

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 coefficient
- comparing the actual pipe friction coefficient with the theoretical friction coefficient

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 coefficient, a dimensionless number. The friction coefficient 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 coefficient is determined.

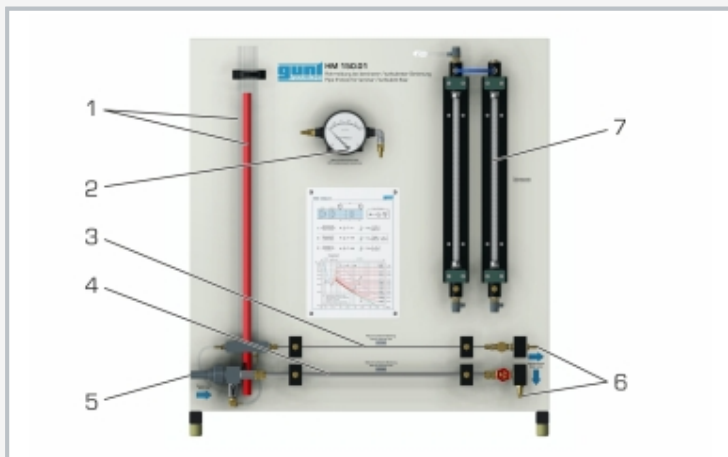
The experimental unit includes two pipe sections with different diameters. The large diameter pipe section is used to analyse turbulent flows and is supplied directly from the water supply. The pipe section for laminar flow is supplied via a tank with overflow. This ensures the constant inlet pressure required for laminar flow. A gate valve or flow control valve can be used to adjust the flow rate. The Reynolds number and the pipe friction coefficient are determined from the flow rate and pressure loss.

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

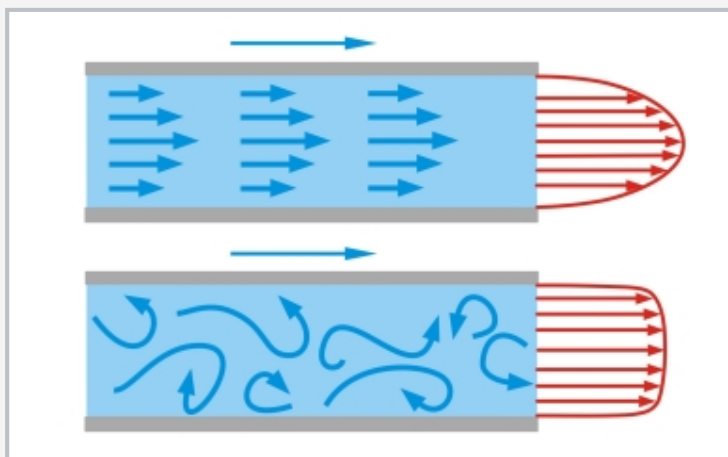
The experimental unit is positioned easily and securely on the work surface of the HM 150 base module. The water is supplied and the flow rate measured by HM 150. Alternatively, the experimental unit can be operated by the laboratory supply.

HM 150.01

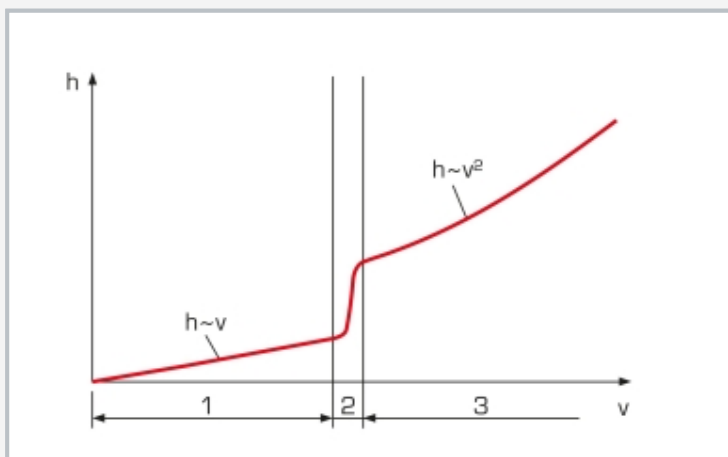
Pipe friction for laminar / turbulent flow



1 tank with overflow, 2 dial-gauge manometer, 3 pipe section for experiments with laminar flow, 4 pipe section for experiments with turbulent flow, 5 water supply, 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 pipe friction using two pipe sections 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 gate valve or flow control valve
- [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

- 2 pipe sections
- length: 400mm
 - \varnothing inner:
 - ▶ 1x 3,3mm
 - ▶ 1x 8,2mm

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

HM 150.01

Pipe friction for laminar / turbulent flow

Optional accessories

HM 150 Base module for experiments in fluid mechanics