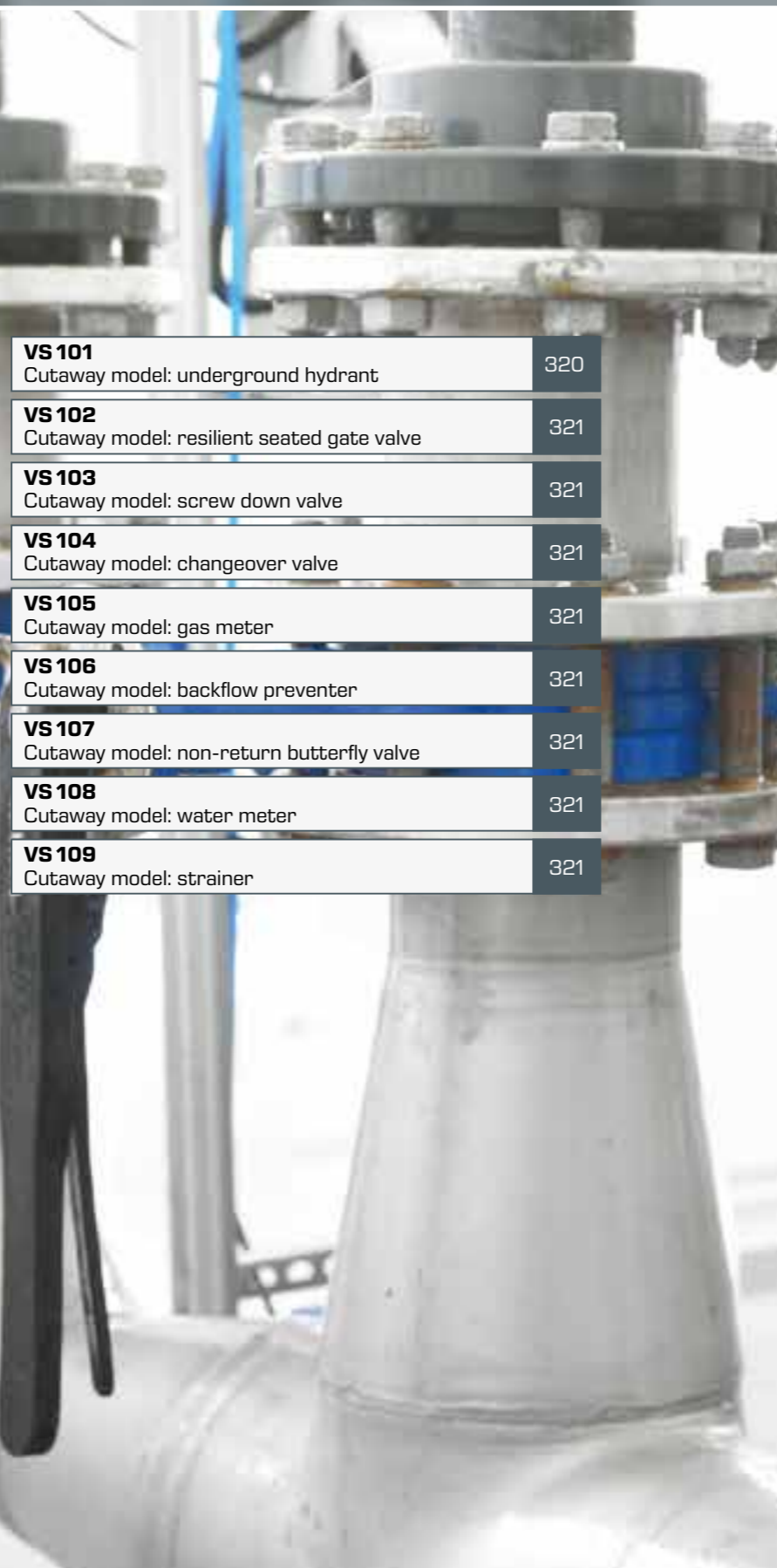


# 6 Components in piping systems and plant design

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## Components in piping systems and plant design

The demonstration and teaching of fluid mechanical processes in valves and fittings and pumps is extremely important when training engineers, technicians and skilled workers. These complex issues are difficult to teach without direct practical relevance.

The topics of planning, assembly, commissioning and maintenance are closely linked. Extensive knowledge of equipment design and assembly are required for commissioning and

maintenance. Planning and design of pipe systems require detailed knowledge of the individual steps and their sequence. GUNT offers a comprehensive range of educationally valuable section models, assembly and maintenance exercises from the field of pipe systems and plant construction.

How are pipes of different pressure levels connected?

What does the relevant measuring equipment for pipe systems look like and how is it assembled?

Learning through practice!  
Understand and analyse technical solutions.

How is a pump designed for transporting aggressive fluids?

What do the different pumps look like from the inside and how do they differ?

### Section models of valves and fittings, pumps and meters

- familiarisation with components and their function
- insight into structural details
- comparison of technical illustrations and illustrative models



### Assembly exercises for valves and fittings

- structure and function of typical valves and fittings in pipe systems
- assembly and disassembly for maintenance and repair
- comparison of different valves and fittings
- leak tests



### Assembly and maintenance exercises for pumps

- structure and function of typical pumps in pipe systems
- assembly and disassembly for maintenance and repair
- systematic troubleshooting and error evaluation
- maintenance and repair processes



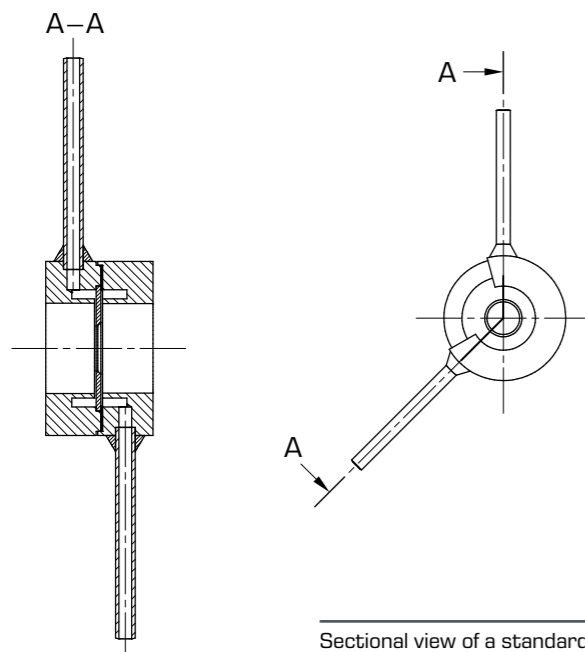
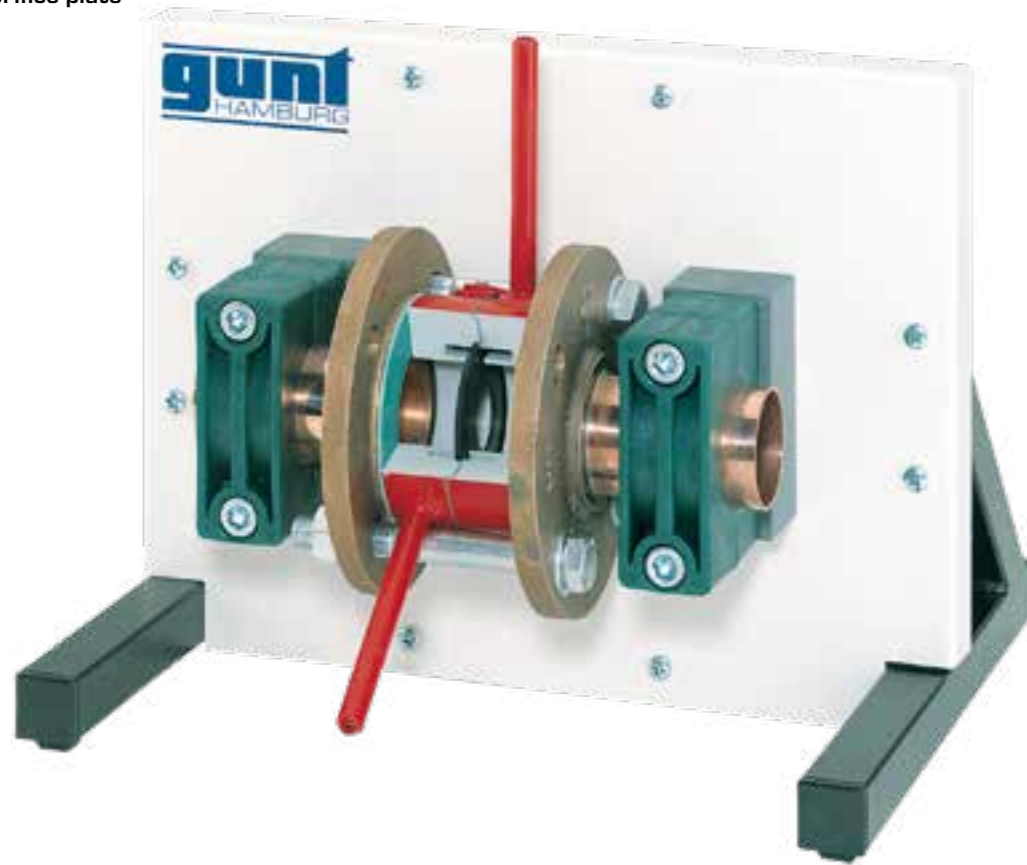
### Design of complex piping and plant systems

- design of piping and plant systems according to specifications
- professional preparation and execution of plant assembly and disassembly
- component selection and preparation of requirements lists
- functional testing, leak testing, operational measurements



## HM 700 Cutaway models of original parts from pipeline constructions

**HM 700.01**  
Cutaway model:  
standard orifice plate



Sectional view of a standard  
orifice plate HM 700.01

### Commercial fittings as cutaway models

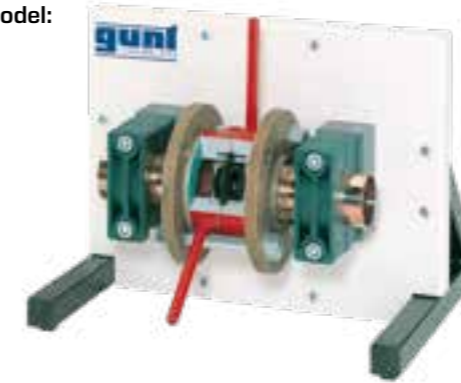
- familiarisation with real components and their functions
- detailed view and principle of operation of the components
- all fittings operate normally, the cuts do not hinder moving parts

The cutaway models are actual fittings and components as used in real pipework installations, e.g. valves, an orifice plate, a measuring nozzle, shut-off fittings, a safety valve and pumps.

The models are clearly laid out on display panels or base plates.

A short description and a sectional view are included, so the models can also be used for technical drawing exercises.

**HM 700.02**  
Cutaway model:  
flow nozzle



**HM 700.03**  
Cutaway model:  
standard Venturi  
meter



**HM 700.04**  
Cutaway model:  
straight-way  
valve



**HM 700.05**  
Cutaway model:  
corner valve



**HM 700.06**  
Cutaway model:  
angle seat  
valve



**HM 700.07**  
Cutaway model:  
non-return  
valve



**HM 700.08**  
Cutaway model:  
pressure reducing  
valve



**HM 700.09**  
Cutaway model:  
strainer



**HM 700.10**  
Cutaway model:  
gate valve



**HM 700.11**  
Cutaway model:  
straight-way  
plug valve



**HM 700.12**  
Cutaway model:  
three-way plug  
valve



**HM 700.13**  
Cutaway model:  
ball valve



**HM 700.14**  
Cutaway model:  
safety valve



**HM 700.15**  
Cutaway models:  
various screwed  
pipe connections



**HM 700.16**  
Cutaway models: pressure gauges



**HM 700.17**  
Cutaway model: centrifugal pump

- familiarisation with components and function

The model shows a standard centrifugal pump that has been prepared as a cutaway model and fitted to a base plate.

The impeller and shaft can be rotated.



**HM 700.20**  
Cutaway model: piston pump

- familiarisation with components and function

A double-acting piston pump with disc piston is shown in cutaway, revealing all moving parts.

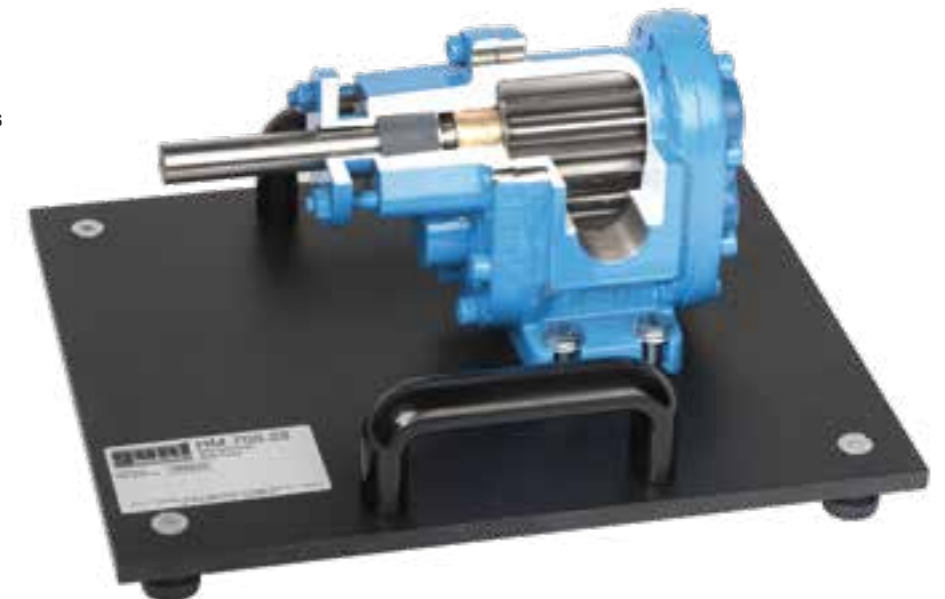
The model is mounted on a base plate with carrying handles.



**HM 700.22**  
Cutaway model: gear pump

- familiarisation with components and function

A simple gear pump that has been prepared as a cutaway model and fitted to a base plate. By rotating the drive shaft it is possible to clearly demonstrate the function.



