Instruction Manual

Estimated Terminal Pressure Constant Control of Water Supply Unit

SVMV-e

Important Notice

Thank you very much for purchasing our water supply unit.

In order to use the water supply unit appropriately, do not operate, maintain, or inspect the water supply unit until you have read and fully understood this instruction manual.

For safety purpose, observe the cautions and warnings in this instruction manual and those on the labels affixed on the unit.

Retain this manual where it can be consulted at any time of operation, maintenance and inspection of the water supply unit.

To whom is performing the utility work:

Please submit this manual to the customer performing the operation, maintenance and inspection of the water supply unit.

TERAL INC.

Limited warranties

1. In the event of failure or breakage under proper use of the product during the warranty period, equipment supplied by TERAL INC. shall be repaired or replaced free of charge within the scope of the relevant part, provided that such failure or breakage is attributable to inadequacy of the design or workmanship of the equipment.
2. The warranty mentioned in the above clause shall be only the mechanical warranty of the defective part, and shall not cover any expenses or other damage arising from the failure or breakage.
3. In the event of the following failures and breakage, the costs of the repairs and consumables (i.e. parts whose consumption or wear is expected at the beginning of purchase) shall be borne by the user.
   (1) Failures and breakage attributable to equipment that was not delivered by TERAL INC.
   (2) Failures and breakage after the expiration of the warranty period
   (3) Failures and breakage caused by disasters or force majeure, such as fire, acts of God or earthquakes
   (4) Failures and breakage resulting from repairs, disassembly or modifications made without the consent of TERAL INC.
   (5) Failures and breakage when parts other than those designated by TERAL INC. are used
   (6) Failures and breakage caused by any use outside the specification limit of the equipment
4. TERAL INC. shall not be liable for any damage caused by incorrect or reckless use of the water supply unit even if such damage occurs within the warranty period. Cost and expenses incurred for sending engineer(s) in such a case shall be borne by the user.
5. If the cause of the failure is unclear, necessary actions shall be determined through mutual consultation.
6. In order to improve performance, some parts and/or components of the product may be changed without prior notice.
   In addition, upon repairs of the product, TERAL INC. may use recycled parts that conform to our quality standards or may use substitutes that are functionally equivalent.

Purpose of this manual / Notice to users

1. The purpose of this manual is to provide the user with detailed information necessary to operate, maintain and inspect the water supply unit (or “the unit”) properly.
   This manual does not cover work that requires highly specialized knowledge (disassembly, repairs, etc.). If the unit needs to be repaired, be sure to contact TERAL INC.
2. This manual is intended for:
   - persons experienced in the operation of water supply units, or those who have been trained by such experienced operators
   - qualified persons, such as licensed electrical engineers, for the content regarding electric wiring work
3. This manual mainly covers standard products. If you have purchased a customized product, some part of this manual may not be applicable to your unit. In such a case, refer to other documents such as the delivery specifications to confirm the product specifications.
4. The product specifications and information in this manual are subject to change without prior notice.
5. In the illustrations of this manual, some part of the product is omitted or simplified to make it easy to understand. Therefore, the illustrations may look different from the actual product you use.

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1. Safety precautions

Before using the unit, thoroughly read this “Safety precautions” to properly use the product. Information described below is vital to safe and proper use of the unit and prevention of hazard and/or damage.

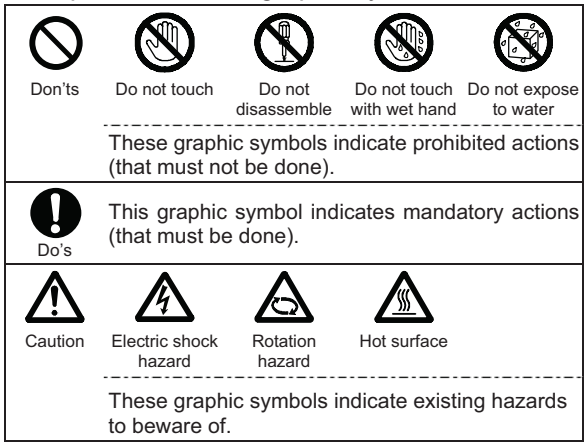
1.1 Explanation of safety indications and graphic symbols

This instruction manual divides safety indications into four categories according to the level of hazard (the extent of damage/losses and the urgency). In addition, the type of user instructions is indicated with a graphic symbol.
This manual uses the following signs. Fully understand these terms and symbols before reading this manual further.

■ Explanation of the safety indications

Indications	Meaning
Danger	Indicates an imminently hazardous situation. Failure to observe this will result in death or serious injury.
Warning	Indicates a potentially hazardous situation. Failure to observe this will result in death or serious injury.
Caution	Indicates a potentially hazardous situation. Failure to observe this will result in minor or moderate injury or property damage.
Note	Indicates information that is in particular to be noted or emphasized.

■ Explanation of the graphic symbols



1.2 Safety precautions

The following are important instructions about safety. Be sure to observe these precautions.

Danger

Once the main power is turned on, do not touch any live parts inside or outside the control panel.
A high voltage applied to live parts causes a serious electric shock.

Warning

Properly move the unit according to lifting instructions. Otherwise, the unit may fall, resulting in injury and/or damage.	Do not carry out any work by/on the water supply unit that is being lifted. Otherwise, the unit may fall, resulting in injury and/or damage.
Only those who are authorized by the site manager may operate the water supply unit. Operation by unskilled personnel may lead to an unforeseen accident.	Only those who are trained to handle the water supply unit may install, maintain, and inspect it. Operation by unskilled personnel may lead to an unforeseen accident.
Only qualified personnel, such as licensed electrical engineers, are allowed to carry out any electric work. Otherwise, it may lead to an electric shock, fire, failures, and/or other problems.	Use the wiring equipment and devices compliant with the use conditions and carry out wiring work safely and securely according to the technical standards for electrical facilities, as well as the indoor wiring regulations. Otherwise, it may lead to an electric shock, fire, and/or other problems.
Before starting wiring work, be sure to turn off the main power and confirm that the pilot lamp is turned off. Take measures to prevent erroneous power supply. Otherwise, it may lead to an electric shock.	At the power supply source, be sure to install a ground fault interrupter dedicated to this unit. Otherwise, it may lead to an electric shock, fire, and/or other problems.

Warning

 Securely install the ground wire and ensure to carry out grounding work. Otherwise, it may lead to an electric leak and/or electric shock.	 Do not connect the ground wire to a gas pipe or water pipe. Such a connection is illegal and leads to an electric shock, explosion and/or fire.
 Ensure that all electric wires are securely connected. Otherwise, it may lead to fire and/or an electric shock.	 Before starting the maintenance or inspection work, be sure to stop the pump and turn off the main power of the panel board. Otherwise, it may lead to an electric shock, injury, damage, water leakage, and/or other problems.
 Before starting the unit or carrying out maintenance/inspection work, ensure that all the relevant workers are informed of the operation and that there are no workers in the dangerous zone around the unit. Otherwise, it may lead to an unforeseen accident.	 Before rotating the pump shaft by hand to check its smooth rotation, be sure to disconnect the main power supply. Otherwise, it may lead to injury and/or damage.
 After turning on the power, do not touch any parts of the water supply unit other than those required for operation. Otherwise, it may lead to an electric shock, injury, and/or other problems.	 Ensure to keep the cover of the control panel closed during operation. Otherwise, it may lead to an electric shock, fire, and/or other problems.
 Do not put your fingers or foreign objects into any openings or rotating part of the motor during operation. Otherwise, it may lead to injury and/or damage.	 Do not perform shutoff operation for more than one minute continuously. Otherwise, the temperature and pressure will increase inside the pump, which may damage the pump and/or cause steam to blow off.
 Do not remove the coupling cover except for maintenance and do not operate the unit without the coupling cover. Be sure to stop the pump before removing and attaching the cover. Otherwise, it may lead to injury and/or damage.	 If you need to carry out work that requires disassembly of the unit—such as replacement of parts, repairs, or inspection, contact TERAL INC. If unskilled personnel carry out the work that requires special knowledge, it may lead to an accident and/or failures.
 Do not operate the unit if abnormal condition is observed in any actions and movement or in any parts, components, and others. Otherwise, it may lead to injury, failures and/or various accidents.	 Motors and control panels should not be used beyond a certain period of time. Otherwise, it may cause ignition or other accidents due to aging deterioration.
 Regularly inspect your equipment and perform maintenance on each component. Otherwise, you cannot prevent potential failures, thus leading to a higher risk of accidents.	 Keep the ambient temperature at 0 to 40°C with sufficient ventilation to prevent damage to the equipment and deterioration of its life. Avoid dust, corrosive or explosive gases, salinity, humidity, condensation. For indoor installations avoid direct sunlight or wind and rain. Electric motor or control panel insulation degradation may result in electric leakage, electric shock, or fire.

Caution

 Do not use the unit outside the range of the product specifications. Otherwise, it may lead to an electric shock, fire, water leakage, failures, and/or other problems.	 Do not use the unit at the power voltage other than the specification. An incorrect voltage may damage the control panel.
 Do not use a single unit as the only means of directly operating key facilities or sustaining life. In the event of a failure, the water supply may stop. Ensure to make a backup unit readily available.	 Do not use the unit to deliver pure water. Otherwise, pure water may be contaminated with impurities.
 Pay special attention to nails when opening the delivered container. Otherwise, it may lead to injury and/or damage.	 As for the installation environment of the unit, strictly observe the installation instructions. Otherwise, it may lead to premature failure.
 Ensure that the floor at the unit's installation place is waterproofed and fitted with drainage. Otherwise, it may lead to serious damage in the event of leakage.	 Since the max. shutoff head is 280m, only devices and piping that meet pressure-resistant specifications should be used. Otherwise, it may damage the unit, devices, and piping.

Caution

Do not merge suction pipes. Otherwise, it may hinder the normal operation.	Do not use any piping materials that are prone to rust. Otherwise, it may damage the unit.
Make sure to install the constant relief pipe and always keep the valve of each relief pipe fully open. Otherwise, the temperature inside the pump may rise and damage the pump	Do not install different or other cables or control wires in one pipe or duct. Otherwise, it may damage the unit and/or other equipment.
Do not step on the control panel, pump, or pipes. Otherwise, it may lead to injury, damage, and/or other problems.	Provide a ground electrode dedicated to the inflow solenoid valve. Otherwise, it does not function normally.
Implement each operation carefully. Otherwise, it may lead to injury and/or damage.	Try to prevent the control panel and the motor from being sprayed water. Otherwise, it may lead to an electric shock, electric leak, failures, and/or other problems.
Before operation, thoroughly clean (flush) the inside of the piping. Otherwise, the piping system may be contaminated with foreign matter, thus leading to an accident or a pump failure.	Properly make each setting of the control panel depending on the conditions of use. Otherwise, it may hinder the normal operation.
Do not cover the motor or the control panel with cloths or other objects. Otherwise, it may lead to overheat and/or ignition.	Do not run the pump without priming. Otherwise, it may damage the sliding parts inside the pump.
In the event of an alarm or abnormal condition that cannot be resolved, immediately contact TERAL INC. Otherwise, it may lead to an accident.	Do not touch the motor body or the cooling fins for the control panel while the unit is running or immediately after the unit has stopped. Otherwise, you may get burns from the hot surface.
Replace the packing and O-rings during inspection involving disassembly. Otherwise, it may lead to water leakage.	Do not place anything on the water supply unit or do not step on the unit. Otherwise, it may lead to injury and/or damage.
Do not perform an insulation resistance test on the control panel. (Before performing an insulation resistance test on the motor, disconnect electric wires and cables from the control panel.) Otherwise, it may damage the control panel.	Ensure to carry out inspection according to the maintenance checklist. Otherwise, you cannot prevent potential failures, thus leading to a higher risk of accidents.
Do not fit an advance phase capacitor to the secondary wiring in the control panel. Otherwise, it may cause malfunction.	Before disassembling, shut the suction and discharge sluice valves, and then discharge pressured water from the pump and the piping. Otherwise, water may spurt out, thus leading to an accident.
To operate the pump, close the bypass of the check valve. If not followed, the check valve will not function.	If you do not use the unit for a long time, turn off the power, drain water from the inside, and then store the unit. Otherwise, it may lead to insulation degradation, freeze cracking, and/or other problems.
If negative suction is necessary, adopt the unit specified for negative suction. Failure to observe this may cause discharge pressure drop and lead to a water cutoff.	

2. Configuration and overview of the water supply unit

This chapter describes standard specifications of the water supply unit. If you have purchased a customized product, some information in this chapter may not be applicable to your unit. Refer to the separately supplied delivery specifications and other documents to check the product specifications in such a case.

2.1 Names and functions of each part

2.1.1 Names and functions of the components of the water supply unit

① Pump
Its motor rotates an impeller to generate pressure for delivering water.

② Flow switch
The flow switch outputs a signal to stop the pump when the water flow rate is not higher than the setup (stop) flow rate.

③ Spring type check valve (with bypass)
It prevents backflow to the standby pump. The bypass can be opened to allow water to flow back on the secondary side.

④ Gate valve
The gate valve is used for maintenance.

⑤ Junction pipe
The junction pipe joins the discharge pipes of the two pumps into one pipe.

⑥ Pressure tank
The pressure tank reduces pressure fluctuations of the pump when the pump start/stops. It also maintains the pressure in the piping when the pump is stopped.

⑦ Pipe for pressure tank drainage
This pipe is for discharging water from the pressure tank when you carry out the maintenance of the pressure tank.

⑧ Pressure gauge
The pressure gauge displays the pressure.

⑨ Pressure transmitter
The pressure transmitter converts pressure into an electric signal so as to use it for control.

⑩ Control panel
The control panel controls the pump and supplies the power to the motor.
It incorporates a control board that monitors the operating condition of pumps, and automatically start/stop pumps.

⑪ Vibration isolator
It prevents vibration of the pump from being transmitted to the floor and others.

⑫ Constant relief pipe
Water is constantly drained to prevent the pump from overheating and to discharge air.

⑬ Lifting lug
It is used to transport the unit in a suspended state.

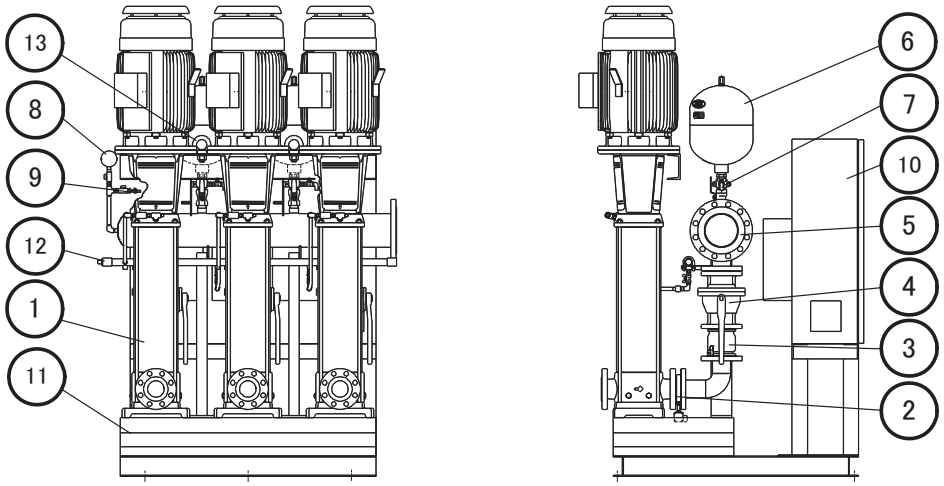


Fig. 2-1-1 SVMV-e Water supply unit (3-pump system)
(*This is a representative drawing and may change depending on the type and specification.)

2.1.2 Names and functions of control panel elements

① Display
It displays a variety of information about the water supply unit. (→ see 6.4)

② Operation selector switch
The switch is to change the operation mode of the water supply unit. (→ see 6.1)

③ Current mode indicator lamp
The lamp is to display the operation mode currently selected.

④ Tank selector switch
Press this switch to select the receiver tank(s) to be used. (→ see 6.2)

⑤ Current tank indicator lamp
The indicator lamp will be on for the receiver tank currently selected.

⑥ Solenoid valve operation selector switch
Press this switch to change the solenoid valve operation mode. (→ see 6.3)

⑦ Current solenoid valve operation indicator lamp
The indicator lamp will be on for the solenoid valve operation currently selected.

⑧ Operation indicator lamp
The indicator lamp will be on while the pump is running. The lamp blinks during checking for low flowrate in automatic mode.

⑨ Operation inhibition indicator lamp (per pump)
The indicator lamp will be on when the operation parameter is set to “Operation inhibition” mode. (→ see 6.5)

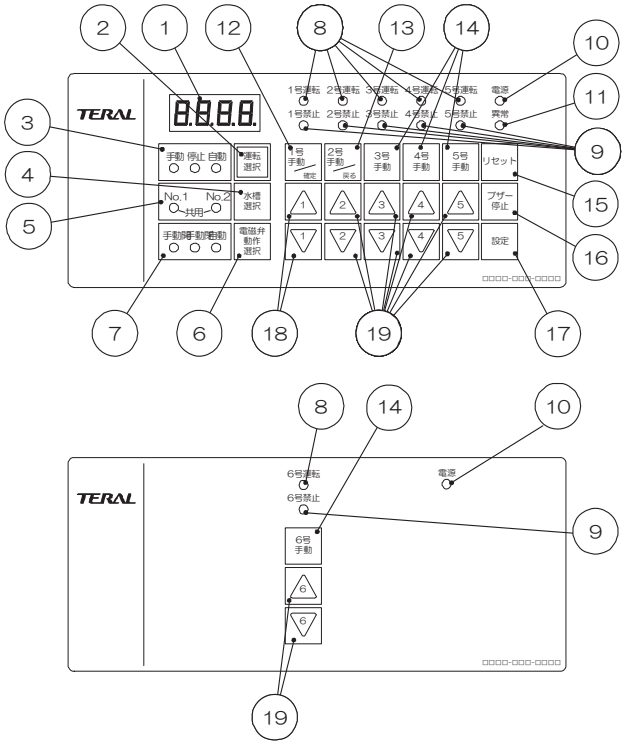


Fig.2-1-2 Operation panel on the control panel
(The lower panel is attached only for 6-pump unit.)

⑩ Power indicator lamp
The indicator lamp will be on while the power is turned ON. It blinks in inspection mode (→ see 7.2).

⑪ Failure indicator lamp
The indicator lamp blinks when an alarm occurs.

⑫ No. 1 Manual/Confirm switch
Press the switch to run the pump No.1 in the manual mode. The switch is also used as the “Confirm” switch in the setting and other modes.

⑬ No.2 Manual/Back switch
Press the switch to run the pump No.2 in the manual mode. The switch is also used as the “Back” switch in the setting and other modes.

⑭ Manual switch (No. 3 to 6)
The switch is to manually operate the pumps No. 3 to 6.

⑮ Reset switch
The switch is used to reset an alarm.
Generated alarms can be reset by pressing the switch once the cause of the alarm is eliminated.

⑯ Buzzer stop switch
The switch is used to manually stop the buzzer when an alarm occurs. The switch is also used in combination with the cursor switch 1 to switch the basic information items on the display.

⑰ Setting switch
The switch is used to switch to or to exit from the setting mode (→ see 6.5).

⑱ Cursor switch 1
The operating frequency can be changed by pressing the switch in the manual mode of Pump no.1.
The switch is used to switch the indication items, make the settings, and switch the indication items of the pump No.1.

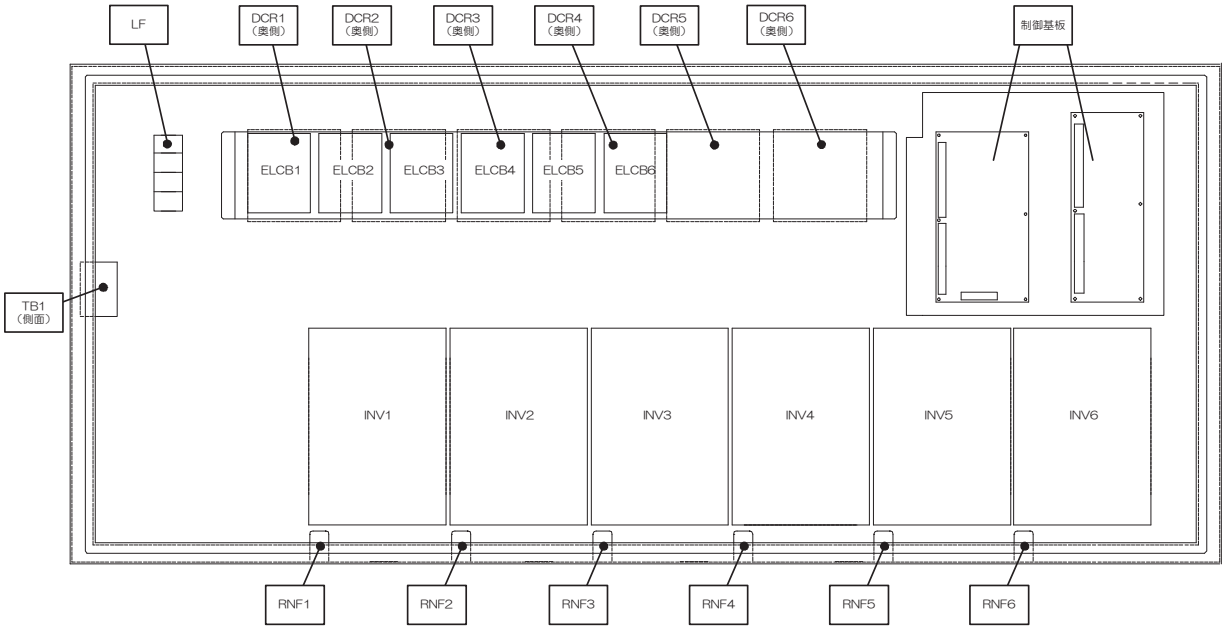
⑲ Cursor switch (No. 2 to 6)
The operating frequency can be changed by pressing this switch in the manual mode of the pumps No.2 to 6. The switch is used to switch the indication items of the pump No.2 to 6.

