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Installation and operating instructions

CC

Horizontal Closed Coupled pumps

Approvals

EU Declaration of conformity

According to the Low Voltage Directive 2006/95/EC
and the Machinery Directive 2006/42/EC
and Electromagnetic Directive 2004/108/EC.

For the following equipment:

Product:	Pump
Trademark:	End-suction Pumps and closed coupled pumps
Type Designation:	ND, CC
Manufacture's Name:	Swiss Pump Company AG
Manufacture's Address:	Moosweg 36, CH-3645, Thun-Gwatt -Switzerland

is here with confirmed to comply with the requirements set out in the Council Directive ErP 2009/125/EC.
And the Machinery Directive 2006/42/EC and Electromagnetic Directive 2004/108/EC.
For the evaluation of the compliance with this Directives, the following standards are applied:

EN 809:1998 +A1:2009/ AC:2010
EN 733

Responsible for making this declaration is the:
Manufacture ☑ Authorized representative established within the EU ☐
Authorized representative established within the EU (if applicable):

Company Name:	Swiss Pump Company AG
Company Address:	Moosweg 36, CH-3645, Thun-Gwatt -Switzerland

Person responsible for making this declaration

Name, Surname:	Michael Bähler
Position/Title:	production Manager

(Place)	(Date)	(Company stamp and legal signature)
Switzerland	14/Jan/2019	M. Bähler

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Safety

1. Safety signs

 It indicates that the user's personal safety may be endangered. Strictly observe the relevant operation rules.

 It indicates that normal operation of the pump may be endangered. Please follow the relevant instructions to avoid this situation.

 It indicates the instructions or suggestions useful for the user. The matters requiring additional attention are in the bold form.

The rotational direction mark on the couplings must be kept clear.

Qualifications and training of personnel

The personnel responsible for maintenance, inspection and installation must have appropriate professional qualification. If such personnel do not have necessary skills, appropriate training and guidance must be provided. In addition, the user must ensure that relevant personnel fully understand the contents of this Manual.

Risks arising from neglect of safety rules

The following may be caused in case of neglect these safety rules:

1. Failure of important functions of the machine or equipment.
2. Failure of the specified maintenance method.
3. Electric shock, machine damage or damage caused by chemicals.
4. Leakage of the conveyed dangerous medium, and hazards to the surrounding environment.

Operation, maintenance, inspection and safety rules

1. The user should eliminate risks before operating the system. At the same time, the user should take necessary safety protection measures.
2. The protective covers of moving parts must not be removed during operation. If the conveyed dangerous substance leaks out of the shaft seal, treatment and protection measures must be taken to avoid hazards and pollution to the human body and environment.
3. The user must ensure that the maintenance, inspection and installation are completed by the authorized professional personnel.
4. The most basic principles: the machine must be stopped in accordance with the requirements of this Manual before maintenance or inspection.
5. Before the system starts up, all protective devices should be installed according to the requirements after maintenance or inspection.
6. During operation, beware of the slippery floor in the work area of the machine.

Improvement and fabrication of spare parts without permission

The machine must be improved or modified with approval of the manufacturer. The original spare parts and accessories authorized by the manufacturer have the safety guarantee, and the manufacturer will not be responsible for any loss caused by use of other accessories.

Illegal operation

The machine must be operated in accordance with the requirements of this Manual to ensure the safety. If the user does not install or operate the machine according to the requirements of this Manual, the manufacturer will not be responsible for any resulting problem.

Storage and transportation

Storage

The received pump should be stored indoors so as to avoid the sunlight or rain and make preparation for installation.

If the indoor storage conditions are not satisfied on the construction site, the pump must be stored on the plank or pallet surrounded by the framework, and covered with waterproof tarpaulin. The waterproof tarpaulin must not be exposed to the pump; otherwise, condensation may be caused. The bottom must be exposed for ventilation. The framework must be able to withstand the wind and snow and also anchored. Also, the framework structure must be accessible for maintenance during the pump storage period, and the cover must be kept stable, without leakage.

If the storage time is more than 3 months but less than 12 months, additional preventive measures must be taken.

1. For wet parts of the pump, water should be discharged, and water stains on the surfaces should be cleared.

2. Transmission components should be rotated manually once a month.

3. Check the anti-rust coating on the machined metal surface, and apply the coating on the exposed area.

4. Check whether the anti-rust coating is corroded or broken. If necessary, repair the coating.

5. Ensure that all threads are protected with grease.

6. If the pump is exposed to the sunlight or rain at any time, please follow the requirements of this Manual.

Transportation

Ensure that the pump or unit is horizontally placed and effectively fixed during transportation, to avoid side slipping and overturning, etc.

