Operating instructions
操作说明

Dead-weight tester in compact design, model CPB3800 EN

CPB3800紧凑型活塞压力计 CN

DH·Budenberg

Dead-weight tester in compact design, model CPB3800

WIKA

Part of your business

Prior to starting any work, read the operating instructions!
Keep for later use!

在开始作业前，请详细阅读本操作说明！
妥善保管好本文件，留待后用！

14062232.04 03/2015 EN/CN

Contents

EN

Declarations of conformity can be found online at www.wika.com.

14062232.04 03/2015 EN/DE

1. General information

EN

- The model CPB3800 dead-weight tester in compact design described in the operating instructions has been designed and manufactured using state-of-the-art technology. All components are subject to stringent quality and environmental criteria during production. Our management systems are certified to ISO 9001 and ISO 14001.
- These operating instructions contain important information on handling the instrument. Working safely requires that all safety instructions and work instructions are observed.
- Observe the relevant local accident prevention regulations and general safety regulations for the instrument's range of use.
- The operating instructions are part of the product and must be kept in the immediate vicinity of the instrument and readily accessible to skilled personnel at any time. Pass the operating instructions onto the next operator or owner of the instrument.
- Skilled personnel must have carefully read and understood the operating instructions prior to beginning any work.
- The general terms and conditions contained in the sales documentation shall apply.
- Subject to technical modifications.
- Factory calibrations / DKD/DAkkS calibrations are carried out in accordance with international standards.

14062232.04 03/2015 EN/DE

1. General information

EN

- Further information:

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A division of WIKA Instruments Ltd.

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- Relevant data sheet:	CT 31.06
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Explanation of symbols

WARNING!
... indicates a potentially dangerous situation that can result in serious injury or death, if not avoided.

CAUTION!
... indicates a potentially dangerous situation that can result in light injuries or damage to equipment or the environment, if not avoided.

Information
... points out useful tips, recommendations and information for efficient and trouble-free operation.

14062232.04 03/2015 EN/DE

2. Safety

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WARNING!
Before installation, commissioning and operation, ensure that the appropriate dead-weight tester has been selected in terms of measuring range, design and specific measuring conditions.
Non-observance can result in serious injury and/or damage to the equipment.

Further important safety instructions can be found in the individual chapters of these operating instructions.

2.1 Intended use

Pressure balances (dead-weight testers) are the most accurate instruments available on the market for the calibration of electronic or mechanical pressure measuring instruments. By direct measurement of the pressure as the quotient of force and area (p = F/A), pressure balances (dead-weight testers) are approved as primary standards.

The core component of the CPB3800 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 applied are proportional to the target pressure and this is achieved through graduated disc weight. A maximum pressure of 1,200 bar must not be exceeded.

The pressure is set via an integrated, finely-adjustable, precision dual area spindle pump. As soon as the measuring system reaches equilibrium, there is a balance of forces between the pressure and the mass load applied.Then the test item can be calibrated or adjustments can be carried out.

Due to its stand-alone operation (integrated pressure generation and the pure mechanical measuring principle), the model CPB3800 is ideal for on-site use for maintenance and service.

The instrument has been designed and built solely for the intended use described here, and may only be used accordingly.

The technical specifications contained in these operating instructions must be observed. Improper handling or operation of the instrument outside of its technical specifications requires the instrument to be taken out of service immediately and inspected by an authorised DH-Budenberg/WIKA service engineer.

14062232.04 03/2015 EN/DE

Handle mechanical precision measuring instruments with the required care (protect from humidity, impacts, strong magnetic fields, static electricity and extreme temperatures, do not insert any objects into the instrument or its openings).

If the instrument is transported from a cold into a warm environment, the formation of condensation may result in instrument malfunction. Before putting it back into operation, wait for the instrument temperature and the room temperature to equalise.

The manufacturer shall not be liable for claims of any type based on operation contrary to the intended use.

2.2 Personnel qualification

WARNING!
Risk of injury should qualification be insufficient!
Improper handling can result in considerable injury and damage to equipment.

- The activities described in these operating instructions may only be carried out by skilled personnel who have the qualifications described below.
- Keep unqualified personnel away from hazardous areas.

Skilled personnel
Skilled personnel are understood to be personnel who, based on their technical training, knowledge of measurement and control technology and on their experience and knowledge of country-specific regulations, current standards and directives, are capable of carrying out the work described and independently recognising potential hazards.

Special operating conditions require further appropriate knowledge, e.g. of aggressive media.

DH-Budenebrg/WIKA can provide dedicated training courses on the correct use of our products. Please contact your local office for further details.

2.3 Personal protective equipment (P.P.E.)
The personal protective equipment is designed to protect the skilled personnel from hazards that could impair their safety or health during work. When carrying out the various tasks on and with the instrument, the skilled personnel must wear personal protective equipment.

14062232.04 03/2015 EN/DE

EN

Follow the instructions, displayed in the work area, regarding personal protective equipment!

The required personal protective equipment must be provided by the operating company.

Wear safety goggles!
Protect eyes from flying particles and liquid splashes.

Wear protective gloves!
Protect hands from contact with aggressive media.

2.4 Special hazards

WARNING!
To ensure safe working on the instrument, the operating company must ensure

- that suitable first-aid equipment is available and aid is provided whenever required.
- that the operating personnel are regularly instructed in all topics regarding work safety, first aid and environmental protection and knows the operating instructions and, in particular, the safety instructions contained therein.

WARNING!
Residual media at the dead-weight tester can result in a risk to persons, the environment and the equipment. Take sufficient precautionary measures.

2.4.1 Mineral oils health and safety information

DH-Budenberg/WIKA provide hydraulic mineral oil in 500 ml containers labelled “ISO VG 22” for use up to 4,000 bar in dead-weight testers. It is no more hazardous than other common lubricating oils.

14062232.04 03/2015 EN/DE

It is the nature of the way in which this equipment is used, that there could be frequent and/or prolonged skin contact; in a few individuals this could give rise to skin irritation (Keratosis or Dermatitis). The use of an effective barrier cream and/or protective gloves will greatly reduce this possibility.

Description	
Closed flash point	greater than 120 °C
Storage	not above 30 °C
Oral LD 50	15 g per kg body weight
Threshold limit value	5 mg/m^3
Fire extinguishing media	CO_2/dry chemical foam or water fog
Spillage	Soak with absorbent clay or proprietary absorbent
Waste disposal	Burn or dump in approved area

Emergency treatment of acute effects	
Ingestion	Do not induce vomiting. Administer 250 ml milk or olive oil. The main hazard following accidental ingestion is aspiration of liquid into lungs.
Aspiration	Send to hospital immediately
Inhalation	Remove to fresh air, if nausea persists seek medical attention.
Eye contact	Wash with copious amounts of water for at least 10 minutes. If irritation results or persists, obtain medical advice.
Skin contact	Where skin rashes or other abnormalities occur as a result of prolonged or repeated contact, medical advice should be obtained as soon as possible.

2.4.2 Other liquids

For some very particular applications we supply specially constructed liquids. Copies of manufacturer's data can be sent on request.

14062232.04 03/2015 EN/DE

2.4.3 Lifting of masses

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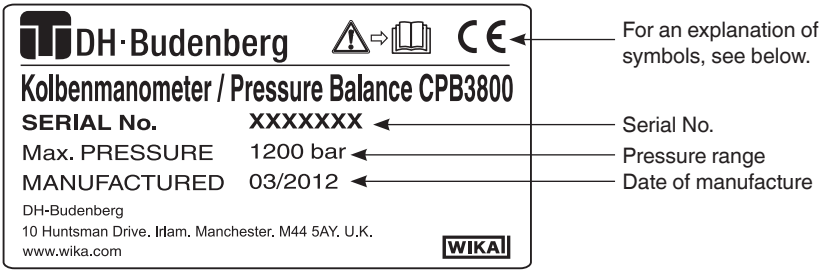
WARNING!
Care must be taken when lifting the masses onto the dead-weight tester. Each mass must be lifted individually and never attempt to lift stack of masses on or off the dead-weight tester.

2.5 Labelling, safety marks

Product label



Explanation of symbols

Before mounting and commissioning the instrument, ensure you read the operating instructions!

CE, Communauté Européenne
Instruments bearing this mark comply with the relevant European directives.

14062232.04 03/2015 EN/DE

3. Specifications

Piston-cylinder systems (standard)

EN

Measuring range [1]	bar	1 … 120	2.5 ... 300	5 ... 700	10 ... 1,200
Required masses	kg	41	50	58	50
Smallest step [2] (Standard mass set)	bar	1	2.5	5	10
Nominal effective area of the piston	in^2	1/16	1/40	1/80	1/160
Measuring range [1]	lb/in^2	10 … 1,600	25 ... 4,000	50 ... 10,000	100 ... 16,000
Required masses	kg	47	47	58	47
Smallest step [2] (Standard mass set)	lb/in^2	10	25	50	100
Nominal effective area of the piston	in^2	1/16	1/40	1/80	1/160
Accuracies					
Standard [3] [4]	0.05 % of reading				
Option [3] [4]	0.025 % of reading				
Pressure transmission medium	Hydraulic fluid based on VG22 mineral oil (0.5 l included in scope of delivery)				
Material					
Piston	Tungsten carbide				
Cylinder	Tungsten carbide				
Mass set	Stainless steel, non-magnetic				
Weight					
Piston-cylinder system	kg	2.4			
BAR mass set incl. mass carrier	kg	41.5	50.5	58.5	50.5
lb/in^2 mass set incl. mass carrier	kg	47.5	47.5	58.5	47.5
Storage case for mass set (optional, 2 pieces required)	kg	5.8			
Dimensions					
Storage case for mass set (optional)	400 x 310 x 310 mm (W x H x D) and 215 x 310 x 310 mm (W x H x D)				

1) Theoretical starting value; corresponds to the pressure value generated by the piston or the piston and its make-up weights (by their 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. To reduce this, a set of fine increment masses is also available.
3) 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.
4) Measurement uncertainty assuming reference conditions (ambient temperature 20 °C, atmospheric pressure 1,013 mbar, relative humidity 40 %). For operation without a CalibratorUnit, corrections must be made if required.

14062232.04 03/2015 EN/DE

3. Specifications

Base

EN

Connections	
Connection for piston-cylinder system	G ¾ B (male)
Test item connection	G ½ female thread, loose union connection
Material	
Wetted parts	Austenitic stainless steel, high tensile brass, nitrile rubber
Pressure transmission medium	Hydraulic fluid based on VG22 mineral oil (0.5 l included in scope of delivery) [5]
Reservoir	170 cm^3
Weight	
Base	13.5 kg
Storage case for the base (optional)	8.5 kg
Permissible ambient conditions	
Operating temperature	18 ... 28 °C
Dimensions	
Base	401 x 397 x 155 mm) (W x D x H), for details, see technical drawings

5) Other pressure transmission media on request.

CE conformity and certificates

CE conformity	
Pressure equipment directive	97/23/EC (Module A)
Certificate	
Calibration	Calibration certificate Option: UKAS calibration certificate (pressure calibration with a mass set) for CPB3800 standard models Option: UKAS calibration certificate (area and mass calibration) for CPS/CPM5800 only

Approvals and certificates, see website

For further specifications see WIKA data sheet CT 31.06 and the order documentation.

14062232.04 03/2015 EN/DE

Tables of masses

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

Should the instrument not be operated under reference conditions (ambient temperature 20 °C, atmospheric pressure 1,013 mbar, relative humidity 40 %), relevant corrections must be made.

The disc weights are manufactured, as standard, to standard gravity of 9.80665 m/s². As an optional extra, mass sets can be manufactured for customer local gravity value.

Standard mass sets

Measuring range [bar]	1 ... 120		2,5 ... 300	
	Quantity	Nominal pressure per piece [bar]	Quantity	Nominal pressure per piece [bar]
Piston and make-up weight	1	1	1	2.5
Piston, mass carrier and mass carrier make-up weight	1	20	1	50
Masses (stackable on mass carrier)	3	20	3	50
Masses (stackable on piston)	1	20	1	50
	1	10	1	25
	2	4	2	10
	1	2	1	5
	1	1	1	2.5

Measuring range [bar]	5 ... 700		10 ... 1.200	
	Quantity	Nominal pressure per piece [bar]	Quantity	Nominal pressure per piece [bar]
Piston and make-up weight	1	5	1	10
Piston, mass carrier and mass carrier make-up weight	1	100	1	200
Masses (stackable on mass carrier)	4	100	3	200
Masses (stackable on piston)	1	100	1	200
	1	50	1	100
	2	20	2	40
	1	10	1	20
	1	5	1	10

14062232.04 03/2015 EN/DE

3. Specifications

EN

Measuring range [lb/in²]	10 ... 1,600		25 ... 4,000	
	Quantity	Nominal pressure per piece [lb/in²]	Quantity	Nominal pressure per piece [lb/in²]
Piston	1	10	1	25
Mass carrier and mass carrier make-up weight	1	190	1	475
Masses (stackable on mass carrier)	5	200	5	500
Masses (stackable on piston)	1	200	1	500
	1	100	1	250
	2	40	2	100
	1	20	1	50
	1	10	1	25

Measuring range [lb/in²]	50 ... 10,000		100 ... 16,000	
	Quantity	Nominal pressure per piece [lb/in²]	Quantity	Nominal pressure per piece [lb/in²]
Piston	1	50	1	100
mass carrier and mass carrier make-up weight	1	950	1	1,900
Masses (stackable on mass carrier)	7	1,000	5	2,000
Masses (stackable on piston)	1	1,000	1	2,000
	1	500	1	1,000
	2	200	2	400
	1	100	1	200
	1	50	1	100

14062232.04 03/2015 EN/DE

Transport dimensions for complete instrument

The complete instrument, in its standard version and standard scope of delivery, consists of three packages on a single pallet.
The dimensions are 1,200 x 800 x 500 mm.
The overall weight is dependant on the measuring range.

Standard CPB3800 units

Version in bar	Weight in kg net	gross
1 … 120 bar	71	89
2.5 … 300 bar	71	89
5 … 700 bar	71	89
10 … 1,200 bar	71	89

Version in lb/in²	Weight in kg net	gross
10 ... 1,600 lb/in²	68	86
25 ... 4,000 lb/in²	68	86
50 ... 10,000 lb/in²	68	86
100 ... 16,000 lb/in²	68	86

Optional CPS/CPM5800 units with CPB3800 base

Version in bar	Weight in kg net	gross
Single-piston measuring ranges		
1 … 120 bar	77	95.5
2 … 300 bar	77	95.5
Dual-piston measuring ranges		
1 … 60 bar / 10 … 700 bar	85.5	104
1 … 60 bar / 20 … 1,200 bar	77.5	96
1 … 60 bar / 20 … 1,400 bar	85.5	104

Version in psi	Weight in kg net	gross
Single-piston measuring ranges		
10 … 1,600 psi	73	91.5
30 … 4,000 psi	72.5	91
Dual-piston measuring ranges		
10 … 800 psi / 100 … 10,000 psi	84.5	103
10 … 800 psi / 200 … 16,000 psi	73	91.5
10 … 800 psi / 200 … 20,000 psi	84.5	103

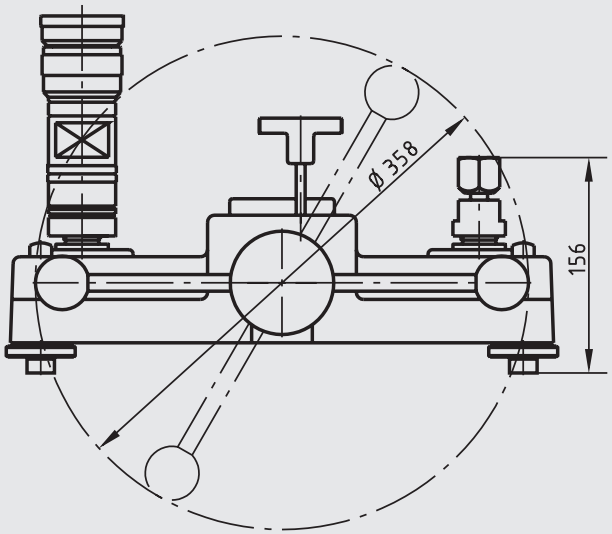
14062232.04 03/2015 EN/DE

Dimensions in mm

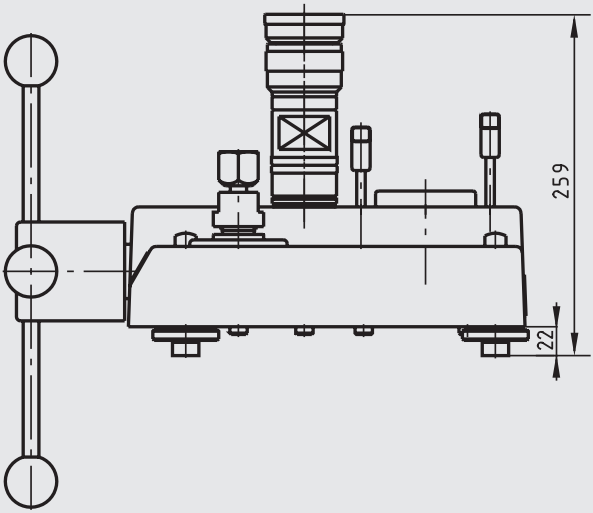
(without disc weigths)

