INSTRUCTION MANUAL

VOLUMETRIC WATER JACKET TEST SYSTEM

MODEL
500-Series

HYDRO-TEST PRODUCTS LLC
85 HUDSON ROAD, STOW, MA 01775 U.S. A

The 500-Series Manual Volumetric Water Jacket Test System

This manual incorporates the following models manufactured by Hydro-Test Products LLC. Please carefully read this entire manual before operating the equipment for the first time. Should you have any questions or concerns, please contact Hydro-Test Products prior to operating. Models listed below are HP for High Pressure, but YOUR SYSTEM MAY BE an LP for Low Pressure or LHP for Low-and High-Pressure Systems.

	Water Jacket Size		Maximum Cylinder Size		
Model No.	**Dia (")**	**Height (")**	**Dia (")**	**Height (")**	**Type of Water Jacket Lid Closure**
500-HP-14S-M	14	40	12	34	Manual
500-HP-14S-P	14	40	12	34	Pneumatic
500-HP-14-M	14	66	12	60	Manual
500-HP-14-P	14	66	12	60	Pneumatic
500-HP-18S-M	18	40	16	34	Manual
500-HP-18S-P	18	40	16	34	Pneumatic
500-HP-18-M	18	72	16	66	Manual
500-HP-18-P	18	72	16	66	Pneumatic
500-HP-24S-M	24	40	22	34	Manual
500-HP-24S-P	24	40	22	34	Pneumatic
500-HP-24-M	24	72	22	66	Manual
500-HP-24-P	24	72	22	66	Pneumatic
500-HP	Test Console Only - No Water Jacket, Calibrated Cylinder or Test Adapters				

Your Model No._____

Your Serial No._____

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Hydro-Test Products LLC

www.hydro-test.com **Tel:** 800-225-9488 / 978-897-4647 **Fax:** 978-897-1942

INTRODUCTION

Water Jacket Volumetric Testing has been a method of re-qualifying compressed gas cylinders since the early 1900's. The test is designed to measure the expansion value of a cylinder at it is designed test pressure (typically 5/3rds the operating pressure) and measure any residual expansion after the pressure is released. If the residual expansion value is greater than a percentage (typically 10%) of the expansion value at the test pressure the cylinder fails, the test. The determination of failure is due to excessive permanent expansion which indicates that the cylinder walls have thinned during the life of the cylinder and thus has been deemed dangerous to be refilled with pressurized gas.

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

1 **RECIEVING HAZMAT TRAINING** (function specific to requalification of cylinders) HAZMAT TRAINING PERTAINING TO THE REQUALIFICATION OF CYLINDERS, MEETING THE U.S. DEPARTMENT OF TRANSPORTATION REGULATIONS, ARE OFFERED BY HYDROTEST PRODUCTS.

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 Special Permits for any Cylinder That Your Facility Will Be Re Qualifying
- Applicable Compressed Gas Association Pamphlets
- Current Certificates for Equipment
- Current Certificate of Training

4 **SECURE A LICENSE FROM THE U.S. DEPARTMENT OF TRANSPORTATION**

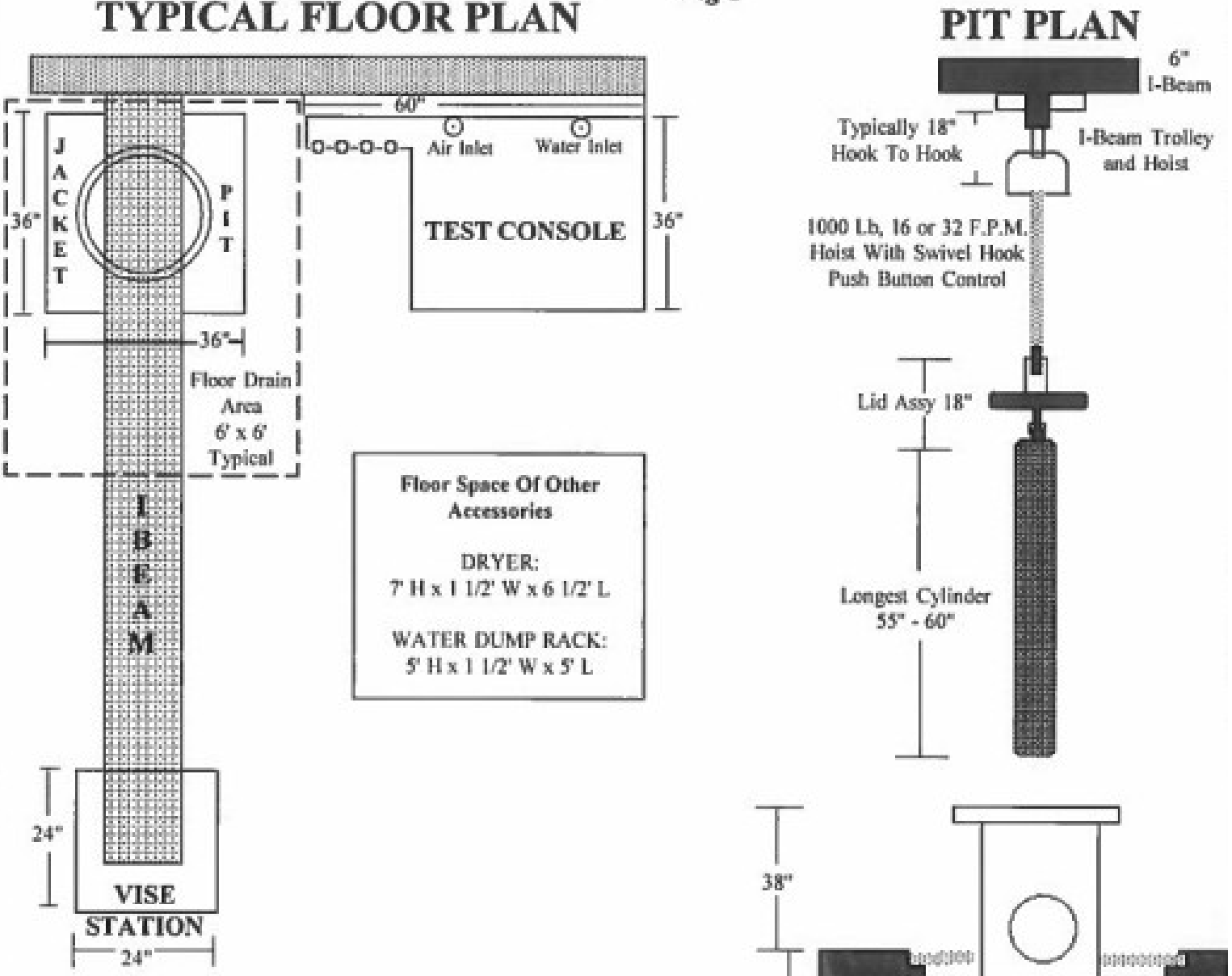
5 REQUIRED UTILITIES

Utilities required checklist:

- 100psi @ 8CFM of pre-regulated shop air to back of test console
- Inlet water supply to back of test console
- Pit for water jackets over 40" tall - see next page for typical floor and pit plan
- Overhead I-beam with hoist and trolley
- 115V-60Hz-15 amp dedicated electrical outlet within 4' of test console
- Any additional utilities that may be required for options or additional equipment purchased - see quotation or manuals for those requirements.

POSITION EQUIPMENT

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

Positioning of Equipment

It is recommended that the test console be left on the pallet. This will help with the vibration of the pump (which can cause erratic readings) and keep the steel cabinet off 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 customer's 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 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/or a convenient working height. The overhead hoist I trolley I 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 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;

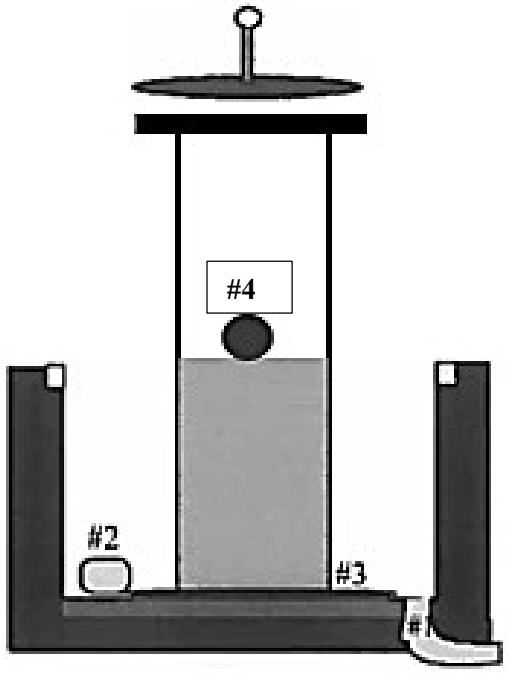
a) A drain line conected to pit for drainage to nearest drain. *Fig 3 #1*

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 shimm 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 posistioned away from operator and test console, yet kept accessible for servicing of safety disc *Fig 3 #4*.

Fig3



UNCRATING

THE TEST STATION IS SHIPPED IN TWO PIECES

I) **TEST CONSOLE**
Includes;

Test Pump
Pressure Indicating Device(s)(P.I.D.) (*High and/or Low-Pressure Gauge(s) with Certificate(s))*
Expansion Indicating Device(s)(E.I.D.) *(Digital Scale, Burettes or both with Certificate(s)*)
Calibrated Cylinder with Certificate(s)
Parts Box
Test Adapters

2) **WATER JACKET (***Test Chamber)*
Includes;

Lid Assy (Valves, Couplers)
Lid Closures (Pneumatic or Manual Clamps)

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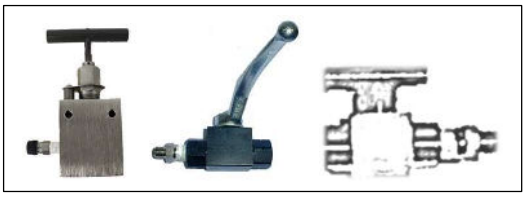
PARTS

OPEN PARTS BOX

Inside the parts box, you will find the following items depending upon your model test system

A) High Pressure Bleed Valve
One of these will be in parts box

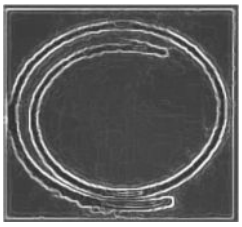


B) Low Pressure Bleed Valve

C) 1/4"Nipple and ½" nipple

D) ¼" and 1/2" Quick Coupler

E) Copper Tubing (2pcs)



F) Rubber Tubing (4')

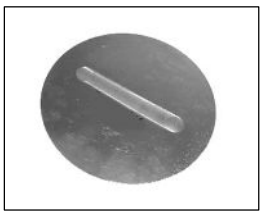
G) Compression Fittings (2pcs)

H) Test Record Forms

I) Test Adapters & Nipples

J) 0-ring Set for Check Valves (spares)

K) Safety Disc for Water Jacket (spare)



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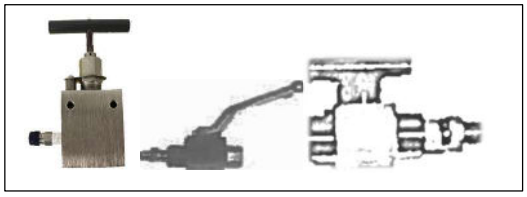
INSTALLATION

STEP 1 ASSEMBLE PARTS TO WATER JACKET/LID

The following items from parts box in step are needed:

A) High Pressure Bleed Valve



8) 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) 

LID

i. Teflon Tape Threaded Connections of Parts A,B,C & G and Male
ii. Threads Located on Underside of Lid Connect Quick Coupler (D)
iii. Assemble and Tighten A,B,C & D as *Shown in* ***Fig 1***

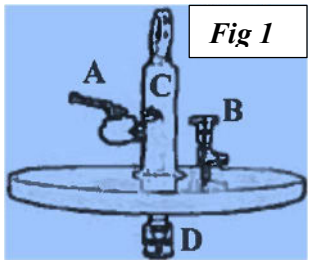
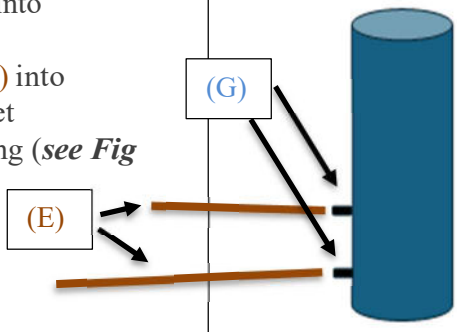


Fig 1

JACKET

i. Tighten both Compression Fittings (G) into the 2 Ports located on the Bottom Side of the Jacket
ii. Attach One End of the Longer piece of Copper Tubing (E) into Compression Fitting G at Lower Port of the Jacket
iii. Attach One End of the Shorter piece of Copper Tubing (E) into Compression Fitting G at Upper Port of the Side of Jacket
iv. Tighten Both Compression Fittings (G) onto Copper Tubing (***see Fig 1b***)

Fig1b Jacket



INSTALLATION (*continued*)

STEP 2 MAKING CONNECTIONS FROM WATER JACKET TO TEST CONSOLE

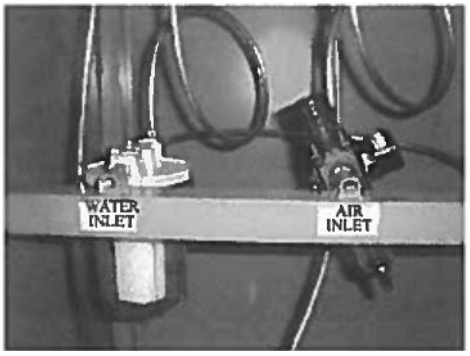
a) Attach the long piece of Copper from the Jacket to the Valve on Console labeled “Water to Jacket and E.I.D.”

b) Slip 4' piece of Black Rubber Tubing (F) over end of short Copper Tubing, coming from the jacket, this is a slip fit. Use a little water to lubricate **Attach the other end of the Black Rubber Tubing to Barb Fitting of your Expansion Device either Scale or Burette**

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 sloping 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 3 CONNECTING AIR AND WATER SUPPLY TO CONSOLE

Fig 3



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 lnlet*"(Fig 3)*. This connection can be hard-pipped - 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 3).*** Incoming air supply cannot exceed 160 psi. The air regulator used on the test console has been preset at the factory for 100 psi. If needed, use adjustment knob on top of regulator to regulate

air supply. A pressure gauge is supplied for viewing of pressure

Step 4: SETUP YOUR SCALE AND/OR BURETTE (EXPANSION INDICATING DEVICE (E.I.D.))

