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SRV-3K WITH VESSEL

SAFETY RELIEF VALVE TESTER

OPERATING MANUAL

CALDER
VALVE TESTING & REPAIR SYSTEMS BY CLIMAX

P/N 90107
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Revision 0

CLIMAX | BORTECH CALDER H&S TOOL

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- Machine model
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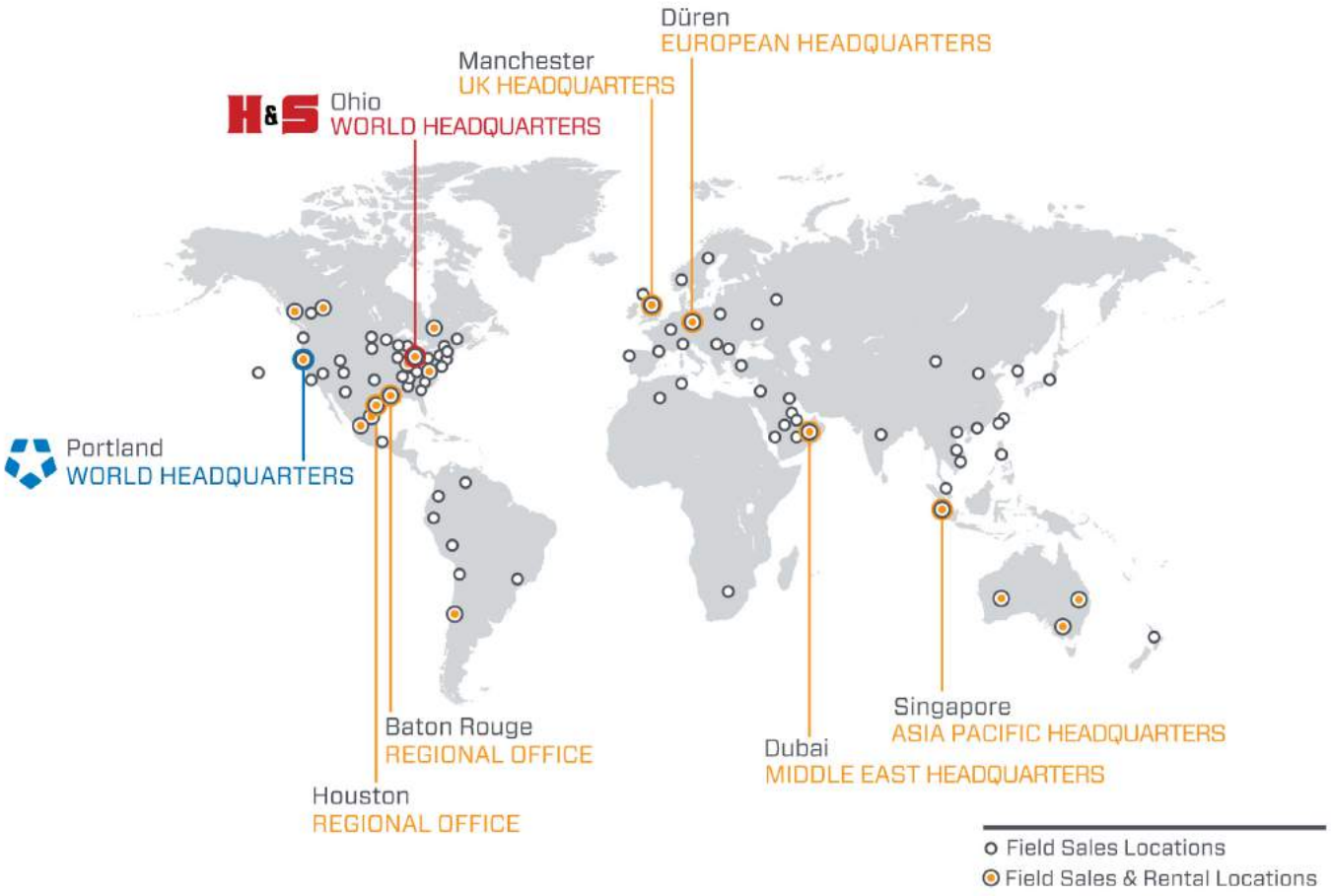
CLIMAX GLOBAL LOCATIONS



LIMITED WARRANTY

CLIMAX Portable Machine Tools, Inc. (hereafter referred to as “CLIMAX”) warrants that all new machines are free from defects in materials and workmanship. This warranty is available to the original purchaser for a period of two years after delivery. If the original purchaser finds any defect in materials or workmanship within the warranty period, the original purchaser should contact its factory representative and return the entire machine, shipping prepaid, to the factory. CLIMAX will, at its option, either repair or replace the defective machine at no charge and will return the machine with shipping prepaid.

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- Damage caused by unauthorized machine modification or repair
- Damage caused by machine abuse
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About this manual

CLIMAX provides the contents of this manual in good faith as a guideline to the operator. CLIMAX cannot guarantee that the information contained in this manual is correct for applications other than the application described in this manual. Product specifications are subject to change without notice.

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1 INTRODUCTION

IN THIS CHAPTER:

1.1 HOW TO USE THIS MANUAL

This manual describes information necessary for the setup, operation, maintenance, storage, shipping, and decommissioning of the SRV-3K with Vessel.

The first page of each chapter includes a summary of the chapter contents to help you locate specific information. The appendices contain supplemental product information to aid in setup, operation, and maintenance tasks.

Read this entire manual to familiarize yourself with the SRV-3K with Vessel before attempting to set it up or operate it.

1.2 SAFETY ALERTS

Pay careful attention to the safety alerts printed throughout this manual. Safety alerts will call your attention to specific hazardous situations that may be encountered when operating this machine.

Examples of safety alerts used in this manual are defined here[1]:

DANGER

indicates a hazardous situation which, if not avoided, ***WILL*** result in death or severe injury.

WARNING

indicates a hazardous situation which, if not avoided, ***COULD*** result in death or severe injury.

1. For more information on safety alerts, refer to *ANSI/NEMA Z535.6-2011, Product safety Information in Product Manuals, Instructions, and Other Collateral Materials*.

⚠ CAUTION

indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE

indicates a hazardous situation which, if not avoided, could result in property damage, equipment failure, or undesired work results.

1.3 GENERAL SAFETY PRECAUTIONS

CLIMAX leads the way in promoting the safe use of portable machine tools and valve testers. Safety is a joint effort. You, the end user, must do your part by being aware of your work environment and closely following the operating procedures and safety precautions contained in this manual, as well as your employer's safety guidelines.

Observe the following safety precautions when operating or working around the machine.

Training – Before operating this or any machine tool, you should receive instruction from a qualified trainer. Contact CLIMAX for machine-specific training information.

Risk assessment – Working with and around this machine poses risks to your safety. You, the end user, are responsible for conducting a risk assessment of each job site before setting up and operating this machine.

Intended use – Use this machine in accordance with the instructions and precautions in this manual. Do not use this machine for any purpose other than its intended use as described in this manual.

Personal protective equipment – Always wear appropriate personal protective gear when operating this or any other machine tool.

Work area – Keep the work area around the machine clear of clutter. Restrain cords and hoses connected to the machine. Keep other cords and hoses away from the work area.

Lifting – Many CLIMAX machine components are very heavy. Whenever possible, lift the machine or its components using proper hoisting equipment and rigging. Always use designated lifting points on the machine.

Lock-out/tag-out – Lock-out and tag-out the machine before performing maintenance.

Moving parts – CLIMAX machines have numerous exposed moving parts and interfaces that can cause severe impact, pinching, cutting, and other injuries. Except for stationary operating controls, avoid contact with mov-

ing parts by hands or tools during machine operation. Remove gloves and secure hair, clothing, jewelry, and pocket items to prevent them from becoming entangled in moving parts.

1.4 MACHINE-SPECIFIC SAFETY PRECAUTIONS

Eye hazard – This machine produces metal chips during operation. Always wear eye protection when operating the machine.

Sound level – This machine produces potentially harmful sound levels. Hearing protection is required when operating this machine or working around it.

Hazardous environments – Do not operate the machine in environments where potentially explosive materials, toxic chemicals, or radiation may be present.

Pressurization – Do not over-pressurize the valve test system beyond the limits described in this manual and on machine labels. Do not pressurize the system while the side panels are removed from the test console.

Test gauges – Do not use any gauge above its rating. Do not remove test gauges while the system is pressurized.

Utility service requirements – Do not exceed the pressure ratings stated in this manual and on the machine labels.

1.5 RISK ASSESSMENT AND HAZARD MITIGATION

To achieve the intended results and to promote safety, the operator must understand and follow the design intent, set-up, and operation practices that are unique to valve testers.

The operator must perform an overall review and on-site risk assessment of the intended application. Due to the unique nature of high-pressure valve testing, identifying one or more hazards that must be addressed is typical.

When performing the on-site risk assessment, it is important to consider the valve tester and the workpiece as a whole.

⚠ WARNING

High-pressure valve testing may result in the sudden, unexpected release of stored energy with the potential to cause property damage or personnel injury. Potential hazards may include the possibility of high-velocity fluid escaping and high-energy projectile impact. The end-user must assess the application and install protective barrier devices, as appropriate.

1.6 RISK ASSESSMENT CHECKLIST

The following checklist is not intended to be an all inclusive list of things to watch out for when setting up and operating this valve testing machine. However, these checklists are typical of the types of risks the assembler and operator should consider. Use these checklists as part of your risk assessment:

TABLE 1-1. RISK ASSESSMENT CHECKLIST BEFORE SET-UP

	Before set-up
☐	I took note of all the warning labels on the machine.
☐	I removed or mitigated all identified risks (such as tripping, cutting, crushing, entanglement, shearing, or falling objects).
☐	I considered the need for personnel safety guarding and installed any necessary guards.
☐	I considered the potential hazards that are inherent in high-pressure valve testing, including the possibility of high velocity fluid escape or workpiece fragmentation, and have installed appropriate protective barriers.
☐	I read the machine assembly instructions (Section 3) and took inventory of all the items required but not supplied (Section 2.3).
☐	I considered how this machine operates and identified the best placement for the controls, cabling, and the operator.
☐	I evaluated and mitigated any other potential risks specific to my work area.

TABLE 1-2. RISK ASSESSMENT CHECKLIST AFTER SET-UP

	After set-up
☐	I checked that the machine is safely installed (according to Section 3).
☐	I identified all possible pinch points, such as those caused by rotating parts, and informed the affected personnel.
☐	I followed the required maintenance checklist (Section 5).
☐	I checked that all affected personnel have the recommended personal protective equipment, as well as any site-required or regulatory equipment.
☐	I checked that all affected personnel understand and are clear of the danger zone.
☐	I evaluated and mitigated any other potential risks specific to my work area.

1.7 LABELS

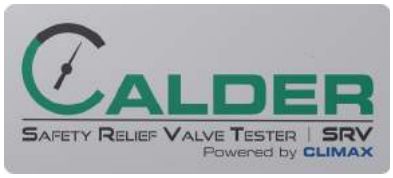
1.7.1 Label identification

The following warning and identification labels should be on your machine. If any are defaced or missing, contact CLIMAX immediately for replacements.

TABLE 1-3. SRV-3K WITH VESSEL LABELS

	P/N 29154 ID plate		P/N 60277 Warning label: fill with appropriate fluid
	P/N 80905 Warning label: hand crush hazard		P/N 81008 Warning label: wear ear and eye protection
	P/N 85417 Warning label: do not release clamp during pressurization		P/N 85496 Warning label: do not over-pressurize
	P/N 87593 Warning label: read the operating manual		P/N 88812 Warning label: splash shield not rated

TABLE 1-3. SRV-3K WITH VESSEL LABELS

	P/N 88813 Warning label: machine is for safety relief valves only		P/N 88820 Warning label: high pressure gas venting
	P/N 88823 Calder label		

1.7.2 Label location

The following figures display the location of the labels on each of the components of the SRV-3K with Vessel. For further identification of location placement, refer to the exploded views in Appendix A.

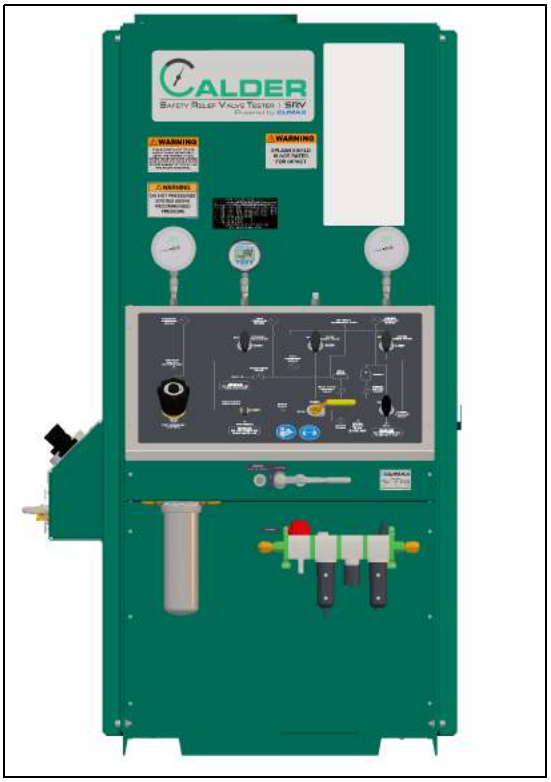


FIGURE 1-1. FRONT CONSOLE LABEL LOCATION

Label P/N: 29154, 81008, 85496, 87593, 88812, 88813, 88823

FIGURE 1-2. RIGHT SIDE CLAMP LABEL LOCATION

Label P/N: 80905, 88823

FIGURE 1-3. BACK LABEL LOCATION

Label P/N: 80905, 88820, 88823

FIGURE 1-4. LEFT LABEL LOCATION

Label P/N: 80905, 85417, 87593, 88820, 88823

FIGURE 1-5. RESERVOIR LABEL LOCATION (NOT VISIBLE WHEN ASSEMBLED)

Label P/N:60277

2 OVERVIEW

IN THIS CHAPTER:

2.1 FEATURES AND COMPONENTS

The SRV-3K with Vessel is a system designed to test and set safety relief valves using water or air.

WARNING

This machine is for testing safety relief valves only. Using the machine to test other valves (control valves, gate valves, etc.) could cause severe damage to the machine and injure personnel.

Principal components of the SRV-3K with Vessel include:

Test console – this controls the test pressure of the valve being tested.

Clamp fixture – this holds the valve being tested and maintains a seal between the test equipment and the valve being tested.

Seal plate adapters – these are used to seal sizes not included on the base seal plate.

The following optional components are sold separately:

DOT bottle assembly – a high-pressure air reservoir.

Compressor – an air pressure source for the high-pressure test.

Seat leakage fixtures – these capture and measure leakage with a bubble jar (API 527 compliant).

The following maximum pressure limitations apply:

- Test pressure: 2,700 psi (186 bar) in nitrogen, air, or water
- Clamp pressure: 9,600 psi (662 bar) in hydraulic

2.2 CONTROLS

The controls are all located on the control console and the clamp fixture console.

