

橡胶机产品介绍

Rubber Machinery Production Introduction

橡胶机主齿轮箱是在充分吸收了国内外先进的基础上，结合本公司经验和特点，开发设计橡胶机重载齿轮箱。它采用平行圆柱齿轮或圆锥齿轮传动，由电机驱动，经齿轮箱减速后传递给工作机工作。

齿轮箱全部采用硬齿面齿轮，经渗碳、淬火、磨齿，精度达6级（ISO1328-1995）以上，齿轮加工应用了齿面修形、齿根喷丸强化、新型留磨滚刀等多项技术。采用立体造型设计，外观流畅美观，油封和机械密封相结合、整洁环保。此外，齿轮箱还设有智能化的电控与检测系统，实现温度与压力自动巡检，使全套装置安全可靠。

The main gearbox for Rubber is developed and designed on the basis of fully absorbing foreign advanced technology, combined with the experience and characteristics of the company. It uses parallel cylindrical gear or bevel gear for transmission, drive by the motor, and transmits the power to the working machine after reduction by the gearbox.

Gears are all hard flank, carburized, quenched, ground. The gear quality is over class 6 (ISO1328-1995). During machining the gear, new technologies are applied, such as teeth relief, shot peening on the root, and new type hob with stock. The gearbox is designed by 3D software and has a smooth and beautiful appearance. And the gearbox is clean and environmentally protection with the combination of seals and mechanical seals. In addition, intelligentized electrical control and inspection system are equipped to fulfill the automatic inspection for bearing temperature and oil pressure, all these make the machine work safety and reliability.

应用范围

Application scopes

输入转速一般 Input revolution $n_1 \leq 1800\text{r/min}$

工作环境温度 Working environmental temperature $-40\sim+50^\circ\text{C}$

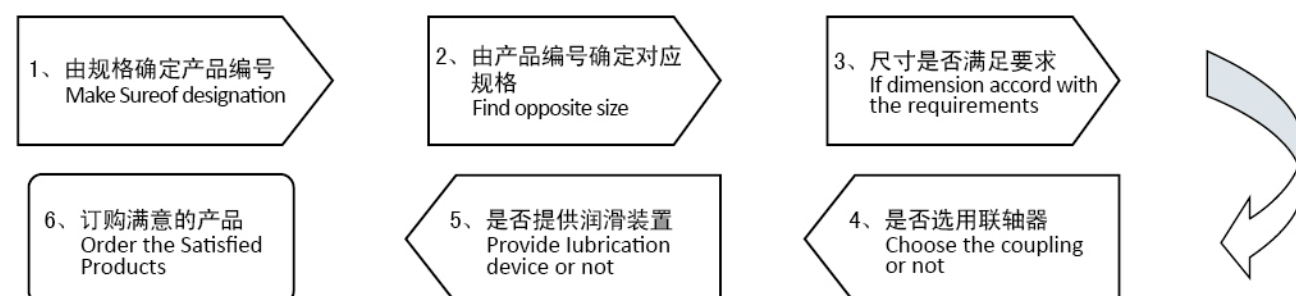
可广泛用于橡胶行业 Be widely used in the rubber industry.

齿轮箱轴伸配键普通型平键按GB/T1096-2003、切向键及其键槽按GB/T1974-2003、普通平键键槽尺寸按GB/T1095-2003执行。

Extension shaft end with key to GB/T1095-2003、GB/1974-2003 and GB/T1096-2003

选型步骤

Selection procedure



单螺杆挤出机齿轮箱

Gearbox For the Single Screw Extruder

单螺杆挤出机用齿轮箱是为复合或单台挤出机配套的齿轮箱，主要用于橡胶塑料行业，作为挤出胶料传递动力装置使用，也可用于其它行业作为挤出物料的传动力装置。

复合挤出机组可用于轿车、轻卡及载重子午线轮胎的生产，可进行胎冠胶与胎肩翼胶及基部胶的复合；胎侧胶与子口耐磨胶的复合；三角胶的复合；及胎肩垫胶的挤出，也可用于斜交轮胎生产，进行胎面和胎侧的机头内复合挤出整体制品。

Single screw extruder gear box is supporting for a single or compound extruder, mainly used for rubber and plastics industry, as a power transmission device for rubber extrusion. It also can be used as a power transmission device for materials extrusion in other industries.



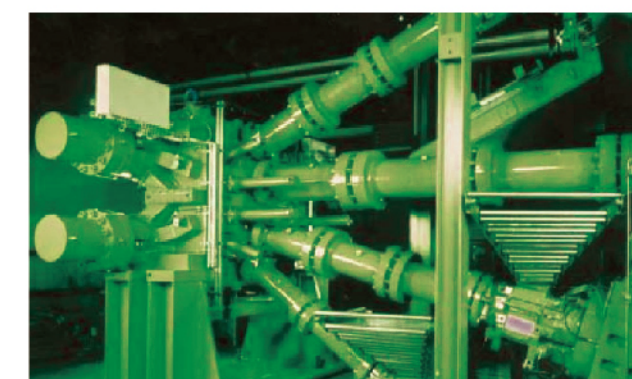
单机挤出机齿轮箱 The Simpex Extruder



双复合挤出机齿轮箱 The Duplex Extruder



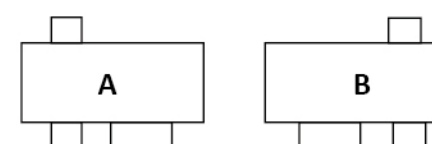
三复合挤出机齿轮箱 The Triplex Extruder



四复合挤出机齿轮箱 The Quadruplex Extruder

装配型式

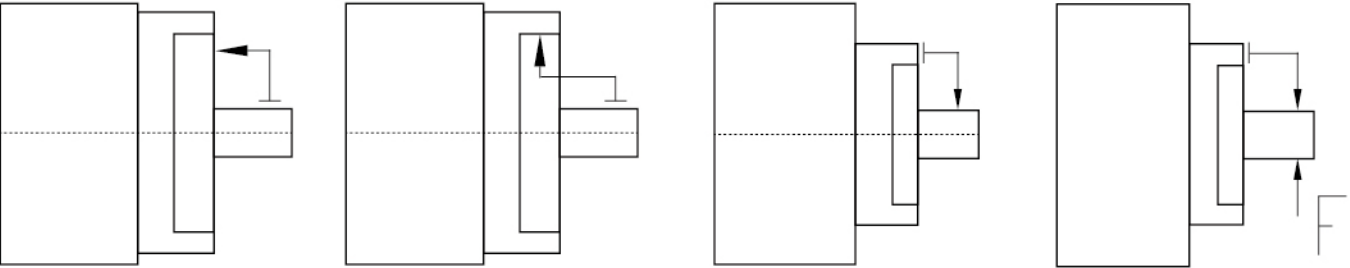
Assembly style



技术参数

Technical parameters

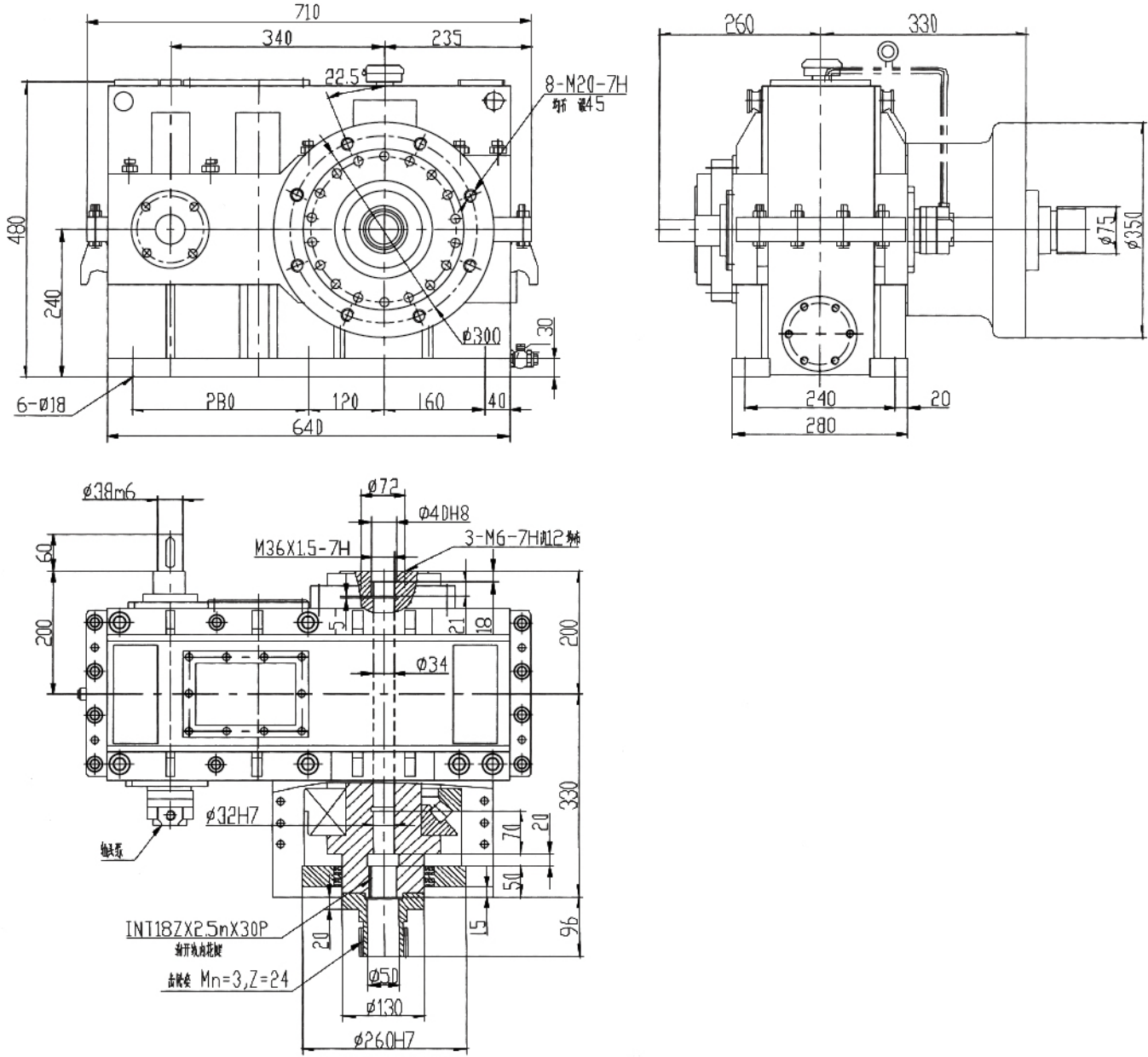
序号 NO.	挤出机 规格 Size	齿轮箱项目 Item				
		倾斜角度 Tilt angle α	I、端面跳动(mm) Face runout to low-speed shaft	II、止口跳动(mm) Seam allowance runout to output shaft	III、低速轴跳动(mm) Runout of the output shaft	IV、低速轴径向 位移(mm) Radial dis-placement of the output shaft
01	60	0°	0.15	0.20	0.06	0.16
02	90	$\leq 30^\circ$	0.15	0.20	0.06	0.16
03	120	$\leq 30^\circ$	0.15	0.20	0.06	0.16
04	150	$\leq 30^\circ$	0.20	0.24	0.08	0.20
05	200	$\leq 25^\circ$	0.20	0.24	0.08	0.20
06	250	$\leq 25^\circ$	0.25	0.28	0.10	0.25



I、端面跳动 II、端面止口跳动 III、低速轴跳动 IV、低速轴径向位移

I、Face runout; II、Face seam allowance runout;
III、Low-speed shaft runout; IV、Radial replacement of low-speed shaft.

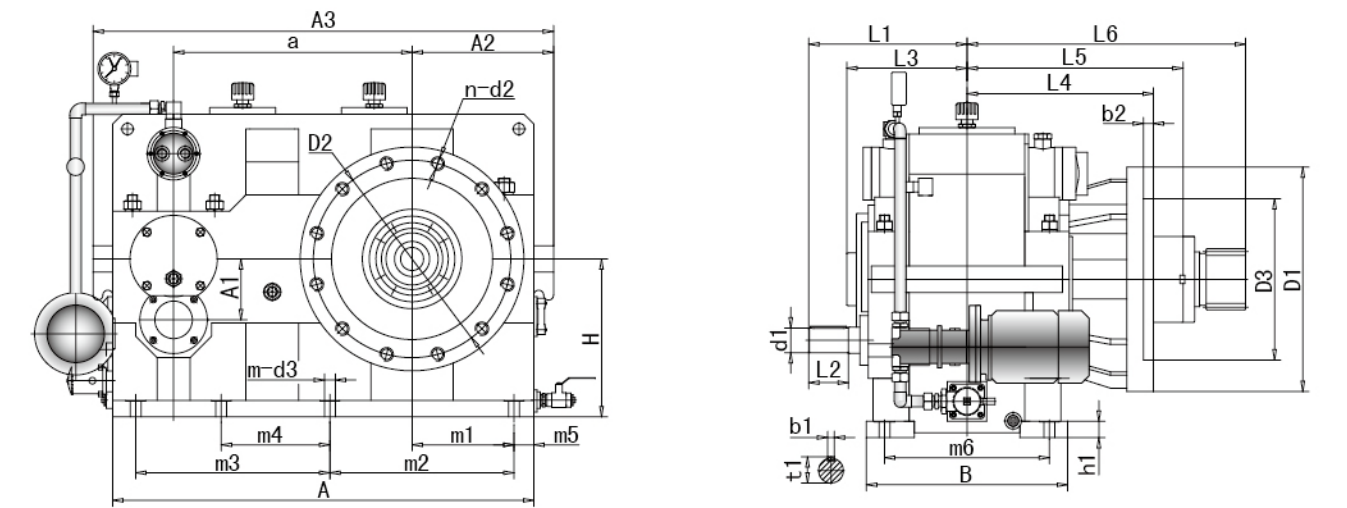
60单螺杆冷喂料挤出机齿轮箱（Size：60）



规格 Size	产品编号 Designation	功率 Power (KW)	输入转速 Input Speed (rpm)	输出转速 Output Speed (rpm)	重量 Weight (kg)
60	XDJ60	22	1500	80	450

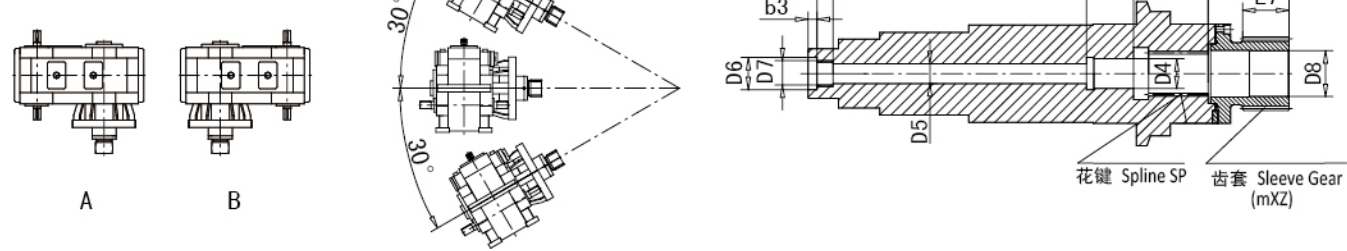
外形安装尺寸

Contour Installation Size



装配形式

Installation Type



型号 Model	a	H	A	A1	A2	A3	B	h1	d1 (m6)	t1	b1	L1	L2	L3	L4	L5
XDJ90	430	280	800	125	285	900	380	35	55	59	16	330	110	285	350	425
XDJ120	545	360	1020	160	370	1120	470	40	65	69	18	440	140	325	475	556
XDJ150	725	480	1280	185	430	1400	610	50	80	85	22	530	170	365	565	655
XDJ200	860	560	1540	250	495	1660	740	60	90	95	25	610	170	480	680	805
XDJ250	1025	630	1880	300	630	2040	850	70	110	116	28	740	210	570	765	885

型号 Model	L6	L7	L8	L9	L10	D1	D2	D3 (H7)	D4 (H7)	D5	D6 (H8)	D7	D8 (D9)	b2	b3	b4
XDJ90	560	75	125	130	365	400	350	285	60	52	60	M56x3	73	12	25	23
XDJ120	704	100	163	150	413	540	480	425	60	55	80	M64x4	100	15	25	42
XDJ150	845	120	177	158	455	680	600	490	90	70	85	M76x4	104	30	30	50
XDJ200	1005	145	218	182	565	805	720	620	120	90	110	M100x4	173	35	30	50
XDJ250	1110	160	245	250	745	950	860	770	170	120	140	M125x4	223	30	30	80

