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DIPPING-BELL PRESSURE STANDARDS Types PTF 3020

Class 0.02 %



Fields of Application

The Dipping-Bell Pressure Primary Standard permits the measurement of lowest pressures with highest precision and resolution. Adjustments, tests and calibrations of

- » Pressure sensors and transmitters
- » Calibrators
- » Handheld pressure gauges etc.

which until now had to be made with inadequate de-

vices such as Betz manometers, Minimeters or even liquid columns, become surely traceable according to EN ISO 9000, FDA and OSHA.

Combined with a PC and software such as C³ (Computer Controlled Calibration) fully automatic calibrations are possible.

Basic Principle

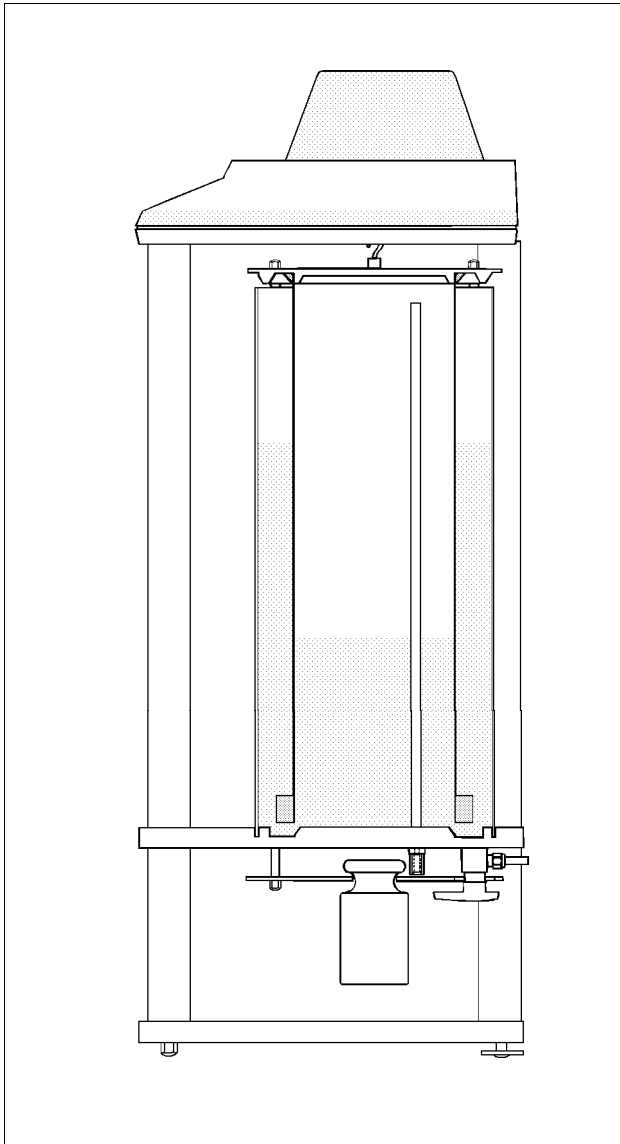
Corresponding to the basic definition (Pressure equals force divided by area) this procedure consists of a bell-shaped hollow cylinder of exactly defined active area hanging on one side of a balance beam and dipping into a separation liquid of low surface tension. Pressure, conducted through the liquid under the bell, results in a buoyancy which is compensated and therefore fundamentally determined by removing weights on a pan on the other side of the beam.

Design Concept

The Dipping-Bell Pressure Primary Standard is a state-of-the-art application of this basic principle: The dipping bell made of a thin-walled stainless steel tube, closed on the top, forms an underload on a precision balance with electronically controlled force compensation.

The buoyancy generated by the pressure arriving under the bell through a tube produces a slight deviation of the force sensing element which is being detected by an opto-electronic device. This signal is used by a PID controller to change its output voltage which, through the compensation coil, nulls the force sensing element again. The current flowing through the coil, being proportional to the pressure, is converted by the measuring resistor into the measurement voltage. Its value, digitised by the AD converter, is fed to the microprocessor which sends the corrected value to the digital display in pressure units. Among others, the following major benefits are realized:

- » Direct readout without any manipulations
- » Automatic control easy through data output
- » Durable reproducibility
- » Optimum damping of pressure fluctuations



The MASCAL calibration procedure, forming an integral part of the pressure standard, permits on one side a fundamental self check and eventually the calibration with a mass of one kilogramme and on the other side it permits the measurement of negative pressure (suction).

Technical Characteristics

Nominal range, separation fluid

Decaline: 0...3.0000 kPa (12 inH₂O)
 (altern. Nonane) 0...~ 2.4 kPa
 (altern. Water) 0...~ 3.4 kPa

Dual range: 0...1.00000 kPa (4 inH₂O)
 Negative range: 0...-1.00000 kPa (-4 inH₂O)
 Maximum error: ± 0.02 %
 Measuring points: 30'000 resp. 100'000

Resolution: 0.003 % (nominal range)
 0.001 % (dual range)
 Measuring units: kPa, mbar, mmH₂O, mmHg, inH₂O, inHg, %
 Digital display: 7-segment LED, 14 mm
 Analogue display: LED beam 0...100%
 Reproducibility: 0.005 %
 Response time: ~ 2.5 s
 Ambient temperature: 15...35 °C (60...95 °F)
 Effect of temperature, Zero: ± 0.0004 %/°C
 Sensitivity: + 0.0032 ± 0.0004 %/°C
 Overload capacity: 5 % (overflow, no damage)
 Pressure connection: spec. O-Ring connection
 Power supply: (110)/230 VAC, 50/60 Hz
 Power consumption: ~ 12 W (VA)
 Net weight: 18.2 kg (40 lbs)
 Dimensions: 240 x 270 x 700 mm
 (9.5 x 10.8 x 27.6 in)
 Data interface: RS-232-C (options TTY or IEEE 488)
 Analogue output: 0...1 V
 Self check: MASCAL calibration procedure

Options

Pressure Primary Standards

For applications which have not to conform to the very highest metrologic standards, the Pressure Primary Standards based on the same balance but with an elastic bellows as pressure sensor are available. They do not need a separation liquid, are therefore somewhat easier and more rapid to operate. With a maximum error of 0.03 %, they feature the same resolution at the same range, but are available in additional ranges stepped up to 0...600 bar (9'000 PSI) as well as for absolute and differential pressure.

Automatic Pressure Calibrators

These are used for the half or fully automatic control of the pressures needed for the calibration. They can be operated from the front panel as well as remotely from a PC.

Calibration and Quality Assurance Software

For the realisation of fully automatic, optimum pressure calibration processes up to the print-out of calibration certificates and graphics, several versions of software are available to the operator: So under MS-DOS one for Computer Aided (CAC) and one for Computer Controlled Calibration (C³) with additional modules for relative, absolute, negative and/or differential pressure as well as under MS-WINDOWS a fully integrated solution IMMS (Instrument Maintenance Management System) for quality assurance and inventory control.

The detailed technical characteristics of the different options are to be found in separate documentations.

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