2.1.3 Configuration of the control panel

Warning

While the power is on, high voltage is applied inside the control panel, which is very dangerous. Any person other than the one authorized to do so must not open cover of the control panel. If not followed, it may cause an electric shock.

Components are shown below.



■ Description of Codes

TB1	Power terminal
INV1,2,3,4,5,6	Inverter
ELCB1,2,3,4,5,6	Earth leakage
DCR1,2,3,4,5,6	Power-factor improvement reactor
RNF1,2,3,4,5,6	Radio noise filter
LF	Line noise filter

Fig 2-1-3 Control panel components
(For output 15kW x 6- pump unit)

2.1.4 Control board

The following are the details of the control board.

Warning

Do not remove the cover of the I/O terminal block when the power is turned on.
Otherwise, it may lead to an electric shock.

<<2-pump unit>>

The control board for 2-pump unit is shown in Fig. 2-1-4 and Table 2-1-4(a), (b).

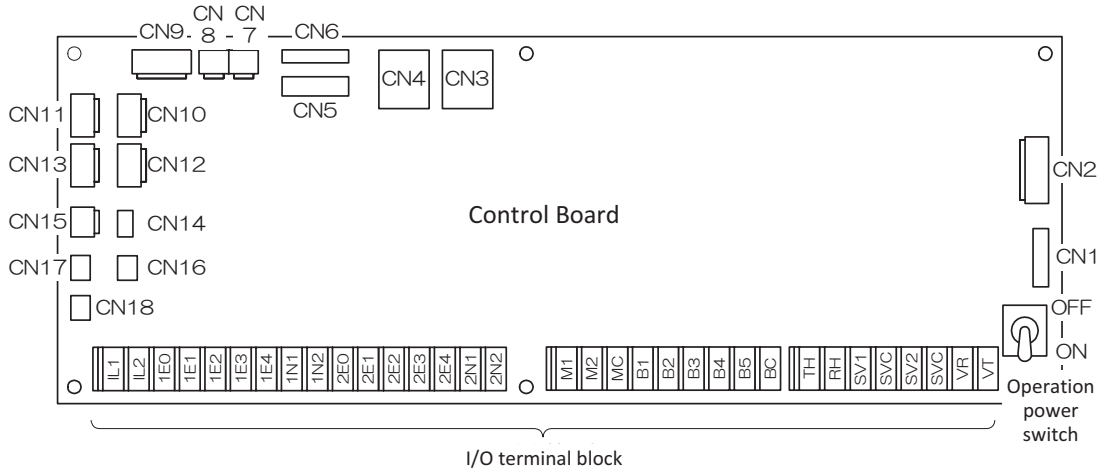


Fig.2-1-4 Control Board Arrangement (for 2-pump unit)

Table 2-1-4 (a) Connector assignments

No.	Connection point	No.	Connection point	No.	Connection point
CN1	Equipment inside the control panel	CN7	Equipment inside the control panel	CN13	Flow switch for pump No.2
CN2	(Unused)	CN8	Equipment inside the control panel	CN14	(Unused)
CN3	Equipment inside the control panel	CN9	(Unused)	CN15	(Unused)
CN4	Equipment inside the control panel	CN10	Pressure transmitter	CN16	(Unused)
CN5	(Unused)	CN11	(Unused)	CN17	(Unused)
CN6	Equipment inside the control panel	CN12	Flow switch for pump No. 1	CN18	(Unused)

Table 2-1-4 (b) Codes and application of input/output terminal block

Code	Application	Code	Application
IL1, IL2	Interlocking signal	B1 to B5	Alarm signal output
1E0 to 1E4	Receiver tank water level detector electrode No. 1	BC	Alarm signal output common
2E0 to 2E4	Receiver tank water level detector electrode No. 2	VR, VT	Power supply for alarm (Power voltage*)
1N1,1N2	Receiver tank solenoid valve control electrode No.1	RH, TH	(Unused)
2N1, 2N2	Receiver tank solenoid valve control electrode No.2	SVC, SV1	Receiver tank solenoid valve No. 1 (Power voltage*)
M1, M2	Pump No. 1 & pump No. 2 operation signal	SVC, SV2	Receiver tank solenoid valve No. 2 (Power voltage*)
MC	Operation signal common		

* The power voltage is 200V in case of 400V specification.

<<3-5-pump unit>>

The control board for 5-pump unit is shown in Fig. 2-1-5 and Table 2-1-5(a), (b).
The same applies to the control boards for 3 and 4-pump units.

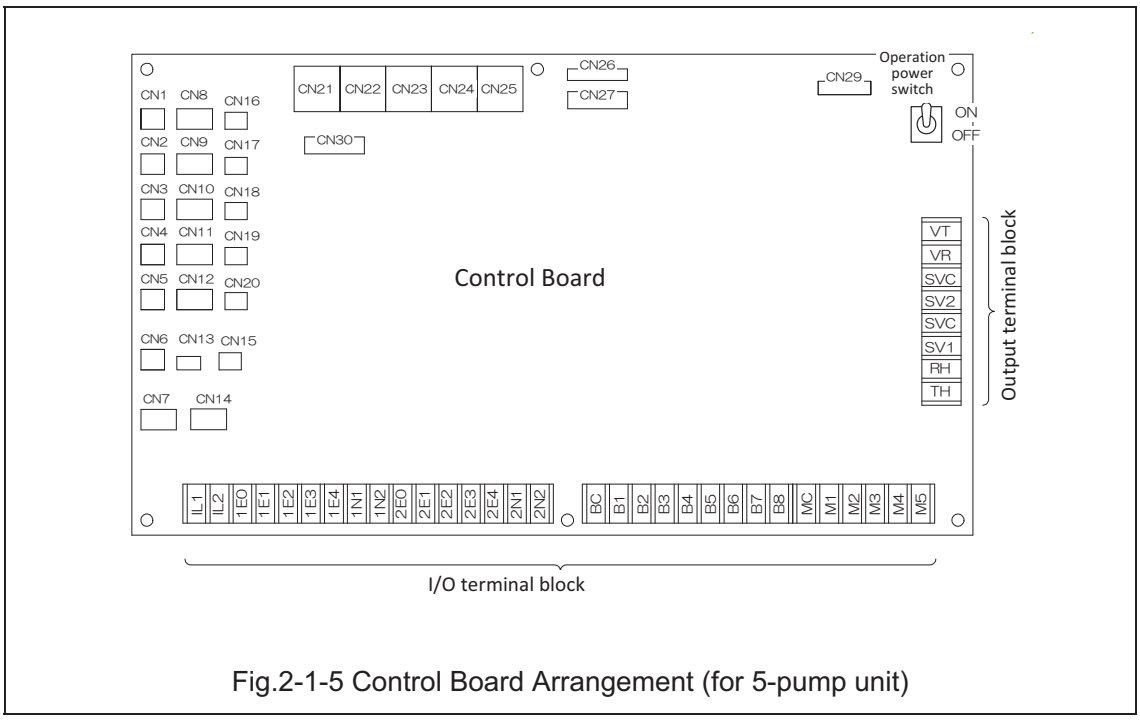


Fig.2-1-5 Control Board Arrangement (for 5-pump unit)

Table 2-1-5 (a) Connector assignments

No.	Connection point	No.	Connection point	No.	Connection point
CN1	Equipment inside the control panel	CN11	Flow switch for pump No. 4	CN21	Equipment inside the control panel
CN2	Equipment inside the control panel	CN12	Flow switch for pump No. 5	CN22	Equipment inside the control panel
CN3	Equipment inside the control panel	CN13	(Unused)	CN23	Equipment inside the control panel
CN4	Equipment inside the control panel	CN14	(Unused)	CN24	Equipment inside the control panel
CN5	Equipment inside the control panel	CN15	(Unused)	CN25	Equipment inside the control panel
CN6	(Unused)	CN16	(Unused)	CN26	Equipment inside the control panel
CN7	Pressure transmitter	CN17	(Unused)	CN27	(Unused)
CN8	Flow switch for pump No. 1	CN18	(Unused)	CN29	Equipment inside the control panel
CN9	Flow switch for pump No. 2	CN19	(Unused)	CN30	(Unused)
CN10	Flow switch for pump No. 3	CN20	(Unused)		

Table 2-1-5 (b) Codes and application of input/output terminal block

Code	Application	Code	Application
IL1, IL2	Interlocking signal	B1 to B5	Alarm signal output
1E0 to 1E4	Receiver tank water level detector electrode No. 1	BC	Alarm signal output common
2E0 to 2E4	Receiver tank water level detector electrode No. 2	VR, VT	Power supply for alarm (Power voltage*)
1N1,1N2	Receiver tank solenoid valve control electrode No.1	RH, TH	(Unused)
2N1, 2N2	Receiver tank solenoid valve control electrode No.2	SVC, SV1	Receiver tank solenoid valve No. 1 (Power voltage*)
M1 to M5	Pumps No. 1 to No. 5 operation signal	SVC, SV2	Receiver tank solenoid valve No. 2 (Power voltage*)
MC	Operation signal common		

* The power voltage is 200V in case of 400V specification.

<<6-pump unit>>

The control board for a 6-pump unit has two boards.
Details are shown below.
First, control board 1 is shown in Fig. 2-1-6 and Table 2-1-6(a), (b).

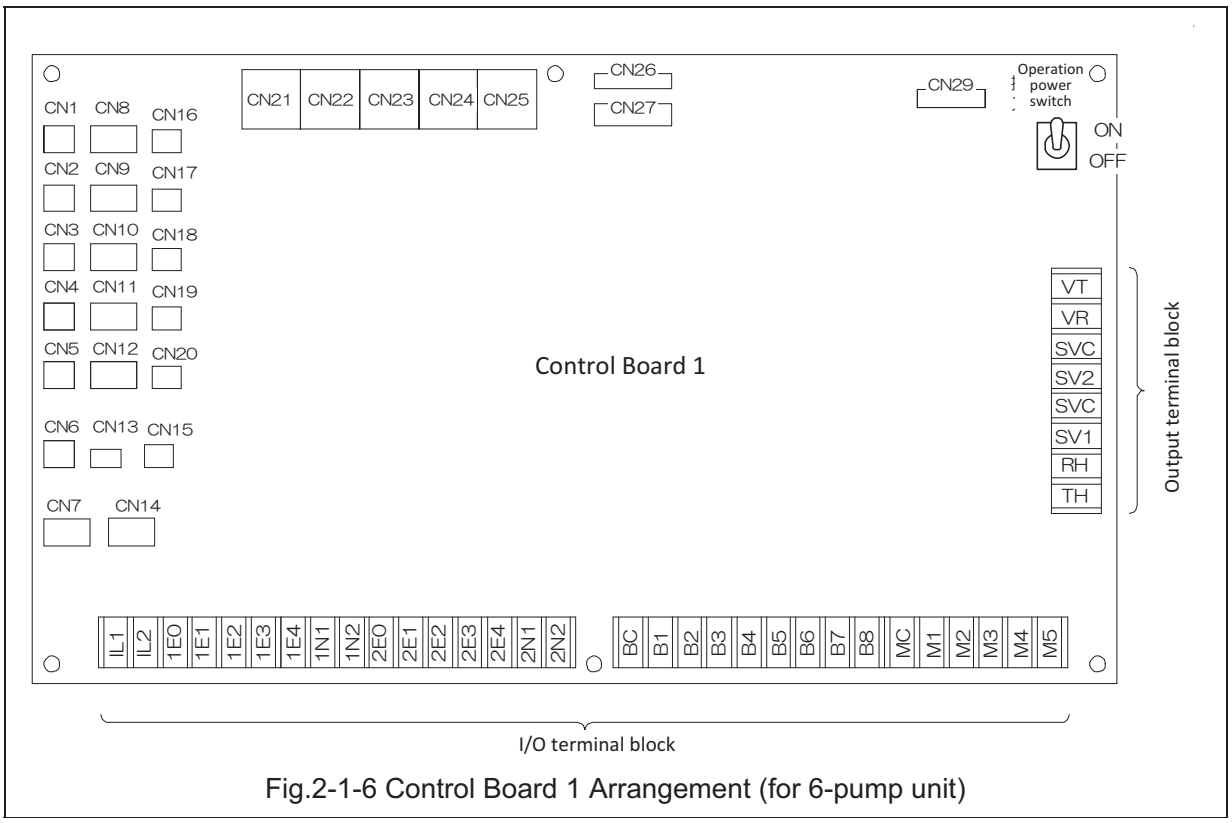


Fig.2-1-6 Control Board 1 Arrangement (for 6-pump unit)

Table 2-1-6 (a) Connector assignments

No.	Connection point	No.	Connection point	No.	Connection point
CN1	Equipment inside the control panel	CN11	Flow switch for pump No. 4	CN21	Equipment inside the control panel
CN2	Equipment inside the control panel	CN12	Flow switch for pump No. 5	CN22	Equipment inside the control panel
CN3	Equipment inside the control panel	CN13	(Unused)	CN23	Equipment inside the control panel
CN4	Equipment inside the control panel	CN14	(Unused)	CN24	Equipment inside the control panel
CN5	Equipment inside the control panel	CN15	(Unused)	CN25	Equipment inside the control panel
CN6	(Unused)	CN16	(Unused)	CN26	Equipment inside the control panel
CN7	Pressure transmitter	CN17	(Unused)	CN27	Equipment inside the control panel
CN8	Flow switch for pump No. 1	CN18	(Unused)	CN29	Equipment inside the control panel
CN9	Flow switch for pump No. 2	CN19	(Unused)	CN30	(Unused)
CN10	Flow switch for pump No. 3	CN20	(Unused)		

Table 2-1-6 (b) Codes and application of input/output terminal block

Code	Application	Code	Application
IL1, IL2	Interlocking signal	B1 to B8	Alarm signal output
1E0 to 1E4	Receiver tank water level detector electrode No. 1	BC	Alarm signal output common
2E0 to 2E4	Receiver tank water level detector electrode No. 2	VR, VT	Power supply for alarm (Power voltage*)
1N1,1N2	Receiver tank solenoid valve control electrode No.1	RH, TH	(Unused)
2N1, 2N2	Receiver tank solenoid valve control electrode No.2	SVC, SV1	Receiver tank solenoid valve No. 1 (Power voltage*)
M1 to M5	Pumps No. 1 to No. 5 operation signal	SVC, SV2	Receiver tank solenoid valve No. 2 (Power voltage*)
MC	Operation signal common		

* The power voltage is 200V in case of 400V specification.

The control board 2 is shown in Fig. 2-1-7 and Table 2-1-7(a), (b).

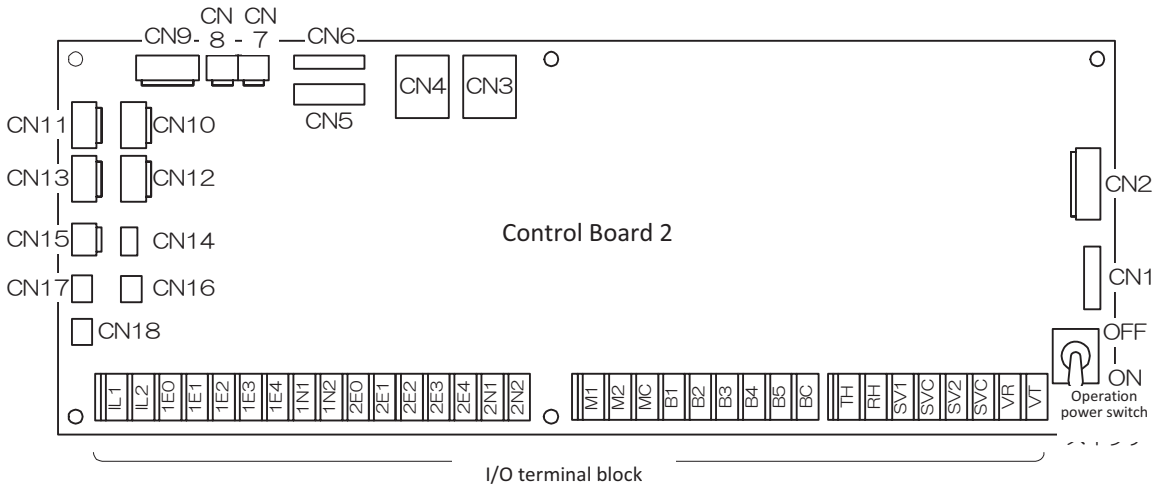


Fig.2-1-7 Control Board 2 Arrangement (for 6-pump unit)

Table 2-1-7 (a) Connector assignments

No.	Connection point	No.	Connection point	No.	Connection point
CN1	Equipment inside the control panel	CN7	Equipment inside the control panel	CN13	(Unused)
CN2	(Unused)	CN8	(Unused)	CN14	(Unused)
CN3	(Unused)	CN9	(Unused)	CN15	(Unused)
CN4	(Unused)	CN10	(Unused)	CN16	(Unused)
CN5	Equipment inside the control panel	CN11	(Unused)	CN17	(Unused)
CN6	(Unused)	CN12	Flow switch for pump No. 6	CN18	(Unused)

Table 2-1-7 (b) Codes and application of input/output terminal block

Code	Application	Code	Application
IL1, IL2	(Unused)	B1	Alarm signal output
1E0 to 1E4	(Unused)	B2 to B5	(Unused)
2E0 to 2E4	(Unused)	BC	Alarm signal output common
1N1,1N2	(Unused)	VR, VT	Power supply for alarm (Power voltage*)
2N1, 2N2	(Unused)	RH, TH	(Unused)
M1	Pump No. 6 operation signal	SVC, SV1	(Unused)
M2	(Unused)	SVC,	(Unused)
MC	Operation signal common		

* The power voltage is 200V in case of 400V specification.

2.2 Specifications of the water supply unit

If you have purchased our standard product, refer to the “Standard specifications” table. In addition, if there are any other special specifications that have been changed at your request, refer to the delivery specifications.

Caution	Do not use this unit under any conditions other than those provided in the specifications. Otherwise, electric shock, fire, water leakage, or property damage may occur.
Note	If the inflow pump head is 5m or more, contact us for consultation.

Table 2-2 Standard specifications of water supply unit

Operation mode		D : Automatic alternative operation W : Automatic alternative parallel operation W3 : 2-pump Parallel, 3-pump Rotation T3 : 3-pump Parallel, 3-pump Rotation T4 : 3-pump Parallel, 4-pump Rotation F4 : 3-pump Parallel, 3-pump Rotation F5 : 4-pump Parallel, 5-pump Rotation G5 : 5-pump Parallel, 5-pump Rotation G6 : 5-pump Parallel, 6-pump Rotation R6 : 6-pump Parallel, 6-pump Rotation
Control method		Estimated terminal pressure constant control by frequency control / Discharge pressure constant control ,With low flow stop function
Applicable liquid	Liquid property	Fresh water（pH5.8～8.6, Chloride ion concentration not exceeding 200 mg/L）
	Temperature	0 to 40°C
Installation location		Indoors (0 to 40°C, Max. RH85%, no condensation, Altitude: Max. 1,000m, Place not exposed to direct sunlight)
Suction conditions		Inflow (Inflow pump head: Max. 5 m)*1
Pump (Material)		SVM model stainless steel horizontal multistage centrifugal pump (Impeller: SUS304, Casing: SCS13, Main shaft: SUS304 *The material is JIS equivalent.)
Motor	Type	Totally-enclosed fan-cooled type for outdoor use
	No. of poles	2 poles
Flange		Pump suction: JIS20K equivalent, Unit discharge: JIS 10K/20K
Pump output		7.5kW to 45kW［×1 to 6-unit］ : 3-phase 200/200-220V(50/60Hz) 3-phase 400/400-440V(50/60Hz)*2
Paint color		Motor/pump(FC casting) : Munsell N-1 Approx. Unit common base/Bases : Munsell N-5 Pressure tank : Munsell 10Y5.5/0.5
Pressure tank		Diaphragm tank 20L x 2 units (1 unit for operation mode D/W)
Pressure detection device		Pressure transmitter (Transmission system: DC5V 3-wire system/Output voltage: 0.5 to 3.5 V DC
Control panel	Model	BQEC type
	Motor Protection	Inverter (with electronic thermal protection)
	Normal display	Indicator lamp: Power supply, Pump operation inhibition (per pump), Abnormal(collective) Other indications: Discharge pressure, Power voltage*3, Operating current (per pump)*3, Operating frequency (per pump), Cumulative operation time (per pump), Cumulative number of starts (per pump), Number of start times of the unit on the previous day, Alarm log (last 5 alarms), Interlock operation
	Abnormal display	Receiver tank full, Receiver tank low, Dry-run prevention, Electrode failure, Start frequency failure, Pressure transmitter 1 failure, Control panel high temperature, EEPROM error, Communication error between control boards, Overload (per pump), Discharge pressure abnormal drop (per pump), Electric leak (per pump), Flow switch failure (per pump), Overcurrent (per pump), Overvoltage (per pump), Undervoltage(per pump), Open phase input(per pump), Inverter overload (per pump), Open phase output (per pump), Inverter overheat (f per pump), Communication error (per pump), Inverter trouble 1 (per pump), Inverter trouble 2 (per pump)
	External outputs	Power supply for alarm (at power voltage*4), Inflow solenoid valve output (at power voltage*4), Operation/alarm signal (No-voltage a-contact)
	External inputs	External stop signal (interlock): supports a/b-contacts

*1)For negative suction models, the actual suction head should be within 4m. The negative suction models support up to 5m (pump bore size 40-50A) or 4m (pump bore size 65m or over) for total pump suction head (at 20°C water temperature).

