

## Before Using the General Catalogs

### ● Adoption of SI Units

- The units of the International System of Units (SI Units) are shown as the main units, while the values in conventional units are presented alongside in brackets, { }, for convenience. The indicated values given in SI units in this catalog are approximate values obtained by conversion from values in conventional units: to obtain more accurate conversion values, refer to page T-17.

<Examples>      The actual conversion value of 20.58 MPa {210 kgf/cm<sup>2</sup>} is given as the approximate indicating value of 21 MPa {210 kgf/cm<sup>2</sup>}.

### ● The sectional structural diagrams presented in the catalog are reference diagrams to indicate consumable parts such as O-rings, and are not drawings for disassembly purposes.

### ● The performance tables and characteristics graphs presented in the catalog show representative characteristics of the devices. The devices have their individual variability, and their characteristics also differ depending on the conditions of use, so please use the information for reference only.

### ● Changing Design Numbers

- Design numbers are subject to change without notice for the sake of product improvement. However, if only the last digit of a design number is changed, the mounting dimensions and other specifications remain unchanged.

### ● Precautions on Maintenance

- Since the products are shipped after being manufactured according to specifications, do not disassemble, reconfigure or modify them without DAIKIN's consent. This may affect the prescribed performance of the products, and cause failures and accidents.

### ● Other Considerations

- Unless otherwise stated in this catalog, DAIKIN's standard paint color is a color equivalent to Munsell code 5B6/3.
- Paint colors used are equivalent to the Munsell codes given in this catalog.

### ● About JIS

- JIS is the industrial standards stipulated in Japan.

# For Safe Use of Hydraulic Equipment and Systems

- Carefully read “Safety precautions when using hydraulic equipment and systems” before using any product, and use the product correctly.
- These cautionary notices are classified into the following three categories. All three categories are important in ensuring safety and must always be followed.

## DANGER

Indicates cases where an imminent risk of death or serious injury is anticipated if the instruction is not followed.

## WARNING

Indicates cases where there is a danger of death or serious injury if the instruction is not followed.

## CAUTION

Indicates cases where there is a danger of injury, and/or a danger of property damage, if the instruction is not followed.

**All of these cautionary notices are important in ensuring safe use of the equipment and systems, so be sure to observe them in order to avoid serious or fatal accidents.**

- \* The DANGER, WARNING and CAUTION notices do not cover all eventualities. Be sure to read the operation manual and understand it fully before actually handling the products, and always to put safety first when handling the products or systems.
- \* Be sure to comply with the following safety-related laws and standards so as to use the products safely.
  - High Pressure Gas Safety Act
  - Industrial Safety and Health Act
  - Fire Service Act
  - General Rules for Hydraulic Equipment (JIS B 8361)

## ■ Cautions relating to hydraulic fluid

### ● Inappropriate hydraulic fluid may cause malfunctions or trouble.

**[CAUTION]** Use the designated fluid only.

**[CAUTION]** Do not mix different types of hydraulic fluid, or mix hydraulic fluid with lubricant.

**[CAUTION]** Flush the circuit adequately before using a different type of hydraulic fluid.

**[CAUTION]** Use hydraulic fluid of a viscosity within the correct range stipulated in the specifications.

**[CAUTION]** Maintain the level of contamination of the hydraulic fluid within the range stipulated in the specifications. Continued use of equipment or systems while the hydraulic fluid is contaminated risks malfunctions or damage to the equipment or systems.

**[CAUTION]** Hydraulic fluid deteriorates with use (deterioration due to temperature variation, generation of sludge, etc.). Change the fluid at regular intervals.

**[CAUTION]** If the equipment malfunctions or becomes damaged, the level of contamination of the hydraulic fluid may be high. Inspect the level of contamination and flush the circuit to bring it within the level recommended by the manufacturer.

**[CAUTION]** Supply fluid at the designated filler port with due care to avoid foreign matter or moisture becoming mixed with it.

**[CAUTION]** If the fluid level in the hydraulic tank goes down too low, it may cause malfunctions or trouble. Maintain the fluid level in the hydraulic tank within the range between the minimum and maximum indications of the level gauge at all times, during operation too.

**[CAUTION]** Thoroughly wash off any hydraulic fluid adhering to your skin with soap or another detergent. It can in some cases lead to skin problems.

**[CAUTION]** Wait until the fluid temperature has fallen before changing hydraulic fluid. It can cause burns while at a high temperature.

