

# 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<sup>2</sup>, kPa and MPa ranges available
- Piston/cylinder design provides stability and repeatability
- Built-in pneumatic hand pumps for pressure and vacuum
- Piston flotation indicator
- 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 Pressurements 3000 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 weight masses are stored in a high-quality

case with a self-locking mechanism to protect them during transit.

All units are provided with a traceable certificate of accuracy, weight mass details, 1/8 inch, 1/4 inch, 3/8 inch and 1/2 inch NPT or BSP female adaptors, operating fluid (where applicable) and spare seals.

The piston/cylinder assemblies are manufactured to the very highest standards with certified accuracies trace-able to international standards laboratories such as the National Institute of Standards and Technology (NIST).

## 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 weight masses (Force) are loaded on the piston (Area), which rises freely within its cylinder. These weights balance the upward force created by the pressure within the system.

The pressure is measured when placed on a correctly spinning and floating piston. The total pressure measured is the summation of the weights plus the piston weight carrier assembly.

## Instrument base

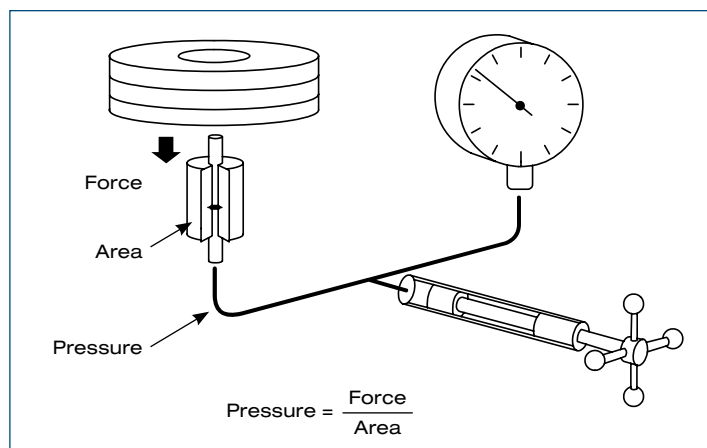
There are four basic variations in the pneumatic offering; single pressure, single vacuum, dual vacuum and pressure, and oil-lubricated pneumatically driven high-pressure models. Pressure or vacuum is generated by an external source or an optional built-in hand pump. The hand pump option is not available on instruments above 500 psi (35 bar).

## 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.

## Weight masses

Standard weight 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. Vacuum weights and the optional fractional weights are stainless steel and/or solution heat treated 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<sup>2</sup>.

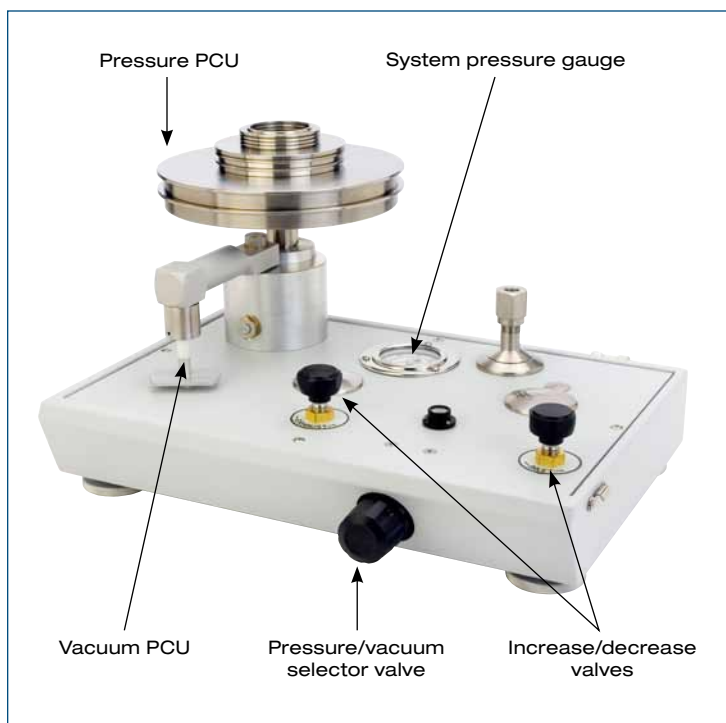
## Gas supply

All instruments are fitted with a /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 (20 bar).

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

### P3000 Series Vacuum and Dual Vacuum/Pressure Models

The combined vacuum/pressure models are extremely versatile instruments providing vacuum through 500 psi (35 bar) capacity in one unit. For added expansion, an additional low range piston/weight set can be provided for pressures to 800 inH<sub>2</sub>O (2 000 mbar). An optional built-in hand pump can be installed to generate vacuum (90%) through 300 psi.



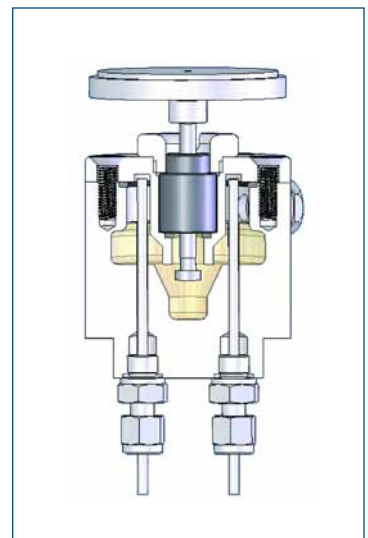
### P3000 Series Liquid Lubricated Gas Operated Models

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 an oxygen-compatible fluid is available.