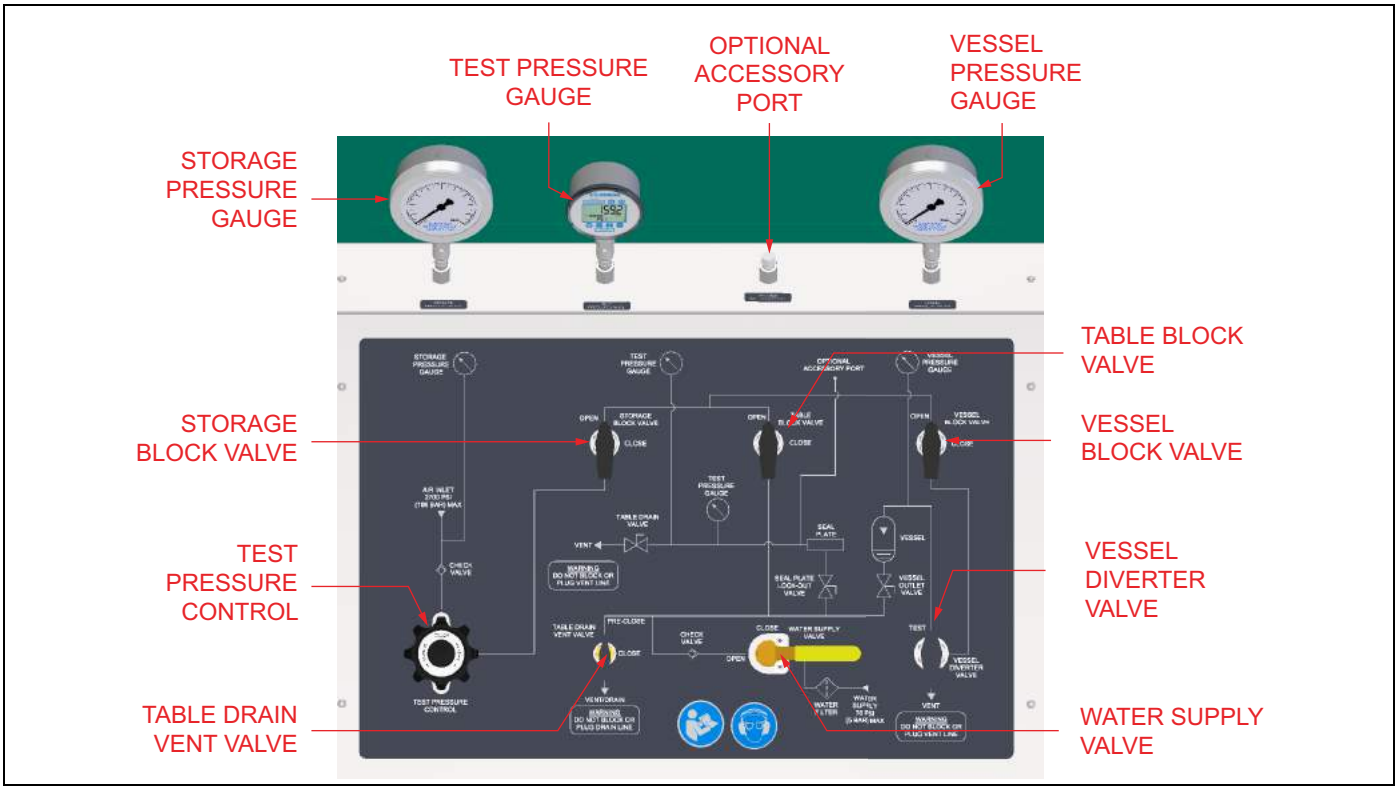


FIGURE 2-1. UPPER CONSOLE CONTROLS

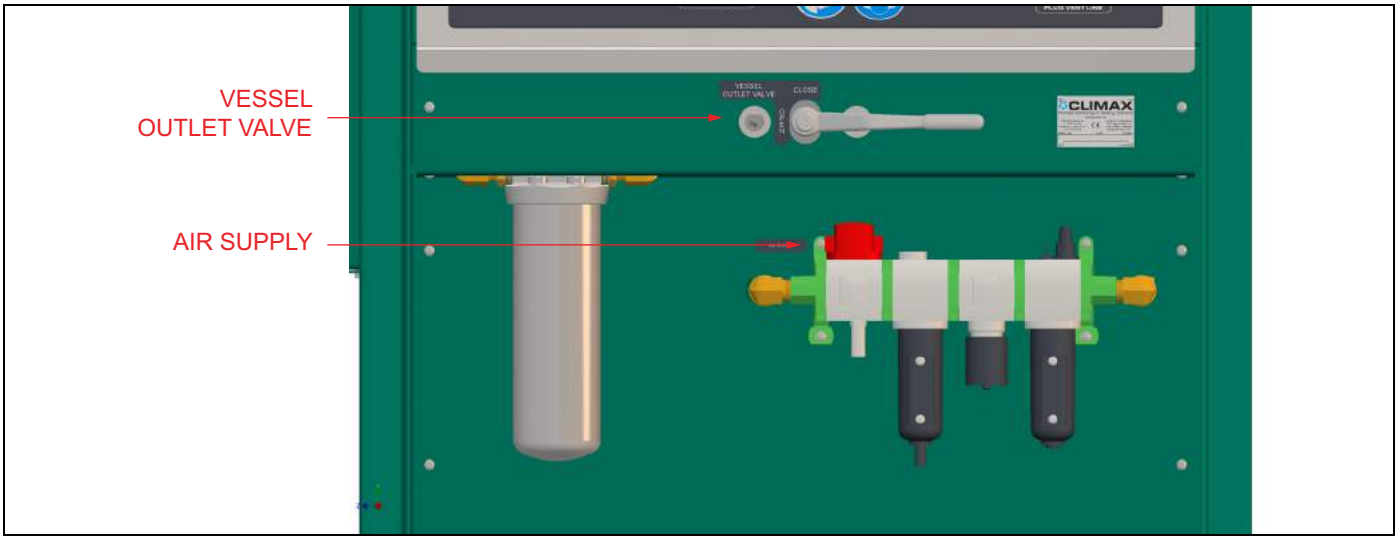


FIGURE 2-2. LOWER CONSOLE CONTROLS

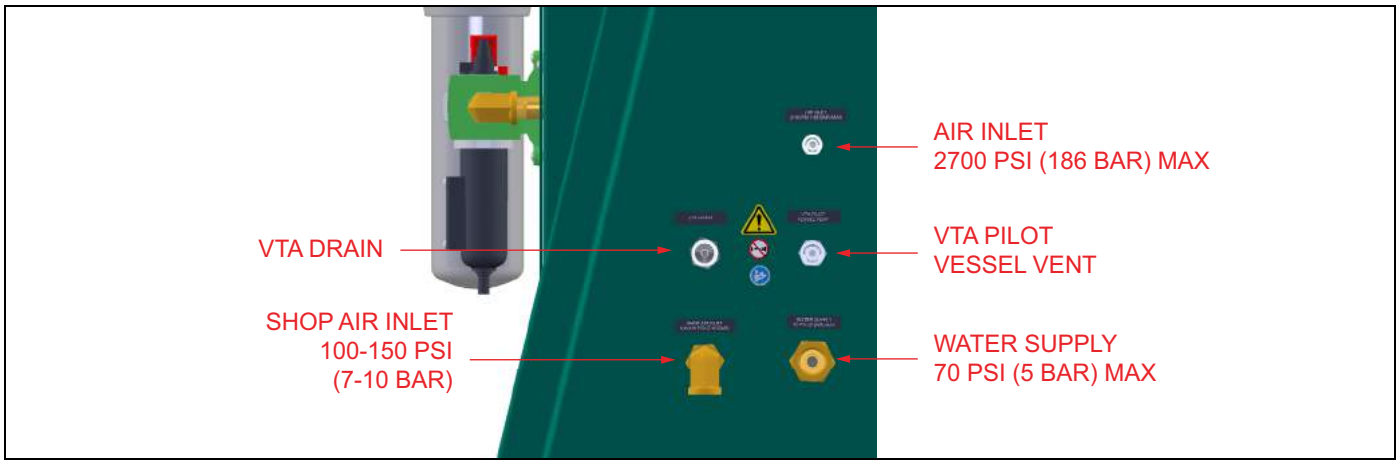


FIGURE 2-3. RIGHT SIDE CONSOLE CONTROLS

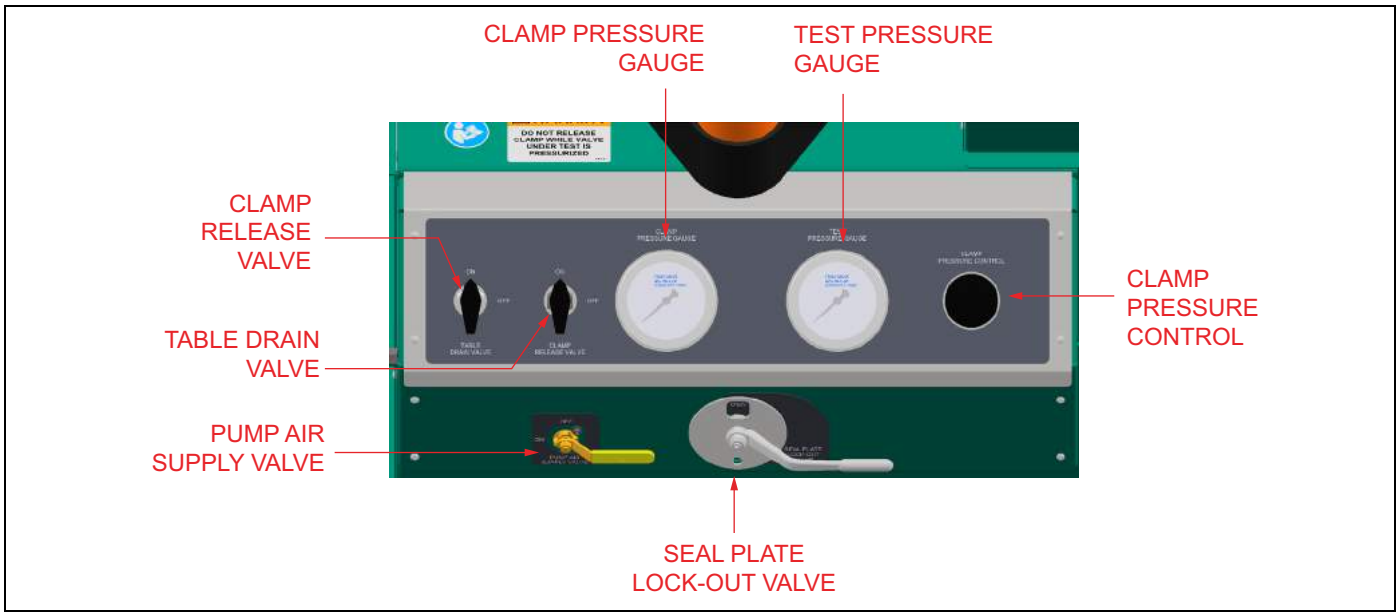


FIGURE 2-4. CLAMP CONSOLE CONTROLS

2.3 DIMENSIONS

Figure 2-5 shows the machine dimensions.

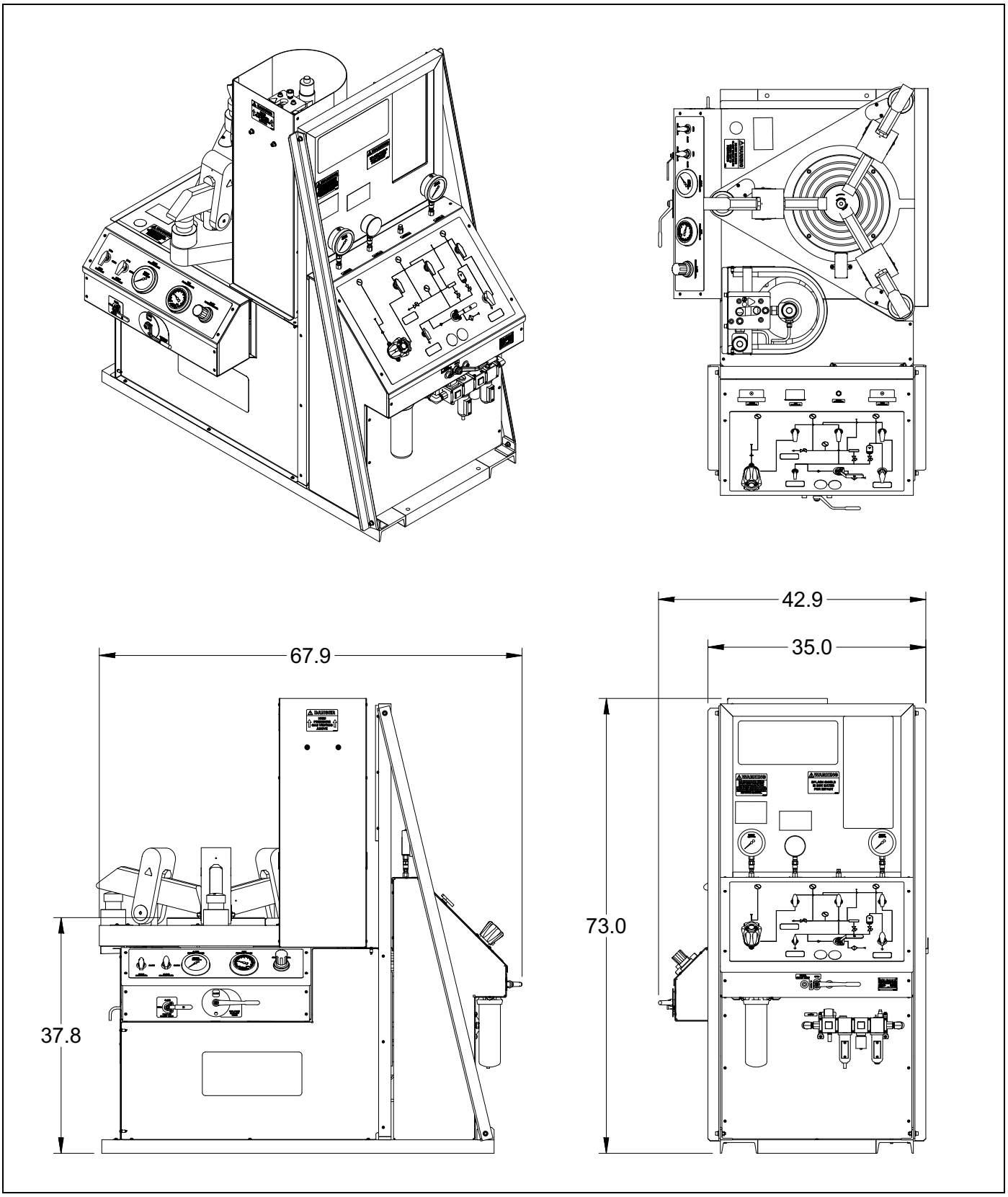


FIGURE 2-5. DIMENSIONS

2.4 SPECIFICATIONS

TABLE 2-1. SPECIFICATIONS

Test media:	Water, air, nitrogen
Maximum water test pressure:	2,700 psi (186 bar)
Maximum air test pressure:	2,700 psi (186 bar)
Maximum nitrogen test pressure:	2,700 psi (186 bar)
Types of valves that can be tested:	Safety relief valves
Shop air required:	100–150 psi at 40 scfm (6,9–10,3 bar at 1,1 m^3/min)
Water quick fill:	3 gpm (11,4 l/min) minimum
Hydraulic ram force:	90 tons (81.6 tonnes)
Approximate machine weight	2,500 lbs (1,134 kg)
Approximate shipped weight	3,000 lbs (1,361 kg)

⚠ WARNING

Do not use the machine in any application that exceeds these operating specifications. Failure to follow these guidelines could result in personnel injury and property damage, and will void the warranty.

2.5 ITEMS REQUIRED BUT NOT SUPPLIED

The following items are required but not supplied in your CLIMAX product kit:

- Shop air (100–150 psi [6,9–10,3 bar]) at 40 scfm (1,1 m3/min)
- Hydraulic fluid AW-32 or AW-46
- Air tool oil (general purpose, such as AW-32)
- Lock-out/tag-out device
- High-pressure storage device, such as a DOT bottle assembly (as applicable)
- Compressor for 2,700-psi (186 bar) pressurized gas (as applicable)

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3 SETUP

IN THIS CHAPTER:

This section describes the setup and assembly procedures for the SRV-3K with Vessel safety relief valve tester.

