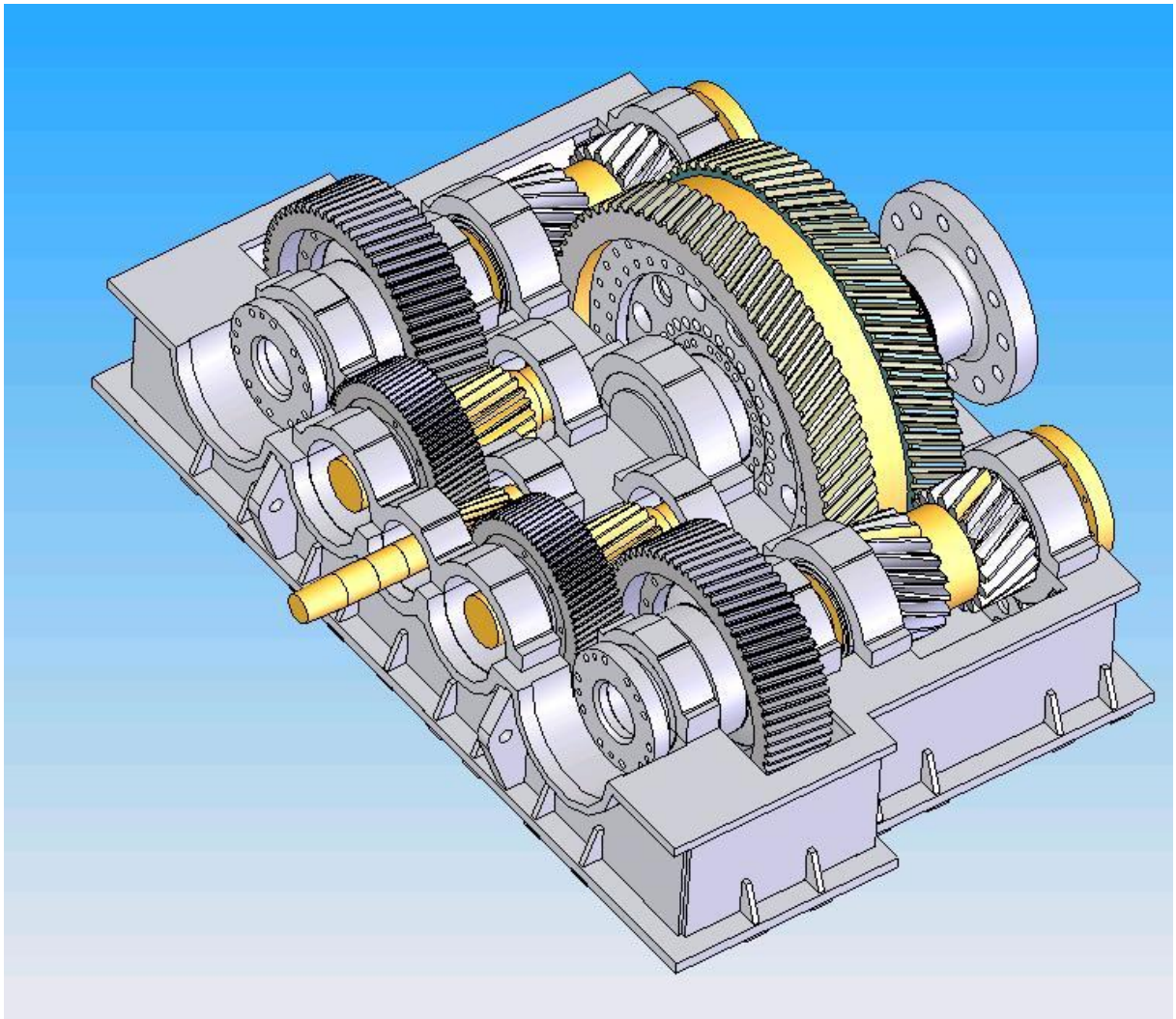
INSTALLATION & MAINTENANCE MANUAL FOR JST SERIES REDUCER



CSSC

重慶齒輪箱有限責任公司

CHONGQING GEARBOX CO.,LTD

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Introduction

JST Series Centrally-driving Mill Reducer consists of four parts, reducer, low-speed driving unit, diaphragm coupling and oil lubrication system. It is mainly used for reduction of centrally-driving tube mill in cement industry and also can be used as driving equipment.

The installation in site of the main reducer and the relevant equipments should be in accordance with this manual, the Rules of Installation & Acceptance for Cement Mechanical Equipment, issued by the State Instruction Bureau, and the commission engineers' comments and decision as well.

The construction of the workshop is mainly based on the local situation and the climate condition. The min. ambient temperature and the max. permitted noise in the mill shop should also be considered. The dust must not directly accumulate on the reducer and there should have enough space for maintenance.

The reducer and the parts should be installed as soon as possible after receiving. Otherwise it should be stored in the damp-proof stock and be coated with rust preventive oil after one year's storage. Before opening the package, check the parts according to the packing list or parts list. Necessary material and tools should be prepared for installation. (See Fig.-1)

In order to ensure the smoothly going of the erection, the tools and instruments, suitable transportation and lifting equipments must be prepared. It is recommended to use movable crane.

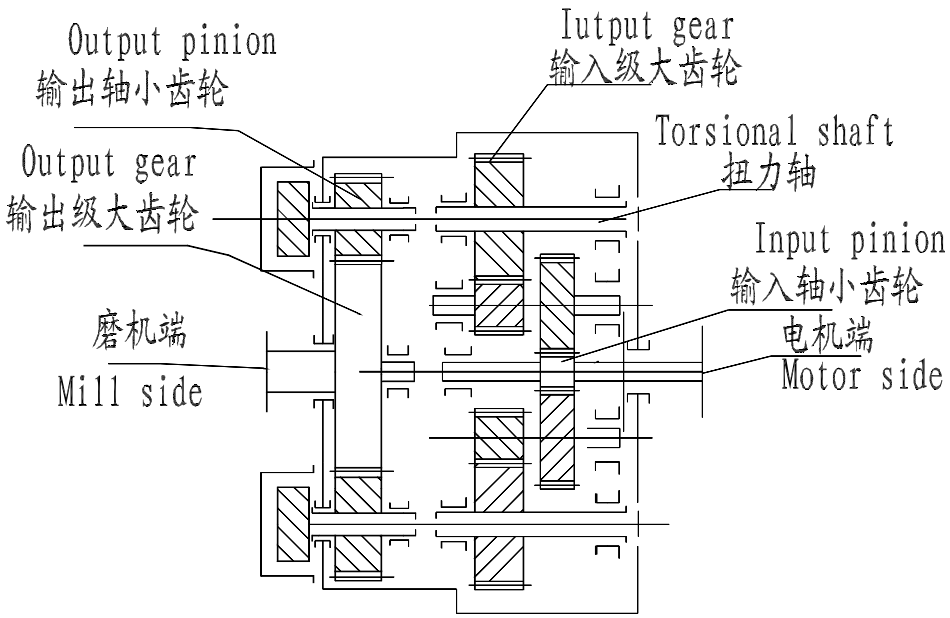
Before installation, study the foundation drawing, assembly drawing and the outline drawing, understand the installation procedure and carefully check the shape, quality, quantity and dimension of all parts, Check if the crane capacity satisfies the requirements. Clean the site to keep it clean and tidy.

MAINREDUCER

1. Generals

JST Series Reducer is designed as centrally driving, double power splitting, even loading with torsional shaft, three-stage reduction and symmetrical construction. (See Fig.1-1)

Fig 1-1



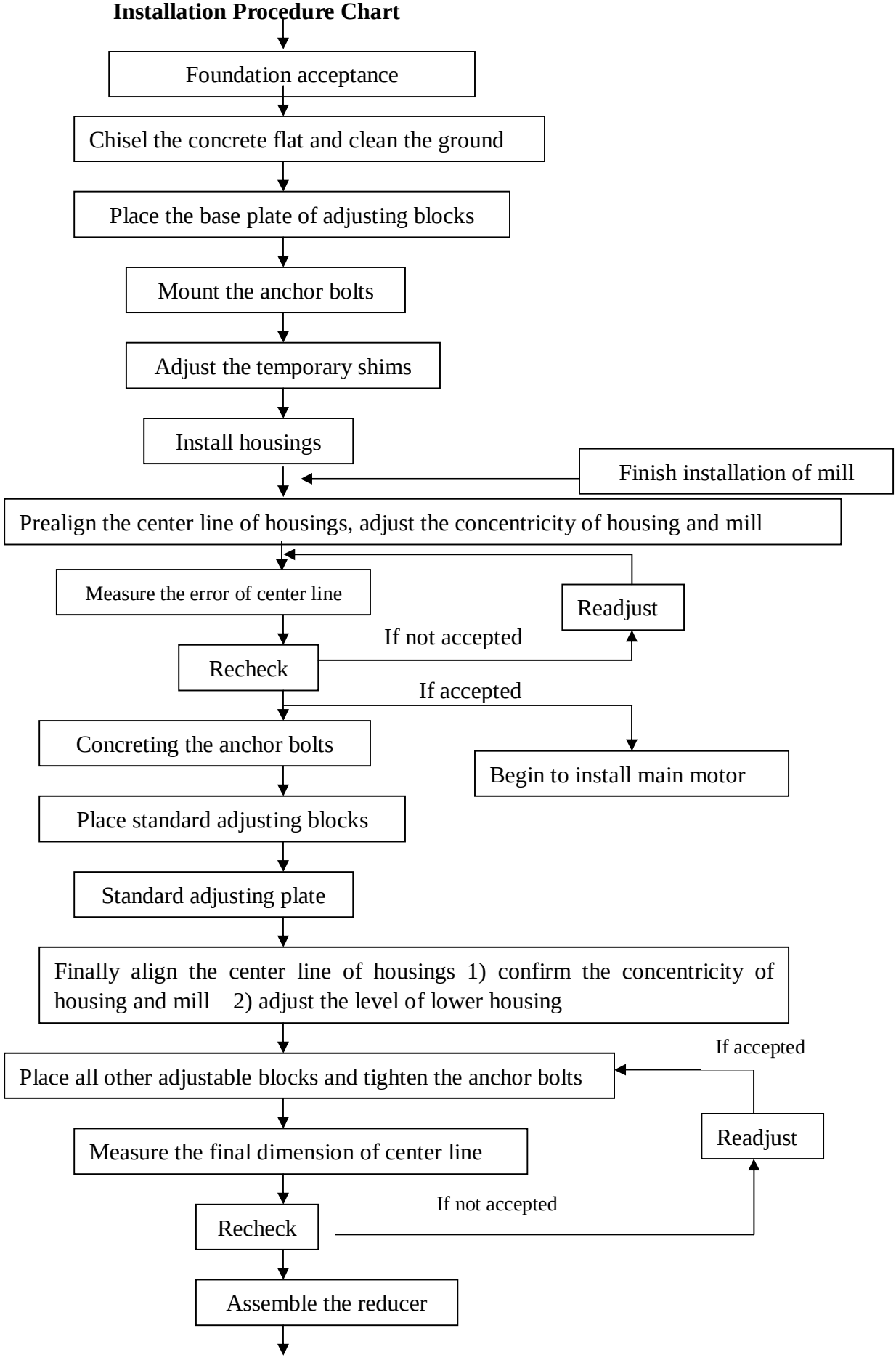
2. Technical Data of the Main Reducer

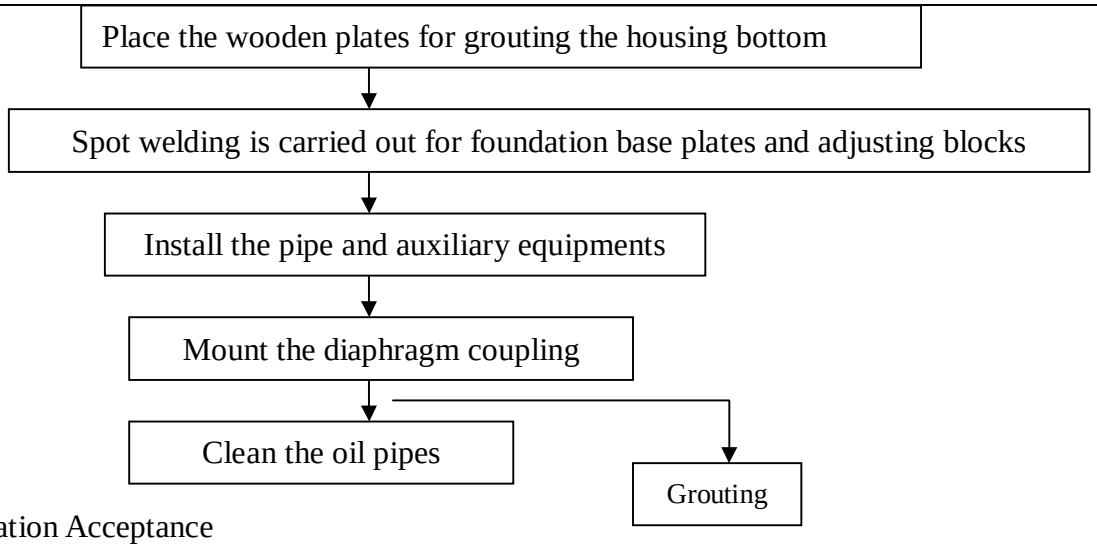
Transmission Power: see contract or technical agreement
Input Speed: see contract or technical agreement
Output Speed: see contract or technical agreement
Ratio: see contract or technical agreement
Center Distance: see contract or technical agreement
Gear Accuracy: grade 6 or better, GB10095
Surface Hardness: HRC60±2
Tooth Contract Pattern: length and height not less than 85% at rated load
Noise:≤90db (A) at idle running
Lubrication Oil Brand: Industrial Closed Gear Oil N320 or N220

3 Installation Procedure of the Main Reducer

The installation of the large-size reducer varies from different structures. JST series reducer is divided into housing, output shaft parts, 2nd gear wheel, torsional shaft, transmission shaft, diaphragm coupling, etc. to shipping due to limitation of transportation condition. The actual installation procedure varies with the whole workshop′s construction and condition. As the manufacturer, we recommend the following installation procedures for the customers:

Installation Procedure Chart





Foundation Acceptance

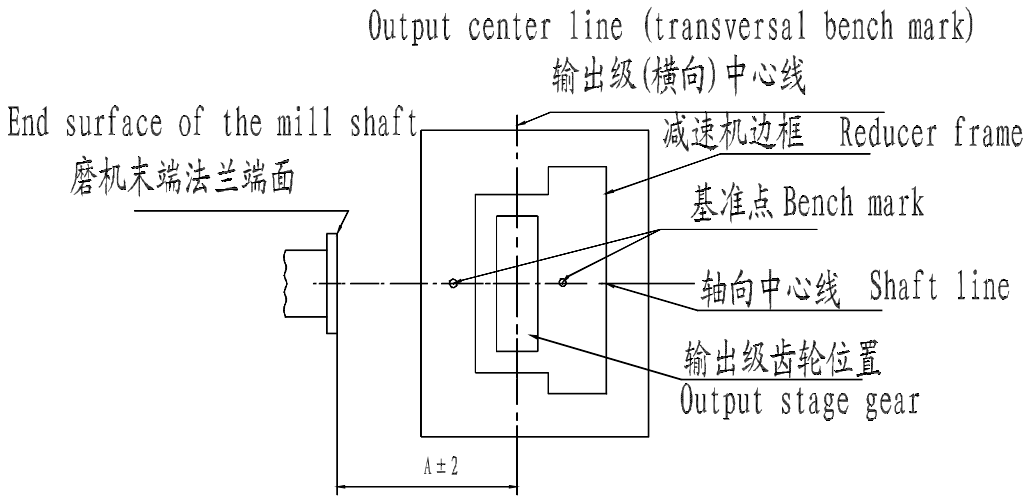
3.1.1 Foundation acceptance is to be done according to the rules 1.3.1 of the standard JCJ1.3-90

3.1.2 Indicate the reference mark of the shaft line on the set position of the foundation surface. Check if the distance between the end surface of the pipe flange and the output stage gear center line satisfy the design requirements. (SEE fig.1-2) The “A” in the drawing is shown in the foundation sketch.

3.1.3 The location & depth of the anchor bolts shall be in accordance with the foundation drawing.

3.1.4 The installation foundation height of the reducer shall be in compliance with the design requirements.

Fig 1-2



3.2 Installation of the Lower Housing

Install the reducer after completing the erection of the mill.

Check the mill′ s level and pipe flange. The shaft journals on both sides of the mill should be in the same level and the relative height difference should be within 1mm. Then check if the

assembly of the transmission tube satisfies the requirements. Then turn the mill to measure the end run-out and radial error of the transmission flange and take records at the same time. The above work is very important, otherwise it will affect the centering of the reducer or even the whole installation. After unpacking the lower housing, lift the gear outside of the housing and put it in a safe place. Some necessary tools and material required for installing and debugging are seen in attached table 1.

3.2.1 Deburr all the base surface where the adjustable blocks are set. Clean the scraps, water or other foreign matters in the ground and the anchor bolts holes. Fill the near ground to level and make it strong.

3.2.2 Mount anchor bolts. Fix a iron wire on the heads of the anchor bolts so as to put it into the holes in the housing . Remove the rust and grease from the bolt, and the thread portion is to be coated with rust preventive oil.

3.2.3 Remove the oil sealer from the adjustable block, grease the thread parts. Place the four temporary adjustable blocks and five ones between the both grooves according to the Fig.1-3. The dimension H of the upper surface of the blocks refers to the formula. (See Fig.1-4)

3.2.4 Put the output oil sump in the groove upwards. Keep the rubber asbestos gasket in good condition

3.2.5 Lift the lower housing and place it on the temporary adjustable blocks, make the center line coincide with the bench mark. At the same time, make the distance between the 2nd center line and the end surface of the mill shaft (A in Feg.1-5) the same as A which is indicated in the foundation sketch.

3.2.6 Adjust the level of the upper surface. Make rough alignment through the four temporary adjustable blocks, level blocks, straight scale and water level. The allowed error between the actual value and the Ex-work measurement result for the upper surface level of the lower housing shall be within ±0.1mm. (See enclosed table 3)

Fig 1-3

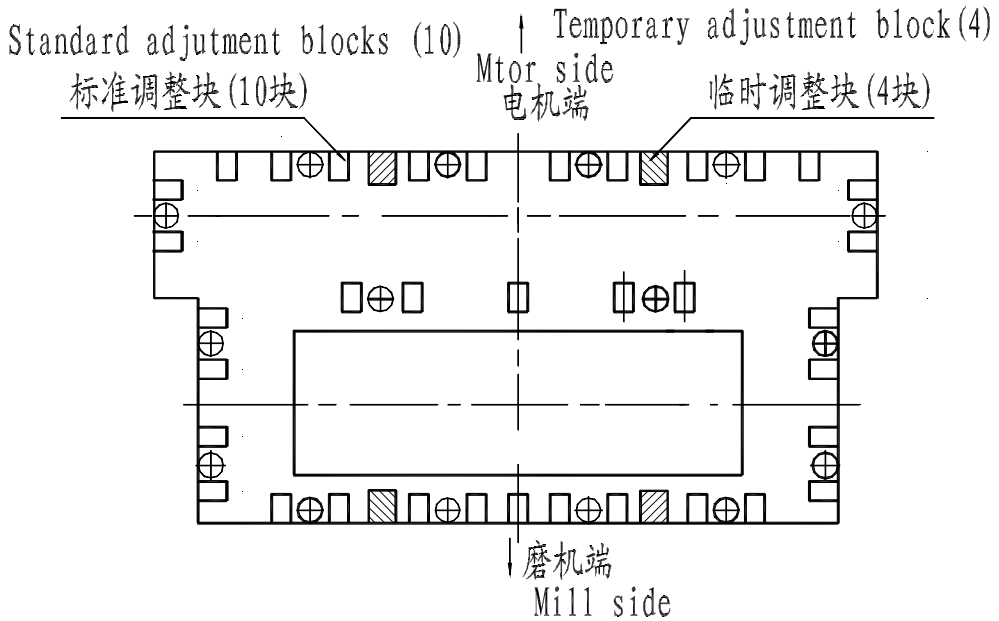
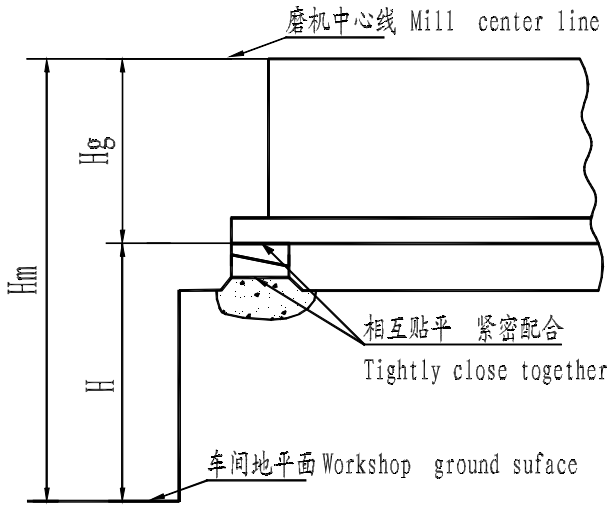


Fig 1-4



H=Hm-Hj-(0.4-0.4)mm

式中: Hm-磨机中心高 Height of mill center

Hj-减速机下箱体高 Height of lower housing

3.2.7 Roughly adjust the coaxiality of the mill and the reducer center line. Assemble the flange of the diaphragm coupling on the output shaft and them mount on the lower housing. According to fig1-7, mount a support on the shaft flange of mill and install a dial gauge on it. Then turn the mill manually (as same as the working direction) to make rough aligning and the error range is according to table 1-1. Measure the outside diameter and the end surface run-out with dial gauge (two dial gauges might be fixed for measuring at the same time.) Ageing and deformation might occur during alignment. Do not be anxious to get the result and a longer time might be needed.

Table 1-1

	Coaxiality Error	End Face Error
Rough alignment	A= ϕ 0.5mm	B=1mm
Finish alignment	A= ϕ 0.3mm	B=0.7mm

3.2.8 The concreting of the anchor bolt should comply with the standard 1.4.4 of JCJ03-90A)

3.2.8.1 As shown in the fig.1-8, fix the anchor bolts vertically on the center line of the holes for the bolts holes of housing. In order to avoid deviate, put a distance ring made of steel sheet (σ =2) between the bolt and the housing hole. Take it out after concreting.

3.2.8.2 The proportion of the ingredients for the mortar should be decided by the construction engineer. Cement #525 is to be used. Pour within 30 minutes after mixing. Make sure it is fully filled inside. The concrete strength is C30, and the height should be slightly lower than the base surface.

