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C-A OPERATIONS PROCEDURES MANUAL

2.33 Installation and Use of Squat Line and GRIPTITE Pressurization Plugs at Pressures ≤ 100 psig

Text Pages 2 through 9

Attachments

Hand Processed Changes

<u>HPC No.</u>	<u>Date</u>	<u>Page Nos.</u>	<u>Initials</u>
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Approved: _____ *Signature on File* _____
Collider-Accelerator Department Chairman Date

G. McIntyre

2.33 Installation and Use of Squat Line and GRIPTITE Pressurization Plugs at Pressures ≤ 100 psig

1. Purpose

This procedure covers the installation and use of the Expansion Seal Technologies (EST) Squat Line, Part Numbers SQL-0271-N, SQL-0216-N, and GRIPTITE, Part Number GT25P10-N, High Pressure Plugs with high pressure helium or nitrogen gas (**not to exceed 100 psig**), during the pressure and vacuum leak checking of the interconnect supply, return, utility and heat shield helium lines. This OPM may be used for any procedure requiring a pressure indicated as an increment in section 5.3. After achieving the desired incremental pressure by following the steps in section 5.3, paragraph 5.3.6 should be followed to vent the system.

2. Responsibilities

Persons installing and pressurizing the EST Squat Line and GRIPTITE High Pressure Plugs are responsible for following this procedure.

3. Prerequisites

3.1 All personnel involved in implementing this procedure shall have been trained on this procedure, and the equipment, by the cognizant engineer, or the cognizant technical supervisor. A list of personnel trained in this procedure shall be maintained by the cognizant technical supervisor.

3.2 The test operator shall ensure only personnel required for the test enter the restricted area while the test article is pressurized.

3.3 Required Tools

- A. Wrench, Torque $\frac{1}{2}$ " drive; having a maximum torque setting of at least 75 ft-lbs.
- B. Lubricant, Anti-seize, Moly-disulfide or equivalent.
- C. Attachment, Crowsfoot Open End Wrenches; (1 $\frac{7}{8}$ " for SQL-0271-N and GT25P10-N, and 1 $\frac{5}{16}$ " for SQL-0216-N) with $\frac{1}{2}$ " square drive.
- D. Plug, EST Squat Line High Pressure, with neoprene seal, appropriate size SQL-0271-N for 2.71" I.D. pipe (2.5 NPS, Schedule 5) and SQL-0216-N for 2.16" I.D. pipe (2.0 NPS, Schedule 10).
- E. Plug, EST GRIPTITE High Pressure, with neoprene seal, appropriate size GT25P10-N for 2.60" I.D. pipe (2.5 NPS, Schedule 10).
- F. EST Collar and clamp type restraints with chain (SFB-0200-01 for 2.0" NPS pipe and SFB-0250-01 for 2.5" NPS pipe).
- G. Tape, Caution (BNL #K-72110).
- H. Full Faceshield, Adjustable headband

4. Precautions

WARNING 1:

Use extreme caution when working with any type of high-pressure test equipment. An incorrectly installed Squat Line or GRIPTITE high pressure plug may cause the high pressure plug to be explosively ejected from the tube, pipe or vessel.

WARNING 2:

Failure to follow these operating procedures explicitly could result in catastrophic injury and possibly death.

WARNING 3:

Line to be pressurized with these plugs must be investigated to verify the lines don't branch into other systems (i.e. taps in re-coolers or relief valves) that may not be made to withstand the stated test pressure.

WARNING 4:

Never put hands, fingers or any body part over a possible leak. Leaking high pressure gas through a small opening can cause severe lacerations and other injuries.

- 4.1 The Squat Line and GRIPTITE High Pressure Plugs (High Pressure Plugs, hereafter) must be sized correctly for the tube being tested (see Table 1).
- 4.2 The inside diameter of the tube must be clean and dry. The outside surface of the High Pressure Plug must be clean and dry.
- 4.3 When pressure testing all non-test personnel must stay away, a minimum of 50 feet, from the High Pressure Plugs and immediate test area.
- 4.4 Test personnel must stay clear of the ends of the tube(s) under test and obey all safety precautions and warnings.
- 4.5 Immediately abort all pressure testing and relieve the pressure if the High Pressure Plug moves more than 1/8 inch during pressurization.
- 4.6 When system is under pressure, do not, under any circumstances, attempt to adjust, move, or change the High Pressure Plug in anyway, shape, or form.
- 4.7 Ensure all pressure is released from the tube prior to loosening the compression nut on the High Pressure Plugs.
- 4.8 Do not exceed the maximum test pressure 100 psig.

