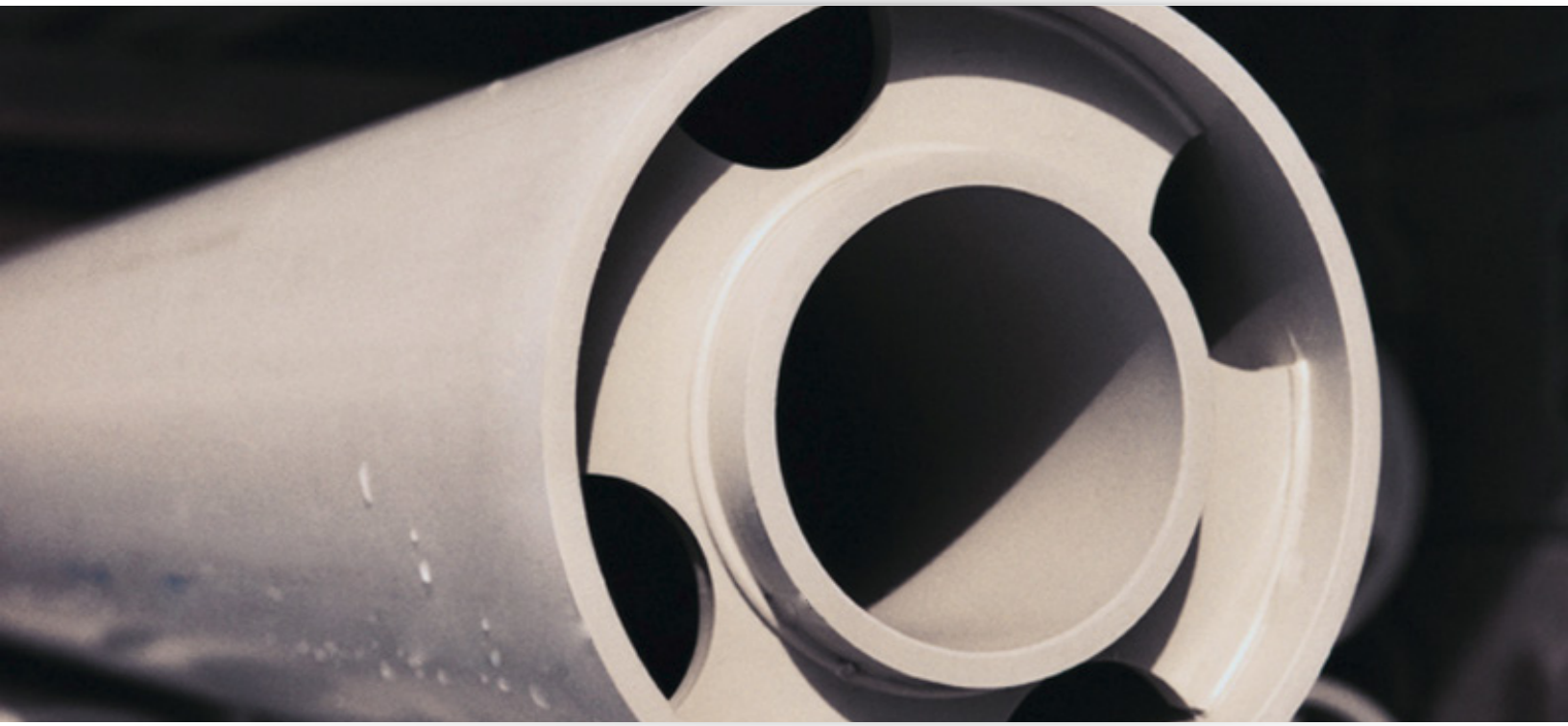
SIMTECH
Process Systems

Expertise In
Engineered Plastics



Contain*Tech*® - Polypropylene
Double Containment Piping Systems

www.Simtech.com

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PREFACE

For over 30 years, ContainTech® thermoplastic double contained piping system has been used for the distribution of fluids and can be used to transport most organic solvents, dilute acids, many strong acids and alkalis.

The consulting engineer has been provided with information on what to expect from a SIMTECH ContainTech® Double Containment System once it is installed. However, the true operating success of the system is greatly dependent upon proper installation. SIMTECH is committed to supporting the proper installation of a complete and high-quality piping system. This support includes clear and concise installation recommendations and expert field technical assistance.

The ContainTech® system has been designed with the installer in mind. ContainTech® arrives at the project site partially assembled. In-plant fabrication means less field work and fewer complications. This significantly reduces the installation cost while maintaining the integrity of the system. The features that make ContainTech® unique extend beyond the product itself. An expert project design staff tailors each system to meet the needs of the customer. Also, an experienced technical service staff is available to provide assistance that will assure a quick and smooth installation.

A series of factors contribute to a reliable, high quality piping system, such as design, construction, delivery, installation and testing, with stringent quality control procedures applied at every step. The importance of proper installation practices for any piping system and adherences to this procedure, in particular, cannot be overstated. When installed according to the recommended practices presented in this manual and from SIMTECH technical service, ContainTech® will provide excellent service, meeting or exceeding expectations.

The installation procedure covers the butt fusion welding process in both leak detected and non-leak detected systems. This procedure conforms to ASTM D2657, Standard Practice for Heat Joining Polyolefin Pipe and Fittings.

This procedure applies to the customer-designated contractor who will perform the installation. A factory-trained, experienced field installation instructor will be on site at the time of job start-up to provide training on use of supplied welding equipment.

Trouble-free, efficient operation will result from close cooperation between the installing contractor and the field installation instructor. SIMTECH is committed to supporting the proper installation of a complete and high quality piping system. Nevertheless, ultimate responsibility for proper installation rests with the installing contractor.

System Specification

SYSTEM SPECIFICATION
AlphaPlus® Polypropylene ContainTech® - Double Containment System

1. SCOPE

All double containment piping shall be factory manufactured. All straight sections, fittings and other accessories shall be factory pre-manufactured to job dimensions to minimize the number of field connections. Components shall be factory assembled to allow for the placement of the leak detection cable. The containment shall be drainable, dryable and air pressure testable. The manufacturer shall have at least ten (10) years experience in the manufacturing of double containment piping systems and offer an integrated sensor cable leak detection/ location alarm system. The manufacturer of the secondary containment piping system will provide guidelines to calculate the need for and location of expansion anchors.

2. CARRIER PIPE

Carrier pipe shall be extruded from Group 1, Class 2; Alpha nucleated homopolymer material in accordance with ASTM D-4101. The alpha nucleated resin shall achieve a minimum tensile strength of 300 bars when tested at 23°C according to ASTM D 638. Material shall allow continuous operating temperatures to 212°F (100° C). Alpha nucleated resin shall comply with relevant food substance regulation, U.S. FDA guidelines as specified in Code of Federal Regulators (CFR), Title 21, Chapter 1: Section 177.1520 and Section 1 78.3297 suitable for contact with foodstuff, pharmaceutical use and potable water. Carrier pipe shall be stress relieved (annealed) by a post extrusion annealing process to ensure that the pipe material will have increased impact resistance, longer life, low shrinkage and dimensional stability required for simultaneous butt fusion welding process.
Carrier pipe shall be pressure rated in accordance with ASTM D-2837 and Din 8077 for hydrostatic design basis. Pipe shall be manufactured to an SDR (standard dimensional ratio) in order to provide the same pressure rating in all diameters. Pipe shall be (select one):

SDR 11	=	150 PSI (PN10)*
SDR 17.6	=	90 PSI (PN6)
SDR 33	=	45 PSI (PN3.2)

*PN = Nominal Pressure Rating in Bar

3. CONTAINMENT PIPE

Containment pipe shall be extruded from Group 1, Class 2; Alpha nucleated homopolymer material in accordance with ASTM D-4101. Alpha nucleated resin shall achieve a minimum tensile strength of 300 bars when tested at 23°C according to ASTM D 638. Material shall allow continuous operating temperatures to 212°F (100° C). Alpha nucleated resin shall comply with relevant food substance regulation, US FDA guidelines as specified in Code of Federal Regulators (CFR), Title 21, Chapter 1: Section 177.1520 and Section 1 78.3297 suitable for contact with foodstuff, pharmaceutical use and potable water. Containment pipe shall be stress relieved (annealed) by a post extrusion annealing process to ensure that the pipe material will have increased impact resistance, longer life, low shrinkage and dimensional stability required for the simultaneous butt fusion welding process. No socket fusion or electro-fusion joints will be allowed. Carrier pipe shall be pressure rated in accordance with ASTM D-2837 and Din 8077 for hydrostatic design basis. Pipe shall be manufactured to an SDR (standard dimensional ratio) in order to provide the same pres¬sure rating in all diameters. Pipe shall be (select one):

SDR 11	=	150 PSI (PN10)*
SDR 17.6	=	90 PSI (PN6)
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SYSTEM SPECIFICATION
AlphaPlus® Polypropylene ContainTech® - Double Containment System

4. FITTINGS

All fittings shall be injection molded or thermo fused at the factory. All secondary contained fittings shall be of unitized construction with the carrier and containment integrally anchored together to prevent the movement of the carrier relative to the containment within the fitting. Manufacturer will calculate end loads and specify the placement of anchors in the system. Anchors shall be of sufficient thickness to withstand the maximum possible end loads that will be generated by the carrier pipe during the life of the system.

5. DIMENSIONS and TOLERANCES

All pipe and fittings shall comply with the dimensions and tolerances outlined in ASTM D-3261. Pipe shall have a 2.5 safety factor for a 50-year life. Pipe shall be furnished in 5-meter (16.4 ft) length.

6. SUBASSEMBLIES

End seals and other subassemblies shall be designed and factory prefabricated to prevent the ingress of moisture into the system. All subassemblies shall be designed to allow for complete draining of the secondary containment.

7. INSTALLATION

Factory trained field representatives of the manufacturer shall provide technical field support during critical periods of piping and leak detection system installation including final test of the leak detection/location system. Manufacturer shall certify each field installer on simultaneous butt fusion equipment prior to beginning of project. The contractor shall install the system in accordance with the directions furnished by the manufacturer and as approved by the engineer.

8. PIPE SUPPORTS

Supports shall be designed and factory installed by the secondary containment manufacturer. No field assembled supports will be allowed. The manufacturer shall design and fabricate the system taking into account pressure and temperature requirements when placing the pipe supports. Double supports will be required throughout the system to minimize stresses due to point loading. All pipe supports shall be circular and welded to the carrier pipe. Pipe supports will have cable leak detection ports at ninety degrees The sup-ports at both ends of every straight section shall be factory welded to both the carrier and containment pipes in order to facilitate the simultaneous butt fusion of all secondary contained pipe and fittings. Support clips will not be allowed.

9. TESTING

The containment pipe shall be air tested at 5 psig, and the carrier pipe shall be hydrostatically tested to 100 psig. The test pressures shall be held for not less than one (1) hour. The contractor shall strictly adhere to the installation guidelines supplied by the system manufacturer and shall keep the secondary containment system clean and dry at all times during the installation process.

10. BACKFILL

A four (4) inch layer of sand or fine gravel shall be placed and tamped in the trench to provide uniform bedding for the containment pipe. The entire trench shall be evenly backfilled with a similar material as the bedding in six (6) inch compacted layers to a minimum height of six (6) inches above the top of the piping system. The remaining trench shall be evenly and continuously backfilled in uniform layers with suitable excavated soil. Bedding and backfill materials shall be as recommended by the manufacture.

Material Characteristics

Technical Information

Introduction

The physical properties and chemical compatibility data provided by most plastic pipe manufacturers is generally reproduced form data supplied by the Raw Material Producer. This data is obtained by testing specimens which are 'ideally' produced and thus lack inherent stresses or orientation. Understandably specimens produced in this manner will provide generally better test result.

