

# Shear Pump

*Directions For Installation And Operation*

HL Petroleum Equipment Co.,Ltd.

## 1. Introduction

The WJQ5 × 6J shear pump generation is uniquely designed pump for shearing polymers and clays.

To improve the drill fluid properties, the polymers or clays should be highly sheared before adding them to the drill fluid system. If not sheared, the polymers maybe jam the strainer and will result in losing amount of polymer and increasing drilling costs, and the large-size solids in the drill fluid will harden and difficult to clear away as well. The WJQ5 × 6J shear pump has proven best for applying the high shear necessary to hydrate polymers and clays and to their best properties. Using the WJQ5 × 6J shear pump reduces the bentonite clay needed by 33% or more and polymer needed by 15% or more. It also improve fluid loss and filter cake, builds gel strength, and low shear rate viscosity to better hold up solids. With reliable shaft seal structure and more convenient in operation and maintenance, it comes up to advanced world standards in the same products.

## 2. Principle of operation

The WJQ5 × 6J shear pump adopts a set of mechanical seal for no leakage at stuffing box. Inside pump is a 300 series stainless steel turbine containing 44 nozzles, four scoops and shear plate. Fifty percent of the fluid is sheared twice each time through the pump. This turbine shear pump is mounted on a special base with belts and sheaves to drive pump, OSHA type belt guard and a explosion proof U/L approved electric motor. Included is a special hopper(ZHP150) with nozzle sized for this application and one

mud kit as a package in order to build a complete shear and hydration system. The pump is designed to give longer service life through the improved shaft seal.

There are many principles of proper pump installation and application as well as special considerations for the pump design which, if followed, will further enhance the performance of your WJQ5×6J turbine shear pump.

This document will deal with both general and specific recommendations for improved WJQ5 × 6J turbine shear pump performance in both oilfield and industrial applications.

**Warning! This pump can not be used on active mud system since it will shear drill solids and barite. These solids will also damage pump very quickly.**

The principle sees figure 1.

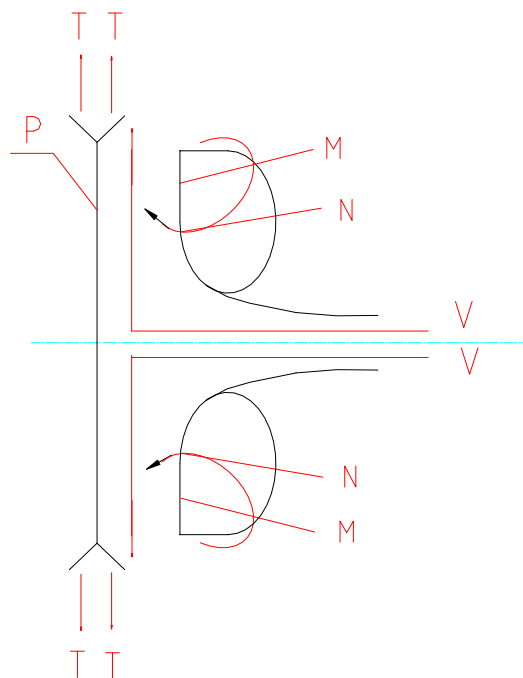
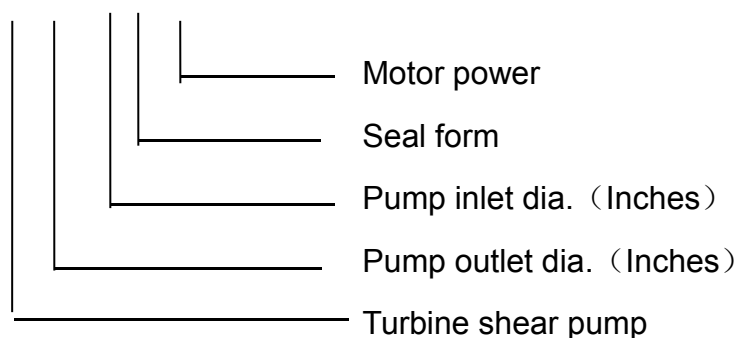


Figure 1 Principle diagram of WJQ5×6J shear pump

Fluid enters at “V” and is pumped parallel to the shear “P”. The chambers scoops 50% of the volume being pumped and jets that fluid through 44 nozzles “N” and impacts the shear plate “P” at very high velocity at “M” 90 degrees to the fluid entering the pump. The total fluid “V” and “N” travels down the shear plate to “T” where the fluid is further sheared due to the shape and speed of the plate tip.

