

# **Submersible Sewage Pump**

**Model: PL / SSU / PV / SVC / BO /  
KO / SCU**

## **⚠ WARNING**

Do not operate, service or inspect this pump until you have read and understood this manual.

Retain this manual carefully at hand where it can be consulted at any time of operation, maintenance and inspection of the pump.

To whom is performing the utility work:

Please submit this manual to the customer performing the operation, maintenance and inspection of the pump.

## **Limited warranties**

1. In the event of a 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.  
The warranty period of this product shall be one year after the date of delivery.
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. Moreover, the warranty is available for Japan domestic use only.
3. In the event of the following failures and breakage, the costs of the repairs 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 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 use or storage outside the specification range
4. TERAL INC. shall not be liable for the damage caused by incorrect or reckless use of the pump. 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.

## Purpose of this manual

The purpose of this manual is to provide the user with detailed information necessary to properly operate, maintain and inspect the pump. Incorrect operation of this product may lead to an unexpected accident. Please use the product correctly according to this instruction manual.

This manual contains the following information and is intended for persons experienced in the operation of pumps, or for those who have been trained by such experienced operators. Only qualified personnel such as licensed electrical engineers are allowed to carry out the electrical wiring work.

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# 1. Safety precautions

Before using the pump, 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 Types and meanings of safety signs and graphic symbols

This instruction manual divides precautions into the following four categories according to the level of hazards (or the severity of the accident). In addition, prohibited or mandatory actions as well as cautions are indicated with a graphic symbol.

Be sure to understand the meanings of the following terms and comply with the content (instructions) of the instruction manual.

### ■ Explanation of warnings

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

### ■ Explanation of the graphic symbols

				
Don'ts	Do not touch	Do not disassemble	Do not touch with wet hand	Do not expose to water
These graphic symbols indicate prohibited actions (that must NOT be done).				
 This graphic symbol indicates mandatory actions (that must be done).				Do's
				Caution      Electric shock hazard      Rotation hazard      Hot surface
These graphic symbols indicate existing hazards to beware of.				

## 1.2 Safety precautions

### Danger



Once the main power is turned on, do not touch any live parts.

A high voltage applied to live parts may cause a serious electric shock, thus leading to death.

### Warning

 Properly move the pump according to lifting instructions. Otherwise, the unit may fall, thus leading to an injury or damage.	 Do not carry out any work with/on the pump that is being lifted. Otherwise, the unit may fall, thus leading to an injury or damage.
 Only those who are authorized by the site manager are allowed to operate the pump. Operation by unskilled personnel may lead to an unforeseen accident.	 Installation, maintenance, and inspection must only be carried out by personnel who have been trained to handle the pump. Operation by unskilled personnel may lead to an unforeseen accident.
 Only qualified personnel, such as licensed electrical engineers, are allowed to carry out electric work.  Otherwise, it may lead to an electric shock, fire, failure, or other problems.	 Use high-quality wiring equipment and devices, 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, or other problems.
 Securely install the ground wire and ensure to carry out grounding work.  Otherwise, it may lead to an electric leakage or electric shock.	 Be sure to install the leakage circuit breaker at the main power supply.  Otherwise, it may lead to an electric shock or fire.

## **Warning**

<p> <b>Correctly and securely connect the wires according to the instruction manual.</b> Incorrect wiring may cause a fire, electric shock, failure, or other problems.</p> <p> <b>Check the wiring sections and wires for any looseness.</b> A loose connection may cause a fire or electric shock.</p> <p> <b>Before starting the pump 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.</b> Otherwise, it may lead to an unforeseen accident.</p> <p> <b>Before turning the pump by hand to check its smooth rotation, be sure to turn off the main power.</b> Otherwise, it may lead to an injury or damage.</p> <p> <b>After turning on the power, do not touch any parts of the pump other than those required for operation.</b> Otherwise, it may lead to an electric shock or injury.</p> <p> <b>Do not install the pump in a high-temperature environment.</b> Otherwise, it may lead to overheating, fire, or electric leakage.</p> <p> <b>Do not use the product in any explosive atmosphere.</b> Otherwise, it may lead to any injury or fire.</p> <p> <b>Do not damage cable, bend it forcibly, twist it, pull it, or place a heavy object on it during transportation or installation.</b> Otherwise, it may lead to fire or electric shock.</p> <p> <b>Install the cable with care so as not to generate heat.</b> If cable is wound, bundled, or used in direct sunlight, cable may overheat, resulting in fires or failures.</p> <p> <b>Do not run the pump with pump sucked in.</b> Otherwise, the motor may burn out and cause an electric shock.</p> <p> <b>Do not put your hands or feet into suction opening of pump during operation.</b> Otherwise, it may lead to an injury.</p> <p> <b>When temporarily placing the pump, place it on a flat and stable surface, hold it with chain or rope to prevent pump from toppling, and place sleepers.</b> Otherwise, the pump may tip over and cause injury.</p> <p> <b>Do not operate with insulation resistance less than <math>1M\Omega</math>.</b> Otherwise, it may lead to electric shock or fire.</p> <p><b>Electric motor or control panel insulation degradation may result in electric leakage, electric shock, or fire.</b></p> <p><b>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.</b></p>	<p> <b>Do not connect the ground wire to a gas pipe, water pipe, lightning rod or telephone line.</b> Such a connection is illegal and leads to an electric shock, explosion, or fire.</p> <p> <b>Do not run the pump if abnormal condition is observed in any operation, movement, parts, etc.</b> Otherwise, it may lead to an injury, failure, or various accidents.</p> <p> <b>Before starting the maintenance or inspection work, be sure to stop the pump and turn off the main power of the panel board.</b> Otherwise, it may lead to an electric shock, injury, damage, or leakage.</p> <p> <b>In the event of a power failure, be sure to turn off the power switch.</b> Otherwise, the pump may suddenly start up on restoration of the power, thus leading to an injury.</p> <p> <b>Do not operate the pump under severe repetitive starting conditions.</b> Otherwise, leakage from the mechanical seal may cause the pump to fail in a short period of time.</p> <p> <b>Do not perform zero-discharge operation for more than one minute continuously.</b> Otherwise, the internal pressure and temperature inside pump may increase, causing damage or burnout.</p> <p> <b>For overhaul, replacement of parts, or repairs, contact TERAL INC.</b> If unskilled personnel carry out work that requires special knowledge, it may lead to an accident or failure.</p> <p> <b>Never immerse cable terminal in water.</b> Otherwise, it may lead to an electric shock or damage.</p> <p> <b>Do not operate the pump beyond the rated current value.</b> Otherwise, it may lead to fire or electric shock.</p> <p> <b>Never use pump in water with persons.</b> In case of electric leakage, there is a risk of electric shock.</p> <p> <b>Do not run the pump dry in air.</b> Otherwise, it may cause electric shock or electric leakage due to insulation deterioration.</p> <p> <b>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.</b></p> <p> <b>Regularly inspect your equipment and perform maintenance on each component.</b></p>
<p> <b>Caution</b></p>	
<p> <b>Do not use the pump outside the range of the product specifications.</b> Otherwise, it may lead to an electric shock, fire, leakage, failure, or other problems.</p>	<p> <b>Check that the delivered items are exactly what you ordered.</b> The use of a wrong product may cause an injury or failure.</p>



