
Coolant Pump

Model : VKD-e

⚠ WARNING

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

Keep this manual in a safe place where it can be consulted at any time.

To : All mechanical Contractor

Make sure to supply copies of this manual to the customer's operator maintenance and inspection personnel.

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.
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.
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.

<Chargeable repair>

Investigation and repair work after the warranty period shall become chargeable. The repair and investigation of the above-mentioned failures outside the warranty range shall be undertaken by Teral Inc., even though outside the warranty period.

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. This product may cause an unexpected accident when handed incorrectly. 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

1.1 Types and meanings of warning terms 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 the warning terms
















Warning Term	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
















				
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	
 	Do not touch any energized parts after turning on the main power. Doing so may cause electric shock leading to death because high voltage is applied to the energized part.
 	Do not use the product in any explosive atmosphere. Doing so may cause an injury and fire.

























 Warning	
 Properly move the unit according to lifting instructions. Otherwise, the unit may fall, resulting in injury and/or damage.	 Do not use the pump or perform any work with the pump lifted up. Otherwise, the unit may fall, resulting in injury and/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 any electric work. Otherwise, it may lead to an electric shock, fire, failures, and/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, and/or other problems.
 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.	  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 operate the pump when its action or parts are abnormal. Otherwise, it may lead to injury, failures and/or various accidents.	  Wiring must be performed reliably according to the connection diagram within the terminal box and the instruction manual. Incorrect wiring may cause fire, electric shock and other accidents.

 Warning	
  <p>Be sure to keep the terminal box cover installed during operation of the pump. Otherwise, it may lead to an electric shock.</p>	  <p>Be sure to keep the side plates installed during operation of the pump. Otherwise, it may lead to injury and/or damage.</p>
  <p>Only after detaching a companion flange from each pump, screw a pipe into it. Failure to observe this may cause breakage or leakage.</p>	  <p>Do not forcibly bend or pull the power cable and the lead wire of the product. Avoid putting them between objects. Failure to observe this may cause electric shock or fire.</p>
  <p>Check that the wire connections and wiring sections are free from looseness. Looseness may cause a fire or electric shock.</p>	  <p>Before starting the maintenance or inspection work, be sure to stop the pump and turn off the main power of the panel board. Failure to observe this may cause electric shock, injury, breakage or leakage.</p>
 <p>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.</p>	  <p>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.</p>
  <p>Do not touch any part of the pump that does not need operation, after energized. Failure to observe this may cause electric shock or injury.</p>	  <p>Never perform the zero discharge operation continuously for a long time. Failure to observe this may increase the internal temperature and pressure of the pump, leading to breakage and steam spouting.</p>
  <p>Do not put your fingers or other objects into the opening and rotating part of the motor during operation. Otherwise, it may lead to injury and/or damage.</p>	  <p>If you need to disassemble the pump for check, parts change, repair and other work, ask the vendor or the service center specified by Teral Inc. Work needing expertise may lead to an accident or failure when an inexperienced person does such work.</p>
 <p>Be sure to turn off the power switch if an electric outage occurs. At the time of power restoration, the machine may suddenly operate, leading to an injury.</p>	

 Caution	
  <p>Do not use the unit outside the range of the product specifications. Otherwise, an electric shock, a fire, leaks, or failures may occur.</p>	 <p>Do not use the unit at an incorrect power voltage. The motor may get damaged if used with an incorrect supply voltage.</p>
 <p>Do not use a single unit as the only means of directly operating key facilities or sustaining life. Otherwise, a failure may lead to the suspension of water supply. Be sure to get a standby machine ready.</p>	 <p>Ensure that the delivered container is placed in the correct orientation (not upside down) before unpacking. Carefully unpack the container, while paying special attention to nails. Otherwise, it may lead to injury and/or damage.</p>
 <p>The floor in the pump installation area must be provided with water-proofing and drainage measures. Otherwise, significant damage may be caused in case of a leak.</p>	 <p>Do not put the cables or control line of other equipment in the same pipe or duct. Otherwise, it may damage the unit and/or other equipment.</p>
 <p>Do not step on the pump and motor. Otherwise, it may lead to injury, damage, and/or other problems.</p>	  <p>Do not allow a liquid to splash on the motor. Otherwise, it may lead to an electric shock, electric leak, failures, and/or other problems.</p>
 <p>Operate the controls carefully. Otherwise, it may lead to injury and/or damage.</p>	 <p>Never run the pump idling (operation with oil level being lower than the lowest oil level) during test operation. Failure to observe this may cause damage or fire.</p>
 <p>Prior to operation, clean the interior of piping thoroughly to remove foreign matter. Otherwise, the foreign matter in the piping system may get into the pump, leading to an accident or pump failure by conveyance of the mixed liquid.</p>	 <p>Do not run the pump dry for more than 30 sec. Failure to observe this may cause damage or fire.</p>




