Engineering drawing and cutaway models

Engineering drawings present a very abstract image of the components or devices with precise specifications. Using geometric and graphical features such as lines and symbols, as well as alphanumeric characters such as digits and letters, a three-dimensional object is described in two dimensions.

Reading and understanding engineering drawings is a fundamental element in the development of professional competence in all engineering disciplines.

Engineering drawing course

The engineering drawing course is composed of two modules. The first module uses geometric models to develop spatial concepts. The second offers the application of rules and standards in technical communication with selected components, cutaway models and assembly exercises that help with the understanding of functions and assembly. An important educational objective of the course is the presentation of specific applications and the use of real workpieces and standard parts. This is intended to develop engineering-related communication skills. The actual drawing tasks are developed from a larger technological environment.

Model sets for developing spatial concepts

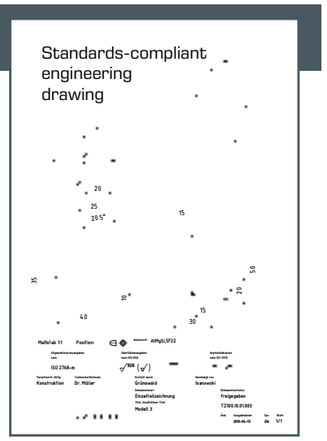
Model constructed in a corner of a room with folded representations

The representation of a body and the “folding” (or changing of the direction of projection) causes difficulties for many students. It requires a large capacity for abstraction and spatial imagination. These skills can be developed with appropriate training. The GUNT geometric models have been designed to teach spatial imagination. These skills are vital for creating perspective drawings and interpreting drawings and sketches, known as the ability to “read” drawings.

Components and assembly exercises for teaching rules and standards in engineering communication

The creation of an engineering drawing, whether manually or computer assisted, follows binding rules – the drafting standards – that do not permit any ambiguity. The drafting standards of the DIN (Deutsches Institut für Normung, German Institute for Standardization) take account of the standards and recommendations of the ISO (International Organization for Standardization) and are therefore applicable internationally. The published drafting standards, identified by the name DIN, ISO or EN ISO, include, for example:

- precise identification and use of line styles, hatches and colours as well as the representation of views and sections
- isometric and diametric representation; simplified representation
- dimension inscriptions, tolerance abbreviations
- drawing-sheet formats, title blocks, standard font
- fits; basic terms of tolerances and fits
- surface characteristics



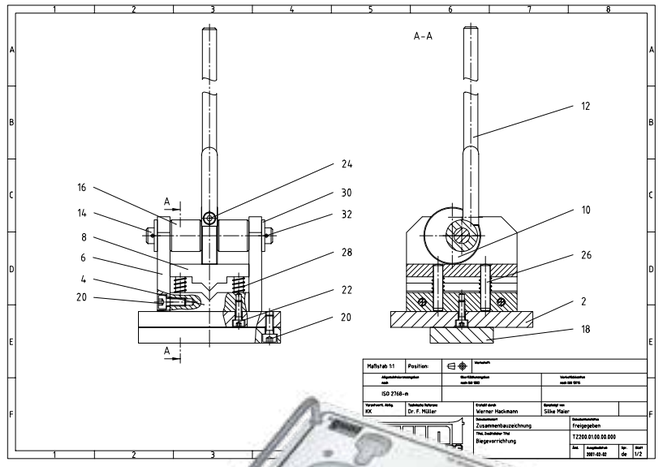
Standards-compliant engineering drawing

Cutaway models and assembly exercises to demonstrate the functions

Using assembly exercises links engineering communication to the associated technical operations such as assembly and manufacturing. In this way, theoretical and practical learning content supports the skills of reading and understanding drawings, graphs and schematics.

Real understanding can only be achieved by doing and by one's own drawing activity.

Engineering animations such as cutaway models are ideally suited to representing processes and functions. GUNT uses up-to-date original parts for its cutaway models. Movement and switching functions are maintained.



General arrangement drawing

The components and assembly exercises of GUNT teach:

- the standards-compliant execution of engineering drawings
- the recognition of standardised representations
- the understanding of contexts of individual components

The ability to read drawings is demonstrates using:

- general arrangement drawings and exploded drawings
- raw casting drawing, production drawings

The types of drawings and their role and content in terms of standardisation are precisely explained.

Assembled lever press

TZ 100
Engineering drawing: three-dimensional display

Description

- **GUNT course: engineering drawing**
- **model set for developing spatial concepts**
- **fundamentals of three-dimensional display**

In order to describe a spatial body adequately and thereby fulfil a basic principle of exact replication and repeatable production, several views of the body are usually necessary. To do this, bodies are shown in three planes: front view, side view and plan or bottom view. The presentation follows fixed rules that are defined in the standards. Even for simple bodies, the presentation in three planes requires a considerable degree of abstraction ability and spatial imagination on the part of students. This ability is a prerequisite for both creating and interpreting engineering drawings or sketches and is taught by means of geometric models.

The TZ 100 model set provides a learning concept with which to introduce students to the discipline of descriptive geometry.

A corner of a room, comprising three flat Plexiglas sheets, holds the models. The corresponding view is inserted into each plane of the room corner, so that it is possible to directly compare model (workpiece) and drawing.

A total of ten models of varying difficulty are included. One model is made of Plexiglas in order to develop an understanding of hidden edges. The other models are made of aluminium.

The models are precision-manufactured so that measuring exercises can also be conducted. All parts are clearly laid out and well protected in a storage system.

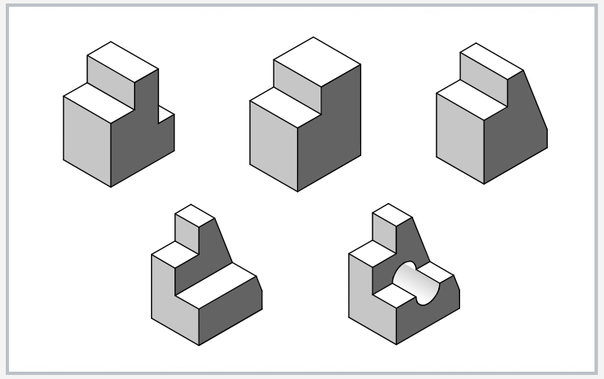
The exercises are ideally performed by the students themselves. Two students can comfortably work with one model set.

The instructional materials include a complete set of drawings. A representation in three views, the 3D view and the production drawing are included for each model.

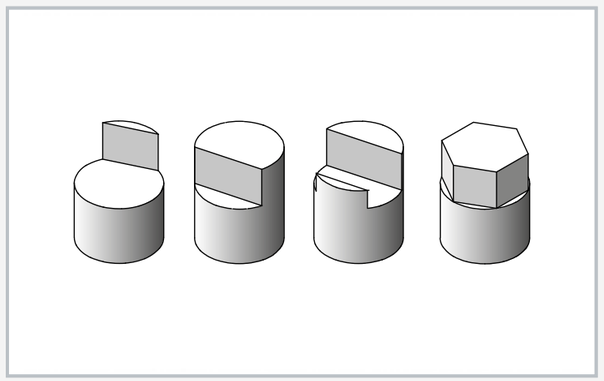
Learning objectives/experiments

- familiarisation with three-dimensional display as a basic principle of engineering drawing
- step-by-step development of spatial thinking: from the concrete situation to the abstract representation in an engineering drawing
- measuring exercises

Room corner made of three Plexiglas planes with inlaid drawing and a prismatic model



Prismatic models



Cylindrical models

Specification

[1] set of models from the descriptive geometry discipline to develop spatial concepts
[2] introduction to engineering drawing
[3] precision manufacture of the models allows measuring exercises
[4] room corner comprising three Plexiglas planes
[5] 9 aluminium geometric models; cylindrical and prismatic shapes
[6] 1 Plexiglas model
[7] storage system for parts

Technical data

5 prismatic models
- LxWxH: 40x30x50mm

4 cylindrical models
- ØxH: 40x50mm

1 transparent model
- LxWxH: 40x30x50mm

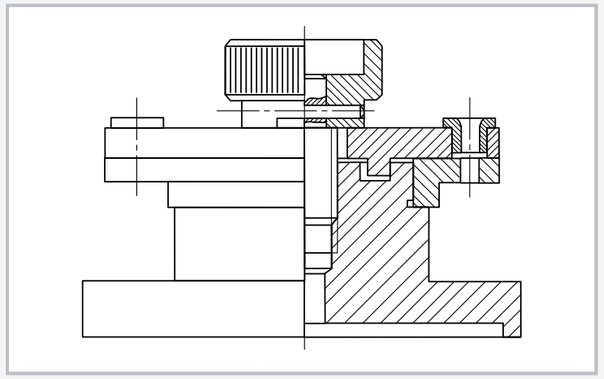
3 Plexiglas planes
- LxWxH: 100x100x100mm