(only one E.I.D. may be utilized at a time)

a) Locate expansion scale, remove red sticker, and turn locking mechanism to unlock position and place platform on scale. Connect the power cord to scale.

b) Locate weight bowl and dip tube assembly. Place the scale on the test console as pictured (***see fig. 4***), level the scale by adjusting the feet on the scale. Quick couple the dip tube as pictured (***see fig.4b***). Be sure the beaker is on top of scale and the copper siphon tube is securely coupled in place. The bottom of the copper tube should be as close to the bottom of the beaker without touching, approximately 1/8” of an inch from the bottom of the beaker

c) For Burettes remove the clamp holding the burette board/counterweight in place
Make sure Zero Reference Marker for the Burettes is level (***see fig 4c***)

Fig 4c

Fig. 4b

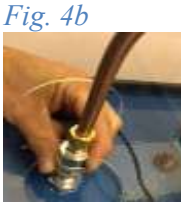


fig 4

INSTALLATION (*continued*)

STEP 5 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 at the air inlet to the pump is adjusted by either an adjustment knob or a slotted screw *#2).* The lubricator must be 3/4 filled with air tool oil. With high pressure uncoupled from jacket lid, slowly and slightly open the "Pump Control" valve on console. 1 drop of oil should pass through sight on lubricator for every 40-50 strokes of pump piston

STEP 6 PREPERATION OF CALIBRATED CYLINDER

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

a) Fill cylinder with water
b) Teflon tape (If needed) and insert test adapter and quick coupler nipple into cylinder.
c) Tighten test adapter

STEP 7 FILL WATER JACKET WITH WATER

At this time all connections 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,

a) Fill water jacket, either by separate garden hose (recommended) or through test console by turning on water valve labeled "Water to Jacket and E.I.D.". 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.

b) Bring water jacket lid, by overhead hoist, over to calibrated cylinder and connect the quick coupler (D) under the lid onto the test adapter and calibrated cylinder. Slowly hoist lid and cylinder up and into water jacket. The first time filling the jacket allow cylinder to rest in water jacket for a minimum of 24 hours. This ensures that water temperature will stabilize.

STEP 8 ADJUSTING WATER JACKET LID CLOSURES

Please locate and follow that manual's instructions before proceeding.

There are currently 3 different styles of clamps being used on the 500-series test systems.
First identify your clamps as follows:

Part No. 210-040:
Used on 14" diameter water jackets

Part No. 210-043:
Used on 18" & 24" diameter water jackets

Part No. 210-115:
Optional pneumatic lid closure for all size water jackets

Hydro-Test

INSTALLATION (*continued*)

Step 8 (*continued*)

The clamps are sent on the water jackets properly adjusted. However, over time you may need to re-adjust the clamps back to factory specifications. It is important to know that the water jacket does not see any pressure other than your incoming water pressure. All the high pressure is being directed to the cylinder that is being tested. Therefore, there is no reason to overtighten the clamps. The manual clamps should be able to be closed with one hand.

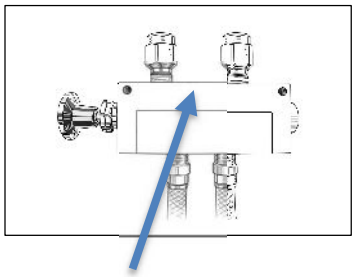
1. Release all clamps to the open position. Back off the adjustment bolt all the way. Return clamps to closed position
2. Screw the adjustment bolt clockwise on all clamps until it touches the lid of the water jacket
3. Release all clamps to open position again
4. Further screw the adjustment bolt 2 turns on all clamps
5. Return the clamps to the closed position and they should now be able to be closed with one hand, and a firm click should be heard.
6. Tighten the locking nut to avoid slippage of bolt

adjustment bolt

1. Release all clamps to the open position. Back off the adjustment bolt all the way. Return clamps to closed position
2. Screw the adjustment bolt clockwise on all clamps until it touches the lid of the water jacket
3. Release all clamps to open position again
4. Further screw the adjustment bolts 1.5 turns on all clamps
5. Return the clamps to the closed position and they should now be able to be closed with one hand, and a firm click should be heard.
6. Tighten the locking nut to avoid slippage of bolt

Set Up of pneumatic clamps:

1) Find the Air Control Valve mounted on the console with the 2 hoses, connect them to the **#1** Clamp which should have 2 open connections. The body of the control valve has multiple ports with numbers labeled next to them. **#4 port** goes to the bottom connection on the **#1** clamp. **#2 port** goes to the top connection on the **#1** Clamp. **#3 port** and **#5 port** are vent holes with snubbers that slow the clamp during opening and closing and are not to be touched.



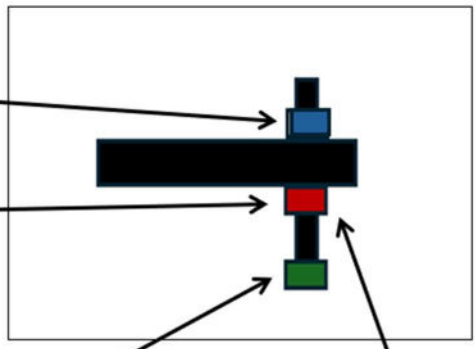
Air Control Valve

2) **Connect air supply** to the **#1 port** that is in between the snubbers on the Air Control Valve. Your air supply **MUST BE PREREGULATED** to 100 PSI before it is attached to the Air Control Valve inlet.
3) To open and close the clamps, you must push or pull the control knob on the Air Control Valve.
4) Closing the clamps. A distinctive click should be heard for all the clamps to indicate the clamps are locked - if not, see adjusting the clamps below.

INSTALLATION (*continued*)

Adjusting Air Clamps:

I. Open the clamps by activating the control knob
II. Loosen the "Top Lock Nut" on the bolt, Turn it approximately 2 turns upwards
III. Turn the "Bottom Lock Nut" upwards approximately 1.5 turns
IV. Close the clamps by activating the control knob



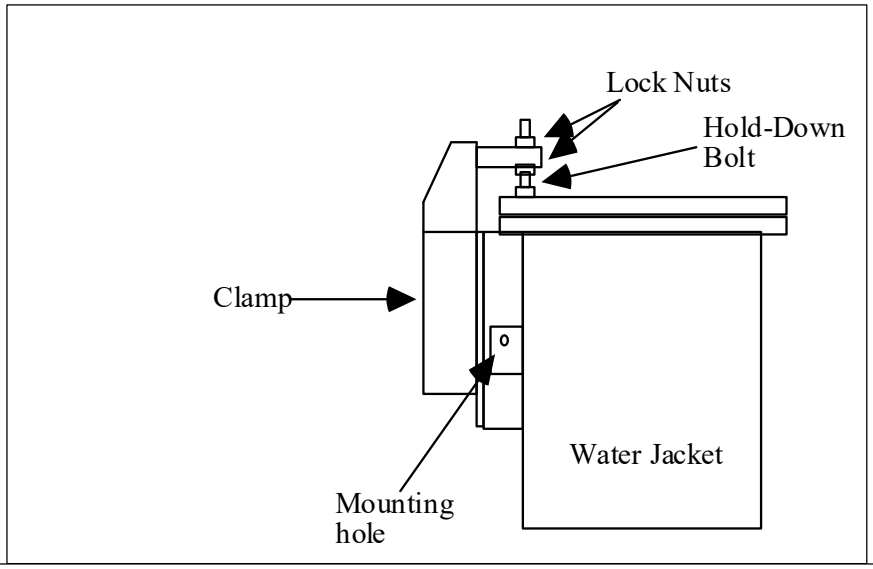
V. Utilize two wrenches, one wrench to secure the" Hold-Down Bolt" and with the second wrench gradually turn the "Bottom Lock Nut" downward towards the lid until the clamp locks and a distinct clicking sound is heard
VI. Tighten the "Top Lock Nut"
VII. Repeat the adjustment steps for each clamp
VIII. Open the clamps. **Note:** When re-closing the clamps if you do not hear the distinctive clicking sound, you must re-adjust the clamps again.

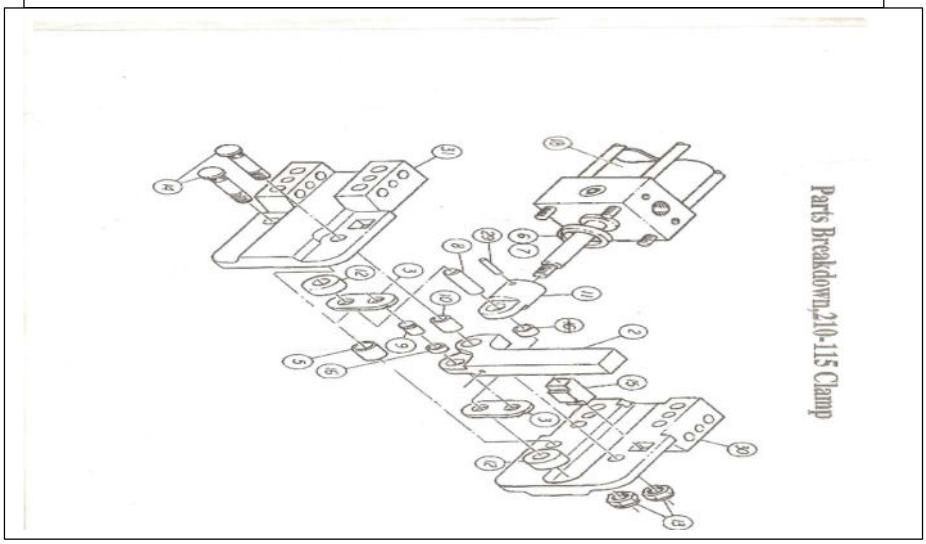
REPLACEMENT PARTS JACKET
ADDITIONAL PARTS PAGE 35

PART NO. DESCRIPTION
058-115 Repair Kit for Air Clamp
120-026 Control Valve
215-026 3/8"Mounting Bolt
215-203 3/8"Lock Washer
215-205 3/8"Hex Nut
215-032 1/2"Hold-Down Bolt
215-202 1/2"Hex Nut
215-302 1/2"Lock Washer
210-115 Replacement Air Clamp
210-240 Replacement Air Cylinder
240-076 Snubber for vent

Parts List for 210-115 Air Clamp

Key #	QTY	Part No.	Description
2	1	895421	90°Arm
3	2	895414	Link
5	1	895108	Spacer
6	1	895109	Ring
7	1	895190	Ring
8	1	895110	Roller Pin
9	1	895415	Arm Pin
10	1	895112	Arm Spacer
11	1	895106	Clevis
12	2	895114	Bearing
13	2	895115	Lock Nut
14	2	895116	Pivot Bolt
15	1	895117	Stop
16	2	895118	Bushing
18	1		Part No. Stamped on Head
28	1	895392	Washer (not shown)
29	1	805021	Roll Pin
30	1	895101	Body, R.H.
31	1	895102	Body, L.H.
Not Shown 1		058-115	Seal Kit





INSTALLATION (*continued*)

STEP 9 PREPERATION OF PRESSURE GAUGE (PRESSURE INDICATING DEVICE (P.I.D.))

