

**FLUKE**®

**Calibration**

# **P5516-400M**

## High-Pressure Hydraulic Comparison Test Pump

### Users Manual

December 2025 (English)

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## Introduction

This manual contains operation and routine and preventive maintenance instructions for the P5516-400M High-Pressure Hydraulic Comparison Test Pump (the Product).

## Contact Fluke

Fluke Corporation operates worldwide. For local contact information, go to our website: [www.fluke.com](http://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](http://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.

## Operating Principle

The Product checks pressure-measuring instruments against Master Test Gauges.

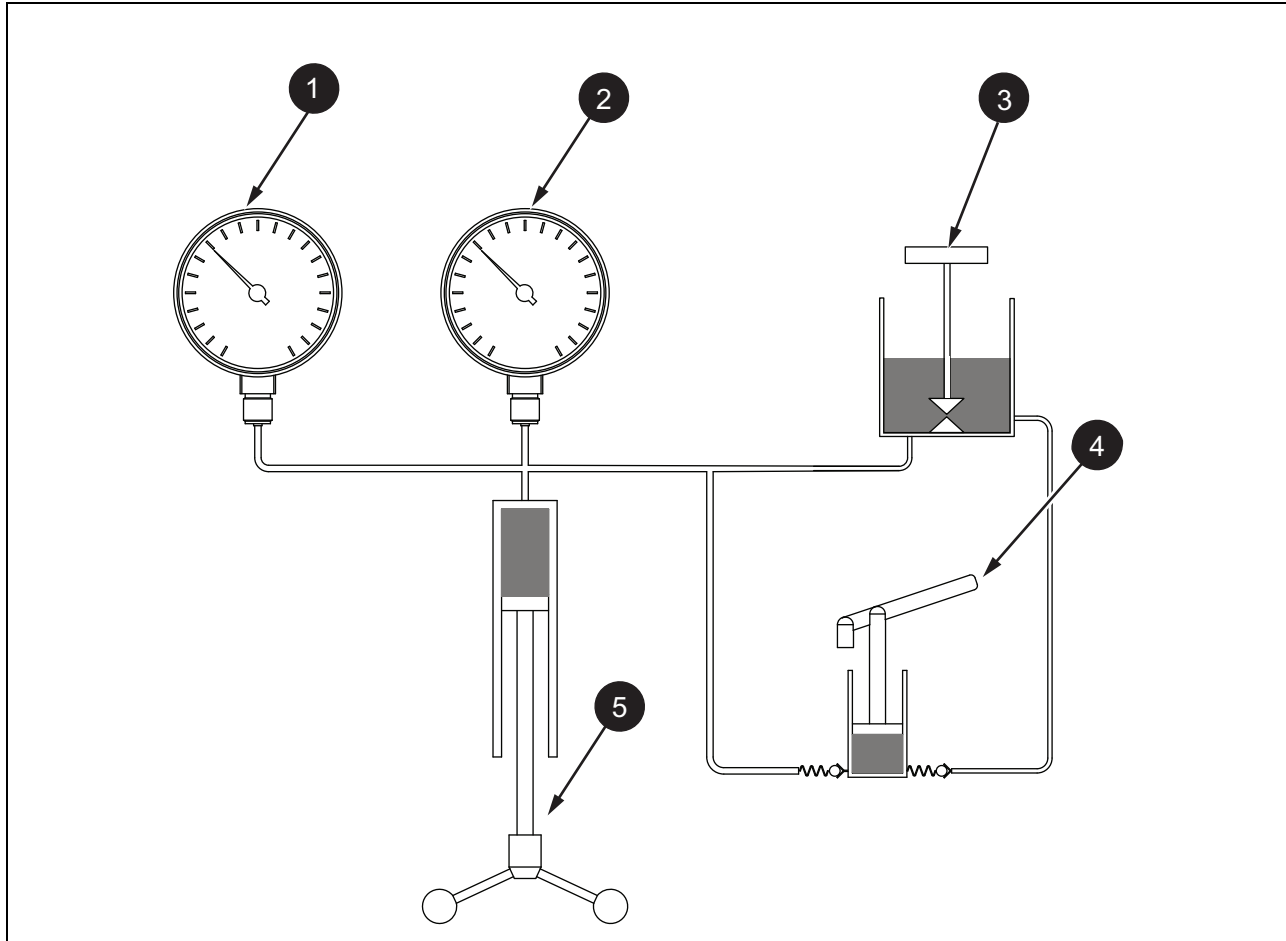
### *Note*

*The terms Master Test Gauge and Gauge in this document refer to any pressure-measuring instrument such as Transfer Standards, Digital Calibrators, and Transducers.*

This system is only as accurate as the Master Test Gauge used. The Master Test Gauge must be regularly calibrated on a Primary Reference Standard (such as a Deadweight Tester) to ensure accuracy is maintained.

