



Innovative Power Transmission



RENK multi-functional test facility
Testing your drive is our strength

RENK multi-functional test facility for drive systems and components: One of the most modern and efficient of its kind in Europe

In the spring of 2016, RENK AG put one of Europe's biggest and most modern test facilities for gear units and power transmission systems into operation at its headquarters in Augsburg. Right from the start, the shop measuring 40 x 60 m and 20 m in height, with a broad range of multi-functional units and systems, was intended not only for testing the special gear and power transmission systems made by RENK, but also those of other manufacturers.

Accordingly, the generously sized layout and comprehensive equipment leave nothing to be desired. The four test beds installed on an area of 1,250 m² have enough capacity to handle enormous workloads and the most challenging customer demands.

Left: RENK Augsburg Plant – New hall with multi-functional test facility
Right: Test bed „B“ 37 x 15 meter





Maximum functionality – precise settings: The test facility as a multi-functional field

The facility is built for testing a number of different parameters under different loads. It is designed in a way that both individual gear units and complete drive systems as well as drive components can be tested.

The extensive equipment allows various types of tests: from functional tests to performance tests, measurement of process parameters as well as highly dynamic response to the effects of structure- and airborne noise. Tests for efficiency or stress tests are also possible.

Perfect logistics – a generous lineup of features: The dimensions of the testing facility

The testing area measures 1,250 m² and is subdivided into two large and two small test facilities housed in separate rooms of the building. The two big ones measure 37 x 15 m and 37 x 13 m, the small ones have testing areas of 15 x 6 m and 20 x 6 m. This area is covered with slabs 30 cm thick and is anchored to a reinforced concrete foundations up to 3 m thick for loads of up to 1,000 t. The cranes in place can lift weights of up to 200 t.

Performance specifications of RENK's multi-functional test facility: Any combination of motor and generator

RENK multi-functional test facilities deliver top performance in terms of other parameters as well. They have the option of a power intake of 12 MW at 10 rpm (e.g. a wind turbine gearbox in back-to-back-operation) which results in an operating torque of 11 million Nm in special strong baseplates.

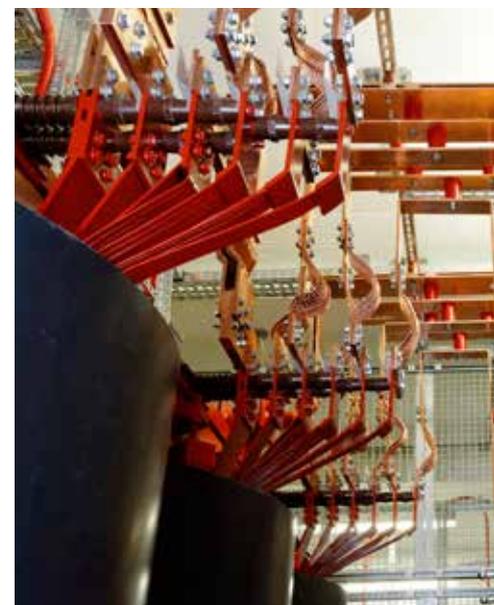
With the aid of intermediate gears, test specimens can be subjected to torques of up to 500,000 Nm and maximum speeds of up to 20,000 rpm under load of up to 12 MW.

For this purpose there are five AC motors with an output of 6 MW each and five DC motors with outputs of 1 MW and 600 KW. Each motor can also be used as a generator, thus feeding the braking energy back into the system. Hence, load tests of 12 MW simply consume the actual losses caused by the tested objects (see general arrangement on page 8).

Power supply for motors



Transformer 690 V-11 KV



Less input, maximum results: Value for money!

The test facility is adapted to the specific needs of manufacturers of complete drive and propulsion systems well as their components such as motors, brakes, compressors, gears and, for every sector – marine, automotive or industrial. The multifunctional test facility is especially suited for testing prototypes and pre-production assemblies. In this way manufacturers save the time and costs that would be caused by setting up the test equipment themselves.

Cost and time savings are particularly high whenever complete marine propulsion systems need to be tested. By outsourcing such work, contractors have the possibility of thoroughly testing the propulsion system in its entirety before the commissioning stage and not having to wait for it to be installed onboard. This translates into significant savings in time and costs otherwise involved in onboard testing.