### 3. Explanation of model

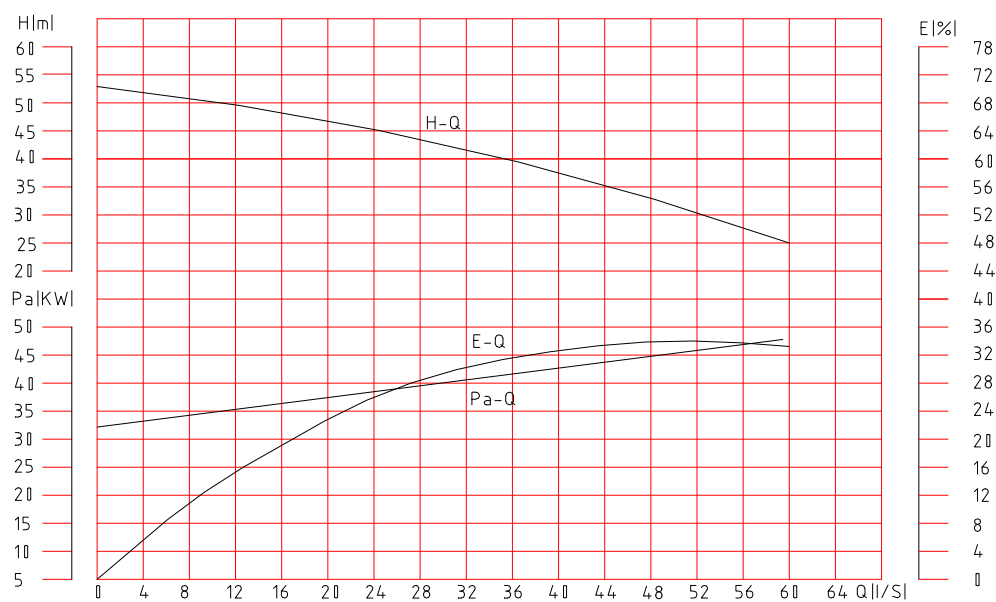
WJQ\_5 × 6 J-75kW



### 4. Performance Table

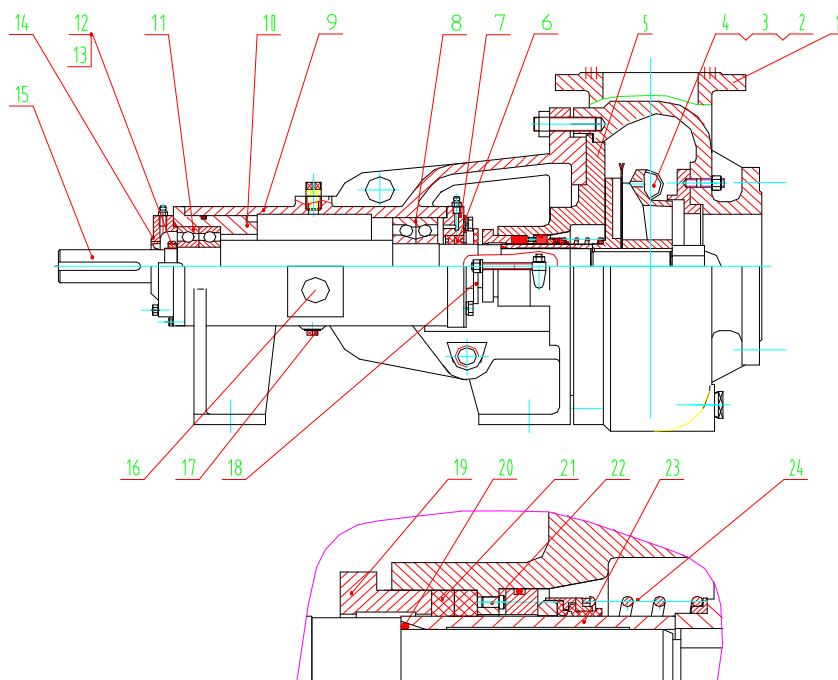
(Table 1)

Model	Capacity (m <sup>3</sup> /h)	Head (m)	Speed (r/min)	Efficiency (%)	NPSH (m)	Power(kW)	
						Shaft power	Motor power
WJQ5×6J-75kW	150	30	2150	28	3	46	75
WJQ5×6J-55kW	140	26	2050	28	3	35	55
WJQ5×6J-45kW	105	24	1750	28	2.8	25	45
WJQ5×6J-37kW	105	24	1750	28	2.8	25	37



**Fig.2 Performance curve:WJQ5×6J**

## 5. Structural drawing



- 1.Case 2.Impeller 3.Shear plate 4.Strengthening board 5.Cover of seal 6.Oil seal 7.Cover  
8.Bearing 9.Frame 10.Bearing housing 11. Bearing 12.Luck nut 13.Lock washer 14.Oil seal  
15.Shaft 16.Oil mark 17.Pipe plug 18.Mud throwing ring 19.Press plate assembly 20.O-ring  
21.Stuffing 22.Pin 23.Shaft sleeve 24.Machine seal

**Fig.3 Structural Drawing for WJQ5×6J Shear pump**

## 6. Guide to installation, operation and maintenance of the WJQ5×6J shear pump.

### 6.1 Foreword

The general problems to installation, operation and maintenance of the WJQ5×6J shear pump are introduced in the guide(for your information only), please contact our company for insolvable problems in this guide and will be replied in time.