Cross-sectional illustration of liquid lubricated piston chamber



## Specifications

<b>Pressure ranges</b>			
Accuracy	± 0.015 % of reading (± 0.008 % optional) Note: Accuracy based on % of reading from 10% to 100% of the piston range when used in accordance with the corrections found on the calibration certificate. Below 10% ± (accuracy class) x 10 % of the piston range.		
<b>Mass and PCU materials of construction</b>			
Standard weight material	Series 3 non-magnetic austenitic stainless steel Density: 7.8 g/cm <sup>3</sup>		
Optional fractional weights	Solution heat treated aluminum Density: 2.7 g/cm <sup>3</sup>		
	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
P3016	Tungsten carbide	Tungsten carbide	11 ppm/°C
<b>General</b>			
Test port adaptors	1/8 in, 1/4 in, 3/8 in and 1/2 in NPT or 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)		
<b>Weight increments</b>			
<b>Minimum standard weight increments</b>			
P3012, P3022 Pressure	1 inH <sub>2</sub> O, (5 mbar)		
P3013, P3023 Pressure	2 inH <sub>2</sub> O, (10 mbar)		
P3014, P3015, P3025 Pressure	1 psi, (0.1bar)		
P3016, P3031, P3032	1 psi, (0.1bar)		
P3011, P3022, P3023, P3025 Vacuum	0.2 inHg (10 mbar)		
<b>Optional fractional weights</b>			
P3014, P3015, P3025 Pressure	0.1 psi (0.01 bar)		
<b>Built-in hand pumps</b>			
Pressure mode	Max pressure 300 psi (20 bar)		
Vacuum mode	To 90 % vacuum		
<b>Operating fluid for liquid lubricated models</b>			
55-655 mineral oil (standard)			
Krytox, for oxygen-safe applications (optional)			

## Ordering information

### Air operated - single PCU

#### Model

P3012-4-P 1.5 to 100 kPa  
 P3012-6-P 15 to 1 000 mbar  
 P3012-7-P 5 to 400 inH<sub>2</sub>O

P3013-4-P 3 to 200 kPa  
 P3013-6-P 30 to 2 000 mbar  
 P3013-7-P 12 to 800 inH<sub>2</sub>O

P3014-1-P 0.2 to 10 bar  
 P3014-2-P 0.2 to 10 kgf/cm<sup>2</sup>  
 P3014-3-P 3 to 150 psi  
 P3014-4-P 20 to 1 000 kPa  
 P3014-5-P 0.02 to 1 MPa

P3015-1-P\* 0.2 to 35 bar  
 P3015-2-P\* 0.2 to 35 kgf/cm<sup>2</sup>  
 P3015-3-P\* 3 to 500 psi  
 P3015-4-P\* 20 to 3 500 kPa  
 P3015-5-P\* 0.02 to 3.5 MPa

P3016-1 1 to 70 bar  
 P3016-1 1 to 70 kgf/cm<sup>2</sup>  
 P3016-1 10 to 1 000 psi  
 P3016-1 100 to 7 000 kPa  
 P3016-1 0.1 to 7 MPa

\* -P indicates built-in pump optional.

### Gas operated

#### Model

P3031-1 1 to 70 bar  
 P3031-2 1 to 70 kgf/cm<sup>2</sup>  
 P3031-3 10 to 1 000 psi  
 P3031-4 100 to 7 000 kPa  
 P3031-5 0.1 to 7 MPa

P3032-1 4 to 140 bar  
 P3032-2 4 to 140 kgf/cm<sup>2</sup>  
 P3032-3 40 to 2 000 psi  
 P3032-4 400 to 14 000 kPa  
 P3032-5 0.4 to 14 MPa

### Vacuum operated - single PCU

#### Model

P3011-4-P\* 3 to 100 kPa  
 P3011-6-P\* 30 to 1 000 mbar  
 P3011-8-P\* 1 to 30 inHg  
 P3011-9-P\* 30 to 760 mmHg

\* -P indicates built-in pump optional.

### Options

**A. 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.

PressCal is provided as standard with all 0.008% instruments.

**B. Krytox**, as operating fluid for liquid lubricated gas operated models.

### Air operated - dual PCU

Model	Pressure range	Vacuum range
P3022-4-P*	1.5 to 100 kPa	3 to 100 kPa
P3022-6-P*	15 to 1,000 mbar	30 to 1 000 mbar
P3022-7-P*	5 to 400 inH <sub>2</sub> O	1 to 30 inHg
P3023-4-P*	3 to 200 kPa	3 to 100 kPa
P3023-6-P*	30 to 2 000 mbar	30 to 1 000 mbar
P3023-7-P*	12 to 800 inH <sub>2</sub> O	1 to 30 inHg
P3025-1-P*	0.2 to 35 bar	30 to 1 000 mbar
P3025-2-P*	0.2 to 35 kgf/cm <sup>2</sup>	30 to 760 mmHg
P3025-3-P*	3 to 500 psi	1 to 30 inHg
P3025-4-P*	20 to 3 500 kPa	3 to 100 kPa
P3025-5-P*	0.02 to 3.5 MPa	3 to 100 kPa

\* -P indicates built-in pump optional.

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