FLUKE®
Calibration

P3117/P3118/P3119

High-Pressure Hydraulic Deadweight Tester

Users Manual

December 2025 (English)

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Introduction

This manual contains operation and routine and preventive maintenance instructions for the P3117/P3118/P3119 High-Pressure Hydraulic Deadweight Tester (the Product).

This manual covers these oil operated instruments:

- P3119: 60,000 psi/400 MPa
- P3118: 40,000 psi/260 MPa
- P3117: 30,000 psi/200 MPa

Contact Fluke

Fluke Corporation operates worldwide. For local contact information, go to our website: www.fluke.com.

To register your product, or to view, print, or download the latest manual or manual supplement, go to our website.

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Safety Information

General Safety Information is in the printed Safety Information document that ships with the Product and at www.fluke.com. More specific safety information is listed where applicable.

A **Warning** identifies hazardous conditions and procedures that are dangerous to the user. A **Caution** identifies conditions and procedures that can cause damage to the Product or the equipment under test.

Specifications

Pressure Ranges

P3117	500 psi to 30 000 psi, or 40 bar to 2 000 bar, or 4 MPa to 200 MPa
P3118	500 psi to 40 000 psi, or 40 bar to 2 600 bar, or 4 MPa to 260 MPa
P3119	500 psi to 60 000 psi, or 40 bar to 4 000 bar, or 4 MPa to 400 MPa

Instrument Measurement Uncertainty

Standard Accuracy[1]	±(0.02 % of reading or 0.001 % of range, whichever is greater)
Optional (Improved Accuracy)[2]	±(0.015 % of reading or 0.00075 % of range, whichever is greater)

[1] Correction factors are not necessary for the standard accuracy of 0.02 % of reading when used within the stated environmental limits of:
Ambient temperature: 18 °C to 28 °C
Ambient pressure: 80 kPa to 105 kPa
Location: local gravity adjusted weights

[2] Windows-based PressCal software program is available and allows users to easily apply all necessary corrections needed for the specific piston range and accuracy.

Note

For more information on the uncertainty, including the % reading threshold, see technical note, Guide for the Uncertainty Analysis in Pressure When Using P3000 Series Deadweight Testers at www.fluke.com.

Standard Weight Materials	Series 3 non-magnetic, austenitic, stainless steel Density: 7.8 g/cm^3
Piston Materials	Tungsten carbide with nickel binder
Cylinder Material	Tungsten carbide with cobalt binder
Thermal Coefficient of Expansion	11 ppm/°C
Test Port Adapters	DH500, equivalent to HiP 60-xxxx high pressure fittings (60 000 psi) for ¼ in and 3/8 in tube sizes
Weight	10.5 kg (23 lb)
Dimensions (W x D x H)	457 mm x 508 mm x 508 mm (18 in X 20 in X 20 in)
Mass Set Weight	45.5 kg (100 lb)
Reservoir Volume	150 cc
Minimum Weight Increments	2 bar, 0.2 MPa, 20 psi
Optional Fine Increment Weight	Minimum increments of 0.2 bar, 0.02 MPa, 2 psi
Seal Materials	Viton and Buna
Operating Fluid	Sebacate, our reference 3069551 (1 gallon standard)

Temperature

Operation	18 °C to 28 °C (64 °F to 82 °F)
Storage	10 °C to 50 °C (50 °F to 122 °F)

Relative Humidity (Non-Condensing)

Operation ..... 20 % to 75 %
Storage ..... 0 % to 90 %

Operating Principle

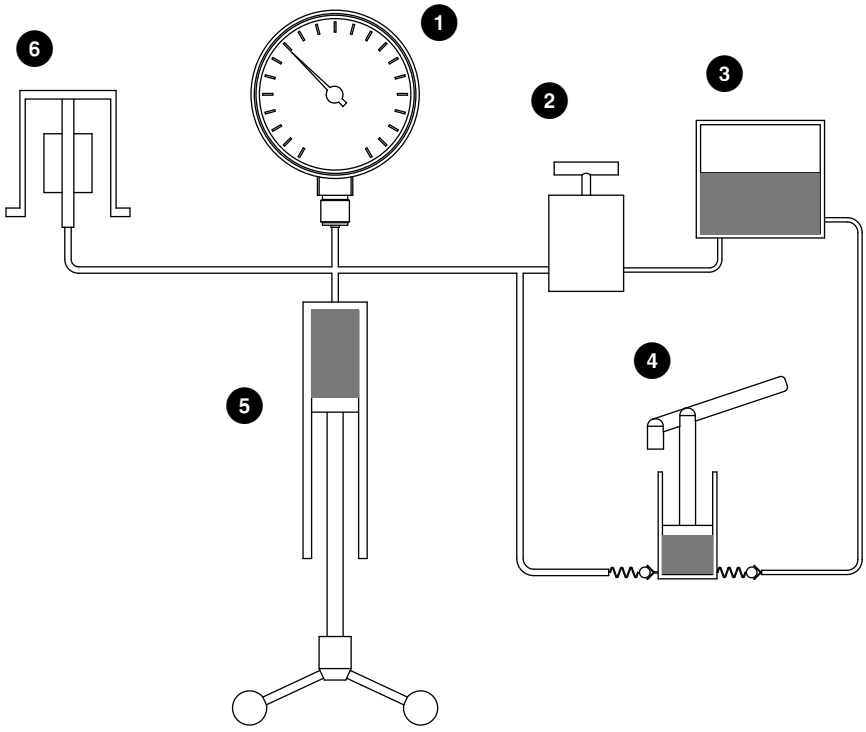
Deadweight testers are the primary standard for pressure measurement. Using a piston-gauge system that consists of a vertically-mounted, precision-lapped piston and cylinder assembly, accurately calibrated weight masses (Force) are then loaded onto the piston (Area). The piston rises freely within its cylinder. These weights balance the upward force created by the pressure within the system.

$$\text{PRESSURE} = \frac{\text{FORCE}}{\text{AREA}}$$

Each weight is marked with the Product serial number and the pressure measured when placed on a correctly spinning and floating piston. The total pressure measured is the sum of the weights + the piston weight carrier assembly.

Table 1 shows the basic hydraulic circuit for a single-PCU (piston cylinder unit) instrument.

Table 1. Hydraulic Circuit Schematic



Item	Description	Item	Description
1	DUT	4	Priming Pump
2	Reservoir Valve	5	Screw Pump
3	Reservoir	6	High Pressure PCU

The system is primed with liquid from the reservoir and the screw pump increases the system pressure. As liquids are considered incompressible, the displaced liquid causes the pistons to rise within their cylinders to balance the downward force of the weights.

Fluids at the same height in a system are at the same pressure, so when the system is in equilibrium (for example, the piston and weights float freely, rotating and falling at its natural sink-rate), the pressure generated by the combined mass of the piston and weights equals the pressure within the Device Under Test (DUT).

The design of a piston/cylinder unit (PCU) fitted to a deadweight tester allows for a small clearance gap between the piston and cylinder. This is required to allow the working fluid to pass between the components. This provides lubrication and prevents metal-to-metal contact.

Therefore, during the normal operation of the Product, the fluid in the system slowly passes through this clearance gap. This is normal and there is a sump ring around the piston body to collect excess fluid, and then capture it in a container.

See *Specifications* for operating and storage specifications.

Environmental Corrections

The Product is calibrated to the gravity, temperature, and air density stated on the calibratio certificate.

Equations and factors are given on the calibration certificate to adjust for any variations in these environmental conditions.

Gravity

Gravity varies greatly with geographic location and so will the reading of the Product.

Due to the significant change in gravity throughout the world (0.5 %), ensure that the Product has either been manufactured to your local gravity, or that you have applied the correction from the calibrated gravity.

