



Standard Specification for Pressure-rated Polypropylene (PP) Piping Systems¹

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1. Scope*

1.1 This specification establishes requirements for polypropylene (PP) piping system components made to metric sizes and IPS schedule 80 sizes, and pressure rated for water service and distribution supply (see [Appendix X1](#)). Included are criteria for materials, workmanship, dimensions and tolerances, product tests, and marking for polypropylene (PP) piping system components such as pipe, fittings, valves, and manifolds.

1.2 The components governed by this specification shall be permitted for use in water service lines, building supply lines, hot-and-cold water distribution, hydronic heating, and irrigation systems.

1.3 The pipe and fittings produced under this specification shall be permitted to be used to transport industrial process fluids, effluents, slurries, municipal sewage, etc. The user shall consult the manufacturer to determine whether the material being transported is compatible with the polypropylene piping system and will not affect the service life beyond limits acceptable to the user.

1.4 *Units*—The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.5 *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.*

1.6 *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.*

¹ This specification is under the jurisdiction of ASTM Committee F17 on Plastic Piping Systems and is the direct responsibility of Subcommittee F17.61 on Water.

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2. Referenced Documents

2.1 ASTM Standards:²

- D792 Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
- D1238 Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer
- D1505 Test Method for Density of Plastics by the Density-Gradient Technique
- D1598 Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure
- D1600 Terminology for Abbreviated Terms Relating to Plastics
- D2122 Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings
- D2749 Symbols for Dimensions of Plastic Pipe Fittings
- D3895 Test Method for Oxidative-Induction Time of Polyolefins by Differential Scanning Calorimetry
- D4101 Classification System and Basis for Specification for Polypropylene Injection and Extrusion Materials
- F412 Terminology Relating to Plastic Piping Systems
- F2023 Test Method for Evaluating the Oxidative Resistance of Crosslinked Polyethylene (PEX) Pipe, Tubing and Systems to Hot Chlorinated Water

2.2 International Organization for Standardization (ISO) Standards:³

- ISO 4065 Thermoplastics Pipes—Universal Wall Thickness Table
- ISO 9080 Plastics Piping and Ducting Systems—Determination of the Long-Term Hydrostatic Strength of Thermoplastics Materials in Pipe Form by Extrapolation
- ISO 9393–2 Thermoplastics valves for industrial applications - Pressure test methods and requirements - Part 2: Test conditions and basic requirements
- ISO 12162 Thermoplastics materials for pipes and fittings for pressure applications -- Classification, designation and design coefficient

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.

³ Available from International Organization for Standardization (ISO), 1, ch. de la Voie-Creuse, Case postale 56, CH-1211, Geneva 20, Switzerland, <http://www.iso.ch>.

*A Summary of Changes section appears at the end of this standard

ISO 13760 Plastic Pipe for the Conveyance of Fluid Under Pressure – Miners Rule – Calculation Method for Cumulative Damage

ISO 15874 Plastics Piping Systems for Hot and Cold Water Installations—Polypropylene (PP)

ISO 15874-2 Plastics Piping Systems for Hot and Cold Water Installations—Polypropylene (PP)—Part 2: Pipes

ISO 15874-3 Plastics Piping Systems for Hot and Cold Water Installations—Polypropylene (PP)—Part 3: Fittings

ISO 15874-5 Plastics piping systems for hot and cold water installations — Polypropylene (PP) —Part 5: Fitness for purpose of the system

ISO/TS 15874-7 Plastics Piping Systems for Hot and Cold Water Installations—Polypropylene (PP)—Part 7: Guidance for the Assessment of Conformity

2.3 *NSF International Standards:*

NSF/ANSI 14 Plastics Piping System Components and Related Materials⁴

NSF/ANSI 61 Drinking Water System Components—Health Effects⁴

2.4 *CEN Standard:*

prEN 10226-1 Pipe Threads Where Pressure Tight Joints are Made on the Threads—Part 1: Designation, Dimensions and Tolerances⁵

2.5 *American Society of Mechanical Engineers (ASME) Standard:*

B1.20.1 Pipe Threads, General Purpose, Inch⁶

2.6 *Plastic Pipe Institute (PPI) Technical Report:*

TR-4 PPI Listing of Hydrostatic Design Basis (HDB), Strength Design Basis (SDB), Pressure Design Basis (PDB) and Minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials⁷

3. Terminology

3.1 *Definitions:*

3.1.1 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 *polypropylene random copolymer (PP-R) or polypropylene random copolymer with modified crystallinity and temperature resistance (PP-RCT), n*—a propylene plastic containing not more than 50% of another olefinic monomer (or monomers), having no functional group other than the olefinic group, and copolymerized with the propylene.

