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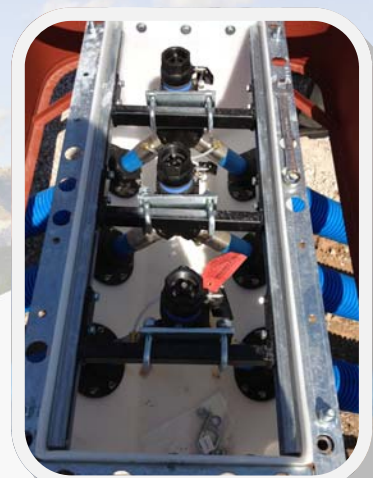
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**FUELING CONTAINMENT SYSTEMS**

# The Loop System Installation Manual

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## IMPORTANT INFORMATION FOLLOW ALL INSTRUCTIONS

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**IMPORTANT INFORMATION - FOLLOW ALL INSTRUCTIONS:** Please contact your OPW Fueling Containment System sales representative or customer service representative at 1-800-422-2525 for FlexWorks product installation procedures. All OPW FCS literature including installation instruction sheets and manuals can be accessed from the OPW FCS website at: [www.opwfcs.com](http://www.opwfcs.com).

### 1.0 INTRODUCTION

The patented Loop System™ is a unique underground piping system using specified component parts that collectively provide an environmentally safe means of conveying fuels from underground storage tanks to above ground fuel dispensers. The system specifically addresses the underground fuel supply piping system and its associated piping connections, secondary containment sumps and means of leak detection. A variety of piping and pipe connections are available that allow for a wide range of pipe routing options to meet requirements of any site design. Flexible piping has proven to be safer than conventional rigid piping which requires numerous connection joints and directional fittings. In addition, flexible piping has proven to be considerably faster to install and more cost effective than rigid piping.

### 1.1 General Information

This product manual contains useful information specifically about the component products and installer tools associated with the patented Loop System™. The information and instructions deal primarily with the double

wall flexible supply piping and containment sumps. Other system components such as, tank vent lines and stage II vapor recovery lines have their own installation instructions. It is recommended that this manual be read prior to specifying and installing the Loop System™.

**IMPORTANT: The patented Loop System™ components may only be installed by factory trained and attested installers in order for the system warranty to be valid. The use of non-trained personnel or any deviations from these recommended procedures could result in damage or leakage of the system and thus void the product warranty. Contact OPW's Customer Service Department at 1-800-422-2525 for more information.**

### 1.2 Read This Manual

This product manual contains useful information about FlexWorks underground piping and containment systems. It is recommended that this manual be read prior to specifying, installing or servicing these systems. Also, read and become familiar with all safety precautions, symbols and warnings. Installation practices must comply with all installation instructions contained within this product manual in order for the product warranty to be valid.

### 1.3 Certifications and Approvals

FlexWorks piping system components have been tested, listed or certified by a number of organizations. For a copy of listings and approvals go to the OPW FCS website [www.opwglobal.com](http://www.opwglobal.com).

**1.3.1 UL Listings:** Underwriters Laboratories Inc. of Northbrook, IL, has created a standard for underground fuel piping. This UL Standard 971 is titled Nonmetallic Underground Piping For Flammable Liquids.

- FlexWorks double wall piping is listed with Underwriter's Laboratories (UL®) under file #MH16678 and labeled as follows: Motor Vehicle Fuels, High Blend Fuels, Concentrated Fuels and Aviation and Marine.
- Listed Fuels: Below are the fuels that have been tested under UL971 and are warranted for use with FlexWorks flexible double wall piping.

#### Motor Vehicle Fuels

100% ASTM Reference Fuel No. 2  
100% ASTM Reference Fuel C  
85% Reference Fuel C - 15% MTBE  
70% Reference Fuel C - 30% Ethanol  
85% Reference Fuel C - 15% Methanol  
**High Blend Fuels**  
50% Reference Fuel C - 50% Methanol  
50% Reference Fuel C - 50% Ethanol

#### Concentrated Fuels

100% Methanol  
100% Ethanol  
100% Toluene

**Aviation & Marine Fuels**  
100% Premium Leaded Gas  
100% Kerosene

## 1.4 Regulatory Requirements

Underground fuel tanks and piping systems that contain flammable liquids, such as gasoline, are regulated by Federal and local jurisdictions. Refer to applicable regulations to make sure that the piping and containment systems to be installed are in compliance with all appropriate Federal, State, Provincial and Local regulations and requirements.

## 1.5 Safety & Warranty Warnings

The following warnings will appear throughout this owner manual for your benefit and safety, as well as to assist you in the installation, operation and maintenance of the equipment. The highlighted words below are used to warn you as to seriousness of the matter, what precautions should be taken to avoid injury or death or to notify or inform you as to warranty compliance matters.

- **WARNING:** Warns of hazards that have the potential to cause death, serious personal injury or major property damage.
- **CAUTION:** Warns of hazards that have the potential to cause minor or moderate personal injury, property damage or environmental contamination.
- **NOTICE:** Indicates special instructions that are extremely important and must be followed to maintain proper system operation and warranty coverage.
- **IMPORTANT:** Indicates special instructions that are very important and should be adhered to for proper installation.

## 1.6 In Case of Emergency

An emergency can come at any time and it is very important to be prepared. Storage, transferring and dispensing of flammable liquids must be considered dangerous and could result in serious injury or even death. The installation and maintenance of underground piping and containment systems such as OPW FCS underground piping and containment sumps can also be hazardous and it is important that this product manual be read prior to performing any work and all instructions, warnings, cautions and notices be adhered to completely.

**1.6.1 Emergency Plan:** Installers and service providers should always be prepared in the event of an emergency and have an emergency plan capable of dealing with the following:

**1.6.2 Emergency Cut-off Switch:** An emergency cut-off switch and outside cut-off switch should be installed at the cashier's station which will instantly cut-off electrical power to equipment such as, fuel pumps, fuel dis-



pensers and any other fueling equipment. This switch should be readily accessible and all station attendants trained on its proper usage. This emergency switch is a requirement of the National Fire Protection Association and is published in NFPA 30A, Section 4-1.2.

## 1.6.3 Work Zone Requirements:

When performing service or maintenance on a piping system, a safety work zone must be established around the dispensers or tank sump access manholes. A safe work zone plan should include the following:



- evacuation plan of unauthorized persons and vehicles
- using barricades and/or safety tape as entry barriers
- completely cut off and tag out all electrical power to the dispenser
- route to the nearest hospital

## 1.7 Piping Applications

The Loop System™ specifies the various types of piping applications allowable under its system warranty.

### 1.7.1 Supply Lines

The Loop System™ specifies flexible double wall piping fitted with double wall swivel couplings and contained within Access Pipe chase piping for all supply piping lines.

### 1.7.2 Vent and Vapor Lines

The Loop System™ specifies single wall or double wall rigid or flexible piping for use as tank vent lines and stage two vapor recovery lines, where required.

**WARNING: FlexWorks piping is not warranted for above ground transmission of flammable liquids due to the possible exposure to fire.**

## 2.0 PIPING SPECIFICATIONS

The Loop System™ offers a variety of piping options for underground fuel delivery applications. Prior to specifying the type of piping required, read Section 5 of this manual entitled "Pre-Installation Planning".