5. Procedure

5.1 Configuring High Pressure Plugs for Testing Operations

High Pressure Plugs are supplied with a ported Support Shaft with a High Pressure Pipe Cap lightly threaded onto the end. Prior to testing the operator must determine the actual function of each High Pressure Plug.

WARNING 1:

Squat Line Plugs SQL-0271-N must be used in 2.5" NPS pipe with a schedule 5 wall (0.083" thick wall) and GRIPTITE Plugs GT25P10-N must be used on 2.5" NPS pipe with a schedule 10 wall (0.109" thick wall). Squat Line Plugs SQL-0216-N must be used on 2.0" NPS pipe with a schedule 10-wall (0.109" thick wall). An incorrectly installed squat line high-pressure plug may cause the squat line high-pressure plug to be explosively ejected from the tube, pipe or vessel.

WARNING 2:

Failure to follow these operating procedures explicitly could result in catastrophic injury and possibly death.

WARNING 3:

Line to be pressurized with these plugs must be investigated to verify the lines don't branch into other systems (i.e. taps in re-coolers or relief valves) that may not be made to withstand the stated test pressure.

- 5.1.1 Four (4) High Pressure Plugs (three (3) Squat Line SQL-0271-N or GRIPTITE GT25P10-N, and one (1) SQL-0216-N) will be used as a ported plug (i.e., a High Pressure Plug through which the operator will inject the test gas). The threaded pipe plug shall be removed, and properly rated hose fittings or Quick Disconnect fittings (either may be used) must be carefully threaded onto the High Pressure Plug. All threads shall be sealed with hydraulic thread sealant. Testing will begin only after the hydraulic thread sealant has had sufficient time to cure, at least 4 hours.
- 5.1.2 Four (4) High Pressure Plugs (three (3) Squat Line SQL-0271-N or GT25P10-N, and one (1) SQL-0216-N) are to be utilized as solid plugs. The threaded pipe plug shall be removed, hydraulic thread sealant shall be liberally spread onto the pipe threads and the threaded pipe plug shall be firmly threaded onto the High Pressure Plug. Testing will begin only after the hydraulic thread sealant has had sufficient time to cure, at least 4 hours.

5.2 Installation Procedure

NOTE:
Refer to Attachments 1 and 2 for part names and configurations.

WARNING:
The inside diameter of the tube must be clean and dry. An incorrectly installed high-pressure plug may cause the high-pressure plug to be explosively ejected from the tube.

- 5.2.1 Inspect the High Pressure Plug for wear and replace any worn components. **Any component which is worn or damaged must be replaced before attempting any further testing.** Contact the factory for Part Lists and additional information on the replacement of worn or damaged parts.

WARNING:
Failure to Replace worn or damaged components may affect the ability of the high pressure plug to hold pressure, and may cause injury or damage to persons or property in the test area.

- 5.2.2 Prepare the tube end. High Pressure Plugs are to be installed in a clean, dry tube end. Any scale or moisture present must be removed prior to testing. Any scale or moisture present may interfere with the gripper action of the High Pressure Plug and may reduce the pressure that the High Pressure Plug will be capable of holding. The High Pressure Plug and pipe bore must be inspected for damage. The High Pressure Plug's seal and grippers must be checked for nicks, gouges and misalignment. The pipe inner diameter must be inspected for scrapes, thinning of the pipe wall and expanding of the pipe's outer diameter. If the damage, as described above, occurs contact your supervisor.

WARNING:
Failure to use anti-seize lubricant may cause an incomplete torque transmittal, which will result in a decrease in the high pressure plug rating.

- 5.2.3 To insure that all installation torque is transmitted to the grippers, liberally spread anti-seize lubricant over both sides of the brass Anti-Gall Washer and onto the threads of the shaft. Use caution when applying the lubricant and handling the High Pressure Plug after lubrication. The lubricant must not come in contact with the gripper segments, neoprene seal or tube I.D., if so, the High Pressure Plug must be disassembled and cleaned.

- 5.2.4 Install the correct size High Pressure Plug into the end of tube being tested. A correctly sized, check Table 1, High Pressure Plug is one that is .030" to .075" (.76 mm to 1.91 mm) smaller than the actual tube I.D. Slide the appropriate size collar clamps on to the tube ends.

