Installation and Operating Instructions

STAIRS

VERTICAL MULTI-STAGES CENTRIFUGAL PUMPS

Models 1, 3, 5, 10, 15, 20, 32, 45, 64, 90, 120, 150

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EC DECLARATION OF CONFORMITY

according to the following EC Directives
-Machinery Directive: 2006/42/EC
-Low voltage Directive: 2006/95/EC
-Electromagnetic Compatibility Directive: 2004/108/EC
Complies with (EU) No 547/2012 and meets European Directive: 2009/125/EC

CE

We, STAIRS INDUSTRIAL CO.,LTD. as manufacturer declares that the machine described hereafter:

Vertical Multistage Centrifugal In-line Pump

Series SB/SBI/SBN 1, 3, 5, 10, 15, 20, 32, 45, 64, 90, 120, 150

Provided that it is used and maintained in accordance with the general accepted codes of good practice and the recommendations of the instructions manual, meet the essential safety and health requirements of the Machinery Directive, Low Voltage Directive and Electromagnetic Compatibility Directive.
For the most specific risks of this machine, safety and compliance with the essential requirements of the Directive has been on elements of:

- EN ISO 12100: 2010 / Safety of Machinery - General principles for design / Risk Assessment and Risk reduction.
- EN 60204-1:2006/A1:2009 / Safety of machinery - Electrical equipment of machines - Part 1: General requirements
- EN 809:1998+A1:2009/ Pumps and pump units for liquids. Common safety requirements
- EN ISO 13857:2008/ Safety of machinery. Safety distances to prevent hazard zones being reached by upper and lower limbs
- EN 414:2000/ Safety of machinery. Rules for the drafting and presentation of safety standards
- EN 953:1997+A1:2009/ Safety of machinery. Guards. General requirements for the design and construction of fixed and movable guards
- EN 61000-6-2: 2005 / Electromagnetic compatibility (EMC)- Part 6-2: Generic standards – Immunity for industrial environments
- EN 61000-6-4: 2007+A1:2011 / Electromagnetic compatibility (EMC)- Part 6-4: Generic standards – Emission standard for industrial environments

Signature : Mr. S.C. HUANG
Responsibility : President
Date : December 17, 2013

宏奇泵浦工業有限公司

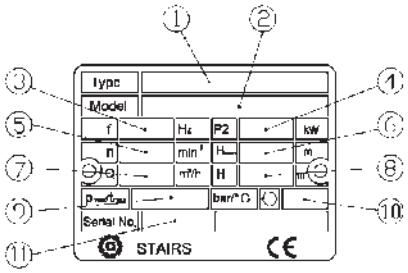
1. Model numbering and nameplate format

1.1 Model numbering

Example: **SB/SBI/SBN 5 16 SQQE**

- **SQQE** — Code for shaft seal
- **16** — Number of stages
- **5** — Nominal flow [m3/h]
- **SB/SBI/SBN** — Type Ranges

1.2 Nameplate format



1. Pump Type – Seal Type
2. Pump Model
3. Frequency
4. Rated Power
5. Speed
6. Maximum Head
7. Capacity
8. Head Range
9. Maximum Operating Pressure
10. Rotating Direction
11. Serial Number

2. Handling

Read these instructions carefully before beginning installation. Lift and handle these pumps carefully. SB, SBI & SBN series are vertical multi-stage non-self priming pumps coupled with standard electric motors. This manual applies to standard version pumps and for standard applications. Contact your supplier or the factory for information about special pump versions and applications.

3. Applications

SB, SBI, SBN series in-line pumps booster pumps are designed for a wide range of applications in various industries – for water treatment, water boosting, water supply, cooling, cleaning, etc.

3.1 Pumped liquids

The pumps are designed for use with clean, viscous and non-explosive liquids that do not contain abrasive matter.

WARNING 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.

4. Technical data

4.1 Temperatures

- Ambient temperature: 0°C to +40°C

WARNING If ambient temperatures are above +40 degrees 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.

- Liquid temperature: -15°C to +120°C

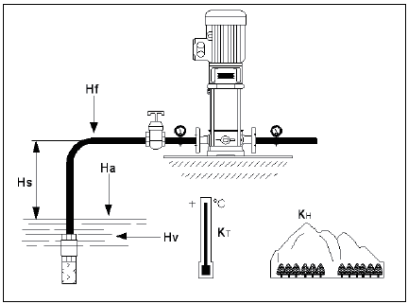
4.2 Maximum operating pressure

- Refer to page 8

4.3 Minimum inlet pressure-NPSH

➢ To avoid cavitation, make sure that there is a minimum pressure on the suction side of the pump.

