Innovative Power Transmission

Double Marine Gearboxes

Gearboxes for highest Demands

Gearing

The dimensioning and design always aim at highest safety and lowest noise and vibration excitation. These objectives are achieved by virtue of the optimum fine tuning of macro and micro gearing geometry.

Casing

The design of the casing and of the foundation considerably influences the load carrying characteristics of the gearing and bearings as well as the noise and vibration excitations.

For this reason, the casings are built torsionally stiff with strong internal ribs and are partly manufactured with double walls.

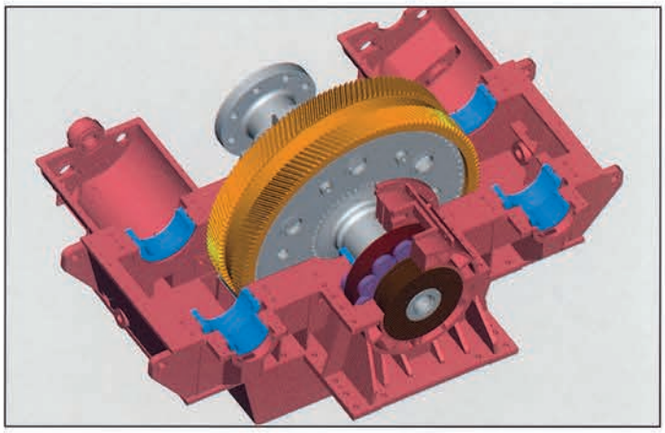
As a standard, the thrust bearing is located on the engine side. This arrangement provides high stiffness of the foundation in the thrust bearing area by linking the gearbox foundation with the engine foundation for optimum absorption of the propeller thrust forces.

