
Vertical multistage stainless centrifugal pump

Model: ASVM, ASVMN, ASVMG

 **WARNING**

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

Retain this manual 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 failure or breakage under the proper use of the product during the warranty period, equipment supplied by TERAL Asia Ltd. (hereinafter referred to as TERAL) will be repaired or replaced free of charge within the scope of the relevant part, provided that such failure or breakage is attributable to inadequacy of the design or workmanship of the equipment.
2. The warranty mentioned in the above clause shall be only the mechanical warranty of the defective part, and shall not cover any expenses or other damage arising from the failure or breakage.
3. In the event of the following failures and breakage, the costs of the repairs and consumables (i.e. parts whose consumption or wear is expected at the beginning of purchase) shall be for the account of the user.
 - (1) Failures and breakage attributable to equipment that was not delivered by TERAL
 - (2) Failures and breakage occurred after the expiration of the warranty period
 - (3) Failures and breakage caused by disasters or force majeure, such as fire, acts of God or earthquakes
 - (4) Failures and breakage resulting from repairs, disassembly or modifications made without the consent of TERAL
 - (5) Failures and breakage occurred when parts other than those designated by TERAL are used
 - (6) Failures and breakage caused by use out of the range of specifications.
4. The warranty shall not cover any damage caused by misuse or abuse of the pump even within the warranty period. Cost and expenses incurred for sending engineer(s) in such a case shall be borne by the user.
5. If the cause of the failure is unclear, necessary actions shall be determined through mutual consultation.
6. In order to improve performance, some parts and/or components of the product may be changed without prior notice.
For repairs, reuse parts conforming to TERAL's quality standards or substitute parts having equivalent functions may be used.

Purpose of this manual / Notice to users

1. The purpose of this manual is to provide the user with detailed information necessary to properly operate, maintain and inspect the pump.
Work that requires highly specialized knowledge (disassembly, repairs, etc.) is not covered in this manual. If the equipment needs to be repaired, make sure to contact TERAL or its relevant service provider.
2. This manual is intended for:
 - persons who have experienced in the operation of pump or those who have been trained by such experienced persons and
 - qualified persons, such as licensed electrical engineers, for the content regarding electric wiring work
3. This manual mainly covers standard products. If you have purchased a customized product, some part of this manual may not be applicable to your equipment. In such a case, please refer to the delivery specification, etc. supplied separately to check the product specifications.
4. The product specifications and information in this manual are subject to change without prior notice.
5. In this document, some parts of illustrations of the product is omitted or simplified in order to provide easy-to-understand descriptions. Therefore, the appearance shown in this document may be different from that of the actual product.

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1. Safety precautions

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

1.1 Explanation of warning terms and graphic symbols

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

■ 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	<p>These graphic symbols indicate prohibited actions (that must not be done).</p>
 Do's	<p>This graphic symbol indicates mandatory actions (that must be done).</p>
 Caution  Electric shock hazard  Rotation hazard  Hot surface	<p>These graphic symbols indicate hazards.</p>

1.2 Safety precautions

Be sure to observe these precautions since they include important instructions about safety.

 Danger	
 	<p>After turning on the main power supply, do not touch the current-carrying parts. A high voltage is applied to the current-carrying parts, and there is a significant danger if you receive an electric shock.</p>

 Warning	
	<p>Properly transport the product according to lifting instructions. Otherwise, it may cause the equipment to fall, resulting in injury and/or breakage.</p>
	<p>The pump should be operated by only those who are authorized by the site manager. Operation by unskilled personnel may lead to an unforeseen accident.</p>
 	<p>Only qualified personnel such as licensed electrical engineers are allowed to carry out electric work. Otherwise, it may lead to electric shock, fire, failure, etc.</p>
	<p>Before starting wiring work, make sure to turn off the main power supply and confirm that the pilot lamp is turned off. Otherwise, it may lead to electric shock.</p>
	<p>While the pump is lifted, do not use the equipment or carry out any work to it. Otherwise, it may cause the equipment to fall, resulting in injury and/or breakage.</p>
	<p>Installation, maintenance and inspection must be carried out only by personnel who have been trained to handle the pump. Operation by unskilled personnel may lead to an unforeseen accident.</p>
 	<p>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 electric shock, fire, etc.</p>
	<p>Be sure to install a ground fault interrupter at the primary power supply. Otherwise, it may cause electric shock, fire, etc.</p>

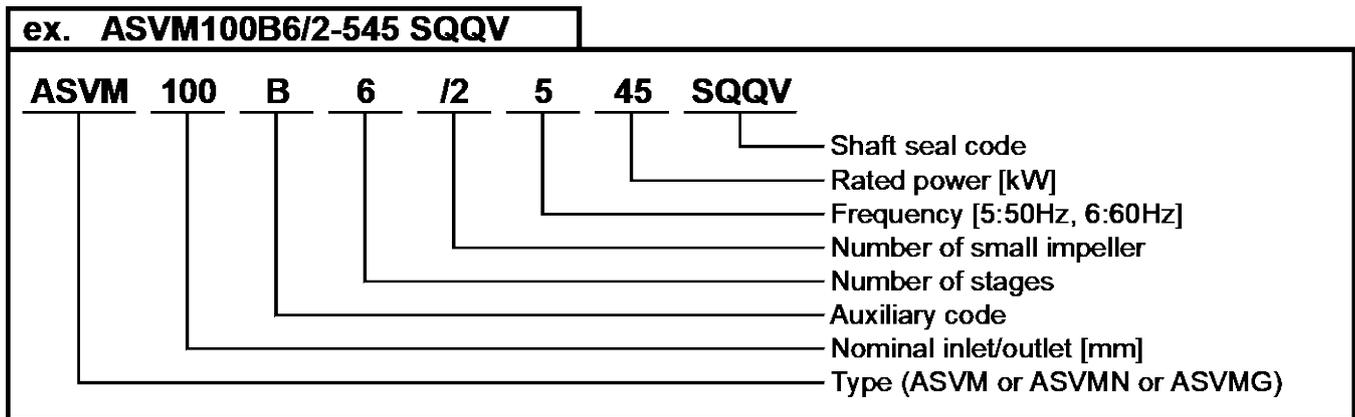
 Warning	
 Securely install the ground wire and make sure to carry out grounding work. Otherwise, electrical leakage or electric shock may result.	 Do not connect the ground wire to a gas pipe or water pipe. Such connection is illegal and leads to electric shock, explosion and/or fire.
 Make sure that all electric wires are securely connected. Otherwise, it may cause fire and/or electric shock.	 Before carrying out maintenance/inspection work, be sure to stop the pump, and turn off the main power supply. Otherwise, electric shock, injury, breakage, water leakage, etc. may result.
 Before starting the equipment or carrying out maintenance/inspection work, ensure that all the relevant operators are informed of the operation and that there are no workers in the dangerous zone around the equipment. Otherwise, it may cause an unforeseen accident.	 In the case of a power failure, turn off the main power supply. Otherwise, when the power is restored, the pump suddenly starts, which may cause injury.
 When checking smooth rotation of the pump shaft, be sure to disconnect the main power supply before rotating it by hand. Otherwise, it may result in injury and/or breakage.	 Do not perform idling or operation with insufficient priming. Otherwise, the internal parts may be damaged by a heat shock.
 Do not put your finger or any foreign objects into openings or rotating part of the motor during operation. Otherwise, injury and/or breakage may result.	 Do not continue shut-off operation more than 1 minute. Otherwise, the temperature and pressure in the pump rise, and it may get broken.
 Do not remove the coupling guard except during maintenance. Do not perform operation when the coupling guard is removed. Otherwise, injury and/or breakage may result.	 For work such as replacement of parts, repairs, or inspection that requires disassembly of the equipment, be sure to contact a specialized vendor or the service center designated by TERAL. If unskilled personnel carry out work that requires special knowledge, it may lead to an accident and/or failure.
 Do not operate the equipment if it does not run normally or abnormal condition is observed in parts, components, and others. Otherwise, it may lead to injury, failure and/or various accidents.	 Do not operate the equipment in an explosive atmosphere. Otherwise, it may lead to injury, failure and/or various accidents.

 Caution	
 Use the equipment within its specified product specifications. Otherwise, it may cause electric shock, fire, water leakage, failure, etc.	 Do not use the product alone in a place directly related to important equipment or maintenance of life. Water supply may be stopped in the case of a failure. Be sure to keep a standby machine.
 Do not modify the product. The warranty does not cover an accident or a failure caused by a modification of the product.	 Do not give a shock to the pump when transporting or carrying in it. Otherwise, breakage may result.
 Check the upside and the downside, and carefully unpack the product with particular attention to the nails. Otherwise, injury and/or breakage may result.	 Install the equipment in the environment in strict compliance with the installation instructions. Otherwise, a premature failure may result.
 Check that the floor surface at the installation location is treated with waterproof materials and equipped with a drainage system. Otherwise, serious damage may result when water leakage occurs.	 Before operation, thoroughly clean (flush) the inside of the piping. Otherwise, foreign objects may enter from the piping system, and an accident or failure of the pump may be caused by the supplied mixed liquid.
 Do not leave any tools and other objects on the top of the pump during operation. Otherwise, injury and/or breakage may result.	 Do not step on the pump or the piping. Otherwise, injury and/or breakage may result.
 Do not touch any part of the pump during operation unless absolutely necessary.	 Do not touch the pump if handled liquid is hot. You may burn your hands because it is hot.

