

# HM 132

## Vertical visualisation of flow fields



### Description

- visualisation of flow fields and streamlines around models using electrolytically generated hydrogen bubbles
- illuminated vertical experimental section
- investigations in laminar flow

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

The trainer consists of a vertical experimental section in which an interchangeable model is inserted. Water flows from bottom to top through the experimental section. Electrolytically generated hydrogen bubbles rise with the flow, flow around the model and visualise the flow.

Different models are available: drag bodies (e.g. aerofoils and cylinders) or changes in cross-sections. The length of the experimental section enables for a long wake, where, for example, vortex streets form completely. The black background and the lateral illumination ensure optimal observation. The model can be inserted in two different positions.

A stabilisation tank with a flow straightener placed upstream of the experimental section generates low-turbulence flow. The experiments run with a low flow velocity. Flow separation and vortex formation are clearly visible. The flow velocity is adjusted by a valve.

Hydrogen bubbles are generated electrolytically at a cathode made of thin platinum wire. The frame of the experimental section is used as an anode. The platinum wire can be inserted into different positions. Cathode current, its pulse and pause duration can be adjusted.

Cathode current and flow velocity are digitally displayed at the switch cabinet.

Image processing evaluation of the experiments (particle image velocimetry, particle tracking velocimetry) is possible using a special camera (i.e. PCO Pixelfy) and suitable software (i.e. ImageJ).

### Learning objectives/experiments

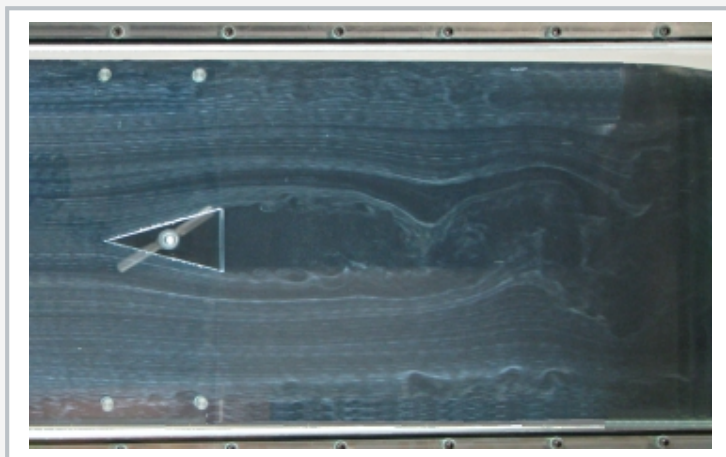
- visualisation of two-dimensional flows
- streamline course in flow around and through models
- flow separation
- vortex formation, demonstration of Karman vortices
- qualitative observation of the velocity distribution in laminar flow
- analogy to air flow
- in conjunction with a special camera (i.e. PCO Pixelfy) and suitable software (i.e. ImageJ):
  - ▶ image processing evaluation of the experiments (particle image velocimetry, particle tracking velocimetry)

# HM 132

## Vertical visualisation of flow fields



1 storage tank, 2 stabilisation tank with nozzle, 3 pump, 4 flow meter (indirect measurement of flow velocity), 5 illuminated experimental section with inserted model, 6 degassing tank, 7 valve to adjust the flow velocity, 8 switch cabinet with display and control elements



Flow around a triangle; flow direction from left to right (illustration rotated by 90°)

### Specification

- [1] electrolytically generated hydrogen bubbles visualise flow fields of different models
- [2] closed water circuit with experimental section, storage tank, pump, valve to adjust the flow velocity
- [3] vertical experimental section with black background, LED illumination on both sides and 2 insert positions for the model
- [4] supplied models: 2 aerofoils, triangle, semicircle, hollow hemisphere, 2 cylinders (different sizes), 2 models for changes in cross-section
- [5] low-turbulence flow using stabilisation tank with flow straightener
- [6] bubble generator: platinum wire as cathode and frame of experimental section as anode
- [7] cathode can be inserted in different positions
- [8] setting cathode current, pulse and pause duration
- [9] switch cabinet with displays for cathode current and flow velocity

### Technical data

Pump, 3 stages

- max. flow rate: 9,7m<sup>3</sup>/h
- max. head: 12m
- power consumption: 400W

Storage tank: approx. 75L

Experimental section

- LxH: 300x860mm, W=49mm

Bubble generator

- current: 0...2A
- platinum wire as cathode

Measuring ranges

- flow velocity: 0...13,3cm/s
- current: 0...2000mA
- temperature: 0...100°C (water)

230V, 50Hz, 1 phase

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

UL/CSA optional

LxWxH: 1850x800x1990mm

Weight: approx. 260kg

### Required for operation

distilled water (80L)

### Scope of delivery

- 1 trainer
- 1 set of models
- 1 set of accessories
- 1 storage system with foam inlay
- 1 set of instructional material