The properties given on the following pages have been measured by testing extruded panels or coupons. The object being to provide data more indicative of what will normally be achieved by these materials when produced as pipe or extruded sheet. The information indicates average values for 4mm thick extruded coupons unless stated otherwise.

The data provided is in no way a guarantee of the suitability of the material for any application. It is not possible to apply our test results automatically to finished components. For this reason the suitability of our materials for a specific application must be rechecked by the user.

Material Characteristics

SIMTECH'S Polypropylene piping is extruded from A Group 1. Class 1, Grade 0 Polypropylene Homopolymer material per ASTM-D4101, Federal Specifications L-P-39413 and Military Spec Mil P 461096. PP material to be heat stabilized UV stabilized and pigmented to RAL 7032. Temperature stabilizers are added to provide the material with enhanced resistance to aggressive media at elevated temperatures.

Stress Relieved

SIMTECH'S pipe is Stress Relieved, through a post extrusion annealing process. This process allows the pipe to perform to its fullest potential. Simtech pipe possess higher impact strength, higher quick burst pressures, improved resistance to oxidizing acids and longer service life expectancy, compared to pipe that is not subject to a post extrusion annealing process.

Chemical Resistance

Polypropylene is especially suitable for handling Dilute Acids, Alkalies, many strong acids and organic solvents.
Polypropylene should not be used to convey Halogens, Halogenated Hydrocarbons, Aromatics or highly concentrated Oxidizing Acids.

Temperature Range

PP is suitable for application within an operating range from 32°F to 212°F.

Material Characteristics

Properties	Test Standard	Test Method Test Specimen	Dimension	PP		
				PP-H	PP-C	PPs
Mechanical Properties						
Density	DIN 53479	Method C	g/cm³	0.91	0.91	0.95
Melting Index Group	DIN 16776	MFI 190-5	Group	006	006	012
Tensile Test	DIN 53455	Test Bar 3	—	—	—	—
Yield Stress	—	Test Speed 50 mm/min	N/mm²	33	26	32
Elongation At Yield Stress	—	—	%	15	17	14
Elongation At Rupture	—	—	%	70	120	70
Bending Test	DIN 53457	Test Bar	—	—	—	—
Bending Modulus E	1 min.	120 x 10 x 4 mm	N/mm²	1200	900	1300
Impact Bending Test	DIN 53453	Charpy	—			
Impact Strength	—	Standard Miniature Bar	kj/m²	Without Break	Without Break	Without Break
Notched Bar Impact Strength	—	Standard Miniature Bar With U-Notch	kj/m²	7	25	5
Surface Hardness						
Ball Impression Hardness	DIN 53456	H 358/30	N/mm²	70	64	70
Shore Hardness	DIN 53505	D	—	72	67	72
Thermal Properties						
Crystallite Melting Range	—	Polarization Microscope	K (°C)	160 - 165	160 - 164	160 - 165
Mean Thermal Coefficient Of Linear Expansion	DIN 53752	—	K (°C)	1.6×10^{-4}	1.6×10^{-4}	1.6×10^{-4}
Thermal Conductivity	DIN 52612	Two-Plate Method	W/m x K	0.22	0.22	0.22
Electrical Properties						
Dielectric Strength	DIN 53481	K 20/P 50	kV/mm	52	52	22
Impedance	DIN 53482	Annular Electrode	Ohm x cm	$> 10^{16}$	$> 10^{16}$	$> 10^{17}$
Surface Resistance	DIN 53482	Electrode A	Ohm	10^{14}	10^{14}	10^{14}
Leakage Path Resistance	DIN 53480	Method KC	Step	> 600	> 600	> 600
Other Properties						
Flammability	DIN 4102	—	Class	B2	B2	B1
Water Absorption	DIN 53495	Method C	% / 24h	< 0.01	< 0.01	< 0.01
Physiologically Harmless	Recommendation	BGA/KTW	—	YES	YES	NO
Chemical Resistance	DIN 8078 Addendum	—	—	Complies	Complies	Complies

Table 1

Installation

EQUIPMENT AND MATERIAL HANDLING

SIMTECH has furnished the following:
1. Pipe assemblies, fittings and accessories
2. Butt fusion welder
3. Hot air welder

Contractor must furnish the following:
1. Crane and excavation equipment
2. Cutting equipment
3. Power source

Receiving, Handling and Storage.

The piping was inspected and loaded with care at the factory. It is the responsibility of the receiver to ensure there has been no loss or damage. The following procedures are suggested to minimize problems:

- It is recommended that the SIMTECH field representative be present during receipt of the shipment.
- Check all shipped materials against the packing slip for shortages.
- Visually inspect the materials of shipment as they are unloaded.

A list of damages and / or shortages should be noted on the packing slip and the bill of lading. DO NOT dispose of any damaged material.

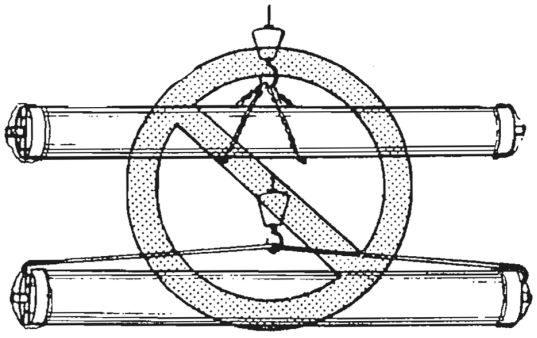
The carrier will notify you of the necessary procedure to be followed.

- Submit claims to the carrier. Failure to do so will result in loss of compensation for missing or damaged material.
- Notify your SIMTECH field representative of these claims if assistance is required. SIMTECH

Material Handling.

The means by which ContainTech® is unloaded and handled in the field is the decision and responsibility of the receiver. If damage does occur due to improper handling, any repairs must be made at the customer's expense. The following procedures are suggested to minimize problems:

- Support each assembly during all phases of handling.
- DO NOT use steel cables or chains for handling any ContainTech assemblies.
- DO NOT drop the ContainTech assemblies or strike them against hard surfaces at any time.



DO NOT use steel cables or chains for handling any ContainTech assemblies.

If an accident occurs, inspect the pipe for damages. Contact SIMTECH to repair or replace damaged product.

Pipe Storage.

ContainTech® assemblies can deteriorate and sustain damage if not stored properly. Proper storage of the product is the responsibility of the receiver. The following procedures are suggested to minimize problems:

- If possible, store the pipe in a warehouse or heated shelter. If this is not possible, store the pipe on high ground to avoid ingress of water into pipe ends.
- ContainTech can be stored during the winter months (or for prolonged periods of time) with minimal special handling.
- When stacking the ContainTech® for storage, stack it in the same fashion that it was received.
- Use foam or other padding between layers.
- DO NOT remove plastic covers or end caps from the ContainTech®, if present.

SIMTECH recommends using a light-colored or opaque tarpaulin to cover pipe stored for a prolonged period. This cover will protect it against ultraviolet (UV) rays that will discolor the piping.

PREPARATION AND SET UP

SIMTECH cannot anticipate every circumstance that might involve a hazard. The warnings in this procedure are not all inclusive. The installing contractor must satisfy himself that each procedure, tool, work method or operating technique is safe. SIMTECH recommends that only trained and qualified personnel perform the steps of the installation procedure. Proper implements, tools and equipment should be used for placement of the pipe in the trench to prevent damage. In no case should pipe or accessories be dropped into the trench. Additional handling and joining procedures are covered elsewhere in this manual. Pipe laying generally should commence at the lowest elevation and terminate at manholes, service branches or clean outs. Use the Pipe Drawing Layout to place the assemblies in correct order

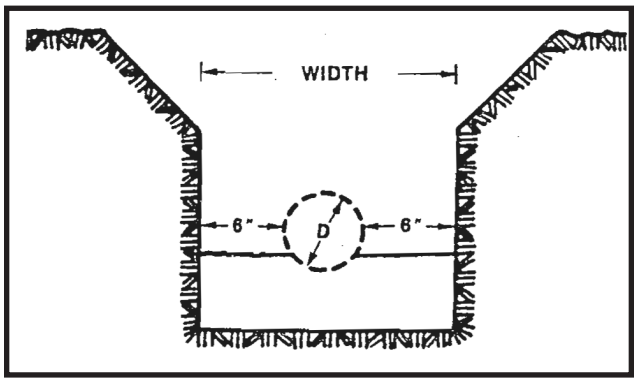
EXCAVATION

Trenching.

All types of flexible pipe derive some of their strength from the passive soil resistance on the sides of the pipe. Therefore, the proper excavation of the trench is very important to ensure a structurally sound system. Usually, the center line dimensions for the placement of the pipe in the trench can be found in the drawings.

ContainTech® is designed to handle normal soil and H-20 loading. If SIMTECH's recommended procedures are followed, a minimum burial depth is required at taxiways, runways, railroads and other areas of high surface loading conditions. It is recommended that the customer contact both SIMTECH and the local authority for more specific burial instructions.

The trench should be considerably wider at field joint locations to allow room for welding equipment and field joint closure operations. The recommended trench width at field joint locations should be 36 inches plus the diameter of the conduit. The trench floor should be completely cleared of stones and rocks and covered with a 4-inch compacted bedding. The bedding soil should correspond with the soil description.



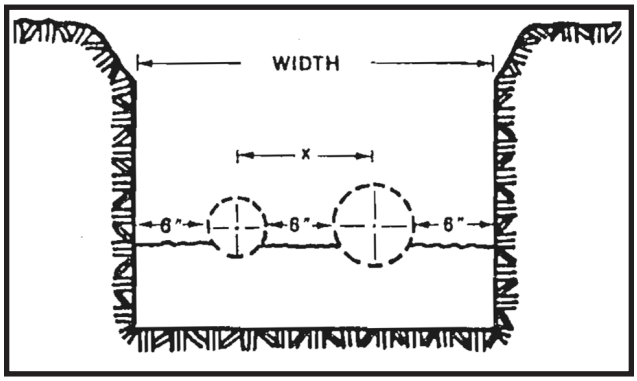
The minimum recommended trench width for single pipe is 12 inches plus the diameter of the conduit.

During excavation, an unstable soil condition may be encountered, particularly in installations with deep burials. If this occurs, shore the trench walls before lowering the piping assembly into the trench.

Local, state and federal regulations for shoring should be followed where applicable. As the shoring is removed, it should be replaced with backfill soil.

Organic soils or plastic clays and silts with high liquid limits may be encountered that are incapable of supporting the pipe. Remove the poor soil, and replace it with the proper bedding soil to a depth that will provide a firm stable foundation.

The minimum recommended trench width for single pipe is 12 inches plus the diameter of the conduit.



Compute the width of a multi-pipe trench by adding 6 inches to the combined radii of each pair of pipes and, then, adding another 12 inches and the combined radii of the two outer-most pipes to allow for clearance.

For multi-pipe installations, center line dimensions can usually be found in the drawings.

If the center line dimensions are not specified in the drawings, SIMTECH recommends computing the width of a multi-pipe trench by adding 6 inches to the combined diameter of each pair of pipes and, then, adding another 12 inches and the combined diameter of the two outermost pipes to allow for clearance.

See contract drawings for specific pipe burial depths. The total trench depth should allow for a 4-inch bedding, the conduit diameter and a minimum 24 inches cover depth above the conduit. It is considered unadvisable to use a shallower burial depth. For depths less than 24 inches, the installing contractor must contact SIMTECH.

A minimum bedding of 4 inches must be raked uniformly along the entire length of the run. The bed of the run must be graded to a minimum slope of 1 inch per 40 feet. The bedding material should conform with the recommendations in the Backfill section of this manual (see Section 9.0).