NPSHA: Net Positive Suction head Available
--The net positive suction head available is a function of the pump suction system.
NPSHR: Net Positive Suction head required
--The net positive suction head required is a function of the pump design at the operating point on the pump performance curve.
NPSHA=Ha-Hs-Hf-Hv-Hst (in meters head)
Ha: Barometric pressure.(That can be set to 10.2 m.)
Hs: Suction lift.
Hf: Friction loss in suction pipe.
Hv = KT+KH: Vapor pressure
KT: Flow resistance due to liquid temperature.
KH: Flow resistance due to elevation above sea level.
If the liquid is water, you can consult the tables to determine the values of **KT** and **KH.**



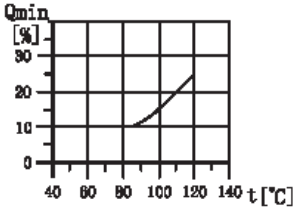
T (℃)	20	30	40	50	60	70	80	90	100	110	120
KT (m)	0.2	0.4	0.8	1.3	2.2	3.3	5	7.4	11	15	22

H (m)	0	500	1,000	1,500	2,000	2,500	3,000
KH (m)	0	0.55	1.1	1.65	2.2	2.75	3.3

Hst: Safety margin. (minimum: 0.5 meters head)
$NPSH_A \geqq NPSH_R$: Pump running will be fine.
$NPSH_A \vee NPSH_R$: The pump will be dry running or cavitating.
WARNING Stop operation of the pump if cavitation occurs. Cavitation will cause pump damage and the resultant damage is not subject to warranty

4.4 Minimum nominal flow rate

To prevent overheating of the internal pump components, the pump should not be used at flows below the minimum flow rate.
WARNING Do not run the pump against a closed discharge valve for longer than a few seconds.
The curve below shows the minimum flow rate as a percentage of the nominal flow rate in relation to the liquid temperature..



4.6 Electrical data

See the motor nameplate.
WARNING Make sure that the supply voltages, phase and frequencies correspond to the motor specifications.

4.7 Number of starts per hour

Motors up to and including 4 kW: Maximum 100 times per hour.
Motors of 5.5 kW and up: Maximum 40 times per hour..
WARNING If you use another brand of motor then check the manufacturer's instructions for the maximum frequency of starts.

5. Installation

Always refer to the local or national regulations and codes relating to the selection of the installation site, the water and power connections, etc.

5.1 Position

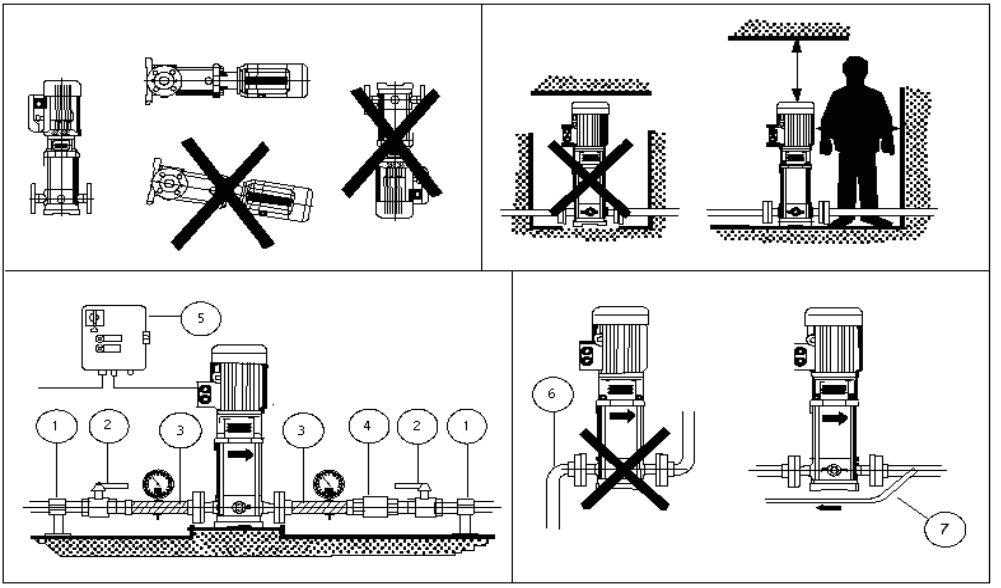
Pumps should be installed in a protected environment – not exposed to weather. Make sure that there are no obstructions to prevent proper motor cooling.

