Digital GTC - 10K Mod II, GTC 1200, GTC 2200 Hydrostatic Test Console Instruction Manual

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1.0 INTRODUCTION

The GTC Hydrostatic Test Console is designed to meet the needs of the low volume cylinder re-qualification facility. It is ideal for Fire Extinguisher, SCBA and SCUBA cylinder re-qualification. However, with the correct size Test Jacket, the GTC may be used to re-qualify up to 100 pound CO_2 size cylinders.

The manually operated GTC Test Console includes the following features:

- Standard Test Pressures up to 10,000 psi, with an overall system accuracy of plus or minus 1% at 2,000 psi, and gauge accuracy of .25%.
- Patented Electronic Expansion Measurement of the cylinder, up to 350 cc with an accuracy of 0.1cc.
- An Air Driven Intensifier Pump
- A Table with Gauge Face Panel
- A convenient Desk Top Shelf which provides a writing area for recording test data and results on the test log.
- Floor Lagging Clips
- An Optional Test Pressure Recorder is available.

1.1 Hydrostatic Testing

In accordance with D.O.T./T.C. regulations, certain cylinders must be periodically re-qualified and certified safe for use. The re-qualification procedure and regulations are discussed in detail in the Code Of Federal Regulation (CFR), Title 49, Section 180.205. Copies of the CFR may be obtained from Galiso or by writing to the following address:

Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402

The Galiso GTC Test Console will perform water jacket (hydrostatic) testing of compressed gas cylinders. The specifications and procedure for hydrostatic testing are outlined in Compressed Gas Association Pamphlet C-1, "Methods for Hydrostatic Testing of Compressed Gas Cylinders". Copies of Compressed Gas Association Pamphlets are available by writing to the following address:

Compressed Gas Association
1235 Jefferson Davis Highway
Arlington, Virginia 22202
(703) 979-0900

1.1 Hydrostatic Testing, continued

In general, the water jacket method for hydrostatic testing consists of loading a water filled cylinder into a sealed chamber (test jacket), which is also filled with water and is connected to a calibrated glass tube (burette). The GTC-8000 uses a patented Electronic Expansion Measuring System (Expansion Bowl) in place of the burette. The burette or Expansion Bowl is first zeroed, and the cylinder is then pressurized to 5/3 of it's D.O.T. or I.C.C. rating, which is stamped on the shoulder of the cylinder. This test pressure is held for thirty seconds.

As pressure is applied to "inflate" the cylinder, the cylinder expands and forces water out of the test jacket and up into the burette or Expansion Bowl. After the thirty second test time has elapsed, the burette or Expansion Bowl is then read to determine the Total Expansion (in cubic centimeters) of the cylinder under test pressure. The test pressure is released and the cylinder "deflates". As the cylinder shrinks to it's approximate original size, water is allowed to drain back into the test jacket from the burette or Expansion Bowl. In most cases, the cylinder will not return to it's original size, having been slightly stretched by the pressurization process. This stretching is called the Permanent Expansion. The difference between the "Total Expansion" and the "Permanent Expansion" is called the Elastic Expansion. The Percent Expansion of the cylinder is determined by the following formula:

$$\text{Percent Expansion} = (\text{Permanent Expansion} \div \text{Total Expansion}) \times 100$$

When the Percent Expansion exceeds the predetermined limits for the cylinder being tested, the cylinder must be condemned and removed from service. A high percent expansion value is an indication that there has been excessive thinning of the cylinder wall and that the cylinder is no longer safe for use.

All test records must be saved and maintained for the life of the test, in the event that there is any future problem with the cylinder.

Plus (+) stamped cylinders may be filled to an additional 10 percent beyond the rating which is stamped on the cylinder shoulder. Star (*) stamping makes the cylinder eligible for an extended ten year retest interval. The procedures and requirements for plus stamping and star stamping are discussed in Compressed Gas Association Pamphlet C-5, "Cylinder Service Life, Seamless High Pressure Cylinders". This pamphlet is available from Galiso, or from the Compressed Gas Association at the address indicated previously.

TEST PROCEDURE FOR GTC 10,000 SYSTEM (MOD II)

Prior to testing and before the system is turned on, it is important to complete the following.

- ensure the cylinders to be tested are free from defects and have been properly inspected according to CGA pamphlet C6.
- completely fill the cylinders with clean water and allow cylinders to achieve room temperature.
- gauge calibration sheet, calibrated cylinder must be on hand to verify calibration each day of testing. *GTC gauge needs to be calibrated every six months unless a master gauge is used.

SYSTEM START UP PROCEDURE (GTC 10,000 SYSTEM, MOD II)

Read all instructions before attempting to operate the GTC 10K test system. Before testing, turn on scale and allow to warm up for 30 minutes for maximum performance.

1) Turn power to scale on and allow scale to warm up.
   Before turning on air and water, ensure all valves on console are off or closed.

2) Turn on air and water to system. Verify that control air pressure is at 90 PSI on small regulator where blue hose connects to the back of the system. Check oil level in lubricator. Place calibrated cylinder in test jacket ensuring cylinder and jacket are completely filled with water. Connect hoses, (blue hose first). Turn 3 way valve (on left side) to expansion.

3) Bleed air from expansion lines by filling bowl using bowl level adjustment valve. Remove blue hose from test head and allow water to drain back to jacket then reconnect blue (head seal) hose before water in bowl goes below probe end in bowl (not allowing air to be sucked into expansion line).

4) Adjust water level to just above probe (approx. ¼ inch). Make sure scale is set on grams, and zero scale. Ensure that before daily calibration, the scale will hold on 0.0 for 30 seconds, to make sure the system is stable. Verify the gauge needle is on the zero line.

5) To verify the bowl reading, place test weights on the bowl platform (with the reading starting at 0.0). The reading for the two 50 gram weights should be 100 grams or (99.7 – 100.3). If the reading is outside this tolerance, you must recalibrate the scale using the calibration procedure in the scale manual.

6) You are now ready to pressurize the system and check calibration. Proceed as follows- Be sure expansion valve (3 way valve on left) is in the open position with calibration cylinder in jacket. Close bleed valve. Press zero on scale. Open water to pump valve. You will see scale and pressure rise as the system reads your local water pressure (this is normal). Open pump speed adjustment valve slowly, (at first) to pressurize system. Do not pressurize system any higher than highest pressure on calibration cylinder. Close pump speed adjustment valve when pressure is reached, (3,000, 4,000, 5,000 etc.). Refer to pressure calibration sheet to stop system at proper indicated value on sheet for given pressure. With pump speed adjustment valve closed, close water to pump valve and start timer. When the desired value is reached, stop the pressurization and hold for 30 seconds. The pressure gauge should indicate the test pressure at the verification point within +/- 1.0%. The expansion and pressure should remain stable during the entire 30 seconds. If the expansion or pressure does not stabilize within +/- 1.00%, the system must be checked and the cylinder needs to be retested. If the test system is to be verified accurate at more than one pressure, it is not necessary to release pressure and return to zero at each pressure level. It is also not necessary to hold for 30 seconds at each pressure level, but the system should be allowed to stabilize at each pressure level before continuing to the next highest pressure level. It is necessary to maintain the 30 second hold on the highest pressure level before releasing the pressure from the system.

7) Bleed off pressure using bleed valve and verify system, (bowl) returns to 0.0. If system does not return to zero, you must (stretch) once or twice to get calibrated cylinder to zero out.
Calibrated cylinder must show NO permanent expansion.
Follow procedure in step 6 as necessary to run calibration cylinder at various pressures.

*NOTE- It is the responsibility of the operator of the equipment to run the daily calibration of the system using the calibration cylinder within the DOT requirements. This means the bowl and pressure readings need to be within the 1% tolerance and the calibration cylinder has been run within 500 psi of the cylinder test pressures of that day.

8) Prior to cylinder testing, the expansion valve needs to be closed, the hoses removed and the calibrated cylinder removed and replaced with the first cylinder of the day to be tested. When that cylinder has been placed in the jacket, fill the jacket, then connect the hoses, then be sure to turn expansion valve before proceeding. Follow step 6 to be sure valves are opened and closed in their proper order. Any questions, call Galiso customer service. (800-854-3789)

CYLINDER TESTING

1) As cylinders are tested and results recorded to the test sheet, it is the responsibility of the operator to perform the proper calculations and record results. As each cylinder is finished and the results show the cylinder passes, the cylinder may then be removed from the jacket and placed in the inverter, (manual or automatic) to be drained and dried.

2) To shutdown the system, turn off (or close) the water and then the air to the system. The scale may now be turned off. Make sure all valves are off or closed.

NOTES- refer to the operation manual (provided) for any detailed information or call customer service at (800-854-3789) for additional information and assistance.

2.0 GTC SYSTEM COMPONENTS AND SPECIFICATIONS

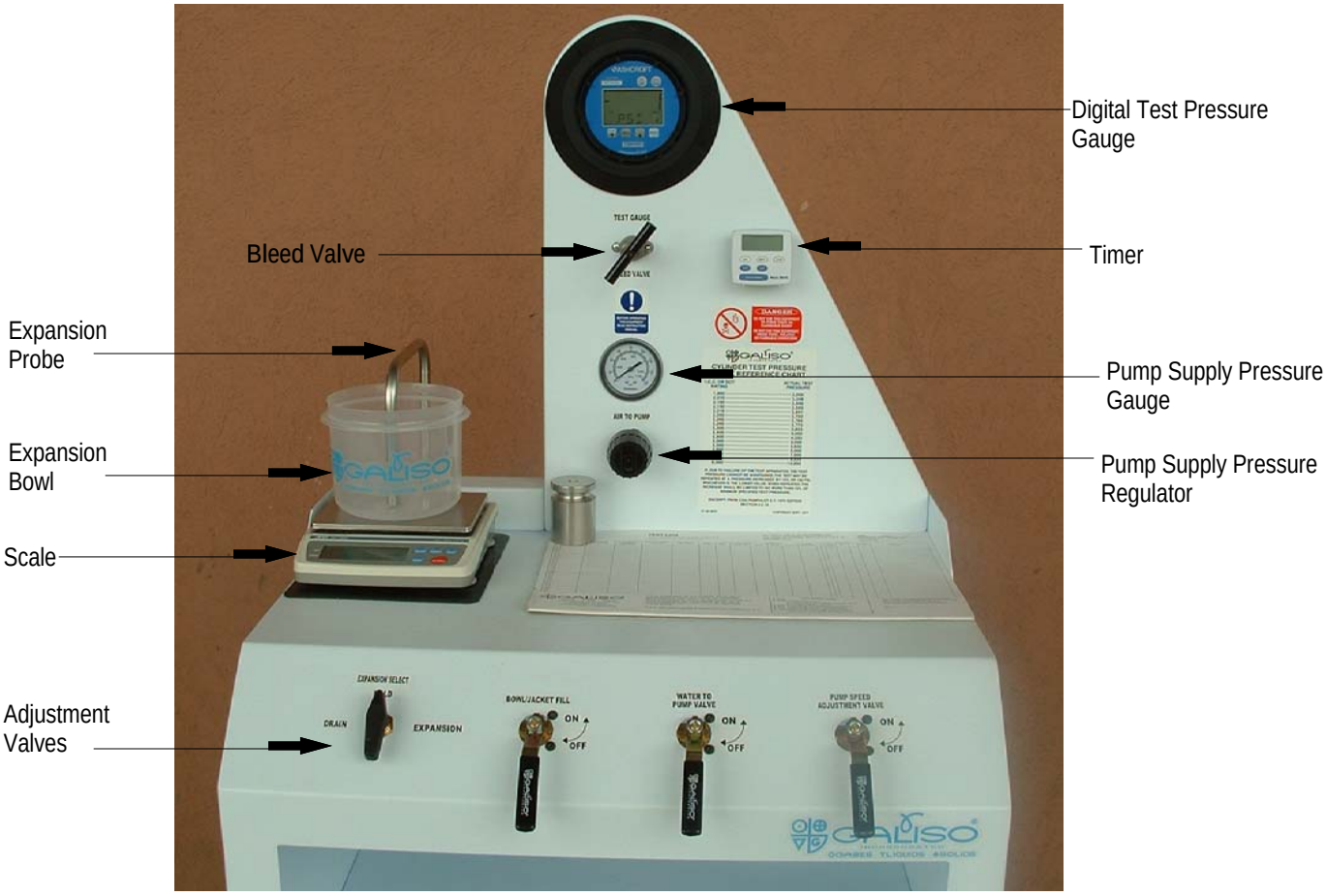


Figure 2- 1 Digital GTC Test Console

2.1 GTC Test Console Specifications:

- Test Stand Dimensions: Height: 65 Inches Width: 27 Inches Depth: 32 Inches
- Air Requirements: A minimum of 10 cfm Shop Air at 100 psig (intermittent)
- Water Requirements: City Water at a minimum of 10 PSI
- Electronic Expansion Scale Electrical Requirements: 110 VAC

