

LW450-1000 Centrifuge

Operation Manual

Xi'an HL Petroleum Equipment Co.,Ltd.

Instruction on operation

- ★ All persons concerned must read through this manual and relevant instructions for operation and use carefully.
- ★ Designate the trained personnel as safety managers of the centrifuge
- ★ Make sure all operators are educated on relevant safety precautions.
- ★ Only the trained personnel designated are allowed for operation and maintenance.
- ★ Electrical and mechanical maintenance must be performed by professional engineers under the guide of relevant documentations or other means.
- ★ Adjustment of electrical system parameters must be authorized by the manufacturer and performed by electrical engineers.
- ★ It is recommended that guides of safe operation and equipment maintenance be hung on the site.
- ★ It is recommended that an equipment use record and a maintenance record be created.
- ★ Sufficient light should be provided for night work.
- ★ No access to the equipment is allowed for any person not concerned.

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Summary

This manual provides detailed information on the installation, operation, and maintenance of the LW450-1000 centrifuge. Before installing, using, or maintaining this equipment, it is essential to carefully read the relevant sections of this manual to ensure the safety of both the equipment and personnel.

The LW450-1000 centrifuge is a sedimentation-type separator capable of separating ultra-fine solid-phase particles in mud. When drilling fluid is pumped into the drum, the solid phase in the drilling fluid is separated under the action of centrifugal force, forming a sand ring on the inner wall of the drum. The rotating spiral propeller pushes the solid phase to the sand discharge hole at the small end of the cone, expelling it from the machine. The separated liquid flows through the spacing between the spiral blades to the overflow port at the large end of the drum, and is discharged from the machine.

The LW450-1000 centrifuge possesses the following characteristics:

1. Large length-to-diameter ratio, high separation factor. The drum adopts a push-rod structure with a length-to-diameter ratio of 2.2 and a separation factor of 840.
2. Reasonable differential mechanism structure, high precision, long lifespan. The differential mechanism employs two 2K-H planetary gear systems in series, an integral planetary frame, high-precision gears, as

well as imported bearings and seals, ensuring the differential mechanism's long operational life.

3. Convenient adjustment of underflow and overflow. The discharge of underflow (dry or wet) from the centrifuge is adjusted by rotating the overflow baffle at the large end of the drum to increase the liquid pool depth, making the underflow wet. Conversely, it can be adjusted to make the underflow dry.

4. Compact structure, rational layout. The centrifuge adopts a dual-motor drive layout, with the drum assembly mounted on a single base. Due to strict balancing of rotating components, the operation is smooth, and noise levels are low.

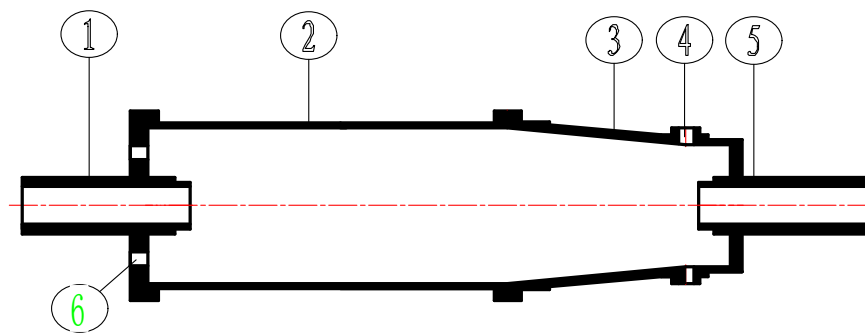
1. Centrifuge introduction

1.1 Centrifuge Components

1.1.1 Drum

The rotating components of the centrifuge include the drum (conical cylinder), helical propeller, and differential mechanism. The drum is the external part of the rotating components of the centrifuge, consisting of a straight cylinder and a conical cylinder. There are six overflow holes on the end plate of the straight cylinder, through which the separated liquid is discharged from the machine. The separated solid phase is discharged from the machine through the sand discharge hole at the small end of

the conical cylinder. There is a hollow shaft on each end plate of the drum, with a bearing on each shaft, allowing the drum to rotate freely. Please refer to the diagram below.

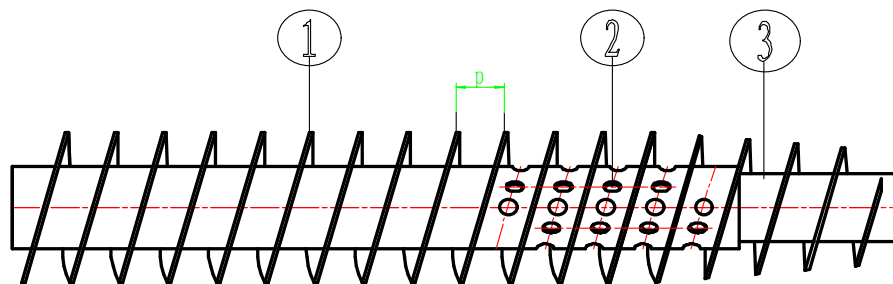


- 1. Large Plate Shaft 2. Straight Cylinder
- 3. Conical Cylinder 4. Sand Discharge Port
- 5. Small Plate Shaft 6. Overflow Port