### 2.1 Loop System Supply Piping

The Loop System™ specifies that all supply piping runs be either 1-1/2" and/or 2" double wall flexible piping contained



within 4" Access Pipe chase piping for future inspection or replacement capabilities. Other piping runs such as tank vent piping, stage II vapor recovery piping and remote fill piping can be made of single wall or double wall flexible or rigid piping that may be directly buried.

OPW FlexWorks piping has a totally bonded multi-layer composite construction. The inner-most barrier layer is smooth, that enhances hydraulic flow efficiency, and is impermeable to gasoline, alcohol blends and a wide variety of other fuels and chemicals. The exterior of the primary pipe also has a barrier layer to protect the outer wall of the pipe from chemical and microbial attack. The double wall flexible piping has an outer containment jacket that includes inner stand-off ribs to create a small interstitial space which allows for optimum fluid migration, continuous monitoring and easy periodic testing.

## 2.2 Access Pipe

This flexible corrugated chase piping (4" I.D.) is used to enable the replacement of the FlexWorks piping without the need for excavation. This non-regulated chase piping is constructed of a high density polyethylene and is strong enough to withstand H-20 loading requirements. It accommodates up to 2" diameter coupled double wall pipe sections.



**2.3. Warranted Fuels:** Listed below are the fuels that have been independently tested and are warranted for use with FlexWorks flexible piping systems.

- |            |                 |                |
|------------|-----------------|----------------|
| • Gasoline | • Methanol      | • Diesel Fuels |
| • Gasohol  | • Alcohol Fuels | • Motor Oils   |
| • Ethanol  | • Av-gas        | • DEF Fluid    |
| • Kerosene | • Jet "A"       |                |

**2.3.1 Liquid Chemicals:** Contact OPW for chemical compatibility of any chemical liquids not listed in Section 2.3. Any other liquids or fuels other than those listed in the above section must be approved in writing from OPW before installation can begin.

**WARNING: Failure to secure written approval from OPW concerning non-warranted fuels and liquid chemicals, will void the product warranty and could potentially cause environmental damage or personal injury.**

## 2.4 Operating Pressures & Vacuums

FlexWorks flexible piping and its associated fitting systems are designed to have a minimum five to one (5:1) safety factor above the maximum operating pressure for rated pressure for the primary pipe. The 1-1/2" and 2" flexible pipe and their associated couplings and fittings

have a rated maximum working pressure of 100 psi for 1-1/2" and 75 psi for 2". The secondary has a 10 psi rating. For suction systems the pipe shall be capable of withstanding 29" mercury vacuum.

## 2.5 Operating Temperatures

The product fluids transferred should not exceed the maximum operating pressures indicated on each pipe size and a fluid temperature of 125°F (52°C).

## 2.6 Allowable Bend Radius

FlexWorks flexible piping is a flexible pipe and should never be bent at a radius of less than the designed bend radius. If a section of pipe becomes kinked, the kinked section should be cut-out of a piping length and it should be discarded. For the Loop System, OPW recommends runs of pipe leave the sump for 5' minimum before bending.



**2.7 Primary Pipe:** FlexWorks flexible primary piping has a smooth (low friction), non-corrugated liner on the interior of the primary pipe. A smooth wall flexible piping system having a minimal amount of directional fittings demonstrates enhanced flow characteristics. There are many variables like, pump size, number of directional fittings in a piping run, pipe diameter, length of piping run, etc. that affect the flow rate of a given piping run. Refer to the "Piping Flow Rate Calculator".

**2.7.1 Secondary Interstice:** FlexWorks double wall piping has a secondary jacket with internal stand-off ribs or legs which creates a non-collapsing "interstitial space" that has excellent fluid flow characteristics in all directions.

## 2.8 Pipe Expansion & Contraction

Underground piping can expand and contract due to internal pressures, and variations in temperature. The amount of expansion or contraction of piping needs to be compensated for by design of the piping system. For long piping runs in excess of 30 feet, "Snaking" the pipe within the pipe trench will help compensate for these characteristics. There is enough room within the Access Pipe chase piping to compensate for expansion and contraction for short piping runs less than 30 feet in length.

## 2.9 Miscellaneous

**2.9.1 Pipe Packaging:** FlexWorks flexible piping and Access Pipe are available in a variety of piping diameters on continuous rolls, and pack-



aged in easy to handle protective cartons and reels. Refer to the FlexWorks Product Price List for pipe diameters and packaging specifications.

**NOTICE: Do not use knives or razor blades to open carton as damage to piping could occur.**

**2.9.2 Storage:** OPW requires that all piping, fittings and system components be stored in such a manner that they will not be subject to direct sunlight and/or excessive environmental conditions for an extended period of time. Please review the below noted warnings during product storage.

- Cover all products with UV protective tarps if stored outside for long periods.
- If tarps are unavailable, store in a trailer at the building location until use.

**2.9.3 Handling:** OPW requires that the piping, fittings and system components are handled in such a manner that it will not cause damage to the system components. Please review the warnings below.

- Do not drop, cut or cause severe impact to any of the components.
- Keep all piping, fittings, and other components in the original packaging until ready for use.
- Keep all coupling protector caps/covers on couplings and fittings until assembly.

### 3.0 PIPING CONNECTIONS

The Loop System™ requires the use of double wall swivel couplings with single wall swivel adapters, swivel fittings and angled shear valves.

#### 3.1 Double Wall Swivel Couplings

Double wall pipe couplings are fitted to the ends of all supply pipe sections. There is an interstitial fluid path and threaded access port built right into the coupling itself for direct attachment of interstitial connector test tubes. Double wall swivel couplings require the use of the OPW coupling machine to internally expand the coupling to the end of the pipe section. These pipe couplings are available in 1-1/2" and 2".

#### 3.2 Double Wall Bolt-On Couplings

Double Wall Bolt-On Couplings do not require the use of coupling machines.

#### 3.3 Pipe Adapters

Within the tank sump, supply piping lines originate by connecting the first pipe section fitted with a double wall swivel coupling to the pipe adapter. The pipe adapter

has male NPT tapered threads on one end and male NPSH straight threads on the other end for connection to a double wall swivel coupling.

#### 3.4 Junction Safety Valves

All junction dispenser sumps, come with factory installed junction safety valves. The pipe sections connect directly to the inlet and outlet of this safety valve.

#### 3.5 Terminating Safety Valves

All terminating dispenser sumps come with factory installed terminating safety valves. The last installed coupling section of a piping run connects directly to this safety valve.

#### 3.6 Jumper and Test Tube Assemblies

These small diameter flexible tube assemblies are connected to the threaded interstitial access port of the double wall swivel coupling. The connector tubes are used to bypass the junction safety valve and connect the interstice of the inlet pipe section to the outlet pipe section. The test tubes are used at the beginning and/or end of a piping run for interstitial testing purposes.

### 4.0 INSTALLER TOOLS

OPW offers a variety of Installer tools for installing contractors for installations. To insure proper installation and product warranty coverage, only OPW pipe coupling equipment and pipe fabricating tools should be used. All tools should be maintained in good condition at all times to ensure proper performance.

#### 4.1 Pipe Cutter

The flexible pipe cutter is designed to produce the clean and even pipe cuts that are necessary for proper coupling attachment.



#### 4.2 Coupling Machine

The OPW coupling machine is required for the installation of double wall pipe couplings. This electrically driven hydraulic machine is designed to internally expand the metal pipe insert installed at the end of a flexible pipe section. These coupling machines are available in both 110 and 220 volt models. Consult your local OPW distributor for availability for rental or purchase of the coupling machines.



