CPB 3000 Deadweight Tester

Applications

- Primary standard for pressure ranges up to 15,000 psi (1,000 bar) hydraulic
- Reference instrument for the test, adjustment and calibration of pressure measuring instruments in factories and calibration laboratories
- Self-contained, complete system suitable for on-site measurements and calibrations

Features

- Total uncertainty of measurement 0.025 % of reading
- Calibration certificate is traceable to the National Institute of Standards and Technology (NIST)
- A2LA calibration certificate optional
- High long-term stability with a recommended recalibration cycle of 5 years
- Masses manufactured from stainless steel and aluminium
- Local gravity adjustment possible at no additional charge
- Compact dimensions

CPB 3000 Deadweight Tester

Description

Proven primary standard
Deadweight testers are the most accurate instruments for the calibration of electronic or mechanical pressure instruments. Pressure is defined as a force applied over an area: P = F/A; this is exactly how a stable pressure is achieved in the CPB 3000. The use of precisely machined, high-quality materials, result in high accuracy and an excellent long-term stability of five years. For these reasons deadweight testers have been used in the calibration laboratories of industry, national institutes and research laboratories for many years.

Self-contained operation
The CPB 3000 is ideally suited to on-site, field use as well as service and maintenance purposes, due to the integrated pressure generation and the purely mechanical measuring principle. Because the CPB 3000 is a purely mechanical system, there is no electrical power required for operation.

Basic principle
In the CPB 3000 a very precisely machined piston cylinder system, with a specific area exposed to the pressure media, is loaded with masses in order to generate a force over that area. The force divided by the area is equal to the pressure for the individual test points. By using optimally graduated weights, pressure points can be generated over a wide range. These weights are manufactured to standard gravity (9.80665 m/s²) although, for fixed location usage, they can be adjusted to a customer specified local gravity.

Ease of use
The pressure is set via an integrated, finely adjustable, precision spindle pump. As soon as the measuring system reaches equilibrium, there is a balance of forces between pressure and the force generated by the mass applied over the area of the piston. The quality of the piston / cylinder system ensures that this pressure remains stable over several minutes so that the device under test can be calibrated or adjusted.

Associated Products:
Deadweight Tester, Model CPB 5000, see CDSCPB5000

Compact instrument design
In addition, the CPB 3000 sets itself apart through its compact size, clearly arranged control elements and the space saving storage of weights, directly on top of the instrument's base-plate.

The built-in spindle pump is very easy to operate even at very high pressures, and features a threaded spindle which moves within the pump body. The spindle pump handle does not move in or out of the body of the pump as the handle is turned, therefore there are no cantilever forces or changes in the overall size of the base as the pressure is changed.

Standard Components

- Instrument base with dust cover
- Spindle pump for pressure generation/fine adjustment
- Quick connection for test devices with 1/2 in. NPT adaptor
- Piston cylinder system with bell
- Basic mass-set stored on the instrument base
- Mass-set extension in carrying case (for measuring ranges to 1,000 bar and 15,000 psi)
- Mass-set manufactured to standard gravity (9.80665 m/s^2)
- Operating fluid (0.5 liter)
- Operating instructions in German and English
- Factory calibration certificate

Options

- Mass-set manufactured to customer's local gravity
- Test connection for gauges exceeding 8 inches
- A2LA calibration certificate