When lifting the pump unit, the lifting lug of the motor cannot be used to lift the whole pump unit. When hoisting a single pump or a whole pump unit, it is recommended to use the lifting method shown in Figures (1) and (2) below:

⚠ *Warning: Please keep the whole pump unit steady in the transportation and lifting process*

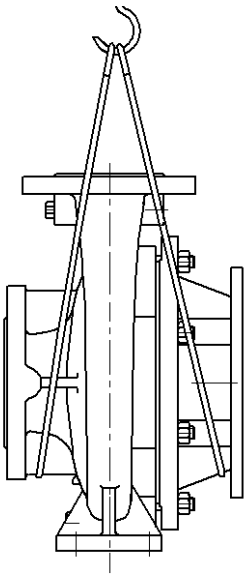


Fig. (1)

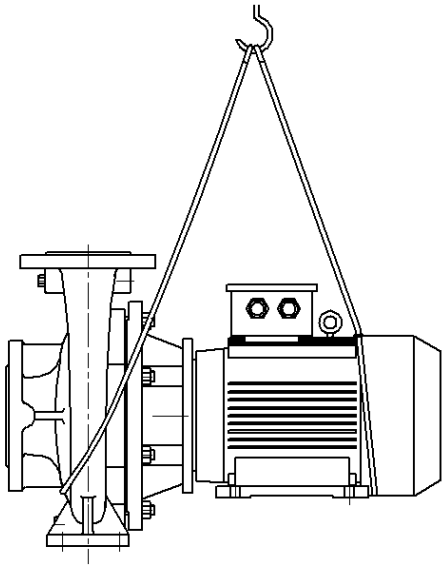


Fig. (2)

Pump description

CC pump series are designed and manufactured according to the European Standard DIN24255. Pump Shaft and motor shaft are close-coupled design. this way of coupling ensures the alignment of pump and motor. pump impeller runs in good balance both dynamically and statically. therefore pump would be kept very well in operation.

CC Series can be adjusted into different performance levels through impeller trimming.

Applications

- Industry
- Water Supply
- Construction
- Air Conditioning
- Fire Fighting
- Irrigation

Structure

CC Series Horizontal Extended Shaft Close-coupled End Suction Pumps are a centrifugal pump with axial end suction, radial discharge and single stage and single suction. The pumps have a back-pull structure and there is no need to remove the inlet and outlet pipes when the pump cover and impeller are removed. The series products have simple structure, the pumps are connected through the shaft, the water pump and the motor have high concentrically, the unit operates with low noise, stability and reliability, and high efficiency; They are maintained conveniently and assembled and disassembled easily, with accurate and reliable positioning; The unique installation structure of the pump unit effectively saves the construction investment cost.

Design

Performance referring to DIN24255 Standard.
Structure: Horizontal single-Stage, Single suction, Volute Casing pump.

Type: Horizontal Closed Coupled Pump
Flange: DIN 2501 PN16, ANSI on request
Rotation: Clockwise as viewed from the drive side. and counterclockwise when viewed from the pump inlet.
Material:
Casing : Cast Iron, Ductile Iron, Stainless Steel.
Impeller : Bronze, Cast Iron, Stainless Steel
Shaft : Stainless Steel.
Shaft Seal : Mechanical Seal (Carbon-Sic/Victon), Use MG1 rubber bellows or M3N single end face universal mechanical seal.

Operating Condition

Flow Rate (Q) : 2-555m3/h

Total Head (H) : 5-150m

Speed : 1450-2900 rpm (50Hz)
1750-3500 rpm (60Hz)

Fluid temperature : -10°C to 85°C

Ambient temperature: Shall not exceed 40°C; Otherwise, the motor shall be used while the power is lowered.

Working pressure :10 Bar, 16 on request.

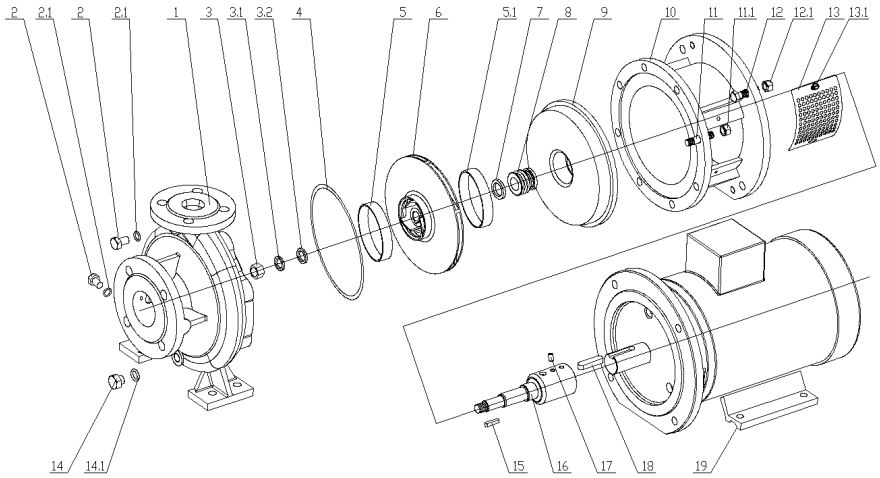
Pump body pressure: 1.6MPa, Optional: 2.4 MPa

