

⚠ Read this manual before operation



**DECANTER CENTRIFUGE
INSTRUCTION MANUAL**



YIXING TEIO INTERNATIONAL TRADE CO.,LTD.

SPECIALIZED IN WATER TREATMENT SOLUTIONS

CATALOGUE

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1. Safety Instructions

Decanter centrifuge is a kind of high-speed rotating equipment. When operating and maintaining the equipment, it is necessary to strictly follow the operating and maintaining procedures, so as to ensure the safe and reliable operation of the equipment. Before leaving the factory, the equipment has been tested to ensure that the equipment can operate reliably. If you follow the procedures in this manual, your equipment will achieve the longest service life.

Terms: there are some terms such as Danger, Warning, Attention, with the following meanings:

Danger: it may lead to human injury or equipment damage.

Warning: it may lead to potential damage to the equipment.

Attention: it refers to very important operation and maintenance instructions.

Leakage: if there is a problem with the sealing parts, leakage may occur. If the material processed by the decanter centrifuge is toxic or harmful, effective measures must be taken to prevent personal inhalation or direct contact with the leaked material. For example, the operator should wear protective work clothes, gloves, safety glasses, gas masks, protective masks, etc.

Protection devices: the centrifuge is equipped with standard protective devices, including drive belt shield, differential shield, etc. Before the centrifuge starts running, the above protective devices must be correctly in place and in good working condition.

Safety regulations: it refers to the relevant rules that should be followed when installing, operating and maintaining the centrifuge.

Before installation, operation and maintenance, the operator should understand the equipment structure and be familiar with the contents of this manual.

- (1) Security protective measures should be taken when operating the centrifuge.
- (2) Before disconnecting wires or repairing the centrifuge, the power supply must be cut off.
- (3) If the centrifuge is remotely controlled or will run automatically, a sign indicating that the equipment can start automatically should be placed in a conspicuous place near the centrifuge.
- (4) The wires and control components must comply with relevant electrical standard. Confirm that the centrifuge is well grounded. Electrical work must be done by an electrical technician who has obtained an electrical certification.
- (5) When the centrifuge is running, it is strictly forbidden to put hand, clothes or other objects (such as tools) close to the rotating parts, inlets and outlets, so as to prevent injury accidents.

- (6) The centrifuge cannot be started before the protective devices are installed. It is strictly forbidden to remove the protective devices when the centrifuge is running. After repair or maintenance, the protective devices should be installed again, and ensure that they are in good working condition.
- (7) It is strictly forbidden to lift the centrifuge with the lifting holes on the bearing seat or the machine cover, because these lifting holes cannot bear the weight of the entire centrifuge. Only the lifting holes on the machine base of machine frame can be used to lift the entire centrifuge.
- (8) Cranes, lifting chains, wire ropes and other lifting devices must be strictly inspected before lifting the centrifuge. Confirm that these devices are safe and have a large safety factor for the maximum equipment load. Otherwise, it may cause human injury, equipment damage and other accidents.
- (9) The lifting chains, wire ropes and other lifting devices should be fixed to prevent the centrifuge from tilting or sliding during lifting. Before lifting the entire centrifuge or large items off the base or ground, it should be tested to see whether it is balanced or whether it will hit other objects. Otherwise, it may cause human injury, equipment damage and other accidents.
- (10) Make sure that the lifting devices will not touch the nearby wires or cables when lifting. Cut off these wires or cables and remove them. Otherwise, it may cause human injury, equipment damage and other accidents. Be careful not to put hands and feet under the lifting devices.
- (11) When handling lubricating oils or components with temperature above 40°C, be careful to avoid burns.
- (12) The lubricating oil of the differential cannot be overfilled, because too much oil will cause the working temperature of the differential to be too high, leading to fault.
- (13) Because of the large inertia of the centrifuge, it will continue to operate for a period of time after the power supply is cut off. Don't start maintenance work the centrifuge until it stops completely. It will take 10-20 minutes for the centrifuge to stop completely after the power is cut off.
- (14) If the material processed by the decanter centrifuge is toxic or harmful, effective measures must be taken to prevent personal inhalation or direct contact with the leaked material. For example, the operator should wear protective work clothes, gloves, safety glasses, gas masks, protective masks, etc.
- (15) Only when the power supply of the centrifuge has been cut off and it has completely stopped rotating, can the machine be repaired or maintained. Otherwise, it may cause human injury, equipment damage and other accidents.
- (16) Without our permission, it is not allowed to adjust any part of the centrifuge. Otherwise, it may cause human injury, equipment damage and other accidents.

