

HM 150.08

Measurement of jet forces



Learning objectives/experiments

- demonstration of the principle of linear momentum
- study of the jet forces
- influence of flow rate and flow velocity
- influence of different deflection angles

Description

- investigation of jet forces on deflectors
- demonstration of the principle of linear momentum
- four interchangeable deflectors with different deflection angles

During deceleration, acceleration and deflection of a flowing fluid, there is a change of velocity and thus a change in momentum. Changes in momentum result in forces. In practice, the motive forces are used to convert kinetic energy into work done, for example in a Pelton turbine.

In HM 150.08 jet forces are generated and studied with the aid of a water jet that acts on and is diverted by an interchangeable deflector.

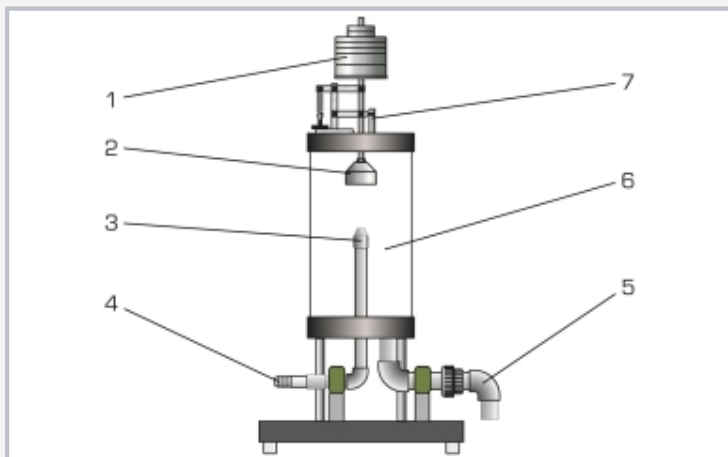
The experimental unit includes a transparent tank, a nozzle, four interchangeable deflectors with different deflection angles and a weight-loaded scale. The force of the water jet is adjusted via the flow rate.

Experiments study the influence of flow velocity and flow rate as well as of different deflection angles. The jet forces generated by the water jet are measured on the weight-loaded scale. The forces are calculated using the momentum equation and compared with the measurements.

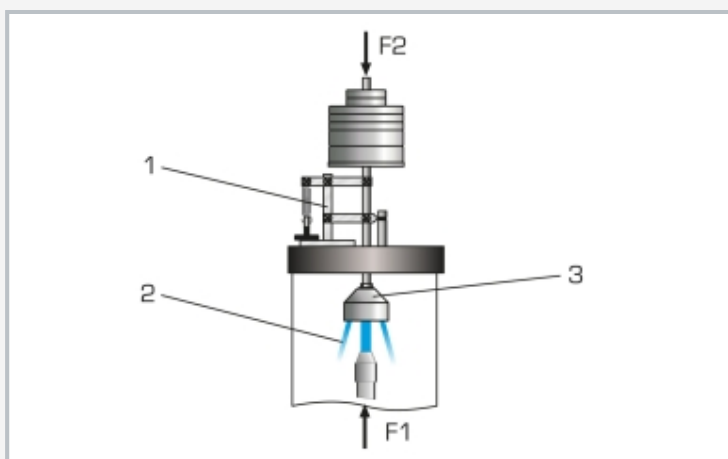
The experimental unit is positioned easily and securely on the work surface of the HM 150 base module. The water is supplied and the flow rate measured by HM 150. Alternatively, the experimental unit can be operated by the laboratory supply.

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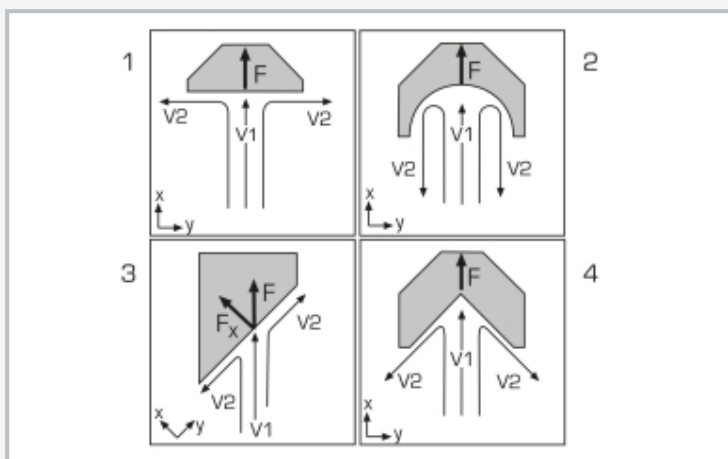
Measurement of jet forces



1 weight, 2 deflector, 3 nozzle, 4 water supply, 5 water drain, 6 tank, 7 lever apparatus



Measurement of the jet forces via the weight-loaded scale
1 lever apparatus, 2 deflected water jet, 3 deflector with conical surface; F1 jet force, F2 weight force



Distribution of velocities v and forces F on deflectors
1 deflector with flat surface, 2 deflector with semi-circular surface, 3 deflector with oblique surface, 4 deflector with conical surface

Specification

- [1] investigation of jet forces and demonstration of the principle of linear momentum
- [2] tank made of transparent material for observing the experiments
- [3] nozzle for generating the water jet
- [4] jet force can be adjusted via flow rate
- [5] four different shaped deflectors: flat surface, oblique surface, semi-circular surface, conical surface
- [6] measurement of the jet forces via the weight-loaded scale
- [7] flow rate determined by HM 150 base module
- [8] water supply using HM 150 base module or via laboratory supply

Technical data

Tank

- \varnothing inner: 200mm
- height: 340mm

Nozzle

- \varnothing 10mm

Deflector

- flat surface: 90°
- oblique surface: $45^\circ/135^\circ$
- semi-circular surface: 180°
- conical surface: 135°

Weights

- 4x 0,2N
- 3x 0,3N
- 2x 1N
- 2x 2N
- 2x 5N

LxWxH: 400x400x880mm

Weight: approx. 23kg

Required for operation

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

Scope of delivery

- 1 experimental unit
- 1 set of weights
- 4 deflectors
- 1 set of instructional material

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Optional accessories

HM 150 Base module for experiments in fluid mechanics