Fig 1-5

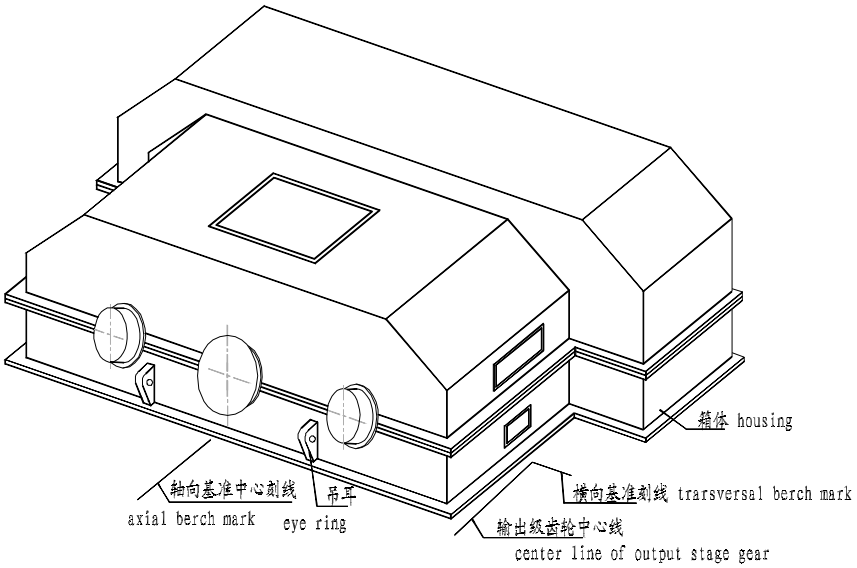


图 1-5

Fig 1-6

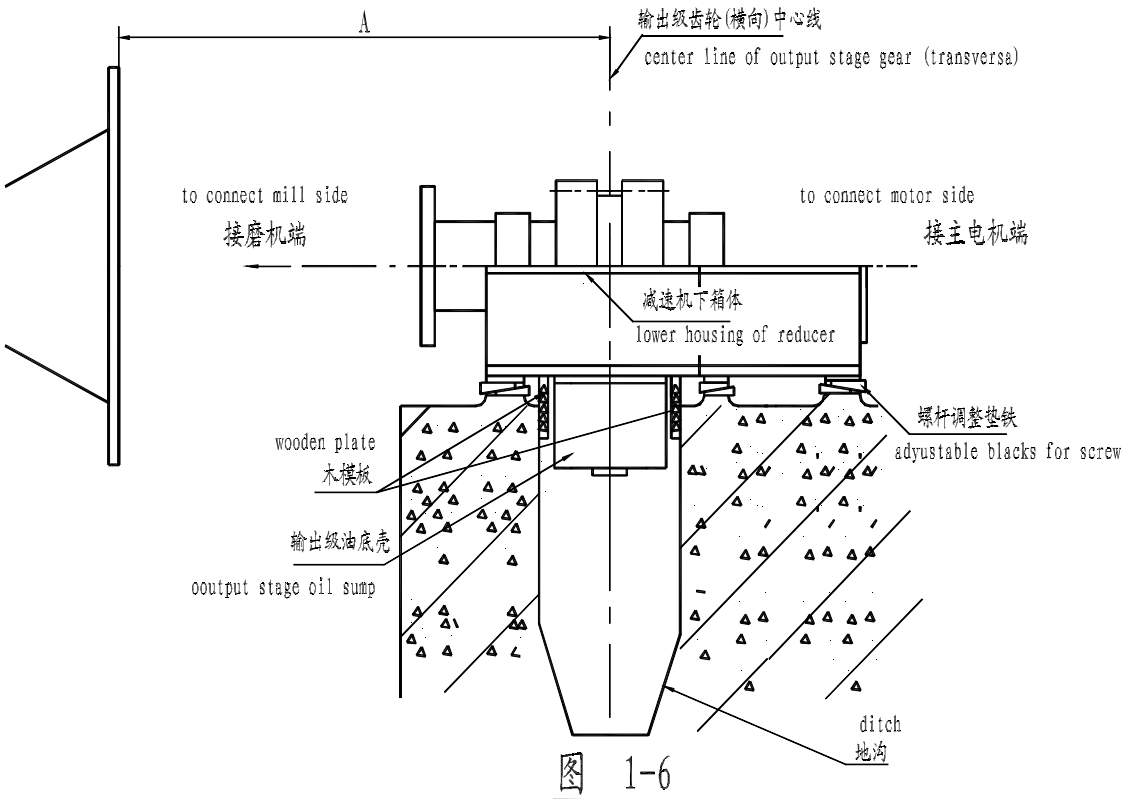


图 1-6

Fig 1-7

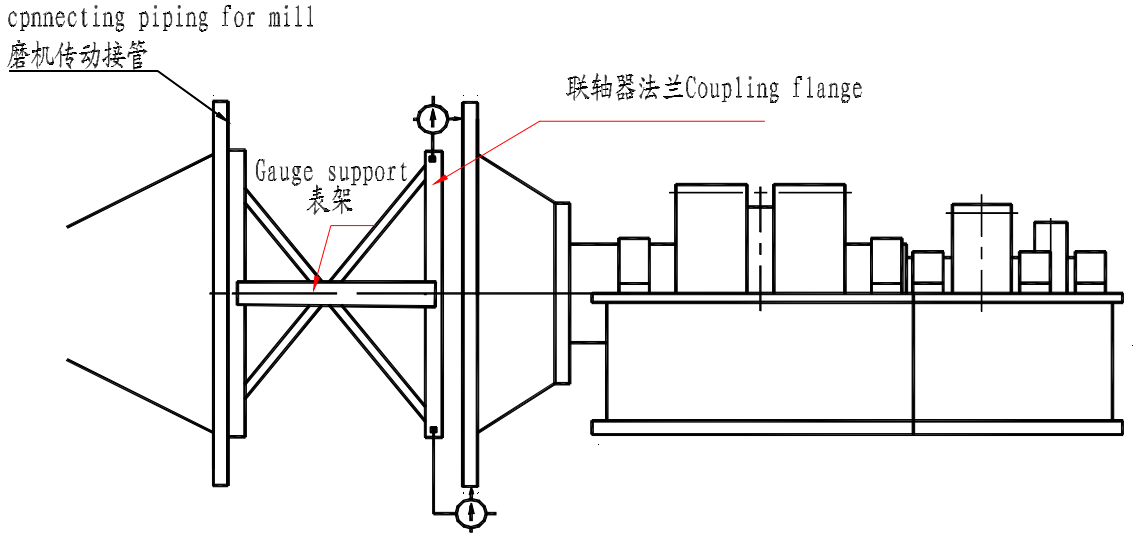


Fig 1-8

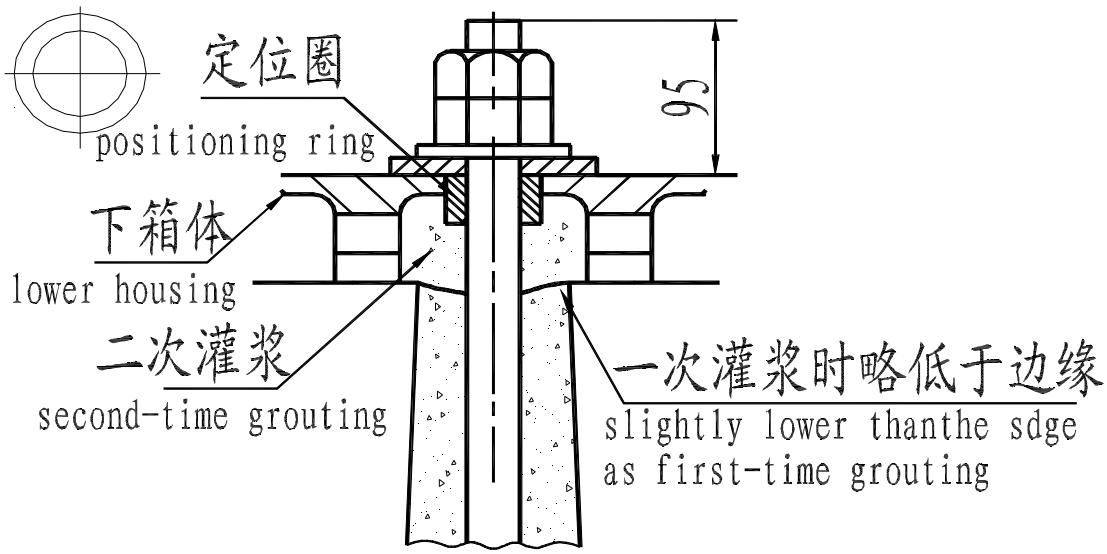


图 1-8

Fig 1-9

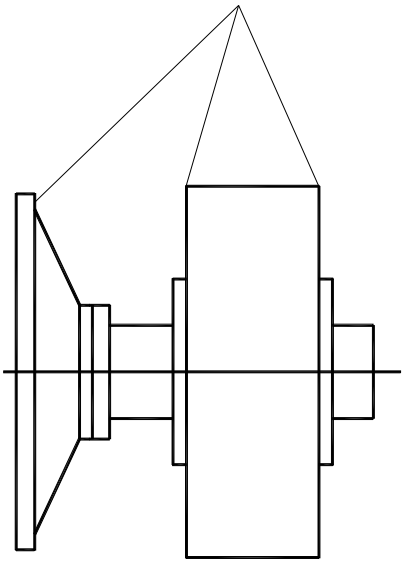


图1-9

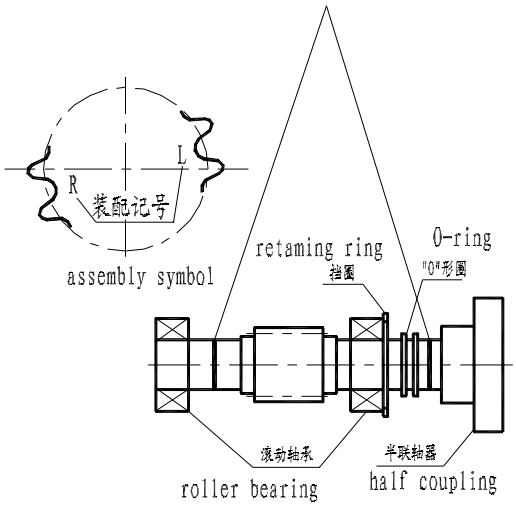


图1-10

3.2.9 Mount the 10 standard adjustable blocks according to the position shown in the fig.1-3. Pay attention to put the head of the bolts on rotating position. Before mounting the blocks, cement blocks should be placed according to the enclosed 2 of the standard JCJ30-90. The block is lower than the base surface. Put the adjustable blocks on the cement blocks and carefully adjust to make them tightly contact with the lower housing and the base surface. But the housing should not be lifted. After assembling the standard blocks, remove the temporary adjustable blocks.

3.2.10 Tighten the anchor bolt only after the concrete strength reaches 80% of design strength. Tighten from the middle to the two sides with even force. Then lock with double nuts, the contact surface between the nut and washer, washer and the housing should be ensured.

3.2.11 Assemble the other adjustment blocks according to 3.2.9,make them closely contact with housing and the cement block. Evenly tighten other anchor bolts, and then carefully check and adjust the block height. Make sure the upper surface level of the housing do not change.

3.2.12 Re-inspect the upper surface level after tightening the anchor bolts. The error between the measuring results and the data in enclosed table 3 should be $\pm$0.4mm/m. Recheck the center line of the housing and the error should comply with the table 1-1. Otherwise realign the housing. Ageing and deformation might occur during adjustment. Do not be anxious to get the result and a longer time might be needed.

3.2.13 Clear the surface of the 2nd stage oil sump, fix the sealing plates on the housing.

3.2.14 Second time concreting. Fit wooden plates according to the fig1-5. Clean the surface. Concrete strength shall be C25. The proportion of the ingredients for the mortar

should be decided by the construction engineer. Concrete height should comply with fig1-0. Make sure the adjustment block is fixed. First concreting the two anchor bolts between the two grooves and the others will be concreted after the load-test of the reducer.

3.3 Assembly of the transmission parts

Before assembling, deburr with file and abrasive paper, especially the portion of shaft journal, plain bearing, thrust bearing, bearing cap, bearing holes etc.

Before assembling, clean the lower housing and all of the parts. Coat the surface with lubricating oil to prevent rust after blowing. Clearness must be ensured, especially places between the shaft and the bearings, no scraps or dust or foreign matters should be found.

Check the symbol and direction mark on the bearings and the gear end surface carefully. Make sure to check first to avoid any damage or mistake.

3.3.1 Output shaft parts

3.3.1.1 Assemble the lower bearing pad, put the bearing pad M03B and M04B into their relevant holes according to the mark. Make the contact surface between the bearing pad and the holes tightly closed. Coat the bearing pad surface with clean lub. oil and cover it with a piece of clean cloth. Do not take it off before assembling the output shaft journal.

3.3.1.2 Lift the output shaft parts as showed in Fig1-9. (Use water level) and then mount the bearing pad slowly. Be careful to put the mark "TOP" on the end face of the gear upwards or red " ↑ " .

3.3.1.3 Put the lower half of the thrust bearings (MT03B and MT04B) on the shaft, make the alloy surface face the thrust side of the output shaft. Then move it slowly to the lower parts. (Note: coat the alloy surface with thin lubrication oil)

3.3.1.4 Assemble these parts in sequence: locating pin, upper half thrust bearing, upper bearing pad (coat the alloy surface with thin lubrication oil), and bearing cap. Insert the locating pins and tighten the bearing cap to lock the bolts.

3.3.2 Input shaft parts

3.3.2.1 First put the half coupling on the input shaft, be careful to put the o-ring and the bearing retaining ring onto the input shaft before assembling (as Fig1-10). Horizontally lift the cleaned input shaft parts, set the bearings into the bearing holes (put small quantity of grease into the rolling bearings). Be sure to make the marks on the gear end face L left-side, R right-side (looking to the motor direction) and put the gear in horizontal position.

3.3.2.2 Put the bearing cap on the relevant bearings according to the group symbols. Insert the locating pins, tighten the bolts.

3.3.3 Input-stage gear wheel and 2^{nd} pinion gear

The input stage gear wheel and 2^{nd} pinion gears are divided into left and right part. The assembly sequence is decided according to the site situation

3.3.3.1 Clean all the bearing pads, bearing cap and the bearing holes. Based on position and group marks(see attached table 4), slowly place the input gear wheels of both sides on the lower housing according to Fig.1-10. Be careful to keep the "TOP" or red " ↑ "upwards. (See enclosed table 5).Place the gear with "R"/"L" into the tooth space with the same symbol carefully and slowly until shaft journal is set onto its relevant lower bearing pad.

3.3.3.2 Put the bearing cap on the relevant bearings according to the group symbols. Insert the locating pins, tighten the bolts.

3.3.3.3 Coated the three continued working surface with even red lead paint at every 120 degree position, At the same time paint the colored agent on the three adjacent working surfaces. Turn the input pinion at the mill rotary direction to make the gear mesh for two to three times. Then check the tooth contact mark and make it comply with the inspection record at the workshop. (see enclosed table 7) It is better that the contact mark deflect to the pinion output end.

3.3.4 2^{nd} gear wheels

3.3.4.1 The 2^{nd} gear wheels are divided into left and right part. The assembly sequence is decided according to the site situation

3.3.4.2 Carefully check the shaft journal portion and gear surface, and remove the accident scratches. Horizontally lift the 2^{nd} gear wheels according the Fig. Be careful to keep the "TOP" or red " ↑ "upwards..Place the gear with "R"/"L" into the tooth space with the same symbol carefully and slowly until shaft journal is set onto its relevant bearing pad.

3.3.4.3 Mount the lower half thrust bearing according to the marks and fit it on the shaft.

3.3.4.4 Coat the 2^{nd} gear pairs with red lead oil as per the above mentioned way by 3.3.3.3. Turn the input pinion at the mill rotary direction to make the gear mesh for two to three times. Then check the tooth contact mark and make it comply with the inspection record at the workshop.

3.3.5 Torsional shaft parts

Clean the two groups of the torsional shaft parts after unpackage. Carefully check all shaft journals and the gear surface, remove the accident crack. The assembly sequence can be varied from the site condition

3.3.5.1 Dismantle the connecting bolts and cylinder pins, take out of the two torsional shafts. Check the parts mark and if the mark is missing, remember to make a new one..

3.3.5.2 Lift the output pinion shaft horizontally, then put it down slowly. Make the output gear pairs with "R/L" into the other tooth space with "R/L" until the shaft journal is set onto the relevant lower bearing bushing.

3.3.5.3 As the method stipulated in 3.3.3.4 coat the output pinions with even red lead paint and the colored agent. Turn the pinions to make the rotary direction of the output gear same as that of the mill. Then check the contact mark and make it comply with the inspection results recorded at the workshop (See enclosed table 7) It is better that the contact mark deflect to the pinion output end

3.3.5.4 Check the clearance of the plain bearing pad and the axial backlash of the thrust bearing.(see enclosed table 6) Make it comply with the inspection record at shop. If there is a big difference, reasons shall be found out.

3.3.5.5 Assemble the sliding bearings, thrust bearings, bearing cap according to the sequence and the marks. Fit the locating pins of the bearing cap and screw on the bolts. Coat the surfaces of bearing pad with lubricating oil.

3.3.5.6 Assemble the torsional shaft and taper sleeve etc. Fix the pin according to the matching symbol and screw on the bolts.

3.3.5.7 Turn the input pinion 1-2 cycles at the mill rotary direction, check the max. backlash of the four meshing points. It is accepted if the 0.1mm thickness gauge can not pass

through.

3.3.6 Assembly of internal lubrication oil pipe

Clean all oil pipes and blow them before assembly. Put 100 (mesh) filter (Cu) at the input oil flange of each bearing to prevent the foreign matters from entering into the bearings. (dismantle the filter after filling the oil) Put the rubber asbestos gasket under the filter and screw on the bolts.

3.3.7 Assembly of temperature sensor

First check the completeness of the Pt100 resistor. (put the Pt100 and the mercury-temperature into water (70-80℃). The Pt100 resistor is in good condition if the indicated value is the same.) Connect the wire according to the wire length and the drawings, one with the M12X1.5 screw hole on the bearing cap, the other one with the junctions on the connection board on the lower housing, Make sure that bearing numbers is the same with the junction numbers.

Do not impact the Pt resistor. Put the wire line along the lub oil pipe, fix the wire on the pipe by thin iron wire. Be careful not to fold the wire.

3.4 Installation of the upper housing

3.4.1 The rusty stain and dust inside and outside the housing shall be completely removed. Remove the rusty stain and dust on the upper surface of the housing. Then lift it horizontally as shown on 1-10.Put it slowly on the lower housing, fix the pin and screw on the bolts which near the holes. Remove the filter at the bearing's inlet after cleaning with oil. Then after no-load testing, the fluid sealant shall be coated on the surface as stipulated in Fig1-11.Cover the upper housing and screw on the bolts.

3.4.2 Install the input shaft end cover, the end cover of the output shaft and the torsional shaft. Rubber asbestos gasket or fluid sealant shall be used during installation.

Fig 1-11

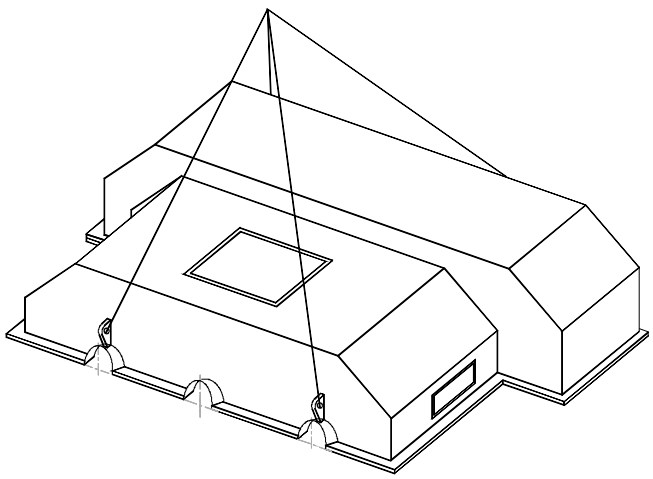
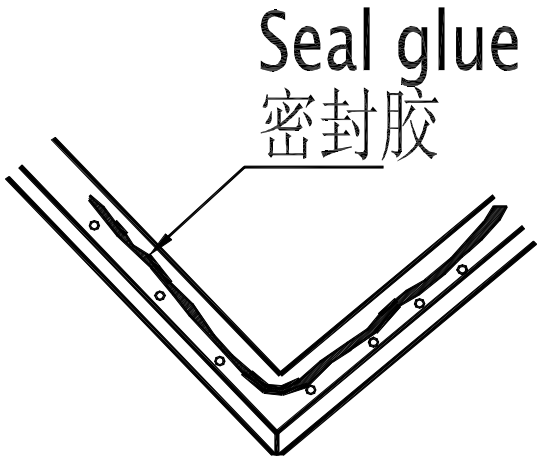


Fig1-12



4.Precautions for installation

4.1 The reducer should be stored in a dry, vented, water-proofing warehouse. Do not unpack the package before the oil sealer expire especially the package of the gear, shaft and bearings.

4.2 Check the foundation level and the dimension &position of the anchor bolts based on the mill center line shall be in accordance with the equipment drawing, foundation drawing. Modify it if there is any difference.

4.3 Since the reducer is an accurate equipment, special attention should be paid to clean and dust preservation.

4.4 Carefully store the plain bearing and thrust bearings before assembly. Any collision or compact is prohibited. Because the bearing bushing and the shaft is adjusted in the shop, do not scrape expect special cases.

4.5 Pay attention not to damage the parts inside the reducer when aligning, especially the lubricating pipes and PT100 resistor.

4.6 Kerosene should be used to clean the important parts of the reducer. Do not use cotton waste for it might stick on the shafts, gears and bearing pads and affect the precision of the installation. Silk or cotton sweater are suggested to be used.

5.Test running, operation and maintenance

Only after completing the assembly of the main reducer, low-speed driving system, lubricating oil system as required and confirming the good condition of the electrical control and lock protection system, the test running of the reducer can be carried out.

5.1 Cleaning

It is very important whether the lubrication oil system of the reducer is clean or not. The reducer must be cleaned with oil before the test run. Connect the inlet & outlet oil pipe between the lubricating oil station and the reducer, the low-speed system, planetary gearbox. Fill 60% of the oil tank with No320 or No14 diesel oil. The copper filter gauze shall be fitted at the reducer′ s oil inlet.

Before cleaning, heat the oil to 50℃. (open the stand-by valve, close the oil outlet valve to make the oil circulate in the tank to avoid carbon accumulation) Then open the outlet valve and close the stand-by valve.

For the firs four hours, check &clean the magnetic filter & duplex filter. Then check it every two hours. After 12 hours, stop cleaning if there is no foreign matters in the oil. Dismount the upper housing, take the Cu filter at the oil inlet. Clean the filters and put it back. Screw on the bolts. Finish the cleaning after confirmation of no foreign matters in the Cu filter.

Each Cu filter at the oil inlet shall be taken off after the cleaning. Drain the oil and remove the foreign matters in the tank. Dough can be used to adhere the sand in the housing. Stipulated lubrication oil shall be fed.

During the cleaning, check if there is any leakage, especially the connecting point of the flange. Check the lubrication condition of every lubricating points through the inspection window on the upper housing

5.2 Test running of the reducer

5.2.1 Preparation prior to test running

Check if all fitting bolts and anchor bolts are tightened. Check the completeness of the control system, especially the low-speed driving motor, the main motor, the pump motor of the lub oil station, the lock safety protection system and other lock systems according to the foundation installation drawing.

Heat the lubrication oil to 38℃ by the heater.(be careful to make the oil circulation inside the oil station) After 30 minutes of the oil filling, check the seal of the connecting flange, the fitting surface and the end palate. Only when there is no leakage and the oil pressure, pump are in good condition, the main motor could be started.

After check the connection of the low-speed driving system, connect the system with reducer by operation handle. Rotate the low-speed driving system manually. The system could be started only when all rotating parts could be rotated smoothly without jam or shock. After 20 minutes` successful running, cut off the main power, adjust the low-speed driving system to the disconnected position and lock the control handle by locking nuts.

5.2.2 No-load test

Running time:360minutes. Inspect & record the following items:

Ambient temperature (℃):	Speed of the main motor (r/min):
Oil inlet temp :	Voltage of the main motor (v):
Oil outlet temp.:	Current of the main motor (A):
Temp of each bearing:	Cleanliness of the filter:

5.2.3 Load running test

The load running test should be done according to the table 1-2.

5.2.4 Precautions

The operator should inspect carefully during the running and take some records. Stop the machine if there is any abnormal phenomena or other problems.

Inspect the filters every 4 hours, if the fragments of steel or foreign matters are found in the filters, it is necessary to stop the main motor and research the abnormal causes. The operation should not be continued until the causes are found out and the troubles shooting.

If the alarm is raised for abnormal temperature of the bearings and abnormal pressure of the oil system or other system, stop the main motor and settle the problems. Under no circumstances it must not be allowed to start the motor by force or to disassemble the safety protection system before the causes are cleared up.

Table 1-2 Load-running and operation time

No	Motor Speed (r/min)	Motor Power (KW)	Grind-bodies (%)	Operation time (H)	Remarks
1	rated speed	1/3P	33	16	The motor′s rated power and operation time shall be in accordance with the test run rules.
2	rated speed	1/2P	50	16	
3	rated speed	3/4P	75	16	
4	rated speed	9/10P	90	16	
5	rated speed	P	100	20	

Note: During running, record the following items except the items stipulated in 5.2.2every 60 minutes.

Cooling water flow (m/h) Cooling water outlet temperature (℃)
Cooling water inlet temperature (℃) Noise & Vibration of the reducer

5.2.5 Inspection and acceptance

After completing test running, carry out the following detailed inspections:

Check and tidy up the records of test running; check the accuracy of each control system; inspect and clean the filters; Check the connecting point of the whole system.

A detailed records of inspection should be made in the picture and documents for the purpose of acceptance.

5.3 Operation and maintenance

JST series reducer is the accurate and important equipment, thus the good management and maintenance should be carried out. The operator should understand the operation manual and do the working according to the requirements. The operating record shall be taken to analyze the running. Stop the machine and solve the problem if it is necessary.

5.3.1Preparation for starting and operating procedure

Every time before starting the main motor, the clutch of the low speed driving unit must be checked and disconnected with the main reducer. Fill the main reducer and the low-speed driving unit after inspecting and maintaining the lubrication oil station according to the operating manual. The motor can be started when the supply oil pressure reaches the stipulated value(0.15-0.3Mpa)

5.3.2 Stop running

If for some reasons the main reducer and the low-speed driving unit must be stopped, first stop the main motor or the motor of the low speed driving unit. It is important to stop the oil station after the reducer stop rotating totally, otherwise the bearing bushing or the reducer will be damaged.

5.3.3Check during the running

5.3.3.1Items of daily inspection

Record every 60 minutes as stipulated in5.2.2; Check if there is any leakage at the connecting points; Inspect the relaxation of the fitting bolts; Check whether there is any abnormal noise or vibration at the moving parts. Maintain the lubrication oil station as required.

