

INSTRUCTION MANUAL

WATER JACKET VOLUMETRIC EXPANSION HYDROSTATIC TEST METHOD

MODEL NO: _____

SERIAL NO: _____

DATE: ____/____/____

OWNER:

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Manual P/N 393-101

Hydro-Test Products Inc.

85 Hudson Road Stow, MA., USA 01775

Tel: 800-225-9488 / 978-897-4647

www.hydro-test.com

Fax: 978-897-1942



INTRODUCTION

ALL HYDRO-TEST PRODUCTS INCORPORATED MANUALLY CONTROLLED WATER JACKET TEST STATIONS OPERATE SIMILARLY. DIFFERENCES IN DESIGN RELATE TO TEST PRESSURES - WATER JACKET SIZES AND ANY OPTIONAL EQUIPMENT

IF OPERATING THIS EQUIPMENT UNDER A D.O.T. LICENSE, YOU MUST:

- 1 **RECEIVING HAZMAT TRAINING** (function specific to re qualification of cylinders)
- 2 **SET UP AND VERIFY ACCURACY OF EQUIPMENT**
- 3 **HAVE ON HAND;**
 - ? Test Record Forms
 - ? Daily Verification Forms
 - ? Current Copy of CFR Title49, sections 100-185
 - ? Current Copies of any Exemption Cylinder That Your Facility Will Be Re Qualifying
 - ? Applicable Compressed Gas Association Pamphlets
 - ? Current Certificate of Training
- 4 **SECURE A LICENSE FROM THE U.S. DEPARTMENT OF TRANSPORTATION**

HAZMAT TRAINING SEMINARS PERTAINING TO THE RE QUALIFICATION OF CYLINDERS, MEETING THE U.S. DEPARTMENT OF TRANSPORTATION REGULATIONS, ARE OFFERED THROUGHOUT THE YEAR BY HYDRO-TEST PRODUCTS. PLEASE VISIT OUR WEBSITE OR CONTACT US FOR LATEST SCHEDULE OF CLASSES.



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UNCRATING

THE TEST STATION IS SHIPPED IN TWO PIECES

1) **TEST CONSOLE**

Includes;

- ? Test Pump
- ? Pressure Gauge(s)
- ? Burettes or Digital Expansion Scale
- ? Calibrated Cylinder
- ? Parts Box
- ? Test Adapters (if purchased)

2) **WATER JACKET**

Includes;

- ? Lid Assy
- ? Lid Closures
- ? Steel Pipe

IMPORTANT:

THE STEEL STRAPPING SHOULD BE CAREFULLY CUT, TAKING PRECAUTIONS TO AVOID "UNCOILING" ACTION OF THE STRAPPING. ONCE STRAPPING IS REMOVED, LIFT OFF THE TOP CORRUGATED CAP. WITH A MINIMUM OF TWO PEOPLE, LIFT THE CORRUGATED SLEEVE, UP AND OVER THE CONSOLE. IF SUPPLIED WITH BURETTE TUBES BE CAREFUL NOT TO CONTACT THE GLASS TUBES WITH BOX . UNTIE THE BURETTE COUNTER WEIGHT (held in place by a screw seal) AND THE TEST HOSE AT THE BACK OF THE MACHINE.

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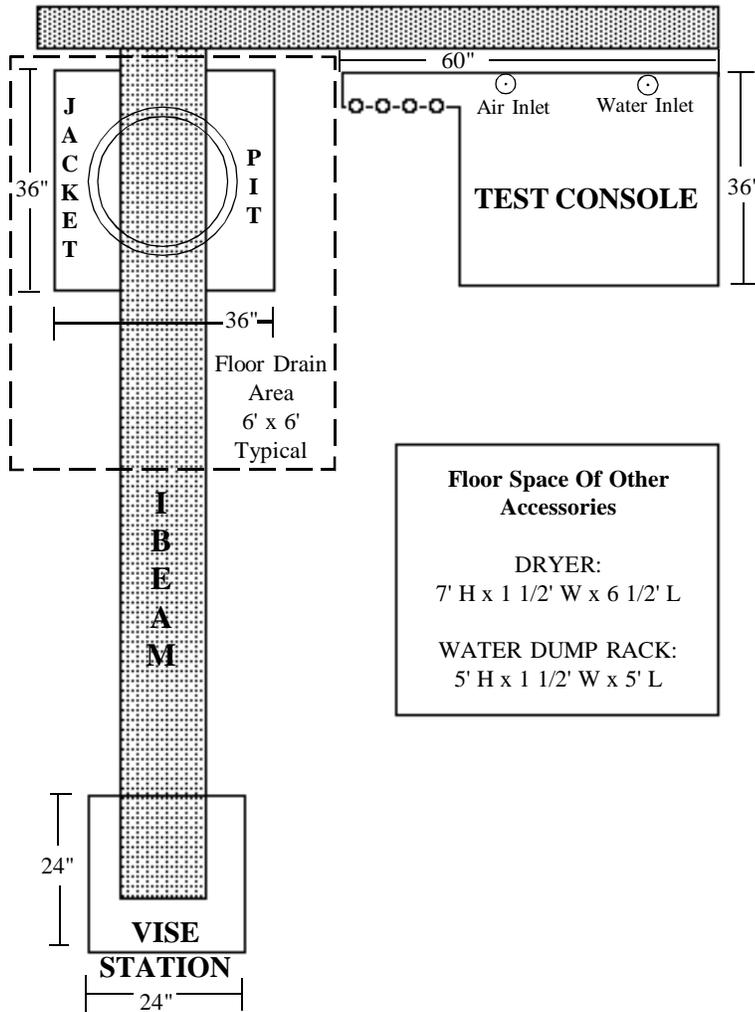
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STEP 2 POSITIONING EQUIPMENT TYPICAL FLOOR PLAN

Fig 1



Floor Space Of Other Accessories

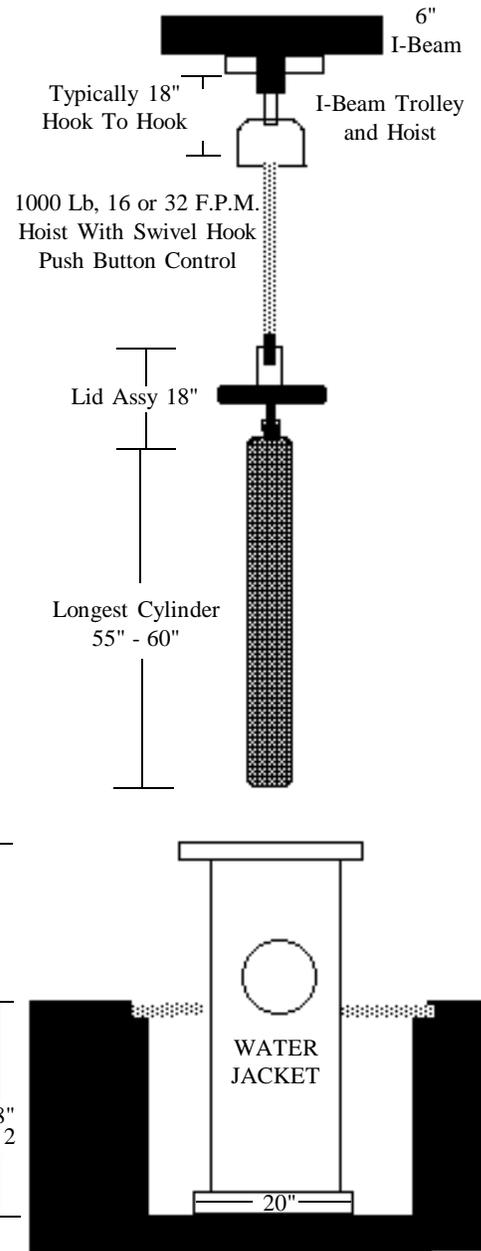
DRYER:
7' H x 1 1/2' W x 6 1/2' L

WATER DUMP RACK:
5' H x 1 1/2' W x 5' L

- NOTES:**
- 1) Provide means of draining pit - directly or by sump pump.
 - 2) Shown for 14" Dia x 66" Tall Jacket, [18" Dia. x 72" Tall: Base 24" Dia., Pit 34" Deep] [24" Dia. x 72" Tall: Base 30" Dia., Pit 34" Deep]
 - 3) Pit dimensions are suggested minimal size.
 - 4) I-Beam (4" - 6") located at ceiling above water jacket and inline with vise station for ease of transporting cylinder to and from jacket and vise.

HYDRO-TEST WOULD BE PLEASED TO REVIEW AND MAKE RECOMMENDATIONS ON YOUR PROPOSED FLOOR PLAN

PIT PLAN



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The test console wooden pallet can be “cut back” as needed to fit into your designated area. However, it is recommended that the test console be left on the wooden pallet. This will stop the pulsation vibration of the pump (which can cause erratic readings) and also keep the steel cabinet off of the floor.

Water jacket must be positioned on the same side of the test console that expansion readings are taken. This is typically to the left of the test console as *Shown in Fig 2*. “Reverse” cabinets are offered at the customers request where water jacket would be positioned to the right of test console.

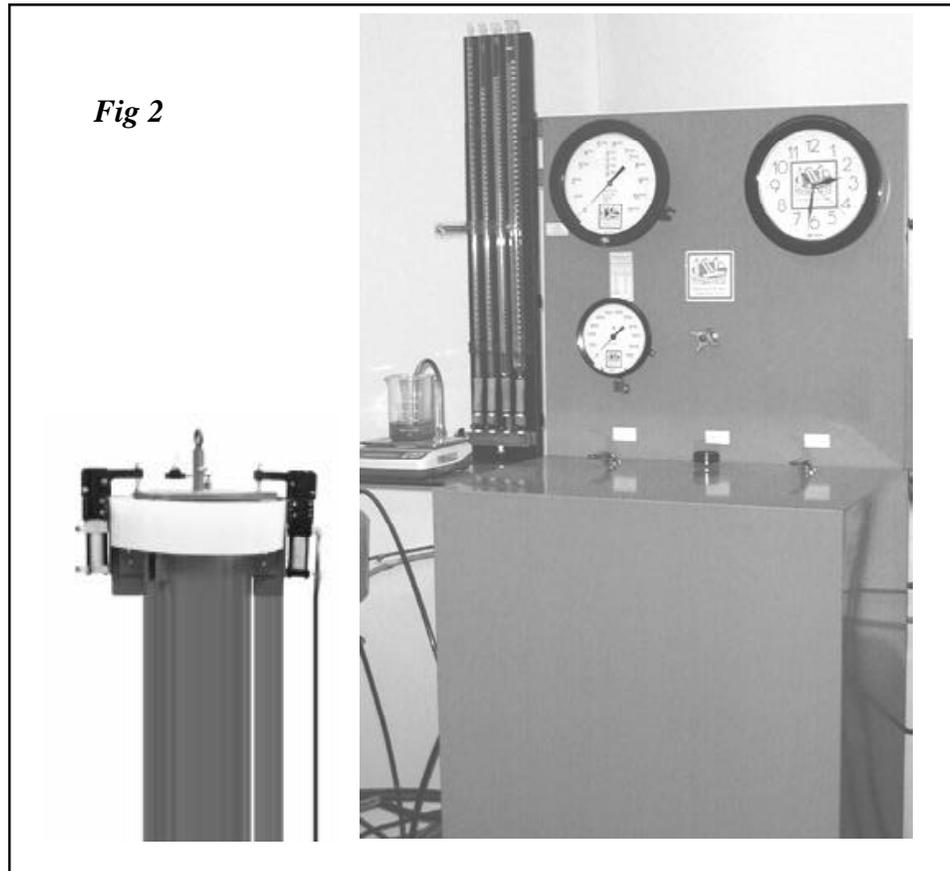


Fig 2

All water jackets greater than 40” in height are placed in a recessed “pit” below floor level. This is done so that the water jacket lid is lower than where the expansion readings are taken.

