

Municipal Advisory Board

Established May 1, 2008 at the University of Texas, Arlington



MAB Model Specifications for PE4710 Buried Potable Water Service, Distribution, and Transmission Pipes and Fittings (MAB-3 2024)

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www.plasticpipe.org/MABpubs

3rd ed. approved at the 31st MAB meeting. Hosted by the Miami-Dade Water & Sewer Dpt., FL, 2023

2nd ed. approved at the 24th MAB meeting. Hosted by the Detroit Water and Sewer Dpt., MI, 2019

1st edition approved by MAB at the Milwaukee Metropolitan Sewerage District, WI 2017

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FOREWORD. This model specification was developed by the Municipal Advisory Board (MAB) and published with the help of the members of the Plastics Pipe Institute, Inc. (PPI).

This model specification is intended as a guide for engineers, users, contractors, code officials, and other interested parties for use in the design, construction, and installation of high-density polyethylene (HDPE) pressure water piping systems. The local utility or engineer may need to modify this model specification to adapt the document to local conditions, operations, and practices.

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The MAB serves as an independent, non-commercial adviser to the Municipal & Industrial (M & I) Division of the PPI. Once adopted, MAB will consider revising this specification from time to time, in response to comments and suggestions from users of the model specification. Please send suggestions of improvements to Camille George Rubeiz, PE, F. ASCE, at crubeiz@plasticpipe.org

ACKNOWLEDGEMENTS.

The Municipal Advisory Board would like to acknowledge the excellent contributions of the MAB-3 Model Specification Task Group for developing and leading this project to provide the water utilities and communities with the best HDPE solutions.

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MAB-3: MAB Model Specifications for PE4710

Buried Potable Water Service, Distribution and Transmission Pipes and Fittings

PART 1 – GENERAL

1.1 The scope of this model specification is for high-density polyethylene (HDPE) water piping systems that conform to AWWA standards. This model specification can be adopted in full or modified by the specifier to suit the project. This model specification provides minimum requirements for PE 4710 pipes and fittings to be used in the design and construction of potable water piping systems.

1.2 DESCRIPTION

- A. Scope: MAB-3 provides a model specification for HDPE pipes and fittings for use by water utilities and consultants as indicated on the drawings, and as shown herein.
- Furnish, install, and test HDPE piping system as indicated and specified herein and as shown in the Drawings.
 - The primary installation method addressed is direct burial by open cut; see MAB-5 and MAB-7 for pipe bursting and Horizontal Directional Drilling (HDD). The means and methods, including the testing for acceptance shall conform to all applicable standards as noted herein with the intention of providing a leak-free self-restrained piping system for the owner.

1.3 REFERENCES

- A. To the extent referenced in this specification, the standards and documents listed in Appendix A are included and are made part of this specification.
- B. In the event of a conflict, the requirements of the project specification shall prevail.
- C. Unless otherwise specified, references to documents shall mean the latest published edition of the referenced document in effect at the bid date of the project.

1.4 SYSTEM DESIGN PARAMETERS

- A. Per AWWA C901, C906 and M55, the Allowable Total Pressure during Recurring Surge conditions (cycles) equals 1.5 times the pipe's Pressure Class (PC). Allowable Total Pressure during Occasional Surge conditions (cycles) equals 2.0 times the pipe's PC. Refer to Table 1 for details.
- B. Flow Capacity: Per AWWA C906: "Matching the ID of other pipe materials to the ID of HDPE for flow and PC will yield incorrect results. Use PPIPACE.com to evaluate flow capacity and PC of HDPE [relative] to other materials." Refer to Table 2 for AWWA recommended design values for flow velocities and number surge of cycles. Refer to Table 3 for an example evaluating flow capacity, PC and required fatigue life of HDPE versus other materials.
- C. Water Hammer/ Fatigue Life: In the absence of a calibrated hydraulic model, refer to Table 2 for minimum and average flow velocities and minimum number of cycles.
- D. Seismic: Refer to AWWA M55 (Apdx B), MAB-9, O'Rourke (2021, 2023), HDPEapp.com

Table 1: PE4710 Preferred Pressure Classes per AWWA C906 and C901 (up to 80°F)

Pipe Dimension Ratio (DR)	Pressure Class / Rating (psi)	Allowable Total Pressure during Recurring Surge (psi)	Allowable Total Pressure during Occasional Surge (psi)	AWWA C906	AWWA C901	Allowable Hydrotest (Field) Pressure (psi)
DR 17	125	188	250	Yes	NA	188
DR 13.5	160	240	320	Yes	NA	240
DR 11	200	300	400	Yes	NA	300
DR 9	250	375	500	Yes	Yes	375

