

Submittal Binder
For
ECO-TECH, INC
Polyethylene Chemical Storage Tanks
JEFFERSON GA WRF
JEFFERSON, GA
FEBRUARY 2023

PREPARED FOR:



Eco-Tech, Inc.

PREPARED BY:



300 N TAYLOR ROAD – GARRETT, INDIANA

CIVIL ENGINEERING CONSULTANTS, INC. MARIETTA, GEORGIA 30068			
No Exceptions Taken	No Exceptions Taken With Comment	Make Corrections Noted	Rejected
DATE Mar 09, 2023			
BY			
APPROVED FOR DESIGN ONLY. CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND QUANTITIES.			

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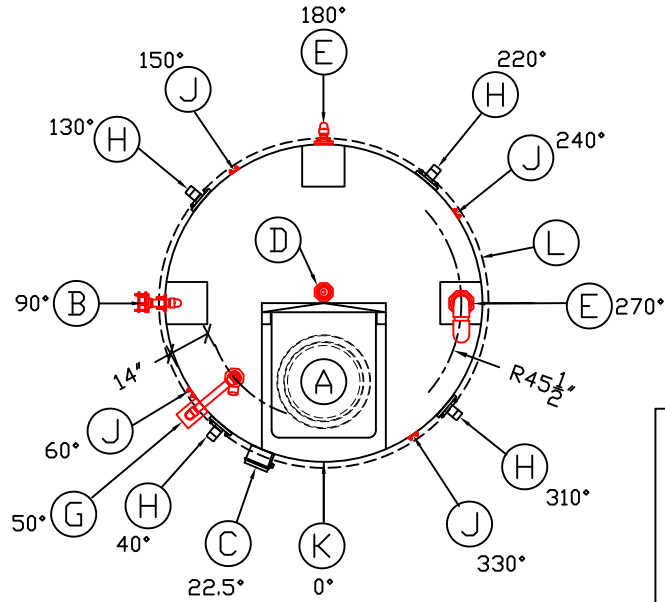
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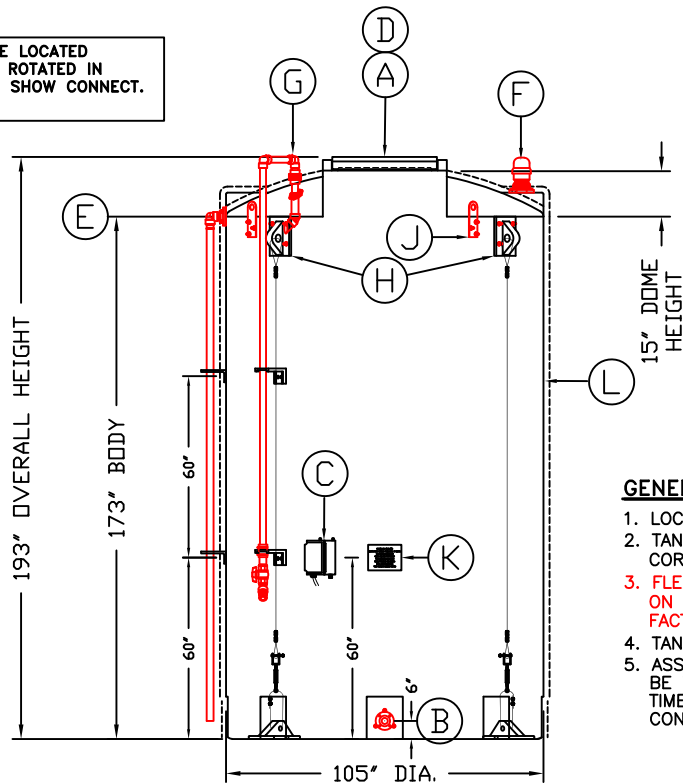
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Supplier: Eco-Tech, INC.
 Manufacturer: Assmann Corporation of America
 Model Number: 20221105X19
 Rated Capacity: 6268 Gallons
 Tank Material: Crosslink PE
 Design Pressure: Atmospheric
 Date of Mfg: November, 2022
 Tank Contents: Aluminum Sulfate

NAMEPLATE


FITTING E LOCATED AT 180° ROTATED IN VIEW TO SHOW CONNECT. DETAILS



GENERAL NOTES:

1. LOCATE FITTINGS FROM PLAN VIEW.
2. TANK(S) MUST BE INSTALLED PER ASSMANN CORPORATION USAGE & GUIDELINES.
3. FLEXIBLE EXPANSION JOINTS MUST BE USED ON ALL SIDEWALL CONNECTIONS TO MAINTAIN FACTORY WARRANTY.
4. TANKS ARE BUILT PER ASTM D 1998.
5. ASSMANN CORPORATION REQUIRES ALL TANKS BE VENTED. MINIMUM VENT SIZE TO BE 1.5 TIMES THE LARGEST INLET OR OUTLET CONNECTION SIZE.

ACCESSORIES					
MK	SIZE	DESCRIPTION	DEG	ELEV	DOME
A	24"	HINGED MANWAY COVER	0°	-	X
B	2"	TITANIUM DOUBLE MALE FTG/EPDM, PVC SIPHON DRAIN, PVC FLANGE ADAPTER, 3 CONV. TEFLON EXPANSION JOINT/GALV LIMIT BOLTS (DRAIN)	90° 90	6'	-
C	-	100° DELTA T HTR PACKAGE, ICT 6500	22.5°	60'	-
D	2"	PVC SELF ALIGN DOME FTG/EPDM (ULTRASONIC LEVEL)	CL	-	X
E	2"	PVC FLANGE/TT-BOLT-EPDM/EPDM, PVC FLANGE ADAPTER, PVC DROP TUBE/TT-EPDM/EPDM (OVERFLOW)	180° 180	173'	-
F	4"	PVC SCH80 U-VENT ASSY/VITON, POLY SCREEN FOR U-VENT ASSY/VITON (VENT)	270° 270	-	X
G	2"	PVC SELF-ALIGN DOME FTG/EPDM, PVC FILL LINE/TT-EPDM/EPDM, PVC ANTI-FOAM ELBOW (FILL)	50° 0-45	-	X
H	-	POLYETHYLENE WIND/SEISMIC RESTRAINT SYSTEM W/ STAINLESS STL CABLES, TURNBUCKLES AND CABLE CLAMPS W/TITAN-VITON BOLTS LOCATED AT 40°, 130°, 220° AND 310° (RESTRAINTS)	-	-	-
J	-	4 SIDE-MOUNT LIFTING LUGS MILD STEEL LOCATED AT 60°, 150°, 240° AND 330° (LIFTING LUGS)	-	-	-
K	-	WHITE PHENOLIC PLASTIC ENGRAVED NAMEPLATE	0°	60'	-
L	-	2" NOMINAL THICKNESS - SPRAYED URETHANE FOAM INSULATION W/ SPRAYED WHITE MASTIC PRIMER COATING (INSULATION)	-	-	-

A	CHANGE FTG B LOCATION FROM 0° TO 90°, CHANGE FTG E LOCATION FROM 90° TO 180°, CHANGE FTG F LOCATION FROM 180° TO 270°, CHANGE FTG G LOCATION FROM 292.5° TO 50°	09/27/22 JL
REV	REVISION DESCRIPTION	REV DATE
ALUMINUM SULFATE		
		RESIN USED: - CROSSLINK POLYETHYLENE
300 N TAYLOR ROAD GARRETT, IN 46738 PHONE: (260) 357-3181 FAX: (260) 357-3738		TANK DESIGNED SPECIFIC GRAVITY 1.9 SP.G. MAX
TITLE ICT 6500 GALLON VERTICAL STORAGE TANK		
DRAWN BY: CHRISTIANSON		TANK WEIGHT 2500 LBS.
DRAWN DATE: 6/2/22		TANK COLOR: NATURAL
SALES ORDER# 95704		DWG NUMBER: 22058GA 175
ECO-TECH		REV A
ALL DIMENSIONS ARE IN INCHES AND ARE ±3%		



Manufacturing Specification for Vertical Storage Tanks

1. Scope

- 1.1 This specification covers polyethylene tanks manufactured in one-piece construction by rotational molding at our facility in Garrett, IN or Marshall, TX. The tanks are molded from FDA conforming linear polyethylene or cross-linked polyethylene for above ground installation and are capable of containing contents at atmospheric pressure. This specification covers flat bottom, closed top tanks 65-gallons to 12,000-gallons, double wall vessels from 20-gallons to 6500-gallons.
- 1.2 This specification does not cover the design of vessels intended for applications involving pressure above atmospheric, vacuum, burial, or temperatures above the maximum limit of the tank design.

