MATERIAL SPECIFICATION 547 – PLASTIC PIPE

1. SCOPE

This specification covers the quality of Poly Vinyl Chloride (PVC), Polyethylene (PE), High Density Polyethylene (HDPE), and Acrylonitrile-Butadiene-Styrene (ABS) plastic pipe, fittings, and joint materials.

2. MATERIAL

Pipe – The pipe shall be as uniform as commercially practicable in color, opaqueness, density, and other specified physical properties. It shall be free from visible cracks, holes, foreign inclusions, or other defects. The dimensions of the pipe shall be measured as prescribed in ASTM D 2122.

Unless otherwise specified, the pipe shall conform to the requirements listed in this specification and the applicable reference specifications in Table 547-2, the requirements specified in Construction Specification 111, Plastic Pipe, and the requirements shown on the drawings.

Fittings and joints – Fittings and joints shall be of a schedule, SDR or DR, pressure class, external load carrying capacity, or pipe stiffness that equals or exceeds that of the plastic pipe. The dimensions of fittings and joints shall be compatible with the pipe and measured in accordance with ASTM D-2122. Joint and fitting material shall be compatible with the pipe material. The joints and fittings shall be as uniform as commercially practicable in color, opaqueness, density, and other specified physical properties. It shall be free from visible cracks, holes, foreign inclusions, or other defects.

Fittings and joints shall conform to the requirements listed in this specification, the requirements of the applicable specification referenced in the ASTM or AWWA specification for the pipe, the requirements specified in Construction Specification 45, and the requirements shown on the drawings.

Solvents – Solvents for solvent welded pipe joints shall be compatible with the plastic pipe used and shall conform to the requirements of the applicable specification referenced in the ASTM or AWWA specification for the pipe, fitting, or joint.

Gaskets—Rubber gaskets for pipe joints shall conform to the requirements of ASTM F 477, Elastomeric Seals (Gaskets) for Jointing Plastic Pipe.

3. PERFORATIONS

When perforated pipe is specified, perforations shall conform to the following requirements unless otherwise specified in Construction Specification 45 or shown on the drawings:

a. Perforations shall be either circular or slots.

b. Circular perforations shall be 1/4 ± 1/16-inch diameter holes arranged in rows parallel to the axis of the pipe. Perforations shall be evenly spaced along each row such that the center-to-center distance between perforations is not less than eight times the perforation diameter. Perforations may appear at the ends of short and random lengths. The minimum perforation opening per foot of pipe shall be as shown in Table 547-1.

Table 547–1 Perforations

Nominal Pipe Size (in)	Minimum number of rows		Minimum opening/foot (in^2)
	circular	slot	
4	2	2	0.22
6	4	2	0.44
8	4	2	0.44
10	4	2	0.44
12	6	2	0.66

c. Rows shall be arranged in two equal groups at equal distance from the bottom on each side of the vertical centerline of the pipe. The lowermost rows of perforations shall be separated by an arc of not less than 60 degrees or more than 125 degrees. The uppermost rows of perforations shall be separated by an arc not to exceed 166 degrees. The spacing of rows between these limits shall be uniform. The minimum number of rows shall be as shown in Table 547-1.

d. Slot perforations shall be symmetrically located in two rows, one on each side of the pipe centerline. Slot perforations shall be located within the lower quadrants of the pipe with slots no wider than 1/8-inch and spaced not to exceed 11 times the perforation width. Minimum perforation opening per lineal foot of pipe shall be as shown in Table 547–1.

e. On both the inside and outside of the pipe, perforations shall be free of cuttings or frayed edges and of any material that would reduce the effective opening.

Table 547–2 Pipe Specification

Pipe	Specification
Poly vinyl chloride (PVC) pipe	
Plastic pipe - Schedules 40, 80, 120	ASTM D 1785 ASTM D 2466
Pressure rated pipe - SDR Series	AWWA C 900 ASTM D 2241
Plastic drain, waste, and vent pipe and fittings	ASTM D 2665
Joints for IPS PVC pipe using solvent weld cement	ASTM D 2672
Composite sewer pipe	ASTM D 2680
Type PSM PVC sewer pipe and fittings	ASTM D 3034
Large-diameter gravity sewer pipe and fittings	ASTM F 679
Smooth-Wall Underdrain Systems for Highway, Airport, and Similar Drainage	ASTM F 758
Profile gravity sewer pipe and fittings based on controlled inside diameter	ASTM F 794
Corrugated sewer pipe with a smooth interior and fittings	ASTM F 949
Pressure pipe, 4-inch through 12-inch for water distribution	AWWA C 900
Water transmission pipe, nominal diameters 14-inch through 36-inch	AWWA C 905
Polyethylene (PE) plastic pipe	
Schedule 40	ASTM D 2104
12 to 60-inch annular corrugated profile-wall polyethylene (PE) pipe and fittings	ASTM F 2306
SIDR-PR based on controlled inside diameter	ASTM D 2239
Schedules 40 and 80 Based on outside diameter	ASTM D 2447
SDR-PR based on controlled outside diameter	ASTM D 3035
High density polyethylene (HDPE) plastic pipe	
Plastic pipe and fittings	ASTM D 3350
SDR-PR based on controlled outside diameter	ASTM F 714
Heat joining polyolefin pipe and fittings	ASTM D 2657
Acrylonitrile-butadiene-styrene (ABS) pipe	
Plastic pipe, schedules 40 and 80	ASTM D 1527
Composite sewer pipe	ASTM D 2680