### 6.2 Emphases

6.2.1 Operate the pump only in the performance range and service for which it was designed.

6.2.2 This pump employs mechanical seal as its primary seal and packing seal as its secondary seal. Packing seal can be compacted only when mechanical seal is disabled. Otherwise, the seal may be damaged.

6.2.3 No-load running time of the pump cannot exceed 5s. The pump must run under the condition of being filled with liquid slurry. Otherwise, the mechanical seal may be damaged.

### 6.3 Installation

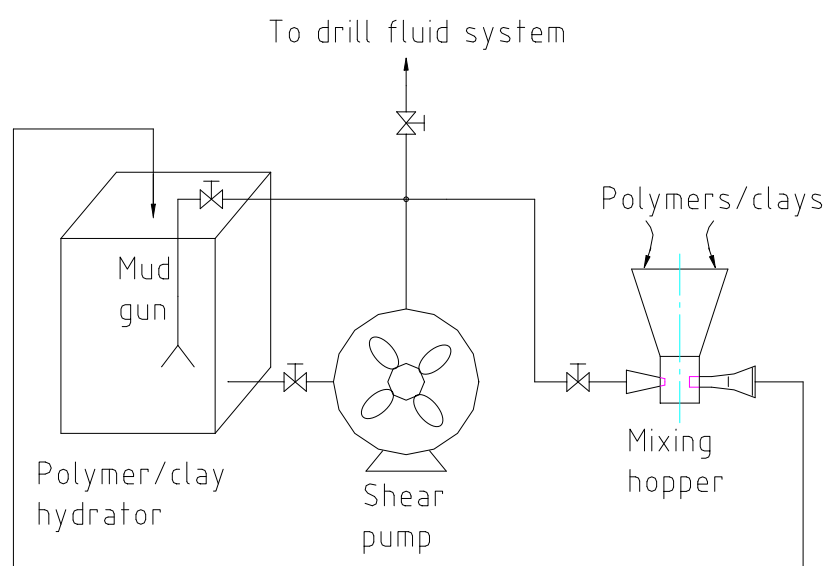
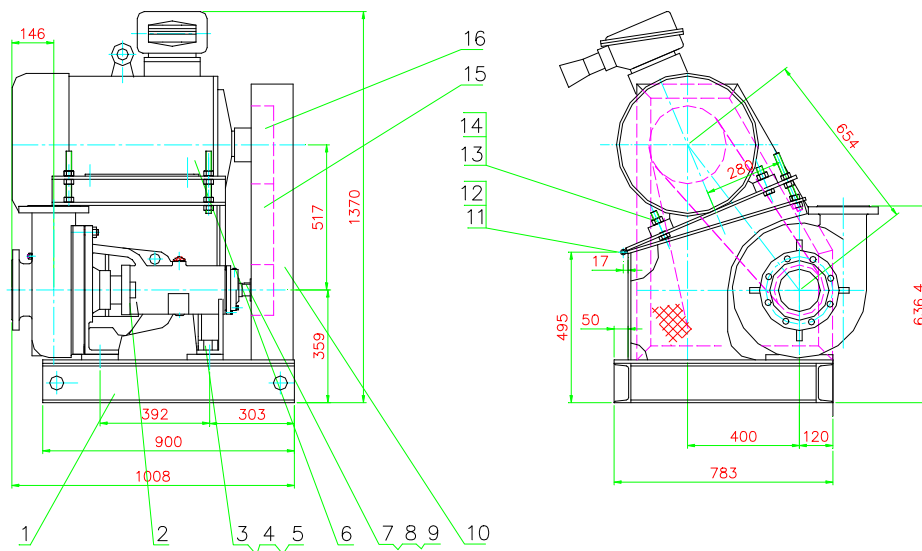


Fig.4 Flow diagram of WJQ5×6J shear pump installation system

The shear pump system is formed by shear pump, mixing hopper, pipeline and polymer/clay hydrator. For installation and transportation, the polymer/clay hydrator is formed by a separate compartment.