**WARNING: The OPW FCS Coupling Machine is not intrinsically safe and must be operated in an open area free from gasoline vapors.**

**NOTICE: The DPC coupling nuts should be hand tight-**

ened then a 1/4 turn with the swivel wrench for proper installation. Over-tightening of the swivel nut could damage the coupling gasket.

#### 4.3 Pipe Test Caps & Plugs

These custom threaded plugs have a 1/4" NPT port in the end for attachment of an air gauge or a valve stem (not included). swivel test caps are used to test the integrity of each pipe section prior to installation. Only the primary pipe of a double wall pipe section can be tested with the swivel test cap.

#### 4.4 Test Gauge Assembly

This air gage assembly provides a means of testing only the interstitial space of the double wall piping. These gauges connect to the end of the interstitial test tubes and have a maximum pressure rating of 15 PSI.



#### 4.5 Fishing Bullnose

The fishing bullnose attaches to the end of a flexible pipe section in order to fish (push or pull) the flexible pipe section through the Access Pipe chase piping. Its rounded nose provides easy feeding through the Access Pipe. The swivel bullnoses are fitted with a metal eyelet for attachment of a plumber's fish.



### 5.0 PRE-INSTALLATION PLANNING

The type of pipe routing design selected for a particular fueling facility is dependent on the quantity and orientation of the tanks and dispensers, and the general layout of the facility. One constant design requirement of the Loop System™ is that all supply piping that runs between containment sumps be continuous with no uncontained piping connections. Single and dual piping lines may be used; depending on the total quantity of dispensers to be serviced and the location and orientation of the islands. The pipe routing design criteria for flexible supply piping is considerably different than that of conventional rigid piping systems. For either new or retrofit installations, good pre-installation planning is a must to insure a proper installation.

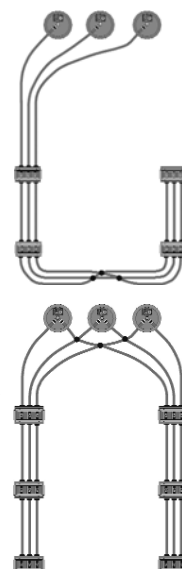
#### 5.1 Piping Design Criteria

The following is some useful information when developing your own site plan using a combination of both flexible and rigid piping lines.

**5.1.2 Pipe Routing Schemes:** There are a variety of pipe routing schemes that are used for flexible and rigid underground supply piping systems.

- **Single Series Routing:** This routing layout is used in pressure systems where one flexible supply piping line originating at the tank sump interconnects with all of the dispenser containment sumps, one after the other.

- **Dual Series Routing:** This system is used in pressure systems where two branched flexible supply piping lines both originate within one tank sump. One supply line interconnects with one group of dispenser sumps and the other supply line with another group of dispenser sumps.



**5.1.3 Piping Turns:** If piping trenches are used in the Loop System™ they should be dug with sweeping turns to accommodate the minimum bend radius of the flexible piping (please refer to Section 2.6). Never kink the pipe while handling, coupling or installing in the piping trench.

**5.1.4 Piping Crossovers:** For pipe routing systems that have piping crossovers, it is important that there is sufficient backfill under the pipe section that is crossing over the other pipe. The actual pipe crossover should be gradual.



**5.1.5 Piping Slope:** The Loop System™ does not require continuous piping fall for the pressure supply pipelines. The interstitial space of the FlexWorks double wall piping is small enough that the fuel pressure or groundwater pressure is sufficient to move any leaking liquid to the tank sump without the assistance of gravity fall.

**5.1.6 Product Sequence:** Piping crossovers (refer to Section 5.2.3) are necessary on "piping loop-arounds" in order to maintain consistent product sequence at the dispenser. Another method to insure product sequence is to turn a dispenser sump around so that the flow arrow is pointing in the opposite direction of the product flow. For further clarification, please refer to OPW's *Flexible Underground Piping Manual*.

### 6.0 PIPE BURIAL REQUIREMENTS

FlexWorks flexible piping is strong, yet still flexible and must be buried in such a manner that it will not compress under normal backfill and traffic loads. The burial requirements depend on proper pipe trenching, backfill material and burial depth. Follow these instructions for warranty

compliance:

### 6.1 Pipe Trench Sizing

Piping trenches should be dug in such a manner that the trench width is equal to at least twice the width of all the flexible pipes contained within. All piping should be positioned in the trench so all are a minimum of one pipe width apart (example: 2" separation for 2" wide piping, etc.). Trench turns should be sweeping rather than sharp angles. The bottom of the trench should be as uniform as possible to eliminate high spots to insure an even layer of bedding material under the pipe. Remove all sharp rocks and debris from the trench bottom before bedding material is installed.



### 6.2 Bedding & Backfill Materials

Approved bedding and backfill materials for the flexible piping and chase piping shall meet the following specifications:



**6.2.1 Pea Gravel:** Rounded pea gravel is permitted with a minimum diameter of 1/8" and a maximum diameter of 3/4".

**6.2.2 Crushed Stone:** Crushed stone is permitted providing it shall be washed clean and be of the free flowing type with an angular stone size between 1/8" and 1/2". (Meets ASTM C-33 paragraph 9.1 requirements.)

**6.2.3 Sand:** River or other approved sand is permitted providing it shall be washed clean and is free flowing. When backfilling, make sure sand is evenly distributed and packed around the piping.

**NOTICE:** A minimum of 6" (150mm) of approved bedding material shall be spread evenly along the bottom of the piping trench. All bedding and backfill material should be dry and free from ice and snow and debris. Using material other than those described above without written approval from OPW Fueling Containment System will void the product warranty.

### 6.3 Pipe Trench Sloping

Adequate piping fall is recommended for all vent piping, stage II vapor recovery piping, remote fill piping and suction supply piping. Pressure supply piping installed for the Loop System™ does not require fall for pressure type piping systems, but traps within the supply lines should be avoided.

### 6.4 Pipe Trench Backfilling

Backfilling the flexible piping system should occur only after the final integrity testing has been performed on both primary and secondary pipes. Prior to backfilling completely, hand shovel the backfill material between and to the outside of the pipe to maintain the "pipe width separation" required between the pipes and walls of the trench. Final backfilling shall be done slowly and evenly in layers so as not to disturb the spacing of the piping. An additional air test is recommended after backfilling is complete to insure the backfill process has not damaged the piping.



**CAUTION:** Use extra caution when backfilling piping in shallow trenches or open excavations so as not to damage or crush the piping or any associated fittings. Avoid sudden impacts from dumping backfill materials. Spread backfill gradually and evenly. Failure to do so could cause immediate or long-term damage to the piping.

### 6.5 Overburden

For the Loop System™, all flexible supply piping is required to be contained in Access Pipe chase piping. Unlike conventional deep dispenser sumps, the Loop System's™ unique shallow dispenser sumps design require that the piping enter and exit the sump wall at a 45-degree angle.

## 7.0 REQUIREMENTS & OPTIONS

The Loop System™ is designed to minimize field labor and piping joints. The system provides a variety of options to meet the design requirements of a fueling facility.

### 7.1 Supply Piping

The flexible supply piping used with the Loop System™ is required to be 1-1/2" or 2" FlexWorks double wall flexible piping.

### 7.2 Chase Piping

All double wall supply piping is designed to be contained within four inch (4") Access Pipe chase piping for future inspection or replacement capabilities without the need for excavation.



