

Machine elements

Components of a technical application that fulfil certain functions in structures are known as machine elements. Machine elements can be both single components and assemblies:

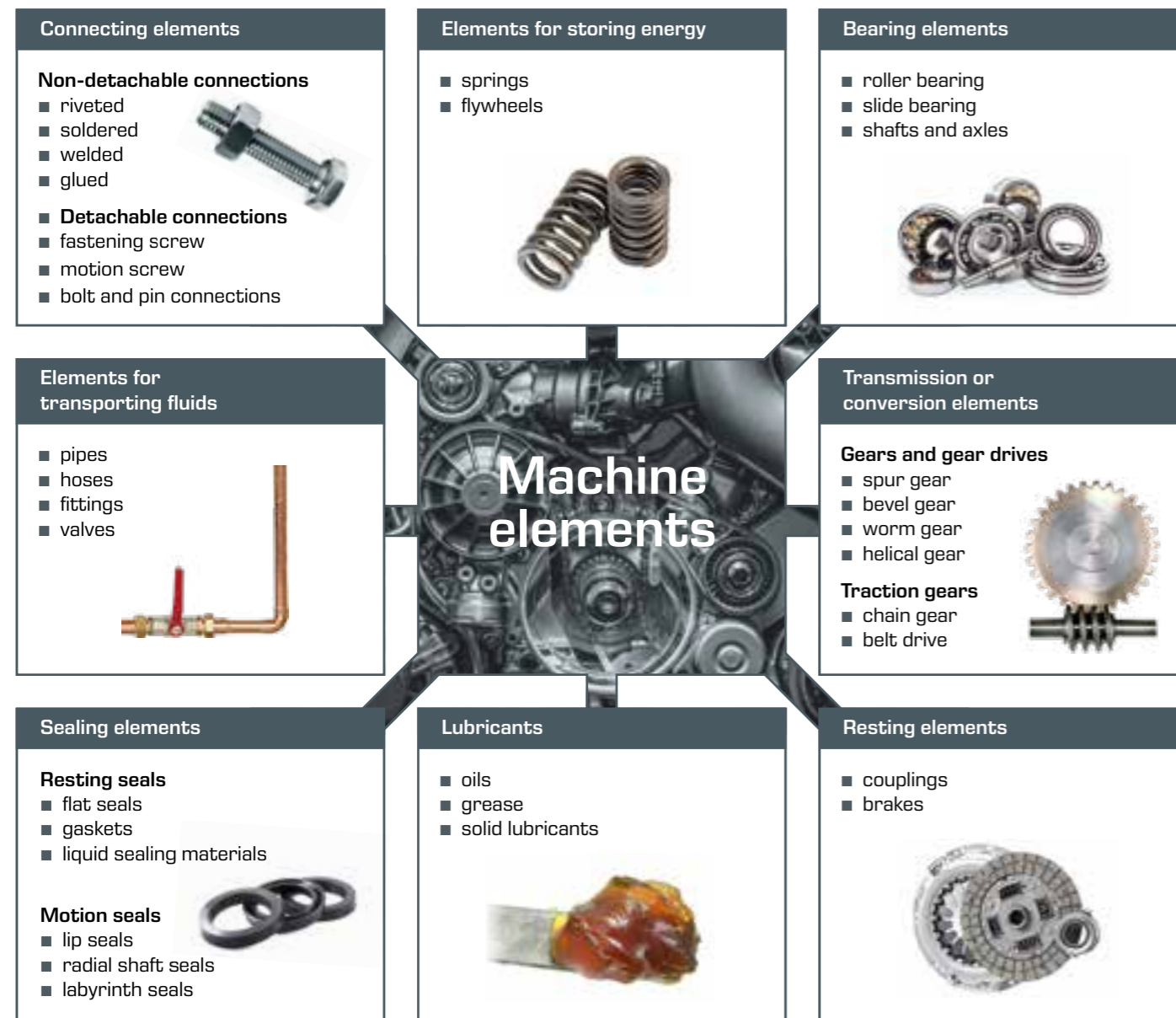
- individual parts such as screws, bolts or gears
- assemblies consisting of individual machine elements, such as couplings, ball bearings, transmissions or valves

An individual machine element always performs the same function, even though it is used in very different structures.

Simple machine elements such as screws, cylinder pins, feather keys or seals are defined according to standards and therefore can be exchanged without difficulty. More complex machine elements such as bearings, couplings, gears or shafts are standardised in only certain important properties, such as main dimensions or flanges, and as such are not fully interchangeable.

Classification of machine elements

Some machine elements can perform different tasks. For example, couplings can be used as linking and/or transmission elements and shafts can be used for bearing and/or transmission.



This section presents the following machine elements:

- various connecting elements
- roller bearings
- various types of gears

Connecting elements



Connecting elements are used when the components in the machine are intended to be fixed firmly to each other. Fixing screws, rivets and studs are discrete elements that are usually detachable and can be reused.

Screws are the most commonly used machine elements and are classified according to their function: **fastening screws** connect two or more parts firmly to each other and can be detached. **Motion screws** convert rotary motion into linear motion and are used under load following assembly.

Bearing elements



Bearing elements can absorb and divert forces, secure rotary motion of shafts and axles, and allow axial guiding of shafts. A distinction is made between slide bearings and roller bearings depending on the design. In **slide bearings**, the opposing, movable parts are in contact with each other. This sliding is usually facilitated by a lubricating film. Slide bearings allow an optimum transfer of force over the entire area of the touching surfaces.

With **roller bearings**, components move by rolling, which therefore reduces friction. In roller bearings, an outer race and an inner race roll against each other. Typical rolling elements are cylinders and spheres. So that the rolling elements do not touch each other, cages are used to keep the cylinders or spheres separate.

Transmission or conversion elements



Complex machine elements used to alter the motion variables of path, velocity and acceleration are known as conversion elements or gears. In a gear drive, positively locking **gears** transfer the rotary motion from one shaft to another. In a traction drive, the rotary motion is transferred between two shafts by

means of a traction gear. Here, a distinction is made between non-positive traction drives (**belt drive**) and positive traction drives (**chain or toothed belt drive**).

MG 901

Nuts and bolts kit



Learning objectives/experiments

- familiarisation with the most important screws and nuts used in mechanical engineering and their specific applications
- familiarisation with relevant standardised designations and terms including their graphical representations

Specification

- [1] kit of screws and nuts
- [2] 42 standard parts arranged clearly on an aluminium plate
- [3] plate with screen print
- [4] shown in the screen print: graphic representation and DIN designation
- [5] all parts arranged clearly in the storage system
- [6] multiple storage systems can be stacked on top of each other

Technical data

Aluminium plate, LxW: 350x255mm
Screws: C4,8, K4,8, M6, M8, M10
Nuts: M6, M8, M10

LxWxH: 500x350x110mm (storage system)
Weight: approx. 3kg

Scope of delivery

- 1 complete kit, arranged in storage system
- 1 set of instructional material

Description

- **extensive kit comprising the most important screws and nuts used in mechanical engineering**
- **standard designations, terms and graphical representation**

Screws and nuts are standardised machine elements that are classified as detachable elements. These connecting elements are used when components of a machine need to be firmly fixed to each other. Different screws and nuts are used depending on the application.

This kit is used for demonstration and information. It is not designed for performing exercises or experiments. The original standard parts are screwed clearly into an aluminium plate. The symbols on the plate show the DIN and standard designation of the relevant part, in addition to the correct graphical representation.

The kit is arranged clearly in a storage system.

MG 903

Screw-locking devices kit



Learning objectives/experiments

- familiarisation with screw-locking devices and their specific applications
- familiarisation with relevant standardised designations and terms including the graphical representation

Specification

- [1] kit of screw-locking devices
- [2] 18 assembled screw-locking devices arranged clearly on an aluminium plate
- [3] transparent container with 18 compartments, each containing 10 pieces of the different screw-locking devices
- [4] all parts arranged clearly in the storage system
- [5] multiple storage systems can be stacked on top of each other

Technical data

Aluminium plate, LxW: 238x100mm
Locking devices for M6

LxWxH: 510x360x120mm (storage system)
Weight: approx. 3kg

Scope of delivery

- 1 complete kit, arranged in storage system
- 1 set of instructional material

Description

- **extensive kit of screw-locking devices**
- **standardised designations, terms and applications**

Screw-locking devices are designed to prevent the unwanted loosening of screw connections because of external influences such as vibration or corrosion. The lock machine element is added to a screw connection by the manufacturer as an additional component.

This kit is used for demonstration and information. It is not designed for performing exercises or experiments. Screw-locking devices are shown in their installed state on an aluminium plate. A transparent box contains a large number of Screw-locking devices.

The kit is arranged clearly in a storage system.

MG 905

Thread types kit



Learning objectives/experiments

- familiarisation with the most important thread types used in mechanical engineering and their specific applications
- use the thread gauge to determine the thread type

Specification

- [1] kit of thread types
- [2] 8 thread types, arranged clearly
- [3] cut-out sections make thread flanks visible
- [4] galvanised parts
- [5] thread gauge for determining thread type
- [6] all parts arranged clearly in the storage system
- [7] multiple storage systems can be stacked on top of each other

Technical data

Thread size: 24mm
Thread gauge for external and internal thread

- metric ISO thread
- Whitworth thread
- Whitworth pipe thread

LxWxH: 500x350x110mm (storage system) Weight: approx. 3kg

Scope of delivery

- 1 complete kit, arranged in storage system
- 1 set of instructional material

Description

- **extensive teaching kit of the most important thread types used in mechanical engineering**
- **standardised designations, terms and specific applications**

Threads are the basis for detachable connections, such as screws with external threads and nuts with internal threads. A number of thread types have been developed over time, depending on the application and loads that a thread has to withstand. Standards guarantee the function of paired components with internal and external threads.

This kit is used for demonstration and information. It is not designed for performing exercises or experiments. Different bolt and nut threads are shown. The thread flanks are made visible by cut-out sections. A thread gauge allows you to determine the thread type and size.

The kit is arranged clearly in a storage system.

TM 320

Screw connections testing



Learning objectives/experiments

- axial tension force in a bolt joint dependent on the tightening torque or the elastic deformation of a slotted block
- measurement of the breakaway torque, including for different fitting situations of the bolt joint
- measurement of thread friction and overall friction

Specification

- [1] experiment on the correlation between the tension force and tightening torque of bolts
- [2] bolt size M8x100, wrench jaw size 13mm
- [3] elastic deformation of a slotted block by the bolt
- [4] determining the tightening and breakaway torque with a mechanical torque measuring device
- [5] 2 dial gauges
- [6] sensitive torque setting by hand wheel

Technical data

Tension force

- max. 40kN

Force/travel constant

- 20kN/mm (on slotted block)

Max. tightening torque

- 40Nm

Torque/travel constant

- 10Nm/mm (on torque measuring device)

Dial gauge

- 0...10mm
- graduation: 0,01mm

LxWxH: 450x400x260mm
Weight: approx. 27kg

Scope of delivery

- 1 experimental unit
- 1 set of bolts in transparent container
- 1 set of instructional material

Description

- **correlation between tightening torque and tension force on standardised bolts**
- **breakaway torque of a bolt joint**

The main element of the unit is a slotted, elastically deformable steel block. By tightening the bolt joint, the slotted area is deformed, thereby generating an axial tension force in the bolt. The resulting deformation is recorded by a mechanical dial gauge, and is directly related to the bolt tension force generated.

The bolt joint is tightened and slackened using a special torque wrench, which can be set sensitively with the aid of a threaded spindle. By using an axial bearing, the head friction of the bolt can be largely excluded, so that only the friction of the threaded joint is measured.

TM 310

Thread testing



Learning objectives/experiments

- determine the friction coefficient of a steel threaded spindle in conjunction with
 - ▶ a cast iron nut
 - ▶ a bronze nut
 - ▶ a plastic nut
- determine the relevant thread efficiency

Specification

- [1] investigation of the thread efficiency with different thread-material pairings
- [2] nuts made of cast iron, bronze and plastic
- [3] spindles with trapezoidal thread, varying pitch
- [4] generate torque using pulley with spring balance and cable
- [5] load via graduated loads

Technical data

Spindle thread
 ■ TR30x6 and TR30x12P6

Rotary plate
 ■ diameter: 140mm

Spring balance
 ■ 0...5N
 ■ graduation: 0,05N

Weight
 ■ 1x 10N
 ■ 1x 20N

LxWxH: 300x300x300mm
 Weight: approx. 15kg

Scope of delivery

- 1 experimental unit
- 1 set of instructional material

Description

■ determine the thread efficiency with different thread-material pairings

The main elements of this experimental unit are a perpendicular pair of thread spindle and nut. A moment is exerted on the spindle by means of a pulley, using a spring balance and cable. Additional weights on the rotary plate influence the axial load of the thread.

Two spindles with trapezoidal threads of different pitch are included. The experimental unit contains three long nuts made of various materials with single pitch and a cast iron nut with double pitch.

The measured values can be used to determine and compare the threads efficiencies.

MG 911

Roller bearings kit



Learning objectives/experiments

- familiarisation with the most important roller bearing types used in mechanical engineering and their specific applications
- familiarisation with relevant standardised designations and terms
- discussion of applications

Specification

- [1] roller bearings kit
- [2] 13 roller bearings, arranged clearly: 5 roller bearings and 8 ball bearings
- [3] 2 axial bearings / 11 radial bearings
- [4] all parts arranged clearly in the storage system
- [5] multiple storage systems can be stacked on top of each other

Technical data

Bearing dimensions
 ■ inner diameter: \varnothing 20mm
 ■ outer diameter: \varnothing 35, 40, 42, 47, 52mm
 ■ bearing width: H=8, 10, 12, 14, 15, 18, 47mm

LxWxH: 500x350x110mm (storage system)
 Weight: approx. 2kg

Scope of delivery

- 1 complete kit, arranged in storage system
- 1 set of instructional material

Description

■ extensive teaching kit of the most important roller bearings used in mechanical engineering

■ standardised designations, terms and applications

Roller bearings are standardised machine elements that are classified as guide and bearing elements. They are responsible for guiding rotating shafts or axles in stationary components and transferring radial and axial forces but not torque. Rolling elements (balls or rollers) are located between mutually movable parts. Roller bearings are classified in different standard series depending on the application.

This kit is used for demonstration and information. It is not designed for performing exercises or experiments. Different roller bearings are shown. The bearings are selected for a shaft size.

The kit is arranged clearly in a storage system.

GL 100

Principle of gear units



Learning objectives/experiments

- principle and differences of belt drives, friction wheels and gear drives
- explanation and demonstration of
 - ▶ gear ratio
 - ▶ pitch
 - ▶ module
 - ▶ function of intermediate gears

Specification

- [1] demonstration of the function of belt drives, friction wheels and gear drives
- [2] plastic pulleys and friction washers
- [3] O-ring as a drive belt
- [4] steel gears
- [5] anodised aluminium profile base frame

Technical data

- Gears, steel
- number of teeth: $z=15, 16, 20$
 - module: 20mm
- Pulleys, plastic
- diameter: $\varnothing=300, \varnothing=320, \varnothing=400\text{mm}$

LxWxH: 1100x320x600mm
Weight: approx. 22kg

Scope of delivery

- 1 experimental unit
- 1 set of instructional material

Description

■ demonstration of function and structure of various gears

Gears are machine elements that are classified as transmission or conversion elements. They are responsible for transferring torque and speed between guiding members such as wheels or pulleys. The motion is transferred either by means of non-positive connections (with gears, friction wheel) or positive connections (with gears, toothed belts, chains).

The GL 100 experimental unit illustrates the function and structure of belt drives, friction wheels and gear drives. Fundamental concepts and relationships, such as transmission ratio, change of direction of rotation, pitch and module or the function of intermediate gears can be explained clearly.

A sturdy anodised aluminium frame forms the base of the unit. The bearings of the wheels are attached to the frame by clamping levers in T-grooves. They are easy to detach and can be moved horizontally, thereby allowing a wealth of different setups.

All experiments are powered by hand. The size of the experimental unit ensures that the experiments are clearly visible even for a larger group of students.