2.0 GTC SYSTEM COMPONENTS AND SPECIFICATIONS

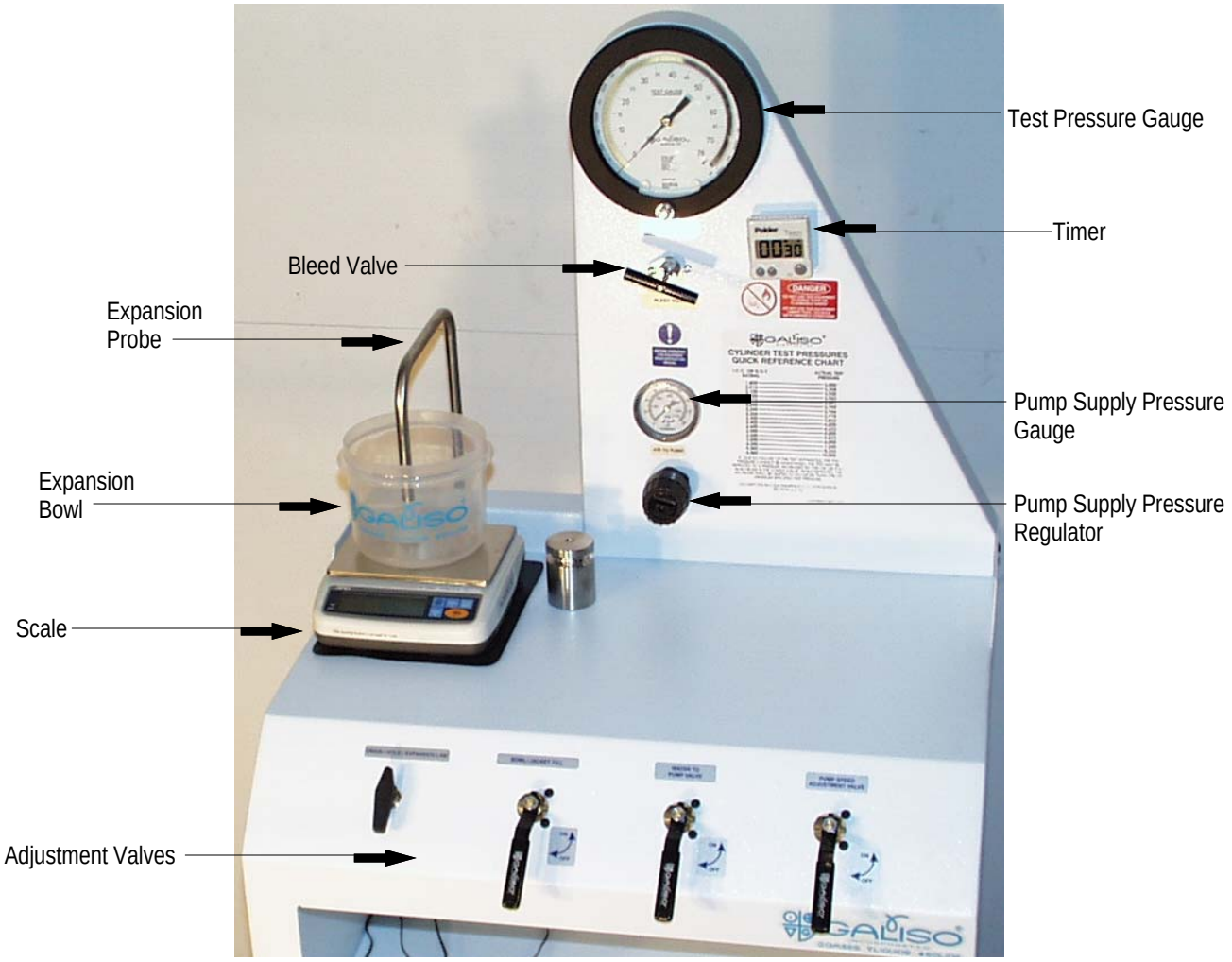


Figure 2- 2 Analog GTC Test Console

2.1 GTC Test Console Specifications:

- Test Stand Dimensions: Height: 65 Inches Width: 27 Inches Depth: 32 Inches
- Air Requirements: A minimum of 10 cfm Shop Air at 100 psig (intermittent)
- Water Requirements: City Water at a minimum of 10 PSI
- Electronic Expansion Scale Electrical Requirements: 110 VAC

2.2 GTC Test Console Options

The GTC model test console is available in three test pressure ranges. The available options are shown in Table 2-1, below.

Model Number	Part Number	Max. Test Pressure
GTC-1200	02-51-2019	1,200 psi
GTC-2200	02-51-2017	2,200 psi
GTC-10000	02-51-2013	10,000 psi

Table 2 - 1 GTC Test Console Options

In addition to the different test pressure ranges, a dual jacket option is available allowing test technicians to increase cylinder test throughput. The dual jacket option is available both as original equipment and as an add-on upgrade. Reference part number 02-41-2021 for the dual jacket option.

3.0 SAFETY

Read all instructions before attempting to install or operate the GTC Test Console. **GALISO, INC. IS NOT RESPONSIBLE FOR DAMAGE OR INJURY CAUSED BY UNSAFE USE, MAINTENANCE OR APPLICATION OF THIS MACHINE**. Please contact Galiso for guidance when you are in doubt as to the proper safety precautions to be taken when installing or operating this machine.

3.1 Personnel Safety

3.1.1 Always double check the cylinder pressure rating stamped on the cylinder shoulder to determine the required test pressure.

⚠ WARNING ⚠

DO NOT OVER-PRESSURIZE CYLINDERS
CYLINDER OVER-PRESSURIZATION CAN CAUSE SEVERE EQUIIPMENT DAMAGE AND RESULT IN PERSONNEL INJURY OR DEATH

3.1.2 Do not handle the test pressure hose while the test vessel is pressurized. Injury could occur due to hose leaks.

3.1.3 When releasing the pressure from the test vessel at the completion of testing always open the Bleed/Vent Valve slowly to avoid sudden high energy pressure releases. Bleed valve should be left in open position, unless testing.

3.1.4 Do not attempt to remove the test connection prior to verifying that the test vessel has been completely de-pressurized.

3.1.5 Always wear eye protection when using the system.

3.2 Equipment Precautions

3.2.1 Before connecting a cylinder for testing, inspect the cylinder neck threads. Cylinders with excessively worn or damaged neck threads must be dispositioned in accordance with CGA Pamphlets C-6, 6.1 or 6.2 as appropriate.

3.2 Equipment Precautions, continued

3.2.2 Before connecting a test vessel (cylinder) for testing, check the test pressure hose and fittings to ensure they are in proper working order.

3.2.3 The test spud (see figure 3-1) must engage the cylinder neck threads with at least four threads for the cylinder to be safely tested. If the test connection is not properly attached to the cylinder, it could be blown off during pressurization. If there is any question about the test connection **do not test the cylinder.**

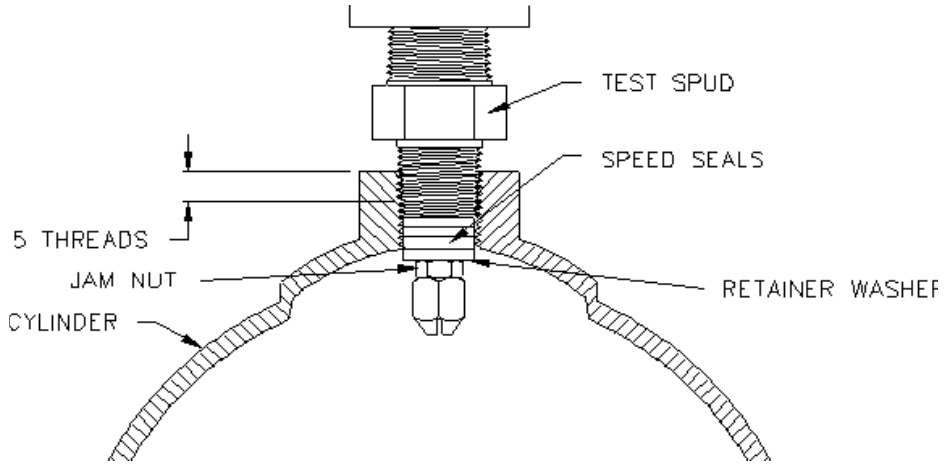


Figure 3 - 1 Hydraclose Seal

3.2.4 Make certain that you are using a test spud that is appropriate for the neck threads of the cylinder that is being tested (see figure 3-2 below). When an incorrect test spud is screwed on to certain types of cylinders (such as Linde cylinders with over-size neck threads or Airco cylinders with double tapered neck threads), the cylinders will appear firmly attached, but they do not properly engage the threads of the test spud. If you have any questions concerning the appropriate test spud to be used with a particular type of cylinder, contact Galiso.

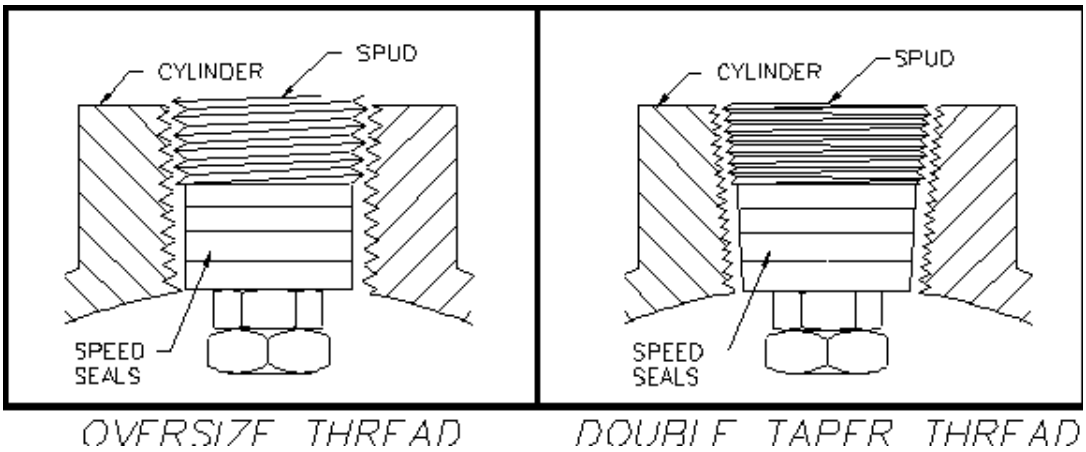


Figure 3 - 2 Cylinder Neck Thread Detail

3.2 Equipment Precautions, continued

3.2.5 Your test jacket must include a suitable safety relief port, which is equipped with a Galiso crystal glass burst disk. Although HYDRACLOSE test jackets include an appropriate safety relief port and burst disk, the HYDRACLOSE test head may also be used with other models of test jackets. If you intend to use the HYDRACLOSE test head with another manufacturer's test jacket, the following criteria must be observed:

The relief port must be at least 4 inches in diameter and must include a suitable flange for installation of a Galiso crystal glass burst disk. If you are unsure of the suitability of the relief port or burst disk, contact Galiso for further information. Detailed drawings and specifications are available upon request.

The purpose of the relief port and burst disk is to protect the operator in the event of catastrophic failure of the cylinder while it is under pressure. The burst disk is designed to shatter in the event of a sudden release of pressure into the test jacket. When the burst disk shatters, excess pressure is released through the relief port, preventing the HYDRACLOSE test head from being forced out of the test jacket.

In the event that you must replace the Test Jacket Burst Disk, make certain that you use a replacement burst disk from Galiso. Never operate the GTC Test Console with an improper burst disk in place. The burst disk is designed to fail at a specific pressure to prevent the test head from being blown out of the test jacket in the event that an improperly mounted cylinder comes off of the test spud while under test pressure, or in the event of a cylinder rupturing.

3.2.6 Before pressurizing a cylinder, adjust the air pressure regulator to the intensifier pump to prevent cylinder over-pressurization. For example, if the cylinder test pressure is 500 psig, adjust the air pressure regulator to stall the pump at approximately 550 to 600 psig. See section 5.4.1.B for additional information regarding pump output pressure adjustment.

3.2.7 Keep the expansion scale clean and dry. If water is spilled on to the scale, immediately unplug the unit and thoroughly dry the unit before plugging the unit back in. After reconnecting the scale to electrical power, the scale must be recalibrated as described in Section 6.0, Maintenance and Calibration.

3.2.8 Keep the work area around the GTC Test Console clean, dry and free of debris to reduce the risk of operator injury due to slips or falls.

4.0 INSTALLATION

Read all instructions and familiarize yourself with the installation drawings before attempting to install or operate the GTC Test Console.

4.1 Receiving

When you receive the GTC, carefully un-crate the Test Console and remove all banding and padding materials.

Inspect the unit for damage, loose parts or disconnected lines. Refer to figure 4-1 and Table 4-1 for information if the lines have been disconnected. Contact Galiso, Inc. immediately if damaged items are identified.

4.2 Placement

Select an area to install your GTC Test Console. The installation location should allow sufficient drainage to prevent water from accumulating around the test system. Refer to the installation drawings supplied with this manual. Detail the flow of cylinders through the test area. Take care not to install your system in such a manner that would inhibit or cause interruptions in the flow of cylinders. If you need help with this, send a detailed drawing of your shop floor to Galiso for suggestions.

The GTC Test Console must be installed in a location that does not allow direct sunlight to shine on the test jackets. The installation location must also be sheltered from breezes, which could move the Expansion Bowl and affect the accuracy of test results.

4.3 Facility Requirements

Construct a suitable test pit and install the I-Beams and Hoist Assemblies as shown in the installation drawings. Figure 4-1 illustrates a completed test facility.

Connect the eye hook to the Hoist Chains.

Install the HYDRACLOSE Test Jacket in the test pit as indicated on the installation drawings. Bolt the test jacket to the floor of the test pit.

Move the GTC Test Console to the installation location. If you do not use the console platform (crate base), bolt the Test Stand and Pump Skid securely to the floor.

