

OPERATING INSTRUCTIONS

●Worm gears ●Jack-up gears ●Bevel gearboxes

General Precautions

- Leave the treatment of the product to qualified or well-experienced engineers. To get familiar with its treatment, engineers should carefully read the instructions contained herein and fully understand them.
- This document of operating instructions should be made available for those who actually work with the product.
- Get through the instructions contained herein before installing and operating the product. Keep this document available on file for future reference.

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Regarding the sorting of packaging materials

The packaging materials of our company are as tabulated below. When discarding them, please sort them while considering the environment, in accordance with local government ordinances.

List of packaging materials

	Item name	Purpose of use	Material
1	LG board	Bottoms of package boxes for heavy goods	Recycled paper
2	Multi-layer corrugated board	Supports and cushioning materials for heavy goods	Recycled paper
3	Corrugated board	Package boxes for products	Recycled paper
4	Shipping tag	Package boxes	Adhesive paper
5	Product sticker	Package boxes	Adhesive paper
6	Nameplate sticker	Stickers for products	Yupo synthetic paper
7	Double-faced tape	Package boxes	Non-woven paper
8	Fabric tape	Package boxes	Sufumos
9	Instapak	Cushioning material	Blowing agent (polyurethane), bag (polyethylene)
10	Plastic bag	For packaging products	Polyethylene
11	PP band		Polypropylene
12	PP band stopper		Polypropylene
13	Manual		Recycled paper



This printed matter is made of recycled paper and the environmentally friendly "vegetable ink."

May. 2012

Safety Precautions

Thank you very much for patronizing the products of Aoki Seimitsu Kogyo (Aoki Precision Industries). Before their installation, use, operation, maintenance and inspection, read the instructions contained herein and their relevant information carefully and thoroughly to avoid an accident resulting in injury and/or damage. Make yourself familiar beforehand with their mechanical information, safety precautions and notices. Negligence of those instructions contained herein may result in injury and/or damage. In this document, potentialities of injury and damage are classified into "Danger" and "Notice", depending on the extent of their seriousness. Their definitions are as follows.

	Negligence of this precaution will produce a dangerous condition, which may result in major injuries or death.
	Negligence of this precaution will produce a dangerous condition, which may result in moderate or minor injuries and/or damage.

In some situation, even those precautions which are classified into "Notice" may lead to a major accident. Always observe the precautions in "Notice" for they are as important as those classified in "Danger".

For your safety, always observe the following precautions by all means.

	<ul style="list-style-type: none"> ●Don't use the product in an explosive atmosphere. Its use in such an atmosphere may cause an explosion, ignition, fire, electric shock, injury or damage. ●When you use an explosion-proof motor, follow its operating instructions to prevent an explosion, ignition, fire, electric shock, injury and damage. ●For the installation, earthing, wiring, operation, use, maintenance and inspection of the product, leave these works to well-experienced engineers with sufficient expertise and skills to prevent an explosion, ignition, fire, electric shock, injury and damage. ●Don't try to conduct any work when the product is energized. Always isolate it from its power supply whenever you work on it to avoid an electric shock. ●Don't touch the product's rotating parts. Cover them with well-ventilated protective guards to prevent an accident resulting in injury. The protective guards should be equipped with a safety mechanism that stops their rotating parts immediately when they are opened in the middle of operation. ●Following the development of corrosion and the expiration of service life, brakes and gears will lose their designed capabilities and finally fail to carry loads. When you use them for personnel transport systems, provide safety devices for the systems to prevent an accident resulting in injury and/or damage, which is caused by the sudden fall of their elevating parts. ●Always keep brakes free of water and oil. Decrease of brake torque may cause a dropdown or runaway accident. ●Don't operate the product when you deactivate its brake with a manual release lever, which may cause a dropdown or runaway accident.
	<ul style="list-style-type: none"> ●Don't use the product for other purposes and manners than those designated in its nameplate, manufacturing drawing, specification sheet, purchase agreement and operating instructions to avoid an electric shock, injury and/or damage. ●Don't insert your fingers or objects into the opening of the product to avoid an electric shock, injury and/or damage. ●Don't continue to use damaged product to prevent an accident resulting in injury and/or fire. ●Don't remove nameplate from the product. ●Unauthorized modification of the product will nullify Aoki Seimitsu Kogyo's accountability for its warranty.

1. Inspection upon delivery

Upon the delivery of the product, conduct the following inspections.