GL 110

Cam mechanism



Learning objectives/experiments

- elevation curves in cam mechanisms
- cams come in different shapes
 - ▶ circular arc, tangent, hollow, asymmetric
 - ▶ optionally with roller plunger, flat plunger or cam follower as engaging member

Specification

- [1] function of cam mechanisms
- [2] 4 different shapes of cam: circular arc, tangent, hollow or asymmetric
- [3] 3 different engaging members: roller plunger, flat plunger or cam follower
- [4] cam and engaging member can be exchanged without tools
- [5] dial gauge for determining the stroke
- [6] angular scale for determining the angle of rotation

Technical data

- Angular scale
- 0...360°
 - graduation: 1°

- Dial gauge for the stroke
- 0...30mm
 - graduation: 0,01mm

LxWxH: 160x160x300mm
Weight: approx. 7kg

Scope of delivery

- 1 experimental unit
- 4 cams in cam shape
- 3 engaging members
- 1 dial gauge
- 1 set of instructional material

Description

■ demonstration and measurement of elevation curves in cam mechanisms

Cam mechanisms are non-uniform translatable gears that help convert uniform rotating drive motions into non-uniform drive motions with or without latching. Generally speaking, cam mechanism consists of cams, engaging members and the frame. The desired movement path is defined by the geometry of the cam and produced by pressing a contour or a profile on the engaging member.

The GL 110 unit is used to clearly demonstrate the function of a cam mechanism. Cams are available in different shapes. A roller plunger, flat plunger or cam follower can be used as the engaging member. The stroke is determined by measuring the travel. An angular scale indicates the corresponding angle of rotation.

TM 123

Spur gear unit



Learning objectives/experiments

- development of the main variables and relationships in a straight-toothed spur gear
 - ▶ velocity ratios in spur gears
 - ▶ gear with intermediate wheel or two-stage gear
 - ▶ influence of gear ratio on friction
 - ▶ determine the efficiency

Specification

- [1] function and design of gear drives
- [2] 4 galvanised steel gear wheels
- [3] 2 anodised aluminium pulleys
- [4] ball-bearing-mounted gears and pulleys
- [5] anodised aluminium base plate

Technical data

- 4 gear wheels
- 2x $\varnothing=126\text{mm}$, 84 teeth
 - 2x $\varnothing=42\text{mm}$, 28 teeth
 - module: $m=2\text{mm}$

Pulleys effective radius: 35mm

- Weights
- 2x 1N (hanger)
 - 2x 0,25N
 - 1x 0,5N
 - 2x 1N
 - 2x 2N
 - 2x 2,5N

LxWxH: 350x150x100mm
Weight: approx. 6kg

Scope of delivery

- 1 experimental unit
- 4 gear wheels
- 2 pulleys
- 1 set of weights
- 1 set of instructional material

Description

■ design and principle of gear drives

Gears and gear drives are machine elements that are classified as transmission or conversion elements. Gears transfer the rotational motion from one shaft to another by means of a positive connection. In a spur gear, the gears are arranged on parallel axes. This type of gear is characterised by its relatively simple construction, since only a few moving parts are used and the external teeth gears are simple to manufacture. Spur gears are robust and highly efficient because of their direct, purely mechanical transmission.

The TM 123 experimental unit illustrates the relationship between the ratio of the number of teeth and the transmission ratio of gears. Simple experiments are used to study the torque conversion in gear pairs and the efficiency of a gear. The forces are generated by weights and can be varied quickly and easily.

TM 124

Worm gear unit



Learning objectives/experiments

- development of the main variables and relationships in a worm gear
 - ▶ investigation of transmission ratio, torque, friction and self-locking
 - ▶ determine the efficiency

Specification

- [1] function and design of worm gears
- [2] bronze worm wheel
- [3] steel worm
- [4] 2 aluminium cable drums
- [5] worm, worm wheel and pulleys mounted on ball bearings
- [6] anodised aluminium base plate

Technical data

- Cable drum
- worm shaft diameter: $\varnothing=40\text{mm}$
 - worm wheel shaft diameter: $\varnothing=120\text{mm}$

- Worm gear
- centre distance: 80mm
 - gear ratio: 30:1
 - module: $m=4\text{mm}$
 - number of gears: 1
 - force transmission: 10

Weights on the worm side

- 1x 50N
- 1x 20N
- 2x 10N
- 1x 10N (hanger with equalising mass)

Weights on worm wheel

- 1x 5N
- 4x 2N
- 1x 1N
- 1x 0,5N
- 1x 0,5N (hanger)

LxWxH: 250x150x200mm
Weight: approx. 22kg

Scope of delivery

- 1 experimental unit
- 1 worm
- 1 worm wheel
- 1 set of weights
- 1 set of instructional material

Description

■ design and principle of worm gears

Worm gears are a category of helical rolling gears that are classified as transmission or conversion elements within machine elements. This type of gear comprises the usual driving worm and the driven worm wheel. Worm gears are quiet and have a damping effect. They are smaller and easier to operate than spur gears or bevel gears of the same performance and gear ratios.

The TM 124 experimental unit is used to study their torque ratios and efficiency. The transmission ratio of the gear can be determined. The basic concepts of toothing such as tooth number and gear number, module, pitch and centre distance are illustrated.

The worm wheel and worm are mounted on ball bearings. The forces are generated by weights and can be varied quickly and easily.

TM 125
Cable winch**Learning objectives/experiments**

- determine
 - ▶ transmission ratio
 - ▶ unwinding rate
 - ▶ angular velocity
 - ▶ efficiency
- behaviour under load

Specification

- [1] function and design of cable winches
- [2] investigation of hoisting rate and force transmission
- [3] demonstration of a return stop
- [4] winding the supporting cable on a cable drum
- [5] movement of loads on the supporting cable
- [6] variation of loads and forces

Technical data

Cable drums

- aluminium
- driving wheel
 - ▶ diameter: 220mm
- driven wheel
 - ▶ diameter: 110mm

Gears

- POM
- small: 12 teeth
- large: 60 teeth
- module 2mm each

Total transmission ratio: 10

Weights on driving wheel

- 1x 5N
- 4x 2N
- 1x 1N
- 1x 0,5N
- 1x 0,5N

Weights on driven wheel

- 1x 50N
- 2x 20N
- 1x 10N

LxWxH: 270x200x250mm

Weight: approx. 19kg

Scope of delivery

- 1 experimental unit
- 2 cable drums
- 1 set of weights
- 1 set of instructional material

Description■ **structure and principle of a cable winch**

Cable or hoist winches are machine elements that are classified as transmission or conversion elements. In a cable winch, a supporting cable is wound on a cable drum by means of a gear transmission. This allows loads secured to the supporting cable to be moved.

The TM 125 experimental unit is used to study the hoisting velocity and force transmission of a cable winch. It also demonstrates the function of a return stop. By considering equilibrium states, it is possible to determine force transmission and efficiency. The two cable drums are mounted on ball bearings. The forces are generated by weights and can be varied quickly and easily.

Laboratory and conceptual design from A–Z



Are you planning a new laboratory?

A new specialist room?

An entire department?

Do you want to modernize?

Then take advantage of our know-how and experience! Our engineers design complete laboratories and fit them out. We provide an individual response to your requirements, taking into account the specific local environment:

- room drawings
- supply connections
- equipment lists
- performance specifications, etc.

If you have any questions please contact our sales or customer service, who would be glad to help you.

TM 220

Belt drive and belt friction



Learning objectives/experiments

- effect of wrap angle, coefficient of friction and cable force (Eytelwein's belt friction formula)
- comparison of flat belts and V-belts
- consequences of an unadapted V-belt groove

Description

- function of a belt drive
- friction of different belt types on a metal pulley

The belt drives are machine elements that are classed as traction mechanisms in the field of transmission or conversion elements. They transfer torque and speed between guiding members such as wheels or pulleys. The motion is transferred by traction mechanisms that can only absorb tensile forces. Toothed belts and chains deliver positive transmission of movements. Traction mechanisms such as cables, flat belts and V-belts, on the contrary, allow for non-positive transmission.

In non-positive belt drives, the circumferential force between the belt and the pulley is transmitted according to the principle of cable friction.

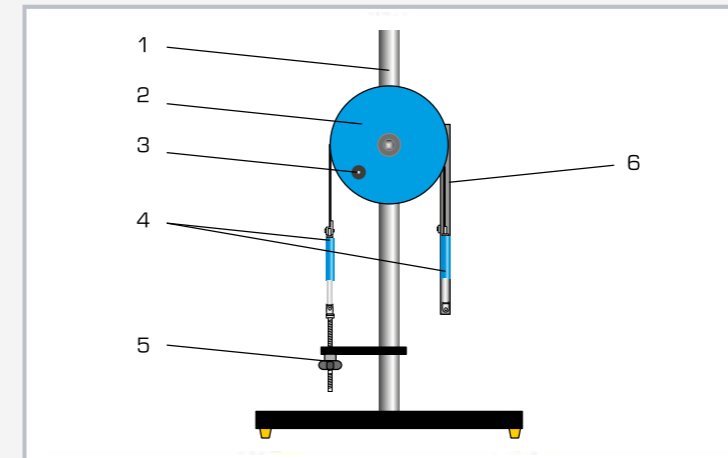
Cable friction arises due to tangential static-friction forces at the points where the cable is in contact with the wheel or the pulley. Eytelwein's cable friction formula is used to calculate both cable and belt friction.

The TM 220 experimental unit allows the study by experiment of belt drives and belt friction. At the core of the experimental unit is a cast iron pulley, whose circumference features grooves for V-belts and flat belts. The pulley is mounted on ball bearings and is powered by a crank handle. Its flywheel mass favours an even rotation of the pulley. The belts rub on the pulley at a wrap angle between 30° and 180°. The wrap angle can be adjusted in increments of 15°.

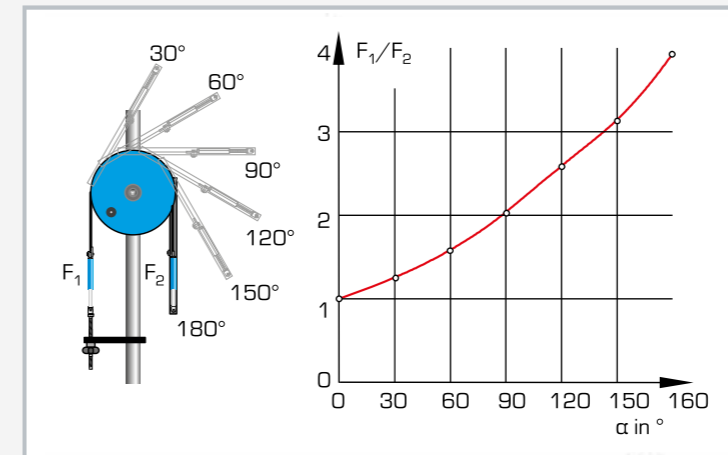
Two spring balances detect the tensile forces on the respective belt ends. This makes it possible to precisely adjust the belt tension using a threaded spindle.

Two flat belts made of different materials, a V-belt and a cable belong to the scope of delivery. The experiments compare different belt types and materials and investigate the effect of the wrap angle.

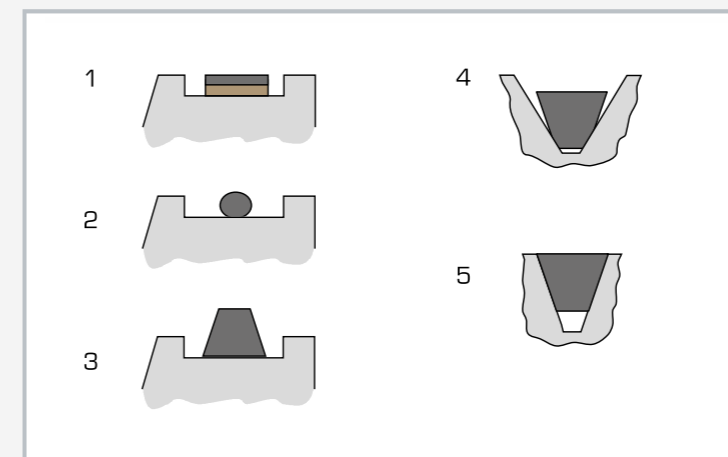
In addition, for V-belts, it is possible to study how the groove shape affects the coefficient of friction.



1 support column, 2 pulley, 3 crank handle, 4 spring balance, 5 belt tension adjustment, 6 pivoting belt holder



Gradual adjustment of the wrap angle from 30° to 180°. Diagram shows the force ratio F_1/F_2 as a function of the wrap angle α .



Comparison of different belt types: 1 flat belt, 2 cable, 3 V-belt, 4 adverse belt seat in the groove, 5 optimum belt seat in the groove

Specification

- [1] function of a belt drive
- [2] belt friction and comparison of different belt materials and types
- [3] ball-bearing mounted pulley with 3 different belt grooves
- [4] 2 flat belts made of different materials, 1 V-belt and 1 cable
- [5] wrap angle of the belts 30°...180°, graduation 15°
- [6] force measurement with 2 spring balances

Technical data

Flat belts

- 1x leather/polyamide, 15x2,2mm, Extremultus LT10
- 1x polyamide, 15x0,6mm, Extremultus TT2

V-belt

- ISO 4184
- profile: SPZ
- 9,7x8,0mm, rubber/fabric

Cable

- hemp, $\varnothing=3$ mm

Pulley

- $\varnothing=300$ mm
- material: grey iron
- Dynamometer: 100N ± 1 N

LxWxH: 700x350x1100mm

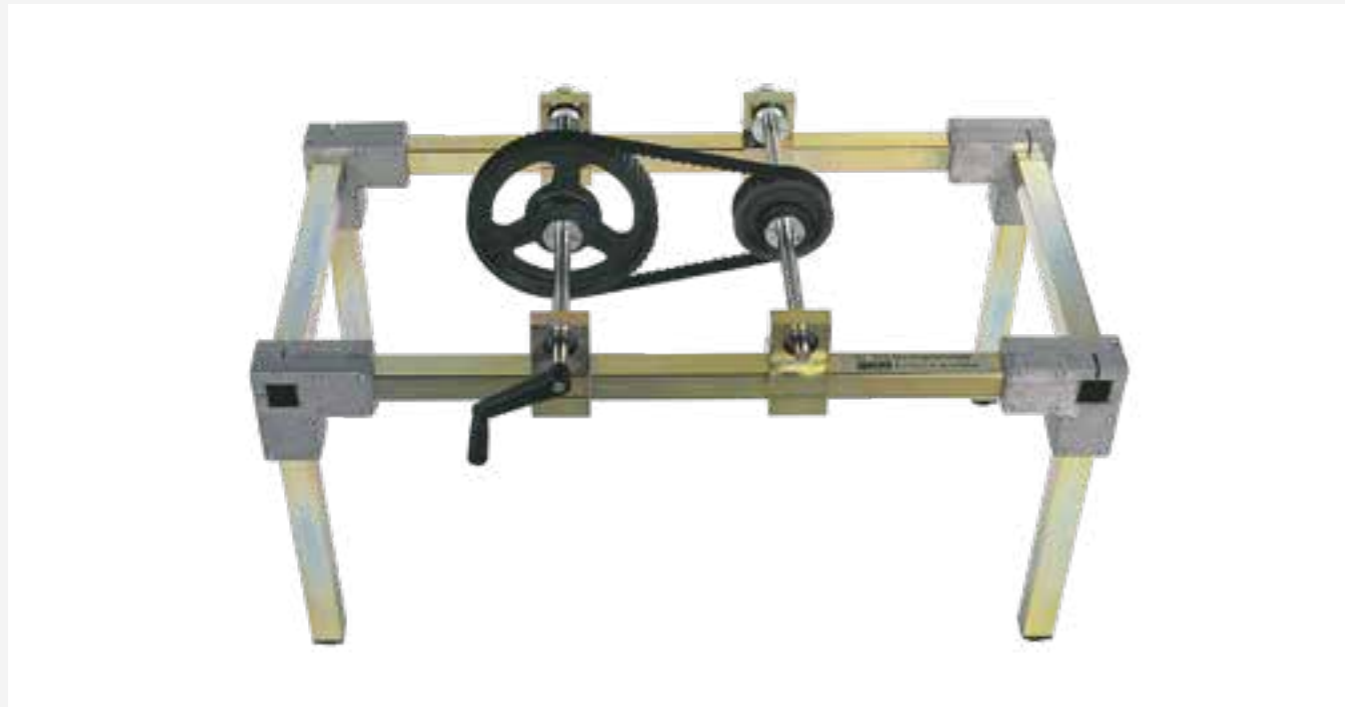
Weight: approx. 47kg

Scope of delivery

- 1 experimental unit
- 2 flat belts
- 1 cable
- 1 V-belt
- 2 dynamometers
- 1 set of instructional material

GL 410

Assembly simple gears



Description

- flexible and robust assembly kit for the fundamentals of mechanical gear engineering
- uses industrial components to represent the real world accurately
- quick and simple assembly

Gears are responsible for transferring the magnitude and/or direction of rotary motion and torque. In machine elements, gears are categorised as transmission or conversion elements. There are different types of gears depending on their task. Wheel gears such as gear drives, friction gears and traction gears are uniformly translating gears.

