



Pressure Balance;
Hydraulic Standard



Pressure Balance;
Standard used in Absolute Pressure



Pressure Balance;
Pneumatic Standard

The Pressure Laboratory is responsible for the National Standards of Pressure providing the following additional services:

- Dissemination of the unit of pressure;
- Calibrations;
- Participation and coordination of international laboratory comparisons;
- Technical support for legal metrology.

Derived unit of the International System (SI) of the quantity Pressure (p):

pascal (Pa) defined as:

The pressure generated by a force of one newton per square meter.

Multiples of Pa can be used as measurement unit as well as the bar and mmHg (just for sphygmomanometers).

Pressure Quantity

The traceability to the SI Unit of the Laboratory for Pressure is assured by the calibration of the standards at IPQ and international NMI.

Pressure balances (PB) are systems using piston-cylinder assemblies that define pressure directly from 3 base quantities (mass, length and time), for that reason PB are pressure standards.

Pressure balances consists of finely machined pistons mounted vertically in very close-fitting cylinders, the internal pressure required to support the weight of the rotating piston and associated masses is calculated from the fundamental relationship between three quantities; mass, length and time:

$$\text{Pressure} = \text{force/area} = (m \times g) / A$$

Where:

m is the mass of the piston and associated masses,

g is the local value of acceleration due to gravity,

A is the effective area of the piston-cylinder combination

Calibration

MEASURAND	MEASURING INTERVAL	EXPANDED UNCERTAINTY ($k=2$)	CMC (CIPM-MRA)
gauge pressure (oil)	(0,2 to 10) MPa	$[27^2 + (5,8 \cdot 10^{-5} \cdot p)^2]^{1/2}$	
	(10 to 100) MPa	$5,5 \cdot 10^{-5} \cdot p$	
gauge pressure (gas)	3,5 kPa to 2 MPa	$3,0 \cdot 10^{-5} \cdot p$	
negative gauge pressure	-10 kPa to -0,1 MPa	$(25 \cdot 10^{-5} \cdot p + 25)$ Pa	-----
absolute pressure	3,5 kPa to 170 kPa	$0,4 \text{ Pa} + 3,5 \cdot 10^{-5} \cdot p$	

Note: p in Pa

Metrological Control

EQUIPMENT	TESTS	LAWS
Manometers, vacuum meters, and manovacuum meters	Pattern Approval	Portaria n.º 422/98 de 21 de Julho
Manometers for automobile pneumatics without pre-booking	Pattern Approval	Portaria n.º 963/90 de 9 de Outubro
Manometers for automobile pneumatics with pre-booking and digital manometers	Pattern Approval	Portaria n.º 389/98 de 6 Julho

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