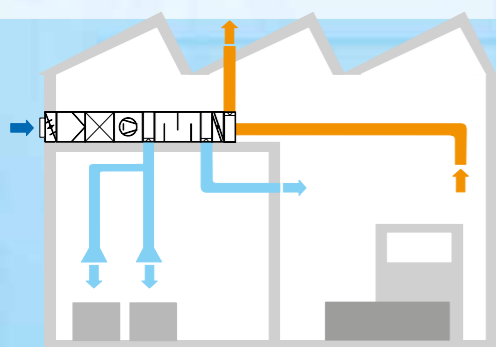


# VENTILATION SYSTEMS AND THEIR COMPONENTS



Ventilation systems supply commercial premises, hospitals, restaurants or conference rooms with outer air. Important for the design of these systems are the characteristic variables of fans and the pressure losses of components, such as air outlets, pipes, bends etc.

GUNT offers in this chapter systems for basic investigations in real components. Different fans, typical components of ventilation systems, a complete ventilation system and an air duct system provide deep insights into the specialist field and a practical training.

Ventilation system in the building:  
blue: inlet air, orange: exhaust air



Ventilation system



Ventilation system on the roof of a building



Ventilation system components

## DETERMINATION OF FAN CHARACTERISTICS WITH THE EXPERIMENTAL UNITS HM 280 AND HM 282

- Examine the dependence of the differential pressure on the flow rate
- Interchangeable impellers with different blade shapes
- Represent measured values and record characteristics with the aid of software



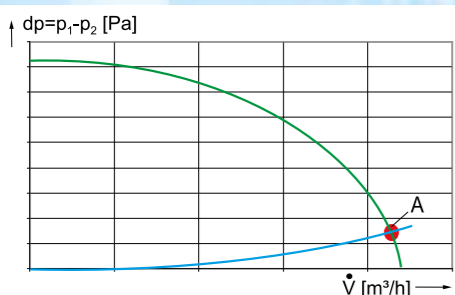
HM 282  
Experiments with an Axial Fan



HM 280 Experiments with a Radial Fan

## REAL COMPONENTS FROM VENTILATION TECHNOLOGY IN THE EXPERIMENT: RADIAL FAN HM 210

- Determine the characteristic variables of a radial fan
- Determine the flow rate through the iris diaphragm or venturi nozzle
- Different fluid column manometers with different measuring ranges for differential pressure measurement



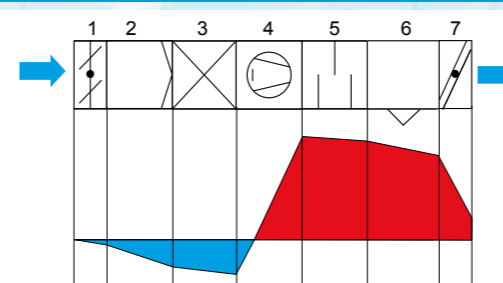
Determination of the operating point:  
green: fan characteristic, blue: system characteristic, A operating point of the system

HM 210  
Characteristic Variables of a Radial Fan



## PRACTICAL EXPERIMENTS WITH COMPLETE VENTILATION SYSTEMS VENTILATION SYSTEM HL 720 AND AIR DUCT SYSTEM HL 710

- Real components from ventilation technology, some with sight windows to observe the components
- Different air outlets for air distribution in rooms
- Measure pressure and differential pressure, represent pressure curve



Pressure curve within the ventilation system  
1 multi-leaf damper, 2 filter, 3 heat exchanger, 4 fan, 5 sound insulation link, 6 wall air outlet, 7 fire protection flap;  
red: overpressure, blue: vacuum



HL 720 Ventilation System



HL 710 Air Duct Systems

- Set-up a variable air duct system from real components
- Investigate pressure loss and determine the operating point of the system
- Carry out ventilation technology measurements

**HM 280 Experiments with a Radial Fan**



**Technical Description**

Radial fans are used to transport gases with non-excessive pressure differences. The medium is drawn in axially to the drive shaft of the radial fan and is deflected by 90° by the rotation of the rotor and discharged radially.

The experimental unit provides the basic experiments to get to know the operating behaviour and the most important characteristic variables of radial fans.

HM 280 features a radial fan with variable speed via a frequency converter, an intake pipe and a delivery pipe. The transparent intake pipe is fitted with guide plates for flow guidance and with a flow straightener to calm the air. This enables precise measurements even with heavily reduced operation. The air flow is adjusted by a throttle valve at the end of the delivery pipe.

To demonstrate the effect of different blade shapes two rotors are included in the scope of delivery: one rotor with forward curved blades and one with backward curved blades. The rotors are easily interchangeable.

The experimental unit is fitted with sensors for pressure and temperature. The flow rate is determined via differential pressure measurement on the intake nozzle.

The microprocessor-based measuring technique is well protected in the housing. All the advantages of software-supported experiments and evaluation are offered by the GUNT software and the microprocessor. The connection to a PC is made by USB.

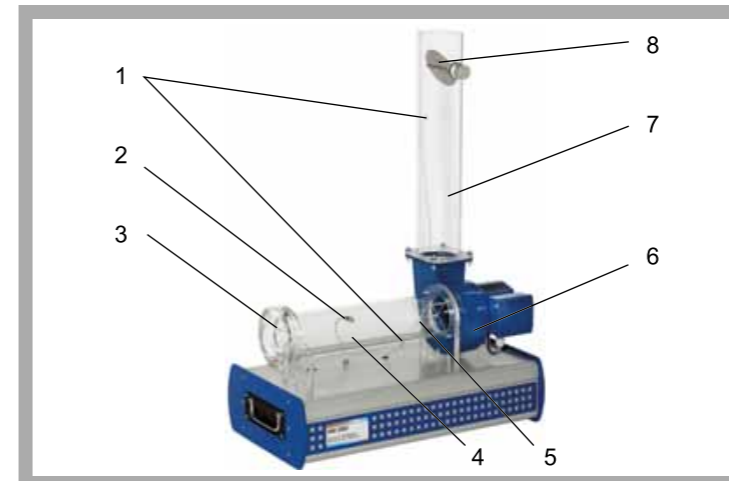
The well-structured instructional material sets out the fundamentals and provides a step-by-step guide through the experiments.

**Learning Objectives / Experiments**

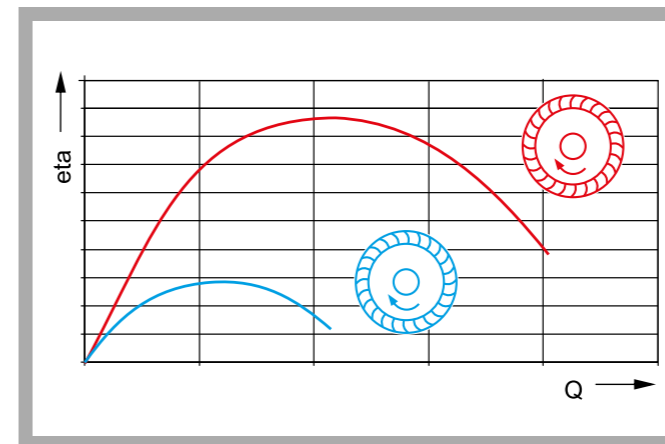
- operating behaviour and characteristic variables of a radial fan
- recording the fan characteristic (differential pressure as a function of the flow rate)
- effect of the rotor speed on the pressure
- effect of the rotor speed on the flow rate
- effect of different rotor shapes on the fan characteristic and efficiency
- determination of hydraulic power output and efficiencies

- \* 2 interchangeable rotors
- \* Transparent delivery pipe and intake pipe
- \* GUNT software for data acquisition, visualisation and operation
- \* Part of the GUNT Labline fluid energy machines