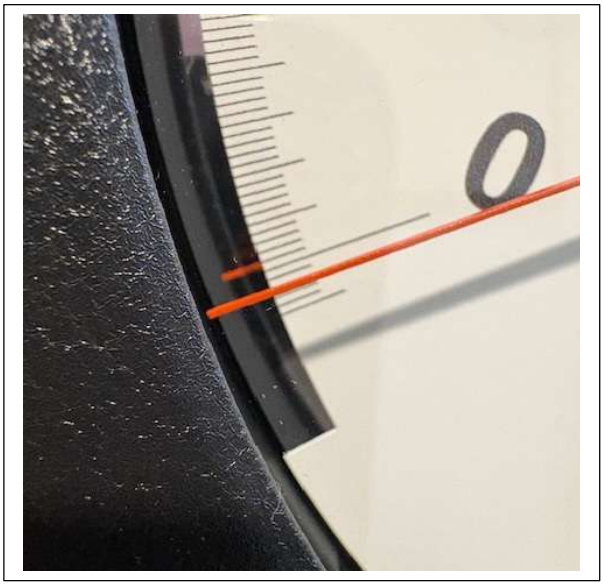
This is the primary calibrated instrument in the system. **Before starting, understand how to read the gauge, and "True Zero" point MAY need adjusting, check Calibration Certificate for "True Zero" (Most gauge true zero readings are not 0, (may be +20, -10, etc...).**

(*See how to adjust "True Zero" point at the bottom of this page)*

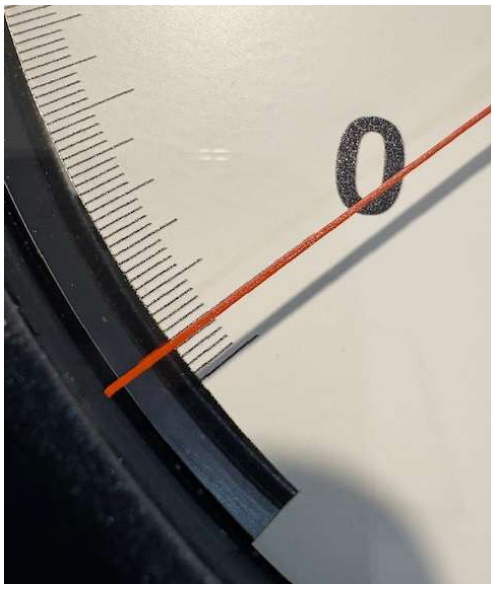
READING THE GAUGE

a) LOCATE THE NEEDLE,
b) FIND THE MIRROR LOCATED ON THE OUTER EDGE OF THE DIAL FACE
c) ALIGN THE NEEDLE WITH ITS OWN REFLECTION, BY MOVING YOUR HEAD UP, DOWN, LEFT OR RIGHT UNTIL THE NEEDLE AND ITS REFLECTION ARE PERFECTLY ALIGNED

Example below is INCORRECT



Example below is CORRECT



If the "True Zero "adjustment is required follow steps below:

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, -10, etc...).
b) Adjusting the "**True Zero**" point, locate the knob in front of the gauge, turn small locking knob counterclockwise, then turn the large knob **on** front of gauge either clockwise or counterclockwise to adjust needle to true zero. **This adjustment is to be made only at the true zero point and never at test pressures**

Note: The "True Zero "point is where the needle should be pointing when it's at zero pressure

Checklist

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

I) 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

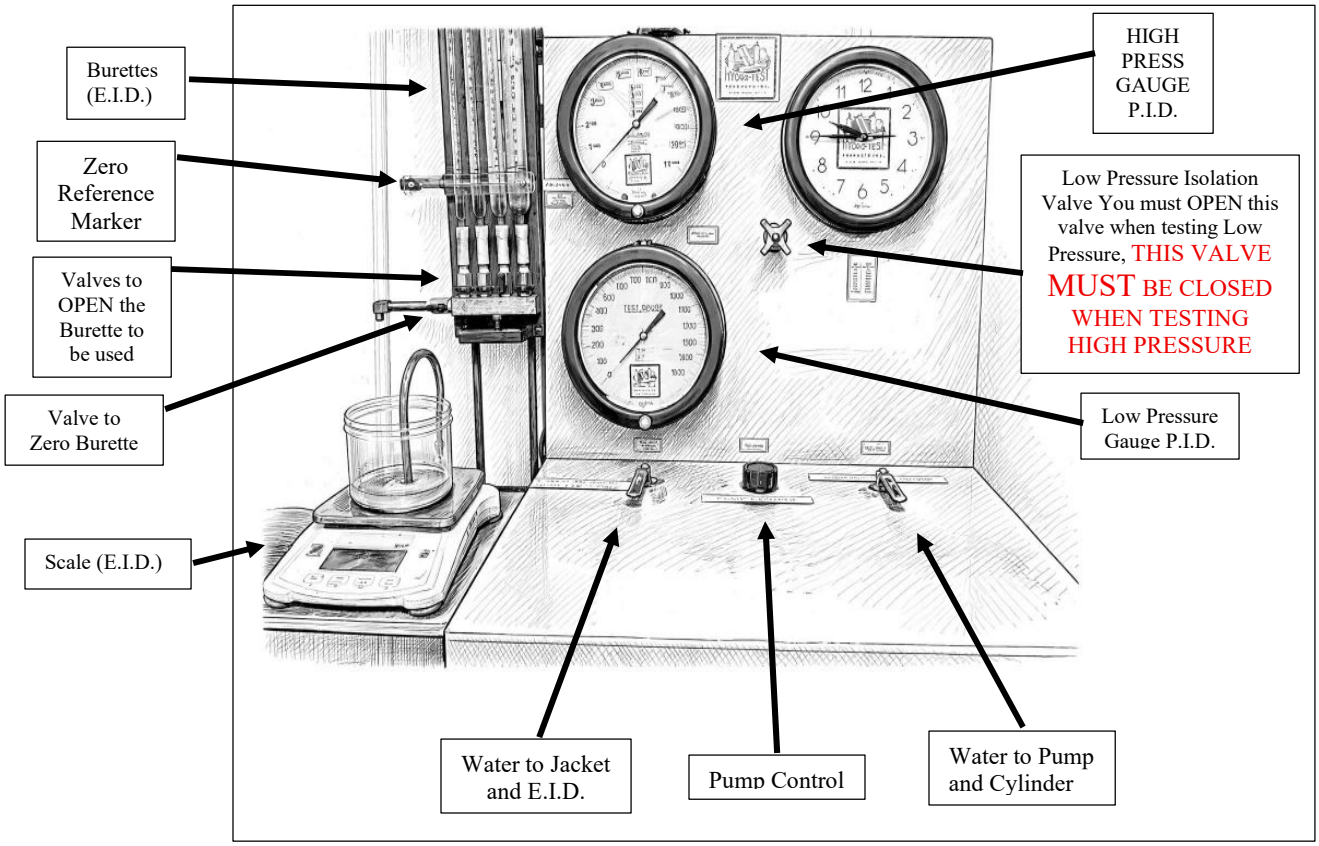
6) ALL FITTINGS ON WATER JACKET LID HAVE BEEN TEFLON TAPED (If needed) AND TIGHTEN

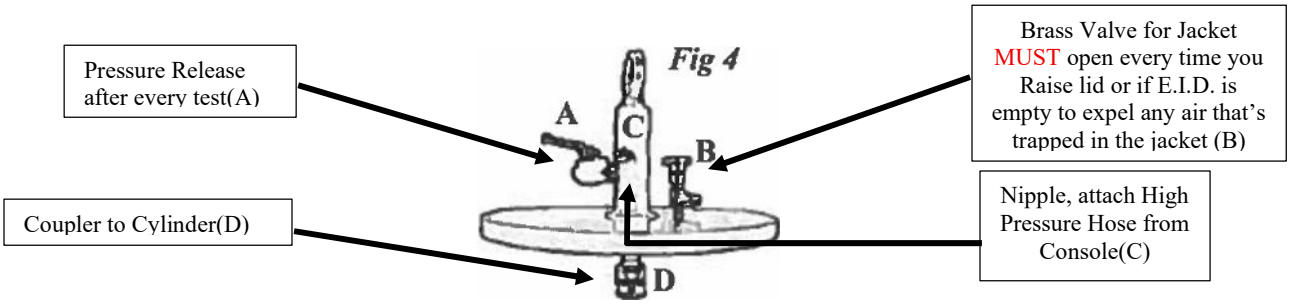
7) AIR OPERATED TEST PUMP LUBRICATION HAS BEEN ADJUSTED PROPERLY

8) CLAMPS HAVE BEEN ADJUSTED PROPERLY

9) TRUE ZERO POINT OF PRESSURE GAUGE(S) HAS BEEN ADJUSTED, IF REQUIRED

10) KNOW VALVES ON YOUR SYSTEM SEE BELOW (MODEL SHOWN 500-LHP)





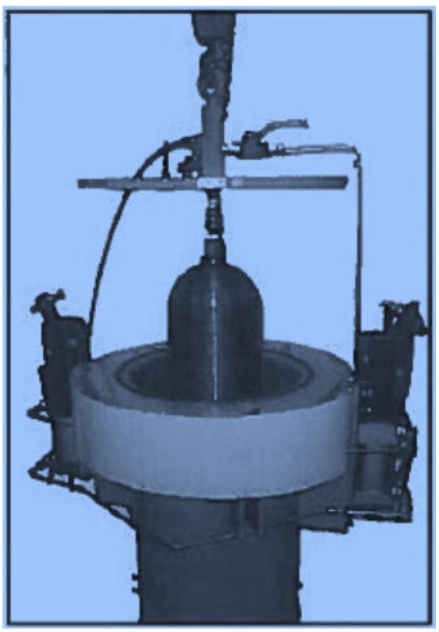
VERIFICATION/CALIBRATION

THIS PROCEDURE IS TO BE DONE AS THE FIRST EXERCISE EACH DAY THAT TESTING IS PERFORMED

USING THE DIGITAL SCALE (E.I.D.)

If you are using Burette(s) go to PAGE 20

STEP 1:



A) **CALIBRATED CYLINDER IS FILLED WITH WATER, TEST ADAPTER TIGHTENED, QUICK COUPLED ONTO THE UNDERSIDE OF WATER JACKET LID AND LOWERED INTO THE WATER JACKET**

B) **LID CLOSURES (CLAMPS) ARE ACTIVATED IN CLOSED POSITION**

C) **QUICK COUPLE HIGH PRESSURE HOSE TO LID QUICK COUPLE NIPPLE ON LID**

D) **OPEN THE HIGH-PRESSURE BLEED VALVE AND THE BRASS VALVE LOCATED ON TOP OF LID**

E) ***IF INSTALLED (ONLY ON 500-LHP SYSTEMS) OPEN ISOLATION VALVE IF TESTING LOW PRESSURE, CLOSE ISOLATION VALVE IF TESTING HIGH PRESSURE***

STEP 2: FILLING THE JACKET AND FILLING THE SCALE

A) HAVE SCALE TURNED ON AND BEAKER ON TOP OF SCALE WITH TUBE INSIDE BEAKER.

B) OPEN VALVE LABELED "WATER TO JACKET AND E.I.D."

C) ONCE WATER STARTS TO FLOW OUT OF THE BRASS VALVE ON TOP OF THE LID AND THE WATER LEVEL IN THE SCALE IS APPROXIMITLY 1/4" OVER TUBE CLOSE VALVE LABELED "WATER TO JACKET AND E.I.D.", AND CLOSE BRASS VALVE ON TOP OF LID YOU MUST CLOSE THIS VALVE BEFORE THE WATER IN THE SCALE DROPS BELOW THE COPPER TUBE **Note***: If the water drops below the copper tube add more water by opening Valve labeled "Water to Jacket and E.I.D." on console, If there's too much water in the beaker drain it by opening the brass valve on the lid*

D) LET IT STABLIZE (NORMALLY TAKES ABOUT A MINUTE) PUSH ZERO /TARE WEIGHT BUTTON ON SCALE, SCALE WILL THEN READ

0.0g

VERIFICATION/CALIBRATION *(CONTINUED)*

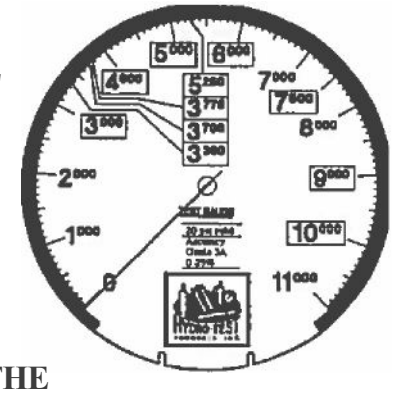
IF USING SCALE

STEP 3: PRESSURIZING THE CALIBRATED CYLINDER

A) MAKE SURE SCALE IS READING ZERO

B) OPEN VALVE ON CONSOLE LABELED "WATER TO PUMP AND CYLINDER"

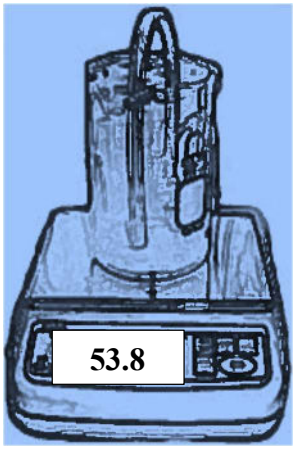
C) CLOSE THE HIGH-PRESSURE BLEED VALVE ON THE LID ONCE WATER STARTS TO FLOW.