3.1 RECEIPT AND INSPECTION

Your CLIMAX product was inspected and tested prior to shipment, and packaged for normal shipment conditions. CLIMAX does not guarantee the condition of your machine upon delivery.

When you receive your CLIMAX product, perform the following receipt checks:

1. Inspect the shipping containers for damage.
2. Check the contents of the shipping containers against the included invoice to make sure that all components have been shipped.
3. Inspect all components for damage.

Contact CLIMAX immediately to report damaged or missing components.

NOTICE

Keep the shipping container and all packing materials for future storage and shipping of the machine.

3.2 LIFTING AND RIGGING

Follow these lifting instructions for each component (as applicable):

DOT bottle assembly – Use the lifting points near the top, or lift at the bot-

tom skids with a forklift.

Console/clamp fixture – Lift at the bottom skids with a forklift.

Compressor – Refer to the manufacturer's manual.

3.3 SECURING THE TEST STAND

The safety relief valve tester and DOT bottle assembly (if separately purchased) must be anchor-bolted to the floor before operation.

⚠ WARNING

All units must be stabilized for the safety of the operator. The operator must determine what is necessary to provide a safe environment.

⚠ DANGER

Position the machine so that high-pressure venting (either from the machine or the safety relief valve under test) is not orientated towards personnel or nearby equipment. Failure to do so may result in machine damage or personnel severe injury or death.

3.3.1 Cement in place (option 1 – recommended)

Cement the anchor bolts into the floor. The exposed threads of the anchor must protrude a minimum of two threads past the nut and washer. See Figure 3-1.

3.3.2 Drill and anchor (option 2)

Drill holes into the floor for an expanding type anchor sleeve. A .5" (12.7 mm) lag bolt will require a minimum of 1.5" (38.1 mm) thread engagement. See Figure 3-1.

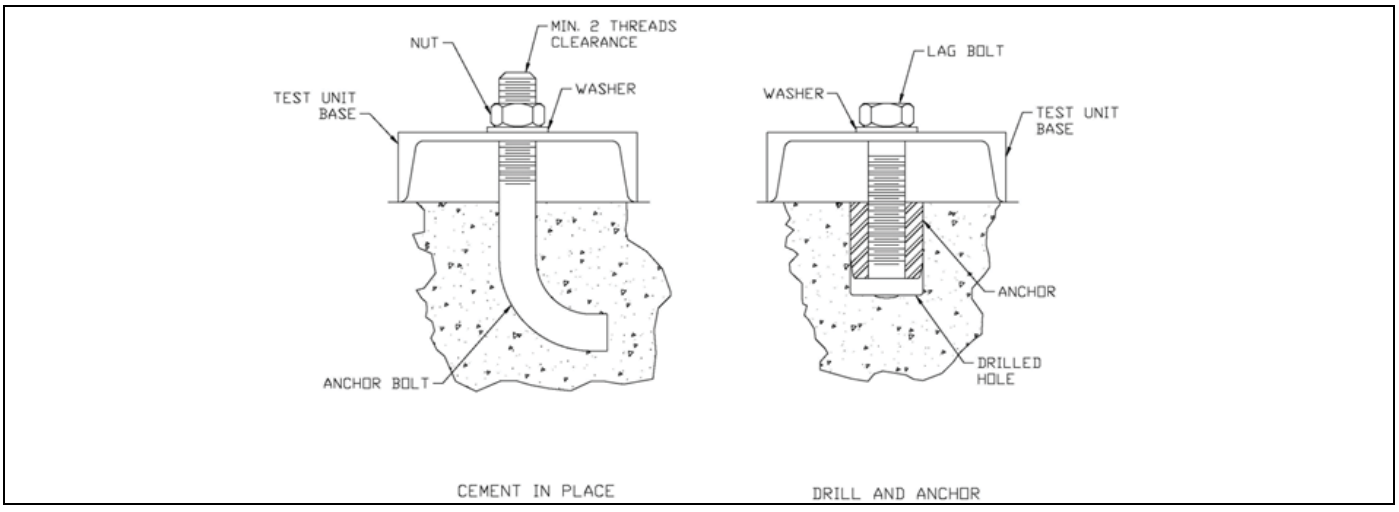

FIGURE 3-1. SECURING THE TEST STAND

3.4 FILLING THE RESERVOIR AND LUBRICATOR

Do the following before operating:

1. Fill the reservoirs with hydraulic oil (AW-32 or AW-46) to half of the sight gauge.
2. Fill the lubricators with air tool oil (generic purpose, such as AW-32) and adjust the knob to set it to one drop per 25 strokes of the pump.

NOTICE

Operating the pump with insufficient lubrication will result in pump failure.

3.5 INSTALLING UTILITIES

3.5.1 Connecting air from the source

Low-pressure air (100–150 psi [6,9–10,3 bar]) is the primary source of power in the clamping system. The consoles has an air filter with a 1/2" (13 mm) NPT air inlet.

Connect the shop air to the air filter at 100–150 psi (6,9–10,3 bar).

3.5.2 Connecting water from the source

One 3/4" (19 mm) NPT low-pressure water (70 psi [4,8 bar] maximum) inlet connection port is located on the right side of the console (see Figure 2-3 on page 12). Connect the shop water supply at this location.

3.5.3 High-pressure sources for testing

The right side of the console has one 1/4" NPT (2,700 psi [186 bar] maximum) inlet connection port for testing. Connect the customer-supplied high-pressure air or gas at this location, or use a compressor or DOT bottle assembly (sold separately) at the high-pressure sources.

⚠ WARNING

Exceeding the rated pressure for the inlet could result in machine damage or personnel injury.

⚠ WARNING

The optional auxiliary port is plugged for shipment. Removing this plug while there is pressure in the system could result in severe personnel injury or death.

3.5.4 Tethering the hoses (DOT bottle, as applicable)

Tether the following hose ends to prevent hose whip:

- Hose from compressor to DOT bottle assembly, both ends
- Hose from the DOT bottle assembly to the test console, both ends

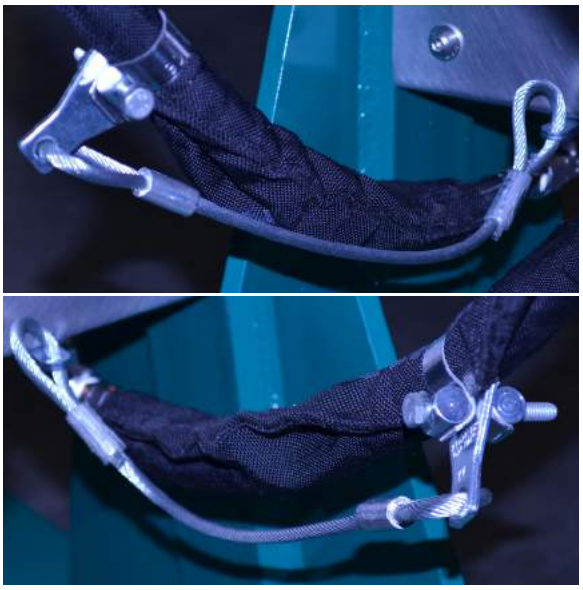

FIGURE 3-2. TETHERED HOSES

WARNING

If an air test hose needs replacement, only use a high-pressure hose rated above 3,500 psi (241 bar). Refer to Appendix A for all other components. Failure to follow these specifications could result in machine damage or personnel injury.

NOTICE

Always use thread tape or thread lubricant/sealer when connecting any stainless steel fittings or components. Failure to do so will result in galling and permanently bonding the two pieces being connected.

3.5.5 Connecting to vents or drains

When connecting to the VTA PILOT VESSEL VENT, only use fittings and components rated to or above 3,000 psi (207 bar).

When connecting to the VTA DRAIN, only use fittings and components rated to or above 3,000 psi (207 bar).

WARNING

Failure to utilize fittings and components with adequate pressure ratings could result in machine damage or personnel injury.

See Section 4 for details on the TABLE DRAIN/VENT VALVE.

3.6 CLAMPING PROCEDURE

Do the following (refer to Figure 2-2 on page 11 and Figure 2-4 on page 12 as needed):

1. Check the integrity of the o-rings on the seal plates. Replace any damaged o-rings.
2. Check that the SEAL PLATE LOCK-OUT VALVE on the clamp fixture console is closed and locked to prevent accidental table pressurization during the clamping process.
3. Check that the VESSEL OUTLET VALVE on the control console is closed to prevent accidental table pressurization during the clamping process.
4. Place the test valve on the table and align the valve with the correct o-ring.

⚠ WARNING

The relief port of the safety relief valve (that is, the device under test) should face away from the operator and any other personnel during the test. The splash shield is not rated for impact.

5. For a flanged valve, slide the clamp arms in until they securely engage with the flange. Use the extended clamp arm spacer blocks as needed.
6. On the clamp fixture console, close the CLAMP RELEASE VALVE.

TIP:

The Safety Interlock Switch reduces the likelihood of the clamps from releasing the device under test while the test system is under pressure or if there is a loss of shop air.

⚠ WARNING

Do not use the safety interlock in place of the primary hand-operated controls. The safety interlock is only a secondary measure to the correct operating procedure. Some residual pressure (up to 75 psi [5.2 bar]) may remain in the device under test when the safety interlock disengages, which may cause a pressure release and personnel injury, if the CLAMP RELEASE VALVE is not closed. Always remove test pressure, vent the test circuit, and close the SEAL PLATE LOCK-OUT VALVE before opening the clamp release valve.

7. Check that the CLAMP PRESSURE CONTROL is turned counter-clockwise until it stops.
8. Open the PUMP AIR SUPPLY VALVE.

9. Turn the CLAMP PRESSURE CONTROL clockwise while monitoring the clamp pressure gauge until the correct pressure is achieved, as listed in Table 3-1.

⚠ WARNING

Check Table 3-1 for recommended clamping pressures. Excess clamp pressures may damage the workpiece and machine and may result in serious personnel injury.

If the valve flange does not seal against the seal plate, refer to Section 5.2 on page 29 for troubleshooting before increasing the clamp pressure.

REQUIRED CLAMPING PRESSURE, MODEL SRV-3K					
VALVE SIZE	O-RING	MAXIMUM TEST PRESSURE PSI (BAR)*			
		600 (41)	1,000 (69)	2,000 (138)	2,700 (186)
		HYDRAULIC PRESSURE REQUIRED TO SEAL PSI (BAR)			
3/4	2-319	300 (21)	300 (21)	500 (35)	700 (48)
1	2-220	300 (21)	300 (21)	600 (41)	800 (55)
1-1/2	2-227	400 (27)	600 (41)	1,200 (83)	1,600 (110)
2	2-230	500 (35)	800 (55)	1,600 (110)	2,100 (145)
3	2-238	800 (55)	1,300 (90)	2,600 (179)	3,600 (248)
4	2-245	1,200 (83)	1,900 (131)	3,800 (262)	5,100 (352)
6	2-363	2,200 (152)	3,700 (255)	7,300 (503)	
8	2-372	3,400 (234)	5,600 (386)		
10	2-379	4,500 (310)	7,400 (510)		
12	2-382	5,000 (345)	8,400 (579)		
*THE OPERATOR IS RESPONSIBLE TO SELECT THE ACTUAL TEST PRESSURE THAT IS REQUIRED FOR THE FLANGED SAFETY RELIEF UNDER TEST. SEE OPERATING MANUAL.					

TABLE 3-1. HYDRAULIC LOAD CHART FOR FLANGED VALVES

⚠ WARNING

To minimize the risk of damage to the machine, workpiece, and personnel injury, use technical judgment and discretion when increasing the clamping pressure above the recommendations listed in Table 3-1.

Determine the correct hydraulic load by following these steps with Table 3-1:

1. Locate the size of the valve to be tested in the valve nominal diameter column (example: 4").
2. Choose the appropriate required test pressure in the header (example: 2,000 psi [138 bar]).

3. Identify the cell in the valve diameter row and clamp pressure column to find the hydraulic gauge pressure required to seal the valve being tested (example: 3,800 psi [262 bar]).

3.7 LEAK DETECTION FIXTURE AND BUBBLE JAR

To mount the leak detection fixture (sold separately) to the device under test, do the following:

1. Clamp the seat leakage fixture to the outlet flange of the device under test, using the clamp arm knobs (hand-tight is sufficient).
2. Fill the bubble jar with water to the tube's scribe line.
3. While testing, use leak detection fluid (for example, soapy water) to check for leaks between the valve outlet flange and the leak detection fixture.

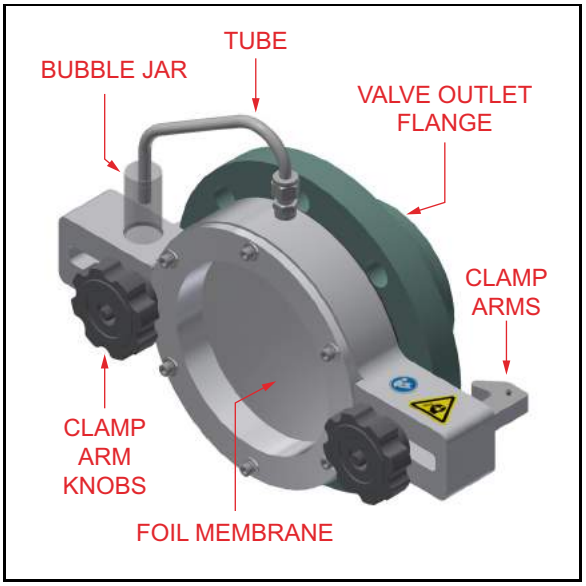

FIGURE 3-3. SEAT LEAKAGE FIXTURE AND BUBBLE JAR

⚠ WARNING

Each leakage fixture accommodates a range of nominal valve sizes (see Table 3-2 on page 23). It is critical that they be used in the applicable ranges so that "D" is greater than or equal to "d" (see Figure 3-4). Failure to do so could apply pressure to the fixture assembly upon relief valve release and potentially detach the assembly from the valve flange with great force. This could result in severe injury and equipment damage.

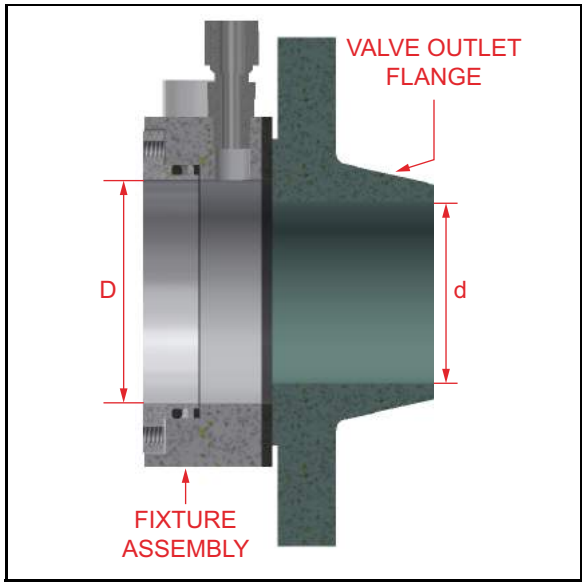

FIGURE 3-4. FIXTURE SIZE LIMITATIONS

TABLE 3-2. LEAK DETECTION FIXTURE VALVE RANGES

Part Number	Nominal valve size range (150 and 300 ANSI class) in inch (mm)
89051	2–2.5" (51–64)
89065	3–3.5" (76–89)
89066	4–5" (102–127)
89067	6–8" (152–203)
89068	10–12" (254–305)

NOTICE

The leak detection fixtures use a thin foil membrane that will rupture if the relief valve trips during leakage testing.

WARNING

Do not stand in front of or near the leak detection fixtures during testing. If the relief valve trips, the foil membrane will rupture to release test pressure. Standing near the fixture when this happens could result in severe injury. Always wear ear and eye protection.