5.3.3.2 Items of monthly inspection

Check and clean the magnetic filter and duplex filter of the lubricating oil station. If the

fragment of steel or plastic are found in the filters, it is necessary to stop running and find the causes. Check the couplings and other connecting points, the found problem should be settled immediately. Monthly maintenance of the lubricating oil station is carried out as demands.

5.3.3.3 Items of half yearly inspection

Examine the lubrication oil quality. The degenerative oil should be changed promptly. Check the reliability of the control system.

5.3.4 Periodic inspection and maintenance(see attached table 1-3)

Table 1-3 Periodic inspection and maintenance

Checking Places	Check Items	Remarks
Foundation	Sinkage; alignment of the mill & the reducer	one time per year
Inside of the reducer	Gear surface damage; contact crack Relaxation of the4 connection bolts Other abnormal phenomena	
Outside of the reducer	Concentricity of the couplings; axial clearance Relaxation of anchor bolts Seal surface; Pipe Multiple-temp indicator	Leakage as operation
Low-speed driving system	Manual equipment; angle belt	Adjustment
Diaphragm coupling	Abnormal noise; relaxation of bolts	

Lub oil system	Clean the oil tank when change oil Oil pump; oil cooler; oil heater Magnetic filter; duplex filter; valve Control cabinet; instruments & electrical parts	Refer to the operation manual

5.4 Failure analysis and trouble shooting

The causes for the troubles occurred in the reducer are usually complicated, which require more careful investigation. What shown in Table1-4 are common phenomena and elementary causes.

Table 1-4 Fault causes & trouble Shooting

Phenomena	Cause	Trouble Shooting
bearing temperature rising of the reducer	1. Bearing damaged 2. Oil quality change 3. Over-load 4. Temp sensor damaged 5. Insufficiency of oil 6. Excessive rising temperature of the supply oil	Check the adherence of the white meta in the filter; Check bearing alloy surface Inspect the oil quality Check motor current, voltage (power) Check or change Check supply oil pressure; pipe clogging Check water supply of the cooler; wate temperature
Abnormal noise of the reducer	1. Damage of the gear/bearing 2. Over load or shock load 3. Relaxation of bearings 4. Mill or motor centering deflection	Open the housing & check Check the mill and the motor Tighten the bolts of the bearing cap Check the centering and find the causes
Oil leakage of the reducer	1. Damage of the gasket/seal wrong installation 2. Relaxation of the bolts 3. Clogging of the air vent cap	Check or change seal/gasket Screw on the bolts Clear the clogging matter
Oil pressure drop of the reducer	1. Damage of the oil pump/motor 2. The valve is not closed 3. Leakage of the piping /oil piping 4. Mixture of air in the pump suction piping 5. Damage of the pressure gauge	Check, repair or change Check and adjust the valve Check and repair Check the oil level Check the pressure gauge
Excessive rising of supply oil pressure of	1. Oil pipe or bearing inlet clogging 2. Too high oil viscosity	Check and clear Check oil brand; oil temp

the reducer	3. Damage of the pressure gauge

Diaphragm coupling vibration and noise	1. Relaxation of mill fitting pipe 2. Sinkage of foundation 3. Damage of diaphragm coupling	Check and repair Check the centering Change
Noise or vibration of the oil pump	1. Over-load; too high oil viscosity 2. Misalignment of the pump and the motor 3. Damage of the coupling 4. Damage of the bearing, gear or pump	Check the foreign matters in pump Check the alignment Check and change the rubber ring Check; repair; change
Oil leakage or end cover heating of pump	1.Misalignment of the pump and the motor 2. Damage of the seal in the end cover	Check the centering Check and change
Change of the oil level	1. Damage of the cooler or leakage of water 2. Leakage of oil	Pump test of the cooler; check the water percentage in the oil Check inlet/outlet oil pipe
Too high temp of the supply oil in the oil station	1. Too high temp of the cooling water 2. Insufficiency of the cooling water 3. Dirtiness of the cooling tubes 4. Mixture of the air in the pipes	Decrease the water temp Increase the water quantity Clean the tubes Open the drainage plug
Metal fragments in the magnetic filter	1. Insufficiency of the cleaning by oil circulation 2. Damage of the gears or bearings	
Caution: If some metal fragments are found in the filter, judge the kind of metal and the possible damaged parts in accordance with the following table.		
Kind the metal	**Discriminative method**	**Checking parts**
Steel	Adhere to the magnet	Check the gear
White metal	not adhere to the magnet	Check the bearing
Paint of the interior	not adhere to the magnet, while they are easy to crush by finger	Check interior paint

Slow-driving unit

1. Generals

Slow-driving unit JMS660 is designed as an auxiliary driving unit for JST series mill reducer of. This unit is used for engaging running during the assembly, commissioning and repairing of reducer, as well as charging, lining change, improving or complementing the lapping medium of cement production line.

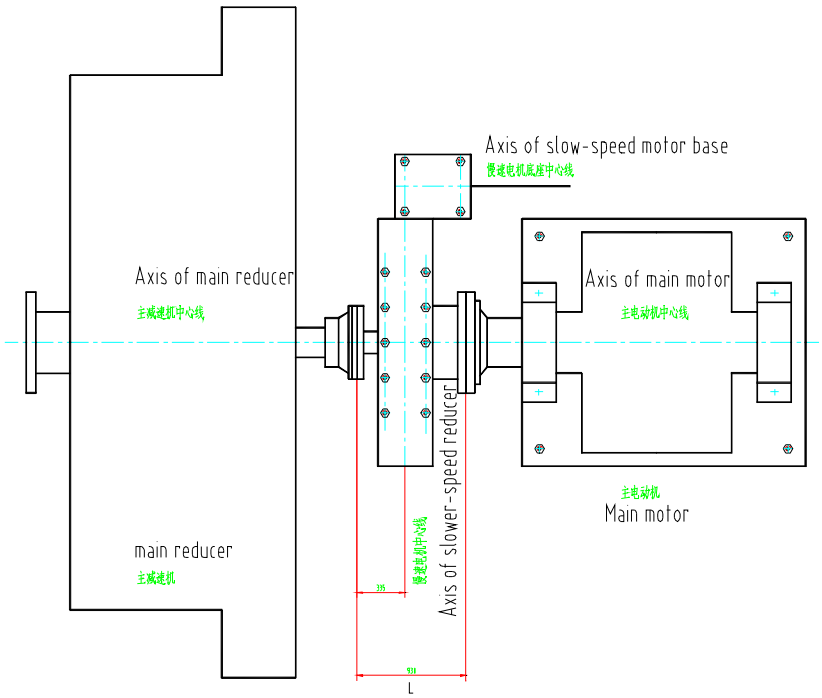
The slow-driving unit is designed for slow-driving the mill only for short time. This unit may not be allowed to long-time continuous full-load running. Every running time may not exceed 0.5h.

Slow-driving unit JMS660 is installed between the main reducer and main motor (See sketch 2-1, the main motors is designed as one shaft extension) It is composed of diaphragm coupling and manually-operated clutching device.

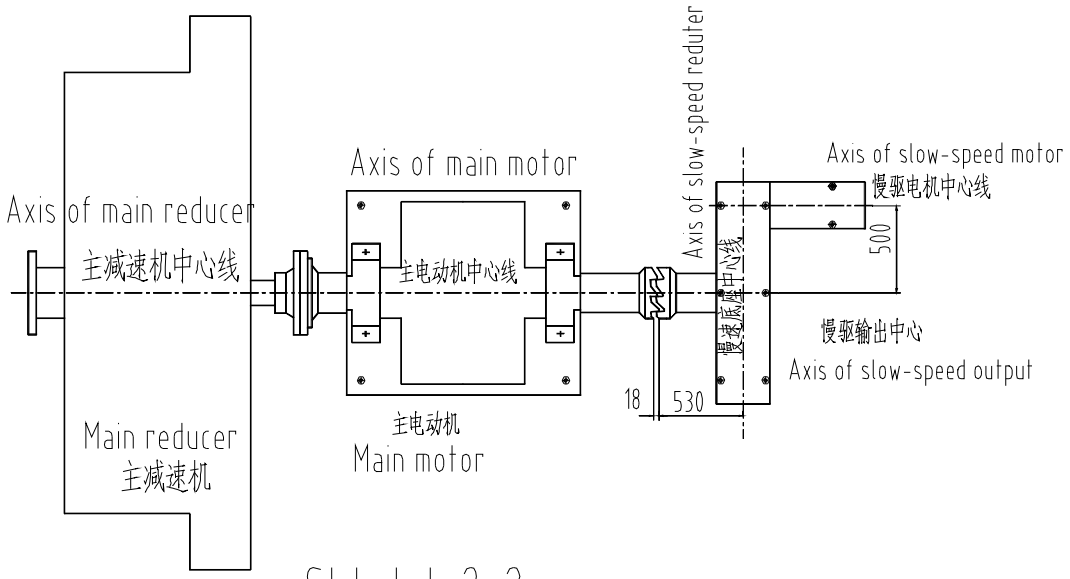
The Slow-driving unit HMS660 is installed behind the main motor (See sketch 2-2, the main motor is designed as double shaft extension). This unit consists of slow-driving reducer, motor, brake and manually-operated clutching device.

Technical parameters of 2 slow-driving units

Type / Description	JMS660	HMS660	Remark
Application range	JST80-JS150		
Output torsion range	21KN,M-69KN.M		
Reduction ratio	98.58:1-150:1	93:1	
Motor power	22KW-55KW		
Motor speed	970r/min-0.3r/min		
Speed range of mill	0.15r/min-0.3r/min		


Axis of slow-speed motor base
慢速电机底座中心线
Axis of main reducer
主减速机中心线
Axis of main motor
主电动机中心线
main reducer
主减速机
慢速电机中心线
Axis of slower-speed reducer
L
主电动机
Main motor

Sketch 2-1



Sktetch 2-2

2. **Installation of slow-driving unit**

The installation of slow-driving unit will be carried out after the assembly of main reducer and main motor has been completed. If selecting slow-driving unit JMS660, the main motor (one shaft extension) shall be placed according to the drawing of foundation and assembly to ensure the designed dimension (L of sketch 1-1).The coaxality of main reducer and main motor must not exceed ϕ0.1mm and the run-out not more than 0.1mm.

2.1 Inspection before installation

2.1.1 Check the foundation height of slow-driving unit and position, depth, and dimension of anchoring bolt whether it meets the drawing requirement

2.1.2 Mark the axis of slow-driving unit on the surface of foundation according to drawing.

2.2 Deburr foundation surface where shims or adjustable blocks are located and clean off the residual oil and dust on the foundation and slots.

2.3 Install the anchoring bolts and tie one wire on the head of each anchoring bolt for guiding them through the hole on the casing. The rust on the bolt must be cleaned and thread is to be coated with anti-rust grease before mounting the anchor bolts.

2.4 Place all shims in the correct position showed on the drawing. The height tolerance may be not bigger than 0.2mm.

2.5 Lift, positioning and alignment of slow-driving unit

2.5.1 Before lifting of JMS660, one flange of high speed diaphragm coupling and clutch ring of slow-driving reducer are to be fixed by two screws of M20X60 through tapped hole on the circle of ϕ650 and keep the high speed diaphragm coupling horizontal. Then lift it horizontally and place it on the shims between main reducer and main motor, afterwards adjust the height of shims to enable the coaxiality tolerance of its output axis and the axis of main reducer and main motor not bigger than ϕ0.1mm,

then lock the fixing bolt of two ends of coupling (at same time dismount the temporary bolt),then install the slow-speed motor base and align it through the sloping shims and adjust the distance of pulleys.

2.5.2 Lift HMS660 completely and place it on the shims, adjust the height and shift the base plate to keep the coaxiality tolerance of the output axis to the axis of main motor not more than ϕ 0.1mm and then fix coupling.

2.6 Pour concrete for anchor bolt, the concrete strength shall be C20 and the mortar quality shall be decided by the civil work engineer.

2.7 After the concrete strength reaches 80% of design value, tighten the screws. During the tightening, be careful to adjust shim to keep coaxiality not changed and to ensure each coupling can freely and flexibly engaged and disengaged. After confirming good assembly do second pouring of concrete.

2.8 Install the control box and switches according to the foundation and assembly drawing. The control box has two positions: at position 1, the slow-driving motor will be switched off and main motor is in normal operation; at position 2, the main motor is to be switched off and slow driving motor works.

2.9 In order to help operator observe directly, the switch box should be placed near the mill.

2.10 When the slow-driving unit is running, remember to open the valve.

3. Operation of slow-driving unit

3.1 Preparation before operation

Fill the ZC-4 calcium-based grease (GB491-65) into the output bearing and other places through the nozzles of slow-driving unit and start the oil station to supply oil to main reducer and slow-driving unit. Check the tightening of delta-ribbon (JMS660) and do some adjusting. The adjusting method is firstly loose the 4 screws on the motor base and shift motor using two adjusting screws to reach the proper expansion. After adjusting, install the ribbon cover.

3.2 Idle-running

Idle-running of pin clutch (JMS660) and claw clutch (HMS660) is to be carried out under condition of disengaging (slow-driving unit without main reducer and mill) the running time is 1 hour. Check if the rotating direction of slow-driving unit is same as that of mill; if it is necessary to change the connecting cable of slow-driving motor, pay attention to the temperature change of bearing position.

3.3 No-load running (nothing in mill)

Loose the fixing screws below the switching handle, move the handle to enable the cylindrical pins at circumference of socket to slide into the holes at clutch ring (jms660) or to make the claw coupling engaged (HMS660). Then tighten the screws and fix the handle to prevent loosening (Attention: to maintain certain clearance at two sides of sliding piece and socket concave to prevent unnecessary wear out.

If the contact between cylindrical pins and hole or two claws have problem during the engagement, so push the three buttons on the switching box (ahead, astern and stop) to start the slow-speed motor to make the clutch engaging with each other. Another way is to dismount the two wire stoppers mounted on the pulley shaft (JMS660),then install the handle and run the motor by hand, enabling them engaged. After that, dismount the handle and reassemble the two wire stoppers. After good engagement of clutches, tighten the fixing screws of the handle. After confirming it is impossible to damage all the moving

position, then start the slow-driving unit with main reducer and mill running together, the running time is 0.5 hour or the mill runs three-four rounds.

3.4 Running with load (mill has be charged)

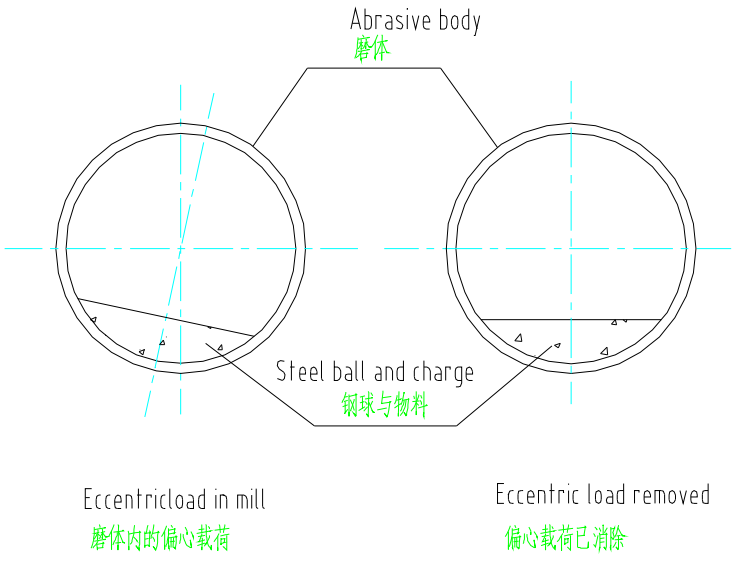
For running with load, each continuous running time may not exceed 0.5 hour. During the running, pay attention to any vibration, noise, heating, and stop the equipment if any abnormals.

3.5 Stop of slow-driving unit

Once the slow-driving unit drives the mill to the required position, push the button “stop”, the mill stops at the required position. Before normal operation, disengage the clutch of slow-driving unit, loose the fixing bolts of handle, move the handle to make cylindrical pins and the claws disengaged in reverse direction. After the limit position has been reached, tighten the fixing bolts of the handle.

If it is difficult to operate the handle, it means that the steel ball and charges in the mill has gravity deviation off the vertical line (See sketch 2-3). Due to the eccentric torque, the clutch can’t disengage, in that case open the brake through the switch unit ,the mill will run due to the eccentric load torque. At this time the rotating direction should be same with that of working condition. If the rotation direction is reverse to the working direction, the brake shall close, then start the slow-driving unit (at this time the slow-speed motor starts and brake releases through the switch unit) to make the mill running and reaching certain angle, then release the brake and repeat several times until the eccentric torque has been eliminated, after that stop the mill and disengage the clutch a little.

It is to point out, the mill will normally shake several times due to the eccentric load. In this case the operator shall use the brake to prevent this shaking. The slow-driving unit is a speed-up device when the mill runs in reverse direction. Because of the big transmission ratio ,the slow-driving reducer and motor run very fast ,so it will shorten the life time of slow-driving unit and even damage the whole slow-driving unit



Sketch 2-3

Diaphragm coupling

1. Generals

The JL-series diaphragm coupling is consisted of diaphragm pack, driving device, coupling flange, clearance adjusting shims and locking parts. One diaphragm pack is coupled with output flange of main reducer, the other one is coupled with the driving connecting pipe at mill side. Diaphragm pack is comprised of coupling ring, diaphragm, pressure ring coupled by screws. Except transmission of torque the diaphragm coupling has the function of compensating the system axis change due to deformation of mill and damping the vibration for protecting the reducer.

2. Assembly procedure

The assembly of diaphragm can be carried out after the installation of main reducer and idle-running test has been finished. Before assembly deburr the diaphragm packs, driving shaft, coupling and screws, then clean and assemble it according to the following procedure;

2.1 Assemble the coupling on output flange of reducer according to the marks given by manufacturer, coat the cylindrical surface of the square head reamed bolts with molykote and then put them in the reamed holes as per pairing marks, tighten the connecting screws. Before assembly, coat the thread with adhesive to prevent looseness.

2.2 Place the driving shaft on the holder horizontally referring to position marks and assemble the diaphragm pack and pressure plate (See sketch 3-1), tighten the reamed bolts. Before assembly, coat the threads with adhesive

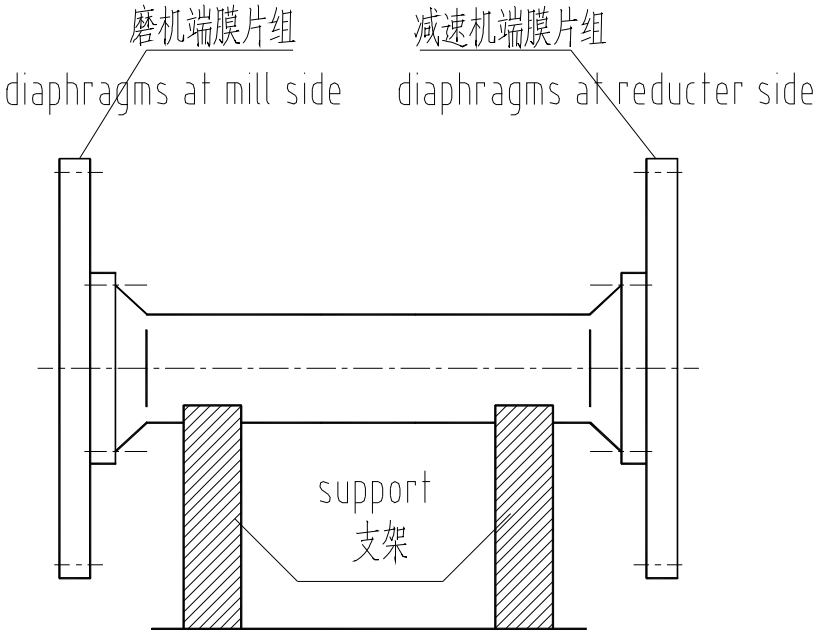


图3-1

2.3 Remove the 8screws of coupling diaphragms (16 screws at two sides)

2.4 Lift the assembled driving shaft and diaphragm pack according to sketch 3-2. Align the

driving connecting pipe flange of mill as per sketch 3-3 and mark the pairing marks on the outer circle of two flanges in order to facilitate the mounting and dismounting.

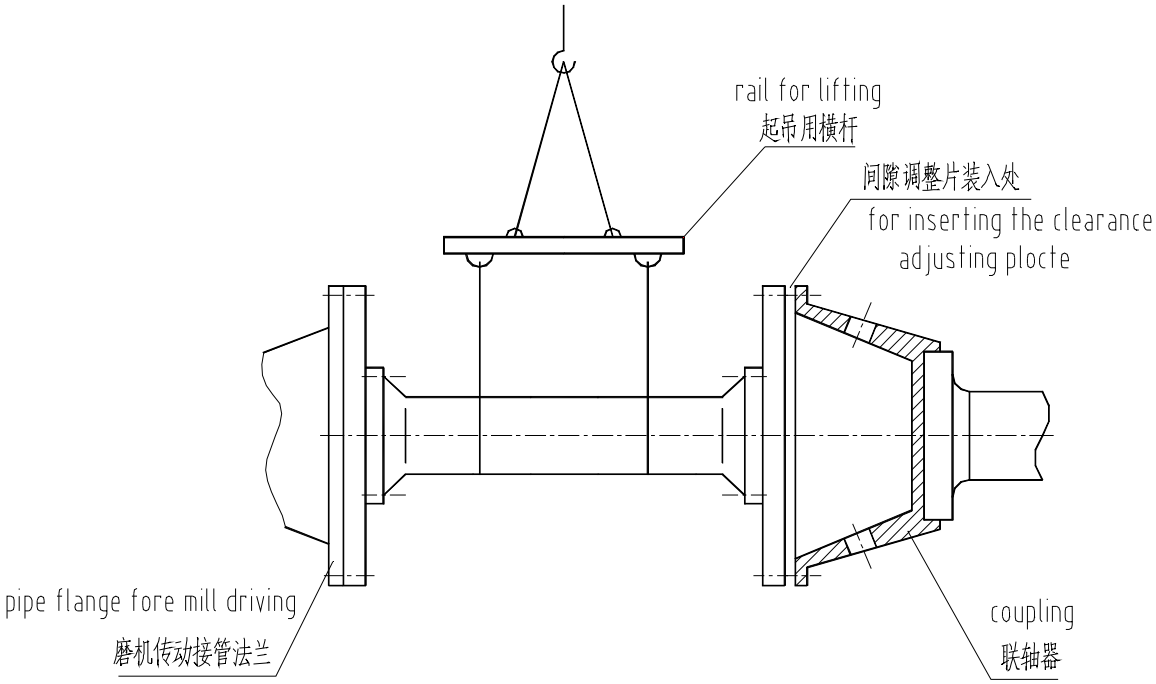


图 3-2

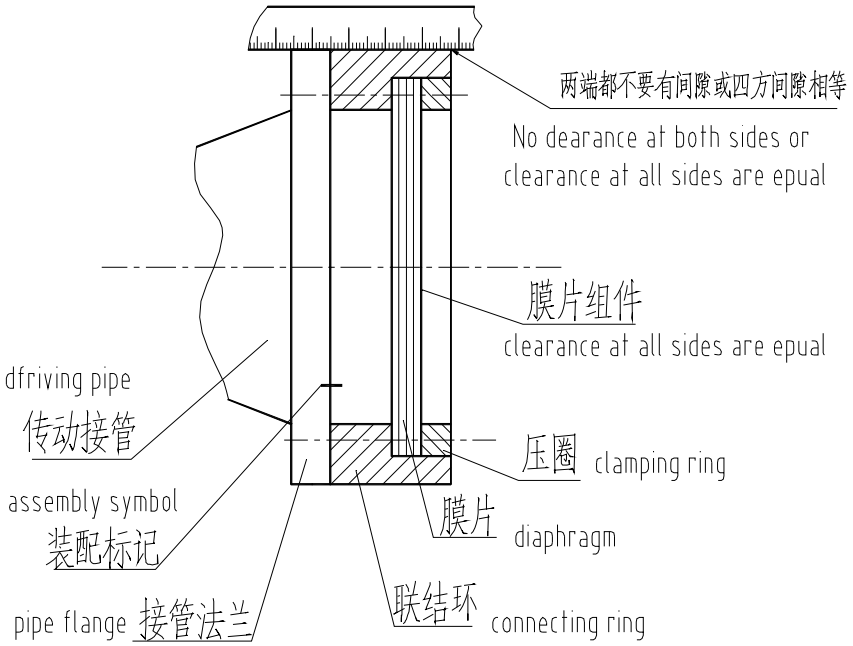


图 3-3

2.5 Align the coaxiality of coupling with the output shaft flange of main reducer as per sketch

3-3. Measure the distance between two flanges, put in the clearance adjusting shims between the two flanges according to the measuring result (clearance of 1-3mm maintained according to the ratio of length: diameter of mill).

