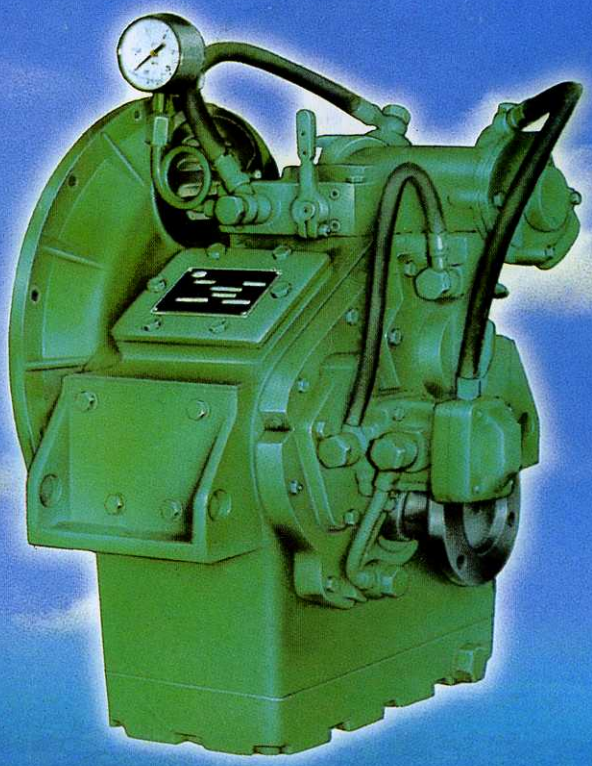
MA 系列

船用齿轮箱

Marine gearbox



杭州前进齿轮箱集团有限公司

（杭 州 齿 轮 箱 厂）

HANGZHOUADVANCEGEARBOXGROUPCO.,LTD.

(HANGZHOU GEARBOX WORKS)

使用说明书

SERVICE MANUAL

CONTENTS

FOREWORD

In order to bring into play the function of the gearbox and obtain a long and reliable service, it is advised to study this manual carefully and be familiar with the technical feature and the operation, as well as maintenance.

For model MA100, the cooler is not fixed on the gearbox. When installating the power unit, ought to choose the suitable place for fixing cooler and connecting oil or water pipe correctly according to the mounting dimensions.

In a column order No, x means an alternative part. If need, should be marked when ordering.

Care should be taken that the contents covered in this manual may be somewhat different from the structure of the newly-made products, it is merely due to the improvements of our products in the lapse of time.

SECTION Ⅰ General

Marine gearbox series MA possess the capabilities of ahead and astern, clutching and dis-clutching, reducing speed and bearing the propeller thrust. They can be coupled with various marine diesel engines according to their Capacity Chart so as to form a complete marine power unit, which is suitable for small boats navigating in inland rivers or in coasts.

The gearbox feasures are as follows:

1. The hydraulic system built in the gearbox made the operation easy from the bridge with remote control. A unit of pressure delay stepping up is fitted in the hydraulic control system and the clutch is smooth in engagement and thorough in disengagement.

2. Two sets of multiplate clutches are mounted at the output end and easy to dis-and re-assemble and maintain.

3. The housing is integral to ensure its rigidity and the precision for engaging.

4. Both ahead and astern are identical in reduction ratios and can transmit the rated power, especially suitable for boats equipped with twin-engines, which with the same rotation, and twin-propellers.

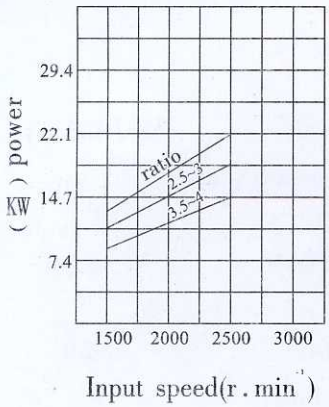
5. The emergency set is provided to ensure the boat travelling continuously in case of severe hydraulic failure.

6. Bell housing and flexible input coupling are connected with the engine, so as to be looked-perfectly the whole unit and easily in mounting.

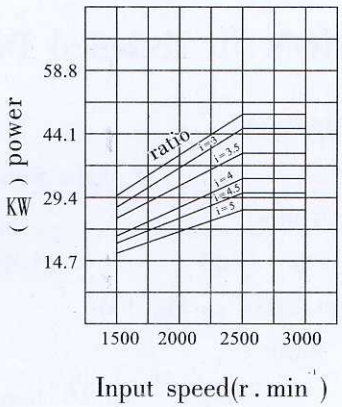
7. The range of the speed reduction ratios is wider as follows. Customer can choose it reasonably in accordance with the data of the engine or the boat and with transmission capacity.

