

HM 365.31

Pelton and Francis turbine



Description

- comparison of impulse and reaction turbines
- constant speeds and torques can be adjusted in combination with HM 365
- part of the GUNT FEMLine

Water turbines are turbomachines utilising water power. They convert pressure and flow energy into mechanical energy and mostly are used for driving electrical generators. Water turbines can be divided into impulse and reaction turbines depending on their operating principle.

The HM 365.31 accessories contain a Pelton turbine as an example for an impulse turbine and a Francis turbine as an example for a reaction turbine. The two turbine types are examined and compared with each other together with the supply unit HM 365.32 and the brake unit HM 365. The brake unit offers the possibility to set constant speeds resp. torques. Thus you can realise experiments in different realistic operating modes.

The Pelton turbine is a free-jet turbine which converts the pressure energy of the water into kinetic energy entirely in the distributor. As the complete pressure difference is reduced exclusively in the nozzle, the pressure is constant in the Pelton wheel. The turbine is also known as a constant pressure turbine. The turbine output is adjusted by adjusting the nozzle cross-section.

The Francis turbine converts the pressure energy of the water into kinetic energy in the distributor and in the rotor. The pressure at the rotor inlet is higher than at the rotor outlet. The turbine output is adjusted by adjusting the guide vanes.

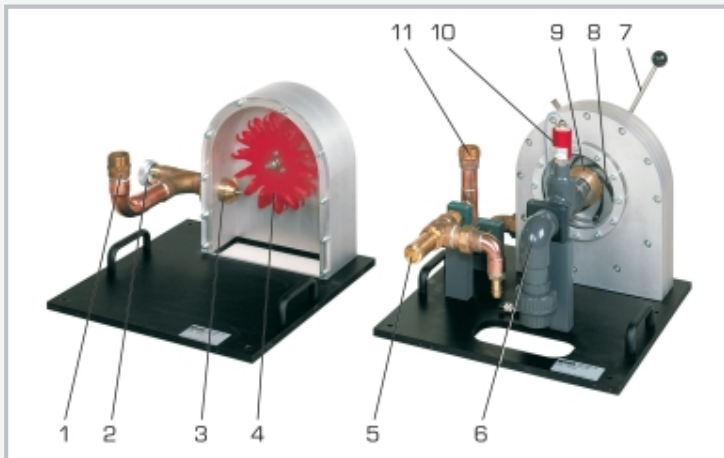
HM 365.32 provides the water supply, the pressure measurement at the turbine inlet and the flow rate measurement. In order to measure the pressure at the turbine outlet, the Francis turbine is equipped with an additional pressure sensor. The brake unit HM 365 measures the braking torque and the speed.

Learning objectives/experiments

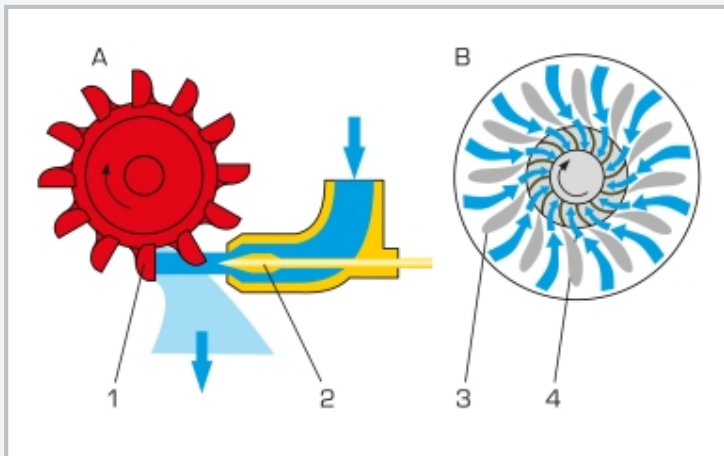
- in combination with HM 365 and HM 365.32
 - ▶ comparison of impulse and reaction turbines
 - ▶ determination of the mechanical and hydraulic power
 - ▶ determination of the efficiency
 - ▶ recording of characteristic curves
 - ▶ influence of the nozzle cross-section of the Pelton turbine on the characteristics
 - ▶ influence of the guide vane position of the Francis turbine on the characteristics

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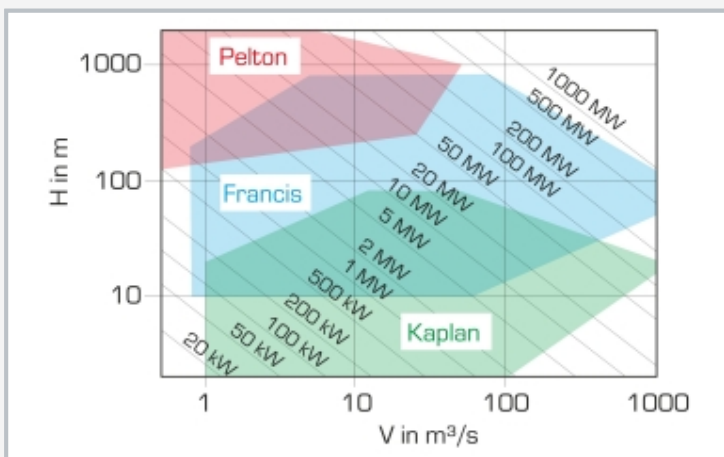
Pelton and Francis turbine



1 water inlet, 2 adjustment of the nozzle cross-section, 3 nozzle, 4 Pelton wheel, 5 safety valve, 6 water outlet, 7 lever for adjusting the guide vanes, 8 guide vanes, 9 rotor of Francis turbine, 10 pressure sensor at the turbine outlet, 11 water inlet



A operating principle of the Pelton turbine: 1 Pelton wheel with blades, 2 adjustable nozzle needle; B operating principle of the Francis turbine: 3 guide vanes, 4 rotor



Operative ranges of the different turbine types in practice; H head, V flow rate

Specification

- [1] comparison of a Pelton turbine as impulse turbine and a Francis turbine as reaction turbine
- [2] operation by use of the HM 365.32 Turbine supply unit
- [3] turbine load by use of the HM 365 Universal brake and drive unit
- [4] constant torques and speeds can be adjusted with HM 365
- [5] transparent front panel in the turbines for observing the operating area
- [6] adjustable nozzle needle for setting different nozzle cross-sections (Pelton turbine)
- [7] adjustable guide vanes for setting different angles of incidence (Francis turbine)
- [8] pressure sensor at the Francis turbine for measuring the pressure at the turbine outlet
- [9] digital display for flow rate, pressure and temperature in HM 365.32
- [10] braking torque and speed measured in HM 365

Technical data

Transmission ratio between brake and turbine: 1,44:1

Pelton turbine

- output: 1,5kW at 2750min⁻¹ at 6,5bar
- wheel diameter: 165mm
- variable nozzle setting

Francis turbine

- output: 1kW at 3500min⁻¹ and 4,2bar
- rotor diameter: 80mm
- variable guide vane setting

Measuring ranges

- pressure (outlet): 0...1,6bar

LxWxH: 590x370x490mm (Pelton turbine)

Weight: approx. 25kg

LxWxH: 560x510x400mm (Francis turbine)

Weight: approx. 50kg

Scope of delivery

- 1 Pelton turbine
- 1 Francis turbine

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Required accessories

HM 365	Universal drive and brake unit
HM 365.32	Turbine supply unit