



E-DWT, A Modern Alternative to the Conventional Deadweight Tester

Topics We Will Discuss

- Overview of High Pressure Calibrations
- Traditional Method of Performing High Pressure calibrations – Deadweight Tester
- Disadvantages of Deadweight Tester
- New Idea To Improve the process – Electronic Deadweight Tester (E-DWT)
- E-DWT features/benefits

High Pressure Calibration

What is High Pressure?

Above 500 kPa?

Above 4 MPa ?

Above 100 MPa?

YES – Depends on the user



Usually Liquid is used as Medium Why?

- Liquid is non compressible
- Much safer than gas; very little stored energy
- Relatively easy and low cost to generate pressure

High Pressure Calibration

What type of instruments do we calibrate?

Gauges, sensors, transmitters and DWTs

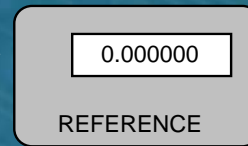
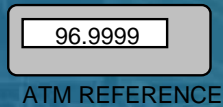


Pressure gauges are still among the most common instruments calibrated in labs and shops.

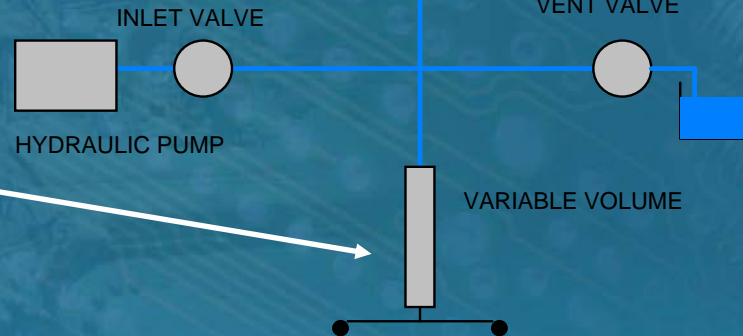
High Pressure Calibration

A typical system includes...

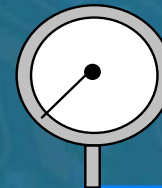
Reference Pressure Instrument(s)



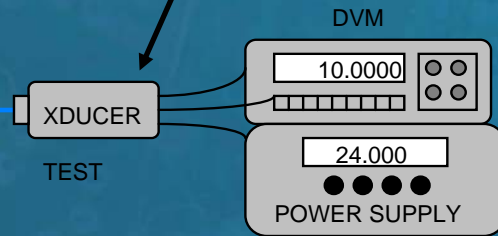
Pressure Generation and Control



TEST GAUGE



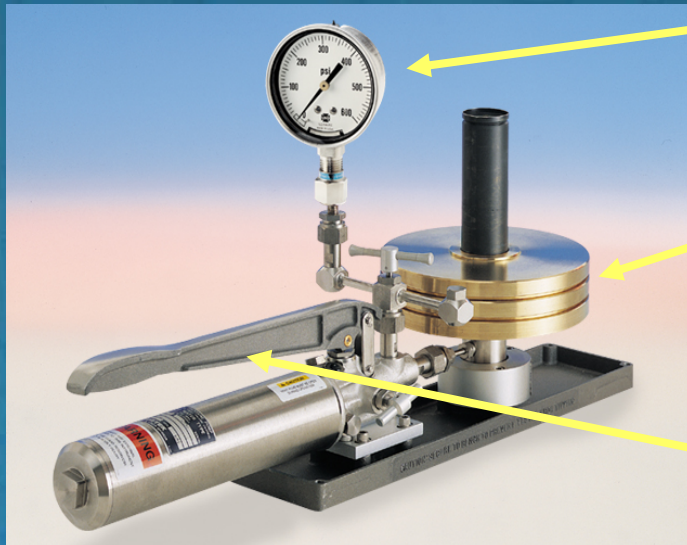
Instrument to be calibrated (UUT)



