前　言

GW系列船用齿轮箱是本厂购买西德罗曼·斯托尔福特公司许可证产品之一。

GW系列船用齿轮箱体积小，当速比从2至6、输入转速500至1800r/min时，传扭能力可以从0.28到17kw/r/min。传扭能力的确切数值由中心距和减速比决定。

GW系列齿轮箱共有八种不同的结构形式，四种倒顺离合减速齿轮箱和两种离合减速齿轮箱，一种倒顺离合双速齿轮箱和一种离合双速齿轮箱，每种齿轮箱按中心距的大小又分15个规格，根据输入与输出轴的相对位置的不同，齿轮箱分为同心和偏心形式。为了降低成本和减少备件，GW系列齿轮箱采用模件设计，用相同的模件可组成不同结构形式的变形产品，以满足各种船舶的需要。

Preface

GW series marine gearboxes are designed and manufactured according to the license from LOHMANN & STOLTERFOHT, Germany.

GW series marine gears have minimum space requirements. In case of reduction ratio from 2 to 6 and input speed ranging from 500 to 1800r/min, the torque transmission capacity shall be 0.28 to 17kw/r/min, however the exact torque depends on the center distance and reduction ratio.

GW series gears have eight different models, four reverse reduction gears, two reduction gears without reversing function, one reverse double-reduction gears and one double-reduction gears without reversing function, each can be divided into fifteen sizes according to center distance or classified as coaxial and offset type as per relative arrangement of input and out-put shafts. For reasons of low-cost manufacture and less spare parts, GW series gears adopt modular design, which can form differing variant products with the same modules to meet various Classification Societies.

目 录

Content

1. 技术参数表 1.List of Technical Data

1.技术参数表/Technical Data

1.一般参数表 / General data：

主机制造厂 / Engine manufacturer：

主机型号 / Engine type：

主机输出功率 / Output power of engine： P= kw(千瓦)

齿轮箱输入转速 / Input speed of gearbox： n_i= r/min(转/分)

主机旋转方向(面对飞轮向前看)

Direction of rotation of engine (facing the flywheel:)

船级社 / Classification Society：

船厂/Shipyard:

船号 / Hull No：

2.齿轮箱参数 / Gearbox data：

产品编号 / Product No：

型号和规格 / Type and size：GW

齿轮箱速比 / Gear ratio：i=

双速齿轮箱 (double-reduction gearbox)
- i1（低速 low speed）=
- i2（高速 high speed）=
- i3（倒速 reverse speed）=

冷却水量 / Cooling water flow rate： V= m^3 / h (立方米 / 小时)

冷却水人口温度 / Cooling water inlet temperature： t≤32℃

重量 / Weight： G= kg(公斤)

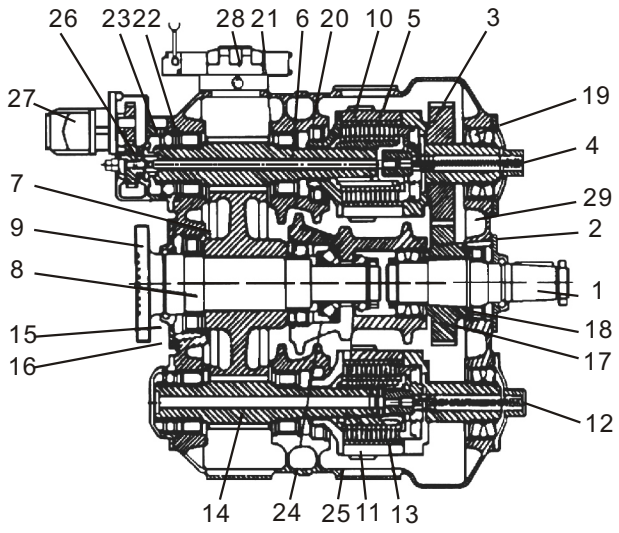
润滑油容量 / Lubrication oil capacity： L= L(升)

润滑油类型 / Lub oil group：CD30,CD40

2．齿轮箱简介

2．Description of gearbox

主要零、部件Gear Components



GWC系列齿轮箱展开剖视图

(fold out section for GWC series gearbox)

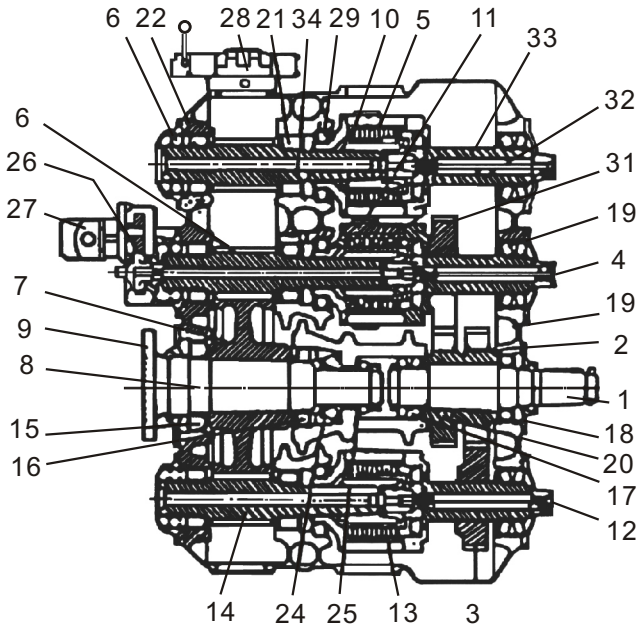
1．输入轴
2．斜齿轮 } 输入级
3．斜齿轮
4．中间轴
5．多片离合器
6．空心齿轮轴 } 减速级
7．斜齿轮
8．输出轴
9．输出法兰
10．斜齿轮 } 反转级
11．斜齿轮
12．中间轴
13．多片离合器
14．空心齿轮轴

1.Input shaft
2.Helical gear } Input stage
3.Helical gear
4.Intermedaite shaft
5.Multiple-plate clutch
6.Hollow pinion shaft } Reduction stage
7.Helical gear
8.Ouput shaft
9.Output flange
10.Helical gear } Reversing stage
11.Helical gear
12.Intermediate shaft
13.Multipce-plate clutch
14.Hollow pinion shaft

2. 齿轮箱简介

15、16. 滚动轴承*
17～23. 滚动轴承
24. 推力轴承**
25. 推力轴承**
26. 油泵传动部件
27. 齿轮泵
28. 气动操纵阀
29. 箱体
30.圆柱斜齿轮 } 传动级
31.圆柱斜齿轮 }
32.片式离合器
33.中间轴
34.空心齿轮轴
*等于和小于49 / 54型齿轮箱适用。
52 / 59以上齿轮箱输出轴采用滑动轴承。
**等于和小于49 / 54型齿轮箱适用，
52 / 59型以上采用密切尔止推轴承。

主要零、部件Gear components



2. Description of Gearbox

15,16: rolling bearing*
17 ~ 23: rolling bearing
24 Thrust bearing**
25 Thrust bearing**
26 Gear set for driving gear pump
27 Gear pump
28 Gear controller (pneumatic)
29 Gear housing
30.Helical gear } Driving stage
31.Helical gear }
32.Multiple-plate clutch
33.Intermediate shaft
34.Hollow pinion shaft
*)for gear sizes up to 49.54.
for gear size larger than 52.59, plain bearings are used.
**)for gear sizes up to 49.54.
for gear sizes larger than52.59, Michel-type thrust bearings are used.

GWM系列齿轮箱展开剖视图
(fold out section for GWM series gearbox)

2. 齿轮箱简介

GW系列船用齿轮箱有8个系列，GWC、GWD、GWS和GWH为倒顺离合减速齿轮箱，GWT为离合双速齿轮箱，GWM为倒顺离合双速齿轮箱。GWL和GWK为离合减速齿轮箱，没有倒顺功能，其结构特征列述如下:

GWC型:

有2级减速(输入级和减速级)和换向级，输入和输出轴是同心的。

GWD型:

有1级减速(无输入级)和换向级，而2根离合器轴之一变成驱动轴。输入和输出轴是斜异心的，其运转方向相反(常规)。

GWS型:

与GWD系列一样没有输入级，只有减速级和换向级，输入和输出轴是垂直异心的，其运转方向相反(常规)。

GWH型:

与GWD／GWS系列一样也没有输入级，只有减速级和换向级，输入和输出轴是水平异心的，其运转方向相反(常规)。

GWL型:

没有倒顺功能，结构与GWC系列相似，但仅有输入级和减速级。输入和输出轴是同心的，其运转方向相同(常规)。

2. Description of Gearbox

GW series marine gearboxes cover eight models. There are the GWC, GWD, GWS, GWH reverse reduction gears, the GWT double-reduction gears(without reversing function), the GWM reverse double-reduction gears and the GWL and GWK reduction gears(without reversing function). The models differ as follows:

GWC design

GWC reverse reduction gear has a primary stage and a reduction stage and a reversing tage. Input and output shafts are coaxial .

GWD design

GWD reverse reduction gear has no primary stage hut a reduction and a reversing stage, either one of the clutch shafts is driven directly. Input and output shafts are diagonally off-set and have opposite sense of rotation.

GWS design

Like the GWD version the GWS reverse reduction gears has no primary stage, but a reduction and reverse stage. Input and output shafts are vertically off-set and have opposite sense of rotation.

GWH design

Like the GWD and GWS version, the GWH reverse reduction gear has a reduction and a reverse stage, but no primary stage. Input and output shafts are horizontally off-set and have opposite sense of rotation.

GWL design

GWL reduction gear without reverse function, similar to the GWC version, has a primary stage and a reduction stage. Input and output shafts are in line and have the same sense of rotation.

2. 齿轮箱简介

GWK型:

没有倒顺功能，仅有1级减速。输入和输出轴是垂直异心的，运转方向相反。

GWT型:

没有倒顺功能，但有2个减速级，因而具有2个减速比。输入和输出轴是同心的，运转方向相同。

GWM型:

有倒顺功能和2个减速比，输入和输出轴是同心的，运转方向相同。

2. Description of Gearbox

GWK design

GWK reduction gear has no reversing function and is of single stage design. Input and output shafts are vertically off-set and have opposite sense of rotation. (i=1.5 to 4:1)

GWT design

GWT double-reduction gears has no reversing function, but has two reduction stages and two ratios. Input and output shafts are in line and have the same sense of rotation.

GWM design

GWM reverse double-reduction gears has reverse function and has two ratios. Input and output are in line and have the same sense of rotation.

2. 齿轮箱简介

2. Description of Gearbox

简　介

GWC、**GWD**、**GWH**、**GWS**和**GWM**系列齿轮箱，是由圆柱斜齿轮和多片式离合器构成的。GWL、GWK和GWT系列齿轮箱没有换向功能，仅有减速、离合机构，多片式摩擦离合器供螺旋桨离合用。

箱体

用灰铸铁铸造或焊接，在承受负荷的地方有加强筋，以防变形。在轴的支承部位，尤其在推力轴承部位作了特别的加强，以承受推力。

减速比

可提供的减速比范围为2:1-6:1，其中标准速比为2:1、2.5:1、3:1、3.5:1、4:1，4.5:1，5:1，5.5:1，6:1

齿轮

所有齿轮和齿轮轴均为斜圆柱齿轮，齿面经气体渗碳淬火，且用现代化的磨齿机磨削齿面。多年来积累的渗碳淬火经验，精心地选择适合渗碳淬硬的材料和采用大圆弧滚刀，可保证齿轮质量优良。齿轮的啮合几何计算和齿轮的承载能力计算，是按照特有的计算程序(符合船级社规范)进行运算。

Generals

The GWC，GWD，GWS，GWH and GWM reverse gears are helical gears incorporating multi-plate clutches. The GWL，GWK and GWT reduction gears have no reversing function. The multi-plate clutch is used only for engaging or disengaging the propeller.

Housing

The housings are made of grey cast iron or welded, and are provided with reinforced ribs at points to prevent distortion. At the bearing points and especially in the thrust bearing section the casings are extra stiffened to absorb thrust forces.

Gear ratios

The ratios available are ranging between 2:1 and 6:1 among them are standard ratios 2:1，2.5:1，3:1，3.5:1，4:1，4.5:1，5:1，5.5:1 and 6:1.

Gears

All gears and pinion shafts are of single-helical design. Tooth flanks are case hardened(by gas carburization)and finish-machined on modern grinding machines. Carefully selecting of materials and the use of protuberance cutters in combination with many years experience in the field of case hardening guarantee superior quality gears. Geometric calculation for gear meshing and load capacity computation are individually established based on our own calculation programs in accordance with the rules of various Classification Societies.

2. 齿轮箱简介

轴和轴承

轴用优质调质钢制成，装配在滚动轴承上。49／54及其以下型号的齿轮箱的螺旋桨推力由轴向自位滚子轴承承受，52／59及其以上型号齿轮箱的输出轴用滑动轴承支承，螺旋桨推力由密歇尔推力轴承承受。

输入和输出端:

输入端有标准锥度为1:10或1:30的轴头，输出轴与输出法兰锻为一体，以传递螺旋扭矩。

离合器

钢片和粉末冶金摩擦片组成多片式摩擦离合器，采用液压操纵，通过齿轮箱上二级压力控制阀使离合器接排平稳。

齿轮箱操纵

离合器的接脱排是通过带有手动应急装置的气动操纵阀来实现。若用电气或机械控制装置，则需另行订购。

供油系统

齿轮箱不需单独设立油箱，而将下箱体的底部作为油池，并设油液防溅板，即使齿轮箱倾斜时也能保证吸油时不带空气。

2. Description of gearbox

Shafts and bearings

The shafts are made of high grade quenched and tempered steel and carried in rolling bearings. Axial self-aligning roller bearings are provided up to gear size 49.54. For gear size 52.59, the output shaft is supported by plain bearings and the propeller thrust is absorbed by the Michel-type thrust bearing.

Input and output

The gears have a free input shaft end with a standard taper of 1:10 or 1:30. Torque transmission at the propeller side is achieved via a forged-on output flange.

Clutches

The integral multi-plate clutches with steel/sinter pairing are pressure oil operated. The two-stage pressure regulating valve on the gearbox results in smooth engagement.

Gear operation

The multiple-plate clutch engagement and disengagement is carried out by a pneumatically actuated gear controller with manual emergency control. Electrical or mechanical control of the gears is arranged at extra cost.

Oil supply system

The bottom of lower housing can serve as oil sump without needing any separate oil tanks. Moreover additional wash plates ensure air-free oil suction even at extreme heeling of gearbox.

3. 安装与使用说明

齿轮箱交付时已放净机油。

齿轮箱内部涂有防锈油，存放在干燥、温度均匀的库房内，有效期为六个月。

齿轮箱外表涂油漆，法兰、轴端涂有防锈油。

在安装时才联接的压缩空气管，油管和水管的接头已用法兰或塞头封住。

如需更换齿轮箱的管路、接头，则在装配前必须仔细酸洗干净。

输入轴转向及输出轴顺车转向用箭头表示。

齿轮箱的可调部位（如压力控制阀、喷嘴等）在出厂前均已调定。在特殊情况下，可在船上作进一步调整。

未经许可，擅自拆开齿轮箱，本厂恕不承担责任。

3.Installation and operating instructions

The gearbox is delivered without oil.

The gearbox is protected internally with preservative oil, effective against corrosion for a period of six months when the gearbox is stored in a dry area at an even temperature.

The gearbox is painted externally. Flanges and shaft ends have a preservation paint.

The connections for the air pipes, oil tubes and water pipes to be assembled at the site are sealed by means of flange or plugs.

Pipelines, pipe connections etc. to the gearbox which have to be installed after having left our works, must be carefully pickled and cleaned before they are mounted. The direction of rotation is shown by an arrow.

The adjustable parts of the gearbox (such as pressure control valves, variable nozzles etc.) are set before they are delivered. According to particular circumstances on board further adjustments may be necessary.

Our liability is invalid when the gearbox is opened without our authorization.

4. 存储、吊装、安装基础

4.Intermediate storage, transportation and foundation

中间贮存

如齿轮箱在露天存放必须用蓬布或顶棚遮盖

吊运

齿轮箱用钢丝绳吊运，在起吊时，避免钢丝绳碰到齿轮箱上的附件，并应缓慢起吊，小心安放，上箱体的吊耳仅仅用于吊运齿轮箱的上体，整台吊运则用运输吊耳。

为安全起见，钢丝绳应用卡子。

基础

为便于更换机油和清洗齿轮箱，油底壳应留有足够的空间，以便在放油塞的下方安放集油盘。

Intermediate storage

If the gearbox is stored outside it must be protected from the atmospheric conditions by a protective cover or canopy.

Transportation

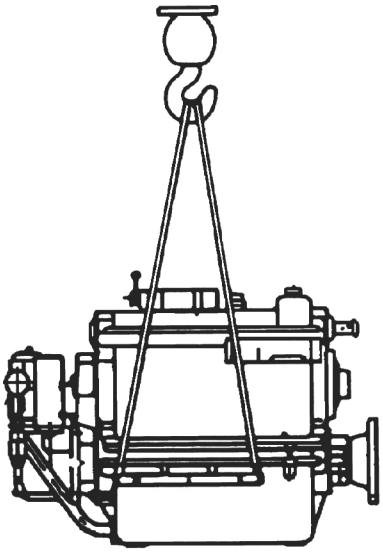
The gearbox is suitably suspended on cables for transportation. Therefore, all cables taking the gearbox weight should be clear of the fittings. Slowly lift the gearbox and place in position. The lifting lugs on the upper part of the housing serve only to remove the upper section. To lift the complete gearbox the transportation lugs are to be used.
For safety, cables are to be used with shackles.

Foundation

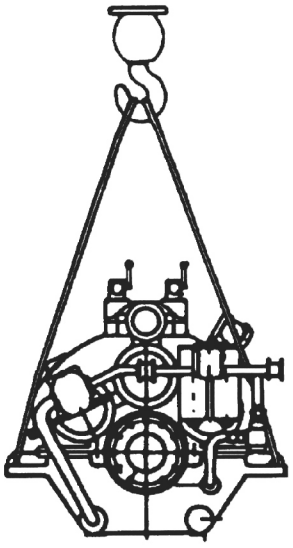
In order to facilitate the changing of oil and washing-out of the gearbox， the foundation has been constructed so that there is sufficient space for the installation of an oil-collector below the drain plug.

