DEADWEIGHT TESTERS

Pressurements

- The Most Comprehensive Range
- Gauge Pressure
- Absolute Pressure
- Differential Pressure
- Vacuum
- Separators and Comparison Test Pumps

A Druck Company

DEADWEIGHT TESTERS

Pressurements Deadweight Testers

Deadweight testers are the basic primary standard used world-wide for the accurate measurement of pressure.

No other piece of equipment can match the stability, repeatability and accuracy of the deadweight tester. It is ideal for calibrating pressure gauges, transducers, transfer standards, recorders, digital calibrators, etc. and can also be used to measure directly the pressure in systems and processes where precise readings are important.

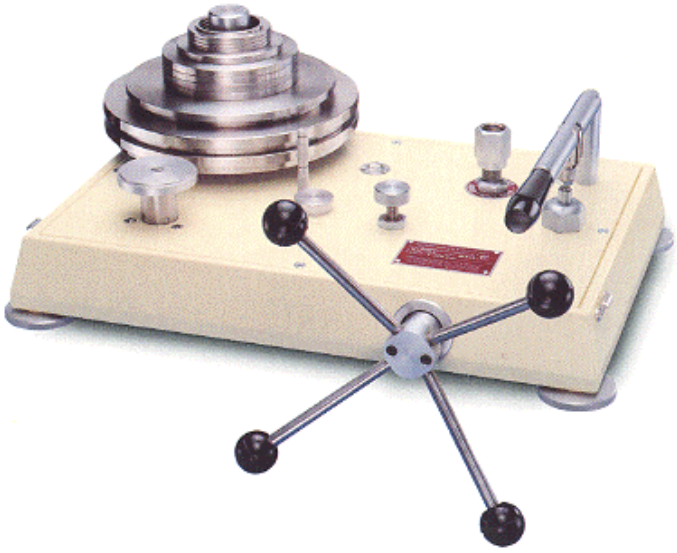
Utilising the well proven piston gauge system, consisting of a vertically mounted precision lapped piston and cylinder assembly. Accurately calibrated masses are loaded onto the piston, which rises freely within its cylinder. These weights balance the upward force created by the application of pressure within the system.

Pressurements offer one of the most comprehensive series of Deadweight Testers available, covering a wide variety of applications and ranges of pressure and vacuum. The piston assemblies are manufactured to the very highest standards with certified accuracies traceable to International Standards Laboratories such as:

National Physical Laboratory, UK. (NPL).
National Institute of Standards and Technology, USA, (NIST).

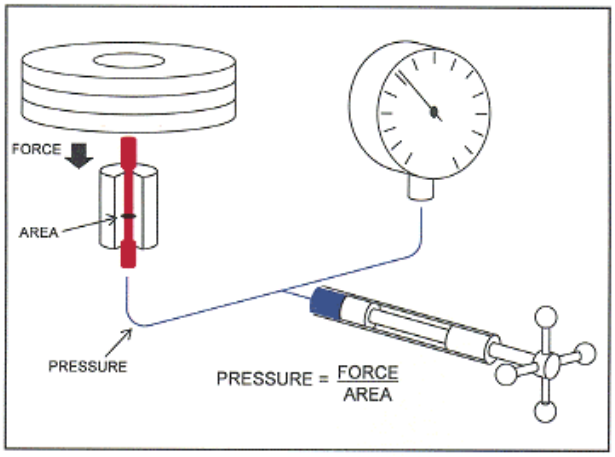
Gravity varies significantly with geographical location and this variation has a direct effect on the force of the weights and the accuracy of the Deadweight Tester. Each instrument can be calibrated to local gravity at no extra cost. If unspecified, instruments will be supplied calibrated to Standard Gravity 980.665 cm/s^2.

Instruments are supplied with an integral carrying case, which makes them neat, compact and easily portable. Components are stowed in the detachable lid, which also provides excellent protection from dirt and damage when the tester is in transit or storage. Unique test-station connections allow quick hand-tight sealing, no need for Teflon tape and spanners. A spirit level and adjustable feet are provided to enable the operator to level the instrument. A floatation indicator is mounted on the top plate removing guesswork when floating the piston. Weights are stored in a separate box (except low pressure pneumatic models).



Standard with every Deadweight Tester

- 3 year guarantee against normal operating failure.
- $^1/_8$", $^1/_4$", $^3/_8$", $^1/_2$" BSP or NPT female adaptors.
- Calibrated weight set in carrying case.
- Traceable certificate of overall accuracy.
- Individual piston certificate.
- List of the weight masses.
- Operating Fluid (where applicable).
- Spare seals.



Pressurements primary standards laboratory

Other products and services

We can provide:

- Full overhaul and recalibration service. All re-calibrated deadweight testers are adjusted to the original manufactured accuracy and full certification is supplied traceable NPL and NIST. Optional NAMAS.
- Conversion and fractional weights in all pressure units.
- Instruments to measure ranges and units, other than those stated in this catalogue.
- Higher accuracies.
- Custom built equipment.
- Training courses in pressure.