**[DANGER]** Most hydraulic fluids are flammable, so do not use naked flames or sparks, and avoid welding, beside the equipment and systems since this could cause fire.

# Safety precautions when using hydraulic equipment and systems

## ■ Cautions on use of pumps/motors

### ● Read the operation manual carefully before using a pump or motor.

#### Using products of the correct models

- [CAUTION] There are many hydraulic devices that look the same or similar. When installing a pump or motor, check that it is the right model by checking the nameplate or marking.
- [DANGER] In environments where there is a risk of an explosion or fire, do not use products other than those suited to the conditions of use.

#### Handling products

- [CAUTION] When handling a pump or motor you could be injured, so wear protective gear appropriate for the circumstances.
- [CAUTION] Many pumps and motors are heavy, so you could trap your fingers or hurt your back depending on your working posture. Take care to adopt the right working method.
- [CAUTION] Do not subject the products to external forces, for example by getting onto them, striking them or dropping them. This could cause malfunctions, product damage or leakage.
- [CAUTION] Thoroughly wipe up any hydraulic fluid adhering to the product or floor. It could cause someone to drop the product or to slip and sustain an injury.

#### Fitting, removing, installing, piping and wiring pumps and motors

- [CAUTION] Ensure that the fitting faces and fitting holes of pumps and motors are clean. Incorrect tightening of bolts and seal breaks can cause product damage or leakage.
- [CAUTION] When fitting a pump or motor, be sure to use the stipulated bolts, and tighten them to the stipulated torque. An installation that doesn't comply with the stipulations could cause malfunctions, product damage or leakage.
- [CAUTION] Workers are required to have the appropriate knowledge to handle work such as fitting, removing and plumbing pumps and motors, and changing their seals.
- [CAUTION] Always shut off the power supply to the equipment and check that motors, engines, etc. have stopped before starting work such as fitting, removal, piping or wiring of a pump or motor. When starting the work, be sure to release the pressure in the hydraulic circuits and check that they have no residual pressure.
- [CAUTION] Select hydraulic piping that is appropriate for the pressure used.
- [CAUTION] Ensure that the bases on which pumps and motors are fitted have sufficient rigidity.
- [CAUTION] During fitting and removal, do not subject the shafts of pumps or motors to impact by hitting them with a hammer. This could cause product failure.
- [CAUTION] Check if the misalignment of the center and face of pumps and motors after fitting is within the tolerances.
- [CAUTION] Before installing a pump, check that the direction of rotation indicated by nameplate marked with an arrow symbol, or the marking, is the same as that of the engine, motor or other drive source when it is operated in isolation.
- [CAUTION] For pumps and motors that require drainage piping, arrange drainage piping that doesn't make the pressure in the casing exceed the specified value.
- [CAUTION] With pumps and motors so constructed that their casings have to be filled with hydraulic fluid, provide drainage piping that will ensure that the casing is always full of hydraulic fluid with no accumulation of air. Also provide drainage piping to ensure that the level of the hydraulic fluid inside the casing will not drop even when the pump or motor is not operated for a long time.
- [CAUTION] When installing a pump, take care about residual foreign matter in the suction line piping and hoses.
- [CAUTION] When performing trial operation or changing the hydraulic fluid, for example, take care to avoid inclusion of foreign matter or air.
- [CAUTION] Take care about higher resistance in the suction line since it can cause insufficient flow due to impaired oil suction, or unstable pressure, or seizure of the pump due to cavitation, or abnormal noise.

#### Wiring work, and connection of rotating parts

- [WARNING] Electrical wiring work must be carried out by qualified personnel only.
- [WARNING] Be sure to shut off the power supply before starting electrical wiring work. Otherwise you could sustain an electric shock.
- [WARNING] Secure the connected portions of the rotary shafts of pumps and motors using a reliable method so that they will not come off or fly out during operation.  
Also be sure to fit a protective cover so that people's hands, clothes, etc. will not get entangled.
- [CAUTION] Check the operation manual, catalog, drawing and specifications, for the wiring for the power supply.

### Maximum pressure restriction

- [△WARNING]** When using pumps without a pressure compensation function (with maximum pressure adjustment), be sure to install a relief valve that restricts the maximum pressure of the hydraulic circuit, near the discharge side of the pump.

