



DOCUMENT TITLE

**HYDRO-TESTING PROCEDURE FOR
BONDSTRAND GRE AND GRV PIPE**

REVISION HISTORY

REV	DESCRIPTION	DATE	PRODN	ENGRG	QA
0	Originated	26-Jun-00	-	YK Tan	HC Fou
1	Revision on Para.8	28-Sep-04	-	YK Tan	HC Fou

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SPECIFICATION NO.

INS-004

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Prepared by	Approved	Approved
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ENGRG	ENGRG	QA

1.0 SCOPE

This procedure covers the minimum requirement for the pressure testing of AMERON piping system at site.

2.0 RESPONSIBILITIES

The execution is under the responsibility of the installer in co-ordination with the owner representative.

3.0 EXCLUSION


3.1 The following piping accessories and equipment shall be excluded or isolated from pressure testing of piping.

- Rotating machinery, pumps, compressors, etc.
- Filter elements of strainers.
- Pressure relieving devices such as rupture discs and pressure relief valves.
- Vessels that would be overstressed at piping test pressures;
- All instruments, including level controllers and gauge glasses;
- Pressure gauges;
- Metallic expansion joint / bellow;
- Orifice plates;
- Flow nozzles;
- Pressure control valves;
- Corrosion probes;
- Deluge nozzles;
- Any other piping or equipment designated by owner representative (packaged units/ Equipment shall be isolated or by-passed as required)

3.2 All the elements that are not to be tested along with the piping shall either be blanked off during testing or spool pieces inserted during testing.

4.0 TEST PRESSURE, EQUIPMENT AND INSTRUMENT

4.1 For pressure testing of piping system, the test pressure indicated in the construction drawings shall be strictly followed. The recommended test

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pressure is 1.5 times the anticipated design operating pressure. When higher test pressures are desired, the test pressure should not exceed 1.5 times the maximum rated operating pressure of the lowest rated element in the system. Therefore it is important to check the pressure rating of all components of the system, because fittings, tanks, or hoses may carry a pressure rating lower than that of the pipe.


- 4.2 Sudden pressure surge or “water hammer” should be avoided during test. In some instances, surge and hammer can produce pressures of several times the rating of the pipe and fittings. In order to prevent water hammer or over pressurization, quick closing valves and booster pumps without suitable controls must not be used.
- 4.3 All test gauges used for field-testing shall have a suitable range and shall be used for test purposes only.
- 4.4 Pressure gauges shall be selected so that the test pressure of the system falls between 30% to 75% scale range of the gauge.
- 4.5 Gauge shall be new, of good quality, and in good working condition.
- 4.6 The date of calibration shall be certified on the gauges.

5.0 TEST MEDIUM

- 5.1 All AMERON pipe shall be hydrostatically tested with the following provisions:
 - Water used for testing shall be clean and free from filth or undissolved solids of any description.
 - Unless otherwise specified, all piping shall be hydrostatically tested with fresh industrial water

6.0 PRECAUTIONS AND SAFETY

- 6.1 Qualified and experienced personnel should operate pressurizing equipment. Untrained or unauthorized personnel should not be around the pressurizing equipment.
- 6.2 Do not make any adjustments on pressurized fittings under pressure. For example, if an adapter or flange joint is leaking, take the pressure off the line before attempting to tighten.
- 6.3 The test operation should be well planned and carried out with all due precautions. It is always best for one man to be in charge of the


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operation so that all other persons on the job take their direction from him.


- 6.4 Testing with air or gaseous media is particularly dangerous and should be avoided. Gas or air pipelines shall be hydraulically tested then “de-watered”. Never test with flammable fluids or gases.
- 6.5 The effect of hydrostatic head shall be considered when determining correct test pressure from gauge reading.
- 6.6 Caution shall be exercised in system hydrostatic testing to ensure that simultaneous testing of large sized adjacent equipment and piping does not overload supporting structures and foundations.
- 6.7 Any system under hydrostatic test shall be carefully observed, to prevent overpressure of lines and any connected equipment.
- 6.8 The pressure generator shall be disconnected if the operator leaves the equipment for any reason.
- 6.9 The testing operations shall be conducted diligently, thoroughly, and in a safe workman like manner in accordance with accepted piping testing practices.
- 6.10 During testing, safety standards shall be observed at all times.
 - a) Barrier distance per pressure test values.
 - b) Signs and Notices
 - c) Toolbox talks etc.
- 6.11 The working area shall be roped off and sign positioned.
- 6.12 This work shall be carried out in open space or shelter with sufficient ventilation.
- 6.13 The installer’s supervisor shall be responsible for safety provisions.

7.0 PREPARATION FOR TESTING

- 7.1 All vent and other connections, which can serve as pressure test vents shall be open during filling so that all air can be vented prior to applying test pressure to the system.
- 7.2 Lines that are spring or counterweight supported shall be temporary blocked up during test in order to sustain the hydrostatic load.
- 7.3 Before pressure testing, all lines or systems shall be inspected to ensure that all connected parts to be excluded from the test are isolated by blinds.