WARNING:
Failure to leave an approximately 1/8 inch gap between the positioning washer and the tube end may result in a decreased pressure rating.

- 5.2.5 Position the High Pressure Plug in the tube allowing approximately 1/8" (3 mm) between the tube end and the Positioning Washer. The Positioning Washer is strictly to prohibit the High Pressure Plug from falling into the pipe and must not be butted against the tube end.
- 5.2.6 Using an appropriate open-end crowsfoot wrench (see Table 1), begin tightening the large Compression Nut on the High Pressure Plug. This will cause the Gripper segments to expand outward. When the Grippers contact the tube wall the seal material will expand and seal the tube. Note: The Seal will not expand when the High Pressure Plug is outside the tube.

WARNING:
Failure to apply the installation torques specified in Table 1 may result in the high pressure plug being explosively ejected from the tube and may cause injury to persons or property in the test area.

CAUTION:
To avoid damage to the tube do not exceed installation torque values by more than 5%.

- 5.2.7 Using a torque wrench and the appropriate open-end crowsfoot wrench (see Table 1), continue tightening the large Compression Nut to the prescribed installation torque of 50 ft.-lbs (Table 1).

WARNING:
Failure to properly install the collar clamps and chains may result in the high pressure plug being explosively ejected from the pipe and may cause injury to persons or property in the test area.

- 5.2.8 Move the collar clamps about the pipe end such that the clamp is less than ½" from the pipe opening containing the plug. The larger clamps (SFB-0250-01) shall be fit around the 2.5" NPS pipes and smaller clamps (SFG-0200-01) shall be fit around the 2.0" NPS pipes. Tighten the clamp bolts to a torque of 35 ft.-lbs. Pull the clamp chain taut towards the plug's port. Pass a link of the chain over the port such that the chain is as tight as possible for the clamp's bolted position. During pressurization there may be some settling of the High Pressure Plug.

- 5.2.9 Verify the necessary restraint fixtures are installed. String Caution Tape across the tunnel a minimum of 50 feet from either end of the magnet string being pressurized. The test operator shall ensure only personnel required for the test enter this restricted area while the test article is pressurized.

5.3 Pressure Testing

WARNING:

If at any time during pressurization or testing the High Pressure Plug moves more than a total of one-eighth of an inch (.125" or 3 mm) the test must be halted and the pressure released immediately. The High Pressure Plug and pipe bore must be inspected for damage. The installation procedure should be reviewed prior to reattempting the pressure test. If the situation continues contact your supervisor.

- 5.3.1 Connect the pressure source to the High Pressure Plug using a regulator with a calibrated gauge, a bleed valve and a calibrated relief valve. The relief valve shall prevent the line pressure from exceeding 105 psig.

WARNING 1:

When pressure testing, all non-test personnel shall remain a minimum of 50 feet away from the immediate test area. Only authorized test personnel are permitted in the immediate test area when a high pressure plug is pressurized.

WARNING 2:

Never attempt to loosen or adjust the high pressure plug while under pressure.

NOTE:

If the required pressure indicated in the document referencing this procedure is less than 100 psi, stop at the referencing document's required pressure. When the pressure is to be released, follow step 5.3.4 below and continue with this procedure.

- 5.3.2 Slowly increase gage pressure to 30 psi. Standing out of the line of potential ejection, inspect the High Pressure Plugs to ensure it has not moved more than 1/8". Pause two to three minutes to equalize piping strains.
- 5.3.3 Slowly increase gage pressure to 100 psi. Standing out of the line of potential ejection, inspect the High Pressure Plugs to ensure it has not moved more than 1/8". Pause two to three minutes to equalize piping strains.

WARNING 1:

When pressure testing all non-test personnel shall remain a minimum of 50 feet from the immediate test area. Only authorized test personnel are permitted in the immediate test area when a high pressure plug is pressurized.

WARNING 2:

Never attempt to loosen or adjust the high pressure plus while under pressure.

- 5.3.4 Inspect the line joints and connections for leakage, maintaining the test pressure for at least 10 minutes. Be careful not to place any body part in line with the High Pressure Plugs under pressure.
- 5.3.5 If this OPM is used in conjunction with a pressure leak check, leak checking shall be executed when the leak check pressure is reached. This pressure shall be detailed in the leak check procedure.
- 5.3.6 After test completion, release all test pressure from the pipe.

