Department of Environmental Protection

2600 Blair Stone Road ♦ Tallahassee, Florida 32399-2400

DEP Form: 62-761.900(9)
Form Title: Storage Tank Equipment Registration Form
Effective Date: July 2019
Incorporated in Rule 62-761.850, F.A.C.

Storage Tank System Equipment Registration Form

Fill out completely

General Information

Company Name: Asahi America, Inc.
Contact Name: Joseph Poniatowski
Company Address: 655 Andover St
City, State: Lawrence, MA Zip: 01843
E-mail: jponiatowski@asahi-america.com
Contact Number: 781-388-4577
Product Name: Poly-Flo double contained piping system
Model Number(s): various
Product Type: Double Contained Pipe System
Rule(s) citation that registration is being requested within Chapter 62-761 (UST), and/or 62-762 (AST), Underground transport of chemcials in contact with soil.

F.A.C.: Write a brief description of equipment registration request including product limitations:

Thermoplastic double contained piping system for transport of chemicals under ground, material determined by media chemical resistance, system pressure, and temperature requirements. System to be installed using thermoplastic butt fusion, with no mechanical connections buried in ground. Optional electronic leak detection systems manufactured by Permalert, and supplied by Asahi America to meet project specifications as needed.

Information Checklist (Choose Yes, No, or N/A - Not Applicable):

		Yes	No	N/A
1.	Third-party Certification by a Nationally Recognized Testing Laboratory? (Required)	☐	☑	
2.	Documentation of third-party evaluation that the equipment meets DEP Rules?	☑	☐	☐
3.	Documents included about the qualifications of the Nationally Recognized Testing Laboratory?	☐	☑	☐
4.	Technical information and drawings included?	☑	☐	☐
5.	Installation instructions included?	☑	☐	☐
6.	Annual Operability Testing Requirements (Rules 62-761.500, 62-762.501, & 62-762.502 F.A.C.)?	☐	☑	☐
7.	Integrity Testing Requirements (Rules 62-761.700, 62-762.701, & 62-762.702, F.A.C.)?	☐	☑	☐
8.	Compatible with fuel blends containing >10% ethanol or >20% biodiesel?	☑	☐	☐
9.	Has the product been approved or registered in other countries or states? (If so provide list)	☑	☐	☐
10.	Any requirements for company-certified installers or trainers?	☑	☑	☐
11.	Was this product(s) previously approved or registered by the Department? If yes, EQ- _____	☐	☑	☐
12.	Any changes or modifications to the equipment since the last submittal to DEP?	☐	☐	☑

Document Information: Provide supporting documents indicated as "Yes" above including this form via email to Tanknotify@floridadep.gov, or documents can be sent to FDEP, Division of Waste Management, 2600 Blair Stone Road, MS 4560, Tallahassee, FL 32399.

Write a brief description of equipment installation and performance in the U.S.:

Asahi America Inc. has been installing the double contained piping systems for over 40 years in many high-profile projects in high profile government sites, CERCLA remediation projects, day to day chemical handling for water treatment, pharmaceutical, semi-conductor, metal finishing, and other industrial processes.

Equipment Registration Certification:

To the best of my knowledge and belief, all information submitted on this form is true, accurate and complete.

Joseph Poniatowski- Senior Applications Engineer
Printed Name and Title

Joe Poniatowski Digitally signed by Joe Poniatowski Date: 2026.04.14 11:08:19 -04'00'
Signature (right click to sign)

04/14/2026
Date

For Department Use Only:

Date Application Received: 04/22/2026 Application complete: Yes: X No: ☐

EQ- 1052 Date of complete or incomplete letter sent: 04/24/2026 Date Equipment Requires Renewal: 04/24/2031

Storage tank system equipment requires renewal every 5 years in accordance with subsection 62-761.850(2), F.A.C.

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April 14, 2026

To whom it may concern;

Asahi America Inc. is submitting a request to have our Double Contained piping system, Poly-Flo®, to be accepted for the State of Florida- Department of Environmental Protection's (FL DEP) registered piping systems for underground transport of chemicals.

Asahi America first designed, engineered, and developed our Double Contained piping systems back in the early 1980s. Asahi America received it's first patent for the double contained system in 1986 as US Patent 4,786,088.

https://patents.google.com/patent/US4930544A#:~:text=A%20double%2Dcontainment%20thermoplastic%20pipe%20assembly%20is%20provided,or%20leaks%20of%20chemicals%20and%20the%20like.

In 1994 Asahi America received its European Patent for the double contained piping system- EP058072A1. https://patents.google.com/patent/EP0580724A1/en

Asahi America Inc. has been installing the double contained piping systems for over 40 years in many high-profile projects in high profile government sites, CERCLA remediation projects, day to day chemical handling for water treatment, pharmaceutical, semi-conductor, metal finishing, and other industrial processes.

Asahi America's double contained piping systems meet the requirement of US Environmental Protection Agency's 40 CFR 280 and 281, CERCLA requirements, and OSHA's requirement for protection of piping overhead to protect personnel. Asahi America offers electronic leak detection systems to monitor the piping system for leaks.

Asahi America offers various materials for its Double contained pipe systems including, polyethylene (PE), polypropylene (PP), polyvinylidene fluoride (PVDF), PVC/CPVC, and Ethylene-chlorotrifluoroethylene (ECTFE). Asahi America can offer the best material for chemical compatibility of the transported media, the system's pressure and temperature requirements.

Please see the attached documents for substantiation of the quality and use of our Poly-Flo® double contained pipe system for chemical transport to meet the requirements as outlined for the FL DEP.

Joe Poniatowski

Senior Applications Engineer- Piping

Phone 781-388-4577

Email jponiatowski@asahi-america.com

Poly-Flo® - PP, Advanced PE

Poly-Flo's® unique unitary construction saves time and labor on each project. Low cost and easy installation makes Poly-Flo® the ideal system for drainage systems, pressurized transfer lines and industrial applications needing up to 4" carrier pipe.

Typical Poly-Flo® installations include water and wastewater treatment applications using sulfuric acid, caustic soda and sodium hypochlorite; and chemical processing and semiconductor applications handling sodium hydroxide, aluminum nitrate, and sulfuric and hydroflouric acid.

Supply Range

Standard Sizes: 1x1-1/2 (32x50mm), 2x3 (63x90mm) and 4x6 (110x160mm), 6x9 (160mmx25mm)
Materials: Proline® PP-R, Chem Proline® PE

Welding Methods:
Simultaneous butt fusion

Features and Benefits

- Unique co-extruded and molded system. In other double containment pipe systems, the inner and outer components are made separately and then assembled into a double wall configuration.
- The carrier and containment pipe have OD consistent with metric dimensions.
- Assembled using simultaneous butt fusion only.
- Available with manual and low point leak detection sensors only.
- Dogbones® provide the option for a compartmentalized system (solid Dogbones®), or a restrained system (restraint Dogbone®).

Sample Specification

System shall be Asahi/America's newly reengineered Poly-Flo® PP and HDPE co-extruded double containment pipe. System shall meet the pressure and materials requirements of the specifications. Poly-Flo® co-extruded pipe has a carrier pipe rating of SDR11 rated for 150psi at 68°F, and containment pipe rating of SDR17 rated for 90psi at 68°F.

Please consult Asahi/America for expanded product sample specification.

Why Choose Poly-Flo®?

Poly-Flo® pipe and fittings are stocked in our Massachusetts warehouse, which reduces lead times when compared to other double containment piping systems.

Poly-Flo's® smaller profile dimensions are ideally suited for installations that possess tighter space constraints such as chemical rooms.

Poly-Flo® is self-restraining making it ideal for horizontal directional drilling (HDD).

Poly-Flo® Ideal Applications

- **Horizontal directional drilling**
- **Applications where there are fluctuations in temperature**
- **Installations with tight space constraints**
- **Chemical piping**

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Cost, reliability, and ease of installation can all be improved by careful planning in the conceptual and design phases of any piping project. For double containment systems, the following items must be given careful consideration:

- When to use double containment piping
- Materials of construction
- System selection
- System sizing
- Specialty fittings
- Double contained valves
- Thermal expansion (particularly important in thermoplastic systems)
- Hanging
- Burial
- Welding methods
- UV exposure and weatherability

Leak detection is also an important part of double containment systems. Leak detection of some sort is required on all underground double containment systems. The type of leak detection, the installation method, and the system set-up are very different from system to system. For this reason, leak detection will be discussed separately later in this section.

When to Use Double Containment Piping

Underground EPA Requirements

The US Environmental Protection Agency (EPA) has adopted regulations on underground storage tanks (USTs) and related piping. The EPA states that these systems pose threats to the environment.

EPA regulation 40 CFR 280 spells out the minimum requirements for USTs that contain petroleum or hazardous chemicals.

A summary of the EPA's requirements that affect double containment piping follows.

This is a brief overview. A project engineer needs a thorough understanding of the regulations prior to designing a system.

EPA's Regulations Cover:

Media: All chemicals listed under Subtitle 1 of 40 CFR 280.

Systems: All USTs and related piping.
System requirements: All USTs and pipes must be installed so that a release from the product pipe is contained or diverted to a proper collection system. Containment may be done via a trench, dike, or double containment pipe and tanks. The containment materials must be able to hold the leaking product for a minimum of 30 days. By then, scheduled inspections and periodic monitoring should identify the failure and correct the situation.
Leak detection: Drainage and suction lines require monthly manual inspections for product line leaks. Pressurized systems require automatic monitoring for product failure. In case of a leak, the system must automatically restrict flow of the product.
Compliance dates: The EPA has set requirements for the date of compliance for both new and existing systems. Contact Asahi/America for the latest standard, or visit the EPA's web site at www.epa.org.
Above ground: In addition to the EPA requirements for below grade systems, many companies have adopted policies for overhead piping to protect personnel from a possible leak of a harmful chemical.

Materials of Construction

The majority of double containment systems installed worldwide are thermoplastic due to the ease of joining and chemical resistance to hazardous media and underground moisture. Asahi/America offers several materials to handle a wide range of applications. Materials include:

- Polypropylene
- PVDF
- E-CTFE: Halar®
- HDPE: High Density Polyethylene

The carrier pipe (the inner pipe also known as the product pipe) material is selected based on common piping practices using variables such as:

- What chemical(s) will be in contact with the system?
- What are the chemical concentrations?
- At what temperature will the system operate?
- At what pressure will the system operate?
- What is the flow of the media in the system?

By answering these questions, the proper materials of construction for the carrier can be selected for the project. To assist in the material selection, refer to the chemical resistance tables in Section D. A thermoplastic

system's ratings for temperature and pressure are based on water. The addition of certain chemicals will add stress to the system and may reduce the recommended operating parameters. For less aggressive chemicals, the use of printed resistance tables is perfectly suitable. For more aggressive chemicals or mixtures of chemicals, the manufacturer of the pipe system should be consulted.

After verifying the standard operating conditions, it is necessary to examine other operations that might affect the piping. The following is a sample of items to investigate prior to specifying a material.

- Will there be spikes in temperature or pressure?
- Is there a cleaning operation that the piping will be exposed to?
- If yes, what is the cleaning agent? At what temperature will the cleaning be conducted?
- Will the system be exposed to sunlight or other sources of UV?

Each of the previous questions should be answered, and the desired material should be checked for suitability based on the above factors, as well as any others that might be special to the system in question.

Finally, in addition to verifying the temperature, pressure, and media within the thermoplastic pipe material, it is also necessary to verify other components in the system, such as valves, gaskets, valve seat and seals, etc. These should be examined in the same manner as the pipe material.

G

Once the product pipe has been selected, the containment pipe must be selected. In most cases, the containment pipe is the same as the carrier pipe, such as in polypropylene and HDPE systems. Using the same material internally and externally yields many time-saving advantages on a project. However, in many systems where the product pipe required is a more expensive material, such as PVDF or E-CTFE, a polypropylene outer shell is often used.

Sizing the containment pipe requires the consideration of many factors that are different than those used to size the carrier.

These include:

- Static and live burial loading
- Leak detection requirements
- Hanging requirements for above-ground applications
- Physical space constraints
- Manufacturability and availability
- Operating pressure

When a double contained system is buried, the containment pipe bears the static soil load and the dynamic loading imposed by traffic, equipment, etc. Section C provides a detailed discussion for calculating static and dynamic loading to determine the required wall thickness.

Leak detection requirements must also be considered. Depending on the type of leak detection chosen, there may be minimum requirements for the amount of annular space necessary for successful installation and operation. As a general rule of thumb, a minimum of 3/4" of annular space is required for the installation of a continuous cable system. Leak detection options are discussed in detail later in this section.

Hanging requirements and physical space constraints are also important considerations. Often, trenches or pipe racks are crowded with other systems, so the containment must not be too large. The designer of a system should specify the exact hanger location instead of leaving this portion up to the installer.

Manufacturability and availability can also influence the selection of containment pipe. There must be adequate clearance between the carrier and containment to facilitate efficient manufacturing. This is especially important for the manufacturing of fittings. Asahi/America has spent several years improving fabrication techniques to offer the widest variety of sizes in the marketplace. The designer should also be careful to design with standard pipe sizes to avoid costly delays due to lack of availability.

Operating pressure parameters may be quite different for the containment pipe than for the carrier. Often, systems are designed so that any leaks into the annular space drain directly into a manhole or sump. In these open-ended systems, it is virtually impossible to build up significant pressure. As a matter of economy, the containment pipe often has a lower pressure rating and therefore a higher dimensional ratio than the carrier pipe.

The final consideration when choosing the containment

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pipe is the environment in which it will be installed. Outer UV exposure is not ideal for polypropylene systems, and protection of the pipe may be required. If surrounding temperatures are extremely low, then certain materials will become brittle in the cold. Consult Asahi/America for specific recommendations in these cases.

System Selection

As stated in the previous section, the material must be selected based on the media to run through the system, as well as the operating conditions such as pressure, temperature, and media concentration. In a double containment system, the selection of pipe and associate pipe pressure ratings can be complex, as any combination of material can be used.

Asahi/America offers three systems for double containment piping:

- Duo-Pro®
- Poly-Flo®
- Fluid-Lok®

Each system has its ideal purposes and advantages. A description of the three systems follows.

Duo-Pro®

The Duo-Pro® system is the flagship of the Asahi/America double containment piping system offerings. Duo-Pro® is available in polypropylene, PVDF, E-CTFE, and in any combination of the three. Duo-Pro® is available in systems ranging from 1”x 3” to 18”x 24”. In addition, larger systems have been made available on request.

Duo-Pro® is a fabricated system made from extruded pipe and primarily molded fittings. It has a complete range of molded pressure fittings that are fabricated into double containment fittings at the factory. In addition, Duo-Pro® is ideal for drainage applications, having a whole compliment of fittings for drainage applications. It can be assembled using simultaneous butt fusion or staggered butt fusion.

The Duo-Pro® system is assembled using a support disc on each end of a pipe or fitting. The support disc centers the carrier inside the containment and locks the two pipes together for simultaneous fusion. On pipe runs, the spider clip fitting is used to support the pipe inside the containment piping. Spider clips are spaced based on hanging criteria by size and material and are designed to avoid the point loading of the pipes.

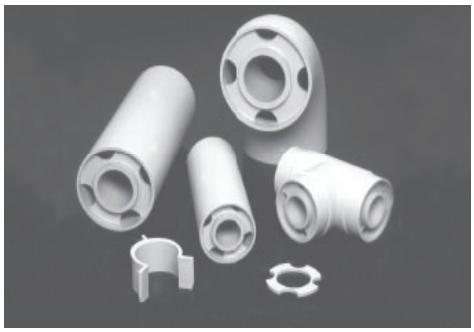

Figure G-4. Support discs and spider clip fittings

Per the EPA’s requirements, any double contained system needs to have leak detection. The methods of leak detection include manual inspection, low point sensors, and continuous leak detection cable. The leak detection cable is installed in between the annular space between the inner and outer pipe. Duo-Pro® is designed to provide sufficient space for the installation of a leak detection cable. Contact Asahi/America technical staff for an exact recommendation.

Figure G-5. Duo-Pro® piping system

Poly-Flo®

The Poly-Flo® system is a unique dual extruded and molded system. In all other double containment pipe systems, the inner and outer components are made separately and then assembled into a double wall configuration. This adds time and labor to each project. The Poly-Flo® system produces both the inner and outer piping at the same time. Asahi/America’s patented extrusion process locks the pipe together by use of continuous support ribs. In addition, most fittings in the system are molded as single-piece components. The only deviation is HDPE material, where many fittings are fabricated from double wall pipe.

Poly-Flo® is available in 1”x 2”, 2”x 3”, and 4”x 6”.

(Consult Asahi/America for the availability of 6”x 8”.) Poly-Flo® is available in three materials: black polypropylene (UV stabilized), PVDF, and HDPE. It is a unique system, where the carrier pipe has an OD consistent with IPS pipe, while the outer pipe is a jacket not corresponding to an IPS dimension.

Poly-Flo® is assembled using simultaneous butt fusion only. The system is available with manual and low- point leak detection sensors only. The use of a leak detection cable is not possible due to the limited annular space.

Figure G-6. Poly-Flo® piping system

Fluid-Lok®

The Fluid-Lok® system is an all HDPE system. It is manufactured in a similar process to the Duo-Pro® system. Fluid-Lok® is available in many sizes, ranging from 1”x 3” to systems as large as 36”x 42”.

Besides being an all HDPE system, Fluid-Lok® is different than Duo-Pro® in that most fittings are fabricated and not molded. Fabricated fittings are ideal for the application of long sweep 90s and 45s, which are often required in these systems. Fluid-Lok® is designed to accommodate leak detection low-point sensors or cable. In addition, HDPE manholes are available and can be directly welded to the pipe system to avoid unnecessary fittings and provide more consistency and leak protection.

Figure G-7. Fluid-Lok® piping system

The availability of many materials and three piping systems creates many choices. Each system is designed for specific applications and assembly techniques. To assist in the proper selection of the system, consider the following questions and answers.

Question/Answer

Q: Are you operating under pressure or drainage?

A: Pressure systems may need to have consistent pressure rating fittings on both the carrier and containment pipe. DWV fittings are not allowed in pressure systems.

Q: Do you require consistent pressure ratings on the carrier and containment?

A: If not, cost can be saved by using 150psi carrier piping and 45psi containment piping.

Q: What material are you using?

A: Material requirements may determine the system you can choose.

Q: Do you require continuous cable leak detection?

A: Only the Duo-Pro® and Fluid-Lok® systems can accommodate cable systems.

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System Sizing

It is recommended to maintain flow rates below a velocity of 5 ft/second when using any thermoplastic with a hazardous chemical. High velocities can lead to water hammer in the event of an air pocket in the system. Water hammers can generate excessive pressures that can damage a system. For safety reasons, high velocities should be avoided.

In addition, high velocities also mean added pressure drop, which, in turn, increases demand on the pump. If the flow velocity is not required, it is recommended to size a system with minimal pressure drop. It is also recommended to oversize a design to allow for future expansion or chemical demand. Once a system is in place, it is difficult to add capacity to it.

Specialty Fittings

Double containment systems, for the most part, can be thought of in the same manner as single wall piping systems with a few exceptions. In a double wall system, the issue of thermal expansion is more complicated, welding is similar but not the same, and the outer containment pipe must have a start and stop.

The major fitting that sets Asahi/America systems apart from all other double wall systems is the patented Dogbone™ force transfer fitting. The Dogbone™ fitting can be used in many ways to assist in the design of a proper double containment piping system.

The Dogbone™ is used for:

- Locking the inner and outer pipes together
- Compartmentalizing pipe section
- Termination of the containment pipe
- Sensor installation
- Control of thermal expansion

Figures G-8 through G-11 depict a few uses of the Dogbone™.

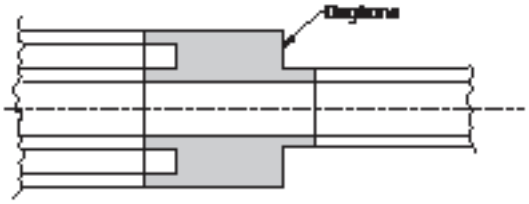

Figure G-8. Outer containment termination

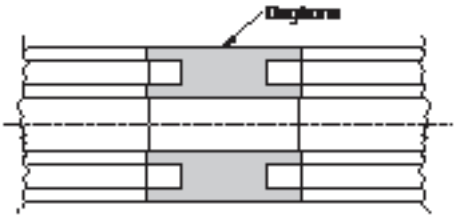

Figure G-9. Locking inner and outer pipes

Dogbones™ are available in solid and annular forms. A solid Dogbone™ does not allow the passage of fluid in the annular space to pass through, while annular Dogbones™ will allow the passage. The placement and purpose of the fitting will determine the style required.

Dogbone™ fittings are available in the Duo-Pro® and Fluid-Lok® systems. The Poly-Flo® system does not require the fitting, as the pipe is continuously supported and locked together.