Special Trench Conditions.

Rock Bottom Trench.

- A rocky or uneven trench foundation should be covered with a firm soil or gravel before bedding is constructed.

Unstable Soil.

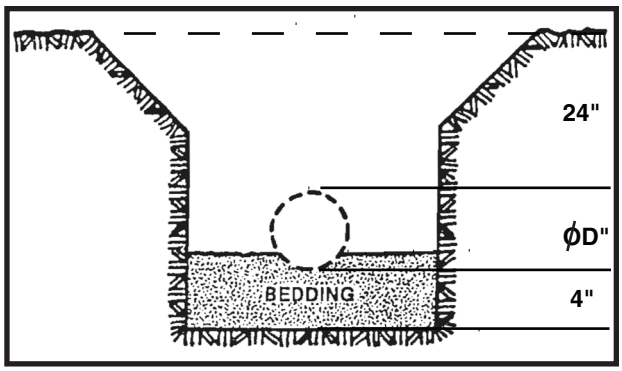
- When trenching in unstable soil, DO NOT lay any ContainTech® until the trench walls are stabilized with staybracing or shoring.
- Replace and compact the soil as the shoring is removed.

Granular Soil.

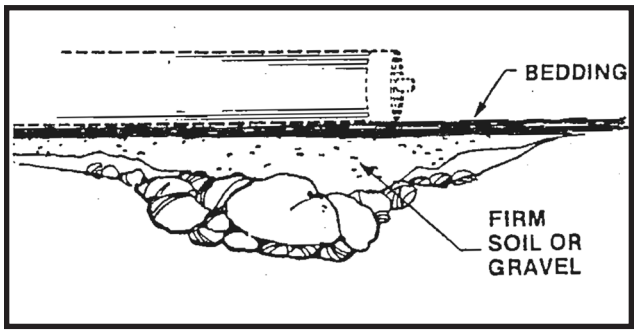
- In granular soil, the trench wall should be sloped at the natural angle of repose.

Over-excavation.

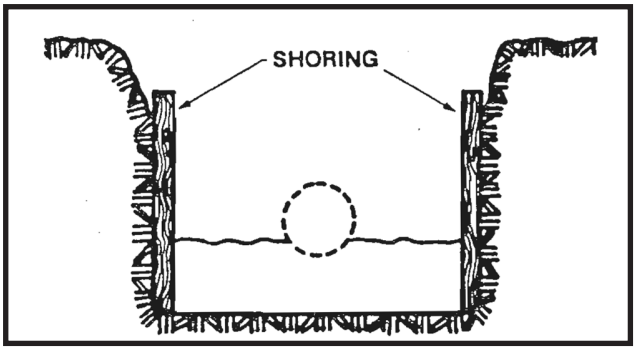
- Any accidental over-excavation should be filled with bedding material and compacted to 90-95% modified proctor



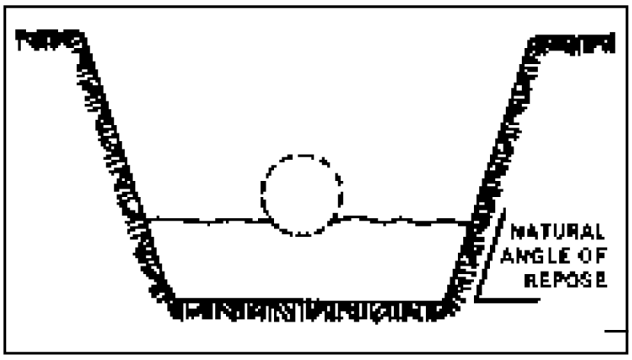
The total trench depth should allow for a 4-inch bedding, the pipe diameter and a minimum 24 inches cover depth above the conduit.



A rocky or uneven trench foundation should be covered with a firm soil or gravel before bedding is constructed.



Replace and compact the soil as the shoring is removed.



In granular soil, the trench wall should be sloped at the natural angle of repose.

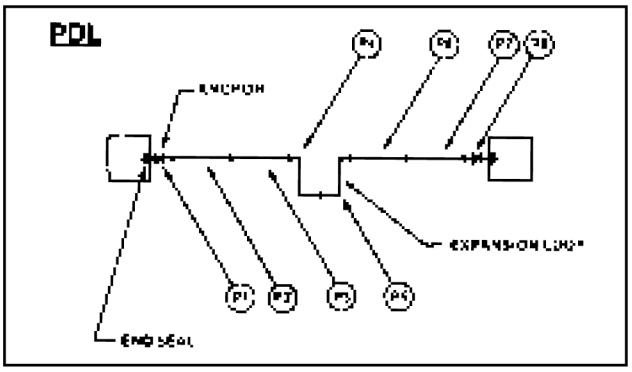
INSTALLATION AND ASSEMBLY

NOTE: When installing pipe in ambient temperatures below 40° F, contact your SIMTECH field representative for special weather specific procedures (see Section 6.04.3.1).

Layout.

After trench excavation is complete and installation of the pipe is to start, the ContainTech® assemblies should be distributed along the trench top. Installation can be simplified by laying the assemblies in order along the trench.

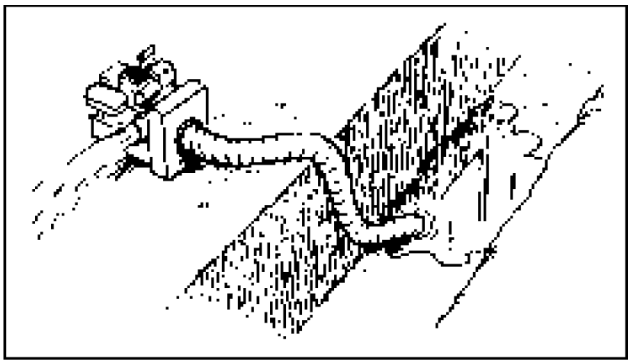
Laying assemblies in order next to the trench will simplify installation. Assembly of the system can be made out of the trench.



Installation can be simplified by laying the assemblies in order along the trench.

Lowering of the Piping.

- Remove freestanding water in the bell hole and trench before lowering assemblies. The bedding must be dry during pipe assembly installation.
- Hot air welds of carrier piping supports will be done outside of the trench (see Section 6.04.2). When ready, lower ContainTech assemblies into the trench. DO NOT drop piping.



Remove freestanding water in the bell hole and trench before lowering assemblies. The bedding must be dry during pipe assembly installation

Pipe Connections.

Pipe connections must be made in sequence. Before continuing, verify the correct order of piping assemblies for the length of the run.
NOTE: For ContainTech® systems equipped with leak detection, DO NOT commence welding without first consulting Section 4 of the PAL-AT Installation Manual.

Welding Procedures.

To join ContainTech® piping joints in the field, it is necessary to perform two weld procedures, a hot air weld to place the carrier pipe supports, and a butt fusion weld to join the ends of piping. Both procedures are explained in this installation manual

NOTE: High voltage electric power, hot metal, hot plastic, sharp rotating cutters and hydraulically operated machine parts capable of large crushing forces are all present during the fusion process. These weld procedures should be performed only by trained and qualified personnel. These personnel must read and fully understand the procedures before starting the welding process.

Equipment Required.

Butt fusion welders are portable electromechanical or electrohydraulic machine tools, designed for both shop and field welding of thermoplastic pipe. Their operation is dependent on careful control of pipe alignment, applied force, material and environment to assure reliable butt fusion joints.

The electrical power requirements vary depending upon the specific welder model being used. It is essential that the required power be maintained in order to provide optimum performance of the welding equipment. If the power requirements are not met, equipment failure and poor weld joints will occur. See Electrical Power Requirements table for details.

ELECTRICAL POWER REQUIREMENTS

Containment Pipe Size	Volt	Phase	AMP	Number Of Outlets
3” thru 6”	120	1	20	2
8” thru 12”	240	1	20	3

A diagram and detailed description of butt fusion welding equipment are given in pages 20/21. The following equipment and tools are needed to support the complete weld process:

- Hot Air Welder: an electrically powered self-contained unit used for welding the inner supports of a pipe in place. The SIMTECH hot air welding procedure is provided later in this manual (see Section 6.04.2).
- Contact Pyrometer: An electronic device used to check the surface temperature of the heating mirror. The pyrometer must accurately measure temperature in the range: 375°F to 500°F (190°C to 260°C)
- Tempil Sticks: These are temperature-specific melt crayons that can be used to check the surface temperature of the heating mirror. Use these crayons carefully, and do not leave any crayon or other residue on the mirror surface. Clean using a lint-free cloth.
- Timer: Any timing device that can measure the time for various cycles of the welding procedure.
- Cleaning Solvent: A solvent used to clean the pipe surface, preferably denatured alcohol. The cleaner should be applied with a lint-free cloth to assure no residue remains on the pipe surface after cleaning.
- Lint free cloth to clean heater surface. DO NOT USE ANY SOLVENT ON THE HEATER SURFACE.

Hot Air Weld Procedure.

ContainTech® piping has an internal carrier pipe support at one end of the pipe, hot air welded in place at the factory. In the event that pipe is cut to length the second end support must be installed prior to the butt fusion process. While the butt fusion welds can be completed in the trench, the hot air weld of the piping supports should be done before the piping is lowered into the trench

Hot air welding uses a preset heating element with the appropriate size and type of weld rod and dry air as recommended. SIMTECH provides the following:

- Hot-Air Portable welder.
- 1/8” Polypropylene Welding Rod

The installing contractor must provide the following:

- 120v power source with GFI
- End cutters
- Residue-free solvent (denatured alcohol is recommended)
- Clean, lint-free wiping cloths

Weld Surface Preparations

Prepare the external surface to be welded by hand-abrading the surface with 50 grit emery cloth. The abraded area should cover the entire welding surface.

- All foreign material must be removed from the pipe.
- Wipe the abrasion residue from the pipe with a clean, lint-free cloth.
- If oil or grease touches the abraded surface, clean with a denatured alcohol and wipe with a clean, lint-free cloth. Wait one minute for the vapors to flash before continuing with the weld procedure.

Hot Air Weld

When the proper welder temperature has been established, proceed with the hot air welding process.

- Ensure weld rod selection is compatible with the piping material. Weld rod size depends on the size of the hot air speed tip being used. Weld rod size ranges from 1/8" to 3/16", with most field applications requiring 1/8".
- Cut the end of the hot air weld rod to a 60° angle.
- Insert a support into the unsupported end of the pipe. Place the support into the bore of the containment pipe using the same distance measured at the factory-welded end.
- Clamp or secure the mating pieces to be welded so both hands are free to operate the welder.
- Slide the rod approximately 1/4 inch past the welder tip.
- Hold the welder tip just above the weld starting point for 5-10 seconds or until the weld rod and the seam areas, where the mating parts meet, are tacky.
- Hold the welder at a 45° angle to the junction of the two mating surfaces when welding.
- Press the tacky end of the welding rod into the weld starting point, and begin moving the welder tip around the weld area while feeding the welding rod into the welder tip.
- Weld the support to the containment pipe and the carrier pipe.
- At the end of each weld seam, strip the welder from the weld rod, and cut off any excess rod left on the welded surfaces.

NOTE: At no time should charring, warping or discoloring appear when the proper weld temperature has been used. DO NOT melt into the surface of the carrier pipe or the containment pipe.

Butt Fusion Weld Procedure

This procedure was developed to fusion weld thermoplastic pipe. Two pipes, one inside the other, are fusion welded to two identical pipes simultaneously. The inner pipe is called the carrier pipe and the outer pipe is called the containment pipe. The material for both pipes must be the same (i.e. PP, PVDF).

Each pipe material has slightly different heating, joining, and holding attributes, but the end result is the same, a fusion joint that is as strong or stronger than the pipe itself.