The GL 410 unit provides an introduction to the fundamentals of gear engineering. The unit focuses in particular on the practical assembly of gear components.

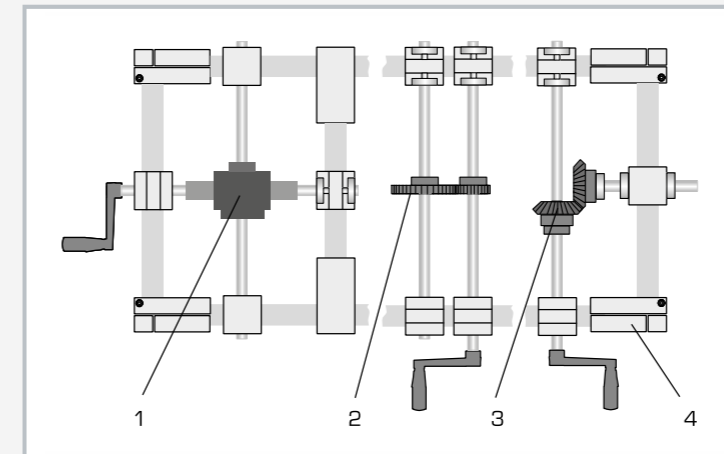
The exercise system can be used to configure six different, simple gear types. The setup of the components is flexible so that you can configure your own ideas and try out different gears.

Individual activities such as understanding the task and reading the drawing, assembling the components, adjusting, calibrating and checking the gear, and performing calculations are performed one after the other. The unit is driven by a hand crank. Various bearings and a solid frame made of square steel tubes ensures sufficient accuracy to be able to set precise tooth interlocking. All components of the exercise system are ready at hand and securely housed in a storage system.

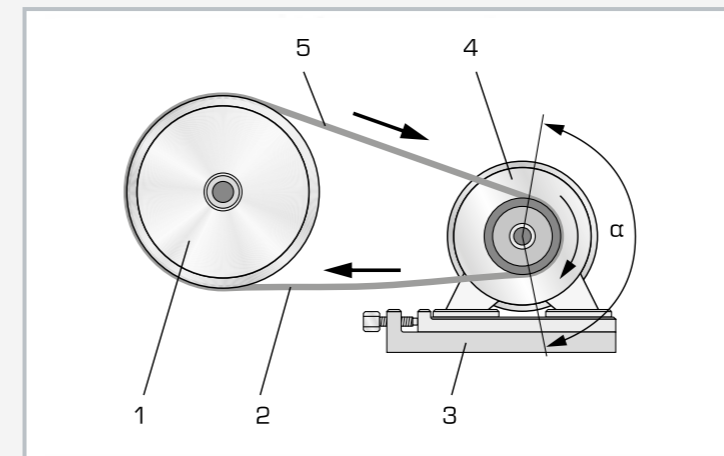
GUNT offers three assembly kits in this product range: from simple gears (GL 410) to combined gears (GL 420) and control gears (GL 430). Each assembly kit can be used completely independently of the other parts in the range.

Learning objectives/experiments

- familiarisation with main components of mechanical gear engineering
- basic gear types
 - ▶ simple belt drive
 - ▶ simple chain gear
 - ▶ simple spur gear
 - ▶ bevel gear
 - ▶ worm gear
 - ▶ rack-and-pinion drive
- calculations on mechanical gears
- practical setup of different gears, associated with simple setup and configuration exercises
- read and understand engineering drawings, familiarisation with technical terms



1 worm gear, 2 spur gear, 3 bevel gear, 4 square steel tube frame



How a belt drive works: 1 driven pulley, 2 slack span, 3 tensioning rail with screws, 4 drive pulley, 5 tight span; α wrap angle

Specification

- [1] assembly, demonstration and experiments with simple gears
- [2] simple belt drive
- [3] simple chain gear
- [4] simple spur gear
- [5] bevel gear
- [6] worm gear
- [7] rack-and-pinion drive
- [8] driven by hand crank
- [9] uses industrial components
- [10] solid, universal frame made of square steel tube

Technical data

Toothed belt disk

- number of teeth: $z=30, 60$

Chain wheels

- number of teeth: $z=20, 30$
- DIN 8192 ISO 10B-1

Spur wheel

- number of teeth: $z=30, 60$
- module $m=2\text{mm}$

Pair of bevel gears

- number of teeth: $z=30$
- module: $m=3\text{mm}$
- transmission ratio: $i=1$
- angle of rotation: 90°

LxWxH: ca. 1030x500x520mm (assembled frame)

Weight: approx. 70kg

LxWxH: 600x400x220mm (storage system)

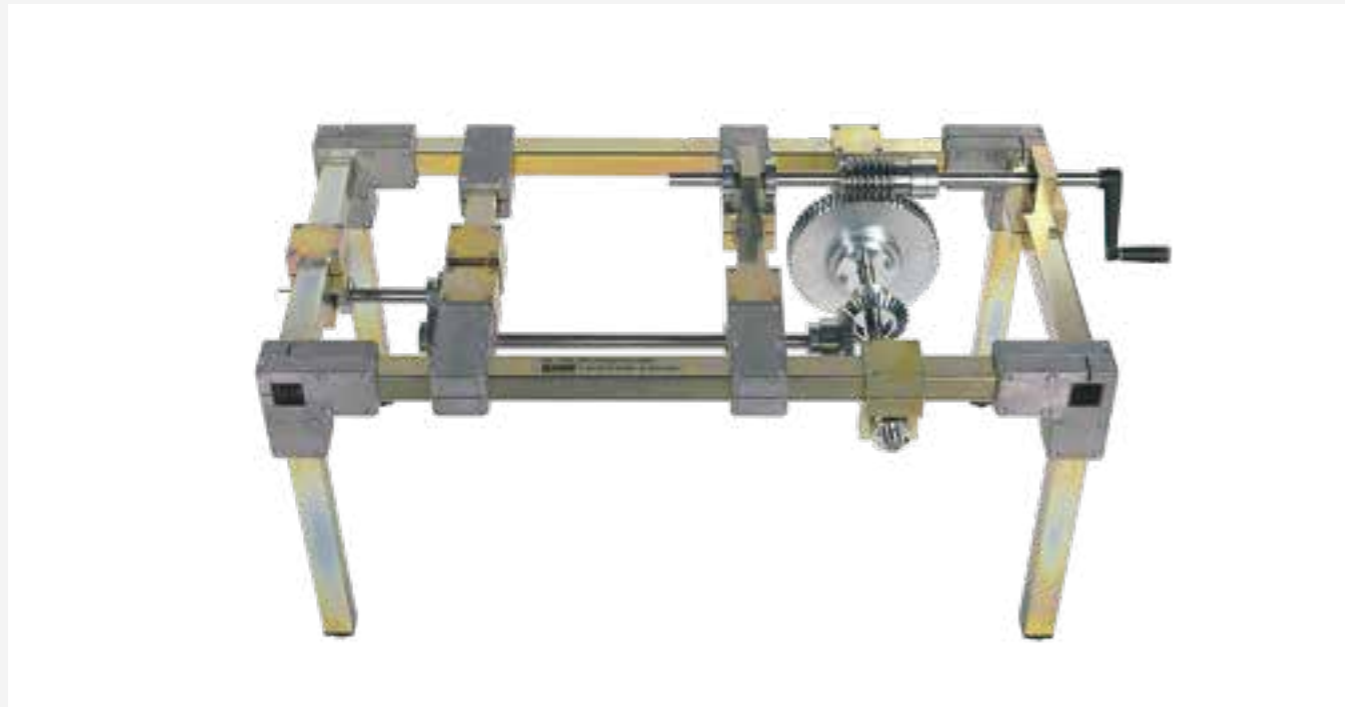
LxWxH: 600x400x170mm (storage system)

Scope of delivery

- 1 frame
- 1 set of bearings
- 1 set of gear components
- 1 set of tools
- 1 set of instructional material

GL 420

Assembly combined gears



Description

- flexible and robust assembly kit for continuing mechanical gear engineering
- uses industrial components to represent the real world accurately
- quick and simple assembly

Different types of gear can be combined to achieve significantly altered transmission functions and new properties. The combination or interconnection can be done in series or in parallel. For example, several gear stages are often connected in series in order to achieve larger transmission ratios.

The GL 420 unit offers extensive exercises on the fundamentals of gear engineering. The unit focuses in particular on the practical assembly of gear components.

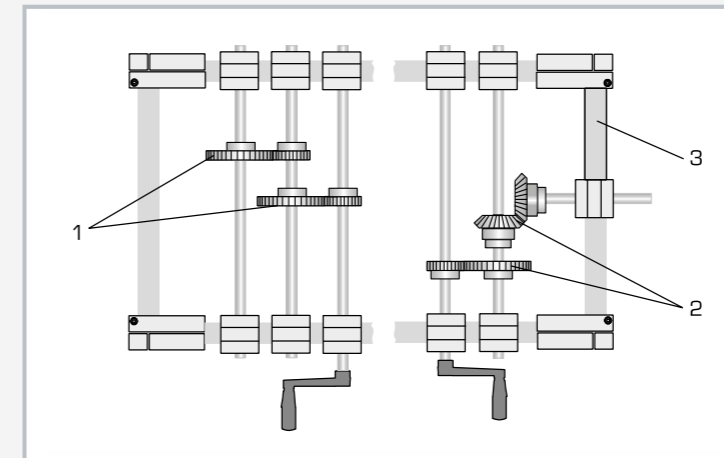
The exercise system can be used to configure six different gear types in various combinations. The setup of the components is flexible so that you can configure your own ideas and try out different gears.

Individual activities such as understanding the task and reading the drawing, assembling the components, adjusting, calibrating and checking the gear, and performing calculations are performed one after the other. The unit is driven by a hand crank. A solid frame made of square steel tubes and various bearings ensures sufficient accuracy to be able to set precise tooth interlocking. All components of the exercise system are ready at hand and securely housed in a storage system.

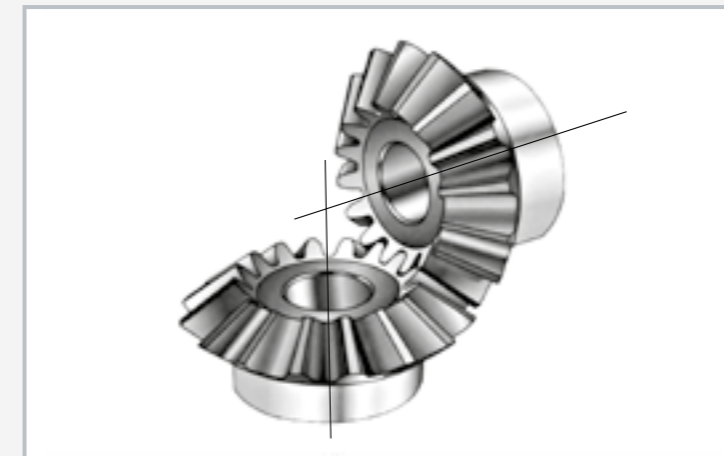
GUNT offers three assembly kits in this product range: from simple gears (GL 410) to combined gears (GL 420) and control gears (GL 430). Each assembly kit can be used completely independently of the other parts in the range.

Learning objectives/experiments

- familiarisation with main components and forms of mechanical gear engineering
 - ▶ two-stage belt drive
 - ▶ chain gear with tensioning wheel and spur gear ratio
 - ▶ two-stage spur gear
 - ▶ combined bevel and spur gears
 - ▶ combined worm and bevel gears
 - ▶ rack-and-pinion drive with spur gear
- calculations on mechanical gears
- practical setup of different gears, associated with setup and configuration exercises
- read and understand engineering drawings, familiarisation with technical terms



1 two-stage spur gear, 2 combined spur-bevel gear, 3 square steel tube frame



Bevel gear: drive and driven shaft at 90 degrees to each other. The outer form of the gear wheels (envelope) is equivalent to cones. The central axes intersect.

Specification

- [1] assembly, demonstration and experiments with combined gears
- [2] two-stage belt drive
- [3] chain gear with tensioning wheel and spur gear ratio
- [4] two-stage spur gear
- [5] combined bevel and spur gears
- [6] combined worm and bevel gears
- [7] rack-and-pinion drive with spur gear
- [8] driven by hand crank
- [9] uses industrial components
- [10] solid, universal frame made of square steel tube

Technical data

Toothed belt disk

- number of teeth: $z=30, 32, 48, 60$

Chain wheels

- number of teeth: $z=20, 30$
- DIN 8192 ISO 10B-1

Gear wheels

- number of teeth: $z=30, 36, 50, 60$
- module: $m=2\text{mm}$

Pair of bevel gears

- number of teeth: $z=30$
- module: $m=3\text{mm}$
- transmission ratio: $i=1$
- angle of rotation: 90°

LxWxH: 1000x500x500mm (assembled frame)

Weight: approx. 72kg

LxWxH: 600x400x120mm (storage system)

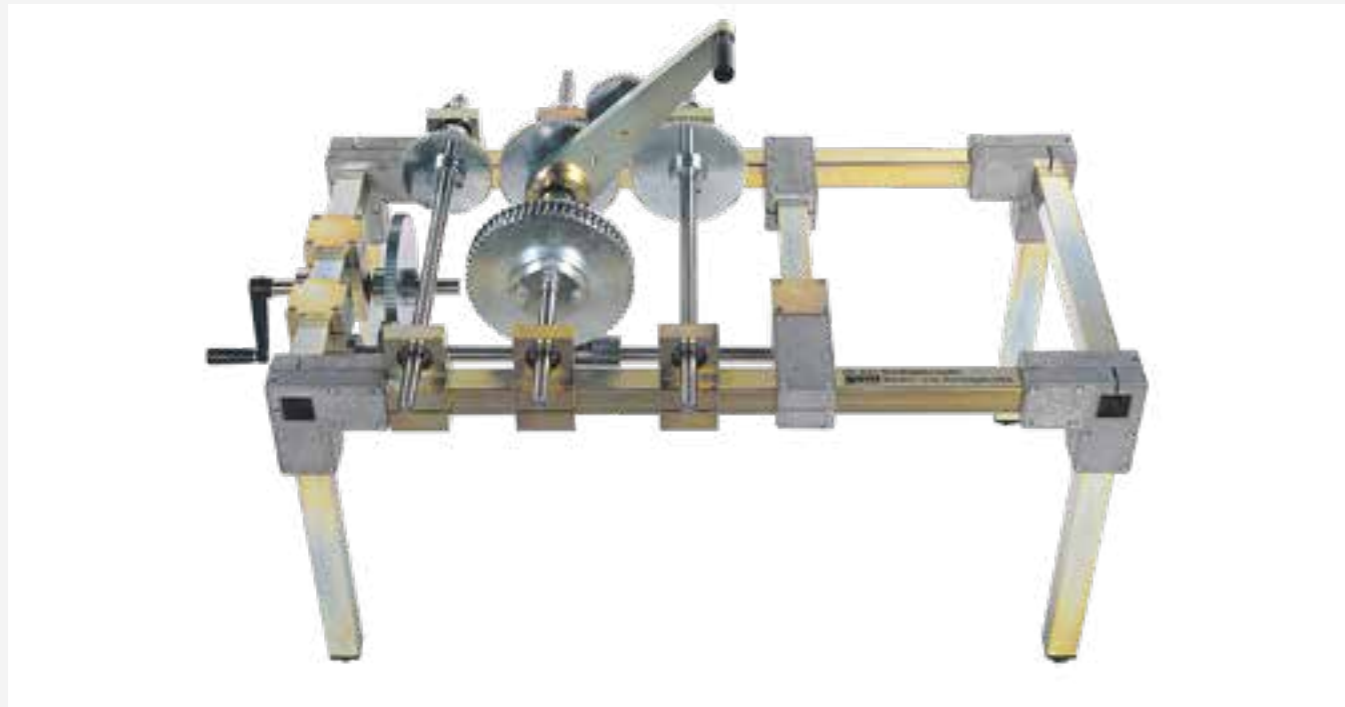
LxWxH: 600x400x170mm (storage system)

Scope of delivery

- 1 frame
- 1 set of bearings
- 1 set of gear components
- 1 set of tools
- 1 set of instructional material

GL 430

Assembly control gear



Description

- flexible and robust assembly kit for continuing mechanical gear engineering
- uses industrial components to represent the real world accurately
- quick and simple assembly

Control gears are also known as variable or change gears. They are characterised by the fact that the speed is transferred differently via various pairs of gear wheels. The most famous example is the transmission in a car, which has one pair of gear wheels for each "gear".

