

Proline® PP Piping System Specification

PART 1: GENERAL

1.1 Summary

Furnish a complete polypropylene piping system including piping, fittings, anchors, pipe supports, valves, and associated pipe joining equipment.

1.2 References

A. The following standards are referenced to products used within this section:

EN ISO 15494 Supplement B	Plastic piping systems for industrial applications – polypropylene (PP) – metric series for specifications for components and the system
DVS 2207-11	Welding of thermoplastic materials – heated element welding of pipes, piping parts and panels made of PP
DIN 8077	Polypropylene (PP) - dimensions
DIN 8078	Polypropylene (PP) pipes - general quality requirements and testing
ASTM D4101	Standard specification for polypropylene injection and extrusion materials
DVS 2205-1	Design calculations for containers and apparatus made from thermoplastics; characteristics values
ISO 9080	Determination of long-term hydrostatic pressure resistance of thermoplastics pipes
ASME NM.1	Thermoplastic piping systems
ASME B31.3	Process piping code
ASTM D2657	Standard practice for heat fusion joining of polyolefin pipe and fittings
ISO 15874-2	Plastic piping systems for hot and cold-water installations PP-Part 2
AWS B2.4	Specification for welding procedure and performance qualification for thermoplastics
Safety Factor (Design coefficient)	A number greater than 1.00 which divides a base value which takes into consideration variables and degree of safety involved to provide a specific value for an application. The inverse of the Service Factor.
Service Factor (Design Factor)	A number less than 1.00 which multiplies a base value which takes into consideration variables and degree of safety involved to provide a specific value for an application. The inverse of the Safety Factor.

B. The system design shall meet the requirements of ASME/ANSI B31.3 Chapter VII for design criteria where temperature and pressure fall within the limits of that code

1.3 System Description and Pressure Rating

System shall be a piping system of material and pressure rating as specified below (See Section 2.3).

1.4 System Performance Requirements

System design performance requirements shall fall within the defined parameters within this specification

- Operating Pressure
- Operating Temperature
- Test Pressure
- Media

1.5 Submittals

- A. Product data for the piping system specified including details of construction relative to materials, dimensions of individual components, profiles, and finishes.
- B. Welder certificates certifying that welders have been trained by the manufacturer of the piping system and comply with the installation procedures as outlined by ASME NM.1 and/or ASTM D2657 and/or AWS B2.4 and/or DVS 2207. All required training should be scheduled and completed at job start-up.
- C. Qualifications of contracting firms supplying thermoplastic piping: Contracting firms must have the appropriate experience in installation (fusion welding) and operation of a thermoplastic piping system.

1.6 Quality Assurance

- A. Obtain components from a single source having responsibility and accountability to answer and address questions regarding proper installation, compatibility, performance, and acceptance.
- B. Design and install piping to meet ASME/ANSI B31.3 and where applicable manufacturer shall provide thermal stress analysis demonstrating the ability of the piping system to handle the stated piping conditions.

1.7 Delivery and Handling

- A. Care shall be taken to prevent damage to the supplied components. Avoid scraping, denting, and gouging the components. Surface damage deeper than 10% of the wall thickness shall be rejected. Pipe shall have adequate support at all times to prevent sagging or distortion.
- B. Store products on elevated platforms in a dry location with protection from elements affecting product integrity
- C. Lift, support, and transport piping per manufacturers recommendations

1.8 Warranty

The warranty period is one year after date of substantial completion for job installations lasting no longer than one year. Asahi/America is not responsible for failures due to installation error or neglect.

PART 2: PRODUCTS

2.1 Manufacturers

Subject to compliance with requirements, products which may be incorporated in the work include: Proline® piping system as supplied by Asahi/America, Inc., of Lawrence, Massachusetts, 800-343-3618. No equal.

2.2 Materials

Pipe and fittings

Testing certifications for this pipe and fittings are per EN 10204 standard per ISO specifications and DIN8077 polypropylene random copolymer PPR and PPH resin

Polypropylene random copolymer (PPR) resin with minimum classification of: ASTM D4101 Group 2, Class 1

Polypropylene homopolymer (PPH) resin with minimum classification of: ASTM D4101 Group 1, Class 2.

2.3 Pressure Rated Pipes

A. Components shall be pressure rated in accordance with ISO9080 and ISO15494. Pressure rating is based on continuous service life of 50 years at 68° F (20° C) for water.

- PPR SDR 11 (PRO150) and shall be pressure rated to a minimum of 225psi at 68° F (20° C) for water for all diameter sizes 1/2" - 20" (20mm - 500mm).
- PPH SDR 17.6 (PRO90) and shall be pressure rated to a minimum of 109psi at 68° F (20° C) for water for all diameters 2" - 24" (63mm - 630mm).
- PPH SDR 33 (PRO45) and shall be pressure rated for a minimum of 57psi at 68° F (20° C) for water for all diameter sizes 4" - 48" (110mm - 1200mm).