1.1.2 Propeller

The helical propeller is positioned inside the drum, with a bearing supporting each end. It rotates in the same direction as the drum, but at a slightly slower speed (clockwise rotation when viewed from the inlet pipe side). The helix of the propeller blades is left-handed. When slurry enters the drum through the holes in the hollow tube of the propeller, the solid phase separated under the action of centrifugal force is thrown towards the inner wall of the drum, forming a sand ring. Due to the speed difference, the solid phase is pushed to the sand discharge port at

the small end. The separated liquid phase flows through the spacing between the blades to the overflow port at the large end. The large end of the propeller is equipped with a spline sleeve, connected to the differential mechanism through a spline shaft, thus driving the rotation of the propeller.



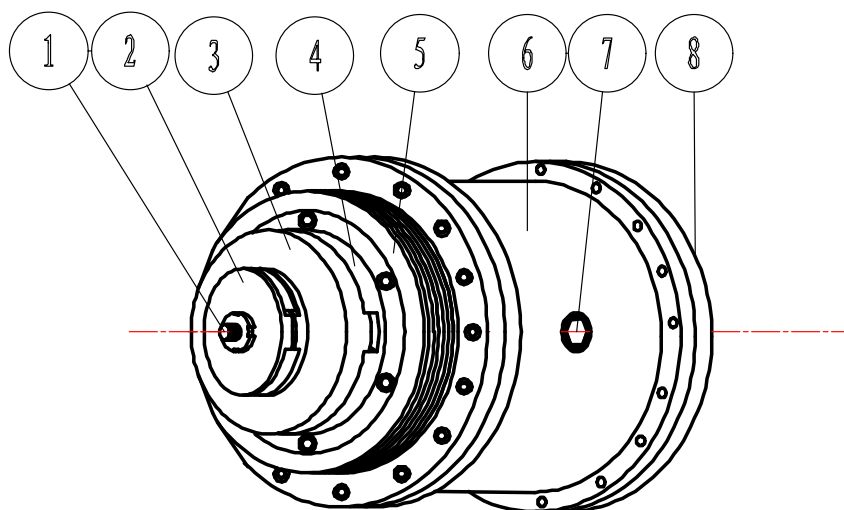
1.Propeller Blades 2. Inlet Holes

2.Hollow Shaft 4. Helix Pitch of Propeller Blades $P=112\text{mm}$

1.1.3 Differential

The differential is installed on the hollow shaft at the large end of the drum, and it is driven by a spline shaft passing through the hollow shaft to drive the propeller. In the opposite direction of the differential mechanism, there is a small input shaft with a cam installed on it. The cam has three steel balls, which are pressed tightly against the toothed

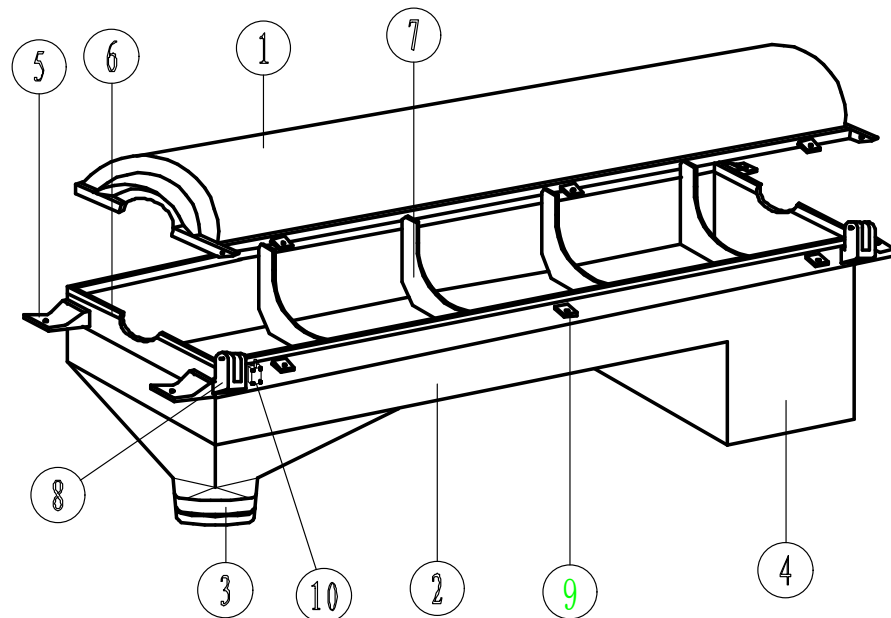
clutch by the pressure of the butterfly spring. The auxiliary motor pulley transmits torque through the steel balls. When the centrifuge is overloaded, the cam slips, disengaging the clutch, disconnecting the power, and stopping the equipment. The installed differential mechanism consists of two series-connected planetary gear systems (2K-H), with a differential ratio of 1:64. All gears, except the ring gear, undergo carburizing, quenching, and grinding, ensuring high precision and a long service life.