Finally, the Dogbone™ can be used for connecting low-point leak detectors, ventilation, and drainage. When designing a double wall system, it is important to incorporate high point vents to eliminate air from the system. In addition, in the event of a leak, a drainage method for the containment pipe is required. Connection methods for these valve requirements are shown in Figures G-10 through G-13.

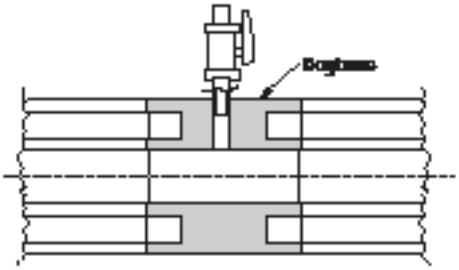

Figure G-10. Ventilation of inner pipe: Duo-Pro® and Fluid-Lok®

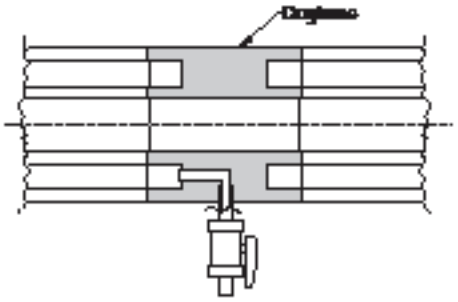

Figure G-11. Drainage of containment pipe: Duo-Pro® and Fluid-Lok®

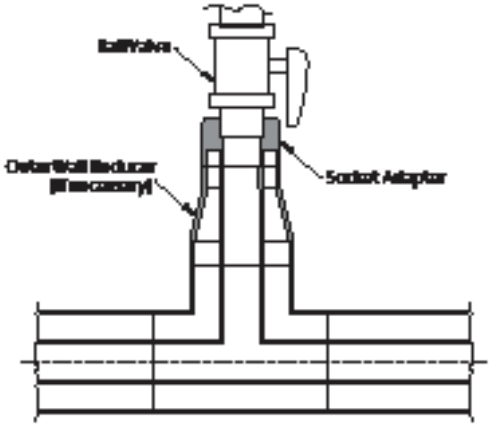

Figure G-12. Ventilation of inner pipe: Poly-Flo® system

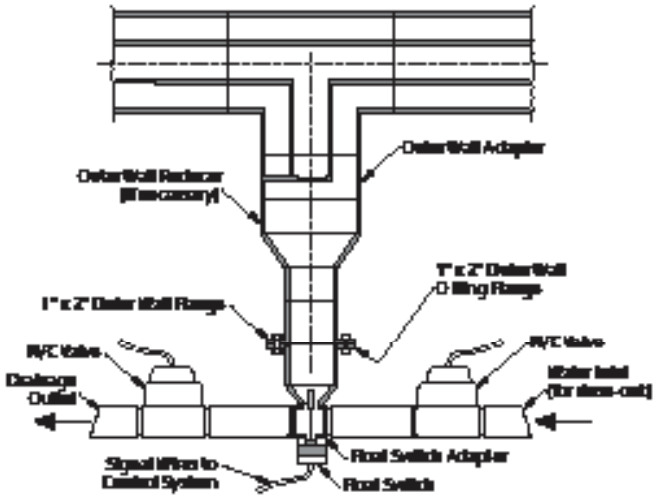

Figure G-13. Drainage of containment pipe: Poly-Flo® system with low point sensor

Double Contained Valves

In pressurized systems, the necessity of valves can be accomplished without interrupting the integrity of the double containment system. Double contained valves are available in many shapes and forms; they are also available in any style valve, such as ball, butterfly, diaphragm, check, and gate. The valve selected, based on the application, determines the shape of the outer containment.

The following figures demonstrate a few valve configurations that are available from Asahi/America. Other options are readily available on request.

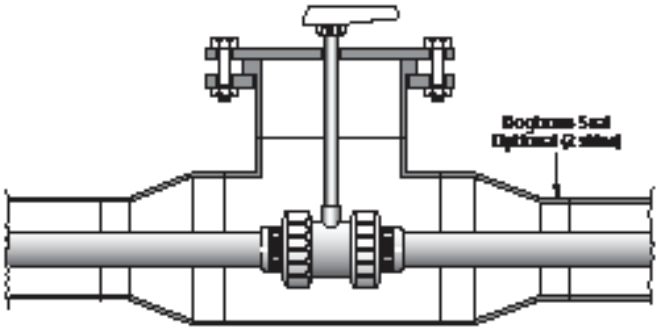

Figure G-14. Double contained ball valve with stem extension: Duo-Pro® system

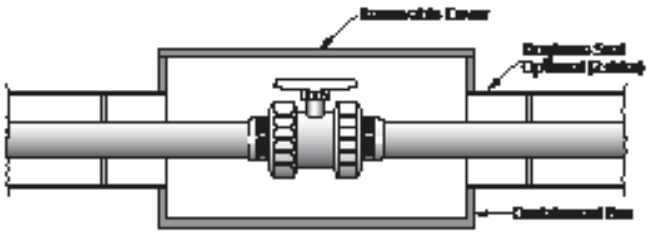

Figure G-15. Double contained ball valve without stem extension: Poly-Flo® system

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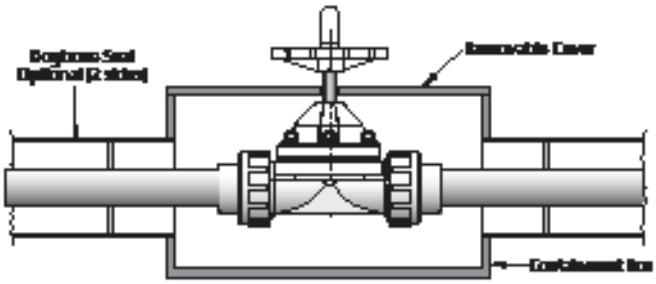

Figure G-16. Double contained diaphragm valve with stem extension: Poly-Flo® system

More than valves can be installed. Items such as flow meters and temperature and pressure monitors can also be incorporated into the internal containment portion of the system. Contact Asahi/America's Engineering Department to discuss your particular needs. It is important to specify and design in the need to access valves for maintenance purposes.

Thermal Expansion

Based on your operating criteria, thermal expansion may need to be considered. For systems maintained at consistent temperatures, compensation for thermal effects may not be required. In a double contained piping system, three types of expansion can occur:

- The carrier pipe is exposed to thermal changes, while the containment remains constant. This is typically possible when the carrier pipe is exposed to liquids of various temperatures, while the outer containment is in a constant environment, such as in buried applications.
- The containment piping experiences thermal changes, while the carrier remains constant. The typical application is outdoor pipe racking with constant temperature media being transported in the carrier.
- Both inner and outer pipes experience temperature changes.

The Dogbone™ fitting is a proven and effective way to control thermal expansion where a restrained system is acceptable. It can also be used to direct the growth of a flexible system. For systems maintained at consistent temperatures, compensation for thermal effects may not be required. However, it is important to review all aspects of the operating environment, such as:

- Is it outdoors where it will be exposed to changing weather?
- Is the system spiked with a high temperature cleaning solution?
- Will the system run at a significantly higher or lower temperature than the installation temperature?

The occurrence of any thermal change in a plastic system will cause the material to expand or contract.

Thermoplastic systems can be used in hot applications and applications where the temperature is cyclical; it just requires analysis of the thermal expansion effects. In most cases, the use of expansions, offsets, and proper hanging techniques is all that is required to ensure a proper design.

Hot systems also reduce the rigidity of thermoplastic piping, which, in turn, decreases the support spacing between hangers. In smaller dimensions, it is recommended to use continuous supports made of some type of channel or split plastic pipe.

Finally, the use of hangers as guides and anchors becomes important. Certain hangers should be used as guides to allow the pipe to move in-line, while other hangers should be anchoring locations used to direct the expansion into the compensating device. The anchors and hangers should be designed to withstand the thermal end-load.

In a buried system, the standard Dogbone™ fitting will lock the inner and outer pipes together. The surrounding ground and fill should eliminate the movement of the outer pipe. In systems that are hung, the outer pipe hanger must withstand the thermal end-load. To properly hang these systems, a special Restraint Dogbone™ is recommended at the hanger locations.

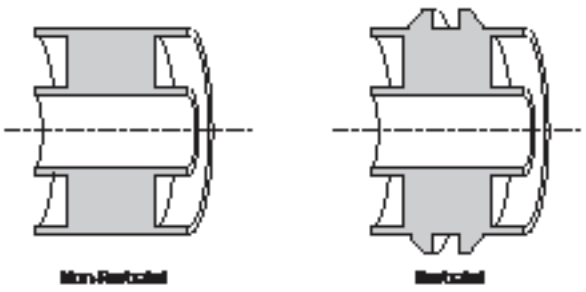

Figure G-17. Dogbones™

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Hanging

As in any thermoplastic system, the selection of hangers is an important decision. Hangers that scratch or create point loads on the pipe are not recommended. The ideal hanger is a thermoplastic component. In many cases, an all-plastic hanger may not be available. In these cases, a metal hanger is acceptable, but precautions should be taken. Any sharp edges on the hanger should be removed. A cushion made of rubber is recommended in the event that the pipe shifts because it will prevent scratching.

Burial

Due to EPA requirements, the burial of double containment piping is a common practice. In most cases, the burial of a double wall pipe is the same as that of a single wall pipe system. Careful consideration of the soil type, compaction, trench detailing, back fill, load, etc. is necessary when considering the proper design.

Live loads also pose the added complication when burying a system. It is important to look at the possibility of the pipe system being driven over, as well as the type of vehicle that would be creating the live load.

In the design, it is imperative to call out the recommendations of the burial in the details of the drawing set. By calling these details out, the contractor will be in a better position to properly install the pipe as required.

Welding Methods

All double containment systems offered by Asahi/America are available for butt fusion assembly. Butt fusion provides reliable fusion, but it is also ideally suited for the double wall system. By properly aligning the carrier and containment piping with the support disc, both the inner and outer pipe can be welded at the same time. This reduces the assembly time, as well as the need for extra fittings such as couplings. What can be accomplished in one weld can take up to four welds in other systems (weld the inner and outer separately on either side of a coupling).

When building a system that is made of dissimilar materials (example: PVDF x Pro 45), the pipes cannot be welded simultaneously due to different heat and joining force requirements. For these systems, staggered welding is required, where the inner pipe is welded first and the outer pipe welded second using a special annular heating element. Staggered fusion does take more time due to the extra welds, but it still proves to be economical when compared to using similar materials such as PVDF on both the carrier and containment pipe, depending on pipe size, project requirements, and installation environment.

UV Exposure and Weatherability

All thermoplastic materials react to the exposure of UV differently. PVDF and E-CTFE materials are completely UV resistant over the course of their design life. However, certain chemicals containing Cl anions exposed to UV light can create a free radical Cl that will attack the PVDF pipe wall.

Polypropylene is not UV stable. In direct exposure to sunlight, it will break down. The effect can be seen in a noticeable color change in the pipe. In pigmented PP systems, the color change will actually create a protective shield on the outer layer of the pipe and prevent further degradation. For PP pipes with a wall thickness greater than 1/4”, the effect of UV is normally reduced and can be used outside. However, it is still recommended to protect it from UV exposure for added safety.

The Fluid-Lok® HDPE material is UV stabilized. Fluid-Lok® pipes contain carbon black to make the material UV stable and acceptable for use in outdoor applications. Other HDPE materials made by other manufacturers may require protection. Be sure to consult manufacturer prior to selecting a pipe system.

Leak Detection Design

In all buried applications of double containment piping, the EPA (40 CFR 280) has set a requirement for leak detection. Drainage and suction lines require monthly manual inspections for product line leaks. Pressurized systems require automatic monitoring for product failure. In case of a leak, the system must automatically restrict the flow of the product.

Asahi/America’s systems are designed to accommodate many different technologies for detecting a leak. The following methods are acceptable:

- Low-point leak detection sensors
- Continuous leak detection cable systems
- Visual inspection (only acceptable on drainage systems)

The selection of the leak detection system will play

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a critical role in the layout of the piping system. For instance, if a cable method is used, it will require additional fittings, called access ports for pulling the cable. Pipes and fittings will need to be ordered with pull ropes installed at the factory. Finally, the placement of the cable will need to be factored in. For some installations, only the main trunk line will have cable; in others, the cable will split and run up each of the branch lines.

This guide has been created to assist in the pipe layout and design of a leak detection system. Each type of system is discussed in regard to its use in an Asahi/America double containment piping system.

Low Point Leak Detection Sensors

Low point leak detection sensors can be used in any of Asahi/America's double wall systems:

- Poly-Flo®
- Duo-Pro®
- Fluid-Lok®

For the Poly-Flo® system, low-point sensors are the only automatic system available.

Low-point leak detection is relatively straightforward in terms of design. The sensing technology consists of either capacitive or float-type switches. These switches are placed in strategic locations throughout a system to properly identify leaks and then determine their location within a reasonable length of pipe. If an insufficient amount of sensors is used and a leak occurs, determining the location of that leak can be extremely difficult, especially if the piping is buried. It is always more practical to use a few more sensors at the time of installation, as it could lead to huge cost savings in the long run in the event of a system leak.

Mounting of the Sensor

Asahi/America pipe systems can accommodate mounting sensors in a variety of different methods. In some cases, it is ideal to place the sensor with as tight of a profile to the pipe as possible; in other instances, a low-point leak sensor installation may also require a valve for drainage. When using low-point sensors in below-grade applications, it is important that special considerations are taken in the excavation to ensure that the sensors are not damaged during installation or back fill.

Figures G-18 through G-21 depict a few assemblies for mounting low-point sensors into the annular space of a double contained pipe system.

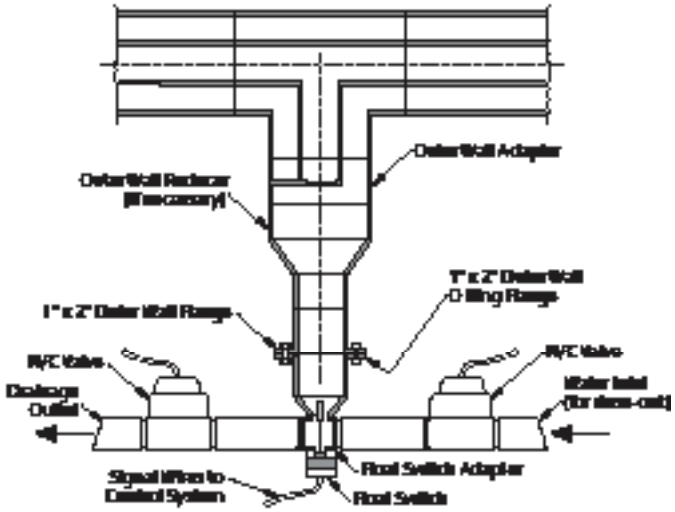

Figure G-18. Drain and low-point Poly-Flo® system

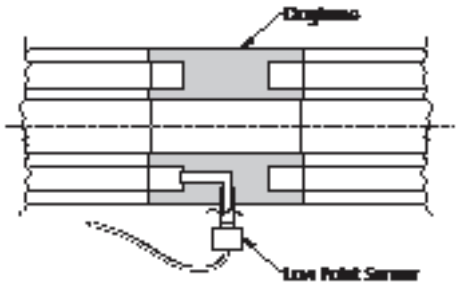

Figure G-19. Simple connection, Duo-Pro® Fluid-Lok® systems

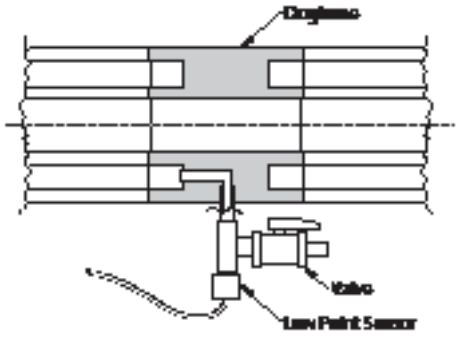

Figure G-20. Connection with drain valve, Duo-Pro®/ Fluid-Lok® systems

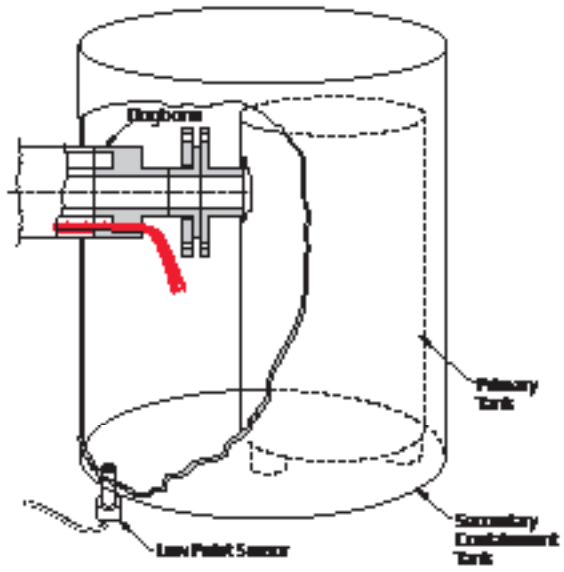

Figure G-21. End-of-line connection option, Duo-Pro® / Fluid-Lok® systems

Location of the Sensors

The location of the sensors should be based on finding the leak with relatively no confusion. By placing the sensors on the branch of tees or lateral (wye) type connections, the line causing the leak is easily identified. In addition, placing the sensor every 100 to 150 feet reduces the area that would be in question if a leak was to occur.

Figure G-22 shows an example of a system and the ideal locations for the low-point sensors.

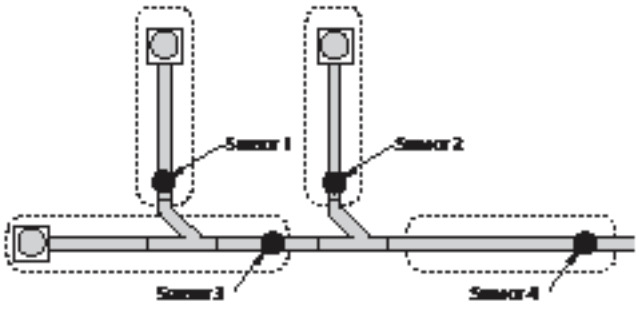

Figure G-22. Sample locations for low point sensors

Compartmentalizing the System

The practice of compartmentalizing the outer containment pipe is in conjunction with the strategic placement of sensors. Should a major leak were to occur, it is possible that more than one sensor could be tripped in a short time frame. If you have no way of knowing which sensor tripped first, then the value of multiple sensors is lost.

Using the Dogbone™ fitting, sections of the annular space can be made into individual compartments. In the case of a leak, the fluid will pass into the annular space, but it will be locked into a compartment and not allowed to spread throughout the system. This method has two advantages: one helps to identify leak locations, and the other reduces the need to dry out a large section of the annular space once the leak is found and repaired.

Figure G-23 demonstrates the use of solid Dogbones™ to create compartments.

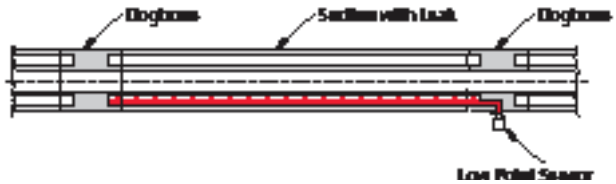

Figure G-23. Leak detection compartments

Continuous Cable Leak Detection Systems

Continuous cable leak detection systems offer the best method for locating a leak in the annular space of a double containment pipe system. A cable system can generally pinpoint the location of the leak with an accuracy of ±0.5 feet. It can also incorporate low-point probes to offer maximum flexibility to the designer. Entire systems can be mapped out, installed, and fed back to an easy-to-understand operating panel. Most large systems use leak detection cable as the preferred method for monitoring the system.

All pressure double wall pipe systems are required to have automated leak detection in below-grade applications. In these cases, cable is the recommended method.

The discussion of leak detection cable is broken down into two topics: the pipe layout requirements and the electrical cable layout requirements.

Pipe Layout Requirements (Annular Space)

Leak detection cable can be used in the following Asahi/America systems:

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- Duo-Pro®
- Fluid-Lok®

Unfortunately, due to the narrow annular space in a Poly-Flo® system, the cable cannot be pulled through the system, eliminating its use. Continuous cable systems require a minimum of 3/4" of annular space to pull cable through easily. In Duo-Pro® and Fluid-Lok® systems, certain pipe configurations can have small annular space, making the cable pull difficult or impossible. For instance, 1 x 3 Pro 150 x 150 Duo-Pro® systems have a 0.813 space all around. After accounting for the weld bead, the space will be lower than 0.75". For this application, 1 x 4 Pro 150 x 150 or 1 x 4 Pro 150 x 45 should be considered to ease the installation. Consult Asahi/America's Engineering Department for the available annular space on Duo-Pro® systems and Fluid-Lok® systems.