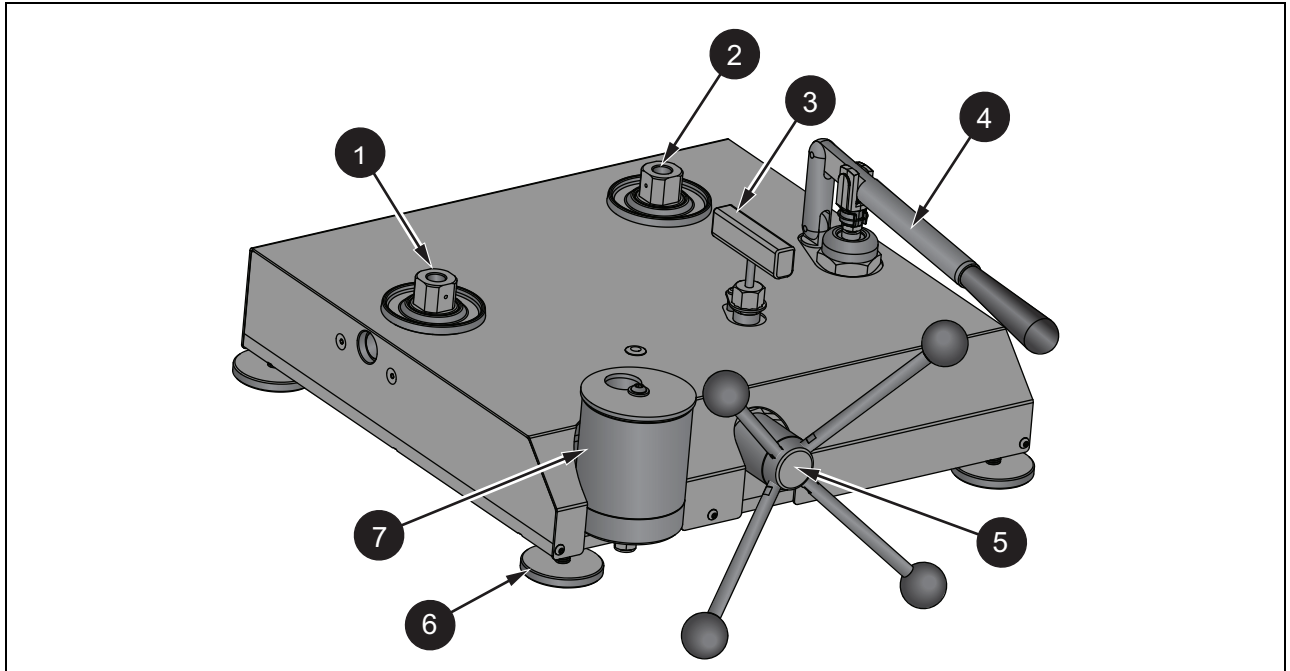
Table 1 shows the basic hydraulic circuit for a single-PCU (piston cylinder unit) instrument.

**Table 1. Hydraulic Circuit Schematic**



Item	Description	Item	Description
1	Device Under Test (DUT)	4	Screw Pump
2	Master Test Gauge	5	Priming Pump
3	Reservoir		

**Table 2. High-Pressure Hydraulic Comparison Pump**



Item	Description
①	Test Port
②	Test Port
③	Reservoir Valve
④	Priming Pump
⑤	Screw Pump
⑥	Adjustable Foot 4x
⑦	Reservoir

## 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 spokes from the accessory bag and fit into the capstan hub.
3. Remove the priming pump handle from the accessory bag and fit it to priming pump.
4. Remove waste oil container from the accessory bag and place it into the waste oil container tray. Then, insert waste oil tube into waste oil container.
5. Level the device with the four adjustable feet to the spirit level supplied in the accessory bag. Use the spirit level to prevent rocking.
6. Rotate the reservoir dust cover to uncover the filling hole and fill the reservoir approximately  $\frac{3}{4}$  full of the operating fluid. Rotate the dust cover back to cover the hole.