Example:

Deadweight Tester calibrated gravity	980.665 cm/s^2
(980.665 cm/s^2 is the International Standard Gravity)	
Gravity at site	981.235 cm/s^2
Indicated Pressure	250 psi

$$\text{TRUE PRESSURE} = \frac{981.235}{980.665} \times 250$$

$$TRUE\ PRESSURE = 250.1453\ psi$$

The ability to determine the local gravity value depends on the data available in the country of instrument use. Some countries have geographic/geological survey/mapping organizations that have the data readily available. If not, the countries' National Standards Laboratory may be able to recommend a source of suitable information.

Temperature

Temperature and air density variations are less significant than gravity. Correct variations when you require maximum accuracy.

Temperature variation example:

Deadweight Tester calibrated temperature	20 °C
Operating temperature	24 °C
Percentage change per °C	0.002 %
Indicated Pressure	250 psi

$$\text{TRUE PRESSURE} = 250 + (20\text{-}24) \text{ x } \frac{0.002 \text{x } 250}{100}$$

$$TRUE\ PRESSURE = 249.98\ psi$$

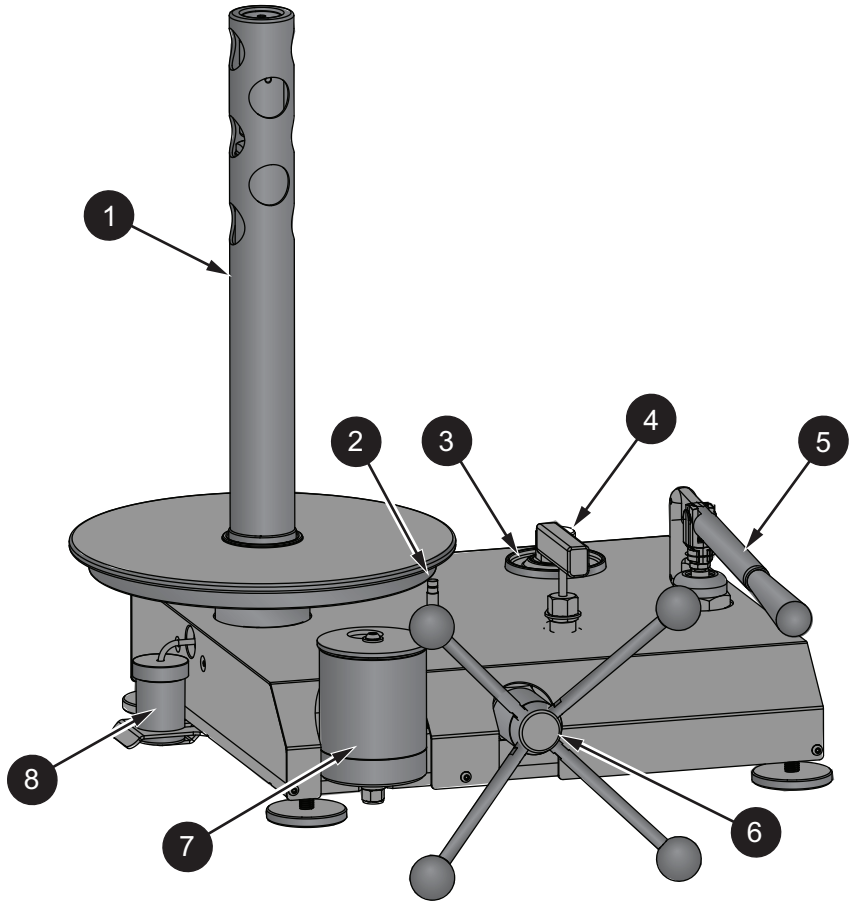
Head of Fluid

The pressure measured is at the top of the test port.

Compensate for the vertical height difference between this datum and the connection to the DUT. To correct for vertical heights above and below the datum line, either subtract or add respectively the amount stated on the calibration certificate.

To maintain accuracy, the piston and weights must be kept clean and undamaged. The Product is accurate when the piston and weights are floating and rotating freely, see Table 2.

Table 2. Deadweight Tester



Item	Description
1	High Pressure PCU
2	Indicator Rod
3	Test Port
4	Reservoir Valve
5	Priming Pump
6	Screw Pump Handles (into Capstan Hub)
7	Reservoir
8	Waste Oil Container

Preparation

To prepare the Product for use:

1. Set up the Product on a level, stable workbench or similar surface. Remove spokes from the accessory bag and fit to capstan hub.
2. Remove the priming pump handle from the accessory bag and fit it to priming pump.
3. Remove the waste oil container from the accessory bag and place it into the waste oil container tray, then insert the waste oil tube into the waste oil container.
4. Level the Product with the four adjustable feet to the spirit level supplied in the accessory bag. Use the spirit level to ensure the mounting post is plumb.
5. Rotate the reservoir dust cover to uncover the filling hole and fill the reservoir approximately ¾ full of the operating fluid. Rotate the dust cover back to the cover hole.

Operating Fluid

Oil: The Product is supplied with Di2-EthylHexyl Sebacate (synthetic oil).

⚠ Caution

To prevent Product damage:

- **Use the Product only with the fluids described above. Use of other fluids can affect the operation and performance of the Product and can cause permanent damage.**
- **Check the quality of the operating fluid during use. If the fluid becomes discolored, cloudy, or particles appear in the reservoir, drain the system and flush with clean fluid.**

Connections

Fit the DUT to the test port with the method described in this section:

⚠ Caution

To prevent Product damage:

- **Ensure that all devices are internally clean and free from contamination before connecting to the tester.**
- **Particle contamination can damage the sensitive piston assemblies, valve seats, and screw pump.**

Note

To prevent incorrect sealing and leakage, do not use PTFE tape on these connections.

Standard Test Port Connection

The standard test port connection is DH500 (cone and threaded connection compatible with Autoclave F250C and HIP HF4).

Note

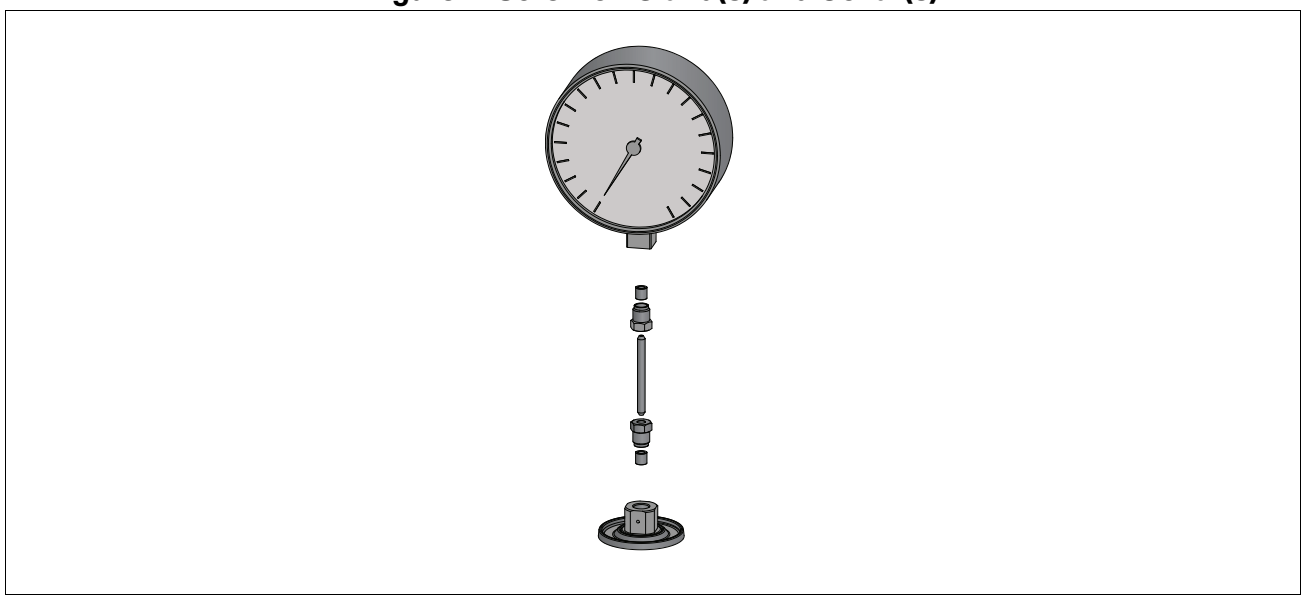
The thread on the DH500 collar, and the gauge/nipple are left-handed.

