



DWT Series

Hydraulic Dead Weight Testers

DWT-6 to DWT-2500 · 6 bar to 2500 bar · classes 0.05, 0.02 and 0.01

Operating Manual

Issue 1 · September 2026

General Polytronic Systems Ltd · 14 Regent Street, Brent, London NW10 5LG
+44 (0) 203 093 0914 · sales@gpslimited.com · www.gpslimited.com

1 Safety

A dead weight tester is a slow instrument that stores a lot of energy. Read this section before using one; every item is here because ignoring it can injure you, wreck a piston or damage the instrument under test.

- Never exceed the upper limit of the model in use. The weights supplied can only reach it; do not stack weights from another set.
- Rotate the weights steadily with both hands. Single-handed rotation throws the stack off centre and can break the piston rod.
- Spin the piston first, then raise it to the working position. Never raise a stationary piston under load.
- Pressurise and depressurise smoothly. A sudden change strikes the limit stop, sets the stack vibrating and can break the rod.
- Add and remove weights only with the piston at its lowest working position, and handle them gently. A dropped weight is a damaged weight, and a damaged weight is a wrong pressure for the rest of its life.
- Open the vent valve and release all pressure before disconnecting anything from an output port.
- Keep the working liquid off the weights and off the floor. Wipe spills at once.

The piston, cylinder, plate and weights of each instrument are calibrated together as one set and carry the same serial number. They are not interchangeable between instruments, even of the same model.

2 Introduction

The DWT series are hydraulic piston pressure gauges, better known as dead weight testers, for calibrating digital pressure gauges, precision pointer gauges, pressure transmitters, pressure sensors and other pressure instruments. Seven models cover 0.6 bar to 2500 bar, each named by its upper limit in bar, and each available in accuracy class 0.05, 0.02 or 0.01 percent of reading.

The piston and cylinder are tungsten carbide, chosen for hardness and a low coefficient of thermal expansion, so wear is slow, deformation under pressure is negligible and the effective area stays put over years of use. Models from 250 bar upward run on diisooctyl sebacate, which gives the piston its sensitivity at high pressure.

The four lowest models share the standard construction. The DWT-1000 and DWT-1600 add a pre-pressurising system to get the working liquid to pressure quickly, and the DWT-2500 adds a digital piston position indicator that replaces the reference lines with a reading.

3 Specification

Models

The last column is the pressure produced by the plate and piston alone, with no weights fitted, which is also the lower limit of each model.

Model	Range, bar	Range, MPa	Piston area, cm ²	Plate and piston, kg	bar
DWT-6	0.6 to 6	0.06 to 0.6	1	0.6	0.6
DWT-60	1 to 60	0.1 to 6	0.5	0.51	1
DWT-250	5 to 250	0.5 to 25	0.1	0.51	5
DWT-600	10 to 600	1 to 60	0.05	0.51	10
DWT-1000	10 to 1000	1 to 100	0.05	0.51	10

Model	Range, bar	Range, MPa	Piston area, cm ²	Plate and piston, kg	bar
DWT-1600	20 to 1600	2 to 160	0.05	1.02	20
DWT-2500	50 to 2500	5 to 250	0.025	1.2	50

Weight sets

Each weight is marked with the pressure it produces on its own instrument. Pressure is set by adding weights until their marked pressures, plus the plate and piston, sum to the value required.

Model	Weight set supplied	Pressure per weight
DWT-6	0.102 kg × 6, 0.51 kg × 10	0.1 bar, 0.5 bar
DWT-60	0.51 kg × 4, 2.55 kg × 11	1 bar, 5 bar
DWT-250	0.51 kg × 4, 2.55 kg × 9	5 bar, 25 bar
DWT-600	0.51 kg × 4, 2.55 kg × 11	10 bar, 50 bar
DWT-1000	0.51 kg × 4, 2.55 kg × 11, 5.1 kg × 4	10 bar, 50 bar, 100 bar
DWT-1600	0.51 kg × 4, 2.55 kg × 11, 5.1 kg × 10	10 bar, 50 bar, 100 bar
DWT-2500	0.255 kg × 3, 0.5 kg × 4, 2.5 kg × 6, 5.1 kg × 9	10 bar, 20 bar, 100 bar, 200 bar