S700 series calibration software

User friendly, menu driven, DOS based calibration software designed specifically for primary pressure standards, Deadweight Testers. This software has been developed as a flexible working tool to make pressure calibrations quicker, easier and more accurate. The software calculates which weights are required to generate a specific pressure. The program can also calculate the pressure for given weights and piston. The software will work in an unlimited number of pressure units, regardless of the pressure unit the Deadweight Tester has been manufactured to. Details can be stored of as many Deadweight Testers as required. The software generates calibration certificates which can be either printed or stored.

Program calculations incorporate:

- Gravity
- Temperature
- Air density
- Actual weight mass
- Head of fluid or gas
- Density of fluid
- Combined surface tension and fluid loading/buoyancy
- Piston effective area
- Piston distortion coefficient

Software is also available for

- Piston effective area calibration
- Area and mass calculations
- Differential Deadweight Testers

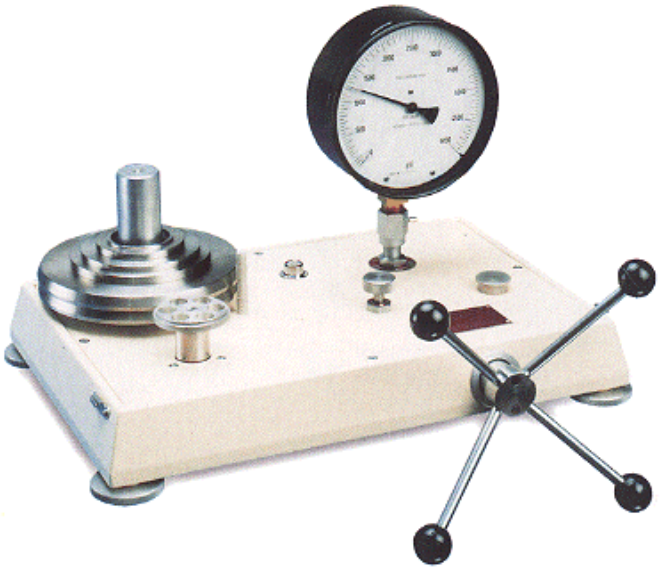
Technical specification:

- Run on an IBM compatible PC
- Supplied on 3.5" 1.44 mb diskettes
- 3 mb hard disk free space required
- Minimum 1 mb ram, recommend 2 mb or more
- Vga monitor or better (preferably colour)
- Require DOS version 3.2 or later
- Can run under WindowsTM and Windows '95™

DEADWEIGHT TESTERS

Hydraulic deadweight testers

- Accuracy better than 0.015% of reading. 0.010% reading available.
- Dual piston models allow calibration over a wide range.
- Piston automatically selected without valving or piston exchange.
- Overhanging weight carrier protects tungsten carbide piston, improves rotational spin, sensitivity and stability.
- Water models eliminate oil contamination.
- Pressure is generated by a integral ram screw.



OIL OPERATED MODELS

Dual piston series

Model	Range
M 1900/1 M 1900/3	1 to 300 bar 10 to 4000 psi
M 2000/1 M 2000/3	1 to 350 bar 10 to 5000 psi
M 2100/1 M 2100/3	1 to 600 bar 10 to 8000 psi
M 2200/1 M 2200/3	1 to 700 bar 10 to 10000 psi
M 2800/1 M 2800/3	1 to 1100 bar 10 to 16000 psi

Single piston series

M 1800/1 M 1800/3	1 to 35 bar 10 to 500 psi
M 4000/1 M 4000/3	1 to 120 bar 15 to 1800 psi
M 2000/1H M 2000/3H	10 to 350 bar 200 to 5000 psi
M 2200/1H M 2200/3H	20 to 700 bar 400 to 10000 psi
M 2800/1H M 2800/3H	20 to 1100 bar 400 to 16000 psi
M 2820/1 M 2820/3	20 to 1400 bar 400 to 20000 psi
M 3800/1 M 3800/3	30 to 2500 bar 500 to 40000 psi
M 3820/1 M 3820/3	40 to 4000 bar 500 to 60000 psi