4.3 Facility Requirements, continued

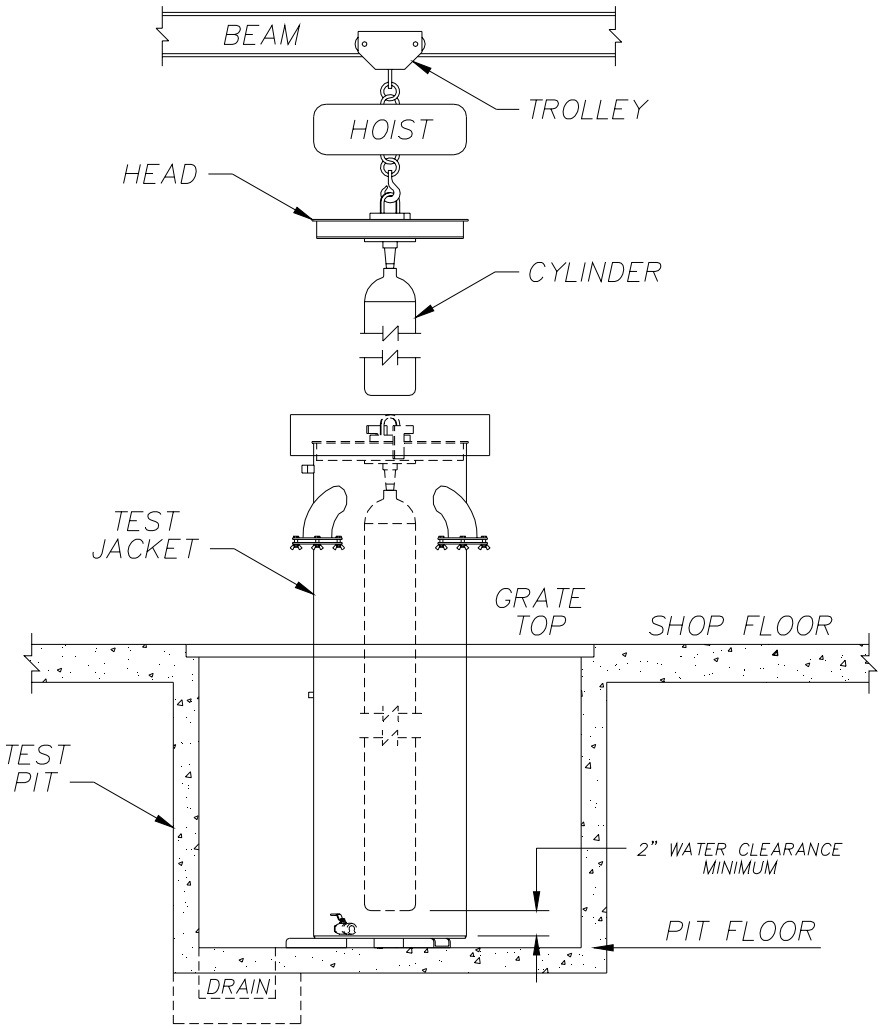


Figure 4 - 1 Hydrotest Facility

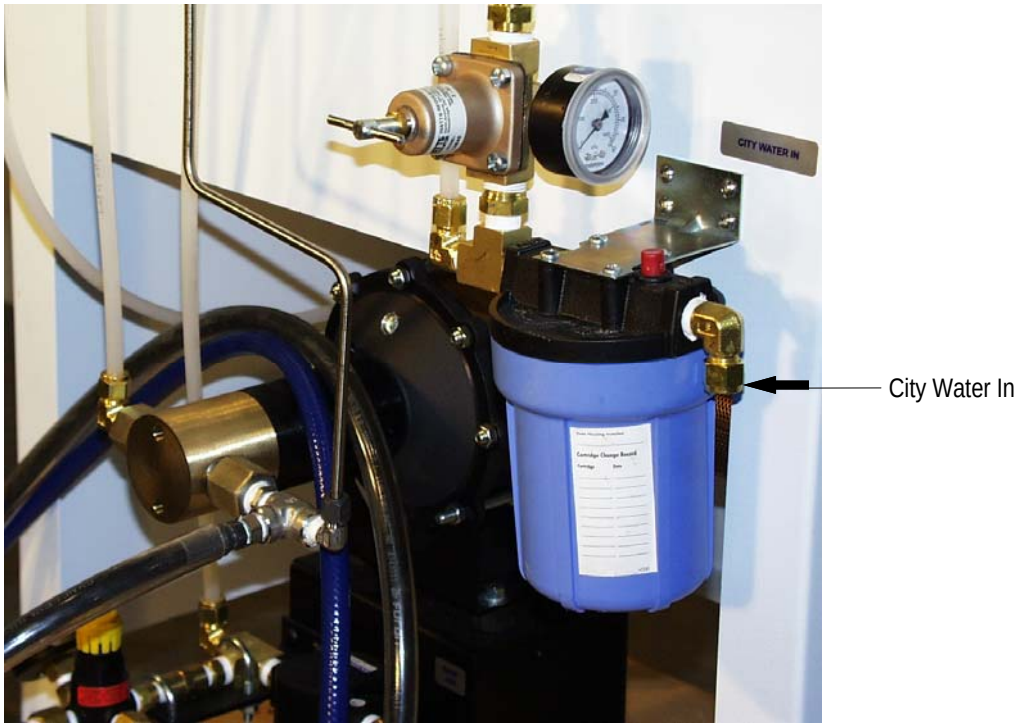
4.4 Utility Connections

Familiarize yourself with the Water and Air plumbing required for the GTC Test System. Carefully consider your individual system layout and plan the route of each plumbing line.

Connect a 100 psig shop air supply to the GTC Test Console at the location labeled "Shop Air In". Connect a water supply to the GTC Test Console. The utility service connection locations are shown in figure 4-2.

4.4 Utility Connections, continued

Figures 4-2a & 4-2b



4.5 Plumbing Installation

In addition to the utility service connections, the following additional plumbing connections must be made:

4.5.1 Expansion Line and Jacket/Bowl Fill Plumbing

Route the ½" plastic tubing from the GTC console expansion valve to the Hydraclose test jacket ½" brass CPI connection. Note that if the dual jacket option purchased, two expansion lines will need to be plumbed as indicated in figure 4-3.

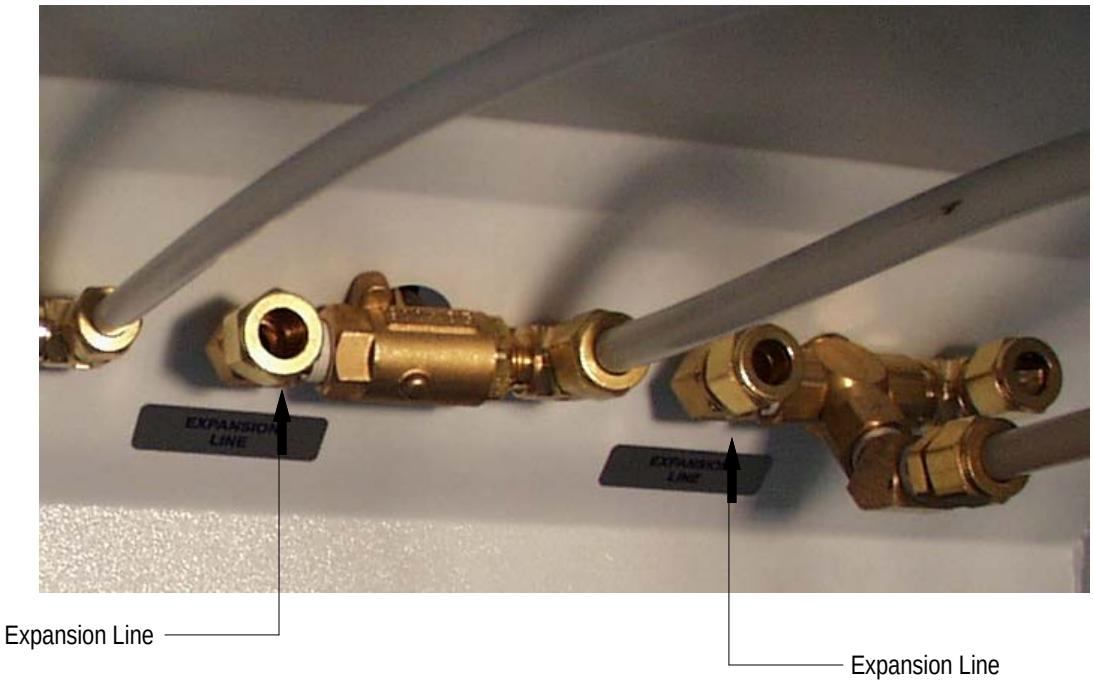


Figure 4-3 Digital and Analog GTC Console Plumbing

4.5.2a Digital GTC Bleed Line Plumbing

Route the ¼" stainless steel tubing provided, from the bleed valve exhaust to a convenient pit or drain location, see figure 4-3

Table 4-1 summarizes the required plumbing connections.

Figure 4-3b.1 Digital GTC Console Plumbing

4.5.2b Analog GTC Bleed Line Plumbing

Route the ¼" stainless steel tubing provided, from the bleed valve exhaust to a convenient pit or drain location, see figure 4-3b.1 for the Digital GTC, and 4.3b.2 for the Analog GTC.

Table 4-1 summarizes the required plumbing connections.

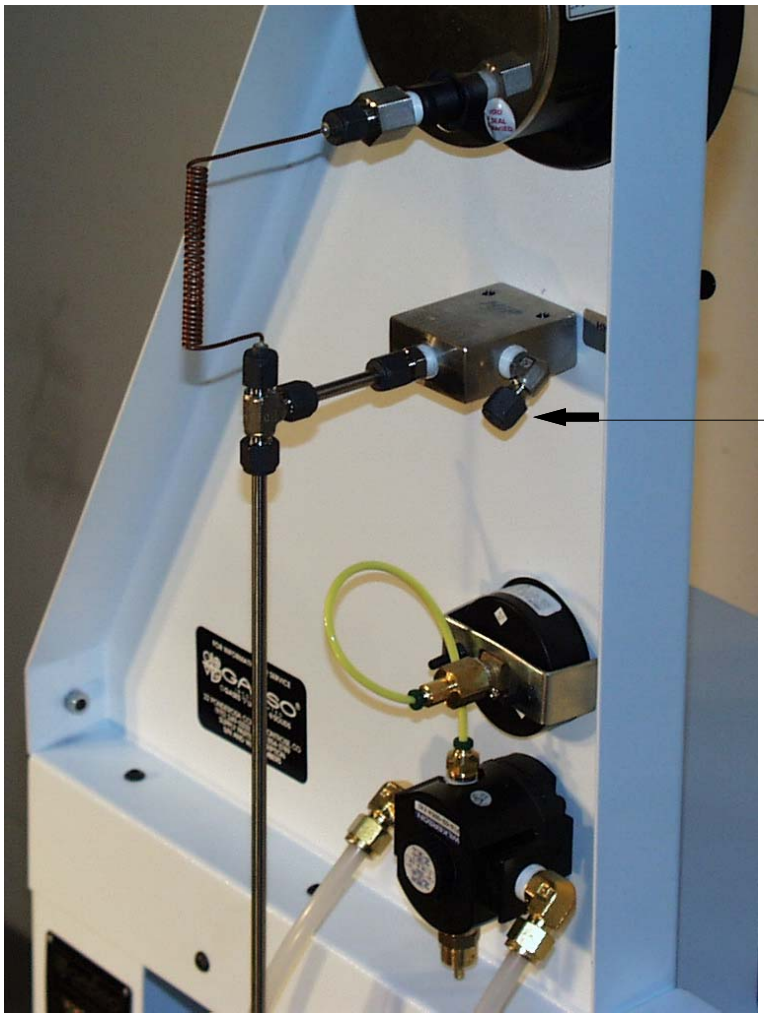


Figure 4-3b.2 Analog GTC Console Plumbing

4.5 Plumbing Installation, continued.

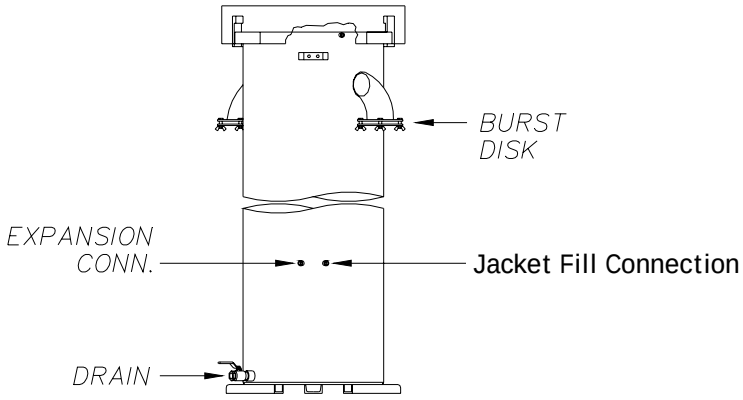


Figure 4 - 4 Hydraclose Test Jacket

Table 4-1 Field Plumbing Connections

Line	From	To
Expansion Line 1 (1/2" Nylon)	Expansion Valve (1/2" CPI Brass)	Test Jacket 1 (1/2" CPI Brass)
Expansion Line 2 (Dual Jacket Only, 1/2" Nylon)	Dual Jacket Expansion Valve (1/2" CPI Brass, Dual Jacket only)	Test Jacket 2 (1/2" CPI Brass, Dual Jacket only)
Bleed Drain Line (1/4" x .065 SST)	Bleed Valve (1/4" SS CPI)	Pit/Drain
Water Supply	Customer Supply	GTC Water Filter Inlet (3/8" Prestolok)
Air Supply	Customer Supply	GTC Air Filter Inlet (1/2" Prestolok)
Jacket Fill	Jacket/Bowl Fill Valve	Test Jacket 1

4.6 Expansion Bowl and Scale Setup

Remove the packing materials from the Scale and Expansion Bowl and place the scale on the shelf located on the upper left side of the Test Console. Place the circular metal pan (platform) into position on top of the scale, then place the scale unit onto the rubber pad. Place the Expansion Bowl on top of the Scale platform and under the probe. Be careful not to bump the probe.

Plug the power cable into the Scale through the hole in the console, then plug other end of the power cable into a 110 VAC outlet. Turn the unit ON and wait at least five minutes for the scale to warm up. The Scale will need to be calibrated prior to initiating any system checkout or cylinder testing activities. See the manufacturers OEM literature for scale calibration instructions.

4.7 HYDRACLOSE Test Head Preparation

HYDRACLOSE Test Heads are normally shipped completely assembled. The following instructions are provided to ensure the installer has all the information necessary in the event individual component replacements are required.
The top end of the test spud must be securely attached to the HYDRACLOSE Test Head. With GHH-6H and GHH-6B HYDRACLOSE Test Heads, Teflon tape should be used to seal the connection between the threaded test spud and the spud plate on the bottom of the Test Head. **Do not overtighten** the test spud. The test spud uses a maximum seal pressure of 100 psi.

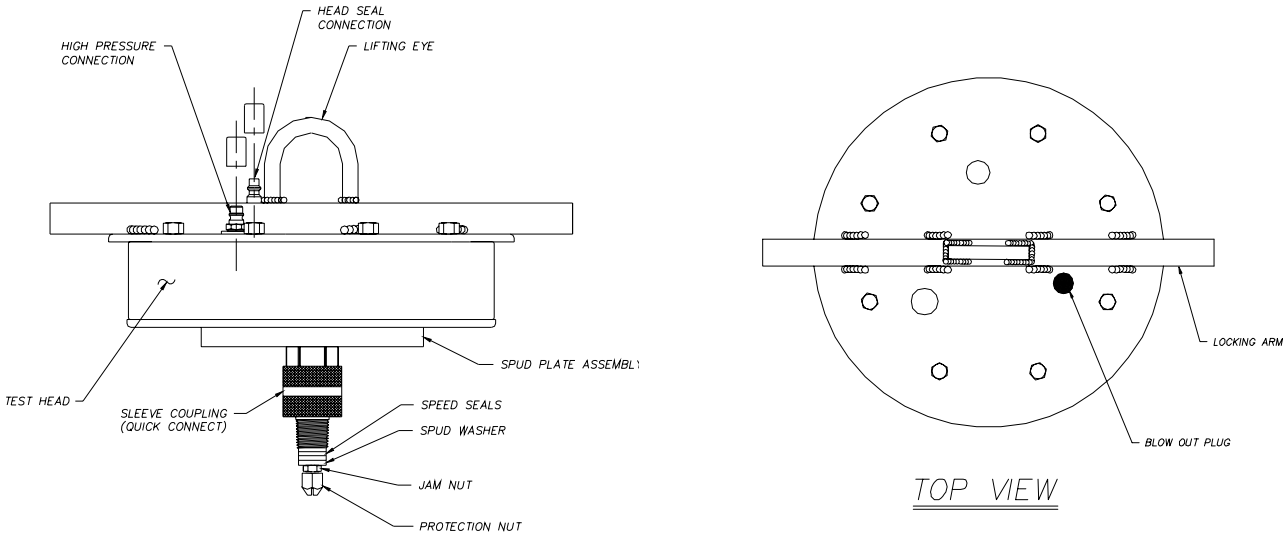


Figure 4 - 5 Hydraclose Test Head

With GHH-6G Hydraclose Test Heads, the "Quick Change" test spud snaps in place on the Hydraclose Test Head. Before attaching the GHH-6G Hydraclose Test Head to the cylinder, grasp the "Quick Change" Test Spud and check to make sure that it is securely attached to the Test Head.