型号 Model	m1	m2	m3	m4	m5	m6	d2	d3	n	m	花键 Spline	齿套 Sleeve Gear mXZ
XDJ90	195	360	360	-	40	330	M24	26	12	6	INT23Zx3Mx30Px7H	Mn=4, Z=27
XDJ120	260	450	450	-	60	400	M30	33	12	6	INT28Zx3Mx30Px7H	Mn=4, Z=34
XDJ150	310	560	590	330	60	500	M36	33	12	8	INT32Zx3Mx30Px7H	Mn=6, Z=29
XDJ200	370	650	760	400	65	650	M36	45	12	8	INT33Zx5Mx30Px7H	Mn=8, Z=29
XDJ250	350	700	920	500	200	700	M36	52	12	8	INT36Zx6Mx30Px7H	Mn=10, Z=29

承载能力

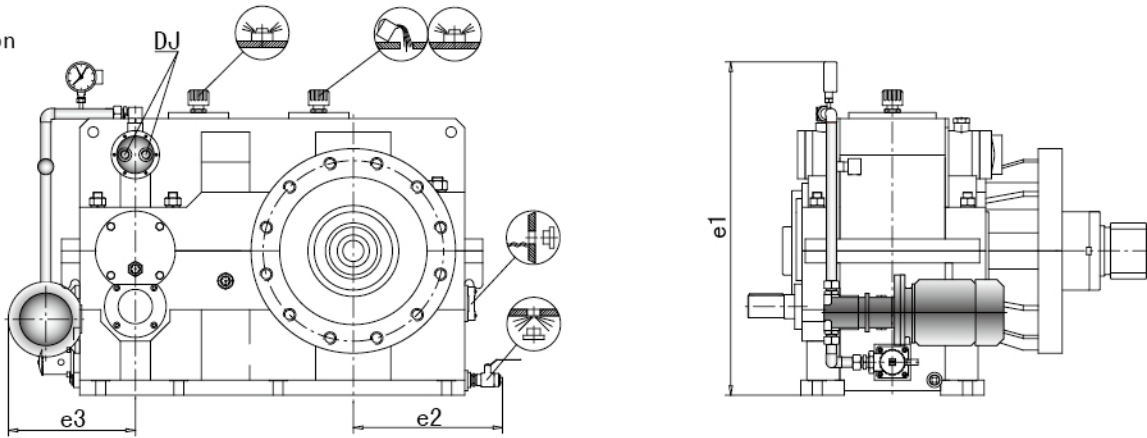
Carrying capacity

型号 Model	XDJ90	XDJ120	XDJ150	XDJ200	XDJ250
螺杆规格 Gear screw Specification	φ 90	φ 120	φ 150	φ 200	φ 250
公称输入功率 (kW) Nominal Input Power (kW)	55	90/110	220/250	315/355	450/500
常用减速比 Common Reduction Ratio	25/27/30	30/37. 5	33/37. 5	45. 5/53. 5	38. 5/50
许用输出扭矩 (N·m) Allowable Output Torque (N·m)	10505	26260	59680	120910	183830
输出轴轴向推力 (kN) Axial Thrust Of Output Shaft(kN)	190	340	530	942	1470
重量 (KG) Weight (KG)	900	1600	3000	5200	8200

表中数据已经考虑安全系数与与橡胶挤出机的工况系数
The data in sheet has taken the safety coefficient and application factor of rubber extruder into account.

润滑

Lubrication



规格 Specification	外形尺寸 Contour Size			冷却水接口 Cooling Water Connector	加油量 Fuel Charge
	e1	e2	e3	DJ	I
XDJ90	810	370	320	2-ZG3/4"	30
XDJ120	940	440	410	2-ZG3/4"	50
XDJ150	1170	500	450	2-ZG1"	120
XDJ200	1320	570	540	2G1"	190
XDJ250	1460	680	600	2-ZG1 1/2"	270

- 一、加油量为参考数值，精确数值以油面处于油标中间位置时的加油量为准。
二、外形尺寸是参考值，我们保持以后做修改的权利。
1.The fuel charge is for reference. The accurate value is subject to the amount when oil surface is in the middle of oil mark.
2.Contour size is for reference. We keep the right to make modification in the future.

密炼机齿轮箱

Gearbox For the Internal Mixer

密炼机主齿轮箱是为密闭式炼胶机（以下简称密炼机）配套的主齿轮箱，是高精度重载荷硬齿面齿轮箱。密炼机主齿轮箱采用平行圆柱齿轮减速的传动形式。输入轴重载荷硬齿面齿轮箱。密炼机主齿轮箱采用平行圆柱齿轮减速的传动形式。输入轴通过联轴器与电机轴相联，由电机驱动，经过齿轮减速和两输出轴之间齿轮的减速与功率分流，再通过联轴器把动力传递给密炼机转子轴，带动密炼机转子进行炼胶。

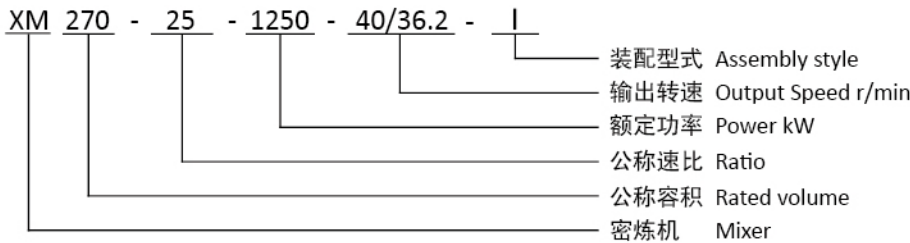
齿轮箱采用渐开线斜齿轮和滚动轴承，输入和输出密封结构采用油封和机械密封相结合的密封形式，保证密封安全可靠。润滑系统采用强制喷油润滑方式，小规格齿轮箱配有安装在齿轮箱箱体上的简易润滑装置，外观简洁美观，实用性强；大规格齿轮箱配独立稀油站润滑。

The main gearbox, namely closed type rubber refining machine (for short Internal batch Mixer) is a kind of high precision, heavy duty and tooth-flank hardened product matched for main gearbox. For this gearbox, we adopt paralleled cylindrical gear to perform speed reducing. Through flexible coupling, the input shaft is connected to the motor shaft. Drove by the motor, reduced by parallel shafts and the gears between two output shafts and power dividing. The power now has been transmitted to rotor shaft of mixer by the crown coupling for the two output shafts separately. The two rotor shafts of the mixer refine rubber.

Gears in this gearbox are involutes helix gears. All supporting bearings are rolling bearing. The input and output shafts are sealed by seals together with mechanical parts to realize safe and reliable sealing. We adopt separate lubrication system, the equipment must be forcedly lubricated, the lubrication system may be erected as a separate oil unite or be installed outside the gear case. Simple lubrication device is installed outside the gear case, which provide separate pump and mainly be applied for small specification gear box, external appearance of this kind of equipment is beauty and succinct. All the parts of the separate lubrication unite are assembled together, the pipe is used for connected the gearbox with the lubrication unite, which mainly be applied for large specification gear box.

产品编号示例

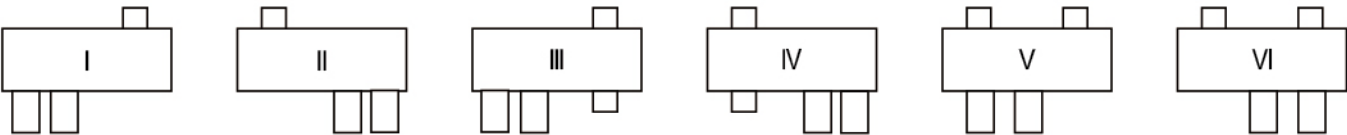
Designation example



密炼机齿轮箱
Gearbox for Internal Mixer

装配型式

Assembly style



产品索引

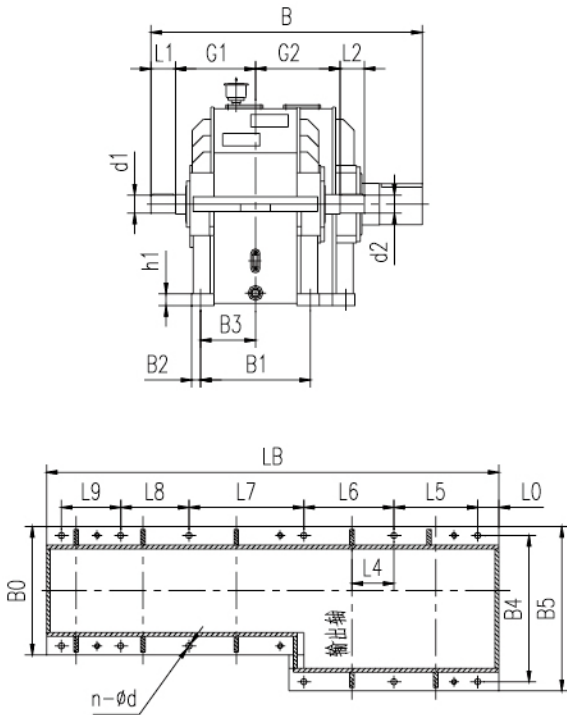
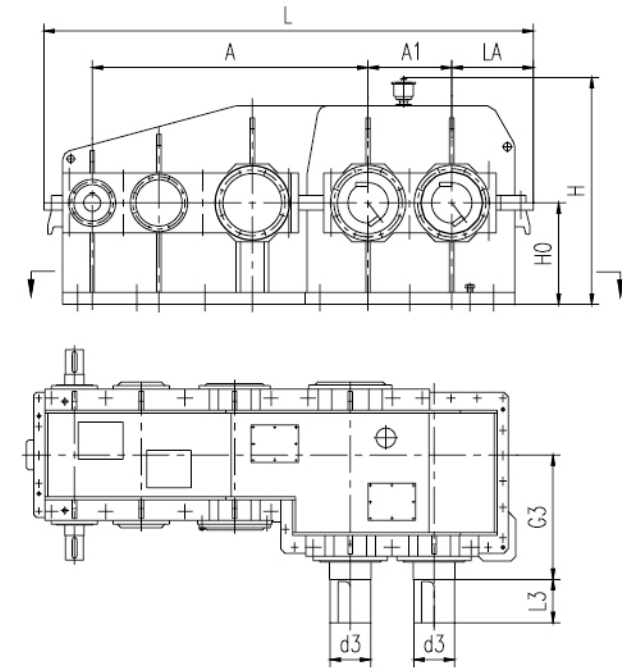
Product index

型号 Type	产品编号 Designation	规格 Size
1.5	XM1.5-18-22-100/87-I/II	01
1.5	XM1.5-15-30-100/87-I/II	02
5E	XM5E-18.75-55-80/80-I/II	03
45E	XM45E-16.67-280-60/60-I/II	04
50	XM50-15-110-40/34.7-I/II	05
75	XM75-18.64-210-40/33.75-I/II	06
90E	XM90E-16.67-630-60/60-I/II	07
110E	XM110E-17.16-600-60/60-I/II	08
110	XM110-16.67-400-60/52.2-I/II	09
135E	XM135E-20-750-60/60-I/II	10
160	XM160-25/50-500/250-40/20-I/II	11
190E	XM190E-16.67-1250-60/60-I/II	12

型号 Type	产品编号 Designation	规格 Size
250E	XM250E-20-1250-50/50-I/II	13
255	XM255-25-1250-40/36.1-I/II	14
270	XM270-25/50-1000/500-40/20-I/II	15
270	XM270-25-1100-40/36.2-I/II	16
270	XM270-25-1250-40/36.2-I/II	17
270	XM270-16.67-1500-60/54.4-I/II	18
300	XM200-25-1300-40/-I/II	19
320E	XM320E-20-1500-50/50-I/II	20
320E	XM320E-17.5-2*900-60/60-III/IV	21
400	XM400-16.7-2*1250-60/54.4- III/IV	22
580E	XM580E-22.2-2*1250-45/45- III/IV	23
590T	XM590TE-20-800-50/50-I/II	24

外形尺寸

Outline Dimensions



技术参数
Technical parameters

规格 Size	型号 Type	传动功率 Power kw	输入转速 Input Speed rpm	输出转速 Output Speed rpm	速比 Ratio	油量 Oil Volume L/min	重量 Weight kg
01	1.5	22	1800	100/87	18	----	280
02	1.5	30	1500	100/87	15	----	280
03	5E	55	1500	80/80	18.75	----	480
04	45E	280	1000	60/60	16.67	----	3200
05	50	110	600	40/34.7	15	10	1774
06	75	210	750	40/33.75	18.64	16	3000
07	90E	630	1000	60/60	16.67	40	5100
08	110E	600	1000	60/60	16.67	40	5460
09	110	400	1000	60/52.2	16.67	40	5300
10	135E	750	1200	60/60	20	63	7390
11	160	500/250	1000	40/20	25/50	80	8620
12	190E	1250	1000	60/60	16.67	80	11400
13	250E	1250	1000	50/50	20	100	13500
14	255	1250	1000	40/36.1	25	125	14500
15	270	1000/500	1000	40/20	25/50	100	15000
16	270	1100	1000	40/36.2	25	125	11900
17	270	1250	1000	40/36.2	25	125	13500
18	270	1500	1000	60/54.4	16.67	125	14900
19	300	1300	1000	40/	25	125	15100
20	320E	1500	1000	50/50	20	125	15100
21	320E	2*900	1050	60/60	17.5	160	21000
22	400	2*1250	1000	60/54.4	16.67	160	22500
23	580E	2*1250	1000	45/45	22.2	160	27500
24	590TE	800	996	50/50	20	100	10500

注：1、功率500/250表示齿轮箱为机械变速； 2、功率2*900表示齿轮箱有两台电机。
Note: 1. Power 500/250 indicates that the gearbox uses mechanical transmission; 2. Power 2*900 indicates there are two motors.

技术参数
Technical parameters

G3	220 220	240 560	380 510	560 560	560 700	690 755	835 885	885 885	885 960	885 885	1130 1060	1120 700
G2	---	---	---	---	---	---	---	---	---	---	380 700	750 ---
G1	213.5 215.5	210 420	340 360	525 525	525 480	510 690	540 600	600 600	600 590	625 625	380 700	750 610
d3	52 52	80 155	140 170	190 210	200 220	230 270	275 285	275 275	285 285	285 285	285 300	360 240
d2	---	---	---	---	---	---	---	---	---	---	140 150	150 ---
d1	48 48	42 85	70 85	110 110	100 100	120 140	135 140	120 125	140 140	140 140	140 150	150 110
n-d	6-19 6-19	10-28 10-33	8-35 10-35	10-35 10-35	10-35 10-45	12-42 12-46	12-42 10-45	10-39 10-39	10-45 12-42	12-45 12-45	16-45 14-45	12-45 10-45
B5	380 400	395 730	530 680	880 880	880 970	990 1150	1100 1160	1170 1170	1160 1260	1205 1205	1230 1530	1440 1040
B4	310 350	345 623	470 600	790 790	790 830	870 1030	980 1070	1070 1070	1070 1150	1085 1085	1110 1380	1290 900
B3	155 175	172.5 248	235 230	395 395	395 330	360 515	370 425	425 425	425 420	410 410	410 515	500 450
B2	35 25	25 52	30 40	45 45	45 70	60 60	60 45	50 50	45 55	60 60	60 75	75 70
B1	310 350	345 496	470 460	790 790	790 660	720 1030	740 850	850 850	850 840	820 820	820 1030	1000 900
B0	380 400	395 600	530 540	880 880	880 800	840 1150	860 940	950 950	940 950	940 940	940 1180	1150 1040
B	555.5 555.5	660 1290	995 1210	1458 1458	1460 1595	1740 1965	1865 1943	1943 1943	1943 2080	2010 2010	1980 2340	2520 1765
A1	120 120	165 340	325 360	420 435	440 480	500 530	565 612	565 565	565 565	615 622	622 680	750 750
A	260 305	450 780	575 780	960 960	860 1325	1250 1330	1860 1680	1480 1480	1680 1680	1760 1760	2210 2255	2570 1325
型号 Type	1.5	5E 45E	50 75	90E 110E	110 135E	160 190E	250E 255	270 270	270 270	300 320E	320E 400	580E 590TE
规格 Size	01 02	03 04	05 06	07 08	09 10	11 12	13 14	15 16	17 18	19 20	21 22	23 24

