

Wherever possible, **piping** systems should be hydrostatically tested prior to being put into service. Care should be taken when testing, as in actual installation, to avoid water hammer.

These procedures must be followed in order to avoid serious personal injury or property damage. Failure to do so will result in loss of warranty. The buyer, installer, or any employee, agent or representative thereof, assumes the risk of any damage or injury to person or property when proper test procedures are not followed.

Installed pipe systems should be tested prior to use to assure soundness of all joints and connections. In testing, sudden pressure surges or "water hammer" must be avoided. Such pressure surges or water hammer can produce pressures of several times the rating of the pipe and fittings.

Testing with air or gas is extremely dangerous and is not recommended. Consult with Industrial Fiberglass (937) 222-9000, if you contemplate exceeding the recommended pressures for the lowest rated element of the system or if you contemplate using air or gas in spite of warning. Review safety precautions before starting the test.

Test Pressure and Testing Cycles - A Hydrostatic Test of the installed piping system provides a means to check the integrity of the assembled piping and its interaction with all components of the system. The field Hydrostatic Test pressure test shall be as agreed upon between purchaser and the pipe supplier. The test pressure will usually be 1.5 times the normal working pressure, but never exceeding the design pressure. Often a 10 cycle pressurization test is most desirable to confirm good soundness. Then the measurements are taken in the last pressurization. Prior pressurization cycles in a cyclic test many use holds at pressure for 10 minutes or more.

The normal recommended procedure is to conduct a cyclic pressure test. The piping system is subjected to 10 pressurization cycles at 1-1/2 times the anticipated operating pressure. Pressure is then kept on the system for 1-8 hours while the line is inspected for leaks. When higher test pressures are desired, the test pressure should not exceed 1-1/2 times the maximum rated operating pressure for the lowest rated element in the system. For low pressure applications, such as drain lines, the cyclic test may be replaced by a steady pressure test. Lines which can be subjected to severe temperature cycles - such as steam condensate lines, hot water lines and cold water lines - should be tested using the cyclic test procedure at 1.5 times the cyclic pressure rating even if the system is to operate at relatively low pressure. Vacuum or external pressure testing must not exceed the external pressure rating (after safety factor) provided by the pipe manufacturer.

If a mechanical joined line is installed with change-in-direction fittings, and if the test pressure is greater than 150 psig **and** the line is not restrained, it is necessary to pull the slack out of each joint before pressure testing. Removing the gap between the locking ring and spigot is necessary under these conditions because any gap will allow the line to grow in length - and could apply a severe bending stress to joints near direction changes.



Testing with air or gas is extremely dangerous and should be avoided. If an air test is still planned contact the pipe fabricator's Engineering department for alternative or special provisions. Again, Testing with Air is NOT Recommended!

Items to be verified prior to filling the piping for the hydrostatic test.

Visual Inspection and Repair - Prior to pipe installation, conduct a visual inspection and repair of any shipping and handling induced damage. After the pipe has been installed and prior to the hydrotest, conduct an external visual inspection. Also conduct an internal inspection on fiberglass piping larger than 36" (900mm). Any crazes, cracks imperfections in joints or etc., are to be repaired.

Remove Debris From Inside The Pipe - Any loose material such as working platforms, fabric overlay supplies, etc., must be removed from the inside of the pipe.

All support and anchors shall be in place and secure per the drawings and project requirements. If segments of the pipe are tested, additional anchorage may be required.

To hydrostatically test, the following hydrotest procedure should be observed as follows:

Construction schedules may necessitate that the piping system is tested in sections rather than in its fully assembled condition. If this is necessary, care must be taken to assure that the piping system has the necessary anchors in place, and that the temporary closures are adequately designed.

It is recommended that large or complex installations be tested in subsections as they are completed. When properly installed, the tapered bell and spigot system offers the strongest, most reliable of all adhesive bonded connections; but its performance depends on proper installation. Therefore, it is strongly suggested that pressure tests be performed on a small section of the installation as early as possible in construction to assure that the installation techniques are satisfactory. This is particularly important when the installing personnel have not previously worked with FRP composite piping.

Provision for bleeding air from the system should be made. Check to verify that air release valves are open. These valves are provided at high points, so that all the air is purged during filling. If the system is not flanged or otherwise fitted to permit tying in with standard fittings, a threaded or grooved adapter can be bonded to the system to permit testing. This can be cut off after the test, so allowance must be made for a small amount of pipe loss.