LxWxH: 335x240x71mm (storage system)
Weight: approx. 3kg

Scope of delivery

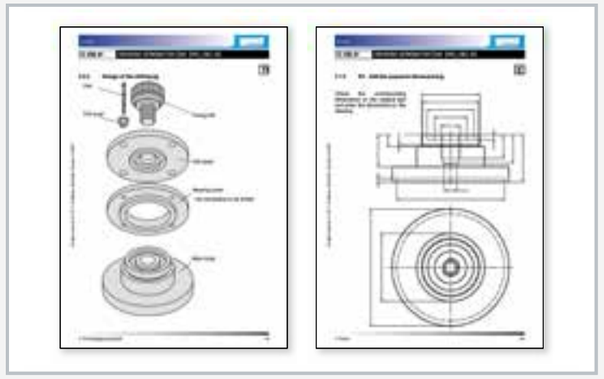
1 storage system with foam inlay
1 set with 10 geometric models
3 Plexiglas planes for constructing a room corner
1 rod for holding the models
1 paper punch
1 set of instructional material, complete set of drawings included

TZ 200.61
Engineering drawing: rotationally symmetrical components



Sectional view of the drilling jig with the workpiece to be drilled (bearing cap)

Assembled drilling jig with workpiece:
1 fastening screw, 2 drill plate, 3 drill bush, 4 workpiece (bearing cap), 5 base



Instructional material

Description

- **GUNT course: engineering drawing**
- **consists of drilling jig and workpiece**
- **introduction to sectional views**

Reading and understanding complex engineering drawings are core skills. They are at least equivalent to drawing ability itself, and are the aim of this GUNT course. The use of concrete applications and real-world workpieces and standard parts is intended to develop engineering communication skills. The actual drawing tasks are developed from a larger technological environment.

TZ 200.61 provides an introduction to the graphical representation of rotationally symmetrical components and the representation of sections. The central element is a drilling jig that can be used, in this case, to drill into a bearing cap. A quarter has been cut out of the base of the drilling jig. This illustrates the concepts of “section” and “half-section”.

The cut-out quarter is also provided on the base plate, so that the difficult topic of sectional views can be demonstrated clearly.

All parts are clearly arranged on a base plate. An exploded view, attached to the base plate, illustrates the overall arrangement.

The manufactured parts are precision-manufactured and therefore are also suitable for measuring exercises.

Ideally, the parts should be used in the classroom as an exercise. Two or three students can work meaningfully with one kit.

Learning objectives/experiments

- introduction to graphical representation of rotationally symmetrical components
- familiarisation with sectional views: full section and half section
- dimensioning of rotating parts and threads
- production engineering aspects
  - devices as aids for drilling and reaming
  - complete machining on modern tooling machines
  - tolerances, fits, surface specifications
- classification of the workpiece (bearing cap) in a larger technological context

Specification

[1] part of the GUNT course on engineering drawing
[2] rotationally symmetrical components using the example of a practical drilling jig for machining of a workpiece (bearing cap)
[3] base of the drilling jig prepared as a half section
[4] all individual parts of the drilling jig precision-manufactured from aluminium
[5] PVC bearing cap as workpiece
[6] base plate with printed exploded drawing
[7] storage system for parts
[8] accompanying instructional material considers practical and interdisciplinary forms of teaching

Technical data

LxWxH: 420x300x75mm (storage system)
Weight: approx. 2kg

Scope of delivery

1 base plate with the individual parts of the drilling jig
1 workpiece (bearing cap)
1 set of standard parts (drill bush, pin, O-ring)
1 set of instructional material

TZ 200.02
Engineering drawing: casting

Machined (left) and raw casting (right)

Learning objectives/experiments

- engineering drawing
  - cast drawings and their features: machining allowances, mould draughts, shrinkage, sectional views
  - from casting to finished part: production-based and standards-compliant dimensioning for the subsequent machining
- technology
  - manufacture of castings in sand casting; production processes
  - tool and machine selection; longitudinal measuring exercises
  - machine elements and their function

Specification

[1] part of the GUNT course on engineering drawing
[2] graphical representations: from raw casting to finished machine part
[3] 2 models showing the development of the manufacturing process: 1 raw casting, 1 cutaway model
[4] accompanying instructional material considers practical and interdisciplinary forms of teaching

Technical data

LxWxH: 100x100x125mm (per model)
Weight: approx. 3kg

Scope of delivery

2 models
1 set of instructional material

Description

- **GUNT course: engineering drawing**
- **from raw casting to finished machine part**

A bearing housing made from sand-cast aluminium is used in teaching as an example to illustrate the subject of cast parts in a detailed and practical way. TZ 200.02 comprises a raw casting of a bearing housing, manufactured and polished in a foundry, and a finished part of the same bearing housing, which has been machined after being cast. The machined part has also been prepared as a cutaway model.

The two components can be used to describe the process from forming to machining. An ideal learning situation would be to allow two or three students to study the model set together.

TZ 200.08
Engineering drawing: safety catch

Learning objectives/experiments

- readily understandable engineering drawings and lists of parts
- production-based and standards-compliant representation of single parts: dimensioning, surface and tolerance specifications
- technological aspects: material selection, functions, production processes, work planning and more

Specification

[1] part of the GUNT course on engineering drawing
[2] practical functional model of a safety catch
[3] all production parts made from precision-manufactured burnished steel surfaces
[4] accompanying instructional material considers practical and interdisciplinary forms of teaching

Technical data

LxWxH: 130x100x60mm
Weight: approx. 1kg

Scope of delivery

1 safety catch
1 set of instructional material

Description

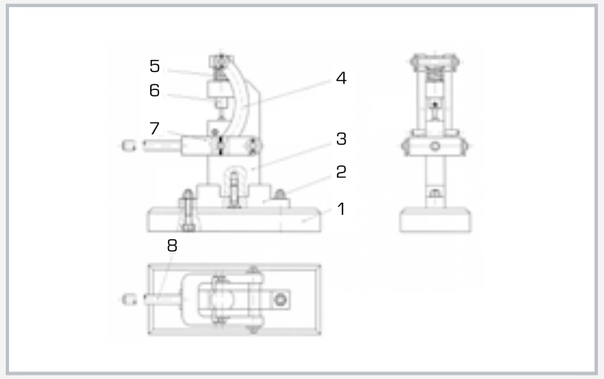
- **GUNT course: engineering drawing**
- **complete production-ready drawing set**

The model of a safety catch is part of the extensive GUNT course providing an introduction to engineering drawing. The didactic approach is based on a real-world component and systematically develops transferable learning content.

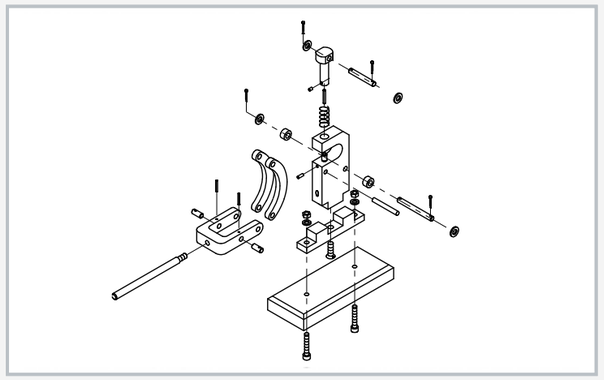
The manufactured parts are precision-manufactured and therefore also suitable for measuring exercises. The surfaces of the manufactured parts are burnished to prevent corrosion.

Ideally, the part should be used in the classroom as an exercise. Two or three students can work meaningfully with one kit.

TZ 300
Assembly of lever press



1 base plate, 2 foot, 3 stand, 4 arch, 5 compression spring, 6 pressure pin, 7 fork, 8 handle



Exploded drawing of the lever press

Functional groups of the lever press: fork, pressure pin, main body

Description

- **GUNT course: engineering drawing**
- **lever press as assembly kit**
- **exercise for interdisciplinary teaching**

A drawing is the most important means of information and communication in engineering. The ability to read and understand drawings, graphics and schematics is a fundamental element in the development of professional competence in all engineering disciplines. Linking engineering communication to the associated technical operations such as assembly structure, work plans and manufacturing is just as important.

The TZ 300 assembly kit is an interdisciplinary and practical project. In addition to the primary learning area of “engineering drawing”, it is also possible to deal with the topics of machine elements, assembly processes and in particular production engineering.