Caution

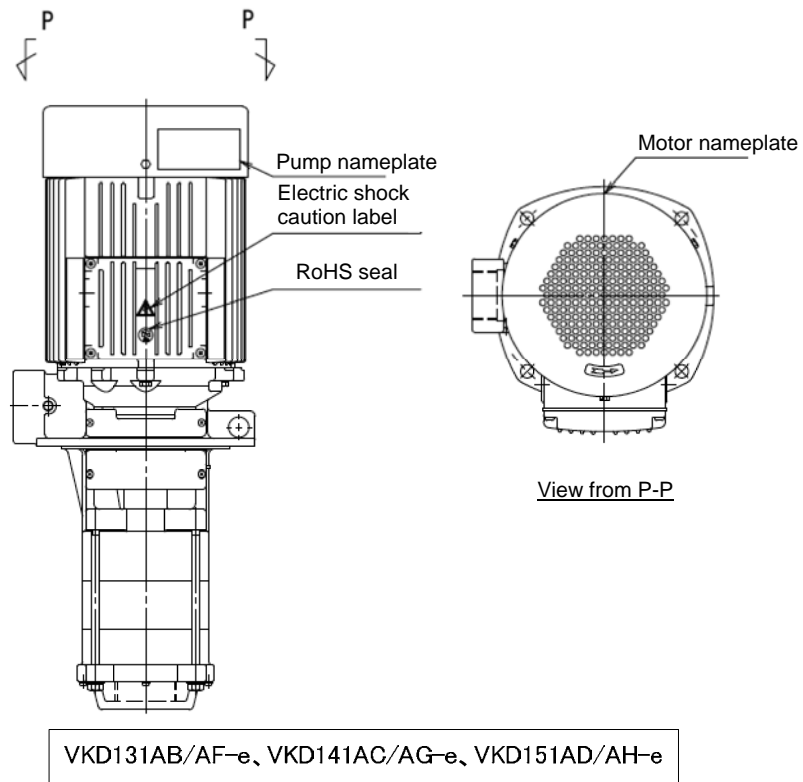
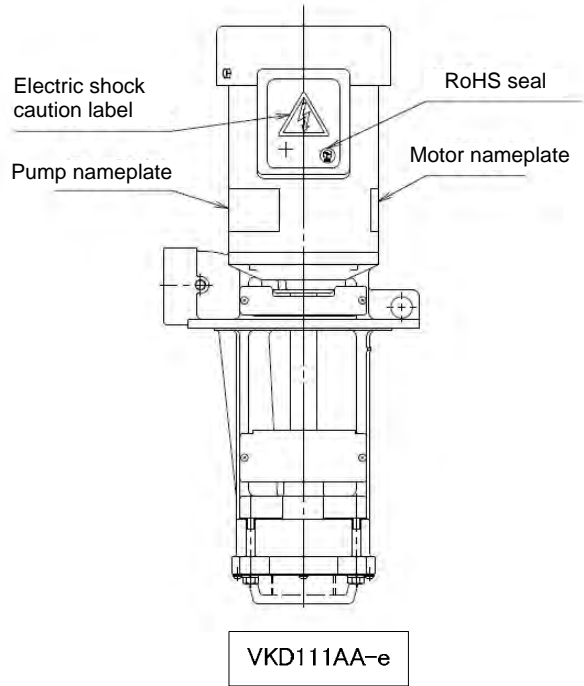
<p> Do not put a cloth on the motor. Failure to observe this may cause overheating or ignition.</p>	<p> Do not touch the motor body during operation or immediately after the stop of operation.  Failure to observe this may cause a burn due to high temperature of the pump.</p>
<p> If any unrestorable failure occurs on the pump or if you find anything wrong with the pump, stop the operation immediately and turn off the power, and then contact Teral Inc. or the service company. Otherwise, it may lead to an accident.</p>	<p> Do not operate the pump when tools or other items are placed on the pump. Otherwise, it may lead to injury and/or damage.</p>
<p> Check to verify that the product is exactly what you ordered. The use of a wrong product may cause an injury or failure.</p>	<p> Ensure to carry out inspection according to the maintenance checklist. Otherwise, you cannot prevent potential failures, thus leading to a higher risk of accidents.</p>
<p> Do not place any obstacle that disturbs ventilation, around the product. Failure to observe this may cause a fire.</p>	<p> Do not provide any strainer at the tip of the pump. Failure to observe this may cause the strainer to come off, resulting in an injury or breakage.</p>
<p> Do not operate the pump with a frequency beyond 60 Hz. Failure to observe this may cause a burnout or fire.</p>	<p> Do not place any combustible objects around the product. Failure to observe this may cause a fire.</p>
<p> Be sure to install an overcurrent protection device. Installation of the device is obliged by the Technical Standards for Electrical Equipment. Failure to observe this may cause a fire or breakage due to damage to the product. In addition, it is recommended to install a protective device, e.g. an earth leakage circuit breaker.</p>	<p> Do not touch the pump impeller, fastening bolts, strainer and other items with bare hands. Failure to observe this may cause an injury or breakage.</p>
<p> Do not run the pump with its strainer removed. Failure to observe this may cause an injury or breakage.</p>	<p> Do not use any operating fluid beyond the viscosity limit. Failure to observe this may cause a burnout or fire.</p>
<p> Do not touch the impeller and other parts after removing the strainer. Failure to observe this may cause an injury.</p>	<p> Do not touch any terminal or wire when measuring the insulation resistance. Failure to observe this may cause an electric shock.</p>
<p> Do not use thinner or benzine for cleaning the product. Failure to observe this may cause the product to be discolored or the coating to be peeled off.</p>	<p> After power-off, do not restart the pump until it comes to a complete stop. Failure to observe this may cause an excessive load to act on the pump spindle, resulting in a shortened service life of the pump.</p>
<p> When lifting the product, pay attention to its center of gravity. Failure to observe this may cause the product to topple over or fall down, leading to an injury.</p>	<p> If using a solvent for cleaning the product, pay attention to the handling and use environment of the solvent. Failure to observe this may cause poisoning.</p>
<p> When lifting the product, give attention to its weight. Do not allow any product heavier than 15 kg to be lifted by a single person. Failure to observe this may put a burden on the body, leading to an injury.</p>	<p> When disposing of the product, treat it as industrial waste.</p>
<p> If adopting star-delta starting, use a starter with an electromagnetic switch (three-contactor type) on the primary side. Failure to observe this may cause a fire.</p>	

1.3 Location of warning labels and caution labels

The figure below shows the locations of warning labels and caution labels. If these labels become dirty and hard to read or if they are peeled off, replace them with a new one.




Observe all the warnings and cautions affixed to the machine as well as those described in this instruction manual.



2. Configuration and overview of the pump

This chapter describes the standard specifications. For details, refer to the specifications including the external dimensions drawing and the internal structure drawing.

Also if you purchased a custom-made product with special specifications, refer to the specifications including the external dimensions drawing and the internal structure drawing, because the contents may differ partially.

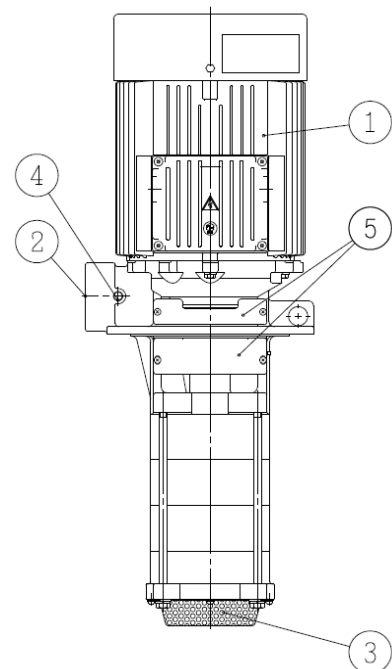



Caution

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

2.1 Part names and functions

- ① Motor
- ② Discharge port
- ③ Suction port (Strainer)
- ④ Air vent
 - Removes the air in the pump to prevent dry run, if it is impossible to open the discharge piping to the atmosphere.
- ⑤ Side plate





Warning **Caution**

Be sure to keep the side plates and strainer installed when the pump is running. Failure to observe this may cause an injury.

2.2 Type description

VKD 15 1 A D -e
 ① ② ③ ④ ⑤ ⑥

- | | |
|--|---|
| <ul style="list-style-type: none"> ① Model ② Output code
(11:0.75kW, 13:1.5kW, 14:2.2kW, 15:3.0kW) ③ Series No. | <ul style="list-style-type: none"> ④ Phase (A: 3-phase) ⑤ Number of impellers & leg length
[standard: 260 mm (2.2kW or less), 300 mm (3.0kW), long: 400 mm]
(A: 1 pc., standard, B: 2 pcs., standard, C: 3 pcs., standard, D: 4 pcs., standard, F: 2 pcs., long, G: 3 pcs., long, H: 4 pcs., long) ⑥ Top Runner Energy Efficiency Standards (IE3-equivalent) motor-equipped pump |
|--|---|

2.3 Standard specifications *

Applicable liquid	Quality	Grinding fluid, cutting fluid, etc. after primary treatment ^{Note1}
	Temperature	-20 to 40°C (No freezing is allowed.)
	Dynamic viscosity	See ^{Note2} .
Installation location		Indoors, Height above sea level: 1,000 m or less, Ambient temperature: -20 to 40°C, Humidity: 85% or less (No condensation is allowed.), Place not exposed to direct sunlight, Place whose atmosphere contains no corrosive gas, explosive gas or vapor
Material	Pump leg	FC200
	Casing	FC200
	Impeller	FC200
	Motor spindle	S45C
Shaft sealing structure		Non-seal (mechanical seal-free) structure
Motor	Type	Totally-enclosed fan-cooled indoor type
	IP protection	IP54
	Power ^{Note3}	3-phase 50/60Hz 200/200-220V
	Insulation class	Class F
	Number of poles	2P
	Standard	IEC60034-1
Noise[dB(A)]		77
Coating color		Munsell N1

Note1 Notice that the liquid in question cannot be used with water and special liquids such as printing liquids and acidic liquids. For other special liquids (ceramic etc.), contact Teral Inc.

Note2 When the dynamic viscosity of liquids used becomes higher than that in the table below, the useful life of the motor may become shorter, leading to a burnout. Be sure to use a liquid with a dynamic viscosity lower than its lime value in the table below. In addition, the dynamic viscosity of a liquid may drastically increase with decreasing temperature of the liquid. When using a liquid, confirm the dynamic viscosity of the liquid when its temperature is lowest.

The characteristics of the pump deteriorate as the dynamic viscosity of liquid used increases.

Applicable limit value of dynamic viscosity [mm^2/s]	
Operation at 50Hz / 60Hz	75

Note3 Limit the fluctuations of the power voltage within $\pm 10\%$ of the rated voltage, and also limit the fluctuations of the frequency within -5% to $+3\%$ of the rated value. Avoid continuous operation if the voltage is not within the range of $\pm 5\%$ of the rated value or if the frequency is not within the range of $\pm 2\%$ of the rated value.