1.Base-plate 2.Shear pump 3.Bolt 4.Washer 5.Nut 6.Motor 7.Key 8. Distended sheath  
9. Pump pulley 10.Shield cover 11.Pin 12.Split pin 13.Bolt 14.Nut 15.V-belt 16.Motor pulley

Fig.5 WJQ5×6J Shear pump Sketch

Flange Dimensions (mm) (Table 2)

Flange	DN	D	d	b (mm)	n-d
Discharge Flange	125	250	210	26	8 -Φ17.5
Suction Flange	152	285	240	26	8 -Φ22

**Note:** DN-Flange inside dia., D-Flange outside dia., d-Dia.of bolt circle, b-Flange thickness, n-d—No.& size of bolt holes.

### 6.3.1 Pump installation

The pump should be located near the liquid source so that the suction line can be short and reduce losses. The foundation should be sufficiently

rigid and substantial to absorb any vibration and support the base plate at all points. The base plate should be installed in a level position.

#### 6.3.2 Pulley installation

A. The axes of two pulleys must be parallel to each other and the end surface error can not exceed 2 mm.

B. The belts should be aligned and tightened.

C. The electric motor must be mounted stably.

#### 6.3.3 Connection of suction pipes

A. The suction line should be equal to or larger than the pump suction.

B. The capacity of a centrifugal pump should never be adjusted by throttling the suction line, but a positive shut-off valve of a type to cause minimal turbulence should be installed in the suction line to permit the closing of the line for removal of the pump for inspection and maintenance.

C. The suction line should be designed to eliminate any air pockets. The pipes should gradually slope downwards to the supply source to eliminate air pockets. Please use a vacuum pump or foot valve for priming if you operate the pump the pump under the condition of suction lift.

D. The suction line should have a straight section into the pump of a length equivalent to at least two times its diameter.

E. For temporary hook-up when flexible hose is used, a non-collapsing hose is essential since the suction line pressure is often below atmospheric pressure. A collapsed suction line will result in below average or complete loss of flow.

#### 6.3.4 Discharge pipes

A. A positive shut-off valve should be located in the discharge pipe to permit the closing the line for removal of the pump for inspection and maintenance.

B. All pipes(including suction pipes) should be independently supported and accurately aligned. The pump must not support the weight of pipe or



compensate for misalignment.

C. If operating conditions are not known with sufficient accuracy, it will be necessary to provide a throttle valve in the discharge line to ensure that the pump operates at the design point.

D. If the pump is connected to a pressurized system, it is important to install a check valve between the discharge and the throttling valve. The check valve will prevent back flow through the pump. Back flow may cause the impeller to become loose on the shaft. A loose impeller will likely lead to mechanic damaged and fluid leakage beneath the shaft sleeve.

## 6.4 Operation

### 6.4.1 Preparation

A. Pump rotates freely by hand.

B. Check the pump rotate direction, the correct direction can be found by an arrow on the casing.

C. Open the suction valve fully.

D. Pump and suction line full of fluid for venting air.

### 6.4.2 Operation for running

Start the motor after finishing all the preparations.

### 6.4.3 Lubrication

A. Bearings lubrication

a. Add a good grade of 30# weight motor oil until the middle level of dipstick. Do not overfill the oil. High levels nay cause churning and overheating of the bearings. Oil should be changed every 90 days or 1000 hours.

b. Under the special condition, you may select a grease which can dissolve with the motor oil for lubrication.

## 6.5 Maintenance (Reference to figure 3 and table 2)

A. Disassembly:

a. Remove the pulley kit.

- b. Remove the Pressing board.
- c. Remove the pump case.
- d. Remove impeller, shear plate and Strengthening board : Screw the left-hanged nuts off use a wrench (Restrain the shaft at the pulley end to prevent rotation, If you do not have a wrench). Put a block of wood against the ribs of turbine and hit the wooden block with a hammer to withdraw the impeller.
- e. Remove reinforce sleeve and mechanical seal.
- f. Withdraw cover of seal.
- g. Remove the shaft sleeve. A wedge may be driven between the end of the sleeve and the shoulder of the shaft to free the sleeve.
- h. Remove the blocking mud ring.
- i. Remove left right cover.
- j. Pull the complete shaft and bearing subassembly from the frame.
- k. Remove the lock nut and the lock-washer.
- l. Remove the bearing frame and bearings from the shaft. **Note:** Impacting of the entire shaft assembly against a board on the ground will remove the bearing assembly.
- m. The bearing may now be pressed off the shaft. **Note:** A piece of 3" standard wall pipe slipped over the shaft and impacted against the inner race of the bearing works exceptionally well.