	●Check to see that the delivery conforms to your purchase order. Installation of a wrong product may cause injury and/or damage.
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- Check to see that the product is intact without damage during transportation.
 - Check to see that the product's bolts and nuts are not loosened.
- For any nonconformities and questions, you may feel free to get in touch with your local distributor or us.

2. Precautions on relocation

	●When the product is lifted up for relocation, don't step in the area below the product. Its accidental drop will result in injury or death.
	<ul style="list-style-type: none"> ●Take a good care of yourself when you relocate or transport the product, which may drop down or turn over. Always use the lifting eyebolts as long as they are provided for the product. Once the product is installed in a machine, don't try to lift up the entire machine with the product's eyebolts. They may be damaged, which causes the machine's dropdown or turnover and results in injury and/or damage. ●Don't lift up the product with the motor's lifting eyebolt, which may be damaged. ●Before lifting up the product, see its catalogue or specification sheet to make it sure that the lifting device's rated capacity is large enough to carry the product's weight. Overload on the lifting device will result in the injury and/or damage caused by the damage of lifting eyebolts, dropdown or turnover of the product. ●When you relocate the product, don't hold its shaft end, handle, cover, lead wire, terminal box and the like to prevent the product's dropdown or turnover accident, which may result in injury and/or damage.

- When you open the crate of the product, check to see to avoid injury that the crate is not turned upside down.
- When the product is not equipped with a lifting eyebolt, carry it with both hands. In this instance, don't forget to wear anti-slip protective gloves to avoid the injury caused by its dropdown.

3. Precautions on installation, mounting and adjustment

●Installation

Wrong choice of an installation area or installation manner will cause troubles.

	●Install the product in the area free of explosive, flammable and corrosive gases. These gases may ignite and explode.
	●When you install the product, observe the following environmental conditions in its installation area. Negligence of those conditions may impair its safety and performance or cause abnormal heat generation.

●Atmospheric conditions

Ambient temperature	-10/+40°C (Cold and heat resistance models to be used within their specifications.)
Humidity	85% or below
Altitude	Less than 1,000 meters above sea level
Installation area	Indoor use (Outdoor model to be used within its specifications)

Don't install the product in such places as listed below.

- Outdoor or the area exposed to water or oil splashes.
- Area filled with dust.
- Area easily exposed to corrosive or explosive gas.
- Area difficult for ventilation.
- Area not accessible for maintenance and inspection.

●Mounting

	<ul style="list-style-type: none"> ●When you mount the product on a wall or hang it from a ceiling, provide adequate supports for it to prevent its dropdown and avoid injury and/or damage. ●When you mount the product on a base plate or a flange, tighten its bolts at a designated torque to avoid injury and/or damage. ●Don't touch the rotating parts. Cover them with well-ventilated protective guards to prevent an accident resulting in injury. The protective guards should be equipped with a safety mechanism that stops their rotating parts immediately when they are opened in the middle of operation. ●Always keep brakes free of water and oil. Decrease of brake torque may cause a dropdown or runaway accident.
	<ul style="list-style-type: none"> ●To prevent a fire, don't leave any inflammables in the area adjacent to the product. ●To ensure favorable ventilation, don't leave obstacles in the area adjacent to the product. Insufficient ventilation will result in cooling failure and overheating, which may cause a burn or a fire. ●Don't climb up on the product or hang down from it to avoid injury. ●Don't touch the product's shaft end and borings with bare hands to avoid injury. ●When you mount the product on a machine like a food processor, which must be free of industrial oil, provide an oil pan or any other adequate measures against possible oil spillage caused by the product's mechanical trouble or the expiration of its service life. Your products may be rejected due to oil contamination.

- For the product which is equipped with a lubrication port, mount it horizontally as far as possible. If it is unavoidable to install it with a tilt, its inclination must be less than 15 degrees against the level in all directions. Its excessive inclination will cause oil spillage. The product with no lubrication port may be mounted at any angles in all directions.
- Improper mounting of the product will generate abnormal vibration and/or noise. Less rigid mechanical foundation may cause the damage of the product's bearing, gear tooth and shaft.
- Before mounting the product on your machine, check to see that the machine's construction and rigidity conform to the product. Inadequate construction and rigidity of the machine will generate abnormal vibration and cause an accident resulting in injury and/or damage.
- Before mounting the product on a building's column or wall, check to see that the column or the wall has a construction and rigidity sufficient to hold the product. Support the mounted product firmly with adequate angles or fixtures to prevent its dropdown accident resulting in injury and/or damage.
- Tighten the product's mounting bolts at a designated torque not to allow them loosened during operation. Uneven tightening of the bolts may generate stress on the product and damage its housing.