Install the proper size "Speed Seals" on the end of the test spud. Next, the Retainer Washer fits over the "Speed Seals" to hold them in place, followed by the Jam Nut and then the Brass Protector Nut, as shown in figure 4-2. The "Speed Seals" and Retainer Washer must be of the proper size to match the Test Spud and cylinder neck that they are being used with, otherwise the spud seal may leak and the head sealing mechanism may be damaged.

4.7 HYDRACLOSE® Test Head Preparation, continued

The Jam Nut should only be snug against the retaining washer. Do not over tighten. You should still be able to turn the Speed Seals with your fingers, however, they should not be loose. Lock the Jam Nut and the Brass Protector Nut together so that they will not unscrew. Do not use the test head without the Brass Protective Nut in place, the stem threads will be damaged, resulting in unnecessary repairs.

The 1/2 inch spud requires only one 1/2 inch "Speed Seal". The 1/2 inch "Speed Seal" is manufactured as one unit since 1/2 inch cylinder neck threads are generally shorter than 3/4 inch and one inch neck threads.

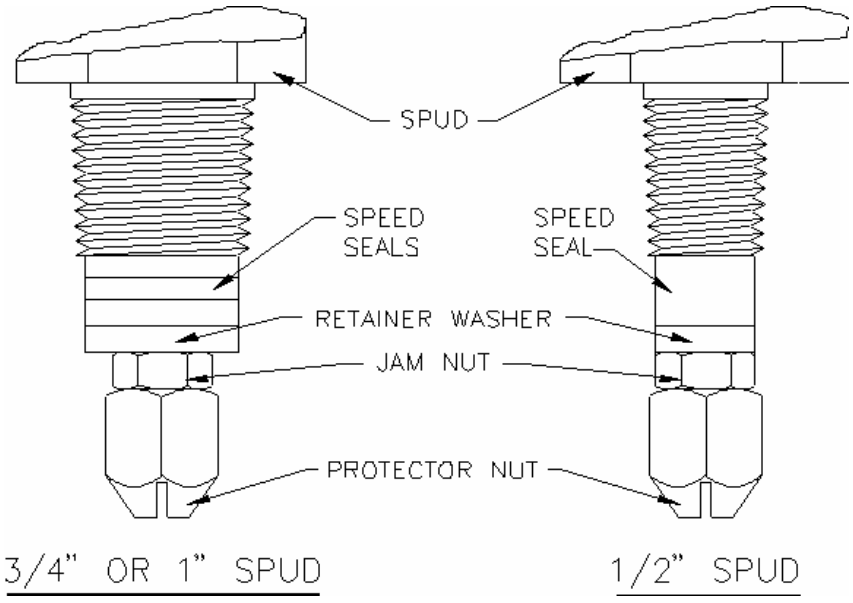


Figure 4 - 6 Speed Seal Details

The 3/4" and 1" spuds require three "Speed Seals" to properly seal. If the cylinder neck threads are short, the spud can be sealed with two or even one "Speed Seal", providing that spacer washers of the appropriate diameter are used adjacent to the Retainer Washer to maintain the proper stack up.

4.8 Preparations for Testing

Fill the test jacket with water using a garden hose or other suitable means.

Recheck the lines and fittings on the GTC Test Console for tightness.

Turn on the air and water supply to the system. Check the lines for leaks. If leaks are detected, turn off the air and water supplies and tighten the leaking fittings.

The system should now be ready for start-up and checkout. Refer to Section 5.0 of this manual for the necessary operating instructions.

4.9 Dual Jacket Conversion Installation

This section provides additional installation instructions for converting a single jacket GTC system to a dual test jacket GTC system. The dual jacket conversion kit, Galiso part number 01-41-2021, includes a replacement 3-way expansion valve, labels and miscellaneous tubing. Proceed as follows to connect a second test jacket to the GTC test console.

A. Remove the tubing from the existing 2-way expansion valve on the back side of the console, and remove the valve from the console.

B. Install the new 3-way valve in the console and connect the plumbing from the Water Level adjustment Valve as shown in figure 4-7.

C. Plumb the Expansion lines using ½" natural plastic tubing and brass compression fittings. See figures 4-7 and 4-8.

NOTE:

During GTC test system operations, the operator must verify that the three way expansion valve on the test console is in the correct position for the test jacket being used. See Section 5.0, Operations.

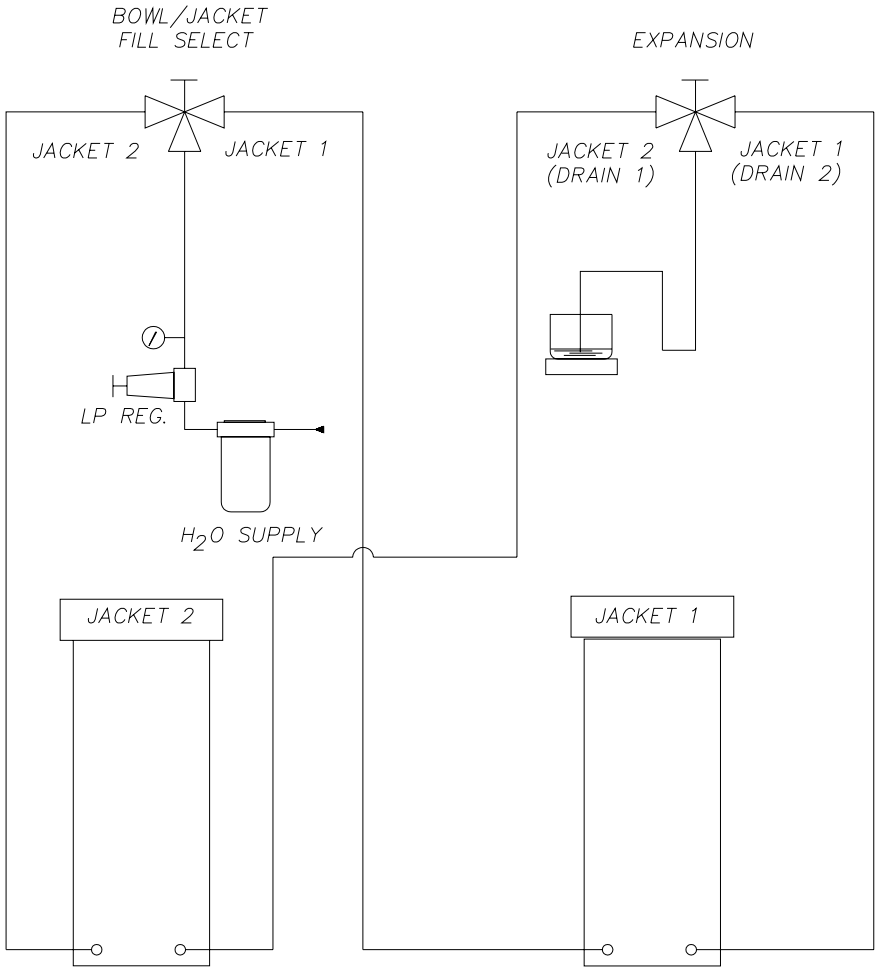


Figure 4 - 7 Dual Jacket Schematic

When utilizing both jackets, it is advisable to completely disengage the test head on the jacket that is not testing. This is so the Safety Interlock, of the non-testing jacket, is not engaged while the other jacket is testing.

Place Test Jacket Select Valve to the jacket that is currently ready for testing. Follow normal procedure, being sure to have the Expansion Select valve selected to the correct Jacket, and the Bowl/Jacket Fill Select on “Hold” during testing. Monitor the bowl water level over time, after testing cylinders, and adjust as needed.

5.0 OPERATIONS

These operating instructions describe procedures required for system start-up and cylinder testing activities.

5.1 Precautions

Hydrostatic testing of cylinders involves the use of high pressure equipment and components. Hydrostatic testing should be performed only by personnel properly trained in hydrostatic testing and the specific equipment to be used.

Take care not to disturb the Expansion Bowl Assembly, located on the upper left hand shelf of the Test Stand.

Do not lean on the GTC Test Console or test jackets while tests are in progress. Weight applied against the side of the Test Stand can cause the Expansion Bowl to sway and affect the accuracy of expansion readings.

The water supply should be turned off if the air supply to the system is turned off. The water supply to the system should also be turned off when the system is not in use.

The GTC Test Console should not be installed in a location that is subject to direct sunlight or breezes. Breezes or drafts will cause the Expansion Bowl to move and affect the accuracy of the expansion reading. Even minor changes in the temperature of the test jacket will cause expansion readings to drift, invalidating test results.

Never pressurize the Test Head outside of the jacket. The "Speed Seals" can be constrained by screwing the Test Spud into a cylinder neck or appropriate test blank (available from Galiso). The test boot can be constrained with either the test jacket or with a snug fitting metal band at least 2" wide and 1/16" thick which is slipped over the head boot to prevent rupturing. At 50 psig sealing pressure, there is over 3000 pounds of force exerted by the sealing boot on the test head. HYDRACLOSE head testing and maintenance systems are available from Galiso.

Make certain that you are using a test spud that is appropriate for the neck threads of the cylinder that is being tested. Certain types of cylinders (such as Linde cylinders with oversize neck threads or Airco cylinders with double tapered neck threads) will appear firmly attached when screwed on to an incorrect test spud, without properly engaging the threads of the test spud. If you have any questions concerning the appropriate test spud to be used with a particular type of cylinder, contact Galiso.

5.1 Precautions, continued

Never operate the GTC Test Console with an improper burst disk in place. In the event that you must replace the Test Jacket Burst Disk, make certain that you use a replacement burst disk from Galiso as these discs are specially designed to burst between 14 and 19 psig.

Before each starting operation of the GTC Test Console, a visual check of the system should be made to assure the unit is ready for testing. Check the lines to make certain they are tight and there is no damage.

With the air and water to the system OFF, remove the Air Filter bowl to check for accumulation of water.

5.2 System Start-Up

The following Start-Up procedures should be performed before attempting to operate the GTC Test Console after initial installation or for the first time after water pressure to the unit has remained off for a prolonged period of time.

5.2.1 Calibrated Cylinder Preparation

Add water as needed to completely fill the cylinder before using. Ensure that the water temperature has stabilized prior to testing cylinders. Water should be left in the Calibrated Cylinder at all times. If the cylinder is emptied, it should be dried immediately to prevent corrosion.

The Calibrated Cylinder should be protected from freezing temperatures. The force generated by the freezing water can permanently damage the calibration of the cylinder and possibly rupture the cylinder wall.

5.2.2 Test Jacket Preparation

Check the expansion line connection(s) to the Console. Ensure that the Test Jacket (both jackets for the dual jacket system) is filled to the proper level and that the water temperature has stabilized prior to testing cylinders.

NOTE:

Expansion measurements are extremely sensitive to temperature variations. Temperature changes and variations must be held to less than ±5 ^{o}F for large cylinders, and ±2^{o}F for small cylinders.

5.2.3 Scale Calibration Check

Scale calibration should be checked on a daily basis immediately prior to initiating cylinder testing activities. Turn the Scale ON and let it warm up for at least five minutes before using.

Remove the Expansion Bowl from the scale platform. Press the Tare button and place the 1kg gram weight on the platform. If the scale is properly calibrated, the display will read "1kg." plus or minus 1.0 grams. If the scale does not read properly, re-calibrate in accordance with the manufacturers literature.

Remove the weight and return it to a clean storage area. Replace the Expansion Bowl on the scale platform.

5.2.4 Cylinder and Test Head Installation

Screw the HYDRACLOSE Test Head into the cylinder neck, engaging with 3 to 5 neck threads.

Attach the hoist to the HYDRACLOSE Test Head with attached cylinder, and load the assembly into the HYDRACLOSE Test Jacket, see figure 5-1.

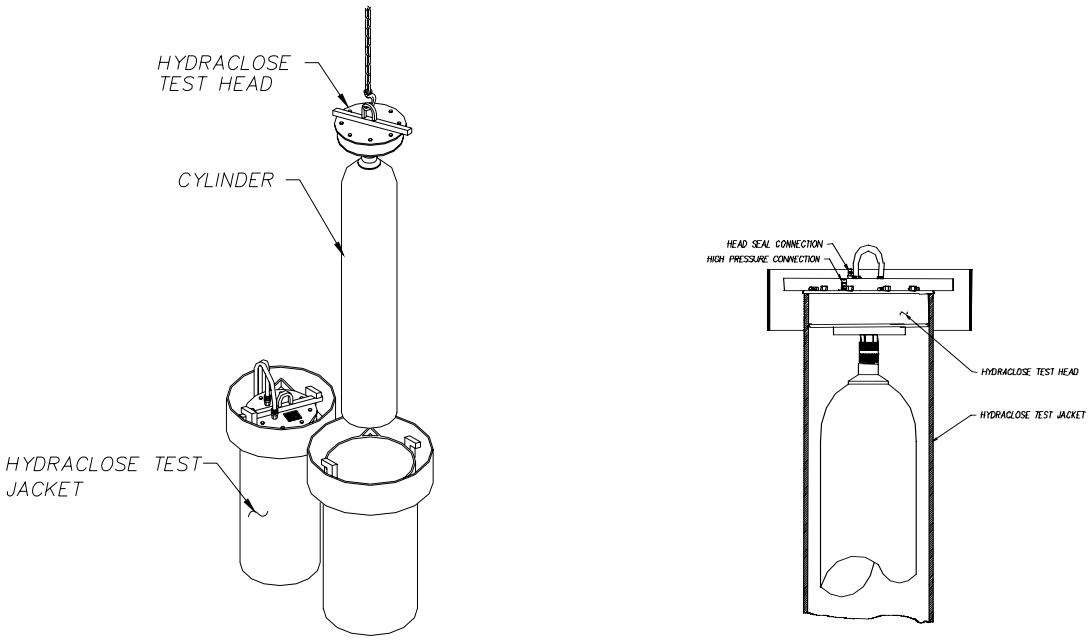


Figure 5 - 1 Cylinder/Test Head Installation

5.2.4 Cylinder and Test Head Installation, continued

When the Test Jacket is full and ready to use, lower the cylinder, attached to the Test Head, into the Test Jacket. Twist the Test Head to lock it into place under the Head Retaining Brackets.

