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OPERATING MANUAL

For

PNEUMATIC DEAD-WEIGHT TESTER PDWT-10

Model C1-X-13-090313-01
P -Man PDWT-E-0716-2



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Model CI-X-13-090313-01
P -Man PDWT-E-0716-2

1. GENERAL INFORMATION

Dead weight tester models PDWT-10 describes in this manual are designed and manufactured in Europe.

This manual commissioning informs the user about the functioning of the instrument and the safety limits for work peacefully.

This manual is an integral part of the device. It must be kept close to the workstation and accessible at any time by the user.

CALREF reserves the right to alter the content or form of this manual at any time and without notice. And to make technical amendments to change the product.

Responsibility CALREF is not liable for any damage caused by :

- not in accordance with intended usage,
- non compliance with instructions for use,
- use of the instrument by unqualified untrained operator ,
- a transformation / modification of the device carried by the user.

The operator must have read and understand prior to operating mode and use the device to start handling.

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2. SAFETY

2.1 Device identification

1. Model: PDWT-10
2. Serial number: on the instrument's rear label
3. Production date: on the instrument's rear label

2.2 Before to use the device

Before switching on the device, ensure that the technical characteristics (measuring range, precision, fluid etc...) correspond to your needs



> FOR EXAMPLE : THE MAXIMUM PRESSURE
DEFINED FOR THIS COMPRESSOR MUST NOT BE
EXCEEDED

The pressure compensator is designed and manufactured for use as described in this document

In this case of misuse or mishandling, outside the technical specifications contained in this manual. The instrument must be immediately isolated, identified as inoperative and must be checked by our service department.

2.3 Precautions storage and transport

It's necessary to take care of the unit during storage or transportation. It must be protected from moisture, shock, extreme temperatures and shouldn't be removed or changed

If the dead weight is moved to a new environment (warmer, colder, etc..). Observe the phase of "quarantine" and wait until the device temperature stabilizes at room temperature before handling.

2.4 User qualifications



> IMPROPER USE OF THE DEVICE CAN CAUSE
SIGNIFICANT BODILY INJURY AND PROPERLY

Qualified operator, due to : it's product training, knowledge in the field of metrology and experiences in field of pressure and knowledge on standards and guidelines, is able to perform the operations describes in this manual. He will be able to detect potential dangers.

CALREF offers on demand, training on metrology and dead-weight tester use.

2.5 Personal protective equipment (PPE)

The personal protective equipment must be defined in the security register of the user company and made available to the operator. These devices are used to protect the operator from potential risks that impede their safety and health at work.

a) Protecting fluid



> WEAR EYE PROTECTION : PROTECTS THE EYES AGAINST SPLASHES AND PROJECTIONS OF THE FLUID.



> WEAR GLOVES : PROTECT THE SKIN AGAINST IRRITATION, ALLERGIES.

b) Heavy lifting



> WEAR SAFETY SHOES : PROTECTS AGAINST CRUSHING DURING DROP WEIGHT.

Ergonomics and workstation management are necessary to facilitate the work of the operator and avoid musculoskeletal disorders

3. INSTALLATION

3.1 Unpacking the unit

Upon receipt of the equipment, check the status and content of your package. All of the following elements must be present in the package :

- 1 compressor
- 1 set of weights
- 1 piston/cylinder
- 1 capstan consists of 4 delivered arms removed
- 2 connectors G1/2 (supplied as standard unless otherwise specified)
- 1 manual

Check that there isn't damage or breakages during transport. If there are missing items, please immediately notify CALREF or your local distributor for what is missing.

3.2 Installation

Preferably, install your unit in a stable and controlled environment.