The principle of fusion welding is to heat two surfaces to a specified temperature, and then to fuse them together by the application of pressure. This pressure causes flow and mixing of the softened material. The thermoplastic molecular structure is transformed from a crystalline state into an amorphous condition. When fusion pressure is applied, the molecules return to crystalline form. The original interface disappears, and the two pipes become one homogeneous pipe. The joint area becomes as strong as the pipe itself.
The principle fusion operations are:

- Clamping: the pipe ends are held firmly with clamps to allow all subsequent operations to take place.
- Facing: the pipe ends must be "faced" to establish clean mating surfaces perpendicular to the center line of the pipes.
- Alignment: the pipe ends must be aligned to each other to minimize a mismatch of the pipe walls.
- Heating: provides a thermoplastic heat pattern that penetrates down the pipe walls. This pattern must be formed around the ends of both pipes.
- Joining: the heat patterns must be pressed together with a specific force. The force must be uniform around the interface area of the pipes.
- Holding: the molten joint must be held immobile, under pressure, with a specified force until cool.

Environmental Conditions

The welding area must be protected against unfavorable weather conditions: rain, snow, high winds, and exposure to extreme temperatures (below 40° F).
Suitable measures, such as covering the welding site with a tent and using a space heater, should be considered to ensure the pipe wall is dry and has a uniform temperature. If the welding operation is to be done in the trench, the trench must be free of water. When the pipes are heated by intense sun, the inner and outer pipes are heated unequally which can prevent successful welding. The work area should be protected with a tent or temporary awning until the pipe wall temperatures are reasonably equal. To prevent excessive uneven cooling by wind during the welding operation, the pipe ends near the welding site should be closed off.

Safety

High voltage electric power, hot metal, hot plastic, sharp rotating cutters and hydraulically operated machine parts capable of large crushing forces are all present during the fusion process. The fusion welding machines should be operated only by trained and qualified personnel. Eye protection and hot work gloves should be used at all times.

Welding Data Table

Before the fusion welding process can begin, a table of data related to the specific ContainTech® system will be supplied by SIMTECH during the project start-up. This data is designed based on the following:

- ContainTech system size, pipe material, and pressure rating. Data is needed for both the carrier and the containment pipe.
- Fusion model of the fusion welding machine being used for the containment size
- Weld Temperature: Setting for the heating mirror, this value is based upon the containment pipe material and the wall thickness of the pipes.
- Weld Pressure: for initial heating and final fusion. The same pressure is used for both operations.
- Drag Pressure: The amount of pressure needed to just move the moveable pipe clamps and the pipe.
- The Bead Width: formed during the heating cycle.
- The Heating Soak Time: The time needed to heat the pipe wall to the proper fusion depth.
- The Changeover Time: The maximum time allowed for the removal of the heating mirror from the machine to the establishment of pressure contact between the pipe ends.
- Cooling Time: the fused joint must remain under pressure.

Equipment Preparation.
Place the welder on a solid surface so neither the weight of the pipe nor the machine operation will cause the machine to shift position during the welding cycle.

- Open the clamps and install the proper reducing inserts for the pipes being welded.
- Connect the welding machine and all components to the correct power source.
- Connect the hydraulic unit to the clamping frame.
- Preheat the heating mirror to the proper temperature determined and recorded on the welding table. Check the temperature of the mirror using the pyrometer or tempil stick. Adjust thermostat and recheck as needed. Allow time for mirror temperature to stabilize after any adjustment to the temperature controller.
  Approximate operating temperatures:
  Polypropylene: 374° F to 410° F (190° C to 210° C)
  Polyvinylidene Flouride: 404° F to 487° F (207° C to 253° C)

Use a pyrometer periodically to verify the surface temperature of the tool. Select multiple checkpoints on the mirror faces to ensure uniform surface temperature. In the field, a temperature-indicating crayon can be used on the sides of the heating mirror as a check on temperature conditions. DO NOT place the crayons on the mirror surfaces where the pipe ends will be welded be-cause the crayon will contaminate the fusion interface.

The mirror surfaces must be kept clean and free of contaminants such as dirt, oil and melted plastic buildup. This can cause excessive sticking and create unsatisfactory joints. Contaminants can be removed from the hot mirror surfaces using a clean, dry, dust-free and lint-free cloth. Cheesecloth is recommended as an appropriate material for cleaning the hot surface of the mirror. DO NOT use synthetic fabrics. Pigments, such as carbon black, may stain a heating surface and probably cannot be removed. Such stains will not contaminate the weld joint surfaces.

Mounting Pipe in Machine

On the fixed clamp side of the machine, mount the fixed pipe and clamp. Try to place one of the clamps over the internal support. Let the end of the pipe extend about an inch beyond the inboard side of the clamp. Mount the pipe so that, when the facer is mounted in the center of its mounting location, about 1/2 inch of clearance space is available between facer and pipe.

Mount the loose pipe in the machines moveable end, allowing about an inch to protrude beyond the inboard face of the clamp. Again, try to place one of the clamps over the internal support, and mount the pipe so that, when the facer is mounted in the center of its mounting location, about 1/2 inch of clearance space is available between facer and pipe.

Tighten all clamps securely to prevent the pipe from slipping axially during the weld cycle.
NOTE: When tightening the clamps, en-sure uniform pressure is applied so axial alignment is maintained. DO NOT over-tighten.

Pipe Alignment.
Draw the pipe ends together, but leave enough room between the two to align the carrier (inner) pipe ends both vertically and horizontally and match up the marks used to identify the location of the detection cable holes.

NOTE: Keep fingers and hands out of the area between the pipes. Pressures exerted by the machine are sufficient to crush bone.

To achieve proper alignment, it may be necessary to unclamp and re-adjust the pipe and clamps. 10% of the wall thickness is the maximum misalignment allowable. Any greater misalignment is NOT acceptable.

Leak Detection Hole.
Ensure that all ContainTech® inner pipe supports are properly aligned with a hole at the bottom of the pipe (6 O'clock position). This positioning is critical when leak detection pull cable is installed to ensure alignment when pulling the cable. Rotate the pipes in the clamping frame to align the hole location marks and then set the clamps. Match up both pipe ends so that the detection pull cable runs straight through, from one pipe to the other.

Drag Pressure.
At this time the drag pressure must be determined. Drag pressure is the amount of pressure exerted in the moveable end of the machine to initiate and maintain pipe movement. This pressure is determined by engaging the hydraulic unit in the forward motion (close) position and measuring the actual pressure required to move the pipe.

Set the pressure control valve to minimum and then place the control lever in the "close" position.
Increase the pressure with the pressure control valve until the moveable end just starts to move. Quickly reduce the pressure until the carriage is just barely moving. The gauge is now registering the drag pressure. Record this pressure value on the weld table for future use. The drag pressure may change from weld to weld and must be rechecked.
NOTE: Drag pressure must be added to the weld pressure as determined in Section 6.04.3.4. For example, if the chart pressure required for welding is 10 bars and the drag pressure is 3 bars, the total actual weld pressure required is 13 bars.

Facing Operation.
Place the facing tool between the pipe ends; secure the unit on the guide rails with the cotter pin. The facer must move freely back and forth along the rails. Figure A

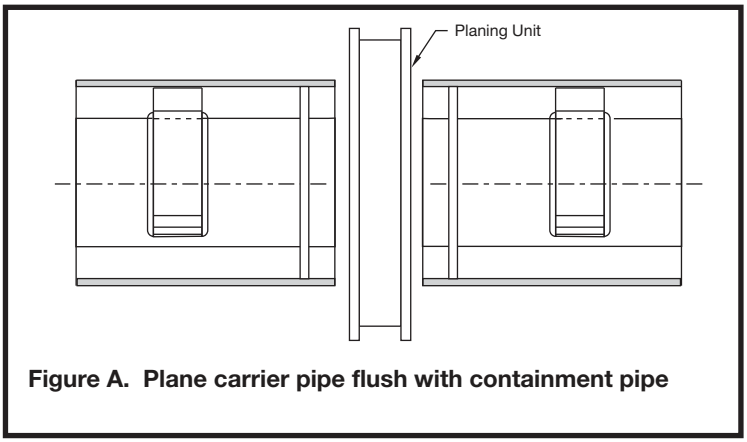


Figure A. Plane carrier pipe flush with containment pipe

NOTE: There is a safety switch in the facing tool which deactivates power if the tool is not securely placed on the guide rails.

- Activate the facer motor. Activate the moveable end by shifting the motion control lever to the close position, and bring the pipe ends into the cutters of the facing tool. Adjust the pressure control valve to apply minimum pressure to the facing tool.
- Carefully shave the ends of both pipes at the same time, using as little pressure from the hydraulic unit as possible (i.e. less than 2-3 bars). Facing cuts should produce a thin, continuous ribbon of material from both pipe ends. If a clean, square surface has been achieved at the end of one pipe and the other pipe end still requires facing, it is possible to continue the facing operation on the unfinished pipe by placing blocks between the clamp holding the finished pipe and the frame of the facing tool.
- Remove the facer, retract the moveable end by shifting the motion control lever to the open position. DO NOT stop the facer tool motor until the pipe ends have been retracted. To do so leaves a step in the pipe face surface
- Deactivate the facer and, when it has stopped, remove the facer and visually inspect the pipe ends to ensure a

smooth, uniform cut has been accomplished. Repeat the facing process until proper end-to-end mating surface has been achieved.

- Clean surface using a non-residue solvent (denatured alcohol) and a clean cloth.

Pipe Heating Procedure.

- Place the heating mirror into position between the pipe ends. Verify that the heat of the mirror is correct by using a temperature measuring device. Leak detected systems should use split plate mirrors. Figure B
- Align the pull cable to the 6 O'clock position and place it into the split of the mirror.

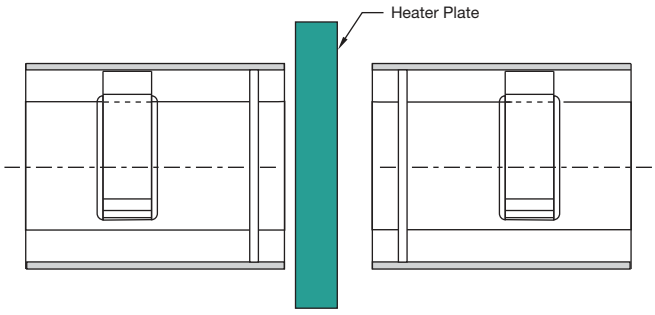


Figure B. Insert heating element between pipe ends

- Activate the moveable end by shifting the motion control lever to the close position, and bring the pipe ends SLOWLY up against the heating mirror. When the pipe ends are against the mirror, set the machine pressure using the pressure control valve to the designated weld pressure (weld pressure plus drag pressure) shown on the weld table.
- Observe the weld bead forming around the edge of each containment pipe. A uniform bead must form around the entire circumference of the pipe ends. The bead should be approximately equal on each side of the heating mirror.
- Maintain weld pressure until the bead width has reached the correct size given on the weld table.
- After achieving proper bead size, reduce the weld pressure using the pressure release lever. Establish light contact between the heating mirror and pipe ends (1 to 2 bars). Return the pressure release lever to the fixed position to maintain this light contact pressure. This step begins the heat soak period. Refer to the weld chart for proper heat soak time. Figure C
- Carefully observe the position of the mirror after the pressure is reduced to ensure contact remains with the

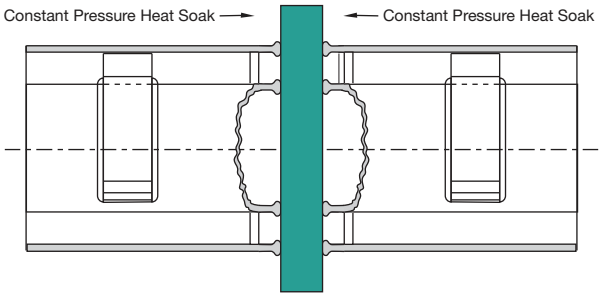


Figure C. Apply welding pressure to the heating element

pipe ends through-out the entire heat soak period. The pipe ends must not lose contact with the heating mirror at any time during this stage of the procedure.