## Operating Fluid Compatibility

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

### Caution

**To prevent Product damage:**

- **The system is for use with a wide range of fluids, however, the reservoir tube is Acrylic, and the O-ring seals are Viton. Use of solvents, fuel oils, brake fluids, or other, similar aggressive fluids can cause damage to the seals and/or the reservoir tube. If alternate fluids are used, first evaluate them for use with Viton and acrylic.**
- **Check the quality of the operating fluid during use. If the fluid becomes discolored, cloudy, or particles appear in the reservoir, drain and flush the system 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 Product.**
- **Particle contamination can damage the sensitive piston assemblies, valve seats, and screw pump. To avoid cross-contamination from other fluids, and protect the system from particulates, use a Liquid-to-Liquid Separator.**

*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*

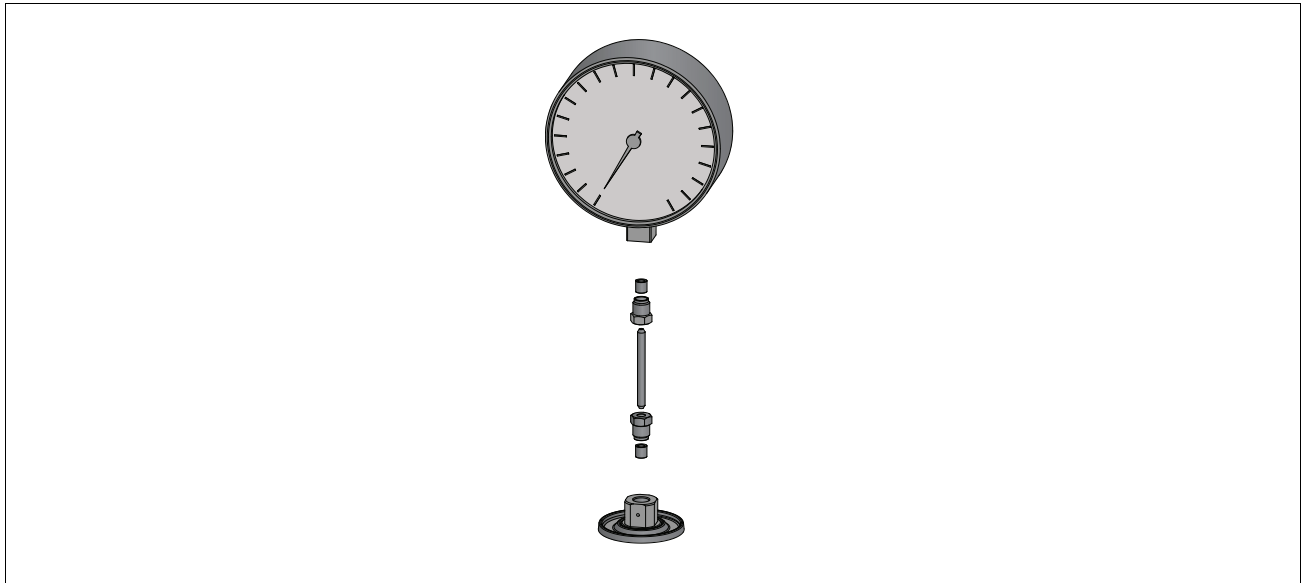
*The thread on the DH500 collar, and the gauge/nipple are left-handed.*

## DUT Connection

To connect a DUT:

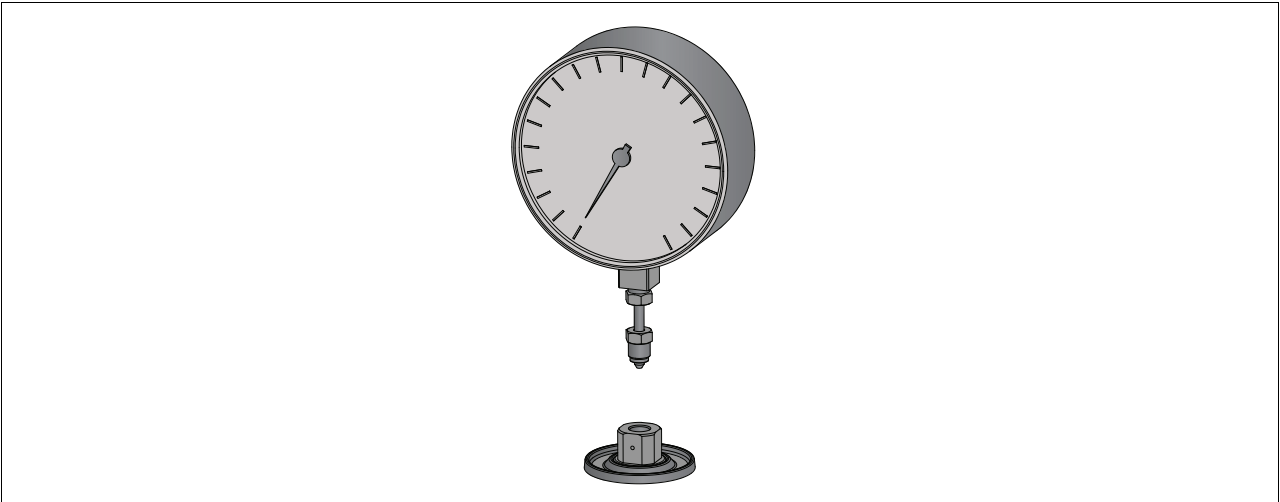
1. Place gland(s) onto the gauge stem/nipple and then thread on the collar(s). Ensure that 2 to 3 threads show between collar and cone. See [Figure 1](#).