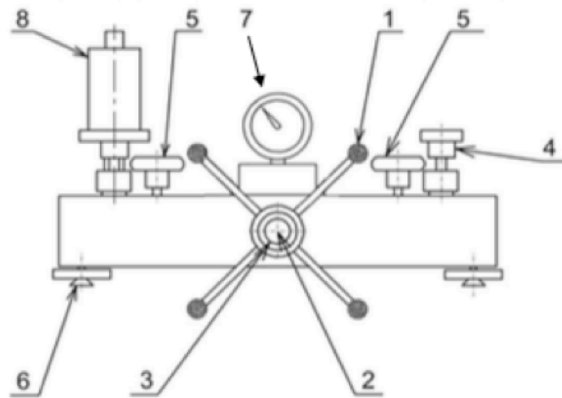


YOU WILL GET BETTER PERFORMANCE IF :

- > THE TEMPERATURE AND HUMIDITY OF THE ROOM ARE STABLE,
- > THE WORKSTATION IS CLEAN AND DRY, PROTECTED FROM DRAFTS, NOISE, VIBRATION, AND WITHOUT PASSING

Component Identification

- 1 : capstan
- 2 : axis of rotation
- 3 : clamping knob
- 4 : connectors
- 5 : valves
- 6 : sidesteps
- 7 : gauge
- 8 : set piston / cylindre



Installation / Assembly

- Install pressure generator on a established stable an rigid about 0,90 m tall.
- Adjust the stability of the generator through sidesteps 6.
- Insert the capstan 1 on the axis of rotation 2, the screw tightening knob 3 to the axis of rotation.
- Remove the yellow caps protections pressure connections.
- Make sure the O-rings are positioned in their throats.
- Install the piston / cylinder 8 on the connector left.
- Set up the adapter nut 4 on the right connector pressure. Make sure that the o-rings are well positioned.
- Connect the pressure source on the outlet 1/4 gas cylindrical located behind the generator.

Note on source pressure : Use a clean gas, no aggressive and no-toxic dry such as nitrogen U. Provide a single regulator output pressure source.

3.2 Run-Test after installation

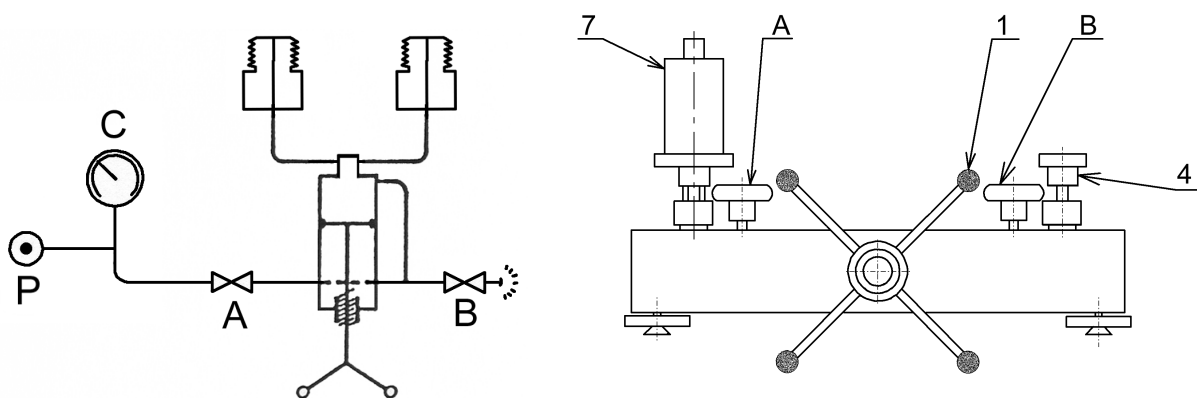
- a) Perform a calibration test instrument with a "test" known correct (see chapter procedure) to verify and validate the operational statues of the dead weight.

b) Lower the pressure by turning the capstan in the opposite direction of the needle clockwise and remove the instrument "test". If necessary use the key to initiate the unscrewing of the swivel.

c) The device is now ready for use.

4. OPERATING PROCEDURE

4.1 Pneumatic diagram



IMPORTANT

The dead-weight testers is fitted with instrumentation valves, it is essential to observe the following recommendations for preserve your equipment is good working order:

- Maximum torque applicable to the stop with open valve : 0,3 Nm
- Maximum torque applicable to the stop with closed valve : 4 Nm

When the open valve stop is reached, turn the valve wheel $\frac{1}{4}$ turn in a clockwise direction.