If your water jacket is 66” tall	The pit must be a minimum of 28” deep
72” tall	34” deep
84” tall	46” deep

*Pit depth stated is minimum - deeper pits can be constructed if ceiling height restrictions require. These depths place the water jacket lid at 38” above floor level for a convenient working height. The overhead hoist / trolley / I-beam should be 12’ above floor level. A floor plan should be drawn, incorporating the tallest cylinder height to insure adequate clearance. Use our generic floor plan **Fig 1** on previous page to determine ceiling height and pit depth requirements.*



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PIT CONSTRUCTION

The lowest cost pit construction is a piece of preformed concrete pipe. A 3' to 4' diameter x 30" or 36" or 48" tall (depending on water jacket height) concrete pipe can be located (under overhead I-beam) on center of 6' x 6' floor draining area, such that top of pipe is 2" below finished floor level.

The 6' x 6' floor draining area should be slightly sloped toward pit for drainage of any possible water spillage. *see Fig 1*

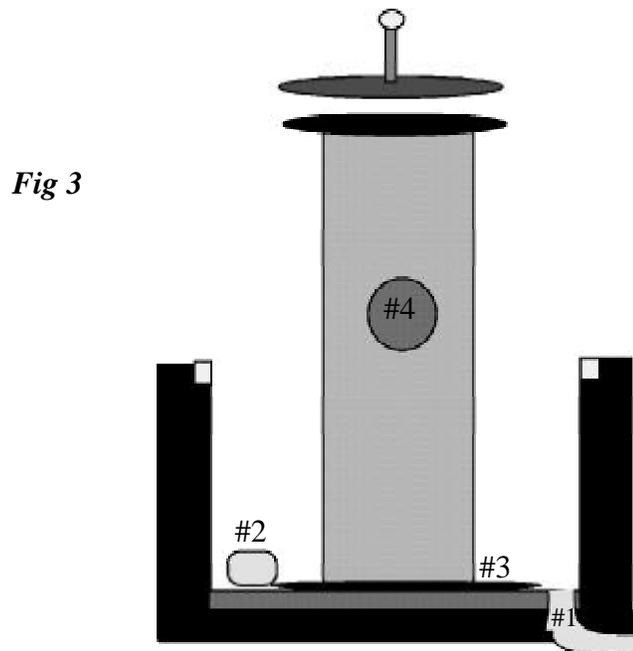
Within the pit, at 28" or 34" or 46" (depending on water jacket height) a flat concrete pad is poured. Before pouring the concrete pad, decide how water is to be drained out of pit.

Either by;

- a) A drain line connected to pit for drainage to nearest drain. *Fig 3 #1*
- b) A sump pump located at bottom of pit, allowing water to be pumped from pit to nearest drain or for possible recycling. *Fig 3 #2*

All water jackets (over 40" in height) that require a pit are supplied with a base plate with mounting holes pre drilled *Fig 3 #3*. It is recommended although not required that the water jacket be lag bolted onto the concrete pad with stainless steel hardware. If you are lagging the water jacket in, before tightening, put a level across the jacket top and shim the jacket base plate with stainless washers until level. The use of stainless steel hardware will allow for easier removal of jacket during recommended bi annual cleaning of pit and jacket.

The rupture port of jacket should be positioned away from operator and test console, yet kept accessible for servicing of safety disc *Fig 3 #4*.



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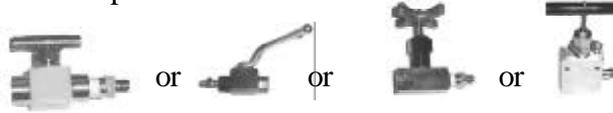
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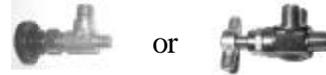
STEP 3 ASSEMBLE PARTS TO WATER JACKET

The following items from parts box in step 1 are needed:

A) High Pressure Bleed Valve



B) Low Pressure Bleed Valve



C) 1/4" Disconnect Nipple



D) 1/2" Quick Coupler



E) Copper Tubing (2pcs)



F) Rubber Tubing (4')



G) Compression Fittings (2pcs)



Teflon Tape Threaded Connections of Parts A,B,C & G and Male Threads Located on Underside of Lid That Connect To Quick Coupler (D)

Assemble and Tighten A,B,C & D as Shown in *Fig 4*

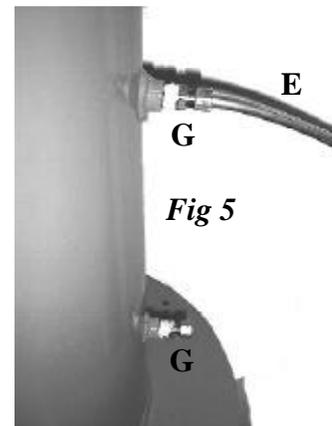
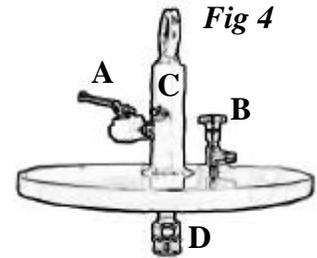
Tighten 1 Compression Fitting (G) into Upper Threaded Port of Water Jacket Shown in *Fig 5*

Tighten other Compression Fitting (G) into Lower Threaded Port of Water Jacket Shown in *Fig 5*

Attach One End of Longer pc of Copper Tubing (E) into Compression Fitting G at Lower Port

Attach One End of Shorter pc of Copper Tubing (E) into Compression Fitting G at Upper Port

Tighten Compression Fittings (G) onto Copper Tubing



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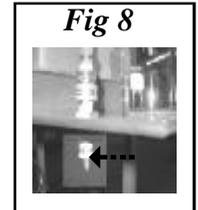
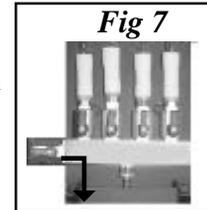
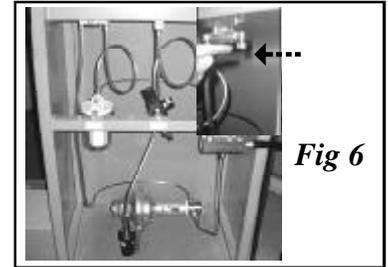
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STEP 4 MAKING CONNECTIONS FROM WATER JACKET TO TEST CONSOLE

Attach other end of copper tubing from lower connection of water jacket in *Fig 5* to compression fitting installed on valve on console *Fig 6*.

Slip 4' piece of black rubber tubing (F) over other end of copper tubing from upper connection of water jacket (*Fig 5*). This is a slip on fit.

Attach the black rubber tubing (F) open end to barb fitting of expansion device, either burette bank (*Fig 7*) or digital scale (*Fig 8*)



It is **MOST IMPORTANT** that these copper lines are not “crimped/bent” (so as to restrict flow). The line from the water jacket to the expansion indicating device (burette or scale) must be slopping upwards from the jacket and cannot be bent or looped. When connecting to burette bank; with burette board at zero reference level, the rubber tubing should be extended but not stretched. Some cutting of copper tubing and/or rubber tubing may be needed for proper fit. In some cases you may require a longer piece of copper tubing than what is supplied. This is common 3/8” refrigeration tubing.

STEP 5 CONNECTING AIR AND WATER SUPPLY TO CONSOLE

Fig 9

With Water jacket and test console in position and 3 control valves on front of console closed;

A) Connect tap water supply to 1/4” water inlet connection marked “Water Inlet” (*Fig 9*). This connection can be hard piped - soft piped or a garden hose can be used. Incoming water supply must be a minimum of 20psi and a maximum of 50psi. If over 50psi a water reducing regulator is required (available as p/n 160-102).

B) Connect pre regulated air supply to 1/4” air inlet connection marked “Air Inlet” (*Fig 9*). Incoming air supply cannot exceed 175 psi. The air regulator used on the test console has been pre set at the factory for 100 psi. If needed, use black adjustment knob on top of regulator to regulate air supply. A pressure gauge is supplied for viewing of pressure.

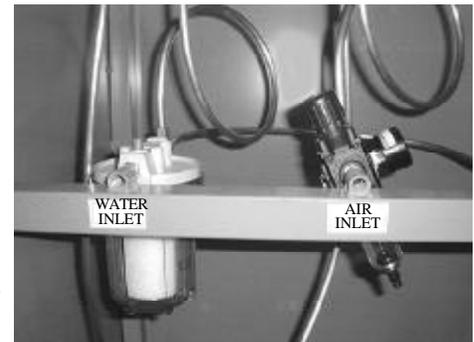


Fig 10

STEP 6 LUBRICATION OF AIR OPERATED TEST PUMP

The air operated section of the test pump requires lubrication. A high quality air tool oil is recommended and is available from Hydro-Test as P/N 230-135.

The in line lubricator found (*Fig 10*) at the air inlet to the pump is adjusted by either an adjustment knob (*Fig 10 #1*) or a slotted screw (*Fig 10 #2*). The lubricator must be 3/4 filled with the air tool oil. With high pressure uncoupled from jacket lid, slowly and slightly open air control valve on console. 1 drop of oil should pass through sight gauge on lubricator for every 20 strokes of pump piston.



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STEP 7 PREPERATION OF CALIBRATED CYLINDER

The calibrated cylinder shipped with the test system is to be used only as a calibrated cylinder. A chart of expansions is shipped with the cylinder. This is needed for daily verification of system accuracy. To prepare calibrated cylinder;

- A) Fill cylinder with tap water
- B) Teflon tape and insert test adapter and quick coupler nipple into cylinder.
- C) Tighten test adapter



STEP 8 FILL WATER JACKET WITH WATER

At this time all connection from water jacket to test console must have been made. Air inlet and water inlet to back of console must have also been completed. With the water jacket lid off, fill water jacket with tap water, either by seperate garden hose (recomended) or through test console by turning on water valve labeled water to water jacket.

As jacket is filled observe that compression fittings (G) and copper tubing (E) are leak tight and exhibit no droplets of water at these connections.

Once water reaches 3/4 full on inside of jacket turn off water supply.

Bring water jacket lid, by overhead hoist, over to calibrated cylinder and via the quick coupler (D) couple the lid onto the test adapter and calibrated cylinder. Slowly hoist lid and cylinder up and into water jacket.