CPB 3000 with Device Under Test

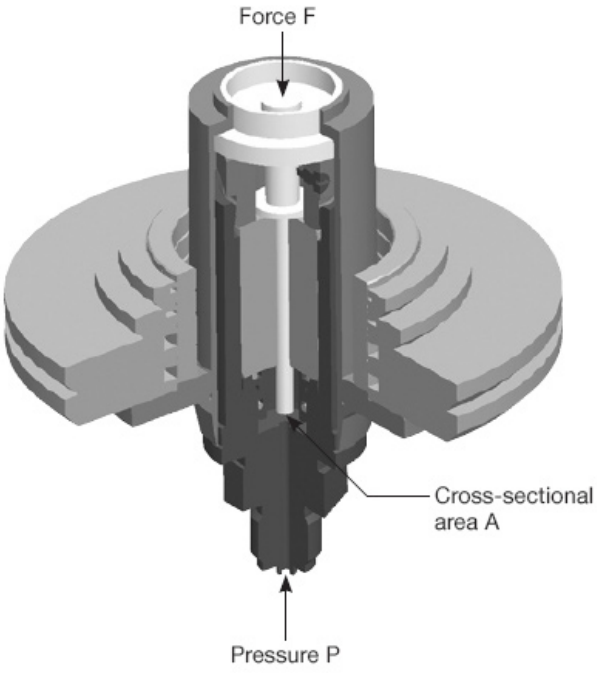
ConTect System - Piston Cylinder

Both the piston and cylinder are manufactured from Tungsten Carbide, a material often associated with more expensive deadweight testers. Tungsten Carbide has very small thermal and pressure expansion coefficients compared to other materials, improving overall performance and enhancing long term stability. The result is a recommended re-calibration interval of 5 years.

The piston and cylinder are protected in a solid stainless steel housing from contact, impacts and contamination. In addition, overpressure protection is integrated in the design, which prevents the piston from being forced out vertically and avoids damage to the piston cylinder system in the event of weight removal under pressure.

The weights are stacked on a bell which is fitted to the piston skirt. The center of gravity for the stacked weights is very low, minimizing both the side thrust on the piston cylinder system and the friction. For relatively low starting pressures, a lighter aluminium plate can be used instead of the bell.

The design of the piston/cylinder unit and the precision manufacturing process for both the piston and the cylinder ensures excellent operating characteristics: a long free rotation time, low sink rates and a very high long-term stability. The recommended re-calibration interval is 5 years.



Piston Cylinder system

Masses

The following tables show the number of weights per measuring range, within a weight set, with their nominal mass values and the resulting nominal pressures. When operating the device outside the standard reference conditions (ambient temperature 20 C, air pressure 1013 mbar, relative humidity 40%), corrections should be considered. These weights are manufactured to standard gravity (9.80665 m/s²) although for fixed location usage they can be adjusted to a customer specified local gravity.

Measuring Range (psi)	2.9 to 1000		14.5 to 5000		29 to 10,000		29 to 15,000	
	Number of Pieces	Nominal Pressure per Piece (psi)	Number of Pieces	Nominal Pressure per Piece (psi)	Number of Pieces	Nominal Pressure per Piece (psi)	Number of Pieces	Nominal Pressure per Piece (psi)
Piston	1	2.9	1	14.5	1	29	1	29
Bell	1	23.1	1	115.5	1	231	1	231
Aluminum Plate	1	1.1	1	5.5	1	11	1	11
Masses 3.5 kg	9	100	9	500	9	1000	14	1000
Masses 1.4 kg	1	40	1	200	1	400	1	400
Masses 1 kg	1	30	1	150	1	300	1	300
Masses 0.7 kg	2	20	2	100	2	200	2	200
Masses 0.35 kg	1	10	1	50	1	100	1	100
Masses 0.175 kg	1	5	1	25	1	50	1	50
Masses 0.14 kg	1	4	1	20	1	40	1	40
Masses 0.07 kg	1	2	1	10	1	20	1	20