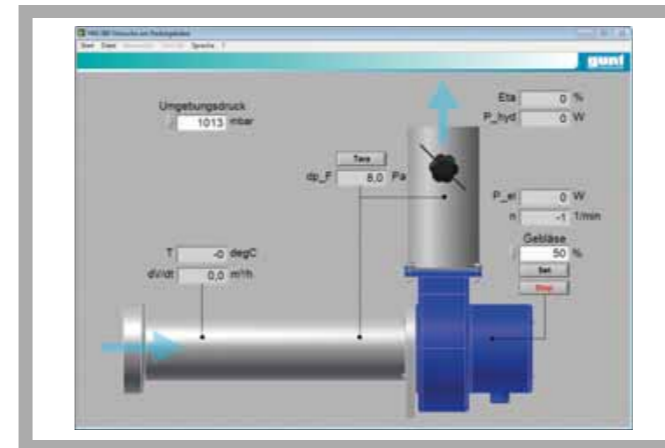
**HM 280 Experiments with a Radial Fan**



1 measuring points for pressure, 2 measuring point for temperature, 3 inlet nozzle with measuring point for static pressure, 4 intake pipe, 5 guide plates, 6 radial fan with drive motor, 7 delivery pipe, 8 throttle valve



Efficiencies in comparison; red: rotor with forward curved blades, blue: rotor with backward curved blades; eta efficiency, Q débit



Operating interface of the powerful software

**Specification**

- [1] functioning and operating behaviour of a radial fan
- [2] radial fan with 3-phase AC motor
- [3] variable speed via frequency converter
- [4] transparent intake and delivery pipes
- [5] throttle valve to adjust the air flow in the delivery pipe
- [6] interchangeable rotors: 1 rotor with forward curved blades and 1 rotor with backward curved blades
- [7] determination of flow rate via intake nozzle
- [8] display of differential pressure, flow rate, speed, electrical power consumption and hydraulic power output, temperature and efficiency
- [9] microprocessor-based measuring technique
- [10] unit-specific GUNT software for data acquisition and operation via USB under Windows Vista or Windows 7

**Technical Data**

- Intake pipe
  - inner diameter: 90mm
  - length: 430mm
- Delivery pipe
  - inner diameter: 100mm
  - length: 530mm
- Radial fan
  - power consumption: 110W
  - nominal speed: 2800min<sup>-1</sup>
  - max. flow rate: 480m<sup>3</sup>/h
  - max. differential pressure: 300Pa

- Displayed / measuring ranges
- differential pressure: 0...1800Pa
  - flow rate: 0...1000m<sup>3</sup>/h
  - temperature: 0...100°C
  - speed: 0...3300min<sup>-1</sup>
  - electrical power consumption: 0...250W

**Dimensions and Weight**

- LxWxH: 670x340x940mm
- Weight: approx. 20kg

**Required for Operation**

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

**Scope of Delivery**

- 1 experimental unit
- 2 rotors
- 1 GUNT software CD + USB cable
- 1 set of instructional material

**Order Details**

070.28000 HM 280 Experiments with a Radial Fan

**HM 282 Experiments with an Axial Fan**



- \* Illustrative model of an axial fan
- \* Transparent delivery pipe and intake pipe
- \* GUNT software for data acquisition, visualisation and operation
- \* Part of the GUNT Labline fluid energy machines

**Technical Description**

Axial fans are used to transport gases. The medium to be transported is drawn in axially to the drive shaft of the axial fan by the rotation of the rotor. The medium flows through the rotor and is discharged axially behind the rotor.

The experimental unit provides the basic experiments to get to know the operating behaviour and the important characteristic variables of axial fans.

HM 282 features an axial fan with variable speed via an integrated controller, an intake pipe and a delivery pipe. The transparent intake and delivery pipes are fitted with guide plates for flow guidance. A flow straightener in the intake pipe serves to calm the air. This enables precise measurements even with heavily reduced operation. The air flow is adjusted by a throttle valve at the end of the delivery pipe.

The experimental unit is fitted with sensors for pressure and temperature. The flow rate is determined via differential pressure measurement on the intake nozzle.

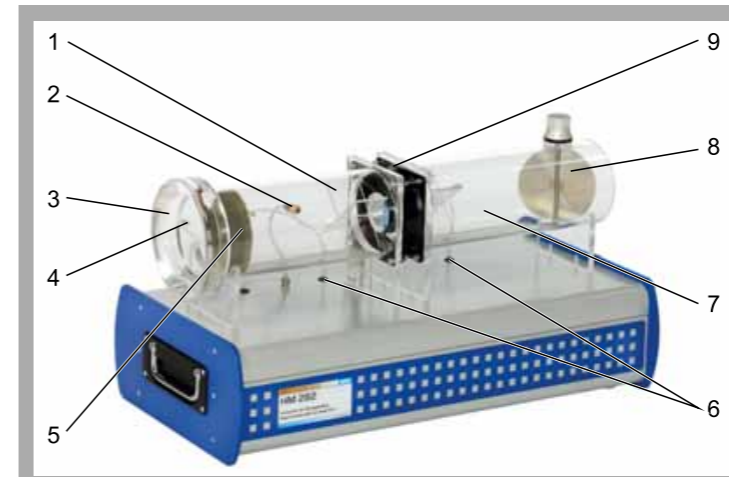
The microprocessor-based measuring technique is well protected in the housing. All the advantages of software-supported experiments and evaluation are offered by the GUNT software and the microprocessor. The connection to a PC is made by USB.

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

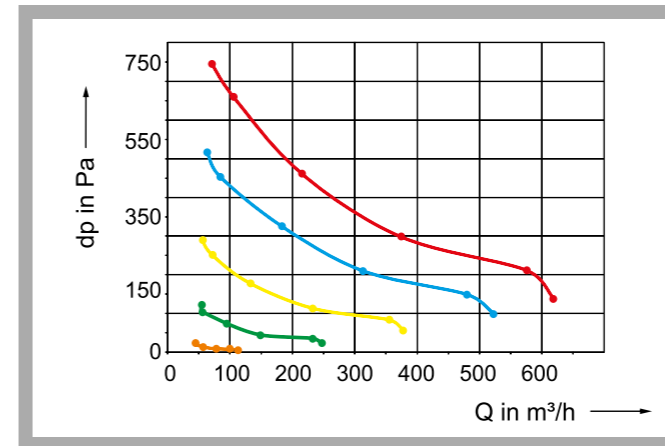
**Learning Objectives / Experiments**

- operating behaviour and characteristic variables of an axial fan
- recording the fan characteristic (differential pressure as a function of the flow rate)
- effect of the rotor speed on the pressure
- effect of the rotor speed on the flow rate
- stall
- determination of hydraulic power output and efficiencies

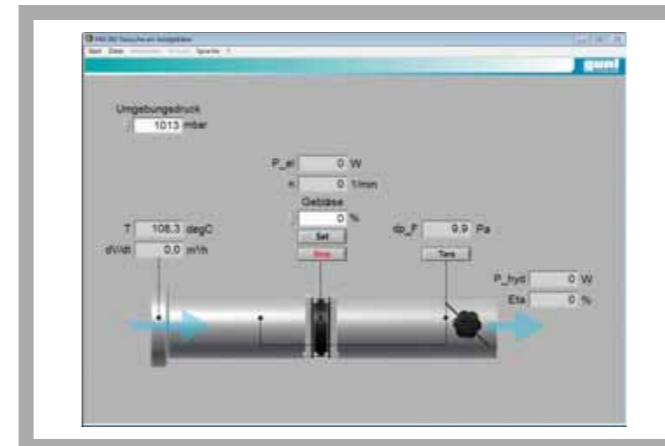
**HM 282 Experiments with an Axial Fan**



