

**i**con  
Containment Solutions



# Secondary Containment Sump

Leak Repair Product  
Applications

# What Gets Tested overflow prevention devices and ball floats

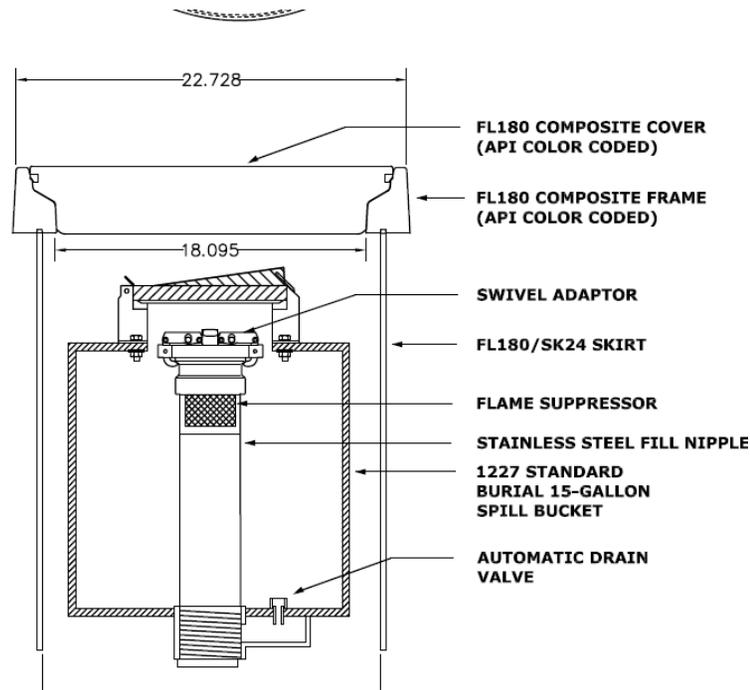


How can an owner guarantee that his delivery will be by gravity?



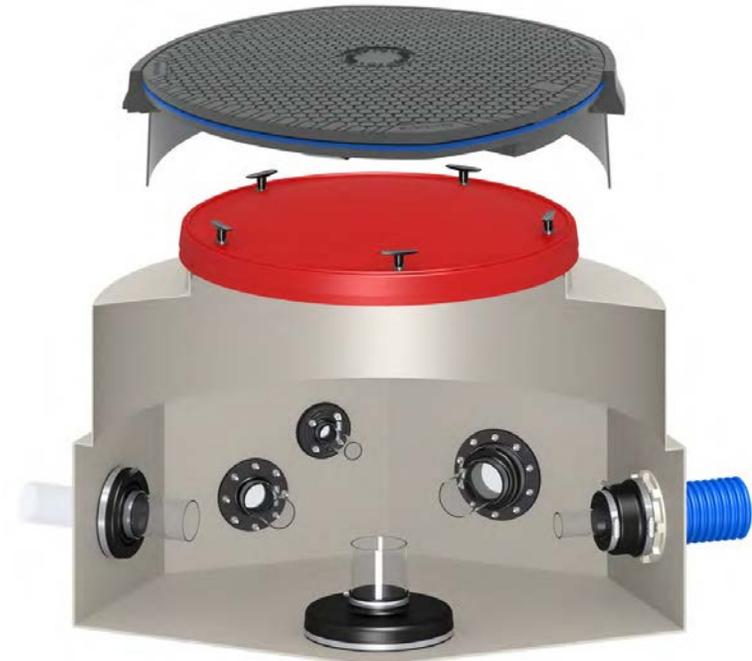
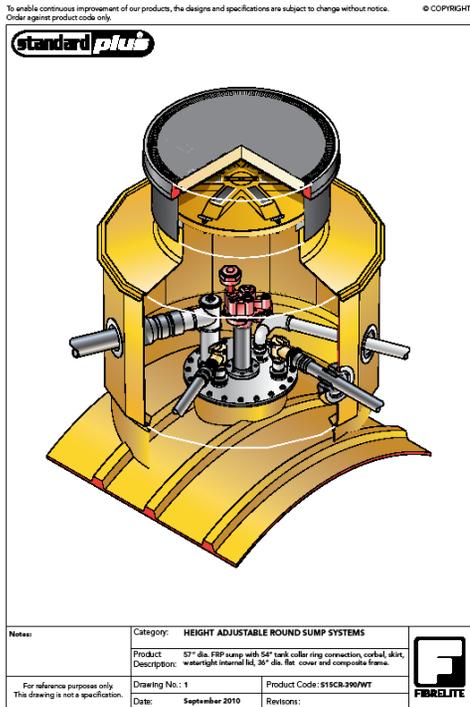
There is only one Positive shut off valve UL listed for both deliveries

# What Gets Tested – Spill Buckets



# What Gets Tested

## Pipe Sumps on USTs and Transition boxes



# You Must Do These too Dispenser Pans, install them if not there



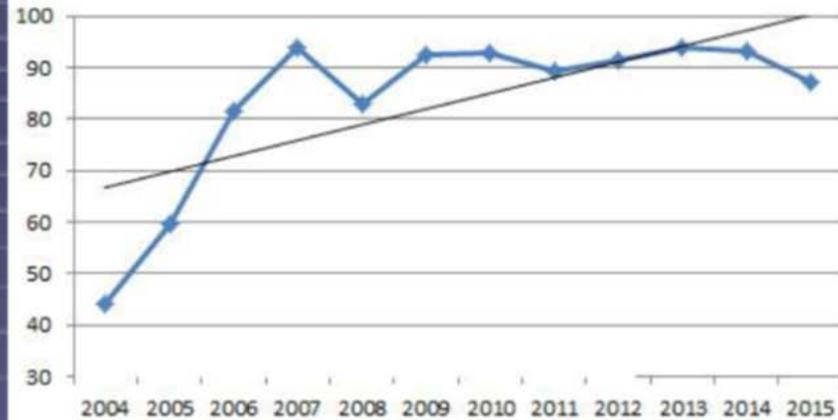
# What the testing will show

- Typical retail gas station equipment is
  - **Designed for 5- 7 years**, Installed by qualified contractors Is serviced by factory authorized technicians
- Over Fill Prevention Fill Pipes – 50% failure, require replacement
- Spill Prevention Fill Boxes – 66% failure on plastic 20% failure on steel, require replacement
- Piping Sumps on Tanks – 50% failure at entry boots and tank connection, require repair
- Dispenser Sumps – 50% failure at entry boots and 25% will require replacement

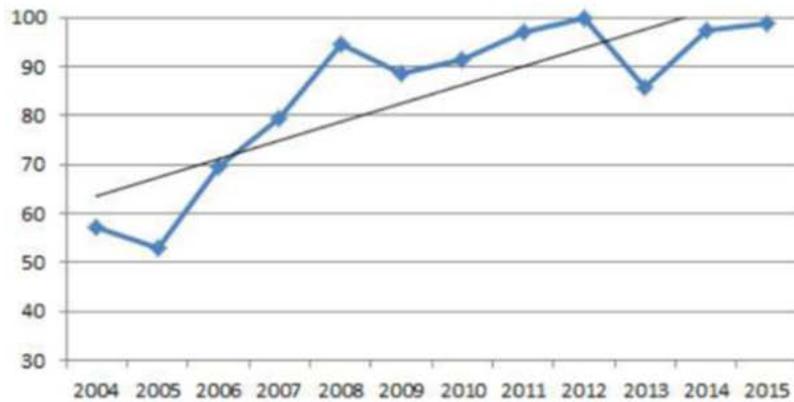


# Containment Sump Testing Will Be Painful in the Beginning

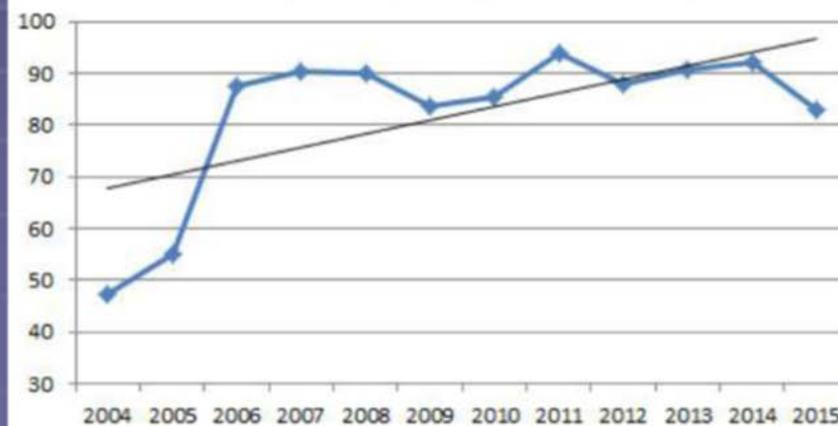
### Plastic (HDPE) tank-top sumps



### Fiberglass tank-top sumps



### Plastic (HDPE) dispenser sumps



Here's what MD test data looked like when they first started testing containment sumps back in 2005/2006 with their new rules.



# Questions for the local regulator

- Will the station owner be allowed to self certify

Will the station owners be allowed to repair these, in the unlikely possibility of a failure

**What happens when you fail a spill container test, or dispenser pan and no product leakage visible**

# What happens if you do nothing

- Historically we can review the 1988 EPA tank regulations, the deadlines never moved or extended
- Non-compliance was fined
- Non-compliance tanks were locked out
- All fuel deliveries were monitored for compliant only tanks, fuel vendors in some states were significantly fined for non compliant fuel deliveries



# Test, then repair where required



# You Must Do These sort of repairs



## BEST RESOURCES

From EPA 40CFR 280.35, (B) Code of practice developed by a nationally recognized association

Petroleum Equipment Institute RP 900

Petroleum Equipment Institute RP 1200

ICON Training and Installation via Webex. 45 minute Code review and 2 hour training and certification



- <http://icontainment.com/>
- 905 N. Main St. STE D1
- N. Salt Lake, UT 84054
- Email: info@icontainment.com
- Phone: 855.DRY.SUMP
- Fax: 855.DRY.SUMP
- Paul Reber

