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1. Information on This Operating Instruction

- The manual is aimed at specialists and semi-skilled personnel.
- Please read the instructions carefully before carrying out any operation and keep the specified order.
- Thoroughly read and understand the information in chapter 2 "Safety Instructions".

If you have any problems or questions, please contact your supplier or contact us directly at:

ARMANO

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1.1 Pictographs Used

In this manual, pictographs are used as hazard warnings.

Particular information, instructions and restrictions designed for the prevention of personal or substantial property damage:



WARNING! Is used to warn you against an imminent danger that may result in personal injury or death.

IMPORTANT! Is used to warn you against a possibly hazardous situation that may result in personal, property or environmental damage.

CAUTION! Is used to draw your attention to important recommendations to be observed. Disregarding them may result in property damage.



DANGER! This symbol is used for hazards generated by electric current. Disregarding these safety instructions may result in serious or fatal injuries.



Passages in the text containing **explanations, information or advice** are highlighted with this pictograph.



The following symbol highlights **actions** you have to conduct or **instructions** that have to be strictly observed.

1.2 Exclusion of Liability

We accept no liability for any damage or malfunction resulting from incorrect installation, inappropriate use of the device or failure to follow the instructions in this manual.

2. Safety Instructions

Please read this operating instruction thoroughly before operating the dead weight tester.

Disregarding the containing warnings, especially the safety instructions, may result in danger for people, the environment, and the device and the system it is connected to.

The dead weight tester corresponds with the state of engineering at the time of printing. This concerns the accuracy, the operating mode and the safe operation of the device.

In order to guarantee that the device operates safely, the operator must act competently and be conscious of safety issues.

The ARMANO Messtechnik GmbH provides support for the use of its products either personally or via relevant literature. The customer verifies that our product is fit for purpose based on our technical information. The customer performs customer and application specific tests to ensure that the product is suitable for the intended use. With this verification, all hazards and risks are transferred to our customers. Our warranty expires in case of inappropriate use.

Qualified personnel:

The personnel that is charged for the installation, operation and maintenance of the dead weight tester must hold a relevant qualification. This can be based on training or relevant tuition. The personnel must be aware of this manual and have access to it at all times.

General safety instructions:

- In all work, the existing national regulations for accident prevention and safety at the workplace must be complied with. Any internal regulations of the operator must also be complied with, even if these are not mentioned in this manual.
- Use the dead weight tester in its perfect technical condition only. Damaged or defective instruments need to be checked immediately and replaced if necessary.
- Only use appropriate tools for mounting, connecting and dismantling the dead weight tester.
- Nameplates or other information on the device shall neither be removed nor obliterated, since otherwise any warranty and manufacturer responsibility expires.

Operating Instructions

Dead Weight Tester PD 2500



Special safety instructions:

Warnings, which are specifically relevant to individual operating procedures or activities, are to be found at the beginning of the relevant sections of this operating instruction.

3. Device Description

Dead weight testers are high-precision mechanical measuring instruments that are suitable for testing, adjusting and calibrating pressure measuring instruments without using an external reference device.

The main components are measuring system, hand pump, valve units, spindle unit for fine adjustment of the pressure and set of weights.

The measuring system consists of a fine lapped piston / cylinder pair. The weight-loaded piston is pressed down by the local gravitation of the weights. From below the test pressure, which is generated and adjusted by the spindle pump or hand pump, acts towards the piston surface area. This test pressure is increased until the hydraulic force of the medium on the piston surface area (acting from below) compensates the weight force of the piston / weight system and the equilibrium of forces is reached. During this state of equilibrium, the piston floats freely in the cylinder.

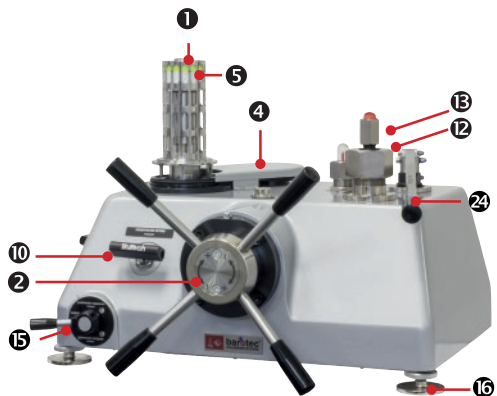
In order to simplify the handling, the weights are already standardised to the specific determined piston surface area and the local gravitation at the installation site. The set of weights is available discretely graduated in different pressure units (bar, Pa, psi).

