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StandardSpecification for Billets made by Winding Molten Extruded Stress-Rated High Density Polyethylene (HDPE)[1]

This standard is issued under the fixed designation F3034; 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 specification covers billets made from stress-rated high-density polyethylene (HDPE) materials.

1.2 The billets are manufactured by application of molten extruded material onto a rotating mandrel to form a monolithic mass. Machining prior to dimensioning is acceptable.

NOTE 1—Although it is impossible to address all manufacturing details related to the fabrication of billets in this specification, successful heat fusion bonding of HDPE is obtained through controlled application of sufficient heat to cause melting in combination with applied force over a period of time.

1.3 The billets are intended for fabrication into pipe fittings such as flange adapters and reducers.

1.4 Requirements for and use of the fabricated pipe fittings shall be in accordance with an applicable product specification. This specification for billets does not include requirements for items fabricated from the billets.

1.5 This specification includes thermoplastic pipe material designation codes for selection of appropriate stress-rated material, together with performance requirements for billets and test methods for determining conformance with the requirements.

1.6 Minimum quality control measures are prescribed for manufacturers. See Annex A1 for quality control for billets conforming to this specification.

1.7 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.

1.8 *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.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D618 Practice for Conditioning Plastics for Testing

D638 Test Method for Tensile Properties of Plastics

D1238 Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer

D1600 Terminology for Abbreviated Terms Relating to Plastics

D1603 Test Method for Carbon Black Content in Olefin Plastics

D2122 Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings

D2837 Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products

D3350 Specification for Polyethylene Plastics Pipe and Fittings Materials

D4218 Test Method for Determination of Carbon Black Content in Polyethylene Compounds By the Muffle-Furnace Technique

F412 Terminology Relating to Plastic Piping Systems

2.2 *NSF/ANSI Standards:*[3]

Standard No. 14 for Plastic Piping Components and Related Materials

Standard No. 61 for Drinking Water Systems Components—Health Effects

2.3 *PPI Standards:*[4]

PPI TR-3 Policies and Procedures for Developing Hydrostatic Design Basis (HDB), Pressure Design Basis (PDB), Strength Design Basis (SDB), and Minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipe

PPI TR-4 HDB/SDB/PDB/MRS Listed Materials, PPI Listing of Hydrostatic Design Basis (HDB), Strength Design

[1] This specification is under the jurisdiction of ASTM Committee F17 on Plastic Piping Systems and is the direct responsibility of Subcommittee F17.26 on Olefin Based Pipe.

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

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

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Basis (SDB), Pressure Design Basis (PDB), and Minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipe

3. Terminology

3.1 Unless otherwise specified, definitions are in accordance with Terminology F412 and abbreviations are in accordance with Terminology D1600.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *average outside diameter, n*—the average distance following all forming and machining operations when measured in accordance with 6.3.1.

3.2.2 *billet, n*—a mass formed from a single polyethylene compound in the approximate shape of a thick-walled cylindrical shell.

3.2.3 *mid-wall, n*—the location half-way between the outside diameter and the inside diameter following all forming and machining operations.

3.2.4 *minimum wall thickness, n*—the minimum distance following all forming and machining operations when measured in accordance with 6.3.2.

4. Materials

4.1 *Polyethylene Compound*—Polyethylene compounds used in the manufacture of billet under this specification shall have thermoplastic pipe materials designation code PE3608, PE4608 or PE4710; shall have a minimum Specification D3350 cell classification of 333344C and shall meet all other requirements of Specification D3350.

4.1.1 *General*—The PE compound used to make billet shall be virgin PE compound or reworked PE compound (see 4.3) and shall have a hydrostatic design basis listed in Plastics Pipe Institute (PPI) TR-4.

4.1.2 *Color and Ultraviolet (UV) Stabilization*—Polyethylene compounds shall meet Specification D3350 code C. In addition, Code C polyethylene compounds shall have 2.0 to 3.0 percent carbon black.

4.1.3 *Hydrostatic Design Basis (HDB) Substantiation*—The HDB for PE compound at 73°F (23°C) shall be substantiated to be linear to 50 years as described in Substantiation of the HDB for Polyethylene Materials in Test Method D2837.

