

How to handle the pump

This section provides an overview of how to handle the pump.

Some points may differ depending on the model. Please also refer to the catalog and operation manual of each model.

Improper use may cause an accident.

1-1. Safety

"Safety precautions" are described in the instruction manual for each model. Confirm these precautions before using the product safely.

1) Safety precautions for bath filtration equipment

1. Do not use filtration equipment other than clean water.
2. To prevent suction accidents, check the specifications of the suction hardware to be installed and be sure to install the required number of suction hardware. (min. 2 pcs.)
3. Indirect waste connections must be provided for back wash and washing waste water. Also, since the flow rate is the same as the filtration flow rate, take care not to overflow the catch basins.
4. Clean and disinfect the hair catcher daily.
5. At least once a week, the filter should be thoroughly backwashed to remove dirt, and biofilms should be removed by an appropriate disinfecting method for the filter and circulation piping.
6. Bath tub water that has been used daily shall not be used in a bathtub equipped with a bubble generator, etc.
7. Do not use circulating bathtub water for cascading bath or showers.
8. Clean the bathtub by completely changing water every day. However, even if this is difficult, clean the bathtub by completely changing the water at least once a week.
9. Injection or inlet port for chlorine-based agents used for disinfecting bathtub water shall be installed immediately before the bathtub water enters the filter.
10. When disinfecting bathtub water, use chlorine agents and frequently measure the concentration of free residual chlorine in bathtub water to maintain the normal level of 0.4mg/L, and the maximum level of free residual chlorine should not exceed 1.0mg/L. In case of monochloramine, the combined chlorine, maintain the normal level of about 3mg/L. The measurement results should be stored for 3 years from the date of inspection.
11. Disinfection equipment should be properly maintained.
 - *1 Check the amount of chlorine-base agents in the chemical tank and do not fail to supply.
 - *2 Check daily that the feed pump is operating normally and solution is being injected, such as whether the nozzle of the injection valve is clogged or whether the solution supply is stopped due to air entrainment.
 - *3 Clean the injection valve periodically to prevent clogging.
12. The hot water storage tank to store low hot water (hereafter referred to as "hot water storage tank") shall be equipped with a heating device capable of maintaining the temperature at the temperature of 60°C or more including hot water supply port, tank bottom, etc. in normal use, and also maintaining the temperature at 55°C or more even during maximum use. If this is difficult, the hot water storage tank should be equipped with disinfecting equipment to prevent the growth of Legionella spp.
13. The frequency of water quality inspections should be at least once a year for bathtub water that is completely replaced every day and at least twice a year for bathtub water that is used every day (However, if the disinfection of the bathtub water is not chlorine disinfection, at least four times a year). The results should be stored for three years from the day of inspection.
14. Always operate the filter and the disinfection equipment while the bathtub contains with hot water.

Water quality standards

- Turbidity shall not exceed 5 degrees.
- Organic matter (Amount of total organic carbon (TOC)) should be below 8 mg/l, or potassium permanganate consumption should be below 25 mg/l.
- E. coli groups shall not exceed 1 pc./mL.
- Legionella spp. shall not be detected. (less than 10cfu/100mL)

The above-mentioned water quality standards are cited from "Amendment of hygiene management guidelines, etc. in public baths" No. 0919-8, September19, 2019, and the above-mentioned 4-13 are cited "Amendment of hygiene management guidelines, etc. in public baths" No. 0909-8, September19, 2019.

1-2. Installation

Refer to the instruction manual for details.