EN

Front view



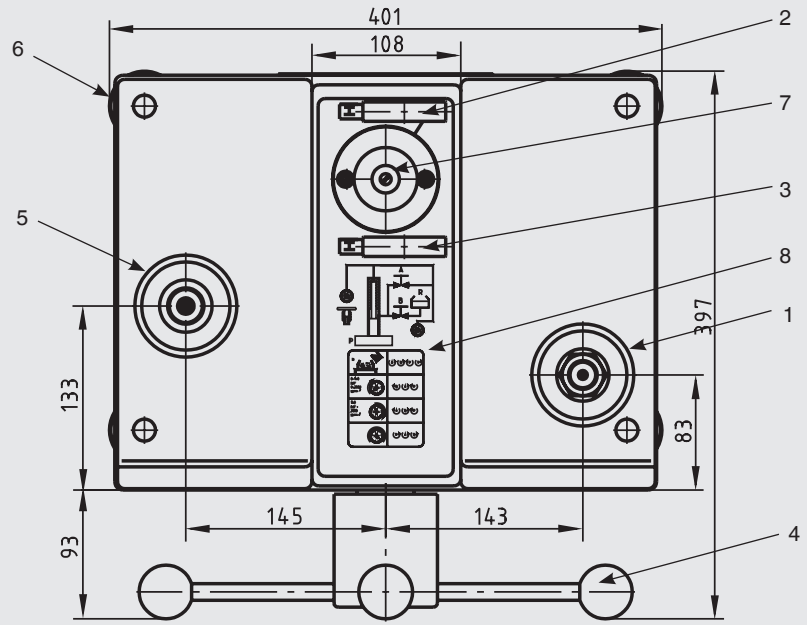
Side view



14062232.04 03/2015 EN/DE

3. Specifications

Top view



(1) Test item connection
(2) High-pressure shut-off valve
(3) Low-pressure shut-off valve
(4) Dual-area spindle pump with star handle
(5) Piston-cylinder system
(6) Rotatable feet
(7) Reservoir with screwed sealing plug
(8) Pressure generation control schematic

14062232.04 03/2015 EN/DE

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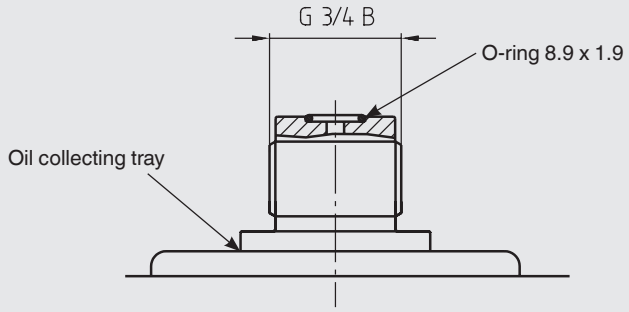
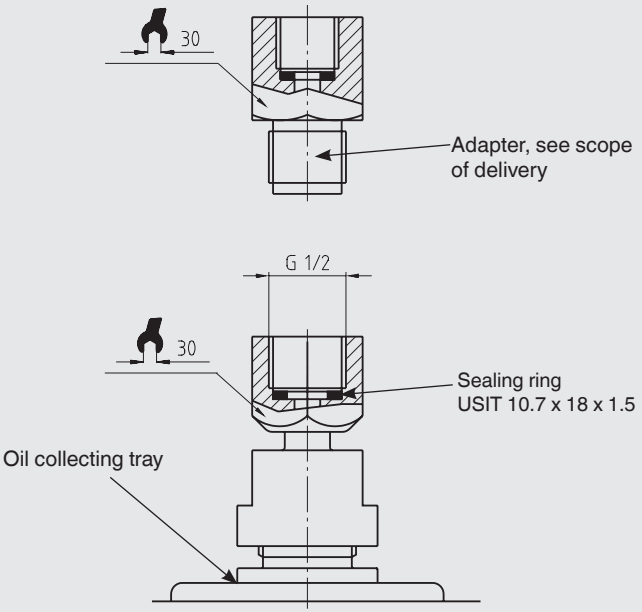
Standard connection piston-cylinder system



Test connection



When using thread adapters, the thread adapter has to be connected pressure tight to the test item first.
After that the test item with mounted adapter can be inserted into the test connection and can be oriented.

14062232.04 03/2015 EN/DE

3. Specifications

Liquids used

A hydraulic mineral oil viscosity 20 ... 37 cSt at 40 °C viscosity grade VG20 to VG37 to ISO 3448 (BS 4231) is used for the CPB3800 base unit. Most users will be able to obtain locally suitable oil (see below) as used in hydraulic machinery. However, for the convenience of users we can supply a 500 ml bottle of oil, viscosity grade VG22.

Oils suitable for dead-weight testers

The following oils are the commercially available oils suitable for use in the dead-weight testers.

ISO 3448 viscosity grade	Approx. SAE viscosity classification	Shell	Esso	Mobil
VG22	--	Tellus 22 Tellus R22	Nuto H22	DTE 22
VG32	10W	Tellus V32 DTE 24	Nuto H32	DTE Oil Light
VG37	--	Tellus 37 Tellus R37 Tellus T37 Tellus V37	--	--

Other liquids

The dead-weight tester model CPB3800 is manufactured for use on mineral oil only. If an end user wishes to use it on another fluid, it is the end user responsibility to ensure that the fluid is compatible with high tensile brass, stainless steel, mild steel, and nitrile rubber, which are the materials that will come into contact with the fluid.

Fluids, which attack ABS, should be used with caution. Continual immersion of the cover in such fluids will cause deterioration. Spillages should be wiped off immediately.

Wear safety goggles!
Protect eyes from flying particles and liquid splashes.

Wear protective gloves!
Protect hands from contact with aggressive media.

14062232.04 03/2015 EN/DE

4. Design and function

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4.1 Description

The model CPB3800 dead-weight tester in compact design provides optimum features for laboratory use whilst being rugged enough for industrial requirements. It provides a highly accurate measurement of pressure.
The piston unit is screwed on to the left hand side pressure block of the base unit and the test item is connected to the right hand pressure block.

4.2 Scope of delivery

- Base
- Dual-area spindle pump for filling, pressure generation and fine pressure adjustment
- Piston connection with G ¾ B male thread
- Test item connection with G ½ female thread, loose union connection
- Adapter set for test item connection selectable from 3 different sets:
  - Adapter set “BSP” G ½ male on G ⅛, G ¼, G ⅜ and G ½ female
  - Adapter set “NPT” G ½ male on ⅛ NPT, ¼ NPT, ⅜ NPT and ½ NPT female
  - Adapter set “metric” G ½ male on M12 x 1.5 and M20 x 1.5 female
- Piston-cylinder system
- Mass set manufactured to standard gravity (9.80665 m/s^2)
- VG22 mineral oil (0.5 litre)
- Tool and maintenance set consisting of:
  1 hexagon wrench key 3 mm A/F
  2 x 30 mm A/F open-ended spanners
  1 spirit level
  4 level plates
  1 bag of seals
  1 G ½ (½” BSP) angle connection
  1 pointer press-on tool
  1 pointer remover
  1 test item connection
- Operating instructions in German and English language
- Factory calibration certificate

Cross-check scope of delivery with delivery note.

4.3 Base unit

The model CPB3800 series base unit consists of a solid aluminium base plate mounted on four adjustable levelling feet, a spindle pump, reservoir, control valves, pipework to

14062232.04 03/2015 EN/DE

two stainless steel pressure connection blocks. The pipework and above mentioned assemblies are covered by an easy to clean ABS cover.

4.3.1 Spindle pump

The spindle pump is bolted to the reservoir/high pressure cylinder block fastened to the base unit. A sectioned view of the pump is shown. The rotating handwheel **(C)** which is operated by the spokes **(D)** is attached to a threaded spindle **(E)**. The spindle is supported in a sintered bearing **(F)**. As the spindle **(E)** is rotated, it drives a non-rotating ram **(E** and **K)** forward, the thrust being taken by a needle thrust bearing **(G)**. The large diameter of the ram **(H)** in the barrel of the pump **(J)** primes the pressure system and provides the low pressure up to approximately 140 bar (2,000 lb/in^2). The small diameter of the ram **(K)** in the reservoir/ high pressure cylinder block provides the higher test pressures up to 1,200 bar (16,000 lb/in2).

4.3.2 Reservoir

A liquid reservoir is provided on the top of reservoir/high pressure cylinder block.
The reservoir is provided with a translucent cover to enable the reservoir level to be monitored. A plug in the middle of the reservoir cover to allow the reservoir to be filled or topped up (the plug is removed whilst the dead-weight tester is in use). The reservoir contains enough liquid (approximately 150 cm^3) to enable normal operation of the dead-weight tester to be carried out.
Low pressure ram displacement = 60 cm^3
High pressure ram displacement = 10 cm^3

4.3.3 Control valves

Two control valves are provided on the top of reservoir/high pressure cylinder block. The valve mechanisms are built into the reservoir/high pressure cylinder block and they control the flow of liquid through internal drillings in the reservoir/high pressure cylinder block. The rear valve is referred to as valve **A** and is used to control the output from the larger diameter ram of the spindle pump. The front valve is referred to as valve **B** and is used to control the flow of liquid to and from the reservoir.

4.3.4 Connection blocks

Pressure supply pipes from the spindle pump are terminated at two pressure blocks mounted on the base unit. The pressure blocks are fitted with threaded bosses projecting up through the cover plate of the base unit. These threaded bosses enable piston units to be directly screwed on to them or connections for various sizes of gauge connections to be screwed on to them. Oil cups are fitted to the unit cover around the threaded bosses of the connection blocks to catch any oil drips from the gauge stand during gauge fitting and removal.

14062232.04 03/2015 EN/DE

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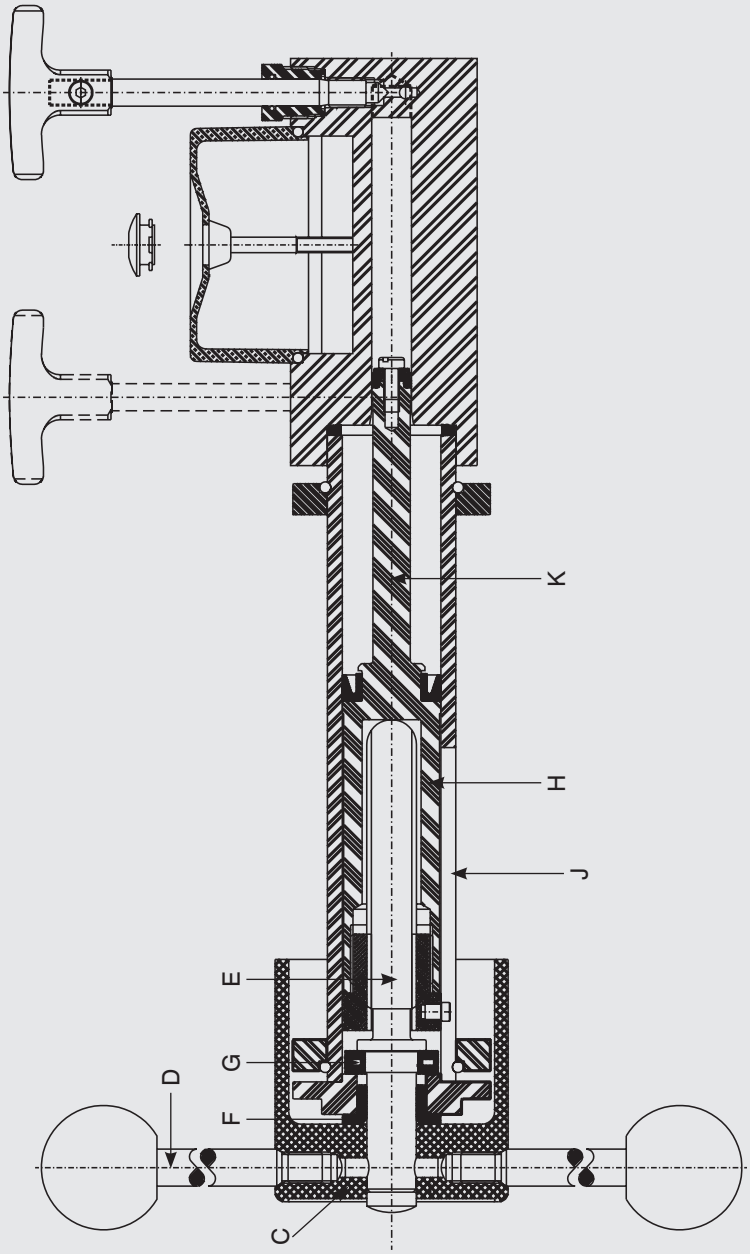
Sectioned view of spindle pump



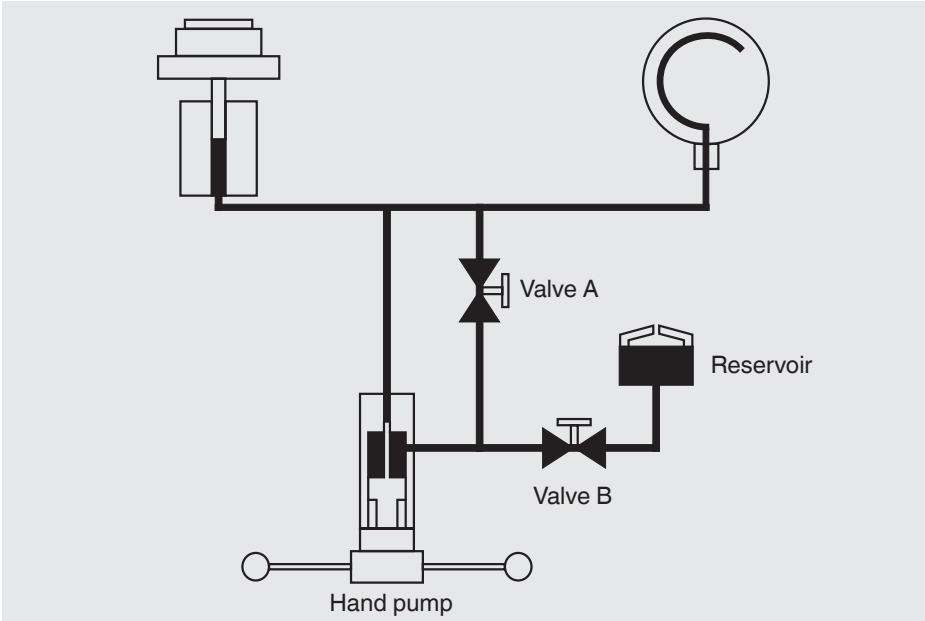
14062232.04 03/2015 EN/DE

4.4 Piston unit

The piston unit of the model CPB3800 is a single range piston unit, which covers the range up to 1,200 bar (16,000 lb/in^2).
Masses are loaded directly onto the piston head for low pressure calibration points. A coloured band indicates when the piston is floating.
For higher pressure points, a mass carrier is fitted directly to the piston head, and disc weights located at the bottom of the mass carrier or located on top of it. A machined groove on the main piston body indicates when the piston is floating.

4.5 Function

Operation of the dead-weight tester is controlled by the two valves **A** and **B** on the top of the reservoir/high pressure cylinder block. When initially priming the system valves **A** and **B** are opened to fill the system with oil from the reservoir. Valve **B** is then closed with valve **A** left open and the spindle pump operated to provide the lower test pressures.
To provide the higher pressures valve **A** is closed to seal off the test circuit from the low pressure part of the spindle pump and valve **B** is opened to allow the liquid in the low pressure part of the spindle pump to return to the reservoir as the pump is operated. This ensures that the pump can be operated without having to put large forces on the spindle pump handwheel. To release the test pressure the spindle pump is wound out and valve **A** is opened.



14062232.04 03/2015 EN/DE

5. Transport, packaging and storage

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5.1 Transport

Check the model CPB3800 dead-weight tester for any damage that may have been caused by transport. Obvious damage must be reported immediately.

5.2 Packaging

Do not remove packaging until just before mounting.
Keep the packaging as it will provide optimum protection during transport (e.g. change in installation site, sending for repair or recalibration).

Disc weights are shipped in cardboard and not in their respective wooden cases, if ordered.
Wooden cases are not suitable for use as shipping cases.

5.3 Storage

Permissible conditions at the place of storage:

- Storage temperature: -10 ... +50 °C
- Humidity: 35 ... 85 % relative humidity for instrument base and mass set
  35 ... 65 % relative humidity for piston-cylinder system (no condensation)

Avoid exposure to the following factors:

- Direct sunlight or proximity to hot objects
- Mechanical vibration, mechanical shock (putting it down hard)
- Soot, vapour, dust and corrosive gases
- Potentially explosive environments, flammable atmospheres
- Corrosive liquids

Store the model CPB3800 dead-weight tester in its original packaging in a location that fulfils the conditions listed above. If the original packaging is not available, pack and store the instrument as described below:

1. Wrap the instrument in an antistatic plastic film.
2. Place the instrument, along with shock-absorbent material, in the packaging.
3. If stored for a prolonged period of time (more than 30 days), place a bag, containing a desiccant, inside the packaging.

14062232.04 03/2015 EN/DE

6. Commissioning, operation

6.1 Unpacking the dead-weight tester

As soon as possible after delivery open the packaging of the deat-weight tester and check that you have all the items detailed in the packing list (see chapter 4.2 “Scope of delivery”). As you are unpacking the items, examine them for signs of damage or breakage during transit.
If any items are missing get in touch immediately with DH-Budenberg/WIKA to inform us of the shortage.

6.2 Environmental requirement

When siting the dead-weight tester if not in a temperature controlled laboratory look for an area that satisfies the following criteria as much as possible:

- A constant temperature area free from draughts and sources of heat or cold
- An area free from noise and vibration, constantly used pathways
- A clean dry area free from corrosive liquids or vapours

A strong, stable, level table or workbench with the capability of supporting the system with sufficient space to operate is required.