1 guide plates for flow guidance, 2 measuring point for temperature, 3 intake nozzle at intake pipe, 4 measuring point for pressure (to determine the flow rate), 5 flow straightener, 6 measuring points for pressure, 7 delivery pipe, 8 throttle valve, 9 axial fan



Characteristic curves for an axial fan: differential pressure dependent on the flow rate at different speeds; pd differential pressure, Q flow rate



Operating interface of the powerful software

**Specification**

- [1] functioning and operating behaviour of an axial fan
- [2] axial fan with electronically commutated drive motor
- [3] variable speed via integrated controller
- [4] transparent intake and delivery pipes
- [5] throttle valve to adjust the air flow in the delivery pipe
- [6] determination of flow rate via intake nozzle
- [7] display of differential pressure, flow rate, speed, electrical power consumption and hydraulic power output, temperature and efficiency
- [8] microprocessor-based measuring technique
- [9] unit-specific GUNT software for data acquisition and operation via USB under Windows Vista or Windows 7

**Technical Data**

- Intake pipe
- inner diameter: 110mm
  - length: 275mm
- Delivery pipe
- inner diameter: 110mm
  - length: 310mm
- Axial fan
- power consumption: 90W
  - nominal speed: 9500min<sup>-1</sup>
  - max. flow rate: approx. 600m³/h
  - max. differential pressure: approx. 700Pa

- Displayed / measuring ranges
- differential pressure: 0...1800Pa
  - flow rate: 0...1000m³/h
  - temperature: 0...100°C
  - speed: 0...3000min<sup>-1</sup>
  - electrical power consumption: 0...500W

**Dimensions and Weight**

- LxWxH: 670x340x370mm
- Weight: approx. 20kg

**Required for Operation**

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

**Scope of Delivery**

- 1 experimental unit
- 1 GUNT software CD + USB cable
- 1 set of instructional material

**Order Details**

070.28200 HM 282 Experiments with an Axial Fan

**HM 210 Characteristic Variables of a Radial Fan**



**Technical Description**

Fans are key components of ventilation systems, providing ventilation, cooling, drying or pneumatic transport. For optimum design of such systems, it is important to know the characteristic variables of a fan.

HM 210 investigates a radial fan. This trainer determines the interdependencies between the delivery pressure and volumetric flow rate as well as the influence of the fan speed on the delivery pressure and volumetric flow rate.

The radial fan aspirates the air in axially from the surrounding environment. The high-speed rotating rotor accelerates the air outwards. The high velocity at the outlet from the rotor is partially converted into pressure energy in the spiral housing. The vertical pipe section is connected to the spiral housing. A Venturi nozzle to measure the volumetric flow rate and a throttle valve to adjust the volumetric flow rate are inserted into the pipe section. An iris diaphragm can optionally be used. Its variable cross-section enables simultaneous adjustment and determination of the volumetric flow rate. The effective pressures to calculate the volumetric flow rate are read from liquid column manometers. The delivery pressure of the radial fan is likewise measured by liquid column manometers. U-tube manometer, single tube manometer and inclined tube manometer with graduated measuring ranges are available.

A frequency converter is used to adjust the fan speed. The speed, torque and electric power capacity are digitally displayed. This permits energy analyses, and enables the efficiency of the fan to be determined.

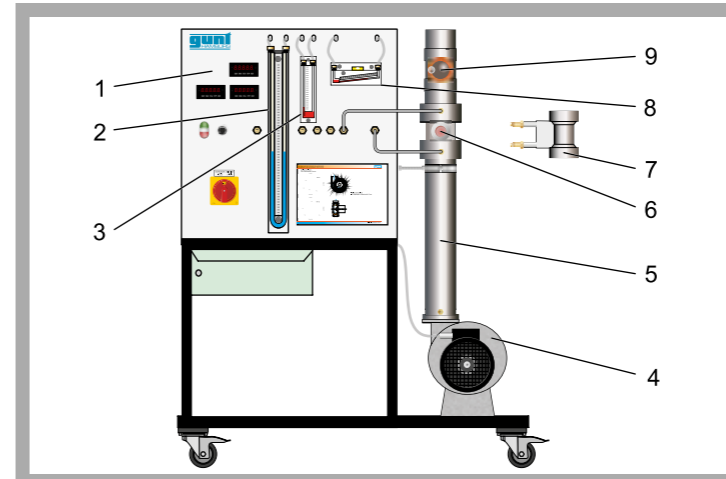
The system characteristic curve is determined by recording the characteristic variables at a constant throttle setting but at variable speed. The interaction of the fan and system at the operation point – the so-called system dimensioning – is investigated.

**Learning Objectives / Experiments**

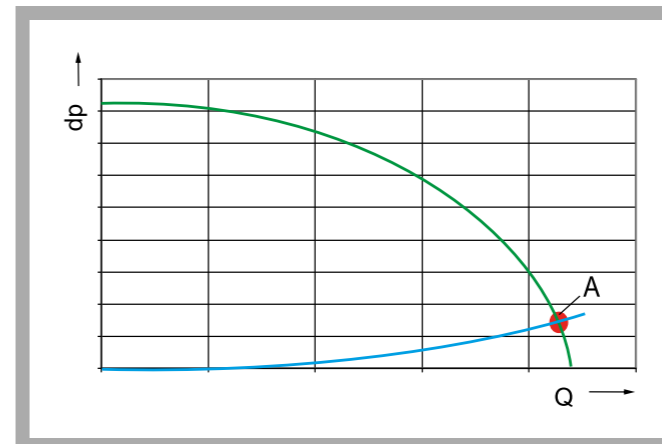
- set-up and principle of a radial fan
- plotting fan and system characteristics
- volumetric flow rate measurement methods based on the differential pressure method using:
  - \* iris diaphragm
  - \* Venturi nozzle
  - \* comparison of both measurement methods
- familiarisation with various differential pressure gauges
- determining efficiency

- \* Investigation of a radial fan and determination of characteristic variables
- \* Determination of volumetric flow rate via iris diaphragm or Venturi nozzle
- \* Different liquid column manometers measure the differential pressure with varying accuracy
- \* Well-structured instructional material

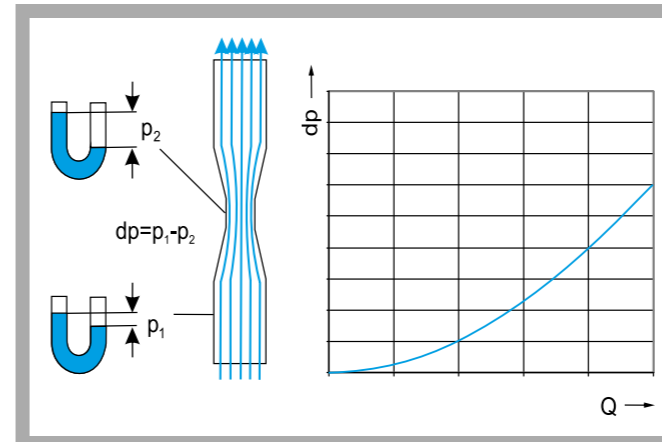
**HM 210 Characteristic Variables of a Radial Fan**



1 switch cabinet with display elements, 2 U-tube manometer, 3 single tube manometer, 4 radial fan with air intake, 5 pipe section, 6 iris diaphragm, 7 Venturi nozzle, 8 inclined tube manometer, 9 throttle valve



Green: fan characteristic; blue: system characteristic; A, red: system operation point