The assembly kit includes all single parts required to assemble a functional lever press. The parts are clearly displayed on a base plate. All single parts and the corresponding drawings are available in a standards-compliant and practical form.

The manufactured parts are precision-manufactured from original materials and with common tolerances and surfaces. The surfaces of the manufactured parts are burnished to prevent corrosion. All parts are clearly laid out and well protected in a storage system. Multiple storage systems can be stacked on top of each other, allowing space-saving storage.

Usage in the classroom should ideally be as a practical exercise, in which two or three students can work comfortably on one assembly kit.

Learning objectives/experiments

- introduction to engineering drawing
  - read and understand engineering drawings
  - three-dimensional display
  - sectional views
  - drawing types
  - 3D representation
  - lists of parts
  - dimensioning
  - surface and tolerance specifications
  - difference between standard and production parts
  - materials specifications
- planning and execution of simple assembly operations
  - plan and describe operations
  - evaluate results
- measuring exercises
  - longitudinal measurements
  - angular measurements
- manufacturing processes
  - working examples of handmade production and production on machine tools

Specification

[1] part of the GUNT course on engineering drawing
[2] assembly kit of a functional lever press
[3] all production parts of the lever press made from steel, precision-manufactured, burnished surfaces
[4] storage system for parts
[5] multiple storage systems can be stacked on top of each other
[6] accompanying instructional material considers practical and interdisciplinary forms of teaching

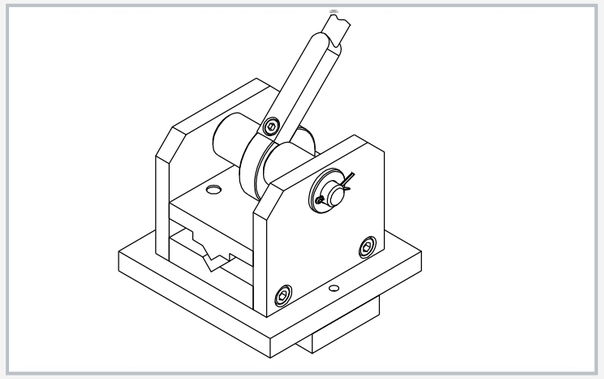
Technical data

LxWxH: 420x300x70mm (storage system)
Weight: approx. 3kg

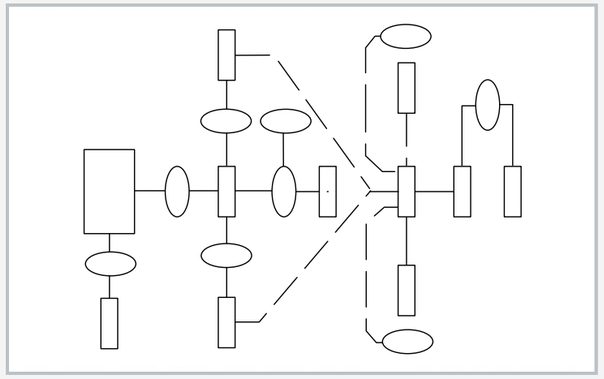
Scope of delivery

1 storage system with the individual parts of the lever press
1 set of tools for assembly and disassembly
1 set of small parts
1 set of instructional material

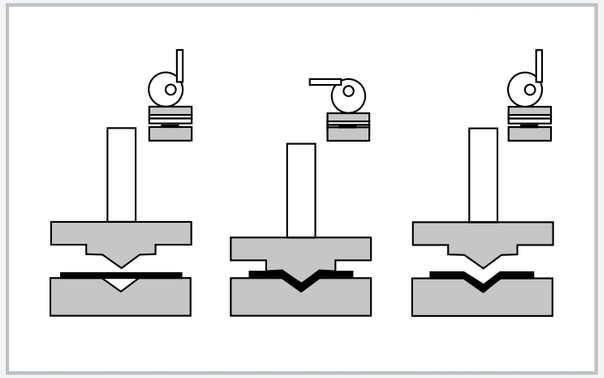
TZ 200.11
Assembly of bending device



3D representation of the assembled bending device



Graphical representation of the assembly structure



Bending process

Specification

[1] part of the GUNT course on engineering drawing
[2] assembly kit of a functional bending device with eccentric operation
[3] all production parts made from precision-manufactured burnished steel surfaces
[4] assembly structure on transparent cover plate
[5] storage system for parts
[6] multiple storage systems can be stacked on top of each other
[7] accompanying instructional material considers practical and interdisciplinary forms of teaching

Technical data

LxWxH: 540x350x75mm (storage system)
Weight: approx. 6kg

Scope of delivery

1 storage system with the individual parts of the bending device
1 cover plate with assembly structure
1 set of tools for assembly and disassembly
1 set of instructional material

Description

- **GUNT course: engineering drawing**
- **bending device as assembly kit**
- **exercise for interdisciplinary teaching**

A drawing is the most important means of information and communication in engineering. The ability to read and understand drawings, graphics and schematics is a fundamental element in the development of professional competence in all engineering disciplines. Linking engineering communication to the associated technical operations such as assembly structure, work plans and manufacturing is just as important.

The TZ 200.11 assembly kit is an interdisciplinary and practical project. In addition to the primary learning area of "engineering drawing", it is also possible to deal with topics such as assembly planning and execution as well as measuring exercises. The assembly kit includes all single parts required to assemble a functional bending device.

The parts are grouped on a base plate so that individual assembly sequences are clearly displayed. Above the base plate is a transparent cover plate with a graphical representation of the assembly structure. The graphic symbolizes standard and production parts and displays fixed and moving connections differently. All single parts and the corresponding drawings are available in a standards-compliant and practical form.

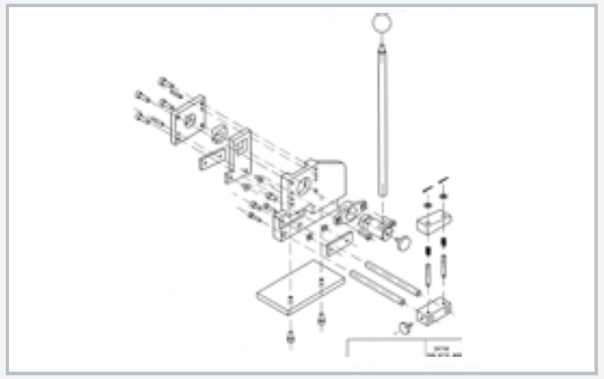
The manufactured parts are precision-manufactured from original materials and with common tolerances and surfaces. The surfaces of the manufactured parts are burnished to prevent corrosion. All parts are clearly laid out and well protected in a storage system. Multiple storage systems can be stacked on top of each other, allowing space-saving storage.

Usage in the classroom should ideally be as a practical exercise, in which two or three students can work comfortably on one assembly kit.

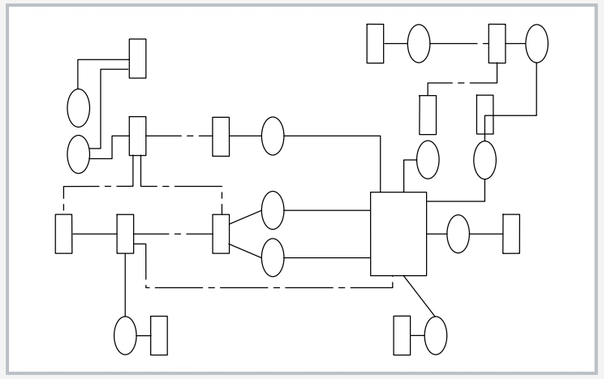
Learning objectives/experiments

- introduction to engineering drawing
  - read and understand engineering drawings
  - three-dimensional display
  - sectional views
  - drawing types
  - 3D representation
  - lists of parts
  - dimensioning
  - surface and tolerance specifications
  - difference between standard and production parts
  - materials specifications
- planning and execution of simple assembly operations
  - plan and describe operations
  - evaluate results
- measuring exercises
  - longitudinal measurements
  - angular measurements

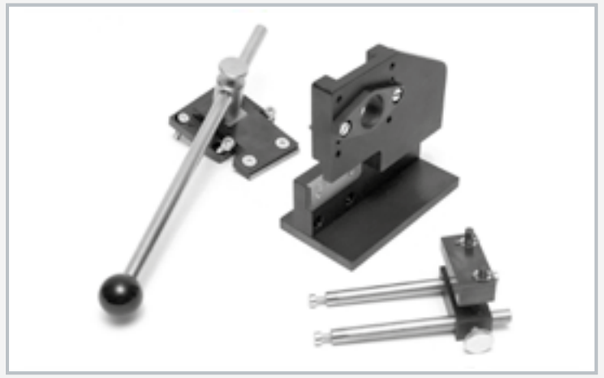
TZ 200.71
Assembly of lever shears



Exploded drawing of lever shears



Graphical representation of the assembly structure



Functional groups of the lever shears: shear body, base, stop

Description

- **GUNT course: engineering drawing**
- **lever shears as assembly kit**
- **exercise for interdisciplinary teaching**

A drawing is the most important means of information and communication in engineering. The ability to read and understand drawings, graphics and schematics is a fundamental element in the development of professional competence in all engineering disciplines. Linking engineering communication to the associated technical operations such as assembly structure, work plans and manufacturing is just as important.

