2020

ICS MILL MASTER HEAVY DUTY PUMPS

550 SERIES OPERATION AND MAINTENANCE MANUAL

ICS WEAR GROUP IMPROVED OPERATIONS

Revision 6: March 2020

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SAFETY

ICS Wear Group Inc. Heavy Duty Mill Master (HDMM) slurry pumps have been designed for safe and reliable operation. A pump is a pressure-containing device with rotating parts that could be hazardous. Operators and maintenance personnel must realize this and follow the necessary safety measures. All statutory requirements relating to this equipment must be complied with at all times and site safety procedures strictly adhered to.

ICS shall not be liable for damage or delays caused by a failure to observe either the instructions in this manual or the usual industry safety procedures.

CAUTION

Never completely restrict the discharge flow. It may result in adverse temperature increase and possible explosion (as applicable to all centrifugal pump brands).
Never apply heat to the impeller to assist removal from shaft. Heating may result in shattering the impeller RESULTING IN INJURY OR EQUIPMENT DAMAGE
Direction test driven WITHOUT belt drives or couplings fitted. The impeller is threaded, and incorrect rotation may cause personnel injury or equipment damage.
If pump is operating with a very hot or very cold liquid, gradually change pump temperature to prevent damage by thermal shock. Thermal shock may cause personnel injury or equipment damage

NOTE

Proper alignment is essential for long pump life.

GENERAL PRECAUTIONS

Warning: Personal injuries will result if procedures outlined in this manual are not followed.

- Never work on the pump set with the power connected.
- Never work on the pump set without the appropriate work tags (e.g. ‘Danger Tags’) fitted in compliance with site safety procedures.
- Never operate pump without drive guard correctly installed.
- Never operate pump beyond the rated conditions for which the pump was sold.
- Never run pump below the recommended minimum flow or when dry.
- Never operate pump without safety devices installed.
- Never operate pump with discharge valve closed.
- Never use heat to disassemble pumps due to risk of explosion from trapped liquid.
- With the pump disconnected from the driver, check the motor rotation. Incorrect motor rotation can cause the impeller to back off of its threads and rupture the casing. It may also cause personal injury.

WHERE AUXILIARY EQUIPMENT IS ASSOCIATED WITH A PUMP (e.g. MOTORS, DRIVE BELTS, DRIVE COUPLINGS, SPEED REDUCERS, VARIABLE SPEED DRIVES, ETC), ALL RELEVANT INSTRUCTION MANUALS SHOULD BE CONSULTED, AND RECOMMENDED PROCEDURES IMPLEMENTED, DURING INSTALLATION, OPERATION AND MAINTENANCE OF THE PUMP SYSTEM

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1. USES AND SCOPE OF APPLICATION

The ICS Mill Master Series of Heavy-Duty Pumps, Model ICSHDMM550CrWI28 is an energy-saving single-case pump. These pumps are innovative in hydraulic design, structural design, and materials of castings after integrating congeneric products throughout the world. The 550 Series has many features including but not limited to high efficiency, user friendly, reliable operation, long service time, easy maintenance, and lower running costs. These pumps lead their domestic counterparts in various technical performances, with most of them approaching an unprecedented world level, and widely used for handling abrasive and/or corrosive slurries with solids in mining, metallurgical, dredging, backfilling, and environmental sectors, They are suitable for handling abrasive and/or corrosive solids-bearing slurry with maximum concentrations of wt. 45% (Ash) and wt. 60% (Ore)

2. TYPE AND STRUCTURAL FEATURE OF PUMP

MM550 C 160 (150)

MM: Mill Master
550: Outlet Diameter
C: Number of vanes of impeller, A=5,B=4,C=3,F=6
160: Diameter of Impeller (cm)
(150): External Diameter of Impeller (cm)

STUCTURAL FEATURES OF MM550 PUMP

The way in which a centrifugal pump works is that centrifugal force is generated by the rotation of the impeller causing the fluid to pump out of the pump chamber. The ICSHDMM550CrWI28 pump is a single-suction, single stage centrifugal pump; its suction inlet is connected with the conveying pipe. When fluid leaves the pump, it is pumped into the pipe connected to the outlet along the tangent direction under the pressure of the fluid.

1. PUMP HEAD

The single case and the double case pump can be selected in accordance to requirements. The outer casing of the double case pump has a vertical split structure. The discharge port can be positioned in 8 different positions at an interval of 45°.

2. IMPELLER

The impeller is made up of a front cover plate, rear cover plate, blades, and back vanes. The blades are twisted; generally, an impeller has 3 to 6 blades and 8 back vanes which usually are distributed outside of the front cover plate and rear cover plate. The impeller is manufactured in a 28% high chrome alloy (CrWI28) and it is fixed on the pump shaft via the thread.

The wet ends of the ICSHDMM550CrWI28 pump are all cast and manufactured in 28% high chrome alloy; various wear resistant alloys are available based on different mediums.