The GL 430 unit provides different configurations of control gears, which serve as an introduction to gear engineering. The unit focuses in particular on the practical assembly of gear components.

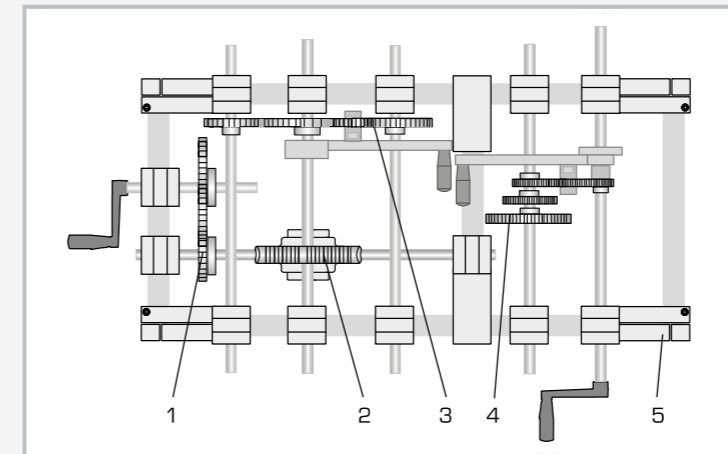
The exercise system can be used to configure six different gears in various combinations. The setup of the components is flexible so that you can configure your own ideas and try out different gears.

Individual activities such as understanding the task and reading the drawing, assembling the components, adjusting, calibrating and checking the gear, and performing calculations are performed one after the other. The unit is driven by a hand crank. A solid frame made of square steel tubes and various bearings ensures sufficient accuracy to be able to set precise tooth interlocking. All components of the exercise system are ready at hand and securely housed in a storage system.

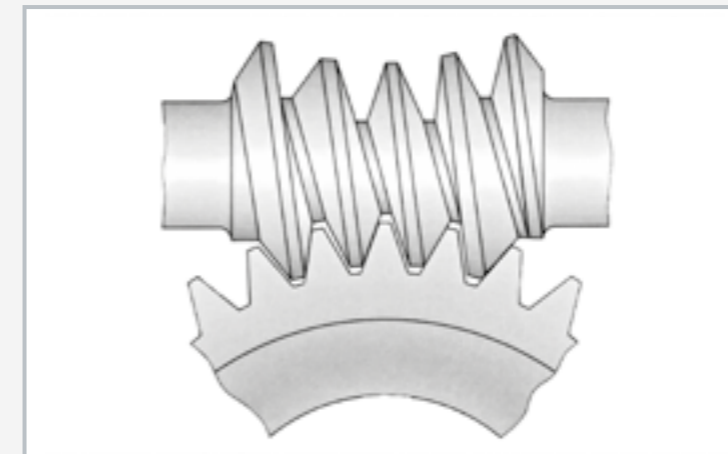
GUNT offers three assembly kits in this product range: from simple gears (GL 410) to combined gears (GL 420) and control gears (GL 430). Each assembly kit can be used completely independently of the other parts in the range.

Learning objectives/experiments

- familiarisation with main components and forms of mechanical gear engineering
 - ▶ step pulley gear
 - ▶ sliding gear drive
 - ▶ Norton gear
 - ▶ tumbler gear
 - ▶ change gear
 - ▶ cam box (tripping device for lathe)
- calculations on mechanical gears
- practical setup of different gears, associated with setup and configuration exercises
- read and understand engineering drawings, familiarisation with technical terms



1 spur gear, 2 worm gear, 3 change gear, 4 Norton gear, 5 square steel tube frame



Worm gear

Specification

- [1] assembly, demonstration and experiments with different control gears
- [2] step pulley gear
- [3] sliding gear drive
- [4] Norton gear
- [5] tumbler gear
- [6] change gear
- [7] cam box (tripping device for lathe)
- [8] driven by hand crank
- [9] uses industrial components
- [10] solid, universal frame made of square steel tube

Technical data

Spur gears

- number of teeth: $z=24, 30, 36, 40, 45, 50, 60, 76, 80, 95$
- module: $m=2\text{mm}$

Worm gear

- worm
 - ▶ number of teeth: $z=6$
- worm wheel
 - ▶ number of teeth: $z=62$
 - ▶ module: $m=3,15\text{mm}$

LxWxH: 1000x500x500mm (assembled frame)

Weight: approx. 80kg

LxWxH: 600x400x120mm (storage system)

LxWxH: 600x400x170mm (storage system)

Scope of delivery

- 1 frame
- 1 set of bearings
- 1 set of gear components
- 1 set of tools
- 1 set of instructional material

GL 200
Lathe gear**Learning objectives/experiments**

- investigation of all essential gear functions of a lathe
- main gear
- change gear
- tumbler gear
- feed gear (Norton gear)

Specification

- [1] design and function of a lathe gear
- [2] fully functional experimental unit
- [3] optimum insight thanks to open design
- [4] shiftable main gear
- [5] Norton gear as feed gear to drive the lead screw
- [6] change gear and tumbler gear
- [7] record the feed on paper via recorder drum on the primary spindle driven by hand crank
- [8]

Technical data

Primary spindle speed stages: 9
Feed gear stages: 7

LxWxH: 750x500x800mm
Weight: approx. 42kg

Scope of delivery

- 1 lathe gear
- 1 set of instructional material

Description
■ safe and clear demonstration of the gear functions on a lathe

The GL 200 lathe gear has all the essential features and characteristics of a workshop lathe: a shiftable main gear, a feed gear for driving the lead screw (Norton gear), a change gear and a tumbler gear.

Drive is supplied by a hand crank with graduated dial. As such, the processes run slowly and completely safely.

The tool slide in this experimental unit performs only longitudinal motion. The automatic longitudinal feed is achieved by a lead screw. A removable recorder drum simulates the workpiece, while the cutting tool is replaced by a stylus.

Since the gear parts are exposed, all functions can be observed clearly. All experiments are easily repeatable and offer numerous variations.

First-rate handbooks



GUNT's policy is simple: high quality hardware and clearly developed accompanying instructional material ensure successful teaching and learning about an experimental unit.

The core of the accompanying material are detailed reference experiments that we have carried out. The description of the experiment contains the actual experimental setup right through to the interpretation of the results and findings. A group of experienced engineers develops and maintains the instructional material.

Nevertheless, we are here to help should any questions remain unanswered, either by phone or – if necessary – on site.

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.

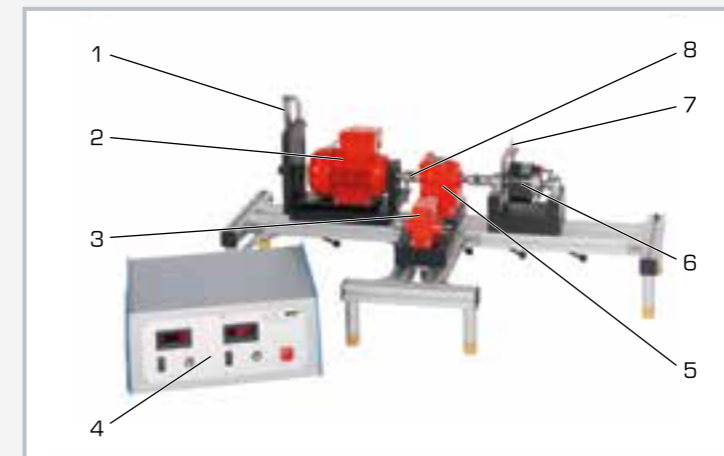
A three-phase AC motor with variable speed via frequency converter serves as the drive unit. An electromagnetic brake is used as the brake unit. The constant braking effect can be very finely adjusted via the exciting current; it then serves as a tunable load. The properties of the magnetic particle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

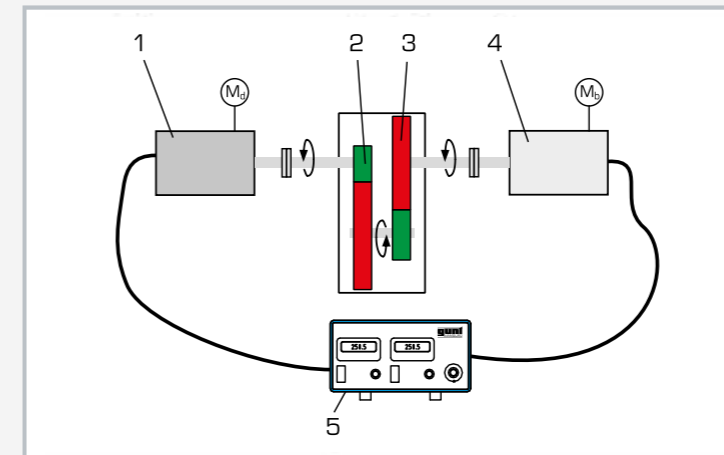
Motor and brake are mounted on pendulum bearings in order to determine the torques. The torques are measured by spring balance and lever arms. The speed of the motor is detected contact-free by means of an inductive displacement sensor on the motor shaft. The speed is displayed digitally. The exciting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

Learning objectives/experiments

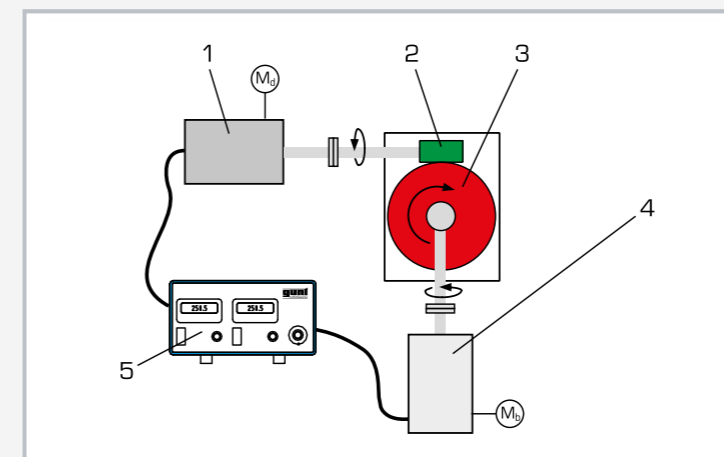
- determination of the mechanical efficiency of gears by comparing the mechanical driving and braking power for
 - ▶ spur gear, two-stage
 - ▶ worm gear
- plot the torque/current characteristic curve for a magnetic particle brake
- drive and control engineering



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

Assembly exercises

Assembly process

In industrial manufacturing, the repeated fashioning of individual prefabricated components and assemblies into a finished product, unit or device is called assembly.

The entire assembly process comprises the assembly operations:



Joining (DIN 8593)

- joining together
- filling
- pressing on and impressing
- joining by moulding
- joining by forming
- welding
- soldering
- bonding
- textile joining



Handling (VDI 2860)

- retaining
 - ▶ changing quantities
 - ▶ dividing
 - ▶ merging
- moving
 - ▶ turning
 - ▶ positioning
- securing
 - ▶ holding
 - ▶ detaching
- inspecting
 - ▶ checking



Special operations

- cleaning
- aligning
- marking
- lubricating
- ...

Design based on assembly requirements

An optimum design based on assembly requirements is characterised by the fact that only a few simple, unique or essential steps are required to assemble a product. Similarly, a parallel assembly of components should be planned at the design stage. If fully automated assembly is planned, this requires sophisticated solutions especially for the automated, safe grasping

of the workpiece. In design based on assembly requirements, the prerequisites and constraints have to be taken into account when building the product in assembly. Design based on assembly cannot be learned by theoretical teaching, but must be practised.

Specifications for the design

Excerpt from the book, Grundlagen der Konstruktionslehre, Klaus-Jörg Conrad

When designing individual parts:

- design parts so that the ordering of the parts before assembly is not needed
- simplify position and orientation of the parts by external features, such as symmetrical shape
- simplify positioning by bevels, grooves, recesses, guides, etc.
- design joints so as to be easily accessible for tools and observation of the assembly process

When designing assemblies:

- structure product division with clear, testable assemblies in order to perform assembly operations with simple types of movement
- choose functional tolerances, but not too tight
- take note of disassembly and recycling in the design stage
- simplify or avoid calibration processes by means of good accessibility
- reduce number of individual components and joints
- design repetitive assemblies

Assembly exercises

The assembly exercises from GUNT are part of the GUNT-Practice Line. This series of units has been designed specifically for the areas of assembly, maintenance and repair (see also catalogue 2). Together with cutaway models, these units represent a practical addition to the field of engineering design. With our assembly exercises, we offer lecturers an interface between general, rather theoretical learning content and application-based, practical work.

Learning objectives

- Develop broad knowledge of assembly technology as a basis for the design of assemblies
- Introduction to technical terms and technical language
- Familiarisation with machine elements and standard parts
- Recognise assemblies, understand functions, describe systems
- Read and understand technical documentation
- Plan and execute assembly steps and sequences
- Familiarisation with typical tools and devices
- Check and evaluate work results



The typical scope of delivery of our assembly exercises is shown using the example of the MT 152 spur gear:

Spur gear deconstructed into individual parts, delivered in a solid metal case

Engineering drawing

Assembly plan

Extract from the documentation

Assembled spur gear

MT 170

Assembly shaft with journal bearings



The illustration shows the tool box with the kit and, in the foreground, the fully assembled journal bearing.

Description

- practical kit based on the assembly of a shaft / journal bearings arrangement
- part of the GUNT-Practice Line for assembly, maintenance and repair

Journal bearings execute a sliding motion between a bearing journal and a bearing shell. This sliding motion is usually lubricated by an intermediate medium. The damping effect of the lubricant in the bearing gap means journal bearings run particularly smoothly and quietly. Vibration and shock impact from gear wheels or crank mechanisms are also damped by journal bearings. They are widely used in piston engines, punches and presses as they are insensitive to high shock loads.

The MT 170 unit comprises a ground steel shaft and two horizontally split pedestal bearings. The journal bearings in MT 170 are grease-lubricated ones. Grease lubrication allows for a simple bearing construction. The upper bearing shell includes a lubrication fitting with a female thread to which a Stauffer lubricator can be screw-fitted by way of an intermediate pipe to supply the bearing with lubricant.

The face of the upper bearing shell, which is not subjected to load, contains a flat lubricating slot.

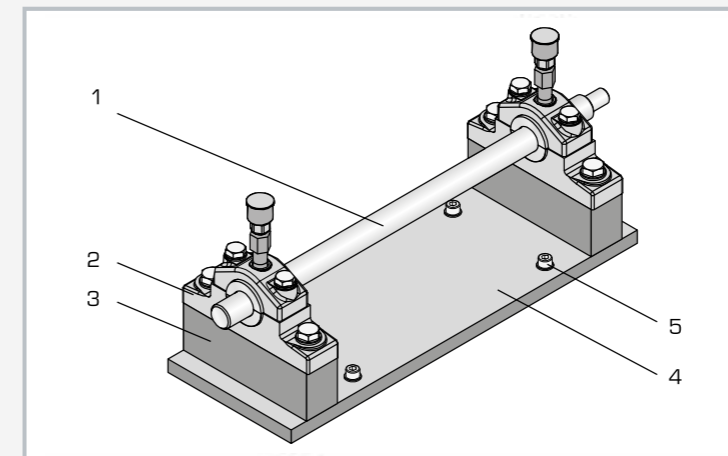
This distributes the grease over the full width of the bearing. The grease serves not only as a lubricant but also seals the bearing against external dirt and foreign bodies.

The MT 170 kit is part of the GUNT-Practice Line for assembly, maintenance and repair, which has been designed for technical colleges and company training centres. The close link between theory and practice-based learning content is evident.