## Caution

<p> Do not modify the pump. Any accident or damage due to the modification by customer is beyond our warranty.</p>	<p> Do not run the pump at a frequency exceeding 60 Hz (50 Hz for models dedicated to 50Hz). Otherwise, it may lead to motor burnout or a fire.</p>
<p> Do not use the pump in food-related facilities, critical facilities, or places directly involved in sustaining life. In the event of malfunction, the water supply may stop.</p>	<p> Do not give the product any physical shock during transportation, transfer, and installation. Otherwise, it may cause damage to the product.</p>
<p> Do not use it for liquids, oils, seawater, organic solvents, chemicals, or sticky liquids other than water.</p>	<p> Strictly observe the precautions for installation on pump installation environment. Otherwise, it may lead to quick damage of the pump.</p>
<p> Install a spare pump in case of pump shutdown. Otherwise, the water supply may be cut off and the equipment may be stopped.</p>	<p> Before unpacking the delivered container, check that the container is placed in the correct orientation (not upside down). Carefully unpack the container, while paying special attention to nails. Otherwise, it may lead to an injury or damage.</p>
<p> Do not step on the pump, motor, wiring and piping. Otherwise, it may lead to an injury, damage, or other problems.</p>	<p> Do not install two or more different cables or control wires in one pipe or duct. Otherwise, noise may cause this product or other equipment to malfunction.</p>
<p> Operate the controls carefully. Otherwise, it may lead to an injury or damage.</p>	<p> Be sure to provide pipe supports for the pipes. Otherwise, the main shaft may be displaced from the center, thus leading to the equipment damage, vibration, or noise.</p>
<p> Before operation, thoroughly clean (flush) the inside of the piping to remove foreign matter. Otherwise, the piping system may be contaminated with foreign matter, thus leading to an accident or a pump failure.</p>	<p> When connecting a cable extension, do not put the connection in water. An incomplete connection may cause an electric shock.</p>
<p> Remove a protective seal or closure cover if it is attached to the discharge port of pump before piping work. Operating the pump with the seal attached may cause damage to the pump and piping.</p>	<p> Never run the pump dry (no-discharge operation) or with insufficient amount of priming liquid. Otherwise, it may cause damage to the sliding part of the pump.</p>
<p> Do not touch the motor body while the pump is running or immediately after the pump has stopped. Otherwise, you may get burns from the hot surface.</p>	<p> In the event of an alarm or abnormal condition that cannot be resolved, immediately stop the operation, turn off the power, and then contact TERAL INC. Otherwise, it may lead to an accident.</p>
<p> Make sure that the rotation direction is correct. Incorrect rotation direction may cause overload and failure.</p>	<p> Be sure to conduct inspection according to the Maintenance checklist. Otherwise, you cannot prevent potential failures, thus leading to a higher risk of accidents.</p>
<p> Be sure to wire thermal protector at 11kW or higher. Otherwise, the motor cannot be protected and may burn out.</p>	<p> Keep the float switch away from obstructions and incoming water. If the float switch comes in contact with the tank wall, piping, or incoming water, the float switch may become stuck and the pump will not start and stop.</p>
<p> Ensure to keep a distance of at least 50 mm between the floats. If the starting water level and the stopping water level are too close to each other, pump will start and stop frequently, resulting in failure.</p>	<p> When you lift the product by hand, pay attention to its weight. Do not allow a single person to lift a product heavier than 15 kg. Otherwise, it may put strain on the body, thus leading to an injury.</p>
<p> Do not place any combustibles around the product. Otherwise, it may lead to an injury or damage.</p>	<p> Whenever disassembly and inspection of the pump, replace the packing and O-ring. Otherwise, it may lead to liquid leakage</p>
<p> When you hoist the product, pay attention to its center of gravity. Otherwise, the product may topple over or fall, thus leading to an injury.</p>	<p> If the position of the float switch changes from the initial operation due to water flow, vibration, etc., check it periodically as proper automatic operation will not be possible. Otherwise, it may cause malfunction or pump failure.</p>
<p> Before lifting the product, refer to the catalog, dimensional drawing, and other documents to check the weight of the product. Do not lift the product if its weight exceeds the rated load of the hoisting devices. Otherwise, the product may topple over or fall, thus leading to an injury.</p>	<p> When the pump is not used for a long time, turn off the main power and the pump shall be sufficiently drained for storage. Otherwise, it may cause breakage by freezing.</p>



## Caution

<p> Minimize the frequency of startups and shutdowns of the pump (Max. 6 times per hour). Otherwise, it may lead to quick damage of the pump.</p>	<p> Keep the cocks of the pressure gauges, compound pressure gages, and other parts closed <b>all</b> the time except when they are used for measurement. they become more susceptible to failure</p>
<p> Before restarting the pump, confirm that the pump has stopped completely. Turning on the power while the pump is still rotating causes an excessive torque on the pump and may cause a failure.</p>	<p> Contact a specialized company to dispose of lubricants, parts, etc., that have been wasted due to inspections or repairs.</p>
<p> Do not operate the pump beyond the rated current. Otherwise, it may cause the motor to burn out.</p>	<p> After lubrication, apply sealant to the plug and fasten securely. Insufficient fastening may result in a failure of pump</p>
<p> Periodically clean the strainer for PL, SSU models. A clogged strainer may cause pressure fluctuations, a lower discharge rate, unusual noise, and other problems, thus leading to a pump failure.</p>	<p> Dispose of the product as industrial waste.</p>
<p> Take the companion flange out of the pump and screw the pipes. Otherwise, it may lead to damage or leakage.</p>	<p> Ask a waste-disposal company to dispose of the packing materials that are no longer necessary.</p>
<p> Remove any dust from the blade and blade mounting surface of the power plug. Otherwise, it may cause fire.</p>	

## 2. Configuration and overview of the pump

This chapter describes the standard specifications of the pump. If you have purchased a customized product, some information in this chapter may not be applicable to your pump. Refer to the delivery specifications for the details separately.

### 2.1 Model type description

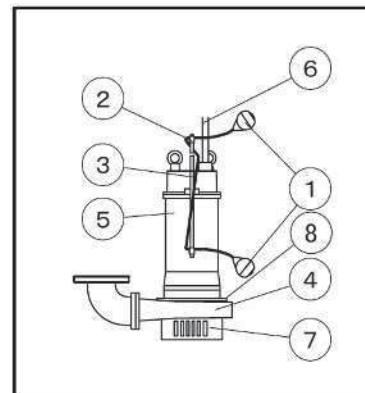
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① Nominal diameter	Unit: mm
② Model	Non-automatic: PL, SSU, PV, BO, KO, SVC, SCU Automatic: PLA, SSUA, PVA, BOA, KOA, SVCA, SCUA Automatic alternate parallel operation: PLT, SSUT, PVT, BOT, KOT, SVCT, SCUT
③ Frequency	50Hz(5: 50Hz, 60:60Hz)
④ Output	Unit: kW
⑤ Detachable device	Blank: None C: C-type detachable device S: SEC-type detachable device

### 2.2 Part names and functions

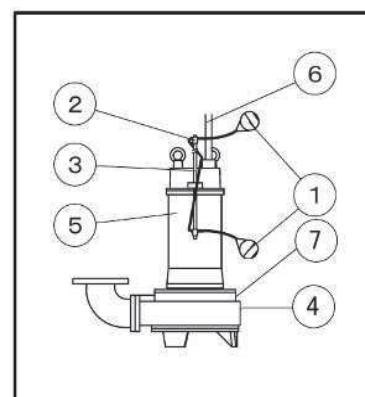
Applied models: PL, SSU

- ① Float switch (except for non-automatic)
- ② Float switch holder (except for non-automatic)
- ③ Float mounting bar (except for non-automatic)
- ④ Casing
- ⑤ Motor
- ⑥ Cabtyre cable
- ⑦ Strainer  
(PL has a strainer of different shape.)
- ⑧ Air vent hole



Applied models: PV, BO, KO, SVC, SCU

- ① Float switch (except for non-automatic)
- ② Float switch holder (except for non-automatic)
- ③ Float mounting bar (except for non-automatic)
- ④ Casing
- ⑤ Motor
- ⑥ Cabtyre cable
- ⑦ Air vent hole



## 2.3 Pump specifications

If you have purchased our standard product, refer to the "Standard specifications" table. For details, refer to the specifications including the dimensional drawing and the internal structure drawing. Also if you have purchased a customized product with special specifications, refer to the specifications including the dimensional drawing and the internal structure drawing.



Do not use this product under any conditions other than those provided in the specifications. Failure to observe this may cause an electric shock, a fire, leaks, or failures.



The pump cannot be used for food processing, food transportation and other applications, or for facilities for living creatures (fish farms, aquariums, etc.). Do not use it for critical facilities (such as computer cooling equipment and freezer cooling equipment).



Do not use it for liquids, oils, seawater, organic solvents, chemicals, or sticky liquids other than water.



Do not operate the pump under severe repetitive starting conditions. Otherwise, leakage from the mechanical seal may cause the pump to fail in a short period of time.



Install a spare pump in case of pump shutdown. Otherwise, the water supply may be cut off and other solutions may not be able to be discharged, and the drainage tank may overflow.

