

# **Vibrating Sieve HZS703 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 shale shaker.
- ★ 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.

## 1. Summary

Drilling fluid vibrating sieve designed for drilling fluid solid control system of petroleum and gas drilling is the first-level equipment for liquid-solid separation of drilling fluid.

By utilizing two vibrating motors equal in mass-radius product, HZS703 linear vibrating sieve for solid phase isolation of drilling fluid has realized linear motion to a certain direction of the screen box according to the principle of self-synchronization, thus achieving the goal of screening and isolation of shale particles in drilling fluid.

## 2. Technical parameters

### 2.1 List of technical parameters

Vibrating motion: Linear motion

Vibrating sieve model: HZS703

Screen: 3-694×1052

Motor: 2-1.88kW

Excitation rpm: 1500 r/min

Vibration frequency: 25 Hz

Vibration amplitude:  $\geq 5$  mm

Vibration intensity:  $\geq 7$  g

Adjusting range of dip:  $-1^\circ \sim +5^\circ$

Capacity: 35,3L/S

Voltage/Frequency: AC380V, 50Hz

Dimension (LxWxH): 2825x1882x1605mm (mm)

Weight: 1960kg

### 2.2 Environmental conditions

Ambient temperature:  $-20^\circ\text{C} \sim +40^\circ\text{C}$

Ambient relative humidity: no more than 95%

Degree of explosion-proof: Exd II BT4

Corrosive environment: No corrosive gas or vapor that may damage metal and insulation

Degree of electrical protection: IP55

## 3. Safety specifications

### 3.1 Installation

- A. Use proper crane and lifting devices;
- B. Lifting the equipment beyond the designated lifting point is not allowed;
- C. Be sure that the installation platform is strong enough to bear sufficient weight;
- D. The equipment should be placed stably and tightly fixed on the tank level.

### 3.2 Operation

- A Make sure the screen box fixing block is already dismounted and put in place before start-up of the equipment;
- B. Do not touch the screen box and spring during operation;
- C Stop the machine, find out the cause and correct it in case of any abnormal sound or vibration arising after start-up.
- D Cut off the main power source after shut-down.

### 3.3 Maintenance

- A Open the control box only after the main power is cut off;
- B No adjustment of the eccentric block for vibrating motors;
- C No drilling and welding on the screen box.

#### 4. Components and overall dimension

HZS703 linear vibrating sieve consists of the base, screen box, slurry box, dip adjustment device and electrical control system.

Customers can choose to buy base and feed pipe.

The screen box is mounted on the base through four springs, thus forming a typical “spring-mass” vibrating system.

#### 5. Principle of operation

HZS703 vibrating sieve is a kind of inertia linear vibrating screen with double shafts in self-synchronization and two inversely rotating vibrating motors equal in mass-radius product that are mounted slantways. According to the theory of self-synchronization, the two motors in rotation will follow each other when certain requirements being satisfied, thus realizing synchronous reverse rotation with zero phase difference within a short time, as shown in Diagram 1.

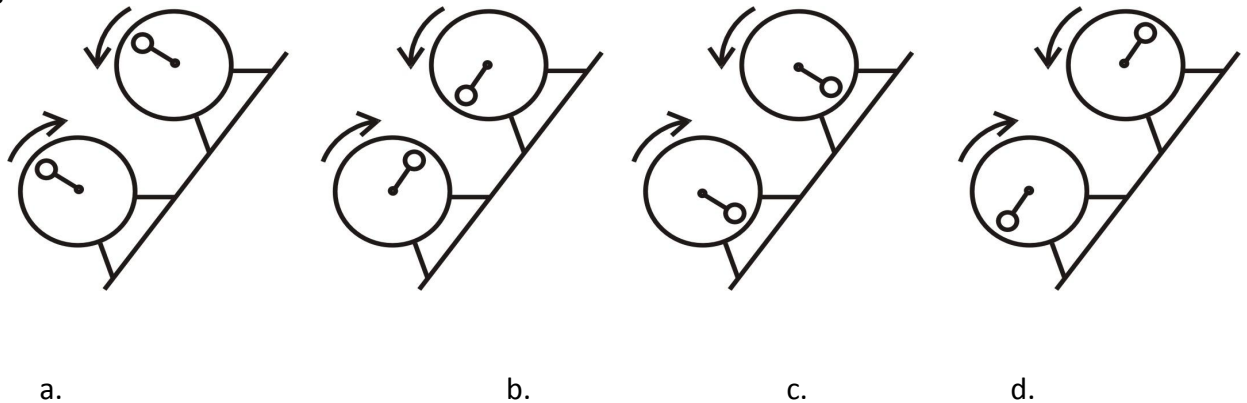


Diagram 1

At positions a and c, the two centrifugal forces overlap to get a maximum excitation force; at positions b and d, the two centrifugal forces counteract to reduce the excitation force to zero. It follows that the centrifugal forces created by the two motors overlap to form a resultant force, direction of which is always vertical to the installation platform of motors and the strength of which varies in a sinusoidal curve.

