

# Double Containment Piping Systems

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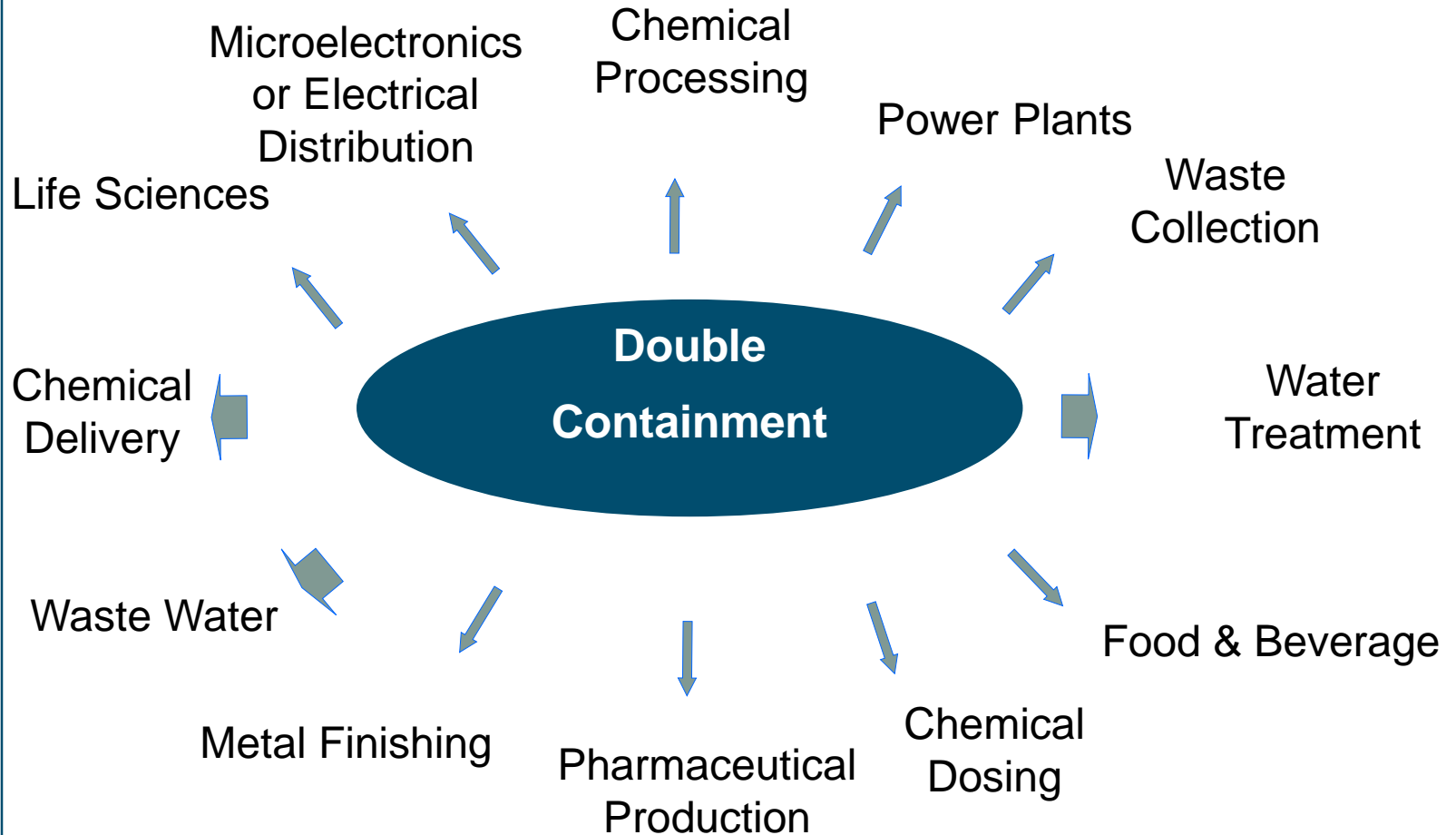
GF Piping Systems

**Kendall Group  
Tech Summit Presentation**

## The Two Big Questions

- Where and when are double contained piping systems required?
  - EPA
  - OSHA
  - FDA
  - NEC
- What types of systems are available for the various applications when double containment piping is necessary?

# Market Applications / Requirements



# Environmental Protection Requirements – Underground Systems



U.S. Environmental Protection Agency (EPA) Regulations Requirements apply to:

- All Hazardous fluids as defined in Code of Federal Regulations (CFR), Title 40, part 302.4 (eg.: Ammonia compounds, acetone, acetic acid, butane, chlorine, chromic acid, ethanol, hydrochloric acid, hydrofluoric acid, nitric acid, sodium hydroxide, sodium hypochlorite, sulfuric acid + hundreds of others)
- All Underground Storage Tanks (USTs) or associated piping systems with 10% or more of its volume underground.

40 CFR 280 Requirements:

- All “releases” (ie – leaks) must be contained or diverted to a proper collection system.
- Containment may be via a trench, dike or DC Piping & Tanks.
- Must contain leaking product for a minimum of 30 days.
- Must be inspected (monthly or continuously) via manual or automatic Leak Detection.

# Environmental Protection Requirements – Above Ground Systems



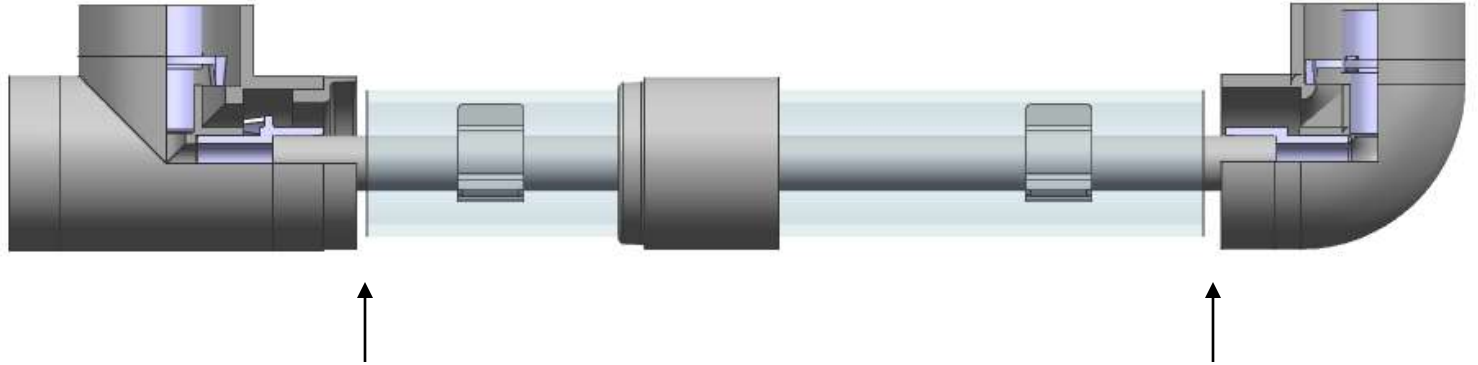
U.S. Environmental Protection Agency (EPA)  
Regulations Require:

- 40 CFR 112 – Petroleum Oils
- Spill containment must be provided for 100% of the volume capacity of the largest vessel in the system.