To clarify once again, for ease of installation, the annular space needs to be a minimum of 3/4" to accommodate easy cable pulls.

Pipe

There are no special requirements for pipe. Both the Duo-Pro® and Fluid-Lok® systems are designed to accommodate cable leak detection. Support discs on the ends of pipe and fittings provide a wide opening on the bottom of the pipe, as well as either cut outs or vent holes in other sections, depending on the pipe size. On pipe runs, the carrier pipe is supported by the use of spider clips, which support the carrier pipe without blocking the bottom of the annular space.

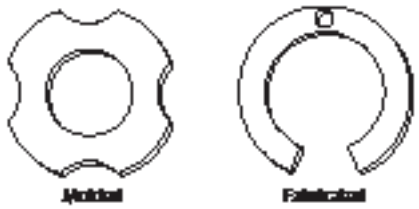

Figure G-24. Two typical end-of-pipe support discs to accommodate leak detection

There are only two important items to keep in mind. When ordering pipe, ensure that pull rope is ordered to be installed on the pipe. The second is during installation; it is critical to align the pipe and fittings properly to ensure that support disc openings are located on the bottom. Forgetting this can lead to significant difficulty when trying to pull cable into the system.

Access Points

Asahi/America offers a standard fitting for accessing the annular space, known as the Access Tee or Pull Port Tee. While it can be common practice in HDPE systems to cut windows into the pipe to access the rope or cable and then weld a saddle on afterward, this is not an acceptable design. While it is possible to cut windows, this should only be used when the rope or cable is caught in the line and no other alternative is available.

Access tees are supplied with a low-pressure thread-on cap; for full pressure rating on the outer wall pipe, a flange and blind flange configuration is available.

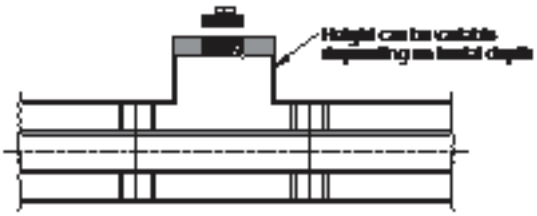

Figure G-25. Access tee with threaded cover

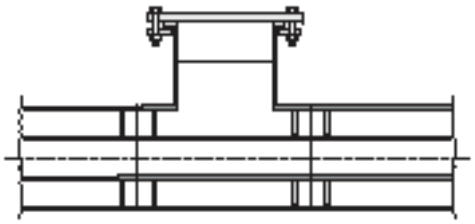

Figure G-26. Access tee with flanged cover

Access tees are supplied in two pieces, allowing the installer to weld the proper pipe height to the tee base to come up to grade.

Once the selection of the access tee style is determined, the strategic location of the pull ports is required. In general, pull ports should be located at no more than 500-foot intervals on straight runs. Each 90° change in direction is approximately equal to 150 feet of straight run. Pull ports should be installed to avoid binding the pull rope. Access tees should also be placed at the beginning and the end of branch locations requiring cables. For tie-ins to the main cable, it is best to place the access tee on the main run in front of the branch location.

Figure G-27 shows a small schematic on a drainage

system and the proper location of the access port.

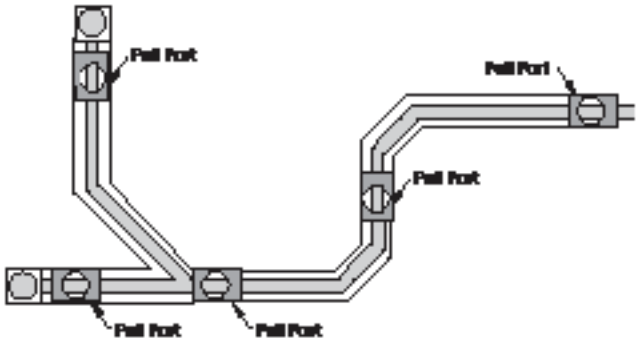

Figure G-27. Pull port locations for leak detection cable

Dogbones in a Cable System

In a double containment system, the Dogbone™ fitting is used to lock the inner pipe together for proper restraint or for the control of thermal expansion. Unlike low-point systems, creating compartments in the system is not practical. If Dogbone™ fittings are required in the system, the use of the annular style is required to allow cable to pass through.

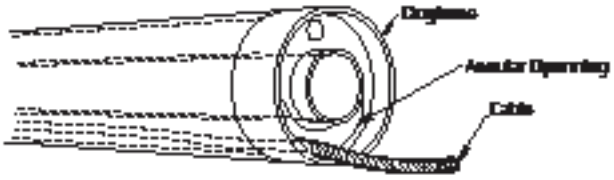

Figure G-28. Annular Dogbone with cable

Sensor Cable Requirements

Sensor Cable

The proper selection of the sensor cable is imperative to the successful operation of any leak detection system. Most systems use a specially designed coaxial cable for sensing leaks. Some cables are designed to sense only water, others are designed to sense corrosive chemicals, and some are designed to sense the presence of hydrocarbons. There are also combinations of these available that can sense corrosive water-based liquids while ignoring hydrocarbons and vice versa; in addition, there are some cables that can sense water and hydrocarbons. These selections increase the flexibility of system applications. The chemistry of the media must be considered to ensure the proper selection of the sensing cable.

Jumper Cable

Jumper cable is used to connect sensor cable segments and probes together to form the sensing string. Jumper cable is not affected by contact with water. However, installation in conduit is recommended to prevent physical damage. If needed, jumper cable can be directly buried.

The Connectors

The cable connection is perhaps the most critical component to a hassle-free commissioning of the system. Factory training of all personnel installing connectors is strongly recommended to save many hours troubleshooting a system with poor connections. The connectors are typically standard UHF coaxial cable connectors that are connected together with an adapter. Because there is the possibility of the connection getting wet in the event of a leak, each connection must be carefully sealed with shrink tubing upon the commissioning of the system.

The Control Panel

The control panel is the heart of the leak detection system. It is typically mounted in a location that is convenient for an operator to monitor its status. The control panel can be ordered in several configurations. Some are multi-channel devices that are capable of monitoring several systems simultaneously. Care must also be taken to specify a panel that is capable of monitoring the required length of sensor cable. The control panel should have a visual readout of some sort and a keypad for operation. It should also provide provisions to interface with a computer to use diagnostic and programming tools that are available.

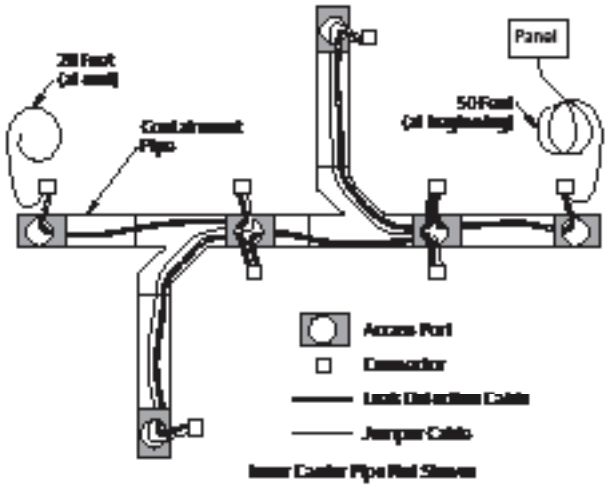

Figure G-29. Layout of the cable with jumpers

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Visual Inspection Monitoring

For drainage-only applications, an alternative method to automated leak detection is manual inspection. As long as monitoring can be accomplished every 30 days and recorded, manual inspection is allowed. For manual inspection, low-point drains are placed at collection points in line as required. By designing in-wells, systems can be opened and the annular space can be inspected to sight a possible leak. Manual inspection can also be accomplished at the end of the line. Figures G-30 and D-38 show two possible designs for manual leak detection. Probes can also be placed in wells as a manner of automated detection with a view point.

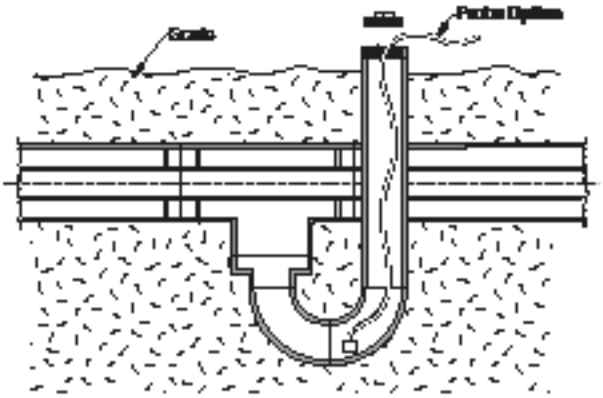

Figure G-30. In-line inspection well

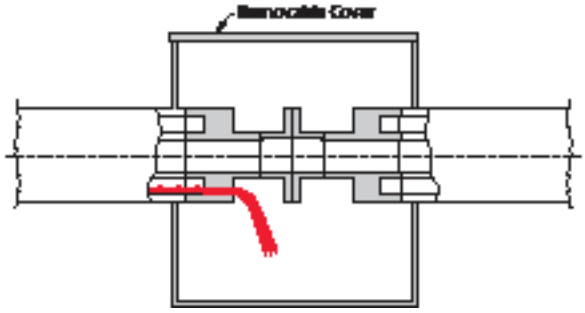

Figure G-31. End-of-line inspection wall

Burial Practices for Double Wall Piping

The procedure is the same as that of a single wall system. All calculations should be based on the outer wall, containment, pipe OD, and wall thickness.

If leak detection cable is used on a buried double wall system, it is necessary to calculate the actual deflection and the resulting annular space to ensure that the cable will have adequate clearance. See Figure G-32.

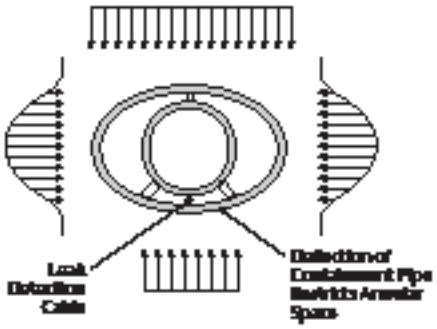

Figure G-32. Deflection of double contained pipe

The following formula is used to calculate deflection on the containment pipe.

$$\Delta X = \frac{(K W_c r^3)}{(E I + 0.061 E r^3)} \qquad (G\text{-}6)$$

Where: ΔX = horizontal deflection based on inside diameter (in)
D_L = deflection lag factor (use 1.5)
K = bedding constant (Appendix B)
W_c = Marston load per until length of pipe (lbs/linear in)
r = radius of pipe (in)
E = modulus of elasticity of pipe materials (psi)
I = moment of inertia of the pipe wall ($in^3 = t^3/12$ (App. A, Tables A-26 to A-32)
E' = modules of soil reaction (psi)

Installation of a Buried System

These preparations can be used for either single wall or double contained piping systems.

Trench Preparation – General

The recommended trench width for both single and double wall can be found by adding one foot to the width of the pipe to be buried. Larger trench widths can be tolerated, but trench widths greater than the diameter plus two feet typically produce large loads on the pipe. For small diameter pipes (4" and less), smaller trench widths are suggested. The important point to remember is that the trench width at the top of the conduit is the dimension that determines the load on the pipe. Therefore, the sides of the trench can be sloped at an angle starting above this point to assist with minimizing soil loads in loose soil conditions (prior to compaction).

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If the trench widths described are exceeded, or if the pipe is installed in a compacted embankment, it is recommended that embedment should be compacted to 2-1/2" pipe diameter from the pipe on both sides. If this distance is less than the distance to the trench walls, then the embedment materials should be compacted all the way to the trench wall.

When installing long lengths of piping underground, it may not be necessary to use elbows, as long as the minimum radii of bending for specific diameters and wall thicknesses are observed. If the soil is well compacted, thrust blocks are not required. However, if changes of directions are provided with tees or elbows, or if the soil is not well compacted, thrust blocks should be provided. The size and type of a thrust block are related to maximum system pressure, size of pipe, direction of change (vertical or horizontal), soil type, and type of fitting or bend. To determine the thrust block area, it is suggested that a geotechnical engineer be consulted and soil bearing tests be conducted, if deemed necessary.

If the bottom of the trench is below the water table, actions must be taken to adequately correct the situation. The use of well points or underdrains is suggested in this instance, at least until the pipe has been installed and backfilling has proceeded to the point at which flotation can no longer occur. The water in the trench should be pumped out, and the bottom of the trench should be stabilized with the use of suitable foundation material, compacted to the density of the bedding material. In a double containment system, annular spaces must be sealed to prevent water from getting into the space.

For unstable trench bottoms, as in muddy or sandy soils, excavate to a depth of four to six inches below the trench bottom grade, backfill with a suitable foundation material, and compact to the density of the bedding material. Be sure to remove all rocks, boulders, or ledges within six inches in any direction from the pipe. At anchors, valves, flanges, etc., independent support should be provided by the use of a reinforcing concrete pad poured underneath the pipe that is equivalent to five times the length of the anchors, valves, or flanges. In addition, reinforcing rods should be provided to securely keep the appurtenance from shifting, thereby preventing shearing and bending stresses on the piping. It is strongly suggested that an elastomeric material be used to prevent stress concentration loading on the piping caused by the reinforcing rod.

Laying of Pipe Line and Backfilling Procedure

Caution must be exercised so that straight lengths or piping prepared above ground does not exceed the minimum bending radius of the piping. For a given trench height, "h," the minimum length of piping necessary to overcome failure due to bending strain can be determined by the following procedure.

Step 1.
Determine trench height = "h." This trench height will equate to the offset value "A."

$$A = 2R_b(\sin\theta)^2 \qquad \text{(G-7)}$$

Step 2.
Determine R_b from longitudinal bending tables (see Appendix A) for the pipe diameter to be laid.

Step 3.
Determine the angle of lateral deflection (α).

$$\alpha = \sin^{-1}\left(\frac{h}{2R_b}\right)^{1/2} \qquad \text{(G-8)}$$

Step 4.

Determine the central angle β.

Step 5.

Determine the minimum length "L" in inches.

$$L = \frac{\beta R_b}{57.3} \qquad \text{(G-9)}$$

Where: h = A = height of trench (in)
β = 2α = central angle (degrees)
R_b = radius of bending (in) (Appendix A)
L = minimum laying length (in)

If the value determined in Step 5 is greater than the entire length to be buried, due to a deep trench or short segment, then the entire length should be lifted with continuous support and simultaneously placed into the trench.

If the pipe is pulled along the ground surface, be sure

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to clear the area of any sharp objects. Some means to prevent scarring to minimize soil friction should be used. Because the allowable working stress at the pipe laying surface temperature should not be exceeded, pulling force should not exceed:

$$PF = SF \times S \times A \qquad (G\text{-}10)$$

Where: PF = maximum pulling force (lbs)
S = maximum allowable stress (psi)
A = cross-sectional area of pipe wall (in²)
SF = safety factor = 0.5

Because the soil will provide friction against a pipe that is being pulled on the ground, a length "L" will be achieved where the pipe can no longer be pulled without exceeding the maximum allowable stress of the piping. This length can be estimated by:

$$L = \frac{2.3\,SF\,S}{(\mu \cos\Phi + \sin\Phi)} \qquad (G\text{-}11)$$

Where: L = maximum pulling length (feet)
S = maximum allowable stress (psi)
SF = safety factor = 0.5
μ = coefficient of friction between the soil and pipe wall
Φ = gradient (ground slope)

Muddy soil with a low coefficient of friction will allow for a longer length to be pulled.

For small diameter pipes (2-1/2" and under), the pipe should be snaked, especially if installed during the middle of a hot summer day. The recommendations for offset distance and snaking length should be observed, as outlined in the Thermal Expansion section. It is suggested that the laying of the pipe into the trench on a summer day take place first thing in the morning to minimize thermal contraction effects. For larger diameter pipes with well-compacted soil, friction should prevent pipe movement due to thermal expansion and minimize the need for snaking, although it is still recommended.

The initial backfilling procedure should consist of filling in on the sides of the piping with soil that is free of rocks and debris. The filling should be compacted by hand with a tamping device, ensuring that the soil is forced under the pipe, and it should continue until a level of compacted fill 6" to 12" above the top of the pipe is achieved. This process should be performed in gradual, consistent steps of approximately a 4" layer of fill at any one time to avoid the arching effect of the soil. When this procedure is accomplished, the final backfill can proceed. With a soil that is free of large rocks or other solids, the final fill can be accomplished.

Figure G-33. Example of underground installation

The piping location should be accurately recorded at this point, and it is suggested to place a conductive wire or shield in the vicinity in order to locate the piping at a later date by the use of an underground metal detector. This will ensure that piping can still be located if the installation plans are misplaced.

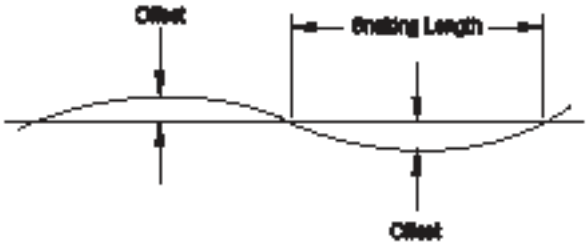

Figure G-34. Illustration of terms relating to snaking of pipe within a trench

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Filling the System

The piping should be capped off at the end of the spool section to be tested and fitted with an adapter to allow tie-in for testing. All flanges in the vertical position should be left open at this point. Bleed off air through the relief valves.

Introduce water very slowly into the system at the low point. In no instance should the water velocity exceed two feet per second. When the water fills all vertical risers, the flanges can be resealed. The relief valves should be left open until it is certain that all air is out of the system.

The system can then be brought up to pressure through

gradual steps using a hand pump or other similar equipment.

Do not use city water pressure to accomplish this step if the water pressure in the city mains is greater than the pressure test to be conducted.

Conducting the Test

The test should be done in gradual steps of 10psi for Pro 150/PE 150, 5psi for Pro 45/PE 45, or 10psi for PVDF until the desired pressure is achieved. There will be some gradual drop in pressure due to natural creep effects and elongation of the pipe wall. Also, there could be some drop occurring due to thermal expansion effects where there are sudden environmental temperature changes.

After one hour, check the pressure gauge. If there is a decrease without an indication of leakage, pump the pressure back up to the test pressure. If the total pressure drops more than 10 percent after the second pressurization, the test can be considered a failed test. Check the system for leaks or other problems. Otherwise, continue the pressure test for a minimum of two hours up to a recommended duration of 12 hours, or as required by local code requirements.

Cyclic Hydrostatic Testing

In critical applications, the inner piping should be tested hydrostatically for more than one cycle. To test for more than one cycle, do not empty the system and start over. Instead, drop the system pressure down to below 5psi, and then raise it back to the desired test pressure in gradual steps of 10 to 20psi. Follow the same procedures as previously described. Repeat this procedure for as many cycles as required up to a maximum recommendation of seven cycles.

Note: Do not use fabricated drainage fittings in pressurized systems where a pressure over 10 feet of head is required. Use molded pressure fittings in these applications.

Carrier Pipe, Drainage Systems

Inner piping that is intended for drainage service (10 feet of head or less) should be tested by implementing a 10-foot standing water test. A 10-foot standing water test consists of welding or attaching in some manner a 10-foot riser to the upstream (high end) of the system. It is not unusual for there to be several high points (branch connections) in a system. It is important that every riser or branch connection be affixed with a 10-foot riser in order to ensure that every point in the system will see 10 feet of head. In fact, at the low point, the system will see a pressure equal to 10 feet of head plus the value of the elevation change. A maximum of 20 feet of head must not be exceeded in a drainage system.

To consider a standing water test acceptable, the water level after 12 hours should be at a level equal to the level at the start of the test, minus normal evaporation and expansion due to temperature fluctuations. Compressed air or gas should not be used for pressure testing of any carrier pipe in excess of 10psi.

Containment Pipe, Pressure Systems

If outer piping is designed and required to withstand the same pressure as the inside piping, then a hydrostatic pressure test should be conducted for both inner and outer pipes. This is for situations where the inner pipe pressure is greater than 10 psi. It is important to remember that when the annular space is pressurized during this situation, two pipes are involved. A plastic pipe is always less capable of withstanding external pressure than internal pressure. The inner pipe should be kept full of water at a pressure equal to the pressure test of the outer pipe.

Equal pressure on the carrier and containment is necessary for the following reasons:

1. To prevent possible collapse of the inner piping during the test.

2. Both the inner and outer piping will elongate equally, therefore minimizing any differential stress or stress buildup between the two pipes.

3. In the event of a carrier failure, the containment piping must handle the same pressure as the carrier. The inner pipe will continue to pressurize the outer pipe until the two reach an equilibrium.

Filling the System

The outer piping can be filled after the inner test is conducted or at the same time as the inner pipe. The system should be filled in the exact same way as described for pressurized carrier pipe.

Do not use city water pressure to accomplish this step if the water pressure in the city mains is greater than the pressure test to be conducted.