## Cutaway models from water and gas mains

**VS 101**  
Cutaway model:  
underground hydrant



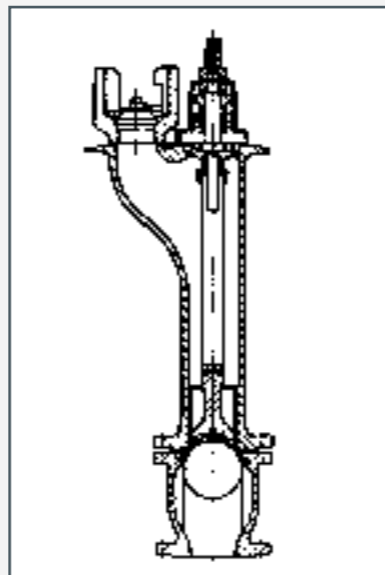
- familiarisation with components and their functions
- view of the details and understanding the principle of operation
- movable parts retain functionality

The cutaway models shown on the following page illustrate commercial components used for drinking water and gas plumbing, such as shut-off fittings, backflow prevention valves and volumetric totalisers. These are similar in concept and design to the VS 101 model, but are mounted on vertical display panels.

A short description and a sectional view are included. In this way the models can also be used for technical drawing exercises.

The VS 101 is a normal underground hydrant made of cast iron. Hydrants are points for drawing water from the public water supply for emergency services or street cleaning. The location of the cuts allow the design details to be clearly seen.

The cutaway model is mounted on a robust base plate. Two handles make it easier to carry.



Sectional view of the underground hydrant

**VS 102**  
Cutaway model:  
resilient seated  
gate valve



**VS 103**  
Cutaway model:  
screw down  
valve



**VS 104**  
Cutaway model:  
changeover valve



**VS 105**  
Cutaway model:  
gas meter



**VS 106**  
Cutaway model:  
backflow  
preventer



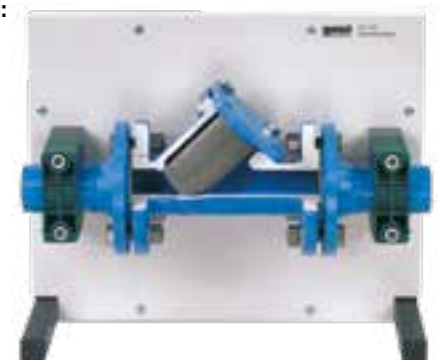
**VS 107**  
Cutaway model:  
non-return  
butterfly valve



**VS 108**  
Cutaway model:  
water meter



**VS 109**  
Cutaway model:  
strainer



## Assembly exercises valves and fittings

Valves and Fittings are pipe elements that are used in particular to shut off or adjust material flows. These primarily include valves, gate valves and taps. Different valves and fittings are suitable for different tasks depending on the way in which they work.

With the MT series of devices on the topic of assembly exercises for valves and fittings, GUNT offers prospective installation engineers and system mechanics the opportunity to learn about the structure, function and maintenance of valves, gate valves and ball valves. After assembly the component can be tested for leaks with hydraulic valves and fittings test stand MT 162.

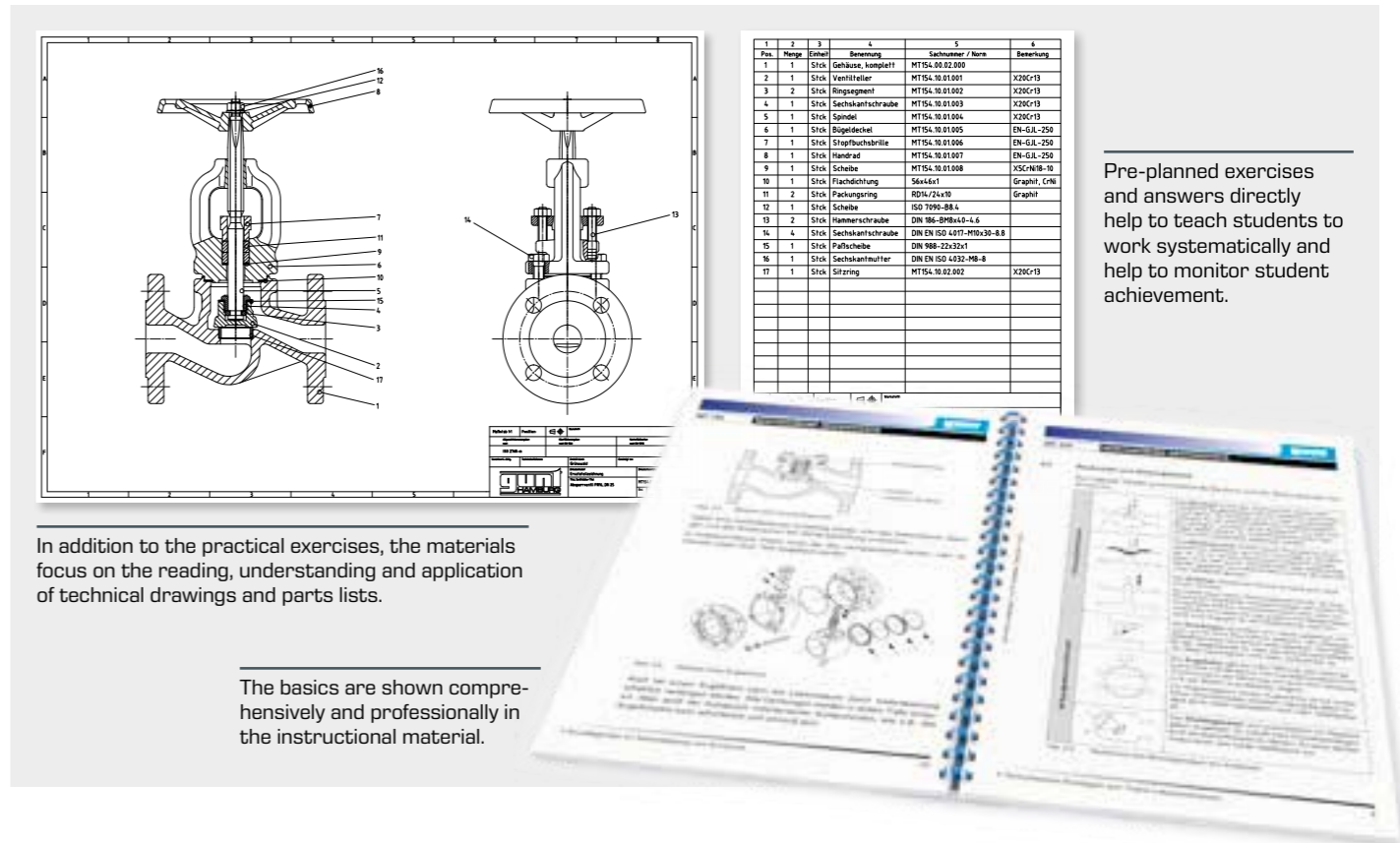
The individual assembly exercises are suitable for collaborative group work or project work

Assembly exercises using real world examples

Comparison of different valves and fittings and their operation



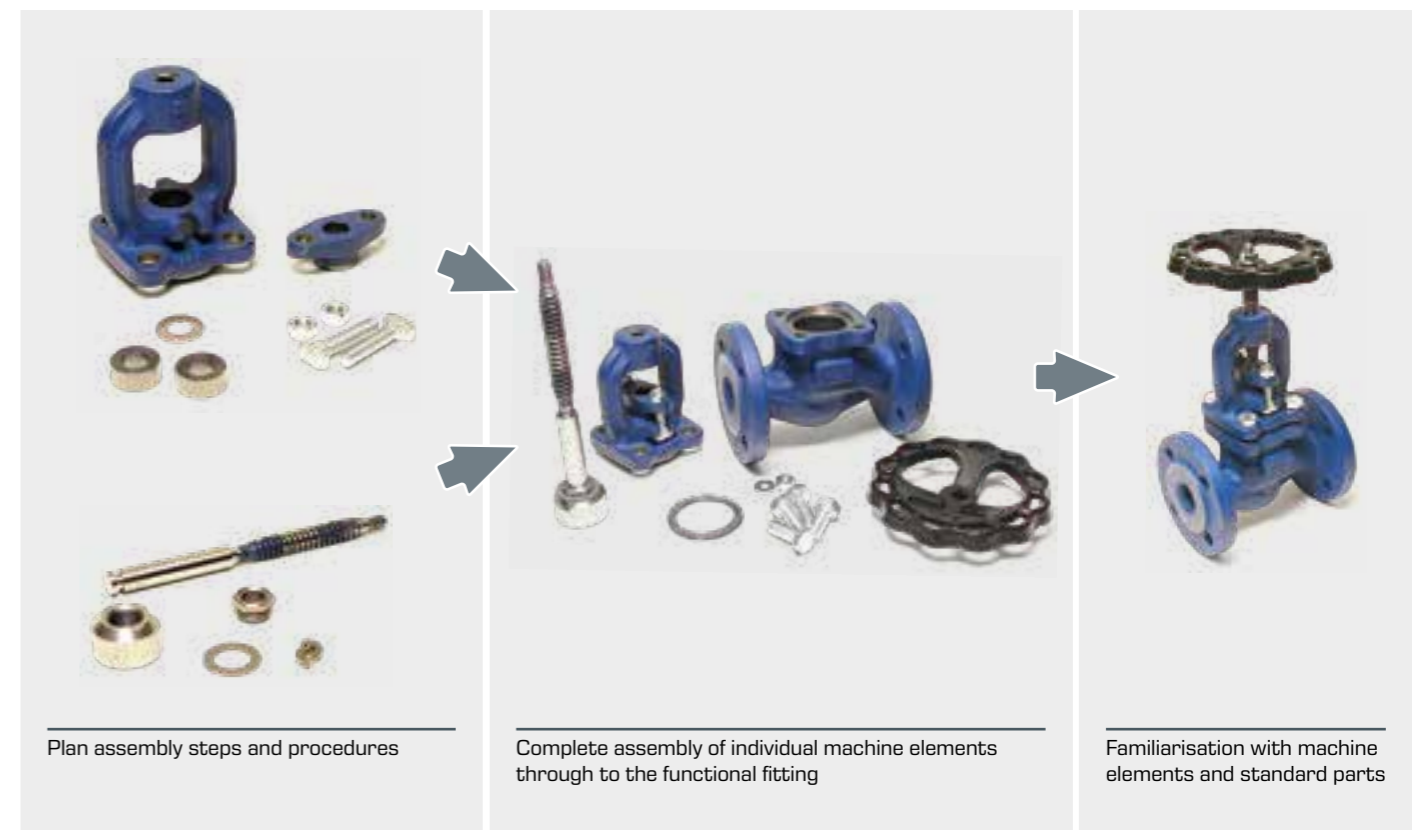
- quality control of assembly with hydraulic valves and fittings test stand MT 162
- proper connection of valves and fittings
- leak testing of housings and flange seals



Pre-planned exercises and answers directly help to teach students to work systematically and help to monitor student achievement.

In addition to the practical exercises, the materials focus on the reading, understanding and application of technical drawings and parts lists.

The basics are shown comprehensively and professionally in the instructional material.



Plan assembly steps and procedures

Complete assembly of individual machine elements through to the functional fitting

Familiarisation with machine elements and standard parts

## MT 154

### Assembly exercise: shut-off valve



#### Learning objectives/experiments

- design and function of a shut-off valve
  - assembly and disassembly, including for the purposes of maintenance and repair
  - reading and understanding engineering drawings
  - planning and presentation of the assembly process
  - familiarisation with various machine elements: thread mechanism, seals, packing gland
  - material selection criteria
- together with the valves and fittings test stand MT 162
    - ▶ leak testing of the assembled valve

#### Description

- **practical exercise based on the assembly of a shut-off valve**
- **broad scope of learning with interdisciplinary problems**
- **part of the GUNT-Practice Line for assembly, maintenance and repair**

Shut-off valves of the type included in the MT 154 unit are used to shut-off and restrict the flow of media. They must be capable of total flow shut-off. The closing of the valve should be such that the volumetric flow does not suddenly drop to zero so as to prevent shock loads. The valve taper is moved by the spindle and ensures a metallic seal against the seating ring pressed into the housing. The spindle is sealed by a packing gland. The joint between the housing and the clamp cover is sealed by a flat seal.

The MT 154 project unit presents an introduction exercise to the area of assembly techniques. The assembly and disassembly processes can easily be completed within standard lesson times. Basic tools, all supplied with the kit, are required for assembly.

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

The comprehensive instructional material is oriented to practical needs. It includes a complete set of drawings with a general arrangement drawing, parts list and individual part drawings.

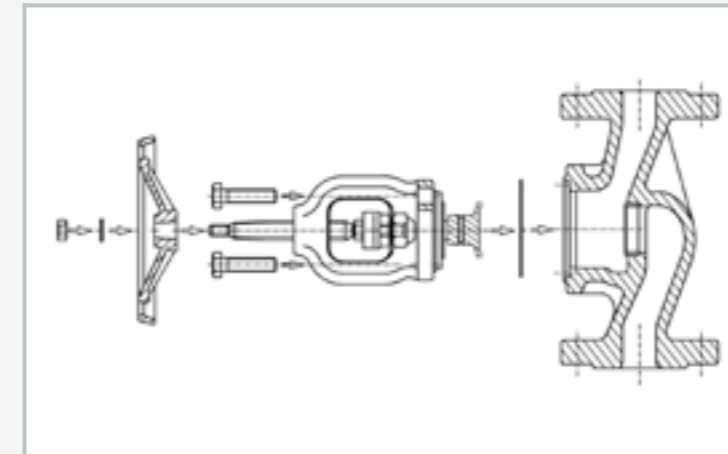
Together with the valves and fittings test stand MT 162, the assembled valve can be subjected to a pressure test.

## MT 154

### Assembly exercise: shut-off valve



The illustration shows the shut-off valve fully assembled.