1. When you receive the pump and filtration equipment, check the pump, filtration equipment and accessories are exactly what you ordered. Also check for any damaged parts during transportation, peeling off of paint, loose bolts, etc. If there are any defects, contact the place of order.
2. Consider the weight and center of gravity when transporting the product.
3. Be careful not to cause rust on the pump and filtration equipment during the storage period until installation.
4. Ensure that there is sufficient space around the pump and the filtration unit for inspection and maintenance after installation.
5. The foundation must be strong enough to support the weight of the pump and filtration equipment, and vibration or load during rotation. Also, the top surface of the foundation should be level. If the top surface of the foundation is not level, use a metal wedge to level the equipment. Do not install the drain pump directly on soft ground or mud. Otherwise, the pump will sink, and the inside of the pump and piping will be clogged with earth and sand, and the operation will be disabled.
6. Do not apply any piping load to the main body of the pump or filtration equipment. Doing so may cause the pump or filtration equipment to malfunction, break, or vibrate.
7. When using a spring vibration isolator, install the vibration isolator evenly around the center of gravity of the pump so that the pump is level.
8. The pump is aligned before shipment at the factory, but it should be rechecked alignment after installation is complete.
9. Be sure to attach a ground wire to prevent electric shock.
10. Be sure to install a ground fault interrupter and an overload protection device on the primary power supply of the pump. Perform electrical wiring and wiring work safely and securely according to the technical standards of electric installation and indoor wiring regulations.
11. In the case of automatic type drainage pump, be sure to keep the float switch away from the direct inflow of water. (Refer to Fig. 1) Otherwise, automatic operation does not work properly, which could cause air to be sucked in and/or lead to dry run.
12. The suction port of the pump must be kept at a distance of at least five times the inflow pipe bore from the inflow of water so that the flow does not get close to the port.
13. In the case of drainage pumps with a detachable device, the dimensions (Max. diameter ϕW) required for taking out the pump section are shown in the assembly drawing. Install the necessary openings. (See Fig. 2.)

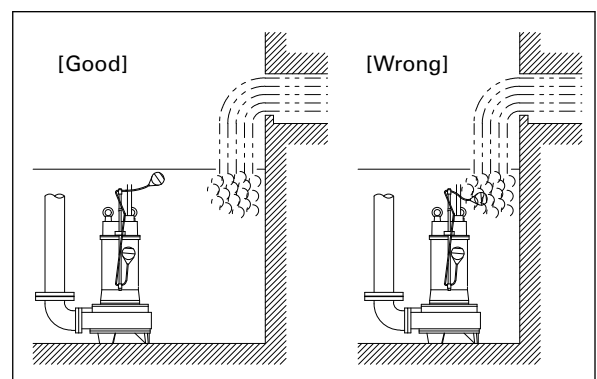


Fig. 1

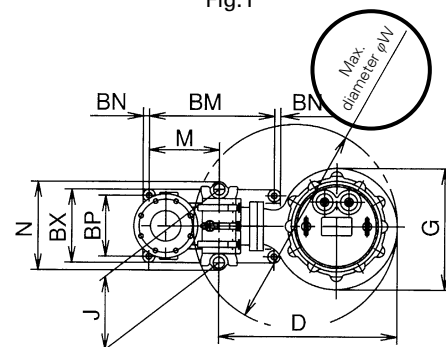


Fig. 2

1) Precautions for piping work of above-ground pumps

- The suction pipes must be as short and straight as possible with minimal bends.
- Install an adequate pipe support so that the weight of the piping system will not be applied to the main unit. If the weight of the piping is applied to the pump, the shaft center may be shifted, causing damage, vibration, or noise to the equipment.
- Provide a rising gradient (1/100 or more) leading up to the pump to prevent air accumulation in the middle of the suction pipe.
- Use a suction pipe with the same or larger diameter as the suction port of the pump. Using a suction pipe with smaller diameter may cause cavitation. If the suction pipe diameter is larger than the pump suction port diameter for negative suction, use an eccentric reducer to prevent air accumulation.
- Install a gate valve and a check valve on the discharge piping.
If water hammer may occur, install a buffer-type check valve.
- For positive suction, be sure to install a sluice valve on the suction pipe.
- For positive suction, install a strainer on the pump suction side to prevent foreign matter (cutting chips, sand, rust, scale, etc. in the piping) from entering the pump. (Our recommended strainer mesh: 40 mesh for regular use, 40-mesh for cleaning)
- For negative suction, do not install a sluice valve on the suction pipe.
- For negative suction, install a foot valve with a strainer to prevent foreign matter from being sucked into the end of the suction pipe.
- Carefully install the joint of the suction pipe so that air does not enter.
- Be sure to clean the inside of the water receiving tank after completion of construction to prevent foreign matter from being sucked in.