Nominal ratio		1.5 : 1	2 : 1	2.5 : 1	3 : 1	3.5 : 1	4 : 1	4.5 : 1	5 : 1	5.5 : 1
Actual ratio	MA100	1.6 : 1	2 : 1	2.55 : 1	3.11 : 1	3.59 : 1	3.88 : 1			
	MA125		2.03 : 1	2.46 : 1	3.04 : 1	3.57 : 1	4.05 : 1	4.39 : 1	4.7 : 1	
	MA142		1.97 : 1	1.52 : 1	3.03 : 1	3.54 : 1	3.95 : 1	4.5 : 1	5.06 : 1	5.47 : 1

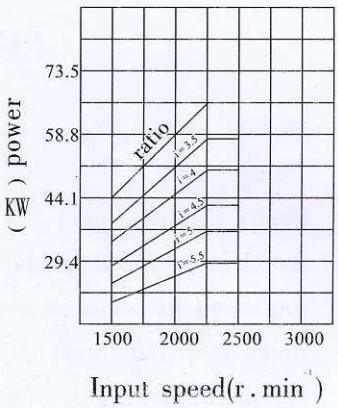
MA100齿轮箱



MA125齿轮箱



MA142齿轮箱



SECTION II Technical Data

Model	MA100A	MA125A	MA142A
Transmission	3 shafts with 5 helical gears		
Centre distance (mm)	100	125	142
Rated input speed (r/min)	1500 ~ 3000	1500 ~ 3000	1500 ~ 2500
Ratio and transmission capacity (detail as Fig. 1)			
Rated propeller thrust (N)	3000	5500	8500
Permissible inclination angle	10° longitudinally 15° transversely		
Control type	Hydraulic control		
Time for reversing (s)	≤10		
Rotational direction of input shaft (facing the output end foreward)	Counter-clockwise		
Rotational direction of output at ahead position	Contrary to that of input shaft		
Hydraulic pressure (MPa)	1—1.3		
Initial oil pressure (MPa)	0.15—0.4		
Max. oil temp. (℃)	≤80		
Flow of cooling water (L/min) (inlet water temp. ≤30℃)	~15	~25	~35
Oil grade	SD/CC30, SAE30; SD/CC40, SAE40 (in summer of the torrid zone)		
Oil capacity (L)	~2	~4.8	~5.8
Type of connected with engine	Flexible coupling		
Overhaul (bearing life) (h)	6000		
Overall dimensions (L × W × H)	289 × 420 × 420	343 × 494 × 485	367 × 560 × 540
Net weight (kg)	~60	~100	~130

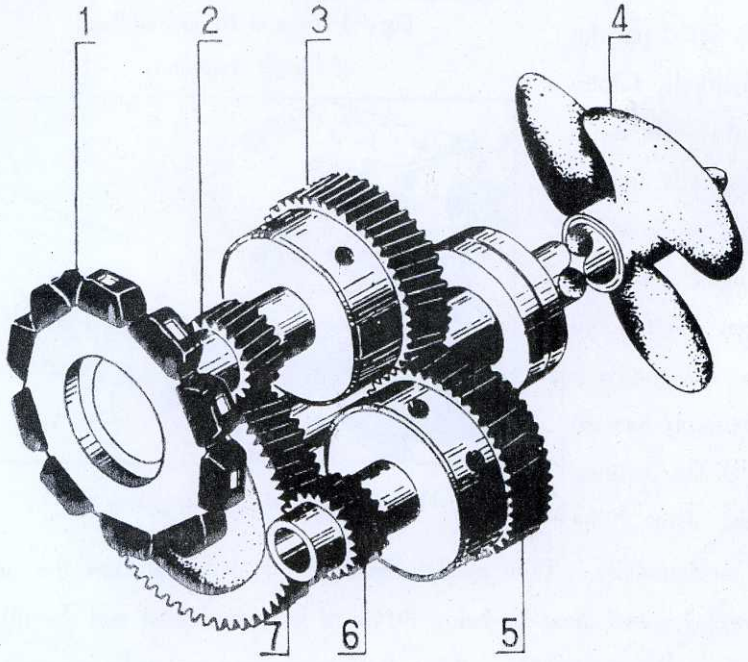
SECTION III Constructional Features and Dis-and Re-assembling of Gearbox

The said gearbox consists of input shaft, transmission shaft, output shaft, housing and hydraulic control system etc. Its principle of transmission as shown in Fig. 2.