DUT Connection

To connect a DUT:

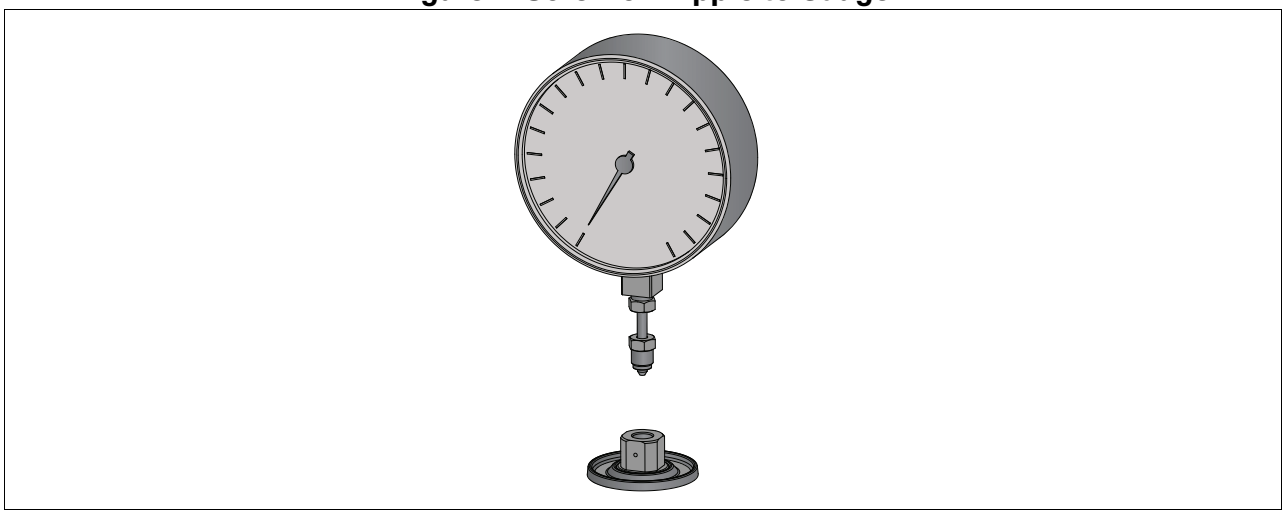
1. Place gland(s) onto the gauge stem/nipple and then thread on the collar(s). Ensure that 2 to 3 threads show between collar and cone. See Figure 1.

Figure 1. Screw on Gland(s) and Collar(s)



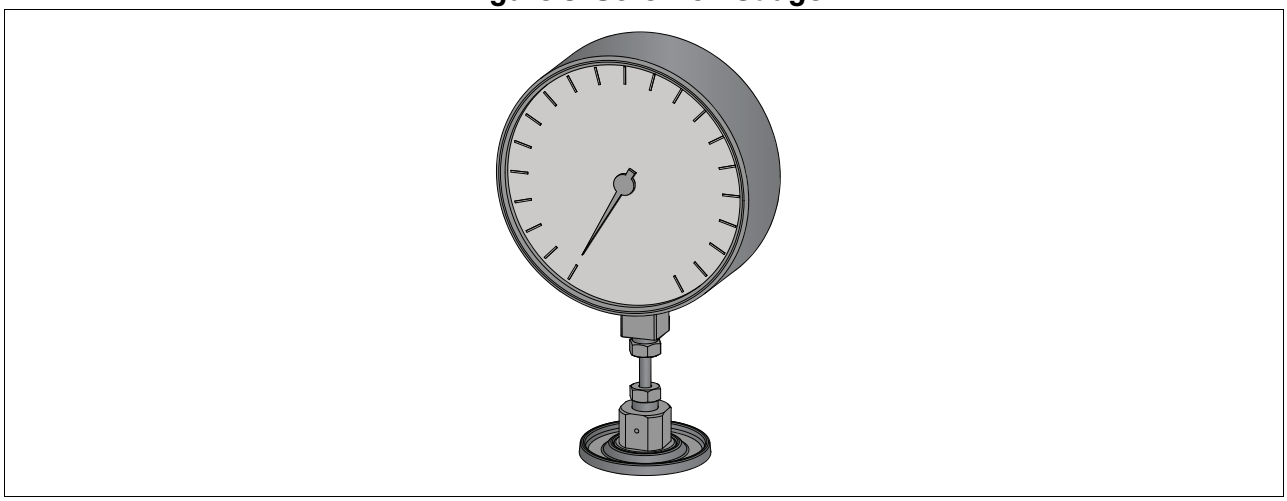
2. If applicable, tighten the nipple into the gauge with a 5/8 in wrench and the appropriate backup wrench for the gauge. See Figure 2.

Figure 2. Screw on Nipple to Gauge



3. Use 5/8 in and 1 in wrenches to tighten the gauge into the test port. See Figure 3.

Figure 3. Screw on Gauge



PK-DH500-P3000 Connection

For pressures of 20,000 psi/1,400 bar and below, a DH500 to P3000 gauge adapter sealing system is supplied.

⚠ Caution

To prevent Product damage:

- **To prevent thread damage or sealing faces, do not over tighten. The gauge adapter sealing system is for hand-tight sealing up to 20,000 psi / 1,400 bar. Wrenches or similar tools are not required.**
- **Before connection, ensure that there is an O-ring fitted to the test port.**
- **Check that the sealing face of the device to be fitted is clean and undamaged. Scratches or dents can form leak-paths.**

Note

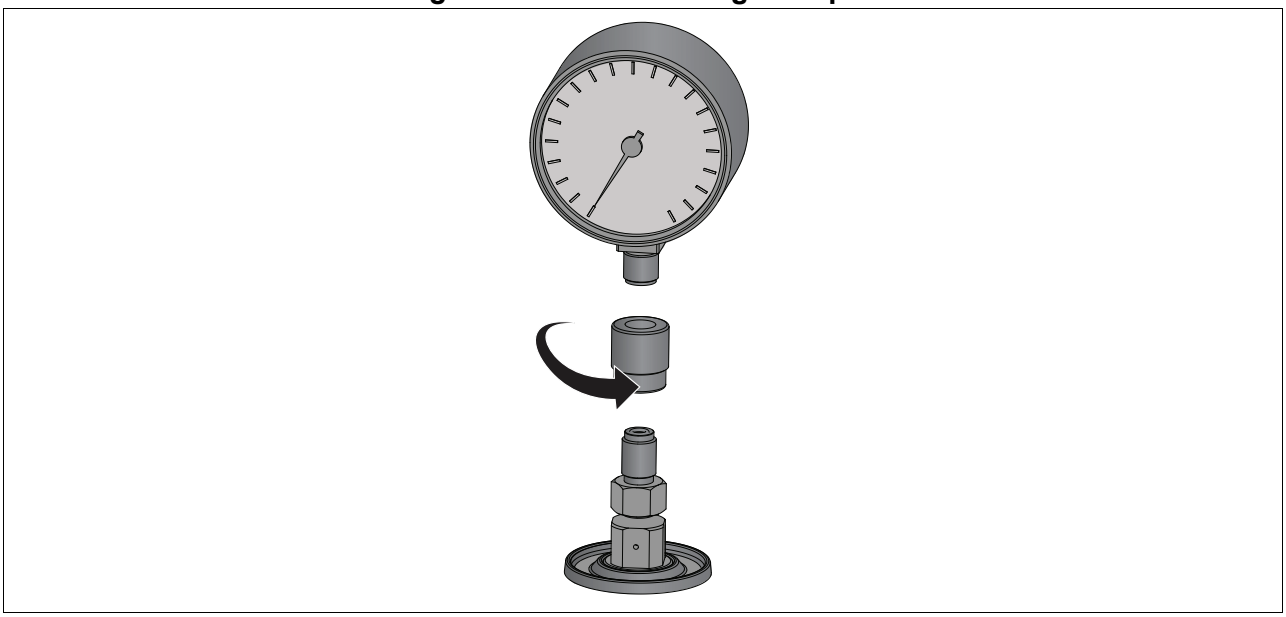
The thread on the test port, and the lower part of the gauge adapters is left-handed. The next procedure details the correct method to mount devices using these adapters