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



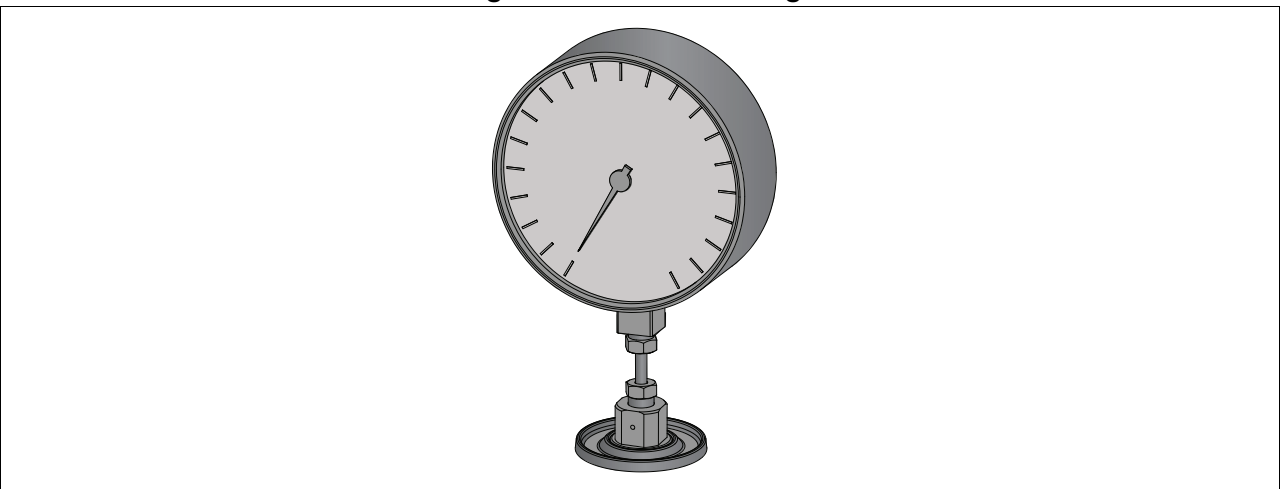
2. If applicable, tighten the nipple into the gauge with a 5/8 in wrench and the appropriate backup wrench for the gauge. See [Figure 2](#).

**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*

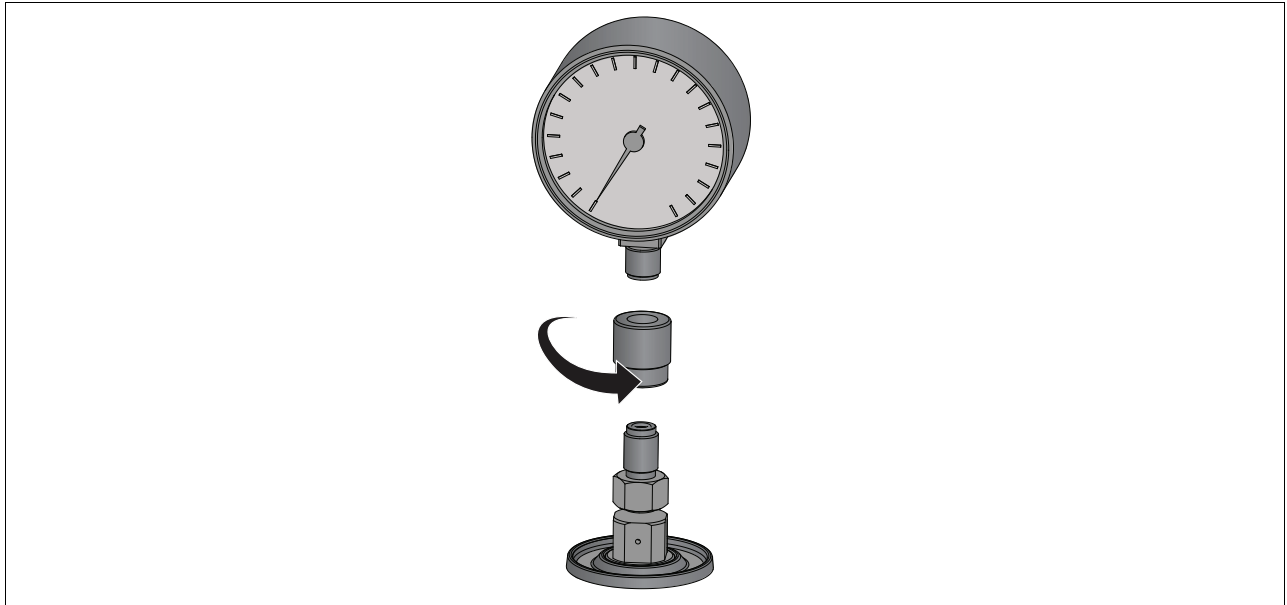
*The thread on the test port, and the lower part of the gauge adapters is left-handed.  
The next procedure details the correct method to mount devices using these adapters.*