As the resultant force passes through mass center of the screen box, the sinusoidal excitation force will drive the whole screen box into a vibrating motion along a periodically varying linear path vertical to the installation platform of motors, with all vibrating points of the box identical in direction and intensity.

#### 6. Installation and commissioning

##### 6.1 Installation

##### 6.1.1 Preparation

A Check whether marks on the nameplate comply with requirements in the order or on operation;

B Check the field power supply as required;

C Check whether the tools and accessories are complete and keep them safely;

D Clean and check the installation platform.

6.1.2 Lifting

Lifting must be performed at the designated point, as shown in Diagram 2.

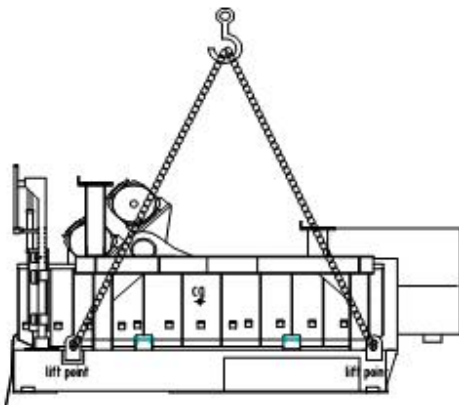


Diagram 2

When lifting, place proper cardboard or clothing at the position where wire rope and the equipment meet to avoid damage to the paint coating.

6.1.3 Installation

Under ordinary conditions, two to three shale shakers are installed on the tank level transversely in a row and the base is clamped with bolts or a pressure plate. A properly enough space is reserved around each shale shaker for operation and maintenance.

Customers can choose base to connect two shale shakers directly. The whole can be lifted when transiting.

6.1.4 Feeding

The following three feeding alternatives are provided for customers.

A Back feeding: There is a DN 300 PN1.0 flanged opening on the back of slurry box, and a blind board which has welded slurry pipe ,customers can broach the board and weld steel tube ( $\leq$ DN300)on it directly, then connect blind board to flanged opening with steel tube by bolts.

B Side feeding: With DN200, DN250 and DN300 circles spray printed on both sides of the slurry box, customers can make an opening according to the printed circles at their own discretion, weld the flange and then connect with external feeding pipes. The printed circles are shown in Diagram 3.

C Above feeding: Overhead pipes or tanks can be suspended over the slurry box, and after embranchment, feeding from above can be achieved.

No matter what method of feeding installation is selected, inlet pipeline of slurry box of each shale shaker is arranged with a valve for control of feeding rate and passage on-off.

6.1.5 Liquid discharged

On both sides of the shale shaker base is designed with a quadrate draining hole, and drilling fluid can be discharged through anyone of them. The discharge hole not used should be

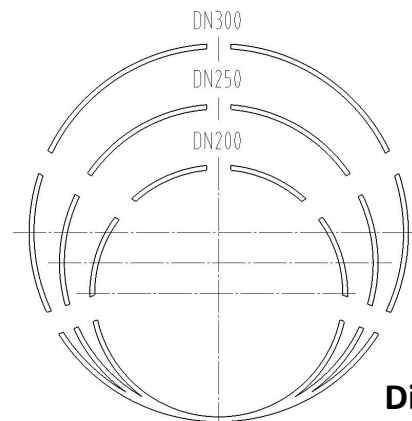


Diagram 3

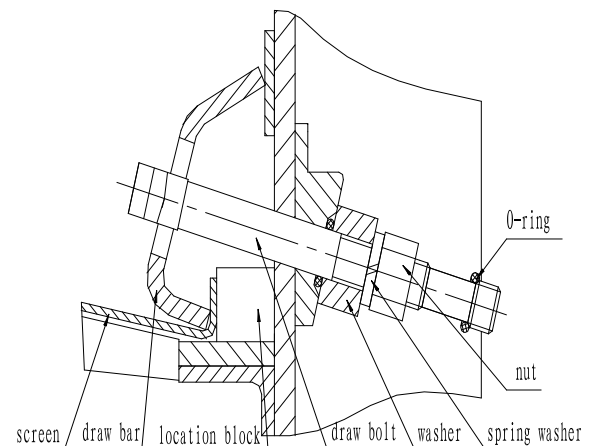


Diagram 4

sealed with a dam board.

#### 6.1.6 Solid discharged

The chute made by the customer is installed at the solid discharge port. Customers are also allowed to install the self-made shield at the port when necessary to prevent spillage of slurry.

