

# Fiber Glass Systems

UL/ULC Listed  
RED THREAD® IIA Piping System

## General Installation Instructions



**Time-Tested  
Fiberglass Primary Piping and  
Secondary Containment Piping for  
Underground Fuel Installations**



## IMPORTANT - READ THIS FIRST

Before beginning the actual assembly procedures, read and verify all individuals involved in the installation thoroughly understand the following suggestions and precautions.

Matching taper angles for the spigot and the bell make it possible to mechanically “lock up” a joint by wedging the spigot into the bell. This produces a very thin line of adhesive called the bond line, or glue line, that is only a few thousandths of an inch thick.

In all cases, the bonding surfaces must be clean before applying adhesive.

Joint strength of the bell and spigot joint is controlled by the adhesive thickness between the two matching tapered surfaces. The adhesive is relatively brittle in thick sections and fails easily if the bond line is too thick. The mechanical lock determines adhesive thickness.

Joints that are not “locked up” during installation may pass an initial steady pressure test but can fail prematurely at a later date due to reduced bond strength caused by the thick adhesive. Therefore, it is essential that the installation crew be familiar with the joint concept and understand the importance of completely inserting and locking the spigot into the bell. The mechanical locking of the joint is essential to develop the full strength of the joint.

Using the mechanical force (such as hammering against a wooden block placed against a fitting or bell end of pipe) helps achieve “lock up.” NOTE: This is the same mechanical lock of matching tapers that is commonly used in machine tools. For T.A.B. (threaded and bonded) joints, special T.A.B. wrenches or Ridgid strap wrenches are recommended to achieve the mechanical lock up of the joint.

Cool weather conditions require special precautions when bonding pipe and fittings. The adhesive is very viscous (thick) when it is cool or when it is applied to cool pipe. This thick adhesive can actually be stiff enough to prevent complete joint “lock up.” There are different installation procedures for both warm and cool weather installations. This concept is often overlooked when a crew installs piping and there are significant temperature variations throughout the day or week.

All bonding surfaces must be factory fresh in appearance. When end caps have been lost, surfaces will weather and result in loss of bond strength. When surfaces are weathered, retaper spigots and sand bells to achieve a factory fresh appearance. NOTE: DO NOT USE T.A.B. COUPLINGS THAT ARE WEATHERED.

Matching taper angles allows the joint to mechanically lock up, producing a thin line of adhesive called a glue line.

Bonding surfaces must be clean.

Joint strength is controlled by the adhesive thickness - thin is good, thick is bad.

Mechanical locking of the joint is absolutely essential to develop full strength of the joint.

Using mechanical force helps achieve joint lock up.

Follow the appropriate installation procedures for warm or cool weather.

All bonding surfaces must be factory fresh in appearance.

# INTRODUCTION

## INTRODUCTION

### FIBER GLASS SYSTEMS PIPE INSTALLATION HANDBOOK UL/ULC Listed RED THREAD IIA Product Primary and Secondary Containment Pipe and Fittings

This manual is offered to assist in the proper fabrication and installation procedures when assembling Fiber Glass Systems (FGS) piping systems.

This manual covers the installation procedures for FGS RED THREAD IIA primary and secondary containment pipe and fittings.

Part one details installation procedures for 2", 3", and 4" (50, 75, and 100 mm) diameter primary product piping.

Part two explains installation procedures for 3", 4" and 6" (75, 100 and 150 mm) diameter secondary containment piping.

#### ENGINEERING AND PRODUCT DATA:

FGS provides *Success by Design* software to perform flow and other calculations. Included in the CD-Rom is a complete catalog and installation video. Contact your FGS representative to obtain a copy or visit our web site at [www.smithfibercast.com/ULPiping.htm](http://www.smithfibercast.com/ULPiping.htm).



Fiber Glass Systems' products must be installed and used in accordance with sound, proven practice and common sense.

The information supplied by FGS in its literature must be considered as an expression of guidelines based on field experience rather than a warranty for which FGS assumes responsibility. FGS offers a limited warranty of its products in the *Terms and Conditions of Sale*. The information contained in the literature and catalogs furnished by FGS cannot ensure, of itself, a successful installation and is offered to customers subject to these limitations and explanations.

It is the policy of Fiber Glass Systems to improve its products continually. Therefore, the company reserves the right, without notice, to change specifications and/or design at any time without incurring an obligation for equipment previously sold. Descriptions contained in this catalog are for the purpose of identification and neither limit nor extend the standard product limited warranty set forth in the *Terms and Conditions of Sale and Trade Customs*.

#### SAFETY



This safety alert symbol indicates an important safety message. When this symbol is visible, be alert to the possibility of personal injury.

#### CAUTION

This pipe may carry hazardous material and/or operate at a hazardous pressure level; therefore, it is imperative the instructions in this manual are followed to avoid serious personal injury or property damage. In any event, improper installation can cause injury or damage. Installers should read and follow all cautions and warnings on adhesive kits, heat packs, propane torches, etc. to avoid personal injury. Also, observe general safety practices with all saws, tools, etc. to avoid personal injury. Wear protective clothing when necessary. Make sure work surfaces are clean and stable and that work areas are properly ventilated.

#### INSTALLATION TRAINING SEMINARS

Fiber Glass Systems requires installers to attend training every three years by a factory-trained representative. Fiber Glass Systems offers in-depth training seminars covering both primary product and secondary containment piping installation procedures. The training seminar involves hands-on participation, and each attendee receives a complete FGS Smith Fibercast Petroleum Marketing Catalog containing installation manuals used during the seminar. Each installer attending also receives documentary proof of attendance.

It is recommended that anyone directly involved in underground piping installations attend the FGS Smith Fibercast installation training seminar. For information on training seminars, contact your local distributor or representative.

To assist installers with proper installation of fiberglass piping systems, Fiber Glass Systems has prepared a Red Thread IIA Installation Checklist for Underground Petroleum Pipe. This sheet is included in the FGS Smith Fibercast Petroleum Marketing Catalog and accompanies each bundle of pipe. For a copy of this checklist, contact your local distributor or representative.

#### Publications available:

- B2101** RED THREAD IIA Product Brochure
- B2102** General Specifications
- B2104** Vacuum Monitoring System
- B2107** Single-Wall Sump Entry/Termination Fitting
- B2108** Bonded Sump Entry/Termination Fitting
- B2109** Gasketed Sump Entry/Termination Fitting
- B2161** RED THREAD IIA Installation Checklist
- F6600** 1"-6" Tapering Tool Instructions
- F6625** Model 2100 Power Tool Instructions
- F6624** Model 2102 Power Tool Instructions  
Case Histories
- F6640** Operating Instructions for Electric Heating Collar

**TABLE OF CONTENTS**

Read This First..... I  
 Introduction of Fiber Glass Systems..... II  
 Installation Training Seminars..... II

**Piping System Information**

Pipe Products..... 1  
 Storage and Handling..... 1

**PART ONE  
 RED THREAD IIA PRIMARY  
 PIPING INSTALLATION**

Joining Systems..... 2  
 Layout and Preparation..... 2  
 Tools, Equipment, and Supplies..... 3  
 Cutting & Tapering Pipe..... 4  
 Trenching & Backfilling..... 5  
 Joint Prep..... 6  
 Adhesives..... 6  
 Adhesive Mixing..... 6  
 Adhesive Working Life..... 7  
 Joint Assembly:  
     Bell x Spigot Joints..... 8  
     T.A.B. Joints..... 9  
 Joint Cure..... 9  
 Connecting to Other Systems..... 11  
 Potential Causes of Joint Failure..... 12  
 Testing..... 12  
 Repair Procedures..... 14

**PART TWO  
 RED THREAD IIA SECONDARY  
 PIPING INSTALLATION**

General Concepts..... 15  
 Layout and Preparation..... 16  
 Scarfing Pipe..... 16  
 Piping Layout..... 17  
 Containment Fittings..... 17  
 Containment Crossover Detail..... 18  
 Sump Connections..... 18  
 Reducers..... 20  
 Saddles..... 20  
 Joint Prep..... 21  
 Adhesives..... 21  
 Adhesive Mixing..... 21  
 Joint Assembly..... 22  
 Joint Cure..... 22  
 Testing..... 23  
 Repairs..... 23

**PART THREE  
 HELPFUL INFORMATION**

Conversions..... 25  
 Decimal Equivalents of Fractions..... 25  
 Definition of Terms..... 25

**LIST OF TABLES**

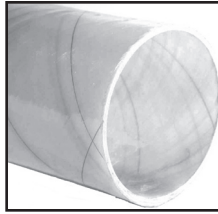
Table 1 Standard Packaging of Pipe..... 1  
 Table 2 Suggested Units of Labor  
     for Installation..... 2  
 Table 3 Wattage Requirements for  
     Electric Heating Collars..... 3  
 Table 4 Extension Cord Length..... 4  
 Table 5 Recommended Minimum Burial Depths..... 5  
 Table 6 Adhesive Kit Data..... 7  
 Table 7 Adhesive Cure Times..... 9  
 Table 8 Adhesive Cure Times When  
     Using Electric Heating Collars..... 10  
 Table 9 Make-up Dimensions (Wet)..... 15  
 Table 10 Containment Crossover Information..... 18  
 Table 11 Pipe Separation Distances..... 18  
 Table 12 Sump Entry Fitting Dimensions..... 18  
 Table 13 Termination Fitting Connections..... 20  
 Table 14 Number of Containment Fitting  
     Bonds Per Adhesive Kit..... 21

# Piping System Information

## PIPE PRODUCTS

### RED THREAD IIA PIPE

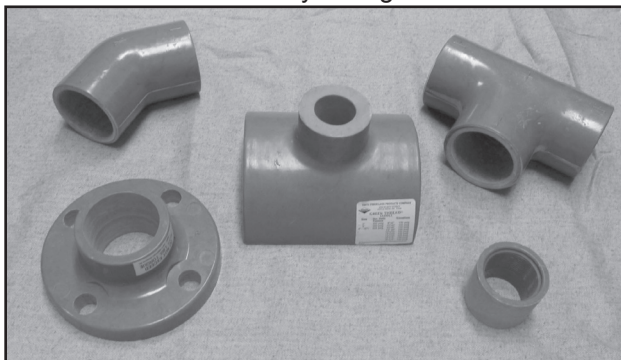
Epoxy pipe that is light weight and provides long service life and corrosion resistance. UL/ULC Listed piping is available in 2"-4" primary pipe sizes and 3", 4", and 6" containment pipe sizes. Non UL/ULC Listed containment piping is available in 8"-16" diameters. T.A.B. (Threaded and Bonded bell and spigot) is the primary joining method for 2"-6" pipe. Pipe comes in 15, 25, and 30 foot random lengths.



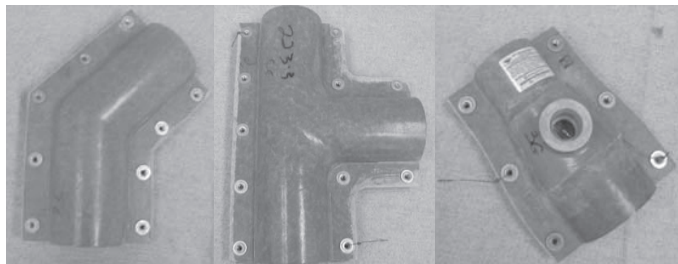
### FITTINGS

(UL Labels are supplied on the smallest packaging container, not the Fitting.)

Primary Fittings



Clam Shell Secondary Containment Fittings



## STORAGE AND HANDLING

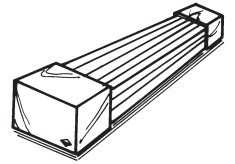
### Packaging, Ordering and Shipping Information

Pipe comes in 15, 25 and 30 ft. (5, 7.6 and 9.2 meter) random lengths. The number of lengths per bundle varies with the pipe diameter. Two-inch pipe is supplied with a protective mesh covering. **The protective mesh covering must remain in place on primary pipe that is not contained. However, the protective mesh covering may be removed when installed in containment pipe.**

TABLE 1. Standard Packaging of Pipe

Pipe Size		Random Length		Lengths Per Bundle
In.	mm	Ft.	m	
2	50	15, 25, 30	5, 7.6, 9.2	8
3	75	15, 25, 30	5, 7.6, 9.2	6
4	100	15, 25, 30	5, 7.6, 9.2	4
6	150	15, 25, 30	5, 7.6, 9.2	2

FGS pipe is furnished factory packaged in compact, easy-to-handle bundles complete with protective end caps. **Leave these caps in place until installation time to protect the pipe ends as well as to prevent dirt or other material from getting into the pipe.** Fittings and adhesives should be stored in a cool dry area. If fittings are removed from the boxes, protect machined bells and spigots from exposure to direct sunlight.



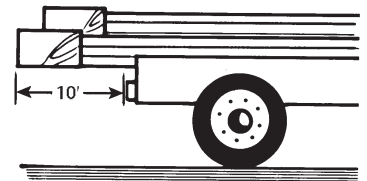
### Storing

Bundles can be safely stored on level ground or on racks with 10 foot (3 m) or less support spacing. Avoid point loads. Use supports with a minimum of four-inch (100 mm) wide bearing area to prevent damage to the pipe. Do not store on rocks or other hard objects that could cause point-loading damage. When outdoor storage is required, check to assure the pipes' protective end caps are in place to protect the spigots and insides of the bells from weathering. Use black polyethylene or other ultraviolet ray blocking material to cover all factory-prepared bonding surfaces if end caps are missing or not available.



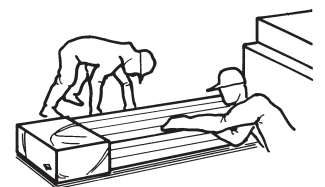
### Transporting

Use reasonable care in handling the pipe and fittings. When transporting from storage to the job site, do not allow pipe to extend more than 10 feet (3 m) beyond the end of the truck or trailer bed; permanent damage can result from excessive bending stress. **Protect pipe to prevent impact and point-loading damage.** NOTE: During transport, strap the pipe down with nylon or hemp rope tie downs. This will help prevent abnormal movement of the pipe during transportation. Wood or padded supports are essential for truck or trailer beds that have sharp edges (such as metal plates on the back of a flat-bed trailer). When transporting the pipe on trucks with narrow overhead piping racks (1 1/2" to 2"/40 mm to 50 mm in width or diameter), padded supports must be used to prevent point loads. If chains are used during transport, they must also be well padded to prevent damage to pipe walls.



