

Fluid-Lok® Engineered Double Contained Piping System Specification

PART 1: GENERAL

1.1 Summary

Furnish a complete double containment piping system including piping, fittings, anchors, terminations, floor drains, cleanouts, access tees, carrier pipe supports and associated pipe joining equipment including pipe manufacturer installed leak detection pull rope.

1.2 References

- A. The following standards apply to products used within this section ASTM D3350 (HDPE).
- 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.
- C. The system design shall meet the stated minimum requirements of Federal Regulations 40 CFR-280 for double containment piping systems.

1.3 Definitions

Primary Pipe: inside pipe (carrier pipe)

Secondary Pipe: outside pipe (containment pipe)

Simultaneous Welding: Method of installing double contained piping by joining the primary and secondary pipe of a similar material system to a mating component at the same time.

1.4 System Description and Pressure Rating

- A. System shall be a double containment piping system of materials and pressure rating as specified below. System product pipe shall be capable of transporting stated media under continuous exposure for 25 years. System secondary pipe shall be capable of containing stated media, in the event of failure of primary pipe, per state or federal guidelines for a minimum of 30 days.
- B. System shall provide the ability to incorporate leak detection as specified within the leak detection section. Access tees, pull ropes, and low-point instrumentation taps shall be provided as specified by leak detection vendor and/or contract drawings.
- C. System shall provide full containment of all accessories such as cleanouts, valves and catch basins, etc.

1.5 System Performance Requirements

System performance requirements shall handle the following:

	Primary Pipe	Secondary Pipe
Operating Pressure		
Operating Temperature		
Test Pressure		
Media		

1.6 Submittals

Submit the following:

- A. Product data for each type of double containment 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 double containment piping. Firms must have a minimum of 10 years' experience in the design, installation and operation of a thermoplastic double contained piping system.

1.7 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, fabricate and install double containment piping to meet ASME/ANSI B31.3. Where applicable manufacturer, may provide thermal stress analysis demonstrating the ability of the double containment piping system to handle the stated piping conditions during the design phase of the project.

1.8 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. Deliver double containment piping as a factory assembled unit with protective caps.
- C. Store products on elevated platforms in a dry location with protection from elements.
- D. Lift, support, and transport double containment piping per manufacturer's recommendations.

1.9 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: The Fluid-Lok® system as supplied by Asahi/America, Inc. of Lawrence, Massachusetts, 800-343-3618. No equal.

2.2 Materials

Components shall be pressure rated in accordance with ASTM D2837 for hydrostatic design basis. Pressure rating is based on continuous service life of 25 years at 68° F (20° C).

A. Product Pipe

ASTM D3350 cell class_445574C_PE4710 SDR11 Alternative: ASTM D3350 cell class_445574C_PE4710 SDR 17.

B. Containment Pipe

Same as product pipe

2.3 Pressure Rated Piping

Product Pipe

ASTM D3350 _PE4710 SDR 11 shall be pressure rated to 200psi at 68° F (20° C) for water for all diameter sizes.

Alternative: ASTM D3350 PE4710 SDR 17 shall be pressure rated to 130psi at 68° F (20° C) for water for all diameter sizes.

Containment Pipe

Is either the same pressure rating as the product pipe or a lower pressure rating.

ASTM D3350 _PE4710 SDR 11 shall be pressure rated to 200psi at 68° F (20° C) for water for all diameter sizes.

Alternative: ASTM D3350 PE4710 SDR 17 shall be pressure rated to 130psi at 68° F (20° C) for water for all diameter sizes

2.4 Pressure Rated Fittings

No split fittings shall be allowed.

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

All fittings shall be pressure derated per industry standards.

2.5 Unlisted Components

Any customer requiring non-standard components (non-standard welding or wall thickness) can request pressure testing for verification.

Products falling into this category shall be pressure tested.

2.6 Valves

A. Pressure Rated

Valving arrangements that are to be double contained in molded tee's shall be supplied preassembled and pressure rating listed on drawing or datasheet. Actuators, stem extensions, and other accessories shall be part of a pre-assembled package where appropriate.

B. Non-Pressure Rated

Valving arrangements that are to be double contained in boxes shall be supplied pre-assembled and rated for no more than 5psi.

2.7 Pipe Centralizers

Product pipe centralizers (spider clips) shall be welded to the product pipe. Centralizers will allow axial movement of containment pipe and maintain a concentric relationship between product pipe and containment pipe. The centralizers shall be machined for accuracy from pipe grade resin sheet stock HDPE. Centralizers have openings at 6 o'clock and 12 o'clock per the drawings. The opening at 6 o'clock will permit the flow of liquid between the carrier pipe and the containment pipe and the pulling of the leak detection cable. The OD of the centralizer shall match the ID of the containment piping as closely as possible.

