

AT 200

Determination of gear efficiency



2E

Description

- **mechanical efficiency of gears**
- **three-phase AC motor as the drive and magnetic particle brake as the brake unit**
- **comparison of worm and spur gears**

The AT 200 unit is a complete test system with drive and brake unit and two different gears. Driving and braking power are calculated to determine the efficiencies. The components used are common in drive technology and therefore closely related to practice.

A three-phase AC motor with variable speed via frequency converter serves as the drive unit. An electromagnetic brake is used as the brake unit. The constant braking effect can be very finely adjusted via the exciting current; it then serves as a tunable load. The properties of the magnetic particle brake can be investigated in an additional experiment.

A two-stage spur gear and a worm gear are available to be studied. The characteristic properties of the gear are adapted to the performance of the motor. Flexible couplings connect the gear to the motor and the brake.

Motor and brake are mounted on pendulum bearings in order to determine the torques. The torques are measured by spring balance and lever arms. The speed of the motor is detected contact-free by means of an inductive displacement sensor on the motor shaft. The speed is displayed digitally. The exciting current of the magnetic particle brake is used as a measure of the braking torque and is also displayed.

Learning objectives/experiments

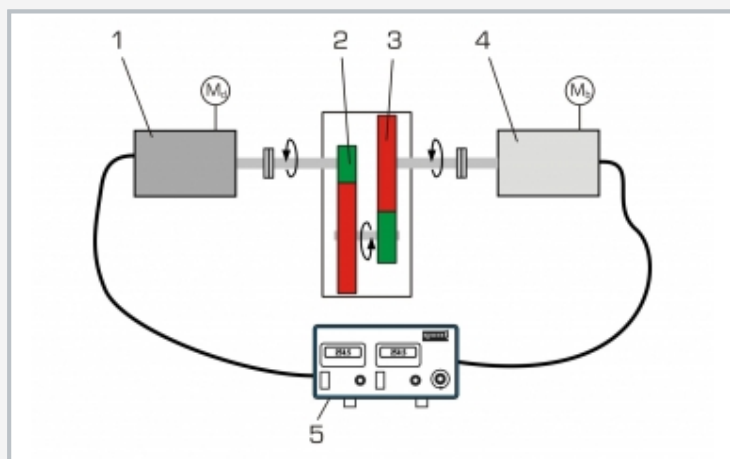
- **determination of the mechanical efficiency of gears by comparing the mechanical driving and braking power for**
 - ▶ spur gear, two-stage
 - ▶ worm gear
- **plot the torque/current characteristic curve for a magnetic particle brake**
- **drive and control engineering**

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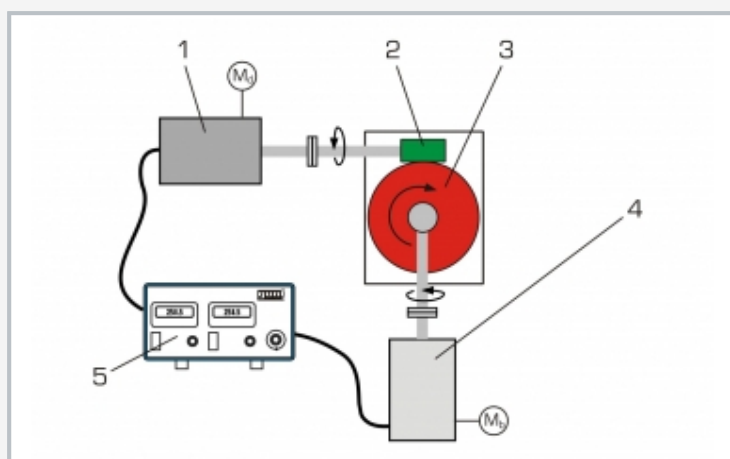
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1 spring balance, 2 motor, 3 worm gear, 4 display and control unit, 5 spur gear, 6 brake, 7 brake lever arm, 8 coupling



Determining the efficiency in the 2-stage spur gear: 1 motor, 2 first stage, 3 second stage, 4 brake, 5 display and control unit; M_1 drive torque, M_2 braking torque



Determining the efficiency in the worm gear: 1 motor, 2 worm, 3 worm gear, 4 brake, 5 display and control unit; M_1 drive torque, M_2 braking torque

Specification

- [1] determination of mechanical efficiency in gears
- [2] investigation on worm gear and two-stage spur gear
- [3] three-phase AC motor with variable speed via frequency converter
- [4] magnetic particle brake with adjustable braking torque via exciting current
- [5] inductive speed sensor on the motor
- [6] display of speed and exciting current
- [7] determination of torques on motor and brake via spring balance and lever arms

Technical data

Three-phase AC motor with variable speed

- power output: 0,25kW
- speed: 0...3000min⁻¹

Magnetic particle brake

- rated braking torque at exciting current 0...0,37A: 0...10Nm

Two-stage spur gear

- transmission ratio: $i=13,5$
- torque: 23,4Nm

Worm gear

- transmission ratio: $i=15$
- torque: 10Nm
- worm: $z=2$
- worm gear: $z=40$

Measuring ranges

- speed: 0...3000min⁻¹
- current: 0...0,37A
- force: 0...100N

230V, 50Hz, 1 phase

230V, 60Hz, 1 phase; 120V, 60Hz, 1 phase

UL/CSA optional

LxWxH: 1060x600x420mm (experimental unit)

Weight: approx. 35kg

LxWxH: 420x450x180mm (display and control unit)

Weight: approx. 5kg

Scope of delivery

- 1 experimental unit
- 1 display and control unit
- 1 set of accessories
- 1 set of instructional material

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Optional accessories

020.30009

WP 300.09

Laboratory trolley