技术参数

Technical parameters

	LB	LA	L9	L8	L7	L6	L5	L4	L3	L2	L1	L0	L	H1	H0	H	型号 Type	规格 Size
01	620	180	---	---	265	265	---	195	52	---	70	45	740	25	180	350		01
02	663	179	---	---	---	245	300	196.5	52	---	70	42.5	755	25	210	380	1.5	02
03	915	315	---	250	160	170	230	55	130	---	80	50	1065	42	315	660	5E	03
04	1740	440	---	340	385	405	410	170	170	---	140	100	1140	45	500	1060	45E	04
05	1330	354	---	---	400	400	400	110	170	---	105	65	1538	45	380	950	50	05
06	1620	390	---	355	355	355	355	185	210	---	130	100	1840	50	500	1057	75	06
07	2170	450	---	540	450	450	530	210	210	---	163	100	2230	60	580	1080	90E	07
08	2100	410	---	540	450	450	530	210	210	---	163	65	2180	60	580	1080	110E	08
09	2000	405	---	500	470	380	520	220	210	---	165	65	2080	60	560	1060	110	09
10	2530	480	---	580	580	580	580	260	250	---	165	105	2645	60	600	1252	135E	10
11	2260	460	480	480	160	480	480	250	330	---	210	90	2540	60	600	1272	160	11
12	2690	590	500	500	500	500	500	385	320	---	200	95	2970	80	770	1540	190E	12
13	3120	550	400	460	775	607.5	565	282.5	290	---	200	142.5	3370	80	680	1550	250E	13
14	2950	578	---	850	550	640	710	240	290	---	168	95	3240	80	700	1600	255	14
15	2950	585	---	850	550	640	710	290	290	---	168	100	3050	80	650	1440	270	15
16	2950	585	---	850	550	640	710	290	290	---	168	100	3050	80	650	1440	270	16
17	2950	585	---	850	550	640	710	290	290	---	168	45	3200	80	700	1600	270	17
18	3210	630	430	450	655	665	710	280	330	---	200	150	3320	80	760	1580	270	18
19	3060	605	645	570	400	610	630	340	300	---	200	105	3350	80	760	1600	300	19
20	3060	598	645	570	400	610	630	340	300	---	200	105	3350	80	760	1600	320E	20
21	3750	533	450	540	660	690	749	311	300	170	170	95	3860	80	760	1680	320E	21
22	3850	625	627.5	585	481	599	806	259	380	200	200	79	4010	80	1000	2030	400	22
23	4200	740	780	780	780	750	750	375	450	200	200	195	4540	120	1000	2100	580E	23
24	2900	610	---	---	600	600	700	790	290	---	165	105	3030	70	600	1160	590TE	24

开炼机齿轮箱

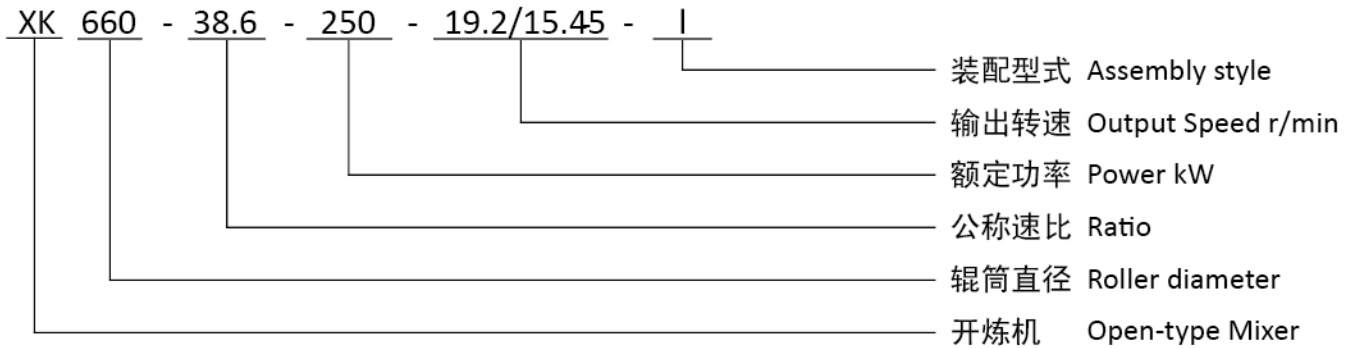
Gearbox For the Open-type Mixing Mills

开炼机齿轮箱是为开放式炼胶机（简称开炼机）配套的主齿轮箱，是高精度重载荷硬齿面齿轮箱。齿轮箱采用平行圆柱齿轮减速的传动形式。输入轴通过弹性联轴器与电机轴相联，由电机驱动，经过齿轮减速和两输出轴之间齿轮的减速与功率分流，两输出轴分别通过联轴器把动力传递给开炼机转子轴，带动开炼机转子进行炼胶。

The main gearbox, namely Open-type mixing mill is a kind of high precision, heavy duty and tooth-flank hardened product matched for main gearbox. For this gearbox, we adopt paralleled cylindrical gear to perform speed reduction, the input shaft is connected to the motor shaft through the flexible pin coupling. Driven by the motor, reduced by parallel shafts and power dividing between the two output shafts, two output shafts transfer the power to the rotor shaft of the roller mixing mill through the coupling, in such a manner, two rotor shafts of the roller mixing mill start to refine the rubber.

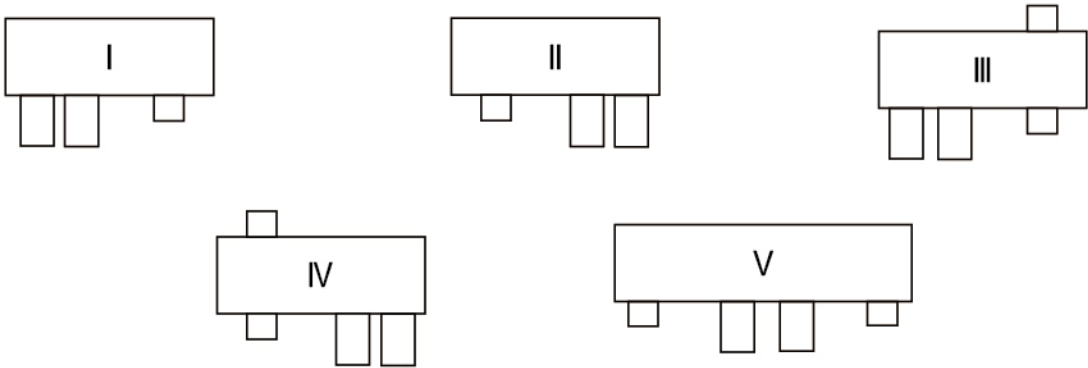
产品编号示例

Designation example



装配型式

Assembly style



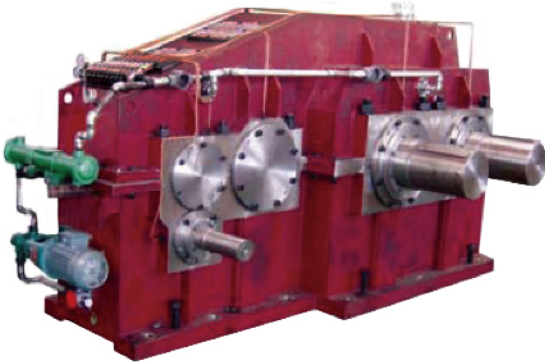
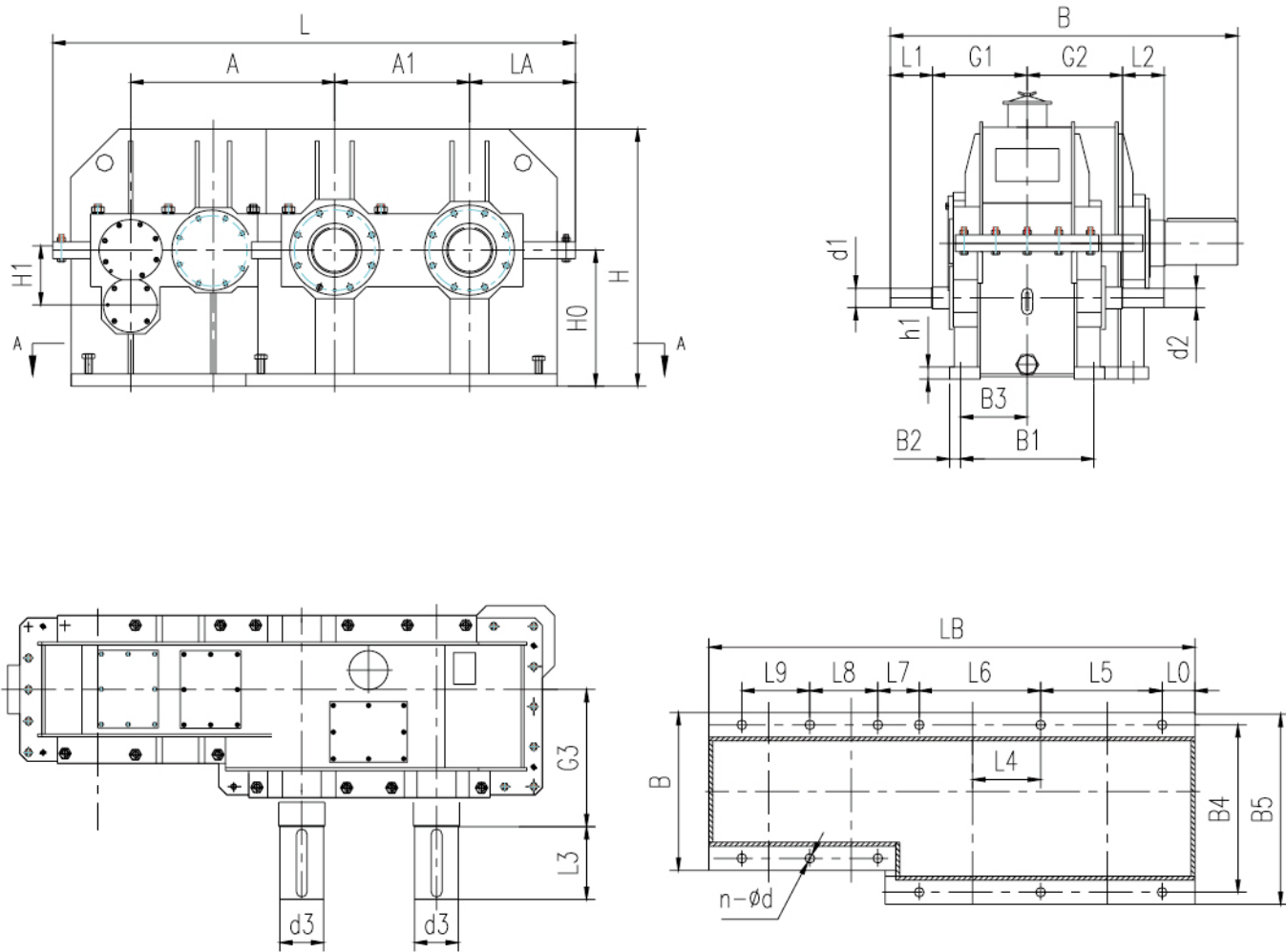
产品索引
Product index

型号 Type	产品编号 Designation	规格 Size	型号 Type	产品编号 Designation	规格 Size
360	XK360-34.5-37-29/26.6-I/II	01	660	XK660-38.6-250-19.2/15.45-I/II	09
550	XK550-63-110-15.6/16.8-I/II	02	660	XK660-43-250-17.1/13.8-I/II	10
550	XK550-50-110-19.8/16.2-I/II	03	660	XK660-47.5-250-15.8/14.5-I/II	11
550	XK550-48.5-132-20.2/16.6-I/II	04	660	XK660-59-250-16.6/14.7-I/II	12
610	XK610-40.9-110-22/18.1-I/II	05	660	XK660-34.5-2*132-28.95/25.62-V	13
610	XK610-43.8-160-16.9/15.65-I/II	06	660	XK660-34.5-250-28.95/25.62-I/II	14
660	XK660-36.5-180-16/14.7-I/II	07	710	XK710-50-280-20/18.2-I/II	15
660	XK660-48.9-180-15/13.8-I/II	08	710	XK710-63-280-15.6/14.3-I/II	16

技术参数
Technical parameters

规格 Size	型号 Type	传动功率 Power kw	输入转速 Input Speed rpm	输出转速 Output Speed rpm	速比 Ratio	油量 Oil Volume L/min	重量 Weight kg
01	360	37	1000	29/26.6	34.5	----	1250
02	550	110	980	15.6/16.8	63	16	3800
03	550	110	980	19.8/16.2	50	16	3070
04	550	132	980	20.2/16.6	48.5	16	3750
05	610	110	900	22/18.1	40.9	25	4050
06	610	160	740	16.9/15.65	43.8	25	5750
07	660	180	585	16/14.7	36.5	40	7500
08	660	180	734	15/13.8	48.9	40	7500
09	660	250	740	19.2/15.45	38.6	40	7500
10	660	250	735	17.1/13.8	43	40	8344
11	660	250	750	15.8/14.5	47.5	40	8220
12	660	250	980	16.6/14.7	59	40	8200
13	660	2*132	1000	28.95/25.62	34.5	40	4300
14	660	250	1000	28.95/25.62	34.5	40	5640
15	710	280	1000	20/18.2	50	63	9550
16	710	280	1000	15.6/14.3	63	63	9920

外形尺寸
Outline Dimensions



开炼机齿轮箱
Gearbox for the
Open-type Mixing Mills

技术参数

Technical parameters

规格 Size	型号 Type	A	A1	B	B0	B1	B2	B3	B4	B5	n-d	d1	d2	d3	G1	G2	G3
01	360	660	365	----	570	490	40	245	490	570	6-33	----	42	120	----	320	350
02	550	995	550	----	710	630	40	315	630	710	10-40	----	80	180	----	455	500
03	550	730	555	1000	666	566	50	283	566	666	10-35	75	75	180	395	395	410
04	550	880	555	----	690	615	37.5	307.5	615	690	10-39	----	80	180	----	455	500
05	610	910	615	----	710	630	40	315	630	710	10-35	----	70	170	----	425	470
06	610	1240	620	----	820	720	50	360	720	820	10-35	----	100	250	----	550	580
07	660	1240	665	----	980	880	50	440	880	980	10-42	----	80	240	----	550	580
08	660	1240	665	----	980	860	60	430	860	980	10-39	----	100	250	----	550	580
09	660	1240	665	----	980	880	50	440	880	980	10-42	----	80	240	----	550	580
10	660	1228	665	----	780	660	60	330	870	990	12-39	----	100	250	----	460	700
11	660	1228	665	----	780	660	60	330	870	990	12-39	----	100	250	----	460	700
12	660	1110	665	----	1020	900	60	450	900	1020	8-52	----	110	260	----	500	580
13	660	880	665	----	710	630	40	315	630	710	16-40	----	70	180	----	370	420
14	660	1240	665	----	710	630	40	315	630	710	10-46	----	80	180	----	460	500
15	710	1145	715	----	870	760	55	380	955	1065	10-48	----	100	260	----	520	735
16	710	1145	710	1745	960	860	50	430	860	960	10-48	100	100	280	600	600	670

技术参数

Technical parameters

规格 Size	H	H0	H1	h1	L	L0	L1	L2	L3	L4	L5	L6	L7	L8	L9	LA	LB
01	645	340	----	35	1490	145	----	70	200	-120	600	600	----	----	----	310	1390
02	980	530	----	60	2200	85	----	100	250	355	470	470	470	470	----	435	2050
03	880	480	210	50	2040	80	105	105	270	280	570	430	430	300	----	450	1890
04	980	500	250	40	2200	115	----	170	300	285	520	520	450	350	----	440	2050
05	950	500	----	60	2250	70	----	105	240	325	600	560	400	360	----	475	2060
06	1105	580	----	60	2550	65	----	210	330	350	560	560	560	560	----	445	2370
07	1190	630	----	60	2700	170	----	140	320	355	560	560	560	560	----	520	2500
08	1190	630	----	60	2690	90	----	210	330	355	640	560	560	560	----	520	2500
09	1190	630	----	60	2700	170	----	140	320	355	560	560	560	560	----	520	2500
10	1550	800	281	80	2835	100	----	210	330	330	665	610	300	500	400	510	2675
11	1550	800	281	80	2835	100	----	210	330	330	665	610	300	500	400	510	2675
12	1210	600	320	90	2680	----	----	165	380	325	650	780	800	----	----	495	2540
13	1080	630	----	60	2890	90	----	180	210	152.5	360	360	360	360	360	232.5	2700
14	1182	630	----	60	2705	100	----	180	210	400	580	580	580	580	----	510	2520
15	1500	800	335	70	2945	150	----	165	400	395	675	675	555	555	----	595	2765
16	1462	710	340	70	2900	90	125	125	350	470	630	630	630	630	----	560	2700

挤出压片机齿轮箱

Gearbox For the Extruder & Calender

挤出压片机齿轮箱是为密炼机下辅机（双锥双螺杆挤出压片机组）配套的主齿轮箱，由挤出机齿轮箱和压片机齿轮箱组成，为高精度重载硬齿面齿轮齿轮箱。挤出压片机主齿轮箱共有五组传动形式，每组传动形式又分为左、右两种传动方式。

挤出机齿轮箱（A型）包括左、右两套齿轮箱（各含方箱、锥箱一台），其中一台锥箱的输入轴由弹性联轴器与电机联接。两锥箱输入轴通过万向联轴器联接，分别通过锥齿轮换向、两级平行轴齿轮减速，两输出轴（空心轴）得到相同的输出转速，异向同步转动，并分别带动挤出机啮合型螺杆工作。

挤出机齿轮箱（B型）输入轴由弹性联轴器与电机联接，经过三级平行轴齿轮减速，输出轴（空心轴）得到输出转速，挤出机转子轴伸安装到空心轴里，由空心轴将运动和动力传递给工作机转子轴，再通过一对锥齿轮分流，分别带动挤出机啮合型螺杆工作。

挤出机齿轮箱（C型）和压片机齿轮箱（D型）的输入轴由弹性联轴器与电机联接，经过三级平行轴齿轮减速，输出轴 I 得到输出转速 n_1 ，再经过两输出轴之间相同齿数齿轮的功率分流，输出轴 II 得到相同输出转速 n_2 ，两输出轴分别由万向联轴器与工作机转子轴相连，两工作机转子轴以异向同步转速工作。

压片机齿轮箱（E型）输入轴由弹性联轴器与电机联接，经过三级平行轴齿轮减速，输出轴得到输出转速，由鼓形齿联轴器传递给压片机转子轴。

The main gearbox, namely the bipyramid twin screw extruding and sheeting machine group (for short Extruding & Sheeting Machine) is a kind of high precision, heavy duty and tooth-flank hardened product matched for the downside assistant machine of the internal batch mixer, which is comprised of the gearboxes for the extruding and the sheeting machine. There are five types of driving of this main gearbox, and left and right driving kinds for each type.