**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**

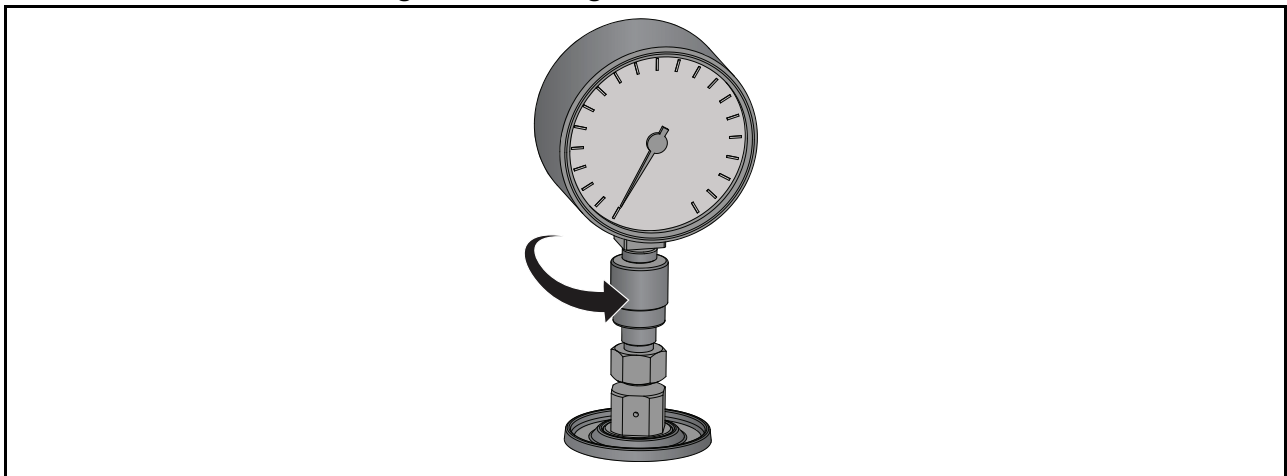


2. Screw the assembly down counterclockwise onto the test port.

*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**



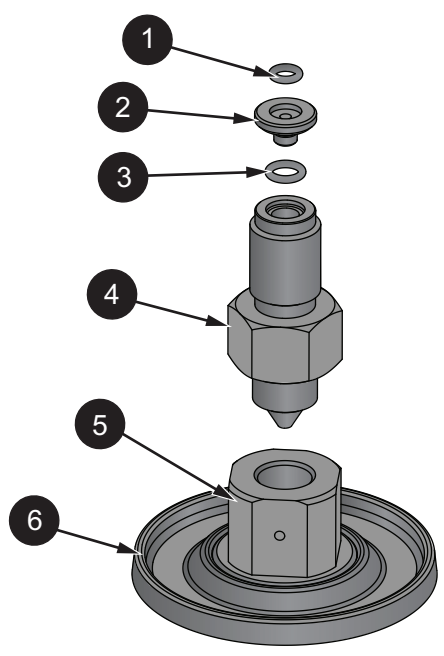
- To adjust the position to face forward, hold the gauge adapter and turn it counterclockwise, so that it faces forward. Hold the instrument steady while you turn the gauge adapter counterclockwise until it pulls down onto the O-ring.

**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. Turn the screw press in (clockwise) to generate pressure.

### Note

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

2. Allow a few moments for the system to become stable before you take any readings, especially after large changes in system pressure.

### Note

*Large, 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.*

3. Compare the reading of the gauge under test with that of the master gauge.
4. For the next, higher calibration point, repeat from step 1.
5. To measure reducing pressures, turn the screw press out (counterclockwise).
6. Turn the screw press FULLY OUT to depressurize the system and then open the reservoir valve.

**⚠ Caution**

**Never release the system pressure with the reservoir valve alone, as sudden depressurization will shock the system and could cause damage to sensitive instruments attached to it.**

## Maintenance and Service

### Top Cover Removal

To remove the top cover:

1. Depressurize the system, open the reservoir valve, and turn the screw press fully in.
2. Disconnect any DUT from the test ports and drain the fluid from the system. The reservoir is fitted with a drain plug which can be accessed from the underside of the reservoir body (see [Reservoir Assembly](#)).
3. Remove the 5 screws from the Product top cover (2 on the back and 3 on the front).
4. Remove the handle from the reservoir valve.
5. Remove the pivot clip from the priming pump handle.
6. Lift the top cover off the Product guiding the priming pump handle through the cover.