### 7.3 Double Entry Boots / Rigid Entry Fittings

All dispenser sumps are outfitted at the factory with 4" double entry boots or Rigid Entry Fittings. Tank sumps must be field fabricated and installed with these same entry boots plus those double entry boots or Rigid Entry Fittings that seal conduit entries and vent and vapor piping entries.

### 7.4 Tank Sumps

The Loop System™ does not require the exclusive use of OPW FCS tank sumps. Other tank sumps may be used providing that they are UL listed and that they are fitted with the appropriate OPW flexible entry boots or Rigid Entry Fittings. OPW does offer a full line of tank sumps that will mount to underground storage tank by a variety of sump mounting methods. OPW FCS tank sumps do not come from the factory preassembled or pre-fitted with corresponding entry fittings. All tank sump fabrication is intended to be performed at the jobsite.



### 7.5 Quick Connect Dispenser Sumps

The Loop System™ is designed to be installed with OPW-Quick Connect Dispenser Sumps. These factory equipped dispenser sumps include a shallow sump with installed: (a) mounting frame; (b) double entry boots/rigid entry fittings; (c) stabilizer bars; and (d) product shear valves. All Dispenser Sumps come packaged in a carton with four (4) height adjustable legs. Factory outfitted Dispenser Sumps are available to accommodate a variety of retail fuel dispenser models and associated footprints.



### 7.6 Vapor Shear Valve Option

It is recommended that all stage II vapor recovery piping penetrations into the dispenser sumps be performed at the job site, unless a specific arrangement has been made with OPW to have a vapor shear valve and pipe

entry boot installed at the factory.

### 7.7 FlexWorks Automatic Fire Extinguisher Option

The FlexWorks Automatic Fire Extinguisher is a small fire extinguisher that is mounted inside shallow dispenser sumps. In the event of a fire inside the sump due to a dispenser knockover or any other reason the FlexWorks Fire Extinguisher will automatically activate to extinguish the fire.

### 7.8 Vent & Vapor Piping

FlexWorks 2" flexible double wall piping and Fittings may be used for all vent and vapor lines. This double wall piping system should always be adequately sloped.

The Loop System™ also allows for the use of rigid single wall and double wall fiberglass piping to be used for vent and vapor piping.

**IMPORTANT: All piping trenches that contain vent and vapor piping must have approved and compacted backfill with adequate slope back to the underground storage tank. Make sure all peaks and valleys within the trench have been eliminated.**

**NOTICE: OPW offers a Transition Sump for the secondary containment of the vent piping transition from underground to above ground.**

### 8.0 INSTALLING TANK SUMPS

The instructions to be followed for tank sumps is dependent upon type of tank sump to be installed. OPW manufactures a variety of different tanks, sumps and tank attachment accessories. Refer to the appropriate tank sump manufacturers' installation manual for specific instructions on how to fabricate and mount the tank sumps to the tanks. Listed are some general installation procedures:

- Specify tank sump model
- Connect tank sump to tank
- Install submersible pump (pressure system)
- Determine pipe exit locations in side wall
- Install the OPW Entry Boot/Rigid Entry Fitting

**NOTICE: Tank sumps must be connected to tanks in accordance with the instructions described in the Tank Sump Manual. Prior to assembling plumbing trees, be sure OPW fittings are aligned with the pipe entries through the sump wall to prevent excessive bending of the pipe within the tank sump.**

### 9.0 TANK SUMP PLUMBING CONNECTIONS

The type of piping application used shall determine what type of piping connections shall be made inside the tank sump.

## 9.1 Pressure Supply Systems

The orientation of the fuel delivery pump outlet and the connected plumbing tree must be configured such that the flexible pipe, coupling and adapter make connection to the plumbing tree perpendicular to the sump entry wall. Installation of the submersible pump and its connected plumbing tree can occur at any time, provided the above requirement is met. This will prevent excessive bending of the flexible pipe that could damage the pipe and its coupling seals.

### 9.1.1 Single Pipeline Connections:

This application includes a plumbing tree assembly which interconnects the submersible pump to a single flexible piping line. Connect the swivel adapter to a 2" NPT female pipe fitting, as shown.

**9.1.2 Dual Pipeline Connections:** This application includes a plumbing tree assembly which interconnects the submersible pump to two (2) flexible pipelines. Typically one pipeline would run to one grouping of dispensers and the other pipeline would run to another grouping of dispensers. Connect the swivel adapters to a 2" NPT female pipe fittings, as shown.

**NOTICE: For NPT thread connections, use only UL classified thread sealant specifically formulated for gasoline and petroleum products. Do not overtighten the adapter as it could cause damage to the NPT threads. Never apply thread sealant to the adapter and coupling connection joint located on the other end of the transition adapter.**

## 10.0 INSTALLING PIPE ENTRY FITTINGS

Regardless of manufacturer, the tank sump is mounted to the underground storage tanks. The Loop System™ requires that OPW FlexWorks entry fittings be used for sealing the double wall flexible pipe and Access Pipe chase piping penetrations into the tanks sumps.

**NOTICE: All pipe entry boots for the Quick Connect Dispenser Sumps are factory installed.**

Adhere to the following installation instructions for the installation of FlexWorks Entry Fittings in the sidewall of the tanks sumps:

### 10.1 FlexWorks Entry Fittings

The Loop System requires the use of FlexWorks Entry Fittings to seal the Access Pipe and FlexWorks sump wall penetrations. Any vent and vapor piping penetrations into the tanks sump wall should be sealed using the appropriate sized Entry Fittings. FlexWorks Entry Fittings are two-piece entry fittings designed to seal 4" Access Pipe to the outside of the tank sump wall and seal the 1-1/2" and 2" double wall piping on the inside of the tank

sump wall.

## 10.2 Access Pipe Entry Fitting Installation Steps

Only after (a) the fuel delivery pump has been installed within the tank sump (b) the plumbing tree has been configured and connected to the pump (c) and the exact exit center-point for the flexible piping has been located on the side wall of the tank sump should installation of the entry fitting begin.

- Step #1: Locate the center entry point in the flat wall section of the tank sump base and drill a 5/16" hole. Install the entry boot template to the sump base wall using a 1/4" bolt and nut. Drill out one hole of the appropriate bolt hole circle for the size boot to be installed using the same 5/16" drill bit. Insert a second 1/4" bolt and nut through this hole to secure the template. Continue to drill the remaining holes of the bolt hole pattern. After drilling, remove the template from the sump base wall.
- Step #2: Drill out the entry fitting opening by using a 4" hole saw. After drilling out the opening, clean any rough edges with a razor knife or deburring tool.
- Step #3: Install the outer 4" Access Pipe entry fitting from outside the sump by inserting the studs through the bolt holes. From the inside of the sump, install the appropriate sized (1-1/2" or 2") inner snout compression ring and nuts as shown.
- Step #4: Using a 7/16" nut driver, tighten all of the nuts evenly and firmly. To prevent deforming entry fittings, do not over tighten nuts. If a torque wrench is used, the setting should be 60 inch pounds.
- Step #5: From outside the sump, insert the end of Access Pipe completely into the outer fitting until it stops. Using a screw driver or nut driver tighten down each band clamp when applicable to 30 inch pounds.
- Step #6: After the double wall flexible piping section has been coupled and fished through the Access Pipe and connected to the pump's plumbing tree, the inner entry fitting can be tightened down. Using a screw driver or nut driver, tighten down each band clamp (when applicable) to 30 inch pounds.

