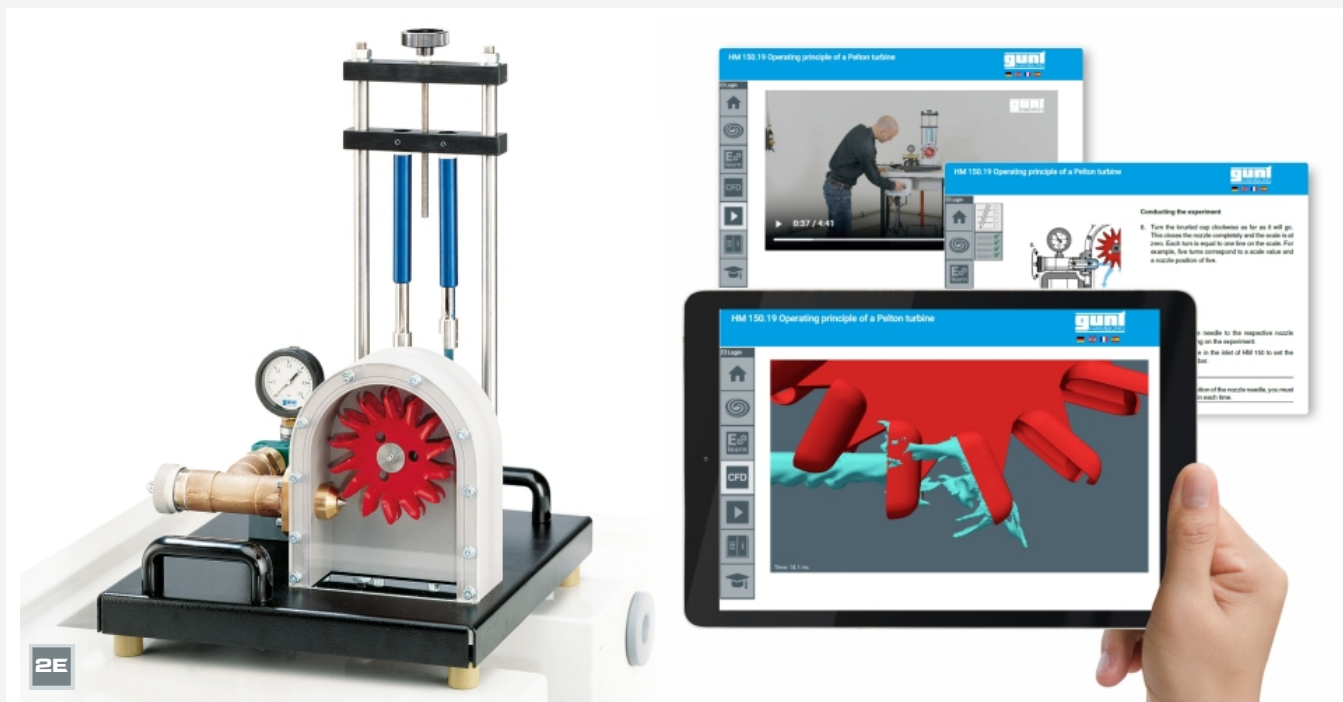


HM 150.19

Operating principle of a Pelton turbine



The illustration shows the experimental unit on the work surface of the HM 150 base module and the GUNT Science Media Center, tablet not included

Description

- **model of an impulse turbine**
- **transparent operating area**
- **adjustable nozzle cross-section**
- **flow visualisation using CFD technology**
- **multimedia teaching material online in the GUNT Science Media Center: E-Learning course, prepared CFD simulations, worksheets, videos**

The Pelton turbine is a type of impulse turbine; such turbines convert the pressure energy of water into kinetic energy entirely in the distributor. During the conversion, the water jet is accelerated in a nozzle and directed onto the blades of the Pelton wheel tangentially. The water jet is redirected by approx. 180° in the blades. The impulse of the water jet is transmitted to the Pelton wheel.

HM 150.19 is a model of a Pelton turbine demonstrating the function of an impulse turbine. The experimental unit consists of the Pelton wheel, a needle nozzle used as distributor, a band brake for loading the turbine and a housing with a transparent front panel. The transparent cover enables to observe the water flow, the Pelton wheel and the nozzle during operation. The nozzle cross-section and thus the flow rate are modified by adjusting the nozzle needle.

The turbine torque is determined by force measurement on a band brake and is read on spring balances. For measuring the rotational speed, a non-contact speed sensor, e.g. HM 082, is required. A manometer shows the water pressure at the turbine inlet.

The experimental unit is positioned easily and securely on the work surface of the HM 150 base module. The water is supplied and the flow rate measured by HM 150. Alternatively, the experimental unit can be operated by the laboratory supply.