Other pressure units available including kgf/cm² and kPa

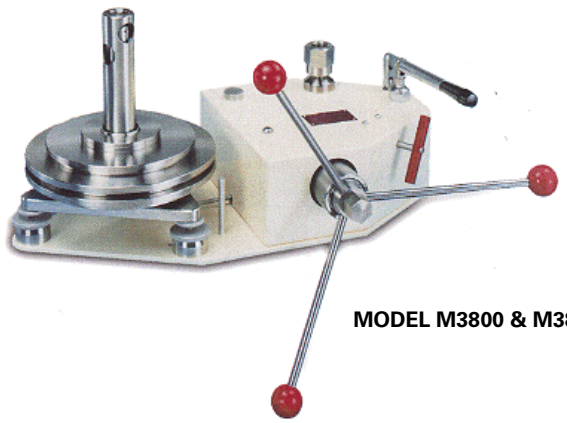
WATER OPERATED MODELS

Dual piston series

Model	Range
W 1900/1 W 1900/3	0.5 to 300 bar 5 to 4000 psi
W 2000/1 W 2000/3	0.5 to 350 bar 5 to 5000 psi
W 2100/1 W 2100/3	0.5 to 600 bar 5 to 8000 psi
W 2200/1 W 2200/3	0.5 to 700 bar 5 to 10000 psi

Single piston series

W 1800/1 W1800/3	0.5 to 35 bar 5 to 500 psi
W 2000/1H W 2000/3H	10 to 350 bar 200 to 5000 psi
W 2100/1H W 2100/3H	20 to 600 bar 400 to 8000 psi
W 2200/1H W 2200/3H	20 to 700 bar 400 to 10000 psi



MODEL M3800 & M3820

Optional extras

Built in hand pump

Large volume systems are easily primed.

Greatly speeds up priming and pressure generation.

Enables an effortless, small bore high pressure ram screw to be fitted.

There is no additional valve operation involved.

Standard on Models M2800, M2820, M3800, and M3820

Motor drive

If a continuous pressure is required, a motor drive can be provided to rotate the weights. Rotating the weights by hand is satisfactory for standard calibrations.

The motor is isolated from the Deadweight Tester by a thermal barrier, preventing warming of the measuring piston. The motor is suitable for 210/250, 105/125 volts at 50/60 HZ, please specify requirement at time of order.

Not available on models M2800, M2820.

Specifications

GENERAL

Accuracy
±0.015% of reading
±0.010% when specified
M3800, M3820
±0.02% of reading
±0.015% when specified

Total instrument weight 12 kg
Up to 1400 bar/20000 psi: 12 kg
M3800, M3820: 29 kg

Total boxed weight set
Up to 700 bar/10000 psi: 30 kg
M2800: 48 kg
M2820: 60 kg
M3800: 120 kg
M3820: 180 kg

Instrument size
47 x 32 x 20 cm L x D x H (including lid)
M3800, M3820: 63 x 41 x 33 x cm L x D x H

GENERAL

Piston carrier start pressure
Low pressure 0.2 bar, 0.2 kgf/cm^2 , 3 psi, 20 kPa
*High Pressure 5 bar, 5 kgf/cm^2, 100 psi, 500 kPa
*High Pressure (above 5000 psi, 350 bar) 10 bar, 10 kgf/cm^2, 200 psi, 1000 kPa
M4000: 1 bar, 1 kgf/cm^2, 15 psi, 100 kPa
M3800: 30 bar, 30 kgf/cm^2, 500 psi, 3000 kPa
M3820: 40 bar, 40 kgf/cm^2, 500 psi, 4000 kPa

* Dual Piston Instruments, high pressure range from 30bar/400psi

WEIGHT INCREMENT

Minimum standard weight increment
Low pressure piston 0.05 bar, 0.05 kgf/cm2, 1 psi, 5kPa
*High pressure piston x 10 or x 20 (for models above 5000 psi, 350 bar).
M4000: 0.2 bar, 0.2 kgf/cm2, 1 psi, 20 kPa
M3800, M3820:1 bar, 1 kgf/cm2, 20 psi, 100 kPa

Optional fractional weights (aluminium)
Low pressure piston 0.01 bar, 0.01 kgf/cm2, 0.1 psi, 1 kPa
*High Pressure Piston x 10 or x 20 (for models above 5000 psi, 350 bar).
M4000: 0.05 bar, 0.05 kgf/cm2, 0.5 psi, 5 kPa

* Dual Piston Instruments, high pressure range from 30bar/400psi

MATERIALS OF CONSTRUCTION

Weight material
Series 3 non magnetic austenitic stainless steel

Weight density
7.9 g/cm3

Piston material
Oil Operated: Tungsten Carbide
Water Operated: Stellite (up to 35 bar/500 psi)
Tungsten Carbide (above 35 bar/500 psi)

Cylinder material
Hardened martensitic steel, Tungsten Carbide (water above 35 bar/500 psi)

DEADWEIGHT TESTERS

Pneumatic deadweight testers

- **Accuracy better than 0.015% of reading. 0.010% available.**
- **Instruments up to 150 psi, 10 bar have fitted hand pumps as standard. Weights are stored within the case, ideal for on-site testing.**
- **Instruments up to 2000 psi, 140 bar and vacuum operate from an external air supply. Hand pumps can be fitted for both pressure and vacuum.**
- **T2700, T2900 are fitted with a ram screw to give fine control and compound pressure.**
- **Special models detailed on page 10.**

LIGHTWEIGHT PRESSURE MODELS

Model	Range
T 5100/1	15 to 250 mbar
T 5100/2	5 to 100 inH_2O
T 5250/1	15 to 600 mbar
T 5250/2	2 to 250 inH_2O
T 5400/1	15 to 1000 mbar
T 5400/2	5 to 400 inH_2O
T 5800/1	15 to 2000 mbar
T 5800/2	12 to 800 inH_2O

T9000 series utilises the following ball principle, and is available in the above ranges. Further information available.

