

Pressure balance

High-pressure version to 5,000 bar [70,000 lb/in²]

Model CPB5000HP



WIKA data sheet CT 31.51



For further approvals,
see page 5

Applications

- Primary standard for calibrating the pressure scale in a hydraulic range of 25 ... 5,000 bar [350 ... 70,000 lb/in²]
- Reference instrument for on-site and calibration laboratories for the testing, adjustment and calibration of pressure measuring instruments
- Stand-alone complete system, also suitable for on-site use

Special features

- Total measurement uncertainty of 0.025 ... 0.02 % of reading
- High long-term stability with recommended calibration interval of two to five years
- Masses manufactured from stainless steel and aluminium, can be adjusted to local gravity
- Factory calibration included as standard, traceable to national standards, with UKAS calibration possible



**Pressure balance, high-pressure version,
model CPB5000HP**

Description

Proven primary standard

Pressure balances (dead-weight testers) are the most accurate instruments available on the market for the calibration of electronic or mechanical pressure measuring instruments. The direct measurement of the pressure ($p = F/A$), as well as the use of high-quality materials enable a very small measurement uncertainty, in conjunction with an excellent long-term stability.

The pressure balance (dead-weight tester) has therefore been used for years in factory and calibration laboratories in industry, national institutes and research laboratories.

Stand-alone operation

Due to its integrated pressure generation and the purely mechanical measurement principle, the model CPB5000HP is ideal for on-site use for maintenance and service.

Basic principle

Pressure is defined as the quotient of force and area. The core component of the CPB5000HP is therefore a very precisely manufactured piston-cylinder system, onto which a mass load is applied in order to generate the individual test points.

The mass load is proportional to the target pressure and this is achieved through optimally graded masses. As standard, these masses are manufactured to the standard gravity (9.80665 m/s²), though they can be adjusted to a specific place of use and calibrated in accordance with UKAS accreditation.

Easy operation

The setting of the pressure is made via an integrated pump. For fine adjustment, a very precisely controllable spindle pump is fitted, with a spindle running within it.

As soon as the measuring system reaches floating position, there is a balance of forces between the pressure and the masses applied. The excellent quality of the system ensures that this pressure remains stable over several minutes, so that the pressure value for comparative measurements can be read without any problems, or also so that more complex adjustments can be carried out on the test item.

Functionality

The piston-cylinder system

Both the piston and cylinder are manufactured from hardened steel or tungsten carbide, respectively. These pairings of materials, in comparison to other materials, have very low pressure and temperature coefficients of expansion, which results in a very good linearity for the effective area of the piston and a very high accuracy.

Piston and cylinder are very well protected against contact, impacts or contamination from outside in a solid stainless-steel case. At the same time, overpressure protection is integrated, which prevents the piston from being forced out vertically and avoids damage to the piston-cylinder system in the event of masses removal under pressure.

The masses are stacked on a mass carrier, which sits on the piston shaft. The construction of the mass carrier provides a very low centre of gravity for the stacked masses, which minimises 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 mass carrier.

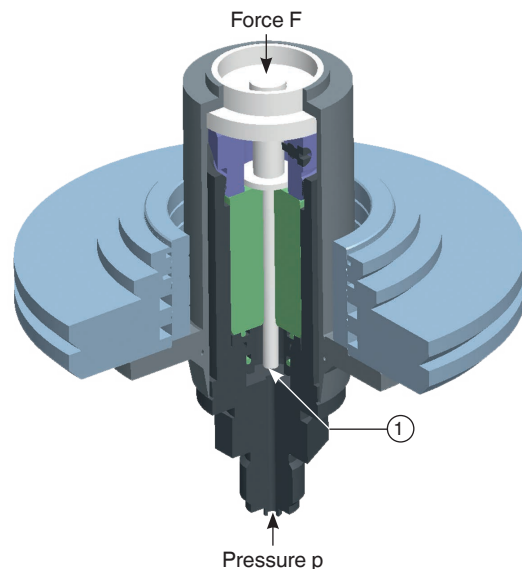
The overall design of the piston-cylinder system and the very precise production of both the piston and the cylinder ensures excellent operating characteristics with long free-rotation time and low sink rates. Thus a high long-term stability is ensured.