And Wesley Yeager, 973-534-4425  
Wesley.Yeager@trustedvendor.com





**Uh Oh!**

**Now  
What?**







**icon**  
Containment Solutions







*Ouch! \$\$\$\$!*





*Ouch!!! \$\$\$\$\$\$!!!*

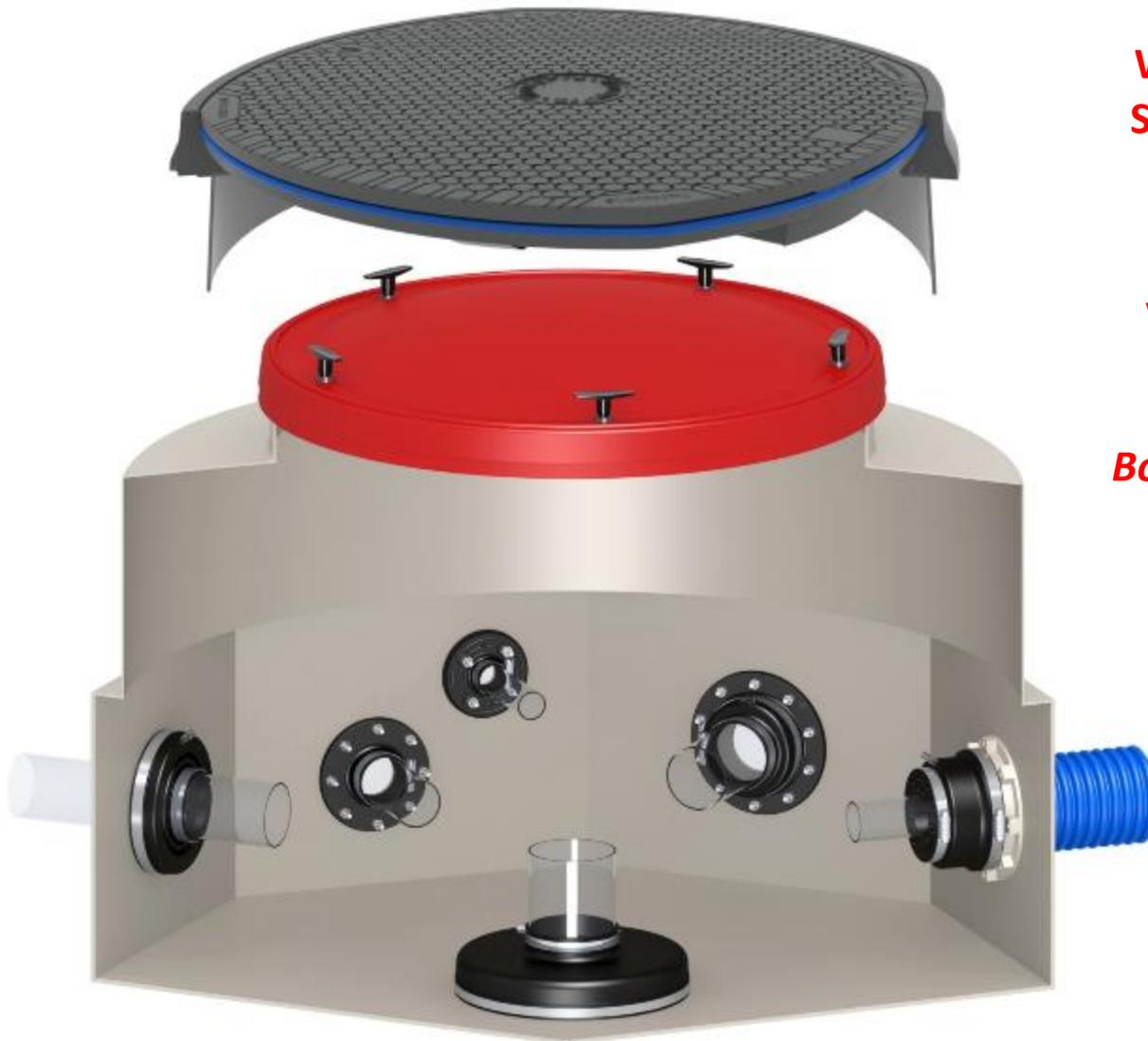




**icon**  
Containment Solutions

*Or...*

# *Leak Repair Solutions Applied Within Existing Sump Structures*



**Watertight Manhole Cover & Sump Lid** Retrofits for Surface Water Leaks

Corrosion Preventing

**Vapor/Humidity Absorbants** for STP Sumps

**Bonded Repairs** for Sump Cracks, Holes, & Seam Leaks

**Split-Repair Fittings** for Leaking Fittings

**Instant Water Blocking** for Active Water Intrusion

**Liquid Moisture Absorbants** in Sumps

# *Why?*

- **Proven Effective & Lasting**
  - **Minimal Site Disruption**
  - **Faster & More Affordable**
- **No Disconnecting Entry Pipe or Excavation**
- **Covers All Types & Brands of Equipment**

*and...*



*Meets the objectives of  
compliance regulations!*



# Water Blocking



# FastFoam

- Instant activation in two-part urethane foam for temporary blocking and spot treatment for active water leaks.
- May eliminate pumping water table & corresponding disposal.
- **50ml, 215ml, and 600ml** cartridge sizes for various applications.
- Approximately **20:1 ratio of material expansion** and a **1-year shelf life**.
- Continuous pumping of the trigger until cartridge is empty or the desired volume is dispensed as applicable to cartridge size.



# FastFoam Application



There are some limits to Water Blocking!



# Sump Structural Repairs



# PolyFuse

- **Highly effective, fast-setting, two-part structural plastic adhesive bonder for poly/HDPE material repairs, and for poly to other materials. All fuels compatible, including ethanol.**
- **Sets within 5 minutes at 70° , so dispense it only when ready for the bonding process.**
- **Has a 12-24 hour cure time generally. Some minor applications may be ready to test after 6 hours. Check with Icon for recommendation.**
- **50ml and 250ml cartridge sizes available. 1-year shelf life, but refrigerated storage recommended.**



# PolyFuse Application

- **Surface must be dry, abraded, and cleaned with acetone or isopropyl alcohol.**
- **Properties are best realized if dispensed when material is at 70° .**
- **Begins to set within 5 minutes at 70° .**
- **Apply to the surface of any additional substrate material; or make sure that repair cloth is fully embedded in material and sufficiently covered with PolyFuse.**
- **Some minor repairs may be cured sufficiently for testing in 6-8 hours.**



# PolyFuse Application



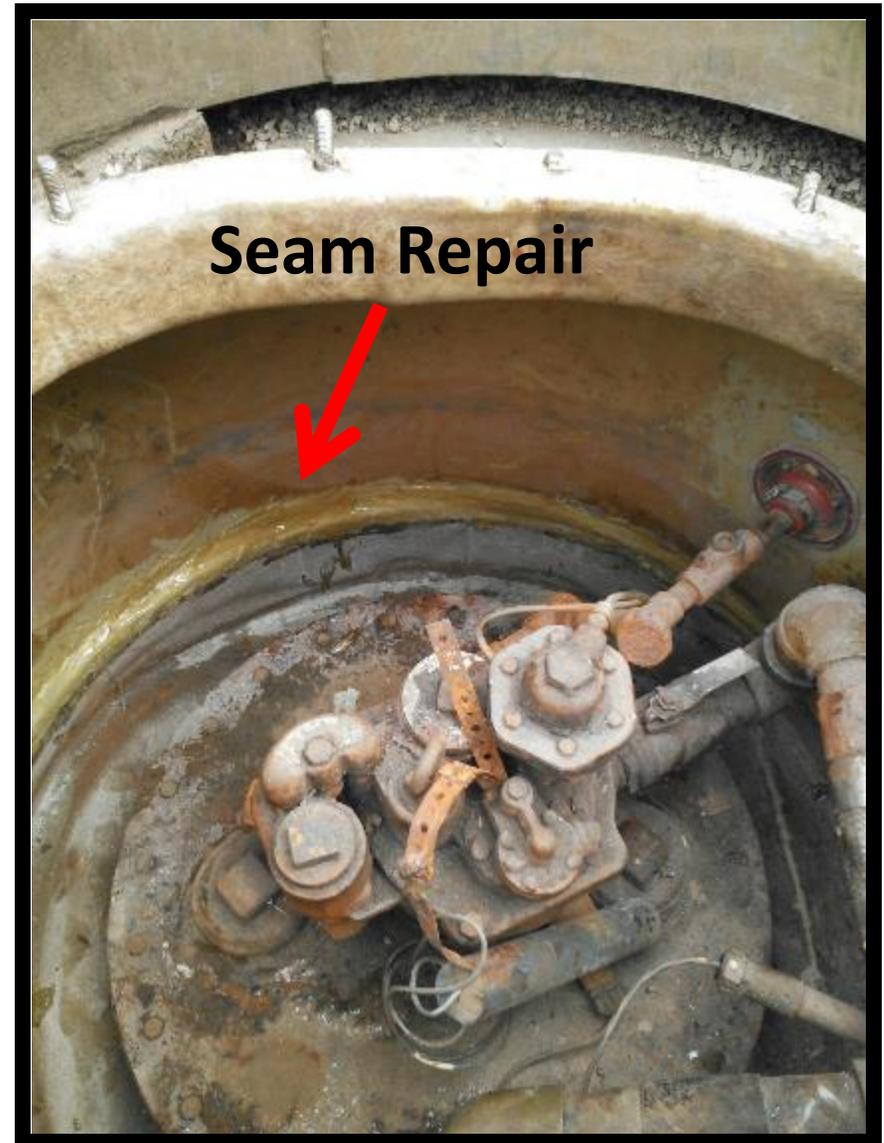
# FiberFuse & iBond

- Highly effective, fast-setting, two-part adhesive bonders, used to permanently bond and seal fiberglass and other materials. All fuels compatible, including ethanol.
- Sets within 5 minutes at 70° , dispense only when ready for the bonding process.
- FiberFuse has a 1 hour cure time, is packaged in a 20oz cartridge, and has a 1-year shelf life. Low Viscosity
- iBond has a 30 minute cure time, is packaged in a 50ml cartridge and has a 1-year shelf life. Gel Consistency



# FiberFuse/iBond Application

- Surface must be dry, sanded (through gel coat), and clean.
- FiberFuse & iBond properties are best when cartridge/material is at 70° .
- FiberFuse has a more liquid consistency initially, and begins to set within 5 minutes.
- iBond has a gel consistency, and begins to set within 5 minutes.



# iBond Application



# Sump Fitting Repair



**No Disconnecting Entry Pipe or Excavation!**

Split Repair Fitting Options are Available for **All** Brands of Sump, Fitting, and Pipe Combinations; and work for angled and off-center pipe entry conditions.