D) OPEN VALVE LABELED "PUMP CONTROL" ON THE CONSOLE COUNTERCLOCKWISE THE TEST PUMP SHOULD BEGIN OPERATING AND AN INCREASE OF PRESSURE SHOULD SHOW ON THE GAUGE AS WELL AS AN INCREASE OF EXPANSION ON THE SCALE/BURETTE.

E) SLOWLY TURN THE VALVE LABELED "PUMP CONTROL" CLOCKWISE TO SLOW THE PUMP TO THE TARGET PRESSURE *(see page 15 step 9 on how to read gauge)*

STEP 4: READING FROM SCALE (E.I.D.) AT PRESSURE



A) RECORD READING FROM DIGITAL SCALE THIS EXPANSION NEEDS TO BE WITHIN 1% OF THE EXPANSION INDICATED ON YOUR CALIBRATED CYLINDER CERTIFCATE

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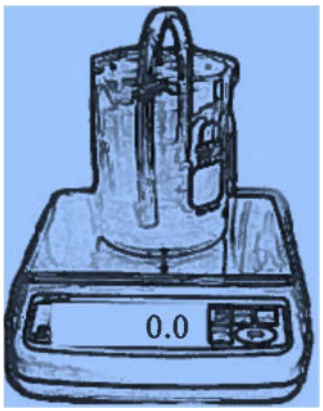
VERIFICATION/CALIBRATION *(CONTINUED*

IF USING SCALE

STEP 5: READING SCALE (E.I.D.) AFTER RELEASING PRESSURE

A) RELEASE PRESSURE BY SLOWLY OPENING THE HIGH-PRESSURE BLEED VALVE ON THE LID
B) TAKE READING FROM SCALE AFTER SCALE IS ALLOWED TO "STABLILIZE"

DIGITAL DISPLAY MUST SHOW 0.0g
IF SCALE DOES NOT RETURN TO ZERO REDO STEPS 3-5
It may take multiple verification runs to achieve 0.0 permanent expansion)



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

YOU CANNOT TEST UNTIL THE PROBLEM IS CORRECTED!!

EXAMPLE VERIFICATION:

Establish pressure on pressure device and then monitory the expansion indicating device, Expansion device must show 1% accuracy to calibrated cylinder correlating pressure value.

Pressure Reading@ Corresponding Expansion	Expected Expansion Reading (cc's) (A)	Actual Expansion Reading @ Corresponding Pressure (B)	Permanent Expansion	Elastic Expansion	% Deviation
From Calibrated Cylinder Chart of Expansions		Reading from P.I.D.	Reading on EID after release of pressure	Difference Between Total and Permanent Expansion	A-B / A x 100 = %
3000	54.0	53.8	0	53.8	0.37%

Formula for percentage deviation: 54.0 - 53.8 = 0.2 ÷ 54.0 = 0.0037 x 100 = 0.37%

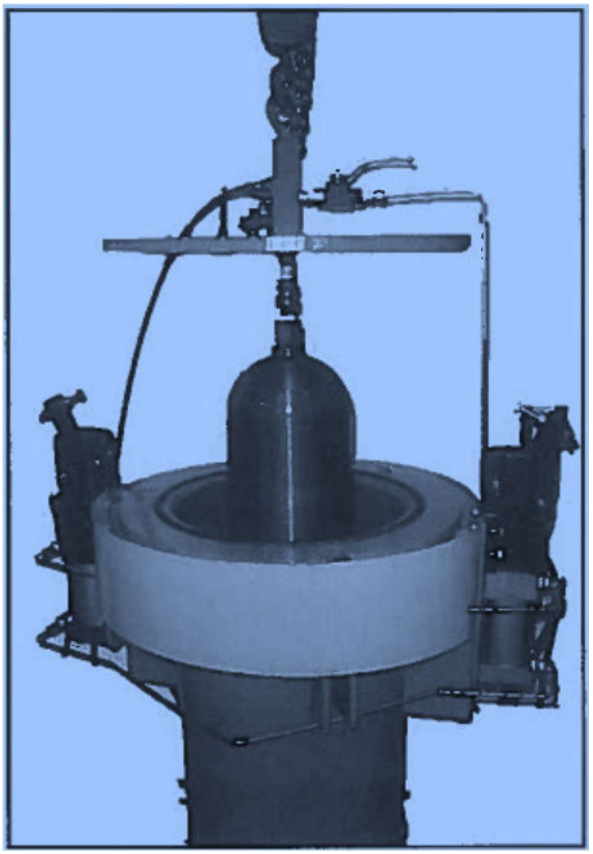
Formula for elastic expansion value: 53.8 (actual expansion) **- 0** (permanent expansion) **= 53.8**

Please note, we strongly suggest a formal training seminar from experts in your industry. Reach out to our team at Hydro-Test Products for more information.

VERIFICATION/CALIBRATION

IF USING THE BURETTE (E.I.D.)

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 BRASS AND HIGH-PRESSURE RELEASE VALVES ON TOP OF LID
- CONNECT HIGH PRESSURE TEST HOSE
- ***IF INSTALLED (ONLY ON 500-LHP SYSTEMS) OPEN ISOLATION VALVE IF TESTING LOW PRESSURE, CLOSE ISOLATION VALVE IF TESTING HIGH PRESSURE***

STEP 2 FILLING JACKET AND FILLING BURETTE

A) **OPEN THE VALVE ON THE BURETTE MANIFOLD FOR THE BURETTE YOU WILL BE USING. CLOSE ALL OTHER VALVES ON THE BURETTE MANIFOLD. (*see Fig 2*)**

B) **OPEN VALVE LABELED "WATER TO JACKET AND E.I.D." ON CONSOLE**

C) **ONCE WATER STARTS TO FLOW OUT OF THE BRASS VALVE ON TOP OF THE LID AND WATER LEVEL IN THE BURETTE IS ABOVE ZERO CLOSE VALVE LABELED "WATER TO JACKET AND E.I.D."**

D) **CLOSE BRASS VALVE ON TOP OF LID YOU MUST CLOSE THIS VALVE BEFORE THE WATER IN THE BURETTE DROPS BELOW THE ZERO.**

E) **ZERO THE BURETTE BY LINING UP THE ZERO OF THE BURETTE WITH THE ZERO REFERENCE MARKER, TEMPORARILY HOLD IT IN POSITION**

F) **THEN BLEED THE WATER IN THE BURETTE TO THE ZERO REFEERNCE MARKER BY OPENING VALVE L ON SIDE OF THE BURETTE MANIFOLD (*see Fig 2 valve L)***

Note: If the water drops below zero add more water by opening valve labeled "Water to Jacket and E.I.D."

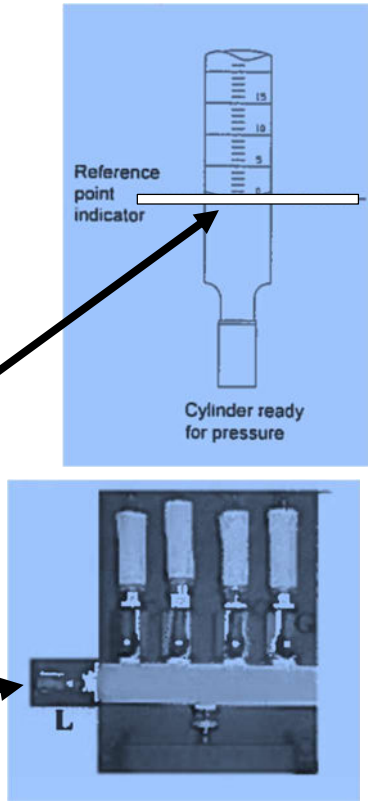


Fig 2

VERIFICATION/CALIBRATION *(CONTINUED)*
IF USING BURETTE

STEP 3: PRESSURIZING THE CALIBRATED

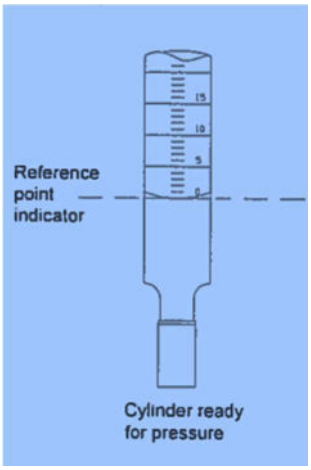
A) **MAKE SURE BURETTE IS READING ZERO**

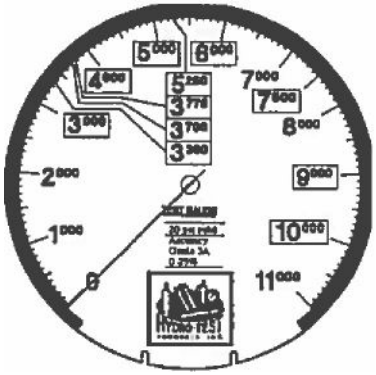
B) **OPEN VALVE ON CONSOLE LABELED "WATER TO PUMP AND CYLINDER",**

C) **CLOSE THE HIGH-PRESSURE BLEED VALVE ON THE LID ONCE WATER STARTS TO FLOW.**

D) **OPEN VALVE LABELED "PUMP CONTROL" ON THE CONSOLE COUNTERCLOCKWISE THE TEST PUMP SHOULD BEGIN OPERATING AND AN INCREASE OF PRESSURE SHOULD SHOW ON THE GAUGE AS WELL AS AN INCREASE OF EXPANSION ON THE BURETTE.**

E) **SLOWLY TURN THE VALVE LABELED "PUMP CONTROL" CLOCKWISE TO SLOW THE PUMP TO THE TARGET PRESSURE.** ***(see page 15 step 9 on how to read gauge)***

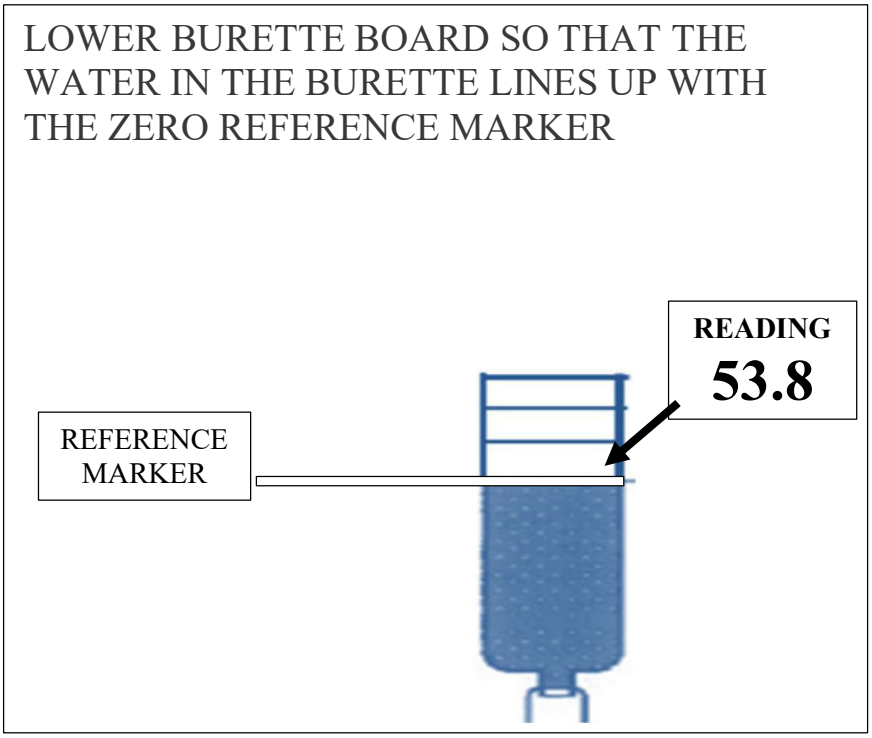




STEP 4: READING FROM BURETTE (E.I.D.) AT PRESSURE

A) **RECORD READING FROM BURETTE THIS EXPANSION NEEDS TO BE WITHIN 1% OF THE EXPANSION INDICATED ON YOUR CALIBRATED CYLINDER CERTIFCATE**

LOWER BURETTE BOARD SO THAT THE WATER IN THE BURETTE LINES UP WITH THE ZERO REFERENCE MARKER



VERIFICATION/CALIBRATION *(CONTINUED*

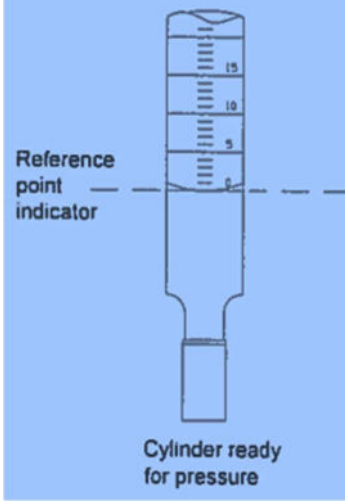
IF USING BURETTE

STEP 5: READING BURETTE (E.I.D.) AFTER RELEASING PRESSURE

A) RELEASE PRESSURE BY SLOWLY OPENING THE HIGH-PRESSURE BLEED VALVE ON THE LID

B) TAKE READING FROM BURETTE BY *RAISING THE BURETTE*

C) LINE UP THE ZERO ON THE BURETTE WITH THE REFERENCE INDICATOR THE WATER SHOULD INDICATE ZERO ON BURETTE **(IF NOT REDO STEPS 3-5)** *It may take multiple verification runs to achieve 0.0 permanent Expansion*



YOU CANNOT TEST UNTIL THE PROBLEM IS CORRECTED!! IT MAY TAKE MULTIPLE TIMES TO ACHIEVE ZERO PERMANENT EXPANSIONON.

