SERVICE MANUAL

ZP495 ROTARY TABLE

105.13.00SM

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TOPLAND

REVISION HISTORY

02	**2010.10**	**the instruction for use added**	**Yang Xiping**	**Wei Kongcai**	**Feng Yanwei**
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CONTENT

Preface

The rotary table is one of the hoisting equipment of a drilling rig. It can be chain driven or universal shaft driven. When placing an order, customers should indicate which kind of rotary table they need.

The design of rotary table is in conformance with API Spec 7K and SY/T5080 Rotary Table for Petroleum Drilling and Workover Rig.

The minimum design temperature & operating temperature of the conventional rotary table shall be 0℃(32℉) as required by API Spec 7K.

The max. torque of ZP495 large-torque rotary table is 64000N.m.

The instruction describes the technical specifications, the structure features, maintenance and service of the rotary table separately in order that customers may understand them thoroughly. Proper application of it may extend the service life, ensure the safety and reliability and improve the production efficiency.

A recommended spare parts list will be provided for customers for ordering spare parts. For those parts not included in the list, reference may be made to the Parts Drawing List, by listing the drawing number and the description of parts required.

A serial number is assigned to each rotary table. Include the model and serial number of the rotary table when ordering spare parts or making inquiries.

The company reserves the right to change the model and design of a rotary table at any time without notice and without incurring any obligation.

We recommend that customers use the replacement parts made by our company. The use of parts not made by our company may reduce the performance of the products.

1 GENERAL DESCRIPTION

1.1 Application and features

The rotary table is mainly used for rotating the drilling string in the drilling operation and supporting the weight of drilling string under the well in the round trip and casing running. The rotary table can bear the max. load of the rig and ensure the enough life of bearing in rotating. The large and small bevel gears can transfer sufficient torque and power.

1.2 Technical specifications

Model	ZP495
Opening diameter	1257.5mm(49-1/2″)
Max. Static load	9000kN(2023381 lbf)
Max. Speed	300r/min
Gear ratio	3.913
The distance between rotary table center and the center of the first row of input sprocket (inner side)	1651mm (65in)
Overall dimension(L×W×H)	3015 x 2254 x 819mm
Weight	12105kg

2 CONSTRUCTION

The rotary table is driven by a pair of bevel gears to reduce speed, which made the turntable obtains the rotary speed and output torque within the specific range, to drive the drilling tool.

The ZP495 rotary table (fig. 1 and 2) is mainly composed of the turntable (8), input shaft assembly (10), locking device (1), cast & welded housing (6) and cover (7).

Spiral bevel gear is applied for bevel gear pair. It is featured by stable driving, small contact stress and high load capacity. All the large and small bevel gears are made of high-strength alloy steel after heat treatment. The backlash between the bevel gear pair shall be adjusted by shims (8-4) at the bottom of compound bearings and shims (10-5) of the flange of bearing bush of input shaft assembly.

The turntable assembly is a rotating part of the rotary table to realize rotating speed & torque output.

Turntable assembly is mounted on the main & hold-down combination bearings (8-3) and supported on the housing. The heavy ring gear (8-1) mounted at the turntable. Thrust Angular Contact Ball Bearing is regarded as main bearing, and the hook bolt (4) is used for connecting the medium seat and the housing. The upper part of middle race plays the role of the main bearing and it can bear the total load of the drill stem & casing string. The lower part of middle race plays the role of the hold-down bearing, and it is fixed under the turntable with the lower race (8-5). It can bear the upward impact load from the bottom well. The lower race (8-5) is fixed under the bottom of turntable with bolts (8-7).

The turntable (8-2) is a steel casting. Its opening is in conformance with API7K. It is used for passing of drilling tools and casing strings. On the top of turntable are there two concave grooves, in which two convex extensions on the master bushing (9) are put, to rotate the drilling string. On the upper plane of turntable is designed with four screwed holes for lifting at the time of installation and maintenance. The holes shall be screw-plugged and be painted with sealant under normal drilling condition.