3. Precautions for installation

3.1 The coaxiality of diaphragm pack has been set before ex-work and assembled together with coupling ring, diaphragm and pressure ring by 4 screws. These 4 screws may not be dismounted to avoid the looseness of parts and coaxiality change(For post assembly, see ketch3-3).

3.2 Lift the driving shaft and diaphragm pack according to sketch 3-2 and place some soft material between steel rope and shaft to prevent to harm shaft and may not lift it at diaphragms to avoid the deformation of diaphragm .

3.3 When respectively connecting the diaphragm with connection pipe flange of mill and coupling flange, due to many holes and indexing error, it is difficult to align hole to hole, in this case you need to shift mill and reducer to find the optimal position, then put in the screws and tighten them. If come screws can't go through you can use proper reamer to ream the hole and then put screws through and tighten them.

3.4 Coat the threads with adhesive before assembly of nut in order to prevent looseness during the operation.

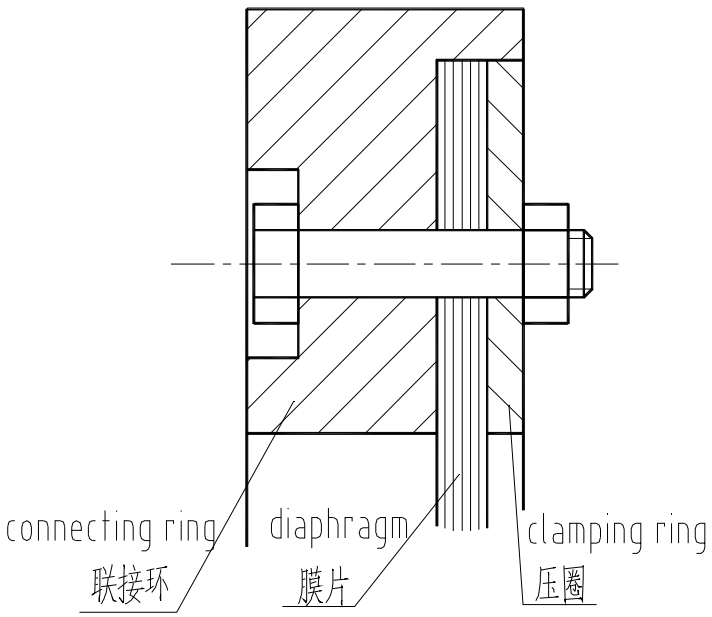


图 3-4

Oil lubrication unit and control system

1. Generals

XRZ and KYZ series oil lubrication unit is specially designed by the lubrication equipment plant according to the lubrication and control requirements of the JST series reducer, it is consisted of oil station, instrument board, electrical cabinet and multi-circuit temperature logging equipment.

In the dilution lubrication unit, the oil will be sucked from the working pump and sent to double-cylinder filter, after filtering, the oil will be transported to heat-exchanger. After filtering and cooling, the oil is to be sent to each lubricating point of reducer and slow driving unit , then return to oil station through oil return pipe . After that the oil will be again pumped up and do same process as before and forms continuous circulation of dilution lubrication system.

The platinum-resistor of Pt100 which is placed at each temperature measuring point of plain bearing of main reducer shall be connected with the multi-circuit temperature logging equipment, not only the measuring result can be displayed on the screen of multi-circuit temperature logging equipment, but also this equipment will give out alarm signal which is connected to oil station and give electric signal of 4-20mA which is connected with computer.

2. Assembly procedure

Install the oil station according to assembly operating instructions, the main process is as follows:

2.1 The cleaned oil station instrument board and control cabinet are to be placed according to the foundation sketch. The foundation must be solid, plain and smooth, there shall be enough space for checking and maintenance.

2.2 The copper pipe of Φ10x1 between oil station and instrument, and connecting cable between oil station ,instrument board and control cabinet shall be connected according to the electrical principle diagram.

2.3 Install the oil inlet pipe and oil return pipe between the oil station and main reducer, slow driving unit. The sloop of oil return pipe shall ensure the smooth flow of returning oil .The oil pipe shall be pickled for removing all the oxidation, residual sand and welding slag. After drying, the pipe must be coated with lubrication oil internally and anti-rust paint externally. The oil resistant rubber gasket shall be placed between pipes and pipe flanges for sealing.

2.4 The multi-circuit temperature logging equipment is to be mounted in the electrical cabinet as required. And connect each sensor (Pt100) at bearing of reducer with the corresponding terminal in terminal box as specified. The wiring shall be orderly and protected with bush.

2.5 According to the application manual of the multi-circuit temperature logging equipment, connect the instrument board of oil station with output alarm signal of control panel. The signal which is controlled by computer can be connected with computer through electric signal of 4-20mA of multi-circuit temperature logging equipment.

Attention: all the connection must be correct. The wiring must be orderly and good outlook and protected with plastic pipe or other thing.

2.6 the wiring between main reducer, slow-driving device and main motor are to be carried

out in accordance with drawing.

3. Notes and maintenance

The oil station and multi-circuit temperature logging equipment shall be operated and maintained according to their individual operation instructions.

Special attention is paid to the alarming system when occurring failures, which must be analysed and solved, in no case taking over the alarm and interlock device in order to ensure the safe operation of reducer. Check the electrical instruments every year after the date of ex-work.

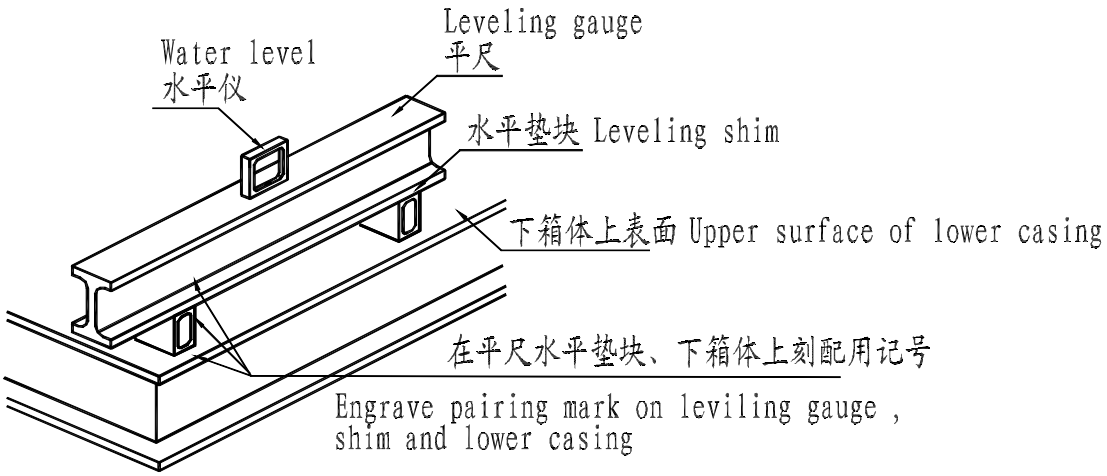
Attached Table 1

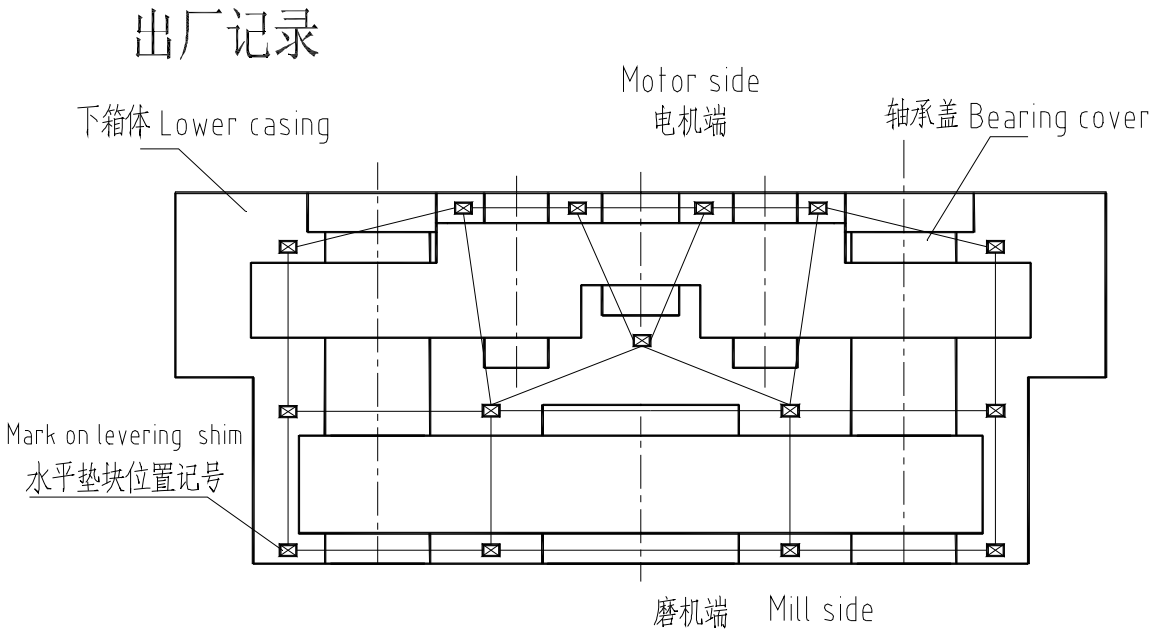
The parts to be prepared by customer for assembly and debugging of gearbox

No.	Designation	Unit	Quan.	Application
1	Seamless steel Pipe Φ114×4.5 (for JST90-JST140)	mm	6000	Reducer oil return pipe (prepare 6-10 bends of 90° with same size)
2	Seamless steel pipe Φ76×3 (for JST90-JST140)	mm	3000	Reducer oil inlet pipe and oil return pipe of slow driving unit (prepare 4-8 bends)
3	Seamless steel pipe Φ159×6 (for JST150-JST160)	mm	6000	Oil return pipe for main reducer (prepare 6-10 bends of 90° with same size)
4	Seamless steel pipe Φ89×4 (for JST150-JST160)	mm	3000	Oil inlet pipe for main reducer (prepare 4-8 bends of 90° with same size)
5	Seamless steel pipe Φ76×3	mm	5000	Oil return pipe for slow driving unit (prepare 2-3 bends of 90° with same size)
6	Seamless steel pipe Φ35×2.5	mm	5000	Oil inlet pipe for slow driving unit
7	Copper-pipe Φ10×1	mm	3000	For oil station
8	N320 industrial closed gear oil	Kg	6000	Lubrication oil for reducer N220 or N460 can also be used depends on region
9	14# diesel oil	Kg	3000	cleaning (N320 also can be used for cleaning)
10	Kerosene	Kg	10	For cleaning gear, shaft and bearing
11	Molykote	Kg	1	For fixing pins
12	Acet	Kg	2	For cleaning all contact surfaces
13	Seal adhesive anti-oil adhesive	Piece	5 each	For upper and lower casings, end cover and connecting screws
14	CT2-displayer	Bottle	1	For check teeth contact mark after test-running
15	Copper filtering net with 100 meshes	M^2	0.5	cleaning
16	Oil resistant rubber and asbestos gasket	Piece	4	For each sealing point
17	Torque wrench	Piece	1	For tightening screws
18	Copper hammer	Piece	2	Tool
19	Socket wrench heavy	Box	1	For tightening screws

Attached table 2:

Level -measuring record of lower housing



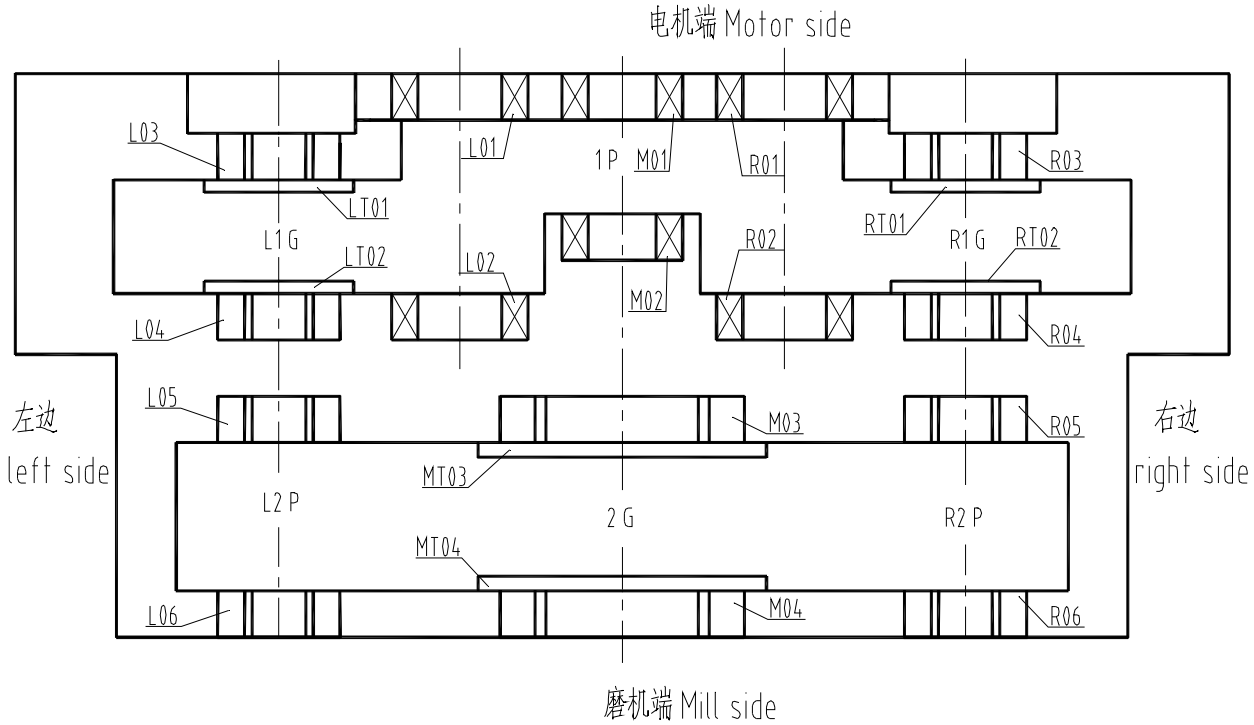


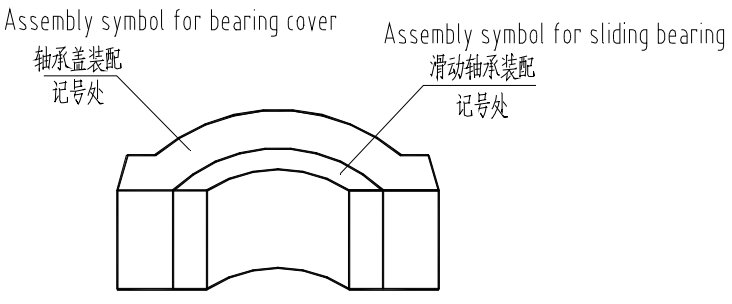
Requirements:

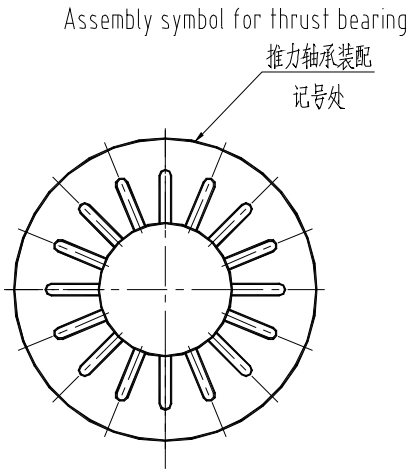
1. ☒ means the setting position of shim and mark at upper surface of lower housing
2. Arrow mark upward
3. The whole level may not exceed 0.04mm/m. The aligning result may be not bigger than ex-work record: ±0.04mm/m

Fitter: Checker: Date:

Attached diagram 3: Assembly mark diagram for bearing and bearing cover



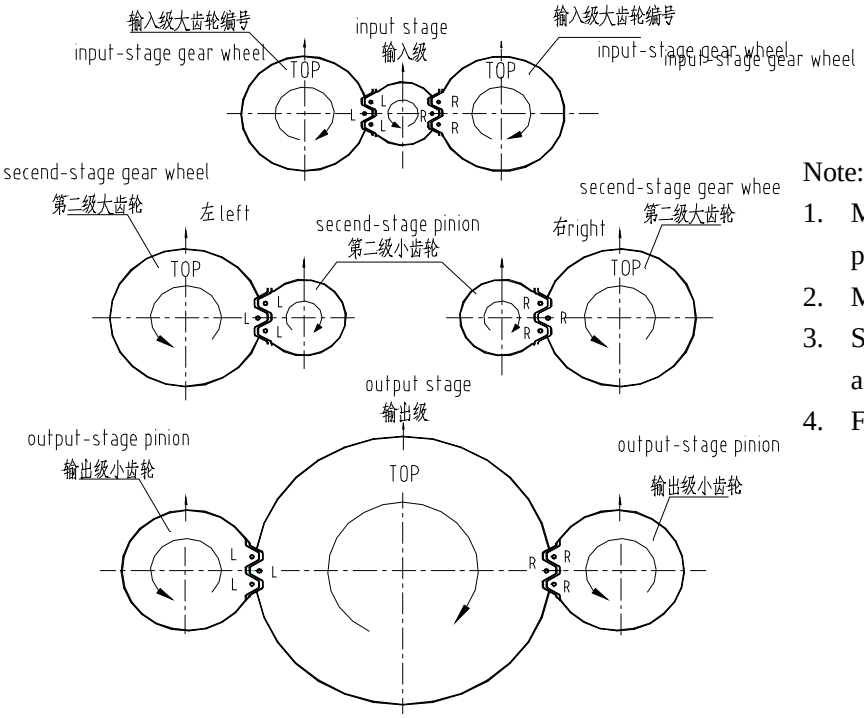




Attached diagram 4: Assembly mark diagram for bearing and bearing cover

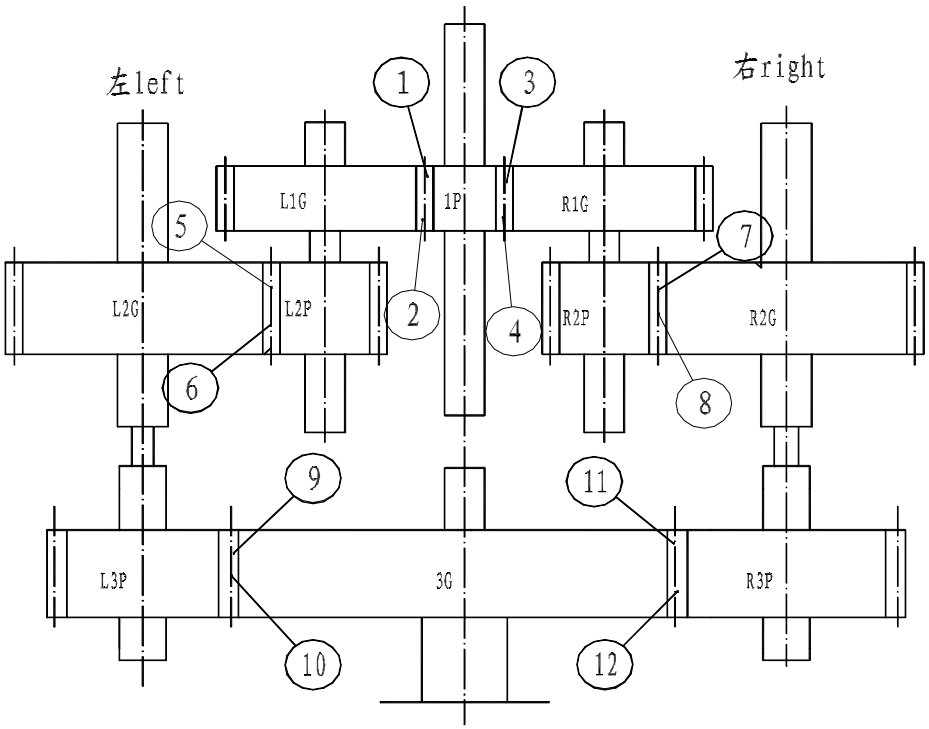
Designation / Position	Assembly mark of sliding bearing	Assembly mark of bearing cover	Assembly mark of thrust bearing
L01	double-row self-aligning spherical roller bearing	L01:bearing cover at L01	
L02	double-row self-aligning spherical roller bearing	L02:bearing cover at L02	
L03	L01T:upper bearing pad at L01	L03:bearing cover at L03	LT01T:upper thrust at L01
	L01B:lower bearing pad at L01		LT01B:upper thrust at L01
L04	L02T:upper bearing pad at L02	L04:bearing cover at L04	LT02T:upper thrust at L02
	L02B:lower bearing pad at L02		LT02B:upper thrust at L02
L05	L03T:upper bearing pad at L03	L05:bearing cover at L05	
	L03B:lower bearing pad at L03		
L06	L04T:upper bearing pad at L04	L06:bearing cover at L06	
	L04B:lower bearing pad at L04		
R01	Assembly mark of sliding bearing	R01:bearing cover at R01	
R02	Assembly mark of sliding bearing	R02:bearing cover at R02	
R03	R01T:upper bearing pad at R01	R03:bearing cover at R03	RT01T:upper thrust at R01
	R01B:lower bearing pad at R01		RT01B:upper thrust at R01
R04	R02T:upper bearing pad at R02	R04:bearing cover at R04	RT02T:upper thrust at R02
	R02B:lower bearing pad at R02		RT02B:upper thrust at R02
R05	R03T:upper bearing pad at R03	R05:bearing cover at R05	
	R03B:lower bearing pad at R03		
R06	R04T:upper bearing pad at R04	R06:bearing cover at R06	
	R04B:lower bearing pad at R04		
M01	double-row self-aligning spherical roller bearing	M01:bearingcover at M01	
M02	double-row self-aligning spherical roller bearing	M02:bearingcover at M02	
M03	M03T:upper bearing pad at M03	M03:bearing cover at M03	MT03T:upper thrust bearing at M03
	M03B:lower bearing pad at M03		MT03B:lower thrust bearing at M03
M04	M04T:upper bearing pad at M04	M04:bearing cover at M04	MT04T:upper thrust bearing at M04
	M04B:lower bearing pad at M04		MT04B:lower thrust bearing at M04

Attached diagram 5: Matching mark of gear pair & measuring record of backlash



Note:

1. Make matching mark for gear pair with paint and stamp.
2. Make arrow upward.
3. Sense of rotation shall be in accordance with notice.
4. Face the motor side.



Symbol explanation:
L: left side
R: right side
ML: left side of intermediate stage
MR: right side of intermediate stag
P: pinion
G: gear wheel
1: input-stage gear
2: intermediate stage gear
3: output-stage gear

Design value												
Measuring position	1	2	3	4	5	6	7	8	9	10	11	12
Actual measuring result												
Installation result												

Fitter: Checker: Date:

Attached diagram 6: Assembly inspection record of sliding bearing and thrust bearing

Items / Position	Contact pattern		Radial clearance		Pad clearance					Thrust bearing clearance	
	Requirement	Actual value	Requirement	Actual value	Requirement	Measuring point				Requirement	Actual value
						1	2	3	4		
L03	100%×45^0 (axial) × (circumferential)		0.25-0.50 (according to drawing notes)		For 4 points indicated in the drawing, insert feeler gauge(0.15mm) inside.The upper& lower pads clearances are the same.						
L04											
L05											
L06											
R03											
R04											
R05											
R06											
M03											
M04											
Left Gear											
Right gear											
Output shaft											

Fitter: Checker: Date:

Attached diagram7: Inspection record of gear pair contact pattern

Position	Requirement	Actual value
Left-side input gear pair(L)	80%×70% (tooth length)×(tooth height)	
Right-side input gear pair(R)		
Left-side output gear pair(L)		
Right-side output gear pair(R)		

Remarks: Original record (indicate face width direction)of contact pattern is printed by tape.