Environmental humidity: relative humidity shall not exceed 95%, no condensation.

Liquid Parameter

It is suitable for conveying water and mediums with physical and chemical properties similar to water. The liquid shall have a kinematic viscosity of less than 20cSt (the performance needs to be modified when it is greater than 20cSt) and contain no solid particle or fibrous liquid that may cause mechanical or chemical damage to the pump.

Pump structure diagram



No.	Name	Quantity	No.	Name	Quantity
1	Pump Body	1	11	Pump Body Stud	1 set
2	Pipe Plug (Pump Body Flange)	2	11.1	Nut	1 set
2.1	Pipe Plug Gasket（(Pump Body Flange)	2	12	Motor Bolt	1 set
3	Nut •	1	12.1	Nut	1 set
3.1	Spring Washer	1	13	Protective Cover	2
3.2	Plain Washer	1	13.1	Slotted Cheese-head Screw	4
4	Pump Cover Gasket •	1	14	Pipe Plug	1
5	Front Seal Ring •	1	14.1	Pipe Plug Gasket	1
5.1	Rear Seal Ring •	1	15	Key	1
6	Impeller •	1	16	Pump Shaft •	1
7	Mechanical Seal Base	1	17	Hexagon Socket Recessed Set Screw	1 set
8	Mechanical Seal •	1	18	Key	1
9	Pump Cover	1	19	B35 Motor	1
10	Coupling	1			

The parts followed by（•) in the table are wearing parts.

Installation height of pump

If the installation height is too high, the pump can't absorb water or work normally, so it is necessary to verify the installation height of pump during installation and use. The relevant calculations and values are as follows:

h=p1/ρg-Hv1-pv/ρg-1.2NPSHr
h: Installation height of pump
p1: Inlet pressure ρ: Density of the medium g: Acceleration of gravity; pv: Vaporization pressure of medium at this temperature;
NPSHr: Net positive suction head of pump obtained on sample curve.

The estimated values (%) of altitude and ambient temperature to the allowable power of the motor are shown in the Table below:

Altitude (m)	Ambient Temperature (℃)			
	＜30	30～40	45	50
＜1000	100	100	96	92
1500	100	97	93	89
2000	100	94	90	86
2500	96	90	86	83
3000	92	86	82	79

* Example: If the altitude is 1,500m, ambient temperature is 45C, it is only allowed to run at 93% of the rated power.

Installation

1. After receiving the pump unit, immediately check whether any part is missing or damaged. If any, separately pack accessories and transport them along with the unit.

2. If the equipment is damaged in the transportation process, immediately and directly report the damage to the shipping agent. Fully indicate the damage information in the shipping document to accelerate the settlement of the transport company.

3. Remove the pump unit with the sling.

Temporary storage

1. If the pump is not installed within a few days after arrival, keep it in the clean and dry place under appropriate temperature.
2. Rotate the pump shaft to apply grease on the bearing, to avoid oxidation and corrosion.
3. Observe the suggestions of the motor manufacturer on storage.
4. Check the anti-rust coating on the machined metal surface, and apply the coating on the exposed area. Check whether the anti-rust coating of the surface is corroded or broken. If necessary, repair the coating.

Note: The pump must not be exposed to the sunlight or rain in a long term.

Location

1. Locate the pump as close to the pipe as possible. Select the shortest and straightest pipe.
2. If possible, position the pump below the system level, which will simplify pump start-up, ensure stable flow, and provide a positive inlet head.
3. Check the relative position of the pump and the whole system to ensure that there is enough net positive suction head (NPSH) at the pump inlet; Ensure enough space for inspection and maintenance, and reserve a clear space for proper lifting appliance operation; Ensure the power supply applicable to the pump motor, and the electrical parameters are matched with the values marked on the motor nameplate.
4. The pump shall not be exposed to temperatures below the freezing point to prevent the fluid inside from freezing.