Common to all models

Item	Specification
Accuracy class	±0.05%, ±0.02% or ±0.01% of reading, as ordered
Reference conditions	20 ±2 °C, temperature drift not exceeding 0.5 °C during a measurement
Piston and cylinder	Tungsten carbide: high hardness, low thermal expansion, negligible deformation under pressure
Working liquid, DWT-6 and DWT-60	Mixed oil or transformer oil, kinematic viscosity 9 to 12 cSt at 20 °C, acid value 0.05 mg KOH/g or less
Working liquid, DWT-250 and above	Diisooctyl sebacate recommended, kinematic viscosity 20 to 25 cSt at 20 °C, acid value 0.05 mg KOH/g or less
Output connections	Two, M20 × 1.5, with union nuts
Construction	DWT-6, DWT-60, DWT-250 and DWT-600: standard. DWT-1000 and DWT-1600: pre-pressurising system fitted. DWT-2500: digital piston position indicator fitted
Operating environment	20 ±5 °C, air free of corrosive gases
Storage	5 to 35 °C, relative humidity 80% or less, free of corrosive vapour

4 How it works

A known mass on a piston of known area produces a known pressure. The weights and the piston press down; the liquid in the system presses up; when the piston floats freely, spinning, the two are equal, and whatever is connected to the output port is at that pressure. Nothing else is measured. That is why a dead weight tester is a primary standard and a gauge is not.

The instrument has two parts. The pumping unit is a hand pump with an oil cup and two output ports with union nuts, which raises the system to pressure and connects the instrument under test. The measuring system is the precision piston and cylinder, with the plate that carries the weights.