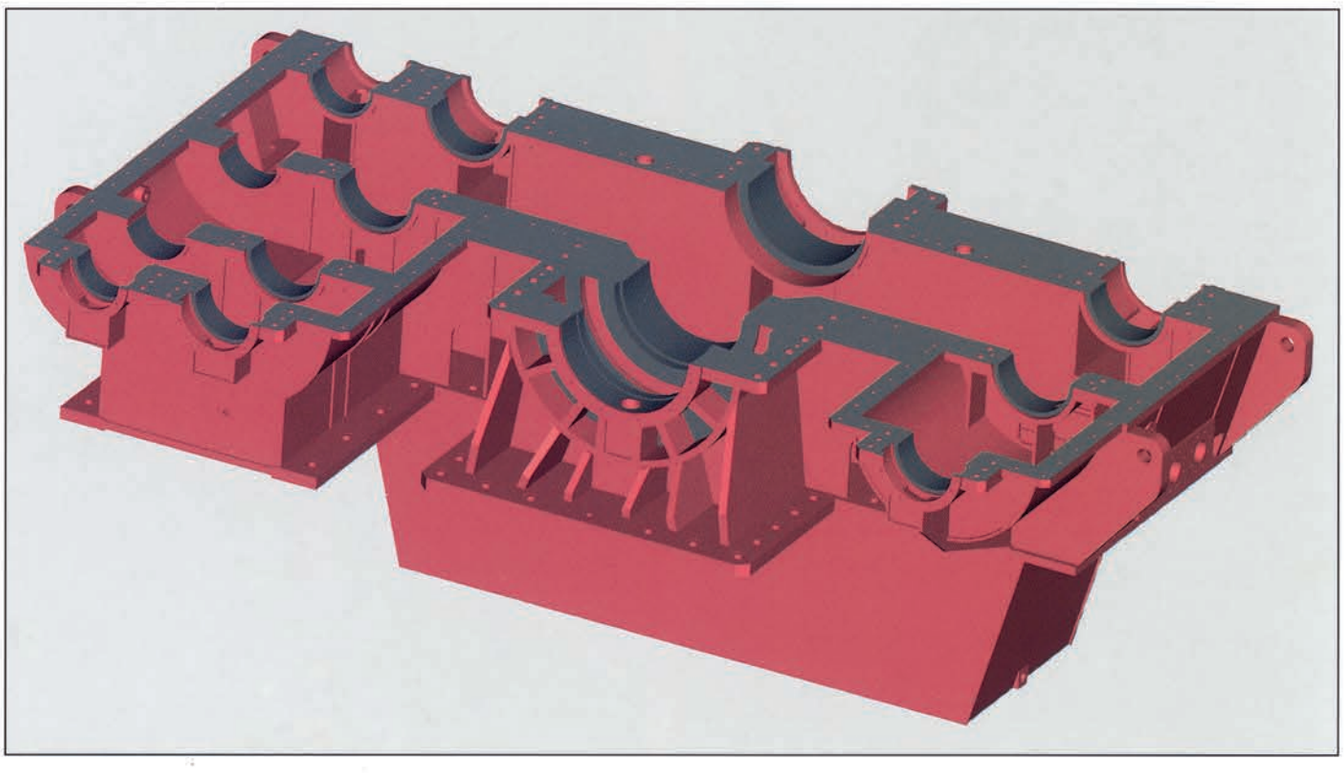
Bearings

High quality gearboxes require bearings with particular properties. Therefore, RENK cares very much about the selection of safe and amply dimensioned bearings that secure high performance and a long service life. Thick-walled radial and axial bearings with circular thrust pads provide a trouble-free and durable operation.

The following aspects are of particular advantage:

- Maintenance of the thrust bearing is possible without draining the oil and disassembling the gearbox housing.
- Astern and ahead pads of the thrust bearings are of identical construction, a fact that simplifies replacements to a considerable extent.





Noise Reduction

The noise and vibration characteristics of the gearboxes are crucial quality features, particularly for ferries and cruise vessels. RENK has demonstrated for many years that even highest requirements can be fulfilled by combining different measures. This can be verified already during the shop test run. The noise and vibration characteristics are measured by means of a back-to-back test during which the gearboxes are tested at full load.

Lube Oil/Clutch Oil Supply

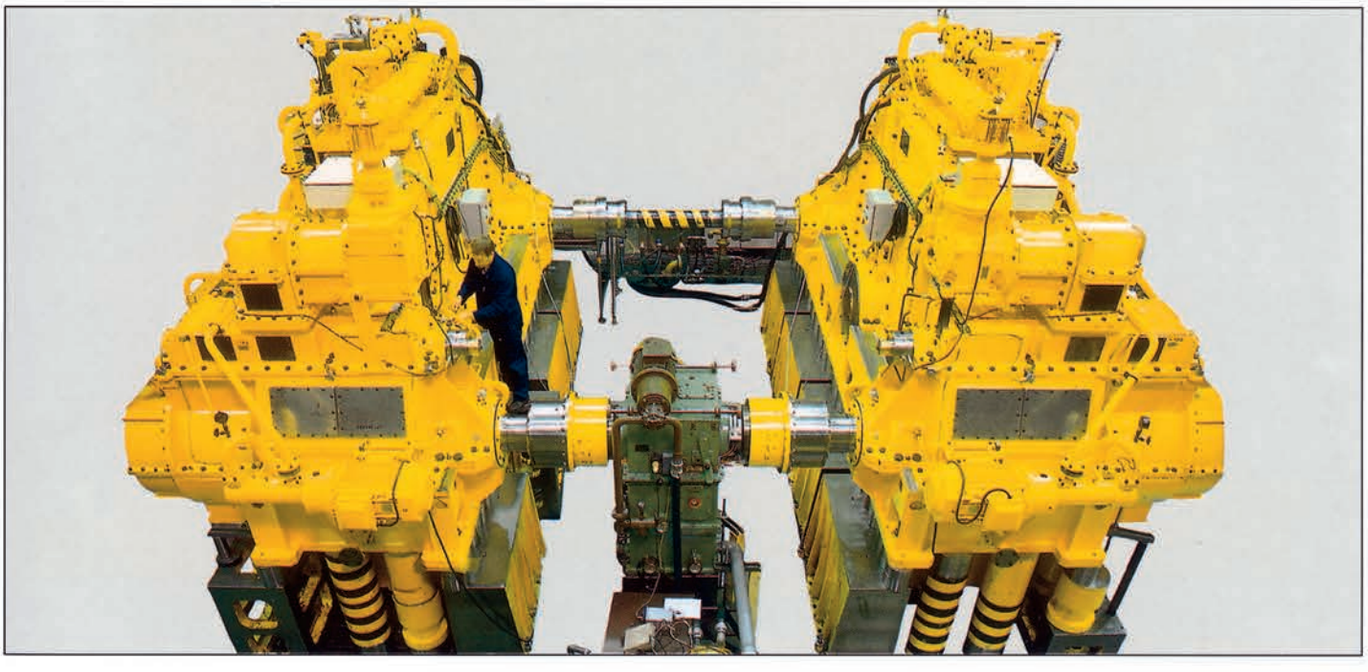
As a standard, RENK double marine gearboxes are equipped with several lube oil/clutch oil pumps. In addition to electrically driven starting and standby pumps, double marine gearboxes are equipped with a primary clutch oil pump arranged on each input shaft. This ensures safe engagement of the multiple-disc clutch while the main engine is running. Therefore, even in case of power failure or cable burn, highest operation safety is also provided in case of averages.