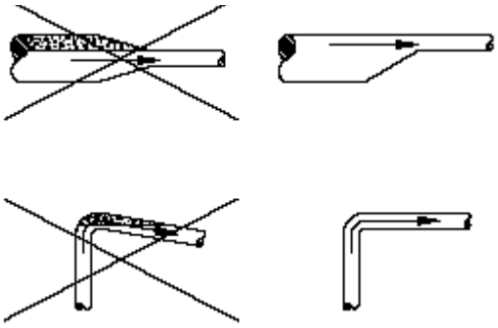
Note: The pump unit must not be operated outdoors. To operate the pump unit outdoors, necessary protective measures against rain and snow must be taken, so as to avoid the influence on the service life or the failure of functions and unnecessary risks arising from rain erosion of relevant parts and electrical components of the pump units.

Pipe connection

1. During pump maintenance, it is necessary to install stop valves on both sides of the pump in order to ensure that the pumped liquid in the system is not drained off.
2. The pump must not be used as the pipe anchoring point or placed under the force exceeding the allowable value. The whole pipe must not be supported by the pump. Instead, it should be supported by hangers or other brackets at a certain interval near the pump. The inlet pipe and outlet pipe must be separately supported and concentric with the pump inlet and outlet, so that no stress will be transferred to the pump after flange bolts are fastened. The appropriate pipe support must not be replaced by the expansion joint or vibration isolating buffer.
3. The pipe must be as straight as possible. Unnecessary bends and joints should be avoided. If necessary, the 45° elbows or 90° elbows of large curvature radius should be used to reduce the frictional loss.
4. The inner diameters of flanges should be matched with each other, and bolt holes should be aligned with each other.
5. External force for installation must not be applied in pipe connection.

Inlet pipe connection

The following precautions should be taken in pipe installation:
1. The inlet pipe should be as straight as possible, but the length must be more than 10 times of the pipe diameter. The shorter inlet pipe may have the same diameter as the suction port, while the longer inlet pipe should be 1-2 grade(s) above the suction port (depending on the pipe length), with the diameter reduced at the suction port of the pump.
2. The eccentric side of the eccentric reducing pipe for reduction between the pipe and the pump suction port is shown below.
When using an eccentric reducing pipe or straight pipe to connect the pump inlet, please pay attention to avoid gas accumulation.



3. The diameter of the suction pipe must be in no case smaller than the pump suction port.
4. If possible, the inlet pipe should have the steady slope. When the pump is used for lifting, the slope should gradually increase from the pipe to pump and if the suction head is positive, the slope should gradually decrease from the pipe to pump.
5. Install the stop valve on the inlet pipe. Separate the pump from system during the downtime and maintenance, to facilitate pump movement. If two or more pumps are coupled to one inlet pipe, install several valves to separate each pump from the system.
6. Cavitation should be avoided at the valve installation location. The ball valve must not be used, especially in places with high NPSH requirements.
7. The inlet valve must be fully open during pump operation.
8. Install the pressure gauge of appropriate range on the inlet and outlet pipes of the pump. By observing the value indicated by the pressure gauge, the operator can monitor the pump operation and check whether the operating parameters comply with the performance curve requirements. In case of cavitation, bubbling or instable operation, the pressure gauge will show fluctuations of inlet and outlet pressure within a large range.

Outlet pipe connection

1. The shorter outlet pipe may have the same diameter as the pump outlet. The diameter of the longer outlet pipe should be 1-2 grade(s) above the pump outlet.
2. Preferably, the horizontal and long outlet pipe should have the gentle slope
3. Install the valve at the pump outlet to inject water into the pump and start the pump. The outlet valve can also be used for separate the pump during the downtime and maintenance, so as to facilitate pump movement
4. Gas may be gathered at any high point of the outlet pipe, affecting the pump operation. If necessary, install the exhaust valve.
5. If the check valve is used or water impact may occur, close the outlet valve before shutdown.