Shut-off valve assembly drawing

#### Specification

- [1] assembly exercise for engineering training
- [2] shut-off valve PN16 as parts set, with associated set of small parts, in a sturdy case
- [3] shut-off valve consisting of housing, hand wheel, clamp cover, packing gland frame, taper and spindle
- [4] spindle sealing based on the gland principle
- [5] part of the GUNT-Practice Line for assembly, maintenance and repair

#### Technical data

Shut-off valve with flange connections:

- DN25
- PN16
- stroke: 13mm
- housing, hand wheel, clamp cover, packing gland frame: grey cast iron
- taper, seating ring, spindle, ring segment etc.: stainless steel

LxWxH: 600x450x180mm (case)

Weight: approx. 16kg

#### Scope of delivery

- 1 kit
- 1 set of tools
- 1 set of small parts
- 1 case
- 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, also in relation to repair operations

**MT 157****Assembly exercise: butterfly valve and non-return valve**

The illustration shows the tool box with kits and tools. In the foreground the valves and fittings as they are assembled from the kits.

**Description**

- practical exercise based on the assembly of a butterfly valve and a non-return valve
- part of the GUNT-Practice Line for assembly, maintenance and repair

Non-return valves are used where flow reversal is not permitted. They must fully seal off the reverse direction while offering the lowest possible resistance in the forward flow direction. If the differential pressure of the medium falls below the value as dictated by the spring force, the valve closes. Non-return valves are installed in pipelines, and must close if the pressure drops or if a high back-pressure occurs. They are largely maintenance-free and low-wearing.

Butterfly valves are installed in the pipelines of water supply pumping stations and filter systems; in power plant cooling circuits; in the chemical industry for process water, including acidic and alkaline media; and in sewage treatment plants. They seal drip-tight like gate valves, and take up little space, as they are usually similar in size to the pipe cross-section.

Butterfly valves are constructed for ultra-large nominal widths (DN5300). Their operating pressure is normally in the range 4...16bar. Butterfly valves may be operated by hand, by electric motor via a spur gear segment or worm gear, or by a hydraulic piston. The valve is closed by rotating its shaft through 90°.

The MT 157 practice kit forms part of the GUNT-Practice Line for assembly, maintenance and repair designed for training at technical colleges and in company training centres. A close link between theory and practice is key to the learning content.

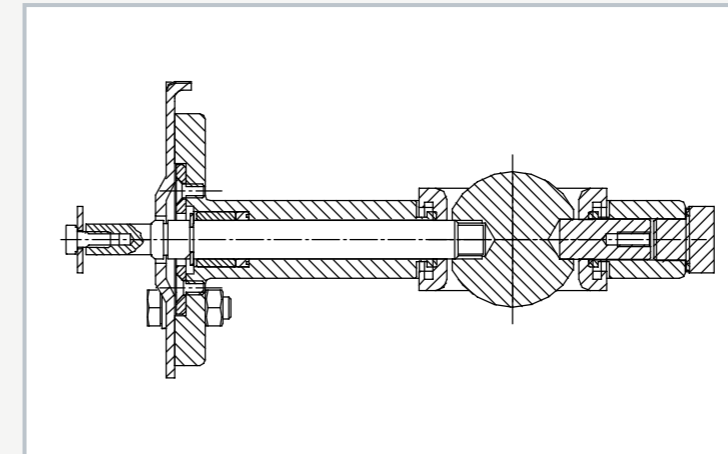
MT 157 enables two typical industrially relevant valves and fittings to be assembled and disassembled. Students become familiar with all the components and their modes of operation. The parts are clearly laid out and well protected in a tool box. Systematic assembly and disassembly of the valves and fittings is practiced. 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 valves and fittings.

**Learning objectives/experiments**

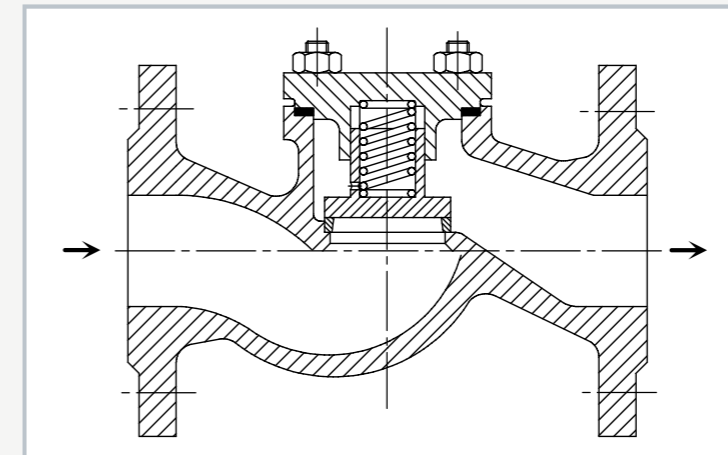
- design and function of a butterfly valve
- design and function of a non-return valve
- assembly and disassembly, including for the purposes of maintenance and repair
- replacing components (e.g. seal)
- comparison of 2 different valves and fittings
- reading and understanding engineering drawings and operating instructions
- together with the valves and fittings test stand MT 162
  - ▶ leak testing of the assembled valve

**MT 157****Assembly exercise: butterfly valve and non-return valve**

Non-return valve, disassembled



Sectional drawing of the butterfly valve



Sectional drawing of the non-return valve

**Specification**

- [1] learning concept for assembly exercises on valves and fittings
- [2] butterfly valve with manual adjuster, as set of parts
- [3] typical non-return valve, as set of parts
- [4] complete assembly tool kit
- [5] valve parts and tools housed in a sheet-steel tool box
- [6] part of the GUNT-Practice Line for assembly, maintenance and repair

**Technical data**

Butterfly valve with flange connections

- DN40, PN16
- materials: housing: grey cast iron; disk, shafts: stainless steel; sleeve: rubber; hand lever: aluminium; bush: bronze

Non-return valve with flange connections:

- DN25, PN16
- materials: housing: grey cast iron; taper, spring: stainless steel; flat seal: graphite

LxWxH: 720x360x310mm (tool box)

Weight: approx. 35kg

**Scope of delivery**

- 1 kit (butterfly valve)
- 1 kit (non-return valve)
- 1 set of tools
- 1 set of small parts
- 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, also in relation to repair operations

**MT 156****Assembly exercise: wedge gate valve and angle seat valve**

The illustration shows the tool box with kits and tools. In the foreground the valves and fittings as they are assembled from the kits.

**Description**

- **practical exercise based on the assembly of a wedge gate valve and an angle seat valve**
- **comprehensive and well-structured instructional material**

Wedge gate valves are used as fittings for water, water vapour, oil and other non-aggressive liquids. Operating temperatures of up to 200°C are possible. Wedge gate valves in this design are operated by a hand-wheel turned spindle. During closing, the slider is pushed by the spindle nut into the sealing rings in the housing.

Angle seat valves are the typical fittings used in drinking water pipes. Angle seat valves are also used in many areas of industry. They are designed for neutral fluids and gaseous media. Stainless steel versions are suitable for mildly and highly aggressive media. The valves can be used for high flow rates, and are non-sensitive to lightly contaminated and high-viscosity media. The valve spindle is usually arranged at a 45° angle to the direction of flow. Angle seat valves generate substantially lower pressure loss than screw down valves or corner valves owing to the less tortuous flow path of the fluid.

The MT 156 practice kit forms part of the GUNT-Practice Line for assembly, maintenance and repair designed for training at technical colleges and in company training centres. A close link between theory and practice is key to the learning content.

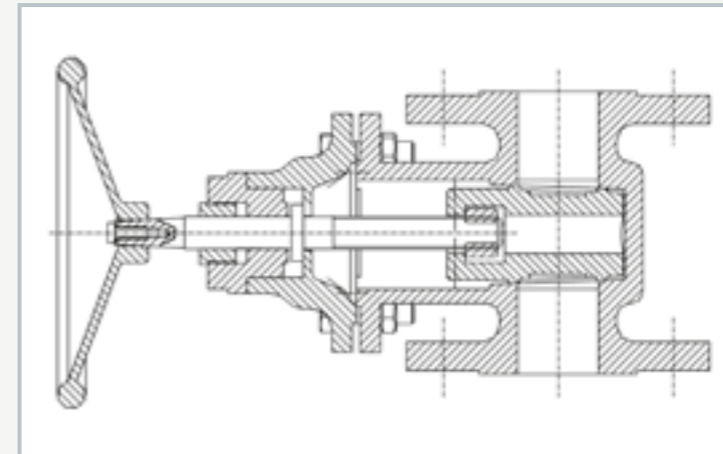
MT 156 enables two typical industrially relevant valves and fittings to be assembled and disassembled. Students become familiar with all the components and their modes of operation. The parts are clearly laid out and well protected in a tool box. Systematic assembly and disassembly of the valves is practiced. 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 valves and fittings.

**Learning objectives/experiments**

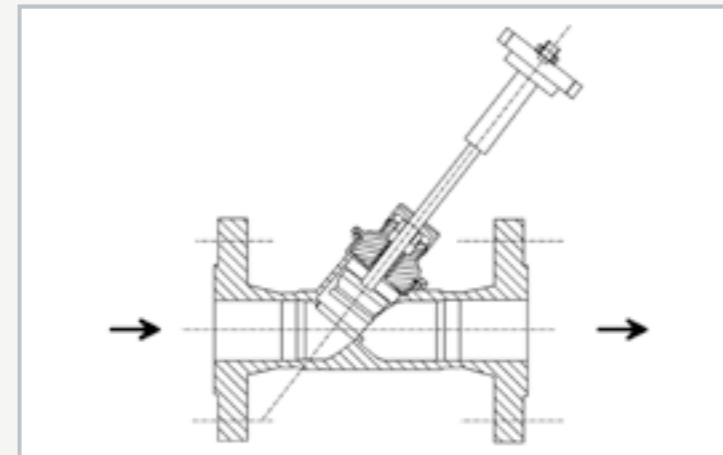
- design and function of a wedge gate valve
- design and function of an angle seat valve
- assembly and disassembly, including for the purposes of maintenance and repair
- replacing components (e.g. seal)
- comparison of 2 different valves and fittings
- reading and understanding engineering drawings and operating instructions
- together with the valves and fittings test stand MT 162
  - ▶ leak testing of the assembled valve

**MT 156****Assembly exercise: wedge gate valve and angle seat valve**

Assembly of the slider



Sectional drawing of the wedge gate valve



Sectional drawing of the angle seat valve

**Specification**

- [1] learning concept for assembly exercises on valves and fittings
- [2] wedge gate valve with hand wheel, as set of parts
- [3] angle seat valve with manual drive, as set of parts
- [4] complete assembly tool kit
- [5] valve parts and tools housed in a sheet-steel tool box
- [6] part of the GUNT-Practice Line for assembly, maintenance and repair

**Technical data**

Wedge gate valve with flange connections

- DN40, PN10
- materials: housing, cover, taper: grey cast iron; spindle, sealing surfaces of housing and taper: stainless steel; packing rings: graphite

Angle seat valve with flange connections

- DN25, PN16
- materials: housing: stainless steel; metallic inner parts: stainless steel; seals: PTFE

LxWxH: 720x360x310mm (tool box)

Weight: approx. 35kg

**Scope of delivery**

- 1 kit (wedge gate valve)
- 1 kit (angle seat valve)
- 1 set of tools
- 1 set of small parts
- 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, also in relation to repair operations

**MT 158****Assembly exercise: ball valve and shut-off valve**

The illustration shows the tool box with kits and tools. In the foreground the valves and fittings as they are assembled from the kits.

**Description**

- practical exercise based on the assembly of a ball valve and a shut-off valve
- part of the GUNT-Practice Line for assembly, maintenance and repair

Shut-off valves, of the design presented here, are used to shut off and restrict the flow of media. They must be capable of complete flow shut-off. Closure of the valve should be such that the volumetric flow does not suddenly drop to zero in order to prevent shock loads. The valve taper is moved by the spindle and makes a metallic seal against the seating ring pressed into the housing. The spindle is sealed by a packing gland. The joint between the housing and the clamp cover is sealed by a flat seal.

Ball valves are used where media flows or pressures in pipelines need to be stopped quickly and easily, e.g. when valves and fittings are to be removed from a pressurised pipeline. They have a very low flow resistance when open, require little space due to the compact design, and have a self-cleaning sealing face. The sealing body is a ball with a cylindrical bore allowing full flow when the

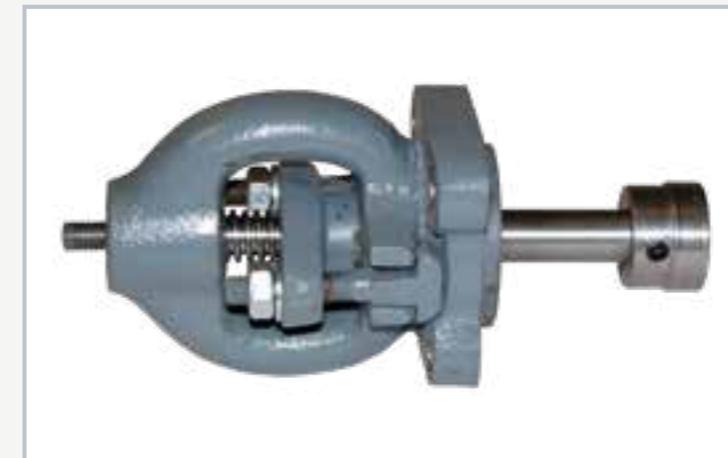
valve is fully open. The ball is rotated through 90° by way of a lever with spindle, enabling it to open or close the valve fully.

The MT 158 practice kit forms part of the GUNT-Practice Line for assembly, maintenance and repair designed for training at technical colleges and in company training centres. A close link between theory and practice is key to the learning content.

