

P6234/35/36/37 HYDROSTATICS EXPERIMENTS

P6234 CALIBRATION OF A PRESSURE GAUGE

INTRODUCTION

The most common type of pressure gauge used as an industrial instrument uses a Bourdon tube as the sensing element. It consists of a curved tube of elliptical cross section which is closed at one end. When pressure is applied at the open end of the tube, the tube cross section tries to become circular which causes the tube to straighten slightly. This change of shape is used as a measure of the pressure by clamping the open end to the pressure gauge casing and allowing the subsequent movement of the free end of the tube to be transmitted by a mechanical linkage to move a pointer over a scale. The movement of the pointer is dependent on the mechanism and the elastic properties of the Bourdon tube. The normal industrial practice is therefore to calibrate pressure gauges by applying known pressures to the gauge. Pressure sources for calibrating pressure gauges are derived using fundamental principles, the standard method being to use calibrated weights acting on a piston of accurately known dimensions.

DESCRIPTION

Cussons P6234 Calibration of Pressure Gauges is used for the calibration of the Bourdon type pressure gauge supplied with the Cussons Hydraulic Bench and other gauges of a

similar rating using the dead weight method. The apparatus, which is illustrated in Fig. 1, consists of a valve base and a bronze barrel which has a precision machined bore into which fits a stainless steel piston. The piston is fitted with a platform which can carry calibration weights. The weights supplied with the apparatus are equivalent to pressures of 0.5 bar and 1 bar. The piston and platform have a total weight equivalent to 0.5 bar pressure. Fitted to the valve base are two connections and a blanking plug. A connection for the pressure gauge under test is pre-fitted and supplied with a length of plastic pipe suitable for connection to the pressure gauge via the auxiliary tapping on the Hydraulics Bench. A non-return connection for the water supply from the hydraulics bench is fitted on one side of the valve block. On the third side of the block is a blanking plug which is removed to allow the apparatus to be drained of water. The apparatus is mounted on a plastic

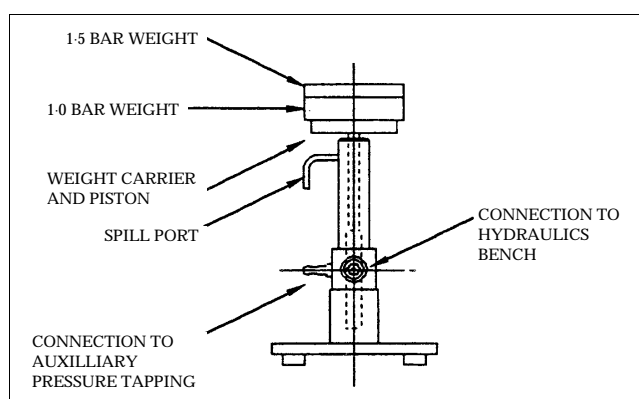


FIG. 1

base for stability. A spill-pipe is fitted into the barrel which prevents the piston being ejected by excess pressure. The Bourdon gauge, fitted on the Bench, is a simple device and normally very reliable in service. The basic element of the gauge is a curved, elastic-metal tube, usually of brass or stainless steel, which changes its geometry when filled with fluid under pressure. This distortion is transmitted by linkage to the gauge pointer. After an extended period of use, slight deviations of value are likely to occur and for "accurate" work a calibration curve for the instrument is necessary. The dead weight tester is not subject to variations and can, therefore, be used as a reliable standard for calibration purposes.

EXPERIMENTAL CAPABILITIES

- ◆ Calibration of Hydraulic Bench pressure gauge.
- ◆ Calibration of other pressure gauges of similar rating to the Bench pressure gauge.

DIMENSIONS AND WEIGHTS

Nett:- 225 x 150 x 280 mm, 4.0 Kg.

Gross:- 0.013m³, 6.0 Kg.

P6235 FLAT BOTTOMED VESSEL (METACENTRIC HEIGHT APPARATUS)

DESCRIPTION

Cussons P6235 Flat Bottomed Vessel is constructed from non-ferrous materials and has a detachable bridge piece and loading system. The bridge piece can be used with other hull sections so that floatation characteristics may be directly compared. Provision is made to alter the keel weight and the mast weight so obtaining a variety of loading conditions. For off balance loadings the degree of list can be directly measured using the plumb-bob line attached to the mast and swinging over a scale mounted on the bridge piece. The floatation experiments can be carried out using the measuring tank of the P6100 Hydraulics Bench.