Therefore, the recommended calibration interval is two to five years dependent on the conditions of use.

Robust instrument design

With the high-pressure model, calibrations up to a maximum pressure of 5,000 bar [70,000 lb/in²] are possible. It is built into a stable base and offers exceptional ease-of-use. With the integrated priming pump and the 250 ml tank, large test volumes can also be easily filled and primed.

Both test connections are fitted with knurled nuts and exchangeable thread adapters with sealing cones. M16 x 1.5, M20 x 1.5 and 9/16-18 UNF thread adapters with male threads are included in the scope of delivery.



Piston-cylinder system model CPS5000

① Effective area A

Tables of masses

The following tables show the number of masses within a mass set with their nominal mass values and the resulting nominal pressures for the respective measuring ranges.

Should the instrument not be operated under reference conditions (ambient temperature 20 °C [68 °F], atmospheric pressure 1,013 mbar [14.69 psi], relative humidity 40 %), the measured values must be corrected arithmetically.

For the measurement of the ambient conditions, the CPU6000-S CalibratorUnit can be used, see page 8.

The masses are manufactured, as standard, to the standard gravity of 9.80665 m/s², although they can also be adjusted for any local gravity.

The mass sets can be manufactured for the different pressure units, bar or lb/in², and can be used with the same piston-cylinder system.

Measuring range in bar	25 ... 4,000		25 ... 5,000	
	Quantity	Nominal pressure per piece [bar]	Quantity	Nominal pressure per piece [bar]
Piston incl. mass carrier	1	25	1	25
Masses	6	250	10	250
	8	200	8	200
	9	100	9	100
	1	50	1	50
	2	25	2	25
	1	10	1	10
	1	5	1	5
	1	2.5	1	2.5

Measuring range in lb/in ²	350 ... 60,000		350 ... 70,000	
	Quantity	Nominal pressure per piece [lb/in ²]	Quantity	Nominal pressure per piece [lb/in ²]
Piston incl. mass carrier	1	350	1	350
Masses	6	5,000	8	5,000
	8	2,500	8	2,500
	8	1,000	8	1,000
	1	750	1	750
	2	500	2	500
	1	250	1	250
	1	100	1	100
	1	50	1	50

Specifications

Piston-cylinder system model CPS5000		
Measuring range ¹⁾	25 ... 4,000 bar	25 ... 5,000 bar
Required masses	80 kg	100 kg
Smallest step ²⁾ (Standard mass set)	2.5 bar	2.5 bar
Nominal effective area of the piston	0.02 cm ²	0.02 cm ²
Measuring range ¹⁾	350 ... 60,000 lb/in ²	350 ... 70,000 lb/in ²
Required masses	83 kg	97 kg
Smallest step ²⁾ (Standard mass set)	50 lb/in ²	50 lb/in ²
Nominal effective area of the piston	0.02 cm ²	0.02 cm ²
Accuracies	The accuracy from 10 % of the measuring range is based on the measured value. In the lower range, a fixed error based on 10 % of the range applies.	
Standard	0.025 % of reading	
Premium	0.02 % of reading	
Reference conditions of masses		
Ambient temperature	20 °C [68 °F]	
Atmospheric pressure	1,013 mbar [14.69 psi]	
Humidity	40 % relative humidity	
Material		
Piston	Hardened steel	
Cylinder	Tungsten carbide	
Mass set	Stainless steel, non-magnetic	
Weight		
Piston-cylinder system	2.7 kg [6.0 lb] 5.0 kg [11.0 lb] (incl. storage case)	
bar basic mass set, carrying case 1	34.0 kg [75.0 lb]	34.0 kg [75.0 lb]
bar basic mass set, carrying case 2	27.5 kg [60.6 lb]	27.5 kg [60.6 lb]
bar extension mass set, carrying case 1	33.5 kg [73.9 lb]	33.5 kg [73.9 lb]
bar extension mass set, carrying case 2	--	23.5 kg [51.8 lb]
lb/in ² basic mass set, carrying case 1	51.0 kg [112.5 lb]	51.0 kg [112.5 lb]
lb/in ² basic mass set, carrying case 2	15.0 kg [33.1 lb]	15.0 kg [33.1 lb]
lb/in ² extension mass set, carrying case 1	31.8 kg [70.1 lb]	31.8 kg [70.1 lb]
lb/in ² extension mass set, carrying case 2	--	17.8 kg [39.2 lb]