After the test head is in place in the test jacket, attach the Head Seal Hose first, and then attach the Test Pressure Hose, see figure 5-2.

Figure 5 - 2

Test Jackets, 24" and larger, have thumb screws incorporated on the Test Head retainer brackets to prevent Test Head "Floating," giving inaccurate expansion reading. Tighten thumb screws against head, hand tight after head is in place. After testing, back-off thumb screws to prevent damage to them during subsequent head installation.

5.2.5 Pump Pressure Adjustment

GTC Test consoles are supplied with either a low pressure or a high pressure pump depending on the model ordered. Table 5-1 shows the pump specifications for the available GTC Test Consoles. The pump pressure adjustments are required to ensure that cylinders are not over-pressurized.

Table 5 - 1 Pump Specifications

GTC Model	Pump Type	Press. Ratio	Max. Pump Press.	Remarks
GTC-1200	LP, AZ-1-12	12:1	1225 psi	Figure 5-3
GTC-2200	LP, AZ-1-26	26:1	2625 psi	Figure 5-3
GTC-10K ModII	HP, AZ-1-140	140:1	14000 psi	Figure 5-4

A. To determine the required air pressure regulator setting, first determine the required cylinder test pressure. Then, find the corresponding air pressure regulator setting using the graph shown in figure 5-3 or 5-4 whichever applies to your test system (see Table 5-1). Alternatively, the required air pressure may be determined by dividing the cylinder test pressure by the pressure ratio value (either 26 or 140) shown in Table 5-1.

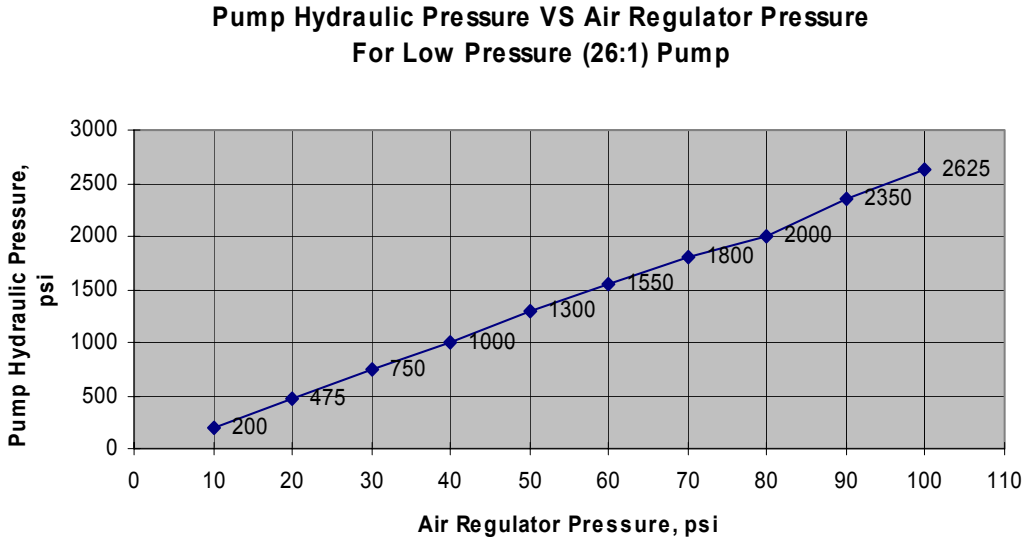


Figure 5 - 3

B. Since the values shown in figures 5-3 and 5-4 are approximate, add 5 to 10 psig to the air to pump pressure regulator setting determined from the graph (or from the pressure ratio multiplier) to insure that the pump will not stall out prior to reaching the required test pressure.

5.2.5 Pump Pressure Adjustment, continued

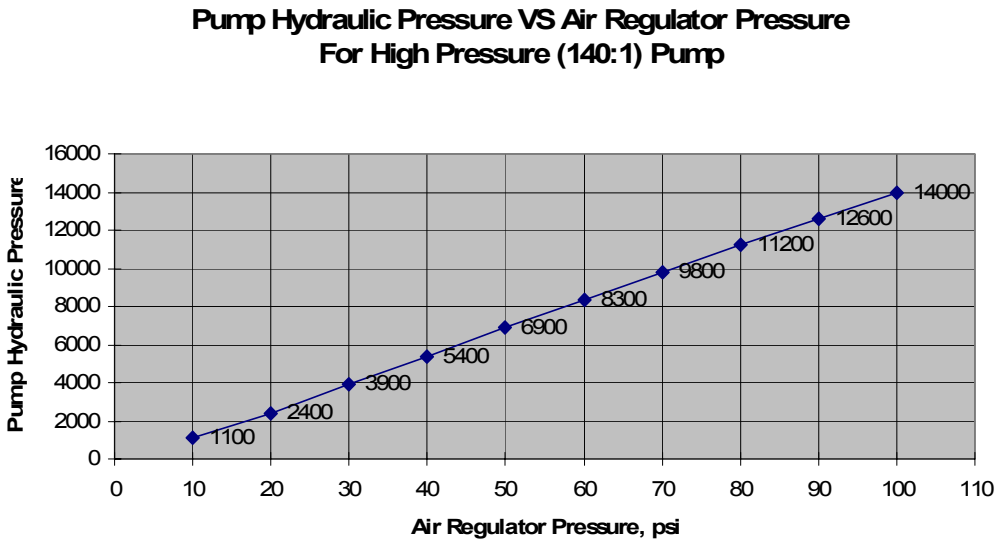


Figure 5-4

C. Adjust the Air To Pump Pressure Regulator to the pressure determined above as indicated on the air to pump regulator pressure gauge, see figure 5-5.

5.2.6 System Fill and Purge

A. Turn Jacket/Bowl Fill valve on to fill jacket. Select expansion line. Apply head seal pressure hose. Water will fill the bowl. CAUTION, DO NOT OVERFILL THE BOWL! Turn Bowl/Fill valve off. Turn Expansion valve to <Drain>, to remove excess water from bowl. Bowl water level should be approximately 1/4" above the tip of the probe.

B. There may still be some air in the water line when first setting up the system. This will be noticeable by a 'milky' color to the water. To completely clear the lines, Repeat the BOWL FILL / BOWL DRAIN steps described in A. and B. above until the water runs clear.

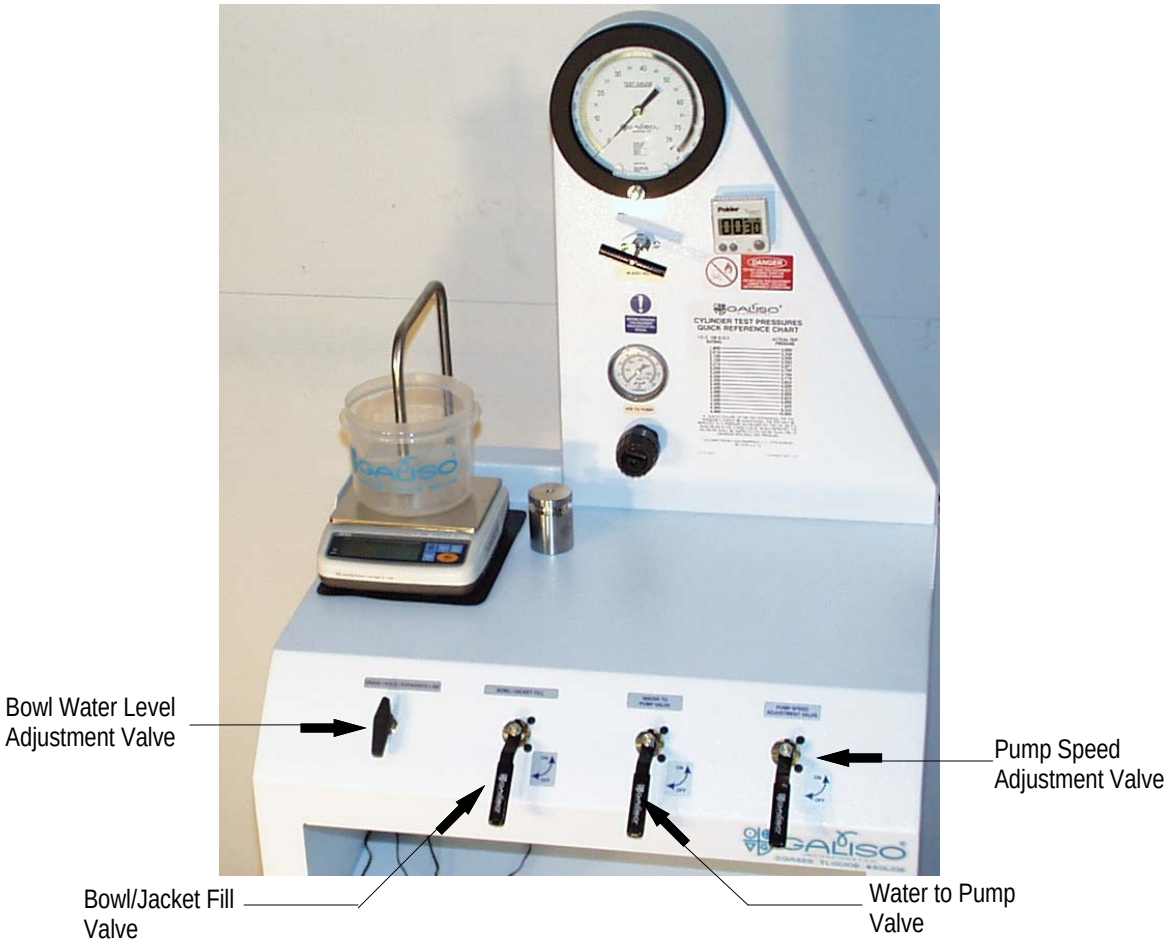


Figure 5 - 5 GTC Console

5.3 Cylinder Preparation

Cylinders to be tested must be subjected to an internal and external visual inspection in accordance with CGA pamphlet C-6, "Standards for Visual Inspection of Compressed Gas Cylinders".

The exterior of each cylinder should be cleaned of dirt, scale, grease, oil and any other contamination before inspection. The inspector should check the entire exterior surface, including the bottom of the cylinder, for any damage such as dents, arc or torch burns, bulges, serious corrosion or any other damage that could appreciably weaken the cylinder. Any cylinders that do not pass the inspection should be removed from further service.

Steel cylinders should be tapped with a 1/2 pound machinist's hammer. If the cylinder has a dull or dead ring, it should be internally cleaned by tumbling or other suitable means. If the dull or dead ring persists after the cylinder has been internally cleaned, the cylinder must be condemned.

⚠ WARNING ⚠

Do not test obviously defective cylinders. Testing of defective cylinders is a safety hazard and can result in equipment damage, personnel injury or death.

5.3 Cylinder Preparation, continued

Remove the cylinder valve and tag it with the cylinder serial number so that the valve will be reinstalled in the same cylinder. Cylinder valves generally conform themselves to the particular neck threads of the cylinder in which the valve is first installed and may not seal as well in cylinders with a slightly different neck thread configuration.

If the cylinder has contained a flammable gas it must be washed prior to internal visual inspection. Either fill the cylinder with water and then dump it out, or purge the cylinder with clean, dry air or Nitrogen.

Use a Galiso Opti-Lite, Fiber Optic Inspection Light or low voltage bulb to inspect the interior of the cylinder per CGA pamphlet C-6, "Standards for Visual Inspection of Compressed Gas Cylinders".

Carefully check the interior of the cylinder for excessive corrosion, dirt, scale, or sludge which must be removed prior to hydrostatic testing. Internal cleaning of the cylinder should be performed prior to hydrostatic testing.

Add water as needed to completely fill the cylinder before testing. The temperature of the water in the cylinder should be within a maximum of five (5) degrees Fahrenheit of the temperature of the water in the test jacket and the water used to pressurize the cylinder during testing. A large variation of the two water temperatures will cause inaccurate test results.

5.3.1 Cylinder Test Log

The Test Log will list a series of cylinder/test data to be filled out by the operator prior to or during the test for each cylinder to be tested. The following information is required for each cylinder to be tested:

1. CYLINDER OWNER:
2. SERIAL NUMBER:
3. ICC OR DOT RATING:
4. MANUFACTURER or symbol and date of manufacture:
5. DIMENSIONS:
6. GAS SERVICE:
7. VISUAL INSPECTION: Record the results of the Visual Inspection.
8. ACTUALTEST PRESSURE: See CGA Pamphlet C-5
9. **EXPANSION: Record the results of the Expansion Tests in this area.**
10. TOTAL EXPANSION:
11. PERMENANT EXPANSION:
12. REE SOURCE:
13. PERCENT PERMENANT EXPANSION:
14. PLUS: Indicate YES or NO.
15. STAR: Indicate YES or NO.
16. TEST RESULT CODE: Enter the appropriate code:
17. PASS
18. FAIL, Permanent Expansion exceeds 10%, or 5% on fiber wrapped cylinders.
19. FAIL, Excessive Elastic Expansion.(cannot + or * these cylinders)
20. FAIL, Visible Defects, See Remarks.
21. RETESTED, Equipment Failure.
22. TESTED BY: The test equipment operator's name or initials.
23. REE Reject Elastic Expansion
24. REE Source
25. REMARKS: Write in any remarks pertinent to the test in this area.

5.4 Cylinder Test Procedure

The first test should be on the user's calibrated cylinder, in order to have a record showing that the test system is accurate to 1%. This test is done to verify that the components of the system are in proper working order.