Table 547-3. PVC Plastic Irrigation Pipe (PIP) and Iron Pipe Size (IPS) ASTM D-2241

Nominal Pipe Size (in)	SDR	PVC Pressure Rating lb/in^2							
		Material				PIP		IPS	
		1120 1220 2120	2116	2112	2110	Wall Thickness (in)	Avg. O. D. (in.)	Wall Thickness (in)	Avg. O.D. (in.)
6	51	80				.120	6.140		6.625
	41	100	80	63	50	.150		.162	
	32.5	125	100	80	63	.189		.204	
	26	160	125	100	80			.255	
8	51	80				.160	8.160		8.625
	41	100	80	63	50	.199		.210	
	32.5	125	100	80	63	.251		.265	
	26	160	125	100	80			.332	
10	51	80				.200	10.200		10.750
	41	100	80	63	50	.249		.262	
	32.5	125	100	80	63	.314		.331	
	26	160	125	100	80			.413	
12	51	80				.240	12.240		12.750
	41	100	80	63	50	.299		.311	
	32.5	125	100	80	63	.377		.392	
	26	160	125	100	80			.490	
14	51	80							14.000
	41	100	80	63	50			.341	
	32.5	125	100	80	63			.430	
	26	160	125	100	80			.538	
15	51	80				.300	15.300		
	41	100	80	63	50	.373			
	32.5	125	100	80	63	.471			
	26	160	125	100	80	.588			
16	51	80							16.000
	41	100	80	63	50			.390	
	32.5	125	100	80	63			.492	
	26	160	125	100	80			.615	
18	51	80				.366	18.701		18.000
	41	100	80	63	50	.456		.439	
	32.5	125	100	80	63	.575		.554	
	26	160	125	100	80	.719		.692	
20	51	80							20.000
	41	100	80	63	50			.488	
	32.5	125	100	80	63			.615	
	26	160	125	100				.769	
21	51	80				.432	22.047		
	41	100	80	63	50	.538			
	32.5	125	100	80	63	.678			
	26	160	125	100		.848			
24	51	80				.486	24.803		24.000
	41	100	80	63	50	.605		.585	
	32.5	125	100	80	63	.763		.738	
	26	160	125	100		.954		.923	
27	51	80				.548	27.953		
	41	100	80	63	50	.682			
	32.5	125	100	80	63	.860			
	26	160	125	100		1.075			

Other standard pipe sizes available in PVC IPS are 30 and 36 inches, but are not shown on this table see ASTM D2241

Table 547-4. Water Pressure Ratings for Schedules 40, 80 and 120, Un-threaded Plastic Pipe; Polyvinyl Chloride (PVC)

Nominal Pipe Size (in)	Average Inside Diameter (in)			(ASTM D-1785 Schedule 40, 80 and 120 Pipe) Working Pressure Rating (lb/in^2)											
				1120 1220 2120			2116			2112			2110		
	Sch. 40	Sch. 80	Sch. 120	Sch. 40	Sch. 80	Sch. 120	Sch. 40	Sch. 80	Sch. 120	Sch. 40	Sch. 80	Sch. 120	Sch. 40	Sch. 80	Sch. 120
1/2	0.622	0.546	.500	600	850	1010	480	680	810	370	530	630	200	420	510
3/4	.824	742	.710	480	690	770	890	550	620	300	430	480	240	340	390
1	1.049	.957	.915	450	630	720	360	500	570	280	390	450	220	320	360
1-1/4	1.380	1.238	1.23	370	520	600	290	420	480	230	320	370	180	260	300
1-1/2	1.610	1.500	1.45	330	470	540	260	380	430	210	290	340	170	240	270
2	2.067	1.939	1.875	280	400	470	220	320	380	170	250	290	140	200	240
2-1/2	2.469	2.323	2.275	300	420	470	240	340	370	190	260	290	150	210	230
3	3.068	2.900	2.800	260	370	440	210	300	360	160	230	280	130	190	220
3-1/2	3.548	3.364	3.530	240	350	380	190	280	310	150	220	240	120	170	190
4	4.026	3.826	3.626	220	320	430	180	260	340	140	200	270	110	160	220
5	5.047	4.813	4.563	190	290	400	160	230	320	120	180	250	100	140	200
6	6.065	5.761	5.501	180	280	370	140	220	300	110	170	230	90	140	190
8	7.981	7.625	7.189	160	250	380	120	200	290	100	150	250	80	120	180
10	10.020	9.564	9.064	140	230	370	110	190	290	90	150	230	70	120	180
12	11.938	11.376	10.750	130	230	340	110	180	270	80	140	210	70	110	170