#### 6.1.7 Installation of bypass pipeline

There is a DN100 bypass pipe on the bottom of slurry box, which routes to the slurry tank through a valve.

#### 6.1.8 Electrical installation

External power cable is connected to the explosion-proof terminal box on the base holder.

When AC380V power is supplied, the vibrating motor is wired with Y connection, as specified in the manual for vibrating motors.

Motors and the control box should be grounded as specified.

#### 6.1.9 Mounting and dismounting of the screen

Place the edged screen on the screen bed flatly, hook the screen edge with a draw bar, then connect the bar and side plate of the screen box with a draw bolt passing through a washer, and tighten the bolt. For tensioning of the screen, the side with a location block should be tensioned first and then the other side. And for tightening of the draw bolts, the one in the middle of each screen should be tensioned first, and then the ones on both sides alternately with an equal strength till the screen is tensioned evenly on the bed, especially when the screen surface gives a “Beng Beng” sound when struck by a mallet, as shown in Diagram 4.

For dismounting the screen, loosen the nut and push draw bolt, then rotate 90 degrees (as shown in Diagram 5) to draw the bolt head from the strip hole of draw bar to a position of the empty slot on the rear part of the draw bolt but not completely. After the draw bolt is drawn out, remove the draw block to extract the screen.

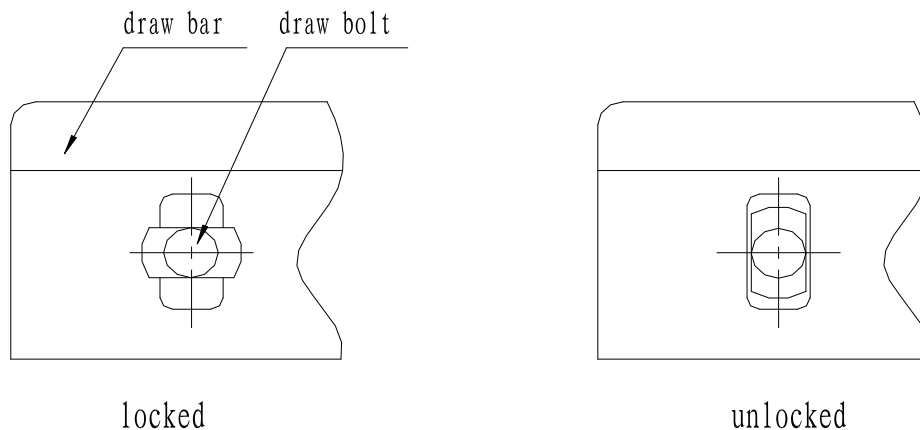


Diagram 5

## 6.2 Commissioning

6.2.1 Check the items listed below and settle timely in case of any abnormality.

A Check whether the equipment is complete and there is any parts neglected or mounted incorrectly.

B Check whether the equipment is grounded safely, and measure the ground resistance when necessary.

C Check whether the bolts are tightened.

D Check whether the dip adjustment structure can fluctuate normally. The cushion should be in contact with

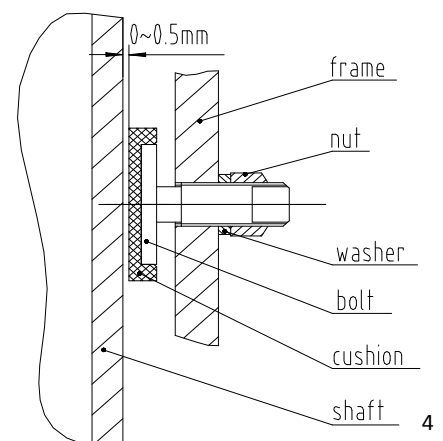
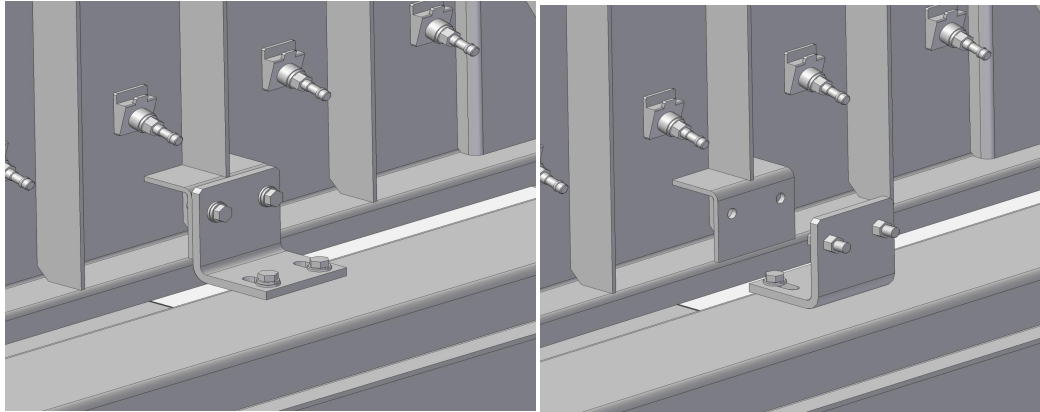


Diagram 6

the shaft properly, or adjust the gap between the shaft and the cushion when necessary.