*2) 400V specification is a special specification.

*3) The power voltage and operation current values are reference values. Use a measuring instrument for maintenance and inspection.

*4) In case of 400V specification, it is 200V.

*5) Communication error between control boards is displayed only for 6-pump units.

2.3 Specifications of control panel

Table 2-3 Specifications of control panel

Item				Standard specification
Control panel model				BQEC
Operation mode				Automatic rotational operation (D/W/W3/T3/T4/F4/F5/G5/G6/R6)
Material and external color of casing				Steel plate (Munsell 5Y7/1 semigloss/baking finish)
Output range		3-phase 200/200-220V (50/60 Hz) 3-phase 400/400-440V (50/60 Hz)*1		7.5kW to 45 kW
Circuit configuration		Ground fault interrupter	Individual pump systems	S
		Power-factor correcting reactor (DCR)	Individual pump systems	S
		Motor protection	—	Inverter (electronic thermal protection)
		Double receiver tank circuit	Can be switched on the operation panel	S
		Inflow solenoid valve circuit	Can be operated on the operation panel	S
		Electrode 5P circuit	—	S
Functions		Dry-run prevention	—	S
		Automatic switching upon failure	—	S
		Pump continuous operation prevention function	—	S
		Pump operation time equalization function	—	S
		External stop signal (interlock) available	a/b-contact available	S
		Buzzer stop timer setting	1 to 60 min, ∞, no buzzer	S
		Full/low water alarm automatic recovery setting	—	S
		Inflow solenoid valve automatic alternation setting	—	S
		Inspection mode	—	S
		Alarm buzzer	—	S
		Buzzer stop switch	—	S
		Energy-saving operation setting	—	S
Indications on control panel	Indicator lamp	Power	—	S
		Operation (per pump)	—	S
		Inhibition (per pump)	—	S
		Failure (collective)	—	S
	Various indications	Discharge pressure	Unit: m·H_2O	S
		Power voltage	Unit: V	S
		Operating current (per pump)	Unit: 0.1 A	S
		Operating frequency (per pump)	Unit: 0.1 Hz (only automatic)	S
		Cumulative operation time (per pump)	Unit: Hour	S
		Cumulative number of starts (per pump)	Unit: times	S
		Number of start times of the unit	Number of starts on the previous day	S
		Alarm log	5 latest alarms	S
		Interlock operation	—	S
	Alarm indications	Receiver tank full	No: E001	S
		Receiver tank low	No: E002	S
		Dry-run prevention	No: E003	S
		Electrode failure	No: E004	S
		Start frequency failure	No: E006*3	S
		Pressure transmitter 1 failure	No: E051	S
		EEPROM error	No: E080	S
		Communication error between control boards	No: E099*7	S
		Overload (per pump)	No: E#01	S
		Discharge pressure abnormal drop (per pump)	No: E#02	S
		Electric leak (per pump)	No: E#03	S
		Flow switch failure (per pump)	No: E#05	S
		Overcurrent (per pump)	No: E#11	S
		Overvoltage (per pump)	No: E#12	S
		Undervoltage (per pump)	No: E#13	S
		Open phase input (per pump)	No: E#14	S
		Inverter overload (per pump)	No: E#15	S
		Open phase output (per pump)	No: E#16	S
		Inverter overheat (per pump)	No: E#17	S
		Inverter communication error (per pump)	No: E#18	S
		Inverter trouble 1 (per pump)	No: E#19	S
		Inverter trouble 2 (per pump)	No: E#20	S
External output		Power for alarm	Power voltage*6	S
		Inflow solenoid valve output	Power voltage*6	S (Open/closed selectable when the power is supplied)
		Operation signal	No-voltage a-contact	S (per pump)
		Fault signal	No-voltage a-contact	S (5 points: patterns 0 to 4)*5

"S" indicates standard features.

*1 400V specification is a special specification.

*2 Power voltage and operation current values are estimated values. There is an error of approximately 10% with respect to the full scale.

*3 "E006" can be disabled using settings. Refer to "6.5 Parameter setting."

*4 The character "#" is replaced by the corresponding pump number.

*5 For the fault signal external output pattern, refer to "6.5 Parameter setting.

*6 In case of 400V specification, it is 200V.

*7 Communication error between control boards is displayed only for 6-pump units.

3. Installation

3.1 Before using the water supply unit

Note	After unpacking, ask the vendor to dispose of packaging materials that are no longer necessary.

When you receive the water supply unit, check the following points immediately after unpacking.

(1) Check the nameplate to verify that the delivered product is exactly what you ordered.

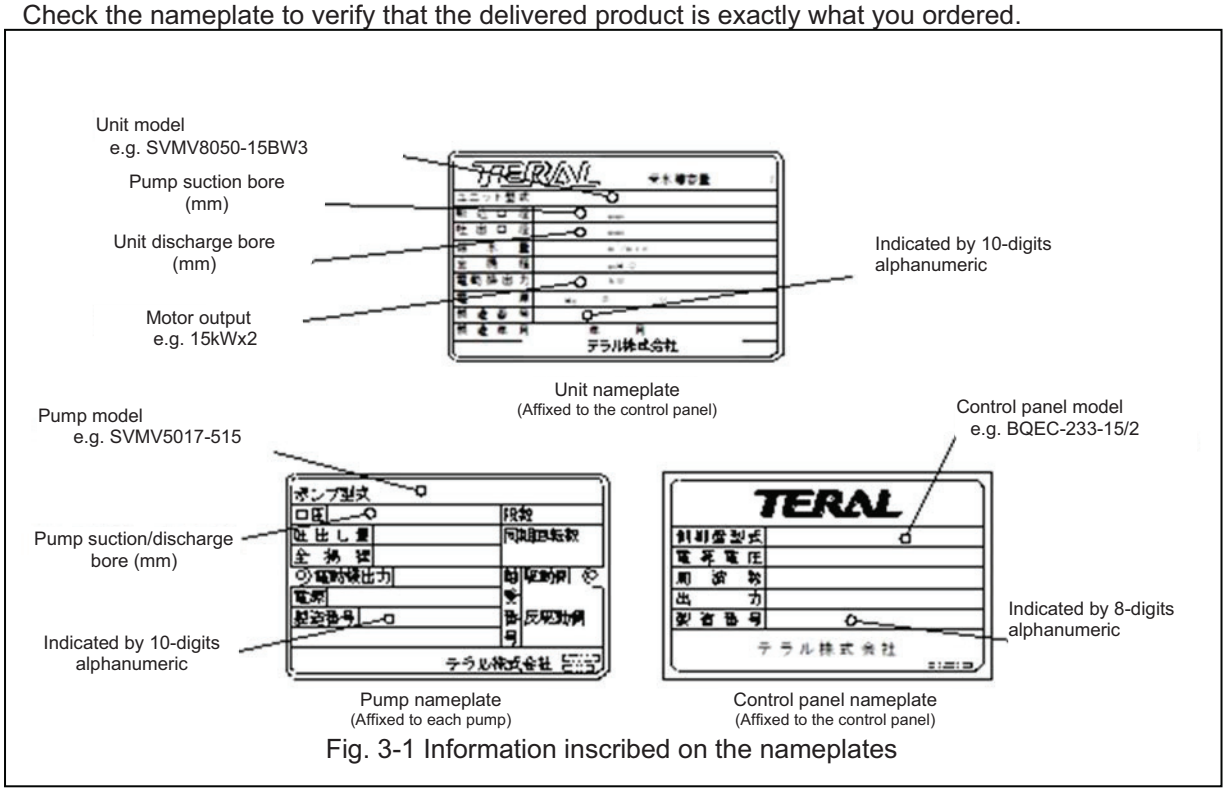


Fig. 3-1 Information inscribed on the nameplates

(2) Check that no part of the unit has been damaged during transportation.

(3) Check all fastening parts including bolts and nuts are securely tightened.

(4) Check all the accessories that you ordered have been completely delivered.

3.2 Precautions for installation

Warning	When moving or installing the unit, never lift it in an unstable condition or with any load applied to the pressure tank, pipes, or control panel. Otherwise, the unit may fall, resulting in injury and/or damage. Before lifting the unit, refer to the catalog, the external dimensions drawing, or other documents to check the weight of the unit, and use an appropriate lifting device of which rated load is over the unit. Otherwise, the unit may fall, resulting in injury and/or damage.
Warning	Electric motor or control panel insulation degradation may result in electric leakage, electric shock, or fire. Keep the ambient temperature at 0 to 40°C with sufficient ventilation to prevent damage to the equipment and deterioration of its life. Avoid dust, corrosive or explosive gases, salinity, humidity, condensation. For indoor installations avoid direct sunlight or wind and rain.
Caution	For the installation environment, follow the precautions described below. Otherwise, it may lead to failures and/or other problems as well as a shorter life of the units.
Caution	To suck up water from a lower position, use a water supply unit designed for lifting operation. Otherwise, discharge pressure may drop, thus leading to disruption of water supply.

(1) Install the unit at a place that meets the following conditions:
- a place that meets the requirements in Section “2.2 Specifications of the water supply unit “;
- a place that is not exposed to the wind or rain (This unit is designed for indoor use);
- a dry, well-ventilated environment, which as free of dust or moisture as possible;
- a location where unauthorized persons cannot easily enter or operate the product;
- a location as close to the water source as possible so that the suction pipe can be short.; and

(2) Fix the water supply unit firmly on a level concrete foundation with anchor bolts.

(3) Be sure to provide a drain ditch around the water supply unit, and waterproof the floor.

(4) If the system could be exposed to the freezing temperature in winter, be sure to take measures to prevent freezing in the pump room or prevent the pump, valves, piping, pressure transmitter, pressure tank, and other devices from freezing. Please consult with us in advance.

(5) Use sound insulating materials for the door and walls of the pump room. Particularly when generated noise may pose a problem, take necessary measures against the noise.

(6) When lifting and transporting the water supply unit, be sure to follow the instructions below.

① Common
- When lifting this unit, be sure to have an operator qualified in crane operation and slinging.
- Be sure to check the product weight and use a crane and a hoisting device with the allowable load range.
- Do not lift the unit using the eyebolts of the motor.
- Hang the product so that the hoisting device does not interfere with the product. If this cannot be avoided, protect the product by inserting a protective material between the hoisting device and the product.
- Do not perform any sudden operations.

② Lifting procedures

For 11 kW or more

As shown in FIg.3-2-1-a, lift and transport the unit by the two lifting lugs on pump connecting member.

For 7.5 kW or less

As shown in Fig. 3-2-1-b, lift and transport the unit by balancing it on two lifting lugs of the pump connecting member and two lifting lugs of the control panel frame, for a total of four points.

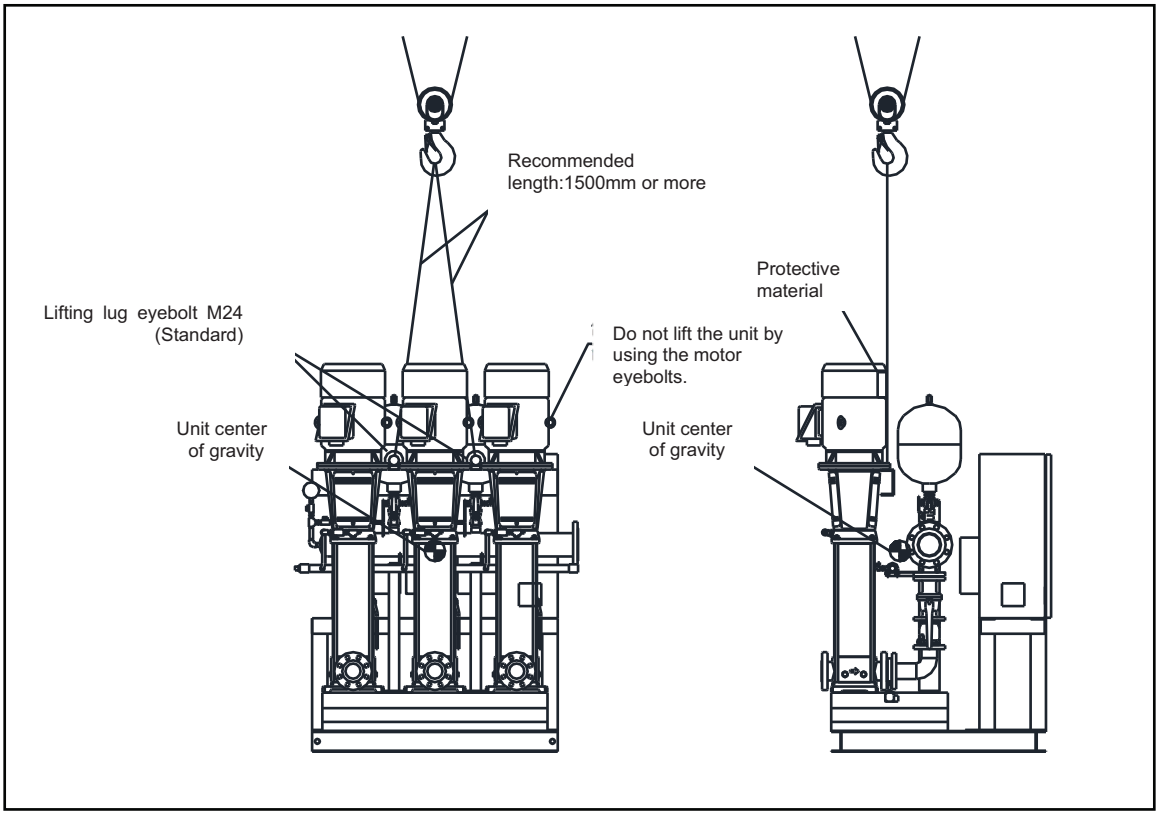


Fig. 3-2-1-a Suspended transportation (11kW or more）

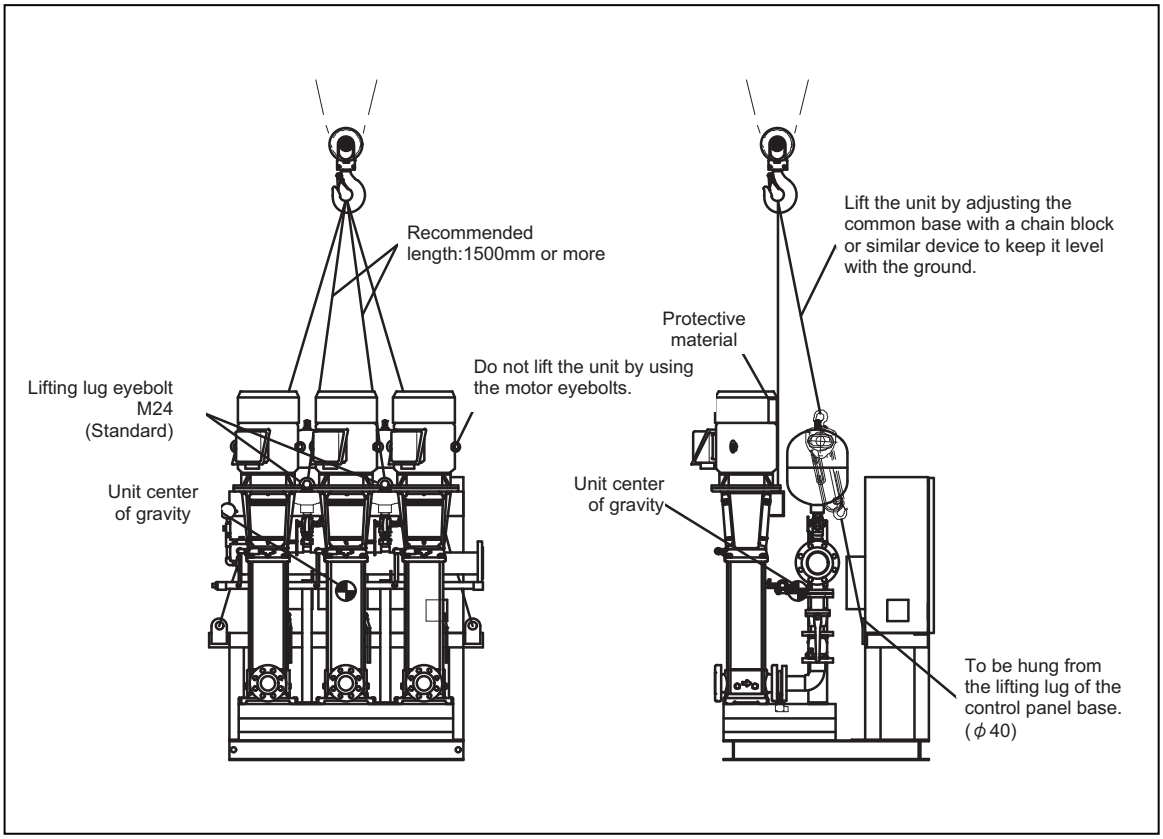


Fig. 3-2-1-b Suspended transportation (7.5kW or less）

(7) Follow the procedures below to adjust the vibration isolator after installing the unit.

Caution	The vibration isolator is shipped with the stopper tightened to prevent shaking during transportation. If it is left tightened, the expected vibration isolation effect cannot be obtained. Be sure to perform the adjustment.
Caution	The isolator of the vibration isolator frame has been adjusted to the level prior to shipment. However, the level difference or inclination may occur after installation due to the condition of the connecting pipe or installation location in the site.
Caution	If the isolator moves significantly during transportation or handling, refer to the marking sticker to return the isolator to the correct position.

(7-1) Prior to piping installation, loosen the locknut ① and anti-vibration metal fitting ② and leave a gap between washer ③ and the vibration-proof bracket ④.

(7-2) After installing the piping, make sure that the height difference between the four corners of the vibration isolator is 5mm or less. At this time, make sure that the vibration-proof bracket ④ does not hit the locknut ① and anti-vibration metal fitting ②. In addition, provide adequate support devices and anti-vibration fittings for the piping so that the piping load is not applied to the water supply unit.

≪ When the height difference between the four corners of the vibration isolator exceeds 5mm ≫
Jack up the upper frame ⑥, move the isolator ⑤ toward the inclined side of the vibration isolator, and adjust it so that the height difference is 5mm or less.
When jacking up, loosen the locking nut ① and use four or more jacks to jack up the entire top frame ⑥, paying attention to the overall balance.
When jacking up, loosen the locking nut ① and use four or more jacks to jack up the entire top frame ⑥, paying attention to the overall balance.
To prevent the top frame ⑥ from falling even if the jaws of the jack come off during jack-up operation, insert a wooden block, etc., well-balanced between the top frame ⑥ and the bottom frame ⑦.

(7-3) The clearance between the anti-loosening nut ① and washer ③, and the anti-sway bracket ② and the anti-seismic bracket ④.

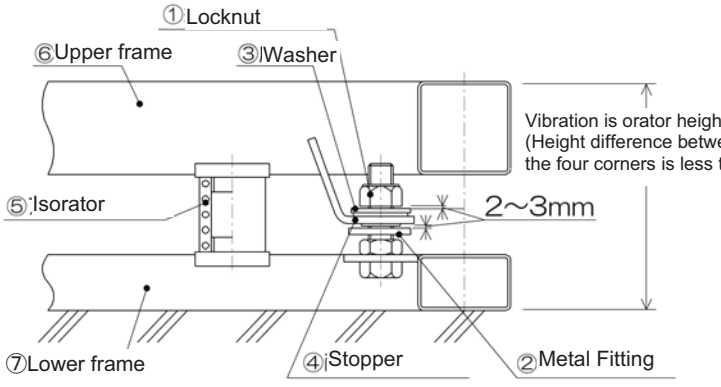


Fig.3-2-2 Vibration isolator level adjustment

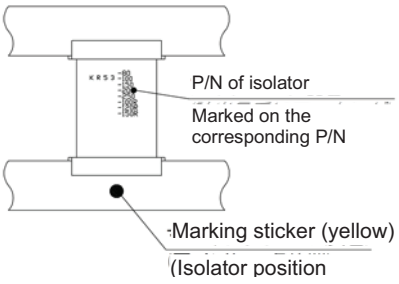


Fig.3-2-3 Enlarged view of isolator

3.3 Precautions for piping work

Caution	❗	Make sure to install the constant relief pipe and always keep the valve of each relief pipe fully open.
Caution	⊘	Do not merge the suction pipes. Do not install the piping with a shape of upward bend (i.e. providing the piping with a rising slope and then a descending slope). Otherwise, it may hinder the normal operation.
Caution	⊘	Do not use any piping materials that are prone to rust. Otherwise, it may damage the unit.
Caution	❗	After work, thoroughly clean (flush) the inside of the receiver tank and piping.