Air flow in the Venturi nozzle;  $p_1, p_2$  pressure measuring points; graph: differential pressure  $dp$  as function of volumetric flow rate  $Q$

**Specification**

- [1] radial fan as turbomachine
- [2] iris diaphragm or Venturi nozzle to determine volumetric flow rate via the differential pressure
- [3] speed adjustment by frequency converter
- [4] U-tube manometer, single tube manometer and inclined tube manometer measure the differential pressure
- [5] air flow rate in pipe section adjustable by throttle valve
- [6] speed, torque and electric power capacity digitally displayed

**Technical Data**

- Radial fan
- max. power consumption: 370W
  - max. pressure difference: 860Pa
  - max. flow rate:  $4\text{m}^3/\text{min}$
  - nominal speed:  $3000\text{min}^{-1}$
  - speed range:  $1000\text{...}3000\text{min}^{-1}$

- Iris diaphragm adjustable in 6 stages
- diameter:  $40\text{...}70\text{mm}$
  - $K=1,8\text{...}7,8$
- Venturi nozzle
- air inlet diameter:  $100\text{mm}$
  - pipe neck diameter:  $80\text{mm}$
  - $K_v=7,32$

- Pressure measuring ranges
- U-tube manometer:  $30\text{...}0\text{...}30\text{mbar}$
  - single tube manometer:  $0\text{...}15\text{mbar}$
  - inclined tube manometer:  $0\text{...}50\text{Pa}$

**Dimensions and Weight**

LxWxH:  $1300\text{x}720\text{x}1500\text{mm}$   
Weight: approx.  $111\text{kg}$

**Required for Operation**

$230\text{V}, 50/60\text{Hz}, 1$  phase or  $230\text{V}, 60\text{Hz}, 3$  phases

**Scope of Delivery**

- 1 trainer
- 1 set of instructional material

**Order Details**

070.21000 HM 210 Characteristic Variables of a Radial Fan

# HM 220 AIR FLOW EXPERIMENTAL PLANT

In practice, when designing turbomachines or pipe systems it is important to know the flow course and the corresponding pressure and velocity distribution. The experimental plant HM 220, together with the extensive range of accessories, offers a variety of fluid mechanics experiments.

The illustrative experiments provide an in-depth understanding and knowledge of the physical laws of steady flows. The experiments impart knowledge about determining the flow course, pressure distribution and velocity profiles.



- use of various pipe elements
- adjustment of the air flow through a frequency converter
- up to 20 pressure measuring points
- calculation of the volume flow and the flow rate from the measurement results
- representation of system characteristics
- recording the different velocity profiles in both the free jet and the pipe cross-section
- representation of the increase in pressure loss due to pipe friction at different pipe elements
- optimal formation of the air flow due to a low-loss inlet and the large length of the pipe section

## THE HM 220 EXPERIMENTAL PLANT ALLOWS AN EXTENSIVE RANGE OF EXPERIMENTS WITH THE VARIED ACCESSORIES:

Measuring and investigating the air flow via a Pitot tube	Boundary layer measurements on a flat plate in longitudinal flow via a Pitot tube (HM 220.02 accessory)	Change in volume flow	Measurement and investigation of air flow	in a free jet	within a pipe	in an orifice plate or nozzle	in an iris diaphragm	via a Venturi tube (accessory HM 220.01)	in different pipe fittings	
Velocity profile $v$ in the air outlet jet	Velocity profile $v$ along the pipe cross-section $s_y$	Velocity distribution (green) and boundary layer thickness (blue)	Comparison of the change in volume flow $Q$ through an orifice plate $A$ or nozzle $B$	Velocity profile (red) along the contraction in cross-section (green)	Investigation of pipe friction losses in pipe bend (green), segment bend (purple), pipe angle (orange)					

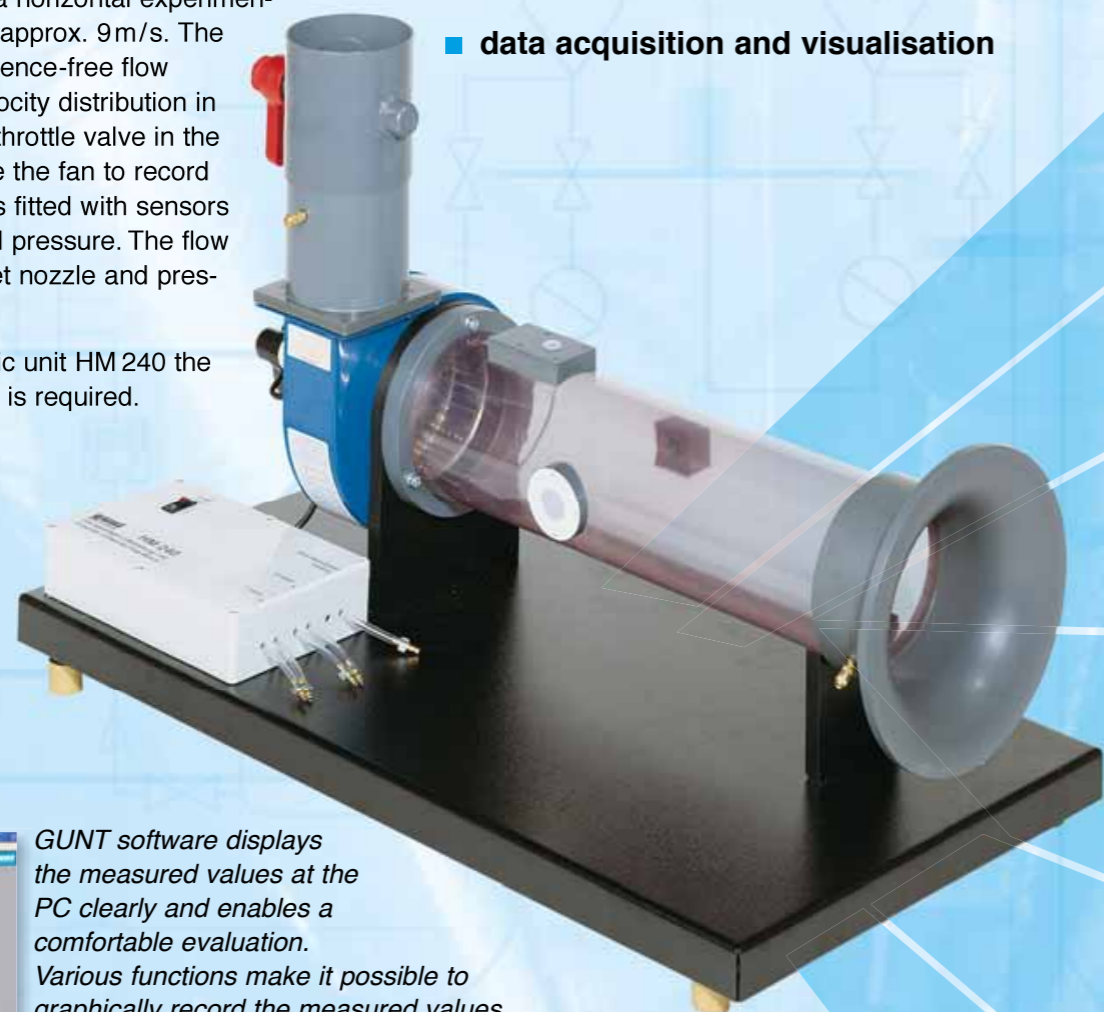
# HM 240 PRINCIPLES OF AIR FLOW

The HM 240 base unit allows experiments on a radial fan. The unit can be used in conjunction with the extensive range of accessories to open up a large number of additional experiments on the topic of air flow.