4 OPERATION

IN THIS CHAPTER:

4.1 PRE-OPERATION CHECKS

Refer to Figure 2-1 on page 11 as necessary.

Do the following checks before operating the machine:

1. Complete the risk assessment checklist in Table 1-2 on page 5.
2. Check that the work area is clear of non-essential personnel and equipment.
3. Check that the TEST PRESSURE GAUGES show 0 psi/bar (except for the storage gauge, which is the maximum psi/bar that the operator can achieve at test pressure).
4. Check that all valves, including the BLOCK VALVES, SEAL PLATE LOCK-OUT VALVE, VESSEL OUTLET VALVE, and TABLE DRAIN VALVE, are in the closed position and that the TEST PRESSURE control is turned counter-clockwise until it stops.
5. Check that the test piece is securely clamped on the clamping table, and at the correct clamping pressure according to Table 3-1. (See Section 3.6 on page 35.)

NOTICE

Follow any pressure ratings indicated on the clamping arms. Exceeding the rated pressures could result in equipment damage.

⚠ WARNING

High-pressure valve testing may result in the sudden, unexpected release of stored energy with the potential to cause property damage or personnel injury. Potential hazards may include the possibility of high-velocity fluid escaping and high-energy projectile impact. The end-user must assess the application and install protective barrier devices, as appropriate.

NOTICE

This system has two relief valves (shown in Figure 4-1) that will vent high pressure air or nitrogen if the test pressure exceeds the rated pressures.

6. Check that the VESSEL DIVERTER VALVE is in the VENT position, and that the TABLE DRAIN/VENT VALVE is in the open (VENT/DRAIN) position.

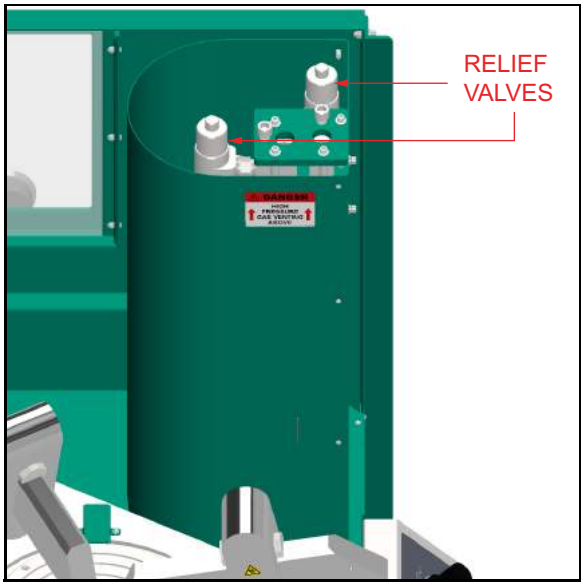

FIGURE 4-1. RELIEF VALVE VENT POINTS

4.2 CONDUCTING AN AIR OR NITROGEN TEST

4.2.1 Test procedure

NOTICE

The internal 5-gallon vessel and system should be drained of water before conducting an air test. Failure to do so could result in a mixed water/air test medium that could contaminate the device under test and startle the operator during safety relief valve lift or leakage testing. See Section 4.4 for details.

Do the following for an air or nitrogen test:

1. Open the SEAL PLATE LOCK-OUT VALVE at the clamp fixture control panel.

2. Close the TABLE DRAIN/VENT VALVE (according to Figure 4-2 and the notice below) and the VESSEL BLOCK VALVE.

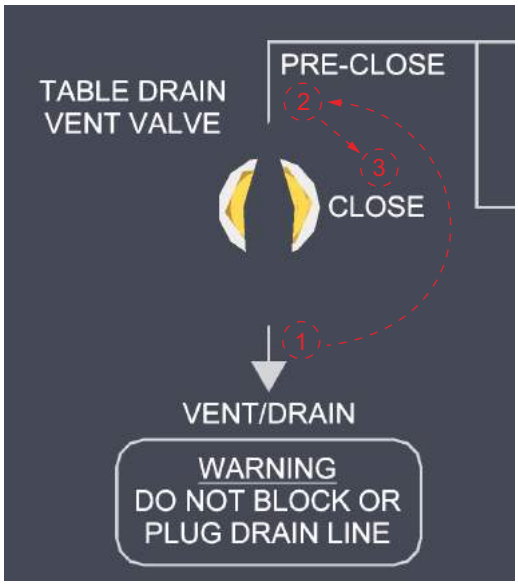

FIGURE 4-2. STEPS TO CLOSE THE TABLE DRAIN VENT VALVE

NOTICE

In order to close the TABLE DRAIN VENT VALVE from the open (VENT/DRAIN) position (1), rotate the valve handle to PRE-CLOSE (2) and then to the CLOSE position (3), as shown in Figure 4-2.

3. Open the INLET/OUTLET VALVE for the supply hose at the pressure source (for example, the DOT bottle assembly or compressor).
4. Open the STORAGE BLOCK VALVE and the TABLE BLOCK VALVE. (The TEST PRESSURE GAUGES should show 0 psi/bar.)
5. Check that the VESSEL OUTLET VALVE is closed.
6. Check that the TABLE DRAIN VALVE is closed at the clamp fixture control panel.
7. Set the VESSEL DIVERTER VALVE to VENT.
8. Turn the TEST PRESSURE CONTROL clockwise while monitoring the TEST PRESSURE gauge, until it reaches the desired test pressure. Increase pressure gradually.

4.2.2 Adjusting the device under test

If the safety relief valve (device under test) needs to be adjusted, do the following:

1. Rotate the TEST PRESSURE CONTROL counter-clockwise until it stops.
2. Open the TABLE DRAIN/VENT VALVE to vent out all remaining pressure within the system.
3. Close the BLOCK VALVES.
4. Check that both TEST PRESSURE GAUGES show 0 psi/bar.
5. Close and lock the SEAL PLATE LOCK-OUT VALVE at the clamp fixture.
6. Adjust the device under test as necessary.
7. Repeat Section 4.2.1 until no more adjustments are necessary.

4.3 CONDUCTING HYDROSTATIC OR WATER TEST

4.3.1 Test procedure

Do the following for a hydrostatic or water test:

1. Open the SEAL PLATE LOCK-OUT VALVE at the clamp fixture.
2. Open the VESSEL OUTLET VALVE.
3. Set the VESSEL DIVERTER VALVE to VENT.
4. Open the TABLE DRAIN VALVE.
5. Close the TABLE DRAIN/VENT VALVE (according to step 2 in Section 4.2.1 and Figure 4-2 on page 25).
6. Open the WATER SUPPLY VALVE and allow the system and device under test to fill with water.
7. When water begins to exit the TABLE without any bubbles, close the TABLE DRAIN VALVE, the WATER SUPPLY VALVE, and turn the VESSEL DIVERTER VALVE to TEST.
8. Open the STORAGE BLOCK VALVE and the VESSEL BLOCK VALVE.
9. Turn the TEST PRESSURE CONTROL clockwise while monitoring the TEST PRESSURE GAUGE, until it reaches the desired test pressure. Increase the pressure gradually.

NOTICE

If the system is overfilled with water, it is possible for water to escape by spraying under the TEST PRESSURE CONTROL knob when lowering the system pressure with the test pressure control. This is a normal occurrence and does not adversely affect machine performance.

4.3.2 Adjusting the device under test

If the safety relief valve (device under test) needs to be adjusted, do the following:

1. Rotate the TEST PRESSURE CONTROL counter-clockwise until it stops.
2. Set the VESSEL DIVERTER VALVE to VENT, to vent out all pressure within the system.
3. Verify that the VESSEL BLOCK VALVE is open and that the VESSEL PRESSURE GAUGE and both TEST PRESSURE GAUGES show 0 psi/bar.
4. Close the BLOCK VALVES.
5. Close and lock the SEAL PLATE LOCK-OUT VALVE at the clamp fixture.
6. Open the TABLE DRAIN VALVE to drain water as needed, and close when finished.

NOTICE

A pressure limiting valve is installed upstream of the table drain valve. Ensure test pressure gauge at clamp fixture shows zero psi/bar before draining. If test pressure is still present, the pressure limiting valve will shut and not reopen until all the test pressure has been drained.

7. Adjust the device under test as necessary.
8. Repeat Section 4.3.1 until no more adjustments are necessary.

4.4 PREPARING FOR THE TEST PIECE REMOVAL

When no more adjustments are necessary, do the following to remove the test piece:

1. Rotate the TEST PRESSURE CONTROL counter-clockwise until it stops.
2. Turn the VESSEL DIVERTER VALVE to vent to release all pressure within the system and inside the valves.
3. Verify that the VESSEL PRESSURE GAUGE and both TEST PRESSURE GAUGES show 0 psi/bar.
4. Open the TABLE DRAIN/VENT VALVE and TABLE DRAIN VALVE to drain any water from the system.
5. Keep the VESSEL DIVERTER VALVE in the VENT position.
6. Close the BLOCK VALVES.

After the tests, do the following:

1. Check that all valves are closed with two exceptions: the VESSEL DIVERTER VALVE (set to VENT) and the TABLE DRAIN/VENT VALVE (set to VENT/DRAIN).
2. Turn the TEST PRESSURE CONTROL counter-clockwise until it stops.
3. Lock the SEAL PLATE LOCK-OUT VALVE at the clamp fixture. See Figure 2-1 on page 11.

4.5 RELEASING THE CLAMP

To release the clamp, do the following:

1. Check that there is no residual pressure in the safety relief valve (that is, the device under test) as shown by both TEST PRESSURE GAUGES and that the SEAL PLATE LOCK-OUT VALVE is closed.

WARNING

Always vent the system pressure, then close the SEAL PLATE LOCK-OUT VALVE at the clamp fixture before removing (unclamping) the valve being tested. A sudden release of pressure could cause personnel injury and damage to the workpiece.

2. Close the PUMP AIR SUPPLY VALVE.
3. Turn the CLAMP PRESSURE CONTROL counter-clockwise until it stops.
4. Open the CLAMP RELEASE VALVE.
5. When the clamp pressure gauge reads 0 psi/bar, slide the clamp arms back and remove the test valve. Refer to Figure 1-4 on page 8 and Figure 2-4 on page 12.

TIP:

The Safety Interlock Switch reduces the likelihood of the clamps from releasing the device under test or if there is a loss of shop air while the test system is under pressure.

WARNING

Do not use the safety interlock in place of the primary hand-operated controls. The safety interlock is only a secondary measure to the correct operating procedure. Some residual pressure (up to 75 psi [5,2 bar]) may remain in the device under test when the safety interlock disengages, which may cause a pressure release and personnel injury, if the CLAMP RELEASE VALVE is not closed. Always remove test pressure, vent the test circuit, and close the SEAL PLATE LOCK-OUT VALVE before opening the clamp release valve.

5 MAINTENANCE

5.1 MAINTENANCE CHECKLIST

Table 5-1 lists maintenance intervals and their associated tasks.

TABLE 5-1. MAINTENANCE INTERVALS AND TASKS

Interval	Task
Before each use	Inspect the testing unit, including all hose connections, inlet supply lines, and outlet lines.
	Check the o-rings on the seal plates for cracks or nicks. Replace if necessary.
During use	Check the lubricator to ensure one drip to every 25 strokes of the pump. Adjust as needed. Use air tool oil (general purpose, such as AW-32) for the lubricator.
After each use	Wipe the component parts clean and dry to prevent corrosion.
Once a month	Inspect mufflers for damage and plugging. Replace if any are clogged.
	Check the oil level in the hydraulic clamp reservoir. The level should be half of the sight tube. Use Hydraulic Oil AW-46.
As needed	Change the air filter element (Parker PN PS701P Kit 40 micron).

5.2 TROUBLESHOOTING

If unable to hold a seal, remove the valve and do the following:

1. Check for the correct minimum hydraulic gauge pressure required to seal, according to Table 3-1 on page 21.
2. Check for the correct test pressure, according to Table 3-1 on page 21.
3. Check that all clamp arms are making good contact with the flange. Adjust if necessary.
4. Check for any cracks or nicks in the O-rings and replace any damaged ones.
5. Check for any damage (such as gouges, scratches, dents) on the raised face of the valve and the seal plate on the test bench.
6. Check the seal plate and raised face for any debris. Clean both surfaces.

⚠ WARNING

To minimize the risk of damage to the machine, workpiece, and personnel injury, use technical judgment and discretion when increasing the clamping pressure above the recommendations listed in Table 3-1 on page 21.

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6 STORAGE AND SHIPPING

IN THIS CHAPTER:

6.1 STORAGE

Proper storage of the safety relief valve tester will extend its usefulness and prevent undue damage.

Before storing, do the following:

1. Clean and dry the machine.
2. Drain the hydraulic fluid and air tool oil.

Store the safety relief valve tester in its original shipping container. Keep all packing materials for repackaging the machine.

6.1.1 Short-term storage

Do the following for short-term storage (three months or less):

1. Remove the tooling.
2. Remove the hoses.
3. Cap the ports.
4. Remove o-rings in the seal plate.
5. Remove the workpiece from the machine.
6. Spray all unpainted surfaces with LPS-2 to prevent corrosion.
7. Store the safety relief valve tester in its original shipping box.

6.1.2 Long-term storage

Do the following for long-term storage (longer than three months):

1. Follow the short-term storage instructions, but use LPS-3 instead of LPS-2.
2. Add a desiccant pouch to the shipping container. Replace according to manufacturer instructions.
3. Store the shipping container in an environment out of direct sunlight with temperature < 70ºF (21ºC) and humidity < 50%.

6.2 SHIPPING

Before shipping, remove the hydraulic and air tool oil fluids.

6.3 DECOMMISSIONING

To decommission the safety relief valve tester prior to disposal, remove the air tool oil and hydraulic fluid before dismantling machine components. Refer to Appendix A for component assembly information.