1. Install the measurements or regulation testing device on the right pressure connection.
2. Turn the capstan **1** an anti-clockwise till the rear stop is reached.
3. Close **A** and **B** valves. The valves fitted on the dead weight tester must be simply closed **but never locked** (valves might be damaged).
4. When bench test is supplied with pressure (positive or negative), check if the pressure showed by the pressure gauge **C** is near to the calibrate pressure.

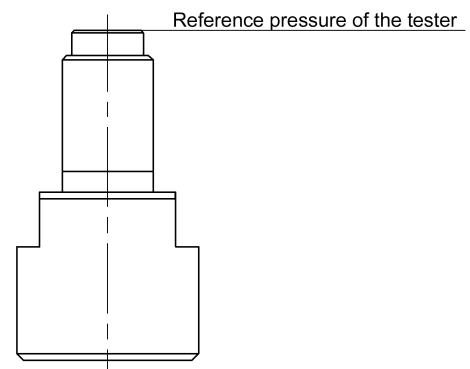
5. Load the piston-cylinder unit with weights to obtain the desired pressure. Do not forget to take into account the weight of the piston and the compensating weight
6. Put the mass in rotation at 0,5 rps (rotation per second)
7. Open **A** valve (the dead weight tester is loading compressed air)
8. Close gradually **A** valve until the piston float in the middle of the measurement range. If there is more pressure than you want open gently **B** valve to purge the surplus air inside the dead weight tester.
9. Turn the capstan **1** clockwise until the piston float in the middle of the yellow range located at the button of the device.

The pressure comparator is ready for use.

10. To decrease the pressure, turn the capstan **1** anti-clockwise until the dead weight tester reaches its low thrust
11. In order to take the following measurement points, repeat 5 to 9 step.
12. To unfit the calibrate device, put the dead weight tester to atmospheric pressure by opening **B** valve.

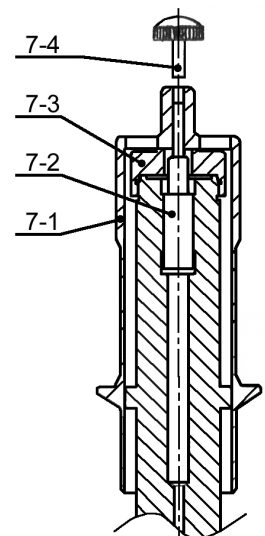
REMARKS :

Before any measurement, it's advised to use the dead weight tester alone in closed circuit. Move the piston upend down at around half of its measurement range. If the dead weight tester don't move easily, clean it according to following instruction.



4.2 Piston cleaning for PDWT

1. Unfit the mass support bell **7-1** from the piston-cylinder unit **7-2** thanks to the supplied screw **7-4**
2. Unscrew the nut **7-3**
3. Take off piston-cylinder unit **7-2**
4. Clean and wipe it with a clean and dryness rag.



Do not touch directly the piston with fingers, risk oxidization.

5. Fit with care the piston-cylinder unit **7-2**, the nut **7-3** and the mass support bell **7-1**

4.3 Precautions during use

Respect the maximum pressure allowed in use for the dead weight testers.

Maximum working pressure :

- 10 bar for PDWT-10

This device is not compatible with oxygen device .

Do not use pressure gauges which are dirty or contaminated by chemical compounds without cleaning them beforehand, they can contaminate the tester and cause serious damage to the piston-cylinder unit.

5. GENERAL INFORMATION ON CALIBRATION

A manometric tester is an instrument which generates a pressure based on two main physical quantities:

The force generated by the addition of weights.

The actual cross section of the piston cylinder of the tester.

These two elements may vary according to environmental conditions: atmospheric pressure, acceleration of gravity (g), temperature and ambient humidity.

For generating pressures within values accurate to $\geq \pm 1.10^{-3}$, it is necessary to verify that local environmental conditions are close to environmental conditions under which the tester was calibrated.

Acceleration of gravity (g) = 9,80665 m/s²

Temperature = 20°C

Standard atmospheric pressure = 1013,25 Hpa

Relative humidity = 50%

For generating pressures within values accurate to $< \pm 1.10^{-3}$, you must apply the corrective formula for the dead weight tester generated pressure.