In order to perform a virtual analysis of flow behaviour, CFD simulations are often used in practice. Such simulations allow, for example, flow visualisations in areas that cannot be visualised experimentally. In the GUNT Science Media Center, flow visualisations based on CFD calculations are available online. There are also multimedia teaching materials including E-Learning courses on basic knowledge and calculations. Videos show a complete experiment with preparation, execution and evaluation. Worksheets with solutions supplement the teaching material.

Learning objectives/experiments

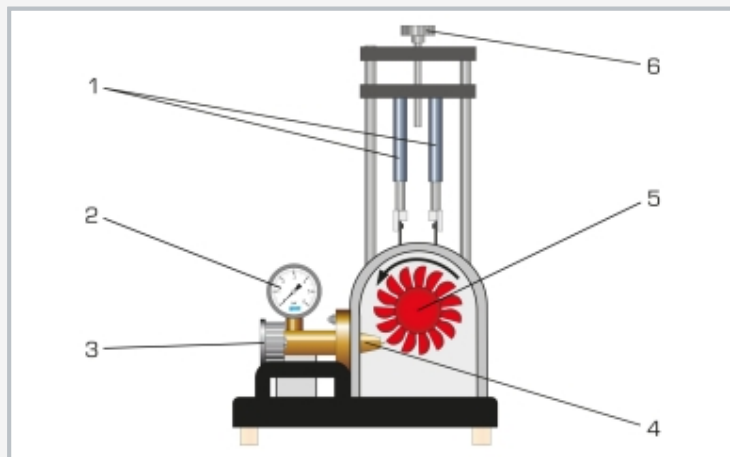
- **design and function of a Pelton turbine**
- **determination of torque, power and efficiency**
- **graphical representation of characteristic curves for torque, power and efficiency**

GUNT Science Media Center, develop digital skills

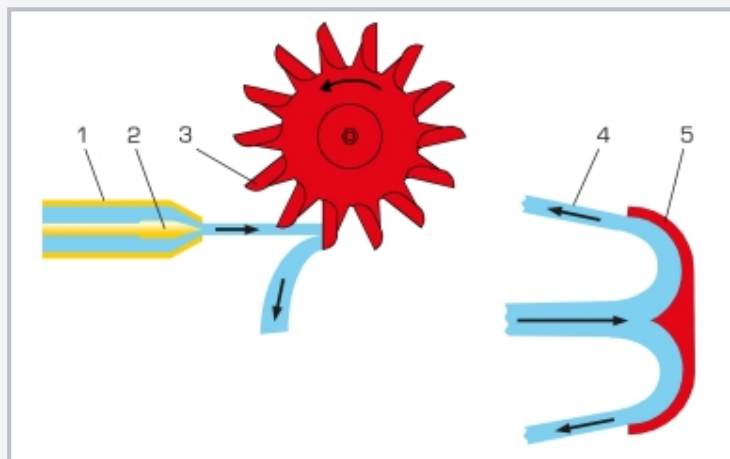
- **E-Learning course with fundamental knowledge and calculations**
- **prepared CFD simulations for flow visualisation**
- **videos with detailed demonstration of the experiments: preparation, execution, evaluation**
- **assured learning success through digital worksheets**
- **retrieve information from digital networks**

HM 150.19

Operating principle of a Pelton turbine



1 spring balance, 2 manometer, 3 adjustment of the nozzle cross-section, 4 needle nozzle, 5 Pelton wheel, 6 adjustment of the band brake



Operating principle of the Pelton turbine:
1 needle nozzle, 2 adjustable nozzle needle, 3 blade on the Pelton wheel, 4 redirected water jet, 5 profile of the blade



Screenshot of the GUNT Science Media Center

Specification

- [1] function of a Pelton turbine
- [2] transparent front panel for observing the operating area
- [3] loading the turbine by use of the band brake
- [4] adjustable nozzle needle for setting different nozzle cross-sections
- [5] marking on brake drum for non-contact speed measurement
- [6] instruments: spring balances for determining the torque, manometer shows pressure at turbine inlet
- [7] flow rate determination by base module HM 150
- [8] water supply using base module HM 150 or via laboratory supply
- [9] flow visualisation using prepared CFD simulations
- [10] digital multimedia teaching material online in the GUNT Science Media Center: E-Learning course, prepared CFD simulations, worksheets, videos

Technical data

Pelton turbine

- output: 5W at 500min^{-1} , approx. 30L/min, $H=2\text{m}$

■ Pelton wheel

- ▶ 14 blades
- ▶ blade width: 33,5mm
- ▶ external \varnothing : 132mm

Needle nozzle

- jet diameter: 10mm

Measuring ranges

- force: 2x 0...10N
- pressure: 0...1bar

LxWxH: 400x400x620mm

Weight: approx. 15kg

Required for operation

HM 150 (closed water circuit) or water connection, drain;

PC or online access recommended

Scope of delivery

- 1 experimental unit
- 1 set of instructional material
- 1 online access to GUNT Science Media Center

HM 150.19

Operating principle of a Pelton turbine

Optional accessories

HM 150	Base module for experiments in fluid mechanics
HM 082	Speed sensor