5.4 Removal

WARNING:

Failure to release all pressure from the pipe may result in the high pressure plug being explosively ejected from the pipe when the compression nut is loosened. Never attempt to loosen or adjust the high pressure plug while under pressure.

- 5.4.1 Release all test pressure from the pipe.
- 5.4.2 Relax the seal and grippers by loosening the compression nut. Remove the High Pressure Plug clamps and chains.
- 5.4.3 Withdraw the High Pressure Plug from the pipe end.

WARNING:

Failure to Replace worn or damaged components may affect the ability of the High Pressure Plug to hold pressure and may cause injury or damage to persons or property in the test area.

- 5.4.4 Inspect the High Pressure Plug for wear and replace any worn components. **Any component which is worn or damaged must be replaced before attempting any further testing.** Contact the factory for

Part Lists and additional information on the replacement of worn or damaged parts.

5.4.5 Follow steps 5.2 through 5.4 for additional lines to be tested.

TABLE 1

Pipe I.D. Size Range (in.)	E.S.T. Squat Line Part Number	Open End Crowfoot Wrench Size	Installation Torque (ft.- lbs)*	Maximum Operating Pressures (psig)**
2.12 to 2.60	SQL-0216-N	1 5/16"	50	100
2.67 to 2.77	SQL-0271-N	1 7/8"	50	100
2.61 to 2.74	GT25P10-N	1 7/8"	50	100

* - TO AVOID DAMAGE DO NOT EXCEED INSTALLATION TORQUE VALUES BY MORE THAN 5% (5 FT-LBS).

** - MAXIMUM OPERATING PRESSURES HAVE BEEN DETERMINED FROM TESTS PERFORMED IN CLEAN, DRY, ASTM A-269 STAINLESS STEEL PIPE USING NEOPRENE SEALS.

6. Documentation

None

7. References

None

8. Attachments

1. Squat Line Parts List Type 3
2. Squat Line Type 3 High Pressure Test Plug.
3. E.S.T. GRIPTITE Operating Procedure DC2510, Page 1 only. Page 2 not applicable for Neoprene seals.

Attachment 1

Squat Line Parts List Type 3

SIZE RANGE: 1.13 - 6.50
SQL-XXXX-M

ITEM	QUANTITY	DESCRIPTION	PART NUMBER
2	1	COMPRESSION WASHER	
3	1	SEAL, STANDARD (SIZE 1.13 - 4.50) - URETHANE (SIZE 4.51 - 6.50) - NEOPRENE	SQL-XXXX-URS SQL-XXXX-NRS
4	2	CONE	
5	1	GRIPPERS	
6	1	GARTER SPRING	SQL-XXXX-TT
7	1	POSITIONING WASHER	
8	1	SHAFT, SEE TABLE 1 FOR SHAFT SIZE	
10	1	ANTIGALL WASHER	
11	1	COMPRESSION NUT	
12	1	HIGH PRESSURE PIPE CAP	
	1	REPLACEMENT GRIPPER ASSEMBLY INCLUDES ITEMS #5 - GRIPPERS #6 - GARTER SPRING	SQL-XXXX-GR