The TZ 200.71 assembly kit is an interdisciplinary and practical project. In addition to the primary learning area of “engineering drawing”, it is also possible to deal with the topic of assembly processes, in particular production engineering.

The assembly kit includes all single parts required to assemble functional lever shears. The parts are grouped on a base plate so that individual assembly sequences are clearly displayed.

Above the base plate is a transparent cover plate with a graphical representation of the assembly structure.

The graphic symbolizes standard and production parts and displays fixed and moving connections differently. All single parts and the corresponding drawings are available in a standards-compliant and practical form.

The manufactured parts are precision-manufactured from original materials and with common tolerances and surfaces. The surfaces of the manufactured parts are burnished to prevent corrosion. All parts are clearly laid out and well protected in a storage system. Multiple storage systems can be stacked on top of each other, allowing space-saving storage.

Usage in the classroom should ideally be as a practical exercise, in which two or three students can work comfortably on one assembly kit.

Learning objectives/experiments

- introduction to engineering drawing
  - read and understand engineering drawings
  - three-dimensional display
  - sectional views
  - drawing types
  - 3D representation
  - lists of parts
  - dimensioning
  - surface and tolerance specifications
  - difference between standard and production parts
  - materials specifications
- planning and execution of simple assembly operations
  - plan and describe operations
  - evaluate results
- measuring exercises
  - longitudinal measurements
  - angular measurements
- manufacturing processes
  - working examples of handmade production and production on machine tools

Specification

[1] part of the GUNT course on engineering drawing
[2] assembly kit of functional lever shears
[3] all production parts of the lever shears made from precision-manufactured burnished steel surfaces
[4] assembly structure on transparent cover plate
[5] storage system for parts
[6] multiple storage systems can be stacked on top of each other
[7] accompanying instructional material considers practical and interdisciplinary forms of teaching

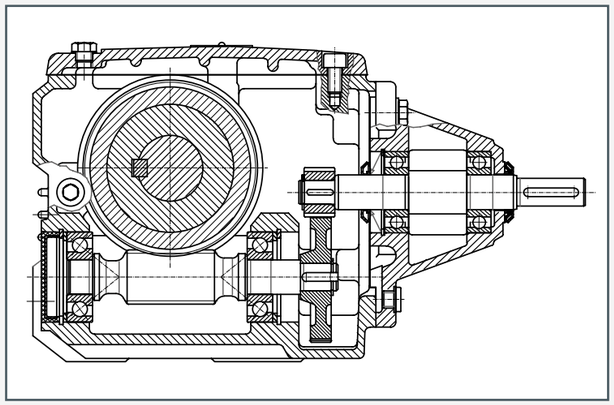
Technical data

LxWxH: 540x350x70mm (storage system)
Weight: approx. 7kg

Scope of delivery

1 Weight: approx. with the individual parts of the lever shears
1 cover plate with assembly structure
1 set of tools for assembly and disassembly
1 set of small parts
1 set of instructional material

GL 300.01
Cutaway model: worm gear



The technical drawings are part of the instructional material.

Manually operated open samples of various drive components and elements

- view of the details and function of the components
- despite the cut outs the movement functions are completely retained
- operation using a hand crank

These models are fitted to sturdy metal base plates. Lifting handles make the models easier to carry. Technical descriptions and sectional drawings are included so that calculations and design aspects can be used as an educational topic.

GL 300.02
Cutaway model: mitre gear

GL 300.03
Cutaway model: spur gear

GL 300.04
Cutaway model: two-stage spur gear

GL 300.05
Cutaway model: planetary gear

GL 300.06
Cutaway model: variable speed belt drive

GL 300.07
Cutaway model: control gear

GL 300.08
Cutaway model: multiple-disk clutch

GL 300.12
Cutaway model: pedestal bearing

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:

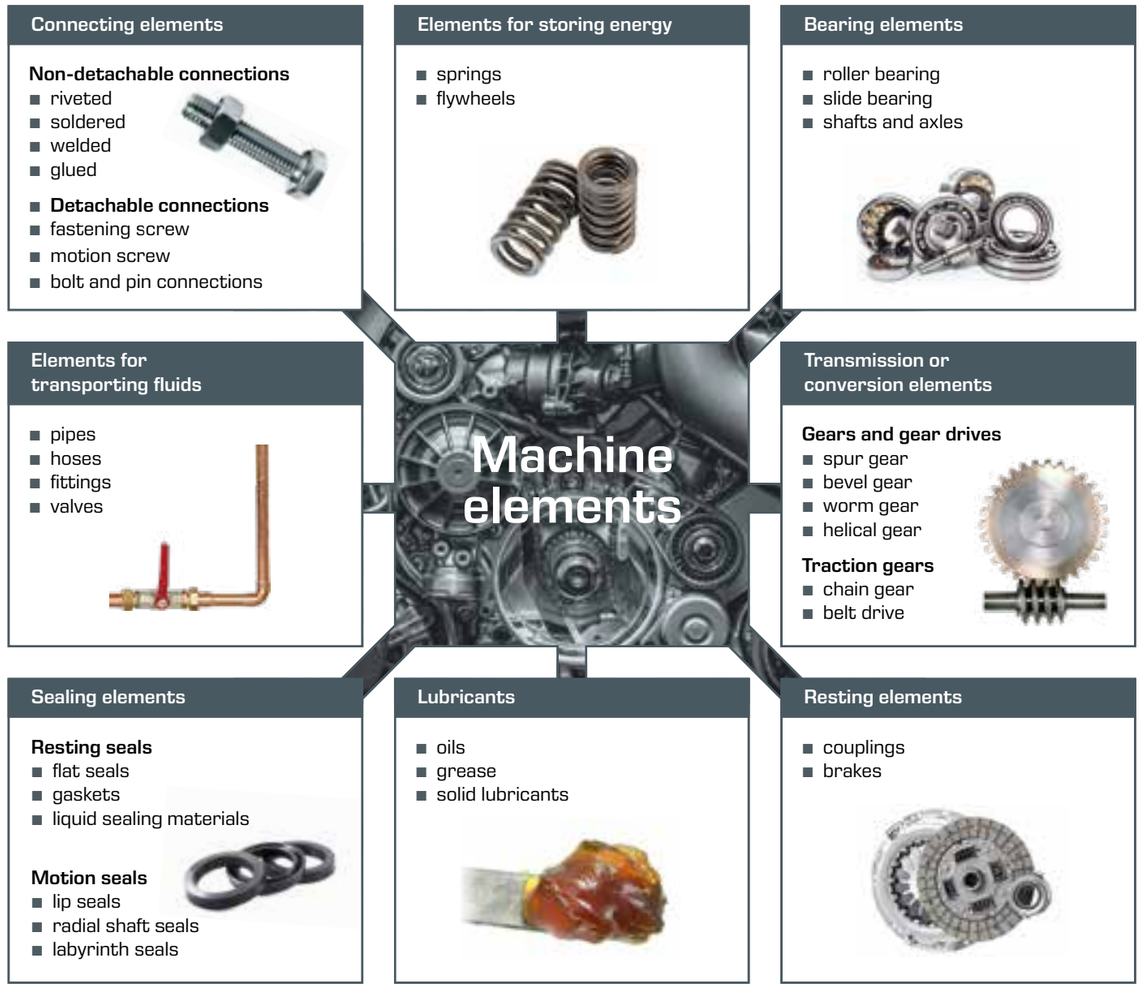
- individual parts such as screws, bolts or gears
- assemblies consisting of individual machine elements, such as couplings, ball bearings, transmissions or valves

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: Ø 20mm
- outer diameter: Ø 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

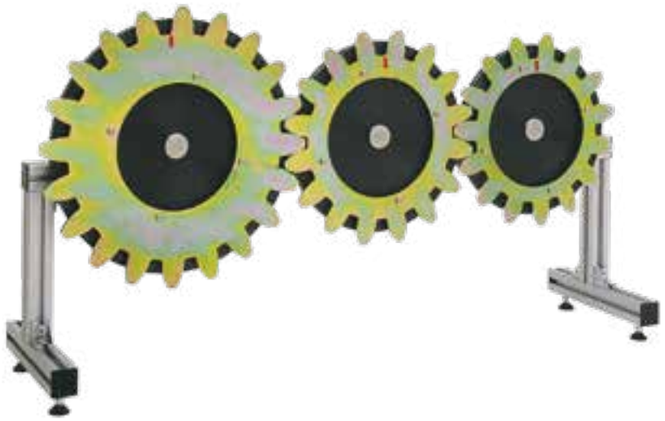
- **extensive teaching kit of the most important roller bearings used in mechanical engineering**
- **standardised designations, terms and applications**

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: Ø=300, Ø=320, Ø=400mm

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 Ø=126mm, 84 teeth
- 2x Ø=42mm, 28 teeth
- module: m=2mm

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

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 axles. 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.