Floatation characteristics of flat bottomed vessel P6235

Depth	170 mm
Length	380 mm = L
Width	250 mm = D
Distance from pontoon centre line to added weight	123 mm
Centre of gravity of pontoon with mast	125 mm approx. from outer surface of vessel base
Weight of vessel with mast	3 kg approx.
Height of mast loading position above water surface of vessel base	790 mm

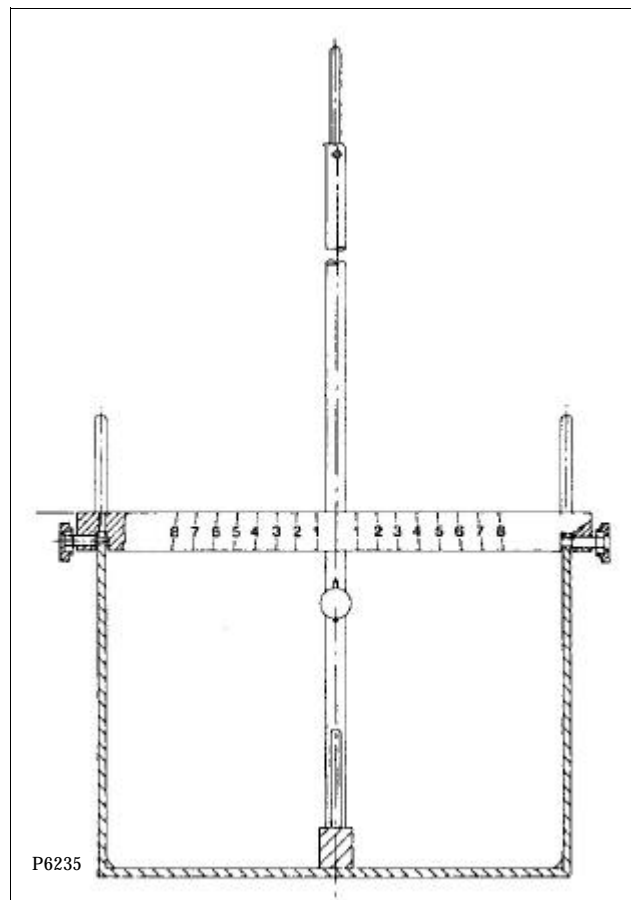
EXPERIMENTAL CAPABILITIES

- ◆ Experiment to illustrate the floatation characteristics of a flat bottomed vessel (pontoon).
- ◆ Determination of the Metacentric Height for a flat bottomed vessel.

DIMENSIONS AND WEIGHTS

Nett:- 390 x 300 x 800 mm, 13.0 Kg.

Gross:- 0.107m³, 16.0 Kg.



P6236 ALTERNATIVE HULL SECTIONS

DESCRIPTION

Two further types of hull section are supplied to be used in conjunction with the bridge piece, keel and mast weights etc. supplied on P6235 "Floatation characteristics of a Flat Bottomed Vessel".

Both additional hulls are made from non-ferrous material and one is representative of a typical hull section whilst the other is of semi-circular form.

The bridge piece is removed from the flat-bottomed hull section P6235 by unscrewing the bridge piece fixing screws until they are clear of the locating holes in the hull, and then lifting the bridge piece and mast clear of the hull.

Fixing the bridge piece to either the 'typical' or 'semi-circular' hull section involves the reverse of the above removal instructions.

Semi circular hull : Length 380 mm
 Width 250 mm
 Weight 2600 gms approx.
 (including mast and bridge
 piece from P6235)

Typical hull section : Length 380 mm
 Width 250 mm
 Weight 2700 gms approx.
 (including mast and bride
 piece from P6235).

EXPERIMENTAL CAPABILITIES

- ◆ Experiment to illustrate the floatation characteristics of alternative hull sections under various loading conditions.

ACCESSORIES REQUIRED

P6235 Flat Bottomed Vessel

DIMENSIONS AND WEIGHTS

Nett:- 380 x 250 x 500 mm, 9.0 Kg.

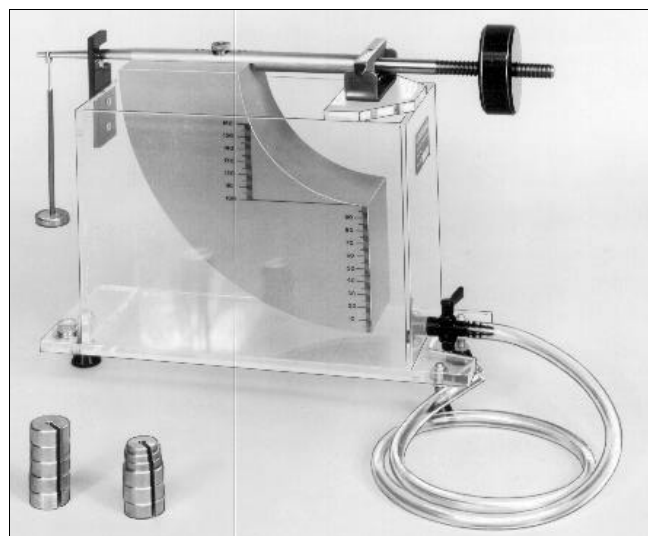
Gross:- 0.056m³, 11.0 Kg.

P6237 CENTRE OF PRESSURE APPARATUS

INTRODUCTION

The study of pressure forces acting on plane submerged surfaces is a fundamental topic in the subject of hydrostatics involving assessment of the value of the net thrust and the concept of centre of pressure, which are so important in the design of innumerable items of hydraulic equipment and civil engineering projects.