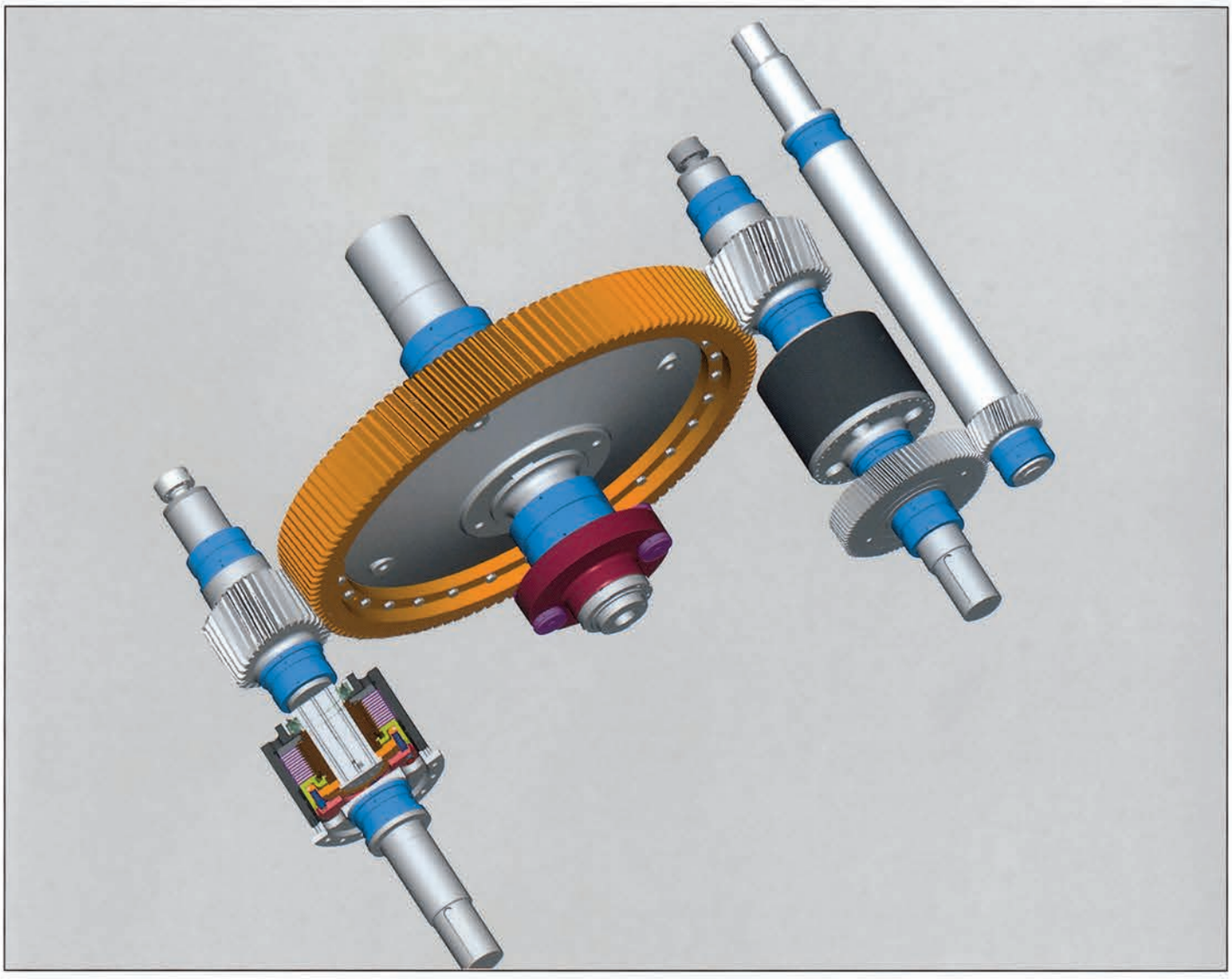
Optional Accessories for Double Marine Gearboxes