4. 存储、吊装、安装基础

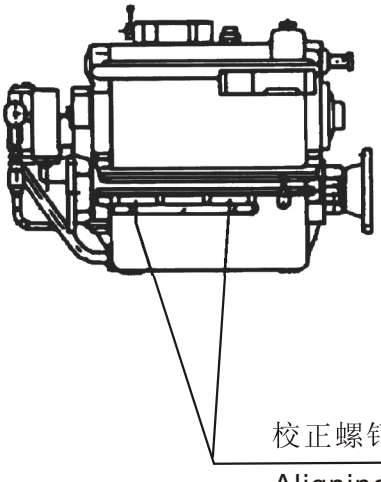
4.Intermediate storage, transportation and foundation

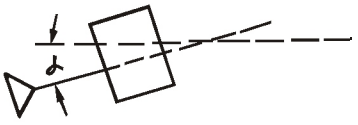


齿轮箱在机舱中安装
Installation in the engine room



The aligning screws are to be inserted into the tapped holes in the mounting feet. Via the aligning screws the gearbox rests on the to plates.





允许最大纵向固定安装角， α =5°
Maximum permissible permanent installation angle fore and aft α =5°

4. 存储、吊装、安装基础

4.Intermediate storage, transportation and foundation

联轴节或输入法兰的装配

如在齿轮箱轴上要装配联轴节或输入法兰，其内孔尺寸应与外形图上的轴端尺寸一致，装配时加热毂体使其比相配轴高40℃（锥度配合时），避免敲击，以保护齿轮和轴承。

冷却水

齿轮箱接入冷却水循环系统后，为避免渗漏时水进入油箱中，引起运行故障，冷却水压应低于油压。

Mounting of couplings or input flange

If couplings have to be fitted onto the gearbox shafts, the calibers of the bore holes in the coupling hubs have to be adapted to the diameters of the shaft ends according to our assembly drawings. When mounting the couplings the hubs have to be heated with hub temperatures to be by 40℃ higher than that of the shaft in case of taper fits. This will render shocks and heavy blows unnecessary when mounting the coupling.

Cooling water

The gearbox is to be connected into the water circulation system. The cooling water pressure should be lower than the oil pressure，in order to avoid water intake into the oil in case of water leakage, and so avoid trouble in the operation of the gearbox.

5. 齿轮箱的找正

找正时，船必须处于漂浮状态，船底不得搁滩，首先对机组进行粗略校正，然后通过箱体支架上的安装孔配作铰制螺栓孔。

螺旋轴的校正

螺旋桨在支承轴承和法兰之间由于轴的垂力会产生挠度，其值与该轴的延伸长度及直径有关（参见下图），此挠度应予以补偿。

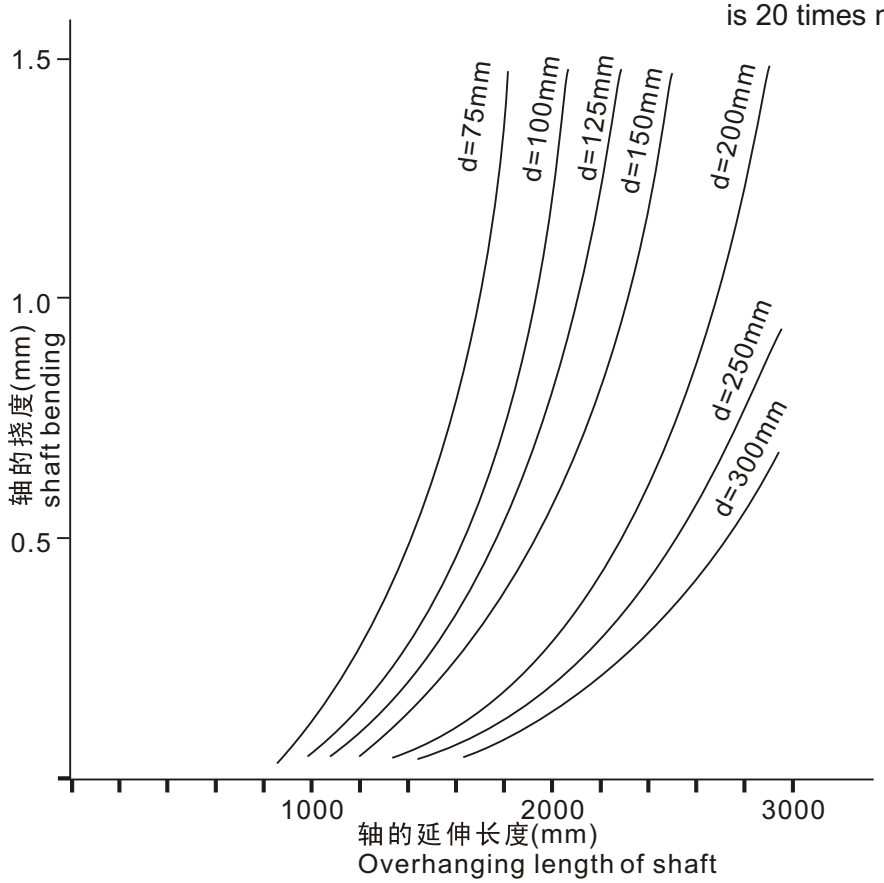
支承轴承和法兰之间的距离应大于轴直径的20倍。

5 Alignment of the gearbox

The propulsion unit shall only be aligned when the vessel is afloat and it is definitely ensured it is not in contact with the ground. At first, the gearbox is placed in position in order to roughly align the unit. Now the holes for the fastening bolts shall be drilled through the holes in the mounting brackets.

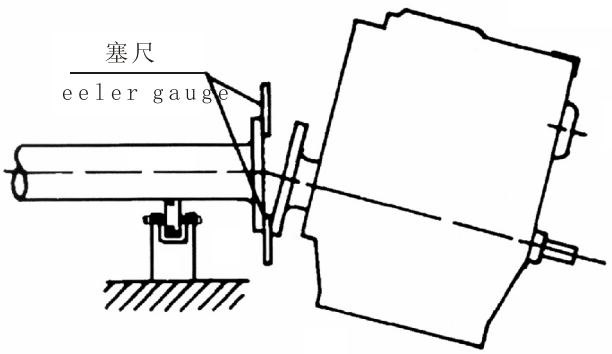
Alignment of the propeller shaft

The completely assembled propeller shaft shows s deflection between the supporting bearing and the flange due to shaft gravity. The extent of the deflection in relation to the shaft overhang and diameter can be seen in the diagram. This deflection is to be compensated. The distance between the bearing and flange is 20 times more than shaft diameter.

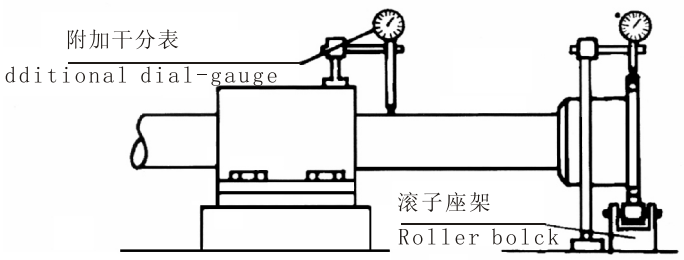


5. 齿轮箱的找正

首先消除齿轮箱安装位置的角偏移。



上图示以塞尺校正来消除角偏移，测定时，应注意轴只允许朝一个方向转动，每100mm法兰直径，轴向平行度不大于0.01mm。



上图示为找正齿轮箱时消除挠度的方法，把一个滚子座架置于螺旋桨轴端法兰的下方，根据查得挠度，抬高该滚子座架。

由于附加负载使推进器轴自由挠度比自然状态的挠度要大，为此应把一个附加千分表安置在靠近轴承的地方，当该千分表示出轴承中的轴刚要升高时，设置在轴端法兰处的千分表测得的读数就是实际挠度的两倍，把滚子座抬高到读数值的一半，即可精确地补偿螺旋桨轴在这个部位的挠度。

5 Alignment of the gearbox

Aligning the gearbox begins with eliminating the angular displacement.

The illustration shows how this is to be done with the help of feeler gauges. It is important for this measurement that the shafts be turned in one direction only. The accuracy of axial parallelism should be no more than 0.01mm for 100mm of flange diameter.

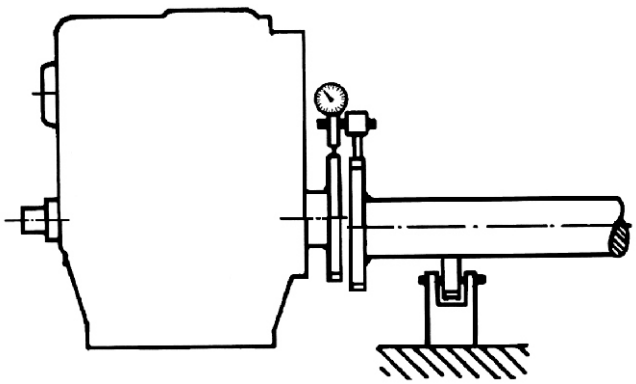
The above illustration shows how the deflection is eliminated for gearbox alignment. A roller block is placed underneath the end flange of the propeller shaft and raised by the amount of deflection ascertained. There are, however, cases where the free end of the propeller shaft due to additional loads is bent more than is required by natural deflection. In this case，an additional dial gauge can be installed near the bearing which indicates the amount of lift required at the shaft end to ensure that the shaft in the bearing is evenly raised. The reading thus taken at the shaft flange dial gauge is twice the value of the actual deflection. Raising the roller block by half of this value corrects exactly the position of the propeller shaft flange.

5. 齿轮箱的找正

5 Alignment of the gearbox

在找正齿轮箱与螺旋桨轴法兰处的平行度后，即可进行轴线偏移的找正。

When the gearbox is arranged parallel to the propeller flange，the axial displacement is to be aligned.



如图所示，测量时把千分表装在螺旋桨轴法兰上，并向一个方向转动，以确保测量准确。同时转动螺旋桨轴法兰和齿轮箱法兰，即可在千分表上读出偏差值，要求的精度是0.025mm（千分表上读数为0.05mm）。

In the illustration it shows the procedure to be followed. Here，turning must also be in one direction only. A dial gauge can as well be mounted in a suitable manner on the propeller shaft flange to ensure correct and true measurements. Propeller shaft flange and gearbox flange are turned simultaneously so that the dial deflection can be read. The required accuracy is 0.025mm(i.e.0.05mm deflection on the dial gauge).

5. 齿轮箱的找正

热膨胀的补偿

通常齿轮箱是在冷态下校正，故须对其安装支架的推进器轴法兰中心之间的竖向热膨胀量给予补偿。

GW系列各种型号和规格的齿轮箱补偿如下图所示：用找正螺钉按图中查明的数值抬高齿轮箱即可得到补偿。

该图除了考虑膨胀的因素外也考虑了轴承的游隙。

该图不适用于贮油槽安置在齿轮箱底座下面的情况，因为在船舶运行期间，底座温度将发生变化。

此外，该图仅适用于齿轮箱，主机的热膨胀补偿则另予考虑。

补偿线Compensation diagram

5 Alignment of the gearbox

Compensation for thermal expansion

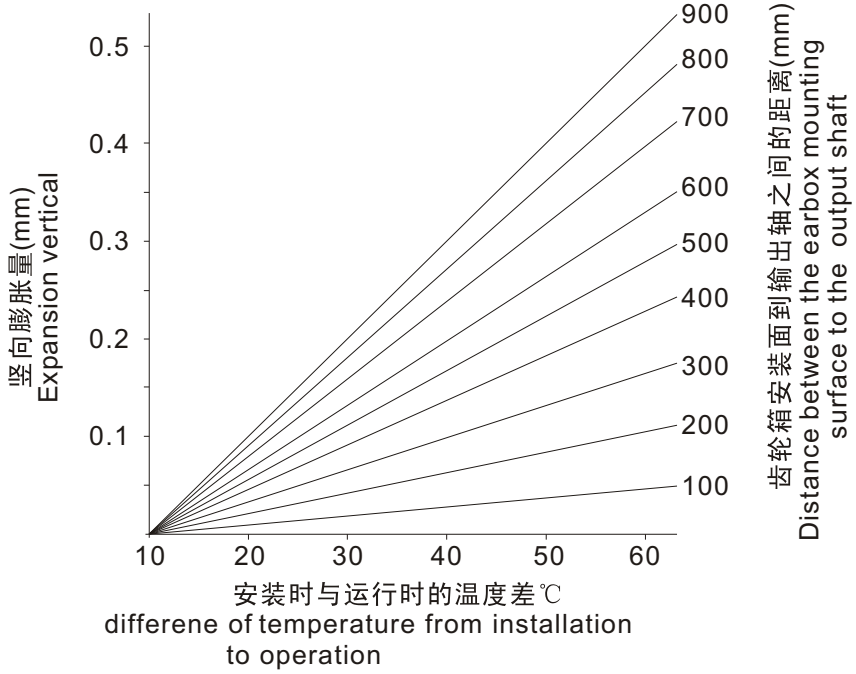
Since as a rule gearboxes are aligned when in cold condition，the amount of vertical thermal compensation between the support and propeller flange center must be compensated for. The following diagram shows the degree of compensation required for various types and sizes of the GW series gearbox. With the help of the aligning screws on which the unit rests during aligning the gearbox is raised by the dimension indicated, to bring it to the position where the gearbox has reached its operating temperature.

The Compensation diagram considers not only the thermal expansion but also the bearing play.

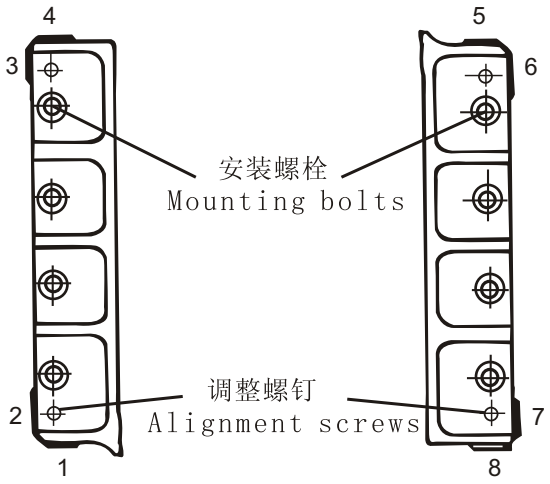
This diagram is not applicable if tanks are to be found underneath the gearbox foundation，which have varying temperatures during the ships operation.

The compensation diagram takes into account only the position changes of the gearbox shafts.

Thermal expansion for the engine are to be observed.



6. 齿轮箱的安装



齿轮箱底座安装图
Foundation Drawing of Gearbox

用铸铁或钢制楔形块调整

1—8挡块支承面

1.调整螺钉为常规随机附件

2.如仅用螺栓固定齿轮箱在底座上，则所有紧固螺栓必须是铰制孔用螺栓，其相配孔预先钻出并铰到紧配螺栓的尺寸。

3.如用止动挡块固定齿轮箱在底座上，则可用一般螺栓，螺栓与其相配孔有一定间隙，应使用8个挡块，其结构原理图如下页示。

4.螺栓强度级别为8.8

抗拉强度：800N / mm^2

屈服强度：640N / mm^2

5.楔形块须符合船级社的要求。

6.Gearbox Mounting

Adjust by means of wedge chocks made from cast iron or steel

1-8.stopper faces(machined)

1.Alignment screws are part of supplied standard accessories.

either

2.If the gearbox is fixed to the foundation with bolts，then all bolts must be fitted bolts. The holes are pre-bored and must be reamed to the next larger clearance bolt size.

or

3.If the gearbox is mounted and fixed with stoppers against the foundation，normal bolts can be used the sizes in the assembly drawings can be taken for clearance of the holes. The bolts can now be chosen to fit.8 stoppers must be used，the principle of which can be seen on the drawings(following page).

4.Use bolts of strength specification 8.8

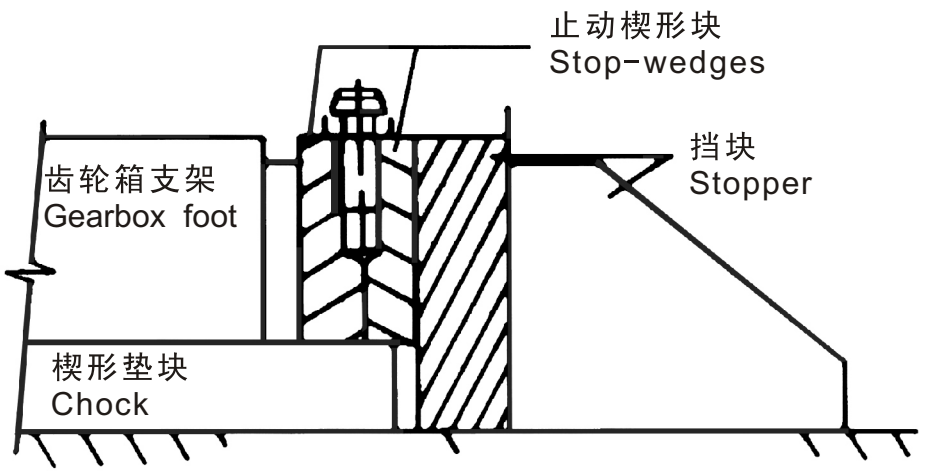
Tensile strength:800N/mm^2

Yield strength:640N/mm^2

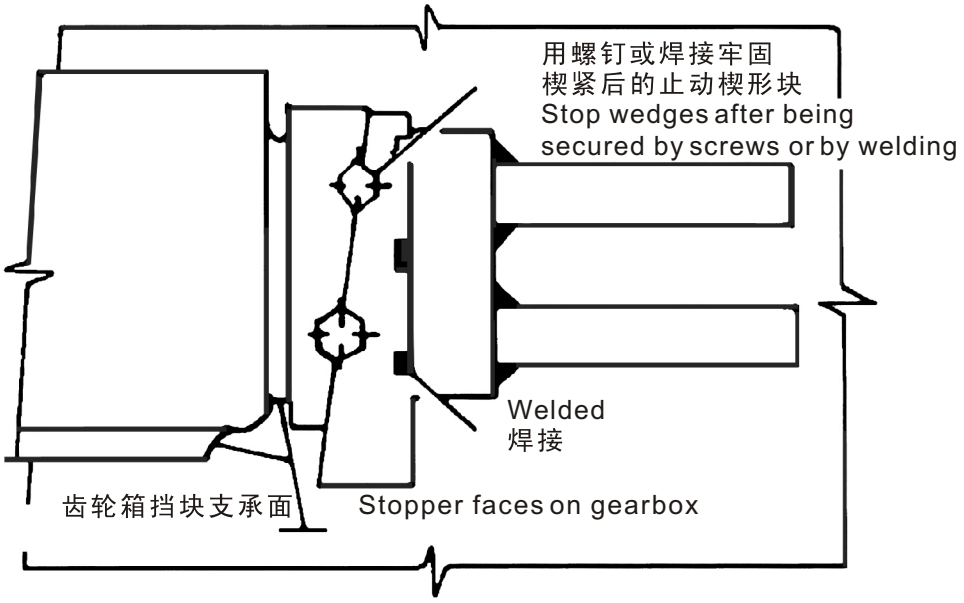
5.The required chocks must conform to the classification requirements.