The power flow is:

Ahead 1→3→2→7→4

Astern 1→3→5→6→7→4



1. Input coupling
2. Ahead pinion
3. Ahead clutch
4. Output shaft
5. Astern clutch
6. Astern pinion
7. Driven gear

Fig. 2 Diagram for Transmission System

1. Input Shaft Assembly

The input shaft assembly consists of input flange, input shaft, friction plates, piston and gear etc., connected with engine by flexible coupling of which have two types, toothed rubber block and rubber transmission plate, be selected by customers.

The clutch is of wet-type multi-plates and the friction plates are made of powdered alloy and steel separately. In case of any crack on the plate surface, or crushed mark on toothface, or

warp with inclination of over 1.0mm, or worn out so such as its thickness is, for MA142A, the powder plate ≤2.4mm and the steel plate ≤1.7mm, and for MA100A or MA125A, the powder plate ≤1.8mm and the steel plate ≤1.3mm, they are must be renewed.

When disassembling and inspecting, the clutch housing together with piston, friction plates and input shaft etc. are to be drawn out as shown in Fig. 3. For reassembling, the clutch housing should be turned while pushed along so that the internal friction plates can be slipped into the clutch bracket in turn.

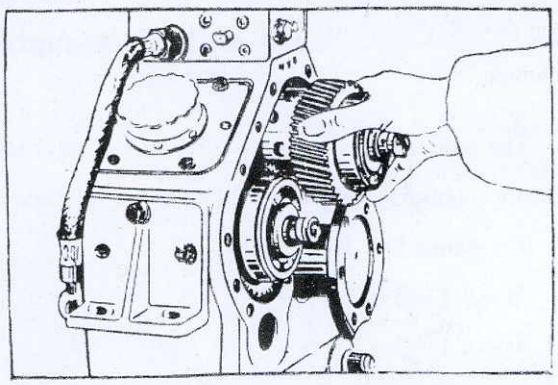


Fig. 3 Dis-and Re-assembling of Clutch Assembly

The emergency set is fitted on the clutch. In case of severe hydraulic failure and not be repaired instantly, use it for engaging the clutch mechanically to ensure travelling. In this case, as shown in Fig. 4, first stop the engine, remove the rear-end cover of input shaft, and screw two inner-hex screws on the rear end of clutch housing alternatively forward by the wrench to make the piston pressing against the friction plates. Thus, the clutch could be connected mechanically. Then reassemble the end-cover and start the engine.

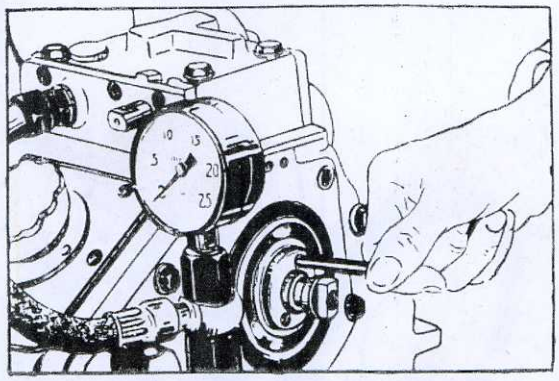


Fig. 4 Using of the Emergency set

Note: When starting the engine speed must be below 80% of its rated speed and the oil level over 20mm of the upper mark on the oil dipstick. When back to the port and to be repaired, the emergency screws should be turned in oppsite direction to be fastened on clutch housing.

2. Transmission Shaft Assembly

Its construction is similar to the input shaft assembly except that there is no coupling at the fore end and the oil pump is driven by the rear end of the transmission shaft. And the parts of both assemblies are available except the transmission shaft and the clutch housing. Its dis-and re-assembling is as same as the input shaft assembly.

3. Output Shaft Assembly

The output shaft and the driven gear are connected in conical fitting with key. The ahead or astern thrust are supported by the bearing at the fore end. According to the customer's request, at the output shaft end, a companion coupling can be fitted, and its hole with allowance is for machining by user according to connecting mode.

When disassembling, first unscrew the fastening nut at the fore end of output shaft, then screw two bolts by tbe special tool into the holes of driven gear (see Fig. 5) and turn the screw lever of special tool to separate the fore-end bearing and the driven gear from the shaft, and the shaft can be drawn out.

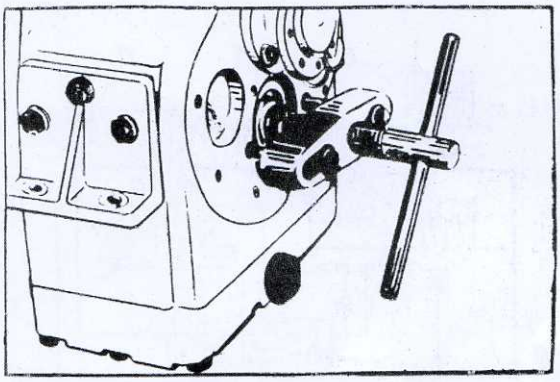


Fig. 5 Detachment of the Driven Gear

When reassembling, both the bearing and the gear are to be fastened on the shaft by means of the nut.