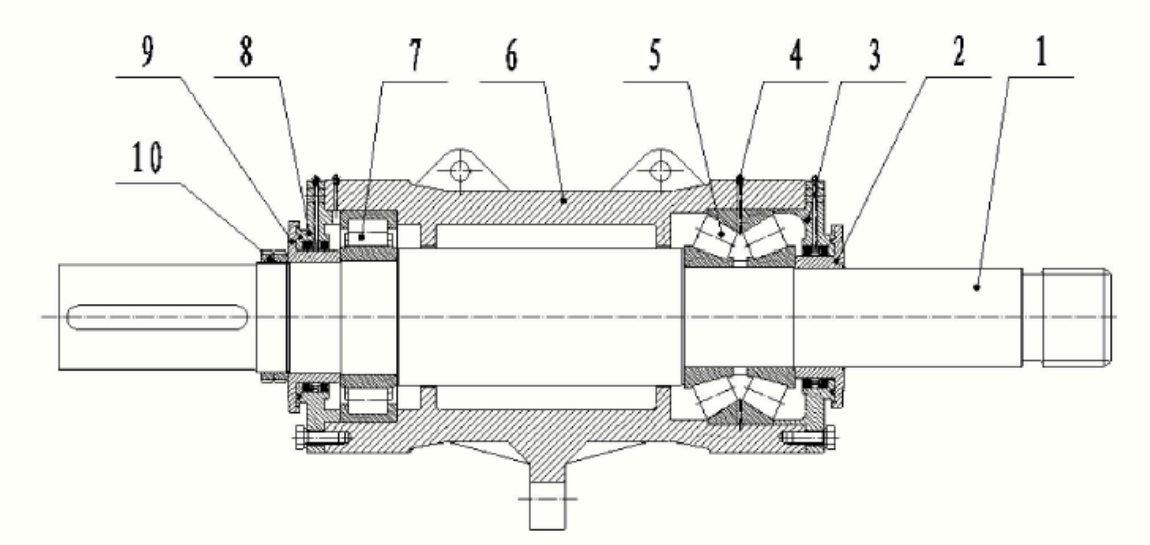
3. BEARING ASSEMBLY

The bearing assembly adopts a cylinder bracket-like structure to ensure more stable and reliable operations. The bracket is lubricated by oil and it is made up of the bracket body, bracket cover, shaft, bearings, bearing cover, oil cup, water retaining plate, disassembly ring, etc. (Figure below)

NOTE'S

- The axial adjustment device of the impeller is designed to keep the clearance between the impeller and the inlet constant and improve the operating efficiency of the pump
- The pump has excellent rigidity and you can stable operation by increasing the size of the pump shaft and bearing
- In order to improve the ability to withstand torque and impact, the impeller is connected to the shaft with acme thread. We also design and provide disassembly rings to make the rebuild and maintenance of wet ends and impellers safe and cost effective
- The bearing seal uses double oil seal structure which is contaminant proof (i.e. dust) and waterproof labyseal design.

THE STRUCTURAL DRAWING OF THE BEARING ASSEMBLY (BAU)



No.	North American Designation	Global Designation
1	Shaft	Shaft
2	Laby Seal Non-Drive end	Front Water Baffle
3	Bearing Ring Seal	Front Bearing Gland
4	Grease Fitting	Grease Fitting
5	Bearing	Bearing
6	Bearing Housing	Bearing Body
7	Bearing Drive End	Rear Bearing
8	Bearing Ring Seal	Rear Bearing Gland
9	Laby Seal	Real Water Baffle
10	Round Nut	Round Nut

4. TYPES OF SHAFT SEAL

A. The ICS Mill Master packing seal is suitable for various working conditions; the packing can be manufactured and supplied in PTFE, graphite, and/other site-specific materials. Packing seals can be used for corrosive or high-temperature applications. Pacing must be rolled on the shaft sleeve, and joints of the adjacent packing rings should be staggered. Then push the connected packing into the ring cavity between the stuffing box and the shaft sleeve until the packing clings to the front face of the water-sealing ring. Once all the packing is pushed into the ring cavity, squeeze the entire packing ring evenly to keep the packing in its loop-shape. Components of a packing seal arrangement include stuffing box, water-sealing ring, packing, packing gland, shaft sleeve, and pipe joints. (oil cup) – See below
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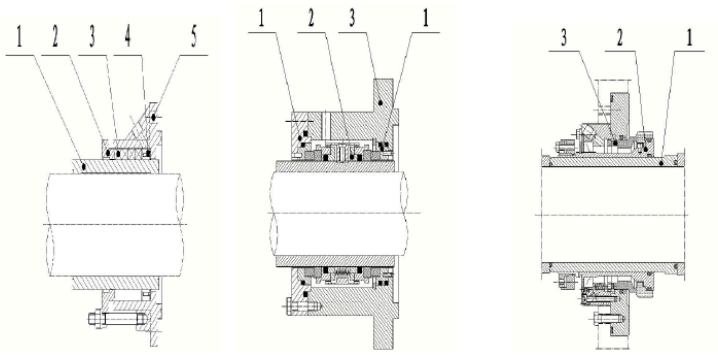
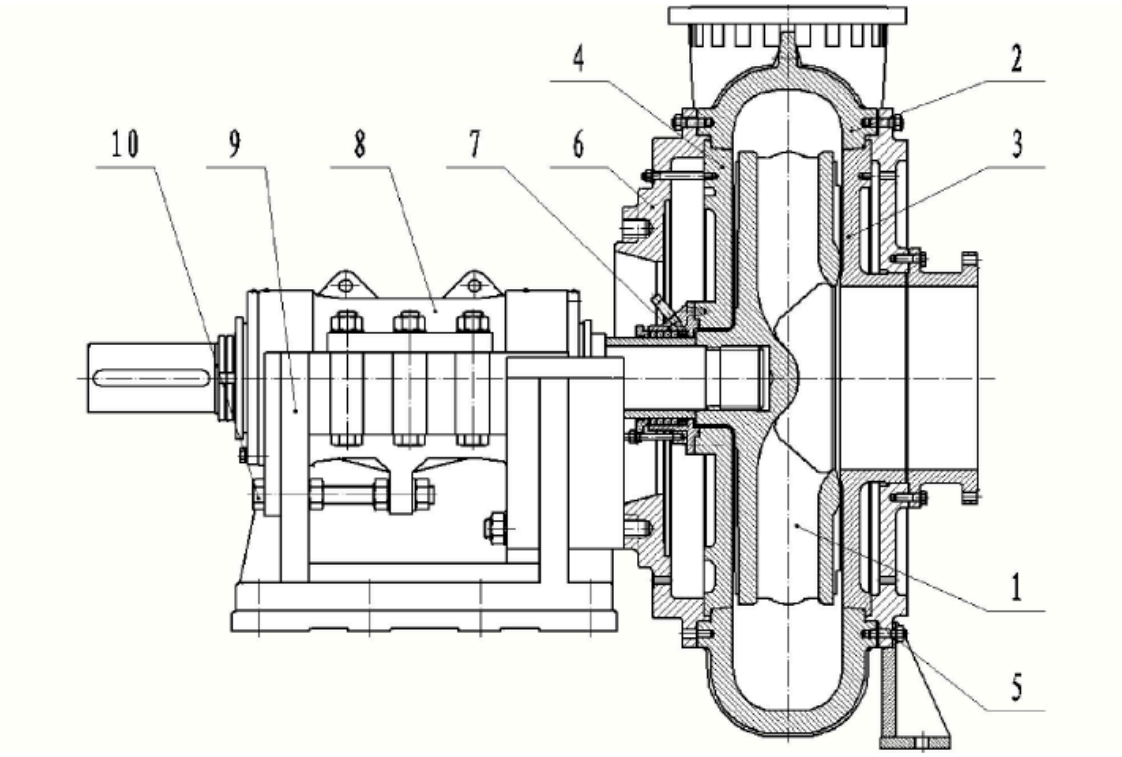
B. Mechanical seals have the advantages of high quality and no leakage. The contained structure makes for easy installation and replacement. A variety of configurations are available based on the working conditions. According to site conditions and applications, the pump can be equipped with a suitable sealing structure and flushing cooling system. No matter the extreme conditions of your operation, the sealing effect of the mechanical seal can meet your expectations. (See below)