Piston and weights are kept rotating with a motor while floating in order to minimise the influence of static friction of piston and cylinder and therefore to guarantee a sensitive discrimination threshold.

The dead weight tester described herein operates in a range from 25 to 2500 bar.

Components:

- 1 Measuring system
- 2 Spindle pump with star handle
- 4 Electric drive
- 5 Reading device
- 10 Stop valve "Measuring System / Messsystem"
- 12 Test connection
- 13 Union nut (AF 32)
- 15 Change-over valve for external admission pressure ("Admission pressure / Vordruck", "Closed / Zu", "Vent / Entlüften")
- 16 Adjustable feet
- 24 Hand pump



Nameplate and label:

The nameplate is placed on the back of the dead weight tester. It contains the most important technical data and information.

Scope of delivery:

The delivery includes – in addition to the dead weight tester and the set of weights in a transport case:

- 1 operating instruction
- 1 l special oil (medium)
- 1 protective cover
- 1 connection for G ½ (union nut)
- 1 connection for M20x1.5 (union nut)
- 4 O-rings as spare parts
- 2 adapters for N 6x1 (admission pressure connection)
- 1 plug for oil drain (mounted)
- 1 mains cable

Operating Instructions

Dead Weight Tester PD 2500

3.1 Intended Use

The dead weight tester shall only be used for testing, adjusting and calibrating pressure measuring equipment. Do not use the dead weight tester beyond its specification or contrary to the operating instructions.

The operational safety of the device supplied is only guaranteed by intended use. The specified limit values (⇒ chapter 4 "Technical Data") must not be exceeded. This particularly applies for the adherence to the permissible full scale value and the permissible temperature range.

When using the dead weight testers, a high degree of care and precaution is required. It has to be protected from strong vibrations, moisture, shocks, magnetic fields and static electricity.



IMPORTANT! Risk of injury or material damage due to overpressure!

Exceeding the maximum overload values may lead to material failure of the dead weight tester. This may also cause serious damage to health.

→ Ensure that the overload values are never exceeded.

Please check if the dead weight tester is suitable for your application before ordering and installation.

4. Technical Data

Set of weights	in bar / MPa
Basic load	25 bar
Main measuring range	250 – 2 500 bar
Required admission pressure air	6 bar
Admission pressure attainable with hand pump	1 600 bar
Reference condition for the guaranteed accuracy	ambient temperature +20 °C ±2 °C (+68 °F ±3.6 °F)
Accuracy (factory calibration)	±0.02 % of the measured value ¹⁾ ±0.05 % of the measured value ¹⁾
Medium	special oil
Nominal piston cross-section	0.02 cm ²
Rotation of the weights	by electric drive (230 – 240 V AC / 50 Hz / 3 W)
Fuse / microfuse	Ø 5 x 20 mm (0.2 x 0.79"), 0.1 A, 250 V, slow
Standard connection	High-pressure connection ¾" HPF-M20x1.5 with 2 adapters for G½ and M20x1.5 (union nut)
Connection for external compressed air	plug connection (Prestolock) for PA hose N4x1, with adapter for N6x1
Case	aluminum case, grey enamelled (self-supporting cover), 3 adjustable feet for precise horizontal alignment according to integrated circular level
Case dimensions incl. star handle (L x W x H)	600 x 500 x 450 mm (23.62 x 19.69 x 17.72")

Approx. weight	
Dead weight tester	48 kg (105.82 lb)
Set of weights	56 kg (123.46 lb)
Device packaging	41 kg (90.39 lb)
Transport case set of weights	9.2 kg (20.28 lb)

¹⁾ in the main measuring range, the accuracy refers to the measured value; in the secondary measuring range, it refers to 250 bar

Operating Instructions

Dead Weight Tester PD 2500

5. Preparation, Functions and Measuring Process

If the dead weight tester is not operated under typical laboratory conditions, the installation site should most widely meet the following criteria:

- Kept at constant temperature, without draughts and heat or cold sources
- Dust-free and dry, free from corrosive liquids or vapours
- Vibration-free and low-noise

The work station should be a solid plain table or workbench. Attention should be paid to sufficient free space for operating the dead weight tester.