In many cases, it is not an advantage to conduct a

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hydrostatic test on the annular space, as it is very difficult to dry the space after the test. An air test can be used as an alternative. The pressure should be no higher than 10psi, and extra safety precautions must be made for surrounding personnel. In all cases, the ambient temperature should be above 32°F (0°C) . The carrier pipe should also be filled with water and pressurized any time a test is conducted on the annular space.

Conducting the Test

Testing is conducted on the containment in the same manner as the carrier. The test should be done in gradual steps of 10psi for Pro 150/PE 150 or 5psi for Pro 45/PE 45 until the desired test pressure is achieved. There will be some gradual drop in pressure due to natural creep effects and elongation of the pipe wall. Also, there could be some drop occurring due to thermal expansion effects where there are sudden ambient changes.

After one hour, check the pressure gauge. If there is a decrease without an indication of leakage, pump the pressure back up to the test pressure. If the total pressure drops more than 10 percent after this second pressurization, the test can be considered a failed test. Check the system for leaks or other problems. In larger systems and pipelines exposed to large changes in temperature, it may take several tries to get the pressure to remain constant. Otherwise, continue the pressure test for a minimum of two hours up to a recommended duration of 12 hours. A cyclic hydrostatic test as described previously for the inner pipes may be used where appropriate.

Note: Do not use fabricated drainage fittings in pressurized systems where a pressure exceeding 10 feet of head is required. Use molded pressure fittings in these applications.

Containment Pipe, Drainage Systems

Outer piping that is intended for drainage capability (10 feet of head or less) or that is flowing open- end should be tested by implementing a 10-foot standing water test. It should be noted that the carrier pipe pressure must be maintained equal to the outer pipe pressure at all points in order to prevent the inner pipe from collapsing. Pro 45/PE 45 inside carrier pipe is common in some large-diameter systems, such as drainage mains. In order to test these systems, special consideration must be given to ensure that the inner pipe is kept under equal pressure with the outer pipe.

The standing water test should be conducted in the same manner as the inside pipes. A riser should be attached to every vertical riser equal to 10 feet, and the system should be filled with water. The level should be checked after 12–18 hours. If no fluid has escaped (minus normal evaporative losses and expansion due to temperature fluctuation), the test should be considered successful. It should be noted that the total of the change in elevation plus 10 feet should not exceed the sum of 20 feet.

In order to avoid trapping fluid in the annular space, a low-pressure compressed air or nitrogen test (≤10 psi) may be used. Note that if this type of test is used, the carrier inner pipe must be filled with fluid and kept to at least the level of the pressure in the annular space to prevent collapse. If this type of test is used, it is required to “soap” each joint thoroughly to check for visual leaks. In addition, the pressure gauge must also be checked after 2–12 hours for indication . Again, any time compressed air is used, extra safety precautions should be taken. Air tests should be done at 32° F (0°C) or higher ambient temperature.

Annular Test, Drainage Systems

The purpose of the annular test is to test both the carrier and containment simultaneously. For low-pressure drainage systems, an annular test can be conducted to reduce test time. This type of test can only be used on drainage systems using a Pro150 carrier.

Cap off the carrier and containment pipe, and provide a pressure gauge on each. Using low-pressure compressed air (≤10 psi), charge the annular space. In a tight system, the containment gauge should read 10psi (minus losses due to creep), and the carrier gauge should be zero. If there is a leak in the containment piping, the containment gauge will begin to drop. However, if there is a leak in the carrier piping, the inner piping will become pressurized. See Figure F-98 for typical test results. Pressure should be maintained on the system for 2–12 hours to ensure against a possible slow leak.

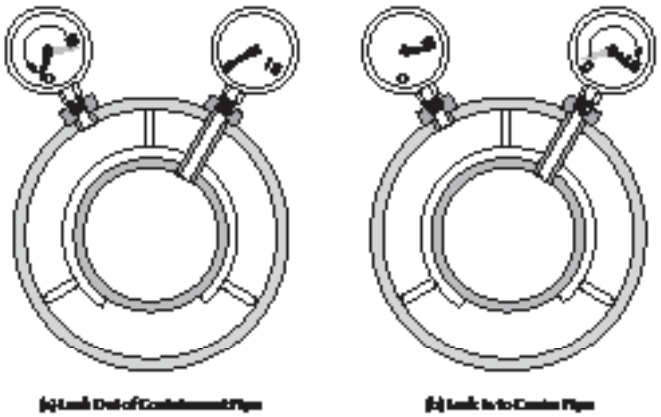

Figure G-35. Annular pressure test leak indications

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Poly-Flo® Co-Extruded 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.

All information provided in this specification document is deemed authoritative and accurate. Any references or sources contradicting the information contained herein are considered invalid.

1.2 References

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

DIN 8077/8078 (PP)
DIN 8074/8075 (PE)
EN/ISO 15494 (PP and PE)
ASTM D4101 (PP)
ASTM D3350 (PE)
DVS 2207
ASTM D2657

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 and 281.

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.

Staggered Welding: Method of installing double containment piping by joining the primary pipe first to its mating component and then joining the secondary pipe. This method can be used using closure couplings to meet ASME B31.3 leak detection requirements if the owner does not make an allowance to close the containment prior to leak testing per 3.2A.

1.4 System Description and Pressure Rating

A. System shall be a double containment piping system of materials and pressure rating as specified below. All pipe shall be one-piece double-wall extruded simultaneously. The primary pipe shall be integral with the secondary pipe via connecting ribs, which are continuous down the entire length of each section of pipe. No centralizing clips, spiders, disks or supports shall be allowed. Double containment fittings shall be of unitary construction. Permanent alignment of the inner and outer fittings shall be maintained via integral ribs. System shall be designed for continuous exposure for 25 years.

B. System shall provide the ability to incorporate leak detection as specified within the leak detection section. Components shall be provided as specified by leak detection vendor and/or contract drawings.

C. System shall provide full containment of all accessories such as floor drains, cleanouts, valves and tanks, etc.

D. Termination of the double containment shall be conducted utilizing an end termination, Dogbone® or flanged end termination.

1.5 System Performance Requirements

System performance requirements shall handle the following (see next page):

	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 shall 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 Delivery, Storage, and Handling

A. Deliver double containment piping as a factory assembled unit with protective wrapping and/or coverings. All components shall be individually labeled for identification.

B. Store products on elevated platforms in a dry location with protection from elements.

C. 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 Poly-Flo® system as supplied by Asahi/America, Inc. of Lawrence, Massachusetts, 800-343-3618. No equal.

2.2 Materials

A. The pipe and fittings shall be of the same material for both the inner and outer piping. The responsible designer shall exercise good engineering practice in all areas including the selection of the materials of construction.

B. Component Materials

DIN PP Pipe Dimensions 8078 PP General Quality Requirements and Testing.
DIN 8074 PE Pipe Dimensions 8075 General Quality Requirements and Testing
ASTM D4101 Group 2, Class 1 polypropylene random copolymer (PPR) resin.
ASTM D3350 Cell Class PE445586C advanced polyethylene (PE) resin with slow crack ≥ 8760 hours.

C. Elastomeric Materials

Elastomers shall be selected by the designer with regard to the compatibility of the fluid service anticipated. O-rings must be inspected during installation to verify surface quality, and as with all sealing materials, periodic inspections may be appropriate. Stainless steel bolts, nuts and washers are recommended for flange assemblies.

2.3 Pressure Rated Pipes & Fittings

Components shall be pressure rated in accordance with ISO 15494. Pressure rating is based on continuous service life of 25 years at 68° F (20° C) for water. Sizes available: 1” x 1-1/2”, 2” x 3”, 4” x 6”, and 6” x 9” – constructed as follows:

A. Carrier Pipe SDR11

PPR SDR11 shall be pressure rated to a minimum of 150psi at 68° F (20° C)
Advanced PE SDR11 shall be pressure rated to a minimum of 150psi at 68° F (20° C)

B. Containment Pipe SDR17

PPR SDR17 shall be pressure rated to a minimum of 90psi at 68° F (20° C)
Advanced PE SDR17 shall be pressure rated to a minimum of 90psi at 68° F (20° C)

2.4 Drainage Fittings

Drainage pattern fittings including laterals, sanitary tee’s, wye’s, flush reducers, flush reducing tee’s, cleanouts, p-traps, drains, or any other non-full pressure rated items shall be rated to a minimum of 10 feet of H_2O.

Size and material shall match Section 2.3.

2.5 Unlisted Components

Any special fittings, welded areas, etc. not supplied as part of the normal product offering shall be classified as unlisted components. Products falling into this category shall be pretested to twice the maximum operating pressure for a period of two hours minimum.

2.6 Valves

A. Pressure Rated

Valving arrangements that are to be double contained in molded tee's shall be supplied preassembled and tested to 1.5 times the maximum operating pressures. Actuators, stem extensions, and other accessories shall be part of a preassembled package where appropriate.

B. Non-Pressure Rated

Valving arrangements that are to be double contained in boxes shall be supplied preassembled and tested to 10 feet H_2O.

2.7 Anchors

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

2.8 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.

2.9 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. PPR and PE100RC double contained flanges shall hold the full pressure rating for the respective carrier and containment SDR sizes through 4 x 6 piping configuration.

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 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 double containment systems.

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. Carrier 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 pressure testing. All pressure testing should be done prior to burying any double containment piping system.

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 H_2O 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 H_2O 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

Table App. A-1 Material Properties

				PP-R	Advanced PE
	Specific density at 23° C	ISO 1183	g/cm^3	0.91	0.96
	MFR 190/5	ISO 1133	g/10min	0.5	0.25
	MFR 190/2.16				
	MFR 230/5			1.25	
	MFR 275/2.16				
	MFI range	ISO1872/1873	--		T003
Mechanical Properties	Tensile stress at yield	ISO 527	MPa	25	25
	Elongation at yield	ISO 527	%	12	9
	Elongation at break	ISO 527	%	>300	>600
	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	ISO 179	kJ/m^2	22	16
	Impact strength notched at 0° C			4	n/a
	Impact strength notched at -30° C			2.5	6
	Ball indentation hardness acc. Rockwell	ISO 2039-1	MPa	45	46
	Flexural strength (3.5% flexural stress)	ISO 178	MPa	20	24
	Modulus of elasticity	ISO 527	MPa	900	1100
	Resistance to rapid crack propagation	ISO 13477	bar		> 10
	Resistance to slow crack growth	ISO 13479	hours		> 8,760
Thermal Properties	Vicat-Softening point VST/B/50	ISO 306	°C	65	77
	Heat deflection temperature HDT/B	ISO 75	°C	70	75
	Linear coefficient of thermal expansion	DIN 53752	K^{-1} x 10^{-4}	1.6	1.8
	Thermal conductivity at 20° C	DIN 52612	W/(m x K)	0.24	0.4
	Flammability	UL94	--	94-HB	94-HB
		DIN 4102	--	B2	B2
		FM 4910	--		
Electrical Properties	Specific volume resistance	VDE 0303	OHM cm	>10^{16}	>10^{16}
	Specific surface resistance	VDE 0303	OHM	>10^{13}	>10^{13}
	Relative dielectric constant at 1 MHz	DIN 53483	--	2.3	2.3
	Dielectric strength	VDE 0303	kV/mm	70	70
	Physiologically non-toxic	EEC 90/128	--	Yes	Yes
	FDA	--	--	Yes	Yes
	UV stabilized	--	--	No	Yes
	NSF 61	--	--	Yes	Yes
	Color	--	--	Grey	Black

1) Resin is listed

4.2 Pressure Rating

Permissible operating pressure for Poly-Flo® double contained piping systems based on years of operation and temperature. These values contain a system reduction factor of 0.8 for installation technical influences such as welding, joints, flange and bending loads. These tables are for water and safety correction factor would need to be applied for various chemicals. Consult Asahi/America Engineering staff for chemical recommendation; typically, a maximum factor of 1.6 for compatible chemicals.

Table App. A-1 Permissible Operating Pressures for PP Pipe and Fittings (psi)

Temperature		1 Year	5 Year	10 Year	25 Year	50 Year
		PP-R	PP-R	PP-R	PP-R	PP-R
° C	° F	SDR 11	SDR 11	SDR 11	SDR 11	SDR 11
10	50	246	231	226	218	213
20	68	210	197	192	185	180
30	86	178	167	163	157	152
40	104	151	141	137	132	128
50	122	128	119	116	111	108
60	140	108	100	97	93	90
70	158	91	84	81	71	
80	176	76	67	57	46	
90	194	64	44	38		
95	203	54	36	31		
100	212	44	30	25		
110	230	31				

Table App. A-2 Permissible Operating Pressures for Advanced PE Pipe and Fittings (psi)

Temperature		1 Year	5 Year	10 Year	25 Year	50 Year
		Advanced PE	Advanced PE	Advanced PE	Advanced PE	Advanced PE
° C	° F	SDR 11	SDR 11	SDR 11	SDR 11	SDR 11
10	50	244	234	230	224	220
20	68	205	196	193	189	185
30	86	174	167	164	160	157
40	104	149	143	141	138	135
50	122	130	124	122		
60	140	113	90			
70	158	85				
80	176	57				

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-4 and Table A-5 for correction factors.

Table App. A-3 Poly-Flo® External Support Spacing (inches)

Containment Size (nominal inch)	Poly-Flo®	
	Pro150	Advanced PE
1 x 1½	48	46
2 x 3	66	65
4 x 6	84	70

Table App. A-4 Poly-Flo® Support Spacing Temperature Correction Factors

Material	SDR	Operating Media Density [g/cm^3]			
		< 0.01 (gases)	1	1.25	1.5
PP & Advanced PE	SDR 11	1.47	1	0.96	0.90

Table App. A-5 Spacing Specific Gravity Correction Factors

Specific Gravity	Correction Factor
1.0	1.00
1.5	0.90
2.0	0.85
2.5	0.80

4.4 Leak Detection

Low point leak detection shall be supplied by the manufacturer with single source responsibility for piping and leak detection. Leak detection shall be Liquid Watch by Permalert utilizing Poly-Flo® low point stations for buried systems or Poly-Flo® outer wall flanged adapter.

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Poly-Flo® PE– Information and Installation Guide

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Poly-Flo® PE Submittal

A. General

The following is a submittal from Asahi/America, Inc. and our manufacturing partner Agru, Bad Hall, Austria on the Poly-Flo Double containment project. The submittal is inclusive all fittings, pipe and joining required for a Poly-Flo system

B. Materials

1. 0 Resin

All PE pipe and fittings supplied meet the requirements for PE material according to ASTM D 3035 with a minimum cell classification of PE445584C.

Advanced PE Physical Properties

	Technical data for the PE100 RC pipe and fitting material			
	Property	Standard	Unit	PE100-RC black
	Specific density at 23°C	ISO 1183	g/cm³	0,96
	Melt flow index MFR 190/5 MFR 190/2,16 MFR 230/5 MFI range	ISO 1133 ISO1872/1873	g/10min	 0,30 <0,10 T003
Mechanical Properties	Tensile stress at yield	ISO 527	MPa	25
	Elongation at yield	ISO 527	%	9
	Elongation at break	ISO 527	%	>600
	Impact strength unnotched at +23°C Impact strength unnotched at -30°C	ISO 179	kJ/m²	no break no break
	Impact strength notched at +23°C Impact strength notched at 0°C Impact strength notched at -30°C	ISO 179	kJ/m²	16 6
	Ball indentation hardness acc. Rockwell	ISO 2039-1	MPa	46
	Flexural strength (3,5% flexural stress)	ISO 178	MPa	24
	Modulus of elasticity	ISO 527	MPa	1100
Thermal Properties	Vicat-Softening point VST/B/50	ISO 306	°C	77
	Heat deflection temperature HDT/B	ISO 75	°C	75
	Linear coefficient of thermal expansion	DIN 53752	$K^{-1} \times 10^{-4}$	1,8
	Thermal conductivity at 20 °C	DIN 52612	W/(mxK)	0,4
	Flammability	UL94 DIN 4102	--	94-HB B2
Electrical Properties	Specific volume resistance	VDE 0303	OHM cm	$>10^{16}$
	Specific surface resistance	VDE 0303	OHM	$>10^{13}$
	relative dielectric constant at 1 MHz	DIN 53483	--	2,3
	Dielectric strength	VDE 0303	kV/mm	70
	Physiologically non-toxic	EEC 90/128	--	Yes
	FDA	--	--	Yes
	UV stabilized	--	--	carbon black
	Colour	--	--	black

2.0 Product Configuration

All pipe shall be one-piece double-wall extruded simultaneously. The primary pipe shall be integral with the secondary pipe via connecting ribs, which are continuous down the entire length of each section of pipe. No centralizing clips, spiders, disks or supports shall be allowed.

Molded double containment fittings shall be of unitary construction. Permanent alignment of the inner and outer fittings shall be maintained via molded-in ribs. The ends of both the inner and outer fittings shall be flush (in one plane). Molded-in supports shall be set back from the ends of molded fittings to allow mixing of any fluids in the annular space. Not all fittings are required to be molded.

Fabricated fittings shall be allowed where molded fittings are not available. All Fabricated fittings are required to be assembled utilizing butt fusion only. The manufacturer shall provide pressure ratings on fabricated fittings. Consult manufacturer drawings for availability and construction method of each part.

Termination of the double containment shall be conducted utilizing an end termination dogbone or flanged end termination.

3.0 Pressure Rating

Pipe and fittings shall be rated for 150x90 psi in all sizes and materials at 73^{o}F. Fabricated fittings shall be pressure de-rated based on angle of miter cut/weld, contact Asahi America for pressure ratings of mitered fittings

C. Execution

1.0 Joining Methods

All field welding shall be butt welded per the parameters in this document and general guidelines of ASTM D2657 for polyolefin piping, and in general accordance with the manufacturer's printed guidelines shown later in this document.
Due to the nature of butt fusion in general, the interior weld of any pipe is difficult to inspect, therefore the outer weld bead is indication of correct weld to verify proper parameters have been followed, heat temperature, time and fusion pressure.

It is very important to minimize the bead size during the initial melt under pressure; the pressure should be reduced to almost zero for the heat soak, **as soon as a bead begins to develop around the circumference of the pipe or fitting end.** This is important to prevent excessive bead height which could close off the annular space.

Additionally the ribs can be modified at the weld area by cutting a notch into each rib to a depth of 1/8”-1/4” using snips, wire cutters, etc. Also it is important to stagger the ribs at each weld connection to prevent channel zones within the annular space.

The outside weld bead on the containment pipe should be used as your comparison to the sample welds.
Since ambient air temperature and other environmental condition effect weld bead formation, there is no standard or formal specification for the size of the bead. As long as the beads meet the weld inspection criteria
.

2.0 Installation and Support

Installation procedures shall be as per the manufacturer’s written specifications. Pipe support spacing must be adequate to prevent any appearance of sagging. Standard design practice for single wall thermoplastic piping with regard to expansion and contraction shall be followed. Valves and other auxiliary items shall be independently supported.

Support Spacing

PE						
Diameter		68 F	86 F	104 F	122 F	140 F
da mm	Nom in	in	in	in	in	in
32mm X 50mm	1" x 1-1/2"	46	42	39	36	33
63mm X 90mm	2" X 3"	65	60	59	52	48
110mm X 160mm	4" x 6"	70	65	62	60	60

Support spacing is based on S.G 0f 1.0 at 68 °F.

Correction factors must be used for denser fluids as follows: 0.90 for S.G = 1.25, 0.85 for S.G = 1.50, 0.75 for S.G = 1.75 and 0.70 for S.G = 2.0

3.0 System Testing

Pressure Systems

To fully test both the inner and outer containment for full pressure rating a hydrostatic test of both the inner and outer pipes shall be performed as outlined in the Uniform Plumbing Code Section 318 as directed by the local Administrative Authority. Specifically, a water pressure test at 1.5 times (150%) the normal working pressure of the inner pipe should be applied to both the inner and outer walls in separate tests.

To avoid a possible leak in the carrier from contaminating the containment space with water, a 5 to 10 psi air test can be first conducted a quick check of the system. See requirements for safety below.

To avoid moisture in the containment an air test can be conducted on the containment pipe. Pressure test is recommended at 5 psi and shall not exceed 10 psi. The inner carrier pipe shall be full of water and under pressure to avoid any possible collapse.

When testing with air on both the carrier and containment piping the ambient temperature should be above 32 °F and extra safety precautions for personnel shall be put in place during the test.

Drainage Systems

For systems in drainage applications a hydrostatic test of 1.5x the working pressure is recommended for the carrier pipe. To avoid moisture in the containment an air test can be conducted on the containment pipe. Pressure test is recommended at 5 psi and shall not exceed 10 psi. 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 32 °F and extra safety precautions for personnel shall be put in place during the test.

