



armfield

FLUID PROPERTIES & HYDROSTATICS BENCH

F9092

issue 13



The Armfield Properties of Fluids and Hydrostatics Bench is designed to demonstrate the properties of fluids and their behaviour under hydrostatic conditions (fluid at rest). This allows students to develop an understanding and knowledge of a wide range of fundamental principles and techniques, before studying fluids in motion.

INSTRUCTIONAL CAPABILITIES

The provision of practical instruction exercises demonstrating the principles of fluid mechanics, in particular:

Understanding the properties of fluids:

- *determining the density, specific gravity and viscosity of different liquids*
- *observing the effects of capillarity*

Understanding the effects of static pressure:

- *demonstrating that the free surface of a static liquid is horizontal*
- *studying the effect of flow on a free surface*
- *measuring changes in liquid level*
- *studying the relationship between intensity of liquid pressure and depths*
- *determining the position of the centre of pressure on a plane surface*

Studying the operation and application of pressure gauges and manometers:

- *using a direct reading Mercury barometer (Mercury not supplied)*
- *measuring air and water pressure using manometers*
- *comparing results obtained from various devices*
- *calibrating a Bourdon-type pressure gauge using a dead weight pressure gauge calibrator*

Investigating the buoyancy force and stability of floating bodies:

- *verifying Archimedes' principle*
- *determining metacentric height*

Basic Fluid Mechanics

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DESCRIPTION

The equipment is mounted on a steel-framed bench fitted with castors. A variety of measuring devices is incorporated, either fastened to the back of the bench or freestanding.

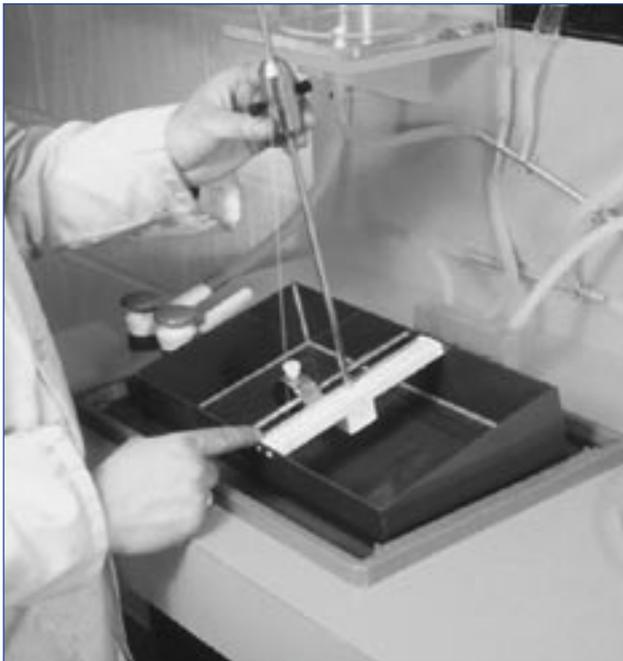
Water is stored in a polythene tank situated on the lower shelf of the bench.

The water can be transferred by two positive displacement hand pumps either to an elevated open storage tank connected to a number of glass tubes for free surface studies, or to a plastic sink recessed into the working surface so that bench top experiments may be conducted without spillage. All excess water is returned to the storage tank via the sink drain.

The following experimental apparatus is included:

- universal hydrometer and hydrometer jars
- falling sphere viscometers

- free surface tubes
- hook and point gauge
- Mercury barometer (Mercury not supplied)
- Bourdon gauge
- u-tube manometers
- deadweight pressure gauge calibrator and weights
- hydrostatic pressure apparatus
- Pascal's apparatus
- parallel plate capillary apparatus
- capillary tube apparatus
- lever balance with displacement vessel, bucket and cylinder
- metacentric height apparatus
- measuring cylinder
- thermometer
- air pump
- 600ml beaker
- stop clock



Determining the stability of a floating body



Calibration of a Bourdon gauge using a dead weight calibrator



Demonstration of the free surface of a static liquid



Pressurizing a manometer

TECHNICAL DETAILS

Universal hydrometer:

range 0.70 to 2.00 sub-divided in 0.01 intervals

Falling sphere viscometer:

40mm tube diameter

Hydrostatic pressure apparatus:

comprises counter-balanced precision quadrant pivotted on knife edges at its centre of arc

Direct reading barometer:

with compensated silvered metal scale

range 585 to 790mm subdivided in 1mm intervals
includes thermometer

100mm dial pressure gauge:

range 0 to 200 kN/m² (kPa) and equivalent head of water in metres

Dead weight pressure gauge calibrator:

with 2 x 1/2 kg, 1kg and 2 1/2 kg weights

Lever balance:

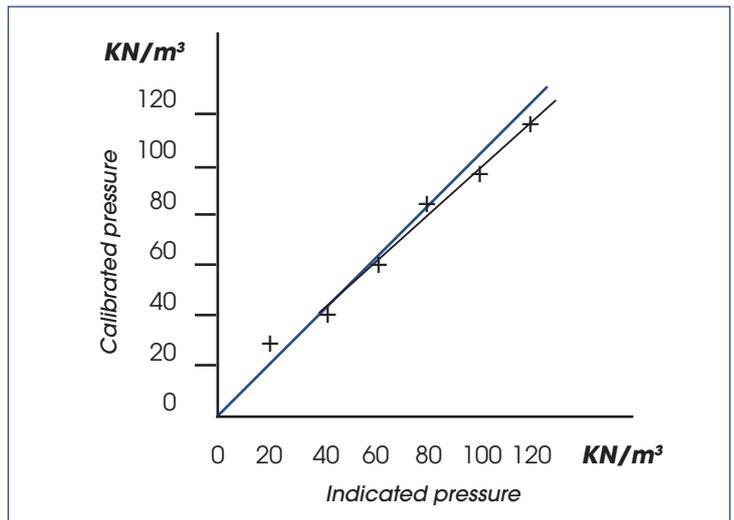
178mm diameter pan, hook for use in buoyancy experiments, anti-parallax cursor, double scale 0 to 0.25kg and 0 to 1.00kg

