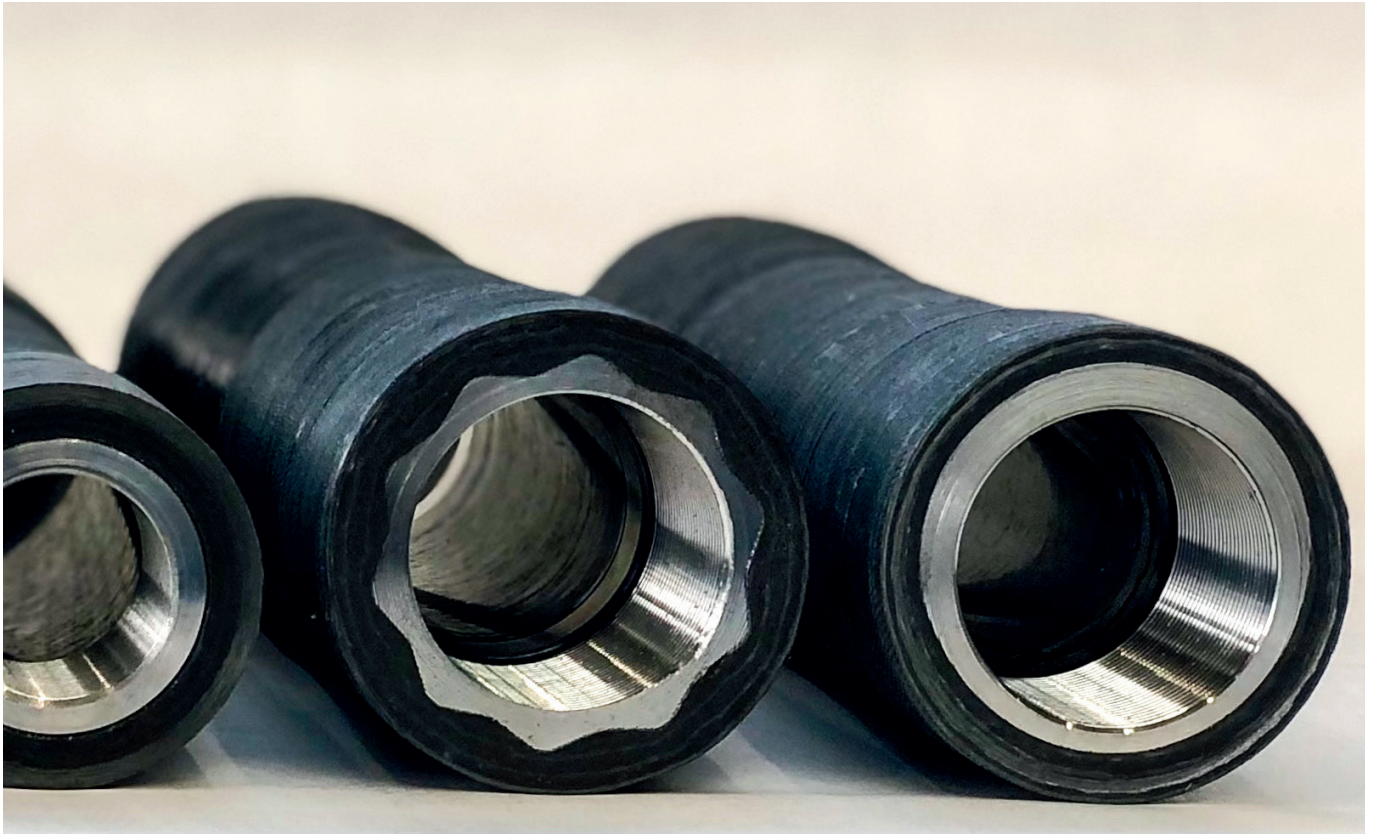


Short description

# Designing connections for carbon fibre-reinforced plastic (CRP)

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Fibre-reinforced composites can make a crucial contribution to increasing efficiency and conserving resources via reducing weight in a wide range of industries. Through fibre selection, fibre orientation and fibre volume fraction, equivalent properties can be achieved as with steel components - but at a significantly lower weight.

In order to ensure that the prevailing forces are optimally transferred into the fibre material, special fasteners are required. Research into various connecting concepts, especially for carbon fibre-reinforced plastic (CRP), is crucial for a successful use in lightweight material construction.

The combination of a layering structure and suitable fibres allow for the component to be optimally adapted to the load condition.

**Our research doesn't stop:** We are examining how this material can best be combined with steel.

## **What has been studied in the field of research and development on connecting concepts for CRP?**

The different properties of material-hybrid connections through practical research on cylindrical CRP specimens.

## **What was the goal of the research?**

The goal is to develop a universally applicable connecting concept to ensure an economically and technically sensible integration of primary composite structures.

## **What were the biggest challenges?**

The identification of appropriate design and calculation guidelines.

**LIEBHERR**

# The right connection for weight savings at equal performance

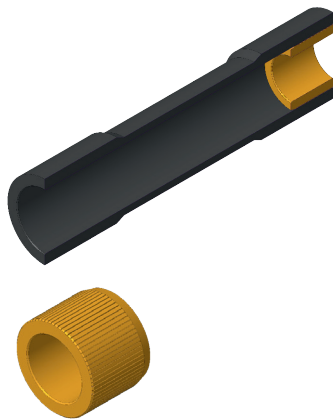
Depending on the requirement, it makes sense to consider the interface to the overall system or to the existing system. The choice of connecting elements also impacts the subsequent final weight of the component. In most cases, however, the interfaces will be made of metal. Knowing the loads facilitates the selection of suitable connections that are as light as possible:

1. Connection with subsequently pressed-in bushing for e.g. a torsional load
2. Connection with wrapped connection element for e.g. a combined torsion and tension load

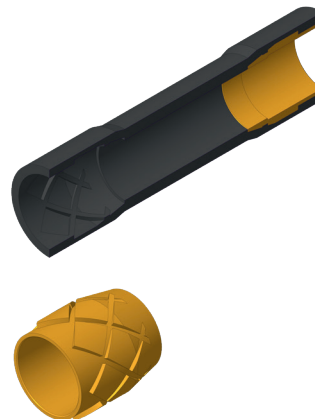


## Various connection elements for different products

1. Longitudinal press-fit connection



2. Loop connection by winding around diamond-shaped grooves in the cylindrical metal element



## Into the future through close cooperation

Only through comprehensive field tests under real operating conditions can the potential of connecting concepts for carbon fibre-reinforced plastic be tested for exact properties and behaviour. In a close cooperation with the customer, Liebherr determines suitable solutions for corresponding areas of application. Customers benefit from tailored advice from the hydraulics experts and from their support throughout the entire development process.