A: Packing Seal B: Double Mechanical C: Single Mechanical

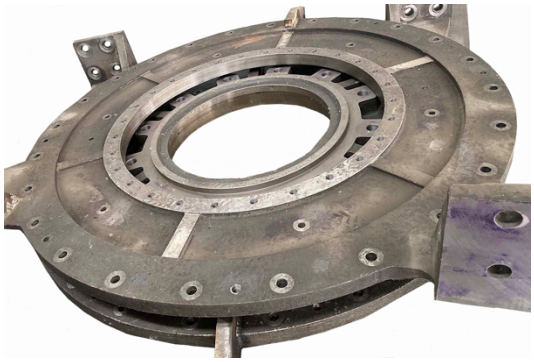
1	Sleeve	Stationary Ring	Sleeve
2	Packing Gland	Rotating Ring	Rotating Ring
3	Packing	Stuffing Box	Stationary Ring
4	Water-Seal Ring		
5	Stuffing Box		

STUCTURAL DRAWING OF MM550 PUMP



Item	Description	Unit Weight (KGS)
1	Impeller	2700 KGS
2	Volute Liner	5700 KGS
3	Front Liner Plate	1160 KGS
4	Liner Plate (rear)	1265 KGS
5	Front Casing	1420 KGS
6	Casing (rear)	1650 KGS
7	Seal Assembly	
8	Bearing Assembly	2670 KGS
9	Support / Bracket	3900 KGS
10	Adjusting Bolts	

3. STORAGE OF ICS MILL MASTER PUMPS



Drain the slurry in the pump chamber after the pump stops; rinse well and dry out. It is recommended that the pump be placed in a storehouse; if the pump is placed outside, the pump should be covered with tarpaulin sheets instead of plastic sheeting to a better air circulation. Inlet and outlet flanges should be covered with cover plates. Loosen the packing gland to loosen the packing.

NOTE: Rotate the quarter circle weekly so that the shaft of the pump bears static load and vibration of the base evenly.

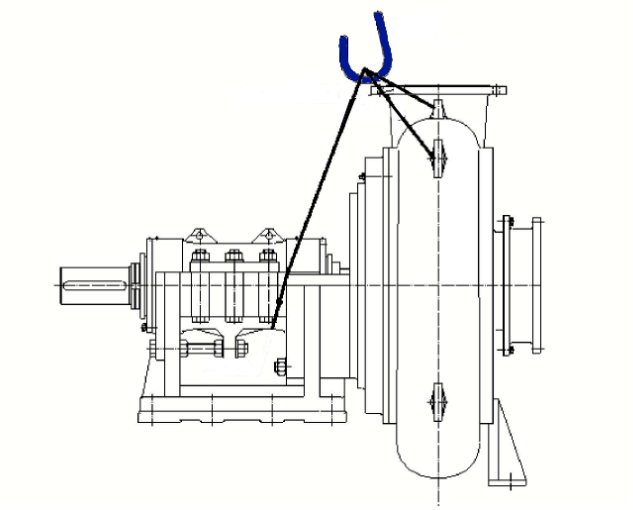
The pump has been adjusted well prior to delivery, so the pump when not being used does not need a strip inspection. Check only if the rotation is flexible and if in a corrosive condition/environment.

NOTE: Keep facility and areas clean, dry, without dirt and other contaminants, and free of leakage.

4. SLING, INSTALLATION, ADJUSTMENT, AND OPERATION OF PUMPS

1. SLING – when slinging a packed pump, we recommend in accordance with the markings on the packing case, select the suitable hoisting machinery according to the weighted mark on the case. AVOID: violent vibrations, over-inclining, hitting the pump, and placing the pump upside down.

When slinging an unpacked pump, we operate according to these requirements and standards:



The lifting weight should be near the connection of the casing (rear) and the bracket. A wire rope or sling passes through the lower part of the bracket to join with the lifting hook. The other two wire ropes or slings pass respectively through the holes on gusset plates above the front casing and rear casing to join with the lifting hook.

NOTE: The lifting lugs on the bearing housing and volute liner are assembled only to dismount rotating parts and volute liners. They cannot be used when lifting the complete pump in case of an accident.