Left-side input gear pair(L)
Mill side: _____ Motor side

Right-side input gear pair(L)
Mill side: _____ Motor side

Left-sidemiddle gear pair(L)
Mill side: _____ Motor side

Right-side middle gear pair(R)
Mill side: _____ Motor side

Left-side output gear pair(L)
Mill side: _____ Motor side

Right-side output gear pair(R)
Mill side: _____ Motor side

Attached diagram 8: Ex-work no-load testing record

Output speed r/min				
Running time min				
Lubricating oil pressure Mpa				
Lubricating oil temperature ℃				
Bearing temperature at each point (℃)				
L01				
L02				
L03				
L04				
L05				
L06				
R01				
R02				
R03				
R04				
R05				
R06				
M01				
M02				
M03				
M04				
Noise test(dB)	Requirement:		Actual value:	
Tester: Checker: Date:				

目　　录

前　言

JST 系列中心传动磨机减速机由减速机、慢速驱动装置、膜片联轴器和稀油润滑装置四大部分组成。主要用于水泥工业管磨机的中心传动的减速装置，也可用于其它机械作传动装置。

主减速机及配套设备的现场工作应按本说明书规定和国家建材局颁布的“水泥机械设备安装工程施工及验收规范”《JQ03-90》有关规定进行，还应执行现场指导工程师的意见和决定。

减速机机房的建筑标准主要取决于当地情况和气候条件。要考虑出现最低的环境温度和整个粉磨车间所容许的最大噪音，特别要考虑防止粉尘直接沉积在减速机上，机房应有足够的检修场地，为的是方便日后的大修工作。

减速机及其配套部件在收到后应当及早安装，不能立即安装的应存放在防潮的仓库中，存放一年后应开箱进行防锈保养。开箱时应按装箱清单或零件目录、图纸仔细查对零部件数量和完好状况。同时贮备必要的材料和工具以备安装需要（见附图表 1）。

为了使安装工作顺利进行，必须准备好所需要的各种工具和仪器，要有合适的运输和吊装设备，最好用移动式起重机完成。

安装前必须仔细阅读本说明书，看懂安装基础图、装配图及外形图，熟悉安装程序，仔细查看减速机各部件和其它配套件的形状尺寸、重量以及数量。检查吊车的吊装能力是否符合 安装工程的需要。清除灰尘、杂物，保证安装工程周围环境的整洁。

第一部分：主减速机

1. 概述

JST 系列减速机采用中心传动，功率双分流，扭力轴均载，三级减速对称布置的结构形式（图 1-1）。

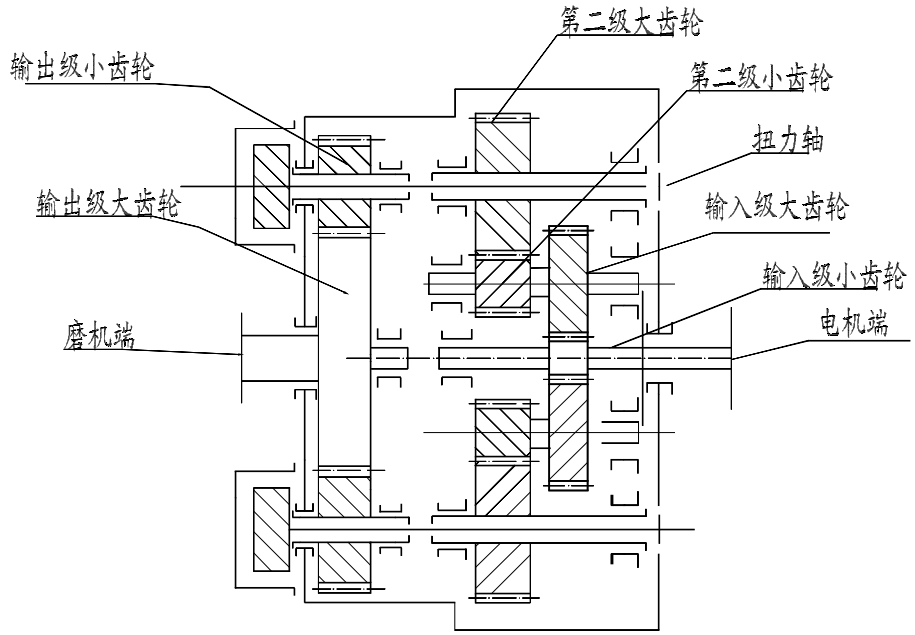


图1-1

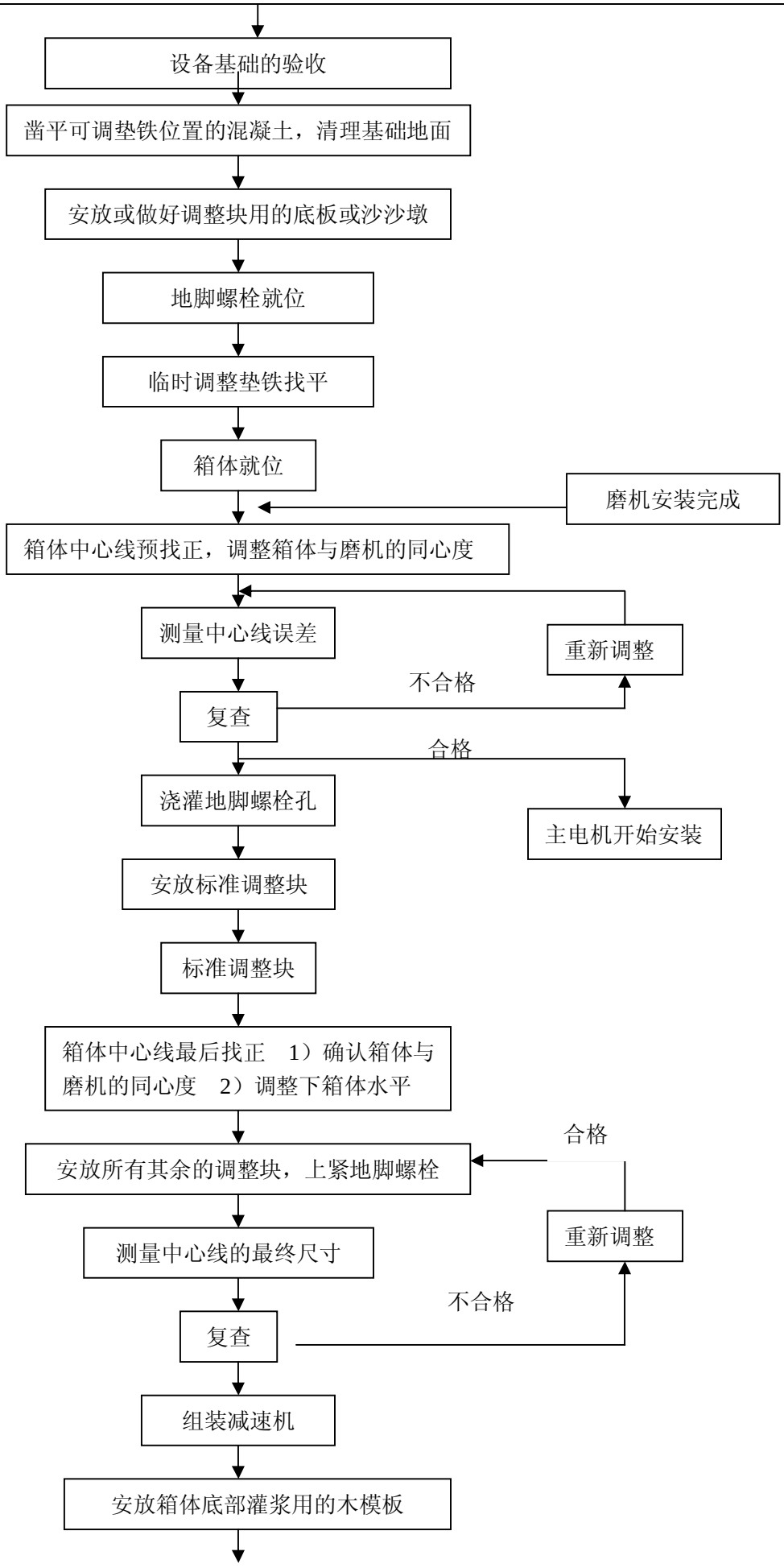
2. 主减速机的技术参数

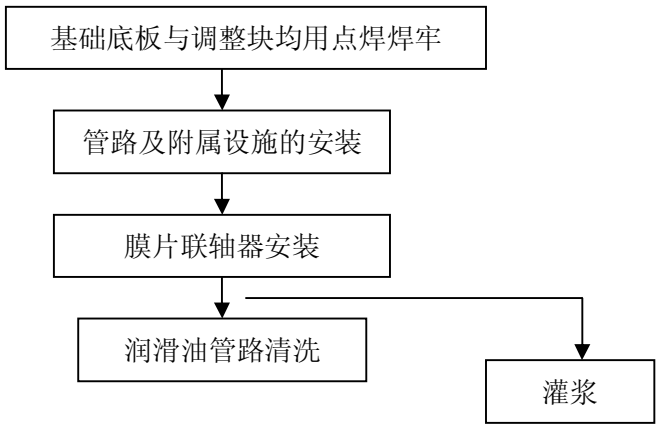
传递功率：见合同或技术协仪
输入转速：见合同或技术协仪
输出转速：见合同或技术协
传 动 比：见合同或技术协仪
中心距：
齿轮精度：6 级或 6 级以上　GB10095
齿面硬度：HRC60±2
齿面接触斑点：额定载荷时，长度和高度不少于 85%
噪音：空载时小于或等于 90 dB（A）
润滑油牌号：工业闭式齿轮油　N320 或 N220

3. 主减速机的安装程序

大型减速机安装，因其结构形式不同而安装内容和方法存在较大差别。由于运输条件限制，JST 系列减速机被分为箱体、输出轴组件、第二级大齿轮组件、扭力轴组件、传动轴、膜片联轴器等进行包装，运到现场后进行组装。由于受到整个车间的安装计划和厂房条件的影响，实际安装程序并不总是一成不变的。从技术上看，可以采用不同的分步安装程序，然而作为减速机制造公司推荐的安装程序如下:

安装流程图


设备基础的验收
凿平可调垫铁位置的混凝土，清理基础地面
安放或做好调整块用的底板或沙沙墩
地脚螺栓就位
临时调整垫铁找平
箱体就位
磨机安装完成
箱体中心线预找正，调整箱体与磨机的同心度
测量中心线误差
重新调整
不合格
复查
合格
浇灌地脚螺栓孔
主电机开始安装
安放标准调整块
标准调整块
箱体中心线最后找正 1）确认箱体与磨机的同心度 2）调整下箱体水平
合格
安放所有其余的调整块，上紧地脚螺栓
重新调整
测量中心线的最终尺寸
不合格
复查
组装减速机
安放箱体底部灌浆用的木模板



3．1　　设备基础的验收

3．1．1　按 JC03-90 标准中第 1。3。1 条有关规定验收基础。

3．1．2　在减速机安装基础的表面，在指定的位置上应标有减速机轴心的基准点。磨机接管法兰端面与减速机输出级传动齿轮中心线的基准点，并检查距离是否符合设计要求（见图 1-2）。图中“A”的设计尺寸，在减速机基础安装示意图中给定。

3．1．3　地脚螺栓孔的位置和深度以及基础上的地沟是否满足基础安装图的要求。

3．1．4　减速机安装基础标高是否符合设计要求。

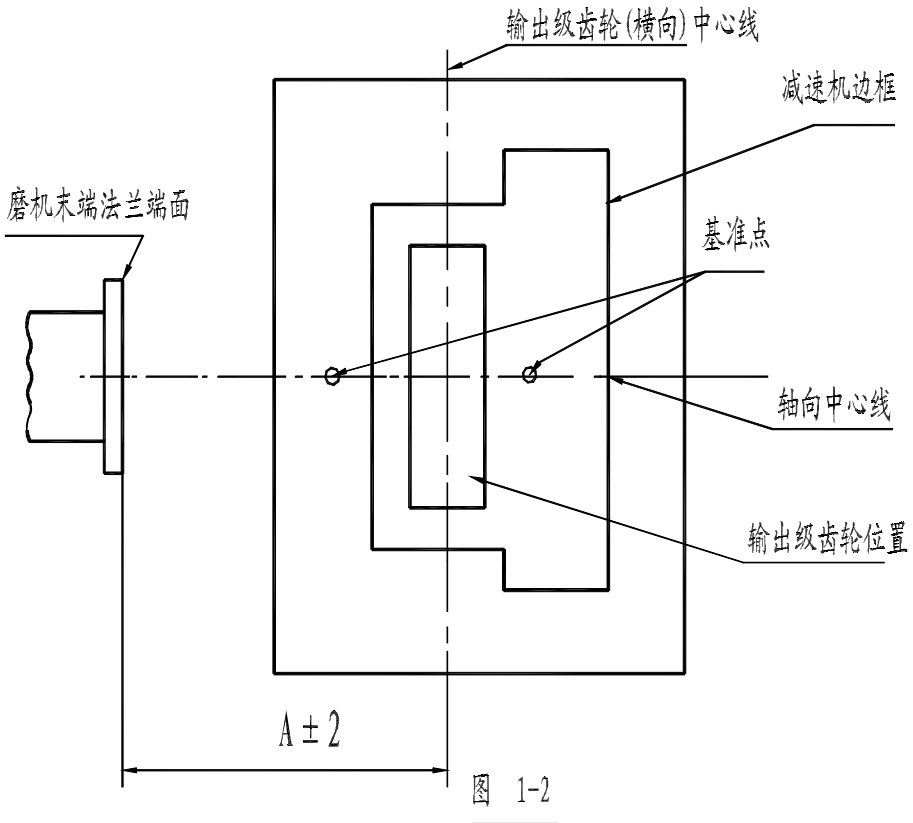


图 1-2

3．2 下箱体的安装

下箱体安装前，应完成磨机安装，为了保证整个工程的安装质量，应检查磨机水平和接管法兰安装情况。磨机两端支撑轴颈应在同一个水平面上，其相对标高偏差不应超过 1mm。磨体符合水平要求后，检查传动接管法兰的安装是否符合要求。旋转磨体测量传动接管法兰径向跳动和端面跳动，并做好记录。上述检查工作很有必要，否则将影响减速机的水平找正，甚至影响整个工程的安装质量。下箱体拆开包装箱后，将安放在下箱体里面的齿轮吊出放好。减速机安装调

试运转用户需要准备的物品见附图表 1

3．2．1　所有安放可调垫铁的基础表面必须凿毛，彻底清除设备安装场地及地脚螺栓孔内碎屑，杂物及积水。基础周围必须填平、夯实。

3．2．2　安放地脚螺栓。在每根螺栓头部系一细铁丝，以便能将螺栓穿过箱体相应的孔。安放前清除螺杆上的锈垢、油污。螺纹部分涂脂防锈。

3．2．3　将可调垫铁油封清除干净，螺纹部分涂脂防锈。按图 1-3 安放四块临时调整垫铁和地沟上的 5 个调整垫铁，其标高差不大于 0.2mm.。垫铁上表面标高 H 按下式确定（见图 1-4）。

$H=H_m-H_j-$（0.2-0.4）mm

式中：H_m-磨机中心高

H_j-减速机下箱体

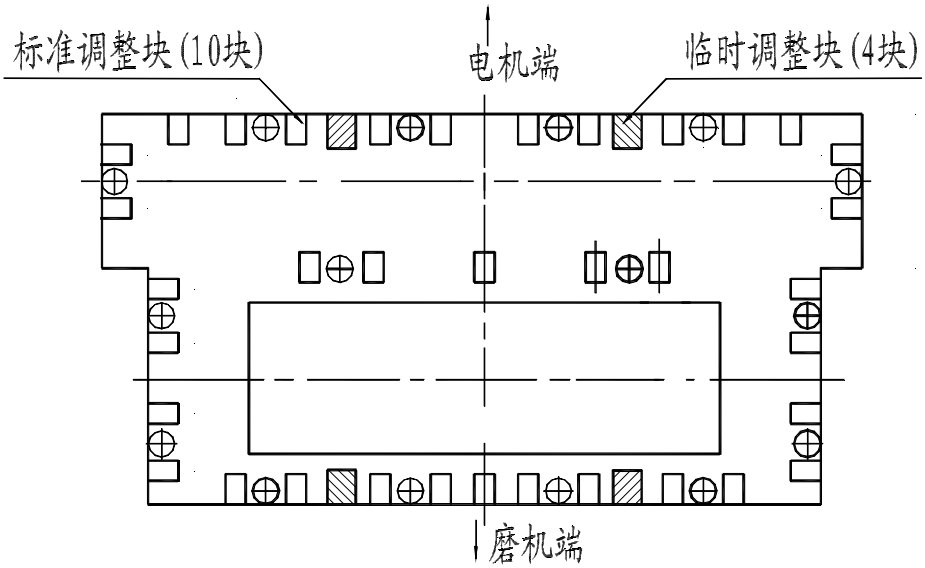


图　1-3

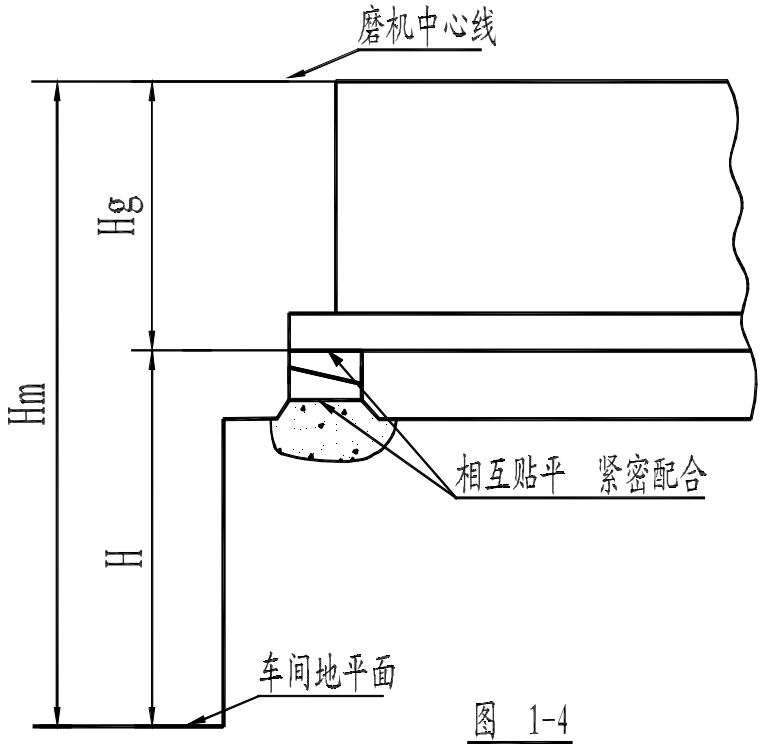


图　1-4

3．2．4　将输出级的油底壳仰放在地沟内，将其橡胶石棉垫收拾好，以防破损。

3．2．5 将下箱体水平吊放到临时垫铁上，使其中心线对准基础面上已好的两个基准点。同时使输出级中心线与磨机传动接管端面的距离（见图1-6）A 值等于基础安装示意图中规定的“A”值。

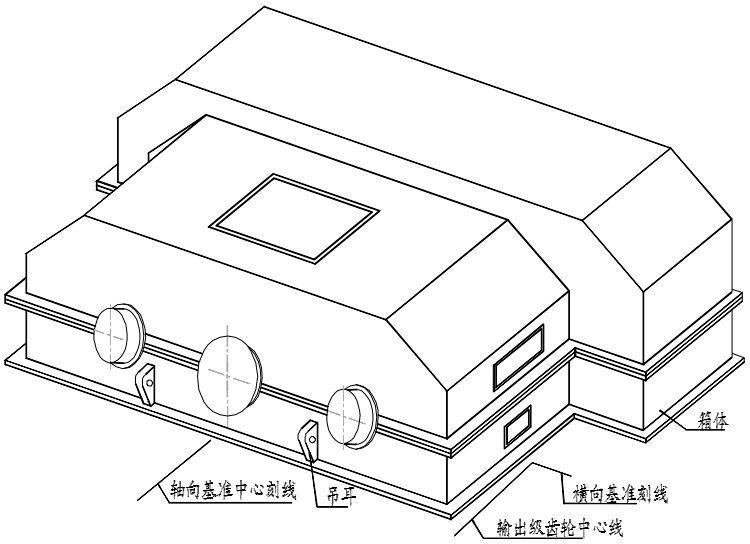


图　1-5

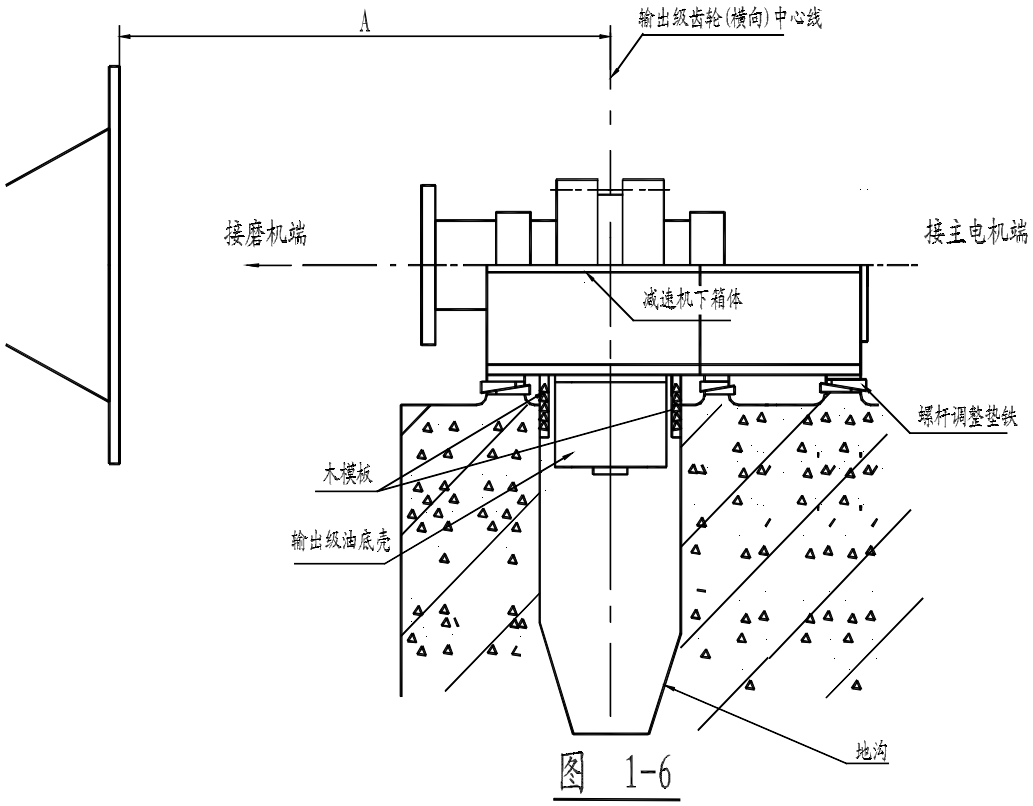


图　1-6

3．2．6　减速机下箱体就位后，调整其上表面的水平。通过调整四个临时垫铁，利用水平垫块、平尺和水准仪进行初找正，使其与出厂“下箱体上平面水平测量记录”数据误差范围在±0.1mm（见附图表 3）

3．2．7　初找磨机与减速仙中心线的同轴度。

将膜片联轴器的法兰装在输出轴组件上，并将其安装在下箱体上（详见 3。3。1)。按图 1-7 做一简易支架，将其安装在磨机传动接管法兰上，在支架端装上百分表。盘动磨机慢速转动（转向和工作转向一致）进行初找正。其误差范围按表 1-1 确定。用表打法兰的外径和端面跳动。（可同时装两块百分表找正)在找正调整过程中有时效变形现象，因此不要急于求成，时间可长些。

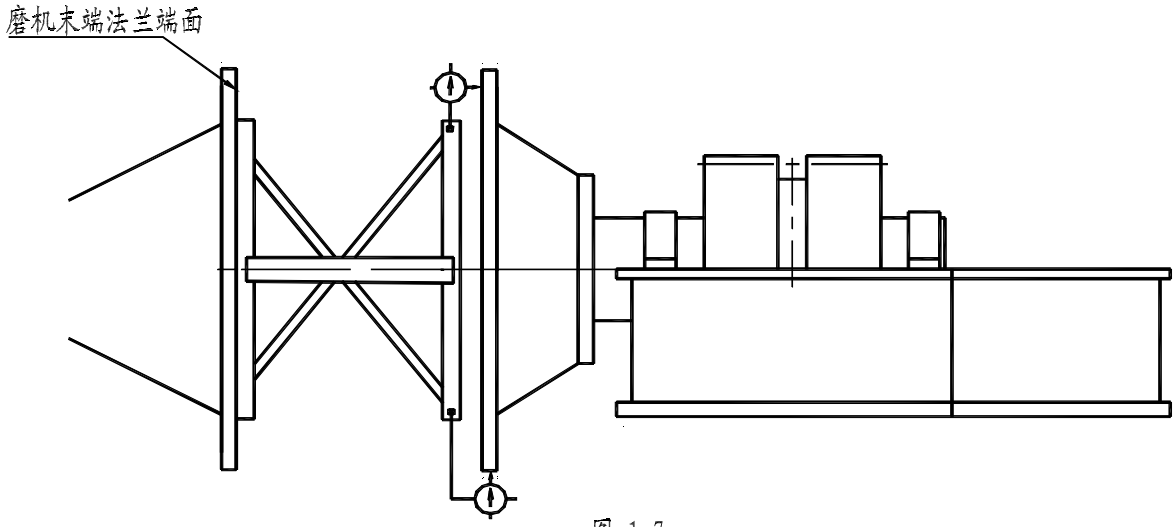


图 1-7

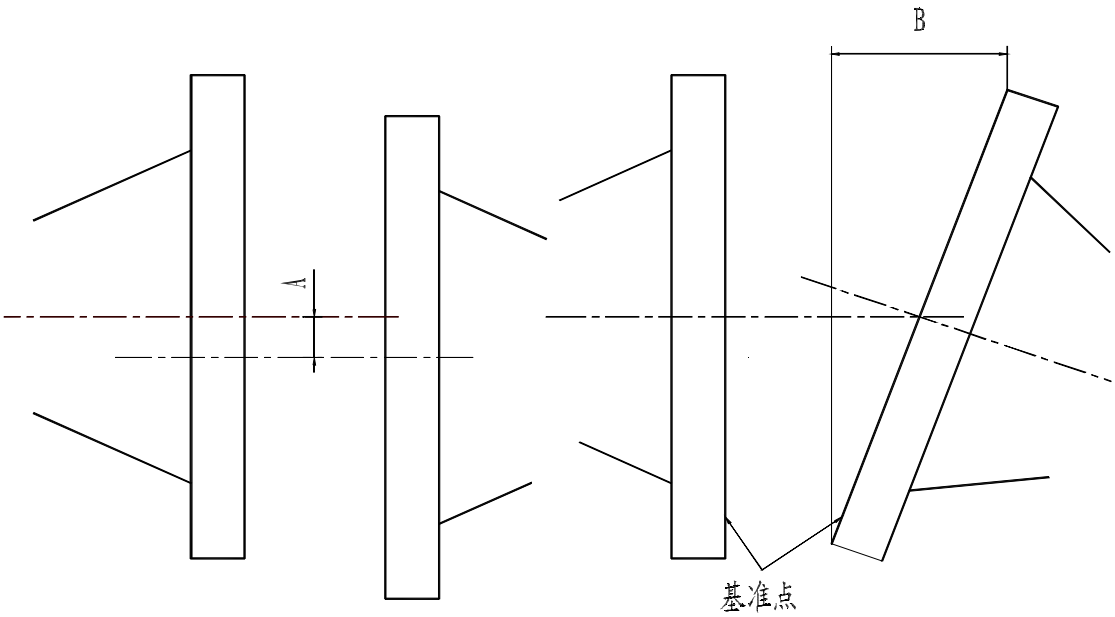


表 1-1

	同轴度误差	端面误差
初找正	A=∅0.5mm	B=1mm
精找正	A=∅0.3mm	B=0.7mm

3．2．8　地脚螺栓浇灌应符合 JC03-90A 标准中第 1.4.4 条规定.