Standard specifications

Model		PL	SSU	PV	SVC
Liquid handled	Quality	Wastewater	Wastewater	Wastewater, Miscellaneous wastewater	Wastewater, Sewage, Miscellaneous wastewater
	Temperature	0 to 40°C	0 to 40°C	0 to 40°C	0 to 40°C
	PH	5.8-8.6	5.8-8.6	5.8-8.6	5.8-8.6
Pump	Diameter of foreign objects	5mm or less	10% or less of nominal dia.	20mm or less	60 to 70% of nominal dia.
	Length of foreign objects	-	100% or less of nominal dia.	-	400% or less of nominal dia.
	Strainer	included	included	-	-
	Pump nominal dia.	32-50	50-100	40-50	50-80
	Pump structure	-	-	Semivortex	Semivortex
	Impeller shape	Semi-open	Semi-open	Semi-open	Semi-open
	Impeller material	Resin	Cast iron	Resin	Cast iron
	Flange spec	Dedicated companion flange	JIS10K thin type	Dedicated companion flange	50A: Dedicated companion flange 65A 80A: JIS10K thin type equivalent
Motor	Phase,/Voltage	Single phase100V/ 3-phase 200V	3-phase 200V	Single phase100V/ 3-phase 200V	3-phase 200V
	No. of poles	2P	2P	2P	2P
	Type	Dry type submersible motor	Dry type submersible motor	Dry type submersible motor	Dry type submersible motor
	Starting method	Single phase: Capacitor induction 3-phase: Direct-on-line	Direct-on-line	Single phase: Capacitor induction 3-phase: Direct-on-line	Direct-on-line
	Protective device	Auto-reset type auto-cut	Auto-reset type auto-cut	Auto-reset type auto-cut	Auto-reset type auto-cut
Mechanical seal	Seal	Double mechanical seal	Double mechanical seal	Double mechanical seal	Double mechanical seal
	Sliding part material	Pump side: SiC vs. SiC Motor side: Ceramics vs Carbon	SiC vs. SiC Ceramics vs Carbon	SiC vs. SiC Ceramics vs Carbon	SiC vs. SiC Ceramics vs Carbon
	Lubricating oil	Turbine oil VG10	Turbine oil VG32	Turbine oil VG10	Turbine oil VG32

Model		BO	KO	SCU
Liquid	Quality	Wastewater, Sewage, Miscellaneous wastewater	Wastewater, Sewage, Miscellaneous wastewater	Wastewater, Sewage, Miscellaneous wastewater
	Temperature	0 to 40°C	0 to 40°C	0 to 40°C
	PH	5.8-8.6	5.8-8.6	5.8-8.6
Pump	Diameter of foreign objects	40 to 70% of nominal dia.	50 to 70% of nominal dia.	100% or less of nominal dia.
	Length of foreign objects	300% or less of nominal dia.	300% or less of nominal dia.	500% or less of nominal dia.
	Strainer	-	-	-
	Pump nominal dia.	50-200	50-100	40-50
	Pump structure	-	-	Vortex
	Impeller shape	125A or less: Semi-open non-clog 150A, 200A: Closed non-clog	Semi-open non-clog With cutter disk	Semi-open
	Impeller material	Cast iron	Cast iron	Cast iron
	Flange spec	JIS10K thin type	JIS10K thin type	JIS10K thin type
Motor	Phase,/Voltage	3-phase 200V	3-phase 200V	3-phase 200V
	No. of poles	4P	4P	4P
	Type	Dry type submersible motor	Dry type submersible motor	Dry type submersible motor
	Starting method	7.5kW or less: Direct-on-line 11kW or more: Star-delta starter	7.5kW or less: Direct-on-line 11kW or more: Star-delta starter	7.5kW or less: Direct-on-line 11kW or more: Star-delta starter
	Protective device	7.5kW or less: Auto-reset type auto-cut 11kW or more: Thermal protector	7.5kW or less: Auto-reset type auto-cut 11kW or more: Thermal protector	7.5kW or less: Auto-reset type auto-cut 11kW or more: Thermal protector
Mechanical seal	Seal	Double mechanical seal	Double mechanical seal	Double mechanical seal
	Sliding part material	Pump side: SiC vs. SiC Motor side: Ceramics vs Carbon	SiC vs. SiC Ceramics vs Carbon	SiC vs. SiC Ceramics vs Carbon
	Lubricating oil	Turbine oil VG32	Turbine oil VG32	Turbine oil VG32

### 3. Installation

#### 3.1 Before using the pump

When you receive the pump, check the following points first.

If there are any problems, contact the vendor from which you purchased the product.



Before unpacking, ensure that the delivered container is placed in the correct orientation (not upside down). Pay special attention to nails especially when opening a wooden crate. Otherwise, you may get injured.



After the unpacking, ask the waste-disposal company to dispose of packaging materials that are no longer necessary.

- (1) Check the nameplate to verify that the delivered product is exactly what you ordered.
- (2) Check that no part of the product is damaged during transportation.
- (3) Check all the fastening parts including bolts and nuts are securely tightened.
- (4) Check all the accessories that you ordered have been delivered.

#### 3.2 Precautions for installation



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.



Observe the precautions for installation in the main text below. Failure to observe this may cause failure or damage. It may also result in shortening the service life of the pump.

- (1) Install the product at a location where the following conditions are all satisfied:
  - A well-ventilated place at an ambient temperature of 0°C to 40°C with minimum exposure to dust and moisture
  - A place that is free from the exposure to a jet of steam and salt damage
  - A place where the pump cannot easily be accessed or operated by unauthorized persons



Do not install the product in a place exposed to high temperature and moisture. Otherwise, it may cause heating, ignition or electric leakage.

- (2) When handling or installing the pump, check the weight and shape of the device with the external dimensional drawing and work safely.



Before lifting the product, check the weight and shape of the device with the external dimensional drawing and work safely. Do not lift the product if its weight exceeds the rated load of the hoisting device.



Do not damage, bend, twist, pull or place a heavy object on cable during transportation or installation.



Never use a pump or install parts to it while the pump is lifted. Otherwise, the pump may fall, thus leading to an injury.



When lifting the product, pay attention to its center of gravity. Otherwise, the product may topple over or fall, thus leading to an injury.

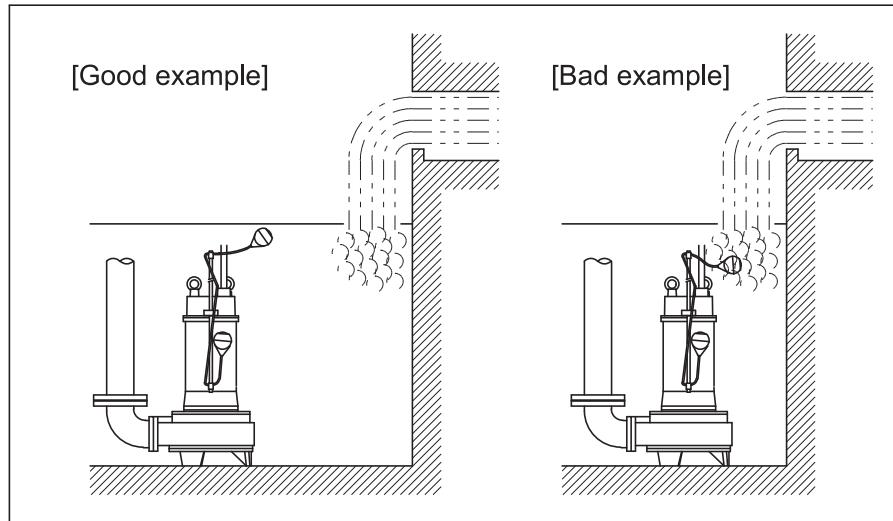


When lifting the pump by hand pay attention to its center of gravity and weight. Do not allow a single person to lift a product heavier than 15kg. Failure to observe this may put a burden on the body, thus leading to an injury.

- (3) When temporarily placing the pump, place it on a flat and stable surface, hold it with chain or rope to prevent pump from toppling, and place sleepers.
- (4) The pump cannot be used horizontally or suspended in air. Use the pump standing on a solid tank bottom or stand.
- (5) Do not install the pump directly on soft or muddy ground for operation. Otherwise, the pump may sink, which may cause the pump and piping system to be clogged with mud, sand, and other foreign matter, and ultimately disabling the operation.
- (6) Install the pump in a location that is free from turbulence in the tank. For an automatic type, be sure to keep the float switch away from the direct inflow of water.



The suction port of the pump must be kept at a distance of at least five times the inflow pipe nominal diameter from the inflow of water so that the flow does not get close to the port. Otherwise, automatic operation does not work properly, which could cause air to be sucked in and/or lead to dry run.



- (7) Carry out repair painting at a time period appropriate for the environment in which the product is used. Depending on the environment in which the product is used, rust may form on parts such as threads, processed parts, and rust-preventive painted parts.
- (8) Do not put a cover or a filter over the motor. The temperature may rise inside the motor, thus leading to failures.
- (9) Install detachable device considering "7. Detachable device (Optional)".

### 3.3 Precautions for piping work

- (1) Remove a protective seal or closure cover if it is attached to the discharge port of pump.