Input shaft assembly is the power input part of the rotary table, and it is a cylinder type. The pinion (10-1) mounted at one end of the shaft (10-4) which lies on the two bearings (10-2), (10-6) in the bearing pedestal (10-3): a radial short-roller bearing and a radial spherical-roller bearing. The other end of the shaft is provided with sprockets (10-7) or flange (10-8). The shaft end diameter of input shaft and size of key slot are in conformance with the requirements of No.5 shaft ends in API 7K.

The housing (6) is a steel casting and welded structure. It is stress relieved after post-weld heat treatment. It has features of high strength and stable structure, and it can bear max. static load. It can be used as the oil tank for lubricating the bevel gears and bearings. Labyrinth structure is applied for the sealing between the turntable and the housing, and two mud scrapers are welded at the circle of the turntable to prevent mud flowing into housing. In the housing, the lock assembly (1) is mounted to stop the rotation of the turntable to the right or left. For locking the turntable, the left or right lock pawl (1-1) is put into one of the 28 slots by the operating rod (1-2) in order to bear the reactive torque in drilling under the well or special drilling operation.

Cover (7) is a rectangular plate welded by Checkered Steel Plate. It is secured on the substructure by using socket head screw.

Gears and bearings of the rotary table are splash-lubricated by the oil tank. Both the oil levels in operation and in stop condition of lubrication system can be measured by oil level gauge. Grease shall be applied for the lock pawl pins in the locking device.

Labyrinth sealing is applied for dynamic sealing between turntable and housing. Spring oil seal is applied for dynamic sealing between input shaft and the bearing cover, and O-ring for other static sealing.

49 1/2″bushing set device (9) of rotary table is of integral type, with two notches on the top. The two projecting portions of the master bushing device (9) can be placed into notches to transmit torque. There are two matching forms for rotary table bushing device:

- 1.Drilling operation shall be performed by placing 37-1/2″ master bushing device into the 49 1/2″ bushing set device, the inner bore size of the first equals to API No.3 bushing and four pin holes loaded with roller bushing(105.51.00),
- 2. Drilling operation shall be performed by placing the master bushing device of ZP375 rotary table and API No.3 bushing into 49 1/2″ bushing set device and applying four pin drive roller bushing (105.51.00).

The driving mode of input shaft of rotary table is normally sprocket and flange driving. The sprocket driving mode is realized by placing sprocket directly on the input shaft, with the distance between rotary table center and the center of the first row of inner sprocket is 1651mm (65in).The flange driving mode is realized by placing flange on the input shaft, which is connected to the prime motor by universal shaft. If other special driving mode is required, we can manufacture.

Note: Flanges by which the high torque is driven are equipped for this rotary table. The distance between the end face of flange and the center of rotary table is 1834 mm. If there is other requirement from customers, an extra order shall be required.

3 INSTALLATION & ADJUSTMENT

3.1 Installation

The rotary table is normally mounted at the table beam which is located at the drill floor of substructure. The center of opening shall be aligned with the well center indicated by the table beam when the rotary table is installed. The axial line of pinion shaft of the rotary table shall be aligned with the longitudinal well centerline of the table beam. Weld the V-type position block and secured with bolts (or any other methods).

3.2 Adjustment

The opening center of rotary table shall be aligned with the marking of well center on the rotary beam of the substructure, and the allowed error at any direction is ≤5mm. The rotary table shall be adjusted according to the requirements of table 1 in installation.

Table 1 Requirement in Installation and Alignment of the Rotary Table

Item	Driven mode	Installation and alignment requirements	Design requirements
1	Chain driven	Flatness allowance between sprockets at the shaft ends of input shaft and output sprocket of the drive assembly	≤1.5mm
2	Universal shaft driven	Parallelism allowance between two surfaces of flange at the shaft ends of input shaft and output flange of the drive assembly (measured at the four points at an angle of 90)	≤1mm
		Axiality allowance between input shaft and output shaft of drive assembly	≤3mm
3	Tooth coupling driven	Axiality allowance between input shaft and output shaft of drive assembly	≤1.5mm

4 USE AND OPERATION

4.1 Preparation and inspection prior to use:

For the newly used rotary table, the closed industrial gear oil listed in table 3 shall be filled into the oil tank, and the oil level shall reach the upper limit of the STOP level of the scale of the oil level gauge. Both the oil level in the RUN condition (H and L) and the STOP condition can be indicated in the oil level gauge.

