

HM 133

Visualisation of flow fields



Description

- visualisation of flow fields and streamlines by using electrolytically generated hydrogen bubbles
- illuminated experimental section
- different models: drag bodies and changes in cross-section
- investigations in laminar and turbulent flow

Fine gas bubbles are perfectly suited to visualising flow fields. Due to Reynolds scaling, many flow processes that occur in air can also be demonstrated by experiments in water.

The experimental unit HM 133 can be used to visualise laminar and turbulent flow processes in a water channel. Hydrogen bubbles are generated electrolytically at a cathode made of thin platinum wire. A stainless steel plate is used as an anode. Small bubbles that detach from the platinum wire are easily carried along by the flow due to their small size.

An interchangeable model is used in the shallow water channel and flow travels around and through it. White LED illumination is located along the experimental section on the walls of the water channel. The indirect illumination results in a high-contrast image.

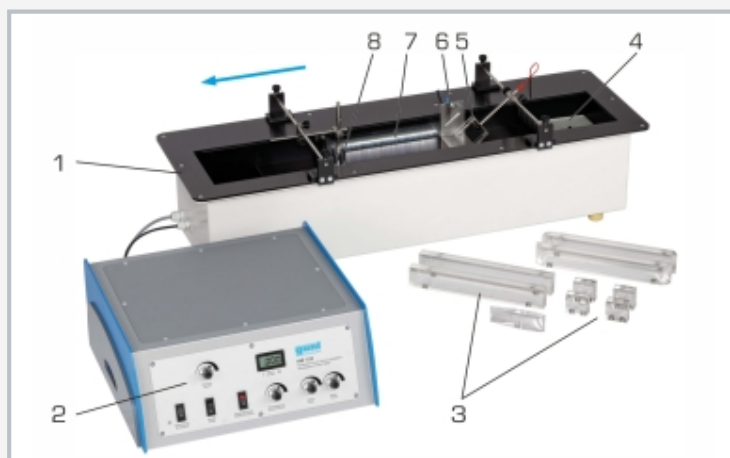
The experiments run with a low flow velocity. Flow separation and vortex formation are clearly visible. Different drag bodies or changes in cross-sections are used as models, e.g. cylinder, aerofoil profile and rectangle. A flow straightener and a layer of glass spheres ensure a smooth and low-turbulence flow. The power for the electrolysis, its pulse and pause duration and the flow velocity in the water channel can all be adjusted.

Learning objectives/experiments

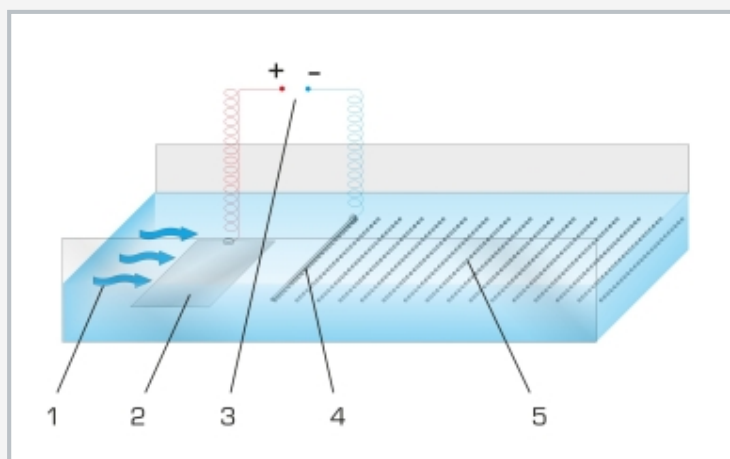
- visualisation of two-dimensional flows
- streamline course in flow around and through models
- flow separation
- vortex formation, demonstration of Karman vortices
- qualitative observation of the velocity distribution in laminar and turbulent flow
- analogy to air flow

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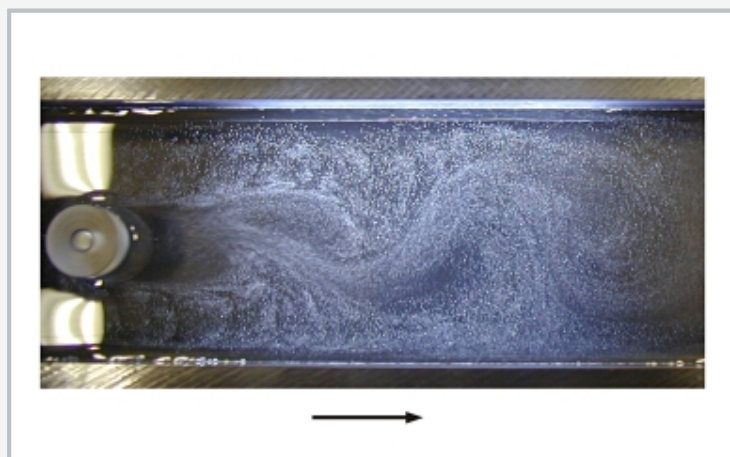
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1 water channel, 2 display and control unit, 3 models, 4 glass balls, 5 cathode, 6 anode, 7 LED illumination along the experimental section, 8 model in the experimental section; arrow shows the direction of flow



Principle of electrolytic generation of hydrogen bubbles
1 water inlet, 2 anode, 3 power source, 4 cathode, 5 diffusion of bubble fronts (pulsed)



When flowing around a cylinder, Karman vortices form behind the model; arrow shows the direction of flow

Specification

- [1] visualisation of flow fields by using electrolytically generated hydrogen bubbles
- [2] platinum wire as cathode and stainless steel plate as anode for electrolysis
- [3] shallow water channel fitted with indirect LED illumination along the experimental section
- [4] various models are included: aerofoil, rectangle, straight plate, curved plate, cylinder (various sizes), various models for changes in cross-section
- [5] flow straightener and glass spheres ensure consistent and low-turbulence flow
- [6] different flow velocities via variable-speed circulating pump
- [7] setting power (with display), pulse and pause duration of the power and the flow velocity in the water channel

Technical data

Pump with adjustable speed

- max. flow rate: 20L/min

Bubble generator

- current: 0...200mA
- pause: 8,4...1800ms
- pulse: 8,4...1800ms
- 3 cathodes with platinum wire
 - ▶ Ø 0,2mm
 - ▶ length 30, 50, 75mm
- anode, stainless steel plate, L-shaped

Water channel: approx. 6L

Experimental section: LxWxH: 550x150x50mm

Illumination: white LEDs on the side walls of the water channel

230V, 50Hz, 1 phase

230V, 60Hz, 1 phase; 120V, 60Hz, 1 phase

UL/CSA optional

LxWxH: 900x300x220mm (experimental unit)

LxWxH: 410x400x170mm (display and control unit)

Weight: approx. 24kg

Scope of delivery

- 1 experimental unit
- 1 display and control unit
- 3 cathodes
- 1 set of models (drag bodies, changes in cross section)
- 1 set of instructional material

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Optional accessories

WP 300.09 Laboratory trolley