5.2 Anchoring

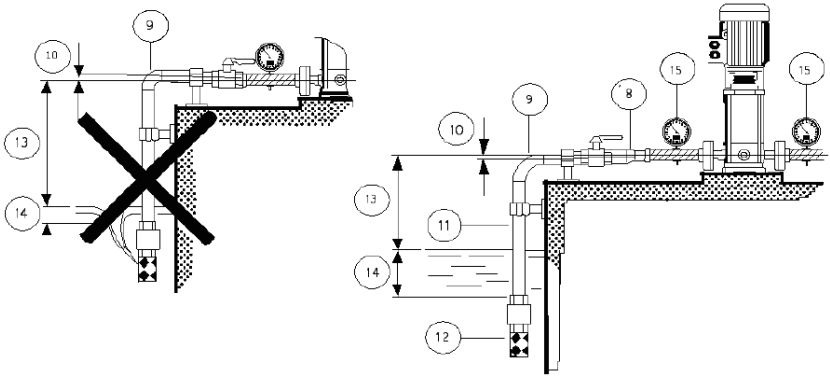
The pump must be secured to a solid foundation by bolts through the holes in the flange or base plate.
An illustration of page 9 shows the bolt location and the pipe connections.

5.3 Installation example

When positioning and installing the pump, follow the installation examples next page in order to avoid damaging the pump.



Pos.	Description
1	Pipe support: Support piping system properly to avoid stresses on connections.
2	On-off valves: Install on-off valves for easy access- before the pump intake and after the pump discharge.
3	Use flexible piping on both input and output sides of the pump to reduce vibration and transmission of noise.
4	Check valves will prevent return flow of pumped liquid when pump is stopped, reducing the danger of pump damage.
5	Control Panel: Use high quality components. Make sure that the panel conforms to local standards and regulations.
6	Do not place elbows next to the pump intake and discharge.
7	If pump needs to be operated with on-off valve closed, install a by-pass line to avoid damaging the pumping system.



8	If it is necessary to increase the diameter of the suction pipe, place an eccentric reducer between the check valve and the flexible pipe section.
9	Using elbows will increase the flow resistance. Wide bends will result in lesser flow resistance.
10	The piping must have a level or positive gradient to prevent the formation of air pockets.
11	The diameter of the drop pipe must be bigger than the diameter of the pump's suction port.
12	Use a foot valve in case of negative suction head.
13	Size pump for correct head.
14	Place the intake of the suction pipe so that the intake is always submerged to prevent entry of air.
15	Install a compound gauge at the pump suction and a pressure gauge at the pump discharge.

6. Electrical connection

- All electrical connection should be in accordance with the local regulations and made by a qualified electrician.
- Make sure that the supply voltages and frequencies, and phase are suitable for the motor used.
- Before proceeding, make sure that all the connections are grounded and well insulated.
- Overload protection should be provided.
- To connect, proceed as shown on the inside of the terminal board cover.
- The terminal box can be turned to four positions.
- Check the direction of rotation (Three-phase motor only).
- Make sure that the controls are properly grounded.
- To avoid the possibility of dry running, we strongly recommend installing dry running protection.

7. Start-up

The pump and suction pipe should be filled with the liquid to be pumped before start-up to prevent dry running at start-up.
WARNING Dry running can damage the pump bearing and shaft seal.