4.1.1 Fill grease onto the lock pawl pins of the locking device.

4.1.2 Braking block and pins be rotated freely and braked reliably.

4.2 Braking of turntable

The locking device is used for locking the turntable and bearing the reactive torque during the drilling operation or special drilling operation. It is normally at the start position in the operation. In braking, low-speed gear is used for drive the turntable and handle is used for putting the left or right lock pawl into the slot on the turntable. Handle forward（to the center of the rotary table）is braking, and pulled out is opening.

Note：

Start the braked rotary table may seriously damage the parts inside the rotary table.

4.3 For matched bushings and tools for rotary table, see table 2.

Table 2 Matched Bushings and Tools for the Rotary Table

Item	DWG. No.	Model	Description	Hoisting tools	Remarks
1	105.62.00	3-1/2”（Four pins driven）	Roller bushing		For oil leakage testing
2	105.51.00	5-1/4”（Four pins driven）	Roller bushing		In normal drilling operation
3	105.59.00	4-1/4”（Four pins driven）	Roller bushing	105K.54.00	In normal drilling operation
4	105.72.00		Master bushing	105K.54.00	In normal drilling operation
5	105.82.00	37-1/2″	Master bushing	105K.54.00	In normal drilling operation
6	105.54.00	2 3/8”~8 5/8”	Bushing device	105K.54.00	In normal drilling operation and casing running (API 3＃)
7	105.55.00	9 5/8”~10 3/4”	Bushing	105K.54.00	Casing running (API 2＃)
8	105.56.00	11 3/4”~13 3/8”	Bushing	105K.56.00	Casing running (API 1＃)
9	105.77.00	20”	Bushing	105K.54.00	Casing running
10	105.61.00	2 3/8”~8 5/8”	Bushing device	105K.54.00	Casing running
11	105.78.00	26”	Bushing	105K.54.00	Casing running
12	105.79.00	30”	Bushing	105K.56.00	Casing running
13	105K.54.00		Lifting hooks		
14	105K.56.00		Lifting hooks		
15	105.66.00		Bit-box seat		

Note:

1. Components abovementioned are independent, they are not included in this rig. Customers may place extra orders from manufacturers.

2. During casing running operation, remove API No.3 bushing device (105.54.00), placing API No.2 9-5/8″ casing(105.55.00) and API No.1 13-3/8″ casing(105.56.00),remove master bushing device from 49-1/2″ bushing set device, matched with 20″ , 26″ and 30″ casing bushing, the taper of bushing is 1:3 so that both short and long slips are available.

3. At the time of the replacement and maintenance of turntable, bushing, master bushing and master bushing device, it shall be lifted by the relevant lifting hook piece by piece to ensure security

4. Item 4 & 5 are master bushing devices, with two drilling modes.(See Fig.2)

Instructions for use:

Each rotary table has been commissioning tested before delivery (type test to the first) .If it is required by the user to perform commissioning test, please consult the manufacturer and performed as commissioning procedure required. It is not allowed to perform reversal trial test only of it is required in commissioning procedure to rotate under light load.

The front side and the reverse side of gears are subjected to different loads when rotating as the bevel gears are spiral type. The side which is subjected to the heavier load is called working surface, the side which is subjected to the lighter load is called non-working surface. When the concave side of the driving gear and the convex side of the driven gear are meshed, the axial force of the two gears are pointing to the each big end, with the backlash has a tendency to increase to ensure the gears are not stuck, which will extend the service life .

5 MAINTENANCE AND SERVICE

5.1 Lubrication

5.1.1 The bevel gears and all the bearings are splash-lubricated. The closed industrial gear oil with anti-rust, anti-foam, sulfur-phosphorous type extreme pressure anti-fraying additive shall be used as lubricant. Change the oil every two weeks. The oil level of 5 min. after stop shall be adopted. Supply the oil when it is below the lower limit of the STOP level of the oil level gauge to the upper limit of the STOP level. Excessive lubricant will cause the oil leakage in the labyrinth oil seal under the turntable. The lubricating oil shall be changed every two months. Check oil every week for contamination. If oil becomes dirty, change it immediately.