Remove a protective seal or closure cover if it is attached to the discharge port of pump before piping work.

Operating the pump with the seal attached may cause damage to the pump and piping.

- (2) Be sure to provide pipe supports so that the weight of pipes is not applied directly to the pump main body.



Be sure to provide pipe supports for the pipes. Otherwise, the main shaft may be displaced from the center, thus leading to the equipment damage, vibration, or noise.



Do not forcibly screw a pipe into the pump. Otherwise, the pump may be damaged.

- (3) The drain pipe should be corresponding to or larger diameter than the discharge port size, and lay the piping to achieve minimal piping resistance.
- (4) Provide a sluice valve in the middle of the discharge pipe for adjusting the pump discharge rate or for easier maintenance.
- (5) If a strainer or filter is installed in the discharge piping, the piping resistance will increase and the specified performance may not be obtained. Select the appropriate mesh for the application.
- (6) If the discharge port of piping is submerged in water, back flow may occur from the siphon effect when the pump stops. Also, backflow of wastewater may cause damage to the pump or overflow of the drainage tank in the case of long rising piping or long-distance pumping. Install a check valve for each pump in piping.



Caution



Install a check valve (or a check valve for sewage in the case of sewage pumps) for each pump. In case of automatic control operation, wastewater may flow backward and the water level control device may work immediately. This may result in severe repetitive starting conditions, which may cause pump failure.

- (7) Piping should be installed so that air does not accumulate in the piping during pump operation.
- (8) On completion of the piping work, be sure to clean the inside of the receiver tank.



Warning



Be sure to stop the pump and turn off the power source before cleaning. Working with the power on may cause an electric shock.



Caution



Cutting oil, rubber mold release agent, foreign matter, etc. from the pump manufacturing process can get mixed in with the liquid to be handled. Flush thoroughly depending on the facility and confirm that there is no foreign matter before using.

### 3.4 Precautions for wiring work



Warning



Use high-quality wiring equipment and devices, 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 electrical wiring work. Unqualified persons are prohibited by law to carry out wiring work, and it is very dangerous.



Warning



Securely connect the terminals of the power cable. Loose terminals may cause the motor to run in open-phase condition, thus leading to motor burnout.

- (1) Be sure to install a ground fault interrupter on the primary power side of the pump.



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.

- (2) Be sure to attach a ground wire to prevent an electric shock.



Warning



Be sure to attach a ground wire to the motor and perform grounding work. Insufficient grounding work may result in an electric shock.



Do not connect the ground wire to a gas pipe, water pipe, lightning rod or telephone line.

(3) Tighten the connection screws of the conductive part securely and make sure that they are not loosened. If there is dust on the wiring connections, wipe with a dry cloth.



Leaving a poor connection due to loosen wiring connections or dust adhering to the terminals may cause ignition, resulting in fire.



Never immerse the cable terminals in water. Otherwise, it may lead to an electric shock.

(4) Support the cable to the discharge piping with tape or vinyl band.



Install the cable with caution to avoid heat generation. Winding, bundling, or exposing the cable to direct sunlight may cause the cable to overheat, resulting in fire or failure.

(5) Pass the power cable through a metal tube or a metal conduit for shielding, and connect a ground wire to the outer surface of the tube.



Do not install two or more different cables or control wires in one pipe or duct. Otherwise, noise may cause this product or other equipment to malfunction.

(6) When connecting a cable extension, select an appropriate cable in accordance with the extension rules and regulations, and install a relay terminal box at the ground for connection, since voltage drop may cause performance degradation or other malfunctions.



When connecting a cable extension, do not put the connection in water. An incomplete connection may cause an electric shock.

(7) Limit the fluctuations of the supply voltage within  $\pm 10\%$  of the rated voltage, and also limit the fluctuations of the frequency between  $-5\%$  and  $+3\%$  of the rated value. Although you can run the pump in these ranges, avoid continuous operation if the voltage is not within  $\pm 5\%$  of the rated value or if the frequency is not within  $\pm 2\%$  of the rated value. Even if the power fluctuations fall within the allowable ranges, the pump characteristics, motor characteristics, and the temperature rise of the motor may differ from those at the rated voltage and frequency.

(8) Precautions for using the inverter drive

- Ensure that the electric current during operation does not exceed 90% of the rated value.
- Ensure that the minimum frequency is set to 20Hz. However, depending on the pumped liquid, operation may not be possible due to insufficient torque. Be sure to confirm that the pump can pump the pumped liquid at that frequency.
- Do not drive a single-phase motor or a motor with a self-protection device (7.5kW or lower) for inverter.
- When driving a 400V-class motor, contact TERAL INC. In some cases it might be necessary to take measures for inverter surge.
- An inverter-driven motor generates a magnetic sound which may be annoying

- compared with the drives using commercial power supply.
- Although this magnetic sound does not adversely affect the quality of the motor, some inverters allow the user to adjust the tone by changing the carrier frequency. However, changing the frequency may reduce the allowable output of the inverter. Pay particular attention when selecting the inverter.
- If the pump, motor and pipes produce resonance during normal operation, do not run them in the range of the rotation speed.



Do not operate a pump designed for 50 Hz at 60 Hz. Do not operate a pump designed for 60 Hz at a frequency exceeding 60 Hz. Otherwise, electric motor may burn out due to an overload.

Operating a pump designed for 60 Hz at 50 Hz will result in performance degradation.

(9) When connecting the connection terminals of the cabtyre cable to a power supply, be sure to check the rotation direction.

To reverse the rotation direction, swap two of the three wires.

Reverse rotation with incorrect wiring may generate abnormal noise, reduce the amount of water pumped and cause in overcurrent. Forward rotation with normal wiring becomes high pressure and high pumping rate. Install pump in the water, open the valve on the discharge side slightly, and turn the power switch on and off once or twice to check.

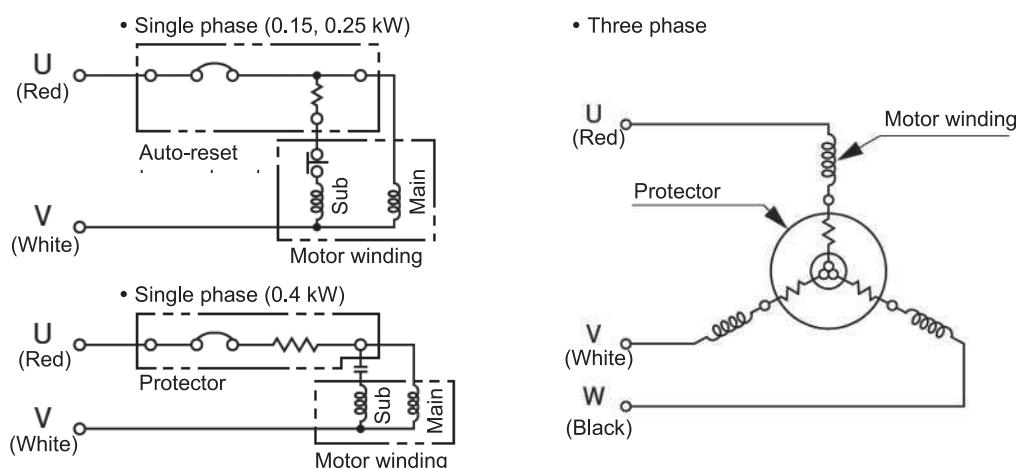


Make sure that the rotation direction is correct. Incorrect rotation direction may cause overload, resulting in malfunction.

(10) The motor has a motor protection device to prevent burnout if the motor temperature becomes abnormally high because of an overload, lockup, or open phase.

[7.5 kW or less output]

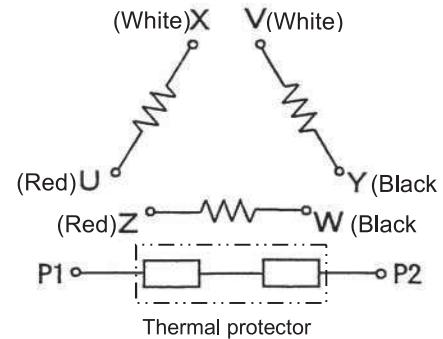
- The motor protection device for motors 7.5 kW or less has an auto-reset type auto-cut built into the winding circuit.
- When the temperature of the winding circuit rises abnormally, the auto-reset type auto-cut shuts down the winding circuit and cuts off the power supply. When the temperature of the winding circuit drops after the shutdown, the auto-reset type auto-cut automatically recovers. Therefore, the motor is protected independently of the control panel on the ground.