#### B. Inspection

- a. Impeller: Replace if the impeller shows excessive erosion, corrosion, extreme wear, or vane breakage.
- b. Shaft: Check for run-out to see that the shaft has not been bent. If run-out exceeds 0.05mm, replace the shaft. Bearing seats and oil seal area must be smooth and free of scratches or grooves. Shaft threads must be in good condition. Replace shaft, if necessary.
- c. Shaft sleeve: Sleeve surface in the stuffing box must be smooth and

free of grooves. If grooved, replace it.

d. Oil seal: The removed oil seal must be replaced.

e. Ball bearings: Replace if worn, loose, or rough and noisy when rotated. New bearings should not be unwrapped until ready for use replacement bearings must be of the proper size and type as supplied with the original equipment.

f. Seal O-ring: It is recommended that all O-ring and gasket seals should be removed during disassembly and replaced. In those cases ones can be reused if they are not worn or otherwise damaged.

#### C. Assembly (reference to attached A)

a. All parts should be clean before assembly. This is especially important for O-ring grooves, threads, gasket surfaces, bearings and bearings surfaces. Any burrs should be removed with crocus cloth.

b. Firstly slip the bearings onto the shaft. The two bearings are to be mounted back-to-back (that is, the sides of the bearings with the manufacturer's name and the bearing number are placed together), with lock-washer in place tighten locknut with the bevel positioned against the bearings tighten the locknut to 346N. M of torque. Then, put the shaft with bearings into the frame from left and slip the bearing onto the shaft from right of frame.

c. The sleeved area of the shaft must be lightly coated with anti-seized compound before installing the sleeve.

d. Install the impeller. The clearance between the back of impeller and protecting plate is 0.6mm.

e. With the packing gland in position, swing the gland bolts into place. Initially tighten the gland hard to compress the packing. Then back off the gland bolts and retighten only finger tight. **Caution:** Tighten the gland against the packing finger tight only If packing is over-tightened it may be burned when the pump is started.

f. Assembly can be proceeded as the opposite sequence of disassembly. The pump rotates freely by hand after assembly. If not free, adjust the shaft assembly by loosening or tightening the bolt /nut.

**Note:** In spite of adjust the shaft to left or right, the bolt /nut must be tighten to prevent the shaft move after adjusting complete.

#### D. Failures and shooting

a. The shaft sleeve surface have been seriously worn.

——Remove the packing. Bend a wire with 90 degrees and pull it down the sleeve surface and renew the shaft sleeve if grooved.

b. The polyurethane lip seal's excessive erosion may result in excessive leakage.

——Replace it.

Usually renew the polyurethane lip seal located at the shaft seal and shaft sleeve once per 3-6 month operation.

c. Packing burning

——Reason: Over-tightened packing cause overheating.

——Shooting: renew the packing and properly loosen the packing gland nuts.

d. Unusual rotation of impeller/auxiliary impeller

——Reason: The clearance between the protecting plate and back of impeller is too little, and that between the auxiliary impeller and protecting plate/stuffing box as well.

——Shooting: Adjust the clearances by the bolt and nut .