### When operating pumps and motors

- [△WARNING]** Before operating an oil hydraulic unit with a pump or motor for the first time, check that the hydraulic circuit and electrical wiring are correct, and that there is no looseness in the connected parts. Check the control system between electrical control circuits and solenoid valves in particular. Before starting the pump or motor, supply current to each solenoid valve in isolation and check if each solenoid works as instructed.
- [△WARNING]** Start the system with the pressure setting of the pressure control device such as a relief valve lowered, and check if the pressure decreases, with a pressure gauge for example. After checking that the system is operating properly in this state, start normal operation and check if the operating pressure is normal.
- [△WARNING]** Never operate the unit without the covers for rotating parts.
- [△WARNING]** Be sure not to wear clothing or accessories that could become entangled in rotating parts, and never touch rotating parts.
- [△WARNING]** Check with an ammeter whether an excessive load is input into the unit. If the load is excessive, it is probably caused by faulty installation or seizing. Resolve the cause of the problem before operating the unit again.
- [△CAUTION]** When dealing with a pump or motor that has an filler port in its casing, supply clean hydraulic fluid to fill the inside of the casing when starting the pump or motor for the first time, after its hydraulic circuit has been inspected/repared or after it has been stopped for a long time.
- [△CAUTION]** Repeat inching operation until a pump is definitely sucking in fluid. If this doesn't work, get air out of the piping (e.g. with an air bleed valve). Once foam or hydraulic fluid start coming out of the air bleed plug or the operating sound of the pump changes, tighten up the air bleed plug immediately, then leave the pump to run for about 5 minutes in no-load operation.
- [△CAUTION]** Start motors under a low load, and check if the direction of rotation is correct.
- [△CAUTION]** Operate pumps within the specified suction pressure range.
- [△CAUTION]** Check if pressure inside the casings of pumps and motors is within the specified range.
- [△CAUTION]** If the operating sound of a pump is louder than normal it may indicate cavitation, so check the level of fluid in the tank, check for clogging of suction strainers and filters, and check for looseness of the suction piping. Check in particular that the suction pressure remains within the permissible range even when operation is started and stopped, and when the speed is changed.  
  
(If the operating sound is different from normal, it may indicate a malfunction or failure. It is important to commit the normal operating sound of the pump to memory so that you can discover abnormalities early.)
- [△CAUTION]** Operate pumps and motors correctly in accordance with the pressure, flow rate, rotational speed, kind of fluid, fluid temperature, viscosity, etc. that are stated in the operation manual, catalog, drawings, and specifications. When changing the pressure or flow rate setting, first carefully read to sections giving guidance about adjustments, and make the change within a range that will not cause fluid to gush out or parts to fly off.
- [△CAUTION]** The casings of pumps and motors may become hot, so do not touch them directly.
- [△CAUTION]** In the event of a pump/motor abnormality such as abnormal noise, abnormal heat generation, abnormal vibration, leakage, smoke, or abnormal odor, immediately stop operation and take the necessary corrective action. Continuing operation in the abnormal status could lead to damage, fire, or injury. It is advisable to fit sensors to detect abnormalities so as to ensure early discovery.

### Management of hydraulic fluid

- [△CAUTION]** Operate the unit within a circuit configuration which ensures that the level of contamination of the hydraulic fluid used is always within the manufacturer's recommended value, and periodically inspect the level of contamination and the filters. Also periodically inspect clearness of the hydraulic fluid, including its oxidation, degradation and moisture content, and change the fluid if these characteristics exceed the values recommended by the manufacturer of the hydraulic fluid.
- [△CAUTION]** Flush the circuit adequately before changing to a different type of hydraulic fluid. Also be careful not to mix different types of hydraulic fluid.

### Handling of maintenance

- [△WARNING]** Do not modify, disassemble or reconfigure pumps or motors. This may make them unable to achieve their prescribed performance, and cause failures and accidents.

### Handling of maintenance/storage

- [△CAUTION]** In cases where there is no alternative but to modify, disassemble or reconfigure the product, consult the manufacturer.
- [△CAUTION]** When transporting or storing pumps or motors, pay attention to environmental conditions like the ambient temperature and humidity, and maintain dust-proofing and rust-proofing.
- [△CAUTION]** When using a pump or motor after it has been in storage for a long time, it may be necessary to replace the seals. Check the size and hardness of seals before replacing them. If a seal is replaced with one of the wrong size, it will cause a leak.