3．2．8．1 按图 1-8 要求将地脚螺栓垂直固定在箱体地脚螺栓孔的中心位置，为防止偏离，可用 δ=2mm 的铁皮做一定位圈，其内孔套在螺栓上，外圈放在箱体孔中，浇注后将其取出。

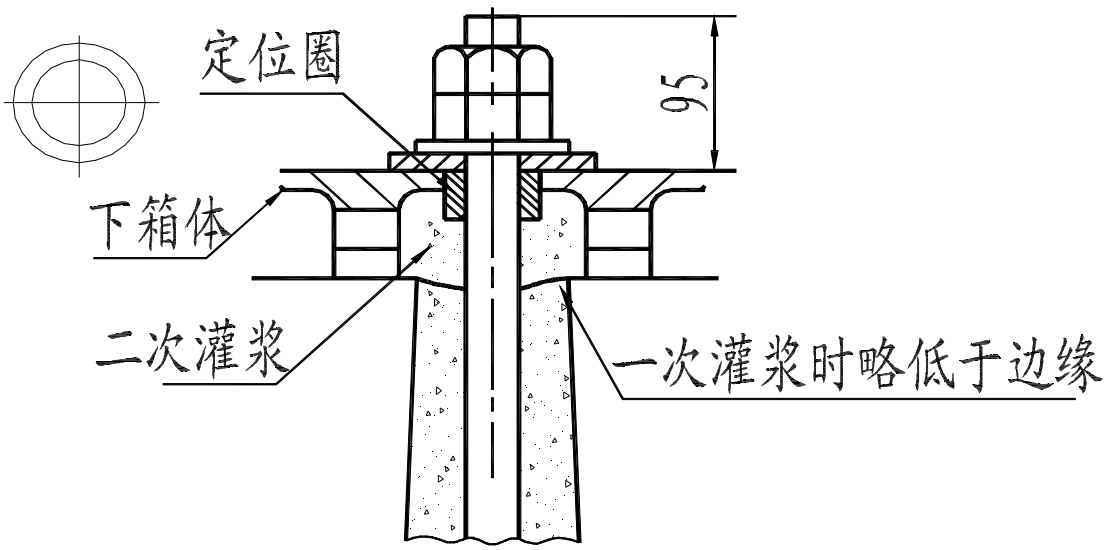


图 1-8

3．2．8．2 砂浆质量比由土建工程师确定。水泥标号 525，拌匀后 30 分钟内浇入孔内，充分使浆捣固密实，混凝土强度等级 C30，其标高应略低于基础表面。

3．2．9　按图 1-3 所示位置安装其余标准可调垫铁。安放时注意将螺栓头部放在旋动处。可调垫铁安放前，按 JC30-90 标准中附录二的要求敷设水泥砂墩，其标高应比基础表面低，可调垫铁置于砂墩上后仔细调整其高度。使其上下表面分别与下箱体和基础表面紧密贴合，但不得使箱体抬高。标准垫铁安装好后，拆除临时调整垫铁。

3．2．10 拧紧地脚螺栓。在混凝土达到设计强度 80%以上后，才允许拧紧地脚螺栓。拧紧次序一般从中间向两侧交错对角进行，施力应均匀。按图 1-8 用双螺母锁紧。螺母与垫圈。垫圈与箱体均应保持面接触。

3．2．11 按 3。2。9 方法安装其余可调垫铁，使其与箱体底面和砂墩紧密贴合，均匀地拧紧螺栓。紧定时用百分表监视并仔细调整垫铁高度，保证箱体上平面不变。

3．2．12　所有地脚螺栓拧紧后复查箱体上平面水平，使其与附图表 2 的水平测量记录数据误差在±0.04mm/m。复查箱体中心线位置，使之符合表 1-1 中的误差要求，否则重新对箱体进行找正。注意在调整过程中的时效变形现象，因此不要急于求成，时间可长些。

3．2．13 清洗干净仰放在地沟内的输出级油底壳表面放好密封垫，并将其紧固在下箱体上。

3．2．14 二次灌浆。灌浆前应按图 1-6 安好木模板，清理干净表面杂物、油污，混凝土强度等级 C25。砂浆质量比由土建工程师确定，其标高应符合图 1-8 要求，确保调整垫铁固定牢靠。

二次灌浆先进行中间的两个地脚螺栓，其余待减速机负荷试验后进行。

3。3 减速机传动零件的安装

传动零件在安装前，必须用锉刀和砂纸将所有锐边毛刺去除。特别是轴颈、滑动轴承、推力轴承、轴承盖、箱体轴承孔等处。

安装前，将下箱体及所有零部件彻底清洗干净，用压缩空气吹干表面后涂润滑油防锈。必须确保安装的清洁度，特别是轴与轴承之间绝对、不允许掉入铁屑、灰砂及其它异物。应仔细查对轴承和齿轮组件端面的同组标记和方位标志，确认正确无误后方可安装，以免造成返工甚至损坏零件。

3．3．1　输出轴组件

3．3．**1**．1　安装下轴瓦。按标记将 M03B 和 M04B 轴瓦安放在相应的轴承座孔内，检查瓦背与座孔面的贴合情况。保证紧密贴合。在瓦面抹一薄层干净的润滑油后，用干净布将其掩盖，直至输出轴颈将要装上时取出，以防脏物掉入。

3．3．1．2 按图 **1**-9 将输出轴组件水平吊起（可

用水平仪确认水平），缓慢地将轴放至轴瓦上。注意使输出大齿轮端面上有标记“TOP”或用红油漆画的“↑”处于上方。

3．3．1．3 安装两端推力轴承。按标记先将下半块（MT03B 和 MT04B）扣在轴上，使轴承合金面朝输出轴推力面，然后使其慢慢滑到下部。（注意在轴承合金面上抹上一薄层干净润滑油）。

3．3．**1**．4 按次序装好止动销，上半块推力轴承，上轴瓦（注意均在合金面上抹一层润滑油），轴承盖（注意配对记号）。打好定位销，拧紧轴承盖与下箱体联接的螺栓。

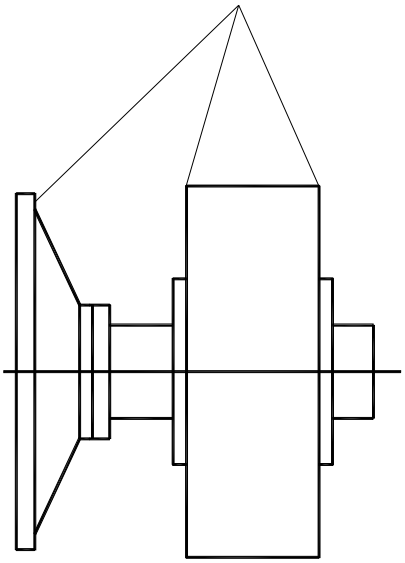


图1-9

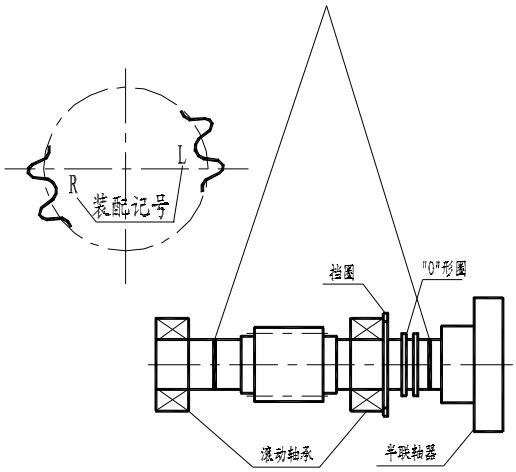


图1-10

3．3．2 输入轴组件

3．3．2．1　先将半联轴器装在输入轴上。注意安装前应将轴承挡圈和“**O**”形密封圈套在输入轴上。将已清洗干净的输入轴组件水平吊起，缓慢地将两端轴承放在轴承座孔内（滚动轴承内注入少量润滑脂），将齿轮端面打印的字符“**L**”朝左，“**R**”朝右（向电机方向看），并处于水平位置。

3．3．2．2 按成组印记，将轴承盖扣在对应的轴承上，打好定位销，拧紧螺栓。

3．3．3 输入级大齿轮与第二级小齿轮组件

输入级大齿轮与第二级小齿轮组件分左侧和右侧各一件。安装的先后次序视现场情况确定。

3．3．3．1 清除所有轴承以及相应轴承盖、轴承座孔上可能有的毛刺和碰痕，按方位和成组印记（见附图表 **4**）将左右两侧输入级大齿轮组件先后按图 **1-10** 吊装方式缓慢将其安放在下箱体上。注意起吊时将端面上的“TOP”或红“↑”印记转到正上方。在缓慢下放过程中，让输入级齿轮副刻有“R”或“L”标记的一轮进入另一轮刻有两个“L”或“R”标记的齿槽，缓慢地将两端轴承放在轴承座孔内（滚动轴承内注入少量润滑脂），并处于水平位置。放好轴承挡圈。

3．3．3．2 按成组印记，将轴承盖扣在对应的轴承上，打好定位销，拧紧螺栓。

3．3．3．3 在每个大齿轮的相隔 **120**° 的方位在三个连续三个工作齿面上均匀在涂一层红丹油，同时在相邻的三个工作齿面上涂着色剂。按磨机工作转向转动输入小齿轮，使涂丹油齿面接触两三次，然后检查接触斑点，使之符合出厂时的检验记录。接触斑点偏离小齿轮功率输入端为佳。

3．3．4 第二级大齿轮组件

第二级大齿轮组件分左侧和右侧各一件。安装的先后次序视现场情况确定。

3．3．4．1 仔细检查第二级大齿轮组件各轴颈和齿轮表面，清理意外发生的碰痕。安图所示将第二级大齿轮组件水平吊起。注意起吊时将端面上的“TOP”或红“↑”印记转到正上方。在缓慢下放过程中，让第二级齿轮副刻有“R”或“L”标记的一轮进入另一轮刻有两个“L”或“R”标记的齿槽，直至组件轴颈轻轻放到相应轴瓦上。

3．3．4．2 按印记安装大齿轮两端的推力轴承

下半块。将下半块扣在轴上，使轴承合金面朝齿轮推力面，然后使其慢慢滑到下部。（注意在轴承合金面上抹上一薄层干净润滑油）。

3．3．4．3 按 **3**。**3**。**3**。**3** 款所述方法，在第二级齿轮副涂红丹油、着色剂。按磨机工作转向转动输入小齿轮，使涂丹油齿面接触两三次，然后检查接触斑点，使之符合出厂时的检验记录。

3．3．5 扭力轴组件

拆开包装箱，清洗箱内两组扭力轴组件。仔细检查各轴颈和齿轮表面，清理意外发生的碰痕，安装的先后次序视现场情况而定。

3．3．5．1 拆除扭力轴与齿轮轴组件上联接螺栓和圆柱销，将两根扭力轴从组件中抽出。查各零件印记，如没印记应及时补上，以免互相装错。

3．3．5．2 将组件中的输出级小齿轮轴水平吊起，缓慢下放，让输出级齿轮副刻有“**R**”或“**L**”标记的一轮的齿进入另一轮刻有两个“**R**”或“**L**”标记齿槽，直到齿轮轴轴颈轻轻放到相应的下轴瓦上。

3．3．5．3 按 **3**。**3**。**3**。**3** 款所述方法，在输出级两侧小齿轮上涂红丹油、着色剂。按磨机工作转向转动小齿轮，使涂丹油齿面接触两三次，然后检查接触斑点，使之符合出厂时的检验记录。接触斑点偏离小齿轮功率输入端为佳。

3．3．5．4 检查各滑动轴承瓦口处的间隙和推力轴承的轴向间隙，使之符合出厂检验记录，如相差较大，应查明原因。

3．3．5．5 按次序和成组印记装好左右两侧所有滑动轴承、推力轴承、轴承盖。打好轴承盖定位销，并拧紧所有联接螺栓。

3．3．5．6 按印记安装左右两侧的扭力轴、锥套等。注意分别在两端对好对位记号后，按配对记号装好圆柱销，并拧紧所有联接螺栓。

3．3．5．7 检查同步。按磨机工作转向转动输入小齿轮 **1-2** 圈后，用塞尺检查六个啮合副的啮合处，**0.1mm** 塞尺不能通过时，视为合格。

3．3．6 安装内部润滑油管路

油管安装前所有油管应清洗干净，用压缩空气吹干，在下箱体上进油管口法兰处安放 **100** 目铜滤网（防止串油时，异物进入轴承。串油完毕拆除）并衬以耐油橡胶石棉垫，螺栓上防松胶并拧紧。

3．3．7 安装温度传感器

安装前应先检查 **Pt100** 铂热电阻是否完好（将水银温度计和 **Pt100** 同时放入 **70-80**℃的热水中，**Pt100** 示值与温度计示值相同为完好。按导线的长短（见标记）和图纸规定，一端与轴承盖上的 **M12×1.5** 的螺孔相连，另一端与下箱体上接线盒中的接线端子相接，确保轴承编号和接线端子序号一致。

安装时应严防碰撞和冲击铂热电阻，其导线沿润滑管路布置，并用细铁丝将其固定在油管上，以防被齿轮挂住；导线不得折叠，以免传感器失效，影响减速机工作。

3．4 上箱体的安装

3．4．1 仔细检查并清除上箱体上结合面的锈斑和碰痕，清洗干净后按图 1-11 水平吊起，轻轻安放到下箱体上。打好定位销，拧紧靠近座孔处螺栓。待串油清洗完毕，拆除各油管法兰进口处的滤网并空负荷试车后按图 1-12 在下箱体接合面板上的螺孔内侧涂上密封胶，仔细地落下上箱体，不要碰撞齿轮，在下箱体上就位，装上定位销，拧紧所有螺栓。

3．4．2 安装所有端盖、轴盖，安装时衬以耐油橡胶石棉垫或涂密封胶。

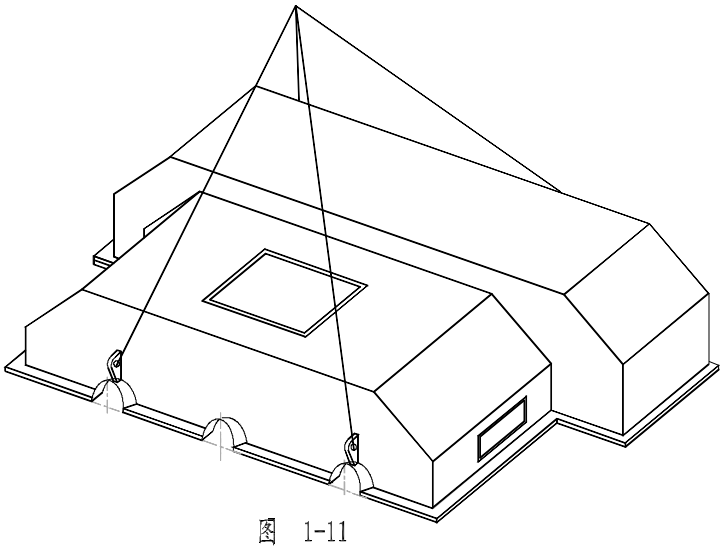


图 1-11

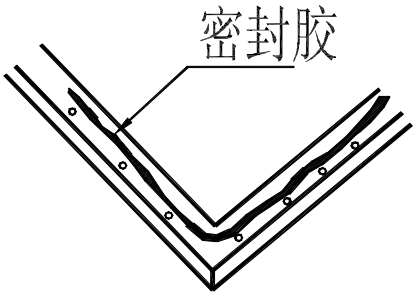


图 1-12

4．安装施工中的注意程序

4．1 减速机应存放在干燥、防晒、防潮的库房内。设备在油封有效期内不要将防锈的包装拆除，特别是齿轮、轴、轴承等重要零部件，以防锈蚀。

4．2 照工艺设备图、土建图，以磨体中心线为基础，检查所有基础标高及地脚螺栓孔尺寸，位置是否相符，发现不符及时修正。

4．3 由于减速机是精密设备，为了保证安装质量，清洁防尘是重要环节，应特别加以重视。

4．4 减速机的上箱体吊开后，到减速机上去找正测量的人员应穿戴干净的衣鞋，以避免脏物掉入减速机内，随身携带的工具应用绳套在手上，以防掉入机内。

4．5 减速机在找正测量时，应注意避免损坏减速机内零件，特别是润滑管系和测温用的 PT100 铂热电阻。非找正测量期间应将上箱体盖上。

4．6 减速机重要零部件的清洗，应使用煤油或汽油。清洗时禁用棉纱擦抹，以防粘附在轴、齿轮、轴瓦上影响安装质量。应采用绸、棉毛衫等为好。

5．试运转、使用及维护

减速机必须在主电机、慢速驱动装置、稀油润滑装置等按规定安装完毕，各种电器控制，互锁系统准确无误的情况下才能进行试运行。

5．1　　串油清洗

减速机润滑系统的清洁度是十分重要的，运转前必须进行串油清洗。接好油站与减速机、慢速驱动装置之间的进油管和回油管，向油箱内注入其容积约 60%的 N320 或 14 号柴油机油，在减速机进油口处放置铜滤网。

清洗前，将清洗油加热到 50℃（开通旁路阀并关闭出油口阀门，使油在油箱内自循环，以防加热时结碳），然后打开出油阀，关闭旁路阀，

启动油站串油。

清洗过程中，开始每小时检查并清洗一次磁过滤器和双联过滤器滤网。4 小时后每隔两小时检查一次，串油 12 小时并确认没有杂物后，停止冲洗。拆下减速机进油口处安放的铜滤网并清洗干净后放回原处。拧紧螺栓，继续进行串油清洗，直到安放的铜滤网确认无杂物后，此项工作才可结束。

串油清洗结束后，取出减速机进油法兰处安放的铜滤网，排干油箱内清洗用油，彻底清除油箱内油泥杂物，必要时用灰面团将箱内砂粒粘贴干净后灌入规定的润滑油。

整个串油过程中仔细检查管路有无渗漏，特别是各法兰联接处，同时通过上箱体观察孔，察看各润滑点是不有油润滑。

5．2 减速机试运转

5．2．1 试运转前的准备和检查项目

检查整个系统地脚螺栓和所有联接螺栓是否紧固，检查整个控制系统是否完备和准确可靠。特别是慢速驱动电机和主电机，油站的油泵电机和主电机互锁，以及基础安装图上要求的其它联锁。

运转前使油站加热器工作，将润滑油加热到 38℃（注意加热时使油站自循环），才可向减速机供油。供油 30min 后，检查确认管系各联接法兰，油站油压、油温及各系统工作正常后，才能启动主电机使减速机运转。

检查慢速驱动装置各联接处确认可靠后，通过操纵手柄使其与减速机相连，用手盘动慢速驱动装置，确认运转灵活，无卡滞或撞击发生后，方可启动慢速驱动电机进行运转。运行 20min 后如无异常，可停止其运转，通过操纵手柄使其与主减速机处于脱离状态，并用锁紧螺栓 将操纵手柄锁定。

5．2．2 减速机空负荷（磨机未装钢球）运转时间为 360min，运行中每 30min 检查记录一次，记录内容如下：

环境温度（℃）：

润滑油出口温度（℃）：

各轴承处温度（℃）：

主电机电压（V）：

主电机转速（r/min）：

主电机电流（A）：

润滑油出口压力（MPa）：

过滤器滤网清洁度：

5．2．3 负荷试运转

减速机负荷试运转按表 1-2 进行

各工况运行时，每隔 60min 除按 5.2.2 记录内容记录外，补充记录如下内容：

冷却水流量（m^3/h）：

冷却水出口温度（℃）：

冷却水进口温度（℃）：

减速机噪音及振动：

表 1-2 负荷试运转各工况及运行时间

序号	电机转速（r/min）	电机功率（kW）	研磨体装入量（%）	运行时间（H）	备注
1	额定转速	1/3P	33	16	P：电机额定功率 各工况运行时间可根据磨机试运行规定进行。
2	额定转速	1/2P	50	16	
3	额定转速	3/4P	75	16	
4	额定转速	9/10P	90	16	
5	额定转速	P	100	20	

5．2．4 试运转期间操作人员应加强巡回检查，作好运行记录，发现异常声响或其它问题应立即停机检查。

每隔 4 小时检查一次过滤器滤网，如发现有金属碎屑或其它杂质，应停机查明原因并确认故障安全排除后，方可继续运转。

各轴承温度，滑油压力或其它系统超过额定整定值时，报警系统报警后应立即停机并查明原因予以排除，不允许原因未查明或故障未排除前强行启动或拆除保险装置。

5．2．5 检查和验收

试动转结束后，进行详细检查，其内容如下；

检查并整理试运转的各项记录；检查各控制系统的准确可靠性；检查滑油过滤器并清洗干净；检查整个运转系统各联接处是否松动。用水平仪测量下箱体底板上 4 处平面情况（反映今后地基是否下沉）。

上述检查内容应作全面文字记录和图片记载，并作为验收的的依据。

5．3 使用维护

JST 系列减速机是精密、重要的设备，必须加强管理和维护，操作人员应全面了解掌握各项设备使用说明书的要求，并切实遵照执行。设备管理人员应每天根据运行记录分析减速机的运行情况，必要时停机检查及时排除故障，以防酿成严重后果。

5．3．1　启动前的准备和操作程序

每次启动主电机前，必须检查慢速驱动装置离合器并使其与主减速机脱离，必须按油站使用说明书规定进行检查维护后向主减速机和慢驱减速机供油，确认供油压力达到规定值（0.15-0.3Mpa）后，才能启动电机进行工作。

5．3．2　停机操作程序

因各种原因需停止主减速机或慢速驱动装置工作时，应先停主电机或慢速驱动电机工作。由于惯性原故，减速机还会摆动，必须待减速机完全停止运转后，才能关闭油站停止供油，否则会烧损轴瓦甚至损坏减速机。

5．3．3　运行中的检查

5．3．3．1　每日检查内容

按 5。2。2 款检查记录内容每隔 60min 检查记录一次；检查各联接部位是否漏油；检查各紧固螺栓是否有松动；检查各运动副处是否有异常响声或振动。按油站规定进行维护保养。

5．3．3．2　每月检查内容

检查并清洗油站磁性过滤器和双联过滤器，如发现有铁屑和塑料的碎屑，应立即停机查明原因并加以排除；检查各联轴器及其它联接部位的情况，发现问题及时排除。按油站规定进行每月的维护保养内容。