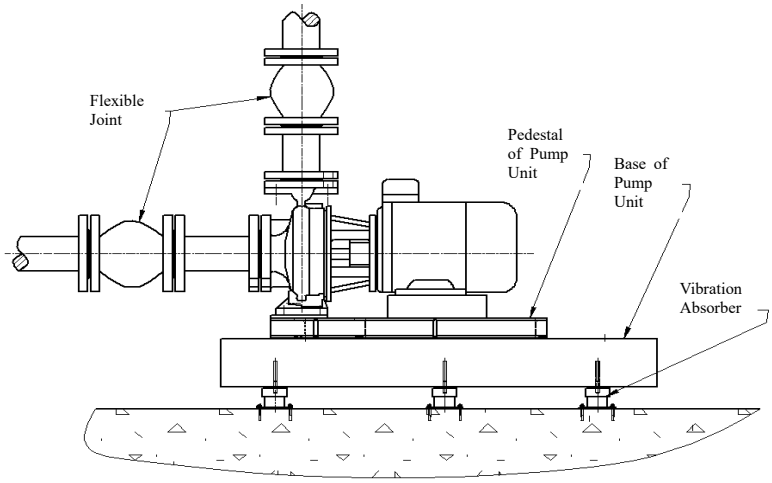
! *Note: If hoses or flexible joints are installed on the inlet and outlet pipes to be connected with the pump, it is necessary to take appropriate measures to compensate the thermal expansion of the pipe and the installation errors of the pump and pipes, to ensure the steady operation of the unit and safety of the system.*

! *Note: Appropriate bottom valves, stop valves or other valves must be installed on the inlet and outlet pipes of the pump. The pipes should also be equipped with the appropriate pressure gauge, so that the user can better monitor the system operating conditions and unit operating level.*

7. Pump installation and foundation adjustment

The pump with no motor is equipped with a fixed bracket at the inlet to protect the mechanical seal during transportation. The motor must be properly installed according to the Installation guide of CC Series Horizontal Extended Shaft Close-coupled End Suction Pumps.

Main operating process: Remove the protective cover of the motor shaft sleeve inlet pump shaft, install motor bolts to fix the motor and the coupling, coat the hexagon recessed set screws with Loctite 243, and tighten to fix the pump shaft and the motor shaft, remove the adjusting shim between the pump cover and the shoulder and the fixed bracket at the inlet and install the protective cover. After installation, the adjusting shim shall be properly stored for use at the next disassembly.
The pump unit shall be installed on a firm and reliable base which shall be strong enough and have a flat surface. It can provide permanent and firm support for the whole pump unit, and the base must be able to absorb vibration, normal stress and impact. The company recommends using concrete foundation, in order to reduce the floor load, etc., and profile steel base also can be used.
To facilitate inspection and repair, proper space shall be left for the pump and motor for easy movement.
To avoid the transmission of vibration to buildings and pipes, it is recommended that a vibration isolation device (vibration absorber) be installed under the base.



Electric Installation

The control circuit of the motor should be equipped with the following devices, according to national electrical standards.
1. Motor breaker: one breaker used for disconnecting the controller (motor starter) and motor from the power supply must be installed. The motor should be located in the way that the controller (motor starter) is visible. The distance between the breaker and controller must be less than 15m in any case.
2. Motor short-circuit and grounding protection device: the circuit switch or fuse breaker is generally applied for motor short-circuit and grounding protection. The function and model of the circuit switch or fuse breaker must be selected according to relevant requirements of national electrical standards.
3. The motor controller: should involve current protection (electromagnetic starter). Should be installed according to local and national electrical standards.

Wiring installing
1. Keep the control box or starter close to the pump to facilitate control and installation.
2. Junction box or starter of the motor and controller: the wire capacity of each motor should be at least 125% of the full-load current marked on the motor nameplate.
3. Check whether the voltage and phase number of the power supply, confirm to the motor parameters.
4. Check whether the starter parameters are matched with the voltage and phase number of the pump motor.

Note: The pump must be prevented from dry operation. Be careful to check the direction of motor rotation.

Operation

Water injection

1. Self-priming or automatic water injection is not allowed in CC Series Horizontal Close-coupled Centrifugal Pumps, pump body must be filled with liquid before starting the pump.

2. To operate the pump under the positive suction head (positive pressure in the pipe), open the valve of the suction port and inject water through the pump casing. Then open the top outlet of the pump casing and the exhaust plug of each suction port, and tighten the plugs after water is completely discharged.

Check before start-up

Check the CC Series Horizontal Close-coupled Centrifugal Pumps according to the following procedures before start-up:
1. Check whether the motor is properly grounded.
2. Check whether all wires of the motor (and starter) are connected according to the wiring diagram and whether the motor rotates in the correct direction.
3. If the pump has been kept for a long time before or after installation, refer to the Manual before start-up.
4. Check the voltage, phase number and frequency according to the parameters on the motor nameplate.
5. Tighten the screw plug and drain plug of the instrument. If the pump is not equipped with any pressure gauge, the valve must be closed when the pump is not operated.
6. Check inlet and outlet pipes for leakage, and ensure that all flange and bolts are tightened.
7. Check whether terminals in the junction box are installed securely, so as to prevent motor faults caused by terminal loosening (such as motor terminal overheating and instantaneous high voltage arising from virtual connection).

