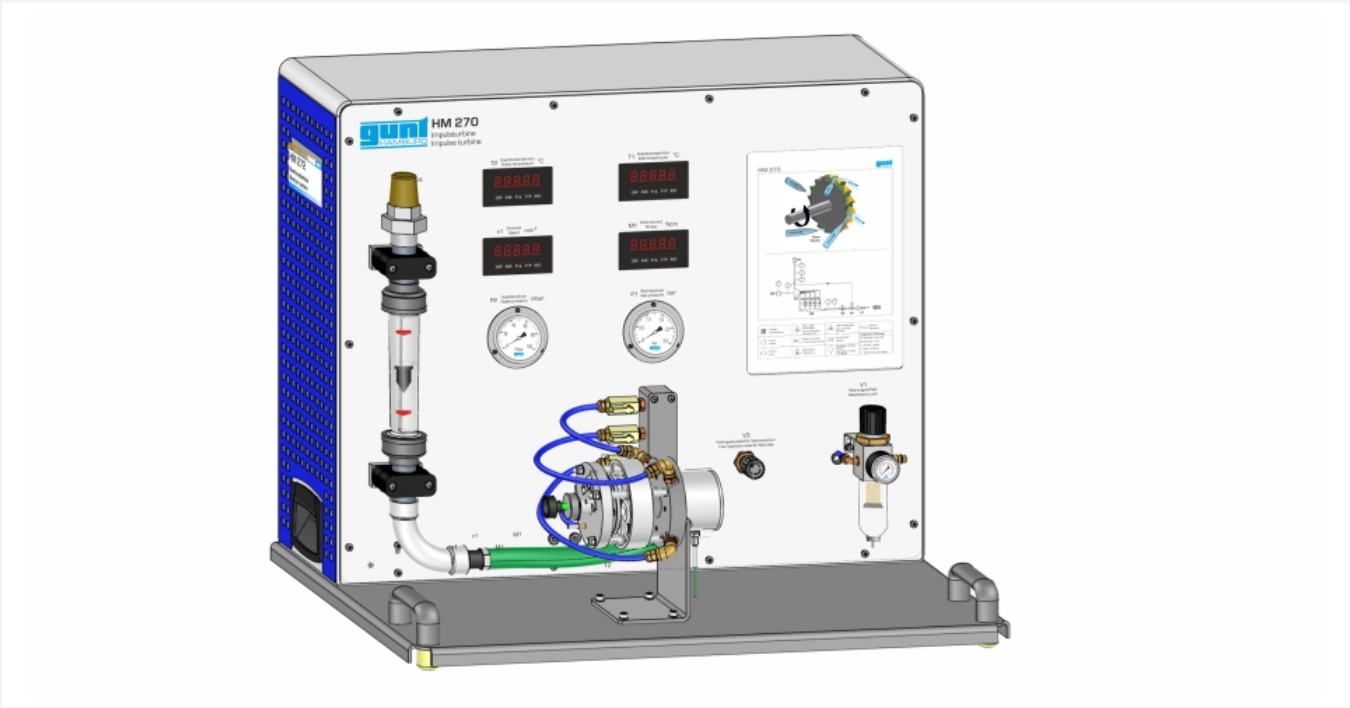
HM 270
Impulse turbine



Description

- **characteristic behaviour of an impulse turbine with air flow**
- **optimal view of the operating area of a turbine**
- **load applied by wear-free eddy current brake**

In impulse turbines, the working medium has the same static pressure in front of and behind the rotor. The conversion of pressure energy into kinetic energy takes place in the fixed nozzles of the distributor, not at the turbine rotor. This compressed-air driven experimental unit can be used to understand turbines powered by steam or water.

The HM 270 is a single-stage, axial impulse turbine. The turbine consists of a rotor that is installed inside a transparent housing, a distributor with four nozzles and an eddy current brake for applying a load to the turbine. The number of active nozzles can be adjusted by means of the valves. The compressed air velocity is increased in the nozzles. The air flow that hits the blades generates an impulse that causes the rotor to start moving.

The inlet and outlet pressure at the turbine are indicated on manometers. The turbine torque is determined by measuring the force on the eddy current brake. The speed is measured with an optical speed sensor. Torque, speed and temperatures are digitally displayed. The air flow rate is measured with a rotameter and set by means of a valve.

The turbine is fitted with a solenoid valve as a safety device in case of overspeed.