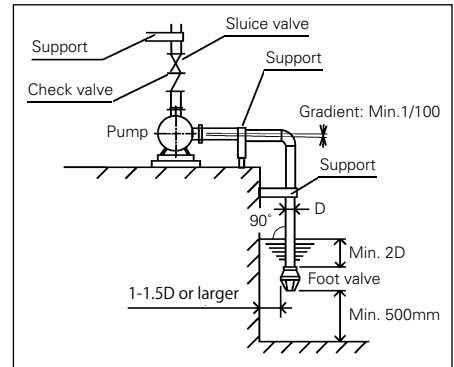


Fig.3

Example of piping construction for negative suction

2) Precautions for piping work of drainage pumps

- Use a drain pipe with the same or larger diameter as the discharge port of the pump, and install piping so that the piping resistance is as low as possible.
- If the piping outlet is submerged under water, back flow may occur due to siphon phenomenon when the pump stops. Keep the discharge end above the water level or install a check valve.
- It is convenient to install a check valve with a bypass if water in the ground water pipe needs to be drained when it is stopped.
- Clean the inside of the water storage tank after completion of piping work.

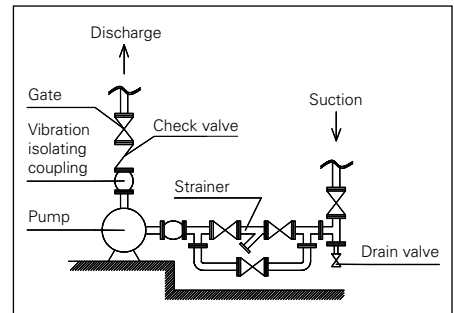


Fig.4

Example of piping construction for positive suction

1-3. Precautions before starting above-ground pump operation

The following are the items to be noted before starting operation for the above-ground pumps with typical standard specifications. Refer to the instruction manual for other precautions.

- Removal of foreign matter in piping
Be sure to close the valves on the suction and discharge sides of the pump and drain the water from the piping by natural drainage or other methods.
- Check of sliding parts
Turn the pump by hand and check if it turns smoothly. If the pump moves hardly or moves unevenly, check the pump for rust or foreign matter inside the pump.
- Priming of the pump
Prime the pump through the priming funnel or the priming port. (In case of positive suction, open the suction valve to prime the pump.) Also, when priming the pump, turn the pump shaft by hand to completely expel the air from the inside of the pump.
- Checking rotational direction of pump
After checking 1 to 3 above, turn ON and OFF the power switch once or twice to check the rotation direction of the pump. The normal rotation direction is clockwise when viewed from the motor side. (The rotation direction may vary depending on the model.)
- Circulation cleaning
During the initial period or pump operation and circulation, perform circulation cleaning with the flow rate (the water volume used) or more. Clean the strainer after circulation cleaning.

Caution

Never check the rotation direction after power supply wiring in running the pump dry. Even a short period of dry-running may cause damage to the sliding parts (casing, bearing, mechanical seal, etc.) inside the pump, water leakage, or abnormal noise.

Caution

Do not run the pump dry or do not allow foreign matters to enter the pump. Failure to observe this may cause damage to the sliding parts (bearings, mechanical seals, etc.) inside the pump, disability of pumping, water leakage, or abnormal noise. In addition, the pump may heat up and cause burns.

1-4. Precautions for inverter operation

- When using the product with an inverter, please inform us at the time of your order.
Inverter operation may not be possible with motors with standard specifications.
- The default settings for a commercially available inverter are not suitable for pumps.
Using the product with the default settings may cause abnormal vibration or damage to the pump.
Be sure to set the inverter before operation by referring to the following.
Changing the inverter setting may eliminate the problem.

[Inverter setting value (Reference)]

- Base frequency : Set to the specification frequency (frequency indicated on the nameplate)
- Maximum frequency : Set to the specification frequency (frequency indicated on the nameplate)
- Maximum output voltage : Set to the rated voltage of the motor
- Upper limit frequency : Set to the specification frequency (frequency indicated on the nameplate)
- Lower limit frequency : 25Hz to 30Hz. When operating at a frequency lower than this range, the motor may not turn, generate heat, or the inverter output may become unstable.
- V/F characteristics : Set to Square Reduced Torque
- Acceleration/Deceleration Time : Set to 10 to 20 seconds. If it starts and stops in a short time, the inverter may trip.
- Carrier frequency : The normal inverter factory setting seems to have been set to a higher level due to noise problems.
If abnormal vibration or noise occurs in the current setting, it may be eliminated by changing the carrier frequency setting.