- 1) Theoretical start value; corresponds to the pressure value generated by the piston and its own weight. To optimise the operating characteristics more masses should be loaded.
2) The smallest pressure change value that can be achieved based on the standard mass set. For further reductions, a class M1 or F1 set of fine increment masses is available.

Dimensions of the storage cases	
For basic mass set, carrying case 1	400 x 310 x 310 mm [15.7 x 12.2 x 12.2 in]
For basic mass set, carrying case 2	215 x 310 x 310 mm [8.5 x 12.2 x 12.2 in]
For extension mass set, carrying case	215 x 310 x 310 mm [8.5 x 12.2 x 12.2 in]
For piston-cylinder system	370 x 150 x 150 mm [14.6 x 5.9 x 5.9 in]

Base model CPB5000HP		
Pressure transmission medium		
Base	Up to 4,000 bar [60,000 lb/in ²]	Hydraulic fluid based on VG22 mineral oil
	Up to 5,000 bar [70,000 lb/in ²]	Sebacate oil
Reservoir	250 cm ³	
Connections		
Connection for piston-cylinder system	M30 x 2, female thread with sealing cone	
Test connection	Freely positionable, with three thread adaptors: M16 x 1.5, M20 x 1.5 and 9/16-18UNF	
	→ For additional adapters for test connections, see accessories	
Material		
Piping in base	1.4404 stainless steel, 6 x 2 mm	
CPU6000-S sensing technology	■ Without	
	■ With installation	
Weight	32.5 kg [71.7 lb]	
Dimensions	→ For details, see technical drawings	

Operating conditions	
Operating temperature	18 ... 28 °C [64 ... 82 °F]
Storage temperature range	-10 ... +50 °C [14 ... 122 °F]
Humidity	
Instrument base and mass set	35 ... 85 % relative humidity
Piston-cylinder system	35 ... 65 % relative humidity
Condensation (place of storage)	Non-condensing

Approvals

Logo	Description	Region
	EU declaration of conformity	European Union
	Pressure Equipment Directive PS > 200 bar; module A, internal production control	

Optional approvals

Logo	Description	Region
	EAC	Eurasian Economic Community
	Pressure Equipment Directive	
	Machinery Directive	

Certificates

Certificate	
Calibration	
Piston-cylinder system	■ 3.1 inspection certificate per DIN EN 10204 (factory calibration) ■ UKAS calibration certificate (pressure calibration with a mass set) ■ DAkkS calibration certificate (traceable and accredited in accordance with ISO/IEC 17025)
Recommended calibration interval	2 to 5 years (dependent on conditions of use)

→ For approvals and certificates, see website

Transport dimensions for complete instrument

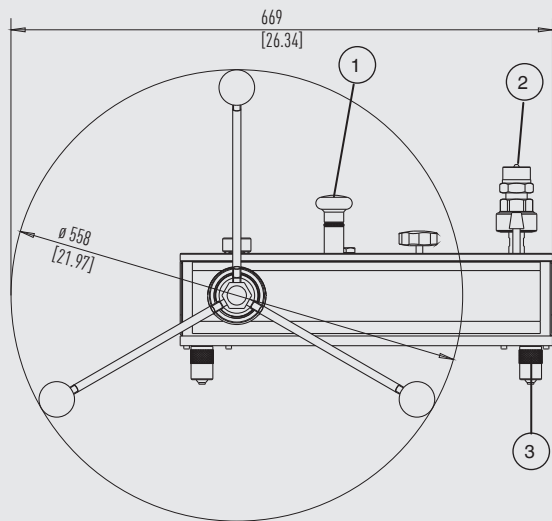
The complete instrument, in its standard version and standard scope of delivery, is shipped on two pallets.
The dimensions are 1,200 x 800 x 500 mm [47.3 x 31.5 x 19.7 in] and 800 x 600 x 500 mm [31.5 x 23.6 x 19.7 in].
The total weight is dependent on the measuring range.