B. Components shall be pressure rated in accordance with ISO9080 and ISO15494. Pressure rating is based on continuous service life of 25 years at 68° F (20° C) for chemical service.

(Consult Asahi/America engineering staff for chemical recommendation)

- PPR SDR 11 (PRO150) and shall be pressure rated to a minimum of 145psi at 68° F (20° C) for water for all diameter sizes 1/2" - 20" (20mm - 500mm).
- PPH SDR 17.6 (PRO90) and shall be pressure rated to a minimum of 90psi at 68° F (20° C) for water for all diameters 2" - 24" (63mm - 630mm).
- PPH SDR 33 (PRO45) and shall be pressure rated for a minimum of 45psi at 68° F (20° C) for water for all diameter sizes 4" - 48" (110mm - 1200mm).

2.4 Pressure Rated Fittings

All pressure rated fittings will be per the piping SDR rating unless specifically identified on drawings or datasheet. Molded fittings shall be central injection gate molded PPR rated to a minimum of the pressure pipe.

2.5 Non-pressure Rated Fittings

All fittings shall be pressure derated per industry standards. Specifically; laterals, sanitary tees, etc. shall be rated to a minimum of 10 feet of H₂O.

All other fittings not meeting the piping SDR rating will be specifically identified on drawings and/or datasheets.

2.6 Unlisted Components

Any customer requiring non-standard components (non-standard geometry, welding or wall thickness) that are not supplied as part of our normal product offerings can request pressure testing for verification.

2.7 Valves

Pressure rated valves to be supplied rated for the service or specified lower pressure/temperature rating as pipe.

PART 3: EXECUTION

3.1 Installation

- A. Install piping to comply with manufacturer's recommended procedures.
- B. Installers may be pre-qualified through sufficient training in butt fusion and socket fusion techniques according to ASME NM.1 and/or ASTM D2657 and/or AWS B2.4 and/or DVS 2207.
- C. Hot gas and extrusion welding shall not be allowed for wetted pressurized components.
- D. Manufacturer/manufacturer's representative shall provide on-site training in the assembly, installation, and operation of the Proline piping system.

3.2 Testing

A. Inspection

Prior to pressure testing, the system shall be examined for the following items:

- 1. Pipe shall be completed per drawing layout with all pipe and valve supports in place.
- 2. Pipe, valves, and equipment shall be supported as specified, without any concentrated loads on the system.
- 3. Pipe shall be in good conditions, void of any cracks, gouges or deformation.
- 4. Pipe flanges shall be properly aligned. All flange bolts should be checked for correct torques.
- 5. All diaphragm valve bonnet bolts shall be checked for correct torques.
- 6. All joints should be reviewed for appropriate welding technique.
 - a) Butt fusion welds: to have two beads, 360° around the joint.
 - b) Socket fusion welds: To have full insertion of pipe and fitting.
 - c) Electrofusion welds: To have full insertion of pipe and fitting.
- 7. Verify that all high points are provided with an adequate vent for hydrotesting

B. Pressure Test for Pressure Systems

- 1. Pressure systems should be tested hydrostatically to 1.5 times the operating pressure per local code or ASME B31.3 Chapter VII, part A345.

C. Pressure Test for Non-Pressure Systems

- 1. Non-pressure systems can be hydrostatically tested to 10 feet of H₂O or less.

PART 4: APPENDICES

Disclaimer: This information is provided for convenience. For additional information, please consult our engineering design guide or contact our engineering staff at 781-321-5409.