**WARNING: Keep all fiberglass cleaning solvents away from entry fittings. These types of solvents and other cleaners could cause severe damage to the fittings.**

**IMPORTANT: The recommended hole saw size must always be used for proper installation of the entry fitting and to maintain the product warranty.**

### 10.2 Rigid Entry Fittings

All dispenser sumps are outfitted at the factory with 4" double entry boots or Rigid Entry Fittings. Tank sumps

must be field fabricated and installed with these same entry boots. For proper installation, a template (supplied with fitting) must be used for accurate hole drilling. **Rigid fittings cannot be installed on round surfaces.**

Please see OPW Publication *Rigid Entry Fitting (REF) Installation Instructions* (Publication REF-0001, Part Number 205913) for further information and Installation Instructions.

### 10.3 Double Entry Boots

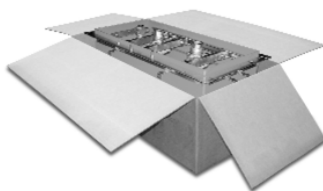
OPW FCS's double entry boots are used to seal; (a) vent pipe; (b) vapor return pipe; (c) and conduit penetrations into the tank sumps. Quick Connect Dispenser Sumps do not require conduit entry seals because they provide conduit pass-through openings in the metal frame.

## 11.0 INSTALLING DISPENSER SUMPS

The Loop System™ requires factory fabricated Dispenser Sumps. Installation of these pre-assembled shallow dispenser sumps are fast and easy because most of the fabrication and installation work is done at the factory. Follow these pre-installation and installation steps for proper installation:

### 11.1 Pre-installation Inspection

All fully fabricated and assembled Loop Sumps come delivered from the factory in an engineered box. Remove the Dispenser Sump from its carton. Inspect all sump components for any shipping damage.



### 11.2 Loop Take-offs

Each Sump is fabricated and assembled at the factory based upon the information contained from the Loop "take-off" that is generated from the customer's engineered site plan. The information contained on this plan identifies the desired dispenser sump configuration such as:

- (1) Dispenser sump model (relates to dispenser)
- (2) Dispenser sump type (junction or terminating)
- (3) Sump ID Number (OPW take-off)

### 11.3 Sump Height Adjustability

Four (4) rigid conduit legs are provided with each Dispenser Sump for adjusting the sump frame (flange) to the predetermined height of the island (or pavement with no island). Place the sump in the trench and hammer the rigid conduit legs through the holes in the frame. Lift



the sump up to the desired height and clamp it in place by tightening the corner brackets.

## 12.0 INSTALLING CHASE PIPING

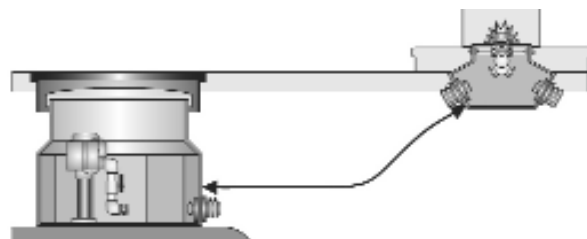
Access Pipe chase piping is a larger diameter corrugated flexible piping that adds additional protection to the FlexWorks flexible supply piping and allows the inner pipe to be removed and replaced without the need for excavation. Measuring and cutting the chase piping should be completed prior to measuring and installation of the flexible supply piping. Follow these installation procedures for the Access Pipe chase piping.

### 12.1 Access Pipe Measuring

Prior to measuring for the corrugated and flexible chase pipe, install the specified and supplied Access Pipe entry boot into the sidewall of the tank sump as specified in Section 10.2.

#### 12.1.1 Between Tank Sumps and Dispenser Sumps:

For the first Access Pipe chase pipe section, measure the distance from the tank sump wall to the wall of the first Dispenser Sump while making sure to follow the contour of the piping trench. Make an allowance in your measurement for the Access Pipe to gradually weave side to side within the trench to allow for future thermal expansion and contraction of the flexible supply pipe contained within.



**12.1.2 Between Dispenser Sumps:** For other Access Pipe chase pipe sections running between dispenser sumps measure the distance from one dispenser sump wall to the next allowing for the natural chase pipe position between sumps. Make an allowance in your measurement for the chase pipe to gradually weave side to side within the trench to allow for future thermal expansion and contraction of the flexible supply pipe section contained within.



### 12.2 Access Pipe Cutting

Transfer measurement to the chase pipe and make a cut

in the closest valley using the OPW Access Pipe Cutter.

### 12.3 Access Pipe Connections

Locate the plastic insert that fits inside the end of the access pipe and insert it. Insert one end of the chase pipe section into the outer entry boot of the preinstalled Access Pipe entry boot in the tank sump or dispenser sump. After the chase has been positioned, install the band clamps around the boot and tighten (see Section 10.2). Repeat this same installation procedure at the other end of the Access Pipe conduit section.

### 13.0 FLEXIBLE SUPPLY PIPE FABRICATION

After all tanks sumps have been interconnected to the Dispenser Sumps with Access Pipe chase piping, fabrication and installation of the flexible supply piping may proceed.

**IMPORTANT: Only certified installers with a valid factory certification card are authorized to install OPW piping systems.**

#### 13.1 Pipe Handling At Jobsite

Care must always be taken when handling the FlexWorks flexible piping to prevent damage. It is recommended that the box or reel be placed in the sunlight several hours before measuring and cutting the pipe, so the pipe may relax for easier extension when measuring.

**WARNING: Never drag, cut or scrape the pipe during installation to avoid damage to the external surface of the piping. Use only OPW approved backfill materials.**

#### 13.2 Cold Weather Pipe Handling

FlexWorks flexible piping can be installed in ambient temperatures as low as zero degrees, provided that the flexible piping has been sufficiently warmed prior to unrolling. If the pipe is unrolled and straightened while it is warm, it will cool in a straighter position making it easier to install. For cold weather installations where the ambient temperature is below 40 F (5 C), it is recommended that the piping cartons be placed in a warm room for 8 hours directly prior to installation.

**WARNING: Never heat the pipe directly with an open flame or high direct heat.**

#### 13.3 Rolling Out Flexible Pipe

In a cleared and flat area free of debris, sharp rocks and equipment, unroll a desired length of flexible piping. It may be necessary to secure one or both ends while the flexible piping begins to relax. Keep the unrolled section of

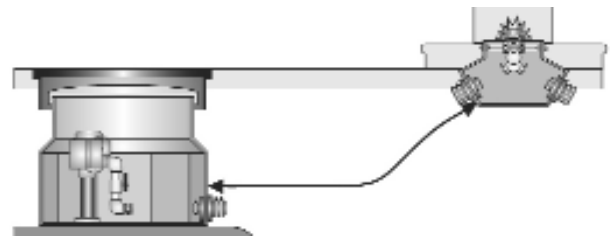


pipe as straight as possible for accurate measuring and marking for cutting purposes.

#### 13.4 Flexible Pipe Measuring

Measurements for the flexible supply piping must always be taken through the previously installed Access Pipe chase piping to insure proper length.

**13.4.1 Measuring Between Tank Sumps and Dispenser Sumps:** Feed the measuring tape through the chase piping and measure the distance from the center of the swivel adapter installed inside the tank sump to the center of the angled shear valve that was factory-installed inside the Dispenser Sump. Do not pull the measuring tape too tightly and allow it to lay inside the chase piping.