- Programmable logic control system (PLC), integration of the main and PTO-multiple-disc clutches into the central ship's automation system
- RENK Clutch Processor (RCP) - Monitoring element to protect the multiple-disc clutches against overload, e.g. during navigation in ice
- Turning device for turning the propeller shaft
- Attachment of high-pressure pumps for the controllable pitch propeller
- Attachment of brake systems
- Emergency engagement device for multiple-disc clutches

Back-to-Back Test

Modern test facilities are available to RENK AG, Rheine Plant, equipped with state-of-the-art testing and measuring instruments. Double marine gear boxes up to largest sizes can be back-to-back tested under load.
In a back-to-back test configuration, two double marine gearboxes of mirrorinverted design are connected to each other. With this configuration RENK is able to apply high partial or full load to the gearing by a hydraulic torsion unit. The system which is closed in itself is driven by the output shaft or the PTO-shaft. Thus, extensive air and structure-borne noise measurements as well as pressure and temperature measurements can be carried out under load which allow correlations to the operational performance on board. This extensive test is frequently requested by customers and is often the final activity within the scope of comprehensive in-house and external quality assurance steps. The quality assurance activities performed throughout the entire production cycle up to the final assembly comply with the requirements set forth by DIN ISO 9001 as well as with specific rules of the classification societies.





Hydraulically actuated RENK Multiple-Disc Clutches

Main propulsion engines as well as auxiliary drives, auxiliary outputs and inputs connected to the gearbox can be engaged or disengaged during operation by means of RENK multiple-disc clutches.

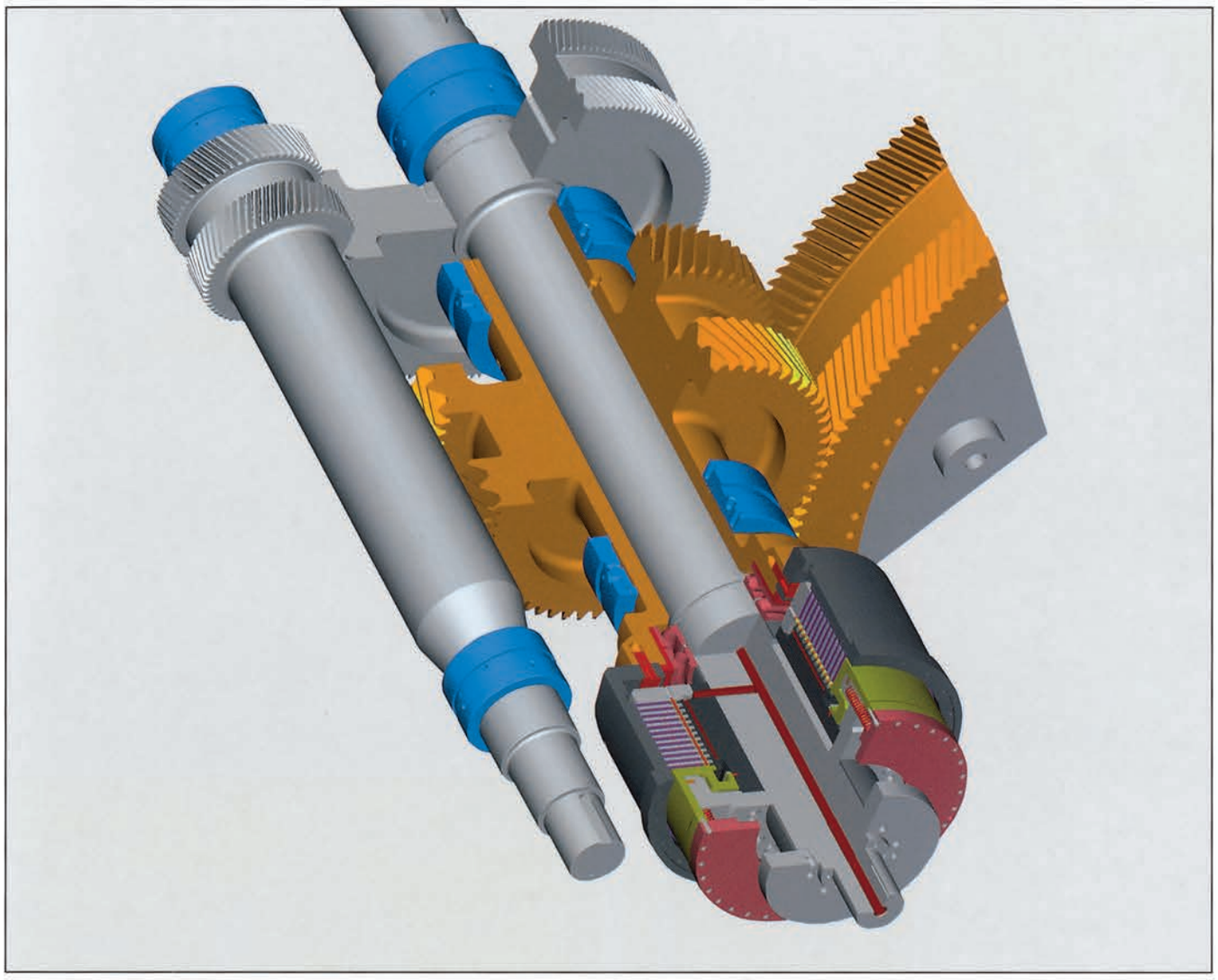
These multiple-disc clutches have been specifically developed by RENK AG and have proven their high reliability and longevity throughout many years, even under extreme service conditions.