## ■ Cautions on Using Hydraulic Valves

### ● Read the operation manual carefully before using a valve.

#### Valves in general

- [⚠️] Use valves within the maximum operating pressure specified in the manual. (The maximum operating pressure given in this catalog is the value including surge pressure.)
- [⚠️] Use valves within the specified ranges for flow rate, temperature, hydraulic fluids, and viscosity.
- [⚠️] Tighten valve fitting bolts and piping screws with the specified torque.
- [⚠️] Connect the valve ports correctly, using the specified piping.
- [⚠️] Maintain the hydraulic fluid at the recommended contamination level.
- [⚠️] Do not operate a valve too quickly in manual operation.

#### Solenoid valves, proportional valves and servo valves

- [⚠️] Use valves within the specified power supply voltage.
- [⚠️] Do not use valves at more than the maximum switching frequency.
- [⚠️] In environments where there is a risk of an explosion or fire, do not use products other than those suited to the conditions.
- [⚠️] In environments where waterproofing is necessary, use products suited to those conditions.
- [⚠️] Do not perform wiring work with the power still on, or while any pressure is being applied at the valve or in the hydraulic circuit.
- [⚠️] The surfaces of solenoids may become hot, so do not touch them directly.
- [⚠️] For electrical wiring, use wires of the type and diameter that suit the product.
- [⚠️] Check the operation manual, catalog and specifications, for the wiring connection of the power supply in detail.
- [⚠️] Connect appropriate earth wiring to terminals for which earthing is specified.
- [⚠️] Do not supply power to both the solenoids of a twin solenoid valve at the same time.
- [⚠️] With AC solenoid valves not equipped with a rectifier, the solenoid coil may burn out (breaking the wires) if a foreign object gets trapped in the spool or similar trouble occurs. The solenoid coil is molded with fire-retardant resin and there is no danger of it catching fire. However, if the molding deteriorates over a long period in use, it may catch fire.

#### Fitting and removal

- [⚠️] Do not remove the caps (protective plugs) on valve ports until just before putting a hydraulic valve into use (fitting it or connecting the piping). Take care to avoid the entry of dust, etc. into the inside of the valve during fitting or piping work.
- [⚠️] When a valve has been removed, fit covers on the valve ports, valve fitting faces and disconnected piping so that foreign matter will not enter. Do not remove these covers until just before the valve is fitted again.
- [⚠️] Check the type and cleanliness of hydraulic fluid before supplying it.
- [⚠️] With valves that can be operated manually, check that they switch correctly through manual operation, and their manual settings, before starting regular operation for the first time or before starting operation after a prolonged stop.
- [⚠️] After setting the pressure or flow rate of a valve, secure the adjustment screw by tightening the lock nut or by other means. Fit the cap or lid to the valve if provided.
- [⚠️] Do not stand on a valve to use it as a foothold, for example. This could cause valve failure.
- [⚠️] Do not subject a valve to external forces, for example by striking it or dropping it.
- [⚠️] Do not apply excessive force to wiring and connectors.
- [⚠️] Before removing valves or piping, turn off the power supply to bring power sources to a complete stop and check that the pressure inside the hydraulic circuit has been completely released and there is no residual pressure. If there is any remaining pressure in the hydraulic circuit it may cause fluid to gush out, leading to injuries. If you do come into contact with high-pressure fluid and it penetrates your skin, seek medical treatment immediately.
- [⚠️] When disassembling valves, follow the manufacturer's operation manual. Never disassemble valves whose disassembly is prohibited.
- [⚠️] When fitting a valve, or reassembling disassembled valves, use authorized new sealing parts such as gaskets and O-rings.
- [⚠️] Before starting inspection, adjustment or disassembly of valves, clean away oil, dust, water, etc. adhering around the valves to avoid foreign matter getting inside valves or connectors.
- [⚠️] Before starting operation for the first time after installation or starting operation after completing inspection/adjustment/repair work or after a prolonged stop, supply the specified volume of hydraulic fluid, then perform air bleeding of the hydraulic circuit, inspection for leaks, and run-in operation without fail.
- [⚠️] Be sure to shut off the main power supply before starting valve fitting or removal work.

