**CAUTIONS ON USING PUMPS AND MOTORS**

1. To avoid serious accidents and injuries!
   - Thoroughly read “Cautions on Using Pumps” in the Operating Manual and make sure you understand the information in this section before operating a pump or motor.
   - The cautions and warnings below do not cover all possible dangers. Read through the Operating Manual before using a pump / motor and give top priority to safety during use.
   - To ensure safe use of the products, observe the applicable regulations.
      - Fire Service Act
      - Industrial Safety and Health Law

2. Use a Product of the Correct Type
   - **WARNING** There are many hydraulic devices that have the same or similar outside dimensions. When installing a pump / motor, check the specification indicated on the nameplate or the inscribed information to confirm that the pump / motor is the correct one.
   - **DANGER** When installing a pump / motor in an explosive or combustible environment, be sure to use a product suitable for this operating environment.

3. Handling of Products
   - **WARNING** Before operating the equipment where the pump and motor are installed, confirm that the hydraulic circuit and electric circuit to the reservoir, it is effective to prevent failure by contamination of hydraulic oil and extend the pump life.
   - **CAUTION** It is recommended to provide a circuit that can make the discharge pressure no load, on the pipe at the discharge side in long time.
   - **CAUTION** Operate with a circuit configuration that will maintain always the degree of pollution of hydraulic oil to be used within the recommended value, and check the pollution and the filter regularly. Also inspect regularly conditions of oxidizing, heating, abnormal vibration, oil leakage, smoke or an abnormal smell, is detected. It is advisable to use sensors that are available for detecting these conditions.
   - **CAUTION** While connecting the pump to the coupling, operate the motor independently to confirm that it rotates in the same direction as indicated on the arrow symbol nameplate, inscribed symbols, or other. Use a flexible coupling not to exert the radial or thrust load to the shaft. Unless the shaft is centered properly, it could damage the bearing or oil seal, or damage the shaft. Pay careful attention to the centering of shaft.

<table>
<thead>
<tr>
<th>Coupling</th>
<th>Axial eccentricity</th>
<th>Angle error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chain</td>
<td>0.05 mm or less</td>
<td>Within 0.5°</td>
</tr>
<tr>
<td>Dry</td>
<td>0.5 mm or less</td>
<td>Within 1°</td>
</tr>
</tbody>
</table>

   Never use the belt drive.

   **CAUTION** Do not subject the pump shaft or motor shaft to shock by tapping them with a hammer during installation or removal. Failure to observe this instruction can cause damage to the product or deteriorate its functions significantly.

   **CAUTION** When installing a pump or a motor, always use the specified bolts and tighten them to the specified torque. Installation of a pump or a motor at a site where centering accuracy by deformation, poor performance of pump, decrease in life or breakage could occur if any excessive load is applied from the piping. The same care must be taken also on excessive load being exerted from the piping as a result of vibration on equipment or sudden changes in pressure during operation.

   **CAUTION** Confirm that the rotating direction of the motor or engine, operated independently, agree with each other. Install the pump only after confirming this.

   **CAUTION** Before connecting the pump to the coupling, operate the motor independently to confirm that it rotates in the same direction as indicated on the arrow symbol nameplate, inscribed symbols, or other.

   **CAUTION** Confirm that the runout of center or face at the installation of pump / motor is within the allowable value. Soiling will cause trouble such as breakage and oil leakage due to insufficient tightening of bolts and damage seals.

4. Installation / Removal / Piping / Wiring of Pumps / Motors
   - **CAUTION** Only personnel with sufficient knowledge are allowed to install / remove pumps and motors (including piping).
   - **WARNING** Connection of cables and other electrical work must be carried out by an authorized person.
   - **WARNING** Shut off the power supply to the pump / motor and ensure that the motor or the engine has stopped completely before starting work such as installation, removal, piping or connection of cables. Also release the residual pressure from the system and confirm that the system is completely free from residual pressure before starting the necessary work.
   - **CAUTION** The pump / motor mounting base must have sufficient rigidity.
   - **CAUTION** Do not stand on a product, knock it, or drop it, and also avoid exerting external force on it.
   - **CAUTION** Failure to observe this instruction can cause malfunctioning, damage, oil leakage and other product failures.