Allow cylinder to rest in water jacket for a minimum of 24 hours. This assures that water temperature will stabalize.

STEP 9 ADJUSTING WATER JACKET LID CLOSURES

Prior to checking the system the lid closures must be adjusted. If closures are not adjusted properly, water will leak out between o-ring and lid. It is important that adjustments be made equal on all clamps. By overtightening 1 clamp, you will cause leakage opposite that clamp.

There are 3 basic types of closures:

A) Wing Nut and Swing Bolt

To adjust equal tightening must be made on all wing nuts.



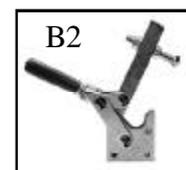
B) Quick Acting Cam Clamps

B1) Used on jackets with 3 clamps

B2) Used on jackets with 4 or more clamps

To adjust either type of these clamps, open clamps fully and turn back (loosen) adjustment screws. Close clamps to locked position. Turn adjustment screws clockwise until tips touch water jacket lid. Open clamps back up and turn adjustment screws 2 revolutions clockwise. Close clamps.

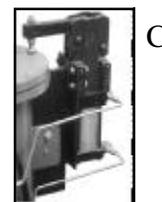
Clamps should "lock" equally without excessive force.



C) Pneumatic Lid Closure

A seperate manual is sent when these clamps are ordered with test station.

Please locate and follow that manuals instructions before proceeding.



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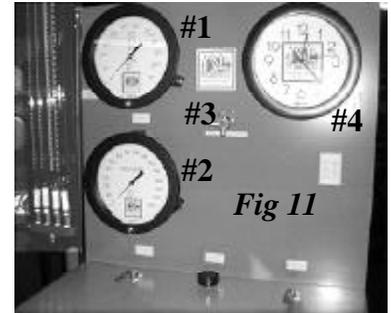
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STEP 10 PREPERATION OF PRESSURE GAUGE(S)

This is the primary calibrated instrument in the system. Depending on model of test sytem, there may be more than one pressure gauge (*Fig 11*). If more than one gauge is mounted on test console an isolation valve (*Fig 11 #3*) is also included. Before continuing you will need to have your certificate of calibration for each gauge.

To prepare gauge(s) for use;

- A) Gently tap gauge face (to relieve any friction). Observe indicated pressure of pointer. Compare this reading to the “true zero” reading found on the calibration certificate for this gauge. Most gauge true zero readings are not 0, (may be +20, -5, -10, etc...).
- B) If gauge reads to calibration chart true zero, proceed to below.
- C) If not, the true zero point needs to be adjusted. This is an adjustment of zero only and may be required due to shifting in shipment. **This adjustment is to be made only at the true zero point and never at test pressures.**
- D) To adjust, turn small locking knob (*Fig 12 #1*) counterclockwise, turn large knob (*Fig 12 #2*) on front of gauge either clockwise or counter clockwise to adjust needle to true zero.



BEFORE PROCEEDING, PLEASE BE SURE THAT THE FOLLOWING HAS BEEN ACCOMPLISHED

- 1) WATER JACKET IS IN PLACE (pit if required) AND LEVEL
- 2) WATER JACKET AND CALIBRATED CYLINDER ARE BOTH FILLED WITH WATER
- 3) NO LEAKS HAVE BEEN OBSERVED AROUND CONNECTIONS TO WATER JACKET
- 4) 100 PSI OF AIR PRESSURE IS SHOWN ON AIR REGULATOR AT BACK OF CONSOLE
- 5) INLET WATER CONNECTION TO BACK OF CONSOLE HAS BEEN MADE
- 6) ALL FITTINGS ON WATER JACKET LID HAVE BEEN TEFLONED TAPED AND TIGHTENED
- 7) AIR OPERATED TEST PUMP LUBRICATION HAS BEEN ADJUSTED PROPERLY
- 8) CLAMPS HAVE BEEN ADJUSTED PROPERLY
- 9) TRUE ZERO POINT OF PRESSURE GAUGE(S) HAS BEEN ADJUSTED, IF REQUIRED

THE TEST SYSTEM IS NOW READY TO PERFORM A LEAK CHECK TEST

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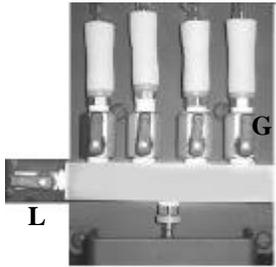
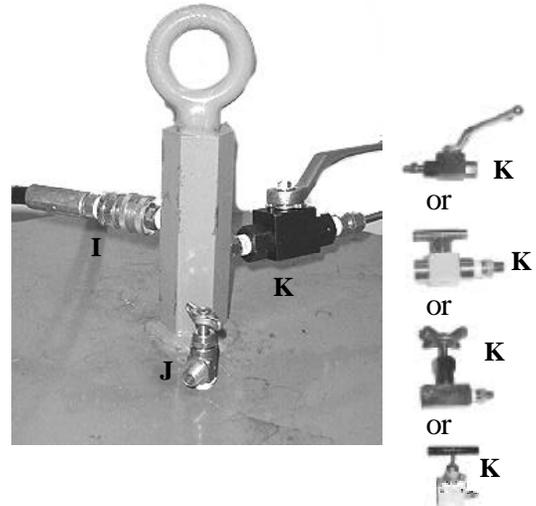
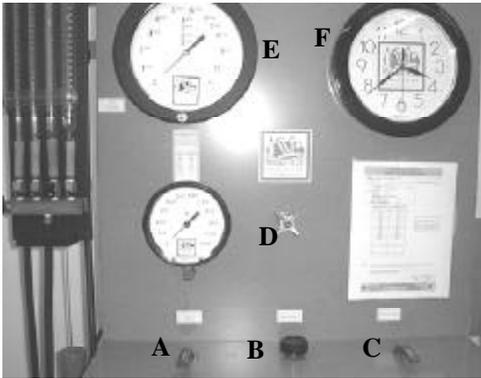
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PERFORMING SYTEM LEAK CHECK

This test is run to verify that all hook ups were done correctly and that system is operating properly.

- 1) Calibrated cylinder is filled with water, test adapter tightened, quick coupled onto underside of water jacket lid and loaded into water jacket
- 2) Lid closures are activated in closed position
- 3) Quick couple high pressure hose to lid quick coupler niple (I)
- 4) Open valve (J)
- 5) Open burette valve (G) to 360cc burette all other burette valves closed. If using digital readout (H) have scale turned on and beaker on top of scale with tube in beaker as pictured.
- 6) If so equipped turn off valve (D)
- 7) Open valve (A) labeled water to water jacket
- 8) When water comes out of valve (J) and into burette or into beaker shut off valves (A) and (J)
- 9) Bleed water level to zero on burette at reference level by opening burette bleed valve (L). If using digital scale(H), be sure that water level is over tube by a minimum of 1/4" and push zero tare weight button.
- 10) Open high pressure bleed valve on jacket lid (K)
- 11) Open Valve (C) labeled water to pump and cylinder
- 12) When steady stream of water with no air bubbles comes out of valve (K), close valve (K). Leave valve (C) open.
- 13) Slowly open valve (B), by turning counterclockwise.
- 14) The test pump should begin operating and an increase of pressure should show on the pressure gauge as well as an increase in water on the expansion measuring device (burette or scale)
- 15) When gauge reaches 1000psi stop for 5 seconds and observe if pressure holds. Repeat in 1000psi increments to highest test pressure rating of system.
- 16) Observe at each interval that pressure is holding on gauge and water level is stable on expansion device.
- 17) If pressure drop or water level drop or increase is observed, see trouble shooting guide.
- 18) To relieve the pressure from the cylinder, close valve (C) and slowly open valve (K)
- 19) Water level should drop back close to zero on burette or digital readout and gauge should display loss of pressure



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AFTER SUCCESSFUL COMPLETION OF LEAK TEST, THE ACCURACY OF THE TEST SYSTEM NEEDS TO BE VERIFIED. THIS PROCEDURE IS TO BE RUN AS THE FIRST EXERCISE EACH DAY THAT TESTING IS PERFORMED

VERIFICATION METHODS AND PROCEDURES FOR WATER JACKET TESTING

METHOD 1

Recommended method for those using burettes.

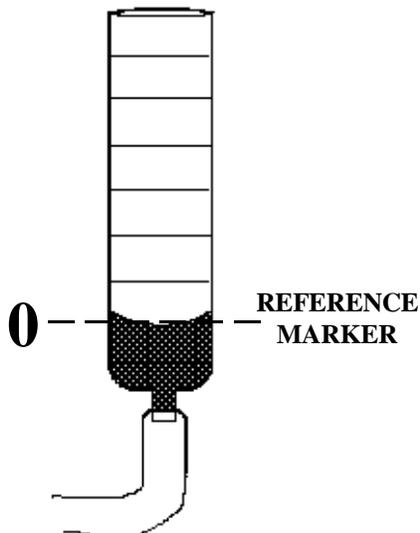
If using digital expansion scale Method 2 (pg16) is recommended



STEP 1:

- A) Quick couple calibrated cylinder to water jacket lid.
- B) Activate (close) lid closures
- C) Quick couple high pressure hose to lid

STEP 2: ZERO BURETTE



- ALIGN "0" OF SELECTED BURETTE TO REFERENCE POINTER
- OPEN WATER VALVE TO JACKET, EXPELLING ANY AIR OUT OF JACKET, CLOSE WATER VALVE, CLOSE JACKET BLEED VALVE.
- BLEED WATER IN BURETTE DOWN TO "0" ON SELECTED BURETTE VIA MANIFOLD BLEED VALVE.

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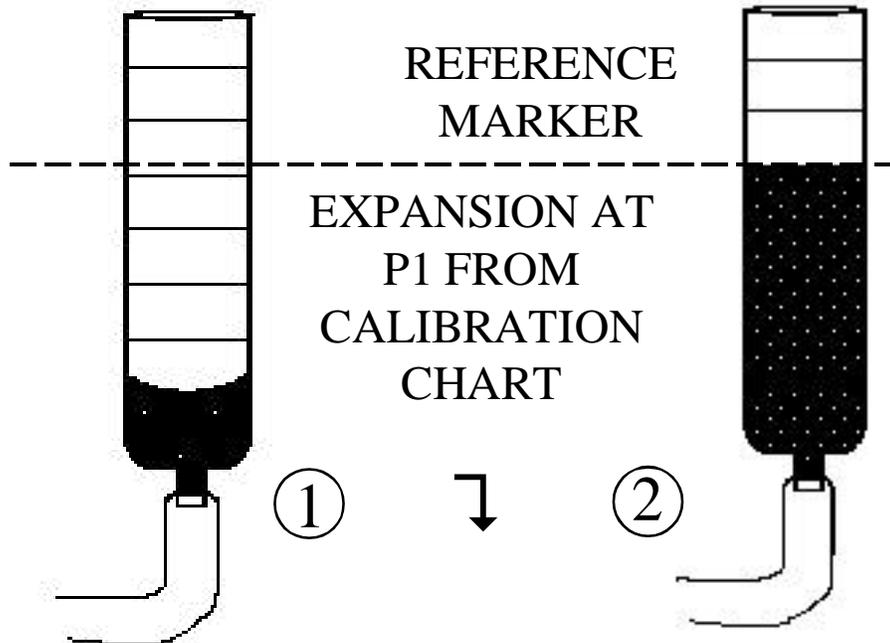
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STEP 3:

LOWER BURETTE SO THAT EXPANSION READING FROM CALIBRATED CYLINDER CHART IS LOCATED AT REFERENCE MARKER



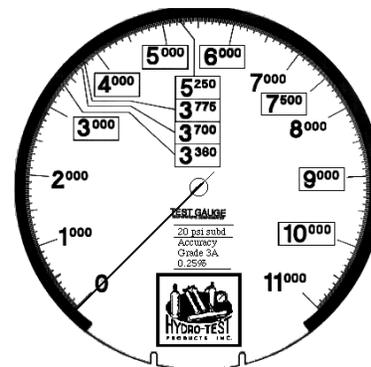
STEP 4:

RAISE PRESSURE UNTIL WATER LEVEL IS AT REFERENCE MARKER ON BURETTE

RECORD GAUGE PRESSURE

IS GAUGE PRESSURE WITHIN $\pm 1\%$ OF EXPECTED PRESSURE ?