# “FastFill” Fitting Filler

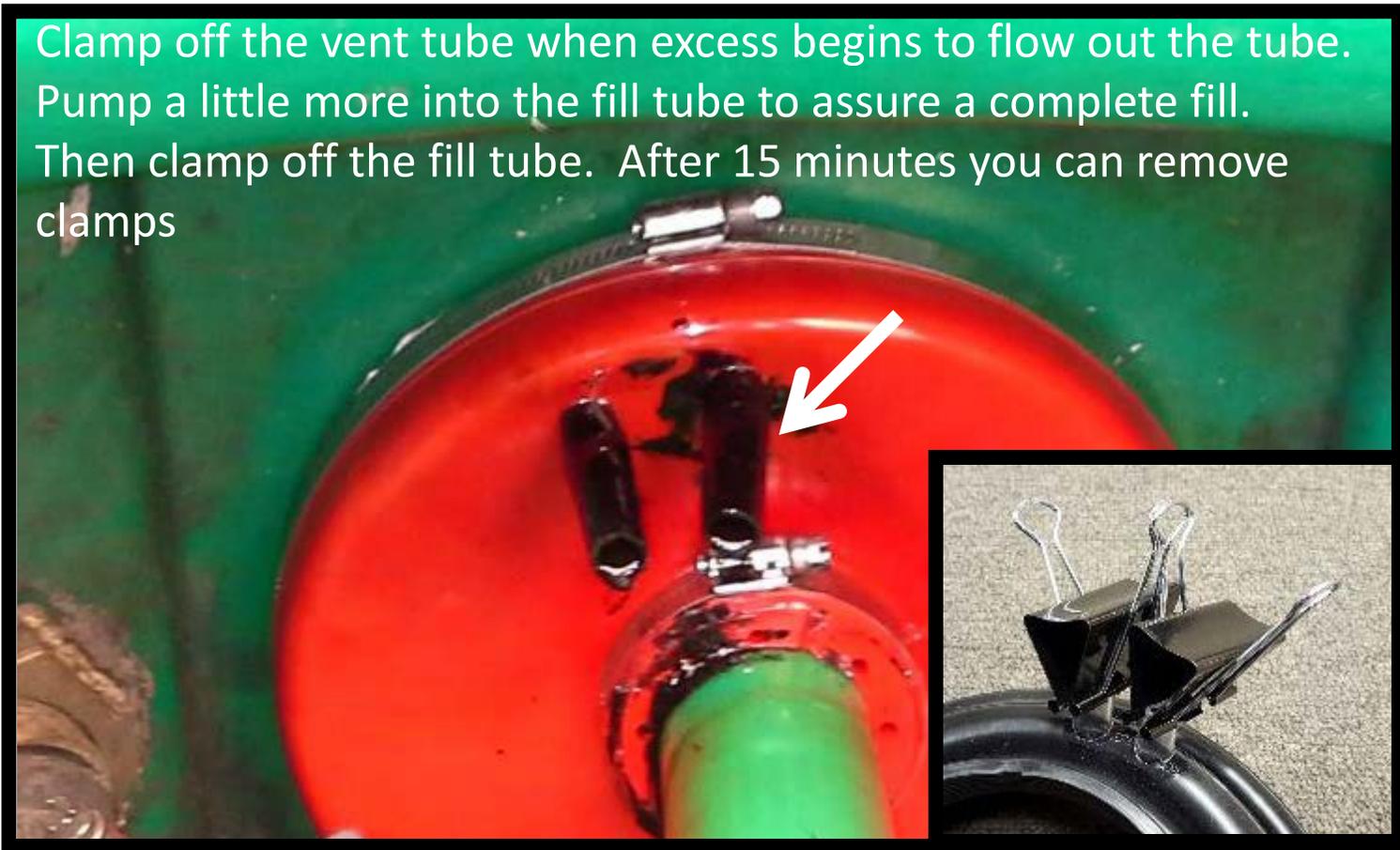
- **Two-part, rapid-setting liquid polyurea fitting filler that remains flexible after curing. Highly fuel resistant.**
- **Very low viscosity when dispensed, self leveling and extremely adhesive.**
- **Gels within 10-15 minutes, solid in 1 hour, and testing can be attempted immediately afterwards.**
- **1-year shelf life and comes in a 20oz double cartridge.**



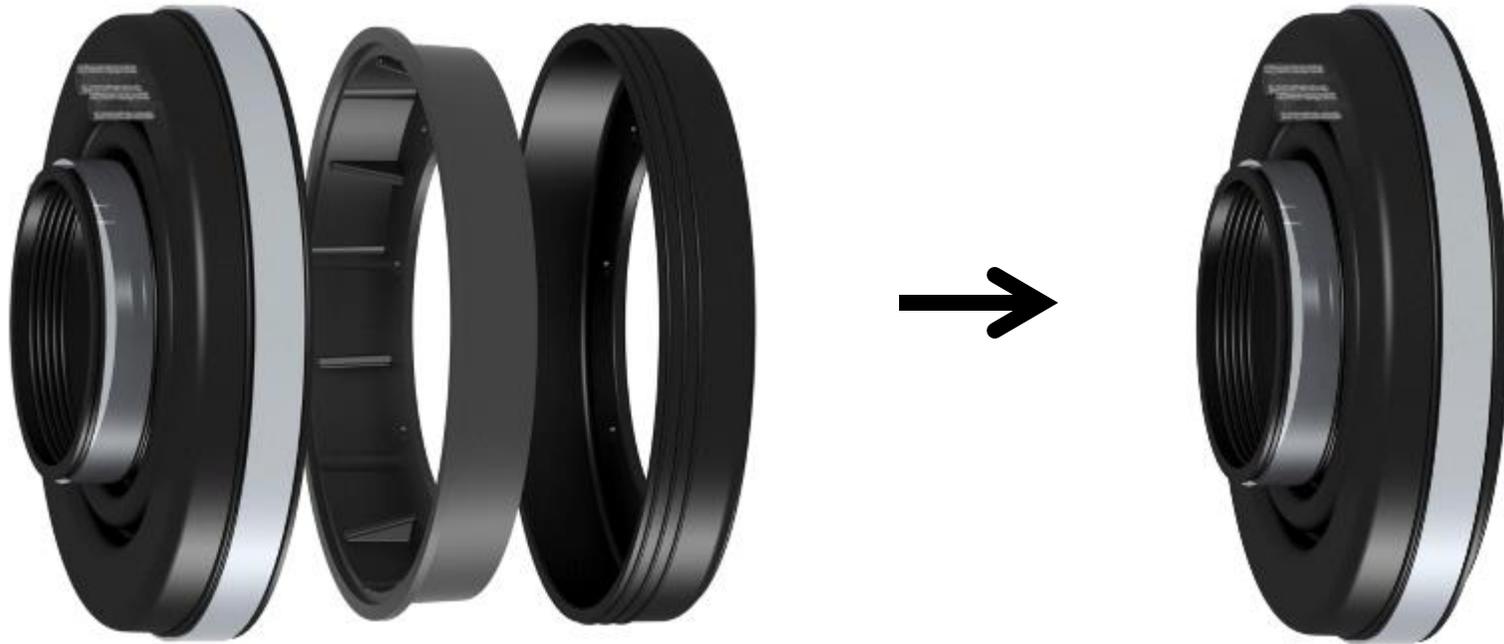
- **Re-sealable cartridge and two mixer tips for multiple use.**

## FastFill Application

Clamp off the vent tube when excess begins to flow out the tube. Pump a little more into the fill tube to assure a complete fill. Then clamp off the fill tube. After 15 minutes you can remove clamps

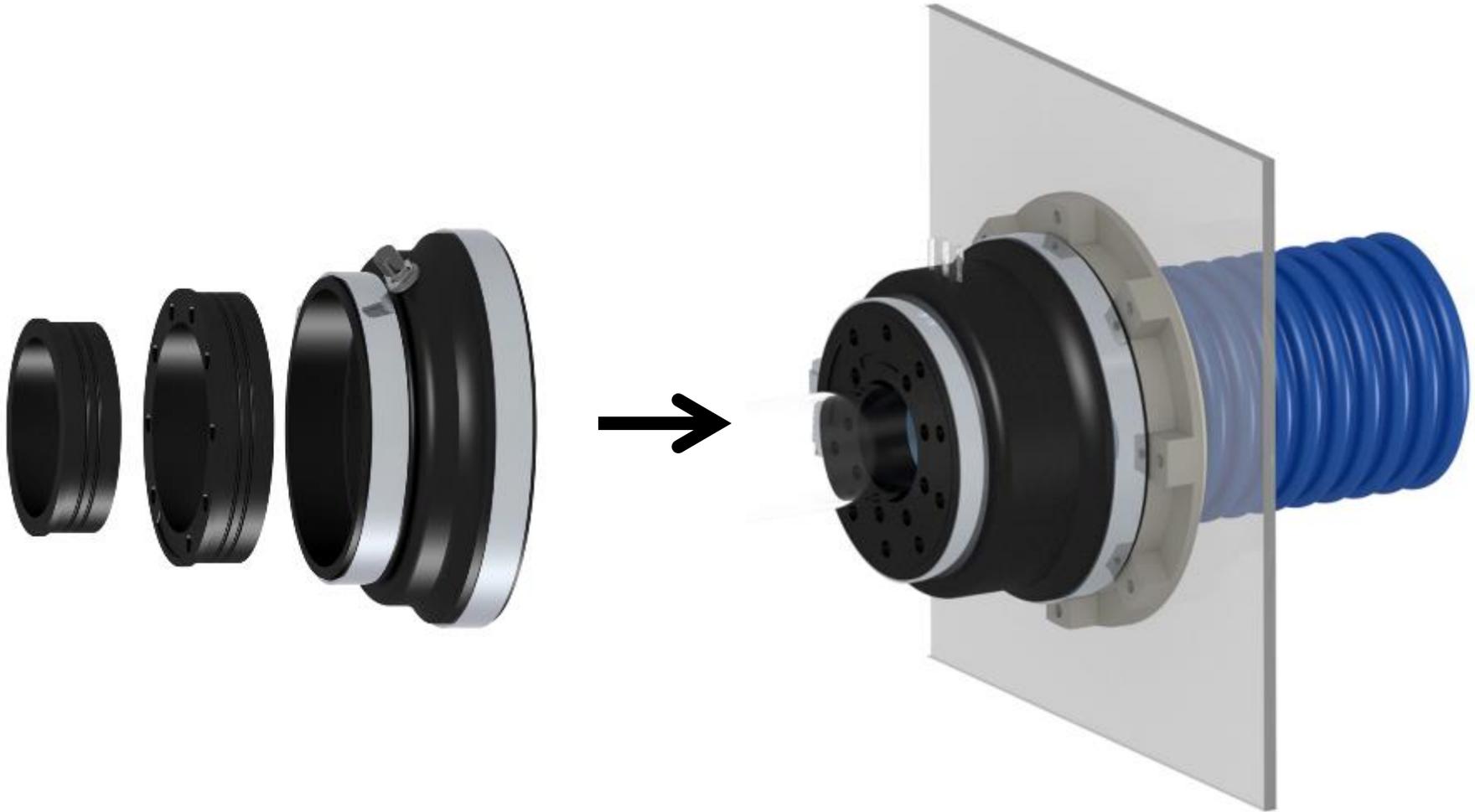


# Fitting Types – Encapsulation



Icon's **preferred** fitting repair solution  
when the design is appropriate for the situation.