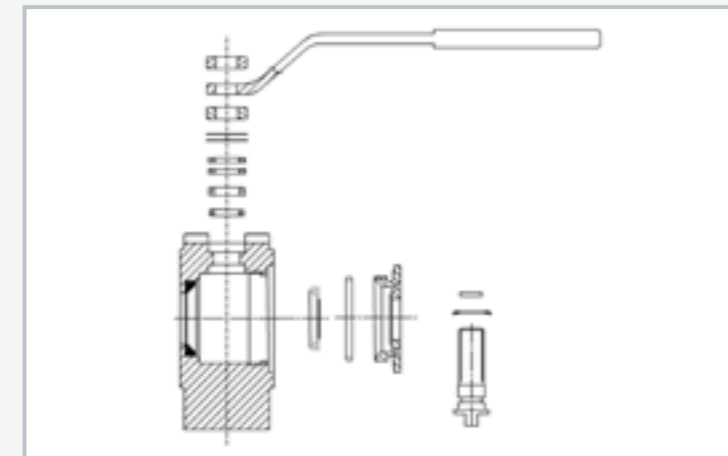
MT 158 enables two typical shut-off valves to be assembled and disassembled. Students become familiar with all the components and their modes of operation. The parts are clearly laid out and well protected in a tool box. Systematic assembly and disassembly of valves and fittings is practiced. The accompanying material details the individual steps involved, and provides additional information on the areas of application, mode of operation and design of the fittings.

**Learning objectives/experiments**

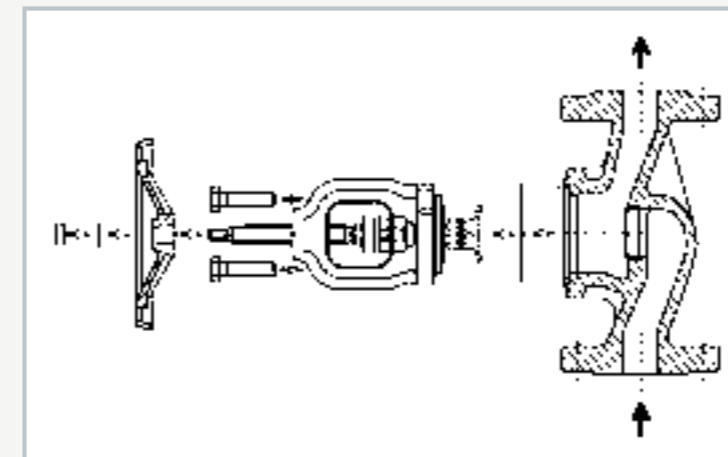
- design and function of a ball valve
- design and function of a shut-off valve
- assembly and disassembly, including for the purposes of maintenance and repair
- replacing components (e.g. seal)
- comparison of 2 different valves and fittings
- reading and understanding engineering drawings and operating instructions
- together with the valves and fittings test stand MT 162
  - ▶ leak testing of the assembled valve

**MT 158****Assembly exercise: ball valve and shut-off valve**

Assembly unit 2 of the shut-off valve, assembled



Assembly drawing of the ball valve



Assembly drawing of the shut-off valve

**Specification**

- [1] learning concept for assembly exercises on valves and fittings
- [2] shut-off valve, as kit
- [3] 2-way ball valve, as kit
- [4] complete assembly tool kit
- [5] valve parts and tools housed in a sheet-steel tool box
- [6] part of the GUNT-Practice Line for assembly, maintenance and repair

**Technical data**

Shut-off valve with flange connections

- DN25, PN16
- housing, hand wheel, clamp cover, packing gland frame: grey cast iron
- taper, seating ring, spindle, ring segment etc.: stainless steel

Ball valve with flange connections

- DN25, PN16
- housing: C22
- ball: brass
- spindle, lever, disks etc.: galvanized steel

LxWxH: 720x360x310mm (tool box)

Weight: approx. 35kg

**Scope of delivery**

- 1 kit (shut-off valve)
- 1 kit (ball valve)
- 1 set of tools
- 1 set of small parts
- 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, also in relation to repair operations

## MT 162

### Hydraulic valves and fittings test stand



The illustration shows MT 162 together with the gate valve from MT 156.

#### Learning objectives/experiments

- the following experiments can be conducted together with valves and fittings, such as a wedge gate valve or angle seat valve (MT 156), butterfly valve or non-return valve (MT 157), ball valve or shut-off valve (MT 158)
  - ▶ correct connection of valves to a flange coupling
  - ▶ familiarisation with the terms "nominal pressure" and "test pressure"
  - ▶ performing the final test for the GUNT MT 154, MT 156, MT 157 and MT 158 assembly kits
  - ▶ checking the free movement of the valves and fittings
  - ▶ pressure testing: leak testing of housing and flange seals
  - ▶ pressure testing: leak testing of the valve seat
  - ▶ drafting a test report

#### Description

- **mobile test stand for pressure testing of valves and fittings**
- **final testing for the GUNT MT 154, MT 156, MT 157 and MT 158 assembly kits**

MT 162 is used for pressure testing of various types of valves and fittings. The unit can be used to test if the valve opens and closes easily under pressure, and if the housing and seals can withstand the test pressure. A manually operated piston pump draws water from the storage tank, fills the valve interior, and generates the test pressure. A manometer indicates the test pressure. The welded-in collector tray is fitted with a ball valve to allow it to be drained.

The valve under test is attached to a mounting flange and sealed by a blank flange. The piston pump and mounting flange are interconnected via a pressure hose. The test stand includes its own storage tank so it can be operated independently of a water pipe supply. The tank must be topped up occasionally.

The test stand is used in particular for the final testing of the valves assembled and disassembled in the GUNT MT 154, MT 156, MT 157 and MT 158 assembly kits series. This ensures that a successfully completed assembly kit can be examined for operability with a formal test procedure.

## MT 162

### Hydraulic valves and fittings test stand



1 manometer, 2 mounting flanges with blank flange, 3 benchtop tray with drain, 4 pressure test pump with water tank, 5 hand lever, 6 hose

#### Specification

- [1] test stand on which to mount industrial valves and fittings
- [2] pressure testing of valves and fittings
- [3] hand-operated piston pump to generate the test pressure, a return valve to relieve the system pressure, and a manometer for pressure measurement
- [4] 2 different sizes of mounting flange with blank flange and flange seal
- [5] connection of pump and test flange via pressure hose
- [6] test medium: water
- [7] mobile frame with collector tray and ball valve to drain
- [8] water storage tank
- [9] part of the GUNT-Practice Line for assembly, maintenance and repair

#### Technical data

Piston pump with tank

- test pressure: 0...60bar
- tank capacity: 12L
- manometer: 0...60bar

Mounting flanges for valves and fittings under test

- DN25
- DN40

LxWxH: 1000x750x1200mm  
Weight: approx. 80kg

#### Scope of delivery

- 1 test stand
- 1 set of accessories
- 1 set of tools
- 1 manual

A	B
4 bar	5.2 bar
6 bar	7.8 bar
10 bar	13.0 bar
16 bar	20.8 bar
40 bar	52.0 bar

Column A: nominal pressure, column B: test pressure

# Assembly & maintenance exercises pumps

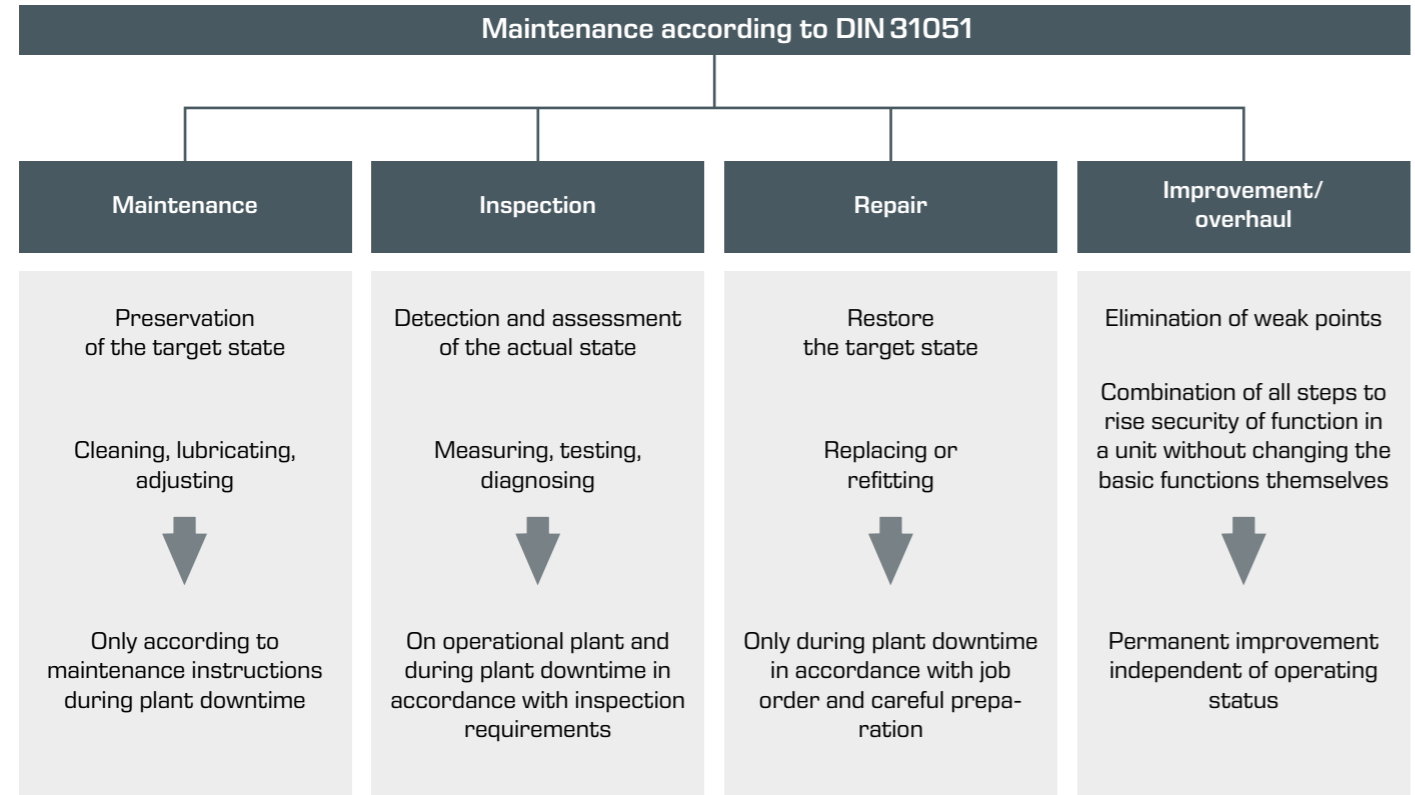
## What is maintenance?

Maintenance is a complex field, and in Germany is defined by the DIN 31051 standard. Maintenance is one of the main tasks for technicians and skilled workers in mechanical engineering or mechatronics. The attention that curricula give to the topic is correspondingly large.

With GUNT's assembly and maintenance exercises for pumps, students are given the opportunity to gain insight into the function and structure of various pumps.

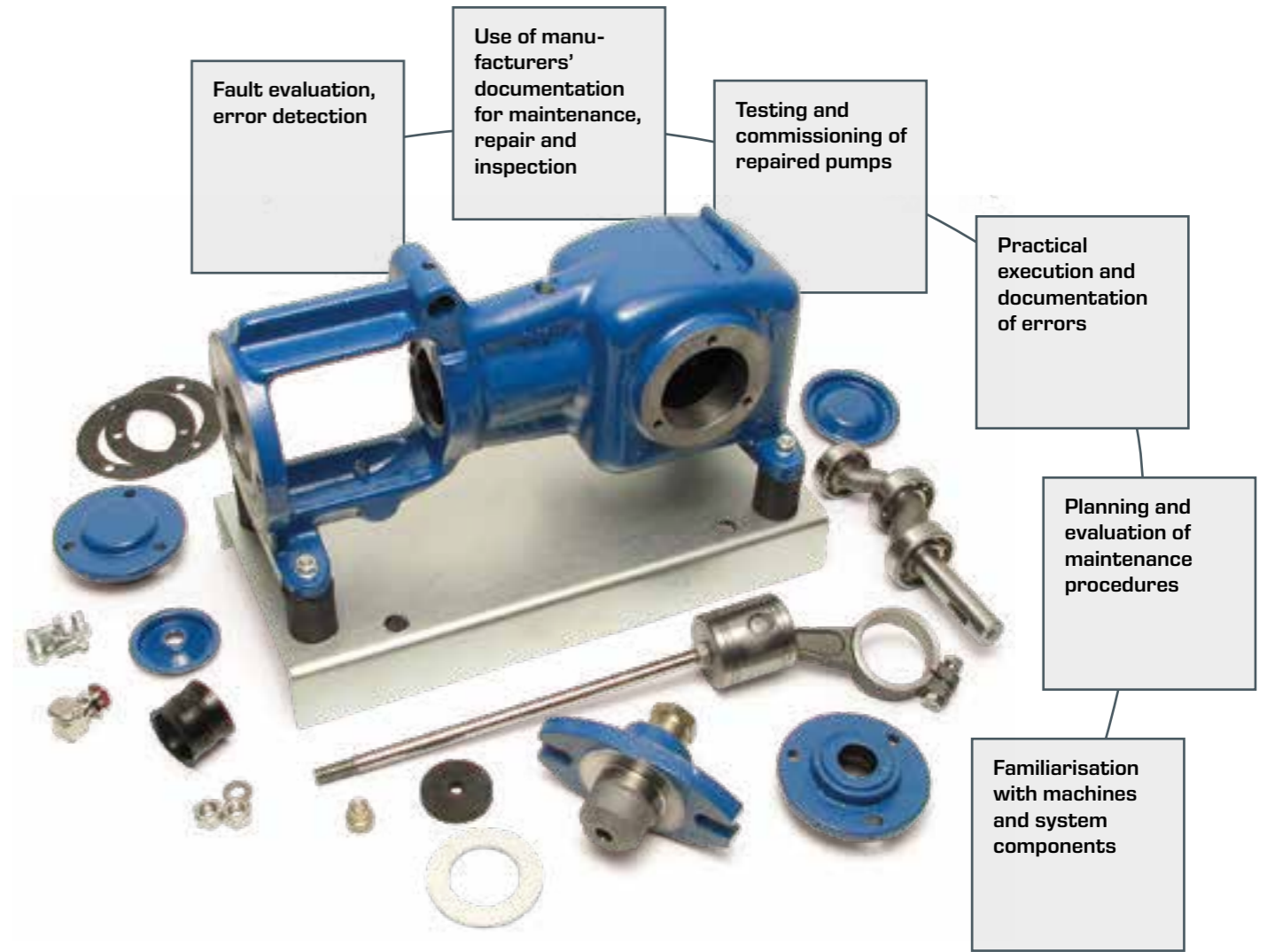
maintained or restored and includes the fields of maintenance, inspection and repair. Extensive knowledge of installation technology is essential for the topic of maintenance.