2. Applicable Documents

- 2.1 ASTM Standards
- | | |
|----------|---|
| D648 | Heat distortion temperature |
| D638 | Tensile properties |
| D790 | Flexural properties of plastic |
| D883 | Definitions of terms relating to plastics |
| D1505 | Density by density gradient technique |
| D1693 | Environmental stress crack resistance |
| D1921 | Particle size (sieve analysis) of plastic |
| D2765 | Degree of cross-linking ethylene plastics as determined by solvent extraction |
| D2837 | Standard method for obtaining hydrostatic design basis for thermoplastic pipe materials |
| D3892 | Practice for packaging/packing of plastics |
| F412 | Definitions of terms relating to plastic piping |
| ARM Std. | Low temperature impact resistance (Falling dart test) |

3. Terminology

- 3.1 General – definitions are in accordance with ASTM D883 and F412, unless otherwise specified.
- 3.2 Rotational molding – a four stage process consisting of loading resin in the mold; heating/fusion of the material while biaxial rotating; air-cooling, and removal.

4. Materials

- 4.1 The resin used shall be virgin cross-linked polyethylene, (Schulink XL 350) or Exxon Escorene 8460 conventional.
- 4.2 All tanks used for outdoor installation shall contain a suitable ultraviolet stabilizer, minimum 0.3% 2-hydroxy-4-n-Octoxy-benzophenone or equivalent. The stabilizer shall be compounded into the polyethylene.
- 4.3 The resins can be pigmented (black, blue, green, yellow, gray). Standard loading is limited to 0.02% to avoid degradation of material.
- 4.4 Tanks molded in cross-linked polyethylene shall be Schulink XL 350 or equivalent.
- 4.5 Tanks molded in LDPE polyethylene shall be Exxon Escorene 8460 resins by Exxon or equivalent.

- 4.6 No fillers shall be added to either resin.
- 4.7 The resin suppliers' recommended maximum material use temperature for cross linked resin is 150 degrees F, and for LDPE resins is 120 degrees F. Generally, the less exposure to elevated temperatures, the greater the tank life.
- 4.8 Laboratory (ideal) material properties are set forth in **Materials Properties Table** (below) as stated by the resin suppliers.

This chart lists nominal properties as supplied by the resin suppliers

Material Properties

	<u>LMDPE</u>	<u>XLPE</u>
Density (g/cc)	.938	.942
ASTM D1505		
ESCR (hrs) 100% solution	>1,000	>1,000
10% solution	145	>1,000
ASTM 1693		
Flexural modulus (psi)	112,000	102,000
ASTM D790		
Tensile strength (psi)	2,575	2,800
ASTM D638		
Impact (ft.-lbs.)	190	450
ARM ¼ -in. thickness		
UV-stabilized	Yes	Yes
FDA-grade resin	Yes	No

5. Design requirements

- 5.1 The minimum required wall thickness of the cylindrical straight shell at any fluid level shall be determined by the following equation, but shall not be less than 3/16-in. thick. The tolerance indicated in section 7.3 applies to these dimensions.

$$T = \frac{P \times O.D.}{2 SD} = .433 \times S.G. \times H \times \frac{O.D.}{2.SD}$$

T = Wall thickness, inches

SD = Hydrostatic design stress, psi

P = Pressure (.433 x S.G. x H), psi

S.G. = Specific gravity of fluid

O.D. = Outside diameter, inches

H = Height, feet

Standard product line includes tanks designed for use with materials having a specific gravity of 1.5, 1.9 and 2.2

- 5.2 The hydrostatic design shall be determined by multiplying the hydrostatic design basis (determined by ASTM D2837 using rotationally molded samples) by a service (design) factor selected for the application. The standard product line of tanks is engineered using a maximum hydrostatic design stress, 600-psi for Cross linked and 550 psi for Conventional, respectively.
- 5.3 **Note:** The hydrostatic design basis for various polyethylenes are typically supplied by the resin manufacturer.



- 5.4 The vessels are designed and molded with a **uniform wall thickness** equal to or greater than the minimum thickness requirement per the Barlow Formula shown in this specification. This procedure in the manufacturing process allows the part to cure evenly throughout the entire surface area, thus allowing a more controlled and higher cross-linking percentage with less stress on the part when reaching the cooling process. The end result will give each unit greater structural integrity and a longer life span.
- 5.5 Each vessel is **air-cooled** in chambers with high velocity fans giving a controlled temperature drop, insuring a more uniform resin cure, less stress on the part, improved shrinkage parameter and a more consistent product.
- 5.5 Top head shall be integrally molded (one piece) with the cylinder shell. The minimum thickness of the top head shall be 3/16-in. The tolerance indicated in section 7.3 applies to this dimension.
- 5.6 Tanks are designed with top mounting flats to enhance fixture assemblies.
- 5.7 The bottom head of a tank shall be integrally molded (one piece) with the cylinder shell. The minimum thickness for a fully supported flat bottom head shall be 3/16-in. All parting lines shall be located within the top 1/3 of the vertical sidewall.
- 5.8 Double wall vessels shall be designed so the top head of the primary vessel covers the interstitial space between the two structures providing protection against the elements. The secondary structure shall be the same diameter as the top head of the primary vessel. The secondary vessel shall hold a minimum 120% of the primary vessel.

6 Nozzles

- 6.1 Nozzle material types available are PVC, CPVC, PVDF, virgin polypropylene, black polypropylene, and stainless steel. Bolt material types are Stainless Steel, Hastelloy, and Titanium.
- 6.2 Gasket materials types are EPDM, Viton, XLPE, and Buna N. Other gaskets are available upon request.
1. All sidewall nozzles shall be a bolted design. All flanged nozzles shall be 150 lb. ANSI-drilled bolt patterns.
- 6.3 Vents will be provided as agreed, to prevent pressure or vacuum from damaging the tank when filling or draining. Vents shall be sized to maintain atmospheric pressure under normal filling and discharge operations. Some applications or service conditions may require larger vents.
- 6.5 All piping shall be supported independently of the tank. **Flexible expansion joints are required to allow the tank to expand and contract when filling and draining.**

2. Ladder and Restraint Systems

1. Ladder assemblies shall be built to the most recent OSHA guidelines from a material that is chemically resistant to the environment. Suitable materials shall be Isophthalic Polyester or Vinyl ester Fiber Glass Reinforced Plastic, or Mild Steel with two-part epoxy primer and black epoxy finish. The ladder shall have a 24" x 24" platform with a 48" high handrail on both sides and safety chain enclosure. The top of the platform shall be located 48" below the top manway promontory. The ladder shall be fastened to the vessel with 1/2" dia Viton or EPDM gasketed bolts at the platform and shall be anchored to the concrete at the base of the ladder. Concrete anchors supplied by others.

2. Wind and Seismic Restraint Systems shall be designed to meet UBC1997. Restraints shall be cable design with foot pads anchored to the concrete foundation. The cable assemblies shall extend from an anchor up and over the centerline of the vessel's top head and down 180 degrees from the point of origin. A turnbuckle shall be supplied on at least one side of each cable assembly to adjust cable tension. The cable assemblies shall be tethered together at the intersection. Design calculations shall be provided with the technical drawings.

9 Dimensions and Tolerances

9.1 General - dimensions shall be taken with tank empty.

1. 9.2 Thickness – The tolerance for thickness is specified in section 5 shall be +/- 3%

9.3 Fitting placement – The tolerances for fitting placement shall be +/- 3% in elevation and degree.

10 Workmanship

10.1 The finished tank wall, so far as is commercially practical, shall be free of visual defects such as foreign inclusions, air-bubbles, and pinholes that may impair the serviceability of the vessel.

10.2 The inner surface shall be smooth and free of cracks, crazing or pits. Waviness is a characteristic of the molding process for large tanks and is acceptable, provided the surface is smooth and free of cracks.

11 Quality Assurance

11.1 Materials (Resins)

- Manufacturer will verify receipt of a supplier certification that each lot of resin conforms to supplier's specification.
- Manufacturer will verify that each lot of resin complies with its purchase order.
- Manufacturer will visually examine each lot of resin for contamination, color, texture, etc.
- Samples of each lot must be stored a minimum 3 years.
- Each Crosslinked lot sample shall be processed and tested for gel consistency.

11.2 Vessels

- Available testing; impact, gel test, hydrostatic test, ultra sonic thickness test, and HIC specialty procedures shall be provided upon request.

12 Marking

12.1 Each tank shall be marked with a quality and routing control number. This number will be used to trace the vessel and shall be common to all required documentation.