4. Housing Assembly

The housing is designed as a integral and there are a cover at the rear and an inspection hole on the side for observing the mesh condition of clutch or gear. The supports are removable, and can be replaced by user according to the installation condition. In addition, the bell housing is separable from the housing body and can be changed with type of diesel.

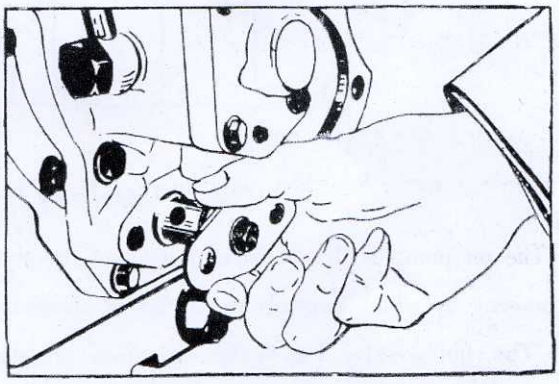


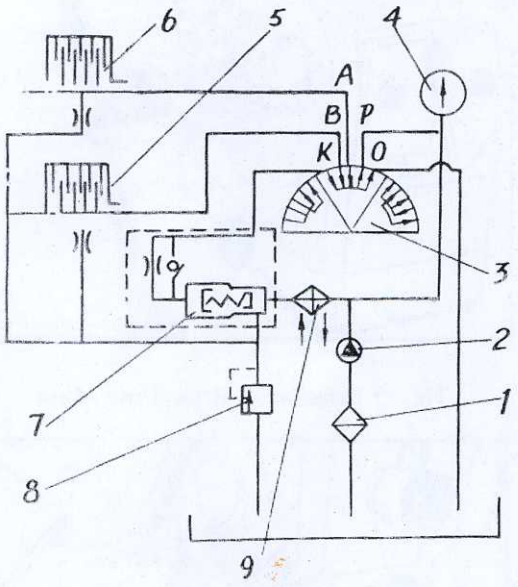
Fig. 6 Dedachment of the Oil Filter

Under the pump, there is an oil filter which can be drawn out by unscrewing the two bolts, as shown in Fig. 6.

5. Hydraulic Control System

The hydraulic system consists of oil pump and control valve etc.. The working principle is as shown in Fig. 7, in which the control valve is under idle and the passage is disconnected with holes A, B and K. When the control valve is at AHEAD position (turn the valve lever 45°

ahead), hyd. oil enters into the buffer-valve and the ahead clutch, simultaneous to be opened to P and B, K. When reversing, the control lever should be remained under idle for 2—3 sec. so as to disengage the ahead clutch and then turn the lever to ASTERN position (turn the lever 45° astern), make P connect with A, K, thus engaging the astern clutch. On the contrary, the control lever should be remained under idle for 2—3 sec. then turned to AHEAD position.



1. Filter
2. Pump
3. Control valve
4. Hydraulic pressure gauge
5. Ahead clutch
6. Astern clutch
7. Buffer valve
8. Overflow valve
9. Cooler

Fig. 7 Diagram for Hydraulic System

The oil pump is driven by output shaft directly. The control valve is installed on the top of the housing by which controls the duties of ahead and astern, engaging and disengaging of gear-box. The buffer-valve can make operation pressure raising gradually to ensure the reversing smooth.

There are seal rings on the piston, input shaft and transmission shaft. The rings are with two radial gaps and can be broken in assembling. The break-end of both half ring should be aligned and in pairs for using.

The oil cooler is provided to keep the oil temperature under the permitted limits. Cooling water is offered by the water pump driven by diesel. The temperature of inlet water must be lower than 30℃.

6. Auxilary Power Take-off (P. T. O) Unit

The P. T. O unit can be assembled at the rear end of input shaft for customer' s particular demand as shown in the double-dot line in the diagram of mounting dimension. The data are as following:

Gearbox Model	Triangle belt		Transmission Torque (N·m)
	Type	Qty.	
MA100A	0	2	≤7
MA125A	A	4	≤21
MA142A	A	4	≤21

SECTION Ⅳ Installation and Operation

1. Installation

Before installing, a new gearbox is necessary to open the side cover for observing the surfaces of the parts which should be not rusted. The input and output couplings should be ready to rotate freely by hand.