(1) Install an adequate pipe support ① and vibration isolation joints so that the weight of the piping system will not be applied to the main unit.

(2) For test operation and adjustments, be sure to attach gate valves ③ and a test pipe ④ to the discharge pipe ②.

(3) Ensure to install a suction pipe ⑤ to each pump.

(4) The suction pipe ⑤ must be as short and straight as possible with minimal bends.

(5) To minimize the piping loss, the bore of the suction pipe ⑤ must be equal to or one size larger than that of the pump.

(6) Be sure to attach a gate valve ⑥ to the suction pipe ⑤.
(For negative suction type, do not attach gate valve ⑥to the suction pipe.)

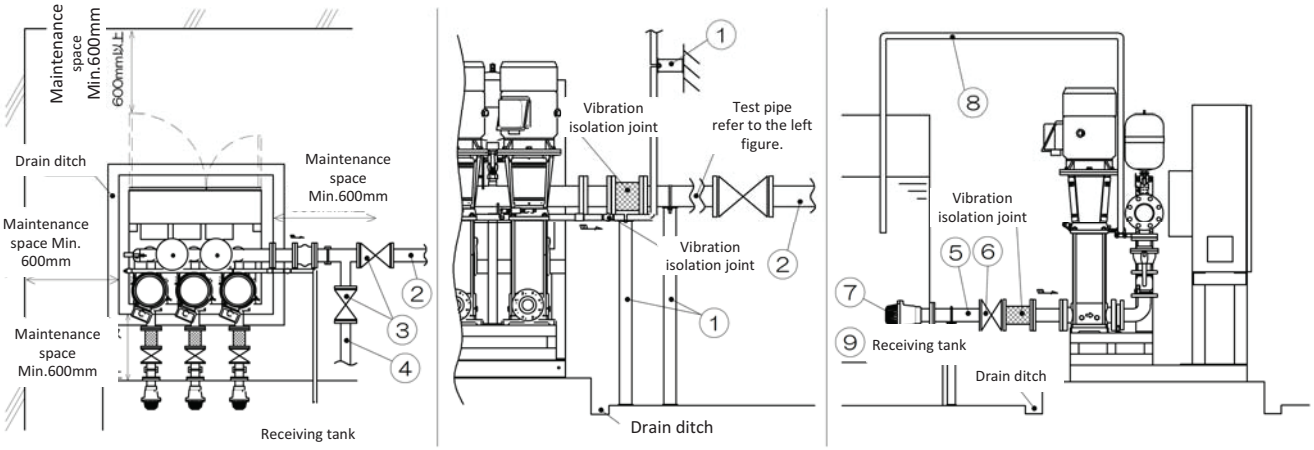
(7) Ensure to attach a strainer ⑦ to the end of the suction pipe ⑤ in order to block the entrance of foreign matter.

(8) A constant relief pipe ⑧ should be returned to the receiving tank at the end and be submerged under the water level.

(9) After piping work, be sure to clean the inside of a receiver tank ⑨ to prevent the entry of foreign matter into the pumps.

Note	For installation procedure of the constant relief pipe, there may be applicable guideline or guideline from local governments or other official institutions. Carefully check for such guidelines and follow the instructions.
Note	For negative suction type, please also refer to “9. Special specification”.

<Piping work example>



Note) Maintenance space indicates manufacturer’s recommendations.

Fig. 3-3 Piping work example

3.4 Precautions for wiring work

Warning		Use the wiring equipment and devices compliant to use conditions and carry out wiring work safely and securely according to the technical standards for electrical facilities, as well as the indoor wiring regulations. Only qualified personnel such as licensed electrical engineers are allowed to carry out electric wiring work. Incomplete wiring work by unqualified persons is prohibited by law.

3.4.1 Wiring work for power supply

Warning		Be sure to install a ground fault interrupter dedicated to this unit at the primary power supply. Otherwise, it may lead to an electric shock and/or fire.
Warning		Ensure to securely install a ground wire to the control panel. Ensure to perform grounding work.
Warning		Connecting a ground wire to gas or water pipes is not only prohibited by law but also extremely dangerous.
Caution		Do not install different or other cables or control wires in one pipe or conduit.
Caution		Do not attach a phase advance capacitor to the secondary wiring of the control panel. Otherwise, it may lead to failures in the inverter or the phase advance capacitor.

(1) On the primary power supply side of the water supply unit, be sure to install a ground fault interrupter dedicated to this unit.
Check the capacity of the ground fault interrupter fitted inside the control panel, and then select a ground fault interrupter on the power supply side in consideration of protection coordination.

(2) Be sure to attach a ground wire to prevent an electric shock.
Connect the ground wire to the ground terminal inside the control panel.

(3) Connect the primary power line to the power terminal block inside the control panel.
Pass each wire through a metal tube or a metal conduit for shielding and ground the covering of the tube.

(4) Control the fluctuation of the voltage within ±10% of the rated voltage, and the frequency within ±5% of the rated frequency.
Keep in mind that if you use the unit at a voltage or frequency out of the range, the unit may break down. Also note that if the power voltage is lower than the rated voltage, an overload may occur even if the flow rate is within the specified range.

(5) Before running the pump, check the following points again:

- An appropriate ground fault interrupter is installed.
- Wiring is correct.
- The unit is securely grounded.
- None of the three wires of the motor has come loose or is disconnected.
  Note that poor or incorrect connection of motor terminals may burn out the motor.

3.4.2 Instrumentation

All instrumentation wiring is connected to terminal blocks on the control board.

Note	Insert the instrumentation wires into the inlet ports for instrumentation wires, secure the wires by passing the binding band through the clamps on the right side face inside the control panel and under the control board, and then connect them to the board. If the clamps are not used for binding the wires, it may cause some trouble in the maintenance of the unit.

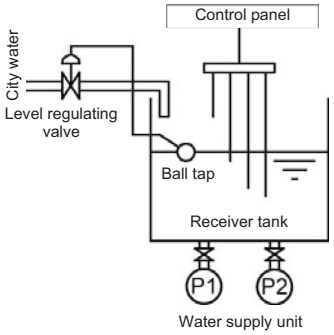
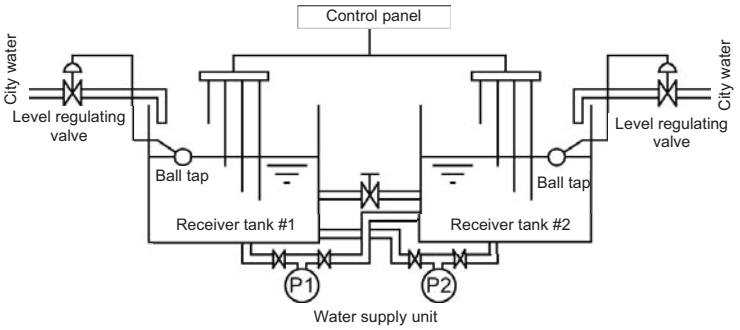
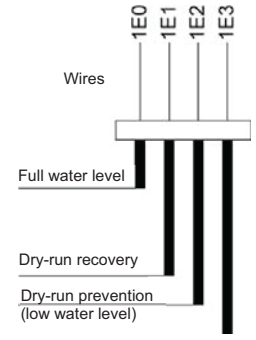
(1) Wiring work for water level control

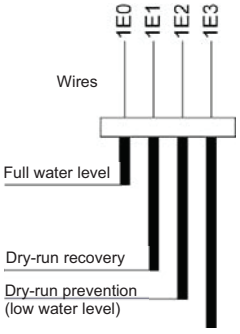
Referring to the following table, connect wires to receiver tank electrodes. Note that in the case of 6-pump unit, wire to control board 1.

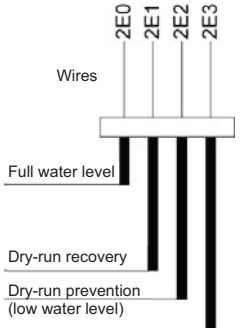
- Ball tap type ·····Table 3-4-2(a)
- Inflow solenoid valve type·····Table 3-4-2(b)

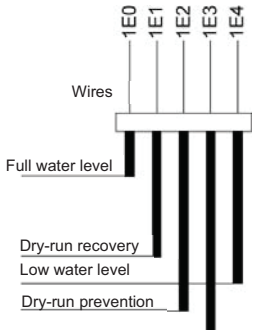
Note	· The Tank Selection setting is set to “No tank” before shipment. Before starting the operation of the pumps with receiver tank electrodes connected, select water tank(s) you use on the operation panel. (→ see 6.2.) · When using an inflow solenoid valve, check the type of the solenoid valve (normally open or normally closed), and set the type (parameter P103). (→ see 6.5.) · Set the Solenoid Valve Operation setting to “自動” on the operation panel before use. (→ see 6.3.)

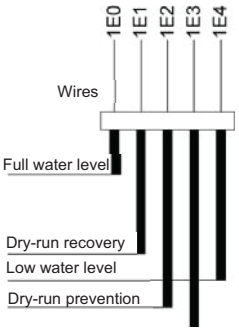
Table 3-4-2 (a) Wiring patterns (ball tap type)

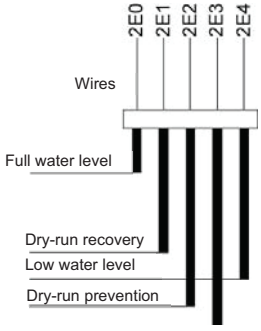
<table>
<tr><th></th><th></th><th>Single receiver tank</th><th>Double receiver tank</th></tr>
<tr><td></td><td></td><td> 
</td><td> 
</td></tr>
<tr><td rowspan="2">4P type electrode</td><td>Settings</td><td>Tank Selection setting: No.1
Solenoid Valve Operation setting: 手動閉
Parameter P101: 4</td><td>Tank Selection setting: 共用
Solenoid Valve Operation setting: 手動閉
Parameter P101: 4</td></tr>
<tr><td>Wiring pattern</td><td>Terminal block for receiver tank No.1
 

Electrodes for receiver tank</td><td>Terminal block for receiver tank No.1
 

Electrodes for receiver tank No.1
Terminal block for receiver tank No.2
 

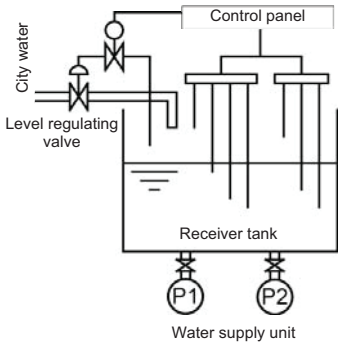
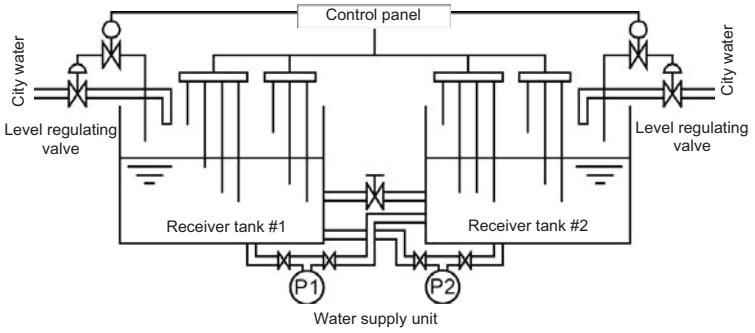
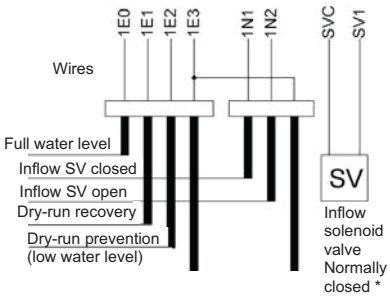
Electrodes for receiver tank No.2</td></tr>
<tr><td rowspan="2">5P type electrode</td><td>Settings</td><td>Tank Selection setting: No.1
Solenoid Valve Operation setting: 手動閉
Parameter P101: 5</td><td>Tank Selection setting: 共用
Solenoid Valve Operation setting: 手動閉
Parameter P101: 5</td></tr>
<tr><td>Wiring pattern</td><td>Terminal block for receiver tank No.1
 

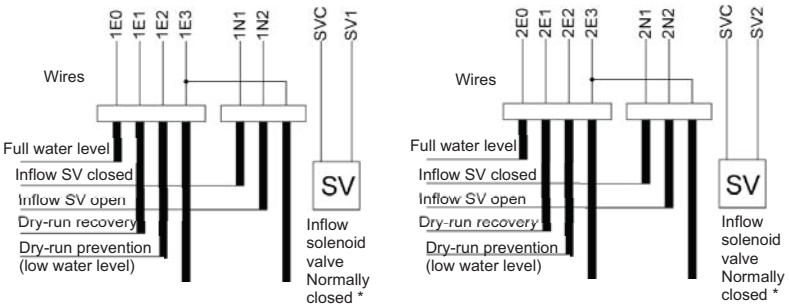
Electrodes for receiver tank</td><td>Terminal block for receiver tank No.1
 

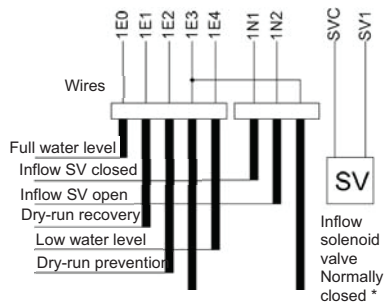
Electrodes for receiver tank No.1
Terminal block for receiver tank No.2
 

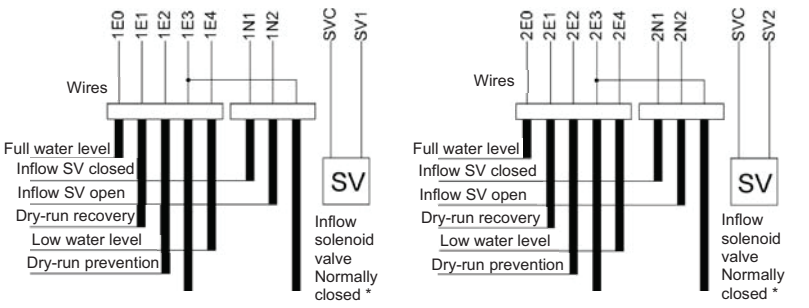
Electrodes for receiver tank No.2</td></tr>
</table>

Table 3-4-2 (b) Wiring patterns (inflow solenoid valve type)

<table>
<tr><td></td><td></td><td>Single receiver tank</td><td>Double receiver tank</td></tr>
<tr><td></td><td></td><td> 
</td><td> 
</td></tr>
<tr><td rowspan="2">4P type electrode</td><td>Settings</td><td>Tank Selection setting: No.1
Solenoid Valve Operation setting: 自動
Parameter P101: 4</td><td>Tank Selection setting: 共用
Solenoid Valve Operation setting: 自動
Parameter P101: 4</td></tr>
<tr><td>Wiring pattern</td><td>Terminal block for receiver tank No.1
 

Electrodes for receiver tank</td><td>Terminal block for receiver tank No.1 Terminal block for receiver tank No.2
 

Electrodes for receiver tank No.1 Electrodes for receiver tank No.2</td></tr>
<tr><td rowspan="2">5P type electrode</td><td>Settings</td><td>Tank Selection setting: No.1
Solenoid Valve Operation setting: 自動
Parameter P101: 5</td><td>Tank Selection setting: 共用
Solenoid Valve Operation setting: 自動
Parameter P101: 5</td></tr>
<tr><td>Wiring pattern</td><td>Terminal block for receiver tank No.1
 

Electrodes for receiver tank</td><td>Terminal block for receiver tank No.1 Terminal block for receiver tank No.2
 

Electrodes for receiver tank No.1 Electrodes for receiver tank No.2</td></tr>
</table>

* A normally-open type inflow solenoid valve can also be used by setting the parameter P103 to the type.

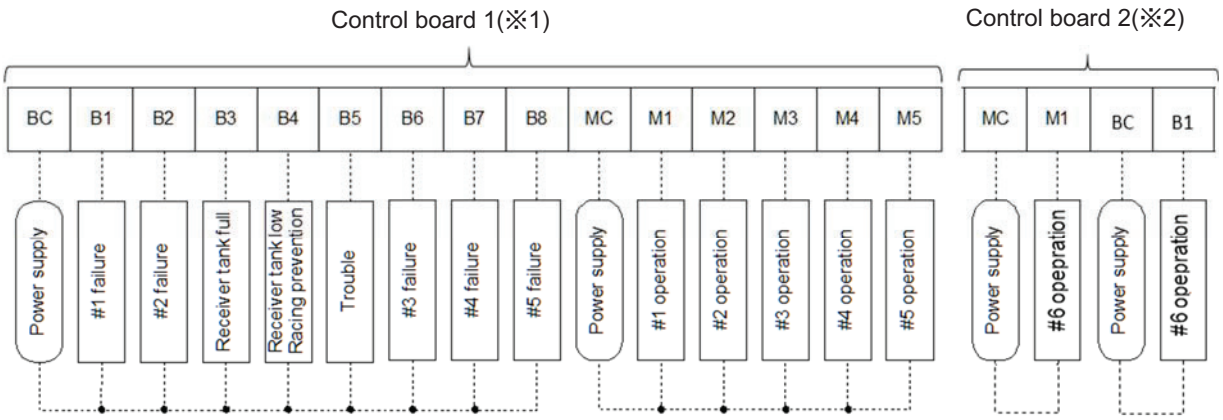
Caution

Provide a ground electrode dedicated to the electrodes for the inflow solenoid valve.

(2) External output signals

Connect wires to the external output terminals as shown in the following diagram.

External output terminals
(Control board I/O terminal block)



※1：For 2-pump unit, the terminal arrangement is different. Also, terminal blocks B6 to B8 and M3 to M5 are not provided.

※2：For 2-pump to 5-pump units, control board 1 is not provided.

Fig. 3-4-2 Standard specification
(Parameter：P100, setting：0)

Note

The parameter P100 allows you to select an external relay output pattern from 5 options.
For details and the setting method, refer to “6.5 Parameter setting.”

4. Preparation for operation

4.1 Points to be checked before test operation

4.1.1 Electrical system

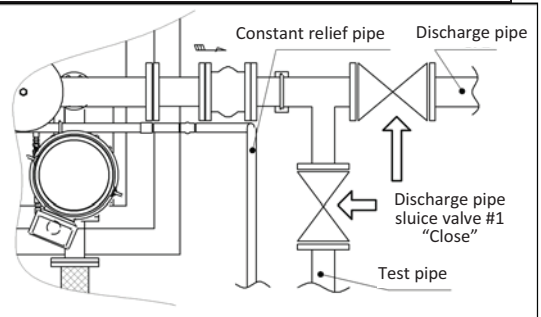
Warning	Before carrying out work such as wiring change, be sure to shut down the power of the panel board and confirm that the pilot lamp is turned off. Otherwise, it may lead to an electric shock.

(1) Check if the unit is correctly wired.
(2) Check if the terminals are securely connected.
(3) Check if the unit is securely grounded.

4.1.2 Pump system

Warning	Before manually turning the pump, be sure to turn off the main power supply of the water supply unit.
Caution	When operating the pump, close the bypass of the check valve. If the bypass is opened, the check valve will not function.
Caution	Never operate the pump without priming water. It may cause seizure to the sliding part inside the pump or damage to the internal parts of the pump due to heat shock.
Caution	When operating the pump discharge valve, be careful not to pinch your hand or fingers between the valve handle and the pump.

(1) Check that the water level of the receiver tank is between the dry-run recovery level and the full water level.
(2) Close the discharge pipe check valve ①.
(3) Make sure that pressure tank drain valve ② is closed and that pressure tank pipe valve ③ is open.
(4) Make sure that the check valve bypass valve ④ is closed, and pump discharge valve ⑤ is open.
(5) Ensure to fully open the relief pipe valve ⑥.
(6) Remove the coupling cover, hold the coupling, and manually turn the pump to confirm that the shaft rotates smoothly and that the rotation is not abnormally heavy.
(7) Open the air vent valve and fully open the suction side gate valve.
(8) Again manually turn the pump to discharge the air inside the impeller and close the air vent valve ⑦.