Moving parts are installed in all pumps, which means these must be serviced regularly and wear parts replaced. Maintenance is intended to ensure that the functional state of a component is

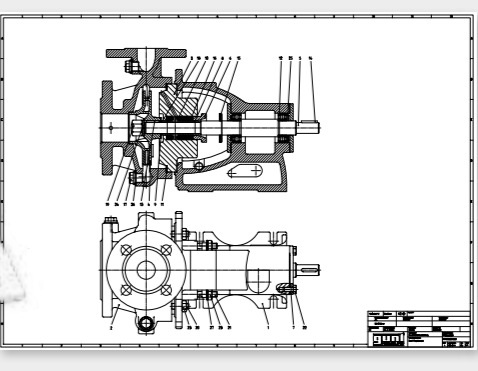


If the function of a pump is disturbed, there is the danger of production or supply failures. Replacing a pump is often considerably less economical than proper preventive maintenance.

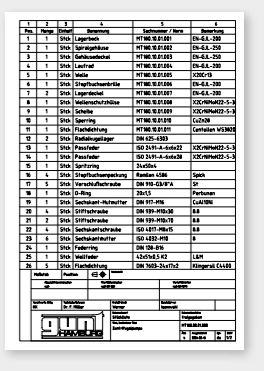
The versatile assembly and maintenance exercises provide real-world industrial experience. In particular, the maintenance exercises are sometimes time-consuming and are suitable for project work. The exercises require that students have a technical and systematic approach to work.



Professional presentation of the technical fundamentals



Exercises allow systematic work and performance assessments



Standards-compliant set of drawings with parts list and assembly instructions

**MT 180****Assembly & maintenance exercise: centrifugal pump**

The illustration shows the tool box with kit and tool inlay, and in the foreground the fully assembled pump.

**Description**

- practical exercise on the assembly and maintenance of a standard centrifugal pump
- part of the GUNT-Practice Line for assembly, maintenance and repair

Centrifugal pumps are rotodynamic pumps and operate normally primed. They are in widespread use, and are deployed primarily in the pumping of water. Their applications include use in shipbuilding, the process industries and in water supply systems. They are compact and relatively simple in design. The water is conveyed by centrifugal force generated by the rotation of the pump impeller. Standard pumps are – as the term suggests – standard items. As a result they are relatively inexpensive to purchase and maintain. In the lifecycle of a pump, maintenance and repair work is usually required as in many cases pumps are not considered as pure replacement items.

The MT 180 kit forms part of the GUNT-Practice Line for assembly, maintenance and repair designed for training at technical colleges and in company training centres. A close link between theory and practice is key to the learning content.

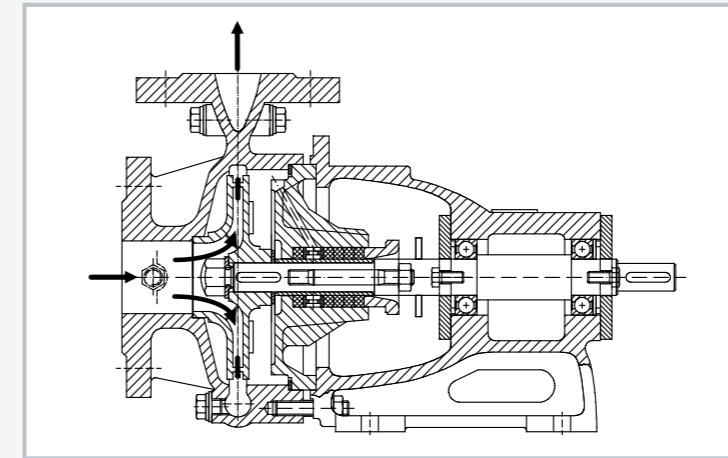
The kit is ideally suited to project based learning with a particular emphasis on 'hands-on' work. Independent working by the students is assisted and encouraged. Learning in a small team offers a useful learning format.

MT 180 enables a typical standard centrifugal pump to be assembled and maintained. Students become familiar with all the pump components and their modes of operation. The parts are clearly laid out in a tool box. Systematic assembly and disassembly of a pump is practiced.

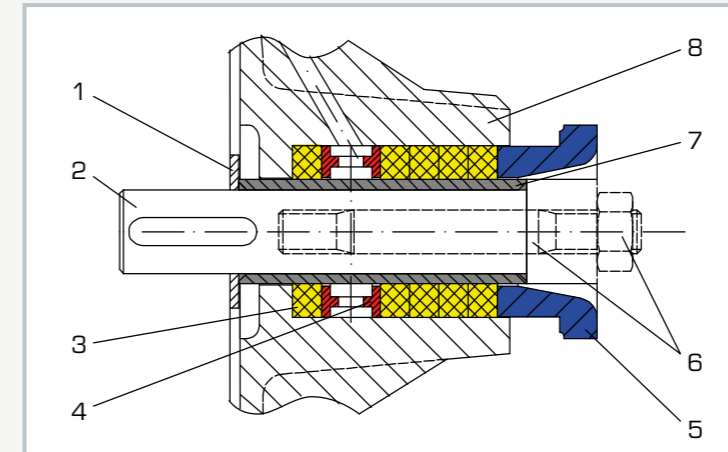
The instructional material details the individual steps involved in the exercise, and provides additional information on the areas of application, mode of operation and design of the pump.

**Learning objectives/experiments**

- design and function of a centrifugal pump and its components
- assembly and disassembly for maintenance and repair purposes
- replacing components (e.g. seals or bearings)
- troubleshooting, fault assessment
- planning and assessment of maintenance and repair operations
- reading and understanding engineering drawings and operating instructions

**MT 180****Assembly & maintenance exercise: centrifugal pump**

Sectional drawing of the centrifugal pump



Packing gland: 1 disk, 2 shaft, 3 gland packing, 4 locking ring, 5 packing gland frame, 6 stud bolt with hexagon nut, 7 shaft sheath, 8 housing cover



Assembly of the centrifugal pump: fixing of the bearing cover with screws

**Specification**

- [1] learning concept for maintenance and repair exercises on a single-stage, normally primed centrifugal pump with a spiral housing
- [2] pump according to DIN 24255
- [3] enclosed pump impeller with 5 blades, designed for pure liquids
- [4] pump shaft sealing, based on the gland principle
- [5] 2 assembly jigs and a complete tool set
- [6] pump parts and tools housed in a tool box
- [7] part of the GUNT-Practice Line for assembly, maintenance and repair

**Technical data**

Single-stage centrifugal pump

- power consumption: max. 1100W
- max. flow rate: 19m<sup>3</sup>/h
- max. head: 25m
- speed: 3000min<sup>-1</sup>
- intake connection: DN50
- delivery connection: DN32
- housing and impeller: grey cast iron

LxWxH: 690x360x312mm [tool box]  
Weight: approx. 35kg

**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 maintenance and repair processes, suggested exercises; manufacturer's manual

**MT 181****Assembly & maintenance exercise: multistage centrifugal pump**

The illustration shows the tool box with kit and tools. The fully assembled pump is shown in the foreground.

**Description**

- practical exercise on the assembly and maintenance of a multistage centrifugal pump
- part of the GUNT-Practice Line for assembly, maintenance and repair

Centrifugal pumps are rotodynamic pumps and operate normally primed. They are in widespread use, and are deployed primarily in the pumping of water. Their range of applications include use in shipbuilding, the process industries and in water supply systems. Very high delivery pressures can be generated by connecting multiple impellers in series. Centrifugal pumps are compact and relatively simple in design. The water is conveyed by centrifugal force generated by the rotation of the pump impeller. In the lifecycle of a pump, maintenance and repair work is usually required as in many cases pumps are not considered as pure replacement items.

The MT 181 kit forms part of the GUNT-Practice Line for assembly, maintenance and repair designed for training at technical colleges and in company training centres. A close link between theory and practice is key to the learning content.

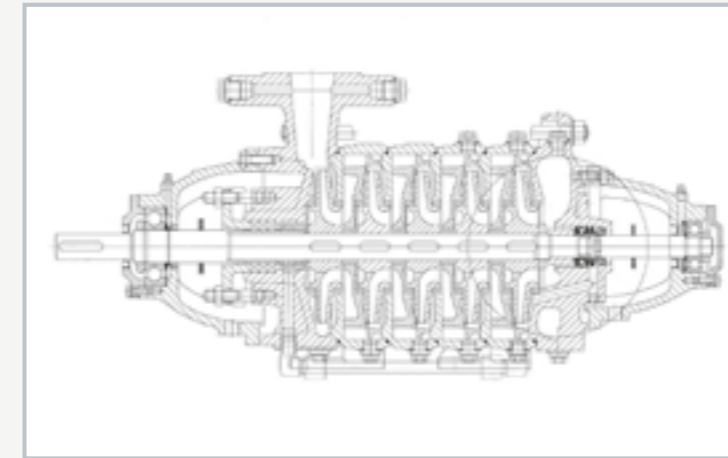
The kit is ideally suited to project-based learning with a particular emphasis on 'hands-on' work. Independent working by the students is assisted and encouraged. Learning in a small team offers a useful learning format.

MT 181 enables a typical multistage centrifugal pump to be assembled and maintained. Students become familiar with all the pump components and their modes of operation. The parts are clearly laid out in a tool box. Systematic assembly and disassembly of a pump is practiced.

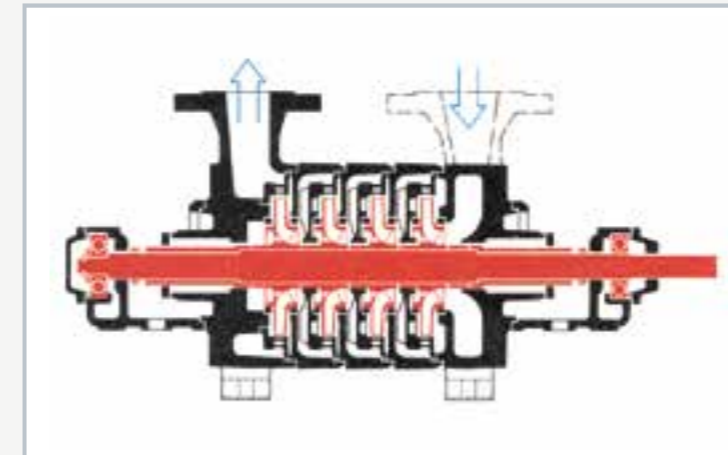
The instructional material details the individual steps involved in the exercise, and provides additional information on the areas of application, mode of operation and design of the pump.

**Learning objectives/experiments**

- design and function of a multistage pump and its components
- assembly and disassembly for maintenance and repair purposes
- replacing components (e.g. seals, bearings or impellers)
- troubleshooting, fault assessment
- planning and assessment of maintenance and repair operations
- reading and understanding engineering drawings and operating instructions

**MT 181****Assembly & maintenance exercise: multistage centrifugal pump**

Sectional drawing of a similar multistage centrifugal pump (MT 181 has four stages; the intake and delivery connections are on the same side)



Schematic view of a four-stage centrifugal pump



Assembly of the four-stage centrifugal pump: assembling the packing gland rings

**Specification**

- [1] learning concept for maintenance and repair exercises on a four-stage, normally primed centrifugal pump
- [2] shaft sealing based on the gland principle (delivery side) and with floating ring seal (intake side)
- [3] driven by motor (not included) and clutch via pump shaft
- [4] 4 assembly jigs and complete tool set
- [5] pump parts and tools housed in a tool box
- [6] part of the GUNT-Practice Line for assembly, maintenance and repair

**Technical data**

Four-stage centrifugal pump

- power consumption: max. 1400W
- max. flow rate: 18m<sup>3</sup>/h
- max. head: 28m
- speed: 1450min<sup>-1</sup>
- intake connection: DN50
- delivery connection: DN40
- housing and impellers: grey cast iron

LxWxH: 690x360x312mm (tool box)  
Weight: approx. 58kg

**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 maintenance and repair processes, suggested exercises; manufacturer's manual

**MT 185****Assembly & maintenance exercise: in-line centrifugal pump**

The illustration shows the tool box with kit and tools. The fully assembled pump is shown in the foreground. The illustration shows a similar unit.

**Description**

- practical exercise on the assembly and maintenance of an in-line centrifugal pump
- part of the GUNT-Practice Line for assembly, maintenance and repair

In-line centrifugal pumps are rotodynamic pumps and operate normally primed. In-line pumps are installed in the straight runs of pipelines. The difference between an in-line pump and a standard pump is that the intake and delivery connections of an in-line pump are aligned on a single axis.

The in-line centrifugal pump presented here is used to pump mechanically and chemically non-aggressive liquids. Its range of applications include use in water supply, irrigation and sprinkler systems, and heating engineering systems.

The MT 185 kit forms part of the GUNT-Practice Line for assembly, maintenance and repair designed for training at technical colleges and in company training centres.

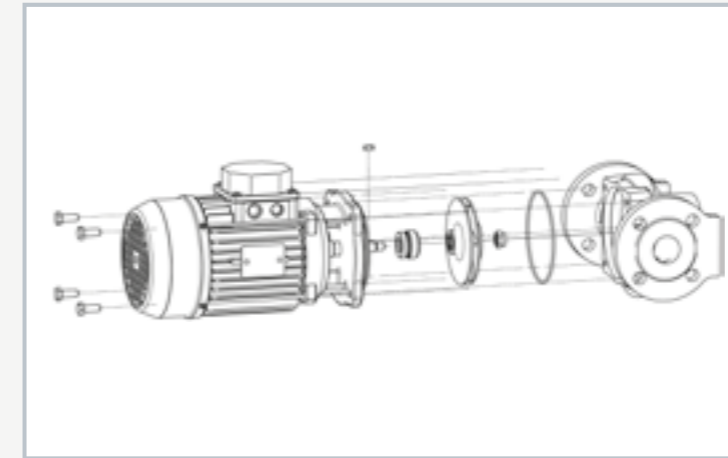
A close link between theory and practice is key to the learning content. The kit is ideally suited to project-based learning with a particular emphasis on 'hands-on' work. Independent working by the students is assisted and encouraged. Performing exercises in a small team offers a useful learning format.