EXAMPLE: VERICATION RECORD

Establish pressure on pressure device and then monitory the expansion indicating device, Expansion device must show 1% accuracy to calibrated cylinder correlating pressure value.

Pressure Reading@ Corresponding Expansion	Expected Expansion Reading (cc's) (A)	Actual Expansion Reading @ Corresponding Pressure (B)	Permanent Expansion	Elastic Expansion	% Deviation
From Calibrated Cylinder Chart of Expansions		Reading from P.I.D.	Reading on EID after release of pressure	Difference Between Total and Permanent Expansion	A-B / A x 100 = %
3000	54.0	53.8	0	53.8	0.37%

Formula for percentage deviation: 54.0 - 53.8 = 0.2 ÷ 54.0 = 0.0037 x 100 = 0.37%

Formula for elastic expansion value: 53.8 (actual expansion) **- 0** (permanent expansion) **= 53.8**

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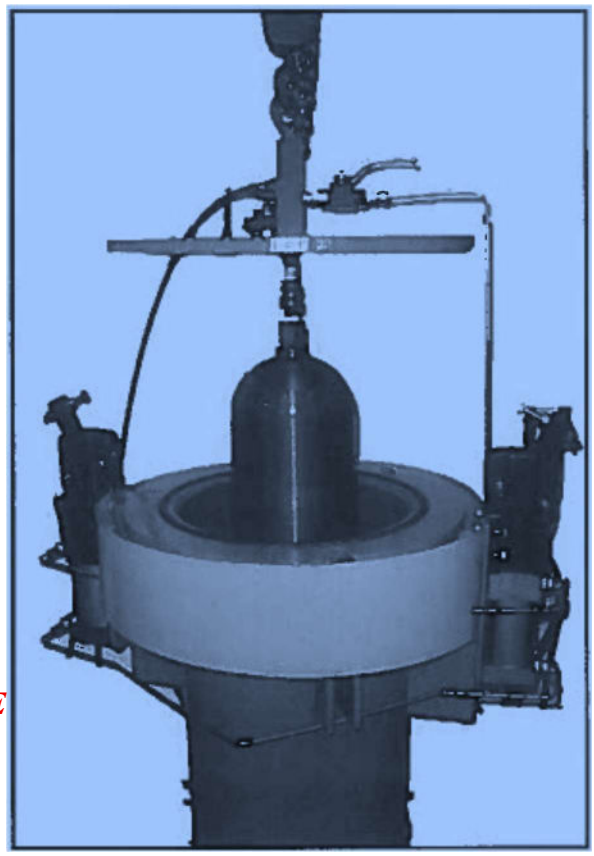
TESTING CYLINDERS



STEP 1

- PREFILL CYLINDER WITH WATER
- INSERT AND TIGHTEN PROPER TEST ADAPTER
- CONNECT CYLINDER TO BOTTOM OF JACKET LID
- LOAD CYLINDER INTO JACKET
- LOCK LID CLOSURE CLAMPS
- OPEN BRASS AND HIGH-PRESSURE RELEASE VALVES ON TOP OF LID
- CONNECT HIGH PRESSURE TEST HOSE
- ***IF INSTALLED (ONLY ON 500-LHP SYSTEMS)***

OPEN ISOLATION VALVE IF TESTING LOW PRESSURE, CLOSE ISOLATION VALVE IF TESTING HIGH PRESSURE

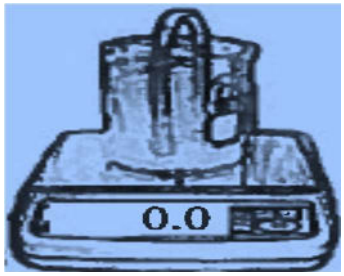
STEP 2 FILLING JACKET AND SCALE / BURETTE

(IF USING SCALE SEE BELOW. IF USING BURETTE, CONTINUE TO NEXT PAGE STEP 2 CONTINUED)

IF USING DIGITAL SCALE:

- HAVE SCALE TURNED ON AND BEAKER ON TOP OF SCALE WITH TUBE INSIDE BEAKER
- OPEN WATER VALVE LABELED "WATER TO JACKET AND E.I.D." EXPELLING ANY AIR OUT OF JACKET, WHEN WATER LEVEL IS 1/4" OVER TUBE IN BEAKER AND WATER IS FLOWING OUT OF BRASS VALVE ON LID
- CLOSE WATER VALVE AND THE BRASS VALVE
- PUSH ZERO/TARE WEIGHT BUTTON ON SCALE, SCALE WILL THEN READ **0.0g**

NOTE: *IF WATER GOES BELOW COPPER TUBE ADD MORE WATER BY OPENING "WATER TO JACKET AND E.I.D" VALVE. If there's too much water in the beaker drain it by opening the brass valve on the lid*

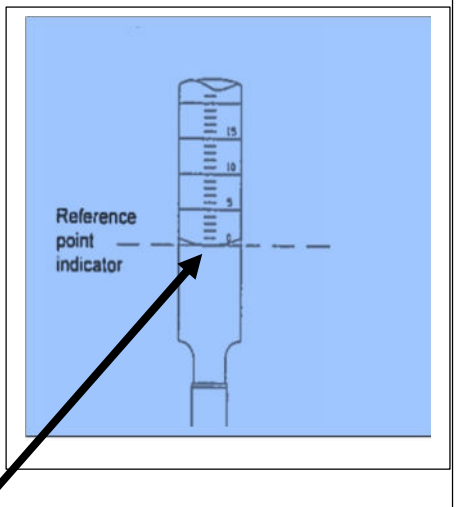


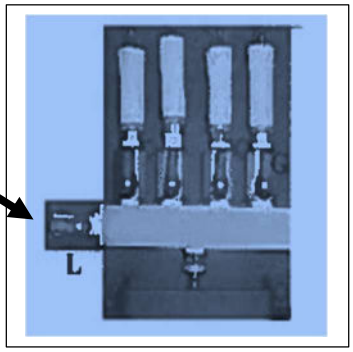
TESTING CYLINDERS (*CONTINUED*)

STEP 2 (*CONTINUED*)

IF USING BURETTE

- SELECT BURETTE THAT YOU WILL BE USING BY OPENING VALVE ON THE BURETTE SO AS TO BE ABLE TO READ TOTAL EXPANSION OF CYLINDER AT TEST PRESSURE TO WITHIN I% OR 0.1CC, WHICHEVER IS LARGER.
- OPEN WATER VALVE LABELED "WATER TO JACKET AND E.I.D." ON THE CONSOLE. EXPELLING ANY AIR OUT OF JACKET, ONCE WATER STARTS TO FLOW OUT OF BRASS VALVE LOCATED ON THE LID AND WATER IN THE BURETTE IS ABOVE ZERO
- CLOSE WATER VALVE LABELED "WATER TO JACKET AND E.I.D." AND THE BRASS VALVE ON LID
- ALIGN "**0**" OF SELECTED BURETTE TO REFERENCE MARKER
- DRAIN WATER IN BURETTE TO **"0"** USING VALVE L ON BURETTE MANIFOLD
- IF WATER GOES BELOW ZERO OPEN "WATER TO JACKET AND E.I.D" VALVE AND REZERO





Next 3 steps using either the scale or burette

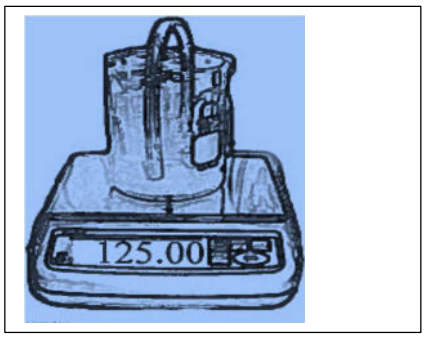
STEP 3 PRESSURIZE CYLINDER

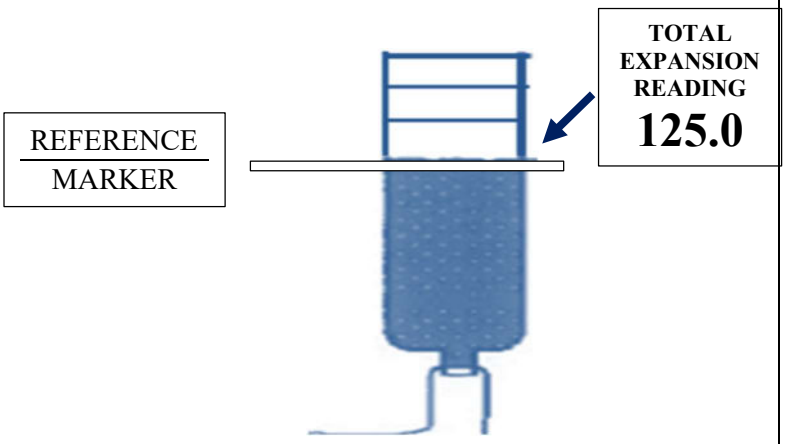
- OPEN HIGH PRESSURE BLEED VALVE ON JACKET LID
- OPEN WATER VALVE LABELED "WATER TO PUMP AND CYLINDER", TOPPING OFF CYLINDER WITH WATER AND BLEEDING OFF ALL AIR.
- CLOSE HIGH PRESSURE BLEED VALVE ON JACKET LID
- OPEN AIR VALVE LABELED "PUMP CONTROL" TO ACTIVATE PUMPING
- STOP PUMP AT A PRESSURE NOT TO EXCEED 80% OF TEST PRESSURE, CHECKING TO ENSURE THAT SYSTEM IS FREE OF LEAKS AND IS STABLE FOR 10 SECONDS, IF NOT ABORT THE TEST AND CONSULT TROUBLSHOOTING GUIDE
- REACTIVATE PUMP, STOPPING AT PRESCRIBED DOT TEST PRESSURE **WARNING:** *It is the responsibility of the operator not to Over-Pressurize the Cylinder, additional equipment may be required, for info contact Hydro-Test Products*
- HOLD PRESSURE FOR MINIMUM OF 30 SECONDS OR THE TIME PRESCIBED BY THE CYLINDER SPECIFICATION, PRESSURE MUST HOLD AT OR ABOVE MINIMUM PRESCRIBED TEST PRESSURE ***(see page 15 step 9 on how to read gauge)***

TESTING CYLINDERS (CONTINUED)

STEP 3 *(CONTINUED)*

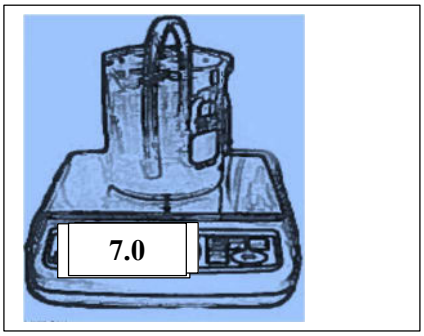
- OBSERVE THE READING ON THE SCALE, OR IF USING BURETTE, LOWER BURETTE UNTIL THE WATER LEVEL IS AT THE REFERENCE MARKER.
- RECORD TOTAL EXPANSION VALUE

