

## 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 impeller accelerates the air outwards. The high velocity at the outlet from the impeller 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 manometers, tube manometers and inclined tube manometers 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.

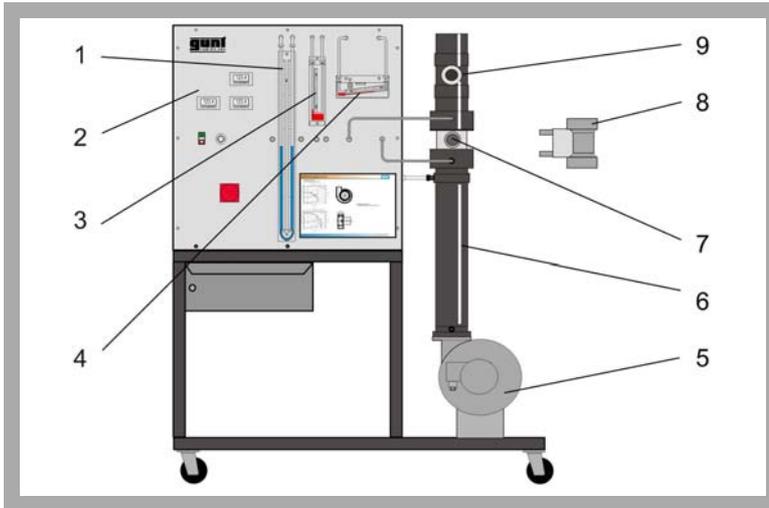
### Learning Objectives / Experiments

- \* 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

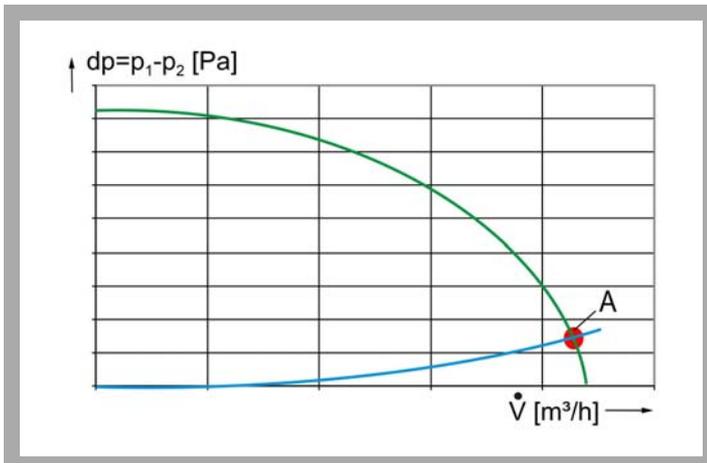
- set-up and principle of a radial fan
- plotting fan and system characteristics
- volumetric flow rate measurement methods based on the differential pressure method using:
  - \* iris diaphragm
  - \* venturi nozzle
  - \* comparison of both measurement methods
- familiarisation with various differential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

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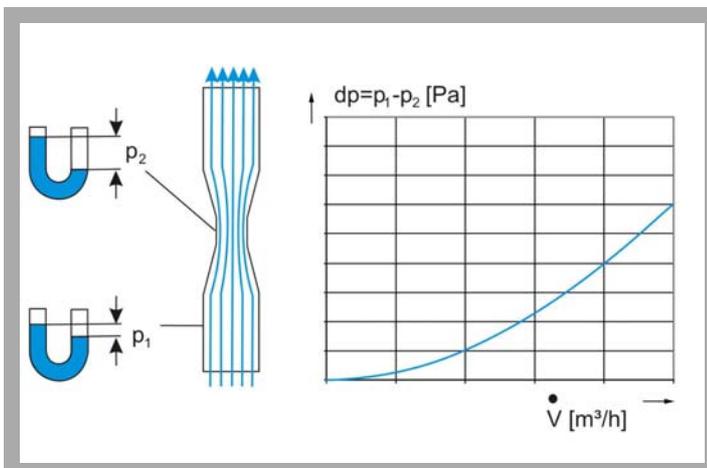
## Characteristic Variables of a Radial Fan



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



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



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

### 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, tube manometer and inclined tube manometer measure the differential pressure
- [5] airflow rate in pipe section adjustable by throttle valve
- [6] speed, torque and electric power capacity digitally displayed

### Technical Data

#### Radial fan

- max. power consumption: 50W
- max. pressure difference: 860Pa
- max. flow rate:  $4\text{m}^3/\text{min}$
- nominal speed:  $3.000\text{min}^{-1}$
- speed range:  $1.000\text{--}3.000\text{min}^{-1}$

#### Iris diaphragm adjustable in 6 stages

- diameter: 40...70mm
- $k=1.8\text{...}7.8$

#### Venturi nozzle

- air inlet diameter: 100mm
- pipe neck diameter: 80mm
- $k_v=7.32$

#### Pressure measuring ranges

- U-tube manometer: 30...0...30mbar
- tube manometer: 0...15mbar
- inclined tube manometer: 0...50Pa

### Dimensions and Weight

LxWxH: 1.300x720x1.500mm

Weight: approx. 111kg

### Connections

230V, 50/60Hz, 1 phase or 230V, 60Hz, 3 phases

### Scope of Delivery

- 1 trainer
- 1 set of instructional material

### Order Details

070.21000 HM 210 Characteristic Variables of a Radial Fan