IF WITHIN 1%, CONTINUE TO ADDITIONAL PRESSURE POINTS AS REQUIRED



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STEP 5:

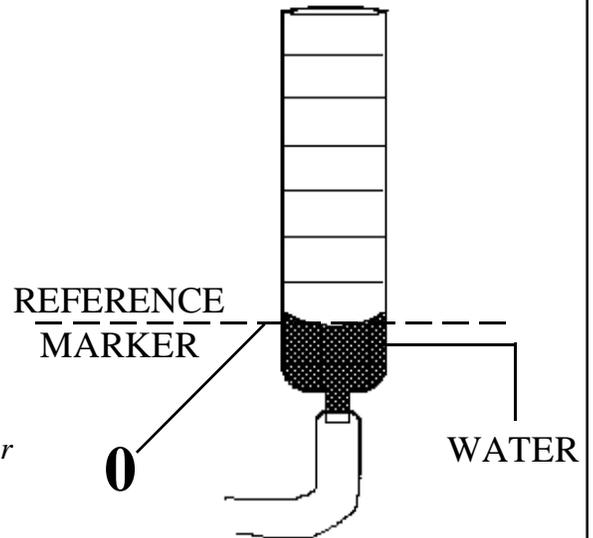
**AFTER CHECKING PRESSURE
CORRELLATION AT AS MANY
PRESSURE POINTS AS NECESSARY**

RELEASE PRESSURE

LEVEL BURETTE

**0 PERMANENT EXPANSION MUST
BE INDICATED ON BURETTE**

*If either 1% correlation at test pressures is not achieved or
water level does not return to 0 after relieving pressure,
consult troubleshooting guide*



ESTABLISHED EXPANSIONS	ANTICIPATED PRESSURE	ACTUAL PRESSURE	% DEVIATION
15.0 cc	3000 psi	3015 psi	.5%
$3015 - 3000 = 15 \div 3000 = .005 \times 100 = .50\%$			
30 cc	4000 psi	4025 psi	.62%
$4025 - 4000 = 25 \div 4000 = .0062 \times 100 = .62\%$			
45 cc	5000 psi	5015 psi	.30%
$5015 - 5000 = 15 \div 5000 = .003 \times 100 = .30\%$			

FROM CALIBRATION
CERTIFICATE OF
CALIBRATED
CYLINDER USED

FROM CALIBRATION
CERTIFICATE OF
CALIBRATED
CYLINDER USED

OBSERVED
ON GAUGE

CALCULATED

AS RESULTS ARE < 1%, VERIFICATION TEST PASSES FOR
TESTING RANGE OF 2500 - 5500 PSI FOR THAT DAY

PERMANENT
EXPANSION
MUST BE 0

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VERIFICATION METHOD 2
Alternative Procedure for Burettes
Recommended Procedure for Digital Expansion Scale



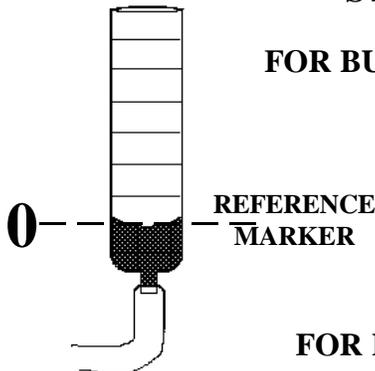
STEP 1:

- A) Quick couple calibrated cylinder to water jacket lid.
- B) Activate (close) lid closures
- C) Quick couple high pressure hose to lid

STEP 2: ZERO EXPANSION DEVICE

FOR BURETTE:

- ALIGN "0" OF SELECTED BURETTE TO REFERENCE POINTER
- OPEN WATER VALVE TO JACKET, EXPELLING ANY AIR OUT OF JACKET, CLOSE WATER VALVE, CLOSE JACKET BLEED VALVE.
- BLEED WATER IN BURETTE DOWN TO "0" ON SELECTED BURETTE VIA MANIFOLD BLEED VALVE.



FOR DIGITAL SCALE:

- HAVE SCALE TURNED ON AND BEAKER ON TOP OF SCALE WITH TUBE INSIDE BEAKER
- OPEN WATER VALVE TO JACKET, EXPELLING ANY AIR OUT OF JACKET, WHEN WATER LEVEL IS 1/4" OVER TUBE IN BEAKER CLOSE WATER VALVE.
- PUSH ZERO TARE WEIGHT BUTTON ON SCALE, SCALE WILL THEN READ 0



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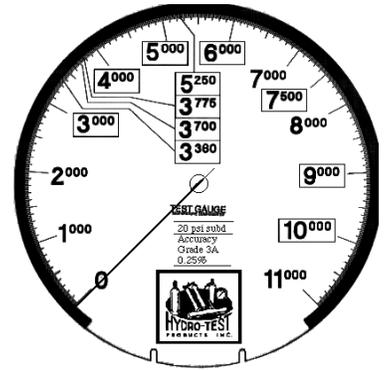
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STEP 3:

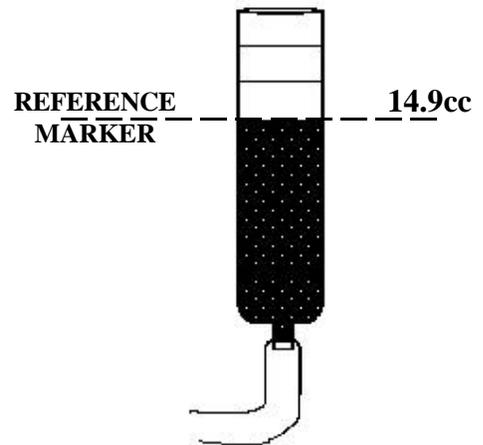
RAISE PRESSURE UNTIL GAUGE INDICATES REFERENCED PRESSURE ON CYLINDER CALIBRATION CHART



STEP 4:

IF USING URETTES:

LOWER BURETTE SO THAT WATER LEVEL IS AT REFERENCE MARKER AND RECORD EXPANSION



IF USING DIGITAL SCALE:

RECORD READING FROM DIGITAL READOUT



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STEP 5:

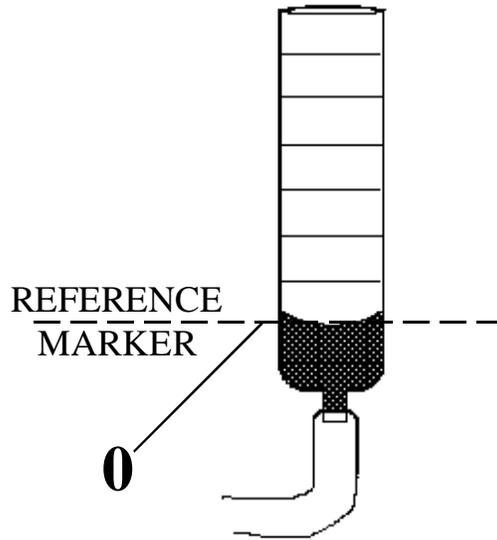
AFTER CHECKING PRESSURE CORELLATION AT AS MANY PRESSURE POINTS AS NECESSARY AND RECORDING RESULTS

RELEASE PRESSURE

IF USING BURETTE:

LEVEL BURETTE AT REFERENCE MARKER, BY BRING BURETTE BOARD UP

0 PERMANENT EXPANSION MUST BE INDICATED IN BURETTE, 0 LOCATED AT REFERENCE MARKER



IF USING DIGITAL SCALE:

TAKE READING FROM SCALE AFTER SCALE IS ALLOWED TO "STABALIZE"

DIGITAL DISPLAY MUST SHOW 0.0

If either 1% correlation at test pressures is not achieved or water level does not return to 0 after relieving pressure, consult troubleshooting guide



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EXAMPLE: VERIFICATION METHOD 2

ESTABLISHED PRESSURES	ANTICIPATED EXPANSIONS	ACTUAL EXPANSIONS	% DEVIATION
3000 psi	15.0 cc	14.9cc	.66%
$15.0 - 14.9 = .1 \div 15.0 = .0066 \times 100 = .66\%$			
4000 psi	30.0 cc	30.1 cc	.33%
$30.1 - 30.0 = .1 \div 30.0 = .003 \times 100 = .33\%$			
5000	45.0 cc	45.4 cc	.88%
$45.4 - 45.0 = .4 \div 45.0 = .0088 \times 100 = .88\%$			

FROM CALIBRATION
CERTIFICATE OF
CALIBRATED
CYLINDER USED

FROM CALIBRATION
CERTIFICATE OF
CALIBRATED
CYLINDER USED

OBSERVED
ON BURETTE
OR
SCALE

CALCULATED

AS RESULTS ARE < 1%, VERIFICATION TEST PASSES FOR TESTING RANGE OF 2500 - 5500 PSI FOR THAT DAY

**PERMANENT EXPANSION
MUST BE 0**

STEP 6: RECORD VERIFICATION DATA ON TEST LOG

**TEST APPARATUS CALIBRATION VERIFICATION DATA
FOR WATER JACKET VOLUMETRIC EXPANSION TESTING**

DATE: ___/___/___ TIME: ___:___ AM ___ PM SERIAL NO. OF CALIBRATED CYLINDER: _____

RETEST OPERATOR: _____

Calibration verification using Expansion Indicating Device (EID)
against Pressure Indicating Device (PID)

Calibration verification using Pressure Indicating Device (PID)
against Expansion Indicating Device (EID)

METHOD 1

Expansion Reading @ Corrolating PSI	Expected Pressure Reading (PSI) (A)	Actual Pressure Reading @ Corrolating Expansion (B)	Permanent Expansion (cc)	% Deviation
FROM CYLINDER CALIBRATION CERTIFICATE		Reading from PID	Reading on EID after pressure is released	$\frac{A-B}{A} \times 100 = \%$
15.0	3000	3015		.5%
30.0	4000	4025		.62%
45.0	5000	5015	0.0	.3%