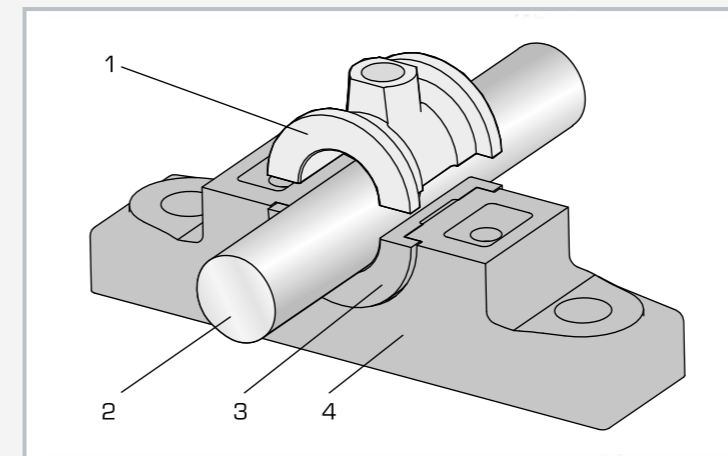
MT 170 enables a simple journal bearing to be assembled and disassembled. Students become familiar with all the components and how they work. The individual parts are laid out clearly and are well protected in a tool box. The accompanying material details the individual steps involved in assembly, and provides additional information on the areas of application, mode of operation and design of the journal bearing.

Learning objectives/experiments

- function and design of a simple journal bearing
- assembly and disassembly, including for the purposes of maintenance and repair
- measure the bearing clearance
- check the alignment
- read and understand engineering drawings and operating instructions
- together with MT 172
 - ▶ investigate the running properties of the journal bearing



1 steel shaft, 2 pedestal bearing, 3 spacer, 4 base plate, 5 bolt to fix MT 170 into MT 172



1 upper bearing shell, 2 shaft, 3 lower bearing shell, 4 bearing block

Specification

- [1] kit of a shaft with journal bearings
- [2] part of the GUNT-Practice Line for assembly, maintenance and repair
- [3] horizontally split pedestal bearing according to DIN 505, grease lubricated
- [4] steel shaft, hardened and ground
- [5] 2 pedestal bearings with split shells
- [6] set of plastic strips to measure bearing clearance
- [7] checking bearing alignment using touch-up paste
- [8] complete set of tools for assembly
- [9] journal bearing parts and tools housed in a sheet-steel tool box

Technical data

Shaft

- Ø 25mm
- shaft journal for coupling: Ø 16mm

Materials

- pedestal bearing, bearing cap: grey cast iron
- bearing shells: red bronze to DIN 8221
- shaft: hardened and ground steel
- Stauffer lubricator: steel

LxWxH: 640x230x230mm (tool box)

Weight: approx. 45kg

Scope of delivery

- 1 kit
- 1 metal bellows coupling for connection to MT 172
- 1 set of tools
- 1 set of small parts
- 1 1 tool box with foam inlay
- 1 set of instructional material

MT 171

Assembly hydrodynamic journal bearing



The illustration shows the tool box with kit and parts compartment insert. A fully assembled journal bearing is shown in the foreground.

Description

- practical kit of a hydrodynamic journal bearing
- part of the GUNT-Practice Line for assembly, maintenance and repair

Journal bearings generally execute a sliding motion between a bearing journal and a bearing shell. This sliding motion is usually lubricated by an intermediate medium. Hydrodynamic journal bearings give wear-free continuous duty for large diameters at high speeds, and are suitable for high and shock-type loading. They are usually constructed as split bearings. Frictional heat occurring during operation must be dissipated by the lubricant.

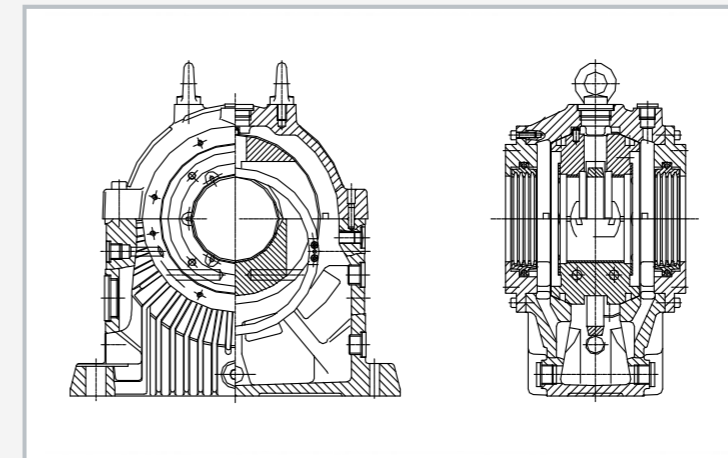
MT 171 is a horizontally split hydrodynamic pedestal journal bearing. The bearing shells are supported by a spherical face in the bearing housing so as to ensure uniform transfer of any forces that arise on the bottom part of the housing. The journal bearing is lubricated by a loose lubricating ring. Standard commercially available mineral oils can be used. An auxiliary shaft is supplied together with the bearing as an aid to assembly and functional testing.

The MT 171 kit is part of the GUNT-Practice Line for assembly, maintenance and repair, which has been designed for technical colleges and company training centres. The close link between theory and practice-based learning content is evident. MT 171 enables a hydrodynamic journal bearing to be assembled and disassembled. Students become familiar with all the components and how they work.

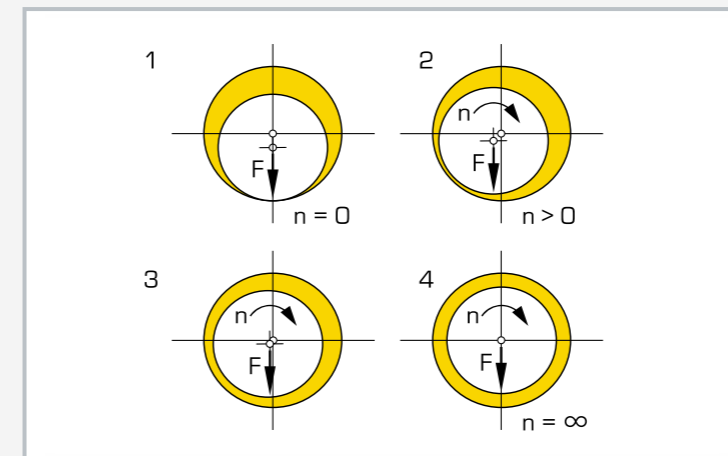
The individual parts are laid out clearly and are well protected in a tool box. The accompanying material details the individual steps involved in assembly, and provides additional information on the areas of application, mode of operation and design of the journal bearing.

Learning objectives/experiments

- function and design of a hydrodynamic journal bearing
- principles of lubrication and sealing elements
- assembly and disassembly, including for the purposes of maintenance and repair
- read and understand engineering drawings and operating instructions



Sectional drawing of a hydrodynamic journal bearing



Operation of a hydrodynamic journal bearing: 1 to 4 build-up of a load-bearing oil film at increasing speed

Specification

- [1] kit of an upright hydrodynamic journal bearing
- [2] part of the GUNT-Practice Line for assembly, maintenance and repair
- [3] journal bearing to DIN 31690
- [4] stainless-steel drive shaft
- [5] lubrication via oil lubricating ring
- [6] floating edge seal to the face of the shaft seal
- [7] contact surfaces of the housing halves sealed with non-hardening sealant
- [8] complete set of tools for assembly
- [9] journal bearing parts and tools housed in a sheet-steel tool box

Technical data

Bearing bore
■ \varnothing 80mm

Drive shaft
■ nominal diameter: \varnothing 80mm

Materials

- bearing housing: grey cast iron
- bearing shells: steel supports, coated with white metal
- seal: ultra-heat-resistant, fibre-reinforced plastic
- shaft: stainless steel

LxWxH: 690x360x312mm (tool box)
Weight: approx. 60kg

Scope of delivery

- 1 kit
- 1 drive shaft
- 1 set of tools
- 1 set of small parts
- 1 tool box with foam inlay
- 1 set of instructional material

MT 152

Assembly spur gear



Learning objectives/experiments

- function and design of a helical spur gear unit
- planning and presentation of the assembly process
- assembly and disassembly, including for the purposes of maintenance and repair
- read and understand engineering drawings
- dimensioning exercises, gauging of parts
- familiarisation with various machine elements: ball bearings, shaft seals
- familiarisation with assembly aids and jigs
- material selection criteria

Description

- **practical kit based on a spur gear unit**
- **broad scope of learning with interdisciplinary problems**
- **part of the GUNT-Practice Line for assembly, maintenance and repair**

Gears transfer rotary motion. They adapt the torques and speeds of a consumer drive according to demand.

The MT 152 unit is a spur gear unit with helical gear wheels. The gear is single stage and has a fixed transmission ratio (fixed gear unit). It is a standalone gear unit, i.e. a self-contained transmission in its own gear housing. Self-contained gear units are usually arranged between the motor and the driven machine, or are used as installation kits in machines.

By contrast, open-running gear-wheel pairs forming part of a machine are termed non-self-contained gears.

Helically cut gear wheels run more smoothly and quietly than straight-toothed gears because the gear teeth intermesh gradually and multiple teeth are engaged. They are suitable for higher speeds, and can withstand greater loading than comparable straight-toothed gears.

The MT 152 kit is part of the GUNT-Practice Line for assembly, maintenance and repair, which has been designed for technical colleges and company training centres. The close link between theory and practice-based learning content is evident.

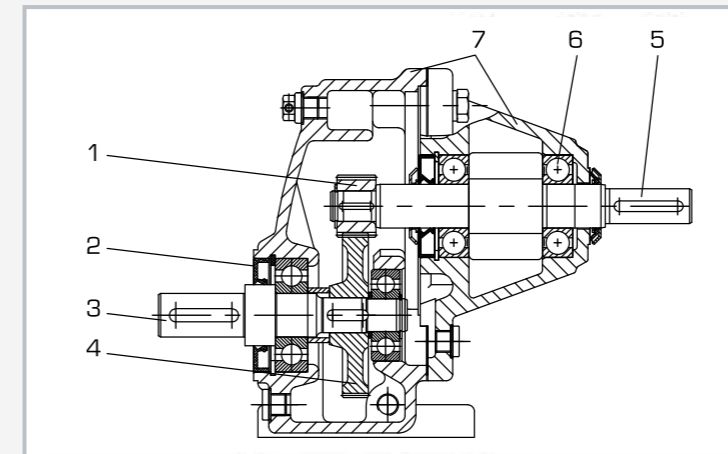
The assembly and disassembly processes can be completed easily within standard lesson times. Only basic tools are required for assembly, all of which are supplied with the kit. The fit seatings of the gear unit are designed to allow the complete assembly process to be performed by hand.

The unit is of most benefit in teaching if two or three students work together in a small group. The group has a defined task to perform, with clear assignments to complete.

The comprehensive instructional material focuses on practical needs. It includes a complete set of drawings with a general arrangement drawing, parts list and single-part drawings.



The illustration shows the assembled spur gear unit.



1 pinion, 2 shaft seal, 3 driven shaft, 4 gear wheel, 5 drive shaft, 6 ball bearings, 7 housing parts

Specification

- [1] kit of a spur gear unit
- [2] part of the GUNT-Practice Line for assembly, maintenance and repair
- [3] disassembled spur gear with set of small parts and 4 assembly jigs, housed in a sturdy case with foam insert
- [4] helical spur gear wheels
- [5] gear unit comprising input housing, pedestal housing, input and output shafts, input gear and output pinion, as well as bearings

Technical data

Gear dimensions without shaft connections
 ■ LxWxH: 160x135x175mm

Transmission ratio

- pinion
 - ▶ number of teeth: $z=24$
 - ▶ real pitch module: $m=1$ mm
- gear wheel
 - ▶ number of teeth: $z=68$
 - ▶ real pitch module: $m=1$ mm
- transmission ratio: $i=2,83$

Max. drive torque
 ■ 54Nm at 494min⁻¹

Materials

- housing: cast iron
- shafts: tempered steel
- spur wheels: alloyed case-hardened steel

Shaft connections

- drive: $\varnothing \times L$: 16x40mm
- driven: $\varnothing \times L$: 20x40mm

LxWxH: 600x450x180mm (case)

Weight: approx. 18kg

Scope of delivery

- 1 kit
- 1 set of tools
- 1 set of assembly jigs
- 1 set of small parts
- 1 case
- 1 set of instructional material with complete set of drawings with individual parts and parts list

MT 110.02**Assembly spur wheel / worm gear mechanism**

The illustration shows the tool box with the kit. The compartment insert for tools and small parts is shown in the foreground.

Description

- **practical assembly of an industrial gear unit, using simple tools and devices**
- **broad scope of learning with interdisciplinary problems**
- **part of the GUNT-Practice Line for assembly, maintenance and repair**

The MT 110.02 unit deals with a two-stage gear. The kit contains all the individual parts to build the gear. The gear comprises a spur gear stage as its input, with a downstream worm gear stage (combined gear). The fit seatings of the gear unit are designed to allow the complete assembly process to be performed by hand. All parts are laid out clearly and are well protected in a sheet-steel tool box. Small parts are contained in a box with a transparent lid. A set of tools is included.

The project-based nature of this assembly kit allows for varied and above all interdisciplinary work in the classroom. The project is particularly recommended for a practical-based teaching organisation, in conjunction with independent student activity and teamwork.

The contemporary instructional materials provide extensive technical information that provides the basis for lesson design. The core element of the teaching materials is a complete set of drawings with lists of parts, individual part designations, exploded views and assembly drawings. All drawings are to standard and are dimensioned in accordance with production requirements. Pdf files and assembly videos are also useful features.

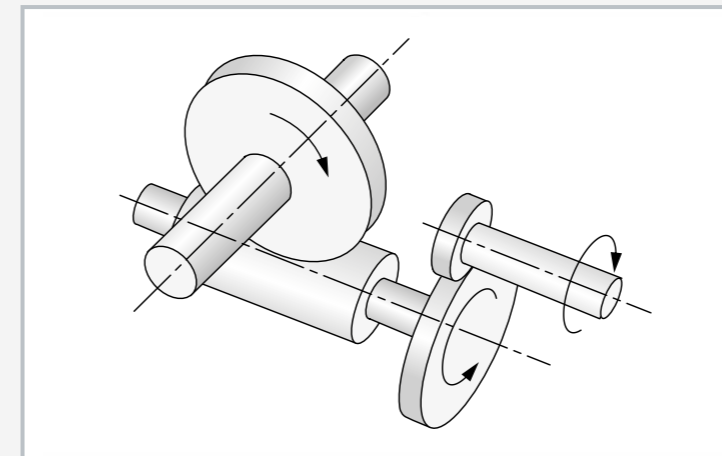
The fully assembled gear can be tested for functionality using the optionally available MT 172.

Learning objectives/experiments

- function and design of a combined gear unit
 - reading and understanding engineering drawings
 - familiarisation with components and assemblies, their design features and functions
 - dimensioning exercises, gauging of parts
 - work planning, in particular planning and representation of the assembly process
 - familiarisation with assembly aids and jigs
 - assembly exercises: assembly of modules and complete units
 - analysis of faults and damage, in conjunction with maintenance and repair steps
 - material selection criteria
- in conjunction with MT 172
- ▶ functional testing of the assembled gear unit



The illustration shows the assembled gear unit.



Drive principle of the two-stage spur wheel / worm gear mechanism

Specification

- [1] kit of a spur wheel / worm gear mechanism
- [2] part of the GUNT-Practice Line for assembly, maintenance and repair
- [3] complete, disassembled gear unit with set of small parts and 12 assembly jigs in a storage box
- [4] spur gear stage with helical gear wheels
- [5] worm gear stage with cylindrical worm and globoid wheel
- [6] gear unit comprising drive housing, worm pedestal housing, driving and driven shafts, spur gear stage and worm gear stage

Technical data

Gear dimensions without shaft couplings
 ■ LxWxH: 282x138x188mm, approx. 22kg

Transmission ratios

- spur gear stage: $i=2,83$
- worm gear stage: $i=12,33$
- total gear ratio: $i=34,89$

Spur gear stage

- pinion: number of teeth: $z=24$, real pitch module: $m=1\text{mm}$
- gear wheel: $z=68$, $m=1\text{mm}$

Worm gear stage

- worm: $z=3$
- worm gear wheel: $z=37$, $m=2,578\text{mm}$

Max. output torque: 212Nm

Materials

- housing: cast iron
- shafts: tempered steel
- spur gear wheels, worm: alloyed case-hardened steel

Shaft connections

- drive: $\text{ØxL: } 16 \times 40\text{mm}$
- driven: $\text{ØxL: } 30 \times 60\text{mm}$

LxWxH: 700x380x320mm (tool box)
 Weight: approx. 38kg

Scope of delivery

- 1 kit
- 1 set of tools
- 1 set of assembly jigs
- 1 set of small parts
- 1 set of gaskets
- 1 tool box with foam inlay
- 1 set of instructional material, consisting of technical description of system, complete set of drawings with individual parts and parts list, description of assembly and disassembly sequences, pdf files, assembly videos

MT 172

Alignment of drives, shafts and gears



2E

The illustration shows MT 172 together with a combination gear unit assembled from the kit MT 110.02.