### Loading and Unloading

When the pipe is not specially packaged, it should be loaded and unloaded by hand. When properly palletized or otherwise adequately protected, forklifts may be used. Do not throw or drop pipe and/or fittings from the truck to the ground. Protect pipe and fittings from point-loading or impact damage at all times.





## PART ONE

### INSTALLATION INSTRUCTION FOR RED THREAD IIA PRIMARY PRODUCT PIPING

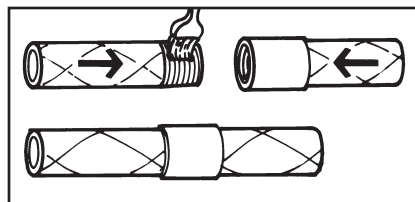
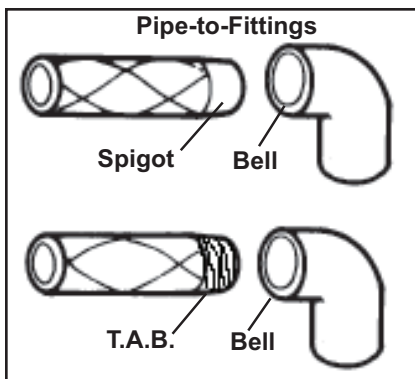
- Proper installation is the key to achieving a highly reliable, adhesive bonded, matching taper, bell and spigot joint.
- Matching taper angles on spigot and bell ends make it possible to lock up a joint by wedging the spigot into the bell so that it takes significant force to separate them. Proper lock up is essential.
- A very **thin** line of adhesive (called the bond line or glue line) between the two matching tapered surfaces is necessary to achieve **optimum** joint strength.
- Cool weather installations require different bonding procedures from warm weather installations.
- Proper installation results in joint strength equivalent to or stronger than the piping systems.
- To achieve the most reliable piping system, **it is essential that the installation crew be familiar with the joining techniques described in this manual.**
- Proper and safe methods of testing are recommended to assure the bonded joints in the piping system have been properly bonded and cured. See pages 12-13 and 23.

## JOINING SYSTEMS

The adhesive bonded, tapered bell and spigot joint is the primary joining method for 2"-4" (50 mm-100 mm) pipe-to-fittings. **However, T.A.B. (threaded and bonded) spigots can be bonded into smooth tapered fittings.**

The T.A.B. joint is the primary joining method for pipe-to-couplings. When combined with the adhesive, the mechanical locking action promotes positive make up of the joint and prevents backout during adhesive curing.

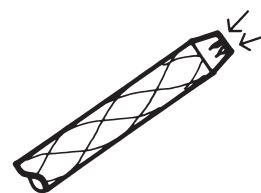
Pipe is supplied with T.A.B. spigot x T.A.B. spigot ends. Fittings are manufactured to accept either a tapered spigot or T.A.B. spigot end of the pipe. Tapers can be made in the field with tools designed for this purpose (see page 4). Bells cannot be field made. When a belled end is needed, use a sleeve coupling.



## LAYOUT AND PREPARATION

While handling, storing, and transporting the pipe, it sometimes incurs rough treatment. Therefore, inspect all pipe surfaces for possible damage to the pipe wall and spigot ends. Inspect fittings for signs of damage. **Damaged pipe must be cut out and replaced. Damaged fittings must not be used. If in doubt about damage, contact your local FGS Smith Fibercast distributor or representative.**

Exposing machined surfaces to direct sunlight will result in loss of joint bonding strength. Because the degree of weathering, surface degradation, and subsequent effect on bond strength varies greatly, depending on geographic location and related factors such as cloud cover, seasonal hours of daylight, intensity of sunlight, humidity, etc., it is difficult to place a fixed time limit on the acceptable amount of exposure. Cover exposed areas of pipe and fittings to protect from UV damage. In all instances where protective coverings are removed from machined surfaces and ultraviolet exposure exceeds one day, corrective action must be taken.



### Layout

Advance planning of the piping layout can reduce the quantities of material required and will make servicing the system easier. **NOTE: The scarfed containment pipe must be positioned over the product pipe before bonding the product pipe.**

### Installation Crew Size and Organization

Each installation is different and requirements change depending on whether the installation is simple (long, straight runs of piping) or complex. Requirements are also affected by pipe size, installation temperature, and similar influences. See Table 2.

TABLE 2. Suggested Units of Labor for Installation

Pipe Size In.	mm	Cutting Min/Opr	Tapering		Joint Make-up Minutes
			Hand Tool Min/Opr	Power Tool Min/Opr	
2	50	.5	1.5	0.3	1.0
3	75	.5	2.5	0.3	2.0
4	100	.5	3.5	0.5	3.0

For guidance under specific circumstances, consult your FGS Smith Fibercast distributor or representative.

**Before beginning an installation, it is important that all crew members be familiar with the installation procedures described in this manual.** Review the Red Thread IIA Installation Checklist with the crew and fill out as the job progresses. A completed copy should be retained to

# Primary Piping System Installation

document the installation complies with current State/Federal regulations. Installation checklists are available from your local FGS Smith Fibercast distributor or representative.

Following are general guidelines that apply to most piping installations:

- For most average-size service stations, the minimum recommended crew size is two. We suggest that the crew size be increased as the pipe diameter increases or when installing secondary containment piping.
- Organize the crew so that the adhesive is spread on the bonding surfaces as quickly as possible after mixing the adhesive, particularly in extremely hot weather.
- Plan adhesive kit usage so that sufficient kits are available in the area where the bonding will take place.
- Plan ahead so that a sufficient number of bonds are available to use one whole adhesive kit before the kit is mixed.

Following is a basic list of equipment that should be available before installation. Always be certain that appropriate tapering tools and adhesive kits are at the job site.

NOTE: Use the proper tapering tool for tapering each size of pipe. See page 4.

## TOOLS, EQUIPMENT AND SUPPLIES REQUIRED FOR INSTALLATION

- Chain vise (bench mounted or portable) capable of securing the pipe size used. NOTE: Use protective pads such as split sections of the same size fiberglass pipe or a sheet of 1/8" (3 mm) thick rubber to protect the pipe from clamp or chain damage.
- Power or hand tapering tool (see page 4).
- Felt tip marking pen
- Pipe cutting equipment:
  - Chop saw
  - Fine-tooth (32 teeth/inch) hack saw
  - Circular saw with abrasive cutting blade (carbide grit or masonry blade)
  - Sabre saw with a fine-tooth metal or carbide grit blade
  - Jigsaw with carbide grit abrasive blade
- Wrap around (for marking pipe),
- T.A.B. or strap wrenches (see pages 8-9),
- Shop hammer, 3-6 lbs. (4-9 kg.), and a 2x4 block of wood
- Adjustable pipe stands
- Power drive adapter (optional)
- Electric heating collars
- Clean rags

## Equipment for Cold Weather Pipe Assembly:

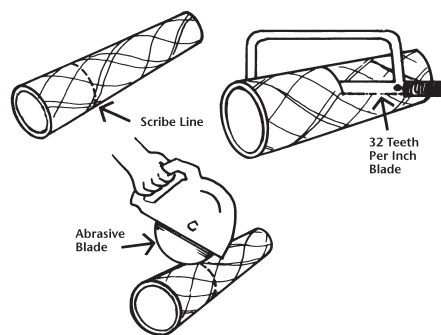
- Heat source for prewarming:
  - Electric heating collar,
  - Portable electric heat lamp, or
  - Hot air blower
- A means of maintaining adhesive kits at 70°-80°F (21°-27°C). Use a box with a 25 watt light bulb or keep the adhesive in a heated truck cab or building
- Heat assisted curing source - **Retract protective mesh covering on 2" pipe prior to use of heating collars.**
  - FGS Smith Fibercast electric heating collars - When using electric heating collars, make sure an adequate power source is available and that extension cords are properly sized. Wattage requirements and extension cord lengths are shown on Tables 3 and 4.

**Table 3. Wattage Requirements for Electric Heating Collars**

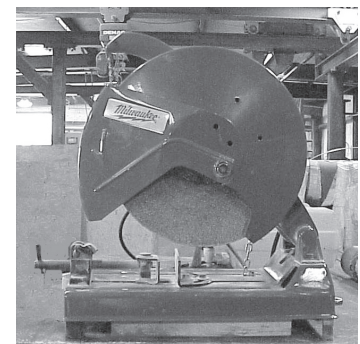
Size		110V or 220V Heating Collar (Watts)
In.	mm	
2	50	90
3	75	155
4	100	200
6	150	285

**Table 4. Extension Cord Length**

Wire Size (AWG)	Suggested Length (Ft.)	Maximum Length (Ft.)
12	20	22
10	30	36
8	50	57



Chop Saw



## CUTTING AND TAPERING PIPE

### Cutting

To cut fiberglass pipe, refer to page 3.



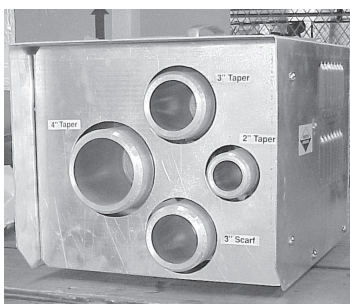
**NOTE:** Cutting operations for fiberglass pipe can generate dust or cutting chips that are irritating to the skin, upper respiratory tract, and eyes. Because these materials are irritating, good ventilation for the installation crew should be used to prevent exposure.

A nuisance dust breathing filter should be used when working in areas where dust will be present. Operators should wear heavy cotton clothing, including long-sleeve shirts, that protect the skin from the dust. Eye protection is required for the tool operator.

### Tapering

The matched taper concept employed by FGS is the key to excellent joint performance. Retract the protective mesh covering on 2" pipe approximately 12" from the end to be tapered.

- **Model 2100 Tool (Bulletin F6625)** - Power tool designed to taper 2"-3" RED THREAD IIA pipe and scarf 3"-4" RED THREAD IIA pipe. See Part Two for secondary containment information.
- **Model 2102 Tool (Bulletin F6624)** - Power tool designed to taper 2"-4" RED THREAD IIA pipe and scarf 3" RED THREAD IIA pipe. See Part Two for secondary containment information.



- Model 2100-I and Model 2102-I are available where 240 volt is required.
- If the power tools are not available, a manual tapering tool kit from FGS may be used. The 1" - 6" Tool (Bulletin F6600) is a hand-held tool that can be adapted for power when a large number of tapers is necessary.

Proper tapering tolerances are factory set. However, it is recommended the tool settings be checked prior to installation of the pipe and fittings. To compensate for wear of the grinding drum, the mandrels can be field adjusted. Refer to the tool operating instructions for field adjustment procedures.

The tapering tools will reproduce a field-made taper that inserts into the same bell to a  $\pm 1/8$ " (3 mm) tolerance when compared to a factory-made tapered spigot. The angle for properly made field tapers for 2"-4" (50 mm-100 mm) diameter pipe should be  $13/4$  degrees. **NOTE:** If the

manual tapering tool has an old-style blade holder, it must be replaced. The correct taper angle is  $13/4$  degrees for 2", 3" and 4" pipe sizes.

There are several power tapering tools available for use with FGS Smith Fibercast piping systems that are not manufactured by FGS. **It is the tool operator's responsibility to ensure that the tool being used is reproducing a field-made taper that is within the tolerances of a factory-made tapered spigot.** Refer to Bulletin No. F6600 for the correct procedures to verify matching tapered spigot tolerances (factory versus field made).



**WARNING** - When tapering pipe with a 2000 series power tool, **DO NOT rotate pipe with your hand over the end of the pipe as this could result in serious injury.** Place both hands firmly around the pipe a minimum of 2" from the end of the pipe and rotate counter clockwise. Keep a firm grip on the pipe at all times and keep moving in a constant motion. If you loosen your grip on the pipe, the grinding drum could grab the pipe and spin it backwards resulting in the pipe being locked up on the tool and possibly causing injury.

**NOTE:** Protect pipe from chain vise damage by placing rubber sections or sleeves (180° sections of pipe cut from the same size pipe being tapered) between the pipe and the chain vise. When using a manual tool and pipe is clamped into a chain vise, extend pipe at least 12 inches (300 mm) beyond chain to prevent oval shaping of the pipe. For short nipples, taper one end of the pipe (or use an existing factory taper) and cut to the desired finished length. Insert the tapered side into a sleeve coupling. Insert into tool and taper per the supplied instructions.

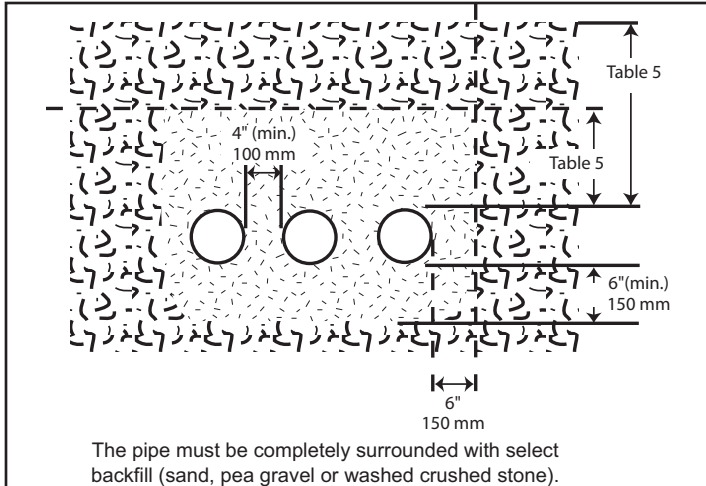


# Primary Piping System Installation

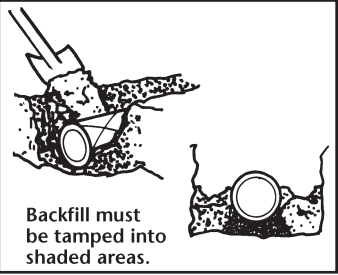
## TRENCHING AND BACKFILLING

Proper construction of trenches is important. They should be wide and deep enough to accommodate the piping and backfill material. See Table 5 for recommended minimum burial depths.