E Remove the fixing block for the screen box, rotate the block to a degree of 180 before fixing it on the base to avoid loss, as shown in Diagram 7.



Mount the fixing block during transport

Remove the fixing block before operation

### Diagram 7

6.2.2 Start the equipment, check the rotating direction of the motors and change the phase line if the direction is not correct.

Start the two motors one after another, check whether the screen box moves in a line and whether the objects on the screen bed (glove, cardboard and etc.) can be delivered to the slag outlet; Change the phase line of any one of the motors if vibration is found to be abnormal.

Method for observation of the vibrating path: Mark a small point on the side of screen box and observe the shape of the point during vibration after the screen box starts to vibrate normally. The vibrating path should be normal if the point forms a short segment of a line inclining forward and upward but abnormal if it comes to be a circle or ellipse.

It is not necessary to change the motor phase line when it is newly installed for the rotating direction of the motor was set before ex-factory. The direction may only be checked when rewiring is performed for replacement of the motor by the customer and other reasons.

The other cause of abnormal vibration is that one of the motors does not function.

### 6.2.3 No-load run

Start the shale shaker following the stipulated procedures, check whether there is any abnormal sound and shake, whether the vibrating path is normal and the screen is well mounted and tensioned.

## 7. Operating procedures and precautions

### 7.1 Preparation for start-up

7.1.1 Install the equipment in accordance with the requirements in Chapter 6 “Installation and commissioning” and check carefully for commissioning before first operation and use after re-installation.

7.1.2 Preparation and check before daily start-up

- A Clean the environment around the site, No parts or sundries is allowed;
- B Check whether the fixing block on the screen box is removed;
- C Check whether the screen is damaged or has large dry or sticking section;
- D Check whether the screen is well installed and properly tensioned;
- E Check whether the mesh number meet with operating requirements;
- F The screen box dip should be proper without excessive inclination.

## 7.2 Start-up procedures

A Connect with external main power supply;

B Start up the two vibrating motors one after another;

C Open the feeding valve step by step to achieve the required settlement capacity;

D Adjust the dip of screen box to an extent that the slurry-submerged surface of the screen bed accounts for 2/3 to 3/4 of the whole length of the bed.

## 7.3 Shut-down procedures

A Close the feeding valve;

B Stop the two vibrating motors one by one;

C Cut off external main power.

## 7.4 Adjustment of dip

The dip adjustment structure is a set of reversible unidirectional mechanism with ratchet and pawl that can drive a pair of devices with left-hand and right-hand threads. The dip will decrease when turning the lifting handle to the left and increase when to the right. Push the pawl and the direction can be reversed. A locking handle is arranged for the shafts on both sides. Loosen the locking handle before adjustment, tighten it and block the lifting handle into the above elastic blocking groove after adjustment. The inclination angle of the screen box can be read through the scale on the column side, as shown in Diagram 8.

## 7.5 Precautions for operation

A Check whether there is any abnormality after start-up, and feed after confirmation;

B It is a normal condition if there is obvious shake on the part of screen box and dip adjustment gantry when passing through the resonance section after shut-down.

C Clean the residual clay on the screen bed when replacement of screen after shut-down, and wash the bed with clean water when necessary.

## 8. Lubrication and maintenance

### 8.1 Lubrication

#### 8.1.1 Lubrication of the vibrating motor bearing

The vibrating motor bearing should be greased every two thousand hours with 40g grease added on each part at each time.

Kluber NB52 grease must be exclusively used, which can be purchased from Kluber, or our company.