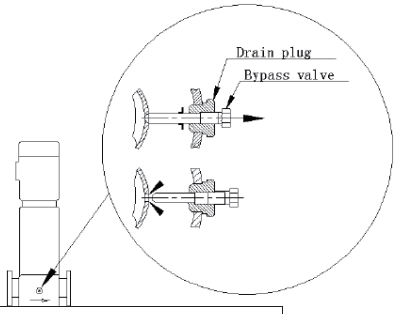
7.1 Operation

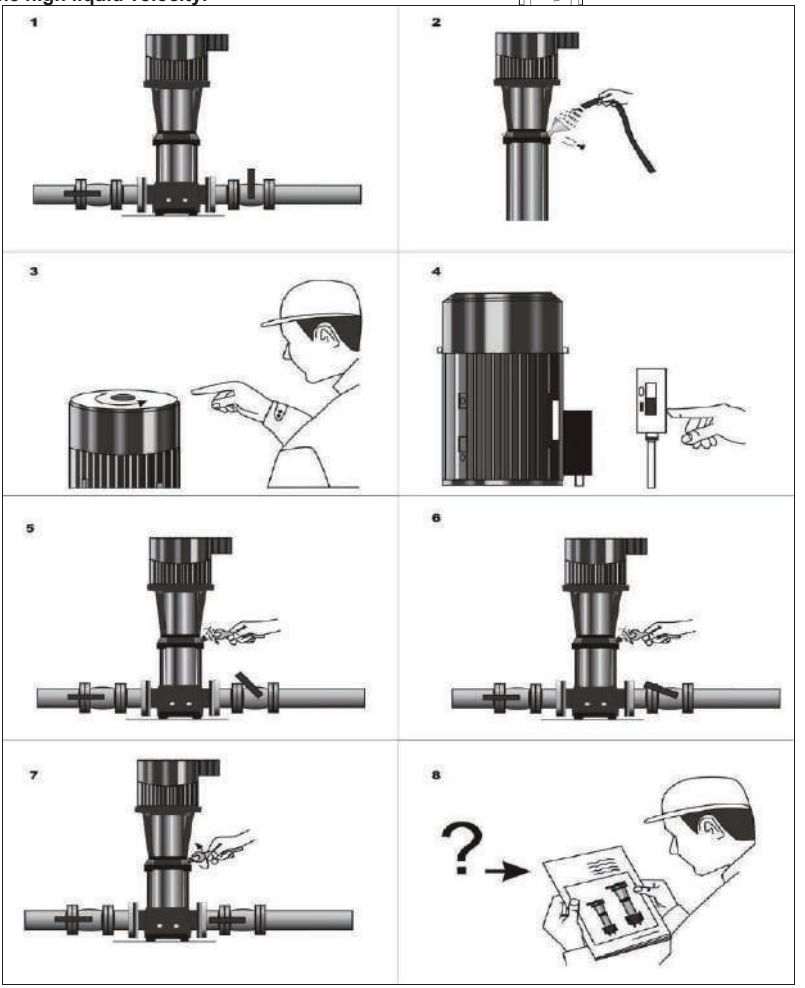
- Start the pump and check the direction of rotation of the motor (Three –Phase motors).
- Start the pump, keeping the on-off valve of the discharge side of the pump closed. Then, open the on-off valve slowly. The pump must run smoothly and noiselessly. If not, then it may be necessary re-prime the pump.
- Check the current drawn of the motor. If necessary, adjust the setting of the thermal relay.
- Any air pockets trapped inside the pump may be released by adjusting the air screw.

WARNING If the pump is installed in a location where it is subject to freezing when not in operation, then the pump and the pipe system should be drained to prevent damage from freezing.

7.2 Others (Only for SB, SBI, SBN 1, 3, 5 series)

- For these pumps, it is advisable to open the bypass valve during start-up. The bypass valve connects the suction and discharge sides of the pump, thus making the filling procedure easier. When the operation is stable, the bypass valve can be closed.
- If the pumped liquids contains air, it is advisable to leave the bypass valve open if the operating pressure is lower than 6 kg/cm². If the operating pressure constantly exceeds 6 kg/cm², the bypass valve must be closed. Otherwise the material at the opening will be worn because **of the high liquid velocity.**





8. Maintenance

WARNING Before starting maintenance work on the pump, the motor, or other parts of the system, make sure that the power supply has been switched off.

- The pump does not have a recommended scheduled maintenance schedule.
- If the motor is fitted with grease nipples, then the motor should be lubricated with a high temperature lithium-based grease. If not, then the motor does not require regular maintenance.
- If the pump and motor are used infrequently with long intervals of non-operation, then we recommend that the motor be greased.
- Coupling adjustment: Refer to page 10 and 11.

9. Troubleshooting

Fault	Probable cause	Possible Solution
Pump does not run when the motor starter is activated.	a. Supply failure or no power supply.	Check connections or restart the power supply.
	b. Main contacts in motor starter are not making contact or the motor coils are defective	Reconnect or replace contacts or magnetic coil.
	c. Pump or auxiliary circuits protection fuses blown.	Replace fuses.
	d. Pump or piping system may be obstructed causing a jam.	Clean the obstruction and restart pump.
	e. Motor may have failed.	Replace the motor.
	f. Motor protector or thermal relay has tripped out.	Reset the motor or thermal protector.
	g. Tripping of anti-dry running protection.	Check the water level in the tank or the water system pressure. If everything is in order, check the protection device and its connection cables.
Starter overload trips immediately when the power is switched on.	a. Overload setting is too low.	Set the motor starter correctly.
	b. The cable connection is loose or faulty.	Fasten or replace the cable connection.
	c. One fuse is blown.	Replace fuse and try starting again.
	d. Pump is jammed by an obstruction	Check and clean obstruction from system.
	e. Contacts in overload are faulty.	Replace motor starter contacts.
	f. The motor winding is defective.	Replace the motor.
	g. Low voltage (Especially at peak time).	Check the power supply.
The pump starts but, after a short time, the thermal protector trips out or the fuses blow.	a. The voltage is not within the motor's operating limits.	Check the operating conditions of the pump.
	b. The control panel is situated in an excessively heated area or is exposed to direct sunlight.	Protect the control panel from heat sources and from the sun.
	c. A phase in the power supply is missing.	Check the power supply.
The pump starts up but, after a period of time, the thermal protector trips.	a. Worn motor bearings causing motor to overheat.	Replace motor bearings.
	b. The pump's delivery rate is higher than the specified rate on the pump nameplate.	Partially close the on-off valve located discharge side until the delivery rate returns to within the specified limits.
	c. There are obstructions inside the pump or pumping system.	Disassemble and clean the pump and piping.
	d. Less viscous liquids may cause the motor to work too hard and overload the motor, causing the motor to overheat.	Check the actual power requirements based on the characteristics of the liquid being pumped, and replace the motor accordingly.
Pump runs but no water delivered.	a. Pump is not primed with liquid.	Fill the pump with the liquid to be pumped.
	b. The pump, suction or discharge pipes are blocked by solids in the liquid being pumped.	Clean the pump, suction or discharge pipe.
	c. The foot or check valve is blocked or has failed.	Replace the foot or check valve.
	d. The suction pipe leaks.	Repair or replace the suction pipe.
	e. The air is in the suction pipe or pump.	Remove trapped air from system..
	f. Motor operating in wrong direction (three-phase motor).	Change the direction of rotation of the motor by reversing motor connections.
The pump capacity is not constant.	a. The pump draws in air or the inlet pressure is too low.	Improve the suction conditions.
	b. The pump or the suction side of the piping system partly blocked by foreign bodies.	Clean the pump or suction pipe.
The system's general protection cuts in.	Short circuit.	Check electrical system.
The pump rotates in the wrong direction when switched off.	a. The foot or the check valve has failed.	Check and replace check valve.
	b. Leakage in the suction pipe.	Repair or replace the suction pipe.