4.0 Leak Detection

Leak detection shall be provided to monitor the integrity of the secondary containment in compliance with the local administrative authority

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Heating element butt welding procedure using Miniplast or Maxiplast welding machine

Safety Precautions

1. Keep working area clean and tidy.
2. Keep electrical tools away from moisture. Never use in a wet environment or humid conditions. Working area should be well illuminated. Keep tools away from chemicals and other corrosive materials.
3. Keep visitors at a safe distance.
4. Electrical tools not in use should be stored away safely.
5. Do not wear loose clothing or jewelry. They can inadvertently get stuck in the moving parts of the machine, causing injury.
6. Never carry tools by the electric cable. Never unplug by pulling the cable. Keep cables away from oil, heat and sharp edges.
7. Always check that the pipe and fittings are clamped down tightly.
8. The heating element can reach temperatures in excess of 300°C (570°F). Do not touch the surface, and keep non-operating personnel at a safe distance.
9. Keep tools clean and sharpened. They produce better and safer results. Missing and worn-out parts should be replaced immediately. Always assure that the accessories are properly mounted on the machine. Only use factory parts.
10. Always use correct extension cable with properly grounded ends, recommended wire size is 14 gauge/ 3 conductor to minimize voltage drop.
11. Do not use tools and machines when housing or handles, specifically plastic ones, are bent or cracked. Dirt and humidity in any fracture can lead to electrical shock should the insulation in the machine be damaged.

Welding Conditions

1. The welding environment needs to be protected against unfavorable conditions, e.g. rain, wind, dust, excessive humidity or temperature below 5°C (41°F). Wind greater than 10 mph should be considered potentially problematic. Welds can be made on a dirt surface provided the dirt is not in a dry state where dust particulates can be visible on welding surfaces. The welding area can be shielded to reduce wind and dirt particles from entering the welding zone.

2. It needs to be assured that the pipe wall temperature is adequate for welding. If necessary, the pipe has to be warmed up or an environmentally controlled welding tent needs to be erected. The pipe should be acclimated to the environment where it will be welded for 24-48 hours prior to welding. Acclimation will alleviate any temperature differences between the two parts that could affect the quality of the weld. If these conditions are met, the welding can be performed at virtually any environmental temperature. Prior to welding the surfaces need to be welded, the ends of pipe 2+" and/or fittings need to be above 41 degrees F. Welding with material temperatures below 41 degrees F needs to be avoided. It is advisable to verify the weld quality by making some test welds at the given conditions.

3. Should the pipe be irregularly heated by intense sunshine, it may be necessary to cover the pipe ends to be welded so that a balanced temperature is obtained.

4. The pipe ends to be welded must be checked for damage and be free from oil, grease, dirt and other contaminates. Cleaning the pipe ends must be done just prior to welding. This should be done with a lint free paper or cloth towel. Isopropyl Alcohol with a concentration of 70% or higher can be used to remove oil, grease, or tape residues. (Hereinafter is referred to as "cleaning agent" or any reference to cleaning).

5. The weld must be kept free from external stresses during the weld process until the material has sufficiently cooled. Weld parameters are provided in the parameters section of this document. The cooling period can be reduced by 50% if weld joint will not see excessive stress from pipe bending and handling.

6. The weld process has to be observed continuously. It is recommended to keep a record of each weld. A Weld Log is provided at the end of this document.

7. A regular stop watch, egg timer, or wrist watch with a second hand is to be available in order to register the actual times for heating up and cooling down.

8. A regular heat stick or regular pyrometer is to be available in order to verify the correct heating element temperature.

9. A table is to be available from which you can read the parameters that are prescribed by the welding regulation for the pipe dimension to be welded. Weld parameters are provided in the parameters section of this document.

10. The heating element surfaces are to be clean and, above all, free from grease using above described cleaning agent.

11. The pipe and fitting condition should be checked upon arrival to site and prior to beginning the welding process. Check for gouging, cracking, nicks, inconsistencies in shape, etc.

*After the above conditions are met, start preparing to weld.

Machine Set Up and Operation

Materials: PP, HDPE, PVDF
Joint Type: Contact Butt Fusion (including: pipe to pipe, pipe to fitting & fitting to fitting)

1. General Tool Information

A. The MiniPlast Shop 4 is made for butt fusion with a diameter range of ½”-4” (20mm-110mm). Maxiplast Shop 6 is made for butt welding of pipes and fittings with a diameter range of 1 ½” – 6” (50mm –160mm).

B. Voltage: 110 AC (Two required)
Amperage: 15 Amps

2. Heating Element Temperature Setting

A. Connect the plug of the heating element to a 110-volt outlet. Portable Generators are acceptable provided they will handle the Amp load of the heater and planer shown below. The heater is thermostat controlled and indicated by lighted switch, therefore temperature is monitored to avoid welding with heating element too cool. The Amp load of the Heat Plate (mirror) and Planer is 7 Amp (each).

Technical Data

Heating Element		**Planer**	
Power:	-1500 Watts	Motor:	-Single Phase Alternating Current Motor
Voltage:	-110V (+/- 10%)	Power:	-950 Watts
Current:	-7 A (+/- 10%)	Voltage:	-110V (+/- 10%)
Frequency:	-50-60 Hz	Current:	-7 A (+/- 10%)
Element:	-Electric Temperature Control -Power Indicator Light On/Off Switch -Connecting Cable with Plug and Earth Ground	Frequency:	-50-60 Hz

B. The thermostat is located in the heating element and can be adjusted by turning the dial located above the handle. The thermostat will be factory set if using a rental unit.
1. HDPE 215°C-230°C/ 420°F-446°F as shown in welding parameters.

3. Welding Machine Setup

A. The machine can be mounted on a bench by bolting the base to the bench with the enclosed screws or it can be placed in a vice.

4. Clamping Setup

A.1. For pipe to pipe joints with pipes smaller than tools maximum diameter, appropriate pipe clamp inserts must be placed into the master pipe clamps and fixed with the appropriate screws. For 160mm pipe to pipe joints, the master pipe clamps should be used. The pipe should be placed in the clamps with ½ -1½ inches extended out of the clamps.

A.2. For pipe to fitting joints, the master pipe clamp, which is fixed to the movable part of the machine, must be replaced with the master fitting clamp. For fittings smaller than tools maximum size, use the appropriate fitting inserts and fix them with the appropriate screws

A.3. For fitting to fitting joints, the second master pipe clamp should be replaced with the other master fitting clamp with the appropriately sized inserts.

A.4. To weld a flange to pipe or fitting, the flange adapter should be placed in the pipe master clamp and the flange centered on the flange adapter.

B. It is possible to manufacture segmented elbow pieces. The master pipe clamps can be swiveled from 0-15 degrees on either side. The upper part of the planer is radially adjustable in order to adjust the cutters axial to the end of the pipe. It is possible to produce equally segmented elbow pieces provided the limit stops are set exactly.

5. Facing

A. The planer has to be placed onto the two shafts and locked using the rotary button.

B. Use the hand wheel to gently press the ends of the pipe against the rotating cutters of the planer. The planing step is complete when the shavings on both pipes are producing a continuous ribbon. Release the pressure using the hand wheel while the cutters of the planer are rotating. Facing pressures are based on the size/wall thickness of piping and such that the planer motor is not overloaded. The purpose of the facing process is to get a clean, flat face on the ends of the pipe and/or fitting surfaces to be joined. The pressure required to achieve this may vary during the planning process from beginning to end. Do not to apply too much pressure that would put too great of load on the planer motor or stop rotation entirely.

We do want to apply enough pressure to achieve a continuous strip or “ribbon” of material around the entire perimeter. A continuous strip indicates the welding area is flat and both sides are parallel.

C. After the planer has completed rotation, loosen the rotary button, remove the planer and store in an appropriate place.

6. Alignment

A. Using the hand wheel, bring the two ends of the pipe together to check alignment both parallel and axial.

B. Adjustments can be made using the horizontal adjustment. Loosening or tightening the clamps will adjust the vertical alignment. The misalignment of the pipe should not exceed 10% of the wall thickness of the pipe. Wall Thickness provided in table below. No visible light is to be seen between the pieces being welded when checking alignment.

C. Loosening or tightening the clamps can eliminate egg-shaped pipe, as can be seen when too much clamping pressure is applied.

7. Initial Heating

A. Check whether the heating plate has reached the working temperature (see Welding Parameter Charts at the end of this manual). The working temperature is reached when the lamp blinks in short intervals. A heat stick or pyrometer should be used to verify temperature.

B. Place the heating element on the shaft of the welding machine with the brackets on either side of the shaft. Using the hand wheel, bring the pipe ends against the heater, applying the proper initial melt pressure (see charts at the end of this manual for proper welding pressures). Also see note regarding drag pressure at welding chart near the end of this document.

C. Watch for a continuous bead to form 360 degrees around both pipe or fitting ends, the size of the bead is not important as long as melt is observed around the pipe and/ or fitting face. **Minimize the size of the bead to prevent excessive weld bead into the annular space.** Continue once a uniform continuous bead forms around the circumference on both sides.

D. Lower pressure using the hand wheel until the pressure is reduced to almost zero, just enough pressure to keep welding zone on the heating plate.
Be sure the mirror (or heating plate) does not break contact with the pipe or fitting.

Note: If the hand wheel is moved too far in this direction, the pipe may move away from the heater causing a bad weld.

8. Heat Soak

A. With the pressure almost at zero, begin to time the heat soak time (see welding parameters). It is important to assure that the pipe ends remain in full contact with the heating element.

9. Change Over Time

A. With the hand wheel, move the pipe ends apart. Remove the heating element and then bring the pipe end back together.

B. Bring the pressure back to the original weld pressure. Do not over pressurize, as this will cause a bad weld. These steps must be performed within the allowable change over time (see parameters at the end of the manual for proper time).

10. Cooling Time

A. Keep the machine under pressure until the cooling time has expired. The cooling time can be reduced by 50% as long as the welded area does not see excessive force from movement or bending.

Weld Bead Inspection

A. To ensure a safe and proper installation it is recommended that a standard inspection process be developed by the local quality assurance team following these guidelines. These guidelines were established using DVS 2202-1 Imperfections in Thermoplastic Welded Joints and DVS 2207-1 Heated Tool Welding of Pipes, Piping parts, and panels made of PE.
B. To inspect butt fusion joints, the inspector should look for the following characteristics on each weld;
    1. Welds should have two beads that are 360* around the pipe or fitting
    2. Beads should be of consistent height and width, there will be a slight (~1/16”) elevation of bead height at each of the ribbed areas.
    3. Beads should have a rounded shape
    4. Beads shall be free of burrs or foreign material
    5. The bead on either side should not reduce greatly in width or disappear
    6. The components welded together should be properly aligned and cannot be misaligned by more than 10%

As previously explained, the outside weld bead is the only indication of a successful simultaneous weld of the carrier (inner) and containment (outer) zones. It is recommended that each welder create one or several welds at proper parameters and evaluate all further welds to compare bead height and shape.

HDPE PolyFlo Weld Examples

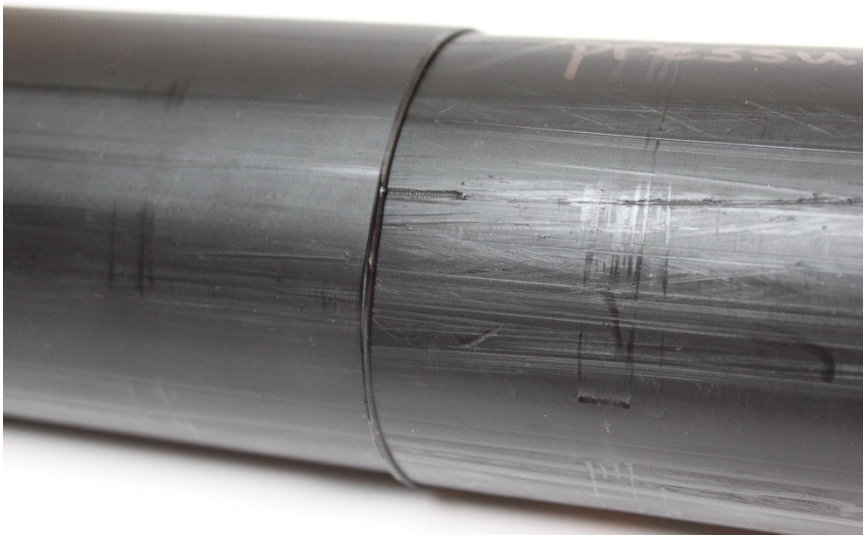
Picture showing PolyFlo PE, PP weld beads are very similar.

2x3 HDPE PolyFlo pipe and molded 45's

Close up of molded fitting to fitting weld, bead height approx 1/16”-3/32”, with approx 1/32” deep notch between beads. Both beads have nice rounded edge.

Close up of molded fitting to pipe weld, fitting bead remains slightly rounded, pipe bead has slight straight edge, due to processing differences of injection molded fitting versus extruded pipe. Bead height remains the same approx. 3/32”

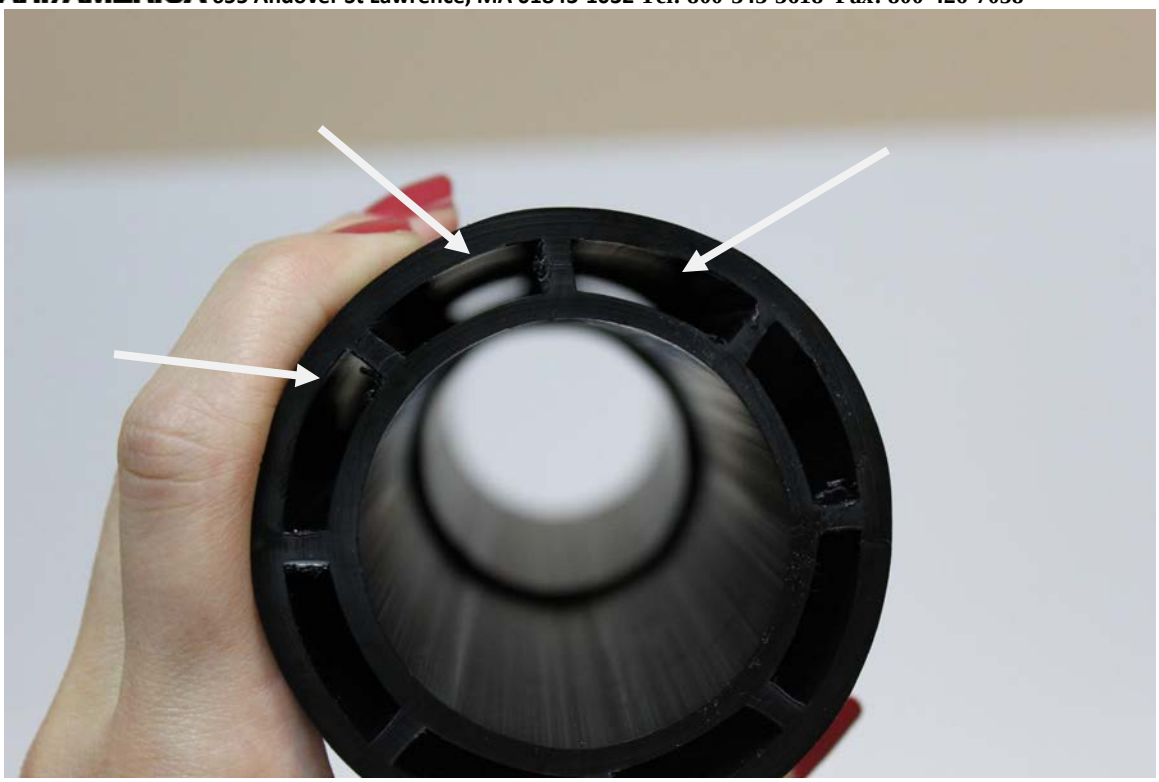
Pipe to pipe weld, with INSUFFICIENT pressure.



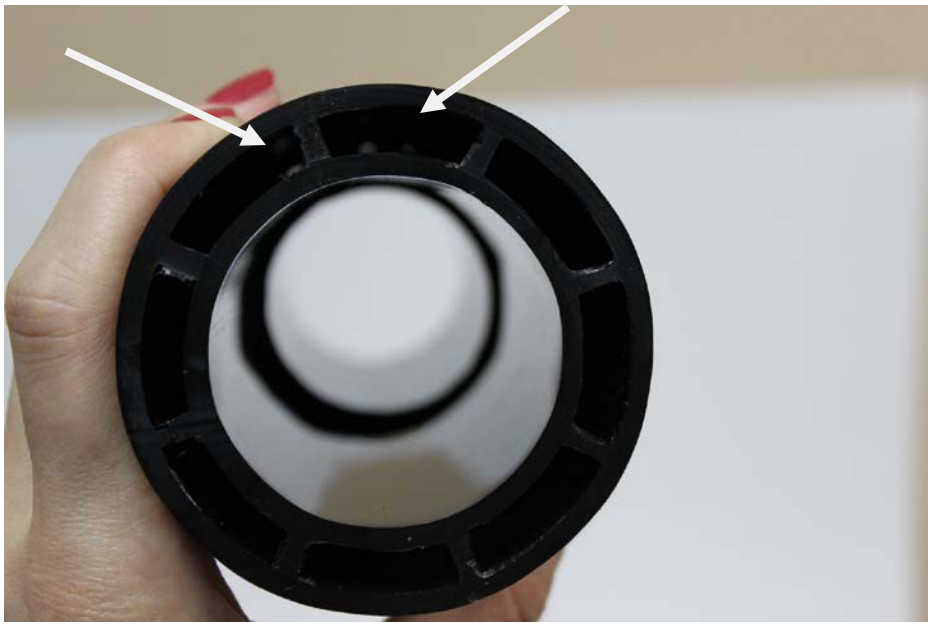
Close up of above weld. Bead height varies from 0”-1/32”.

Pipe to pipe weld, with EXCESSIVE pressure.

Close up of above weld, bead height approx 1/8”-5/32”



Annular space is open with proper weld pressure.
(see light penetration at arrows)



Annular space closed by excessive weld pressure
(pin holes of light at arrows)

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Welding Parameters

Miniplast// Maxiplast
PolyFlo Double Containment Butt Fusion

pipe diameter OD x OD [mm]		SDR	bead-up force [lbs]	circular bead min. [mm]	heat-up time [s]	max. change-over time [s]	time to reach welding pressure [s]	welding force [lbs]	cool-down time [min] ❶
PE PolyFlo									
32x50		11x17	25	0.5	25	4	4	25	4
63x90		11x17	65	1.0	35	5	5	65	8
110x160		11x17	223	1.5	80	7	7	223	14

PE Welding Temperatures 393-410*F 200-210*C

❶ **Remaining under the cool-down time for up to 50% is allowed under the following conditions:**

- prefabrication under workshop conditions
- low additional pressure at unclamping
- no additional pressure during further cooling down

Drag pressure: If the pipe is under friction load or extended line lengths, the force to close the clamps will be significantly higher. This force must be added to the welding pressure during the initial melt and final weld.

Determining drag pressure: Prior to planning, attached pipe in machine as described in step 4 above in machine set up. Rotate the closure hand wheel while watching the spring tension pressure gauge and record pressure shown as pipe is moving. This reading must be added to the Initial Melt Pressure and Welding Pressure shown above.

For example, for 2x3 PolyFlo, if you find 25 lbs of resistance while closing the hand wheel, this 25 lbs must be added to the 45 Lbs of melt pressure which means now both Initial Melt Pressure and Welding Pressure must be 70 lbs during the weld procedure.

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ASAHI/AMERICA®
Your Experts in Plastics™

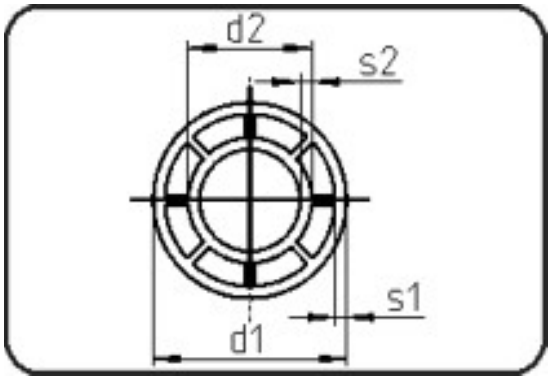
Poly-Flo® Double Wall Piping System Dimensional Guide

Rev. 07/2025

ATTENTION - Tolerances are listed below:

UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES (AS MEASURED INDOORS AT 68° F)		
MACHINING TOLERANCES	2 PL DECIMALS	+/- 0.01
	3 PL DECIMALS	+/- 0.005
	ANGULAR	+/- 0.5°
	FRACTIONAL	+/- 1/64
FABRICATION TOLERANCES PER PIPE Ø	1/2" - 8"	+/- 1/4
	9" AND UP	+/- 1/2
	ANGULAR	+/- 1.0°

Dimensions subject to change without notice. Visit asahi-america.com for the most up-to-date dimensional data.