- (17) Before operation, check and confirm that the lubrication system has been filled with the correct lubricating oil to the appropriate oil level. Regularly check the lubrication system and make sure it is in good condition.
- (18) When lifting or moving the motor, be careful not to hit the rotating shaft, which may damage the bearings.
- (19) Be careful when adjusting the overflow weir plate to prevent the overflow plate or bolts from falling into the discharge hopper.
- (20) When adjusting the overflow weir plate, ensure that all overflow weir plates are at the same height, otherwise unstable operation phenomena such as vortexes will occur.
- (21) Without our permission, it is not allowed to use the belt pulley provided by other manufacturers.
- (22) It is not allowed to disassemble the differential.
- (23) Before leaving the factory, the entire rotor has been dynamically balanced. If any part of the rotor has been repaired, the entire rotor should be dynamically balanced again, so as to prevent excessive vibration.
- (24) When installing the centrifuge, flexible joints (pipes) should be used.
- (25) All parts that need to be correctly positioned must be equipped with locating pins, and they must be firmly positioned to avoid unbalanced movement or vibration.
- (26) After starting the centrifuge, wait until the centrifuge reaches the operating speed, then gradually feed the material into the centrifuge. This can reduce vibration and ensure that the centrifuge reaches the best operating state.

2. Machine Overview

2.1 Performance and Application

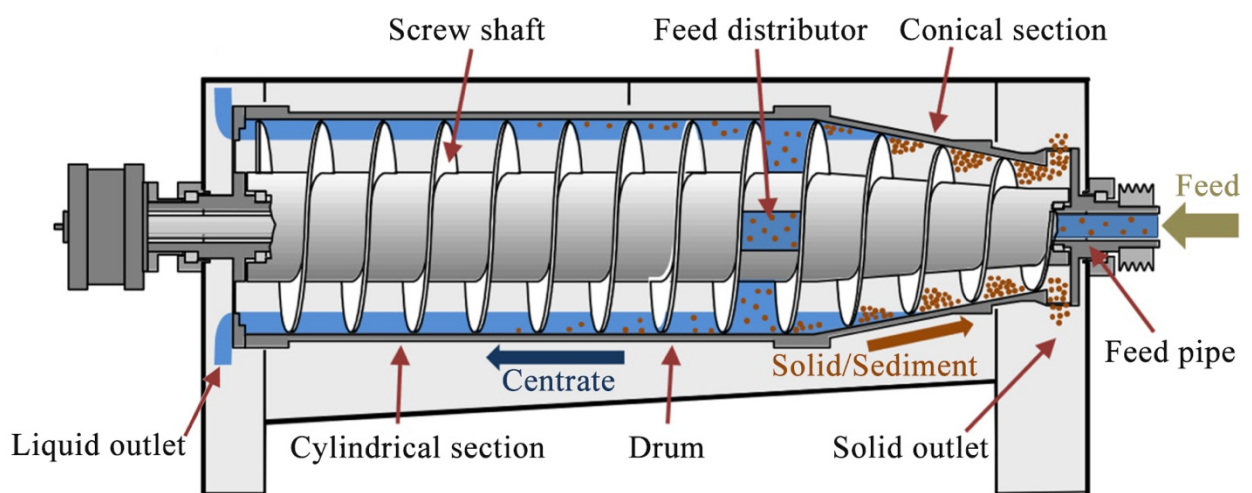
Decanter centrifuge is a kind of mechanical equipment for continuous separation of suspension with density differences. It has the following characteristics:

- (1) It has a wide range of applications and good adaptability to materials. It can be widely used in chemical, light industry, food, papermaking, mining and other industrial fields. It is suitable for solid-liquid separation of suspensions with a solid phase weight concentration of $\leq 10\%$ (or a volume concentration of $\leq 50\%$ after 24 hours of free sedimentation), a solid phase particle equivalent diameter of $\geq 0.005-2\text{mm}$, and a liquid-solid weight difference of $\geq 0.05\text{g/cm}^3$. For example, it can effectively dehydrate calcium carbonate, calcium sulfate, polyvinyl chloride, distiller's grains, bean dregs, soybean protein, paper pulp, vegetable oil, kaolin, white mud,

sludge in the environmental protection industry, and various chemical products suitable for sedimentation centrifugal separation.

- (2) It can run continuously, has large production capacity, low unit energy consumption, and a high degree of automation. It is especially suitable for industrial assembly line operation.
- (3) It is equipped with frequency converter, which can be used for stepless speed regulation to achieve the best separation effect. In the case of machine overload or screw and drum blockage, the electrical control system will automatically alarm and cut off the feeding system. Therefore, the centrifuge can operate reliably.
- (4) It is equipped with satellite differential, with large pushing torque, and controlled by frequency converter. The differential speed can be adjusted steplessly, and it has strong adaptability to materials.
- (5) The entire separation process of the centrifuge is carried out under sealed conditions, which is pollution-free and odorless to the environment, and is particularly suitable for pipeline production.
- (6) It has the advantages of compact structure, small floor space, convenient installation and simple maintenance. The outer edge of the screw is sprayed with high-content tungsten carbide, which greatly improves the wear resistance and prolongs the service life.
- (7) The parts in contact with the materials are all made of stainless steel, which has strong corrosion resistance.