# Fitting Types - OPW & TCI Compression Nut



# Fitting Types - Bolted Flange



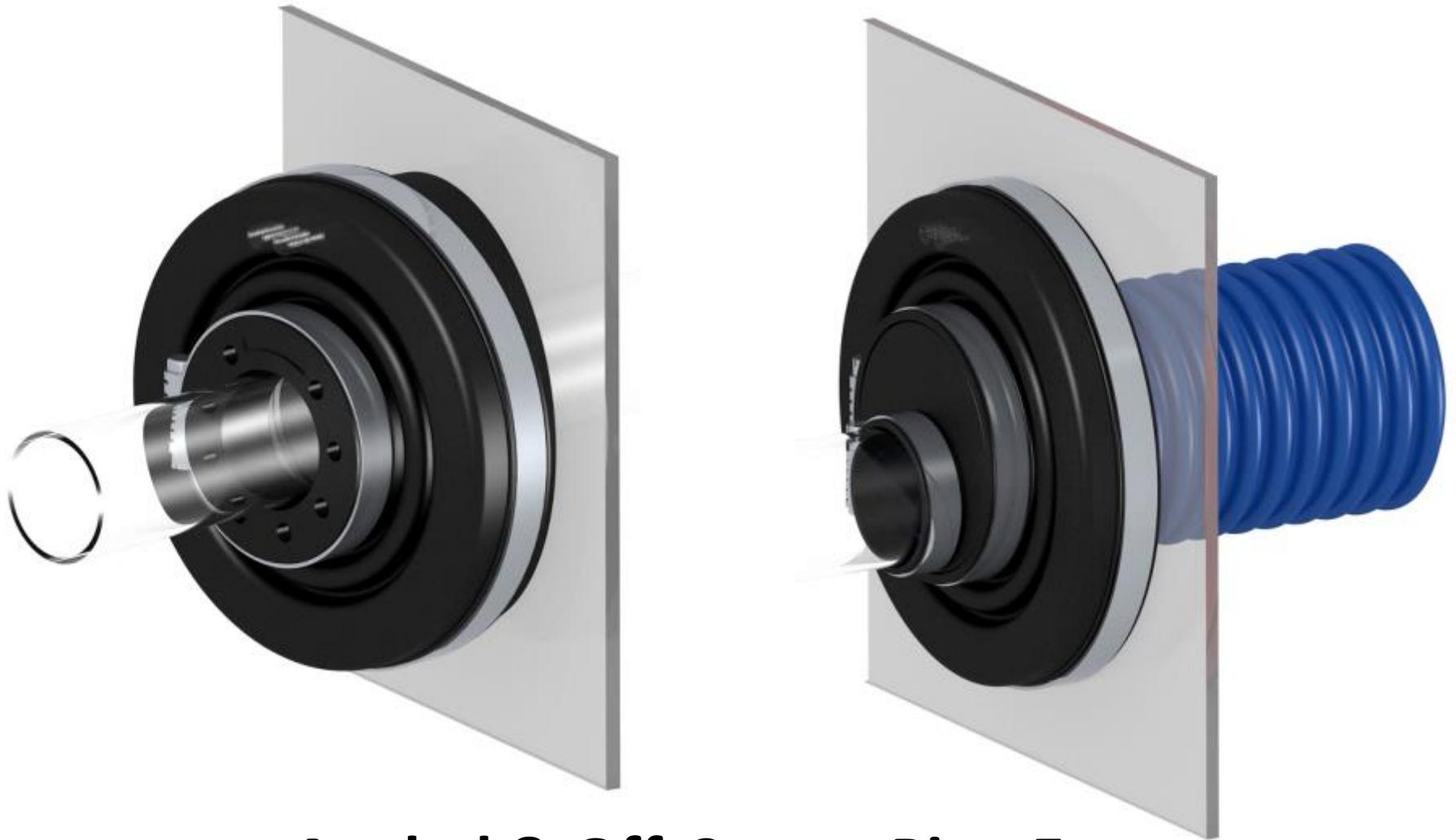
# Fitting Types - Reducer



# Fitting Types - Adaptions



# Fitting Types - Adaptions



**Angled & Off-Center Pipe Entry**

# Fitting Types - Field Cored Plugs



# Fitting Types - Custom



**Custom Fittings Are Possible**

# Fitting Limitations!!!



**Ok, so there are some limitations to customized fittings.**

# Fitting Types - "Split Rigid" w/ iBond



# Sump Lid Replacement



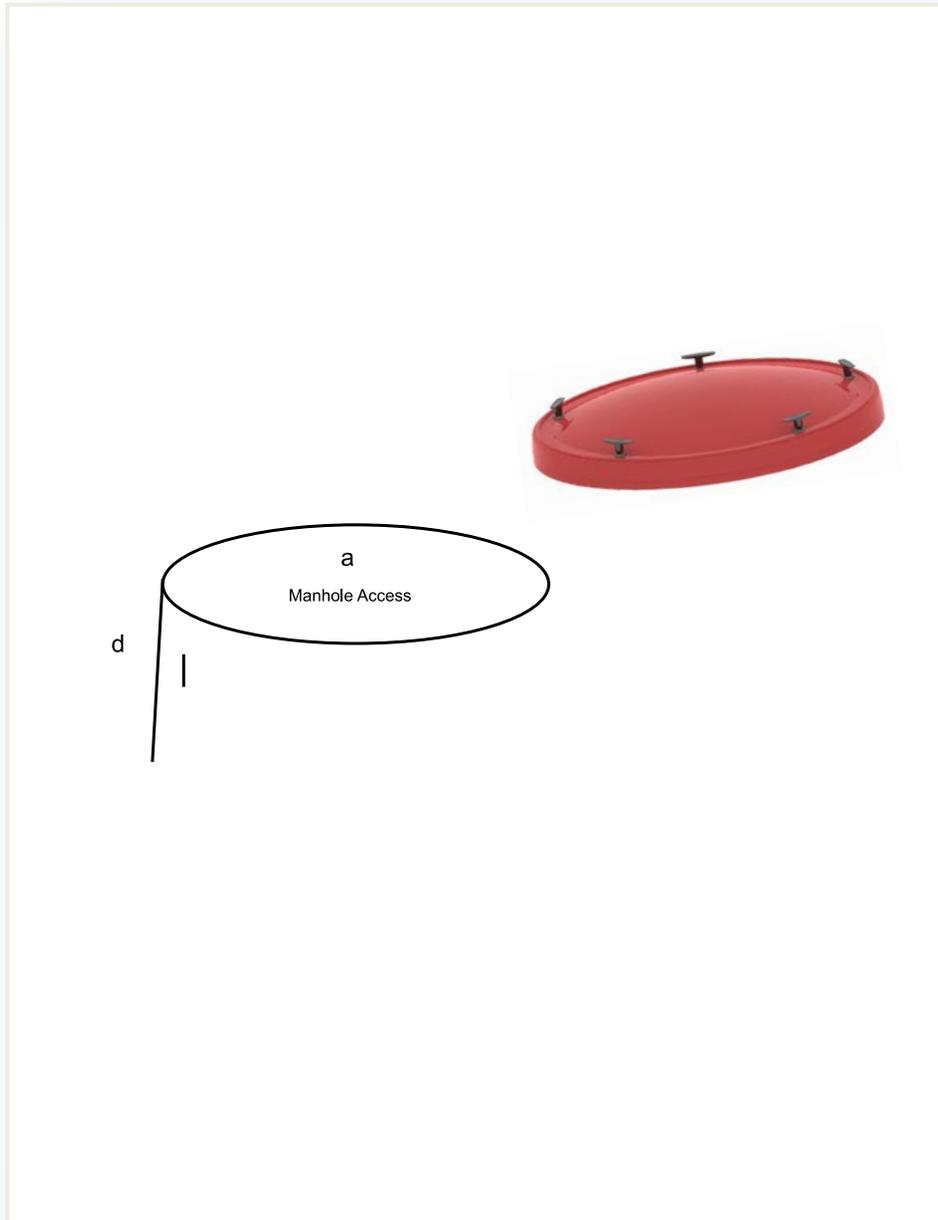
# EasyFit

Sump Lid



- Easy & Fast Installation
- Easily Removed & Serviced
- Bonded Attachment to Any Sump
- Durable & Lightweight