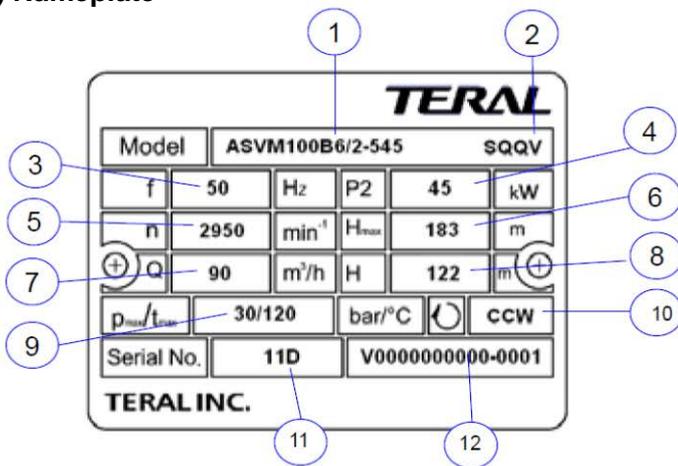
 Caution	
 Operate the controls carefully. Otherwise, it may result in injury and/or breakage.	 Do not start and stop the pump too frequently. (Up to 5 times per 1 h) Otherwise, a premature failure of the pump may result.
 Do not cover the motor with cloth, etc. Otherwise, overheat or fire may result.	 Do not water the motor. Otherwise, electric shock, electric leakage, failure, etc. may result.
  Do not touch the motor while it is running or immediately after it has stopped. Otherwise, you may suffer burn due to its hot surface.	 Be sure to carry out inspection according to the maintenance checklist. Otherwise, failures cannot be prevented, which raises the risk of accidents.
 Before disassembly, close both the suction and discharge sluice valves, and then discharge pressured water from the pump and the piping. Otherwise, water may spurt out, leading to an accident.	 If there is any alarm or any abnormality that cannot be resolved, immediately contact us or your service company. Otherwise, it may lead to an accident.
 Replace the packing and O-rings during an overhaul. Otherwise, it may cause water leakage.	 If the product is not used for a long time, turn off the power, discharge internal water, and then store the product. Otherwise, cracking, etc. may be caused by freezing.

1.3 Identification code and Nameplate

(a) Identification code



(b) Nameplate



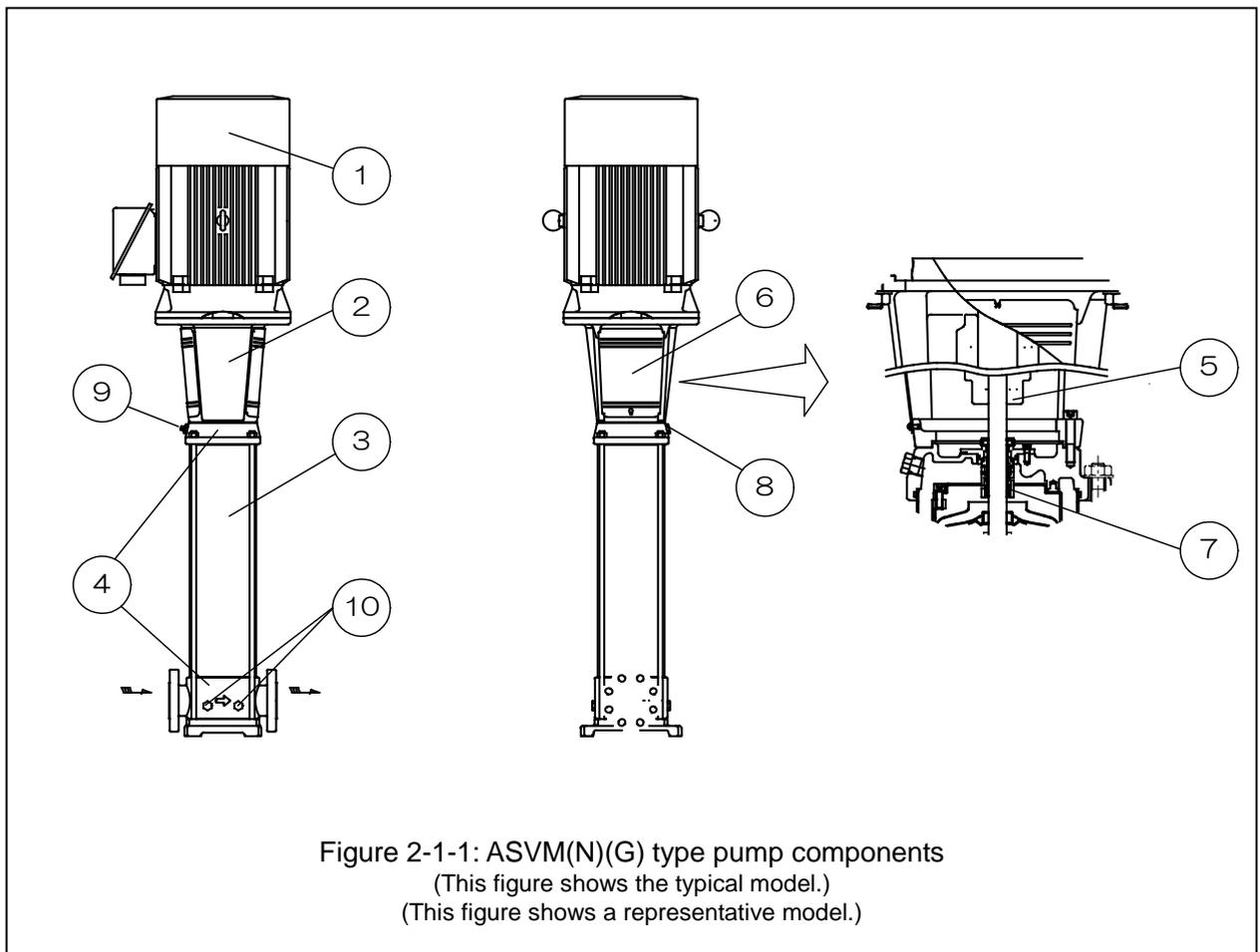
1. Pump Model
2. Shaft seal code
3. Frequency
4. Rated Power
5. Speed
6. Maximum Head
7. Capacity
8. Head Range
9. Maximum Operating Pressure/ Temperature
10. Rotating Direction
11. Manufacturing Month and Year
12. Serial number

2. Configuration and overview of the pump

This section describes standard specifications of the equipment. If you have purchased a customized product, some information in this section may not be applicable to your equipment. In such a case, please refer to the delivery specifications, etc. supplied separately to check the specifications.

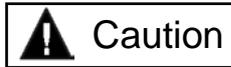
2.1 Part names of the pump

- ① Motor
 - ② Motor bracket
 - ③ Outer sleeve
 - ④ Pump head / Base
 - ⑤ Coupling
 - ⑥ Coupling guard
 - ⑦ Mechanical seal
 - ⑧ Priming plug
 - ⑨ Air vent plug
 - ⑩ Drain plug
- (ASVM(N)(G) 25 and 32 have a double structure of a drain/bypass plug.)



2.2 Pump specifications

If you purchased a standard product, refer to the standard specifications in the following table. For a custom-made product with special specifications that you ordered, refer to the delivery specifications.



Caution



Do not use this product under any conditions other than those provided in the specifications. Failure to observe this may cause electric shock, fire, water leakage, and/or product failure.

Table 2-2-1: Standard pump specifications

50 Hz / 60 Hz Common	ASVM / ASVMN / ASVMG											
	25L	25	32	40	50	50B	65	80	100	100B	125	125B
Pumped liquid ^{*1}	Clean, viscous and non-explosive liquids that do not contain abrasive matter											
Ambient temperature [°C] ^{*2}	0 to +40											
Fluid temperature [°C] ^{*3}	-15 to +120											
Material												
ASVM	Stainless steel EN 1.4301 / AISI 304 / SUS304											
ASVMN	Stainless steel EN 1.4401 / AISI 316 / SUS316											
ASVMG	Pump body: Stainless steel EN 1.4301 / AISI 304 / SUS304											
	Pump base: Cast iron EN-GL-200 / ASTM25N / FC200						Pump base: Cast iron EN-GL-250 / ASTM35B / FC250					
Motor												
Insulation class	F											
Enclosure class	IP 55 (≤7.5kW) IP 54 (≥11kW)											
Ambient temperature [°C]	50											
Number of starts per hour ^{*4}	Motors up to and including 4.0kW: Maximum 100 times per hour Motors of 5.5kW and up: Maximum 40 times per hour											
Pipe Connection												
Flange	DN25/32	DN25/32	DN25/32	DN40	DN50	DN50	DN65	DN80	DN100	DN100	DN125	DN125
Shaft Seal												
Mechanical seal ^{*3}	Cartridge type Sic / Sic + Viton (Seal code: SQQV)											

50 Hz	ASVM / ASVMN / ASVMG											
	25L	25	32	40	50	50B	65	80	100	100B	125	125B
Nominal inlet/outlet [mm]	25	25	32	40	50	50	65	80	100	100	125	125
Nominal flow [m³/h]	1	3	5	10	15	20	32	45	64	90	120	150
Flow range [m³/h]	0.7-2.4	1.2-4.5	2.5-8.5	5-13	8.5-23.5	10.5-29	15-40	22-58	30-85	56-120	60-160	75-180
Max. pressure [bar]	21.5	23	24	21.5	23	24.3	27.5	33	21.8	20	20.4	18.7
Motor power [kW]	0.37-2.2	0.37-3	0.37-5.5	0.37-7.5	1.1-15	1.1-18.5	1.5-30	3-45	4-45	5.5-45	11-75	11-75
Motor												
Main connection 1~[V/Hz] (Premium voltage tolerance ±10%)	220-240V 50Hz											
Main connection 3~[V/Hz] (Premium voltage tolerance ±10%)	0.37-7.5kW 220-240/380-415V 50Hz From 11kW 380-415V 50Hz											

60 Hz	ASVM / ASVMN / ASVMG											
	25L	25	32	40	50	50B	65	80	100	100B	125	125B
Nominal inlet/outlet [mm]	25	25	32	40	50	50	65	80	100	100	125	125
Nominal flow [m³/h]	1.2	3.6	6	12	18	24	38	51	77	108	140	180
Flow range [m³/h]	0.8-2.9	1.5-5.4	3-10	6-15.5	10.5-28	12.5-35	18-48	26-70	36-102	54-146	60-160	75-180
Max. pressure [bar]	23.5	23.3	23	24.5	23.5	20.5	27	26	17.8	15.9	18.5	15.3
Motor power [kW]	0.37-3.0	0.37-4.0	0.55-7.5	0.75-11	1.5-18.5	2.2-18.5	2.2-30	5.5-45	7.5-45	11-45	18.5-75	18.5-75
Motor												
Main connection 1~[V/Hz] (Premium voltage tolerance ±10%)	220-240V 50Hz											
Main connection 3~[V/Hz] (Premium voltage tolerance ±10%)	0.37-1.1kW 220-255/380-440V 60Hz 1.5-7.5kW 220-277/380-480V 60Hz From 11kW 380-415V 50Hz											

^{*1} These pumps are not designed to be used with abrasive, solid containing, explosive and corrosive liquids. For special application, please contact your supplier or the factory.