Requirements:

- Restrain drainage from diked storage areas by valves to prevent discharge into the site drainage or facility effluent treatment system.
- Design facility systems from undiked areas (such as where piping is located outside of diked areas) to either retain the oil, or return it to the facility. Hence the need for double contained piping that drains back to containment areas or dikes.

# ASME B31.3 Compliance



**Section B31.3 Part 345.3.1 of ASME Standard states:**

**“All joints, welds (including structural attachment welds to pressure-containing components), and bonds shall be left un-insulated and exposed for examination during leak testing, except that joints previously tested in accordance with this Code may be insulated or covered. All joints may be primed and painted prior to leak testing unless a sensitive leak test (para.345.8) is required.”**

# GF's Double Containment System Options

	<b>Double-See</b>	<b>Fuseal Squared</b>	<b>Contain-It</b>
Primary material options	<b>PVC &amp; CPVC</b>	<b>PPNFR, PPRF &amp; PVDF</b>	<b>User Defines</b>
Primary pressure capability	<b>Varies by size</b>	<b>Up to 50 psi</b>	<b>n/a</b>
Secondary material options	<b>PVC, CPVC &amp; Clear PVC</b>	<b>PPNFR &amp; PPRF</b>	<b>Clear PVC</b>
Secondary pressure capability	<b>Up to 50 psi</b>	<b>Up to 5 psi</b>	<b>Up to 32 psi</b>
Retrofit capable for existing primary system	<b>No</b>	<b>No</b>	<b>Yes</b>
Primary size range	<b>½" – 6"</b>	<b>1½" – 8"</b>	<b>½" – 4" 20-110mm</b>
Secondary size range	<b>2" – 10"</b>	<b>4" – 12"</b>	<b>4" &amp; 6"</b>



# EPA Application Example #1

- Underground containment of hazardous pumped chemical piping by EPA CFR 40 standards.
- Chemical Compatibility (mild caustics or acids, or bleach solutions such as sodium hypochlorite)
- Pressure rated carrier pipe (to 150 psi).
- Pressure rated containment pipe (to 50 psi)
- ASME B31.3 pressure testing compliance (ie – inner and outer piping systems tested separately)



# Double-See™ Vinyl Double Containment



Available in: PVC x PVC, CPVC x PVC, CPVC x CPVC

- **Easiest** joining method available on the market today
- **Innovative** closure coupling design allows practical ASME B31.3 compliant system installation
- **Patented** fitting centralizer adapter compensates for 3D thermal expansion
- **Unique** valve-in-valve pressure rated design
- **Broadest** standard product line offering available (manual and actuated valve boxes, leak detection fittings)

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## Size Range

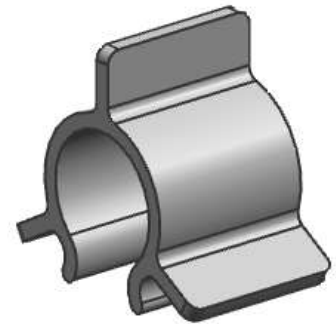


**Sizes:**     $\frac{1}{2}'' \times 2''$              $\frac{3}{4}'' \times 3''$              $1'' \times 3''$   
                  $1\frac{1}{2}'' \times 4''$              $2'' \times 4''$              $3'' \times 6''$   
                  $4'' \times 8''$              $6'' \times 10''$

# Pipe Design



**Pipe Comes Pre-Assembled**

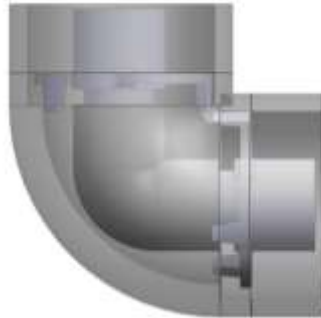
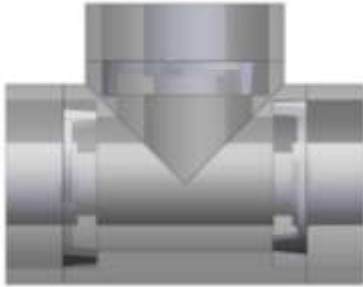


**Primary Material: PVC 80, CPVC 80**

**Secondary Material: PVC 80, CPVC 80, Clear PVC 40**

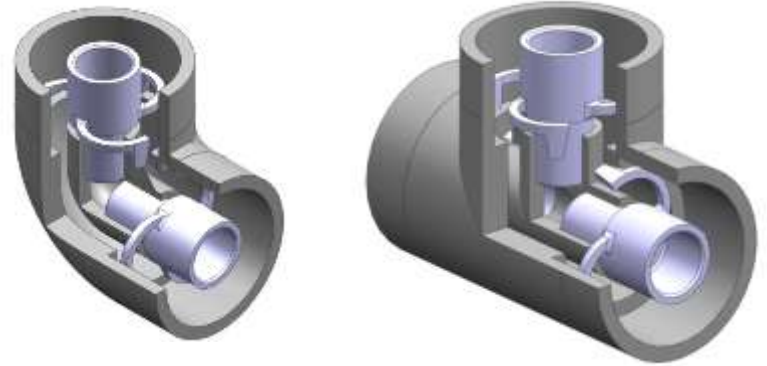
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# Flush Fitting Design for Easiest Joining Method



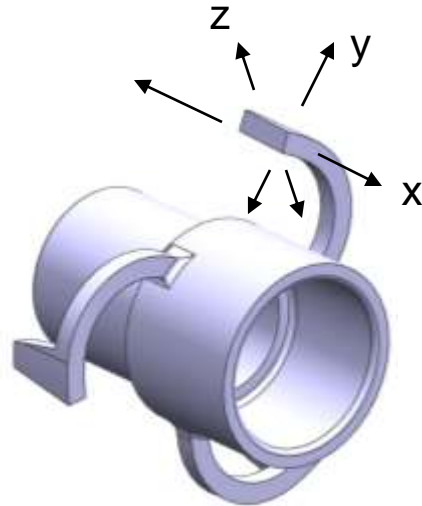
**Primary is flush with face of  
secondary fitting**