Description

- **assembly and alignment of drive elements**
- **understanding a wide range of mechanical drive systems**
- **functional testing of completed GUNT assembly kits**

The MT 172 unit is used to perform functional tests on MT 170 (shaft with journal bearings), MT 110 and MT 110.02 (combination gear units). The assembled element system – journal bearing or gear unit – is mounted on the MT 172 test bed. Here, the complete system is properly assembled, with particular regard to the alignment of the system components. A successfully completed assembly project can then be examined in operation with a formal final test. Parameters examined during test procedure are running noise, heat generation, vibrations or leakage.

MT 172 includes a single-phase asynchronous motor drive, a magnetic particle brake with adjustable braking torque, and a rigid machine bed with T-slots on which the motor and the drive element under test are mounted.

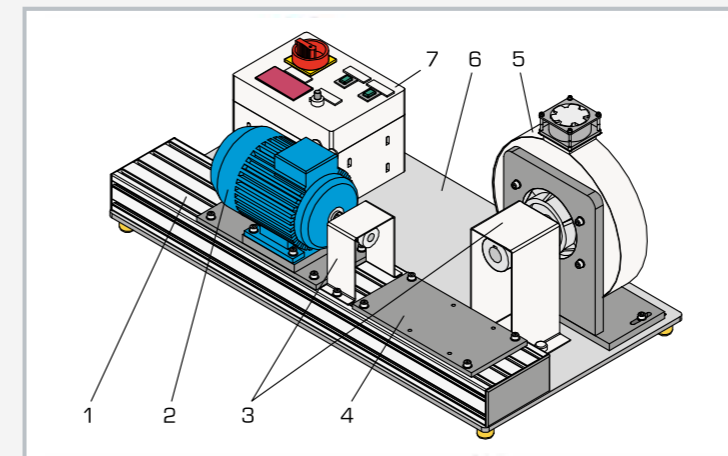
The T-slots allow the installed length to be varied, and therefore can be easily adapted to the drive element. Two couplings connect the element system to the motor and the brake. The students must align the connections between the motor and the element system, and between the element system and the brake. The controls are located on the switch box.

The braking torque is set here using a potentiometer. The exciter current of the magnetic particle brake serves as a measure of the braking torque, and is displayed in digital form. Removable guards protect the couplings.

The MT 172 unit is part of the GUNT-Practice Line for assembly, maintenance and repair, which has been designed for technical colleges and company training centres.

Learning objectives/experiments

- in conjunction with MT 170 and MT 110.02
 - ▶ assembly and alignment of gears or shafts with journal bearings
 - ▶ planning and execution of final testing on a helical worm gear (MT 110.02)
 - ▶ planning and execution of final testing on a journal-bearing-mounted shaft (MT 170)
 - ▶ familiarisation with gear components and their functions
- in conjunction with combined gear unit MT 110.02
 - ▶ checking gear functionality after assembly using a load test
 - ▶ running of the gear under variable load: assessment of running noise; checking for heat build-up; checking for leaks
- in conjunction with MT 170 shaft with journal bearings
 - ▶ running properties of a journal bearing



1 machine bed, 2 drive motor, 3 coupling guard, 4 combination gear unit mounting plate, 5 magnetic particle brake, 6 base plate with flexible elements for vibration damping, 7 switch box with displays and controls



The illustration shows MT 172 together with the journal bearing-mounted shaft MT 170.

Specification

- [1] experimental unit for functional testing of mechanical gear units: shaft on journal bearing, combined gear unit
- [2] part of the GUNT-Practice Line for assembly, maintenance and repair
- [3] single-phase asynchronous motor with metal bellows coupling
- [4] externally vented magnetic particle brake with claw clutch, braking power adjustable by potentiometer
- [5] machine-bed T-slot aluminium profile for adjustable mounting of gear components
- [6] switch box with controls and digital display of exciter current of the magnetic particle brake
- [7] coupling guards

Technical data

Drive motor

- 4-pole asynchronous motor
- max. power: 0,55kW
- speed: 1400min⁻¹

Magnetic particle brake with fan and temperature sensor

- nominal braking torque at exciter current 0...0,4A
 - ▶ 0...45Nm
- max. braking torque at 1A: 110Nm
- bi-metallic strip temperature protection: 70°C

Aluminium machine bed with T-slots

- installation space: LxW: 640x160mm
- slot spacing: 40mm
- for M8 sliding blocks

230V, 50Hz, 1 phase
120V, 60Hz, 1 phase; 230V, 60Hz, 1 phase
UL/CSA optional
LxWxH: 950x500x450mm
Weight: approx. 75kg

Scope of delivery

- 1 experimental unit
- 1 set of small parts
- 1 set of tools
- 1 set of instructional material

MT 190

Assembly materials tester



Description

- kit of a unit for basic experiments in materials testing
- can be expanded with electronic data acquisition
- part of the GUNT-Practice Line for assembly, maintenance and repair

The MT 190 unit is supplied as a kit and contains all mechanical parts, measuring units, hydraulic components with seals and pipe material with all connecting parts. Assembly comprises the mechanical structure, the hydraulic assembly of both cylinders and the piping installation. All tools and aids required are included, as well as extensive teaching materials.

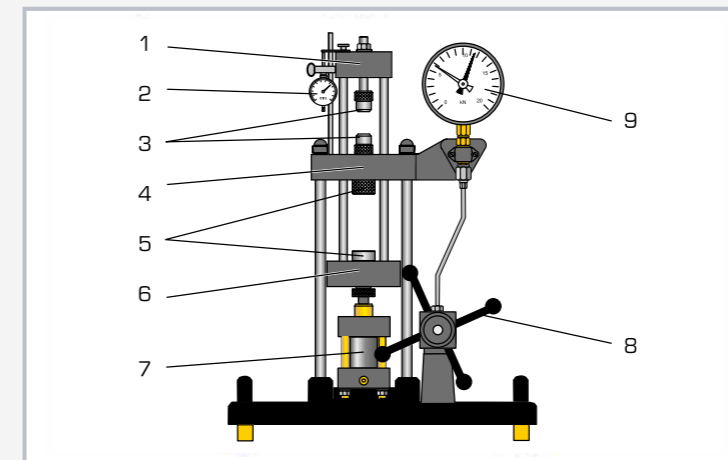
The MT 190.01 assembly set allows for data acquisition as an extension to the range of experiments. Using MT 190, students can learn about working on a complex project. This involves the planning, implementation and checking of processes related to assembly, commissioning and repair.

The assembled MT 190 experimental unit represents a real, fully functional materials tester that can be used to conduct tensile tests and Brinell hardness tests. The experimental unit has been developed specifically for experiments in small groups and is characterised by a clear design, simple operation and accessories that are easy to exchange.

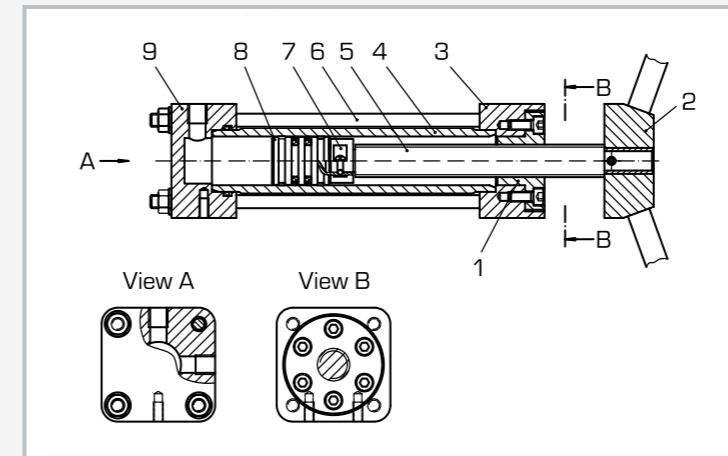
The tensile specimens are clamped between the upper cross member and the crosshead. The hardness specimens are secured between the crosshead and lower cross member. The test force is generated by means of a hand-operated hydraulic system and displayed on a large force gauge with a drag indicator. A dial gauge measures the elongation of the specimens.

Learning objectives/experiments

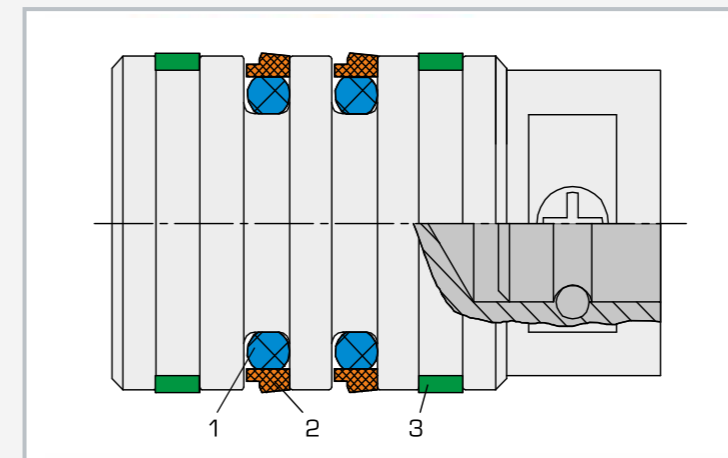
- read and understand technical documentation
- plan and execute assembly steps and sequences
- familiarisation with machine elements and components
- commission and inspect materials tester after successful assembly
- plan, implement and evaluate maintenance operations
- fault analysis: troubleshooting, fault analysis and remedy
- after successful assembly
 - ▶ tensile test on metallic specimens
 - ▶ plot load-extension diagrams
 - ▶ Brinell hardness test



1 upper cross-member, 2 dial gauge for elongation, 3 clamp, 4 crosshead, 5 compression piece and pressure plate, 6 lower cross-member, 7 hydraulic cylinder, 8 hand wheel, 9 force gauge



Sectional drawing of the horizontal hydraulic cylinder: 1 trapezoidal nut, 2 hand wheel axle, 3 crank side flange, 4 cylindrical tube, 5 trapezoidal threaded spindle, 6 clamping bolt, 7 retainer, 8 piston, small, 9 pressure side flange



Piston in detail: 1 O-ring, 2 piston sealing ring, 3 guide ring

Specification

- [1] assembly kit of a materials tester
- [2] part of the GUNT-Practice Line for assembly, maintenance and repair
- [3] hydraulic assembly of two cylinders
- [4] pipework assembly of the hydraulic system
- [5] classic destructive tests from the field of materials testing: tensile tests, Brinell hardness test
- [6] generation of tensile and compressive forces
- [7] forces generated by hand-operated hydraulic system; no power supply required
- [8] force gauge, pointer instrument with drag indicator
- [9] dial gauge for determining the elongation
- [10] hardness specimens: aluminium, copper, steel, brass
- [11] tensile specimens according to DIN 50125: aluminium, copper, steel, brass
- [12] assembly kit for MT 190.01 data acquisition available as an option

Technical data

Test force: max. 20kN
 Stroke: max. 45mm
 Free installation space for specimens: 165x65mm
 Tensile specimens: B6x30mm, DIN 50125
 Hardness specimens: LxWxH 30x30x10mm
 Sphere for hardness testing: \varnothing 10mm

Measuring ranges

- force: 0...20kN, graduation: 0,5kN
- travel: 0...10mm, graduation: 0,01mm

LxWxH: 610x520x850mm (assembled)
 Weight: approx. 53kg

Scope of delivery

- 1 kit
- 1 set of tools
- 1 set of assembly jigs
- 1 set of small parts
- 1 set of accessories
- 1 set of specimens (4 tensile specimens, 4 hardness specimens)
- 1 set of instructional material, consisting of: technical description of system, complete set of drawings with individual parts and parts list, description of maintenance and repair processes, suggested exercises

FASTENERS AND MACHINE PARTS

WORKSHOP EXERCISES

| CODE | PRODUCT | PAGE |
|--------|--|------|
| MG 100 | Instructional Kit: Assembly with Dowel Pins | 66 |
| MG 110 | Instructional Kit: Assembly with Keys | 67 |
| MG 120 | Instructional Kit: Assembly with Taper Keys | 68 |
| MG 200 | Instructional Kit: Threaded Fasteners and Lock Washers | 69 |

DEMONSTRATION KITS

| CODE | PRODUCT | PAGE |
|--------|---------------------------|------|
| MG 901 | Nuts and Bolts Kit | 70 |
| MG 903 | Screw-Locking Devices Kit | 71 |
| MG 905 | Thread Types Kit | 72 |
| MG 911 | Roller Bearings Kit | 73 |

TECHNOLOGICAL EXPERIMENTS

| CODE | PRODUCT | PAGE |
|--------|------------------------------|------|
| TM 123 | Spur Gear Lifting Apparatus | 74 |
| TM 124 | Worm and Wheel Apparatus | 75 |
| GL 110 | Cam Mechanism | 76 |
| TM 232 | Bearing Friction | 77 |
| TM 282 | Friction in Journal Bearings | 78 |
| TM 320 | Screw Tester | 80 |



Knowledge of fasteners and machine parts is key to gaining an understanding of mechatronic systems.

Our **workshop exercises** cover a range of joining techniques. They are less suitable for use in the classroom or for demonstration purposes.

The **demonstration kits** provide an overview of standard parts such as bolts, bolt locking devices, nuts and roller bearings. Their purpose is purely demonstrative; they do not contain experiments or exercises.

A third area is represented by our **technological experiments**. Here, students are able to learn about basic aspects of technical mechanics in a simple, clearly illustrated manner.

You will find more training and practice units relating to mechanical engineering in our catalogue number 1: **ENGINEERING MECHANICS & ENGINEERING DESIGN**

Visit our website www.gunt.de

MG 100 *Instructional Kit: Assembly with Dowel Pins*



- * Practical workshop exercise relating to pin joints
- * Familiarisation with various pin types, their special features and applications

Technical Description

The practice kit provides the material necessary for students to systematically learn how components can be joined together in a professional way using pins. Both flat and cylindrical parts are pinned together. We recommend that the exercises are carried out in a workshop, as all preparations such as scribing, drilling, clamping, reaming and joining must be carried out in a correct and proper manner by the student.

The material is clearly laid out on a plastic tray. The well-structured instructional material outlines all the necessary technical information and provides a step-by-step guide through the exercises.

Learning Objectives / Experiments

- familiarisation with different types of pin and their specific applications: grooved pins, dowel pins, straight pins, tapered pins
- familiarisation with the relevant standard designations and terms, including graphical representation
- planning and execution of all steps in the workshop environment
- familiarisation with types of pinned joint
- working with fits and tolerances

Scope of Delivery

- 1 complete set of material, laid out on a tray
- 1 set of instructional material

Specification

- [1] set of material for workshop exercises relating to pin joints
- [2] joining flat items
- [3] joining cylindrical items
- [4] pin puller
- [5] all parts clearly laid out on a tray
- [6] multiple trays stackable

Technical Data

Straight pins: d=6, 8mm
 Grooved pins: d=3, 5, 8mm
 Dowel pins: d=5mm
 Tapered pins: d=6, 8mm
 Studs: d=8mm
 Shaft with set collar: shaft diameter: d=40mm
 All parts made from steel, some with gunmetal finish

Dimensions and Weight

LxWxH: 500x350x110mm (tray)
 Weight: approx. 14kg

Order Details

053.10000 MG 100 Instructional Kit: Assembly with Dowel Pins

G.U.N.T Gerätebau GmbH, Hanskampring 15-17, D-22885 Barsbüttel, Phone +49 (40) 67 08 54-0, Fax +49 (40) 67 08 54-42, E-mail sales@gunt.de, Web http://www.gunt.de
 We reserve the right to modify our products without any notifications.