2.2 Working Principle



Decanter centrifuge is mainly composed of cylinder-cone drum, screw shaft, differential system, bearing seats, frame, cover, main and auxiliary motors and electrical control system. The main motor

drives the drum, and the auxiliary motor drives the differential to generate a differential speed between the drum and the screw shaft.

The drum and screw shaft rotate at a high speed with a certain differential speed. The raw materials are continuously fed into screw shaft through the feed pipe and then be distributed to the drum.

Under the action of centrifugal force, the heavier solid phase is deposited on the drum wall to form a sediment layer. The screw shaft continuously pushes the deposited solid phase to the conical end of the drum, after dewatered, it is discharged through the solid outlet. The lighter liquid phase forms an inner liquid layer, which continuously flows out of the overflow port at the cylinder end of the drum, and then discharged through the liquid outlet.

The parts in contact with materials are all made of stainless steel. Other parts not in direct contact with liquid, such as machine base and main bearing seat, are made of steel, cast iron or other suitable materials.

2.2.1 Machine Base

The machine base provides a solid foundation for installing the main components of the centrifuge. The base is a steel welded part, it is used to support the bearing seats, the lower shell of the centrifuge, the feed pipe bracket, the motors, etc.

2.2.2 Machine Cover

The machine cover consists of an upper cover and a lower cover. There is a rubber sealing gasket on the contact surface of the upper and lower covers to prevent leakage of the machine body. The sealing gasket is nitrile rubber or fluororubber. The cover completely encloses the rotating parts, and at the same time, it plays the role of flow guiding and discharging solid particles from the rotating parts. The lower cover is divided into a solid slag holding chamber, a slag discharge hopper and a liquid discharge hopper.

2.2.3 Drum

The drum is a cone-cylinder rotor composed of a cone and a cylinder. When the drum is rotating at high speed, under the action of the centrifugal force, heavier solid particles will be separated from the liquid. The cylindrical part of the drum is conducive to the clarification of filtrate (centrifugal separation), and the conical part is conducive to the dehydration of solid materials.

2.2.4 End Cover

One is the drum cover for solid materials (also called small end cover), the other is the drum cover for clarified liquid (also called big end cover). The two drum covers and the drum are installed together to form a closed rotating container. Both the two drum covers are equipped with hollow shaft neck for rotating the drum. Bearings at both ends for supporting the screw shaft are installed on

the two drum covers. There are two sets of height adjustable overflow plates installed in the drum cover at the big end cover, which is used to adjust and control the depth of the overflow pool and the interface between solid and liquid phases. The range of adjustment is determined by technical parameters of the treated materials.

Attention: the overflow plates should be adjusted at the same height, otherwise, it may lead to unstable operation.

2.2.5 Screw Shaft

It plays the role of accelerating the feeding of materials and pushing the materials deposited on the inner wall of the drum to the solid discharge outlet. Two bearings for supporting the screw shaft are pressed into the drum covers respectively, and the bearings are separated from the treated materials by the framework oil seal assembled in the two drum covers.

The screw shaft is composed of a screw core shaft, screw blades and two connecting discs supporting the rotation of the screw shaft. There are a feed chamber and several feed holes in the screw core shaft, the neck of the feed chamber is hollow structure, the feed pipe is connected to the feed chamber through the hollow neck. The neck of the differential is spline structure, and connected with the spline of the differential.

The materials are sent into the feed chamber, and be discharged to the external drum through the feed holes. The feed holes are evenly distributed along the screw core shaft, so that the materials will be evenly arranged, at the same time, the feed holes accelerate (increase) the speed of material enters the external drum.

The screw blades are wrapped around the screw core shaft, combined into a multiple helical structure. The outer diameter of the screw blades must be controlled within the minimum distance (gap) between the blades and the inner wall of the external drum, about 1mm-3mm, so as to ensure good unloading performance. When the screw shaft is worn due to long-term working, the gap will increase, resulting in the reduction of treatment capacity, poor separation effect and increase of pushing load. Generally, when the gap is more than 5mm, the centrifuge must be stopped for overhaul.

2.2.6 Feed Pipe

The feed pipe is used to feed the material into the feed chamber. The feed pipe is made of stainless steel, the inlet end of the feed pipe is connected by flange, so as to connect with the flexible joint (pipe).

2.2.7 Bearings

The main bearings are all rolling bearings and support the whole rotor. These bearings are assembled into bearing seats. The bearing seats are accurately aligned and positioned with pins when fixed to

the centrifuge base.