MT 185 enables a typical in-line centrifugal pump to be assembled and maintained. Students become familiar with all the pump components and their modes of operation. The parts are clearly laid out in a tool box. Systematic assembly and disassembly of a pump is practiced.

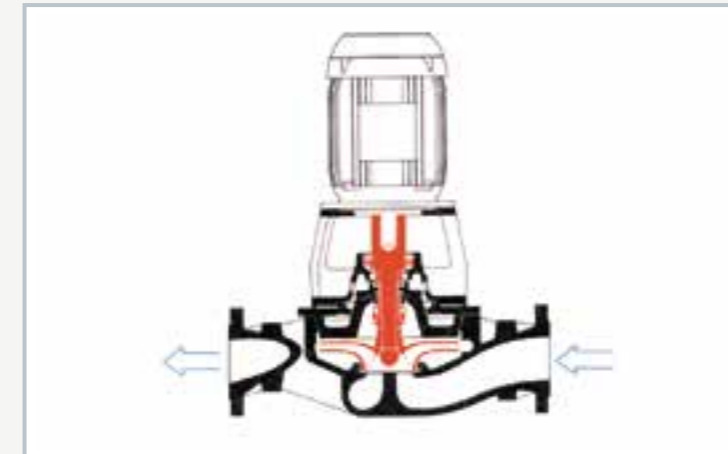
The instruction material details the individual steps involved in the exercise, and provides additional information on the areas of application, mode of operation and design of the pump.

**Learning objectives/experiments**

- design and function of an in-line centrifugal pump and its components
- assembly and disassembly for maintenance and repair purposes
- replacing components (e.g. seals)
- troubleshooting, fault assessment
- planning and assessment of maintenance and repair operations
- reading and understanding engineering drawings and operating instructions

**MT 185****Assembly & maintenance exercise: in-line centrifugal pump**

Exploded-view drawing of the in-line centrifugal pump



In-line centrifugal pump: intake and delivery connections on the same axis



Individual parts of the in-line centrifugal pump

**Specification**

- [1] learning concept for maintenance and repair exercises on an in-line centrifugal pump
- [2] enclosed pump impeller with 6 blades, designed for pure liquids
- [3] pump shaft sealing with floating ring seal
- [4] pump drive by 3-phase AC motor
- [5] pump parts and tools housed in a tool box
- [6] part of the GUNT-Practice Line for assembly, maintenance and repair

**Technical data**

In-line centrifugal pump

- power consumption: max. 370W
- max. flow rate: 13m<sup>3</sup>/h
- max. head: 11m
- speed: 2830min<sup>-1</sup>
- intake connection: DN32
- delivery connection: DN32
- housing: grey cast iron
- impeller: GRP

Drive motor

- 400V, 50Hz, 3 phases; or 230V, 60Hz, 3 phases

LxWxH: 690x360x312mm (tool box)

Weight: approx. 28kg

**Scope of delivery**

- 1 kit
- 1 set of tools
- 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 maintenance and repair processes, suggested exercises; manufacturer's manual

**MT 184****Assembly & maintenance exercise: piston pump**

The illustration shows the tool box with kit and tools. The fully assembled pump is shown in the foreground.

**Description**

- practical exercise based on the assembly and maintenance of a piston pump
- part of the GUNT-Practice Line for assembly, maintenance and repair

Piston pumps are positive displacement pumps and operate in an oscillatory manner, normally primed. At constant speed, their characteristic is an almost vertical straight line; at different pressures the volumetric flow remains approximately constant.

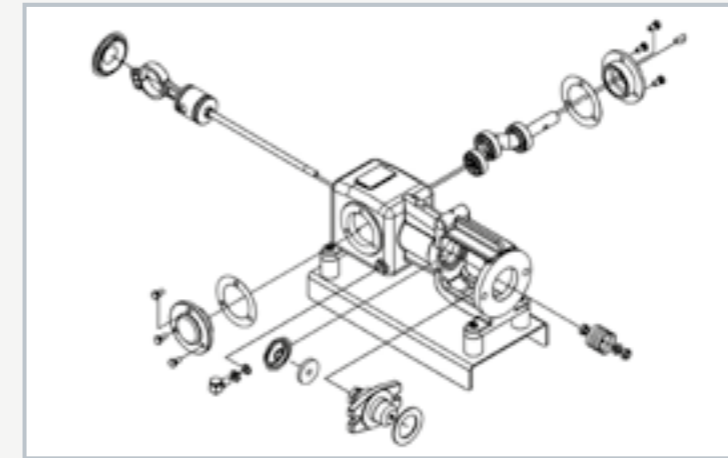
The pump presented here is a dual-action piston pump. This means that each piston stroke is both an intake and delivery stroke. Typical applications of the pump dealt with here are the pumping of drinking and service water for domestic use, in agriculture, shipping, industry and gardening centres.

The MT 184 kit forms part of the GUNT-Practice Line for assembly, maintenance and repair designed for training at technical colleges and in company training centres. A close link between theory and practice is key to the learning content. The kit is ideally suited to project-based learning with a particular emphasis on 'hands-on' work. Independent working by the students is assisted and encouraged. Performing in a small team offers a useful learning format.

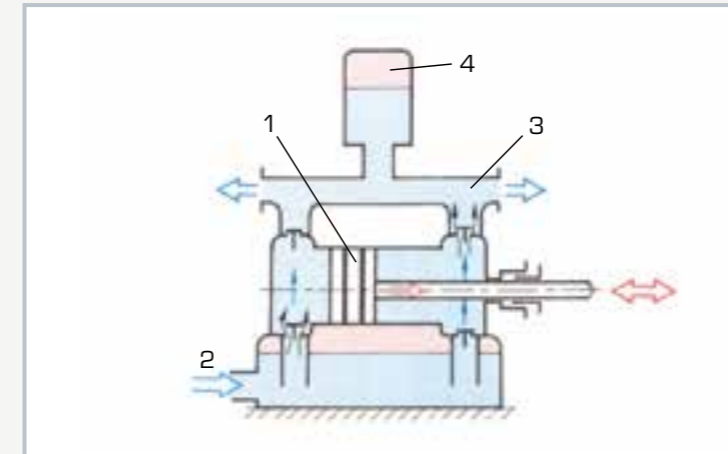
MT 184 enables a typical piston pump to be assembled and maintained. Students become familiar with all the pump components and their modes of operation. The parts are clearly laid out in a tool box. Systematic assembly and disassembly of a pump is practiced. The instructional material details the individual steps involved in the exercise, and provides additional information on the areas of application, mode of operation and design of the pump.

**Learning objectives/experiments**

- design and function of a piston pump and its components
- assembly and disassembly for maintenance and repair purposes
- replacing components (e.g. seals or bearings)
- troubleshooting, fault assessment
- planning and assessment of maintenance and repair operations
- reading and understanding engineering drawings and operating instructions

**MT 184****Assembly & maintenance exercise: piston pump**

Exploded-view drawing of the piston pump



Principle of a double-acting piston pump: 1 piston, 2 inlet, 3 outlet, 4 air vessel



Disassembly of the piston pump: pulling off the ball bearing of the eccentric shaft (using a bearing puller)

**Specification**

- [1] learning concept for maintenance and repair exercises on a double-acting piston pump
- [2] air vessel to compensate for pressure surges
- [3] integrated safety valve returns a portion of the flow back to the intake side in event of overpressure
- [4] piston rod seal based on the gland principle
- [5] pump drive via V-belt pulley
- [6] pump parts and tools housed in a tool box
- [7] part of the GUNT-Practice Line for assembly, maintenance and repair

**Technical data**

Piston pump

- max. flow rate: 1000L/h
- max. head: 60m
- max. power consumption: 370W
- drive via V-belt, motor speed: 1450min<sup>-1</sup>
- intake connection: 1"
- delivery connection: 1"

LxWxH: 690x360x312mm (tool box)

Weight: approx. 33kg

**Scope of delivery**

- 1 kit
- 1 set of tools
- 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 maintenance and repair processes, suggested exercises; manufacturer's manual

**MT 183****Assembly & maintenance exercise: diaphragm pump**

The illustration shows the tool box with kit and tools. The fully assembled pump is shown in the foreground.

**Description**

- practical exercise on the assembly and maintenance of a diaphragm pump
- part of the GUNT-Practice Line for assembly, maintenance and repair

Diaphragm pumps are positive displacement pumps and operate in an oscillatory manner, normally primed. Since diaphragm pumps operate absolutely leakage-free, they are particularly suitable – provided the appropriate pump materials are used – for handling aggressive fluids such as acids and caustic solutions as well as radioactive, combustible, odorous and toxic liquids. Another advantage is that they can run dry. Diaphragm pumps are often used for volumetric metering (metering pumps).

The materials used in the construction of the diaphragm pump employed here make it particularly suitable for use in chemical engineering. It is equipped with a stroke length adjuster, and is deployed as a metering pump.

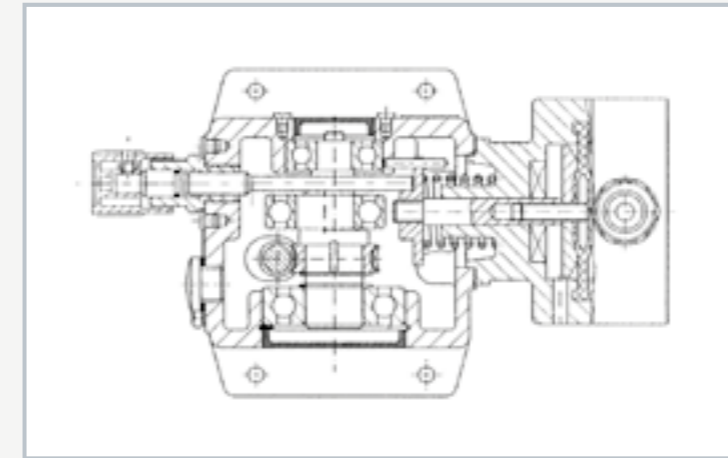
The MT 183 kit forms part of the GUNT-Practice Line for assembly, maintenance and repair designed for training at technical colleges and in company training centres. A close link between theory and practice is key to the learning content. The kit is ideally suited to project-based learning with a particular emphasis on 'hands-on' work. Independent working by the students is assisted and encouraged. Learning in a small team offers a useful learning format.

MT 183 enables a typical diaphragm pump to be assembled and maintained. Students become familiar with all the pump components and their modes of operation. The parts are clearly laid out in a toolbox. Systematic assembly and disassembly of a pump is practiced.

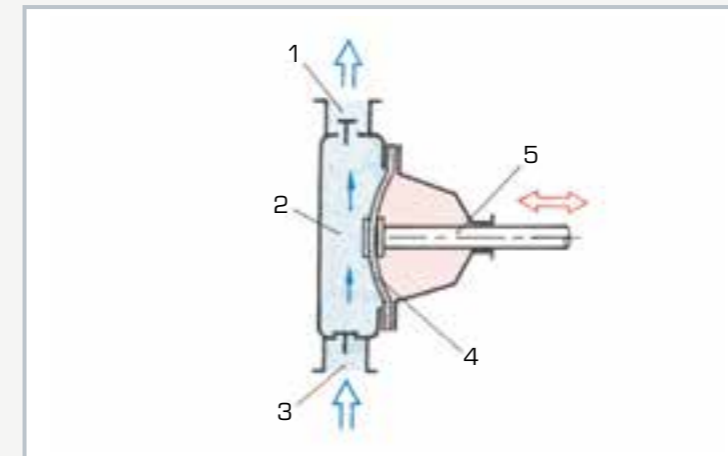
The instructional material details the individual steps involved in the exercise, and provides additional information on the areas of application, mode of operation and design of the pump.

**Learning objectives/experiments**

- design and function of a diaphragm pump and its components
- assembly and disassembly for maintenance and repair purposes
- replacing components (e.g. seals or bearings)
- troubleshooting, fault assessment
- planning and assessment of maintenance and repair operations
- reading and understanding engineering drawings and operating instructions

**MT 183****Assembly & maintenance exercise: diaphragm pump**

Sectional drawing of the diaphragm pump



Operating principle of the single diaphragm pump: 1 outlet, 2 pumping chamber, 3 inlet, 4 diaphragm, 5 push rod



Assembly of the diaphragm pump: driving the eccentric into the housing (using a device)

**Specification**

- [1] learning concept for maintenance and repair exercises on a single-diaphragm pump
- [2] diaphragm and push rod directly linked
- [3] flow setting by manual stroke length adjustment (including during operation)
- [4] manual drive with crank instead of a drive motor
- [5] pump parts and tools housed in a tool box
- [6] part of the GUNT-Practice Line for assembly, maintenance and repair

**Technical data**

Diaphragm pump

- flow rate: 0...2,4L/h
- max. head: 100m
- nominal stroke rate at 50Hz: 156min<sup>-1</sup>
- power consumption: max. 90W
- intake connection: DN5
- delivery connection: DN5
- pump materials
  - ▶ pump body: Polypropylene (PP)
  - ▶ double-ball valves: PP/glass fibre-reinforced plastic
  - ▶ valve balls: glass
  - ▶ valve seals: FPM
  - ▶ drive diaphragm: PTFE-lined

LxWxH: 690x360x312mm (tool box)  
Weight: approx. 15kg

**Scope of delivery**

- 1 kit
- 1 set of tools
- 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 maintenance and repair processes, suggested exercises; manufacturer's manual

**MT 186****Assembly & maintenance exercise: gear pump**

The illustration shows the tool box with kit and tools. The fully assembled pump is shown in the foreground.