Thermometer:

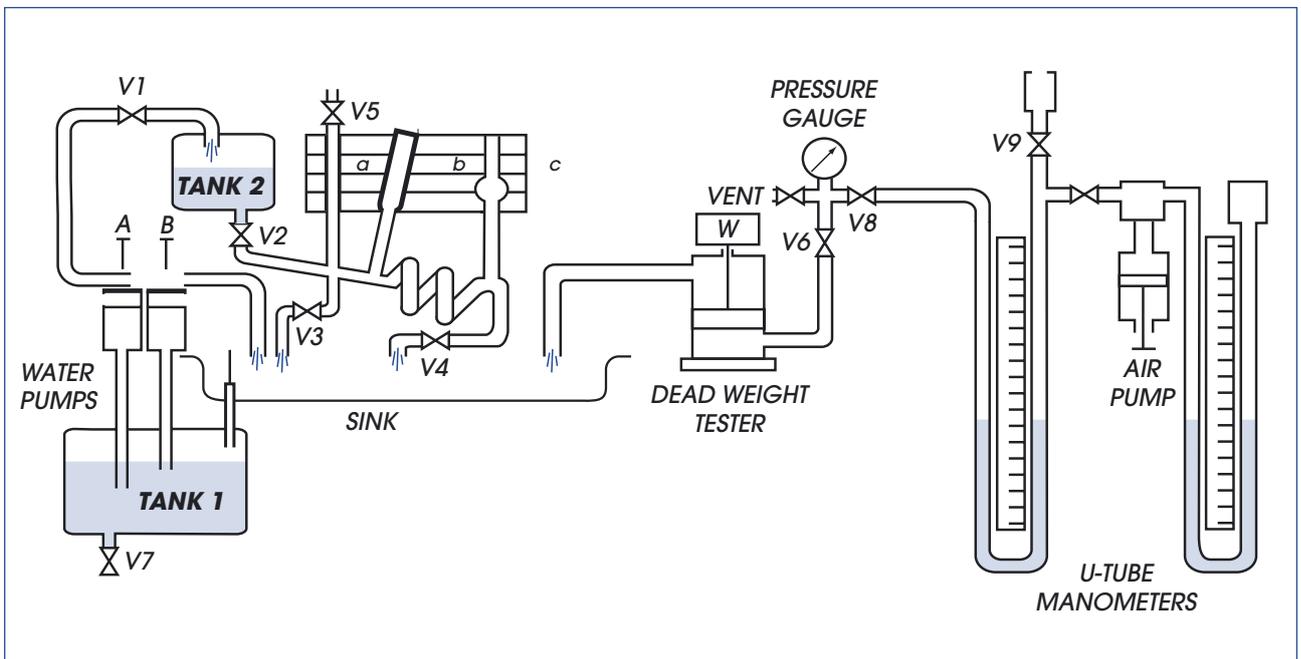
range -10°C to +50°C.



Demonstration of Archimedes' principle



Calibration of a Bourdon gauge



Pressure and liquid level experiments are conducted using a built-in pipe system shown in outline in this diagram

ORDERING SPECIFICATION

- *A self-contained and mobile unit for demonstration of the properties of fluids and hydrostatics.*
- *The equipment is mounted on a steel-framed bench fitted with castors.*
- *The bench top incorporates a recessed plastic sink.*
- *A variety of measuring devices is incorporated in the unit including a universal hydrometer, range 0.70 to 2.00; falling sphere viscometer; hook and point gauge; hydrostatic pressure apparatus; Pascal's apparatus; double scale lever balance with displacement vessel, bucket and cylinder; metacentric height apparatus; direct reading barometer range 585 to 790mm; dial pressure gauge range 0 to 200 kN/m² (kPa); dead weight pressure gauge calibrator with weights; thermometer range -10°C to +50°C.*
- *These devices allow a full range of 16 experiments to be carried out, demonstrating the properties of fluids, the effects of static pressure, the operation and application of pressure gauges and manometers and the investigation of the stability of floating bodies.*
- *A comprehensive manual is included describing how the experiments are performed as well as how to commission the equipment.*

RECOMMENDED INSTRUMENTS

*Vernier caliper
Reference pressure gauge - Bourdon type
Electronic top loading balance*

OPTIONAL ACCESSORIES

Consequent to its hazardous nature many technicians prefer not to use Mercury or its use may be prohibited in the laboratory. In any case Armfield is unable to include it in the supply with the purchase of Mercury manometers due to shipping restrictions. With this in mind Armfield offers a hand held, portable, battery operated pressure meter (H12-8) which is capable of measuring pressures of air or water from 0-2000mBar (0-1500mm Hg).

A full description and ordering specification is provided in data sheet:

H12: Manometers and Pressure Meters

COMPLEMENTARY PRODUCTS

*F1: Hydraulics Bench & Accessories
F1-301: Computer Aided Learning Programs (PC: Windows)
F5: Osborne Reynolds Demonstration
F6: Air Flow Studies
F10: Cavitation Demonstration
F12: Particle Drag Coefficients
F14: Hydrogen Bubble Flow Visualisation System*

OVERALL DIMENSIONS

*Height: 1450mm
Width: 1830mm
Depth: 610mm*

SHIPPING SPECIFICATION

*Volume: 2.7m³
Gross weight: 270kg*

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