* This product is labeled with a self-declaration CE mark and complies with the Essential Safety Requirements (ESRs) of the "EU (EC) Directive. The following are the general descriptions.

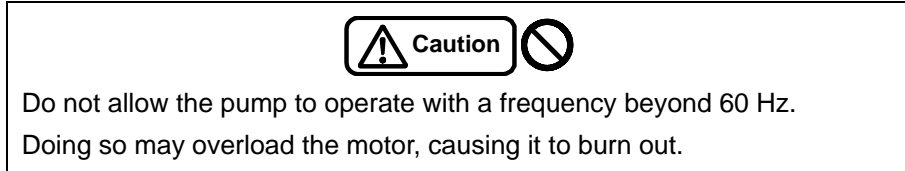
Manufacturer	Teral Inc. 230 Moriwake, Miyuki-cho, Fukuyama-city, Hiroshima 720-0003 Japan
Object product	VKD-e model coolant pump
Standards	Machinery Directive 2006/42/EC
	EN 809/A1:2009、EN ISO 12100:2010、EN 60204-1/A1:2009
Manufacturer (Japan)	Teral Inc., Hiroshima
Administrator (EU nation)	Shiran Tower 5F Luzna 716/2 160 00 Vokovice, Praha 6 CZECH REPUBLIC Person in charge: Tomohisa Yamamoto
Place of declaration	Hiroshima, Japan Manager: Taiji Monden

2.4 Nameplate entries

The specifications of the pump are shown on the nameplate. When you receive the pump, check the nameplate to verify that the product is exactly what you ordered. Be sure to confirm the model, motor output, frequency and voltage.

If any part of the product should be different from what you ordered, contact the vendor from which you purchased the product.

Keep the nameplate easy to check without placing an obstacle in front of it or removing it.



TERAL		COOLANT PUMP		CE	
		3-PHASE a. c. INDUCTION MOTOR			
TYPE	①	Hz	⑥		
OUTPUT	②	kW	VOLT	⑦	
PIPE SIZE	③	B	AMP	⑧	
HEAD	④	m	min ⁻¹	⑨	
Q' TY	⑤	L/min	Maximum safe operating speed	⑩	
Year of manufacture			⑪	BRG	D-END ⑬
Main document NO.			⑫		N-END ⑭
SER NO.			⑬		
230, Moriwake, Miyuki-cho, Fukuyama-city, Hiroshima, 720-0003, Japan					
TERAL INC.				M-6021-→	

Symbol	Item
1	Type
2	Motor output (kW)
3	Nominal discharge diameter (B)
4	Total head (m)
5	Discharge rate (L/min)
6	Frequency (Hz)
7	Voltage (V)
8	Current (A)
9	Rotating speed (min ⁻¹)
10	Max. permissible rotating speed (min ⁻¹)
11	Year of manufacture
12	Instruction manual No.
13	Inboard bearing type
14	Outboard bearing type
15	Production No.

Pump nameplate

2.5 Specification table

• Standard leg

Type	VKD111AA-e		VKD131AB-e		VKD141AC-e		VKD151AD-e	
Specifications								
Output (kW)	0.75		1.5		2.2		3.0	
Rated voltage (V)	200	200 220	200	200 220	200	200 220	200	200 220
Frequency (Hz)	50	60	50	60	50	60	50	60
Rated current (A)	4.7	5.0 4.9	7.6	9.1 7.9	12.0	12.1 10.7	14.5	16.2 14.6
Starting current (A)	34.0	32.5 36.0	49.0	45.5 50.0	78.0	72.0 79.0	120	115 126
Discharge rate (L/min)	80 to 300	100 to 400	80 to 400	100 to 500	80 to 400	100 to 500	80 to 400	100 to 500
Total head (m)	8 to 4	12 to 4	20 to 7	28 to 7	29 to 9	40 to 9	40 to 14	54 to 14
Applicable limit value of dynamic viscosity (mm ² /s)	75	75	75	75	75	75	75	75

Note 1) The discharge quantity / total head is indicated with the value when tested at a dynamic viscosity of 1 mm²/s (equivalent to normal-temperature fresh water). Notice that the pump cannot be used with water.

Note 2) The rated current in the above table (current value stated on the pump nameplate) is the recommended preset current value of the protective device.

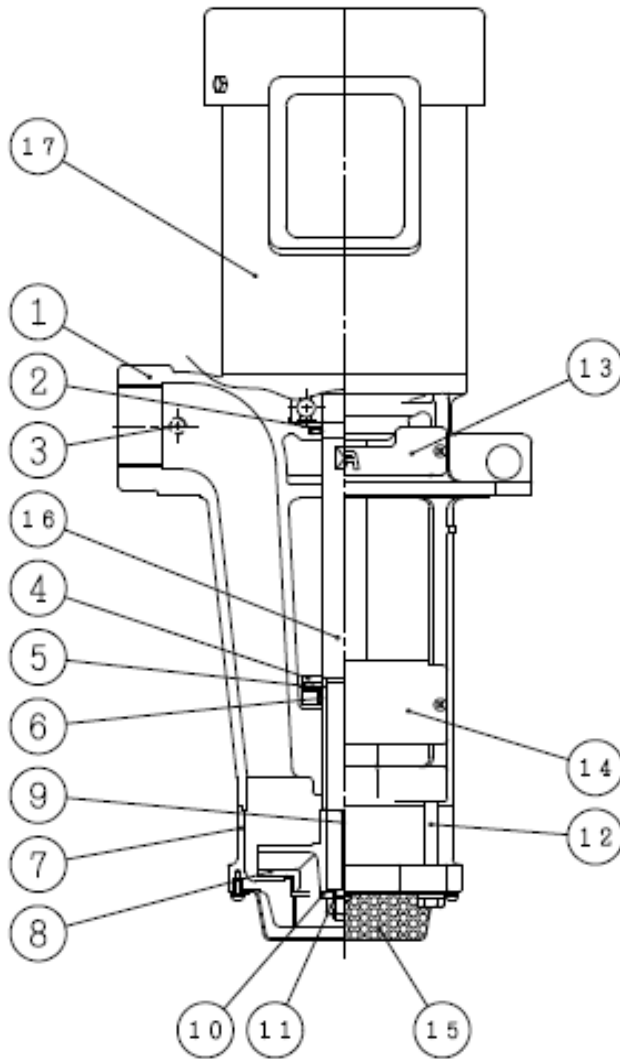
• Long leg

4Type	VKD131AF-e		VKD141AG-e		VKD151AH-e	
Specifications						
Output (kW)	1.5		2.2		3.0	
Rated voltage (V)	200	200 220	200	200 220	200	200 220
Frequency (Hz)	50	60	50	60	50	60
Rated current (A)	7.6	9.1 7.9	12.0	12.1 10.7	14.5	16.2 14.6
Starting current (A)	49.0	45.5 50.0	78.0	72.0 79.0	120	115 126
Discharge rate (L/min)	80 to 400	100 to 500	80 to 400	100 to 500	80 to 400	100 to 500
Total head (m)	18 to 4	25 to 2	27 to 7	38 to 7	37 to 11	50 to 8
Applicable limit value of dynamic viscosity (mm ² /s)	75	75	75	75	75	75

Note 1) The discharge quantity / total head is indicated with the value when tested at a dynamic viscosity of 1 mm²/s (equivalent to normal-temperature fresh water). Notice that the pump cannot be used with water.