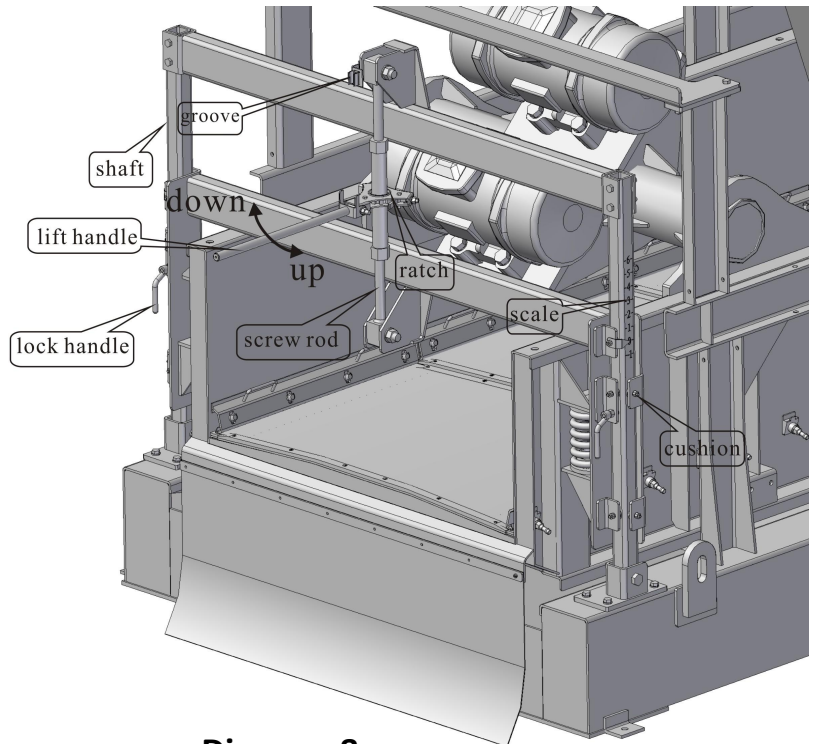
The grease gun exclusively arranged for the shale shaker cannot be used for adding grease of any other kinds.

The greasing quantity must be within the stipulated limit, for excessive greasing will not only cause the bearing overheat but also shorten the service time of the bearing.

No other grease is allowed for use, or else, the motor may be damaged.

Use 3/16" inner hexagon spanner to screw lubricated oil hole bolt.

For more information on lubrication of vibrating motors, please read carefully the



**Diagram 8**



accompanying manual for this regards.

#### 8.1.2 Lubrication of dip adjustment screw rod and nut

In case of failure to lubricate the adjustment screw rod and nut, it is not only difficult to adjust the dip, but the rod and nut will rust. When the rod and nut are cleaned with gasoline or kerosene every months, new grease should be added. There is no specific requirement on the kind of grease at ordinary times, but the one with sufficient lubricating capacity under low temperature is preferred when the environment is cold.

### 8.2 Check and maintenance

#### 8.2.1 Routine check items for each shift:

A Whether the sound is normal when the shale shaker is in operation;

B Whether temperature of the motor shield is excessively high (normal value below 90°C) .

Handle as stipulated in the manual for vibrating motors if the temperature is above 90°C;

C Whether the motor bolt is loosened;

D Whether the screws and bolts on the dip adjustment structure are loosened.

If any abnormality is checked out, stop the machine immediately for settlement or re-start after settlement.

#### 8.2.2 Items of periodical check

A Check all the screwed connections to see whether there is any loosing or dropping on a weekly basis;

B Check whether the rubber strip is damaged or aged at each time of screen replacement;

C Check whether there is any permanent deformation or damage to the damping spring on a weekly basis.

D Check whether there is any obvious corrosion or damage to the equipment weekly.

#### 8.2.3 Routine maintenance

A Clean the clay on the screen bed at each shut-down and wash with clean water when necessary.

B Clean the clay and dirt on the installation surface thoroughly at each time of screen replacement to ensure correct installation of a screen.

C Clean the dirt in the slurry box and base weekly to avoid pipeline and passage blocking caused by deposits.

### 8.3 Electrical maintenance

A Electrical maintenance must be performed by professional electrical technicians;

B Cut off external main power before opening the control cabinet;

C Pay special attention to the flameproof surface and add isolation grease on it before the cabinet cover is closed. No scoring and collision on the surface is allowed, and the sealing ring should be in good condition.

D The cable and rubber sealing ring at the inlet and outlet must be firmly clamped for flame-proof purpose.

E The thermal relay should be set around 5.4A. A too high or too low value is not suggested.

## 9. Principle of electrical control

Schematic diagram of electrical control see Fig 3.

## 10. Transport and storage

### 10.1 Transport

A Adjust the screen box dip to zero and use a special locking block to fix the box before transport, as shown in Diagram 7;

B Lifting on the specified point is required when the complete is loaded or unloaded, and

attention should be paid to avoid collision during transport, see Diagram 2;

C The equipment should be tightly fixed in the carriage or cabin and the latter should be sealed or covered with protective canvas during transport to avoid damage to the equipment caused by atrocious weather.

### 10.2 Storage

A The equipment should be stored in a well ventilated warehouse with a relative humidity no more than 60%;

B The warehousing environment should be cleaned of strongly corrosive gas harmful to metal and insulation;

C For long-term storage, the parts or components vulnerable to corrosion should be coated with grease;

D The electrical control cabinet should be powered semiannually to avoid electrical component failure caused by moisture.