Table 2: AWWA M55 Recommended Design Values for Flow Velocity and Fatigue

	Normal Flow/ Recurring Surge	Fire Flow / Occasional Surge	Cycles / day	Design Fatigue Life
Minimum	4 fps	8 fps	55	100 years
Average	6.7 fps	11.6 fps		

Table 3: Example- Comparison of required AWWA Pressure Class (PC), Flow Capacity, and Design Fatigue Life for HDPE, PVC and DI*

8" DIPS/CIOD	HDPE (PE4710)	PVC	Ductile Iron
Average Working Pressure	70 psi		
Min. Surge Flow Velocities	4 fps / 8 fps (See Table 2)		
PC	PC125 (DR17)	PC235 (DR18)	PC350
Flow Capacity @ 8fps	1229 gpm	1248 gpm	1390 gpm
Design Fatigue Life	100 years	58 years	Not Available

**In accordance with AWWA C906 standard, M55 manual and PPI PACE: Calculate the required PC for 8" DIPS PE4710, PVC and Ductile Iron pipes installed by open cut, operating at these conditions: 70 psi working pressure, with 4 fps normal flow/recurring surge and 8 fps fire flow/occasional surge; 55 cycles per day for 100 years and at 57°F average annual operating temperature.*

1.5 SUBMITTALS: Quality Assurance / Control Submittals

- A. Affirmation that product shipped meets or exceeds the requirements of the standards set forth in this specification. This shall be in the form of a document from the product's manufacturer attesting to the manufacturing process meeting the standards including associated testing reports confirming compliance.
- B. Owner reserves the right, at its own cost, to conduct in-plant audit and observe extruding/molding facilities.

1.6 DELIVERY – STORAGE – HANDLING

- A. Handle and store the pipe in accordance with the PPI *Handbook of Polyethylene Pipe, Chapter 2* using approved strapping and equipment rated for the loads encountered. Do not use chains, wire rope, forklifts or other methods or equipment that may gouge or damage the pipe or endanger persons or property.
- B. Ship with recyclable end-caps or other suitable sealing devices to prevent contamination during shipping.
- C. Refer to MAB-6 (titled Guidelines for HDPE Pipeline Inspection) for documenting condition of pipe (and all other HDPE related materials) upon delivery. If any gouges (10% or greater of wall thickness), scrapes, or other damage/manufacturing defects are noted, these materials shall be rejected. Other possible reasons for rejection include pipe that does not meet the project specifications (e.g., incorrect markings, blue striping, and/or DR), wrong sizes/sizing standards (DIPS, IPS, CTS), missing end caps, and/or other specified items.

PART 2 – HDPE PRODUCTS FOR 4 INCH AND LARGER PIPE PER AWWA C906

2.1 – PIPE

- A. HDPE pipe from 4" to 65" diameters shall be PE4710 conforming to the latest edition of ANSI/AWWA C906 and ANSI/NSF Standard 61. For potable water applications, PE4710 compound shall conform to ASTM D3350 minimum Cell classification *PE445574C-CC3*.
 - i. HDPE pipes should be extruded by a PPI member listed in PPI TR-4 and shall meet the requirements of AWWA C906. Sample list of sizes is shown in Appendix B.1.
 - ii. Dimensions and tolerances for HDPE pipes and fittings shall meet the requirements of AWWA C906.
- B. HDPE pipe shall be rated for use at a pressure class of _____ *[User specified]* psi. *[The specifier chooses the pressure class from Table 1].* The outside diameter of the pipe shall be based upon either IPS or DIPS sizing systems. *[User to specify the appropriate sizing system on the plans.]*
- C. Pipe marking in accordance with Section 2.3.
- D. HDPE manufacturers are listed in PPI TR-4 and in here: *[The specifier is referred to the list of manufacturers as shown on the PPI website]*
https://www.plasticpipe.org/MunicipalIndustrial/Municipal_Industrial/About-Municipal---Industrial/List-of-Members.aspx?hkey=4afd0f22-ee29-4a02-8928-b803cea45ae4