- 1. Input Shaft 2. Cam 3. Toothed Clutch
- 4. Toothed Clutch Seat 5. Auxiliary Motor Pulley
- 6. Differential Gearbox 7. Oil Filling Plug
- 8. Connecting Plate

1.1.4 Casing

The centrifuge casing is composed of a semi-circular casing cover and a lower casing, both manufactured using stainless steel. The casing cover is connected to the lower casing by a spiral chain, and the casing cover can rotate 95 degrees. It is installed in the frame of the base, capable of separately collecting the separated solid and liquid phases and enclosing the drum to ensure personal safety. To prevent slurry from entering the sand discharge trough during high-speed rotation, there are reinforcing plates in the casing cover and casing. The casing cover and lower casing are connected with stainless steel bolts, and except for opening the casing cover for maintenance and troubleshooting inspections, it is generally not necessary to open the cover.



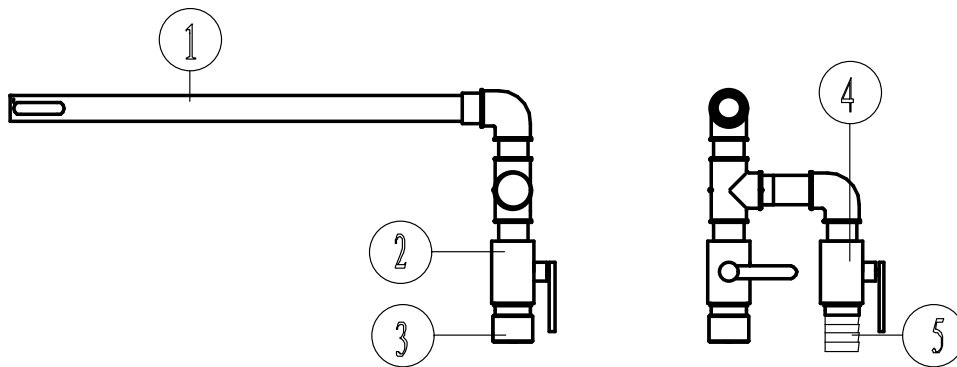
1. Semi-Circular Casing Cover 2. Lower Casing

3. Liquid Discharge Port
4. Sand Discharge Port
5. Lower Casing Fixed Plate
6. Rubber Pad
7. Reinforcing Plate
8. Spiral Chain Link
9. Connecting Plate
10. Micro Switch (Not installed in medium-speed centrifuges)

1.1.5 Inlet Pipe

The centrifuge's inlet pipe is a stainless steel pipe, 1140mm in length and 54mm in diameter. It extends through the hollow shaft of the small plate into the drum and propeller, supplying liquid to the centrifuge through it. The inlet pipe is secured to the support structure.

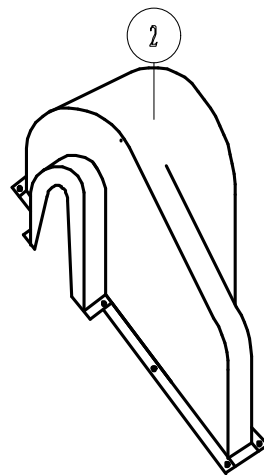
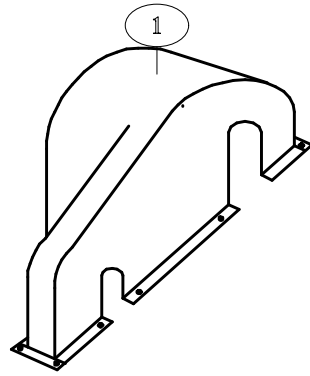
At the end of the inlet pipe is a manifold assembly, equipped with a main valve, water supply valve, supply rubber hose joint, and water supply rubber hose joint. The main valve controls the liquid supply, while the water supply valve controls the cleaning water volume. The inlet pipe is connected to the liquid supply pump with a 2.5m long rubber hose.



- 1. Inlet Pipe 2. Main Valve
- 3. Liquid Supply Rubber Hose Joint
- 4. Water Supply Valve
- 5. Water Supply Rubber Hose Joint

1.1.6 Belt Guard

The belt guard for the LW450-1000 centrifuge includes the main motor guard for the drive rotating assembly and the auxiliary motor guard for the drive differential mechanism, with both guards having similar structures. The main motor guard covers the drive belt and the coupling; the auxiliary motor guard covers the auxiliary motor drive belt and the differential mechanism. For easy maintenance, the guard should be easily removable.