^{*2} If ambient temperatures are above +40 degree C, or if the pump is located at elevations more than 1,000 meters above sea level, the motor's output must be decreased to compensate for less effective cooling, and may have to be replaced with a stronger motor.

^{*3} If fluid temperature is lower than 0 degree C or above 80 degree C, or if special liquid is to be used, please contact your supplier or the factory.

^{*4} If you use another brand of motor then check the manufacturer's instructions for maximum frequency of starts.

Table 2-2-2: Maximum operating pressure and inlet pressure

Size	50Hz					60Hz				
	Stages	Maximum Operating Pressure [bar]	Stages	Maximum Inlet Pressure [bar]	Flange Pressure Rating	Stages	Maximum Operating Pressure [bar]	Stages	Maximum Inlet Pressure [bar]	Flange Pressure Rating
25L	2 - 36	25	2 - 36	10	PN 25	2 - 27	25	2 - 25	10	PN 25
								27	15	
25	2 - 36	25	2 - 29	10	PN 25	2 - 25	25	2 - 15	10	PN 25
			31 - 36	15				17 - 25	15	
32	2 - 36	25	2 - 16	10	PN 25	2 - 24	25	2 - 9	10	PN 25
			18 - 36	15				10 - 24	15	
40	1 - 16	16	1 - 6	8	PN 16	1 - 10	16	1 - 5	8	PN 16
	17 - 22	25	7 - 22	10	PN 25	12 - 17	25	6 - 18	10	PN 25
50	1 - 10	16	1 - 3	8	PN 16	1 - 8	16	1 - 2	8	PN 16
	12 - 17	25	4 - 17	10	PN 25	9 - 12	25	3 - 12	10	PN 25
50B	1 - 10	16	1 - 3	8	PN 16	1 - 7	16	1	8	PN 16
	12 - 17	25	4 - 17	10	PN 25	8 - 10	25	2 - 10	10	PN 25
65	1/1 - 7	16	1/1 - 4	4	PN 16	1/1 - 5	16	1/1 - 2	4	PN 16
	8/2 - 14	30	5/2 - 10	10	PN 25/40	6/2 - 10/2	30	3/2 - 6	10	PN 25/40
			11/2 - 14	15				7/2 - 10/2	15	
80	1/1 - 5	16	1/1 - 2	4	PN 16	1/1 - 4	16	1/1 - 1	4	PN 16
	6/2 - 11	30	3/2	10	PN 25/40	5/2 - 7	30	2/2 - 3	10	PN 25/40
	12/2-13/2	33	6/2 - 13/2	15				4/2 - 7	15	
100	1/1 - 5	16	1/1 - 1	4	PN 16	1/1 - 3	16	1/1	4	PN 16
	6/2 - 8/1	30	2/1 - 3/2	10	PN 25/40	4/2 - 5/2	30	1 - 2/1	10	PN 25/40
			4/1 - 8/1	15				2 - 5/2	15	
100B	1/1 - 4	16	1/1 - 1	4	PN 16	1/1 - 3	16	1/1 - 2/2	10	PN 16
	5/2 - 6	30	2/1 - 3/2	10	PN 25/40	4/2	30	2/1 - 4/2	15	PN 25/40
			3 - 6	15						
125	1 - 7	30	1 - 2/1	10	PN 25/40	1 - 5/2	30	1	10	PN 25/40
			2 - 5/1	15				2/2 - 3/1	15	
			6/1 - 7	20				3 - 5/2	20	
125B	1/1 - 6	30	1/1 - 1	10	PN 25/40	1/1 - 4/2	30	1/1	10	PN 25/40
			2/1 - 4/2	15				1 - 2	15	
			5/2 - 6	20				3/2 - 4/2	20	

3. Installation

3.1 Before using the pump

 Caution	 Check the top and the bottom, and open the wood package with special attention to the nails. Otherwise, you may get injured.
Note	After unpacking, ask a specialized contractor to dispose of packing materials that are no longer necessary.

When you receive the pump, check the following points immediately after unpacking:
If there are any problems, contact the sales agent you purchased the product from.

- (1) Check the nameplate to verify that the equipment is the one you ordered.
- (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.

Note	The plate included with the instruction manual is necessary when you attach the mechanical seal. Keep it with the instruction manual.
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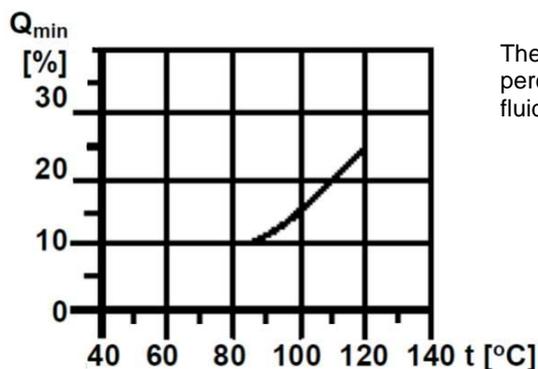
3.2 Precautions for storage

 Warning		Before hoisting the unit, refer to the catalogue or external dimensions drawing etc. to confirm that the weight of the equipment does not exceed the rated load limit of the hoisting equipment.
 Warning		Never use the pump or attach any part while hoisting it. Otherwise, it may fall.
 Caution		Check that the floor surface at the installation location is treated with waterproof materials and equipped with a drainage system. If water leakage occurs, it may cause serious damage.

- (1) Install the pump in a place where the following conditions are satisfied:
- Well-ventilated place with little dust and moisture at an ambient temperature from 0°C to 40°C
 - Place that is not affected by a steam outlet or salt damage
 - Place that is not easily accessible to unauthorized persons or that is impossible for them to operate the equipment from.
 - Place where the water supply source is as close as possible and a suction pipe as short as possible.
 - Place where a secondary disaster does not occur when water leakage occurs
 - Place suitable for maintenance and inspection of the pump, where a maintenance space can be secured

 Caution		Install the pump so that the total suction head (suction height + suction pipe resistance) is as small as possible within the standard specifications.
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- (2) The arrow of the casing indicates the liquid flow direction. Do not install it in the reverse direction.
- (3) Install the pump vertically. Do not install it horizontally or reversely.
- (4) Firmly fix the pump with foundation bolts on level foundation concrete.
- (5) Be sure to dig a drain ditch around the pump, and apply waterproof treatment to the floor surface.
- (6) If the pump may be frozen during the winter season, be sure to take measures to protect the pump room, or the pump, valve, pipes, etc. from freezing.
- (7) Use a material with the high-noise absorbing effect for the door and walls of the pump room. In particular, if noise may become a problem, take measures against it.
- (8) When hoisting the pump, do not hoist the whole pump using the lifting bolts of the motor. Remove the coupling guards on both sides, and pass two pieces of rope through the frame to hoist it, while ensuring that the rope will not catch the terminal box or the coupling of the motor.
- (9) To prevent overheating of the internal pump components, the pump should not be used at flows below the minimum flow rate. Do not operate the pump against a closed discharge valve for larger than a few seconds. If the pump can be operated at a flow rate not larger than the minimum flow rate (except when the pump is started), install a relief pipe (bypass pipe).



The curve left shows the minimum flow rate as a percentage of the nominal flow rate in relation to the fluid temperature.

Figure 3-2-1: Minimum nominal flow rate

3.3 Installation procedure

- (1) The area and thickness of the foundation concrete must be appropriate for the pump weight and the operating load.
- (2) Make foundation holes in advance so that they match the drawing or the actual dimensions of the pump.

Table 3-3-1: Table of foundation bolts and foundation holes

FD	FL	FB	Wa	H
M10	200	45	100	250
M12	250	55	120	300
M16	315	70	150	370

- (3) Make sure that the top surface of the foundation concrete is level, and properly cure the concrete before installing the pump.
- (4) Place the pump on the foundation concrete. In doing so, insert a square steel plate and metal wedges between the common base and the foundation concrete to create clearance into which mortar is to be poured. (A clearance of approximately 10 mm to 30mm)
- (5) Fix foundation bolts with nuts to the common base so that they hang at the center of the foundation holes.

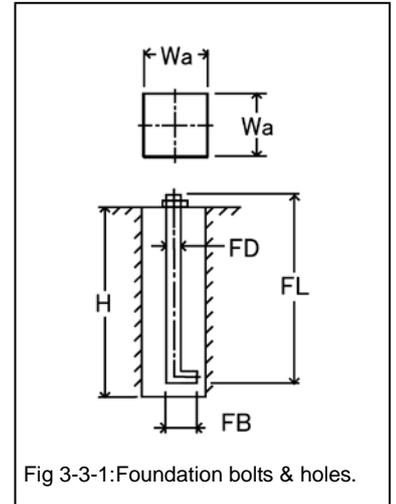


Fig 3-3-1: Foundation bolts & holes.

Note

The metal wedges adjust the horizontal level of the pump, and withstand the pump weight and the operating load. Use metal wedges as thick as possible to reduce the number of them. Uniformly place them near foundation bolts.