Table 1

| Carrier frequency | Low → High |
|--|---------------|
| Sound from motor (beep sound) | Large → Small |
| Noise generated by the inverter | Small → Large |
| Number of times surge voltage is applied | Low → High |

- (3) When using with an inverter, confirm that there is no abnormality at all frequencies used during the trial run.
If the pump is operated under abnormal vibration or other conditions, the pump may be damaged.
To avoid abnormal vibration, set the inverter to jump the resonance frequency of the eigenvalue of the pump, motor, pump + foundation, etc.
- (4) Keep the operating current to 90% or less of the rated current value.
Driving with an inverter increases the temperature of the motor compared to the commercial power supply operation.
- (5) If the starting torque of the motor is insufficient, raise the frequency.
- (6) Do not drive a single-phase motor or a motor with a self-protection device by an inverter.
- (7) For 400V class, measures against inverter surge are required.
- (8) Do not drive a self-priming pump with an inverter.
Otherwise the self-priming performance may not be achieved.
- (9) Do not drive the gear pump with an inverter.
Otherwise the starting torque of the motor may be insufficient.

1-5. Instructions for downtime

Refer to the instruction manual for details.

1. Be sure to turn off the main power supply when the product will not be used for a long time.
2. To protect the bearing, put on a plastic bag or take other protective measures. Turn the bearing manually about once a month.

1-6. Daily/periodic inspection

Table 2. Daily Inspection Table

| Classification | Inspection point | Example of inspection items | Inspection method | Criteria |
|---------------------|---------------------------|----------------------------------|-------------------|---|
| Pump / Motor | Gland packing | Leakage condition | Visual check | An appropriate amount |
| | Mechanical seal | Leakage condition | Visual check | No visible water leakage |
| | | Abnormal noise | Listen | No abnormality |
| | | Abnormal vibration | Listen | No abnormality |
| Control panel | Instrument | Ammeter instruction check | Visual check | Should be within the rated value. |
| | Each indicator lamp | Checking the lighting | Visual check | No abnormality |
| | ELB, MCB, selector switch | Operation position | Visual check | Not tripped |
| Equipment | Pressure gauge | Confirmation of indicated values | Visual check | When closing the meter cock and releasing the pressure, the needle should point to 0. |
| | Pressure switch | Operation | Visual check | Operation shall be in accordance with the set value. |
| | Flow switch | Operation | Visual check | Operation shall be in accordance with the set value. |
| | Solenoid valve | Operation | Visual check | Normal operation |
| | Exhaust valve | Operation | Visual check | Normal operation |
| | Inlet valve | Operation | Visual check | Normal operation |
| | Safety valve | Operation | Visual check | Not operating |
| Environment /Others | Voltmeter | Voltage fluctuation | Visual check | Specified voltage or not |
| | Temperature | Range of specifications | Measure | Must be within the specified range. |
| | Humidity | | Measure | |
| | Dust or other contaminats | | Visual check | No dust or contaminants (should be clean) |
| | Pumps, pipes and valves | Water leakage | Visual check | No abnormality |
| | Frequency of startup | Number of times | Measure | No abnormally high frequency |

* The above is a guideline for daily inspection.

* The values may vary depending on the model, etc. Refer to the instruction manual for details of inspection items.

Table 3. Scheduled Periodic Inspection

| Classification | Inspection and adjustment points | Example of inspection items | Inspection method | Criteria | Rough guide for periodic inspection | | | | |
|----------------|---|-----------------------------------|--------------------|--|--|----------------|--------|---|---|
| | | | | | 3 Months | 6 Months | 1 year | | |
| Pump / Motor | Impeller | Foreign matter clogging | Disassemble | No clogging | | | ○ | | |
| | | Wear | Disassemble | No abnormality | | | ○ | | |
| | Around the main shaft Bearing | Uneven rotation | Rotate manually | Not unusually heavy | | | ○ | | |
| | | Heat generation, abnormal noise | Listen Touch | No abnormal heat generation or noise | | ○ | | | |
| Power supply | Insulation resistance | Resistance value | Measure | Must be 1MΩ or more | | ○ | | | |
| | | Power terminal | Voltage | Measure | The specified voltage must be satisfied. | | ○ | | |
| Control pane | Each connection terminal block | Voltage fluctuation | Measure | Within the allowable fluctuation range | | ○ | | | |
| | | Loose screws | Retighten | Not loosened | | | ○ | | |
| | | Trace of heat generation | Visual check | No discoloration | | | ○ | | |
| | Magnetic switch | Adhesion of dust | Visual check | Clean if necessary | | | ○ | | |
| | | Wear of contacts | Visual check | The thickness is 2/3 or more of a new product. | | ○ | | | |
| | | Contact condition of the contacts | Visual check | Smooth contact surface | | ○ | | | |
| | | Loose screws | Retighten | Not loosened | | ○ | | | |
| Equipment | Pressure tank | Sealing pressure | Measure | The sealing pressure is as specified. | ○ | | | | |
| | Pressure switch | Contact | Visual check | No foreign matter is attached. | | ○ | | | |
| | Pressure transmitter | Setting signal | Visual check | To display pressure | | ○ | | | |
| | Check valve Reducing valve Solenoid valve Exhaust valve Intake valve Foot valve | Foreign matter clogging | | Disassembly | No clogging | | | ○ | |
| | | | Wear of valve body | | Disassembly | No abnormality | | | ○ |
| | | | | | | | | | |