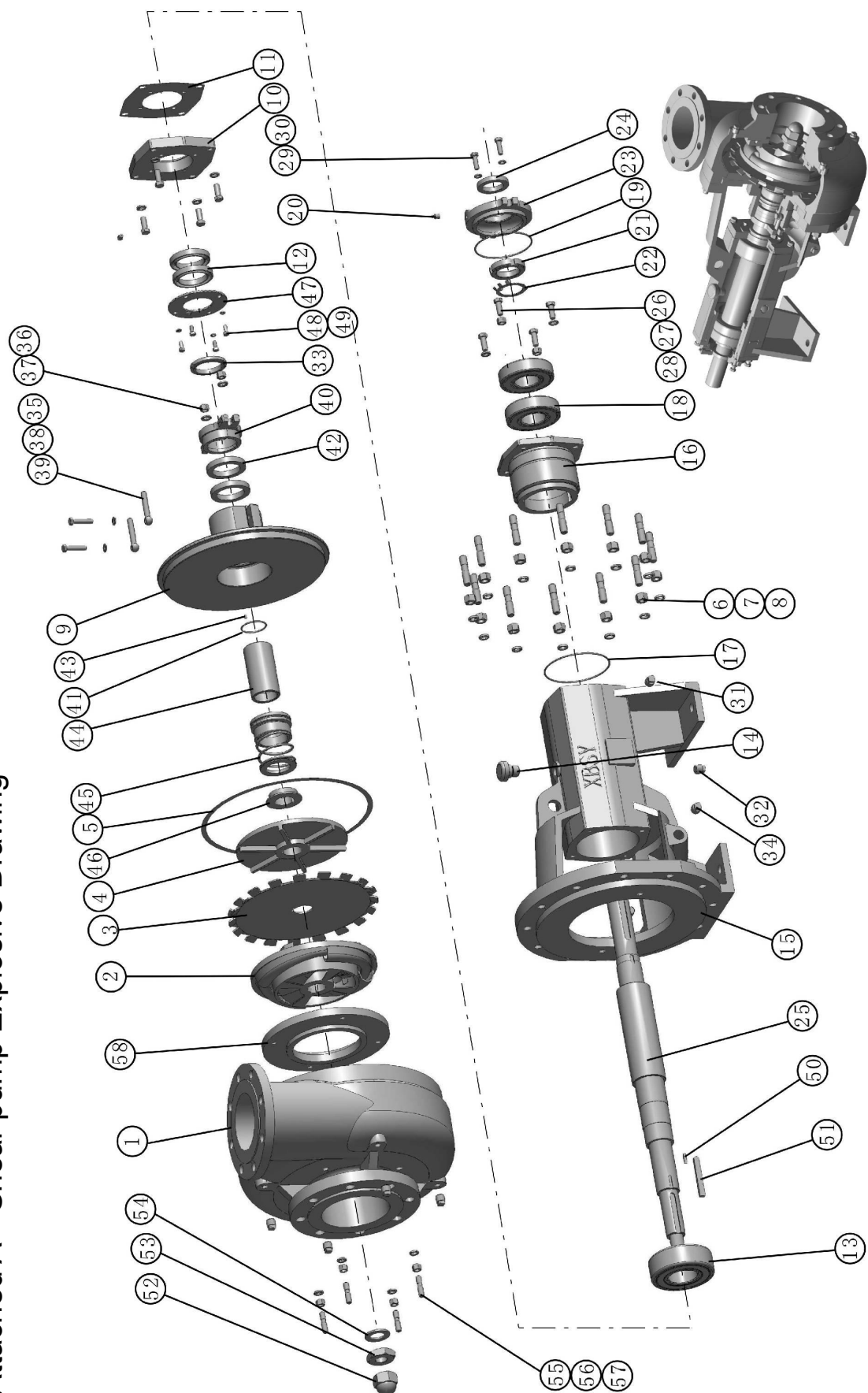
e. The WJQ5×6J shear pump's common failures and shooting list see table 3.

## WJQ5×6J shear pump's common failures and shooting list

( Table 3 )

Item No.	Reason	Method of shooting
1.Exceeding shaft power.	<ol style="list-style-type: none"> <li>1. The impeller fractionates the end face of pump casing, the sleeve or auxiliary impeller.</li> <li>2. The pump works under the condition of than the designed head.</li> <li>3. The packing is over-tightened.</li> <li>4. The belts slips.</li> </ol>	<ol style="list-style-type: none"> <li>1. Adjust the clearances.</li> <li>2. Inspect the complete machine and properly close the delivery valve for the pump to operate at the design point.</li> <li>3. Readjust the locking force of gland.</li> <li>4. Re-tighten them(check the two pulleys installation position).</li> </ol>
2.Fall in head and capacity.	<ol style="list-style-type: none"> <li>1. Big particle jams the suction pipe and flowing channel of impeller.</li> <li>2. Fall in speed.</li> <li>3. The impeller is worn.</li> <li>4. Too much clearance between the impeller and end face of pump casing and the increased leakage.</li> <li>5. The opening degree of inlet valve is little.</li> </ol>	<ol style="list-style-type: none"> <li>1. Clear away the jamming object.</li> <li>2. Operate the pump at the rated speed.</li> <li>3. Renew the impeller.</li> <li>4. Adjust the impeller.</li> <li>5. Increase it.</li> </ol>
3.The bearing is overhead.	<ol style="list-style-type: none"> <li>1. The lubricant is too much or little.</li> <li>2. There is impurity in the lubricant.</li> <li>3. The bearing is worn.</li> </ol>	<ol style="list-style-type: none"> <li>1. Keep the surface oil at the limited lever of the dipstick.</li> <li>2. Change of the lubricating grease.</li> <li>3. Renew the bearing.</li> </ol>
4.The pump produces vibration and unusual noise.	<ol style="list-style-type: none"> <li>1. The impeller is worn and non-equilibrium.</li> <li>2. The bearing is worn.</li> <li>3. The connection is loose.</li> <li>4. The pump occurs cavitation.</li> </ol>	<ol style="list-style-type: none"> <li>1. Renew it.</li> <li>2. Replace.</li> <li>3. Tighten the loosened locations.</li> <li>4. Improve the suction condition to prevent air from getting into the pump.</li> </ol>
5.The leakage is excessive when stopping the pump.	<ol style="list-style-type: none"> <li>1. The seal is over-worn.</li> <li>2. The shaft sleeve is extremely worn.</li> <li>3. The packing is extremely worn.</li> </ol>	<ol style="list-style-type: none"> <li>1. Renew.</li> <li>2. Replace the sleeve.</li> <li>3. Renew.</li> </ol>