The bearing seats are made of cast iron. The bearing at the end of the feed pipe is a centrifugal ball bearing, it is fixed type, it limits the axial movement of the drum. The bearing at the end of the differential is a roller bearing, it does not limit the axial movement of the drum due to thermal expansion or cold contraction.

2.2.8 Differential

The differential drives the screw shaft to rotate at a constant speed. The speed difference between the external drum and the screw shaft is determined by the reduction ratio of the differential and the speed difference between the external drum and the input shaft of the differential. In addition to replacing the lubricating oil, it is not allowed to disassemble the differential.

2.3 Selection of Working Parameters

The users should consider and select the reasonable working parameters according to the physical properties, process requirements and other factors of the raw materials (suspensions). In this way, excellent separation effect and economic benefit can be achieved.

2.3.1 Properties of Raw Materials (Suspensions)

- (1) The larger the solid particles in the suspension, the easier to be separated. When the size of the solid particles is different, the final separation effect is determined by smaller solid particles. The centrifuge can remove the solid particles with the diameter of more than $5\mu\text{m}$. When the solid particles are very small, they will not be separated, but be discharged together with the filtrate. In short, the final separation effect depends on the distribution of the solid particles, the more solid particles are larger than $5\mu\text{m}$, the better the separation effect is. On the contrary, the more solid particles are smaller than $5\mu\text{m}$, the worse the separation effect is.
- (2) Generally, crystalline solids and fibrous solids are easier to be separated, flocculent and pasty solids are more difficult to be separated. Because the flocculent and pasty solids have high water solubility, it is easy to slide when the slag is pushed by the screw shaft, which will affect the separation effect. Therefore, when separating the flocculent and pasty solids, the flow rate should not be too large.
- (3) The larger the weight difference between the solid phase and the liquid phase, the better the separation effect. Otherwise, the smaller the weight difference, the worse the separation effect.
- (4) The lower the liquid viscosity, the easier to be separated. When the liquid viscosity increases, the solid content in the filtrate will increase, the separation effect will be worse. At this time, the material temperature (the temperature cannot be more than 95°C) can be increased to reduce the liquid viscosity, so as to improve the separation effect.

2.3.2 Selection of Feed Flow (Treatment Capacity)

The smaller the feed flow rate, the smaller the axial flow velocity of the material in the drum, the longer the material stays in the drum, and the better the separation effect. As the feed amount increases, the axial flow rate increases, the material stays in the drum for a shorter time, and the separation effect becomes worse. The feed amount of the centrifuge is also limited by the maximum slag discharge capacity of the screw shaft. If the feed amount is too large, the separated sediment will not be discharged in time, causing drum blockage. Therefore, the appropriate feed flow rate should be selected according to the material characteristics, separation requirements and solid content of the material.

Generally, the feed amount should not be too large when the solid content is high. For materials that are difficult to separate, it is recommended that the flow rate should not be too large, and for materials that are easy to separate, the flow rate can be larger, but attention should be paid to the maximum slag discharge capacity of the screw shaft, otherwise it will cause drum blockage.

2.3.3 Overflow Diameter

If the overflow diameter of the drum (mainly determined by the light liquid phase) is small, the sedimentation zone is long and the drying zone is short, the water content of the solid phase sediment is high, the clarified liquid is clearer, and the separation effect is better.

On the contrary, the larger the overflow diameter, the drier the sediment, and the worse the separation effect. In actual use, the overflow diameter should be reasonably selected according to the requirements for the water content of the solid phase sediment after operation experiments.

2.3.4 Drum Rotating Speed

The higher the rotating speed of the drum, the larger the separation factor, and the better the separation effect. However, the vibration and noise of the centrifuge will increase, and the service life of the bearings will decrease. It is not economical to select too high rotating speed, on the premise of meeting the requirements of separation process, select the appropriate rotating speed as the working speed.

2.3.5 Differential Speed Between Drum and Screw Shaft

The higher the differential speed, the larger the slag discharge capacity of the screw shaft, but the water content of the solid sediment will increase. The larger the disturbance of the screw shaft to the material, the worse the separation effect.

But for the materials are easy to be separated, the larger rotating speed can be used to improve the slag discharge capacity of the screw shaft, so as to increase the treatment capacity, but the water content of the solid sediment will increase. Therefore, the differential speed should be determined by material separation test and technological requirements.

3 Installation

Before leaving the factory, the centrifuge has been assembled. When installing the centrifuge, any local disassembly is not required.

Reference drawings: Dimension and foundation drawings.

Danger: It is strictly forbidden to lift the centrifuge with the lifting holes on the bearing seat or the machine cover, because these lifting holes cannot bear the weight of the entire centrifuge. Only the lifting holes on the machine base of machine frame can be used to lift the entire centrifuge.