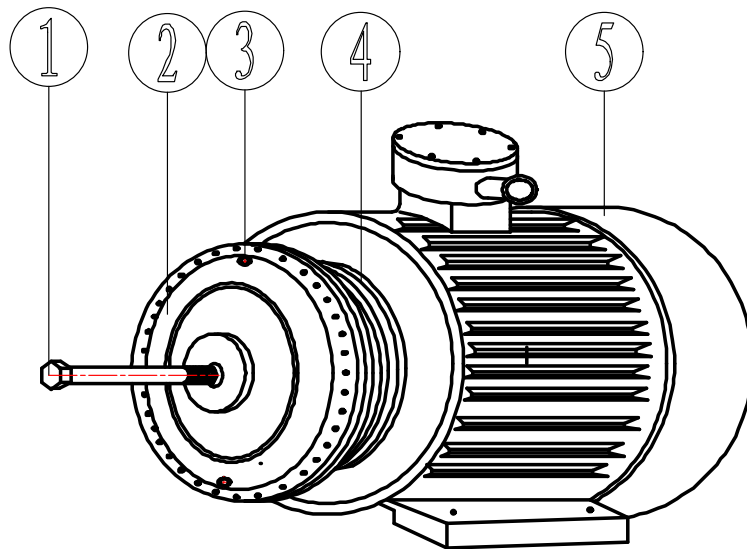
1.Main Motor Guard

2.Auxiliary Motor Guard

1.1.7 Hydraulic Coupling

To reduce the starting load, there is a hydraulic coupling installed on the main motor shaft. The output shaft of the coupler is equipped with a V-belt pulley to transmit power to the rotating assembly. For safety, the coupling is securely connected to the shaft with a bolt. Two oiling plugs (melting plugs) are symmetrically installed on the coupling. When the

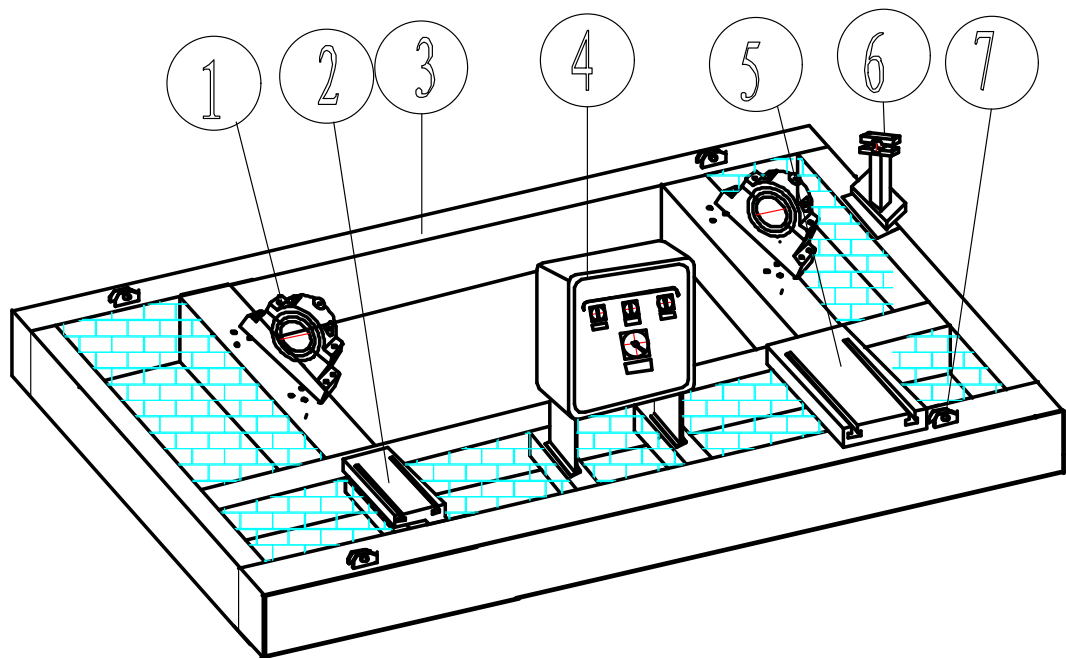
centrifuge is overloaded, the oil temperature rises, and the melting plugs melt, releasing oil and unloading the centrifuge. Once the fault is resolved, fill with 30# mechanical oil, and replace the melting plugs to restore operation.



- 1. Coupling Fixed Bolt 2. Hydraulic Coupling
- 3. Melting Plug (Oil Filling) 4. V-Belt Pulley
- 5. Main Motor

1.1.8 Centrifuge Base

The centrifuge base is welded from rectangular steel tubes. It is equipped with the rotating assembly, support bearing seats, main motor, main motor base, main motor guard, auxiliary motor, auxiliary motor base, auxiliary motor guard, casing, inlet pipe bracket, and control box on top.