**13.4.2 Measuring Between Dispenser Sumps:** Feed the measuring tape through the chase piping and measure the distance from the center of the factory-installed shear valve located within one Dispenser Sump to the center of the factory-installed shear valve located within the next Dispenser Sump. Do not pull the measuring tape too tightly and allow it to lay inside the chase piping.



#### 13.5 Cutting Flexible Pipe

When cutting the flexible piping into pipe sections, cut the pipe at the measured cut mark using the pipe cutter tool. This cutting tool is designed to make clean and even cuts in the flexible piping. Clean and even piping cuts are necessary for the proper installation of the Swivel pipe couplings.

- **Step 1 Cutter Positioning:** Locate the cutter blade at the measured mark on the pipe.
- **Step 2 Blade Activation:** Squeeze the handles up and down to activate the movement of the blade. Continue until the blade will no longer continue to activate. This procedure will slightly compress the pipe.
- **Step 3 Pipe Cutting:** Rotate the entire pipe cutter

1/4 turn to permit the blade to penetrate the wall of the pipe. Continue to squeeze the handles up and down to complete the entire pipe cut. Inspect the cut to make sure it is even.

**NOTICE: Do not rotate blade more than 1/4" turn. Inspect edge inside of the piping after cutting.**

**IMPORTANT: FlexWorks double wall flexible piping systems using double wall swivel couplings and double wall bolt-on couplings do not require the use of rubber test boots. Therefore, there is no reason to cut back the secondary standoff jacket when using either style of couplings.**

#### 14.0 COUPLING FLEXIBLE PIPING

The Loop System™ flexible supply piping system requires the use of the OPW coupling machine for proper installation of the double wall swivel couplings onto the ends of the flexible supply piping sections. Double wall swivel couplings require the use of the correct face plate for the coupling machine that accommodates the 1-1/2" or 2" couplings.

**NOTICE: Using the OPW coupling machine with couplings or piping not manufactured by OPW shall void the coupling machine warranty. Installing OPW couplings and piping with coupling machines manufactured by others will void our piping warranty.**

##### 14.1 Coupling Machine Set-up

Select a dry, flat and clean area for location of the coupling machine. Use a heavy-duty exterior type extension cord with a proper ground plug.

- **Step 1:** Remove cover and install under the base.
- **Step 2:** Install the correct faceplate.
- **Step 3:** Install the correct threaded shaft.
- **Step 4:** Install the correct size swage kit.
- **Step 5:** Open the vent plug.
- **Step 6:** Plug in machine with proper ext. cord.

**WARNING: Connect the coupling machine to a properly grounded outlet only. Failure to do so could cause electrical shock resulting in injury or death.**

**WARNING: The OPW Coupling Machine is not intrinsically safe and must be operated in an open area free from gasoline vapors.**

**IMPORTANT: Connect the coupling machine to a properly grounded outlet only. Piping must be held**

**vertically throughout the coupling process.**

#### 14.2 Protective Coupling Caps

Prior beginning the coupling process remove the protective plastic cap from the end of the coupling body and place it on top of the coupling machine making sure it is kept clean of sand and gravel. After the pipe end has been coupled immediately replace the plastic cap onto the end of the coupling.

#### 14.3 Swage Kits

Different size and types of flexible pipe couplings require the use of different size Swage Kits. These Swage Kits include a swage, a swage shaft and a faceplate. The swage is drawn through the inside of the Double Wall Swivel Coupling to internally expand it and the faceplate positions and secures the coupling to the top of the coupling machine during the swaging cycle. The following swage kits are available for the double wall Swivel Fittings:

- |                           |           |
|---------------------------|-----------|
| • 1-1/2" Swivel Swage Kit | CSK-0150S |
| • 2" Swivel Swage Kit     | CSK-0200S |

**NOTICE: Before and after the coupling process the supplied dust covers should be kept on all couplings. This precaution will lessen the possibility of damage and contamination from dirt, sand and debris. If dust covers are not available, cover the ends of the couplings with duct tape or a plastic bag.**

#### 14.4 Positioning Pipe Coupling

Install the appropriate size faceplate; unscrew and remove the tapered swage from the threaded shaft. Lubricate the inside of the coupling insert with lithium grease. Insert the pipe coupling assembly over the threaded shaft and seat it onto the face plate.



#### 14.5 Installing Tapered Swage

Thread the tapered swage onto the threaded shaft until it meets the back opening of the pipe coupling assembly. Apply a very light coating of white lithium grease or metal assembly paste around the swage at this stage.

**NOTICE: Do not use silicone-based lubricants to lubricate the swage. Only white lithium grease/ MolyKote should be applied around the swage. Do not use lubricants or sealants in or around the end of the pipe.**

#### 14.6 Inserting Pipe into Coupling

Insert the end of a flexible pipe section inside the pipe

coupling until it bottoms out.

**IMPORTANT: Keep the hole for the test port that is on the outside of the collar pointed towards the inside curl of the pipe. This will insure the coupling is in the proper position for the test assembly once inside the sump.**

Inspect the entire assembly, prior to switching on the machine, for the following:

- Swivel nuts are flush against the base plate.
- The coupling and pipe are totally vertical.

#### 14.7 Swaging Cycle

To begin the swaging cycle, turn the switch to the DOWN position. Once the tapered swage passes through the pipe coupling assembly, the motor will turn off. Remove the coupled pipe section. Turn the switch to the UP position to allow the shaft to return to the starting position.



**NOTICE: Make sure that the pipe is in a vertical position and that the coupling swivel nut is flush against the faceplate at all times during the swaging cycle.**

#### 14.8 Coupling Inspection

Inspect the installed pipe coupling assembly and pipe, inside and out, to make sure there was no damage to the insert, ferrule or swivel nut or pipe during the swaging operation. Always replace the protective coupling cap after the coupling has been swaged onto the pipe end.



**NOTICE: Before and after the coupling process, the protective coupling cover should be kept on the coupling. This precaution will lessen the possibility of damage and contamination by dirt, sand and debris that could compromise the sealing process.**

**IMPORTANT: Connect the coupling machine to a properly grounded outlet only. Piping must be held vertically throughout the coupling process.**

**IMPORTANT: Using this coupling machine with pipe or couplings other than those manufactured by OPW shall void the product warranty.**

#### 15.0 FISHING COUPLED PIPE SECTIONS

After a pipe section has been coupled on both ends, the coupled pipe section may be inserted and pushed through the chase piping from one sump to the next.

- **Step 1 Install Bullnose:** Prior to installing the supply pipe, attach the appropriate bullnose to the coupled swivel coupling on one end of a pipe section. The bullnose prevents the flexible supply pipe section from hanging up inside the chase pipe while being pushed through.
- **Step 2: Disconnect Chase Pipe:** On the outside of one containment sump, loosen the band clamps and remove the end of the chase pipe section from the outside portion of the Access Pipe entry fitting.
- **Step 3 Pushing Pipe Through Access Pipe:** Once one end of the chase pipe pipe has been disconnected from the entry fitting, insert the bullnose end of the coupled flexible pipe into the chase pipe. Push the flexible pipe section into the chase pipe until it reaches the inside of the next containment sump.
- **Step 4: Reconnect Chase Pipe:** After the flexible supply pipe has been pushed entirely through the chase pipe, insert the flexible supply pipe end and the chase pipe end into the outside boot of the Access Pipe entry boot. Then reconnect the stainless steel band clamp by tightening to 30in/lbs.
- **Repeating Previous Steps:** Repeat Steps 1-4 for installing remaining pipe sections between the other containment sumps.