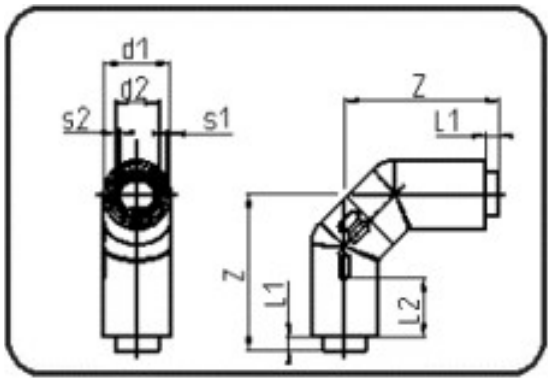
- **Poly-Flo® Pipe 5m (16.4')**
- **Extruded**
- **Simultaneous & staggered welding**

PIPE

Size[1]		Dimensions								Part Number	
mm	inch	SDR[1]	MOP (psi)	s1 (in)	s2 (in)	d1 (in)	d2 (in)	Weight (lbs/ft)		PP-R	PE100-RC
								PP-R	PE100-RC		
32 x 50	1 x 1-1/2	11 x 17	150 x 90	0.12	0.12	1.97	1.26	0.53	0.56	507850211	587850211
63 x 90	2 x 3	11 x 17	150 x 90	0.21	0.23	3.54	2.48	1.69	1.78	507850338	587850338
110 x 160	4 x 6	11 x 17	150 x 90	0.37	0.39	6.30	4.33	5.05	5.33	507850532	587850532
160 x 225	6 x 9	11 x 17	150 x 90	0.53	0.57	8.86	6.30	9.83	10.37	507850606	587850606
110 x 160	4 x 6	17 x 33	90 x 45	0.19	0.26	6.30	4.33	2.99	3.15	507817532	587817532
160 x 225	6 x 9	17 x 33	90 x 45	0.27	0.37	8.86	6.30	5.99	6.32	507817606	587817606

1. Carrier x Containment

Some CAD models can be found at https://cad.asahi-america.com. For any questions on dimensional info, please contact Asahi/America Technical Services at 1-800-343-3618 or asahi@asahi-america.com.

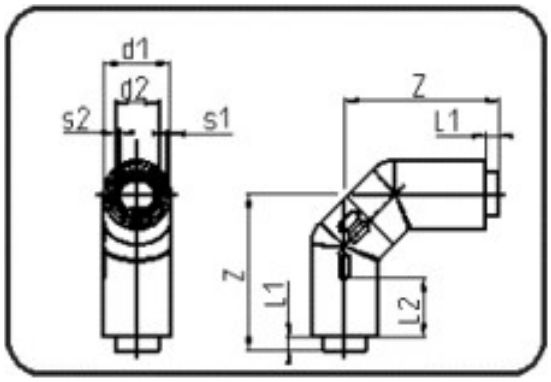


- Poly-Flo® elbow 90°
- Fabricated from two (2) elbows 45°
- Injection molded + welded
- Simultaneous & staggered welding
- Short radius - ideal for pressure applications

90 DEGREE ELBOW - SHORT RADIUS

Size[1]		Dimensions											Part Number	
mm	inch	SDR[1]	MOP (psi)	s1 (in)	s2 (in)	d1 (in)	d2 (in)	z (in)	L1 (in)	L2 (in)	Weight (lbs) PP-R	Weight (lbs) PE100-RC	PP-R	PE100-RC
32 x 50	1 x 1-1/2	11 x 17	150 x 90	0.12	0.12	1.97	1.26	4.76	0.28	1.69	0.37	0.54	507868211	587868211
63 x 90	2 x 3	11 x 17	150 x 90	0.21	0.23	3.54	2.48	5.75	0.39	2.09	1.47	1.56	507868338	587868338
110 x 160	4 x 6	11 x 17	150 x 90	0.37	0.39	6.30	4.33	9.69	0.39	2.87	7.04	7.61	507868532	587868532

1. Carrier x Containment



- Poly-Flo® elbow 90°
- Fabricated from two (2) elbows 45°
- Injection molded + welded
- Simultaneous & staggered welding
- Long radius - ideal for drainage applications

90 DEGREE ELBOW - LONG RADIUS

Size[1]		Dimensions											Part Number	
mm	inch	SDR[1]	MOP (psi)	s1 (in)	s2 (in)	d1 (in)	d2 (in)	z (in)	L1 (in)	L2 (in)	Weight (lbs) PP-R	Weight (lbs) PE100-RC	PP-R	PE100-RC
32 x 50	1 x 1-1/2	11 x 17	150 x 90	0.12	0.12	1.97	1.26	6.78	0.28	1.69	0.51	0.54	507853211	587853211
63 x 90	2 x 3	11 x 17	150 x 90	0.21	0.23	3.54	2.48	7.52	0.39	2.09	1.89	1.99	507853338	587853338
110 x 160	4 x 6	11 x 17	150 x 90	0.37	0.39	6.30	4.33	10.39	0.39	2.87	8.07	8.51	507853532	587853532

1. Carrier x Containment

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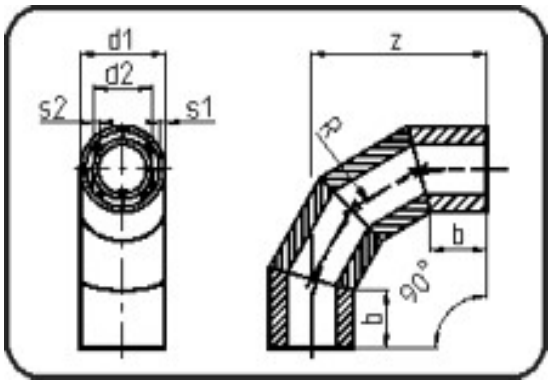


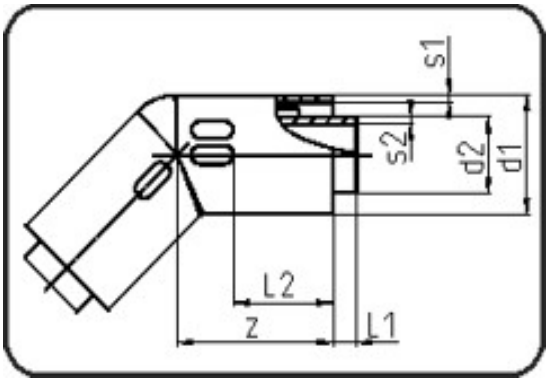
- **Poly-Flo® elbow 90°**
- **Fabricated in four (4) segments**
- **Derating factor 0.8**
- **Segmented**
- **Simultaneous & staggered welding**

90 DEGREE MITERED ELBOW

Size[1]		Dimensions											Part Number	
mm	inch	SDR[1]	MOP (psi)	s1 (in)	s2 (in)	d1 (in)	d2 (in)	z (in)	L1 (in)	b (in)	Weight (lbs)		PP-R	PE100-RC
											PP-R	PE100-RC		
160 x 110	4 x 6	17 x 33	72 x 36	0.19	0.26	6.30	4.33	9.29	0.39	1.97	4.58	4.83	507904532	587904532
225 x 160	6 x 9	17 x 33	72 x 36	0.27	0.37	8.86	6.30	15.59	0.39	4.33	12.79	13.49	507904606	587904606
225 x 160	6 x 9	11 x 17	120 x 72	0.53	0.57	8.86	6.30	15.59	0.39	4.33	20.90	22.05	507863606	587863606

1. Carrier x Containment

Some CAD models can be found at https://cad.asahi-america.com. For any questions on dimensional info, please contact Asahi/America Technical Services at 1-800-343-3618 or asahi@asahi-america.com.



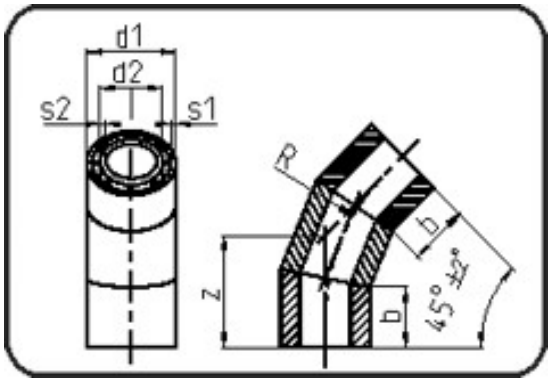
- **Poly-Flo® elbow 45°**
- **Injection molded**
- **Simultaneous & staggered welding**

45 DEGREE MOLDED ELBOW

Size[1]		Dimensions											Part Number	
mm	inch[2]	SDR[1]	MOP (psi)	s1 (in)	s2 (in)	d1 (in)	d2 (in)	z (in)	L1 (in)	L2 (in)	Weight (lbs)		PP-R	PE100-RC
											PP-R	PE100-RC		
32 x 50	1 x 1-1/2	11 x 17	150 x 90	0.12	0.12	1.97	1.26	2.76	0.28	1.81	0.25	0.27	507870211	587870211
63 x 90	2 x 3	11 x 17	150 x 90	0.21	0.23	3.54	2.48	3.03	0.39	2.09	0.94	1.00	507870338	587870338
110 x 160	4 x 6	11 x 17	150 x 90	0.37	0.39	6.30	4.33	4.21	0.39	2.87	4.03	4.25	507870532	587870532

1. Carrier x Containment

Some CAD models can be found at https://cad.asahi-america.com. For any questions on dimensional info, please contact Asahi/America Technical Services at 1-800-343-3618 or asahi@asahi-america.com.



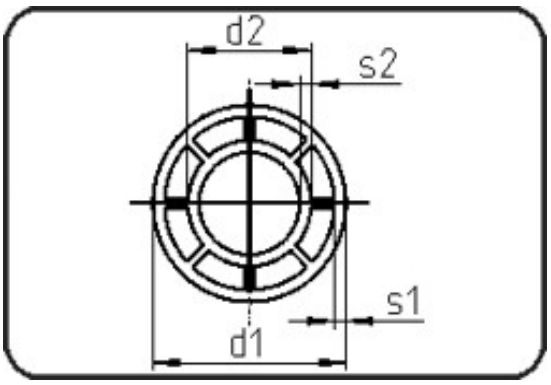
- **Poly-Flo® elbow 45°**
- **Fabricated in three (3) segments**
- **Derating factor 0.8**
- **Segmented**
- **Simultaneous & staggered welding**

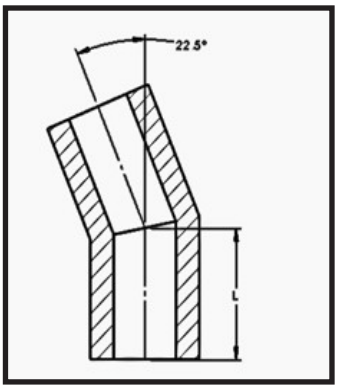
45 DEGREE MITERED ELBOW

Size[1]		Dimensions											Part Number	
mm	inch	SDR[1]	MOP (psi)	s1 (in)	s2 (in)	d1 (in)	d2 (in)	z (in)	L1 (in)	L2 (in)	Weight (lbs)		PP-R	PE100-RC
											PP-R	PE100-RC		
110 x 160	4 x 6	17 x 33	72 x 36	0.19	0.26	6.30	4.33	5.94	0.39	2.76	2.73	2.88	507901532	587901532
160 x 225	6 x 9	17 x 33	72 x 36	0.27	0.37	8.86	6.30	9.13	0.39	4.33	9.51	10.03	507901606	587901606
160 x 225	6 x 9	11 x 17	120 x 72	0.53	0.57	8.86	6.30	9.13	0.39	4.33	13.95	14.72	507852606	587852606

1. Carrier x Containment

Some CAD models can be found at https://cad.asahi-america.com. For any questions on dimensional info, please contact Asahi/America Technical Services at 1-800-343-3618 or asahi@asahi-america.com.





- **Poly-Flo® elbow 22.5°**
- **Fabricated**
- **Derating factor 0.8**
- **Segmented**
- **Simultaneous & staggered welding**

22.5 DEGREE MITERED ELBOW

Size[1]		Dimensions									Part Number	
mm	inch	SDR[1]	MOP (psi)	s1 (in)	s2 (in)	d1 (in)	d2 (in)	L (in)	Weight (lbs)		PP-R	PE100-RC
									PP-R	PE100-RC		
32 x 50	1 x 1-1/2	11 x 17	120 x 72	0.12	0.12	1.97	1.26	3.00	0.13	0.14	507869211	587869211
63 x 90	2 x 3	11 x 17	120 x 72	0.21	0.23	3.54	2.48	4.00	0.56	0.59	507869338	587901338
110 x 160	4 x 6	11 x 17	120 x 72	0.37	0.39	6.30	4.33	6.00	2.53	2.66	507869532	587852532

1. Carrier x Containment

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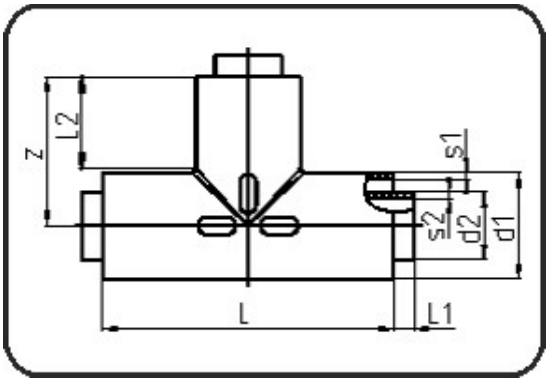

- **Poly-Flo® tee**
- **Injection molded**
- **Simultaneous & staggered welding**

TEE - MOLDED

Size[1]		Dimensions												Part Number	
mm	inch	SDR[1]	MOP (psi)	z (in)	L (in)	s1 (in)	s2 (in)	d1 (in)	d2 (in)	L1 (in)	L2 (in)	Weight (lbs)		PP-R Grey	PE100-RC
												PP-R	PE100-RC		
32 x 50	1 x 1-1/2	11 x 17	150 x 90	2.87	5.75	0.12	0.12	1.97	1.26	0.28	1.69	0.36	0.39	507871211	587871211
63 x 90	2 x 3	11 x 17	150 x 90	3.94	7.87	0.21	0.23	3.54	2.48	0.39	2.09	1.57	1.71	507871338	587871338
110 x 160	4 x 6	11 x 17	150 x 90	6.10	12.20	0.37	0.39	6.30	4.33	0.39	2.87	6.92	7.36	507071532	587881532

1. Carrier x Containment

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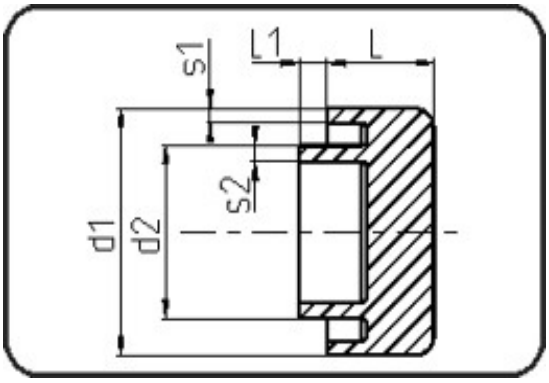

- **Poly-Flo® end cap**
- **Machined**
- **Simultaneous & staggered welding**

END CAP

Size[1]		Dimensions										Part Number	
mm	inch	SDR[1]	MOP (psi)	s1 (in)	s2 (in)	d1 (in)	d2 (in)	L (in)	L1 (in)	Weight (lbs)		PP-R	PE100-RC
										PP-R	PE100-RC		
32 x 50	1 x 1-1/2	11 x 17	150 x 90	0.12	0.12	1.97	1.26	1.18	0.39	0.09	0.10	507873211	587873211
63 x 90	2 x 3	11 x 17	150 x 90	0.21	0.23	3.54	2.48	1.57	0.39	0.43	0.45	507873338	587873338
110 x 160	4 x 6	11 x 17	150 x 90	0.37	0.39	6.30	4.33	1.97	0.39	1.74	1.84	507873532	587873532

1. Carrier x Containment

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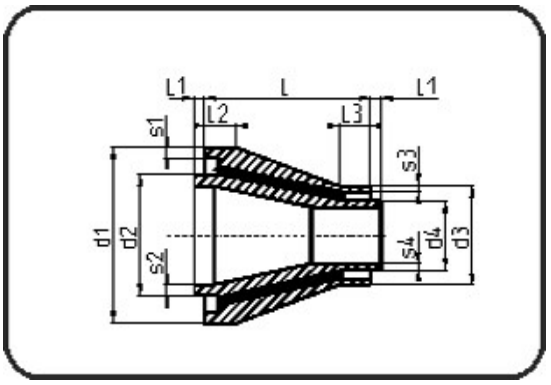

- **Poly-Flo® reducer**
- **Concentric**
- **Machined**
- **Simultaneous & staggered welding**

CONCENTRIC REDUCER

Size[1]	Dimensions																Part Number	
inch	SDR[1]	MOP (psi)	d1 (in)	d2 (in)	d3 (in)	d4 (in)	s1 (in)	s2 (in)	s3 (in)	s4 (in)	L (in)	L1 (in)	L2 (in)	L3 (in)	Weight (lbs)		PP-R	PE100-RC
															PP-R	PE100-RC		
2 x 3, 1 x 1-1/2	11 x 17	150 x 90	3.54	2.48	1.97	1.26	0.21	0.23	0.12	0.12	4.33	0.39	1.18	1.10	0.58	0.62	507865249	587865249
4 x 6, 2 x 3	11 x 17	150 x 90	6.30	4.33	3.54	2.48	0.37	0.39	0.21	0.23	6.10	0.39	1.18	1.14	2.76	2.92	507865420	587865420
6 x 9, 4 x 6	11 x 17	150 x 90	8.86	6.30	6.30	4.33	0.53	0.57	0.36	0.39	7.28	0.39	1.18	1.14	7.51	7.92	507865532	587865532
4 x 6, 2 x 3	17 x 33	90 x 45	6.30	4.33	3.54	2.48	0.19	0.26	0.09	0.14	6.10	0.39	1.18	1.14	2.19	2.31	507845420	587845420
6 x 9, 4 x 6	17 x 33	90 x 45	8.86	6.30	6.30	4.33	0.27	0.37	0.19	0.26	7.28	0.39	1.18	1.14	5.88	6.20	507845532	587845532

1. Carrier x Containment

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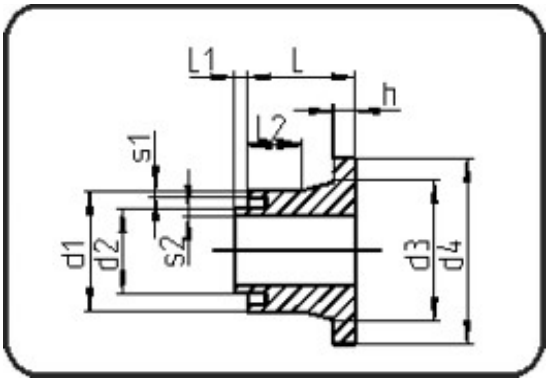
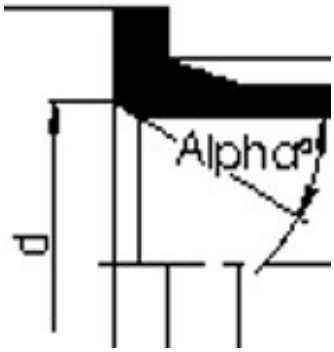


- Poly-Flo® stub flange
- Solid
- Machined
- Simultaneous & staggered welding
- Straight bore

STUB END - SOLID (STRAIGHT BORE)

Size[1]		Dimensions															Part Number	
mm	inch	STD	SDR[1]	MOP (psi)	L (in)	s1 (in)	s2 (in)	d4 (in)	d1 (in)	d2 (in)	d3 (in)	h (in)	L1 (in)	L2 (in)	Weight (lbs)		PP-R	PE100-RC
															PP-R	PE100-RC		
32 x 50	1 x 1-1/2	ANSI	11 x 17	50	2.17	0.12	0.12	3.25	1.97	1.26	2.40	0.47	0.39	0.87	0.27	0.29	507872211	587872211
63 x 90	2 x 3	ANSI	11 x 17	50	3.23	0.21	0.23	5.21	3.54	2.48	4.13	0.67	0.39	1.55	0.86	0.91	507872338	587872338
110x160	4 x 6	ANSI	11 x 17	50	3.70	0.37	0.39	8.35	6.30	4.33	6.89	0.98	0.39	1.49	3.42	3.60	507872532	587872532

1. Carrier x Containment



- Poly-Flo® stub flange
- Solid
- Machined
- Simultaneous & staggered welding
- 30° chamfered bore

STUB END - SOLID (CHAMFERED BORE)