The discs of the hydraulically actuated clutches are made of steel and the outer discs are additionally provided with a profiled sinter coating. The discs are forced lubricated and cooled. The clutches are en-/disengaged hydraulically.

The lube oil and clutch oil circuits are incorporated into the gearbox lubrication and cooling system.

The two-stage engagement system, also developed and optimized by RENK, ensures soft engagement with lowest possible wear.

To avoid increased heating up at high power or speeds, the discs are forced-segregated after disengagement.



Power Take-Off

For ships equipped with auxiliary drives "Power Take Off" two design options are available:

- Secondary PTO
  Generator operation is possible while the propeller is rotating.
- Primary PTO
  Generator operation is possible even if the propeller is at standstill.
  This means that electricity can still be generated with the main propulsion engine when the ship is not sailing, e.g. in harbours, or additional pumps or auxiliary drives etc. can be driven.

RENK has also proven during the last decades that custom-built gearbox solutions show best performance, e.g. PTO's equipped with two-speed gears so as to be able to run the generator at different engine speeds.

Quillshaft Design

Double marine gearboxes for very high power ranges and equipped with multiple-disc clutches are provided with quillshaft input shafts resulting in following advantages:

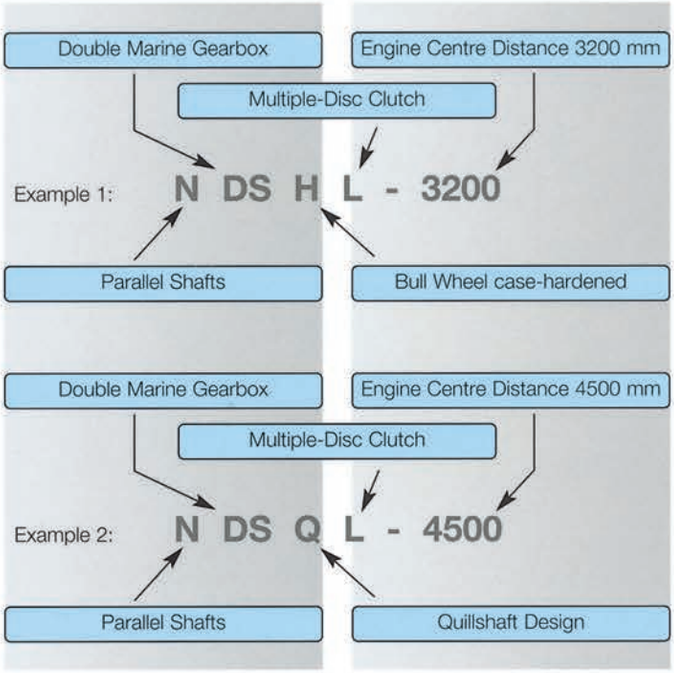
- Distinct functional separation of the gearing from the input shaft due to the hollow shaft design,
- in case of resiliently mounted engines the gear teeth are not adversely affected by misalignments,
- the specific bearing arrangement ensures optimum distribution of the forces.

Most diverse quillshaft combinations can be realised with RENK multiple-disc clutches for tailor-made PTO/PTH and PTI configurations.