12.3 Product identification label with installation and use instructions will be applied to each tank.

13 Shipping

13.1 When the tank arrives at the destination, the purchaser shall be responsible for inspecting the tank. If damaged, notify Assmann Corporation of America at (260) 357-3181.

14 Product Handling

14.1 The purchaser shall follow recommendations as shown in the installation and use instructions. The purchaser is responsible to insure that all products shipped will be stored, handled and installed in such a manner as not to degrade quality, serviceability or appearance. Vertical tanks should be stored in an upright position on a clean surface with no sharp objects under the tank.



15 Installation

- 15.1 Tanks and accessories shall be installed and handled according to the manufacturer's recommendations as shown in the installation and use instructions as supplied with the tank. Failure to follow these recommendations will void the warranty. This includes support of all pipes leading to and from the tank and a method to control expansion and vibration of the piping.
- 15.2 Purchaser should position the tank before assembling to peripheral equipment to ensure proper clearances.

16 Submittals

- 16.1 Approved Drawings
ASTM D-1998
- Certification of testing requested by customer

17 Warranty

- 17.1 Assmann Corporation of America warrants that all tanks manufactured and sold shall be free of defects in material and workmanship for a period of five (5) years limited. Full warranty terms can be supplied upon request.

SCHULINK® XL 350

Crosslinked Polyethylene

General

Material Status	• Commercial: Active	
Availability	• North America	
Appearance	• Black	• Natural Color
Forms	• Pellets	• Powder
Processing Method	• Rotational Molding	

Physical	Nominal Value (English)	Nominal Value (SI)	Test Method
Specific Gravity ¹	0.944	0.942 g/cm ³	ASTM D792
Environmental Stress-Cracking Resistance 100% Igepal, Compression Molded, F50	> 1000 hr	> 1000 hr	ASTM D1693
Mechanical	Nominal Value (English)	Nominal Value (SI)	Test Method
Tensile Strength ² (Yield, Rotational Molded)	2800 psi	19.3 MPa	ASTM D638
Tensile Elongation ² Break, Rotational Molded	350 %	350 %	ASTM D638
Flexural Modulus - 1% Secant (Rotational Molded)	102000 psi	703 MPa	ASTM D790
Impact	Nominal Value (English)	Nominal Value (SI)	Test Method
Impact Strength -40°F (-40°C), 0.125 in (3.18 mm), Rotational Molded	61 ft-lb	83 J	ARM
Thermal	Nominal Value (English)	Nominal Value (SI)	Test Method
Deflection Temperature Under Load 66 psi (0.45 MPa), Unannealed, Rotational Molded	145 °F	63.0 °C	ASTM D648
Flammability	Nominal Value (English)	Nominal Value (SI)	Test Method
Flame Rating (Any Color)	HB	HB	UL 94

Notes

¹ Compression Molded

² 2.0 in/min (51 mm/min)

Technical Data

www.aschulman.com



A. Schulman
COMPOUNDING YOUR SUCCESS™

SCHULINK® XL350

SchuLink XL350 is a cross-linkable high density polyethylene used for rotational molding. This resin offers high impact strength, good abrasion resistance, good stiffness, and excellent environmental stress crack resistance. It is typically used for chemical containment and gas tanks.

NOTE: Physical properties are based on rotationally molded samples from unpigmented resins. Density and ESCR tests were performed on compression molded samples.

Properties	Standard	Parameters	Unit
Chemical			
ESCR	ASTM D1693	10%	>1000 hours F50
		100%	>1000
UV stabilization			UV-6
General			
Density	ASTM D792	-----	.942 g/cc
Melt Index	ASTM D1238	2.16/190	n/a g/10 minutes
Mechanical			
ARM Impact		(-40°C), 1/8 Specimen	63 ft-lbs
Flexural Modulus	ASTM D790	@ 1% Secant	702 MPa
Flexural Modulus	ASTM D790	@1% Secant	102,000 psi
Tensile Strength @ Yield	ASTM D638	2"/minute	19.3 MPa
Tensile Strength @ Yield	ASTM D638	2"/minute	2,800 psi
Ultimate Elongation	ASTM D638	2"/minutes	350 %
Thermal			
Heat Deflection Temperature	ASTM D648	@ 66 psi	60 °C

Reported values pertain only to natural resins: pigmenting may vary properties. Pellet cut, size, color, and other properties may vary depending on the manufacturing location.

NOTE: While the information herein is believed to be reliable and correct, nothing herein is intended and should not be construed as a representation of warranty, expressed or implied as to results obtained or to be obtained by others who may make use of this information or with respect to the absence, existence or validity of patent rights, if any of others involving any composition or process herein referred to; or an inducement or recommendation for the violation of any such patent rights; and responsibility therefore is disclaimed.



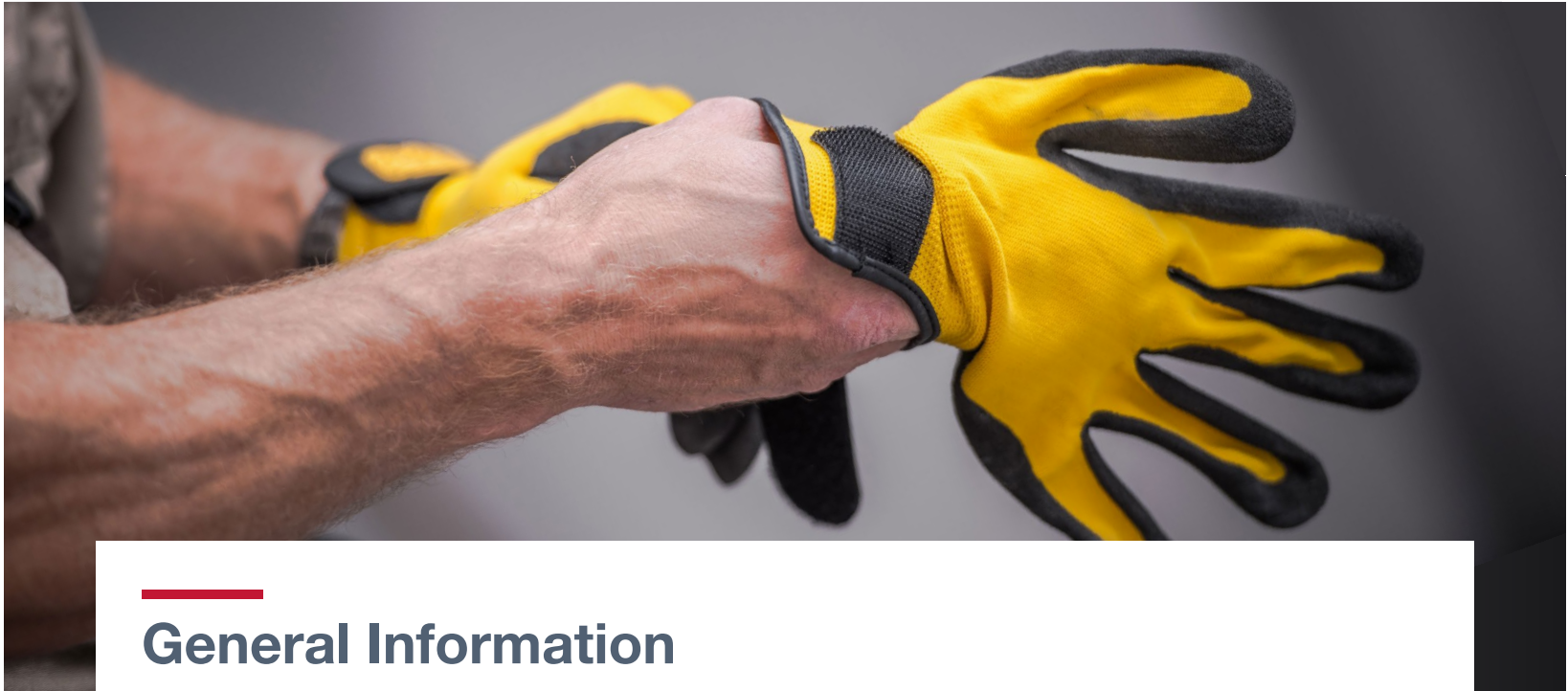
Assmann
Corporation
of America

300 North Taylor Road,
Garrett, IN 46738 USA
888-357-3181 or 260-357-3181
Assmann-usa.com



TANK INSTALLATION & USE GUIDELINES

for Bulk Storage Tanks



General Information

Assmann polyethylene storage tanks are manufactured to give you the toughest; most reliable and economical vessels offered for storing industrial strength chemicals such as sulfuric acid, sodium hydroxide, sodium hypochlorite and many other corrosives. Our unique process utilizing uniform walls and air-cooling provides us with an advantage over any other polyethylene tank manufactured today. However, these vessels are not immune to damage. Precautions must be taken while off loading, handling, installing, and utilizing to protect your investment.

