Proposed Revision To: ☒ **Standard Specifications For Public Works Construction** ☐ **Standard Plans For Public Works Construction**	**Change No.** 338 UM (ASSIGNED BY GREENBOOK COMMITTEE)
BNi Publications Inc. Attn: Public Works Standards, Inc. 990 Park Center Drive, Suite E Vista, California 92081	**Date Proposal Received** 03/22/24 (ASSIGNED BY GREENBOOK COMMITTEE)
Subsection or Standard Plan to be revised:	**On page(s):**

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Revision & Reason:

I am proposing changes to the following sections of the Greenbook:

- 207-19 – Update the material properties of HDPE for PE4710 resin and correct text.
- 209-5 – Update Table 209-5.2 for PE4710 resin and correct pressure ratings. Remove references to AWWA since F714 is the manufacturing standard.

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Instructions: Use a separate form for each revision. Attach plain paper if more space is needed. For minor changes, copy present wording striking out words to be deleted and underlining new text. For major changes, rewrite or add paragraph or sections. All proposed revisions must include the reason(s) for the revision

Subcommittee Action:	**Editorial Standards Subcommittee Review:**
On _____ (Date)	On _____ (Date)
☐ Recommended For _____ Supplement/Edition	☐ Reviewed For Surf/Und/Spec/Plans Subcommittee
☐ Rejected ☐ As Modified	☐ NO Modifications ☐ As Modified

Greenbook Committee Action:

On _____ **(Date)** ☐ **Approved For** _____ **Supplement/Edition** ☐ **As Modified**

☐ **Rejected**

d) Measure the maximum radial distance between pipe and fittings or between bell and spigot, during test and after the load is removed.

Pipe connections shall not separate to create a gap exceeding 3/16 inch (5 mm) when measured in the radial direction between pipe and coupling or between bell and spigot portions of the pipe. The gap measurement shall be taken at the gasket or hinge point. The test shall be conducted on a fully assembled joint, including the gasket. Fittings shall not crack or delaminate.

207-18.5.8 Cell Classification. Cell classification of pipe and fittings shall conform to 207-18.2.1.

207-18.6 Marking. Pipe and fittings shall be clearly marked at intervals of 11.5 feet (3.5 m) or less. Markings shall display the manufacturer's name and/or trademark, nominal size, plant designation code, and date of manufacture.

207-18.7 Pipe Acceptance or Rejection. Pipe shall be free of cracks, holes, delaminations, foreign inclusions, blisters, or other defects that would, due to their nature, degree or extent, have a deleterious effect on pipe performance as determined by the Engineer. Prior to installation, damaged pipe shall either be repaired or field cut to remove the damaged portion as approved by the Engineer and in accordance with the manufacturer's recommendations.

207-19 POLYETHYLENE (PE) SOLID WALL GRAVITY PIPE.

207-19.1 General. Polyethylene (PE) plastic solid wall pipe and liner for use in gravity flow sanitary sewers, storm drains, and house connection sewers shall comply with ASTM F714 for IPS 4 to 65 and DIPS 3 to 60 or ASTM D3035 for IPS 3 and smaller. Unless otherwise specified, pipe DR shall be 21. Fittings shall comply with ASTM D2683 for socket type, D3261 for butt-type, ASTM F1055 for electrofusion type, ASTM F1924 for plastic body mechanical fittings, ASTM F1984 for metallic mechanical fittings.

207-19.2 Material Composition. Pipe shall be made from PE4710 resins complying to ASTM D3350 cell classification 445574C, and which shall further meet the requirements as listed in the following table:

TABLE 207-19.2

Property	Value	ASTM Test
Density (g/cm^3)	>0.941-0.955	D1505
Melt Index (g/10 minutes)	<0.15	D1238 cond. 190/21.6
Flexural Modulus, psi (MPa)	110,000 to <160,000 (758to < 1103)	D790
Tensile strength at yield, psi (MPa)	3,500 to <4,000 (24 to <28)	D638
Elongation at break	>400%	D638
Brittleness temperature, °F (°C)	≤-76° (≤-60°) max.	D746
Thermal Stability. °F (°C)	≥220 ()	
PENT, hours	≥500	F1473
Hydrostatic Design Basic, psi (MPa) @ 73°F (23°C)	1600 (11.0)	D2837
Color and UV Stabilizer	Black with 2% to 3% well dispersed carbon black	

1. F_o indicates no failures.

Additives and fillers including, but not limited to, stabilizers, antioxidants, lubricants, colorants, etc., shall not exceed 5 parts by weight per 100 of PE resin in the compound. The Engineer may require a Certificate of Compliance by the manufacturer that the test results conform to the requirements of the Specifications.

207-19.3 Pipe Acceptance. At the time of manufacture, all pipe, liner, and fittings shall be inspected for defects.

At the time of delivery, the pipe shall be homogeneous throughout, uniform in color, free of cracks, holes, foreign materials, blisters, or deleterious faults.

207-19.4 Marking. Pipe shall be marked at 5-foot (1.5 m) intervals or less. Pipe markings shall consist of production standard (ASTM F714), date of manufacture, manufacturer name or trademark, SDR, size, size system (IPS or DPS), resin material code (PE4710), production code to identify resin lot used in manufacture of pipe .

Fittings shall be marked with the name of the manufacturer or its logo, the size, and the material from which they were molded or fabricated.

207-19.5 Chemical Resistance and Physical Testing. PE resins shall be tested in accordance with 211-2 and conform to the requirements shown in Table 207-19.5.