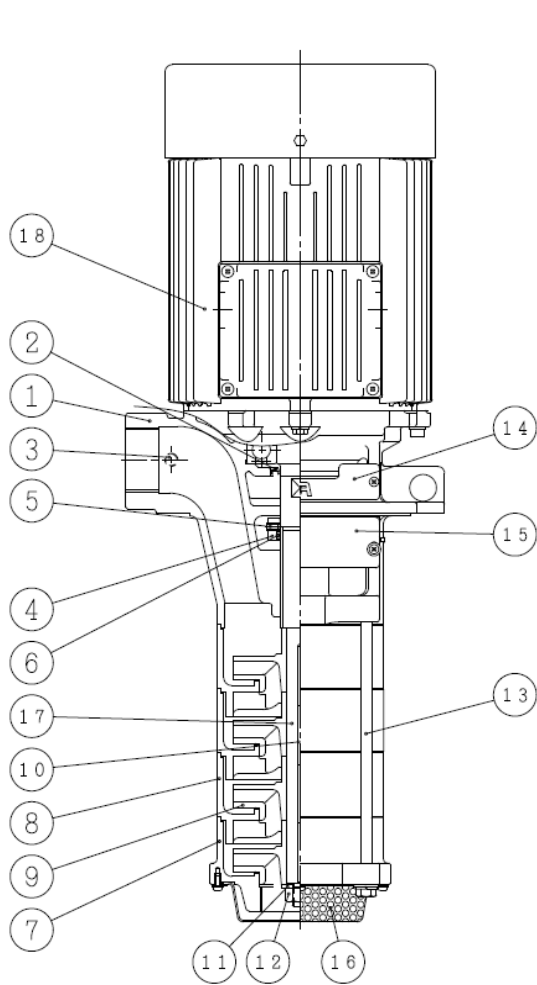
Note 2) The rated current in the above table (current value stated on the pump nameplate) is the recommended preset current value of the protective device.

2.7 Internal structural drawing

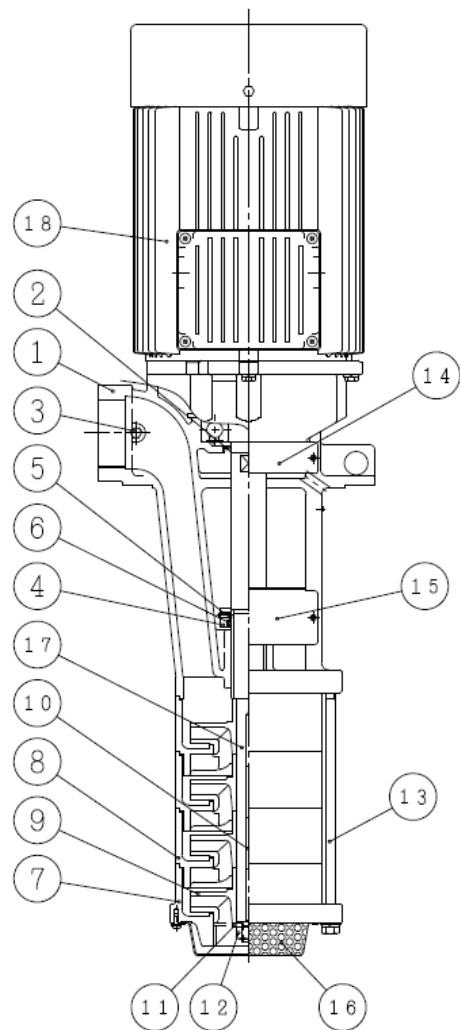


No	Part name	Material
1	Pump leg	FC200
2	Oil seal	NBR
3	Air vent valve	SUS
4	Oil deflector	SUS304
5	Hexagon socket head screw	SCM435
6	O-ring	Fluororubber
7	Casing	FC200
8	Impeller	FC200
9	Key	S45C-D
10	Washer	SPCC
11	Hexagon nut (left-hand thread)	SS
12	Tight bolt	SS
13	Side plate	SPCC
14	Side plate	SPCC
15	Strainer	SPCC
16	Motor shaft	S45C-D
17	Motor	-

Note) The structure and others are subject to change without notice.



VKD131AB-e, VKD141AC-e, VKD151AD-e



VKD131AF-e, VKD141AG-e, VKD151AH-e

No	Part name	Material	No	Part name	Material
1	Pump leg	FC200	10	Key	S45C-D
2	Oil seal	NBR	11	Washer	SPCC
3	Air vent	SUS	12	Hexagon nut (left-hand thread)	SS
4	Oil deflector	SUS304	13	Tight bolt	SS
5	Hexagon socket head screw	SCM435	14	Side plate	SPCC
6	O-ring	Fluororubber	15	Side plate	SPCC
7	Casing	FC200	16	Strainer	SPCC
8	Casing	FC200	17	Motor shaft	S45C-D
9	Impeller	FC200	18	Motor	-

Note) The structure and others are subject to change without notice.

3. Transportation, conveyance, storage and installation

3.1 Precautions for transportation, moving and storing the pump

- (1) Do not unpack the container unnecessarily.
If you unpack the container unnecessarily, securely pack again in such a manner that the product body does not jump out of it and fall down during transportation, conveyance or storage.
- (2) When you transport, move, or store the pump, ensure that the pump is located in a well-ventilated place with minimum exposure to dust and moisture in an environment at an ambient temperature of -25 to 55 degrees Celsius and humidity of lower than 85%RH. The packing materials, made mainly of corrugated cardboards, break more easily when they absorb moisture.
- (3) Check the orientation of the container and then place it in the correct orientation (not upside down).
- (4) Do not stack the containers of the product more than the allowable number of units indicated on the packing material.
The maximum permissible number of stacks for this product is four.
- (5) Use extreme care so as not to give an impact or offset load to the pump during conveyance or transportation. The container may greatly incline depending on its center of gravity.



Before transporting or moving the product, confirm the weight of each unit by referring to the catalog, dimensional outline drawing, and other documents, and then determine the appropriate method.



When lifting the product by hand, give attention to its center of gravity and weight. Do not allow any product heavier than 15 kg to be lifted by a single person. Otherwise, it may put strain on the body, thus leading to an injury.

3.2 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.



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

- (1) Check the nameplate to verify that the delivered product is exactly what you ordered. (Refer to 2.4 "Nameplate entries", page 2-3).
- (2) No part of the product is damaged during transportation.
- (3) All fastening parts including bolts and nuts are securely tightened.
- (4) All the accessories that you ordered have been delivered.



Do not hold the strainer on the tip of the pump during handling. Failure to observe this may cause the strainer to come off, resulting in an injury or breakage.



Do not allow the pump to operate with a frequency beyond 60 Hz.
Doing so may overload the motor, causing it to burn out.

3.3 Precautions for installation



Before rotating the pump shaft by hand to check it, be sure to turn off the main power. Sudden operation of the pump may cause an accident.

- (1) Install the product in a well-ventilated place with minimum exposure to dust and moisture. (Refer to 2.3 “Standard specifications”.) In particular, avoid installing the product in a place where the liquid used is splashed on the motor section.

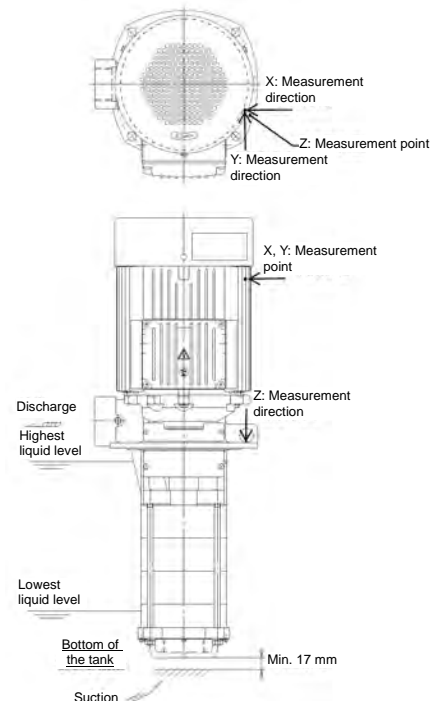


Do not install the product in a place exposed to high temperature and moisture.
Failure to observe this may cause heating, ignition and electric leakage.