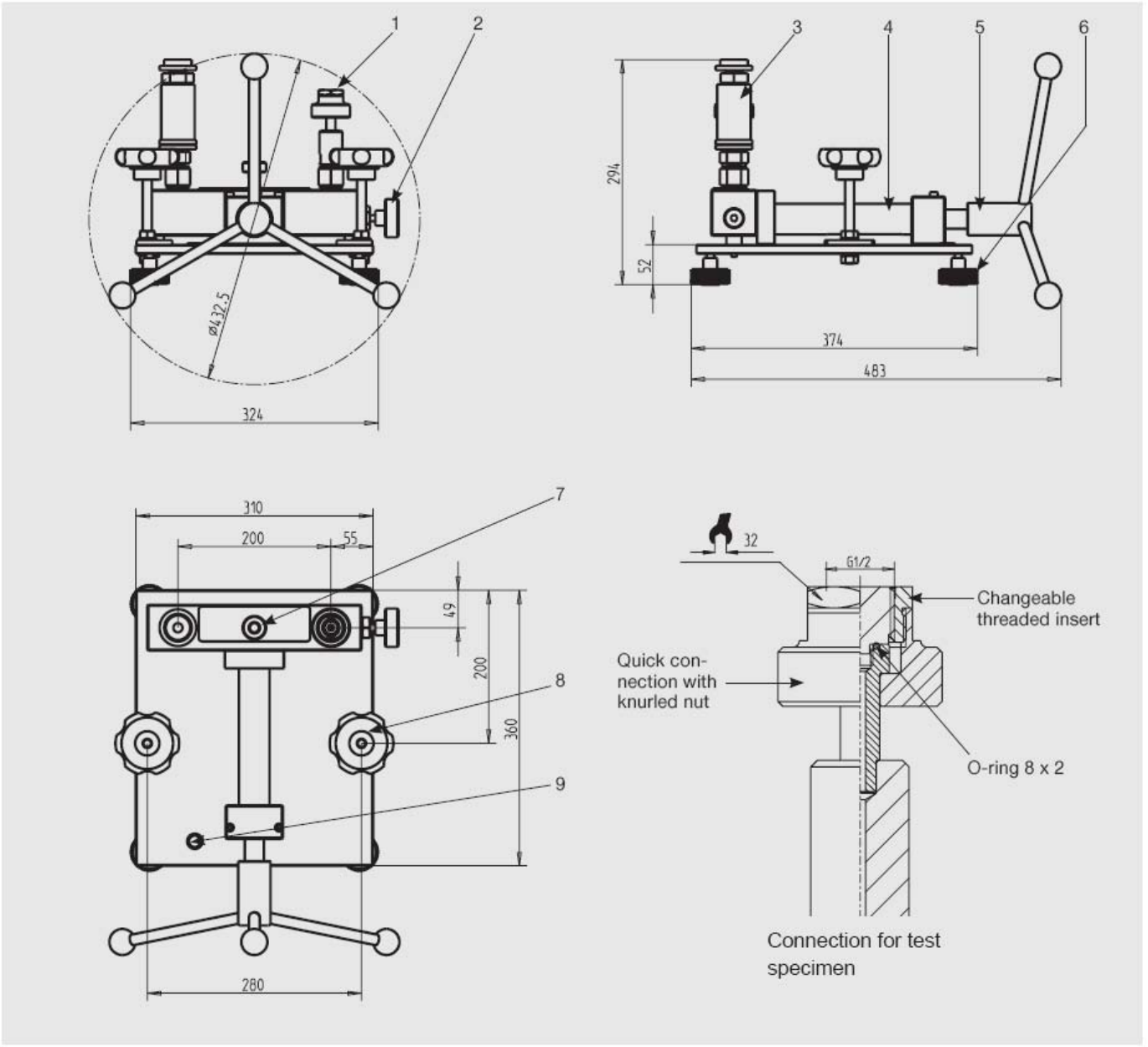
Measuring Range (bar)	0.2 ... 60		1 ... 250		2 ... 600		2 ... 1000	
	Number of Pieces	Nominal Pressure per Piece (bar)	Number of Pieces	Nominal Pressure per Piece (bar)	Number of Pieces	Nominal Pressure per Piece (bar)	Number of Pieces	Nominal Pressure per Piece (bar)
Piston	1	0.2	1	1	1	2	1	2
Bell	1	1.6	1	8	1	16	1	16
Aluminum Plate	1	0.1	1	0.5	1	1	1	1
Masses 4 kg	6	8	6	40	6	80	11	80
Masses 2 kg	2	4	2	20	2	40	2	40
Masses 1 kg	1	2	1	10	1	20	1	20
Masses 0.5 kg	1	1	1	5	1	10	1	10
Masses 0.2 kg	1	0.4	1	2	1	4	1	4
Masses 0.1 kg	1	0.2	1	1	1	2	1	2
Masses 0.05 kg	1	0.1	1	0.5	1	1	1	1

