

lightweight
transmission
components



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drive shaft and
flexible coupling in one:
the **flexshaft**

a revolutionary **transmission design**

Multifunctional CFRP component

The new flexshaft combines the key features of a drive shaft with a coupling – in a single, integrated component. flexshaft torque shafts provide maximum torque strength for high torque transmission, while offering low bending stiffness. As a result, the shaft takes on flexible coupling properties, balancing misalignments between connected components in the drive train.

This reduces the number of mechanical components in the design such as couplings, universal joints, bearings, and assembly parts – the kinds of parts that are prone to wear and often require a lot of maintenance.

01

Fit and forget

Our unique composite construction of CFRP and steel is what makes flexshaft torque shafts stand out in terms of function and performance. Conventional torque shafts made exclusively of steel can only match the performance of our torque shafts in more intricate setups, and at much larger weights. What's more, due to its special material properties, CFRP offers a number of advantages for the construction of transmission components: flexshaft torque shafts are corrosion resistant and virtually maintenance free. Also, the relatively low coefficient of thermal expansion of CFRP in comparison to steel guarantees stable running characteristics, even at varying temperatures under a variety of operating conditions.

The innovative, patent-pending design and manufacturing concept behind these unique torque shafts means that our flexshafts can be customised to meet a variety of demands in terms of dynamic load, drive and installation conditions. As a result, the geometric design, as well as the laminate are optimally designed based on transmittable torque, desired torque strength and the bending stiffness outlined in the requirements specification.

In a fully integrated manufacturing process, the entire shaft – including load transfer elements and attachment flanges – is completed in a single manufacturing step, prior to the final cure of the carbon fibre laminate.

This eliminates the need for bonded joints or bolted connections, ensuring a safe load transfer and enhanced manufacturing consistency.

drive shaft and flexible coupling in one.

the **flexshaft**.



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manufactured by
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Features and benefits at a glance

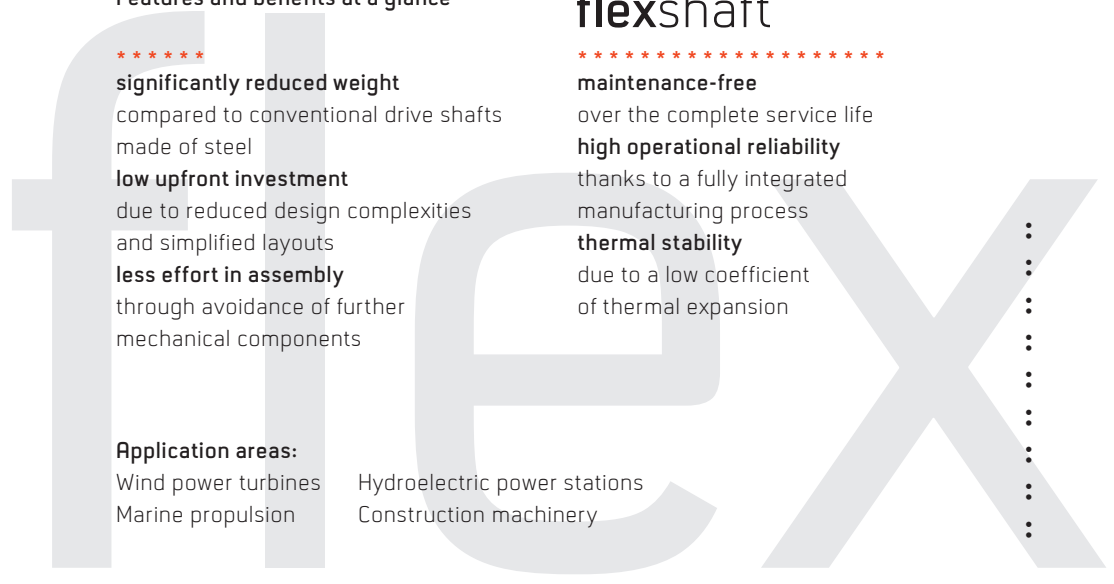
- *****
significantly reduced weight
compared to conventional drive shafts
made of steel
- low upfront investment**
due to reduced design complexities
and simplified layouts
- less effort in assembly**
through avoidance of further
mechanical components

Application areas:

- Wind power turbines
- Hydroelectric power stations
- Marine propulsion
- Construction machinery

flexshaft

- *****
maintenance-free
over the complete service life
- high operational reliability**
thanks to a fully integrated
manufacturing process
- thermal stability**
due to a low coefficient
of thermal expansion





flexshaft torque shafts in offshore wind turbines

03

Designed for high loads and reliable compensation of misalignments

Drive trains in wind turbines are constantly exposed to varying wind speeds and loads. Resulting misalignments in the drive train between connected components such as the rotor, couplings and the generator must be compensated to reduce wear and bearing reactions. flexshaft 5.0 torque shafts are specially designed with these particular demands of wind turbine transmissions in mind. The flexshaft 5.0 enables a direct transfer of torque loads from the rotor to the generator, and is designed for a permanent load of 2000 kNm; up to 5000 kNm at peak loads. This ensures safe operation under any conditions, even during strong gusts of wind. The shaft also offers sufficient bending flexibility to counterbalance the misalignments that typically affect wind turbines. This is achieved through targeted intrinsic deformation over the lateral axis. The flexshaft 5.0 absorbs angle displacements and axial offsets, thus serving as a flexible coupling. As a result, there's no need for moving parts that require a lot of maintenance. This significantly reduces system complexity and the need for maintenance of mechanical components.