**These handling and installation instructions are only recommendations and do not relieve the purchaser of the responsibility to inspect the tank upon delivery and to properly handle and install the vessel. Any damage that is the result of improper handling or installation will be the sole responsibility of the purchaser. Failure to comply with handling and installation instructions will void all warranties, expressed or implied. Misuse or undocumented applications are the burden of the purchaser.*

1: Preparing The Tank Site

CAUTION: Complete bottom support of all polyethylene tanks must always be maintained. Tanks cannot be placed on grating or open floor design where the tank base is not fully supported. It is critical that the tank foundation be clean of all foreign debris. Make sure that your pad is swept clean and 6 layers of roofing felt are placed between the tank base and the foundation.

Assmann Corporation recommends that all tanks be placed on a concrete foundation capable of supporting the weight of the tank with accessories and its intended service (chemical). Vertical tanks over 6,500-gallon capacity require a reinforced concrete foundation. Tanks from 6,500 gallons and below that cannot be placed on a concrete foundation must be placed on an area that is compacted, level, smooth, and free of any foreign objects that may damage the vessel.

Assmann Corporation also recommends that at least six (6) layers of 15 Lb. roofing felt be placed between the tank and its intended foundation. This will allow the tank to move without restriction.

** Assmann Corporation is not responsible for damage due to improper tank base preparation.*

2: Receiving Your Polyethylene Tanks

At the time of delivery, the purchaser shall be responsible for inspecting the tank and accessories for shipping damage before off loading. If damage has occurred, contact Assmann prior to unloading. All freight damage must be noted on the driver's shipping papers/bill of lading prior to signing for acceptance regardless of whether it is Assmann Corporation's truck or a contract carrier. Look inside the tank for fittings or accessories that may have been shipped loose before offloading.

** Failure to document damage or shortcoming of the vessel becomes the responsibility of the purchaser. Contact Assmann Corporation for information on which party is responsible for filing the claim for damaged equipment. Once offloading occurs it becomes the responsibility of the purchaser to file a freight claim in the event of concealed damage.*

3: Off Loading Polyethylene Tanks

Assmann rotationally molded tanks are by far the toughest polyethylene tanks offered to the industrial market. However, the fittings and tanks are susceptible to damage if improperly handled. **CAUTION: DO NOT ALLOW THE TANK TO ROLL OVER INSTALLED FITTINGS. Whenever possible, use a crane or other suitable lifting devices to remove the tanks from the truck.** Because the stability of the tanks can be affected by wind, the party responsible for off-loading the tank shall secure the tank to keep total control of the vessel while handling. Since there are multiple ways that your tank can arrive the following figures are to be used as a general outline when offloading your storage tank. Assmann recommends hiring a skilled rigging company for both safety and to prevent damage to your tank. See Figure #1, #2, and #3 (next page) for suggestions on how to handle the tanks when off loaded. **CAUTION: Do Not use factory-installed fittings as lifting lugs.**

Figure #1

Using an overhead lifting device, make a choker collar and grasp top one-third of the tank while gently raising. Lower onto permanent site. Use caution to prevent tank from slipping on the foundation.

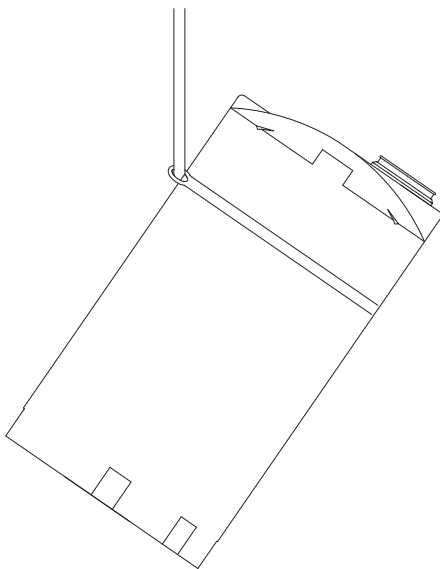
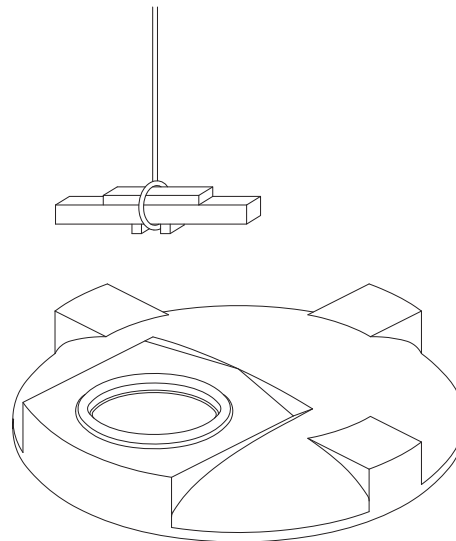


Figure #2

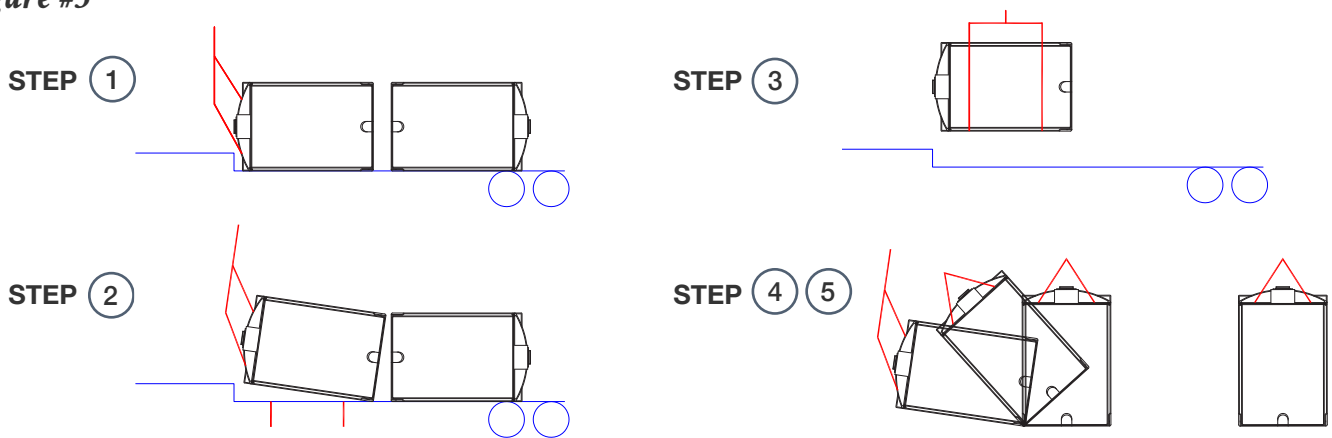
Insert 4-in. x 4-in. wooden beam through the top of the manway, lift and deliver to permanent site. Units over 400 lbs may require steel I-beam in place of the wooden beam.



Often Assmann tanks arrive laying on their side. When your tank arrives in this position it is required to make multiple lifts in order to properly handle the storage tank. Shown below are basic steps necessary to properly off load the tank from the truck.

- ① Attached crane to top lifting points or through the manway opening on the storage tank.
- ② Lift the top portion of the storage tank and place straps across the bed of the truck. Then lay the tank back down onto the truck over the straps.
- ③ Reattach the crane to the straps beneath the tank. Then lift the tank in the horizontal position and place on a solid foundation. Reattach the crane to the top lifting points or manway opening.
- ④ While maintaining control of the tank slowly upright the tank to the standing position.
- ⑤ Once the tank is upright. Lift the tank into its final position. Be sure to follow the instructions within this manual to prepare the tank site.