2.8 Simultaneous Weld Support Discs

Support discs are welded near the ends of the primary and secondary pipe and fittings with enough strength to allow simultaneous fusion.

2.9 Anchors

Simultaneous weld anchor shall be manufactured with the same material and pressure rating as the product and containment pipe
2.3. Simultaneous anchors shall be Dogbone® style by Asahi/America, Inc.

2.10 Vents and Drains

High point vents and low point drains shall provide adequate flows to completely drain annular space. Vents and drains shall be located per contract drawings. Vents and drains shall be of same resin as product pipe.

2.11 Access Tees

Shall be provided per contract drawings and per leak detection manufacturer's requirements. Access tees shall be of same resin as containment pipe 2.3.B.

2.12 Double Contained Flanges

All double contained flange connections shall be of unitary construction and consist of mating double O-ring flange and a flat faced flange. The flow-through flange design shall provide adequate flow of fluid through the annular space. All flanges shall be of the same material and SDR dimensions as the pipe 2.3.A and 2.3.B.

2.13 Leak Detection

PAL-AT® manufactured by PermAlert and supplied by the pipe manufacturer, Asahi/America, Inc., with continuous leak detection cable capable of detecting liquids. No separate supply of leak detection and pipe is allowed. Single source responsibility is required for leak detection and piping. Low-point probes can be used in conjunction with the cable system for monitoring tanks and sumps.

The leak detection system shall identify the presence of a liquid at any point along its sensing string and indicate its location within \pm one percent (1%) of the distance from the last calibration point, or \pm five (5) feet, whichever is greater.

The system shall be capable of monitoring (detecting and locating) for multiple leaks or additional liquid on the sensor cable. The system shall be capable of identifying the location of breaks and shorts in the cable. When either of these faults occur, an alarm shall sound and a display visible on the front of the monitoring unit shall clearly indicate the type of fault, i.e. BREAK or SHORT, and display the location of the fault.

A location map shall be provided with the system by the installing contractor indicating the "As Installed" system configuration and sensing string layout. Footage along the cable shall be provided as references to locate leaks.

The contractor will secure manufacture/supplier's technical assistance for contractor training, installation inspection, start up and owner operating and maintenance training. Contractor is to follow all manufacturer's/supplier's instructions for installation. A time domain reflectometry (TDR) graph of the cable installation shall be furnished at time of owner training.

PART 3: EXECUTION

3.1 Installation

- A. Install double containment piping to comply with manufacturer's recommended procedures.
- B. Installers may be pre-qualified through sufficient training in butt fusion techniques according to ASTM D2657 and/or AWS B2.4.
- 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 double containment systems.
- E. Install continuous running pull rope for installation of leak detection cable if required. Manufacturer shall supply pipe spools with pull rope in place.
- F. Support discs and welding rod are required for field cut pipe lengths, support disc quantity can be approximated as follows $2/3 \times (\#cuts + \#fitting)$.

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: To have two beads, 360° around the joint.

B. Pressure Test for Pressure Systems

1. Product Pipe

Should be tested hydrostatically to 1.5 times the operating pressure per local code or ASME B31.3 Chapter VII, part A345. The owner may allow closure of the containment piping prior to the pressure testing.

2. Containment Pipe

To avoid moisture in the containment space, an air test can be conducted on the containment pipe. Pressure test is recommended at 5psi and shall not exceed 10psi. The inner carrier pipe shall be full of water and under pressure to avoid any possible collapse. When testing with air, the ambient temperature should be above 45° F and extra safety precautions for personnel shall be put in place during the test.

Alternate testing: The containment piping shall be tested hydrostatically to 1.5 times the operating pressure per ASME B31.3 or per local codes. The product pipe must be pressurized to the same pressure as the test to prevent collapsing of product pipe.

C. Pressure Test for Non-Pressure Systems

1. Product Pipe

Product pipe shall be tested to 10 feet of H₂O or less. Compressed air or gas may be used at 5psi and shall not exceed 10psi where conditions warrant at temperatures above 45° F. Systems with elevational changes greater than 20 feet of H₂O shall be tested at 1.5 times the elevational head. Fabricated fittings shall not be used for these systems; pressure fittings should be used in their place.

2. Containment Pipe

Containment pipe should be tested per 3.2.C.