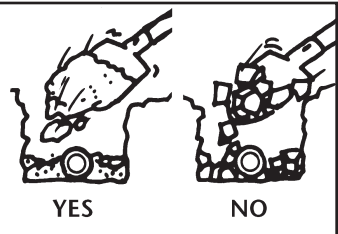
- Typically, all piping should slope at least 1/8" (3 mm) per foot toward the tank. Support pipe properly to prevent low points.
- The piping should be separated by a distance of at least four to six inches (100 mm-150 mm). For double-wall secondary containment piping installations, refer to Table 11 on page 18 for proper distances.



- Compact backfill carefully over and around the piping system. When using tamping equipment, take care to prevent vibration from driving small stones into the pipe wall. The amount of compaction and the type of soil determines the soil modulus. For example, pea gravel has a typical modulus of 1,000 psi with no compaction, while sand requires slight compaction (85% Proctor density) to achieve a modulus of 1,000 psi. Refer to ASTM D3839 or AWWA C950 for further details.



- Cover the pipe as soon as possible after successful testing to eliminate the chance of damage to the pipe, floating of the pipe due to flooding, or shifting of the line due to caving in of the trench walls. If damage is suspected, the lines should be retested.
- Frozen earth will eventually thaw, leaving the pipe with insufficient support and voids around the pipe. Take care to remove frozen lumps from all backfill materials before backfilling.



In all cases, the pipe must be completely surrounded with select backfill (sand, 1/8" to 3/4" pea gravel, or 1/8" to 1/2" washed, crushed stone). There should never be voids under or around the pipe. Six inches (150 mm) of the fill must be placed under the pipe as bedding material. **Native backfill materials should never be used.**

**TABLE 5. Recommended Minimum Burial Depths Based on Soil Modulus of 1,000 psi or Higher (Refer to ASTM D3839 or AWWA C950 for Method/Theory)**

Pipe Size		Surface Condition	Minimum Burial Depth		Min. Amount of Sand, Pea Gravel, Washed Stone Above Top of Pipe	
In.	mm		In.	mm	In.	mm
2	50	Unpaved	17	432	12	305
		Paved, min. 4" (100 mm) asphalt	12	305	8	203
		Paved, min. 4" (100 mm) concrete	9	229	5	127
		Paved, min. 6" (150 mm) concrete	9	229	3	76
3	75	Unpaved	20	508	14	356
		Paved, min. 4" (100 mm) asphalt	13	330	9	229
		Paved, min. 4" (100 mm) concrete	11	279	7	178
		Paved, min. 6" (150 mm) concrete	10	254	4	102
4	100	Unpaved	20	508	14	356
		Paved, min. 4" (100 mm) asphalt	14	356	10	254
		Paved, min. 4" (100 mm) concrete	11	279	7	178
		Paved, min. 6" (150 mm) concrete	10	254	4	102
6	150	Unpaved	36	914	14	356
		Paved, min. 4" (100 mm) asphalt	24	610	10	254
		Paved, min. 4" (100 mm) concrete	20	508	7	178
		Paved, min. 6" (150 mm) concrete	16	406	4	102

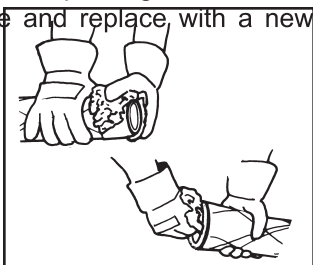
## JOINT PREP

### Cleaning the Bonding Surfaces

It is recommended that all bonding surfaces be cleaned before bonding. **DO NOT TOUCH THE BONDING SURFACES OR ALLOW THEM TO BECOME CONTAMINATED.**

Acceptable cleaning methods are as follows:

- Sand all bonding surfaces until contamination is removed. However, the sanding operation must be light enough to prevent changing the taper angle.
- Cut off contaminated surface and replace with a new taper or sleeve coupling.
- Wire brushes may be used for cleaning T.A.B. surfaces; however, they must be clean and free of oil contamination.
- Dirt contamination can be removed by water washing.



NOTE: Using solvent as a cleaning method is optional.

Solvent may be used if preferred by the customer. Some alternate cleaning solvents available through local hardware or industrial supply houses are acetone, methylene chloride, and methyl ethyl ketone. After cleaning, be sure any residual solvent has evaporated before applying adhesive. **DO NOT USE SOLVENTS THAT LEAVE AN OILY FILM ON THE BONDING SURFACES.**



**WARNING:** Some degreasers and solvents are extremely flammable. Be sure to read warning labels on containers. Never use gasoline, turpentine, or diesel fuel to clean joints. Be sure all solvent has evaporated before applying adhesive.

### Repairing Weathered Surfaces (UV Degradation)

When machined surfaces of pipe and fittings are exposed to direct sunlight for a prolonged period of time, the result could be a loss of bond strength. All machined surfaces that have turned yellow or brown in color must be repaired. For exposed T.A.B. ends, cut 1/2" minimum off of the end of the spigot and retaper. Exposed fitting bells and pipe tapers should be lightly sanded with an 80 to 120 grit sandpaper or Emery cloth until the original factory-fresh appearance returns. T.A.B. couplings cannot be repaired; they must be replaced.

## ADHESIVES

Several basic adhesive systems are available from FGS Smith Fibercast. The 7000 and 8000 series adhesives differ in operating characteristics and working time (pot life). See Table 6 for recommended usage and approximate number of bonds per kit. The working life of each kit is based on an ambient temperature of 75° F (24° C).

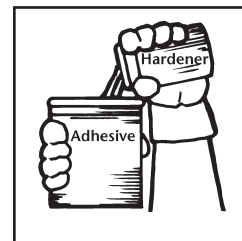
The adhesives are a two-component system that must be mixed prior to use. Detailed instructions for adhesives are provided with each kit. Read these instructions thoroughly and follow the recommended procedures. The cure time and pot life of the adhesive is dependent on temperature. Refer to the adhesive instructions. Ambient temperatures above 100° F require extra care by the fabricator to assure sufficient working time of the adhesive. Refer to *Adhesive Working Life* (page 7) for both warm and cool weather conditions.

## ADHESIVE MIXING



Thoroughly mix the adhesive. **Complete information and safety precautions are packaged with each adhesive kit. Review all safety precautions thoroughly before mixing the adhesive.**

- At 65°F or below, prewarm the adhesive kits to 70° to 80°F minimum.
- Empty all of the contents of the hardener bottle into the can of base adhesive.
- Mix **all** of the adhesive with all of the hardener. **NEVER SPLIT A KIT.**
- Do not spill hardener during the mixing process. Cut through the adhesive with the edge of the mixing stick to assist in mixing the two components.
- Mix until the adhesive has a uniform color and a consistent flow off the mixing stick. Wipe down the sides, bottom, and under the rim of the can with the mixing stick to assure complete mixture.



# Primary Piping System Installation

**TABLE 6. 7000 & 8000 Adhesive Kit Data**

Kit ID Number (Excludes Solvent)	Label Colors <sup>(1)</sup>	2" Quantity Base Adhesive	Approx. No. of Bonds Per Kit <sup>(2 &amp; 4)</sup>			Working Life <sup>(2)</sup> at 75°F (23.9°C) Minutes
			2" (50 mm)	3" (75 mm)	4" (100 mm)	
7014	Red	5.4 oz. (153 grams)	25	18	10	25
7024 (Twin Pack)	Black	2.0 oz. ea. (57 grams ea.)	9/9	6/6	4/4	25
7069 <sup>(3)</sup>	Blue	7.8 oz. (221 grams)	-	-	-	25
8014	Green	5.5 oz. (156 grams)	21	15	8	15
8024 (Twin Pack)	Yellow	2.3 oz. ea. (65 grams ea.)	9/9	6/6	4/4	15
8055 (Bag Kit)	No Color	1.6 oz. (45 grams)	3	2	1	15
8069 <sup>(3)</sup>	Orange	8.0 oz. (227 grams)	-	-	-	15

(These adhesives are for RED THREAD IIA piping systems conveying petroleum products including leaded and unleaded gasoline, diesel, 100% ethanol or methanol, all alcohol-gasoline mixtures and biodiesel fuels.)

<sup>(1)</sup>Match the labeled adhesive color to the hardener color before mixing.

<sup>(2)</sup>When adhesive is properly mixed, it has a limited "working life" during which joints may be bonded. Use of the adhesive beyond the working life is prohibited.

<sup>(3)</sup>Recommended for secondary containment installations due to size of kit.

<sup>(4)</sup>Number of bonds depend on ambient temperature.

## ADHESIVE WORKING LIFE

Working life or pot life is the time it takes for the adhesive to harden in the mixing can. This time is measured from the time the adhesive and hardener are first mixed. **Working life is shorter at temperatures above 75°F (21°C)** and becomes longer as the temperature drops below 75°F (21°C). Working life is affected by the quantity of mixed adhesive as well as by temperature. Use the following methods to increase the working life of adhesives:

### Warm Weather:

- Occasionally stir the adhesive mixture during application.
- Use small ice chests or other containers with freezer packs to keep adhesive cool.

### Cool Weather:

- Store adhesive kits inside.
- Prewarm to between 70°-80°F (21.1°-26.7°C) before use.



**CAUTION: If adhesive becomes warm and starts to harden in the container, discard immediately. DO NOT USE THIS ADHESIVE TO BOND A JOINT!**

**When adhesive is allowed to harden in the metal container, the container may reach approximately 400°F (205°C).** Do not handle hot containers without heavy gloves. This exothermic reaction will generate a dense, foul-smelling smoke. Therefore, place the container outdoors in an open area until it cools. Avoid inhaling smoke.

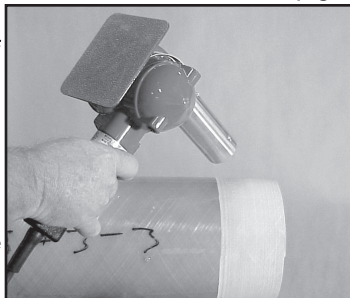
**ADHESIVE DISPOSAL:** Once the adhesive and catalyst have been mixed and reacted, nothing can be extracted, and it is classified as non-hazardous material. Dispose of in a normal manner as other solid waste. Excess adhesive and catalyst can be mixed, allowed to react, and disposed of as above. If extra cans of adhesive or tubes of catalyst have accumulated without the other component to mix and react, contact your FGS regional manager. Catalyst tubes, when empty are not subject to EPA regulation and can be disposed of in a normal manner. These guidelines are based on federal regulations. State and local regulations and ordinances should be reviewed.

## JOINT ASSEMBLY

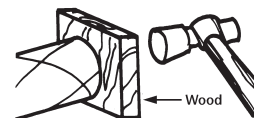
### Bell and Spigot Joint

THE SPIGOT MUST BE ALIGNED AND LOCKED IN THE BELL. A cocked or misaligned joint will result in false lock up and possible joint failure either during testing or at a later date.

- When the temperature is below 65°F (18.3°C), prewarm the bonding surfaces (after the joint has been cleaned and the cleaner has evaporated). CAUTION: Evaporation may be slow at extremely low temperatures. Use a hot air blower and apply heat uniformly to the bell and spigot until warm (not hot) to the touch. Check temperature by touching outside of the bell and inside of the spigot to avoid contact with clean bonding surfaces. If hot to the touch, let cool before applying adhesive. If an electric heating collar is used to prewarm, place the joint together dry, then heat the O.D. of the bell to avoid contaminating the spigot.



If the adhesive or the pipe surfaces are cool, push and hold for a few seconds to allow time for the adhesive to start flowing out of the tapered joint. If additional force is needed, a rubber mallet or a strong piece of wood, or a dead blow hammer to drive the pipe together is the preferred method.



When the adhesive starts squeezing out of the joint, use stronger blows. Proper pipe alignment is important. Maintain back pressure against previously assembled joints to avoid shaking them loose. After the joint has started to make up, hit until no further engagement can be seen at the joint. When engagement stops, the joint is locked. Always check previous bonded joints to ensure they have not backed out.

NOTE: Do not use this method where the spigot end would be hit. Use come-alongs in this case. On 2"-4" (50 mm -100 mm) diameter pipe, a three-pound (4 kg) shop hammer is adequate.

- Brush adhesive on both surfaces, applying a thin uniform coating. To minimize contamination, apply adhesive to the bell first. Adhesive should always be worked into the machined surface by applying pressure during application. This will "wet out" the machined surface and maintain the required thin bond line. Be sure that the adhesive is deep down into the bell past the insertion depth and that all machined taper surfaces on the spigot and the cut end of the pipe are uniformly covered. **Excess adhesive will make the joint more difficult to lock and can result in a flow restriction.** Wet out the machined surfaces with a thin layer of adhesive to produce a good bond.



Connections into fittings are made using the normal bell and spigot method. A threaded (T.A.B.) spigot can be bonded into a smooth bell (fitting), or a smooth spigot can be bonded into a threaded (T.A.B.) bell.

- Align and lock the joint. For 2" (50 mm) fittings, insert spigot into the bell until surfaces touch, then push and turn at the same time until a lock is achieved. Only a quarter turn to a half turn is usually needed. On 3 and 4" (75 and 100 mm) diameter fittings, pushing and turning to lock the joint is impractical. Driving force must be used.

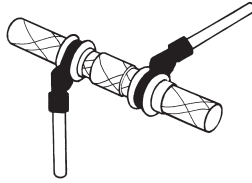




# Primary Piping System Installation

## T.A.B. Joint

T.A.B. joint installation procedures follow the normal bell and spigot operations of cleaning, adhesive mixing, etc. as described previously. The threads on the bonding surfaces are designed to improve the reliability of the joint, particularly under adverse conditions. Two T.A.B. wrenches or strap wrenches are recommended when joining T.A.B. pipe. Separate T.A.B. wrenches are available from FGS Smith Fibercast for each size pipe. The wrenches lock around the pipe and force the pipe into a very slight oval shape. Therefore, the wrenches must be placed 6" to 12" (150 mm to 300 mm) away from the joint to assure good joint make up.

