R E I N T J E S

S E R V I C E M A N U A L

Twin Input-Single Output Reduction Gear

with Hydraulically Operated Disc Clutches

Type	:	DVAL 1818	
Reduction	:	3,048:1	
Work No	:	54 536	54 535
	:	54 538	54 537

Direction of Rotation	Port Gear	Starboard Gear
Input :	clockwise	anticlockwise
Output :	anticlockwise	clockwise

Contents

Eisenwerke REINTJES GmbH
P.O.Box 10 13 44
D-3250 Hameln
Federal Republic of Germany

Telex 9 2 862
Telephone (05151) 104-0
Telefax (05151) 104-300

OPERATING MANUAL DVAL 1818 1/90-E

CONTENTS

1 General Particulars and Function

1.1 General Particulars

REINTJES marine reduction gearboxes of type DVAL are horizontally offset, single stage spur wheel gearboxes with built-in, hydraulically operated disc clutches.

Both input shafts are symmetrically arranged to the output shaft.

1.2 Direction of Rotation

The direction of rotation marked on the name plate is the direction of rotation of both input shafts and the output shaft looking in the direction of travel.

The output shaft is turning in the opposite direction to both input shafts.

If both engines have a direction of rotation other than that indicated on the name plate, it is essential to check back with the works because alterations might be necessary.

1.3 Lubrication

The gearbox is supplied without oil. Before start-up, the gearbox should be filled up to the top mark on the dipstick with an oil in accordance with our enclosed lubrication recommendation.

The gearbox is equipped with two symmetrically designed, separate pressure oil systems including the connections for the electric standby pumps.

Notice
For the connection of the left and right standby pump to the left and right side pressure oil system pay attention to the drawing of installation.

Each input shaft drives a gear pump, which generates the oil pressure, adjusted by a spring loaded pressure limiting valve in each systen.

Both pressure oil systems are feeding into the mutual lubrication oil system.
Even when starting or operating one engine only with idling speed, an adequate quantity of lubrication oil is availabe, which is fed to the meshing and the whole bearings through pipes and portings.

Concerning setting and control of the oil pressure please refer to para 5 Maintenance.

1.4 Oil Quantity

Gearbox type: DVAL 1818
Quantity of oil in litres: 800

The exact quantity of oil is marked on the name plate. The bottom part of the housing is designed to contain the necessary quantity of oil, a separate tank is not needed.

1.5 Oil Filter

A duplex filter is fitted in each pressure oil system.

1.5.1 Duplex Filter

The duplex filter has two filter elements.
Oil flow through the filter elements is from outside to inside.

Contamination of the filter elements is indicated visually or electrically.
The signal is given, when the maximum permitted pressure difference is reached (pressure loss between the "dirty" side and the "clean" side of the filter element).
Visual contamination indication:
when the visual signal (red pin) comes out, it has to be pressed down again. If the red pin comes out immediately, the filter element is dirty.
Electric contamination indication:
at remaining signal the filter element is dirty.

Note:
With high viscosity or cold oil during the run-up phase, the differential pressure is higher. Therefore temporary false-alarm may appear.
Experience has shown that the contamination indicator must be observed most carefully during the first 100 operating hours.

When a remaining signal is received, the oil feed must be set to the other filter element by means of the change over handle.
The dirty element must be cleaned or replaced (see section 5, maintenance).

In addition, the filter is equipped with inserted, reusable magnetic stripe.

1.6 Clutch Function and Path of Drive

Engaging of the built-in, hydraulically operated disc clutches left, right resp. is effected with oil pressure via the control valve.
The moment the engine is started the input shaft drives the oil pump E 19.
This description with the items has to be used for the left and/or right side.

1.6.1 Stop Position

When the clutches are disengaged, the discs are lubricated. Unlimited operation in stop position is guaranteed.
The annular pistons K 17 are held in their original position by the return springs K 6. The clutches are disengaged and the output shaft P 1 is stationary.

1.6.2 Engaging

The engaged control valve leads the oil flow through the pipes and the borings of the input shaft W 1 of bush W 9 and clutch cover K 3 behind the annular piston K 17.
Annular piston K 17 forces the inner and outer discs K 22 and K 23 together. As a result of the frictional engagement of the discs the power of the engine is transmitted to the output shaft P 1.
Path of drive:
Input shaft W 1 - clutch cover K 3 - clutch housing K 15 - discs K 22 and K 23 - carrier K 30 - pinion carrier R 9 - pinion R 1 - gear R 2 - output shaft P 1.
When disengaging the clutch, the pressure is released and the annular piston is moved into its original position.

Important
Engaging of the clutch at full speed of the engine is inadmissible.
The engaging speed range specified in the order acknowledgement has to be observed. Any increase intended afterwords must be approved by REINTJES.
The propeller pitch has to be 0 before engaging command.

For engaging both clutches at the same time it is essential to ensure that both engines are perfectly synchronised.
If one clutch is engaged only, the second clutch must be engaged in addition when both engines are perfectly synchronised.

1.7 Turn Drive (at shaft W 197)

The non-controllable shaft W 197 is installed above the portside input shaft.
Path of drive:
Turn drive E 821 - clutch E 815 - shaft W 197 - wheel R 106 - pinion R 1 - wheel R 2 - output shaft P 1.

The turn drive is powered by a motor (capacity 0,75 KW) with worm and planetary gear (ratio 336,6:1).
The output speed from worm and planetary gear is 5,1 rpm.
As total gearbox reduction ratio is 5:1 the speed at propeller shaft is 1,02 rpm.
The connection between shaft for the turn drive and worm and planetary gear is effected via an electro-magnetic clutch.
The primary part of the clutch is fixed on the shaft end of the worm and planetary gear and the secondary part is screwed to shaft W 197 for turn drive.
The clutch is disengaged during gearbox operation.

An interlocking device is installed in the starter of the turn drive motor to guarantee that

1. the turn drive motor can only be started at main engine shut down,

2. the main engine cannot be started when turn drive motor is in operation.

It is not necessary to start the electric stand-by pump for turn drive operation.
When stand-by pump is running and oil pressure available **the control valves V 1 for gearbox clutches must not be actuated under any circumstances, neither electrically nor by hand, provided that the turn drive is under operation.**

Note:
To avoid false engagement due to operating errors, our recommendation for additional safety is an engaging interlocking for control valves V 1 during turn drive operation acc. to drawing 0-210-42578 (see appendix).

Pay attention to description 4.3 Control Valve.

2 Materials and Delivery

2.1 Materials and Production

The gearbox is produced in accordance with the most up-to-date engineering knowledge on modern production facilities.
Selection of the most suitable materials, high quality, and the strength of all parts, together with the sophisitcated design ensure the maximum reliability in operation and long service life.

The gearbox housings are made of grey cast iron or fabricated steel (St 37-2) and are provided with ribbing and points particulary subject to distortion.
All shafts are supported with anti-friction bearings.
Case hardened steels are used for the ground helical spur gears. Our long standing experience in manufacturing of spur gears and case hardening guarantees first class quality in production of spur gears.
For the clutch housings heat treated and nitrided special steel is used. The sinusoidal disc clutches of the gearboxes are so dimensioned that they can safely transmit the torque in continuous operation.
The outer discs are lined with highly wear-resistant sintered metal. When the clutch is not engaged, friction is reduced to a minimum due to the sinusoidal shape of the inner discs.
To absorb the propeller thrust amply dimensioned thrust bearings are fitted.

2.2 Delivery

The gearbox is supplied without oil. The interior is threated against corrosion.In Europe this anti-corrosion treatment will protect the gearbox for about six months if it is stored in a dry room at an even temperature. All bright metal parts on the outside (flange at propeller side, input shaft) are protected with an anti-corrosion agent.

All connections (oil, water, etc.) which cannot be connected up until the unit has been installed, are sealed with blanking plugs or flanges resp. in our factory. Where connectors and lines are changed at the time of installation, i.e. are replaced, the replacement items must be acidified and cleaned, in all cases, before use.

If, for any reason, accessories, filters, heat exchangers or pipes other than those supplied from our works are used, it is essential that they have the same characteristics as the components supplied with the gearbox.

The adjustable units on the gearbox (pressure limiting valves, possibly pressure switches, etc.) have been set for the pressure specified by us before delivery.

Gearboxes are supplied in accordance with the general conditions of the VDMA.

2.3 Preservation and Storing Instructions

All REINTJES gearboxes are provided with an inside and outside preservation at the works. If stored in dry and temperate facilities, the gearboxes are protected against corrosion for 6 months. If they are to be stored longer than 6 months, or if they are shipped to overseas resp. to be stored there, special preservation measures are to be taken.

The gearbox inside has to be sprayed with a special inhibitor oil against corrosion. This is a V.C.I. product (volatile corrosion inhibitors), which protects the gearbox inside not only at direct contact, but by the volatilization the additives build up a corrosion protective atmosphere as well.