* The above is a guideline for daily inspection.

* The values may vary depending on the model, etc. Refer to the instruction manual for details of inspection items.

Part replacement cycle

Use the following table as a guide for the replacement cycle of parts of the pump used.

Table 4

| Pump category | Applicable model range | Reference table no. |
|--|--|---------------------|
| Air-conditioning pumps | Diameter 200mm or less | Table 5 |
| Pump for pumping water (horizontal) | Diameter 200mm or less | Table 6 |
| Pump for pumping water (vertical) | Diameter 100mm or less | Table 7 |
| Circulation pump for hot water supply | Diameter 25 to 100mm | Table 8 |
| Submersible motor pump for sewage, miscellaneous wastewater and sewage | 32 to 150mm in aperture for building equipment, 22kW or less | Table 9 |

Table 5. Air-conditioning pumps

| Classification | Part name | Criteria for replacement | Standard replacement cycle |
|--|--|--|----------------------------|
| Overall | Entire pump | Renewal of the entire pump (including electric motor) | 10-15 years |
| | Overhaul | Disassembly, inspection and maintenance | 4-7 years |
| Parts | Impeller | Replace if worn out remarkably and performance degrades. | 4-7 years |
| | Main shaft | Replace if worn out remarkably. | 4-7 years |
| | Gland packing | Replace if water leaks remarkably even after tightening. | 1 year |
| | Mechanical seal | Replace if water leaks visually. | 2 years |
| | Liner ring | Replace there is a problem due to performance degradation. | 3-4 years |
| | Bearing | Replace if overheated or abnormal noise or vibration occurs. | 3-4 years |
| | Shaft sleeve | Replace if worn out remarkably. | 3-4 years |
| | Shaft coupling rubber bush | Replace the rubber part if worn out or damaged. | 2-3 years |
| | Bearing oil | Replace if overheated or abnormal noise occurs. | 1 year |
| | O Rings and packings | | Whenever disassembled |
| | Deflector | | Whenever disassembled |
| Motor | Replace after insulation deterioration or burning. | 10-15 years | |
| <Assumed replacement cycle> 1. Applicable models shall have a diameter of 200 mm or less. 2. The operating hours shall be 12 hours per day. | | | |

* The values may vary depending on the model, etc. Refer to the instruction manual for details of inspection items.

Table 6. Pump for pumping water (horizontal type)

| Classification | Part name | Criteria for replacement | Standard replacement cycle |
|--|--|--|----------------------------|
| Overall | Entire pump | Renewal of the entire pump (including electric motor) | 10-15 years |
| | Overhaul | Disassembly, inspection and maintenance | 4-7 years |
| Parts | Impeller | Replace if worn out remarkably and performance degrades. | 4-7 years |
| | Main shaft | Replace if worn out remarkably. | 4-7 years |
| | Gland packing | Replace if water leaks remarkably even after tightening. | 1 year |
| | Mechanical seal | Replace if water leaks visually. | 2 years |
| | Liner ring | Replace there is a problem due to performance degradation. | 3-4 years |
| | Bearing | Replace if overheated or abnormal noise or vibration occurs. | 3-4 years |
| | Shaft sleeve | Replace if worn out remarkably. | 3-4 years |
| | Shaft coupling rubber bush | Replace the rubber part if worn out or damaged. | 2-3 years |
| | Bearing oil | Replace if overheated or abnormal noise occurs. | 1 year |
| | O Rings and packings | | Whenever disassembled |
| | Deflector | | Whenever disassembled |
| Motor | Replace after insulation deterioration or burning. | 10-15 years | |
| <Assumed replacement cycle> 1. Applicable models shall have a diameter of 200 mm or less. 2. The operating hours shall be 12 hours per day. | | | |

* The values may vary depending on the model, etc. Refer to the instruction manual for details of inspection items.