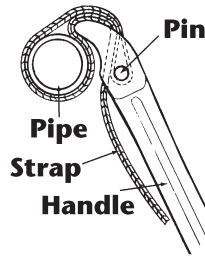


NOTE: If T.A.B. wrenches are not available, strap wrenches such as Ridgid No. 2-P, can be used. To prevent damage to the pipe wall, wrap the strap wrench around the pipe as shown.



**CAUTION: Improper use of strap wrenches can cause point-loading damage and/or bad joints that are locked up.**

In order to gain experience in determining the proper amount of torque to use, the following procedure is recommended for the first few joints. DO NOT OVER TIGHTEN.



- Cover all machined areas on the spigot and at least one-half inch beyond the last thread in the bell with the adhesive.
- Screw the pipe together by hand, ensuring that the joint is not cross threaded. Two inch (50 mm) diameter pipe can be hand tightened. To ensure complete joint make up for 3" and 4" (75 mm and 100mm) diameter pipe, use T.A.B. wrenches.
- Check lock up by moving free end of pipe in an up-and-down or side-to-side motion. The movement must be sufficient to move the joint being checked. No movement should be visible in the joint. If any movement exists, continue to tighten until no movement is visible.

Connections into fittings are made using the normal bell and spigot methods.

## JOINT CURE

### Ambient Cure

Cure time is the time required for the adhesive in the assembled joint to harden. Cure time depends on the type of adhesive and the ambient temperature, as shown in Table 7.

**TABLE 7. Adhesive Ambient Cure Time**

Adhesive Type	Temperature		Cure Time (Hours)
	Degrees F	Degrees C	
7000	110	43.3	2
	90	32.2	3
	80	26.7	5
	70	21.1	8
	60	15.6	18
	55	12.8	24
8000	110	43.3	1
	90	32.2	2
	80	26.7	4
	70	21.1	6
	60	15.6	12
	55	12.8	18

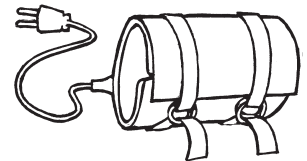
NOTE: Cure time is the time before the line can be tested. Times may vary depending on temperature, humidity, etc.

### Heat Assist Methods

When working at temperatures below 55°F or in situations where rapid cure is necessary, Fiber Glass Systems has developed heat assist methods for curing adhesive bonded pipe or fitting joints.

#### A. Electric Heating Collar -

The most effective method of heat assist is electric heating collars. Reusable heating collars are energized by a 100/120 volt power source. NOTE: 220/240 volt heating collars are available on special order and are shipped without the male plug.



- Curing Operation - It is desirable, but not necessary, for the curing operation to immediately follow the bonding operation. However, in cold weather it is preferable to bond only the amount of pipe that can be cured during the same day.

If generator is used, assure the power supply is adequate for all of the units being used. Use 110/120 Volt A.C. only. When extension cords are used, make certain they can handle the total wattage of the collars used. Refer to Table 4 on page 4.

- When temperatures fall below 32°F (0°C), fiberglass insulation should be added to heat collars to achieve a proper cure.

# Primary Piping System Installation

- Pipe or sub-assemblies can be moved before the joints are cured if care is taken that the joint is not disturbed. Bending or excessive movement is not advised.
- Operating Instructions - **Refer to Bulletin F6640 for complete operating instructions.**

Do not bend or fold heating collar as this may break the heating elements and cause the collar to work improperly or not at all.

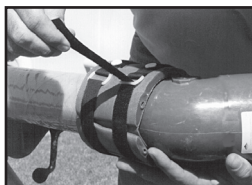
## For Pipe and Fittings:

- Use the same size heating collar as the pipe size being installed, with the exception of flanges. Retract protective mesh covering on 2" pipe prior to use of heating collars.



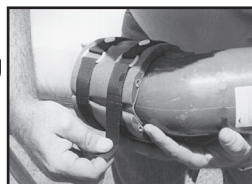
**Do not** use a heating collar that is designed for a larger size pipe.

- With the uninsulated flap on the bottom (next to the fitting), carefully wrap the heating collar around the joint. Feed the strap through the square ring.



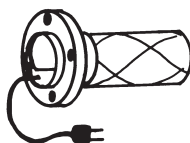
**CAUTION:** The uninsulated flap is extremely hot when the collar is on. **DO NOT TOUCH with bare hands.**

- Tighten the straps until the heating collar is snug against the joint.



## For Flanges:

- For 3" and 4" flange joints, use a heating collar that is one pipe size smaller. Remove the straps from the heating collar.
- Carefully turn the collar inside out with the heated area facing the I.D. of the pipe. Place the heating collar in the I.D. of the flange.
- A split ring of pipe may be used to hold the collar in place while the joint is curing.
- Heat collar is not available for 2" flanges. An industrial heat gun may be required to cure the joint. Be sure the end of the gun is at least six inches from the opening of the flange.



**CAUTION:** The adhesive bead will cure faster than the adhesive in the joint. It is important that the joint not be pressurized until it has been subjected to the proper time-temperature cycle. A temperature versus time to pressure curve is indicated in the instructions packaged with each adhesive kit.

## For Saddles:

To heat cure a saddle, place the heating collar over the saddle outlet. During cool weather, a wind shield is recommended to keep heat on the joint. Saddles must be heat cured for two hours.

## All:

Cure times are listed in Table 8.

**TABLE 8.**  
**Adhesive Cure Times for Electric Heating Collars**

Piping System/ Adhesive Grade	Pipe Size	Cure Time		
		Pipe (Min)	Fitting (Min)	Flange (Min)
RED THREAD IIA 7000 or 8000	2"-6"	10	20	15

Allow the joint to return to ambient temperature before applying stress to the joint.

**NOTE:** FGS Smith Fibercast electric heating collars are designed to fit around fittings and will overlap on pipe joints and couplings. Exceeding the recommended cure time on pipe joints where the heating collar overlaps may shorten the life of the heating collar and/or damage the pipe.

**B. Fiber Glass Systems' Heat Packs** - Although Heating Collars are the preferred method for heat curing joints, FGS Heat Packs that cure joints in approximately one hour are also available. Retract protective mesh covering on 2" pipe prior to use of heat packs.

Refer to Bulletin No. 4500, included with each kit for complete instructions. Observe all safety precautions listed on the installation sheet.

# Primary Piping System Installation

## CONNECTING TO OTHER SYSTEMS

Adapters available for connecting to other systems include the following: threaded adapters (bell or spigot by NPT or BSP threads), reducer bushings (NPT), and flanges.

NOTE: When using adapters with spigot ends, it may be necessary to cut off a portion of the factory pipe bell if the threads are not fully exposed.

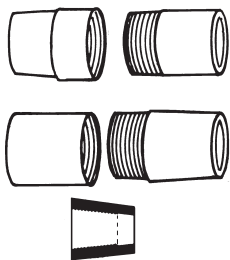
- **Threaded Adapters (NPT or BSP) and Reducer Bushings (NPT)**

Before making up threaded connections, inspect the threads. Do not use fittings with damaged threads. **Inspect all steel threads and remove any burrs.**

Threads must be clean and dry before applying thread lubricant.

When using threaded adapters, thread them into the other system before bonding onto FGS Smith Fibercast pipe. Otherwise, unless a union is used, it may be impossible to turn the adapter into the mating thread. You will obtain best results using a strap wrench and a solvent-free, soft-set, non-metallic thread lubricant. The thread lubricant must be chemically resistant (compatible) with the petroleum or alcohol product conveyed in the piping system. **Do not use thread sealing tapes.** For best results, apply thread lubricant to both the male and female threads. FGS 7000 or 8000 series adhesive may be used in place of thread lubricant.

Tighten threads 1 to 1<sup>1</sup>/<sub>2</sub> turns past hand tight to ensure a proper seal. Do not use metallic wrenches to tighten threaded adapters as this may cause damage to the fitting.



FGS Smith Fibercast flanges meet ANSI B16.5 Class 150 bolt hole standards. Full-face gasketing materials, 1/8" (3 mm) thick, with a Shore A hardness of 60 to 70 durometer, are recommended for flanges. Gaskets made from Teflon and PVC usually have high durometer ratings and are not acceptable.

**Connecting to Flat-Face Flanges** - FGS Smith Fibercast flanges must be joined to flat-face flanges. The recommended maximum torque is listed on the flange label.

- **Connecting to Pump/Dispenser**

Several methods are available to connect the product piping lines and vent/vapor recovery lines to the underground storage tank and dispenser: fiberglass fittings, flexible connector, steel fitting or swing joint.

**Use of flexible connectors at each location facilitates ease of installation.**



CAUTION: Do not over tighten. Tighten the adapters as if they were brass or other soft material.

NOTE: When using threaded reducer bushings, the bushing should be BONDED and CURED before the male thread is screwed into the bushing. Adhesive instead of thread lubricant may be used on threaded adapters. Tighten the threaded adapters as with standard thread lubricant.

- **Flanges**

Before bonding the flange onto the pipe, make sure the bolt holes line up with the mating bolt holes on the other system. Do not bolt the flange before bonding unless insertion depth of the spigot is previously checked to be certain that the spigot does not bottom out or extend through the flange.

The use of flat washers on all nuts and bolts is required. The maximum allowable torque is indicated on each flange.



## INSPECTING FOR POTENTIAL CAUSES OF JOINT FAILURE

**Joint Backout** - When assembling a bell and spigot joint, a bead of adhesive is normally formed at the edge of the bell. If the joint is not locked up and backs out before the adhesive cures, the bead will no longer be next to the edge of the bell.

**Cocked Joint** - If a joint is cocked or misaligned, there will usually be a large gap between the bell and spigot on one side. The opposite side will usually have a smaller or no gap. Misalignment is easier to detect if one sights down the line and views the joint from a distance.

NOTE: When using heat assist, the pipe may bend if it is under stress while curing. In this case it is extremely difficult to determine if the pipe is bent because of heating or if it is a cocked joint. Avoid making up pipe and fitting joints when pipe is under stress.

**Improperly Cured Joint** - If the adhesive bead is soft or flexible, the adhesive is not sufficiently cured. If the bead is cured, it is hard and brittle when checked with a knife. When the bead is not hard after exposure to the recommended temperature and time cycle, the adhesive was not mixed properly. CAUTION: The adhesive bead will cure faster than the adhesive in the joint. It is important that the joint not be pressurized until it has been subjected to the proper time-temperature cure cycle. A temperature vs. time-to-pressure chart is included in the instructions packed with each adhesive kit.

**Weather Damage** - If a joint has been exposed to sunlight for a long period of time and the machined area has turned from white in color to yellow or brown and was bonded without a proper repair, the joint may be suspect and could leak or even separate. Inspect for color change on all machined areas before bonding.

Although not all inclusive, the conditions mentioned above are the most common indications of failure to achieve a properly assembled joint.

All damaged or improperly assembled joints must be replaced. See Repair Procedures on pages 14-15.

## TESTING RECOMMENDATIONS



- **Safety Precautions**  
**FIBER GLASS SYSTEMS SHALL NOT BE LIABLE UNDER ANY WARRANTY, CONTRACT, OR IN TORT, FOR ANY RESULTING INJURY TO PERSONNEL OR DAMAGE TO EQUIPMENT, PIPE, OR OTHER PERSONAL PROPERTY FOR FAILURE TO FOLLOW THE PROCEDURES AND COMPLY WITH THE PRECAUTIONS SET FORTH.**

As in any system where pressure is employed, adequate safety precautions should be exercised. EXERCISE DUE CARE IN INSTALLING AND TESTING THE PIPING SYSTEM.

In buried applications, it is suggested that long pipe runs be partially backfilled at various points to secure them in place. All joints and connections should be left exposed for inspection.

FIBER GLASS SYSTEMS RECOMMENDS THAT YOU DO NOT TEST ANY INSTALLATION WITH AIR OR GAS BECAUSE OF THE SAFETY HAZARDS CREATED. The light weight, flexibility, and elasticity of fiberglass pipe creates different conditions than are present with steel pipe. **If a failure should occur while testing fiberglass pipe with air or gas, the system would be subject to considerable whipping and other shock-induced conditions due to the sudden release of stored energy. The violent release can cause severe personal injury or death to personnel in the area and can also cause property damage to the pipe or other property.**

If a line is tested with air or gas, Fiber Glass Systems will not be responsible for any resulting injury to personnel or damage to property, including the pipe. If there is no alternative to testing with air or gas, FGS will recommend test procedures and precautions to minimize possible hazards but will not bear responsibility for damage or injury under any circumstances. **Such testing is done entirely at the risk of those involved.**

**Test Procedures** - Installed FGS Smith Fibercast pipe systems should be tested prior to use to assure soundness of all joints and connections. In testing, sudden pressure surges or "water hammer" must be avoided, as in some instances surge or hammer can produce pressures of several times the rating of the pipe and fittings. Locate pressure gauge in close proximity to the pressurizing equipment, not directly on the piping system. Pressure gauge with the test pressure at mid scale is recommended.



## Primary Piping System Installation

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The normal recommended procedure is to conduct a hydrostatic cyclic pressure test. The piping system is subjected to 10 pressurization cycles at 1<sup>1/2</sup> times the anticipated or design operating pressure. NOTE: For low pressure applications, it is best to use the pressure rating of the pipe as the design operating pressure, i.e. test at 1<sup>1/2</sup> times the cyclic rating. **The test pressure should not exceed 1<sup>1/2</sup> times the maximum rated operating pressure for the lowest rated element in the system.** Pressure is then kept on the system for 1-8 hours while the line is inspected for leaks.

### Air Test Procedures and Safety Precautions<sup>(1)</sup>

TESTING WITH AIR OR GAS IS EXTREMELY DANGEROUS AND SHOULD NOT BE DONE. CONSULT YOUR FGS REPRESENTATIVE OR CALL 501-618-2243 FOR TECHNICAL ASSISTANCE. IF YOU CONTEMPLATE EXCEEDING THE RECOMMENDED PRESSURES FOR THE LOWEST RATED ELEMENT OF THE SYSTEM OR IF YOU CONTEMPLATE USING AIR OR GAS IN SPITE OF THE WARNING, REVIEW ALL SAFETY PRECAUTIONS BEFORE STARTING THE TEST.