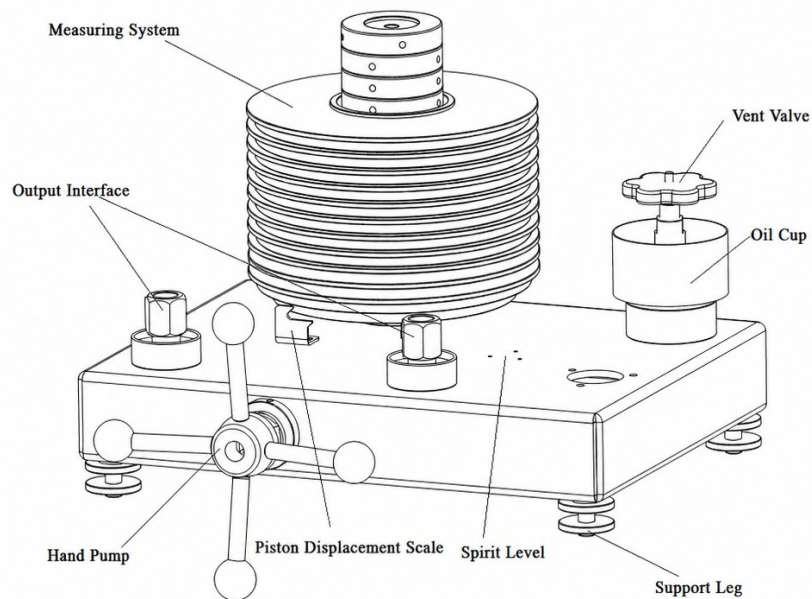


Figure 1 Standard construction: DWT-6, DWT-60, DWT-250 and DWT-600

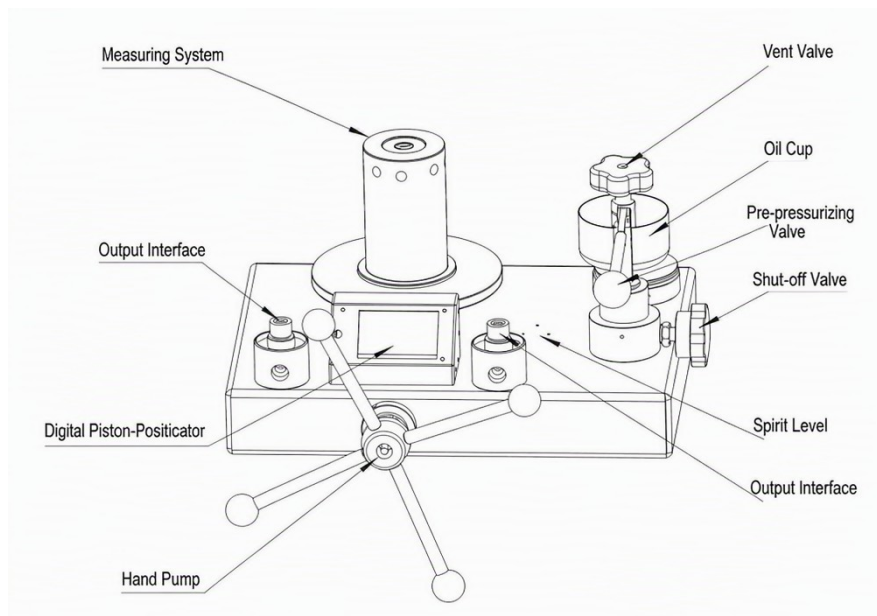


Figure 2 Pre-pressurising construction: DWT-1000 and DWT-1600

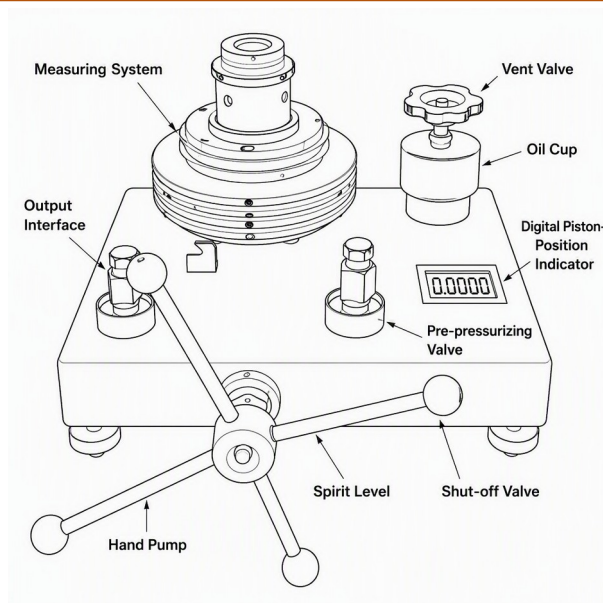


Figure 3 DWT-2500 with digital piston position indicator

5 Level compensation

The pressure at the output port is the pressure at the bottom of the piston cylinder. If the sensing element of the instrument under test sits higher or lower than that, the column of liquid between them adds or subtracts a small pressure. At class 0.05 and better it matters, and there are two ways to deal with it.

By mass

Add a small weight to the plate to cancel the head of liquid. The compensation is 0.9 g per centimetre of height on the DWT-6 and 0.45 g per centimetre on the DWT-60.

- Digital gauges, pressure modules, sensors and transmitters on union-nut connections sit about 1.6 cm above the piston base. This series is compensated for that at calibration; no further compensation is needed.
- A precision pointer gauge with a 150 mm dial has its centre about 11.9 cm above the connection. Subtract the 1.6 cm already allowed for and compensate the remaining 10.3 cm. On the DWT-6 that is 0.9×10.3 , about 9.3 g, placed on the plate.

By height

Mount the instrument under test with its sensing diaphragm at the same level as the bottom of the piston cylinder. An adapter can be machined to do this, and for routine work on one type of instrument it is the cleaner solution.

Finding the level difference

- Digital gauges, sensors and transmitters: the distance from the connection to the sensing diaphragm, about 3 cm.
- Precision pointer gauges: the distance from the connection to the centre of the dial, about 11.9 cm for a 150 mm dial.
- The bottom of the piston cylinder sits 1.6 cm below the end face of the union-nut output port.

6 Unpacking and storage

1. Check the packing case before opening it. If it is damaged, photograph it and tell us before going further.
2. Remove the cushioning and check the instrument, the weight set, this manual and the calibration certificate are complete and undamaged. Report any shortage at once.

3. Store the instrument indoors between 5 and 35 °C, at 80% relative humidity or less, away from anything corrosive, with the dust cover fitted and the weights in their case in a dry place.

7 Installation and use

7.1 Setting up

1. Place the instrument on a solid bench where you can stand at it and turn the pump comfortably. Level it with the levelling screws until the bubble of the spirit level is centred.
2. Clean every part of the liquid path with white spirit before first filling. The liquid must be clean; a fibre or a grain of dirt in the cylinder will score it.
3. Fill the oil cup to two thirds with the correct working liquid for the model (section 3), then fill the hand pump and the measuring system, working the air out of the cavities as you go.
4. Turn the pump handwheel and check the liquid path is clear. If everything is in order, fit the instrument under test to an output port and tighten the union nut.

The working temperature is 20 ± 5 °C, and the reference conditions in section 3 apply for measurements at the stated accuracy class. Give the instrument and the weights time to reach room temperature after they have been moved.