**Description**

- **practical exercise on the assembly and maintenance of a gear pump**
- **part of the GUNT-Practice Line for assembly, maintenance and repair**

Gear pumps are piston-type rotary pumps which operate on the positive-displacement principle. They are simple in design, and easy to handle. Gear pumps can generate operating pressures of up to 40bar and flow rates of up to 60m<sup>3</sup>/h. Their pulse-free delivery increases linearly with speed. High-viscosity media (oils, paints, adhesives, etc.) can also be pumped. Gear pumps are sensitive to hard solid-matter particles in the flow.

The materials used in the construction of the pump presented here make it resistant to most corrosive and aggressive chemicals. The plastic / metal gear wheel pairing results in relatively quiet running.

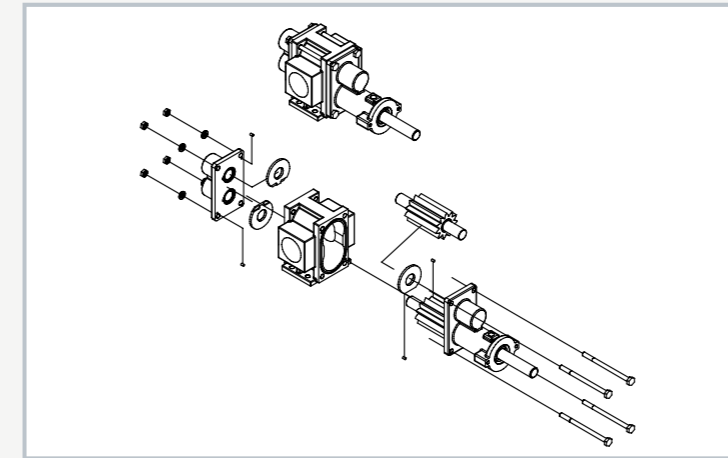
The MT 186 kit forms part of the GUNT-Practice Line for assembly, maintenance and repair designed for training at technical colleges and in company training centres.

A close link between theory and practice is key to the learning content. The kit is ideally suited to project-based learning with a particular emphasis on 'hands-on' work. Independent working by the students is assisted and encouraged. Performing exercises in a small team offers a useful learning format.

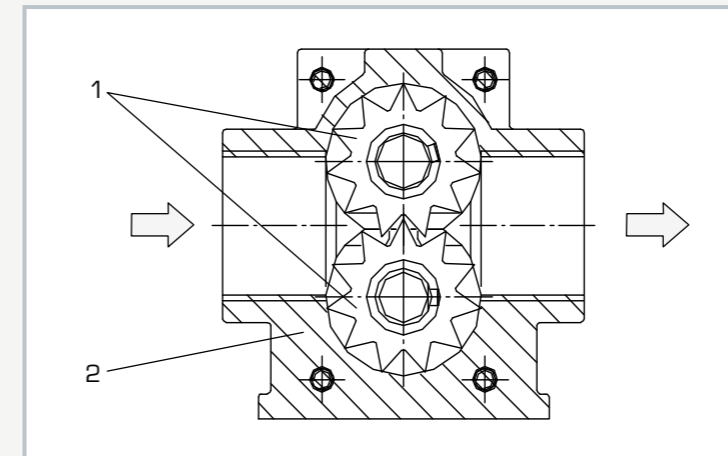
MT 186 enables a typical gear pump to be assembled and maintained. Students become familiar with all the pump components and their modes of operation. The parts are clearly laid out in a tool box. Systematic assembly and disassembly of a pump is practiced. The instructional material details the individual steps involved in the exercise, and provides additional information on the areas of application, mode of operation and design of the pump.

**Learning objectives/experiments**

- design and function of a gear pump and its components
- assembly and disassembly for maintenance and repair purposes
- replacing components (e.g. seals)
- troubleshooting, fault assessment
- planning and assessment of maintenance and repair operations
- reading and understanding engineering drawings and operating instructions

**MT 186****Assembly & maintenance exercise: gear pump**

Exploded-view drawing of the gear pump



Function of a gear pump: 1 gear pair, 2 housing



Assembly of the centrifugal pump: assembling the driving shaft

**Specification**

- [1] learning concept for maintenance and repair exercises on a gear pump
- [2] relatively quiet running owing to the plastic/metal gear wheel pairing
- [3] pump shaft sealing with floating ringseal
- [4] suitable for solids-free media with dynamic viscosity up to 0...10000mPas
- [5] pump parts and tools housed in a tool box
- [6] part of the GUNT-Practice Line for assembly, maintenance and repair

**Technical data****Gear pump**

- power consumption: max. 2kW
- max. flow rate: 80L/min
- max. head: 70m
- motor speed: 300...1750min<sup>-1</sup>
- intake connection thread: R 1 1/4"
- delivery connection thread: R 1 1/4"
- pump materials
  - ▶ housing: stainless steel 316 [1.4401]
  - ▶ gear wheels: stainless steel 316 [1.4401]/PTFE
  - ▶ wearing plates: PTFE
  - ▶ bearings: PTFE
- speed-dependent viscosities
  - ▶ n=300min<sup>-1</sup>: 10000mPas
  - ▶ n=1750min<sup>-1</sup>: 3000mPas

LxWxH: 690x360x312mm (tool box)  
Weight: approx. 20kg

**Scope of delivery**

- 1 kit
- 1 set of tools
- 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 maintenance and repair processes, suggested exercises; manufacturer's manual

**MT 182****Assembly & maintenance exercise: screw pump**

The illustration shows the tool box with kit and tools. The fully assembled pump is shown in the foreground.

**Description**

- **practical exercise on the assembly and maintenance of a screw pump**
- **part of the GUNT-Practice Line for assembly, maintenance and repair**

Screw pumps are positive displacement pumps and operate in a rotary manner, normally primed. The pump presented here can be used for a number of different fluids. These include any non-aggressive fluids with lubricating properties, with viscosities between 2...1500mm<sup>2</sup>/s, such as lubricating oil, vegetable oil, hydraulic fluid, glycols, polymers and emulsions. Typical applications include: lubricating diesel motors; gears; gas, steam and water turbines; and cooling and filtration circuits in large-scale machines and hydraulic systems.

The MT 182 kit forms part of the GUNT-Practice Line for assembly, maintenance and repair designed for training at technical colleges and in company training centres.

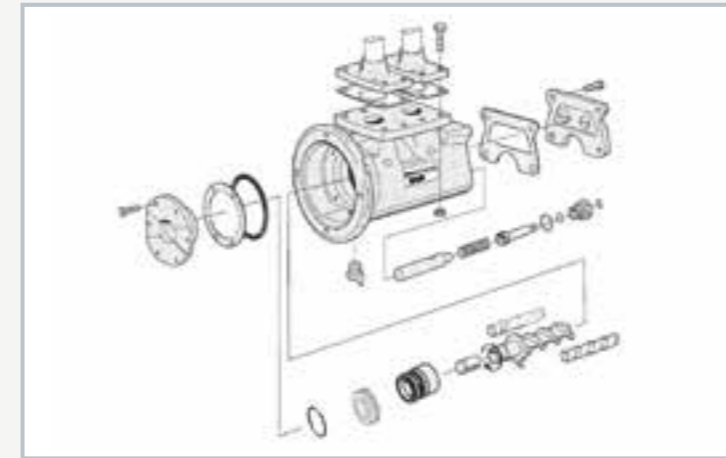
A close link between theory and practice is key to the learning content. The kit is ideally suited to project-based learning with a particular emphasis on 'hands-on' work. Independent working by the students is assisted and encouraged. Learning in a small team offers a useful learning format.

MT 182 enables a typical screw pump to be assembled and maintained. Students become familiar with all the pump components and their modes of operation. The parts are clearly laid out in a toolbox. Systematic assembly and disassembly of a pump is practiced.

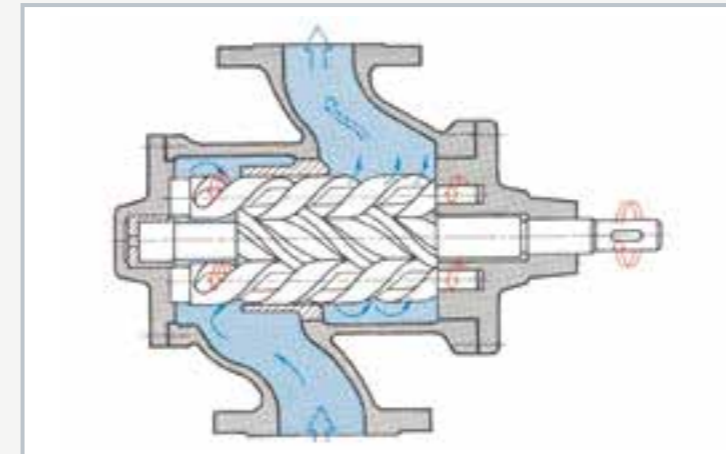
The accompanying material details the individual steps involved in the exercise, and provides additional information on the areas of application, mode of operation and design of the pump.

**Learning objectives/experiments**

- design and function of a screw pump and its components
- assembly and disassembly for maintenance and repair purposes
- replacing components (e.g. seals)
- troubleshooting, fault assessment
- planning and assessment of maintenance and repair operations
- reading and understanding engineering drawings and operating instructions

**MT 182****Assembly & maintenance exercise: screw pump**

Exploded-view drawing of the screw pump



Principle of operation of the screw pump



Assembly of the screw pump: assembling the valve piston with the valve spring

**Specification**

- [1] learning concept for maintenance and repair exercises on a screw pump
- [2] three-spindle screw pump with 1 driving spindle and 2 delivery spindles
- [3] integrated pressure limiting valve; at overpressures a portion of the flow is returned to the intake side
- [4] used for media with a kinematic viscosity in the range 2...1500mm<sup>2</sup>/s
- [5] pump parts and tools housed contained in a tool box
- [6] part of the GUNT-Practice Line for assembly, maintenance and repair

**Technical data****Screw pump**

- power consumption: max. 1350W
- max. head: 12bar
- displacement: 13,9cm<sup>3</sup>/spindle revolution
- max. speed: 3600min<sup>-1</sup>
- intake connection: DN25
- delivery connection: DN25
- grey cast iron housing

LxWxH: 690x360x312mm (tool box)  
Weight: approx. 50kg

**Scope of delivery**

- 1 kit
- 1 set of tools
- 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 maintenance and repair processes, suggested exercises; manufacturer's manual

## HL 960 Assembly station pipes and valves and fittings

Pipelines are key components of modern production plants and are used to transport gases and liquids. The main components of pipe systems are pipes, pipe fittings and valves and fittings. In order that pipe systems can work properly, it is necessary to use seals, connecting elements such as flanges, screw connections, sleeves and fastening elements for pipes. Therefore the correct assembly of pipes is an important area of responsibility for future plant technicians. With its assembly station HL 960, GUNT offers a real-scale system from pipeline construction and plant engineering. The assembly station consists of a variety of valves and fittings, pipe elements and tanks as well as seals and fastening components. A U-shaped frame allows variable construction of pipe systems, valves and fittings and functional devices such as pressure vessels.



HL 960 Assembly station  
pipes and valves and fittings



HL 960 Assembly station: pipes  
and valves and fittings



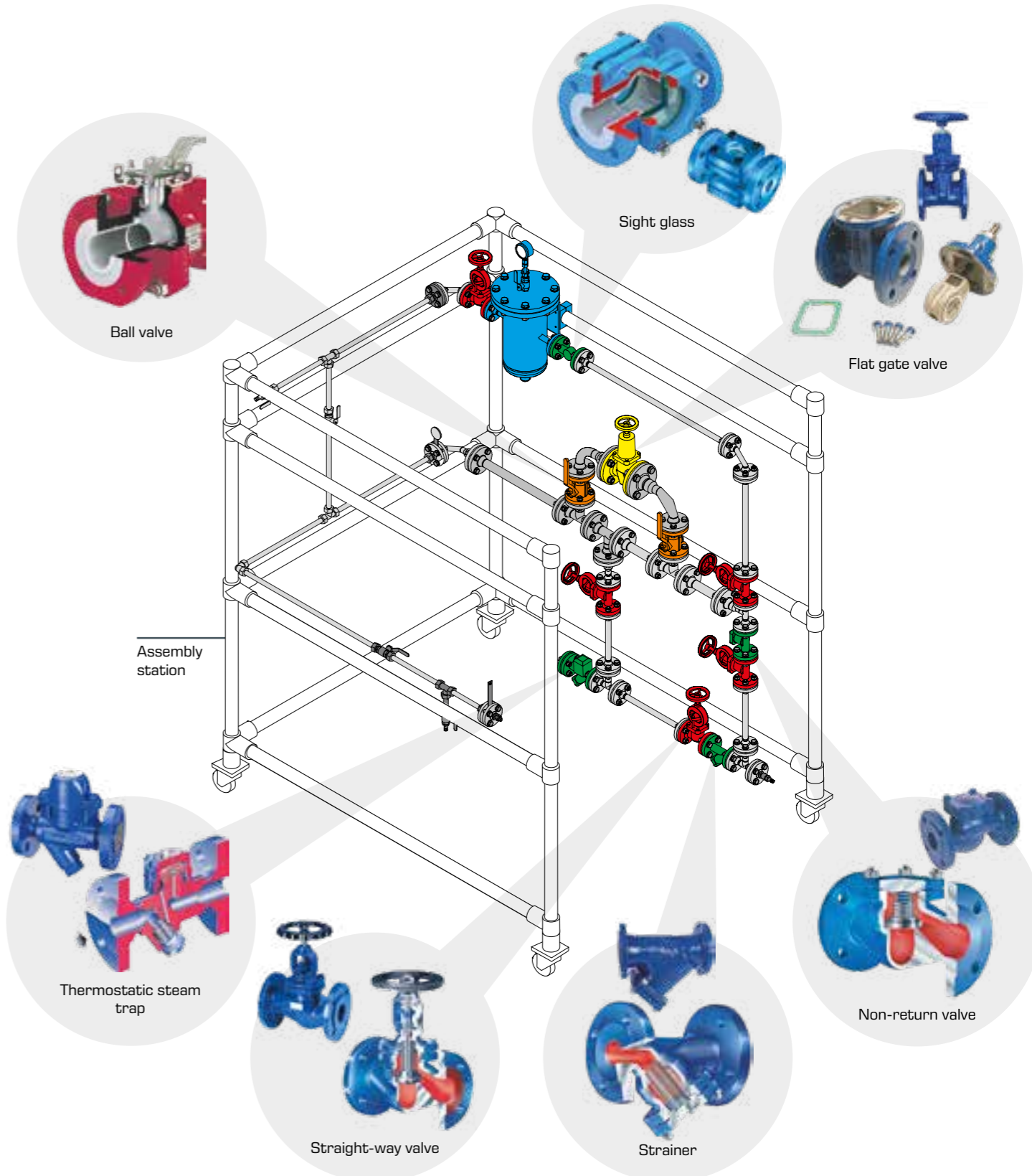
HL 960.01 as closed water circuit



A real functional test can be conducted with the HL 960.01  
trainer after a pipe system has been constructed.