DUT Connection

To connect the DUT:

1. Screw the appropriate gauge adapter fully on to the DUT. See Figure 4.

Figure 4. Screw on Gauge Adapter

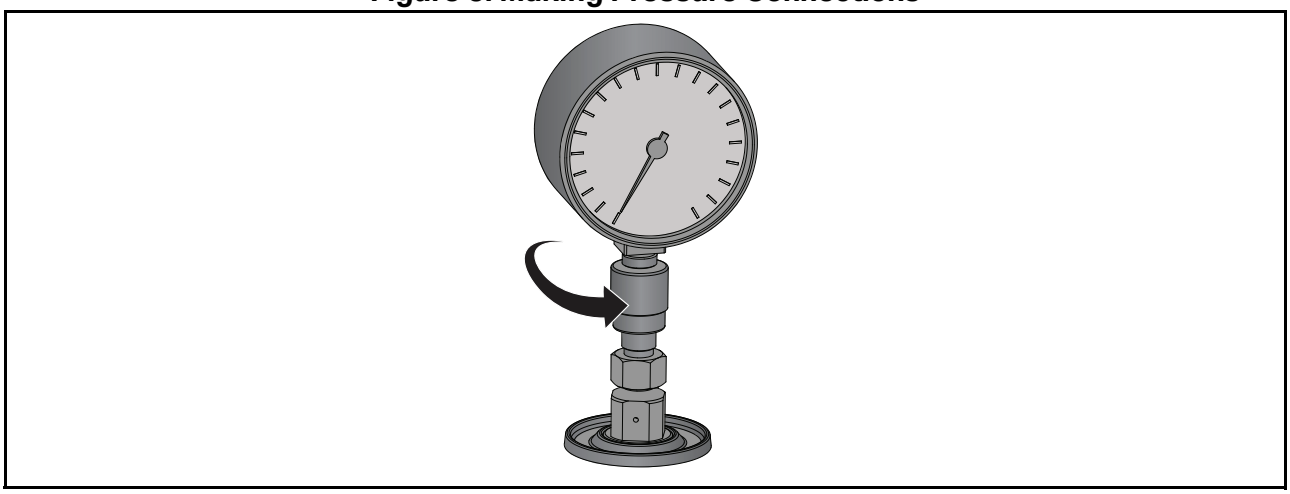


2. Screw the assembly down counterclockwise on to test port.

Note

Hand-tight is sufficient. Make sure that the bottom face contacts the O-ring on the test port. See Figure 5.

Figure 5. Making Pressure Connections



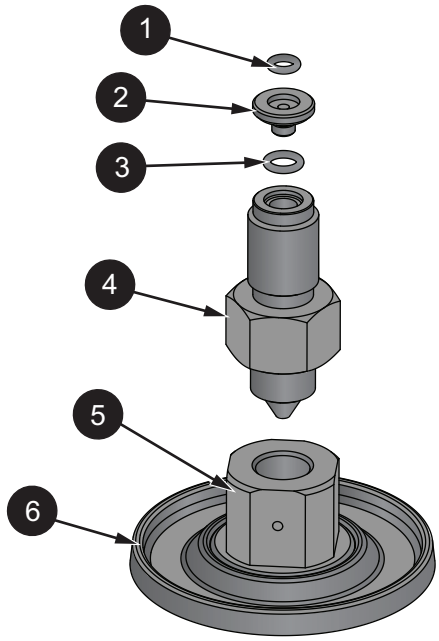
3. To adjust the position to face forward, hold the gauge adapter and turn it counterclockwise, so that it faces forward. Hold the instrument steady while turning the gauge adapter counterclockwise until it pulls down onto the O-ring.

Test Port Insert

For devices with 1/8 BSP or NPT mounting threads, the diameter of the thread is close to the effective sealing diameter of the O-ring fitted to the test port.

This can make it difficult to achieve a good seal. When mounting these devices, use the test port insert as shown in Table 3.

Table 3. ATCL and Test Port Insert Parts List



Item	Description	Part Number
1	2-008 VITON O RING	3865163
2	TEST PORT INSERT	3919892
3	2-011 VITON O RING	3865174
4	ATCL TEST PORT	3919877
5	TEST PORT	5598503
6	SUMP RING	3921391

Priming

To prime the Product:

1. Open the reservoir valve one turn counterclockwise and turn capstan fully in.
2. Pump the priming pump two times.
3. Close the valve and turn the capstan fully out.

4. Open the valve and turn capstan fully in.

Note

During this operation, bubbles may appear in the reservoir as trapped air is expelled. For large volumes, repeat steps 3 and 4 until no further bubbles appear.

5. With the valve open, turn the capstan fully out and close the valve. The Product is now ready for use.

⚠ Caution

Turning the capstan out with the reservoir valve closed generates approximately 15 inHg / 0.5 bar vacuum. If the DUT is vacuum sensitive, leave the valve open during priming operation to prevent damage to the DUT.

Operation

To operate the Product:

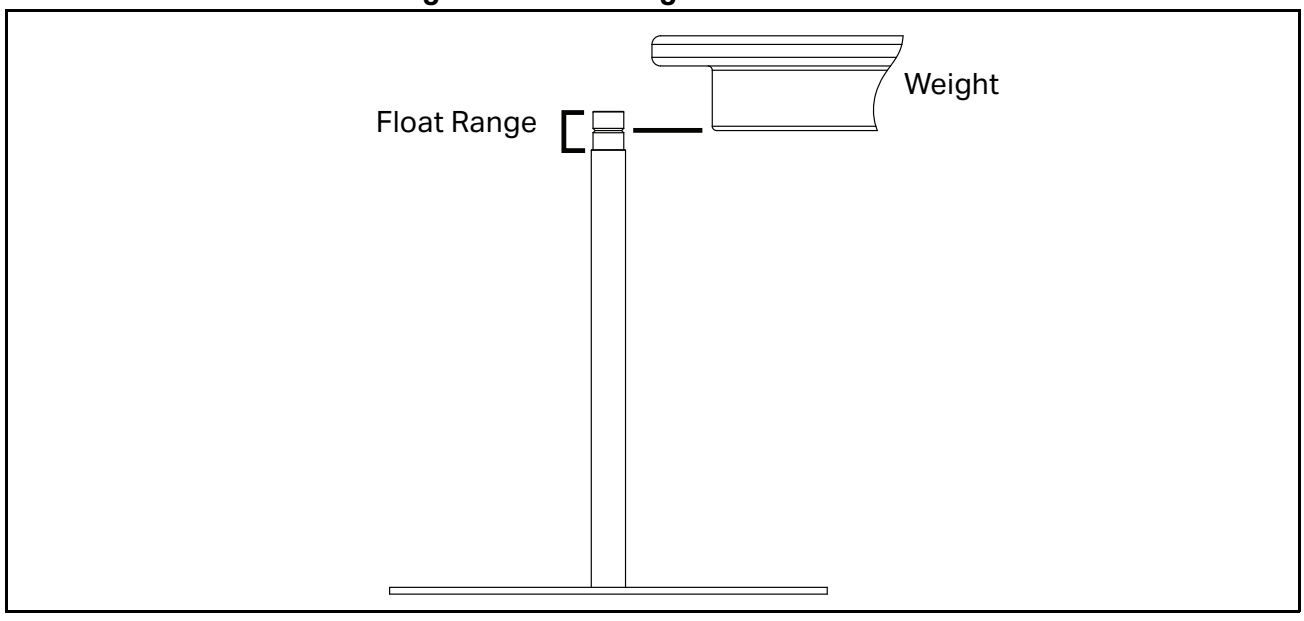
1. Select the required weights and stack them on the appropriate piston assembly. The pressure measured is the sum of the weights + the piston/weight carrier.