If testing with air or gas is required or requested to be performed, the following testing procedures and precautions must be followed. As in any system where pressure is employed, adequate safety precautions must be exercised. EXERCISE DUE CARE IN INSTALLING AND TESTING THE PIPING SYSTEM.

- Visually inspect all bonded joints for proper insertion and adhesive cure prior to pressurizing the piping system. A gap between the adhesive bead and the fitting shoulder indicates that the possibility of joint failure exists. Make any necessary repairs before pressurizing the piping system. See page 12 for potential causes of joint failure.
- Check the integrity of the joints by pressurizing the system to 25 psig (0.172 MPa) and holding the pressure for a minimum of one minute. Soap all joints to test for leaks.
- If there are no leaks, raise the line pressure in the system to a **maximum** of 50 psig (0.345 MPa). Again, hold the pressure for at least one minute and soap all joints to check for leaks.
- As serious personal injury or death can result, the pipe inspector should take precautions for his/her personal safety and protection against flying debris and also against the whipping action of the pipe that can result from the sudden release of stored energy. Goggles should be worn to protect against flying debris.

- Avoid personal contact with the piping system while it is pressurized during testing except for actual checking of the joints for leaks. Absolutely no one should be in the trench while the pipe is being initially pressurized for leak testing. Notify all site personnel before beginning the testing procedure.
- Do not straddle the pipe during testing or while checking the piping system for possible leaks.
- While the pipe is being checked for leaks, do not stand at the end of the piping system or where it changes directions.

**CAUTION: Failure to strictly follow these instructions can result in serious personal injury, death, and/or property damage.**

- FGS recommends that after the piping has passed the 50 psig (0.345 MPa) pressure test, the contractor should reduce the product line pressure to a pressure of not more than 25 psig (0.172 MPa) and maintain this pressure until all paving has been completed. Leave pressure gauge on each line for inspection. The contractor should check the gauge daily to verify the pipe is holding pressure.

If a leak is encountered during the test procedure, immediately release all pressure in the piping system and refer to pages 14-15 for proper repair procedures. Upon completing any necessary repairs to the piping system, follow the proper testing sequence and verify the system's integrity.

### Vacuum or Inert Gas Test Procedures

Testing with vacuum and/or pressurized inert gases have been successfully used with FGS Smith Fibercast piping systems. Although helium testing in a closed atmosphere and at measured levels is useful, testing in the field with helium has shown inconsistencies when attempting to identify leak location.

<sup>(1)</sup>Do not use these testing procedures and safety precautions for FGS Smith Fibercast RED THREAD IIA secondary containment piping systems. See page 23 of this manual for testing procedures for secondary containment piping systems.

## REPAIR PROCEDURES

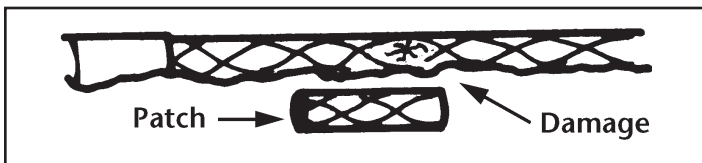
For damaged pipe and for leaking joints, FGS Smith Fibercast recommends only the repair methods listed below. DO NOT attempt to repair damaged fittings. Always pressure test repair work before putting the line back into service to assure the soundness of the repaired section. Contact your local FGS representative for further information.

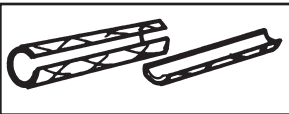
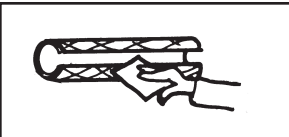
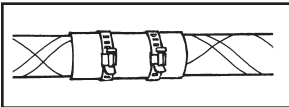
During repair, the pipeline cannot be under pressure, and the area to be repaired must be clean and dry throughout the procedure.

### Pipe Patching

Follow these instructions to repair pipe wall damage where the damaged area is two inches (50 mm) or less in diameter:

- For 2" pipe, cut the protective mesh covering and slide away from damaged area.
- Cut a length of good pipe long enough to adequately cover the damaged area and extend at least three inches (75 mm) (and preferably four inches/100 mm) to either side of the damaged area.



- Slit the "patch" lengthwise twice and remove a section so that about three-fourths of the circumference remains. 
- Thoroughly sand the inner surface of the patch and sand a corresponding area on the pipe around the damaged section. Use coarse sandpaper, a file, or a disc sander to remove all gloss from the surface to be bonded. 
- If solvent is used to clean all bonding surfaces, allow the solvent to evaporate then apply a thick coating of adhesive to both surfaces, snap the patch in place, and apply pressure with hose clamps or banding material until the adhesive hardens. The clamps may be left on or removed after heat curing. 
- Replace the protective mesh covering if the repair is made on 2" pipe.

### Repairing Extensive Damage

When the damaged area in the pipe wall is larger than two inches (50 mm) in diameter, follow these instructions:

- For 2" pipe, cut the protective mesh covering and slide away from damaged area,
- When damage is local (less than two inches/50 mm long but more than two inches/50 mm around the circumference of the pipe), check to see if there is enough slack in the pipe to cut out the damaged section. If so, cut out the damaged section, retaper the cut ends, and bond a sleeve coupling between the tapered ends. Make sure the joints are locked up and fully cured before pressure testing the repair.

If the pipe is buried, excavate a working area large enough to allow for tapering tool rotation. Taper the cut ends of the pipeline and install the sleeve coupling.

- When damage is extensive (too large for replacement by a sleeve coupling), cut out the damaged section, taper the cut ends, and install two sleeve couplings and a pipe nipple. This procedure requires sufficient slack in the line to make the final joint by lifting the pipe (or moving the pipe to one side) to engage the bell and spigot joint. Therefore, it may be necessary to remove additional backfill from a buried line to allow the pipeline movement of several feet.

- Cut out the damaged section of pipe,
- Taper one end of a piece of pipe at least as long as the damaged section. When tapering, carefully observe the position of the nipple on the tapering tool. This taper will be used as a gauge. Cut this nipple to the proper length in the following steps.
- When pipe is buried, excavate a working area large enough to allow for tapering tool rotation. Taper the cut ends of the pipeline and install the two sleeve couplings. Cure these joints and then measure the gap between the sleeve couplings. Determine the proper length of the pipe nipple. This length is the sum of the distance between the two sleeve couplings, the insertion length of the tapered ends, and an additional "wet" make-up length to assure joint lock up.

To determine the insertion length of the tapered ends, move one of the couplings to the side and use the end of the repair nipple made in the previous step to determine the dry fit into each bell. (NOTE: The dry fit must be very tight, i.e. use a 2x4 to drive the joint together tightly enough that it is difficult to separate.) The total length of the repair nipple is determined by adding these two measurements to the distance between the sleeve couplings and then adding the two make-up dimensions from Table 9.

# Secondary Containment System Installation

**TABLE 9. Make-up Dimensions (Wet)**

Pipe Size		Make-up Dimensions	
In.	mm	In.	mm
2	50	1/8	3
3	75	3/16	5
4	100	3/16	5

This added length is needed due to additional insertion that occurs because the adhesive acts as a lubricant. (CAUTION: This additional insertion will be greater if a tight, dry fit is not achieved when measuring. It will also be different for each size of pipe.)

After the final nipple length is determined, cut the other end of the nipple and taper it, making sure the nipple is on the tapering tool in exactly the same position as the first taper that was used to measure the insertion length.

- If solvent is used to clean bonding surfaces, allow the cleaner to evaporate. Apply adhesive to all bonding surfaces and insert the nipple into the line by lifting the line or moving it to one side. Pushing the pipe back into the line will push the nipple into the bell. Make certain all tapers are tightly locked.
- Replace the protective mesh covering if the repair is made on 2" pipe.

## Leaking Joints

Any adhesive-bonded joint that leaks during pressure testing **MUST BE REMOVED AND REPLACED**. Follow the previous procedures using two sleeve couplings and pipe nipple.

After completing any necessary repairs to the piping system, follow the proper testing sequence to verify the system's integrity.

## PART TWO

### INSTALLATION INSTRUCTIONS FOR RED THREAD IIA SECONDARY CONTAINMENT PIPING

**Before beginning an installation, it is important that all crew members read and be familiar with the installation procedures described in this manual.**

The secondary containment piping system is designed for use with RED THREAD IIA product pipe. The system consists of the next larger size pipe and special two-piece clam shell fittings.

Many of the procedures used for installing primary product pipe and fittings are also used for installing secondary containment pipe and fittings. Refer to these sections and to Bulletin Nos. F6625 or F6624 for tapering tool operating instructions.

**Following are useful sections previously outlined:**

- Storage and Handling** (page 1)
- Layout and Preparation** (pages 2-3)
- Tool and Equipment List** (page 3)

**For installation of bolts, the following is recommended:**

- 3/8" variable impact wrench with 3/8" socket
- 1/4" variable speed drill motor with 3/8" socket
- One 3/8" wrench

**For installing saddles, the following is recommended:**

- Sanding equipment:
  - power sander with rough surface sanding disc (flexible pad with 40 grit or less disc), or
  - hand file (coarse)
- Fine tooth circular hole saw with pilot drill
- Hose clamps or Band-It banding tool large enough to secure saddles to pipe. (If banding is used, the Band-It banding tool is preferred as this tool does not leave slack in the band when the tool is removed. Two Band-It tools are recommended so the saddle can be pulled down uniformly. Use 3/4" (19 mm) banding. (Band-It information is available at [www.band-it-idex.com](http://www.band-it-idex.com).)

**Cutting and Tapering** (page 4)

**Installation (piping layout and trench design; adhesive mixing and curing)** (pages 5-11)

## Secondary Containment Pipe

FGS Smith Fibercast secondary containment piping sizes are as follows:

Containment Pipe Size		Primary Pipe Size	
3"	75 mm	2"	50 mm
4"	100 mm	3"	75 mm
6"	150 mm	4"	100 mm

## Secondary Containment Fittings

Available secondary containment fittings are tees, 90° elbows, 45° elbows, couplings, nipples, concentric reducers, termination fittings (with or without 3/4" NPT threaded outlet), saddles (belled or with NPT threaded outlets), and sump entry termination fittings. Inserts are required on 3" and 4" 90° elbows and tees for *Closed Interstitial Monitored Systems*. Inserts are *not* required for *Open Gravity Flow Systems*.

## Adhesive for Secondary Containment Piping

For petroleum products, alcohols, and alcohol/gasoline mixtures, use 8000 or 7000 series adhesive for installing secondary containment piping systems. **When joining secondary containment pipe-to-fittings and fittings-to-fittings, fiberglass filler must be added to the adhesive to ensure optimum performance of this type of bonded joint.** Filler is available from FGS Smith Fibercast. Due to the quantity of adhesive required for join secondary containment fittings, it is recommended that only 7069 or 8069 kits be used (See Table 14 on page 21). If 7014 and 8014 kits are used, please note that extra kits (50% more than 7069 or 8069) must be used for each secondary containment fitting.

### LAYOUT AND PREPARATION

Before installing the secondary containment piping system, review and verify the recommendations for proper installation set forth previously:

**Layout and Preparation** (Installation Crew Size and Organization) (pages 2-3)

**Piping Layout, Pipe Trenches and Burial** (page 5)

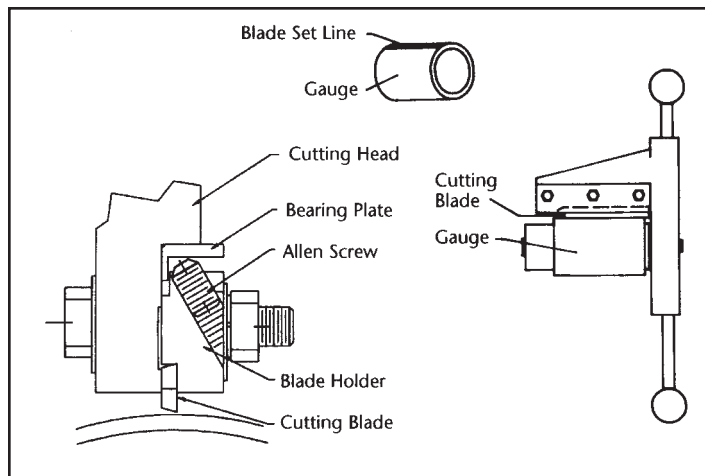
Most of the standard procedures for installing a secondary containment piping system can be handled by the same size crew that would install a single-wall product piping system. It is essential that each phase of an installation be evaluated and the proper number of workers be assigned to assure an efficient installation.

### SCARFING PIPE

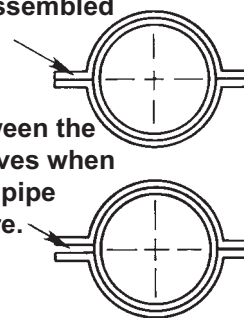
All piping should be scarfed before bonding. Couplings may be needed for making containment pipe size reductions or straight pipe runs. Spigots may be needed for pipe runs or for making a containment sump connection.

The ends of the containment pipe that are to be joined to secondary containment fittings must be thoroughly scarfed for a minimum length of 3 inches (75 mm). See page 4 for scarfing tools available or refer to Bulletin Nos. F6624, F6625, or F6600 for complete operating instructions.

Any surface irregularities must be removed. This procedure is most easily accomplished by using the Model 2100 or 2102 power tool. Preset at the factory, it can scarf 3" and 4" (75 mm and 100 mm) RED THREAD IIA secondary containment pipe. (It also tapers 2" and 3" (50 mm and 75 mm) RED THREAD IIA primary pipe.



**Scarf O.D. of pipe so that the clam shell fitting halves fit together when assembled by hand.**



**If there is a gap between the clam shell fitting halves when assembled by hand, pipe must be scarfed more.**

If the Model 2100 or 2102 power tool is not available, the ends may be scarfed using the FGS Smith Fibercast manual tapering tool in conjunction with a secondary containment scarfing adapter kit. This kit consists of a special scarfing blade (approximately 4"/100 mm long), scarfing blade holder, 1/8" Allen wrench, and 3" and 4" (75 mm and 100 mm) scarfing gauges, that are required to set the tool tolerances. The scarfing adapter kit is easily adapted to FGS Smith Fibercast 2"-6" (50 mm-150 mm) manual tapering tool kit.