APPENDIX A ASSEMBLY DRAWINGS

Drawing list

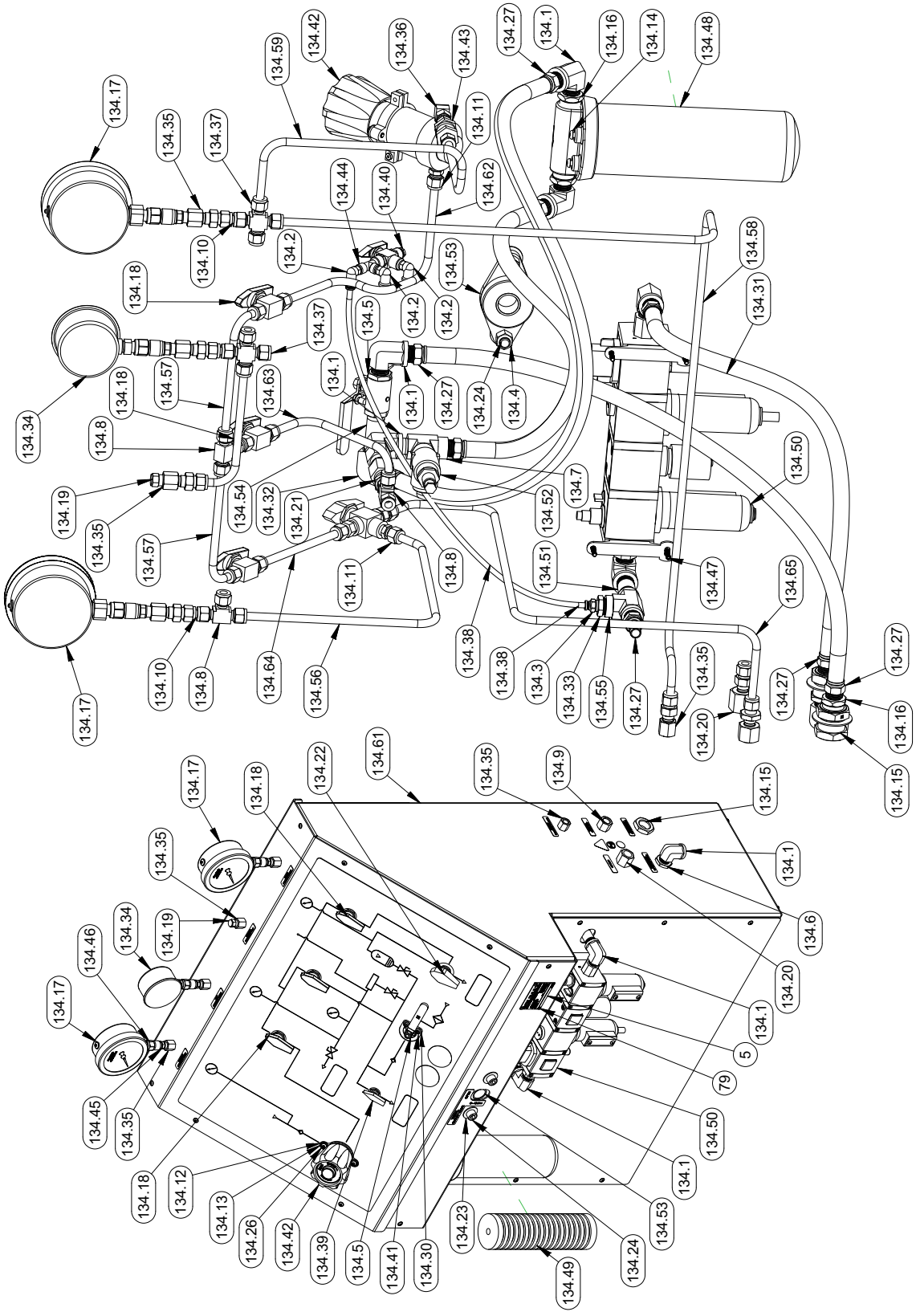


FIGURE A-1. SRV-3K WITH VESSEL FRONT CONSOLE ASSEMBLY (P/N 88845)

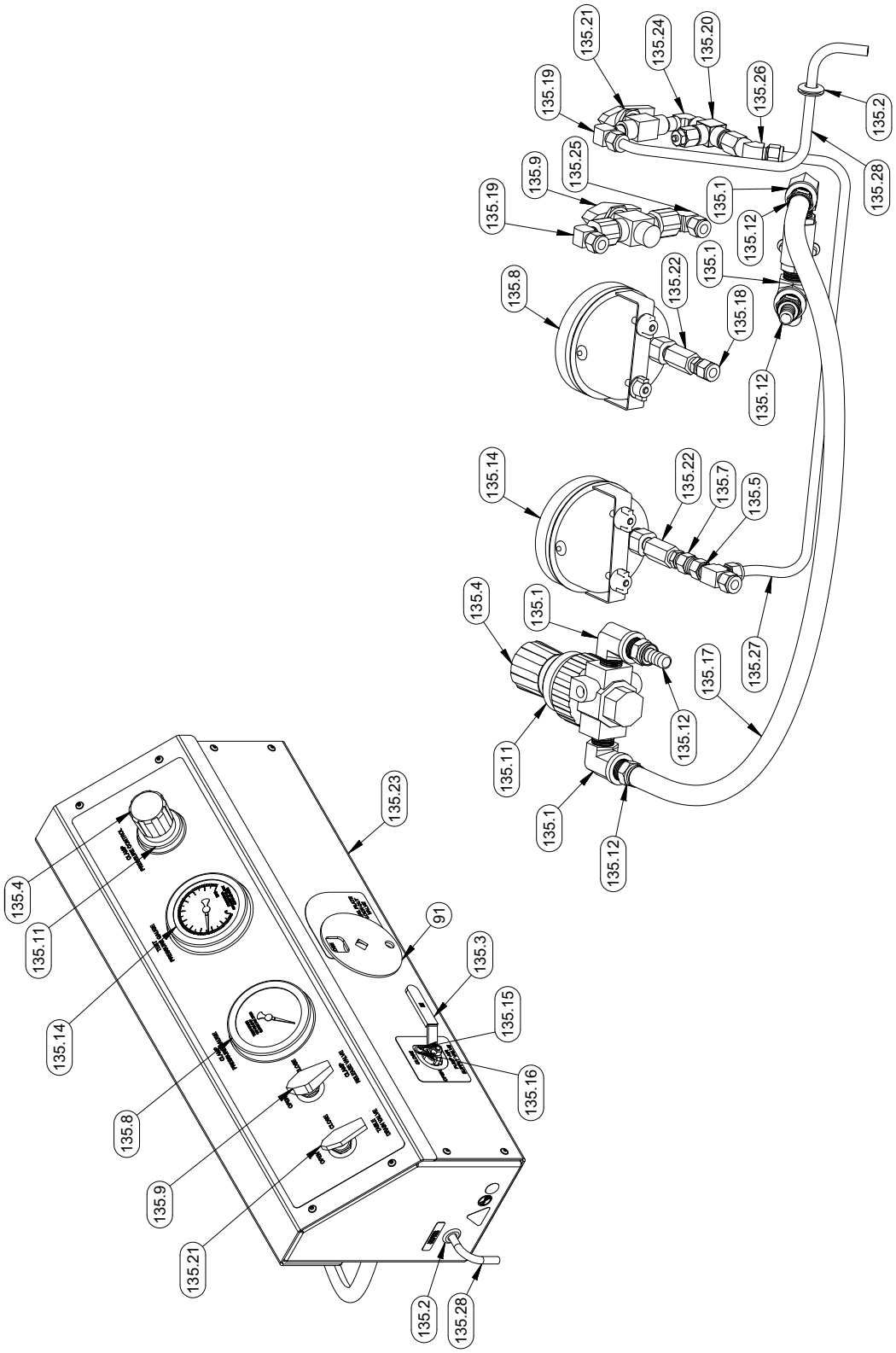


FIGURE A-2. SRV-3K WITH VESSEL CLAMP CONSOLE ASSEMBLY (P/N 88845)

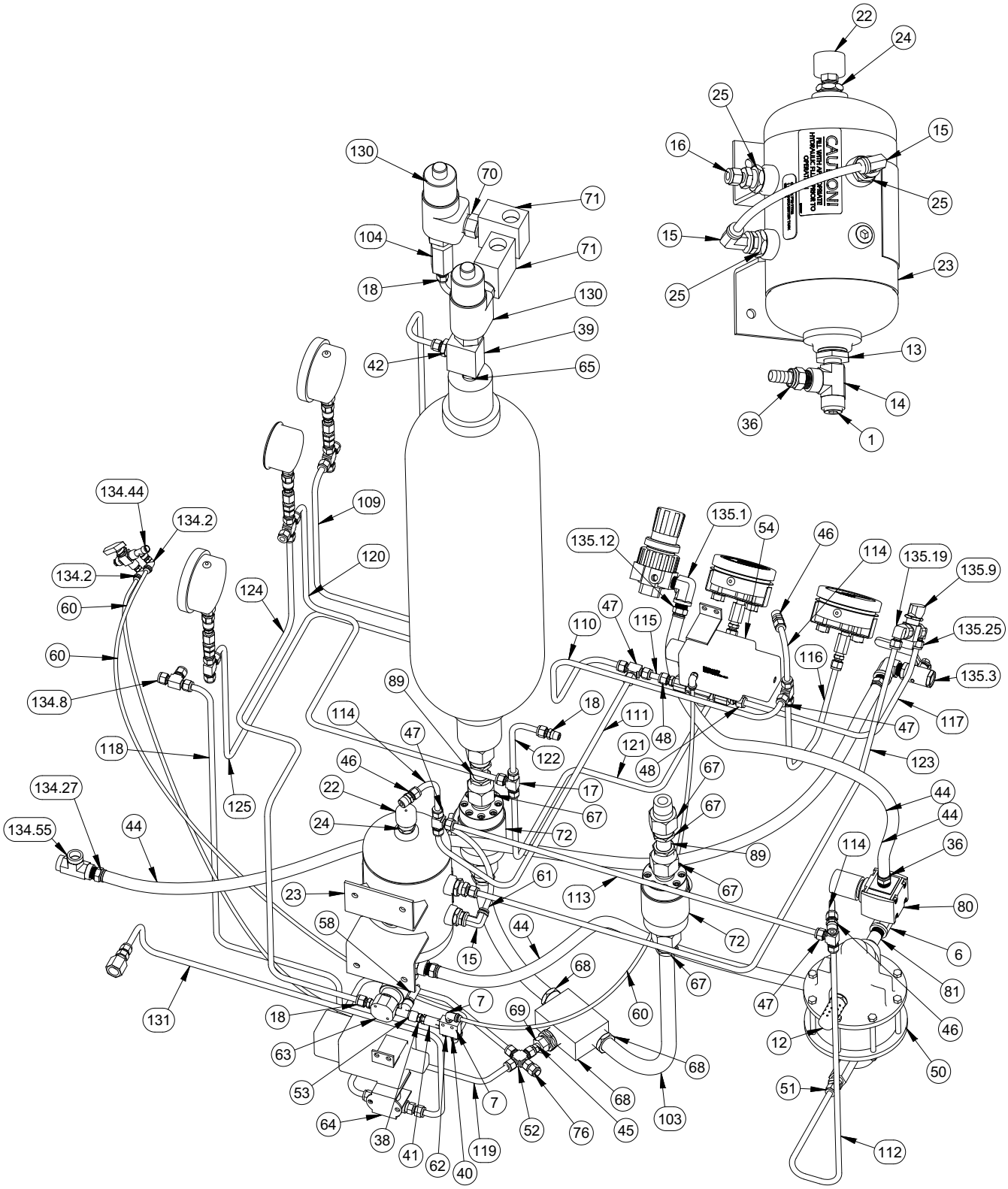


FIGURE A-3. SRV-3K WITH VESSEL PLUMBING ASSEMBLY (P/N 88845)

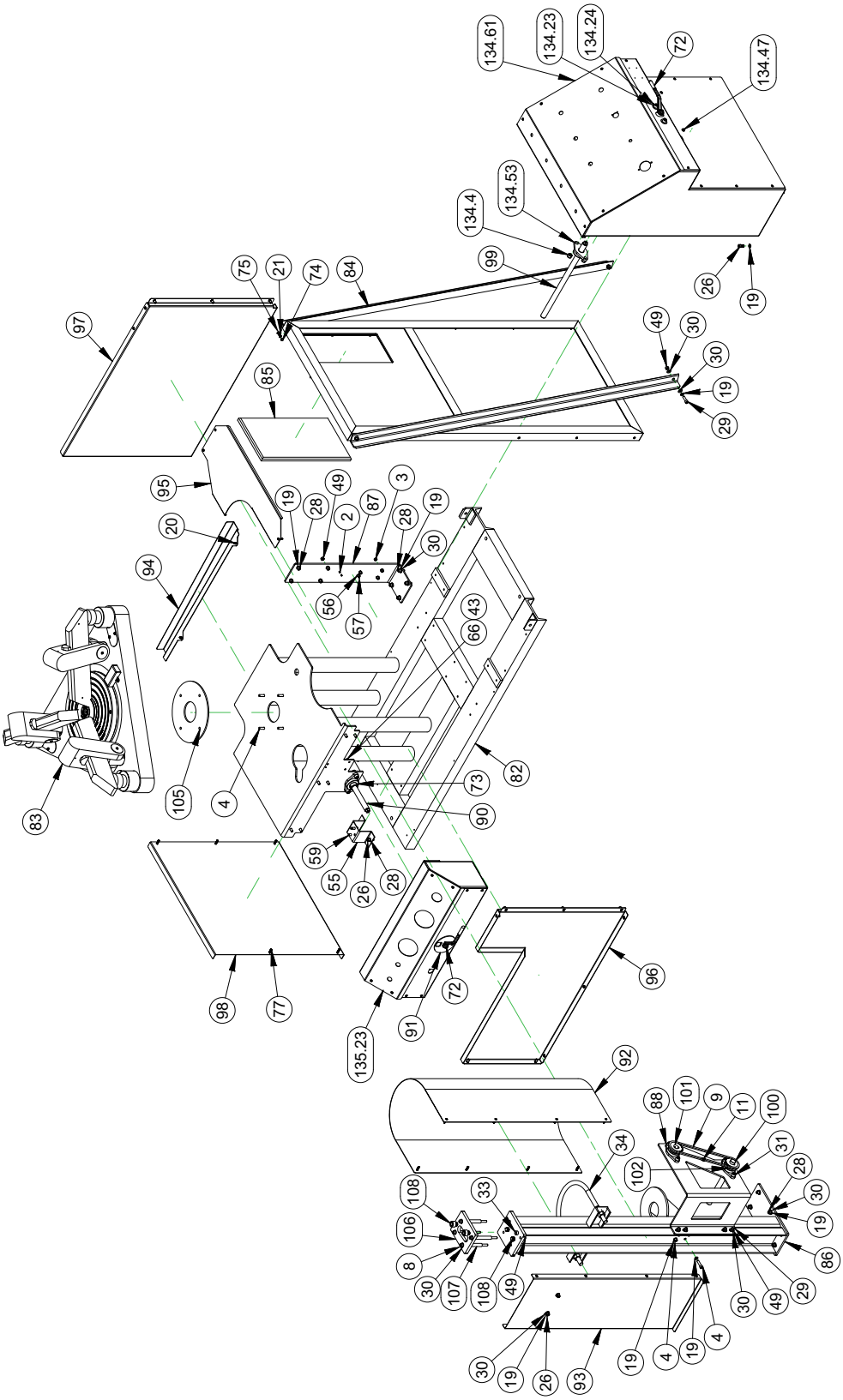


FIGURE A-4. SRV-3K WITH VESSEL PLUMBING LABEL ASSEMBLY (P/N 88845)

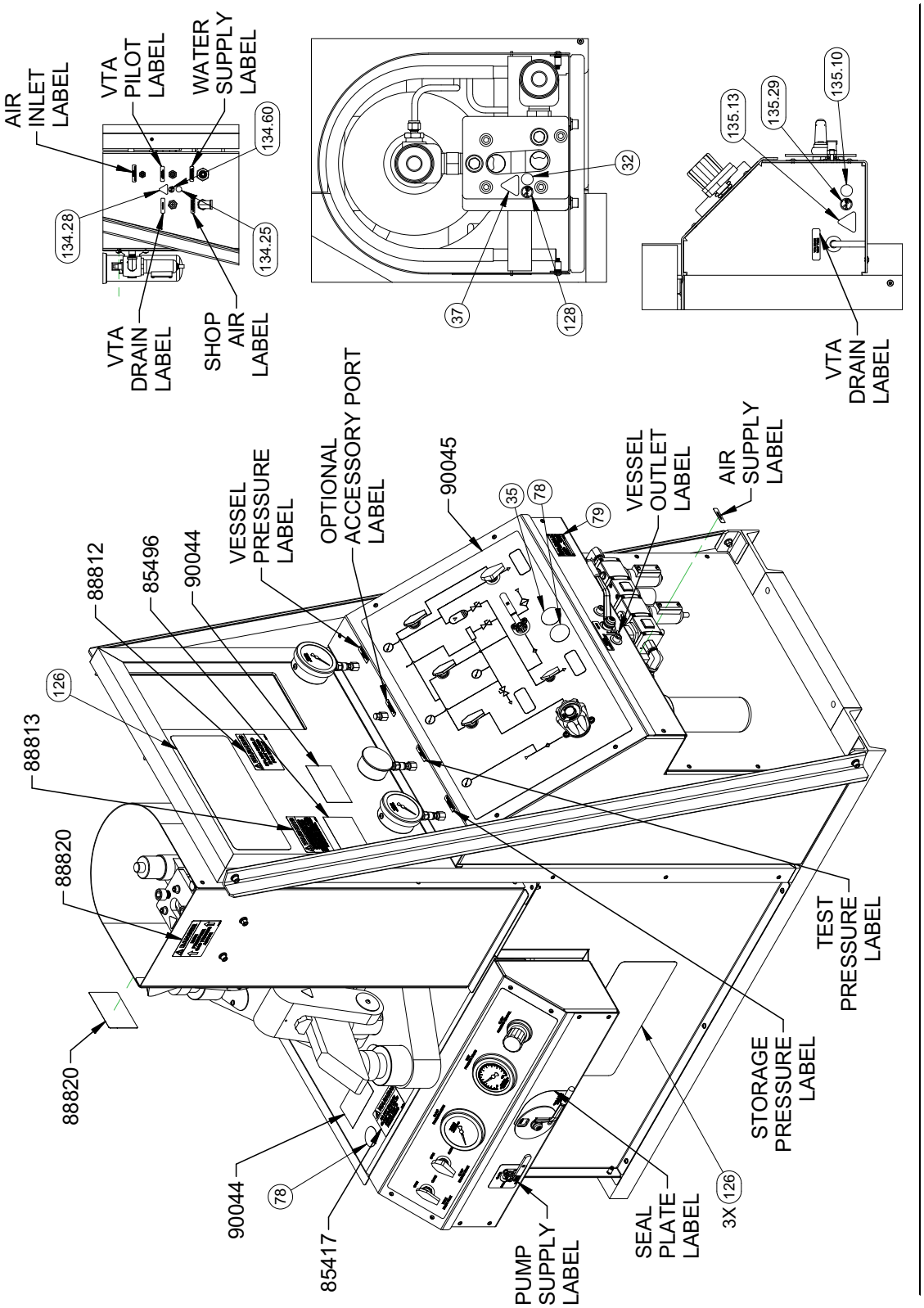


FIGURE A-5. SRV-3K WITH VESSEL PLUMBING OVERVIEW ASSEMBLY (P/N 88845)