- | | |
|------------------------|-------------------------|
| 1.Support Bearing Seat | 2. Auxiliary Motor Base |
| 3. Frame | 4. Control Box |
| 5. Main Motor Base | 6. Inlet Pipe Bracket |
| 7. Lifting Lug | |

1 . 2 Technical parameters

1 . 2 . 1 Overall technical parameters

- 1) Max capacity : 50m³/h
- 2) Mini separation particle : 5-7μm
- 3) Separation factors : 840
- 4) Length-to-diameter ratio : 2.2
- 5) Differential ratio : 1 : 64

- 6) Drum rotation speed : 1750RPM
- 7) Half cone angle : 9°
- 8) Main motor power : 30kw-4 50Hz , 380v
- 9) Auxiliary motor power : 7.5kw-6 , 50Hz , 380v
- 10) Feeding pump motor : 5.5kw-4 , 50HZ , 380v
- 11) Dimension : 2670x1540x1850 (mm)
- 12) Weight : 2680kg

1 . 2 . 2 Component parameters

- 1) Drum : Drum inner diameter 450mm

Drum length 1000mm

Drum material Stainless steel

- 2) Propeller : Model Left helix

Helix pitch 112mm

Material Stainless steel

- 3) Differential : Model Planetary Gear System

Differential ratio 1 : 64

1.3 Rotating components of the centrifuge

The rotating components of the centrifuge include the drum, propeller, and differential. Refer to sections 1.1.1, 1.1.2, and 1.1.3 for details.

1.4 Safety components of the centrifuge

1.4.1 Motor overcurrent protection device.

The motor's overcurrent protection device is installed inside the control box. This protection device is called a thermal relay. When the current flowing through the motor exceeds a certain limit, the contacts of the thermal relay open, cutting off the power supply.

1.4.2 Cam clutch.

At the opposite end of the differential relative to the drum is a small input shaft, equipped with a press-fit clutch. The toothed clutch comprises a cam, teeth, toothed seat, and six butterfly springs. On the cam, there are three steel balls that the toothed seat tightly presses against with the help of butterfly spring elasticity to transmit torque. When the centrifuge is overloaded, the cam disengages from the cam seat. Due to the elastic thrust pushing the cam seat, the centrifuge powers off by triggering a collision stroke switch.

2. Centrifuge installation

2.1 Transportation and Hoisting

2.1.1 Hoisting.

To ensure safety during the hoisting of the centrifuge, two steel cables of equal length should be used, suspended from the four lifting lugs for balanced lifting. Using a single cable for lifting is prohibited to prevent

imbalance and the risk of overturning, which could damage the equipment.

2.1.2 Transportation.

When the centrifuge leaves the factory, it is fixed to a raised platform. For safety during transportation, it should be securely bound with brown ropes. If the vehicle bed height exceeds 1.1m, binding may be omitted. In the absence of a high-bed truck, transportation can also be carried out with the equipment disassembled.

2.2 Centrifuge Installation

The LW450-1000 centrifuge should be installed at a suitable position on mud tank #2 for efficient sand discharge. The external sand discharge trough of the machine should have a certain slope to ensure the free flow of discharged mud and sand.

2.3 Installation of feeding pump

The provided feeding pump for this centrifuge is a vertical centrifugal pump. It should be installed approximately 2m away from the centrifuge's inlet pipe, with the pump head immersed in the mud and the pump flange placed on the tank surface. Connect the feed rubber hose and the cleaning water hose.

2.4 Electrical installation

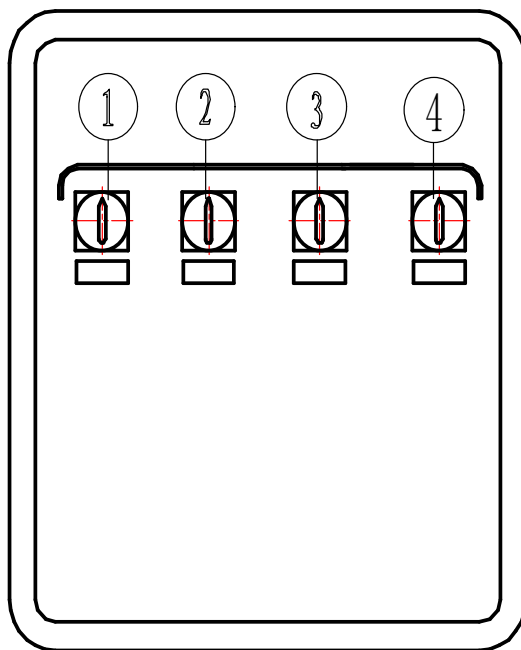
2.4.1 Open the front and rear covers of the control box. Inside the rear cover box, connect the main power line and the feed pump power line.

2.4.2 Power on and check if the rotation direction of the centrifuge and feed pump aligns with the indications on the labels.

3. Centrifuge startup and shutdown

3.1 Centrifuge control box

All control knobs for the centrifuge are installed on the control box. These include the main motor startup knob, the main motor operation stop knob, the auxiliary motor startup and stop knob, and the feeding pump startup and stop knob, as shown in the diagram.



(1) Auxiliary motor startup knob, (2) Main motor startup knob, (3) Main motor operation knob, (4) Feeding pump startup knob. Due to the main motor's pressure-reducing startup, two knobs are designed.