Fault	Probable cause	Possible Solution
The frequency of Pump start-up is too high.	a. Leakage in the foot valve, check valve or system.	Repair or replace the components.
	b. Ruptured membrane or no air pre-charge in surge tank.	See relevant instructions in surge tank's manual.
Vibration and noise	a> Cavitation	Reduce the required flow or improve the operating conditions of the pump (suction conditions, head, flow resistance, liquid temperature, viscosity,…etc.).
	b> Make sure that pump and motor shafts are properly aligned.	Adjust the pump and/or motor shafts.
	c> Worn motor bearings.	Replace the bearings or the motor.
	d> Operation with frequency converter.	Consult a qualified engineer form the supplier of the frequency converter.
	e> Check vibration and noise damping devices	Replace vibration & noise dampers, if worn.

Maximum Operating Pressure and inlet Pressure

50Hz

Stages	Maximum Operating Pressure	Stages	Maximum Inlet Pressures
SB, SBI, SBN 1			
2 - 36	25 bar	2 - 36	10 bar
SB, SBI, SBN 3			
2 - 36	25 bar	2 - 29	10 bar
		31 - 36	15 bar
SB, SBI, SBN 5			
2 - 36	25 bar	2 - 16	10 bar
		18 - 36	15 bar
SB, SBI, SBN 10			
1 - 16	16 bar	1 - 6	8 bar
17 - 22	25 bar	7 - 22	10 bar
SB, SBI, SBN 15			
1 - 10	16 bar	1 - 3	8 bar
12 - 17	25 bar	4 - 17	10 bar
SB, SBI, SBN 20			
1 - 10	16 bar	1 - 3	8 bar
12 - 17	25 bar	4 - 17	10 bar
SB, SBI, SBN 32			
(1-1) - 7	16 bar	(1 -1)- 4	4 bar
(8-2) - 14	30 bar	(5-2) - 10	10 bar
		(11-2) - 14	15 bar
SB, SBI, SBN 45			
(1-1) - 5	16 bar	(1-1) - 2	4 bar
(6-2) - 11	30 bar	(3-2) - 5	10 bar
(12-2) - (13-2)	33 bar	(6-2) - (13-2)	15 bar
SB, SBI, SBN 64			
(1-1) - 5	16 bar	(1-1) - (2-2)	4 bar
(6-2) - (8-1)	30 bar	(2-1) - (4-2)	10 bar
		(4-1) - (8-1)	15 bar
SB, SBI, SBN 90			
(1-1) - 4	16 bar	(1-1) - 1	4 bar
(5-2) - 6	30 bar	(2-1) - (3-2)	10 bar
		3 - 6	15 bar

50Hz

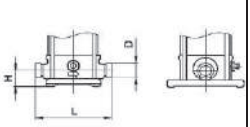
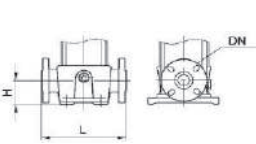
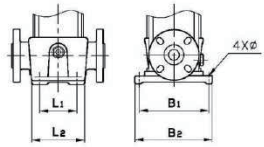
SB, SBI, SBN 120			
1-7	30 bar	1-(2 – 1)	10 bar
		2-(5-1)	15bar
		(6-1)-7	20 bar
SB, SBI, SBN 150			
(1-1)-6	30 bar	(1-1)-1	10 bar
		(2-1)-(4-2)	15bar
		(5-2)-6	20 bar