Another advantage: the systems are installed in the test field complete with all the wiring and electric barring. This means that the signals and interfaces can also be tested. Such an all-inclusive test set-up provides a high level of validation certainty even before commissioning.

All-inclusive customer service: Close to the action yet safe

RENK's multifunctional test facility is one of the few worldwide to allow customers to personally experience the testing in close proximity of drive systems and their components while safely protected from potential hazards. To make this possible we provide observation rooms in a gallery around the test fields. There they can follow the testing of their products in every detail, either on a monitor and through camera installations or live from the viewing platforms.



Motor generator set 8-MW



The four pillars

The following four elements neatly sum up the testing procedures and options available on the four test beds of the multi-functional test facility.

Oil

Oil as a lubricant plays a decisive role in the operation of gears and bearings. Our test systems take this into full account. In order to have the right amount of oil available throughout operation, each of our four test beds has an integrated hydraulic system for recirculating lubrication. The oil capacity of each is 14,000 liters, and they can each deliver up to 4,500 liters/min during which the incoming oil passes through a filter with a nominal width of 10 μm . For the purpose of heat discharge, four oil heat exchangers (3 x 1,000 kW, 1 x 600 kW) are available per oil unit.

There are two oil filling units for test specimens which have their own oil reservoir with a capacity of 24,000 liters each. In total RENK stores about 100,000 liters of oil at its test facility.

Water

The test facilities cooling system requires vast volumes of water. At present, the available cooling capacity is 8 MW which, if and when needed, can be raised to 12 MW. Added to this are three refrigeration machines with a capacity of 600 KW each, by means of which the oil temperature of the hydraulic systems can be lowered all year round for special tests. The complete cooling system contains around 300,000 liters of water, distributed by 30 pumps along various circuits for cooling the test specimens, oil units, and other components. The aggregate pumping capacity is 1,450 m³/h.

Pumps of cooling tower



Hydraulic system



Switch gears of electrical system



Electrics

Another essential element of test facility is the electrical system we make available to our customers. The RENK facility has ten motors in total which also work as (bi-directional) generators. Configured adjustably, they can also operate in test combinations.

The five 6-MW AC motors run at maximum speeds of up to 2,400 rpm and develop a torque of 38,000 Nm each, while the five 1-MW DC motors run at 2,100 rpm and develop a torque of just under 12,000 Nm. In each case, two motors can be connected in series. This way two 6-MW AC motors can be combined into a 12-MW power package with two additional motors acting as brake generators. This means that high-load test cycles are possible without extensive set-up preparations.

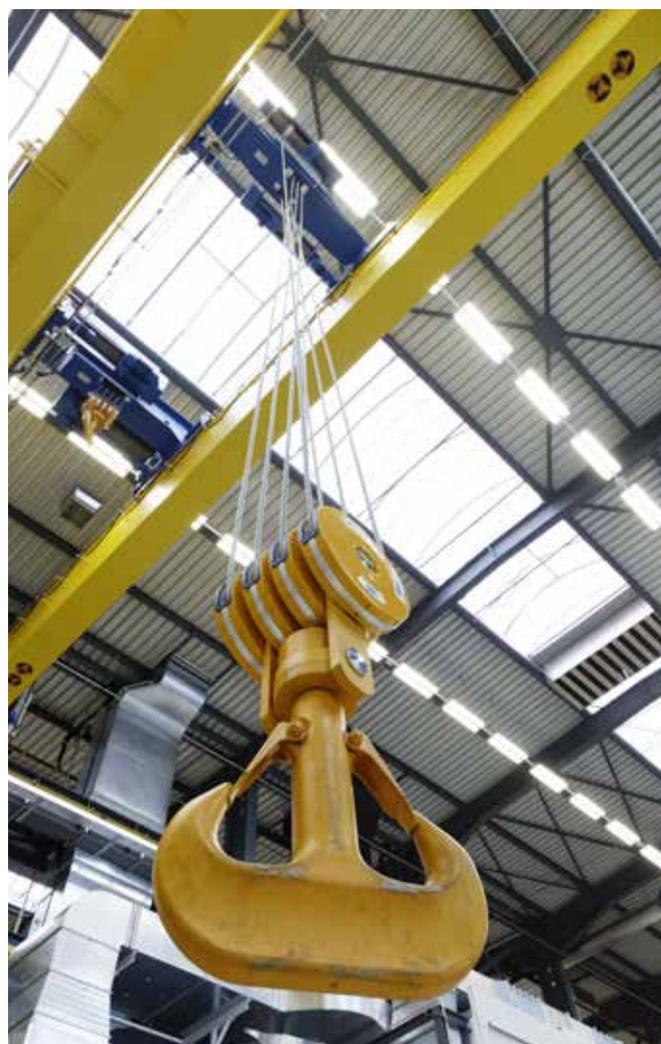
All our motors are adapted to the high requirements placed on the test specimens in terms of air- and structure-borne sound emissions. Therefore the five AC motors each feature additional stiffening elements and special insulation. They also have a connecting flange at either end as well as low-noise water coolers underneath.