Version in bar	Weight	
	Net	Gross
25 ... 4,000 bar	133 kg [293.3 lb]	166 kg [366.0 lb]
25 ... 5,000 bar	156 kg [344.0 lb]	194 kg [427.8 lb]

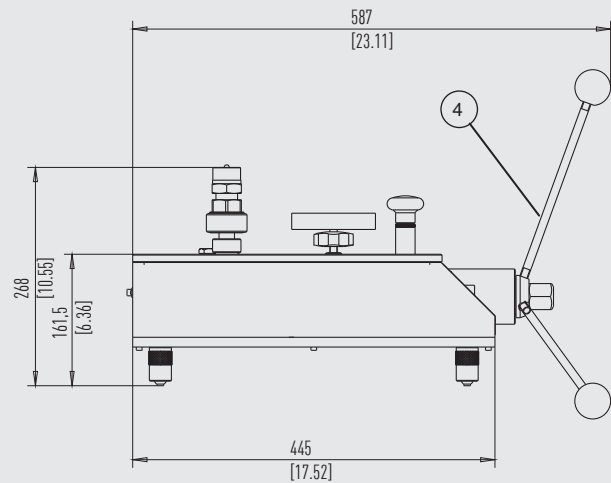
Version in lb/in ²	Weight	
	Net	Gross
350 ... 60,000 lb/in ²	136 kg [299.9 lb]	169 kg [372.6 lb]
350 ... 70,000 lb/in ²	153 kg [337.4 lb]	191 kg [421.2 lb]

Dimensions in mm [in]