Cranes, lifting chains, wire ropes and other lifting devices must be strictly inspected before lifting the centrifuge. Confirm that these devices are safe and have a large safety factor for the maximum equipment load. Otherwise, it may cause human injury, equipment damage and other accidents.

The lifting chains, wire ropes and other lifting devices should be fixed to prevent the centrifuge from tilting or sliding during lifting. Before lifting the entire centrifuge or large items off the base or ground, it should be tested to see whether it is balanced or whether it will hit other objects. Otherwise, it may cause human injury, equipment damage and other accidents.

Make sure that the lifting devices will not touch the nearby wires or cables when lifting. Cut off these wires or cables and remove them. Otherwise, it may cause human injury, equipment damage and other accidents. Be careful not to put hands and feet under the lifting devices.

Installation position: Before installing the centrifuge, the installation position must be carefully considered and the following principles must be given priority: the installation position must be convenient for operation or maintenance, the design of the connecting pipeline must ensure that the feed flow can meet the requirement and not affect the separation effect of the centrifuge.

Warning: According to the dimension and foundation drawings, the up, down, left and right distance required for disassembling the feed pipe should not be less than the specified value. Single track for lifting chain should be installed directly above the center line of the centrifuge. The design of single track must ensure that there is a clean position for maintenance when the component is lifted away from the machine base.

Foundation: Before leaving the factory, the centrifuge is dynamically balanced. However, due to the characteristics of the materials to be treated and other reasons, unbalanced load will occur occasionally during the operation of the centrifuge. Therefore, the strength of the foundation must be sufficient to withstand the unbalanced load.

The foundation can be concrete, mud or steel plate structure, the user can select the best one. Flexible foundation is used for the centrifuge, the machine body and transmission parts (motor, differential) are installed on the machine base. Four sets of shock absorbers are installed on the foundation.

Warning: When installing the centrifuge, flexible joints (pipes) should be used.

Electrical installation: Test the electrical circuit and motor rotation direction. All joints connected to the centrifuge must be flexible, so as not to affect the movement of the centrifuge.

Safety shield: All exposed rotating parts are equipped with safety shields. Before starting the centrifuge, make sure that all safety shields are in place and intact.

Belt tension: Install the belt, apply force vertically to the belt, and adjust the belt tension. The degree of tightness should be 1.5-3.5 cm. It should not be too tight. Check whether the belt is damaged or cracked. Usually, during the first 24-28 hours of operation, the adjusted and tightened belt will still cause the belt to sag (or be too loose). After this period of "saturation", the belt and the pulley groove are saturated and the belt will no longer stretch. Therefore, after the initial "saturation", the belt tension should be checked and readjusted according to the following steps.

- (1) Stop the centrifuge (all rotating parts should be stopped).
- (2) Cut off all electrical control devices.
- (3) Remove the safety shield.
- (4) Adjust the belt to ensure that the tension achieves the specified value.
- (5) Reinstall the safety shield.

Warning: If the tension is too low, the belt will be too loose, so it is necessary to increase the distance between the two pulleys. If the tension is too high, it is necessary to reduce the distance between the two pulleys.

Danger: Before maintenance, the power supply must be cut off, otherwise it may cause human injury.

Mechanical and electrical inspection: Before leaving the factory, the centrifuge has been put into trial operation. In order to meet the needs of transportation and long-term storage, necessary measures have been carried out. Before starting the centrifuge, the following inspections must be carried out.

- (1) Before starting, check the tightness of all feed pipes and discharge pipes.
- (2) Check that whether the belt tension is appropriate.
- (3) Check and confirm that all the safety shields have been installed in place and in good condition.
- (4) Make sure that all rotating parts rotate freely.

- (5) Check that whether the whole operation area meets the requirements of safe operation.
- (6) Check all the feed and flow pipes and confirm that there is no blockage, all valves must be opened as required.
- (7) Check the conveying equipment, confirm that the equipment can remove the slag from the centrifuge in time.
- (8) Start the centrifuge and confirm that the rotation direction of the rotor is consistent with the arrow direction indicated on the belt shield. After the centrifuge runs for 15 minutes (temperature rise), observe and record the no-load current.
- (9) It is recommended to run the centrifuge for three hours at working speed without feeding the material (including flushing water), so as to observe the temperature of bearings.
- (10) Record all the temperatures for reference.

4. Machine Commissioning

4.1 Check the Installation

- (1) All exposed bolts of the centrifuge should be tightened (including motor bolts and pulley bolts).
- (2) The tightness of the belt is subject to press 1.5-3.5 cm, check whether the belt is damaged or cracked.
- (3) Check the flexibility of the drum, when turning the drum by hand, it should be flexible without collision and it should rebound when stationary.