3.2 Centrifuge startup

3.2.1 Before starting the centrifuge, the following preparations should be made:

- a) Manually rotate the main motor and auxiliary motor pulleys, and promptly eliminate any obstructions or blockages.
- b) Check the tension of the drive belts.
- c) Secure the protective cover.
- d) Open the main control valve on the inlet pipe and close the cleaning water valve.
- e) Clean all debris that may affect the operation of the centrifuge.

3.2.2 Turn on the power switch.

3.2.3 Rotate knob (1) clockwise to start the auxiliary motor. Observe the operation, and if any anomalies occur, stop for inspection and promptly address them.

3.2.4 Rotate knob (2) clockwise to initiate the pressure-reducing start of the main motor. Once the main motor speed increases, turn knob (3) clockwise to operate the main motor. Observe the operation, and if any abnormalities occur, stop for inspection and promptly address them.

3.2.5 Rotate knob (4) clockwise to start the feed pump motor and supply liquid to the centrifuge. Observe the operation, and if any anomalies occur, stop for inspection and promptly address them.

3.2.5 Centrifuge faults and troubleshooting

Faults	Reasons	Troubleshooting
Discharge of solid phase absent in underflow	<ol style="list-style-type: none"> 1. Feeding pump is not functioning. 2. Differential safety clutch disengaged, propeller not working. 3. Low liquid pool depth in the drum, solid phase is dry. 	<ol style="list-style-type: none"> 1. Inspection or replacement. 2. Stop and reset. 3. Stop, adjust the overflow baffle, increase the liquid ring depth.
Underflow discharging mud slurry	<ol style="list-style-type: none"> 1. Excessive inflow rate. 2. Excessive liquid ring depth in the drum. 3. Inlet pipe breakage. 	<ol style="list-style-type: none"> 1. Properly close the main valve to reduce the feed rate. 2. Stop and adjust the overflow baffle to decrease the liquid ring depth. 3. Replace the inlet pipe.
Centrifuge vibration	<ol style="list-style-type: none"> 1. Not cleaned after the last use, causing imbalance during operation. 2. Scraper detachment or damage. 	<ol style="list-style-type: none"> 1. Thoroughly clean the interior of the drum. 2. Replace the scraper blades.

Centrifuge overload	<ol style="list-style-type: none"> 1. Excessive inflow rate, resulting in an accumulation of solid phase inside the machine. 2. Low liquid ring depth in the drum, causing the solid phase to dry out and increased propelling resistance. 	<ol style="list-style-type: none"> 1. Properly close the main valve to reduce the feed rate. 2. Stop and adjust the overflow baffle to increase the liquid ring depth.
The coupling is prone to fuse and burst open.	<ol style="list-style-type: none"> 1. Insufficient oil supply, leading to an increase in oil temperature. 2. Centrifuge overload. 	<ol style="list-style-type: none"> 1. Add sufficient oil and replace with a new easily melting fuse. 2. Same as the previous troubleshooting method.

3.3 Centrifuge shutdown

3.3.1 Rotate knob (4) counterclockwise to stop the feed pump motor.

3.3.2 Close the main valve, open the water supply valve to supply water to the interior of the centrifuge, thoroughly clean the drum interior. Stop when clear water is discharged.

3.3.3 Rotate knob (3) counterclockwise to stop the main motor. After 2 minutes, you can then turn off the auxiliary motor.

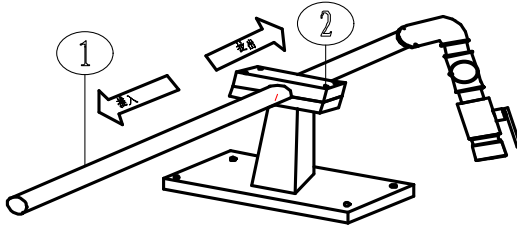
3.3.4 Rotate knob (1) counterclockwise to stop the auxiliary motor.

4. Centrifuge underflow and overflow adjustment

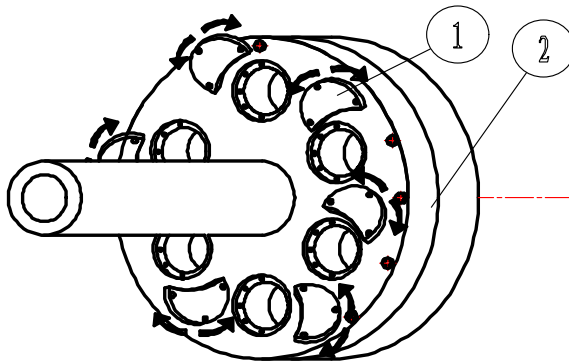
In order to achieve satisfactory separation performance of the centrifuge, adjustments must be made to the underflow and overflow. The ideal outcome is that the underflow (discharged solid phase) can freely flow in the sand discharge trough without discharging excessive mud. Due to changes in mud properties, adjustments should be made promptly.