Table 7. Pump for pumping water (vertical)

| Classification | Part name | Criteria for replacement | Standard replacement cycle |
|--|--|--|----------------------------|
| Overall | Entire pump | Renewal of the entire pump (including electric motor) | 10-15 years |
| | Overhaul | Disassembly, inspection and maintenance | 4-7 years |
| Parts | Impeller | Replace if worn out remarkably and performance degrades. | 4-7 years |
| | Main shaft | Replace if worn out remarkably. | 4-7 years |
| | Gland packing | Replace if water leaks remarkably even after tightening. | 1 year |
| | Mechanical seal | Replace if water leaks visually. | 2 years |
| | Liner ring | Replace there is a problem due to performance degradation. | 3-4 years |
| | Bearing | Replace if overheated or abnormal noise or vibration occurs. | 3-4 years |
| | Shaft sleeve | Replace if worn out remarkably. | 3-4 years |
| | Shaft coupling rubber bush | Replace the rubber part if worn out or damaged. | 2-3 years |
| | Bearing oil | Replace if overheated or abnormal noise occurs. | 1 year |
| | O Rings and packings | | Whenever disassembled |
| | Deflector | | Whenever disassembled |
| Motor | Replace after insulation deterioration or burning. | 10-15 years | |
| <Assumed replacement cycle> 1. Applicable models shall have a diameter of 200 mm or less. 2. The operating hours shall be 12 hours per day. | | | |

* The values may vary depending on the model, etc. Refer to the instruction manual for details of inspection items.

Table 8. Circulation pump for hot water supply

| Classification | Part name | Criteria for replacement | Standard replacement cycle |
|----------------|---|--|----------------------------|
| Overall | Entire pump | Renewal of the entire pump (including electric motors) | 8-10 years |
| | Overhaul | Disassembly, inspection and maintenance | 4-5 years |
| Parts | Impeller | Replace if worn out remarkably and performance degrades. | 4-5 years |
| | Mechanical seal | Replace if water leaks visually. | 1 year |
| | Liner ring | Replace there is a problem due to performance degradation. | 3-4 years |
| | Bearing | Replace if overheated or abnormal noise or vibration occurs. | 2-3 years |
| | O Rings and packings | | Whenever disassembled |
| | Deflector | | Whenever disassembled |
| | Motor | Replace after insulation deterioration or burning. | 8-10 years |
| | <Assumed replacement cycle> 1. Applicable models shall have a diameter of 25 to 100mm. 2. The operating hours shall be 24 hours per day. | | |

* The values may vary depending on the model, etc. Refer to the instruction manual for details of inspection items.

Table 9. Submersible motor pump for sewage, miscellaneous wastewater and sewage

| Classification | Part name | Criteria for replacement | Standard replacement cycle |
|--|-----------------------|--|----------------------------|
| Overall | Entire pump | Renewal of the entire pump (including electric motors) | 7-10 years |
| | Overhaul | Disassembly, inspection and maintenance | 3-4 years |
| Parts | Impeller | Replacement after significant abrasion/corrosion and decreased performance | 3 years |
| | Mechanical seal | Replace the oil if it becomes turbid. | 1-2 years |
| | Oil seals and packing | | Whenever disassembled |
| | Bearing | Replace the product if overheated or abnormal noise or vibration occurs. | 3-4 years |
| | Cable | Replace after trauma, deterioration, swelling, or hardening. | 3-4 years |
| | Oil | Replace if discolored or turbid | 1 year |
| | Motor | Replace the product after insulation deterioration or burning. | 7-10 years |
| <Assumed replacement cycle> 1. For use in building equipment, the applicable models shall have a diameter of 32 to 150mm and 22kW output or less. 2. The operating hours shall be 6 hours per day. | | | |

* The values may vary depending on the model, etc. Refer to the instruction manual for details of inspection items.