Figure #3

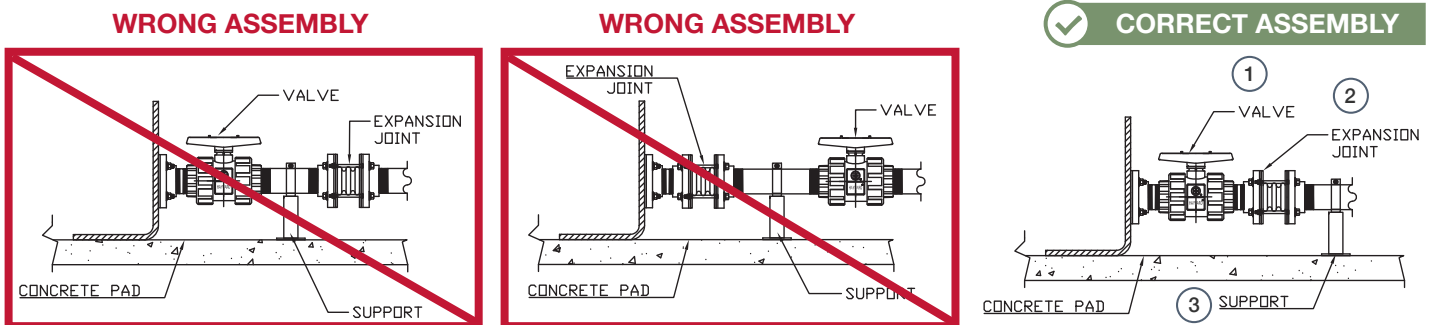


4: Tank Piping

All pipes, valves and other accessories must be independently supported. See Figure #4

CAUTION: Do not support piping, valves or other accessories with tank connections. Flexible expansion joints and/or flexible hoses must be used on all sidewall fittings to allow the tank to expand and contract while filling or draining. Not using an expansion joint or flexible hose will result in premature failure of the vessel.

Figure #4



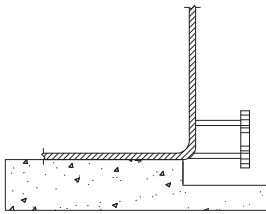
- ① Tank isolation valve should be installed directly after tank wall connection.
- ② Expansion joint should be installed after isolation valve.
- ③ Piping needs to be supported after expansion joint to allow tank to move without restrictions.

Assmann recommends that a hydro-test be performed after the installation is complete to ensure all piping has been installed properly.

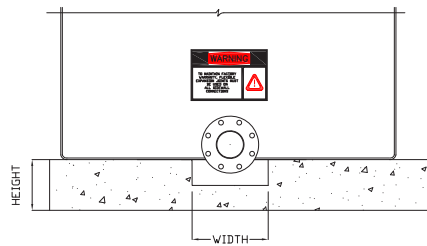
Assmann offers a Full Drain Outlet (FDO) assembly on some of our storage tanks. When installing tanks with the FDO connection it is critical that the tank connection be plumbed correctly and that the tank pedestal or pad is designed to hold the storage tank properly and not restrict the movement of the nozzle. *Figure #5* below has critical pedestal dimensions along with an outline of proper piping procedures.

Figure #5

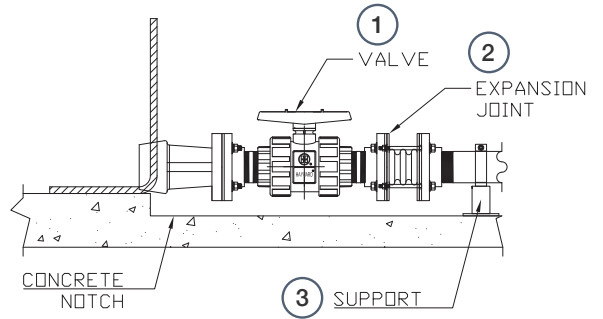
Side View Pad Notch



Front View Pad Notch



CORRECT ASSEMBLY



<i>Minimum NOTCH WIDTH Recommended</i>					
Tank Diameter	86"	96"	105"	119"	143"
Notch Width 3" FDO	10.5"	10.5"	10.5"	10.5"	10.5"
Notch Width 4" FDO	12"	12"	12"	12"	12"

<i>Minimum PAD HEIGHT Recommended</i>					
Tank Diameter	86"	96"	105"	119"	143"
Pad Height 3" FDO	7"	7"	7"	7"	7"
Pad Height 4" FDO	8"	8"	8"	8"	8"

<i>Minimum PAD DIAMETER Recommended</i>					
Tank Diameter	86"	96"	105"	119"	143"
Pad Diameter	89"	99"	109"	123"	148"
Pad with Restraint	117"	127"	137"	151"	176"

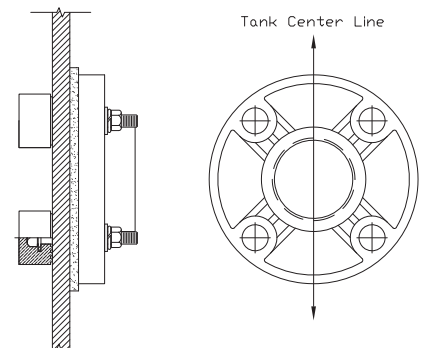
- 1 Tank isolation valve should be installed directly after tank wall connection.
- 2 Expansion joint should be installed after isolation valve.
- 3 Piping needs to be supported after expansion joint to allow tank to move without restrictions.

5: Installation of Fittings and Accessories

Flange Fitting Assembly

1. Locate on the tank where you want to place the fitting and mark the tank.
2. Place the flange on the tank and trace the center hole and the bolt holes on the flange. **NOTE: The bolt holes must straddle the centerline of the tank.** See *Figure #6*
3. Drill pilot holes in the center of each hole traced using a 1/4" drill.
4. For the center hole you will need a hole saw the same size as the flange. Example: A two-inch flange will require a two-inch hole saw.

Figure #6



5. Carefully drill out the center hole with the hole saw.
6. Use a 1/2" drill to finish the bolt holes. The bolts should fit snug when placed through the holes.
7. Trim all burrs inside and out that may have been caused by drilling.
8. Place the bolts through the tank wall so the threads are outside and the gasket head is on the inside.
9. Slip the flange gasket over the threads on the bolts. Push the gasket flush against the tank wall.
10. Slip the flange over the bolts.
11. Coat the threads of the bolts with anti-seize to keep the threads from galling.
12. Place the flat washer, lock washer, and nut on the bolt threads and torque to 11-ft. lbs.
13. Hydro-test before introducing chemical.

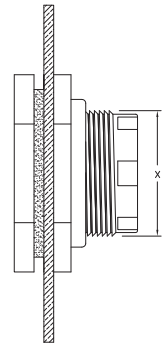
Installation of Bulkhead and Self-Aligning Dome Fittings

CAUTION: Do not install self-aligning dome fittings in the sidewall of the tank. Self-aligning fittings are for top use only.

1. Locate on the tank where you want to place the fitting and mark the tank.
CAUTION: Do not locate sidewall fittings too close to the bottom radius on tank.

Figure #7

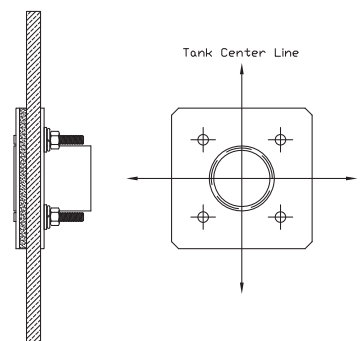
2. Drill a pilot hole using a 1/4" drill.
3. Measure the body of the bulkhead fitting you intend to install. *See figure #7*
4. Using a hole saw that is slightly larger than the body of the bulkhead fitting, carefully drill the access hole.
5. Trim all burrs inside and out that may have been caused by drilling.
6. Place the body of the bulkhead fitting with the gasket through the hole from the inside.
7. Thread the nut of the bulkhead on hand tight. Hold the body of the bulkhead fitting steady and tighten the nut another 1/4 to 1/2 turn.
8. Hydro-test before introducing chemical.



Installation of Stainless Steel Bulkhead Fitting

1. Locate on the tank where you want to place the fitting and mark the tank.
2. Place the backer plate on the tank wall and trace the center hole and the bolt holes. **NOTE: The bolt holes must straddle the centerline of the tank.** *See figure #8*
3. Drill pilot holes in the center of each hole traced using a 1/4" drill.
4. For the center hole you will need a hole saw slightly larger than the outside diameter of the pipe nipple (male fitting) or coupler (female fitting).

Figure #8



5. Carefully drill out the center hole with the hole saw.
6. Use a 3/8" drill to finish the bolt holes. The bolts should fit fairly snug when placed through the holes.
7. Trim all burrs inside and out that may have been caused by drilling.
8. Install the body of the bulkhead with the gasket through the inside of the tank.
9. Slip the backer plate over the threads and the pipe connection. Push the plate flush against the tank.
10. Coat the threads of the bolts with anti-seize to keep the threads from galling.
11. Place the lock washer and nut on the threads and torque to 11-ft. lbs.
12. Hydro-test before introducing chemical.