The following instructions describe the recommended cylinder testing procedure(s).

5.4.1 Air Regulator Settings

Verify that the gauge on the Head Seal Pressure mini regulator is set at 90 PSI.

Verify the gauge on the Intensifier Pump regulator indicates the proper air pressure setting for the cylinders to be tested. Refer to Section 5.2.5, Pump Pressure Adjustment, for instructions.

5.4.2 Expansion Bowl and Scale Set-up

Ensure that the scale is properly calibrated per Section 5.2.3. If necessary, recalibrate the scale in accordance with the manufacturers OEM literature.

Verify that the system has been purged of air, and that the expansion bowl level is approximately ¼" above the probe tip, see Section 5.2.6 for system purge instructions. During the process of testing cylinders, the water level in the bowl may change. It may become necessary to adjust the water level in the bowl. Turn the Bowl Water Level Adjustment Valve to BOWL FILL to add water to the bowl and to BOWL DRAIN to drain water.

5.4.3 Cylinder Test Connections

Verify that the Water To Pump Valve is in the OFF position and the Bleed Valve handle is securely in the OFF position. Verify the Regulator Gauge is set for the proper pressure for the cylinders being tested.

Attach the test head to the cylinder for which you have entered the information. The test spud should engage with 3 to 5 neck threads in order for the cylinder to be safely tested. Cylinders with excessively worn neck threads should be condemned.

Load the cylinder to be tested into the jacket and lock into place. Attach the Head Seal Hose and Test Pressure Hose to the Test Head.

5.4.4 Cylinder Test Procedure

A. Turn the Expansion Valve ON (or select a jacket for dual jacket systems).

B. Check the pressure gauge for zero reading, allow the bowl level to stabilize and press the TARE button on the Expansion Scale to re-zero the scale.

C. CLOSE the Bleed Valve.

D. Turn the Water To Pump Valve to the ON position (the pressure gauge will indicate incoming water supply pressure).

E. Turn ON the Pump Speed Adjustment Valve to pressurize the cylinder to the required pressure for the cylinder being tested. Test pressures for DOT rated cylinders are listed in CFR49.

F. If the needle on the gauge bounces erratically during pressurization, reduce the speed of the pump with the Pump Speed Adjustment Valve until there is a steady rise from the needle. Erratic movement of the needle could affect the performance of the gauge.

G. When the gauge indicates that pressurization is within 500 psi of the test pressure, turn the Pump Speed Adjustment Valve toward the OFF position to slow the pump until the desired pressure is reached. A rate of approximately 100 psi per three seconds is recommended.

H. Upon reaching the desired pressure, turn the Pump Speed Adjustment Valve to OFF. Turn OFF the Water To Pump Valve.

I. To accurately read the Test Gauge, tap it lightly, and line the indicator needle up with its mirrored image and read the gauge where the needle and mirror form a single image.

J. If the gauge pressure has not reached minimum test pressure, slowly turn the Pump Speed Adjustment Valve to increase the pressure in the cylinder.

K. Maintain the test pressure for at least 30 seconds, or for however long it takes to allow for complete expansion of the cylinder. If fluctuations occur, allow for extra time until the system stabilizes and the gauge and scale display hold steady. If the pressure does not stabilize, the system must be checked and the cylinder will need to be re-tested. (See CFR49, 180) Refer to Section 6.0, Maintenance and Troubleshooting, for possible problems and remedies.

5.4.4 Cylinder Test Procedure, continued

L. After assuring that the expansion reading has stabilized, record the Total Expansion, shown on the scale display, on the Test Log.

M. Turn the Bleed Valve counter clockwise to bleed the pressure from the cylinder. When testing the Calibrated Cylinder, the Test Gauge and the scale display should both return to zero readings. When testing other cylinders, the Test Gauge should return to zero and the scale display will show the amount of permanent expansion after the cylinder has been bled.

N. Allow approximately 30 seconds for the scale to stabilize. The scale readout will display the amount of permanent expansion for the cylinder. Record this information on the Test Log in the Permanent Expansion column.

O. Turn OFF the Expansion Valve (turn to HOLD for dual jacket systems), leave the Bleed Valve OPEN until the next cylinder is ready to test.

P. Remove the Head Seal Hose and Test Pressure Hose from the test head.

Q. Remove the test head and cylinder from the test jacket and detach the test head from the cylinder.

Repeat Steps 5.4.4.A through Q. for additional cylinders to be tested.

5.4.5 System Shutdown Procedure

The system should be shut-down whenever it will be left unattended for any length of time such as between shifts, overnight and over weekends.

A. Drain the water from the bowl.

B. Verify that all valves are in the OFF or HOLD position, EXCEPT for the bleed valve

C. Turn OFF the power to the scale.

D. Turn OFF the City Water and Shop Air Supply sources to the system.

6.0 Maintenance And Troubleshooting

6.1 GTC Test Console

Keep the Test Console and components clean and dry and free of dirt and debris.

Regularly inspect the plumbing components of the Test Console for leaks. Also inspect the lines which connect the Test Console to the test jacket, test head and Pump Assembly for leaks.

6.2 Expansion Bowl Assembly

Before start up, place the 1Kg, or 2 X 50 gram weights on the pan of the Scale to verify the calibration of the scale. If the scale display does not read 1Kg or 100 grams, (99.7-100.3 grams), the Scale will need to be re-calibrated. Refer to the Scale manufacturers' literature, included in this manual, for calibration procedure.

Regularly inspect the Expansion Bowl Assembly. If dirt and residue have accumulated in the Expansion Bowl, carefully remove the Expansion Bowl and clean it. Avoid using sharp instruments and abrasive cleaners. Replace the Expansion Bowl as described in Section 4.0, Installation.

Keep the scale housing and pan clean and free of foreign material. A damp cloth with a mild detergent may be used to clean the scale.

6.3 HYDRACLOSE®Test Head

Regularly inspect the head boot for cuts and gouges which could damage the sealing surface.

Change the Speed Seals when they become excessively worn or ragged to avoid leakage and damage to the test system sealing mechanism.

Regularly Inspect the threads on the bottom of the test spud. If the threads become excessively worn or damaged, replace the test spud.

The Quick Connect Fittings should be inspected for wear periodically and replaced as needed. The hose couplers should fit snugly on the Quick Connect Fittings.

The O-Ring (or u-cup) seal, Galiso Part Number: 69-87-0021, in the Quick Connect Fittings should be changed when wear prevents proper sealing.

6.3 HYDRACLOSE® Test Head, continued

The metal surfaces of the HYDRACLOSE Test Head should be kept clean and free of rust and corrosion. Metal surfaces should be painted with a high quality, cold galvanizing, metal primer.

Protect the Spud Stem from being bent or twisted. A bent or twisted Spud Stem will interfere with sealing action.

Protect the Head Boot from cuts and gouges that could damage the sealing surface. If the head boot is properly cared for, it should last for years. If the test head is damaged, it can either be sent to the factory for repairs or you can repair it yourself with Galiso replacement parts. Rental heads are available from Galiso to allow you to continue testing while your Test Head is being repaired.

6.4 HYDRACLOSE Test Jacket

The inside upper 12 inches of the test jacket should be painted with cold galvanizing, metal primer to protect the sealing area.

The Test Jacket should be cleaned periodically to remove any accumulation of dirt or debris as needed or at least once every three months.

Test jacket water that has become stagnant or brackish should be drained from the test jacket and replaced with fresh water.

6.5 Calibrated Cylinder

Water should be left in the Calibrated Cylinder at all times. If the cylinder is emptied, it should be dried immediately to prevent corrosion.

The water filled Calibrated Cylinder must be protected from freezing temperatures. The force generated by the freezing water can permanently damage the calibration of the cylinder and possibly rupture the cylinder wall.

6.6 Master Gauge Assembly

In accordance with CGA recommendations, the Master Gauge Assembly should be recalibrated at least once per year.

Handle the Master Gauge Assembly very carefully. Sudden shocks and rough handling can damage the calibration of the gauge.

6.7 Intensifier Pump Assembly

Regularly inspect the plumbing components of the Pump Assembly for leaks.

Pump speed and pressure must be adjusted for the size/rating of cylinders being tested. Refer to Section 5.3.5, for the adjustment procedure.

Replace worn pump seals and packings as needed.

Regularly inspect the filters of the Pump Assembly. Clean or replace as needed.

6.8 Troubleshooting

If you develop what appears to be a problem, please check the following section to identify where the problem might be located. If you should need additional help, please call Galiso, Inc. at (800) 854-3789.

Table 6 - 1 Troubleshooting

PROBLEM	POSSIBLE CAUSE	REMEDY
Expansion Increasing	1. Bowl fill valve leaks	1. Remove valve and check to see if water is leaking through valve. Replace as necessary.
	2. Head Seal Leak	2. Switch heads (if another is available). If the problem ceases, repair the faulty head. If another head is not available, check the head around the diaphragm and boot using the Head Retaining Device. If any leaks exist, repair or replace the head.
	3. Temperature Fluctuations	3. Check to see that incoming water, test jacket, filled cylinders and ambient air temperature are within 5 ^{0}F of each other.
Expansion Decreasing	1. Burst Disc is leaking.	1. Replace burst disc.
	2. Head Boot is not sealing against the jacket.	2. Check the inside sealing surface of the test jacket to ensure that the surface is smooth. Check the Head Boot for deformations.
	3. Leak in expansion plumbing.	3.Dry off all tubing with an air hose and check for drops of water.
	4. Temperature Fluctuations	4. Check the inside sealing surface of the test jacket to ensure that the surface is smooth. Check the Head Boot for deformations.

Table 6 - 2 Troubleshooting, continued

PROBLEM	POSSIBLE CAUSE	REMEDY
Expansion Decreasing (cont'd)	5. Bowl Drain Valve leaks	4. Remove plastic tubing from the bottom of the Drain Valve and check to see if water is dripping from the tube.
	6. Leak in Bleed Valve	5. Remove the tubing from the Bleed Valve. If drops begin to form at the elbow or end of the tubing when the system is pressurized, the valve needs to be re-built.
Expansion Unstable	1. Air trapped in expansion line	1. Flush Expansion Line by filling the bowl with water and removing the Head Seal to the jacket.
	2. Vibration	2. The Expansion bowl must be stable. If there is vibration coming through the floor or other sources, the scale and bowl must be isolated.
Pressure Decreasing	1. Leak in Bleed Valve	1. Remove the tubing from the Bleed Valve. If drops begin to form at the elbow or end of the tubing when the system is pressurized, the valve needs to be re-built.
	2. Leak in High Pressure tubing	2. Check all connections from the Test Console out to the jacket.
	3. Test head has a high pressure leak	3. Change test heads if possible. If the problem ceases, check the old head for leaks around the diaphragm and boot. If any leaks exist, repair the head.
Pressure Increasing	1. Pump continues to run after turning off pump speed control valve.	1. Turn the air to the pump off. If this stops The increase, repair or replace the pump speed control valve.
Pump will not Cycle	1. Low air pressure	1. Check the incoming air pressure.
	2. Restricted air volume	2. Check air lines for contamination and leaks.
No Scale Display	1. Power not connected	1. Connect power adapter
	2. Batteries are dead.	2. Replace batteries
Underweight Readings	1. Scale pan is off balance	1. Balance the pan and perform zero adjust.

Table 6 - 3 Troubleshooting, continued

PROBLEM	POSSIBLE CAUSE	REMEDY
Underweight Readings, cont'd	2. Scale is out of calibration	2. Re-calibrate scale
Incorrect Weight Readings	1. Balance was not re-zeroed before weighing.	1. Press TARE with no weight on pan, then weigh item.
	2. Scale out of calibration	2. Re-calibrate scale
Lo Bat Indicator	1. Batteries are weak	1. Replace batteries

6.9 Spare Parts

Common Parts for both High and Low Pressure Test Consoles:

01-11-2965	6' LOW PRESSURE HOSE
01-32-2531	1/2" SPEED SEALS
01-32-2532	1/2" S.S. WASHERS
01-32-2534	3/4" SPEED SEALS
01-32-2535	3/4" S.S. WASHERS
01-32-2537	1" SPEED SEALS
01-32-2538	1" S.S. WASHERS
01-32-2545	BRASS PROTECTOR NUT
01-41-2931A	COUPLER KIT HIGH AND LOW PRESSURE
01-41-3235	BURST DISK W/GASKET
01-41-3901	SNUBBER LINE
36-11-2500	11,000 PSI GAGE
37-11-3055	WATER PRESSURE REGULATOR
37-11-3058	HEAD SEAL PRESSURE REGULATOR
37-11-3064	AIR TO PUMP REGULATOR
38-11-5405	INLET CHECK VALVE REPAIR KIT
38-11-5406	OUTLET CHECK VALVE REPAIR KIT
40-87-6110N	CHECK VALVE O-RING
40-94-7505	LOW PRESSURE COUPLER SEAL
62-33-6862	S.S. JAM NUT
69-87-0021	HIGH PRESSURE COUPLER SEAL
80-11-0204	WATER FILTER ELEMENT
80-11-0205	AIR FILTER ELEMENT
81-11-0299	HIGH PRESSURE BLEED VALVE
81-11-1012	PANEL MTG. BALL VALVE
81-11-1013	3 WAY BALL VALVE
83-11-5010	OUTLET CHECK VALVE