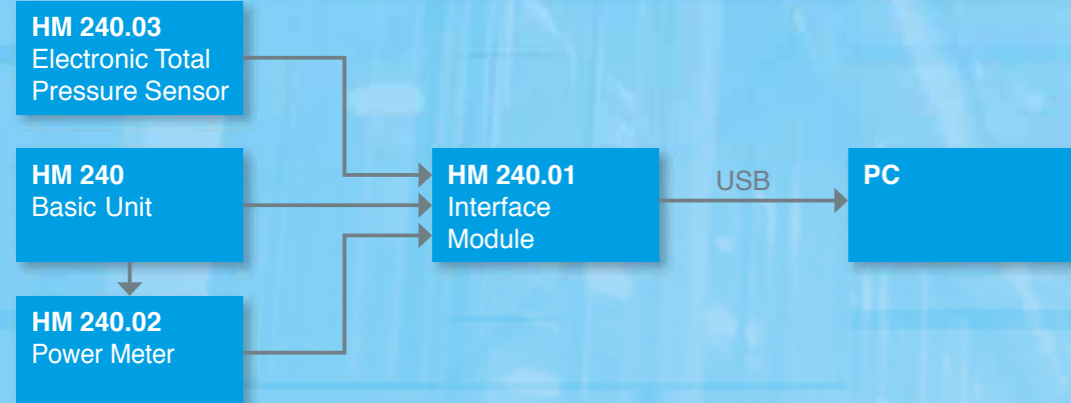
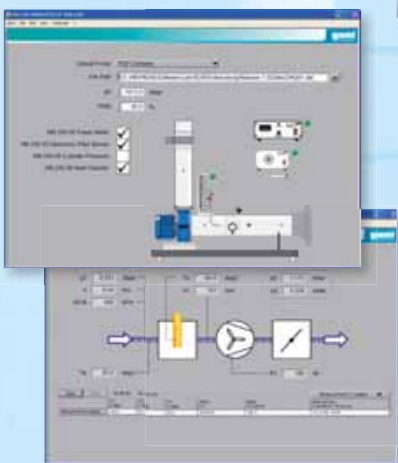
The radial fan generates in a horizontal experimental section a flow velocity of approx. 9m/s. The inlet nozzle ensures a turbulence-free flow and thus a homogenous velocity distribution in the experimental section. A throttle valve in the outlet can be used to throttle the fan to record characteristics. The device is fitted with sensors to measure temperature and pressure. The flow rate is determined by an inlet nozzle and pressure measurement.

For the operation of the basic unit HM 240 the interface module HM 240.01 is required.

- modular system for experiments with air flows
- numerous experiments from fan-characteristic to heat transfer
- data acquisition and visualisation



GUNT software displays the measured values at the PC clearly and enables a comfortable evaluation. Various functions make it possible to graphically record the measured values and to store the results.



Concept of the data acquisition HM 240 in the example "velocity distribution in the intake pipe"

## BASE UNIT AND ACCESSORIES ENABLE A VARIETY OF FLUID MECHANICS AND THERMODYNAMIC EXPERIMENTS



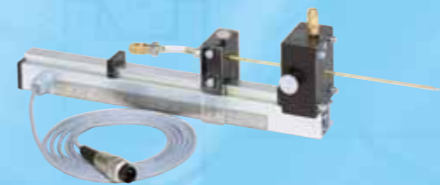
### HM 240.01 Interface Module

- digitisation of measurement data
- PC connection via USB



### HM 240.02 Power Meter

- measurement of the electrical fan power
- output signals fed to interface module HM 240.01
- determination of the fan efficiency



### HM 240.03 Electronic Total Pressure Sensor

- movable Pitot tube
- electronic record of the position fed to the interface module HM 240.01
- pressure transducer in the base unit
- investigation of flow fields and recording of flow profiles



### HM 240.04 Pressure Distribution on a Cylinder

The cylinder can be rotated about its axis and includes a pressure measurement hole. It is inserted transverse to the direction of flow so that air flow circulates around the cylinder. Thus the complete pressure distribution can be measured by rotating the cylinder. The angular position is measured and fed into the interface module of HM 240.01. The pressure transducer is located in the base unit.



### HM 240.05 Friction Losses in Pipe Elements

The set consists of a smooth pipe section with extension, two different inlets and two different 90° deflections. All parts are fitted with pressure measurement ports so that the pressures can be measured along the pipe section. From this the friction losses for the different components can be determined.

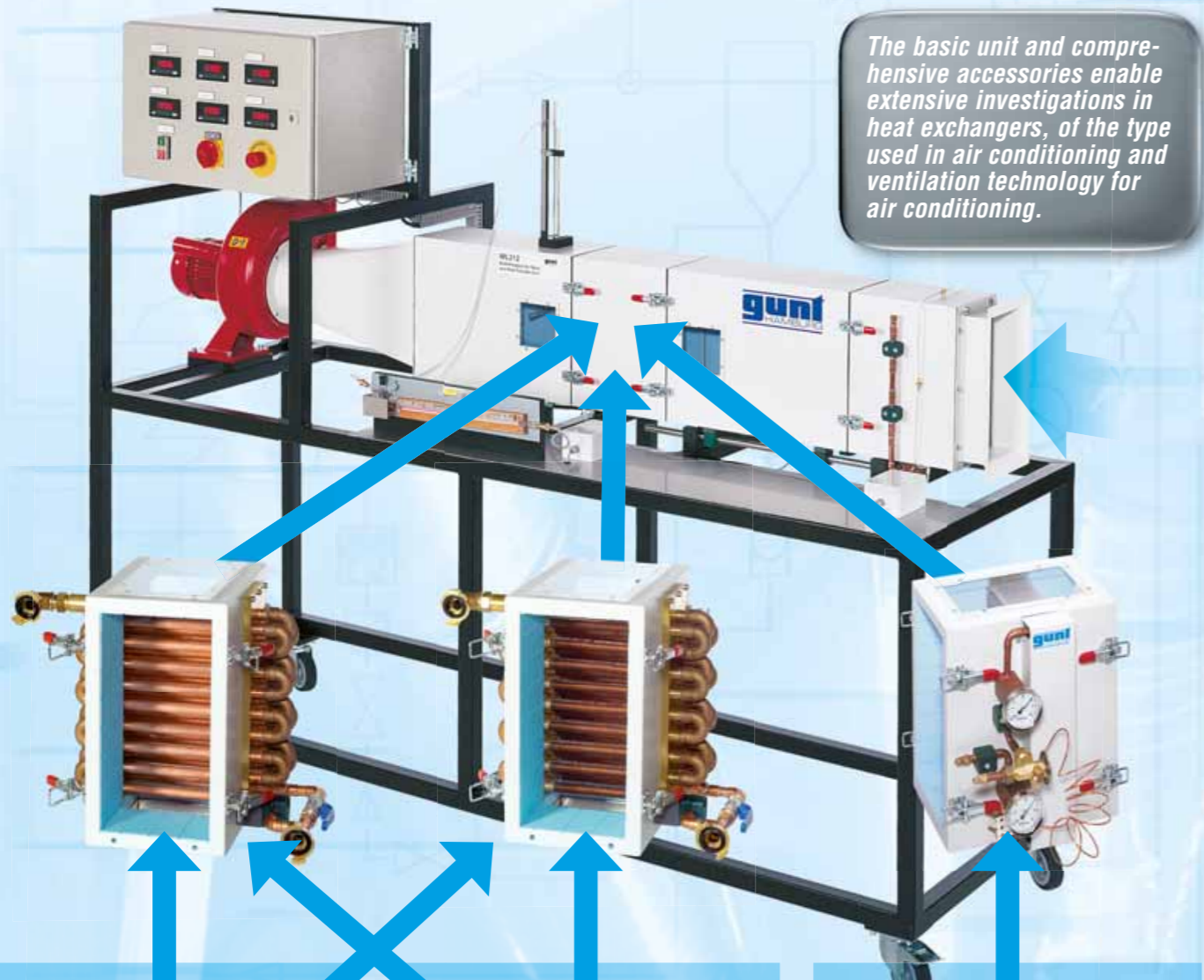


### HM 240.06 Heat Transfer at a Cylinder in Transverse Flow

The accessory consists of a copper cylindrical test piece and an electric heater for the test piece. The test piece is fitted with a temperature measurement point. It is heated to a defined temperature prior to the experiment and then inserted into the flow section. The cooling process occurs by forced convection in the air flow. The heat transfer on the test piece can be determined from the cooling rate. The temperature signal is fed into the interface module of HM 240.01