[11 kW or higher output]

- The motor protection device for 11 kW or higher has a built-in thermal protector(b-contact) in a separate circuit from the winding circuit to stop the pump or send out an alarm when the temperature inside the motor rises.
- When the temperature of the winding circuit rises abnormally, the circuit with the built-in thermal protector (P1-P2 circuit) is shut down and restored when the temperature drops.
- To protect the electric motor, a control panel on the ground must detect the continuity of the P1-P2 circuit and control the power supply to the pump. The control panel provides power supply when the P1-P2 circuit is conducting and cuts off power when the circuit is interrupted, thereby protecting the motor windings from abnormal temperature rise.
- The thermal protector can protect the motor against the overload, but cannot protect the motor against open phase and lockup. Please protect the motor by the control panel on the ground.
- The specification of thermal protector is shown below.

Item	Specifications
Max. contact rating	24V DC18A 230V AC13A
Contact type	b-contact
Cable	VCT 1.25mm <sup>2</sup> 2-core
Lead wire color	Red, white (non-polarized)
Detective circuit	The circuit configuration should be such that the voltage is 24V or more and the current is 100mA or more.



The thermal protector must be connected to the control panel to stop the pump or send out an alarm when the temperature inside the motor rises, and must protect the motor. Otherwise, the motor may burn out.

## 4. Preparation for operation

### 4.1 Check items before test operation

#### 4.1.1. Check items related to the electrical system



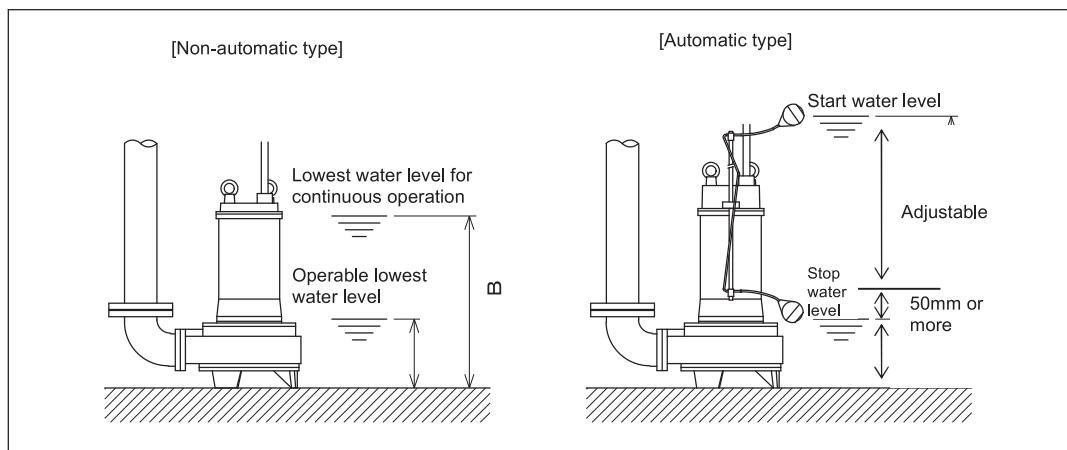
Before changing the wiring, be sure to turn off the main power supply. Otherwise, you may receive an electric shock.



Do not use the product at any voltage other than the rated value. A fire or electric shock may occur.

- (1) Check that the pump is correctly wired.
- (2) Check that the terminals are securely connected.
- (3) Check that the pump is securely grounded.
- (4) Check that the setup value of the overload protection device is consistent with the motor rated current. The rated current is indicated on the nameplate.

#### 4.1.2. Check items related to the operating water level



##### (1) For non-automatic type

- The pump does not have a built-in automatic operation device using a float switch level. Pay close attention to pump operating water level. Note that the motor protective device may be activated if the pump is operated continuously for more than 10 minutes near the lowest operable water level.
- The operating water level can be adjusted as desired by using control panel and float switch together.
- When the water level gradually decreases from the lowest water level for continuous operation to the lowest operable water level, the continuous operation time is within 30 minutes.



Do not allow air to be sucked into the pump during the operation. Otherwise, it may cause the motor to burn out and lead to an electric shock.

(2) For automatic type

- Automatic operation is possible simply by turning on the power with float switch and the automatic operation device (built in the pump).
- The stop water level is set above the lowest water level that can be operated even if the water level drops during operation, and when the water level reaches the stop water level, float switch is activated to automatically stop pump operation.
- Set the stop float switch to the water level at which the float switch be off when the casing is completely submerged.



Do not allow air to be sucked into the pump during the operation.  
Otherwise, it may cause the motor to burn out and lead to an electric shock.

- The starting water level can be adjusted as desired by moving float holder up and down.



If the starting water level and the stopping water level are too close to each other, pump will start and stop frequently, resulting in failure. Set the float switches so that the minimum distance between them is 50 mm or more.



Do not place the float switch in contact with the tank wall, piping, etc., or in a position where the float switch is directly exposed to incoming water. The float switch may become stuck and the pump may not start and stop.

- If you wish to set the water level higher than the level that can be set with the attached float switch mounting rod, replace the PVC pipe ( $\phi$  18 OD for 13A water supply) with a longer one, insert it into the holder attached to the float, and fix it.

(3) Automatic alternating parallel type

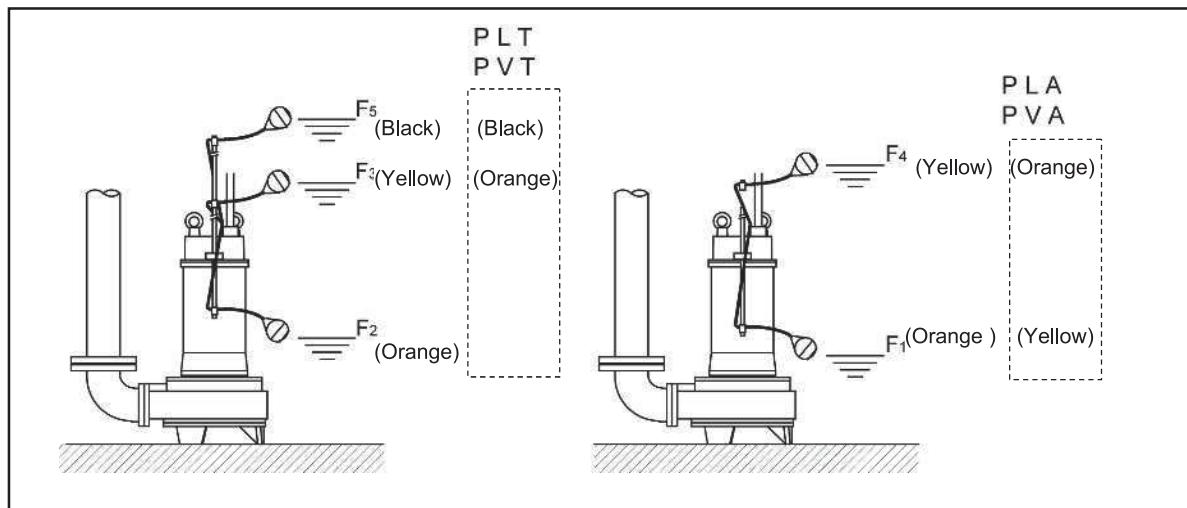
- Automatic alternating parallel operation is possible simply by turning on the power with float switch and the automatic operation device (built in the pump).
- The stop water level is set above the lowest water level that can be operated even if the water level drops during operation, and when the water level reaches the stop water level, float switch is activated to automatically stop pump operation.
- Set the stop float switch to the water level at which the float switch be off when the casing is completely submerged.
- Set the float switches so that their positions are arranged in the ascending order of: F1<F2<F3<F4<F5 (see Figure 1). Set the float switches so that the minimum distance between them is 50 mm or more. If the water level is not set properly, it may cause malfunction.



If the starting water level and the stopping water level are too close to each other, pump will start and stop frequently, resulting in failure. Set the float switches so that the minimum distance between them is 50 mm or more.



Do not place the float switch in contact with the tank wall, piping, etc., or in a position where the float switch is directly exposed to incoming water. The float switch may become stuck and the pump may not start and stop.



- If you wish to set the water level higher than the level that can be set with the attached float switch mounting rod, replace the PVC pipe ( $\phi$  18 OD for 13A water supply) with a longer one, insert it into the holder attached to the float, and fix it.

#### 4.2 Running the pump (Test operation)



Warning



Do not operate the pump if any abnormal condition is observed or if there is anything wrong with the parts, components, and others during the check before test operation. Otherwise, it may lead to an injury, failure, accident, or other problems.



Warning



Never use pump in water with persons.

In case of electric leakage, there is a risk of electric shock.