Assemble the proper size mandrel and scarfing blade holder following the procedures in Bulletin No. F6600, Installation Instruction for 1"-6" Tapering Tool.

Rotate the tool body so that the scarfing blade holder is at a 12 o'clock position; this assures the blade will rest on top of the gauge. Slide the proper size gauge all the way to the back of the mandrel. Insert the special blade into the blade holder all the way to the back of the tool body. After positioning the black reference mark on the gauge under the blade, be sure the blade makes uniform contact with the gauge and the blade holder is resting on the blade.



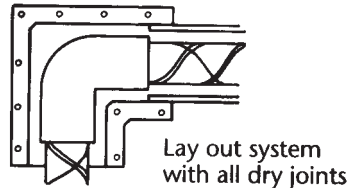
## Secondary Containment System Installation

Using the nuts, bolts, and washers supplied, tighten the blade holder to secure the blade. Now insert and slide the bearing plate into the slot located between the tool body and the blade holder. The bearing plate will rest loosely on the blade holder until it is locked into place using the supplied Allen screws. The two Allen screws should now be positioned so each makes LIGHT contact with the bearing plate. NOTE: The Allen screws only prevent the blade holder from opening during use.

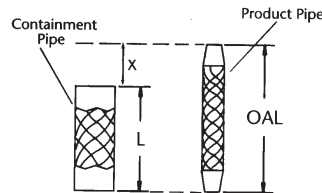
The tool is now prepared to remove (scarf) the resin gloss from the ends of the containment pipe. After removing the gauge, insert the tool into the pipe to be scarfed until the point of the blade touches the end of the pipe. NOTE: The tool must be rotated in the same direction the wide side of the blade faces. Advance the tool in approximately 1/4" (6 mm) increments after each revolution. Continue the operation until the resin gloss has been removed for a minimum length of 3" (75 mm).

### PIPING LAYOUT

The scarfed containment pipe must be positioned over the product pipe before bonding the product pipe. Pre-installation of the secondary containment pipe (only) is best accomplished at the same time the product pipe is dry fitted together. This will speed up installation and prevent unnecessary delays.

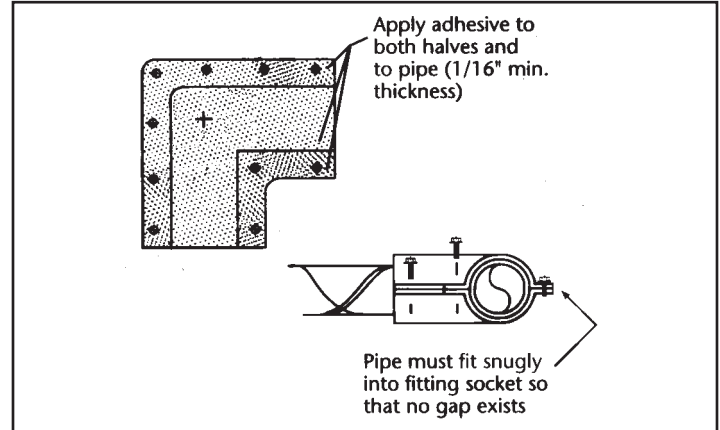


Typically, the length of the containment pipe should be 4" shorter than the primary pipe.

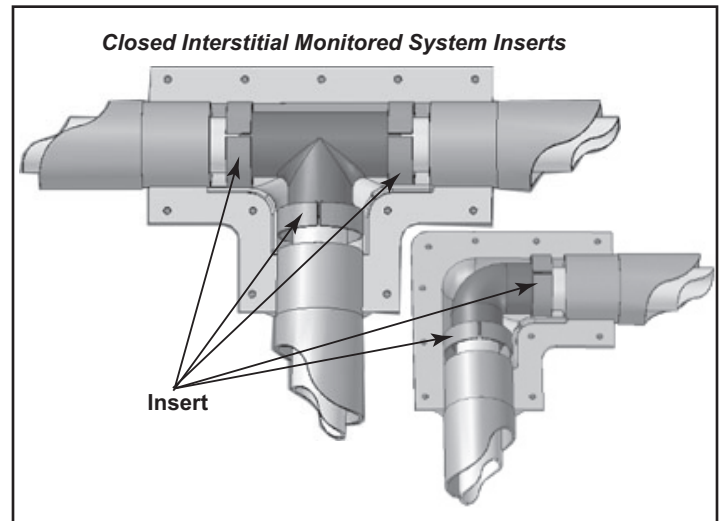


**WARNING:** Fit all secondary containment connections to make sure the insertion is approximately 3". Be sure the containment pipe is not inserted too far into the containment fitting. **The glossy O.D. of the pipe should not be seated in the containment fitting.**

The bonding surfaces of the containment fittings are pre-sanded when manufactured. Two-piece secondary containment fittings must be joined using a greater amount of adhesive than is necessary for joining bell and spigot joints of product piping. **Coat the ID of both halves of the containment fittings completely.**



Inserts must be used on 3" and 4" 90° elbows and tees for *Closed Interstitial Monitored Systems*. Prior to bonding the insert, spread the insert splice 3 or 4 times to relax the insert. The insert may be placed on the containment pipe or primary fittings for easy access prior to bonding of the containment fitting. Locate the inserts adjacent to the inside radius of the containment fitting, as shown below. The split in the insert must be facing up. Do not allow insert to overlap.



### CONTAINMENT FITTINGS

All clam shell containment fittings consist of two halves with flanges. The bottom half has threaded inserts for ease of assembly.

These fittings are assembled with adhesive and 1/4-20 washer head bolts that are furnished with the fittings. The required bolts are supplied in small plastic bags. If extra bolts are required, they can be purchased from your distributor or standard 1/4-20 x 1" long hex head bolts can be used. If standard bolts are used, place a flat washer on the bolt before torquing.

## CONTAINMENT CROSSOVER DETAIL

When installing a secondary containment system, some preparation is necessary if the closest possible separation of lines is required. To minimize the overall change in elevation when installing a clam shell containment crossover, it is necessary to shorten one leg of the 45° containment elbow and the side outlet run of the containment tee.

Refer to Table 10 for the maximum length that can be removed and for the minimum nipple length of both product piping and secondary containment piping.

NOTE: Use self-tapping screws or match drill two holes (5/16") at a distance of 3/4" (19 mm) from the cut end of the 45° elbow and the tee.

**TABLE 10. Containment Crossover Information**

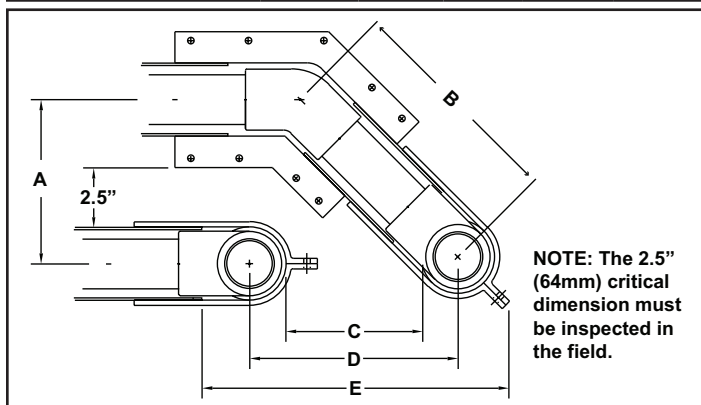
Fitting	Containment Pipe Size		
	3" (max. in.)	4" (max. in.)	6" (max. in.)
Remove from 45° elbow	1.25	2.00	1.25
Remove from side run of tee	1.50	1.63	1.00
Product nipple size <sup>(1)</sup>	2x8	3x8	4x10
Containment nipple size	3x6	4x6	6x8

<sup>(1)</sup> Actual length of the product nipple will vary slightly because of different insertion lengths due to variations of tapers.

To prevent interference of the pipelines, do not locate two containment fittings closer than shown in Table 11 and the drawing below.

**TABLE 11. Pipe Separation Distances**

Containment Pipe Inches	A In.	B In.	C In.	D In.	E In.
3	7.50	10.60	6.50	10.00	14.50
4	8.50	12.00	7.50	12.00	16.50
6	10.65	15.00	8.00	14.75	22.00
Containment Pipe mm	A mm	B mm	C mm	D mm	E mm
75	191	269	165	254	368
100	216	305	191	305	419
150	271	381	203	375	559



## SUMP CONNECTIONS

### Entry and Termination at the Sump

#### • Double Wall (DW) Sump Entry/Termination Fitting with Bonded Fiberglass Alignment Rings

NOTE: Alignment rings can be bonded to a flat fiberglass surface only. DO NOT install on round or thermoplastic sumps.

1. Determine entry hole location and cut entry hole in sump wall using dimensions in Table 12. (maximum allowable offset is 5° .)

**Table 12. Fitting Dimensions**

Size	A	B	C
(In.)	(In.)	(In.)	(In.)
3x2	6.88	4.00	4.00
4x3	6.88	4.00	5.00

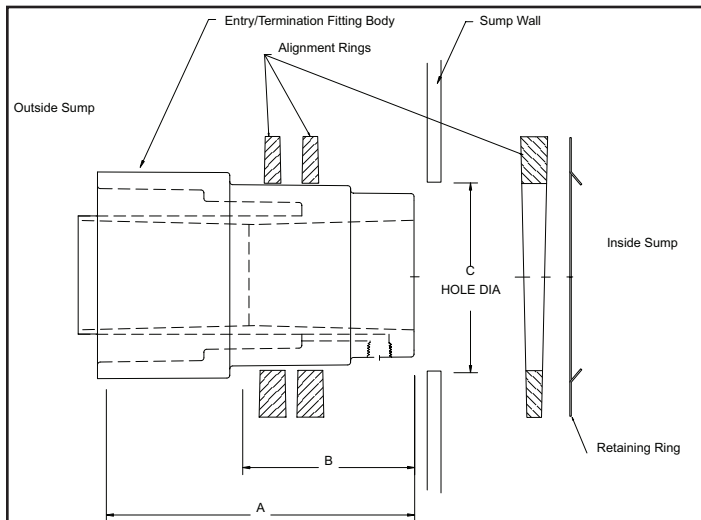
2. Using 40-60 grit sanding surface, sand the area around the hole where the alignment rings will bond to the sump. Lightly sand the rings. Remove dust and wipe with solvent (optional).
3. Place two alignment rings on sump entry/termination fitting and insert through sump wall with the rings on the outside of the wall. Locate the 1/4" threaded outlet to the desired location. For a gravity drain or open system, the 1/4" threaded outlet should be located at the 6 o'clock position. Leave 1/4" plastic threaded outlet protector in place until 1/4" fitting installation.
4. Dry fit primary pipe and rotate the two rings until the desired angle is reached. Make alignment marks on the rings, fitting body and the sump wall.
5. Place one ring over the sump fitting in the inside of the sump and rotate to the desired angle. Make alignment mark on both the sump wall, fitting body, and the ring.
6. Mix one 7014 or 8014 adhesive for each fitting per the instructions in the adhesive kit. Mix in filler to thicken adhesive (**fiberglass alignment ring will not seal properly without filler**),
7. Apply adhesive generously, approximately 1/16" thick to the inside and outside of the sump walls where the alignment rings are located. **Coat cut edges of the entry hole.** Apply a thin coating of adhesive to the bonding surfaces of the alignment rings.
8. Line fitting body and rings up with alignment marks and press together firmly.
9. Slide the metal retaining ring over the inside section of sump fitting against the alignment rings until they are tight against sump wall. (A short section of 4" pipe may be used to drive the metal retaining ring over the fitting.) **There must be an adhesive bead visible between the rings and the sump wall.** The metal ring must hold the assembly in position while the adhesive cures. If the assembly is not tight against the sump wall, firmly press

# Secondary Containment System Installation

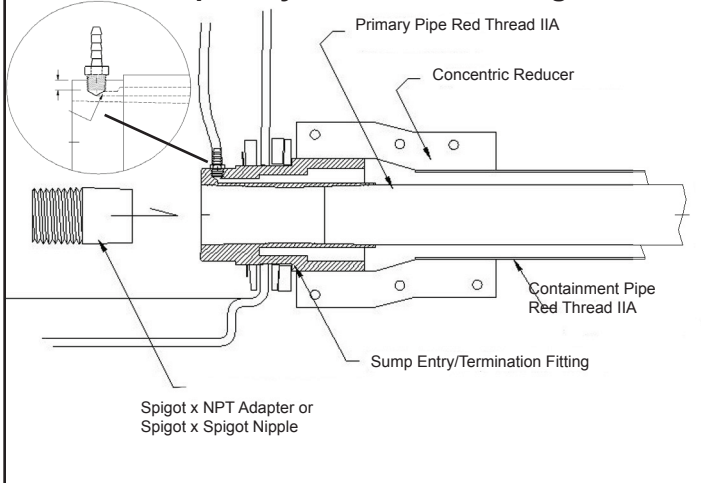
the entry fitting against the outside sump wall while pressing the metal ring against the alignment ring on the inside.

10. Do not disturb assembly until the adhesive is cured. This includes bonding of pipe to the entry fitting and installing the threaded outlet fitting. Clean excess adhesive from all bonding surfaces. See adhesive kit instructions for cure time.
11. The use of an industrial hot air gun may speed up the curing process. Do not overheat.
12. Remove 1/4" plastic threaded outlet protector. Apply adhesive to the 1/4" fitting and screw into the 1/4" threaded outlet. Tighten to 40 in-lbs or 1 1/2-2 turns past hand tight. After installing the fitting, be sure the interstitial space is free from excess adhesive. Install a short hose and blow excess adhesive through the air passage.
13. Connect only flexible tubing or hoses to the 1/4" side outlet. NOTE: Tubing or hoses must be rated to full vacuum.
14. Bond primary pipe.
15. After primary pipe has been tested, use a concentric reducer to bond the sump entry/termination fitting to the secondary containment piping. Do not use a clam shell termination fitting in place of the concentric reducer. See termination example below.

Refer to Bulletin No. B2104 for more detailed information.