Maintenance-free drive elements for reliable operation on the high seas

flexshaft drive shafts for wind turbines are designed and manufactured in accordance with DNV standard DS-J102 ("Design and Manufacture of Wind Turbine Blades"). Reduced weight (important when it comes to simplifying logistics and improving handling) is a key factor in the assembly of wind turbines – especially with offshore wind farms. It's here that flexshaft torque shafts offer decisive advantages, with significant weight reductions versus drive shafts made of steel. Considering the absolutely maintenance-free operation over its complete service life, the flexshaft 5.0 decisively contributes to the economical generation of wind energy, particularly on offshore wind farms that are difficult to access.

flexshaft 5.0

Nominal torque
2000 kNm

Max torque
5000 kNm

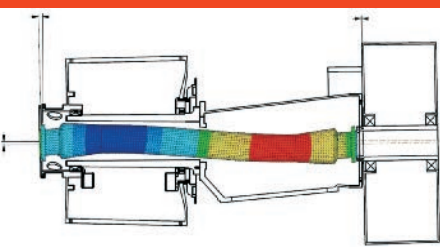
Length
8500 mm

Diameter
995 mm

Weight
3500 kg

Material
CFRP

Patent Pending



High bending flexibility can balance angle and axial misalignments, shown here, an angle displacement of $2 \text{ rad} \cdot 10^{-3}$ and an axial offset of 17 mm.

high torque strength

The double tapered design ensures easy load transfer between the carbon fibre shaft and the steel attachments.

low bending stiffness

can compensate misalignments.

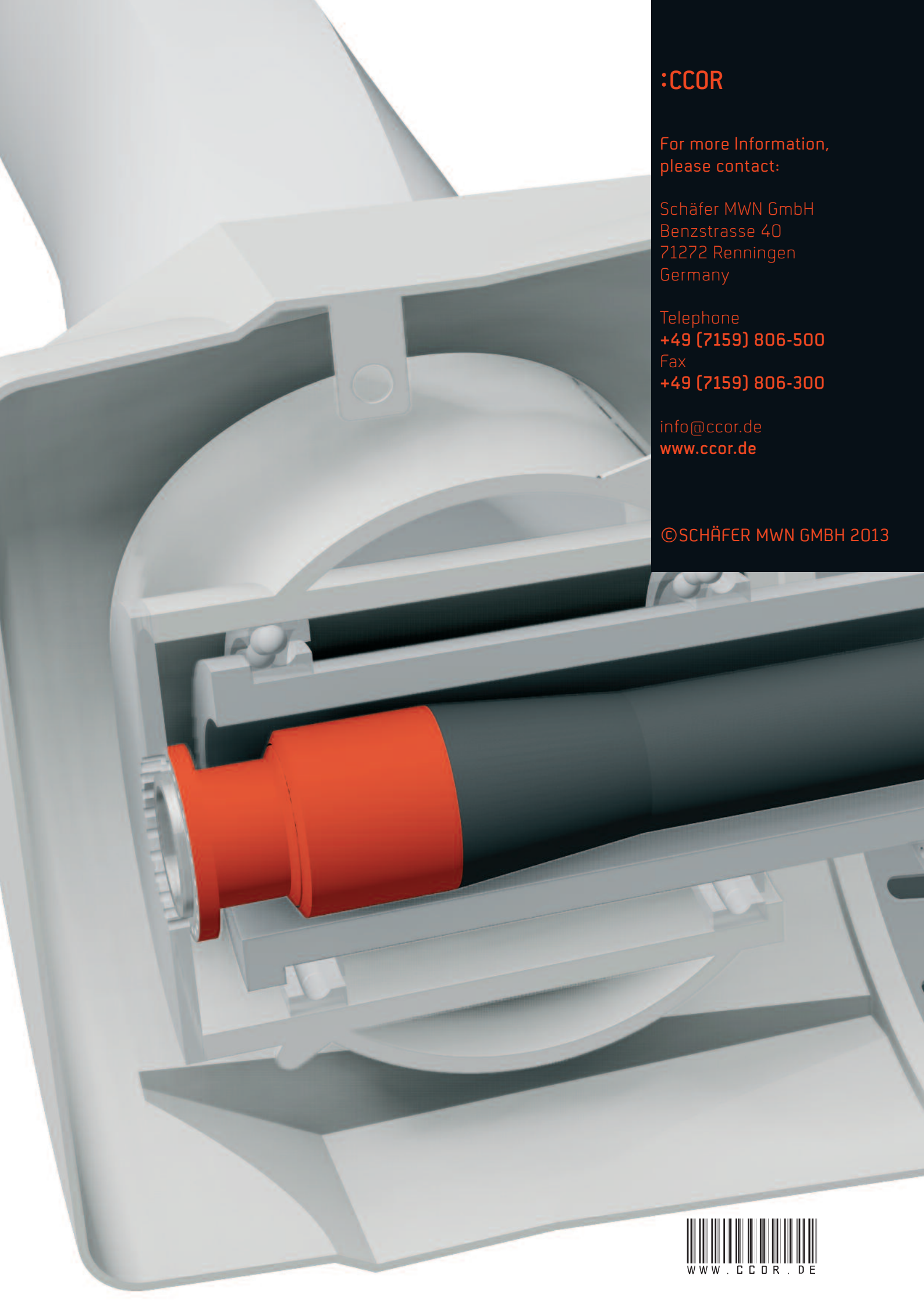
high buckling strength

Balanced aspect ratio provides a torsional stiffness of $> 28,000,000 \text{ Nm/rad}$ and ensures maximum torque capacity.

flexshaft 5.0 – winner of the JEC Awards 2013

The flexshaft 5.0 was distinguished with the JEC Europe Innovation Award 2013 in the Wind Energy category.





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