Scope of delivery

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

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: Ø=40mm
- worm wheel shaft diameter: Ø=120mm

Worm gear
- centre distance: 80mm
- gear ratio: 30:1
- module: m=4mm
- 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

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.

Scope of delivery

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

TM 125
Cable winch

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.

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

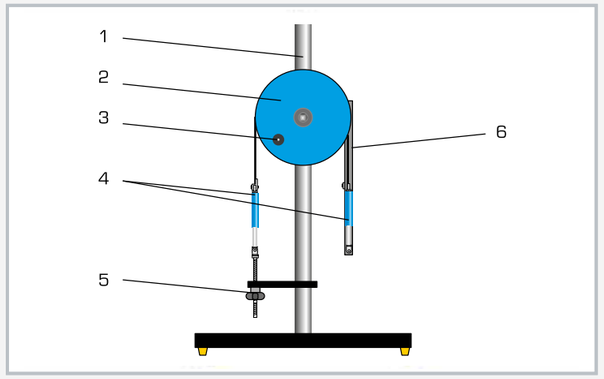
Scope of delivery

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

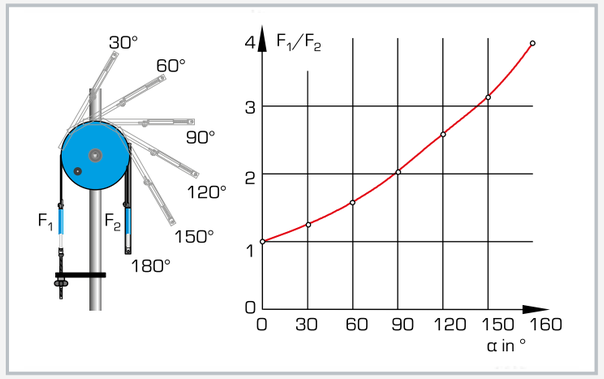
TM 220
Belt drive and belt friction

Learning objectives/experiments

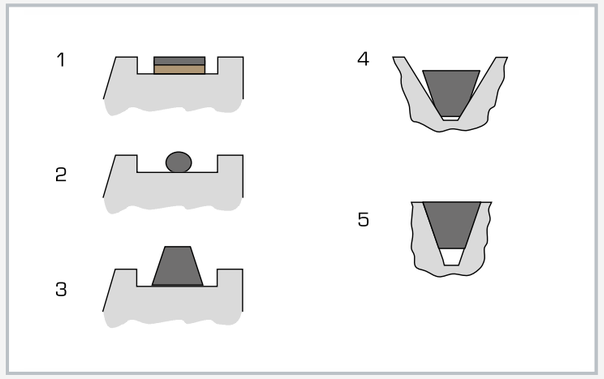
- effect of wrap angle, coefficient of friction and cable force (Eytelwein's belt friction formula)
- comparison of flat belts and V-belts
- consequences of an unadapted V-belt groove



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, Ø=3mm

Pulley
- Ø=300mm
- material: grey iron

Dynamometer: 100N ±1N

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

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.

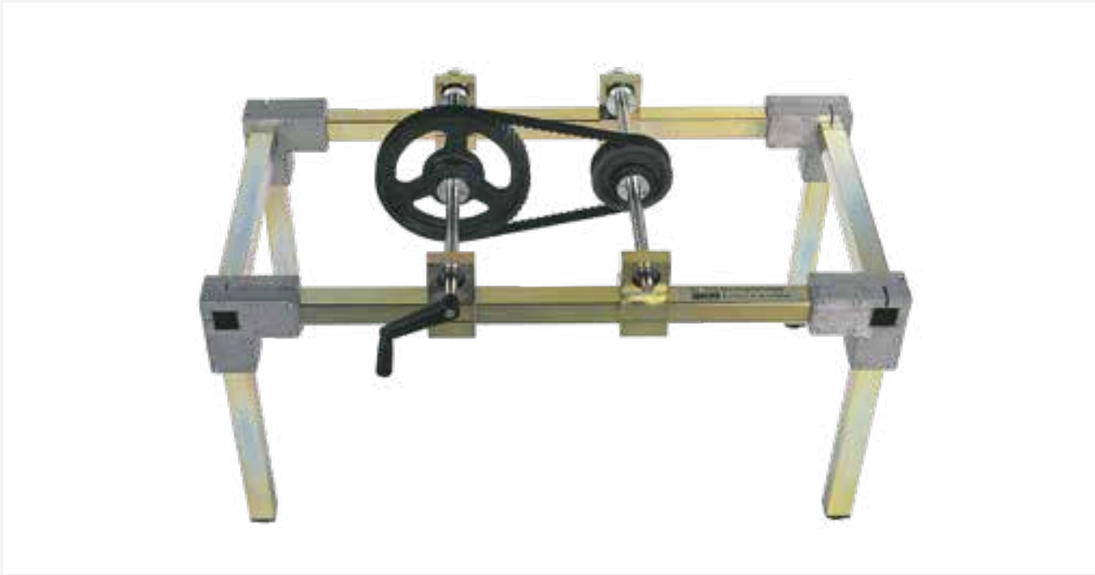
The TM 220 experimental unit allows the study by experiment of belt drives and belt friction. At the core of the experimental unit is a cast iron pulley, whose circumference features grooves for V-belts and flat belts. The pulley is mounted on ball bearings and is powered by a crank handle. Its flywheel 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°.

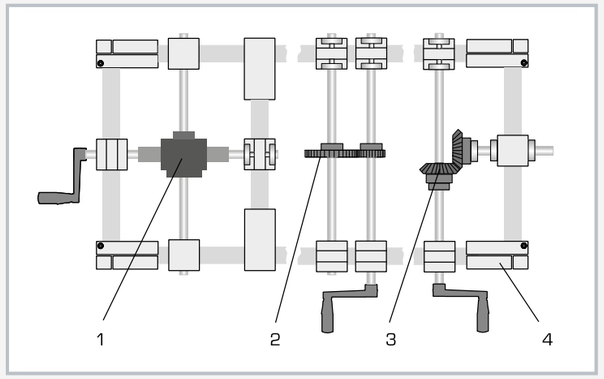
Two spring balances detect the tensile forces on the respective belt ends. This makes it possible to precisely adjust the belt tension using a threaded spindle.

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.

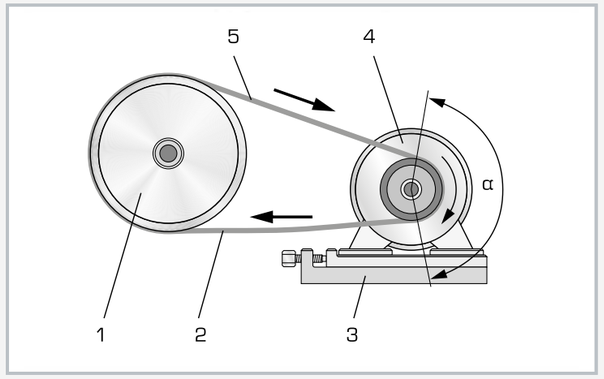
In addition, for V-belts, it is possible to study how the groove shape affects the coefficient of friction.