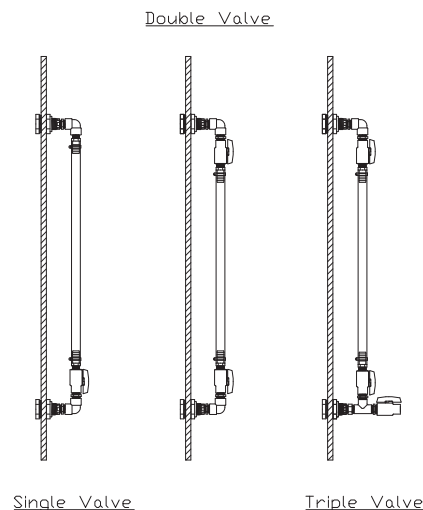
Installation of Sight-glass Assembly

Normally, the bulkhead fittings for the sight-glass assembly will be factory installed. If not, follow instructions on how to install bulkhead fittings. **NOTE: Sight-glass assemblies are normally packaged and shipped with the tanks to avoid damage in transit.**

Assmann Corporation offers three styles of sight-glass assemblies. See figure #9 for the style you received.

1. Coat the threads of the bottom assembly with pipe joint compound and thread into the bottom bulkhead fitting. Do not over tighten. Align the hose barb in the vertical position so the barb is pointing straight up.
2. Follow the same steps for the top assembly. This time the hose barb will point down.
3. Cut the flexible PVC tubing to the necessary length. Slip the hose clamps over the tubing and slide the tubing over the hose bars.
4. Tighten the hose clamps snug over the tubing and bars.
5. Hydro-test before introducing chemical.

Figure #9



Installation of Fill Line Assembly

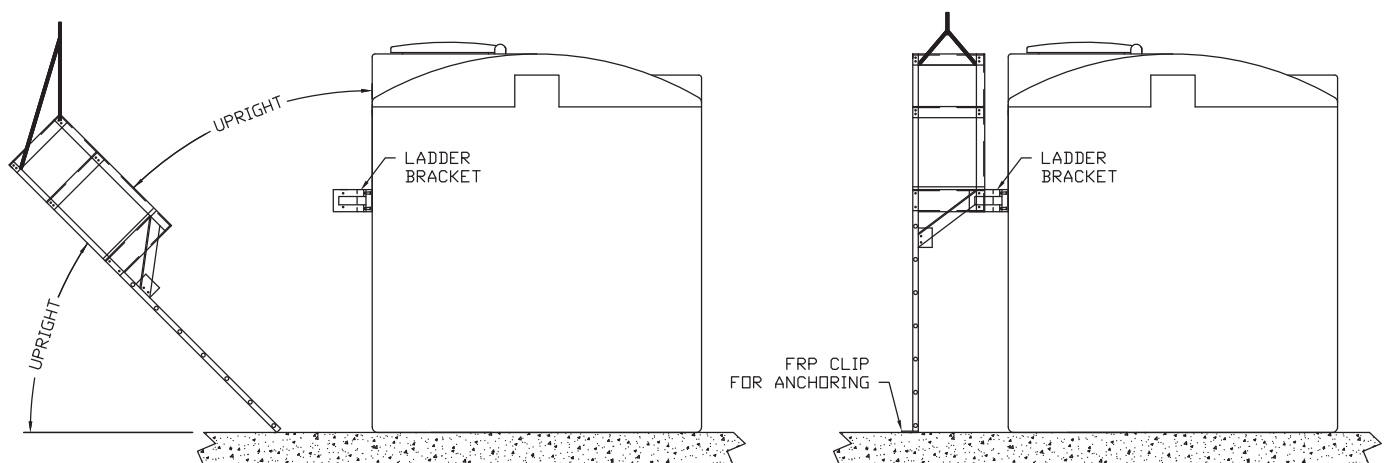
1. Remove the ball valve from the fill line assembly.
2. Slip the threaded end of the fill line through the bracket on the sidewall of the tank.
3. The fill line will have a half union with o-ring. Carefully remove the tape that holds the o-ring in place while shipping. Place the o-ring in the groove cut into the union and thread the two halves back together.
4. Use pipe joint compound on the pipe threads at the bottom of the fill line assembly and reinstall the ball valve.
5. Hydro-test the assembly before introducing chemical.

Installation of Bolted and Gasketed Cover

1. Place the flat plate on the top of the tank and mark out the hole pattern.
2. Drill $\frac{1}{4}$ " pilot holes in the center of each hole marked on the tank.
3. Drill each pilot hole with a $\frac{15}{32}$ " drill.
4. Thread the holes with a $\frac{1}{2}$ -13 tap.
5. Set the gasket on the tank top and line up the holes.
6. Place the flat plate on the gasket and carefully thread one of the PVC bolts into the tank.
CAUTION: Do not over tighten.
7. Check each existing hole for alignment and continue installing the remainder of the bolts.

Installation of Ladder Assembly

1. Assmann Corporation will have already pre-fit your ladder assembly to the tank prior to shipping.
2. After setting tank in place. Situate ladder so that it can be safely stood up and fastened into the existing standoff bracket installed on the side of the storage tank. **NOTE: It is necessary to have the ladder held in place by proper crane or safety equipment, to prevent tipping during installation.**
3. The standoff bracket installed on the tank should snugly fit against the ladder.
4. Install factory supplied bolts through the standoff bracket and ladder. Loosely install bolts, do not tighten.
5. While still supporting the ladder drill anchors in the concrete through the angle supports located on the lower base of the ladder. Ladders that are not anchored at the base are not safe to use.
6. Install proper anchors to hold ladder base in place.
7. After lower portion of ladder is fastened securely, tighten bolts at upper ladder support bracket.
8. Once all hardware is tightened, remove crane or ladder support. **CAUTION: Polyethylene tanks are extremely slippery when wet. Assmann does not recommend that anyone climbs or stands on the roof of a polyethylene tank. Unless special ordered, our ladders terminate purposely 48" below the tank roof, to prevent access to the tanks dome.**



Installation of Tie Down Assembly

Assmann Corporation offers multiple types of restraint systems for our storage tanks. We offer a passive type restraint and also a wind load / Seismic restraint. Please refer to the instructions to your specific type of restraint.

**Assmann does not provide any type of concrete anchors with either of our restraint systems. We do not provide engineering or calculations outlining foundation requirements.*

Wind Load & Seismic Restraints

1. Read all installation instructions prior to assembly process.
2. Upper restraint lugs, with cables attached, are pre-installed by Assmann. Cut tether attaching restraint cables loose from top mounted restraint lugs. This will ease installation further through the process. *See figure #10*
3. Allow upper restraint cables to hang freely from tank roof—this will help in aligning the upper and lower lugs. Base lugs should be placed directly below upper restraint lugs. It is critical to the restraint systems design that all base clips are evenly spaced around the storage tank. *See figure #11*
4. Loop base cables through base restraint clips and attached to the turn buckles with supplied hardware. *See figure #12*
5. Attached upper restraint cables to turnbuckles.
6. Double-check alignment of upper restraint lugs and base restraint clips.
7. Sit base restraint clips against sidewall of storage tank and mark anchor bolt holes on concrete.
8. Drill all anchor bolt holes and epoxy anchors into place.
9. Install base restraint clips over anchors and tighten bolts.
10. Fill tank with water to allow tank to naturally “squat” into place.
11. Tighten turnbuckles hand tight, plus 1 full revolution of turnbuckle. Note that cables to do need to be pre-tensioned to a specific value. Pre-tensioning of restraint cables, can cause excessive force if the restraint system is placed under seismic or wind loading.
12. Installation is complete.