6. 齿轮箱的安装

6.Gearbox Mounting



齿轮箱底座Gearbox foundation



7. 齿轮箱遥控、操纵阀

可靠遥控装置是船用传动系统的重要组成部份。

GW系列齿轮箱按常规带有1个气动操纵阀，但GWM型齿轮箱带有2个气动操纵阀，1个控制顺车—停止—倒车，1个控制高速和低速，也可采用电动操纵阀。

气动操纵阀，带有气动返回装置，切断气源后亦可手动应急操纵。

齿轮箱操纵阀的细节见本说明书第13节。

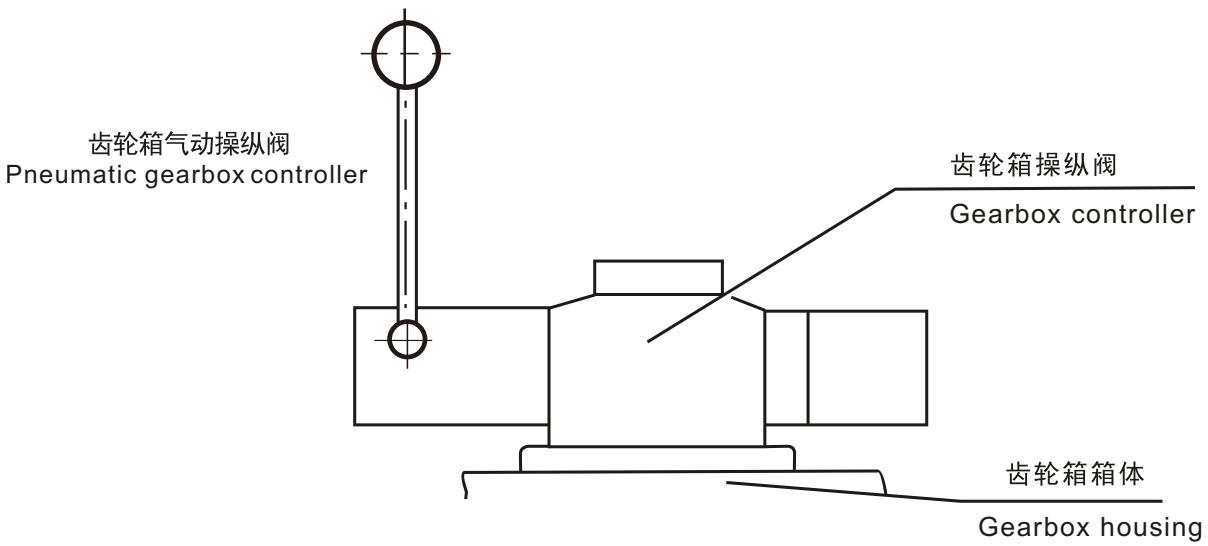
7. Remote control systems for gearbox

A dependable remote control is of great importance for a ships driving system.

GW series gearboxes are supplied, as standard, with one pneumatic gearbox switch. However, GWM gearboxes are normally equipped with two sets of pneumatic gearbox switches, one for switching over between ahead-stop-astern and another for switching between high and low speeds. Electrical gearbox controllers are also available.

Pneumatically operated controller is provided with a return to the stop position through main air. Manual emergency operation is provided when cut off the air.

Further details of the gearbox controllers paragraph also see in paragraph 13 of this manual.



7. 齿轮箱遥控、操纵阀

控制系统的要求(不适用GWM)

为了使发动机调速器与齿轮箱离合器以及制动器(如已安装)相互之间协调动作，须按下列步骤对该系统进行检查：

所有操纵系统均应遵循如下程序。

驾驶台控制

操纵位置　　全速顺车到倒车
或
全速倒车到顺车
或
全速顺车到全速倒车
或
全速倒车到全速顺车

程序

1、控制装置转换到低速位置，使推进器轴转速下降到额定转速60％以下

2、脱开离合器

2.1推进器轴制动器开始制动

2.2推进器停止转动

2.3推进器轴制动器脱开

(如未装制动器，操纵阀应在脱开位置滞留2-3秒)

3、接合离合器

4、离合器接合1.0秒后

5、升速

控制系统必须仔细维护，发现故障应立即排除，操作须谨慎小心！

7. Remote control systems for gearbox

Requirements of the control system (not suitable for GWM)

Even though the tuning of motor governor, gearbox coupling and, if supplied, shaft brake is difficult, it is necessary to perform the following steps to check the system:

The switching sequence for all （switching）systems should conform to the following specifications.

Bridge control

Controller positions:

Full Ahead onto Astern
Or
Full Astern onto Ahead
Or
Full Ahead onto Full Astern
Or
Full Astern onto Full Ahead

Sequence

1 Control unit onto low speed
let the propeller shaft speed drop to 60% of the rated speed or below

2 Coupling in zero position

2.1 Propeller shaft brake engages

2.2 Propeller shaft brake stops

2.3 Propeller shaft brake disengages

(In case without brake，the controller should be retained at zero position for approx.2-3 sec.)

3.Engage coupling

4.Retain switch position for approx.1.0 sec.

5.Increase speed.

The control system must be carefully maintained. Any faults must be immediately repaired. The control units must be handled very carefully.

7. 齿轮箱遥控、操纵阀

7. Remote control systems for gearbox

控制系统的要求(仅适用GWM)

发动机调速器与齿轮箱离合器以及制动器(如已安装)相互之间的完善协调是不容易的，故须按下列步骤对该系统进行检查：

所有操纵系统均应遵循如下程序

驾驶台控制

操纵位置　全速顺车(i1或i2)到倒车

全速顺车(i1或i2)到全速倒车

程序

1、控制装置转换到低速位置，使推进器轴转速降到额定转速的60%

2、脱开离合器

(两个操纵阀均操纵于空车位置)

2.1推进器轴制动器开始制动

2.2推进器轴停止转动

2.3推进器轴制动器脱开

3、接合离合器

(正倒车操纵于倒车位置，高低速操纵阀保持在空车位置)

如未装制动器，操纵阀应在脱开位置滞留2～3秒)

4、离合器接合1.0秒后

5、升速

Requirements of the control system (for GWM model only)

Even though the tuning of motor governor, gearbox coupling and, if supplied, shaft brake is difficult, it is necessary to perform the following steps to check the system:

The switching sequence for all switching system should conform to the following specifications.

Bridge control

Controller positions:

Full Ahead (i1 or i2) onto Astern

or

Full Ahead (i1 or i2) onto Full Astern

Sequence

1.Control unit onto low speed

Let the propeller shaft speed drop to a minimum of 60% of the rated speed

2.Coupling in zero position

(Put both controllers in neutral position)

2.1Propeller shaft brake engages

2.2Propeller shaft stops

2.3Propeller shaft brake disengages

3.Engage coupling

(Put the ahead-astern controller in the astern position and the high-low speed controller is kept in the neutral position)

(In case without brake, the controller should be retained at zero position for approx.2-3 sec.)

4.Retain switch position for approx.1.0sec.

5.Increase speed

7. 齿轮箱遥控、操纵阀

7. Remote control systems for gearbox

驾驶台控制

操纵位置　全速倒车到顺车(i1或i2)

或

全速倒车到全速顺车(i1或i2)

程序

1、控制装置转换到低速位置，使推进器轴转速降到额定转速的60%

2、脱开离合器

(两个操纵阀均操纵于空车位置)

2.1推进器轴制动器开始制动

2.2推进器轴停止转动

2.3推进器轴制动器脱开

(如未装制动器，操纵阀应在脱开位置滞留2—3s)

3、离合器接合

(正倒车操纵阀操纵于顺车位置，高低速操纵阀操纵于i1或i2位置)

4、离合器接合1.0秒后

5、升速

Bridge control

Controller position

Full Astern onto Ahead (i1 or i2)

or

Full Astern onto Full Ahead (i1 or i2)

Sequence

1.Control unit onto low speed
let the propeller shaft speed drop to
a minimum of 60% of the rated speed

2.Clutch in zero position
(Put both controllers in the neutral position)

2.1 Propeller shaft brake engages

2.2 Propeller shaft stops

2.3 Open propeller shaft brake

2.4 Put the ahead-astern controller in the ahead position
(In case without brake the controller should be retained at zero position for approx.2-3sec.)

3.Engage clutch
(Put the high-low speed controller in the i1 or i2 position)

4.Retain switch position for approx.1.0 sec.

5.Increase speed

7. 齿轮箱遥控、操纵阀

驾驶台控制

操纵位置

全速顺车（i1）到顺车（i2）

或

全速顺车（i2）到顺车（i1）

或

全速顺车(i1)到全速顺车(i2)

或

全速顺车(i2)到全速顺车(i1)

程序

1、控制装置转换到低速位置，使推进器转轴转速降到额定转速的60%

2、脱开离合器

（高低速操纵操纵于空车位置，倒顺车操纵阀仍保持在顺车位置）

（如装有制动器，不应该使用制动器制动）

3、离合器接合

（高低速操纵阀操纵于i1或i2位置约1秒）

4、离合器接合1.0秒后

5、升速

控制系统必须仔细维护，发现故障应立即排除，操作须谨慎小心!

7. Remote control systems for gearbox

Bridge control

Controller position

Full Ahead (i1) onto Ahead (i2)

or

Full Ahead (i2) onto Ahead (i1)

or

Full Ahead (i1) onto Full Ahead (i2)

or

Full Ahead (i2) onto Full ahead (i1)

Sequence

1.Control unit onto low speed

let the propeller shaft speed drop to

a minimum of 60% of the rated speed

2.Clutch in zero position

(Put the high-low speed controller at the neutral position and ahead-astern controller is kept in the ahead position)

(Don’t use brake if propeller with brake.)

3.Engage clutch

(Put the high-low speed controller for approx.1 sec. in position il or i2)

4.Retain switch position for approx.1.0 sec.

5.Increaee speed

The control system must be carefully maintained. Any faults must be immediately repaired. The control units must be handled very carefully.

7. 齿轮箱遥控、操纵阀

气动遥控

当按常规操纵阀配备齿轮箱时，采用气动遥控。换向、离合和制动必须按一定的程序，以便操纵平稳。

图示的单手柄控制系统可保证离合器接排和主机转速调节的协调安全可靠。

如有需要可包括轴的制动控制，也可在多个操纵位置进行遥控，而操纵时间仍保持不变。

换向时主机转速不得超过额定转速的60%，控制系统的生产厂应和重庆齿轮箱有限责任公司协商，以满足“紧急换向”操纵的要求。

船舶传动气动控制的设计示例（仅适于GWM型齿轮箱）

序号	名称
1	减压站
2	气包
4	截止阀
6	控制阀
13	减压阀
14	双向止回阀
15	双向止回阀
16	节流止回阀
17	二位三通阀(10kp / cm^2)
19	可调二位三通阀
24	气液三位四通阀
27	控制装置

7. Remote control systems for gearbox

Pneumatic remote control

When the gearbox is equipped with the standard controller, pneumatic remote controls can be used. The reversal speed, the clutch and the shaft brake are essential for a smooth operation over a long period.

The illustrated single-level control system offers safe operation for the clutch engagement and engine speed adjustment

A control for the shaft brake can be connected if required. The system, if wanted, can be operated from numerous control positions. And the control time would not be altered.

When planning the remote control system attention should be paid to:

The switching speed, by which the reversal follows, should not amount to more than 60% of the motor rated speed. An agreement between the supplier and Chongqing Gearbox Co.,Ltd must be made for the requirements of the “Crash-Stop” manoeuvre design.

Design example for pneumatic control of the ships drive (suitable for GWM gears only)

Position	Description
1	Pressure reducing station
2	Air reservoir
4	Stopcock
6	Control valve
13	Pressure reducing valve
14	Double non-return valve
15	Double non-return valve for oil
16	Non-return valve
17	3-way valves 10kp/cm^2
19	Adjustable 3-way valves.
24	Multi-way valve，hydraulic-pneumatic
27	Control unit

7. 齿轮箱遥控、操纵阀

7. Remote control systems for gearbox

船舶推进系统气动控制设计示例的说明

气动遥控操纵船舶传动系统包括主机，倒顺齿轮箱和定距螺旋桨，用单手柄操纵的控制阀6获得所需要的主机转速和螺旋桨的转向。

控制用的压缩空气由减压站1提供，气量为所需的两倍，并须经滤清、工作压力从3MPa降到0.6MPa，在气包2中储存压缩空气，必要时应经排水处理。

控制气则由控制阀6导至控制装置27和气控制操纵阀24，以调整主机和齿轮箱，达到所要求的运行状态。

通过离合器工作油压的作用，装置15和19可确保离合器只能在低速时换排。

当齿轮箱倒车时，通过装置13、17、19和14的组合使用,主机转速略为升高，以便克服推进器惯性。

Pneumatic control ship propulsion system description

This example shows that the pneumatic remote operation system is consisted of motor, reversing gearbox and fixed propeller. With the single-lever operation of the control valve 6, the desired value for the motor speed and the rotation direction of the propeller will be given.

The control air is supplied via a pressure reducing station 1, whereby the doubled supply of air is filtered and reduced from 3 MPa to the operating pressure of 0.6 MPa .In the air-reservoir 2 the air is stored and if necessary, the water shall de drained off.

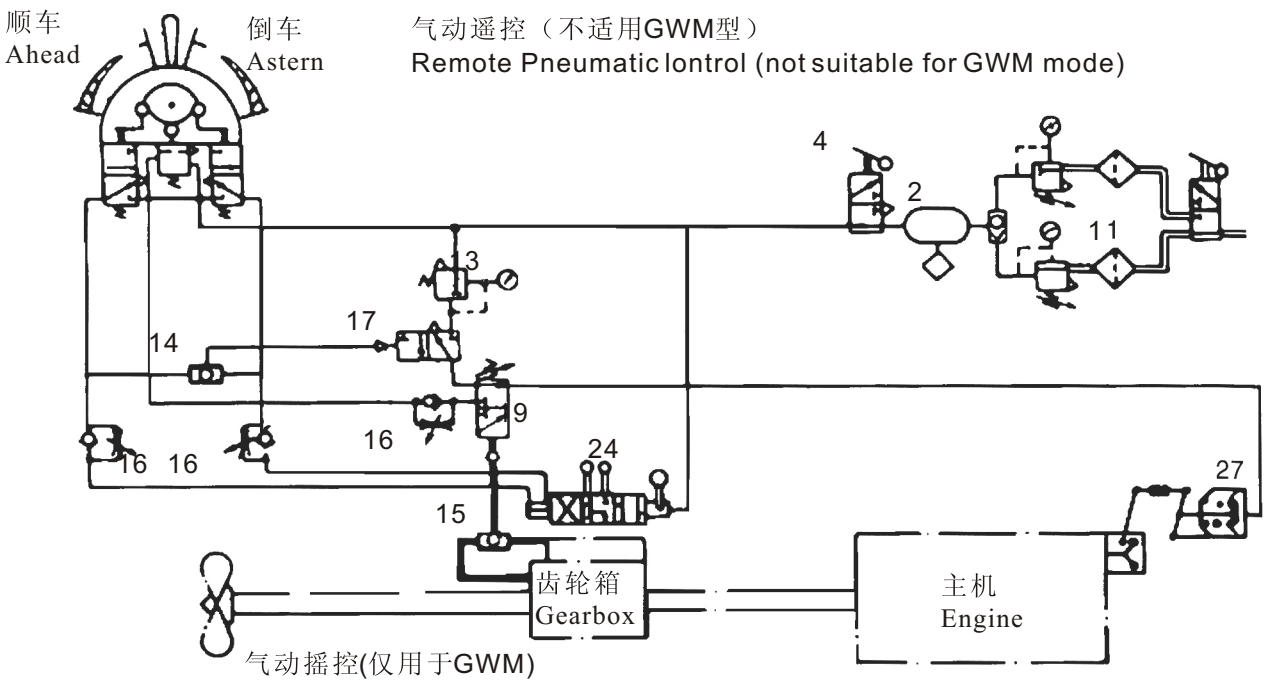
The control air is over control valve 6 which then goes to control unit 27 and then the pneumatic / mechanic multi-way valve 24 for the motor and gearbox to be adjusted into the required operating condition.

Also depending on the switching oil pressure of the clutches, units 15 and 19 make sure that the clutches can only be changed at a low motor speed.

The motor speed is raised slightly by the combination of units 13,17,19 and 14 when the gearbox is in an astern position, so that the motor governs the propeller-inertia.