- (6) Put a level on the flange surface to check that it is vertical. If it is not vertical, adjust it with metal wedges.
- (7) After checking verticalness, pour mortar into the foundation holes and the clearance around the lower part of the common base. After it has hardened completely, tighten the foundation bolts.

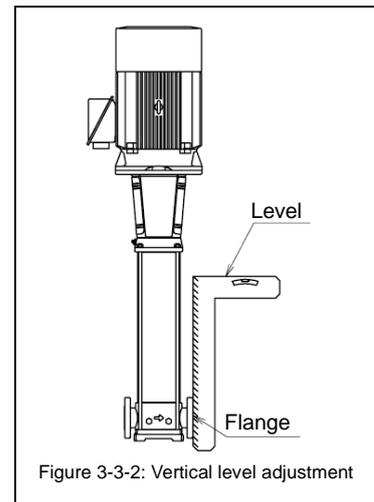
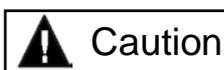


Figure 3-3-2: Vertical level adjustment

3.4 Precautions for connecting the ducts



Caution



Before piping work, remove the dust caps from the suction side and the discharge side of the casing of the pump. If the pump is operated with them attached, the pump, pipes, etc. may be damaged.



Caution



Do not screw the pipe when the companion flange is attached to the pump. The pump may be damaged.

- (1) Remove the dust caps from the suction side and the discharge side of the casing of the pump.
- (2) Be sure to install pipe supports so that the weight of pipes, etc. is not applied on the main body of the pump.

 Caution	 If the weight of pipes, etc. is applied on the pump, the casing may be damaged.
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- (3) The connection flanges of the suction/discharge parts of the pump are loose flanges. Connect the pipe after checking that the flange fits in the retaining ring of the casing part as shown in the figure below. Tighten the bolts at the recommended torque shown in the table below while carefully avoiding uneven tension.

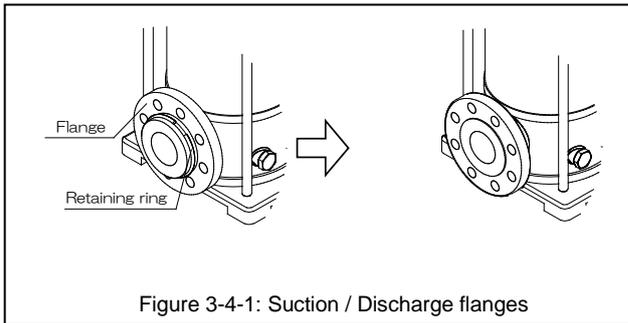


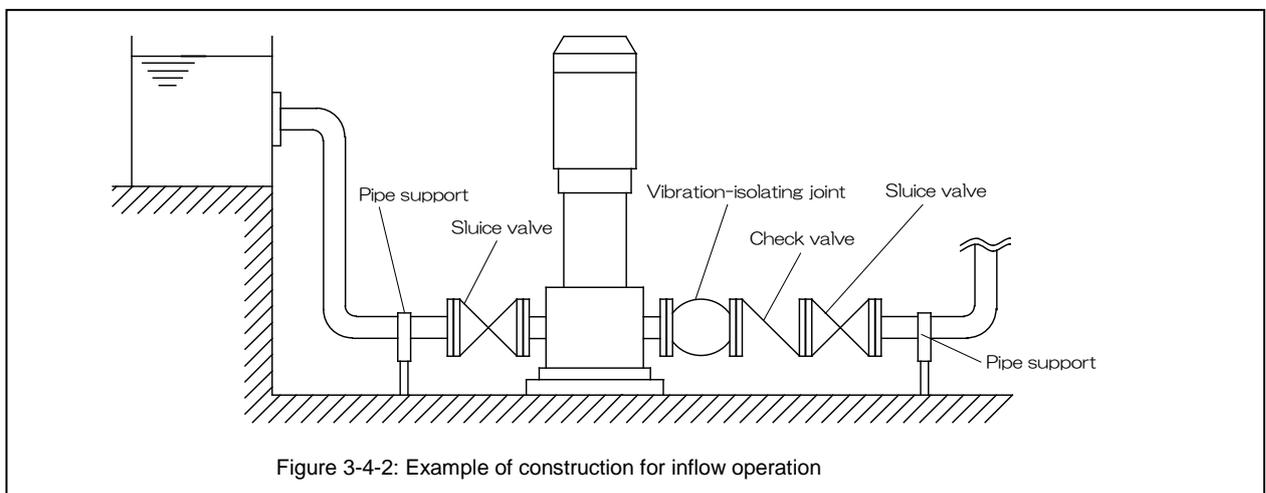
Table 3-4-1: Recommended tightening torque for flanges

Pump type	Recommended tightening torque
ASVM(N)(G) 25,32,40,50,65	70 N · m
ASVM(N)(G) 80,100,100B,125,125B	90 N · m

- (4) In order to reduce the transmission of vibration and noise, attach vibration-isolating joint(s) to the discharge side or both the suction side and the discharge side of the pump.
- (5) Do not install any elbow near the suction port or the discharge port of the pump.
- (6) The suction pipe must be made as short and straight as possible.
- (7) Carefully attach joints, etc. to the suction pipe so as not to allow the entry of air.
- (8) Ensure that the diameter of the suction pipe is equal to or larger than that of the pump.

 Caution	 Ensure that the diameter of the suction pipe is equal to or larger than that of the pump. If the suction pipe is small, cavitation may occur.
--	--

- (9) For inflow operation
 - (9-1) For inflow operation, attach a sluice valve to the suction pipe as shown in the figure. The maintenance of the pump can be performed without the need to discharge water from the tank and the pipe.

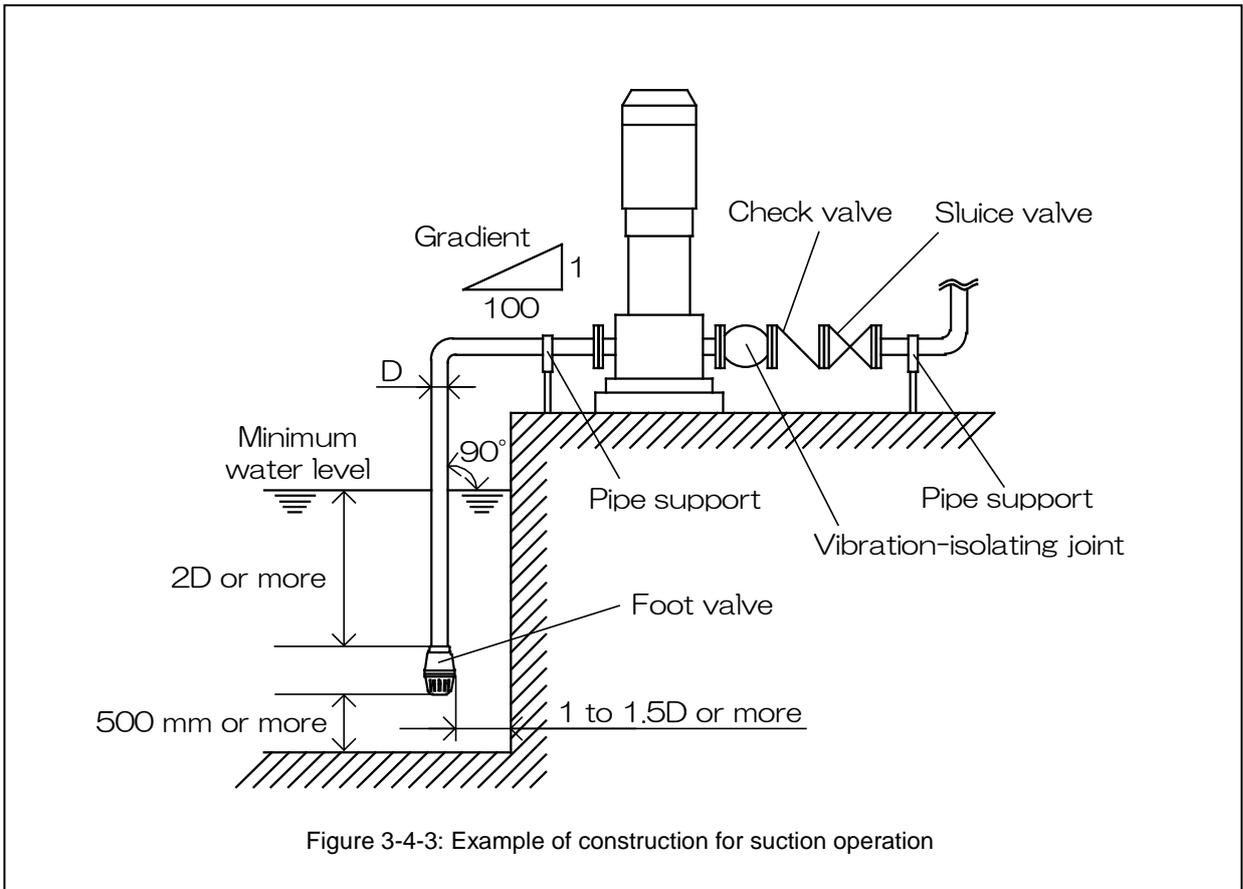


(10) For suction operation

- (10-1) The suction pipe must be made as short and straight as possible, and no sluice valve must be attached. Do not use any inverted-U-shaped loop (that includes ascending and descending lines) for the piping system.
- (10-2) Provide the suction pipe with a rising gradient of 1:100 or more toward the pump to prevent air from being trapped.
- (10-3) If the diameter of the suction pipe is larger than that of the suction port of the pump, use an eccentric reducer to prevent air from being trapped. The diameter of the suction pipe can be up to 2 sizes larger than that of the pump.
- (10-4) Attach a foot valve with a strainer to the end of the suction pipe so as not to suck any foreign objects, etc. Immerse the foot valve in water and set it at a depth of at least twice the diameter of the pipe from the surface of water to prevent the suction of air. In addition, ensure that it is set above 500 mm or more from the bottom of water.