MUST BE LESS THAN 1.0% →

METHOD 2

Pressure Reading @ Corrolated Expansion	Expected Expansion Reading (cc's) (A)	Actual Expansion Reading @ Corrolated Pressure (B)	Permanent Expansion (cc)	% Deviation
FROM CYLINDER CALIBRATION CERTIFICATE		Reading from EID	Reading on EID after pressure is released	$\frac{A-B}{A} \times 100 = \%$
3000	15.0	14.9		.66%
4000	30.0	30.1		.33%
5000	45.0	45.4	0.0	.88%

MUST BE LESS THAN 1.0% →

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TESTING OF CYLINDERS PROCEDURE



STEP 1:

- **PREFILL CYLINDER WITH WATER**
- **INSERT AND TIGHTEN PROPER TEST ADAPTER FITTING**
- **COUPLE CYLINDER TO BOTTOM OF JACKET LID**
- **LOAD CYLINDER INTO JACKET**
- **LOCK LID CLOSURE CLAMPS**
- **OPEN JACKET BLEED VALVE ON LID PLATE**
- **CONNECT HIGH PRESSURE TEST LINE**



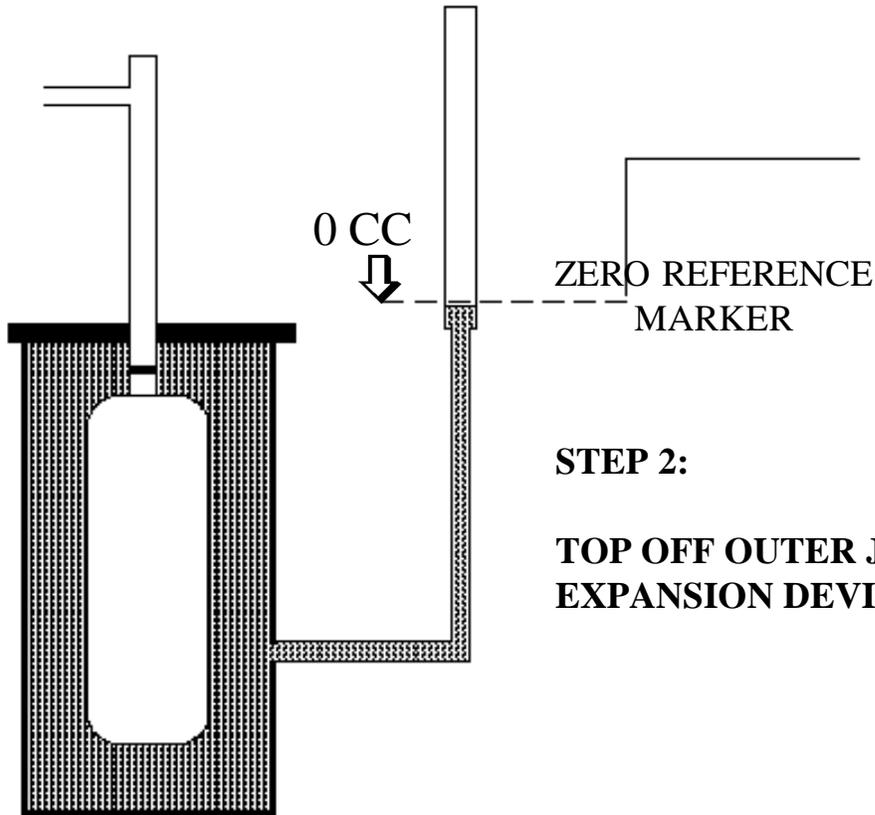
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STEP 2:

TOP OFF OUTER JACKET & ZERO EXPANSION DEVICE

IF USING BURETTES:

- SELECT BURETTE SO AS TO BE ABLE TO READ TOTAL EXPANSION OF CYLINDER AT TEST PRESSURE TO WITHIN 1% OR 0.1CC, WHICHEVER IS LARGER.
- ALIGN "0" OF SELECTED BURETTE TO REFERENCE POINTER
- OPEN WATER VALVE TO JACKET, EXPELLING ANY AIR OUT OF JACKET, CLOSE WATER VALVE, CLOSE JACKET BLEED VALVE.
- BLEED WATER IN BURETTE DOWN TO "0" ON SELECTED BURETTE VIA MANIFOLD BLEED VALVE.
- OBSERVE THAT WATER LEVEL HOLDS AT "0"

IF USING DIGITAL SCALE:



- HAVE SCALE TURNED ON AND BEAKER ON TOP OF SCALE WITH TUBE INSIDE BEAKER
- OPEN WATER VALVE TO JACKET, EXPELLING ANY AIR OUT OF JACKET, WHEN WATER LEVEL IS 1/4" OVER TUBE IN BEAKER CLOSE WATER VALVE.
- PUSH ZERO TARE WEIGHT BUTTON ON SCALE, SCALE WILL THEN READ 0

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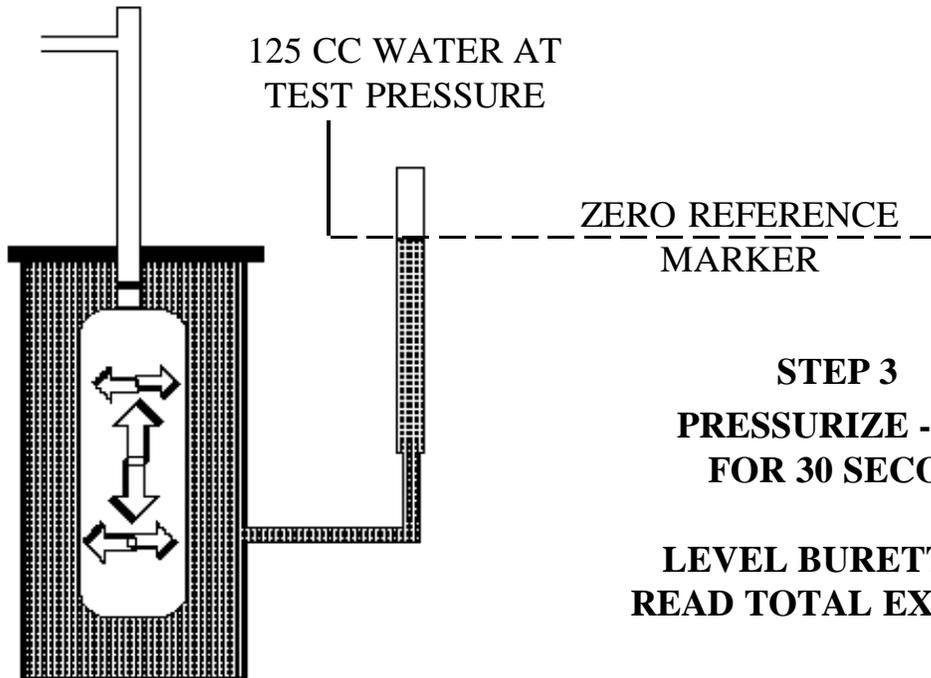
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PRESSURIZATION / TOTAL EXPANSION



STEP 3
PRESSURIZE - HOLD
FOR 30 SECONDS

LEVEL BURETTE AND
READ TOTAL EXPANSION

- OPEN HIGH PRESSURE BLEED VALVE ON JACKET LID
- OPEN WATER VALVE TO PUMP / CYLINDER, TOPPING OFF CYLINDER WITH WATER AND BLEEDING OFF ALL AIR.
- CLOSE HIGH PRESSURE BLEED VALVE ON JACKET LID
- OPEN AIR VALVE TO ACTIVATE PUMPING
- STOP PUMP AT A PRESSURE NOT TO EXCEED 90% OF TEST PRESSURE, CHECKING TO ENSURE THAT SYSTEM IS FREE OF LEAKS AND IS STABLE.
- REACTIVATE PUMP, STOPPING AT MINIMUM PRESCRIBED DOT TEST PRESSURE
- HOLD PRESSURE FOR MINIMUM OF 30 SECONDS, PRESSURE MUST HOLD AT OR ABOVE MINIMUM PRESCRIBED TEST PRESSURE
- LEVEL BURETTE TO WATER LEVEL AT REFERENCE MARKER
- RECORD TOTAL EXPANSION VALUE

IF USING DIGITAL SCALE:
RECORD READING FROM DIGITAL READOUT



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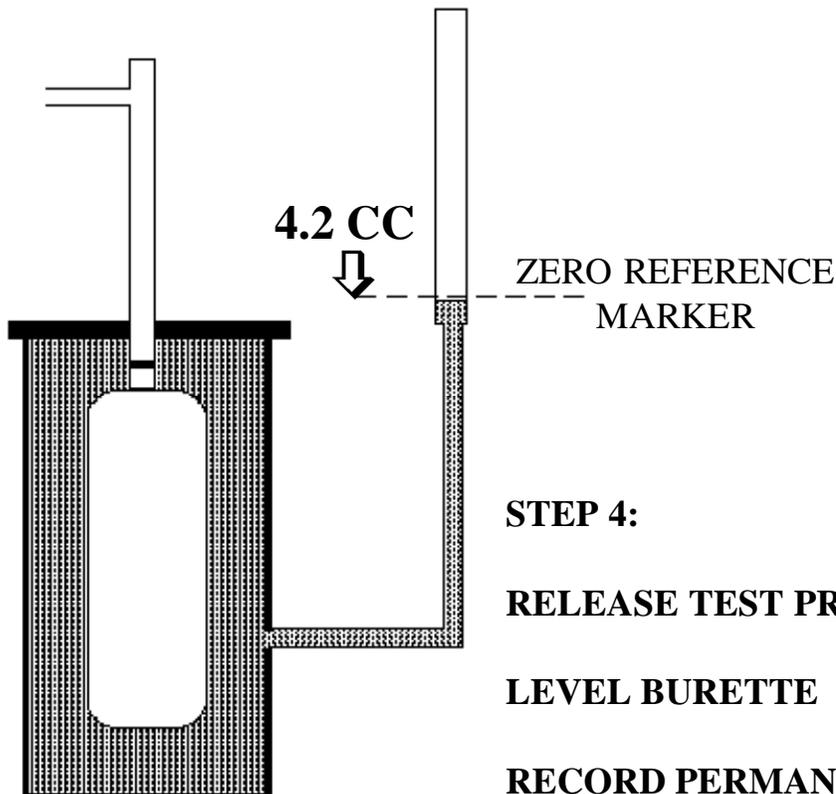
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PERMANENT EXPANSION



STEP 4:

RELEASE TEST PRESSURE

LEVEL BURETTE

RECORD PERMANENT EXPANSION VALUE

- CLOSE WATER VALVE TO PUMP / CYLINDER
- SLOWLY OPEN HIGH PRESSURE BLEED VALVE ON JACKET LID, FULLY RELEASING TEST PRESSURE FROM CYLINDER
- RAISE BURETTE BANK SO THAT THE WATER LEVEL IN BURETTE IS AT REFERENCE MARKER
- READ / RECORD BURETTE LEVEL FOR PERMANENT EXPANSION