Warning



Do not put your hands or feet into suction opening of pump during operation. Otherwise, it may lead to an injury.



Warning



Never operate the pump while it is lifted as it is dangerous. The pump body may rotate and damaged.

- Measure the insulation resistance between the ground wire and each phase using an insulation resistance tester while the motor and cables are immersed in water. If each insulation resistance value is  $20\text{ M}\Omega$  or more, there is no problem.
- Referring to "3.4. Precautions for wiring work," be sure to check the rotation direction of the motor after installing the pump in water.
- Turn on the power to start the pump.



Warning



Do not perform zero-discharge operation for more than one minute continuously. Otherwise, the internal pressure and temperature inside pump may increase, causing damage or burnout.



Do not run the pump dry in air. Otherwise, it may cause electric shock or electric leakage due to insulation deterioration.

(4) As a guide, limit the frequency of the startups and shutdowns to about 6 times or less per hour.



High frequency of starting and stopping the pump may cause premature damage to the pump; therefore, start and stop the pump as infrequently as possible. The maximum frequency of starting and stopping should be 6 times per hour.



Do not operate the pump under severe repetitive starting conditions. Otherwise, leakage from the mechanical seal may cause the pump to fail in a short period of time.

(5) In the event of a power failure during operation, be sure to turn off the power.



In the event of a power failure, be sure to turn off the power switch. Otherwise, the pump may suddenly start up on restoration of the power, thus leading to an injury.

(6) Before restarting the pump, confirm that the pump has stopped completely.



Before restarting the pump, be sure to check that the pump has stopped completely. Turning on the power while the pump is still rotating causes an excessive torque on the pump and may cause a failure.

(7) Check for any abnormal pressure, electric current, vibration, noise, and other abnormal conditions.  
(8) There is an air vent hole on the side of the pump casing to prevent air lock. A portion of the discharge water spouts out from the air vent hole, but this does not affect the performance of the pump.  
(9) Stop the pump.



Keep the cocks of the pressure gauges, compound pressure gages, and other parts closed all the time except when they are used for measurement. Otherwise, they become more susceptible to failure.



Do not run the pump using the power beyond the allowable current value. Otherwise, the motor may burn out.

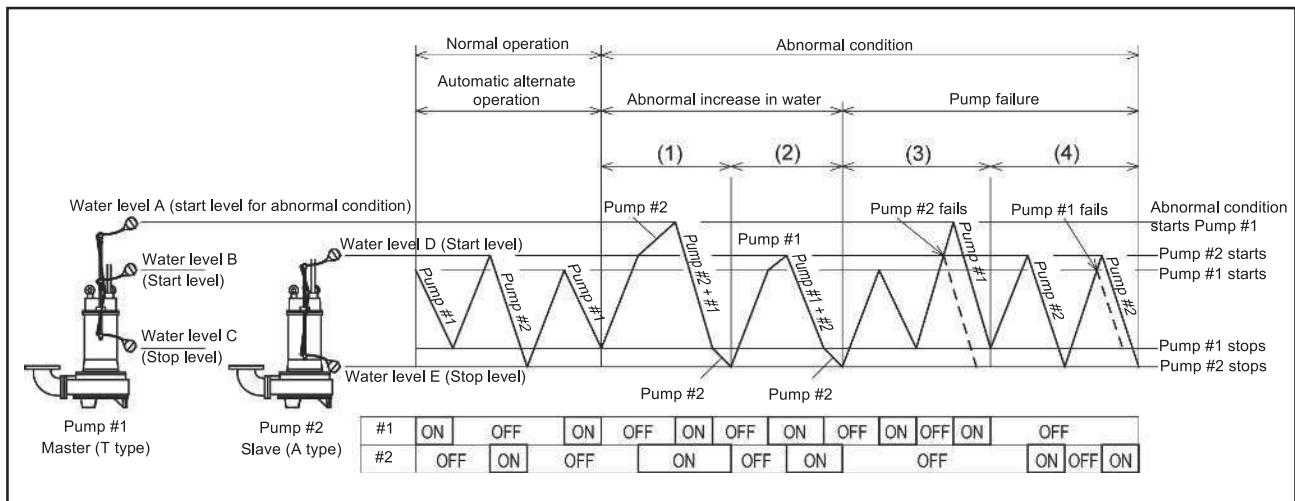
## 4.3 Check items related to automatic operation

### 4.3.1. Automatic alternate operation

Each time the water level B is reached, the system starts and stops the pump #1 and the pump #2 alternately.

### 4.3.2. Automatic alternate/parallel operation

- (1) If an abnormal increase in water raises the water level even though the pump #2 is running, the pump #1 also starts up at the water level A, and the two pumps run at the same time to lower the water level.
- (2) If an abnormal increase in water raises the water level even though the pump #1 is running, the pump #2 also starts up at the water level D, and the two pumps run at the same time to lower the water level.
- (3) If the pump #2 fails, the system repeats the cycle of starting the pump #1 alternately at the water level B and at the water level A and stopping the pump at the water level C.
- (4) If the pump #1 fails, the system repeats the cycle of starting the pump #2 at the water level D and stopping the pump at the water level E.



## 5. Maintenance and inspection



Before checking the pump, be sure to turn off the main power. The pump may suddenly start up in automatic mode or on other occasions and lead to a great danger.



Before starting the pump 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.



For overhaul, replacement of parts, or repairs, contact TERAL INC. Incorrect work may cause a failure or accident.



When temporarily placing the pump, place it on a flat and stable surface, hold it with chain or rope to prevent pump from toppling, and place sleepers. Otherwise, the pump may tip over and cause injury.

### Note

Contact a specialized company to dispose of lubricants, parts, etc., that have been wasted due to inspections or repairs.

### 5.1 Precautions for maintenance and inspection



Regularly inspect your equipment and perform maintenance on each component.

#### (1) Daily inspection

- ① A large deviation in the pump's discharge pressure, electric current, vibration, noise, or other conditions from the normal status is a sign of a failure. Therefore, immediately take measures, referring to the Maintenance checklist in Section "5.2 Maintenance check list" for this purpose, it is recommended to keep an operation log.
- ② If the current fluctuation is large even if it is within the rated current value, foreign matters may be caught. If the discharge rate is decreasing rapidly, there is also a possibility that foreign matter is clogging the impeller. If the current value is clearly increasing, the foreign matters may be adhering to the surface of the impeller. Raise the pump at the earliest possible time and remove it.
- ③ Check the piping for any water leakage or damage.
- ④ Check that all mounting bolts and the power terminal block are securely connected.
- ⑤ Except when inspection is required, keep the cocks of the pressure gauges and compound gauge closed all the time with the pressure being released.
- ⑥ In the event of a power failure, be sure to turn off the power. The pump suddenly starts up on restoration of the power, and it is dangerous.



Warning



In the event of a power failure, be sure to turn off the power switch. The pump may suddenly start up on restoration of the power, which leads to a danger.

(2) Regular inspection

① Because a submersible motor is used, periodically (once a month) check the insulation resistance. If the insulation has degraded rapidly, inspect the motor.

Insulation resistance 20MΩ or more	The pump can be operated continuously.
Insulation resistance 1MΩ to 20MΩ	The pump can be operated, but make sure to inspect the motor and the cables at the earliest possibility.



Warning



Do not run the pump if the insulation resistance is not higher than 1MΩ. Otherwise, it may lead to an electric shock and/or a fire

② In case of automatic type, check the position of float switches regularly.

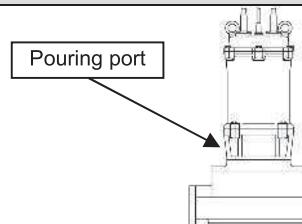
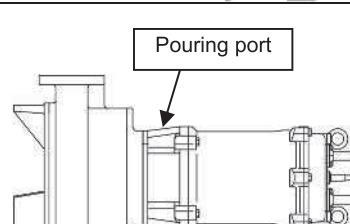


Caution



If the position of the float switch changes from the initial operation due to water flow, vibration, etc., check the position periodically because proper automatic operation will not be possible. Otherwise it may cause malfunction or pump failure.

③ The oil in the mechanical seal chamber should be changed every 6 months. Follow the table below for the posture when lubricating the oil. At this time, if water gets mixed in the oil and the oil is very cloudy, replace the mechanical seal. In case of automatic type, check the position of float switches regularly.

Model	Posture of pump	
BO KO		Place the pump vertically on a level surface and lubricate the pump until it overflows from the pouring port.
PL/PV SCU SVC SSU		Place the pump horizontally on a level surface with the oil inlet facing straight up and lubricate the pump to the overflow from the pouring port.