Transporting the dead weight tester from a cold to a warm environment, condensation may result in an impairment of the device function. Thus, make sure that the device temperature has adjusted to the ambient temperature before commissioning.



IMPORTANT!

When transporting or repositioning, carry the dead weight tester at the case only, never at the measuring system. Otherwise, this may cause serious damage.

Do not tilt the device since the oil reservoir ③ is filled. If oil leaked anyhow, the reservoir must be refilled according to the instructions.

Preparation and functions:

The dead weight tester and the set of weights are supplied in separate cases.

→ Loosen the transport screws before taking the instrument out of the box.

→ Place the instrument at the work station and adjust it with the integrated circular level by screwing the adjustable feet in or out. The adjustable feet are equipped with orifices for mounting to the work station.

→ Screw the handles into the spindle pump head.

→ Connect the electric drive.

Electrical connection:



DANGER due to electric current!

Disregarding these safety instructions may result in serious or fatal injuries.

The dead weight tester is a device with protection class I (device with earth conductor) and has to be connected to a power socket with earth conductor.

- Always use a technically flawless mains cable with appropriate mains plug that is plugged into a socket with protective earthing.
- Only connect the dead weight tester to a properly installed and earthed 3-pin socket for mains plugs with protective contact.
- To ensure the connection to protective earth, all extension cables used must also have a protective conductor.
- Only use a mains cable that is approved for the voltage and plug configuration in your region.

Connection of the admission pressure:

The admission pressure is either connected via PA hose N 4x1 or via adapter for N 6x1 to the plug connection ⑦ (Prestolock).

To protect the dead weight tester from contamination, a maintenance unit consisting of pressure regulator and filter (pore size 10–20 µm with oil and water separator) is to be placed into the line of the admission pressure to the dead weight tester. With the pressure regulator, the pressure needs to be limited to max. 10 bar.

Refilling the oil reservoir (medium) ③:

The instrument is supplied filled.

If the red float pin is no longer visible in the window of the oil column, oil must be refilled.

Please use only the oil included in the delivery or the re-ordered oil.



IMPORTANT!

Turn the change-over valve ⑮ to "Vent / Entlüften".

The system must be unpressurised.

- Close valve ⑨ "Pressure compensation / Druckausgleich" and turn change-over valve ⑮ to "Closed / Zu".
- Remove the union nut and the cap from the oil reservoir.
- Fill in the oil up to the lower rim of the reservoir while pressing down the float pin.
- Close the reservoir again with cap and union nut.
- Open valve ⑨ and turn the change-over valve ⑮ to "Vent / Entlüften".

Operating Instructions

Dead Weight Tester PD 2500



Please note:

After approximately 40 operating hours, the overflow oil of the system should be drained via oil drain 13.

Measuring process:

Test process with connected admission pressure:



With admission pressure (up to 10 bar), the system can be filled faster and working with the hand pump is facilitated.

All valves have to be closed.

→ Press oil up to the sealing edge of connection 12 with the spindle pump before screwing in the test item.

→ The test item is tightly screwed into the union nut 13 at the test connection 12.



IMPORTANT! Attention must be paid to thorough sealing! Please use an appropriate wrench and the designated wrench flat. During screwing in, the pressure measuring devices should never be held at the case!

→ Open valve 10.

→ Move out the spindle pump 2 completely by turning counterclockwise.



CAUTION! The total travel of the spindle pump is approximately 16 revolutions. At the lower and the upper end a distinct stop is noticeable. Do not attempt to turn beyond those points forcibly! Otherwise, the spindle pump will be damaged!

→ According to the required pressure, place weights upon the base plate 14 with due regard to the instructions (⇒ "Set of weights").



IMPORTANT!

Carefully place the weights onto the dead weight tester. All weights need to be applied separately. Never try to place and remove several weights or the entire stack on and from the dead weight tester respectively.

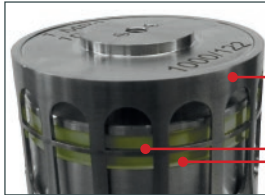
→ In order to fill the system, turn the change-over valve 15 to "Admission pressure / Vordruck".

→ Generate the required pressure (up to 1 600 bar) with the hand pump 24.

→ Increase the pressure by turning the spindle pump 2 clockwise until the piston with the weights starts floating slightly.

→ Switch on the electric drive via switch 19.