ITEM	QTY	P/N:	DESCRIPTION	SCHEMATIC ID
1	1	12579	FTG PLUG 1/2 NPTM SOCKET	
2	2	13695	SCREW 10-32 X 1/2 SHCS SS	
3	4	13904	NUT 5/16-18 STDN STAINLESS STEEL	
4	8	13907	SCREW 3/8-16 X 1-1/2 SHCS STAINLESS	
5	1	14684	PLATE SERIAL YEAR MODEL 2.0 X 3.0	
6	2	35692	FTG ELBOW 1/2 NPTM X 1/2 NPTF ST 90 DEG BRASS	
7	4	48648	FTG ELBOW 1/8 NPTM X 1/4 TUBE PRESTOLOK	
8	4	66159	SCREW 3/8-16 X 6 SHCS ZINC PLATED	
9	33	67663	ROLLER CHAIN #35 SINGLE 3/8 P .20 DIA	
10	6	68976	NUT 1/2-13 NYLON INSERT ZINC PLATED GRADE 5	
11	1	70218	LINK #35 CHAIN CONNECTING	
12	1	77399	HIGH FLOW MUFFLER 3/4 NPTM COMPACT	M1
13	1	77403	STRAINER OIL 1 NPTM X 1/2 NPTF	F3
14	1	77422	FTG TEE 1/2 NPTM X 1/2 NPTF MALE RUN TEE BRASS	T1
15	2	77459	FTG ELBOW 1/2 NPTM X 3/8 TUBE PRESTOLOC SWIVEL 90 DEG BRASS	
16	1	77460	FTG CONNECTOR 1/2 NPTM X 3/8 TUBE	
17	1	77461	FTG TUBE TEE UNION 3/8 TUBE	
18	3	77493	FTG CONNECTOR 1/4 NPTM X 3/8 TUBE SS	
19	55	77523	WASHER 3/8 LOCK SS	
20	11	77557	SCREW 1/4-20 X 1/2 BHCS SS	
21	17	77558	WASHER 1/4 LOCK SS	
22	1	77787	FILLER BREATHER 3/8 NPTM	F2
23	1	77788	RESERVOIR HYDRAULIC 1 GAL	
24	1	77797	FTG BUSHING BRASS 3/4 NPTM X 3/8 NPTF	
25	3	77877	FTG BUSHING BRASS 3/4 NPTM X 1/2 NPTF	
26	12	77979	SCREW 3/8-16 X 3/4 SHCS SS	
27	6	78415	WASHER 1/2 FLTW SS	
28	21	78427	SCREW 3/8-16 X 1 SHCS SS	
29	8	78526	SCREW 3/8-16 X 1 1/4 SHCS SS	
30	36	78672	WASHER 3/8 FLTW SS	
31	6	79103	SCREW 1/2-13 X 1-1/4 SHCS SS	
32	1	79328	LABEL WARNING - CONSULT OPERATOR'S MANUAL GRAPHIC .75 DIA	
33	1	79520	SPACER AL 3/8 ID X 3/4 OD X 3/8	
34	1	79977	U-BOLT(RUBBER SLEEVE) FOR 10" PIPE 3/4-10 THREAD	
35	1	81008	LABEL WEAR HEARING AND EYE PROTECTION 2.0 DIA	
36	3	81917	FTG BARB 1/2 NPTM X 1/2 HOSE SWIVEL BRASS	
37	1	82144	LABEL WARNING - GENERAL DANGER GRAPHIC 1.30 X 1.13	
38	1	82411	FTG BRASS REDUCING HEX NIPPLE 1/4 MNPT X 1/8 MNPT	
39	1	82450	FTG HP TEE 10KSI 3/4 FNPT	
40	1	82455	VALVE PUSH BUTTON AIR N/O 1/8 FNPT	PRS1
41	1	82456	AIR PILOT OPERATOR 1/8 FNPT	
42	1	82476	FTG TUBE CONNECTOR 3/4 NPTM X 3/8 TUBE	
43	4	82687	WASHER 5/16 FLTW SS	
44	139	82847	HOSE LOW PRESSURE PUSH LOK 1/2 ID	
45	1	82873	FTG, TUBE MALE ADAPTER, 3/8" TUBE X 1/4" MNPT	
46	3	83092	FTG CONNECTOR 3/8NPTM X 3/8 TUBE SUPER DUPLEX	
47	4	83094	FTG TUBE TEE UNION 3/8 TUBE SUPER DUPLEX	
48	2	83105	FTG TUBE CONNECTOR 1/4 NPTM X 3/8 TUBE SUPER DUPLEX	
49	26	83159	NUT 3/8-16 HEX SS	
50	1	83521	PUMP AIR DRIVEN 10,000 PSI OIL SERVICE	P1
51	1	83671	FTG CONNECTOR 1/2 NPTM X 3/8 TUBE SUPER DUPLEX	
52	1	84083	FTG UNION CROSS 3/8 TUBE	

FIGURE A-6. SRV-3K WITH VESSEL PLUMBING ASSEMBLY PARTS LIST 1–52 (P/N 88845)

ITEM	QTY	P/N:	DESCRIPTION	SCHEMATIC ID
53	1	84571	FTG TEE 1/4" NPT STREET BRASS	
54	1	84602	VALVE BALL AIR ACTUATED 10KSI 1/4 NPTF NORMALLY CLOSED	V12
55	1	84859	PUMP BRACKET BLACK	
56	8	84970	WASHER 5/16 LOCW SS	
57	4	84985	SCREW 5/16-18 X 7/8 SHCS SS	
58	1	85240	VALVE PRESSURE RELIEF AIR 120 PSI 1/4 NPTM	R3
59	2	85271	SCREW 3/8-24 X 3/4 SHCS SS	
60	122	85288	TUBING 1/4 OD X .170 ID POLYETHELYNE	
61	8	85289	TUBING 3/8 OD X 1/4 ID POLYETHELYNE	
62	1	85338	VENT BREATHER 1/8 NPTM	
63	1	85550	REGULATOR PRESSURE REDUCING PRE-SETTABLE 80-140 PSI 2 PORTS 1/4 NPTF	PRV3
64	1	85943	VALVE BALL AIR ACTUATED 6KSI 3/8 TUBE 1/8 FNPT PILOT PORT NORMALLY OPEN	V10
65	1	85968	FTG NIPPLE 3/4 NPTM X 3/4 NPTM SS	
66	4	85973	SCREW 5/16-18 X 1/2 SHCS SS	
67	6	85986	FTG HP ADAPTER 1 NPTM X 1 MEDIUM PRESSURE W/ COLLAR AND GLAND	
68	1	86000	FTG, MP TEE, 20KSI, 1" OD MP TUBE	
69	1	86006	FTG ADAPTER MEDIUM PRESSURE 1/4 FNPT X 1" M.P. MALE	
70	2	86008	FTG HP ADAPTER 1 NPTM X 1 NPTM 10000 PSI	
71	2	86042	FTG HP ELBOW 10KSI 1 FNPT	
72	2	86060	BALL VALVE 6KSI .88" BORE 1" NPTF	V5, V6
73	3	86066	SHAFT COLLAR ALUMINUM SEAL PLATE VALVE	
74	6	86075	NUT 1/4-20 X 1/4 ACON SS	
75	6	86129	SCREW 1/4-20 X 5/8 BHCS SS	
76	1	86524	FTG PLUG 3/8" TUBE SS	
77	22	87231	SCREW 10-32 X 1 BHSCS FLANGED SS316	
78	2	87593	LABEL WARNING - CONSULT OPERATORS MANUAL 2.0 DIA	
79	4	87775	RIVET BLIND 1/8 DIA SS 316	
80	1	87838	REGULATOR 1/2 NPTF 7-125 PSIG W/BRACKET & PANEL NUT	PRV2
81	1	88033	FTG NIPPLE 1/2 NPTM X 2-1/2 BRASS	
82	1	88407	WELDMENT CLAMP FIXTURE 3-ARM AND SKID FRAME	
83	1	88408	ASSY TABLE TOP SEAL PLATES 3 ARM CLAMP SRV 3K & 6K	C1, C2, C3
84	1	88466	WELDMENT FRAME WINDOW SHIELD	
85	1	88467	SHEET HYGARD BR750 21.25" X 11.25"	
86	1	88481	WELDMENT VESSEL MOUNT	
87	1	88482	BRACKET HYDRAULIC RESERVOIR MOUNT	
88	3	88487	BEARING BRONZE ALUMINUM FLANGE MOUNTED 1" SHAFT	
89	2	88488	FTG NIPPLE MEDIUM PRESSURE 1 MP X 6 LG	
90	1	88489	SHAFT EXTENSION 1" DIA SEAL PLATE VALVE	
91	1	88491	BRACKET LOCKOUT SEAL PLATE VALVE	
92	1	88698	ENCLOSURE BARRIER A	
93	1	88699	ENCLOSURE BARRIER B	
94	1	88700	CHANNEL FLUID CATCH	
95	1	88701	ENCLOSURE BARRIER C	
96	1	88702	ENCLOSURE BARRIER D	
97	1	88703	ENCLOSURE BARRIER E	
98	1	88704	ENCLOSURE BARRIER F	
99	1	88705	SHAFT EXTENSION 1" DIA VESSEL VALVE A	
100	1	88714	SHAFT EXTENSION 1" DIA VESSEL VALVE B	
101	2	88716	SPROCKET 3/8 PITCH #35 CHAIN 23 TOOTH 1 IN BORE	

FIGURE A-7. SRV-3K WITH VESSEL PLUMBING ASSEMBLY PARTS LIST 53–101 (P/N 88845)

ITEM	QTY	P/N:	DESCRIPTION	SCHEMATIC ID
102	4	88717	WASHER 1.015 ID X 1.75 OD X .098 T FLTW SS	
103	1	88720	TUBING SET 1 OD X .688 ID SS 316	
104	1	88733	FTG ADAPTER 10000 PSI 3/4 NPTF X 1/4 NPTF	
105	1	88753	PLATE SPACER TABLE TOP	
106	1	88765	RELIEF VALVE ASSY BRACKET	
107	4	88769	RELIEF VALVE CLAMP SPACER	
108	4	88770	SCREW 3/4-16 X 1-1/2 SHCS SS 18-8	
109	1	88784	TUBE 3/8 SRV 6	
110	1	88786	TUBE 3/8 SRV 8 SUPER DUPLEX	
111	1	88787	TUBE 3/8 SRV 9 SUPER DUPLEX	
112	1	88788	TUBE 3/8 SRV 10 SUPER DUPLEX	
113	1	88789	TUBE 3/8 SRV 11 SUPER DUPLEX	
114	3	88790	TUBE 3/8 SRV 12 SUPER DUPLEX	
115	1	88791	TUBE 3/8 SRV 13 SUPER DUPLEX	
116	1	88792	TUBE 3/8 SRV 14 SUPER DUPLEX	
117	1	88793	TUBE 3/8 SRV 15 SUPER DUPLEX	
118	1	88794	TUBE 3/8 SRV 16	
119	1	88795	TUBE 3/8 SRV 17	
120	1	88798	TUBE 3/8 SRV 20	
121	1	88799	TUBE 3/8 SRV 21	
122	1	88800	TUBE 3/8 SRV 22	
123	1	88803	TUBE 3/8 SRV 25	
124	1	88805	TUBE 3/8 SRV 27	
125	1	88806	TUBE 3/8 SRV 28	
126	4	88823	LABEL CALDER SRV-6K SYSTEM 16 X 7	
127	1	88824	(NOT SHOWN) CRATE 86 X 64 X 86 LIGHTWEIGHT ECORRCRATE	
128	1	89548	LABEL DO NOT PLUG / BLOCK PORT	
129	1	89974	VESSEL 3 KSI 5 GAL (NON-CE CERTIFIED) - SEE ADDITIONAL INFORMATION	
130	2	89980	VALVE PRESSURE RELIEF SET @ 3000 PSI, 3/4 MNPT INLET, 1 FNPT OUTLET, NON-CE CERTIFIED	R1, R4
131	1	90049	TUBE 3/8 SRV-3K 4	
132	1	90052	KIT - LABEL SRV 3K US STANDARD	
133	1	90107	(NOT SHOWN) MANUAL INSTRUCTION SRV-3K W/ VESSEL	
134	1	90110	ASSY MAIN CONSOLE SRV 3K	
134.1	7	35692	FTG ELBOW 1/2 NPTM X 1/2 NPTF ST 90 DEG BRASS	
134.2	3	48648	FTG ELBOW 1/8 NPTM X 1/4 TUBE PRESTOLOK	
134.3	1	51263	FTG ADAPTER 1/4 NPTM X 1/4 TUBE F PRESTOLOCK NICKEL PLATED	
134.4	2	68976	NUT 1/2-13 NYLON INSERT ZINC PLATED GRADE 5	
134.5	1	77389	BALL VALVE 1/2 NPT FEMALE 160 PSI	V8
134.6	1	77421	FTG BULKHEAD 1/2 NPTF BRASS	
134.7	1	77422	FTG TEE 1/2 NPTM X 1/2 NPTF MALE RUN TEE BRASS	
134.8	3	77461	FTG TUBE TEE UNION 3/8 TUBE	
134.9	1	77465	FTG BULKHEAD 3/8 NPTF X 3/8 TUBE	
134.10	5	77492	FTG CONNECTOR PORT 3/8 TUBE	
134.11	2	77493	FTG CONNECTOR 1/4 NPTM X 3/8 TUBE SS	
134.12	2	77544	WASHER 1/4 FLTW SS	
134.13	2	77558	WASHER 1/4 LOCK SS	
134.14	4	77602	SCREW 1/4-20 X 3/8 BHCS SS	
134.15	1	77872	FTG BULKHEAD 3/4 NPT BRASS	
134.16	3	77877	FTG BUSHING BRASS 3/4 NPTM X 1/2 NPTF	
134.17	2	77882	GAUGE PRESSURE 4 INCH DIA 3000 PSI GLYCERIN FILLED 1/4 MNPT BOTTOM MOUNT	G1, G3