●Connection to a machine

	<ul style="list-style-type: none"> ●When you connect the product's shaft to a load or a motor, make sure of their alignment, belt tension, parallelism of pulleys and parallelism of both shafts. Check to see the connecting accuracy when they are connected to each other directly. Adjust the belt tension properly when they are connected to each other with a belt. Before operation, check to see that the locking bolts of pulleys or couplings are tightened firmly. If such connections are destroyed during operation, flying fragments may cause injury and/or damage. ●When you attach a coupling, sprocket or gear to the product's shaft to connect it to a load or a motor, don't give a physical shock to the product's bearing to avoid damage. ●Don't touch the rotating parts. Cover them with protective guards to prevent an accident resulting in injury. ●Before connecting the product to a machine, make sure of their rotating directions. Rotation in a wrong direction may cause injury and/or damage. ●When you use the product without connection to anything else, remove the key, which is temporarily attached to its output shaft, to avoid injury. ●Following the development of corrosion and the expiration of service life, brakes and gears will lose their designed capabilities and finally fail to carry loads. When you use them for personnel transport systems, provide safety devices for the systems to prevent the injury and/or damage caused by the sudden fall of their elevating parts.
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- Wipe off the rust inhibitor from the product's shaft end with a solvent. Coat the shaft end with grease and connect it to a coupling, sprocket, gear or pulley.
- Fit quality of the shaft with a coupling, sprocket, gear or pulley should be around H7. Position the coupling, sprocket, gear or pulley as close to the product body as possible so that the shaft can carry loads at its root.
- Pitch diameter of a sprocket, pulley or gear, which will be connected to the shaft, should be at least three times larger than the diameter of the shaft.
- When you connect the product directly to a machine, provide a driven bearing stand with a built-in bearing on the machine side, which can bear up the thrust and radial loads generated by the machine.
- The overhang load on the shaft should be within the tolerance designated in the product's specification sheet.
- When the product is driven by gear, secure a certain backlash. Absence of backlash will cause damage.
- When the product is driven by gear, the force acting on its slow-speed shaft should be directed toward the product foot.
- With a chain used for the product's connection, check its tension. Deficiency of the tension allows an excessive shock to be generated at the startup or the load change, causing damage.
- With a chain used for the product's connection, minimize the distance between the product's shaft and its corresponding machine. A long distance will generate abnormal vibration and load fluctuation, causing damage.
- With a chain used for the product's connection, arrange the product's shaft and its corresponding machine in parallel as far as possible with the upper shaft as the tensioning side. Avoid the vertical transmission of power. If it is unavoidable, Aoki Seimitsu Kogyo recommends that the larger sprocket should take the lower position, regardless of its rotating direction.

4. Precautions on wiring

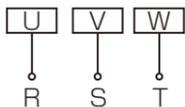
	<ul style="list-style-type: none"> ●When you connect a power cable to the motor, always refer to the connection diagram provided in the motor's terminal box or follow the instructions mentioned in its specification sheet or this document. If the motor is not equipped with a terminal box, insulate the cable connections adequately. ●Don't bend, pull or press the power cable and the motor's lead wires to avoid an electric shock. ●Ground the motor by using its earthing terminal to avoid an electric shock. ●Before starting the connecting work, always isolate the motor from its power supply to avoid an electric shock. ●To prevent the motor burning and a fire, check to see that the supply voltage of your power source conforms to the rated one mentioned on the motor's nameplate. ●When you finish the connecting work, don't forget to close the motor's terminal box with its cover to avoid an electric shock. ●Use a power cable whose capacity conforms to that of the power source. Deficiency in cable capacity will result in the meltdown of the cable's insulation sheathing, causing insulation failure and an electric shock or a fire.
	<ul style="list-style-type: none"> ●When you measure the motor's insulation resistance, don't touch the terminal to avoid an electric shock. ●Conduct the cabling, connecting and wiring works in accordance with the local standards of the electrical equipment work and the wiring work as well as the regulations of the power company. ●Protective devices are not provided for the motor as standard accessories. Installation of an overload protective device is obliged in Japan and may be obliged by the electrical equipment work standard of your country. Aoki Seimitsu Kogyo recommends the installation of other protective devices, such as earth leakage breaker, to prevent an electric shock, fire, injury and/or damage. ●For star-delta starting, provide its starter with an electromagnetic switch (three-contact type) on the motor's primary side to prevent a fire. ●Don't use a starting capacitor to operate the motor. It will rupture in the middle of operation. ●Take care not to damage the vinyl sheathing of the starting capacitor to avoid an electric shock. ●Voltage drop over the cabling distance should be less than 2%. A long cabling distance allows a large voltage drop, which may result in failure to start up the motor. ●When you want to rotate the motor in the reverse direction, stop it once and start to turn it in the reverse direction not to damage the motor by reciprocal operation with a plugging relay. ●For the motor with a brake system, don't supply power to the brake coil when the motor stops to avoid the coil burning and a fire.