MG 110 *Instructional Kit: Assembly with Keys*



- * Practical workshop training relating to feather key joints
- * Familiarisation with various feather keys, their production, special features and applications

Technical Description

This instructional kit provides the necessary material for students to learn systematically how a hub and a shaft can be joined together in a professional way using feather keys. We recommend that the exercises are carried out in a workshop, as all preparations such as filing, drilling, countersinking and tapping must be carried out in a correct and proper manner by the student.

The material is clearly laid out on a plastic tray. The well-structured instructional material outlines all the necessary technical information and provides a step-by-step guide through the exercises.

Learning Objectives / Experiments

- production of different feather keys: round ended and straight ended
- assembly of feather key joints: light fit/sliding fit
- familiarisation with the relevant standard designations and terms, including graphical representation
- planning and execution of all steps in the workshop environment
- familiarisation with types of keyed joint
- working with fits and tolerances

Scope of Delivery

- 1 complete set of material, laid out on a tray
- 1 set of instructional material

Specification

- [1] set of material for workshop exercises in feather key joints
- [2] shaft with slots
- [3] hub with 1 slot
- [4] hub with 2 slots
- [5] driver sleeve
- [6] 1 set of semi-finished items for the production of feather keys to DIN 6885
- [7] all parts clearly laid out on a tray
- [8] multiple trays stackable

Technical Data

Semi-finished items
 - feather key shape AS (round ended): 14x9x65mm
 - feather key shape E (round ended): 14x9x142mm
 - feather key shape E (straight ended): 14x9x142mm
 All parts made from steel, some with gunmetal finish

Dimensions and Weight

LxWxH: 500x350x110mm (tray)
 Weight: approx. 18kg

Order Details

053.11000 MG 110 Instructional Kit: Assembly with Keys

G.U.N.T Gerätebau GmbH, Hanskampring 15-17, D-22885 Barsbüttel, Phone +49 (40) 67 08 54-0, Fax +49 (40) 67 08 54-42, E-mail sales@gunt.de, Web http://www.gunt.de
 We reserve the right to modify our products without any notifications.

MG 120 *Instructional Kit: Assembly with Taper Keys*



- * Practical workshop exercise relating to taper key joints
- * Familiarisation with various taper keys, their production, special features and areas of application

Technical Description

This instructional kit provides the necessary material for students to learn systematically how a shaft is joined to a hub or a coupler in a professional way using taper keys. We recommend that the exercises are carried out in a workshop, as all preparations such as filing, drilling, countersinking and tapping must be carried out in a correct and proper manner by the student.

The material is clearly laid out on a plastic tray. The well-structured instructional material outlines all the necessary technical information and provides a step-by-step guide through the exercises.

Learning Objectives / Experiments

- production of different taper keys: round ended, straight ended, nose key, tangential key pair, cotter
- assembling taper key joints:
- familiarisation with the relevant standard designations and terms, including graphical representation
- planning and execution of all steps in the workshop environment
- familiarisation with types of taper-keyed joint
- working with fits and tolerances

Scope of Delivery

- 1 complete set of material, laid out on a tray
- 1 set of instructional material

Specification

- [1] set of material for workshop exercises in taper key joints
- [2] shaft with slots
- [3] 2 hubs with slots
- [4] coupler
- [5] key driver, key extractor, driver sleeve
- [6] 1 set of semi-finished items for the production of taper keys to DIN 6886 and DIN 6887
- [7] all parts clearly laid out on a tray
- [8] multiple trays stackable

Technical Data

- Semi-finished items
- taper key shape A (round ended): 14x9x75mm
 - taper key shape B (straight ended): 14x9x82mm
 - nose key: 14x9x90mm
 - tangential key: 10x6x165mm
 - cotter key: 25x6x62mm
- All parts made from steel, some with gunmetal finish

Dimensions and Weight

LxWxH: 500x350x110mm (tray)
Weight: approx. 18kg

Order Details

053.12000 MG 120 Instructional Kit: Assembly with Taper Keys

G.U.N.T Gerätebau GmbH, Hanskampring 15-17, D-22885 Barsbüttel, Phone +49 (40) 67 08 54-0, Fax +49 (40) 67 08 54-42, E-mail sales@gunt.de, Web http://www.gunt.de
We reserve the right to modify our products without any notifications.

MG 200 *Instructional Kit: Threaded Fasteners and Lock Washers*



- * Practical workshop training relating to threaded joints
- * Familiarisation with the key influencing factors

Technical Description

This training kit provides the necessary material for joining workpieces with threaded joints. In the process, specific influencing factors (e.g. type of bolt locking, bolt length) can be analysed independently of each other. Bolt tightening and breakaway torques are measured using a torque wrench. The workpieces are held securely in a vice during the experiments.

The material, including the torque wrench, is clearly laid out on a plastic tray. The well-structured instructional material outlines all the necessary technical information and provides a step-by-step guide through the exercises.

Learning Objectives / Experiments

- tightening a threaded joint to a preset torque
- measuring the breakaway torque as a function of the bolt length, property class, bolt locking type and tightening torque
- familiarisation with the relevant standard designations and terms, including graphical representation

Scope of Delivery

- 1 complete set of material, laid out on a tray
- 1 set of instructional material

Specification

- [1] set of material for workshop exercises relating to threaded joints
- [2] brace with drill holes, 5 flat bars
- [3] bolts to ISO 4014 and ISO 4017
- [4] nuts to ISO 4032 and ISO 7040
- [5] measurement of the tightening torque using a torque wrench with dial indicator
- [6] all parts clearly laid out on a tray
- [7] multiple trays stackable

Technical Data

- Bolts M10
- property classes 5.6 and 8.8
 - lengths: 35, 55, 75mm
- Nuts M10, some self-locking
- Various bolt locks, spring ring, toothed washer, strain washer
- Torque wrench: 0...50Nm
- Joined workpieces (flat bar and brace) made from steel, some with gunmetal finish

Dimensions and Weight

LxWxH: 500x350x110mm (tray)
Weight: approx. 9kg

Order Details

053.20000 MG 200 Instructional Kit: Threaded Fasteners and Lock Washers

G.U.N.T Gerätebau GmbH, Hanskampring 15-17, D-22885 Barsbüttel, Phone +49 (40) 67 08 54-0, Fax +49 (40) 67 08 54-42, E-mail sales@gunt.de, Web http://www.gunt.de
We reserve the right to modify our products without any notifications.

MG 901 Nuts and Bolts Kit



- * Comprehensive instructional kit of the main nuts and bolts used in engineering
- * Familiarisation with standard designations and terms

Technical Description

This instructional kit is used for demonstration and information purposes. No provision is made for conducting exercises or experiments. The industrially-standard items are clearly laid out, screw-fitted into an aluminium panel. The symbols on the panel show the correct graphical representation as well as the DIN and standard designations of the items concerned.

The kit is clearly laid out on a plastic tray. The well-structured instructional material enhances the informational value of the kit.

Learning Objectives / Experiments

- familiarisation with the main nuts and bolts used in engineering and their specific applications
- familiarisation with the relevant standard designations and terms, including graphical representation

Scope of Delivery

- 1 complete kit, laid out on a tray
- 1 set of instructional material

Specification

- [1] nuts and bolts demonstration kit
- [2] 42 standard parts, clearly laid out on an aluminium panel
- [3] screen-printed panel
- [4] screen-printing shows graphical representation and DIN designation
- [5] all parts clearly laid out on a plastic tray
- [6] multiple trays stackable

Technical Data

Aluminium panel, LxW: 350x255mm
Bolts: C4.8, K4.8, M6, M8, M10
Nuts: M6, M8, M10

Dimensions and Weight

LxWxH: 500x350x110mm (tray)
Weight: approx. 5kg

Order Details

053.90100 MG 901 Nuts and Bolts Kit

G.U.N.T Gerätebau GmbH, Hanskampring 15-17, D-22885 Barsbüttel, Phone +49 (40) 67 08 54-0, Fax +49 (40) 67 08 54-42, E-mail sales@gunt.de, Web http://www.gunt.de
We reserve the right to modify our products without any notifications.

MG 903 Screw-Locking Devices Kit



- * Comprehensive instructional kit of the main screw-locking devices used in engineering
- * Familiarisation with standard designations and terms

Technical Description

This instructional kit is used for demonstration and information purposes. No provision is made for conducting exercises or experiments. Screw-locking devices are presented in the as-fitted position on an aluminium panel. A transparent multi-compartment storage tray holds large numbers of screw-locking devices.

The kit is clearly laid out on a plastic tray. The well-structured instructional material enhances the informational value of the kit.

Learning Objectives / Experiments

- familiarisation with the main screw-locking devices used in engineering and their specific applications
- familiarisation with the relevant standard designations and terms, including graphical representation

Scope of Delivery

- 1 complete kit, laid out on a tray
- 1 set of instructional material

Specification

- [1] screw-locking devices demonstration kit
- [2] 18 fitted screw-locking devices, clearly laid out on an aluminium panel
- [3] transparent storage tray with 18 compartments each holding 10 of the different screw-locking devices
- [4] all parts clearly laid out on a plastic tray
- [5] multiple trays stackable

Technical Data

Aluminium panel, LxW: 238x100mm
Locking devices for M6

Dimensions and Weight

LxWxH: 500x350x110mm (tray)
Weight: approx. 5kg

Order Details

053.90300 MG 903 Screw-Locking Devices Kit

G.U.N.T Gerätebau GmbH, Hanskampring 15-17, D-22885 Barsbüttel, Phone +49 (40) 67 08 54-0, Fax +49 (40) 67 08 54-42, E-mail sales@gunt.de, Web http://www.gunt.de
We reserve the right to modify our products without any notifications.

MG 905 Thread Types Kit



- * Comprehensive instructional kit of the main thread types used in engineering
- * Familiarisation with standard designations and terms

Technical Description

This instructional kit is used for demonstration and information purposes. No provision is made for conducting exercises or experiments. Various bolt and nut threads are included. The thread flanks are made visible by cut-outs. A thread gauge enables the thread type and size to be determined.

The kit is clearly laid out on a plastic tray. The well-structured instructional material enhances the informational value of the kit.

Learning Objectives / Experiments

- familiarisation with the main thread types used in engineering and their specific applications
- determining the thread type with the thread gauge

Scope of Delivery

- 1 complete kit, laid out on a tray
- 1 set of instructional material

Specification

- [1] thread type demonstration kit
- [2] 8 thread types, clearly laid out
- [3] thread flanks visible with cut-outs
- [4] galvanized parts
- [5] thread gauge for determining thread type
- [6] all parts clearly laid out on a plastic tray
- [7] multiple trays stackable

Technical Data

Thread size: 24mm diameter
 Thread gauge for male and female threads
 - metric ISO thread
 - Whitworth thread
 - Whitworth pipe thread

Dimensions and Weight

LxWxH: 500x350x110mm (tray)
 Weight: approx. 5kg

Order Details

053.90500 MG 905 Thread Types Kit

G.U.N.T Gerätebau GmbH, Hanskampring 15-17, D-22885 Barsbüttel, Phone +49 (40) 67 08 54-0, Fax +49 (40) 67 08 54-42, E-mail sales@gunt.de, Web http://www.gunt.de
 We reserve the right to modify our products without any notifications.

MG 911 Roller Bearings Kit



- * Comprehensive instructional kit of the main roller bearings used in engineering
- * Familiarisation with standard designations and terms

Technical Description

This instructional kit is used for demonstration and information purposes. No provision is made for conducting exercises or experiments.

The kit presents various roller bearings. The bearings are selected for one size of shaft.

The kit is clearly laid out on a plastic tray. The well-structured instructional material enhances the informational value of the kit.

Learning Objectives / Experiments

- familiarisation with the main roller bearings used in engineering and their specific applications
- familiarisation with the relevant standard designations and terms
- discussion of specific applications

Scope of Delivery

- 1 complete kit, laid out on a tray
- 1 set of instructional material

Specification

- [1] roller bearings demonstration kit
- [2] 13 roller bearings, clearly laid out: 5 roller bearings and 8 ball bearings
- [3] 2 axial bearings / 11 radial bearings
- [4] all parts clearly laid out on a plastic tray
- [5] multiple trays stackable

Technical Data

Bearing dimensions
 - inside diameter: d=20mm
 - outside diameter: d=35, 40, 42, 47, 52mm
 - bearing width: h=8, 10, 12, 14, 15, 18, 47mm

Dimensions and Weight

LxWxH: 500x350x110mm (tray)
 Weight: approx. 6kg

Order Details

053.91100 MG 911 Roller Bearings Kit

G.U.N.T Gerätebau GmbH, Hanskampring 15-17, D-22885 Barsbüttel, Phone +49 (40) 67 08 54-0, Fax +49 (40) 67 08 54-42, E-mail sales@gunt.de, Web http://www.gunt.de
 We reserve the right to modify our products without any notifications.

TM 123 *Spur Gear Lifting Apparatus*



Specification

- [1] demonstration and student experimental unit on setup and principle of toothed gearing mechanisms
- [2] 4 galvanised steel gear wheels
- [3] 2 anodised aluminium cable pulleys
- [4] 2 sets of weights
- [5] ball bearing-mounted gear wheels and pulleys
- [6] anodised aluminium base plate

Technical Data

- 4 gear wheels
- 2x D=126mm, 84 teeth
- 2x D=42mm, 28 teeth
- modulus: m=2mm
- Driving pulley radius: 35mm

- Set of weights
- 2x 1N suspended
- 2x 0,25N
- 1x 0,5N
- 2x 1N
- 2x 2N
- 2x 2,5N

- Base plate
- LxWxH: 350x150x10mm

Dimensions and Weight

- LxWxH: 350x70x150mm
- Weight: approx. 5kg

Scope of Delivery

- 1 gear unit, mounted on base plate
- 2 sets of weights
- 1 set of instructional material

*** Setup and principle of toothed gearing mechanisms**

Technical Description

The mechanism demonstrates the relationship between the ratio of the number of teeth on spur gears and the transmission ratio of gears. With straightforward experiments, the torque conversion in gear wheel pairs and the efficiency of a gear unit are investigated.

The model is intended for wall mounting. The well-structured instructional material sets out the fundamentals and provides a step-by-step guide through the experiments.

Learning Objectives / Experiments

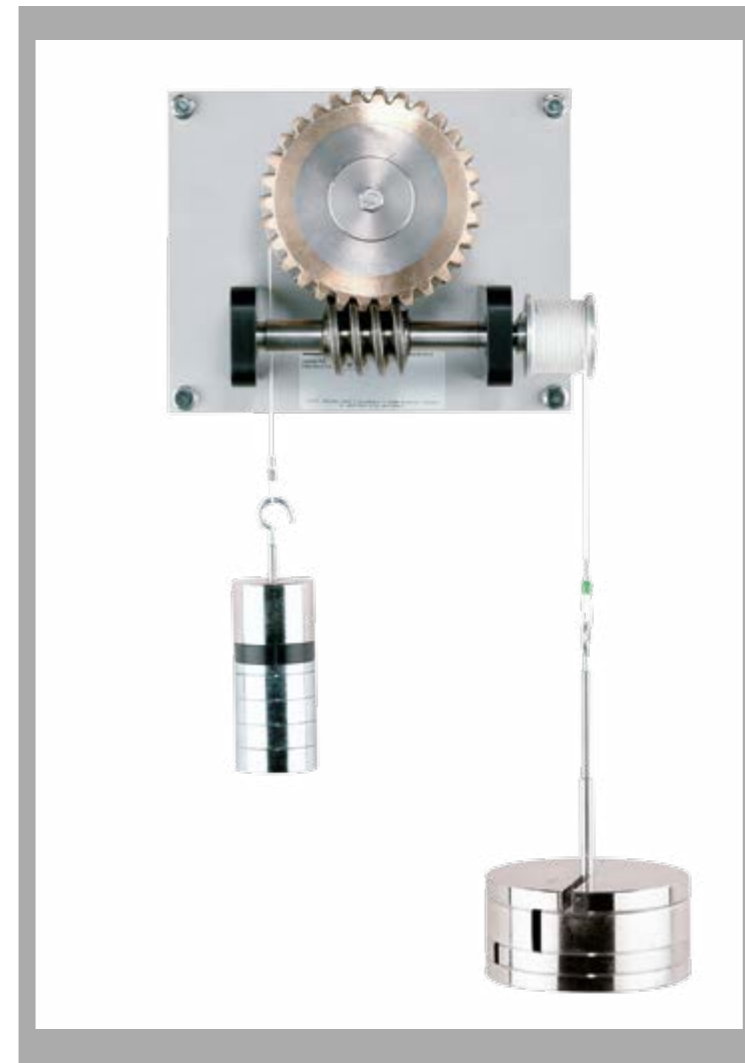
- Learning the key variables and correlations of a spur gear
- velocity ratios of spur gears
- gear with intermediate wheel or two-stage gearing
- influence of friction on transmission
- determining efficiency

Order Details

040.12300 TM 123 Spur Gear Lifting Apparatus

G.U.N.T Gerätebau GmbH, Hanskampring 15-17, D-22885 Barsbüttel, Phone +49 (40) 67 08 54-0, Fax +49 (40) 67 08 54-42, E-mail sales@gunt.de, Web http://www.gunt.de
We reserve the right to modify our products without any notifications.