5．3．3．3　半年的检查内容

检查润滑油的质量，发现变质，及时更换。检查控制系统的准确可靠性。

5．3．3．4　定期检查及维护（详见表 1-3）

5．3．3．5　特别注意事项及建议

减速机运行 1 年后，应重新对磨机与减速机中心线的同轴度进行复查，如有超差，应查明原因（如基础下沉），并按 3。2 的规定重新调整。

减速机首次使用的润滑油应半年进行更换，以后换油期为 15000h。

减速机如长期停止运行（15 天以上）每周需启动油泵向其供油，同时启动慢速驱动装置使其运行 10min

当主电机由于紧急跳闸而停车时，跳闸原因没有查清和完全排除以前，不得重新启动主电机。

润滑油质量是减速机安全运行的重要保证条件之一，我们推荐选用 GB5903-1995 工业闭式齿轮油标准中的 N320 或 N220。生产厂家推荐兰州炼油厂。

正确选用润滑油添加剂，可改善减速机的润滑条件和效果，延长齿轮和轴承的使用寿命。

表 1-3　　定期检查及维护

检查部位	检查项目及内容	备注
基础	基础沉降，磨机与减速机中心线对中	每年检查一次
减速机内部	齿轮表面损伤及接触印痕	每月检查一次
	内部各零件联接螺栓	是否松动
	有否其它异常现象	
减速机外部	各联轴器同轴度误差及轴向间隙	
	地脚螺栓有否松动	
	各密封面、管路	是否漏油、漏水
	多路温度巡检仪	按说明书要求校验
慢速驱动装置	手动操纵机构、三角皮带	灵活性及松紧度调整
膜片联轴器	有否异常响声及螺栓松动	按说明书要求校验
稀油润滑装置	更换油时清洗油箱	
	油泵、油冷却器、电加热器	
	磁过滤器、双联过滤器、阀门	
	控制柜、仪表盘上仪表及电器元件	

5.4 故障的分析及排除

减速机发生故障的原因往往比较复杂，需要作多方面的调查、了解 、分析、 研究。这里讲述的是一般的现象与初步原因的分析。（详见表 1—4）。

表 1—4　故障原因及排除措施

现　　象	故 障 原 因	采取措施
减速机轴承温度升高	1.轴承损伤	检查滤网有否合金碎屑，检查轴承塑料瓦面
	2.润滑油质量发生变化	观察和化验润滑油质
	3.过载荷	检查电动机电流、电压（输出功率）
	4.温度传感器失真	校验或更换
	5.供油量不足	检查供油压力和润滑管路畅通情况
	6.供油温度过高	检查冷却器供水情况和水温
减速机异常噪音或振动	1.齿轮或轴承损伤	开盖检查
	2.过载荷或冲击载荷	检查磨机或电动机是否有故障
	3.轴承松动	检查并紧固轴承盖的锁定螺栓
	4.磨机端或电动机中心线偏移	教正中心线并检查偏移原因
减速机漏　油	1.油封和垫片损坏或安装不当	检查或更换油封、垫片
	2.联接螺栓松动	拧紧螺栓
	3.通气帽堵塞	检查并排除堵塞物
减速机供油压力跌落	1.油泵或油泵电机损坏	检查、修理或更换
	2.油站旁通阀未关严	检查并调整旁通阀
	3.管路或冷却器漏油	检查并排除
	4.油泵吸油管吸入空气	检查油站的油位
	5.压力表失灵	检查校验压力表
减速机供油压力陡升	1.油管或轴承进油口堵塞	检查并排除
	2.油的粘度过高	检查供油牌号和供油温度
	3 压力表失灵	检查校验压力表
膜片联轴器摇晃和噪声	1.磨机传动接管松动	检查并排除
	2.基础下沉引起对中偏差	采取措施校正中心线
	3.膜片损坏	更换膜片
油泵异常噪音或振动	1.油泵过载,油的粘度过高	油泵齿轮被杂质咬住
	2.油泵轴和电机轴不同心	校验同轴度
	3.联轴器损坏	检查并更换橡胶圈
	4.油泵轴承、齿轮和泵体损坏	检查、修理或更换
油泵漏油或端盖发热	1. 油泵轴和电机轴不同心	校验同轴度
	2.端盖内的油封损坏	检查并更换填料
油箱的油位增高或降低	1.冷却器损坏或漏水	对冷却器泵压试验,检查油中水份
	2.管路漏油	检查进回油管
油站供油温度过高	1.冷却水温度过高	采取措施降低水温
	2.冷却水水量不够	加大供水量
	3.冷却器管路积垢	去积垢
油站磁过滤器发现金属碎屑	1.串油清洗不彻底	
	2.齿轮或轴承损伤	检查、修理或更换
警告:如在磁过滤器上发现金属碎屑,可根据下表判断金属性质及可能发生故障部位		
金属种类	**判别方法**	**检查部位**
钢	粘附在磁铁上	检查齿轮、滚动轴承
塑料	不粘附在磁铁上	检查滑动轴承
油漆涂料	不粘附在磁铁上,用手易捻碎	检查箱体内部油漆

第二部分：慢速驱动装置

1. 概述

JMS660 和 HMS660 慢速驱动装置是为 JST 系列中心传动磨机减速机设计配置的辅助传动装置。该装置是主减速机的安装、调试、检修及为水泥生产线的磨机检修、更换衬板、装进和补给研磨体等需要盘车时使用。

慢速驱动装置是为短时间低速转动磨机而设计的，不允许长时间全负荷连续运行，每次运行时间不得超过 0.5 小时。

JMS660 型慢速驱动装置安放在主减速机和主电机之间见图 2-1（主电机为单轴伸）。该装置由慢速驱动减速器、电动机、制动器、膜片联轴器以及手动离合机构等组成。

HMS660 型慢速驱动装置安放在主电机之后，见图 2-2（主电机为双轴伸）。该装置由慢速驱动减速器、电动机、制动器以及手动离合机构等组成。

两种型号的慢速驱动装置技术参数

项目 / 型号	JMS660 型	HMS660 型	备注
适用范围	JST80-JST150		
输出扭矩范围	21KN.M－69KN.M		
传动比范围	98.58:1－150:1	93:1	
电机功率	22KW-55KW		
电机转速	970r/min－740r/min		
磨机转速范围	0.15r/min－0.3r/min		

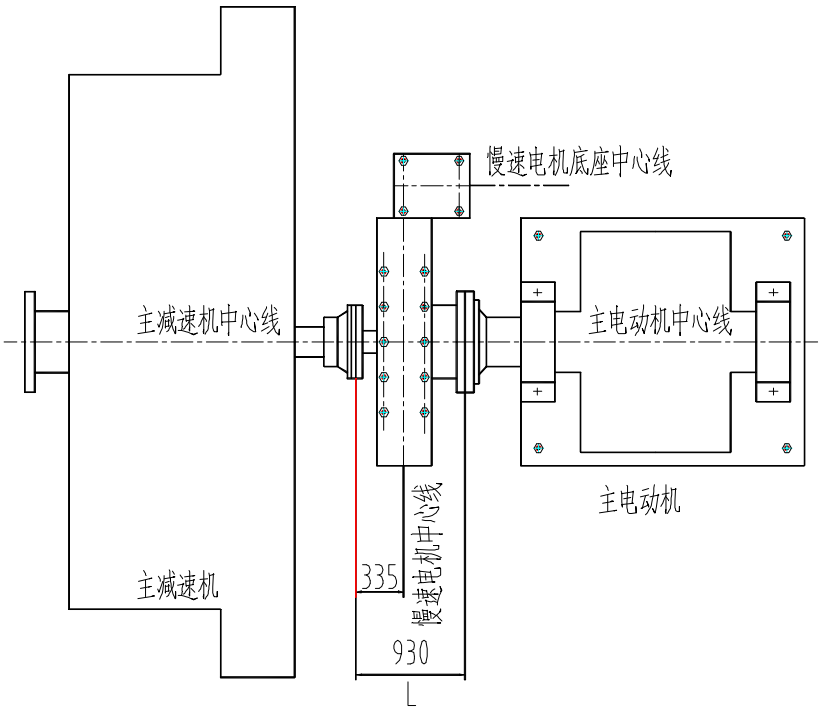


图 2－1

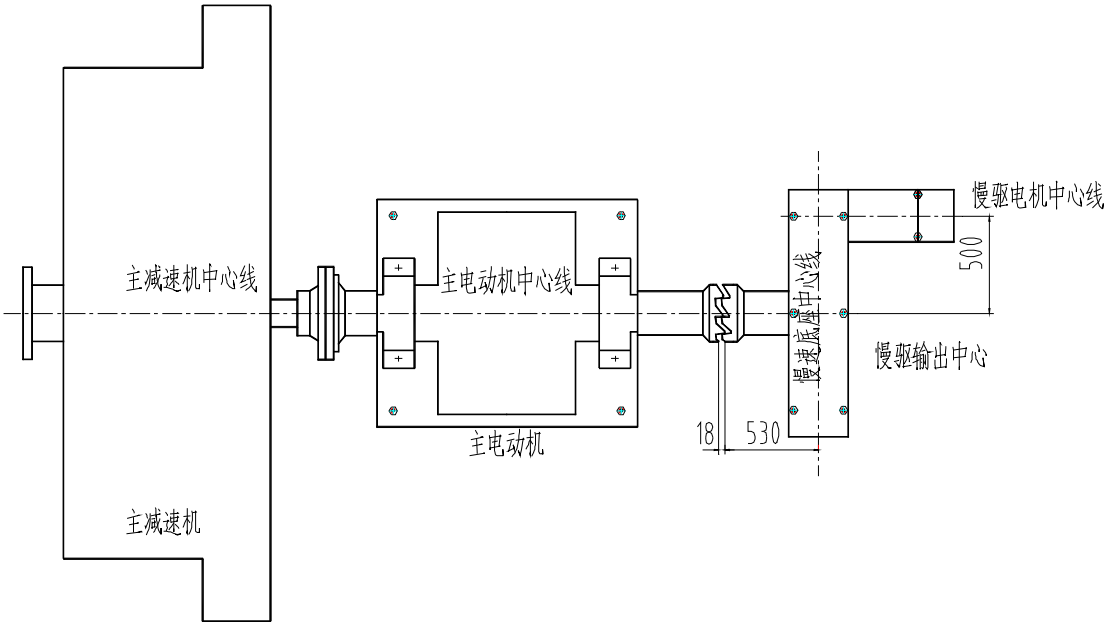


图 2-2

2. 慢速驱动装置的安装

慢速驱动装置的安装应在主减速机和主电动机安装已基本完成之后，使用 JMS660 型慢驱装置时，主电动机（单轴伸）的就位，应按基础安装示意图保证主减速机和主电动机两联轴器法兰之间的设计尺寸（图 2-1 中的 L）。同时找正主减速机和主电动机的同轴度不得大于 φ0.1mm，端面跳动误差不得大于 0.1mm。

2.1 安装前的检查项目

2.1.1 慢速驱动装置的基础标高，地脚螺栓孔的位置，深度和尺寸并确保符合图纸的要求。

2.1.2 按图在基础表面画出慢速驱动装置中各中心线。

2.2 将所有安放斜垫铁或可调垫铁基础表面凿毛，彻底清除基础表面及孔沟槽内的尘渣油污。

2.3 安放地脚螺栓，在每根地脚螺栓头部系一铁丝，以便能将螺栓穿过箱体相应的孔。敷设前清除螺杆上的锈垢，螺纹部位涂脂防锈。

2.4 按图纸要求，将所有斜垫铁或可调垫铁放在指定的位置上，其标高误差不大于 0.2mm。垫铁上表面标高＝主减速机或主电动机中心高－慢驱装置中心高。

2.5 慢驱装置起吊，就位，找正。

2.5.1 JMS660 型慢驱装置吊装前先将高速膜片联轴器的一端法兰和慢驱减速器的离合环用两个 M20×60 的螺栓通过 φ650 圆上的螺孔紧固，使高速膜片联轴器处于水平，然后水平地将其吊放在主减速机和主电动机之间已安放好的斜垫铁上，通过调整斜垫铁的高度和移动减速器，使其输出轴心线与主减速机及主电机轴线同轴度不大于 φ0.1mm。紧固联轴器两端的定位销和联接螺栓（联接的同时将临时螺栓拆除），安装慢速电动机底座并通过下面斜垫铁将其找正，同时调整好皮带轮的距离。

2.5.2 HMS660 型慢驱装置安装，将其整体吊运在调整垫铁上，通过调整其高度和移动底板，使其输出轴中心线与主电机中心线同轴度不大于 φ0.1mm，锁紧联轴器。

2.6 浇灌地脚螺栓，混凝土强度 C20，砂浆质量比由土建工程师确定。

2.7 待砂浆凝固，混凝土强度达到设计值 80％以上后，允许拧紧地脚螺栓。拧紧过程中注意调整斜铁和调整垫铁，使同轴度保持不变，并保证各

联轴器能自由灵活地离合。确认安装合格后，立即进行二次浇灌。

2.8 按照基础安装示意图中对慢速驱动装置的电控要求，安装好控制盒，转换开关等电气设备。控制盒有两个位置，即慢速电机切断，主电机正常运转（位置 1）和主电机切断，慢驱电机可以运行（位置 2）。

2.9 为了方便盘车操作人员直接地观察，开关盒应放在磨机附近或认为方便的地方。

2.10 配制润滑管系。配制供油管，在供油管上接一润滑支管（ϕ35×2.5）到慢驱装置；配制主减速机至稀油站的回油管，配制慢驱装置回油管（ϕ76×3）与总回油管相通。

2.11 用户可在慢驱供油管上安装截止阀，当慢驱工作时，开启阀门向慢驱供油，不工作时可关闭阀门。注意慢驱工作时，千万不要忘了开启阀门，以免损坏慢驱装置。

3. 慢速驱动装置的运行

3.1 运行前的准备

运行前通过慢驱装置的全部油嘴，向输出轴承及其它部位加注 ZG-4 钙钠基润滑脂（GB491-1987）并开启供油站向主减速机和慢驱减速器供油。

按常规检查三角皮带（JMS660）的松紧程度，并作适当调整。其方法是先松开电机底座上的 4 个螺栓，利用两个调整螺栓，移动电机以达到合适的张紧程度，调整完后注意装好皮带罩。

3.2 空车运转

空车运转是柱销式离合器（JMS660）或爪形离合器（HMS660）脱开的状况（即慢驱装置不带主减速机和磨机）下运转，运行时间为 1 小时。注意其转向是否和磨机方向一致，否则应调整慢驱电机接线，注意各轴承部位温度变化；是否有异常声响。

3.3 空负荷运转（磨机内不装物料）

松开变换手柄下的紧固螺栓，操纵手柄，使套筒圆周上的柱销，滑入到离合器的销孔中（JMS660）或使爪形联轴器啮合（HMS660）。拧紧螺栓，将手柄位置固定，以防松脱（注意应使滑块与套筒凹槽的两边有一定间隙，以防不必要的磨损）。

如果在啮合过程中因柱销与孔或两爪不相吻合，此时可利用开关盒的三个按钮（正、反、停）点动慢速电机使离合器互相啮合，也可拆下装在慢驱电机上的皮带轮轴上两个丝堵（JMS660）或电机端半联轴器上的两个丝堵（HMS660），装上手柄，用手盘动电机，使之啮合，完后拆下手柄，复装两丝堵。

离合器啮合好后，拧紧手柄固定螺栓。确认所有运转部位不会发生危险后，方可启动慢驱电机带动主减速机和磨机运转，运行 0.5 小时或磨机转动 3－4 圈。

3.4 负荷运转（磨机内装有物料）

负荷运行时间每次连续运转不得超过0.5小时，运行中注意观察慢驱装置的振动、噪音、发热情况，发现异常，立即停机检查。

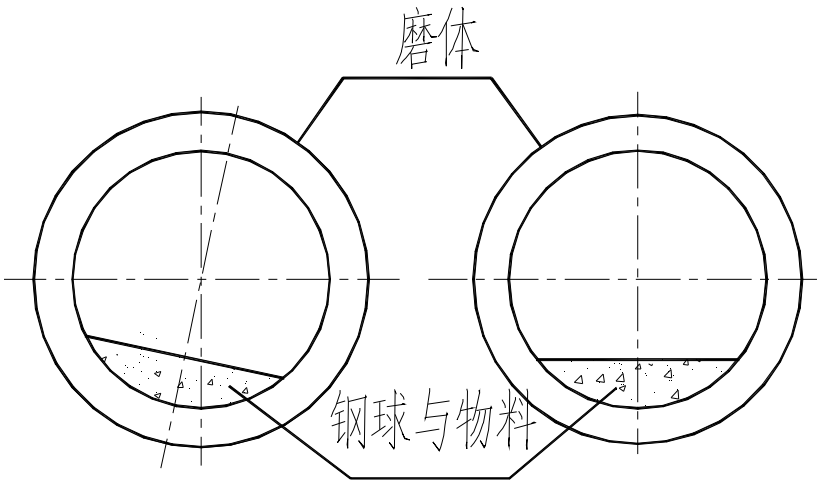
3.5 慢驱装置的停机

慢驱装置带动磨机转到需要的位置时，即可按“停止”按钮，此时经转换开关，制动器同时抱闸，使磨机停止在所需的位置。

当磨机要由主电动机带动磨机进行正常运行前，应使慢驱装置离合器脱开，先松开操纵手柄的紧固螺栓，以反方向推动手柄，使柱销与离合环的孔（JMS660）或两爪（HMS660）脱开，并推到极限位置后，拧紧手柄上的紧固螺栓。

如果操纵手柄扳动困难，这就意味着磨机内钢球和物料重心偏离垂线（见图 2－3）。由于偏载力矩作用，离合器难以脱开，此时应经转换开关使制动器松闸，磨机因偏载力矩作用开始转动。注意此时转向应与工作转向一致，如果相反，须立即使制动器抱闸，然后启动慢驱电机工作（此时经转换开关，慢驱电机启动的同时制动器松闸），使磨机转动到一定角度再停车松闸，这样重复试几次，直到偏载力矩消除，磨机停止转动，离合器可较轻松脱离。

必须指出的是，磨机由于偏心载荷的作用，一般会来回摆动数次。操作者应通过制动器尽量制止来回摆动。因磨机与工作转向作相反转动时，慢驱装置成为增速装置。由于传动比非常大，慢驱减速器及电机将飞快运转，这样会缩短使用寿命甚至可能会损坏整个慢驱装置。



磨体内的偏心载荷　　偏心载荷已消除

图 2-3

第三部分：膜片联轴器

1．概述

JL 系列膜片联轴器由膜片组、传动组、联轴器法兰、间隙调整片和紧固件组成。膜片一组与主减速机输出轴法兰相联，另一组与磨机端的传动接管相联。膜片组由联接环、膜片、压圈通过螺栓联接而成。膜片联轴器除了传递扭矩外，同时具有补偿磨机变形造成的系统轴线变化和减振功能，起保护减速机的作用。

2．安装程序

膜片联轴器在减速机安装完成后并经空载试验后才能进行。安装前应清除膜片组、传动轴、联轴器和螺栓等零部件的锐边毛刺并清洗干净后，按下列程序进行。

2.1 根据工厂的装配印记，将联轴器装到减速机输出轴的法兰上，在方头铰制孔用螺栓的圆柱面上涂以二硫化钼润滑剂后，按配对号装入铰制孔中，拧紧联接螺栓，装前在螺纹处涂上粘结剂，以防松脱。

2.2 将传动轴水平地放在支架上，对准同位印记，分别装好两端膜片组和压板（见图 3－1），拧紧铰制螺栓，拧紧前在螺纹处涂粘结剂防松。（此工序可在主减速机下箱体就位后进行。将其装好后按图 3－1 放在减速机与磨机基础之间的地面。）

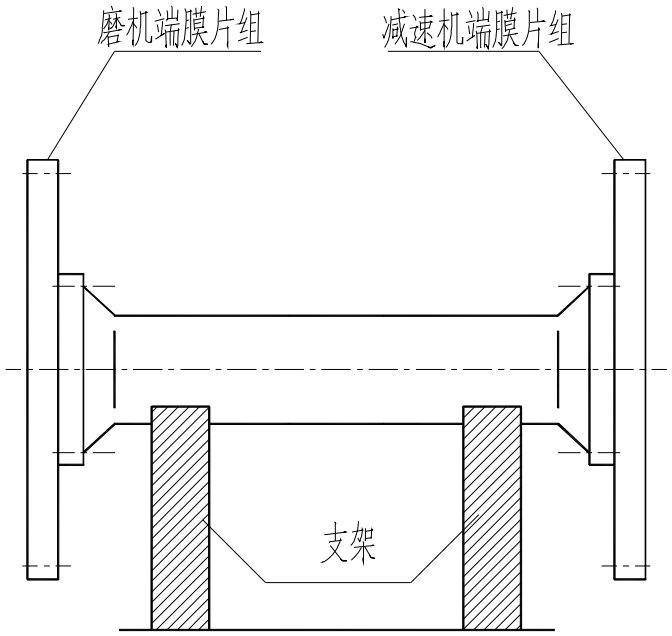


图3-1

2.3 拆除联接膜片的八个螺栓（两端共 16 个）。

2.4 按图 3－2 水平吊起已安装好的传动轴和膜片组件：按图 3－3 方法找正磨机传动接管法兰；按规定的力矩拧紧所有联接螺栓，并在两法兰外圆做上配对记号，以方便今后的拆装。

2.5 同样按图 3－3 方法找正，装于主减速机输出轴上的法兰与联轴器的同心度，测量两法兰之间的距离，根据测量值选配适当的间隙调整片（根据磨机长径比留 1－3mm 间隙）放入两法兰之间，按规定的力矩拧紧所有联接螺栓。

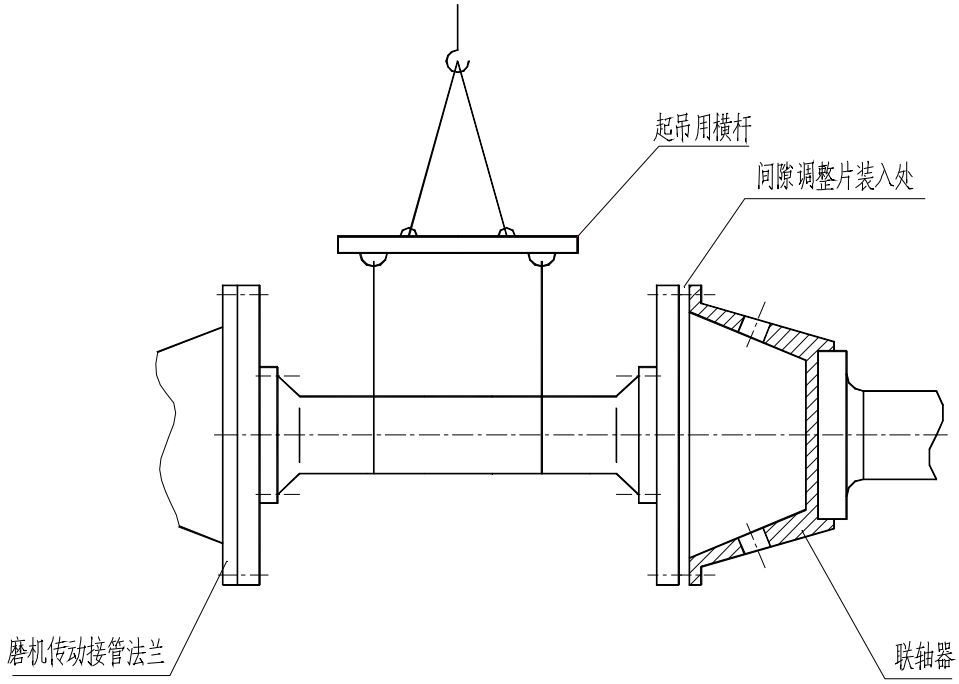


图 3-2

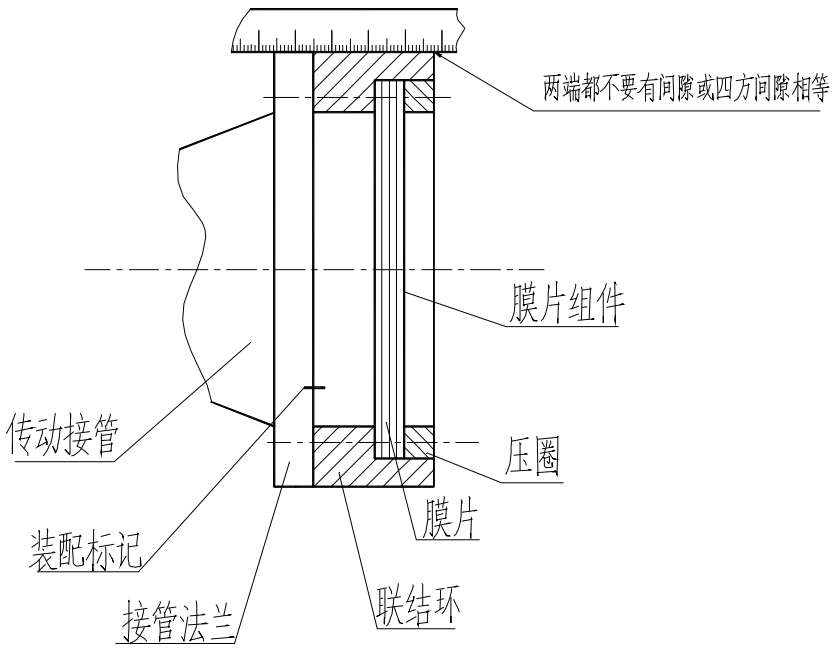


图 3-3

3．安装注意事项

3.1 膜片组件在出厂时，已找正同心度，并用四个铰制孔用螺栓将联接环、膜片和压圈组装在一起。不允许拆卸这四个螺栓，以防零件松落，而引起同心度的变化（组装后情况见图 3—4）。