●Wiring to the motor

Connect the motor's lead wires as shown in the figures below.

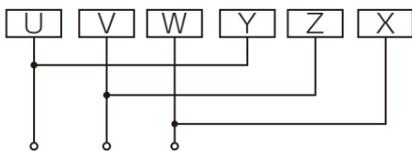
- Three-phase motor (0.1 - 3.7kW)
When you want to change the motor's rotating direction, switch 2 wires among U, V and W.

Fig. A



- Three-phase motor (5.5 - 7.5kW)
When you want to change the motor's rotating direction, switch 2 wires among U, V and W.

Fig. B and C



●Wiring to the brake

For the motor with a brake system, wiring to the brake has been finished in our factory before shipment. You can use the motor as it is.

- Change its terminal connections for those applications listed below.
 - AC breaking: When you want to shorten the down time or to install a phase-advancing capacitor.
 - AC operating: When you want to install an inverter or to operate the brake separately. (With an inverter installed in the motor, brake operation during a high-speed rotation at 60Hz or above will accelerate the abrasion of the brake lining.)
 - DC breaking: When you want to use the motor for an elevating system (with negative loads) or to secure the stop accuracy.
- When you want to drive the motor with a brake system by means of inverter or start it up at a lower voltage, always supply electric power to the brake from the primary side of the inverter or the low-voltage starter. Operate it also with DC or AC switching.
- Always use the power unit provided for the motor with a brake system or the one designated by Aoki Seimitsu Kogyo. Use of an unauthorized power unit will nullify our accountability for the performance of the brake.

5.Operation

●Preparation

	<ul style="list-style-type: none"> ●Don't operate the motor with its terminal box cover left open to avoid an electric shock. After the electrical work, don't forget to reinstate the cover.
	<ul style="list-style-type: none"> ●Whenever you notice something abnormal, stop operation immediately to avoid an electric shock, injury and/or fire. ●Don't operate the motor at a load exceeding its rated capacity to avoid injury and/or damage. ●Don't loosen the lubrication plug during operation. Heated lubricant may spout out, resulting in a burn. ●Don't touch the energized parts of the single-phase motor's starting capacitor until complete discharge of electricity to avoid an electric shock.

- For the motor with a lubrication port, follow the instructions printed on a label and purge air before opening the lubrication plug to release its internal pressure.
- For the motor with an oil gauge, check to see that oil level stays at the center of the gauge.
- For the oil-lubricating motor, start it with no load and gradually increase the load for running-in. Check to see that the motor does not generate abnormal vibration, noise or physical shock.
- When you start up an oil-lubricating motor after the shutdown for a long period of time, operate it at a light load until it is thoroughly lubricated.
- Check to see that the brake exciting voltage conforms to the motor's rated one at the brake's lead wires.

●Precautions on operation

	<ul style="list-style-type: none"> ●During operation, don't touch or approach to the motor's rotating parts, such as shaft, to avoid being caught and getting injured. ●If a power failure occurs during operation, always turn off the motor's power switch to avoid injury and/or damage when the power supply is recovered.
	<ul style="list-style-type: none"> ●During operation or even not in service, the motor is fairly heated up with power supply. Don't touch it to avoid a burn. ●When you want to rotate the motor in the reverse direction, stop it once and start to turn it in the reverse direction. Without stoppage, the motor may not change its rotating direction but run away.

- Don't operate an oil-lubricating motor at an extremely low speed. Inadequate splash lubrication will affect its performance and service life.