With the aid of adapting transformers, various levels of voltage ranging from 690 V (4 MVA) to 11 kV (8 MVA) can be provided for the test beds. These are used, for example, during the testing of complete propulsion systems. With the aid of a motor-generator set, these voltage levels can also be used with frequencies varying between 5 and 80 Hz, for example, when testing motors. Thanks to the perfect sinus created, both motors for frequency-converter- and DOL-operation can be tested at various voltages, speeds and power levels.

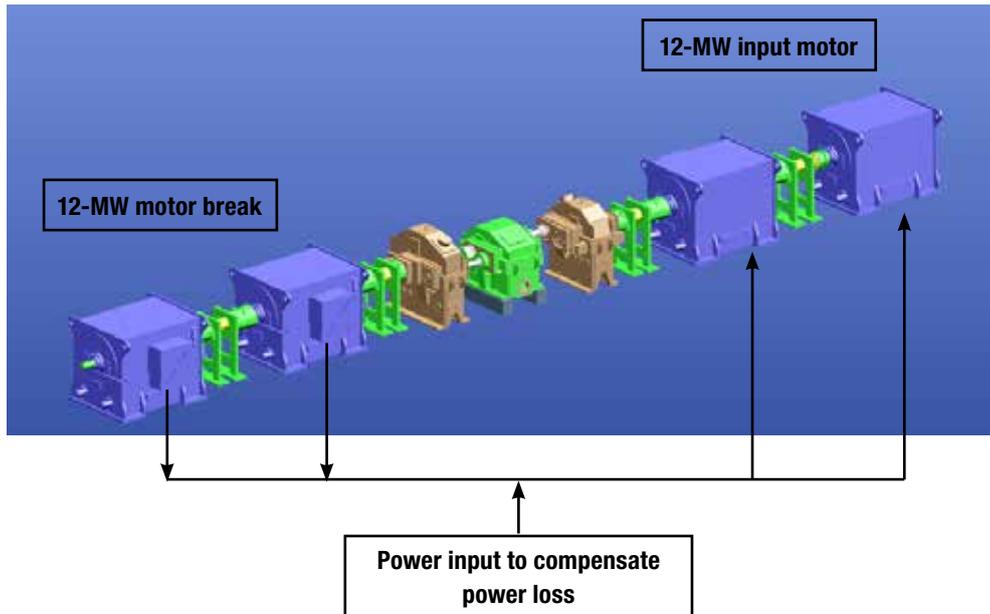
Generators can also be tested. They are synchronized to the powersystem through a synchronizing unit and can be tested for up to 10 MW.

Mechanics

From torque to high-speed transmission: covering an area of 1,250 m², our test beds A, B, C, and D feature state-of-the-art mechanical equipment throughout to allow the testing of even complex and bulky drive and propulsion systems, with very little assembly and set-up time required and equally uncomplicated dismantling of the system elements. Crane capacities of 200 t make sure that assembly/dismantling work can be carried out quickly from start to finish.

