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FLUKE®
Calibration

P3000 Series

Pneumatic Deadweight Testers Model P3000

Technical Data

Features

- Pressure ranges from Vacuum through 2 000 psi (140 bar)
- Accuracy better than 0.015 % of reading. (Increased accuracy option of 0.008 %)
- Gas operated with optional hand pumps
- Dual vacuum/pressure models available
- Psi, bar, kgf/cm^2, kPa and MPa ranges available
- Piston/cylinder design provides stability and repeatability
- Built-in pneumatic hand pumps for pressure and vacuum
- High quality needle valves provide optimum control
- Mounted spirit level and adjustable feet
- Test station design with O-rings eliminates the need for PTFE tape or wrenches
- Improved case with spring-loaded latches for hood
- Sturdy weight box with hinged lid and side handles for easy transport

The P3000 Series is the culmination of over 50 years experience in the production and design of primary pressure standards. With features designed to improve accuracy and performance, increase reliability and simplify operation these deadweight testers can be used to calibrate virtually any pressure sensing device, including transducers, transmitters, gauges or pressure switches.

Each instrument is supplied with a detachable lid that makes it neat, compact and easily portable. The masses are stored in a high-quality case with a self-locking mechanism to protect them during transit.

All units are provided with an accredited calibration certificate, M14X1.5, M20X1.5, 1/8, 1/4, 3/8, and 1/2 NPT and BSP female adaptors, operating fluid (where applicable) and spare seals.

The piston/cylinder assemblies are manufactured to the very highest standards and are supplied with accredited calibration reports with stated instrumental measurement uncertainties.

Operating principle

Deadweight testers are the primary standard for pressure measurements. Utilizing the well proven piston-gauge system consisting of a vertically mounted, precision lapped piston and cylinder assembly, accurately calibrated masses (Force) are loaded on the piston (Area), which rises freely within its cylinder. These masses balance the upward force created by the pressure within the system.

Instrument base

There are four basic variations in the pneumatic offering; single pressure, single vacuum, dual vacuum and pressure, and oil-lubricated pneumatically driven high-pressure models. Pressure or vacuum is generated by an external source or an optional built-in hand pump (standard on the lower pressure models). The hand pump option is not available on instruments above 500 psi (3.5 MPa).

Piston/cylinder assemblies

The piston/cylinder assembly is the heart of each deadweight tester. They are manufactured from materials that provide stability, durability, and low thermal coefficients and distortion. Our experience and knowledge of piston/cylinder production and calibration ensure the precision and performance required for today's demanding calibration requirements.

Masses

Standard masses are series 3 non-magnetic austenitic stainless steel. Each mass is marked with the serial number of the instrument and the nominal pressure value relative to the high- or low-pressure piston, when applicable. The masses for the vacuum ranges and the optional fine increment masses are stainless steel and/or aluminum.

Gravity correction

Gravity varies significantly with geographical location and this variation has a direct effect on the force of the weights and the accuracy of the deadweight tester. Each instrument can be calibrated to local gravity at no extra cost. If unspecified, instruments will be calibrated to Standard Gravity at 980.665 cm/s^2.

Gas supply

All instruments are fitted with a 1/4 inch NPT female external supply port for connection to the gas supply source. A compressed gas bottle (nitrogen or dry air) fitted with a pressure regulator is recommended. Ten percent above the maximum pressure is required. A built-in hand pump is available on some models to generate pressures to 300 psi (2 MPa).

For vacuum requirements, an external vacuum pump can be connected to the 1/4 inch port. The built-in hand pump will also generate up to 90% vacuum.

PressCal Software

Windows-based software program that allows users to easily apply all necessary corrections to enhance the deadweight tester performance. Calibration details are then stored and/or used to automatically create a calibration certificate.

The use of PressCal allows for an improved accuracy of 0.008%.

P3000 Series Vacuum and Dual Vacuum/Pressure Models

The combined vacuum/pressure models are extremely versatile instruments providing vacuum through 500 psi (3.5 MPa) capacity in one unit. An optional built-in hand pump can be installed to generate vacuum (90 %) through 300 psi (2 MPa).

P3000 Series Liquid Lubricated Gas Operated Models

The Models P3031 and P3032 feature an oil lubricated piston/cylinder assembly, which ensures that the instrument is less susceptible to performance issues caused by contamination of the gas supply or the environment in which the unit is being operated.

The supply gas, via the deadweight tester controls, is introduced into the piston/cylinder chamber. As the gas acts directly on the surface of the oil, there is a rate-less transfer of pressure within the system.

The instrument is designed to prevent inadvertent over-filling of the chamber, thus avoiding contamination of the gas system. There is no physical barrier between the gas and oil so there is some "oil-mist" transfer potential. Therefore, we do not recommend the standard version for oxygen service. A special version of these instruments using a hydrocarbon free fluid is available.