- After heat soak has been completed, quickly retract the moveable end by shifting the motion control lever to the open position, remove the heating mirror, shift the motion control lever to the close position and move the pipe ends back together. Refer to changeover time on the weld chart.

It is imperative that this changeover be performed quickly and within the allotted time, but DO NOT slam pipes together.

Final Weld Operation.

- Move the pipe ends together to ensure full contact. Using the pressure control valve, increase the weld pressure until the pressure designated on the weld chart (weld pressure plus drag pressure) has been achieved. Figure D
- NOTE: When re-applying pressure, DO NOT slam the pipes back together, and DO NOT exceed the recommended

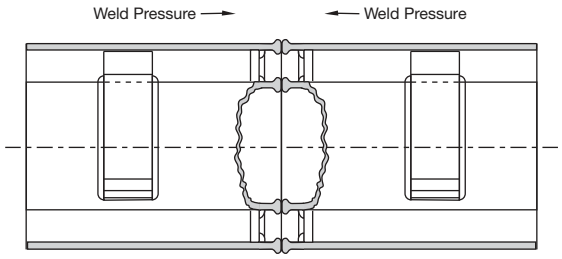


Figure D. Bring pipe ends together and apply welding pressure

weld pressure. Excessive force will push the molten material from the weld area and thus create a defective weld.

- NEVER allow the pipe ends to separate during the welding period. Check alignment marks to assure alignment has been maintained.
- Carefully observe the weld bead that forms during the weld cycle. This bead should be uniform around the pipe, round in shape and should curl back onto the outer pipe surface.

Weld Cooling Operation.

- Allow the weld to fully cool before releasing the weld pressure. Refer to the weld table for the minimum cooling time.
- NOTE: A fingernail test only confirms that the weld of the containment pipe is cool. Refer to the weld table to

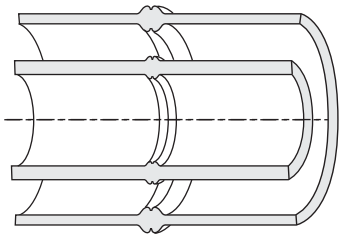


Figure E. Visual inspection of welds

determine the cooling time for the carrier pipe weld. Figure E

- After the cooling time has elapsed, release all pressure from the moveable end by opening the pressure release lever and by setting the motion control lever in the neutral position.

Final Operations.

- Loosen all clamps, open all jaws, raise the pipe slightly above the lower clamp jaws and move the machine to the next welding position. Insert another piece of pipe and repeat this entire procedure.

Pipe Supports

Typically, the spacing between hangers is shorter due to the flexibility of plastic. In addition, the type of hanger is important. Hangers should be placed based on the spacing requirements provided in Table 1. Since thermoplastic materials vary in strength and rigidity, it is important to select hanging distances based on the material you are hanging. Also, operating conditions must be considered. If the pipe is operated at a higher temperature, the amount of hangers will generally be increased. Finally, if the system is exposed to thermal cycling, the placement of hangers, guides, and anchors is critical In these cases. The hanger locations should be identified by the system engineer and laid out to allow for expansion and contraction of the pipe over its life of operation.

When selecting hangers for a system, it is important to avoid using a hanger that will place a point load on the pipe when tightened. For example, a U-bolt hanger is not recommended for thermoplastic piping systems. See Figures 1 and 2.

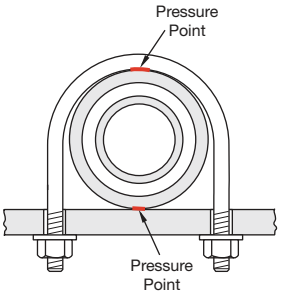


Figure 1. Effects of U-bolt on pipe
Not recommended

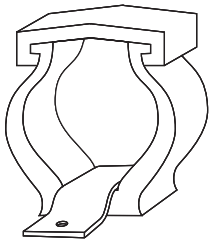


Figure 2. Recommended hanger

Hangers that secure the pipe 360° around the pipe are preferred. Thermoplastic clamps are also recommended over metal clamps, as they are less likely to scratch the pipe in the event of movement. If metal clamps are specified for the project, they should be inspected for rough edges that could damage the pipe. Ideally, if a metal clamp is being used, an elastomeric material should be used in between the pipe and
the clamp. This is a must for PVDF and E-CTFE systems, which are less tolerant to scratching.

Table 1 - Double Containment External Support Spacing (inches)*

Containment Size	PP		PVDF
	SDR11 / PN10 / 150psi	SDR33 / PN3.2 / 45psi	
3	72	N/A	124
4	96	70	130
6	108	80	144
8	112	86	157
10	118	98	165
12	125	110	165
14	137	125	N/A
16	150	140	N/A
18	N/A	148	N/A
20	N/A	148	N/A
24	N/A	170	N/A

* Support spacing is based on S.G. of 1.0. Corrections factors must be used for denser fluids as follows:
0.90 for S.G.=1.5, 0.85 for S.G.=2.0 and 0.80 for S.G.=2.5.
Support spacing based on water at 68° F.
Corrections factors must be used for elevated temperatures. Refer to Table 2.

Table 2 - Double Containment Support Spacing Temperature Correction Factors

Temperature °F	PP	PVDF
73	1.00	1.00
100	0.94	0.85
140	0.86	0.71
180	0.76	0.64
200	N/A	0.50
240	N/A	0.30
280	N/A	0.20

Testing

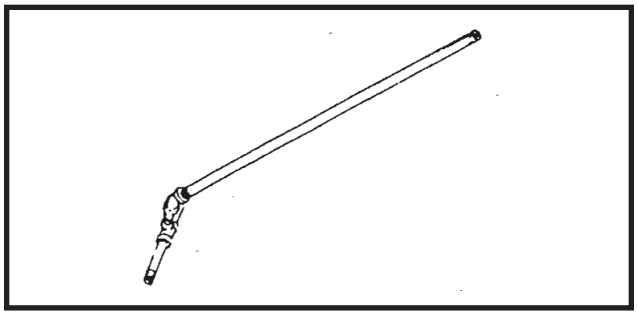
The containment piping shall be air tested at 5 psig, the carrier pipe shall be hydrostatically tested at 1.5 times operating pressure or 10 feet of head pressure for drainage systems. The test pressures shall be held for not less than one (1) hour. The contractor shall strictly adhere to the installation guidelines supplied by the system manufacturer and shall keep the secondary containment system clean and dry at all times during the installation process.

Proper venting of the system is necessary during the testing of the system and system operation.

BACKFILL PROCEDURES

NOTE: Although it may be necessary to partially backfill the trench in order to perform the piping installation and testing, DO NOT complete backfill operation until after successful hydrostatic test of the carrier pipe, air test of the containment pipe, and test of the leak detection system (if equipped).

Materials.
The most crucial part of the backfill process is the compaction of soil underneath and alongside the conduit. A hand tamping device can be constructed easily and economically by joining small diameter pipe. This tool will compact the soil firmly and evenly around the conduit and should be used instead of mechanical tampers when compacting to prevent damage to the piping.



A hand tamping device can be constructed easily and economically by joining small diameter pipe

If SIMTECH's recommended procedures are followed, a minimum burial depth of 2 feet can be established.
Special analysis of minimum burial depths is required at taxiways, runways, railways and other areas of high surface loading conditions. It is recommended that the customer contact both SIMTECH and the local authority for more specific instructions.

Backfill Description.

1. Sand or a sand-gravel mixture in which the gravel is either pea gravel or crushed stone without sharp edges.
2. Particles not larger than a half-inch in diameter.
3. 90% of the soil passing a No. 4 sieve.
4. 90% of the remainder retained by a No. 200 sieve.
5. Separate all unsuitable soil from the backfill soil.

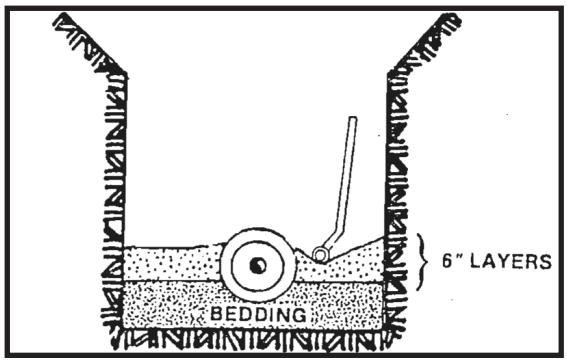
Initial Backfill.

- Prior to backfilling, remove any foreign materials, such as shoring, braces and support blocks.

NOTE: DO NOT use frozen fill, sod, cinders or stones greater than a quarter inch in diameter as primary backfill.

- Carefully compact the area directly around the piping in 6-inch layers.
- Proper compaction of the haunching materials, that section of the embedment extending from the bottom of the pipe to the spring line, should be performed to provide soil densities as specified by the design engineer.
- Primary backfilling of selected earth should be packed and tamped to 6 inches minimum over the top of the jacket.
- Compact in 6-inch layers to 90-95% proctor. If surface loading conditions exist, backfill to grade in this manner.

NOTE: DO NOT use wheeled or tracked vehicles for tamping.



Carefully compact the area directly around the piping in 6-inch layers.

Final Backfill (95%) Compaction.

The backfill operation can now be completed by any convenient means. Remainder of backfill should be free of large boulders, and rocks larger than 6 inches in diameter, frozen earth, or foreign matter.

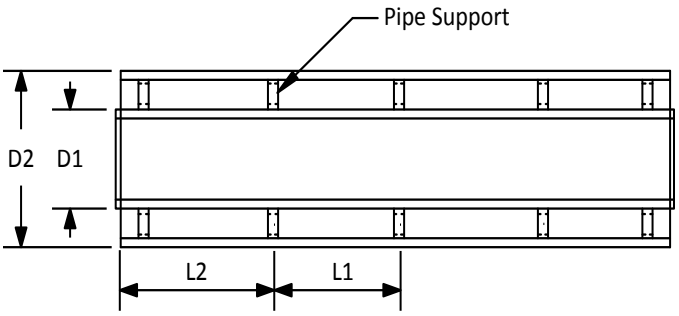
After placement and compaction of pipe embedment materials, the balance of backfill materials may be machine

placed. Provide compaction to required soil densities. Use of mechanical compaction equipment to complete the final backfill is suggested, but DO NOT use mechanical compactors until the piping is covered with at least 12 inches of firmly compacted soil.

Under normal conditions, backfill to grade in 1-foot lifts and compact to 85% proctor. Native soil can be used, provided it is non-organic and all particles are less than 1 inch in size.

