Book 3: Chapter 4 - Inspection & Testing

Pre-Construction

Inspections and tests begin before construction. Jobsite conditions dictate how piping may be installed and what equipment is appropriate for construction. Soil test borings and test excavations may be useful to determine soil bearing stress and whether or not native soils are suitable as backfill materials.

In slipline rehabilitation applications, the deteriorated pipeline should be inspected by remote TV camera to locate structurally deteriorated areas, obstructions, offset and separated joints, undocumented bends and service connections. In some cases, a test pull, drawing a short section of slipliner through the line, may be conducted to ensure that the line is free of obstructions.

The contractor should carefully inspect contract specifications and plans. It is important that the specifications and plans fit the job. Different piping materials require different construction practices and procedures. These differences should be accurately reflected in the contract documents. Good plans and specifications help protect all parties from unnecessary claims and liabilities. Good documents also set minimum installation quality requirements and the testing and inspection requirements that apply during the job.

As presented in the *Performance Pipe Engineering Manual, Book 3, Chapter 1,* "Handling and Storage," all incoming materials should be inspected to be sure that sufficient quantities of the correct products for the job are at hand and that they arrived in good condition, ready for installation.

For critical jobs, an inspection of the manufacturer's facilities may be in order. The manufacturer should have an established reputation for quality products, should have a detailed, well-documented quality control and quality assurance program and should have adequate facilities to make the size and quantities required.

During Construction

Tests and inspections performed during construction include butt fusion joint quality tests; soil compaction and density tests; pipe deflection tests, pressure tests and other relevant inspections.

Butt Fusion Joint Quality

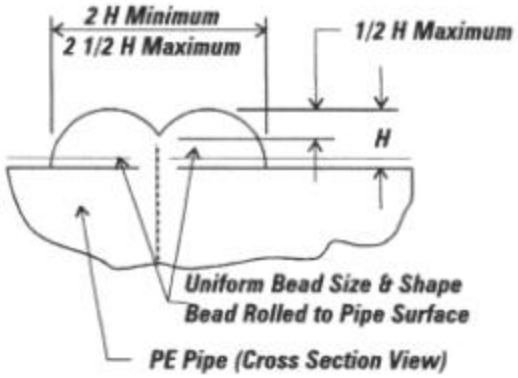
Visual inspection is the only reliable non-destructive joint evaluation test applicable to all sizes of OD controlled Pipe. Non-destructive tests such as microprocessor controlled ultrasonic inspection may be available for selected sizes. X-ray inspection is generally unreliable because x-ray is a poor indicator of cold fusion.

Butt fusion joints are visually inspected to ensure joint quality. The size and shape of the external fusion beads indicate if a proper joint has been made. As illustrated in Figure 4-1, a) the double bead width should be 2 to 2-1/2 times the height from the pipe surface, b) both beads should be uniform in size and shape all around the joint, and c) the depth of the v-groove between the beads must not be more than half the bead height.

If the v-groove is too deep, a "cold" fusion may be indicated. Cold fusion results when most of the melt is pressed out of the joint. It is caused by insufficient heating (heating iron too cold or cold spots or insufficient heating time), or excessive pressure during heating, or excessive

pressure during joining. A non-uniform bead shape around the pipe indicates uneven heating, possibly from cold spots on the heating iron surface.

Figure 4-1 Butt Fusion Bead – Visual Inspection Guidelines



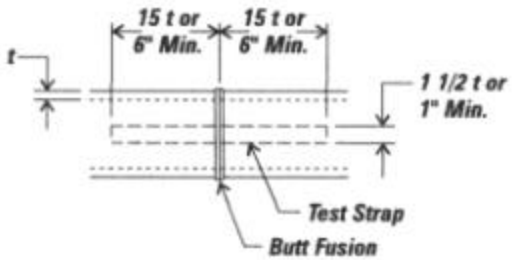
Cold fusion is a poor quality joint that should be removed and re-done. If not repaired, joint failure can occur.

When butt fusion is between pipe and molded fittings, the fitting-side bead may exhibit shape irregularities that are caused by the fitting manufacturing process. A slightly irregular fitting-side bead may not indicate an improper joint, provided that the pipe-side bead is properly shaped, and the v-groove between the beads is correct. Contact Performance Pipe Technical Services if assistance is required.

During construction fusion joining, Performance Pipe recommends that the installer should verify operator procedure, equipment set-up and field fusion quality by making and testing a trial fusion. The trial fusion is allowed to cool completely; then test straps are cut out and bent strap tested in accordance with ASTM D 2657. If the bent strap test of the trial fusion fails at the joint, any field fusions represented by the trial fusion should be redone.