"XXXX" = TUBE I.D. ROUNDED TO (2) DECIMAL PLACES XX.XX

"M" = SEAL MATERIAL DESIGNATION

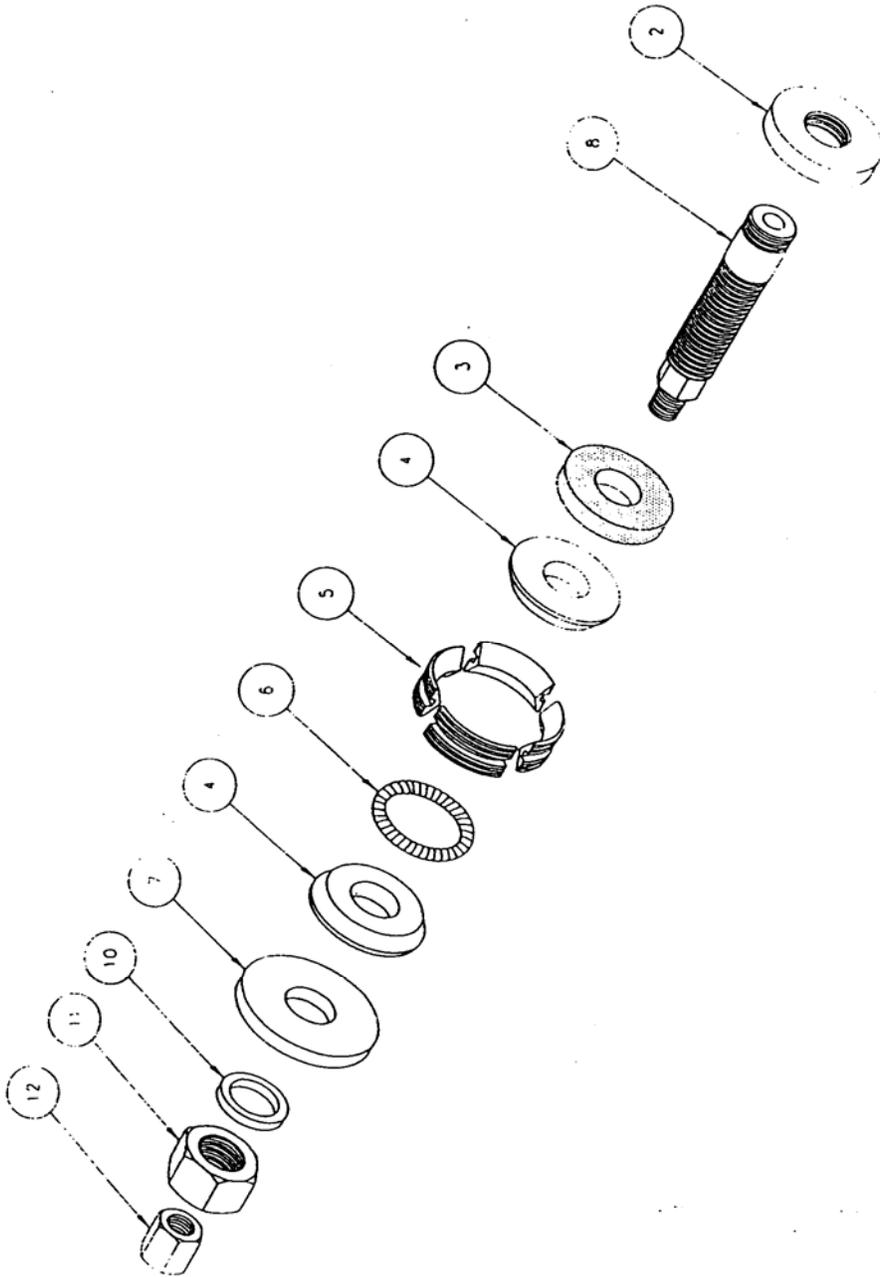
B - BUNA-N
N - NEOPRENE
S - SILICONE
U - URETHANE
V - FLUROELASTOMER (VITON
OR EQUIVALENT)

TABLE 1

<u>I.D. RANGE</u>	<u>SHAFT SIZE</u>
1.13 - 1.40	5/8
1.41 - 2.60	7/8
2.61 - 4.50	1-1/4
4.51 - 6.50	1-1/2

Attachment 2

Squat Line Type 3 High Pressure Test Plug



Attachment 3

EXPANSION SEAL TECHNOLOGIES

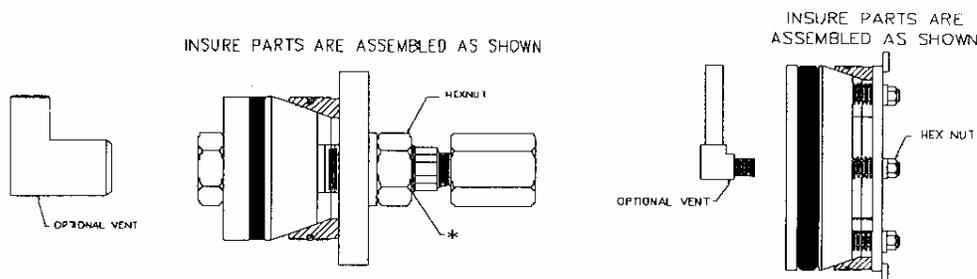
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OPERATING PROCEDURES FOR GRIP TIGHT HIGH PRESSURE TEST PLUGS

Contact E.S.T. Customer Service at (USA) 800/355-7044, (Outside USA) 215/513-4300 - between 8:00 am - 5:30 PM Eastern Time, (Europe) 31-(0)-3328-67147 - between 8:00 am - 5:30 PM Central European Time with any questions.