5.1.2 The lubrication parts of rotary table and oils shall be as required in table 3.

Table 3 the lubrication parts of rotary table and the selection of oil

Lubrication Parts	ambient temperature	Oil grades	Capacity
lock pawl pins of the locking device		NLGI 2 Extreme pressure lithium lubricating grease	as required
		NLGI 1 Extreme pressure lithium lubricating grease	
Oil tank（Note：with anti-rust, anti-foam, sulfur-phosphorous type extreme pressure anti-fraying additive）		L-CKD460 gear oil API GL-5 85：140 gear oil	：70L(18gal) below the upper limit of oil level gauge
	-7^oC：10^oC	L-CKD320 gear oil API GL-5 85：90 gear oil	
	-20^oC：-7^oC	API GL-5 80：90 gear oil	

5.2 Items for daily maintenance and inspection

5.2.1 Check that the oil level, oil temperature and oil quality is normal every shift.

5.2.2 Check the oil seal on the input shaft and labyrinth oil seal under the turntable to see if the there is oil leakage.

5.2.3 Check if there is abnormal noise or vibration during operation of rotary table every shift. No jamming or bumping is allowed.

5.2.4 Check if the locking device is free and reliable and at the correct position every shift.

5.2.5 After the rotary table suffered a great impact load (e.g. drill stuck or drill string free fall), check if there is any abnormal noise.

5.3 Items for periodic maintenance and inspection

5.3.1 Inspect the hook bolts and the connecting bolts of bearing sup0070ort to see if they

are loose after every well completion.

5.3.2 Inspect the input shaft and the flange of universal shaft (or sprocket) to see if there is any movement after every well completion. If any, tighten them with screws.

5.3.3 Check the wear and deformation of the bushing device after every well completion. If it is unacceptable, bushing device shall be repaired or changed.

5.3.4 Check if the lock device is flexible and in the desired drilling position.

5.3.5 Recommended that when the accumulated drilling depth of rotary table reaches 90000m~100000m, check the wear and spot corrosion of the tooth of bevel gear and the roller of the bearing, if it is unacceptable, they shall be changed.

6. PACKAGING, TRANSPORTATION AND PRESERVATION

6.1 Packaging and transportation

The rotary table shall be under the braking condition, and the shaft ends shall be greased and packaged as per the requirements.

The rotary table shall be delivered without outer packing. Crane and other transportation tools shall be used in handling, and it is not allowed to tug or trail the rotary table on the ground. It shall be lifted by the four lower corners. Discharge the lubrication oil and clean the other foreign matters from the oil tank before delivery.

6.2 Preservation

For long-term storage, the rotary table should be put into a dry, ventilated place to prevent from rust. For those used rotary tables, discharge oil & sediments from the oil tank and lubricate and fill the surfaces of bearings, gears and fit clearance of moving parts with antirust oil. And then store them.

7. LISTS OF BEARING AND SPARE PARTS

7.1 For bearings used for this rotary table, see table3.

Table 3 List of Bearing

Type	Description	Qty per unit	Weight (kg)
2327/1375-1/HCP5	Compound bearing 1651x1375x247.7	1	675
NU2334M	Bearing 170x360x120	1	57.8
22334CA/W33	Bearing 170x360x120	1	59.8