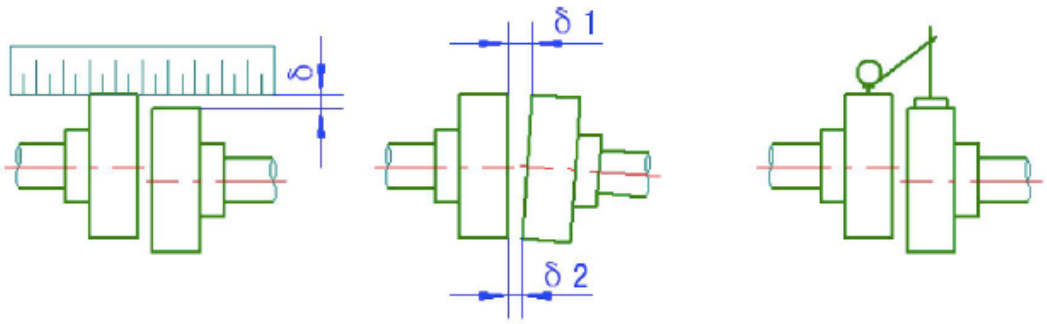
2. INSTALLATION: the pumps have been inspected and tested prior to shipping. Pumps should be set up correctly in order to guarantee smooth start-up. You must check the packing list prior to installation for types of pumps, parameters of pumps and components shipped. We ensure the that all technical date and quality certificate of each pump has been completed. Pumps can be installed after reading technical data carefully.

3. INSTALLATION AND CAPTURING OF PUMP: the pumps should be equipped by grouting twice. The central line of pumps is consistent with the central line of the foundation. The deviation between the center-height of the pump and the design value is smaller than +/- 2mm vertically and 0.1/1000 horizontally.

We assure axis of our pump units by adjusting the couplings when the pumps are driven by couplings. There are two methods:

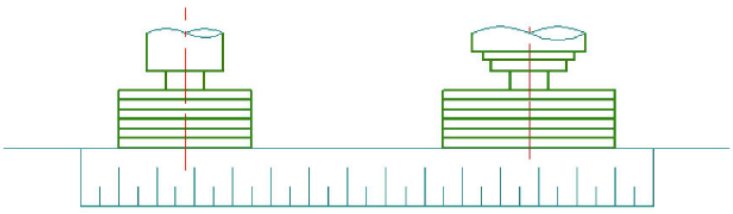
I. The first method is the use of a knife ruler and plug-gauge. We adjust the outside diameter of the couplings with the knife ruler to guarantee alignment in every direction and the max tolerance (δ) less than 0.1mm (See Figure a below). We examine the interval between the coupling to guarantee the max tolerance Δ (Δ = δ 1-δ 2) smaller than 0.1mm (See Figure b below)

II. The other method is to use the plug-gauge and a magnetic centigrade scale. We fix the magnetic-centigrade on the outside diameter of one coupling and put the measuring head on the outside diameter of the other coupling. The pulsation of the centigrade scale should be less than 0.15mm (See Figure c below), when the rotor turns. We check the space between the couplings with the plug-gauge to ensure the maximum tolerance is less than 0.1mm (See Figure b below)



(a) (b) (c)

The shaft of the pump and the motors should assure the parallelism when the pumps are being driven by belts, so we adjust the direction based on the pulleys. When center distance is smaller, we can align end faces of the pulleys with a ruler; when the center distance is large, we can adjust them by aligning the end faces through a span wire system. (See drawing below)



III. Configuration and Requirement of Discharge and Suction Pipeline

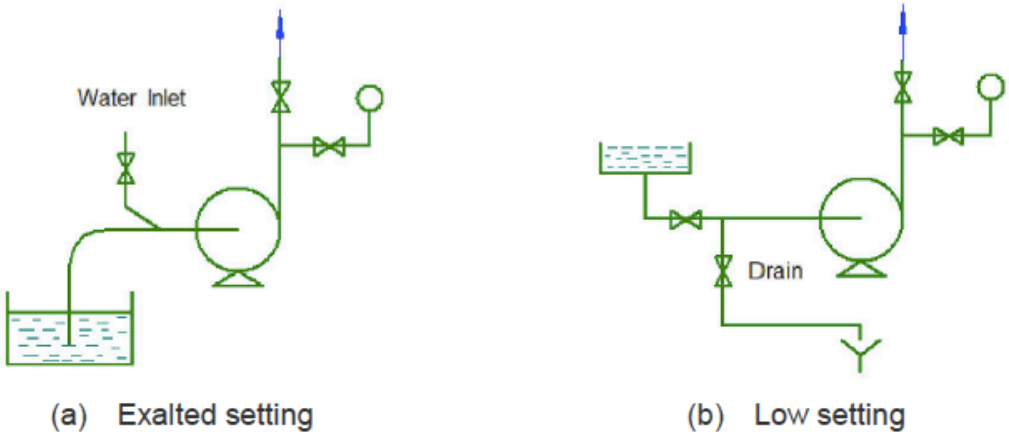
A. Suction Pipeline: the diameter of the suction pipeline should be equal or larger that the pump inlet to avoid cavitation and deposition of slurry in the pipeline

B. Discharge Pipeline: the diameter of the discharge pipeline is usually bigger than the outlet of the pump because the diameter of the discharge pipeline is related to properties of slurries and sedimentation flow rate.

C. Gate Valve Pipeline: the diameter of the outlet gate valve is equal to the diameter of the discharge pipeline.

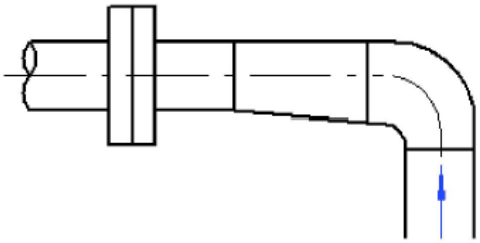
D. Pressure Gauge: the pressure gauge should be set up on the ascending pipe between the outlet of the pump and the first valve.

The diameter of the pipeline is related to the system resistances, critical sedimentation, velocity of slurry, etc. Before the inlet of the pump, one-stage pipe 3 times the diameter of the pipeline should be installed. The velocity of slurry is between 1.5 and 3.0m/s which is determined by critical sedimentation velocity of slurry.