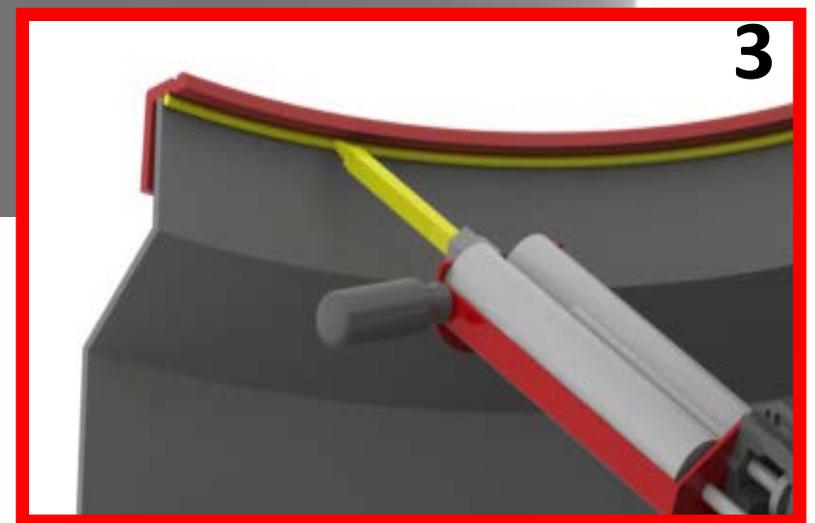
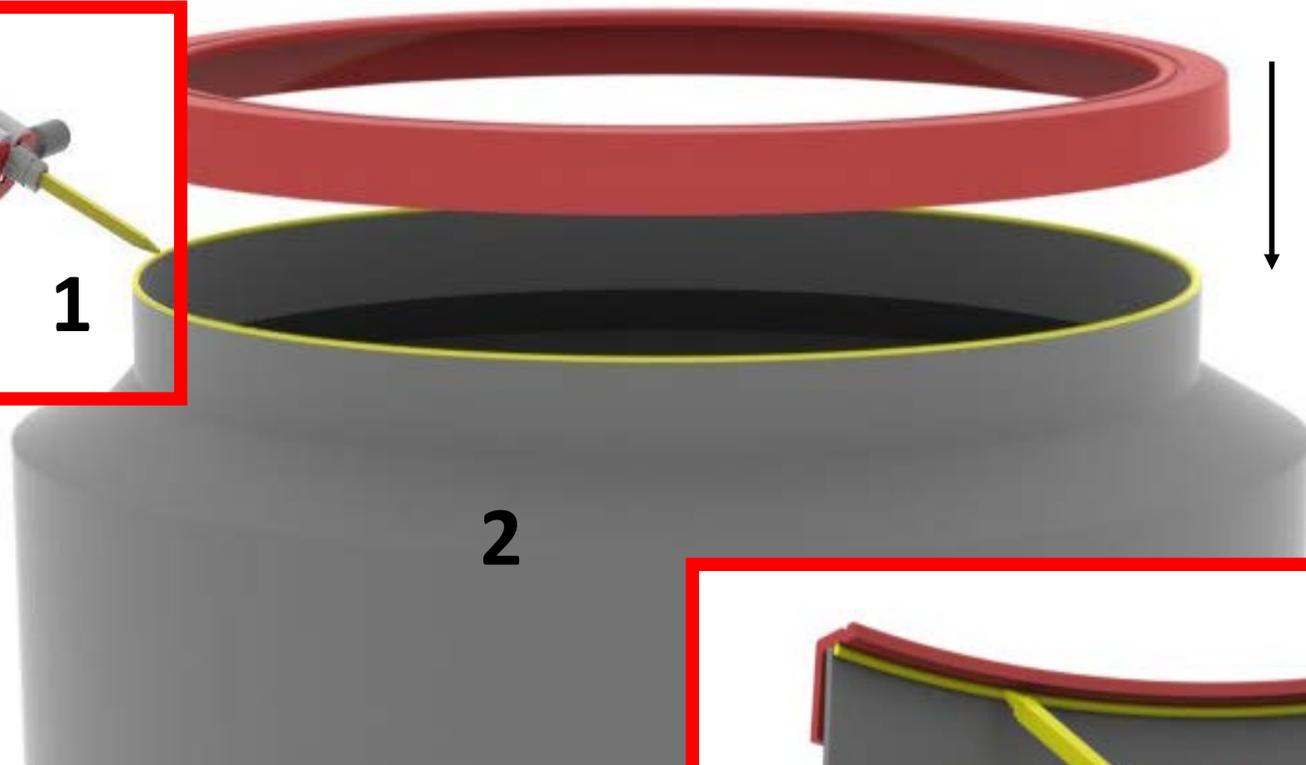
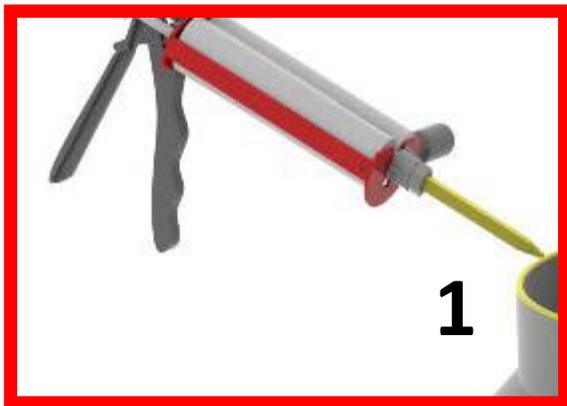
For **All** Brands and Types of Existing Sump Risers for  
Sizes in 24" to 38" diameter or larger.



- **Worksheet must accompany an order.**
- **Collect the critical measurements at the initial survey.**
- **The measurements dictate whether an adaptor ring is required and the overall size of the assembly to make the fit correctly.**

# EasyFit

Sump Lid



- **FiberFuse or PolyFuse Bonder**  
Depending up Fiberglass or HDPE  
Sump Material.

# **EasyFit**

Sump Lid



- **Half-turn cam locks allow for tight seal & easy vertical removal.**
- **Gasket in lid reduces maintenance.**



# **EasyFit**

Sump Lid

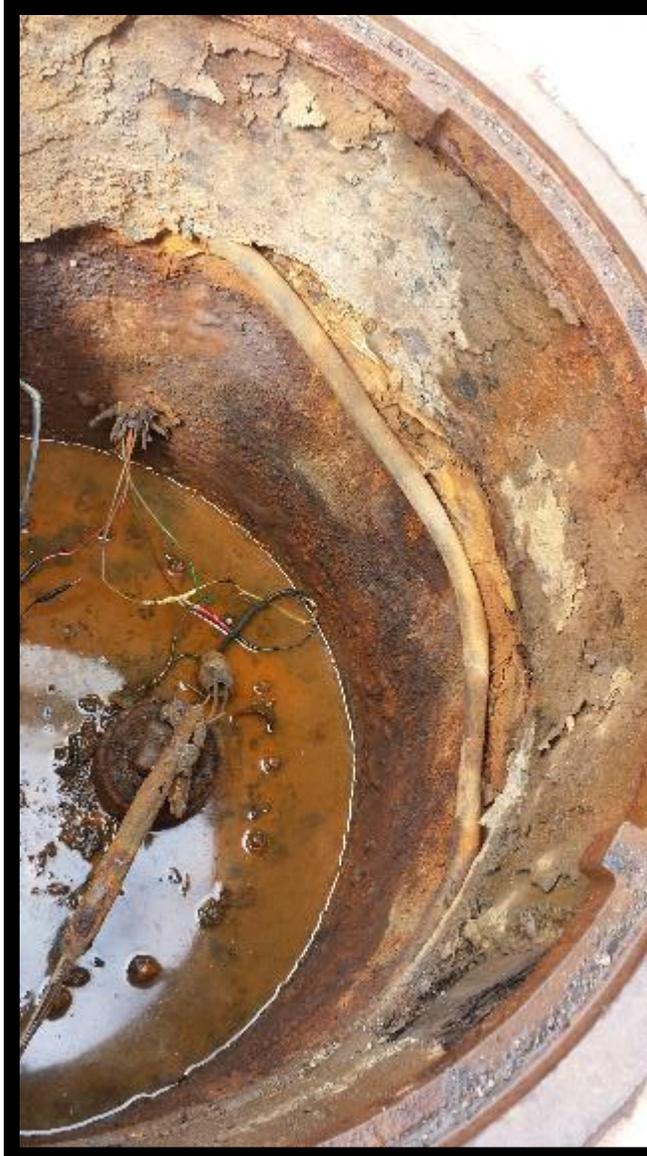


# *Easy*Fit

Sump Lid



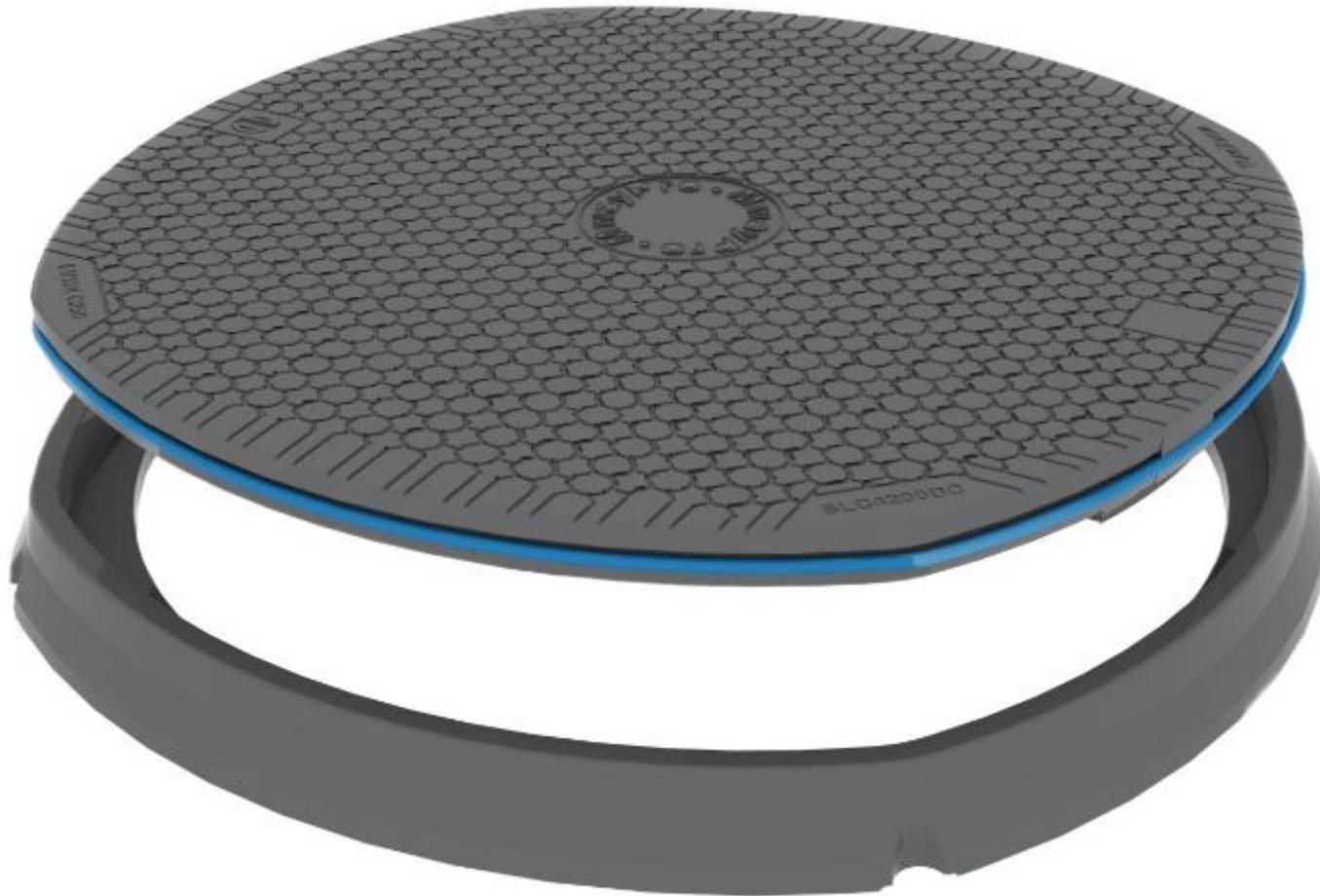
# Manhole Cover Replacement





# MwayPro

Composite Covers



15 YEAR  
product  
guarantee

**Warranty  
Includes Surface  
Wear of Cover!**

**Newest composite technology and leading structural design!**



Retrofit



New  
Construction

# Technical Support

## Parts Specification Service



**Containment Solutions**

### Sump Fitting Survey Worksheet

**Sump Identification:** \_\_\_\_\_ **Sump Type:** \_\_\_\_\_  
Date: \_\_\_\_\_ Tank

Company: \_\_\_\_\_  
Contact: \_\_\_\_\_  
Phone: \_\_\_\_\_  
Email: \_\_\_\_\_  
Project ID: \_\_\_\_\_  
Sump ID: \_\_\_\_\_

Pipe Entry	Threaded (T) or Studed (S) Fitting	Ducted Entry	Stu #	Stu
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				



 T 855.379.7867 / F 855.