4.2 Trial Operation Without Feeding

- (1) Start the auxiliary motor, then start the main motor, run the centrifuge at low speed. Observe the rotation direction of the centrifuge, it should be the same as the arrow direction indicated on the belt shield.
- (2) After confirmed that the rotation direction is correct, speed up the centrifuge to the working speed. The acceleration time should not be less than 8 minutes, so as to ensure the stable start-up of the centrifuge.
- (3) When the centrifuge starts and speeds up, it is necessary to observe its running condition. In case of large vibration or noise, the centrifuge must be stopped immediately. After troubleshooting, it can be started again.

- (4) Check the vibration of the centrifuge, the vibration intensity of the main bearing should not be more than 7.1 mm/s.
- (5) Observe the current of each motor, the no-load current of the main motor and auxiliary motor should not be more than the set value of the frequency converter.
- (6) After running for two hours, check and confirm that the temperature of the two main bearings should not be more than 70 °C, and the temperature rise should not be more than 35 °C. The temperature of the differential should not be more than 70 °C, and the temperature rise should not be more than 40 °C.

4.3 Load Test

- (1) After trial operation without feeding, check the sealing parts by water test, leakage is not allowed.
- (2) The water flow should be even, and it is strictly forbidden to open the valve suddenly.
- (3) Check the vibration of the centrifuge, the vibration intensity of the main bearing should not be more than 11.2 mm/s.
- (4) Observe the current of each motor, the no-load current of the main motor and auxiliary motor should not be more than the set value of the frequency converter.
- (5) After running for four hours, check and confirm that the temperature of the two main bearings should not be more than 75 °C, and the temperature rise should not be more than 40 °C.
- (6) After the new belt is used for 1-2 days, the tightness of the belt needs to be readjusted.

4.4 Feeding Operation

- (1) Start the centrifuge.
- (2) After the centrifuge reaches the working speed, monitor the current of each motor, it should not exceed the no-load rated current.
- (3) After running for 3-5 minutes, rinse with clean water for 5-10 minutes, and then feed the materials into the centrifuge.
- (4) Control the flow rate of the feed valve strictly. The flow rate should be increased gradually from small to the working flow rate. Monitor the current of each motor, it should not be more than the set value of the frequency converter.

4.5 Stop

- (1) Close the feed valve.
- (2) Press the washing button, the centrifuge will slow down to the washing speed.
- (3) Open the washing valve and wash the centrifuge for at least 3 minutes.
- (4) Close the washing valve.
- (5) Turn off the power supply.

Warning: It is not allowed to wash the centrifuge after stop, so as to avoid the water entering into the bearings.

Attention: The washing process must be repeated 2-3 times until the clean water comes out. When the raw materials are sticky or prone to foaming, the centrifuge should be washed more frequently.

4.6 Discharge of the Slag and Filtrate

- (1) The slag can be transported by screw conveyor, trolley and manual shovel.
- (2) The filtrate can be discharged from the pipeline or open ditch. The diameter of the pipeline should not be less than 80 mm, the position difference at the outlet of the pipeline should be more than 1m. The pipeline should not be too long, otherwise the back pressure will be too large. If long pipeline is used, a pump should be added to reduce the back pressure.

5. Equipment Operation

The centrifuge is specially designed for the treatment of slurries. Before leaving the factory, the centrifuge has been assembled according to the process specifications. In order to obtain the ideal performance, adaptability adjustment should be done for the centrifuge.

5.1 Feed

The slurry is fed into the feed chamber by the feed pump.

5.2 Feed Chamber

In the feed chamber, the slurry will be accelerated to approach the rotation speed of the drum. And then the slurry will evenly flow into the drum through the feed holes distributed on the screw shaft.

5.3 Drum

The drum rotates at a high speed. Under the action of centrifugal force, the slurry will be thrown to

the inner wall of the drum. Due to the different specific gravity of the solid phase and liquid phase, the heavier solid phase will settle on the inner wall of the drum, while the lighter liquid phase will form an annular clear liquid layer. The depth of the clear liquid layer can be adjusted by the overflow weir plate installed on the large end cover. The screw shaft rotates at a slightly lower (or slightly higher) speed than the drum, it will collect the solid phase to the solid discharge area (the cone part of the drum) and then discharge the solid filter cake.

5.4 Screw Shaft

The screw shaft has good solid discharge performance, and can obtain transparent clear liquid and dry filter cake.

5.5 Solid Discharge

When the solid filter cake reaches the discharge area (conical part), it will be discharged through the slag discharge outlet.

5.6 Filtrate Discharge

The filtrate continuously overflows from the overflow weir plate and flows out of the centrifuge through the filtrate outlet.

Danger: It is not allowed to overfeed, otherwise the feed chamber will be blocked or the motor current will be too high, then the motor will alarm and stop.