Arrangement of Suction and Discharge Pipeline

When we install the suction pipe in a suction-arrangement we adopt piping of various diameters, whose upper generating line is horizontal to avoid cavitation. When we adjust the capacity of the pump with the throttle, the throttle should be installed on the discharge pipeline. When the throttle is fixed on the suction pipeline, cavitation will occur.



IV. Configuration and Requirement of Shaft Seal Water Pipeline

The configuration of the shaft water pipeline is shown in Figure 8. Packing seal is equipped with an exposed pipe joint (G1) and a pressure gauge (See Figure a Below). The external flushing water (Capacity is 3~5 m3/hr, Pressure is Pout/2) is necessary.

Mechanical seals are generally equipped with two exposed pipe joints (See Figure b Below). The pipe joint on the outlet side of the pump is the outlet of shaft seal water, and a pressure gauge and an adjusting valve should be fixed on it. The pipe joint on the other side is the inlet of shaft seal water, the capacity is 2~3 m3/hr, the Pressure is (Pin + Pout)/2. The bearings of the pumps are oil-lubricated and cooling water is not required.

V. Requirements of Packing

In general, oil-immersed asbestos packing should be used when the working pressure of the pump is less than 0.5MPa; the PTFE packing should be used when the working pressure is more than 0.5MPa. The size of the packing is 25 x 25 (mm)

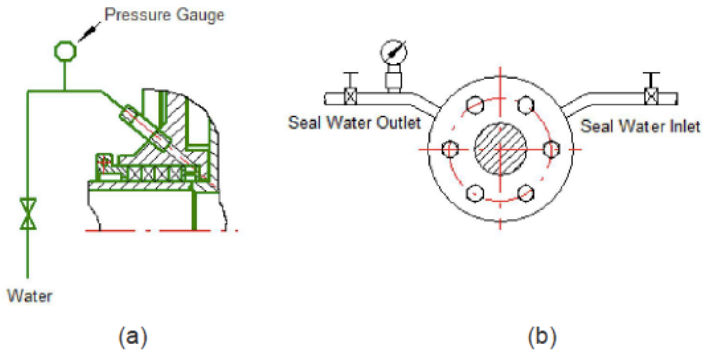
The standard of packing should be in accordance with the stuffing box size and the joints of the adjacent packing rings should be staggered at 120° in the axial.

VI. Mechanical Seals

Mechanical seals are an end face seal with features including no leakage and less power consumption. These seals are generally the type with flushing water, and they include seal water pipe, pressure gauge, three links, as well as other accessories. Users can install the accessories themselves before installation and debugging of pumps.

All of our mechanical seals are custom designed for each pump; they have been installed and debugged prior to leaving our ship. Users are not required to debug.

The two exposed pipe joints of the mechanical seals are the inlet and outlet of shaft water respectively. The one located on the same side with the outlet of the pump is the outlet of shaft seal water, and the other one is the inlet. A valve should be installed in the inlet, while a pressure gauge and a valve should be installed in the outlet. The valve can be adjusted according to the actual conditions of when the pump is running. The configuration of the shaft seal water pipeline should be rigid.



The shaft seal water must be non-polluted; it must be clean industrial water.

When the shaft seal is a mechanical seal, the seal water should be supplied first, and it should be closed after the pump stops for 3 minutes.

ATTENTION:

All ICS Mill Master Pumps equipped with mechanical seals are strictly forbidden to operate without water in the chambers of the pumps and the mechanical seals; otherwise the mechanical seals will fail.

When your pump is equipped with a mechanical seal and has been idle, the mechanical seal should be filled with N46 oil (hydraulic) to prevent the mechanical seal parts and rubber components from rusting and from failing.

The bearings of your pump should be lubricated by grease. The grease is generally a lithium-based grease. Check if the grease is full before starting the pump; add grease as required.

4. ADJUSTMENT OF PUMP:

We examine and adjust pumps after assembly including the interval between the impeller and front liner.

The motor's direction of rotation must be in accordance with the pump's direction of rotation. When the pump operates in the opposite direction, significant damage to parts and pump will occur.

After pumps are disassembled from the motor, you can regular the motor direction of rotation. When they are in the same direction, we attach pumps to the motors. We cannot start the motor up blindly.

When pumps are driven by elastic pin coupling, a protective cover and pins should be set up carefully.

When pumps are belt driven, we adjust the sliding tracks so as that each belt has the same pre-tightening force and install the protective cover (guard) attentively.

When pumps are driven by VFD's, they need to be adjusted according to the installation instructions.

All fasteners must be checked and tightened prior to start-up.

NOTE: Pumps should be test-run after all adjustments. If possible, have slurry transported through the pump during the test.

When starting up the pump, switch on the shaft seal water; adjust the pressure to the specified value.

Open the suction valves completely

Open water-flooding valves to pour the water into the pump

Open the outlet valves and adjust the opening degree of valve gate to a quarter.

Start the pump units; turn on the pressure gauge on the discharge pipeline after the speed of rotation is stable. If the pressure of the discharge pipeline is stable, open the discharge valves slowly up to the required working conditions.

ATTENTION: When the discharge valves are opened fully, starting the pumps will overload the motor. Opening suction valves partly will bring about cavitation.