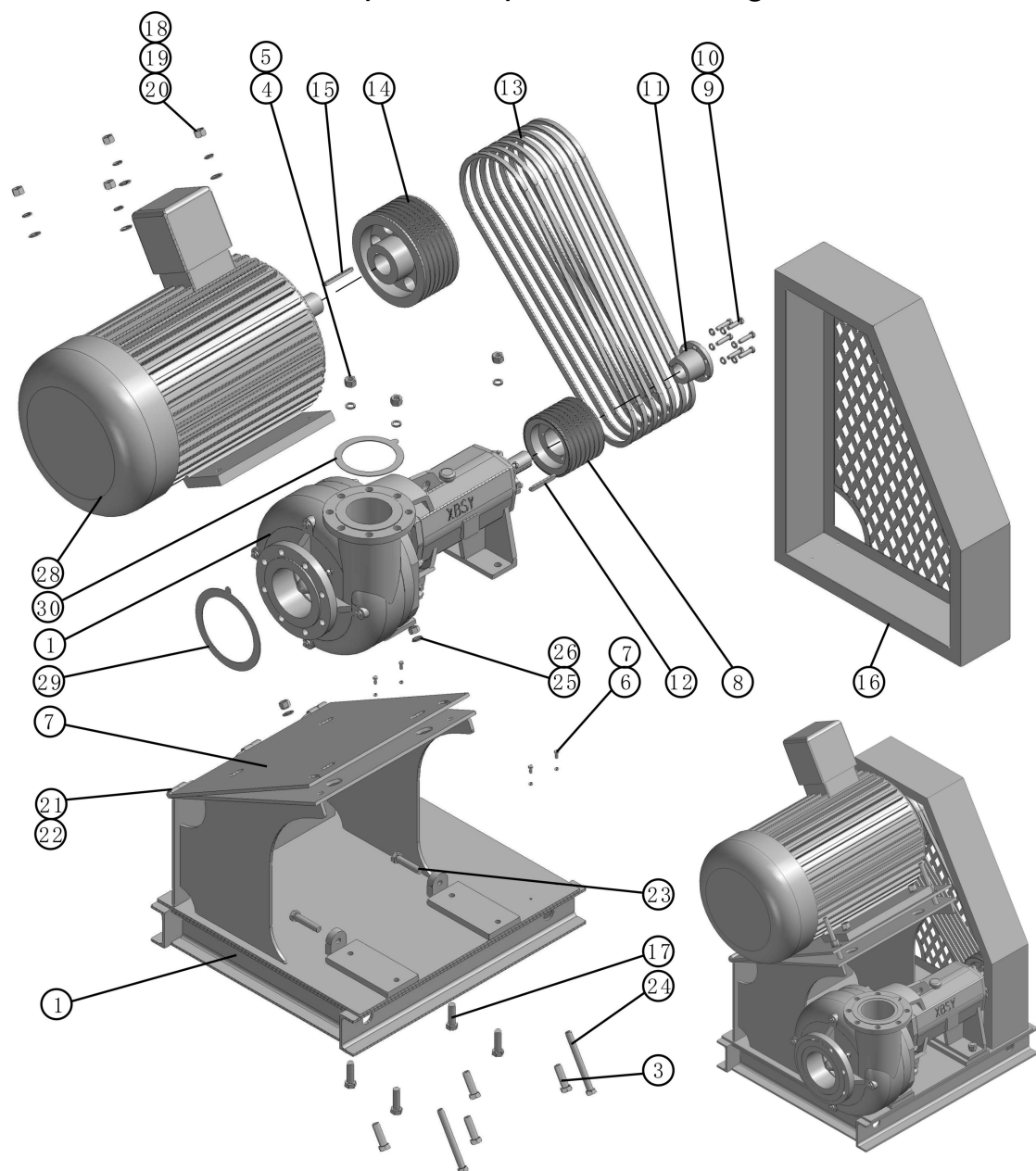
Attached A Shear pump Explosive Drawing



Part list(Shear pump Explosive Drawing)