Traditional High Pressure Calibration Solution

Deadweight Tester

Test Instruments



Reference Pressure Measurement

Pressure Generation and control



Traditional High Pressure Calibration Solution

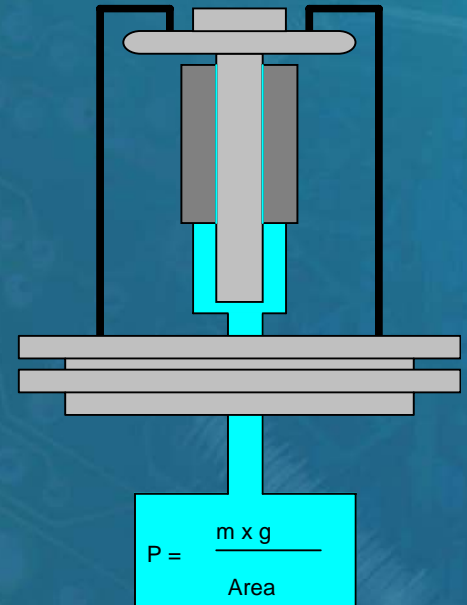
Deadweight Tester

Pressure is a force over an area

$$P = F/A$$

Mass x Gravity

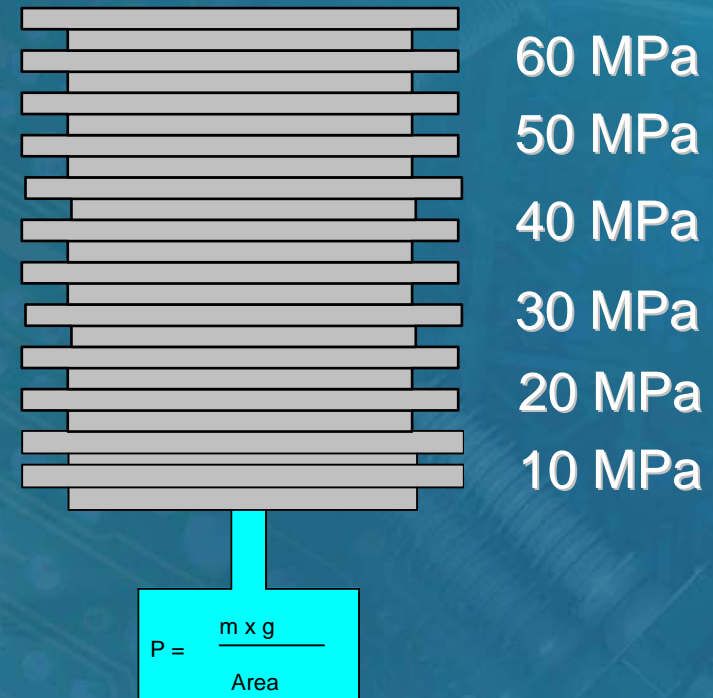
Effective Area of Piston-Cylinder



Traditional High Pressure Calibration Solution

Deadweight Tester

- Each Mass = Specific Pressure
- More Mass = Higher Pressure



Disadvantages of a Deadweight Tester

1. Must know gravity at location
2. Lots of parts to calibrate
3. Needs to be level and stationary
4. Pressure units are limited to the ONE that masses and piston are sized for
5. Does not measure pressure – Sets specific pressure defined by masses loaded, must ensure that correct mass is loaded. Limited pressure resolution
6. For more accurate applications we need to know a wide variety of operating and environmental conditions



A New Idea

Instead of using a piston and masses to define pressure why not simply read a digital output?

What are the limitations?



RPM4

Does it have low enough measurement uncertainty?

A New Idea

We still need to
generate and
control the
pressure.