Dimensional Data

PIPE



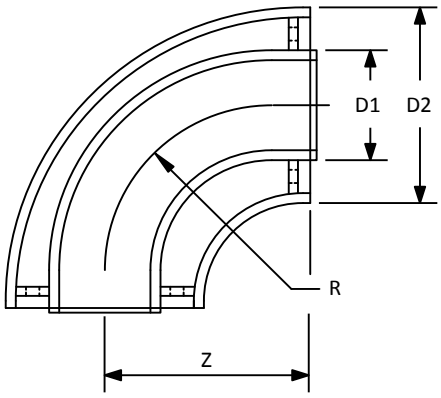
Material: AlphaPlus® Polypropylene

Pressure Rating: 150x150psi
150x45psi
45psi x 45psi

Connection: Simultaneous Butt-Fusion

Size	D1 in	D2 in	L1 FT	L2 FT	Number Of Supports	Length
1” x 3”	1.26	3.54	5.25	3.0	5	16.4
2” x 4”	2.48	4.33	5.25	3.0	5	16.4
3” x 6”	3.54	6.30	5.25	3.0	5	16.4
4” x 8”	4.33	7.87	5.25	3.0	5	16.4
6” x 10”	6.30	9.84	5.25	3.0	5	16.4
8” x 12”	7.87	12.40	5.25	3.0	5	16.4
10” x 14”	9.84	13.98	5.25	3.0	5	16.4
12” x 16”	12.40	15.75	7.50	3.5	4	16.4
14” x 18”	13.98	17.72	7.50	3.5	4	16.4
16” x 20”	15.75	19.69	7.50	3.5	4	16.4
18” x 24”	17.72	24.80	7.50	3.5	4	16.4

90° ELBOW



Material: AlphaPlus® Polypropylene

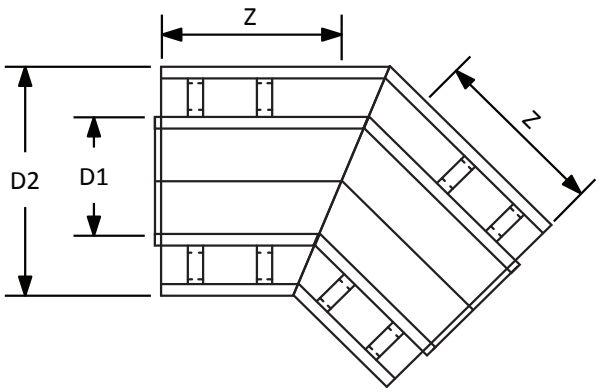
Pressure Rating: 150x150psi
150x45psi
45psi x 45psi

Connection: Simultaneous Butt-Fusion

NOMINAL PIPE SIZE	D1 in	D2 in	R in	Z in
1” x 3”	1.26	3.54	3.54	3.66
2” x 4”	2.48	4.33	4.33	4.53
3” x 6”	3.54	6.30	6.30	6.57
4” x 8”	4.33	7.87	7.87	8.11
6” x 10”	6.30	9.84	9.84	10.08
8” x 12”	7.87	12.40	12.40	12.76
10” x 14”	9.84	13.98	13.98	15.16
12” x 16”	12.40	15.75	15.75	17.24
14” x 18”	13.98	17.72	17.72	32.80
16” x 20”	15.75	19.69	19.69	35.43
18” x 24”*	17.72	24.80	24.80	38.39

* Outer Elbow is Segmented

45° ELBOW



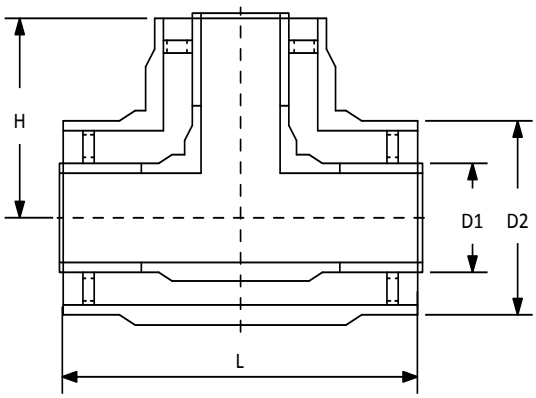
Material: AlphaPlus® Polypropylene

Pressure Rating: 150x150psi
150x45psi
45psi x 45psi

Connection: Simultaneous Butt-Fusion

NOMINAL PIPE SIZE	D1 in	D2 in	Z in
1” x 3”	1.26	3.54	6
2” x 4”	2.48	4.33	6
3” x 6”	3.54	6.30	8
4” x 8”	4.33	7.87	10
6” x 10”	6.30	9.84	12
8” x 12”	7.87	12.40	14
10” x 14”	9.84	13.98	16
12” x 16”	12.40	15.75	18
14” x 18”	13.98	17.72	20
16” x 20”	15.75	19.69	22
18” x 24”	17.72	24.80	24

TEE



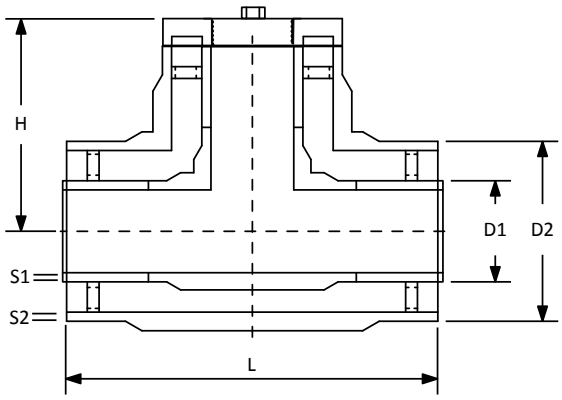
Material: AlphaPlus® Polypropylene

Pressure Rating: 150x150psi
150x45psi
45psi x 45psi

Connection: Simultaneous Butt-Fusion

NOMINAL PIPE SIZE	D1 in	D2 in	H in	L in
2” x 4”	2.48	4.33	4.13	8.46
3” x 6”	3.54	6.30	5.51	10.63
4” x 8”	4.33	7.87	6.69	13.39
6” x 10”	6.30	9.84	8.46	17.24
8” x 12”	7.87	12.40	10.63	21.06
10” x 14”	9.84	13.98	13.62	27.20
12” x 16”	12.40	15.75	13.98	27.95
14” x 18”	13.98	17.72	18.90	37.80
16” x 20”	15.75	19.69	19.69	39.37
18” x 24”	17.72	24.80	20.67	41.34

Tee w/ Clean Out



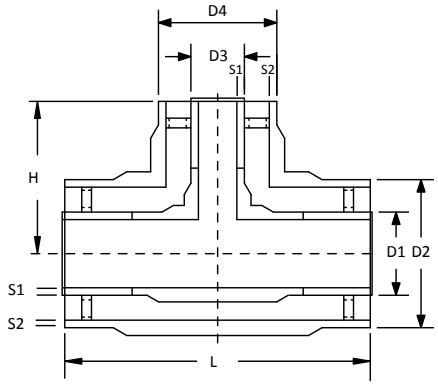
Material: AlphaPlus® Polypropylene

Pressure Rating: 150x150psi
150x45psi
45psi x 45psi

Connection: Simultaneous Butt-Fusion

NOMINAL PIPE SIZE	D1 in	D2 in	H in	L in
1" x 3"	1.26	3.54	5.81	8.23
2" x 4"	2.48	4.33	5.88	8.46
3" x 6"	3.54	6.30	7.26	10.63
4" x 8"	4.33	7.87	8.69	13.39
6" x 10"	6.30	9.84	10.71	17.24
8" x 12"	7.87	12.40	13.13	21.06
10" x 14"	9.84	13.98	16.37	27.20
12" x 16"	12.40	15.75	16.98	27.95
14" x 18"	13.98	17.72	20.72	35.43
16" x 20"	15.75	19.69	20.72	35.24

TEE: REDUCED



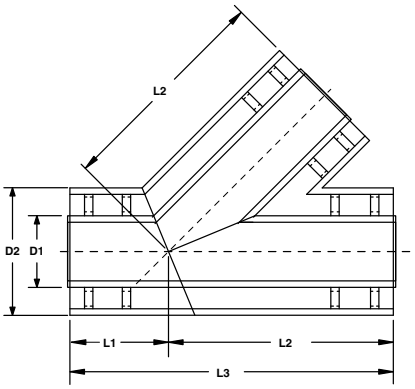
Material: AlphaPlus® Polypropylene

Pressure Rating: 150x150psi
150x45psi
45psi x 45psi

Connection: Simultaneous Butt-Fusion

NOMINAL PIPE SIZE	D1 in	D2 in	D3 in	D4 in	H in	L in
3" x 6" x 2" x 4"	3.54	6.30	2.48	4.33	11.42	10.63
4" x 8" x 2" x 4"	4.33	7.87	2.48	4.33	19.29	13.39
4" x 8" x 2" x 6"	4.33	7.87	2.48	6.30	14.41	13.39
4" x 8" x 3" x 6"	4.33	7.87	3.54	6.30	14.41	13.39
6" x 10" x 2" x 4"	6.30	9.84	2.48	4.33	29.21	17.24
6" x 10" x 3" x 6"	6.30	9.84	3.54	6.30	24.33	17.24
6" x 10" x 4" x 8"	6.30	9.84	4.33	7.87	24.72	17.24
8" x 12" x 3" x 6"	7.87	12.40	3.54	6.30	26.42	21.06
8" x 12" x 4" x 8"	7.87	12.40	4.33	7.87	20.87	21.06
8" x 12" x 6" x 10"	7.87	12.40	6.30	9.84	20.24	21.06
10" x 14" x 4" x 8"	9.84	13.98	4.33	7.87	30.31	27.20
10" x 14" x 6" x 10"	9.84	13.98	6.30	9.84	23.39	27.20
10" x 14" x 8" x 12"	9.84	13.98	7.87	12.40	23.39	27.20
12" x 16" x 6" x 10"	12.40	15.75	6.30	9.84	24.41	27.95
12" x 16" x 8" x 12"	12.40	15.75	7.87	12.40	24.41	27.95
12" x 16" x 10" x 14"	12.40	15.75	9.84	13.98	24.41	27.95
14" x 18" x 8" x 12"	13.98	17.72	7.87	12.40	25.55	35.43
14" x 18" x 10" x 14"	13.98	17.72	9.84	13.98	25.55	35.43
14" x 18" x 12" x 16"	13.98	17.72	12.40	15.75	25.55	35.43
16" x 20" x 14" x 18"	15.75	19.69	13.98	17.72	27.17	35.24

LATERAL



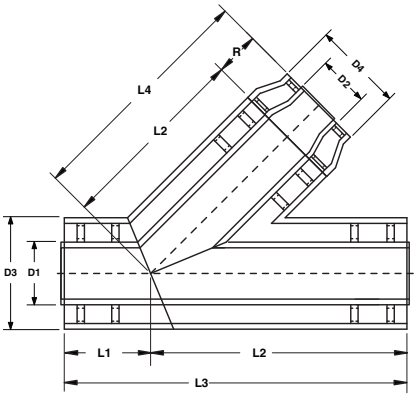
Material: AlphaPlus® Polypropylene

Pressure Rating: 150x150psi
150x45psi
45psi x 45psi

Connection: Simultaneous Butt-Fusion

NOMINAL PIPE SIZE	D1 in	D2 in	L1 in	L2 in	L3 in
1” x 3”	1.26	3.54	6.00	12.00	18.00
2” x 4”	2.48	4.33	6.00	12.00	18.00
3” x 6”	3.54	6.30	8.00	16.00	24.00
4” x 8”	4.33	7.87	10.00	20.00	30.00
6” x 10”	6.30	9.84	12.00	24.00	36.00
8” x 12”	7.87	12.40	14.00	28.00	42.00
10” x 14”	9.84	13.98	16.00	32.00	48.00
12” x 16”	12.40	15.75	18.00	36.00	54.00
14” x 18”	13.98	17.72	20.00	40.00	60.00
16” x 20”	15.75	19.69	22.00	44.00	66.00
18” x 24”	17.72	24.80	24.00	48.00	72.00