5. COMMON FAILURES AND HANDLING MEASURES

No.	Fault	Analysis	Solution
1	No water in the pipeline when the pump is operated normally. The pressure gage needles are moving violently.	Not enough water in the suction line	Fill water into suction line
		Pipe is blocked up and the suctions valves were not opened completely	Open suction valves and clean pipes
		Serious a leak from the stuffing box	Find and plug the air leak
2	No water in the pipeline when the pump is operated normally. The Vacuum gage shows high vacuum.	Inlet valves are closed of blocked	Open suction valves and clear possible dirt out.
		Plugged pipe	Clean the pipe out or look at improving the suction line
		The mounting height is too great	Lower the mounting height.
3	No water in the pipeline when the pump is operated normally. The pressure gages show little pressure	Resistance in the pipe discharge	Examine and adjust discharge pipe
		Impellers blocked	Clean impellers
		Rotation speed of the pump is to low	Increase rotation speed of the pump
4	Pump cannot rotate normally .	Volute / Impeller is blocked	Clean the wet ends
		Outlet valve is not functioning properly, and slurry got in	Examine and replace valve, clean out slurry
5	Not enough pump capacity	Discharge and Suction pipes are blocked up	Clean impellers and pipe
		Impellers are worn	Exchange impellers
		Rotation speed of the pump is slower then designed	Increase speed to improve efficiency
		Improper installation, air leak in the suction line	Remount pumps and locate the air leak
		Transportation height is too great	Lower the transportation height
		Suction valve isn't open enough	Open the suction valve completely, if not enough replace for a larger valve

		Air leak in the stuffing box	Ensure the packing is packed tight
		Pumps are unfit for pumping conditions	Consult ICS engineers
6	Motors overloaded	The head is higher than should be, causing the pump to move outside the curve	Bring down the rotation speed of the pump
		The slurry is thicker than that was thought	Consult ICS Engineers
		Stuffing capping nut is too tight	Adjust stuffing capping nut
7	No water in the pipe and pump is making an abnormal sound	Too much resistance in the suction line	Clean the suction line and inlet gate valves
		Height of suction is too great	Bring down the suction height
		Air leak in suction line	Locate and patch air leak
8	Pumps vibrate violently	Cavitation happens	Bring down the height of installation this will lessen the resistance of the suction pipe
		Impeller is blocked	Clean the impeller
		The shaft and motor are not connected properly	Readjust
		Foundation fastening has loosened	Tighten anchor nuts and reinforce foundation
9	Bearings overheat	Cooling water valves are closed	Turn on cooling water valves
		Bearings are not lubricated	Adjust oil level
		Oil is not clean	Clean the bearings and replace oil
		Installation direction of the thrust bearings is not correct	Correct direction of thrust bearing according to pressure
		Bearing is worn out	Change out bearings
10	Excessive leakage from stuffing box	Packing is worn	Replace packing
		No shaft seal water	Open the shaft seal valve
		Rubber parts are worn	Replace rubber parts
		Improper assembly	Reassemble pump
11	Water is leaking from pump head	Rubber parts and seal are worn	Replace all seals

6. MAINTENANCE AND DISASSEMBLY / ASSEMBLY

In order for the ICSHDMM550 pumps to operate safely and fully maximize your equipment's effectiveness, the manner in which you assemble and disassembly your pumps is critical. We have established the following guidelines for you to follow:

- As previously mentioned, you should check/examine the pump, specifically the flexibility of rotation, erosion, and adding of oil
- Always examine your equipment: check for vibration and leakage every day. It is best to solve issues immediately and not delay in addressing them
- Do not operate when pump is out; then operating in this condition, pumps will vibrate violently and severely reduce service life.
- Monitor that no metal pieces or big blocks pass through your pumps; these sorts of contaminants must not enter the pumps, neither should rubbers, plastics, and cottons. This will damage wet ends of pump and cause blockage.
- Examine leakage of shaft seal water regularly. When leakage becomes severe, we need to immediately adjust bolts and replace damaged parts.
- Examine temperature of bearings and ensure that they are lower than 75°C
- If standby pumps have not been operation for a long period of time, clean sediment with water before running pumps
- Examine supporting mechanism of pipeline regularly so that the support is reliable and that the body of the pump does not bear the supporting force
- Examine fastening parts of the base frequently; this will ensure that the coupling remains reliable

ATTENTION:

I. Pins can be set up after testing rotor direction of rotation for pumps just assembled and those rebuilt/repaired.
II. Belts can be set up after testing motor direction of rotation when pumps are belt-driven
III. Pumps most not rotate oppositely. When motors lose power, slurry in the pipeline can make impellers rotate oppositely. When pump head is above 80m, we must prevent slurry from flowing back.
IV. Before starting pumps, we should switch on shaft seal water and cooling water. After stopping pump for 15 minutes, we switch off the shaft seal water and cooling water.

In addition to considering the above points, we need to address the following parts for daily maintenance.

- Fasteners: we complete balance testing for each impeller prior to leaving the machine shop and warehouse, but due to asymmetrical abrasion in the course of daily use, it is difficult to maintain a precise balance and pump vibration may occur, causing bolts to loosen. All fasteners must be checked during each inspection.

- Cleaning of Bearing Sealing Device: the smaller the amount of dirt and contaminants entering into the bearing assembly, the longer the life of the bearings. It is mandatory maintenance item; clean the bearing sealing device when the pump is running.

This table displays when and how much grease to add to the bearings.

Bearing	Grease	200rpm	400rpm	600rpm	800rpm
HH949549/ HH949510D+L	250g	_____	2000hr	1200hr	700hr
SKF NU2252MA	135g	_____	10000hr	5500hr	3500hr

The amount of grease (gram) and the interval adding grease (at a certain speed)

ATTENTION:

The data in the table above are given as a reference when the temperature of the bearing is 70°C. When the bearing temperature exceeds 70°C, the interval is reduced by half to 15°C.

DISMANTLING OF ICSHDMM550CrWI28 PUMP

1. Disconnect the coupling and separate the pump from the other components. Clean up area to ensure safe working conditions.

2. Dismantling can occur on-site as long as the mine-site has sufficient lifting tools (i.e. Crane) and working space, otherwise move the pump to your local workshop. Remove the inlet, the outlet, and casing to check the inner casing situation. Some of the components such as the front liner plate, front casing, or impeller can be replaced in this state without dismantling the entire pump.

3. It is highly recommended that the bearing assemblies only be dismantled for rebuild and repairs in a workshop. (free of contaminants) When bearing components are removed from the pump, they should be identified with suitable tags so that if they are reused, they may be replaced in the same position in the pump with their correcting mating parts.