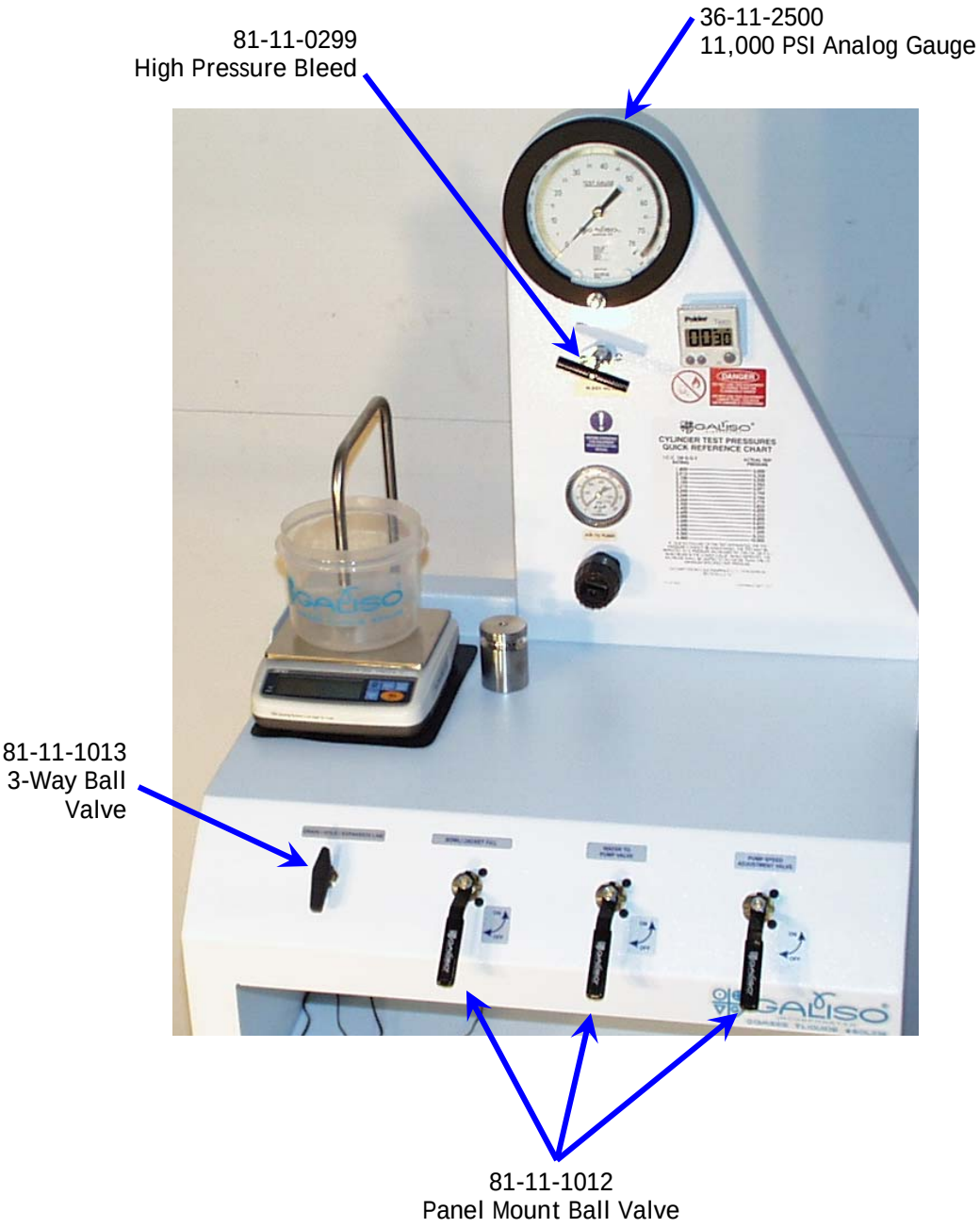
GTC 10K ModII parts:

38-11-3084	PUMP REPAIR KIT
40-11-3033	PUMP PISTON SEAL KIT
41-11-3010	6' HIGH PRESSURE HOSE
83-11-5009	INLET CHECK VALVE

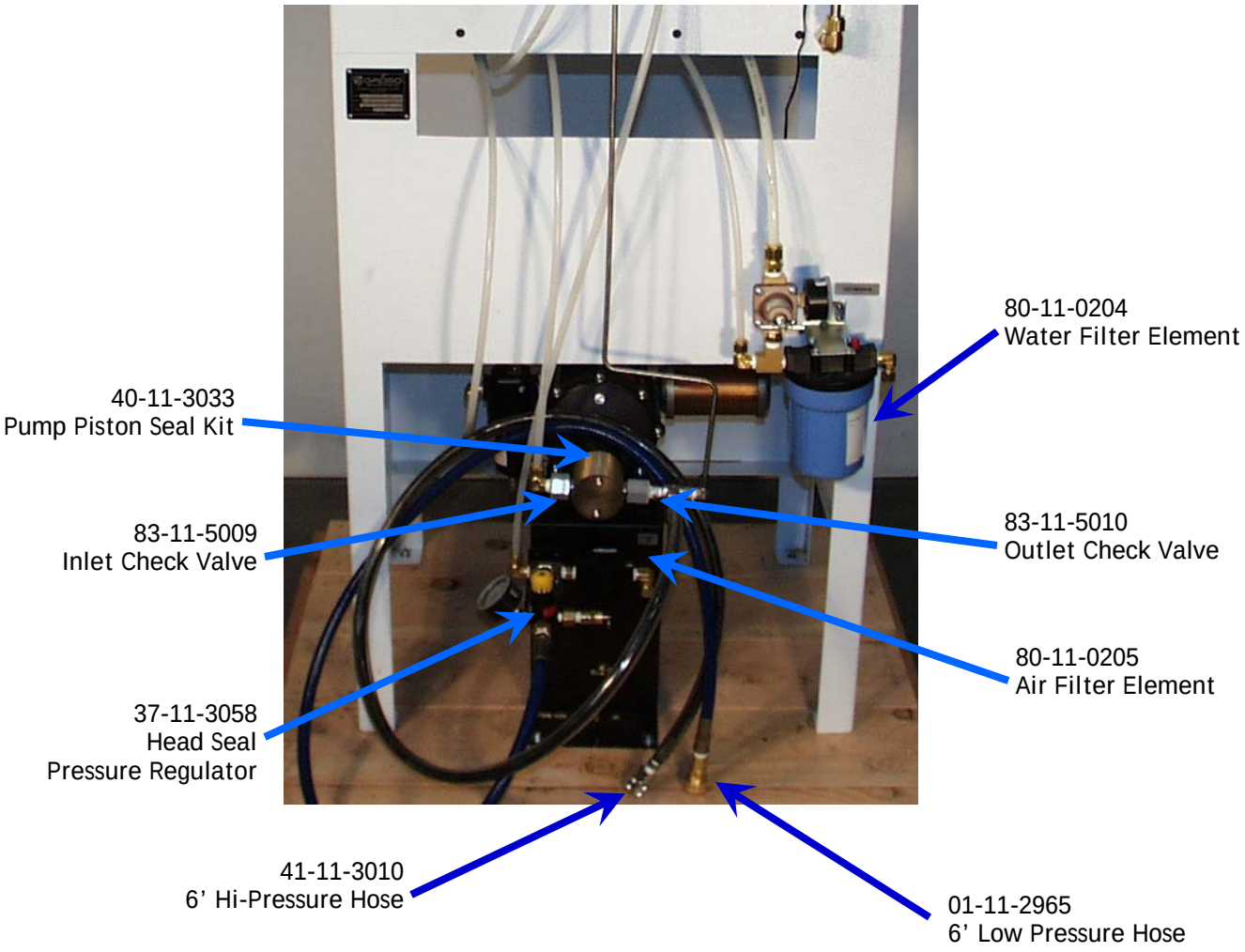
GTC 1200 parts:

41-11-3020 6’ High Pressure Hose (GTC 2200 also)
38-11-5569 Pump Repair Kit
38-11-5570 Pump Piston Seal Kit
36-11-1515 1500PSI Test Gauge
83-11-5012 Inlet Check Valve

Spare Parts Visual ID:



Spare Parts Visual ID continued:



7.1: Head Safety Interlock Option

This option ensures that the head is properly locked into the jacket safety elbows, before allowing tool controls to operate. Operator safety, and tool longevity is increased.
If your test system uses a 24" diameter, or larger, test jacket, then it is equipped with thumbscrews in the jacket safety bars. These are to prevent a "Floating Head" condition. Hand tightening the thumbscrews onto the Test Head Safety Bars, will help prevent faulty scale readings due to the head floating up, or rising, inside the jacket.
Test systems that include only one jacket, will operate the same as the standard GTC with Safety Interlock. Dual jacket systems will have a two position selector valve on the gauge panel, labeled "Test Jacket Select".
Operator will position valve to either "Jacket 1", or "Jacket 2", depending on which jacket is being used for testing. See Figure A2-1.
With the test head properly interlocked in the jacket, the actuator arm of the Safety Valve is positioned for cylinder testing operations.
You may now refer to the System Start Up Procedure (Pg 7-1), to commence testing.
Refer to subsequent Figures to further familiarize yourself with the Safety Interlock Option.

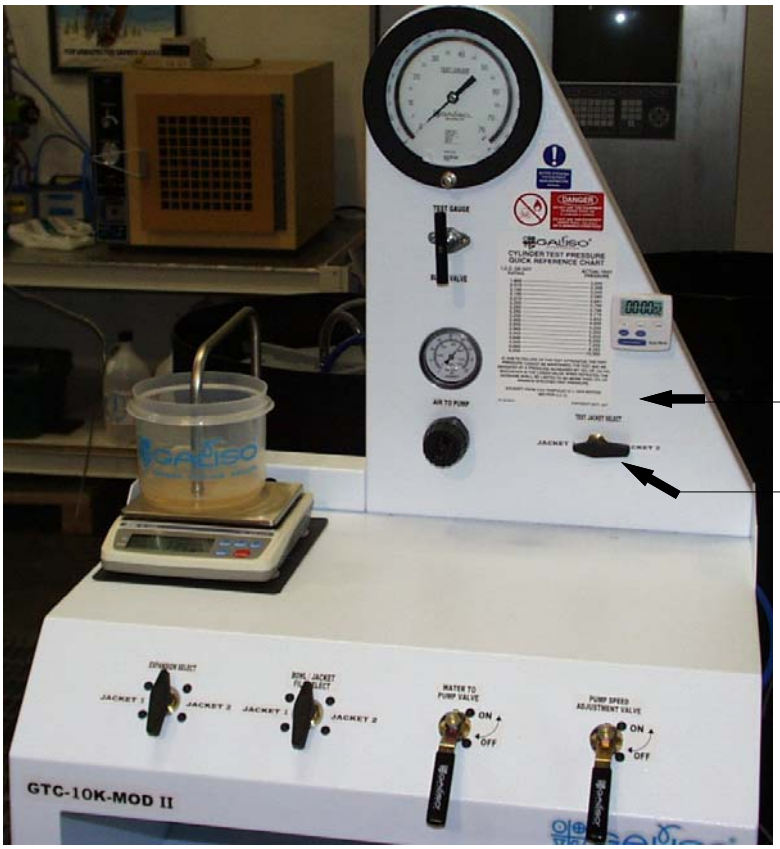


Figure 7-1 Valve Selection

Figure 7-2 Interlock Parts-Rear of Console

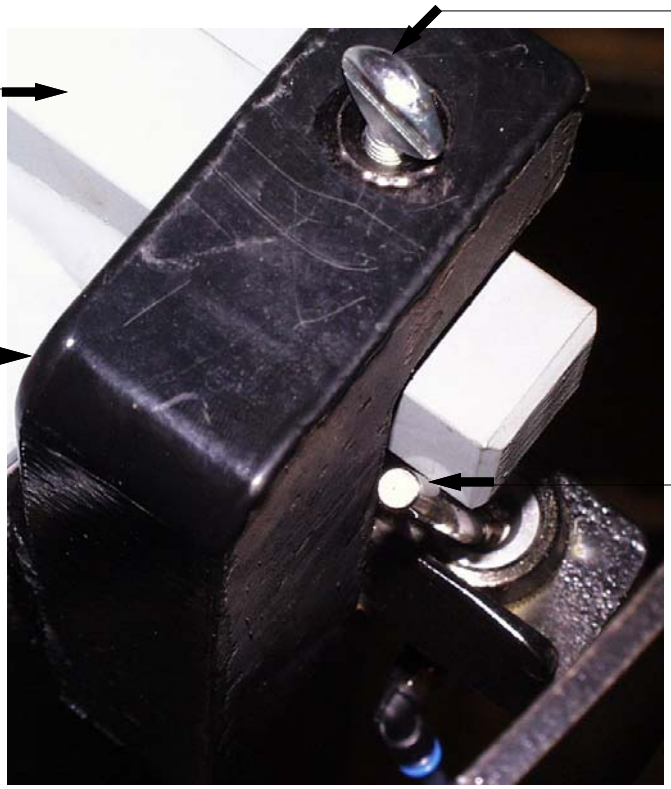


Figure 7-3 Interlock Actuator

8-1: QUICK REFERENCE DIAGRAM

.88" high digital display (4.5" case)
.60 high digital display (3" case)

Bar graph
% of full scale

Flashing display when unit pressured below zero

Press to indicate minimum or maximum pressure gauge has measured Press again to return to pressure units

Press to turn unit on or off

While in unit of measurement mode (eg:psi), press the ZERO CLEAR button to rezero the gauge. This feature functions when displayed pressure is within ±5% or 10% of zero value

Flashing display when unit pressurized beyond full scale

This bar graph indicates battery level; the more segments, the closer the battery is to full charge (only displayed on units with battery)

Press to read menu

Range on keypad; complies with ASME B40.7

UNITS (Pressure)
ENGLISH
INHG
PSI*
INH20
@ 4°C, 20°C, 60°F
FTW
FTSW
METRIC
BAR
MBAR
KPA
CMH20
KG/CM2

UPDATE RATE
(Pressure measurement per second)
10x (100MS)*
5x (200 MS)
2x (500ms)
1x (1 Sec)

AUTO OFF
(Turns unit off after option selected)
Never*
2 minutes
5 minutes
15 minutes
30 minutes

CALIBRATE
Zero and span adjustments, password protected

BACKLITE
(Off options)
Never
2 SEC
5 SEC
15 MIN
30 MIN

DAMPENING
(Takes pressure reading and averages process pressure)
None*
Avg 2
Avg 4
Avg 6
Avg 8

DISABLE
Allows for "lockout" of MENU options

* indicates default

8.2: KEYPAD FUNCTIONS

ON/OFF

Turns the gauge on and off. When pressing the ON/OFF key while in the off position, gauge start-up display first indicates the software version followed by the model number and gauge pressure range. The gauge will then display indicated pressure and be ready for use.

ZERO
CLR

Press this key for one second prior to gauge usage to re-zero any initial zero shift. If zero shift is greater than programmed zero allowance, the gauge will display **Ofset** (blinking) for one second, then return to the measure mode. To clear minimum and maximum values, press **ZERO/CLR** button (when min/max values are indicated). Gauge will auto advance once zeroed.

MAX/ MIN
▼

The **MAX/MIN** key allows review of minimum and maximum pressure values since unit star-up or last push of the clear key. Press key to:

1) Indicate maximum pressure.
2) Indicate minimum pressure.
3) Exit **MAX/MIN** mode and return the unit to pressure measurement mode. To clear minimum and maximum values press **ZERO/CLR** key (must be in **MAX/MIN** mode).