#### 16.0 PIPE COUPLING CONNECTIONS

After the coupled flexible pipe section has been fished from one containment sump to the next remove the protective plastic cap from the end of the coupling. Follow these coupling connection instructions:

**IMPORTANT: Prior to connection, inspect the pipe couplings to make sure all Viton gaskets located inside the swivel nut are properly seated. Look for any damage to the gasket which may have occurred during the coupling or fishing procedure. Also, inspect the sealing face of the swivel adapter, fitting or angled shear valve to make sure they are clean, smooth and undamaged.**

##### 16.1 Making Swivel Connections:

Double wall swivel couplings make compression gasket sealed connections. A flat Viton ring gasket is tightly compressed between two (2) sealing faces; one located on the end of the coupling and one on the end of an adapter, fitting or angled shear valve. Double wall swivel couplings make connection to the following:

- Swivel Pipe Adapters 1-1/2" and 2"
- Junction Shear Valves 1-1/2" and 2"
- Terminating Shear Valves 1-1/2" and 2"

### 16.2 Pre-connection

Remove the protective cap from the double wall swivel pipe coupling and verify that the flat ring gasket is properly seated in the back inside of the swivel nut. Remove the plastic protective cap from the metallic swivel adapter, fitting or angled shear valve and then inspect the sealing face to make sure that it is smooth and undamaged.

### 16.3 Hand Tightening of Swivel Nut

Position the double wall swivel coupling to the male threaded opening of the adapter, fitting or shear valve. This connection has proprietary threads and does not require the use of pipe dope or sealant. Hand-tighten the female threaded swivel nut onto the male threaded opening until it can no longer be turned by hand.

### 16.4 Final Tightening of Swivel Nut

Using only an OPW short handled swivel wrench, tighten the couplings swivel nut an additional quarter (1/4") turn beyond hand tight.

**CAUTION: Over-tightening of the swivel nut beyond 200 in/lbs could cause damage to the sealing gasket possibly resulting in a fuel leak. Under-tightening of the swivel nut could also result in a possible fuel leak due to the lack sufficient sealing compression.**

**CAUTION: Never use pipe dope or sealant inside Swivel Couplings or on the connection threads that can cause damage to the gasket seal and cause it to fail.**

### 16.5 Swivel Bolt-On Coupling Installation

For installation of Swivel Bolt-On Couplings, please see OPW's Publication *Installation Instructions for Stainless Steel Swivel Barbed Couplings* (Publication SBC-0001, Part Number 205864A).

### 17.0 INTERSTITIAL TUBE ASSEMBLIES

The Double Wall Swivel Couplings attached to the ends of the flexible supply pipe sections have threaded (1/8" NPT) interstitial access ports on their ferrule or SBC Clamp for connection to Interstitial Tube Assemblies that come in various lengths. All tube assemblies are fitted on each end with 1/8" NPT brass compression couplings and fittings.

### 17.1 Test Tubes

Test Tubes are connected to the Double Wall Swivel Couplings located within tank sumps and the last dispenser sump in a series piping run. These 36" (900mm) long tubing assemblies are used to provide a means of air pressure integrity testing of the pipe interstitial space after installation. They can be cut to any desired length.

Installed inside a terminating dispenser sump they are used as another means of testing the interstitial space. When not used for testing purposes they may be plugged or left open depending on the pipe interstitial monitoring application.

### 17.2 Connector Tubes

Connector Tubes are connected to the double wall swivel couplings located within dispenser sumps and are 9" long. Installed inside junction dispenser sumps, connector tubes are used to interconnect the interstice of one pipe section to the next by bypassing the junction safety valve.

### 17.3 Interstitial Tube Connections

The steps required for connecting the connector tubes and/or test tubes to the threaded interstitial access ports of the double wall swivel couplings is as follows:

- **Step 1:** Apply Teflon tape to only the NPT threads of the adapter.
- **Step 2:** Thread the adapter into the NPT threaded interstitial access port.
- **Step 3:** Cut the tube evenly to the desired length
- **Step 4:** Slide the compression nut onto the tubing
- **Step 5:** Slide the ferrule onto the tubing
- **Step 6:** Insert tube end into preinstalled adapter
- **Step 7:** Slide down and thread on compression nut to adapter by hand
- **Step 8:** Complete tightening compression nut with a 1/2" wrench

### 18.0 TESTING SUPPLY PIPE

It is important to properly test the flexible piping system prior to backfill to insure there are no leaks in the primary or secondary piping. The following test procedures are provided as a guideline only and the manufacturer assumes no responsibility or liability for the consequences of any testing practices.

**IMPORTANT: Integrity testing with air or gas can be dangerous and it is very important that the proper testing equipment be used and that the pre-testing procedures be read.**

### 18.1 Testing Equipment

OPW does offer pipe testing equipment. The test equipment used must be in good working order and capable of the following:

- Pressurizing equipment should be of sufficient size to accommodate line pressure testing requirements.

- Pressurizing equipment should have controls to gradually increase pressures.
- Only experienced and qualified personnel should operate pressurizing equipment.
- The pressure gauge should be located in close proximity to the pressurizing equipment.
- Pressure gauges must have a full-scale reading not to exceed twice the required test pressure.
- Pressure gauges should be accurate and routinely calibrated for reliability.

## 18.2 Pre-Testing Procedures

The following pipe testing procedures are recommended for determining the containment integrity of the primary piping only.

- **Tanks:** The underground storage tank should be isolated from the piping system prior to hydrostatic or aerostatic testing.
- **Safety Valves:** The shear valves located under dispensers should be sealed with pressure rated plugs or caps.
- **Piping Runs:** Long flexible piping runs should be secured at various points with backfill material.
- **Pipe Couplings:** All pipe coupling should be properly tightened securely before testing.
- **Test Tubes:** For double wall flexible piping the Interstitial Test Tube should be connected to an air pressure gauge assembly and the should be interconnected and fitted with an air gauge.
- **Code Compliance:** All local building, safety and fire codes should be followed prior to and during testing.

## 18.3 Air Pressure Testing Procedures

The air pressure integrity test procedure for the flexible supply piping is one and one half (1-1/2) times the normal operating pressure of the fuel pump, not to exceed sixty pounds per square inch (60 psi). Make sure the flexible pipeline is isolated from both the underground storage tank and the above ground product dispenser when conducting this test. All pressure testing should be conducted by qualified and experienced personnel. Do not attempt to disconnect couplings, caps, or plugs unless the air pressure has been released. Comply with the following test procedures for the primary and secondary of the flexible double wall piping.

**CAUTION: Integrity testing with air, gas or water can be dangerous and it is very important that the proper testing equipment be used and that the pre-testing procedures be read. OPW FCS assumes no responsi-**

**bility or liability for the consequences of any testing practices. Only qualified and experienced personnel should conduct the air pressure testing. Never disconnect couplings, caps, or plugs unless the air pressure has been released.**

**NOTICE: All testing requirements, operations and procedures must be performed in accordance with all applicable codes.**

**CAUTION: Always make sure the underground storage tank is isolated from the piping system when conducting pipe air pressure tests.**

**NOTICE: Significant temperature changes can result in a pressure reading differential.**

**18.3.1 Pre Backfill Air Pressure Testing:** Before backfill, an air pressure hold & soap test is recommended. Pressurize the primary pipe to one and one half (1-1/2) times the normal operating pressure of the fuel pump, not to exceed sixty pounds per square inch (60 PSI). Gradually apply air pressure into the flexible piping line and maintain this pressure until the soap test is completed. During the pressurizing period, apply a soapy water solution to all piping connections and inspect for air bubbles.