**Fittings Come Assembled**

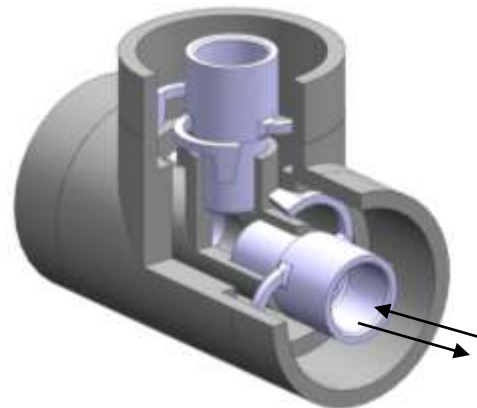
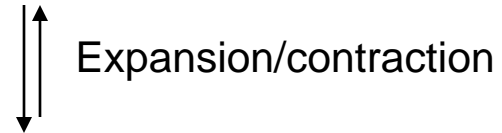


**100% Factory tested to 150 psi**

# Patented Centralizing Adapter Compensates for Thermal expansion



Centralizer adapter arms allow for 3 dimensional primary pipe movement



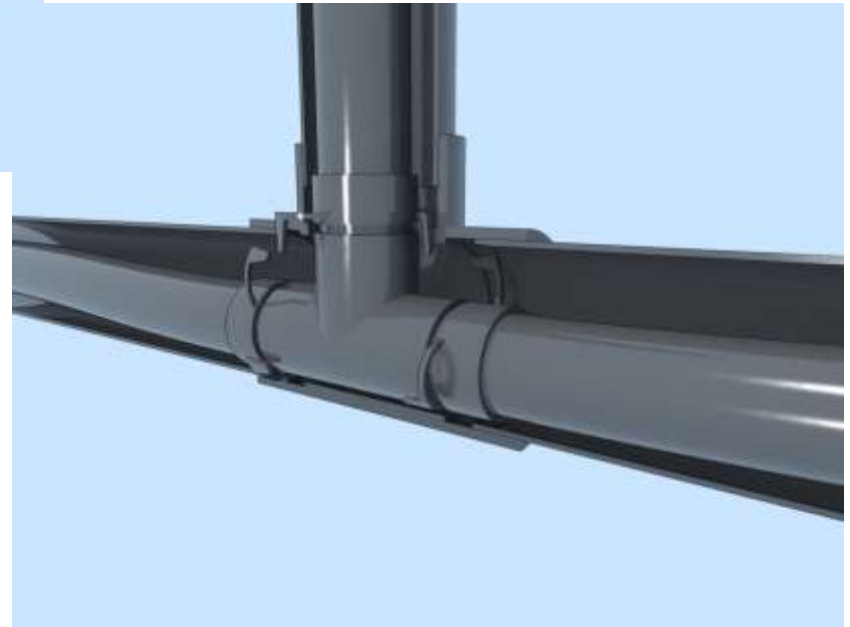
Expansion/contraction

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# Patented Centralizing Adapter Compensates for Thermal expansion



Example of deflection in tee / branch



# Engineered charts to guide users...

Shaded area will compensate for expansion/contraction

3 x 6 PVC

Distance Between Fittings (L) (ft)	Expansion [inches]																			
	ΔT [F]																			
	10°		20°		30°		40°		50°		60°		70°		80°		90°		100°	
	ΔL	a	ΔL	a	ΔL	a	ΔL	a	ΔL	a	ΔL	a	ΔL	a	ΔL	a	ΔL	a	ΔL	a
10	0.03		0.07		0.10		0.13		0.17		0.20		0.24		0.27		0.30		0.34	
20	0.07		0.13		0.20		0.27		0.34		0.40		0.47		0.54		0.60		0.67	
30	0.10		0.20		0.30		0.40		0.50		0.60		0.71		0.81		0.91		1.01	
40	0.13		0.27		0.40		0.54		0.67		0.81		0.94		1.08		1.21		1.34	
50	0.17		0.34		0.50		0.67		0.84		1.01		1.18		1.34		1.51		1.68	
60	0.20		0.40		0.60		0.81		1.01		1.21		1.41		1.61		1.81	54.62	2.02	57.70
70	0.24		0.47		0.71		0.94		1.18		1.41		1.65		1.88	55.66	2.12	59.11	2.35	62.23
80	0.27		0.54		0.81		1.08		1.34		1.61		1.88	55.66	2.15	59.53	2.42	63.15	2.69	66.58
90	0.30		0.60		0.91		1.21		1.51		1.81	54.62	2.12	59.11	2.42	63.15	2.72	66.95	3.02	70.55
100	0.34		0.67		1.01		1.34		1.68		2.02	57.70	2.35	62.23	2.69	66.58	3.02	70.55	3.36	74.42

Shaded area = expansion absorption between two 3" x 6" PVC fittings. No expansion loop required.

White area = expansion loop necessary; first number is expansion value (ΔL); second number is length of section "a" of expansion loop

Theoretical maximum distance per fitting 0.965"