PRESSURE MODELS

Model	Range
T 1150/1	15 to 1000 mbar
T 1150/3	5 to 400 inH_2O
T 1100/1	30 to 2000 mbar
T 1100/3	12 to 800 inH_2O
T 2400/1	0.2 to 7 bar
T 2400/3	3.0 to 100 psi
T 2500/1	0.2 to 10 bar
T 2500/3	3.0 to 150 psi
Model	**Range**
T 1400/1	0.2 to 30 bar
T 1400/3	3 to 400 psi
T 2300/1	0.2 to 35 bar
T 2300/3	3 to 500 psi

HIGH PRESSURE MODELS

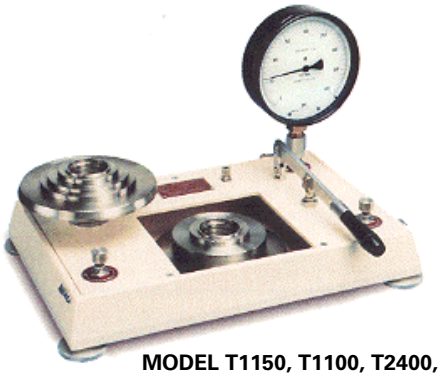
Model	Range	Model	Range
T 2700/1	1 to 70 bar	T 2700/1L	1 to 70 bar
T 2700/3	10 to 1000 psi	T 2700/3L	10 to 1000 psi
T 2900/1	1 to 140 bar	T 2900/1L	1 to 140 bar
T 2900/3	10 to 2000 psi	T 2900/3L	10 to 2000 psi

These instruments are fitted with liquid lubricated piston assemblies where cleanliness and environmental control cannot be assured

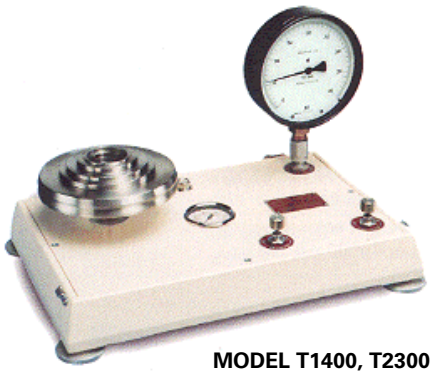
Other pressure units available including kfg/cm² and kPa

T5000 SERIES

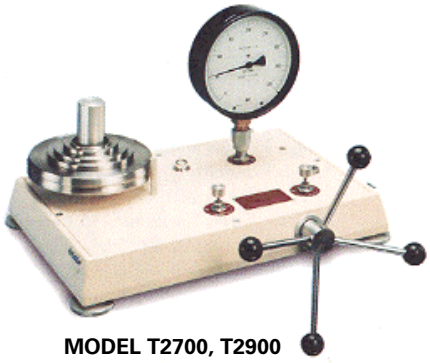
T9000 SERIES



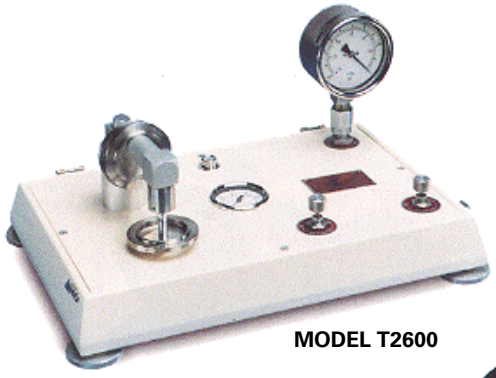
MODEL T1150, T1100, T2400, T2500



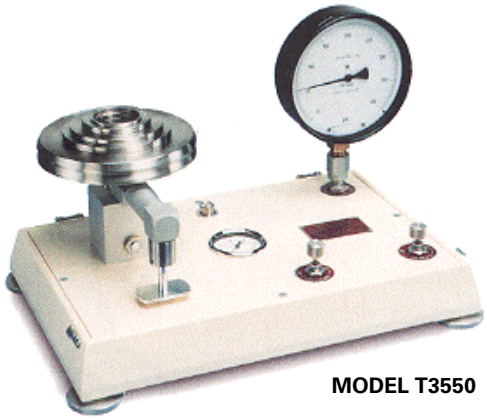
MODEL T1400, T2300



MODEL T2700, T2900



MODEL T2600



MODEL T3550

Optional extras

Built in hand pumps

To generate pressure (up to 150 psi, 10 bar) and/or vacuum (up to 80%), as illustrated on Page 5. Fitted as standard on models
T1150, T1100, T2400, T2500, T5000 SERIES

