

HM 272

Reaction turbine



Description

- characteristic behaviour of a reaction turbine with air flow
- optimal view of the operating area of a turbine
- load applied by band brake

In reaction turbines, the static pressure of the working medium in front of the rotor is higher than that behind it. In pure reaction turbines with a degree of reaction of one, the entire pressure energy in the rotor is converted to kinetic energy. This compressed-air driven experimental unit can be used to understand turbines powered by steam or water.

HM 272 is a single-stage, pure reaction turbine with a horizontal shaft. The rotor of the turbine has four outlet nozzles and is installed in a transparent housing. The air flows radially through the rotor and expands and accelerates as it exits through the outlet nozzles. The exiting air flow drives the turbine rotor according to the reaction principle. A band brake is used to apply a load to the turbine.

The inlet and outlet pressure at the turbine are indicated on manometers. The turbine torque is determined by measuring the force on the band 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.

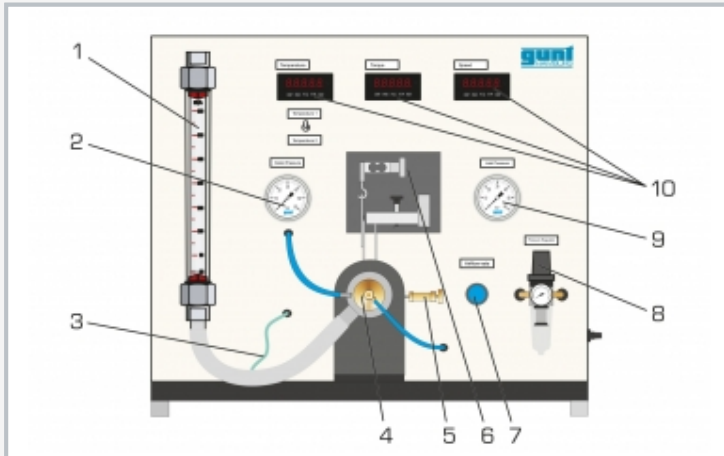
The turbine is fitted with a solenoid valve as a safety device in case of overspeed. The brake drum on the turbine shaft is cooled by means of the compressed air.

Learning objectives/experiments

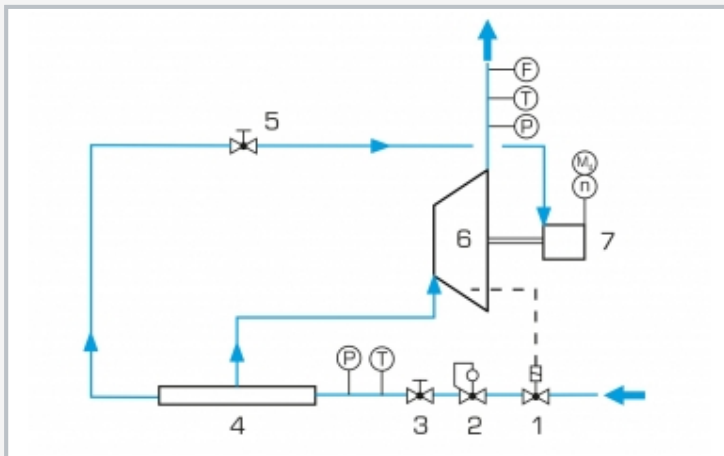
- familiarisation with the design and function of an impulse turbine
- determination of torque, power and efficiency
- graphical representation of characteristic curves for torque, power and efficiency

HM 272

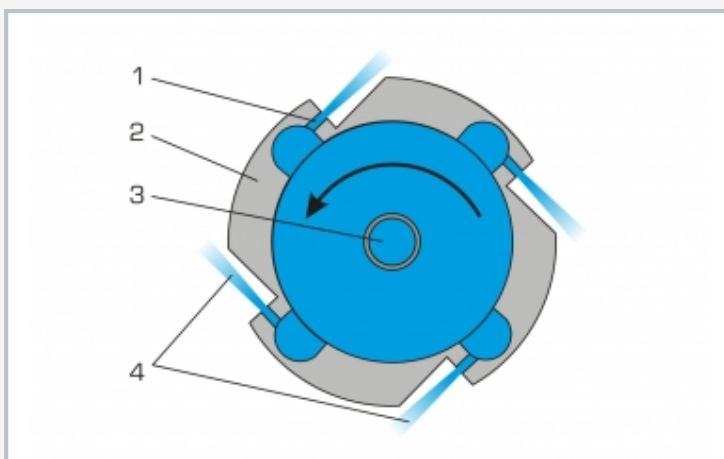
Reaction turbine



1 rotameter, 2 outlet manometer, 3 temperature sensor, 4 turbine, 5 shut-off valve for air cooler, 6 band brake with torque measurement, 7 valve for setting the flow rate, 8 pressure reducing valve with filter, 9 inlet manometer, 10 displays



1 solenoid valve as a safety device, 2 pressure reducing valve, 3 valve for setting the flow rate, 4 compressed air distributor, 5 shut-off valve for air cooler, 6 turbine, 7 band brake; P pressure, T temperature, F flow rate, n speed, M_t torque



Principle of operation of the reaction turbine rotor
1 outlet nozzle, 2 turbine rotor, 3 compressed air inlet, 4 exiting air flow

Specification

- [1] investigation of a compressed air driven radial reaction turbine
- [2] transparent housing for observing the operating area
- [3] rotor with 4 outlet nozzles
- [4] application of load to the turbine by means of a band brake
- [5] setting of the primary pressure with the pressure reducing valve
- [6] valve and flow meter for setting the flow
- [7] solenoid valve as a safety device to prevent over-speed
- [8] determination of the torque on the turbine shaft using a force sensor
- [9] measurement of the turbine speed with an optical speed sensor
- [10] manometer for displaying the pressure on the inlet and outlet side
- [11] digital display of speed, torque and temperature

Technical data

Reaction turbine

- max. power: 20W at 19000min⁻¹

Rotor

- diameter: 55mm
- 4 outlet nozzles, diameter: 1,5mm

Measuring ranges

- temperature: -20...1100°C
- speed: 0...30000min⁻¹
- torque: 0...10Ncm
- flow rate: 25...315L/min
- inlet pressure: 0...2,5bar
- outlet pressure: 0...0,1bar
- primary pressure: 0...10bar

230V, 50Hz, 1 phase
120V, 60Hz, 1 phase
LxWxH: 900x370x750mm
Weight: approx. 35kg

Required for operation

Compressed air supply 6...10bar, max. 300L/min

Scope of delivery

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

HM 272

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Optional accessories

020.30009

WP 300.09

Laboratory trolley