TM 124 *Worm and Wheel Apparatus*



Specification

- [1] demonstration and student experimental unit on the setup and principle of a worm gear
- [2] bronze worm gear wheel
- [3] steel worm
- [4] 2 Aluminium side drums
- [5] 2 sets of weights
- [6] worm, worm gear wheel and pulleys ball bearing-mounted
- [7] anodised aluminium base plate

Technical Data

- Side drum diameter
- on worm shaft: d=40mm
- on worm gear wheel shaft: d=120mm

- Worm drive
- axle base: 80mm
- transmission ratio: 30:1
- modulus: m=4mm
- number of gears: 1
- power transmission: 10

- Weights on worm side
- 1x 50N
- 1x 20N
- 2x 10N
- 1x 10N (suspended with balance mass)

- Weights on worm gear wheel
- 1x 5N
- 4x 2N
- 1x 1N
- 1x 0,5N
- 1x 0,5N (suspended)

- Base plate
- LxWxH: 250x200x12mm

Dimensions and Weight

- LxWxH: 250x150x200mm
- Weight: approx. 22kg

Scope of Delivery

- 1 gear unit, mounted on base plate
- 2 sets of weights
- 1 set of instructional material

*** Setup and principle of a worm gear**

Technical Description

TM 124 permits investigations of the torques and the efficiency of the gear unit. The transmission ratio of the gear can be determined. Students learn the basic terminology of gearing in a simple manner: numbers of teeth; modulus; reference circle and axle base.

The worm gear wheel and worm are ball bearing-mounted. The forces are generated by the sets of weights and can be quickly and easily varied.

The model is intended for wall mounting. The well-structured instructional material sets out the fundamentals and provides a step-by-step guide through the experiments.

Learning Objectives / Experiments

- Learning the key variables and correlations of a worm gear
- investigating: transmission ratio, torque, friction and self-locking
- determining efficiency

Order Details

040.12400 TM 124 Worm and Wheel Apparatus

G.U.N.T Gerätebau GmbH, Hanskampring 15-17, D-22885 Barsbüttel, Phone +49 (40) 67 08 54-0, Fax +49 (40) 67 08 54-42, E-mail sales@gunt.de, Web http://www.gunt.de
We reserve the right to modify our products without any notifications.

GL 110 Cam Mechanism



Specification
 [1] action principle of cam mechanisms
 [2] 4 different cams: arc/tangent/concave/asymmetric cam
 [3] roller tappet, cup tappet and trailing lever
 [4] angled scale 0...360°, D=100mm
 [5] dial gauge D=58mm
 [6] cams and tappets easy to change, without use of tools

Technical Data
 Angle scale
 - 0...360°
 - graduations: 1°
 Dial gauge for displacement
 - 0...30mm
 - graduations: 0,01mm

Dimensions and Weight
 LxWxH: 160x160x260mm
 Weight: approx. 7kg

Scope of Delivery
 1 cam mechanism experimental unit
 4 cams
 2 cam tracers
 1 dial gauge
 1 set of instructional material

- * Demonstration and measurement of the displacement curves for cam mechanisms
- * Rapid part changing without tool

Technical Description

Cam mechanisms are used in many areas of technology, such as for valve control in combustion engines. The simple experimental setup permits quick demonstration of the action principle, and can be used to demonstrate the influence of different cam shapes. The cam follower can work either as a roller tappet, cup tappet, or trailing lever. The stroke is measured using a mechanical position measurement gauge. A scaled disk indicates the associated angle of rotation.

The well-structured instructional material sets out the fundamentals and provides a step-by-step guide through the experiments.

Learning Objectives / Experiments

- displacement curves for cam mechanisms
 - * arc/tangent/concave/asymmetric cam
 - * choice of roller tappet, cup tappet or trailing lever

Order Details
 030.11000 GL 110 Cam Mechanism

G.U.N.T Gerätebau GmbH, Hanskampring 15-17, D-22885 Barsbüttel, Phone +49 (40) 67 08 54-0, Fax +49 (40) 67 08 54-42, E-mail sales@gunt.de, Web http://www.gunt.de
 We reserve the right to modify our products without any notifications.

TM 232 Bearing Friction



Technical Description

TM 232 provides experiments relating to friction on sliding and rolling bearings. Bearing shells in various materials serve as sliding bearings. Bearing forces are generated by the dead-weight of a heavy flywheel. A torque is applied by means of weights which correspond to the frictional torque when the motion begins. When the rolling bearings are used the bearing friction is very low. In this case the flywheel can be used for fundamental experiments in rotational dynamics.

The unit is intended for mounting on a laboratory wall.

Learning Objectives / Experiments

- determination of friction torque on sliding bearings: various material pairings by means of interchangeable bearing shells
- determination of the friction torque on a rolling bearing
- comparison between sliding and rolling bearing
- fundamental experiments in rotational dynamics

- * Sliding bearing friction with different bearing materials; comparison with rolling bearing friction

G.U.N.T Gerätebau GmbH, Hanskampring 15-17, D-22885 Barsbüttel, Phone +49 (40) 67 08 54-0, Fax +49 (40) 67 08 54-42, E-mail sales@gunt.de, Web http://www.gunt.de
 We reserve the right to modify our products without any notifications.

TM 282 Friction in Journal Bearings



- * Fundamentals of hydrodynamic lubrication
- * Friction states for different operating states
- * Electronic speed control and digital display of speed and lubricant temperature

Technical Description

There are many factors of influence concerning the friction states in a hydrodynamic journal bearing. Speed, load, and viscosity are focused in particular.

TM 282 enables to study various factors of influence on friction.

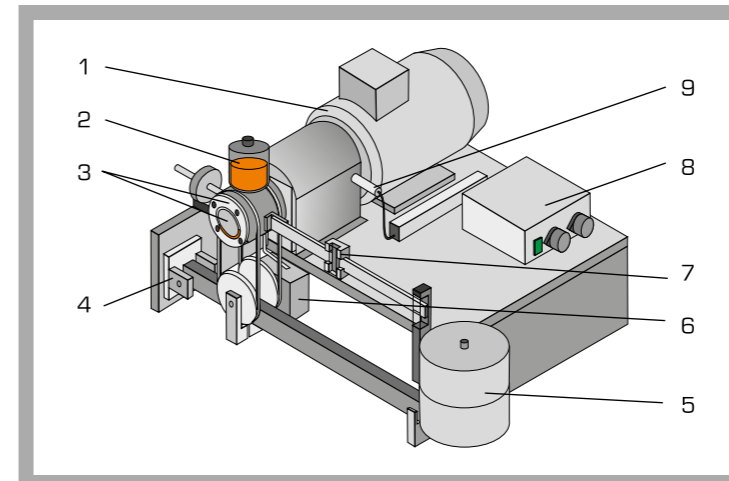
The journal bearing consists of an electrically driven journal rotating in a freely movable bearing housing. The transparent bearing housing enables the observation of the displacement of the journal depending on the speed and the direction of rotation as well as the characteristic behaviour when starting.

A load device transfers the applied load to the bearing housing. The load can be varied with the supplied weights. The determination of the friction moment is realised by a sliding weight balancing the moment on a balance beam. The shaft is driven by an electric motor. The speed is variably adjustable by a frequency converter. A temperature sensor in the bearing bush records the temperature and therefore the viscosity of the lubricant. The temperature is indicated at the display and control unit. Lubricant is supplied by a drip-feed lubricator that feeds oil to the bearing bush via two lubrication channels. A drip tray collects the oil that leaks out.

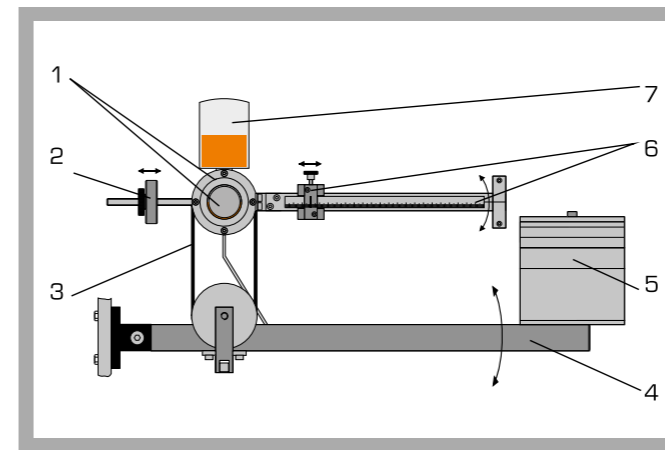
Learning Objectives / Experiments

- developing technological correlations involved in hydrodynamic lubrication by experimentation
- moment of friction in a journal bearing dependent on
 - * speed
 - * bearing load
 - * lubricant and lubricant temperature

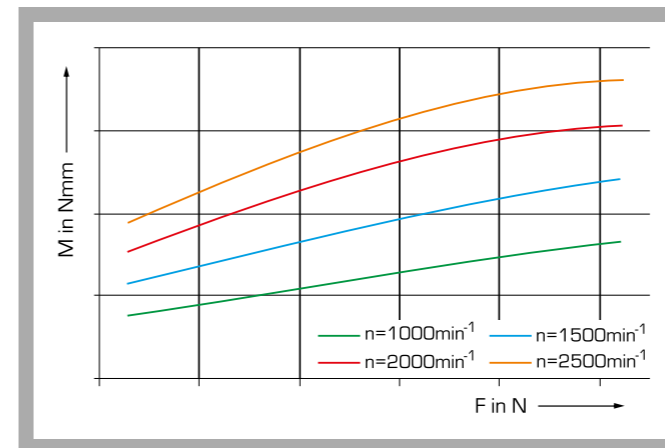
TM 282 Friction in Journal Bearings



1 motor, 2 drip-feed lubricator, 3 journal bearing housing with shaft, 4 fixed bearing for load lever, 5 load weights, 6 leakage oil tank, 7 sliding weight for measuring the friction moment, 8 switch box, 9 speed sensor



1 journal bearing housing with shaft, 2 balance weight, 3 belt for force transmission to bearing housing, 4 load lever, 5 weights, 6 measuring lever with scale and sliding weight, 7 drip-feed lubricator



Influence of load F and speed n on friction moment M

Specification

- [1] investigation and visualisation of a hydrodynamic bearing
- [2] radial journal bearing with stainless steel shaft journal and freely movable bronze bearing shells
- [3] drip-feed lubrication for continuous lubricant supply (drip-feed lubricator)
- [4] load applied to journal bearing using a mechanical lever
- [5] variable speed via frequency converter
- [6] measurement of friction moment using a lever with sliding weight
- [7] inductive speed measurement
- [8] thermocouple at the bearing housing for oil temperature measurement
- [9] display and control unit with digital displays for oil temperature and speed

Technical Data

- Journal bearing
 - bearing journal diameter: D=30mm
 - bearing width: 45mm
 - friction pairing: steel / bronze
- Motor: 0,37kW
- Oil viscosity class: ISO VG 32
- Set of weights
 - 1x 50N, 1x 20N, 2x 10N, 2x 5N;
 - lever transmission ratio: 5:1

Measuring ranges

- temperature: -50...200°C
- speed: 0...3.000min⁻¹
- bearing load: max. 525N
- friction moment: max. 295Nmm

Dimensions and Weight

- LxWxH: 610x440x360mm (experimental unit)
- LxWxH: 360x340x160mm (display and control unit)
- Weight: approx. 40kg

Required for Operation

- 230V, 50/60Hz, 1 phase or 120V, 60Hz, 1 phase

Scope of Delivery

- 1 experimental unit
- 1 display and control unit
- 1 set of weights
- 0,5L oil
- 1 set of instructional material

Order Details

040.28200 TM 282 Friction in Journal Bearings

TM 320 Screw Tester



- * Correlation between tightening torque and tension force on standardised bolts
- * Breakaway torque of a bolt joint

Technical Description

The main element of the unit is a slotted, elastically deformable steel block. By tightening the bolt joint, the slotted area is deformed, thereby generating an axial tension force in the bolt. The resulting deformation is recorded by a mechanical dial gauge, and is directly related to the bolt tension force generated. The bolt joint is tightened and slackened using a special torque wrench, which can be set sensitively with the aid of a threaded spindle. By using an axial bearing, the head friction of the bolt can be largely excluded, so that only the friction of the threaded joint is measured.

The well-structured instructional material sets out the fundamentals and provides a step-by-step guide through the experiments.

Learning Objectives / Experiments

- axial tension force in a bolt joint dependent on the tightening torque or the elastic deformation of a slotted block
- measurement of the breakaway torque, including for different fitting situations of the bolt joint
- measurement of thread friction and overall friction

Scope of Delivery

1 bolt tester complete with switchable ratchet, 1 set of bolts in transparent container, 1 set of instructional material

Specification

- [1] experiment on the correlation between the tension force and tightening torque of bolts
- [2] bolt size M8x100, wrench jaw size 13mm
- [3] elastic deformation of a slotted block by the bolt
- [4] determining the tightening and breakaway torque with a mechanical torque measuring device
- [5] 2 position dial gauges
- [6] sensitive torque setting by hand wheel

Technical Data

Tension force: max. 40kN
 Force/travel constant: 20kN/mm (on slotted block)
 Max. tightening torque: 40Nm
 Torque/travel constant: 10Nm/mm (on torque measuring device)
 Position dial gauge: 0...10mm, graduations: 0,01mm

Dimensions and Weight

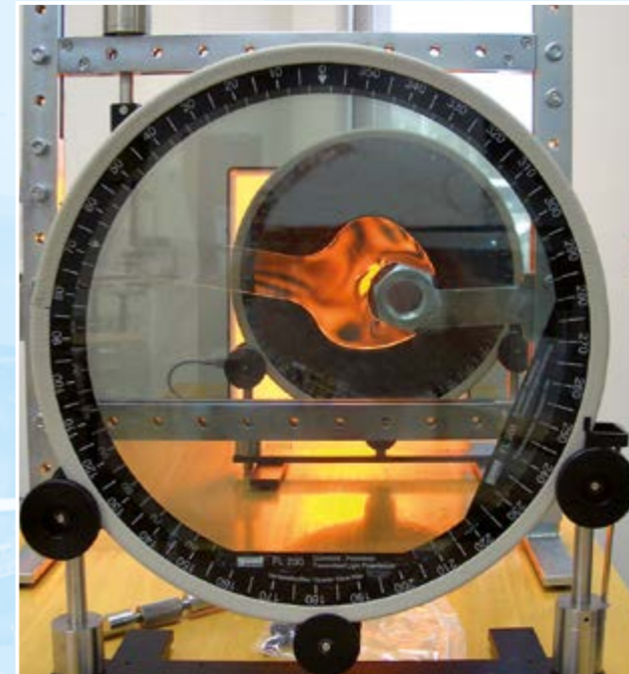
LxWxH: 450x400x260mm
 Weight: approx. 27kg

Order Details

040.32000 TM 320 Screw Tester

G.U.N.T Gerätebau GmbH, Hanskampring 15-17, D-22885 Barsbüttel, Phone +49 (40) 67 08 54-0, Fax +49 (40) 67 08 54-42, E-mail sales@gunt.de, Web http://www.gunt.de
 We reserve the right to modify our products without any notifications.

A LOOK INSIDE OUR CUSTOMERS' LABORATORIES



GUNT demonstration and experimentation units have been in use for many years at hundreds of technical education and training centres, and have always proved highly satisfactory to our customers

The very finest design and detailing: Working with GUNT demonstration and experimentation units teaches students in an engaging, illustrative manner.