4. The bearing's inner ring which are an interference fit on the shaft should only be removed if the replacement is required.

5. Bearings should be replaced whenever you observe the following:
    a. Face of race is worn to such an extent that a detectable shoulder is evident at the edge of the rolling track
    b. Cage is worn to such an extent that there is excessive slackness or burrs
    c. Any roughness or pitting of roller or rolling track.

6. Care should be exercised during dismantling; when driving bearing cups out of the assembly with the shaft and rollers, the shaft should be held hard in the direction of driving so that the rollers are seated hard up against the face of the cup and the effects of impact on the bearing faces in minimized.

7. If inspection of the bearings shows that they require replacement, then a press or suitable puller should be set up to bear – on the end of the shaft and the bearings.

8. If any portion of a bearing needs replacing, then replace the bearing in its entirety.

PUMP OVERHAUL REASSEMBLY

Used parts being replaced should be thoroughly cleaned and painted. Mating faces should be free from all contaminants including rust, dirt, and burrs. Coat the parts with grease prior to fitting together.

All small bolts and screws should be replaced, and all threads should be coated with graphite grease prior to reassembly.

All elastomer parts (seals, O-rings, and rings) should be replaced during reassembly of pump.

Store only clean pumps; pumps taken out of service should be flushed with water and dried before storage.

Indoor storage is recommended and cover all flanges. Turn the shaft of the pump a quarter turn by hand once a week. This ensures all the bearing rollers are made to carry static loads and external vibration.

Apply a rust preventing coat to the shaft drive end.

MAINTENANCE SCHEDULE

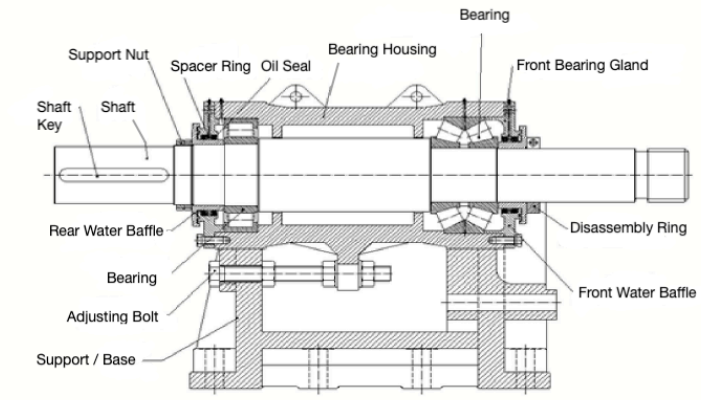
PROJECT	Period	Details	Remarks
Grease Bearing	See Bearing Lubrication	See Bearing Lubrication	
Grease Bearing Sealing	See Labyrinth Grease Purging	See Labyrinth Grease Purging	
Bearing Temperature	Every Shift	Monitoring, if higher than 80°C	Stop, if higher than 80°C
Bearing Vibration	Every Shift	Monitoring, if finding excess vibration	Review, if higher than 7.5mm/s
Performance	Every Week	Measure electric current, speed, and discharge pressure	Stop and check, if pump varies by more than 15%, or the motor's speed reaches the highest magnitude
Tighten Bots	Every Month	Monitor tightness	Care more on bearing component bolts
Adjust Impeller	Every 500 hours after 100 hours' performance	See Impeller Adjusting	Check the alignment of the pump and motors shafts after performance
Casing	Every 3 months	Pump should be dismantled for inspection	Replace if necessary
Impeller, Front Liner Plate, Rear Liner Plate	Every 2 months	Pump should be dismantled for inspection	Measure the thickness of the front liner plate, replace if necessary

ASSEMBLY, DISASSEMBLY, and EXAMINATION

All elements and parts should be checked up and washed before assembly. We examine if all elements and parts are fit for requirement; after exchanging any damaged parts, we assemble the pump.

When the pump needs a repair, all parts must be checked and repaired carefully; all new elements should be checked for fit. All used parts need to be cleaned thoroughly and painted; mating faces should be free from all contaminants.

BEARING HOUSING COMPONENTS



Assembly of Shaft and Bearing

I. The shaft should be given a coat of grease
II. Fit the inner ring (SKF NU2252MA) and shaft together, while holding the shaft. The other side, fit the bearing (HH949510D+L) inner ring, rollers, and shaft together
III. Fit the bearing (HH949510D+L) aperture ring and shaft together, holding the small end face of inner ring, and fitting the outer ring components, holding the rollers.
IV. Fitting the second rollers of the bearing (HH949510D+L), make the small end face hold aperture ring.

Assembly of Drive End

V. The drive side of the bearing housing should be given a coat of grease inside
VI. Make the bearing housing stand, drive side up, and fit the outer (SKF NU2252MA) ring and bearing housing together, knocking the outer ring with hammer until it holds the bearing housing.
VII. Add grease inside the bearing housing as required

VIII. Fit the oil sealing, aperture ring, and rear bearing gland together
IX. Fit cushion, rear bearing gland, and bearing housing together, screwing and tightening the bolts

Assemble the Shaft to the Bearing Housing

I. Make the hearing housing stand up with rear bearing gland down; clean the oil hole and paint grease.
II. Fit ring bolts on the end of the shaft, hang it inside the bearing housing, put it down until it holds the bearing housing
III. Put the shaft sleeve inside the bearing housing and push it until holding the outer ring.
IV. Fit oil seal, aperture ring, and front bearing gland together
V. The front bearing gland should be given a coat of grease; fit the cushion and tighten the bolts