60Hz

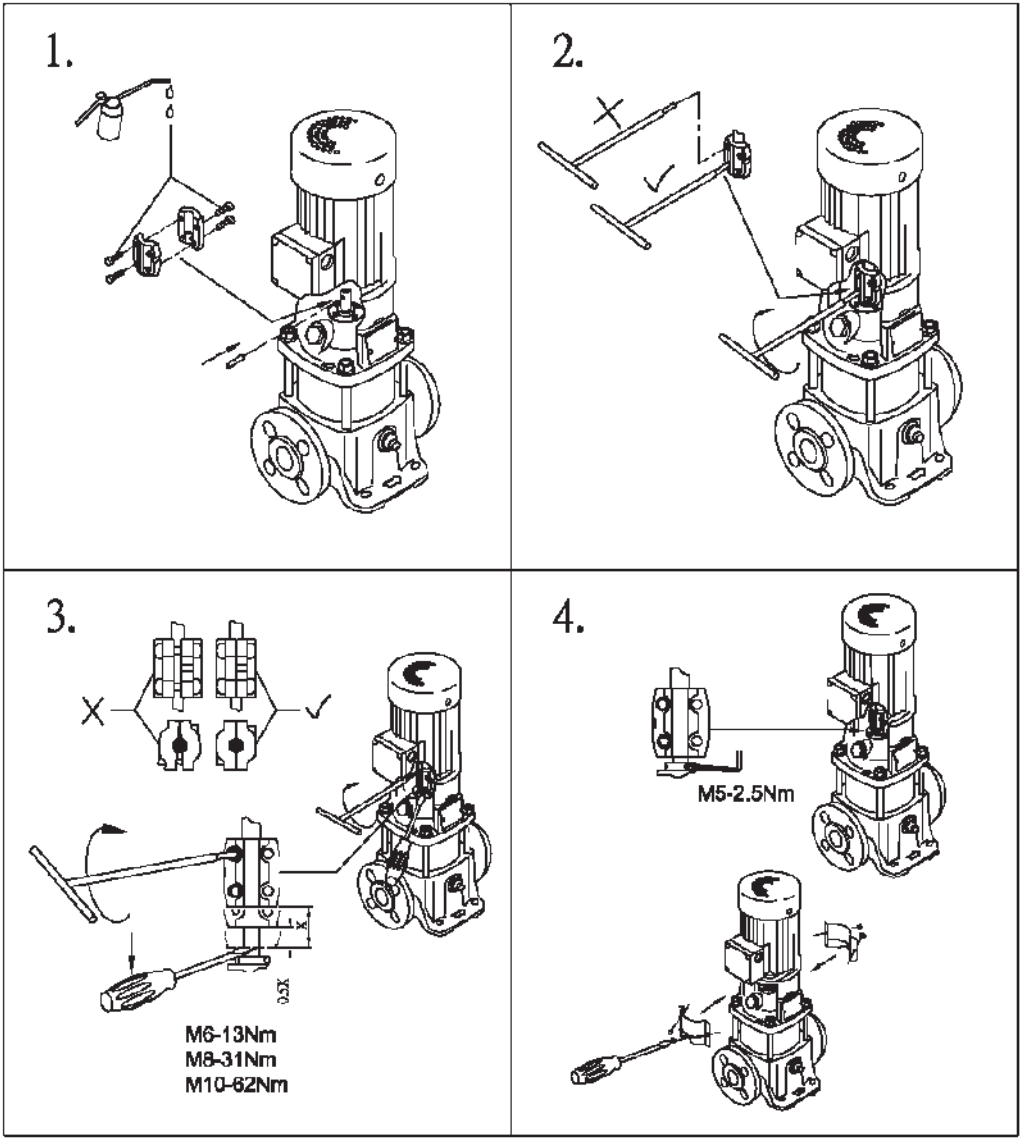
Stages	Maximum Operating Pressure	Stages	Maximum Inlet Pressures
SB, SBI, SBN 1			
2 - 27	25 bar	2 - 25	10 bar
		27	15 bar
SB, SBI, SBN 3			
2 - 25	25 bar	2 - 15	10 bar
		17 - 25	15 bar
SB, SBI, SBN 5			
2 - 24	25 bar	2 - 9	10 bar
		10 - 24	15 bar
SB, SBI, SBN 10			
1 - 10	16 bar	1 - 5	8 bar
12 - 17	25 bar	6 - 18	10 bar
SB, SBI, SBN 15			
1 - 8	16 bar	1 - 2	8 bar
9 - 12	25 bar	3 - 12	10 bar
SB, SBI, SBN 20			
1 - 7	16 bar	1	8 bar
8 - 10	25 bar	2 - 10	10 bar
SB, SBI, SBN 32			
(1-1) - 5	16 bar	(1-1) - (2)	4 bar
(6-2) - (10-2)	30 bar	(3-2) - (6)	10 bar
	30 bar	(7-2) - (10-2)	15 bar
SB, SBI, SBN 45			
(1-1) - 4	16 bar	(1-1) - 1	4 bar
(5-2) - 7	30 bar	(2-2) - 3	10 bar
		(4-2) - 7	15 bar
SB, SBI, SBN 64			
(1-1) - 3	16 bar	(1-1)	4 bar
(4-2) - (5-2)	30 bar	1 - (2-1)	10 bar
		2 - (5-2)	15 bar
SB, SBI, SBN 90			
(1-1) - 3	16 bar	(1-1) - (2-2)	10 bar
(4-2)	30 bar	(2-1) - (4-2)	15 bar