Learning objectives/experiments

- design and function of an impulse turbine
- determination of torque, power and efficiency
- graphical representation of characteristic curves for torque, power and efficiency
- investigation of the effect of nozzle pressure and number of nozzles

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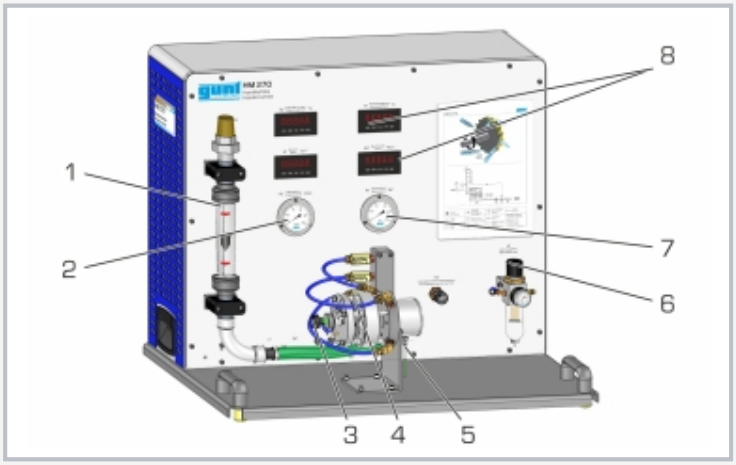
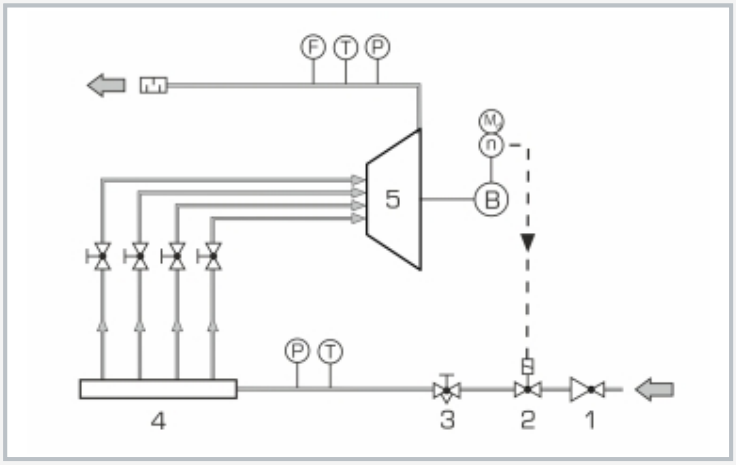
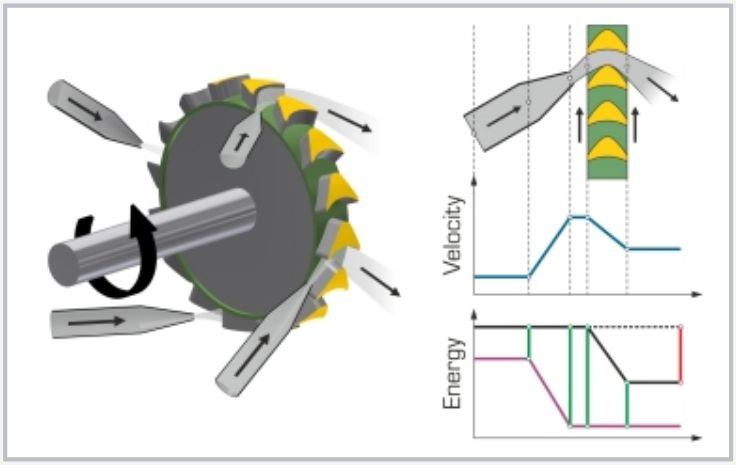


1 rotameter, 2 outlet manometer, 3 handwheel eddy current brake, 4 turbine, 5 temperature sensor, 6 pressure reducing valve with filter, 7 inlet manometer, 8 displays



1 pressure reducing valve, 2 solenoid valve as a safety device, 3 valve for setting the flow rate, 4 compressed air distributor, 5 turbine, B eddy current brake;
P pressure, T temperature, F flow rate, n speed, M_d torque



Principle of operation of the impulse turbine rotor
Velocity profile
blue: flow velocity
Energy profile
black: total energy, purple: potential energy, green: kinetic energy,
red: mechanical energy

Specification

[1] investigation of a compressed air driven axial impulse turbine
[2] transparent front panel for observing the operating area
[3] distributor with 4 nozzles
[4] selectable number of nozzles
[5] applying a load to the turbine by using the wear-free eddy current brake
[6] setting the primary pressure with the pressure reducing valve
[7] valve and flow meter for setting the flow rate
[8] solenoid valve as a safety device to prevent overspeed
[9] determination of the torque on the turbine shaft using a force sensor
[10] measurement of the turbine speed with an optical speed sensor
[11] manometer for displaying pressures on the inlet and outlet side
[12] digital display of speed, torque and temperature

Technical data

Axial impulse turbine
- max. power: approx. 30W at 15000min^{-1}

Rotor
- Ø outer: 55mm
- number of blades: 28

Distributor
- 4 nozzles, number can be selected
- entry and exit angle: 20°

Measuring ranges
- temperature: -20...1100°C
- speed: 0...30000min^{-1}
- torque: 0...10Ncm
- flow rate: 2...16Nm^3/h
- pressure (inlet): 0...2,5bar
- pressure (outlet): 0...0,1bar
- primary pressure: 0...10bar

230V, 50Hz, 1 phase
230V, 60Hz, 1 phase; 120V, 60Hz, 1 phase
UL/CSA optional
LxWxH: 850x600x700mm
Weight: approx. 48kg

Required for operation

compressed air connection: 6...10bar, max. 300L/min

Scope of delivery

1 experimental unit
1 hose with pressure connection
1 set of instructional material

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Optional accessories

020.30009	WP 300.09	Laboratory trolley