The gearbox of extruder (type A) includes left and right sets of gear boxes (a cylindrical gearbox and a bevel gearbox respectively), and one of the bevel gearbox is connected to motor through resilient coupling with its input shaft. Input shafts of the two bevel gearboxes are connected by flexible coupling. Both bevel gearboxes are reversed the rotation director by bevel gears, and reduced the speed by parallel gears, and finally the speed of two output shafts (hollow shaft) get the same but rotate on opposite directions and drive the meshing thread rod respectively.

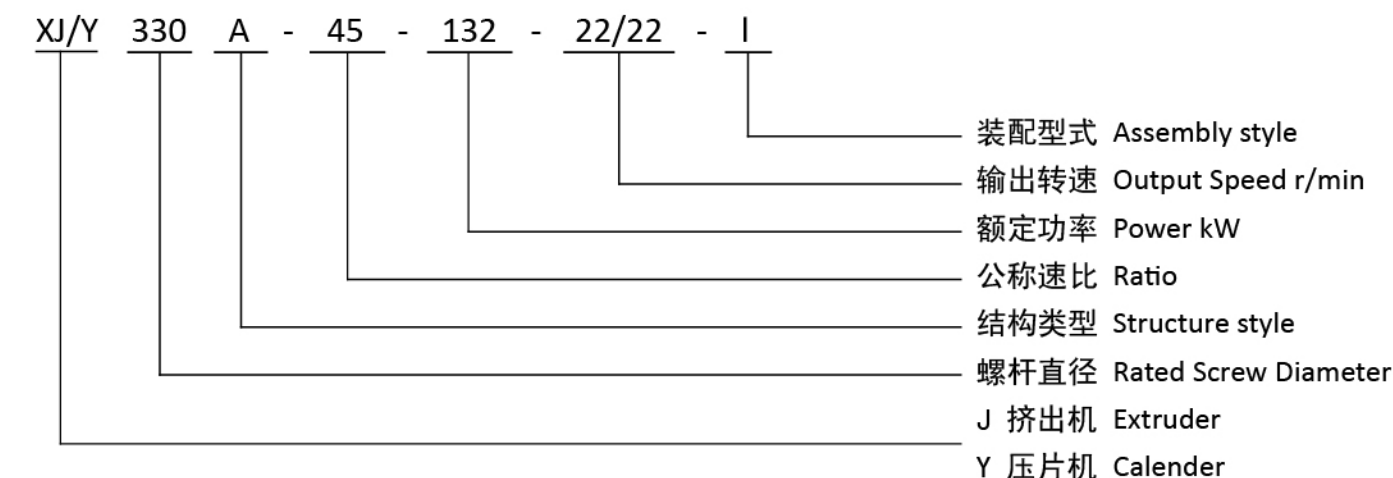
The gearbox of extruder (type B) is connected to the motor by resilient coupling, and through three stages of gears reducing the speed, the output shaft (hollow shaft) gets the output speed. As the rotor shaft of the extruder has been assembled into the hollow shaft, the movement and power are transmitted to the rotor shaft through hollow shaft, after that, through a pair of bevel gearboxes, it drives the meshing thread rod of the extruder.

The input shafts of gearboxes of extruder (type C) and sheeting machine (type D) are connected to motors through resilient couplings. Reduced by three stages of parallel gears, the rotation speed at the output shaft I is n_1 , and then the power is distributed by a gear between two output shafts with has the same teeth number, shaft II gets the same rotation speed with shaft I. These two output shafts are connected to rotor shafts of the working machine through flexible couplings, thus the two rotor shafts work under same rotation speed and opposite directions.

The input shaft of gearbox of sheeting machine (type E) is connected to the motor through resilient coupling. By three stages' reduction, the output shaft gets it speed, this speed is transmitted to the rotor shaft of sheeting machine through crowned teeth coupling.

产品编号示例

Designation example



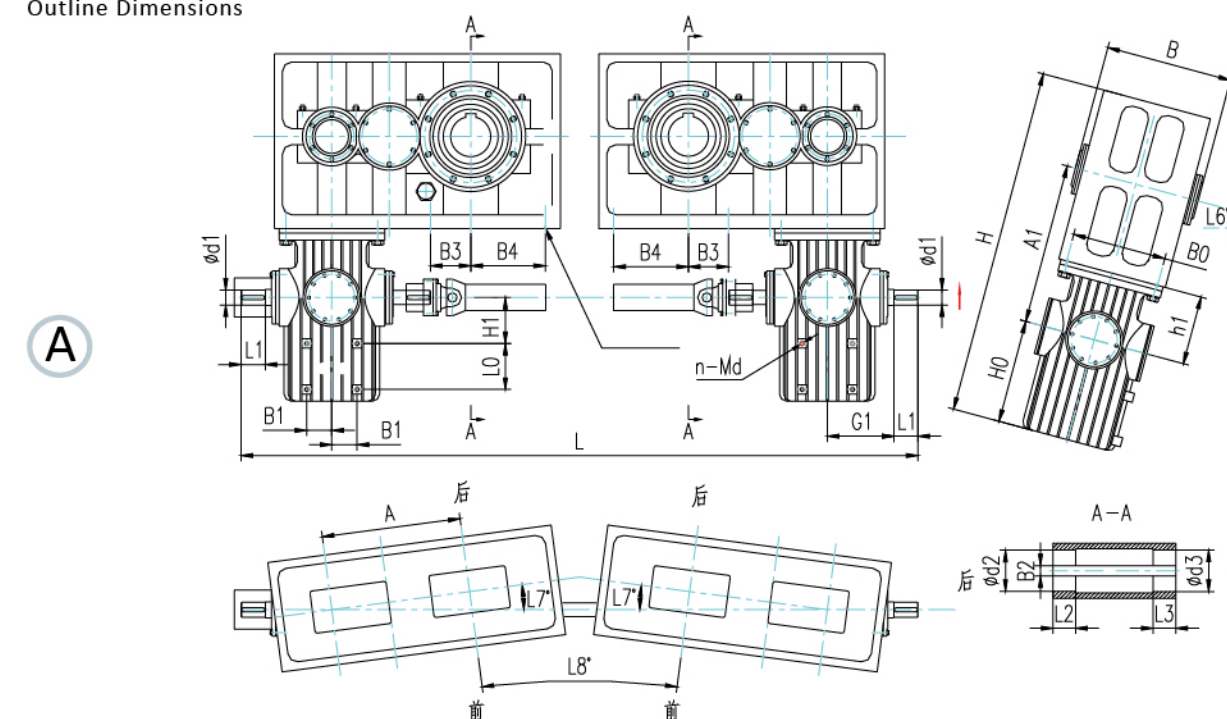
装配型式

Assembly style

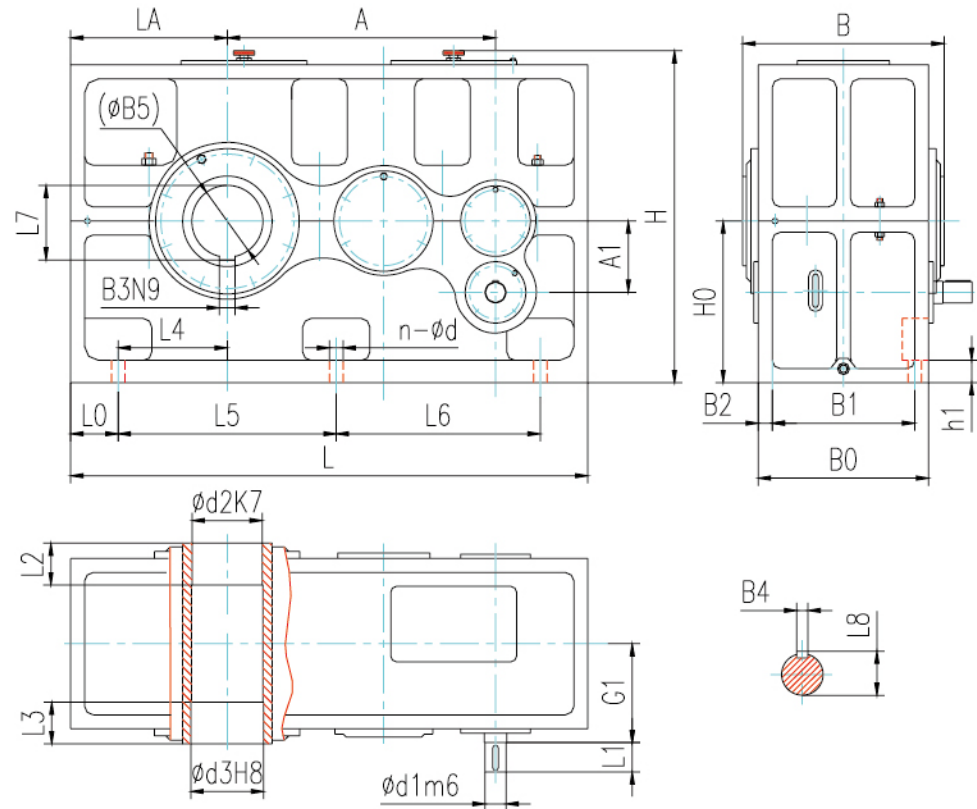


外形尺寸

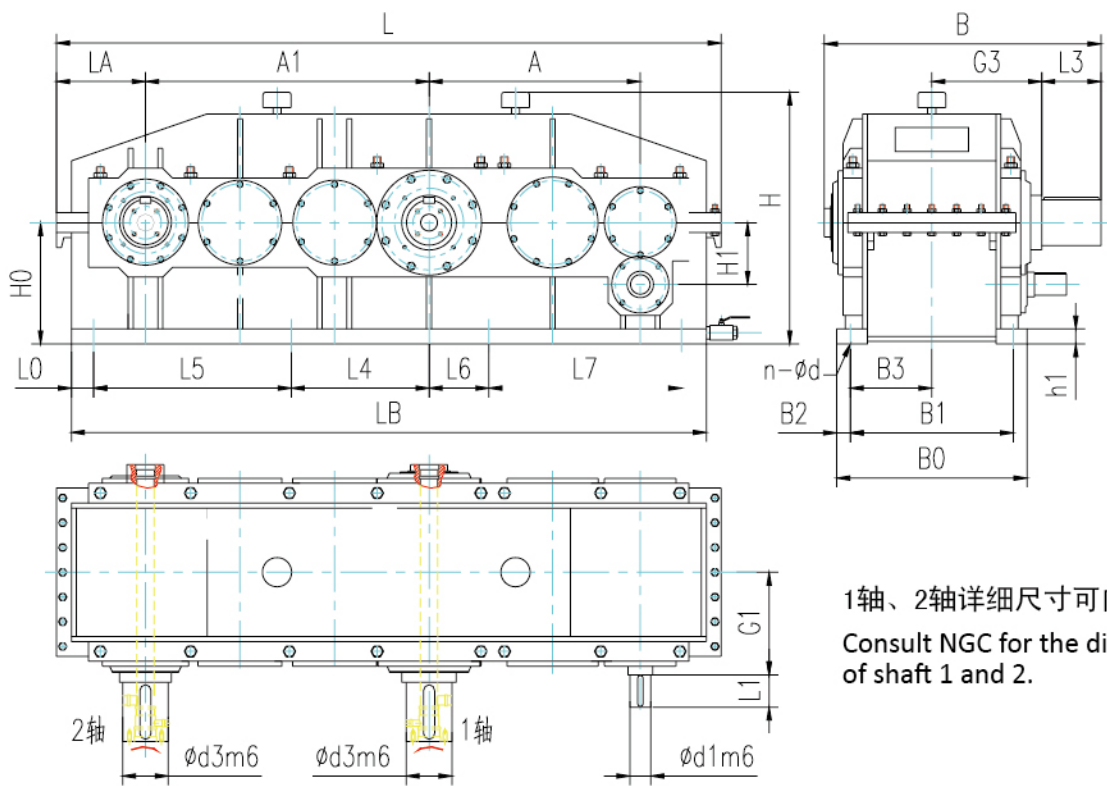
Outline Dimensions



B

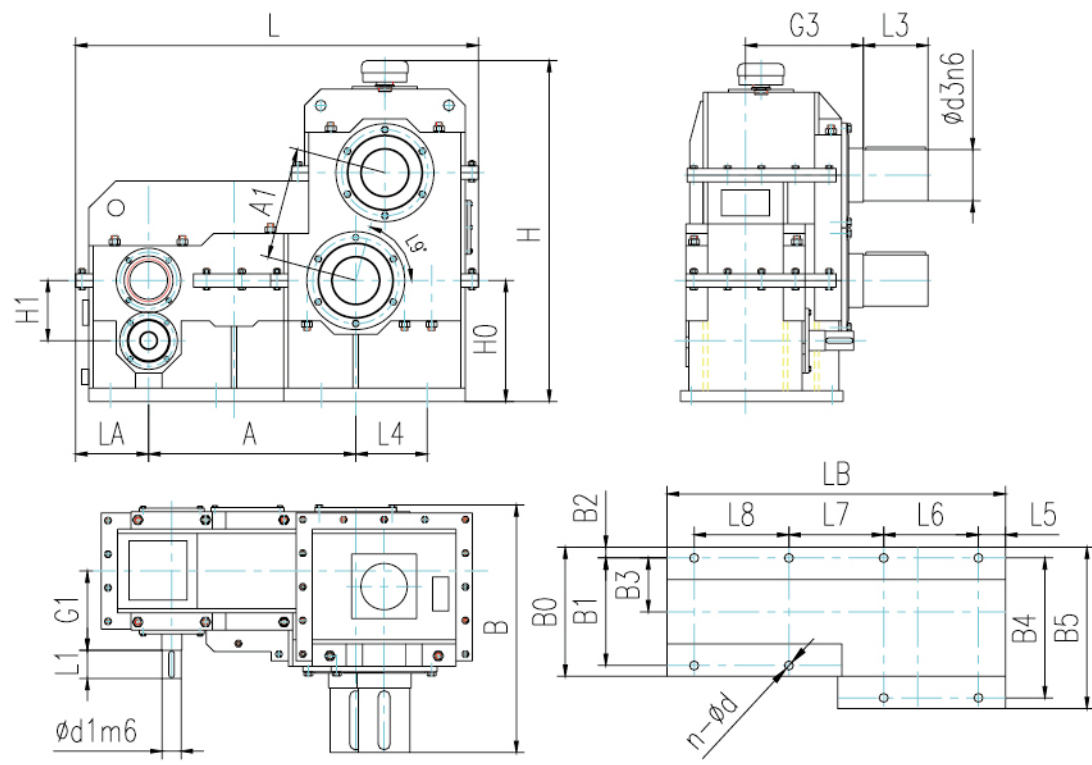


C

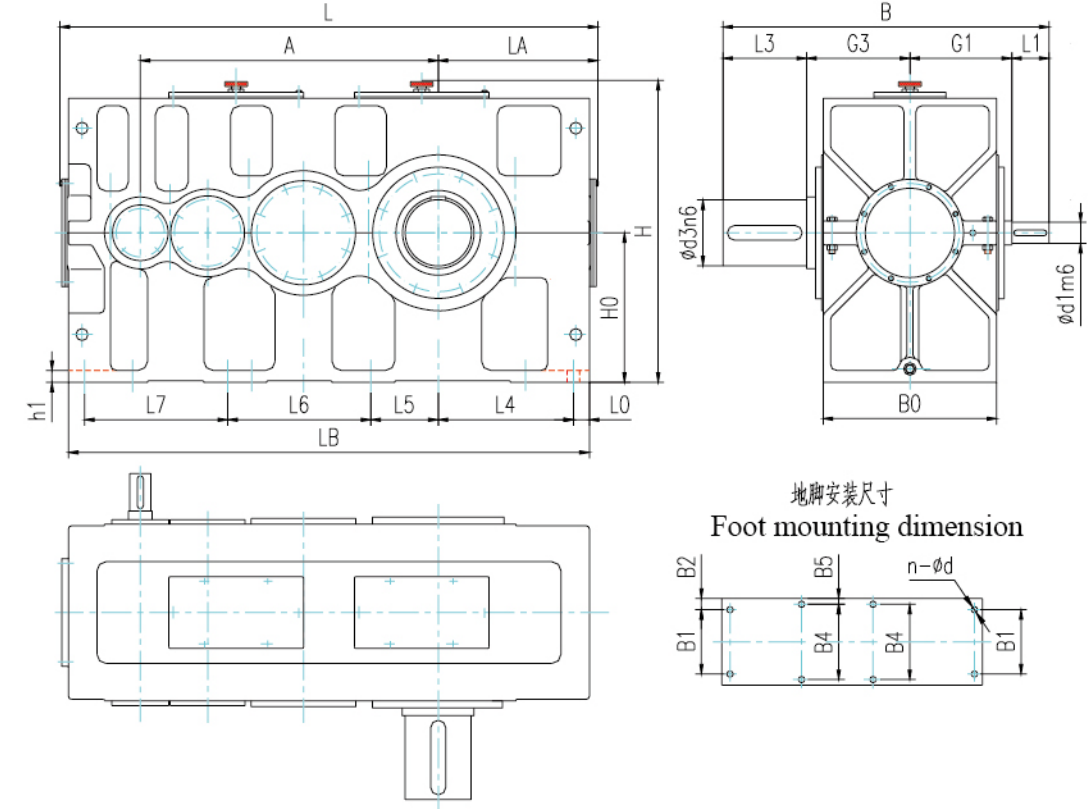


1轴、2轴详细尺寸可向NGC咨询
Consult NGC for the dimensions
of shaft 1 and 2.