The required amount is dependent from the inner space volume.

Gearbox inner space volume	Required amount of special corrosion protecting oil
1 m^3	0,5 l
2 m^3	1,5 l
3 m^3	3,0 l
4 m^3	5,0 l
5 m^3	7,5 l
10 m^3	30,0 l

At represervation it is sufficient to fill the gearbox inner space with the required quantity. After spraying, filling resp. the gearbox is to be closed firmly, i.e. the venting filter E 107 is to be exchanged against a plug. All external metallic bright parts are to be provided with an anti-corrosion agent, by which the surface is protected for approx. 12 - 18 months. If required, this protecting coat is to be patched-up.

The gearbox has to be welded into a plastic laminate together with a sufficient quantity of dryer bags (powder-free execution). The dryer bags should mainly be fixed in the upper section. At that points, where they have contact with the gearboxes, a plastic laminate is to be put underneath the dryer bags. It must be ensured that the dried air reaches all components of the gearbox.

To check the relative air humidity, which is to be lower than 40 %, humidity indicators should be fitted within the plastic laminate at the gearbox, well visable from the outside.

During the storage period the gearbox has to be checked in 4 weeks intervals. Should the colour of the 40 % mark of the humidity indicator change from blue to pink, the following measures should be taken:

- Check external metallic bright parts for rust and patch-up the protecting coat. At the same time inform REINTJES or the REINTJES agency.

- Replace or regenerate the humid drying agent. For regeneration dry the drying agent for about 12 hours in an oven at 130 degrees Celsius.

- Replace the humidity indicator.

- Seal plastic laminate again tightly.

Prior to commissioning the gearbox stored in above manner, REINTJES or the REINTJES agency has to be informed to carry out necessary checks of the gearbox.

The plug has to be exchanged against the supplied venting filter E 107.

The V.C.I. agent has to be drained; small quantities may remain in the gearbox. The protective coat on the external metallic bright parts can easily be removed with a solvent, such as gasoline, petroleum or similar.

No warrenty is taken over by us for damages being due to improper storage, otherwise the V.D.M.A. warrenty conditions apply.

3 Alignment

A basic prerequisite for trouble free operation of a propulsion plant is careful alignment of engine and gearbox to the propeller shaft. Accurate alignment to the engine is also necessary if torsio elastic couplings are used, since every alignment error has a disadvantageous effect on the service life of the driving elements or accesories. Only high flexible couplings must be used.

On request REINTJES does supply information which is needed for an alignment calculation.
If an alignment calculation of the propulsion plant is available, the plant has to be aligned according to these calculation results. The alignment calculation should be submitted to REINTJES for their use.

The alignment diagrams for the complete plant originate in the superimposition of the full load temperature characteristics of the cardan shaft of the engine and gearbox input shaft, gearbox output shaft and propeller shaft resp. These full load temperature characteristics of the shaft displacement allow an alignment in cold condition for optimal full load operating conditions.

If an alignment calculation of the entire propulsion plant is not made, then - for alignment of the gear - you have to consider all details of the REINTJES full load characteristics.

3.1 Installation and Alignment of the Gearbox

During installation of the gearbox it has to be strictly considered that sufficient free space for dismantling of housing and shaftings is available for later maintenance. The gearbox has to be installed onto an adequate strengthened foundation so that no housing distortion can occur. The necessary dimensions of the gearbox seating surfaces are indicated on the drawing of installation.

Particulars up to individual case are to be asked at the works.

The alignment cannot be carried out until the ship has been launched and does not touch the ground.

The alignment of the propeller shaft connection to the gearbox output shaft, the engine to the gearbox input shaft as well as the units to the additional gearbox shafts (power take off) has to be effected according to the corresponding rules of the manufacturer.

The vertically and horizontally alignment of the gearbox to the propeller or intermediate shaft is effected by the aid of set screws. For vertically alignment the set screws are delivered with the gearbox seating.

3.2 Propeller Shaft Alignment and True Running

The propeller or intermediate shaft must not sag and has to be lifted and brought into working position.
The truth of running as well as the axial run out must not exceed a deviation of 0,05 mm. This alignment has to be done before the gearbox can be aligned and fixed to the propeller shaft.

3.3 Radial and Angularity Alignment

For this check the recesses of the coupling flanges are disengaged.
A gauge holder with two gauges has to be fixed at the gearbox flange, so that the flange of the stationary propeller shaft can be touched with one gauge radial at the circumference and with the second gauge axial at the mating surface.

Following max. alignment tolerances of the flanges towards each other are permissible considering the full load operating conditions and normal operating temperature of the propulsion plant:
Centre line out of true 0,025 mm (0,05 mm gauge deflection)
Angular misalignment 0,05 mm per 300 mm flange diameter.
For the alignment with cardan shafts separate, depending on order instructions are valid.

3.4 Seat Chocks and Foundation Bolts

Seat Chocks
Rectangular seat chocks must be used only. Round discs or shim plates arranged one upon the other are not permissible.
Seat chocks must be adequately dimensioned and closely fitted. They are to be made in accordance with the rules of the classification societies.

Fitting Bolts
The used fitting bolts should correspond material quality 8.8 according to ISO 898. The holes in the gearbox seatings are rough drilled and must be reamed for the fitting bolts.

Machined Screws
The machined screw quality must be equal to the used fitting bolts.

Up to individual case the foundation bolts have to be fixed with the necessary torque.

3.5 Mounting Arrangement Transverse

After accurate alignment the gearbox has to be fastened with the foundation so that it is secured against displacement.

For the foundation of gearboxes provided with seatings on input and output side (transverse foundation) the same conditions as for the execution with seat chocks or cast resin apply:
Due to constructional reasons utmost attention has to be paid that no collision chocks for absorption of the ahead propeller thrust are fitted at the engine side gearbox seating.
The propeller thrust is transmitted and led into the foundation within the area of the thrust bearing. For this purpose the closely fitted seat chocks with fitting bolts must be used. All other foundation bolts are machined screws.
The position of the seat chocks with their number of fitting bolts and further information can be taken from the drawing of installation.
Particulars up to individual case are to be asked at the works.

3.5.1 Foundation with Seat Chocks

Seat chocks with fitting bolts are only used in the area of the thrust bearing. All other seat chocks are used with machined screws.

3.5.2 Foundation with Cast Resin

Seat chocks with fitting bolts must be used in the area of the thrust bearing only. All other foundation bolts are machined screws.
The other parts of the foundation are filled with cast resin.

After the thermosetting of the cast resin the set screws have to be srewed back (of the foundation).

Important:
Design, calculation and workmanship of cast resin foundations should be effected by an authorised company which also submits the necessary drawing, calculations and material for approval to the classification society.

3.6 Alignment Check

Upon alignment and tightening of the engine and gearbox foundation bolts, it is advisable to check both gearbox connection flanges for accuracy. For this purpose, the flange fixing bolts must be removed.
If the two gearbox flanges are not in parallel alignment, we cannot accept any responsibility (warrenty).

4 Operation and Control

4.1 Commencement of Operation

The oil to be used must be in accordance with the oil types specified by the works in the lubrication chart. It must be free from impurities as well molybdenum disulphide and graphite. EP-oil should not be used in gearboxes with built-in disc clutches.
In many cases a malfunction is due to oil contamination or to incorrect lubricants.

Before commencement of operation the V.C.I. agent has to be drained; small quantities will mix with the lubrication oil and may remain in the gearbox. The oil must be filled up to the upper dipstick mark. The quantity of oil is marked on the name plate.

After 5 to 10 minutes of operation, the oil level must be checked again and the oil must be topped up, if necessary, as the pipe system is then full. The oil level can be checked with the aid of dipstick E 23 only when the plant is shut down.

4.2 Heat Exchanger (Tube Bundle)

For cooling of the oil a heat exchanger is needed. In standard execution it is installed in the pressure oil system at the gearbox.
The calculated heat to be dissipated is stated in our order acknowledgement. The cooling water data are mentioned on the drawing of installation.
It has to be considered that the cooling water sockets have to be coupled only elastically with bellow expansion joints.

The fitted tube bundle heat exchangers are seawater resistant.
The oil flows around the pipe bundle.
The cooling water flows through the pipe bundle. The cooling water sockets can reciprocally be used for inlet, outlet resp.

On commencement of operation it is necessary to check that the rate of water flow through the heat exchanger is as specified (the rate of water flow may be taken from the installation drawing).
The maximum rate of water flow must not be exceeded to avoid an inadmissible velocity of flow.
If the minimum rate of water flow is less than recommended during continuous operation, possible sediments in the heat exchanger may decrease the cooling efficiency.