Note

The priming pump is for system priming only and cannot be used to generate high pressures.

2. Turn the capstan in (clockwise) to generate pressure. When the piston rises, ensure that the bottom face of the lowest weight is level with the groove, midway in the recessed area on the indicator post. See Figure 6.

Figure 6. Float-Height Indicator Post

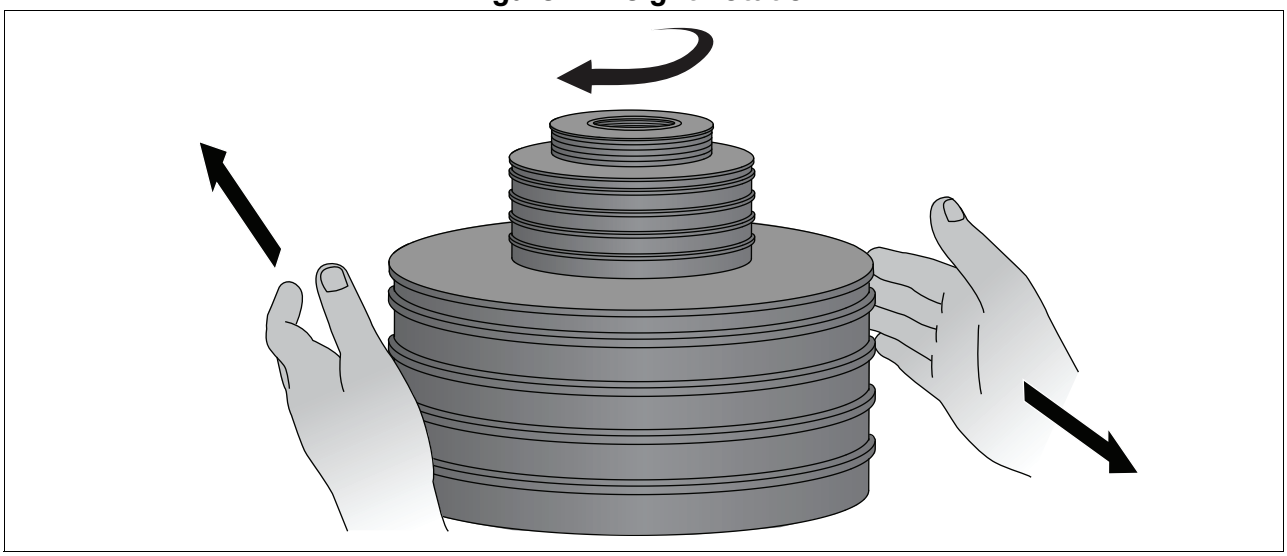


Note

This is the PCU mid-float position, which is the point at which all internal corrections have been made with reference to the pressure datum (at the top of the test port). The recessed area is a guide to indicate the PCU travel limits.

3. Gently rotate the weight stack clockwise such that it is turning between approximately 10 rpm and 60 rpm. Avoid side-loads when you turn the weights by placing your palms on either side and *rolling* the stack by pulling in opposite directions, see Figure 7.

Figure 7. Weight Rotation



⚠ Caution

To prevent damage to the Product, do not rotate weights when the piston is against the top or bottom limits of travel.

4. Allow a few moments for the system to stabilize before you take readings, especially after large changes in system pressure.

Note

Large and sudden changes in pressure cause the system temperature to rise or fall, which can cause Product readings to change as the fluid in the system expands or contracts, thus increasing or decreasing the pressure.

5. For the next higher calibration point, repeat step 1.
6. To measure reducing pressures, remove the necessary weights, and turn the capstan out so that the weight stack floats at the correct height and then rotate clockwise.
7. Depressurize the system by turning the capstan fully out.

⚠Caution

To prevent product damage, never release the system pressure without turning the capstan fully out. Sudden depressurization causes the weight stack to fall quickly, which can damage the piston assembly.

8. Remove weight stack.

Note

The Piston/Cylinder Unit (PCU) fitted to a deadweight tester allows for a small clearance gap between the piston and cylinder. This gap is required to allow the working fluid to pass between the components, providing a lubricating film, and preventing metal-to-metal contact.

Therefore, during normal operation of a deadweight tester, the working fluid in the system slowly passes through this clearance gap. This is normal and does not mean that the system leaks. However, over time, the fluid collects and runs down the side of the PCU mounting body.

The Product includes a sump ring around the base of the PCU mounting body to collect the excess fluid and direct the fluid into the waste container. Empty the waste container periodically to avoid fluid overflowing onto the Product top plate.

The sump ring is also fitted at the base of the test station, as it is common for fluid to fall from the DUT when it is disconnected from the Product after calibration. Keep this ring clean to prevent spills on the top plate.

Calibration in Different Pressure Units

Use the Product to calibrate in different pressure units in either of two methods.

Conversion Weights

A set of conversion weights can be supplied, marked in the required pressure unit, and adjusted to the correct mass for use with the existing piston(s).

The set includes a replacement low-pressure weight carrier table, and a replacement high-pressure weight carrier ring. These items are exchanged for the original items when you use the conversion weights. Calibration is carried out as described above, with logical pressure increments throughout the operating range, avoiding the need to do pressure unit conversion calculations.

Software

PressCal software is available for use with the Product and allows users to apply all necessary corrections (for example, local gravity, temperature, pressure head, and more) to enhance the pressure measurement accuracy of the Product.

The software allows calibration in any of 12 different pressure units, using the existing weight set.

Maintenance

Note

The piston/cylinder assembly is the most critical and sensitive part of the Product. To maintain accuracy, the piston must always slide freely in the cylinder, and the hydraulic fluid must remain clean.

Tables 4 through 8 detail the components of each assembly, together with the relevant part numbers. Where *Spec* appears as a part number indicates that this particular component varies with the specification of the Product and is usually associated with other components in an assembly for replacement purposes.

Change the operating fluid (Fluke part number 3069551) at regular intervals due to potential contamination from items under test. As soon as discoloration of the fluid is observed, replace the fluid as soon as possible. A replacement seal kit is available to replace all soft seals, Fluke part number 6029415.

⚠ Warning

To prevent personal injury, wash at once with soap and water if operating fluid contacts the skin. A mild allergic reaction can result.

⚠ Caution

To prevent product damage, reduce the system pressure to zero as described above before you start any maintenance or servicing.

PCU Assembly

Piston Removal/Disassembly

To remove or disassemble the Piston, see Table 4.

1. Carefully lift off the weight carrier assembly.
2. Unscrew piston nut B and lift out the piston. Use the dowel hole if the nut is tight.

⚠ Caution

To prevent Product damage, do not apply any side-loads to the piston to avoid possible breakage.

3. Unscrew piston Nut A, taking care to not drop the cylinder, as it may be inside of piston nut A assembly. Use the dowel hole if the nut is tight.

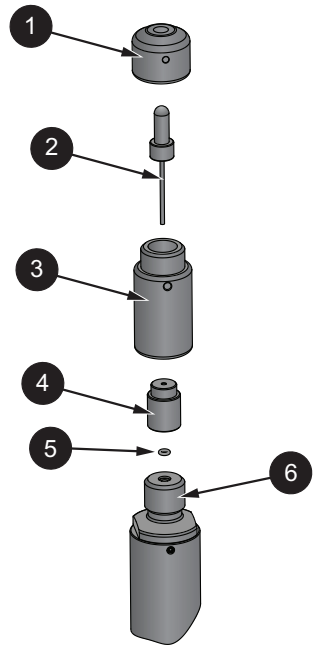
Note

Piston Nut A contains a bearing assembly held in place by a snap-ring. This should not normally require any maintenance or additional lubrication.