4.1 Material Properties

Table 1 - Material Properties PP

	Properties	Standards	Units	PP-H	PP-R
Mechanical Properties	Specific density at 23° C	ISO 1183	g/cm ³	0.91	0.91
	Melt Flow Rate (MFR) 190/5	ISO 1133	g/10min	0.5	0.5
	Melt Flow Rate (MFR) 190/2.16			--	--
	Melt Flow Rate (MFR) 230/5			1.5	1.25
	Tensile stress at yield	ISO 527	MPa	30	25
	Elongation at yield		%	10	12
	Elongation at break			>300	>300
	Impact strength unnotched at +23° C	ISO 179	kJ/m ²	no break	no break
	Impact strength unnotched at -30° C			no break	no break
	Impact strength notched at +23° C			8	20
	Impact strength notched at 0° C			2.8	3.5
	Impact strength notched at -30° C			2.2	2.0
	Shore-D Hardness (3 sec)	ISO 868	1	70.2	62.0
	Flexural strength (3.5% flexural stress)	ISO 178	MPa	28	20
	Modulus of elasticity	ISO 527	MPa	1300	900
Thermal Properties	Vicat-Softening point VST/B/50	ISO 306	° C	91	65
	Heat deflection temperature HDT/B	ISO 75	° C	96	70
	Linear coefficient of thermal expansion	ISO 11359-2	K ⁻¹ x 10 ⁻⁴	1.6	1.5
	Thermal conductivity at 20° C	DIN EN 12667	W/ (m x K)	0.22	0.24
	Flammability	UL94 EN	--	94-HB	94-HB
		EN 13501	--	--	--
		DIN 4102	--	B2	B2
Electrical Properties	Specific volume resistance	DIN EN 62631-3-1	Ω X cm	>10 ¹⁶	>10 ¹⁶
	Specific surface resistance	DIN EN 62631-3-2	Ω	>10 ¹³	>10 ¹³
	Relative dielectric constant at 1 MHz	DIN 53483	--	2.3	2.3
	Dielectric strength	DIN IEC 60243	kV/mm	75	70
General	Food Contact (FDA)	EU 10/2011	--	Yes	Yes
	UV stabilized	--	--	No	No
	Color	--	--	Ral 7032 Grey	Ral 7032 Grey

* Fire classification B1 only valid for wall thickness of 2 - 10mm

4.2 Pressure Rating

Permissible operating pressure for Proline® piping systems based on years of operation and temperature. These tables are for water, a safety correction factor shall be applied for chemical service. Consult Asahi/America engineering staff for chemical recommendation. Typically for compatible chemicals; for PPR use a safety factor of 1.6. For PPH use a safety factor of 1.25 between 10° C and 39° C, 1.4 between 40° C and 59° C and 1.6 for 60° C and above. Additionally, a system reduction factor of 0.8 shall be used for influences such as welding, joints, flange, and bending loads for aboveground installations and 1.0 should be used for below ground installation.

Table 2 - Permissible Operating Pressures for Polypropylene Proline® PRO150, PRO90, PRO45 (psi)

Temperature		1 Year			10 Year		
		PP-H	PP-H	PP-R	PP-H	PP-H	PP-R
		PRO45	PRO90	PRO150	PRO45	PRO90	PRO150
° C	° F	SDR 33	SDR 17.6	SDR 11	SDR 33	SDR 17.6	SDR 11
10	50	82	158	307	73	140	282
20	68	71	137	262	62	120	240
30	86	61	117	223	53	102	203
40	104	51	99	189	44	85	172
50	122	49	95	160	42	81	145
60	140	41	79	135	35	67	122
70	158	37	72	114	31	60	102
80	176	30	58	95	21	41	71
90	194	24	46	80	14	28	47
95	203	21	41	67	12	23	38
100	212	12	24	55	*	*	32
110	230	9	17	38	*	*	*
Temperature		25 Year			50 Year		
		PP-H	PP-H	PP-R	PP-H	PP-H	PP-R
		PRO45	PRO90	PRO150	PRO45	PRO90	PRO150
° C	° F	SDR 33	SDR 17.6	SDR 11	SDR 33	SDR 17.6	SDR 11
10	50	70	133	273	67	128	266
20	68	60	114	231	57	109	225
30	86	51	96	196	48	92	190
40	104	42	81	165	40	77	161
50	122	40	76	139	38	73	135
60	140	33	62	117	31	59	113
70	158	27	50	88	22	42	75
80	176	18	33	57	*	*	*
90	194	*	*	*	*	*	*
95	203	*	*	*	*	*	*
100	212	*	*	*	*	*	*
110	230	*	*	*	*	*	*

Tables 3, 4 and 5 – Support Spacing for Proline® (based on a medium of water)
Table 3 – App. A-6 Proline® PRO150 Support Spacing (feet)