NOTE 2—This is 5.7 in the 2011 publication of Test Method D2837.

4.1.4 *Melt Flow Requirement*—Polyethylene compounds shall be tested in conformance with Test Method D1238 either at condition 190/2.16 or 190/21.6. When tested at condition 190/2.16, the resulting value shall be ≤0.15 g/10 min. When tested at condition 190/21.6, the resulting value shall be ≤20 g/10 min.

4.2 *Potable Water Requirement*—When required by the purchaser, billets intended for fabrication into products intended for contact with potable water shall utilize PE compounds certified for conformance with NSF/ANSI Standard No. 61 or the health effects portion of NSF/ANSI Standard No. 14 by an acceptable certifying organization.

4.3 *Rework Material*—Clean polyethylene compound from the manufacturer's own production that meets 4.1 and 4.2 of this specification as new compound is suitable for reextrusion into billet, when blended with new compound of the same thermoplastic pipe material designation code. Billet containing rework material shall meet the requirements of this specification.

5. Requirements

5.1 *Workmanship*—The billet shall be uniform in appearance and consistent throughout. The walls shall be free of cracks, holes, blisters, voids, foreign inclusion, or other defects that are visible to the naked eye and that affect the wall integrity (see Annex A1). A single hole deliberately placed in the center of the billet is required.

NOTE 3—Manufacturers should use appropriate quality assurance procedures to ensure that billets are free from injurious defects including laminations.

5.2 Dimensions and Tolerances: Requirements for dimensions shall only apply to a billet that is transferred from a seller to a buyer prior to being fabricated into one or more pipe fittings. When a billet is produced and fabricated into pipe fittings by a single manufacturer, there are no dimensional requirements specified for the billet by this Standard. All dimensional requirements for pipe fittings are as given in the applicable product standard.

5.2.1 *Average Outside Diameter and Minimum Wall Thickness*— The average outside diameter and minimum wall thickness shall fall within the range of acceptable values established in either Table 1 or Table 2 depending on nominal mandrel dimensions for billets manufactured to meet a standard size. When measured in accordance with Test Method D2122 conditioning is required according to Practice D618, Procedure A to standard temperature without regard to relative humidity.

5.2.2 *Length*—Any length shall be allowable, provided it is agreeable to both buyer and seller. When specified, the minimum length shall be measured following conditioning according to Practice D618, Procedure A to standard temperature without regard to relative humidity.

5.2.3 *Special Sizes*—Where existing system conditions or special local requirements make other average outside diameters or minimum wall thicknesses necessary, other average outside diameters or minimum wall thicknesses, or both, shall be acceptable when mutually agreed upon by the customer and the manufacturer, provided the billet meets all other requirements of this specification. For average outside diameters not shown in Table 1 or Table 2, the tolerance shall be the same percentage as that used in Table 1 or Table 2 for the next smaller listed average outside diameter. Maximum and minimum wall thicknesses for mandrel sizes not shown in Table 1 or Table 2 shall be determined by subtracting the mandrel size from the maximum and minimum average outside diameter, respectively, then dividing by 2 and, finally, by rounding the third decimal place of the resulting value to give the maximum or minimum wall thickness respectively.

5.3 *Thermal Stability*—The PE material shall contain sufficient antioxidant so that the minimum induction temperature for mid-wall, outside diameter and inside diameter shall each be 428°F (220°C) when tested in accordance with both

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TABLE 1 Dimensions of Standard Billet Sizes up to Nominal Mandrel Size of 21