Pump inspection report

Ref. No:

Date:

Inspection date:

Name of inspector:

| | |
|--|------------|
| Customer | Supervisor |
| Address: TEL () | |
| Type | Serial No. |
| Specification/Application | |
| Installation conditions: Indoor / Outdoor (with cover / without cover), (Lifting head: m, Suction head: m), Electrode (Y/ N) | |

_____ years after installation

<Measurement items>

| Water volume | m ³ /min | | Discharge pressure | MPa | Rotation speed | rpm | | Temperature | °C |
|---------------------------|---------------------|-------|--------------------|-----|-------------------------------|-------|-------|-------------|----|
| Voltage (when stopped) | r - s | s - t | t - r | V | Voltage (during operation) | r - s | s - t | t - r | V |
| | V | V | V | | | V | V | V | |
| Current (open) | u | v | w | A | Rated current | u | v | w | A |
| | A | A | A | | | A | A | A | |
| Current (shut-off) | u | v | w | A | Insulation value | | | | MΩ |
| | A | A | A | | | MΩ | MΩ | MΩ | |

The water volume and discharge pressure are measured only when abnormalities are observed and necessary.

<Details of inspection>

| Item | Good | Bad | Record | Item | Good | Bad | Record | Item | Good | Bad | Record |
|--------------------|------|-----|--------|--------------------------------|------|-----|--------|-----------------------|------|-----|--------|
| Alignment | | | | Pressure gauge | | | | Valves | | | |
| Check valve | | | | Power supply voltage | | | | Vibration isolator | | | |
| Bearing unit | | | | Current | | | | Foundation & mounting | | | |
| Rotation speed | | | | Insulation | | | | Accessories | | | |
| Vibration | | | | Control panel & wiring | | | | Construction | | | |
| Noise | | | | Protection device | | | | Application | | | |
| Water volume | | | | Relay | | | | Environment | | | |
| Discharge pressure | | | | Mechanical seal, Gland packing | | | | Foot valve | | | |

Corrosion-proof paint shall be applied to the main shaft when replacing the motor.

<Special notes>

The above contents are approved.

Signature: _____

1-7. Example of noise and vibration

Table 11

| Parts | Examples of noise/ vibration/cause |
|--------------|--|
| Casing | Water flow sound, cavitation, resonance sound, vibration sound |
| Bearing unit | Bearing, wear, insufficient lubrication |
| Coupling | Misalignment, wear |
| Common base | Resonance sound, vibration sound |
| Piping | Water flow sound, vibration |
| Gate valve | Water flow sound |
| Check valve | Water hammer |
| Motor | Magnetic sound, external fan, bearing, beat sound |

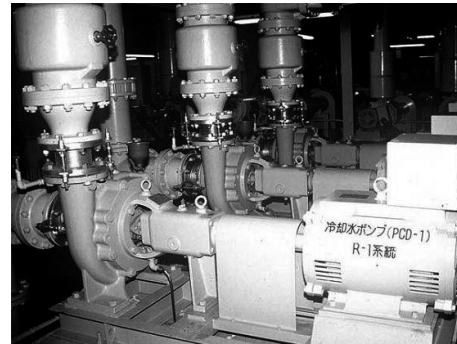


Fig.5

1-8. Proposed noise prevention measures

Table 12. Measures for noise control

| Type of measure | Possible causes | Recommended action | Contents | Remarks | |
|------------------------|---|--|---|--|--|
| Physical measures | Reduce the causes of noise generation | Prevent rapid change in flow velocity and sudden change in flow direction. | | | |
| | | Eliminate unbalance and misalignment | Eliminate deflection and looseness. Eliminate unbalance. | | |
| | | Vibration isolation | Install a vibration isolator, etc. | | |
| | | Damping | Use damping steel plates and attach damping materials. | Up to about 10dB | |
| | | Resonance prevention | Avoid use at natural frequencies. | | |
| | Reduce sound transmission | Sound absorption | Apply a silencer or sound absorbing material. | | |
| | | Sound insulation | Cover the sound source with a cover, box, or building. Install sound insulation walls. | Up to about 25dB | |
| | | Distance attenuation | Place the sound source far away. | 0 to 6 dB/Double distance | |
| | | Attenuation using directivity | Change the direction in which a sound source emits sound. | Up to about 10dB | |
| | | Attenuation by sound absorption on the ground surface, walls, etc. | Change to sound-absorbing ground. Change the surface of a wall into a shape and a material hard to reflect sound. | With 30 cm grass About 0.7dB/10m (1000Hz) | |
| Natural attenuation | Install the sound source downwind. Make use of trees. | Densely leafed tree | | | |
| Psychological measures | Masking | Use vibration | Eliminate noise by generating vibration opposite to sound. | | |
| | | Prior understanding, and awareness | Psychological consideration. | | |