D



E



产品索引

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型号 Type	产品编号 Designation	规格 Size	型号 Type	产品编号 Designation	规格 Size
250	XJ250B-45-110-22-I/II	01	416	XJ416B-45-250-22-I/II	09
	XY250E-40-110-25-I/II	02		XY416E-40-250-25-I/II	10
300	XJ300A-45-132-22/22-I/II	03	416	XJ416C-35.5-220-28-I/II	11
	XY300E-40-132-25/25-I/II	04		XY416D-35.5-220-28-I/II	12
330	XJ330B-49-160-23.5-I/II	05	450	XJ450B-80-220-18.75-I/II	13
	XY330D-40-160-28.75-I/II	06		XY450D-56-220-26.5-I/II	14
416	XJ416A-45-180-22/22-I/II	07	450	XJ450B-80-250-18.75-I/II	15
	XY416E-40-180-25-I/II	08		XY450D-56-250-26.5-I/II	16

技术参数

Technical parameters

规格 Size	型号 Type	传动功率 Power kw	输入转速 Input Speed rpm	输出转速 Output Speed rpm	速比 Ratio	油量 Oil Volume L/min	重量 Weight kg
01	250	110	1000	22.2	45	16	1590
02		110	1000	25	40	-----	1760
03	300	132	1000	22.2	45	16	3780
04		132	1000	25	40	-----	2320
05	330	160	1150	23.5	49	16	3100
06		160	1150	28.7	40	16	3000
07	416	180	1000	22.2	45	16	5800
08		180	1000	25	40	-----	3200
09	416	250	1000	25	40	25	3635
10		250	1000	25	40	-----	4300
11	416	220	1000	28	35.7	40	5600
12		220	1000	28	35.7	25	4140
13	450	220	1500	18.75	80	16	3900
14		220	1500	26.5	56	16	4100
15	450	250	1500	18.75	80	16	5375
16		250	1500	26.87	55.8	16	5120

技术参数

Technical parameters

G3	---	291	---	290	---	475	---	345	---	480	445	420	---	420	---	445
G2	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
G1	275	275	320	305	355	365	325	340	385	385	415	420	355	420	530	445
d3	199	170	180	180	240	220	200	220	280	240	185	185	260	240	260	240
d2	200	---	179	---	236	---	199	---	279	---	---	---	250	---	250	---
d1	60	60	65	65	75	75	70	70	80	80	85	85	85	85	85	85
n-d	2-35	8-35	4-M20	8-39	8-40	8-38	4-M20	8-42	8-48	8-48	8-45	8-42	6-48	8-42	8-48	8-42
B5	198	35	---	40	237	740	---	38	282	45	---	740	255	740	255	860
B4	18	410	325	430	20	650	362	504	22	570	---	650	22	650	22	770
B3	45	---	175	---	56	270	184	---	63	---	330	325	56	325	56	385
B2	54	64	45	40	50	45	45	75	45	45	55	45	50	45	50	45
B1	352	352	110	430	500	650	210	430	570	570	660	650	510	650	670	770
B0	460	480	410	510	600	740	460	580	660	660	770	740	610	740	---	860
B	536	861	536	940	720	996	566	1090	785	1245	1120	1050	720	1060	770	1105
A1	---	---	700	---	---	415	880	---	---	---	1148	503	---	515	300	515
A	785	785	605	880	1094	765	680	995	1105	1105	855	855	1216	855	1025	960
型号 Type	250	250	300	300	330	330	416	416	416	416	416	416	450	450	450	450
规格 Size	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16

技术参数
Technical parameters

LB	---	1351	---	1540	---	1440	---	1740	---	1790	2570	1600	---	1600	---	1725
LA	388	388	---	445	500	314	---	505	485	485	400	380	590	330	630	330
L9	---	---	---	---	---	---	---	---	---	---	---	---	475	75	---	---
L8	---	---	15	---	---	320	14	---	---	---	---	360	90	360	---	405
L7	210.4	376	7.5	425	248.9	380	7	478	292.4	500	780	400	267.4	400	267.4	460
L6	---	376	15	425	450	500	15	478	500	500	242	540	475	540	440	540
L5	---	176	M36	187	550	145	M36	225	500	160	800	195	780	195	700	215
L4	928	353	6	387	300	266	4	452	340	340	558	275	390	275	350	275
L3	75	220	100	240	220	240	140	280	200	330	240	240	150	260	150	260
L2	75	---	100	---	220	---	140	---	200	---	---	---	150	---	150	---
L1	95	95	120	105	105	105	140	125	130	130	130	130	130	130	130	130
L0	1316	35	200	58	200	---	320	53	145	145	90	---	170	---	280	---
L	1351	1351	3038	1540	1800	1540	3416	1740	1790	1790	2770	1990	2050	1760	2040	1835
H1	50	50	300	60	60	---	350	40	50	50	60	50	60	50	70	---
H0	---	---	200	---	---	224	140	---	---	---	250	250	---	250	---	256
H	400	400	450	450	500	450	500	500	560	560	490	500	580	500	630	560
型号 Type	800	800	1510	906	1080	1280	1720	1020	1120	1120	1020	1320	1100	1400	1190	1380
规格 Size	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16

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安全须知：

进行搬运、安装、操作、保养和检查时，必须由具有专业知识技能的人员实施，否则有可能因为处置不当而引起人员的受伤或设备的破损。

一、使用环境

- 环境温度：-20℃~+50℃
- 环境湿度：85%以下
- 氛围环境：没有腐蚀性气体、爆炸性气体和蒸汽等；没有尘埃的、换气良好的场所。
- 如在上述以外的条件下使用时，就是特殊要求使用，请与制造商联系。
 - 如果定货时指定室外并要防爆，设计制作将按要求进行。在制造方明确指定的安装环境中使用则没有问题。
 - 应安装在检查、保养等各种作业容易进行的场所。
 - 应安装在刚性良好的台架上。

二、收到货物时的检查

1. 注意事项
- 外部进行确认后再打开包装箱。打开包装箱时要注意安全，防止有异物掉落造成人员伤害事故。
 - 检查收到的货物是否与订单一致。如果使用了与订单不一致的产品，有可能造成人员受伤或设备损坏。
 - 不要拆卸铭牌。
2. 检查要求
- 传动装置或齿轮箱到货，应检查以下事项。如果有问题或有疑问，请与制造商联系。
- 铭牌上所写的项目内容以及装箱单中的供货范围是否与订单相同。
 - 运输途中有无破损。
 - 螺栓和螺母是否松动。
 - 仪器仪表是否损坏，油路是否松动。

三、起吊、运输和保管

1. 起吊
- 在起吊传动装置或齿轮箱货物时，绝对注意不要进入起吊物（货物）的下方。有可能因货物掉下而引起人身事故。
 - 起吊时注意起吊位置，按照图1进行平稳起吊，并注意轻吊轻放。
 - 起吊时有落下或反转的危险，要充分加以注意。有起吊螺栓、起吊孔等起吊装置的传动装置或齿轮箱，必须使用起吊螺栓和起吊孔

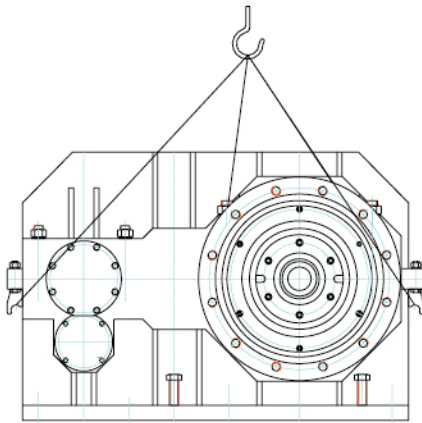


图 1 起吊示意图

等起吊装置，起吊整台传动装置或齿轮箱时，必须使用下面部位或下箱体的起吊孔起吊，不允许使用传动装置上部或上箱体起吊孔起吊。传动装置或齿轮箱安装到机器上以后，不可使用起吊螺栓和起吊孔来起吊整个机器。否则，会因落下、反转或起吊螺栓、起吊孔的破损而引起人员受伤或机器破损。

- 起吊前通过铭牌、包装箱、外形安装图和产品样本等确认一下传动装置或齿轮箱的重量，超出起吊工具额定重量的传动装置或齿轮箱不能起吊。否则会因吊具的破损、落下或反转而引起人身伤害或设备破损。

2. 运输

- 运输前应先排尽齿轮箱中的润滑油。
- 齿轮箱应进行可靠的固定。
- 采取防风、防雨、防潮措施。
- 禁止直接放置在地面上。

3. 保管

传动装置或齿轮箱短期内不使用时，应按以下注意事项进行保管

- 1) 保管场所
- 应保管在室内清洁、干燥的地方。不要保管在室外、有潮气、粉尘大、温度变化大、有腐蚀性气体的场所。
 - 输入、输出轴伸部分必须涂防锈油。
 - 分解后润滑油管用乙烯树脂包起来，避免异物混入。
 - 保管时应注意采取防风、防雨、防潮措施。
 - 禁止直接放置在地面上。
- 2) 保管期限
- 保管期限应为下述防锈期间以内。
 - 当保管期长于下述防锈期间时，需要特殊防锈规格，请与制造商联系。
 - 如果是出口产品时需使用出口防锈规格，应与制造商联系。
 - 标准防锈规格

外部防锈	
产品出厂时，都已涂过防锈油，出厂后6个月应检查一次防锈状态，必要时再次采取防锈措施。	
内部防锈	
防锈期间	6个月
保管条件	没有潮气、没有粉尘、温度变化不大、没有腐蚀性气体等的环境，一般保管在工厂的室内或仓库内。

- 3) 保管后的使用
- 油封受到温度和紫外线等的环境影响后容易老化、变质，所以经过长期保管后开始运行前一定要进行检查，如果认为有老化、变质时，应及时更换新品。
 - 开始运行时要检查是否有异常声音、振动、发热等现象，带制动器时应确认制动器的动作是否正常。如果有异常时要立即与制造商联系。

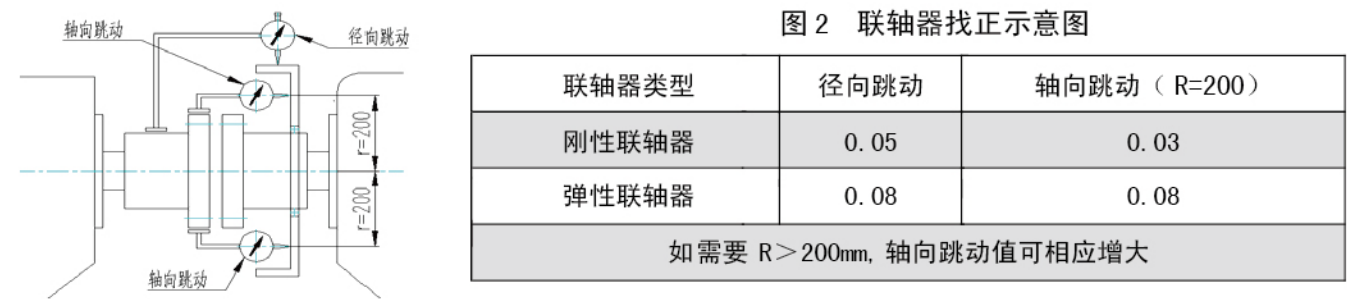
四、安装与找正

1. 安装前检查
- 产品的型号、规格是否正确；
 - 零部件及附件是否齐全；
 - 随机资料是否齐全；
 - 运输及存放过程中有无损伤、锈蚀；
2. 安装时的注意事项
- 不要在有爆炸性氛围的环境中进行使用。否则，有可能引起爆炸、起火、触电、受伤、火灾或设备破损。如果确实需要在此环境下使用，请使用防爆型电动机。
 - 如果选用防爆型电动机时，应使用适合危险场所（存在气体或蒸汽爆发性氛围的场所）使用的电动机型号。否则，有发生爆炸、起火、触电、受伤、火灾的危险。
 - 传动装置的周围绝对不能放置可燃物。否则，有可能引起火灾。
 - 传动装置和齿轮箱周围不要放置影响通风的障碍物，否则会因冷却不畅、异常过热而引起损伤或火灾。
 - 不要踩在传动装置或齿轮箱上，不要悬吊，否则，有可能造成人员受伤或设备破损。
 - 传动装置或齿轮箱安装方式是否正确，齿轮箱有三种安装方式：上位机安装、中位机安装和下位机安装。

- 3、地基
- 齿轮箱必须安装在刚性好、无振动、水平的地基上。例：齿轮箱可安装在支承面经过机械加工的基础框架上，基础框架须与水泥基础浇灌成一体。经找正后的齿轮箱必须用锥销定位后，再用螺栓把其他基础框架连接在一起。

- 4、找正
- 齿轮箱与主电机找正、齿轮箱与主机的找正必须符合图2的要求。良好的安装精度不仅可以提高设备的运行效率，还可以延长齿轮箱的使用寿命。采用下图的找正方法可以排除由于输入、输出联轴器制造精度不高引起的误差累积。

- 1) 齿轮箱与主电机找正
- 齿轮箱与主电机相连接的输入轴在运转时必须与电机轴同心。为了满足这个需要，其轴向与径向跳动必须用专用测量装置来测量，具体如图2所示（要求电机与齿轮箱输入轴同步转动）：



- 在与主机连接前，先确认旋转方向。否则，会因旋转方向错误而引起受伤或机器损坏。
- 安装齿轮箱时，不要对轴施加冲击力或过大的负荷。否则，有可能会引起轴承的损伤或油封的损坏。
- 齿轮箱与主机之间的安装工作必须正确而细致的进行。安装时必须检测输出轴与主机转子轴的同轴度，径向跳动小于0.15mm, 端面跳动小于0.10mm。