5.7 Result Analysis

After the centrifuge runs stably, sample and analyze the filtrate and filter cake, so as to determine whether further adjustment is needed.

5.8 Speed Adjustment

Generally, increasing the speed of the drum will decrease the water content of the filter cake and the solid content of the filtrate. However, for some materials, the water content of the filter cake will be decreased by decreasing the speed of the drum.

Danger: The maximum operating speed of the centrifuge should not exceed the specified value on the nameplate.

Danger: Before the power supply is cut off and the rotor completely stopped, it is not allowed to disassemble or remove the machine shield/cover.

5.9 Adjustment of the Discharge Time

For some slurries, the change of the rotating speed has little effect on the water content of the filter cake. Practice has proved that another method is to extend the discharge time of the filter cake. The specific measure is to adjust the overflow plates, that is, to reduce the depth of the liquid pool, adjust the overflow plates repeatedly until the best effect is achieved.

Warning: If the depth of the liquid pool is too shallow, the filtrate will not be clear.

Attention: When adjusting, make sure that all the overflow plates are at the same height.

5.10 Centrifuge Washing

It is recommended that the centrifuge should be washed whenever the machine is stopped. In addition, if the centrifuge runs unstably, it means that there are solid blocks on the inner wall of the drum or screw shaft, the solid blocks should be washed away. The number of the washing times depends on the characteristics of the raw materials. The easier the materials are to stick together, the more times for washing.

6. Lubrication

It is very important to formulate a reasonable lubrication procedure, which can prolong the service life of the bearings, differential and other mechanical parts.

6.1 Lubrication List

Lubricating parts	Lubricant	Lubrication amount	Lubrication period
Main bearing	NLGI 3# grease	5-10 mL	Every day
Screw bearing	NLGI 3# grease	Fill until oil leakage	Every month
Differential	85W/90 or 250# gear oil	80%	Every six months

6.2 Main Bearing Lubrication

Generally, the main bearing should be lubricated every day, 5-10 mL each time.

6.3 Planet Gear Differential

There are two oil injection holes symmetrically distributed on the outer edge of the differential. Remove the plugs of the two oil injection holes, turn the differential to a vertical plane, and empty the waste oil. Then, screw on one oil injection hole plug, turn the other hole to the 10 o'clock plane, and inject the lubricating oil to about 80% full. Install the plugs again, and check whether they are properly tightened. Under normal operation, check the lubricating oil every two months. If there is deterioration or discoloration, the oil should be replaced. In addition, the lubricating oil must be replaced every six months.

Danger: When handling lubricating oils or components with temperature above 40°C, be careful to avoid burns.

6.4 Screw bearing

The oil injection holes of the screw bearings are located between the two end covers of the drum and the bearing seat. Normally, the oil injection holes are blocked with screws. Open the upper cover and manually turn the drum. There are two plugs symmetrically distributed at both ends, remove the screws, use a grease gun to inject the grease until new grease overflows from the other side. The grease should be replaced once a month.

7. Maintenance

7.1 Disassembly

- (1) Cut off the power supply.
- (2) Remove all the protection shields and covers.
- (3) Remove all the pipes connected to the centrifuge.
- (4) Loosen the screws on the support cover of the feed pipe, pull out the feed pipe.
- (5) Before disassembly, a suitable lifting device should be prepared.
- (6) Loosen the drive belts and remove them from the drive pulleys. Make sure not to squeeze the belts.
- (7) Remove the screws on the upper cover of the main bearing seats and remove the upper cover. Then put the wire rope or lifting rope on the both ends of the drum unit. Move the drum unit to an open area, and place it on a wooden frame or protective plate.
- (8) Screw the bolts (longer than the differential connection screws) into the screw holes located on the differential connecting flange, remove the differential connection screws, and use the bolts to disengage the differential.
- (9) Remove the fixed cover on the connecting flange of the differential, and pull the flange down.
- (10) Remove the fastening screws from the big end cover and the flange of the drum, screw the bolts (longer than the connection screws) into the screw holes, remove the big end cover and the screw shaft.
- (11) If the drum is difficult to disassemble, it is necessary to wash the sediment on the drum wall. After the drum is disassembled, place it on a wooden frame or protective plate.

(12) Remove the fastening screws at the shaft neck of the big end cover, carefully pull the end cover out of the screw shaft.

Attention: After the differential is disassembled, the pinion shaft or spline shaft cannot be touched and the differential cannot be turned over.

Warning: For some models of the centrifuge, the outer edge of the screw shaft is inlaid with cemented carbide plates or ceramic wear plates. Do not hit them, otherwise they will be damaged. If damaged, they need to be repaired.

Warning: It is not allowed to use the wedges or other tools to remove the end cover, otherwise the end cover may be seriously damaged or deformed.