Cross-sectional illustration of liquid lubricated piston chamber

Specifications

Pressure ranges			
Instrumental measurement uncertainty	± 0.015 % of reading (± 0.008 % optional) Note: For more information on the uncertainty, including the % reading threshold, please see technical note, "Guide for the Uncertainty Analysis in Pressure When Using P3000 Series Dead-weight Testers"		
Mass and PCU materials of construction			
Standard weight material	Series 3 non-magnetic austenitic stainless steel Density: 7.8 g/cm^3		
Optional fine increment masses	Aluminum Density: 2.7 g/cm^3		
	Piston material	Cylinder material	Coefficient of expansion
P3011, P3012, P3013, P3022, P3023, P3025 (V)	Ceramic	Martensitic steel	11 ppm/°C
P3014, P3015, P3025 (P), P3031, P3032 (P & V)	Tungsten carbide	Martensitic steel	16.5 ppm/°C
General			
Test port adaptors	M14 X 1.5, M20 X 1.5, 1/8 in, 1/4 in, 3/8 in and 1/2 in NPT and BSP		
Weight	11 kg (24 lb)		
Dimensions (W x D x H)	440 mm x 300 mm x 215 mm (17.5 in x 12 in x 8.5 in)		
Mass set weight (typical)	29 kg (65 lb)		
Weight increments			
Minimum standard weight increments			
P3012, P3022 Pressure	1 inH_2O, (5 mbar, 0.5 kPa)		
P3013, P3023 Pressure	2 inH_2O, (10 mbar, 1 kPa)		
P3014, P3015, P3025 Pressure	1 psi, (0.1bar, 10 kPa)		
P3031, P3032	1 psi, (0.1bar, 10 kPa)		
P3011, P3022, P3023, P3025 Vacuum	0.2 inHg (10 mbar, 1 kPa)		
Optional fractional weights			
P3014, P3015, P3025 Pressure	0.1 psi (10 mbar, 1 kPa)		
Built-in hand pumps			
Pressure mode	Max pressure 300 psi (2 MPa)		
Vacuum mode	To 90 % vacuum		
Operating fluid for liquid lubricated models			
55-655 mineral oil. For oxygen clean applications, please consult factory.			

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Ordering information

Air operated - single PCU

Model

P3012-KPA-P 1.5 to 100 kPa
P3012-MBAR-P 15 to 1 000 mbar
P3012-INH2O-P 5 to 400 inH_2O

P3013-KPA-P 3 to 200 kPa
P3013- MBAR-P 30 to 2 000 mbar
P3013-INH2O-P 12 to 800 inH_2O

P3014-BAR-P 0.2 to 10 bar
P3014-KGCM2-P 0.2 to 10 kgf/cm^2
P3014-PSI-P 3 to 150 psi
P3014-KPA-P 20 to 1 000 kPa
P3014-5MPA-P 0.02 to 1 MPa

P3015-BAR-P* 0.2 to 35 bar
P3015-KGCM2-P* 0.2 to 35 kgf/cm^2
P3015-PSI-P* 3 to 500 psi
P3015-KPA-P* 20 to 3 500 kPa
P3015-MPA-P* 0.02 to 3.5 MPa

* -P indicates built-in pump optional.

Liquid lubricated

Model

P3031-BAR 1 to 70 bar
P3031-KGCM2 1 to 70 kgf/cm^2
P3031-PSI 10 to 1 000 psi
P3031-KPA 100 to 7 000 kPa
P3031-MPA 0.1 to 7 MPa

P3032-BAR 1 to 140 bar
P3032-2KGCM2 1 to 140 kgf/cm^2
P3032-PSI 10 to 2 000 psi
P3032- KPA100 to 14 000 kPa
P3032-MPA 0.1 to 14 MPa

Vacuum operated - single PCU

Model

P3011-KPA-P* 3 to 100 kPa
P3011-MBAR-P* 30 to 1 000 mbar
P3011-INHG-P* 1 to 30 inHg
P3011-MMHG-P* 30 to 760 mmHg

* -P indicates built-in pump optional.

Air operated - dual PCU

Model	Pressure range	Vacuum range
P3022-KPA-P*	1.5 to 100 kPa	3 to 100 kPa
P3022-MBAR-P*	15 to 1,000 mbar	30 to 1 000 mbar
P3022-INH2O-P*	5 to 400 inH_2O	1 to 30 inHg
P3023-KPA-P*	3 to 200 kP	3 to 100 kPa
P3023-MBAR-P*	30 to 2 000 mbar	30 to 1 000 mbar
P3023-INH2O-P*	12 to 800 inH_2O	1 to 30 inHg
P3025-BAR-P*	0.2 to 35 bar	30 to 1 000 mbar
P3025-KGCM2-P*	0.2 to 35 kgf/cm^2	30 to 760 mmHg
P3025-PSI-P*	3 to 500 psi	1 to 30 inHg
P3025-KPA-P*	0.02 to 3.5 MPa	3 to 100 kPa
P3025-MPA-P*	0.02 to 3.5 MPa	3 to 100 kPa

* -P indicates built-in pump optional.

Options

Built-in pump (where applicable)
Fine Increment Weights (where applicable)
Conversion Weight Set to allow pressure increments in other pressure units
0.008 % Improved Accuracy (PressCal Software)
COMPASS for Pressure Calibration Software

Fluke Calibration.

Precision, performance, confidence.™

- Electrical
- RF
- Temperature
- Pressure
- Flow
- Software

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