

# Guidelines for Hydrostatic Testing of Specialty RTP pipe and tubing in accordance with DOT Pipeline Safety Regulations Part 192 for Natural Gas or Part 195 for Hazardous fluids

It is the responsibility of the pipe operator to determine the suitable hydrostatic test procedure and testing times. The procedure listed below is based upon the guidelines listed in DOT specifications Part 192 for natural gas and Part 195 for hazardous liquids.

The intent of Part 192 - Subsection J is to insure that, prior to operation, piping is tested to substantiate maximum operating pressure and identify any potential leaks. The basic requirement is to perform a hydrostatic test at 1.5 times (or greater) of the actual maximum operating pressure (at any point) for a period of 8 hours. Part 195 - Subsection E prescribes a hydrostatic test of 1.25 times (or greater) of the actual maximum operating pressure (at any point) for a period of up to 8 hours. Listed below are guidelines to aid in hydrostatic testing of Specialty RTP pipe and tubing.

## Pre-Test Set-Up:

- The preferred hydrostatic testing liquid is clean water. Other non-hazardous liquids may be acceptable. Pneumatic (air) testing is not recommended.
- Testing may be conducted on the full system or in sections.
- The pipeline test section must be restrained against movement in the event of catastrophic failure. **All Specialty RTP piping and tubing systems and must be properly buried prior to testing or in the case of an RTP-Rehab™ through an existing pipeline, the RTP system must be flanged off at each end.** Backfill must be properly placed and compacted. Risers that are attached to buried couplings must be fully restrained against movement.
- All low pressure filling lines and other items not subject to the test pressure should be disconnected or isolated.
- The test section should be completely filled with the test liquid, taking care to bleed off any trapped air. Venting at high points and at the ends of the test section may be required to purge air pockets while the test section is filling.
- Valve openings and closings should be slow and sequenced to prevent water hammer and prevent any potential creation of a vacuum inside the pipe that could cause collapse.
- **Before applying test pressure, allow time for the test fluid and the test section to equalize to a common temperature.** A minimum wait time of 1 hour should be used.. Preferably, the test fluid temperature should be less than 80°F to expedite temperature equalization with the soil, but should never exceed the rated temperature of the Specialty RTP pipe.
- Pressure monitoring equipment and hoses should be protected from direct sunlight exposure or other potentially large temperature swings during testing, as this can provide erroneous pressure data.
- **Ideally, testing should be conducted and pressures measured at the lowest elevation in the test section.** When this is not possible, correction to the test pressure must be made for the hydrostatic head to insure that the pipe will not be over pressurized. Use the equation below or Table 1 to determine the amount to reduce the test pressure.

$$P_H = .4335 \times Z$$

$P_H$  = Hydrostatic Head Pressure (psi)

$Z$  = Elevation difference between lowest point in test section and test location (ft)

Z (ft)	25	50	75	100	125	150	175	200
P <sub>H</sub> (psi)	10.8	21.7	32.5	43.4	54.2	65.0	75.9	86.7

When using the table, round up to the nearest elevation difference.

**Test Procedure:**

The test procedure consists of an initial expansion and a test phase. All thermoplastic pipes initially expand when first pressurized. The length of time for measurable expansion is relatively short, but varies with pressure, materials, and temperature. The rate of expansion also decays logarithmically. For Specialty RTP gathering lines in a buried or pull through applications, significant expansion usually subsides after four (4) hours, but this is a function of line length, pipe size and pressure rating.

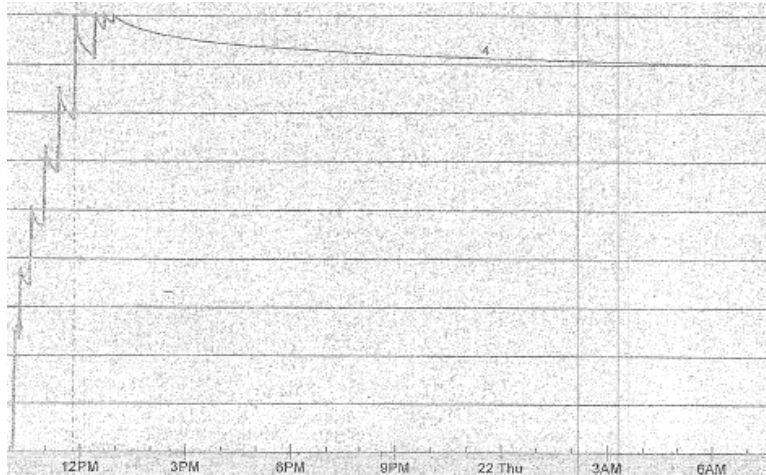
Depending upon utilizing either Part 192 or Part 195, the target test pressure is 1.5 times the max operating pressure for gas, or 1.25 times the max operating pressure for hazardous liquids. Since initial expansion will reduce pressure over time, an additional 10% is added to these values for the initial expansion phase. The following test procedure is suggested.

- For the initial expansion phase, the test pressure (P<sub>E</sub>) should be the difference between the max operating pressure (MOP) minus any hydrostatic head pressure (P<sub>H</sub>) times the target pressure multiplier plus 0.1.

**Natural Gas: P<sub>E</sub> = (MOP - P<sub>H</sub>) x 1.6**  
**Hazardous Liquids: P<sub>E</sub> = (MOP - P<sub>H</sub>) x 1.35**

- This pressure is to be **maintained** within +0 psi/-10 psi for four (4) hours. Additional test liquid will be required to maintain pressure. It is not necessary to monitor the amount of liquid added during the initial expansion phase.
- Immediately following the initial four (4) hour expansion phase, the test phase can begin. If test pressure remains above the target level for an additional eight (8) hours, no leakage is indicated and strength is verified.
- Variations in pressure will occur due to changes in temperature, and there can be variations during the test, but the test pressure cannot go below the target level

Below is a picture of an actual hydrostatic test chart of pressure as a function of time. It took approximately two hours to pressure up the line and two hours of stabilization before the test was begun. There was a pressure decay of 75 PSI or an 1800PSI test over the term of the test due to the pipe moving and the water cooling in the pipe, but with each progressive hour the pressure decline was reduced. For tests in excess of eight hours there can be an increase in pressure as the test goes from cooler nights into warmer days as a result of the test fluid heating up in the hoses to the charts.



## Example of Hydrostatic test Procedure

### Test Conditions:

500 psi pipe

Highest elevation 1800'

Lowest elevation 1700'

Test elevation 1725'

Hazardous Liquid

### Hydrostatic head due to elevation:

$Z = \text{Test Elevation} - \text{Lowest elevation} = 25 \text{ ft}$

$PH = 10.8 \text{ psi (from chart)}$

### Expansion Pressure:

$PE = (\text{MOP} - PH) \times 1.35$

$PE = (500 \text{ psi} - 10.8) \times 1.35$

**PE = 660 psi**

### Expansion Phase:

Maintain between 660 psi and 650 psi (660 psi – 10 psi) for 4 hours.

### Test Pressure:

$PT = (\text{MOP} - PH) \times 1.25$

$PT = (500 \text{ psi} - 10.8) \times 1.25$

PT = 612 psi

### Test Phase:

Charge pipe to 660 psi then wait 8 hours.

Must stay above PT or 612 psi for valid test.

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