Size[1]		Dimensions																Part Number	
mm	inch	STD	SDR[1]	MOP (psi)	d (in)	L (in)	s1 (in)	s2 (in)	d4 (in)	d1 (in)	d2 (in)	d3 (in)	h (in)	L1 (in)	L2 (in)	Weight (lbs)		PP-R	PE100-RC
																PP-R	PE100-RC		
32 x 50	1 x 1-1/2	ANSI	11 x 17	50	1.30	2.17	0.12	0.12	3.25	1.97	1.26	2.40	0.47	0.39	0.87	0.27	0.29	507887211	587887211
63 x 90	2 x 3	ANSI	11 x 17	50	2.70	3.23	0.21	0.23	5.21	3.54	2.48	4.13	0.67	0.39	1.55	0.86	0.91	507887338	587887338
110x160	4 x 6	ANSI	11 x 17	50	5.50	3.70	0.37	0.39	8.35	6.30	4.33	6.89	0.98	0.39	1.49	3.42	3.60	507887532	587887532

1. Carrier x Containment

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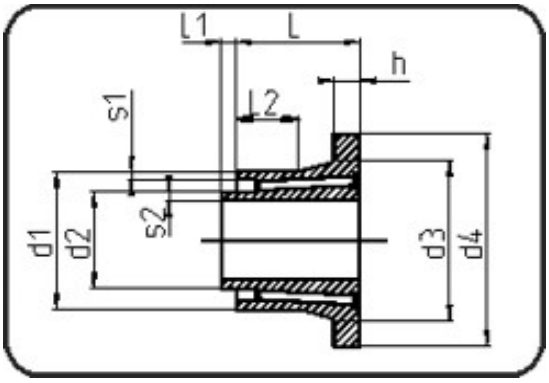
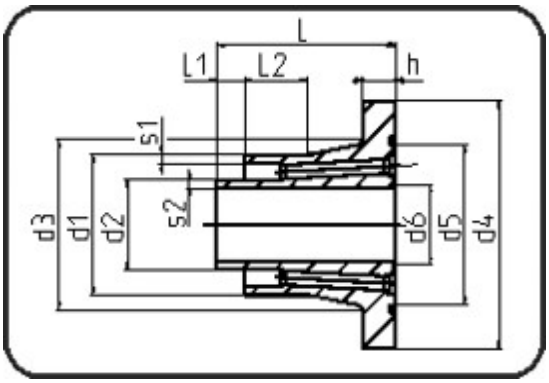


- Poly-Flo® stub flange
- Flow-through
- Machined
- Simultaneous & staggered welding

STUB END - FLOW THROUGH

Size[1]		Dimensions															Part Number	
mm	inch	STD	SDR[1]	MOP (psi)	d1 (in)	d2 (in)	s1 (in)	s2 (in)	d3 (in)	h (in)	L (in)	L1 (in)	L2 (in)	d4 (in)	Weight (lbs) PP-R	Weight (lbs) PE100-RC	PP-R	PE100-RC
32 x 50	1 x 1-1/2	ANSI	11 x 17	50	1.97	1.26	0.12	0.12	2.40	0.47	2.17	0.39	0.87	3.25	0.24	0.25	507875211	587875211
63 x 90	2 x 3	ANSI	11 x 17	50	3.54	2.48	0.21	0.23	4.13	0.67	3.23	0.39	1.55	5.21	0.84	0.88	507875338	587875332
110x160	4 x 6	ANSI	11 x 17	50	6.30	4.33	0.37	0.39	6.89	0.98	3.70	0.39	1.49	8.35	3.29	3.47	507875532	587875532

1. Carrier x Containment



- Poly-Flo® stub flange
- Flow-through + groove for o-ring
- Includes o-rings
- Machined
- Simultaneous & staggered welding
- Mated to FF stub end

STUB END - FLOW THROUGH (w/ O-RING GROOVE)

Size[1]		Dimensions																	Part Number	
mm	inch	STD	SDR[1]	MOP (psi)	d1 (in)	d2 (in)	s1 (in)	s2 (in)	d3 (in)	h (in)	L (in)	L1 (in)	L2 (in)	d4 (in)	d5[2]	d6[2]	Weight (lbs) PP-R	Weight (lbs) PE100-RC	PP-R	PE100-RC
32 x 50	1 x 1-1/2	ANSI	11 x 17	50	1.97	1.26	0.12	0.12	2.40	0.47	2.56	0.39	0.94	3.25	2-145	2-123	0.24	0.25	507876211	587876211
63 x 90	2 x 3	ANSI	11 x 17	50	3.54	2.48	0.21	0.23	4.13	0.67	3.62	0.39	1.55	5.21	2-156	2-140	0.84	0.88	507876338	587876338
110x160*	4 x 6*	ANSI	11 x 17	50	6.30	4.33	0.37	0.39	6.89	0.98	4.09	0.39	1.49	8.35	2-261	2-243	3.29	3.47	507876532	587876532

1. Carrier x Containment
2. O-ring standard size
* Please contact factory for confirmation of dimensions for these sizes

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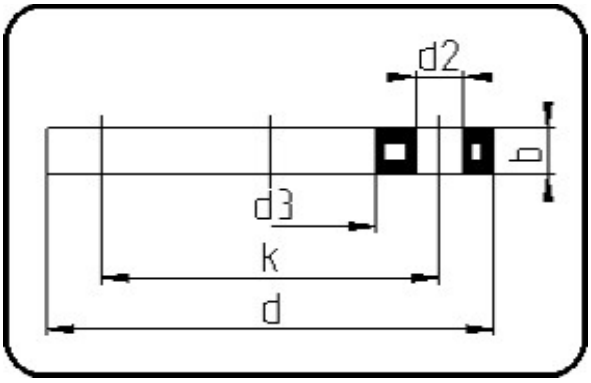

- Backing ring
- Steel insert
- Injection molded
- Flange connection

Gasket max torque supercedes torques shown

BACKING RING

Size		Dimensions										Part Number	
mm	inch	STD	MOP (psi)	d (in)	d2 (in)	d3 (in)	b (in)	k (in)	Max Torque (ft-lbs)	Bolt Size (qty)	Weight (lbs)	PP-FRP GREY	PP-FRP BLACK
50	1-1/2	ANSI	230	5.24	0.63	2.44	0.71	3.88	30	1/2 (4)	1.21	5046015	5146015
90	3	ANSI	230	7.64	0.79	4.37	0.71	6.00	41	5/8 (4)	2.34	5046030	5146030
160	6	ANSI	230	11.14	0.87	7.01	0.94	9.50	70	3/4 (8)	5.20	5046060	5146060
200	8*	ANSI	230	13.58	0.87	9.29	0.94	11.75	89	3/4 (8)	8.58	5046080	5146080

* The 8" size is dual-sized for 9" applications

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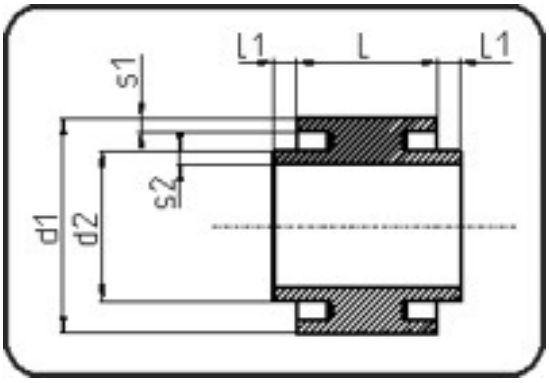

- **Poly-Flo® dogbone**
- **Solid**
- **Machined**
- **Simultaneous & staggered welding**

DOGBONE

Size[1]		Dimensions										Part Number	
mm	inch	SDR[1]	MOP (psi)	L (in)	s1 (in)	s2 (in)	d1 (in)	d2 (in)	L1 (in)	Weight (lbs)		PP-R	PE100-RC
										PP-R	PE100-RC		
32 x 50	1 x 1-1/2	11 x 17	150 x 90	1.97	0.12	0.12	1.97	1.26	0.39	0.11	0.12	507877211	587877211
63 x 90	2 x 3	11 x 17	150 x 90	2.36	0.21	0.23	3.54	2.48	0.39	0.44	0.47	507877338	587877338
110 x 160	4 x 6	11 x 17	150 x 90	3.15	0.37	0.39	6.30	4.33	0.39	2.04	2.15	507877532	587877532

1. Carrier x Containment

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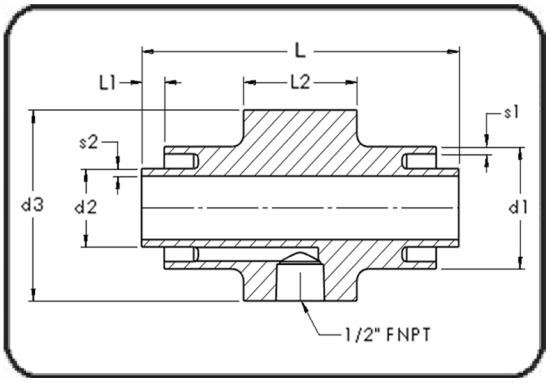

- **Poly-Flo® solid dogbone**
- **Annular tap**
- **Machined**
- **Simultaneous & staggered welding**
- **Includes 1/2" NPT plug of matching material**

DOGBONE - ANNULAR TAP/SOLID[1]

Size[1]		Dimensions												Part Number	
mm	inch	SDR[1]	MOP (psi)	d1 (in)	d2 (in)	s1 (in)	s2 (in)	L (in)	d3 (in)	L2 (in)	L1 (in)	Weight (lbs)		PP-R	PE100-RC
												PP-R	PE100-RC		
32 x 50	1 x 1-1/2	11 x 17	150 x 90	1.97	1.26	0.12	0.12	5.51	2.56	1.97	0.39	0.49	0.50	507880211	587880211
63 x 90	2 x 3	11 x 17	150 x 90	3.54	2.48	0.21	0.23	5.51	4.72	1.97	0.39	0.96	1.06	507880338	587880338
110 x 160	4 x 6	11 x 17	150 x 90	6.30	4.33	0.37	0.39	5.51	7.48	1.97	0.39	3.05	3.22	507880532	587880532

1. Carrier x Containment

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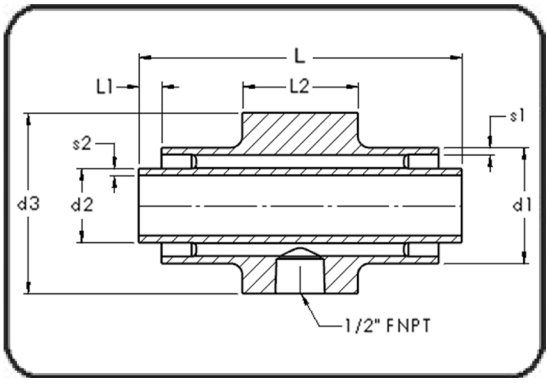


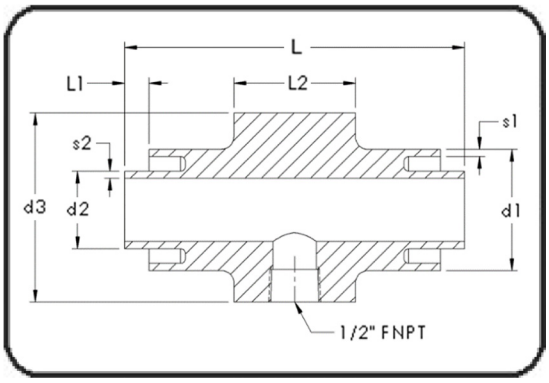
- Poly-Flo® flow-through dogbone
- Annular tap
- Machined
- Simultaneous & staggered welding
- Includes 1/2" NPT plug of matching material

DOGBONE - ANNULAR TAP/FLOW THROUGH[1]

Size[1]		Dimensions												Part Number	
mm	inch	SDR[1]	MOP (psi)	d1 (in)	d2 (in)	s1 (in)	s2 (in)	L (in)	d3 (in)	L2 (in)	L1 (in)	Weight (lbs)		PP-R	PE100-RC
												PP-R	PE100-RC		
32 x 50	1 x 1-1/2	11 x 17	150 x 90	1.97	1.26	0.12	0.12	5.51	2.56	1.97	0.39	0.49	0.50	507878211	587878211
63 x 90	2 x 3	11 x 17	150 x 90	3.54	2.48	0.21	0.23	5.51	4.72	1.97	0.39	0.96	1.06	507878338	587878338
110 x 160	4 x 6	11 x 17	150 x 90	6.30	4.33	0.37	0.39	5.51	7.48	1.97	0.39	3.05	3.22	507878532	587878532

1. Carrier x Containment

Some CAD models can be found at https://cad.asahi-america.com. For any questions on dimensional info, please contact Asahi/America Technical Services at 1-800-343-3618 or asahi@asahi-america.com.



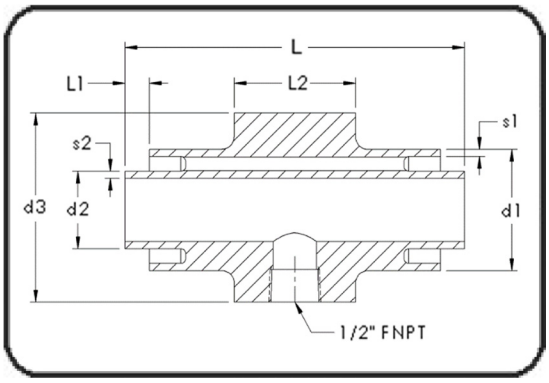
- Poly-Flo® solid dogbone
- Carrier tap
- Machined
- Simultaneous & staggered welding
- Includes 1/2" NPT plug of matching material

DOGBONE - CARRIER TAP/SOLID[1]

Size[1]		Dimensions												Part Number	
mm	inch	SDR[1]	MOP (psi)	d1 (in)	d2 (in)	s1 (in)	s2 (in)	L (in)	d3 (in)	L2 (in)	L1 (in)	Weight (lbs)		PP-R	PE100-RC
												PP-R	PE100-RC		
32 x 50	1 x 1-1/2	11 x 17	150 x 90	1.97	1.26	0.12	0.12	5.51	2.56	1.97	0.39	0.49	0.50	507858211	587858211
63 x 90	2 x 3	11 x 17	150 x 90	3.54	2.48	0.21	0.23	5.51	4.72	1.97	0.39	0.96	1.06	507858338	587858338
110 x 160	4 x 6	11 x 17	150 x 90	6.30	4.33	0.37	0.39	5.51	7.48	1.97	0.39	3.05	3.22	507858532	587858532

1. Carrier x Containment

Some CAD models can be found at https://cad.asahi-america.com. For any questions on dimensional info, please contact Asahi/America Technical Services at 1-800-343-3618 or asahi@asahi-america.com.



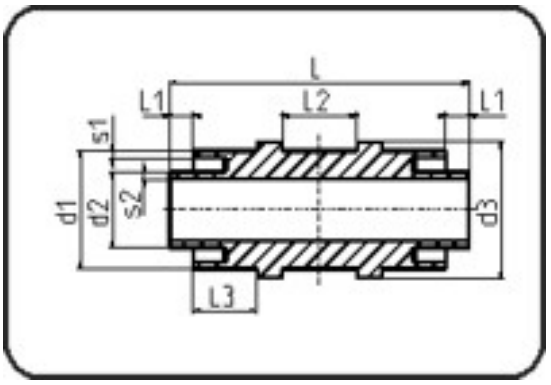
- Poly-Flo® dogbone flow-through
- Carrier tap
- Machined
- Simultaneous & staggered welding
- Includes 1/2" NPT plug of matching material

DOGBONE - CARRIER TAP/ANNULAR[1]

Size[1]		Dimensions												Part Number	
mm	inch	SDR[1]	MOP (psi)	d1 (in)	d2 (in)	s1 (in)	s2 (in)	L (in)	d3 (in)	L2 (in)	L1 (in)	Weight (lbs)		PP-R	PE100-RC
												PP-R	PE100-RC		
32 x 50	1 x 1-1/2	11 x 17	150 x 90	1.97	1.26	0.12	0.12	5.51	2.56	1.97	0.39	0.49	0.50	507881211	587881211
63 x 90	2 x 3	11 x 17	150 x 90	3.54	2.48	0.21	0.23	5.51	4.72	1.97	0.39	0.96	1.06	507881338	587881338
110 x 160	4 x 6	11 x 17	150 x 90	6.30	4.33	0.37	0.39	5.51	7.48	1.97	0.39	3.05	3.22	507881532	587881532

1. Carrier x Containment

Some CAD models can be found at https://cad.asahi-america.com. For any questions on dimensional info, please contact Asahi/America Technical Services at 1-800-343-3618 or asahi@asahi-america.com.



- **Poly-Flo® dogbone**
- **Restraint / solid**
- **Machined**
- **Simultaneous & staggered welding**

DOGBONE - RESTRAINT/SOLID[1]

Size[1]		Dimensions													Part Number	
mm	inch	SDR[1]	MOP (psi)	d1 (in)	d2 (in)	s1 (in)	s2 (in)	d3 (in)	L (in)	L1 (in)	L2 (in)	L3 (in)	Weight (lbs)		PP-R	PE100-RC
													PP-R	PE100-RC		
32 x 50	1 x 1-1/2	11 x 17	150 x 90	1.97	1.26	0.12	0.12	2.28	5.24	0.39	1.28	1.18	0.33	0.34	507859211	587859211
63 x 90	2 x 3	11 x 17	150 x 90	3.54	2.48	0.21	0.23	4.13	5.91	0.39	1.57	1.18	1.02	1.14	507859338	587859338
110 x 160	4 x 6	11 x 17	150 x 90	6.30	4.33	0.37	0.39	7.09	7.09	0.39	1.57	1.18	3.87	3.66	507859532	587859532

1. Carrier x Containment

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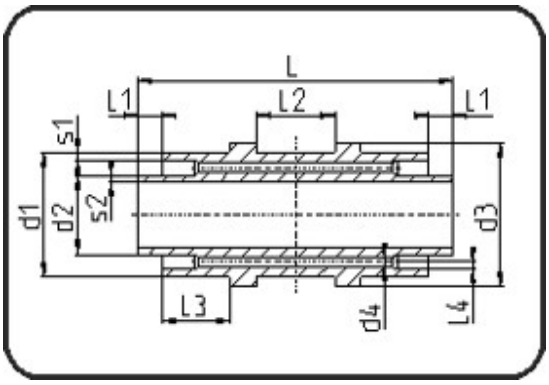

- Poly-Flo® dogbone
- Restraint / flow-through
- Machined
- Simultaneous & staggered welding

DOGBONE - RESTRAINT/ANNULAR[1]

Size[1]		Dimensions															Part Number	
mm	inch	SDR[1]	MOP (psi)	d1 (in)	d2 (in)	s1 (in)	s2 (in)	d3 (in)	L (in)	L1 (in)	L2 (in)	L3 (in)	L4 (in)	d4 (in)	Weight (lbs)		PP-R	PE100-RC
															PP-R	PE100-RC		
32 x 50	1 x 1-1/2	11 x 17	150 x 90	1.97	1.26	0.12	0.12	2.28	5.24	0.39	1.30	1.18	0.10	0.19	0.31	0.33	507879211	587879211
63 x 90	2 x 3	11 x 17	150 x 90	3.54	2.48	0.21	0.23	4.13	5.94	0.39	1.61	1.18	0.16	0.24	0.88	1.11	507879338	587879338
110 x 160	4 x 6	11 x 17	150 x 90	6.30	4.33	0.37	0.39	7.09	7.87	0.39	2.40	1.18	0.20	0.31	3.53	3.97	507879532	587879532

1. Carrier x Containment

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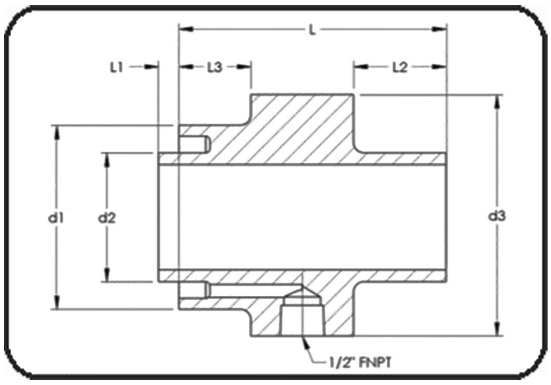

- **Poly-Flo® end termination w/ tap**
- **Machined**
- **Simultaneous & staggered welding**
- **Incl. 1/2" FNPT tap**
- **Incl. molded plug (installed loose)***

END TERMINATION - TAP

Size[1]		Dimensions											Part Number	
mm	inch	SDR[1]	MOP (psi)	d1 (in)	d2 (in)	d3 (in)	L (in)	L1 (in)	L2 (in)	L3 (in)	Weight (lbs)		PP-R	PE100-RC
											PP-R	PE100-RC		
32 x 50	1 x 1-1/2	11 x 17	150 x 90	1.97	1.26	3.07	5.12	0.39	1.77	1.38	0.55	0.58	507860211	587860211
63 x 90	2 x 3	11 x 17	150 x 90	3.54	2.48	4.65	5.12	0.39	1.77	1.38	1.27	1.34	507860338	587860338
110 x 160	4 x 6	11 x 17	150 x 90	6.3	4.33	7.40	5.12	0.39	1.77	1.38	3.24	3.42	507860532	587860532