The operating temperature can be up to 80 degrees Celsius, depending on operation and installation condition.
In order to quickly achieve the operating temperature of the lubrication oil, a thermostat valve is installed parallel to the heat exchanger.

4.3 E-Control Valve with Manual Emergency Operation

For each built-in, hydraulically operated disc clutch an electrically operated control valve suitable for emergency operation by hand is mounted.
The impuls actuated solenoid moves the valve piston into the required position: clutch ENGAGED or DISENGAGED.
The valve piston is kept in switched-in pisition by a detend, even with a failure of electrical supply.
Additionally the control valve is provided with limit switches.

Manual Emergency Operation
For emergency operation the valve piston is manually pressed into position - clutch engaged or disengaged - by hand via rubber end cup (covered control) until valve piston latches into required position.
Observe markings ON and OFF on control valve.
Before controlling manually carefully check the reason for this and ensure that faulty operation is impossible.

When stand-by pump is running and oil pressure available **the control valves V 1 for gearbox clutches must not be actuated under any circumstances, neither electrically nor by hand, provided that the turn drive is under operation.**

Note:
To avoid false engagement due to operating errors, our recommendation for additional safety is an engaging interlocking for control valves V 1 during turn drive operation acc. to drawing 0-210-42578 (see appendix).

Pay attention to description 1.7 Turn Drive

The spring loaded pressure limiting valve is integrated into the intermediate plate below the control valve.

An additional pressurizing valve with operation delay pot allows a smooth engaging of the built-in clutch.

4.4 Operation with one Engine

When a twin input-single output gearbox is operated by one engine only for a longer period (2nd engine not operating) this is possible without any special precautions.
The symetrically designed lubrication oil system guaranties sufficient lubrication even when operating with one engine only.

4.5 Gearbox Lubrication under Towing Condition

For twin input-single output gearboxes there is no need to take any special steps when following short term operating conditions apply:

- Both engines are shut down and the clutches or clutch couplings are disengaged.
- Strong water flow towards the propeller might turn the propeller shaft and gearbox, e.g. when towing.

If the towing condition lasts longer than 12 hours the whole bearings must be sufficiently lubricated for about 5 minutes.
This can be done by taking into operation of one main engine or starting the stand-by pump.

4.6 Emergency Operation Main Clutch

If the supply of pressurized oil for engaging the clutch fails, emergency operation is possible by mechanically tightening of the concerned clutch.
To do this, both engines must first be shut down.
Detach corresponding cover.
After having removed the locking wire and loosening the hexagon nuts K 9 the hexagon screws K 8 must be tightened up, working steady diagonally.
So the disc package will be compressed and the disc clutch is frictionally engaged.
Put control valve into STOP-position (OFF) and for safety reasons do not engage any more.

Important:
The moment the corresponding engine is restarted the propeller starts turning.
For twin input-single output gearboxes several conditions are possible so that this emergency operation has to be executed with special care and precaution.

In case of emergency operation with main clutch continue operation very carefully and at lowest possible engine speed (below 70 % nominal speed).

Note:
When using the hexagon screws K 8 (emergency screws) the max. input torque must not be transmitted.

If this emergency operation is no longer necessary the hexagon screws K 8 must be screwed back, tightened with the nuts K 9 and secured again with a wire.
When entering the port the clutch discs have to be checked for damages. Replace the hexagon screws K 8.
Under severe conditions in emergency operation (failure of pressurized oil supply) the gearbox should be dismantled and all bearings and gearbox components should be thoroughly checked.

5 Maintenance

Oil level and oil pressure must be checked daily.

5.1 Oil Pressure and Pressure Gauge

The pressure gauge on the gearbox indicates the operating pressure. With the engine running at full speed, the clutch engaged and the gearbox at normal operating temperature, this pressure should be within the green area on the gauge.
The operating pressure is approx 16 to 20 bar.

The operating pressure is regulated by a spring-loaded pressure limiting valve and is set by adjusting screw V 13.
For readjustment purposes, nut V 12 must be slackened off. Pressure is increased by turning adjusting screw V 13 clockwise and decreased by turning it anticlockwise.

Before a re-setting of the pressure limiting valve is intended due to changed pressure readings, possible causes must be checked carefully.

5.2 Oil Change

The first change or proper cleaning of oil (for example by a separator) has to be made after approx. 250 operating hours.
The process being as follows:

1. Drain oil upon removal of drain screw Pos. G 3 or pump out oil for cleaning.
2. Firmly screw in oil drain screw and fill up oil to upper dipstick mark, and check, wether oil level is at the upper mark.
3. Clean or change filter elements.

The change resp. proper cleaning of oil must be repeated annually or every 4000 operating hours.
A later change of oil can only be made under the prerequisite that a reliable oil analysis is performed and the analysis shows a satisfactory result. Hereby the oil has to be checked for its oiliness and aging.

5.3 Changing or Cleaning the Filter Element

Duplex Filter Type HYDAC

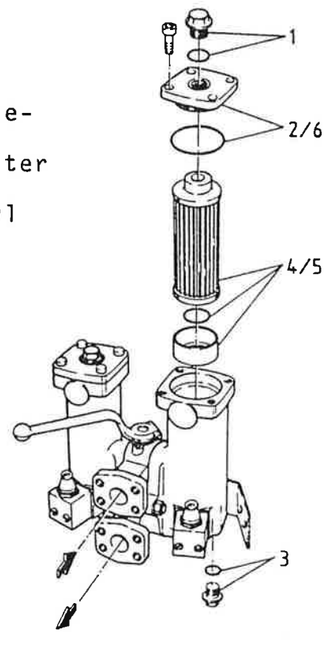
Ensure that spare filter elements are held in stock.

A prerequisite for filter element removal is that the filter bowl concerned is taken out of service.
When changing over the pressure compensation is achieved by the changeover mecanism, which does not block or interrupt the oil flow during change over procedure.
The changeover handle points to the other, operative, filter bowl.

Element replacement:

1. Open the vent screw.
2. Screw off cover screws of the inoperative filter bowl, turn cover by 45 degrees and remove it (take care not to damage the O-ring).
3. Remove the drain plug with O-ring from the lower end of the filter bowl and drain the sludge sump into a trough or drip pan.
4. Withdraw the filter element with dirt trap basket and magnetic stripe.
   Clean the filter bowl, dirt trap basket and magnetic stripe and reinstall the drain plug with O-ring.
5. Insert the cleaned or new filter element with dirt trap basket and magnetic stripe into the filter bowl.
   Take special care not to damage the O-ring on the lower filter seat. The upper filter seat is not provided with an O-ring.
6. Install the filter bowl cover.
   Prior to cover installation, ensure that the gasket is undamaged and correctly seated.

Prior to operation, the filter bowl must be vented.
Set the changeover handle approx. 10 degrees to the central position and fill the filter bowl until bubble-free oil emerges at the vent screw.
Tighten the vent screw and check filter bowl seals for leaks.
Set changeover handle for single-bowl operation.

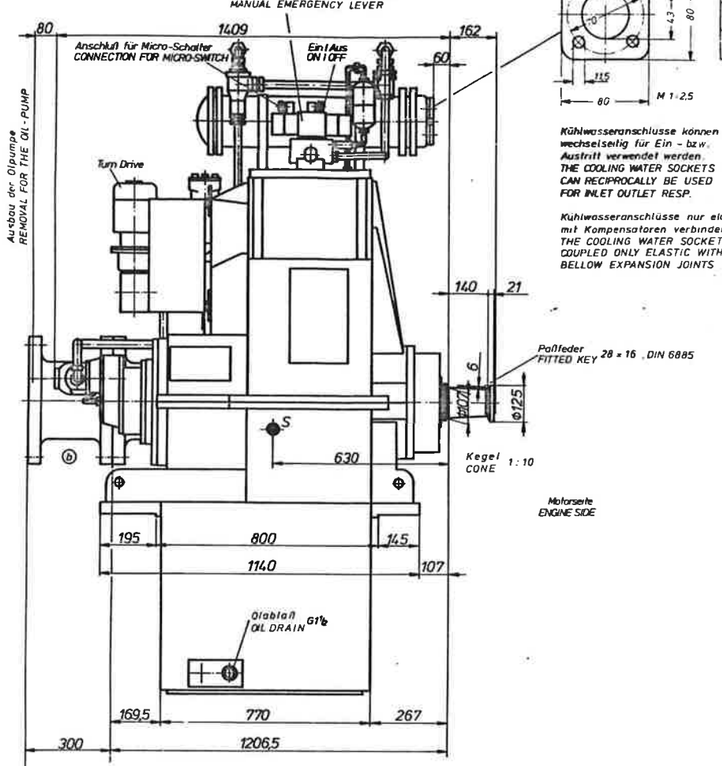


Malfunction	Possible Causes	Remedial Measures
Gearbox noise	Idle speed is within a critical range	Increase idling speed
	Gearbox runs within the critical speed range	For continuous operation choose another speed ran
	Pump sucks in air a) oil level too low	Correct oil level, trace cause of oil loss
	b) suction pipe not tight	Tighten or reseal all fittings, flanges resp.
	Bearings damaged (pieces) of metal in filter)	Inspect and renew bearings Check alignment and gear box mounting
Loss of oil	Shaft sealing rings (normal wear)	Renew shaft sealing ring
	Piping system	Locate leakage, repair
	Covers	Clean parting surfaces and reseal
	Plugs	Tighten or repair
	Heat exchanger	Inspect and reseal
Gearbox temperature too high	Oil level too high	Reduce oil filling
	Rate of cooling water flow too low	Increase water flow to recommended rate
	Heat exchanger fouled up	Clean heat exchanger
	Bearings damaged (pieces of metal in filter)	see above
	Clutch is slipping	see next page
	Gearbox is overloaded	Reduce input power
Operating pressure too high	Pressure limiting valve defective or blocked	Clean, repair or renew
	Unsuitable oil	Check viscosity of oil, change oil, if necessary
	Cold oil	Run gearbox up to operating temperature