4. Remove the cylinder

5. The O-ring seal under the PCU can now be replaced as required.

Table 4. PCU Assembly Parts List



Item	Description	Part Number
1	Piston Nut B	3919474
2	Piston w/Cap	Spec
3	Piston Nut A	3919474
4	Cylinder	Spec
5	2-801 Buna O-ring	3919508
6	PCU Mount	5598490

Piston Cleaning

To clean the piston:

1. Use a *non-fluffing*, non-abrasive, lint-free tissue or absorbent cloth. Hold the piston by the larger *head* end and rub the tissue back and forth along its length.
2. To remove all traces of contamination, clean the piston with a suitable solvent.

⚠Caution

To prevent damage, do not immerse the Nitrile rubber O-ring seals in solvents. Wipe the O-ring seals carefully with a new tissue.

3. After removal from the solvent, use a NEW tissue and repeat step 2.
4. Place the piston carefully on a new tissue where it will not be damaged while the cylinder is cleaned.

⚠Caution

To prevent Product damage, never touch the working surface of a clean piston with bare fingers. Natural skin oil causes the piston and cylinder to stick.

5. Wipe excess fluid from the outside surfaces of the cylinder.
6. Roll a new tissue into a tapered rod of appropriate size. Force the tissue through the cylinder bore while rotating. Make sure that the tissue is a tight fit inside the bore so that dirt and contamination is removed.
7. Use a new tissue and repeat step 6, but from the opposite end of the cylinder.
8. Immerse the cylinder in a suitable clean solvent, see note in step 2.
9. After removal from the solvent, use a new tissue and repeat the cleaning procedure in steps 6 and 7.

Piston Reassembly

To reassemble the piston:

1. Make sure the O-ring is clean and undamaged and is fitted correctly in the counter-bore in the PCU mount.
2. Place the cylinder on top of the PCU mount, with the reduced diameter on top.
3. Hand tighten the cylinder to the PCU mount with piston nut A.
4. Hold the piston by the larger *head* end and dip the smaller *working* end into a container of clean operating fluid. Transfer the piston to the top of piston nut A and allow a few drops of operating fluid to run through the bearing assembly and through the bore of the cylinder. Repeat this step 3 or 4 times to make sure that a good film of fluid is in the cylinder.
5. Carefully introduce the working end of the piston into the cylinder and make sure that it is held vertically, and then push gently through.

⚠ Caution

To prevent damage, never force the piston into its cylinder.

6. If resistance is felt, add more fluid. If resistance continues, clean the piston, cylinder, or both again. If, after repeated cleaning the piston still will not slide freely within the cylinder, then permanent damage may have occurred. Return the part to Fluke for evaluation or replacement.
7. Hand tighten piston nut B onto nut A to retain the piston.
8. Carefully replace the weight carrier tube assembly. Make sure that the central hole in the top is located correctly on the top of the Piston.

Replacement PCU Assembly

⚠ Caution

The piston and cylinder assembly are a matched pair, calibrated and adjusted to a calculated mass figure. If the piston or cylinder becomes damaged, then the entire assembly must be replaced.

Top Cover Removal

To remove the top cover:

Note

To do maintenance procedures on the hydraulic system, remove the first top cover from the Product case.

1. Depressurize the system, open the reservoir valve, and turn the capstan fully in.
2. Remove all masses and the carrier assembly from PCU column.
3. Disconnect any DUT from the test station and remove the fluid from the reservoir. The reservoir is fitted with a drain plug which can be accessed from the underside of the reservoir body (see *Reservoir Assembly*).
4. Remove the 5 screws from the Product top cover (2 on the back and 3 on the front).
5. Remove the handle from the reservoir valve.
6. Remove the pivot clip from the priming pump handle.
7. Lift the top cover off the Product guiding the priming pump handle through the cover.
8. Replacement is simply the reverse of the above procedure.

Screw Pump Assembly

Disassembly

To disassemble the screw pump assembly, see Table 5:

1. Remove all the handle assemblies from the capstan hub.
2. Unscrew the barrel union nut (just behind the capstan hub) of the screw press assembly.
3. Withdraw the lead screw assembly from the lead screw housing. Take care to not drop the keyway key.
4. Remove the 6 M6x40 mm socket head cap screws (SHCS) from the lead screw housing.
5. Slide the lead screw housing forward so that the seal support and cup seal can be accessed.
6. Remove the seal support from the screw pump barrel taking note not to damage the seal support or the bore where it is held.
7. Remove the cup seal from the screw pump barrel.

Reassembly

To reassemble the screw pump assembly, see Table 5:

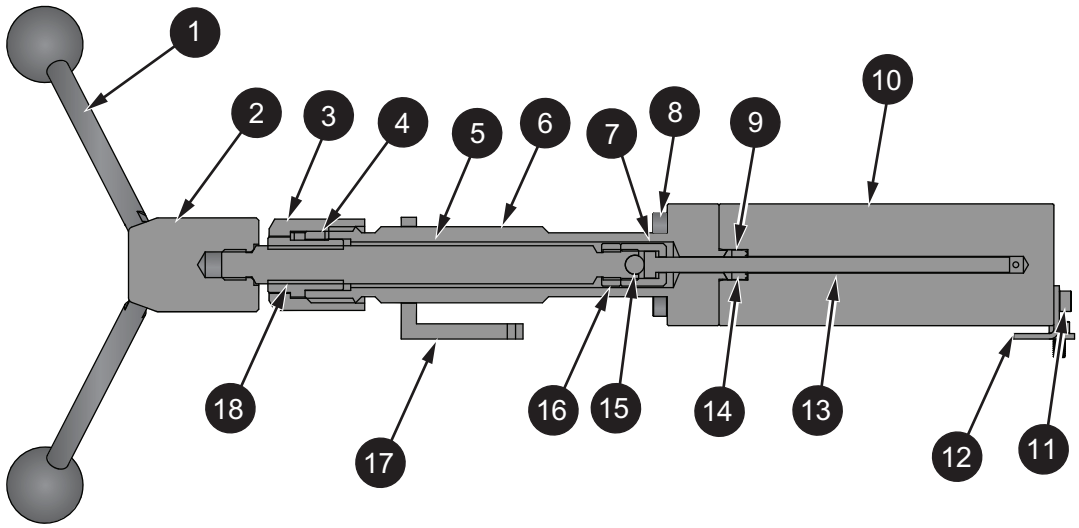
1. Lubricate the cup seal with operating fluid and install into the screw pump barrel with the o-ring facing inward.
2. Install the seal support into the screw pump barrel with the tapered side facing outward.
3. Clean and re-lubricate the lead screw threads with a light coat of red wheel bearing grease.
4. Slide the lead screw back into place, and secure with 6 M6x40 mm SHCS.
5. Lightly lubricate the pressure piston with operating fluid and install into the lead screw assembly in the lead screw housing.

   ⚠ Caution

   To prevent damage to the cup seal and/or seal support, never force the pressure piston into the screw pump barrel.

6. Secure the lead screw assembly in place by tightening the barrel union nut.
7. Re-install the handle assemblies into the capstan hub.

Table 5. Screw Pump Assembly Parts



Item	Description	Part Number	Item	Description	Part Number
1	Spoke Assembly	6029732	10	Screw Pump Barrell	5598434
2	Capstan Hub	3921489	11	M5x10mm SHCS	3133939
3	Barrel Union Nut	3921445	12	Screw Pump Bracket	5598628
4	Steel Key	3917951	13	Pressure Piston	6024150
5	Lead Screw	5601143	14	Cup Seal	3910811
6	Lead Screw Housing	5598441	15	Ball Bearing	3917855
7	Plunger Retainer	5598465	16	Retainer Locknut	5601128
8	M6x40mm SHCS	6024099	17	Barrel Support Bracket	3921492
9	Seal Support	5598452	18	Ram Nut	3921477

Priming Pump Assembly

Disassembly

To disassemble the pump assembly see:

1. Remove the instrument top cover, see *Top Cover Removal*.
2. Disconnect the high-pressure connection on the front of the pump.
3. Disconnect the supply line by pressing in on the black plastic locking ring and pulling the PFA tube out.
4. Remove the priming pump assembly and pump bracket by removing the 4 M5x10 mm SHCS.
5. The pump arm assembly can be swung out of the way.