60Hz

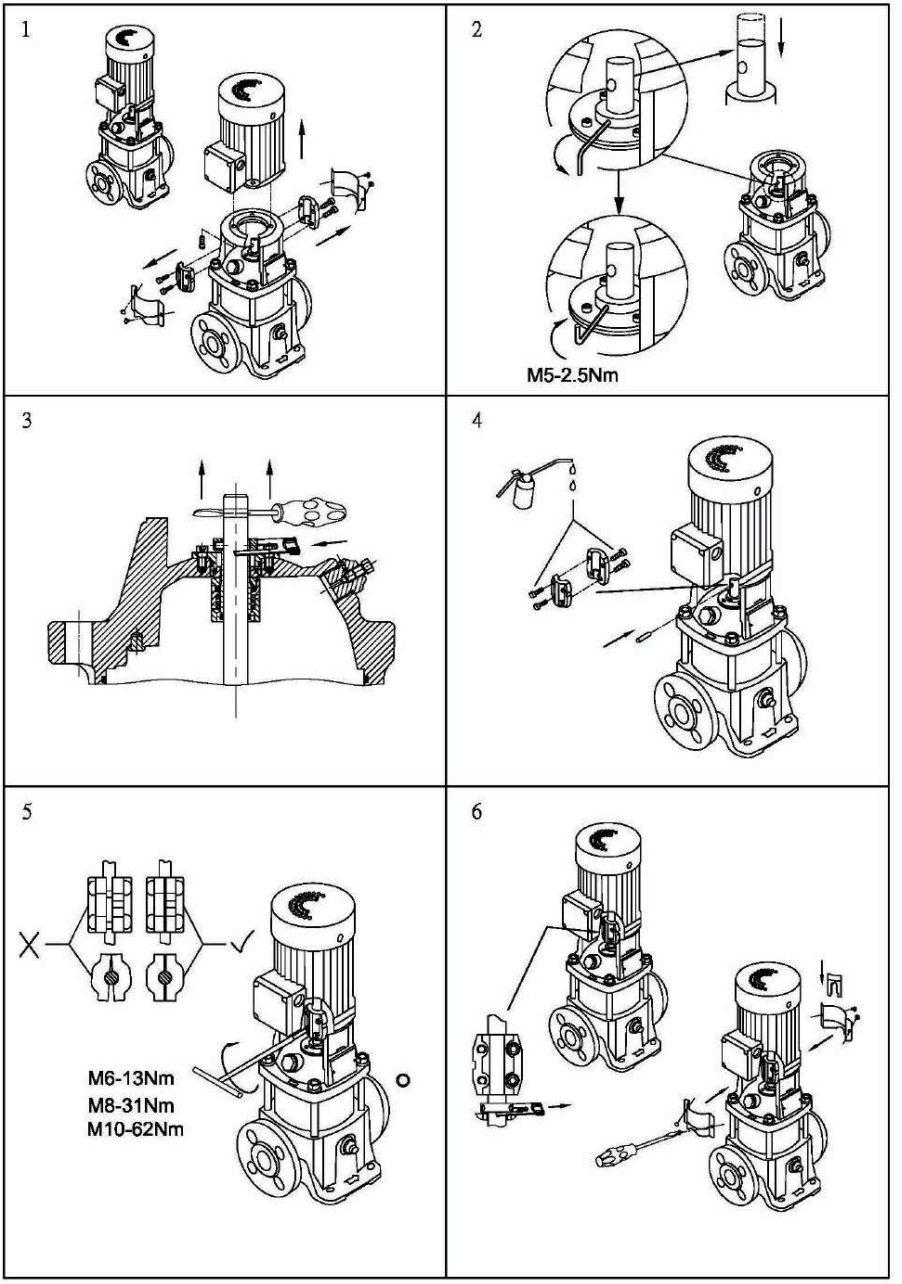
SB, SBI, SBN 120			
1-(5-2)	30 bar	1	10 bar
		(2-2) - (3-1)	15 bar
		3 - (5-2)	20 bar
SB, SBI, SBN 150			
(1-1)-(4-2)	30 bar	(1-1)	10 bar
		(1-2)	15 bar
		(3-2) - (4-2)	20 bar