6.3 Assembly of base units

Fastening base to bench

The base is to be mounted on a firm, level table or bench about 0.9 m high. The centre line of the front adjustable feet of the unit should be about 40 mm from the front edge of the bench to allow adequate clearance for the handwheel.

1. Mark the position of the adjustable feet of the unit on the top of the bench.
2. Position a level plate at the centre of each of the adjustable feet of the unit and screw the plate to the bench to ensure that the dead-weight tester is rigid.
3. Fit the base unit on the bench with the adjustable feet on the level plates and the handwheel shaft projecting over the front of the bench.
4. Screw in the four handwheel spokes into the hub.
5. Using the spirit level provided, level the unit in both the front/rear axis and the side to side axis by adjusting the four knurled feet, by placing the spirit level on top of the piston-cylinder system.

14062232.04 03/2015 EN/DE

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6.4 Assembly of piston unit

The piston unit of the CPB3800 has its own transportation box that should be used for storing the unit when not in operation, and if the customer ever has to send the unit back for recalibration. The following details show how the piston is to be assembled/ disassembled to the main body.

1. Unscrew the knurled retaining cap from the main body.
2. Place the piston head on a flat surface, with the piston facing vertically.
3. Fit the knurled retaining cap to the piston via the eccentric hole.
4. Place the main piston body with the external thread in a vertical position.
5. Lubricate the piston with the pressure medium, and insert the piston into the cylinder in the main body in a vertical direction only.

WARNING!
Do not apply any transverse force. Excess force is not required.

6. Tighten the knurled retaining cap to the main body.
7. Lift the piston head until it engages against its internal stop. This movement should be free.

14062232.04 03/2015 EN/DE

6.5 Assembly of the dead-weight tester

1. Fit the piston unit to the left hand connection. Ensure that the mating faces are clean and the 12 mm diameter O-ring seal correctly located. Excess force is not required to achieve an effective seal.
2. Check the level of the system base with the spirit level on the piston-cylinder system. Level if necessary by using the levelling screws. If using as a comparator, fit additional loose union connection (order number 14031251) to port that piston unit would be fitted to.
3. Fit the appropriate connection to the gauge stand, using a bonded seal to make the joint and screw a test gauge (for installation use a known gauge) into position, also with a bonded seal.
   If preferred, a copper or leather washer can be substituted for the bonded seal at the gauge. The loose nut on the dead-weight tester base enables the gauge to be positioned as required and for back connection gauges the angle connection is screwed into the loose union connection.

When using thread adapters, the thread adapter has to be connected pressure tight to the test item first.
After that the test item with mounted adapter can be inserted into the test connection and can be oriented.

6.5.1 Filling the base unit with liquid

1. Remove filler plug from reservoir by prising plug out. (This plug should be left out whilst in use).
2. Open valves **A** and **B**.
3. Wind spindle pump handle fully clockwise.
4. Fill reservoir with appropriate liquid. Use the oil supplied or an approved substitute for oil systems. Do not use other liquids. Castor based oils, Skydrol, solvents or similar liquids will attack the seals fitted in the dead-weight tester.
5. Wind spindle pump handle fully anti-clockwise.
6. Top up reservoir if necessary.

Wear safety goggles!
Protect eyes from flying particles and liquid splashes.

14062232.04 03/2015 EN/DE

Wear protective gloves!
Protect hands from contact with aggressive media.

6.5.2 Post assembly test

1. Carry out a test calibration of a known instrument (see chapter 6.6 “Procedure”) to ensure that the unit is working correctly.
2. Release the pressure and remove the test instrument.

To remove the instrument from the system, use the appropriate size of spanners on the top section of the pressure connection and on the body of the instrument only. Ensure that the lower part of the pressure connection is not rotated as this may release it from the base.

3. The system is now ready for use.

CAUTION!
If the volume required to be filled is very large requiring the use of an additional pump and reservoir to be connected to the model CPB3800, it is ESSENTIAL to ensure that valve **B** is kept open and valve **A** closed at all times otherwise a high pressure can be built up on the low pressure ram of the screw press and damage caused. To ensure this does not happen we can supply the system fitted with a relief valve, which will release at a set pressure, should the valve operation be incorrect.

Alternatively, we can supply a modified system and hand pump for this operation. For further information on both items contact DH-Budenberg/ WIKA.

When testing equipment with a large volume, the capacity of the spindle pump (65 cm^3) may be insufficient to reach the pressure required. In this case, the equipment should be filled as far as possible with the liquid before connecting it to the system, so that the displacement needed is reduced.

Dirty or chemically contaminated test items should not be fitted as they contaminate the system unless they are first cleaned.

14062232.04 03/2015 EN/DE

Wear safety goggles!
Protect eyes from flying particles and liquid splashes.

Wear protective gloves!
Protect hands from contact with aggressive media.

6.6 Procedure

1. Fit instrument to be tested to gauge stand.
2. Load the masses equivalent to the desired pressure. Each mass is marked with its pressure value. The piston-cylinder system has a basic lb/in^2 start, for other pressure units a make-up weight is added to the piston head for conversion to bar.

For calibrating pressures less than the pressure value of the mass carrier make-up weight value, it is recommended that the top loading disc weights are used for calibration. When the required pressure calibration unit is bar, it is essential that the small make-up weight is fitted first before any other top loading disc weights.

For calibrating pressures greater than the pressure value mass carrier make-up weight value, the mass carrier should be fitted. All disc weights must be removed before fitting the mass carrier.

When the mass carrier is fitted, the initial masses that goes onto it is a large annular make-up weight. The small type make-up weight should not be used when the mass carrier is fitted.

6.6.1 To apply pressure

For pressures up to 140 bar (2,000lb/in^2)

1. Close valve **B** (valve **A** remaining open).
2. Wind spindle pump handle clockwise. This will generate pressure up to approximately 140 bar or 2,000 lb/in^2, as handle is wound in. When handle becomes stiff to rotate this will indicate that the pressure limit for this range has been reached.

14062232.04 03/2015 EN/DE

For pressures above 140 bar (2,000lb/in²)

1. Ensure valve **B** closed and valve **A** open.
2. Wind spindle pump handle clockwise until the handle becomes stiff to operate.
3. Close Valve **A** and open valve **B**.
4. Continue to wind spindle pump handle clockwise. This will generate pressure up to approximately 1,200 bar or 16,000 lb/in².
5. When the piston rises and appears to floats, this indicates it is at its nominal desired pressure. When **only** disc weights are being utilised, a blue and yellow band indicates the float position. When the mass carrier is being employed, the bottom of the mass carrier will line up with a machined groove in the piston holders main body, to indicate its nominal desired pressure.

6.6.2 During calibration

When the dead-weight tester is correctly set up and there are no leaks the piston should "float" for many minutes without it being necessary to touch the spindle pump handwheel. On the initial setting up, however, there may be some air trapped in the base of the piston/cylinder unit. As this leaks past the piston the masses may fall slightly but it will only be for a matter of a few minutes until the air has escaped. If the piston continues to fall, check the connections for leaks.

During calibration, the masses should be rotated by hand. It is desirable that the masses should only be rotated when approximately the correct pressure is obtained. Masses should not be brought to rest by fully releasing the pressure and allowing the piston head to rotate against its stop under the full load of the mass pile.

It is essential that the masses spin freely during readings. The piston stops moving when the pressure is too high or too low. At the lowest pressures the masses will not spin for more than a few seconds unless a very thin oil is used, but providing the mass is rotated by hand before taking a reading and is obviously "floating" an accurate reading will be given.

CAUTION!

Care should be exercised at all times when rotating the masses. Failure to do so may cause damage to the actual piston unit, or possibly injury to the operator.

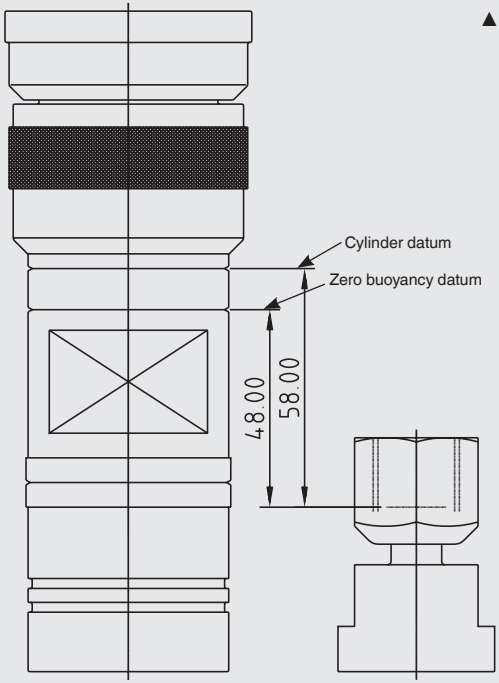
Therefore, the rotational motion should be stopped by hand. Only then new masses for further test points can be placed or the pressure can be released completely.

14062232.04 03/2015 EN/DE

6.6.3 Datum levels

When testing gauges on liquid it is occasionally necessary to take into account heads of liquid since a height difference of 10 mm corresponds to approximately 1 mbar. The datum levels of the models CPB3800 piston units are marked with a groove on the outer diameter of the piston unit. It should be noted that when the dead-weight tester is re-calibrated by a laboratory other than DH-Budenberg/WIKA, the datum level at which the tests have been carried out may differ from this standard and therefore allowance should be made for any variation.

The drawing shows the head effect that may have to be compensated for when high accuracy calibration is desired. The following formula will enable the head correction to be calculated.



▲P due to head effects

Pressure (Pa) = σ • H • g

Where

σ = density (kg/m³)

H = height (in metres)

g = gravity (m/s²)

Density of VG 22 oil = 885 kg/cm³

14062232.04 03/2015 EN/DE

6.7 Completion

1. After the test is finished wind spindle pump handle anti-clockwise to lower pressure.
2. Gently open valve **A** or **B** to release residual pressure.
3. Ensure that both valves **A** and **B** are fully open.

The system is now ready for another test and any residual pressure is relieved.

6.8 Pressure calculation computer software standard accuracy program

This software enables the user to define his equipment and local conditions (gravity, temperature), so that when nominal pressures are entered, actual achieved pressures are displayed

These actual pressures will then be to the standard accuracy of the dead-weight tester.

To achieve the improved standard accuracy the user must enter the correction factor given on the improved accuracy certificate supplied with the piston unit.

Default conditions are input at DH-Budenberg/WIKA but once the user alters these, his values then become the default (no need to repeatedly insert your values).

This program has been written to aid users to maintain the standard accuracy of DH-Budenberg/WIKA dead-weight tester. It has not been written for use with any other makes of dead-weight testers.

The software can be accessed from the supplied CD in the folder “Customer Software” and “Standard Accuracy DWT”. Installation/Operating instructions should be read before using the software.

6.9 Temperature measurement of piston units

For many purposes, such as calibrating most type of dial gauges and sensors, accurate knowledge of the temperature of a piston unit is not necessary. However, in order to achieve the utmost accuracy from a dead-weight tester it is important to know the temperature of the piston unit as close as possible to the working part of the unit.

In laboratories where the room temperature is controlled it is most likely that the temperature of the working parts of the unit will not differ from the ambient temperature by more than 0.5 °C. When working in uncontrolled temperatures, however, one would have to measure the temperature of the piston unit.

14062232.04 03/2015 EN/DE

A possible way to do this is to use a disc shaped thermistor type probe sensing element taped to the outer surface of the piston unit. The sensing element should be insulated from the ambient temperature by covering the element with a thin strip of polystyrene, or other insulating material, then taping this to the piston unit. Alternatively, a model CPU6000 CalibratorUnit may be used.

We can supply a suitable instrument. Please contact DH-Budenberg/WIKA.

6.10 Cleaning gauges

This cleaning/degreasing process is only suitable for use with pressure gauges with either phosphor bronze, beryllium copper, monel or stainless steel bourdon tubes in the form of a “C”.

It is not advisable to degrease pressure gauges with steel bourdon tubes since a very small amount of corrosion on the bore of a bourdon tube can cause inaccuracies of reading and early failure of the tube.

Wear safety goggles!
Protect eyes from flying particles and liquid splashes.

Wear protective gloves!
Protect hands from contact with aggressive media.

This method of cleaning is not suitable for use with pressure gauges which are fitted with coiled bourdon tubes, nor any gauges which are to be used on oxygen, as complete removal of oil is not assured. Please contact DH-Budenberg/WIKA.

Equipment

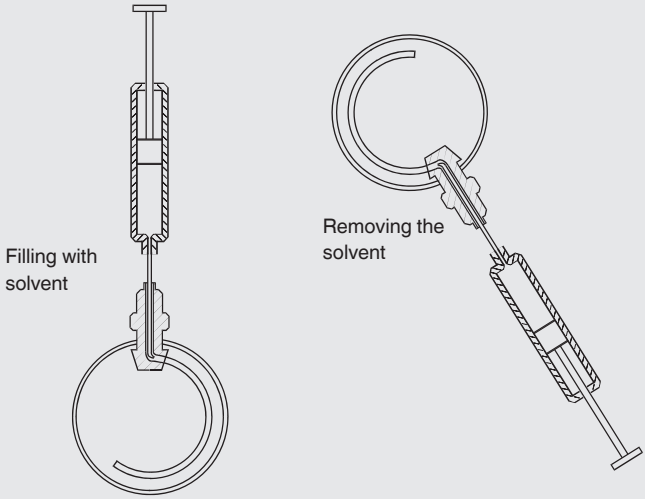
This consists of a syringe and a special needle with the point bent through 90°.

Instructions

1. Fill syringe with solvent (suitable cold degreasing liquid).
2. With gauge connection pointing upwards put needle into connection and insert by feel the point into the hole leading to the tube.

14062232.04 03/2015 EN/DE

3. Inject the solvent. Ideally the tube should be half full.
4. Shake gauge in various attitudes to agitate solvent.
5. Suck solvent back into syringe, holding gauge at an angle.
6. Check that solvent removed is clean. To be sure that all oil has been removed, repeat cleaning process until solvent removed from gauge is as clean as that put in.



Cleaning of gauges

7. Maintenance, cleaning and recalibration

7.1 Periodic maintenance

Repairs must only be carried out by the manufacturer.
Cleaning the units and checking the liquid levels is the only periodic maintenance required. With normal use, no further maintenance should be necessary. If required, the system can be returned to the manufacturer for re-conditioning. Accuracy, overhaul and re-certification are also explained in chapter 7.4.1 “Factory overhaul and re-certification of dead-weight testers maintenance of accuracy”.

Fluids, which attack ABS, should be used with caution. Continual immersion of the cover in such fluids will cause deterioration. Spillage’s should be wiped off immediately.

14062232.04 03/2015 EN/DE

7.2 Corrective maintenance

7.2.1 General

This section contains details on stripping the unit and replacing the spare parts which are listed (see chapter 10 “Accessories”). The component identification numbers in brackets in each procedure refer to the following figure.

7.2.2 Removing the cover

1. Drain as much oil as possible from the dead-weight tester by winding the screw-press fully clockwise and using a drain screwed in the gauge stand.
2. Unscrew the loose union connection and piston-cylinder system.
3. Remove the oil cups by levering upwards carefully.
4. Slacken the socket set screw using a 3 mm hexagon wrench key and remove both handwheels.
5. Remove the four cover retaining screws and lift off the cover.

7.2.3 Reservoir seals

1. Unscrew two screws and remove the reservoir cover
2. Remove the O-ring seal **(6)** from the recess and the seloc seal **(7)** from the screws.
3. On replacement ensure all sealing faces are absolutely clean and do not overtighten screws.

7.2.4 Valve seals

1. Unscrew the gland nut.
2. Unscrew the valve spindle and remove the bonded seal.
3. Slide gland nut off spindle.
4. Using a suitable hooked tool remove the O-ring seal **(9)** from the bore of the gland nut. Renew O-ring and bonded seal **(10)**.
5. On replacement ensure that O-ring is correctly located in the groove and all sealing faces are clean. Remove all burrs from spindle.

7.2.5 Spindle pump

1. Using a 4 mm hexagon wrench key unscrew the six socket head cap screws securing the hub locating plate. (These are positioned inside the recess in the back of the aluminium hub).

14062232.04 03/2015 EN/DE

2. By carefully pulling the hub the complete ram assembly can now be withdrawn from the barrel (During this operation a container is required beneath the barrel to catch any liquid).
3. Unscrew the ram from the hub assembly.
4. The high pressure seal **(12)** and low pressure seal **(15)** can now be replaced. Before fitting the new seals check the ram is not scored on the locating diameters.
5. At this point the hub assembly should be checked for excess play indicating wear in the bearing and for wear in the screwed spindle and nut. If any wear is found it will be necessary to dismantle the hub assembly.
6. Check the bore of the block assembly **(11)** is not badly scored or pitted. If a replacement is required this item is supplied complete with valves. The block is attached to the base by socket head cap screws.
7. Re-assembly is a straightforward reversal of the above procedures.