IF USING DIGITAL SCALE:
RECORD READING FROM DIGITAL READOUT



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**STEP 5:
PERFORM CALCULATION AND RECORD TEST RESULTS**

EXAMPLE CALCULATION FOR A DOT 3AA 1800 RATED CYLINDER

- ⌋ IF TOTAL EXPANSION IS DETERMINED TO BE : 125.0 CC
- ⌋ AND PERMANENT EXPANSION IS DETERMINED TO BE : 4.2 CC
- ⌋ THEN: $\frac{4.2}{125.0} \times 100 = 3.4\%$ (% PERMANENT EXPANSION)
- ⌋ FOR THIS CLASSIFICATION CYLINDER, % PERMANENT EXPANSION IS < 10%, THEREFORE IT PASSES TEST
(WOULD BE CONDEMNED IF % PERMANENT EXPANSION WAS > 10%)

DATE: / /

CYLINDER OWNER	CYLINDER SERIAL NO.	MFG. ID	SIZE	DOT SPECIFICATION & SERVICE PRESSURE	TEST PRESSURE	EXPANSION READINGS (cc's)					VISUAL INSPECTION		DISPOSITION CODE	RETEST OPERATOR
						TOTAL	PERMANENT	ELASTIC	% PERMANENT	REE	PASS	FAIL		
Calibrated Cylinder: Must be used to verify system accuracy as the first exercise each day of testing. Use back of this form to perform and record the verification procedure														
Penn State Univ.	X1234	PST	7"D x 24"T	DOT3AA1800	3000	125.0	4.2	120.80	3.4		X		A	JC
NOTES:														

RECORDING TEST DATA ON TEST RECORD FORMS

DATE: / /

CYLINDER OWNER	CYLINDER SERIAL NO.	MFG. ID	SIZE	DOT SPECIFICATION & SERVICE PRESSURE	TEST PRESSURE	EXPANSION READINGS (cc's)					VISUAL INSPECTION		DISPOSITION CODE	RETEST OPERATOR
						TOTAL	PERMANENT	ELASTIC	% PERMANENT	REE	PASS	FAIL		
Calibrated Cylinder: Must be used to verify system accuracy as the first exercise each day of testing. Use back of this form to perform and record the verification procedure														
NOTES:														

- | | |
|---|---|
| <p>1) DATE: Date by month, day & year that test is performed</p> <p>2) OWNER: Owner of the cylinder</p> <p>3) SERIAL NO: Insert serial no. of cylinder</p> <p>4) MFG IDENT: Identify by symbol or name the manufacturer of the cylinder</p> <p>5) SIZE: Physical size (dia x length) of cylinder</p> <p>6) DOT/ICC or Exemption Classification: List Full DOT/ICC rating and service pressure,
Example: DOT 3AL1800, DOT E7235 4500, etc...</p> <p>7) Pressure that cylinder has been tested to</p> <p>8) At test pressure, the expansion reading in cc's</p> <p>9) After releasing pressure, the expansion reading in cc's</p> | <p>10) Difference between Total & Permanent</p> <p>11) [Permanent Expansion divided by Total Expansion]
x 100 = % Permanent Expansion</p> <p>12) Rejection of Elastic Expansion needs to be recorded only if the retest facility is + stamping cylinders. See CFR Title 49 & CGA Pamphlet C-5 for detailed information</p> <p>13) Check if cylinder passed or failed visual inspection</p> <p>14) Insert Disposition Code(s) listed at bottom of test record form</p> <p>15) Name or initials of the retest operator</p> <p>16) Insert any notes that pertain to the test</p> |
|---|---|



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MAINTENANCE CHECK LIST

ITEM / PART(S)	CHECK	REPLACE
ALL JOINTS, SEALS, CONNECTIONS FOR LEAKS OR DAMAGE	DAILY	AS NEEDED
INCOMING AIR SUPPLY	DAILY	AS NEEDED
INCOMING WATER FILTER	WEEKLY	12 MONTHS
LUBRICATOR FOR TEST PUMP	WEEKLY	12 MONTHS
GAUGE CALIBRATION	6 MONTHS	AS NEEDED
HIGH PRESSURE BLEED VALVE	DAILY	6 MONTHS
CHECK VALVES – CLEAN / REBUILD	MONTHLY	12 MONTHS
BURETTES – CLEAN FOR VISIBILITY	DAILY	AS NEEDED
ADAPTER SEALS	DAILY	AS NEEDED
QUICK COUPLERS	DAILY	MONTHLY
JACKET LID O-RING	MONTHLY	12 MONTHS
JACKET RUPTURE PORT	WEEKLY	12 MONTHS

Above recommended maintenance check list is generic and for the typical retest facility. Larger volume facilities should do maintenance more frequently.

If your water supply contains abnormally high mineral deposits that cause corrosion, parts should be checked more often.

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TROUBLE SHOOTING

WHENEVER TROUBLESHOOTING A PROBLEM WITH A WATER JACKET TEST SYSTEM. IT IS ADVISABLE TO USE YOUR CALIBRATED CYLINDER TO RUN THE BELOW TEST.

THE CALIBRATED CYLINDER IS THE MOST STABLE INDICATOR ON THE TEST SYSTEM.

	PROBLEM	CAUSES	SOLUTION
1	Open console water valve to jacket or to pump and no water flows.	Water not turned on	Turn water supply on
		Water not connect to console	Connect water supply to water inlet at back of test console
2	Open console air valve to pump and pump piston does not move or "stalls" randomly.	Insufficient air supply	Check air regulator. Inlet air to pump must be @ 100 psi
		Detent(s) / spring(s) in air operator section of pump are worn	Replace detent / springs or return pump to factory for overhaul.
3	Oil accumulates below muffler on pump.	Pump is over lubricated	Adjust oil control valve on top of lubricator at inlet of pump. Proper adjustment is 1 drop of oil thru sight gage for every 20 strokes of pump piston.
4	Water in EID rises above zero without introducing any pressure to cylinder.	Leaking water valve from console to water jacket	With console water valve in closed position, un hook copper tubing. If water is dripping from valve, valve needs to be cleaned or replaced
		Deviation between water and ambient air temperatures	As water warms up, expansion will occur, as heat causes expansion. Air temperature must be kept stable, which in turn will keep water in water jacket stable. In many cases air conditioning or heating the hydro area is necessary. Whatever can be done to keep air temperature stable will greatly assist in keeping water temperatures stable. In some instances a hot / cold water mixing valve is required to regulate water temperature to ambient air temperature.
		Leakage on burette manifold valves.	Open all burette valves and bring water level to 0 on each. Close all burette valves except one that you are using. Observe to see if water level is stable on all burettes. Replace valve that is loosing water.
		Lid closure clamps adjusted improperly	Re adjust clamp(s) to manufacturers specifications.
		Water jacket o-ring has become too soft and is compressing.	Replace o-ring



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TROUBLE SHOOTING

Continued...

PROBLEM	CAUSES	SOLUTION	
5	Physical leak from EID to and including water jacket.	Check and replace these items as necessary; 1) Bleed valve on jacket lid 2) O-ring on lid seal 3) Rupture port disc 4) Inlet / outlet water connections on jacket 5) Burette manifold valves 6) Burette bleed valve 7) Rubber tubing on burette valves 8) Connection between EID and jacket	
	Water Jacket not level	Put level across jacket lid and shim jacket base until level	
	Restriction at copper tubing between EID and jacket	Check copper tubing and rubber hose to EID for any kinks or restrictions. Rubber hose should not have any loops and not be stretched if using moveable burette bank.	
	Water in jacket is cooling down	Maintain consistent and stable air and water temperature.	
6	Water level on EID rises and the gage pressure drops	Leak inside water jacket	Check and repair or replace these items as necessary; 1) Test adapter o-ring 2) Test adapter/cylinder threads 3) Quick coupler 4) Quick coupler nipple 5) Pin hole in cylinder
7	Water level on EID drops and gage pressure drops	Leak between and including pump and cylinder under pressure.	Check and repair or replace these items as necessary; 1) Outlet check valve on pump 2) High pressure bleed valve 3) All connections from pump to manifold 4) Connections/fittings on manifold 5) High pressure hose assy 6) Quick coupler on end of hose
8	When pump is activated, the pressure gauge does not register pressure smoothly and is "jumping" with the pulsation of the pump.	Pressure snubber is clogged or faulty	Replace pressure snubber. Most all pressure snubbers are located in line with gauges stainless steel tubing and are screwed into the manifold on back of test console.

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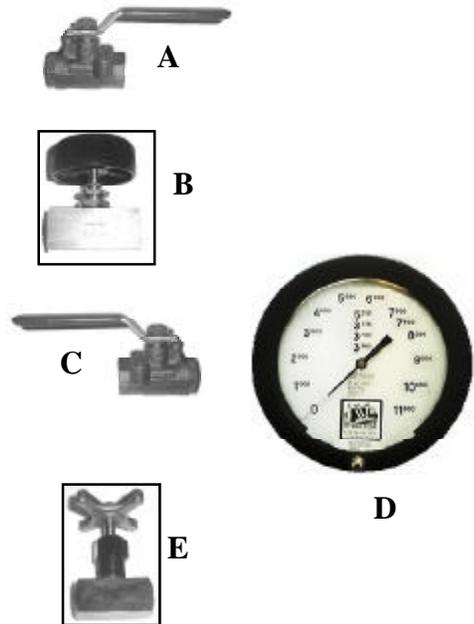
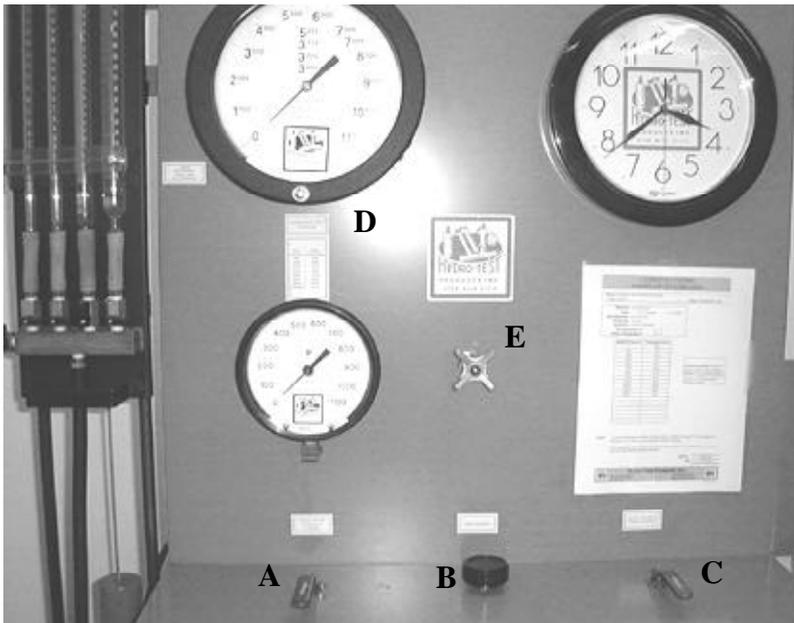
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PARTS BREAKDOWN

