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INTERNATIONAL ASSOCIATION OF PLUMBING AND MECHANICAL OFFICIALS

IAPMO GUIDE CRITERIA FOR

POLYETHYLENE OF RAISED TEMPERATURE (PE-RT) TUBING

IAPMO IGC 228-2006

1. PURPOSE

- 1.1** This standard establishes general requirements for Polyethylene of Raised Temperature (PE-RT) Tubing. Its purpose is to serve as a guide for producers, distributors, architects, engineers, contractors, installers, inspectors and users; to promote understanding regarding materials and manufacture; and to provide for identifying PE-RT tubing.
- 1.2** The provisions of this standard are not intended to prevent the use of any alternate material or method of construction, provided any such alternate meets the intent and requirements of this standard.

2. SCOPE

- 2.1** This standard establishes requirements for polyethylene of raised temperature (PE-RT) tubing made to standard thermoplastic tubing dimension ratios (SDR) that is outside diameter controlled, and pressure rated for water at 73°F (23°C), 140°F (60°C) and 180°F (82.2°C). Included are requirements for material, workmanship, dimensions and tolerances, product tests, and markings for PE-RT tubing.
- 2.2** The tubing produced under this standard is intended for use in general fluid transport, including hydronics and irrigation systems. This standard does not address potable water applications.

3. REFERENCED STANDARDS

- 3.1** All standards referenced herein shall be the current edition of the standards.

ASME B36.10	Welded and Seamless Wrought Steel Pipe
ASTM D 618	Conditioning Plastics and Electrical Insulating Materials for Testing
ASTM D 1598	Time-to-Failure of Plastic Pipe Under Constant Internal Pressure
ASTM D 1599	Short-Time Hydraulic Failure Pressure of Plastic Pipe, Tubing and Fittings
ASTM D 2122	Determining Dimensions of Thermoplastic Pipe and

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ASTM D 2657
ASTM D 3350
ASTM D 3895

ISO 1167

Fittings
Heat Fusion Joining of Polyolefin Pipe and Fittings
Polyethylene Plastics Pipe and Fittings Materials
Oxidative-Induction Time of Polyolefins by Differential
Scanning Calorimetry
Thermoplastics Pipes for the Conveyance of Fluids –
Resistance to Internal Pressure Test Method

4. GENERAL REQUIREMENTS

4.1 Tubing Classification

4.1.1 General. This standard covers one PE-RT tubing material in one standard dimension ratio and having pressure ratings for water of three temperatures. The pressure ratings decrease as the temperature is increased.

4.1.2 Standard Thermoplastic Pipe Dimension Ratio (SDR). This specification covers PE-RT tubing in one standard dimension ratio (SDR 9) and nominal tubing diameters from 1/8 in. through 6 in. with a maximum continuous use temperature that shall be 180°F (82°C). The pressure ratings are uniform for all nominal tubing sizes.

4.2 Materials

4.2.1 General. The plastic used to make tubing shall be virgin plastic or reworked plastic, as specified in 4.2.3 of this standard, and shall have a Plastics Pipe Institute (PPI) long-term hydrostatic design stress and hydrostatic design basis rating at 73°F, 140°F and 180°F. The ratings at 140°F are non-mandatory.

4.2.2 Layers. PE-RT tubing may incorporate an optional interior wall, mid wall or outer wall layer(s) or a combination of layers of non-PE-RT material for the express purpose of providing gas barrier properties to the tubing. Such layers shall consist of material compatible with the base PE-RT material. A layer may consist of multiple layers such as a gas barrier layer with associated layers promoting adhesion between the PE-RT and the barrier material.

4.2.3 Rework Material. Clean rework material of the same commercial designation, generated from the manufacturer's own pipe production shall not be used unless the tubing produced meets all the requirements of this standard.

4.2.4 Classification. Polyethylene materials suitable for use in the manufacture of tubing under this standard shall be classified in accordance with ASTM D 3350 and as shown in Table 1 of this standard. The material shall have minimum HDS and pressure ratings as per Table 2 of this standard. The ratings at 140°F are non-mandatory.

4.2.5 Tubing Material Designation. The tubing meeting the requirements of this standard shall be designated PE-RT.

TABLE 1: Required ASTM D 3350 Cell Classifications for PE-RT

<i>Physical Properties:</i>	<i>Cell Number</i>
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Density	2, 3, or 4
Melt index	2, 3, 4, or 5
Flexural modulus	3 or 4
Tensile strength	2 or 3
Slow crack growth resistance	7
Hydrostatic design basis	3 or 4

TABLE 2: Minimum Hydrostatic Design Stresses and Pressure Ratings for PE-RT SDR 9 Plastic Tubing for Water at Different Temperatures

Rated Temperature		Hydrostatic Design Stress		Pressure Rating for Water	
°F	°C	psi	(MPa)	psig	(MPa)
73.4	23	630	(4.34)	160	(1.10)
140	60	400	(2.76)	100	(0.69)
180	82.2	315	(2.15)	80	(0.55)

4.3 Workmanship. The tubing shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, or other defects. The tubing shall be as uniform as commercially practicable in color, opacity, density, and other physical properties.

4.4 Outside Diameters of Tubing. The outside diameters and tolerances shall be as shown in Table 3, when measured in accordance with 5.4 and 5.4.1 of this standard.

TABLE 3: Outside Diameters and Tolerances for PE-RT Tubing

Nominal Tubing Size		Average Outside Diameter		Tolerances for Average Diameter		Out-of-Roundness ^A	
in.	mm	in.	mm	in.	mm	in.	mm
1/8	3	0.250	6.35	±0.003	±0.08	0.008	0.20
¼	7	0.375	9.52	±0.003	±0.08	0.008	0.20
5/16	8	0.430	10.92	±0.003	±0.08	0.008	0.20
3/8	10	0.500	12.70	±0.003	±0.08	0.012	0.32
½	13	0.625	15.88	±0.004	±0.10	0.016	0.40
5/8	16	0.750	19.05	±0.004	±0.10	0.016	0.40
¾	19	0.875	22.22	±0.004	±0.10	0.016	0.40
1	25	1.125	28.58	±0.005	±0.12	0.020	0.48
1 ¼	32	1.375	34.92	±0.005	±0.12	0.020	0.48
1 ½	38	1.625	41.28	±0.006	±0.16	0.024	0.60
2	51	2.125	53.98	±0.006	±0.16	0.030	0.76
2 ½	64	2.625	66.68	±0.007	±0.18	0.038	0.95
3	76	3.125	79.38	±0.008	±0.20	0.045	1.14
3 ½	89	3.625	92.08	±0.008	±0.20	0.046	1.16
4	102	4.125	104.78	±0.009	±0.23	0.052	1.32
4 ½	114	4.625	117.48	±0.009	±0.23	0.059	1.49
5	127	5.125	130.18	±0.010	±0.25	0.065	1.65
6	152	6.125	155.58	±0.011	±0.28	0.072	1.83

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