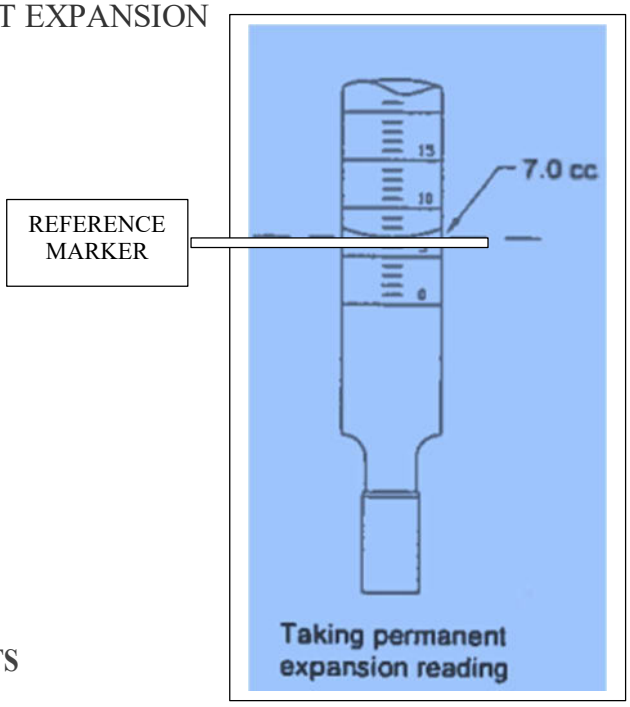




STEP 4 PERMANENT EXPANSION READING

- CLOSE WATER VALVE LABELED "WATER TO PUMP/ CYLINDER"
- SLOWLY OPEN HIGH PRESSURE BLEED VALVE ON JACKET LID, FULLY RELEASING TEST PRESSURE FROM CYLINDER
- RAISE BURETTE BOARD SO THAT THE WATER LEVEL IN BURETTE IS AT THE REFERENCE MARKER TAKE PERMANENT EXPANSION READING
- OR OBSERVE SCALE AND RECORD PERMANENT EXPANSION





PERFORM CALCULATION AND RECORD TEST RESULTS
EXAMPLE: NEXT PAGE

STEP 5 RECORD KEEPING

EXAMPLE CALCULATION FOR A DOT 3AA 1800 RATED CYLINDER

Explanation of Required Fields on Test Record Form

Date 1								Expansion Readings (cc's)					Visual Insp.			
CylOwner 2	Serial No. 3	MFG ID 4	Mfg. date 5	Gas service 6	Size DiaxHgt 7	DOT Spec & Service Pressure 8	Test Pressure 9	Total	Permanent	Elastic	% Permanent	REE	Pass	Fail	Disposition Code	Retest Operator
Joe's Garage	X1234	TW	3/99	Argon	8" x 30"	DOT3AA1800	3000	62.4	2.8	59.6	4.48		X		A	JP
Notes: 18								10	11	12	13	14	15		16	17

1) **DATE:** Date by month, day & year that test is performed
2) **OWNER:** Owner of the cylinder
3) **SERIAL NO:** Insert serial no. of cylinder
4) **MFG IDENT:** Identify by symbol or name the manufacturer of the cylinder
5) **Manufactures date:** Date cylinder was manufactured
6) **Gas Service:** Gas inside cylinder
7) **SIZE:** Physical size (dia x length)of cylinder
8) **DOT/ICC or Exemption Classification:** List Full DOT/ICC rating and service pressure, Example: DOT 3AL1800, DOT E7235 4500, etc...
9) **Test Pressure** that cylinder has been tested to
10) At test pressure, the **total expansion** reading
11) After releasing pressure, **permanent expansion** reading
12) **Elastic:** Difference between Total & Permanent
13) PE ÷ TE x 100 = % **Permanent Expansion**
14) **REE:** May or may not be required based on specification of cylinder. Ex: plus stamping of steel cylinders or carbon fiber special permit cylinders
15) Check if cylinder passed or failed **visual inspection**
16) Insert **Disposition Code**(s) listed at bottom of test record form
17) **Name** or initials of the retest operator
18) Insert any **notes** that pertain to the test

Please note, we strongly suggest a formal training seminar from experts in your industry. Reach out to our team at Hydro-Test Products for more information.

Hydro-Test Products LLC

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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.

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

TROUBLE SHOOTING

Continued...

	PROBLEM	CAUSES	SOLUTION
5	Water level in EID drops when you first zero out EID	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.

Digital Expansion Scale Re-Calibration Procedure

The scale is calibrated prior to shipping – re-calibrate scale periodically. Keep record of recalibration.

Step 1: Turn the scale off by pressing and holding the "ZERO" button *(see fig. 1)*. Remove the plastic beaker from the scale and wipe any residue from the scale platform.
Turn scale over and slide switch to unlocked position
(see fig. 1a).

fig. 1


fig. 1a

Step 2: Turn the scale back on by pressing and holding the "ZERO" button. Press and hold the "MENU" button until "MENU" shows on the display *(see fig. 2)*

Release the "MENU" button and the display will now show "CAL" *(see fig. 2a)*

fig. 2

fig. 2a

Step 3: Press the "YES" button to accept. "SPAN" will then show on display. *(see fig. 3)*
Press the "YES" button again to begin the calibration.
(see fig. 3a)

fig. 3


fig. 3a

Step 4: Place the supplied 2000g and additional offset weight on scale. *(see fig. 4)* "C" will be displayed while the reading is being stored.

The display will then show "DONE" when calibration is finished. *(see fig. 4a)*


fig. 4

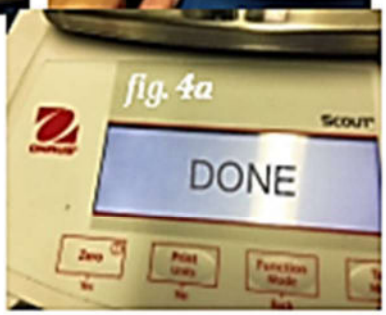


fig. 4a

Step 5: Remove weights from the scale.

Turn scale off by pressing and holding the "ZERO" button. *(see fig. 1)*

Turn scale back on and it is now ready to use.

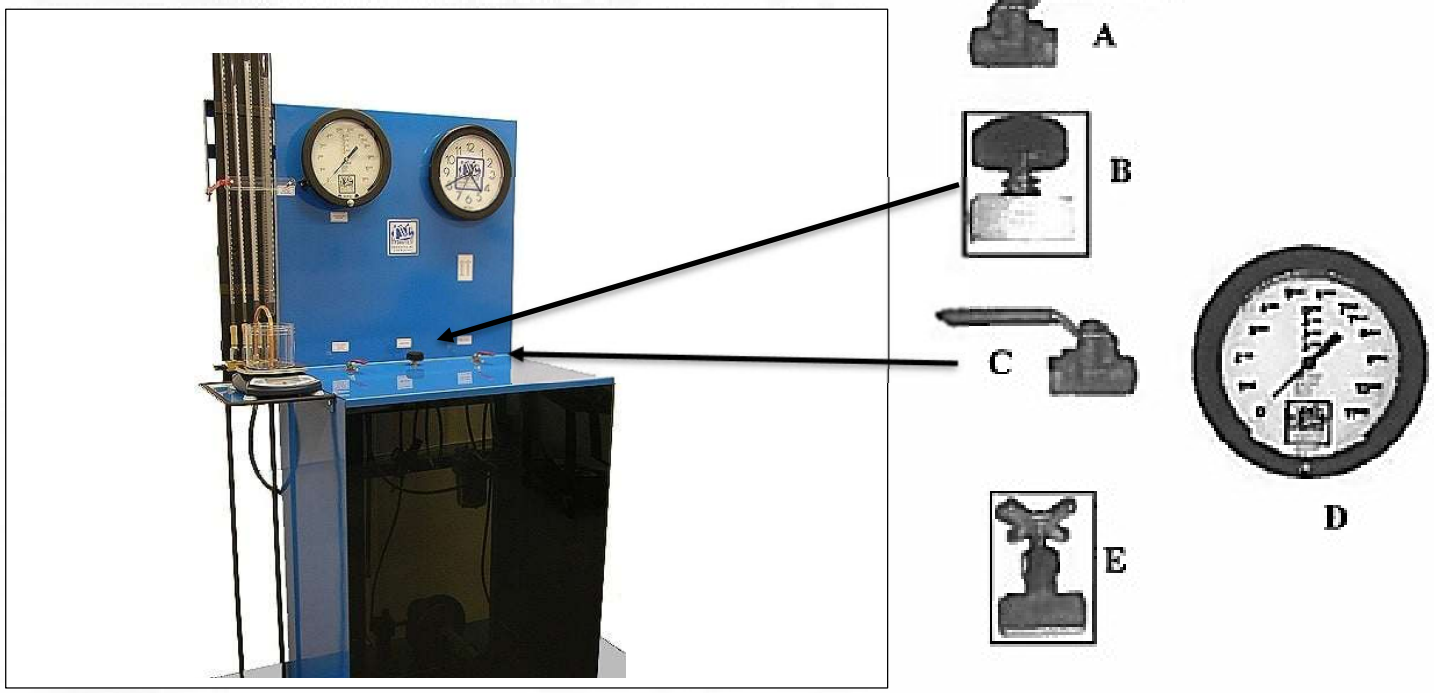
Notes:

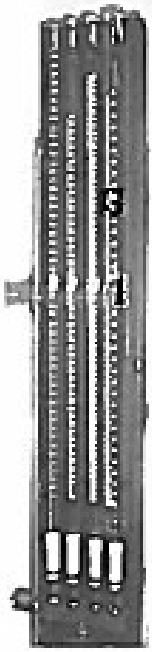
1) Calibration of the scale should be done periodically. Do not send the scale out for periodic calibration as a calibration house will not use additional weight to compensate for the siphon tube being used.

2) After calibration of the scale - use your calibration cylinder to verify system accuracy before proceeding to test cylinders. Verification must be in accordance with **49CFR section 180.205(g).**

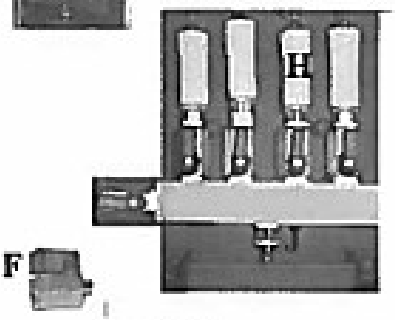
PARTS BREAKDOWN

FRONT OF CABINET





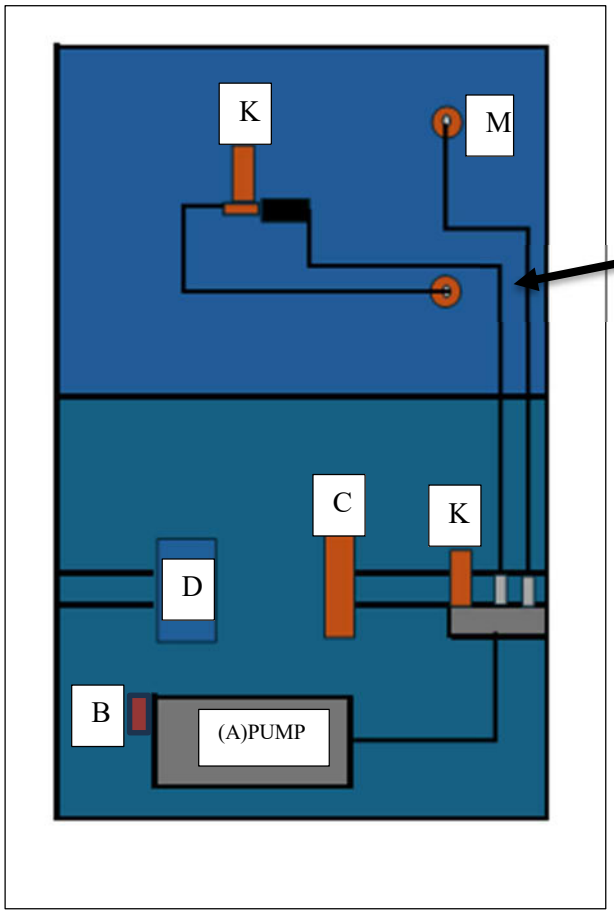

K



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
K	**230-501**	**SCALE**

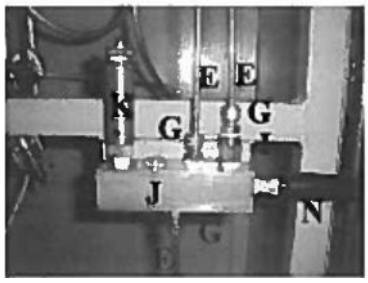
Parts Breakdown

BACK OF TEST CABINET



Kev	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-I04	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, ¼"
H	220-I05	Stainless Steel Tube Fitting, 3/8"
I	220-070	Cooper Tubing Compression Fitting, ¼" Elbow
J	240-080	Manifold Block
K	120-112	Safety Relief. Adjustable (5000- IO,000psi)
	120-018	Safety Relief. Fixed (1500psi)
L	240-076	Pressure Pulsation Snubber
M	I00-224	Adapter for Pressure ¼"F x ½"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