TABLE 207-19.5

Property	ASTM Test Method	Initial Value	Value After 112 Days Exposure
Tensile stress at yield, psi (MPa) min.	D638	3,200 (22.1)	3,200 (22.1)
Impact Strength, ft-lb/inch (J/m) min.	D256 Method A Size 1/2 x 1/8 x 2-1/2" (12.7 x 3.17 x 63.5 mm)	3.5 (187)	3.5 (187)
Weight Change	D543		
Unconditioned			± 1.5% max.
Conditioned			± 1.0% max.

The Engineer may, at any time, direct the manufacturer and/or Contractor to obtain compound samples and to obtain compression molded test specimens in accordance with ASTM D4703. These specimens shall conform to the minimum property values shown in Table 207-19.5.

Note: PPI TR-19 lists the chemical resistance of several thermoplastic piping materials including polyethylene (see https://www.plasticpipe.org/PPI-Home/ALL-PPI-PUB/Technical-Reports.aspx).

207-20 FIBERGLASS REINFORCED POLYMER MORTAR (FRPM) PIPE.

207-20.1 General. These specifications apply to FRPM pipe to be used for the construction of direct bury gravity sanitary sewers. storm drains, and related structures. Pipes. joints, and fittings shall conform to ASTM D3262. Unless otherwise specified, the minimum pipe stiffness shall be 46 pounds per square inch (318 kPa) when tested in accordance with ASTM D2412. The size, type, and stiffness of the pipe to be furnished shall be as shown on the Plans or specified in the Special Provisions.

207-20.2 Materials. The amount, location, and orientation of the chopped and continuous glass-fiber reinforcement shall be specifically designed for each application. The glass shall be a commercial grade of E-type glass fibers with a finish compatible with the resin used. The sand shall be a minimum 98 percent silica kiln-dried and graded. The polyester wall resin shall be an isophthalic, orthophthalic, or other approved resin with a minimum tensile elongation of 2 percent. A vinyl ester liner resin shall

be used to meet the chemical requirements of 207-20.5. Designation per ASTM D3262 shall be Type 1, Liner 1 or 2, Grade 1 or 3, and a minimum pipe stiffness of 46 pounds per square inch (318 kPa) or greater, unless a higher value is indicated in the Plans or specified in the Special Provisions. Elastomeric sealing gaskets shall conform to the requirements of ASTM F477.

209-5 HIGH-DENSITY POLYETHYLENE (HDPE) SOLID WALL PRESSURE PIPE.

209-5.1 General. This subsection specifies HDPE solid wall pipe to be used for pressure piping applications for water and recycled water pressure pipes and for sewage force mains.

209-5.2 Materials. Unless otherwise specified, HDPE pressure pipe shall conform to the following.

TABLE 209-5.2

Item	Material	Reference Specification/Requirements	
Pipe	Manufacturing Standards (Potable Water Pipe)	Conform to AWWA C901 for IPS 1/2 to 3 (12.5 mm -75 mm). Conform to AWWA C906 for IPS 4 to 63 (100 mm -1575 mm).	
	Manufacturing Standards (Non-Potable Water Pipe)	Conform to ASTM F714 for IPS 4 to 65 and DIPS 3 to 60 Conform to ASTM D3035 for IPS 3 and smaller.	
	Design Standards	Conform to AWWA M55.	
	NSF Certification	NSF 61 certification required for potable water pipe.	
	HDPE Material	PE4710 conforming to 207-19.2	
	Markings (each pipe)	Conform to manufacturing standard	
		applicable standard.	
		nominal pipe size and size system (e.g., IPS, DIPS, CTS)	
		material code designation (PE4710).	
		pressure class or DR.	
		Third Party Certification (NSF 61 for potable water).	
		manufacturer name or trademark, manufactured date, and production code to identify resin lot used in manufacture of pipe	
	Minimum Wall Thickness (Dimension Ratio)	**Pressure Rating at 73F, psi (MPa)**	**Dimension Ratio (DR)**
		100 (0.689)	21
		110 (0.758)	19
		125 (0.862)	17
		140 (0.965)	15.5
		160 (1.10)	13.5
		200 (1.38)	11
		250 (1.72)	9
		320 (2.21)	DR 7.3
		335 (2.31)	7
Joints	Style	Heat fusion joining in accordance ASTM F2620. Electrofusion joining in accordance with fitting manufacturer recommendations.	
		Flanged for connections to appurtenances and other pipe materials other than PE4710 in accordance with PPI TN-38 (Polyethylene Flanged Joints).	
	Flange Back-up Ring	Provide flange back-up ring of Type 316 SS or fusion bonded epoxy coated ductile iron.	
	Design Pressure	Match design pressure rating of pipe	
Fittings & Valves	Standards	ASTM D2683 for socket-type, ASTM D3261 for butt-type, or ASTM F1055 for electrofusion type, ASTM F1924 for plastic body mechanical fittings, ASTM F1984 for metallic mechanical fittings, ANSI B16.40 for PE valves	
	Internal Stiffener Ring	Required for mechanical compression fittings	
	Thrust Restraint	Not required for heat fused or flanged joints	

209-6 FIBERGLASS PRESSURE PIPE.

209-6.1 General. This subsection specifies fiberglass pressure pipe up to 64-inch (1600 mm) diameter to be used for pressure piping applications for water and recycled water pressure pipes and for sewage force mains.