 Caution		Properly install the foot valve vertically. If it is installed obliquely, the valve does not open or close properly, which may impair the function of the foot valve.
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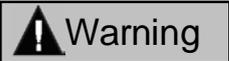
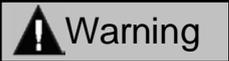
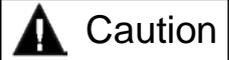
- (10-5) If the suction operation is performed using two or more pumps, do not connect each suction pipe to another pipe.
 - (10-6) Attach a sluice valve and a check valve to the discharge pipe. If water hammer occurs, attach a buffer type check valve.
 - (10-7) If there is a convex part in the discharge pipe, ensure that air can be released. Do not attach an air vent valve to a place where there is a negative pressure, such as the suction pipe.
- (11) After construction work, be sure to clean the inside of the water receiving tank so that foreign objects will not be sucked into the pump.



3.5 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 electric wiring work. Unqualified persons are prohibited by law from performing wiring work.
 Caution		Check that the supply voltage and frequency are suitable for the motor.

3.5.1. Power cable

 Warning	 	Be sure to install a ground fault interrupter exclusively for this equipment at the primary power supply. Otherwise, an electric shock and/or fire may occur.
 Warning	 	Be sure to attach a ground wire to the motor, and be sure to perform grounding work.
 Warning		Connecting a ground wire to gas or water pipes is illegal and extremely dangerous.
 Caution		Securely tighten the power cable connection terminal. A loose terminal may lead to open-phase operation and damage the motor.

- (1) Be sure to install a ground fault interrupter and an overload protection device on the primary power side of the pump.
- (2) Be sure to attach a ground wire to prevent an electric shock. Connect the ground wire to the ground terminal in the terminal box of the motor.
- (3) Put the power cable in a metal pipe or metal duct to shield it, and ground the outer surface of the pipe.
- (4) Keep power voltage fluctuations within the range of $\pm 10\%$ of the rated voltage, and frequency fluctuations within the range from $+3\%$ to -5% of the rated value. The use of the equipment beyond these limits may cause a failure. Even if they are within the allowable ranges of fluctuations, the pump characteristics, motor characteristics, temperature rises, etc. are different from the rated values.
(If the power voltage is lower than the rated voltage, any fluctuations may cause an overload even within the range of specified flow rates.)
- (5) Precautions for inverter driving
 - (5-1) Ensure to keep the operation current value within 90% of the rated current value.
 - (5-2) Ensure to keep the operation frequency within 95% to 50% of the commercial power frequency.
 - (5-3) Do not perform the inverter driving of the motor with a self-protection device.
 - (5-4) The pump and the piping system may vibrate sympathetically at a certain operation frequency. Avoid operation at a frequency that leads to significant vibration.
 - (5-5) In the case of inverter driving, magnetic noise occurs from the motor, and may sounds noisy in comparison with commercial power driving. This magnetic noise does not adversely affect the quality of the motor. The noise tone can be adjusted by changing the carrier frequency depending on the inverter. However, if the carrier frequency is changed, the allowable output of the inverter may be reduced. Therefore, be careful when selecting an inverter.

4. Preparation for operation

4.1 Points to be checked before test running

4.1.1. Checking the electrical system

 Warning	 Before changing the wiring, etc., be sure to turn off the main power supply. Otherwise, you may receive an electric shock.
 Warning	 Do not use the product at any voltage different from the rated voltage. A fire or electric shock may occur.

- (1) Check that wiring is correct.
- (2) Check that the terminals are securely connected.
- (3) Check that the equipment is securely grounded.
- (4) Check that the settings of the overload protection device match the rated current value of the motor.

4.1.2. Checking the pump system

 Warning	 Before rotating the pump by hand for checking, be sure to turn off the main power supply of the pump.
 Warning	 At the time of priming (air release), prevent the motor or the parts from being damaged by spouting water. When handling hot water, be careful not to suffer burns.
 Caution	 Never run the pump without priming. Otherwise, the sliding parts in the pump may seize up.

- (1) Rotate the pump shaft by hand to check smooth rotation. Remove the coupling guard, and hold the coupling to rotate the pump by hand. The rotation must be smooth without binding (no sticking points).

- (2) Priming (air release)

 Caution	 Do not excessively tighten the air vent plug needle. Otherwise, damage or water leakage may occur.
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- (2-1) For inflow operation

- Close the sluice valve on the discharge side of the pump.
- Loosen the air vent plug needle.
- Slowly open the sluice valve on the suction side.
- Rotate the pump by hand to completely expel air from the inside.
- Check that water comes from the air vent plug.
- Tighten the air vent plug needle.
- Fully open the sluice valve on the suction side.

(2-2) For suction operation

- Close the sluice valve on the discharge side of the pump.
- Remove the priming plug, and pour water.
(In the case of ASVM(N)(G) 25 and 32, also loosen the bypass plug.)
- Rotate the pump by hand to completely expel air from the inside.
- After checking that the suction pipe and the pump are sufficiently filled with water, attach the priming plug.
- After starting the pump, gradually loosen the air vent plug needle to check that water comes from the air vent plug.
* When starting the pump, be sure to refer to "4.2 Pump operation (test run)."
- After air release, tighten the air vent plug needle.
(In the case of ASVM(N)(G) 25 and 32, also tighten the bypass plug.)

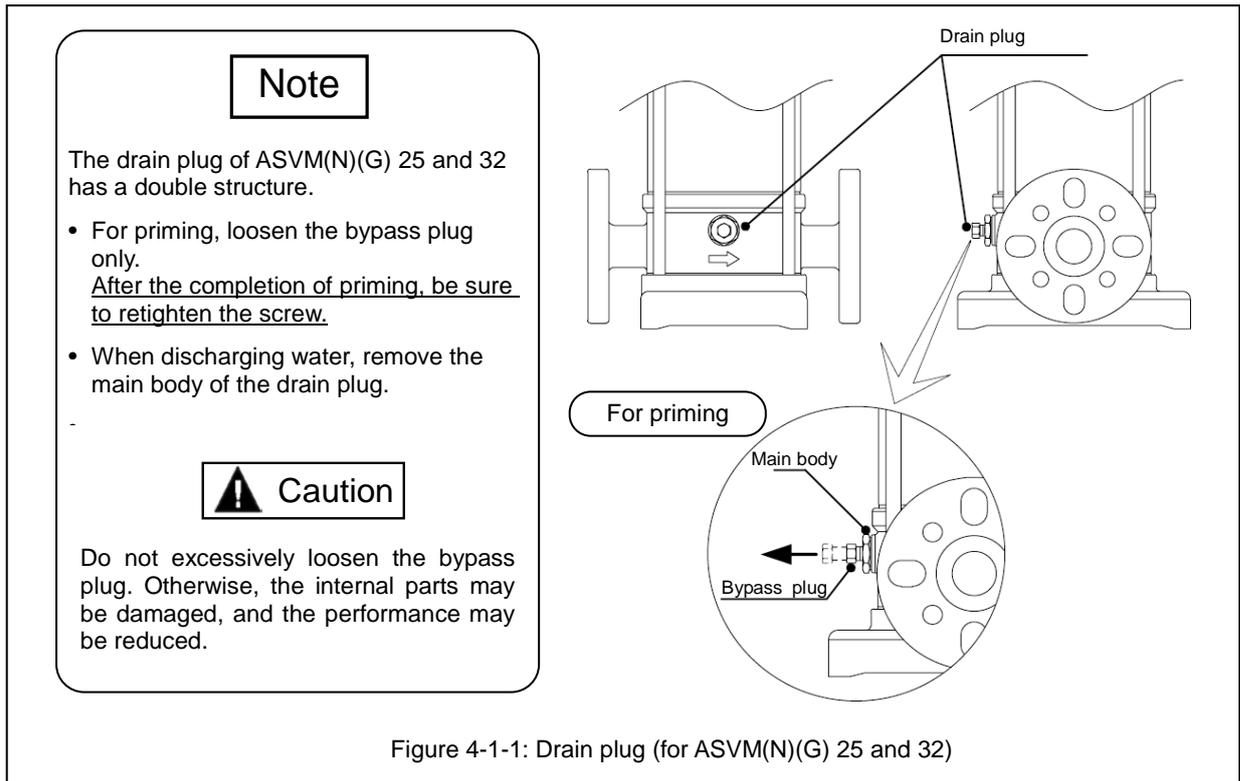


Figure 4-1-1: Drain plug (for ASVM(N)(G) 25 and 32)

4.2 Pump operation (test run)

<p>Danger</p>	 	<p>After turning on the main power supply, do not touch the current-carrying parts. Because a high voltage is applied to the current-carrying parts, a significant danger may be posed if you may receive an electric shock.</p>
<p>Warning</p>	 	<p>Be sure to install the cover of the terminal box of the electric motor. Otherwise, you may receive an electric shock.</p>
<p>Warning</p>	 	<p>Before operating the pump, be sure to attach the coupling guard. Otherwise, you may get entangled and injured.</p>
<p>Warning</p>	 	<p>Do not put your fingers or other objects into the opening of the motor. An electric shock or injury may occur.</p>

 Caution	 Before operating the pump, be sure to flush the inside of the piping. If foreign objects enter, the pump may be damaged.
 Caution	  Do not touch the pump if the handled liquid is warm or hot. Otherwise, you may burn yourself.
 Caution	  Do not touch the motor during or immediately after operation. Otherwise, you may burn yourself because it is hot.
 Caution	 Do not cover the motor with a blanket, cloth, etc. Otherwise, the internal temperature of the motor increases, which may cause a failure.
 Caution	 Be sure to restart the pump after the pump stops completely. If the power is turned on during rotation, an excessive torque occurs, which may cause a failure.
 Caution	 Be sure to close cocks of instruments such as pressure gauges and compound pressure gages and remove them unless they are used for measurement so that any pressure is not always applied on them. If pressure is always applied, the instruments become prone to malfunction.
 Caution	 If the pump starts and stops frequently, a premature failure may occur to it. Therefore, reduce the number of starts and stops as much as possible. The maximum number of starts shall be approximately 5 times per hour.