6. DENSITY OF AIR (kg/m³) AS FUNCTION OF PRESSURE AND TEMPERATURE (relative humidity 50%)

Atmospheric pressure (KPa)	Temperature of air (°C)						
	14	16	18	20	22	24	26
87	1.052	1.045	1.037	1.029	1.021	1.014	1.006
88	1.064	1.057	1.049	1.041	1.033	1.025	1.018
89	1.077	1.069	1.061	1.053	1.045	1.037	1.029
90	1.089	1.081	1.073	1.065	1.057	1.049	1.041
91	1.101	1.093	1.085	1.077	1.069	1.061	1.053
92	1.113	1.105	1.097	1.089	1.080	1.072	1.064
93	1.125	1.117	1.109	1.100	1.092	1.084	1.076
94	1.137	1.129	1.121	1.112	1.104	1.096	1.088
95	1.149	1.141	1.133	1.124	1.116	1.108	1.099
96	1.162	1.153	1.145	1.136	1.128	1.119	1.111
97	1.174	1.165	1.156	1.148	1.139	1.131	1.123
98	1.186	1.177	1.168	1.160	1.151	1.143	1.134
99	1.198	1.189	1.180	1.172	1.163	1.154	1.146
100	1.210	1.201	1.192	1.184	1.175	1.166	1.158
101	1.222	1.213	1.204	1.196	1.187	1.178	1.169
102	1.234	1.225	1.216	1.207	1.199	1.190	1.181
103	1.247	1.237	1.228	1.219	1.210	1.201	1.193
104	1.259	1.249	1.240	1.231	1.222	1.213	1.204
105	1.271	1.261	1.252	1.243	1.234	1.225	1.216
106	1.283	1.274	1.264	1.255	1.246	1.237	1.228

7. MAINTENANCE

IMPORTANT :

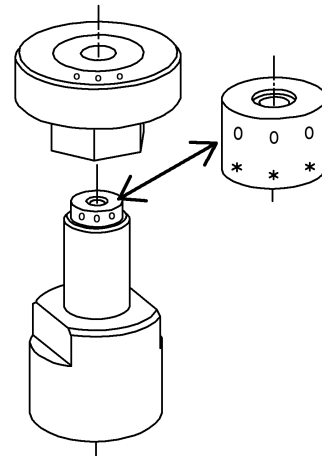
- The piston-cylinder unit is designed for extremely narrow pressure limits. Therefore dismantling is forbidden.
Since measuring benches and balances are fitted with instrumentation valves, it is essential to observe the following recommendations :
 - maximum torque applicable to the stop with open valve = 0.3 Nm
 - maximum torque applicable to the stop with closed valve = 4 Nm
 - When the open valve stop is reached, turn the valve wheel $\frac{1}{4}$ turn in a clockwise direction.
- Wipe clean the O-rings under: the piston-cylinder unit, swivel nut adapter.
- Do not use cleaning solutions as these can damage the O-rings.
- The piston-cylinder unit represents an important part in the value of the tester. It should be handled with care and kept clean. If for some reason, the piston-cylinder unit is removed, place it vertically on a clean surface.
- In case of damage of the piezometric unit, send back the complete unit for replacement or repair.
- The serial number of the piston-cylinder unit appears on the accuracy certificate and on the body of the unit. Quote this number and also the serial number of the tester during all correspondence related to the piston-cylinder unit.
- If required, the dead-weight tester may be sent back to our workshop for reconditioning.

8. ACCOUPLEMENT SYSTEM

The device is fitted with specific accouplement system
Orientation of the ring is essential according to the connection type

8.1 Threads M10x100, G1/8, 1/8 BSP-TR, 1/8 NPT

For this connector, orient the ring to see **000** reference.
Squeeze with the hand.



8.2 Threads M12x150, M16x150, M18x150, M20x150, G1/4, G3/8, G1/2, 1/4 BSP-TR, 3/8 BSP-TR, 1/2 BSP-TR, 1/4 NPT, 3/8 NPT, 1/2 NPT

For this connector, orient the ring to see ******* reference.
Squeeze with the hand.