GL 410
Assembly simple gears





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

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 tubesensures 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

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=2mm

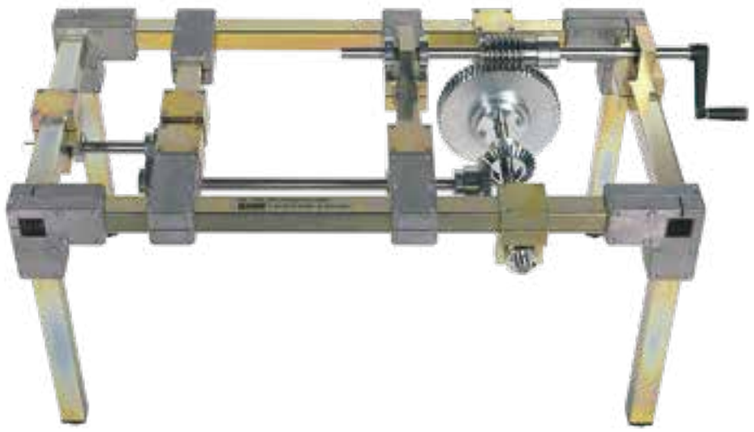
Pair of bevel gears
- number of teeth: z=30
- module: m=3mm
- transmission ratio: i=1
- angle of rotation: 90°

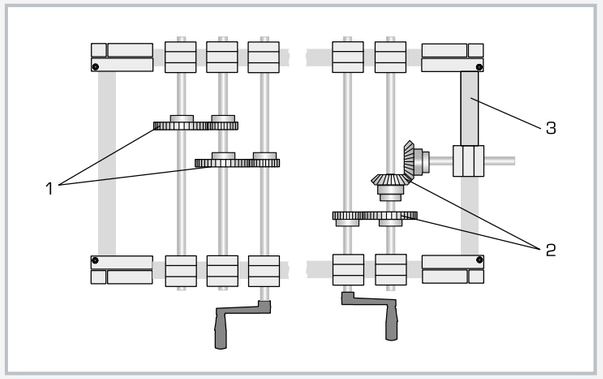
LxWxH: ca. 1030x500x520mm (assembled frame)
Weight: approx. 70kg
LxWxH: 600x400x220mm (storage system)
LxWxH: 600x400x170mm (storage system)

Scope of delivery

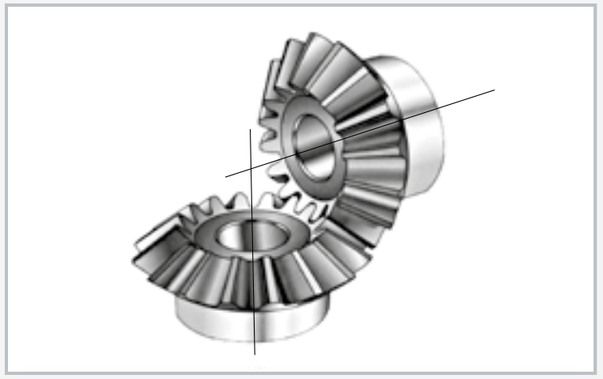
1 frame
1 set of bearings
1 set of gear components
1 set of tools
1 set of instructional material

GL 420
Assembly combined gears





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.

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

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=2mm

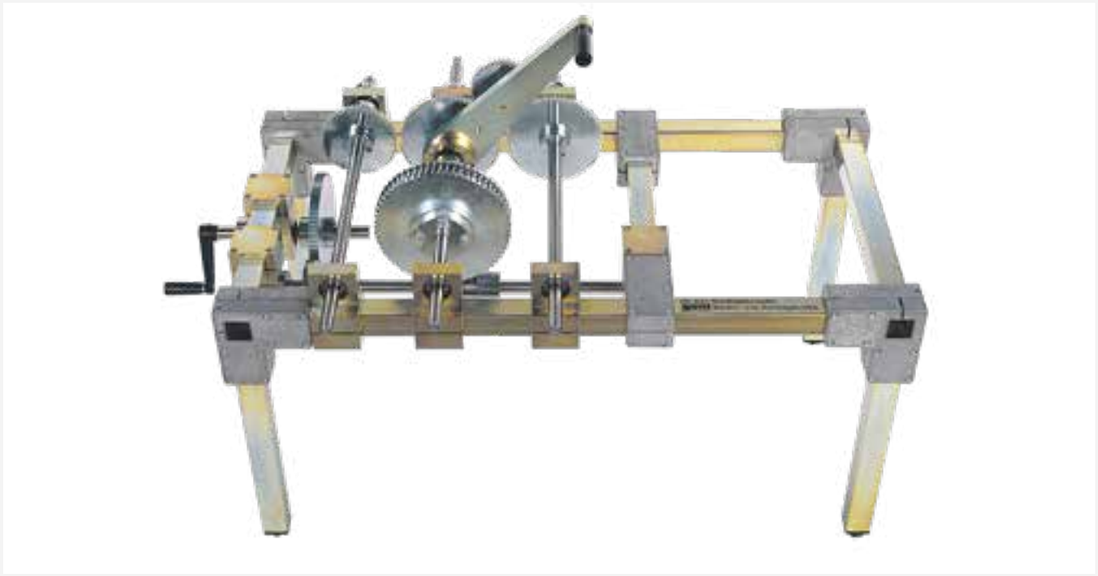
Pair of bevel gears
- number of teeth: z=30
- module: m=3mm
- transmission ratio: i=1
- angle of rotation: 90°

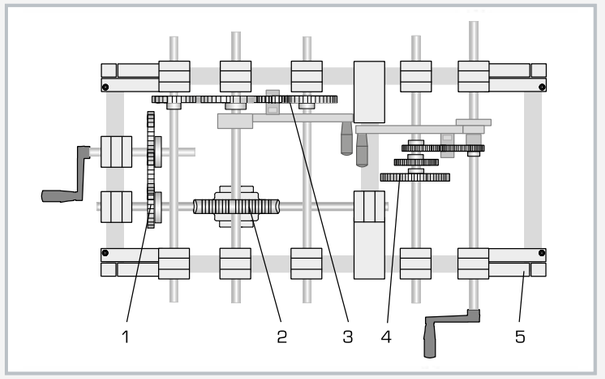
LxWxH: 1000x500x500mm (assembled frame)
Weight: approx. 72kg
LxWxH: 600x400x120mm (storage system)
LxWxH: 600x400x170mm (storage system)

Scope of delivery

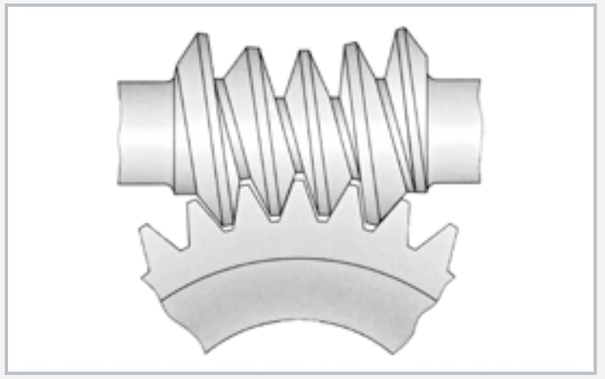
1 frame
1 set of bearings
1 set of gear components
1 set of tools
1 set of instructional material

GL 430
Assembly control gear





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



Worm 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

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=2mm

Worm gear
- worm
  - number of teeth: z=6
- worm wheel
  - number of teeth: z=62
  - module: m=3,15mm

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
[8] driven by hand crank

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

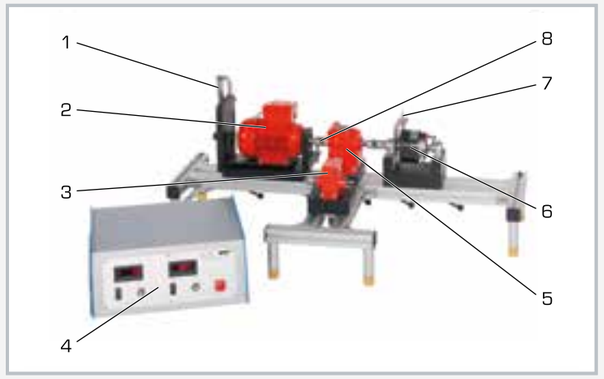
GUNT's policy is simple: high quality hardware and clearly developed accompanying instructional material ensure successful teaching and learning about an experimental unit.

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.

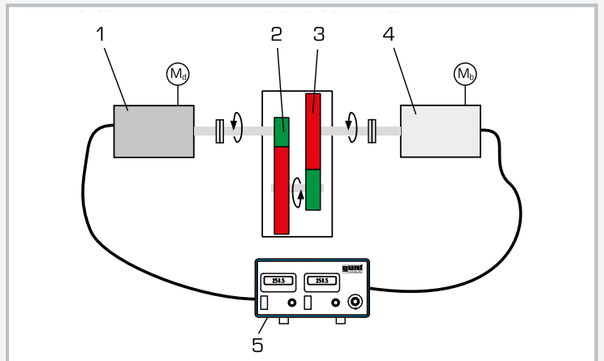
Nevertheless, we are here to help should any questions remain unanswered, either by phone or – if necessary – on site.