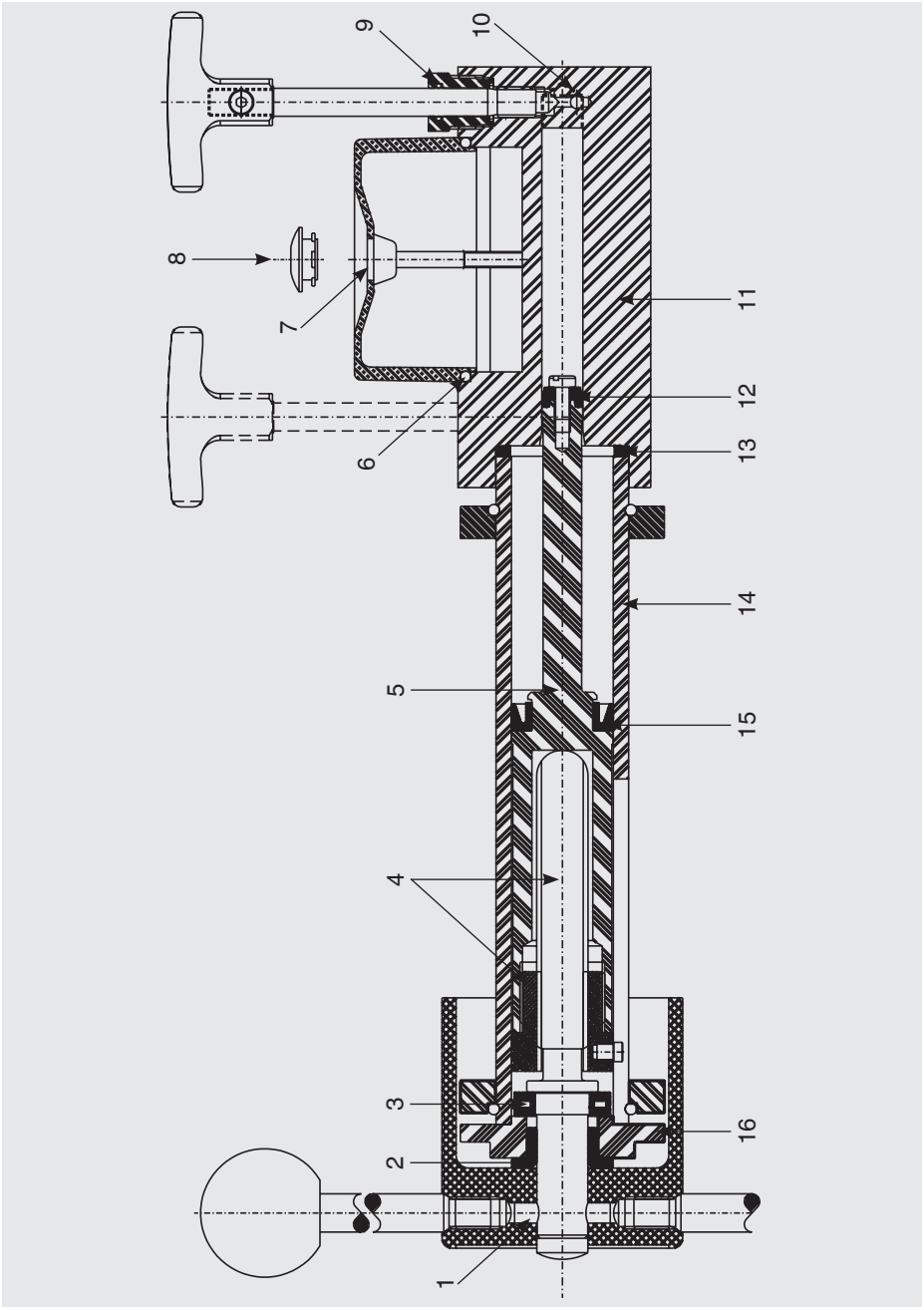
On assembly care should be taken to align the ram to prevent bending, or damage to the seals. Excessive force should not be used.

The socket head cap screws are not spaced equally around the locating flanges so check hole alignment before inserting screws.

7.2.6 Hub assembly

1. Unscrew the ram from the spindle. **NOTE:** left hand thread.
2. Unscrew the spokes from the hub.
3. Knock out the spring pin **(1)**, found at the bottom of one of the tapped spoke holes in the hub, using a punch 6 mm dia. Pull off hub.
4. The hub locating plate and thrust bearing can now be removed from the spindle.
5. If the flanged bush **(2)** is to be renewed, it should be pressed out of the locating plate and a new one pressed in squarely.
6. The thrust bearing **(3)** is renewed as a complete assembly.
7. The nut, pin and spindle sub-assembly **(4)** can only be replaced as a matched pair. Unscrew the nut from the ram, gripping in a soft jaw vice and screw in the new nut.
8. Assemble the thrust bearing, locating plate and hub on to the spindle, lubricating with molybdenum disulphide grease.
9. Clamp these items together to eliminate end play and re-assemble spring pin. If using new spindle drill through 6.3 mm diameter to fit spring pin **(1)**.
10. Lubricate the thread with molybdenum disulphide grease and screw into ram nut.

14062232.04 03/2015 EN/DE



14062232.04 03/2015 EN/DE

7.2.7 Piston-cylinder system

As the piston-cylinder system represents a high proportion of the total value of the dead-weight tester, it should always be handled with care and every effort made to keep it clean.

The piston-cylinder system is made to extremely fine limits of accuracy and it is not advisable to dismantle it. If it is necessary to clean it, the piston and cylinder bore must be oiled immediately, in order to protect the high grade finish.

Should the unit become damaged it should be returned complete for replacement or repair. Parts from different units are not interchangeable as they have to be weighed and evaluated as a whole.

The serial number of the piston-cylinder system appears in the certificate of accuracy and is marked on the body of the unit. This number, as well as the dead-weight tester serial number should always be quoted in correspondence concerning the piston/ cylinder unit.

The piston-cylinder connections should be blanked if it is removed from the dead-weight tester. If the unit is taken off for any reason it should be stored upside-down, resting on its mass carrier.

This covers stripping the unit to enable simple repairs and the fitting of recommended spare parts to be carried out.

7.3 Cleaning

Cleaning the unit and checking the liquid levels.

Oil operation

Keep the system clean and free from spilt oil. Wipe out the oil cups under the gauge stands as necessary. Do not use any cleansing solvents as they may damage the seals.

Ensure that the reservoir contains sufficient liquid to carry out any calibrations required. If necessary top up the reservoir with the same liquid that is already being used. Do not mix various types or brands of liquid in the dead-weight tester.

If the oil in the system becomes dirty, use the spindle pump to flush through the clean oil with a drain screwed in the gauge stand. (An angle connection is suitable). The spindle pump should be turned fully clockwise before starting.

14062232.04 03/2015 EN/DE

Wear safety goggles!
Protect eyes from flying particles and liquid splashes.

Wear protective gloves!
Protect hands from contact with aggressive media.

For information on returning the instrument see chapter 9.1 “Return”.

7.4 Recalibration

UKAS, DKD/DAkkS certificate - Certificates:

We recommend that the instrument is regularly recalibrated by the manufacturer, with time intervals of 5 years. The basic settings will be corrected if necessary.

7.4.1 Factory overhaul and re-certification of dead-weight testers maintenance of accuracy.

The accuracy of a dead-weight tester depends primarily on the effective area of the piston unit and on the masses applied to the piston. The effective area of the piston unit can be affected by wear of the unit. This is generally caused by contamination of the oil in the dead-weight tester by foreign matter from instruments being calibrated, by water, or by chemicals from instruments, or by rust or corrosion caused by contaminants.

Masses are made of austenitic stainless steel which are entirely stable. They should be periodically cleaned using a non abrasive method to remove any foreign matter.

7.4.2 Need for overhaul and re-certification

We recommend that the dead-weight tester be returned to us for overhaul and re-certification at any time if when used in accordance with instructions:

1. The piston does not spin freely.
2. The rate of fall of the piston is appreciably greater than when new and makes use of the dead-weight tester difficult.
3. The masses are damaged.
4. The dead-weight tester cannot be made to operate satisfactorily due to wear or damage to pump piping or valves which cannot be rectified by the user.

14062232.04 03/2015 EN/DE

This dead-weight tester can be used for calibration of instruments with an expected accuracy of 1, 0.5 or 0.25 %. Such dead-weight testers need not be sent back frequently for overhaul and re-certification and provided they are working well can be trusted for many years. Under these circumstances, an interval of five years might be appropriate between overhauls.

When high accuracy of the dead-weight tester is required, it should be returned for overhaul and re-certification more frequently. The actual period will depend on how the dead-weight tester is used. A dead-weight tester kept in a laboratory and carefully used might need to be returned every two to five years. A dead-weight tester carried from site to site and used for calibrating high accuracy gauges or sensors from industrial process plant or for measuring pressures directly might well need to be returned at intervals of less than specified above.

The actual period between overhaul and re-certification should be fixed by the user in the light of the above comments taking into account the requirements of any inspection authority, which might be involved.

7.4.3 Identification of masses

All mass sets supplied with a dead-weight tester have allocated, and are marked, with a mass set number. Additionally, if users wish to ensure that only specific masses are used with an individual dead-weight tester or piston and cylinder unit, then the serial number of the dead-weight tester, and/or piston-cylinder system may also be marked on the main masses. Regrettably due to size of certain masses, not all the above information may be marked.

7.4.4 Overhaul and re-certification

To provide the best possible service, the dead-weight tester should be returned as complete units comprising the base, the piston and cylinder unit, and all the masses. The base can also be serviced itself. The piston-cylinder system with masses has to be sent back for overhaul. In such instances, certification issued after overhaul can only refer to the piston and cylinder and mass set numbers and not to the base to which they were originally fitted.

Dead-weight tester bases will be stripped, all pipework cleaned, all seals replaced, worn components replaced where desirable, and all reassembled and tested.

The masses will all be checked and brought to within original limits if possible. If one or two masses are missing or beyond economical repair they will be replaced. If more are missing/beyond economical repair customer instructions will be sought.

14062232.04 03/2015 EN/DE

The piston unit will be checked for accuracy and sensitivity. If it is not satisfactory for any reason a quotation will be submitted for a replacement unit.

A new certificate of accuracy will be issued for each overhauled dead-weight tester. Unless otherwise instructed on order when there has been a slight change in area of the piston unit the certificate will reflect this; the accuracy will not be affected by more than 0.03 %. For example the certificate of accuracy of an overhauled dead-weight tester might show that the error does not exceed 0.05 % when the original certificate shows that the error did not exceed 0.02 %.

We can issue an UKAS or DKD/DAkkS certificate of calibration for an overhauled system. Details will be supplied on request.

8. Faults

Faults	Causes	Measures
Equipment does not provide any output pressure.	No liquid in dead-weight tester.	Check that dead-weight tester is filled with liquid. Fill the equipment with fluid as necessary. See chapter 6.5.1 “Filling the equipment with liquid”.
	Valve B is open.	Close valve B and try again.
	Component being tested has a large volume.	Pre-fill component with liquid before test.
	Missing or damaged liquid seals shown by signs of unexplained liquid leaks.	Examine seals on equipment to ensure they are fitted correctly and are undamaged. Replace as necessary.
	Valve B handwheel disconnected from spindle.	Examine valve B. Tighten up nut securing handwheel to spindle as necessary.
	Valve B assembly or valve seat damaged.	Examine condition of valve B and valve seat. Replace valve assembly or return dead-weight tester to DH-Budenberg/WIKA for overhaul as necessary.
	If unable to locate a cause.	Return dead-weight tester to DH-Budenberg/WIKA for investigation.

14062232.04 03/2015 EN/DE

Faults	Causes	Measures
Equipment provides pressure but pressure decays when valves A and B are operated.	Incorrect operating procedure being used.	Ensure that correct operating procedure is being followed (see chapter 6.6).
	If unable to locate a cause.	Return dead-weight tester to DH-Budenberg/WIKA for investigation.
Equipment provides pressure but pressure decays to zero	Incorrect operating procedure being used.	Ensure that correct operating procedure is being followed (see chapter 6.6).
	Missing or damaged liquid seals shown by signs of unexplained liquid leaks.	Examine seals on equipment to ensure they are fitted correctly and are undamaged. Replace as necessary.
	Valve A or Valve B valve assembly or valve seat damaged.	Examine condition of valves A and B and valve seat. Replace valve assembly or return dead-weight tester to DH-Budenberg/WIKA for overhaul as necessary.
	If unable to locate a cause.	Return dead-weight tester to DH-Budenberg/WIKA for investigation.
Equipment provides pressure but pressure decays to lower value then remains steady.	Insufficient liquid in dead-weight tester.	Check liquid level in reservoir. Fill reservoir with correct liquid as necessary (see chapter 6.5.1).
	Air in the system	Prefill component under test with appropriate liquid. If necessary re-fill dead-weight tester with appropriate liquid.
	If unable to locate a cause.	Return dead-weight tester to DH-Budenberg/WIKA for investigation.
	Internal damage	Return dead-weight tester to DH-Budenberg/WIKA for investigation.
	Incorrect operating procedure being used.	Ensure that correct operating procedure is being followed (see chapter 6.6).
	If unable to locate a cause.	Return dead-weight tester to DH-Budenberg/WIKA for investigation.

14062232.04 03/2015 EN/DE

Faults	Causes	Measures
Dead-weight tester screw press becomes very stiff to operate when dead-weight tester is being used in range below 140 bar (2,000 lb/in²)	Internal damage	Return dead-weight tester to DH-Budenberg/WIKA for investigation.
Dead-weight tester screw press becomes very stiff to operate when dead-weight tester is being used in range above 140 bar (2,000 lb/in²)	Incorrect operating procedure being used.	Ensure that correct operating procedure is being followed (see chapter 6.6).
	If unable to locate a cause.	Return dead-weight tester to DH-Budenberg/WIKA for investigation.

CAUTION!
If faults cannot be eliminated by means of the measures listed above, the dead-weight tester must be shut down immediately, and it must be ensured that pressure is no longer present, and it must be prevented from being inadvertently put back into service.
In this case, contact the manufacturer.
If a return is needed, please follow the instructions given in chapter 9.1 “Return”.

9. Return and disposal

WARNING!
Residual media at the dead-weight tester can result in a risk to persons, the environment and equipment. Take sufficient precautionary measures.

9.1 Return

WARNING!
Strictly observe the following when shipping the instrument:
All instruments delivered to DH-Budenberg/WIKA must be free from any kind of hazardous substances (acids, bases, solutions etc.).

14062232.04 03/2015 EN/DE

9. Return and disposal

When returning the instrument, use the original packaging or a suitable transport package.

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To avoid damage:

1. Place the piston-cylinder system into the designed transport box (see chapter 6.4 „Assembly of piston unit“).
2. Wrap the instrument in an antistatic plastic film.
3. Place the instrument, along with the shock-absorbent material, in the packaging. Place shock-absorbent material evenly on all sides of the transport packaging.
4. If possible, place a bag, containing a desiccant, inside the packaging.
5. Label the shipment as transport of a highly sensitive measuring instrument.

Information on returns can be found under the heading “Service” on our local website.

9.2 Disposal

Incorrect disposal can put the environment at risk.
Dispose of instrument components and packaging materials in an environmentally compatible way and in accordance with the country-specific waste disposal regulations.

This marking on the instruments indicates that they must not be disposed of in domestic waste. The disposal is carried out by return to the manufacturer or by the corresponding municipal authorities (see EU directive 2002/96/EC).

14062232.04 03/2015 EN/DE

10. Accessories

Designation/Variant	Order no.
Set of trim-masses (1 mg up to 50 g), class F1	7093874
Set of trim-masses (1 mg up to 50 g), class M1	14025325
Set of 2 carrying cases for bar mass set	14031236
Set of 2 carrying cases for psi mass set	14068416
Carrying case for CPB3800 Instrument base	14031237
Adapter set “BSP” for test item connection G ½ B male on G ⅛, G ¼, G ⅜ and G ½ female	14031238
Adapter set “NPT” for test item connection G ½ B male on ⅛ NPT, ¼ NPT, ⅜ NPT and ½ NPT female	14031239
Adapter set “metric” for test item connection G ½ B male on M12 x 1.5 and M20 x 1.5 female	14031242
Test item connection, G ¾ female to G ½ female, rotating	14031251
90° angle connection, for test items with back mounting connection	1564838
Separator (to separate two liquid media by a diaphragm), max. 700 bar	14031253
Separator (to separate two liquid media by a diaphragm), max. 1,200 bar	14031254
Sealing set for CPB3800 instrument base	14031255
Operating fluid for CPB series up to a max. 4,000 bar, 0.5 litre	2099954
Tool set consisting of open-ended spanner, BSP adapter, replacement seals, pointer remover and pointer punch	14031263

14062232.04 03/2015 EN/DE

EN

DH - Budenberg

EG-Konformitätserklärung

Dokument Nr.:

14048028.01

Wir erklären in alleiniger Verantwortung, dass die mit CE gekennzeichneten Produkte

Typ:

CPB3800

Beschreibung:

Kolbenmanometer in Kompaktausführung

gemäß gültigem Datenblatt:

CT 31.06

die grundlegenden Schutzanforderungen der folgenden Richtlinie(n) erfüllen:

97/23/EG (DGRL)[1]

(1) PS > 1000 bar; Modul A, druckhaltendes Ausrüstungsteil

EC Declaration of Conformity

Document No.:

14048028.01

We declare under our sole responsibility that the CE marked products

Model:

CPB3800

Description:

Pressure balance in compact design

according to the valid data sheet:

CT 31.06

are in conformity with the essential protection requirements of the directive(s)

97/23/EC (PED)[1]

(1) PS > 1000 bar; Module A, pressure accessory

Unterzeichnet für und im Namen von / Signed for and on behalf of

DH-Budenberg Ltd.