<Discharge pipe/Constant relief pipe>
Fig. 4-1-2(a) Preparation for pump system operation

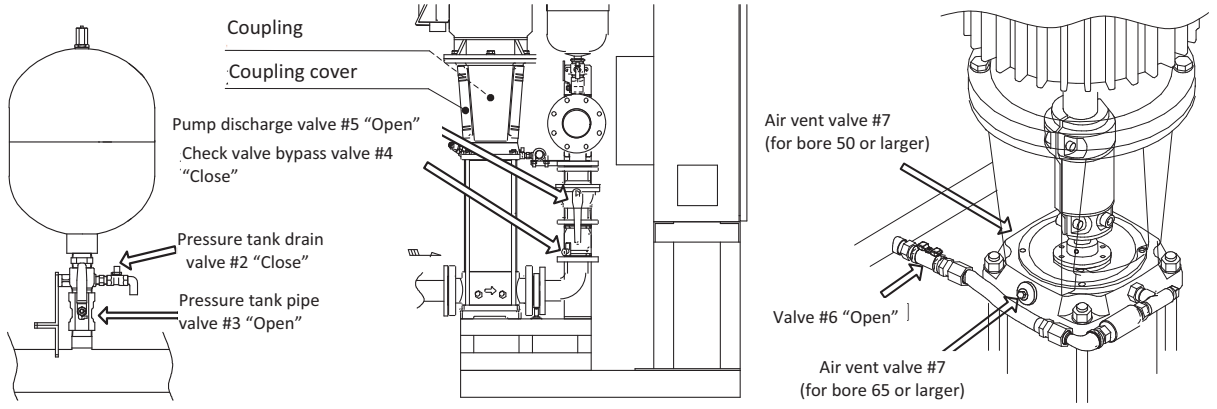


Fig. 4-1-2(b) Preparation for pump system operation

4.2 Turning on the power

Danger	After turning on the power, do not touch any parts other than those mentioned below that are required for operation. Otherwise, it may lead to an electric shock.
Warning	Do not operate the control panel with a wet hand. Otherwise, it may lead to an electric shock and/or a short circuit.

(1) Open the cover of the control panel.
(2) Turn on the main power of the panel board.
(3) Turn on the ground fault interrupter inside the control panel.
(4) Turn on the operation power switch on the control board 2. (This is only for 6-pump unit.)
(5) Turn on the operation power switch on the control board 1.
(6) Check that the pilot lamp on the control board is turned on.

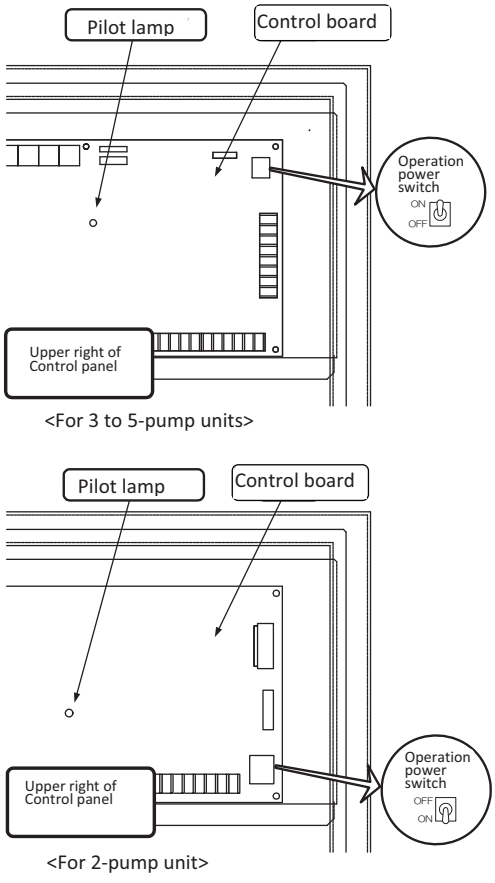


Fig. 4-2(a) Operation power switch and pilot lamp
(2 to 5-pump units)

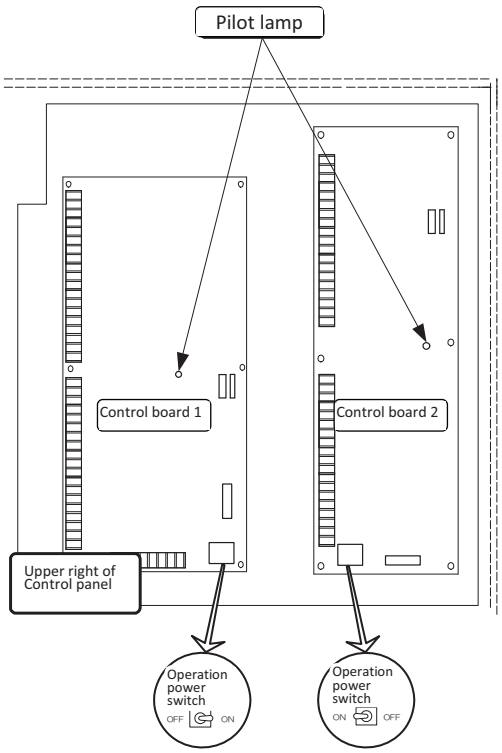
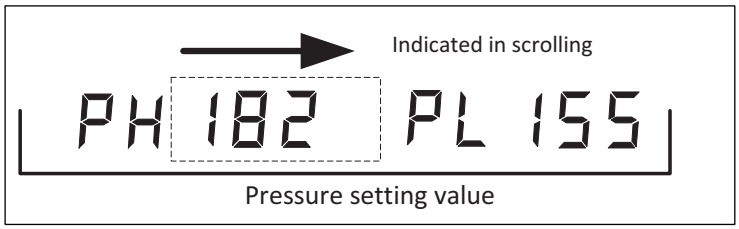


Fig. 4-2(b) Operation power switch and pilot lamp
(6-pump unit)

(7) At that time, the initial set values and other information are shown on the display of the panel, in the following order:

① Program version
When the power is supplied to the board, the system shows the version of the installed control program twice.
Note that the program version is subject to change without notice.

② Pressure setting value
The pressure setting value is indicated on the display in scrolling.



③ Initial check monitor
When the power is turned on, the system checks its status. If no abnormal condition is detected, the flashing Good message appears on the display of the panel for about 2 seconds. If any abnormal condition is detected, the system generates the corresponding alarm.

④ In normal operation
The pressure in the discharge piping is indicated on the display.

Example: Pressure in the discharge piping: 175[m·H_2O] h 175

(8) Close the cover of the control panel.

5. Test operation

5.1 Check items related to manual operation

Note Check the following items related to manual operation for all the pumps.

(1) Select “手動” with the 運転 選択 switch.

(2) Press “手動” switch n号 手動 of the pump to be operated (pump No. should be indicated instead of “n”.), and then press the cursor switch △ n. While gradually increasing the operation frequency, make sure that if the following does not have problems.

① Installation and piping condition (if water leakage or abnormal vibration, etc. is not caused.)
② Pump rotation direction
(Remove the coupling cover, start/stop the pump, and check the rotation direction. The counterclockwise rotation is correct direction when viewed from the external fan side of the motor. After checking the rotating direction, be sure to install the coupling cover.
③ Priming condition (if you hear water flowing or not)

Switches to operate

For pump #1 operation	• • •	1号 手動 確定	△ 1	▽ 1
For pump #2 operation	• • •	2号 手動 戻る	△ 2	▽ 2
For pump #3 operation	• • •	3号 手動	△ 3	▽ 3
For pump #4 operation	• • •	4号 手動	△ 4	▽ 4
For pump #5 operation	• • •	5号 手動	△ 5	▽ 5
For pump #6 operation	• • •	6号 手動	△ 6	▽ 6

Warning Do not remove the coupling cover except for maintenance.

(3) While confirming that the pump is running properly, gradually open the gate valve of the test pipe until air is completely removed from the pump.

Warning	⊘	Do not run the pump continuously for over one minute while the gate valve on the discharge line is shut (zero-discharge operation). Otherwise, the temperature and pressure will increase inside the pump, which may damage the pump and/or cause steam to blow off.
Caution	❗	Make sure to install a constant relief pipe and always keep the valve of each relief pipe fully open.

(4) After air has been completely removed, shut the gate valve of the test pipe.

(5) Press the “Manual” switch of the running pump to stop the pump.

5.2 Check items related to automatic operation

Select “自動” with the 運転 選択 switch to perform automatic operation.

First, carefully read the following sections to understand how automatic operation works, and then confirm that the unit runs properly in automatic modes using the test pipe. During the operation, also check each pump for any abnormal pressure, noise, or vibration.
Note that you can change the Total Head setting and the Minimum Pump Head setting from their factory defaults, depending on the conditions on site. Follow the instructions in “6.5 Parameter setting” in such a case.

＜Explanation about operation (2-pump Parallel, 3-pump Rotation type)＞
The “2-pump Parallel, 3-pump Rotation” operation uses 3 pumps. In this operation, the 3 pumps are operated in rotation when the water consumption is below the max. water supply amount of one pump, and 2 pumps will be operated together in parallel when the water consumption exceeds the max. water supply amount of one pump.

(1) When the hydrant is opened and the water is consumed, the pressure inside the discharge pipe will decrease. When the pressure inside the discharge pipe decreases to near the preset min. pump head (P_L), it is detected by the pressure transmitter, which makes the pump to start.
(2) While the water consumption is below the max. water supply amount (Q_3), the discharge pressure is changed from P_L to P_H by controlling the rotating speed with the inverter according to the increase/decreased in water consumption, which makes the estimated terminal pressure constant-controlled.
(3) When the water consumption increases to near the water supply amount of the 2nd parallel pump (Q_2), the 2nd pump starts operating.

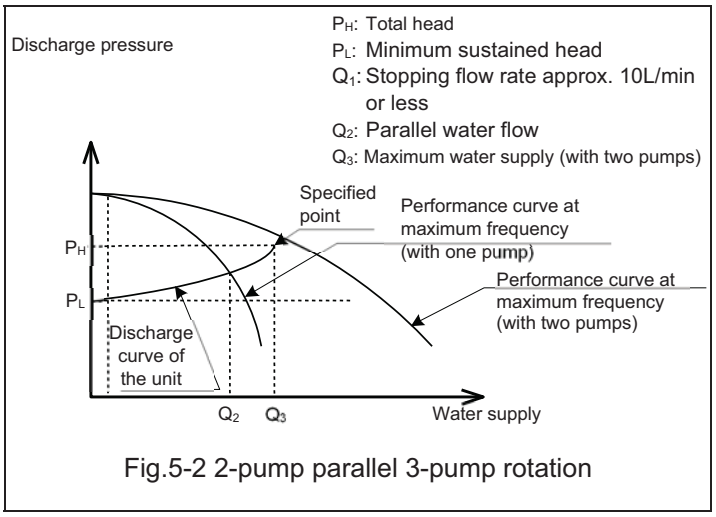


Fig.5-2 2-pump parallel 3-pump rotation

(4) If the water supply amount changes even while 2 pumps are operated in parallel, the operation continues at pressure corresponding to the unit discharge curve.
(5) When the water consumption decreases and the pressure decreases to below the water supply amount of the 2nd unit in parallel operation (Q_2), the 2nd pump stops, and the 1st pump only continues the operation.
(6) When the water consumption decreased to below the stop flow rate (Q_1), it is detected by the flow switch, which makes the pump to stop. While the pump is stopped, the operation indicator lamp will blink. (See 6.5.3.)
(7) When the hydrant is opened and the water is used again, the pump which has been stopped starts operating as above.

Note Operations based on the above operation should be performed for other operation method.

6. Basic operations and indications/settings

This section describes detailed information about operation, display and setting for the unit.

6.1 Pump Operation

6.1.1 Selecting operation mode

Select an operation mode with the [運転 選択] switch on the operation panel.

Table 6-1 Operation mode selection

手動 停止 自動 ◉ ○ ○	**“手動”** This mode is to operate the pump manually. For the instruction of the manual operation, refer to “6.1.2 Manual Operation”.
手動 停止 自動 ○ ◉ ○	**“停止”** In this mode, the pump will not operate under any circumstances.
手動 停止 自動 ○ ○ ◉	**“自動”** In this mode, the pressure transmitter, flow switch, etc. detect pressure inside the discharge pipe or flow rate of water consumed to automatically operate/stop the pump. Select this mode normally.

The system enables the setting of “手動” or “自動” one second after the indicator lamp comes on.

6.1.2 Manual operation

In “手動” mode, you can start and stop each pump with the [1号 手動 確定] [2号 手動 戻る] [3号 手動] [4号 手動] [5号 手動] or [6号 手動] switches on the operation panel. You can also change the operation frequency of the corresponding pump with the [n△] [n▽] switches (pump No. should be indicated instead of “n”.) on the operation panel.

① When the switch is pressed while the pump is stopped, the pump will be operated.

② When the switch is pressed while the pump is operated, the pump will be stopped.

6.1.3 Automatic operation

As soon as “自動” mode is enabled, the system starts the automatic operation.
For the procedures, refer to “5.2 Check items related to automatic operation.”

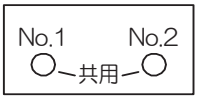
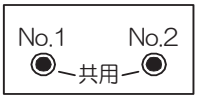
Note When a pump is running in either mode (手動 or 自動), the system turns on the corresponding operation indicator lamp in steady or blinking lamp and outputs the operation signal.

6.2 Selecting a receiver tank

Select a receiver tank to be used with the 水槽選択 switch on the operation panel.

For selecting a water tank and the circuits to be used, refer to Table 6-2-2.

Table 6-2-1 Water Tank Selection

	**“No tank”** Select this mode when the control for the receiver tank is not used. When this mode is selected, the electrode signal will be ignored, and preventing dry operation will not be performed. Solenoid valve operation cannot be selected since all the indicator lamps are turned off.
	**“Tank No.1”** This mode is to select the water tank No.1. When only one receiver tank is used, select this mode. Also select this mode to clean the water tank No. 2 in “共用” mode.
	**“共用”** Select this mode to operate 2 receiver tanks. To select this mode, provide a communicating tube between the tanks to make the water levels of both the tanks equal.
	**“Tank No.2”** This mode is to select the water tank No.2. Select this mode when cleaning the water tank No. 1 in “共用” mode.

“No tank” is selected before shipment.
The system enables the setting one second after the indicator lamp comes on.

Table 6-2-2 Water tank selection and circuit used

Selected water tank	Water level electrode circuit		Solenoid valve circuit
	For alarm and dry-run prevention	For solenoid valve	
No. 1	1E0, 1E1, 1E2, 1E3, 1E4	1N1, 1N2	SVC-SV1
共用	1E0, 1E1, 1E2, 1E3, 1E4	1N1, 1N2	SVC-SV1 SVC-SV2
No. 2	2E0, 2E1, 2E2, 2E3, 2E4	2N1, 2N2	SVC-SV2
No tank	N/A	N/A	N/A

6.3 Selecting the operation of the inflow solenoid valve

You can select the operation of the inflow solenoid valve with the 電磁弁 動作 選択 switch on the operation panel.

Note that setting the Tank Selection to “No tank” disables these settings.

Table 6-3 Solenoid Valve Operation setting

手動開 手動閉 自動 ◉ ○ ○	**“手動開”** The inflow solenoid valve is normally open.
手動開 手動閉 自動 ○ ◉ ○	**“手動閉”** The inflow solenoid valve is normally closed.
手動開 手動閉 自動 ○ ○ ◉	**“自動”** The inflow solenoid valve is automatically controlled according to the water level of the tank.

Except for selecting “手動閉,” the system enables the setting in one second after the indicator lamp comes on.

Note

For the electrode circuit and the solenoid valve circuit to be used, see Table 6-2-2.
Setting the Tank Selection to “No tank” turns off all the indicator lamps for the Solenoid Valve Operation setting and disables the operation of the solenoid valve.
Then, if you change the Tank Selection to any options other than “No tank,” the system automatically selects the Solenoid Valve Operation to “手動閉.”
Whether the solenoid valve is normally open or normally closed while eenergized depends on the solenoid valve type (Parameter P103) setting.

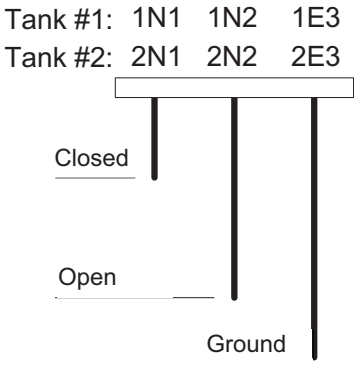


Fig. 6-3 Electrodes for automatic control of the solenoid valve

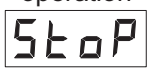
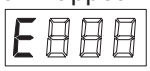
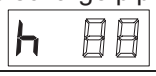
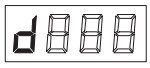
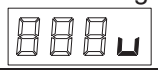
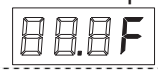
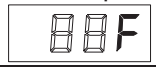
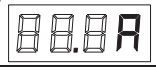
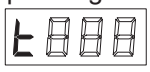
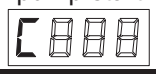
Caution

Provide a ground electrode dedicated to the electrodes for the inflow solenoid valve.

6.4 Indications on the display

The items described in Table 7-4 can be displayed, through display switching procedures.
For the procedures, refer to each section shown in the “Reference page” column.

Table 7-4 Display item list

Display item	Description	Priority	Category	Reference page
Interlocking in operation 	It shows that the system is currently suspended by an interlock signal received from an external source. The message appears only when the interlock function is activated.	①	Basic information	6-5
Alarm appearing 	When the alarm is given, the alarm code is displayed. The message appears only when an alarm occurs. If multiple alarms are given at the same time, the displayed codes are switched every two seconds.	②	Basic information	6-5
Pressure inside the discharge pipe 	Pressure inside the discharge pipe is displayed. Indication unit : Hydraulic head meter [m·H2O]	③	Basic information	6-5
Number of start times of the unit 	Number of start times of the unit on the previous day is displayed. The counter starts when the power is turned on. When the counter exceeds 999, it is scrolled for display.	-	Basic information	6-5
Power voltage 	The power voltage detected in the inverter section is displayed. Indication unit: [V]	-	Basic information	6-5
Alarm log	Up to past 5 alarm histories are displayed.	-	Basic information	6-6
Operation frequency 	Operation frequency during automatic operation for each pump is displayed. Indication unit: Hertz [Hz] < one decimal place>	-	Pump information	6-6
Preset frequency 	Preset frequency for manual operation of each pump is displayed. Indication unit: Hertz [Hz] <increment of 1 Hz>	-	Pump information	6-7
Operation current 	Operation current for each pump is displayed. Unit of indication: Ampere [A] <one decimal place>	-	Pump information	6-6 6-7
Cumulative pump operating time 	The cumulative operating time of each pump is displayed. Unit of indication: Hours When the time exceeds 999 hours, it is scrolled for display.	-	Pump information	6-6
Cumulative number of pump start 	The cumulative number of starts of each pump is displayed. When the counter exceeds 999, it is scrolled for display.	-	Pump information	6-6

To display in scrolling, add a period to the millionth or thousandth digit.

6.4.1 How to switch basic information display

Normally, the display shows the pressure in the discharge piping.

In special cases such as the activation of an interlock, the occurrence of an alarm, or during the freeze-proofing cycle, however, the display shows the corresponding message based on the sequence specified in Table 6-4.

To switch the indications on the display, press the keys at the “Indication Switching Operation” shown below.

The display automatically returns to normal indication when no operation is carried out for 30 seconds.

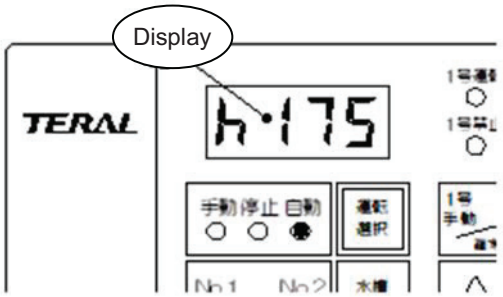


Fig. 6-4-1(a) Display
(e.g. when the pressure in discharge piping is 175 m·H_2O)

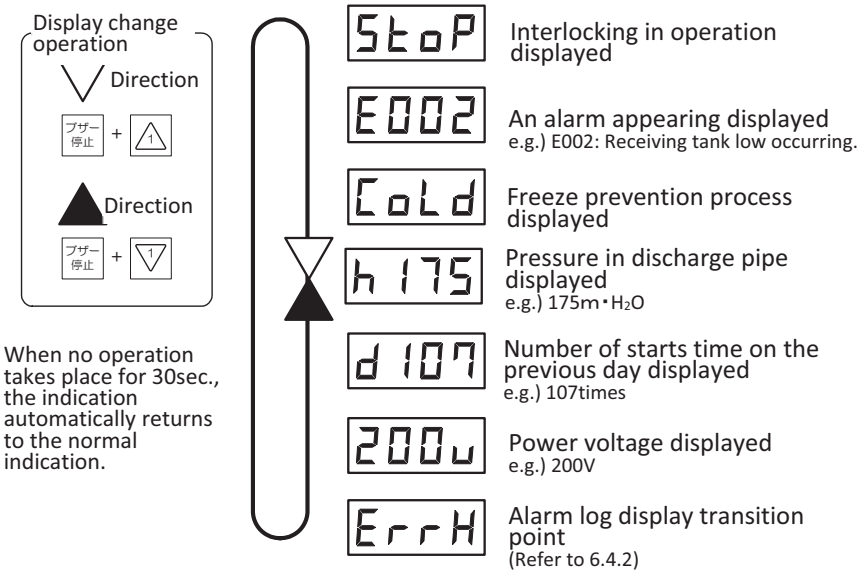


Fig. 6-4-1(b) Basic information - Changing the display item

Note

The displays for “Interlocking in operation” and “Alarm appearing,” are indicated only when the necessary conditions are met.
The “Number of starts time on the previous day” remains “0” for 24 hours after the power is turned on.