- (1) Turn on and off the power once or twice to check the rotation direction of the pump. The normal rotation direction is left (counterclockwise) as viewed from the upper side of the motor fan. If the pump rotates in the reverse direction, swap two of the three wires of the power cable.

 Caution	 Avoid rotations in the reverse direction because it may cause a failure.
--	--

- (2) Turn on the power to start the pump.

 Warning	 Do not perform continuous operation (shut-off operation) for more than 1 minute while the sluice valve of the discharge pipe is closed. If shut-off operation is performed for a long time, the internal temperature and pressure of the pump rise, and the pump may get damage or steam may spout out.
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- (3) Gradually open the sluice valve on the discharge side, and perform the continuous operation of the pump.

 Caution	 Gradually open the sluice valve on the discharge side of the pump. If it is quickly opened, water hammer may occur.
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- (4) Check the pressure, current, vibration, noise, etc. for any abnormalities.

 Caution	 Do not operate the pump at any current value exceeding the rated current value because the motor may be damaged
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- (5) Close the sluice valve on the suction side, and stop the pump.

5. Maintenance and inspection

5.1 Precautions for maintenance and inspection

Perform the maintenance/checking of the pump in accordance with "5.1 Maintenance/inspection table."

 Caution	 Be sure to carry out a daily/periodic inspection according to the Maintenance/inspection table. Without carrying out such inspections, it may be impossible to prevent failure and accidents, which also shortens the product life.
 Warning	 If you find any problems during inspection, immediately stop operation, and solve the problem or contact TERAL or its relevant service provider. Incorrect work may cause an accident.

- **When carrying out a daily inspection, carefully observe the following points:**
 - If the discharge pressure, electric current, vibration, noise, etc. of the pump are substantially different from usual, it is a sign of impending failure. Therefore, closely investigate the matter and carry out necessary service as soon as possible. For this purpose, it is recommended to keep an operation log.
 - The allowable temperature difference between the motor bearing surface temperature and the ambient temperature shall be 40°C or less.
 - Check the mounting bolts and the screw of the power terminal block for looseness.
 - Check the piping for any water leakage or damage.
 - Check the mechanical seal for water leakage.

- **Keep the following points in mind when the pump is left unused for a long period:**
 - Be sure to keep the pump warm or discharge completely water from the piping of the pump because freezing may occur inside the pump during the winter season, etc.
 - When the pump is not used for a long time, turn off the main power for safety. Otherwise, accumulated dust may cause heating or ignition.
 - Since it may be difficult to rotate the pump because of a stuck sliding surface of the mechanical seal, periodically operate the pump to prevent the sliding surface from being stuck.
 - If you have a spare pump, operate it periodically so that it can be used at any time.

- **When checking the mechanical seal, pay attention to the following items.**
 - High-frequency sound (creak) may occur from the mechanical seal occasionally, but it does not indicate a failure of the pump. Therefore, there is no problem with the quality of the pump which can be used without taking any measures.
 - Normally, the mechanical seal leaks little water. If the water leakage increases, replace the mechanical seal.
 - The mechanical seal is a precise device for preventing water leakage of the pump shaft penetration part. In order to ensure satisfactory operation, carefully handle it.
 - At the early stage of operation of the pump, a small amount of water may leak due to the sliding surface of the mechanical seal that have not been yet fitted, but the leakage will stop after several hours of operation. This initial leakage is not a failure of the mechanical seal and the pump can be used without any concern.
 - The Teflon ring of the mechanical seal for ASVM(N)(G) 25 and 32 may wear at an early stage of operation of the pump, but such wear is not a failure of the mechanical seal. Therefore, there is no problem with the quality of the pump which can be used without taking any measures.

5.2 How to replace the mechanical seal

The mechanical seal of the pump is of a cartridge type. It can be replaced without disassembling the pump.

5.2.1. How to remove the mechanical seal

- (1) To prevent the operation of the pump during work, check that the main power is turned off.
- (2) Close the sluice valves on the suction side and discharge side, and discharge the liquid from the pump using the drain plug.

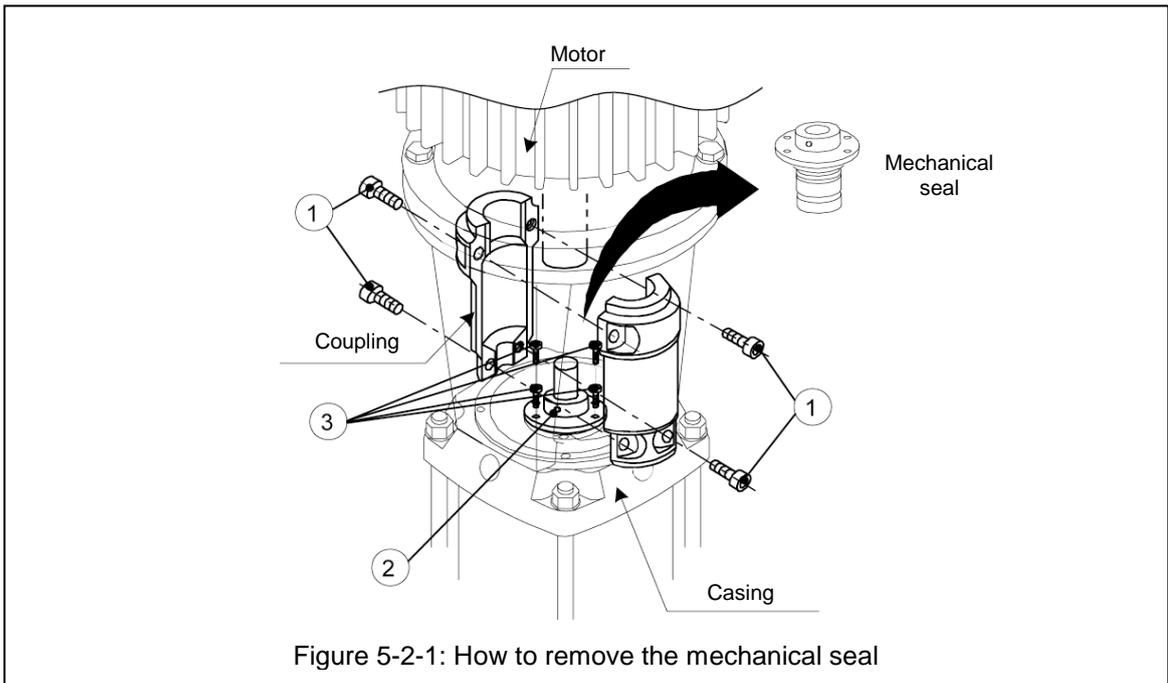
 Caution		Be careful when discharging water if the handled liquid is warm or hot. Otherwise, you may burn yourself.
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- (3) Loosen the screw for fixing the coupling guards, and remove the coupling guard.
- (4) Remove the hexagon socket bolts ① for fixing the coupling, and remove the coupling.
 - * Insert a flat-blade screwdriver into the clearance of the coupling and widen it, and then the coupling can be easily removed.
 - * For the models of ASVM(N)(G) 25 to 50, remove the parallel pin from the main shaft of the pump.
- (5) For a model with a motor output of 7.5 kW or less, use a proper crane to remove the motor. For models with a motor output of 11 kW or more, a spacer coupling is used and it is not necessary to remove the motor.
- (6) Loosen the three set screws ② for fixing the mechanical seal and the main shaft of the pump.

Note	Do not completely remove the set screws. Otherwise, the mechanical seal may be disassembled.
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- (7) Remove the hexagon socket bolts ③, and remove the mechanical seal from the casing.
- (8) Insert a flat-blade screwdriver into the circumference of the mechanical seal flange, and push up the whole using leverage.

This completes the removal work of the mechanical seal.



5.2.2. How to attach the mechanical seal

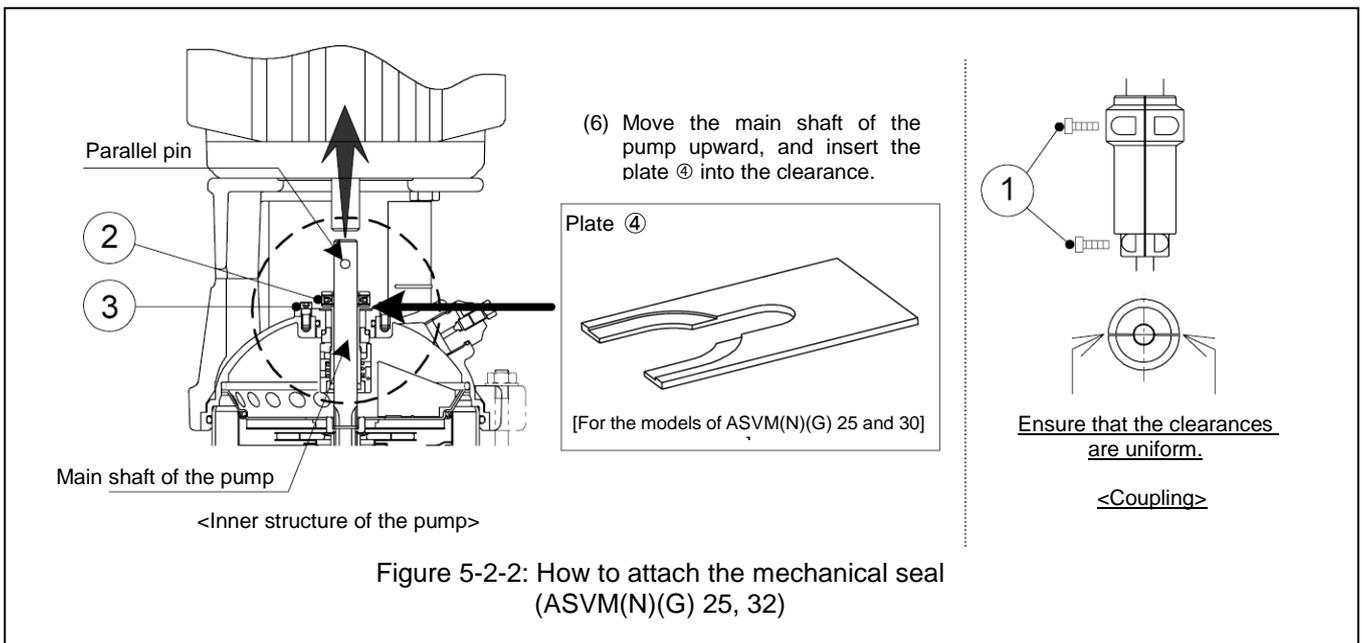
 Caution		<p>Do not directly touch the sliding surface of the mechanical seal. In addition, ensure that no dust, dirt, etc. will adhere to it.</p>
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■ ASVM(N)(G) 25, 32 series