7.2 Reassembly

- (1) Wash the bearings and bearing seats.
- (2) Assemble the parts according to the reverse steps of disassembly.
- (3) Replace the bolts on the bearing seats and tighten them.
- (4) Rotate the drum by hand and make sure that it rotates flexibly.
- (5) Rotate the differential 50-100 times and make sure that the screw shaft rotates flexibly.
- (6) With proper lubrication and maintenance, the differential generally has few problems. However, it is still necessary to conduct regular inspections every six months. If the differential is noisy or hot, the lubricating oil is leaking, or the oil is dirty or deteriorated, a thorough inspection should be carried out.
- (7) The inevitable result of high-speed mechanical operation is that some parts that are subject to friction and loads need to be repaired and replaced in time. It is recommended that the drum should be thoroughly inspected after 2,000 hours of operation or one year.
- (8) If the centrifuge is blocked during the slurry feeding process, the solid materials will fill the entire drum until the drum stops. Before restarting the centrifuge, the differential should be rotated in the opposite direction by hand to remove the accumulated solid materials.

7.3 Replace the Main Bearing

The actual load of the main bearing will be larger than the working load, so the main bearing is rarely out of order. Almost all the faults of the main bearing are caused by improper lubrication, impurities, non-axial stress, etc. After lifting out the drum, remove the pulley of differential connecting flange and replace the main bearing.

Before installing the bearing, the installation position of the bearing should be clean and burr-free. In addition, the other obstacles that may affect the bearing installation should be removed. For easy installation, the bearing can be immersed in oil at a temperature of not more than 120°C. When the bearing sleeve is heated, the bearing can be easily installed. Do not assemble the bearing by hammering, so as to avoid damaging the bearing.

Warning: The centrifuge is a precise high-speed rotating machine. In any case, it is not allowed to repair or heat the components with fire or welding.

7.4 Replace the Bearing Seals

Each sealing point on the end cover is equipped with a skeleton oil seal. The seal is usually installed like this: one sealing surface faces the material to isolate the contact between the material and the bearing. The other sealing surface faces the shaft sleeve to keep the lubricating oil in good condition. When the centrifuge is repaired or maintained, the seals should be checked, at least once a year. When installing new gaskets and seals, make sure the seals are installed correctly and take care not to damage the seals during installation.

Warning: If the centrifuge will stop for a long time (more than one week), rotate the drum every week. Because if the main bearing stays at the same position for a long time, the bearing is easy to damage.

8. Troubleshooting

No.	Fault	Possible causes	Troubleshooting
1	The motor can't be started	<ol style="list-style-type: none"> 1. No power supply 2. Phase failure of 1 phase or 2 phases 	<ol style="list-style-type: none"> 1. Check the power supply 2. Check the frequency converter is working normally or not; check if there is any alarm
2	The main bearing is overheated and the temperature rise is too high	<ol style="list-style-type: none"> 1. Improper oil filling of the bearing (too much or too little) 2. Bearing matching is too tight 3. Bearing damaged 	<ol style="list-style-type: none"> 1. Adjust the oil filling amount 2. Adjust the bearing matching 3. Replace the bearing
3	Large vibration when on-load	<ol style="list-style-type: none"> 1. Drum or screw shaft blockage 2. The connecting flange of the differential is loose 3. Poor dynamic balance 	<ol style="list-style-type: none"> 1. Remove the sediment 2. Tighten the connecting flange 3. Adjust the dynamic balance 4. Replace the main bearing or

		<p>4. Main bearing or screw support is damaged</p> <p>5. Rigid connection of inlet and outlet pipes</p> <p>6. Screw shaft seriously damaged</p>	<p>screw support</p> <p>5. Use flexible connection</p> <p>6. Repair the screw shaft</p>
4	The current exceeds 60A when no-load	<p>1. The voltage is too low</p> <p>2. The belt is too tight</p> <p>3. The differential or main bearing is damaged</p> <p>4. The rotating parts rub against the machine shell</p>	<p>1. The voltage should not be lower than 360V</p> <p>2. Loosen the belt</p> <p>3. Check and replace</p> <p>4. Stop for inspection</p>
5	When feeding, the vibration becomes larger	<p>1. Uneven feeding or impact</p> <p>2. The screw shaft is seriously worn</p> <p>3. The auxiliary motor does not work, so the drum and the screw shaft rotate synchronously, which leads to blockage</p> <p>4. The outlet pipe is too small and the back pressure is too large, which causes the mixing friction between the filtrate and the drum</p>	<p>1. Feed evenly, reduce pulse</p> <p>2. Stop for inspection</p> <p>3. Check the auxiliary motor, remove the sediment</p> <p>4. Enlarge the outlet pipe or add pipeline pump to reduce back pressure</p>



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