# WL 312 MULTIPURPOSE AIR DUCT AND HEAT TRANSFER UNIT

*The basic unit and comprehensive accessories enable extensive investigations in heat exchangers, of the type used in air conditioning and ventilation technology for air conditioning.*



- Investigation of the heat transfer in heat exchangers from air conditioning and ventilation technology
- Temperature and humidity measuring instruments record the condition of the air
- Coolers and the additional humidification option (steam humidifier WL 312.12) also enable the investigation of dehumidification and humidification processes. Thus all changes of state occurring in an air conditioning system can be implemented.
- Flow conditions on the air side can be examined using a movable pitot sensor and inclined tube manometer. The pressure losses can also be determined.
- The air velocity can be adjusted via a throttle valve within generous limits
- Optional hot and cold water supply (WL 312.10, WL 312.11) allow an operation independent of the water mains
- Optional refrigerant condensing unit WL 312.12 for the use of the direct evaporator WL 312.03

## DIFFERENT HEAT EXCHANGERS

**WL 312.01 Heat Exchanger Element Plain Tubes**

This water-to-air heat exchanger is inserted into the duct section of WL 312 and fastened using fasteners. It is supplied with hot or cold water via hoses with quick-release couplings. The pipe bundle consists of smooth pipes. Transparent covers allow insights even when the heat exchanger is installed.

For the supply the modules WL 312.10 or WL 312.11 can be used.

**WL 312.02 Heat Exchanger Element Finned Tubes**

This water-to-air heat exchanger is inserted into the duct section of WL 312 and fastened using fasteners. It is supplied with hot or cold water via hoses with quick-release couplings. The pipe bundle consists of finned tubes which are often used in water-to-air heat exchangers. Transparent covers allow insights even when the heat exchanger is installed.

For the supply the modules WL 312.10 or WL 312.11 can also be used here.

**WL 312.03 Heat Exchanger Element Direct Expansion Coil**

This so-called direct evaporator is inserted into the duct section of WL 312 and fastened using fasteners. It is connected to the refrigerant evaporator set WL 312.12 with hoses and special couplings.

In the pipes the refrigerant evaporates and withdraws heat from the air. The pipes are finned to increase the surface. Here too, transparent covers provide insights.

For the supply the accessory WL 312.12 is required.



**WL 312.11 Cold Water Bench**  
This allows for the supply of the heat exchangers WL 312.01 and WL 312.02. The heat exchangers then operate as air coolers.



**WL 312.10 Hot Water Bench**  
This also allows for the supply of the heat exchangers WL 312.01 and WL 312.02. The heat exchangers then operate as air heaters.



**WL 312.12 Condensing Unit**  
Used to operate the direct evaporator WL 312.03 for air cooling. At the same time it includes a steam generator to supply the air humidifier in the basic unit.

# HL 710 PLANNING AND SET-UP OF AIR DUCT SYSTEMS



## AIR DUCT SYSTEMS WITH TYPICAL COMPONENTS FROM VENTILATION TECHNOLOGY: SET-UP AND EXPERIMENTS

### The components



Pipe bends



Reduction (left) and connection elements



Branches



Throttle valve (left) and iris diaphragm (right)



Disc valve (left) and slotted vent (right)



Filter

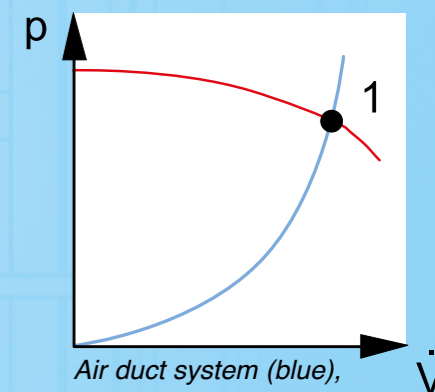
### The experiments

In the air duct system several components with measuring points for pressure measurements are installed. With an inclined tube and a digital manometer the static and dynamic pressure can be measured at these points. This allows a determination of the pressure losses of the individual components in the whole air duct system.

With the anemometer the air velocities and air flows are measured at the outlets of the system. The measured values are used to generate the system and fan characteristics. From the characteristics the operating point is determined.