1. Carrier x Containment

* Installed loose for shipping - must be tightened once fitting is installed

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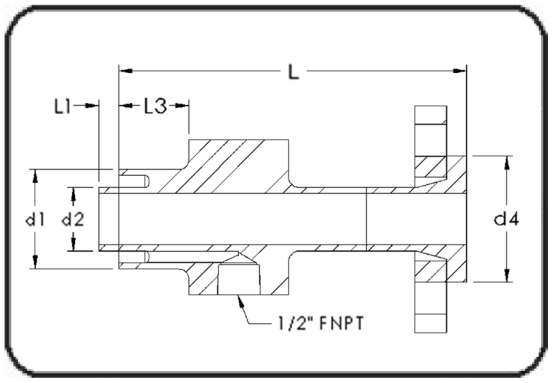

- **Poly-Flo® end termination w/ tap**
- **Fabricated**
- **Simultaneous & staggered welding**
- **Incl. 1/2" FNPT tap**
- **Incl. molded plug (installed loose)***
- **Backing ring drilled ANSI 150# - see backing ring dimensions for details (PN 5149_)**

END TERMINATION - TAP, FLANGED

Size[1]		Dimensions										Part Number	
mm	inch	SDR[1]	MOP (psi)	d1 (in)	d2 (in)	d4 (in)	L (in)	L1 (in)	L3 (in)	Weight (lbs)		PP-R	PE100-RC
										PP-R	PE100-RC		
32 x 50	1 x 1-1/2	11 x 17	150 x 90	1.97	1.26	2.50	7.25	0.39	1.38	1.47	1.49	507861211	587861211
63 x 90	2 x 3	11 x 17	150 x 90	3.54	2.48	3.95	7.25	0.39	1.38	3.32	3.38	507861338	587861338
110 x 160	4 x 6	11 x 17	150 x 90	6.3	4.33	6.22	8.25	0.39	1.38	7.61	7.75	507861532	587861532

1. Carrier x Containment

* Installed loose for shipping - must be tightened once fitting is installed

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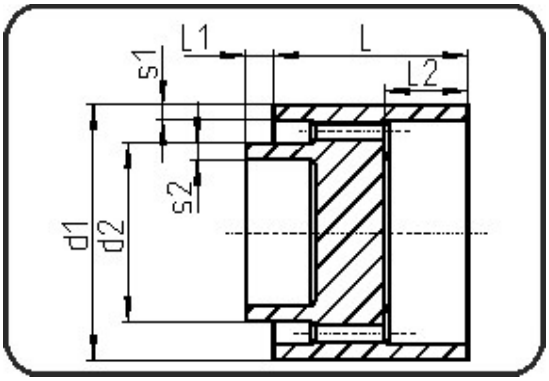

- Poly-Flo® outer wall adapter
- Machined
- Simultaneous & staggered welding
- Used with low point leak detection

OUTER WALL ADAPTER

Size[1]		Dimensions											Part Number	
mm	inch	SDR[1]	MOP (psi)	d1 (in)	d2 (in)	s1 (in)	s2 (in)	L (in)	L1 (in)	L2 (in)	Weight (lbs)		PP-R	PE100-RC
											PP-R	PE100-RC		
32 x 50	1 x 1-1/2	11 x 17	150 x 90	1.97	1.26	0.12	0.12	2.36	0.39	1.18	0.12	0.13	507857211	587857211
63 x 90	2 x 3	11 x 17	150 x 90	3.54	2.48	0.21	0.23	2.76	0.39	1.18	0.51	0.55	507857338	587857338
110 x 160	4 x 6	11 x 17	150 x 90	6.30	4.33	0.37	0.39	3.15	0.39	1.18	2.02	2.09	507857532	587857532

1. Carrier x Containment

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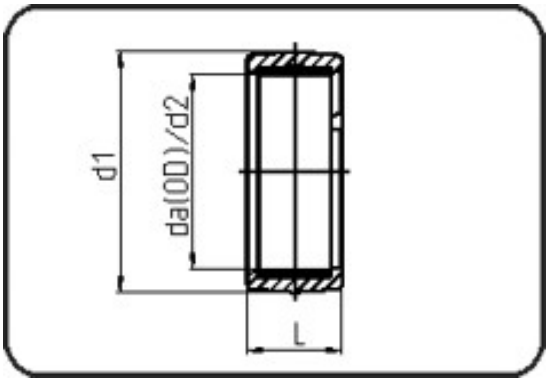


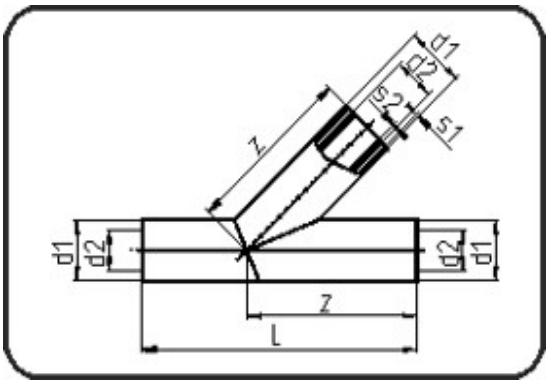
- **Poly-Flo® induction coupling**
- **Injection molded**
- **Induction welding**

INDUCTION COUPLING

Size		Dimensions							Part Number	
mm	inch	SDR	MOP (psi)	da(OD) (in)	L (in)	d1 (in)	Weight (lbs)		PP-R	PE100-RC
							PP-R	PE100-RC		
50	1 x 1-1/2	17	90	1.97	0.98	2.46	0.07	0.07	505850050	585850050
90	2 x 3	17	90	3.54	1.18	4.19	0.17	0.18	505850090	585850090
160	4 x 6	17	90	6.30	1.97	7.28	0.74	0.77	505850160	585850160

Requires use with induction welding tool, sold separately

Some CAD models can be found at https://cad.asahi-america.com. For any questions on dimensional info, please contact Asahi/America Technical Services at 1-800-343-3618 or asahi@asahi-america.com.



- **Poly-Flo® lateral**
- **Fabricated**
- **Simultaneous & staggered welding**
- **Drainage service only**

LATERAL - MITERED

Size[1]		Dimensions										Part Number	
mm	inch	SDR[1]	MOP (psi)	s1 (in)	s2 (in)	d1 (in)	d2 (in)	L (in)	z (in)	Weight (lbs) PP-R	Weight (lbs) PE100-RC	PP-R	PE100-RC
32 x 50	1 x 1-1/2	11 x 17	5	0.12	0.12	1.97	1.26	11.81	7.87	0.77	-	507874211	-
63 x 90	2 x 3	11 x 17	5	0.21	0.23	3.54	2.48	15.75	9.84	3.11	3.28	507874338	587874338
110 x 160	4 x 6	11 x 17	5	0.37	0.39	6.30	4.33	21.65	13.78	12.58	13.27	507874532	587874532
160 x 225	6 x 9	11 x 17	5	0.53	0.57	8.86	6.30	26.54	18.66	32.10	33.86	507874606	587874606
110 x 160	4 x 6	17 x 33	5	0.19	0.26	6.30	4.33	21.65	13.78	7.79	8.22	507903532	587903532
160 x 225	6 x 9	17 x 33	5	0.27	0.37	8.86	6.30	26.54	18.66	22.95	24.21	507903606	587903606

1. Carrier x Containment

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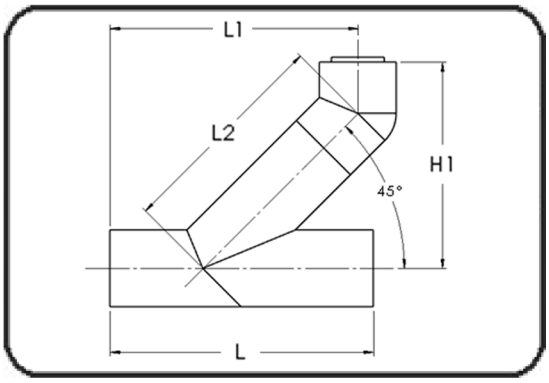

- **Poly-Flo® lateral w/ bend**
- **Fabricated**
- **Simultaneous & staggered welding**
- **Drainage service only**

LATERAL W/ BEND

Size[1]		Dimensions								Part Number	
mm	inch	SDR[1]	MOP (psi)	L (in)	L1 (in)	L2 (in)	H1 (in)	Weight (lbs)		PP-R	PE100-RC
								PP-R	PE100-RC		
63 x 90	2 x 3	11 x 17	5	15.75	14.88	12.75	12.00	4.06	4.28	507888338	587888338
110 x 160	4 x 6	11 x 17	5	21.65	20.38	18.00	17.00	12.58	13.27	507888532	587888532

1. Carrier x Containment

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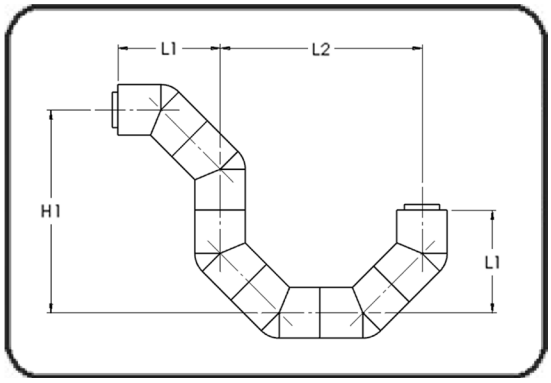

- **Poly-Flo® P-trap**
- **Fabricated**
- **Simultaneous & staggered welding**
- **Drainage service only**

P-TRAP

Size[1]		Dimensions							Part Number	
mm	inch	SDR[1]	MOP (psi)	L1 (in)	L2 (in)	H (in)	Weight (lbs)		PP-R	PE100-RC
							PP-R	PE100-RC		
63 x 90	2 x 3	11 x 17	5	7.13	14.13	14.13	5.67	5.97	507888338	587888338
110 x 160	4 x 6	11 x 17	5	10.00	19.88	19.88	24.21	25.53	507888532	587888532

1. Carrier x Containment

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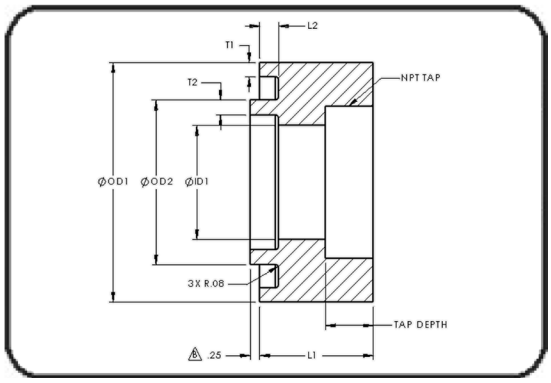

- **Poly-Flo® cleanout**
- **Machined**
- **Simultaneous & staggered welding**
- **FNPT thread**
- **Incl. machined plug***

CLEANOUT

Size		Dimensions													Part Number	
mm	inch	SDR	MOP (psi)	OD1 (in)	OD2 (in)	T1 (in)	T2 (in)	ID1 (in)	L1 (in)	L2 (in)	Tap (in)	Tap Depth (in)	Weight (lbs)		PP-R	PE100-RC
													PP-R	PE100-RC		
32 x 50	1 x 1-1/2	11x17	5	1.97	1.26	0.12	0.12	0.75	3	0.5	1	1.12	0.26	0.27	507886211	587886211
63 x 90	2 x 3	11x17	5	3.54	2.48	0.21	0.23	1.75	3	0.5	2	1.26	0.73	0.77	507886338	587886338
110 x 160	4 x 6	11x17	5	6.3	4.33	0.37	0.39	3	3	0.5	4	1.26	2.38	2.51	507886532	587886532

* Must be fully tightened once fitting is installed

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Aluminum Sulfate Solution
SAFETY DATA SHEET

Section 1 – Product and Company Identification

Material Name: Aluminum Sulfate Solution

Manufacturer Information:
Affinity Chemical, LLC
PO Box 601298
Dallas, TX 75360
973-908-8053 (M-F, 8:00 AM -5:00 PM Eastern Time)

24 Hour Emergency Telephone:
Chemtrec 1-800-424-9300

Other Name(s): Alum

Product Usage:
Water treatment coagulant/flocculant, pH control, phosphate control, paper sizing aid, pitch control

Section 2 – Hazard(s) Identification

Classification: Skin Irritant 2, Eye Irritant 2A , Corrosion 1
Signal Word: **Warning**
Hazard Statements: May cause skin irritation ; Causes serious eye irritation; May be corrosive to metals
Symbol(s): Exclamation Mark, Corrosion
Precautionary Statements:

Prevention:
Wash hands, along with any other body parts that may have been exposed, thoroughly after handling.
Wear protective gear to prevent contact with skin (Rubber gloves, aprons, slicker suit)
Wear eye protection/face protection (clear goggles and face shield)
Keep only in original container.

Response:
If on skin: Wash with plenty of water.
If skin irritation occurs: Get medical advice/attention.
Refer to first-aid measures (section 4) for any specific treatment
Take off contaminated clothing and wash it before reuse.
If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
If eye irritation persists: get medical attention
Absorb spillage to prevent material damage.

Storage: Store in compatible containers such as polypropylene , polyethylene, PVC, or 316 SS

Other Hazards: Ingestion or inhalation not recommended and could present hazards not otherwise classified.

Section 3 – Composition/Information on Ingredients

Common Name(s): Alum
Chemical family: inorganic, salt

Hazardous Components	CAS#	Weight %
Aluminum Sulfate tetradecahydrate	16828-12-9	48.5

Section 4 – First-Aid Measures

Skin/Eye Contact: For skin, immediately remove contaminated clothes under safety shower. Flush skin with running water for at least 15 minutes. Launder clothes before reuse. For eyes, flush carefully in eye wash for several minutes;remove contact lenses if present and easy to do;cautiously flush person's eyes with running water for at least 15 minutes. Seek Medical attention if irritation persists.

Ingestion: Rinse mouth. Immediately dilute swallowed material by orally administrating large amounts of water or milk. DO NOT INDUCE VOMITING. NEVER administer liquids orally to an unconscious person. Call physician or poison control center if person feels unwell or more than a few drops are ingested.

Inhalation: Seek medical assistance if irritation is noted ,person is having difficulty breathing, or the possibility exists of fluid in the lungs. Remove victim from the contaminated atmosphere. If breathing stopped, give artificial respiration. Weak breathing may be supplemented with a bag-mask or manually operated air supply that delivers at least 1 liter/second.

Aluminum Sulfate Solution
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Section 5 – Fire-Fighting Measures

Suitable Extinguishing Media: Not combustible. Use extinguishing agents appropriate for surrounding fire

Special Fire Fighting: Move container from fire area if it can be done without risk. Avoid inhalation of material or combustion byproducts by wearing a self contained breathing apparatus. Dike area to prevent runoff and contamination of water source. Stay upwind and keep out of low areas.

Unusual Fire/Explosion: Under fire conditions at temperatures greater than 650°C or 1202°F, decomposes to give off sulfur trioxide, an oxidizing agent which will support combustion. Sulfur trioxide will react to form sulfuric acid.

Section 6 – Accidental Release Measures

Spill or Leak: Wear PPE appropriate for handling the material. No smoking or eating in spill areas. Absorb small spills with sand or vermiculite. Place contaminated material in appropriate container for disposal. If spilled on ground, the affected area should be removed to a depth of 1 to 2 inches and placed in an appropriate container for disposal Large spills should be handled according to a predetermined plan. Do not flush material to public sewer systems or any waterways. Wear appropriate protective clothing and equipment during cleanup activities. Ensure adequate decontamination of tools and equipment following cleanup. Adequate ventilation is required when neutralizing spills / leaks.

Section 7– Handling and Storage

Smoking and/or eating is not recommended in storage areas. Stainless steel or fiberglass tanks are recommended. Keep product away from heat sources and direct sunlight. Do not reuse storage containers unless properly reconditioned.
Isolate appropriately from chemicals where low pH could create a hazardous byproduct; for example a combination with hypochlorite could lead to the evolution of chlorine gas.

Section 8– Exposure Controls/Personal Protection

Component	CAS#	OSHA PEL	ACGIH TLV
Aluminum Sulfate tetradecahydrate	16828-12-9	2.0 mg/m^3 (as Al)	2.0 mg/m^3 (as Al)

If airborne exposures exceed 1.0 mg/m^3, a negative pressure air-purifying respirator is recommended. Cartridges must be NIOSH / MSHA approved against dusts and mists having TWA than 0.05 mg/m^3
Eye wash and safety shower should be available near storage and usage points
Exposed skin and eyes should be protected and contact with skin and clothing avoided. Minimal PPE would be closed goggles and/or face shield and gloves (rubber,neoprene,PVC) with work clothing covering other exposed skin.
Arriving material may be hot; personnel performing unload operations should have additional PPE such as a rainsuit/slicker suit, goggles with faceshield, and appropriate footwear and gloves.

Section 9– Physical and Chemical Properties

Appearance	Clear, water white to amber	**Upper/lower flammability or explosive Limits**	N/A
Odor	N/A	**Vapor pressure**	Similar to water
Odor threshold	N/A	**Vapor density**	Similar to water
pH	3.5 (1% soln)	**Relative density (15.6°C)**	1.315-1.345
Melting point/freezing point	-15°C	**Solubility**	high in water
Initial boiling point	100°C	**Partition coef n-octanol/water**	N/A
Flash point	N/A	**Auto-ignition temp**	N/A
Evaporation rate	N/A	**Decomposition Temp**	650°C
Flammability	N/A	**Viscosity**	5-25 cP

Aluminum Sulfate Solution
SAFETY DATA SHEET

Section 10- Stability and Reactivity

Reactivity:	Stable at normal temperatures and pressures
Chemical stability:	Stable; water component can evaporate
Possibility of hazardous reactions:	May produce hazardous decomposition products if mixed with pH sensitive materials (e.g. chlorine gas when mixed with sodium hypochlorite).
Conditions to avoid:	Temperatures at or near to crystallization, -15°C or 4°F. At temperatures greater than 650°C or 1202°F, it decomposes to form aluminum oxide and sulfur trioxide
Incompatible materials:	Corrosive to carbon steel
Hazardous decomposition products:	This may include aluminum oxide and sulfur oxides.

Section 11- Toxicological Information

Acute Toxicity Estimate:	The acute oral LD50 is greater than 5,000 mg/kg.
Chronic Toxicity Estimate:	The acute oral LD50 is greater than 5,000 mg/kg.
Symptoms of Overexposure:	May cause skin and eye irritation. If inhaled, may cause headaches, nausea, and respiratory irritations.
Carcinogenicity:	Not listed as a carcinogen by NTP, IARC, or OSHA.
Other Possible Health Hazards:	The common recognized injury from Aluminum Sulfate is local tissue irritation. The irritating action is often from hydrolysis to form sulfuric acid and may occur from ingestion, skin or eye contact, or inhalation of dusts and mists. Remove victim from contaminated area. SKIN / EYES: May cause corneal burns or severe irritation in eyes. Fumes or mists may cause irritation or burns to skin. INGESTION: Oral and gastrointestinal irritation. Local tissue damage. Nausea, vomiting, diarrhea, and gastrointestinal bleeding may follow. Can be fatal if swallowed in sufficient quantities. INHALATION:Irritation of the respiratory system. Long term exposure may cause bronchial irritation, coughing, and bronchial pneumonia. Medical conditions generally aggravated are acute and chronic respiratory diseases.
Routes of Entry:	Ingestion, skin or eye contact, or inhalation of dusts and mists.

Section 12- Ecological Information

(For CAS 10043-01-3)

Toxicity LC50 :	96h Mosquitofish: 235 mg/l (ECOTOX Database Ref 508, result 2063538)
Persistence and Degradability:	Can be eliminated from water by precipitation or flocculation

Section 13- Disposal Considerations

Disposal: Contact site environmental personnel and/or state and federal agencies for disposal procedures that are in accordance with environmental regulations.

Section 14- Transport Information

U.S. DOT

PROPER SHIPPING NAME: Environmentally hazardous substance,liquid, N.O.S. (Contains Aluminum Sulfate)

HAZARD CLASS	UN ID NUMBER	PACKING GROUP	RQ (lbs)
9	UN3082	PG III	10,300

Aluminum Sulfate Solution
SAFETY DATA SHEET

Section 15 – Regulatory Information

SARA Title III information:

SECTION 302 EXTREMELY HAZARDOUS SUBSTANCES: Not listed
SECTION 313 TOXIC CHEMICAL: Not listed
RCRA HAZARD WASTE: Not listed

311/312 HEALTH & PHYSICAL HAZARDS:

Immediate	Delayed	Fire	Pressure	Reactivity
YES	NO	NO	NO	NO

NFPA RATING

Health	Fire	Reactivity
1	0	1

MAXIMUM USE LEVEL (water treatment): 150 mg/l

Section 16– Other Information

Date of preparation: 6/1/15 Version SDS 1.0

Disclaimer of Warranty:

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