●Manual release of a brake

	<ul style="list-style-type: none"> ●Don't operate the motor with a brake system while deactivating the brake by its manual release lever to avoid a dropdown or runaway accident.
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- If the brake system is equipped with a manual release lever as illustrated in Figure 1, it is an unexcited actuation type electromagnetic brake. This brake is activated when the motor stops and power supply is shut down. When it is definitely necessary to release the brake for inspection or fine adjustment of the motor, make sure of the safety before manually releasing the brake by setting the manual release lever at the release position. After finishing the work, always reset the lever at the normal position to secure the safety.

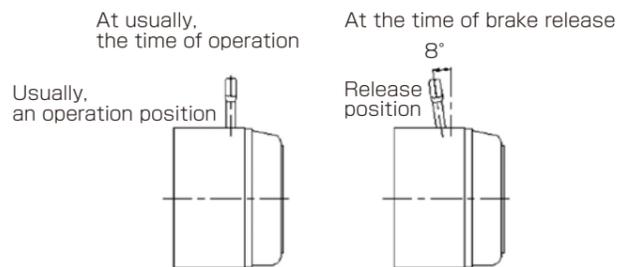


Fig. 1. SB brake and the operation of its manual release lever

6.Daily inspection and maintenance

Diligent practice of inspection and maintenance will prevent undesirable accidents and prolong the product's service life.

	<ul style="list-style-type: none"> ●During operation, don't touch the rotating parts to avoid being caught and getting injured. ●During operation, don't remove the cover of the inspection hole. Heated lubricant may spout out, resulting in a burn. ●When you inspect the gear tooth condition when the machine is not in operation, always lock both driving and driven components to avoid being caught by the gear and getting injured. ●After finishing the inspection and maintenance work, reinstate the protective guards. Don't operate the machine without the guards to avoid being caught and getting injured. ●Don't operate the motor with a brake system while deactivating the brake by its manual release lever to avoid a dropdown or runaway accident. ●Before starting operation, turn on and off the power switch several times to ensure the favorable function of the brake system to avoid a drop down or runaway accident. ●After inspecting or adjusting the gap between the brake disks, don't operate the motor without the fan cover to avoid being caught and getting injured. ●When you use the motor as a component of an elevating system, don't release its brake system when the motor has lifted up a load to prevent a dropdown accident. ●Keep the brake system free of water and oil. Its contamination with water or oil will drastically reduce the brake torque, resulting in the machine's inertial or uncontrollable runaway.
	<ul style="list-style-type: none"> ●When you measure the motor's insulation resistance, don't touch the terminal to avoid an electric shock. ●When you replace the lubricant, follow its instructions. Always use the lubricant recommended by Aoki Seimitsu Kogyo to avoid damage. ●Don't touch the product's surface with a bare hand to avoid a burn. The surface is heated up during operation. ●Don't try to replace the lubricant during or immediately after operation to avoid a burn. ●Whenever you notice something abnormal, take actions in compliance with operating instructions. Don't restart operation unless you identify the cause of the trouble and fix it. ●When you use the motor with a brake for an elevating system, wiring to the brake must be the DC breaking termination to prevent a dropdown accident. ●Repairing, disassembling and reassembling works should be left to qualified or well-experienced maintenance engineers to avoid an electric shock, injury or a fire. ●When you discard the used lubricant of the product in Japan, you may treat it as general industrial waste.

●Daily inspection

Conduct a daily inspection on the matters listed below.

- Check to see that neither oil nor grease leaks from the product.
- Check to see that the product's surface temperature is neither excessively high nor increased sharply. On the top surface of a gearbox, measurement with a thermometer should not exceed 40 degree Celsius above the ambient temperature.
- Check to see that the product does not generate abnormal noise and vibration and that its performance does not change suddenly.
- Check to see that the product does not smell burnt.
- Check to see that the product rotates at its designated revolution.
- Check to see that the play of the output shaft is adequate.
- Check to see that the locking bolts do not get loose.
- Check to see that the chains and V-belts are not loosened excessively.
- Check to see that the supply current does not exceed the rated one mentioned on the product's nameplate.

●Replacement of lubricant

For the oil-lubricating product with a lubrication port, replace its lubricant in the following manner.

- The product is filled with Bon-Knock M of JX Nippon Oil & Energy Co., Ltd. (New Japan Petroleum) as a standard lubricant in our factory before its shipment. Although you may use it as it is, replacement of the lubricant after the product's running-in at a light load will contribute to the prolongation of its service life.
- Replace Bon-Knock M lubricant after the initial operation for 500 hours and every 2,000 hours thereafter. You should replace it at shorter intervals when the lubricant deteriorates excessively.
- When you replace the lubricant, discharge the used one while it is still warm after operation. Flush the inside of the product with a flushing oil and charge it with a fresh lubricant up to the oil gauge's marked level.
- Use the designated lubricant or its equivalent as far as possible. Don't mix the lubricants of different brands. Mixture of different lubricants may affect the product's performance and cause oil leakage.
- The viscosity of standard lubricating oil varies according to model numbers. Please refer to the technical data written in the catalogue.