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- 7.4 Instruments shall be excluded from hydro-test of piping system.
- 7.5 Adequate temporary supports should be used where volume and weight of water may cause line deflection.
- 7.6 Hydrostatic test loops shall have all high points in the piping with a vent and all low points with a drain, regardless of whether or not they are specifically shown on the drawings. When filling, the test fluid shall be introduced at the lowest point of the system to minimize the risk of entrapped air and all vents shall be opened. Vents and drains shall be closed once a continuous flow of fluid is obtained through the vent or drain.
- 7.7 Calibrated/ certified gauges and recorders should be used for all hydrostatic tests. The pressure shall be shown in kg/ cm² or KPa. Pressure gauges or recorders used to indicate and record test pressure shall be dead weight tested for accuracy according to a procedure, dependent of type of equipment. The validity of calibration for all gauge and recorder shall be one (1) year.
- 7.8 Where required piping and equipment may be insulated or coated before testing, but all joints shall be left un-insulated or un-coated and exposed until suitable test acceptance by owner representative. This is applicable to insulated piping or GRE pipe with fire coating.
- 7.9 Hydro testing shall be performed via a manifold. The test pump shall be isolatable from the system with its own pressure gauge. Valves, hoses used in tests shall be suitably rated (preferably use rating of max. test on line list throughout to avoid any confusion)
- 7.10 Lines containing check valves shall have the sources of pressure upstream of the check valve so that the pressure is applied under the seat. The point of draining shall be downstream of check valve. If this is not possible, the check valve disc shall be removed or jacked open.
- 7.11 At least 2 gauges and recorders shall be installed in the test system, one near the pressure generator (at the lowest point) and the other at the highest point, both of which to be positioned so that they can be easily reached and observed.
- 7.12 When testing underground systems, the line should be partially backfilled and temporarily blocked at directional changes to prevent excessive movement during the test.

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7.13 Care should be taken to prevent above ground systems from buckling or moving excessively during test or in case of sudden depressurization.

8.0 HYDROSTATIC PRESSURE TESTING

8.1 Test pressure shall be in accordance to paragraph 4.0 of this procedure.

8.2 Care shall be exercised to avoid increase in pressure due to temperature variation during the test.

8.3 Hydrostatic testing shall not be done against closed valves.

8.4 Vents shall be open during filling of water so that air is vented prior to applying pressure to the system. Vents will then be closed to permit pressurization to commence.

8.5 Suitably rated spectacle blinds, spades, skillets, blank inset chokes, blind flanges or other means of positive closure shall be used for each section of pipeline tested.


8.6 Hydrostatic pressure tests on each major section of piping shall be carried out with all pressure relief valves removed and their respective nozzles or connections blanked off or plugged.

8.7 Hydrostatic test pressure connections shall be on the upstream side of check valves.

8.8 The pressure shall be brought up slowly and gradually to allow for equalizing for strain during the test, and in stages to allow checking for leaks and inspection of the system. (Pressure shall first be brought up to 10 bar and hold for 30 minutes. After that increase in stages of 3 bars and hold for 10 minutes before proceed to next stage). In any case, the test pressure shall be raised over a period of 30 minutes or longer to 1.5 times the design pressure.

8.9 Once attained, the test pressure shall be held for a period of two hours or such time as required for a full visual inspection of the system to be made. During the first half hour of hydro-test, if pressure drops it is necessary to bring up to test pressure and test for two hours or such time as required for a full visual inspection of the system. A $\pm 4\%$ pressure change during hydro-test is acceptable.

8.10 Temperature changes have a definitive effect on the pressure in the line. In closed systems, where a pipe is directly exposed to the sun,

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pressure increases up to 25% may occur. Take necessary precautions to prevent over pressurization. An overnight decrease in pressure from afternoon to early morning is normal due to temperature changes and does not necessarily indicate a leak.

- 8.11 Any lines changed or modified after they had been tested shall be retested unless waived by the owner representative in writing.

9.0 POST-HYDROSTATIC TEST MEASURES.

- 9.1 After completion of hydrostatic test, the pressure shall be released gradually in steps. All the vents and drains shall be kept open until the lines are fully drained. All temporary facilities installed to facilitate pressure test shall be removed.
- 9.2 Where permanent or temporary strainers have remained in place for the hydrostatic pressure test they shall be removed following the test and thoroughly cleaned before reinstalling.
- 9.3 Records are made on each piping system when test is completed. These records shall be retained in the installer's quality document, as a permanent record and a copy will be given to owner's representative.
- 9.4 These records shall be prepared in tabulated forms and shall include, but not limited to:
- Date of test;
 - Identification of piping system and Package number;
 - Test medium & Pressure;
 - Test duration;
 - Inspector's name and signature;
 - Reference P & ID's and Isometrics;
 - Acceptance of test results by installer and owner representative

10.0 CORRECTIVE ACTIONS

- 10.1 If the pressure drop is found during the test due to leakage at some joint(s), the system shall be depressurized, repaired and re-testing shall be done at pressure originally specified for the test.
- 10.2 All joints and/or components failing to pass the pressure test shall be repaired in accordance with the relevant specification, and the relevant sections shall be retested to the applicable test pressure.