MPG2

A New Idea

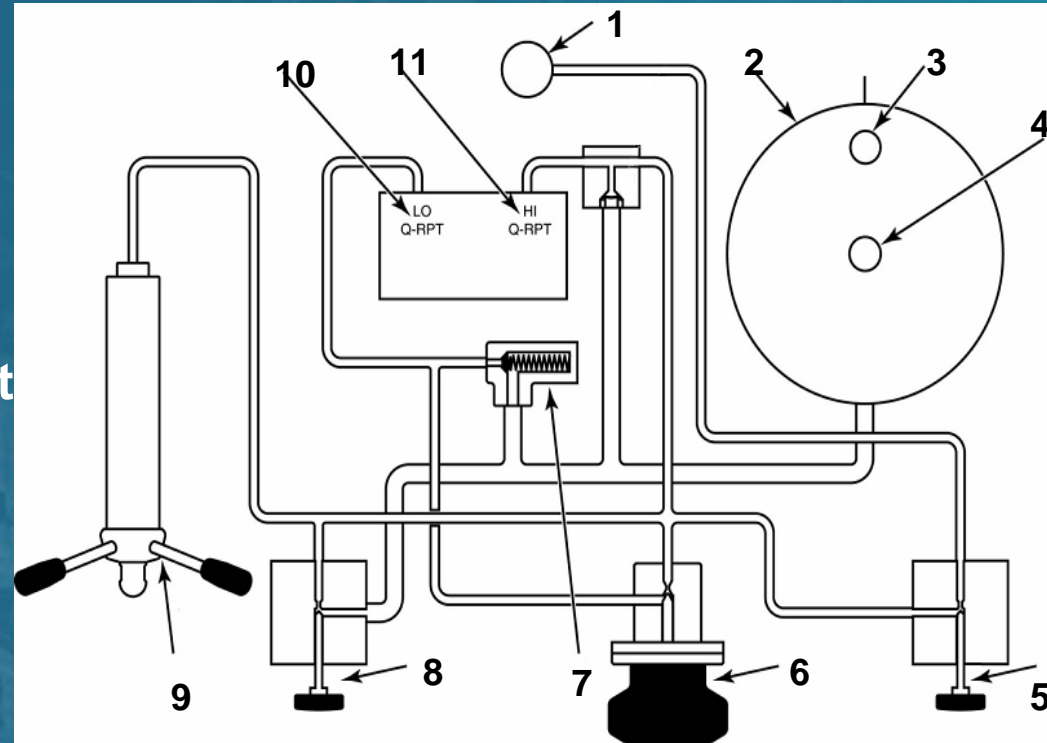
Why not combine pressure control and digital measurement along with convenient UUT connections and dedicated programming into the same package?



Electronic Deadweight
Tester
E-DWT

A New Idea

1. Test Port
2. Reservoir
3. Reservoir Vent Valve
4. Priming Pump
5. Test Shut Off Valve and Fine Pressure Adjustment
6. Lo Q-RPT Shut Off Valve
7. Lo Q-RPT Pressure Relief Valve
8. Reservoir Shut Off Valve
9. Variable Volume Pump
10. Lo Q-RPT (Ref Transducer)
11. Hi Q-RPT (Ref Transducer)



Electronic – Deadweight Tester

E-DWT has everything you need to perform high pressure, hydraulic calibrations

Test Instrument Connections on Top and Back

Pressure Generation/Control



Reservoir & Priming Pump

Fine Pressure Adjust

Reference Pressure Measurement

Electronic – Deadweight Tester Features

1. Pressures up to 200 MPa (30,000 psi)
2. One or two reference sensors
3. Uncertainty $\pm 0.025\%$ of reading
4. Two reference sensors provide $\pm 0.025\%$ reading from 1 to 100% of E-DWT range
5. Active pressure display eliminates mass/pressure errors
6. Reference sensors are only metrological elements - no need to ship masses away for regular calibrations
7. Unlimited pressure control resolution



Electronic – Deadweight Tester Features

1. System provides Ready/Not Ready indication based on stability
2. Built-in AutoTest calibration routines prompt user through the calibration sequence
3. AutoTest data can be manually viewed or requested via remote command by PC
4. Electronic output also allows for automated data collection using calibration software



**Run AutoTest:
1Quick 2File**

**5669.8 psi g Hi
F5670.4 5/11**

**AutoTest complete
1data 2new 3repeat**

Electronic – Deadweight Tester Features

1. Lightweight for easy transport, ~15 kg (35 lb)
2. Battery options for up to 8 hours of field operation
3. Rugged, reusable case with handle and wheels is available



Electronic – Deadweight Tester Summary

- An Electronic Deadweight Tester provides the features that make Deadweight Testers popular but it avoids the negatives of these devices.
- Pressure can be adjusted to where it is required making it very convenient to calibrate analog gauges because the needle can be put on the exact point and the precise pressure is read from the digital display.

Electronic – Deadweight Tester Summary

- On-board calibration routines that can automate calibrations for gauge calibrations. The E-DWT logs the final pressure at each point and provides in/out of tolerance determination.
- Another benefit of the Electronic Deadweight Tester is the UUT filling and priming pump. This is very easy so you don't have to use variable volume stroke to fill and prime the system.

Questions

