

## The Pressure Reference



---

### **Model 5111 Very Large Area PCA Primary Pressure Standard**

Model 5111 pressure balance was designed to host DH-Budenberg's very large diameter Piston Cylinder Assemblies whose effective area can be determined directly by dimensional measurement, hence eliminating the need to crossfloat the piston gauge with an other pressure standard.

Developped in the early 1980's by DH-Budenberg's founder company Desgranges & Huot of France, those Piston Cylinder Assemblies have established the Pressure Balance as a true primary pressure standard that can challenge the Mercury Manometer.

Nowadays, DH-Budenberg's 5000 series pressure standards are operated by more 50 countries as there National Pressure Reference.

## **CONSTRUCTION**

The 5111 is a self contained pressure balance with a strong cast aluminium housing which provides high thermal stability and low sensitivity to environmental influences.

It is designed for pure gas pneumatic operation up to 5 MPa with external pressure control through a precision pressure control block.

Features include :

- Power rotation of Piston (clockwise @ 30 rpm nominal) with non interfering drive principle, disengaged position and low heat 12 Vdc motor with external power supply.
- Built-in inductive dual Piston Position Sensor with external signal conditioning
- Built-in 4 wires Platinum Resistance Thermometer for measurement of piston temperature, located inside the measuring post and with external signal conditioning
- Built-in spirit level and precision levelling feet

The 5111 is compatible with the optional Terminal 5000 interface which eases up the achievement of its metrological excellence.

## **MASS SET**

The 5111 has a 100 kg mass set with main masses of 5 kg and fractional masses down to 0.01 g which can be combined in anyway to give a resolution of 0.1 ppm over the full range.

Masses are made of type 304L austenitic non magnetic stainless steel and are machined to a tolerance of 10 ppm of nominal value.

All masses are hanged over to lower the centre of gravity and limit side forces.

The very large mass provides an efficient way to cover extended pressure ranges with lower uncertainties.

## **PISTON CYLINDER ASSEMBLY**

The 5111 accepts 10 and 20 kPa/kg piston cylinder assemblies giving pressure ranges to 1 and 2 MPa.

The PCAs are pure gas operated and made of tungsten carbide with Titanium head. There nominal mass is 500 g.

Features include :

- Clearance between piston and cylinder of 0.2 micrometer nominal
- Straightness, roundness and parallelism within 0.1 micrometer
- Minimum floating time of 20 minutes at full load
- Thermal expansion coefficient of 9 ppm /°C
- Pressure distorsion coefficient of  $c0.85 \cdot 10^{-7} \text{ bar}^{-1}$
- Young's modulus of  $6 \cdot 10^{11} \text{ N/m}^2$

Uniquely, the very large area of the piston cylinders of the 5111 gives the possibility to determine their effective area not only by cross-floatation with an other pressure standard, but also from true dimensional measurements. The uncertainty on the effective area can therefore be reduced to a few ppm.

## **METROLOGICAL SPECIFICATIONS**

- Pressure ranges:  
With 10 kPa/kg PCA: 5 kPa to 1MPa  
With 20 kPa/kg PCA: 10 kPa to 2MPa
- Sensitivity: < 0.1 ppm
- Repeatability: < 1 ppm
- Stability over time: < 1 ppm/year

## **CALIBRATION**

The 5111 is delivered with a calibration certificate drawn-up by the DH-Budenberg SA COFRAC accredited laboratory. (Accreditation nr 2-1033 for pressure and 2-1129 for mass).

The COFRAC accreditation gives traceability of the calibration to French and International standards. It is also a third party guarantee for the user that presented calibration results are true and unbiased.

All results are expressed with 2 standard deviations ( $k=2$ ).

Optionally calibration of the instrument at the French National Laboratory BNM-LNE can be arranged. This provides direct traceability to French National Standards and reduced uncertainties.

**DH-Budenberg SA**  
56, rue des Ecoles-BP125  
93303 Aubervilliers Cedex  
FRANCE  
Telephone : 33 (0)1 48 39 83 00  
Telefax : 33 (0)1 48 33 65 90  
E-mail : dhonline@desgranges.com

**DH-Budenberg Co Ltd**  
PO BOX 224  
Altrincham, Cheshire WA 14 4FY  
UNITED KINGDOM  
Telephone : 44 (0)161 942 4700  
Telefax : 44 (0)161 942 4701  
E-mail : sales@dh-budenberg.co.uk

**DH-Budenberg GmbH**  
Raiffeisenstrasse 2  
D-63110 Rodgau  
DEUTSCHLAND  
Telephone : 49 (0)6106/8294-0  
Telefax : 49 (0)6106/829417  
E-mail : desgranges.support@t-online.de