The Swel-Plug pressure test manufactured by Tube Turns, Louisville, Kentucky, is an excellent expansion plug with can be used for testing piping.

Compression sleeve couplings such as Dresser Style 38 or Rockwell International 411 can be used to tie into testing fixtures. (NOTE: Stiffeners must be used inside of all 6" and smaller pipe when using a compression coupling. For test purposes this stiffener can be made from steel pipe machined to the i.d. of the pipe being tested.) Compression couplings have only limited ability to withstand end



loading. Before testing with this type of fixture, take precautions to tie down the compression fitting to prevent movement and leakage when the line is pressurized.

If possible, the pressure test gage should be located at the centerline elevation - of the lowest pipe in this particular system. If the test gage must be at a higher location, the test pressure must be decreased for this difference in head. Verify that the pressure gage's calibration date has not expired.

Fill the pipeline with water slowly and carefully, allowing all the air to escape through the air release valves. Filling of line can be accomplished with any available pump of suitable capacity. Water is usually introduced into the system through a 1" diameter or smaller pipe. Care must be taken to insure that air is vented through release valves - beginning with those at the lowest points in the line and progressing to the highest elevation of the line. Water should be introduced at the lowest point in the system, and the air bled off through a partially open valve or loose flange at the highest point. On long, straight pipe runs, the use of a soft pig ahead of the test fluid is recommended to insure purging of the line of all air.

The pipe must be in contact with all hangers and supports before filling. If pipe is bowed out of hangers, it will settle or lengthen during filling and can exert damaging forces at changes in direction.

When all air has been vented, filling of line should be stopped until equilibrium is established. This is necessary because of thermal and mechanical affects of filling the system. Generally two hours or more are required for this to occur.

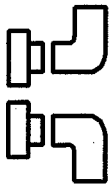
Pressurization Rate - Pressurization can then proceed at a predetermined rate not to exceed 10 psi per minute. Care must be exercised to avoid water hammer or over pressurization due to placement of test gage. Test pressure should not be more than 1-1/2 times the working pressure of the piping system, and never exceed 1-1/2 times the rated operating pressure of the lowest rated component in the system.

Slowly close the valve, and bring the system gradually up to the desired pressure. Pressurize the system at a slow rate to (1/2) one-half test pressure and hold at this pressure until the pipeline can be re-examined and determined that its movement has stabilized. Generally this takes one-half hour to two hours.

Once the system is filled and all air purged, the outlet can be slowly closed and the system slowly brought up to the desired test pressure. To prevent water hammer or over-pressurization, quick-closing valves and booster pumps without suitable controls must not be used.

Locate the pressure gage in close proximity to the pressurizing equipment - not directly on the piping system. Pressure gage with the test pressure at midscale is recommended.

Then, pressurize to the test pressure and hold at this pressure for two hours. A slight reduction in pressure is to be expected from any additional temperature change.



A reduction of 5 psi is considered normal and should be considered a valid test if no further reduction occurs.

Visually inspect the pipe at the test pressure for any leakage or movement of supports, anchors, etc., and note any abnormalities.

Documentation - Record the test pressure at the beginning of the test and test pressure each one-half hour for the two hour test period for each test gage. Document any visual abnormalities. Besides identification of line tested also document the time of day of the test.

If no visible leakage is found from the piping and a reduction in pressure of not more than 5 psi occurs, the test is considered as successful and complete.

Removal of Water - When the test is completed, the water from the test should be removed. (NOTE: Open vent valves when removing water so that a vacuum is not created!)

Internal Inspection of Piping - After the Hydrostatic Test and water and dangerous fumes from seawater, etc., are removed, an internal inspection should be made by the contractor for pipe sizes 36" (900mm) and larger. This inspection may show additional zones requiring repair or rework.

Safety Precautions - As in any system where pressure is employed, adequate safety precautions should be exercised. Exercise due care in installing and testing the piping system. Don't assume the risk of injury or property damage.

In buried applications, it is suggested that long pipe runs be partially backfilled at various points to secure them in place. All joints and connections should be left exposed for inspection.

In exposed pipe systems, standard pipe guides and hangers will normally be sufficient to restrain the pipe during testing.