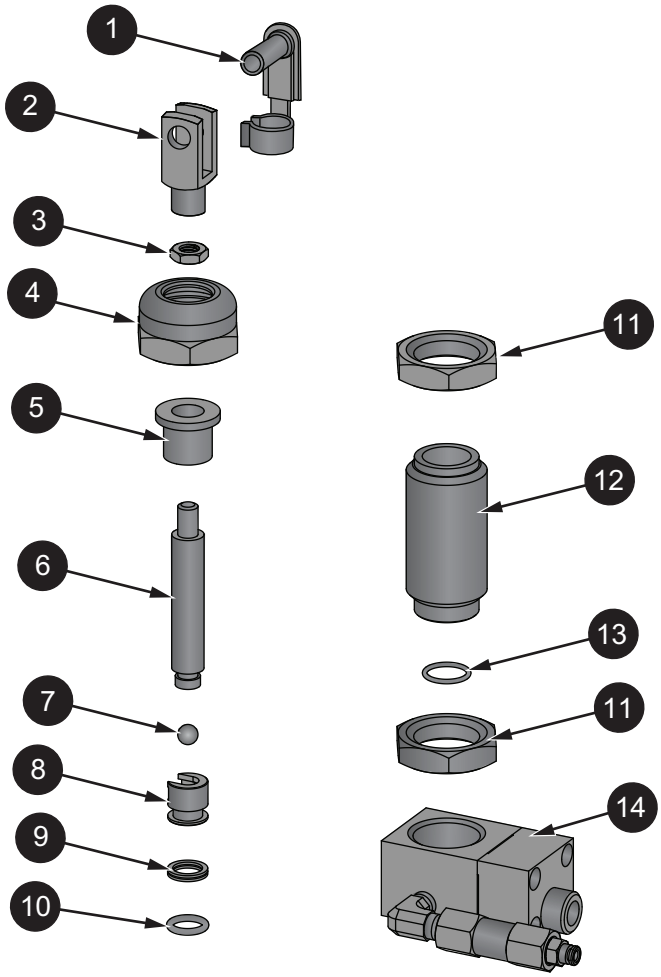
6. Remove the locknut and clevis.
7. Unscrew the union nut and withdraw pump assembly from the pump bracket.
8. Withdraw pump shaft, taking care not to drop shaft bearing or rambler assembly.
9. The white, anti-extrusion ring is a PTFE spiral and can be removed by *unwinding* it from the rambler.
10. When you remove the rambler seal, do not use any tool that has a sharp edge that will scratch the surfaces of the groove in the rambler, otherwise the rambler may leak when reassembled.
11. The replacement rambler seal can be eased over the front of the rambler, and into the groove.
12. Similarly, the new anti-extrusion ring can be *wound* into the groove in the rambler, behind the rambler seal.
13. If it is necessary to remove the barrel, the locknut must be loosened approximately ½ turn. The barrel can then be unscrewed from the pump block assembly.

Re-Assembly

To re-assemble the pump assembly see Table 6:

1. Before re-fitting the barrel, make sure that the O-ring is correctly located in the counter-bore in the front of the barrel. Screw the barrel fully into the pump block assembly, and secure with the locknut.
2. Ensure that the rambler assembly is correctly located on the end of the pump shaft. Carefully guide the rambler into the open end of the barrel making sure that it does not tilt when it enters the barrel.
3. Slide the pump bearing over the shaft and locate it inside the barrel.
4. Re-introduce the pump assembly from the underside of the pump bracket, and secure with the union nut.
5. Install the pump assembly and bracket into the Product base using the 4 M5x10 mm SHCS.
6. Reconnect the high-pressure line to the front of the pump.
7. To reconnect the supply line, push the supply line into the *push-lock* fitting.
8. Replace the locknut and clevis.

Table 6. Priming Pump Assembly Parts List



Item	Description	Part Number	Item	Description	Part Number
1	Pivot Clip	3920224	8	Rambler	3919165
2	Clevis	3920236	9	Back-Up Ring	3920516
3	Locknut	3918713	10	2-111 Viton O-Ring	3922070
4	Pump Union Nut	3921527	11	Barrel Locknut	3921438
5	Shaft Bearing	3867744	12	Pump Barrel	3921511
6	Pump Shaft	3921509	13	2-016 Viton O-Ring	3865359
7	Ball	3917855	14	Pump Block Assembly	N/A

Check Valves

Inlet Check Valve

The inlet check valve is not readily user-serviceable. To remove, see Table 7:

1. To disconnect the nylon tubing from connector (9), push in the collar at the top of the connector, and gently pull on the tubing.
2. Unscrew and remove the connector.
3. Remove the check valve assembly (8).
4. When you replace the check valve assembly, take care to remove all traces of PTFE tape from the mating threads of the elbow (7). New tape (or a similar sealing method) must be applied to ensure a pressure-tight joint.

Reassembly is the reverse of removal.

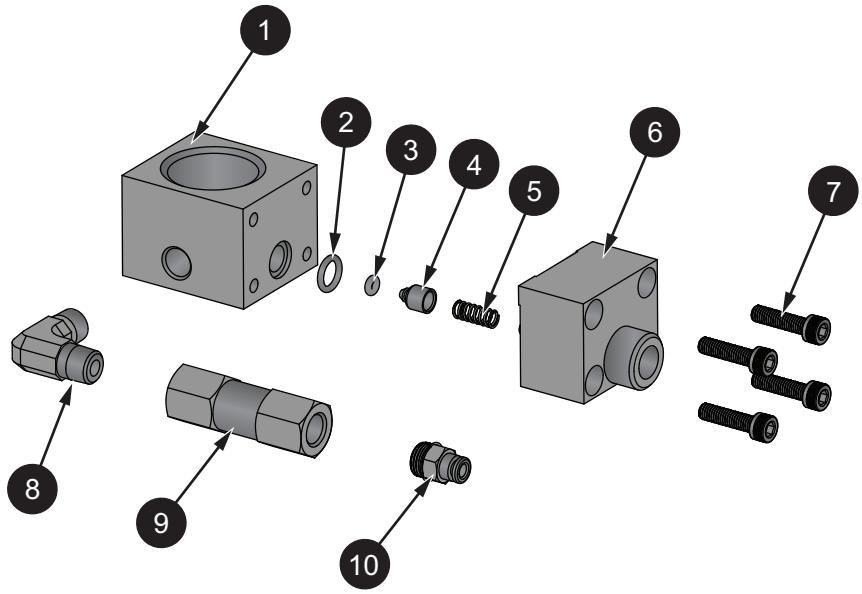
Outlet Check Valve

To remove the outlet check valve, see Table 7:

1. Remove the screws (7) and the pump check flange (6). Take to not drop the check valve bullet (3) and spring (4).
2. Inspect the parts for cleanliness and damage, particularly the sealing surfaces.
3. When you remove O-rings, do not use any tool that may have a sharp edge that will scratch the surfaces of the mating groove, otherwise it may leak when reassembled.

Reassembly is the reverse of removal, but make sure that the spring and bullet are seated correctly.