- (2) Install the product in such a way that the motor can take in air.
- (3) Select a flat place for the mounting surface and then install the product so as not to rattle.
- (4) Select a place convenient for maintenance and inspection. Ensure maintenance clearances.
- (5) The mounting surface should be strong enough to prevent vibration from being amplified when the pump is running.

(Restrict the total amplitudes in X, Y and Z directions (see the right figure) to $33\mu\text{m}$ at 50 Hz and $29\mu\text{m}$ at 60 Hz during pump operation.)

- (6) It is necessary to make a mounting hole larger than the outside diameter of the pump section so as to put the pump section into the tank (oil tank). See the dimensional outline drawing.
- (7) Install the product so that the pump shaft becomes vertical.
- (8) Use the product with the pump section immersed under the oil level. The suction port should be at least 17 mm away from the bottom surface of the tank (oil tank) to prevent the strainer from getting clogged with cutting powder, dirt, etc. If it is conceivable that cutting powder, dirt, etc. are deposited on the bottom of the tank, ensure as large a distance as possible at the design stage.



Note

The oil level in the tank (oil tank) should always be above the lowest oil level.
Keep a distance of at least 17 mm from the pump suction plane to the tank (oil tank).

- (9) The product is coated, but if it is overcoated to another color for unavoidable reasons, lightly roughen the product surface with sand paper and then coat it. The adhesion properties of the coating film are improved. (Be sure to check that a paint to be used is applicable to overcoating.)

- (10) When the liquid leaks from the product, install it in a place where it is not subjected to secondary damage.
- (11) If the system could be exposed to the freezing temperature in winter, be sure to apply antifreeze measures such as heat insulation and heater installation to the pump, valves, piping, etc.
- (12) Install the pump securely.
 Recommended size of pump mounting bolt:
 VKD111AA-e, VKD131AB-e, VKD141AC-e, VKD151AD-e: M10
 VKD131AF-e, VKD141AG-e, VKD151AH-e: M8

Note

Fasten the pump with bolts securely. Incomplete fixation may cause a problem such as abnormal vibration.

- (13) When lifting the pump, put ropes etc. through its lifting holes and then lift it up.
 Do not lift the pump together with the equipment to which it is attached. Failure to observe this may cause the pump to break and fall down.
- (14) Use extreme care so as not to give an impact or offset load to the pump section during pump lifting or conveyance. The pump may greatly incline depending on its center of gravity.

Warning 

Before hoisting the equipment, refer to the catalogue or external dimensions drawing etc. and ensure that the total weight of the equipment does not exceed the rated load of the hoisting device.

Warning 

Do not use the pump or install any parts with the pump lifted up. Otherwise, the unit may fall down.

Caution 

When lifting up the pump, make sure the center of gravity position. Otherwise, the unit may overturn or fall, resulting in injury and/or damage.

Caution 

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

- (15) If the temperature of the liquid used is low, dew condensation may occur in the motor during a pump stop. Take condensation prevention measures such as installing in a fully dry room or heating and insulating the motor during a stop.
- (16) Carry out refinish painting with a period appropriate to a use environment. Threaded parts, worked areas, coated parts for rust prevention and other parts may rust may depending on use environments such as high humidity and dew condensation.
- (17) Do not put a cover or a filter over the motor, or it may increase the temperature inside the motor and lead to breakage, fire, etc. of the product.

3.4 Precautions for piping work

- (1) The pipes should be as short and straight as possible (with minimal joints and valves). Use pipes whose bore size is equal to or larger than that of the pump. Piping which is thin and has many bends may decrease the delivery volume.
- (2) Be sure to provide pipe supports so as to prevent the weight of the pipes from acting on the pump body.



Avoid the weight of the pipes from acting on the pump.
Failure to observe this may cause the pump shaft from coming off center, resulting in equipment breakage, vibration and noise.

- (3) Do not forcibly screw the pipe into the pump. Doing so may break the joint.
- (4) Lay the pipes securely in such a way that the pipe connections are kept completely airtight without leakage. Prevent liquid leakage and air leakage by use of seal tape, liquid packing or other means. The seal tape should be wound reliably so as not to block up the piping.
- (5) Use a tank (oil tank) with as larger a capacity as possible.
* A recommended capacity is at least three times the delivery volume per minute.
Too small a capacity may cause problems such as causing the liquid temperature to rise up, causing the strainer to get clogged with cutting powder, and causing the delivery volume to decrease due to the occurrence of air bubbles.
When pouring a liquid used into a tank (oil tank), slowly pour air so as not to trap air in.
- (6) Do not allow a large amount of foreign matters such as cutting powder, dirt, or the like in the pump section. Failure to observe this may clog the pump strainer, break the pump, or promote the performance degradation. Perform the primary treatment by filtration with a mesh net, chip conveyor or magnetic separator, before pump startup.
- (7) If water hammer may occur, attach a pressure damper (e.g. accumulator).
- (8) The companion flange type pump is packaged with a companion flange for the discharge port. Use if necessary.
- (9) If there is an upward curve of the discharge pipe, ensure that air can be vented from the section.
- (10) If you provide an escape pipe on the pump discharge side, provide a sluice valve in the middle of the escape pipe to adjust the relief volume.

Note

If the amount released from the escape pipe is too much, the temperature of the liquid in the tank (oil tank) comes to rise easily.

- (11) On completion of the piping work, clean the inside of the tank (oil tank) to prevent the suction of foreign matter.

3.5 Precautions for wiring work



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.



Securely connect the terminals of the power cable. Loose terminals may cause an open phase fault, which causes the motor to burn out.

- (1) For the size of the power cable, refer to the following:

Type	Minimum size of the cable (200-volt class)
All types	1.6mm

- (2) Be sure to install a ground fault interrupter and an overload protection device on the primary power side of the pump.

* The starting current of the Top Runner Energy Efficiency Standards (equivalent to IE3) motor-equipped product tends to become higher than that of the standard efficiency (IE1) motor-equipped product. Therefore, it is necessary to apply and verify an earth leakage circuit breaker and overload protection device on the occasion of replacement from the IE1 motor-equipped product. (Refer to the startup current and the rated current in 2.5 “Specification table” .page 2-3.)

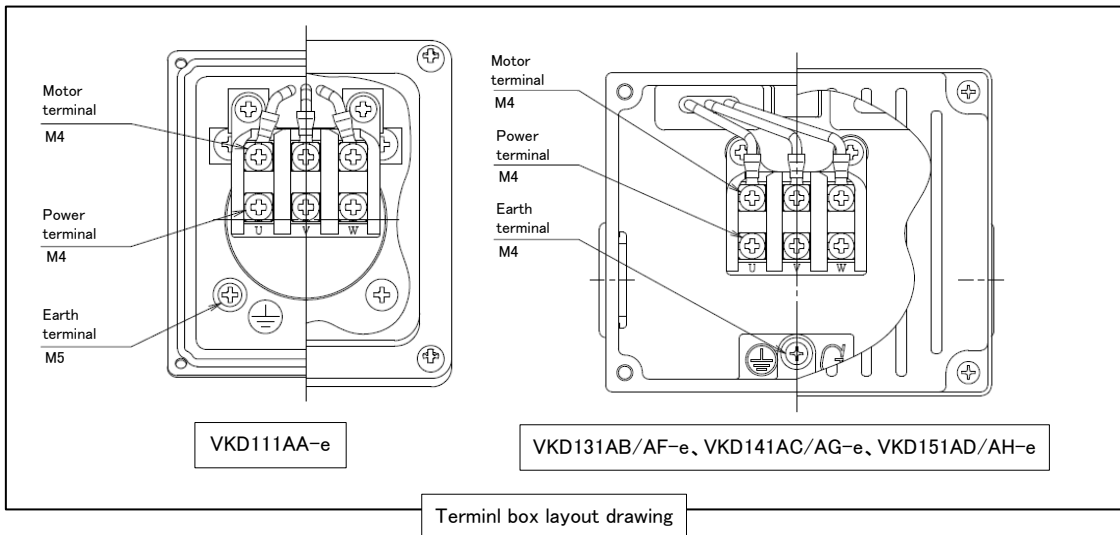
If you have any questions, please contact us.