$$0.965 \times 2 = 1.93"$$

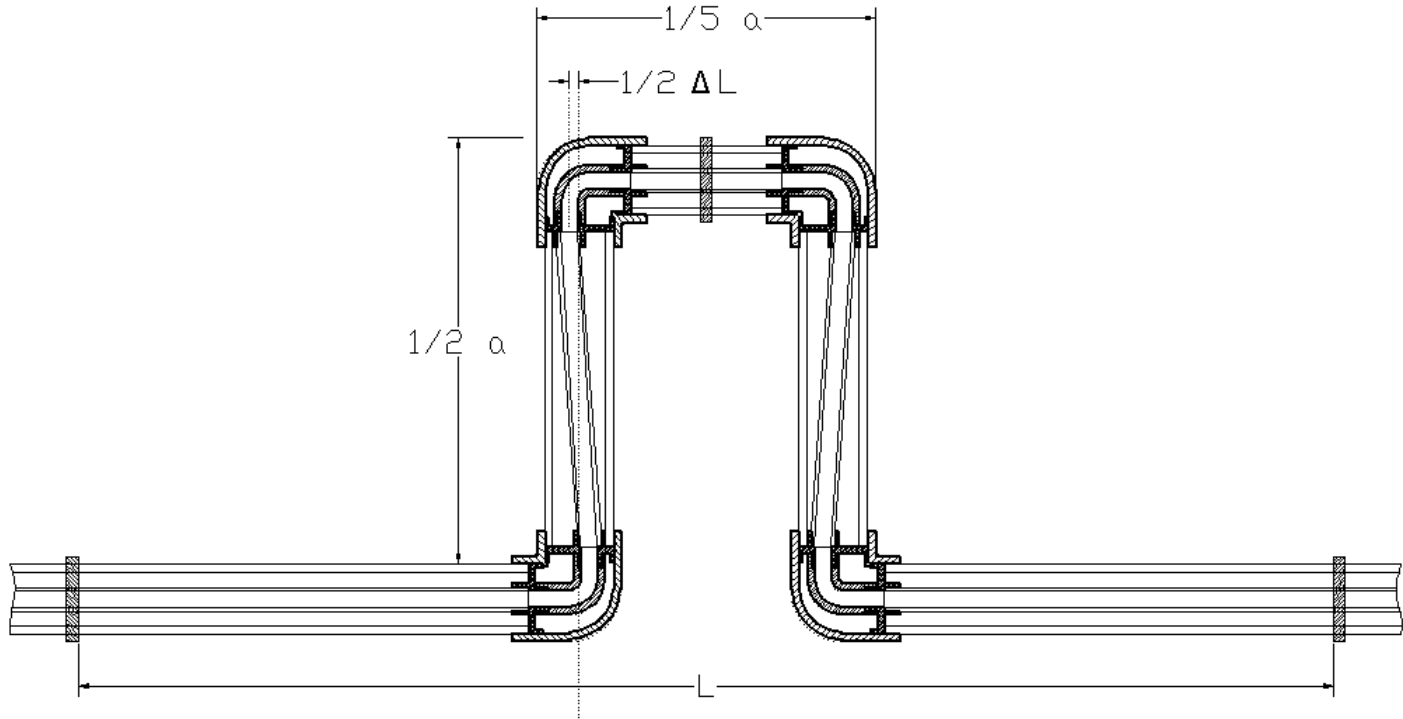
1.93 x 90% = 1.74" maximum movement (absorption of expansion) between two fittings

White areas require an expansion loop- "a" shows loop leg length



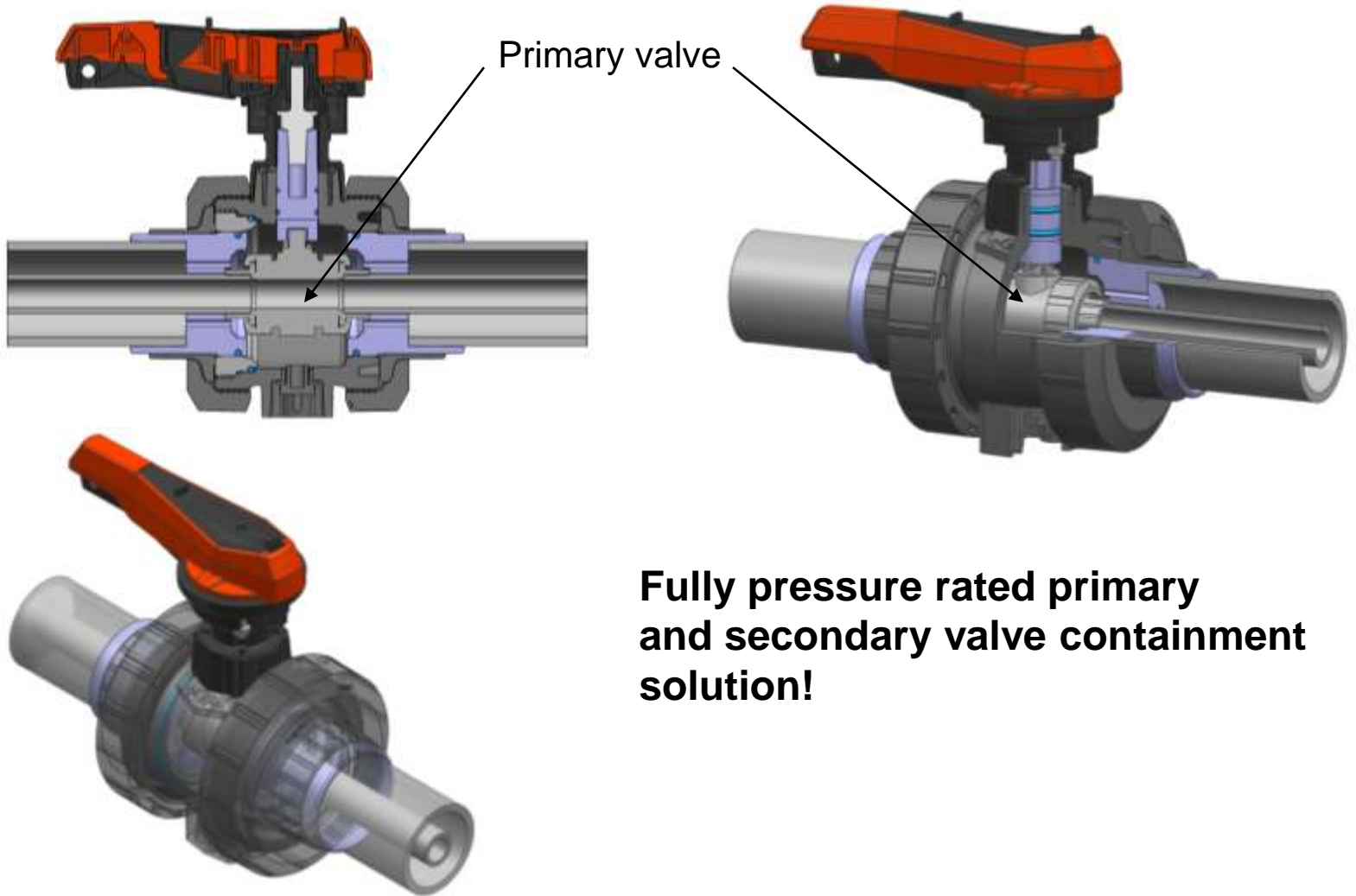
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# Expansion Loop Design