Malfunction	Possible Causes	Remedial Measures
Operating pressure too low or fluctuating	Pump sucks in air a) oil level too low	Correct oil level, trace cause of oil loss
	b) suction pipe not tight	Thighten or reseal all fittings, flanges resp.
	Pump drive or pump damaged (normal wear)	Check pump drive and repair or renew
	Non-return valve defective (for stand-by pump)	Repair or renew
	Pressure limiting valve: normal wear dirty or blocked	 Adjust operating pressure repair or renew
	Unsuitable oil	Check viscosity of oil, change oil, if necessary
Clutch: a) slipping	Operating pressure too low or fluctuating	(see above)
b) does not engage or disengage	Control valve not properly actuated	Check control system and engaging positon repair or renew
	Clutch defective or blocked	Renew clutch discs, check: viscosity of oil operating pressure control valve free running propeller or propeller shaft

Steuerventil	CONTROL VALVE
Elektrisch	ELECTRICALLY
Zeichn Nr	0-104-42719
DRAWING NO	
Pneumatisch	PNEUMATICALLY
Zeichn Nr	0-104-42098
DRAWING NO	

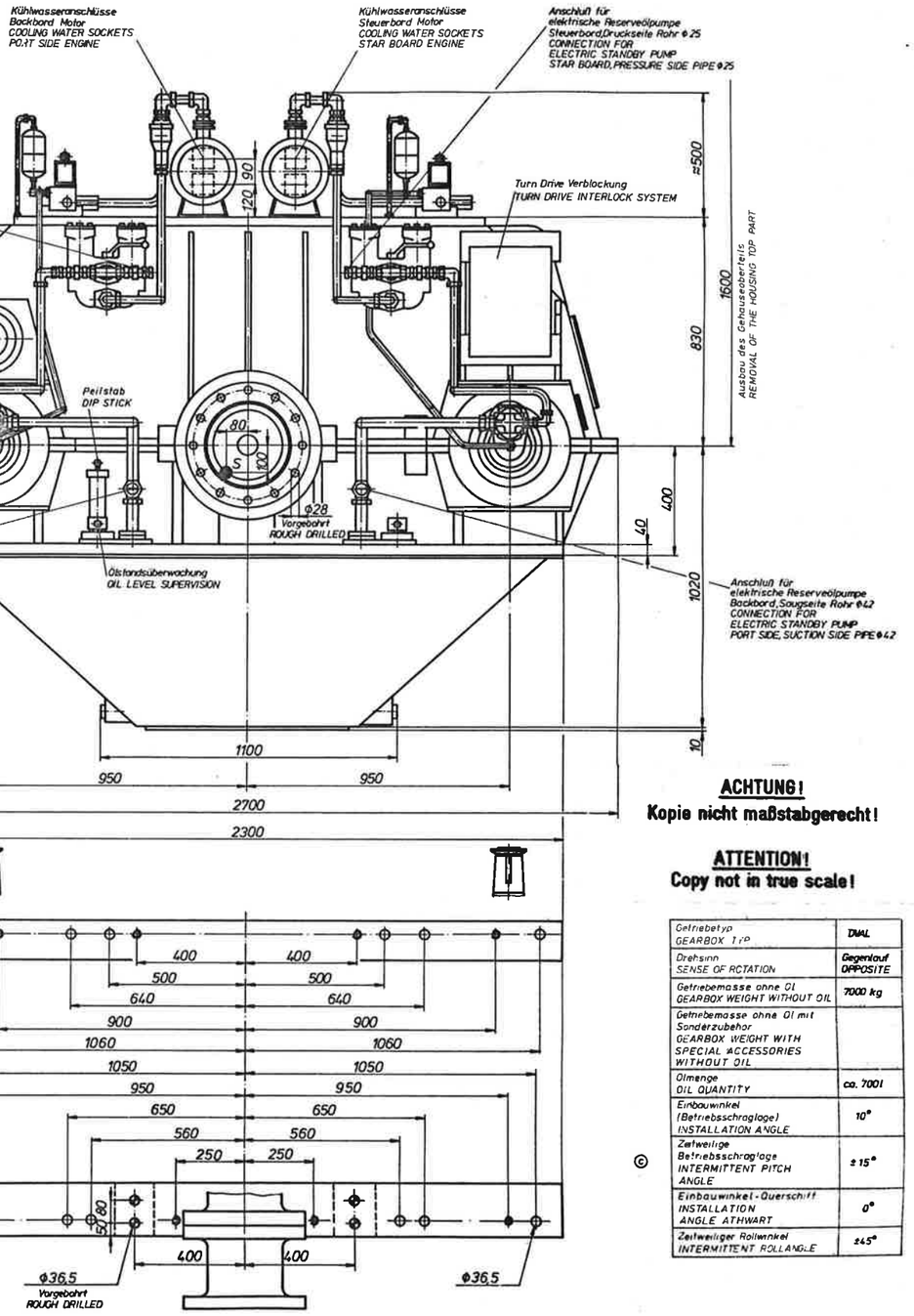
Steuerventil
elektrisch schaltend
mit Hand - Notbetätigung
CONTROL VALVE
ELECTRICALLY OPERATED WITH
MANUAL EMERGENCY LEVER



Kühlwasseren-trittstemperatur	Erforderliche Kühlwassermenge	Wasserseitiger Druckverlust
INLET TEMPERATURE OF COOLING WATER	NECESSARY QUANTITY OF COOLING WATER	PRESSURE LOSS ON WATER SIDE
32°C	min 11000 l/h	0,34 bar
	max. 12000 l/h	0,40 bar
l/h = Liter/Stunde 1dm³/HOUR		

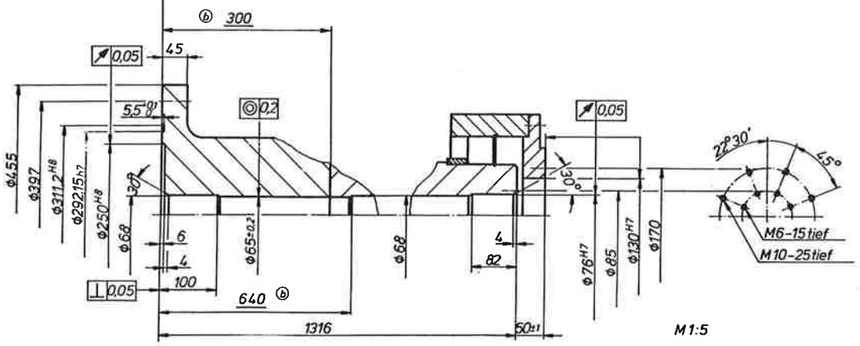
Kühlwasseranschlüsse können wechselseitig für Ein- bzw. Austritt verwendet werden.
THE COOLING WATER SOCKETS CAN RECIPROCALLY BE USED FOR INLET OUTLET RESP.

Kühlwasseranschlüsse nur elastisch mit Kompensatoren verbinden
THE COOLING WATER SOCKETS TO BE COUPLED ONLY ELASTIC WITH BELLOW EXPANSION JOINTS



ACHTUNG!
Kopie nicht maßstabgerecht!

ATTENTION!
Copy not in true scale!