6.4.2 How to display alarm logs

Press the 1号 手動 確定 switch at the alarm log display transition point ErrH to enter the alarm log display mode.

In the alarm log display mode, you can view up to 5 alarms by pressing the 1 or 1 switch.

The display returns to normal indication by pressing the 2号 手動 戻る switch or when no operation is carried out for 10 seconds.

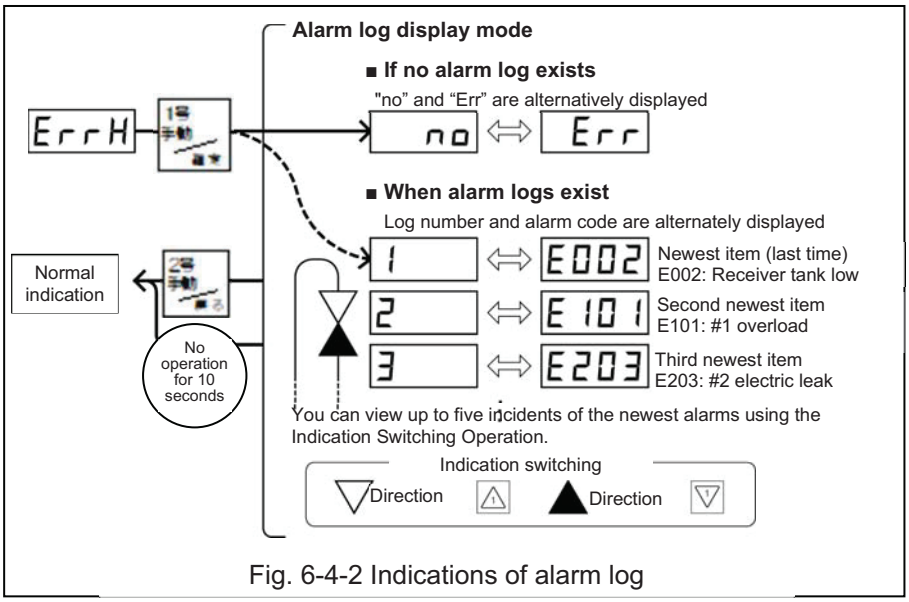


Fig. 6-4-2 Indications of alarm log

Note

- Alarms are recorded in the log as soon as they are generated.
- Smaller numbers are assigned to newer items: the latest item is 1 and the oldest item is 5.
- When five incidents are recorded in the log, the system discards the oldest alarm (item No.5) in the event of a new alarm.
- The alarm log is retained even when the power is turned off.

6.4.3 How to display pump information

(A) If the operation mode is set to "自動" or "停止":

When the basic information is displayed, press 1 or 1 switch and Pump no.1 information is displayed.

Similarly, press either 2 3 4 5 6 or 2 3 4 5 6 switch. Information for No.2 to 6 pumps is displayed.

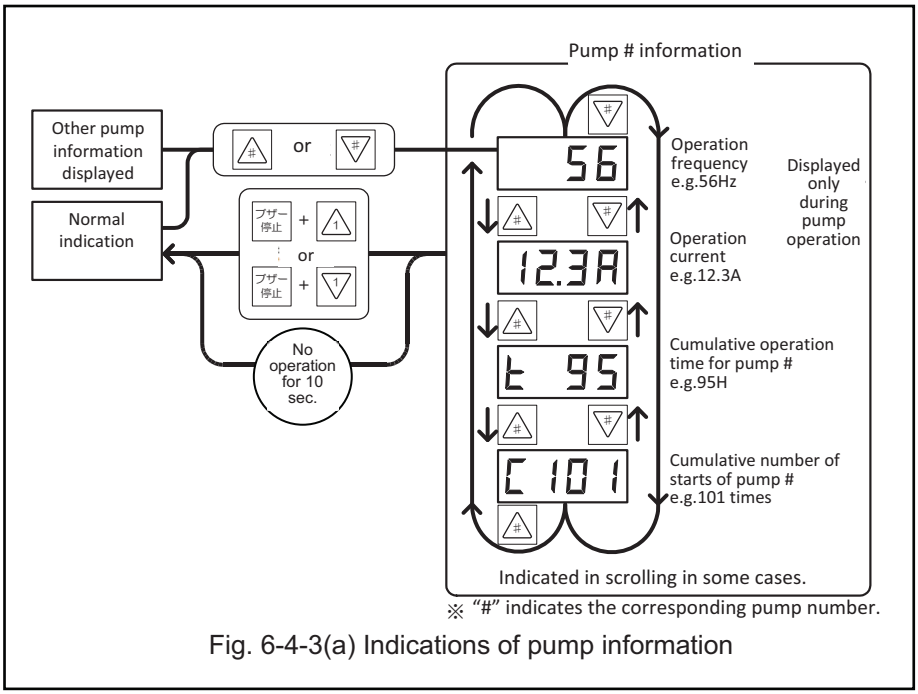


Fig. 6-4-3(a) Indications of pump information

The display returns to normal indication when no operation is carried out for 10 seconds or through indication switching operation for basic information.

Note

"Cumulative operation time" and "Cumulative number of starts" are retained even when the power is turned off.
Note that because the data is written into the memory device only once every 2 hours, unsaved new information (within up to 2 hours) is lost when the power is turned off.

(B) If the operation mode is set to “Manual”:

When basic information is displayed, press ▲1 or ▽1 switch and the Pump no.1 information is displayed. Similarly, press either ▲2 ▲3 ▲4 ▲5 ▽6 or ▽2 ▽3 ▽4 ▽5 ▽6 switch. Information for No.2 to 6 pumps is displayed.

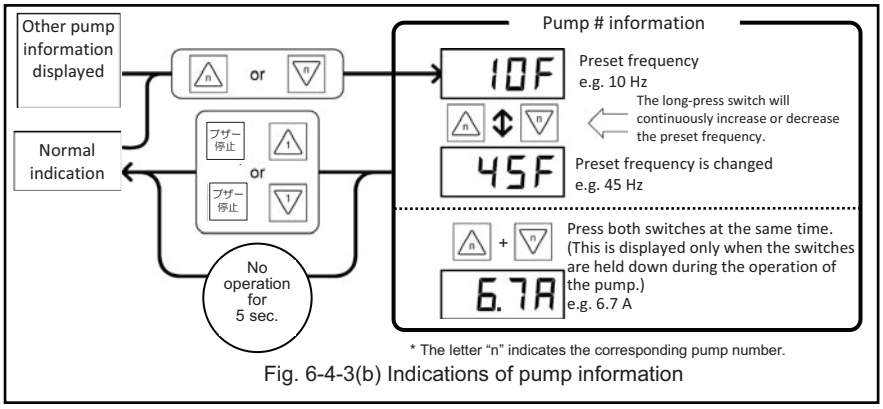


Fig. 6-4-3(b) Indications of pump information

The display returns to normal indication when no operation is carried out for 5 seconds or through the Indication Switching Operation for basic information.

6.5 Parameter settings

Functions of the water supply unit can be configured and adjusted using parameters.
Parameter settings are retained when the power is turned off.

6.5.1 Parameter list

Table 6-5-1 Parameter list

Class	Display code	Parameter	Initial value	Adjustable range
Basic	PH	Total pump head	10	1 to 255 [m·H_2O]
	PL	Min. sustained head	7	1 to PH [m·H_2O]
	1Go	Permission for No. 1 run	on	on : Permission for No. 1 run off : Inhibition for No. 1 run
	2Go	Permission for No. 2 run	on	on : Permission for No. 2 run off : Inhibition for No. 2 run
	3Go	Permission for No. 3 run*1	on	on : Permission for No. 3 run off : Inhibition for No. 3 run
	4Go	Permission for No. 4 run*1	on	on : Permission for No. 4 run off : Inhibition for No. 4 run
	5Go	Permission for No. 5 run*1	on	on : Permission for No. 5 run off : Inhibition for No. 5 run
	6Go	Permission for No. 6 run*1	on	on : Permission for No. 6 run off : Inhibition for No. 6 run
	CHEC	Inspection mode	off	on : In inspection mode off : In normal mode
	ECO	Energy-saving operation setting	on	on : enables energy-saving operation off : disables energy-saving operation
Extended	P100	External relay output pattern	0	0 to 4 : → refer to 6.5.4 (1).
	P101	Number of water level electrodes	4	4 : 4 poles 5 : 5 poles
	P102	5P electrode pattern	0	0 : Standard 1 : Special
	P103	Solenoid valve type	0	0 : Opened when power is turned on 1 : Closed when power is turned on
	P104	Solenoid valve control system	0	0 : All together 1 : Alternately
	P105	Interlock signal	0	0 : Contact “a” 1 : Contact “b
	P200	Buzzer stop time	60	0 : No buzzer 1 to 60 : Time until the buzzer stops [min.] 99 : No buzzer stop
	P202	Abnormal start frequency alarm detection	1	0 : Not detected 1 : Detected
	P203	Water level alarm resetting method	0	0 : Manual 1 : Automatic

*1) It may not be displayed depending on the unit type (operation method).

Note

The initial settings shown above are standard factory defaults.
If you specify a different value or option upon placing an order, the specified value and option are preset in the parameter.

6.5.2 Parameter setting procedure

Parameters are set in “Setting mode.”

① Entering the setting mode

When the normal indication is displayed, hold down the [設定] switch for at least 3 seconds to enter the “setting mode.”
When the system enters the setting mode, the basic parameter selection screen appears, and the indicator lamp alternately shows [PH] and the set value.
The parameter selection screen alternately shows a parameter name and its set value.

② Selecting a parameter to be set

Press the [△1] or [▽1] switch to cycle through the parameters until the target parameter appears.
To select an extended parameter, press the [1号 手動 確定] switch while [oPtn] is displayed, which enters the extended parameter selection screen.
To return to the basic parameter selection screen from the extended parameter selection screen, press the [2号 手動 戻る] switch.

③ Changing a set value

Press the [1号 手動 確定] switch on the parameter selection screen to enter the set value change screen.
Only the preset value is shown in the set value change screen.
Press the [△1] or [▽1] switch to change the set value.

Note

Extended parameters can be changed only when the operation mode is set to “停止.”
In “手動” or “自動” operation mode, pressing the [1号 手動 確定] switch on the extended parameter selection screen the alarm will sound a warning buzzer and does not enter the set value change screen.

④ To save the change of the set value

When you have changed the set value, press the [1号 手動 確定] switch to confirm the change of the set value.
When the change is entered, the system makes a beep sound and the display flashes three times.
Then it automatically goes back to the parameter selection screen.

⑤ Canceling the change of the set value

To cancel the change of the set value and return to the parameter selection screen, press the [2号 手動 戻る] switch.

⑥ Exiting the setting mode

Press the 設定 switch to exit the setting mode and return to the normal mode.

Also, when no operation is carried out for 60 seconds in the setting mode, the system automatically exits the setting mode and returns to the normal mode.

Note

If you press the 設定 switch to exit the setting mode without confirming the change, the setting change will be discarded.

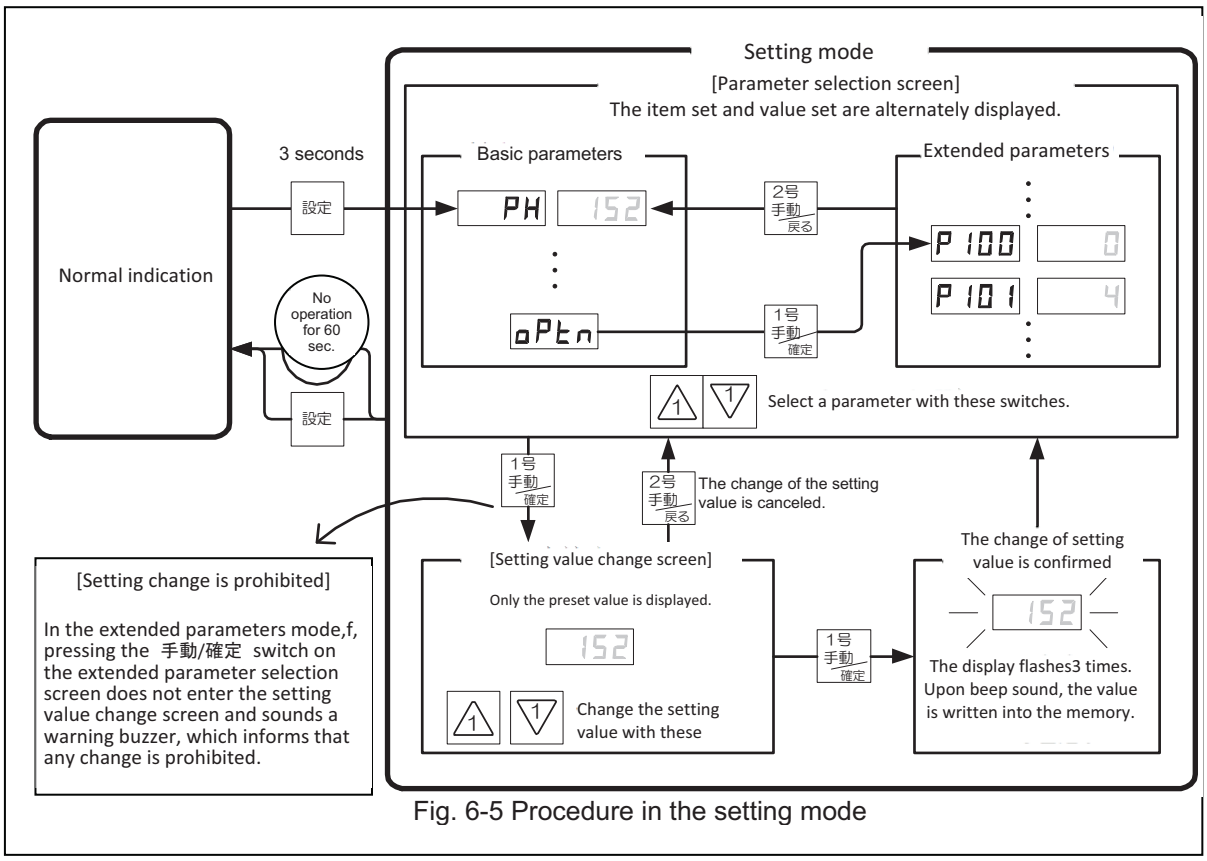


Fig. 6-5 Procedure in the setting mode

6.5.3 Basic parameters

The following are basic parameters for using the water supply unit.

(1) Total pump head

: Total Pump Head

Function	Selects the total head for automatic operation.
Adjustable range	1 to 255 [m·H_2O]
Remarks	The setting values are set at the time of shipment based on the required specifications at the time of order (as shown on the unit nameplate). If you need to change the setting values, contact us.

(2) Minimum sustained head

: Minimum sustained head

Function	Selects the minimum sustained head for automatic operation.
Adjustable range	1 to PH [m·H_2O]
Remarks	The setting values are set at the time of shipment based on the required specifications at the time of order (as shown on the unit nameplate). If you need to change the setting values, contact us.

Caution

Properly make the settings depending on the conditions of use. Incorrect settings may hinder the normal operation of the water supply unit.

(3) Operation permission setting

: Setting for permission for No. 1 run

: Setting for permission for No. 2 run

: Setting for permission for No. 3 run

: Setting for permission for No. 4 run

: Setting for permission for No. 5 run

: Setting for permission for No. 5 run

Function	Permits or prohibits the operation of each pump.
Adjustable range	 : Operation permitted  : Operation blocked
Initial setting	 : Operation permitted
Remarks	Setting this to “Operation blocked” turns on the corresponding “n” block indicator lamp on the operation panel. * The letter “n” indicates the corresponding pump number (1 to 6).

(4) Inspection mode setting

CHEC : Inspection mode setting

Function	Enters/Exits the inspection mode. * The contents of the inspection mode setting are not retained when the power is shut off.
Setting range	on : In inspection mode oFF : In normal mode
Initial setting	oFF : In normal mode
Remarks	For the inspection mode, refer to “7.2 Inspection mode.”

(5) Energy-saving operation setting

ECO : Energy-saving operation setting

Function	Enables/Disables the energy-saving operation. The energy-saving operation enables variable control of pump-stop period depending on the operation conditions of the unit in automatic mode.
Adjustable range	on : Enables the energy-saving operation oFF : Disables the energy-saving operation
Initial setting	on : Enables the energy-saving operation
Remarks	If the energy-saving operation is disabled, the pump-stop check period is set to 60 seconds.

6.5.4 Extended parameters

The following are extended parameters for setting or adjusting various functions of the water supply unit.

Note Extended parameters can be changed only when the operation mode is set to “停止.” Therefore, make the settings before starting the operation of the water supply unit.

(1) External relay output pattern setting

P 100 : External relay output pattern setting

Function	Selects a pattern of the signals to be output from the relays M1 to M5, and B1 to B8. For the patterns, see Table 6-5-4.
Adjustable range	0 to 4
Initial setting	0 (This can be preset to a value that is specified when an order is placed.)
Remarks	The common terminal for M1 to M5 is MC, and the common terminal for B1 to B5 is BC.

Table 6-5-4 External relay output pattern

Board	Terminal	P100 set value				
		0	1	2	3	4
Control board 1	M1	No. 1 run	No. 1 run	No. 1 run	No. 1 run	All run *7
	M2	No. 2 run	No. 2 run	No. 2 run	No. 2 run	On inspection *8
	M3*10	No. 3 run	No. 3 run	No. 3 run	No. 3 run	-
	M4*10	No. 4 run	No. 4 run	No. 4 run	No. 4 run	-
	M5*10	No. 5 run	No. 5 run	No. 5 run	No. 5 run	-
	B1	No. 1 failure *1	Serious failure*3	Overload	INV trip *9	No. 1 failure *1
	B2	No. 2 failure *1	Slight failure*4	Discharge pressure abnormal drop	Discharge pressure abnormal drop	No. 2 failure *1
	B3	Full water	-	Electric leakage	Electric leakage	Receiver tank full
	B4	Receiver tank low Dry-run prevention	-	Abnormal water level *5	Abnormal water level *5	Receiver tank low Dry-run prevention
	B5	Trouble *2	Any failure *6	Any failure *6	Any failure *6	Trouble *2
	B6*10	No. 3 failure *1	-	-	-	No. 3 failure *1
	B7*10	No. 4 failure *1	-	-	-	No. 4 failure *1
	B8*10	No. 5 failure *1	-	-	-	No. 5 failure *1
Control board 2	M1*11	No. 6 run	No. 6 run	No. 6 run	No. 6 run	-
	B1*11	No. 6 failure *1	-	-	-	No. 6 failure *1

*1 The “No.(n) failure” signal is output if one of the following alarms occurs at the No.(n) pump. (n: 1 to 6)
Discharge pressure abnormal drop, Electric leak, INV trip, High temperature, Flow switch failure

*2 The “Trouble” signal is output if one of the following alarms occurs.
Electrode failure, Start frequency failure, Pressure transmitter 1 failure, EEPROM error, Communication error between control boards*12

*3 The “Serious failure” signal is output if no pumps can run in automatic mode in the event of an error. Note that the signal is not output if the “Operation Permission” settings for all the pumps are set to “Operation blocked.”

*4 The “Slight failure” signal is output if any of the pumps can still run in automatic mode in the event of an error.

*5 The “Abnormal water level” signal is output if any of the “Receiver tank full,” “Receiver tank low,” “Dry-run prevention,” or “Electrode failure” alarms occur.

*6 The “Any failure” signal is output if any type of an alarm occurs.

*7 The “Run” signal is output if any of the pumps are running.

*8 The “On inspection” signal is output in inspection mode.

*9 The “INV trip” is output if one of the following alarms occurs.
Overload, Overcurrent, Overvoltage, Undervoltage, Open phase input, Inverter overload, Open phase output, Inverter overheat, Communication error, Inverter trouble 1, Inverter trouble 2

*10 The terminal is not available for 2-pump unit.

*11 The terminal is not available for 2 to 5 pump units.

*12 When communication error between control boards occurs, No.6 pump cannot keep operation. If No. 6 pump is running, the pump will stop.

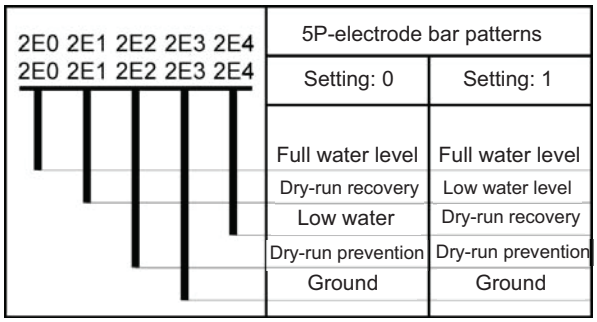
(2) Pole number setting of water level electrodes

P 101 : Pole number setting of water level electrodes

Function	Selects the number of electrode bars for measuring the water level
Adjustable range	4: 4 electrode bars (4P) 5: 5 electrode bars (5P)
Initial setting	4: 4 electrode bars (4P) (If you specify the other value upon placing an order, the specified value is preset in the parameter.)
Remarks	Setting this to “4 electrode bars” causes the system to ignore the input of the electrode bars 1E4 and 2E4.