FRONT OF CABINET



Key	Part No.	Description
A	120-102	Water Control Valve (to jacket)
B	120-056	Pump Control Valve
C	120-102	Water Control Valve (to pump/cylinder)
D	140-001	Pressure Gauge (0-11,000psi)
	140-003	Pressure Gauge (0-5000psi)
	140-005	Pressure Gauge (0-1500psi)
	140-018	Pressure Gauge (0-1100psi)
E	120-083	Isolation Valve
F	120-076	Burette Valve
G	180-001	0-12.5cc Burette Tube
	180-002	0-25cc Burette Tube
	180-003	0-50cc Burette Tube
	180-004	0-125cc Burette Tube
	180-005	0-250cc Burette Tube
	180-006	0-360cc Burette Tube
H	130-016	Set of 4 Ruber Sleeves
I	300-017	Zero Reference Marker
J	220-099	Hose Barb Fitting



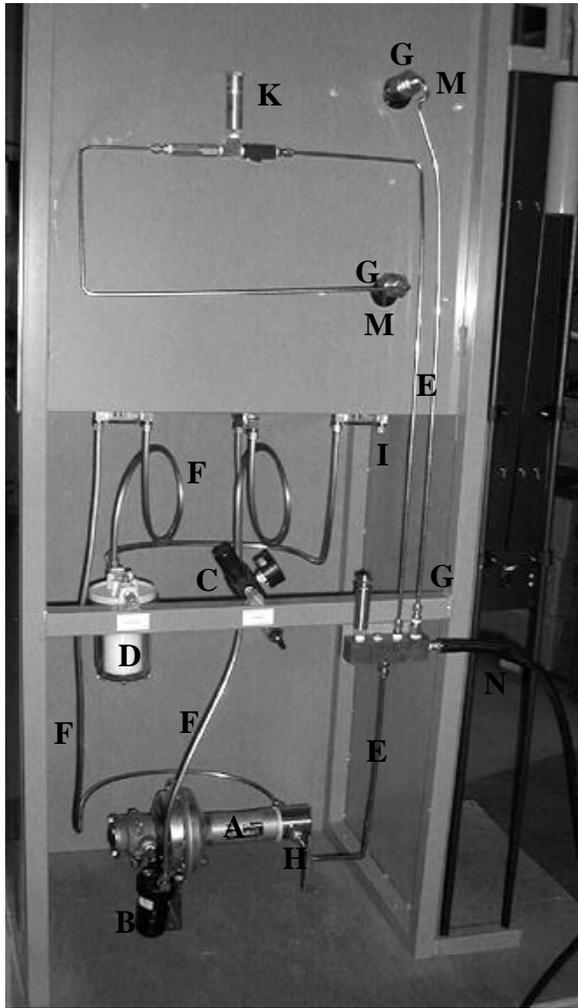
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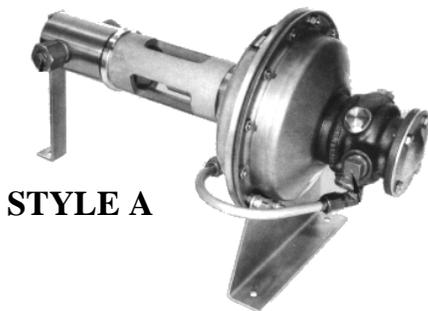
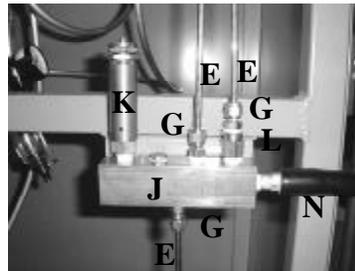
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BACK OF TEST CABINET

Key	Part No.	Description
A	See Below	Air Operated Test Pump
B	160-061	Lubricator
C	160-010	Air Regulator
	160-021	Gauge for Air Regulator
D	160-103	Water Filter
	160-104	Replacement Cartridge for Water Filter
E	290-004	Stainless Steel Tubing (order by ft)
F	290-003	Cooper Tubing (order by ft)
G	220-104	Stainless Steel Tube Fitting, 1/4"
H	220-105	Stainless Steel Tube Fitting, 3/8"
I	220-070	Cooper Tubing Compression Fitting, 1/4" Elbow
J	240-080	Manifold Block
K	120-112	Safety Relief, Adjustable (5000 – 10,000psi)
	120-018	Safety Relief, Fixed (950psi)
L	240-076	Pressure Pulsation Snubber
M	100-224	Adapter for Pressure gauge, 1/4" F x 1/2" F
N	200-100	Pressure Hose (8' long)
	200-130	Pressure Hose (12' long)

MANIFOLD ASSEMBLY



STYLE A

Style A is a contaminant free design



STYLE B

Can be operated in either vertical or horizontal position

STYLE A			STYLE B		
Part No.	Rating (PSI)	Displ. Per Stroke	Part No.	Rating (PSI)	Displ. Per Stroke
190-416	16,000	.20 Cu. Inch	190-414	16,000	.20 Cu. Inch
190-412	8800	.36 Cu. Inch	190-410	8800	.36 Cu. Inch
190-408	6100	.52 Cu. Inch	190-406	6100	.52 Cu. Inch
190-404	1850	1.75 Cu. Inch	190-402	1850	1.75 Cu. Inch
			190-400	1000	3.3 Cu. Inch

Rating based on 100 psi inlet pressure at pump

See Next Page for Parts Breakdown for These Pumps

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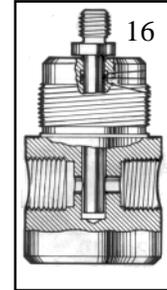
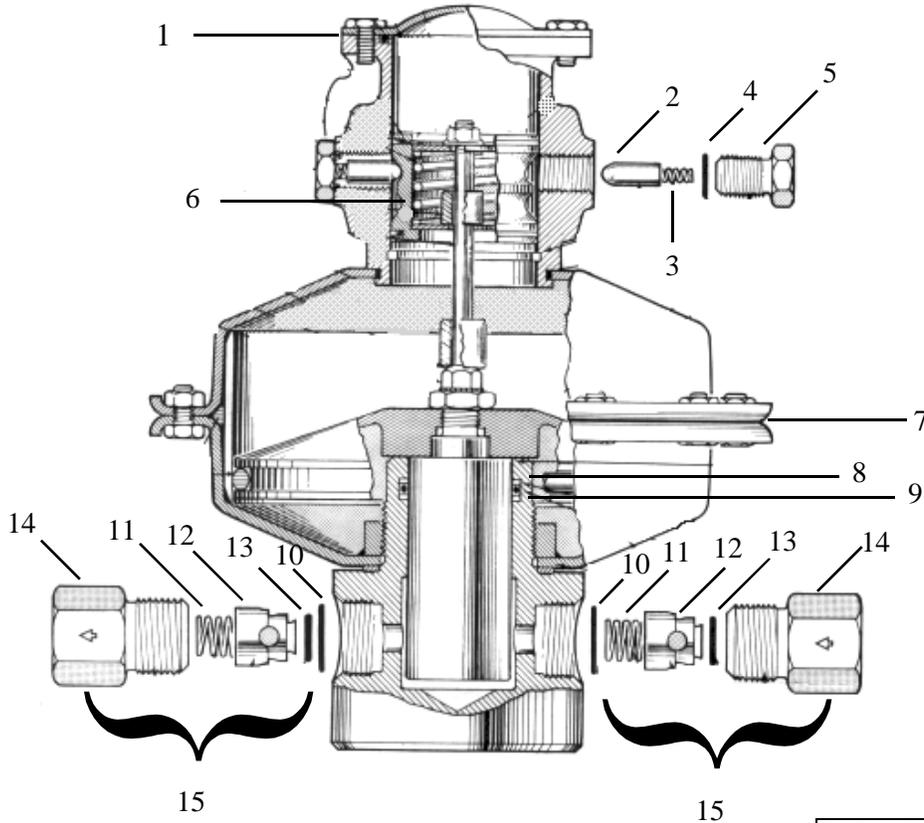
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PARTS FOR STYLE A & B AIR OPERATED TEST PUMP



It is recommended that if any parts other than those listed are required, that the pump be returned to factory for repair. Special tools are required for internal adjustments.

Item	Part No.	Description	Qty	For Pump Rated To: (PSI)				
				1000	1850	6600	8800	16,000
1	190-554	Gasket, Top Cover	1	*	*	*	*	*
2	190-080	Detent Pin	4	*	*	*	*	*
3	190-079	Detent Spring	4	*	*	*	*	*
4	190-560	Detent O-ring	4	*	*	*	*	*
5	190-559	Detent Bolt	4	*	*	*	*	*
6	190-417	Spring	1	*	*	*	*	*
7	190-566	O-ring, Housing	1	*	*	*	*	*
8	190-593	O-ring, Piston	1				*	*
8	190-592	O-ring, Piston	1				*	
8	190-591	O-ring, Piston	1			*		
8	190-590	O-ring, Piston	1		*			
8	190-589	O-Ring, Piston	1	*				
9	190-586	Spiral Teflon Backup Washer	2				*	*
9	190-585	Spiral Teflon Backup Washer	2				*	
9	190-584	Spiral Teflon Backup Washer	2			*		
9	190-583	Spiral Teflon Backup Washer	2		*			
9	190-582	Spiral Teflon Backup Washer	2	*				
10	58-037	O-ring, Check Valve Body	2					*
10	58-019	O-ring, Check Valve Body	2	*	*	*	*	*
11	210-067	Spring, Check Valve	2	*	*	*	*	*
12	240-115	Poppet Shuttle	2	*	*	*	*	*
13	58-031	O-ring, Poppet	2	*	*	*	*	*
14	240-114	Check Valve Body	2	*	*	*	*	*
15	120-090	Complete Check Valve Assy	2	*	*	*	*	*
N/S	120-091	Rbld Kit (#s 10,11,12,13)	2	*	*	*	*	*
N/S	120-093	O-ring Kit for Check Valve (#s 10,13)	2	*	*	*	*	*
N/S	120-094	O-ring Kit for Check Valve (#s 10,13)	2					*
16	190-081	Body / Piston Assy (1/2" dia. piston)	1					*
16	190-119	Body / Piston Assy (5/8" dia. piston)	1				*	
16	190-121	Body / Piston Assy (3/4" dia. piston)	1			*		
16	190-123	Body / Piston Assy (7/8" dia. piston)	1		*			
16	190-124	Body / Piston Assy (1" dia. piston)	1	*				



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WATER JACKETS



WATER JACKETS ARE OFFERED IN STANDARD SIZES, AS LISTED BELOW. SPECIAL APPLICATION JACKETS IN ANY LENGTH x 6", 10", 14", 18", 24", 30", AND 36" DIAMETERS ARE AVAILABLE.