1 digital manometer, 2 inclined tube manometer, 3 anemometer

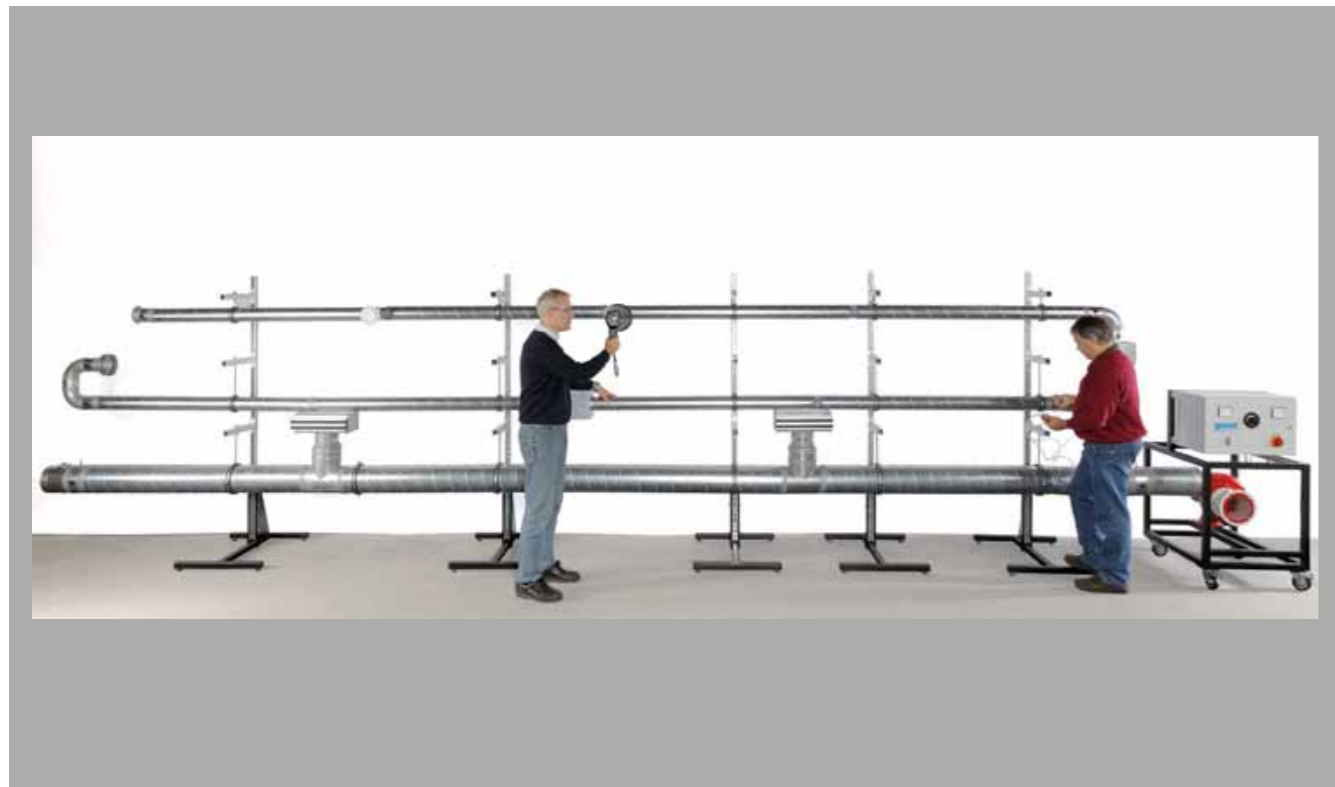


Air duct system (blue), fan characteristic (red), 1 operating point



Measuring points for static and dynamic pressure

**HL 710 Air Duct Systems**



- \* **Planning and set-up of simple and complex air duct systems**
- \* **Measurement of the dynamic and static pressures in air duct systems**
- \* **Measurement of the air velocity and volumetric flow rate under different conditions**

**Technical Description**

Ventilation systems are used in many areas. They are used to ventilate offices, sports halls, production halls, conference halls etc. These systems consist of an air duct system and often other facilities for the conditioning of room air. There may also be elements for air purification or sound insulation, e.g. filters.

The trainer HL 710 examines how the air can be distributed in a building. The air duct system is supplied via a speed-controlled fan. The trainee constructs variable air duct systems from commercial components, such as pipes, pipe bends, branches, filters and disk valves. Connections for pressure measurements can be installed at any position.

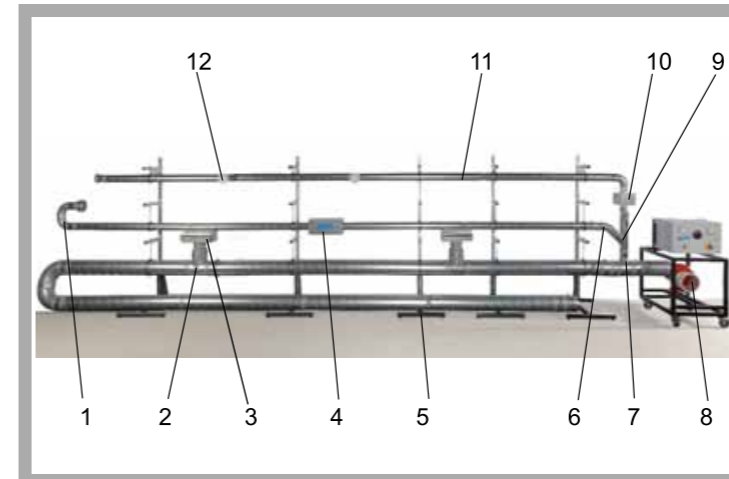
The effects of the individual components on the pressure loss and thus on the velocity and flow rate of the air are examined. For this purpose there are two manometers with different measuring ranges and a manual device for measuring the air velocity. The fan characteristic is also determined. To determine the power consumption of the fan there are a voltmeter and an ammeter.

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

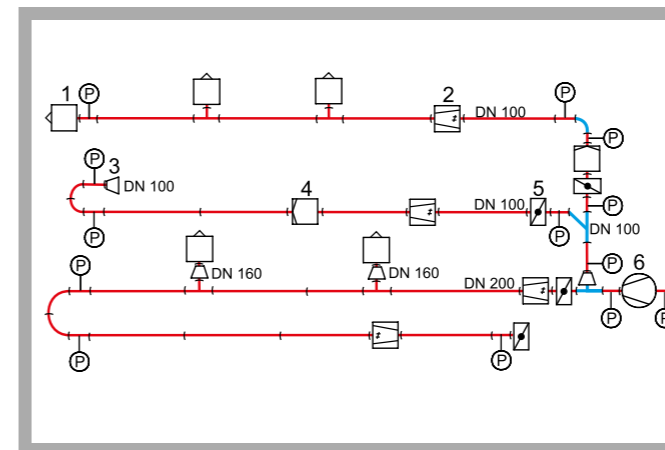
**Learning Objectives / Experiments**

- plan, set-up and test air duct systems
- typical components of ventilation technology
- measure the flow rate and velocity of the air
- measure dynamic and static pressures
- determination of the pressure loss via different components: pipe bends, angles, distributors etc.
- recording of system characteristics
- recording of the fan characteristic
- determination of the operating point
- calculate the electric capacity of the fan motor with regard to current and voltage
- calculate the fan efficiency

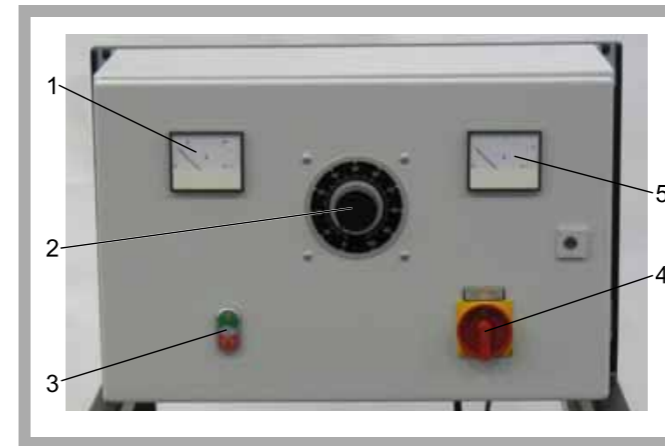
**HL 710 Air Duct Systems**



1 90° pipe bend, 2 reducer, 3 slotted outlet, 4 pocket filter, 5 assembly stand, 6 45° pipe bend, 7 T piece, 8 fan, 9 branch, 10 filter cartridge, 11 iris diaphragm, 12 disk valve



Pipe routing diagram: 1 inlet air or disk valve, 2 iris diaphragm, 3 reducer, 4 filter, 5 throttle valve, 6 fan; P pressure measuring point; blue: pipe bends and joints



1 voltmeter, 2 fan speed adjustment, 3 fan on/off switch, 4 main switch, 5 ammeter

**Specification**

- [1] experimental set-up for training in ventilation engineering
- [2] radial fan, on mobile frame, to connect air ducts
- [3] air ducts from galvanised folded spiral-seam pipe with pipe bends, joints and components
- [4] pressure measuring connections with variable locations
- [5] 5 assembly stands to attach the air ducts
- [6] inclined tube manometer and digital manometer for 2 different measuring ranges
- [7] measuring of the air velocity by anemometer
- [8] switch cabinet with display of current and voltage

**Technical Data**

- Fan**
- power consumption: 1100W
  - max. flow rate: 1680m³/h
  - max. differential pressure: 1000Pa
  - speed: 0...2800min<sup>-1</sup>
- Pipes**
- length: 1600mm
  - diameter: 8x DN200, 8x DN100
- Pipe bends and connections, each DN100 and DN200**
- 90° pipe bend, 45° pipe bend
  - 45° branch
  - T piece, T piece with reducer
  - reducer, plug-in connection, pipe coupling
- Flow restriction elements, each DN100 and DN200**
- throttle valve
  - iris diaphragm
- Filters, each DN100 and DN200**
- pocket filter
  - filter cartridge

**Measuring ranges**

- pressure: 0...200Pa / 0...2000Pa
- velocity: 0.25...30m/s
- current: 0...10A
- voltage: 0...230V

**Dimensions and Weight**

- LxWxH: 1700x650x1400mm (fan)
- Weight: approx. 70kg

**Required for Operation**

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

**Scope of Delivery**

- 1 radial fan on mobile frame
- 5 assembly stands
- 1 set of pipes, pipe bends, connections, components (outlets, filters etc.)
- 1 inclined tube manometer, 1 digital manometer
- 1 anemometer
- 1 set of instructional material

**Order Details**

065.71000 HL 710 Air Duct Systems

**HL 720 Ventilation System**



**Technical Description**

In building services engineering ventilation systems are used for commercial premises, hospitals, restaurants or conference rooms to ensure the change of air exchange in the individual rooms. The air is heated or cooled by a heat exchanger.