CPB 3000 Specifications

Measuring Range	psi [1]	2.9 to 1000	14.5 to 5000	29 to 10,000	29 to 15,000
Required Weights	kg	34	34	34	50
Smallest Step	psi [2]	2	10	20	20
Nominal cross-sectional area of the piston	cm^2	0.5	0.1	0.05	0.05
Measuring Range	bar [1]	0.0 ... 60	1 ... 250	2 ... 600	2 ... 1000
Required Weights	kg	30	25	30	50
Smallest Step	bar [2]	0.1	0.5	1	1
Nominal cross-sectional area of the piston	cm^2	0.5	0.1	0.05	0.05
Accuracy [3]	% of reading	0.025 [4]			
Pressure transmission medium	Hydraulic	Operating fluid (0.5 liter is included), other mediums on request			
Oil reservoir	cm^3	110			
Piston-Cylinder System connection		G 1/2 B male thread			
Test device connection		Quick connector - 1/2 NPT female thread with o-ring face seal, standard			
Material					
■ Piston		Tungsten Carbide			
■ Cylinder		Tungsten Carbide			
■ Mass-set		303 Stainless steel and aluminum, non-magnetic			
Spindle Pump					
■ Volume per revolution	cm^3	Approximately 0.1			
■ Overall volume	cm^3	Approximately 3.9			
Required Torque at					
■ 250 bar	Nm	2.0			
■ 500 bar	Nm	4.0			
■ 1000 bar	Nm	8.0			
Operating temperature	°C	18 to 28			
Weight					
■ Instrument Base (without weight pieces)	kg	11.7			
■ Piston cylinder system	kg	1.5			
■ Basic mass-set incl. bell (bar)	kg	30.8			
■ Mass-set extension incl.carring case (only for 1000 bar)	kg	24.0			
■ Basic mass-set incl. bell (psi)	kg	37.0			
■ Mass-set extension incl. carrying case (only for 15,00 0 psi	kg	21.5			
Dimensions					
■ Instrument base	mm	365 (W) x 483 (D) x 294 (H)			
■ Carrying case for mass-set extension	mm	215 (W) x 310 (D) x 310 (H)			
Calibration		NIST Traceable (Optional A2LA Calibration Certificate)			

1. The starting value corresponds to the pressure value generated by the piston (by its own weight)
2. The lowest pressure change value that is reached based on the standard weight set. A trim weight set is also available for lower values.
3. The accuracy is in reference to the measurement value, from 10% of the measurement range. A fixed error is considered in the lower area in reference to 10% of the area.
4. Measurement uncertainty assuming reference conditions (room temperature 20 °C, air pressure 1013 mbar, relative humidity 40%). Corrections may be required for use without CPU 5000 Calibrator Unit.

Dimensions in mm (without weights)



(1) Connection for the test device ½ female NPT, changeable
(2) Shut-off valve for test connection
(3) Piston cylinder system
(4) Spindle pump
(5) Removable star handle with spring-loaded thrust pad
(6) Adjustable leveling feet
(7) Reservoir with shut-off valve
(8) Storage of weight pieces
(9) Removable level

Options / Accessories

Set of trim-masses
The standard weights included are ideally suited for everyday use. If you would like to generate intermediate values, however, we recommend using a set of Class F1 trim-masses, with the following weights:

1 x 50 g / 2 x 20 g / 1 x 10 g / 1 x 5 g / 2 x 2 g / 1 x 1 g /
1 x 500 mg / 2 x 200 mg / 1 x 100 mg / 1 x 50 mg /
2 x 20 mg / 1 x 10 mg / 1 x 5 mg / 2 x 2 mg / 1 x 1 mg

Set of Trim-Masses

Set of adapters for quick connector
The CPB 3000 comes with a 1/2 Female NPT quick connector to connect the device under test. A set of adapters is available as an option. The set includes various interchangeable threaded adapters.

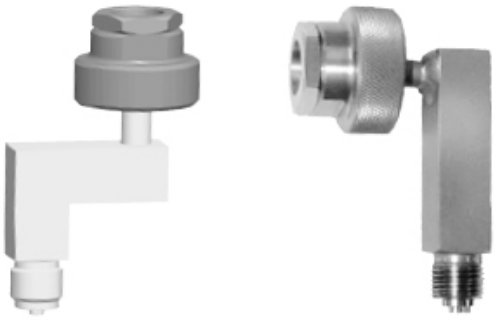
Set of adapters: G 1/4, G 3/8, 1/2 NPT, 1/4 NPT and M20 x 1.5
Set of NPT adapters: 1/8 NPT, ¼ NPT, 3/8 NPT and 1/2 NPT

Additionally, the sets of adapters include spare O-rings as well as a wrench for changing the adapters. Other threaded inserts are available on request.