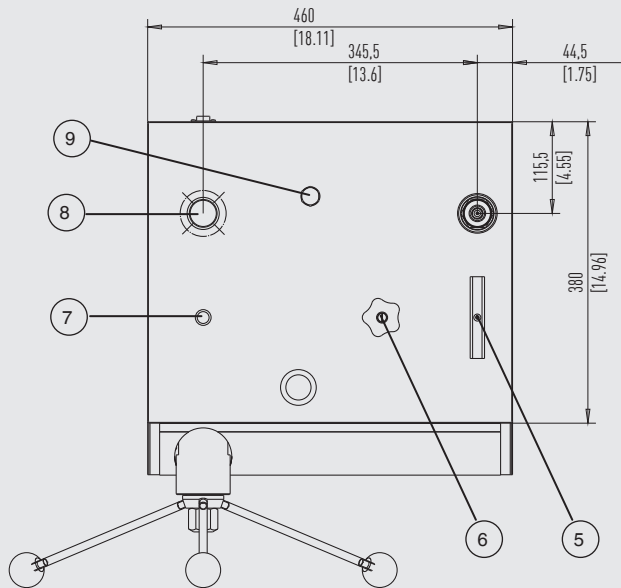
View from the front



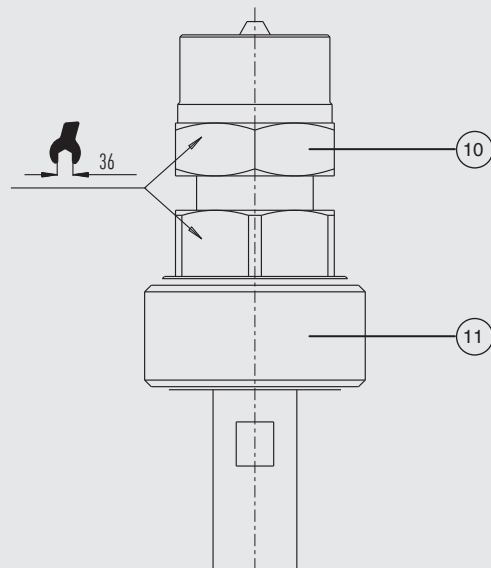
View from the left



View from above



Test connection



- | | |
|--|--|
| ① Priming pump | ⑧ Connector for piston-cylinder system |
| ② Test connection | ⑨ Reservoir with plug screw |
| ③ Levelling feet | ⑩ Threaded insert, changeable |
| ④ Spindle pump with star handle, removable | ⑪ Quick-release connector with knurled nut |
| ⑤ High-pressure shut-off valve (HP) | |
| ⑥ Low-pressure shut-off valve (LP) | |
| ⑦ Level | |

CalibratorUnit, sensor box for pressure balance, model CPU6000-S

The CPU6000-S is used for measured value recording of data relevant for calibration certificates. It simplifies the generation of certificates and increases the productivity and quality of the certificate generation process. In combination with any pressure balance (dead-weight tester) the WIKA-Cal software can determine the necessary masses or the reference pressure. Through simple operation and set-up, the calculation of the masses or the pressure is made easier. The CalibratorUnit takes into account all critical influence quantities and thus increases the accuracy of the measurement.

The CPU6000-S measures the piston temperature and displays the floating position of the masses. The sensing technology is fitted directly to the pressure balance to achieve the highest accuracy.



CalibratorUnit, sensor box for pressure balance, model CPU6000-S

Typical application

WIKA-Cal PC software and mass calculation tool

With the WIKA-Cal software and a CPB series pressure balance (dead-weight tester), the masses to be applied and the corresponding reference pressure can be determined. The pressure balance data (dead-weight tester data) can be entered into the database manually or imported automatically via an XML file available online. The mass calculation tool can be used to calculate the masses required to reach the target pressure.

With the CPU6000-S, the piston temperature can be measured and taken into account in the calculations. As an additional parameter, the local gravity can be given for location-independent measurements.



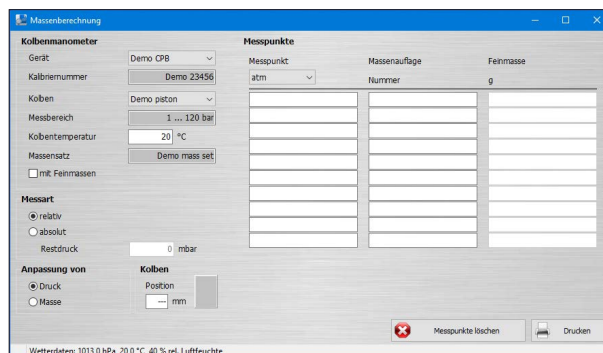
Model CPB5800 pressure balance with model CPU6000-S sensor box and PC with WIKA-Cal software

Floating position sensor

With the floating position sensor, in conjunction with the CPU6000-S, the displacement of the masses can be displayed in WIKA-Cal. Through the automatic detection of the floating position, the software can automatically move to the next calibration point.

For details of the WIKA-Cal calibration software, see data sheet CT 95.10.

Further specifications on the CPU6000-S model can be found in data sheet CT 35.02.



WIKA-Cal PC software and mass calculator

Further pressure balances (dead-weight testers)

Dead-weight tester, compact version, model CPB3800

Measuring ranges

Hydraulic	1 ... 120 to 10 ... 1,200 bar [10 ... 1,600 to 100 ... 16,000 lb/in ²]
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Accuracy	■ 0.05 % of reading
	■ 0.025 % of reading

→ For specifications, see data sheet CT 31.06



Dead-weight tester, compact version, model CPB3800

Pressure balance, pneumatic version, model CPB5000

Measuring ranges

Pneumatic	-0.03 ... -1 to +0.4 ... +120 bar [-0.435 ... -14 to +5.8 ... +1,600 lb/in ²]
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Accuracy	■ 0.015 % of reading
	■ 0.006 % of reading