	Outside Diameter Dimensions				Nominal Mandrel Sizes															
Nominal	Min. OD		Max OD		6.625				8.625				10.75				12.75			
					Min.Wall		Max.Wall		Min.Wall		Max.Wall		Min.Wall		Max.Wall		Min.Wall		Max.Wall	
O.D.	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
13	12.922	328.22	13.078	332.18	3.149	79.98	3.227	81.95	2.149	54.57	2.227	56.55	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
15	14.910	378.71	15.090	383.29	4.143	105.23	4.233	107.51	3.143	79.82	3.233	82.11	2.080	52.83	2.170	55.12	N/A	N/A	N/A	N/A
16	15.904	403.96	16.096	408.84	4.640	117.86	4.736	120.28	3.640	92.44	3.736	94.88	2.577	65.46	2.673	67.89	1.577	40.06	1.673	42.49
18	17.892	454.46	18.108	459.94	5.634	143.10	5.742	145.83	4.634	117.69	4.742	120.43	3.571	90.70	3.679	93.45	2.571	65.30	2.679	68.05
20	19.880	504.95	20.120	511.05	6.628	168.35	6.748	171.39	5.628	142.94	5.748	145.99	4.565	115.95	4.685	119.00	3.565	90.55	3.685	93.60
21	20.874	530.20	21.126	536.60	7.125	180.98	7.251	184.16	6.125	155.56	6.251	158.76	5.062	128.57	5.188	131.78	4.062	103.17	4.188	106.38
22	21.868	555.45	22.132	562.15	7.622	193.60	7.754	196.94	6.622	168.19	6.754	171.54	5.559	141.20	5.691	144.55	4.559	115.80	4.691	119.15
25	24.850	631.19	25.150	638.81	9.113	231.47	9.263	235.27	8.113	206.06	8.263	209.87	7.050	179.07	7.200	182.88	6.050	153.67	6.200	157.48
26	25.844	656.44	26.156	664.36	9.610	244.09	9.766	248.04	8.610	218.68	8.766	222.64	7.547	191.69	7.703	195.66	6.547	166.29	6.703	170.26
27	26.838	681.69	27.162	689.91	10.107	256.72	10.269	260.82	9.107	231.31	9.269	235.42	8.044	204.32	8.206	208.43	7.044	178.92	7.206	183.03
28	27.832	706.93	28.168	715.47	10.604	269.34	10.772	273.60	9.604	243.93	9.772	248.20	8.541	216.94	8.709	221.21	7.541	191.54	7.709	195.81
29	28.826	732.18	29.174	741.02	11.101	281.97	11.275	286.37	10.101	256.55	10.275	260.97	9.038	229.57	9.212	233.98	8.038	204.17	8.212	208.58
30	29.820	757.43	30.180	766.57	11.598	294.59	11.778	299.15	10.598	269.18	10.778	273.75	9.535	242.19	9.715	246.76	8.535	216.79	8.715	221.36
31	30.814	782.68	31.186	792.12	12.095	307.21	12.281	311.92	11.095	281.80	11.281	286.52	10.032	254.81	10.218	259.54	9.032	229.41	9.218	234.14
33	32.802	833.17	33.198	843.23	13.089	332.46	13.287	337.48	12.089	307.05	12.287	312.08	11.026	280.06	11.224	285.09	10.026	254.66	10.224	259.69
34	33.796	858.42	34.204	868.78	13.586	345.08	13.790	350.25	12.586	319.67	12.790	324.85	11.523	292.68	11.727	297.87	10.523	267.28	10.727	272.47
35	34.790	883.67	35.210	894.33	14.083	357.71	14.293	363.03	13.083	332.30	13.293	337.63	12.020	305.31	12.230	310.64	11.020	279.91	11.230	285.24
37	36.778	934.16	37.222	945.44	N/A	N/A	N/A	N/A	14.077	357.54	14.299	363.18	13.014	330.56	13.236	336.19	12.014	305.16	12.236	310.79
39	38.766	984.66	39.234	996.54	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	14.008	355.80	14.242	361.75	13.008	330.40	13.242	336.35
40	39.760	1009.90	40.240	1022.10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	13.505	343.03	13.745	349.12
41.25	41.003	1041.48	41.498	1054.05	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	14.127	358.81	14.374	365.10
42	41.748	1060.40	42.252	1073.20	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
43	42.742	1085.65	43.258	1098.75	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
44	43.736	1110.89	44.264	1124.31	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
48	47.712	1211.88	48.288	1226.52	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
49	48.706	1237.13	49.294	1252.07	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

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