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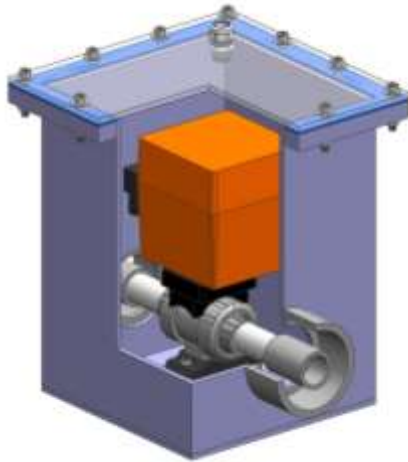
# Valve-in-a-Valve Pressure Rated DC Valve



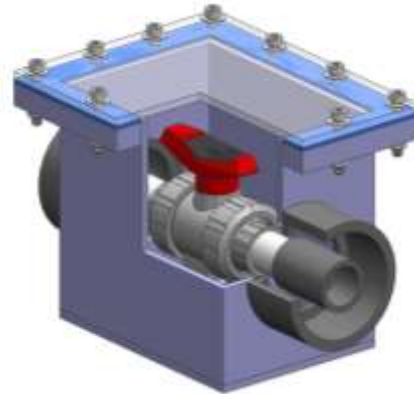
**Fully pressure rated primary and secondary valve containment solution!**

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# Broadest standard product range



Actuated valve box -



Non-pressure rated valve box w/ optional external handle



Access tees-



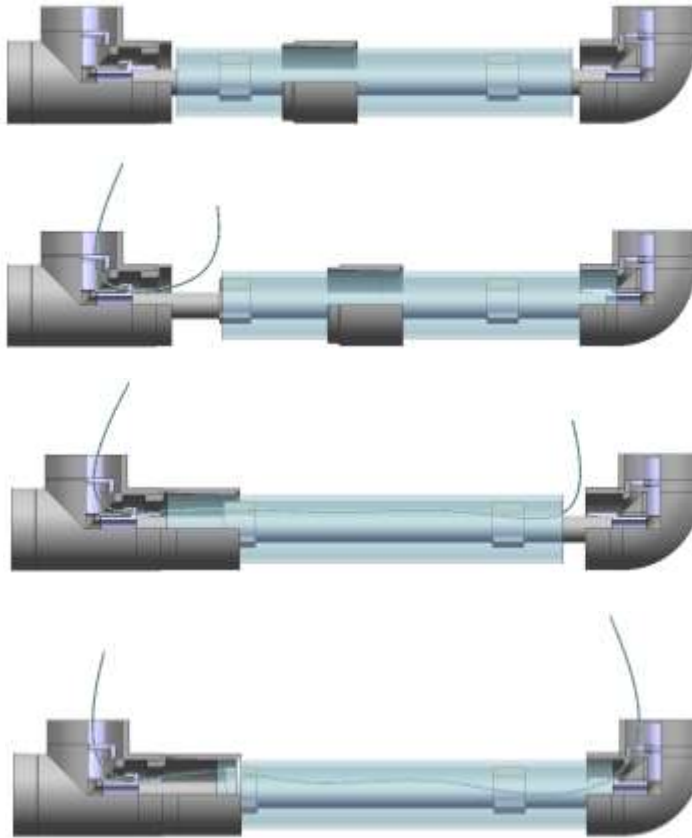
Termination fittings-



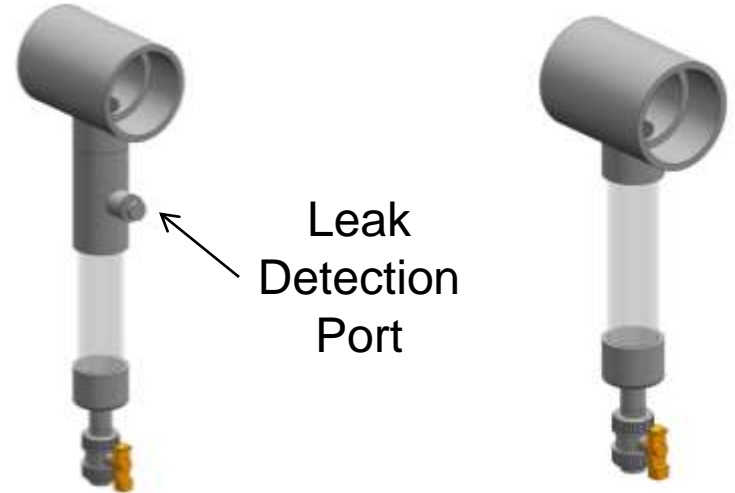
Leak detection w/and w/o level port

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# Compatible with leak detection systems



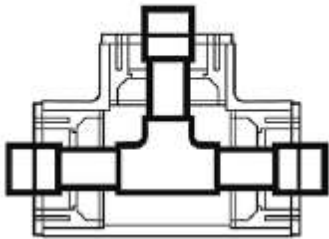
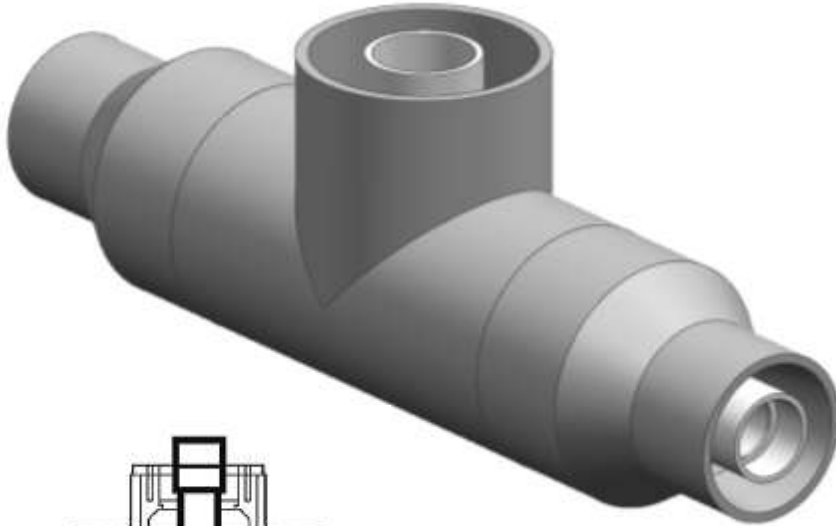
Leak Detection Cable  
Installation



Visual Leak Detection Options  
with Low Point Drains

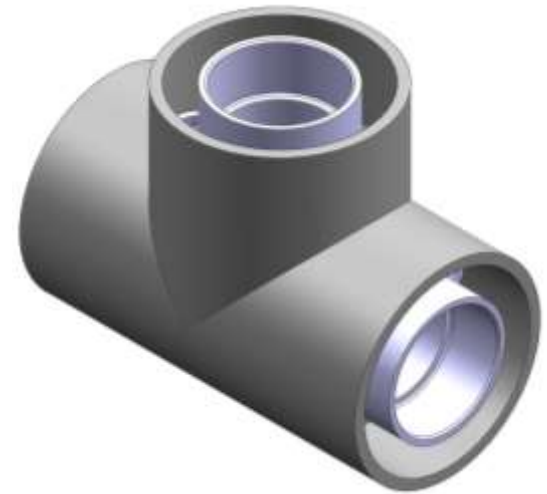
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# Compact Standard Tee Design



Competitors version-  
6" tee in 12" tee  
with reducers

DC Tees are made from standard Spears® pressure fittings in designated material and Schedule selected. Included are separate internal Carrier and external Containment fittings of the same configuration. Carrier fittings are equipped with extenders to facilitate cement assembly. Certain combinations use larger Containment tees that are bushed to specified size.



