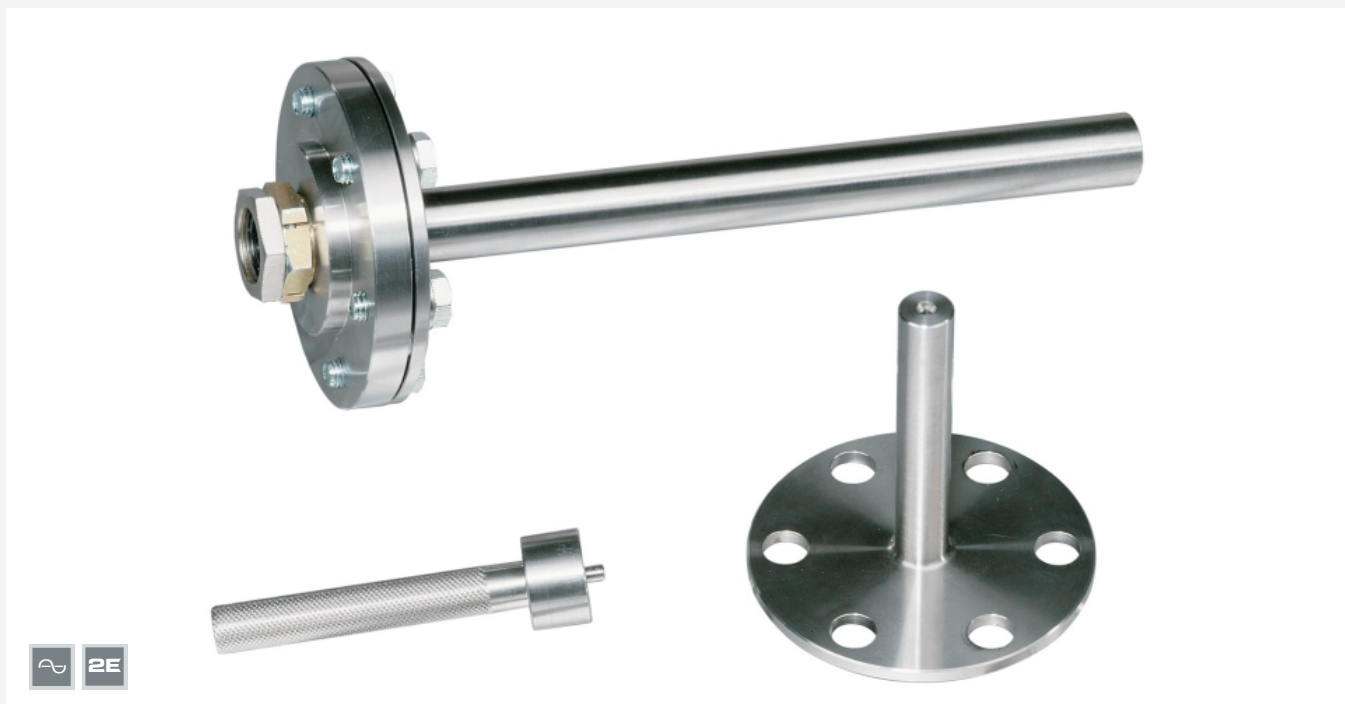


# PT 500.11

## Crack detection in rotating shaft kit



### Description

- **vibration behaviour of shaft with radial crack**
- **identification of damage**

Cracks due to material fatigue are very dangerous for rotating machines. Early detection of any crack is therefore essential before permanent rupture and often fatal consequences can occur. The crack influences the vibration behaviour of the shaft by changing its rigidity. Using suitable analysis software, this change can be registered and inspection of the machine organised in good time.

In the experiment, the crack is simulated by an asymmetric flange joint. Variable tightening of the flange bolts produces a temporary gapping of the butt joint, which closely approximates to the behaviour of a crack.

The accessory setup includes two shafts of different lengths: one short and one long. The short shaft simulates a protruding shaft end, and is loaded with the PT 500.14 belt drive. The long shaft is used in conjunction with a safety bearing from PT 500.10 and an inertia disk from the base unit to investigate the effects of a crack in a shaft on the elastic rotor.

The accessory setup is mounted on the base plate of the machinery diagnostic base system PT 500.

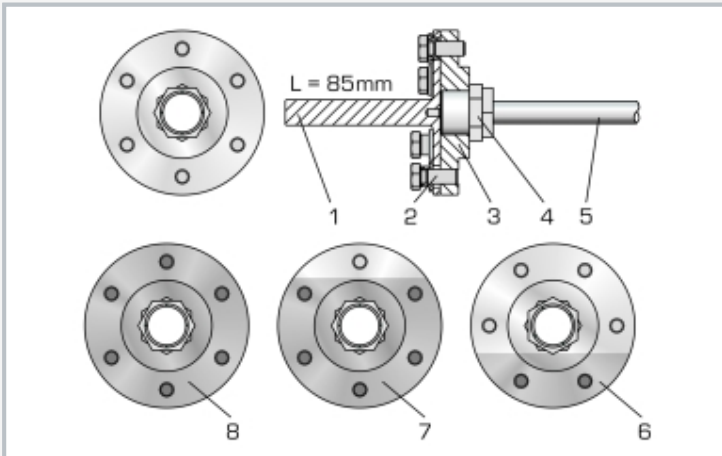
To measure and evaluate the experiment, the computerised vibration analyser PT 500.04 is required. It includes all the necessary sensors, a measuring amplifier and analysis software to record the vibration phenomena.