### 11. Common failures and troubleshooting

Serial No.	Failure	Cause	Troubleshooting
1	<b>The motor cannot be started.</b>	1 Power failure.	1 Designate a professional electrician to examine whether peripheral power supplies are in good condition.
		2 Certain element of the control cabinet was damaged.	2 Designate a profession electrician to check control cabinet elements.
		3 Motor damaged.	3 Designate a profession electrician to check whether motors are in good condition.
2	<b>The motor automatically shut down shortly after being started.</b>	1 Thermal relay current was set with a too low value.	1 Properly adjust the current value to 5.4A around.
		2 Motor wiring error.	2 Y connection is recommended for 380V power, but not shaped connection.
3	<b>The whole set vibrates obviously and sounds abnormally after start-up.</b>	The fixing blocks were not dismounted.	Stop the machine immediately and dismount the four screen box fixing blocks thoroughly.
4	<b>Vibrating path abnormal, failure in slag discharge or very slow discharging.</b>	1 Only one of the two motors was started.	1 Start the other motor or ask a professional electrician to check the control cabinet or motor in case of failure in start-up.
		2 The two motors rotate to a same direction.	2 Reverse the rotation direction of one of the motors after changing the phase line.
5	<b>The gantry shakes and gives much noise.</b>	The dip adjustment handle was not clamped.	Clamp the dip adjustment handle.

6	<b>Dip adjustment difficulty.</b>	1 The dip adjustment handle was not released.	1 Release the dip adjustment handle.
		2 The plastic friction-reducing pad was too tightly placed against the column.	2 Release the locking nut, properly loosen the screw on the pad before tightening the nut, as shown in Diagram 6.
7	<b>Abnormal vibration.</b>	1 The eccentric block of the vibrating motor was not set as stipulated.	1 Reset or secure the eccentric block as stipulated. It is recommended that the two motors should be set with the same size and both ends of a motor be set in a same direction.
		2 The eccentric block of the vibrating motor was loosened.	
		3 The whole set was not stable or well fixed.	2 Stabilize and fasten the whole set.
8	<b>The sound is mixed with abnormal noise</b>	The screwed connection was loose.	Thoroughly check each screwed connection according to judgment of the abnormal position.
9	<b>Slurry spillage</b>	1 Screen box dip was too low.	1 Increase the dip of screen box.
		2 Settlement capacity was too high.	2 Decrease the settlement capacity.
10	<b>Settlement capacity is too low.</b>	1 Screen openings were blocked largely.	1 Clean or replace the screen.
		2 Density and viscosity of the drilling fluid were too high.	2 Capacity decrease caused by high density and viscosity is just normal.
11	<b>Short service time of screen.</b>	1 Screen tension was too loose, too tight or uneven.	1 Tension the screen as required.
		2 The rubber strip was damaged or aged.	2 Replace all the rubber strips.
		3 The drilling fluid was too high in solid content.	3 Short service time of screen caused by drilling fluid high in solid content is just normal.

If any failure mentioned above cannot be eliminated through the suggested means, consult the manufacturer for settlement.