Size OD (inch)	Size OD (mm)	68° F (20° C)	86° F (30° C)	104° F (40° C)	122° F (50° C)	140° F (60° C)	158° F (70° C)	176° F (80° C)
1/2	20	1.7	1.7	1.6	1.5	1.5	1.4	1.4
3/4	25	2	1.9	1.8	1.8	1.7	1.7	1.6
1	32	2.3	2.3	2.2	2.2	2.1	2	1.8
1-1/4	40	2.7	2.6	2.6	2.5	2.3	2.3	2.2
1-1/2	50	3.1	3	3	2.8	2.7	2.6	2.5
2	63	3.6	3.5	3.4	3.3	3.2	3.1	3
2-1/2	75	3.8	3.7	3.6	3.4	3.3	3.2	3.1
3	90	4.1	3.9	3.8	3.7	3.6	3.4	3.3
4	110	4.6	4.4	4.3	4.2	3.9	3.7	3.4
4-1/2	125	4.9	4.8	4.7	4.4	4.2	3.9	3.7
5	140	5.2	5	4.9	4.7	4.4	4.2	3.9
6	160	5.5	5.4	5.2	4.9	4.7	4.4	4.2
7	180	5.8	5.7	5.4	5.2	4.9	4.7	4.4
8	200	6.2	5.9	5.7	5.4	5.2	4.9	4.7
9	225	6.5	6.3	6	5.8	5.5	5.3	4.9
10	250	6.9	6.6	6.4	6.2	5.9	5.7	5.3
11	280	7.3	7	6.8	6.5	6.3	6	5.7
12	315	7.8	7.5	7.3	7	6.6	6.4	6
14	355	8.2	8	7.8	7.4	7	6.8	6.4
16	400	8.7	8.5	8.2	7.9	7.5	7.1	6.8
18	450	9.4	9.1	8.9	8.5	8.1	7.6	7.3
20	500	10.1	9.8	9.5	9.1	8.6	8.2	7.8

Table 4 – App. A-7 Proline® PRO90 Support Spacing (feet)

Size OD (inch)	Size OD (mm)	68° F (20° C)	86° F (30° C)	104° F (40° C)	122° F (50° C)	140° F (60° C)	158° F (70° C)	176° F (80° C)
3	90	4.9	4.8	4.6	4.5	4.3	4.2	4
4	110	5.5	5.4	5.2	5.1	4.8	4.5	4.2
4-1/2	125	6	5.8	5.7	5.4	5.1	4.8	4.5
5	140	6.3	6.1	6	5.7	5.4	5.1	4.8
6	160	6.7	6.6	6.3	6	5.7	5.4	5.1
7	180	7	6.9	6.6	6.3	6	5.7	5.4
8	200	7.5	7.2	6.9	6.6	6.3	6	5.7
9	225	7.9	7.6	7.3	7	6.7	6.4	6
10	250	8.4	8.1	7.8	7.5	7.2	6.9	6.4
11	280	8.8	8.5	8.2	7.9	7.6	7.3	6.9
12	315	9.4	9.1	8.8	8.5	8.1	7.8	7.3
14	355	10	9.7	9.4	9	8.5	8.2	7.8
16	400	10.6	10.3	10	9.6	9.1	8.7	8.2
18	450	11.3	11	10.7	10.3	9.9	9.3	8.8
20	500	12.2	11.9	11.5	11	10.4	10	9.4
22	560	13.1	12.8	12.4	11.9	11.3	10.7	7.2
24	630	14.3	13.9	13.4	12.8	12.2	11.6	11

Table 5 – App. A-8 Proline® PRO45 Support Spacing (feet)

Size OD (inch)	Size OD (mm)	68° F (20° C)	86° F (30° C)	104° F (40° C)	122° F (50° C)	140° F (60° C)	158° F (70° C)	176° F (80° C)
2	63	3.6	3.5	3.4	3.3	3.2	3.1	3.0
2-1/2	75	3.8	3.7	3.6	3.4	3.3	3.2	3.1
3	90	4.1	3.9	3.7	3.7	3.6	3.4	3.3
4	110	4.6	4.4	4.3	4.2	3.9	3.7	3.4
4-1/2	125	4.9	4.8	4.7	4.4	4.2	3.9	3.7
5	140	5.2	5.0	4.9	4.7	4.4	4.2	3.9
6	160	5.5	5.4	5.2	4.9	4.7	4.4	4.2
7	180	5.8	5.7	5.4	5.2	4.9	4.7	4.4
8	200	6.2	5.9	5.7	5.4	5.2	4.9	4.7
9	225	6.5	6.3	6.0	5.8	5.5	5.3	4.9
10	250	6.9	6.6	6.4	6.2	5.9	5.7	5.3
11	280	7.3	7.0	6.8	6.5	6.3	6.0	5.7
12	315	7.8	7.5	7.3	7.0	6.6	6.4	6.0
14	355	8.2	8.0	7.8	7.4	7.0	6.8	6.4
16	400	8.7	8.5	8.2	7.9	7.5	7.1	6.8
18	450	9.4	9.1	8.9	8.5	8.1	7.6	7.3
20	500	10.1	9.8	9.5	9.1	8.6	8.2	7.8
22	560	10.8	10.6	10.2	9.8	9.4	8.9	8.4
24	630	11.8	11.4	11.1	10.6	10.1	9.6	9.1

Table 6 – External Support Spacing Correction Factors based on Operating Media Density for PP

Material	SDR	Media Density [g/cm³]			
		< 0.01	1	1.25	1.5
		Factor			
PP-H	33	1.65	1	0.96	0.92
	17.6	1.47			
PP-R	11	1.3	1	0.96	0.92