

Air-Pro® Specially Formulated PE Piping System Specification

PART 1: GENERAL

1.1 Summary

Furnish a complete polyethylene piping system for compressed air including piping, fittings, anchors, pipe supports, valves, and associated pipe joining equipment.

1.2 References

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

ISO 9080	Determination of long-term hydrostatic pressure resistance of thermoplastics pipes
DVS 2207-5 and -1	Welding of thermoplastic materials – Heated element welding of pipes, piping parts and panels made of PE
EN ISO 15494 supplement B	Plastics piping systems for industrial applications - Metric series for specifications for components and the system.
ASTM D3035	Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter
ASTM D2837	Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products.
ASTM 3350	Standard Specification for PE Plastics Pipe and Fittings Material
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
AWS B2.4	Specification for welding procedure and performance qualification for thermoplastics
DVS 2205-1	Design calculations for containers and apparatus made from thermoplastics; characteristics values

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

- A. System shall be a piping system of material and pressure rating as specified below. System product pipe shall be capable of transporting stated media under continuous exposure for 50 years.
- B. System shall be tested and accepted to meet the State of California's Unfired Pressure Vessel Safety Order Appendix C. The joining methods, marking of pipes and fittings also meet the requirements of the Unfired Pressure Vessel Safety Order 462 (m) (3).

1.4 System Performance Requirements

System performance requirements shall handle the following relative to primary pipe:

- System Operating Pressure
- Operating Temperature
- Test Pressure
- Media

1.5 Submittals

- A. Product data for each type of 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 firms supplying polyethylene piping. 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 where applicable manufacturer shall provide thermal stress analysis demonstrating the ability of the piping system to handle the stated piping conditions.

1.7 Storage 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: Air-Pro® piping system as supplied by Asahi/America, Inc., of Lawrence, Massachusetts, 800-343-3618. No equal.

2.2 Materials

Air-Pro® is made of a specially formulated PE100 polyethylene material compounded with antioxidants for compressed air service. Air-Pro® is manufactured and tested to all applicable International Organization Standardization (ISO) standards.

Pipe and fittings

- Polyethylene (PE) pipe PE100 resin ISO15494 supplement B [Minimum Required Strength of MRS 10] ASTM D3350 a minimum Cell class PE445476E, (1/2" - 4" Blue) or Cell class PE445476C, (6" - 12" Black) Polyethylene resin.
- The testing certification for pipe and fittings are per EN 10204 standard per ISO test specifications.

2.3 Pressure Rated Pipes

Components shall be pressure rated in accordance with ISO9080 for hydrostatic design basis. This pipe is to be utilized for compressed air and other inert gases. The pressure ratings are based on an overall safety factor of 2. For pressure ratings at various temperatures and years of service, see section 4.2.

- PE100 SDR 7.4 pressure rated to a minimum of 226psi at 68° F (20° C) for gas (air) at service life of 50 years for all diameter sizes 1/2" - 4" (20mm - 110mm).
- PE100 SDR 11 pressure rated to a minimum of 145psi at 68° F (20° C) for gas (air) at service life of 50 years for all diameter sizes 6" - 12" (20mm - 110mm).

2.4 Pressure Rated Fittings

All pressure rated fittings will be per the piping SDR rating, unless specifically identified on drawings or datasheet.

2.5 Non-pressure Rated Fittings

There are no non-pressure rated fittings in the Air-Pro® product line.

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 shall be 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 ASTM D2657 and/or AWS B2.4 and/or DVS 2207.
- C. Hot gas welding shall not be allowed for wetted components.
- D. Manufacturer/manufacturer's representative shall provide on-site training in the assembly, installation, and operation of the polyethylene 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 pipes 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 hydro testing.

B. Pressure Test for Pressure Systems

Pipe should be tested hydrostatically to 1.5 times the operating pressure per local code or ASME B31.3 Chapter VII, part A345. If pipe is being utilized for air or other gases, the system needs to be dried out of all water utilized for testing.

Since this piping is specifically designed for air piping, pneumatic pressure testing per ASME B31.3 requires air test pressure to be 1.1 times the design pressure of the system. It is recommended to do an incremental air pressure test from 5 - 10psi and a check of all weld joints prior to increasing pressure slowly until maximum pressure is reached.