**18.3.2 Post Backfill Air Pressure Testing:** After backfilling, an air pressure hold test is required. Pressurize the primary pipe to one and one half (1-1/2) times the normal operating pressure of the submersible pump, not to exceed sixty pounds per square inch (60 PSI). Gradually apply air pressure into the flexible piping line and maintain this pressure for a minimum of three (3) hours, making sure that there is no drop in pressure.

**NOTICE: Significant temperature changes during the air pressure hold testing may cause fluctuations in the pressure readings. It is advisable to record the temperatures when pressure readings are made to make the necessary adjustments.**

## 18.4 Double Wall Pipe Air Pressure Testing

Integrity testing for double wall piping is different than for single wall piping. For this testing application the interstitial test tube should be connected to an air pressure gauge assembly and the rest of the pipe interstice should be connected and closed, and tested to ten pounds per square inch (10 PSI).

**NOTICE: During pressurizing, check the reading on the interstitial test gauge that should be securely connected to the interstitial test tube. Any increase in pressure will indicate a leak in the primary pipe or double wall pipe fittings.**

**18.5 Hydrostatic Testing Procedure (if required)** If a hydrostatic test is required, then comply with the following hydrostatic testing procedures for the primary and

secondary of the flexible double wall piping.

**CAUTION: Integrity testing with air, gas or water can be dangerous and it is very important that the proper testing equipment be used and that the pre-testing procedures be read. OPW assumes no responsibility or liability for the consequences of any testing practices. Only qualified and experienced personnel should conduct the air pressure testing. Never disconnect couplings, caps, or plugs unless the air pressure has been released.**

**NOTICE: All testing requirements, operations, and procedures must be performed in accordance with all applicable codes.**

**CAUTION: Always make sure the underground storage tank is isolated from the piping system when conducting pipe air pressure tests.**

**18.5.1 Water Filling:** Gradually introduce water at the lowest point into the piping system and bleed off air at the highest point in the piping system through an open valve. The hydrostatic pressure applied should be no greater than one-and-one half (1-1/2) times the normal operating pressure of the submersible pump, not to exceed sixty pounds per square inch (60 PSI).

#### **18.5.2 Hydrostatic Testing of Dispenser Sumps**

OPW Fueling Containment Systems recommends the following procedure for hydrostatic testing of dispenser sumps, tank sumps and specialty application sumps.

- 1) Visually inspect all entry boots for band clamps, compression rings and donuts for possible leak points prior to connecting. Correct as needed.
- 2) Be sure all test tubes, connector tubes or any other open secondaries into the sump are sealed and liquid tight.
- 3) Fill all sumps to a minimum of 1" above the highest penetration fitting or sump joint. Mark the liquid level with a permanent marker.
- 4) Hydrostatic test should be held for 1 hour or per local regulations.
- 5) Be sure all water is disposed of properly after completing the test.

Note: Should the liquid level drop during testing, visually identify the leak source. Remove water and tighten band clamps to 30 in/lbs. Entry boot compression rings should be tightened in a clockwise manner until each stud reaches 60in/lbs. Repeat testing procedure.

If you have any questions, please feel free to call our Customer Service Department at 1-800-422-2525 for more details.

## **19.0 ROUTINE VISUAL INSPECTIONS**

OPW recommends routine (at least once a month) visual inspections inside all containment sumps. Use UL approved safety flashlights or lighting that will not cause a spark if dropped. Look for any evidence of a fuel leak or water infiltration into the containment sump. Fuel leaks collected in containment sumps can originate from pumps, valves, pipe, pipe fittings, unions, dispenser plumbing, etc.

When changing fuel filters at the dispenser, make sure any spilled product is cleaned out of the bottom of the dispenser sump to prevent a possible fire hazard. Sumps are to be kept free of debris and spilled fuel.

**CAUTION: Failure to remove fuel and liquids from containment sumps may compromise the performance and integrity of the sump and its associated fittings and seals over prolonged periods of time.**

### **19.1 Periodic Pipe Testing**

Local or federal regulations may require periodic line leak detection tests be performed on the installed piping system. Testing requirements can affect both pressure and suction piping systems and possibly include secondary containment piping and chase piping.

**19.2 Primary Line Testing:** A typical requirement is that the primary piping lines must be tested on an annual basis at one and one half (1-1/2) times the normal operating pressure. The typical test method will require detection of 0.10 gallons (.3785 liters) per hour with a 95% probability of detection and a 5% probability of a false alarm.

- **Line Test Procedures:** A typical line test procedure requires the piping be isolated from the tank and the piping line pressurized to 1-1/2 times the normal operating pressure. A test apparatus that is connected to the piping line will then measure the bleed-back volume of the piping system. Acceptable bleed-back volumes on different types of piping systems will vary due to their inherent expansion and contraction characteristics. Therefore, modifications in the testing procedures are required for piping systems that have significant expansion and contraction characteristics. This characteristic is measured in the average volume increase, per lineal foot, under a standard test pressure.
- **Piping Expansion Characteristics:** FlexWorks flexible piping is a multi-layer reinforced smooth bore flexible pipe that demonstrates only minor expansion and contraction characteristics during pressurization and depressurization. These physical characteristics reduce the affect on the "bleedback tolerances" permitting a more accurate testing procedure. Refer to Section 2.9 of this manual for the flexi-

ble pipe expansion and contraction data.

Volume Increase = gallons per linear foot at 60 PSI pressure.

**19.2.1 Interstitial Line Testing:** For periodic integrity testing of the interstitial space of the double wall flexible piping follow these instructions:

**19.2.2 Interstitial Integrity Testing:** Prior to supply filling and periodically over the life of the flexible piping system, it is recommended that interstitial testing be used to ensure that the secondary containment is intact.

**19.2.3 Air Pressure Testing:** Gradually pressurize the piping's interstitial space through the test tube to no more than 10 psi. During the pressurization period, apply an air pressure soap test to the entire piping line. After testing, disconnect the air hose and lay the test tube down into the bottom of the tank sump.

**19.2.4 Chase Pipe Testing:** Access Pipe chase piping is not a regulated pipe and is not required to carry a UL listing. For this reason, OPW does not require this piping to be periodically tested.

**19.3 Containment Sump Leak Detection** OPW recommends an approved means of continuous leak detection in all containment sumps to provide quick response to fuel collecting in these sumps. According to most envi-

ronmental regulations the collection of fuel inside a containment sump is not permitted to remain in a containment sump for more than 30 days and must be removed with 24 hours after discovery.

**19.3.1 Tank Sump Detection:** OPW recommends the use of any third party approved electronic leak detection sensor that is designed for detecting leaks in containment sumps.

**19.3.2 Dispenser Sump Detection:** OPW recommends the use of any third party approved electronic leak detection sensor that is designed for detecting leaks in containment sumps.

**NOTE: Do not close off or apply pressure to secondary jacket until primary pressure is maintained for a minimum of one hour.**



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