Item No.	Name	Part No.	QTY.	Item No.	Name	Part No.	QTY.
1	Pump case	WJQ56J0001	1	30	Spring gasket	WJQ56J0030	4
2	Impeller set	WJQ56J0002	1	31	Oil mark	WJQ56J0031	1
3	Shear plate	WJQ56J0003	1	32	Plug	WJQ56J0032	5
4	Strengthening board	WJQ56J0004	1	33	Defector	WJQ56J0033	1
5	Paper gasket	WJQ56J0005	1	34	Plug	WJQ56J0034	1
6	Stud	WJQ56J0006	12	35	Gland bolts	WJQ56J0035	2
7	Nut	WJQ56J0007	12	36	Nut	WJQ56J0036	2
8	Spring gasket	WJQ56J0008	12	37	Washer	WJQ56J0037	2
9	Cover of seal	WJQ56J0009	1	38	Bolts	WJQ56J0038	2
10	Cover inboard	WJQ56J0010	1	39	Washer	WJQ56J0039	2
11	Paper cover	WJQ56J0011	1	40	Packing gland set	WJQ56J0040	1
12	Oil seal	WJQ56J0012	2	41	O-ring	WJQ56J0041	1
13	Bearing	WJQ56J0013	2	42	Packing	WJQ56J0042	2
14	Oil hole cover	WJQ56J0014	1	43	Pin	WJQ56J0043	1
15	Pump base	WJQ56J0015	1	44	Sleeve, shaft	WJQ56J0044	1
16	Bearing house	WJQ56J0016	1	45	Mechanical seal	WJQ56J0045	1
17	O-ring	WJQ56J0017	1	46	Reinforce sleeve	WJQ56J0046	1
18	Bearing	WJQ56J0018	2	47	Cover	WJQ56J0047	1
19	O-ring	WJQ56J0019	1	48	Bolt	WJQ56J0048	4
20	Grease fitting	WJQ56J0020	2	49	Spring gasket	WJQ56J0049	4
21	Round nuts	WJQ56J0021	1	50	Key	WJQ56J0050	1
22	Lockwasher	WJQ56J0022	1	51	Key	WJQ56J0051	1
23	Cover outboard	WJQ56J0023	1	52	Domed cap nuts	WJQ56J0052	1
24	O-ring	WJQ56J0024	1	53	Nut	WJQ56J0053	1
25	Shaft	WJQ56J0025	1	54	Washer	WJQ56J0054	1
26	Bolt	WJQ56J0026	8	55	Double head studs	WJQ56J0055	4
27	Nut	WJQ56J0027	4	56	Nut	WJQ56J0056	4
28	Spring gasket	WJQ56J0028	6	57	Spring gasket	WJQ56J0057	4
29	Bolt	WJQ56J0029	4	58	Front protecting board	WJQ56J0058	1

## Attached B Shear Pump Set Explosive Drawing





## Part list(Shear Pump Set Explosive Drawing)

Item No.	Name	Part No.	QTY.	Item No.	Name	Part No.	QTY.
1	Pump head	WJQ56J0001S	1	16	Shield cover	WJQ56J0016S	1
2	Foundation	WJQ56J0002S	1	17	Bolt	WJQ56J0017S	4
3	Bolt	WJQ56J0003S	4	18	Nut	WJQ56J0018S	4
4	Nut	WJQ56J0004S	4	19	Spring gasket	WJQ56J0019S	4
5	Spring gasket	WJQ56J0005S	4	20	Washer	WJQ56J0020S	4
6	Bolt	WJQ56J0006S	4	21	Pin	WJQ56J0021S	3
7	Nut	WJQ56J0007S	4	22	Split pin	WJQ56J0022S	3
8	Pump pulley	WJQ56J0008S	1	23	Bolt	WJQ56J0023S	2
9	Bolt	WJQ56J0009S	3	24	Bolt	WJQ56J0024S	2
10	Spring gasket	WJQ56J0010S	3	25	Nut	WJQ56J0025S	8
11	Distended sheath	WJQ56J0011S	1	26	Spring gasket	WJQ56J0026S	4
12	Key	WJQ56J0012S	1	27	Motor base	WJQ56J0027S	1
13	V-belt	WJQ56J0013S	4	28	Motor	WJQ56J0028S	1
14	Motor pulley	WJQ56J0014S	1	29	Suction rubber pad	WJQ56J0029S	1
15	Key	WJQ56J0015S	1	30	Discharge rubber pad	WJQ56J0030S	1

## Attached C Shear Pump Spare part List Of Stochastic WJQ5× 6J Spare Part List Of Stochastic

Item	Name	Model & specifications	Unit	Qty
1	Mechanical seal	WJQ56J	Set	1
2	Oil seal	63.5×88.8×12	EA	2
3	Oil seal	47.6×69.9×10	EA	1
4	Packing ring		Kg	0.5
5	Suction & discharge rubber	Φ150,Φ125	EA	Apiece 1
6	Oil mouth		EA	2
7	Oil lens		EA	1

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