Figure #10



Figure #11



Figure #12



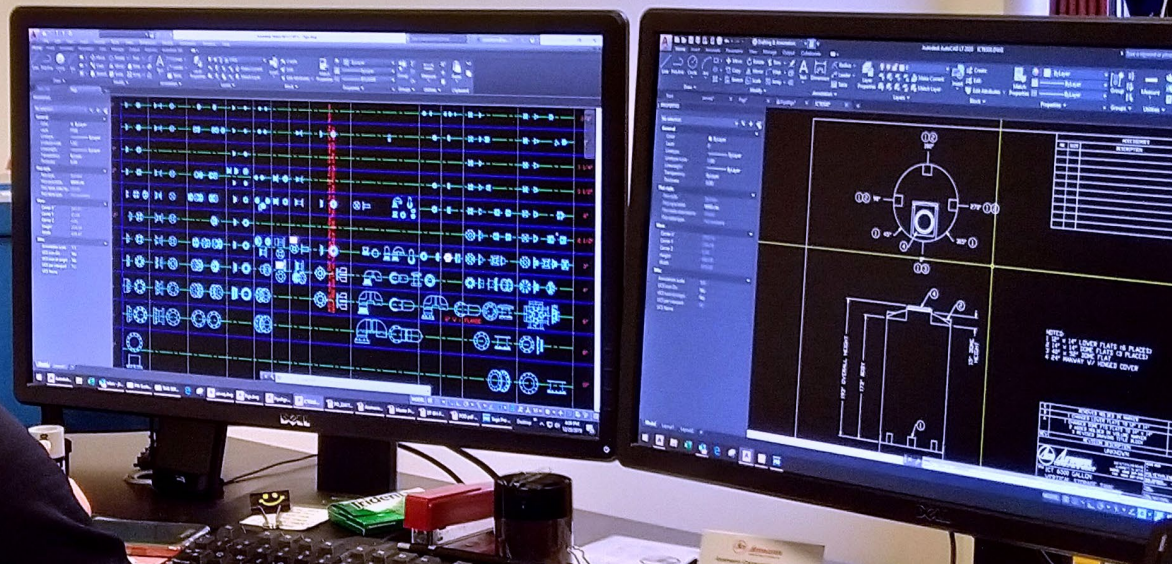
Passive Restraints

1. Place the straps of the tie down assembly around the bottom of the tank.
2. Slip the carriage bolts through the precut holes in the center of each strap.
3. Bolt the straps loosely together so you will be able to slide the straps up into place.
4. Slide the strap up the tank so that the legs can be fastened to the carriage bolts.
5. Mark the holes in the legs where the anchors will be installed and rotate the assembly slightly for drilling.
6. Drill and install the anchors. Rotate the assembly back to its original location.
7. Carefully snug the straps around the tank. **CAUTION: Do not over tighten the straps around the tank.**
8. Tighten the legs to the pad using anchors.

Assmann Polyethylene Tank Maintenance Schedule and Check List

- Never enter a tank without following OSHA approved guidelines.
- Check each fitting monthly for possible seepage or leaks.
- If you detect some seepage, tighten the bolts or the compression nut slightly. Do not over tighten.
- If tightening the hardware does not solve your problem, you may need to replace the gasket or the complete fitting.
- Flush your tank every 12 months. This will help to prevent premature failure due to buildup or oxidation. Do not flush the tank with anything that may cause an exothermic reaction. Check with your chemical supplier for a solution that can be safely used to flush.
- If your tank is five years or older, check the inside and outside surface of the tank for crazing, cracking or unusual discoloration. Focus around fitting areas. If you do not find anything, you should check the tank every year thereafter. For chemicals like sulfuric acid, sodium hypochlorite, sodium hydroxide or other known stress-cracking agents, check the surface area after the second year in service and every six months thereafter.
- Stress cracking is a warning sign that should not be ignored. If you suspect or see any signs that could be stress cracks, call your local Assmann representative or Assmann Corporation direct.
- Make sure all flexible expansion joints are in good working order.
- Do not allow the individual responsible for filling the tank to surge air into the tank after filling is complete. This tank is not a pressure vessel. Do not use more than 7psi when filling your tank. When pneumatically unloading chemical into your storage tank it is critical that you do not allow drivers to purge, clean or blow down their lines into your storage tank. The sudden surge of air from pneumatically unloading chemical into your tank can or will cause damage to your storage tank.
- Keep a log of all inspections on the chart provided on the next page.

**If you have any questions concerning installation call:
Assmann Corporation of America (888) 357-3181**

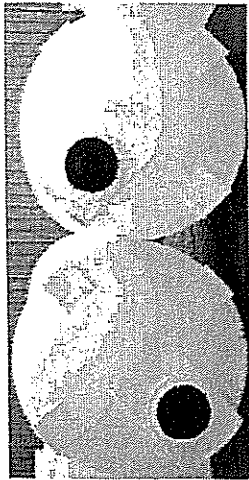


Resin Materials

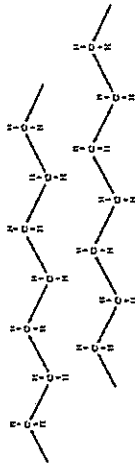
Polyethylene resins can be hard to identify after a tank has been installed. Common misconceptions are HDLPE is the same as HDXLPE. The following pictures will help you determine materials.

The picture on the right is a Linear HDLPE tank: Notice the "White color". Linear PE is a weldable, FDA approved material. Used commonly for day tanks and small chemical feed applications.

On the left, is a Crosslink HDXLPE tank: Notice the "off White / Yellow color". Crosslink polyethylene is used for large industrial bulk storage applications.

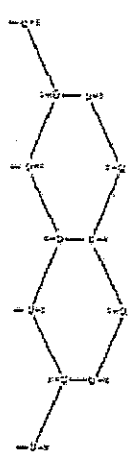


Linear PE molecules when molded bond "end to end" as shown below.



Idealized two-dimensional structure conventional medium density polyethylene

Crosslink PE molecules bond on all three sides forming an "Y" type bond. Crosslink has a stronger molecular structure than linear PE.



Idealized two-dimensional structure crosslinked high density polyethylene

Inspection Guidelines

Polyethylene tanks are a cost-effective method for bulk chemical storage. Routine inspections are required to maintain a safe environment.

The following guidelines should be followed:

- Never enter a tank without following OSHA approved guidelines.
- Check each nozzle monthly for possible seepage or leaks.
- Make sure all flexible expansion joints are in good working condition.
- Flush your tank every 12 months.
- Do not allow tanks to be pressurized. Never use more than 7psi when clearing fill lines.
- Do not change the chemical service without checking chemical compatibility of all equipment, fittings and secondary piping.
- If the vessel has been in service three years or longer, check the inside and outside surface of the tank for crazing, cracking or unusual discoloration. **See Inserts for pictures of UV failure and signs of Stress Cracking.**
- Keep a log of all inspections.



Assmann
Corporation®



Polyethylene Tank Inspection Guide



300 North Taylor Road
Garrett, IN 46738
www.assmann-usa.com
info@assmann-usa.com
Tel: 888-357-3181

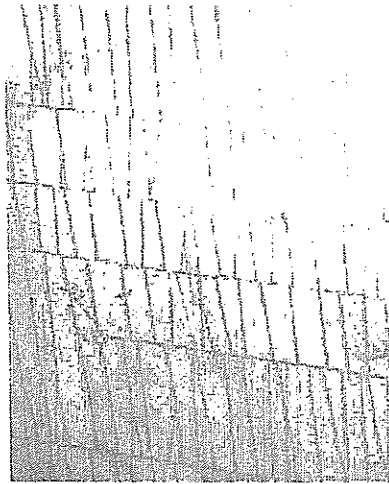
Ultra-Violet Exposure

Over-exposure to Ultra-violet rays is pictured below. Quality polyethylene resins are compounded with Ultra-violet stabilizer prior to being distributed to the tank manufacturer's facility.

Tanks that are installed in areas that have extreme amounts of UV exposure should be sheltered from the environment, insulated or colored for additional protection.

Common in the industry, tank manufacturers reduce wall thickness by using less resin in the upper sidewall and dome of the tank.

This makes the tank roof more susceptible to ultraviolet damage. Assmann polyethylene tanks are constructed with uniform-wall thickness from top to bottom. This added thickness gives additional protection to Ultra-violet exposure and extends the service life of the tank.



A common test method to see if your tank has undergone Ultra-Violet attack is to use water based stain or marker and color in a small area that has been exposed to sunlight. This will fill any voids in the polyethylene material making cracks visible. Areas to check are the dome and lower sidewall of the tank.

Tank Failure

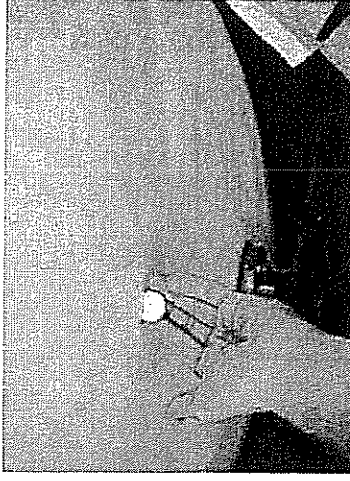
Polyethylene tanks are the most corrosion resistant method for storage of harsh chemicals. Improper plumbing attachments, Chemical and UV attacks are the most common causes for failure. Tanks can also fail due to age. Pictured below is a polyethylene tank that failed due to age. As you can see in the picture this tank has cracked a few inches above the tank floor. Typically cracks will develop near the tank base where the tank expands and contracts under normal operating conditions. When inspecting a tank always look near the tank's knuckle radius.