Paul Reber <paul@containment.com>

### FW: Easy food mart pics 2 of 3 yalaha fl

Paul Reber <paul@containment.com>

Tue, Sep 30, 2014 at 11:09 AM

To: Bill Hauck <BillHauck@adamstank.com>

Bcc: Capsule Contacts for Icon <dropbox@98804957.iconcontainment.capsulecrm.com>

Bill,

If the product pipe is 1.5" OPW, then the parts are as follows per your pictures:

- (2) ISR 5.5x2.0 - Split-Reducer Repair Fitting 5.5" x 2.0" - \$49 List
- (4) ISR 3.5x1.4 - Split-Reducer Repair Fitting 3.5" x 1.4" - \$42 List
- (4) IRI 1.4x1.0 - Split-Reducing Insert 1.4" x 1.0" - \$17 List

- (1) IAC FastFuse - Split fitting Bonding Solvent, 4oz Can - \$75 List
- (1) IAC Sika10 - Sikaflex Fitting Sealant, 10oz Tube - \$9 List

\* See attached installation instructions for BL fitting replacement boots.

**Please determine the accessibility and feasibility of the installation, and confirm the accuracy of measurements, sizes, and applications before you order or attempt to install these parts.**

Knowledge about the installation of these parts and materials is important to success of the application. Icon Installer Certification Training is free of charge and available every week at 7:00 am PST on-line through the WebEx meeting program. Registration is required, so please visit our website "Training" page at <http://www.iconcontainment.com/training/>. Icon training satisfies a certification condition of our warranty. If training is

**techsupport@iconcontainment.com**



Paul Reber

www.iconcontainment.com

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# Technical Support

## Field Support





# Universal Valve Company, Inc.

Compliance Repairs and  
Replacement

# Model: 39-04 Overfill Valve



- For use in UST applications
- Gradual Shutoff
  - No line Shock
  - **ONE** Moving Part
- UL APPROVED
- Only Universal has one moving part to eliminate any line shock.
- This valve is designed to shut off gradually when the fuel reaches a pre-determined level, preventing line shock during gravity drops.
- When there's no line shock, there's no stress put on the system

# Model: 49-03 Overfill Valve



- **The only product on the market approved for use in both UST and AST applications**
- Gradual Shutoff
  - No line Shock
  - Fewest Moving Parts
- Highest Flow rate
  - Tested at 300 gal/min
  - Tested at 600 PSI

	Universal	Competitor
Gravity and Pressure Fill	✓	X
No Minimum Flow Rate	✓	X
UST and AST	✓	X

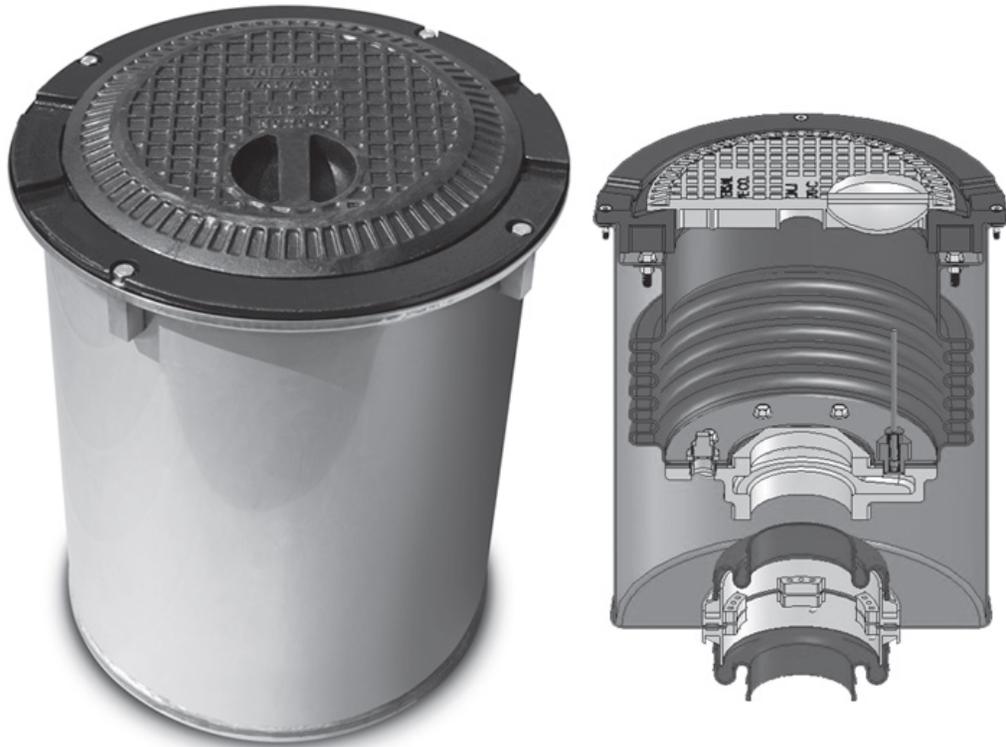
# 15 Gallon Spill Containment Model: 72-1618



- Flexible seal allows both vertical and angular movement.
- All cast water-shedding cover prevents entrance of water into the spill container.
- Retro-fit to existing sites.

# 15 Gallon Double Wall Spill Containment

Model: 71CD-1512-DW



- Stainless Steel secondary containment for wide range of chemical compatibilities.
- Easy replaceable primary containment.
- Monitoring port for secondary containment access.

# Secondary Containment Manhole Model: 74-JH



- Prevents fuel from entering the ground through the tank monitor and brine risers.
- Available for 2" and 4" risers.
- Complete with 18" at grade manhole and Identification marker.
- Equipped with 3 male conduit nipples for easy wire seal off and installation.
- Used by Sheetz and Hess and many other independents.

# ALL METAL Caps and Adapters

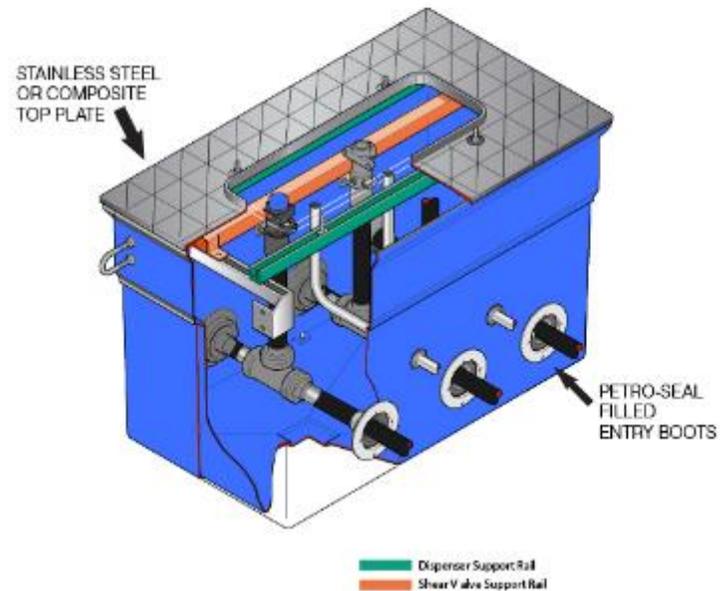
- All Aluminum Cast Caps for added strength, long life and maintenance free use, unlike plastic caps which may crack under pressure or melt in extreme heat or fire, leaving an open path to the storage tank.
- Vapor Adapter all metal, no plastic, guides. Ensuring long life and 100% poppet seal.
- Flat top caps built for low profile situations but also robust for maximum longevity and strength against tampering and vandalism.



# FRP DW Sump

UNIVERSAL VALVE  
DOUBLE WALL FIBERGLASS  
DISPENSOR SUMP

- Testing to UL 2447 standards
- 30 inch wide for Brugg Fittings
- And more room to work
- Dry or Wet annular space

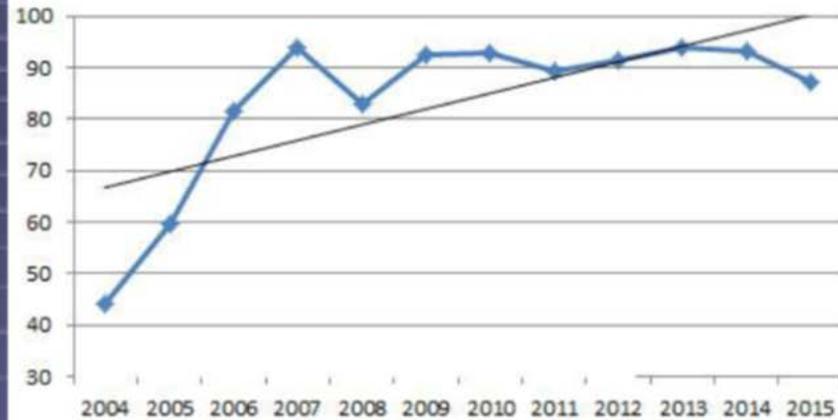


DISPENSER SUMPS	
Product Description:	Universal Institute dispenser sump (Double Wall) 48" x 20" x 20" deep. Optional shear valve rail for pressure systems.
Drawing No.	15-515A
Date:	July 2015
Model #	MF-DW 48W
	WRV