Replacement is the reverse of the above procedure.

### Screw Pump Assembly

#### Disassembly

To disassemble the screw pump assembly, see [Table 4](#):

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 4](#):

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.

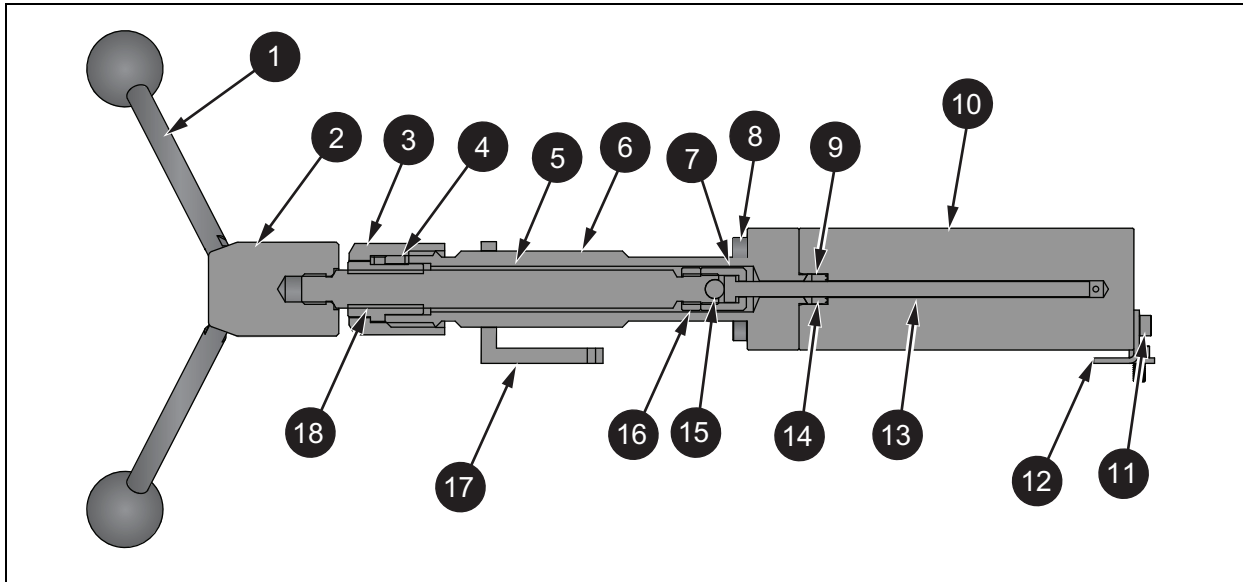
3. Clean and re-lubricate the lead screw threads with a light coat of red wheel bearing grease.
4. Slide the lead screw back into place, and secure with 6 M6x40 mm SHCS.
5. Lightly lubricate the pressure piston with operating fluid and install into the lead screw assembly in the lead screw housing.

**⚠ 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 4. 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, loosen the locknut approximately ½ turn. The barrel can then be unscrewed from the pump block assembly.