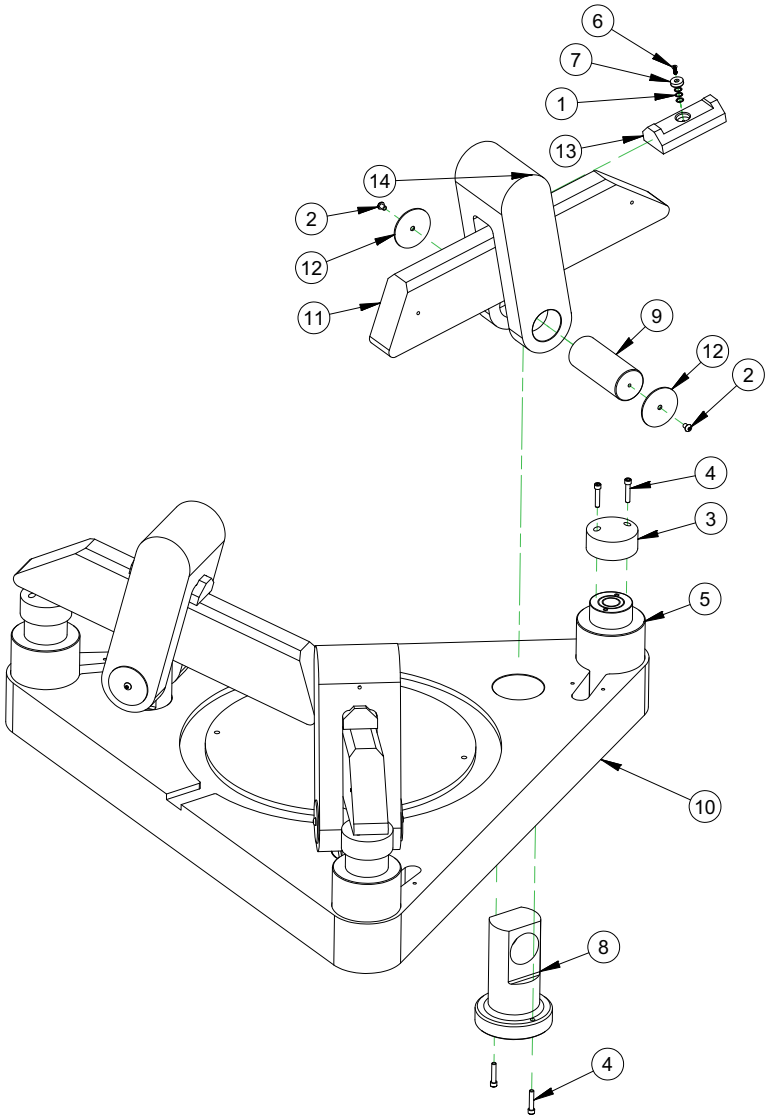
FIGURE A-8. SRV-3K WITH VESSEL PLUMBING ASSEMBLY PARTS LIST 102–134.17 (P/N 88845)

PARTS LIST				
ITEM	QTY	P/N:	DESCRIPTION	SCHEMATIC ID
134.18	3	77901	BALL VALVE 3000 PSI 3/8 TUBE	V1, V2, V4
134.19	1	77902	FTG PLUG 1/4 NPTM	
134.20	1	77911	FTG BULKHEAD 1/2 NPTF X 3/8 TUBE	
134.21	1	77915	FTG MALE ADAPTER 1/2 NPTM X 3/8 TUBE	
134.22	1	77916	BALL VALVE 3 WAY 3/8" TUBE 6000 PSI	V3
134.23	2	78415	WASHER 1/2 FLTW SS	
134.24	2	79103	SCREW 1/2-13 X 1-1/4 SHCS SS	
134.25	1	79328	LABEL WARNING - CONSULT OPERATOR'S MANUAL GRAPHIC .75 DIA	
134.26	2	80952	SCREW 1/4-20 X 3/4 BHCS SS	
134.27	9	81917	FTG BARB 1/2 NPTM X 1/2 HOSE SWIVEL BRASS	
134.28	1	82144	LABEL WARNING - GENERAL DANGER GRAPHIC 1.30 X 1.13	
134.29	1	82378	FTG, CHECK VALVE, 4600 PSI, 1/2" FNPT	CV2
134.30	2	82685	WASHER #10 FLTW SS	
134.31	4	82847	HOSE LOW PRESSURE PUSH LOK 1/2 ID	
134.32	1	82871	FTG BRASS FEMALE ELBOW 1/2 NPT	
134.33	1	83135	FTG BUSHING 1/2 NPTM x 1/4 NPTF BRASS	
134.34	1	83322	GAUGE DIGITAL 3KSI 3 INCH BOTTOM MOUNT 1/4 MNPT	G2
134.35	5	83373	FTG BULKHEAD 1/4 NPTF X 3/8 TUBE	
134.36	1	83801	TUBE MALE ELBOW 3/8 TUBE X 1/4 MNPT	
134.37	2	84083	FTG UNION CROSS 3/8 TUBE	
134.38	1	85288	TUBING 1/4 OD X .170 ID POLYETHELYNE	
134.39	1	85337	BALL VALVE DIVERTING 3 PORT 1500 PSI 1/8 NPTF PORTS	V9
134.40	1	85338	VENT BREATHER 1/8 NPTM	
134.41	2	85457	SCREW 10-24 X 3/8 SHCS SS	
134.42	1	85478	REGULATOR SELF VENT 6 KSI BRASS 1/4 NPT	PRV1
134.43	1	85931	FTG, CHECK VALVE, 6000 PSI, 3/8" TUBE	CV1
134.44	1	85946	FTG TEE BRASS 1/8 MNPT X 1/8 FNPT X 1/8 FNPT	
134.45	3	87040	FTG TEST POINT 10 KSI 1/4 NPTM - M12 X 1.5 SS W/SS COVER	
134.46	3	87041	FTG TEST POINT GAUGE ADAPTER 10 KSI 1/4 NPTF - M12 X 1.5 FEMALE SS	
134.47	4	87231	SCREW 10-32 X 1 BHSCS FLANGED SS316	
134.48	1	87236	FILTER ASSY 3/4 NPTF 9-3/4 CTG LENGTH SS HOUSING	F1
134.49	1	87436	FILTER CARTRIDGE WATER 9-3/4" LONG 125 MICRON	
134.50	1	87836	ASSY AIR PREP UNIT & LUBRICATOR USV	F2, G5, L1, RG1, V14
134.51	1	88033	FTG NIPPLE 1/2 NPTM X 2-1/2 BRASS	
134.52	1	88485	RELIEF VALVE 25-175 PSI 1/2 NPTM INLET X 1/2 NPTF OUTLET BRONZE	R2
134.53	1	88487	BEARING BRONZE ALUMINUM FLANGE MOUNTED 1" SHAFT	
134.54	1	88521	FTG NIPPLE 1/2 NPTM X 3 BRASS	
134.55	1	88522	FTG TEE 1/2 NPTF UNION BRASS	
134.56	1	88778	TUBE 3/8 SRV 1	
134.57	3	88782	TUBE 3/8 SRV 4	
134.58	1	88785	TUBE 3/8 SRV 7	
134.59	1	88796	TUBE 3/8 SRV 18	
134.60	1	89548	LABEL DO NOT PLUG / BLOCK PORT	
134.61	1	90042	CONSOLE SRV 3K TEST SYSTEM	
134.62	1	90046	TUBE 3/8 SRV-3K 1	
134.63	1	90047	TUBE 3/8 SRV-3K 2	
134.64	1	90048	TUBE 3/8 SRV-3K 3	
134.65	1	90050	TUBE 3/8 SRV-3K 5	

FIGURE A-9. SRV-3K WITH VESSEL PLUMBING ASSEMBLY PARTS LIST 134.17–134.65 (P/N 88845)

PARTS LIST				
ITEM	QTY	P/N:	DESCRIPTION	SCHEMATIC ID
135	1	90111	ASSY SECONDARY CONSOLE SRV 3K	
135.1	4	35692	FTG ELBOW 1/2 NPTM X 1/2 NPTF ST 90 DEG BRASS	
135.2	1	67634	GROMMET 1/2 ID X 1 OD	
135.3	1	77389	BALL VALVE 1/2 NPT FEMALE 160 PSI	V11
135.4	1	77394	REGULATOR AIR 1/2 NPT 125 PSI	PRV4
135.5	1	77461	FTG TUBE TEE UNION 3/8 TUBE	
135.6	1	77492	FTG CONNECTOR PORT 3/8 TUBE	
135.7	1	77493	FTG CONNECTOR 1/4 NPTM X 3/8 TUBE SS	
135.8	1	77652	GAUGE PRESSURE 4 DIA 0-10000 PSI 1/4 NPTM LOWER BACK MOUNT	G4
135.9	1	77792	VALVE BALL 2 WAY 1/4 NPTF 10000 PSI	V13
135.10	1	79328	LABEL WARNING - CONSULT OPERATOR'S MANUAL GRAPHIC .75 DIA	
135.11	1	81787	MOUNT NUT REGULATOR PANEL	
135.12	4	81917	FTG BARB 1/2 NPTM X 1/2 HOSE SWIVEL BRASS	
135.13	1	82144	LABEL WARNING - GENERAL DANGER GRAPHIC 1.30 X 1.13	
135.14	1	82379	GAUGE PRESSURE 4 INCH DIA 3000 PSI GLYCERIN FILLED C-CLAMP MOUNT CALIBRATION CERT	G5
135.15	2	82641	SCREW 10-24 X 1/4 SHCS SS	
135.16	2	82685	WASHER #10 FLTW SS	
135.17	1	82847	HOSE LOW PRESSURE PUSH LOK 1/2 ID	
135.18	1	83105	FTG TUBE CONNECTOR 1/4 NPTM X 3/8 TUBE SUPER DUPLEX	
135.19	2	83801	TUBE MALE ELBOW 3/8 TUBE X 1/4 MNPT	
135.20	1	84057	VALVE PRESSURE LIMITING 3 KSI MAX IN 10-150 PSI OUT 1/4 NPT BRASS	PLV1
135.21	1	85467	VALVE BALL 2 WAY 1/4 NPTF 3000 PSI	V7
135.22	2	85922	COUPLING MEDIUM PRESSURE 1/4 FNPT	
135.23	1	88480	CONSOLE SECONDARY SRV TEST SYSTEM	
135.24	1	88735	FTG 1/4 NPTM X 1/4 NPTM SS ELBOW	
135.25	1	88737	FTG ELBOW 1/4 NPTM X 3/8 TUBE 90 DEG SUPER DUPLEX	
135.26	1	88779	FTG ELBOW 1/4 NPTM X 3/8 TUBE 45 DEG	
135.27	1	88801	TUBE 3/8 SRV 23	
135.28	1	88802	TUBE 3/8 SRV 24	
135.29	1	89548	LABEL DO NOT PLUG / BLOCK PORT	

FIGURE A-10. SRV-3K WITH VESSEL PLUMBING ASSEMBLY PARTS LIST 135–135.29 (P/N 88845)



PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	12	67175	WASHER SHIM .313 ID .438 OD .010 THK
2	6	77602	SCREW 1/4-20 X 3/8 BHCS SS
3	3	79723	SPACER RAM
4	12	79724	SCREW 1/4-20 X 1-1/4 SHCS SS
5	3	80246	RAM 30 TON 2-7/16 STROKE SPRING RETURN
6	3	86154	SCREW 8-32 X 1/2 FHSCS SS T15 TORX
7	3	86159	MAGNET 3/4" DIA X 1/4" THICK 15 LBS MAX PULL
8	3	88440	POST BASE PIN
9	3	88441	CLAMP ARM POST PIN
10	1	88443	CLAMP ARM FIXTURE MAIN PLATE
11	3	88715	EXTENDED ARM CLAMP 45° & 60°
12	6	88738	OVERSIZED WASHER 1/4 X 2.5 OD SS 316
13	3	88744	EXTENDED CLAMP ARM SPACER BLOCK
14	3	88745	CLAMP ARM POST SOLID
15	3	88907	(NOT SHOWN) EXTENDED CLAMP ARM LANYARD KIT

FIGURE A-11. TABLE TOP ASSEMBLY (P/N 88408)

TABLE A-1. O-RINGS KIT P/N 88891

Part number	Description	Quantity
77587	O-RING 1-3/8 ID X 1-5/8 OD X 1/8 W NITRILE 90 DUROMETER (2-220)	2
77588	O-RING 2-1/2 ID X 2-3/4 OD X 1/8 W NITRILE 90 DUROMETER (2-230)	2
78458	O-RING 8-3/4 ID X 9-1/8 OD X 3/16 W NITRILE 90 DUROMETER (2-372)	2
78513	O-RING 11 ID X 11-3/8 OD X 3/16 W NITRILE 90 DUROMETER (2-379)	2
78514	O-RING 13 ID X 13-3/8 OD X 3/16 W NITRILE 90 DUROMETER (2-382)	2
79771	O-RING 1 ID X 1-1/4 OD X 1/8 W NITRILE 90 DUROMETER (2-214)	4
83005	O-RING 2-1/16 ID X 2-3/8 OD X 1/8 W NITRILE 90 DUROMETER (2-227)	2
83898	O-RING 1-1/16 ID X1-7/16 OD X 3/16 W NITRILE 90 DUROMETER (2-319)	2
88826	O-RING 3-1/2 ID X 3-3/4 OD X 1/8 W NITRILE 90 DUROMETER (2-238)	2
88827	O-RING 4-3/8 ID X 4-5/8 OD X 1/8 W NITRILE 90 DUROMETER (2-245)	2
88828	O-RING 6-1/2 ID X 6-7/8 OD X 3/16 W NITRILE 90 DUROMETER (2-363)	2

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APPENDIX B SCHEMATICS

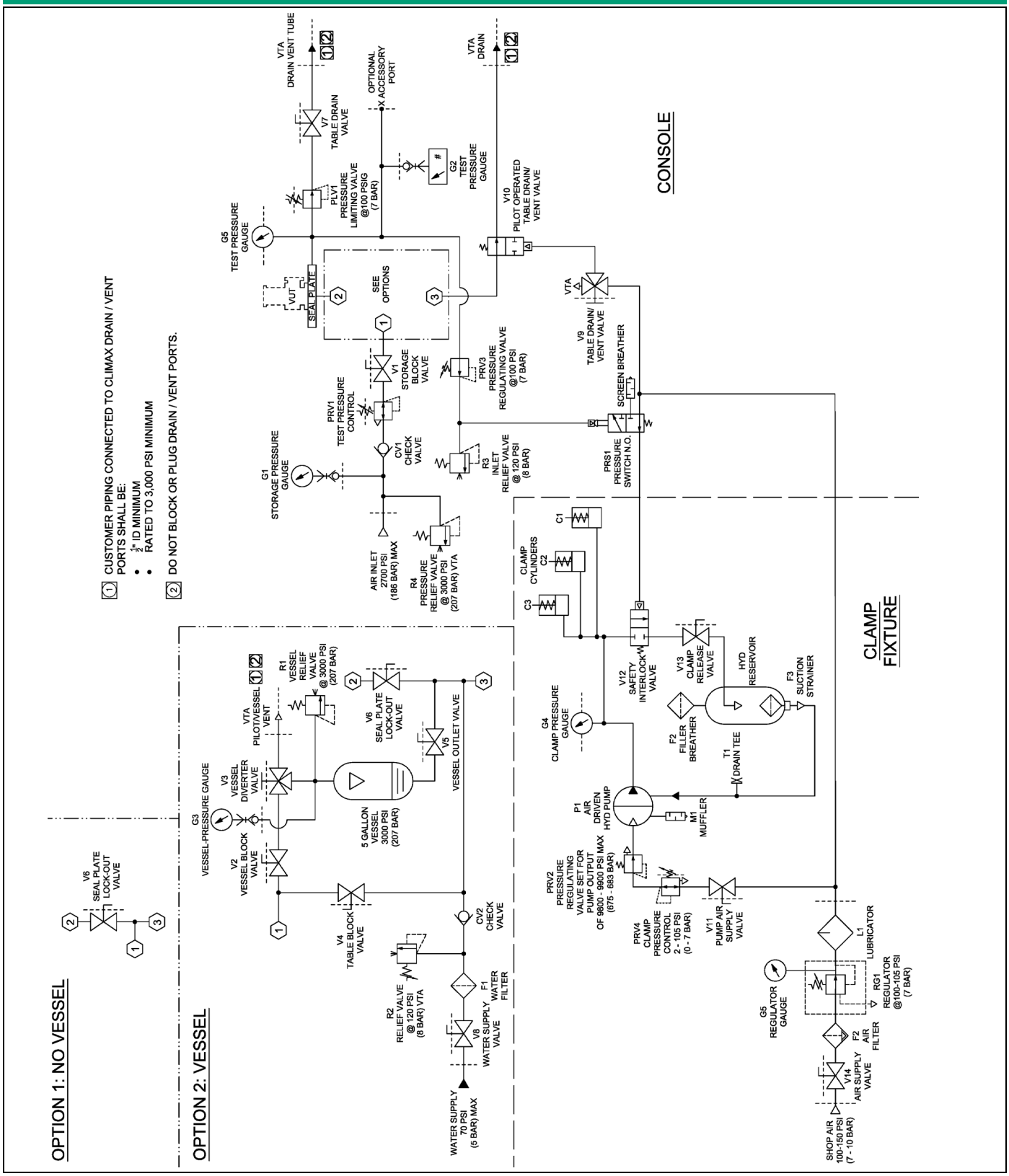

FIGURE B-1. SCHEMATIC (P/N 89986)