This page shows some of the valves and fittings and pipe elements available for assembly projects. The joints only use removable connectors with seals that are suitable for

multiple use. The pipe elements are ready to install and matched to installation lengths and flange connections.



### Learning objectives /experiments

- basics: familiarisation with individual valves and fittings and pipe elements and understanding of their functions
- design: construct pipe projects on the HL 960 frame according to a pipe routing diagram
- planning and selection: create pipe routing diagrams and parts lists and select individual components for piping projects
- monitoring and evaluation: pre-assembled projects can be subjected to a real test with water; optionally, the HL 960.01 trainer offers a closed water circuit

## HL 960

### Assembly station pipes and valves and fittings



#### Learning objectives/experiments

- design and function of valves and fittings, piping elements and system components
- planning of piping and system installations according to specification, e.g. a process schematic
- selection of components and drafting of requirement lists
- technically correct preparation and execution of system assembly
- reading and understanding engineering drawings and technical documentation
- operational testing of the constructed systems (in conjunction with suitable water supply and disposal)

#### Description

- **practically oriented assembly of real piping and system installations**
- **detailed, practically-based familiarisation with system components**

HL 960 is a practical exercise and training system which provides an entirely authentic introduction to industrial pipes and valves and fittings. The assembly kit comprises a wide variety of valve and fittings, piping elements and one pressure tank, as well as sealing and fastening components. A sturdy U-shaped mounting frame permits assembly of a variety of piping systems, plant components and functional units. The piping elements are prepared ready for assembly, and matched to installation lengths and flange connections. The components permit multiple assembly and disassembly.

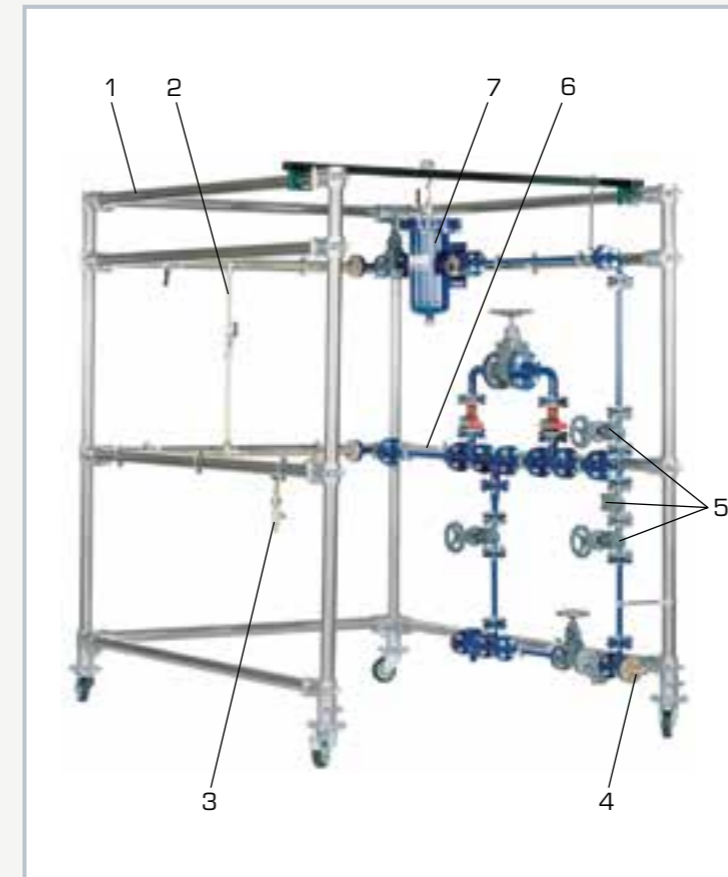
The training system is designed for students to work together in a learning group. The complete process of constructing a system may take several days if all the steps are followed: obtaining information, planning, deciding, executing, checking and assessing.

The detailed instructional material assists in creating an effective and ordered learning process. It contains technical descriptions of all the system components as well as various specimen systems and installations.

Finished setups can be subjected to real testing with water. The pump system HL 960.01 (closed circuit) is available for this purpose.

## HL 960

### Assembly station pipes and valves and fittings



1 mobile frame, 2 DN15 pipe, 3 connection for HL 960.01 (outlet), 4 connection for HL 960.01 (inlet), 5 various valves and fittings, 6 DN25 pipe, 7 pressure vessel with manometer



The picture shows HL 960 with a completed specimen installation. In the foreground: pump system HL 960.01.

#### Specification

- [1] assembly exercise for engineering training
- [2] piping network comprising pipe bends, elbows, T-pieces and transitions in nominal widths DN15, 25, 40
- [3] pipe connections via flanges or cutting ring screw fittings
- [4] standard commercially available flanged fittings: shut-off valve, non-return valve, strainer, condensation drain, inspection glass, ball valve, gate valve
- [5] ball valve with cutting ring screw fitting
- [6] pressure vessel with manometer, connection via DN15 flanges
- [7] connection to water supply via hose with coupling
- [8] mobile frame for mounting of pipe network
- [9] the kit forms part of the GUNT assembly, maintenance and repair practice line

#### Technical data

##### Flange fittings

- grey cast iron
- nominal pressure: PN16 for DN15, 25 / PN10 for DN40

##### Ball valve with cutting ring screw fitting

- brass, nickel-plated
- nominal pressure: PN25
- nominal size: G1/2"

Manometer: 0...4bar

LxWxH: 1540x1840x2020mm

Weight: approx. 300kg

#### Required for operation

Water connection and drain via hoses with couplings

#### Scope of delivery

- 1 frame
- 1 set of valves and fittings, pipes, piping elements with sealing and fastening material
- 1 set of tools
- 1 set of instructions, comprising drawing set and instructional material

**HL 960.01****Assembly and alignment of pumps and drives****Learning objectives/experiments**

- installing a pump in a system
- connecting and aligning motor and pump
- familiarisation with various alignment methods:
  - ▶ straight edge, dial gauges
- familiarisation with key system components
- electrical installation of motor and switching elements
- assembly of pipes and instrumentation
- detail installation on a standard centrifugal pump
- reading and understanding engineering drawings, product documentation and circuit diagrams
- familiarisation with maintenance procedures
- planning assembly and maintenance steps
- in conjunction with HL 960
  - ▶ operational testing in a pipe network

**Description**

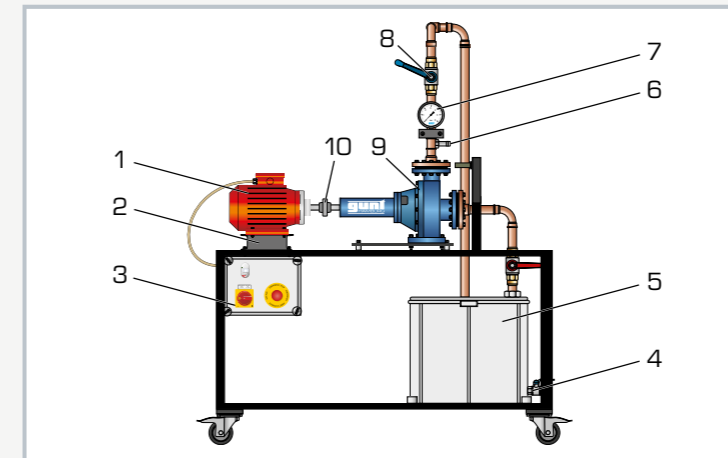
- installing a pump in a system
- alignment of electric motor and pump by different methods

A complete work process when repairing work machines such as pumps consists of the following steps: assembly – alignment – test. The trainer described here was designed with industrial conditions in mind and is primarily intended for the practical training of maintenance engineers. It also offers a variety of topics and starting points for training in vocational schools.

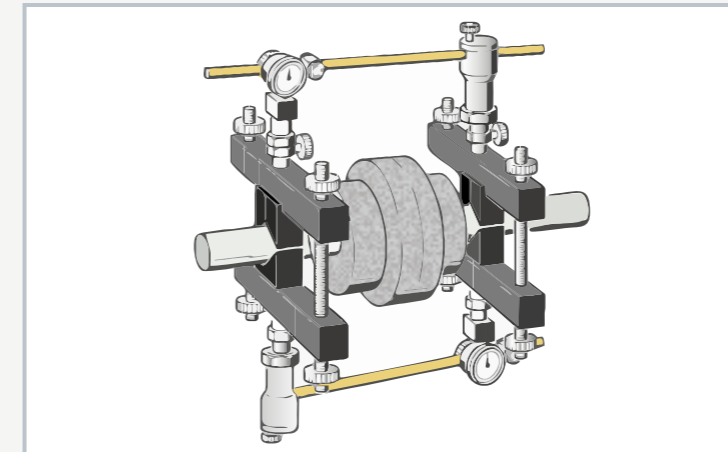
The HL 960.01 trainer enables students to practise the entire maintenance process. On its own, the trainer can be used for assembly exercises with the option of aligning the drive and the pump. Combined with HL 960 Assembly station: pipes and valves and fittings, the HL 960.01 trainer can be used as a test system for the completely assembled piping system.

The trainer consists of an electric drive motor, a standard pump and a piping system with storage tank and can be operated independent of the water supply mains. Students can practise exchanging pumps for inspection or repair as part of the assembly exercise. The exercises cover the entire system and its individual subassemblies. A manometer displays the pressure at the outlet of the pump.

The position of the electric motor can be adjusted in three directions for alignment purposes. The alignment can either be checked in a conventional manner with a straight edge or with the reverse alignment method using two dial gauges. Non-contact, microprocessor-aided methods can also optionally be used (specific alignment systems are not included in the scope of delivery).

**HL 960.01****Assembly and alignment of pumps and drives**

1 electric motor, 2 foundation for electric motor, 3 switch box, 4 HL 960 return connection, 5 storage tank, 6 HL 960 inlet connection, 7 manometer, 8 shut-off valve, 9 pump, 10 coupling



The illustration shows the principle of the dual radial dial gauge method of aligning shafts.

**Specification**

- [1] mobile system for alignment of a standard pump and its drive motor
- [2] asynchronous electric motor with constant speed
- [3] electric motor with positioning frame and fit plates for alignment
- [4] pump and motor connected via coupling
- [5] checking of alignment using straight-edge or dial gauges
- [6] manometer at pump outlet
- [7] pump with ball valves at inlet and outlet
- [8] closed water circuit
- [9] the system forms part of the GUNT assembly, maintenance and repair practice line

**Technical data****Centrifugal pump**

- max. flow rate: 300L/min
- max. head: 16,9m
- power consumption: 750W

**Asynchronous motor, single phase**

- power output: 1100W
- speed: 3000min<sup>-1</sup>

Storage tank: 96L

**Measuring ranges**

- dial gauges: 0...3mm/0...20mm, resolution: 0,01mm
- manometer: 0...1,6bar

230V, 50Hz, 1 phase

230V, 60Hz, 1 phase

LxWxH: 1250x830x1520mm

Weight: approx. 122kg

**Scope of delivery**

- 1 trainer with centrifugal pump and drive
- 1 set of measuring aids, consisting of
  - 2 dial gauges 0...3mm,
  - straight-edge,
  - test shaft for sag measurement,
  - dial gauge with magnetic holder, 0...20mm
- 1 set of tools
- 1 set of instructional material

## Assembly and maintenance exercises pipes, valves, fittings and pumps

**HL 962**  
Assembly stand for pumps



**HL 962.01**  
Standard  
chemical  
pump



**HL 962.02**  
Canned motor pump



**HL 962.03**  
Side channel  
pump



**HL 962.04**  
Standard chemicals  
pump with  
magnetic  
clutch



**HL 962.32** Pipe systems and fittings  
Set of pipes, valves and fittings and connecting elements,  
adapted to the respective order configuration.

**HL 962.30**  
Tank system



### Learning objectives

Familiarisation with plant components:

- different pumps and their drives
- elements of pipeline construction
- valves and fittings, fastening and sealing elements, measuring instruments

Electrical connections of a pump drive plus displays and controls

Alignment of pump and drive motor

Operational measurements in piping and pumping systems

Repair and maintenance tasks and procedures

Reading and understanding technical documents such as:  
drawings, schematics or original operating instructions

Familiarisation with the procedures for commissioning

Repairing machines such as pumps, piping systems and valves and fittings is an important part of the work of maintenance technicians. In particular, the steps are divided into:

- the removal and installation of pumps for inspection, repair or replacement
- aligning the drive
- commissioning and testing the pump, e.g. for leaks

The complete exercise system that allows the individual steps to be practised consists of the following components:

- 1 the assembly stand HL 962 for holding pumps
- 2 a selection of typical centrifugal pumps in process engineering HL 962.01 – HL 962.04
- 3 the tank system HL 962.30
- 4 and the connecting pipes HL 962.32

Several assembly stands with identical or different pumps can be integrated into the training system and expanded to create a network.

The main component of the training system is the assembly stand, which holds the pumps. This assembly stand is prepared for the installation of different centrifugal pumps and provides the drive. Used in conjunction with the tank system and the connecting lines results in a complete system with a closed water circuit.

The training system represents complex project work for training pipeline and plant fitters as well as for service and maintenance mechanics. Several students can cooperate in a small study group. The planning and exercise instruction manuals can take several days to complete. The detailed technical documents provided, in conjunction with the teacher's notes, effectively support the learning process.