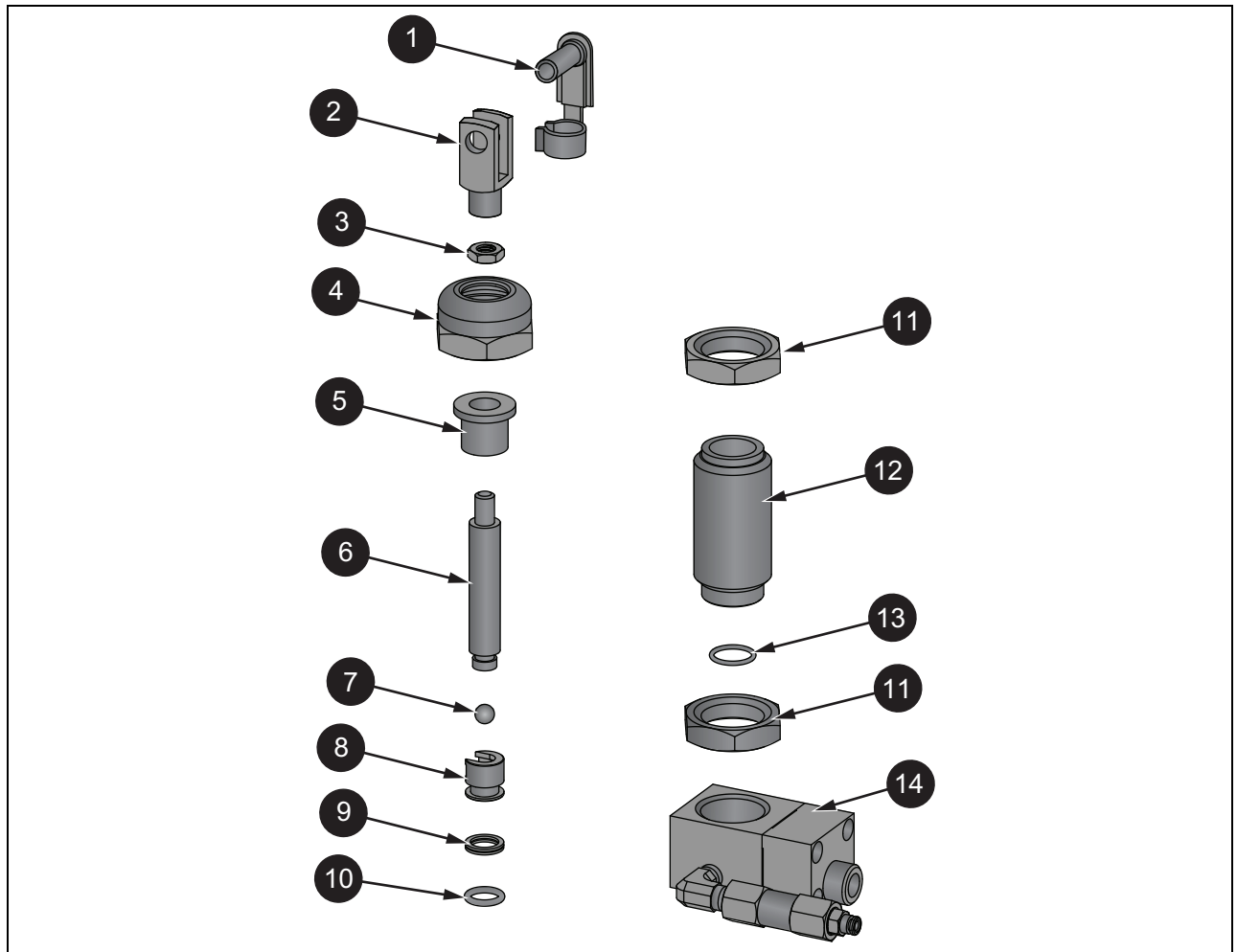
### Re-Assembly

To re-assemble the pump assembly see [Table 5](#):

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. Reconnect the supply line, push the supply line into the *push-lock* fitting.
8. Replace the locknut and clevis.

**Table 5. 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 6](#):

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.

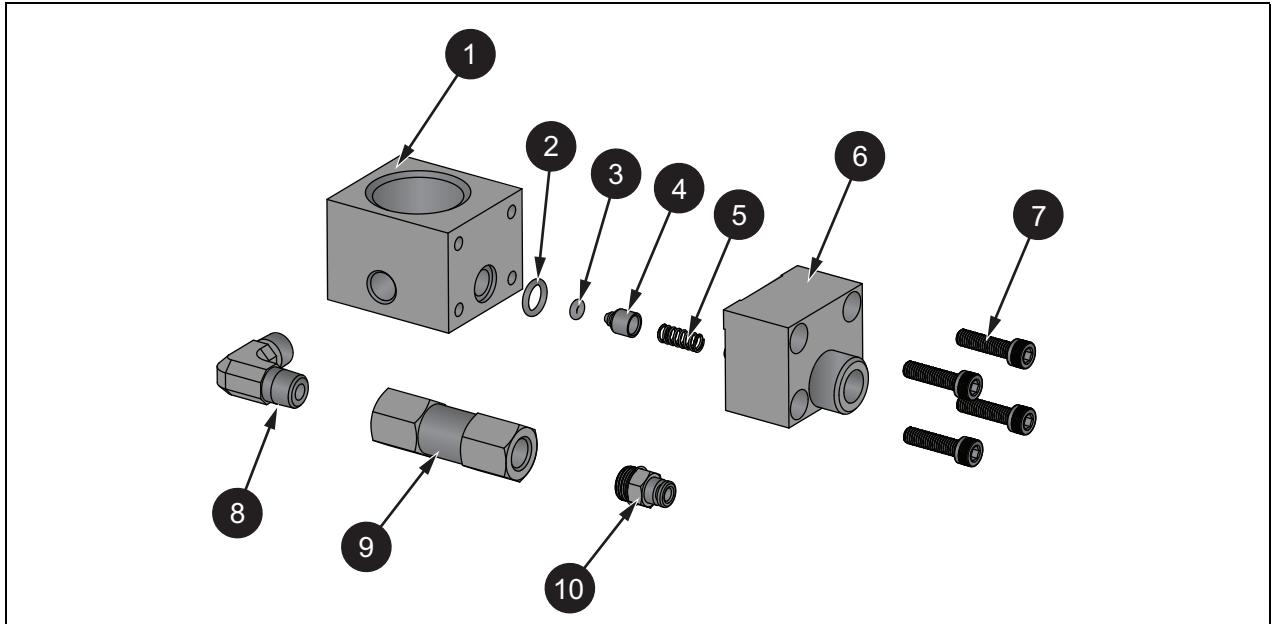
### Outlet Check Valve

To remove the outlet check valve, see [Table 6](#):