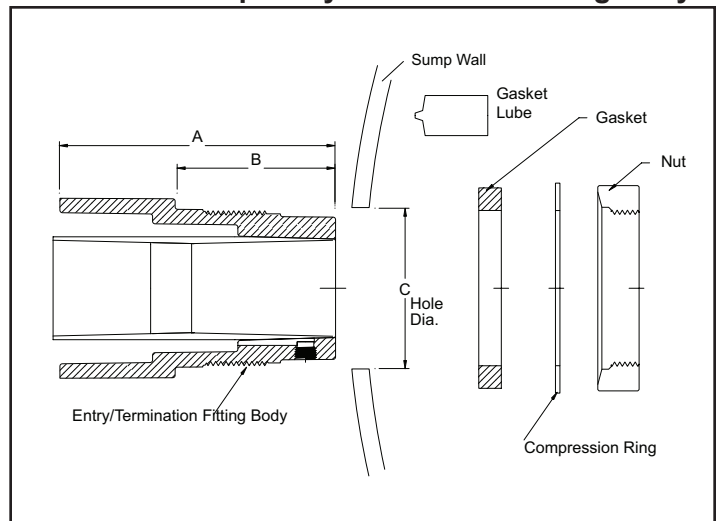
## Termination Example using Sump Entry/Termination Fittings



## • DW Sump Entry/Termination Fitting With Gasket

1. Determine entry hole location and cut entry hole in sump wall using dimensions in Table 12.
2. Place sump entry/termination fitting through hole with the threads on the inside of the sump wall. A maximum of 2° of offset is acceptable for a proper seal on a flat surface. For a rounded surface, no offset will be allowed; pipe must be perpendicular to the sump.
3. Locate 1/4" threaded outlet to the desired location. For a gravity drain or open system, the 1/4" threaded outlet should be located at the 6 o'clock position. Leave 1/4" plastic threaded outlet protector in place until 1/4" fitting installation.
4. Lube gasket with a water-based lubricant and place over the threads and against the sump wall.
5. Thread nut onto fitting hand tight.
6. Apply adhesive to the 1/4" fitting and screw into the 1/4" threaded outlet. Tighten one quarter turn past hand tight. After installing hose connection, be sure the interstitial space is free from excess adhesive. Install a short hose and blow excess adhesive through air passage.
7. Connect only flexible tubing or hoses to the 1/4" side outlet. NOTE: Tubing or hoses must be rated to full vacuum.
8. Allow adhesive to cure before bonding primary pipe, testing or applying stress. See adhesive kit instructions for ambient cure times.
9. The use of an industrial hot air gun may speed up the curing process. Do not overheat.
10. Bond primary pipe.
11. Tighten the nut again after bonding and curing the joint.
12. After primary pipe has been tested, use a concentric reducer to bond the sump entry/termination fitting to the secondary containment piping. Do not use a clam shell termination fitting in place of the concentric reducer. See termination example using Sump Entry/Termination Fittings on page 19.

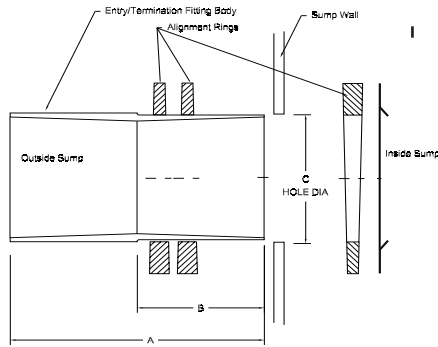
## Gasketed Sump Entry/Termination Fitting Body



# Secondary Containment System Installation

## • Single Wall Sump Entry/Termination Fitting

Refer to Bulletin No. B2107 for installation information.

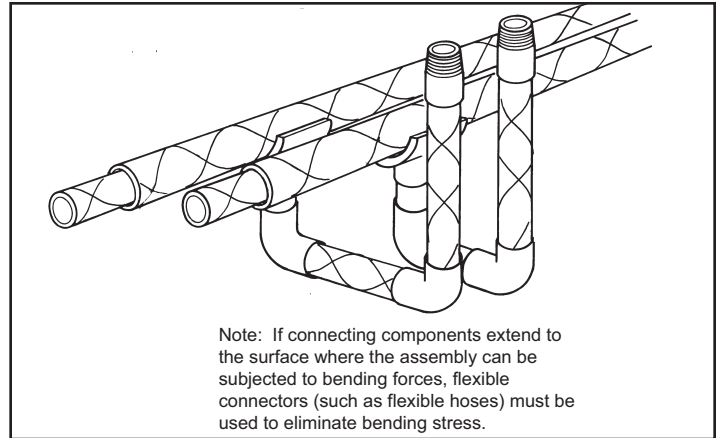


## SECONDARY CONTAINMENT REDUCERS

In-line secondary containment pipe size reductions are made using a concentric reducer. Reductions can be made from 6" to 4" (150 mm to 100 mm) and 4" to 3" (100 mm to 75 mm). Both ends of the concentric reducer are bonded to scarfed end of pipe.

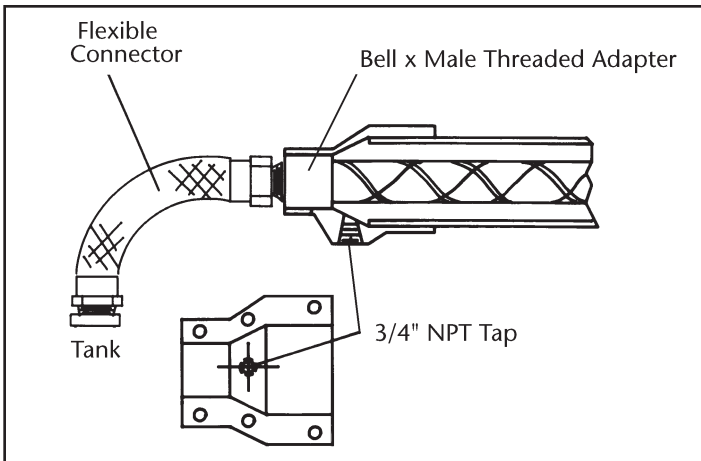
## SECONDARY CONTAINMENT SADDLES

For secondary containment piping installations requiring intermediate access stations for visual or electronic leak detection, several sizes of reducing saddles are available. See Bulletin No. 2101 for saddle sizes and descriptions.



## Alternate Termination

Termination of the secondary containment piping system at the storage tank is accomplished using a termination fitting with 3/4" female NPT threaded outlet. See figure below. The 3/4" threaded outlet allows easy access for pressure testing of the secondary containment piping system and may also be used as an access for a leak detection prove.



Containment saddles must be installed prior to bonding and testing the product piping. Use adhesive when bonding saddles to the pipe.

Procedure for installing secondary containment saddles:

- Locate saddle on pipe and mark around saddle base.
- Use a file or rough sandpaper (40 grit or less) to remove all surface gloss from the pipe O.D. where the saddle is to be bonded. Use circular or random pattern during sanding to eliminate grooves on the pipe surface.
- After sanding, locate saddle on pipe and mark hole to be cut in pipe. Using pilot drill and a fine-tooth circular hole saw, cut a hole of the same size as the outlet of the saddle. Do not force the cutter or it will fray the edges of the hole.
- All bonding surfaces must be free of contamination.
- Apply a heavy coat of adhesive to the O.D. of the pipe, I.D. of the saddle, and the edges of the pipe wall exposed by the hole.
- Place the saddle over the hole and clamp with two hose clamps. Using a large screw driver, hand tighten the clamps alternately until secure and adhesive squeezes out all the way around the saddle. This will ensure the pipe O.D. conforms to the I.D. of the saddle. The clamps may be left on or removed after the bond has cured and after the flexible connector is installed in the outlet.



**CAUTION:** Product pipe may be under pressure if the testing has been completed. Do not attempt to install a saddle on the containment pipe if the product piping system has been installed and tested.

**TABLE 13. Termination Fitting Connections**

Part Number	Termination Fitting Size (In./mm)	Large End Fits (Pipe) (In./mm)	Small End Fits (Male threaded adapter or coupling)
012030-236-3 with tap	3 x 2	3	2" scarfed adapter <sup>(1)</sup>
012030-235-3 without tap	75 x 50	75	50 mm adapter
012040-236-3 with tap	4 x 3	4	3" scarfed adapter <sup>(1)</sup>
012040-235-3 without tap	100 x 75	100	3" scarfed adapter <sup>(1)</sup>
012060-234-7 with tap	6 x 4	6	4" scarfed adapter <sup>(1)</sup>
012060-235-7 without tap	150 x 100	150	100 mm adapter

<sup>(1)</sup> A special coupling with controlled O.D. may be obtained for use with the termination fittings and threaded fittings.



# Secondary Containment System Installation

## JOINT PREP

### Installation Preparation

Before bonding the two-piece clam shell containment fittings, the installation procedures should be reviewed with the installation crew members. In order to maintain the efficiency of the installation, a minimum of three workers is recommended: one worker to mix and apply adhesive to the secondary containment fittings and the two remaining workers to assemble and bolt the fittings together.

### Cleaning the Bonding Surfaces

It is recommended that all bonding surfaces are cleaned before bonding. **DO NOT TOUCH THE BONDING SURFACES OR ALLOW THEM TO BECOME CONTAMINATED.**

Acceptable cleaning methods are as follows:

- Sand all bonding surfaces until contamination is removed.
- Dirt Contamination can be removed by water washing. Be sure the surfaces are dry before bonding.
- Sand all machined ends that have been exposed to sunlight and have turned yellow or brown in color.
- Use of a solvent as a cleaning method is optional. Some alternate cleaning solvents available through local hardware or industrial supply houses are acetone, alcohol, methylene chloride, and methyl ethyl ketone. After cleaning, be sure any residual solvent has evaporated before applying adhesive. **DO NOT USE SOLVENTS THAT LEAVE AN OILY FILM ON THE BONDING SURFACES.**



**WARNING:** Some degreasers and solvents are extremely flammable. Be sure to read warning labels on containers. Never use gasoline, turpentine or diesel fuel to clean joints.

If you have questions, please contact your FGS representative.

Be sure all solvent has evaporated before applying adhesive.

## ADHESIVES

For secondary containment systems conveying alcohols or alcohol/gasoline blends, use 8000 or 7000 series adhesive. Follow the adhesive mixing instructions that are packaged with each kit.

Refer to page 7 for information on adhesive labeling.

## ADHESIVE MIXING

When the weather is cool or the adhesive has been stored in a cool environment (below 65°F), prewarm the adhesive kits. (Do not heat above 100°F)

- Empty all of the contents of the hardener. **NEVER ATTEMPT TO SPLIT A KIT.** Cut through the adhesive with the edge of the mixing stick to assist in mixing the two components.
- Mix until the adhesive has a uniform color and a consistent flow off the mixing stick. Wipe down the sides, bottom, and under the rim of the can with the mixing stick to assure complete mixture.
- **FILLER MUST BE ADDED TO THICKEN THE ADHESIVE.** The filler is packaged in premeasured quantities for use with 7014 or 8014 and 7069 or 8069 adhesive kit. One bag of filler is used for each adhesive kit. Before adding the filler to the mixed adhesive, be sure both the adhesive base and hardener are thoroughly mixed together. All of the filler in the bag should be used. The thickened adhesive may be applied with either the brush or the stir stick provided in the kit.

Refer to Table 14 for the number of adhesive kits required to bond containment fittings.

**TABLE 14. Adhesive Kits Per Containment Fitting**

Type Fitting	7069 or 8069* (Kits per Fitting)		
	3"	4"	6"
90° Elbow	1	1	1.5
45° Elbow	1	1	1.5
Tee	1	1.5	2
Coupling	1	1	1.5
Termination Fitting	1	1	1.5

\*If 7014 or 8014 adhesive kits are used for secondary containment, increase the number of kits in Table 14 by 50%.

**NOTE:** Number of adhesive kits per containment fitting is based on applying a 1/16" (1.6 mm) minimum thickness of adhesive to both halves of the fitting and to the pipe ends.

Complete information and safety precautions are packaged with each adhesive kit. Review all safety precautions thoroughly before mixing the adhesive.

**Adhesive Disposal - See page 7 for instructions.**

### JOINT ASSEMBLY FOR RED THREAD IIA SECONDARY CONTAINMENT PIPING

After cleaning the inside surfaces (I.D.) of both halves of the clam shell fitting, apply a thick coating ( $1/16$ "/1.6 mm minimum) of filled adhesive to the entire I.D. of both halves of the fitting, including the flanges (flat bonding surfaces). Next apply a thick coating ( $1/16$ "/1.6 mm minimum) of adhesive to the scarfed or sanded surfaces of the pipe ends.

Assemble the containment fitting by placing the half with the pre-installed threaded female inserts on the bottom. Do not over-insert pipe past scarfed area.

Inserts must be used on 3" and 4" 90° elbows and tees for *Closed Interstitial Monitored Systems*. Inserts are not required for *Open Gravity Flow Systems*. Prior to bonding the insert, spread the insert splice 3 or 4 times to relax the insert. The insert may be placed on the containment pipe or primary fitting for easy access prior to bonding of the containment fitting. Locate the inserts adjacent to the inside radius of the containment fitting, as shown on page 17 drawing "*Closed Interstitial Monitored System Inserts*." The split in the insert must be facing up. Do not allow insert to overlap.

Use the bolts supplied with the clam shell fitting to assemble the fittings on the pipe. Use of an air or electric wrench with a magnetic socket will greatly facilitate assembly. When starting the bolts, allow the bolt to start with minimal pressure on the tool. Excessive pressure may push the insert from the fitting. Tighten the bolts alternately and with equal force. **DO NOT EXCEED 8 FT-LBS OF TORQUE.**

**NOTE:** Prior to bonding, make sure the pipe fits snugly into the socket ends of the clam shell fittings and there are no gaps between pipe ends and fitting sockets. A properly bonded joint should have adhesive visible from all bonded surfaces.

**NOTE:** Do not disturb a completed containment piping joint when assembling additional joints. The adhesive must be fully cured before applying stress to the assembled joints. Read and observe the filled adhesive instructions supplied with each adhesive kit.

