Designation: F3533/F3533M – 23

Standard Guide for Inspection and Acceptance of Installed Thermoplastic Storm and Sanitary Sewer Pipe[1]

This standard is issued under the fixed designation F3533/F3533M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This guide identifies pipeline components, recommended protocols and evaluation criteria to consider in the inspection and acceptance of installed thermoplastic pipe by either person-entry, or remote inspection.

1.2 This guide is intended for installation related observations and assumes that pre-installation inspection has been completed and all final settlement of fill has occurred. Inspection should be a minimum of 30 days after installation. This inspection period could be increased to accommodate the installer's warranty period, which is typically one year or greater.

NOTE 1—Pipe types covered under this standard are typically installed under the AASHTO LRFD Bridge Construction Specifications or Practice D2321.

1.3 It applies to the thermoplastic non-pressure gravity flow storm and sewer pipe manufactured in accordance with Specifications D3034, F679, F714, F794, F894, F949, F1803, F2306, F2435, F2562, F2648, F2763, F2764, F2881, F2947, F3123, ISO 21138, ISO 4435, ISO 8772 and ISO 8773. It may also be considered for use for any similar thermoplastic pipe products not covered by this list but with similar physical or performance characteristics if approved by the owner.

1.4 Person entry is normally used unless extenuating circumstances preclude this type inspection by the engineer. Remote inspection is recommended for use for pipe diameters of 30 in. [750 mm] and smaller unless otherwise specified by owner or engineer. Person entry ultimately depends on the safety, size, and environmental consideration assessments by the engineer.

1.5 Access of installed pipe for manual inspection should follow OSHA 29 CFR PART 1926 SUBPART AA or ISO 45001, or any other applicable regulations for confined space entry. This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

1.6 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system are not necessarily exact equivalents; therefore, to ensure conformance with the standard, each system shall be used independently of the other, and values from the two systems shall not be combined.

1.7 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.8 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D1600 Terminology for Abbreviated Terms Relating to Plastics

D2321 Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

D3034 Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings

F412 Terminology Relating to Plastic Piping Systems

F679 Specification for Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings

F714 Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter

F794 Specification for Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter

F894 Specification for Polyethylene (PE) Large Diameter

[1] This guide is under the jurisdiction of ASTM Committee F17 on Plastic Piping Systems and is the direct responsibility of Subcommittee F17.62 on Sewer.

Current edition approved Nov. 1, 2023. Published November 2023. DOI: 10.1520/F3533–23

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

Profile Wall Sewer and Drain Pipe
F949 Specification for Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe With a Smooth Interior and Fittings
F1417 Practice for Installation Acceptance of Plastic Nonpressure Sewer Lines Using Low-Pressure Air
F1803 Specification for Poly (Vinyl Chloride)(PVC) Closed Profile Gravity Pipe and Fittings Based on Controlled Inside Diameter
F2306 Specification for 300 mm to 1500 mm [12 in. to 60 in.] Annular Corrugated Profile-Wall Polyethylene (PE) Pipe and Fittings for Non-Pressure Gravity-Flow Storm Sewer and Subsurface Drainage Applications
F2435 Specification for Steel Reinforced Polyethylene (PE) Corrugated Pipe
F2487 Practice for Infiltration and Exfiltration Acceptance Testing of Installed Corrugated High Density Polyethylene and Polypropylene Pipelines
F2562 Specification for Steel Reinforced Thermoplastic Ribbed Pipe and Fittings for Non-Pressure Drainage and Sewerage
F2648 Specification for 50 mm to 1500 mm [2 in. to 60 in.] Annular Corrugated Profile Wall Polyethylene (PE) Pipe and Fittings for Land Drainage Applications
F2763 Specification for 12 to 60 in. [300 to 1500 mm] Dual and Triple Profile-Wall Polyethylene (PE) Pipe and Fittings for Sanitary Sewer Applications
F2764 Specification for 6 in. to 60 in. [150 mm to 1500 mm] Polypropylene (PP) Corrugated Double and Triple Wall Pipe and Fittings for Non-Pressure Sanitary Sewer Applications
F2881 Specification for 12 to 60 in. [300 to 1500 mm] Polypropylene (PP) Dual Wall Pipe and Fittings for Non-Pressure Storm Sewer Applications
F2947 Specification for 150 to 1500 mm [6 to 60 in.] Annular Corrugated Profile-Wall Polyethylene (PE) Pipe and Fittings for Sanitary Sewer Applications
F3080 Practice for Laser Technologies for Measurement of Cross-Sectional Shape of Pipeline and Conduit by Non-Rotating Laser Projector, Infrared Measurement, and CCTV Camera System
F3095 Practice for Laser Technologies for Direct Measurement of Cross Sectional Shape of Pipeline and Conduit by Rotating Laser Diodes and CCTV Camera System
F3123 Specification for Metric Outside Diameter Polyethylene (PE) Plastic Pipe (DR-PN)