M 1:5

Getriebetyp GEARBOX TYP	DVAL
Drehsinn SENSE OF ROTATION	Gegenlauf OPPOSITE
Getriebemasse ohne Öl GEARBOX WEIGHT WITHOUT OIL	7000 kg
Getriebemasse ohne Öl mit Sonderzubehör GEARBOX WEIGHT WITH SPECIAL ACCESSORIES WITHOUT OIL	
Ölmenge OIL QUANTITY	ca. 700 l
Einbauwinkel (Getriebsschraglage) INSTALLATION ANGLE	10°
Zeitweilige Betriebsschraglage INTERMITTENT PITCH ANGLE	± 15°
Einbauwinkel-Querschiff INSTALLATION ANGLE ATHWART	0°
Zeitweiliger Rollwinkel INTERMITTENT ROLLANGLE	±45°

Paßschrauben nur hier
FITTING BOLTS HERE ONLY

Stahlpaßstücke
STEEL SEAT CHOCKS

Die zugehörigen Komponenten der Antriebsanlage sind so zu gestalten, daß ihre Ausrichtung eine nennenswerte Beeinflussung der Lagerreaktionen der angekoppelten Getriebewellen im betriebswarmen Zustand vermeidet, sowie Verformungen des Schiffskörpers weitgehend kompensiert
THE COMPONENTS BELONGING TO THE PROPULSION PLANT ARE TO BE EXECUTED IN SUCH A WAY THAT THEIR ALIGNMENT DOES NOT CONSIDERABLY INFLUENCE THE BEARING REACTIONS OF THE COUPLED GEARBOX SHAFTS AT OPERATING TEMPERATURE AND CONDITION. BESIDES THE ALIGNMENT HAS TO LARGELY COMPENSATE FOR DEFORMATIONS OF THE HULL.

Beim Einbau des Getriebes ist unbedingt darauf zu achten, daß für spätere Wartungsarbeiten genügend Freiraum zur Demontage von Gehäuse und Rotoren vorhanden ist.
DURING INSTALLATION OF THE GEARBOX IT HAS TO BE STRICTLY CONSIDERED THAT SUFFICIENT FREE SPACE FOR DISMANTLING OF HOUSING AND SHAFTINGS IS AVAILABLE FOR LATER MAINTENANCE.

Das Getriebe ist durch Paßschrauben auf dem Fundament gegen Verschieben zu sichern.
IT IS ESSENTIAL TO ENSURE THAT FITTING BOLTS ARE FITTED TO PREVENT THE GEAR FROM MOVING ON THE FOUNDATION

S = Schwerpunkt
CENTRE OF GRAVITY

And.	e			
And.	d			
And.	c	± 15° Betr. Schräglage	22.11.89	
And.	b	Propellerseitigen Gegenflansch nachgetragen	28.89	
And.	a	Zeichnung ergänzt	27.89	

Teil	Teile-Nr.	Stck	Benennung	Abmessung	Zeichnung/Norm	Werkstoff	Pos.	Bemerk.

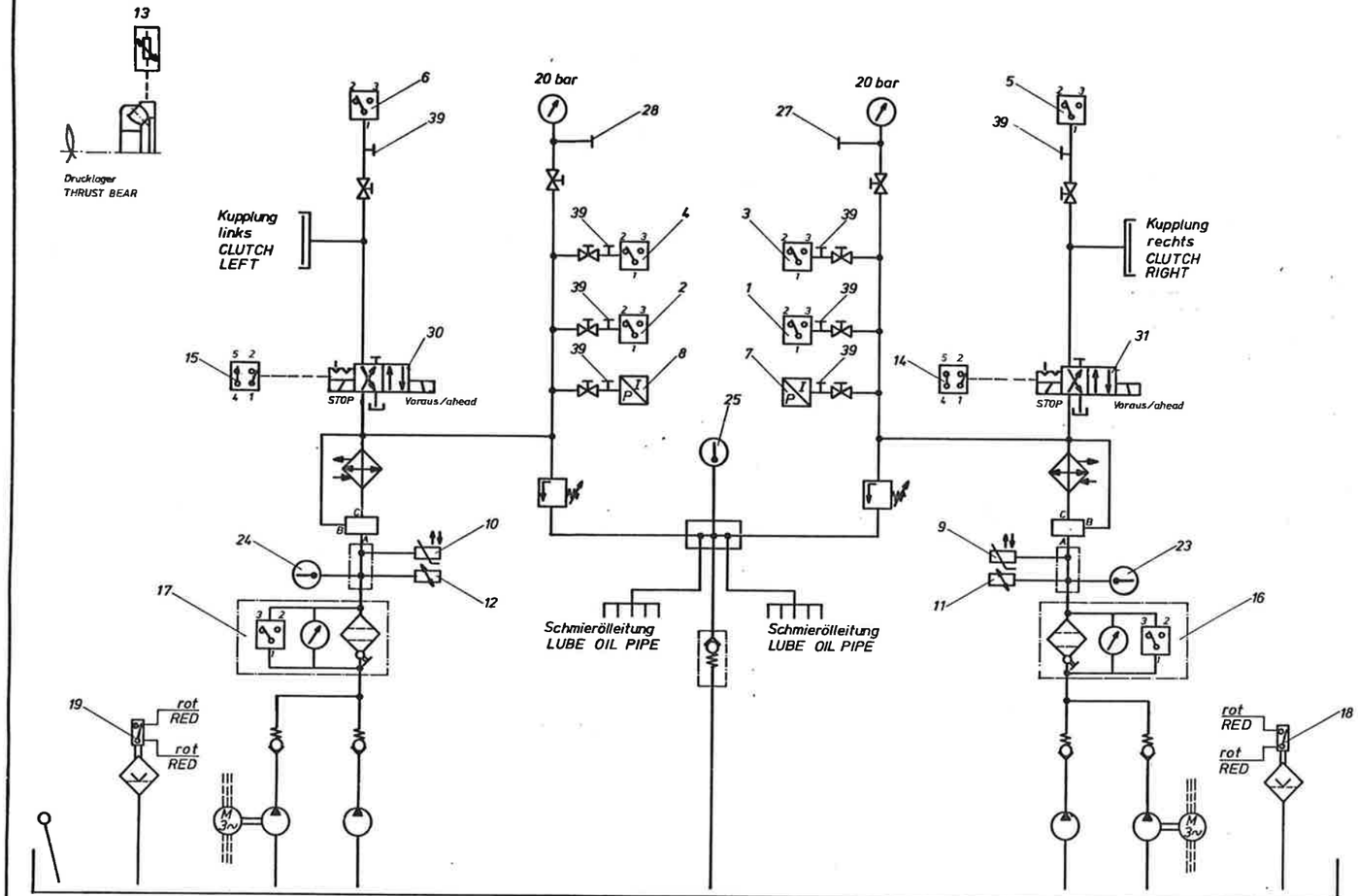
Maßstab 1:10 1:5	Format A1	zul Abw	Oberfläche	Bauart DVAL 1818	Unterseizung
Baugruppe	1989	Name	Datum	REINTJES	
	Bearb	C.	05.06.		
	Gepr			3250 Hameln	
	Norm				

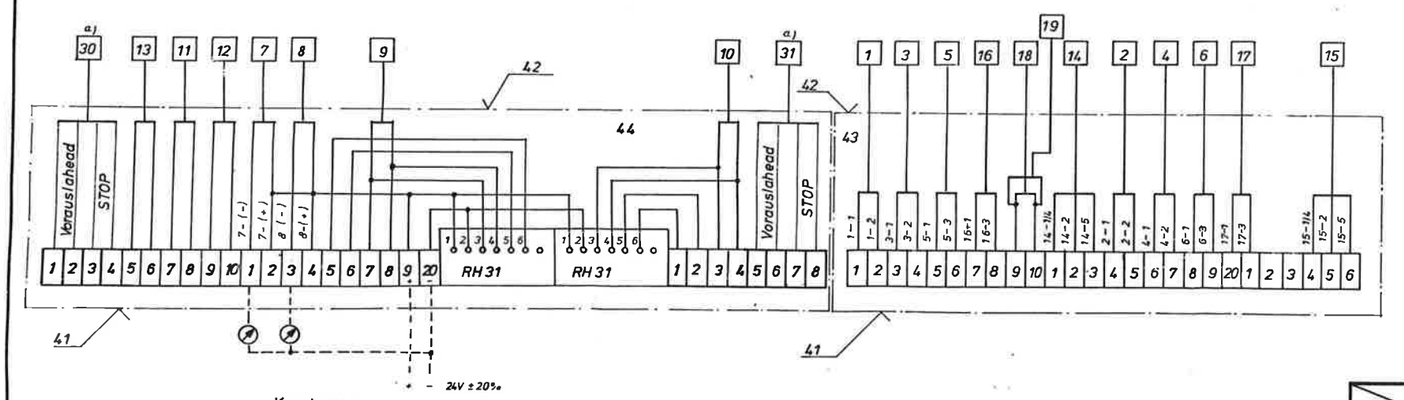
Einbauzeichnung
DRAWING OF INSTALLATION

Zeichn.-Nr 0-104-44201 C Blatt

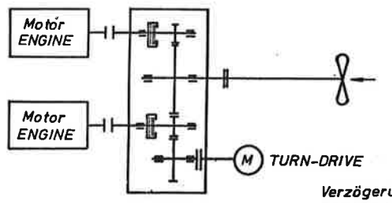
Ersatz für

Ersetzt durch

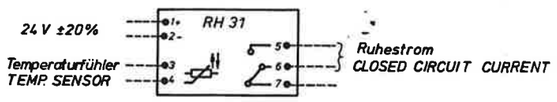




Kupplungen
CLUTCHES



Anschlüsse
CONNECTIONS



Verzögerungsrelais ca. 10 sek. nach den Wächtern Teil 1,2,3,4,18,19 sind vorzusehen
RETARDATION RELAY APPR. 10 SEC. AFTER THE CONTROLER PART 1,2,3,4,18,19 HAS TO BE PROVIDED