(3) 5P-electrodes pattern setting

P 102 : 5P-electrodes pattern setting

Function	Selects the pattern for assigning a monitoring task to each electrode when the “Number of Water Level Electrode Bars” setting is set to “5 electrode bars.”  5P-electrode bar patterns Setting: 0 / Setting: 1 Full water level / Full water level Dry-run recovery / Low water level Low water / Dry-run recovery Dry-run prevention / Dry-run prevention Ground / Ground
Adjustable range	0: Standard 1: Special
Initial setting	0: Standard (If you specify the other value upon placing an order, the specified value is preset in the parameter.)
Remarks	This setting is ignored when 4 electrode bars are selected.

(4) Solenoid valve type setting

P 103 : Solenoid valve type setting

Function	Selects the type of the solenoid valve connected to the control panel.
Adjustable range	0: Normally open type 1: Normally closed type
Initial setting	0: Normally open type (If you specify the other value upon placing an order, the specified value is preset in the parameter.)
Remarks	-

(5) Solenoid valve control method setting

P 104 : Solenoid valve control method

Function	When the Tank Selection is set to “共用” and the Solenoid Valve Operation is set to “自動 selects whether the solenoid valve for Tank No.1 and the solenoid valve for Tank No.2 are controlled simultaneously or alternately.
Adjustable range	0: Simultaneous control 1: Alternate control
Initial setting	0: Simultaneous control (If you specify the other value upon placing an order, the specified value is preset in the parameter.)
Remarks	When the Solenoid Valve Operation is set to “手動閉” or “手動開,” both solenoid valves are simultaneously controlled regardless of this setting.

(6) Interlock signal setting

P 105 : Interlock signal setting

Function	Selects the signal type used for the interlock function that forcibly stops the water supply unit. No-voltage a-contact or no-voltage b-contact can be used for the signal. When no interlock is connected, select “Setting 0: no-voltage a-contact.”
Adjustable range	0: No-voltage a-contact activates the interlock mechanism when the contact is closed. 1: No-voltage b-contact activates the interlock mechanism when the contact is open.
Initial setting	0: No-voltage a-contact (If you specify the other value upon placing an order, the specified value is preset in the parameter.)
Remarks	If an interlock signal is received when the system is stopped, the message StoP appears on the display. If StoP appears without any signal inputs, this setting may be wrong. Therefore, check whether this setting is consistent with the type of signals in use.

(7) Buzzer stop time setting

P200 : Buzzer stop time setting

Function	Selects the time period after which the buzzer automatically stops in the event of an alarm. If this is set to “0,” the buzzer does not sound in the event of an alarm.
Adjustable range	0: Disables the buzzer 1 to 60: Period after which the buzzer automatically stops [minutes] 99: Turns OFF the automatic buzzer stop function
Initial setting	60 [minutes] (If you specify a different value upon placing an order, the specified value is preset in the parameter.)
Remarks	In addition to this automatic stop function, it is possible to manually stop the buzzer by pressing the ブザー停止 switch.

(8) Starting frequency failure alarm detection setting

: Starting frequency failure alarm detection

Function	Selects whether or not to detect a start-frequency failure alarm.
Adjustable range	0: No detection 1: Detection
Initial setting	1: Detection (If you specify the other value upon placing an order, the specified value is preset in the parameter.)
Remarks	-

(9) Water level alarm reset setting

: Water level alarm reset setting

Function	Selects the method to reset the water level alarms (Receiver tank full, Receiver tank low, and Dry-run prevention): Manual reset by using the reset switch or Automatic reset by the recovery of water level.
Adjustable range	0: Manual reset 1: Automatic reset
Initial setting	0: Manual reset (If you specify the other value upon placing an order, the specified value is preset in the parameter.)
Remarks	Selecting Automatic reset automatically resets an active water level alarm when the water level is recovered. Generated alarms can be checked in the alarm log.

7. Maintenance and inspection

7.1 Precautions for maintenance and inspection

Carry out maintenance and inspection of the water supply unit according to the “7.3 Maintenance check list.”

Warning	If any problem is found during inspection, immediately stop operation, and remove the cause or contact TERAL INC. Otherwise, it may lead to an accident.
Warning	Regularly inspect your equipment and perform maintenance on each component.
Caution	Ensure to carry out a daily/periodic inspection according to the checklist. Otherwise, it may be impossible to prevent potential failures and accidents and it also shortens the product life.

■ **When carrying out a daily inspection, carefully observe the following points:**

- A large deviation in the pump’s discharge pressure, current, vibration, noise, or other conditions from the normal status is a possible fault. Therefore, immediately perform detailed inspection and maintenance. For this purpose, it is recommended to keep an operation log.
- Check that the unit is running properly in automatic mode.
- Check the piping for any water leakage or damage.
- Check the mechanical seal for any water leakage.
  In the initial stage of pump operation, a small amount of initial leakage may occur until the sliding surfaces on the mechanical seal completely settle (or fit) into place. In case of initial leakage, the leakage will stop after 10 to 20 hours of operation. This initial leakage is not caused by the mechanical seal failure. You can use the pump with ease.
  High-frequency sounds (mechanical squeaks) may occur occasionally, but this is not a pump failure. Even if you use the pump as it is, there is not problem in the function of the pump.
- Check that the contacts, terminals, and other connections of the control panel are securely tightened and that there are no entries of water droplets inside.
- Completely remove water from the pressure tank, and then check that the pre-charge pressure inside the tank complies with the specifications. Periodically check the pre-charge pressure (at least every 6 months) because the life of the pressure tank depends largely on the pressure.

■ **When the pump is not operated for a long time, observe the following points:**

- To prevent freezing inside the pump in winter, be sure to keep the pump warm enough or completely drain the pump.
- If you have a backup pump, run it from time to time to make it available for operation at any time.

7.1.1 Procedure for checking the pre-charge pressure in the pressure tank

Follow the procedures below for checking and adjusting the pre-charge pressure in the pressure tank.

① Connect a drainage piping with a hose etc. to drain water.
② Close the valve for pressure tank piping.
③ Open the valve for draining the pressure tank to drain water.
④ Remove the cap.
⑤ Inspect the filled pressure through the air valve.
⑥ Adjust the filled pressure if necessary.
⑦ Put the cap back on.
⑧ Close the valve for draining the pressure tank.
⑨ Slowly open the valve for the pressure tank piping and let the water flow through.

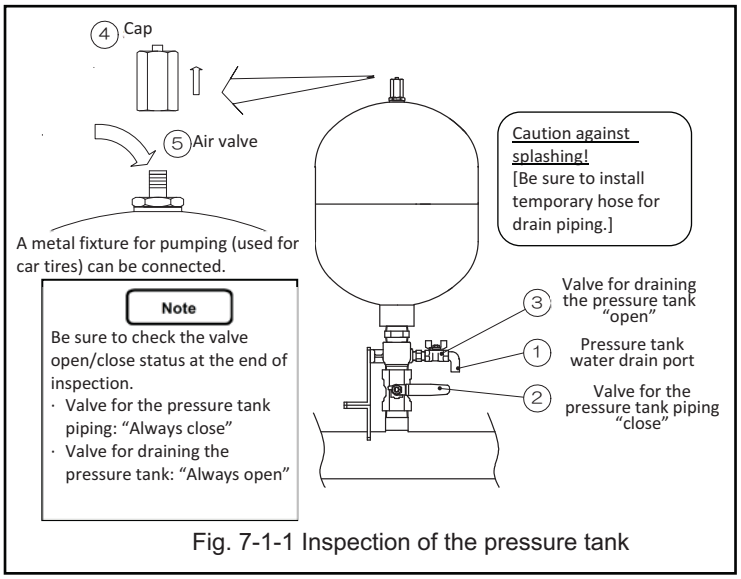


Fig. 7-1-1 Inspection of the pressure tank

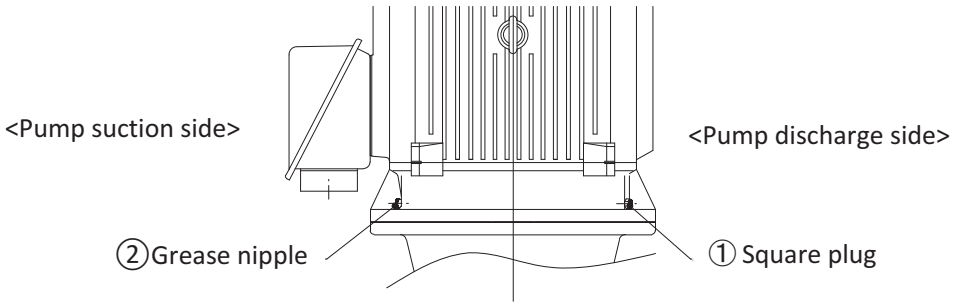
7.1.2 Motor bearing grease replenishment

Our standard motors with an output of 11 kW or more require periodical replenishment of grease. Replenish grease using the following procedure in accordance with the instructions of the grease nameplate (affixed to the motor).

- Before replenishing the grease, ① remove the square plug at the drain port and scrape off the waste grease near the drain port.
- Install the square plug of the oil drain port and then replenish the grease from the oil fill port (grease nipple). Carry out the grease refilling work while the motor is running.
- Do not mix grease with other brand/type of grease.

Table 7-1-2 Grease replenishment

Output(kW)	Supply amount	Replenishment interval	Grease brand
11 - 18.5	10g	8,500 hours	ENS grease (made by ENEOS Corporation)
22	15g		
30 - 45	20g		



7.2 Inspection mode

You can put the system into the inspection mode to notify other personnel that inspection is in progress.

(1) Entering and exiting the inspection mode (→ see 6.5.)

① To enter the inspection mode
Set the basic parameter [CHEC] to “on.”

② To exit the inspection mode
Set the basic parameter [CHEC] to “off.”
* The system automatically exits from the inspection mode in 24 hours, just in case the user forgets cancellation.

(2) Operations in inspection mode

① Display
The power indicator lamp flashes while in inspection mode.
Any other indications are the same as in normal mode.

② External output
Signals are output externally via M2 and MC (no-voltage a-contact) in inspection mode only when the External Relay Output Pattern setting (parameter: P100) is set to “4.”
No signals are output externally when the External Relay Output Pattern setting is set to a value between “0” and “3.”

③ Other operations
Other operations are carried out in the same way as in normal mode.

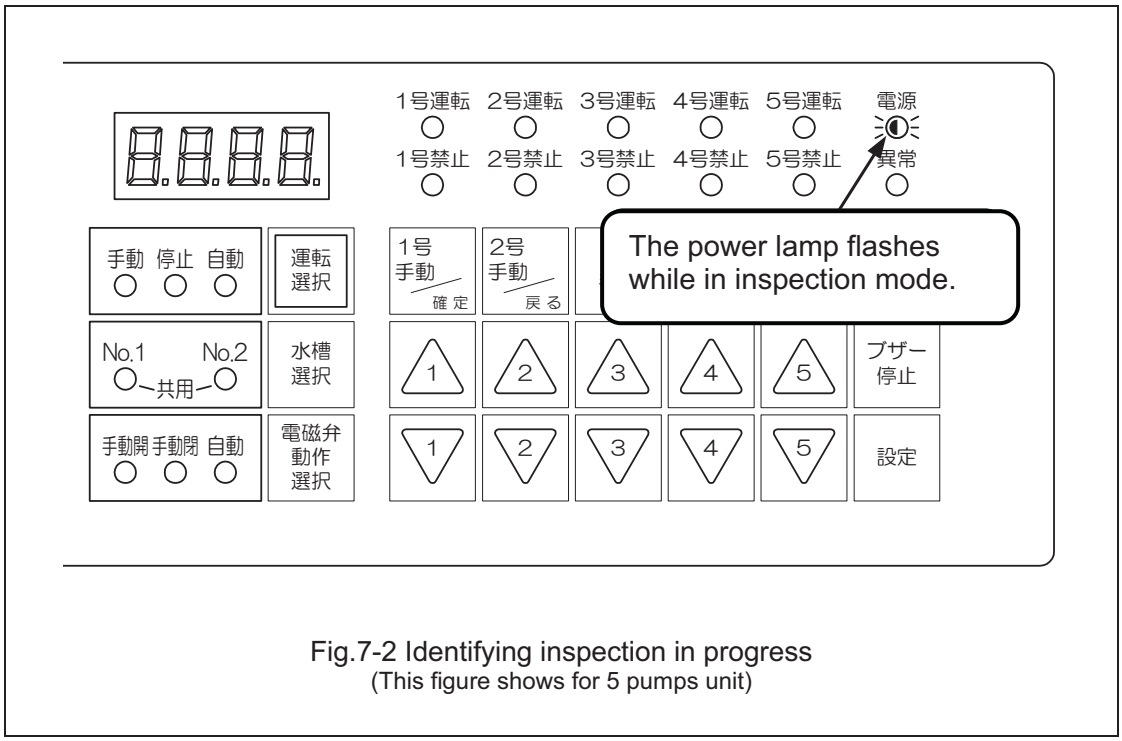


Fig.7-2 Identifying inspection in progress
(This figure shows for 5 pumps unit)

7.3 Maintenance check list

Warning	Before carrying out inspection that requires disassembly and service, be sure to turn off the main power supply. Otherwise, it may lead to an electric shock, and/or causes the pump to start up suddenly in automatic mode etc., thus exposing the personnel to great danger.
Caution	Only the service personnel with special knowledge of repairs are allowed to disassemble the unit. For work such as replacement of parts, repairs, or inspection that requires disassembly of the unit, contact TERAL INC. Incorrect work may cause a failure or accident.
Caution	Do not perform an insulation resistance test on the control panel. Before performing an insulation resistance test on the motors, remove the wires from the control panel. Otherwise, it may lead to a failure in the control panel.
Caution	Replace any packing and O-rings during inspection involving disassembly. Otherwise, it may lead to water leakage.

Table 7-3(a) Maintenance check list

	Inspection point	Inspection item	Method	Criterion	Frequency			Replacement cycle of consumables (as a guide)		
					Daily	Half-yearly	Yearly	Part name	Qty.	Replacement cycle
Ambient environment	Temperature	Check against the specified range.	Measure	Between 0 and 40°C	○					
	Humidity		Measure	85%RH or less No condensation	○					
	Dust and other contaminants		Visual check	No dust or other contaminants	○					
Power	Power terminal block	Voltage	Measure	The specified voltage is applied.	○					
		Voltage fluctuation	Measure	Within the allowable fluctuation range	○					
Control panel	Panel display, indicator lamps	Check if they are lit on	Visual check	No abnormal condition	○					
	Set values	Set values	Visual check	As per the requirements	○					
	Operations	Operations in automatic mode	Visual check	No abnormal condition	○					
	Operating conditions	Startup pressure	Visual check	As per the set value	○					
		Stop pressure	Visual check	As per the specifications	○					
		Number of start time of the unit	Visual check	400 times or less	○					
		Cumulative operation time of each pump	Visual check	Check the adequacy.	○					
		Cumulative number of starts of each pump	Visual check	Check the adequacy.	○					
		Alarm log	Visual check	No alarms are active. Check the past alarms.	○					
	Ground fault interrupter	Operation point	Visual check	Not tripped	○					
	Power supply terminal block, Control circuit terminal block, Power line	Loose screws	Tighten	Securely tightened			○			
		Trace of heating	Visual check	No discoloration			○			
		Adhesion of dust, damage	Visual check	No dust or damage			○			
	Cover and its mounting situation	Open/close the cover	By hand	Smoothly opens/closes			○			
	Structure and appearance	Insulator	Visual check	No cracks or deformation			○			
	Inverter	Looseness of screws	Tighten	Securely tightened			○	Inverter	n	Every 5 years
	Printed board	Operation	Visual check	No abnormal condition			○	Printed board	2*1	Every 5 years
	Inverter cooling fan	Noise, vibration	Listen	No abnormal condition	○			Cooling fan	n	Every 3 years
		Operation	Visual check	Normal rotation	○					
	Control panel cooling fan	Noise, vibration	Listen	No abnormal condition	○			Cooling fan	1	Every 3 years
		Operation	Visual check	Normal rotation	○					

Table 7-3(b) Maintenance check list

	Inspection point	Inspection item	Method	Criterion	Frequency			Replacement cycle of consumables (as a guide)		
					Daily	Half-yearly	Yearly	Consumable	Qty.	Replacement cycle
Pumps and motors	Operating conditions	Head	Visual check	As per the specifications	○					
		Electric current value	Measure	As per the specifications	○					
		Noise, vibration	Listen Touch	No abnormal condition	○					
		Rotation direction	Visual check	Each motor rotates in the correct direction.	○					
	Mechanical seal	Water leakage	Visual check	No water leakage	○			Mechanical seal	n	Every year or after 8000 hrs. of continuous operation
	Main shaft and its surrounding area	Smooth rotation	Rotate manually	Smoothly rotates			○			
	Bearing	Heat, noise, vibration	Touch	No abnormal condition			○	Bearing	1 set	Every 3 years or after 15000 hrs. of continuous operation
								Grease*2	10-20gxn	8500 hrs.
	Winding resistance	Resistance between wires (U-V, V-W, W-U)	Measure	Those resistance values are the same.			○			
	Insulation resistance	Insulation resistance between the ground and each lead	Measure	1 MΩ or more			○			
Accessories and others	Pressure tank	Pre-charge pressure	Measure	As per the setting pressure		○		Pressure tank	2*3	Every 3 years
		Painting conditions	Visual check	No abnormal condition			○			
	Pressure transmitter	Operation	Visual check	Pressure is indicated correctly.	○			Pressure transmitter	1	Every 5 years
	Pressure gauge	Check the reading	Visual check	No abnormal condition	○			Pressure gauge	1	Every 3 years
	Compound pressure gauge	Check the reading	Visual check	No abnormal condition	○			Compound pressure gauge	1	Every 3 years
	Flow switch	Operation	Visual check	Pump stops at a low flow rate.	○			Flow switch	n	Every 3 years
	Check valve	Clogging with foreign matter, wear, water leakage	Disassemble and inspect	No abnormal condition		○		Check valve	n	Every 3 years
	Each section of piping	Water leakage	Visual check	No water leakage	○					
	Packing and O-rings	Flaws, deformation, adherence of foreign matter	Visual check	No abnormal condition		○		Packing and O-rings	1 set	Whenever disassembled

*) The letter “n” indicates number of pump.
*1) In the case of 2 to 5 pump unit, the printed board is 1 pc.
*2) For 7.5kW or less, grease replenishment is not required.
*3) When the operation mode is D/W, it is 1 pc.

Warning	If motors or control panels are used for more than a certain period of time, it may cause ignition or other accidents due to aging deterioration.
Note	Information in the “Replacement cycle of consumables (as a guide)” column shows standard values that are applicable when the unit has been properly used and periodically inspected. The service life may be shortened depending on the operation conditions.
Note	Waste parts and other disposal items removed during repairs or replacement must be disposed of by a specialized contractor.

7.4 Mechanical seal replacement

Replace the mechanical seal as follows.

<Removal>

(1) Remove the hex. socket head cap screw ①for fixing the coupling and remove the coupling.
(2) For the models with a motor output of 7.5 kW or less, remove the motor.
(3) Loosen the hex. socket set screws ②(3 places). At this time do not remove the screws completely but loosen them slightly.
(4) Remove the hex. socket head cap screw ③ for fixing the mechanical seal. Insert a flat-blade screwdriver into the grooves (2 places) of the circumference of the mechanical seal flange and pull it upward using the principle of leverage.