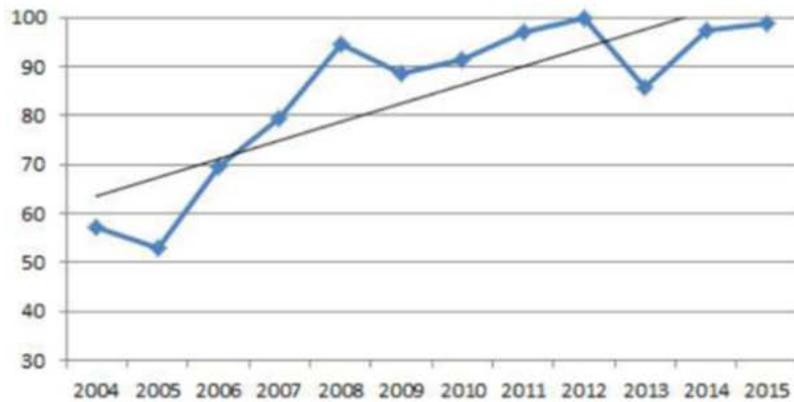


# Containment Sump Testing Will Be Painful in the Beginning

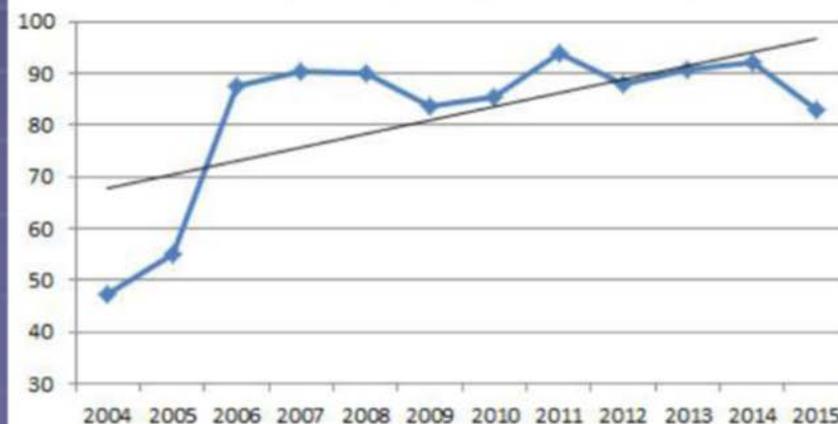
### Plastic (HDPE) tank-top sumps



### Fiberglass tank-top sumps



### Plastic (HDPE) dispenser sumps



Here's what MD test data looked like when they first started testing containment sumps back in 2005/2006 with their new rules.





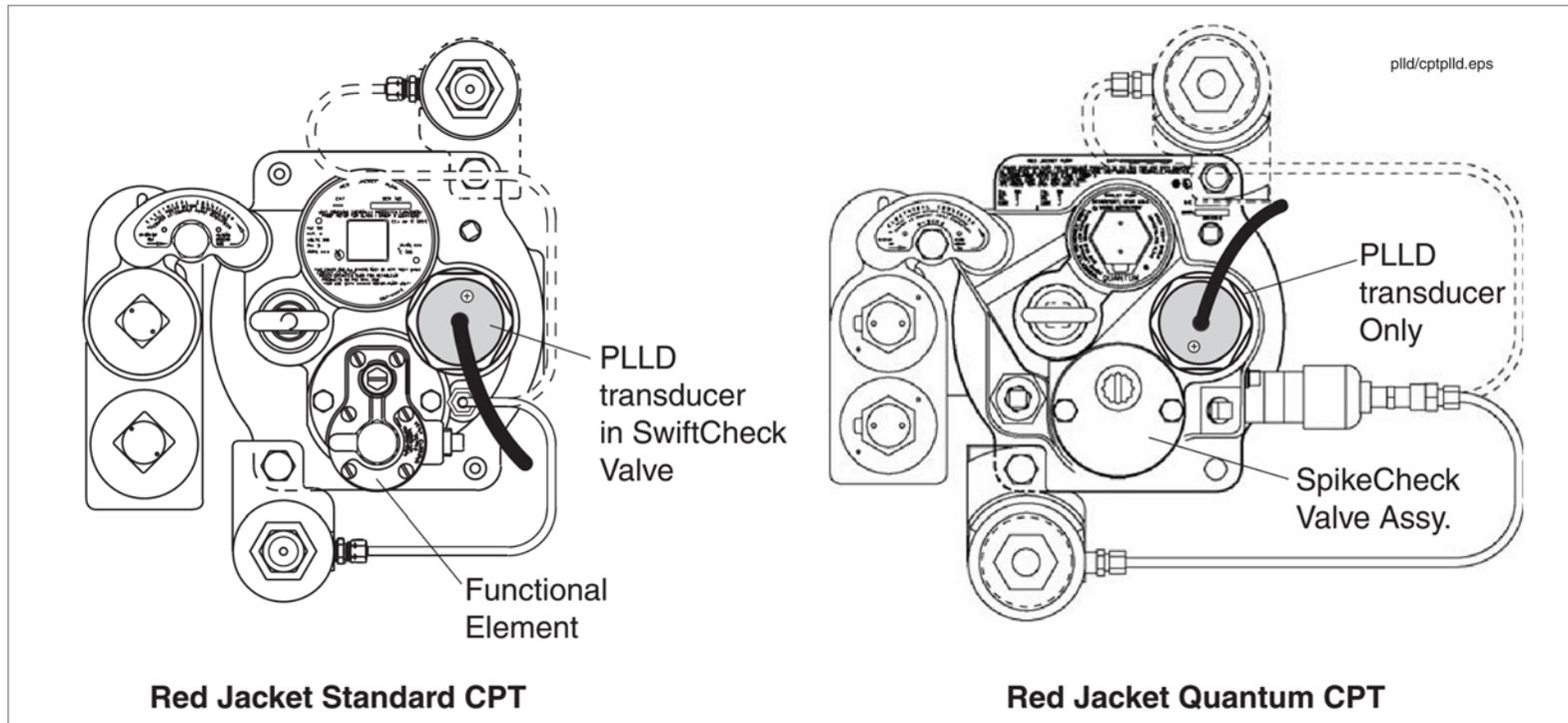


# INSITE360

## FUELQUEST

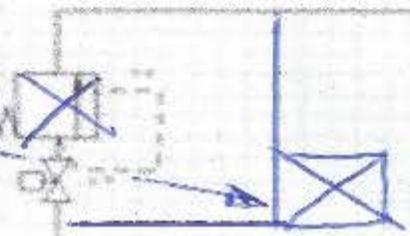


## Red Jacket Standard CPT Red Jacket Quantum CPT PLLD transducer

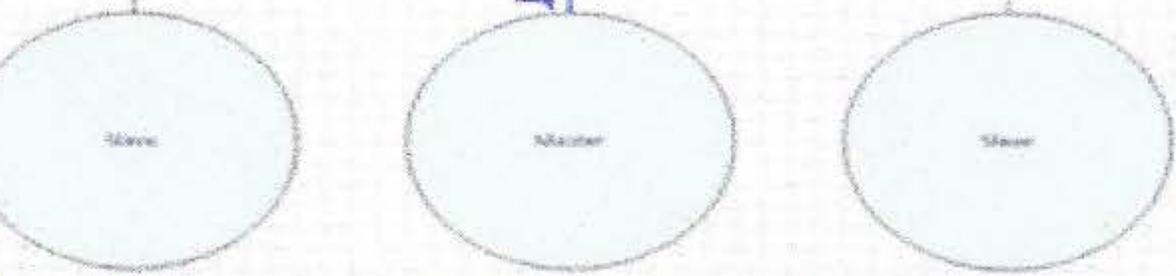


Normally Closed  
Solenoid Valves  
with Pressure  
Relief (4)

Eliminary  
version 4  
Level



Existing Ball Valves  
DPLLD Transducers  
859-080-001

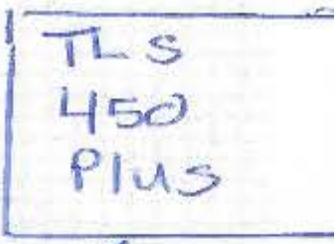


the Pumps - All have existing check valves

5 WRY

To Filter Above Ground Piping

Auto event feature  
Programmed



332812-001  
Universal Sensor Module

Ast piping monitored by Red Jacket PLLD  
On USTs with Red Jacket Submersibles



# VEEDER-ROOT

## TLS Review & Operation



# Question #1: *If our ASTs are fire rated and double wall why not the piping?*

Several Local Code officials have already passed that, such as NYC Building Code and Suffolk Cty



**BUILDINGS BULLETIN 2013-008**  
OTCR

**Supersedes:** Buildings Bulletin 2012-010 dated August 21, 2012

**Issuer:** Alan Price, P.E.  
Director, Office of Technical Certification and Research

**Issuance Date:** June 13, 2013

**Purpose:** This document establishes acceptance criteria for flexible fuel-oil piping systems as alternative materials to the 2008 NYC Construction Code.

**Related Code/Zoning Section(s):**  
AC 28-113.2.1 MC 1301  
AC 28-113.2.2 MC 1302.3  
MC 1305.9

**Subject(s):** Fuel oil, fuel oil piping; Fuel oil, fuel oil piping, flexible; Fuel oil piping, flexible, continuous leak detection

**Background:** Table MC 1302.3 of the 2008 NYC Mechanical Code lists code-prescribed materials and applicable standards for fuel-oil pipes. This bulletin establishes the acceptance criteria for flexible fuel-oil piping systems with continuous leak detection as an alternative to the code.

**Description:** This bulletin covers flexible fuel-oil piping systems consisting of a metallic primary carrier and secondary containment. This may include a single or double metallic piping system encased with outer polymer jacket.

**Evaluation Scope:** 2008 NYC Construction Codes

**Evaluation Criteria:** Pursuant to section AC 28-113, the Office of Technical Certification and Research (OTCR) recognizes flexible fuel-oil piping system tested, and evaluated in accordance with ULCS667-11 "Metallic Underground Piping for Flammable and Combustible Liquids". Acceptable flexible fuel-oil piping systems shall be listed and labeled by an approved agency in accordance with section AC 28-113.2.3 and shall comply with the conditions of this bulletin.

**Uses:** Flexible fuel-oil piping systems may be used for transferring fuel oil below ground pursuant to MC Chapter 13 of the 2008 NYC Mechanical Code. Above ground use in accordance with section (A) (2) or (A) (3) of this bulletin shall be permitted.

**Conditions of Acceptance:** Flexible fuel-oil piping systems shall comply with the 2008 NYC Construction Codes and the following applicable provisions:

## Certificate of Compliance

Certificate Number 20110118-MH45398  
Report Reference MH45398, 20 September 2007  
Issue Date 2011 January 18

Page 1 of 1

**Issued to: BRUGG PIPESYSTEMS**

ADOLF-OSTERHELD-STRASSE 31  
31515 WUNSTORF GERMANY

*This is to certify that representative samples of*

**PIPING, FLAMMABLE LIQUID, UNDERGROUND FLEXWELL** - 1, 1-1/2, 2 and 3 in. diameter Flexible Type Piping for use as Integral Primary/Secondary Pipe System (PS) for underground fuel transfer applications such as gas stations for Motor Vehicle (MV), High Blend (HB), Concentrated (CT) and Aviation and Marine (A&M) Fuels.