Manchester, 2012-07-03

John White, Managing Director

Unterschrift, autorisiert durch das Unternehmen / Signature authorized by the company

DH-Budenberg Ltd.
2 Gilchrist Road, Northbank industrial Estate
Irlam, Manchester M44 5 AY
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14062232.04 03/2015 EN/DE

目录

CN

关于符合性声明，请登录www.wika.com查阅

14062232.04 03/2015 EN/CN

1. 简介

CN

- 本操作说明所提及的CPB3800紧凑型活塞压力计均采用最先进技术进行设计和制造，且所有部件在生产过程中均符合严格的质量和环境标准。我们的管理系统经过ISO 9001和ISO 14001认证。
- 这些操作说明包含了关于仪表操作的重要信息。操作时，必须严格遵守所有安全提示和工作指导，以确保安全。
- 请严格遵守所在国家的相关事故预防条例以及关于仪表使用范围的一般安全规程。
- 操作说明是产品的组成部分，必须置于仪表附近，并确保其可由熟练技术人员随时轻松取阅。当转移仪器时，必须将操作说明一并交付于下一个操作员或所有者。
- 在开始作业前，熟练技术人员必须详细阅读并理解操作说明。
- 销售文件中所包含的一般性条款和条件也应适用。
- 可能随时进行技术改动。
- 按照国际标准进行工厂校验和DKD/DAkkS校验。

14062232.04 03/2015 EN/CN

1. 简介

- 更多信息：

DH-Budenberg
WIKA Instruments Ltd所属部门

- 网址：	www.wika.de / www.wika.com
- 相关数据手册：	CT 31.06
- 应用顾问：	电话： +44 844 4060086
	传真： +44 844 4060087
	sales@dh-budenberg.co.uk

WIKA Alexander Wiegand SE & Co. KG

- 网址：	www.wika.de / www.wika.com
- 相关数据手册：	CT 31.06
- 应用顾问：	电话： +49 9372/132-0
	传真： +49 9372/132-406
	info@wika.com

- **符号说明**

警告！
…表示潜在危险情况，如未避免则可能导致严重伤害甚至死亡。

注意！
…表示潜在危险情况，如未避免则可能导致轻微伤害、设备损坏或环境危害。

提示
…提供实用窍门、建议以及实施高效而无故障的操作所需的信息。

14062232.04 03/2015 EN/CN

2. 安全性

警告！
在安装、试运行和运行之前，请确保所选择的活塞压力计的测量范围、设计和具体测量条件都符合应用要求。
否则可能造成严重人员伤害和/或设备损坏。

CN

可在该操作说明的单独章节中找到其他重要的安全提示。

2.1 指定用途

活塞压力计是市场上用于校验电子或机械式压力测量仪表的最准确的仪表，它通过测量力与面积之比确定测量压力 (P = F/A)，被认定为原始基准。

因此，CPB3800活塞压力计采用精密制造的活塞汽缸系统作为核心组件，可通过加载砝码组生成单独测试点。砝码组以最佳方式分成了不同的质量等级，使得在天平上加载砝码质量与目标压力成正比。最大压力不能超高1200 bar。

通过集成的可微调精密双区螺杆泵设置压力。当测量系统达到平衡时，压力与加载砝码之间将达到力平衡。随后，可以校验测试件或执行相关调节任务。

CPB3800型活塞压力计是一种单机操作设备（集成了压力发生系统并采用纯粹的机械式测量原理），理想适用于维护和维修现场使用。

此仪器的设计和制造仅针对此处描述的预期用途，用户只能够按照预期用途使用仪器。

用户必须遵守此操作说明描述的技术参数。如果在技术参数之外不当地使用或操作仪器，则必须立刻停止使用仪器，并由授权的DH-Budenberg/WIKA服务工程师对其进行检查。

14062232.04 03/2015 EN/CN

在使用机械式精密测量仪器时需要特别注意（防止仪器受到湿度、冲击、强磁场、静电和极端温度的影响，请勿向仪器或仪器开口中塞入任何物体）。

如果将仪器从冰冷环境运送到温暖的环境中，生成的冷凝水滴可能会导致仪器故障。在将仪器重新投入使用之前，请等待仪器的温度上升至室温水平。

如果产品未按指定用途使用而造成损坏，制造商不承担任何责任。

2.2 人员资质

警告！

人员资质不够可能会导致人员伤害！

处理不当会导致相当严重的人员伤害和设备损坏。

- 操作说明中所述的所有活动都只能由具备以下资质的熟练技术人员实施。
- 无资质人员请远离危险区域。

熟练技术人员

熟练技术人员指的是经过技术培训、理解测量和控制技术以及对国内法规、当前标准和指令具有相关经验和知识的技术人员。这些人员具有实施所述工作的能力，并且能够独立辨别潜在的危险。

特殊工作条件（如腐蚀性介质），要求技术人员拥有更多合适的专业知识

DH-Budenebrg/WIKA可针对正确使用我们的产品提供专业的培训课程。请联系当地办公室了解更多详细信息。

2.3 个人防护装备

个人防护装备设计用于保护技术人员在工作中免受安全和健康危险。在仪器上或使用仪器执行多种任务时，技术人员必须穿戴个人防护装备。

14062232.04 03/2015 EN/CN

请遵守工作区域中明示的关于个人防护装备的规定！

所需的个人防护装备必须由使用仪器的公司提供。

CN

穿戴护目镜！
保护眼睛免受飞溅颗粒和液体的伤害。

穿戴防护手套！
防止双手接触腐蚀性介质。

2.4 特殊危险

警告！
为了确保安全使用仪器，用户必须确保

- 提供适当的急救设备，并能够在任何需要的时刻提供急救帮助。
- 定期对操作人员进行工作安全、急救、环境保护和操作说明培训，特别是操作说明中的安全说明内容。

警告！
活塞压力计上的残留介质会对人员、环境和设备造成损害风险。请采取妥善的预防性措施。

2.4.1 关于矿物油的健康和安全信息

DH-Budenberg/WIKA采用贴着 “ISO VG 22” 标签的500 ml容器为活塞压力计提供液压矿物油，这些矿物油的最高使用压力可达4000 bar。它的危险程度不高于其它普通的润滑油。

14062232.04 03/2015 EN/CN

2. 安全性

在使用设备时，经常会发生皮肤频繁和/或长时间接触矿物油的情况，有些人还会产生皮肤过敏（角化症或皮炎）。使用有效的护肤霜和/或穿戴防护手套可以显著地降低这种可能性。

CN

描述

闭口闪点	＞120 °C
存储温度	≤30 °C
经口LD50毒性	15 g/个体
阈值极限	5 mg/m³
灭火介质	CO_2/干燥的化学泡沫或水雾
漏油	使用脱脂棉或适当的吸收剂吸浸
废油处理	燃烧或倾倒到批准的区域

紧急处理急性症状

吞食矿物油	请勿催吐。 饮入250 ml牛奶或橄榄油。 意外吞食矿物油之后的主要危险是将液体吸入肺中。
将矿物油吸入肺中	立刻送往医院
呼吸了矿物油挥发气体	转移到新鲜空气处，如果仍然存在作呕症状，请寻求医疗救助。
眼睛接触了矿物油	使用大量清水至少清洗10分钟。如果出现刺激后果或刺激一直持续，请寻求医疗救助。
皮肤接触了矿物油	当由于长期或反复接触矿物油导致皮疹或其它异常症状时，必须尽快寻求医疗救助。

2.4.2 其它液体

对于一些非常特殊的应用，我们提供特殊配方的液体。我们可根据用户的要求提供液体制造商的数据拷贝文件。

14062232.04 03/2015 EN/CN

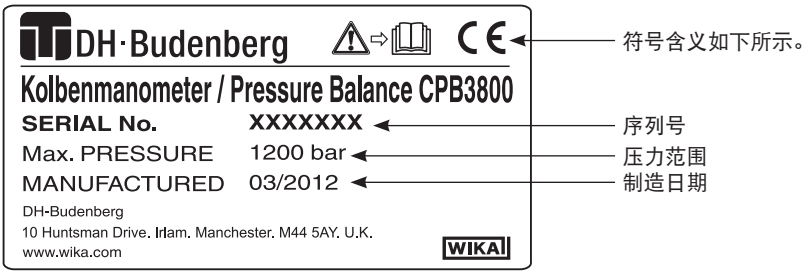
CN

2.4.3 提起砝码

警告！
当提起砝码放至活塞压力计上时必须特别小心。
每次应单独提起一个砝码，禁止一次提起多个砝码放置到活塞压力计上或从活塞压力计上取下。

2.5 铭牌和安全标志

产品铭牌



符号含义

在安装和调试仪器之前，请确保仔细阅读了操作说明！

CE，欧盟CE标志
拥有此标志的仪器符合相关欧盟指令要求。

14062232.04 03/2015 EN/CN

3. 技术参数

活塞 - 汽缸系统（标准）

测量范围[1]	1 … 120 bar	2.5 ... 300 bar	5 ... 700 bar	10 ... 1.200 bar
所需砝码	41 kg	50 kg	58 kg	50 kg
最小压力步距[2]（标准砝码组）	1 bar	2.5 bar	5 bar	10 bar
活塞的额定有效区域	1/16 in²	1/40 in²	1/80 in²	1/160 in²
测量范围[1]	10 … 1.600 lb/in²	25 ... 4.000 lb/in²	50 ... 10.000 lb/in²	100 ... 16.000 lb/in²
所需砝码	47 kg	47 kg	58 kg	47 kg
最小压力步距[2]（标准砝码组）	10 lb/in²	25 lb/in²	50 lb/in²	100 lb/in²
活塞的额定有效区域	1/16 in²	1/40 in²	1/80 in²	1/160 in²
精度				
标配[3] [4]	读数的0.05 %			
可选[3] [4]	读数的0.025 %			
压力传输介质	基于VG22矿物油的液压油（供货时提供0.5L液压油）			
材料				
活塞	碳化钨			
汽缸	碳化钨			
砝码组	不锈钢，非磁性			
重量				
活塞 - 汽缸系统	2.4 kg			
BAR砝码组，包含砝码盘	41.5 kg	50.5 kg	58.5 kg	50.5 kg
lb/in²砝码组，包含砝码盘	47.5 kg	47.5 kg	58.5 kg	47.5 kg
砝码组存储箱（可选，需要2个）	5.8 kg			
尺寸				
砝码组存储箱（可选）（宽x高x深）	400 x 310 x 310 mm (B x T x H) und 215 x 310 x 310 mm (B x T x H)			

1) 理论初始值；对应于活塞或活塞及其附件产生的压力值（自重产生的压力值）。为了实现最佳的使用性能，应加载更多的砝码。
2) 最小的压力变化值是指通过标准砝码组实现的最小压力变化值。若要减小此值，可使用重量更加细化的砝码组。
3) 此精度是指测量范围10%以上量程的精度。在低测量范围内，需要在10%量程范围的测量精度基础上增加一个固定的测量误差。
4) 假定参考条件为室温20 °C、大气压1013 mbar、相对湿度为40%的测量不确定性。对于不带校验单元的仪器，必要时必须进行校验。

14062232.04 03/2015 EN/CN

3. 技术参数

CN

基座

接头	
活塞 - 汽缸系统接头	G ¾ B（公接头）
测试件接头	G ½母螺纹接头，松管接头
材料	
接液部件	奥氏体不锈钢，高抗拉强度黄铜，丁腈橡胶
压力传输介质	基于VG22矿物油的液压油（供货时提供0.5升液压油）[5]
油箱	170 cm³
重量	
基座	13.5 kg
基座存储箱（可选）	8.5 kg
允许环境条件	
使用温度	18 ... 28 °C
尺寸	
基座（宽x高x深）	401 x 397 x 155 mm，更多细节请参见技术图纸

5) 按照用户要求可提供其它压力传输介质。

基座

CE符合性	
压力设备指令	97/23/EC（模块A）
认证	
校验	校验证书 选项：UKAS校验证书（采用砝码组进行压力校验），适用于CPB3800标准型活塞压力计 选项：UKAS校验证书（区域和砝码校验），仅适用于CPS/CPM5800型活塞压力计

关于批准和认证证书信息，请查看网站

更多技术参数信息，请查看威卡 (WIKA) 数据手册CT 31.06和订购文件。

14062232.04 03/2015 EN/CN

3. 技术参数

砝码表
以下表格显示了在各测量范围内砝码组的砝码数量以及对应的额定压力。

当仪器不在参考条件下（室温20 °C，大气压为1013 mbar，相对湿度为40%）使用时，必须相应地进行校正。

CN

标准情况下，砝码均按照9.80665 m/s²的标准重力加速度值确定重量并制造。
作为附加选项，砝码组也可以根据客户的要求按照当地的重力值确定重量并制造。

标准砝码组

测量范围 [bar]	1 ... 120		2.5 ... 300	
	数量	标称压力/件 [bar]	数量	标称压力/件 [bar]
活塞和附件重量	1	1	1	2.5
活塞、砝码容器及其附件的重量	1	20	1	50
砝码（可堆放在砝码盘上）	3	20	3	50
砝码（可堆放在活塞上）	1	20	1	50
	1	10	1	25
	2	4	2	10
	1	2	1	5
	1	1	1	2.5

测量范围 [bar]	5 ... 700		10 ... 1.200	
	数量	标称压力/件 [bar]	数量	标称压力/件 [bar]
活塞和附件重量	1	5	1	10
活塞、砝码容器及其附件的重量	1	100	1	200
砝码（可堆放在砝码盘上）	4	100	3	200
砝码（可堆放在活塞上）	1	100	1	200
	1	50	1	100
	2	20	2	40
	1	10	1	20
	1	5	1	10

14062232.04 03/2015 EN/CN

3. 技术参数

CN

测量范围 [lb/in²]	10 ... 1.600		25 ... 4.000	
	数量	标称压力/件 [lb/in²]	数量	标称压力/件 [lb/in²]
活塞	1	10	1	25
砝码容器及其附件的重量	1	190	1	475
砝码（可堆放在砝码盘上）	5	200	5	500
砝码（可堆放在活塞上）	1	200	1	500
	1	100	1	250
	2	40	2	100
	1	20	1	50
	1	10	1	25

测量范围 [lb/in²]	50 ... 10.000		100 ... 16.000	
	数量	标称压力/件 [lb/in²]	数量	标称压力/件 [lb/in²]
活塞	1	50	1	100
砝码容器及其附件的重量	1	950	1	1.900
砝码（可堆放在砝码盘上）	7	1.000	5	2.000
砝码（可堆放在活塞上）	1	1.000	1	2.000
	1	500	1	1.000
	2	200	2	400
	1	100	1	200
	1	50	1	100

14062232.04 03/2015 EN/CN

完整仪器的运输尺寸

标准版本和按照标准发货的完整仪器包含3个包裹，装在同一货板上。
运输尺寸为1200 x 800 x 500 mm。
总重量取决于仪器的测量范围。

标准CPB3800型活塞压力计

型号 (bar)	重量 (kg) 净重	毛重	型号 (lb/in²)	重量 (kg) 净重	毛重
1 … 120 bar	71	89	10 ... 1.600 lb/in²	68	86
2,5 … 300 bar	71	89	25 ... 4.000 lb/in²	68	86
5 … 700 bar	71	89	50 ... 10.000 lb/in²	68	86
10 … 1.200 bar	71	89	100 ... 16.000 lb/in²	68	86

CPB3800型基座选配CPS/CPM5800装置

型号 (bar)	重量 (kg) 净重	毛重	型号 (psi)	重量 (kg) 净重	毛重
单活塞测量范围			**单活塞测量范围**		
1 … 120 bar	77	95,5	10 … 1.600 psi	73	91,5
2 … 300 bar	77	95,5	30 … 4.000 psi	72,5	91
双活塞测量范围			**双活塞测量范围**		
1 … 60 bar / 10 … 700 bar	85,5	104	10 … 800 psi / 100 … 10.000 psi	84,5	103
1 … 60 bar / 20 … 1.200 bar	77,5	96	10 … 800 psi / 200 … 16.000 psi	73	91,5
1 … 60 bar / 20 … 1.400 bar	85,5	104	10 … 800 psi / 200 … 20.000 psi	84,5	103

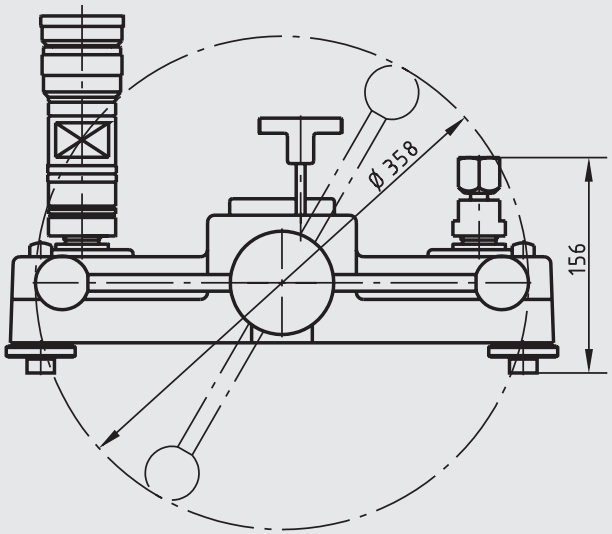
14062232.04 03/2015 EN/CN

尺寸单位为mm

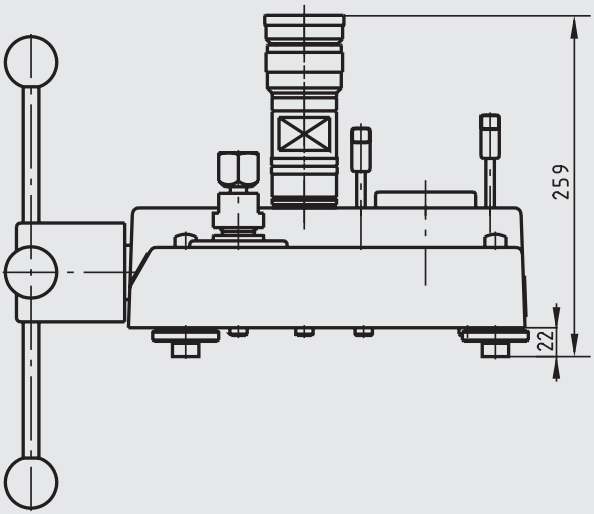
（不包含砝码）

CN

前视图

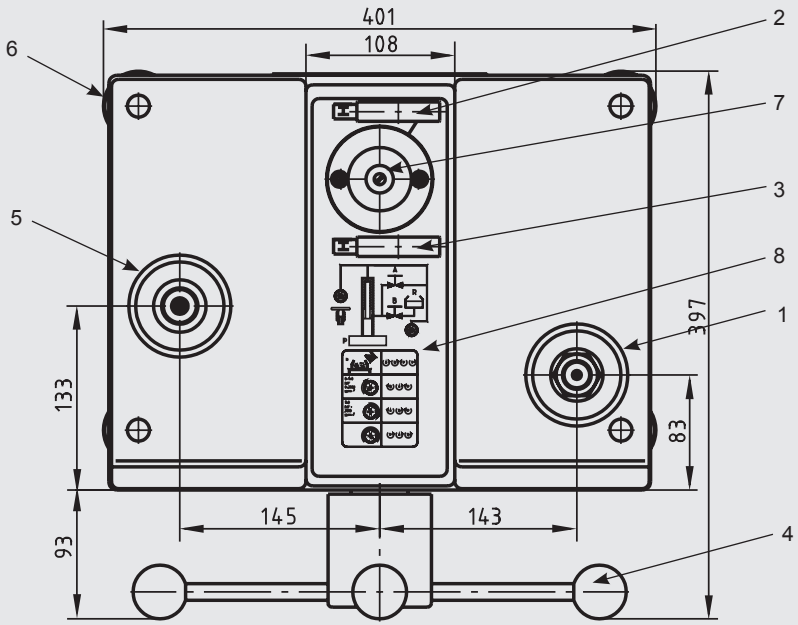


侧视图



14062232.04 03/2015 EN/CN

俯视图



(1) 测试件接头
(2) 高压截止阀
(3) 低压截止阀
(4) 带有星型手柄的双区螺杆泵
(5) 活塞-汽缸系统
(6) 可旋转支脚
(7) 带有螺纹密封塞的油箱
(8) 压力发生器控制示意图