Start-up of the pump

1. Ensure that the protective covers of couplings are installed, and take appropriate protective measures.
2. Fully open the valve on the inlet pipe, and close the valve on the outlet pipe.
3. Fill the inlet pipe with water, and make the pump full of water.
4. Start the motor.
5. Check the pump and inlet pipe for leakage.
6. Before the pump reaches the full speed, slowly open the outlet valve until the system design and type selection conditions are satisfied.
7. Check the outlet pipe for leakage.
8. Check whether the operating parameters of the pump comply with the type selection requirements or the parameter requirements in the contract.
9. Check and record the voltage and current values of three phases. If the power meter is available, measure and record the power value.

Unit operation

According to the operating standards ISO5199:2002 of centrifugal pumps, there are the following specific operating principles:
1. Ensure that the pump operates under the design conditions and within the allowable range. Keep close attention to whether the pressure gauges, voltmeters and ammeters of pump unit and system pipes are abnormal.
2. For the motor power of the pump, the ratio of its rated output power to the rated power of the pump shall not be less than the percentage given as below:

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According to the operating standards ISO5199:2002 of centrifugal pumps, there are the following specific operating principles:

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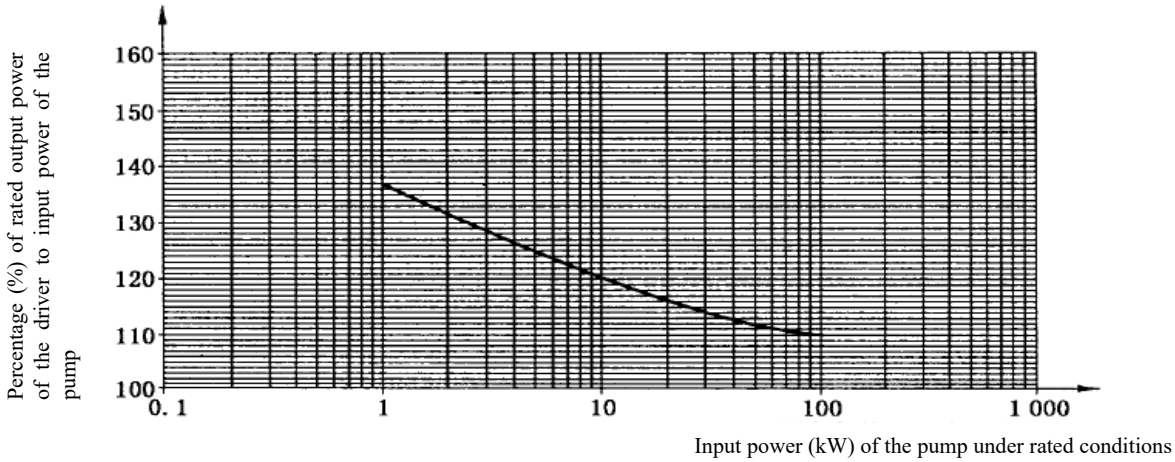


Relationship between Motor Power and Input Power of the Pump

Pump stop

The following stop procedures are applicable to stop of CC Series Horizontal Close-coupled Centrifugal Pumps in normal cases.

⚠ Close the discharge gate valve slowly before stopping the pump to avoid water impact.

Disconnect and lock the power supply of the motor.

Stop at night and temporary stop

1. The pump may be kept in the state of water filling when it is stopped at night under non-freezing conditions or stopped temporarily. Ensure that the pump is full of water before restart.
2. In the case of short-time or frequency stop under freezing conditions, keep fluid flowing in the pump casing, and externally take thermal insulation measures or heat the pump so as to avoid freezing.

Long-time stop

1. Close the inlet valve before long-time stop or pump isolation for maintenance. If the inlet valve is not used and the suction head of the pump is positive, discharge all liquid in the inlet pipe, and prevent liquid from flowing into the pump inlet. If the external cooling or lubricating liquid is used for the shaft seal, close the valve, screw down the drain and discharge screw plug of the pump, and discharge all liquid in the pump.

2. If freezing conditions are involved in the long-time stop period, discharge water in the pump, and use compressed air to purge water accumulated in the pipe and tank. Or, inject the anti-freezing liquid into the pump to prevent liquid freezing in the pump.

! *Note: If the pump is out of use for a long time, the pump and unit should be stored according to storage procedures.*

Maintenance

Motor Lubrication

1. Motor lubrication in operation or downtime: remove the oil drain plug (if any) and oil injection plug on the nozzle. Inject grease until it leaks out from the oil drain hole or along the motor shaft.