Note

It is necessary to apply and verify a protective device on the primary side of the pump on the occasion of replacement from the IE1 motor-equipped product.
If not applied, the protective device may operate at the time of startup.

- (3) When connecting to terminals, securely connect to the power according to the below figure. (Standard voltage product)

* If there are four or more terminals, follow the connection nameplate in the terminal box.

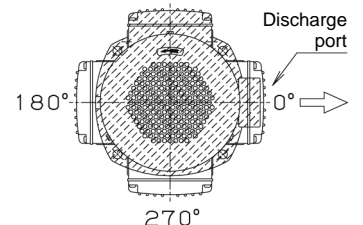


- (4) Be sure to attach a ground wire to prevent an electric shock.
Connect the ground wire to the ground terminal inside the control panel.






Connecting a ground wire to gas or water pipes is illegal and extremely dangerous.

Standard orientation of terminal box 90°





- (5) Fasten the power cable to the terminal box with a cable lock so that no tensile load acts on the motor terminal block.
- (6) The position of the terminal box relative to the discharge port can be changed in steps of 90 degrees by rearranging the frame of the motor.
If you rearrange the frame of the motor, ask Teral Inc. about the operating procedures.

 **Warning**  

Do not change the orientation of the terminal box.
Failure to observe this may cause the liquid to get into the terminal box,
thus imparting an electric shock.

- (7) To prevent the motor from being overloaded and burned out, it is recommended to use a thermal relay for motor protection.
- (8) Carry out adequate dust-proofing and drip-proofing by a connector or gland so that cutting powder and liquid coolant do not get into the terminal box through the external wiring hole.
- (9) 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.
- (10) Limit the fluctuations of the power voltage within $\pm 10\%$ of the rated voltage, and also limit the fluctuations of the frequency within -5% to $+3\%$ of the rated value. Although you can run the pump in these ranges, avoid continuous operation if the voltage is not within the range of $\pm 5\%$ of the rated value or if the frequency is not within the range of $\pm 2\%$ of the rated value. Failure to observe this may cause the pump to be overloaded, resulting in motor breakage or a fire. 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.
- (11) Precautions for using the inverter drive
 - Ensure that the operation current value does not exceed 90% of the rated value.
 - Ensure that the minimum frequency is set to 20 Hz.
(Contact us for operation at 20 Hz or below.)
 - Contact to the nearest Teral office when using a 400V class model. Protective measures may be required against the inverter surge.
 - An inverter-driven motor generates a magnetic sound which may sound more annoying than those generated by the drives using unconverted commercial power.
 - Although this magnetic sound does not cause an adverse effect on 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.
 - Do not use in such a rotating speed range that the pump and motor vibrate sympathetically during normal operation.

 **Caution** 




Do not allow the pump to operate with a frequency beyond 60 Hz.
Doing so may overload the motor, causing it to burn out.

4. Operation

4.1 Check items before test operation

4.1.1 Check items related to the electrical system

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



 **Warning**  

Do not use the product at any voltage other than the rated voltage. Otherwise, a fire or an electric shock may occur.

4.1.2 Check items related to the pump



 **Caution**  

Do not run the pump with its side plates and strainer removed. Failure to observe this may cause an injury or breakage.

 **Caution** 

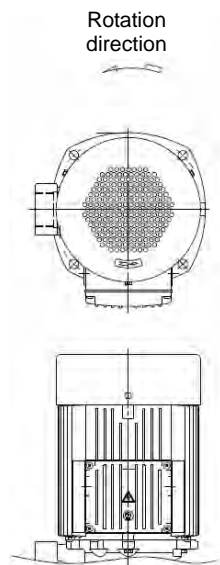
Do not allow a large amount of foreign matter in the pump section. Failure to observe this may cause breakage of the sliding parts (e.g. bearings) in the pump, leakage or unusual noise.





- (1) Ensure that the oil level in the tank (oil tank) is above the "lowest oil level" position.

 **Caution** 

Never run the pump idling (operation with oil level being lower than the lowest oil level) during test operation. Also do not run the pump dry for more than 30 sec. Failure to observe this may seize up the sliding parts in the pump.



- (2) Check the rotational direction. Normal rotational direction is counterclockwise rotation when viewed from the motor side. (See the right figure.)
- (3) Rotate the pump shaft by hand to check smooth rotation. To turn the pump by hand, remove the side plates and then grasp and turn its shaft. If the rotation is stiff or not uniform, there may be some rusting or foreign matter inside the pump. Inspect the pump in such a case.
- (4) After the rotation by hand, fit the side plates.



 **Warning**   




Before rotating the pump shaft by hand to check it, be sure to turn off the main power. Sudden operation of the pump may cause an accident.

- (5) Open the air vent valve to release air. After the air release, close the air vent valve. If the air vent valve is not installed, open the valve of discharge pipe to release the air.
- (6) If you run the pump while changing the speed with the inverter, check the following points through trial runs without fail.
 - The pump may vibrate sympathetically depending on installation conditions. If the pump vibrates sympathetically, avoid that frequency.
 - If the operation frequency is low or the dynamic viscosity of the liquid is high, the pump may discharge no liquid.
 - Do not use the pump with a frequency beyond 60 Hz. Failure to observe this may cause the motor to burn out.





Caution


Do not allow the pump to operate with a frequency beyond 60 Hz.
Doing so may overload the motor, causing it to burn out.

4.2 Running the pump (test operation)


Warning







Be sure to install the cover of the terminal box of the motor.
Failure to observe this may cause an electric shock.


Warning







Be sure to keep the side plates installed during operation of the pump.
Failure to observe this may cause an injury.


Warning


If you find an abnormality in the check prior to test operation, do not run the pump with parts etc. under abnormal conditions. Failure to observe this may cause an injury, failure, accident, etc.


Warning




When the liquid used exceeds 40°C, do not touch the pump.
Failure to observe this may cause the operator to suffer a burn due to high temperature of the pump.


Warning




Do not touch the motor during operation or immediately after the stop of operation.
Failure to observe this may cause the operator to suffer a burn due to high temperature of the pump.

- (1) Check the rotational direction of the pump by turning on and off the power switch once or twice. Normal rotational direction is counterclockwise rotation when viewed from the motor side. If the pump rotates reversely, replace two of the three wires of the power cable.



Do not check the rotational direction by the idling of the pump. Running the pump dry even for a short time may cause breakage of the sliding parts (e.g. bearings) in the pump, leakage or unusual noise.



Avoid reverse rotation because it may cause failures.



Do not run the pump dry, and do not allow a large amount of foreign matter in the pump. Failure to observe this may cause breakage of the sliding parts (e.g. bearings) in the pump, pumping disabled, leakage or unusual noise. Moreover, the pump heats up and causes the operator to suffer a burn. After installing the pump, release air through the air vent, and then supply liquid in the pump above the lowest level.

- (2) If the air vent valve is installed on the pump, slightly open the air vent valve at the time of startup, and confirm that the liquid is discharged. After the confirmation, close the air vent valve securely.
- (3) Turn on the power to start the pump.
- (4) When initially circulating the liquid by pump operation, gradually open the sluice valve on the discharge side to perform circulation cleaning at the flow rate (flow velocity) used or higher. After the circulation cleaning, clean the strainer.



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 failures.