14062232.04 03/2015 EN/CN

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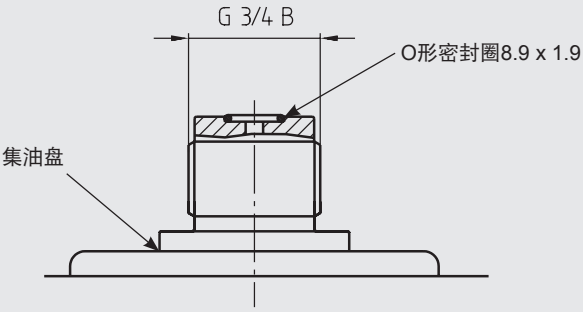
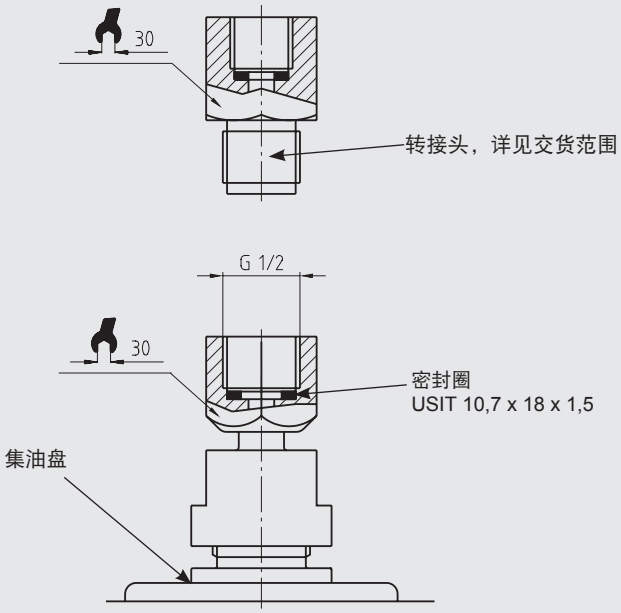
活塞 - 汽缸系统标准接头



测试接头



当使用螺纹转接头时，螺纹转接头必须首先压紧连接测试件。
然后将装有转接头的测试件插入测试接头并对准方向。

14062232.04 03/2015 EN/CN

3. 技术参数

使用的液体

CPB3800基座装置采用符合ISO 3448 (BS 4231) 标准且粘度等级为VG20至VG37的液压矿物油，在40 °C时对应的粘度为20-37 cSt。大部分用户都能够从当地获得合适的液压油，如下所示。然而，为了客户方便，我们在供货时一并提供了一瓶粘度等级为VG22的500 ml液压油。

适用于活塞压力计的液压油

以下油液是适用于活塞压力计，且均可从市场上购买。

ISO 3448 粘度等级	大致对应的 SAE粘度 类别	壳牌公司	埃索石油 公司	美孚石油 公司
VG22	--	Tellus 22 Tellus R22	Nuto H22	DTE 22
VG32	10W	Tellus V32 DTE 24	Nuto H32	DTE Oil Light
VG37	--	Tellus 37 Tellus R37 Tellus T37 Tellus V37	--	--

其它液体

CPB3800型活塞压力计只能使用矿物油。如果终端用户希望使用其它液体，那么终端用户必须确保所用的液体与高抗拉强度黄铜、不锈钢、低碳钢和丁腈橡胶等直接接触液体的材料兼容。

使用腐蚀ABS塑料的液体时需要特别注意。仪器外盖持续地浸在这种液体中会导致材料的恶化。用户必须立即拭除溢出的液体。

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14062232.04 03/2015 EN/CN

4. 设计和功能

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4.1 描述

CPB3800紧凑型活塞压力计不仅拥有适用于实验室的最佳功能，而且坚固耐用的特点也能够满足工业应用要求。它能够提供高精度的压力测量。
活塞装置螺纹连接在基座左侧的压力模块上，而测试件则连接在右侧的压力模块上。

4.2 交货范围

- 基座
- 用于注油的双区螺杆泵，压力发生器和压力微调装置
- 带有G ¾ B公螺纹的活塞接头
- 带有G ½母螺纹的测试件接头，松的管接头
- 用于连接测试件的转接头套件，三种不同的套件可供选择：
  - “BSP”转接头套件，G ½公接头转接G ⅛、G ¼、G ⅜和G ½母接头
  - “NPT”转接头套件，G ½公接头转接⅛ NPT、¼ NPT、⅜ NPT和½ NPT母接头
  - “metric”（公制）转接头套件，G ½ 公接头转接M12 x 1.5和M20 x 1.5母接头
- 活塞-汽缸系统
- 按照标准重力 (9.80665 m/s²) 制造的砝码组
- VG22矿物油（0.5升）
- 工具和维护套件包括：
  1个3 mm A/F六角扳手
  2个30 mm A/F开口扳手
  1个水平仪
  4块水平调节板
  1袋密封件
  1个G ½ (½” BSP) 直角接头
  1个指针式压紧工具
  1个指针拆卸器
  1个测试件接头
- 德文或英语版本操作说明
- 工厂校验证书

反复核对交货范围与交货说明。

4.3 基座装置

CPB3800型产品的基座装置由一块安装在四个可调平支脚上的实心铝板、一台螺杆泵、油箱、控制阀以及连接了两个不锈钢压力接头模块的管道组成。管道以及上述组件采用易于清洁的ABS塑料外壳遮盖。

14062232.04 03/2015 EN/CN

4.3.1 螺杆泵

螺杆泵采用螺栓连接固定在基座的油箱或高压汽缸模块上。泵的剖面图如图所示。通过辐条 **(D)** 操作的旋转手轮 **(C)** 直接连接螺杆 **(E)**。螺杆由烧结合金轴承 **(F)** 支承。当螺杆 **(E)** 旋转时，它将驱动不可旋转的柱塞（**E**和**K**）向前移动，柱塞的推力将被施加在一个滚针推力轴承 **(G)** 上。泵筒 **(J)** 中的大直径柱塞 **(H)** 将驱动压力系统并提供低至约140 bar (2,000 lb/in²) 的低压。油箱或高压汽缸模块中的小直径柱塞 **(K)** 可提供高达1200 bar (16,000 lb/in²) 的测试高压。

4.3.2 油箱

在油箱或高压汽缸模块的上方提供了一个储液油箱。这个油箱采用半透明外盖，从而能够对油箱内的液位进行监控。油箱盖中间的塞子使用户能够向油箱中注油或加满（在活塞压力计处于使用状态时，此塞子应被拆下）。此油箱包含了足够的油液（约150 cm³），可确保活塞压力计的正常操作。

低压柱塞位移 = 60 cm³

高压柱塞位移 = 10 cm³

4.3.3 控制阀

在油箱/高压汽缸模块的顶部有两个控制阀。此阀门装置内置在油箱/高压汽缸模块内部，用于控制油液通过油箱/高压汽缸模块中的内孔。后部的阀门称为阀门**A**，它用于控制螺杆泵大直径柱塞的输出。前面的阀门称为阀门**B**，用于控制油液流入和流出油箱。

4.3.4 接头模块

螺杆泵的压力管道连接在基座的两个压力模块上。此压力模块安装在穿过基座盖板的螺纹头上。这些螺纹头可直接安装活塞装置，或用于连接各种规格的仪器接头。油杯安装在接头模块的螺纹头四周盖板上，从而能够在安装和拆卸仪表过程中收集所有泄露的油滴。

14062232.04 03/2015 EN/CN

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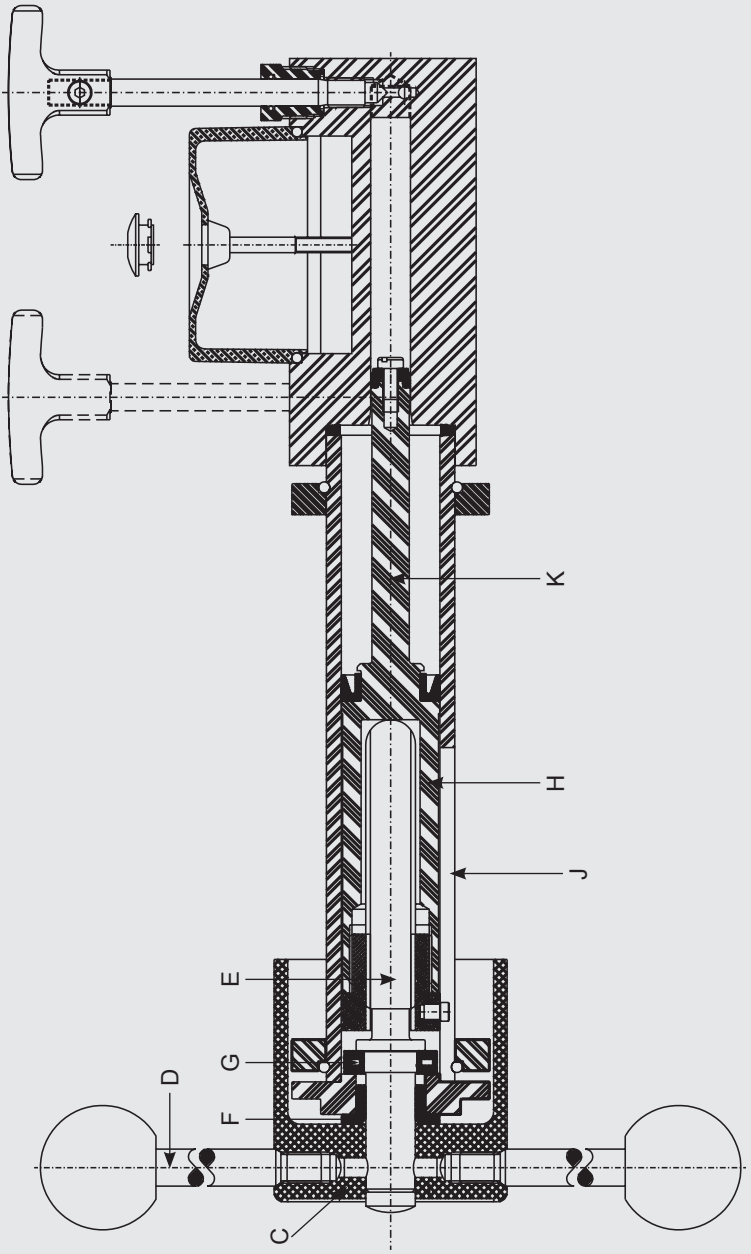
螺杆泵的剖面图



14062232.04 03/2015 EN/CN

4.4 活塞装置

CPB3800型活塞压力计的活塞装置是一种单量程活塞装置，它的测量范围最大可达1200 bar (16,000 lb/in²)。

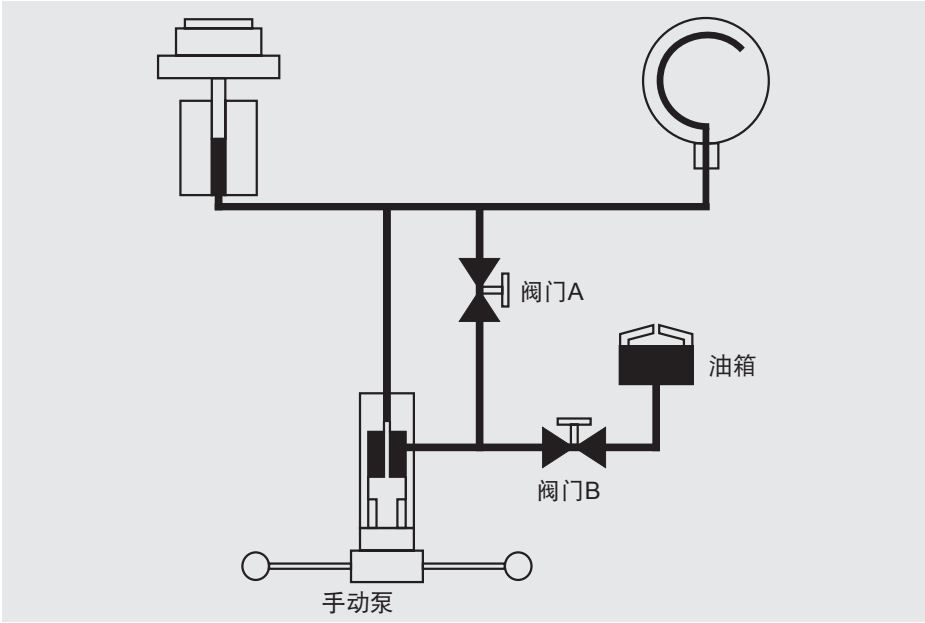
对于低压校验点，砝码直接加载在活塞头上。采用彩带指示活塞的悬浮状态。

对于高压校验点，砝码盘直接安装在活塞头上，砝码放置在砝码盘的底部或顶部。采用主活塞上的机械加工沟槽指示活塞的悬浮状态。

4.5 功能

活塞压力计的操作由油箱/高压汽缸模块顶部的两个阀门**A**和**B**控制。当初始启动系统时，阀门**A**和**B**均处于打开状态，从而将油箱中的油液注入系统中。随后关闭阀门**B**，而阀门**A**仍然保持打开状态，操作螺杆泵以提供较低的测试压力。

若要提供较高的压力，则需要关闭阀门**A**，从而切断螺杆泵的低压测试回路，同时打开阀门**B**，操作螺杆泵，让螺杆泵低压回路中的油液返回至油箱。这可以确保操作泵时无需对螺杆泵手轮施加很大的力。若要释放测试压力，则需要松开螺杆泵并打开阀门**A**。



14062232.04 03/2015 EN/CN

5. 运输、包装和存储

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5.1 运输

检查CPB3800型活塞压力计是否存在任何可能由运输造成的损坏状况。若存在明显的损坏状况，则必须立刻报告。

5.2 包装

在安装之前，请勿拆除包装材料。
保留包装材料以便在未来的运输过程中予以设备最佳的保护（例如，更换安装地点，维修或重新校验时运动设备等）。

砝码采用硬纸箱包装发货，如果订购了存放砝码的木箱，也仍然采用硬纸箱发货。
木箱不适合用作运输箱。

5.3 存储

存储地点的允许条件：

- 存储温度：-10 ... +50 °C
- 湿度：对于仪器基座和砝码组，相对湿度范围为35 … 85%
  对于活塞-汽缸系统，相对湿度范围为35 … 65%（非冷凝）

避免暴露在以下环境下：

- 直接光照，或靠近热的物体
- 机械振动，机械冲击（重重地放在地上）
- 煤烟、蒸汽、灰尘和腐蚀性气体环境
- 可能发生爆炸的环境，可燃气体环境
- 腐蚀性液体

将CPB3800型活塞压力计采用原始包装存放在符合以上所述条件的环境中。如果没有原始包装，则需按照以下所述包装和存储仪器：

1. 采用防静电的塑料膜包裹仪器。
2. 将仪器和缓冲包装材料装入包装箱中。
3. 如果存储较长时间（大于30天），则需要在包装箱中放入一个装有干燥剂的袋子。

14062232.04 03/2015 EN/CN

6. 调试和操作

6.1 打开活塞压力计的包装

在收货之后应立刻开箱检查货物是否包含了包装清单中列出的所有项目（详见第4.2节“交货范围”）。在打开包装时，请检查产品是否存在运输损伤或破坏的迹象。
如果缺失任何部件，请立刻联系DH-Budenberg/WIKA，将发货缺失的情况告知我们。