### Learning objectives/experiments

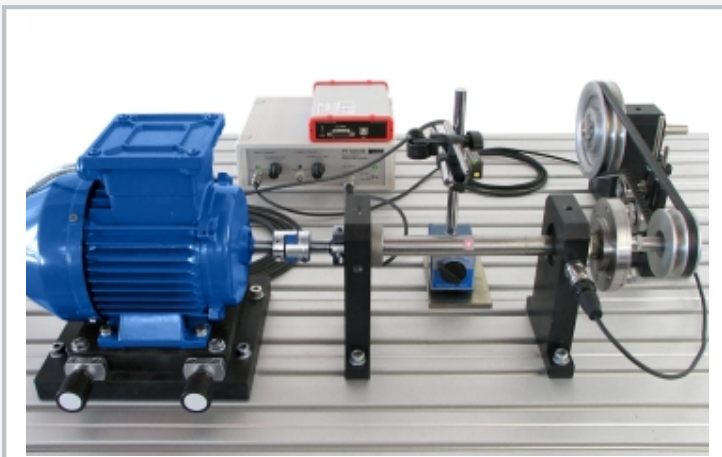
- change in characteristic vibration behaviour (natural frequency, resonance speed, amplitude and phase of vibrations) due to a crack
- crack identification from the change in vibration spectrum
- detection of cracks in rotating shafts at the protruding shaft end
- understanding and interpreting frequency spectra
- use of a computerised vibration analyser
- in conjunction with a safety bearing (e.g. from PT 500.10 – elastic shaft accessory setup)
  - ▶ detection of cracks in rotating shafts (the elastic rotor)

# PT 500.11

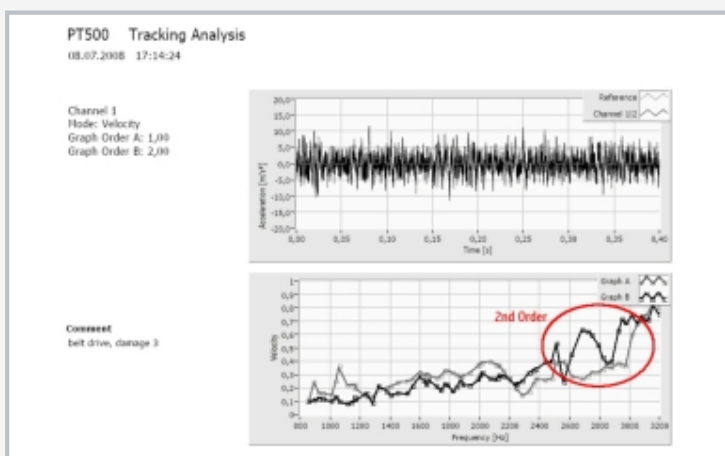
## Crack detection in rotating shaft kit



1 flange with short shaft (loaded by belt drive), 2 bolt, 3 pick-up disk, 4 clamp set, 5 driving shaft, 6 shaft with maximum crack (flange joint with 2 load-bearing bolts), 7 shaft with small crack (flange joint with 5 load-bearing bolts), 8 shaft with no crack (flange joint with 6 load-bearing bolts)



The illustration shows PT 500.11 together with PT 500, PT 500.10 and PT 500.04.



Tracking analysis of a rotor with crack: significant rise in amplitude in 2<sup>nd</sup> order (marked red)

### Specification

- [1] investigation of the vibration behaviour of a cracked shaft
- [2] crack adapter in flange form
- [3] simulation of the crack by opening bolt joints
- [4] 4 different sized cracks can be simulated
- [5] short shaft to simulate a protruding shaft end
- [6] long shaft to simulate an elastic rotor
- [7] PT 500.14 (belt drive) generates required bending torque
- [8] accessory setup for PT 500 machinery diagnostic training system
- [9] stackable storage system to house the components

### Technical data

Flange diameter:  $\varnothing=90\text{mm}$   
6 hexagon flange bolts M8x20

#### Shafts

- diameter:  $\varnothing=20\text{mm}$
- short shaft:  $L=85\text{mm}$
- long shaft:  $L=200\text{mm}$
- max. permissible bending torques
  - ▶ short shaft for belt pulley: 15,9Nm
  - ▶ long shaft for mass disk: 3,9Nm

LxWxH: 400x300x120mm (storage system)  
Weight: approx. 3kg

### Scope of delivery

- 1 pick-up disk
- 1 long shaft
- 1 short shaft
- 1 centering arbor for alignment of shafts in experimental setup
- 6 bolts
- 1 clamp set
- 1 storage system with foam inlay
- 1 manual

# PT 500.11

## Crack detection in rotating shaft kit

### Required accessories

PT 500	Machinery diagnostic system, base unit
PT 500.10	Elastic shaft kit
PT 500.14	Belt drive kit