Table 7. Check Valves Assemblies



Item	Description	Part Number	Item	Description	Part Number
1	Pump Block	3921530	6	Pump Check Flange	3921744
2	2-011 Viton O-Ring	3865174	7	Screw	3909261
3	2mm x 2mm Viton O-Ring	3867912	8	Elbow	3862616
4	Bullet	3920584	9	Check Valve	3867767
5	Spring	3920600	10	Connector	3923564

Reservoir Assembly

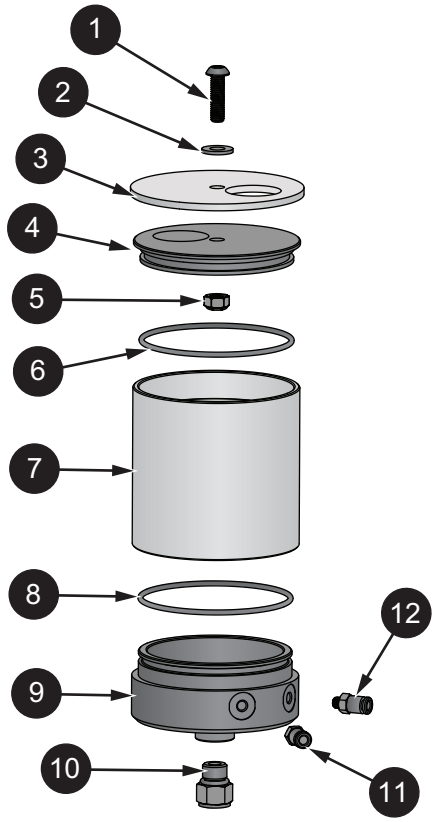
To assemble the reservoir, see Table 8:

1. Drain the fluid from the reservoir:
   a. First remove any weights, and raise the Product a few inches by placing suitably sized blocks under the feet.
   b. Place a suitable catch tray or bowl below the reservoir drain plug.
   c. Remove the reservoir drain plug and completely drain the operating fluid.
2. To completely disassemble the reservoir, the Product cover must be removed from the Product base, see *Top Cover Removal*.
3. To disconnect the low-pressure feed that goes to the priming pump, push down on the black plastic ring at the top of the connector and gently pull on the PFA tubing.
4. To disconnect the low-pressure return, push down on the black plastic ring at the top of the connector and gently pull on the PFA tubing.

5. Remove the mounting screws from the bottom of the Product base.
6. Separate the reservoir lid assembly from the reservoir tube, pull the lid and tube apart.
7. Separate the lid assembly, remove the M6 Nylok nut.
8. Separate the reservoir tube from the reservoir body, pull the tube and body apart.
9. The reservoir body and reservoir lid are a close fit to the reservoir tube, and both rely on the O-ring seal to hold them in place. To separate these parts, gently pull the reservoir body and reservoir lid apart.

Reassembly is the reverse of the above procedure.

Table 8. Reservoir Assembly



Item	Description	Part Number	Item	Description	Part Number
1	M6x22mm Screw	6024236	7	Reservoir Tube	3921608
2	Washer	3916458	8	2-145 Viton O-ring	3865326
3	Reservoir Cover	3921624	9	Reservoir Body	5598515
4	Reservoir Cap	3921613	10	Drain Plug	4799831
5	Hex Nut	6023921	11	Push-lock Fitting	3141516
6	2-145 Viton O-ring	3865326	12	Push-lock Fitting	3141516

Troubleshooting

Use this section to isolate and solve issues with the Product. If these solutions do not solve the issue, contact Fluke Corporation. See *Contact Fluke*.

Poor PCU Spin/Sensitivity

General

The weights that float on a clean PCU assembly will rotate freely and gradually slow down to a complete stop. If the rotation stops quickly, then the PCU requires cleaning.

⚠ Caution

To prevent permanent Product damage, do not rotate the piston if it is dirty.

If the spin/sensitivity of a recently cleaned PCU deteriorates quickly, it is likely that the hydraulic system is contaminated.

During the normal operation of a deadweight tester, the working fluid flows slowly through the tiny gap between the piston and its cylinder. If the hydraulic system is contaminated, any particles tend to move towards the PCU(s) and will affect their performance, and possibly damage them.

If this is the case, the system must be completely dismantled, thoroughly cleaned and rebuilt before further calibration is carried out.

PCU Assembly

Pressurize the system with 1 large weight so that the piston rotates and floats correctly. Gently push down on the rotating weight carrier (2) and release. This results in a smooth, *bouncing* oscillation. If the piston does not rotate or *bounce* freely, remove and clean the piston. See *PCU Assembly*.

High PCU Fall-Rate

The piston always falls slowly due to a small leak between the piston and cylinder. This fall rate is never so fast that a stable reading cannot be made.

- If the system has been pressurized quickly, you must allow sufficient time for the Product to thermally stabilize. Continue to re-float the piston until the fall rate stabilizes. This should take no longer than 1 minute.
- If PCU has just been re-fitted after cleaning:

  Air pockets can be introduced when you re-fit a PCU. This causes the piston to fall faster while the air bleeds between the piston and cylinder.

  Continue to re-float the piston until the fall rate slows. If the piston continues to fall quickly, then check for fluid leakage around the base of the PCU assembly. Check for loose/damaged/dirty seal under the PCU, tighten, clean or replace as necessary. See *PCU Assembly*.
- The reservoir valve may be leaking. Observe the fluid level. The level rises slowly if the valve leaks and indicates that the valve seat may be damaged or dirty.

- The cup seal may be leaking. Check the lead screw in the screw pump for *wetness* when extended. The screw thread should be greased and not running with operating fluid. If the lead screw is *wet*, then replace the cup seal. See *PCU Assembly*.
- There is a leak on the test port, external to the Product.

System Will Not Prime

If the system will not prime:

- Check that the reservoir valve is closed.
- Check for sufficient fluid in reservoir.
- Check for damaged/missing/dirty sealing surface(s) on test station.
- Check that the face of the DUT is in contact with the sealing surface, and that the surface is not scored or dented.

System Will Not Pressurize

If the system will not pressurize:

- Ensure correct valve operation during the priming process.
- Check that the DUT does not leak.
- Clean the system externally and check for fluid leak by continually trying to pressurize. Wherever fluid appears, replace the seal and check that the sealing faces are clean and undamaged before re-assembly.

Priming Pump Malfunction

If the priming pump malfunctions:

- If pumping generates no pressure, the inlet check valve has probably failed and requires replacement.
- If the system pressurizes and depressurizes in conjunction with the downward and upward strokes of the pump, then the outlet check valve has completely failed. Disassemble and inspect for dirt or damage to the valve seat and seal. After inspection, clean all parts and replace as required. Reassemble correctly.
- If the pump handle rises during normal system pressurization, then the outlet check valve is leaking. Inspect as above.

⚠ Caution

To prevent inlet check valve damage, do not continue to pressurize if the pump handle rises.

Cannot Reach Maximum Pressure

If maximum pressure cannot be reached, even after the screw press has been turned fully in and the checks above have been made:

- Make sure that the screw press is FULLY OUT and the priming pump is used for initial pressurization.
- If the DUT has a large internal volume or there is air in the system, then re-prime and increase the initial pressurization with the priming pump from 100 psi/7 bar to at least 200 psi/14 bar.

Storage and Transportation

Product

To store the Product:

1. With the test station plugged, open the reservoir valve and turn the capstan fully in and close the reservoir valve.
2. Remove the spokes from the capstan hub and store in the accessory bag.
3. Remove screw-in handle from pump arm, and store in accessory bag.
4. If fluid is to remain in the reservoir, ensure that the tester is kept level at all times to avoid spills. If not, drain the reservoir as described in *Reservoir Assembly*.

Weights

To store the weights:

1. Start with the largest increments first and stack all the appropriate weights in the wooden weight cases.
2. Pass the threaded rod of the weight clamp assembly down through the center of the weight stack and locate it in the base of the weight box.
3. Screw the clamp assembly in clockwise to secure the weights. Make sure that the stepped rim of the clamping disc locates correctly in the center of the weight stack.
4. Close the lid and secure with the catches at front.

⚠ Warning

To prevent personal injury, know that the weight set is heavy (up to 80 lbs/36 kg per individual box) so us care when you move it. Use both handles when you lift the set for stability. Fluke Calibration recommends that the set be carried by two people.

Shipment

To prevent damage during shipment, place and secure the Product in its crate. Ship the weight boxes palletized.

Product Disposal

Dispose of the Product in a professional and environmentally sound manner:

- Delete personal data on the Product before disposal.
- Remove batteries that are not integrated into the electrical system before disposal and dispose of batteries separately.
- If this Product has an integral battery, put the entire Product in the electrical waste.