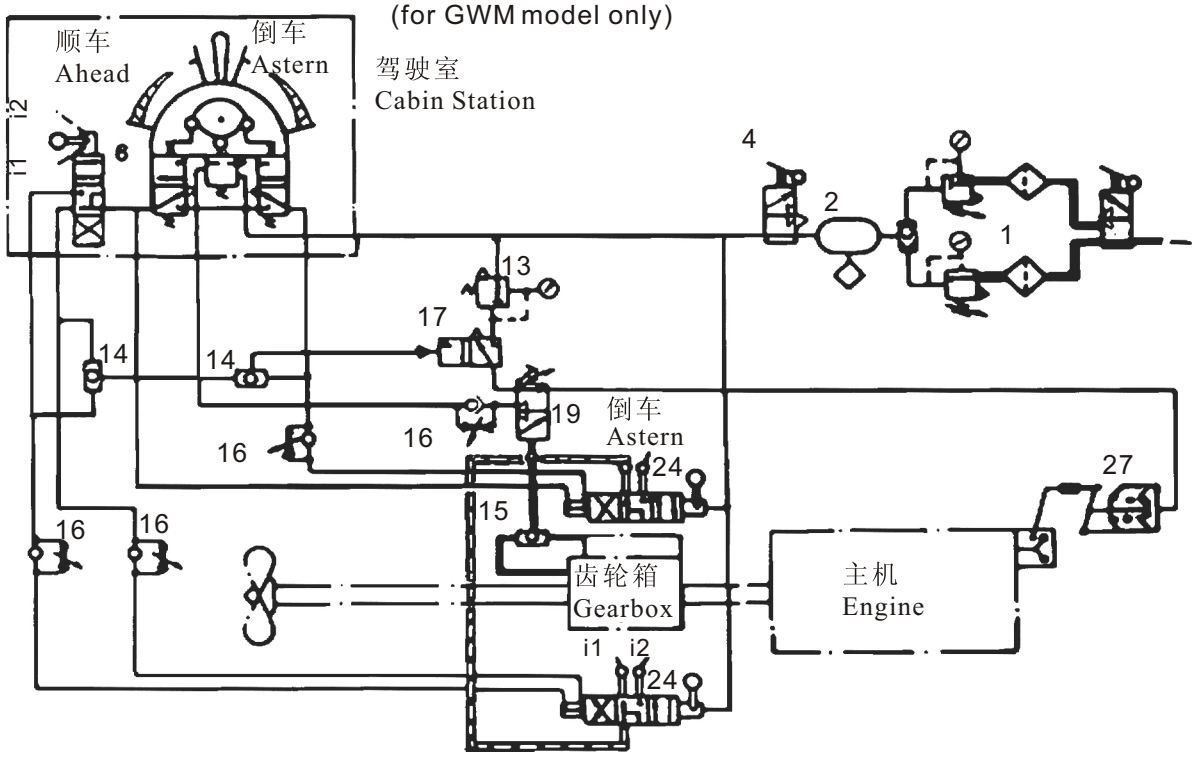
7. 齿轮箱遥控、操纵阀

7. Remote control systems for gearbox



船舶传动气动控制的设计示例
（仅适用GWM型）

Design example for pneumatic control of ship drives
(for GWM model only)



8. 试运转、应急操纵

所有齿轮箱均在本厂内经试车检验合格，控制装置和控制阀均已调整好。

交付时齿轮箱内存油已放净，内部用防锈油保护，该油可与齿轮箱工作油混合而不影响使用性能。

检查工作油路及带有相应单向阀的备用泵油路，并检查滤水器是否已正确安装。

在试运转前注入推荐的清洁润滑油。注油时为防止外部杂物进入齿轮箱，应使用网式过滤器。油面用油标尺测得。油标尺有“静止”和“运转”标记。静止状态的齿轮箱油面应在“静止”的标记之间，运转时的齿轮箱油面应在“运转”标记之间。

8.Initial operation, Emergency operation

All gearboxes are given a test-run and checked by the company in the workshops. The control units and control valves are all adjusted in the workshops.

By delivery the gearbox is without oil and is internally protected by a preservation oil. This oil has the quality to mix without any problem or detriment to the gearbox oil.

Reference must be made to the oil supply diagram to check the working oil circuit and the layout of the stand-by pump with the relative non-return valves. See if the primary water filters are correctly mounted.

Before the first run, the gearbox has to be filled with clean oil according to the enclosed lubricant recommendations. When filling， a closed meshed strainer should be used to avoid foreign matter entering into the gearbox.

The oil level can be read from the dipstick, on which has marks for “ stationary” and “ running” . When taking the oil level reading with a " stationary " gearbox, the oil level must be between the mark " stationary " and with a " running " gearbox between the " running " mark.

8. 试运转、应急操纵

8.Initial operation, Emergency operation

如油面太低，油泵将有吸入空气的危险；如油面太高，运转元件将浸入油中太深而导致额外发热。检查通气帽，因在发运时可能已把它封死。

操纵阀处于“停止”位置，检查主机和推进器轴应能自由相对转动。然后启动主机，把操纵阀手柄在“正车”和“倒车”位置来回扳动几次。最后，在主机怠转下，顺车和倒车各运转5分钟，停车检查齿轮箱油面，必要时补充加油。

在装有独立的备用装置时，试运转前先泵油约2小时。为此，在齿轮箱入油口须装一个滤网，以便挡住外接管路系统中混入的污物。

如果管径超过25mm，则该滤网需衬一个2mm厚的支承盘，盘上开有多个直径约为8mm的孔，以防止一旦污物累积过多损坏滤网，使污物进入管路系统。同时检查外部管路的泄漏。如齿轮箱配有轴承润滑油流指示器，则检查润滑油的循环情况。

If the oil level is too low there is a danger that the oil pump will suck-in air. If the oil level is too high, the rotary components will submerge too deeply into the oil and consequently generate additional heat. As in special cases the vents are closed for transportation, it is necessary to check that the gearbox vents are open.

When the switch is in position “stop”, check that the motor and propeller shaft are running freely. Start the motor and turn the switch lever between “Ahead” and “Astern” several times. Finally, a 5-minute-run in “Ahead” and “Astern” positions respectively should be made while the motor is idling. When it is at a standstill check the oil level and replenish if necessary.

In case of an installation with separate oil pump, the oil must be pumped through the system for approximately 2 hours before the first start. For this a close meshed strainer must be inserted at the oil inlet to the gearbox, in order to catch dirt particles coming from the pipeline system installed after delivery.

If the pipe diameter exceeds 25mm(1″), the strainer has to be supported by a 2mm thick disc with many holes 8mm in diameter approximately, in order to prevent the strainer from being crushed due to dirt accumulation and consequently dirt entering into pipelines. During this pump test, the exterior pipeline system can be checked for leaks.If the bearings are supplied with oil circulation indicators, this gives the opportunity to control the oil circulation.

8. 试运转、应急操纵

然后齿轮箱在部分负载下低速运转直到油温达70℃，检查各结合面和管接头的泄漏情况，必要时予以固紧。然后调整冷却水量，以使全负荷运转时，工作油温保持在正常运行油温范围内。在运行总计达10小时后，检查底座螺栓，必要时再予以固紧。检查所有管接头。

试车程序简述如下：

1.按油路图检查油，水供给系统

2.用说明书推荐的润滑油注入齿轮箱

3.齿轮箱处于“停止”位置，转动主机和推进器轴

4.启动主机,短时间接合 "正车"和"倒车"

5.检查油面

6.部分负载下持续运转，直至达到正常运行油温

7.检查管接头泄漏

8.全负荷运行，调整冷却水流量

9.全负荷运转总计达10小时后，再次拧紧管接头和底座螺栓

8.Initial operation, Emergency operation

The gearbox should be slowly run-in until an oil temperature of 70℃ is reached under a partial loading. Then all joints and connections of the oil pipelines and connecting faces should be checked for leakage and re-tighten if necessary. The cooling system must then be adjusted so that the operating temperature is kept constant within normal range under full load. After a total of 10 operating hours the foundation bolts must be checked and if required tighten again. All pipe connections must also be checked. The following table describes the sequence of operation in an abbreviated form.

1.Check the oil and water supply systems according to oil circuit diagram

2.Fill the gearbox with lubrication oil according to the enclosed lubrication oil specification table

3.Turn the engine and propeller shaft when gearbox in "Stop" position.

4.Start the motor, engage “ Ahead” and “Astern” for a short period.

5.Check the oil level.

6.Operate under partial loading until the operating temperature is reached.

7.Check the connections of the pipelines for leakage.

8.Run at full loading and adjust the cooling water flow.

9.After a total of 10 operating hours under full load re-tighten the connections of the pipelines and the foundation bolts.

8. 试运转、应急操纵

工作油压已在出厂时调定，操纵阀处于“停车”位置时，平均工作油压为0.2-0.6MPa，接排后增高到2.0MPa(3639为1.3MPa)。

在1/3额定转速和在允许的工作油温时，润滑油压不得低于0.04MPa。齿轮箱换向时，用二级控制阀逐步提高工作油压，使接排平稳、柔和，以保护传动装置。

有关二级控制阀后面将作专门论述，滤油器必须定期检查，并保持干净。

如因故不能液压操纵时，可用机械联接，使离合器接合，操纵程序如下

8.Initial operation, Emergency operation

The control oil pressure has been set in the workshop. When the control valve keeps in "stop" position the average working oil pressure is 0.2-0.6MPa and increases to 2.0 MPa (1.3MPa for 36.39 model) when engaging.

The lowest allowed lubrication oil pressure is 0.04MPa at the permissible working temperature and 1/3 rated speed.

To raise the working oil pressure when the gearbox is switching is by means of a built-in two-stage switch. This stage-switch guarantees a smooth engagement and shock-free change of the drive installation and therefore protecting the complete drive system.

The two-stage switch is described in a separate section. The filter must be checked at regular intervals and kept clean.

Emergency operation of the gearbox

If for any reason the hydraulic switching of the gearbox is not possible, then there is always the possibility to block the clutch mechanically.

Do as follows.

8. 试运转、应急操纵

8.Initial operation、Emergency operation

机组停车后把齿轮箱操纵阀手柄扳至“停车”位置。卸下上箱体的检查孔盖，牢固地拧紧应急螺钉，装回检查孔盖，把操纵阀手柄扳至停车位置即可应急操作。

应急操纵时，气控阀不可再使用。

在拖带航行时：

因(在水流冲击下)螺旋桨带转齿轮箱，故应确保滑油（此时备用泵工作）。

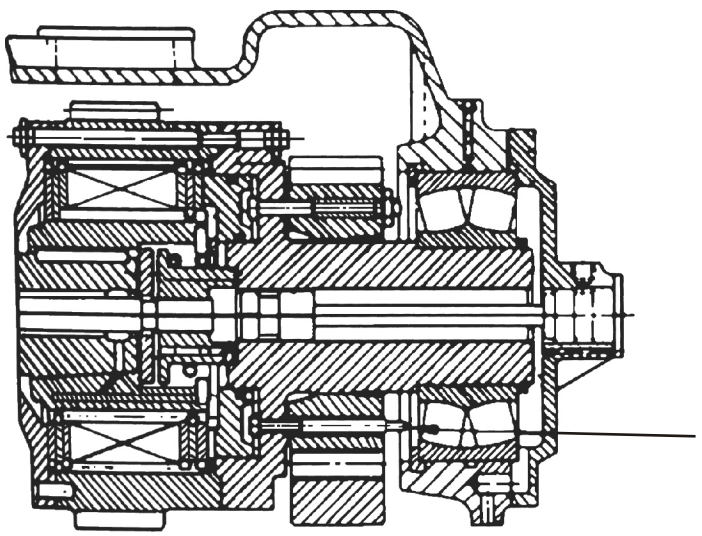
Put the gearbox switch lever in the "stop" position when the installation is at a standstill.

Remove the inspection cover on the upper housing. Remove the locking device of the emergency screw and, firmly tighten the screw. Fix again the inspection cover by means of the screws. And switch the lever to "stop" . The gearbox is now ready for emergency operation.

Pneumatic control valves are not to be used when in emergency operation.

When taken in tow:

When the ship is being towed and therefore the gearbox is being driven by the propeller the oil supply must be assured.(The stand-by pump must be running and the oil pressure existing)



9. 润滑要求

只有下列润滑油可用

CD30或CD40柴油机油

API级：CA、CB、CC、相应为MIL-2104A

粘度级：SAE30

由于GW系列齿轮箱多片摩擦离合器也传递动力，必须使用没有EP添加剂的矿物油，否则会影响离合器的传扭能力。

油组

SOU油不含有影响摩擦性能的添加剂。

粘度组63

其粘度为50-80 cST，相当于在50℃时，其恩氏粘度达6.6到10.5E。

9.Lubrication Instructions

Only the following lubrication oils are to be used:

CD30 or CD40 diesel engine oil

API Class： CA，CB，CC respectively MIL-2104A

Viscosity grade: SAE30

This is mineral oil without an EP additive. This oil brand specification must be strictly adhere to since GW series gear units, incorporate also multiple-plate friction clutches which, in addition to the gearwheels, take part in power transmission.

Oil group

SOU Oils are without additives in friction and wear.

Viscosity group 63

Viscosity from 50 to 80 cSt corresponding to 6.6 to 10.5E at 50℃.

9. 润滑要求

9.Lubrication Instructions

油组SOU63　Oil Group SOU63

公司Firma	油牌号Oil Type
Aral	Aral Kowal M 30
	Aral Motanol HK 100
BP	BP Energol CS68(ISO)
	BP Energol CS100(ISO)
	BP Energol RC100(ISO)
	BP Energol THB 77
	BP Energol OEM30
Chevron	Chevron OC Turbine Oil 150
ESSO	Esstic 100
	Esstic 150
	Teresso 100
FINA	FINA Turbine Oil Extra Heavy
	FINA Solco B30
长城	CD30 Gb11122
	CD40 GB11122
FINA	FINA Dorano 30
	FINA Dilano 30
	FINA Stellano 30
	FINA Cirkan 100
	FINA Solna 100
	FINA Pur finol 30
Fuchs	Renolin LTA 30
	Renolin 20B
Mobil	Mobil D.T.E.Oil Heavy
	Shell Shell Tellus OIC100
	Shell Turbo OIT 100
	Shell Vitrea OI 100
Texaco	Regal Oil R O 150
	Uusa Oil P 100

9. 润滑要求

油　　压　　额　　定　　值		
接排油压（MPa）		
齿轮箱油温：	15°—30°	40°—60°
最低转速※：		
空车油压：	$0.3^{+0.15}_{-0.1}$	$0.2^{+0.15}_{-0.05}$
接合油压：	$1.8^{+0.2}_{-0.1}$	$1.8^{+0.2}_{-0.2}$
	$(1.2^{+0.2}_{-0.1})$	$(1.2^{+0.2}_{-0.2})$
额定油压：		
空车油压：	$0.6^{+0.2}_{-0.1}$	$0.6^{+0.15}_{-0.1}$
	$(0.5^{+0.3}_{-0.1})$	$(0.4^{+0.15}_{-0.1})$
接合油压：	$2.0^{+0.3}_{-0.1}$	$2.0^{+0.2}_{-0.1}$
	$(1.3^{+0.3}_{-0.1})$	$(1.3^{+0.2}_{-0.1})$
润滑油压（MPa）		
最低转速※：		
	最小：0.04	0.04
	最大：0.25	0.15
额定转速：		
	最小：0.10	0.10
	最大：0.40	0.30

二级控制阀接排时间：2—5秒

※相当于1/3额定转速

如实际值与规定值相差太大，则应立即通知本厂用户服务部门

※括号内仅用于GW3639

9.Lubrication Instructions

Rated values for oil pressure		
Switching oil(MPa)when staring normal		
Cearbox temperature	15°-30°	40°-60°
Idling speed*:		
Pre-pressure:	$0.3^{+0.15}_{-0.1}$	$0.2^{+0.15}_{-0.05}$
Switch-pressure:	$1.8^{+0.2}_{-0.1}$	$1.8^{+0.2}_{-0.2}$
	$(1.2^{+0.2}_{-0.1})$	$(1.2^{+0.2}_{-0.2})$
Rated pressure:		
pre-pressure:	$0.6^{+0.2}_{-0.1}$	$0.6^{+0.15}_{-0.1}$
	$(0.5^{+0.2}_{-0.1})$	$(0.4^{+0.15}_{-0.1})$
Switch-pressure:	$2.0^{+0.3}_{-0.1}$	$2.0^{+0.2}_{-0.1}$
	$(1.3^{+0.3}_{-0.1})$	$(1.3^{+0.2}_{-0.1})$
Ludrication oil pressure(MPa)		
Idling speed*:		
	Min: 0.04	0.04
	max: 0.25	0.15
Rated speed*:		
	min: 0.10	0.10
	max: 0.40	0.30

Switching times of the 2-stage-valve 2–5 sec

*approximately 1/3 nominal speed

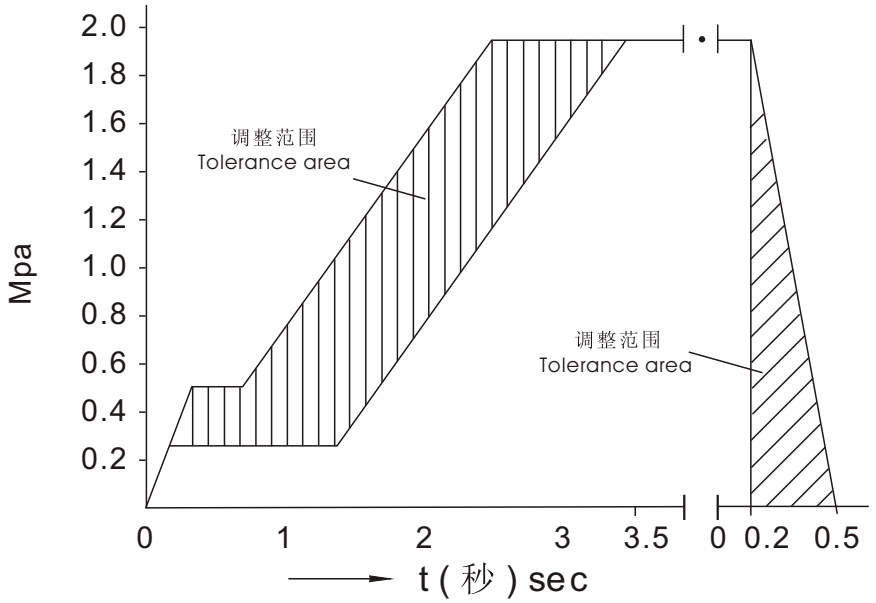
If the actual values differ greatly from the Rated values,immediately inform the CGCL servie department.

*values in bracket only for GW3639

9. 润滑要求 9.Lubrication Instructions

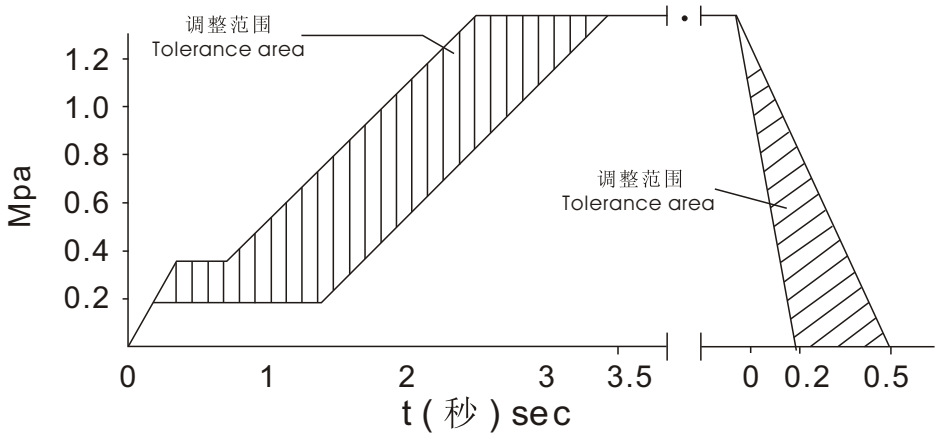
齿轮箱换向阀接合断开后，离合器工作油压力变化图

Pressure relationships in the clutch control pipeline during the gearbox controller engaging and disengaging phases.