2.2 FITTINGS

- A. Butt Fusion Fittings – HDPE Fittings shall be made of PE4710 and with a minimum Cell Classification as shown in Section 2.1.A. All HDPE fittings shall meet the requirements of AWWA C906 and shall have a pressure rating equal to the pressure rating of the pipe to which the fitting is joined.
- B. Molded fittings (includes both butt end and sidewall/branch fittings) shall be manufactured, tested, and marked per ASTM D3261. When the required molded fitting is not available in the project specified DR, a thicker wall molded fitting can be used to maintain the PC, and the spigot ends of the thicker wall molded fitting should be modified by the fitting manufacturer or approved representative to match the DR and the nominal OD of the pipe being installed.
- C. Fabricated fittings shall be manufactured, tested, and marked per AWWA C906 and ASTM F2206. Per AWWA C906, the "PC of a fitting shall be the same as or greater than the pipe to which the fittings will be joined, including a surge allowance equal to or greater than the pipe." When a thicker wall is used to manufacture the fitting to maintain the PC, ends of fitting shall be machined by the fitting manufacturer (or approved representative) to match the DR and the nominal OD of the pipe being installed.
- D. Electrofusion Fittings (EF) - Fittings shall be made of HDPE material with a minimum material designation code of PE4710 and with a minimum Cell Classification as noted in Section 2.1A. EF fittings shall have a manufacturing standard of ASTM F1055 and shall have a pressure rating equal to the pipe unless otherwise specified on the plans. Markings shall be according to ASTM F1055, including couplings and sidewall / branch fittings. Tapping tees and all components shall be in compliance with Annex "G" or NSF/ANSI 372 as conforming with the lead content requirements for "lead free" plumbing as defined by local state/provincial laws and the U.S. Safe Drinking Water Act.

All electrofusion (EF) fittings must remain in original factory packaging until installation. Any EF fittings not in original packaging shall be rejected.

- E. Mechanical Joint adapters (MJ adapters) – MJ adapters shall have a material designation code of PE4710 with a minimum Cell Classification as noted in Section 2.1.A. MJ adapters shall be made in accordance with ASTM D3261. MJ adapters shall have a pressure rating equal to the pipe to which it is joined unless otherwise specified on the plans. Markings for MJ adapters shall be per ASTM D3261. MJ Adapter accessories whether supplied in kits or individual parts, shall include the following:
- AWWA C110 metal glands marked (AWWA C110)
 - Bolts & Nuts shall be High Strength Low Alloy (HSLA) with fluoropolymer finish or Stainless Steel (SS) as specified by the owner.
 - MJ Gaskets shall be as specified by the owner.
 - MJ adapters are the preferred connection method over other mechanical fittings. MJ adapters internal diameters should be checked for butterfly valve clearance, when used, to allow full disc rotation and movement prior to installation in the trench.
- F. Flanges – Flanges shall have a material designation code of PE4710 with a minimum Cell Classification as noted in Section 2.1.A. Flanges shall be made in accordance with ASTM F2880. Flanges shall have a pressure rating equal to the pipe to which it is joined unless otherwise specified on the plans. Markings for molded or machined flange adapters shall be per ASTM D3261.
- G. Mechanical Fittings for pipes - Three primary mechanical fittings or connections that can be used are Stab or insert type; compression type; and clamp ring. Per MAB-4, “Internal stiffeners should be used for all mechanical couplings”. Mechanical fittings shall be designed to restrain and to prevent pull-out or rotation. Refer to Appendix D titled Degradation of Gaskets with Chlorine and Chloramine.
- H. Service connections shall be either electrofusion branch saddles/tapping tees, sidewall fusion branch saddles / tapping tees, butt fusion tees or mechanical saddles. The Owner shall designate outlet diameter and type for each service specified. Various outlet configuration types are available including plain end HDPE or threaded metal in numerous thread types
- i. For electrofusion saddles with metallic threaded outlets, the size of the outlet shall be as shown on the plans including metallic material and thread type. Electrofusion saddles shall be made from materials required in Section 3.1.A.
 - ii. For sidewall fusion saddles, the size of the outlet shall be as indicated on the plans. The saddle can be made in accordance to ASTM D3261 or ASTM F2206.
 - iii. Sidewall tapping tees shall be made to ASTM D3261 or D2683 and MSS SP-60 or if electrofusion shall be made to ASTM F1055. Tapping tees shall be in compliance with Annex "G" or NSF/ANSI 372 as conforming with the lead content requirements for “lead free” plumbing as defined by local state/provincial laws and the U.S. Safe Drinking Water Act.

2.3 PIPE AND FITTING IDENTIFICATION

- A. The pipe shall be marked in accordance with the standards to which it is manufactured. *[or alternative as below]*

Markings shall include the following items: Nominal size (such as 12”), outside diameter base (such as DIPS), dimension ratio (such as DR 17), manufacturer’s name or trademark, standard materials designation code (PE4710), PE compound oxidative resistance for potable water