Set of Adaptors

Test item connections
Up to 8 inch test gauges with bottom mount can be attached to the test port with the standard quick connect adaptor. For larger instruments or gauges with back mount connection the following adapters with quick connection are available:

- Test connection for gauges up 10 inch diameter
- Angle connection 90°, for gauges with back mounting connection



Left: Test Connection for Gauges up to 10” Diameter
Right: Angle Connection 90°

Options / Accessories

Calibrator Unit model CPU 5000

The CPU 5000 Calibrator Unit is a compact tool used with the CPB 3000 to calculate pressure and / or determine the masses needed to generate a specific pressure. The CPU 5000 is useful when high accuracy is critical and all ambient conditions need to be considered to calculate an accurate pressure. With the CPU 5000 all critical ambient parameters are sensed and corrections to the pressure value are automatically calculated.

The basic CPU 5000 package converts masses into the corresponding pressure value, or vice versa, and calculates the masses required for a specific pressure value by considering the local gravity. The pressure is given in all common pressure units.

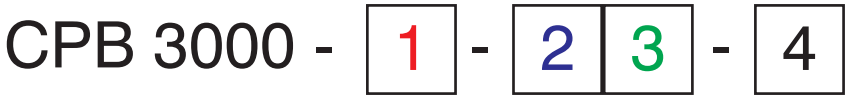
The sensor package option includes sensors for room temperature, air pressure, relative humidity and piston temperature. The sensors track these ambient conditions and dynamically update the calculated pressure value.

The multi-meter option provides a calibrator function for pressure transmitters. Power is supplied to the transmitter and the transmitter output signal is measured. The signal is displayed and automatically converted to a pressure value

Accessories	Order Number
Trim-masses (1 mg up to 50 g), class F1	7093874
Adapter for test item connection for gauges up to 10 inch diameter	11279614
Set of adapters for quick-connector, in a case with threaded inserts G 1/4, G 3/8, 1/2 NPT, 1/4 NPT and M20 x 1.5 for fitting to the knurled nut of the test item connection	2036941
Set of ”NPT“ adapters for quick-connector in a case with threaded inserts 1/8 NPT, 1/4 NPT, 3/8 NPT and ½ NPT for fitting to the knurled nut of the test item connection	12563626
Angle connection 90°, for test specimens with back mounting connection	1564838
Set of O-rings consisting of 10 spares for each pressure connection of the CPB 3000	12822311
Operating fluid for CPB 3000 up to 1,000 bar, 0.5 liter	2099954
Cleaning set for ConTect-Systems, hydraulic version	12481425

Order Entry: Configuring the CPB 3000

Choose a letter corresponding to the desired Version, Connection, Calibration and Additional Instructions as required and place it in the corresponding box to from the part number:



Box 1 - Version

F - 60 bar base, piston-cylinder-system and mass-set
H - 250 bar base, piston-cylinder-system and mass-set
L - 600 bar base, piston-cylinder-system and mass-set
M - 1000 bar base, piston-cylinder-system and mass-set
U - 1000 psi base, piston-cylinder-system and mass-set
V - 5000 psi base, piston-cylinder-system and mass-set
W - 10000 psi base, piston-cylinder-system and mass-set
Y - 15000 psi base, piston-cylinder-system and mass-set

Box 2 - Connection For Test Device

Z - Fixture for test devices up to 8 inch diameter
A - Fixture for test devices up to 10 inch diameter

Box 3 - Calibration

W - Includes calibration report 3.1
D - DKD calibration certificate
M1 - NIST calibration certificate - As found
M2 - A2LA calibration certificate - As found

Box 4 - Additional Instructions

T - Additional instructions included, please state additional requirements clearly

Z - No additional instructions included

Mensor is registered to ISO 9001:2008 and meets the requirements of ISO/IEC 17025:2005 including compliance to ANSI/NCSL Z540-1-1994. Accredited calibrations can be provided.

Quality Management ISO 9001 428797

ACCREDITED

mensor

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