上图适用于额定转速时工作油压力为2.0MPa的齿轮箱

The illustration shown is valid for gearbox of which the working oil pressure is 2.0MPa at rated speed.



上图适用于额定转速时工作油压力为1.3MPa的齿轮箱。

The illustration shown is valid for gearbox of which the working oil pressure is 1.3MPa at rated speed.

增加或加厚二级垫圈可提高最终油压。

Add or thicken the washer of 2-stage valve can increase the final oil pressure.

10. 维护保养

每天：检查油位

检查过滤器前后压差（<0.2MPa）

检查齿轮箱的泄漏

检查油压和油温

每周：清洗油滤清器

检查遥控操纵系统

检查冷却水中是否渗进油

每年：检查所有外部紧固螺栓

检查海水冷却器防腐块

更换油：在正常运转时，250个小时后进行第一次换油

以后换油间隔在约2000小时后，最多不超过12个月

在装新油前，要用油将齿轮箱冲洗干净。

10.Gearbox maintenance

Daily: Check oil level

Check the pressure differential before and after the filter (<0.2MPa)

Check the gearbox for leakages

Check the oil pressures and temperatures.

Weekly: Clean the oil filter

Check the remote control operation system

Check oil for cooling water

Yearly: Check all exterior screw connections

Check the protection covering of the seawater cooler if used

Oil change: Under normal service conditions, the first oil change must be after 250 working hours approximately.

Further oil changes must be completed after approximately 2000 service hours, however, not longer than 12 months.

Before filling with new oil in accordance with the enclosed lubricant specifications the gearbox must be cleaned with flushing oil.

11. 注意事项

监控装置

由船厂配置监控装置时，其压力和温度传感器的参数应符合如下要求:

离合器接排时，因全部油充入离合器油缸，使油路短暂失压，这属正常工况，不必报警。故在监控系统中必须有超越装置，它应符合船级社的有关规定。

电动备用泵装置

吸油管和压力油管的90°弯头不得超过4个，吸油管长度不得超过1.5米，压力油管长度不得超过2.5米。

11.Special Notes

Monitoring Equipment

If monitoring equipment has been installed by the shipyard, then the following information must be observed for sensors (pressure and temperature controls) fitted:

When engaging the clutches, the total oil quantity，for a short period，is required to fill the clutch cylinder. This produces the following，that for a short period there is no oil pressure.

The warning of cut-off system is not necessary since manufacturer has taken this particular feature into consideration. An Over-ride mechanism is included in the Warning of cut-off system and conforms to the Classification requirements for manoeuvre operations.

Stand-by electrical pump units

Together the suction and pressure lines may contain no more than four 90° elbows. The maximum suction pipeline length may not exceed 1.5 metres and the pressure line length 2.5 metres.

11. 注意事项

以下内容仅适用密歇尔滑动推力轴承的GW52.59及其以上型号。

更换输出端密歇尔推力块

拆去螺栓卸出轴承盖，卸去径向滑动轴承的上半部，同时连同推力块一起取出推力块座的上半部。

利用推力块座上的圆孔，转动该盘的下半部，取出推力块座和推力块。

复原装配按相反的次序进行，安装新推力块时注意轴转向(见图)。

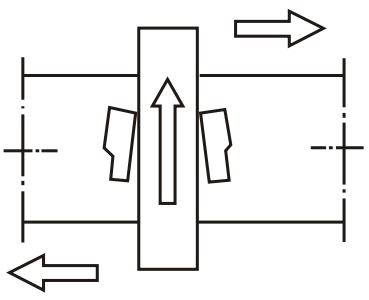
11.Special Notes

Only valid for GW 52.59 or above with Michell thrust bearings. Replacement of the Michell thrust pads on output end:

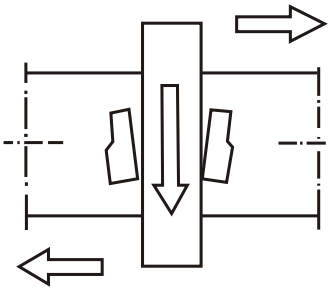
After removing the bolts from the bearing cover vertically. Remove upper part of the radial plain bearing. Lift the upper part of the supporting disk together with the thrust pads.

Turn the lower part of the supporting disk by means of the holes at the circumference and take out the thrust pads and the disk.

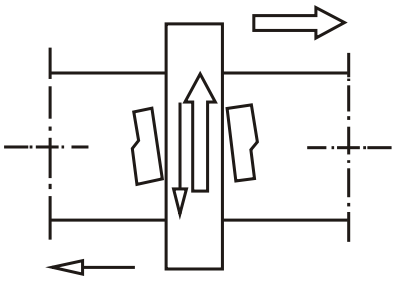
Re-assembling is in the reverse sequence. When installing new pads, take care of the direction of rotation (see sketch).



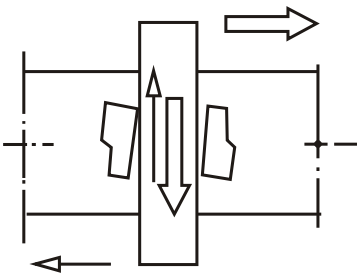
变距桨逆时针转 proreller anti—clockwise



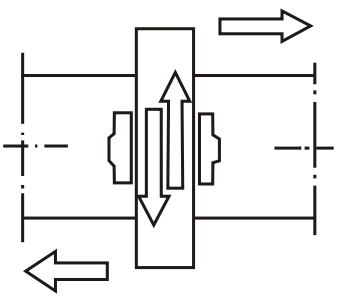
变距桨顺时针转 c.p.proreller clockwise rotation



定距桨顺时针转 Fixed propeller anti—clockwise rotation



变距桨顺时针转 C.P.propeller clockwise rotation



变距桨和逆转主机 C.p.propeller and reversible engine

11. 注意事项

11.Special Notes

密封条(盘根)

1.一般要求

必须把密封条上涂有颜色标记的那一面置于密封槽的底部。否则会损坏封条，使密封失效。如果密封条上无颜色标记，则可以任意装配。切割封条时，必须用锋利小刀，切割面与长度方向成直角。

2.测量和固定

必须仔细测量密封条。在其装入密封槽后，尾端对应处应有微量压缩量，使该处无间隙，以确保密封良好。

Sealing Strips

1.**General Information**

It is absolutely necessary to observe，that the colour marking on the side of the sealing strip lies on the bottom of the sealing strip groove. The total length of the fabric sealing strip has this colour marking. When the sealing strip is incorrectly inserted with the fabric side to the shaft can this fabric sealing strip be damaged. This sealing is inoperative. If there is no colour coding then the assembly is arbitary. To cut the sealing strip a good sharp knife is required. The cut must be at right-angle to the length.

2.**Measuring and Fitting**

The measurement of the sealing strip must be done with great care. Under no circumstances must there be a gap between two adjoining butts of the sealing strips. There must be a slight compression between the two butting ends so as to give a good seal.

11. 注意事项

11.Special Notes

3.跑合运转

在初运转前，密封条的密封面须润滑，运转时为免变干，须持续保持润滑，跑合转速尽可能低。

4.密封条的处置

密封条应储存在凉爽、干燥的库房内，避免与任何液体接触。

如果是卷绕的密封条，则须将绕组起始端远离密封轴，由密封条侧面的刃口可判断绕组的起始端。

(见下图)

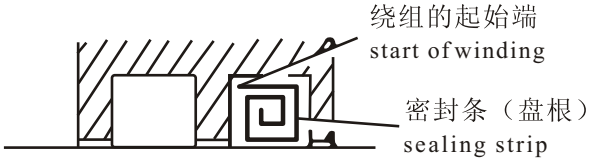
3.**Runing-in conditions**

The sealing area of the sealing strip must be lubricated before the first run. It must be continuously lubricated to avoid the strip drying-up. When systems have an adjustable speed, the running-in of the sealing strip must always be at the lowest possible speed.

4.**Treatment of sealing strips**

Store in a cool room. During storage the strips must not he exposed to a highly humid atmosphere nor must they come into contact with any kind of liquid.

If the sealing strip is wound then the beginning of the winding must be located away from the shaft. The start of the winding can be determined by the frontal cut edge.



rotation(sketch).

如果采用编织的密封条，则可任意装配，装配前应在密封条的滑动面上涂润滑油。用榔头柄把密封条的润滑面涂上润滑油，并在密封条结合处的端头留裕量1.5-2mm，其余部分切掉。

With weaved sealing strips the assembly is arbitrary. Apply oil to the slide way of the sealing strip prior to installation. Press the sealing strip uniformly into the receiving groove using the handle of a hammer.

After pressing in the sealing strip，cut off the ends at the joint leaving 1.5-2mm margin.

11. 注意事项

螺栓的拧紧力矩

拧紧力矩M Nm

	Dr	Schl
M4	2.5	2.4
M5	4.9	4.6
M6	8.5	7.9
M8	21	19.6
M10	42	39
M12	73.5	67.6
M14	114.7	101.8
M16	176.4	166.6
M18	250.8	233.2
M20	357.7	333.2
M22	480	441
M24	617	568

Dr.=用扭力扳手的力矩

Sch1.=用冲击传动扳手（风动扳手）的力矩

本表的力矩值适用于清洁加有少许油的螺栓。

11.Special Notes

Tightening Torques for bolts

Tightening Torques M Nm

	Dr	Schl
M27	902	843
M30	1215	1137
M33	1686	1539
M36	2127	1970
M42	3391	3146
M45	4263	3969
M48	5145	4782
M52	6615	6174
M56	8232	7644
M60	9996	9310
M64	12348	11466
M68	14896	13818

Dr= Torque with torque wrench

Sch1.= Torque with impact driver

The torque values are for clean, lightly oiled bolts.

机械性能/Mechanical properties

强度级别/Strength class		8.8
抗拉强度 σ_b MPa/Tensile strength	Min. Max.	800 1000
布氏硬度HB Brinell hardness	Min. Max.	225 300
洛氏硬度HRC/Rock well hardness	Min. Max.	18 31
0.2屈服极限 $\sigma_{0.2}$/Yie ld point	Mpa	640
延伸率 σ_5/Elongation	%Min.	12
缺口试棒冲击韧性（ISO） Nm.cm^2 min Notched-bar impact strength.		60

12. 故障排除

齿轮箱过热

原因:

1. 齿轮箱油位太高
2. 润滑油压力太低（冷却油量不足）
3. 齿轮箱过载
4. 工作油压太低(离合器发生打滑)
5. 油泵压过高
6. 轴承缺油
7. 轴承损坏
8. 密封填料太紧
9. 冷却器堵塞

排除方法：

1. 调整油位高度
2. 调整润滑油压，到最低允许值，检查油泵出口安全阀，滑油调节阀是否卡死
3. 降低输入功率
4. 调整工作油压（见二级控制阀部分）
5. 清洗滤油器
6. 检查滑油和滑油通道，使之畅通
7. 更换损坏的轴承
8. 适当放松
9. 检查和清洗冷却器

12.Trouble-Shooting

Excessive gearbox temperature

Possible Cause:

Oil level is too high

Lubrication oil pressure too low（ insufficient cooling）

Gearbox is overloaded

Operation oil pressure is too low(clutch is slipping)

Excessive pump Pressure

Bearings are lack of oil

Bearings damaged

Seal too tight

cooler obstructed

Remedy:

Correct oil level

Re-set operating oil pressure to the lowest permitted value, check whether the valve located at outlet of pump, and valve for regulating lube oil are jammed.

Reduce input power

Regulate operating pressure (see2-stage valve)

Clean the filter

Check oil manifold and gallery and ensure that the oil can flow without obstructive.

Replace damaged bearings

Loosen

Check and clean cooler.

12. 故障排除

油压不足
原因:
1. 转向相反(无油压)
2. 滤油器堵塞
3. 油面太低
4. 油粘度太低
5. 油温太高
6. 吸油管堵塞
7. 二级控制阀卡死或损坏
8. 油泵磨损
9. 操纵阀位置不正确
10. 进油接头磨损
11. 快速泄油阀失灵

排除方法:
1. 改变主机转向或齿轮箱转向
2. 清洗滤油器
3. 加油并查出漏油原因
4. 改变油的品质，更换成“推荐的润滑油”。
5. 见“齿轮箱过热”一节
6. 清洗吸油管
7. 更换有关零件或整个二级阀
8. 更换新的油泵传动装置或更换新泵
9. 调整遥控操纵系统
10. 更换新的进油接头
11. 清洗快速泄油阀

12.Trouble-Shooting

Lack of oil pressure
Possible cause:
Wrong direction of rotation (no oil pressure)
Filter obstructed
Oil level too low
The viscosity of the oil is too low
Oil temperature too high
Suction pipe obstruction
2-stage valve is defective or jammed
Pump drive is defective
Pump wear control valve position is not correct
Wear of the oil supply joints
Quick release valve in failure

Remedy:
Reverse engine rotation or alter the gearbox rotation for other direction
Clean filter
Refill with oil and trace cause of oil loss
Change to an oil conforming to the “recommended lubricants”
See “Excessive gearbox temperature”
Clean suction pipe
Replace defective parts or the complete 2-stage valve
Renew the pump drive
Adjust remote control operation
Renew oil supply joints
Clean quick release valve

12. 故障排除

螺旋桨达不到与柴油机相应的转速

原因：

1. 压力表失灵，表值高于实际油压值
2. 工作油压太低
3. 齿轮箱操纵阀的手柄不能准确地处于“顺车”位置
4. 齿轮箱操纵阀故障
5. 螺旋桨轴承损坏
6. 离合器摩擦片安装不正确
7. 离合器摩擦片损坏
8. 离合器密封环损坏
9. 离合器花键损坏

排除方法：

1. 更换压力表并调整油压
2. 清洗滤油器
3. 检查工作油路和两级压力调整遥控操纵系统
4. 更换操纵阀
5. 更换磨损的轴承
6. 正确装配摩擦片
7. 更换损坏的摩擦片
8. 更新密封环
9. 修理花键齿或更换零件并检查是否超过临界转速

12.Trouble-Shooting

The propeller does not reach the corresponding speed of the motor speed

Possible cause:

Pressure gauge defect higher pressure working as in reality

Control oil pressure too low

Gearbox controller is not exactly in the “Ahead” position

Gearbox controller defect

Damaged propeller shaft bearings

Clutch plates in the incorrect sequence

Clutch plates broken

Sealing rings of the clutch damaged

Splines of the clutch are worn

Remedy:

Change pressure gauge and re-adjust oil pressure

Clean filter

Check the remote control system and adjust the remote control system

Replace controller

Replace worn bearings

Mount the clutch plates correctly

Exchange damaged linings

Replace with new sealing rings

Re-work the teeth or renew the part check the installation at critical speed ranges

12. 故障排除

在“停车”位置螺旋桨不停转

原因：

1.船舶继续滑行水流驱动螺旋桨

2.齿轮箱操纵手柄不能正确地停在“停车”位置

3.齿轮箱操纵阀故障(离合器工作油路失控)

4.离合器摩擦片挠曲

5.密封环损坏

6.离合器花键损坏

7.离合器返回弹簧失效

排除方法：

1.等船舶完全停止

2.调整遥控操纵系统

3.更换齿轮箱操纵阀

4.更换离合器摩擦片

5.更换密封环

6.修理花键齿轮或更换该零件

7.清洗离合器，必要时更换弹簧

12.Trouble-Shooting

The propeller does not stop turning in “Neutral”

Possible cause:

The vessel is still moving and the propeller is being driven by a water current

Gearbox controller is not directly on the “stop” position

Defect gearbox controller (uncontrolled oil to one clutch)

Clutch plates broken

Sealing rings damaged

Splines of the clutch damaged

Release springs not working

Remedy

Wait until the vessel at a complete standstill

Adjust the remote control operation

Replace gearbox controller

Renew clutch plates

Renew sealing ring

Re-work the teeth or renew the part

Clean clutch and if required replace springs

12. 故障排除

齿轮箱噪音
原因：
1.空车转速在临界转速范围内
2.齿轮箱在临界转速范围内运转（噪音不是在整个转速范围内出现)
3.输入法兰松动
4.油面太低（泵吸入空气）
5.吸油管漏气（泵吸入空气）
6.滤油器堵塞（油泵超压）
7.油泵传动不正常，如齿轮损坏或松动
8.柴油机和齿轮箱严重失中
9.齿轮箱轴承损坏
10.混入外来物导致损坏齿轮
11.因超载使齿轮在轴上松动
12.螺旋桨损坏
13.输出法兰松动
14.齿轮箱的输出端与轴系严重失中

排除方法:
1.提高空车转速
2.齿轮箱避开临界转速运转
3.拧紧松动的法兰或更换损坏的法兰
4.调整油面
5.紧固吸油管上所有的配合件
6.清洗滤油器
7.修复或更新损坏的零件
8.重新找正
9.更新损坏的轴承
10.研摩损坏的部分如有必要更换齿轮
11.重新固紧该齿轮
12.修理后重新安装螺旋桨
13.重固紧法兰如法兰损坏则予更换
14.重新找正

12.Trouble-Shooting

Gearbox noise
Possible cause:
Idle speed is within a critical range
Gearbox runs within the critical speed range (The noise is not to be observed throughout the whole speed range)
Input flange loose
The oil level is too low (pump sucks in air)
Suction pipe not tight (pump sucks in air)
Filter choked (excessive pump pressure)
Pump drive not in order (Gearwheel damaged or loose)
Extreme misalignment between engine and gearbox
Gearbox bearings damaged
Gear wheels are damaged by foreign matter
The gear rims are loosened due to overloading
Gear wheels are loose on the shaft due to overloading
Propeller damaged
Output flange is loose
Extreme misalignment on the output side of the gearbox and shafting

Remedy:
Increase idling speed
Avoid running the gearbox continuously in the critical range
Tighten the flange or replace when damaged
Correct oil level
Tighten all fittings on the suction line
Clean filter
Repair damaged parts, or replace
Realign the whole installation
Renew damaged bearings
Grind the damaged area and， if necessary replace the gear wheel
Re-tighten the gear rims
Re-tighten the wheels
Re-set propeller and eventually repair
Re-tighten the flange and replace if damaged
Realign installation

12. 故障排除

12.Trouble-Shooting

在齿轮箱换向时柴油机可能熄火，为此，柴油机须加大油门，使柴油机功率在换向时瞬间大于螺旋桨传递的功率。

原因：

空转转速太低

工作油压太高，接排速度太快

齿轮箱操纵阀发生故障

(离合器工作油路失控)

离合器摩擦片损坏

离合器花键损坏

离合器快速泄油阀弹簧失效

密封环损坏离合器活塞卡死

排除方法：

提高空转转速

降低工作油压到额定值

更换齿轮箱操纵阀

更换离合器摩擦片

修理花键齿或更换该零件

清洗离合器，在必要时更换该弹簧

更换损坏的密封环

Stalling of the engine during reversing

To avoid a discrepancy between absorbed propeller input and engine output torque which would stall the engine when engaging the gearbox clutch, the fuel injection to the engine and thus the speed must be suitably increase during clutching.