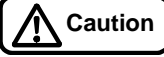

- (5) Adjust the sluice valve on the discharge side to the specified pressure. Restricting the discharge of the pump will not overload the drive motor. However, if the zero discharge operation is continued for a long time, the temperature of the liquid in the pump rises. Therefore, secure even a small flow rate (more than 6L/min), or if the pump is kept unused for a long time, stop the pump operation. If the temperature of liquid in the pump rises significantly, it may lead to deterioration in a lifetime of a motor or breakage of shaft sealing device.



Avoid carrying out the zero discharge operation of the pump for a long time.
If the zero discharge operation is continued for a long time, the temperature of liquid in the pump rises, and unexpected failures may occur.





- (6) This pump adopts the mechanical seal-free structure (without any sealing device of the shaft seal part). Therefore, the liquid may jump out of the side plates of the pump, but that is not a fault of the product.

- (7) If the liquid level is lowered, the pump takes air in, thus decreasing the delivery volume and disabling pumping-up. The liquid level should be above the lowest liquid level indicated in the outline drawing. However, this liquid level changes depending on dynamic viscosity and the liquid level condition. For safety, set the liquid level high enough. However, the liquid level should not exceed the "highest liquid level" indicated in the outline drawing.
- (8) Limit the startup and stop frequencies to 60 times per hour as a guide.


Caution




Minimize the frequency of startups and shutdowns of the pump as it may lead to premature damage to the pump. Do not start the pump more than 60 times an hour.

- (9) If a power failure occurs during operation, be sure to turn off the power.


Warning




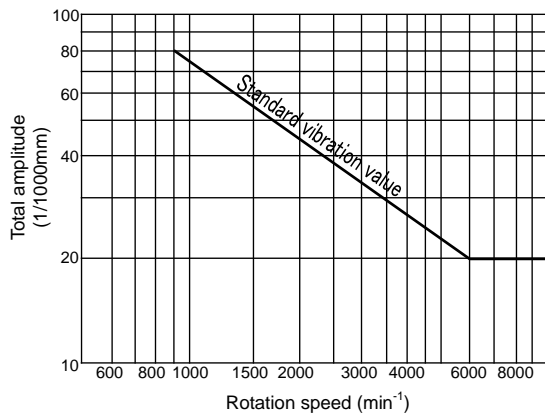
In the event of a power failure, be sure to turn off the power. The pump may be suddenly started at the recovery from a power failure, which leads to a danger.

- (10) Before restarting the pump, confirm that the pump is at a complete stop.


Caution


After power-off, do not restart the pump until it comes to a complete stop. Otherwise, an excessive load may act on the pump shaft, resulting in shortened service life of the pump. Start the pump from a complete stop.

- (11) Avoid abrupt pressure fluctuations during pump operation.
- (12) Check for any abnormal pressure, current, vibration, noise, and other conditions. If you find an abnormality, take appropriate action after reading Section 6 "Troubleshooting". Refer to the following for vibration.



Standard vibration value at the bearing section

<Reference>
Relational expression between total amplitude a and vibration velocity V

$$a = \frac{V \times 4 \times 10^4}{\pi \times n}$$

a: Total amplitude (μm)
V: Vibration velocity (mm/s)
n: Equipment rotation speed (min⁻¹)

- (13) Do not allow a large amount of cutting powder to get in the pump. Failure to observe this may clog the pump strainer, break the pump, or promote the performance degradation. If you use the pump in the grinding process and other processes, e.g. milling and end milling, which discharge cutting powder, select a pump carefully.

(14) Stop the pump.



Keep the cocks of the pressure gauges and compound gauge closed except during measurement. Otherwise, they come to fail with ease.






Do not run the pump beyond the allowable current value, or the motor may burn out. Refer to the performance curve to check the allowable current value.





Do not put your fingers or other objects into the opening of the motor. Doing so may cause an electrical shock or injury.

5. Maintenance and inspection

Before checking the pump, be sure to turn off the main power. Failure to observe this may lead to a danger because the pump may suddenly start in automatic operation or on other occasions.

Before operating, maintaining or checking the pump, ensure that all the relevant workers are informed of the operation and that there are no workers in the dangerous zone.

5.1 Precautions for maintenance and inspection

(1) When carrying out a daily inspection, carefully observe the following points:

- ① A large deviation in the pump's discharge pressure, current, vibration, noise, or other conditions from the normal status is a sign of a failure. Therefore, take measures as soon as possible, referring to the maintenance check list in Section "5.3 Periodic inspection" (page 5-3). For this purpose, it is recommended to keep an operation log.
- ② If the bearing temperature gets too high, immediately stop the pump and check the bearing. The temperature is normal when the difference between the motor surface temperature and the ambient temperature is not greater than 40°C.
- ③ Because shielded grease filled bearings are used, the bearings hardly require grease filling and other maintenance work. Replace the bearings if unusual noise and vibration are produced from them.

Model	Bearing type	
	Load side	Non-load side
VKD111AA-e	6305 ZZ	6203 ZZ
VKD131AB-e, VKD141AC-e	6306 ZZ	6205 ZZ
VKD151AD-e, VKD131AF-e, VKD141AG-e, VKD151AH-e	6307 ZZ	6205 ZZ

* Since urea-based grease is applied for the purpose of a lifetime extension, use urea-based grease filled bearings.

- ④ The bearing section is mounted with an oil seal to prevent the entry of the liquid. When replacing the bearing, replace the oil seal with new one.

Model	Oil seal type	
	Load side	Non-load side
VKD-e – all models	SC 30 45 7	HM 25 38 5

- ⑤ If any oil seal or V-ring is used, high-frequency sound (rubber squeak) may occasionally be generated. However, it is not a symptom of a pump failure. You can continue to use the pump with the same good quality.
- ⑥ Keep the cocks of the pressure gauges and compound gauge closed at all times except when inspection is required.
- ⑦ In the event of a power failure, be sure to turn off the power. The pump suddenly starts on energization of the power, which leads to a danger.



In the event of a power failure, be sure to turn off the power.
The pump may be suddenly started at the recovery from a power failure,
which leads to a danger.

- (2) If you do not use the pump for a long time, observe the following points.



If you do not use the pump for a long time, turn off the power for safety.
Otherwise, accumulated dust may cause heating or ignition.

- ① If the pump could be exposed to the freezing temperature in winter, be sure to apply antifreeze measures such as heat insulation and heater installation to the pump or drain the pump.
- ② If you have a backup pump, run it from time to time to make it available for operation at any time.

5.2 Daily check

Check for any abnormal discharge pressure, current, vibration, noise, and other conditions at the time of startup and during operation.

5.3 Periodic inspection



If you need to change any parts or overhaul or repair the pump, ask the vendor, the service center specified by the manufacturer, or Teral Inc.
Improper work may lead to malfunctions or accidents.

- (1) Clean the dirt and oil deposited on the outside surface of the coolant pump.
- (2) Accumulated cutting powder in the tank (oil tank) may cause a pump failure. Clean the tank (oil tank) at regular intervals.
- (3) Check that the strainer of the pump is not clogged. If clogged, clean the strainer.



Clean the strainer on the pump suction side at regular intervals.
A clogged strainer may cause pressure fluctuations, decrease in delivery volume, unusual noise, etc., which may lead to a pump failure.

- (4) For other inspection items, refer to the maintenance check list given in the next page.

