HM 210

Characteristic variables of a radial fan

Learning objectives/experiments

- setup and principle of a radial fan
- plotting fan and system characteristics
- 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

Description

- **investigation of a radial fan and determination of characteristic variables**
- **determination of flow rate via iris diaphragm or Venturi nozzle**
- **different liquid column manometers measure the differential pressure with varying accuracy**

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 head and flow rate as well as the influence of the fan speed on the head and 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 flow rate and a throttle valve to adjust the 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 flow rate. The effective pressures to calculate the flow rate are read from liquid column manometers. The head 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.

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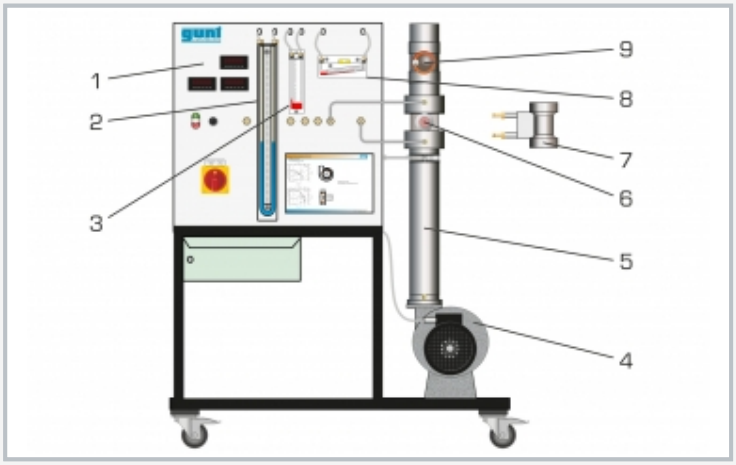
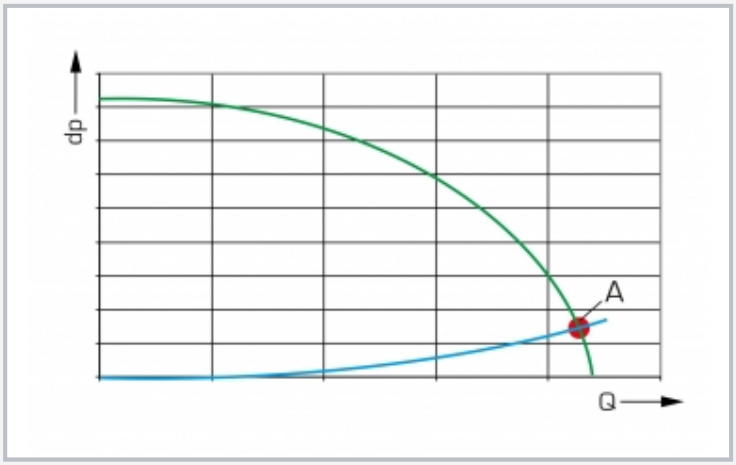
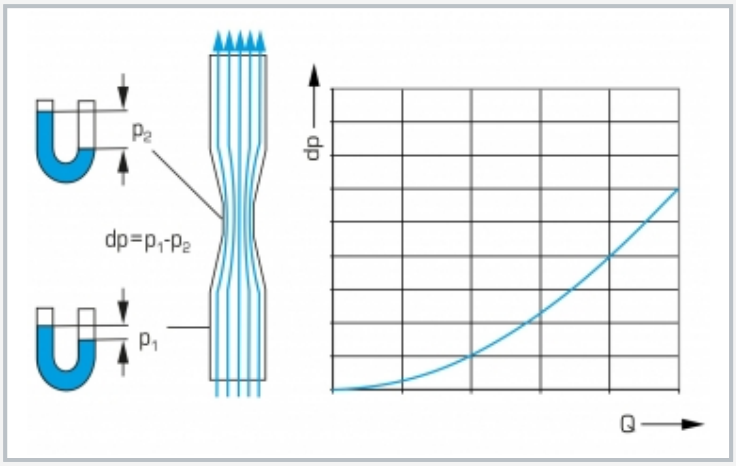


1 switch cabinet with display elements, 2 U-tube manometer, 3 single tube manometer, 4 radial fan with air intake, 5 pipe section, 6 iris diaphragm, 7 Venturi nozzle, 8 inclined tube manometer, 9 throttle valve



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 flow rate Q

Specification

[1] radial fan as turbomachine
[2] iris diaphragm or Venturi nozzle to determine 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 or iris diaphragm
[6] speed, torque and electric power capacity digitally displayed

Technical data

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

Iris diaphragm adjustable in 6 stages
- diameter: 40...70mm
- k=1,8....7,8

Venturi nozzle
- air inlet diameter: 100mm
- pipe neck diameter: 80mm
- k=7,32

Measuring ranges
- differential pressure:
  - 30...0...30mbar (U-tube manometer)
  - 0...15mbar (single tube manometer)
  - 0...50Pa (inclined tube manometer)

230V, 50Hz, 1 phase
230V, 60Hz, 1 phase; 230V, 60Hz, 3 phases
UL/CSA optional
LxWxH: 1300x720x1640mm
Weight: approx. 123kg

Scope of delivery

1 trainer
1 Venturi nozzle
1 iris diaphragm
1 set of accessories
1 set of instructional material