7.2 Making a measurement

1. Open the vent valve and turn the handwheel anticlockwise to fill the pump cylinder. On the DWT-1000 and DWT-1600, open both the pre-pressure shut-off valve and the vent valve, and press the pre-pressure valve to expel air.
2. Close the vent valve. On the DWT-1000 and DWT-1600, close the vent valve, open the shut-off valve to fill the system, then close the shut-off valve.
3. Turn the handwheel clockwise to build initial pressure. With both hands, set the piston spinning clockwise at 30 to 60 turns a minute, and continue pressurising while it spins until the underside of the piston carrier is level with the upper reference line. On the DWT-2500, use the indicator: raise the piston to about 3 mm and let it sink slowly; if it sinks fast at first, pump a little more, so that it descends slowly between 0.5 and 2.5 mm, the working band.
4. With the piston at its lowest working position, add weights until their marked pressures, plus the plate and piston, give the pressure required. Keep the stack spinning clockwise at not less than 30 turns a minute to overcome friction, and take the reading from the instrument under test while the piston floats within the reference lines.
5. Step through the calibration points by adding or removing weights, bringing the piston to its lowest working position each time.
6. To finish, turn the handwheel anticlockwise as you remove the weights step by step, then open the vent valve to release all pressure before removing the last weight and the instrument under test.

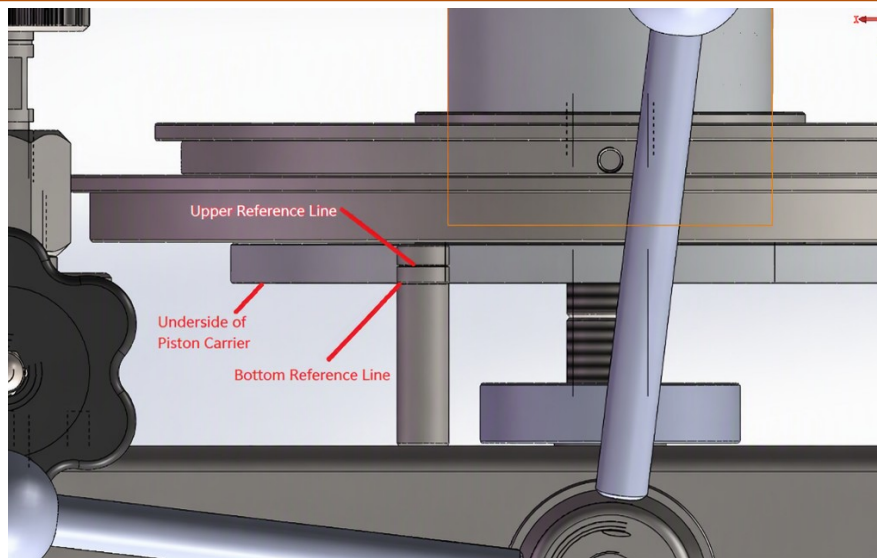


Figure 4 Piston carrier and the upper and lower reference lines

DWT-2500: on first pressurising, raise the piston to 3.5 mm and let it sink; when it reaches 0.5 mm pressurise again to 3.5 mm. Repeat several times until the piston settles. The indicator reading is only meaningful once it does.

8 Maintenance

- The piston and cylinder are the instrument. Do not dismantle them, and do not send them for cleaning with anything that leaves fibres. If they need attention, contact us.
- Clean the other parts periodically. Work carefully during cleaning and reassembly so that nothing enters the liquid path.
- Use filtered liquid only, and replace it after a period of use; used liquid carries wear particles and its viscosity drifts.
- Fit the dust cover whenever the instrument is idle, and keep the weights in their case.
- Check the spirit level before every session. An instrument that has been moved is no longer level.

Calibration

Every DWT is supplied with a calibration certificate for its class. Recalibrate after one year; if the first recalibration shows the instrument stable, a two-year interval is normal practice thereafter. Calibration, traceable certification and repair are available from GPS; contact us with the model and serial number.

Spares

Connection seal: O-ring 12 mm outside diameter × 2.4 mm. Pump cylinder seal: a 17 mm leather cup and a 17 mm outside diameter × 2.4 mm O-ring on the DWT-6 to DWT-600; a 9.5 mm inside diameter × 2.4 mm O-ring on the DWT-1000; for the DWT-1600 and DWT-2500, contact us with the serial number.

9 Ordering

When ordering or asking for a quotation, give the model, the accuracy class required, and where the instrument will be used, since the working liquid and the level compensation depend on what it will calibrate. Two output ports are fitted as standard, and adapters for other threads can be supplied.

10 Warranty

One year from the date of purchase, subject to product registration with GPS. The warranty covers defects in materials and workmanship and does not cover damage caused by operation outside the rated conditions, by contaminated or incorrect working liquid, by weights from another set, by a dropped weight, or by unauthorised dismantling of the piston and cylinder.

For service, calibration or technical support contact GPS at sales@gpslimited.com or +44 (0) 203 093 0914.