→ Readjust the pressure by turning the spindle pump until the marking of the load seating rotates within the green area.



bell-shaped body

marking for reading
light green area

→ The piston is in measuring position if the crosspiece (marking for reading) at the upper part of the bell-shaped body is rotating within the light green area.



IMPORTANT!

It is essential to ensure that the piston neither touches the upper nor the lower stop during the measurement.

Before applying the 250 bar weight, the motor needs to be switched off and the measuring system needs to be stopped.

In general: The motor has to be switched off before relieving pressure.

Pressure relief:

When opening valve 9, the pressure is relieved.

To reduce the pressure to 0 bar, the admission pressure must be relieved as well by turning the change-over valve 15 to "Vent/ Entlüften".

When actuating the change-over valve 15, please make sure that it notably snaps into place at the lever position right above the tags!

Operating Instructions

Dead Weight Tester PD 2500



Set of weights:



IMPORTANT!

Please handle the weights with care and avoid all kinds of damage!

The set of weights is supplied in a transport case.

The weights and the base plate  (basic load) are marked with the pressure (in bar and MPa) they generate on the dead weight tester, with the instrument identification number and the full scale value. The base plate  (basic load) without any weights generates a pressure of 25 bar.

We recommend to use the supplementary weight to facilitate the application of further weights.

The supplementary weight is the weight 225 bar as supplement to the basic load of 25 bar to generate 250 bar pressure.

The supplementary weight is marked with number 1 and the weights (250 bar) are marked with the numbers 2 to 10. Please observe the correct order when placing the weights, i.e. first the supplementary weight with number 1 at the very bottom and the weight number 10 as the last one on top.

The set of weights comprises as follows:

9 weights	250 bar
1 weight	225 bar (supplementary weight)
4 weights	50 bar
1 weight	25 bar
2 weights	10 bar
1 weight	5 bar

The smallest graduation of the supplied set of weights is 5 bar.

Correction weights for smaller graduations and for corrections of ambient parameter deviations of the standard conditions are available upon request.



Please note!

In order to avoid fingermarks, the individual weights should only be touched with clean cotton gloves. Any impurities can be removed with suitable degreasers.

6. Maintenance / Cleaning, Storage and Transport



CAUTION! Material damage and loss of warranty!

Any modifications or interventions in the device, made by the customer, might damage important parts or components. Such intervention leads to the loss of any warranty and manufacturer's responsibility!

→ Never modify the device or perform any repairs yourself.

Fuse

The microfuse of the dead weight tester is located at the rear side and is integrated in the C14 inlet. If the motor does not run when mains voltage is applied, please check the fuses and replace them if necessary.



DANGER due to electric current!

Disregarding these safety instructions may result in serious or fatal injuries.

- Unplug the mains cable from the instrument.
- Carefully lift the fuse compartment from above with a flat screwdriver.
- Remove the compartment with the fuses.
- Check the fuses and replace the defective ones.



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IMPORTANT:

Only use fuses of the same type FST0,1B (microfuse Ø 5 x 20 mm, 0.1 A, 250 V, tripping characteristic slow). A spare fuse is located in the fuse compartment.

Reinsert the fuse compartment and connect the mains cable. If the fuses blow repeatedly, the device is probably defective.

In this case, return the instrument to the ARMANO Messtechnik GmbH for repair.

Maintenance:

The instrument cannot be repaired by the operator. In case of faults, which cannot be eliminated without interference in the device, please return the instrument to the manufacturer for repair. Any arising repairs may only be executed by the manufacturer.

Cleaning:

- Clean the dead weight tester with a dry or slightly dampened lint-free cloth.
- Do not use any sharp objects or aggressive agents for cleaning.

Storage and transport:

- Use the original packaging or comparable packaging for transport.
- Avoid impacts or strong vibrations.
- Protect the device against moisture, dust, direct sunlight and other heat sources.

7. Dismounting and Disposal

Before dismounting:

The test item must be unpressurised before dismounting! For this purpose, the valves should be open.

Disposal:



NO DOMESTIC WASTE!

The dead weight tester comprises various materials. It shall not be disposed of together with domestic waste.

→ Bring the dead weight tester to your local recycling plant

or

→ send the dead weight tester back to your supplier or to the ARMANO Messtechnik GmbH.