Teil / PART	Pos. / POS	Teilenummer / PART-NO.	Stück / UNIT	Benennung / DESIGNATION	Bemerkung / REMARKS	Eingestellt / ADJUSTED
46	A255	506 826	1	Schaltverblockung Turn-Drive INTERLOCKING SYSTEM TURN-DRIVE		
45						
44	A21	492 400	1	Klemmenkasten CLAMPING BOX	ZN.NR. 2-788-43009	
43	A 21	492 400	1	Klemmenkasten CLAMPING BOX	ZN.NR 2-788-43009	
42	A119	186 830	21	Kabeleinführung CABLE GLAND	KM 18×1,5 DIN 89280-Z8	
41	A120	186 856	6	Kabeleinführung CABLE GLAND	LM 30×2 DIN 89280-Z20	
40						
39	A118			Meßanschluß Schraubkupplung M16 MEASURING CONNECTION SCREW COUPLING M16	Zn:Nr. 2-081-44452	
38						
37						
36						
35						
34						
33	A113	524 856	2	Druckschalteranschluß PRESSURE SWITCH CONNECTION	Zn. Nr. 2-081-44452	
32						
31				4/2 Wegeventil Nennspannung 24V leistungsaufnahme 36W 4/2 WAY VALVE RATED VOLTAGE 24V CURRENT DRAW 36W	Zn:Nr. 0-705-42719	
30				4/2 Wegeventil Nennspannung 24V leistungsaufnahme 36W 4/2 WAY VALVE RATED VOLTAGE 24V CURRENT DRAW 36W	Zn:Nr. 0-705-42719	
29						
28				Meßanschluß Φ 6×1 MEASURING CONNECTION "		
27				" " "		
26						
25	A 56	25 232	1	Thermometer in Schmieröl 0-100°C THERMOMETER IN LUBE OIL 0-100°C	Zn.-Nr. 0-705-42852	
24	A 54L	25 232	1	Thermometer vor Ölkühler L 0-100°C THERMOMETER BEFORE OILCOOLER L 0-100°C	Zn.-Nr. 0-705-42852	
23	A 54R	25 232	1	Thermometer vor Ölkühler R 0-100°C THERMOMETER BEFORE OILCOOLER R 0-100°C	Zn.-Nr. 0-705-42852	
22						
21						
20						
19	A 57L	518 450	1	Ölstandsüberwachung L Ruhestrom OIL LEVEL CONTROL L CLOSED CIRCUIT CURRENT	Zn.-Nr. 2-081-44117	
18	A 57R	518 450	1	Ölstandsüberwachung R Ruhestrom OIL LEVEL CONTROL R CLOSED CIRCUIT CURRENT	Zn.-Nr. 2-081-44117	
17	A 43 L	338 370	1	Differenzdruckanzeige optisch/elektrisch Δp 5 bar DIFF. PRESSURE OPTICAL/ELECTRICAL Δp 5 bar		
16	A 43 R	338 370	1	Differenzdruckanzeige optisch/elektrisch Δp 5bar DIFF. PRESSURE OPTICAL/ELECTRICAL Δp 5bar		
15	A 22 L			Endschalter Kupplung „ein" L LIMIT SWITCH CLUTCH „ENGAGED" L	Zn.-Nr. 0-705-42719	
14	A 22 R			Endschalter Kupplung „ein" R LIMIT SWITCH CLUTCH „ENGAGED" R	" " "	
13	A 145	524 867	1	Temperaturfühler „Drucklager" PT 100 TEMPERATURE SENSOR „THRUST BEAR" PT 100	Zn.-Nr. 2-783-42856	
12	A 58 L	485 586	1	Temperaturfühler „Getriebeöl" L PT 100 TEMPERATURE SENSOR „GEARBOX OIL" L PT 100	Zn.-Nr. 2-783-42856	
11	A 58 R	485 586	1	Temperaturfühler „Getriebeöl" R PT 100 TEMPERATURE SENSOR „GEARBOX OIL" R PT 100	Zn.-Nr. 2-783-42856	
10	A 130 L	184 349	1	Temperaturschalter „Getriebeöl" L Ruhestrom TEMPERATURE SWITCH „GEARBOX OIL" L CLOSED CIRCUIT CURRENT	Zn.-Nr. 2-783-42857	88°C
9	A 130 R	184 349	1	Temperaturschalter „Getriebeöl" R Ruhestrom TEMPERATURE SWITCH „GEARBOX OIL R CLOSED CIRCUIT CURRENT	Zn.-Nr. 2-783-42857	88°C
8	A 104 L	231 932	1	Drucktransmitter „Oldruck" L 0-40 bar ≙ 4-20 mA PRESSURE TRANSMITTER L 0-40 bar ≙ 4-20 mA	Trafag 8202.81.2210	
7	A 104 R	231 932	1	Drucktransmitter „Oldruck" R 0-40 bar ≙ 4-20 mA PRESSURE TRANSMITTER R 0-40 bar ≙ 4-20 mA	Trafag " "	
6	A 74 L	496 448	1	Druckschalter Kupplung „ein" L PRESSURE SWITCH CLUTCH ENGAGED" L	Zn.-Nr. 2-783-41697	12 bar
5	A 74 R	496 448	1	Druckschalter Kupplung „ein" R PRESSURE SWITCH CLUTCH ENGAGED" R	" "	12 bar
4	A 105 L	496 421	1	Druckschalter Start Res. Pumpe L Arbeitsstrom PRESSURE SWITCH START STAND BY PUMP L OPERAT. CURRENT	" "	13 bar
3	A 105 R	496 421	1	Druckschalter Start Res. Pumpe R Arbeitsstrom PRESSURE SWITCH START STAND BY PUMP R OPERAT. CURRENT	" "	13 bar
2	A 125 L	496 430	1	Druckschalter Motor Stop L Arbeitsstrom PRESSURE SWITCH ENGINE STOP L OPERAT. CURRENT	" "	10 bar
1	A 125 R	496 430	1	Druckschalter Motor Stop R Arbeitsstrom PRESSURE SWITCH ENGINE STOP R OPERAT. CURRENT	" "	10 bar

	Spannung / CURRENT	Belastung/RESIST LOAD ohmsch / OHMIC	induktiv / INDUCTIV
Druckschalter	24 V=	2 A	1 A
PRESSURE SWITCH	220 V~	15 A	0,9 A
Temperaturschalter	24 V=	0,6 A	0,4 A
TEMPERATURE SWITCH	220 V~	0,01 A	0,01 A
Differenzdruckschalter	24 V=	0,3 A	0,1 A
DIFF. PRESS. SWITCH	220 V~	0,09 A	0,01 A

Änd.		
And.	e	
And.	d	
And.	c	
And.	b	
And.	a	Wegeventile verkabelt 5.10.89

Teil | Teile-Nr | Stck | Benennung | Abmessung | Zeichnung/Norm | Werkstoff | Pos. | Bemerk.

Maßstab: | Format: A1 | zul. Abw. | Oberfläche | Bauart | Größe | Untersetzung

Baugruppe: 524 875

Bearb. | Name | Datum

Gepr.