4.1 Increasing the insertion depth of the inlet pipe can make the underflow drier. Conversely, reducing the depth can make the underflow thinner. When adjusting the depth of the inlet pipe, the equipment should be stopped first. After the equipment comes to a halt, loosen the cover (2) on the inlet pipe support, pull out or insert the inlet pipe (1), and then tighten the screw. After adjustment, manually rotate the drum to check for any friction with the inlet pipe. It is prohibited to adjust the inlet pipe during high-speed operation, as it may lead to accidents. Refer to the diagram for details.

4.2 Adjusting the position of the overflow baffle can regulate the dryness of the underflow. There are six overflow holes on the large end plate (2) of the drum, each equipped with a crescent baffle (1). Adjustment should be synchronized, rotating one screw hole at a time. When rotating counterclockwise, the liquid ring thickens, and the underflow becomes thinner. Conversely, the underflow becomes drier. Refer to the diagram for details.



1. Inlet pipe 2. Cover on the inlet pipe support



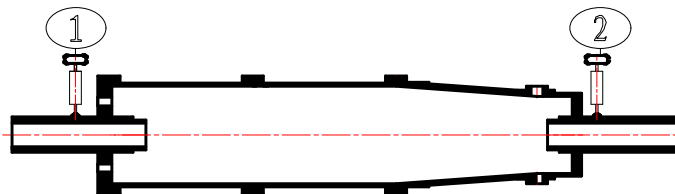
1. Overflow baffle 2. Large end plate

5. Centrifuge maintenance

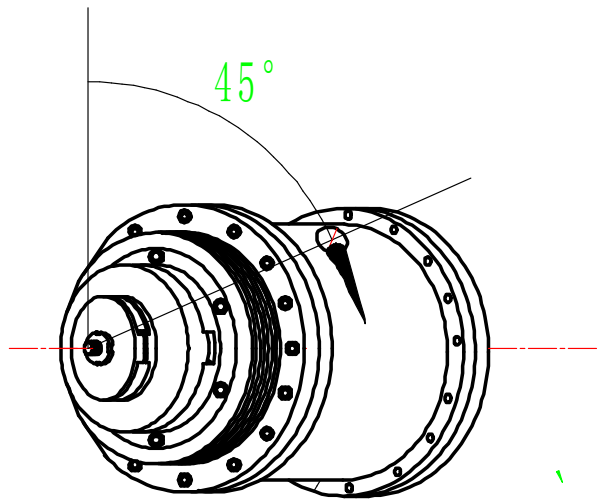
5.1 Maintenance of rotating assembly

5.1.1 There are four grease lubrication points on the rotating assembly, with one each for the two supporting bearings and one at each end of

the propeller (located near the large and small end plates). The former can be lubricated directly with grease, while the latter requires opening the cover. Refer to the diagram for details.



5.1.2 The planetary differential adopts lubrication with 30# mechanical oil. The oil should be replaced after the centrifuge has run for 300 hours. First, drain the old oil completely, add 4kg of diesel for thorough cleaning, and then refill with new oil. The method to determine the oil quantity is: when rotated 45 degrees, there should be oil flowing from the oil filling port, indicating that the oil quantity is sufficient. Refer to the diagram for details.



5.2 Maintenance of the housing

Due to the possibility of sediment accumulation in the housing causing wear on the drum, regular cleaning is essential. Users can take advantage of opening the cover to grease the drum and thoroughly clean it, removing sediment and cleaning the housing.

5.3 Maintenance of the differential

At the end of the differential, there is a cam toothed clutch. When the centrifuge is overloaded, the toothed clutch disengages, shutting down the centrifuge. This situation often occurs when the propeller is jammed. Prompt action should be taken to prevent the mud and sand from drying up and becoming difficult to handle. The solution is to quickly reset the press-fit clutch, manually rotate the auxiliary motor pulley to move the propeller, and immerse it in water from the inlet pipe. As long as it can

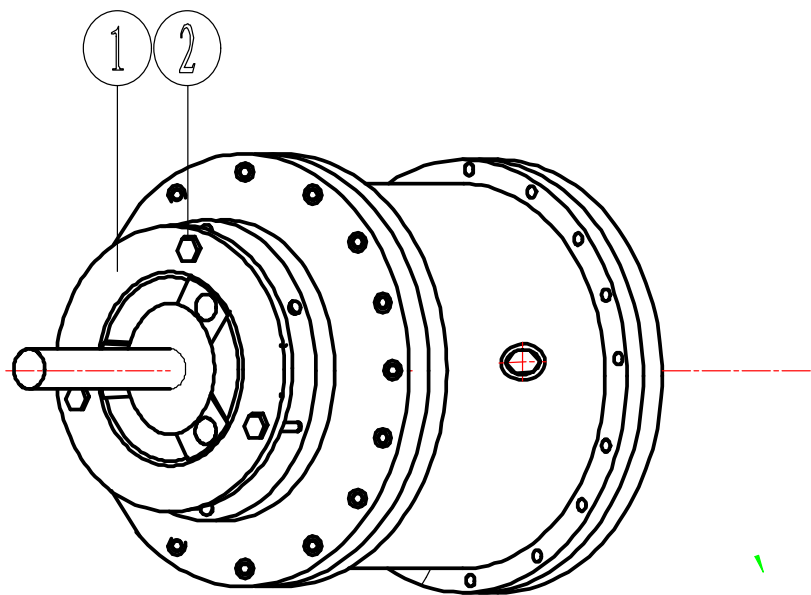
move, it can pour out the mud and sand. Otherwise, it may need to be sent to the factory for treatment.