8. CE Conformity



The CE marking of the instruments certifies the conformity with prevailing EU directives for placing products on the market within the European Union. The following directive applies:

2014/68/EU (PED)

2014/35/EU (Low Voltage Directive)

The corresponding declaration of conformity is enclosed or available upon request.

Operating Instructions

Dead Weight Tester PD 2500

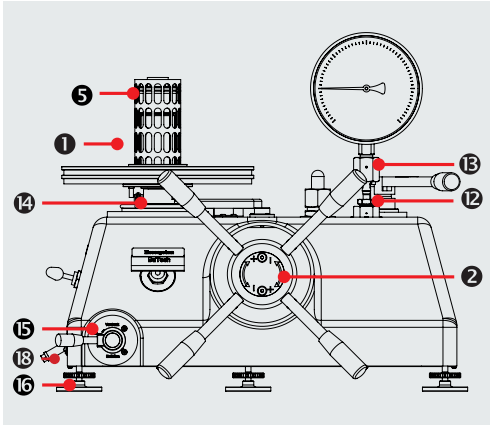


Fig. 1

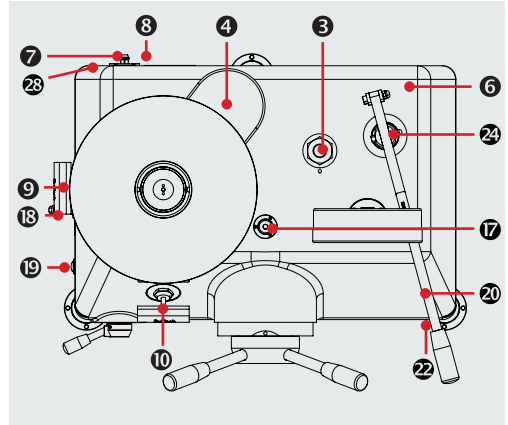


Fig. 2

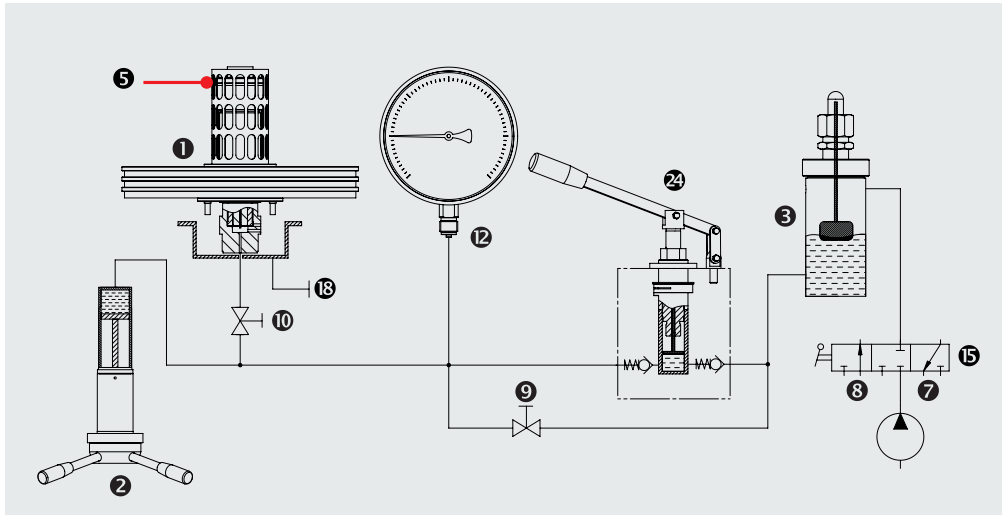


Fig. 3: schematic drawing

- | | | | | | |
|---|--|----|--|----|---|
| 1 | Measuring system | 9 | Valve "Pressure compensation / Druckausgleich" | 16 | Adjustable feet |
| 2 | Spindle pump with star handle | 10 | Stop valve "Measuring system / Messsystem" | 17 | Circular level |
| 3 | Oil reservoir (medium) | 12 | Test connection | 18 | "Oil drain / Ölablass" (overflow of the system) |
| 4 | Electric drive | 13 | Union nut (AF 32) | 19 | Switch electric drive |
| 5 | Reading device (mirror) | 14 | Base plate (basic load) | 20 | Calibration plate (for accredited calibration) |
| 6 | Case | 15 | Change-over valve for external admission pressure ("Admission pressure / Vordruck", "Closed / Zu", "Vent / Entlüften") | 22 | Nameplate |
| 7 | "Connection admission pressure / Anschluss Vordruck" | | | 24 | Hand pump |
| 8 | "Ventilation admission pressure / Entlüftung Vordruck" | | | 28 | C14 inlet |