### JOINT CURE

#### Industrial Heat Gun

An industrial heat gun and heavy duty aluminum foil may also be used to create a mini oven around the clam shell secondary containment fitting. Wrap foil around the fitting and cinch the ends down. Cut a 10" to 12" section of 2" or 3" pipe and place inside of the foil. Place heat gun in the end of the pipe. Do not place heat gun any closer than 12" from the fitting. Cure time is approximately 15 minutes. For a proper cure, maintain the temperature between 250°F and 400°F.

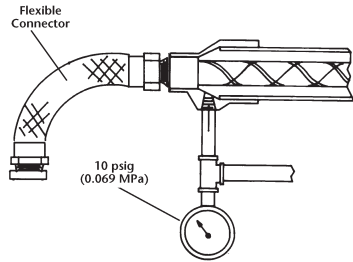


# Secondary Containment System Installation

## TESTING RECOMMENDATIONS FOR SECONDARY CONTAINMENT PIPING

Secondary containment piping, 3" and 4" (75 mm and 100 mm) diameter sizes, can be pressure tested by installing an in-line tee with a pressure gauge and a nipple in the 3/4" threaded outlet of a termination fitting. If the test piping is to be installed temporarily, use care not to over tighten when installing the steel pipe threads. Fiberglass threads may be damaged when removing the steel threads if over tightened. Use soft-set, non-metallic thread dope only.

FGS recommends testing 3", 4", and 6" (75, 100, and 150 mm) secondary containment piping systems with air at pressures not to exceed 10 psig (0.069 MPa). The most convenient place to introduce air for the containment piping pressure test is at the threaded outlet located on the termination fitting near the underground storage tank. It is advantageous to leave the system pressurized until the installation is completed to monitor for possible damage to the containment piping system during additional construction.



The low pressure and low volume of the secondary containment piping system makes this air test a safe procedure if normal safety precautions are followed. Refer to air safety precautions on pages 13-14.

### Test Procedures for "In Service" Secondary Containment UL Piping Systems to Include Open and Closed Systems.

Secondary Containment piping systems can be tested after the line has been installed and in operation for a period of time. All systems must be shut off before testing. It is recommended that where possible, the air input valve be in a different location than the pressure gauge. **Please read and understand all safety instructions and considerations in the FGS Smith Fibercast Installation Manual No. B2160 before testing.**

#### Closed System

FGS recommends testing 3" and 4" secondary containment open systems with air at pressures not to exceed 10 psig. Pressure should be left on the system for a minimum of one hour. The test pressure should not exceed the pressure rating of any component in the piping system.

#### Open System (Gravity Drain)

FGS recommends testing 3" and 4" secondary containment open systems with air to the equivalent static head test pressure listed in Table 1. The pressure should be left on the system for a minimum of one hours. The test pressure

should not exceed the pressure rating of any component in the piping system. It is the responsibility of the installer or customer to temporarily seal the system for testing.

Test Pressure for Open System	
Feet of Head*	Test Pressure (psig)
2	1.0
4	2.0
6	2.5
8	3.0
10	4.0
12	5.0

\*Highest point in system minus the lowest point in system.

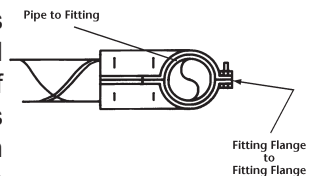
These test procedures are designed specifically for a FGS Smith Fibercast system. FGS is not responsible for any damage to "other" products in the systems such as rubber boots, hoses, etc. Please contact the manufacturer of any non-FGS products for a maximum test pressure and time. Do not exceed FGS recommendations.

### Vacuum or Inert Gas Test Procedures

Testing with vacuum and/or pressurized inert gases have been successfully used with FGS Smith Fibercast piping systems. Although helium testing in a closed atmosphere and at measured levels is useful, testing in the field with helium has shown inconsistencies when trying to identify leak location.

## REPAIR PROCEDURES

For damaged pipe and for leaking joints, FGS recommends only the repair methods listed below. Leaks can occur if secondary containment joints are not properly bonded. Upon completion of required repairs and before putting the line back into service, always pressure test the repair work according to the procedures on this page to assure the integrity of the system.



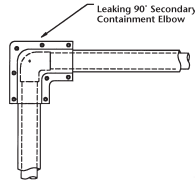
- **Replacing Leaking Clam Shell Secondary Containment Fittings** (Do not use this procedure for containment crossovers.)

Example: 90° Secondary Containment Elbow

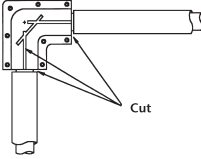
## Secondary Containment System Installation

When cutting out and replacing a secondary containment fitting, do not cut the internal primary product pipe.

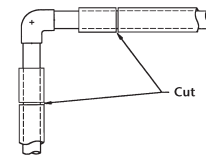
1. Dissect the secondary containment fitting and the secondary containment pipe around its circumference as shown by the arrows. Remove the containment elbow.



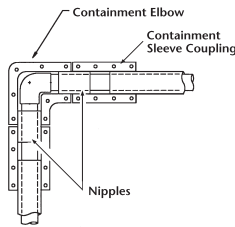
2. Create a pipe nipple at least 7 inches (180mm) long on either side of the joint by making another cut around the circumference of the containment pipe.



3. Using a sander, coarse file, or 30-40 grit Emery cloth, remove surface gloss from both ends of the nipples and the containment pipe. Sanded area must be a minimum of 3 inches (75 mm) in length.



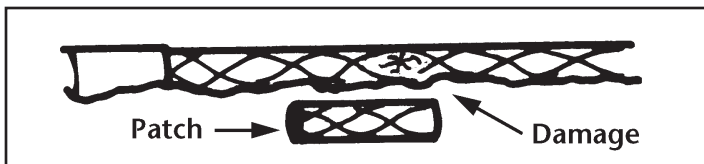
4. Position the nipples between the new containment elbow and containment sleeve couplings. NOTE: It may be necessary to remove additional sections of the containment pipe to provide clearance for the coupling.



5. Bond the elbow and containment sleeve couplings into place according to instructions.

### • Repairing Minor Pipe Damage to Pipe

Follow the pipe patching instructions on page 14 of this manual when the damaged area is two inches (50 mm) or less in diameter.



### • Repairing Minor Damage to Fittings

Small repairs (pinhole leaks and leaks up to 1" in diameter using 8088 Repair Kit:

1. Take pressure off the system and dry the area around the leak.
2. Sand an area 3" minimum on each side of the leak.
3. Cut three 3"x3" patches from the glass supplied with the 8088 repair kit.
4. Mix adhesive per instructions supplied in the kit.
5. Paint adhesive on the sanded area of the fitting.
6. Apply the first layer of glass and wet out with adhesive. The glass may be wet out and before it is applied to the leak area.
7. Repeat the previous step and apply another layer of glass.
8. Cure per the time listed in the adhesive kit.

Flange section or joint leak repairs (overwrapping entire fitting) using 8088 Repair Kit:

1. Take pressure off the system and dry the area around the leak.
2. Grind or cut flange sections off the clam shell secondary containment fitting and sand flush with the fitting body.
3. If needed, mix adhesive with filler to grout in any gaps or voids in the bond line or to create a smooth wrapping surface.
4. Per instructions in the 8088 repair kit, apply adhesive to the sanded area. Wet out glass and wrap around the fitting as though it were a section of pipe, centering the first layer over the joint and extending 2" past the end of the fitting onto the pipe. Apply tension to squeeze adhesive through the glass layer. For elbows and tee, slits may have to be cut in the center section for glass to lie flat.
5. Repeat previous step on the center of the joint and then the other side of the fitting extending 2" over the end of the fitting. When starting the glass, overlap the first wrap a minimum of 2".
6. Repeat two previous steps until three layers of glass have been placed over the fitting.
7. Cure per the time listed in the adhesive kit.

### • Repairing Extensive Pipe Damage

When damage is less than 2" (50 mm) long but more than 2" around the circumference of the pipe, the following repair procedures should be followed. If the pipe is buried, excavate a working area large enough to allow for repairs to be made. Use a secondary containment sleeve coupling to make this type repair. Containment sleeve couplings are 14" (350 mm) long. Do not remove more than 7" (175 mm) of containment pipe.



**CAUTION:** When cutting out extensive damage in the containment pipe (only), be extremely careful not to damage the internal product piping.

1. After cutting free the damaged section of containment pipe (no more than 7"/175 mm long), slit the section of pipe in half and remove.
2. Using a sander, coarse file, or 30-40 grit Emery cloth, remove surface gloss from both ends of the pipe. Sanded area must be a minimum of 3" (75 mm) in lengths. If contaminated, clean the sanded surfaces with solvent.
3. Mix the adhesive with filler. Assemble and bond the containment sleeve coupling into place and heat cure the bond.
4. After the repaired section has cured, pressure test the system following the procedures on page 23.

If damage is beyond these repair procedures, immediately contact your local FGS distributor for assistance.



# HELPFUL INFORMATION

## CONVERSIONS

	Metric Units	U.S. Equivalents
Lengths	1 millimeter	.003937 inch
	1 centimeter	.3937 inch
	1 meter	39.37 inches or 1.094 yards
	1 kilometer	1093.61 yards or 0.6214 mile
Areas	1 square millimeter	.00155 square inch
	1 square centimeter	.155 square inch
	1 square meter	10.764 square feet or 1.196 sq. yards
	1 square kilometer	0.3861 square mile
Volumes	1 cubic millimeter	0.000061 cubic inch
	1 cubic centimeter	0.061 cubic inch
	1 liter	61.025 cubic inches
	1 cubic meter	35.314 cubic feet or 1.3079 cubic yards
Capacities	1 milliliter (0.001 liter)	0.0338 U.S. fluid ounce
	1 liter	2.1134 U.S. liquid pints
	1 liter	1.0567 U.S. liquid quarts
	1 liter	0.2642 U.S. gallon
Weights	1 gram	0.03527 avoird. ounce or 15.4324 grains
	1 kilogram (1000 grams)	2.2046 avoird. pounds

## DECIMAL EQUIVALENTS OF FRACTIONS

Inches	Decimal of an Inch	Inches	Decimal of an Inch
1/64	.015625	29/64	.453125
1/32	.03125	15/32	.46875
3/64	.046875	31/64	.484375
1/20	.05	1/2	.5
1/16	.0625	33/64	.515625
1/13	.0769	17/32	.53125
5/64	.078125	35/64	.546875
1/12	.0833	9/16	.5625
1/11	.0909	37/64	.578125
3/32	.09375	19/32	.59375
1/10	.10	39/64	.609375
7/64	.109375	5/8	.625
1/9	.111	41/64	.640625
1/8	.125	21/32	.65625
9/64	.140625	43/64	.671875
1/7	.1429	11/16	.6875
5/32	.15625	45/64	.703125
1/6	.1667	23/32	.71875
11/64	.171875	47/64	.734375
3/16	.1875	3/4	.75
1/5	.2	49/64	.765625
13/64	.203125	25/32	.78125
7/32	.21875	51/64	.796875
15/64	.234375	13/16	.8125
1/4	.25	53/64	.828125
17/64	.265625	27/32	.84375
9/32	.28125	55/64	.859375
19/64	.296875	7/8	.875
5/16	.3125	57/64	.890625
21/64	.328125	29/32	.90625
1/3	.333	59/64	.921875
11/32	.34375	15/16	.9375
23/64	.359375	61/64	.953125
3/8	.375	31/32	.96875
25/64	.390625	63/64	.984375
13/32	.40625	1	1.0
7/16	.4375		

## U.S. System Units Metric Equivalents

Lengths	1 inch	25.4 millimeters or 2.54 centimeters
	1 foot	0.3048 meter
	1 yard	0.9144 meter
	1 mile	1.6093 kilometers
Areas	1 square inch	645.16 square millimeters or 6.452 square centimeters
	1 square foot	0.0929 square meter
	1 square yard	0.8361 square meter
	1 square mile	2.59 square kilometers
Volumes	1 cubic inch	16,387.2 cubic millimeters or 16.3872 cubic centimeters
	1 cubic foot	0.02832 cubic meter
	1 cubic yard	0.7646 cubic meter
Capacities	1 U.S. fluid ounce	29.573 milliliters
	1 U.S. liquid pint	0.47317 liter
	1 U.S. liquid quart	0.94633 liter
	1 U.S. gallon	3.78533 liters
Weights	1 grain	0.0648 gram
	1 avoird. ounce	28.35 grams
	1 avoird. pound	0.4536 kilogram
	1 Troy ounce	31.1035 grams

## DEFINITION OF TERMS

**BxS** - Bell (female) x spigot (male) joint.

**Bond Line** - Area where two matching tapered surfaces are bonded together.

**Closed Secondary Containment Piping System** - A secondary piping system with ends normally closed at the tank and sump with a minimum rated pressure of 50 psig (350 kPa).

**Cocked Joint** - Appearance of BxS joint that is improperly aligned.

**Cool Weather Conditions** - Below 65°F.

**Cure Time** - Time for a joint to completely cure after it is bonded.

**Damaged Pipe** - Pipe that has been affected by excessive external or bending load(s).

**Glue Line** - See bond line.

**Improperly Cured Joint** - Joint that is not cured.

**Joint Backout** - A spigot that backs out of a bell due to incomplete lock up or movement at the other end of the pipe.

**Lock Up** - Spigot is fully engaged with the bell until there is no pivot action in the joint.

**Machined Surface** - Area of pipe or fitting that is machined to remove the surface gloss so that it may be bonded.

**Matched Taper** - The matching tapers on a BxS or T.A.B. joint.

**Mechanical Locking** - See lock up.

**Open Secondary Containment Piping System** - A secondary piping system with ends normally open at the sump and a minimum rated pressure of 5 psig (35 kPa).

**Pot Life** - Time allowed to make bonds with adhesive after mixed.

**T.A.B.** - Threaded and Bonded - Tapered joint with shallow threads to prevent joint back out.

**Working Life** - See pot life.

**RED THREAD IIA**  
**Time-Tested**  
**Fiberglass Primary Piping and**  
**Secondary Containment Piping for**  
**Underground Fuel Installations**



***INSTALL IT***  
***BURY IT***  
***FORGET IT !***

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