→ For specifications, see data sheet CT 31.01



Pressure balance, pneumatic version, model CPB5000

Pressure balance, hydraulic version, model CPB5800

Measuring ranges

Hydraulic	Single-piston measuring ranges: 1 ... 120 to 2 ... 300 bar [10 ... 1,600 to 30 ... 4,000 lb/in ²]
	Dual-piston measuring ranges: 1 ... 60 bar / 10 ... 700 bar to 1 ... 60 bar / 20 ... 1,400 bar [10 ... 800 lb/in ² / 100 ... 10,000 lb/in ² to 10 ... 800 lb/in ² / 200 ... 20,000 lb/in ²]

Accuracy	■ 0.015 % of reading
	■ 0.006 % of reading

→ For specifications, see data sheet CT 31.11



Pressure balance, hydraulic version, model CPB5800

Pressure balance, differential pressure version, model CPB5600DP

Measuring ranges (= static pressure + differential pressure):

Pneumatic	0.03 ... 2 to 0.4 ... 100 bar [0.435 ... 30 to 5.8 ... 1,500 lb/in ²]
Hydraulic	0.2 ... 60 to 25 ... 1,600 bar [2.9 ... 1,000 to 350 ... 23,200 lb/in ²]

Accuracy	■ 0.015 % of reading
	■ 0.008 % of reading

→ For specifications, see data sheet CT 31.56



Pressure balance, differential pressure version, model CPB5600DP

Accessories and spare parts

Set of fine increment masses M1 and F1

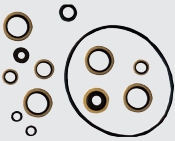
The masses included in the standard scope of delivery are ideally suited for everyday use. If even smaller intermediate values need to be generated, using one of the class M1 or F1 set of fine increment masses with the following masses is recommended:

M1 or F1 set of fine increment masses

Fine increment masses	1 x 50 g	1 x 100 mg
	2 x 20 g	1 x 50 mg
	1 x 10 g	2 x 20 mg
	1 x 5 g	1 x 10 mg
	2 x 2 g	1 x 5 mg
	1 x 1 g	2 x 2 mg
	1 x 500 mg	1 x 1 mg
	2 x 200 mg	



Set of fine increment masses

Description ¹⁾		Order code
		CPB-A-GG-
	Set of fine increment masses	
	1 mg to 50 g, accuracy class F1	-A-
	1 mg to 50 g, accuracy class M1	-B-
-	Adapters for test connection G ½ female thread Max.: 1,600 bar [23,200 lb/in ²] Material: 1.4571	-C-
-	Adapter M30 x 2 male thread to M16 x 1.5 male thread For piston cylinder connection block	-D-
	Special oil In plastic bottle	
	Hydraulic fluid based on VG22 mineral oil For the CPB series up to max. of 4,000 bar [60,000 lb/in ²] Content: 1 litre	-E-
	Sebacate oil For CPB5000HP up to max. of 5,000 bar [70,000 lb/in ²] Content: 0.5 litre	-F-
	Seal set For instrument base	-G-
Ordering information for the request		
1. Order code: CPP-A-GG 2. Option:		↓ []

1) The figures are examples and may change in design, material composition and representation depending on the state of the art

Scope of delivery

- Base with dust protection cover
- Priming pump
- Spindle pump for filling, pressure build-up and fine pressure adjustment
- Test connection with three thread adapters: M16 x 1.5, M20 x 1.5 and 9/16-18 UNF
- Piston-cylinder system with mass carrier
- Mass set divided between several carrying cases
- Masses manufactured to standard gravity (default value: 9.80665 m/s²) or manufactured to the local gravity
- VG22 mineral oil, 1.0 litre, or sebacate oil, 0.5 litre (depending on the pressure range)
- Open-ended spanners SW 36 and SW 46
- Operating instructions
- Calibration certificate

Ordering information

Model / Instrument version / Accuracy / Calibration for the pressure balance / Installation of the CPU6000-S CalibratorUnit sensor system / Further approvals / Additional ordering information

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We reserve the right to make modifications to the specifications and materials.