Possible cause:

The idling speed is too low

The operating pressure is too high, therefore, engagement is too quick

The gearbox controller is defect (uncontrolled at oil circuit to one clutch)

Clutch plates are damaged

The splines of the clutch are damaged

The release springs do not work

Pistons of the clutch are jammed, seals damaged

Remedy:emedy:

Increase the idling speed

Reduce the operating pressure to normal value

Replace gearbox controller

Replace damaged clutch plates

Re-work the splines or renew the part

Clean the clutch. Replace the springs, if necessary

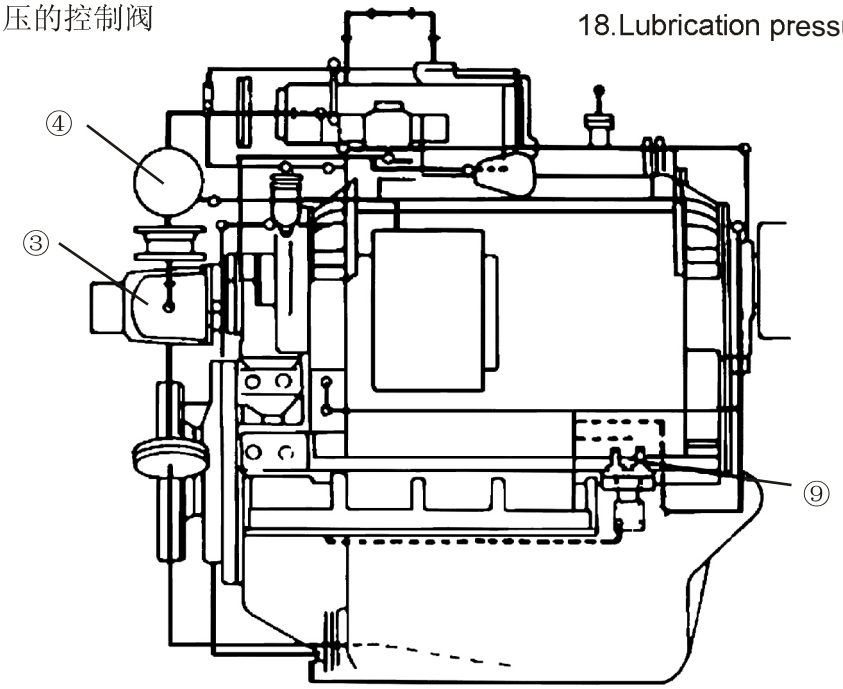
Renew damaged seals.

13. 常规附件

13.Standard Accessories

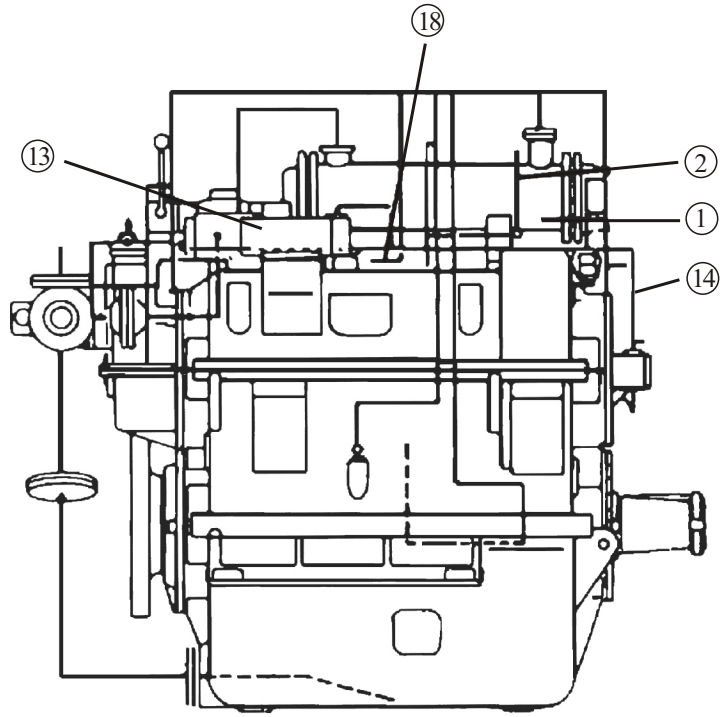
常规供货范围
1.冷却器
2.冷却器放气塞
3.齿轮油泵
4.润滑油滤清器
5.工作油滤清器(不是所有型号都有)
6.注油器
7.油标尺
8.工作油压力表
9.带有油流指示器的油温表(从GW52.59)
10.齿轮箱操纵阀
11.齿轮箱通气帽
12.止回阀
13.二级控制阀
14.离合器工作油管路
15.备用泵接头
16.备用泵(特殊订货)
17.由船厂提供的管路
18.润滑油压的控制阀

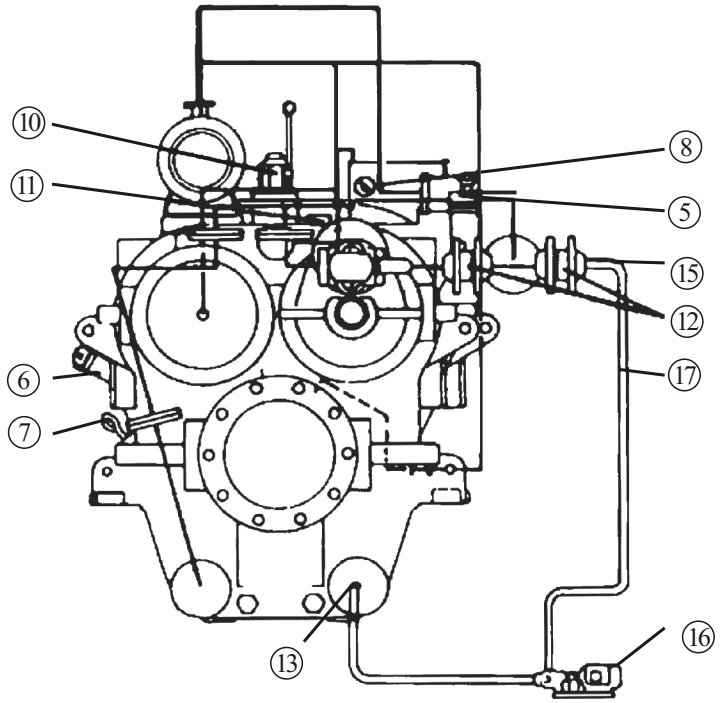
Standard scope of Supply
1.Oil cooler
2.Oil cooler-vents
3.Gear oil pump
4.Filter for lube oil circuit
5.Working oil filter (not for every version)
6.Oil filler 7.Dipstick
8.Pressure gauge for control oil pressure
9.Thermometer with oil indictor(from size 52.59)
1O.Gear controller
11.Gear vent
12.Non-return valve
13.2-stage regulating valve
14.Pipe for control oil supply of clutch
15.Connection for stand-by pump set
16.Stand-by pump set (special order)
17.Pipes (supplied by shipyard)
18.Lubrication pressure regulating valve



13. 常规附件

13.Standard Accessories

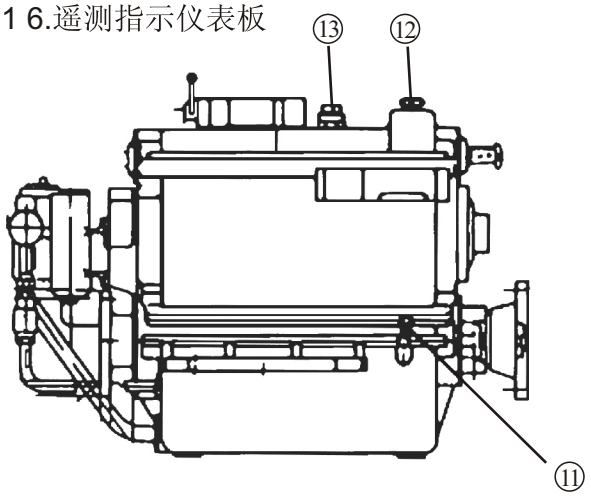


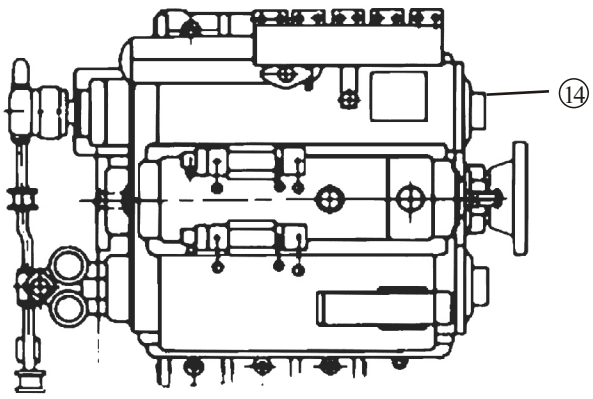


13. 常规附件

常规供货范围(仅适用于GWM)

1.冷却器　　2.齿轮泵
3.齿轮箱操纵阀(控制顺车和倒车)
4.齿轮箱操纵阀(控制i1和i2)
5.二级控制阀　　6.止回阀
7.备用泵接头　　8.滤清器
9.安全阀　　10.备用泵(特殊订货)
11.油标尺　　12.齿轮箱通气帽
13.注油器　　14.润滑油压控制阀
15.离合器快速泄油阀（装在多片摩擦离合器缸体上）
1 6.遥测指示仪表板

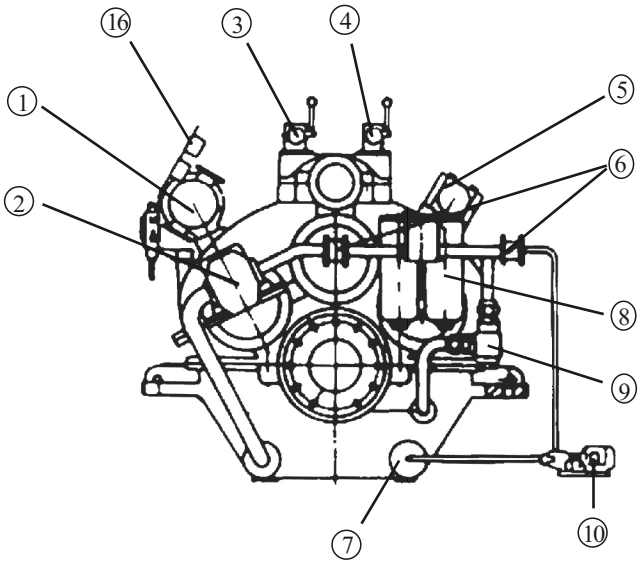




13.Standard Accessories

Standard scope of Supply(only for GWM model)

1.Oil cooler
2.Gear oil pump
3.Gear controller(control Ahead and Astern)
4.Gear controller(controli andi2）
5.2-stage-valve 6.non-return valve
7.Connection for stand-by pump set
8.Filter
9.Relief valve
10.Stand-by pump set（special order）
11.Dipstick
13.oil filler tube
12.Gear vent
14.Lubrication pressure regulating valve
15.Clutch release valve(buit on to the bousing of the multiple plat clutch)
16.Instrument panel for remote-indicators

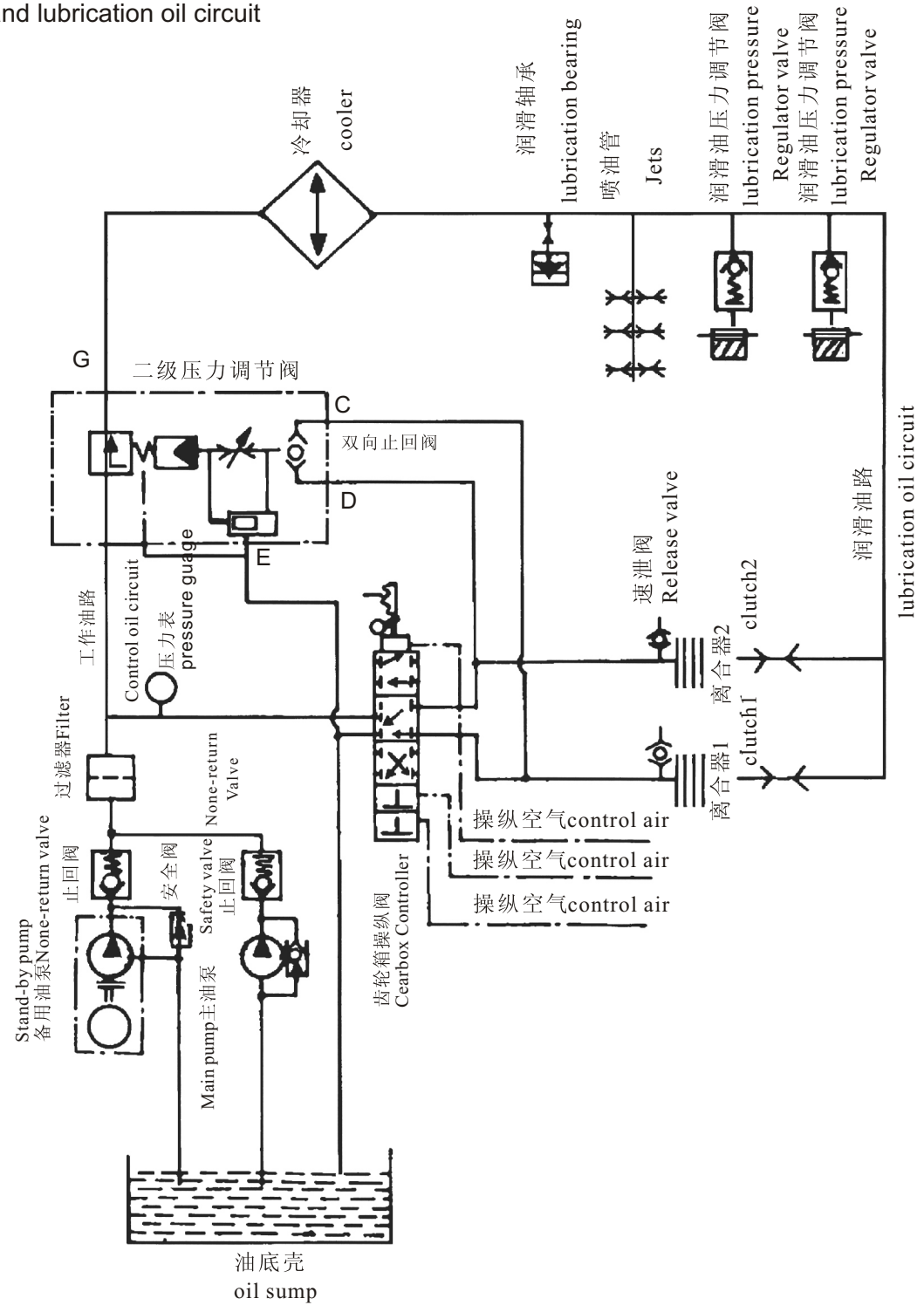


13. 常规附件

13.Standard Accessories

工作和润滑油路图

Control and lubrication oil circuit

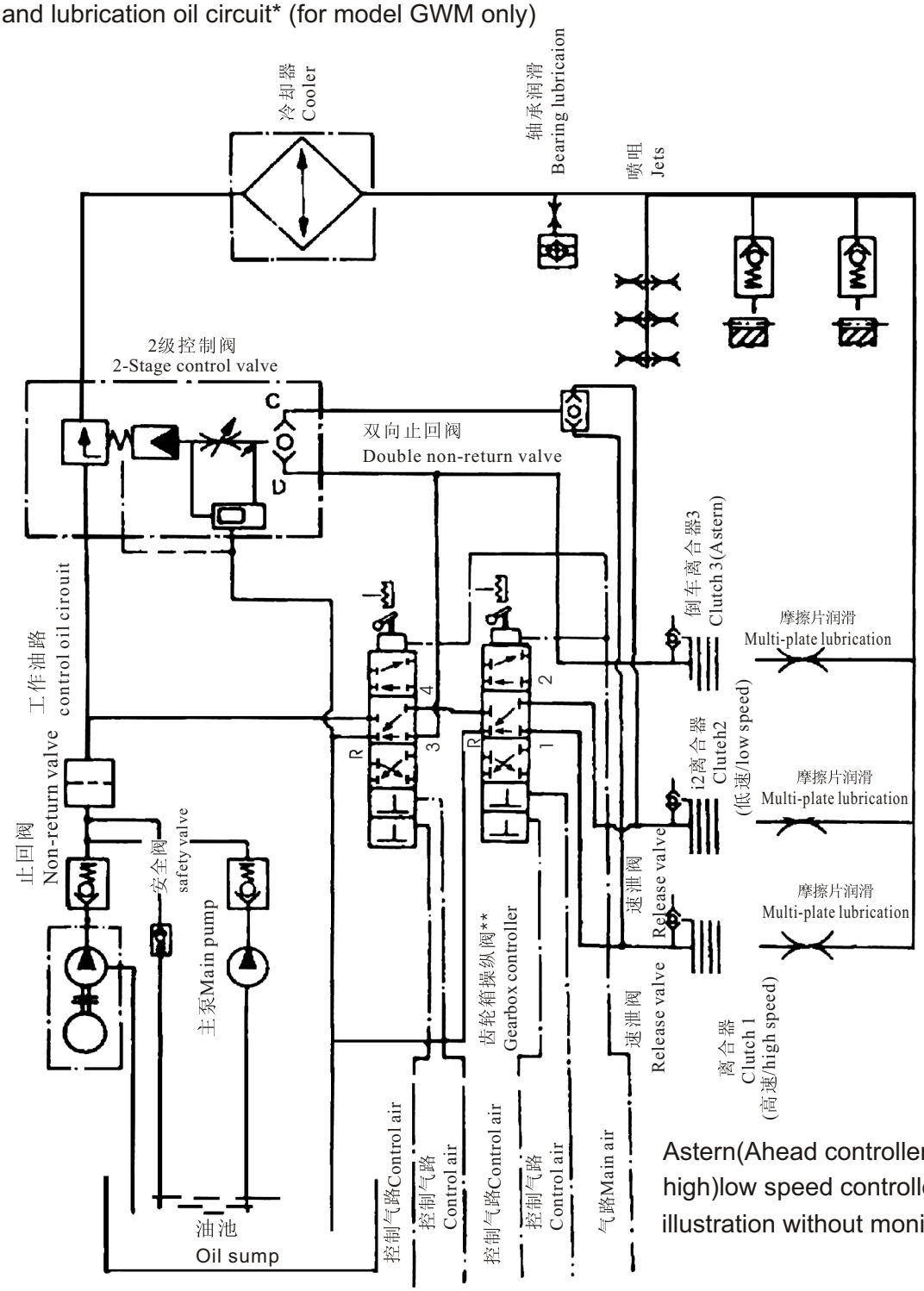


13. 常规附件

13.Standard Accessories

工作和润滑油路图(仅适合于GWM)

