HM 150.01
Pipe friction for laminar / turbulent flow

Learning objectives/experiments

- measurements of the pressure loss in laminar flow
- measurements of the pressure loss in turbulent flow
- determining the critical Reynolds number
- determining the pipe friction factor
- comparing the actual pipe friction factor with the theoretical friction factor

Description

- **pipe friction losses in laminar and turbulent flow**
- **determining the critical Reynolds number**

During flow through pipes, pressure losses occur due to internal friction and friction between the fluid and the wall. When calculating pressure losses, we need to know the friction factor, a dimensionless number. The friction factor is determined with the aid of the Reynolds number, which describes the ratio of inertia forces to friction forces.

HM 150.01 enables the study of the relationship between pressure loss due to fluid friction and velocity in the pipe flow. Additionally, the pipe friction factor is determined.

The experimental unit includes a small diameter pipe section in which the laminar and turbulent flow is generated. The Reynolds number and the pipe friction factor are determined from the flow rate and pressure loss. In turbulent flow, the pipe is supplied directly from the water supply. The constant pressure at the water supply required for laminar flow is provided by a standpipe on the overflow. Valves can be used to adjust the flow rate.

The pressures in laminar flow are measured with twin tube manometers. In turbulent flow, the pressure is read on a dial-gauge manometer.

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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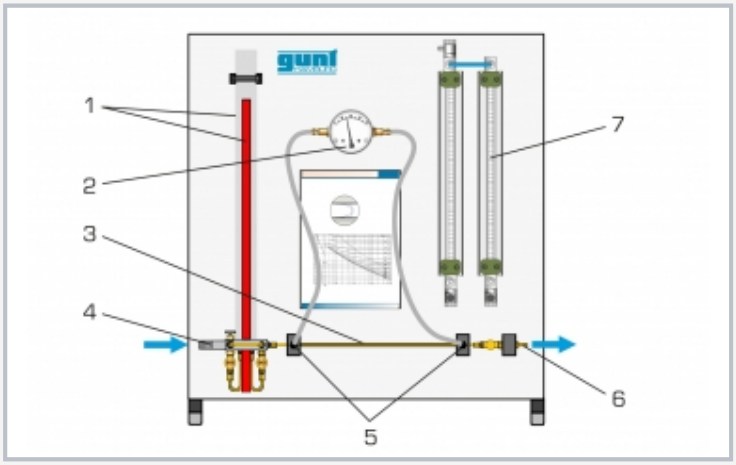
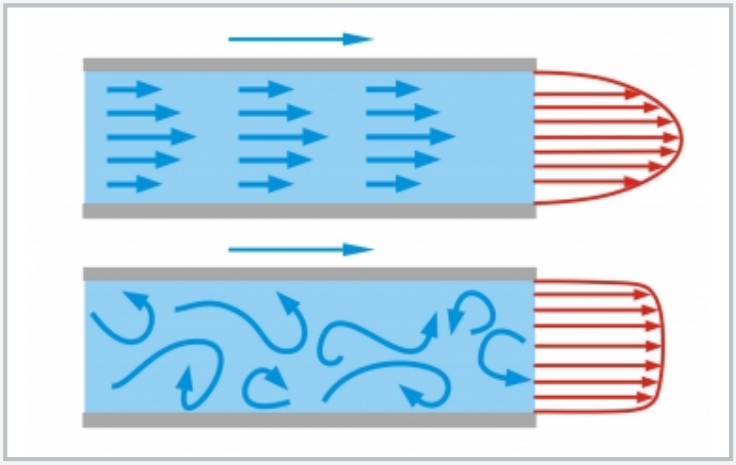
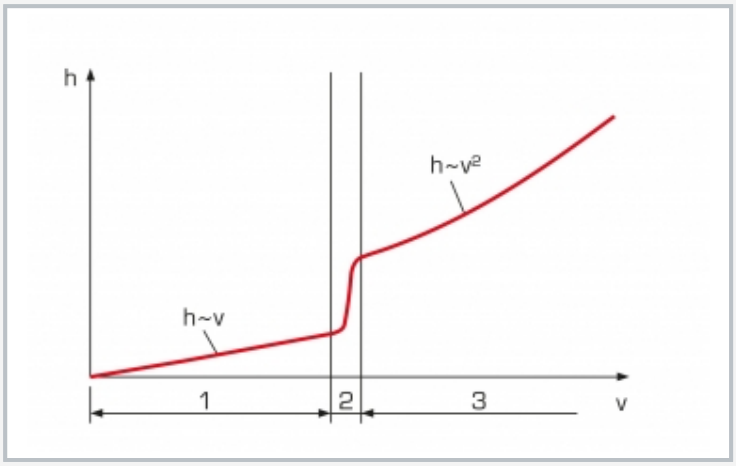


1 tank with overflow, 2 dial-gauge manometer, 3 pipe section, 4 water supply, 5 pressure measuring points, 6 water drain, 7 twin tube manometers



Representation of the laminar and turbulent flow in the pipe
top: laminar flow; bottom: turbulent flow; blue flow, red velocity profile



Pressure losses as a function of velocity in pipe flow
1 laminar flow, 2 transition from laminar to turbulent, 3 turbulent flow;
h pressure loss, v velocity

Specification

[1] investigation of the pipe friction in laminar or turbulent flow
[2] transparent tank with overflow ensures constant water inlet pressure in the pipe section for experiments with laminar flow
[3] flow rate adjustment via valves
[4] twin tube manometers for measurements in laminar flow
[5] dial-gauge manometer for measurements in turbulent flow
[6] flow rate determined by HM 150 base module
[7] water supply using HM 150 base module or via laboratory supply

Technical data

Pipe section
- length: 400mm
- Ø, inner: 3mm

Tank: approx. 2L

Measuring ranges
- differential pressure:
  - 2x 370mmWC
  - 1x 0...0,25bar

LxWxH: 850x680x930mm
Weight: approx. 23kg

Required for operation

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

Scope of delivery

1 experimental unit
1 set of accessories
1 set of instructional material

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Optional accessories

070.15000	HM 150	Base module for experiments in fluid mechanics