D. Pressure Testing with Sensitive Equipment

Equipment such as leak detection sensors or other sensitive equipment that is not to be tested shall be either disconnected from the piping or isolated by blinds or other means during the test. A valve may be used provided the valve (including its closure mechanism) is suitable for the test pressure.

PART 4: APPENDIX

Disclaimer: this information is provided for convenience. For additional information, please consult the Asahi/America, Inc. Engineering Design Guide or contact the engineering staff at 781-321-5409.

4.1 Material Properties (from ASTM D3350)

Table 1 - Material Properties

				HDPE
	Specific density at 23° C	D1505	g/cm ³	0.947 - 0.955
	Melt index	D 1238	g/10min	< 0.15
Mechanical Properties	Tensile stress at yield	D 638	MPa [psi]	24 < 28 [3500 < 4000]
	Flexural modulus, MPa [psi]	D 790	MPa [psi]	758 < 1103 [110,000 to <160,000]
	Hydrostatic design basis at 73° F	D2837	MPa [psi]	11.03 [1600]
	Hydrostatic design basis at 140° F	D2837	MPa [psi]	6.9 [1000]
	Resistance to slow crack growth	F 1473	hours	500
	Thermal stability minimum induction temperature	D3350	° C	220
	Brittleness temperature	D 746	° C	-60
	Thermal expansion	D 696	in/in/° F	1.0x10 ⁻⁴
	Physiologically non-toxic	EEC 90/128	--	Yes
	FDA	--	--	Yes
	UV stabilized	--	--	Yes
	NSF 61	--	--	Yes
	Color	--	--	Black with 2% minimum carbon black

4.2 Pressure Rating

Permissible operating pressure for various materials used in Fluid-Lok® double contained piping systems based on years of operation and temperature. These tables are for water and safety correction factor would need to be applied for various chemicals. Consult Asahi engineering staff for chemical recommendations.

Permissible Operating Pressure for HDPE Pipe (psi) at Various Temperatures

Temperature (°F)	HDPE SDR 11	HDPE SDR 17
40	252	158
50	236	147
60	222	139
73.4	202	126
80	190	118
90	173	108
100	157	98
110	151	95
120	127	79
130	121	76
140	101	63

4.3 Support Spacing

Support spacing is based on media with specific gravity of 1.0 at 20° C (68° F). Correction factors must be used for denser media and elevated temperatures. See Table A-11 and Table A-12 for correction factors.

Table 10 - External Support Spacing for HDPE Containment (feet)

Containment pipe size (nominal inches)		Water at 20° C / 68° F	Water at 20° C / 68° F
mm	in	HDPE SDR 11	HDPE SDR 17
63	2	4.4	4.00
90	3	4.58	4.58
110	4	5.00	5.67
160	6	5.83	6.58
200	8	6.67	7.25
250	10	7.50	7.83
315	12	8.33	8.33
355	14	8.92	8.83
400	16	9.58	4.00

Table 11 - External Support Spacing Correction Factors based on Operating Media Density for HDPE

Material	SDR	Operating Media Density [g/cm ³]			
		< 0.01 (gases)	1	1.25	1.5
HDPE	SDR 11	1.47	1	0.96	0.90

Table 12 - External Support Spacing Correction Factors based on Operating Temperatures for HDPE

Material	SDR	Operating Temperature (° F)		
		73	100	140
HDPE	SDR 11&17	1.00	0.95	0.86

4.4 Leak Detection

All Fluid-Lok® piping systems can be supplied with low point leak detection or with continuous cable leak detection. To supply with continuous leak detection cable Duo-Pro® piping systems must have an annular space greater than 1” and layout needs to be reviewed by the Asahi engineering team to determine correct locations for access tee.

Carrier (Product) Nominal inch	Containment Nominal inch	Containment SDR			
		SDR 11		SDR 17	
		Annular Space (inches)	Cable LD	Annular Space (inches)	Cable LD
1"	4"	1.1345	Y	1.33	Y
1-1/2"	4"	0.842	N	0.97	N
2"	4"	N/A	N	0.72	N
2"	6"	1.451	Y	1.61	Y
3"	6"	0.8885	N	1.08	Y
4"	8"	1.1845	Y	1.4	Y
6"	10"	0.9685	N	1.3	Y
8"	12"	0.7645	N	1.67	Y
10"	14"	N/A	N	1.40	Y
12"	16"	N/A	N	0.92	N
14"	18"	N/A	N	1.03	Y
16"	20"	N/A	N	1.03	Y
18"	24"	N/A	N	1.03	Y