AT 200
Determination of gear efficiency

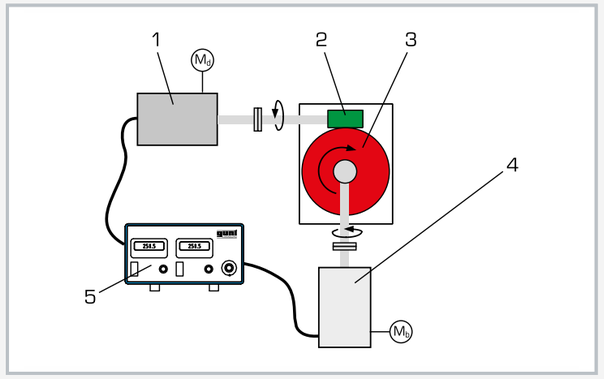
2E



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_d drive torque, M_b braking torque



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

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

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

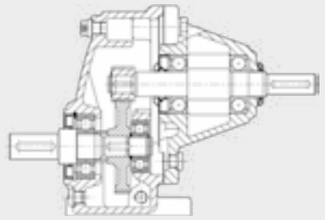
Assembly exercises

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.

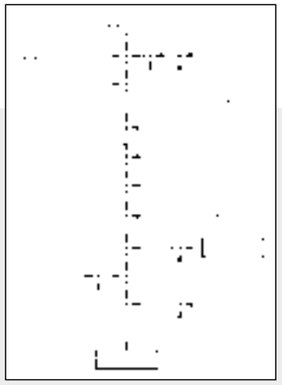
Learning objectives
Develop broad knowledge of assembly technology as a basis for the design of assemblies
Introduction to technical terms and technical language
Familiarisation with machine elements and standard parts
Recognise assemblies, understand functions, describe systems
Read and understand technical 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:

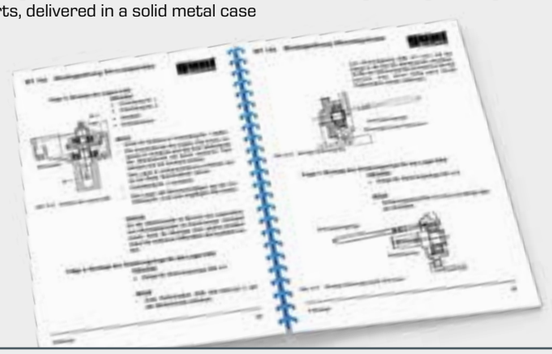
Spur gear deconstructed into individual parts, delivered in a solid metal case



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.

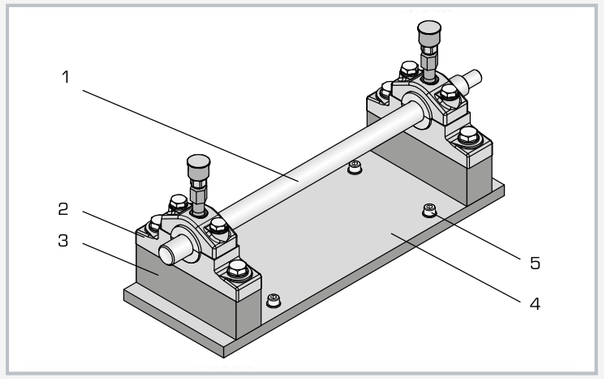
The MT 170 kit is part of the GUNT-Practice Line for assembly, maintenance and repair, which has been designed for technical colleges and company training centres. The close link between theory and practice-based learning content is evident.

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.

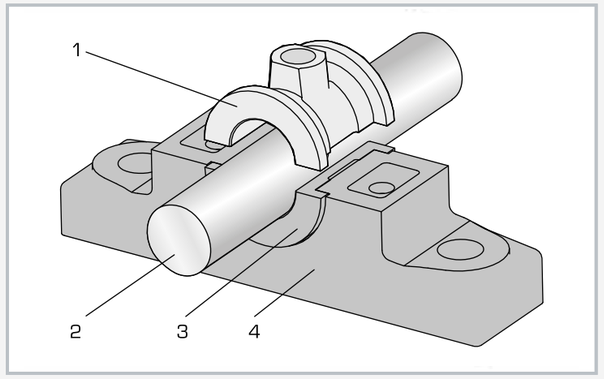
Learning objectives/experiments

- 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.

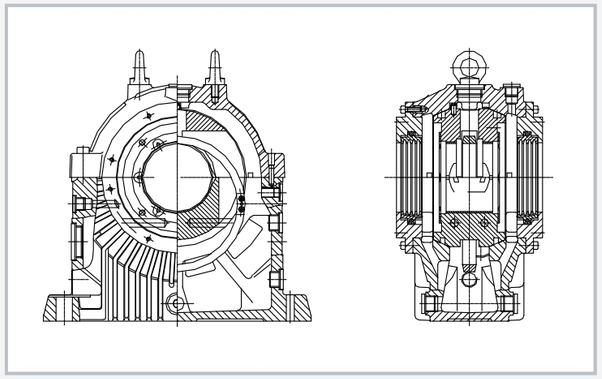
MT 171 is a horizontally split hydrodynamic pedestal journal bearing. The bearing shells are supported by a spherical face in the bearing housing so as to ensure uniform transfer of any forces that arise on the bottom part of the housing. The journal bearing is lubricated by a loose lubricating ring. 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.

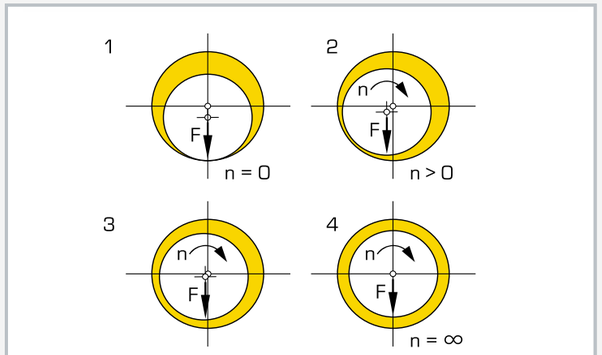
The individual parts are laid out clearly and are well protected in a tool box. The accompanying material details the individual steps involved in assembly, and provides additional information on the areas of application, mode of operation and design of the journal bearing.

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
- Ø 80mm

Drive shaft
- nominal diameter: Ø 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

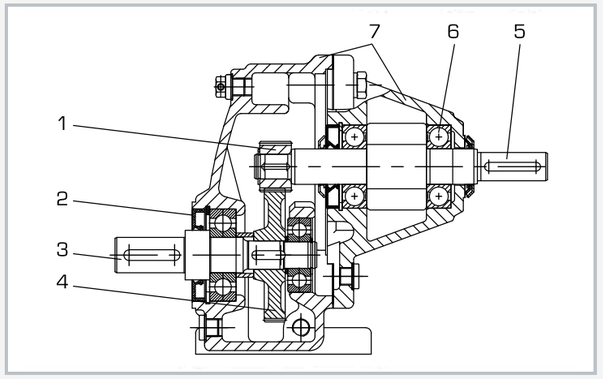
1 kit
1 drive shaft
1 set of tools
1 set of small parts
1 tool box with foam inlay
1 set of instructional material

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

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=1mm
- gear wheel
  - number of teeth: z=68
  - real pitch module: m=1mm
- 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: ØxL: 16x40mm
- driven: ØxL: 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

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.

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.

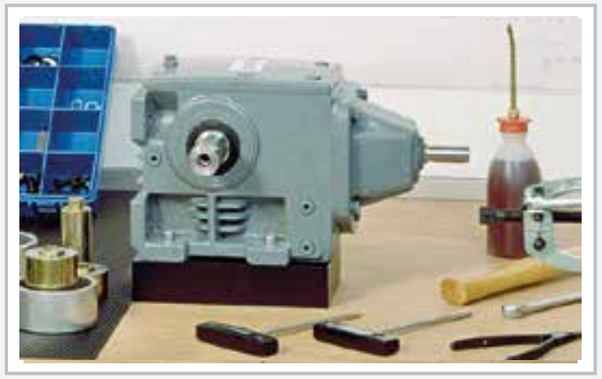
The contemporary instructional materials provide extensive technical information that provides the basis for lesson design. The core element of the teaching materials is a complete set of drawings with lists of parts, individual part designations, exploded views and assembly drawings. All drawings are 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.