2. Some motors with the "full-life sealing" bearing do not need further lubrication within the whole life.

3. If the motor manufacturer provides the lubrication manual, please comply with the requirements in the manual, and regularly check the injection nozzle and oil drain plug for leakage.

4. If the lubrication period requirements are not available, refer to the recommended lubrication period in the following Table:

Motor Speed RPM	Motor Speed KW	Operation Conditions		
		Standard Conditions	Severe Conditions	Extremely Severe Conditions
1500 or below	7.5—30	1 year to 3 years	6 months to 1 year	6 months
	37—110	1 year	6 months	3 months
	Above 110	1 year	6 months	3 months
Above 1500	All	6 months	3 months	3 months

Standard conditions: the motor operates 8h per day, under general or light load and in the environment with clean air and maximum temperature of 38℃.
Severe conditions: the motor operates continuously for 24h, subject to impact load or vibration and poor ventilation, and under the ambient temperature of 38℃ to 65℃.
Extremely severe conditions: the motor operates continuously, subject to serious impact load or vibration and in the environment with unclean air and high temperature.

Pump bearing lubrication

CC Series Horizontal Close-coupled Centrifugal Pumps are equipped with a maintenance-free (double-closed, no additional lubrication) bearing, for which no lubrication and maintenance are required during the service life of the pump unit, saving maintenance costs for customers.

Note: Repair or remove and check the pump bearing at least once every two years. If the bearing is stuck or worn, the shaft seal shall be replaced timely.

Shaft seal

CC Series Horizontal Close-coupled Centrifugal Pumps are equipped with the mechanical seals for water pumps shaft seals. The mechanical seals are MG1 rubber bellows or M3N single-end universal mechanical seals, which have high stability and good reliability, requires no maintenance and adjustment during use, and there is almost no leakage during work. If the amount of leakage increases significantly, the mechanical seal of the shaft shall be inspected immediately. If the friction surface of the seal is damaged, the entire shaft seal shall be replaced.

Mechanical seal

The mechanical seal must be selected according to the type and operation conditions (such as the physical and chemical properties of the medium) in the single-stage centrifugal pump order. Take the following precautions to avoid unnecessary loss arising from damage to the shaft seal and achieve the longest seal life.

1. Use the mechanical seal within the temperature or pressure limits.

2. Do not operate the pump without water or with the valve closed. Dry operation may result in failure of the shaft seal within a few minutes.

3. Clean the inlet pipe before operating a new pump. Pipe scaling and other abrasive materials may result in failure of the shaft seal in a very short time.

Fault finding and solution chart

Fault	Cause	Solution
Pump not primed, both the hands of vacuum gauge and manometer switches violently	Not enough water filled in the pump Air leakage in the pipe or meters	Filled with water again Fix the leakage
Pump not primed and high degree vacuum indicated on the vacuum gauge	Foot valve not open or clogged Suction resistance too high or suction lift too high	Check or replace the foot valve Clean or replace the inlet pipe Reduce the suction lift
No water discharged while outlet pressure is pointed by the manometer	Wrong direction of rotation Impeller clogged	Check or shorten the pipe Check the motor rotation Remove the pipe joint and clean the impeller
Lower capacity than specified value	Pump clogged Wear ring worn out	Clean pump and pipes Replace the wear ring
Too much power consumed by pump	Packing too tight Stuffing box too hot Impeller worn out Too large flow that the pump is working in.	Loosen gland packing Replace impeller Turn down discharge valve to reduce flow
Abnormal noise inside the pump Pump not primed	Flow too large Resistance too high in the inlet pipe Suction lift too high Air leakage into the inlet pipe Liquid temperature too high	Turn down discharge valve Reduce flow Fix leakage Lower liquid temperature
Bearings over-heart	Short of lubricant or lubricant too dirty Pump shaft not in alignment to that of the motor Bearing worn out	Filled with clean oil or grease Align coupling centerline Replace bearing
Vibration	Pump shaft not in alignment to that of the motor	Align coupling centerline

Table of frictional losses

Simple Table of Frictional Losses of Straight Pipes (for estimation)