Norm

DVAL 1818

REINTJES
3250 Hameln

Überwachung
SUPERVISION

Zeichn.-Nr. 1
0-210-44442 A

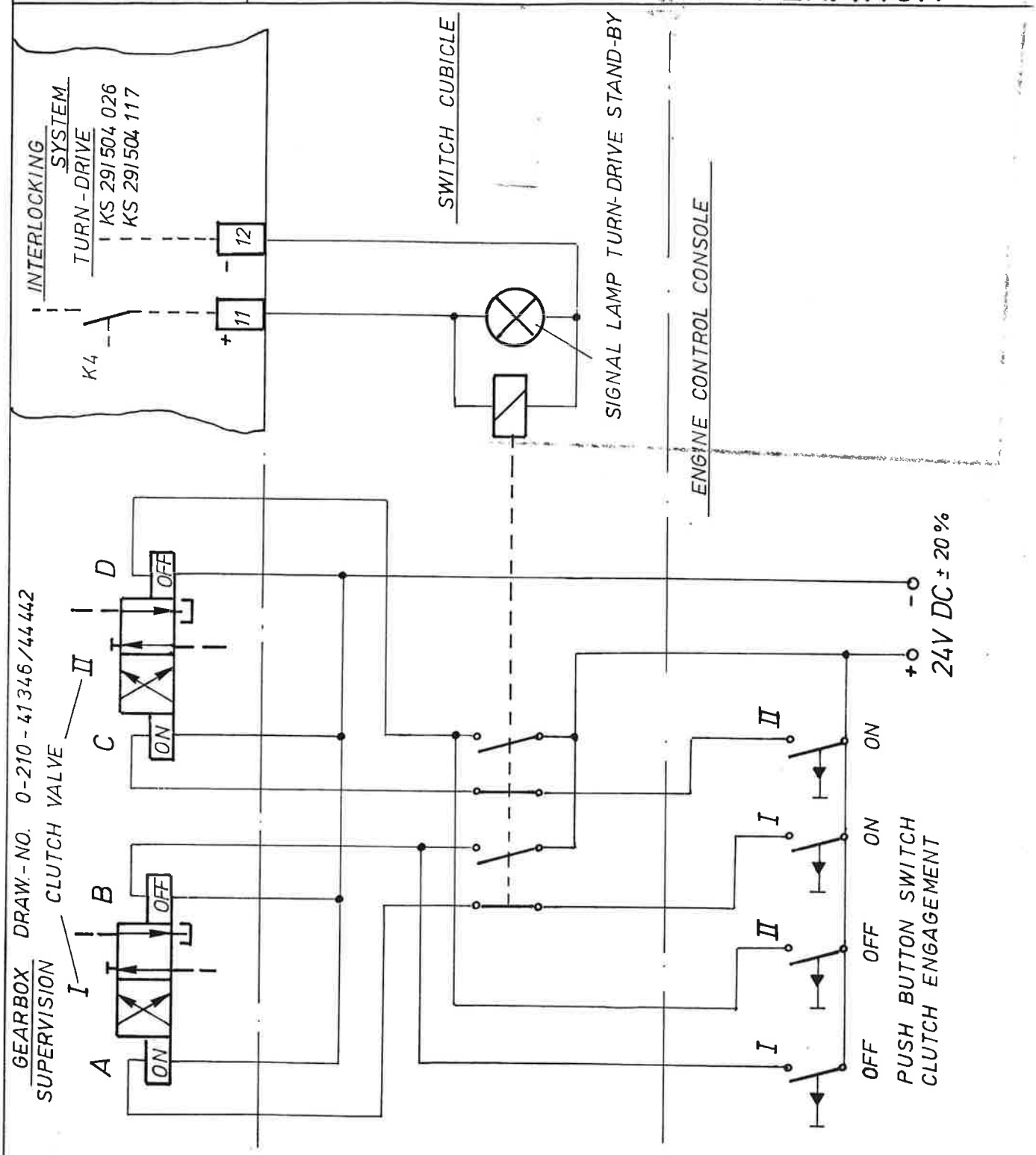
Blatt 1
2 Bl.

Ersatz für

Ersetzt durch

REINTJES

INTERLOCKING OF CLUTCH ENGAGE-MENT AT TURN DRIVE OPERATION



Teil	Stck	Benennung / Abmessung				DIN	Werkstoff	Pos.	Teile-Nr.	Teile-Code
Maßstab	Format		Name	Datum	zul.Abw.	Oberfläche	Bauart	Größe		Untersetzung
	A4	Bearb.		26.7.88						
		Gepr.								
		Norm								

Zeichn.-Nr. / 0-210-42578

Blatt 1 2 Bl

Ersatz für

Ersetzt durch

EISENWERKE REINTJES GMBH · 3250 HAMELN TELEX 09 2862 · TELEFON (0 51 51) 104-0

RF 4

7 Assembly and Dismantling Instructions for Taper Press Hubs with 1:30 Taper

7.1 Assembly Instructions for Taper Press Hubs with 1:30 Taper

7.1.1 Inspection and Checking

Before assembling the components (e.g. shaft and gear wheel, shaft and flange), the taper surfaces must be inspected. Check whether the transition points at the taper surfaces and at the oil distribution grooves are free from burrs. Remove any burrs and rectify any damage. The taper surfaces of the shaft and the component to be fitted (gear wheel, flange, etc.) must mate properly. This can be checked by means of ink applied in a thin film.

7.1.2 Reference Edge for Checking the Allowances

Thoroughly clean all taper surfaces and dry them (grease free). To determine the allowances, slide the component to be fitted onto the shaft (gear wheel, flange, etc.). Do not fit the component to be fitted too tightly onto the shaft . The allowance for the component to be fitted is calculated from the point at which the taper surfaces are in snug contact without pressure being applied. To determine the allowance, establish a reference edge. Edges on the shaft are to be preferred for this purpose. Remove again the component (gear wheel, flange, etc.) to be fitted and coat the taper surfaces with SAE 10 oil (viscosity approx. 20 cSt at 50 degrees Celsius). Push the component to be fitted onto the shaft, fit the hydraulic nut and connect the pressure oil equipment. The allowance is stated in mm and is shown on the component to be fitted (gear wheel, flange, etc.) on one face of the small taper diameter. The word "AUFSCHUBMASS" (allowance) is stamped with a block punch above the allowance. The allowance is made up of the nominal dimension and the admissible tolerance, e.g. 10,3 + 1,2

7.1.3 Prestressing the Hub

After the hydraulic nut and the pressure oil equipment have been fitted, prestress the component to be fitted (gear wheel, flange, etc.) by means of the hydraulic nut.

7.1.4 Expanding and Fitting the Component to be Mounted (Gear wheel, Flange, etc.)

The hub of the component to be fitted must be expanded in order for it to be fitted. The expansion pressure (connection B) is approx. 1.500 bar and can be increased to 1.800 bar. Fit the connection for the hydaulic press provided in the bore for this purpose and force in oil until it emerges from the ends of the hub. Then slide

the component to be fitted into the correct position with the hydraulic nut while oil is continuously fed in. Brisk movement without any pause is to be aimed at. The push pressure (connection A) for the hydraulic nut is dependent on the hub diameter of the component to be pressed on.

Following guide applies:

Hub diameter					
		up to 120 mm		max. 140 bar
	over 120	up to 150 mm		max. 200 bar
	over 150	up to 200 mm		max. 360 bar
	over 200	up to 500 mm		max. 500 bar
	over 500 mm			max. 700 bar

After the component to be fitted has been slid into the correct position, reduce the expanding pressure so that the oil film between the taper surface can disperse. The fitting pressure should not be completely relieved until 30 minutes have elapsed. Before the full load is applied to the press-fit hubs about 24 hours should be allowed to elapse. This time is necessary to ensure that the hydraulic fluid has escaped completely.

7.1.5 Pressure Medium

Expansion of the component to be fitted (gear wheel, flange, etc.) must be carried out with SAE 10 oil (viscosity approx. 20 cST at 50 degrees Celsius). When the component to be fitted (gear wheel, flange, etc.) is being hydraulically fitted or removed in cold rooms, the component should be preheated (about 40 degrees Celsius).

Important
The pressure medium employed for expanding the hub must be free from any contamination and must not contain any EP additives.

7.2 Dismantling Instructions for the Taper Press Hub with 1:30 Taper

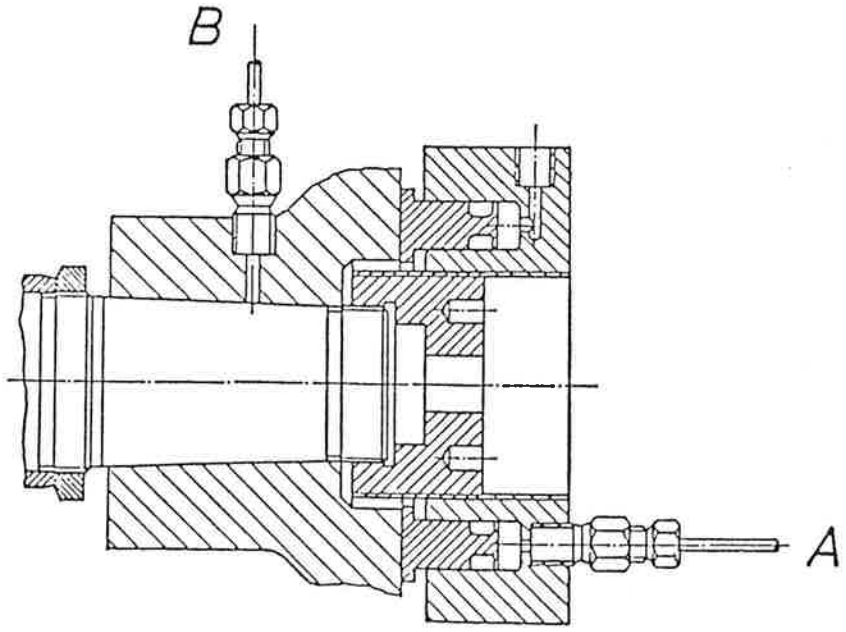
Position the tool (hydraulic nut) and the pressure oil equipment in the same way as when used for assembly in order to remove the particular component (gear wheel, flange, etc.). The hub must first be expanded in order to remove the component. Fit the connections for the hydraulic press into the hole provided for this purpose. Put the hydraulic nut against the component to be removed and build up a push-on pressure (connection A) of approx. 100 bar. Expand the hub of the component to be removed by means of a hydraulic press, until the expanding pressure (connection B) is half of the max. admissible figure. Wait until the oil has penetrated the press bracing. Then reduce the push-on pressure (connection A) slowly to zero. Since the component to be removed becomes detached suddenly with great force, it should be secured by a stop. The expanding pressure is approx. 2.000 bar.