Maintenance check list

Item	Inspection point	Check item	Check method	Criterion (Reference page)	Inspection interval				Consumables	
					Daily	Monthly	Half-yearly	Yearly	Timing of replacement *1	
Ambient environment	Temperature	As per the range in the specifications	Measure	-20 to 40°C or less (2-2)	✓				-	
	Humidity		Measure	85% RH or less (2-2)	✓				-	
	Dust, etc.		Visual check	Free of dust or other contaminants	✓				-	
Power	Power terminal block	Voltage	Measure	Specified voltage (2-2)			✓		-	
		Voltage fluctuation	Measure	Within the allowable range of voltage fluctuation (3-5)			✓		-	
		Loose screws	Retighten	No loose screws				✓	-	
Pump and motor	Impeller	Clogging	Inspect after disassembly	No clogging				✓	-	
		Wear	Inspect after disassembly	No fault shall be found.				✓	When worn out	
	Rotate by hand	Smooth rotation	Rotate by hand	Not unusually stiff, Not even in weight (4-1)				✓	-	
	Bearing (Motor) *2	Heating	Touch	Not unusually hot (5-1)				✓	1 to 2 years	
	Rubber parts	O-rings	-	-	-					Whenever disassembled
		Oil seals, etc.	-	-	No fault shall be found.				✓	1 to 2 years
	Others (screws etc.)	-	-	No fault shall be found.					As needed	
	Appearance	Unusual noise, vibration	Hear Visual check	No fault shall be found.	✓				-	
	Insulation resistance	Between the ground and each lead	Megger tester	1 MΩ or more				✓	-	

*1 The timing of replacement is not a guaranteed value. The useful life of parts varies depending on ambient environment and use conditions.

*2 Since urea-based grease is applied for the purpose of a lifetime extension, use urea-based grease filled bearings.

6. Troubleshooting

The following table lists causes of failures and their measures. In the event of a failure, however, you should carefully investigate the problem and ask the vendor to carry out any measures that are considered difficult.

Problem	Cause (Reference page)	Measures (Reference page)	Operator *
The pump does not start.	Wiring is disconnected or broken.(3-4)	Check the wires and connections. Repair or replace.	Vendor
	The power fuse is blown.	Replace it with an appropriate fuse.	User
	Tripping of the thermal relay	Check the thermal relay.	User
	Poor connection or contact of power wires(3-4)	Check the wires and connections.	Vendor
	The power voltage is too low.(2-2)	Check the power voltage. Contact the power company.	User
	The motor has failed. (e.g. wire breakage of the stator winding)	Repair at vendor's shop. Contact the vendor because disassembly and inspection are required.	Vendor
	Foreign matter is caught in the impeller.	Disassemble, clean, and repair. Contact the vendor because disassembly and inspection are required.	Vendor
	The bearing is rusty.(5-1)	Replace the bearing.(5-1) Contact the vendor because disassembly and inspection are required.	Vendor
Overload and overcurrent of the motor	The rotating speed is too high.	Check with the tachometer.	User
	The voltage is too high or too low.(2-2)	Check the power voltage.	User
	The voltage is unbalanced.	Contact the power company.	
	The stator winding is broken, shorted, and grounded.	Contact the vendor because disassembly and inspection are required.	Vendor
	The stator and rotor are in contact due to wear of the bearing.(5-1)	Replace the bearing.(5-1) Contact the vendor because disassembly and inspection are required.	Vendor
	Open-phase failure occurs.	Check the wiring.	User
	The dynamic viscosity of the liquid used is too high. (2-2)	Use a liquid with low dynamic viscosity.	User
	The discharge rate is high.	Throttle the sluice valve to meet the specifications.	User
	The rotating part is in contact with another part.	Contact the vendor because disassembly and inspection are required.	Vendor
The pump starts, but cannot achieve the specified discharge rate and the specified head.	Lots of air bubbles are contained in the liquid used.	Avoid bubbling and the suction of air bubbles.	User
	The rotation direction is reverse.(4-2)	Correct the wiring so that the direction is normal.(4-2)	User
	The piping loss is high.	Check the piping diameter, route and length.	User
	The piping is clogged up with foreign matter.	Remove the foreign matter, and check the connections.	User
	The impeller is worn.	Replace the impeller. Contact the vendor because disassembly and inspection are required.	Vendor
	Foreign matter is accumulated on the impeller and in the casing.	Remove the foreign matter, and check the connections. Contact the vendor because disassembly and inspection are required.	Vendor
	The rotating speed is low.	Check with the tachometer.	User

Problem	Cause (Reference page)	Measures (Reference page)	Operator *
The pump starts, but cannot achieve the specified discharge rate and the specified head.	The sluice valve is closed.	Open the sluice valve.	User
	The piping is clogged up with foreign matter.	Check and clean the piping.	User
	The strainer in the suction port is clogged.	Check and clean the strainer.	User
	The suction port is exposed above the liquid level.(3-2)	Replenish the liquid or lower the mounting position of pump to adjust the liquid level.	User
	The discharge pipe has a leak.	Check and repair.	Vendor
Overheat of bearing	The bearing is worn and damaged.(5-1)	Replace the bearing.(5-1) Contact the vendor because disassembly and inspection are required.	Vendor
	The grease is degraded.(5-1)	Replace the bearing.	Vendor
	Incorrect installation of the pump and the piping (3-2)	Check, and correctly install.	User
Unusual noise and unusual vibration of the pump	The bearing is worn and damaged.	Replace the bearing. Contact the vendor because disassembly and inspection are required.	Vendor
	The motor is in open-phase operation.	Check the wiring.	User
	The impeller is clogged with foreign matter, resulting in an imbalance.	Disassemble and check. Contact the vendor because disassembly and inspection are required.	Vendor
	Cavitation has occurred.	Contact the manufacturer and vendor.	User
	Incorrect installation of the pump and the piping (3-2)	Check, and correctly install.	User
Water hammer occurs.	Hammering has occurred when the valve is opened and closed rapidly.	Provide a pressure damper (e.g. accumulator).	User

*It is specified for reference because the range where the measure can be taken varies depending on User. Even though the problems of which the operator is User, request the vendor or contact the nearest Teral office, if you have any question.

7. After-sales service



If you need to change any parts or overhaul or repair the pump, ask the vendor, the service center specified by the manufacturer, or the nearest Teral office.
Improper work may lead to malfunctions or accidents.

- For maintenance and repair of the pump you purchased, contact the store from which you purchased or the nearest Teral office.
- If you find an abnormality with the pump in use, stop the pump operation immediately and then confirm the abnormality conditions. (Refer to Section 6 "Troubleshooting", page 6-1.) If your pump needs disassembly, inspection and repair, contact the store from which you purchased or Teral Inc. (Refer to the end of this document.)
- Never repair by yourself because it may pose a danger.
- When you contact the store, give the pump nameplate entries (e.g. pump type and serial number) and abnormality conditions.
- For the warranty, refer to "Limited warranties (page I)" on the opening page of this document.

If you have any question about the product you purchased,
contact the store from which you purchased or Teral Inc.

8. Disposal

8.1 Precautions for disposal

When detaching the pump from the equipment for disposal or replacement of the pump, be sure to turn off the main power in advance.



Before detaching the pump, turn off the main power without fail. Failure to observe this may lead to a danger because the pump may suddenly start in automatic operation or on other occasions.



When lifting the pump, pay attention to its center of gravity. Failure to observe this may cause the product to topple over or fall down, leading to an injury.

- (1) Drain the liquid from the tank (oil tank) so that the bottom of the pump is exposed above the liquid level.
- (2) Close the sluice valve on the discharge side and open the air vent valve of the pump to discharge the liquid from the pump.
- (3) Remove the wiring and piping. (For the layout in the terminal box, refer to Section “3.3 Precautions for installation”, (page 3-2).)
- (4) Remove the pump mounting bolts and lift up the pump by the ropes passed through the lifting holes. Because the liquid remaining in the pump may flow out during pump removal and movement, take measures against it as needed.



Do not hold the strainer on the tip of the pump during handling. Failure to observe this may cause the strainer to come off, resulting in an injury or breakage.

- (5) The pump should be disposed of as industrial waste. Other parts should be disposed of according to the legal regulations and the regulations of the region where they are used, e.g. requesting the vendor to dispose of.

Note

When disposing of the pump, treat it as industrial waste.

Note

The packing materials that became unnecessary after installation and the lubricating oils and parts that became needless in maintenance, check and repair work should be disposed of according to the legal regulations and the regulations of the region where they are used, e.g. requesting the vendor to dispose of.

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