5. Running the Pump / Motor
   - **WARNING** Before operating the equipment where the pump and motor are installed, confirm that the hydraulic circuit and electric cable connection are correct and that there is no looseness in the coupling.

   **CAUTION** When connecting a pipe to the suction side, supply a pressure within +0.02 to +0.03 MPa and a flow rate within 2 m/sec to the suction side. Also install a suction filter or strainer of 150 mesh at the suction side.
   - **WARNING** It is recommended to provide a circuit that can make the discharge pressure no load, on the pipe at the discharge side in order to facilitate air bleeding from the pump and suction pipe at starting. If a line filter (10 to 40μ) is installed on the return circuit to the reservoir, it is effective to prevent failure by contamination of hydraulic oil and extend the pump life.
PUMPS AND MOTORS

6. Management of Hydraulic Oil

CAUTION Use the R&O type and abrasion-resistant hydraulic oil, ISO VG32 to 68, or equivalent and in the recommended proper ranges of oil temperature and viscosity. Recommended proper viscosity is 20 to 100 mm²/s for the pump. Use the oil in the following range.

ISO VG 32: Oil temperature 0 – 60°C (350 – 15 mm²/s)
ISO VG 46: Oil temperature 6 – 65°C (350 – 18 mm²/s)
ISO VG 68: Oil temperature 13 – 65°C (350 – 25 mm²/s)

CAUTION Operate with a circuit configuration that will maintain always the degree of pollution of hydraulic oil to be used within the recommended value, and check the pollution and the filter regularly. Also inspect regularly conditions of oxidizing, deterioration and water content of hydraulic oil, and replace the oil if it exceeds the recommended values of the maker of hydraulic oil.

Recommended control standard of hydraulic oil (Replacement standard)

<table>
<thead>
<tr>
<th>Property</th>
<th>Petroleum base oil</th>
<th>Water-glycol</th>
<th>Fatty acid ester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific gravity</td>
<td>15/4°C</td>
<td>0.05 or less</td>
<td></td>
</tr>
<tr>
<td>Viscosity change</td>
<td>%</td>
<td>10 to 15</td>
<td>10 to 15</td>
</tr>
<tr>
<td>Total oxidation</td>
<td>mgKOH/g</td>
<td>0.5 or less</td>
<td></td>
</tr>
<tr>
<td>Insoluble part N</td>
<td>%</td>
<td>0.5 or less</td>
<td></td>
</tr>
<tr>
<td>Percent</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>%</td>
<td>0.1 or less</td>
<td>35 or less</td>
</tr>
<tr>
<td>PH</td>
<td></td>
<td>09 or less</td>
<td></td>
</tr>
<tr>
<td>Contaminants</td>
<td>mg/100 ml</td>
<td>10 or less</td>
<td>10 or less</td>
</tr>
</tbody>
</table>

*Replace when it emulsifies due to mixed water, even if it is within the control standard value.
*Recommended pollution level is within NAS12 for general hydraulic line and NAS6 or less for servo valve line.

CAUTION Flash the inside of circuit sufficiently before changing the hydraulic oil to be used. Avoid also mixing with a different kind of hydraulic oil.

7. Maintenance and storage

CAUTION Refrain from modifying, disassembling or reassembling the pump and motor. It may fail to achieve the specified performance, resulting in failure or accident. Please consult us when it is obliged to modify, disassemble or reassemble.

CAUTION When transporting or storing the pump and motor, take care of the environment conditions such as ambient temperature, temperature and ensure the prevention of dust and rust.

CAUTION When using the pump and motor after a long time stoppage, it may be necessary to replace seals.

CAUTION Oil leaks from hydraulic devices or equipment, if they are unattended, could cause serious accident. Repair or take other appropriate measures.