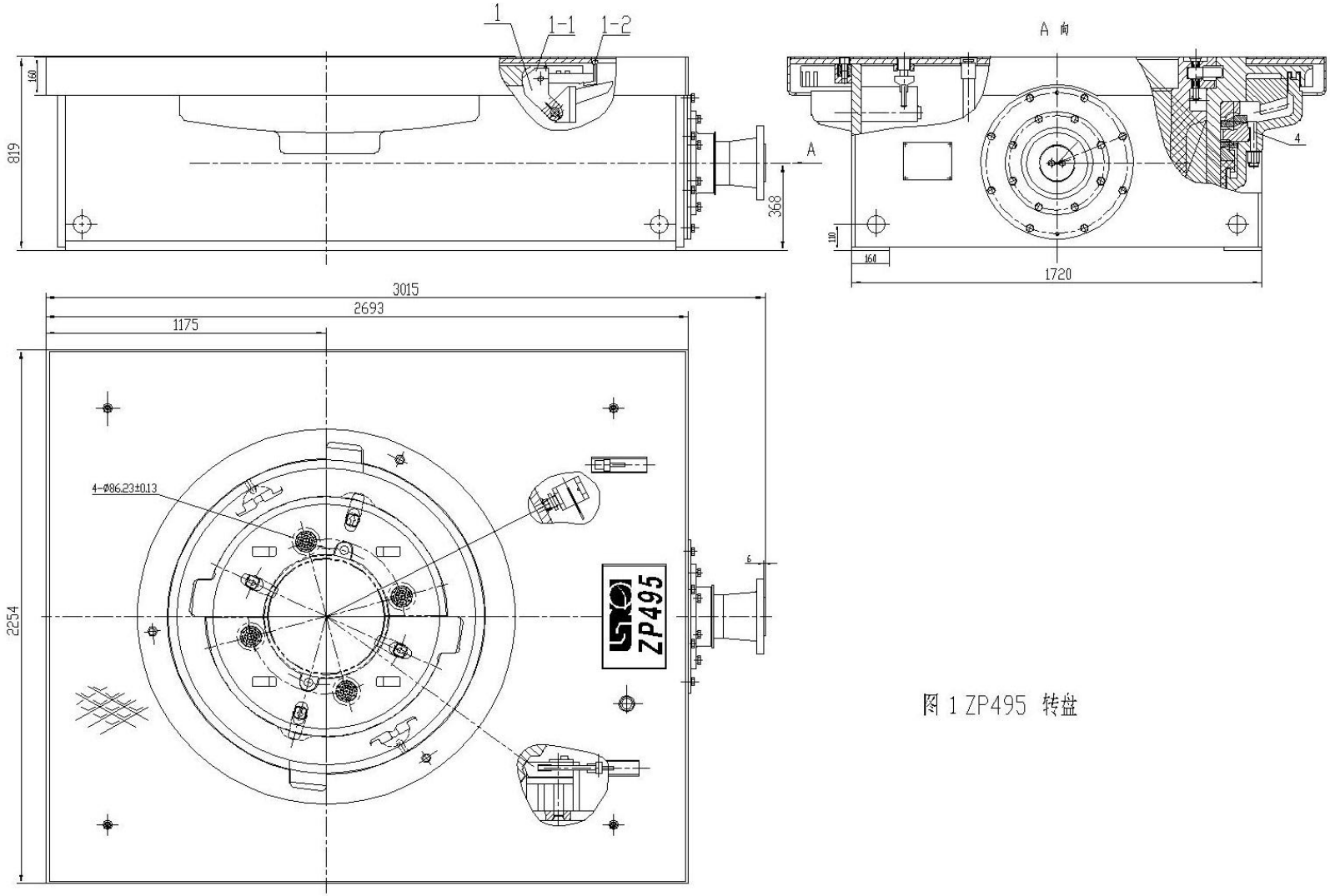
7.2 For spare parts used for this rotary table, see table 4.

Table 4 List of Spare Parts

Type	Description	Qty per unit	Weight (kg)
D4-5-75	O-ring 550x8.6	1	0.17
D7-1-67	Oil seal 220 x260 x18	1	0.178
105.13.50.02	O-ring 545x8.6	1	0.18
105.13.40.04	O-ring 1317.6x8.6	1	0.44