Pump Type	Victaulic connections			DIN Flange Connections							
											
	L [mm]	H [mm]	D [mm]	L [mm]	H [mm]	DN	L_1 [mm]	L_2 [mm]	B_1 [mm]	B_2 [mm]	Ø [mm]
SB 1				250	75	25/32	100	141	180	220	14
SBI, SBN 1	210	50	42.2	250	75	25/32	100	150	180	220	14
SB 3				250	75	25/32	100	141	180	220	14
SBI, SBN 3	210	50	42.2	250	75	25/32	100	150	180	220	14
SB 5				250	75	25/32	100	141	180	220	14
SBI, SBN 5	210	50	42.2	250	75	25/32	100	150	180	220	14
SB 10				280	80	40	130	173	215	256	14.5
SBI, SBN 10	261	80	60.1	280	80	40	130	200	215	248	14
SB 15				300	90	50	130	173	215	256	15
SBI, SBN 15	261	80	60.1	300	90	50	130	200	215	248	14
SB 20				300	90	50	130	173	215	256	15
SBI, SBN 20	261	80	60.1	300	90	50	130	200	215	248	14
SB 32				320	105	65	170	225	240	297	14
SBI, SBN 32				320	105	65	170	227	240	299	14
SB 45				365	142	80	188	247	268	330	14
SBI, SBN 45				365	140	80	190	251	265	330	14
SB 64				365	142	100	188	247	268	330	14
SBI, SBN 64				365	140	100	190	251	265	330	14
SB 90				380	140	100	199	263	280	346	14
SBI, SBN 90				380	140	100	199	260	280	345	14
SB 120				380	180	125	275	344	380	472	18
SBI, SBN 120				380	180	125	275	344	380	472	18
SB 150				380	180	125	275	344	380	472	18
SBI, SBN 150				380	180	125	275	344	380	472	18

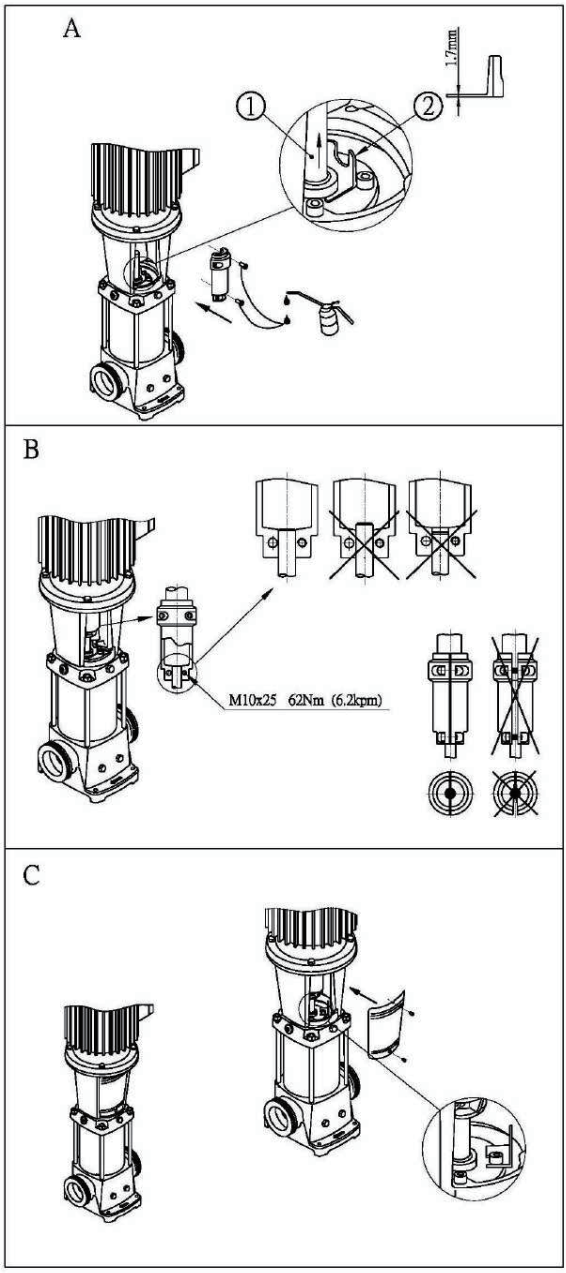
SB, SBI, SBN 1, 3, 5 Coupling adjustments



SB, SBI, SBN 10, 15, 20 Coupling adjustments



SB, SBI, SBN 32, 45, 64, 90, 120, 150 Coupling adjustments



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