2.2 *OSHA References:*[3]
OSHA 29 CFR PART 1926 SUBPART AA

2.3 *ISO Standards:*[4]
ISO/ISE 17025 General Requirements for the Competence of Testing and Calibration Laboratories
ISO 21138 Plastics piping systems for non-pressure underground drainage and sewerage — Structured-wall piping systems of unplasticized poly(vinyl chloride) (PVC-U), polypropylene (PP) and polyethylene (PE)
ISO 45001 Occupational health and safety management systems — Requirements with guidance for use
ISO 4435 Plastics piping systems for non-pressure underground drainage and sewerage — Unplasticized poly(vinyl chloride) (PVC-U)
ISO 8772 Plastics piping systems for non-pressure underground drainage and sewerage — Polyethylene (PE)
ISO 8773 Plastics piping systems for non-pressure underground drainage and sewerage — Polypropylene (PP)

2.4 *AASHTO Specifications:*[5]
AASHTO LRFD Bridge Design Specifications
AASHTO LRFD Bridge Construction Specifications
Culvert and Storm Drain System Inspection Guide

2.5 *National Association of Sewer Service Companies (NASSCO) References:*
NASSCO Pipeline Assessment Certification Program

3. Terminology

3.1 *Definitions*—Definitions are in accordance with Terminology F412 and abbreviations are in accordance with Terminology D1600, unless otherwise specified.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *buckling, n*—visible wall crushing of the pipe structure, essentially a thrust force that exceeds the capacity of the wall section. It may also appear as an offset crease in the pipe wall.

3.2.2 *clock positions, n*—the relative circumferential position, direction or location of an observation on the pipe interior is described using the analogy of a 12-hour clock. For example, when looking downstream as shown in Fig. 1, 12 o'clock is the pipe crown or top of pipe (the inside of the pipe at this location is the obvert); 3 o'clock the spring line right; 6 o'clock the bottom of the pipe (the inside of the pipe at this location is the invert); and 9 o'clock the spring line left. The areas between the top of the pipe and spring line are referred to as the shoulder with the area between the spring line and bottom of the pipe referred to as the haunch. The viewing orientation (upstream or downstream) of the clock position observations should be identified to establish the spring line positions. When two clock positions are utilized to characterize the location or relative size of an anomaly within the pipe, the clock positions should be entered clockwise (for example, circumferential crack begins at 10 o'clock and ends at 2 o'clock).

3.2.3 *crack, n*—

3.2.3.1 *circumferential crack, n*—a crack generally aligned with the circumference of the pipe and generally perpendicular to the longitudinal axis of the pipe.

3.2.3.2 *longitudinal crack, n*—a crack aligned with the axis of the pipe.

[3] Available from Occupational Safety and Health Administration (OSHA), 200 Constitution Ave., NW, Washington, DC 20210, http://www.osha.gov.

[4] Available from International Organization for Standardization (ISO), ISO Central Secretariat, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, https://www.iso.org.

[5] Available from American Association of State Highway and Transportation Officials (AASHTO), 444 N. Capitol St., NW, Suite 249, Washington, DC 20001, http://www.transportation.org.