LATERAL: REDUCED



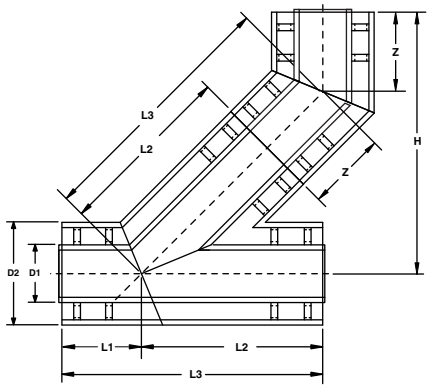
Material: AlphaPlus® Polypropylene

Pressure Rating: 150x150psi
150x45psi
45psi x 45psi

Connection: Simultaneous Butt-Fusion

NOMINAL PIPE SIZE	D1 in	D2 in	D3 in	D4 in	L1 in	L2 in	L3 in	L4 in	R in
3" x 6" x 2" x 4"	3.54	2.48	6.30	4.33	8	16	24	29.04	5.04
4" x 8" x 2" x 4"	4.33	2.48	7.87	4.33	10	20	30	40.75	10.75
4" x 8" x 3" x 6"	4.33	3.54	7.87	6.30	10	20	30	35.71	5.71
6" x 10" x 2" x 4"	6.30	2.48	9.84	4.33	12	24	36	47.73	11.73
6" x 10" x 3" x 6"	6.30	3.54	9.84	6.30	12	24	36	42.69	6.69
6" x 10" x 4" x 8"	6.30	4.33	9.84	7.87	12	24	36	43.09	7.09
8" x 12" x 3" x 6"	7.87	3.54	12.40	6.30	14	28	42	57.43	15.43
8" x 12" x 4" x 8"	7.87	4.33	12.40	7.87	14	28	42	51.72	9.72
8" x 12" x 6" x 10"	7.87	6.30	12.40	9.84	14	28	42	51.09	9.09
10" x 14" x 4" x 8"	9.84	4.33	13.98	7.87	16	32	48	64.73	16.73
10" x 14" x 6" x 10"	9.84	6.30	13.98	9.84	16	32	48	57.65	9.65
10" x 14" x 8" x 12"	9.84	7.87	13.98	12.40	16	32	48	57.65	9.65
12" x 16" x 6" x 10"	12.40	6.30	15.75	9.84	18	36	54	64.24	10.24
12" x 16" x 8" x 12"	12.40	7.87	15.75	12.40	18	36	54	64.24	10.24
12" x 16" x 10" x 14"	12.40	9.84	15.75	13.98	18	36	54	64.24	10.24
14" x 18" x 8" x 12"	13.98	7.87	17.72	12.40	20	60	80	89.06	9.06
14" x 18" x 10" x 14"	13.98	9.84	17.72	13.98	20	60	80	89.06	9.06
14" x 18" x 12" x 16"	13.98	12.40	17.72	15.75	20	60	80	89.06	9.06
16" x 20" x 14" x 18"	15.75	13.98	19.69	17.72	22	64	86	95.06	9.06

LATERAL: COMBO (SANITARY TEE)



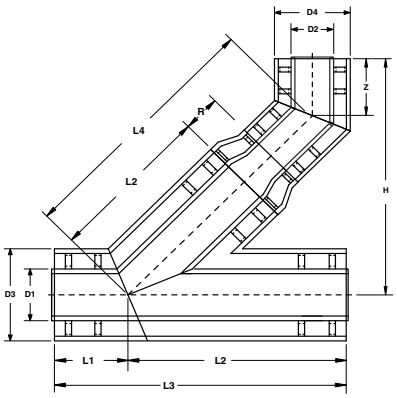
Material: AlphaPlus® Polypropylene

Pressure Rating: 150x150psi
150x45psi
45psi x 45psi

Connection: Simultaneous Butt-Fusion

NOMINAL PIPE SIZE	D1 in	D2 in	L1 in	L2 in	L3 in	Z in	H in
1” x 3”	1.26	3.54	6.00	12.00	18.00	6.00	22.00
2” x 4”	2.48	4.33	6.00	12.00	18.00	6.00	22.00
3” x 6”	3.54	6.30	8.00	16.00	24.00	8.00	25.00
4” x 8”	4.33	7.87	10.00	20.00	30.00	10.00	33.00
6” x 10”	6.30	9.84	12.00	24.00	36.00	12.00	37.00
8” x 12”	7.87	12.40	14.00	28.00	42.00	14.00	43.00
10” x 14”	9.84	13.98	16.00	32.00	48.00	16.00	50.00
12” x 16”	12.40	15.75	18.00	36.00	54.00	18.00	56.00
14” x 18”	13.98	17.72	20.00	40.00	60.00	20.00	62.00
16” x 20”	15.75	19.69	22.00	44.00	66.00	22.00	68.00
18” x 24”	17.72	24.80	24.00	48.00	72.00	24.00	74.00

LATERAL: REDUCED COMBO (SANITARY TEE)



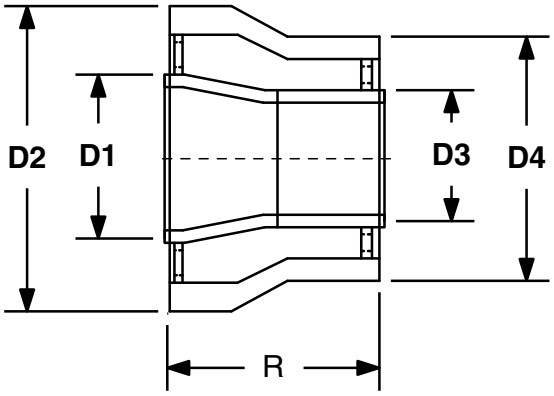
Material: AlphaPlus® Polypropylene

Pressure Rating: 150x150psi
150x45psi
45psi x 45psi

Connection: Simultaneous Butt-Fusion

NOMINAL PIPE SIZE	D1 in	D2 in	D3 in	D4 in	L1 in	L2 in	L3 in	L4 in	R in	Z in
3” x 6” x 2” x 4”	3.54	2.48	6.30	4.33	8	16	24	29.04	5.04	8
4” x 8” x 2” x 4”	4.33	2.48	7.87	4.33	10	20	30	40.75	10.75	10
4” x 8” x 3” x 6”	4.33	3.54	7.87	6.30	10	20	30	35.71	5.71	10
6” x 10” x 2” x 4”	6.30	2.48	9.84	4.33	12	24	36	47.73	11.73	12
6” x 10” x 3” x 6”	6.30	3.54	9.84	6.30	12	24	36	42.69	6.69	12
6” x 10” x 4” x 8”	6.30	4.33	9.84	7.87	12	24	36	43.09	7.09	12
8” x 12” x 3” x 6”	7.87	3.54	12.40	6.30	14	28	42	57.43	15.43	14
8” x 12” x 4” x 8”	7.87	4.33	12.40	7.87	14	28	42	51.72	9.72	14
8” x 12” x 6” x 10”	7.87	6.30	12.40	9.84	14	28	42	51.09	9.09	14
10” x 14” x 4” x 8”	9.84	4.33	13.98	7.87	16	32	48	64.73	16.73	16
10” x 14” x 6” x 10”	9.84	6.30	13.98	9.84	16	32	48	57.65	9.65	16
10” x 14” x 8” x 12”	9.84	7.87	13.98	12.40	16	32	48	57.65	9.65	16
12” x 16” x 6” x 10”	12.40	6.30	15.75	9.84	18	36	54	64.24	10.24	18
12” x 16” x 8” x 12”	12.40	7.87	15.75	12.40	18	36	54	64.24	10.24	18
12” x 16” x 10” x 14”	12.40	9.84	15.75	13.98	18	36	54	64.24	10.24	18
14” x 18” x 8” x 12”	13.98	7.87	17.72	12.40	20	60	80	89.06	9.06	20
14” x 18” x 10” x 14”	13.98	9.84	17.72	13.98	20	60	80	89.06	9.06	20
14” x 18” x 12” x 16”	13.98	12.40	17.72	15.75	20	60	80	89.06	9.06	20
16” x 20” x 14” x 18”	15.75	13.98	19.69	17.72	22	64	86	95.06	9.06	22

REDUCER



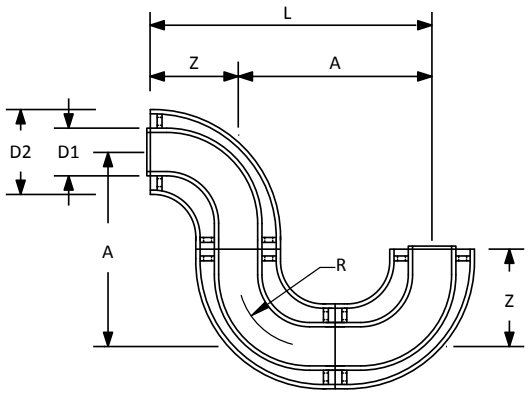
Material: AlphaPlus® Polypropylene

Pressure Rating: 150x150psi
150x45psi
45psi x 45psi

Connection: Simultaneous Butt-Fusion

NOMINAL PIPE SIZE	D1 in	D2 in	D3 in	D4 in	R in
3" x 6" x 2" x 4"	3.54	6.30	2.48	4.33	5.04
4" x 8" x 2" x 4"	4.33	7.87	2.48	4.33	10.59
4" x 8" x 3" x 6"	4.33	7.87	3.54	6.30	5.71
6" x 10" x 2" x 4"	6.30	9.84	2.48	4.33	11.57
6" x 10" x 3" x 6"	6.30	9.84	3.54	6.30	6.69
6" x 10" x 4" x 8"	6.30	9.84	4.33	7.87	7.09
8" x 12" x 3" x 6"	7.87	12.40	3.54	6.30	15.28
8" x 12" x 4" x 8"	7.87	12.40	4.33	7.87	9.72
8" x 12" x 6" x 10"	7.87	12.40	6.30	9.84	9.09
10" x 14" x 4" x 8"	9.84	13.98	4.33	7.87	16.57
10" x 14" x 6" x 10"	9.84	13.98	6.30	9.84	9.65
10" x 14" x 8" x 12"	9.84	13.98	7.87	12.40	9.65
12" x 16" x 6" x 10"	12.40	15.75	6.30	9.84	10.24
12" x 16" x 8" x 12"	12.40	15.75	7.87	12.40	10.24
12" x 16" x 10" x 14"	12.40	15.75	9.84	13.98	10.24
14" x 18" x 8" x 12"	13.98	17.72	7.87	12.40	9.06
14" x 18" x 10" x 14"	13.98	17.72	9.84	13.98	9.06
14" x 18" x 12" x 16"	13.98	17.72	12.40	15.75	9.06
16" x 20" x 14" x 18"	15.75	19.69	13.98	17.72	9.06

P-TRAP



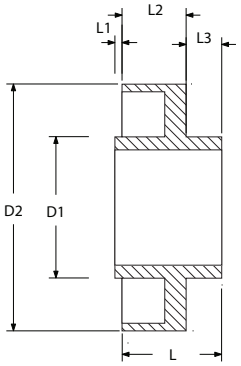
Material: AlphaPlus® Polypropylene

Pressure Rating: 150x150psi
150x45psi
45psi x 45psi

Connection: Simultaneous Butt-Fusion

NOMINAL PIPE SIZE	D1 in	D2 in	A in	L in	R in	Z in
1” x 3”	1.26	3.54	7.32	10.98	3.54	3.66
2” x 4”	2.48	4.33	9.06	13.58	4.33	4.53
3” x 6”	3.54	6.30	13.15	19.72	6.30	6.57
4” x 8”	4.33	7.87	16.22	24.33	7.87	8.11
6” x 10”	6.30	9.84	20.16	30.24	9.84	10.08
8” x 12”	7.87	12.40	25.51	38.27	12.40	12.76
10” x 14”	9.84	13.98	30.31	45.47	13.98	15.16
12” x 16”	12.40	15.75	34.49	51.73	15.75	17.24
14” x 18”	13.98	17.72	35.04	52.56	17.72	17.52
16” x 20”	15.75	19.69	35.04	52.56	19.69	17.52