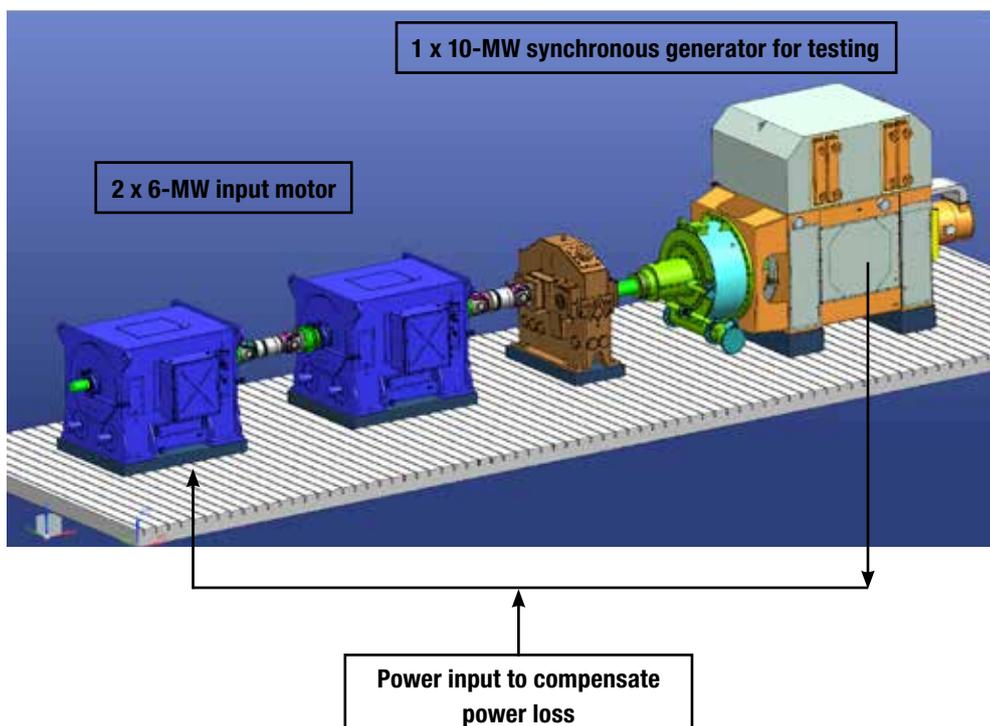


General possible arrangement of a 12-MW testrun



Concept of the power flow of a 12-MW test set-up

Load test of a high-speed gearbox at 12 MW. Two AC-Motors are used for the input, two AC Motors are used as Motor-Break (Generator). Only the power loss (~500 KW) is needed from the mains to perform this 12 MW test run.



Concept of a 10-MW load generator synchronized with the power supply system.

General technical data

Dimensions	
Area	1 x 37 m x 13 m 1 x 37 m x 15 m 1 x 15 m x 6 m 1 x 20 m x 6 m
Cranes	up to 200 t
Oil supply	
Volume	4 x 14,000 liters oil circulation units 2 x 24,000 liters oil filling units
Filtration	10 µm
Cooling capacity	3,600 KW each
Cooling plant	
Power	8,000 KW (cooling tower) 3 x 600 KW (refrigerator)
Motors	
Power	5 x 6,000 KW (2 x 12,000 KW power package) 4 x 1,000 KW 1 x 600 KW
Torque	5 x 38,000 Nm 4 x 12,000 Nm 1 x 3,000 Nm
Speed	5 x 2,400 rpm 2 x 2,100 rpm 2 x 1,800 rpm 1 x 2,000 rpm
Energy	
Energy levels	690 V, 4,000 KW, (5 - 80 Hz) 3.3 kV, 8,000 KW, (5 - 80 Hz) 4 kV, 8,000 KW, (5 - 80 Hz) 6 kV, 8,000 KW, (5 - 80 Hz) 10 kV, 8,000 KW, (5 - 80 Hz) 11 kV, 8,000 KW, (5 - 80 Hz)
Synchronisation unit (on frequency variable mains)	690 V, 4,000 KW, (5 - 80 Hz) 3.3 kV, 8,000 KW, (5 - 80 Hz) 4 kV, 8,000 KW, (5 - 80 Hz) 6 kV, 8,000 KW, (5 - 80 Hz) 10 kV, 8,000 KW, (5 - 80 Hz) 11 kV, 8,000 KW, (5 - 80 Hz)
Intermediate gears	
Max. Power	12,000 KW
Max. Speed	20,000 rpm at 12,000 KW
Gear ratio	1– 8.5 per gear