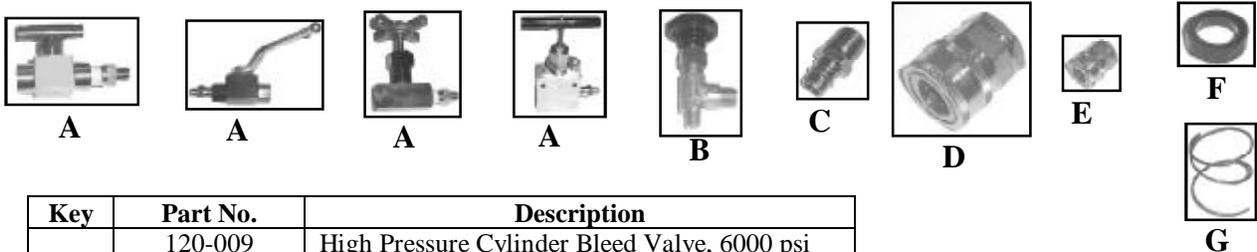
ALL JACKETS COME WITH:

- Lid Closures (manual or pneumatic)
- Low Pressure Safety Rupture Port
- Splash Pan on 40" Tall Models
- High & Low Pressure Bleed Valves
- Master Spud with Lifting Eye
- Inlet & Outlet Water Connections

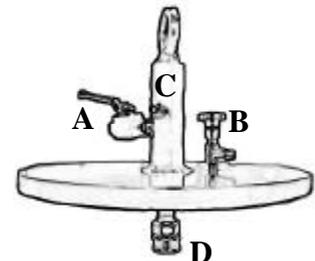
SPLASH GUARD INCLUDED ON NEW WATER JACKETS WITH PNEUMATIC LID CLOSURES

PART NO.	DESCRIPTION	Accepts Cyls In Size Up To:		LID CLOSURES	
		DIA	Lgth	Manual	Pneumatic
500-019S	14"Dia x 40" Tall with splash pan, complete	12"	36"	•	
500-019	14"Dia x 66" Tall , complete	12"	60"	•	
500-019S-P	14"Dia x 40" Tall with splash pan, complete	12"	36"		•
500-019-P	14"Dia x 66" Tall , complete	12"	60"		•
500-020S	18"Dia x 40" Tall with splash pan, complete	16"	36"	•	
500-020	18"Dia x 72", complete	16"	66"	•	
500-020S-P	18"Dia x 40" Tall with splash pan, complete	16"	36"		•
500-020-P	18"Dia x 72", complete	16"	66"		•
500-021S	24"Dia x 40" Tall with splash pan, complete	22"	36"	•	
500-021	24"Dia x 72", complete	22"	66"	•	
500-021S-P	24"Dia x 40" Tall with splash pan, complete	22"	36"		•
500-021-P	24"Dia x 72", complete	22"	66"		•

WATER JACKET PARTS



Key	Part No.	Description
A	120-009	High Pressure Cylinder Bleed Valve, 6000 psi
	120-088	High Pressure Cylinder Bleed Valve, 9000 psi
	120-089	High Pressure Cylinder Bleed Valve, 10,000 psi
	120-100	High Pressure Cylinder Bleed Valve, 10,000 psi
B	120-059	Low Pressure Jacket Bleed Valve, 1000 psi
C	110-016	Nipple Quick Coupler, 1/4"
D	110-001	Quick Coupler, 1/2"
E	110-015	Quick Coupler, 1/4" (at end of test hose)
F	110-005	Replacement Rubber Grommet for 110-001
	110-019	Replacement Rubber Grommet for 110-015
G	110-004	Replacement Spring for 110-001
	110-018	Replacement Spring for 110-015



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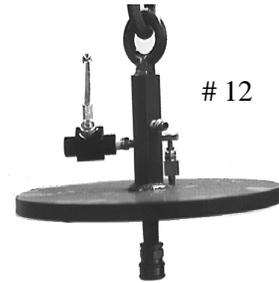
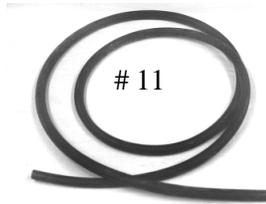
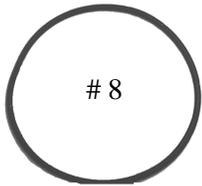
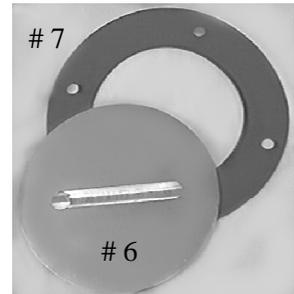
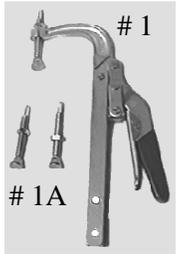
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WATER JACKET PARTS



		LID CLOSURES	Quantity Required For Water Jacket Size:			
Item	Part No	Description	10"	14"	18"	24"
1	210-040	Quick Acting Cam Clamps	3	3	Not Recommended	
2	210-043	Quick Acting Cam Clamps, Heavy Duty	3	3	4	4
3	210-115	Pneumatic Lid Closures	2	2	3	4
1A	210-041	Replacement Swivel Tip Assy for 210-040				
N/S	210-042	Repair Kit for 210-043, (includes drift pins and E-clips)				
N/S	58-115	Replacement Seal Kit for 210-115				
4	240-129	Wing Nut for All Hydro-Test Jackets (3/4"-10 thread)				
5	240-131	Swing Bolt for All Hydro-Test Jackets (3/4"-10 thread, 10"length)				
4	240-130	Wing Nut for All Standard Air Jackets (7/8"-9 thread)				
5	240-132	Swing Bolt for All Standard Air Jackets (7/8"-9 thread, 13 1/2"length)				
COMPONENT ITEMS						
6	300-055	Aluminum Rupture Disc for All Hydro-Test Jackets				
7	130-015	Gasket for Rupture Disc for All Hydro-Test Jackets (4 bolt holes)				
6	300-055S	Aluminum Rupture Disc for All Standard Air Jackets				
7	130-015S	Gasket for Rupture Disc for All Standard Air Jackets (6 bolt holes)				
8	58-200	O-Ring for 10" Dia. Jacket Actual Size of O-ring: 11 5/8" ID x 12 5/8" OD				
8	58-201	O-Ring for 14" Dia. Jacket Actual Size of O-ring: 14 7/8" ID x 15 7/8" OD				
8	58-202	O-Ring for 18" Dia. Jacket Actual Size of O-ring: 19" ID x 20" OD				
8	58-203	O-Ring for 24" Dia. Jacket Actual Size of O-ring: 25" ID x 26" OD				
9	240-124	Replacement Spud, 1/2" (M)NPT, With threaded ports for valve / nipple				
10	240-133	Eyebolt (Lifting Eye) for insertion into Spud				
11	130-017	Non Collapsible Rubber Tubing, From Jacket to Burette Bank (Sold by FT)				
COMPLETE LID ASSEMBLIES						
12	500-880	Water Jacket Lid Assemblies:	10" Jacket			
12	500-882	Including: Lid Cover	14" Jacket			
12	500-884	Spud & Eyebolt	18" Jacket			
12	500-886	Enamel Painted Finish	24" Jacket			



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REGULATIONS

As of the date of this instructional manual the United States Department of Transportation (D.O.T.) requires that anyone who re qualifies a cylinder to be transported with hazardous material (pressure) is required to obtain a license and is issued a Requalification Inspection Number (R.I.N.).

The license is valid for a period of 5 years.

A RETESTER MUST MAINTAIN ON FILE AT THE RETESTING LOCATION THE FOLLOWING DOCUMENTS AND RECORDS

- Current retesters identification number issuance letter from DOT Approvals DHM-32.
 - (If RIN has expired, copy of RIN renewal request)
- Copies of notifications to DOT Approvals For;
 - ↳ Change of name / address / ownership
 - ↳ Change in testing equipment
 - ↳ Change of management or personnel related to inspection or testing of cylinders

{ Notification of any changes above must be submitted to DHM-32 within 20 days }
- Current copy of applicable sections of CFR
- Current copies of exemptions as applicable
- CGA pamphlets incorporated by reference, as outlined in 49CFR §171.1
- Copies of most recent certificate of calibration of calibrated cylinder(s)
- Copies of most recent certificate of calibration of pressure gauge(s)
- Daily records of visual inspection and retest for all DOT / Exemption specification cylinders tested and or inspected. Retain records for full retest period or until cylinder is retested, whichever comes first.
- Daily verification records for test apparatus for each day requalification testing is performed
- Current training records of all employees that requalify DOT / Exemption specification cylinders.

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GLOSSARY OF TERMS

C.F.R. (Code of Federal Regulations)	<i>The U.S. – Department of Transportation regulations that pertain to cylinder re qualification</i>
C.G.A. (Compressed Gas Association)	<i>An organization that provides technical standards for the compressed gas industry</i>
Calibrated Cylinder	<i>A cylinder used to verify overall accuracy of a water jacket test station on a daily basis</i>
Calibration	<i>The process of internal and external adjustments on an instrument to meet a given standard</i>
Condemned Cylinder	<i>A cylinder determined to be unrepairable for continued use in the transport of hazardous materials</i>
D.O.T. (Department of Transportation)	<i>In the U.S. this is the division of the government that controls hazmat safety, including the re qualification of cylinders</i>
Direct Expansion Test	<i>A test procedure used primarily on 1 ton containers</i>
E.E. (Elastic Expansion)	<i>The difference between the total and permanent expansion</i>
E.I.D. (Expansion Indicating Device)	<i>Either burette tubes or digital scale used to indicate expansion</i>
Master Gauge	<i>A gauge having accuracy better than a working gauge. Used as a calibration standard</i>
N.F.P.A. (National Fire Protection Association)	<i>An organization that provides standards for the fire protection industry</i>
Non-Corrosive	<i>A hazardous material that in the presence of moisture is not corrosive</i>
Over Heated	<i>A condition when temperatures reach over 350°F for aluminum cyls. And 650°F for steel cyls.</i>
P.E. (Permanent Expansion)	<i>The expansion indicated on E.I.D. after release of pressure</i>
P.I.D. (Pressure Indicating Device)	<i>Gauge or transducer used to indicate pressure</i>
PRD (Pressure Relief Device)	<i>The safety disc assembly on compressed gas valves</i>
Proof Test (modified test)	<i>A test procedure where expansion values are not used</i>
R.E.E. (Rejection Elastic Expansion)	<i>A factor used in plus stamping for 10% overfill and for re qualifying 3HT specification cylinders</i>
R.I.N. (Requalification Identification Number)	<i>The unique code assigned by DOT/RSPA to a licensed requalification facility</i>
R.S.P.A (Research and Special Programs Administration)	<i>A division of the U.S. Department of Transportation that administers the rules affecting the transport of hazardous materials</i>
Referee Gauge	<i>A gauge having accuracy better than or equal to a working gauge. Used to verify accuracy of working gauge during verification procedure of proof testing</i>
Rejected Cylinder	<i>A cylinder that cannot be used for the transport of hazardous material without repair</i>
T.C. (Transport Canada)	<i>In Canada this is the division of the government that controls hazmat safety, including the re qualification of cylinders</i>
T.E. (Total Expansion)	<i>The expansion indicated on E.I.D. at test pressure</i>
Verification	<i>The daily process of checking accuracy of test equipment prior to beginning testing that day</i>
Water Jacket Test	<i>A test procedure where expansion values of cylinder are determined in re qualification criteria</i>
Working Gauge	<i>The gauge used to indicate pressure on item being tested</i>



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