## ■ Cautions on Using Oil Cooling Units and Inverter Controlled Chillers

### ● Read the operation manual carefully before using an oil cooling unit or inverter controlled chiller.

#### General Cautions

- [△DANGER] Use the product only in accordance with the specified specifications (in the catalog, specification sheet and operation manual, and on caution plates).
- [△DANGER] Never operate the product in an explosive atmosphere.
- [△DANGER] Do not disassemble, repair or modify the product by yourself.
- [△DANGER] Always comply with the laws and regulations relating to safety (Industrial Safety and Health Law, Fire Service Act, JIS B 8361 General Rules for Hydraulic Equipment).
- [△WARNING] Take the following precautions in the event of a refrigerant leak.
  - Ventilate the room adequately (to avoid the risk of suffocation).
  - Avoid direct contact of the refrigerant with skin (to avoid the risk of frost injury).
  - In the event of inhalation of a great deal of refrigerant, contact with skin, or refrigerant in the eyes, seek medical attention immediately.
- [△WARNING] In the event of an abnormal condition, stop operation immediately, investigate the cause of the problem and take appropriate remedial measures.
- [△CAUTION] Do not operate the equipment in a special environment (in a place at high temperature, high humidity, or in the presence of a great deal of dirt, dust, powder dust, steam, oil mist, or corrosive gases: H<sub>2</sub>S, SO<sub>2</sub>, NO<sub>2</sub> or CL<sub>2</sub>).
- [△CAUTION] Fit a flow switch and temperature switch on the main machine to protect the main shaft and other components.
- [△CAUTION] Do not stand on the product, or put anything on top of it.
- [△CAUTION] Use at altitudes no higher than 2,000 m. At altitudes in excess of 1,000 m the cooling capacity is reduced by about 20 to 30% due to the reduced atmospheric pressure, so select a model that has sufficient leeway in its cooling capacity.

#### At transportation

- [△DANGER] When hoisting the product, check its weight first, and be sure to use the eye plates and hangers provided with the product.
- [△WARNING] Never approach the product while it is being hoisted and transported.
- [△CAUTION] When transporting the product, take appropriate measures to prevent it from toppling over.
- [△CAUTION] Do not tilt the product more than 30 degrees while transporting it (including during storage). This will cause compressor failure.

#### At installation

- [△WARNING] Install the product on a rigid, level foundation and secure it appropriately.
- [△CAUTION] Do not place any object near the suction port or discharge port of the product.

#### At piping and wiring

- [△DANGER] Piping and wiring work must be carried out by personnel with specialist knowledge.
- [△DANGER] Always use a commercial power supply for the power source. (The use of an inverter controlled power supply may cause burn damage).
- [△DANGER] Connect the wiring for the power supply in accordance with the electric wiring connection instruction diagram on the specification sheet, and the operation manual.
- [△DANGER] Earth the equipment properly.
- [△WARNING] Install the wiring in accordance with the standard by checking the electric schematic diagram.
- [△CAUTION] Always fit a dedicated breaker (molded case circuit breaker), appropriate for the capacity of the equipment, at the power supply.
- [△CAUTION] Check that the coolant and oil piping/water piping has a pressure resistance of at least 1 MPa before starting piping work.

#### At trial run

- [△CAUTION] Check that the main machine is in a safe status (not activated) before starting the trial run.
- [△CAUTION] Check that the piping and electric wiring are correctly connected to the main machine and that there is no looseness in connections and joints.
- [△CAUTION] Disable the operation lock of the product (oil cooling unit/inverter controlled chiller) before starting the main machine.
- [△CAUTION] The coolant/oil piping system/tank and water piping system must contain the necessary levels of fluid/oil/water. Also check that there are no blockages part way through the piping.

#### At operation

- [△DANGER] Take care not to let water or any other liquid get onto the equipment .
- [△WARNING] Do not push your fingers or any foreign object into gaps between devices.
- [△CAUTION] Do not touch the equipment's exhaust port since it gets hot.

#### At maintenance and inspection

- [△DANGER] Work in a ventilated environment. Doing the work in a hermetically sealed environment could result in suffocation due to leakage of refrigerant.
- [△DANGER] Always turn off the main power supply before starting maintenance and inspection work.
- [△DANGER] Wait for five minutes after turning off the power supply before starting maintenance and inspection work.
- [△DANGER] Do not operate the product with its cover(s) open.
- [△CAUTION] Wear protective gear such as gloves and protective goggles when performing maintenance, inspection and cleaning.
- [△CAUTION] Clean the air filter periodically (once every two weeks as a guide).
- [△CAUTION] Remove chips and other foreign matter from the cooled fluid that goes into the oil cooling unit either by fitting a filter or by dividing the fluid tank into at least three compartments and using an overflow method. (The fluid can be passed through a filtration unit with a mesh gauge of 40 or greater.)
- [△CAUTION] Ensure that contamination of the fluid is no higher than NAS contamination class 10.