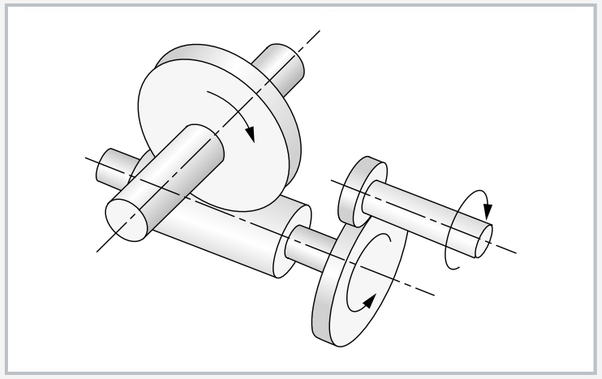
Learning objectives/experiments

- 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=1mm
- gear wheel: z=68, m=1mm

Worm gear stage
- worm: z=3
- worm gear wheel: z=37, m=2,578mm

Max. output torque: 212Nm

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

Shaft connections
- drive: ØxL: 16x40mm
- driven: ØxL: 30x60mm

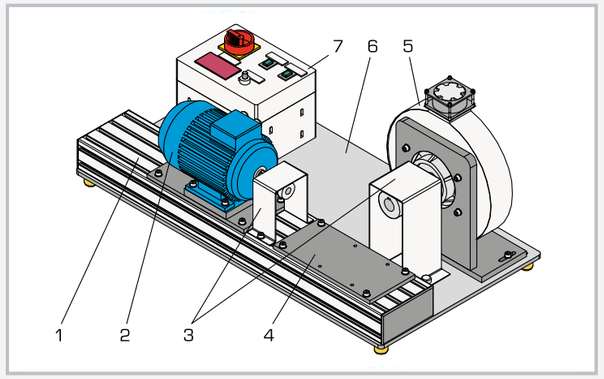
LxWxH: 700x380x320mm (tool box)
Weight: approx. 38kg

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

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



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.

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 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

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

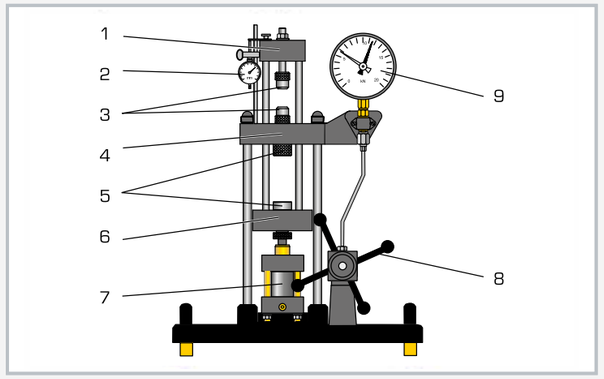
Aluminium machine bed with T-slots
- installation space: LxW: 640x160mm
- slot spacing: 40mm
- for M8 sliding blocks

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

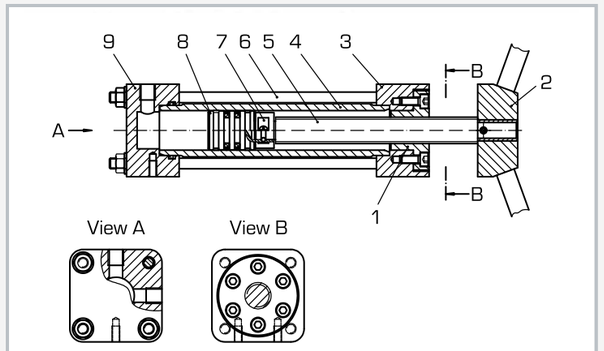
Scope of delivery

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

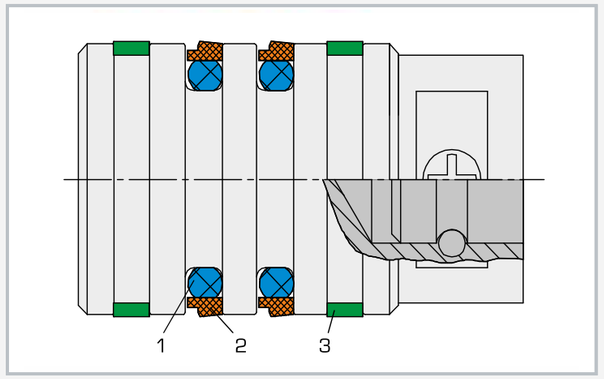
MT 190
Assembly materials tester



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

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

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: Ø 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

MT 190.01
Assembly data acquisition for materials tester

Description

- **interdisciplinary and interlinking kit from the fields of mechanics and electronics**
- **fully functional data acquisition system for a materials tester with USB connection and software**

The MT 190.01 unit is supplied as a kit and contains all components and materials to build a professional data acquisition system. Assembly comprises the mechanical structure and the wiring according to the circuit diagram. All tools and aids required are included, as well as extensive teaching materials.

The assembled MT 190.01 system represents a real, fully functional data acquisition system and can be used to measure pressure (forces) and changes in length.

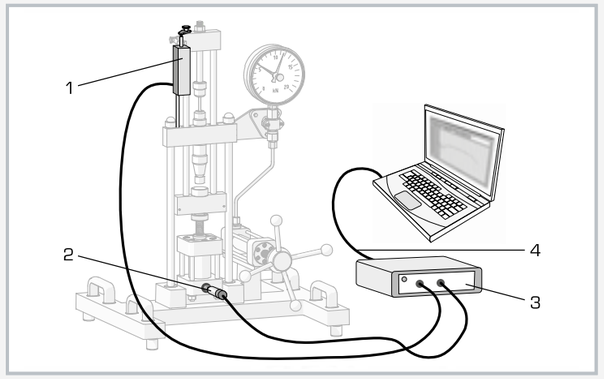
These values are processed further on a PC by means of analysis software. The data acquisition system enhances the options of the MT 190 project considerably. Both projects together give a modern materials tester with data acquisition, which is suitable for a variety of experiments.

Using MT 190.01 students can learn about working on a complex project. This involves the planning, implementation and checking of processes related to assembly, commissioning and repair.

Learning objectives/experiments

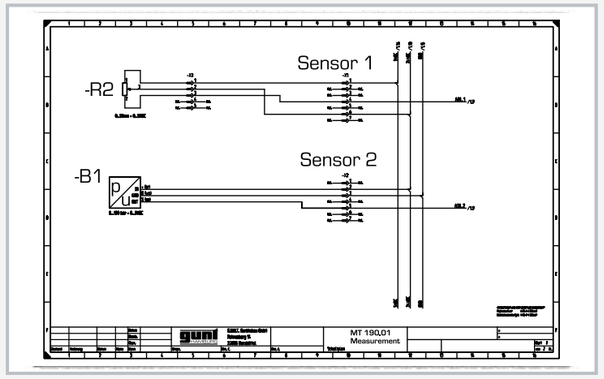
- fundamentals of data acquisition: familiarisation with sensors, electronics for recording and outputting measured values, interfaces, software
- read and understand technical documentation
- plan and execute assembly steps and sequences
- commissioning and inspection of a data acquisition system following assembly
- system integration: connect materials tester and data acquisition

- together with MT 190
  - record load–extension diagrams or stress–strain diagrams
  - prepare, display and store data
  - output diagrams to printer



Port for connecting data acquisition to the basic unit: 1 displacement sensor, 2 pressure sensor for force measurement, 3 measuring amplifier, 4 USB cable

Assembled data acquisition system with software CD; in the foreground: left: pressure sensor, right: displacement sensor



Circuit diagram: port for pressure and displacement sensor

Specification

[1] kit for assembly of a data acquisition system for a materials tester
[2] part of the GUNT-Practice Line for assembly, maintenance and repair
[3] linear potentiometer for displacement measurement
[4] force measurement by pressure sensor
[5] GUNT software for data acquisition via USB under Windows 7, 8.1, 10
[6] software for recording, preparing and storing stress–strain diagrams

Technical data

Pressure sensor for force measurement
- 0...100bar

Displacement sensor
- 0...50mm

Measuring amplifier with USB port
- input: 0...5V
- resolution: 12bit

230V, 50Hz, 1 phase
120V, 60Hz, 1 phase; 230V, 60Hz, 1 phase
UL/CSA optional
LxWxH: 225x200x75mm (measuring amplifier)
Weight: approx. 5kg

Required for operation

PC with Windows

Scope of delivery

1 kit
1 set of tools
1 set of accessories
1 GUNT software CD + USB cable
1 set of instructional material, consisting of: technical description of system, complete set of drawings with individual parts and parts list, circuit diagram,description of maintenance and repair processes, suggested exercises