For the gearbox with bell housing, the alignment between the input shaft and the engine flywheel can be easily achieved by fastening their bell housings by means of bolts tightly. If no bell housing, the concentricity between the input coupling of the gearbox without housing and the engine flywheel and the run-out of the end face all should be corrected within 0.13mm as Fig. 8 and 9. The concentricity and the run-out of the end face between the gearbox output flange and the coupling of the stern shaft must not exceed 0.08 mm max. Be sure that the complete unit is aligned according to the requirement and then screw all the bolts tightly, and the reamer bolts should be used for connecting the supporters and the common baseplate.

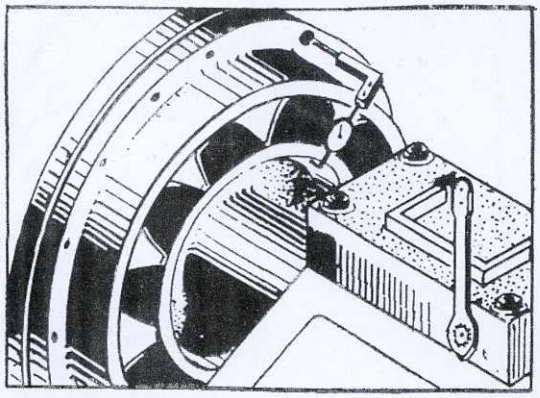


Fig. 8 Correcting the Concentricity between Gearbox and Flywheel

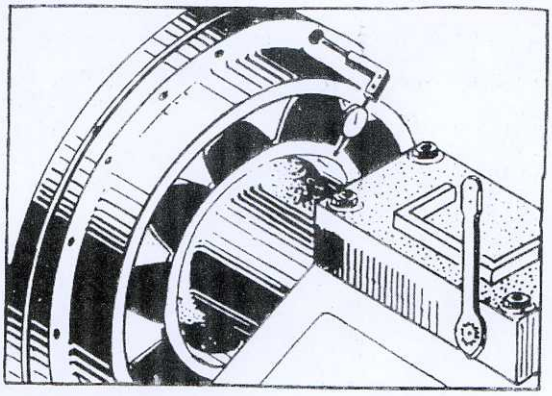


Fig. 9 Correcting the Run-Out of the End Faces between Gearbox and Flywheel

2. Trial Run

After installation, fill in specified oil until the oil level reaches the upper mark on the oil dipstick, and pour less oil into the pump outlet. The oil must be clean, no water and dirt, and it is not permitted to be mixed with other different oil.

After starting the engine, if no pressure indicated on the gauges for one minute, stop the

engine, check, shoot trouble and then start the engine to its rated speed and inspect it again. The gearbox can be put into normal operation after reversing two or three times at 75% rated speed and no abnormal noise.

3. Normal Operation

During the normal operation, when reversing, the engine speed should be reduced below 75% rated speed and let the control lever of the gearbox ramain at STOP position for 2—3 sec. except for an emergency.

In order to keep the gearbox running in proper condition, regular inspection and maintenance should be arranged: change the oil after 500—600 running hours and inspect or replace the friction discs after 2,000 running hours. If the gearbox is to be stored or stopped running for long time, the inspection and maintenance are necessary periodically.

4. Adjusting of Initial Hydraulic Pressure

The oil pressure when the control lever is under idle is the initial hydraulic pressure, which should be adjusted at 0.15 — 0.4 MPa due to the different engine speed or the worn out of the oil seal. It can be adjusted by the adjusting bolts on the overflow valve (see Fig. 10) and then tightened by the nut.

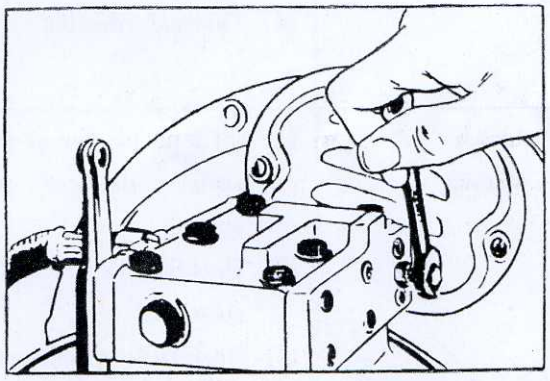


Fig. 10 Adujsting of Initial Hydraulic Pressure

5. Trouble Shootings

General trouble shootings are as shown in following table:

Trouble Shootings

No.	Trouble	Causes	Remedies
1.	Vibration of gearbox	(1) Misalignment at installation (2) Damaged toothed rubber block (3) Loose connecting bolts of couplings (4) Torsional vibration	(1) Readjust it acc. to the manual (2) Renew it (3) Tighten the fittings (4) Readjusting acc. to calculation of torsional vibration
2.	Clutch slipping	(1) Oil level too low or sealing at suction damaged of filter choked (2) Throttling hole in control valve obstructed (3) Stuck friction plates or piston (4) Leakage of sealings	(1) Fill in oil or renew sealings or clean filter (2) Clean the throttling hole (3) Clean and repair (4) Renew the sealings
3.	Turning in company	(1) Friction plates seriously warped or stuck (2) Back spring failure (3) Stuck piston (4) Oil viscosity too high (5) Emergency screws loose out	(1) Repair or renew (2) Renew (3) Clean and repair (4) Use specified oil (5) Turn the screws back, and tighten
4.	Abnormal noise	(1) Damaged toothed rubber block (2) Damaged bearings (3) Loose connecting bolts	(1) Renew (2) Renew (3) Tighten them

No.	Trouble	Causes	Remedies
5.	Excessive oil temperature	(1) Clutch slipping or turning in company (2) Chocked cooler (3) No cooling water (4) Oil level too high (5) Cooling water leak into oil	(1) Refer to Item No. 2 and No. 3 (2) Clean (3) Repair (4) Lower the oil level (5) Repair cooler and renew oil

五、零件目录

SECTION V Parts Lists

1. 输入联轴节、输入轴部件(图11)

Input Coupling, Input Shaft Assembly (Fig.11)

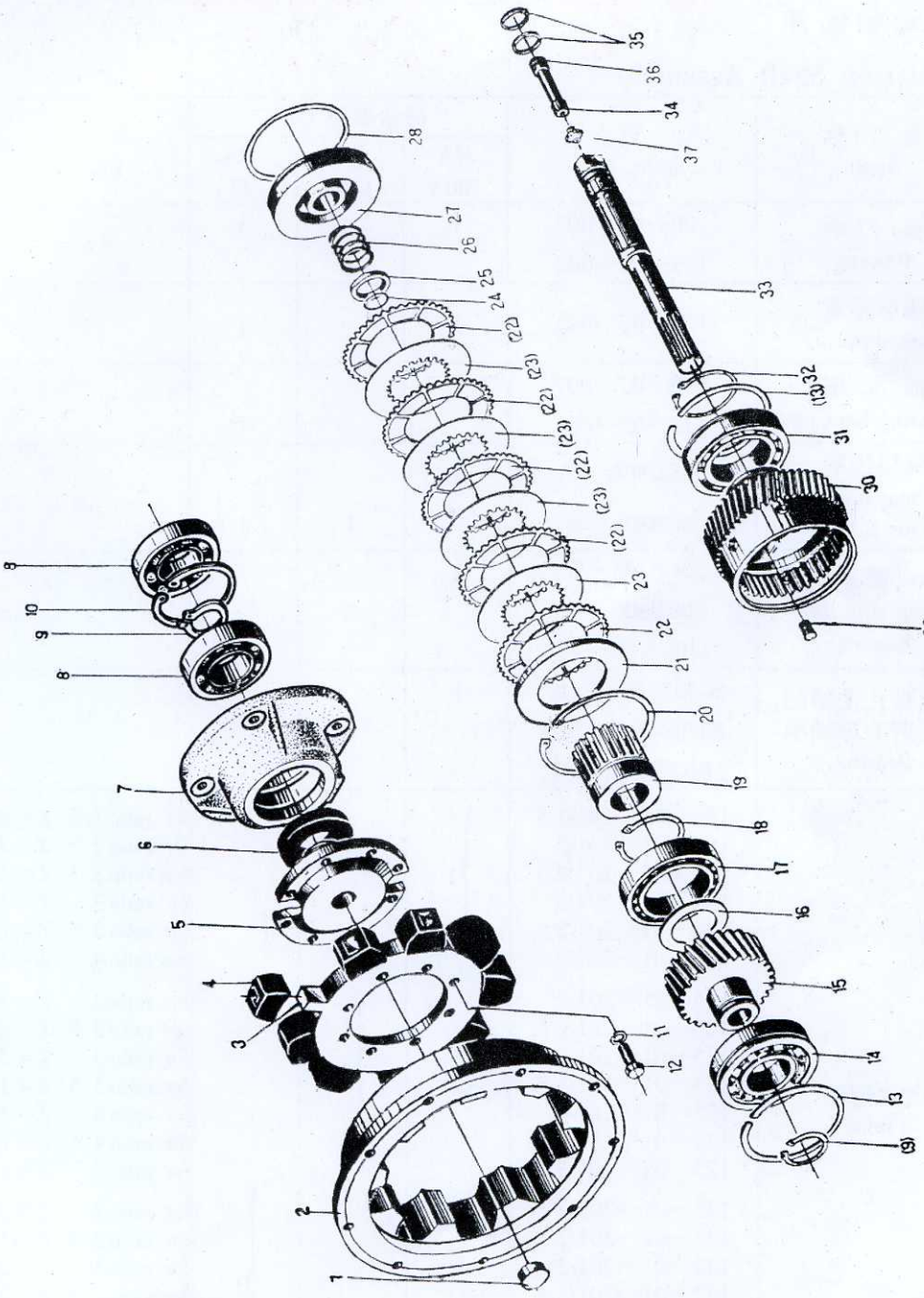
序号 No.	名称 Name	订货号 Order No.	每台数量 Qty.			备注 Remarks
			MA100A	MA125A	MA142A	
1	闷塞 Plug	100—01—008 125—01—003	1	1	1	
2	联轴节内齿圈 Internal toothed ring	Q05—10—03 Q05—10—04 Q05—10—05 Q05—11—02A Q05—11—02X1A	1	1	1	SAE7 1/2" SAE11 1/2" 配285柴油机飞轮 For 285 Diesel flywheel SAE11 1/2" SAE10"
3	联轴节外齿圈 External toothed ring	Q05—10—01 Q05—11—01	1	1	1	
	橡胶传动盘部件 Rubber transmission plate assembly	100—06—000X1	1			
4	齿形橡胶块 Toothed rubber block	Q26—06—01	10	16	16	