8 FIGURES ATTACHED

Fig. 1 and Fig. 2 ZP495 Rotary table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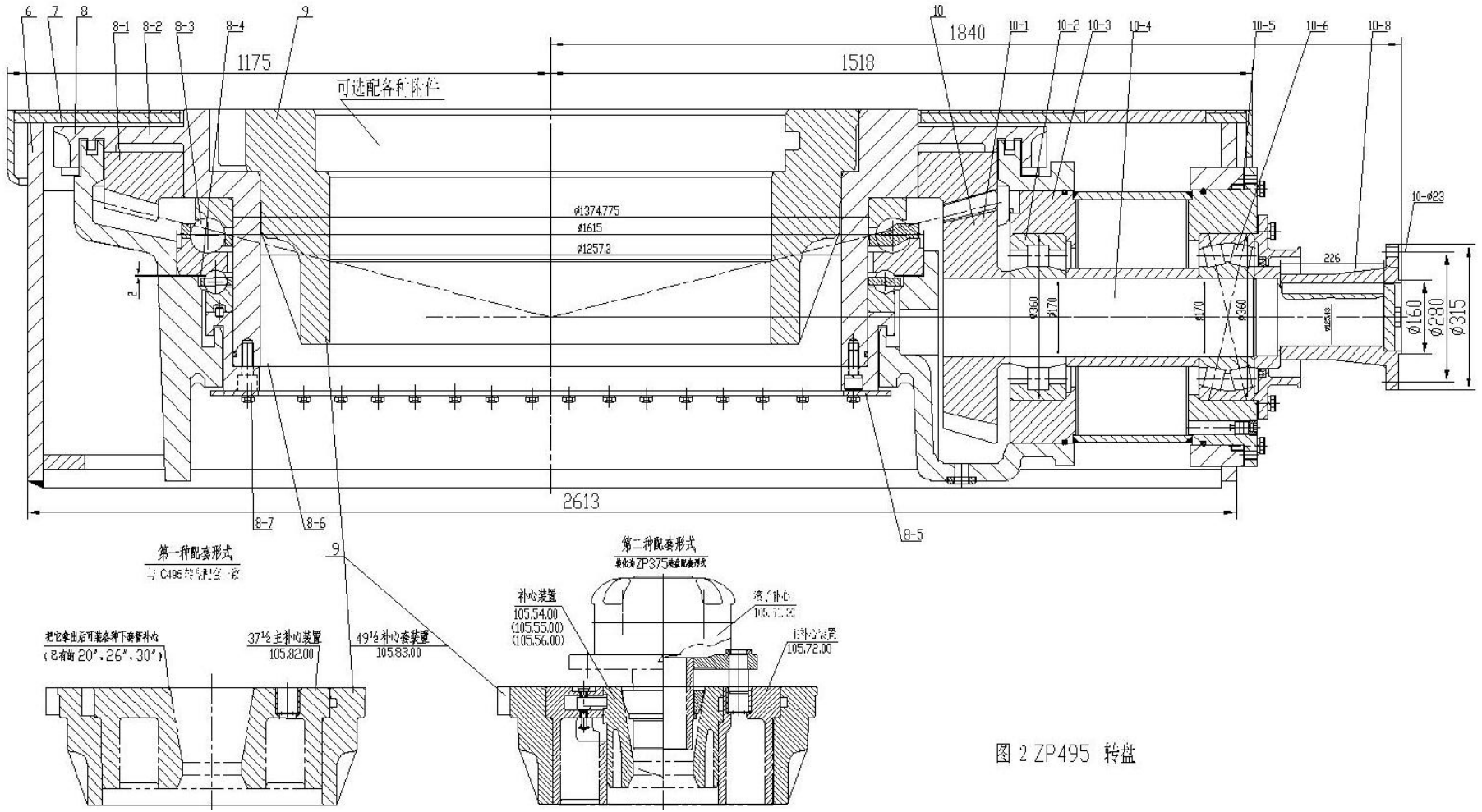
1-2
160
819
A
368
A 向
4
110
160
1720
3015
2693
1175
2254
4-Ø86.23±0.13
6
ZP495

图 1 ZP495 转盘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7
8
8-1
8-2
8-3
8-4
9
1175
可选配各种隔套
10
1840
1518
10-1
10-2
10-3
10-4
10-5
10-6
10-8
10-φ23
φ1374.775
φ1615
φ1257.3
2
226
φ360
φ170
φ170
φ360
φ160
φ280
Ø315
2613
8-7
8-6
8-5
第一种配套形式
9
第二种配套形式
把它拿出后可装各种下套管补心
(已有的 20°、26°、30°)
37½ 主补心装置
105.82.00
49½ 补心套装置
105.83.00
补心装置
105.54.00
(105.55.00)
(105.56.00)
105.72.00

图 2 ZP495 转盘