Table 547-5. Water Pressure Ratings for Schedules 40, 80 and 120, Threaded Plastic Pipe; Polyvinyl Chloride (PVC)

Nominal Pipe Size (in)	Average Inside Diameter (in)			(ASTM D-1785 Schedule 40, 80 and 120 Pipe) Working Pressure Rating (lb/in^2)											
				1120 1220 2120			2116			2112			2110		
	Sch. 40	Sch. 80	Sch. 120	Sch. 40[1/]	Sch. 80	Sch. 120	Sch. 40[1/]	Sch. 80	Sch. 120	Sch. 40[1/]	Sch. 80	Sch. 120	Sch. 40[1/]	Sch. 80	Sch. 120
1/2	0.622	0.546	.500		420	510		340	410		260	320		210	250
3/4	.824	742	.710		340	390		280	310		210	240		170	190
1	1.049	.957	.915		320	360		250	290		200	220		160	180
1-1/4	1.380	1.238	1.23		260	300		210	240		160	190		130	150
1-1/2	1.610	1.500	1.45		240	270		190	210		150	170		120	130
2	2.067	1.939	1.875		200	240		160	190		130	150		100	120
2-1/2	2.469	2.323	2.275		210	230		170	190		130	150		110	120
3	3.068	2.900	2.800		190	220		150	180		120	140		90	110
3-1/2	3.548	3.364	3.530		170	190		140	150		110	120		90	100
4	4.026	3.826	3.626		160	220		130	170		100	130		80	110
5	5.047	4.813	4.563		140	200		120	160		90	120		70	100
6	6.065	5.761	5.501		140	190		110	150		90	120		70	90
8	7.981	7.625	7.189		120	180		100	140		80	110		60	90
10	10.020	9.564	9.064		120	180		90	140		70	110		60	90
12	11.938	11.376	10.750		110	170		90	140		70	110		60	80

[1/] ASTM D-1785 States – The Industry does not recommend threading PVC plastic pipe in Schedule 40 dimensions in normal pipe sizes

Table 547-6. ABS Thermoplastic Pipe (SIDR-PR) Threaded and Un-threaded

(ABS – ASTM D-1527)

Nominal Pipe Size (in)	Schedule Rating	ABS Pressure Rating lb/in^2 (Un-threaded)				Dimension and Tolerance			ABS Pressure Rating lb/in^2 (Threaded)			
		Material				Wall Thickness		O. D Average (in)	Material (See Note)			
		1316	2112	1210	1208	Min (in)	Tolerance (in)		1316	2112	1210	1208
1/2	40	480	370	300	240	.109	+0.020	0.840				
	80	680	530	420	340	.147	+0.020		340	260	210	170
3/4	40	370	300	240	190	.113	+0.020	1.050				
	80	550	430	340	280	.154	+0.020		280	210	170	140
1	40	360	280	220	180	.133	+0.020	1.315				
	80	500	390	320	250	.179	+0.021		250	200	160	130
1-1/4	40	290	230	180	150	.140	+0.020	1.660				
	80	420	330	260	210	.191	+0.023		210	160	130	100
1-1/2	40	260	210	170	130	.145	+0.020	1.900				
	80	380	290	240	190	.200	+0.024		190	150	120	90
2	40	220	170	140	110	.154	+0.020	2.375				
	80	320	250	200	160	.218	+0.026		160	130	100	80
2-1/2	40	240	190	150	120	.203	+0.024	2.875				
	80	340	270	210	170	.276	+0.033		170	130	110	80
3	40	210	160	130	100	.216	+0.026	3.500				
	80	300	230	190	150	.300	+0.036		150	120	90	70
3-1/2	40	190	150	120	90	.226	+0.027	4.000				
	80	280	220	170	140	.318	+0.038		140	110	90	70
4	40	180	140	110	90	.237	+0.028	4.500				
	80	260	200	160	130	.337	+0.040		130	100	80	60
5	40	160	120	100	80	.258	+0.031	5.563				
	80	230	180	140	120	.375	+0.045		120	90	70	60
6	40	140	110	90	70	.280	+0.034	6.625				
	80	220	170	140	110	.432	+0.052		110	90	70	60
8	40	120	100	80	60	.322	+0.039	8.625				
	80	200	150	120	100	.500	+0.060		100	80	60	50
10	40	110	90	70	60	.365	+0.044	10.750				
	80	190	150	120	90	.593	+0.071		90	70	60	50
12	40	110	80	70	50	.406	+0.049	12.750				
	80	180	140	110	90	.687	+0.082		90	70	60	50