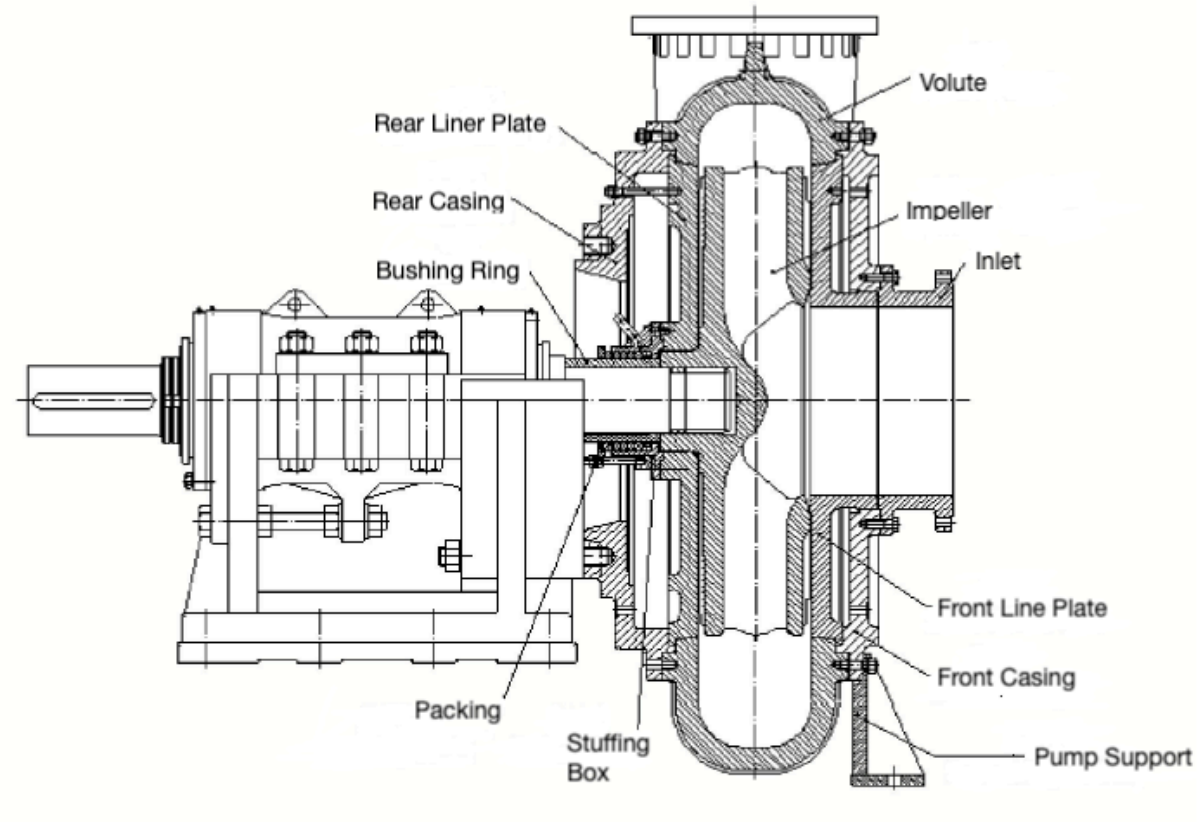
Assemble the Bearing Seal and Round Nut

I. Fit rear wash plate on the end of the shaft, pushing it until it holds the bearing
II. Lock the rear wash plate with the round nut
III. Fit the O-ring inside the front was plate; push the discharge ring to the face of the front wash plate

Assemble the Bearing Components on the Support / Base

I. Fit the bolts on the support from the outside; put a nut and screw; put another two nuts and cushion; the two nuts do not screw
II. Mating faces of the support should be given a good coating of grease. Hang the bearing housing components up and put it on the support. Match up the bearing housing and the support.
III. Install the hardware to hold the bearing assembly to the support
IV. Magnetic centigrade scale is equipped with shaft so as to measure coaxially and perpendicularity between the locating hole and the end faces. The tolerance is smaller than 0.25mm

ASSEMBLY OF PUMP



Assembly Impeller Side

1) Put the O-ring of the shaft sleeve to the face of the discharge ring.
2) Put the shaft sleeve on the shaft and push it on until it holds the O-ring
3) Fi the other end O-ring and give a coat of grease, set it inside the shaft sleeve
4) Hand the rear casing comes distance; moving it until it matches the hole of the support
5) Fit the hardware (bolts and nuts)

Assembly of Rear Liner and Stuffing Box

1) Fix the stuffing box on the rear liner with hardware; pay attention to the position of the tube union
2) Hang rear liner and stuffing box with special tools; fix them on the rear casing
3) Put the O-ring on the rear liner and the apply great
4) Fit the tube union on the stuffing box and screw with a pipe twist.
5) Put water-seal ring and stuffing inside the stuffing box
6) Fix the packing gland on the stuffing box with bolts
7) Turn the shaft with special spanner and make sure it turns freely

Assemble the Impeller

1. The whorl on the shaft should be given a coat of grease
2. Make sure you have all O-rings and that they are intact
3. Fit the impeller on the shaft and screw on with special spanner. Make sure there is no aperture between discharge ring and shaft sleeve.
4. Adjust the impeller towards the liner plate (rear), however they do not touch.

NOTE: Make sure the impeller and shaft turn freely

Assemble the Volute Liner

1. Hang the volute casing up and fix it on the liner plate (rear)
2. Fix the volute liner on the liner plate (rear) with hook-like bolts

Assemble the Front Casing

1. Fit hook-like bolts into front liner plate; lift front liner plate in front casing which is horizontal on the ground. Connect them with bolts
2. Assembly the front liner plate seal rings and rings bolts on the front casing
3. Lift parts of front casing and front liner plate; push the cone-circular of front liner plate into bore-hole of front casing. Tighten all the hook-like bolts after the space of the volute liner and front casing's outlet top surface is 5mm;

NOTE: Make sure the impeller and shaft turn freely

4. Fix the cushion, thickness 5mm on inlet of the rear casing, and check to see if it is pressed or not.

ADJUSTMENT OF IMPELLER

1. The performance of a pump is decided by the aperture between the impeller and front liner. The aperture will be bigger and bigger because of abrasion, therefore decreasing the efficiency. Adjust the impeller regularly for optimal performance and wear life.