3.2 吊装传动轴和膜片组件时，应按图 3—2 所示起吊，并注意在钢丝绳与轴之间垫上软物，以防钢丝绳将轴拉伤，不得挂吊膜片处，以防膜片变形。

3.3 膜片组件分别与磨机传动接管法兰和联轴器法兰联接时。由于孔的数量多和分度误差。孔与孔不容易对准，需分别盘动磨机和减速机，找到最佳位置后，将螺栓穿入并拧紧；少数孔螺栓穿不进时，用相应直径的铰刀铰削后再将螺栓通入拧紧。

3.4 膜片联轴器安装时，装螺母前，每个螺栓螺纹处均应涂粘结剂，以防运转时松脱。

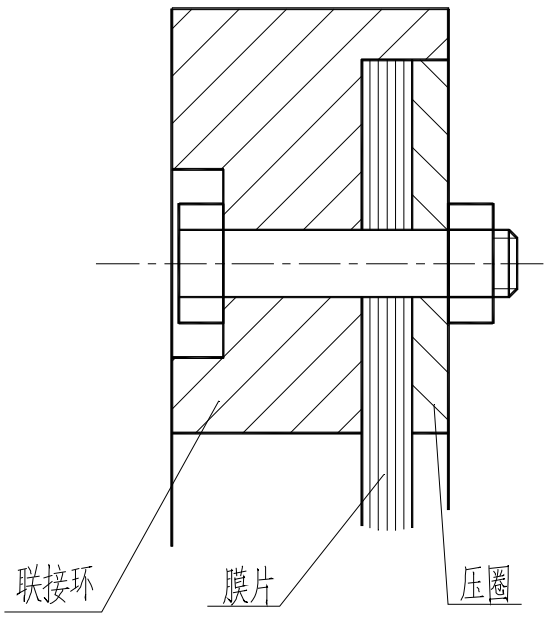


图 3-4

第四部分 油站及控制系统

1．概述

XRZ 和 KYZ 系列油站是润滑设备厂根据 JS、JSX 系列减速机润滑及控制要求专门设计配套的稀油润滑装置，主要由油站、仪表盘、电控柜和多路温度巡检仪四部分组成。

稀油润滑装置由工作油泵将润滑油从油箱内吸入送入双筒网式过滤器，经过虑后送到热交换器。经过虑和冷却的油液按润滑要求送到主减速机和慢速驱动装置的各润滑点，然后通过回油管流回油箱，再由油泵抽出，不间断的工作从而形成稀油循环润滑系统。

主减速机各滑动轴承测温点设置的 Pt100 铂热电阻与多路温度巡检仪相连。除在巡检仪屏幕上显示各点温度外，该巡检仪还输出与油站相连的报警触点信号和与计算机相连的 4－20mA 标准电信号。

2．安装程序

油站的安装调试按使用说明书进行，现将主要程序说明如下：

2.1 按基础安装示意图将清洗干净的油站、仪表盘和控制柜安放在指定位置，基础要牢固可靠，安放应平稳，四周要考虑有足够的用于维护、保养和检修的空间。

2.2 安装油站与仪表盘连接的φ10×1 紫铜管、油站、仪表盘与电控柜连接的线路；按电控原理图安装电气元件。

2.3 安装油站与主减速机、慢速驱动装置的进油管和回油管。回油管的斜度应保证油回流畅通；配制好的管路应进行酸洗彻底清除氧化皮，砂土和焊渣。清洗并吹干后，内壁涂润滑油，外表面涂防锈漆，管与管的法兰联接处用耐油橡胶垫防漏。

2.4 将多路温度巡捡仪按要求安装在油站电控柜上，并按规定连接与主减速机各轴承传感器（Pt100）接线盒中对应端子的电线，布线要整洁美观，并加装护套。

2.5 按多路温度巡检仪使用说明书要求，连接与油站仪表盘和电控柜的输出报警触点信号，用户需用计算机控制的，可通过该巡检仪中 4－20mA 电信号输出与计算机相连。注意所有连接序号要一一对应，切勿接错。布线要整洁美观，并用塑料管或其它材料对线路加以保护。

2.6 按图纸规定安装主减速机，慢速驱动装置和主电动机等电器设备的线路以及他们相互之间互锁控制线路。

3．注意事项及维护保养

油站操作和维护保养应分别按油站使用说明书和多路温度巡检仪使用说明书的要求和规定严格进行。

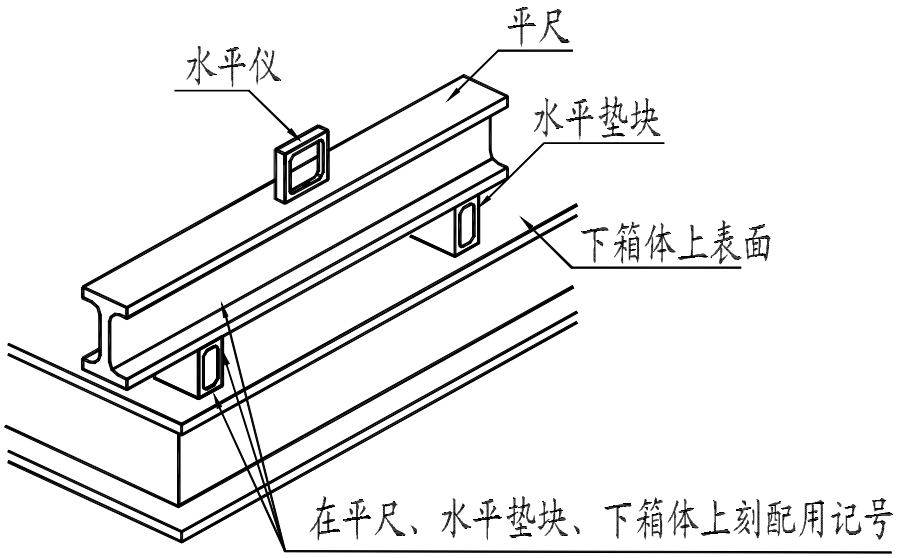
特别注意的是报警系统如发生故障，应查明原因并加以解决，切勿取消报警和互锁装置，以免危及减速机的安全运转。

所有电气仪表自出厂之日起，应每年检定一次。

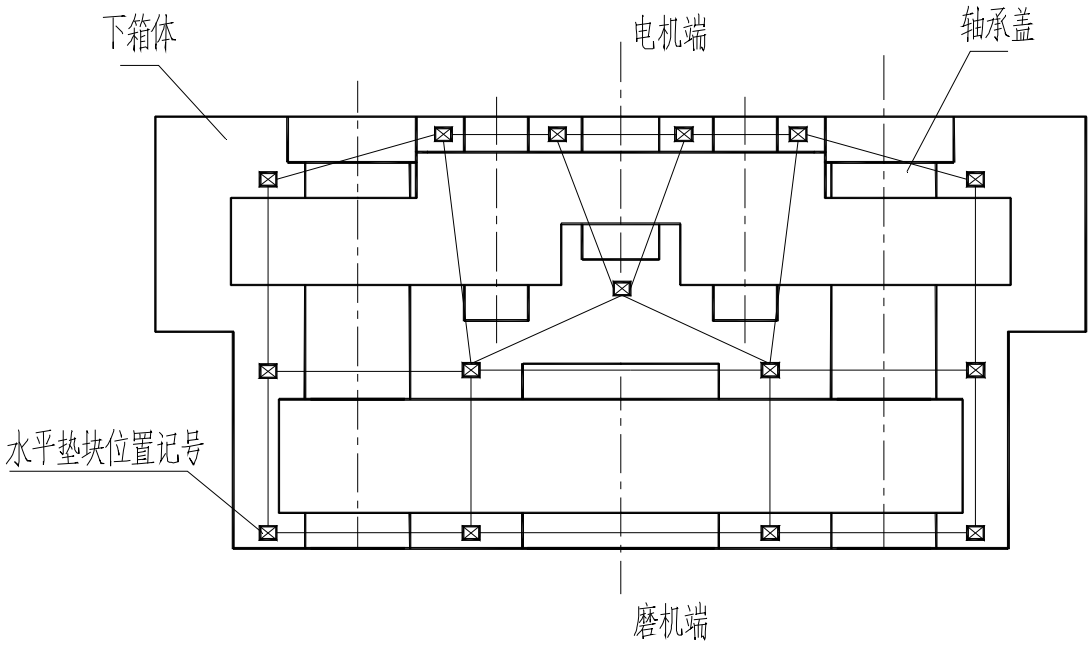
附图表 1：减速机安装调试运转用户需要准备的物品

序号	名　　称	单位	数量	用途
1	无缝钢管∅159×6	mm	6000	主减速机回油管（准备同规格 90 度弯头 6—10 个）
2	无缝钢管∅89×4	mm	3000	主减速机进油管（准备同规格 90 度弯头 4—8 个）
3	无缝钢管∅76×3	mm	5000	慢驱装置回油管（准备同规格 90 度弯头 2—3 个）
4	无缝钢管∅35×2.5	mm	5000	慢驱装置进油管
5	紫铜管∅10×1	mm	3000	供油站用
6	N320 工业闭式齿轮油	kg	6000	减速机润滑油（根据地区情况也可以用 N220 或 N460）
7	１４号柴油机油	Kg	3000	减速机窜油清洗用（可用 N320 正式用油清洗）
8	煤油	kg	10	清洗齿轮、轴、轴承等零部件用
9	二硫化钼润滑剂	kg	1	安装各种定位销用
10	丙酮	kg	2	清洗上下箱体结合面、各处端盖结合面
11	密封胶、厌氧胶	支	各 5	上下箱体、端盖、联结螺栓等用
12	CT-2 跑合显示剂	瓶	1	检查齿轮跑合后实际接触印痕
13	100 目铜滤网	M^2	0.5	串油清洗用
14	耐油橡胶石棉垫	张	4	各密封处用
15	力矩扳手	把	1	拧紧螺栓用
16	铜锤（紫铜）	把	2	工具
17	重型套筒扳手	合	1	轴承座螺栓及传力轴联结螺栓装配用

附图表2 下箱体上平面水平测量记录



出厂记录

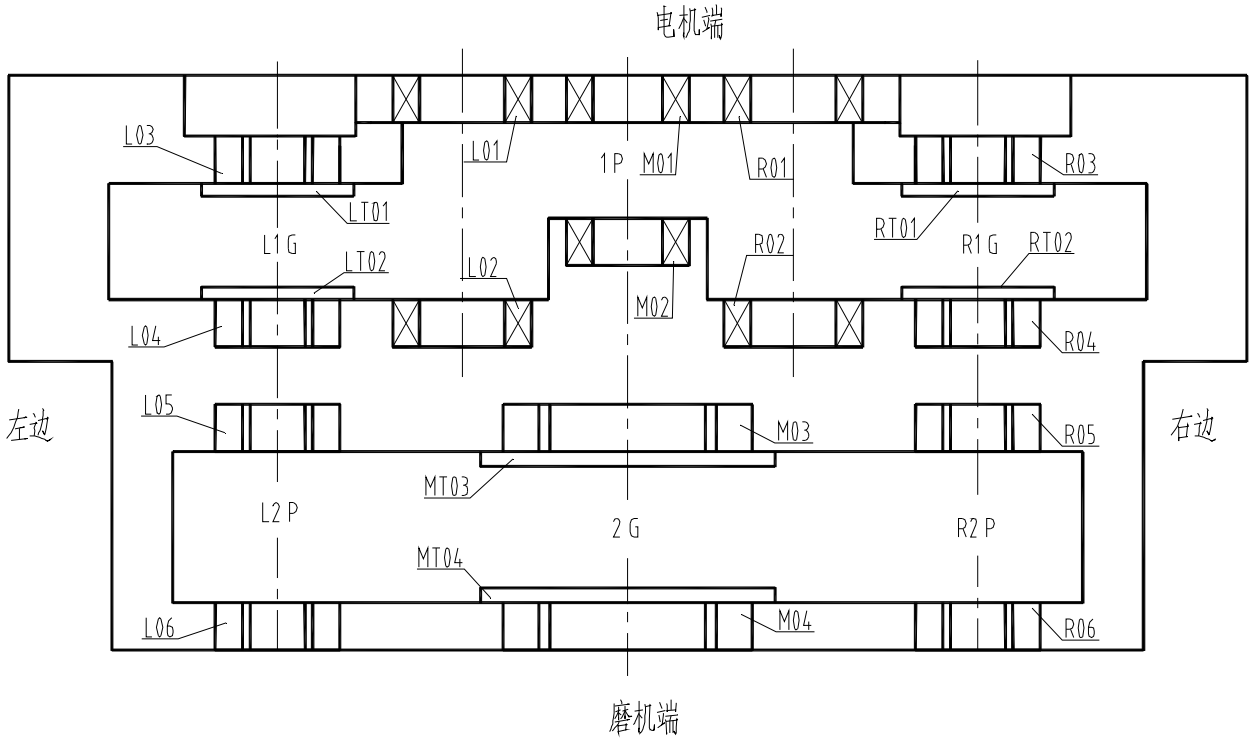


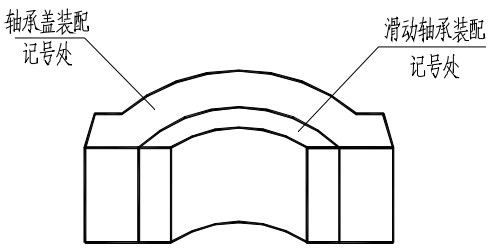
注:

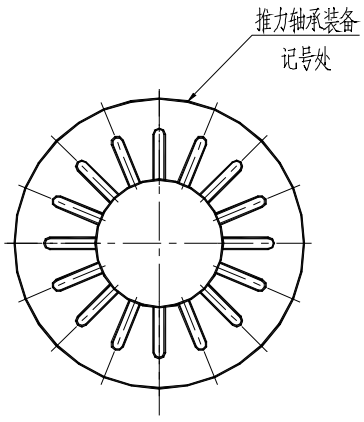
1. ⊠ 表示垫块放置点，在下箱体上平面做出标记。
2. 应标明箭头方向指向高处。
3. 整体水平应不得超过 0.04mm/m，现场找正结果不应大于出厂记录±0.04mm/m

装配: **检验:** **日期:** 年 月 日

附图表 3：轴承、轴承盖装配记号图表



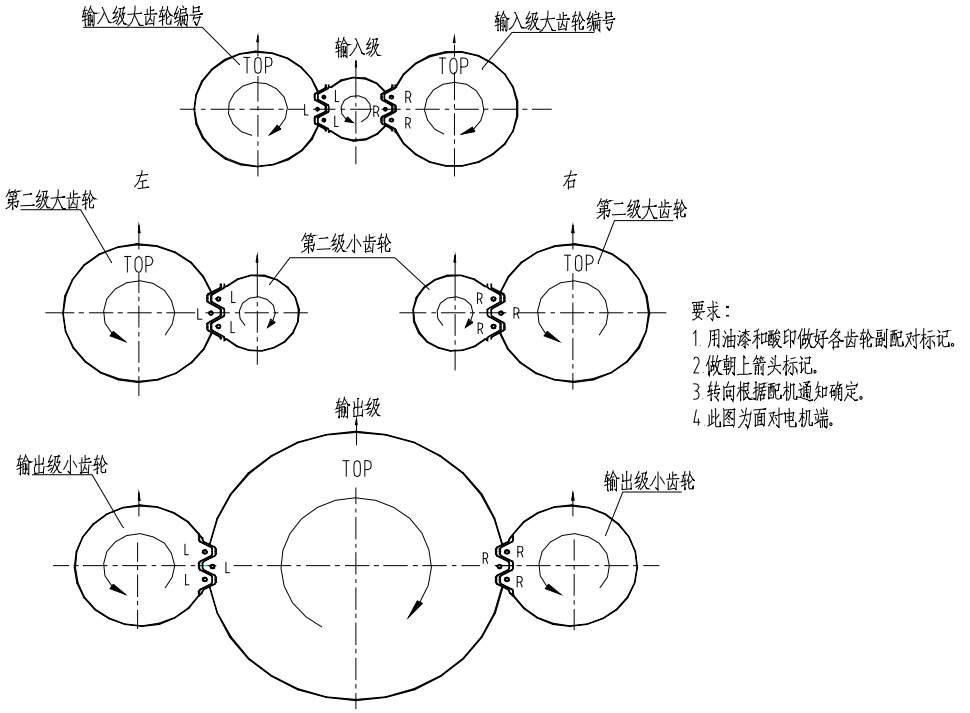


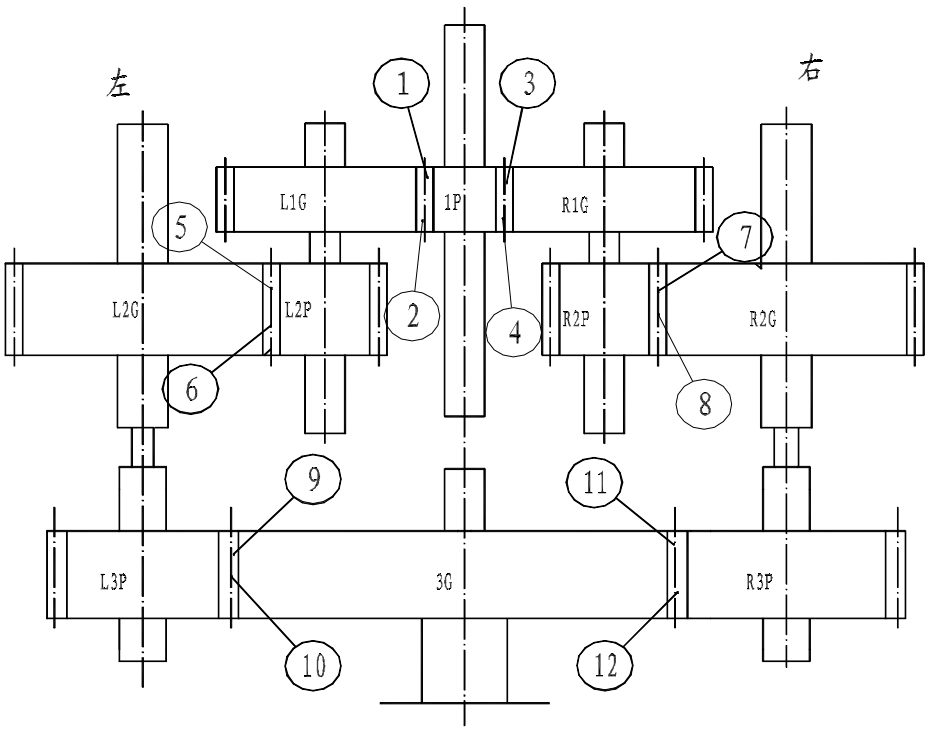


附图表 4：轴承、轴承盖装配记号图表

位置 \ 名称	滑动轴承装配记号	轴承盖装配记号	推力轴承装配记号
L01	双列向心球面滚子轴承	L01：左侧 01 处轴承盖	
L02	双列向心球面滚子轴承	L02：左侧 02 处轴承盖	
L03	L01T：左侧 01 处上轴瓦	L03：左侧 03 处轴承盖	LT01T：左侧 01 处上推力
	L01B：左侧 01 处下轴瓦		LT01B：左侧 01 处上推力
L04	L02T：左侧 02 处上轴瓦	L04：左侧 04 处轴承盖	LT02T：左侧 02 处上推力
	L02B：左侧 02 处下轴瓦		LT02B：左侧 02 处上推力
L05	L03T：左侧 03 处上轴瓦	L05：左侧 05 处轴承盖	
	L03B：左侧 03 处下轴瓦		
L06	L04T：左侧 04 处上轴瓦	L06：左侧 06 处轴承盖	
	L04B：左侧 04 处下轴瓦		
R01	双列向心球面滚子轴承	R01：右侧 01 处轴承盖	
R02	双列向心球面滚子轴承	R02：右侧 02 处轴承盖	
R03	R01T：右侧 01 处上轴瓦	R03：右侧 03 处轴承盖	RT01T：右侧 01 处上推力
	R01B：右侧 01 处下轴瓦		RT01B：右侧 01 处上推力
R04	R02T：右侧 02 处上轴瓦	R04：右侧 04 处轴承盖	RT02T：右侧 02 处上推力
	R02B：右侧 02 处下轴瓦		RT02B：右侧 02 处上推力
R05	R03T：右侧 03 处上轴瓦	R05：右侧 05 处轴承盖	
	R03B：右侧 03 处下轴瓦		
R06	R04T：右侧 04 处上轴瓦	R06：右侧 06 处轴承盖	
	R04B：右侧 04 处下轴瓦		
M01	双列向心球面滚子轴承	M01：中间 01 处轴承盖	
M02	双列向心球面滚子轴承	M02：中间 02 处轴承盖	
M03	M03T：中间 03 处上轴瓦	M03：中间 03 处轴承盖	MT03T：中间 03 处上推力轴承
	M03B：中间 03 处下轴瓦		MT03B：中间 03 处下推力轴承
M04	M04T：中间 04 处上轴瓦	M04：中间 04 处轴承盖	MT04T：中间 04 处上推力轴承
	M04B：中间 04 处下轴瓦		MT04B：中间 04 处下推力轴承

附图表 5：齿轮副啮合配对标记，侧隙测量记录：





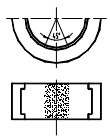
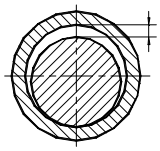
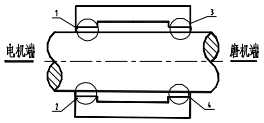
符号说明

L：左端
R：右端
ML：中间级左
MR：中间级右
P：小齿轮
G：大齿轮
1：输入级齿轮
2：中间级齿轮
3：输出级齿轮

设计数值												
测量位置	1	2	3	4	5	6	7	8	9	10	11	12
厂实测值												
安装结果												

装配：　　检验：　　日期：　　年　　月　　日

附图表 6：滑动轴承，推力轴承装配检验记录

项目 / 部位	接触斑点		径向间隙		瓦口间隙					推力轴承间隙	
	要求	实测	要求	实测	要求	测量部位				要求	实测
						1	2	3	4		
左 3 轴承 L03	100%×45°(轴向)×(周向)		0.25 | 0.50 (根据图纸要求)		在图示四处用 0.15 塞尺塞深要求≥15—20 上下瓦口间隙要求一样						
左 4 轴承 L04											
左 5 轴承 L05											
左 6 轴承 L06											
右 3 轴承 R03											
右 4 轴承 R04											
右 5 轴承 R05											
右 6 轴承 R06											
中 3 轴承 M03											
中 4 轴承 M04											
											
左齿轮组件											
右齿轮组件											
输出轴											

装配：　　检验：　　日期：　　年　　月　　日

附图表 7：减速机齿轮副接触斑点检验记录

部　位	要　求	实　测
输入级左侧齿轮副（L）	80%×70% (齿长)×(齿高)	
输入级右侧齿轮副（R）		
中间级左侧齿轮副（L）		
中间级右侧齿轮副（R）		
输出级左侧齿轮副（L）		
输出级右侧齿轮副（R）		

附：接触印痕原始记载（注明齿宽方向）用胶带纸印刷。

输入级左侧齿轮副（L）

电机端：_____ 磨机端

输入级右侧齿轮副（R）

电机端：_____ 磨机端

中间级左侧齿轮副（L）

电机端：_____ 磨机端

中间级右侧齿轮副（R）

电机端：_____ 磨机端

输出级左侧齿轮副（L）

电机端：_____ 磨机端

输出级右侧齿轮副（R）

电机端：_____ 磨机端

附图表 8：减速机出厂空负荷试验检验记录

输出转速 r/min				
运转时间 min				
滑油压力 MPa				
滑油温度 ℃				
各部位轴承温度（℃）				
左 1 轴承 L01				
左 2 轴承 L02				
左 3 轴承 L03				
左 4 轴承 L04				
左 5 轴承 L05				
左 6 轴承 L06				
右 1 轴承 R01				
右 2 轴承 R02				
右 3 轴承 R03				
右 4 轴承 R04				
右 5 轴承 R05				
右 6 轴承 R06				
中 1 轴承 M01				
中 2 轴承 M02				
中 3 轴承 M03				
中 4 轴承 M04				
减速机噪音测试(dB)	要求：		实测：	
试验人员：	检验：	日期：	年 月 日	