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APPENDIX C SDS

Safety Data Sheet list

MATERIAL SAFETY DATA SHEET
76 Unax AW 32, 46, 68

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name: 76 Unax AW 32, 46, 68

Product Code: 4641032000, 4642046000, 4643068000

Synonyms: 76 Unax AW 32
76 Unax AW 46
76 Unax AW 68

Intended Use: Industrial oil

Chemical Family: Petroleum hydrocarbon

Responsible Party: 76 Lubricants
A Division of ConocoPhillips
600 N. Dairy Ashford
Houston, TX 77079-1175

For Additional MSDSs 800-762-0942

Technical Information: 800-435-7761

The intended use of this product is indicated above. If any additional use is known, please contact us at the Technical Information number listed.

EMERGENCY OVERVIEW

24 Hour Emergency Telephone Numbers:

Spill, Leak, Fire or Accident
Call CHEMTREC
North America: (800)424-9300
Others: (703)527-3887 (collect)

California Poison Control System: (800) 356-3129

Health Hazards/Precautionary Measures: Avoid contact with eyes, skin and clothing. Wash thoroughly after handling.

Physical Hazards/Precautionary Measures: Keep away from all sources of ignition.

Appearance: Clear and bright

Physical form: Liquid

Odor: Mild petroleum

NFPA Hazard Class:

```
Health:      1 (Slight)
Flammability:1 (Slight)
Reactivity:  0 (Least)
```

HMIS Hazard Class

```
Health:          1 (Slight)
Flammability:    1 (Slight)
Physical Hazard: 0 (Least)
```

2. COMPOSITION/INFORMATION ON INGREDIENTS

HAZARDOUS COMPONENTS	% WEIGHT	EXPOSURE GUIDELINE		
		Limits	Agency	Type
Zinc Compound CAS# Proprietary	<1	Not Established		

OTHER COMPONENTS	% WEIGHT	EXPOSURE GUIDELINE		
		Limits	Agency	Type
Lubricant Base Oil (Petroleum) CAS# Various	>99	(See: Oil Mist, If Generated)		
Additives CAS# Proprietary	<1	Not Established		

REFERENCE	EXPOSURE GUIDELINE		
	Limits	Agency	Type
Oil Mist, If Generated CAS# None	5 mg/m3	ACGIH	TWA
	10 mg/m3	ACGIH	STEL
	5 mg/m3	OSHA	TWA
	2500 mg/m3	NIOSH	IDLH
	5 mg/m3	NOHSC	TWA

The base oil for this product can be a mixture of any of the following highly refined petroleum streams: CAS 64741-88-4; CAS 64741-89-5; CAS 64741-96-4; CAS 64741-97-5; CAS 64742-01-4; CAS 64742-52-5; CAS 64742-53-6; CAS 64742-54-7; CAS 64742-55-8; CAS 64742-56-9; CAS 64742-57-0; CAS 64742-62-7; CAS 64742-63-8; CAS 64742-65-0; CAS 72623-85-9; CAS 72623-86-0; CAS 72623-87-1

Note: State, local or other agencies or advisory groups may have established more stringent limits. Consult an industrial hygienist or similar professional, or your local agencies, for further information.

1%=10,000 PPM.

All components are listed on the TSCA inventory.

3. HAZARDS IDENTIFICATION

Potential Health Effects:

Eye: Contact may cause mild eye irritation including stinging, watering, and redness.

Skin: Contact may cause mild skin irritation including redness, and a burning sensation. Prolonged or repeated contact can worsen irritation by causing drying and cracking of the skin leading to dermatitis (inflammation). No harmful effects from skin absorption are expected.

Inhalation (Breathing): No information available. Studies by other exposure routes suggest a low degree of toxicity by inhalation.

Ingestion (Swallowing): No harmful effects expected from ingestion.

Signs and Symptoms: Effects of overexposure may include irritation of the nose and throat, irritation of the digestive tract, nausea and diarrhea.

Cancer: Inadequate evidence available to evaluate the cancer hazard of this material. See Section 11 for carcinogenicity information of individual components, if any.

Target Organs: No data available for this material.

Developmental: No data available for this material.

Pre-Existing Medical Conditions: Conditions aggravated by exposure may include skin disorders.

4. FIRST AID MEASURES

Eye: If irritation or redness develops, move victim away from exposure and into fresh air. Flush eyes with clean water. If symptoms persist, seek medical attention.

Skin: Wipe material from skin and remove contaminated shoes and clothing. Cleanse affected area(s) thoroughly by washing with mild soap and water and, if necessary, a waterless skin cleanser. If irritation or redness develops and persists, seek medical attention.

Inhalation (Breathing): If respiratory symptoms develop, move victim away from source of exposure and into fresh air. If symptoms persist, seek medical attention. If victim is not breathing, clear airway and immediately begin artificial respiration. If breathing difficulties develop, oxygen should be administered by qualified personnel. Seek immediate medical attention.

Ingestion (Swallowing): First aid is not normally required; however, if swallowed and symptoms develop, seek medical attention.

Note To Physicians: High-pressure hydrocarbon injection injuries may produce substantial necrosis of underlying tissue despite an innocuous appearing external wound. Often these injuries require extensive emergency surgical debridement and all injuries should be evaluated by a specialist in order to assess the extent of injury.

5. FIRE FIGHTING MEASURES

Flammable Properties:
Flash Point: >384°F/>196°C (COC)
OSHA Flammability Class: Not applicable
LEL/UEL%: No Data
Autoignition Temperature: No Data

Unusual Fire & Explosion Hazards: This material may burn, but will not ignite readily. If container is not properly cooled, it can rupture in the heat of a fire.

Extinguishing Media: Dry chemical, carbon dioxide, foam, or water spray is recommended. Water or foam may cause frothing of materials heated above 212°F. Carbon dioxide can displace oxygen. Use caution when applying carbon dioxide in confined spaces.

Fire Fighting Instructions: For fires beyond the incipient stage, emergency responders in the immediate hazard area should wear bunker gear. When the potential chemical hazard is unknown, in enclosed or confined spaces, or when explicitly required by DOT, a self contained breathing apparatus should be worn. In addition, wear other appropriate protective equipment as conditions warrant (see Section 8).

Isolate immediate hazard area, keep unauthorized personnel out. Stop spill/release if it can be done with minimal risk. Move undamaged containers from immediate hazard area if it can be done with minimal risk.

Water spray may be useful in minimizing or dispersing vapors and to protect personnel. Cool equipment exposed to fire with water, if it can be done with minimal risk. Avoid spreading burning liquid with water used for cooling purposes.

6. ACCIDENTAL RELEASE MEASURES

This material may burn, but will not ignite readily. Keep all sources of ignition away from spill/release. Stay upwind and away from spill/release. Notify persons down wind of the spill/release, isolate immediate hazard area and keep unauthorized personnel out. Stop spill/release if it can be done with minimal risk. Wear appropriate protective equipment including respiratory protection as conditions warrant (see Section 8).

Prevent spilled material from entering sewers, storm drains, other unauthorized drainage systems, and natural waterways. Dike far ahead of spill for later recovery or disposal. Spilled material may be absorbed into an appropriate absorbent material.

Notify fire authorities and appropriate federal, state, and local agencies. Immediate cleanup of any spill is recommended. If spill of any amount is made into or upon navigable waters, the contiguous zone, or adjoining shorelines, notify the National Response Center (phone number 800-424-8802).

7. HANDLING AND STORAGE

Handling: Do not enter confined spaces such as tanks or pits without following proper entry procedures such as ASTM D-4276 and 29CFR 1910.146. The use of appropriate respiratory protection is advised when concentrations exceed any established exposure limits (see Sections 2 and 8).

Do not wear contaminated clothing or shoes. Use good personal hygiene practices.

High pressure injection of hydrocarbon fuels, hydraulic oils or greases under the skin may have serious consequences even though no symptoms or injury may be apparent. This can happen accidentally when using high pressure equipment such as high pressure grease guns, fuel injection apparatus or from pinhole leaks in tubing of high pressure hydraulic oil equipment.

"Empty" containers retain residue and may be dangerous. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose such containers to heat, flame, sparks, or other sources of ignition. They may explode and cause injury or death. "Empty" drums should be completely drained, properly bunged, and promptly shipped to the supplier or a drum reconditioner. All containers should be disposed of in an environmentally safe manner and in accordance with governmental regulations.

Before working on or in tanks which contain or have contained this material, refer to OSHA regulations, ANSI Z49.1 and other references pertaining to cleaning, repairing, welding, or other contemplated operations.

Storage: Keep container(s) tightly closed. Use and store this material in cool, dry, well-ventilated areas away from heat and all sources of ignition. Store only in approved containers. Keep away from any incompatible material (see Section 10). Protect container(s) against physical damage.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering controls: If current ventilation practices are not adequate to maintain airborne concentrations below the established exposure limits (see Section 2), additional engineering controls may be required.

Personal Protective Equipment (PPE):

Respiratory: A NIOSH certified air purifying respirator with a Type 95 (R or P) particulate filter may be used under conditions where airborne concentrations are expected to exceed exposure limits (see Section 2).

Protection provided by air purifying respirators is limited (see manufacturer's respirator selection guide). Use a NIOSH approved self-contained breathing apparatus (SCBA) or equivalent operated in a pressure demand or other positive pressure mode if there is potential for an uncontrolled release, exposure levels are not known, or any other circumstances where air purifying respirators may not provide adequate protection. A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements must be followed whenever workplace conditions warrant a respirator's use.

Skin: The use of gloves impervious to the specific material handled is advised to prevent skin contact and possible irritation (see manufacturers literature for information on permeability).

Eye/Face: Approved eye protection to safeguard against potential eye contact, irritation, or injury is recommended. Depending on conditions of use, a face shield may be necessary.

Other Protective Equipment: A source of clean water should be available in the work area for flushing eyes and skin. Impervious clothing should be worn as needed.

Suggestions for the use of specific protective materials are based on readily available published data. Users should check with specific manufacturers to confirm the performance of their products.

9. PHYSICAL AND CHEMICAL PROPERTIES

Note: Unless otherwise stated, values are determined at 20°C (68°F) and 760 mm Hg (1 atm).
Appearance: Clear and bright
Physical State: Liquid
Odor: Mild petroleum
pH: Not applicable
Vapor Pressure (mm Hg): <1
Vapor Density (air=1): >1
Boiling Point/Range: No Data
Freezing/Melting Point: <-27°F / <-33°C
Solubility in Water: Negligible
Specific Gravity: 0.855-0.871
Percent Volatile: Negligible
Evaporation Rate (nBuAc=1): Negligible
Viscosity: 22-68 cSt @ 40°C / 4.3-8.7 cSt @ 100°C
Bulk Density: 7.13-7.26 lb/gal
Flash Point: >384°F / >196°C (COC)
Flammable/Explosive Limits (%): No Data

10. STABILITY AND REACTIVITY

Stability: Stable under normal ambient and anticipated storage and handling conditions of temperature and pressure.

Conditions To Avoid: Extended exposure to high temperatures can cause decomposition.

Materials to Avoid (Incompatible Materials): Avoid contact with strong oxidizing agents.

Hazardous Decomposition Products: Combustion can yield carbon, nitrogen, sulfur, phosphorus, and zinc oxides.

Hazardous Polymerization: Will not occur.

11. TOXICOLOGICAL INFORMATION

Lubricant Base Oil (Petroleum) (CAS# Various)

Carcinogenicity: The petroleum base oils contained in this product have been highly refined by a variety of processes including solvent extraction, hydrotreating, and dewaxing to remove aromatics and improve performance characteristics. None of the oils used are listed as a carcinogen by NTP, IARC, or OSHA.

12. ECOLOGICAL INFORMATION

Not evaluated at this time

13. DISPOSAL CONSIDERATIONS

This material under most intended uses would become used oil due to contamination by physical or chemical impurities. RECYCLE ALL USED OIL. While being recycled, used oil is regulated by 40 CFR 279. Use resulting in chemical or physical change or contamination may also subject it to regulation as hazardous waste. Under federal regulations, used oil is a solid waste managed under 40 CFR 279. However, in California, used oil is managed as hazardous waste until tested to show it is not hazardous. Consult state and local regulations regarding the proper handling of used oil. In the case of used oil, the intent to discard it may cause the used oil to be regulated as hazardous waste.

Contents should be completely used and containers emptied prior to discard. Rinsate may be considered a RCRA hazardous waste and must be disposed of with care and in compliance with federal, state and local regulations. Large empty containers, such as drums, should be returned to the distributor or a drum reconditioner. To assure proper disposal of small empty containers, consult with state and local regulations and disposal authorities.

14. TRANSPORT INFORMATION

DOT Shipping Description: Not classified as hazardous

15. REGULATORY INFORMATION

EPA SARA 311/312 (Title III Hazard Categories):

Acute Health:	No
Chronic Health:	No
Fire Hazard:	No
Pressure Hazard:	No
Reactive Hazard:	No

SARA 313 and 40 CFR 372:
This material contains the following chemicals subject to the reporting requirements of SARA 313 and 40 CFR 372:

Component	CAS Number	Weight %
Zinc Compound	Proprietary	<1

California Proposition 65:

Warning: This material contains the following chemicals which are known to the State of California to cause cancer, birth defects or other reproductive harm, and are subject to the requirements of California Proposition 65 (CA Health & Safety Code Section 25249.5):

--None Known--

Carcinogen Identification:
This material has not been identified as a carcinogen by NTP, IARC, or OSHA. See Section 11 for carcinogenicity information of individual components, if any.

EPA (CERCLA) Reportable Quantity:

--None--

Canada - Domestic Substances List: Listed

WHMIS Class:
Not regulated
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

16. OTHER INFORMATION

Issue Date: 02/06/03

Previous Issue Date: 01/01/02
Product Code: 4641032000, 4642046000, 4643068000
Revised Sections: New Format
Previous Product Code: 4641032000
MSDS Number: 722330
Status: Final

Disclaimer of Expressed and Implied Warranties:

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