WARNING: FOR PROPER OPERATION, GRIP TIGHT PLUGS MUST BE ASSEMBLED AS SHOWN.

- ◆ **PRESSURE TESTING IS INHERENTLY DANGEROUS. STRICT ADHERENCE TO THESE OPERATION INSTRUCTIONS AND INDUSTRY SAFETY PRACTICES COULD PREVENT INJURY TO PERSONNEL**
 - ◆ **ALL PERSONNEL MUST BE CLEAR OF TEST PLUG WHEN PRESSURE TESTING**
 - ◆ **FOR SAFETY, AN INCOMPRESSIBLE LIQUID SUCH AS WATER SHOULD BE USED AS THE TEST MEDIUM. RESIDUAL AIR OR GAS IS TO BE EVACUATED FROM THE PIPE PRIOR TO TESTING. IN NON-VERTICAL APPLICATIONS THE OPTIONAL VENT, SHOWN ABOVE, WILL ALLOW FOR VENTING MOST AIR OR GAS.**
1. PRIOR TO USE, replace damaged or worn grippers and seal. The surface between the cone and grippers must be free of friction producing dirt or corrosion. Verify proper operation of the test plug by hand tightening the hex nut(s) so that the grippers move freely to the end of the tapered cone surface. Threads should be kept well lubricated with anti-seize. Inspect threads and apply anti-seize if necessary before testing. If the nut cannot be easily advanced to allow full gripper expansion, **DO NOT USE THIS PLUG FOR TESTING** and contact the factory.
 2. The pipe i.d. to be tested must be within the limits specified on the plug. Schedule 5 wall thickness pipe, or tubes with a wall thickness thinner than equivalent schedule 10 pipe, must have an o.d. restraint. Contact factory for information. Position the test plug in clean, lubricant free pipe end so that all of the gripper teeth are within the pipe.
 3. Center the plug within the pipe while hand tightening the hex nut(s). On multi-shaft plugs used horizontally, tightening the bottom hex nuts first will aid in centering the plug. Tighten hex nut(s) until the test plug has gripped the pipe i.d. The hex nuts on plugs with multiple shafts must be tightened in star pattern. Slight wiggling of the hand tightened plug may allow further hand tightening of the hex nuts.
 4. Tighten the hex nut(s) to the installation torque specified in Table 1. Use of a calibrated torque wrench is recommended. **FAILURE TO APPLY THE INSTALLATION TORQUE SPECIFIED IN TABLE 1 COULD RESULT IN UNSAFE OPERATION OR LEAKAGE.**
 5. Install the pressure source or vent to the plug, leak tight. For plugs not being used to pressurize or vent the system, install the pipe cap or pipe plug, leak tight.
 6. Fill the pipe with test medium while evacuating any residual air or gas. Slowly introduce the test pressure. The test pressure must never exceed the strength of the weakest component within the system being tested. Maximum test pressure based on ASTM A106 Grade B pipe is shown on page 2.
 7. As pressure increases, movement of the shaft as large as .10" may be detected. This movement indicates additional squeeze of the seal and expansion of the grippers and is normal for this plug design. Should movement of the shaft or plug exceed .10", release ALL pressure immediately, remove plug, examine, reinstall and begin testing in accordance with this operating procedure. Should movement of the shaft or plug during the test still exceed .10", contact the factory for technical assistance.
 8. Imperfections within the pipe being tested may cause small plug leaks as the test pressure is being increased. Should small leaks develop, additional tightening of the plug may be required. Prior to additional tightening remove pressurization from the system. **NEVER STAND IN THE POSSIBLE PATH OF THE TEST PLUG** Tighten the hex nut(s) further and repressurize the system. **NEVER** exceed the maximum torque specified in Table 1 as damage to the plug may occur. If leakage continues, the imperfections within the pipe must be removed.
 9. At the conclusion of the test, release ALL pressure, loosen the hex nut(s), remove and inspect plug. Any plug component which is worn or damaged must be replaced before attempting further testing. Contact factory for replacement part information.
- Prior to storing, dry all parts of the plug and lubricate the shaft threads and brass anti-gall washers with anti-seize. Store these instructions with the plug.
- * THREADS ON SHAFT HAVE BEEN DEFORMED TO PREVENT PLUG DISASSEMBLY AND IMPROPER REASSEMBLY. HEX NUT SHOULD NEVER BE REMOVED!

GRIP TITE Operating Procedure DC2510