Diameter (mm)	Flow (L/s)																									
	0.5	1	2	4	6	8	10																			
25	7.7	31	124																							
38	0.7	2.9	12	46				15	20																	
50		0.8	3.2	13	29					25	30															
65			0.8	3.2	7.3	13	20					40	50													
75			0.4	1.5	3.4	6.1	9.6	22						60	70											
100				0.3	0.8	1.4	2.1	4.8	8.5	13	19					80	90									
125					0.2	0.4	0.7	1.5	2.7	4.2	6	11						100	110							
150						0.2	0.3	0.6	1	1.6	2.3	4.2	6.5	9.4						120	130					
175							0.1	0.3	0.5	0.7	1.1	1.9	2.9	4.2	5.8	7.5	9.5					140	160			
200								0.1	0.2	0.4	0.5	1	1.5	2.1	2.9	3.8	4.8	5.9	7.2	8.6				180	200	
250									0.1	0.1	0.2	0.3	0.5	0.7	0.9	1.2	1.5	1.9	2.3	2.7	3.2	3.7	4.9	6.2		
300											0.1	0.1	0.2	0.3	0.4	0.5	0.6	0.8	0.9	1.1	1.3	1.5	1.9	2.4	3	

Note: The losses (in meter) of 100m long straight pipes are applicable to new cast iron pipes and should be doubled for old pipes. The loss of plastic pipes is 0.7 time of that of steel pipes, the loss of rubber pipes is the same as that of steel pipes, and the loss of cast iron pipes is 1.4 times of that of steel pipes.

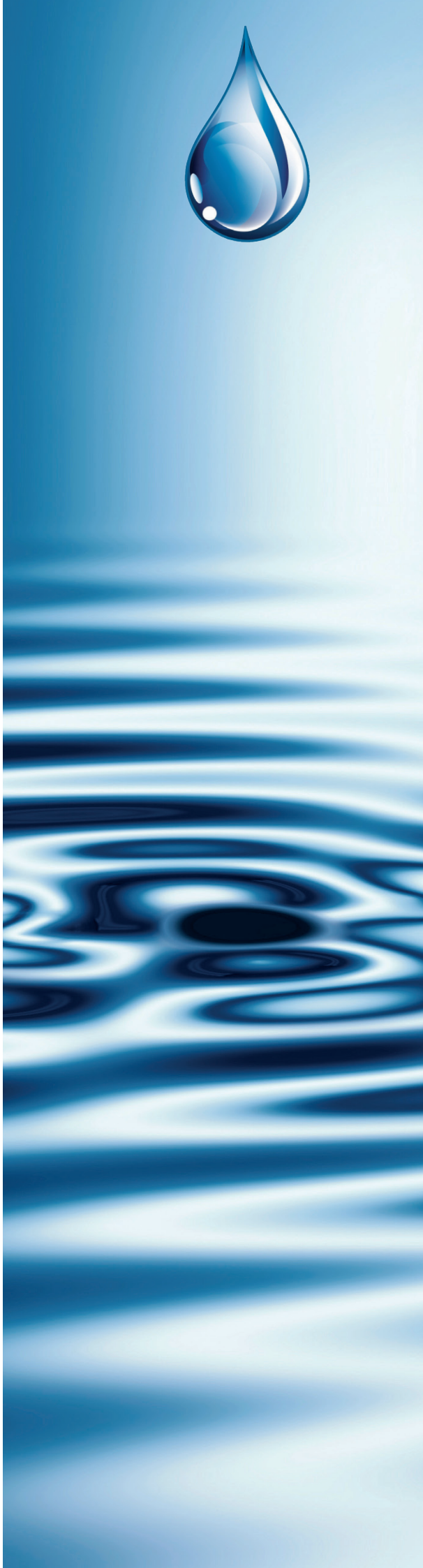
Equivalent Straight Pipe Length (individual) of Valve and Elbow

Type	Equivalent Times of Pipe Diameter	Remarks
Fully open gate valve	12	Doubled if not fully opened
Standard elbow	25	
Check valve	100	
Bottom valve	100	Doubled in case of partial blockage

Note: For the pipes with the diameter of 100mm, the diameter of bottom valves is equivalent to the straight pipe length 100×100=1000mm=10m, after conversion by 100 times. Assume that the flow rate is 8L/s. By consulting the table above, the loss per 100m of straight pipes is 1.3m. That is, the head loss of one 100mm bottom valve is 0.13m under the flow of 8L/s.

Maximum Flow Limits Corresponding to Certain Pipe Diameters

Pipe Diameter	Maximum Flow		Maximum Flow Rate	Pipe Diameter	Maximum Flow		Maximum Flow Rate
(mm)	(L/s)	(m^3/h)	(m/s)	(mm)	(L/s)	(m^3/h)	(m/s)
25	0.9	3.36	1.9	125	30.6	110	2.5
38	2.27	8.17	2	150	45	162	2.55
50	4.11	14.8	2.1	175	62.5	225	2.6
65	7.3	26.3	2.2	200	83.3	300	2.65
75	10.2	36.6	2.3	250	132.5	477	2.7
100	18.9	67.9	2.4	300	194.4	700	2.75



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