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

	Properties	Standard	Unit	PE100	PE100-RC
Mechanical Properties	MRS Classification	ISO 9080	N/mm ²	10	10
	Specific density at 23 °C	ISO 1183	g/cm ³	0.96 ²⁾	0.96 ²⁾
	Melt Flow Rate (MFR) 190/5	ISO 1133-1	g/10min	0.3 ¹⁾	0.3 ¹⁾
	Tensile stress at yield	ISO 527	MPa	≥ 23	≥ 23
	Elongation at yield		%	≥ 9	≥ 9
	Elongation at break at 20 °C		%	≥ 350 ²⁾	≥ 350 ²⁾
	Impact strength unnotched at -30 °C	ISO 179	kJ/m ²	no break	no break
	Impact strength notched at +23 °C			≥ 13 ³⁾	≥ 13 ³⁾
	Impact strength notched at -30 °C			10	10
	Shore D- hardness (3sec)	ISO 868	1	60	60
	Flexural strength (3.5% flexural stress)	ISO 178	MPa	≥ 21	≥ 21
	Young's Modulus of elasticity	ISO 527	MPa	≥ 1000	≥ 1000
	Stress cracking resistance (FNCT)	ISO 16770 EN 12814-3	hours	>300 ³⁾	>8760 ³⁾
Thermal Properties	Heat deflection temperature HDT/B	ISO 75	°C	75	75
	Linear coefficient of thermal expansion	ISO 11359-2	K ⁻¹ x 10 ⁻⁴	1.8 ⁴⁾	1.8 ⁴⁾
	Thermal conductivity at 20 °C	DIN EN 12667	W/ (m x K)	0.4	0.4
	Flammability	UL94	--	94-HB	94-HB
		DIN 4102	--	B2	B3
Application temperature	--	°C	-40 up to +60*	-40 up to +60*	
Electrical Properties	Volume Resistivity	DIN EN 62631-3-1	Ω x cm	≥ 10 ¹⁶	≥ 10 ¹⁶
	Surface Resistivity	DIN EN 62631-3-2	Ω	≥ 10 ¹³	≥ 10 ¹³
	Dielectric coefficient at 1 MHz	DIN 53483	--	2.3	2.3
	Electric Strength	DIN IEC 60243	kV/mm	70	70
General	FDA	EU 10/2011	--	Yes	Yes
	UV stabilized	--	--	Carbon Black	Carbon Black
	Color	--	--	BLUE	BLACK

Guidelines from: 1) DVS 2207-1, 2) EN 12201, 3) DVS 2205-1 suppl.1, 4) DVS 2210-1

*Depending on the application area and operating time

4.2 Pressure Rating

Permissible operating pressure for Air-Pro® piping system is based on years of operation and temperature. These tables are for compressed air with a combined safety factor of 2.0.

Table 2 - Permissible below ground Operating Pressures for Air-Pro® (psi)
SDR 7.4 Pipe

Temperature		5 Year	10 Year	25 Year	50 Year
° C	° F	Gas (PSI)			
		SDR 7.4			
-10	14	238	234	228	224
10	50	285	280	274	269
20	68	240	236	230	226
30	86	204	200	196	192
40	104	175	172	168	165
50	122	152	149	*	*
60	140	110	*	*	*

*N/A

Table 3 - Permissible below ground Operating Pressures for Air-Pro® (psi)
SDR 11 Pipe

Temperature		5 Year	10 Year	25 Year	50 Year
° C	° F	Gas (PSI)			
		SDR 11			
-10	14	152	150	146	144
10	50	183	179	175	172
20	68	153	151	147	145
30	86	130	128	125	123
40	104	112	110	107	106
50	122	97	95	*	*
60	140	70	*	*	*

*N/A

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 4 – Support Spacing for Air-Pro® (inches)
SDR 7.4 and SDR 11**

Size OD		68° F (20° C)	86° F (30° C)	104° F (40° C)	122° F (50° C)	140° F (60° C)
inch	mm					
1/2	20	31	31	28	23	20
3/4	25	36	33	31	31	28
1	32	41	41	36	36	31
1-1/4	40	48	46	41	41	36
1-1/2	50	56	56	48	46	41
2	63	66	64	59	56	48
2-1/2	75	74	71	66	61	56
3	90	84	79	74	69	64
4	110	92	89	84	79	71
6	160	115	107	102	97	90
8	200	128	123	118	113	105
10	250	146	141	133	128	118
12	315	161	156	151	143	131

SDR 7.4, diameter sizes 1/2" - 4" (20mm - 110mm) the support spacing is based on media being air with a density of 0.01g/cm³.

SDR 11, diameter sizes 6" - 12" (20mm - 110mm) the support spacing is based on media being air with a density of 0.01g/cm³.