Types - Sizes - Design Concepts

Type and Size Designations of RENK Double Marine Gear Boxes

N	Parallel Shafts
DS	Double Marine Gearbox
H	Bull Wheel, case-hardened
Q	Quillshaft Design
L	Multiple-Disc Clutch



Standard design: 2 pinions and 1 bull wheel, up to 5000 mm horizontal engine centre distance

Preferred Engine Centre Distances in mm:

1800	2800	3750	4750
2000	3000	4000	5000
2250	3200	4250	
2500	3500	4500	

The engine centre distances can be tailored to the conditions prevailing on board or according to customer requirements.

Power Ranges

Type: NDSL/NDSHL
Size: 1800-3500
Power Range:
2 x 1.500 – 2 x 10.000 kW

Type: NDSQL/NDSHQL
Size: 2250-5000
Power Range:
2 x 1.500 – 2 x 35.000 kW

Gearbox Concepts for Propulsion Systems

Propulsion systems for ships, such as Ro-Pax ferries, supply vessels, ice breakers, etc., are often equipped with 2 propellers and 4 engines. The power of two engines each is transmitted to the propeller by a double marine gearbox.

The gearboxes belong to the most important components of a propulsion system and fulfill multi-functional tasks:

- Combination of individual power of several main engines.
- Reduction of the main engine speed to the optimum propeller speed.
- Power take-off or power take-in for or from auxiliary drives.

RENK gearboxes are tailor-made to suit any particular application.

Apart from the conventional design of arranging the engines parallel to each other, other solutions are also available where, e.g., the engines are arranged facing each other. All possible options have already been realised with various horizontal and/or vertical axial offsets.

The comprehensive experience RENK has gained within decades in the design and manufacture of several thousands of marine gearboxes constitutes the solid base for the development of optimum solutions that entirely meet the requirements set forth by the customer. The above mentioned facts ensure highest reliability and long service life for one of the most essential components in the propulsion system of a ship.

The gearboxes are designed and manufactured always considering the following criteria:

- Customer Specifications
- Classification Rules
- Internal RENK-Standards

RENK's internal standards cover the design and dimensioning of the most important gearbox components, such as gearing, bearings, multiple-disc clutches and thrust bearings. They reflect the experience gained during the long tradition of gearbox manufacturing.

RENK's internal standards are complying with the rules of the classification societies. In addition, they are valuable supplements and partly even exceed classification requirements.

Therefore, these standards guarantee best performance, reliability and longevity.

Service around the Product

Our highly qualified team of experts will be supporting you once the ordered gearbox or coupling has left our factory. The Service Team can be contacted at any time to assist you with any questions or problems you have.
In addition, our after-sales service department is flanked by a group of experienced field engineers. We provide constant support to these team members to ensure that complex queries are solved fast and accurately.

Our service team will arrange and co-ordinate all necessary measures and ensures competent assistance with remedies without any loss of time.

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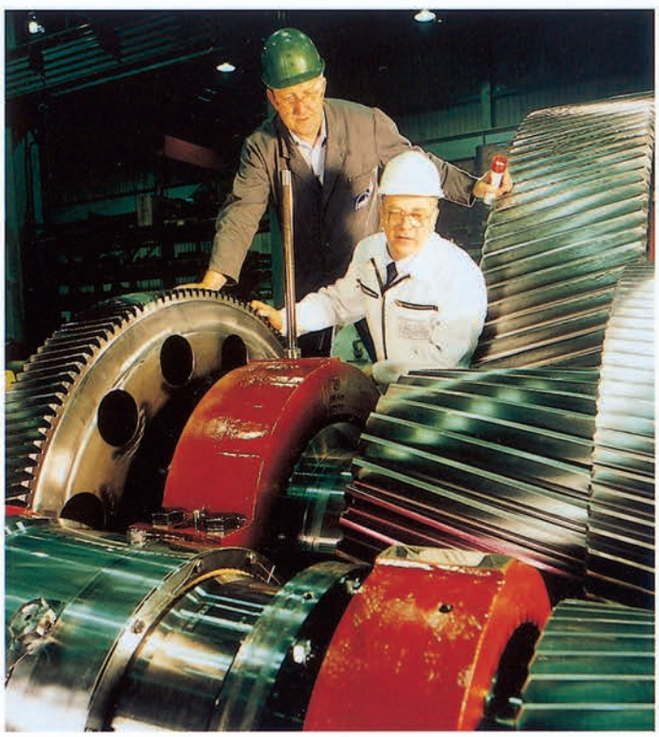
We maintain the most advanced test and inspection facilities:

- 3D gear teeth measurement
- 3D coordinate measurement machine
- crack testing, surface testing and ultrasonic testing
- endoscope to take a look 'inside'

Upon completion of the analysis, you will receive an examination report including suggestions and recommendations how to proceed.