Note: The Industry does not recommend threading ABS plastic pipe in Schedule 40 dimensions

Table 547-7. Polyethylene Plastic Pipe (SIDR-PR) I.D. Controlled (Un-threaded)

(PE-ASTM D-2239)

Nominal Pipe Size (in)	SDR	PE Pressure Rating lb/in^2			Dimension and Tolerance				
		Material			Wall Thickness		Inside Diameter		
								+/- Tolerance	
		4710	2708 3608 4608	1404	Min (in)	Tolerance + (in)	Average (in)	+ (in)	- (in)
1/2	19	100	80		.060	.020	0.622	0.010	0.010
	15	125	100		.060	.020			
	11.5	160	130		.060	.020			
	9	200	160	80	.069	.020			
	7	250	200	100	.089	.020			
	5.3	315	250	125	.117	.020			
3/4	19	100	80		.060	.020	.824	.010	.015
	15	125	100		.060	.020			
	11.5	160	130		.072	.020			
	9	200	160	80	.092	.020			
	7	250	200	100	.118	.020			
	5.3	315	250	125	.155	.020			
1	19	100	80		.060	.020	1.049	.010	.020
	15	125	100		.070	.020			
	11.5	160	130		.091	.020			
	9	200	160	80	.117	.020			
	7	250	200	100	.150	.020			
	5.3	315	250	125	.198	.024			
1-1/4	19	100	80		.073	.020	1.380	.010	.020
	15	125	100		.092	.020			
	11.5	160	130		.120	.020			
	9	200	160	80	.153	.020			
	7	250	200	100	.197	.024			
	5.3	315	250	125	.260	.031			
1-1/2	19	100	80		.085	.020	1.610	.015	.020
	15	125	100		.107	.020			
	11.5	160	130		.140	.020			
	9	200	160	80	.179	.020			
	7	250	200	100	.230	.028			
	5.3	315	250	125	.304	.036			
2	19	100	80		.109	.020	2.067	.015	.020
	15	125	100		.138	.020			
	11.5	160	130		.180	.022			
	9	200	160	80	.230	.028			
	7	250	200	100	.295	.035			
	5.3	315	250	125	.390	.047			
3	15	125	100		.205	.020	3.068	.015	.030
	11.5	160	130		.267	.032			

Table 547-8. Polyethylene and Plastic Tubing

(PE – ASTM D-2737)

Nominal Pipe Size (in)	SDR	PE Pressure Rating lb/in^2 Material 4710	PE Pressure Rating lb/in^2 Material 2708 3608 4608	Dimension and Tolerance: Wall Thickness Min (in)	Wall Thickness Tolerance + (in)	Outside Diameter Average (in)	Outside Diameter +/- Tolerance + (in)	Outside Diameter +/- Tolerance - (in)
1/2	11 9 7.3	200 250 315	160 200 250	0.062 .069 .086	0.010 .010 .010	.625	0.004	0.004
3/4	11 9 7.3	315 250 315	160 200 250	.080 .097 .120	.010 .010 .012	.875	.004	.004
1	11 9 7.3	200 250 315	100 200 250	.102 .125 .154	.010 .012 .015	1.125	.004	.004
1-1/4	11 9 7.3	200 250 315	160 200 250	.125 .153 .188	.012 .018 .019	1.135	.005	.005
1-1/2	11 9 7.3	200 250 315	 160 250	.148 .181 .233	.015 .018 .022	1.625	.006	.006
2	11 9 7.3	200 250 315	160 200 250	.193 .236 .291	.019 .024 .029	2.125	.006	.006

Table 547-9. Pressure Rating Factors for PVC and PE Pipe for Water at Elevated Temperatures

Temperature (Degree Fahrenheit)	PVC Factor	PE Factor
73.4	1.00	1.00
80	.88	.92
90	.75	.81
100	.62	.70
110	.50	-----
120	.40	-----
130	.30	-----
140	.22	-----

NOTE: To obtain the pipe's reduced pressure rating because of water temperature above 73.4 degrees Fahrenheit, multiply normal pressure rating by the appropriate factor from table.