an abnormality occurs in the product, refer to the following table and take measures.

Problem	Cause	Countermeasures
No rotation without load	Damage to gears, shafts, or bearings	Repair at our plant
	Loose input shaft joint clamping bolt	Retightening
	Insufficient motor power	Re-selection of motor
	Motor failure	Replacement of motor
	Motor setting or wiring failure	Review of setting and wiring
No rotation with load	Wear on gears	Repair at our plant
	Overload operation	Lowering load
	Insufficient motor power	Re-selection of motor
	Motor failure	Replacement of motor
	Motor setting or wiring failure	Review of setting and wiring
	Inappropriate motor gain	Reference to motor instruction manual
Abnormal heat generation	Damage to gears, shafts, or bearings	Repair at our plant
	Overload operation	Lowering load
	Installation failure, loose bolts	Centering and/or bolt retightening
	High start/stop frequency	Reducing frequency
	Motor heat generation (when motor torque is too high compared to load torque)	Rechecking assembly procedure
	Motor heat generation (when load torque is too high)	Lowering load
	Input speed too fast	Reducing rotation speed
Abnormal noise	Continuous noise - Damage to bearings or wear on gears	Repair at our plant
	Intermittent noise - Scratches on gears or engagement with foreign matter	Repair at our plant
	Installation failure, loose bolts	Centering and/or bolt retightening
	Motor driving noise or electromagnetic noise	Reference to motor instruction manual
Large vibration	Wear on gears or bearings	Repair at our plant
	Installation failure, loose bolts	Centering and/or bolt retightening
	Inappropriate motor gain	Reference to motor instruction manual
Grease leakage	Oil seal damage	Repair at our plant

11. Storage

When storing the purchased product temporarily or for a long time, pay attention to the following points.

11.1 Storage Location

- If storing the product, store it indoors in a dry location with good ventilation and no direct sunlight, extreme temperature changes, humidity, dust, or corrosive gases, etc.
- Never place the product directly on the ground when it is stored.
- Micro-vibrations may damage the bearings due to fretting corrosion even when the product is stored. Store the product in a place free of vibration.

11.2 Work During Storage

- To prevent the bearings from getting rusty, operate the product every six months to check that it rotates smoothly without abnormal noise.
- Apply rust prevention to the rotating shafts, flange surface, and any other uncoated machined surfaces every six months.

11.3 Usage After Storage

- Check that there is no abnormal noise, vibration, heat generation or other abnormalities during initial operation.

12. Terms and Conditions

Full Terms and Conditions can be found at the link below.

www.brother-usa.com/GM-terms-conditions

Brother International Corporation
Gearmotor Division

200 Crossing Blvd. Bridgewater, NJ 08807
Phone: 866-523-6283 | Fax: 908-704-8235
www.BrotherGearmotors.com
E-mail: GearMotors@brother.com

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