- 5、安装
- 建议按如下步骤进行安装：
- 在齿轮箱输入轴、输出轴端面上划出中垂线，打样冲眼。
 - 齿轮箱就位，保证齿轮箱输入轴、输出轴端面中垂线与基础轴向中心线重合。
 - 在齿轮箱基准面上用水平仪校正水平，水平度允许误差为±0.04mm/m。找正可在箱体底面与基础面之间加垫块（片）或斜铁调整，垫块高度不得超过3块，垫块配置要避免引起箱体变形，应在地脚螺栓两侧对称排列。
 - 校正水平后，齿轮箱输入轴对电机轴，输出轴对主机轴应严格对中，在轴线和径向两个方向的同轴度都必须满足上述要求。良好的轴向和径向对中，可使设备保持优良的性能和长久的机械寿命，齿轮箱和电机工作更加平稳，噪声小，功耗最小。
 - 拧紧全部地脚螺栓，在此过程中要保证齿轮箱不再移动。具体操作为将百分表固定在安装基础上，表头测量附近的齿轮箱座表面，拧紧地脚螺栓过程中观察百分表是否发生改变，如发生改变，说明基础不平或垫块没有垫好，应重新校正。
 - 输入联轴器必须要留有6mm左右轴向间隙。
 - 安装冷却水、联轴器防护罩等其它设备。按要求接好冷却水管路，保证水管在设备运行过程中不出现渗漏水。联轴器防护罩按有关标准现场安装。

6、稀油润滑装置

稀油润滑装置由电机油泵、油过滤器、冷却器、仪表、管道、阀门等组成,工作时润滑油经油过滤器、油泵、冷却器冷却后被送到齿轮箱的各润滑点。稀有润滑装置压力一般在 $0.1\sim 0.4\text{MPa}$,冷却水压力为 $0.2\sim 0.3\text{MPa}$,冷却器进水温度 $\leq 28^{\circ}\text{C}$,油流量和水流量比例为 $1:1.5$ 。

稀油润滑装置建议按如下规程操作:

- 按系统工作压力及工作油温，将压力控制器的动作压力调节到设定值的相应位置，打开稀油润滑装置相应的油路和水路阀门。
- 在主齿轮箱工作前，先开启油泵，使系统达到一定的工作压力稳定运行15分钟后，再启动主齿轮箱运行；在主齿轮箱停止工作10分钟后，再关停稀油润滑装置油泵。
- 稀油润滑装置工作时，油压、流量出现异常情况时，要根据相应的输出信号判断故障原因。故障原因不明时先切断主机电源，待齿轮箱完全停止工作10分钟后再切断稀油润滑装置机电源。
- 油过滤器每三个月清洗一次，如进出口压差超过0.05MPa时应立即清洗或更换。初期使用时，应经常清洗。
- 螺杆泵轴密封圈要经常检视，如有泄露现象或损坏，应及时更换。
- 冷却器必须根据水质情况，5至10个月进行一次内部检查与清洗。

注意：部分特殊齿轮箱某些元件采用干油脂润滑，安装时请按照指示标牌注入润滑脂。

五、现场安装，调试与试车记录

现场安装、调试时应作如下记录:

1. 齿轮箱的型号
2. 齿轮箱出厂编号
3. 单螺杆挤出机规格型号
4. 主驱动电机的规格、型号、功率、转速、电压、电流
5. 驱动方向（由主电机端看）
6. 安装找正过程中应做的详细记录：

- 齿轮箱与电动机的找正结果记录：轴向 径向
- 齿轮箱与主机的找正结果记录：轴向 径向

- ## 7. 磨合运转试验纪录

开始运转时间: 年 月 日

停止运转时间： 年 月 日

挤出机负荷: 运转时间数:

[illegible]

六、齿轮箱的运行与维护

1、启动

1) 启动前的注意事项及准备工作

- 齿轮箱出厂时已将润滑油排出，所以，运行前必须加入推荐的润滑油，并按《样本》提供的油量或箱油位计上线位置加注润滑油；
- 外接润滑油管路安装完毕，安装时应特别注意不能将棉纱、铁屑等留在管内，管道必须清洗干净；
- 检查安全控制和自动保护系统工作可靠；
- 检查油箱的油位是否正常，否则应补充至正常油位；
- 检查各仪器仪表、控制装置、开关等是否安装完毕，安装是否牢固可靠，能否正常工作，电器元件线绝缘情况是否良好；

- 检查各螺栓、螺母等紧固件是否紧好;
- 检查输出轴的转向是否正确;
- 检查联轴器护罩及其他防护装置是否装好;
- 检查润滑油的牌号及粘度是否符合工作要求, 油面高度是否符合要求;
- 先手动盘车, 无异常声音及阻滞现象后启动稀油装置电机, 齿轮箱串油10分钟, 检查油泵旋转方向正确, 检查管路有无渗漏油现象;

- 通过箱盖观察窗口观察齿轮，轴承供油是否正常，回油是否通畅，如有油管堵塞或喷油位置不对，时清洗管路或调整喷油角度，齿轮箱出厂前所有管路已经调整好，一般不需要再作调整。

2) 操作程序

齿轮箱稀油润滑站采用电机油泵，由单独电机带动。在油泵运转后，进油口油压控制在0.1~0.4MPa时，才能接通主电机电气开关。使用电气安全装置（电气顺序开关）保证有一个正确的开关顺序，在齿轮处于静止状态后油泵电机才能关闭。

3) 启动步骤

本齿轮箱出厂前已进行过空载试车，但建议按以下步骤进行操作。

- 在任何情况下，齿轮箱应在空负荷状态下启动，严禁在加载状态下启动主电机。
- 齿轮箱内油温在10℃以上时，启动油泵电机。当油温低于10℃时，先启动加热装置，给冷却器内通蒸气或热水，油温超过25℃后切断加热装置电源，并启动润滑装置电机。
- 当进油温度≥42℃时，启动冷却装置，给冷却器通冷却水冷却。
- 润滑稀油装置先工作10～15分钟，当油温、油压稳定后方可启动主电机。
- 先让挤出机空负荷运行1小时，转速由低到高，升到额定转速15分钟后，再按20%、50%、80%载荷分别运行2、4、6小时后，再满负荷运行。

4) 注意事项和要求

- 试车过程中，应密切注意齿轮箱响声有无异常、振动是否过大、轴承温升是否异常等，出现上述异常情况时应立即停机并检查原因。故障排除后方可再次启动，原因不明时请与制造商联系。
- 带负荷情况下，轴承温升最高不超过40℃，最高温度不超过80℃，润滑油温升不超过35℃，否则，应立即停机。

2、停车

停车前应注意的事项和停车步骤

- 齿轮箱停止工作之前，必须将挤出机负荷卸掉，严禁带载停车。

1) 挤出机卸载

2) 主电机停机

3) 润滑装置停机

a当齿轮箱停止转动后，润滑油泵再工作10分钟后停车；

b如果齿轮箱作短时间停机，润滑油泵可以不关闭，保证齿轮箱再次随时启动；

4) 停止向润滑油冷却器供水

冬季冷却水容易结冰，冷却水不应完全关闭，保持流动状态；或把水全部放空。

- 润滑装置停止工作后，如果需要再次启动齿轮箱，必须先重新启动润滑装置油泵，否则，不允许启动齿轮箱。该顺序应该由电气控制实现。

3、维护

1) 检查与维护项目

- 首次运行48小时后，所有管件及紧固件做一次检查，看是否松动，并重新检查轴线对中情况，以后定期检查。
- 首次启动一周后，对过滤器的滤芯进行清洗，以后每月定期清洗一次。齿轮箱上的通气罩半年清洗一次。
- 每日记录齿轮箱工作负荷、转速、进油回油温度、轴承温度情况。如有异常变化应马上停机，分析

原因，问题解决后再重新开机。

- 推荐做下列常规例行检查：

每日：检查是否漏油，有否异常振动、噪声、进回油温度以及轴承温度；

每周：检查油过滤器是否清洁，是否堵塞；

每月：检查螺栓是否松动，观察油位高度，发现不足及时补充，检查各仪表工作情况；

每六个月：对油质进行化验分析。如油质合格，建议将油从齿轮箱中排出，进行沉淀过滤后，重新使用。如油质已变坏，建议将油排出，并对油路系统进行清洗，注入新油。

- 检查冷却水管是否有水垢或其他沉淀物，管路是否锈蚀。
- 检查联轴器的对中及磨损情况。
- 检查齿面接触情况及轴承情况。
- 较长时间停车不用时，每周应使齿轮箱运转10分钟，否则，应按长期储存方式防锈包装，具体详见第四节齿轮箱的保管。

2) 润滑油

- 齿轮箱使用润滑油的牌号为：HSP220或HSP320（根据齿轮箱使用地的年平均温度选定）（ISO VG220或VG320高级极压工业齿轮油）
- 齿轮箱首次运行6个月即应换油，并对过滤器及齿轮箱进行冲洗。以后润滑油每年更换一次，最长不超过15个月，建议换油后对齿轮箱、油路及过滤器进行清洗。加油时应使用过滤器或滤网。

- 每运行6个月后，对油质进行如下检查一次，如发现以下之一情况则需换油：

- ◇观察箱体底部有无沉淀物。
- ◇观察有无水或乳状物。
- ◇检查粘度与原来相比，如差值超过20%，说明油已失效。
- ◇检查不溶解物，如超过0.2%，则应换油或过滤。
- ◇抗乳化能力检验，用以发现油品是否变质。
- 开始运行时，注意观察进油压力是否明显下降。如果进油压力明显下降，清洗过滤器，过滤润滑油。
- 现场使用情况表明，若采用符合标准规定的润滑油，并在油中加入3%～5%的倍力抗磨节能剂，可以降低齿轮箱的噪声（大约2～4dB）和振动，提高整机效率，并且可以较长时间不须更换润滑油。油品质量检查同上。

七、齿轮箱拆卸与装配注意事项

在工作一定时间后，对齿轮箱进行全面的检查及维修是必不可少的。在齿轮箱进行维修检查及更新安

装时，通知制造商，以便取得适时的帮助。

1、拆卸时的注意事项和要求

- 1) 必须拆卸检查时应在专门的场地进行, 齿轮箱周围场地必须清理干净，没有其他杂物。并准备好木块或垫板放置零件以免损伤零件表面。
- 2) 拆卸前轴承测温用的热电阻应先拆下收好，以免碰坏。
- 3) 拆卸时应把外部油管管路拆下，拆下的管子须用乙烯树脂包扎以防油污渗入油管。
- 4) 起吊齿轮与轴时，注意内部油管，有影响时先拆卸油管。
- 5) 拆装任何零部件时，注意装配记号和定位销位置，重新装配时应按装配记号顺序恢复原来位置。
- 6) 拆箱后，防止任何杂物落入箱体内，重新装配时要清洗箱体，保持箱体清洁。
- 7) 在装拆轴承时，必须用液压装拆工具，如无此工具应与制造商取得联系。

2、检查

齿轮传动零件解体后，零部件应做全面检查并作详细记录：

- 齿面接触与磨损情况。
- 轴承磨损情况。
- 检查后确定易损件更换清单。易损件规格参见制造商提供的易损件清单。

3、装配

- 齿轮箱重新装配时的要求应符合齿轮箱装配的各项要求，并按装配技术条件执行，如需帮助时可向制造商咨询；
- 重新装配时，所有零部件必须清洗干净，仔细检查零件有无损坏，必要时更换；
- 注意原来的装配记号；
- 螺栓、螺母及其他联接元件，如果在拆装时损坏必须更换，弹簧垫圈必须更换；
- 箱体中分面及端盖安装时，结合面必须清洗干净，重新涂密封胶，以免渗漏油；
- 装配后，手动盘车无异常、无卡阻现象后再投入运行；
- 按上述建议的安装与启动步骤运行；
- 装配联轴器时不允许用锤子敲打，应把联轴器适当加热后烘套上去（加热温度应≤100℃），同时采取措施冷却联轴器与油封之间的轴颈，以防止油封高温老化。
- 在较大的维修中应重新更换润滑油，并对齿轮箱的找正进行重新复查。

八、易损件

齿轮箱的易损件主要包括油封和轴承。它们是齿轮箱运行过程中必不可少却又最容易损坏的部件，通常情况下使用者要有一定的备品备件，以防不时之需。

1、油封

油封的材料通常为丁腈橡胶 (NBR) 和氟橡胶 (FPM)，在实际使用时要特别注意，使用和处理不当可能会造成人员伤害。

丁腈橡胶 (NBR) 属于丙烯腈丁二橡胶，是具有很好的工程特性和“通用的”密封材料，是由丙烯腈和丁二烯合成的橡胶，对以下介质有良好的抵受能力：

- 大部分矿物油和矿物油润滑脂
- 一般的燃料，如汽油、柴油和轻质的民用燃油
- 动物油、植物油和脂肪
- 热水

丁腈橡胶 (NBR) 密封唇能允许短时间在无油的情况下运行。工作温度范围在-50至100℃之间；短时间可承受的最高温度为+120℃。但不宜在更高的温度运行，因为温度过高会造成丁腈橡胶硬化，温度越高老化的速度也越快。

氟橡胶 (FPM) 最主要的特性是耐高温和耐化学腐蚀，并有很好的抗老化和抗臭氧的性能，而且渗气度也非常低。即使在非常恶劣的工作条件下，仍然有非常好的耐磨特性。氟橡胶能承受+200℃或以下的工作温度，也能允许短时间在无油的情况下运作。

有些物质可能使其它材料制成的密封圈失效，但氟橡胶仍有很高的抵抗能力，包括油和液压油、燃油、润滑剂、无机酸、脂族烃和芳族烃等。在有酯、醚、酮、某些胺和高温的无水氟化氢等化合物的情况下，不应使用氟橡胶。

在温度超过300℃以上时，氟橡胶会释放出有害气体。所以处理用氟橡胶制成的密封圈时有潜在的安全问题，因此必须详细阅读以下的安全注意事项。

警告！

关于氟橡胶的安全注意事项

在正常工作条件和工作温度+200℃以下，氟橡胶是非常稳定和无害的。但遇到300℃以上的高温，如气割枪的火焰，氟橡胶密封圈会释放出有害气体。吸入这些气体或进入眼睛会对人体健康造成损害。此外，氟橡胶密封圈一旦被加热到300℃以上的高温，即使在冷却之后的处理也会有危害，因此绝不可直接与皮肤有任何接触。如果必需要处理曾经受过高温的氟橡胶密封圈，应遵守以下安全注意事项：

- 在整个过程中要佩戴护目镜、防护手套和合适的呼吸器具
- 将剩余的密封圈放在一个密封的塑料容器中，并在上面加上标记“腐蚀材料”
- 严格遵照材料安全说明书中的安全注意事项

如果不慎接触曾经受过高温的氟橡胶密封圈，应用肥皂和大量清水洗手或以大量水冲洗眼睛，并立即看医生。如果吸入氟橡胶释放的有害气体，必须立即看医生。

在使用期间，用户要负责正确使用和妥善处理产品。对于因氟橡胶密封圈使用或处理不当而造成的伤害，责任由自己承担。

2、轴承

齿轮箱轴承采用的是球面滚子轴承，它可以自动调心，因此可以承受较大的对准误差。如轴与轴承座之间的角度误差或轴的挠曲。特有的结构使得它不仅具有很高的径向负荷承载能力之外，还可以承受作用在两个方向的重轴向负荷。如果轴承的安装正确，允许的轴向负荷为：

$$F_{ap}=0.003Bd$$

式中Fap为最大的允许轴向负荷（kN），B为轴承宽度（mm），d为轴承内径（mm）

滚动轴承的寿命通常指的是工作寿命，表示轴承在实际工作条件下，发生故障之前实际达到的寿命。而轴承寿命计算只是对轴承群体和失效概率为10%、可靠性为90%而言的。在实际使用时出现的故障通常不是疲劳所致，更多的情况是污染、磨损、不对中、腐蚀所致，又或是保持架、润滑剂或其它引起的故障。因此对轴承的保养尤为重要，每年齿轮箱大修或新设备开始运行时，都要对轴承进行清洗，随时监测油品清洁度或更换润滑油。虽然轴承材料都经过特殊的热处理，可以长时间在高温下运行，但建议轴承最好在80℃以下运行，最高不超过100℃。

九、备品和备件

齿轮箱运行一段时间后，易损件或零部件会出现损耗或磨损，为了提高设备的运行效率和维修时间，通常需要准备一些备品备件，建议按如下运行时间准备备品备件。

运行时间	类型	单位	数量	备注
6个月	高速轴油封	个	2	型号请向制造商咨询
12个月	低速轴油封	个	2	型号请向制造商咨询
	联轴器弹性体	件	2	型号请向制造商咨询
	仪器仪表	件	1	型号请向制造商咨询
	润滑系统中的易损件	件	1	
18个月	高速轴轴承	个	2	型号请向制造商咨询
	高速齿轮轴	件	1	
	高速级齿轮	件	1	
24个月	轴承（高速轴除外）	套	1	型号请向制造商咨询
24个月以后	大修后判定需要采购的零部件	件	1	

注：相同型号的易损件可只采购一件备件

十、故障与处理

1、注意事项

- 发生异常时的诊断，请严格按照本使用说明书实施。在未查明原因而采取对策之前，绝对不要使机器运转。
- 运行中发现有异常情况应立即停机，并查找原因。如果原因未明而继续运行机器，可能会导致更严重事故的发生。
- 即使故障已经排除，仍应注意再次发生故障的可能。因此，应该检查所有发生故障部位周围的零部件。

