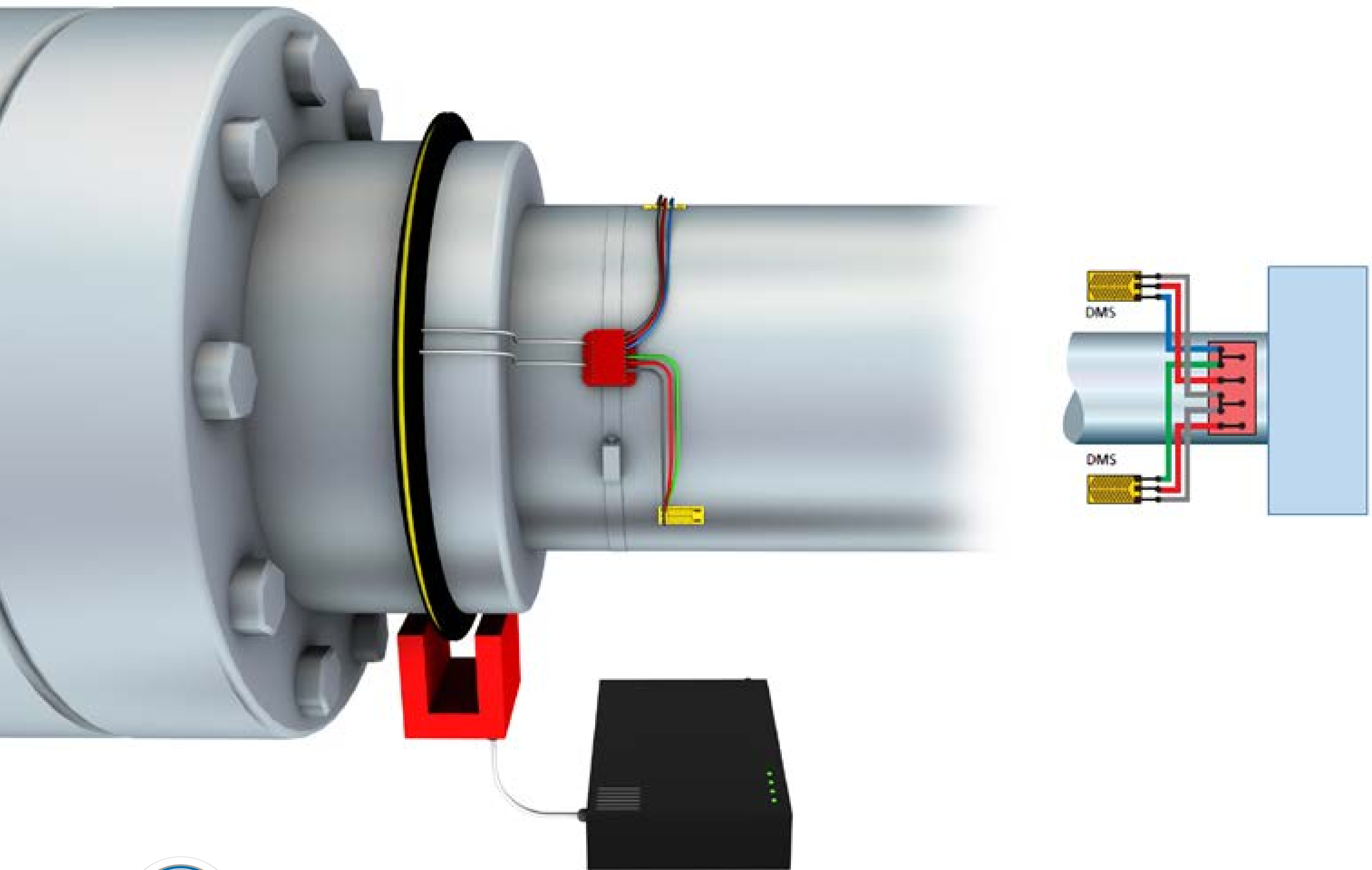
PRÜFTECHNIK ServiceCenter

Making machine with mechanical load visible with torque measurements

- Broken shaft? Learn why!
- Overload and event analysis as a valuable tool
- Strain gauges measurements on rotating shafts
- Increase assets performance