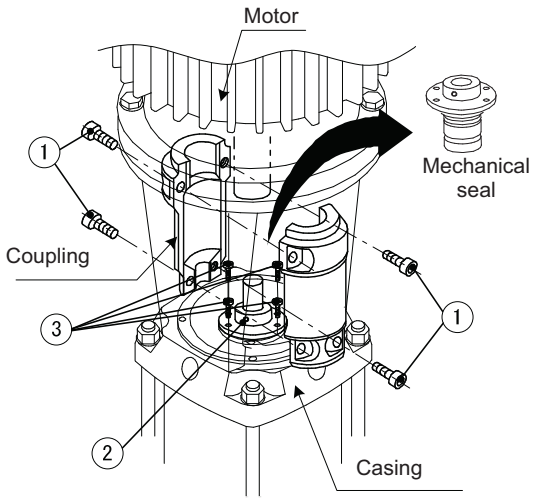


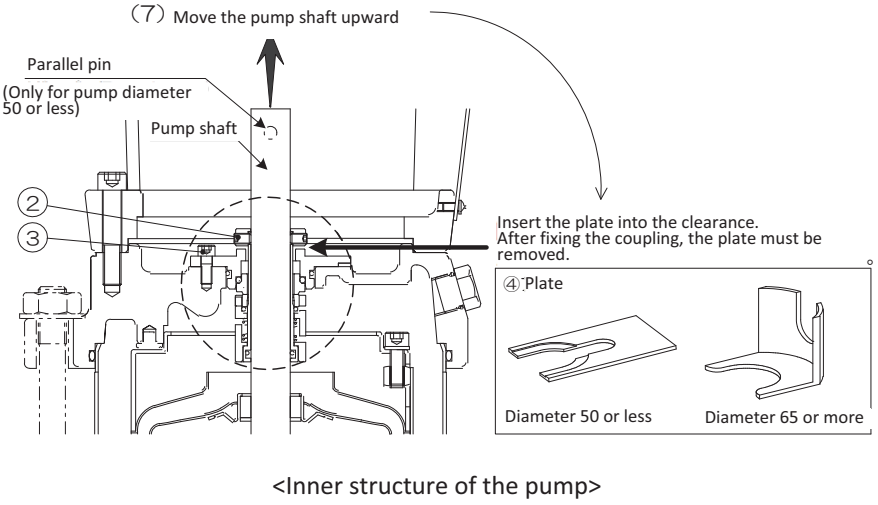
Fig. 7-4-1 Removal of mechanical seal

<Installation>

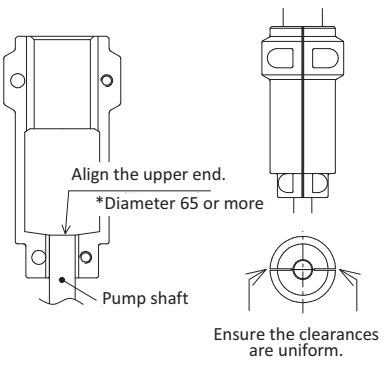
(5) Insert mechanical seal into pump shaft and fix it to casing with the hex. socket head cap screws ③. [* Recommended tightening torque: 8 [N•m]
(6) Tighten the hex. socket set screws ② (3 places) evenly. [* Recommended tightening torque: 2.5 [N•m](M5 screw), 8 [N•m](M6 screw)]
(7) Move the pump shaft upward and insert the plate④ into the clearance at the upper part of the mechanical seal.
(8) For a pump with a motor output of 7.5 kW or less, install the motor.
(9) For a pump with a bore size 50A or less, pass the parallel pin through the holes of the main shaft of the pump and coupling.
For a pump with a bore size 65A or more, there is no parallel pin. Align the upper end of the main shaft of the pump with the upper end of the shaft hole of the coupling as shown in the figure below.
(10) Fix the coupling with the hex. socket head cap screw ① so that the gaps on both sides of the coupling are even.

[* Recommended tightening torque: 13 [N·m] (M6 screws), 31 [N·m] (M8 screws), 62 [N·m] (M10 screws)]

(11) Remove the plate ④, and rotate the coupling by hand.
Check that the shaft rotates smoothly and that rotation is not unusually hard.



<Inner structure of the pump>



<Coupling>

Fig.7-4-2 Installation of mechanical seal

8. How to handle troubles

> **Caution**
>
> In the event of an alarm or abnormal condition that cannot be resolved, immediately stop the operation and contact TERAL INC. Otherwise, it may lead to an accident.
> Before the contact, check the status of abnormal condition and the alarm code No., as well as information shown on the nameplate, and then let us know the information.

8.1 Alarm handling

8.1.1 Checking the alarm description

If an alarm occurs, the buzzer sounds, the Failure indicator lamp on the operation panel blinks, and the alarm code appears on the display.
Some failures do not generate an alarm immediately. Instead, the system takes back and retries the action several times and generates an alarm only if the failure persists.
Referring to the “Table 8-1 Alarm code table,” identify the alarm status and eliminate the cause.
To find out the cause of the problem, refer to “8.2 Troubleshooting.”
If multiple alarms occur at the same time, the displayed codes are switched every two seconds.

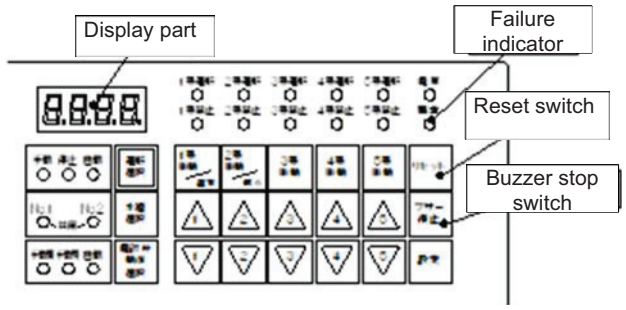


Fig.8-1 Operation panel
(This figure shows for 5 pumps unit)

Table 8-1 Alarm code table

Alarm code	Description	Alarm code	Description
E001	Receiver tank full	E#01	No.# overload
E002	Receiver tank low	E#02	No.# discharge pressure abnormal drop
E003	Receiver tank dry-run prevention	E#03	No.# electric leak
E004	Electrode failure	E#05	No.# flow switch failure
E006	Start frequency failure	E#11	No.# overcurrent
E051	Pressure transmitter 1 failure	E#12	No.# overvoltage
E080	EEPROM error	E#13	No.# undervoltage
E099	Communication error between control boards	E#14	No.# open-phase input
		E#15	No.# inverter overload
		E#16	No.# open-phase output
		E#17	No.# inverter overheat
		E#18	No.# communication error
		E#19	No.# inverter trouble 1
		E#20	No.# inverter trouble 2

* “#” should be replaced with one of pumps No. 1 to 6.

8.1.2 Resetting alarms

Eliminate the cause of the problem and then press the reset switch.
If the reset switch is pressed before the cause of the problem is eliminated, the alarm cannot be reset.
If multiple alarms occur, the system resets only the alarms whose cause has been removed.

8.1.3 Stopping the buzzer

You can stop a sounding buzzer by pressing the Buzzer stop switch.
The Buzzer Stop Time setting (P200) allows you to specify whether to stop the buzzer automatically after a specified period or to prevent the buzzer from sounding.
For the setting procedure, refer to “6.5 Parameter setting.”

8.2 Troubleshooting

Table 8-2(a) Troubleshooting

Alarm code	Description	Probable cause	Remedy
E001	Receiver tank full	Water flows into the tank continuously because the Solenoid Valve Operation setting is set to “手動開.”	Set the Solenoid Valve Operation to “自動
		Water does not stop running because of a failure in the ball tap.	Check and/or replace the ball tap.
		Water does not stop running because of a failure in the inflow solenoid valve.	Check and/or replace the inflow solenoid valve.
		Water has seeped inside the electrode holder.	Check and/or correct the electrode holder section.
		Although water level has reached the point of closing the solenoid valve, water still comes out because an incorrect setting of the Solenoid Valve Type (P103) causes the solenoid valve to open.	Correctly set the Solenoid Valve Type to the type of the inflow solenoid valve in use.
E002 E003	Receiver tank low Dry-run Prevention	The Tank Selection setting is set to a water tank not in use (to which no electrodes are connected or for which cleaning work is in progress).	Set the Tank Selection to the water tank to be used.
		Water does not flow into the receiver tank because the Solenoid Valve Operation setting is set to “手動閉.”	Set the Solenoid Valve Operation to “自動
		Water does not come out because of a failure in the ball tap.	Check and/or replace the ball tap.
		Water does not come out because of a failure in the inflow solenoid valve.	Check and/or replace the inflow solenoid valve.
		Although water level has reached the point of opening the solenoid valve, no water comes out because an incorrect setting of the Solenoid Valve Type (P103) causes the solenoid valve to close.	Correctly set the Solenoid Valve Type to the type of the inflow solenoid valve in use.
		Poor connection or disconnection of the electrode wiring	Check and/or correct the electrode wiring.
		Poor connection of the electrode holder section	Check and/or correct the electrode holder section.
E004	Electrode failure	Wrong electrode wiring	Check and/or correct the electrode wiring.
		Poor connection or disconnection of the electrode wiring	Check and/or correct the electrode wiring.
E006	Start frequency failure	Because of damage to the diaphragm of the pressure tank, its internal pressure cannot be maintained when no pumps are running, thus increasing the start frequency of the pump(s).	It is necessary to check and/or replace the pressure tank. Contact us.
		Water usage continues at low flow rate because of water leakage or the user’s failure to close the faucet.	Check and/or replace the piping. Additionally install a pressure tank with a large capacity.
		A low flow rate is constantly detected because of malfunction of the flow switch.	It is necessary to check and/or replace the flow switch. Contact us.
E051	Pressure transmitter failure	The pressure transmitter is broken.	It is necessary to check and/or replace the pressure transmitter. Contact us.
		The piping is frozen.	Protect the piping with a heat insulating material, or contact us to make modifications for the freeze-proof specifications.
E080	EEPROM error	The memory device of the control board is broken.	Normal operation may not be possible because parameters and operating information cannot be stored. It is necessary to replace the control board. Contact us.
E099	Communication error between control boards	The communication connector between the control boards is released.	Plug the connector in firmly.
		The control board 2 is not powered on.	Turn on the operating power switch of the control board.
		The control board 2 is malfunctioning.	It is necessary to replace the control board. Contact us.

Table 8-2(b) Troubleshooting

Alarm code	Description	Probable cause	Remedy
E101	No.1 overload	An overload has occurred because the unit is running at a flow rate outside the specified range.	Adjust the load so that it falls within the specified range.
E201	No.2 overload	An overload has occurred because of damage to the bearings.	It is necessary to replace the bearings. Contact us.
E301	No.3 overload	An overload has occurred because foreign matter is caught in the pump.	It is necessary to disassemble and inspect the pump. Contact us.
E401	No.4 overload	A drop in power voltage or an imbalance between phases has led to an increase in the electric current value.	Check for any insufficient power capacity or any imbalance between phases and fix the problem.
E501	No.5 overload		
E601	No.6 overload	A failure in the motor has led to an overcurrent flow.	It is necessary to check and/or replace the motor. Contact us.
E102	No.1 discharge pressure abnormal drop	Because of insufficient priming or the escape of water from the piping system, the pump cannot lift water.	Sufficiently perform priming. If water escapes from the piping system, Check and/or correct the suction piping.
E202	No.2 discharge pressure abnormal drop	An entry of air through the suction piping prevents the pump from delivering its rated performance.	Check and/or replace the suction piping.
E302	No.3 discharge pressure abnormal drop	The set value for starting the pump is set to a value beyond the pump capacity.	Check the pump capacity and set the correct set value for starting the pump.
E402	No.4 discharge pressure abnormal drop	Because of problems such as a failure in each pump/motor or the disconnection of the power line, the pump does not run or the motor rotates in reverse.	Check the rotation direction. Check and/or correct the wiring. If further disassembly or inspection is required, contact TERAL INC.
E502	No.5 discharge pressure abnormal drop	Because the suction piping, pump, or other sections are clogged with foreign matter, the flow passage is blocked and the pump cannot lift water.	It is necessary to disassemble and inspect the pump. Contact us.
E602	No.6 discharge pressure abnormal drop		
E103	No.1 electric leak	There is electric leakage somewhere in the secondary circuit of the ground fault interrupter.	Find the location of electric leakage and fix the problem.
E203	No.2 electric leak	The ground fault interrupter is broken.	It is necessary to check and/or replace the ground fault interrupter. Contact us.
E303	No.3 electric leak		
E403	No.4 electric leak		
E503	No.5 electric leak		
E603	No.6 electric leak		

Table 8-2(c) Troubleshooting

Alarm code	Description	Probable cause	Remedy
E105	No.1 flow switch failure	The flow switch is broken or its wiring is disconnected. Or, the flow switch is not working properly because of contamination with foreign matter or other causes.	It is necessary to check and/or replace the flow switch. Contact us.
E205	No.2 flow switch failure		
E305	No.3 flow switch failure		
E405	No.4 flow switch failure		
E505	No.5 flow switch failure		
E605	No.6 flow switch failure		
E111	No.1 overcurrent	An overload has occurred because the unit is running at a flow rate outside the specified range.	Adjust the load so that it falls within the specified range.
E211	No.2 overcurrent	An overcurrent has occurred because of damage to the bearings.	It is necessary to replace the bearings. Contact us.
E311	No.3 overcurrent	An overcurrent has occurred because foreign matter is caught in the pump.	It is necessary to disassemble and inspect the pump. Contact us.
E411	No.4 overcurrent	A drop in power voltage or an imbalance between phases has led to an increase in the electric current value.	Check for any insufficient power capacity or any imbalance between phases and fix the problem.
E511	No.5 overcurrent		
E611	No.6 overcurrent		
E115	No.1 inverter overload	A failure in the motor has led to an overcurrent flow.	It is necessary to check and/or replace the motor. Contact us.
E215	No.2 inverter overload		
E315	No.3 inverter overload		
E415	No.4 inverter overload		
E515	No.5 inverter overload		
E615	No.6 inverter overload		
E112	No.1 overvoltage	The power voltage is too high.	Check the power voltage.
E212	No.2 overvoltage		
E312	No.3 overvoltage		
E412	No.4 overvoltage		
E512	No.5 overvoltage		
E612	No.6 overvoltage		
E113	No.1 undervoltage	The power voltage is too high.	Check the power voltage.
E213	No.2 undervoltage		
E313	No.3 undervoltage		
E413	No.4 undervoltage		
E513	No.5 undervoltage		
E613	No.6 undervoltage		
E114	No.1 open-phase input	The input side wire is disconnected. (single phase power supply)	Check the power supply condition.
E214	No.2 open-phase input		
E314	No.3 open-phase input		
E414	No.4 open-phase input	Large unbalance between phases of power supply.	Check the power supply condition.
E514	No.5 open-phase input		
E614	No.6 open-phase input		

Table 8-2(d) Troubleshooting

Alarm code	Description	Probable cause	Remedy
E116	No.1 open-phase output	The motor has burned out.	It is necessary to check and/or replace the motor. Contact us.
E216	No.2 open-phase output		
E316	No.3 open-phase output		
E416	No.4 open-phase output		
E516	No.5 open-phase output		
E616	No.6 open-phase output		
E117	No.1 inverter overheat	The ambient temperature is too high.	Improve the installation environment.
E217	No.2 inverter overheat		
E317	No.3 inverter overheat	The cooling fan is broken.	It is necessary to replace the cooling fan. Contact us.
E417	No.4 inverter overheat		
E517	No.5 inverter overheat		
E617	No.6 inverter overheat		
E118	No.1 communication error	A cause other than electric leak has turned “off” the ground fault interrupter.	Turn on the ground fault interrupter.
E218	No.2 communication error	The communication connector is coming off.	Firmly insert the connector.
E318	No.3 communication error		
E418	No.4 communication error		
E518	No.5 communication error		
E618	No.6 communication error		
E119	No.1 inverter trouble 1	The inverter is broken.	It is necessary to check and/or replace the inverter. Contact us.
E219	No.2 inverter trouble 1		
E319	No.3 inverter trouble 1		
E419	No.4 inverter trouble 1		
E519	No.5 inverter trouble 1		
E619	No.6 inverter trouble 1		
E120	No.1 inverter trouble 2		
E220	No.2 inverter trouble 2		
E320	No.3 inverter trouble 2		
E420	No.4 inverter trouble 2		
E520	No.5 inverter trouble 2		
E620	No.6 inverter trouble 2		

9. Special specification

9.1 Negative suction type

This section describes specification of the negative suction type water supply unit.
By employing the negative suction type unit, actual pump head of up to 4m and total pump head up to 5m (pump bore size 40-50A) or up to 4m (pump bore size 65A or over) is enabled for total pump suction head.

[Components different from standard specifications]
In case of negative suction type, additional suction piping is required for each pump and the orifice is changed for the negative suction type.

[Priming water]
Please also refer to “4.1.2 Pump system.”

(1) Loosen the air vent plug of the pump.
(2) Open the ball valve of the priming piping and prime the water from the priming funnel.
(3) Hold the coupling and manually turn the pump to completely expel the air from the impeller.
When the water overflows, priming of water is completed. (Be careful of splashing.)
(4) After completion of priming, close the air vent plug of the pump and the ball valve of the priming piping.

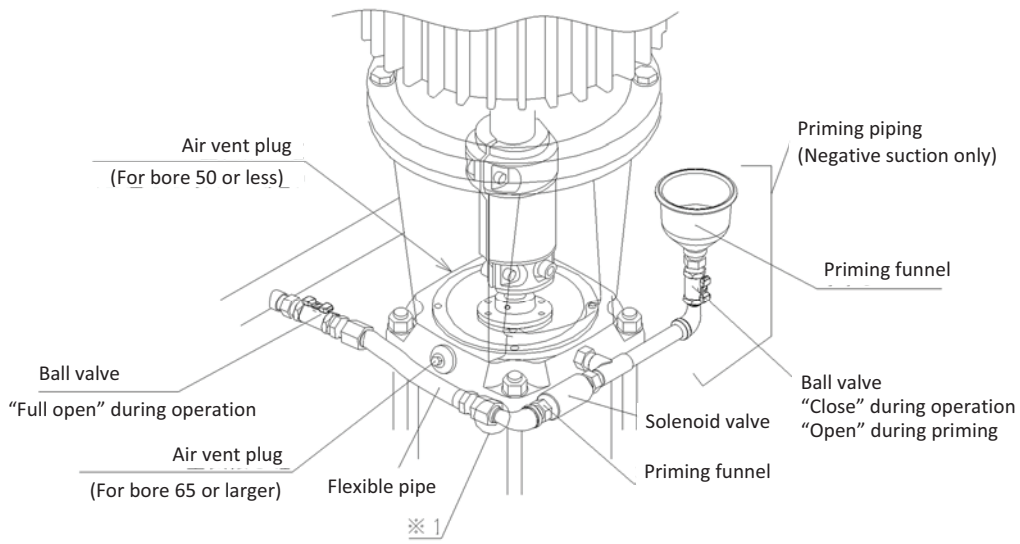


Fig.9-1(a) Priming piping (Negative suction type only)
※Some models have an additional orifice and socket.

Caution	❗	Make sure to install a constant relief pipe and always keep the valves of each relief pipe fully open.
Note		For the installation procedure of the constant relief pipe, there may be an applicable guideline or guidance from local governments or other official institutions. Carefully check for such guidelines and follow the instructions.

[Instructions only applicable to negative suction type]
Please also refer to “3.3 Precautions for piping work.”

(1) Always submerge the end of the constant relief pipe ② securely, and keep a distance of 300mm or more from the suction pipe so that air does not enter the suction pipe.
(2) If it is impossible to submerge the end of the constant relief pipe into the water supply source, install vacuum breaker at the top after installing priming tank and raising the constant relief pipe to priming tank water level or higher.
(3) Fully open the ball valve of the constant relief pipe ② of each pump during operation.
(4) Ensure to install the suction pipe ③ for each pump and provide a rising slope (at least 1/100 degrees) leading up to each pump to prevent the formation of air pockets inside the pipe. Furthermore, install joints in a way that no air enters from there.
(5) Ensure to attach a foot valve ④ with a strainer to the end of the suction pipe ③ to block entrance of foreign matter or objects. The suction port must be located at a position more than twice as deep as the size of the suction pipe diameter (D) below the lowest water level, and at a distance of at least 1 to 1.5 times the pipe diameter (D) away from the bottom and the side of the water tank.
(6) Do not attach a gate valve to the suction pipe ③.
(7) Install strong piping supports ⑤ to prevent the weight of the piping components from being applied to the unit.

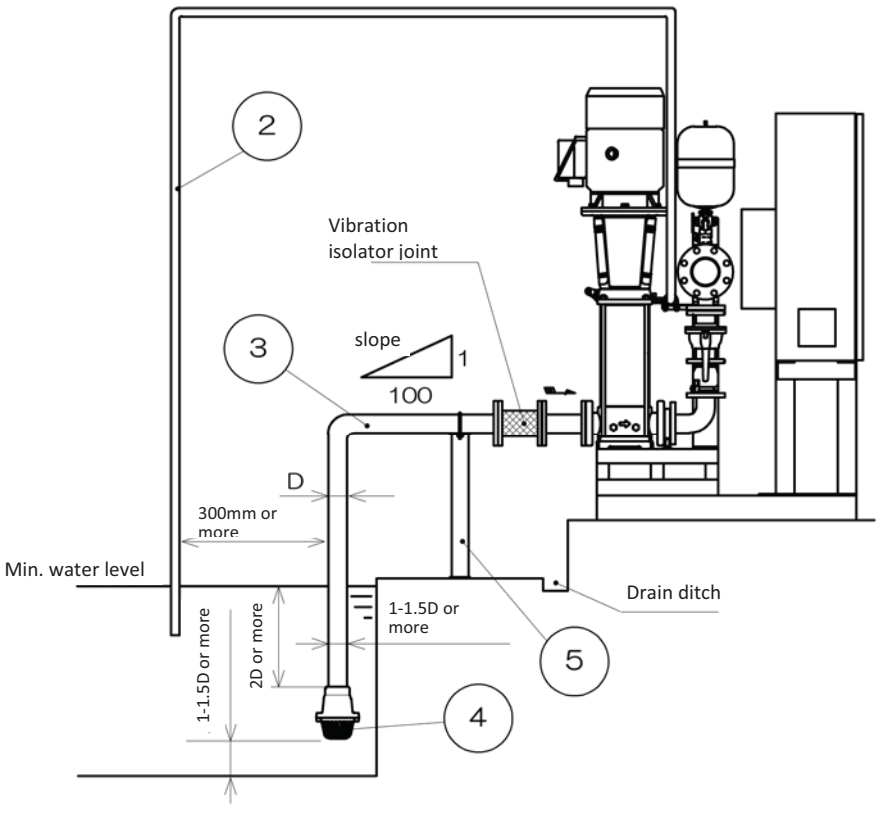


Fig.9-1(b) Piping installation example (negative suction type)

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