Legend

9. Declarations of Conformity

EU-Konformitätserklärung

EU Declaration of Conformity

Für die nachfolgend bezeichneten Erzeugnisse

We hereby declare for the following named goods

VERGLEICHS-PRÜFPUMPEN

Typ PS 2500-G gemäß Datenblatt 10157

COMPARISON PUMPS

Model PS 2500-G according to data sheet 10157

und

and

KOLBEN-MANOMETER

Typ PD 2500 gemäß Datenblatt 10317

DEAD WEIGHT TESTERS

Model PD 2500 according to data sheet 10317

wird hiermit bestätigt, dass sie den Schutzanforderungen der folgenden Richtlinie entsprechen:

that they meet the protective requirements of the directive:

2014/68/EU (DGRL)

2014/68/EU (PED)

Modul A, druckhaltendes Ausrüstungsteil

Module A, pressure equipment parts

Diese Erklärung gilt für alle Exemplare, die nach den entsprechenden Fertigungszeichnungen, die Bestandteil der technischen Dokumentation sind, hergestellt werden.

This declaration applies to any specimen manufactured according to the manufacturing drawings, which are part of the technical documentation.

Die CE-Kennzeichnung erfolgt mittels Aufkleber auf dem Gehäuse.

The CE-marking is made via sticker on the case.

006 EU-Konformitätserklärung Vergleichs-Prüfpumpen Ausg. 04/21

Diese Erklärung wird verantwortlich für den Hersteller:

This declaration is issued under the sole responsibility of the manufacturer:

ARMANO Messtechnik GmbH

abgegeben durch/by
Grünhain-Beierfeld, 2021-04-14



Bernd Vetter
Geschäftsführender Gesellschafter / Managing Director

ARMANO

ARMANO Messtechnik GmbH

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EU-Konformitätserklärung

EU Declaration of Conformity

Für die nachfolgend bezeichneten Erzeugnisse

We hereby declare for the following named goods

KOLBEN-MANOMETER

Typ PD 6	gemäß Datenblatt 10312
Typ PD 10/PD 25	gemäß Datenblatt 10313
Typ PD 60/PD 100	gemäß Datenblatt 10315
Typ PD 600/PD 1000	gemäß Datenblatt 10316
Typ PD 2500	gemäß Datenblatt 10317

DEAD WEIGHT TESTERS

Model PD 6	according to data sheet 10312
Model PD 10/PD 25	according to data sheet 10313
Model PD 60/PD 100	according to data sheet 10315
Model PD 600/PD 1000	according to data sheet 10316
Model PD 2500	according to data sheet 10317

wird hiermit bestätigt, dass sie den wesentlichen Schutzanforderungen entsprechen, die in der nachfolgend bezeichneten Richtlinie festgelegt sind:

that they meet the essential protective requirements, which have been fixed in the following directive:

RICHTLINIE 2014/35/EU DES EUROPÄISCHEN PARLAMENTS UND DES RATES vom 26. Februar 2014

DIRECTIVE 2014/35/EU OF THE EUROPEAN PARLIAMENT AND THE COUNCIL from February 26, 2014

zur Harmonisierung der Rechtsvorschriften der Mitgliedstaaten über die Bereitstellung elektrischer Betriebsmittel zur Verwendung innerhalb bestimmter Spannungsgrenzen auf dem Markt – kurz: **Niederspannungs-Richtlinie**

on the harmonisation of the laws of the Member States relating to the making available on the market of electrical equipment designed for use within certain voltage limits – short: **Low Voltage Directive**

Angewandte Norm: DIN EN 61010-1:2020-03

Applied standard: DIN EN 61010-1:2020-03

150 EU-Konformitätserklärung Kolben-Manometer Ausg. 09/21

Diese Erklärung wird verantwortlich für den Hersteller:

This declaration is issued under the sole responsibility of the manufacturer:

ARMANO Messtechnik GmbH

abgegeben durch/by

Grünhain-Beierfeld, 2021-09-21



Bernd Vetter

Geschäftsführender Gesellschafter / Managing Director

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Operating Instructions

Dead Weight Tester PD 2500



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