Specifications

GENERAL

Accuracy
±0.015% of reading
±0.010% when specified
Total instrument weight
10 kg
T5000: 4.7 kg to 8 kg
Total weight set
Variable from 4.5 kg to 30 kg
Instrument size including lid
47 x 32 x 20 cm L x D x H
T5000: 30 x 25 x 13 x cm L x D x H

WEIGHT INCREMENT

Minimum standard weight increment
T2400, T2500, T1400, T2300, T3400(P), T3500(P):
0.05 bar, 0.05 kgf/cm2, 1 psi, 5 kPa
T5100, T5250, T5400, T1150, T3550(P):
5 mbar, 0.5 kPa, 0.25 psi, 1 inH20
T5800, T1100, T3580(P):
10 mbar, 1 kPa, 0.5 psi, 2 inH20
T2700, T2900:
0.2 bar, 0.2 kgf/cm2, 1 psi, 20 kPa
T2600, T3400(V), T3500(V)
0.01 bar, 10mmHg, 0.2 inHg, 1 kPa

VACUUM MODELS

Model	Range
T 2600/1	0.03 to 1 bar
T 2600/3	1 to 30 in Hg

COMBINED PRESSURE & VACUUM MODELS

Two instruments in one, with a selector valve for pressure or vacuum.

Model	Range
T 3500/1	0.03 to 1 bar V 15 to 1000 mbar P
T 3550/3	1 to 30 inHg V 5 to 400 inH_2O
T 3580/1	0.03 to 1 bar V 30 to 2000 mbar P
T 3580/3	1 to 30 inHg V 12 to 800 inH_2O
T 3400/1	0.03 to 1 bar V 0.2 to 30 bar P
T3400/3	1 to 30 inHg V 3 to 400 psi P
T 3500/1	0.03 to 1 bar V 0.20 to 35 bar P
T 3500/3	1 to 30 inHg V 3 to 500 psi P

V = Vacuum P = Pressure

Motor drive

Available for models T2400, T2500, T1400, T2300, T2700, T2900 only.
Start point increases: Models T2400, T2500, T1400, T2300 to 0.25 bar. Models T2700, T2900 to 2 bar/40 psi.

OPTIONAL FRACTIONAL WEIGHTS (Aluminium)

T2400, T2500, T1400, T2300, T3400(P), T3500(P)
0.01 bar, 0.01 kgf/cm2, 0.1 psi, 1 kPa
T5100, T5250, T5400, T1150, T3550(P):
1 mbar, 0.1kPa, 0.1 psi, 0.5 inH20
T5800, T1100, T3580(P):
5 mbar, 0.5 kPa, 0.25 psi, 1 inH20
T2700, T2900:
0.05 bar, 0.05 kgf/cm2, 0.5 psi, 5 kPa

MATERIALS OF CONSTRUCTION

Weight material
Series 3 non magnetic austenitic stainless steel
Weight density
7.9 g/cm3
Piston material
Tungsten Carbide
T5000, T1100, T1150, Vacuum: Ceramic
Cylinder material
Hardened martensitic steel
T2700, T2900: Tungsten Carbide

DEADWEIGHT TESTERS

Comparison test pumps

These test pumps are used for checking pressure measuring instruments against master test gauges or transducers. All are portable or can be bench mounted. Supplied with BSP or NPT quick hand-tight sealing gauge adaptors.

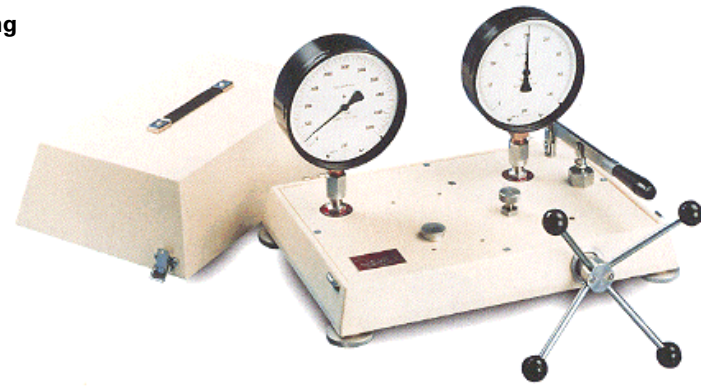
LIQUID

This is the most portable and flexible version of our comparison test pumps. The unit utilises our standard Deadweight Tester system. The piston and weights are replaced by a second test station to which either a test gauge, transducer or transfer standard is fitted for comparison with the instrument being tested. A hand pump is fitted giving the following benefits:

- Large volume systems are easily primed.
- Greatly speeds up priming and pressure generation.
- Enables an effortless, small bore high pressure ram screw to be fitted.
- There is no additional valve operation involved.