- (1) To prevent the operation of the pump during work, check that the main power is turned off.
 - (2) Insert the mechanical seal into the main shaft of the pump.
 - (3) Fix the mechanical seal to the casing using the hexagon socket bolts ③.
 - (4) Push the main shaft of the pump downward, and check that the main shaft system is completely located at the lowest position.
 - (5) Temporarily fix it to the main shaft of the pump using three set screws ②.
 - (6) Move the main shaft of the pump upward, and insert the plate ④ into the clearance at the upper part of the mechanical seal.
 - (7) Use a proper crane to install the motor. (For motors with an output of 7.5 kW or less)
 - (8) Pass the parallel pin through the holes of the main shaft of the pump and coupling.
 - (9) Adjust the coupling so that the uniform clearances are created on both of its sides, fix it using the fixing bolts ①.
- [* Recommended tightening torque: 13 [N·m] (M6 screws), 31 [N·m] (M8 screws), 62 [N·m] (M10 screws)]
- (10) Remove the plate ④. Loosen the three set screws ② to ensure that there is no clearance at the upper part of the mechanical seal.
 - (11) Uniformly tighten the three set screws ②.
- [* Recommended tightening torque: 2.5 [N·m] (M5 screws), 8 [N·m] (M6 screws)]
- (12) Rotate the coupling by hand.
Check that the shaft rotates smoothly and that rotation is not unusually difficult.
 - (13) Attach the coupling guard, and tighten the screws.

This completes the installation work of the mechanical seal.

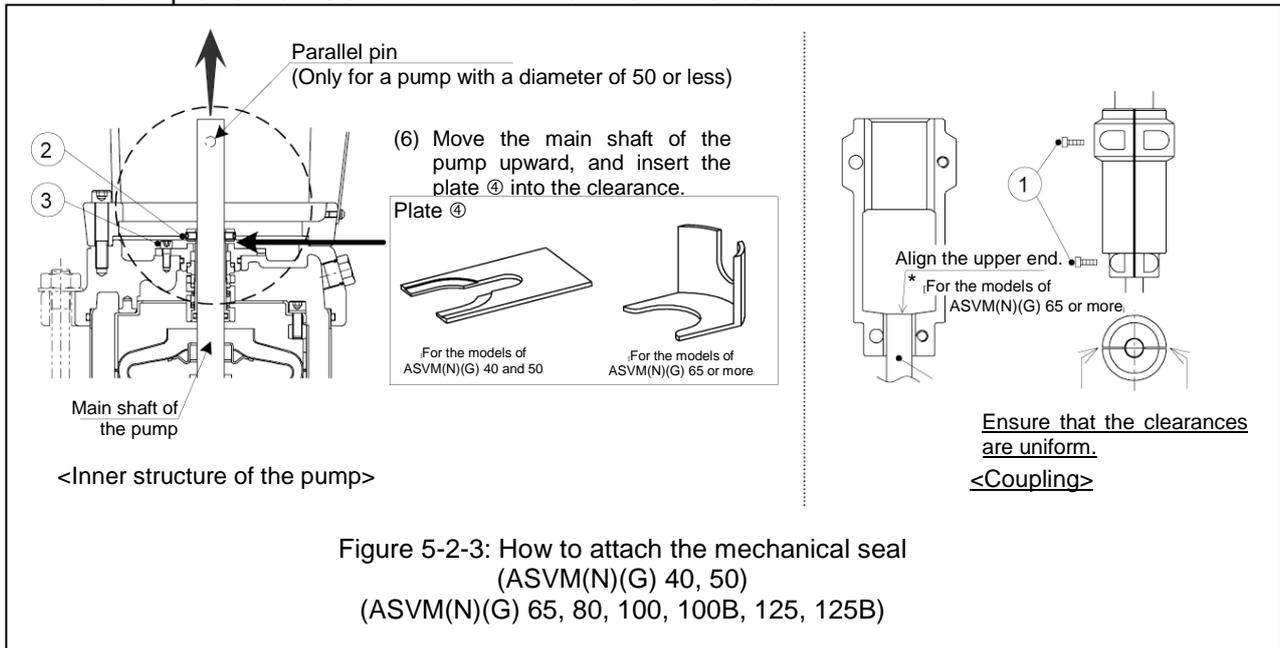
<div style="border: 1px solid black; padding: 5px; display: inline-block;"> Note </div>	<p>The Teflon ring of the mechanical seal may wear at an early stage of operation of the reassembled pump, but it is not a failure of the pump or the mechanical seal.</p>
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- ASVM(N)(G) 40, 50 series
- ASVM(N)(G) 65, 80, 100, 100B, 125, 125B series

- (1) To prevent the operation of the pump during work, check that the main power is turned off.
- (2) Insert the mechanical seal into the main shaft of the pump.
- (3) Fix the mechanical seal to the casing using the hexagon socket bolts ③.
- (4) Push the main shaft of the pump downward, and check that the main shaft system is completely located at the lowest position.
- (5) Uniformly tighten the three set screws ②.
[* Recommended tightening torque: 2.5 [N·m] (M5 screws), 8 [N·m] (M6 screws)]
- (6) Move the main shaft of the pump upward, and insert the plate ④ into the clearance at the upper part of the mechanical seal.
- (7) For a pump with a motor output of 7.5 kW or less, install the motor.
- (8) For the models of ASVM(N)(G) 50 or less, pass the parallel pin through the holes of the main shaft of the pump and coupling.
For the models of ASVM(N)(G) 65 or more, there is no parallel pin. Align the upper end of the main shaft of the pump with the upper end of the shaft hole of the coupling as shown in the figure below.
- (9) While adjusting the clearances on both sides of the coupling in such a way that they are uniform, fix the coupling using the fixing bolts ①.
[* Recommended tightening torque: 13 [N·m] (M6 screws), 31 [N·m] (M8 screws), 62 [N·m] (M10 screws)]
- (10) Remove the plate ④, and rotate the coupling by hand.
Check that the shaft rotates smoothly and that rotation is not unusually hard.
- (11) Attach the coupling guard, and tighten the screws.

This completes the installation work of the mechanical seal.



5.3 Motor bearing grease lubrication

Electric motor are pre-lubricated from factory and do not require additional lubrication at start-up. Motors without external grease nipples have sealed bearing that cannot be re-lubricated.

Motors with grease nipples should only be lubricated with approved types of grease. Do not over-grease the bearings. Over-greasing will cause increased bearing heat and can result in bearing or motor failure. Do not mix oil-based grease and silicon grease in motor bearings.

Bearing grease will lose its lubricating ability over time.

The lubricating ability of a grease depends primary on the type of grease, the size of bearings, the speed at which the bearings operate and the severity of the operation condition.

Good result can be obtained if the following recommendations are used in your maintenance program. It should also be noted that multistage pumps, pumps running to the left of the performance curve, and certain pump ranges may have higher thrust loads. Pumps with high thrust loads should be greased according to the next service interval level.

 Caution		The grease outlet plug must be removed before adding new grease.
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<<Grease lubricating procedure>>

 Caution		Keep grease free from dirt to avoid damage to motor bearings. If the environment is extremely dirty, contact TERAL for additional information. Do not mix dissimilar of grease.
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1. Clean all grease nipples. If the motor does not have grease nipples, the bearing is sealed and cannot be greased externally.
2. If the motor is equipped with a grease outlet plug, remove it. This will allow the old grease to be displaced by the new grease. If the motor is stopped, add the recommended amount of grease. If the motor is to be lubricated while running, add a slightly greater quantity of grease.
3. Add grease slowly taking approximately one minute until new grease appears at the shaft hole in the flange or grease outlet plug. Never add more than 1/2 times the amount of grease shown in the re-lubricating chart.

Note	If the new grease does not appear at the shaft hole or grease outlet, the outlet passage may be blocked. Contact TERAL.
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4. Let motors equipped with a grease outlet plug run for 20 minutes before replacing the plug.