Control and lubrication oil circuit* (for model GWM only)



Astern(Ahead controller

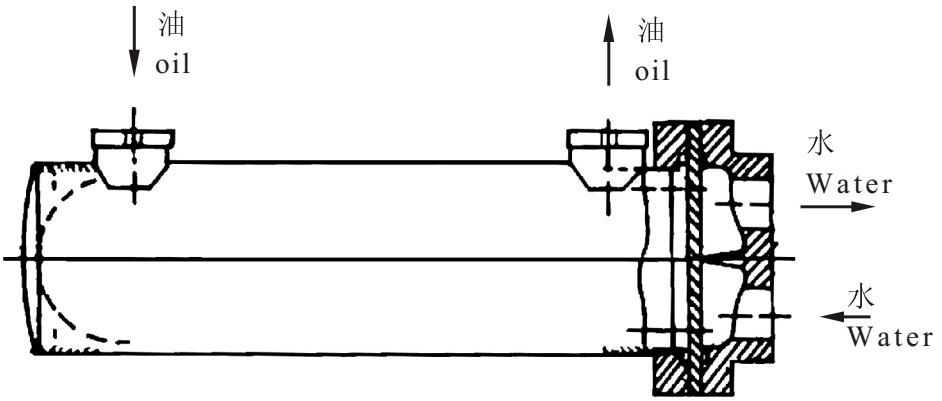
high)low speed controller

illustration without monitoring units

13. 常规附件

13.Standard Accessories

13.1冷却器 Oil cooler



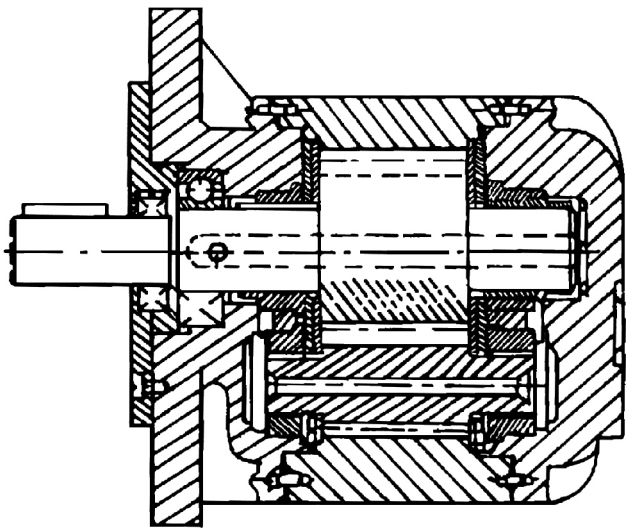
13.2齿轮油泵Gear oil pump

1.通常油泵运转时，无需对油泵注油。但必需避免空腔(断油)运转。

1.Normally when putting into operation the filling of the pumps is not necessary. But dry operation must be avoided.

2.转向：油泵转向可以变更，但一旦确定后只能单向运转，试车时先空负荷短暂驱动油泵以检查油泵转向是否正确。

2.Direction of rotation: Pumps must only rotate in the given direction after operation, but it is possible to alter the direction of rotation. To check the direction of rotation the motor can be switched on and off for short periods, only as the pump is filled and has no load.



13. 常规附件

13.Standard Accessories

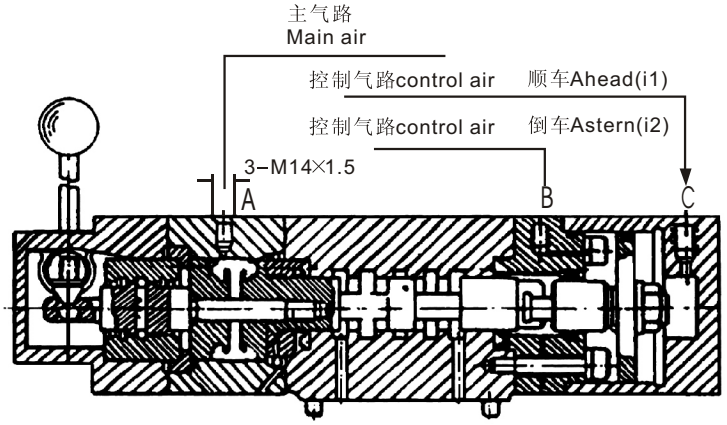
13.3齿轮箱操纵阀

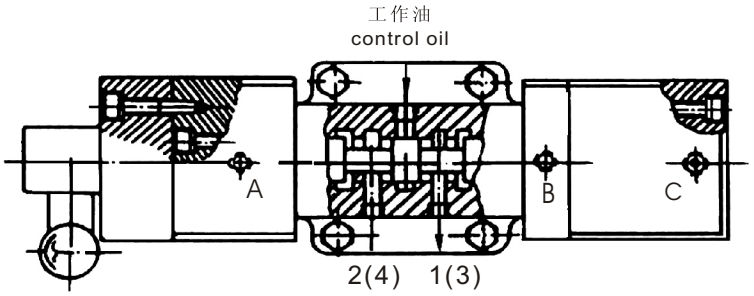
GWM系列齿轮箱按常规有两套气动操纵阀，一套用于顺车—空车—倒车之间的转换，而另一套用于高速(i1)和(i2)。只有当正倒车操纵阀换到正车位置时，高低速操纵阀才能起控制作用，即可置于高速或低速状态，两套操纵阀在形态和结构上完全一样。

除GWM系列齿轮箱外均只带有一套气动操纵阀。

气动空气压力p=0.6～1.2MPa

气动返回装置的气动操纵阀CZ—00
本阀仅用于GW3639以上型号和GWM各型





13.3 Gearbox controller

The GWM series gearbox are supplied, as a standard with two sets of pneumatic gearbox controllers, one for switching over between ahead-neutral-astern and another for switching between high speeds[(i1) and (i2)]. Only when ahead-astern controller is set to ” ahead" position, high & low speed controller can perform the above-described operation. These two sets of pneumatic gearbox controllers are identical in shape and construction.

Except GWM series, each gearbox is equipped with one set of pneumatic controller.

Air pressure p=0.6-1.2MPa.

Gearbox controller with air return device CZ-00 Only for gears sizes bigger than 3639 (including 3639) and GWM gears.

13. 常规附件

13.Standard Accessories

气控操纵调压阀

气控操纵调压阀具有换向和压力调节两个功能。能用压力为0.6-1.2MPa的压缩空气实现遥控，也能通过手柄实现机旁操纵。压力调节可使离合器实现软接排。本阀仅用于GW3235以下型号，不适用于GWM型。

原理同电控操纵调压阀。

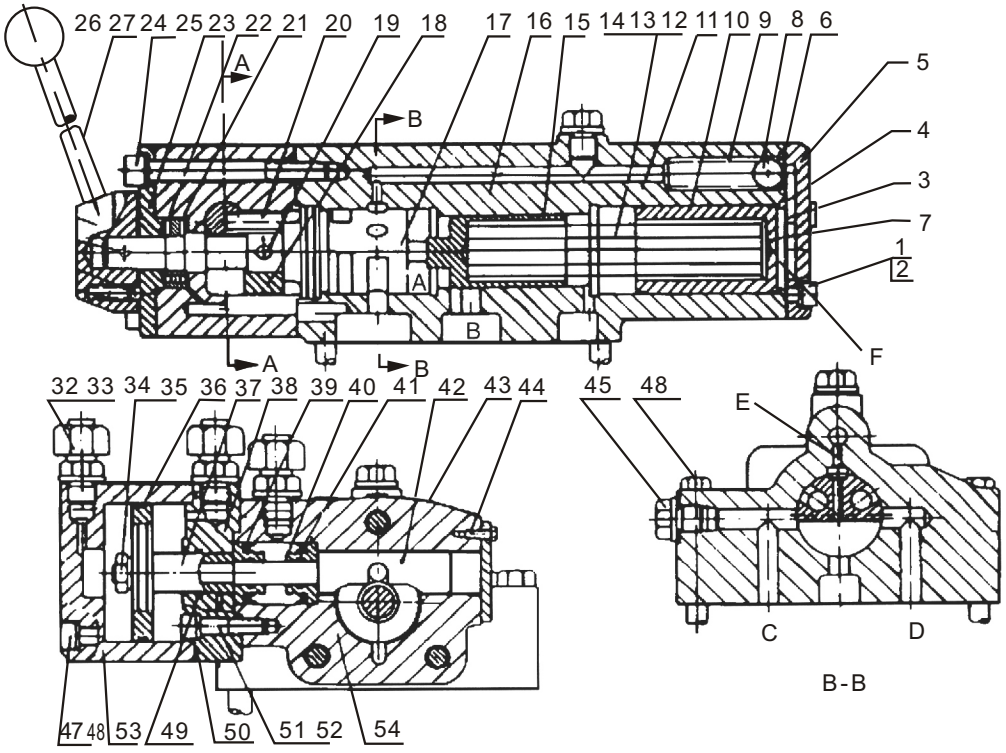
进气管接头螺纹直径为M14×1.5，选配气管为Φ8×1

Gearbox controller pneumatically operated

This device has two functions: reversing and oil pressure regulation. The remote control can be realized by the air of which pressure is 0.6~1.2MPa.The manual operation can be realized nearby the gearbox. Oil pressure regulation is to make the clutch engaging smoothly. This device is not suitable for GWM gears, but only used for gears sizes less than GW3235.

The principle of this device is the same as gearbox controller electrically operated.

The thread diameter of the connection for air manifold is M14×1.5, and suitable air manifold size is Φ8×1.



13. 常规附件

13.Standard Accessories

电控操纵调压阀

电控操纵调压阀具有换向和压力调节两个功能。能用直流24V电源实现遥控，也能靠手柄实现机旁操纵。压力调节可使离合器实现软接排。本阀仅用于Gw3235以下型号，不适用于GWM型。

1.空车　空车时，正车、倒车和增压三条油路与油底壳相通。油泵来的油流到空腔A，压缩弹簧并通过B孔流向润滑油路。

2.离合器接合

正(倒)车操作时，工作油通过D(C)流向离合器。同时经E和件6上的小孔流到空腔F，致使空腔A内油压逐渐升高，实现正(倒)车离合器全压接合。

3.离合器脱开

正(倒)车→空车操作时，D(C)与油底相通，使离合器速泄阀迅速泄油，离合器实现脱开，同时弹簧顶开钢球8，空腔F内的油从E孔迅速排出，使工作油路的油压也迅速下降。

(4)调整

齿轮箱出厂前，二级操纵阀已经调好，一般不必调整。

调整件6，可改变工作油路升压时间。加大孔径可缩短升压时间。

调整件4，可改变工作油路的空车油压。加长件4可提高空车油压。

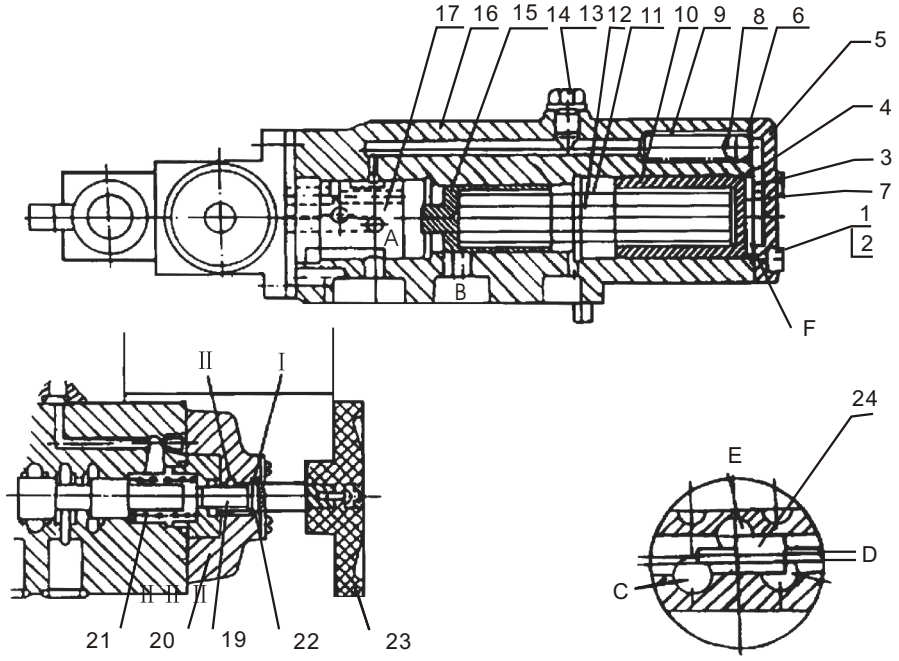
调整7，可改变工作油路的工作油压，增加件7的厚度可提高工作油压。

手柄操纵的方式:

空车操纵:将电磁铁两端的手柄(件23)向外拉出

正(倒)车操纵:将正(倒)车电磁铁两端的手柄向里推进。

注意:在电磁遥控时，电磁铁两端的手柄必须置成空车操纵，否则，电磁控制不起作用。



13. 常规附件

13.Standard Accessories

Gearbox controller electrically operated

The gearbox controller electrically operated has two functions: reversing and oil pressure regulation. The remote control is available by DC 24V. The manual operation can be realized by handle nearby the gearbox. Oil pressure regulating is to make the clutch engaging smoothly. This device is not suitable for GWM gears but only used for gears sizes less than GW3235.

1)Neutral

In neutral position，the oil circuit of ahead，astern and increasing pressure are connected with the oil sump. The oil from the pump flows to chamber A, compresses the spring，then flows to the lubrication circuit through hole B.

2)Clutch engaging

During ahead(astern) operation，the control oil flows to the clutch through D(C), meanwhile pare of oil flows to chamber F through E and the hole in the part 6, so the clutch is engaged under full pressure after that the oil pressure in chamber A is increasing gradually.

3)Clutch disengaging

During operation from ahead(astern)to neutral position the clutch disengages after that D(C)is connected with pump and the oil in clutch discharges quickly through the clutch release valve, meanwhile the spring pushes off the steel ball 8, oil in chamber F discharges rapidly from hole E and the oil pressure fall down quickly.

4)Adjustment

2-stage value is set in the works, re-adjustment is normally not necessary.

Adjust parts 6: enlarge the hole diameter to shorten the time of pressure raising.

Adjust parts 4: lengthen part 4 to increase oil pressure in neutral position.

Adjust part 7: thicken part 7 to increase working oil pressure.

Manual operation

“Neutral” operation: Pull out the knob(part 23) at the both ends of the electric magnet.

Ahead (or astern)operation: Push in the knob of ahead(or astern)located at the end of the electric magnet

Attention!

For remote control，the knobs must be in the neutral position，otherwise remote control is inoperative.

13. 常规附件

13.Standard Accessories

13.4滤油器

Filter

滤油器的清洗：

1.在运行200—300小时后或在初运转后以及积累污物较多时，即需卸下滤清器芯进行清洗。滤油器进出口压力差不得超过0.2MPa，以避免滤油器芯破裂

Cleaning of the filter:

After the initial operation or approximately 200~300 hours of operation，the filter element has to be removed and cleaned. The pressure difference between the filter inlet and outlet can not exceed 0.2 Mpa, otherwise the filter element may be broken.

2.必须在主机停止状态下，才能旋转滤油器转换阀。

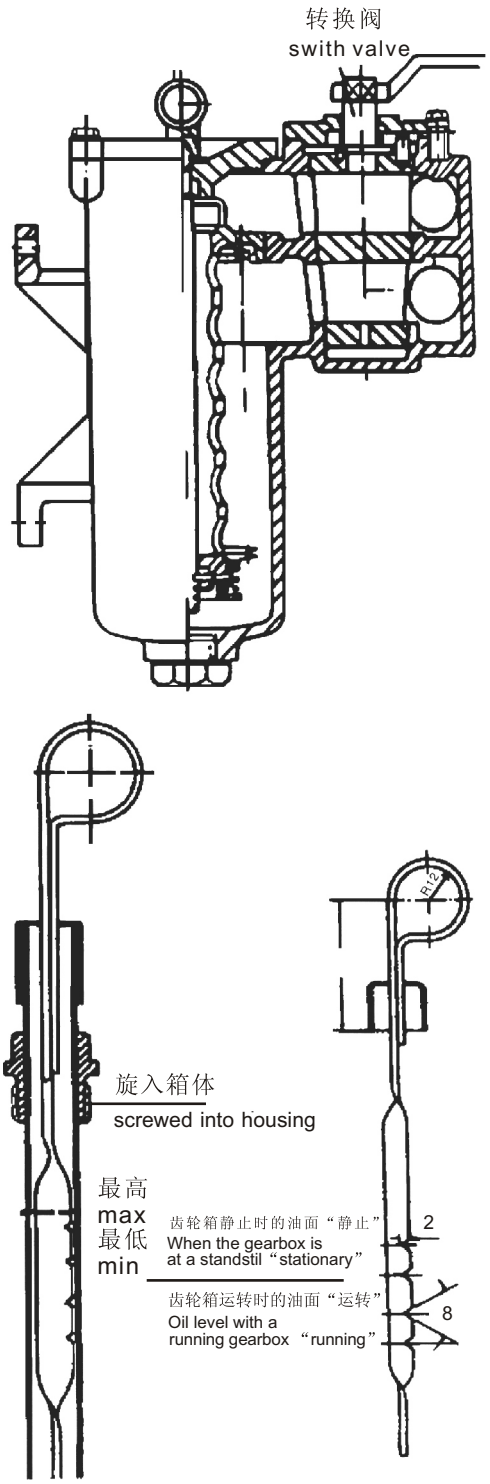
Don’t turn the switch valve until the engine stops.