Model: T1300 is for oil applications.
Model: T1301 is for water application with all wetted parts stainless steel.

Model: T1300 T1301	Range: 0 to 1400 bar	0 to 20000 psi

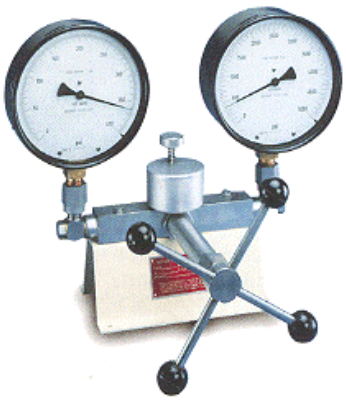


MODEL T1300

LIQUID

Tested with water and suitable for use with:
water, mineral/vegetable oil, alcohol.
Fitted with a reservoir and valve, pressure is quickly generated with the ram screw.

Model: T1200	Range: 0 to 700 bar	0 to 10000 psi



MODEL T1200

MODEL T4100

AIR

Pressure is generated with the sensitive hand pump and is vented with a fine control needle valve.

Model: T4100	Range: 0 to 20 bar	0 to 300 psi

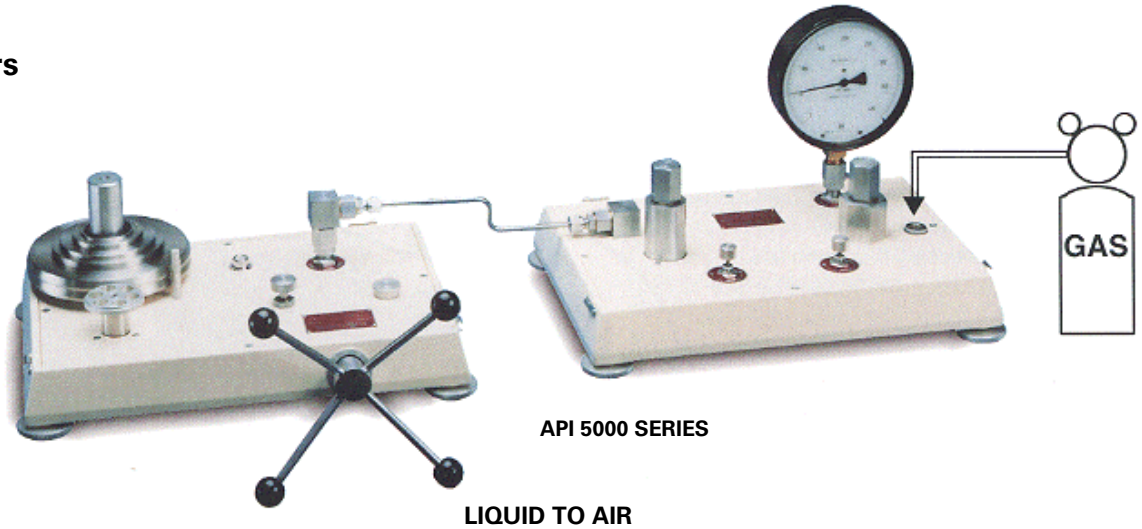
MODEL T4200

VACUUM

Vacuum is generated quickly & easily with the hand pump and vented with a fine control needle valve.

Model: T4200	Range: 0 to 80% Vacuum

Separators

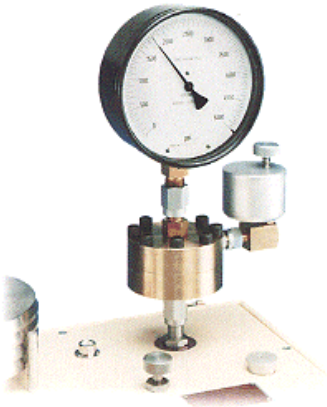


API 5000 SERIES

LIQUID TO AIR

For high pressure pneumatic calibration, this unit interfaces with hydraulic deadweight testers, giving a rateless liquid to air separation. A series of fluid traps ensures the instrument under test remains dry. Needle valves control the pressure, and the deadweight tester ram screw controls the fluid level. Please specify if interface is for oil or water application.

Model: API5000/1	Range: 0 to 300 bar 0 to 4000 psi
Model: API5000/2	Range: 0 to 450 bar 0 to 6000 psi
Model: API5000/3	Range: 0 to 700 bar 0 to 10000 psi

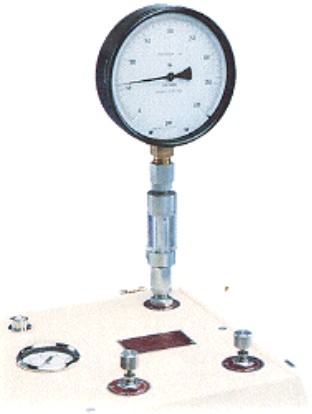


MODEL T3600

LIQUID TO LIQUID

This unit has a flexible "Viton" diaphragm, separating the deadweight tester fluid and a non contaminating liquid. Any liquid can be used that is compatible with "Viton" and aluminium bronze. The unit also protects the deadweight tester from contamination.