Double-See Design-  
6" tee in 10" tee

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# Complete engineered double containment



“By far the simplest double containments system we’ve ever Installed”



## EPA Application Example #2

- Underground containment of hazardous chemical drainage piping by EPA CFR 40 standards.
- Chemical Compatibility (aggressive caustics or mild acids)
- Drainage piping carrying chemicals to treatment (no pressure rating)
- ASME B31.3 pressure testing compliance (carrier and containment piping systems tested separately)

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# Fuseal Squared Double Contained Polypropylene Drainage Piping

## Fuseal Squared™





# Fuseal Squared™ Double Containment Corrosive Waste Piping System

## Raw Material

- Polypropylene Flame Retardant (PPFR)
- Polypropylene Non-Flame Retardant (PPNFR)
- Polyvinylidene Fluoride (PVDF)

## Joint Technology

Electrofusion

1½" thru 8" IPS Primary

4" thru 12" IPS Secondary

## Competitive Advantages

Maintenance free service with low installation & ownership cost

Outstanding chemical resistance

Light, flexible, tough, and dependable

PP can withstand temperatures up to 212° F (100°C)

Primary System Pressure Rated up to 50 psi (fusion)

Primary System May Be Fused and Tested Independent of Containment System (ASME B31.3)



# Fuseal Squared™ Double Containment Corrosive Waste Piping System

## Popular Applications

- Institutional & Commercial Laboratories
- Life Sciences
- Semiconductor
- Pharmaceutical
- Food & Beverage
- Photographic
- Biotechnology

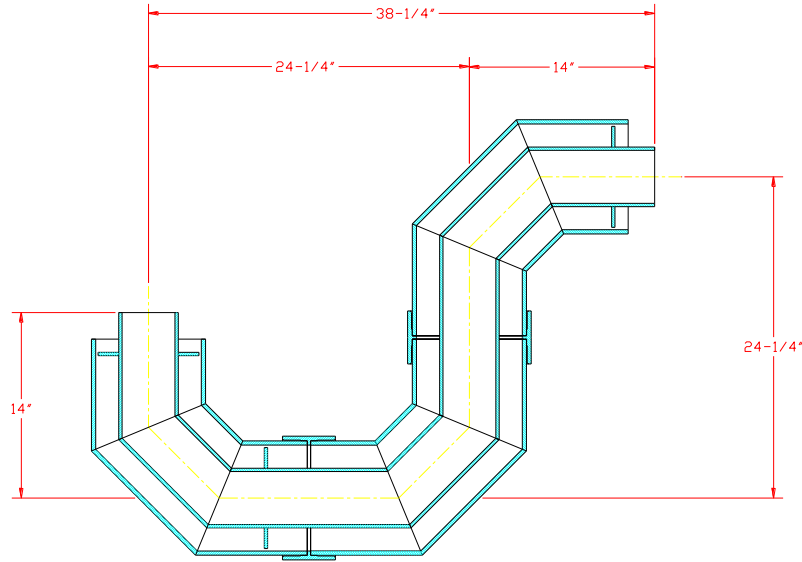
## Standards and Approvals

- NSF Standard 14 (Primary)
- NSF-cw (Primary)
- UPC (Primary)
- ASTM F1412 (Primary)
- ASTM D4101 (Primary)
- ASTM D3311 (Primary)
- CSA B181.3 (Primary)

## Engineering Assistance by GF

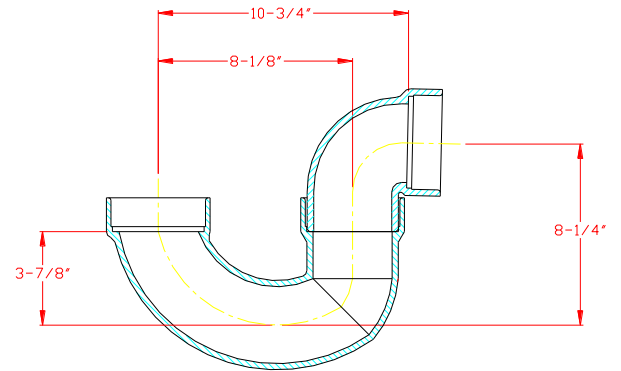
- Spooling of Piping System
- Custom Termination Design
- Layout
- On Site Design





4"x8" P-Trap

4" P-Trap



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# Double Containment Trap



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# OSHA Requirements



- OSHA lists Hazardous Chemicals in its “Hazard Classification Guidance Manual”
- Some common chemicals listed include Ammonia compounds, Bromine, Chlorine, Hydrochloric Acid, Hydrogen Peroxide, Methyl Ethyl Ketone, Nitric Acid, Sulfuric Acid, Sodium Hypochlorite, Sodium Hydroxide (plus hundreds of others)
- OSHA “Engineering Controls” listed under “Chemical Hazards and Toxic Substances” section lists “Isolate or Enclose the Process” as an example of a way to limit chemical exposure to employees. This would include double containment over hazardous chemical piping.