Cussons Centre of Pressure Apparatus is a well proved item of educational equipment that produces excellent experimental results which replicate the theoretical results very closely.



DESCRIPTION

Cussons P6237 Centre of Pressure Apparatus consists essentially of a torroidal quadrant pivoted on its centre line on a balance arm above a water tank, as shown in Fig. 1. The fabricated torroidal quadrant, which has dimensions of 100 mm internal radius, 200 mm outer radius and 75 mm width, is mounted on the balance arm so that its rectangular end face is vertical and the two curved faces are concentric with the line of action of the knife edge pivots; thus, of the hydrostatic forces acting on the quadrant when immersed, only the force on the rectangular end face gives rise to a moment about the knife edge axis. In addition to the quadrant clamping screw, the balance arm incorporates a balance pan and an adjustable counter-balance.

The perspex tank has an integral base which may be levelled by adjusting the three screwed feet. Correct alignment is indicated on the circular spirit level attached to the base of the tank. The top of the tank has a bridge piece at one end with integral pivot supports whilst at the other end of the tank there is a balance arm restraint and datum level indicator.

Water can be poured into the top of the tank from a suitable container and may be drained through the drain cock at the

base of the tank, to which a length of flexible tube may be attached. The water supply may be obtained from the outlet of the P6100 Hydraulics bench.

The water level is indicated on scales which are engraved onto the side face of the quadrant. The scale is split at the top of the end face to indicate the change from partial to total immersion.

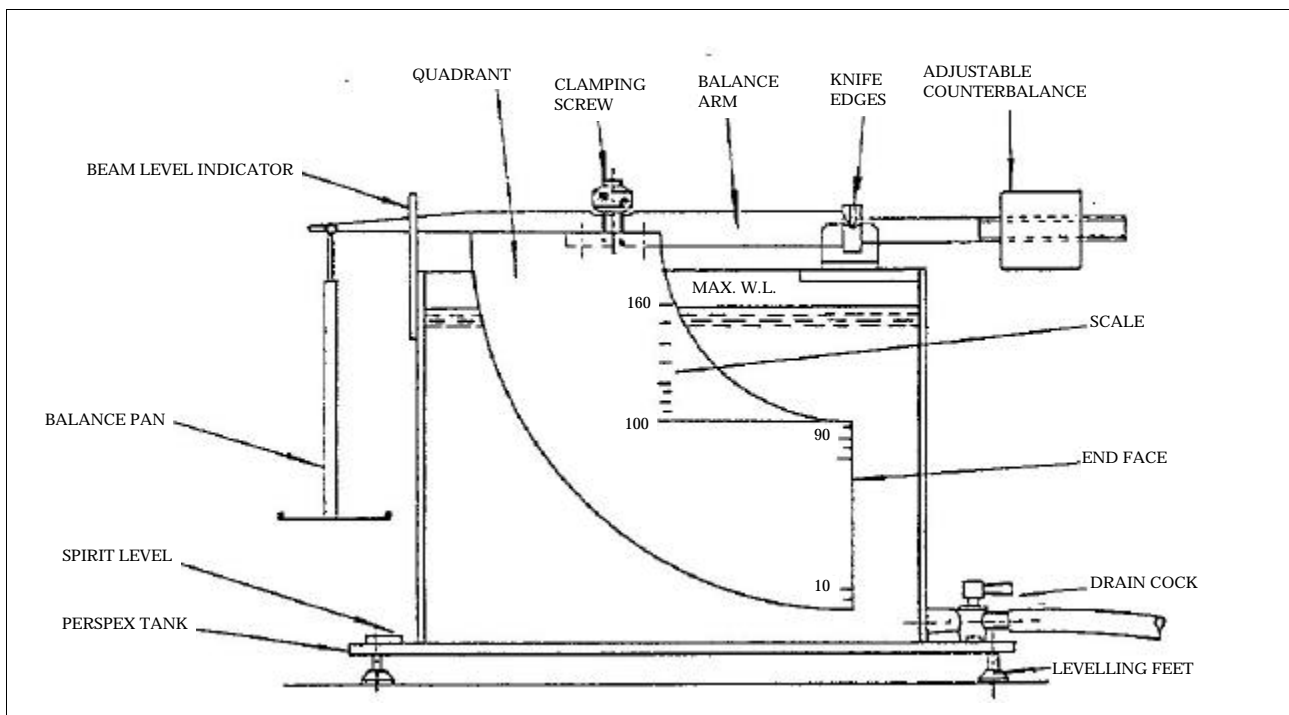
EXPERIMENTAL CAPABILITIES

- ◆ Measurement of the static thrust on a vertical water submerged surface.
- ◆ Determination of the Centre of Pressure of a vertical water submerged surface.

DIMENSIONS AND WEIGHTS

Nett:- 560 x 190 x 520 mm, 4.5 Kg.

Gross:- 0.066m³, 6.0 Kg.



Some of the experiments featured here can also be successfully used with *P6242 Hydrostatics Bench*, detailed spec is available on a separate document, as well as with *P6100 Hydraulics Bench*.

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