Model: T3600	Range: 0 to 600 bar 0 to 8000 psi
Model: T3601	Range: 0 to 700 bar 0 to 10000 psi

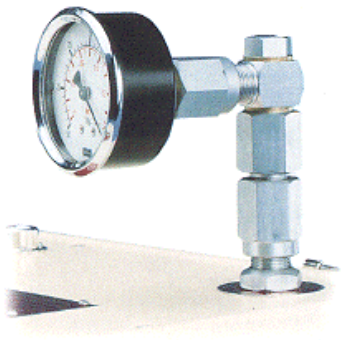


MODEL T4400

DIRT/MOISTURE TRAP

Protects pneumatic Deadweight Testers, when the cleanliness of the instrument under test cannot be guaranteed. The unit is mounted directly onto the test station. Particles and moisture are trapped within the body, which are visible on Model T4400.

Model: T4400	Range: 0 to 35 bar 0 to 500 psi
Model: T4401	Range: 0 to 700 bar 0 to 10000 psi



MODEL T3700

TWO GAUGE ADAPTOR

To calibrate two instruments at the same time. This adaptor is mounted directly onto the test station.

Model: T4500	Range: 0 to 700 bar 0 to 1000 psi

MODEL T4600

ANGLE ADAPTOR

To calibrate back connection gauges, the angle adaptor fits directly onto the test station, converting it through 90° , allowing the same adaptors to be used.

Model: T3700	Range: 0 to 700 bar 0 to 10000 psi

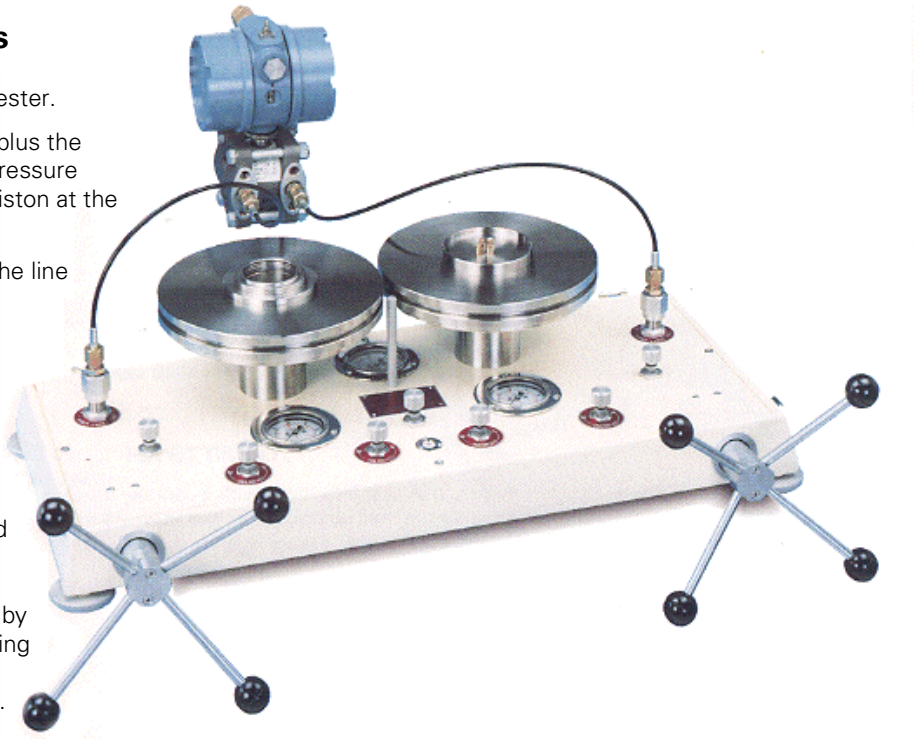
POINTER REMOVER/PUNCH

To remove and refit the pointer of a pressure gauge. This two in one tool has a spring loaded plunger to quickly & consistently refit the pointer.

Model: T4600

DEADWEIGHT TESTERS

Differential Deadweight Testers



- Can be used as a standard Deadweight Tester.
- Accuracy better than 0.015% of reading, plus the differential uncertainty. (The differential pressure between balance piston and measuring piston at the specific line pressure.) 0.010% available.
- The unit of pressure can be different for the line pressure and differential pressure ie line pressure up to 1800 psi differential range 0 to 200 inH_2O.