## ■ Cautions on Use of Hydraulic Equipment

- Read the operation manuals for the system and its components carefully before using hydraulic equipment.
- Use hydraulic equipment within the specification ranges of all of its components.

### Handling hydraulic equipment

- [CAUTION] Hydraulic equipment is heavy and must therefore be handled by personnel qualified for transportation and handling.
- [CAUTION] Check the safety of the machine properly before operating hydraulic equipment.
- [CAUTION] Hydraulic equipment must not be exposed to flames or other sources of ignition. Take due care when handling flames or other sources of ignition.
- [CAUTION] Connect earth terminals properly. Otherwise there will be a risk of electric shock.

### Safety devices and control circuits

- [CAUTION] The person responsible for the work should hold the keys to switches of safety devices.
- [WARNING] Do not modify any safety device or machine without consent. It could lead to unexpected accidents, trouble or failure.
- [WARNING] Do not remove safety devices or covers, or change their installation positions.
- [WARNING] Do not modify hydraulic systems or control circuits without consent.
- [WARNING] Do not change the pressure setting or settings of flow rate adjusting equipment without consent.

### Operating hydraulic equipment

- [WARNING] Make sure that there are no other workers or obstacles in the vicinity of the equipment or machine before starting operation.
- [WARNING] Check that the hydraulic circuit is unloaded before turning the power on.
- [WARNING] Make sure that each stop valve opens and closes correctly before starting operation. Pay particular attention to suction lines and return lines.
- [WARNING] Do not operate the equipment with the covers on rotating parts, etc. removed or open.
- [WARNING] Only operators who have undergone training should operate and maintain equipment and machines.
- [WARNING] Nobody other than authorized personnel should approach equipment or machines during operation.
- [WARNING] In the event of a leak from the equipment or machine, repair it promptly. Also, if you sense something abnormal during operation, stop the equipment/machine and then eliminate the cause.
- [WARNING] Turn the power off before starting maintenance, inspection or cleaning of the equipment or machine. Also be sure to turn off the main power supply before opening a door or cover of an electrical cabinet.

### Accumulators

- [WARNING] When using an accumulator, do not charge it with anything other than nitrogen gas.
- [WARNING] When dealing with a hydraulic system that incorporates an accumulator, purge the hydraulic fluid inside the accumulator and close the main valve of the accumulator before removing any device from the system. The same applies when removing the accumulator itself.
- [WARNING] Do not modify accumulators by machining, welding, or any other method.

### Disassembly and inspection

- [WARNING] Before starting on the disassembly and inspection of a hydraulic system, release the hydraulic pressure from inside the hydraulic circuit, ensure that the actuators are not under any load, and ensure that no pressure will be developed. Care is required because actuators can operate in an uncontrolled manner as a result of their own weight or external forces.
- [CAUTION] Operate all of the actuators several times slowly in order to bleed air from inside the hydraulic circuit. If bleeding from an air bleeding valve, do it at as low a pressure as possible. If the pressure is high, fluid will gush out together with the air, so preparation such as placing a cloth against the valve will be required.
- [CAUTION] Parts of the equipment and the machine may become hot (pumps, relief valves, motors, solenoids, etc.). When handling hot parts, wear protective gear such as work gloves. Do not use pipes as footholds or a ladder.
- [CAUTION] Handling heavy items such as pumps present a risk of developing back trouble or other injuries. Exercise due care.

### Pumps, motors

- [CAUTION] When dealing with units that incorporate a piston pump or rotor pump, fill the pump with hydraulic fluid through its filler port and be sure to plug the port after supplying the fluid, before starting the pump.
- [CAUTION] Check the direction of rotation of a pump before starting it.

### Hoses

- [CAUTION] Do not bend hoses to less than the recommended minimum bending radius.
- [CAUTION] Do not fit hoses while they are excessively twisted or bent.
- [CAUTION] If a hose becomes damaged it is extremely dangerous and could lead to a serious accident. Use hoses based on a full understanding of their operation manuals.
- [CAUTION] Hoses deteriorate due to secular changes and must therefore be inspected and replaced at regular intervals.

### Filters

- [CAUTION] Pay attention to clogging of filters at all times, and clean or replace filters that have become soiled.