Intermediate gear; ratio = 4.037/6.776; 12 MW; 500,000 Nm



AC-Motor; 6 MW; 2,400 rpm; 38,000 Nm

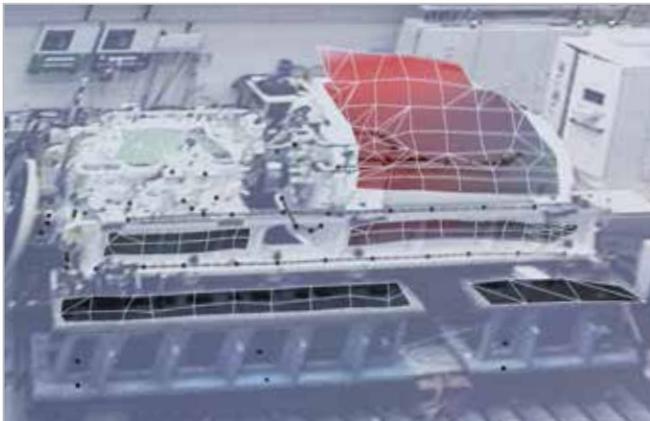
Measurement

RENK offers a multitude of measuring possibilities for process parameters and accoustic measurements as well as special equipments for special customer-requests.

Process parameters

RENK is able to measure process parameters with its brand new RENK Dynamic Data System (RDDS), developed by our subsidiary RENK Test System (RTS). With our RDDS-system it is possible to measure parameters like pressure, temperature, speed, conditions with an sampling rate up to 1000 Hz. Each system has a capacity up to 150 channels.

Dynamic deformation measured by laser vibrometer



Accoustic measurements

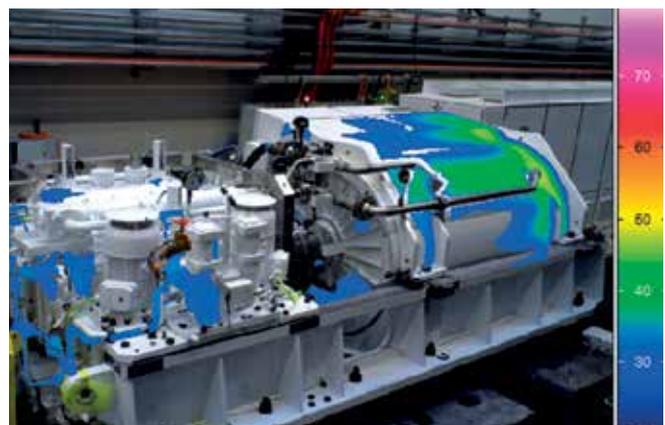
With our well-equipped measurement department RENK measures, records and analyzes many high-dynamic parameters such as airborne-sound, structure borne-sound. These measurements can be performed according to all international standards like ISO or MIL.

Airborne sound is measured either as sound pressure or as sound intensity. To perform high-precision, first class measurements, high quality equipment from a well-known manufacturer is used.

Structure-borne sound is measured with up to 50 channels, each with a measuring range of 50 kHz.

For special purposes modal analyzes, ODS (Operating deflection shape), shaker-analyzes or even laser vibrometers are used.

Distribution measured by infrared camera



Customer-Service „on-site“

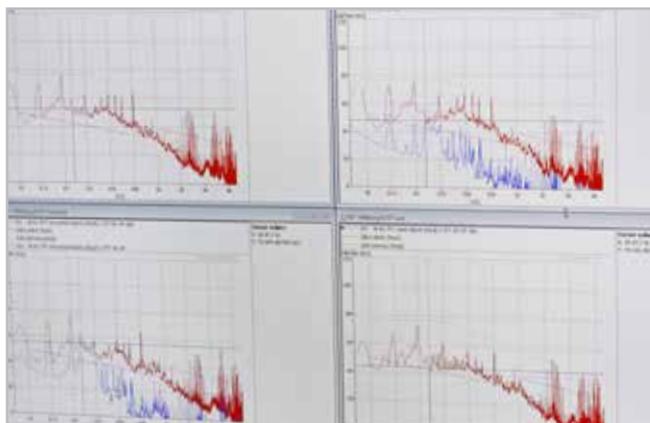
Based on RENK's vast experience with complex gear box systems as integral part of a propulsion plant, RENK is able to undertake worldwide on site measurements in order to give the operator a detailed and comprehensive overview of the current gear system condition. RENK specialists use the latest state of the art test and measurement equipment on board the vessel.

A final inspection report from RENK of onboard measurements is a useful decision support for the operator of the vessel to ensure a most efficient and economic maintenance schedule.

Vibration pickup



High dynamic vibration measurements



Level One - Airborne sounds measuring instruments





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