SUMMARY: HYDROTESTING HDPE WATER LINES

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High-density polyethylene (HDPE) pipe has been used for municipal and industrial water applications for some 50 years. HDPE's heat-fused joints create a leak-free, self-restraint, monolithic pipe structure. The fused joint will also eliminate infiltration into the pipe and exfiltration into the environment. HDPE pipe has other benefits including chemical, abrasion, fatigue, seismic and corrosion resistance, and is designed for water and wastewater applications meeting the latest AWWA C906 and ASTM F714 standards.

It is advisable to begin testing early during the pipeline installation to confirm adequacy of the fusion, laying, embedment procedures, and then later to progressively increase the length of test section as experience is gained.

Hydrostatic testing is universally known and accepted as the primary means of demonstrating the fitness for service of a pressurized component. HDPE pipelines as long as 3000 feet have been commonly tested.

Hydrotesting can be used on runs of HDPE pipe that are hundreds of feet long

The following is an overview of using hydrotesting and the steps to take before a potable line is put into service. The purposes of hydrostatic field testing of HDPE pressure pipes using water include:

- Assessing the installed structural integrity of the pipeline for acceptability.
- Revealing the occurrence of faults or defects in the pipe laying procedures, as exemplified by damaged pipe or fusion joints non-conforming to the qualified fusion procedures.
- Finding the occurrence of faults in the assembly procedures for pipeline components, as exemplified by tapping bands or saddles, flange sets, or mechanical joint assemblies.
- Validating that the pipeline will sustain an acceptable level of overpressure slightly greater than its design pressure, without leakage.

It is important to note that field testing is not intended to supplement or replace product standard test requirements.

Polyethylene pipe is a lower modulus visco-elastic material that dilates in diameter (creep-strains) when subjected to higher stress during hydrotest. This means that for a fixed volume of clean fill water, the hydrostatic pressure will decline slightly during the test time, as the polyethylene molecular chains stretch and align under high stress. This pressure decline does not mean the polyethylene is leaking. It is a visco-elastic material parameter that requires adjustments to the hydrostatic test procedure as compared to rigid elastic metallic pipes. This effect is more noticeable in larger diameter HDPE pipes, due to the large mass of clean fill water. Alternately, to hold constant pressure, an additional volume of make-up water will be required to fill the expanded volume of the stretched pipe diameter. Neither of the above two observations means that a leak is present in the pipeline.

There are two test methods which can be used, depending upon the objectives of the test program. The easiest and quickest method suitable for all pipe diameters is the Modified Rebound Method originally developed by Lars-Eric Janson in the 1980's. As a similar alternate, ASTM F2164 instructs to fill and then thermally stabilize the pipeline with no air entrapment, pressurize the pipeline at test pressure for four hours, slightly reduce the pressure, and then observe the pressure for one hour to remain essentially constant (within five percent variation) to achieve an acceptable test.

In the US and Canada, the prevailing hydro-test method is ASTM F2164, *Standard Practice for Field Leak Testing of Polyethylene Pressure Pipe Systems Using Hydrostatic Pressure*. The ASTM method is essentially a hydrostatic "pressure rebound method" and is referenced in the AWWA M55 (2020), *PE Pipe- Design and Installation* and is summarized below:

- Test pressure: Up to 1.5 times the working pressure and is taken at the lowest point in elevation along the pipe's test section.
- Leak test can be dangerous; restrain test section against movement
- Fill slowly to remove air
- Maintain test pressure for 4 hours; add makeup water as needed to keep the pressure constant; water amount is not monitored
- Reduce pressure by 10 psi and monitor pressure for 1 hour
- Pass if pressure stays within 5% of the reduced pressure

In addition, the AWWA M55 (Chapter 9) describes general hydrostatic testing, based on ASTM F2164.

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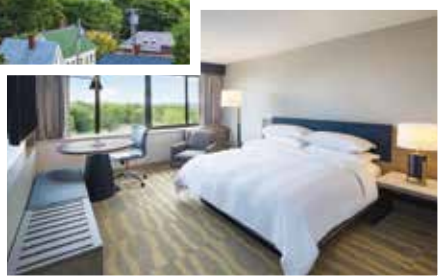

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There are basically six steps to putting a new waterline in service:
- Flushing
- Filling
- Testing for Leaks
- Record Keeping
- Disinfection
- Commissioning

1. Flushing

A new pipeline should be thoroughly flushed prior to testing. This will help to prevent any damage to valves or other fitting from any foreign material left in the pipeline. This can be done by opening and closing hydrants, blow-offs or drains with flow velocities sufficient to flush the foreign material from the pipeline. A minimum of 3ft/s is suggested.

2. Filling

Slowly fill the pipeline to limit the flow to low velocities that prevent surges and air entrapment. Also, air valves at high points should be opened to allow air to escape as the water level increases inside the pipeline. Temporary valves can be installed. Do not loosen flanges or connections to bleed air from the system. The critical filling rate for pipes with air vents is usually based on five to fifteen percent of the pipe design flow.

3. Testing for Leaks

Leak testing can be done either inside or outside the trench. Because joints for HDPE pipe are fused together, leakage should be zero. Leak tests need to be conducted in accordance with ASTM F2164. For HDPE pipe, a pressure of 1.5 times the design working pressure at the lowest point in the test section is used as the test pressure. Acceptance is found by reducing the test pressure by 10 psi and monitoring the pressure for one hour. If the pressure remains steady – within five percent of the target value – for one hour, leakage is not indicated.

4. Record Keeping

Test records should include:
- Name of person conducting the test, including company and contact information
- Test medium – usually water
- Test pressure
- Test duration and data
- Pressure recording chart of pressure log
- Pressure vs. makeup water added chart
- Pressure at high and low elevations
- Elevation at the point test pressure is measured
- Ambient temperature weather conditions
- Pipe and valve manufacturers
- Pipe specifications and/or standards such as AWWA C906-21
- Description of the test section length, location and components
- Description of any leaks, failures and their repair/disposition
- Test times and dates

When disinfecting an HDPE potable waterline, it is important that purging applies to distribution mains as well as each service line and service connection.

5. Disinfection

All new potable water pipelines require disinfection in accordance with ANSI/AWWA C651. This should take place after the initial flushing and after pressure testing the line. Disinfecting solutions containing chlorine should not exceed two percent active chlorine. As soon as the normal pipe disinfection period is over, the disinfection solution should be purged and/or neutralized, and the pipeline filled with fresh, clean water. Remember, purging applies to distribution mains as well as to each service line and service connection.

6. Commissioning

The commissioning of a new or repaired pipeline is normally carried out in the following sequence:
- Cleaning and/or pigging of the pipeline
- Water filling and pressure test
- Disinfection
- Flushing, purging, and/or neutralization
- Refilling the pipeline
- Bacteriological sampling and testing
- Certifying and acceptance
- Initiating the pipeline into service

Additional information can be found in:
- ASTM F2164
- AWWA Manual M55,
- PPI's *Handbook of Polyethylene Pipe*
- PPI's newest technical document, *TN-46 Guidance for Field Hydrostatic Testing of High-Density Polyethylene Pressure Pipelines.*

ABOUT PPI:

The Plastics Pipe Institute, Inc. (PPI) *is the major North American trade association representing the plastic pipe industry and is dedicated to promoting plastic as the materials of choice for pipe and conduit applications. PPI is the premier technical, engineering and industry knowledge resource publishing data for use in the development and design of plastic pipe and conduit systems. Additionally, PPI collaborates with industry organizations that set standards for manufacturing practices and installation methods.*