The bent strap test specimen is prepared by making a trial butt fusion, and allowing it to cool to ambient temperature. A test strap that is at least 6" or 15 pipe wall thicknesses long on each side of the fusion, and 1-1/2 wall thicknesses (at least 1") wide is cut out of the trial fusion pipe. See Figure 4-2. The strap is then bent so that the ends of the strap touch. Any disbondment at the fusion is unacceptable and indicates poor fusion quality. If failure occurs, fusion procedures and/or machine set-up should be changed, and a new trial fusion and bent strap test specimen prepared and tested.

Figure 4-2 Bent Strap Test Specimen



A test strap from thick wall pipe may require considerable effort to bend. Further, the test strap may spring back if the ends are inadvertently released while bending. Appropriate personnel safety precautions should be observed.

Additional information and guidelines for evaluating butt, socket and saddle fusions are presented in Performance Pipe Bulletin PP-750 *Performance Pipe Heat Fusion Joining Procedures.*

Soil Tests

During buried pipe installation, work should be checked throughout the construction period by an inspector who is thoroughly familiar with the jobsite and the contract specifications, materials, and installation procedures. Inspections should reasonably ensure that significant factors such as trench depth, grade, pipe foundation (if required), quality and compaction of embedment backfill, and safety are in compliance with contract specifications and other requirements.

To evaluate soil stability, density and compaction, appropriate ASTM tests may be required in the contract specifications.

Surface Damage

Surface damage may occur during construction handling and installation. Significant damage may impair the future performance of the pipeline. The following guidelines may be used to assess damage significance.

For DriscoPlex™ pressure piping systems, damage or butt fusion misalignment in excess of 10% of the minimum wall thickness required for pipeline operating pressure may be significant. If the pipeline is to operate at the maximum permissible pressure for the material and DR, the damage allowance is 10% of the pipe minimum wall thickness. On the other hand, if the pipe is to operate at lower pressure, damage depth may be greater.

Excessive damage may require removal and replacement of the damaged pipe section, or reinforcement with a full encirclement repair clamp. Damaged pipe cannot be “repaired” by filling damaged area with extrusion or hot gas welding. Misaligned butt fusions should be cut out and redone.

The shape of the damage should also be considered. For small damage areas where the depth is not excessive, sharp notches and cuts should be dressed smooth so the notch is blunted. Blunt scrapes or gouges should not require attention. Minor surface abrasion from sliding on the ground or insertion into a casing should not be of concern.

Deflection Tests

Buried flexible pipes rely on properly installed backfill to sustain earthloads and other loads. Proper installation requires using proper backfill materials and installing the pipe as specified by the designer. See the *Performance Pipe Engineering Manual, Book 2. System Design*, Chapter 7 for detailed information on buried flexible pipe design.

Deflection checks may be used to monitor the quality of installation. Improperly installed flexible pipe can develop significant deflection in a short time, thus alerting the installer and the inspector to investigate the problem. Inspection should be performed as the job progresses; that way, any errors in the installation procedure can be identified and corrected.

Initial deflection checks may be performed after embedment materials have been placed and compacted. Procedures for determining deflection are presented in Performance Pipe Technical Note PP 817-TN *Checking Vertical Deflection of Gravity-Flow Pipe.*

Leak Testing

Recommended leak testing procedures for Performance Pipe polyethylene piping products are published in Performance Pipe Technical Note PP 802-TN *Leak Testing.* Contact any Performance Pipe Representative or Distributor for a copy.

Leak tests should not be confused with pressure tests. Leak tests using a pressurized fluid media are intended to find leaks in a piping system.

Pressure tests are used with some piping materials to verify the pressure capacity of the pipeline. The pressure rating of polyethylene pipe, however, is based on long term sustained pressure tests, not short-term material properties. For polyethylene pipe, short-term pressure tests cannot verify long-term performance and are incapable of verifying the pressure capacity of the pipeline.

If leak tests are required in the Contract Specifications, leak tests should be conducted in accordance with Performance Pipe recommended procedures.

Liquids such as clean water are preferred as the test medium because less energy is released if the test section fails catastrophically. During a pressure test, energy (internal pressure) is applied to stress the test section. If the test medium is a compressible gas, then energy is used to compress the gas as well as apply stress to the pipeline. If a catastrophic failure occurs during a pneumatic test, both the pipeline stress energy and the gas compression energy are explosively released. With an incompressible liquid as the test medium, the energy release is only the energy required to stress the pipeline.

WARNING

Death or serious injury can result from failure at a joint or connection during leak tests with a liquid or gas under pressure. Keep all persons a safe distance away during testing. The test section is to be supervised at all times during the test.

Ensure that all piping is restrained against possible movement from catastrophic failure at a joint or connection. When pressurized, faulty joints or connections may separate suddenly causing violent and dangerous movement of piping or parts. Correctly made joints do not leak. Leakage at a joint or connection may immediately precede catastrophic failure. Never approach or attempt to repair or stop leaks while the test section is pressurized. Always depressurize the test section before making repairs.