MEASURE, EVALUATE AND REDUCE VIBRATIONS

VIB 5 - Load and stress measurements

Mechanical torque measurements based on strain gauges belong to the major discipline in Condition Monitoring. Torque or bending moments from the Nm to the kNm range can be recorded in existing driving systems without technical modifications. Measurements of rotating shaft with strain gauges and telemetric signal transmission are still one of the most accurate method of detecting mechanical loads. However the application requires special application knowledge and careful preparation during the measurement procedure and by the selection of the measuring location.
Comparisons with other load measurement variables are possible, but other load measurement methods do not reach the same measurement qualities, such as measuring mechanical load with strain gauge in a wheatstone full bridge circuit and electrical shunt calibration.

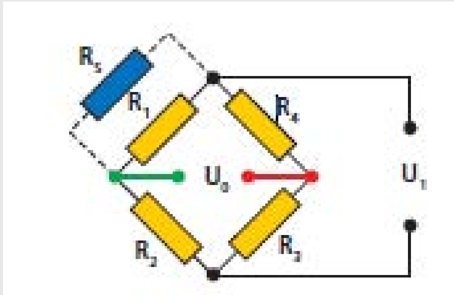


Fig. 1: Electrical shunt calibration

Strain gauges analysis are the major discipline in Condition Monitoring

Static torque measurements are used e.g. in diesel engines or gas turbines for power detection and performance optimization. The load distribution measurements provide information on how torques are distributed in drive systems.

Fig. 2: Record of load distribution

Automatic continuous event measurements with pre- and posthistory are suitable for detecting critical load or stresses situations, e.g. during start-up, loading, shifting, braking or other non-steady operating conditions up to the stones dredging.

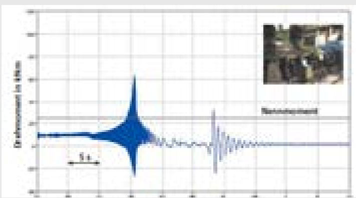


Fig. 5: Start of synchronous motor

Dynamic torque measurements allow to detect and quantify whether load oscillations lead to uniform, pulsating or alternating stress. This allows to determine e.g. ripples or dynamic factors and to compare with the component design.

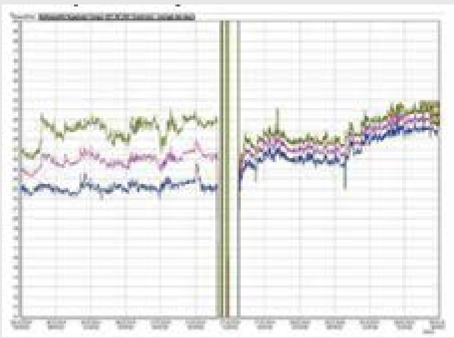


Fig. 3: Load reduction after optimization of an electrical converter in a coal mill

The torque amplitudes are statistically evaluable and can be classified. Using the rainflow counting method permits to estimate the fatigue strength and make reference to the S-N curve (socalled Wöhler Lines).

Diagnostic torque measurements allows you, using FFT for example, to determine and qualify excitation frequencies and possible naturals frequencies to finally find solution to reduce them.

Fig. 4: Mobile load measurement on a small hydroelectric asset

Natural frequencies can be determined with **torsional vibration analysis**, using Campbell diagrams and comparison with torsional vibration calculations. Such acceptance measurements with strain gauges are a must for ship drives and elastic couplings.

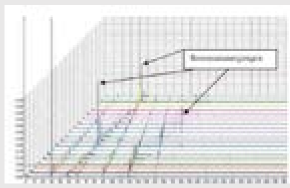


Fig. 6: Torque Campbell diagram

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