TERMINATION FITTING



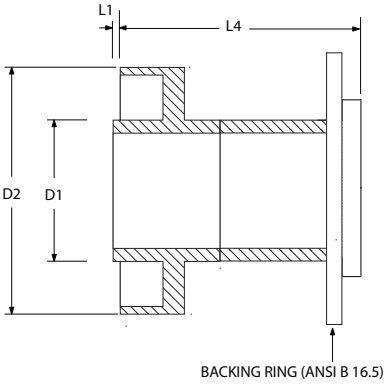
Material: AlphaPlus® Polypropylene

Pressure Rating: 150x150psi
150x45psi
45psi x 45psi

Connection: Simultaneous Butt-Fusion

NOMINAL PIPE SIZE	D1 in	D2 in	L in	L1 in	L2 in	L3 in
1" x 3"	1.26	3.54	2.00	0.13	1.25	0.75
2" x 4"	2.48	4.33	2.00	0.13	1.25	0.75
3" x 6"	3.54	6.30	2.00	0.13	1.25	0.75
4" x 8"	4.33	7.87	2.00	0.13	1.25	0.75
6" x 10"	6.30	9.84	2.00	0.13	1.25	0.75
8" x 12"	7.87	12.40	2.00	0.13	1.25	0.75
10" x 14"	9.84	13.98	2.00	0.13	1.25	0.75
12" x 16"	12.40	15.75	2.25	0.13	1.50	0.75
14" x 18"	13.98	17.72	2.25	0.13	1.50	0.75
16" x 20"	15.75	19.69	2.25	0.13	1.50	0.75
18" x 24"	17.72	24.80	2.25	0.13	1.50	0.75

TERMINATION FITTING - FLANGED



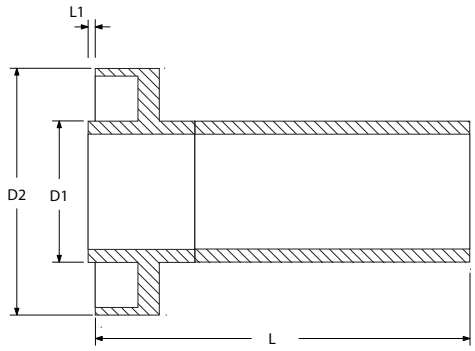
Material: AlphaPlus® Polypropylene

Pressure Rating: 150x150psi
150x45psi
45psi x 45psi

Connection: Simultaneous Butt-Fusion

NOMINAL PIPE SIZE	D1 in	D2 in	L1 in	L4 in
1” x 3”	1.26	3.54	0.13	5.15
2” x 4”	2.48	4.33	0.13	5.19
3” x 6”	3.54	6.30	0.13	5.07
4” x 8”	4.33	7.87	0.13	6.72
6” x 10”	6.30	9.84	0.13	6.65
8” x 12”	7.87	12.40	0.13	8.61
10” x 14”	9.84	13.98	0.13	9.17
12” x 16”	12.40	15.75	0.13	9.85
14” x 18”	13.98	17.72	0.13	7.68
16” x 20”	15.75	19.69	0.13	7.56

TERMINATION FITTING w/ IPS CONNECTION



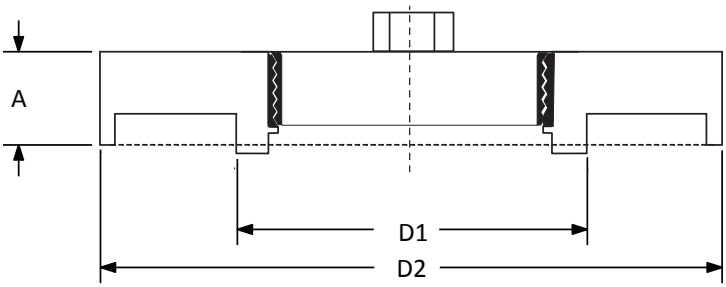
Material: AlphaPlus® Polypropylene

Pressure Rating: 150x150psi
150x45psi
45psi x 45psi

Connection: Simultaneous Butt-Fusion

NOMINAL PIPE SIZE	D1 in	D2 in	L in	L1 in
1” x 3”	1.26	3.54	8.00	0.13
2” x 4”	2.48	4.33	8.00	0.13
3” x 6”	3.54	6.30	8.00	0.13
4” x 8”	4.33	7.87	8.00	0.13
6” x 10”	6.30	9.84	8.00	0.13
8” x 12”	7.87	12.40	8.00	0.13
10” x 14”	9.84	13.98	8.00	0.13
12” x 16”	12.40	15.75	8.25	0.13
14” x 18”	13.98	17.72	8.25	0.13
16” x 20”	15.75	19.69	8.25	0.13
18” x 24”	17.72	24.80	8.25	0.13

Clean Out



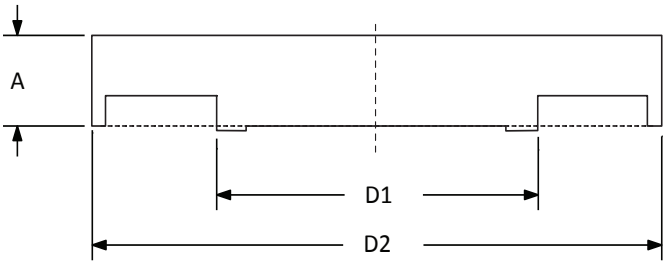
Material: AlphaPlus® Polypropylene

Pressure Rating: 150x150psi
150x45psi
45psi x 45psi

Connection: Simultaneous Butt-Fusion

NOMINAL PIPE SIZE	D1 in	D2 in	A in
1” x 3”	1.26	3.54	1.75
2” x 4”	2.48	4.33	1.75
3” x 6”	3.54	6.30	1.75
4” x 8”	4.33	7.87	2
6” x 10”	6.30	9.84	2.25
8” x 12”	7.87	12.40	2.5
10” x 14”	9.84	13.98	2.75
12” x 16”	12.40	15.75	3
14” x 18”	13.98	17.72	3
16” x 20”	15.75	19.69	3

Cap



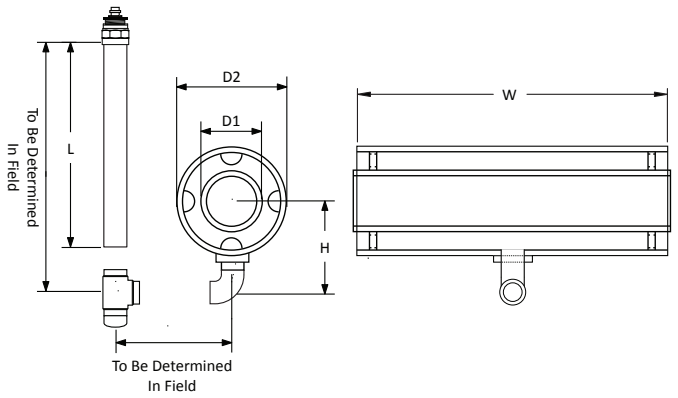
Material: AlphaPlus® Polypropylene

Pressure Rating: 150x150psi
150x45psi
45psi x 45psi

Connection: Simultaneous Butt-Fusion

NOMINAL PIPE SIZE	D1 in	D2 in	A in
1” x 3”	1.26	3.54	1.75
2” x 4”	2.48	4.33	1.75
3” x 6”	3.54	6.30	1.75
4” x 8”	4.33	7.87	2
6” x 10”	6.30	9.84	2.25
8” x 12”	7.87	12.40	2.5
10” x 14”	9.84	13.98	2.75
12” x 16”	12.40	15.75	3
14” x 18”	13.98	17.72	3
16” x 20”	15.75	19.69	3

LOW POINT LEAK DETECTION PORT



Material: AlphaPlus® Polypropylene

Pressure Rating: 150x150psi
150x45psi
45psi x 45psi

Connection: Simultaneous Butt-Fusion

NOMINAL PIPE SIZE	D1 in	D2 in	H in	W in	L Feet
1” x 3”	1.26	3.54	6.25	18	16.4’
2” x 4”	2.48	4.33	6.25	18	16.4’
3” x 6”	3.54	6.30	9.00	18	16.4’
4” x 8”	4.33	7.87	11.00	18	16.4’
6” x 10”	6.30	9.84	12.25	18	16.4’
8” x 12”	7.87	12.40	13.50	18	16.4’
10” x 14”	9.84	13.98	14.49	18	16.4’
12” x 16”	12.40	15.75	15.37	18	16.4’
14” x 18”	13.98	17.72	16.36	18	16.4’
16” x 20”	15.75	19.69	17.34	18	16.4’

WARRANTY

Simtech Process Systems products are warranted to be free from defects in materials and workmanship for one (1) year from date of shipment. No claim shall be permitted under this warranty unless Buyer gives Simtech Process Systems written notice of all respects in which Buyer claims the product to be defective. Notice must be received within ten (10) days from the date which the Buyer discovers, or should have discovered the defect. Buyer shall give Simtech Process Systems a reasonable opportunity to inspect the product after notice has been given. This warranty shall not apply to any products or components, which have been subjected to abnormal use, negligence or accident.

Seller's sole obligation under this warranty shall be limited solely on the repair or replacement, as elected by Simtech Process Systems, of defective or nonconforming material. To the maximum extent permitted by law, Buyer irrevocably waives all claims for money damages relating to the condition, use and performance of the goods purchased. In no event shall Simtech Process Systems liability exceed the purchase price of the product sold by Simtech Process Systems

In no event, whether because of a breach of warranty or representation or any other cause, whether based upon contract, tort, warranty or otherwise, arising out of the performance or nonperformance by seller of its obligations under this agreement or with respect to the products sold pursuant here to; shall seller be liable for lost earnings, income or profits or indirect, incidental, liquidated or consequential damages.

The implied warranties of merchantability and fitness for a particular purpose except as set forth in this warranty, express or implied, are hereby disclaimed and excluded. Nothing shall be construed as an additional warranty unless specifically designated as such in writing and signed by Simtech Process Systems

Simtech Process Systems reserves the right, in its discretion, at any time and from time to time, to make changes to any specification, data or information contained herein.

WTP / WWTP
- Chemical Feed Systems
- Chlorination & Fluoridation
- Pressure Regulation

Chlor-Alkali
- Chlorine Processing
- Brine Preparation
- Caustic Sodas

Mining
- Sulfuric Acid
- Hydrochloric Acid
- Slurry Piping

Aquatics
- Natatoriums
- Corrosion-Free Valves
- Valve Automation

Food and Beverage
- Dairy
- Brewing
- Chemical Sterilization

O.E.M. Supplier
- Valves and Automation
- Controls and Instrumentation
- Custom Fabrication

Automotive
- Fume Exhaust
- Washdown Systems
- Process Waste Drainage

High Purity Water
- RODI Systems
- pH Control
- Semiconductor Cleaning

Power / Utilities
- Demineralization
- Flue Gas Desulphurization
- Nuclear Process Drainage

Biotech / Pharma
- RODI High Purity Water
- WFI Systems
- Environmental Containment

Laboratory Exhaust
- Corrosive Fume Extraction
- Wet Bench Hoods
- Chemical Box Exhaust

Pulp and Paper
- Bleach and Liquor Lines
- Spent Acid and Caustic Lines
- Wet Scrubber Systems

Chemical Processing
- Chemical Transfer & Storage
- Metering and Mixing
- Process Fume Extraction

Life Sciences
- High Purity RODI Water
- Laboratory Fume Exhaust
- University Facilities

Steel / Metal Finishing
- Piping Lines
- Electroplating
- Fume Exhaust

SIMTECH Process Systems | Expertise In Engineered Plastics

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