12. Figures

Fig 1 Overall dimension

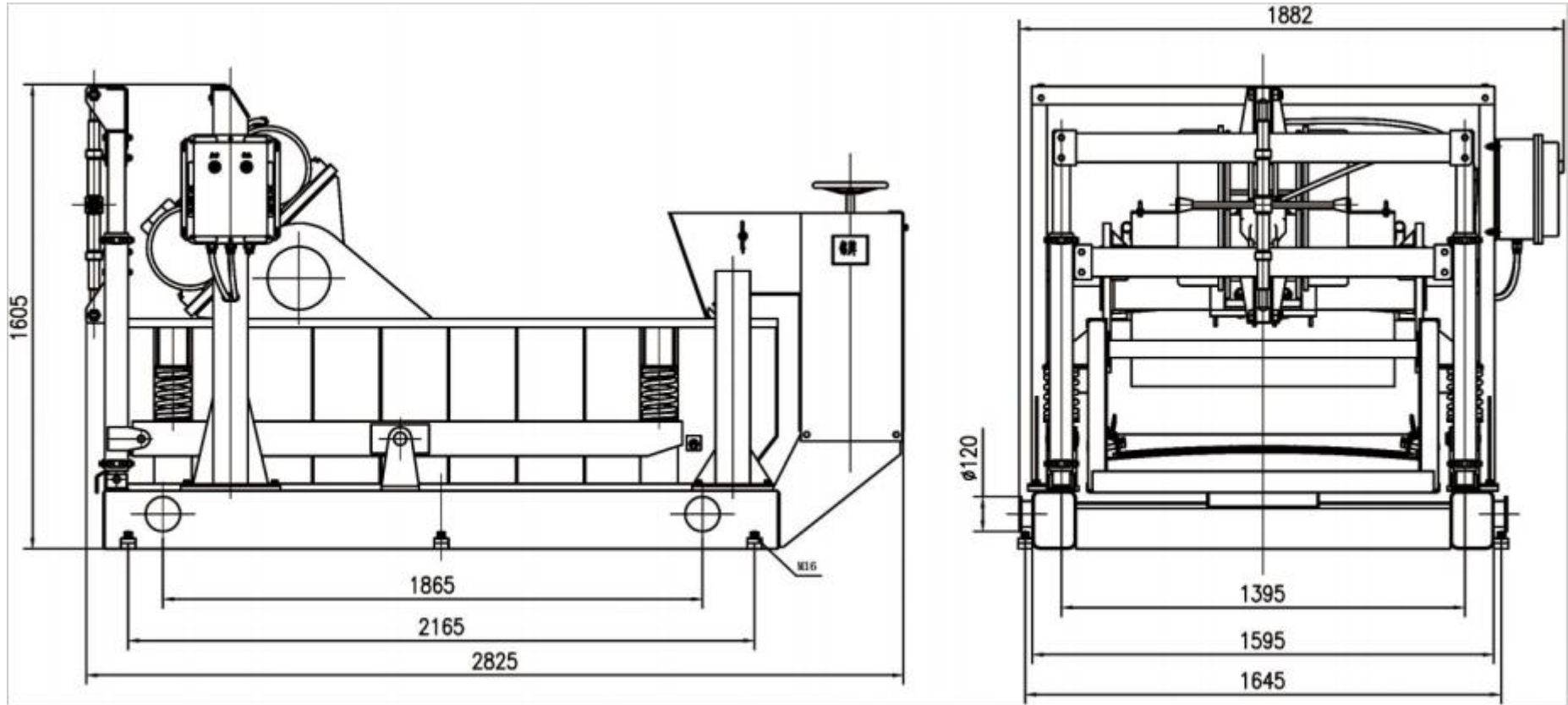
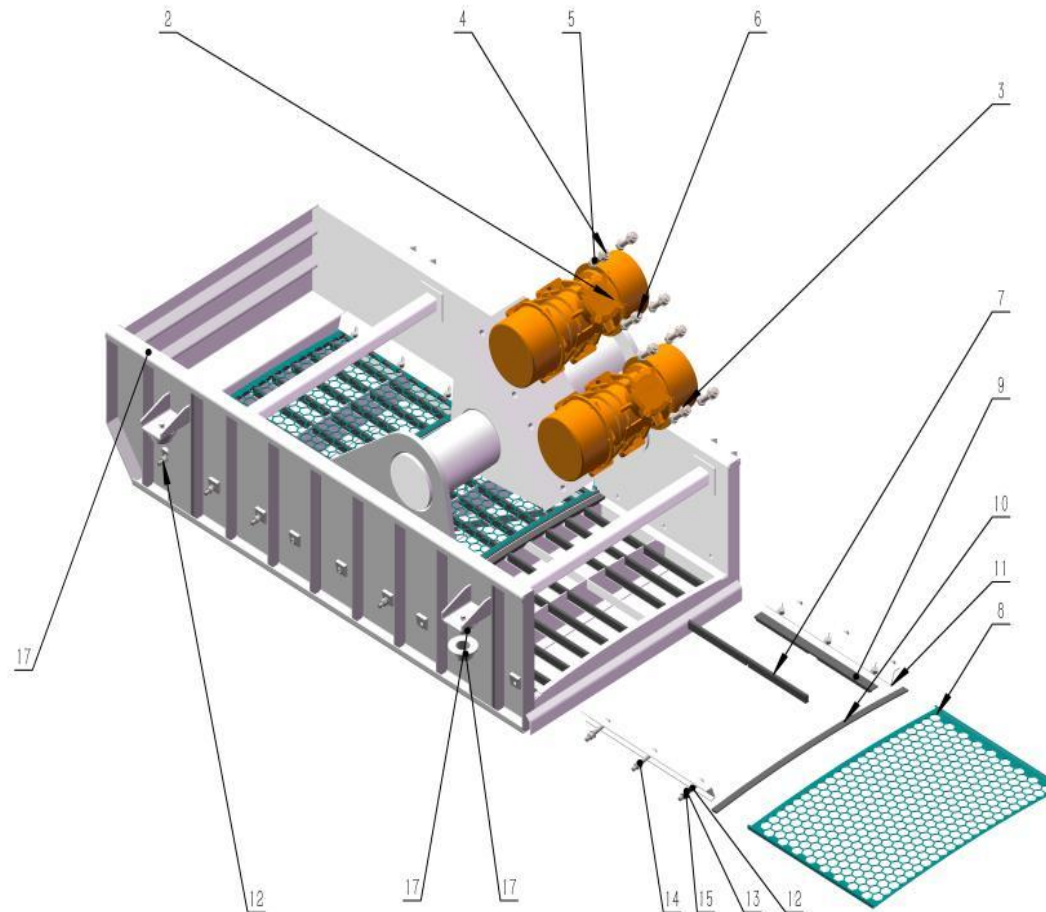