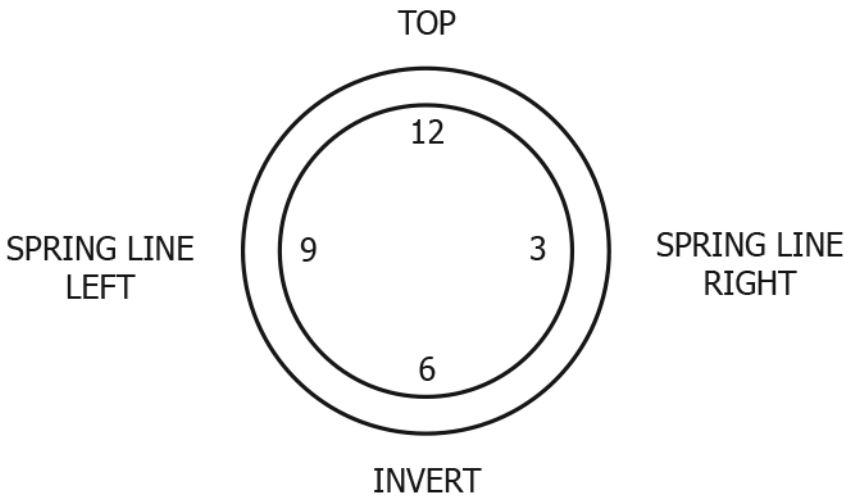

FIG. 1 Clock Positions for Inspection Documentation

3.2.3.1 *Discussion*—When cracks are at 45 degrees, it would be more conservative to classify them as longitudinal cracks.

3.2.4 *ring deflection, n*—the amount the base inside diameter of the pipe is reduced under load. Ring deflection is expressed as a percentage reduction of the base inside diameter. This may also be determined to be an increase in the base inside diameter if the pipe was elongated due to high compaction forces on the sides of the pipe. Ring deflection reflects the amount of vertical and horizontal deformation of the pipe from installation forces and soil consolidation around it.

3.2.4.1 *base inside diameter, n*—the dimensions of the pipe including allowable manufacturing tolerances as well as an out-of-round tolerance.

3.2.5 *engineer, n*—the qualifications for an engineer involved in the evaluation of installed plastic pipe should be established by the owner.

3.2.6 *final settlement, n*—a point at which all appreciable movement and consolidation of the backfill soil has occurred. The time for final settlement will depend on field variables such as soil type, soil moisture content and level of compaction.

3.2.7 *infiltration, n*—ground water entering the pipe.

3.2.8 *joint gap, n*—the space from the end of the spigot to the start of the bell taper of the installed joint.

3.2.9 *ovality, n*—degree of deviation from perfect circularity or elliptical shape of the cross section of the pipe wall: a non-symmetrical deviation, skewing or racking of the pipe which may induce excessive bending strains that present structural concerns for some pipe materials.

3.2.10 *owner, n*—the person or entity that owns or has maintenance and operation responsibility of the pipeline or system being inspected.

3.2.11 *silt tight joint, n*—a joint that limits water leakage at a predetermined rate. As an example, a maximum rate of 200 gallons/(inch of internal diameter) (mile of pipeline) (24h) [18.5 L/(mm of internal diameter) (km of pipeline) (24h)] for the pipeline system.

3.2.12 *soil tight joint, n*—a joint that is resistant to infiltration of particles larger than those retained on a No. 200 sieve.

3.2.13 *water tight joint, n*—a joint that when subjected to internal and external hydrostatic tests allows no leakage when tested to the following conditions:

(1) Application of a vacuum of 74 kPa (22 in Hg) for 10 minutes.

(2) Application of a pressure to 74 kPa (10.8 psi) (gauge) (25 foot head) for 10 minutes.

4. Significance and Use

4.1 The inspection of installed thermoplastic storm and sewer pipe verifies proper installation of the product and establishes a baseline for comparison for further evaluation.

4.2 This guide is useful as a reference by an owner in preparing project specifications and to identify, evaluate and interpret observations during post installation inspections of pipe.

4.3 Field evaluations either remotely or with person entry should be made by an independent 3rd party engineering firm or duly appointed representative of the owner.

5. Pipe Inspection Equipment and Procedures

5.1 Where required, pipe inspections may be made using person-entry, remote equipment, or a combination hereof. In general, pipe diameters 30 in. [750 mm] and smaller are not considered to be person-entry and typically require the use of remote equipment.

5.2 *Crawler Mounted Camera:*

5.2.1 Crawler mounted video camera should be capable of recording the identification, location, and description of the pipe condition with all equipment necessary to perform the inspection.

5.2.2 Camera should be all wheel drive or track mounted.

5.2.3 Camera should be adjustable such that the camera can be centered in the pipe vertically and horizontally.

5.2.4 Crawler should not obstruct the camera's view or interfere with proper recording of the pipe condition.