Table 5-3-1: Replenish lubricating grease chart

Output (kW)	Weight of grease	Service intervals	Approved type of grease
55, 75	80 g	1,000 hours	Polyrex EM (Thickener: Polyurea) / ExxonMobil

Table 5-3-2: Motor bearing type (IEC Standard motors) for reference

Motor output		IE	Frame	Bearing type	
[HP]	[kW]			Load side	Non load side
0.5	0.37	IE 1/2/3	71	6204 ZZ C3	6201 ZZ C3
0.75	0.55	IE 1/2/3	71	6204 ZZ C3	6201 ZZ C3
1.0	0.75	IE 1/2/3	80	6204 ZZ C3	6201 ZZ C3
1.5	1.1	IE 1/2	80	6204 ZZ C3	6201 ZZ C3
		IE3	80	6204 ZZ C3	6304 ZZ C3
2.0	1.5	IE 1/2/3	90S	6205 ZZ C3	6304 ZZ C3
3.0	2.2	IE 1/2/3	90L	6205 ZZ C3	6304 ZZ C3
4.0	3.0	IE 1/2/3	100L	6307 ZZ C3	6305 ZZ C3
5.5	4.0	IE 1/2/3	112M	6307 ZZ C3	6305 ZZ C3
7.5	5.5	IE 1/2/3	132S	6309 ZZ C3	6306 ZZ C3
10	7.5	IE 1/2/3	132S	6309 ZZ C3	6306 ZZ C3
15	11	IE 1/2/3	160M	6310 ZZ C3	6308 ZZ C3
20	15	IE 1/2/3	160M	6310 ZZ C3	6308 ZZ C3
25	18.5	IE 1/2/3	160L	6311 ZZ C3	6309 ZZ C3
30	22	IE 1/2/3	180M	6311 ZZ C3	6309 ZZ C3
40	30	IE 1/2/3	200L	6313 ZZ C3	6312 ZZ C3
50	37	IE 1/2/3	200L	6313 ZZ C3	6312 ZZ C3
60	45	IE 1/2/3	225M	6314 ZZ C3	6313 ZZ C3
75	55	IE 1/2/3	250M	7314	6314
100	75	IE 1/2/3	280S	7314	6314

5.4 Maintenance/inspection table

 Warning	 	Before carrying out inspection that requires disassembly and service, be sure to turn off the main power supply. Otherwise, you may receive an electric shock.
 Caution		Only the service personnel with special knowledge of repairs are allowed to disassemble the product. For work such as replacement of parts, repairs, or inspection that requires disassembly of the equipment, make sure to contact a specialized vendor or the service center specified by TERAL. Incorrect work may cause a failure or accident.
 Caution		Replace the packing and O-rings during an overhaul. Otherwise, water leakage may occur.

Table 5-4-1: Maintenance/checking table

Section	Inspection Point / Place	Item	Method	Criterion	Cycle			Replacement of consumables (as a guide)
					Daily	6 months	1 year	
Ambient conditions	Temperature	Compliant with specifications	Measure	0 thru 40 °C	✓			
	Humidity		Measure	0% to 85%RH No condensation	✓			
	Dust, dirt, etc.		Visual check	No dust and dirt	✓			
Power	Power terminal block	Voltage	Measure	Rated voltage has been applied.		✓		
		Voltage fluctuations	Measure	Within the allowable fluctuation range		✓		
		Loose screws	Retightening	No loose screws			✓	
Pump and motor	Operation status	Performance	Visual check	As per specifications	✓			If any failure is found, overhaul the pump.
		Current value	Measure	As per specifications	✓			
		Noise, vibration	Hear Touch	No unusual vibration	✓			
	Around the main shaft	Smooth rotation	Rotation by hand	Smooth rotation			✓	
	Mechanical seal	Water leakage	Visual check	No water leakage	✓			Once a year or consecutive 8000 hours
	O-ring	-	-	-				Every overhaul
	Bearing (Motor)	Heating/Noise /Vibration	Touch Hear	No abnormal condition			✓	Once every three years or consecutive 15000 hours
		Grease replenishment	Visual check Hear	No unusual vibration and noise No grease flows out.			✓	Refer to Section 5.3 for the amount of grease to be replenished and replenishment intervals.
	Winding resistance	Resistance between wires (U-V, V-W, W-U)	Measure	Uniform resistance between wires			✓	
Insulation resistance	Insulation resistance between the ground and each lead	Measure	1MΩ or more			✓		

Note

Information in the “Replacement of consumables (as a guide)” column shows standard values that are applicable when the equipment has been properly used and periodically inspected. Therefore, depending on the operating conditions, you may need to replace the consumables earlier than those intervals.

Note

Waste used parts or other items removed during repairs or replacement must be disposed of by a specialized contractor.

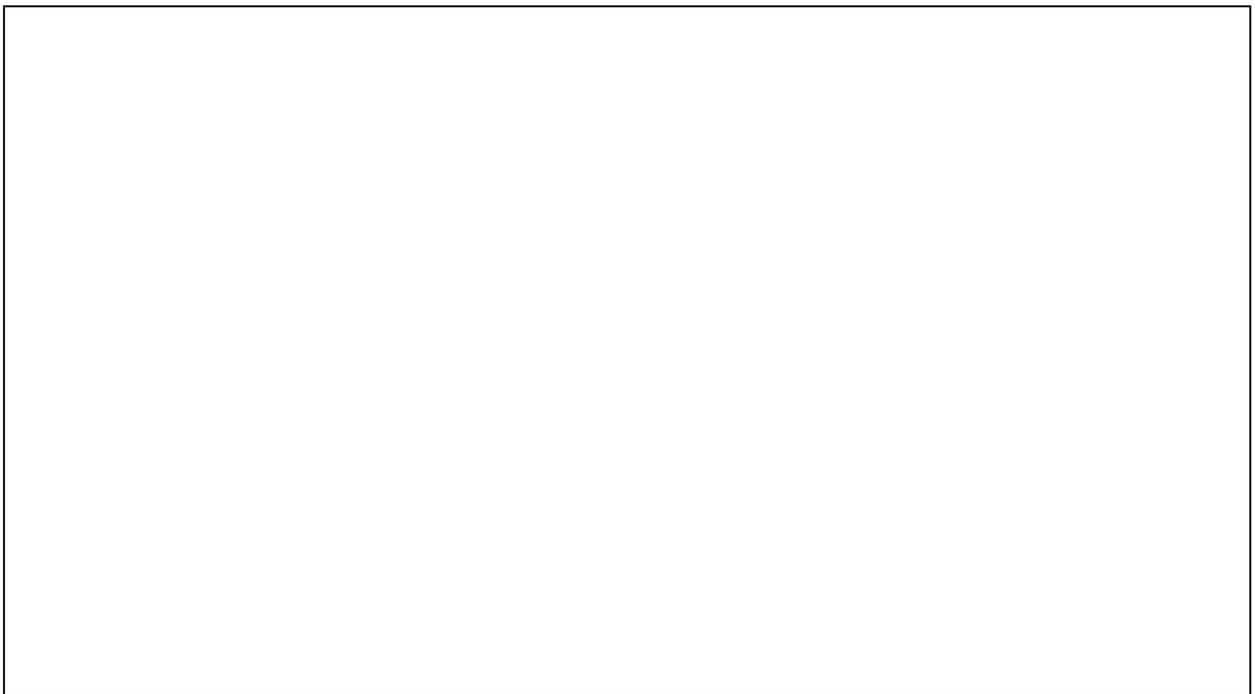
6. Troubleshooting

 Caution	 If there is any failure that cannot be resolved, immediately stop operation, and contact us or your service company. When contacting us/them, please inform us/them of the information shown on the nameplate and the conditions of the failure.
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Table 6-1-1: Troubleshooting

Failure	Probable cause	Measures
When the power is turned on, the pump does not start.	Failure or loss of the power supply	Check the connection or turn on the power again.
	The power fuse is blown.	Replace the power fuse.
	The overload protection device of the motor has tripped.	Reset the overload protection device.
	The power voltage is too low.	Contact the power company.
	The motor has failed.	Replace the motor.
	The shaft seal part has seized up.	Ask the specialized vendor for investigation.
	The bearing is rusty The pump or the piping is clogged with foreign objects.	
The overload protection device of the motor trips.	The overload setting is too low.	Properly set the overload device of the motor.
	The cable connection is loose or a failure has occurred.	Tighten the cable connection or replace it.
	The power fuse is blown.	Replace the power fuse.
	The motor does not operate because the pump is clogged with foreign objects.	Ask the specialized vendor for investigation.
	Rotating parts touch the other part or are damaged.	
	The winding of the motor has a defect.	Replace the motor.
	The power voltage is low.	Contact the power company.
The discharge rate is too large.	Throttle the sluice valve on the discharge side to adjust the discharge rate.	
The pump operates, but water is not fed.	No or insufficient priming of the pump	Fill the pump with liquid.
	The sluice valve on the suction discharge side is closed.	Open the sluice valve.
	The piping is clogged with foreign objects.	Check and clean the suction pipe or the discharge pipe. Ask the specialized vendor for investigation.
	The pump is clogged with foreign objects.	
	The foot valve or the check valve is clogged or has a failure.	Replace the foot valve or the check valve.
	Piping work has been performed with the dust caps attached to the suction or discharge side.	Remove the dust caps.
	Air is trapped in the suction pipe or the pump.	Release air.
The rotation direction of the motor is wrong.	Change the connection of the motor.	
The performance of the pump is unstable or insufficient.	The pressure on the suction side of the pump is too low. (Cavitation)	Check the suction conditions.
	The suction pipe or the pump is partly clogged.	Check the pump or the suction pipe.
	The flow rate of the pump is larger than the specified value.	Throttle the sluice valve on the discharge side to adjust the discharge rate.
	The suction pipe leaks the liquid or sucks air.	Check the suction conditions. Release air from the pump.
	The rotation direction of the motor is wrong.	Change the connection of the motor.
	The screws of the bypass plug are loose. (ASVM(N)(G) 25, 32 series)	Tighten the screws of the bypass plug.
The impeller and the liner ring are worn.	Ask the specialized vendor for investigation.	
When the power is turned off, the pump rotates backward.	The foot valve or the check valve has failed.	Check and replace the foot valve or the check valve.
	The suction pipe leaks.	Repair or replace the suction pipe.
Vibration and noise	Cavitation has occurred in the pump.	Reduce the flow rate or check the suction conditions.
	The discharge rate is too large.	Throttle the sluice valve on the discharge side to adjust the discharge rate.
	The positioning of the main shaft of the pump is wrong.	Adjust the main shaft of the pump.
	The bearings of the motor are damaged.	Replace the bearings.
	An inverter is used.	Change the operation frequency or the carrier frequency.

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