Two deadweight tester systems are built into a single instrument with a cross-connecting valve. The two systems are pressurised in parallel with the cross-connecting valve open, until both pistons and weights are floating at the specific line pressure. With the cross connecting valve closed the differential pressure is generated by each additional weight loaded to the measuring piston. The balance piston remains floating, ensuring that the line pressure is maintained.

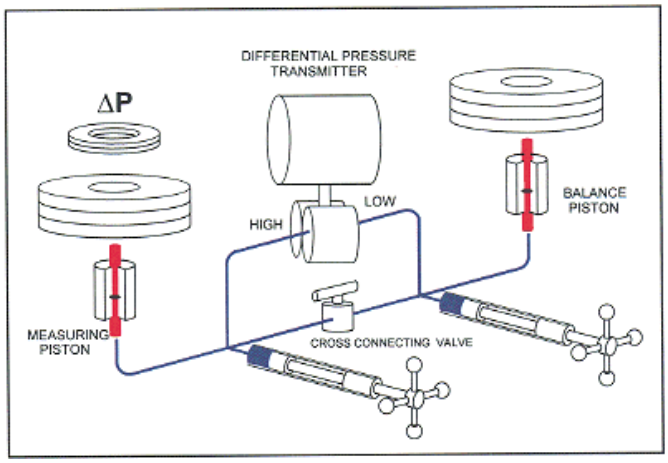
OIL OPERATED MODELS

Model	Range	Differential Uncertainty
M 1800/1D	2 to 35 bar	0.0002 bar
M 1800/3D	20 to 500 psi	0.003 psi
M 4000/1D	2 to 120 bar	0.0002 bar
M 4000/3D	30 to 1800 psi	0.003 psi
M 2000/1D	30 to 350 bar	0.00035 bar
M 2000/3D	400 to 5000 psi	0.005 psi
M 2200/1D	60 to 700 bar	0.003 bar
M 2200/3D	800 to 10000 psi	0.01 psi

AIR OPERATED MODELS

Model	Range	Differential Uncertainty
T 1100/1D	130 to 2000 mbar	0.0025 mbar
T 1100/3D	50 to 800 inH_20	0.01 inH_20
T 2500/1D	0.25 to 10 bar	0.000025 bar
T 2500/3D	7.0 to 150 psi	0.0004 psi
T 1400/1D	0.25 to 30 bar	0.000035 bar
T 1400/3D	7.0 to 400 psi	0.0005 psi
* M 4000/1DA	2 to 100 bar	0.0002 bar
* M 4000/3DA	30 to 1500 psi	0.003 psi

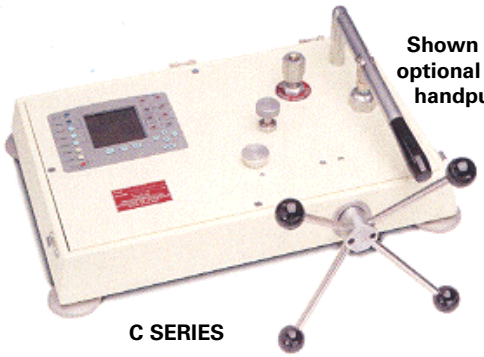
*** Further information available**



MODEL A6100

MODEL V1600D

MODEL P7000



Shown with optional fitted handpump

C SERIES

Other Instruments Available

Combined Absolute & Gauge Pressure Standard Model 6100

- Accuracy from 0.005% of reading

Pressurements Model 6100 operates over an extremely wide pressure range. Three standard ranges (piston and weight set) are available to fit into the instrument base:

Low (L)	Range 30 to 2000 mbar/0.5 to 30 psi
Mid (M)	Range 0.25 to 20 bar/3 to 300 psi
High (H)	Range 20 to 70 bar/300 to 1000 psi

Further information available

Low Pressure Standards Model V1600D

- Accuracy better than 0.020% of reading
- Differential model shown

Models V1600 and V1600D are primary pressure standard for the calibration of low pressure, positive and negative differential.

Range 0.05 to 160 mbar/0.025 to 64 inH2O

Further information available

High Accuracy Pressure Standards Model P7000

- Accuracy better than 0.005% of reading
- Integrated Hardware and Software Systems
- Special Dual Based Deadweight Tester calibrating option

The P7000 has been designed for pressure measurements to the highest level of accuracy. The wide range of options ensures maximum flexibility.

Ranges 15mbar to 1400 bar / 5 inH20 to 60000 psi

Further information available

Low Cost Hydraulic Deadweight Tester L Series

- Accuracy 0.1% of reading, Pressure ranges 0.2 to 700 bar / 2 to 10000 psi

Further information available

C Series, Digital Pressure Calibrators

- Accuracy 0.025% full scale
- Pressure ranges up to 700 bar / 10000 psi
- Oil, Water or Gas operated
- Dual pressure and electrical measurement/readout
- In-built pressure generation

Further information available

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Due to Pressurements continuous improvement, specifications are subject to change without notice

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