●Replacement of grease

For the grease-lubricating product, grease is sealed in it in our factory before its shipment. You may use it as it is.

Although you do not need to replace the grease, overhaul of the product after the operation of 20,000 hours will contribute to the prolongation of its service life.

●Replacement of an oil seal

Oil seal naturally has its own service life. After being used for a long period of time, it will lose its sealing effect. Replace oil seals every one or two years in normal operating conditions. Replace them every year when they are exposed to high temperatures, used in harsh environment such as continuous operation or installed in clean working environment.

●Maintenance of a brake system

Brake systems definitely need regular maintenance. Conduct inspection and maintenance on the matters listed below.

- Check to see that the brake's set screws are intact and tightened adequately.
- Check to see that neither water nor oil penetrates into the brake system.
- Remove abraded particles from the brake disks periodically with compressed air or by vacuum cleaner.

●Adjustment of brake gaps

- Electromagnetic brake works with frictional force. After being used for a long period of time, its frictional face wears out, widening the gap between the brake disks. When the gap exceeds a certain distance, excitation of the brake does no longer activate its armatures. This distance is called a critical gap. Table 1 shows the optimum and critical gaps of the brake disks, depending on the motor capacities. When the distance approaches a critical gap or as required, adjust the brake gap in the procedure discussed below.

SB Brake Gap Adjustment Procedure

- Turn the manual release lever (1 in Figure 2) and remove it beforehand. Remove the brake covers (2 and 3) and expose the brake body.
- Adjust the distance between the brake disks at an optimum gap by loosening the lock bolt (4) and turning the 3 adjusting bolts (5). After the adjustment, tighten the lock bolt (4) firmly.
- Check the gap at 3 points along the circumference, which are separate from each other at 120 degrees, to make it sure that the optimum gap is set at all the measuring points. Reinstall the brake covers (2 and 3) and the manual release lever (1).

Table 1: Critical gaps of SB brakes

Motor capacity (kW)	0.1	0.2	0.4	0.75	1.5	2.2	3.7	5.5
Optimum gap (mm)	-	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Critical gap (mm)	-	0.7	0.8	0.8	0.8	0.8	1.0	1.0

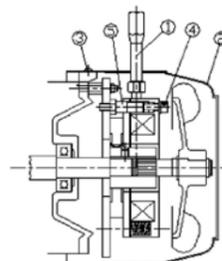


Fig. 2. Construction of an SB brake

Table 2: Parts description of SB brake

No.	Description
①	Manual release lever
②	Fan cover
③	Cover's set screw
④	Lock bolt
⑤	Adjusting bolt

7.Storage

If you do not use a product soon, please store it while paying attention to the following notes.

Storage place

- Store the product in an indoor place that is clean and dry.
- Do not store it outdoors or in a place that is damp or dusty, or where temperature changes steeply or corrosive gas exists.

Storage period

- The storage period of a standard product should be within 6 months.
- If the storage period exceeds 6 months, it is necessary to adopt special anti-corrosion specifications. Please send inquiries.

Use after storage

- Rubber products, such as oil seals, and non-metallic components are vulnerable to temperatures and ultraviolet rays, and may deteriorate. Accordingly, be sure to inspect them before using them after long-time storage, and if any deterioration or abnormality is detected, replace them with new ones.
- After long-time storage, oil film shortage for lubricating occurs at some parts. When using products, it is necessary to lubricate them (by rotating the input shaft or inching the product with a motor). Start full-scale operation after lubricating oil goes through the products.
- Check whether or not there is any abnormal noise, vibration, or heat. If any abnormality is detected, stop the operation immediately, and contact the store where you purchased the product or the sales division of our company.

8.Others

- When you find something abnormal as a result of your daily inspection, get in touch with your local distributor or us without delay.
- When you get in touch with us, check the product's nameplate and tell us its type and serial number.
- Don't disassemble and reassemble any of our product.
- Whenever you find it necessary to overhaul the product, always leave the work to us.
- If you find some unconformity or defect of the product, please feel free to get in touch with your local distributor or our marketing department.