The ▼ (down arrow key) is used in the **MENU** mode; see following **MENU** section.

MENU

This key allows for customization of the gauge. Pressing the **MENU** key allows cycling through the main **MENU** items: **UNITS, CONFIG, GRAPH, OFF, UPDAT** & **DAMP.** Any item changed in the **MENU** becomes the new default setting(s). Revised settings are saved in the event of power loss.

The ▲ (up arrow key) or ▼ (down arrow key) on the keypad allows for scrolling through the **MENU** options to increase or decrease numeric values as required. If in the **MENU** mode, gauge will automatically advance to measure mode once selected **MENU** item has been set.

☼
▲
Key for gauge
With Backlite.

[Key for gauge
Without backlite
Displayed with
▲ (up arrow)
Icon only]

This key manually turns the **BACKLITE** on or off. Five options are available; they include: **NEVER, 10 SEC, 30 SEC, 1 MIN** & **5 MIN*.** With the **NEVER** option, the gauge **BACKLITE** will remain lit whenever the gauge is in the **ON** mode or until the **BACKLITE** button is pushed again. Options, **10 SEC, 30 SEC, 1 MIN** & **5 MIN*** allow the **BACKLITE** to automatically turn off after a selected period of time.

To use the **BACKLITE** option:

Step 1: Press the **MENU** key.
Step 2: Press the ▲ (up arrow key) or ▼ (down arrow key) until the word **LITE** appears.
Step 3: Press **ENTER.**
Step 4: Press the ▲ (up arrow key) or ▼ (down arrow key) to select the **BACKLITE** option.
Step 5: Press the **ENTER** key to finalize your choice of **LITE** options.

ENTER

This key allows for selecting the gauge features in the **MENU** finalizing selection. Use of the **ENTER** key is described throughout the operating instructions.

MENU OPTIONS

UNITS: 12 units of measurement are available: **psi, mmHg, inH_20** (with three temperature options: **20^{O}C, 60^{O}F, 4^{O}C*), mBar, inHg, ftH_20, mPa, kPa, kg/cm^2** and **bar.**

STEP 1: Press the **MENU** key until the word **UNITS** appears.
STEP 2: Press **ENTER.**
STEP 3: Press the ▲ (up arrow key) or ▼ (down arrow key) to select the required unit of measure.
STEP 4: Press **ENTER** to finalize the **UNIT** selection.

*Note: For **inH_20** range with three temperature options, press the ▲ (up arrow key) or ▼ (down arrow key) to select the desired temperature. Then press **ENTER** to finalize the **UNIT** selection.*

CONFIG: This option allows access to additional **MENU** options. Options include:

- **ENTPW** or "enter password" *(this appears as a sub-menu in the **CONFIG** mode if a user password has been set).*
- **RECAL** allows for zero, span and mid-scale calibration of the gauge).
- **ObUNT (**or **ZERO** key) allows for adjustment of % of range that can be zeroed.
- **diSAb** allows for disabling **MENU** options.

SETPW allows for a user defined numeric password. If a user password is not set, all features in the **CONFIG** mode will be accessible without a password. If a user password is set, all items in the **CONFIG** menu options are accessible with or without a user password. If a user password is programmed, it will be required to access the **CONFIG** menu options**.**

MENU FUNCTIONS

How to Use Your Menu Functions

To set a user password (SETPW):

Step 1: Press the **MENU** key on the keypad.
Step 2: Press the ▲ (up arrow key) or ▼ (down arrow key) until the word **CONFIG** appears.
Step 3: Press **ENTER.** The word **SETPW** appears on the gauge display.
Step 4: Press **ENTER.** A five-digit numeric password is now required
Step 5: Press the ▲ (up arrow key) or ▼ (down arrow key) on the keypad to select the first digit of the password.
Step 6: Press **ENTER.**
Step 7: Repeat until the five-digit password is shown on the gauge display.
Step 8: Press **ENTER.**

*Note: to erase password at any time while in the **SETPW** (set password) mode. Press the **ZERO/CLEAR** key. The user will be prompted to reprogram the password once the five-digit password is entered. The gauge will display **SAVE.***

Step 9: Press **ENTER** to save the password setting.

ENTPW: Once a user password has been established and entry into the **CONFIG** mode is required, the user will be prompted to **ENTPW** (or "enter password"). **Follow steps 4-8 above.**

RECAL (or "recalibrate")**:** Allows for zero, mid-scale, full-scale and factory default calibration of the gauge. The **RECAL** feature also allows for recalibration of gauges with 4-20mA output.

To use the RECAL option:

Step 1: Press the **MENU** key on the keypad.
Step 2: Press the ▲ (up arrow key) or ▼ (down arrow key) on the keypad until the word **CONFIG** appears.
Step 3: Press **ENTER.**
Step 4: Enter user password if it has been programmed.
Step 5: Press the ▲ (up arrow key) or ▼ (down arrow key) until the word **RECAL** appears.
Step 6: Press **ENTER**
Step 7: The gauge will now flash between **INPUT** and unit of measure on the lower line and .00 on the top line. Apply zero pressure to the gauge.
Step 8: Press **ENTER.** Zero pressure is now set.
Step 9: The gauge will display full-scale pressure. Apply full scale pressure to the gauge.
Step 10: Press **ENTER.** Full scale pressure is now set.
Step 11: The gauge will now display mid-scale pressure. Apply mid-scale pressure to the gauge.
Step 12: Press **ENTER.** Mid-scale pressure is now set.

Note: For compound ranges this will be full vac.

FOR FACTORY CALIBRATED SETTINGS:

Step 13: To reinstate factory calibrated settings for zero, full-scale and mid-scale press the ▼ (down arrow key) **MENU** key until the word **FACT** appears.
Step 14: Press **ENTER.** Factory calibration settings are now reinstated.
Step 15: After zero, full-scale and/or mid-scale or factory default calibration have been set, the word **SAVE** appears on the gauge display.
Step 16: Press **ENTER** to finalize calibration.

*Note: Calibration of Zero, mid-scale or span can be set independently of each other. For instance, if only half scale calibration is required, press the ▼ (down arrow key) until the gauge indicates full-scale pressure. Press **ENTER** and proceed as indicated above. Calibration of zero, mid-scale and full-scale is recommended when recalibrating the gauge.*

ZERO KEY (ObUTN): This feature allows the user to select percent of full-scale at which the gauge can be re-zeroed using the **ZERO/CLEAR** key on the keypad. Options include: **5% FULL-SCALE*, 10% FULL-SCALE** or **DISAB** (“disable” of the **ZERO** key).

To use the ZERO option:

Step 1: Press the **MENU** key on the keypad.
Step 2: Press the ▲ (up arrow key) or ▼ (down arrow key) on the keypad until the word **CONFIG** appears.
Step 3: Press **ENTER.**
Step 4: Enter user password if it has been programmed.
Step 5: Press the ▲ (up arrow key) or ▼ (down arrow key) until the word **ObUTN** appears.
Step 6: Press **ENTER.**
Step 7: Press the ▲ (up arrow key) or ▼ (down arrow key) to select **5PCT**- (5% full-scale), **dISAb** (disable zero key) or **10PCT** (10% full-scale).
Step 8: Press **ENTER** to finalize the selection.

DISAB (or "disable"): This feature allows the user to **dISAb** ("disable") or **ENAb** ("enable") items in the **MENU.** Some keypad keys can also be enabled or disabled. Any or all **MENU** items can be enabled or disabled.

To use the DISAB option:

Step 1: Press the **MENU** key on the keypad.
Step 2: Press the ▲ (up arrow key) or ▼ (down arrow key) on the keypad until the word **dISAb** appears.
Step 3: Press **ENTER.** The current setting (**ENAb** or **dISAB**) will be displayed.
Step 4: Press the ▲ (up arrow key) or ▼ (down arrow key) on the keypad to select a setting.
Step 5: Press **ENTER** to finalize the selection.

GRAPH: This option allows the user to change the **BAR** graph on the gauge display to correspond to any desired pressure within the pressure limits of the gauge. This option is useful when identifying a select portion of the full-scale range of the gauge. The default setting of the **GRAPH** is zero and full scale pressure. For compound gauges, the default setting for zero is set at full-scale vacuum. Full-scale pressure is set at the positive pressure as displayed on the gauge keypad.

For gauges supplied with the 4-20mA output option, the default is 4mA equals 0% of the bar graph and 20 mA equals 100% of the bar graph.

Note: Changing the graph to a pressure other than 0 and 100% of range will also change the4-20 mA output to correspond with the new bar graph pressures for 0 and 100%.

To use GRAPH option:

Step 1: Press the **MENU** key on the keypad.
Step 2: Press the ▲ (up arrow key) or ▼ (down arrow key) on the keypad until the word **GRAPH** appears.
Step 3: Press **ENTER.** The gauge display will indicate the set full-scale pressure range setting on the top line. The middle line indicates the bar graph at 100% of full-scale. The bottom line of the display will indicate **SETFS** to set the full-scale range as dis played by the bar graph and 4-20 mA.
Step 4: Press the ▲ (up arrow key) or ▼ (down arrow key) on the keypad to increase or decrease gauge value at 100% of range.
Step 5: Press the **ENTER** key to finalize your choice**.** The gauge display will now display **SET.** After two seconds the screen will display the pressure value for 0% on the top line. The middle line indicates the bar graph at 100% of full-scale. The bottom line will display **SET 0.**
Step 6: Press the ▲ (up arrow key) or ▼ (down arrow key) on the keypad to increase or decrease gauge value at 0% of range.
Step 7: Press the **ENTER** key to finalize your choice. The new values for the bar graph and the 4-20 mA settings have now been saved.

OFF: This option sets the amount of time before the gauge will turn itself off. Offerings are: **NEVER*, 30MIN, 10MIN, 5MIN, and 2MIN.**

To use the OFF option:

Step 1: Press the **MENU** key.
Step 2: Press the ▲ (up arrow key) or ▼ (down arrow key) on the keypad until the word **OFF** appears.
Step 3: Press **ENTER.**
Step 4: Press the ▲ (up arrow key) or ▼ (down arrow key) to select the desired **OFF** time.
Step 5: Press **ENTER** to finalize the **OFF** setting.

UPDATE: This option allows for changing the rate at which pressure is updated on the display screen. This feature is useful with rapid changes in process pressure that may cause flutter on the display. Options are: **100ms*, 1 sec, 500ms and 200ms, updates per second or 100ms*.** Since customer processes vary, update rates should be selected based on the application.

To use the UPDATE option:

Step 1: Press the **MENU** key.
Step 2: Press the ▲ (up arrow key) or ▼ (down arrow key) until the word **UPDATE** appears.
Step 3: Press **ENTER.**
Step 4: Press the ▲ (up arrow key) or ▼ (down arrow key) to select the update rate.
Step 5: Press **ENTER** to finalize the selection.

DAMP (or "dampening"): This mode has five different options. This mode allows for taking process pressure readings and averaging them. This option is particularly useful to stabilize minor process fluctuations. The options are: **NONE**[*], **AVG 8, AVG 6, AVG 4** and **AVG 2.**

To use the DAMP option:

Step 1: Press the **MENU** key until the word **dAMP** appears.
Step 2: Press **ENTER.**
Step 3: Press the ▲ (up arrow key) or ▼ (down arrow key) to select a dampening option.
Step 4: Press **ENTER** to finalize your **DAMP** option

(The following MENU item is only seen on units with the switch option.)

SWSET: Allows for setting switch set-points. The gauge is offered with one or two **SPDT** switches. If 1 (one) **SPDT** switch is ordered the **MENU** option is **SW1.** if 2 (two) **SPDT** switches are ordered, the **MENU** options are **SW1** and **SW2.**

To use the SWSET OPTION:

Step 1: Press the **MENU** key.
Step 2: Press the ▲ (up arrow key) or ▼ (down arrow key) on the keypad to select the switch to be set (if two switches are present).
Step 3: Press **ENTER.** The top line of the gauge display will indicate pressure at **60% OF THE FULL-SCALE GAUGE RANGE*** or the **MOST RECENT SWITCH SET-POINT**. The middle line of the disposition will indicate a bar graph that displays the pressure position within the pressure range. The bottom line will display **SETPT** (blinking).

Note: Set-points are limited to the full-scale pressure range of the gauge.

Step 4: Press the ▲ (up arrow key) or ▼ (down arrow key) on the keypad to increase or decrease switch set-point.
Step 5: Press **ENTER** to finalize the switch set-point. The gauge will display **SET.** After two seconds the top line will indicate **RETRP** pressure. The bottom line will read **SET.**
STEP 6: Repeat the above steps to set **RETRP** (re-trip value). If the gauge is supplied with 1 (one) set-point, the screen will advance to the measurement mode. If 2 (two) switches are supplied, the screen will advance to **SW2.**

Repeat the aforementioned if the gauge is supplied with two switches.

Note: The bar graph will increase or decrease as any set-point pressure is adjusted. The bar graph indicates switch set-point position within the full-scale range of the gauge.

*The switch set-point unit of pressure measurement corresponds with the current set unit of measure of the gauge. If gauge unit of measurement is changed after switch (es) is/are set, switch set-point(s) will automatically be updated to correspond with revised unit of measurement. Switch dead-band is the difference between the **SETPT** (set-point) and the **RETRP** (re-trip) pressure.*

3” Gauge:

The 3” gauge case uses a quantity of 2—AA alkaline batteries. Approximate battery life is 1500 hours. The gauge has approximately 7 hours of use left, when the lower bar flashes on the battery icon.

Replacement:

Step 1: Remove the single screw on the back of the case.
Step 2: Hold the keypad in hand.
Step 3: Carefully remove the two batteries from the holder, and replace with new. Use only AA Alkaline Non-Rechargeable batteries.

4.5” Gauge:

The 4.5” gauge uses a quantity of 2 C Batteries. Use only Alkaline, Non-Rechargeable batteries. Approximate battery life is 3600 hours. The gauge has approximately 7 hours of use left, when the lower bar flashes on the battery icon.

Replacement:

Step 1: Remove the ring on the front of the gauge case.
Step 2: Carefully pull the front face out of the case.
Step 3: Carefully remove the 2 batteries and replace them.

General Notes for both gauges:

1) Never replace only one battery.
2) Do not mix ages or brands of batteries.
3) Do not replace batteries in hazardous areas.