Can be operated in either vertical or horizontal position

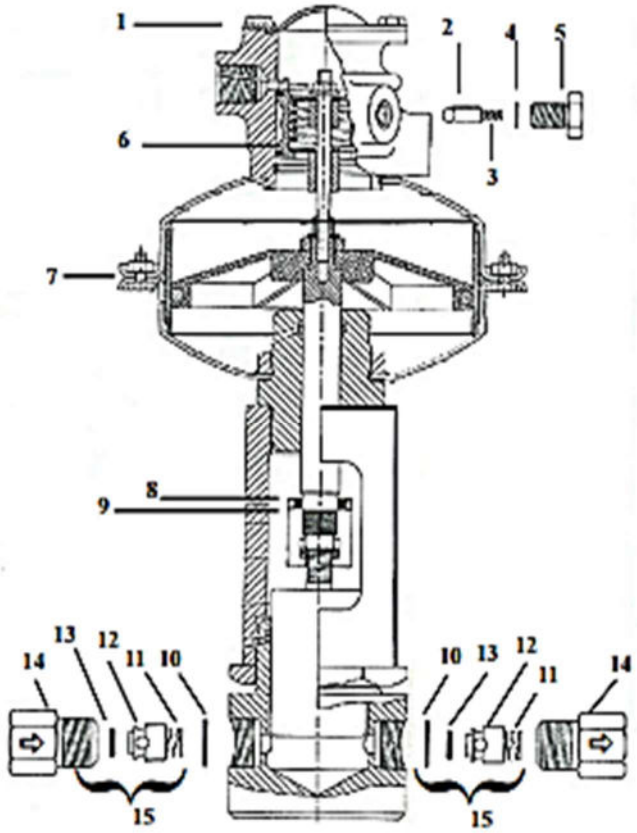
STYLE B

STYLE A			STYLED		
Part No.	Rating (PSI)	Displc. Per Stroke	Part No.	Rating (PSI)	Displc. 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	I.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/or These Pumps

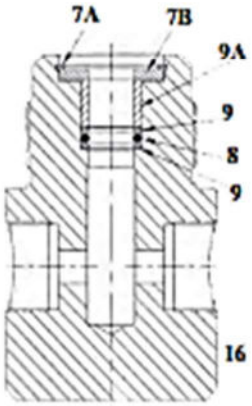
AIR OPERATED TEST PUMP PARTS BREAKDOWN




"JS" / "JBS" Style


"J" / "JB" Style

Pumps utilize the same internal parts except for piston o-rings and backups, diagrams shown for illustrational purposes only



Newer Style "JB" / "JBS" Style Pump Body. Is a direct replacement for older "J" / "JS" style


#17 Rebuild Kit consist of:

Key #	Qty	Key #	Qty
1	1	8	1
2	4	9	2
3	4	10	2
4	4	11	2
5	4	12	2
6	4	13	2
7	2		

For Pump Rated To: (psi)

Key	Part No.	Description	Qty Rqd*	1000	1850	6100		8800		10,000	16,000	
Model No. shown on label of pump: "JS" or "J" or newer model "JBS" or "JB" used since mid 2017				JS / J	JS / J	JS / J	JBS/JB	JS / J	JBS/JB	JBS/JB	JS / J	JBS/JB
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	•	•	•	•	•	•	•	•	•
7A	190-420	Retaining ring, piston body	1				•		•	•		•
7B	190-421	Retainer, piston body	1				•		•	•		•
8	See Chart	O-ring, piston	1	190-589	190-590	190-581	190-430	190-582	190-431	190-431	190-583	190-432
9	See Chart	Teflon backup o-ring, piston	2	190-582	190-583	190-584	190-426	190-585	190-427	190-428	190-586	190-429
9A	See Chart	Teflon bushing for JBS/JB style piston body	1				190-422		190-423	190-424		190-425
10	190-068	Brass washer for check valve body	2	•	•	•	•	•	•	•	•	•
11	210-067	Spring, check valve	2	•	•	•	•	•	•	•	•	•
12	240-115	Poppet shuttle, check valve	2	•	•	•	•	•	•	•	•	•
13	58-031	O-ring for poppet shuttle	2	•	•	•	•	•	•	•	•	•
14	240-114	Check valve body	2	•	•	•	•	•	•	•	•	•
15	120-090	Check valve assembly - includes items 10-14	2	•	•	•	•	•	•	•	•	•
N/S	120-091	Check valve rebuild kits - includes items 10-13	2	•	•	•	•	•	•	•	•	•
N/S	120-094	Check valve seal kit - includes items 10,13	2	•	•	•	•	•	•	•	•	•
16	See Chart	Body / Piston assembly	1	190-124	190-123	190-121	190-121	190-119	190-119	190-126	190-681	190-681
17	See Chart	Rebuild kit-contains common replaceable parts		190-480	190-481	190-482	190-482	190-483	190-483	190-487	190-484	190-484

Starting in 2017, the older style JS and J model pumps were phased out. If replacing piston o-rings it is important to check the model no. on the pump label, so that proper parts are ordered.

Typical label:
"JBS" series rated to 16,000 psi

SPLASH GUARD INCLUDED ON NEW WATER JACKETS WITH PNEUMATIC LID CLOSURES

WATER JACKETS

WATER JACKETS ARE OFFERED IN STANDARD SIZES, AS LISTED BELOW.
SPECIAL APPLICATION JACKETS IN ANY LENGTH x 6'1, 10'1, 14t', 18'1, 24t',30", AND36" DIAMETERS ARE AVAILABLE.

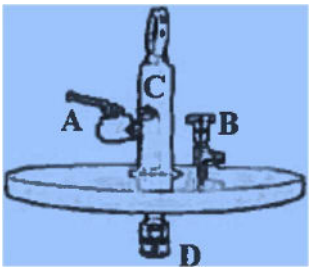
ALL JACKETS COME WITH:

- Lid Closures (manual or pneumatic)
- Low Pressure Safety Rupture Port
- Splash Pan on 40[11] Tall Models
- High- & Low-Pressure Bleed Valves
- Master Spud with Lifting Eye
- Inlet & Outlet Water Connections

PART NO.	DESCRIPTION	Accepts Cyls In Size Up To: DIA	Length	LID CLOSURES Manual	Pneumatic
500-019S	14"Din x 40" Tall with splash pan. complete	12"	36"		
500-019	14"Dia x 66" Tall, complete	12"	60"	•	
500-0l9S-P	14"Din x 40" Tall with splash pan, complete	12"	36"		
500-019-P	14"Dia x 66" Tall , complete	12"	60"		•
500-020S	I8"Din x 40" Tall with splash pan, complete	16"	36"		
500-020	I8"Dia x 72", complete	16"	66"		
500-020S-P	18"Din x 40" Tall with splash can. complete	16"	36"	•	
500-020.P	I8"Din x 72". complete	16"	66"		•
500-021S	24"Din x 40" Tall with splash pan, complete	22"	36"		
500-021	24"Dia x 72". complete	22"	66"	•	
500-021S-P	24"Din 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, 6,000 psi
	120-088	High Pressure Cylinder Bleed Valve, 9,000 psi
	120-089	High Pressure Cylinder Bleed Valve, 10,000 psi
	120-IO0	High Pressure Cylinder Bleed Valve, l0,000 psi
B	120-059	Low Pressure Jacket Bleed Valve, 1,000 psi
C	I l0-016	Nipple Quick Coupler, '/4"
D	110-001	Quick Coupler, ½"
E	I 10-015	Quick Coupler, ¼" (at end of test hose)
F	1l0-005	Replacement Rubber Grommet for 110-001
	I 10-019	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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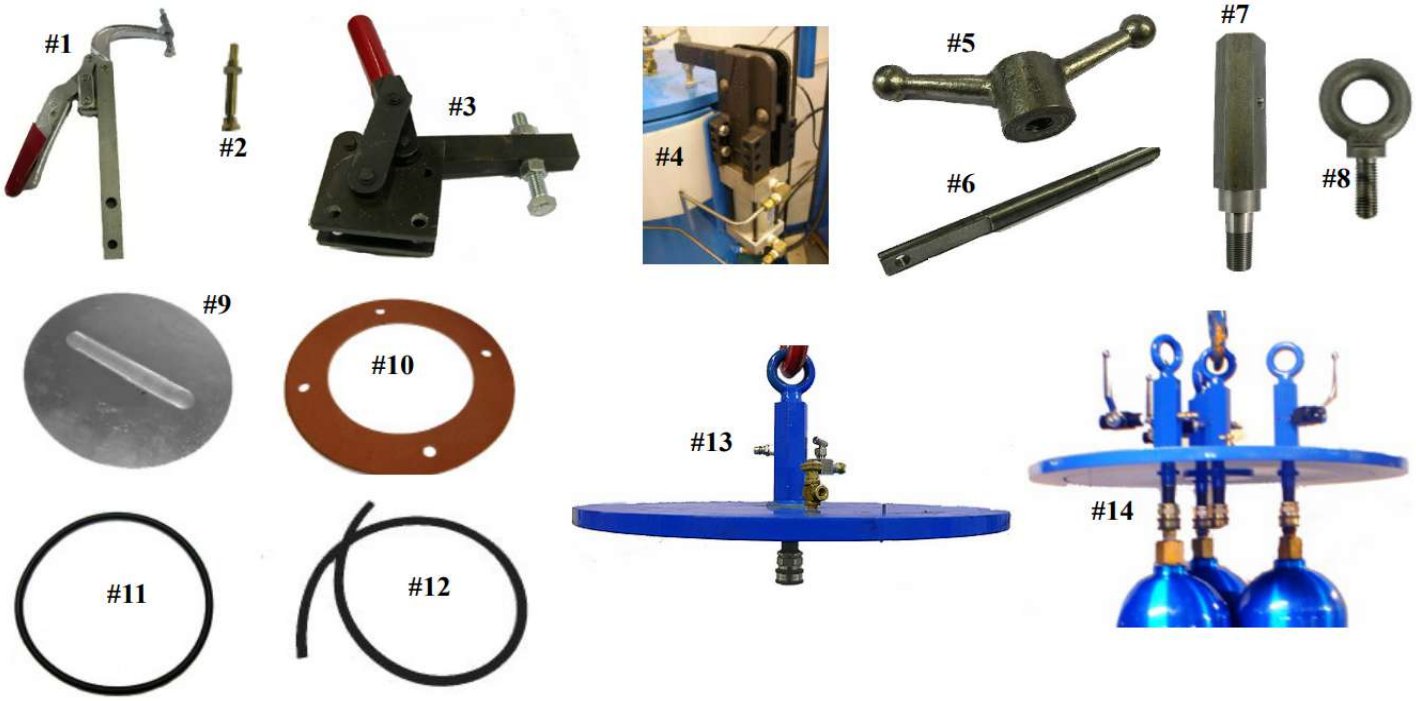
WATER JACKET REPLACEMENT PARTS



Key	Part No.	Description	
		LID CLOSURES	
1	**210-040**	Quick acting cam style clamp used on 10" & 14" diameter water jackets	
2	**210-041**	Replacement threaded swivel tip adjustment for 210-040 clamp	
3	**210-043**	Quick acting cam style clamps (heavy duty design) used on 18" & 24" diameter water jackets	
4	**210-115**	Pneumatic operated replacement clamp	
N/S	58-115	*Replacement seal kit for pneumatic clamp #210-115*	
5	**240-129**	Wing nut for Hydro-Test Products manufactured water jackets	
6	**240-131**	Swing bolt for Hydro-Test Products manufactured water jackets (3/4"-10 thread x 10" long)	
		COMPONENT ITEMS FOR WATER JACKETS	
7	**240-124**	Replacement spud, 1/2"(M)NPT, with threaded ports for valve and nipple	
8	**240-133**	Eyebolt (lifting eye)	
9	**300-055**	Aluminum rupture disc for all Hydro-Test Products manufactured water jackets	
10	**130-015**	Rubber gasket for all Hydro-Test Products manufactured water jackets, 4 bolt hole pattern	
11	**58-200**	O-ring lid seal for 10" diameter water jacket: *Actual size of o-ring 11 5/8" ID x 12 5/8" OD*	
11	**58-201**	O-ring lid seal for 14" diameter water jacket: *Actual size of o-ring 14 7/8" ID x 15 7/8" OD*	
11	**58-202**	O-ring lid seal for 18" diameter water jacket: *Actual size of o-ring 19" ID x 20" OD*	
11	**58-203**	O-ring lid seal for 24" diameter water jacket: *Actual size of o-ring 25" ID x 26" OD*	
12	**130-017**	Non-collapsable rubber tubing, from jacket to expansion device *(sold by the foot)*	
		COMPLETE LID ASSEMBLIES	
13	**500-880**	**Water Jacket Lid Assembly**	For 10" diameter water jacket
13	**500-882**	***Includes:*** Steel lid cover	For 14" diameter water jacket
13	**500-884**	Spud & eyebolt	For 18" diameter water jacket
13	**500-886**	Enamel painted finish	For 24" diameter water jacket
		MULTI SPUD LID ASSEMBLIES	
14	**500-889**	14" Lid assy for 3 cylinders to 4.25" diameter	For 14" diameter water jacket
14	**500-220**	18" Lid assy for 3 cylinders to 7.5" diameter	For 18" diameter water jacket
14	**500-225**	24" Lid assy for 3 cylinders to 10.0" diameter	For 24" diameter water jacket
14	**500-230**	24" Lid assy for 4 cylinders to 8.0" diameter	For 24" diameter water jacket
14	**500-235**	24" Lid assy for 6 cylinders to 6.125" diameter	For 24" diameter water jacket
14	**500-890**	24" Lid assy for 7 cylinders to 5.0" diameter	For 24" diameter water jacket

HYDRO-TEST PRODUCTS, LLC TERMS AND CONDITIONS:

DEFINITIONS: As stated herein:
The term "Seller" or "Manufacturer" shall mean Hydro-Test Products, LLC., the warranting party.
The term "Buyer" shall mean the person(s) or entity that purchases the product from the Seller.
The term "timely inspection" shall mean the Buyer(s) inspection five (5) day period to inspect the product upon receipt of the product and report any product damage(s) as described in the WARRANTY section to the freight carrier that delivered the product.
The term "product(s)" shall mean any and all products, parts, equipment, major equipment, or any other purchase made from Hydro-Test Products, LLC.