1. Remove the screws (7) and the pump check flange (6). Take care 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 6. 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

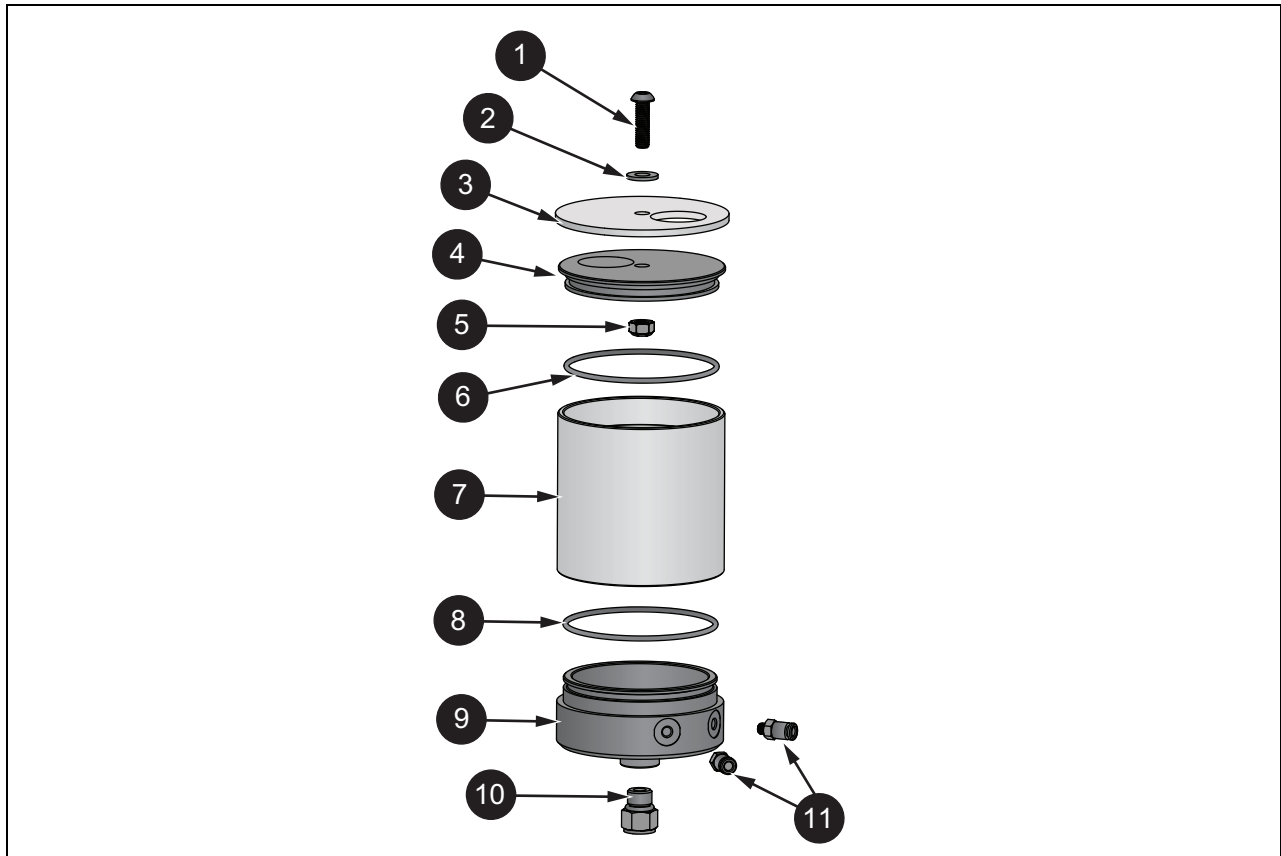
To assemble the reservoir, see [Table 7](#):

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 7. 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			

## 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](#).

### 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.
- Check that the face of the DUT contacts the O-ring, and that the surface is not scored or dented.

### 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.

## Pressure Falls Away

Large, sudden changes in pressure causes the system temperature to rise or fall, which can cause instrument readings to change as the fluid in the system expands or contracts, thus increasing or decreasing the pressure. Allow a few minutes to determine if the system pressure continues to fall away or becomes stable.

## Storage and Transportation

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 you will place the device into long term storage (>6 months) or if you will ship the device, drain the reservoir as described in [Reservoir Assembly](#).

## 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.