3.2.1.1 *Discussion*—Polypropylene materials are described in detail in ISO 15874. The performance of PP-R and PP-RCT is distinguished by the minimum reference curves in ISO 15874. Historically, PP-RCT has referred to a polypropylene

random copolymer with modified crystallinity that delivers performance characteristics referenced in ISO 15874. However, recent developments make it possible to attain the PP-RCT performance requirements other than through modification of crystallinity.

3.2.1.2 *Discussion*—This term is also used for finished compound which comprises the PP-R or PP-RCT resin and additives such as colorants, UV inhibitors, and stabilizers. Polypropylene random copolymers containing more than one additional monomer are often referred to as “terpolymers.”

3.2.2 *plastic-to-metal transition fittings, n*—a fitting designed to provide a means of connection between the PP piping system and metal piping systems such as steel pipe and copper tubing. The fittings include a means of taking into account the differences in thermal expansion of the materials and maintaining a pressure-tight seal over the intended use temperature range.

4. Classification

4.1 *General*—This specification covers PP piping systems made from PP materials (PP-R) in various dimension ratios and pressure ratings.

4.2 *Thermoplastic Pipe Series and Schedule*—This specification covers PP pipe made in schedule 80 IPS sizes and metric sizes in accordance with ISO 4065.

5. Materials and Manufacture

5.1 The pipe and fittings shall be polypropylene material of type PP-R or PP-RCT in accordance with Specification **D4101**. Clean rework material, of the same PP-R or PP-RCT resin generated from the manufacturer’s own pipe or fitting production, shall be permitted to be used provided the pipe or fittings produced meet all requirements of this specification.

5.2 For pipe compound, the melt flow rate (MFR) shall not exceed 10.8 grain/10 min (0.7 g/10 min), when tested in accordance with Test Method **D1238** using conditions of 4.76 lbm (2.16 kg) at 446 °F (230 °C).

5.3 The density of the unreinforced, natural color PP-R and PP-RCT material shall not exceed 56.9 lbm/ft³ (912 kg/m³), when tested in accordance with Test Method **D1505** or Test Method **D792**.

5.4 *Minimum Required Strength (MRS)*—The PP-R material used in the pipe and fittings shall have an MRS value of 1160 psi (8.0 MPa) or 1450 psi (10.0 MPa) and the PP-RCT material used in the pipe and fittings shall have an minimum MRS value of 1624 psi (11.2 MPa) based on testing in accordance with ISO 9080 and classification of the lower confidence limit (σ_{LCL}) at 50 years in accordance with ISO 12162.

5.5 *Categorized Required Strength ($CRS_{0.1}$)*—The PP-R material used in the pipe and fittings shall have a minimum $CRS_{70^{\circ}C, 50 \text{ years}}$ value of 457 psi (3.15 MPa) and the PP-RCT material used in the pipe and fittings shall have minimum $CRS_{70^{\circ}C, 50 \text{ years}}$ value of 725 psi (5 MPa) in accordance with ISO 12162, based on testing in accordance with ISO 9080 and classification of the lower confidence limit (σ_{LCL}) at 158 °F (70 °C) and 50 years.

⁴ Available from NSF International, P.O. Box 130140, 789 N. Dixboro Rd., Ann Arbor, MI 48113-0140, <http://www.nsf.org>.

⁵ Available from European Committee for Standardization (CEN), Avenue Marnix 17, B-1000, Brussels, Belgium, <http://www.cen.eu>.

⁶ Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, Two Park Ave., New York, NY 10016-5990, <http://www.asme.org>.

⁷ Available from Plastics Pipe Institute (PPI), 105 Decker Court, Suite 825, Irving, TX 75062, <http://www.plasticpipe.org>.