# OSHA Application Example #1

- 93% Sulphuric Acid delivery
- Above grade outdoors
- Carrier pipe is carbon steel
- Need outer containment
- ASME B31.3 compliance for testing of inner and outer piping systems separately

## Contain-It™





# Contain-It™ Containment Piping System

## Raw Material

- Polyvinylchloride (Clear PVC)

## Joint Technology

- Two Part Adhesive Bonding Method



## Competitive Advantages

- 4" & 6" Split and Solid Pipe
- 4" & 6" Split Fittings
- 4" & 6" Split & Flexible Alcryn® Terminations
- Handles up to 140° F
- ASME B31.3 Compliant - Primary System May Be Tested Independent of Containment System
- Clear System Allows for Quick Detection of Carrier Leak Points
- Snap on Centralizers Easily Attach to Carrier Piping System
- Split Fittings Held in Place w/Clips for Ease of Dry Fit Installation
- Easy to Use Adhesive Cartridge/Mixing Tip/Cartridge Gun
- Retrofit Capabilities
  - Carrier Piping May Be Contained While Remaining On Line



# Contain-It™ Containment Piping System

## Popular Applications

- Chemical distribution
- Institutional & Commercial Laboratories
- Life Sciences
- Semiconductor
- Pharmaceutical
- Food & Beverage
- Photographic
- Biotechnology

## Standards and Approvals

- ASTM D1784 (material)
- ASTM D3034 (pipe OD)

## Engineering Assistance by GF

- Spooling of Piping System
- Custom Termination & Centralizer Design
- On Site Design



# Sulphuric Acid Distribution with Containit



# Sulphuric Acid Distribution with Containit



## OSHA Application Example #2

- Waste Treatment application using concentrated chlorine
- Above grade outdoors
- Ambient temperature
- 6" carrier pipe
- ASME B31.3 requirement for independent testing of primary and containment pipes

# WWTP – Concentrated Chlorine delivery. Double See PVC





# WWTP – Concentrated Chlorine delivery. Double See PVC



## **FDA CFR - Code of Federal Regulations Title 21:**

- “(5) Work-in-process shall be handled in a manner that protects against contamination.
- (10) Manufacturing steps such as washing, peeling, trimming, cutting, sorting and inspecting, mashing, dewatering, cooling, shredding, extruding, drying, whipping, defatting, and forming shall be performed so as to protect food against contamination. Compliance with this requirement may be accomplished by providing adequate physical protection of food from contaminants that may drip, drain, or be drawn into the food.”

# FDA Application Example

- Pepperoni processing plant with storm drain line crossing conveyor belt
- Storm line is schedule 40 PVC
- Need manual visual leak detection
- ASME B31.3 pressure testing required



# Contain-It over storm water line – Pepperoni Processing Plant



# Contain-it over storm water line – Pepperoni Processing Plant



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# Chopped pepperoni for pizza topping



# The National Electrical Code (NEC) / (NFPA 70)

## **NFPA 70 (NEC) 110.26**

(b) Foreign Systems. The area above the dedicated space required [for electrical switchboards, panel boards, distribution boards, and motor control centers] shall be permitted to contain foreign systems, provided protection is installed to avoid damage to the electrical equipment from condensation, leaks, or breaks in such foreign systems.

➤ Again, double containment piping is the answer.

# NEC Application Example

- Liquid conveyance lines in a switchgear room.
- NEC 110.26 Compliance
- ASME B31.3 pressure testing requirement (independent carrier and containment pipe testing)
- Need visual leak detection



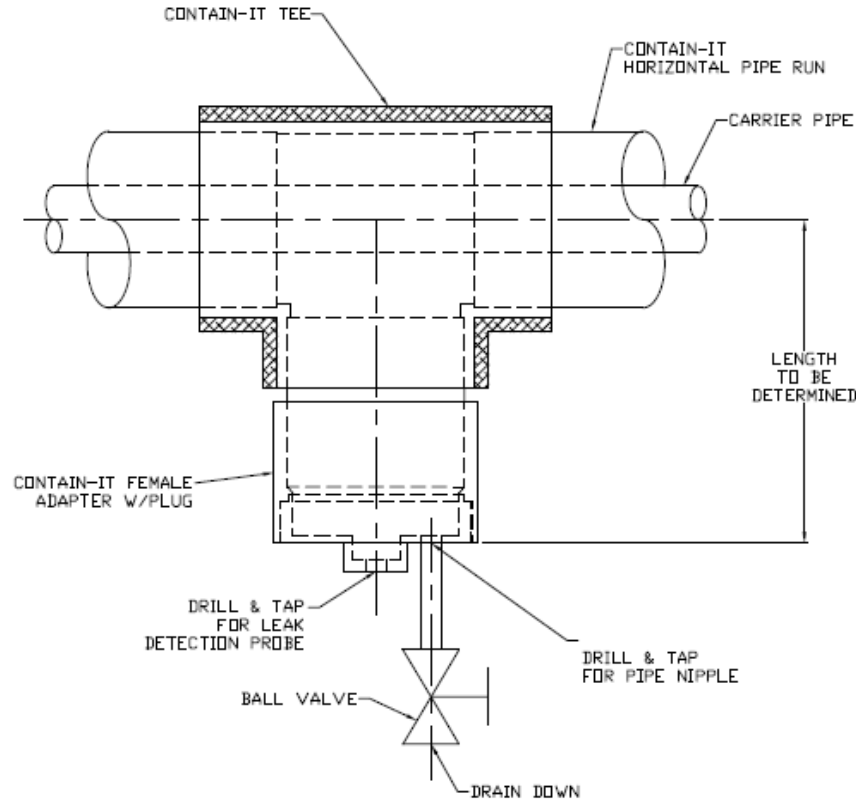
# Contain-it above Electrical Switchgear



## Leak Detection Types:

- Visual Manual (eg.: Clear Containment Pipe)
- Low Point Tees with Liquid Detection
- Continuous Cable Detection