*Have been investigated by Underwriters Laboratories Inc. (UL) or any authorized licensee of UL in accordance with the Standard(s) indicated on this Certificate.*

**Standard(s) for Safety:** Subject 971A, Outline of Investigation for Metallic Underground Fuel Pipe

**Additional Information:** See UL On-Line Certification Directory at [www.ul.com](http://www.ul.com) for additional information.

**Look for the UL Listing Mark on the product**

William R. Carney  
Director, North American Certification Programs  
Underwriters Laboratories Inc.  
Any information and documentation involving UL Mark services are provided on behalf of Underwriters Laboratories Inc. (UL) or any authorized licensee of UL. For questions, please contact a local UL Customer Service Representative at <http://www.ul.com/global/regional/contact/>

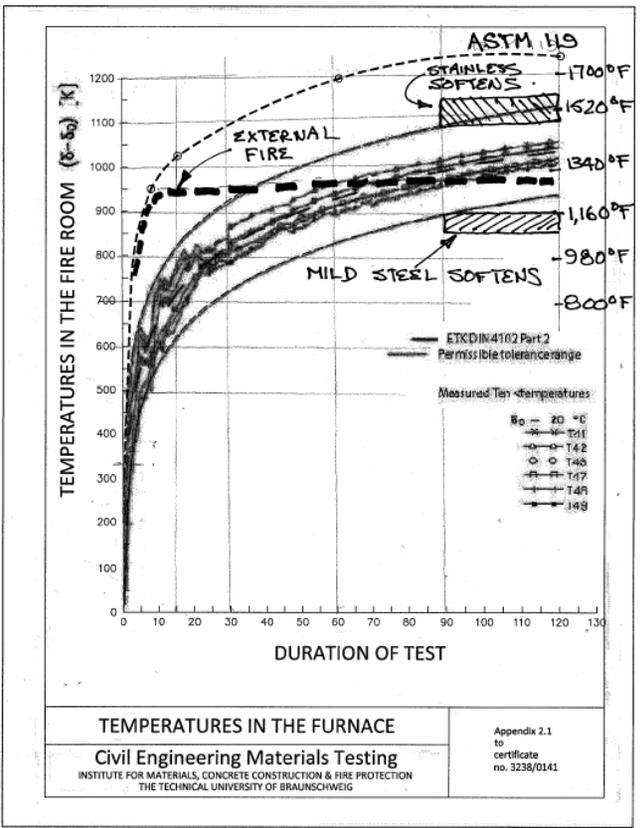


Figure 2 – Standard Fire Curves vs Brugg Flexwell Test Data

# Flexwell

## Double Wall Stainless Steel Pipe UL 971

### FLEXWELL-HL

#### AST and Marina Piping

Double Wall Stainless Steel Pipe for Above Ground Fuel Systems

Flexible, double-wall corrugated pipe system with continuous interstice for leak detection

#### General description

The FLEXWELL-HL pipe system is specifically designed for hazardous fluids and gases, such as gasoline, ethanol blends, biodiesel, LPG and other hazardous fluids typically transported in chemical plants. The pipe is used in gas stations underground as well in above ground applications such as marinas and bulk facilities. FLEXWELL-HL can operate as a suction or pressure systems and can be continuously monitored via suitable and approved leak detection systems.

#### Construction

FLEXWELL-HL is a flexible pipe system made of corrugated 316L (1.4404) or 316Ti (1.4571) corrugated stainless steel primary and secondary pipes with a reinforcement tape in the interstitial space for elevated operating pressures of up to 380 PSIG (25 bar). The interstitial space between primary and secondary pipe can be used for leak detection. The pipe is corrosion protected by a polyethylene jacket.

The stainless steel pipe provides an enduring, impermeable barrier, even with future new fuels or fuel combinations.

#### Applications\*

- Suction pipes
- Pressure pipes
- Fill pipes

\* Subject to compliance with local and national regulations

#### Sizes and pressure ratings

FLEXWELL-HL is available with an ID of 1" (ND 25) to 2" (ND 50) for conventional use at an operating pressure of up to 145 PSIG (10 bar) and temperatures between -50 °C (-68 °F) to +50 °C (+122 °F). For gases such as LPG the pipe can be operated at up to 380 PSIG (25 bar) with a special end fitting that connects the reinforcement tape in the interstitial space.

The 1 1/2" and the 2" size pipes are available with UL label.



#### Installation

FLEXWELL-HL is manufactured in factory lengths up to 3,000 ft. FLEXWELL-HL can be laid directly into a trench in one piece following any directions without necessity of intermediate joints or fittings. The corrugated design of the primary and secondary pipes assure excellent impact resistance while at the same time providing a high degree of flexibility.

#### Double-wall joints and Ts

All our end fittings, T-pieces and other connections are designed for continuous leak monitoring throughout the system.

#### Leak detection

The interstitial space between the primary and secondary pipes is designed for leak detection via either pressure or vacuum, depending on local regulations or operating requirements.



NJ Fuel Oil Application with Suction and Return Lines **Inside building below**



# Question #2: *Will there be enforcement of NFPA 110 version 2013 says “ diesel fuel with bio diesel should be changed every 6 months”*

If they say should, for hospitals and senior care facilities I think it is a must

There is a third party report from an NFPA member D Eryou, PE PHD, that shows the SAE J1488 version 2010 test is sufficient to allow this filtration standard to meet the recommendation without replacement

Diesel fuel quality and filtration is found in the NFPA 110 Standard for Emergency and Standby Power Systems.

## National Fire Protection Association (NFPA) 110 - Standard for Emergency and Standby Power Systems

### 2013 Edition

7.9.1.2\* Fuel system design shall provide for a supply of clean fuel to the prime mover.

7.9.1.3 Tanks shall be sized so that the fuel is consumed within the storage life, or provisions shall be made to remediate fuel that is stale or contaminated or to replace stale or contaminated fuel with clean fuel.

A.5.1.1(1) The grade of diesel fuel selected for use in a prime mover should be based on recommendations from the diesel engine manufacturer and ASTM D975, Standard Specification for Diesel Fuel Oils. Where possible, the purchaser of fuel for the prime mover should specify a diesel fuel that does not contain Biodiesel, which can accelerate the degradation of the diesel fuel if stored longer than 6 months. If diesel fuel is stored outside for long-term storage, it may be necessary to use a winter or arctic grade of diesel fuel or to take precautions such as insulating and heat-tracing fuel tanks and lines to ensure that fuel will flow to the prime mover under the coldest possible conditions.

A.5.5.3 Consideration should be given to sizing tanks in order to meet minimum fuel supplier delivery requirements, particularly for small tanks. Consideration also should be given to over sizing tanks. More important, biodiesel blends up to B5 (ASTM D 975, Standard Specification for Diesel Fuel Oils) have much shorter shelf lives than conventional diesel fuel [ultra-low sulfur diesel (ULSD)] and can accelerate degradation processes, endangering the entire diesel fuel supply. Where fuel is stored for extended periods of time (e.g., more than 12 months), it is recommended that fuels be periodically pumped out and used in other services and replaced with fresh fuel. Prudent disaster management could require much larger on-site temporary or permanent fuel storage, and several moderate-sized tanks can

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## DO NOT OVEREXTEND BIODIESEL STORAGE

A standby generator set must be maintained and serviced so that it will operate effectively and efficiently when needed. These critical generator sets are relying on stored fuel for dependable operation. The care of fuel does not end when it is supplied to your tank.

## IS BIODIESEL IN YOUR FUEL?

The trend toward biodiesel blends is increasing and it will impact your storage limits. In standby applications, where actual fuel use is unpredictable, this could pose a problem. Some diesel specifications allow up to 5% biodiesel content without disclosing the actual amount. Without knowing your biodiesel content, you may run the risk of decreased performance and increased fuel costs. You must determine as best you can the biodiesel content of blended fuel your supplier delivers. This is important when fuel will be stored for an extended period.

## FUEL STORAGE LIMITS

Caterpillar recommends a maximum of one year from production for distillate diesel fuel storage. That time limit drops to six months for biodiesel blends. That is because biodiesel blends have increased thermal and oxidative instability compared to straight petroleum distillate diesel fuels. You can perform tests in a laboratory to better determine fuel stability. Analysis can then be used in predicting the optimum months of storage.

A dependable fuel source and structured storage plan is required to protect your fuel investment, and ensure ultimate performance and reliability of your generator set when it is needed most.

Call Ransome Caterpillar to further discuss the use of biodiesel blends and review your plans for reliable fuel storage.

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May 6, 2014

Robert Daly  
Director - Central Inspections Boiler Division  
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Dear Mr. Daly:

Re: The requirement for diesel fuel polishing;  
Fuel stored on site for emergency generator sets

As a fuel systems engineer with thirty years of experience and a registered professional engineer in twenty six states and two provinces, I would like to share my experience and concerns related to degradation of current ultra low sulfur diesel fuel (ULSD) when stored in tanks for extended periods of time beyond its useful shelf life, which is frequently the cases with typical ULSD fueled emergency generator sets.

## Diesel Fuel Quality Issues:

Diesel fuel systems require filters to remove unwanted contaminants in the fuel that can damage the engine system components. Diesel fuel contaminants come from a range of sources and include: particles, water, biological material, wax crystals and asphaltines. Particles can enter the fuel through the fuel distribution system, engine wear or combustion byproducts. Water is typically introduced into the fuel supply by condensation. Free water in the fuel will promote the growth of microorganisms. Waxes are an important component of diesel fuel but they can form crystals as a result of paraffin precipitation. Asphaltines are present in all diesel fuel and are long chained hydrocarbons that are hard, sticky and generally insoluble.

Particles will cause wear to engine parts and block fuel injector nozzles. Water can reduce fuel lubricity causing seizure of close tolerance parts, increase wear and promote biological growth. Biogrowth in a fuel system will result in a slime coating over the surface of the filter significantly reducing the life. Wax crystals and asphaltines will plug a fuel filter shortening the life.

Tighter air emission standards for diesel engines have caused changes to the blending of diesel fuel. Ultra low sulfur diesel (ULSD) with only fifteen parts per million (15 ppm) sulfur was mandated in 2010 for use in on-road and stationary engines including emergency generators. The removal of the sulfur compounds reduced the lubricity of the fuel and synthetic additives were required to avoid increased wear rates for the fuel injection system. The synthetic additive selected by the refining industry was an organic surfactant which increased water dissolving or emulsifying within the fuel. This in turn increased microbial growth at the fuel / water interfaces which degrades the fuel and causes pitting of steel pipes and tanks. The microbial growth degrades the fuel and produces particles which foul existing filters which cannot remove emulsified water from fuel being supplied to the generator engine.

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# Thank you



- Every Day is a Gift!
- And when recognizing all of our gifts, always remember there are some unfortunates that can use a helping hand



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