Resetting the toothed clutch requires a specialized tool, follow the procedure below:

1. Remove the pulley, round nut, and cam.
2. Place the specialized disc on the press-fit, using three long bolts through the disc holes on the pulley seat.
3. Compress the butterfly spring to allow the toothed clutch to enter the toothed seat by 3mm.
4. Install the cam, aligning the three steel balls on the cam with the steel ball seats on the toothed clutch.
5. Tighten the round nut, loosen the long bolts, and remove the disc.
6. Reinstall the pulley.

As shown in the diagram:

1. Specialized disc
2. Tightening bolt



5.4 Maintenance schedule

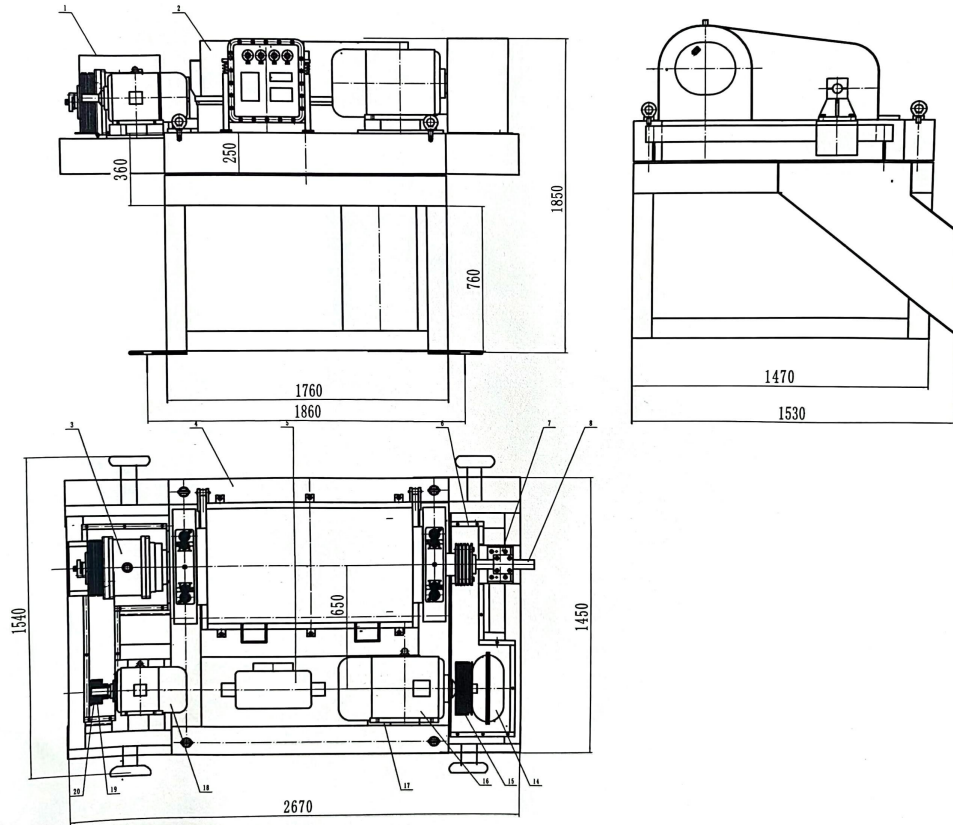
Item	Hours	Methods
Check the belt tension	100	Looseness should be tightened
Check the belt wear condition	300	Wear should be replaced
Add grease to the propeller	70	Inject one shot into each oil nozzle
Add grease to the supporting bearings	24	Inject one shot into each oil nozzle
Replace the lubricating oil in the differential	700	Drain the used oil and add new 30#

		mechanical oil
Check the oil in the hydraulic coupling	1000	Drain the oil and add 30# mechanical oil. The method for determining the oil quantity is the same as that for the differential

6 . List of attachment tools and spare parts

No.	Sort	Name	Specifications	Qt.
1	tools	grease gun		1
2		inner hexagon spanner	3, 6, 8, 10, 14	totally 5
3		jack screw for hydro-coupling		1
5	spare parts	hydro-coupling fusible plug		4
6		gearbox safety pin		12
7		roller wheel		1
8		V-belt	B2032(N1),B2235(N2,N3)	5
9		V-belt	A1803	3
10		grease nipple	M10×1	4
11		grease	2# Extreme pressure lithium-based grease	1

7. Centrifuge overall dimension drawing



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