PRICES: ALL PRICES LISTED ARE IN U.S. DOLLARS. ANY PRICES LISTED ARE SUBJECT TO CHANGE WITHOUT NOTICE.
MINIMUM BILLING: MINIMUM BILLING IS $25.00, exclusive of freight charges.

TERMS: • NET 30 DAYS TO PRE-ESTABLISHED ACCOUNTS • DISCOUNTS ARE OFFERED FOR PRE-PAYMENT • MASTER CARD - VISA AND AMERICAN EXPRESS ARE ACCEPTED. SELECTION AND USE OF CREDIT CARD FOR PAYMENT WILL INCUR AN ADDITIONAL 3% PROCESSING FEE.

EXPORT TERMS: PAYMENT IN U.S. DOLLARS WITH CHECK OR DIRECT TRANSFER. C.I.F. PROFORMA QUOTATIONS UPON REQUEST.

SHIPPING: ALL SALES ARE F.O.B. STOW, MA., AND BECOME PROPERTY OF THE BUYER UPON SHIPMENT. ALL SHIPMENTS ARE MADE BY THE MOST ECONOMICAL MEANS AS DETERMINED BY HYDRO-TEST PRODUCTS, LLC. PREMIUM FREIGHT (UPS AIR, FEDERAL EXPRESS, ETC...) SERVICE IS MADE AVAILABLE TO ESTABLISHED ACCOUNTS; OTHERWISE, CARRIER ACCOUNT NUMBER MUST BE SUPPLIED FOR FREIGHT BILLING. OTHER CHARGES: APPLICABLE TAXES (MA.), SPECIAL PACKAGING, EXPORT DOCUMENTATION, PREMIUM FREIGHT OR OTHER UNIQUE CHARGES ARE PAYABLE BY THE BUYER.

RETURNS: CONTACT HYDRO-TEST PRODUCTS, LLC PRIOR TO MAKING ANY RETURNS FOR R.A. #, AND INSTRUCTIONS. UNLESS OTHERWISE STATED IN THE QUOTATION, A MINIMUM RESTOCKING CHARGE OF 15% APPLIES TO ALL SALEABLE GOODS ACCEPTED AS AN ACCOMMODATION TO THE BUYER. UNAUTHORIZED RETURNS WILL NOT BE ACCEPTED. RETURNS ARE TO BE MADE TO:
HYDRO-TEST PRODUCTS, LLC., 85 HUDSON ROAD, STOW, MA. 01775.

LIMITED WARRANTY: HYDRO-TEST PRODUCTS, LLC WARRANTS THAT ALL MERCHANDISE IS FREE FROM DEFECTS IN MATERIAL AND WORKMANSHIP WHEN SHIPPED FOR A PERIOD OF TWELVE (12) MONTHS ON MAJOR EQUIPMENT, AND THIRTY (30) DAYS ON CONSUMABLE REPLACEMENT COMPONENTS (I.E. VALVES, SEALS, HOSES, QUICK COUPLERS, ADAPTERS, ETC...), AND THOSE COMPONENTS ON MAJOR EQUIPMENT UNDER NORMAL USAGE.
FOR EQUIPMENT OR ITEMS NOT MANUFACTURED BY HYDRO-TEST PRODUCTS, LLC., THE ORIGINAL MANUFACTURERS WARRANTY SHALL BE IN EFFECT.
IT IS THE RESPONSIBILITY OF THE BUYER TO INSPECT THE PRODUCT WITHIN FIVE (5) DAYS OF RECEIPT OF THE PRODUCT, THIS INCLUDES ANY HIDDEN DAMAGE TO THE PRODUCT, AND THE BUYER UPON TIMELY INSPECTION SHALL REPORT KNOWN DAMAGE TO THE FREIGHT CARRIER. ALL WARRANTY WORK IS ON A FOB ("FREE ON BOARD") STOW, MASSACHUSETTS. BASIS AND EXCLUDES ANY / ALL FREIGHT SHIPPING COSTS. THERE ARE NO ADDITIONAL IMPLIED WARRANTIES AND IN NO EVENT WILL HYDRO-TEST PRODUCTS, LLC. BE LIABLE FOR INCIDENTAL OR COINCIDENTAL DAMAGES.

VOID WARRANTY: ALL WARRANTIES ARE VOID IF DUE TO SELLER MISUSE, OR WITH ANY ALTERATION, OR ACCIDENTAL DAMAGES TO THE MANUFACTURER'S PRODUCT(S).

CHOIE OF LAW: All legal disputes shall be resolved through binding arbitration in accordance with the laws of the State of Massachusetts, U.S.A.

DISCLAIMER: Seller is not responsible for ensuring Buyer is up to date and attending required regulatory training or safety training for use of proper use of the equipment or the products sold to Buyer. Buyer is solely responsible for scheduling Buyer's own training and ensuring that Buyer is competent with the current laws and regulations of the product(s) or equipment purchased and competent on use of the equipment and/or product(s) and competent to recognize the need for additional parts or products for updating purchased product(s) and equipment to meet ongoing updated federal and state regulations.

INDEMNITY AND HOLD HARMLESS:

BUYER HEREBY AGREES TO INDEMNIFY, HOLD HARMLESS, AND DEFEND HYDRO-TEST PRODUCTS, LLC., ITS EMPLOYEES, HEIRS, ASSIGNS, AND ANY RELATED COMPANY IN PRIVITY WITH HYDRO-TEST PRODUCTS, LLC, FOR THE BUYER'S MISUSE OF THE EQUIPMENT; FAILURE TO UNDERSTAND, ACKNOWLEDGE, AND IMPLEMENT THE CURRENT FEDERAL REGULATIONS FOR ANY AND ALL PRODUCTS PURCHASED FROM HYDRO-TEST PRODUCTS LLC, INCLUDING DISTRIBUTION OF THE SAME; FAILURE TO ATTEND AND SCHEDULE REQUIRED FEDERAL DEPARTMENT OF TRANSPORATION HAZMAT TRAINING AND REGULATORY INSTRUCTION OF ANY AND ALL PRODUCTS PURCHASED FROM HYDRO-TEST PRODUCTS, LLC; OR TO COMPLY WITH ANY OTHER FEDERAL REGULATORY DEPARTMENT. BUYER AGREES THAT IN NO EVENT SHALL HYDRO-TEST PRODUCTS, LLC BE LIABLE FOR PUNITIVE, SPECIAL, DIRECT, INDIRECT, INCIDENTAL, ACTUAL, OR CONSEQUENTIAL DAMAGES OF ANY KIND, INCLUDING BUT NOT LIMITED TO LOSS OF USE, LOSS OF PROFIT OR REVENUE, LOSS OF GOOD WILL, OR OTHER COMMERICAL LOSS INJURY WHETHER OR NOT HYDRO-TEST PRODUCTS, LLC HAS BEEN ADVISED OR OTHERWISE PUT ON NOTICE OF THE POTENTIAL FOR SUCH DAMAGES. HYDRO-TEST PRODUCTS, LLC SHALL NOT BE LIABLE FOR BUYER MISUSE, OR BUYER OR USER ALTERATIONS OF THE PRODUCTS; OR LACK OF EDUCATION TO PROPERLY AND SAFELY USE EQUIPMENT IN ACCORDANCE WITH THE EQUIPMENT HANDBOOK AND FEDERAL AND STATE REGULATORY REQUIREMENTS. MOREOVER, SELLER SHALL NOT BE RESPONSIBLE FOR THE BUYER'S FAILURE TO RECOGNIZE THE NEED FOR ADDITIONAL EQUIPMENT TO KEEP THE MAJOR EQUIPMENT AND MACHINES UP TO CURRENT REGULATORY CODE AND TO COMPLY WITH UPDATED AND NEW REGULATORY RULES AND REGULATIONS FOR ANY AND ALL TESTING REQUIREMENTS OR GUIDELINES. BUYER ACKNOWLEDGES THAT THE BUYER IS SOLEY RESPONSIBLE AND SOLEY LIABLE FOR ITS SAFE AND PROPER LEGAL USE OF THE EQUIPMENT IT PURCHASES FROM SELLER. FURTHER, BUYER HEREBY AGREES TO INDEMNIFY AND HOLD HARMLESS, AND DEFEND HYDRO-TEST PRODUCTS, LLC FOR ANY LOSS OR INJURIES CAUSED BY THE INSTALLATION OR USE OF PRODUCTS.

ARBITRATION: BY BUYING EQUIPMENT FROM HYDRO-TEST PRODUCTS, LLC. THE BUYER ACCEPTS THE TERMS AND AGREES TO BINDING ARBITRATION SUBJECT TO AND IN ACCORDANCE MASSACHUSETTS LAW, U.S.A, UNLESS BUYER OBJECTS TO ARBITRATION IN WRITING TO SELLER WITHIN 10 DAYS OF A PURCHASE FROM BUYER.

THIS AGREEMENT SHALL APPLY TO ANY AND ALL PRODUCTS PURCHASED FROM HYDRO-TEST PRODUCTS, LLC AND THIS AGREEMENT SHALL BE IN FULL EFFECT UPON THE PURCHASE OF ANY AND ALL PRODUCTS PURCHASED FROM HYDRO-TEST PRODUCTS, LLC.

Training Requirements for U.S. Department of Transportation

In the USA, any employer / employee who performs re-qualification testing on DOT specification or DOT exemption / special permit cylinders is classified as a Hazmat employee.

The employer shall ensure that each Hazmat employee is trained to be knowledgeable of applicable hazardous materials and regulations.
Effective October 1, 1995 (and within three-year intervals thereafter) those who perform hydrostatic test on DOT cylinders must be fully trained, tested and certified.

Training is required covering a wide range of occupational duties, including (but not restricted to) handling, recharging, transportation, etc... of hazardous materials. Our training relates only to the hydrostatic testing of cylinders when re qualified in accordance with 49CFR §180 Subpart C.

See §172.704 of for complete

Training may be provided by the Hazmat employer or other public or private sources.

Hazmat training shall include:

- **General awareness & familiarity training**
- **Safety Training**
- **Function specific training**
- **Security awareness training**
- **In-Depth Security awareness training (in some instances)**

Initial training is required within 90 days of an employee assuming the Hazmat task(s). During the 90 days the trainee can work under the direct supervision of a properly trained Hazmat employee.

Subsequent training must be provided at least once every three years.

Training Opportunities Offered by Hydro-Test

Hydro-Test offers 4 options for training to meet DOT requirements for cylinder re-qualifiers under §172.704 of the 49CFR:

	Includes	
	Operational	Hazmat
At our facility in Stow, Massachusetts	X	X
At your facility	X	X
Zoom over the internet	X	
On-line course		X
Mail out training guide		X

All of the Hydro-Test Training includes the required components for Hazmat Training for cylinder re-testers. Training at our location and your location also includes hands on operational training.

email: **training@hydro-test.com** for a detailed quotation for desired training option

Please visit **www.tc.gc.ca** for Transport Canada (TC) training requirements. To re qualify cylinders in Canada, or operate outside of Canada and be TC certified, an inspection of your facility is required after equipment is installed & operational and TC training has been completed.

NOTES

Hydro-Test Products LLC

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