故障产生的原因是错综复杂的，需要做多方面的调查与研究。以下叙述的是一般的现象及原因。

2、故障检修项目

齿轮设备在质保期间出现的运转故障，如需要修理，应由制造商的服务人员来完成。维修或更换备件后，出现下述情况（见表1）且仍无法解决的，请咨询制造商。

表1：故障与处理

故障	检查内容	应采取的措施
异常噪声或振动	齿轮副侧隙，齿面接触斑点异常 ①	重新配磨齿轮（通知制造商）
	箱体变形	调整箱体下的垫块（片）
	齿轮箱是否过载	降低负荷至额定功率范围内
	润滑油质量	换油并清洗过滤器
	润滑系统是否正常	调节喷油量机喷油位置等
	齿轮、轴承是否损坏	更换齿轮、轴承
	设备固定松动	重新固定，拧紧螺栓或更换螺栓
	联轴器是否有损坏	更换联轴器
油封渗漏油	联轴器是否对中	重新校对并符合要求
	油封唇口是否损坏或油封是否已老化	更换油封
	腔体孔径过大或损	更换透盖
	回油孔是否通畅	清洁回油孔，检查润滑油质量
	腔体孔径小	重新加工腔体孔，更换油封
	装油封处轴颈光洁度，是否有划痕	打磨并用金相砂纸抛光，如严重更换备件
	进油量是否过大	调节油量（加节流塞）
	油封唇口与轴颈的配合是否太松	调节油封内弹簧长度
轴承升温	油封与轴颈的同轴度是否符合要求	重新加工端盖上装油封的孔
	润滑是否充分	加大进油量，检查润滑油质量
	轴承轴向间隙	重新调整 ②
	轴颈尺寸是否超差	重新修磨（通知制造商）

故障	检查内容	应采取的措施
轴承温升高	轴承孔尺寸偏小	重新加工（通知制造商）
	轴承内是否有杂质	彻底清洁轴承
	进油温度偏高	检查冷却管、冷却水温度，加大进水量
	润滑油老化	重新更换润滑油
	油泵故障	更换油泵或致电设备制造商咨询
	轴承损坏	更换轴承
	联轴器是否对中	重新对中
	是否超过额载荷	降低使用载荷
	轴承外径尺寸超差	更换轴承
油压过低	管路是否有泄漏	紧固或堵焊泄漏点
	压力表或油泵损坏	更换压力表或油泵
	过滤器是否堵塞	清洗过滤器
	喷油量是否过大	根据需要各润滑支路加节流塞
	安全阀设定值是否合适	将设定值调节为 0.5Mpa 左右
油温高及润滑装置故障	油老化或油脏	过滤或更换油品
	冷却水流量不足	加大冷却水流量
	冷却水水温高	降低冷却水温度
	冷却器堵塞	清洁冷却器或更换
	其它	请按《使用说明书》操作

注：①齿轮副最小侧隙(与本公司技术部门咨询)，齿面接触斑点为齿高方向≥50%，齿长方向≥70%；
②调心轴承的轴向间隙(与本公司技术部门咨询)，其余各轴上的固定端轴承内圈必须紧贴轴肩或定距环，用0.05mm塞尺检查不得塞入。

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I . WORKING CONDITION

Ambient temperature: $-20^{\circ}\text{C} \sim +50^{\circ}\text{C}$

Ambient humidity: lower than 85%

Environmental conditions: no corrosive gas, explosive gas or vapour. No dust and at better air exchange place.

·If have other special requirements besides the above ones, please contact us.

·If there are requirement for anti-explosion in open on the purchase order, our designers will consider it. It will be safe to install our products under our specification.

·The gearbox should be installed at this kind of place where it is convenient to carry out the inspection and maintenance work.

·The gearbox should be installed on rigid support

II . INSPECTION UPON RECEIPT OF THE GEARBOX

1. Notes:

·Please confirm whether the packing is still in good condition before opening. Please take care when opens the packing. Prevent personnel injury due to unidentified object dropt.

·Check whether received goods are coordinate with goods listed in the purchasing order. If improper products are used, it may cause injury or equipment broken.

·Do not remove the nameplate.

2. Inspection Requirements

The following should be inspected when the driving device or the gearbox arrives. If there are some confusion or problems, please contact manufacturer.

·Whether items on the nameplate or things on the packing list are the same as them in the purchasing order.

·Whether there are some damage caused by transportation.

·Whether bolts or nuts are loose.

·Whether the instruments are damaged and pipings are loose.

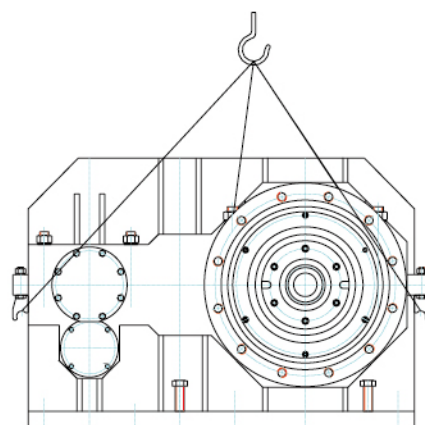
III . LIFTING, TRANSPORTATION & STORAGE

1. Lifting

·When lifting the driving device or the gearbox, it's forbidden to stand below the gearbox, as the dropt gearbox may cause injury.

·Please note the lifting position shown in the drawing 1. Please lift the gearbox with care.

·Please be careful when lifting the gearbox since it may drop down or turn over. If there are lifting bolts or holes, one must use them when lifting. When lifting the whole set of gearbox, one must use lifting holes in the lower housing, while it is forbidden to use them in the upper housing. However, after the gearbox is installed to



Drawing2 Lifting sketch map

the equipment, do not use lifting bolts or holes to lift the equipment as it may cause injury or machine broken.

·Please clarify the gearbox's weight before lifting from the nameplate, package, outline drawing or sample copy. If it exceeds the maximum lift capacity of the lifting device, please do not lift the gearbox, as it may cause injury or machine broken.

2. Transportation

·The lubrication oil must be drained out before transportation.

·The gearbox must be fastened tightly.

·Anti-wind, anti-rain and anti-moist protection must be adopted.

·It is forbidden to place the gearbox directly on the ground.

3. Storage

If the driving device or gearbox stops for a short period, it should be stored as follows:

1) Proper place for storing

·The gearbox should stay in a clean and dry place. Do not lay it out door or at this kind of place where may be humid, dusty and the temperature is changeful or contains corrosive gas.

·Rust preventative oil must be painted to the input and output shafts.

·After dismantlement the lubrication oil pipes should be packed with vinyl resin to prevent foreign substances from getting inside.

·Anti-wind, anti-rain and anti-moist protection must be adopted.

·It is forbidden to place the gearbox directly on the ground.

2) Storage period

·This period should not exceed the rust preventing period as follows.

·If the storage period will be longer than rust preventing period, and needs to do more for rust prevention, please contact us.

·If this gearbox will be utilized in an export product, and needs us to paint in accordance with the specification for export products, please contact us.

·Standard rust prevention

① Outside rust prevention

The gearbox has been painted with rust preventative oil before delivery. The anti-rust status must be inspected in 6 months after delivery, and if it is necessary, it should be painted again.

② Inside rust prevention

Storing Condition	6 months
Rust prevention period	There should be no humidity, on dust, less temperature change, no corrosive gas. Normally it should be lie in doors or in the storage area.

3) Usage after storage

·Be effected by temperature, ultraviolet radiation and other factors, seals are easily aging and metamorphosing. Thus, before restart up the gearbox after a long time storage, therefore one should inspect seals, if the above mentioned happens, please change them into new ones.

·When restarting up the gearbox, please inspect whether there are abnormal noise, vibration or

heating. If a brake is attached, please check whether it works well. If there is any abnormal phenomenon, please contact manufacturer.

IV. INSTALLATION & ALIGNMENT

1. Inspection before installation

- To inspect whether the type or specification is correct
- To inspect whether the parts or accessories are complete
- To inspect whether the attached documents are complete
- To inspect whether there are damage or corrosion caused by transportation or storage.

2. Notice during installing

- Do not running the gearbox in the place where there has explosive factors, or it may cause explosion, fire breakout, electric shock, injury, fire hazard or equipment broken. If it is really necessary to run the gearbox under this kind of condition, be sure to use an anti-explosion motor.
- When choosing an anti-explosion motor, be sure that it's a suitable type for using in dangerous places (where has the danger of gas or vapor eruption). Otherwise it may cause explosion, fire breakout, electric shock, injury, fire hazard or equipment broken.
- It is forbidden to stay any combustibles near the driving device, or it may arise fire hazard.
- Do not put any article that may effect the ventilation around the driving device and gear gearbox, as it may cause equipment broken or fire hazard because of less cooling or abnormal heat.
- It is forbidden to stand upon the driving device or gearbox. Do not hanging the gearbox, or it may cause injury or equipment broken.
- To inspect whether the installation position is correct. There are three installation position of the gearbox: upside, middle and downside position.

3. Groundwork

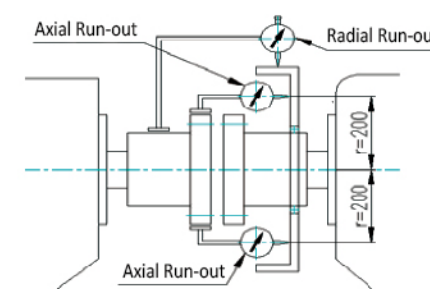
The gearbox must be installed on rigid, no vibration and horizontal groundwork. E. g. , the gearbox can be installed on a supporting surface being machined framework, however the framework must be poured to be one unit with concrete. The aligned gearbox must be oriented by taper pin, and then to connect other frameworks with bolts.

4. Alignment

The fixing of the gearbox's input shaft and motor must accord with request of nether form. The fixing of the gearbox's output shaft and the rotors of the mixer must accord with request of nether form. The idiographic fixing method see drawing 2. Good of installing accuracy not only can advance circulating efficiency of equipments but also prolong service life of equipments. Adopting drawing 2 methods can reduce cumulative error because of lower precision of input Coupling and output Coupling.

1) To align the gearbox with the motor

When the shaft that connects gearbox and main motor rotates, it should be concentric with the shaft of motor. To catch up this requirement, the radial and axial run out should be measured with special measuring device. See the detail in the drawing 2 as follows (motor and input shaft of the gearbox must rotate synchronized):



Coupling Type	Radial Run-out	Axial Run-out(r=200)
Rigid Coupling	0.05	0.03
Flexible Coupling	0.08	0.08
If r>200mm, the axial run-out can be bigger correspondingly		

Drawing 2 sketch map for alignment

·Confirm the rotation direction before connecting to the single screw extruder. Otherwise, it may cause injury or machine damage, as the rotation direction is not correct.

·Avoid bringing impact force of too much load to the shaft when installing the single screw extruder. Otherwise, it may cause broken of bearing or seal.

·Installation of the single screw extruder and gearbox must be carried out with care and correctly. Use core rod to inspect the coaxiality of the positioning inner hole on the low speed hollow shaft and the step hole of the thrust bearing. Radial runout should be less that 0.15mm while surface runout should not exceeds 0.10mm

5. Installation

Please install as follows:

- To draw vertical lines on surfaces of input and output shafts of the gearbox, and then punch holes in the surfaces along axes.
- Place the gearbox, and make sure that vertical lines on the input and output shafts are coincident with the axial centering line of the foundation.
- Using gradienter emendates leveling on level seats of gearbox, leveling error less than $\pm 0.04\text{mm/m}$. Blocks or shims can be filled between bottom surface of the housing and foundation surface to help aligning. The blocks number should not exceed three in height. Blocks should be lined symme trically on both sides of the foundation bolts to avoid deformation of the housing.
- After aligning, input shaft and motor shaft should be strictly centered, the same as hollow shaft and screw bush. The axially of both axial and radial directions must meet the designing requirements. Better aligning will make smoother running of equipment, and the power consumption will be less.
- Be sure there is no movement of the gearbox during fastening all foundation bolts. A dial indicator should be used during this process. First to fix adial indicator on the installing foundation, then to inspect whether the probe moves while fastening bolts, if it moves, that means the foundation is not plane enough or blocks are not proper, and alignment should be carried out for another time.

·There must be about 6mm clearance between input coupling's parts .

·Install the protective covers of lubrication station and coupling and other apparatuses. Connect pipes according to the demand on cooling water. Assure the pipe was aleak during the device was operated. The protective cover of the coupling should be installed according to relevant standards in site.

6. The oil lubrication device

This lubrication device consists of motor tri-screw pump (or gear pump), oil filter, safety valve, cooler, instruments, piping valves, etc. When working, lubrication oil pass through filter, pump and

cooler, then arrive at several lubricating spot of the gearbox. Highest working pressure of the lubrication device can be confirmed by adjusting the security valve. And there's no need to adjust the pressure as it has been adjusted well before delivery. If readjust the highest pressure, please inform the manufacturer. The pressure value of the oil lubrication device is generally 0.1~0.4MPa. The pressure value of the cooling water is 0.2~0.3MPa. The inlet water temperature is under 28℃ in the cooler. The value between the oil and the water is on a scale of 1:1.5.

- Please operate the lubrication device as follows:
- Adjust the operating pressure of the pressure controller to setting value position according to the working pressure and working oil temperature. Then open the related oil piping and water piping valves of the oil station.
 - Before the main gearbox beginning to work, turn on the oil pump first, and after operating 15 min. For stabilizing the working pressure, then start up the main gearbox. Turn off the oil pump of lubrication device 10 minutes after the main gearbox stops.
 - When the oil pressure or flow of the lubrication device is abnormal, please judge blooey reasons from relevant outputting signals. Stopping electrical source of the main motor when the malfunction is uncertainty, the electrical source of lubrication oil unite can be closed when the gearbox stop working after 10 minutes.
 - The oil filter should be cleaned every 3 months. When the oil pressure on the oil inlet exceeds 0.05Mpa than it on the oil outlet, the filter must be cleaned or changed sonly. At the very beginning, the filter should be cleaned frequently.
 - Check the seal ring on the shaft of tri-screw pump frequently, and it should be changes sonly when leakage or damage appears.
 - Inside inspection and cleaning of the cooler must be carried out every 5-10 months according to water quality.

V. RECORDS OF LOCALE INSTALLATION, COMMISSIONING AND TEST RUN

- The following records shall be kept for field installation and debugging:
1. Type of the gearbox:
 2. Product serial number of the gearbox:
 3. Model and specs of the single screw extruder:
 4. Size, model, power, rotation speed, voltage and current of the main driving motor:
 6. Detailed records should be kept for installation and aligning:
 - Alignment result between the gearbox and the motor: axial radial
 - Alignment result between the gearbox and the screw seat: axial radial
 7. Running-in test record
- Starting time: year month day
- Ending time: year month day
- Load of the extruder:
- Running time:

No.	Starting time year month day	Ending time year month day	Load of the main machine (T)	Voltage of motor stator (V)	Starting current of motor stator(A)		Operating Current Of Motor stator (A)	Temperature (°C)			Remark
					Max.	Min.		Ambient tempera ture	oil temperature inside the housing		
									Before test	After test	

VI. OPERATION AND MAINTENANCE OF THE GEARBOX

1. Start-up
 - 1) Notes and preparation before start-up.
 - Lubrication oil has been discharged from the gearbox before delivery, so recommended lube must be filled in before operation . Lubricating oil is immitted gearbox according to oil gauge of gearbox.
 - Assemble the external lubrication piping completely. The pipes should be clean and free of any cotton or chips inside before fitting.
 - Make sure by inspection that the safety controlling and automatic protection systems function reliably.
 - Check oil level in the tank. If oil is less than required, refill to normal level.
 - Check whether all instruments & gauges, controlling apparatus and switches have been installed completely; whether these devices have been assembled firmly and can realise normal functions. Check insulation of outlet lines of electric components.
 - Check fastness of all fastenings including bolts and nuts;
 - Check the rotating direction of the output shaft.
 - Confirm that protecting shields of couplings and other protective devices have been assembled correctly.
 - Check grade and viscosity of the lube oil in accordance with operation requirements. Check the oil level;
 - First turn the machine by hand and if no abnormal noise or excess resistance is detected, start up the motor of the oil lubricating device. Keep lube oil flowing through the gearbox for 10 minutes, verify rotating direction of the oil pump and check for oil leakage in the oil piping.
 - Check the oil supply and oil return of gears and bearings through observation hole in the housing cover. If there is any oil pipe blocked or any oil nozzle misoriented, such pipes should be cleaned/rinsed and nozzles adjusted timely. Normally all piping adjustment has been finished before the gearbox is delivered and no more adjustment is to be executed by the customer.
 - 2) Operation procedure
 - Tri-screw oil pump is used for gearbox lube station, which has separate driving motor. Only after the oil pump has started up and the pressure at oil inlet is controlled between 0.1~0.4Mpa, can the main electric switch of main motor be turned on. Electric safety device (electric seriation switch) is used to

ensure a correct on-off sequence. The motor of oil pump can only be turned off after the gears stop movement.