3.根据齿轮箱型号不同，滤油器可能有不同的型式。

The filters are available varying from different gears sizes.

13.5油标尺:

Dipstick



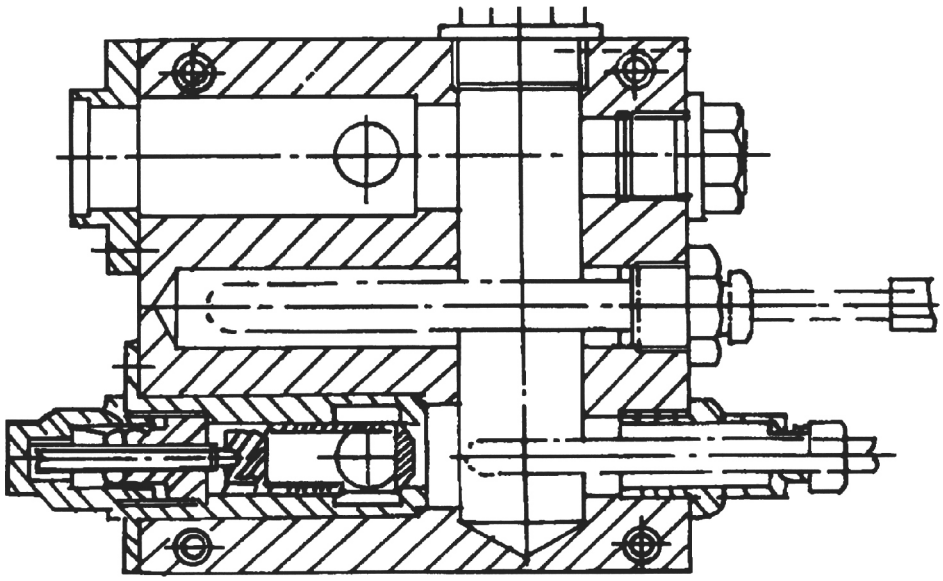
13. 常规附件

13.Standard Accessories

13.6润滑油压控制阀

Lubrication oil pressure regulating valve

不是所有型号齿轮箱都有这个阀。



13. 常规附件

13.Standard Accessories

13.7阀板

阀板是联接工作油路、润滑油路和操纵调压阀的部件。

在阀板上设有工作油压和润滑油压力的测压接头各一个。另外还设有四个润滑油温度测量孔。

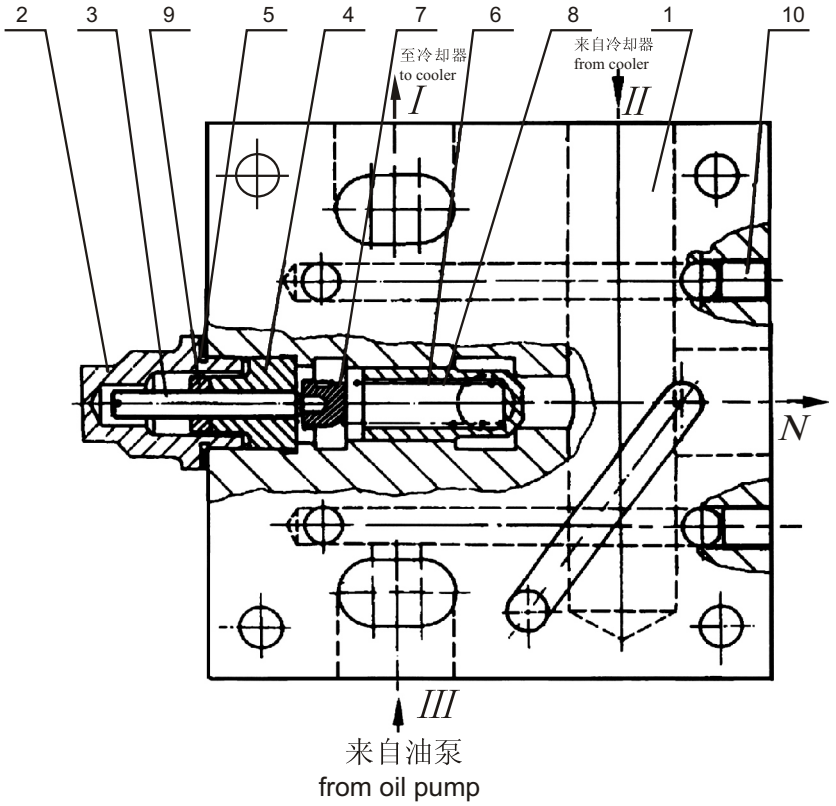
阀板具有润滑油压力调整功能。调整件3可改变润滑油的压力。向外旋出可降低润滑油压力，向内旋进可升高润滑油压力。

不是所有型号齿轮箱都有这个阀

13.7 Valve plate

Valve plate is a component for connection of control & lubrication circuits and the gearbox controllers.

There are two connecting points on the plate for measuring control oil and lube oil pressures respectively, and four additional measuring holes for measuring oil temperature. The valve plate has the function of regulating the oil pressure. Screwing part3 out to decrease the oil pressure, screwing in to increase the pressure.



13. 常规附件

13.Standard Accessories

13.8 二级压力控制阀

在“试运转”这节中简述了齿轮箱二级控制阀，它使离合器接排平缓。工作油路和润滑油路图为原理图，示出工作油路和润滑油路，未包括全部管路和监控装置。

工作油路与润滑油路之间用二级控制阀隔开、各种工况下油压和接排时间见“润滑要求”这节。

13.8 2-stage pressure regulating valve

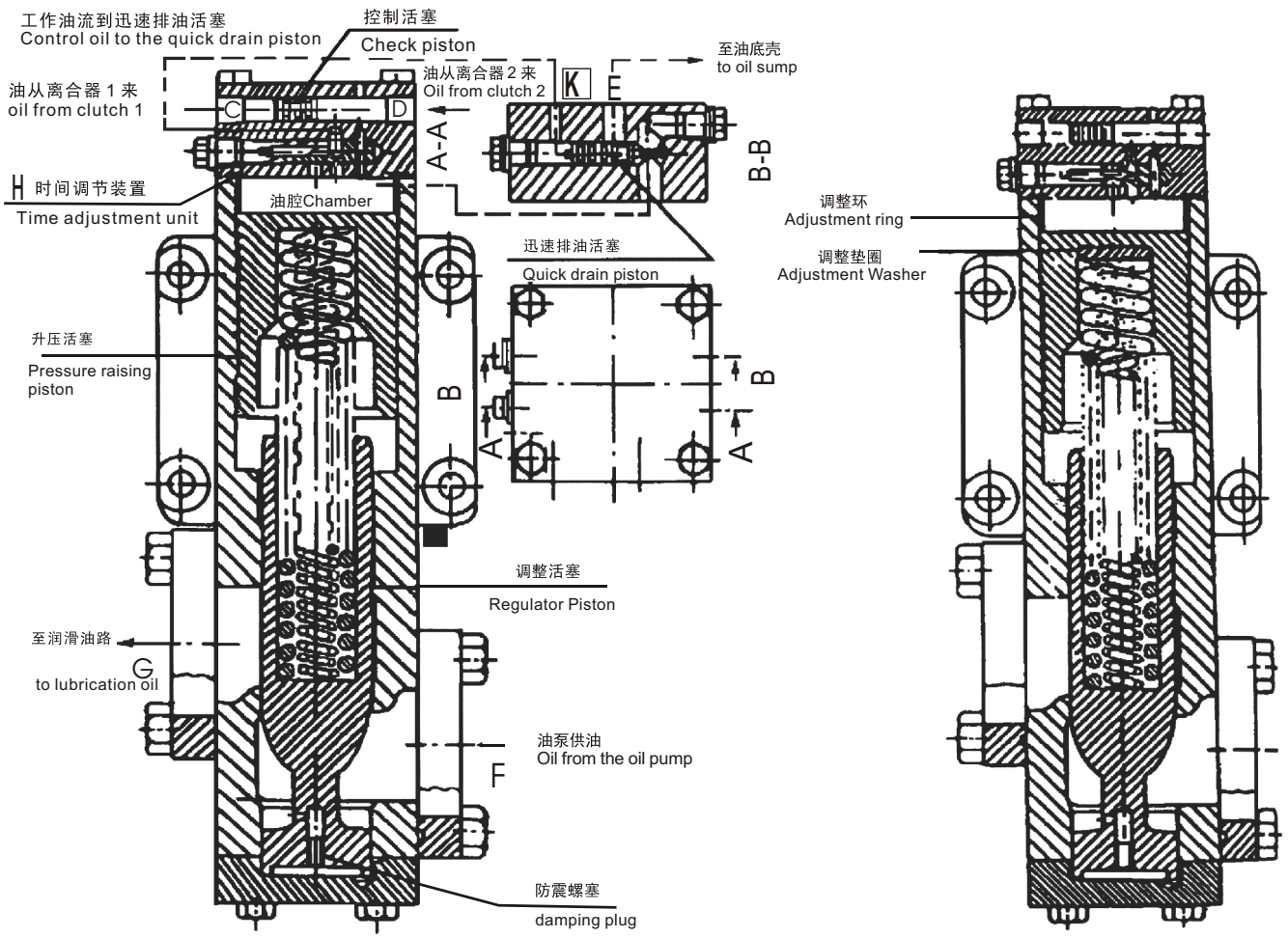
As is briefly described in the "Initial operation” chapter，the gearbox is supplied with a 2-stage valve, which makes smooth engagement of the clutch. The control oil circuit and lubrication circuit are arranged as in the control diagram To simplify the diagram，not all the pipelines are shown and the monitoring units are also not considered.

The oil circuit consists of the control oil circuit and the lubrication oil circuit. The separation of these two circuits is by means of the 2-stage control valve.

Oil pressure and engagement times under the various operating conditions see section ” Lubrication Instructions”.

13. 常规附件

13.Standard Accessories



13. 常规附件

13.Standard Accessories

二级控制阀工作原理

以下内容是针对GWM型进行叙述的，其它类型工作原理类似。

齿轮箱空转，离合器脱开工况：

齿轮箱操纵阀处于“停车”

离合器1，2和3通过齿轮箱操纵阀的接口1，2和3与回油路R相通，直通油池，二级阀的接口C，D亦无压力，并与操纵阀1(或2)3接口相连，通向回路R及油池，接口E也与回路R相连，直通油池，来自油泵的油，由接口“F”，经二级阀，从接口“G”排出.

操纵阀处于“停车”时，接口“C”，“D”和“E”均无压力，升压活塞弹簧经轻微压缩，产生预压，油液经过二级控制阀，进入润滑油路。

齿轮箱接排、离合器接合工况：

齿轮箱操纵阀处于“顺车”(i1或i2)或“倒车”操纵阀接口1(或2)或3与离合器1(或2)或3接通二级阀的接口C或D与接口1(或2)或3接通。

2-stage control valve description

The description in the following is for GWM gears and other models of gears are similar in principle of operation.

Idling of the gearbox. Clutch not engaged:

The gearbox selector is in the stop position.

The clutches 1，2and 3 are connected via the gearbox selector connections1, 2and 3 with the return flow R to the gearbox oil sump. The connections C and D of the 2-stage valve are also pressureless and connected via the gearbox selector connections 1(or2)+3 to R and the oil sump. The same happens to connection "F" to connection "G". Oil from the oil pump flows to the 2-stage valve via connection "F" to connection "G".

In this selector position the connections "C"."D" and "E" are pressureless. And it is the spring assembly on pressure raising piston that is lightly stressed and produces the pre-pressure. The oil comes into the lubrication oil circuit through 2-stage valve.

Engaging the gearbox. Clutch engaged:

When operating the gearbox selector the connection in "ahead" position (ilori2) or connection 1(or2) or 3 in "astern" position is connected to clutch 1(or2)or3. Connection "C"(D) of the 2-stage valve is connected to connection 1(or2) or 3.

13. 常规附件

13.Standard Accessories

进入接口C(或D)的油液，推动闭锁活塞向D（C）口移动、该活塞把离合器1（或2）和3隔开，其功能与双向止回阀相同，来自接口C（或D）的油压进入接排时间调节器H，该调节为一节流阀，作逆时针旋转则使建立油压的时间缩短。

注意！

必须遵守规定的接排时间，否则将导致摩擦片损坏。

油液经时间调节器“H”，进入“升压活塞腔”，使该活塞弹簧强烈压缩，使离合器工作油压升高，同时时间调节器“H”中的油流经接口K，推动快速放油活塞，封住回油接口E。

离合器脱开

油路与齿轮箱空转同时，“升压活塞腔”泄油到油池，因接口K失压，在弹簧的返回力经油压作用下使快速放油活塞退回，从而使“升压活塞腔”的油液泄回油池，因此二级阀可适于频繁换向的工况。

Thereby， oil reaches the clutch and 2-stagevalve at the same time. The oil which enters connection "C"(D)moves the checking piston in the direction of connection "D"(C).The checking piston serves to separate the clutches 1(or 2)+3,the function being like that of a double return valve. The oil from connection "C"(D)reaches the time adjustment "H". The time adjustment consists of the receiving hole with jet needle and the chamber Un-screwing the jet needle (anti-clockwise) shortens the pressure build-up time.

Attention!

See control time. The given time must be adhered to, otherwise it can lead to multiple plate damage.

The oil that flows via the time adjustment unit "H" into the chamber actuates the pressure raising piston， which the spring assembly strongly stresses. Though this the clutch oil pressure raises. At the same time the remaining oil at the time adjustment "H" flows via the connection "K" passes the quick-drain piston and thereby blocking oil return flow "E".

Disengaging the clutch

The connections are the same as in "Idling of the Gearbox". However, draining of the

chamber is additionally required. Through cessation of the pressure at connection "K"

the quick drain piston is not held in position. Because of the return force of the spring

assembly via the pressure raising piston on the oil in the chamber, the quick drain piston rises and the oil flows to the oil sump. Hence, the 2-stage valve is also suitable for high control frequencies.

13. 常规附件

13.Standard Accessories

泄油时间不大于1秒钟。

二级控制阀调压

1.二级控制阀已在出厂时调定，一般无须重调。

2.调整环用于调节二级控制阀的预压力(见图)

加长此环可提高预压力。

缩短此环可降低预压力。

3.调整垫圈用于调节离合器最终工作油压(一般不加该垫圈)。

增加或加厚垫圈可提高最终油压。

卸去或减薄垫圈或缩短弹簧可减小最终油压。

4.在正常运行油温和额定转速下调定工作油压，在齿轮箱空转和冷态情况下校检。

5.油压调定值见“润滑要求”这一节。

Drain period-max.1 sec.

Pressure adjustment for 2-stage valve

1.The 2-stage valve has been adjusted in the works. Readjustment is normally not necessary.

2.Adjustment ring is used for control the pre-pressure of the valve (see sketch)

Lengthening the ring may raise the pre-pressure, while shortening the ring may lower the pre-pressure.

3.The adjustment washer is to adjust the final oil pressure of the clutch. (Normally no adjustment washer is provided)

Adding or strengthening of the washer produces a rise in the final pressure. Removing or making thinner or shortening the spring reduces the final pressure.

4.Ascertain the control pressure at operating temperature and nominal speed. Check at idling and with gearbox cold.

5.For values see Lubrication Instructions.

13. 常规附件

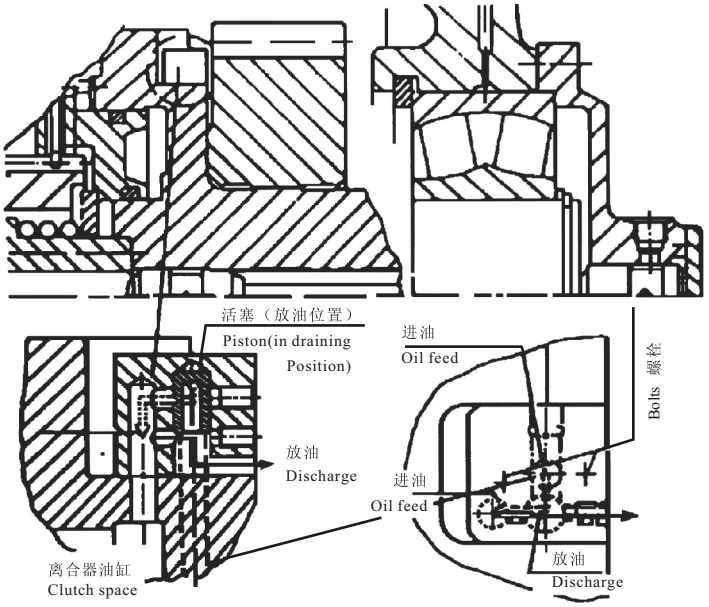
13.Standard Accessories

13.9 离合器速泄阀

在脱开离合器后，该阀使离合器能尽快返回原位，工作油切断后，该阀活塞上的油压消失，弹簧力和离心力使活塞返回到原来位置，离合器油缸中的油液即可泄出。

13.9 Clutch release valve

The release valve has the task of putting the clutch into a renewed working place as quickly as possible after being disengaged. After the disengagement of the clutch, the retaining pressure on the piston is released by centrifugal force and spring force the piston is put into the limiting position. The clutch volume is then discharged into the gearbox.



13.10 附注

本产品形式如有变动，将在说明书再版时予以修订。

13.10 Notes:

Any modification for the product description will be revised in the new issue.