6.2 环境要求

当安装活塞压力计时，如果不处于温度受到控制的实验室中，则用户需要找到尽可能符合以下条件的安装区域：

- 恒温区域，没有气流、热源或冷源
- 没有噪声和振动，远离常用走道的区域
- 洁净干燥的区域，没有腐蚀性液体或蒸汽

能够支撑系统的坚固、稳定、水平的桌面或工作台，并具有操作仪器所需的足够空间。

6.3 装配基座

将基座固定到工作台上

基座需要安装在一个高0.9米的坚固、水平的桌面或工作台上。基座前面的可调支脚中心线离工作台前边沿应保持约40mm距离，从而为手轮预留足够的空间。

1. 将基座可调支脚的位置标记在工作台的上方。
2. 在基座的每个可调支脚上放置一块水平调节板，并用螺纹连接将此板固定到工作台上，从而确保活塞压力计具有足够的刚度。
3. 通过水平调节板上的可调支脚将基座固定在工作台上，手轮的轴伸出到工作台的前方。
4. 将四个手轮辐条旋入中心轮毂。
5. 采用提供的水平仪调平基座。将水平仪放置在活塞-汽缸系统的上方，调节四个滚花支脚，将基座在前/后轴线及两侧轴线上调平。

14062232.04 03/2015 EN/CN

6.4 装配活塞装置

CPB3800的活塞装置有独立的运输箱，当装置不使用时，应使用此运输箱存储活塞装置，或者当用户需要将装置退回重新校验时，应使用此运输箱包装活塞装置。以下内容描述了如何将活塞装配到机身上，或者从机身上拆卸活塞。

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1. 从机身上拧下滚花保护帽。
2. 将活塞头放置在平整的表面上，活塞竖直放置。
3. 通过偏心孔将滚花保护帽安装到活塞上。
4. 将带有外螺纹的活塞机身竖直放置。
5. 使用液压介质润滑活塞，并将活塞插入机身的汽缸中，在插入活塞时必须竖直插入。

警告！
请勿施加任何横向力。插入活塞不需很大的力。

6. 将滚花保护帽紧固到机身上。
7. 提起活塞头，直至活塞到达其内部停止位置。活塞的移动应自由顺畅。

14062232.04 03/2015 EN/CN

6.5 装配活塞压力计

1. 将活塞装置安装在左侧接头。确保配合表面干净整洁且直径12　mm的O形密封圈正确放置到位。获得有效的密封效果不需施加很大的力。
2. 通过活塞-汽缸系统上方的水平仪检测系统基座的水平状况。如有必要，请使用调平螺钉对基座进行调平。如果用作比较仪，则需要在活塞安装的端口上安装额外的松管接头（订货号为14031251）。
3. 将合适的接头安装到仪表座上，使用粘结密封圈密封接头，并将测试仪表（为了便于安装，使用已知的仪表）拧入到位，同样也使用粘结密封圈。
   如果愿意，也可以使用铜质或皮革垫圈替代仪表上的粘合密封圈。活塞压力计基座上的松螺母也使得仪表能够按照要求进行定位，并且对于后部连接的仪表，还可以将直角接头拧入松的管接头上。

当使用螺纹转接头时，螺纹转接头必须首先压紧连接测试件。然后将装有转接头的测试件插入测试接头并对准方向。

6.5.1 向基座中注入油液

1. 拔下塞子，取下油箱上的注液孔塞。（在使用仪器时，可以不塞上此塞子）
2. 打开阀门**A**和**B**。
3. 顺时针满旋螺杆泵的手柄。
4. 将合适的油液注入油箱。使用随货供应的油液或批准用于油液系统的替代品。请勿使用其它液体。蓖麻基油液、特种液压油、溶剂或类似液体会腐蚀安装在活塞压力计中的密封件。
5. 逆时针满旋螺杆泵。
6. 如有必要，可使用辅助油箱。

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6.5.2 装配后测试

1. 对已知仪器进行测试校验（详见第6.6节“流程”），确保装置能够正确工作。
2. 释放压力并拆下测试仪器。

若要将仪器从系统上拆除，请使用合适规格的扳手拧着压力接头的顶部和仪器机身。确保压力接头的底部没有旋转，因为底部旋转可能使压力接头从基座上松动。

3. 系统现在已经可以投入使用了。

小心！
如果所需的注油量很大，需要使用额外的泵和油箱连接CPB3800型活塞压力计，则必须确保阀门**B**保持打开状态，同时阀门**A**处于关闭状态，否则在螺杆泵的低压柱塞上会产生高压，导致仪器损坏。为了避免发生此事故，我们在系统上安装了安全阀，若阀门操作不正确，在设定的压力下安全阀将会泄压。

作为替代选项，我们也可提供改造的系统和手动泵以实现此操作。了解更多关于这两种方案的信息，请联系DH-Budenberg/WIKA。

当测试大容量的设备时，螺杆泵 (65 cm³) 的性能可能达不到所需的压力。在这种情况下，在将设备连接到系统之前应尽可能地将其注满油液，从而减少所需的位移。

禁止安装肮脏或化学污染的测试件，因为它们会污染系统，除非首先对其进行清洁。

14062232.04 03/2015 EN/CN

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6.6 流程

1. 将待测仪器安装到仪表座上。
2. 加载砝码至所需的压力。每个砝码都标记了其等效压力值。活塞-汽缸系统具有基本的lb/in²压力初始值，对于其它压力单位，可在活塞头上添加附加重量以便将压力单位转换为bar。

在校验压力小于砝码盘附加重量压力值时，建议采用顶部加载砝码的方式进行校验。当所需的压力校验单位为bar时，在加载任何其它顶部砝码之前，必须首先添加小的附加重量。

当校验压力大于砝码盘附加重量压力值时，必须安装砝码盘。在安装砝码盘之前，必须去除所有砝码。

当安装砝码盘时，砝码盘上的初始砝码是一个大的环形附加重量。当安装砝码盘时，不能使用小型的附加重量。

6.6.1 施加压力

当压力小于140 bar(2,000lb/in²)时

1. 关闭阀门**B**（阀门**A**仍然保持打开状态）
2. 顺时针旋转螺杆泵的手柄。当手柄旋转时，最大可产生约140 bar或2,000 lb/in²的压力。当手柄很难转动时，表示已经达到了此范围的压力极限。

14062232.04 03/2015 EN/CN

当压力大于140 bar (2,000lb/in²) 时

1. 确保阀门**B**关闭且阀门**A**打开。
2. 顺时针旋转螺杆泵的手柄，直至手柄很难转动。
3. 关闭阀门**A**并打开阀门**B**。
4. 继续顺时针旋转螺杆泵。这将产生最高可达约1,200 bar或16,000 lb/in²的压力。
5. 当活塞升起并呈现悬浮状态时，表示达到了所需的额定压力值。当只使用砝码时，通过蓝色和黄色彩条指示悬浮位置。当使用了砝码盘时，若砝码盘底部与活塞套主体上的机械沟槽对齐，则表示达到了所需的额定压力值。

6.6.2 校验过程

当活塞压力计正确安装且没有泄露时，活塞应能够悬浮数分钟而无需触碰螺杆泵手轮。然而，在初次安装时，活塞/汽缸装置中可能会有一些空气。当空气泄出活塞时，砝码位置可能会略有降低，但这只会持续数分钟，当空气完全排出后，砝码位置将恢复原状。如果活塞持续下降，请检查接口是否漏气。

在校验过程中，用手旋转砝码。最好只在接近正确压力的状态下旋转砝码。在完全释放压力之前，砝码不应停止，让承受全部砝码堆叠负载的活塞头在其中止位置旋转。

砝码在读数期间能够自由旋转非常重要。当压力过高或过低时，活塞将停止移动。在最低压力状态下，砝码只能旋转数秒，除非使用低粘度润滑油，在读数之前及活塞显然处于悬浮状态时，用手旋转砝码，从而获得精确的读数。

小心！

在旋转砝码时需要特别小心，否则可能会对实际的活塞装置造成损坏，或伤及操作人员。

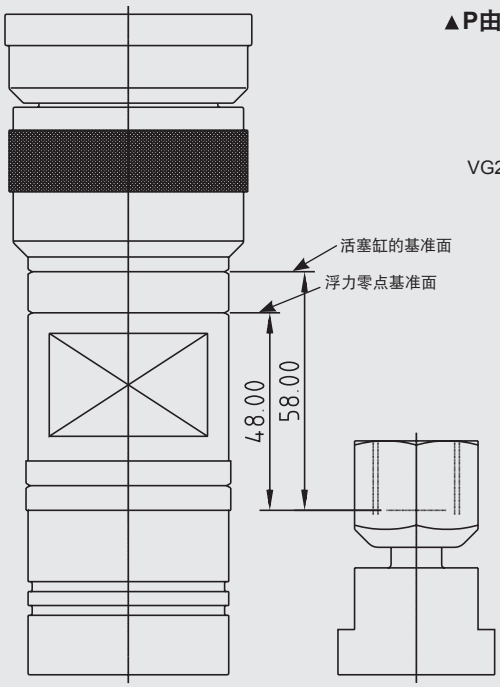
因此，必须用手停止旋转运动。只有在停止状态下才能添加新的砝码以便测试下一个测试点或完全释放压力。

14062232.04 03/2015 EN/CN

6.6.3 基准面

当测试内有液体的仪表时，有时候必须考虑液柱压力，因为10 mm的高度差对应于约1 mbar。对于CPB3800型活塞压力计的活塞装置，采用机械加工沟槽的方式在活塞的外径上标记了基准面。需要注意的是，当活塞压力计由DH-Budenberg/WIKA之外的实验室重新标定时，测试的基准面可能会与标准基准面有所差别，因此必须留有一定余地以便适应任何偏差。

下图显示了当需要高精度校验时可能需要补偿的液柱压力影响。可通过以下公式计算压力修正值。



▲P由液柱压力造成的压力变化

压力 (Pa) = σ • H • g

其中

σ = 密度 (kg/m³)

H = 高度 (m)

g = 重力加速度 (m/s²)

VG22液压油的密度 = 885 kg/cm³

14062232.04 03/2015 EN/CN

6.7 完工

1. 在测试完成后，逆时针旋转螺杆泵，将压力转到较低压力。
2. 轻轻地打开阀门**A**或**B**，释放残余压力。
3. 确保阀门**A**和**B**完全打开。

此时系统可以进行下一次测量，所有残余压力已经被释放。

6.8 用于压力计算的计算机软件标准精度程序

此软件让用户可以定义其设备及本地状态（重力加速度，温度），从而在输入额定压力后，显示实际测试的压力。

随后，这些实测压力将用于确定活塞压力计的标准精度。
为了获得更高的标准精度，用户必须根据随货提供的活塞精度证书输入校正因子。

DH-Budenberg/WIKA已经输入了默认状态，但只要用户更改这些参数，用户输入值将变为默认值（无需反复输入参数值）。

此程序旨在帮助用户使DH-Budenberg/WIKA活塞压力计保持标准精度。它不适用于其它厂商生产的活塞压力计。

用户可通过随货供应的CD光盘获取此软件，在光盘目录“用户软件”和“标准精度DWT”中可查看此软件。在使用软件之前，请阅读安装/操作说明。

6.9 活塞装置的温度测量

在大多数情况下，如校验大多数类型的千分表和传感器等，没有必要获得精确的活塞装置温度。然而，为了通过活塞压力计获得超高的测量精度，了解尽可能接近装置工作部件的活塞装置温度非常重要。

在室温可控的实验室中，装置的工作部件温度与环境温度的差异不大于0.5 °C。然而，当装置在不可控的温度下工作时，用户必须测量活塞装置的温度。

14062232.04 03/2015 EN/CN

一种可行的温度测量方式是将圆盘形的热敏电阻探针传感元件捆绑在活塞装置的外表面上。采用一层薄的聚苯乙烯塑料带或其它绝热材料覆盖传感元件，使其与环境温度隔离，然后再将它捆绑在活塞装置上。此外，用户还可以选择使用CPU6000 CalibratorUnit校验装置。

我们可提供合适的仪器。请联系DH-Budenberg/WIKA。

6.10 清洁仪表

这种清洁/去污过程仅适用于采用磷青铜、铍铜、蒙乃尔合金或不锈钢C型弹簧管的压力表。

不建议对采用钢制弹簧管的压力表去污，因为弹簧管孔中的很少量腐蚀就会造成仪表读数的不准确和弹簧管的提前失效。

穿戴护目镜！
保护眼睛免受飞溅颗粒和液体的伤害。

穿戴防护手套！
防止双手接触腐蚀性介质。

这种清洁方法不适用于安装了绕线弹簧管的压力表，也不适用于任何氧气相关的仪表，因为无法保证完全清除油液。请联系DH-Budenberg/WIKA。

设备

它由一个注射器和一个针尖弯曲90°的特殊注射针组成。

14062232.04 03/2015 EN/CN

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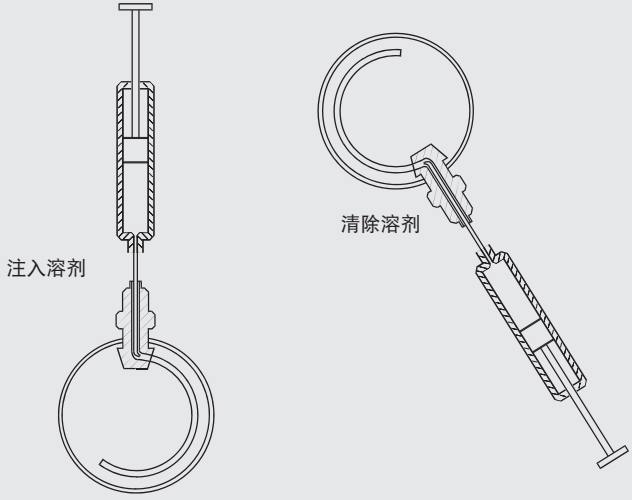
说明

1. 将注射器中注入溶剂（适当的冷脱脂液体）
2. 在仪表接头向上的情况下，将注射针装到接头上，感觉插到通向管道的孔口即可。
3. 注入溶剂。理想情况下，管道应当注满半圈。
4. 多方向摇动仪表以搅动溶剂。
5. 将溶剂吸回注射器，在一个角度上保持仪表不动。
6. 检查排出的溶剂是否洁净。为了确保清除所有油液，请重复以上清洁过程，直至仪表中清除的溶剂如同注入时一样干净。



清洁仪表

7. 维护，清洁和重新校验

7.1 定期维护

维修工作只能由制造商执行。

清洁装置和检查液位是仅需的定期维护工作。在正常使用状况下，不需要更多的维护。如果需要维护，可将系统送回至制造商处重新调节。精度、大修和重新认证将在第7.4.1节“工厂大修和重新认证活塞压力计的维护精度”中说明。

14062232.04 03/2015 EN/CN

7. 维护，清洁和重新校验

使用腐蚀ABS塑料的液体时需要特别注意。仪器外盖持续地浸在这种液体中会导致材料的质变。用户必须立即拭除溢出的液体。

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7.2 校正维护

7.2.1 一般信息

本章节包含了拆卸装置并更换备件的详细信息，备件列表详见第10章“附件”。在每个步骤中，括号中间的部件编号请参考下图。

7.2.2 拆卸外盖

1. 顺时针旋转螺杆泵并在仪表座上拧入排油管，尽可能多地将油液从活塞压力计中排出。
2. 拧下松管接头和活塞-汽缸系统。
3. 小心地向上轻撬油杯，将其拆下。
4. 使用3 mm六角扳手松开内六角紧定螺钉，并拆下两个手轮。
5. 拆下四个外盖固定螺钉，并向上取下外盖。

7.2.3 油箱密封件

1. 拧下两个螺钉并拆下油箱外盖。
2. 从凹座中拆下O形密封圈 **(6)**，并从螺杆上拆下seloc密封件 **(7)**。
3. 在更换密封件时，确保所有密封面完全清洁，并且不要过分拧紧螺钉。

7.2.4 阀门密封件

1. 拧下压盖螺母。
2. 拧下阀杆并拆下粘结密封圈。

14062232.04 03/2015 EN/CN

3. 将压盖螺母从阀杆上滑动拆下。
4. 使用合适的钩状工具将O形密封圈 **(9)** 从压盖螺母的孔中拆下。更换O形密封圈和粘结密封圈 **(10)**。
5. 在更换密封圈时，确保O形密封圈正确位于沟槽中，且所有密封面都保持清洁。清除阀杆上的所有毛刺。

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7.2.5 螺杆泵

1. 使用4 mm六角扳手拧下固定轮毂定位板的六个内六角头螺钉。（这些螺钉位于铝轮毂背部凹槽中）。
2. 小心地拉动轮毂，完整的柱塞组件即可从缸筒中取出（在操作过程中，缸筒下方需要放置一个容器以便收集任何滴出的油液）。
3. 将柱塞从轮毂组件上拧下。
4. 现在可以更换高压密封件 **(12)** 和低压密封件 **(15)**。在安装新的密封件之前，检查并确保柱塞在定位直径上没有刻痕。
5. 此时，必须检查轮毂组件在轴承处是否磨损以及螺杆和螺母是否磨损。如果发现任何磨损，则必须拆下轮毂组件。
6. 检查并确保模块组件 **(11)** 的孔没有严重刻痕或凹痕。如果需要更换，此组件将连同阀门一并更换。该模块通过内六角头螺钉固定在基座上。
7. 重新装配的过程正好与以上步骤相反。