序号 No.	名称 Name	订货号 Order No.	每台数量 Qty.			备注 Remarks
			MA100A	MA125A	MA142A	
5	输入法兰 Input flange	100—01—002A 125—01—002A	1	1	1	
6	骨架油封 Oil seal	SPD 45 × 62 × 8 HG 4—692—67 SPD 50 × 68 × 8 HG 4—692—67	1	1	1	
7	前盖 Front cover	100—01—001A 125—01—001A 142—01—001A	1	1	1	
8	单列向心球轴承 Bearing	108GB276—82 208GB276—82	2	2	2	
9	轴用挡圈 Snap ring (for shaft)	35GB894—76 40GB894—76 45GB894—76	1 1	1 1	1 1	
10	孔用挡圈 Snap ring (for hole)	68GB893—76 75GB893—76	1	1	1	
11	垫圈 Washer	8GB93—76 10GB93—76	8	8	8	
12	螺栓 Bolt	M8 × 25GB21—76 M10 × 25GB21—76	8	8	8	
13	轴承外圈止动环 Stop ring for bearing	80GB305—82 90GB305—82 110GB305—82	2	2	2	
14	外圈带止动槽 单列向心球轴承 Bearing	50307GB277—82 50308GB277—82 50408GB277—82	1	1	1	

序号 No.	名称 Name	订货号 Order No.	每台数量 Qty.			备注 Remarks
			MA100A	MA125A	MA142A	
15	主动齿轮 Pinion	100—01—201/1.5 100—01—201/2 100—01—201/2.5 100—01—201/3 100—01—201/3.5 100—01—201/4	1			
		125—01—201/2 125—01—201/2.5 125—01—201/3 125—01—201/3.5 125—01—201/4 125—01—201/4.5 125—01—201/5		1		
		142—01—201/2 142—01—201/2.5 142—01—201/3 142—01—201/3.5 142—01—201/4 142—01—201/4.5 142—01—201/5 142—01—201/5.5			1	
16	隔圈 Spacer	100—01—203	1			
		125—01—203		1		
		142—01—203			1	
17	单列向心球轴承 bearing	110GB276—82	1			
		111GB276—82		1		
		212GB276—82			1	
18	轴用挡圈 Snap ring (for shaft)	50GB894—76	1			
		55GB894—76		1		
		60GB894—76			1	

序号 No.	名　称 Name	订　货　号 Order No.	每台数量 Qty.			备　注 Remarks
			MA100A	MA125A	MA142A	
19	离合器座 Clutch bracket	100—01—202 125—01—202 142—01—202	1	1	1	
20	孔用挡圈 Snap ring (for hole)	90GB893—76 130GB893—76	1	1	1	
21	承 压 板 Thrust plate	100—01—003 142—01—002	1	1	1	
22	外摩擦片 External disc	100—01—009 MB170—01—012	6	8	5	
23	内摩擦片 Internal disc	100—01—010 142—01—006	5	7	4	
24	轴用挡圈 Snap ring (for shaft)	26GB894—76 30GB894—76	1	1	1	
25	挡　圈 Snap ring	100—01—011 142—01—007	1	1	1	
26	返回弹簧 Return spring	100—01—007 142—01—005	1	1	1	
27	活　塞 Piston	100—01—005 142—01—004	1	1	1	
28	活 塞 环 Piston ring	100—01—004 142—01—003	1	1	1	
29	螺　钉 Screw	M8 × 10GB77—76 M10 × 12GB77—76	2	2	2	
30	传动齿轮 Transmission gear	100—01—102 125—01—102 142—01—102	1	1	1	