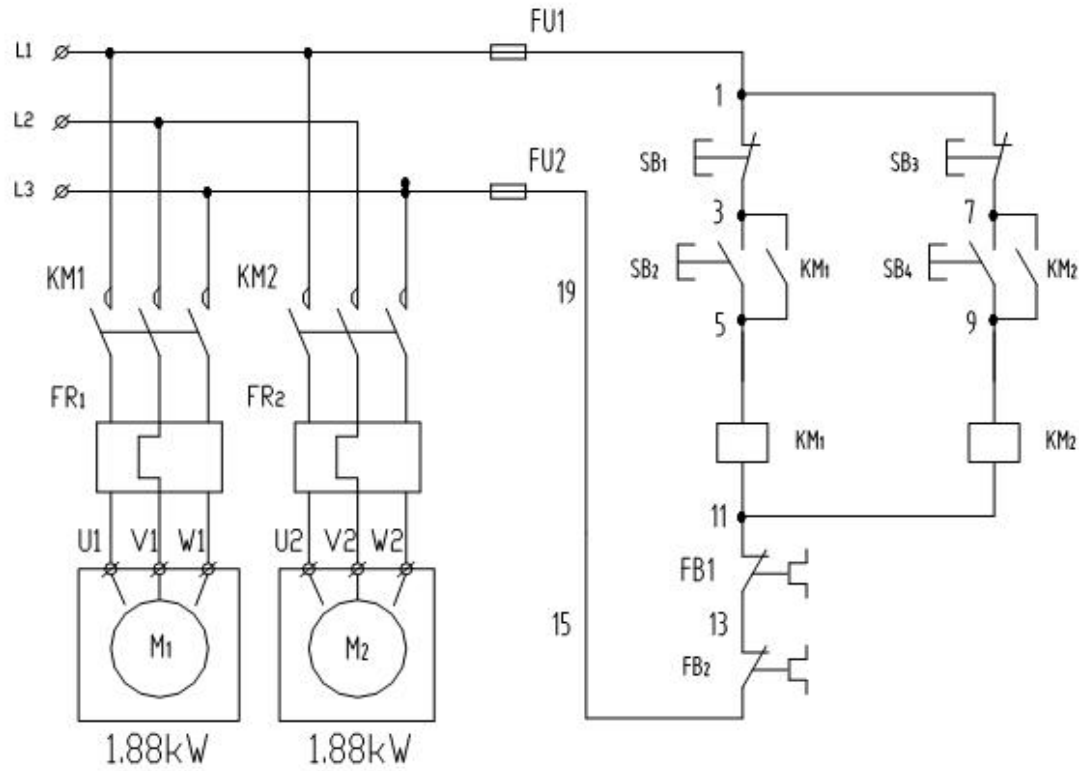
Fig 2 Exploded figure of vibrating sieve assembly



**List of the assembly exploded figure**

Serial No.	Part number	Code/specification	Name	Quantity
1	HZS001	ZS1301310000	Sieve box	1
2	HZS002	VBBX-38184-B	Fit out	2
3	HZS003	GB 93-1987 - 24	Spring washer	8
4	HZS004	GB-T 95-2002 - 24	Plain washer	8
5	HZS005	GB-T 5785-2000 - A M24X2X110-S	Hexagon head bolt	8
6	HZS006	GB-T 6185.1-2000 - B M24-S	All metal hexagon lock nut	8
7	HZS007	ZS1301300001	Adhesive strip	27
8	HZS008	ZS1301300006	Hard hook edge screen	3
9	HZS009	ZS1301300005	Longitudinal pad	6
10	HZS010	ZS1301300002	Transverse pad	6
11	HZS011	ZS1301320000	Hook body	6
12	HZS012	ZS1301300003	Tension bolt	13
13	HZS013	GB/T 849-1988	Spherical washer	18
14	HZS014	GB/T 93-1987	Elastic washer	18
15	HZS015	GB/T 6171-2016	Hexagon nut thin teeth	13
16	HZS016	/	Spring damper sleeve	4
17	HZS017	/	Rubber cover fixed seat	4

Fig 3 Electrical schematic



terminal	1	2	3	4	5	6	7	8	9	10
	L1	L2	L3	PE	15	17	17	19		

source

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