3) Start-up steps

The gearbox has gone through unloaded test run before delivery, but the following steps are still suggested:

- Under any circumstances, the gearbox must start up without any load. Loaded start-up is strictly forbidden for main motor.

- The oil pump can be started up when the oil temperature inside the gearbox is over 10°C. Steam or hot water is led through cooler when oil temperature is lower than 10°C and will be cut off when oil exceeds 25°C.

- When the temperature of input oil \geq 42°C, cooling device is put into function.

- First run the lubrication station for 10~15 minutes, and the main motor can be started up only after the oil temperature and pressure stabilize.

- First, keep the single screw extruder run for 1 hour without any load; increases the rotation speed gradually until the nominal speed is reached; Then run the single screw extruder for 2, 4, 6 hours at 20%、50%、80% of full load respectively; In the end, run under full load.

4) Notes and requirements

- During the commissioning, close attention should be paid to abnormal noise, excess vibration and quick rise of bearing temperatures. If any of the above cases is detected, the equipment should be stopped immediately for inspection. The gearbox can be runned after malfunction is debarred, if don't find malfunction reason, please contact with manufacturer.

- For loaded operation, temperature rise at bearings should not exceed 40°C, the highest temperature not over 80°C, temperature rise of lubrication oil not over 35°C. If these temperature limits are exceeded, the equipment should be switched off immediately.

2. Stop

Notes and Steps of shutting down.

- The single screw extruder should be unloaded before the gearbox is shut down; Shutting down with load is strictly prohibited.

- 1) Unload the single screw extruder.

- 2) Shut down the main motor

- 3) Stop the lubricating device

- a. The lubrication oil pump can only be shut down 10 minutes after the gearbox stops movement

- b. If the gearbox is only turned off for a short time, the oil pump can be kept running during this period so that the gearbox can be started up at any time

- 4) Stop water supply to the cooling device of lubrication oil

In winter time, water can easily freeze so the water supply should not be shut off completely to keep the cooling water running, otherwise the water inside should be discharged entirely.

- If an oil pump in the lubricating device is already stopped, it has to be restarted before the gearbox resumes operation. Otherwise it is not allowed to restart the gearbox. The above-mentioned on-off sequence is realized by means of electric control.

3. Maintenance

- 1) Items of inspection and maintenance

- 48 hours after the first start-up, all piping and fastening pieces should be checked for loosening; alignment of axes should also be inspected. Such check and inspection should be repeated regularly.

- Clean the filter elements inside filters one week after the first start-up. Clean them every month in future operation. Clean the vent covers on the gearbox every 6 months.

- Keep daily records for operation load, rotation speed, inlet & outlet oil temperatures and bearing temperatures of the gearbox, In case of abnormal data, the gearbox should be stopped immediately and timely analysis should be made to detect reasons. Restart the gearbox after malfunction is solved.

- Regular inspections are recommended as follow:

Every day: Check for oil leakage, abnormal vibration, noise, inlet & outlet oil temperatures and bearing temperatures;

Every week: Check whether the oil filters are clean and unblocked;

Every month: Check whether the ground bolts loosen, verify the oil level and refill oil when it is too low, inspect the working conditions of all instruments and gauges;

Every six months: Chemical analysis for oil quality. If the oil is still up to the standard, it is suggested to discharge it from the gearbox for depositing and filtering before being reused. If the oil has deteriorated, it is suggested to discharge the oil, clean the piping system and fill in new oil.

Check for incrustation, other deposits and rustiness inside the cooling piping.

Check the alignment and wearout of the couplings.

Check flank contact of gears and the situation at bearings.

- If the equipment is out of operation for a long period, the gearbox should be run for 10 minutes per week, otherwise the gearbox should be packed against rustiness in accordance with long-term storage method. See the detail in the storage of IV.

2) Lubrication oil

- The lubrication oil for the gearbox: HSP220 or HSP320

(ISO VG220 or VG320 high grade extreme pressure industrial gear oil)

- 6 months after the first operation, oil inside the gearbox should be replaced and filters and gearbox should be rinsed. After that the lubrication oil should be replaced every 12 months, at most 15 months. It's suggested to clean the gearbox, the oil piping and filters after changing oil. Filters or filter screens should be used when fill in oil.

- After every 6 months' operation, inspect the oil and replace it if any of the following cases is detected:

- ◇Deposit at the bottom of housing.

- ◇Water or lacteous substance inside.

- ◇Check the viscosity, if there is a difference of more than 20% from the original value, then the oil is of no use any more.

- ◇When inspection shows insolubles exceed 0.2%, the oil should be changed or filtered.

- ◇Check the emulsion resistance of the oil to determine whether it has deteriorated.

- When start the operation, please pay attention to the inlet oil pressure. If the pressure drops obviously, clean the filter and filtrate the lubrication oil.

- Experiences accumulated in field operation indicates that if certified lubrication oil is used with PowerUp wear resister for energy saving, noise (about 2~4dB) and vibration of the gearbox can be lowered and efficiency of the whole equipment improved. Besides, the lubrication oil can be replaced

with a bigger time interval. Quality inspection for oil should be the same as above.

VII. NOTES FOR DISASSEMBLY AND REASSEMBLY OF THE GEARBOX

After some time of operation, it is necessary to carry out thorough inspection and maintenance for the gearbox. If you want to carry out maintenance & inspection and/or updating installation, please inform manufacturer for timely help.

1. Notes and requirements for disassembly

- 1) When the disassembly is necessary, it should be carried out in dedicated field with clean surroundings and without unnecessary articles. Get ready wood blocks or plates for supporting the parts to avoid damaging part surfaces.
- 2) Before disassembly, first dismantle all external instruments and gauges to avoid damage.
- 3) During disassembly external oil piping should be removed, and the dismantled pipes should be packed with plastic film at both ends to avoid contamination.
- 4) Pay attention to internal oil pipes when lifting up gears and shafts, dismantle the pipes if there is interference.
- 5) Pay attention to assembly marks and positioning pins when disassemble parts. Keep the original positioning in reassembly.
- 6) Prevent any foreign body from falling into the box and keep cleanness inside.
- 7) Hydraulic tools should be used for disassembling bearing. If no such tools are available, please contact NGC.

2. Inspection

After been dismantled, the transmission parts of gears should be inspected and recorded in detail.

- Flank contact and wearout of gears.
- Wearout of bearing.
- After the inspection, list out wearable parts to be replaced about the specification of damageable parts.

3. Assembly

- Reassembly of the gearbox should be according to all requirements in the assembly drawing and the technical conditions, or please inform the manufacturer.
- All parts should be cleaned completely for reassembly. Check all parts carefully for damages, and replace them when necessary.
- Pay attention to the original assembly marks.
- If connecting and fastening parts including bolts and nuts are damaged during dismantlement, the damaged parts should be replaced; besides, all spring washers must be replaced.
- When fitting the connecting surfaces and covers of the housings, clean up the connecting surfaces and reseal with sealing glues to prevent oil leakage.
- After reassembly, turn the equipment by hand. The operation can only be resumed if there is no abnormal movement and excess resistance.
- Follow the above suggested steps for assembly and start-up.
- Hammer striking is not allowed during assembly of couplings. The coupling should be heated (heating temperature $\leq 100^{\circ}\text{C}$) before assembly. At the same time, the shaft journal between the coupling

and oil seal should be cooled to prevent aging.

- For major maintenance lubrication oil should be replaced and the alignment of gearbox should be reinspected.

VIII. THE EXPENDABLES

The damageable parts of the gearbox include oil seal and rolling bearing. They are absolutely necessarily ,but they are furthest damageable parts during the process of the gearbox's running. The consumer should deposit some spare part in order to need when these parts are abrupt shattered.

1. Oil Seal

The material of oil seal usually is nitrile rubber and fluoro rubber. That oil seal is improperly used and disposed will hurt personnel, so handlers must especially notice.

Acrylonitrile butadiene rubber, NBR

The term nitrile rubber is used in this catalogue for acrylonitrile-butadiene rubber. This material has very good engineering properties and is the "universal" seal material. It is a copolymer produced from acrylo nitrile and butadiene. It shows good resistance to the following media.

- Most mineral oils and greases with a mineral oil base
- Normal fuels: petrol, diesel and light heating oils
- Animal and vegetable oils and fats
- Hot water.

It also tolerates short-term dry running of the sealing lip. The permissible operating temperature range is -50 to $+100^{\circ}\text{C}$; for brief periods temperatures of up to $+120^{\circ}\text{C}$ can be tolerated. At higher temperatures the material hardens.

Fluoro rubber, FPM

Fluoro rubbers (FPM) are characterised by their high thermal and chemical resistance. Their resistance to ageing and ozone is also very good and their gas permeability is very slight.

Fluoro rubber seals have exceptionally good properties even under harsh environmental conditions and can withstand operating temperatures of up to $+200^{\circ}\text{C}$. The seals are also resistant to oils and hydraulic fluids, fuels and lubricants, mineral acids and aliphatic as well as aromatic hydrocarbons which would cause seals made of other materials to fail. They will also tolerate dry running of the lip for short periods. The seals should not be used in the presence of esters, ethers, ketones, certain amines and hot anhydrous hydrofluorides.

Seals made of fluoro rubber exposed to extreme temperatures above 300°C give off hazardous fumes. Therefore the safety recommendations must be followed, see "WARNING! Safety precautions for fluoro rubber"

WARNING!

Safety precautions for fluoro rubber

Fluoro rubber is very stable and harmless under normal operating conditions, up to $+200^{\circ}\text{C}$. However, if exposed to extreme temperatures above 300°C , e. g. fire or the flame of a cutting torch, fluoro rubber seals give off hazardous fumes. These fumes can be harmful if inhaled, as well as to the eyes. In addition, once the seals have been heated to such temperatures, they are dangerous to handle even after they have cooled and should not touch the skin. If it is necessary to handle bearings with seals that have been subjected to high

temperatures, such as when dismantling the bearing, the following safety precautions should be observed

- always wear protective goggles, gloves and an appropriate breathing apparatus
- place the remains of the seals in an airtight plastic container marked with a symbol for "material will etch"
- follow the safety precautions in the appropriate material safety data sheet (MSDS). If there is unintentional contact with the seals, wash hands with soap and plenty of water and flush eyes with plenty of water and consult a doctor immediately. If the fumes have been inhaled, consult a doctor immediately.

The user is responsible for the correct use of the product during its service life and its proper disposal. NGC takes no responsibility for the improper handling of fluoro rubber seals or for any injury resulting from their use.

2. Bearing

The gearbox adopts the ball and roller bearings , it can auto adjust center, so it can receive center error of shaft and gear case’s hole or shaft’s bend. The special structure make it not only receive very high radial load ,which make it but also receive two direction axial load. If the bearing is correctly installed, allowable axial load is

$F_{ap}=0.003Bd$.

Fap is the largest allowable axial load (kN), B is bearing’s width(mm), d is bearing’s interior diameter (mm) .

Life of the bearing usually is bearing’s actual working life , which denotes the bearing actually used time before it go wrong under actual working condition. But calculation of life of the bearing only express passel bearings under failure probability is 10% and reliability is 90%. That the bearings go wrong during the actual using commonly is caused by fatigue. It is usually mostly used by pollution、abrasion、wrong center、erode、lubricant etc. So it is very important for bearing’s maintainning. The consumer should rinse bearings during the gearbox is annually heavy repaired or new equipment begin running, and inspect cleanliness of lubrication or replace lubrication. Although the bearings’ material are especial heat treatment, runned under the high temperature for long time. Manufacturer suggest bearings had better run at below 80℃ , not more tallest than 100℃ .

IX. STORE & SPARE PART

Some parts may be wearing down after the gearbox runs a period of time. In order to improve the running efficiency and reduce the maintaining time, having some stock and spare parts is definitely necessary. Preparing spare products and parts according to the following running time .

Runtime	Type	Unit	Number	Reference Column
Six Months	The oil seal of input shaft	PCS	2	Please inform the manufacturer
Twelve Months	The oil seal of input shaft	PCS	2	Please inform the manufacturer
	Coupling elastomer	PCS	2	Please inform the manufacturer
	Instrument	PCS	1	Please inform the manufacturer
	Vulnerable parts in lubricating system	PCS	1	
Eighteen Months	The bearing of the input shaft	PCS	2	Please inform the manufacturer
	The input shaft	PCS	1	
	The 1st stage gear	PCS	1	
Twenty Four Months	Bearing (Except the input shaft)	Set	1	Please inform the manufacturer
Twenty Four Months Later	The spare parts requested after major maintenance	PCS	1	

X. TROUBLE AND SOLUTIONS

1. Notes

- For the diagnosis of abnormities, please follow the Operation Manual. Before the reason of abnormity is found and remedy measure is adopted, never run the machine.
- Stop the equipment if any abnormity is detected during operation and search for its reason. Further operation without inspection may lead to more serious accident.
- Even after the problem is solved, there is still the possibility for the same failure to reoccur. So inspection should be carried out for all neighbouring parts.
- Failures have complicated reasons, so comprehensive investigation and study are necessary. The following are frequent troubles and their reasons.

2. Troubles and solutions

If the gear unit has problem during the guaranteed period, the repair should be done by service persons from manufacturer company.

Fault	Checking Items	Measures should be taken
Abnormal noise or vibration	Abnormal contact field of side clearance of gear and tooth surface ①	Replace grinding gear (notifying manufacturer)
	Deformation of gearbox	Adjust the heel block or slice under the box
	If the gearbox is overloading	Decrease the loading to rated power range
	The lubricate oil quality	Change oil and clean the filter
	If the lubricating system is normal	Adjust the oil spray quantity and location
	If the gear, bearing is damaged	Change gear and bearing
	The fastener of equipment loose	Retighten bolts or change bolts
	If the coupling is damaged	Change coupling
	If the coupling is centring	Collate again to meet the requirement

Fault And Treatment

Fault	Checking Items	Measures should be taken
Leaking oil from oil seal	If the oil sealing lip is damaged or oil sealing is aging	Change oil sealing
	The cavity aperture is too large or damaged	Change cover
	If the oil returning holes are smooth	Clean oil returning hole and check the lubricate oil
	The cavity aperture is small	Reprocess the cavity hole and change the oil sealing
	Check the smooth finish of journal of oil sealing to see if there is any scratch	Grind and polish with metallographic sand paper. Change spare parts if the situation is serious
	If the oil inflow is too much	Regulate oil mass (add a throttle)
	If the joining of oil sealing and journal is too loose	Regulate the spring length in oil sealing
	If the concentricity of oil sealing and journal meets the requirement	Reprocess the hole at oil sealing in cover
The rising temperature of bearing	If the lubrication is adequate	Increase oil inflow and check oil quality
	Axial clearance of bearing	Readjustment ②
	If the journal size is out of tolerance	Repolishing (notifying manufacturer)
	Size of bearing hole is a little bit small	Reprocess (notifying manufacturer)
	If there is any impurity in bearing	Clean up bearings completely
	The oil inflow temperature is a little bit higher	Check cooling water pipes and cooling water temperature and increase water inflow
	Aging of lubricating oil	Change lubricate oil
	Oil pump malfunction	Change oil pump or consult the manufacturer
	Damage of bearing	Change bearing
	If the coupling is centering	Centering again
	If the loading is over-loading	Decrease working load
	The outer diameter size is out of tolerance	Change bearing
	Low oil pressure	If there is any leaking of pipes
The damage of pressure gage or oil pump		Change pressure gage or oil pump
If filter is blocked		Clean filter
If the fuel-injection quantity is too much		Add throttles into every branch pipes as needed
If the setting value of safety valve is proper		Regulate the setting value to about 0.05Mpa
High oil temperature and lubricated device default	Oil aging or dirty	Filtrate or change oil
	Cooling water flow is insufficient	Increase cooling water flow
	High temperature of cooling water	Decrease cooling water temperature
	The cooler blocked	Clean or change cooler
	Others	Handle with instruction sheet

If after maintenance or replacement such problem is still unsolved, please inform the manufacturer.

Notes: ① Min. backlash of the gear pair is $0.35 \sim 0.55 \text{ mm}$, contact spot in tooth width $\geq 50\%$, in tooth length $\geq 75\%$.

② Axial clearance of self-aligning bearings 0.3~0.5mm. Bearings at the fixed ends of other shafts should have inner rings pressed tight to shaft shoulder or spacer ring, i. e. the 0.05mm feeler gauge can't be slipped into the clearance.