Should the component to be removed not become detached, follow the procedure below:

1. Increase the expanding pressure up to max. 2500 bar.
2. Leave the component to be detached under pressure for 1 hour.
3. Heat the component to be detached.
4. Additionally fit a puller.

Remark:

It is absolutely necessary that a stop for the component to be detached is provided.



REINTJES Assembly and Dismantling
Instruction 203/VII/85/E

Taper Press Hubs with 1:10 Taper

1 Components

The force transmission of taper press hubs with 1:10 taper is effected by the pressed surfaces of seat and hub.

A fitting key is inserted against distorsion. A nut in front secure the hub on the seat.
The surface of the seat 1:10 taper is finish grindet on shafts and pinion shafts.
The hub can be named as engine side or propeller side flange, clutch cover or carrier of the disc clutch, gear or pinion.
Applicable items are marked in the spare part list.

2 Inspection and Checking

Before assembling the taper press hub 1:10 taper, all components have to be inspected.
Check the snug fit of the fitting key in the groove as well as the clearance to the hub.
The taper surfaces of seat and hub must mate properly. This can be checked by means of ink applied in a thin film.
Remove any burrs and rectify any damage at taper, groove or thread.
When carrying out repair works the concentricity of the shaft must always be checked incl. bearing seats and taper. Slide the hub onto the seat and check the concentricity and axial run out of the components to be fitted.

3 Assembly

Joining of seat and hub is done by constant heating of the hub.

Assembly temperature 120° - 140° Celsius.

When the assembly temperature is reached, slide the hub onto the seat, fit the shaft nut in front and tighten firmly.
When the taper press hub is cooled down, check the tight fit of the nut and secure it with a screw.

Please note:
The hub part inside of flexible couplings should be heated only up to 80° Celsius assembly temperature.

REINTJES Assembly and Dismantling
Instruction 203/VII/85/E

Taper Press Hubs with 1:10 Taper

4 Dismantling

Hubs with a connection for hydraulic press equipment can be dismantled by hydraulic force.
The tread connection is at the circumference or at the face edge. At flanges the connection is closed with a plug.

Since the component to be removed detaches itself suddenly with great force, the component must be secured by a stop. The shaft nut used to secure the component on the shaft can be used as a stop. Back off the shaft nut until there is at gap of 5 mm between shaft nut and component to be removed.
The hub has to be expanded for dismantling.
Fit the connections for the oil injector or the oil pump to the bore provided for this purpose and force in oil (SAE 10 viscosity approx. 20 cSt at 50° C) until it emerges from the ends of the taper press hub.
If the component to be removed does not become detached, follow the procedure indicated below:

1. Leave the component to be detached for 1 hour under pressure;
2. Heat the component to be detached;
3. Additionally fit a puller.

If a component is not provided with a connection for hydraulic equipment, dismantling has to be done by means of a pulling-off device with hydraulic press (Enerpac) and addionally heating the component.
Even with this method the hub has to be secured by a stop.

~~Schmierstofftabelle 87~~

~~Die umseitig aufgeführten Mineralölgesellschaften gewährleisten mit ihren jeweils genannten Produkten die Einhaltung der geforderten Qualitätsmerkmale für den Einsatz der Schmieröle in REINTJES Schiffsgetrieben.~~

~~Lubrication Chart 87~~

~~The mineral oil companies indicated overleaf guarantee that the products listed by them will meet the quality specifications for the use of their lubricants in REINTJES Marine Gearboxes.~~

Für die Ölauswahl in REINTJES-Getrieben ist zu beachten:

1. Der günstigste Viskositätsbereich bei Betriebstemperatur liegt bei Wälzlagerung zwischen 20 und 60 mm^2/s (cSt) und bei Gleitlagerung zwischen 60 und 120 mm^2/s (cSt).
2. Eine Öltemperatur unter 10—15 °C (50—90 °F) erfordert eine Sumpfheizung im Getriebe (Sonderausstattung).
3. Mineralöle mit Festschmierstoffen (z. B. Molybdändisulfid MoS_2) dürfen nicht eingesetzt werden.
4. Hochalkalisch eingestellte Motorenöle (TBN>20) dürfen bei eingebauter Lamellenkupplung nicht verwendet werden.
5. Turbinenöle dürfen nicht eingesetzt werden

Für den Ölwechsel ist zu beachten:

1. Die in der Betriebsanweisung vorgeschriebenen Ölwechselzeiten sind einzuhalten, besonders beim ersten Ölwechsel. Verlängerung der Intervalle ist nur zulässig, wenn eine regelmäßige zuverlässige Analyse durchgeführt wird.
2. Beim Ölwechsel sind Ölfilter und Luftfilter sorgfältig zu reinigen. Filterelemente mit Drahtgewebe können ab einer Feinheit $\geqq 40\mu m$ vorsichtig mit Pinsel und Bürste in Waschbenzin oder Reinigungsmittel ausgewaschen werden. Die Einsatzzeit sollte auf **1 Jahr** beschränkt werden (nicht beim Spaltfilter). Erste Verschmutzungskontrolle ca. 12 Stunden nach Inbetriebnahme.
3. Der Ölstand muß zwischen den Markierungen des Peilstabes liegen. Die auf dem Typenschild angegebene Ölmenge ist ein Anhaltswert.
4. Erforderliche Getriebespülungen mit niedrigviskosem Öl durchführen. Das Spülöl ist weitgehend aus Getriebe, Filter und Wärmetauscher zu entfernen.
5. Das Getriebe ist im Anlieferungszustand konserviert. (Konservierungsöl ablassen). Reste des Konservierungsöles sind mit Betriebsöl mischbar.

To be observed in selecting oil for use in REINTJES gears:

1. Optimum viscosity range at operating temperature is between 20 and 60 mm^2/s (cs) with anti-friction bearings and between 60 and 120 mm^2/s (cs) with plain bearings.
2. A sump heating installation (special equipment must be fitted to the gear box if oil temperature is lower than 10—15 °C (50—90 °F).
3. Mineral oils containing solid lubricants (e. g. molybdenum disulphide MoS_2) must not be used.
4. Highly alkaline engine oils (TBN $>$ 20) must not be used with built-in disc-clutches.
5. Turbine oils must not be used.

To be observed when changing the oil:

1. Oil change times prescribed in the Instruction Manual must be kept, particularly regarding the first change. Extension of intervals is only admissible if based on a regular, reliable analysis.
2. Oil filter and air filter should be carefully cleaned when changing the oil. Wire mesh filter elements of a size $\geqq 40\,\mu m$ may be carefully brushed in cleaning gasoline or detergent. Use of filters should be restricted to **1 year** (not applicable with split filters). First check for contamination should be made approx. 12 hours after starting up.
3. The oil level must lie between the dip stick markings. The oil quantity indicated on the name plate is a reference value.
4. Cleanse gear-box with low viscosity oil. Remove cleansing oil from gear box, filter and heat exchanger as thoroughly as possible.
5. The gear box will be delivered in an preserved state (the preserving oil must be drained). Residual preserving oil may be mixed with engine oil.

Achtung!

Die in der Schmierstofftabelle aufgeführten Ölsorten werden von den Ölgesellschaften verantwortlich festgelegt. REINTJES übernimmt keine Haftung für die Richtigkeit dieser Angaben sowie aller eintretenden Änderungen. Für alle Schäden, die durch die Verwendung nicht geeigneter Öle entstehen, übernimmt REINTJES keine Haftung.

Attention!

The oil companies are responsible for determination of the oil types stated in the lubrication chart. REINTJES is not liable for correctness of these data nor for any amendments occuring. REINTJES does not accept responsability for any damages due to use of unsuitable oils.