Caution



After lubrication, make sure that the lubrication plug is securely fastened. Insufficient fastening may cause pump failure.

④ In the case of PL and SSU types, check if the strainer is not clogged. If it is clogged, clean it.



Caution



For PL and SSU types, the strainer should be cleaned periodically. If the strainer becomes clogged, pressure fluctuations, reduced discharge volume, or abnormal noise may occur, causing the pump to malfunction.

- ⑤ Replace the mechanical seal every year or 6000 hours of total operation time, whichever is shorter.
- (3) When not operating the pump
  - ① When the pump is not operated for a long period of time, pay attention to the following. Depending on the installation environment, the sliding parts may rust and foreign matter may accumulate. In order to prevent rusting of the sliding parts and accumulation of foreign matter, if the pump is not operated for a long period of time, periodically (once a week as a general rule) turn the pump by hand and operate it. If the pump is to be stored on land, drain the water completely from inside the pump, clean and dry it, and store it in a dry place.
  - ② Before turning the pump by hand to check its smooth rotation, be sure to turn off the main power. If the pump starts unexpectedly, it may cause an accident.
  - ② If you have a backup pump, run it from time to time to make it available for operation at any time



Warning



Before turning the pump by hand to check its smooth rotation, be sure to turn off the main power. If the pump starts unexpectedly, it may cause an accident.

## 5.2 Maintenance check list

	Inspection point	Inspection item	Method	Criterion	Frequency				Consumables
					Daily	Monthly	Half-yearly	Yearly	
Installation environment	Liquid temperature	Check against the specified range.	Measure	Between 0 and 40°C	✓				-
	Ambient temperature		Measure	Between 0 and 40°C	✓				-
Power	Power terminal block inside the panel	Voltage	Measure	The specified voltage is applied.			✓		-
		Voltage fluctuation	Measure	Within the allowable fluctuation range			✓		-
		Loose screws	Tighten	Firmly tightened				✓	-
Pumps and motors	Operating conditions	Performance	Visual check	As per the specifications					When abnormality is recognized, disassemble and inspect the pump.
		Electric current value	Measure	As per the specifications					
		Noise, vibration	Listen Touch	No abnormal condition					
	Impellers	Clogging	Disassemble and inspect	No clogging				✓	
		Wear	Disassemble and inspect	No abnormal condition				✓	When worn out and performance is deteriorated
	Casing	Clogging of the air vent hole	Visual check	No clogging			✓		
	Strainer	Clogging with foreign matter							
	Main shaft and its surrounding area	Smooth rotation	Rotate by hand	Not unusually stiff				✓	-
	Bearings	Smooth rotation	Rotate by hand	Not unusually stiff				✓	Every 3 years (or after 15000-hours operation)
	Oil	Oil condition	Visual check	No milky oil and no mixture of water					Every 6 months
	Mechanical seals	Water leakage	Visual check	No milky oil and no mixture of water			✓		Every year or 6000 hours of total operation
	O-ring	-	-	-					Whenever disassembled
	Sheet packing	-	-	-					Whenever disassembled
	Appearance	Unusual noise, vibration	Listen	No abnormal condition	✓				-
	Winding resistance	Resistance value between each winding (U-V, V-W, W-U)	Measure	Within $\pm 5\%$ of the specified value corresponding to the cable length				✓	-
	Insulation resistance	Between the ground and each lead	Measure	At least 1 MΩ (DC500V megger tester)		✓			-
	Float switch	Location	Visual check	No abnormal condition		✓			-

\*1 The timing of replacing consumables (as a guide) does not mean their guaranteed service life. The service life of parts varies depending on the ambient conditions and the conditions for use.



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

The timing of replacement for the consumables is the reference values when normally used and checked regularly. It may become short according to the use condition.

Note

Contact your local waste disposal partner to dispose of the waste components generated by repair or replacement in accordance with local regulations.

## 6. Troubleshooting

Problem	Cause	Measures
The pump does not start.	Earth leakage breaker is activated.	Inspect and repair the leak spot.
	Disconnection or poor contact of power wires	Check by a tester and replace the defects with a good one if any.
	Tripping of the thermal relay	Check the thermal relay.
	Incorrect wiring or failure of control circuit	Check the control circuit and contact the power company.
	Large voltage drop	Check the validity of cable selection.
	Power supply voltage is out of fluctuation tolerance range.	Check the supply voltage and contact the power company.
	Float switch is obstructed.	Remove obstructions.
	Float switch failure	Contact TERAL INC. because disassembly and inspection are required.
	The water level is lower than the start level.	Store water until it reaches the start level or change the setting position of the float switch.
	The motor has failed.	Contact TERAL INC. because disassembly and inspection are required.
The pump stops after a while of working.	Foreign matter is caught in the impeller and casing.	Remove the foreign matter.
	The impeller and shaft seal are bound.	Contact TERAL INC. because disassembly and inspection are required.
	The motor bearing is damaged.	Contact TERAL INC. because disassembly and inspection are required.
Power protection device is activated.	Air operation is long and the motor protective device is activated.	Raise the stop water level
	The liquid temperature is high and the motor protective device is activated.	Lower the liquid temperature.
	The motor protection device is activated due to overcurrent.	Refer to the measures for "overcurrent".
The pump starts, but cannot achieve the specified discharge rate and the specified head.	Large voltage drop	Check the validity of cable selection.
	Power supply voltage is out of fluctuation tolerance range.	Check the supply voltage and contact the power company.
	A 60Hz pump is run in the 50Hz power zone.	Check the nameplate and replace the pump or the impeller.
	Air is sucked.	Check the current water lever and raise the water level or lower the pump position.
	Blockage of air vent inside the casing	Clean the air vent inside the casing.
	Clogged pump strainer (in the case of PF and SSU)	Clean the strainer.
	Clogged strainer or filter (in installed in discharge piping)	Clean the strainer or filter.
	The rotation direction is reverse.	Correct the wiring so that the motor rotates in normal direction.
	The piping loss is high.	Check the diameter, route and length of the pipes.
	The piping is clogged with foreign matter.	Check and clean the piping.

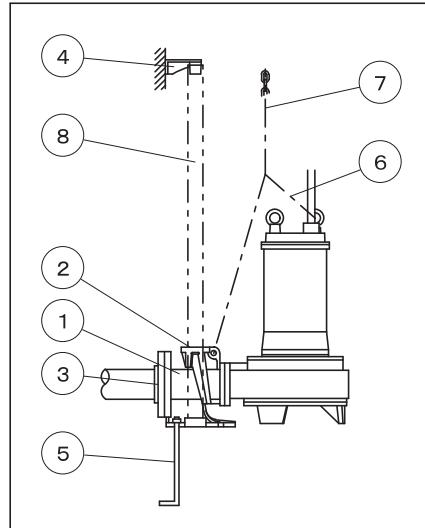
	The impeller and the liner ring are worn.	Contact TERAL INC. because disassembly and inspection are required.
	Foreign matter is accumulated in the impeller and in the casing.	Remove the foreign matter.
	The sluice valve is closed.	Open the sluice valve.
	There is leakage in discharge piping.	Inspect and repair the piping.
Overcurrent occurs.	The rotation speed is too high.	Check the power supply frequency and operating frequency.
	A 50Hz pump is run in the 60Hz power zone.	Check the nameplate and replace the pump or the impeller.
	Large voltage drop	Check the validity of cable selection.
	Power supply voltage is out of fluctuation tolerance range.	Check the supply voltage and contact the power company.
	The rotation direction is reverse.	Correct the wiring so that the motor rotates in normal direction.
	The motor is running in open-phase condition.	Check the wiring.
	The set value of motor overload protector is too low.	Correctly set the motor overload protector.
	The pump is operated on the high flow side due to the gap between actual head and pump performance.	Throttle the sluice valve.
	The narrow part of the rotor and the stator are in contact with each other.	
	Foreign matter is caught in the impeller and casing.	Remove the foreign matter.
Unusual noise and unusual vibration of the pump	The motor bearing is damaged.	Contact TERAL INC. because disassembly and inspection are required.
	The rotation direction is reverse.	Correct the wiring so that the motor rotates in normal direction.
	Foreign matter is accumulated in the impeller and in the casing.	Remove the foreign matter.
	Air is sucked.	Check the current water lever and raise the water level or lower the pump position.
	The sluice valve is closed.	Adjust the opening of the sluice valve.
	Resonance in piping.	Improve piping.
	Looseness of tightening bolts	Tighten the bolts of each part sufficiently.
	Abnormal wear of impeller	Contact TERAL INC. because disassembly and inspection are required.
	The motor bearing is damaged.	Contact TERAL INC. because disassembly and inspection are required.
	Inverter is used.	Change the operating frequency or carrier frequency.