在装配时，必须小心对准柱塞，防止出现弯曲或损坏密封件的情况。装配时不需使用很大的力。

内六角头螺钉并不是沿着定位法兰四周均匀分布的，因此，在插入螺钉之前请确保所有的孔都完全对准。

14062232.04 03/2015 EN/CN

7.2.6 轮毂组件

1. 将柱塞从螺杆上拧下。**注意：左**旋螺纹。
2. 将辐条从轮毂上拧下。
3. 使用直径6 mm的冲头敲出轮毂中一个螺纹辐条孔底部的弹簧销 **(1)**。取下轮毂。
4. 现在可以将轮毂定位板和止推轴承从螺杆上拆下。
5. 如果需要更换法兰衬套 **(2)**，必须将其压出定位板，并将新的衬套直接压入。
6. 止推轴套 **(3)** 作为完整组件更换。
7. 螺母、柱销和螺杆子装配件 **(4)** 只能以配对组件的方式更换。将螺母从柱塞上拧下，用虎钳夹紧并拧上新的螺母。
8. 安装止推轴承，将定位板和轮毂装在螺杆上，并涂上二硫化钼润滑脂。
9. 将这些部件夹在一起，消除轴端余隙并重新装配弹簧销。如果使用新的螺杆，请钻一个直径6.3 mm的通孔以安装弹簧销 **(1)**。
10. 涂上二硫化钼润滑脂并拧入柱塞螺母。

7.2.7 活塞-汽缸系统

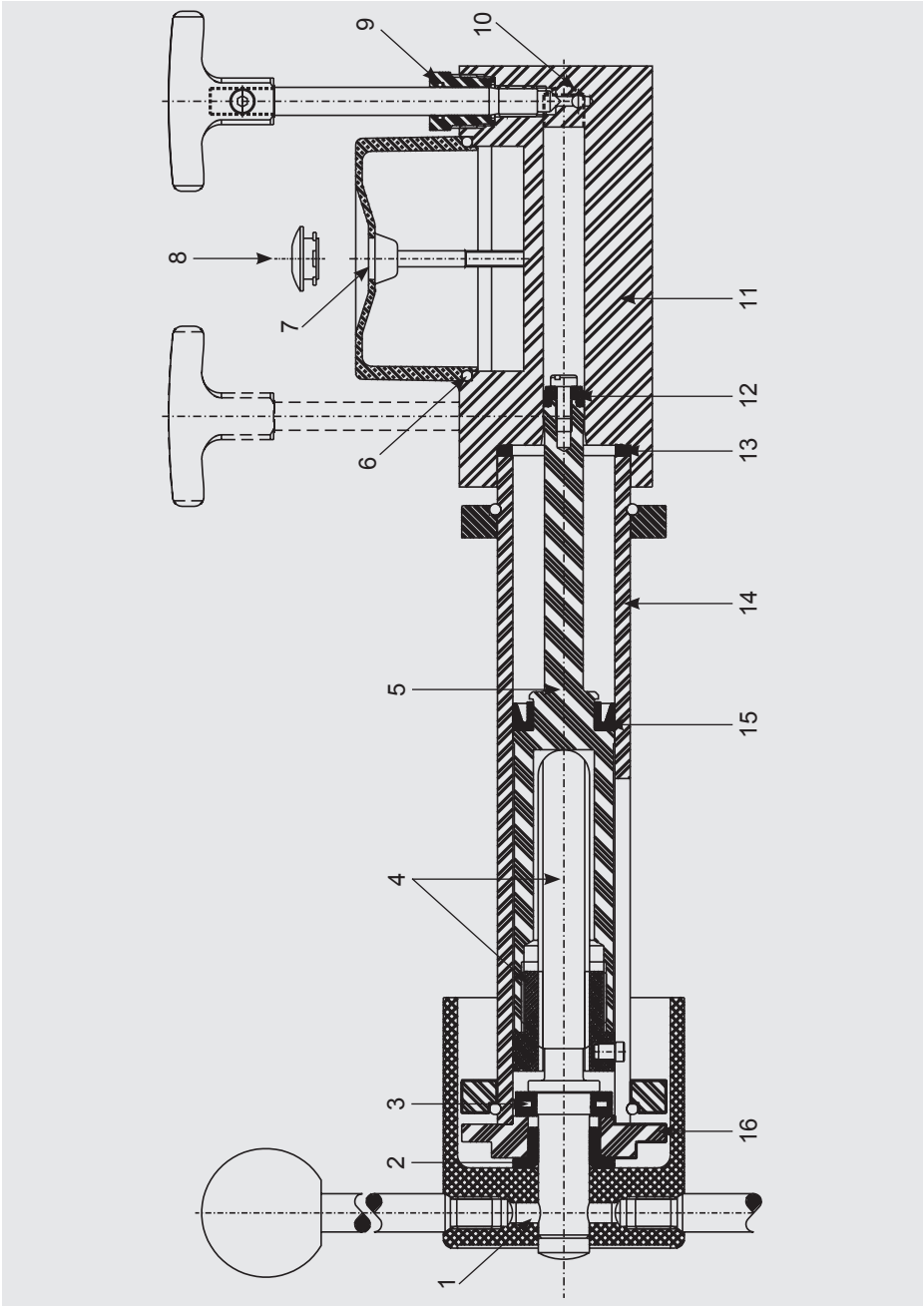
由于活塞-汽缸系统与活塞压力计的测量值成比例关系，所以在处理时始终需要非常小心，并确保它的清洁干净。

活塞-汽缸系统的制造精度非常高，不建议拆卸活塞-汽缸系统。如果必须对其进行清洁，则必须将活塞和气缸的孔立刻涂油，从而保护高级别的表面质量。

若装置发生损坏，则必须将装置全部返厂更换或维修。
不同装置的部件不具有互换性，因为必须称量这些部件的重量并作为一个整体进行评估。

精度认证证书中列出了活塞-汽缸系统的序列号，并且在装置机身上也标记了序列号。在产品报价中必须列出此序列号以及活塞压力计的序列号，并且两种序列号要能够相对应。

14062232.04 03/2015 EN/CN



14062232.04 03/2015 EN/CN

7. 维护，清洁和重新校验

如果将活塞-汽缸系统从活塞压力计中拆下，则必须封住活塞-汽缸接头。如果必须拆下活塞-汽缸系统，那么应将它倒立存放，放置在砝码盘上。

这种脱离装置的外盖使维修和安装推荐的备件非常简单。

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7.3 清洁

清洁装置并检查液位。

使用的油液

保持系统清洁且无溢出的油液。如有必要，擦净仪表座下方的油杯。请勿使用任何清洁剂，因为它们可能会损坏密封件。

确保油箱中的油液足够用于执行校验工作。
如有必要，可将油箱装满油液。请勿在活塞压力计中使用多种类型或多种品牌的混合油液。

如果系统中的油液变脏，请使用螺杆泵注入洁净的油液冲洗，并在仪表座上拧入排油接头以排放污染的油液。（可使用直角接头）。在启动之前，螺杆泵必须顺时针旋转到底。

穿戴护目镜！
保护眼睛免受飞溅颗粒和液体的伤害。

穿戴防护手套！
防止双手接触腐蚀性介质。

关于仪器退运的信息，请查看第9.1节“退运”。

7.4 重新校验

UKAS、DKD/DAkkS认证 – 认证证书：

我们建议每隔5年由制造商对仪器进行重新校验一次。如有必要，可校正基本的参数设置。

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7.4.1 活塞压力计的返厂大修和维护精度的重新认证

活塞压力计的精度主要取决于活塞装置的有效面积和施加在活塞上的砝码重量。活塞装置的有效面积会受到装置磨损的影响。导致磨损的因素包括活塞压力计中液压油受到异物污染、水、仪器中的化学品、或污染物导致的铁锈或腐蚀等。

由奥氏体不锈钢制造的砝码非常稳定。用户应采用非研磨的方法定期清除异物。

7.4.2 需要大修或重新认证

如果按照说明书正确使用但出现了以下状况，我们建议将活塞压力计送回厂家进行大修和重新认证。

1. 活塞无法自由旋转。
2. 活塞坠落的速度明显大于新产品，且导致使用活塞压力计非常困难。
3. 砝码损坏。
4. 由于泵管道或阀门出现磨损或损坏等用户无法矫正的问题，活塞压力计无法实现满意的测量结果。

这种活塞压力计可用于校验预期精度为1%、0.5%或0.25%的仪器。这种活塞压力计不需要经常返厂大修和重新认证，它们能够可靠地工作数年。在这种状况下，两次大修之间的合适间隔约为5年。

当要求活塞压力计具有高精度时，必须更加频繁地返厂大修和重新认证。实际的间隔周期取决于活塞压力计的使用情况。在实验室环境下小心使用的活塞压力计可能需要每2至5年返厂一次。而对于经常变换使用地点、校验工业加工厂中高精度仪表或传感器、或直接测量压力的活塞压力计则可能需要更加频繁地返厂。

14062232.04 03/2015 EN/CN

大修和重新认证的实际周期应由用户根据以上所述信息确定，并且还可能需要考虑检验机构的要求。

7.4.3 砝码标识

与活塞压力计一同供货的砝码组都被分配和标记了一个砝码编码。此外，如果用户希望确保特定的砝码只用于特定的活塞压力计或活塞-汽缸系统，那么砝码上还需要标记活塞压力计和/或活塞-汽缸系统的序列号。遗憾的是，对于较小的砝码，由于尺寸限制无法标记以上所述的全部信息。

7.4.4 大修和重新认证

为了实现最佳的维修效果，活塞压力计应整机返厂，包括基座、活塞-汽缸系统以及所有砝码。

用户可以自己维修基座，但活塞-汽缸系统和砝码必须返厂大修。在这种情况下，大修之后的认证证书只包含对活塞-汽缸系统的认证，不包含对原始安装基座的认证。

在大修时，活塞压力计的基座将会被拆卸，工厂将清洗所有管道，更换所有密封件，更换需要更换的磨损部件，并重新组装和测试。

此外，工厂还将检查全部的砝码并尽可能将其恢复原状。如果丢失了一个或两个砝码或者维修不经济，则将更换砝码。如果丢失了更多的砝码，或者维修不经济，则需要询问用户的处理意见。

14062232.04 03/2015 EN/CN

活塞装置的精度和灵敏度也将被检查。如果因任何原因无法获得满意的维修结果，则会向用户递交一份更换装置的报价。

每次大修之后，都会对活塞压力计签发新的精度认证证书。除非订单中指明当活塞装置的面积发生微小变化时需要在认证证书中标识，否则都不予标识；活塞面积的微小变化对精度的影响不大于0.03%。例如，大修之后活塞压力计的精度证书可能显示误差不大于0.05%，而原始证书显示误差不超过0.02%。

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我们可以对大修的系统签发UKAS或DKD/DAkkS校验证书。按照客户要求可提供详细信息。

8. 故障

故障	原因	措施
设备无法输出任何压力	活塞压力计中没有油液。	检查活塞压力计是否充满油液。如有必要，向设备中注入油液。详见第6.5.1节
	阀门B打开。	关闭阀门B并重试。
	被测试的部件拥有很大容量。	在测试之前将油液预先注入待测部件。
	油液密封件丢失或损坏，显示出原因不明的油液泄漏状况。	检查设备上的密封件，确保密封件正确安装且未损坏。如有必要，请更换密封件。
	阀门B的手轮与螺杆分离。	检查阀门B。如有必要，拧紧螺母，将手轮固定道螺杆上。
	阀门B组件或阀座损坏。	检查阀门B和阀座的状态。如有必要，请更换阀门组件，或将活塞压力计退运至DH-Budenberg/WIKA进行大修。
	如果无法找到问题原因。	将活塞压力计退运至DH-Budenberg/WIKA进行进一步调查。

14062232.04 03/2015 EN/CN

8. 故障

故障	原因	措施
设备能够提供压力，但当打开阀门A和阀门B时压力降低。	使用时操作步骤不正确。	确保遵守了正确的操作步骤（详见第6.6节）
	如果无法找到问题原因	将活塞压力计退运至Budenberg/WIKA进行进一步调查。
设备能够提供压力，但压力逐渐降为零。	使用时操作步骤不正确。	确保遵守了正确的操作步骤（详见第6.6节）
	油液密封件丢失或损坏，显示原因不明的油液泄漏情况。	检查设备上的密封件，确保密封件正确安装且没有损坏。如有必要，请更换。
	阀门A或阀门B组件或阀座损坏。	检查阀门A和B及阀座的状态。更换阀门组件或将活塞压力计退运至DH-Budenberg/WIKA，如有必要，对其进行大修。
	如果无法找到问题原因。	将活塞压力计退运至Budenberg/WIKA进行进一步调查。
设备能够提供压力，但压力会下降至较低的值，然后保持稳定。	活塞压力计中的油液不足。	检查油箱中的液位。如有必要，使用正确的油液注入油箱（详见第6.5.1节）
	系统中存在空气	将待测部件预先装满合适的油液。如有必要，可向活塞压力计中重新注入合适的油液。
	如果无法找到问题原因。	将活塞压力计退运至DH-Budenberg/WIKA进行进一步调查。
	内部损坏	将活塞压力计退运至DH-Budenberg/WIKA进行进一步调查。
	使用时操作步骤不正确。	确保遵守了正确的操作步骤（详见第6.6节）
	如果无法找到问题原因。	将活塞压力计退运至DH-Budenberg/WIKA进行进一步调查。

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14062232.04 03/2015 EN/CN

故障	原因	措施
当活塞压力计在140 bar (2,000 lb/in²) 压力以下工作时，螺杆泵的转动操作非常困难。	内部损坏	将活塞压力计退运至DH-Budenberg/WIKA进行进一步调查。
当活塞压力计在140 bar (2,000 lb/in²) 压力以上工作时，螺杆泵的转动操作非常困难。	使用时操作步骤不正确。	确保遵守了正确的操作步骤（详见第6.6节）
	如果无法找到问题原因。	将活塞压力计退运至DH-Budenberg/WIKA进行进一步调查。

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小心！
如果通过以上所列措施无法消除故障，那么必须立刻关闭活塞压力计，并确保释放了压力，防止仪器再次意外投入使用。
在这种情况下，请联系制造商。
如果需要退运，请按照第9.1节“退运”的说明执行。

9. 退运和废弃处理

警告！
活塞压力计中的残余介质会对人员、环境和设备造成风险。请采取妥善的预防性措施。

9.1 退运

警告！
在运输仪器时，请严格遵守以下规定：
所有运往DH-Budenberg/WIKA的仪器必须不含任何类型的危险品（酸、碱、溶剂等）。

当退运仪器时，请使用原始包装或合适的运输包装。

14062232.04 03/2015 EN/CN

9. 退运和废弃处理

为了避免损坏：

1. 将活塞-汽缸系统放入专门设计的运输箱中（详见第6.4节“装配活塞装置”）
2. 采用防静电的塑料膜包裹仪器。
3. 将仪器和缓冲包装材料一同放入包装箱中。将缓冲包装材料均匀地布置在运输包装箱的四周。
4. 如有可能，在包装箱中放入一个装有干燥剂的袋子。
5. 在外包装上贴上运输高灵敏度测量仪器的标签。

关于退运的信息，请查看我们当地网站的“服务”页面。

9.2 废弃处理

废弃处理不当会导致环境风险。

请根据特定国家的废物处理法规以环保的方式处置仪器部件和包装材料。

仪器上的此标志表示不能以生活垃圾的方式处理此仪器，必须采用退运返厂的方式处置，或由相应的市政当局处置（详见欧盟指令2002/96/EC）。

14062232.04 03/2015 EN/CN

10. 附件

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名称/型号	订货号
精简砝码组（1 mg至50 g），F1级	7093874
精简砝码组（1 mg至50 g），M1级	14025325
以bar为校验单位的砝码组存储箱，2个	14031236
以psi为校验单位的砝码组存储箱，2个	14068416
CPB3800仪器基座存储箱	14031237
“BSP” 转接头套件，用于将测试件的G ½ B公接头连接在G ⅛、G ¼、G ⅜和G ½母接头上。	14031238
“NPT” 转接头套件，用于将测试件的G ½ B公接头连接在⅛ NPT、¼ NPT、⅜ NPT和½ NPT母接头上	14031239
“metric” 转接头套件，用于将测试件的G ½ B公接头连接在M12 x 1.5和M20 x 1.5母接头上	14031242
测试件接头，G ¾母接头转接G ½母接头，旋转	14031251
直角接头，用于连接后部安装的测试件	1564838
隔离器（通过隔膜隔离两种液体介质），最大700 bar	14031253
隔离器（通过隔膜隔离两种液体介质），最大1200 bar	14031254
CPB3800仪器基座的密封套件	14031255
CPB系列产品的工作油液，最大压力为4000 bar，0.5升	2099954
工具套件包括开口扳手、BSP转接头工具、更换密封件工具、指示器拆除工具和指示器打孔工具	14031263

14062232.04 03/2015 EN/CN

附件：CPB3800活塞压力计的EC符合性声明

DH - Budenberg

EG-Konformitätserklärung

Dokument Nr.:

14048028.01

Wir erklären in alleiniger Verantwortung, dass die mit CE gekennzeichneten Produkte

Typ:

CPB3800

Beschreibung:

Kolbenmanometer in Kompaktausführung

gemäß gültigem Datenblatt:

CT 31.06

die grundlegenden Schutzanforderungen der folgenden Richtlinie(n) erfüllen:

97/23/EG (DGRL)(1)

(1) PS > 1000 bar; Modul A, druckhaltendes Ausrüstungsteil

EC Declaration of Conformity

Document No.:

14048028.01

We declare under our sole responsibility that the CE marked products

Model:

CPB3800

Description:

Pressure balance in compact design

according to the valid data sheet:

CT 31.06

are in conformity with the essential protection requirements of the directive(s)

97/23/EC (PED)(1)

(1) PS > 1000 bar; Module A, pressure accessory

Unterzeichnet für und im Namen von / Signed for and on behalf of

DH-Budenberg Ltd.

Manchester, 2012-07-03

John White, Managing Director

Unterschrift, autorisiert durch das Unternehmen / Signature authorized by the company

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14062232.04 03/2015 EN/CN

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14062232.04 03/2015 EN/CN