HL 720 demonstrates the operation of a ventilation system and its components. The components used are common in commercial ventilation technology and therefore are of high practical relevance. The ventilation system is operated as a pure air supply system.

The air enters via a weather louvre and flows through the components of the ventilation system, such as multi-leaf damper and filter. Dependent on the operating mode, heating or cooling, the aspirated air is then heated or cooled in a heat exchanger. The heat exchanger is supplied from the laboratory. A fan ensures the air transport. Further down the air duct, typical components, such as sound insulation link, inspection flap, various air outlets and fire protection flap are arranged.

Sight windows enable an insight into the sound insulation link, filter and fan. The original component function remains intact.

The record of pressures and differential pressures at relevant measuring points enables the representation of a pressure curve for the whole system. The electric drive power of the fan and the volumetric air flow rate are calculated.

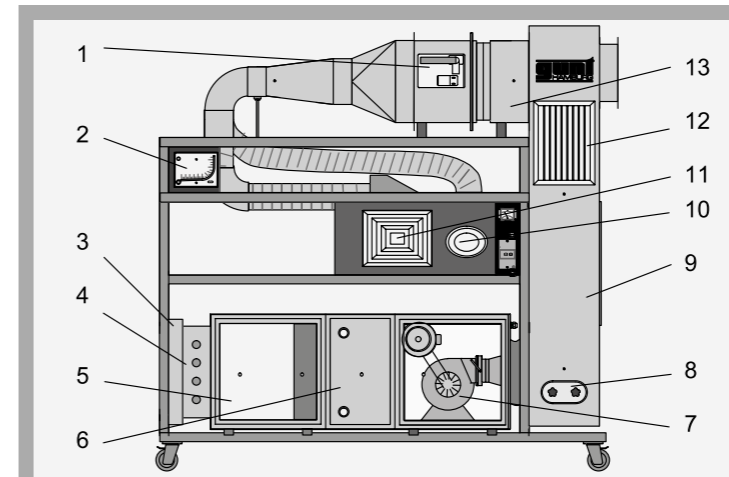
The well-structured instructional material sets out the fundamentals and provides a step-by-step guide through the experiments.

**Learning Objectives / Experiments**

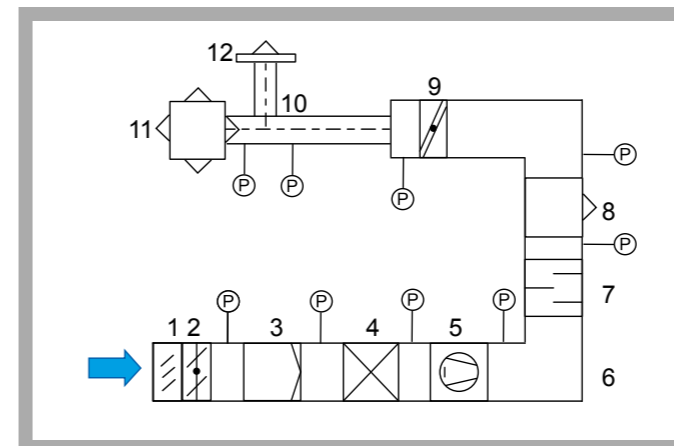
- design and operation of a ventilation system
- pressure measurements in the air duct
- determine the electric drive power of the fan
- determine the flow rate
- design and operation of components such as
  - \* protective grating
  - \* multi-leaf damper
  - \* filter
  - \* heat exchanger as air heater/cooler
  - \* fan
  - \* inspection cover
  - \* sound insulation link
  - \* ventilation grill with adjustable flow rate
  - \* fire protection flap
  - \* ceiling vents

- \* Complete ventilation system
- \* High practical relevance due to the use of industrial components from ventilation technology
- \* Representation of pressure curves

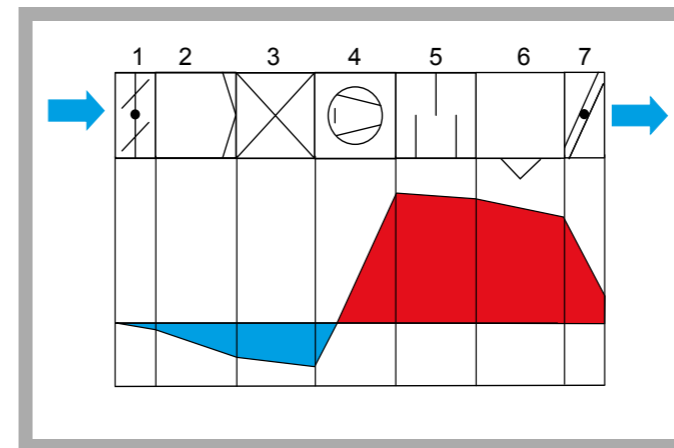
**HL 720 Ventilation System**



1 fire protection flap, 2 inclined tube manometer, 3 weather louvre, 4 multi-leaf damper, 5 filter, 6 heat exchanger, 7 fan with drive motor, 8 inspection cover, 9 air duct, 10 disc valve, 11 ceiling vent, 12 wall vent, 13 pressure measurement connection



1 weather louvre, 2 multi-leaf damper, 3 filter, 4 heat exchanger, 5 fan, 6 air duct, 7 sound insulation link, 8 wall vent, 9 fire protection flap, 10 branch, 11 air outlet for ceiling installations, 12 disc valve; P pressure



Pressure curve within the ventilation system: 1 multi-leaf damper, 2 filter, 3 heat exchanger, 4 fan, 5 sound insulation link, 6 wall vent, 7 fire protection flap; red: overpressure, blue: vacuum

**Specification**

- [1] operation of a ventilation system
- [2] all components from ventilation technology, some with sight windows
- [3] protective grating and adjustable multi-leaf damper at the air inlet
- [4] filter for air purification
- [5] heat exchanger to heat/cool the air
- [6] belt-driven radial fan
- [7] 2 sound insulation links
- [8] various air outlets for air distribution in the room: disc valve, ceiling vent and ventilation grill with adjustable flow rate
- [9] inspection cover for inspection purposes
- [10] fire protection flap prevents the cross-over of fire and smoke in the air duct
- [11] air duct with pressure measurement connections
- [12] pressure measurements with inclined tube manometer
- [13] current measurement to determine the power consumption of the fan
- [14] determine the flow rate via differential pressure

**Technical Data**

- Air duct: 1845x630x305mm
- Fan
  - max. flow rate: 2500m<sup>3</sup>/h
  - speed: 1600min<sup>-1</sup>
  - drive motor: 750W
- Air-to-water heat exchanger as air heater/cooler
  - capacity: 7,6kW

- Measuring ranges
- pressure: 0...700Pa
  - current: 0...4A

**Dimensions and Weight**

- LxWxH: 2000x950x2050mm
- Weight: approx. 284kg

**Required for Operation**

- 400V, 50/60Hz, 3 phases or 230V, 60Hz, 3 phases
- Water connection (hot and cold), drainage

**Scope of Delivery**

- 1 experimental unit
- 1 set of instructional material

**Order Details**

065.72000 HL 720 Ventilation System