# Visual Manual Leak Detection – Contain-it



Contain-IT  
Leak Detection &  
Drain Port



# Low Point Tees with Liquid Detection

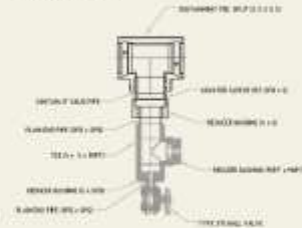
## Leak Detection Systems

### Contain-It™

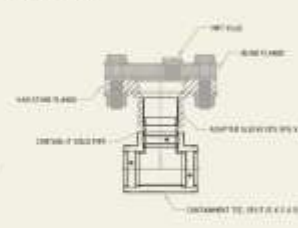
#### Low Point Sump



#### Low Point Drain

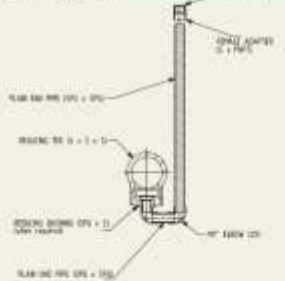


#### Access Tee

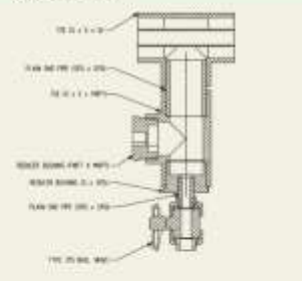


### Double-See®

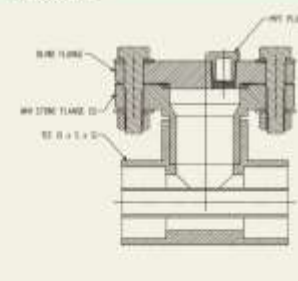
#### Low Point Sump



#### Low Point Drain

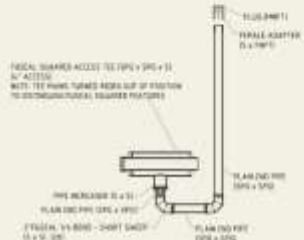


#### Access Tee

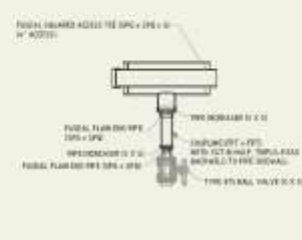


### Fuseal® Squared

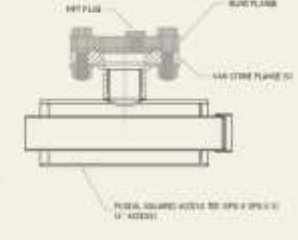
#### Low Point Sump



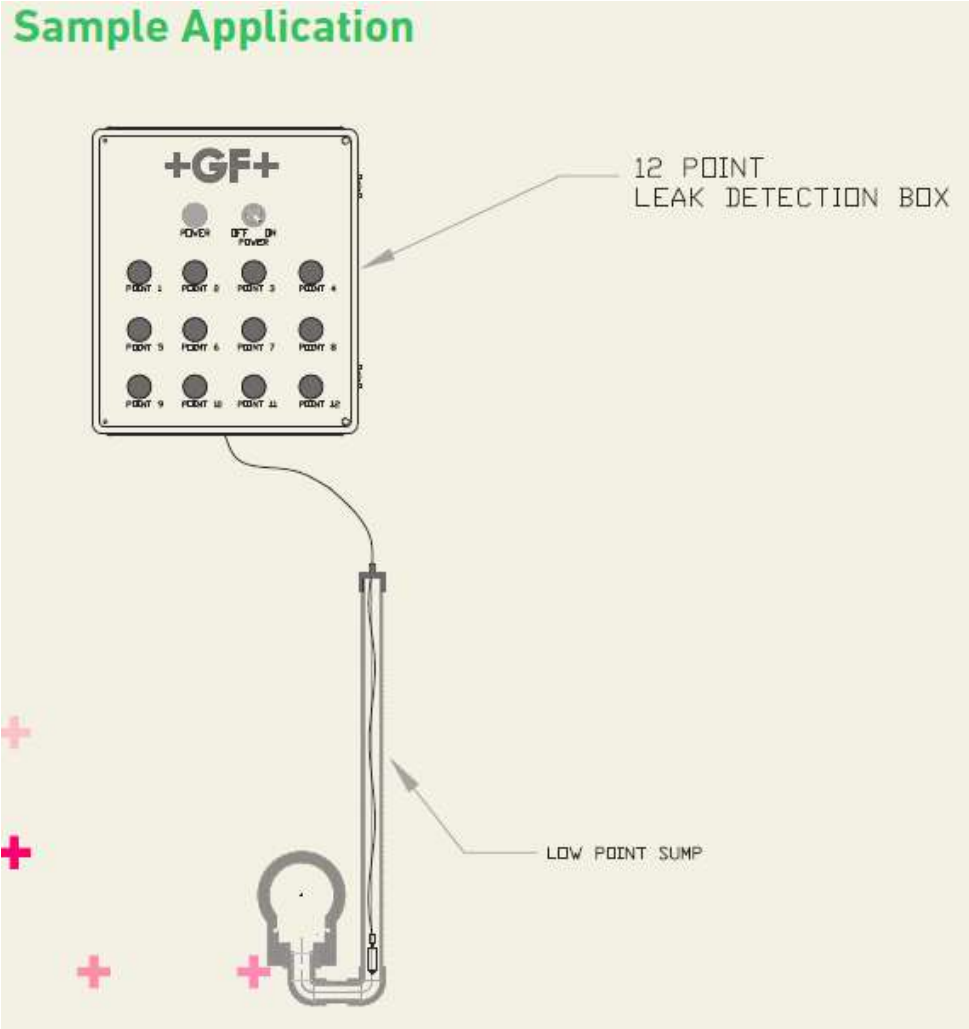
#### Low Point Drain



#### Access Tee



# Leak Detection Panel – Multipoint for Low Point Tees



# Continuous Cable Detection

## PAL-AT Continuous Cable Leak Detection System

For continuous leak detection, Georg Fischer offers the PAL-AT continuous cable leak detection system. PAL-AT is a micro-processor system with multi-sensing and remote monitoring capabilities. The presence of liquids to "wet" the cable will cause a change of the reflection at that specific location. When the system recognizes the change, it will enter into automatically enter into alarm mode and creates a new "map". This will then become the base line for the system, allowing PAL-AT to continue monitoring the cable for growing leaks, new leaks, breaks, shorts and/or faults. The system is capable of monitoring up to four separate sensing zones each having up to 7,500 ft. of sensor cable. The versatility of the PAL-AT makes it ideal for Georg Fischer's Double-See, Contain-It and Fuseal Squared double contained piping systems.

Part No.	Cable Capacity	Maximum Cable Range (ft.)
150 000 061	1	3000
150 000 064	1	7500
150 000 065	4	7500

### Features

- Locates multiple leaks without loss of accuracy or sensitivity
- Detects growing leaks
- Locates breaks and shorts to reduce downtime
- Stores information with time and date
- Monitors for leaks up to location of breaks/shorts
- Ethernet and RS-232/RS-485 serial ports
- Accepts probe and cable sensors in one sensor string
- Able to commission system with limited initial lengths of wet cable
- Not susceptible to dust/dirt contamination of the sensor string
- Zener barrier panel (ZBP) provides intrinsically safe sensor cable output circuits for hazardous locations:
  - Class I, Division 1, Groups C & D Zone 0, Group IIB
- Modbus TCP, RTU, and RTU over TCP protocols

### Advantages

- Wet cable start-up and multiple leak locations
- Monitor up to four separate sensing zones
- Low-power installation
- System archives
- Security system
- UL listed, CE compliance, and EPA third-party tested



### Sample Application