## 7. Detachable device (option)

### 7.1 Names of components

#### 7.1.1. C-type detachable device

- ① Discharge pipe
- ② Sliding guide
- ③ Companion flange
- ④ Pipe supporter
- ⑤ Anchor bolt
- ⑥ Balance chain
- ⑦ Hanging chain
- ⑧ Guide pipe

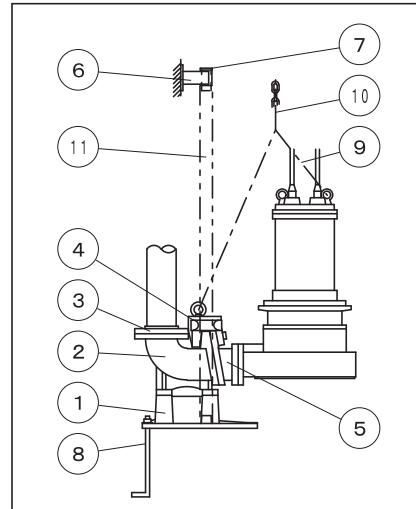


#### Note

The guide pipe is not a standard accessory. When ordering, refer to the catalog, assembly drawing, and other documents to check the dimensions.

#### 7.1.2. SEC type detachable device

- ① Support base
- ② Discharge elbow
- ③ Companion flange
- ④ Sliding guide
- ⑤ Taper flange
- ⑥ Pipe supporter
- ⑦ Guide pin
- (\* Except for detachable device SEC-1B)
- ⑧ Anchor bolt
- ⑨ Balance chain
- ⑩ Hanging chain
- ⑪ Guide pipe



#### Note

The guide pipe is not a standard accessory. When ordering, refer to the catalog, assembly drawing, and other documents to check the dimensions.

## 7.2 Installation of the detachable device

### Note

Ensure to install the detachable device so that it can lift and lower the pump properly. If the guide pipe is not installed precisely vertically, the detachable device may not be able to fully lift or lower the pump.

### Caution

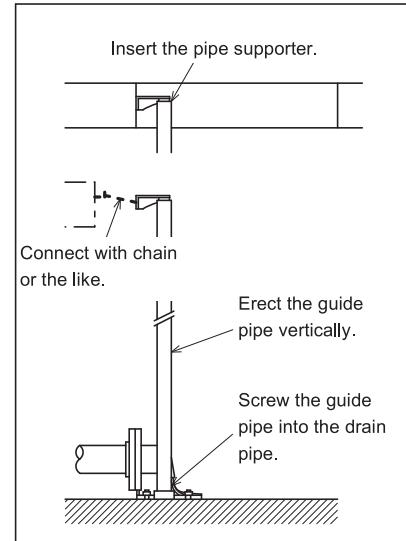
Be sure to provide pipe supports for the pipes. Otherwise, the main shaft may be displaced from the center, thus leading to the equipment damage, vibration, or noise.

### Caution

Secure the main body of the detachable device to the specified position horizontally and sufficiently with foundation bolts. Insufficiently securing the detachable device may cause it to tilt, thereby affecting the function of the detachable device.

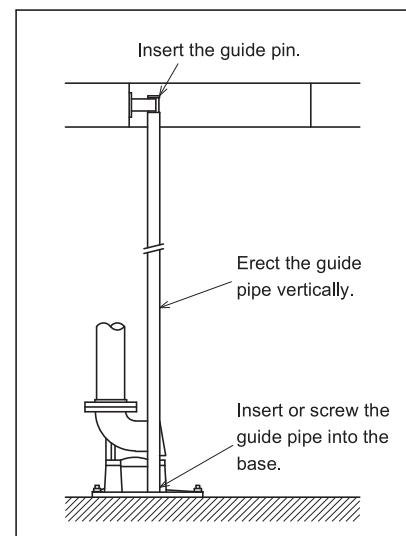
### 7.2.1. C-type detachable device

- (1) On completion of the foundation work, determine the positions of the parts so that the flange face of the discharge pipe and the guide pipe are both vertical. Then fix the gear in place with the anchor bolts.
- (2) Cut off the guide pipe to the required length in advance, and cut taper-pipe threads on one end.
- (3) Screw the guide pipe into the discharge pipe.
- (4) Insert the pipe supporter into the upper end of the guide pipe, and fix it to a manhole wall.  
If the pipe supporter is not fixed to a wall, connect the supporter with a chain or the like to prevent it from falling.
- (5) Install a drain pipe.



### 7.2.2. SEC type detachable device

- (1) On completion of the foundation work, determine the positions of the parts so that the flange face of the discharge elbow is horizontal and the guide pipe is vertical. Then fix the gear in place with the anchor bolts.
- (2) Cut off the guide pipe to the required length in advance. For SEC-1B, cut taper-pipe threads on one end.
- (3) Insert the guide pipe into the projected area of the support base.
- (4) Insert the guide pin or the pipe supporter into the upper end of the guide pipe, and fix the pipe supporter to a manhole wall.
- (5) Install a drain pipe.



### 7.3 Installation of the pump

- (1) Adjust the hanging position of the balance chain so that the hoisted pump is not tilted.
- (2) Hold the hanging chain with a chain block or other tools, and slowly lower the sliding guide along the guide pipe.
- (3) Put the hanging chain on a hook of the manhole so that it does not fall in the tank.
- (4) Ensure that the cabtyre cable is long enough to lift and lower the pump in the tank.



If the cabtyre cable is too long, it may be sucked into the pump, thus leading to damage and an electric leakage.

If the cabtyre cable is too short, the cable may be pulled, thus leading to damage and electric leakage.

- (5) When lifting the pump, hold the hanging chain with a chain block or other tools, and slowly lift it along the guide pipe.



If there is a drag force or catch during lifting because of adherence of foreign matter or other factors, do not lift the pump forcibly. Instead, slightly change the hanging position, and then lift it again.

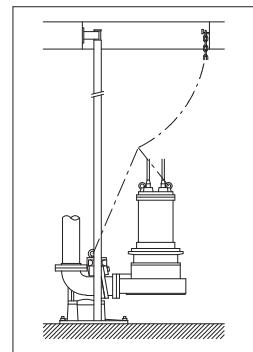
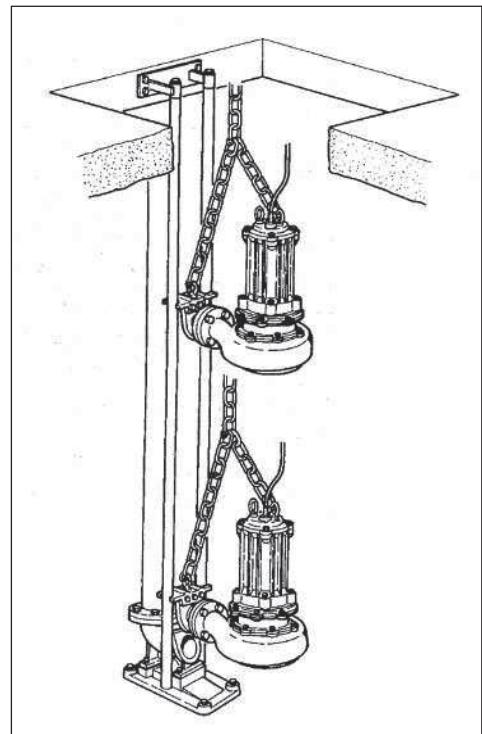
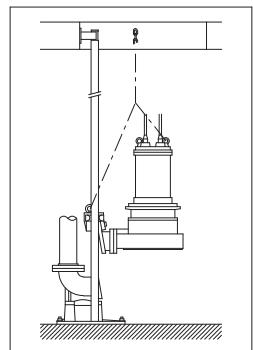


Never pull the cabtyre cable.  
Otherwise, it may lead to an electric leakage.

- (6) For other handling, refer to each section of this manual.
- (7) Perform a test operation of the pump to confirm that there is no excessive leakage from the connection of the detachable device. If a large amount of leakage is found at the connection of the detachable device, pull up the pump and reinstall it. In the case of a detachable device with an O-ring, confirm that the O-ring is properly installed and reinstall the device.



Make sure that a large amount of liquid is not spurting from the connection of the detachable device. Unlike normal piping connections, however, the detachable device is not bolted and is connected only by its own weight, so it may leak a little, but this is not abnormal.









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