3D measurement machine

Gearing measurement



Inspection of a marine gearbox

Further Examples of our Production Range

1 Single Marine Gearbox Type HSU

2 Marine Reversing Gear-box Type SWV

3 Curved Tooth Coupling®, Construction Series SB

4 Tunnel Gearbox Type SHH

5 Pump Gearbox Type SHI-38

6 Diaphragm Coupling - High-Speed Construction Series MCF

7 High-Speed Gearbox, Construction Series TS/TB/TL

8 Raflex® Steel Disc Coupling, Construction Series MTP

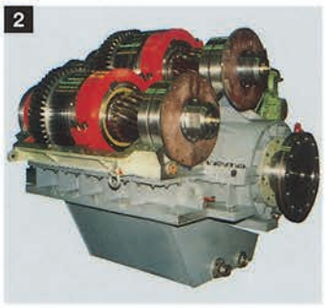
9 Gearbox Series WPS for Wind Power Stations

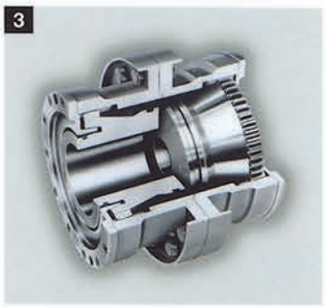
10 Curved Tooth Couplings® for industrial, marine and offshore Applications

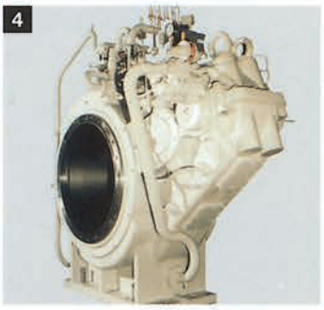
11 Diaphragm Coupling, High-Speed Construction Series MCN

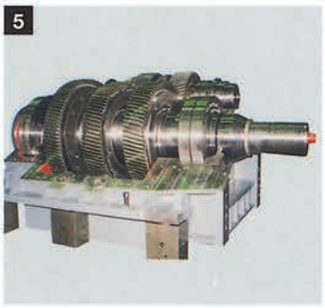
12 HYGUARD® Safety Coupling

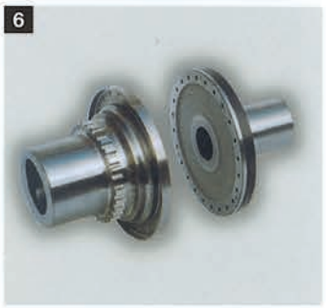
13 Raflex® Steel Disc Coupling - High-Speed Series MTR and MTM

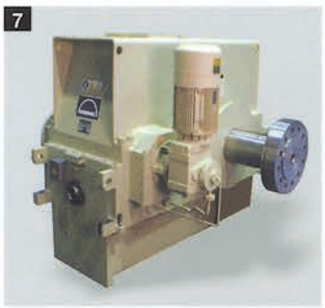


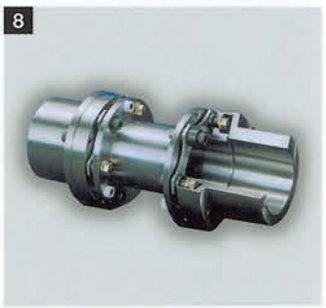


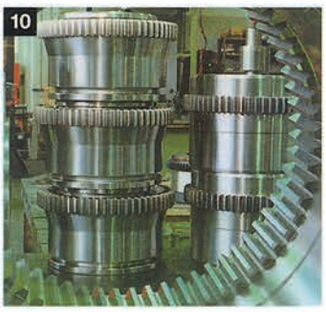


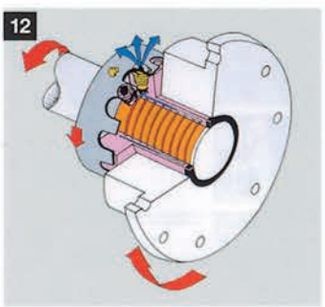












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