序号 No.	名称 Name	订货号 Order No.	每台数量 Qty.			备注 Remarks
			MA100A	MA125A	MA142A	
31	外圈带止动槽的单列向心球轴承 Bearing	50110GB277—82 50210GB277—82 50212GB277—82	1	1	1	
32	轴用挡圈 Snap ring (for shaft)	50GB894—76 60GB894—76	1	1	1	
33	输入轴 Input shaft	100—01—101 125—01—101 142—01—101	1	1	1	
34	分油塞 Dividing oil plug	100—01—103 125—01—103	1	1	1	
35	封油环 Seal ring	100—01—006	2	2	2	
36	压紧螺钉 Fastening bolt	125—01—104		1		
37	铜垫 Copper washer	100—01—104	1		1	



输入联轴节、输入轴部件
Input Coupling, Input Shaft Assembly

2. 传动轴部件

Transmission Shaft Assembly

序号 No.	名称 Name	订货号 Order No.	每台数量 Qty. MA 100A	MA 125A	MA 142A	备注 Remarks
1	轴承 Bearing	100—02—002	1		1	
		125—02—002		1		
2	碟形弹簧 Dished spring	100—02—003	1		1	
3	轴承座 Bearing housing	100—02—001	1			
		142—02—001			1	
4	轴用挡圈 Snap ring (for shaft)	35GB894—76	1			
		40GB894—76		1	1	
5	轴承外圈止动环 Stop ring for bearing	80GB305—82	2			
		90GB305—82		2		
		110GB305—82			2	
6	外圈带止动槽的单列向心球轴承 Bearing	50307GB277—82	1			
		50308GB277—82		1		
		50408GB277—82			1	
7	主动齿轮 Pinion	100—01—201/1.5	1			for ratio 1.5 Z=30
		100—01—201/2				for ratio 2 Z=26
		100—01—201/2.5				for ratio 2.5 Z=22
		100—01—201/3				for ratio 3 Z=19
		100—01—201/3.5				for ratio 3.5 Z=17
		100—01—201/4				for ratio 4 Z=16
		125—01—201/2		1		for ratio 2 Z=32
		125—01—201/2.5				for ratio 2.5 Z=28
		125—01—201/3				for ratio 3 Z=24
		125—01—201/3.5				for ratio 3.5 Z=21
		125—01—201/4				for ratio 4 Z=19
		125—01—201/4.5				for ratio 4.5 Z=18
		125—01—201/5				for ratio 5 Z=17
		142—01—201/2			1	for ratio 2 Z=37
		142—01—201/2.5				for ratio 2.5 Z=31
		142—01—201/3				for ratio 3 Z=27
		142—01—201/3.5				for ratio 3.5 Z=24
		142—01—201/4				for ratio 4 Z=22
		142—01—201/4.5				for ratio 4.5 Z=20
		142—01—201/5				for ratio 5 Z=18
		142—01—201/5.5				for ratio 5.5 Z=17

序号 No.	名　称 Name	订　货　号 Order No.	每台数量 Qty.			备　注 Remarks
			MA 100A	MA 125A	MA 142A	
8	隔　圈 Spacer	100—01—203	1			
		125—01—203		1		
		142—01—203			1	
9	单列向心球轴承 Bearing	110GB276—82	1			
		111GB276—82		1		
		212GB276—82			1	
10	轴用挡圈 Snap ring (for shaft)	50GB894—76	1			
		55GB894—76		1		
		60GB894—76			1	
11	离合器座 Clutch bracket	100—01—202	1			
		125—01—202		1		
		142—01—202			1	
12	孔用挡圈 Snap ring (for hole)	90GB893—76	1	1		
		130GB893—76			1	
13	承 压 板 Trust plate	100—01—003	1	1		
		142—01—002			1	
14	外摩擦片 External disc	100—01—009	6	8		
		MB170—01—012			5	
15	内摩擦片 Internal disc	100—01—010	5	7		
		142—01—006			4	
16	螺　钉 Screw	M8 × 10GB77—76	2	2		
		M10 × 12GB77—76			2	
17	轴用挡圈 Snap ring (for shaft)	26GB894—76	1	1		
		30GB894—76			1	
18	挡　圈 Spacer	100—01—011	1	1		
		142—01—007			1	