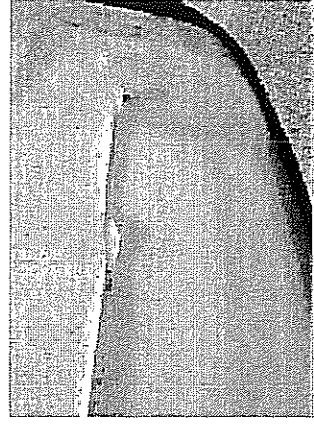
This picture is a chemical stress crack in a Crosslink polyethylene tank. Stress cracks normally develop at or near tank sidewall connections. A Crosslink tank will typically develop a stress crack prior to complete tank failure. This gives the end user warning to get the tank removed from service. Normally a Linear polyethylene tank will not give this type of warning before complete failure.

Gathering Information

Polyethylene tanks are most commonly damaged when they are in transit or being off-loaded at a customer's site. Pictured below is a tank that has been gouged. This customer is using a quarter to gauge the penetration into the tank. If you can provide an accurate depth of a gouge, a reputable manufacturer can calculate the remaining thickness of the tank and give recommendations on how to proceed. A tank manufacturer or a qualified representative should be contacted immediately when damage is found.



Tanks with damage similar to the picture shown below should be reported to the manufacturer, and evaluation should take place prior to the tank being placed in service.



NSF International

789 N. Dixboro Road, Ann Arbor, MI 48105 USA

RECOGNIZES

Assmann Corporation of America

Facility: Garrett, IN

AS COMPLYING WITH NSF/ANSI 61 AND ALL APPLICABLE REQUIREMENTS.
PRODUCTS APPEARING IN THE NSF OFFICIAL LISTING ARE
AUTHORIZED TO BEAR THE NSF MARK.



ANSI Accredited Program
Product Category: 61
Certification Program
Accredited by the
American National
Standards Institute



Certification Program
Accredited by the
Standards Council
of Canada

This certificate is the property of NSF International and must be returned upon request. This certificate remains valid as long as this client has products in Listing for the referenced standards. For the most current and complete Listing information, please access NSF's website (www.nsf.org).

Theresa Bellish
General Manager, Water Systems

September 14, 2017
Certificate# 4P521 - 01



Quality Management System

Certificate of Approval

This is to certify that the QMS of

Assmann Corporation of America.

Site 1 (corporate): 300 N Taylor Road; Garrett, IN 46738

Site 2: 1505 Central Street, Marshall, TX 75672

USA

Has been assessed and found to meet the requirements of

ISO 9001:2015

This certificate is valid for the following scope of operations

Design and Manufacturing of Rotational Molded Polyethylene
Bulk Storage Tanks and Custom Molded Products

Authorized by:

Stan Wright
Director

Date of Certificate Issue: 06 February 2020

Certificate Valid Until: 09 February 2023

Recertification audit before 9 February 2020. Certified since 2014.

This certificate is the property of SN Registrars (Holdings) Limited and remains valid
subject to satisfactory annual Surveillance audits.

SN Registrars (Holdings) Limited

Registration House, 22b Church Street,
Rushden, Northamptonshire,
NN10 9YT, UK

Tel: +44 (0) 1933 381859

Email: enquiries@dascertification.co.uk

Web: www.dascertification.co.uk

Company number: 07659067

Certificate Number: DAS90024930/39/Q Rev: 002





CORPORATION OF AMERICA

300 NORTH TAYLOR ROAD GARRETT, IN 46738 TEL-888-357-3181 FAX (260) 357-3738

February 2, 2010

Re: ARRA Buy American Certification

To: All Affected Parties

Assmann Corporation of America certifies that their products comply with ARRA Buy American requirements. The requirements state that the finished product is to be assembled by an American vendor. This does not require all of the individual components that make up the assembly to be completely manufactured by American Vendors.

IE: Below is the section out of the ARRA Buy American guidelines with regard to manufactured goods.

Manufactured Good: "Manufactured good" means a good brought to the construction site for incorporation into the building or work that has been—

- (1) Processed into a specific form and shape; or
- (2) Combined with other raw material to create a material that has different properties than the properties of the individual raw materials.

There is no requirement with regard to the origin of components or subcomponents in manufactured goods, as long as the manufacture of the goods occurs in the United States.

Please feel free to contact me if you have any questions.

Thank You,

A handwritten signature in black ink, appearing to read 'David Crager', written over a horizontal line.

David Crager

President

Assmann Corporation of America

Tel. (260) 357-3181



Assmann Corporation of America's Exclusive 5 Year Warranty

Because our products are built to last, Assmann Corporation of America stands behind our rotationally molded storage tanks with a 5 year warranty.

Assmann warrants our tanks to be free from defects in workmanship and materials, under normal use and service, to the original purchaser for a period of 5 years from the date of shipment from our factory. Assmann will, at our option, repair any such defect, replace the tank or credit the purchase price. Assmann may require the return of the defective tank, transportation prepaid to Assmann, to establish the claim. No allowance for repairs will be made without Assmann's express written consent and prior approval.

Installation and operation must comply with all applicable federal, state, and local regulations, and must be in accordance with applicable instructions and limitations contained in the Assmann Usage and Handling guidelines for the tank and Assmann chemical specific recommendations. Normal maintenance and repair shall be performed by the customer. By accepting delivery of the tank, the customer accepts full responsibility for providing secondary containment appropriate and adequate for the stored material.

Any and all damage, whether patent or latent, to the tank or missing parts or accessories must be filed with the carrier and Assmann within five (5) business days of receipt of product. Any and all such omissions or damage must be noted on the Bill of Lading.

The following products are warranted for one (180) days from date of shipment:

- Intermediate Bulk Containers;
- Hardware and accessories;
- Custom fabricated items;
- All types of welded polyethylene connections; and
- Custom rotationally molded parts.

This Warranty shall not apply to any product that after leaving our factory: 1) has been repaired or altered in any manner not authorized by Assmann; 2) has been subject to abuse, misuse, fire, accident, neglect, or improper handling; 3) has not been used in accordance with Assmann chemical resistance charts; 4) has been exposed to pressures greater than atmospheric pressure; 5) has been exposed to internal or external temperatures greater than 120° F (for linear polyethylene) or 150° F (for Crosslink polyethylene); or 6) has been connected, installed, adjusted or used otherwise than in accordance with the instructions provided by Assmann.

Assmann's sole liability and our customers' sole remedy shall be limited to the warranties contained herein. Under no circumstances, shall Assmann be liable for special, indirect,

incidental, punitive or consequential damages resulting from the performance or operation of any product manufactured or sold by Assmann.

This warranty constitutes the full understanding between Assmann and the customer, and no terms, conditions, understandings, or agreements purporting to modify or vary the terms of this Warranty shall be effective unless made in writing and signed by an authorized representative of Assmann. All liability of Assmann shall terminate within 5 years from the date of shipment of the product. Assmann also disclaims all liability, whether in contract, tort, warranty or otherwise, to any party other than the customer.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES AND GUARANTEES, WHETHER EXPRESSED OR IMPLIED, INCLUDING STATUTORY WARRANTIES, SUCH AS WARRANTIES OF MERCHANTABILITY AND/OR FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT SHALL ASSMANN BE LIABLE FOR CONSEQUENTIAL OR INCIDENTAL DAMAGES, OR CONTINGENT LIABILITIES OF ANY KIND, RESULTING FROM THE MANUFACTURE, SALE, INSTALLATION OR USE OF THE PRODUCT. In no event shall Assmann's liability on any claim for damages arising out of or connected with the sale, manufacture, delivery or use of the product exceed the purchase price of the product. All legal actions for breach of this limited warranty, or the terms and conditions of the contract for sale of the product, must be commenced on or before the expiration of one year from the date of such breach. Otherwise, such action shall be considered barred by a period of limitations established by agreement.

The exclusion of indirect or consequential damages and the disclaimer of implied warranties herein may not be applicable to customers who are deemed "consumers" and who reside in states that do not allow the limitation of implied warranties or the exclusion of indirect or consequential damages otherwise applicable to consumers. Moreover, if you are deemed a "consumer," you may have specific legal rights in addition to those set forth in this warranty, which vary from state to state.

Should customer not pay for the tank in full as due, Assmann's warranty shall be deemed suspended until such time as Assmann receives payment in full. The suspended period will not be added on to the warranty period applicable to said order.

This warranty is only binding upon Assmann if notified of the defect or fault in writing within seven (7) days of it occurring, and where Assmann has been given the opportunity to inspect the product within twenty-eight (28) days of such notification.



STANDARD TERMS AND CONDITIONS OF SALE

GENERAL. All sales by Assmann Corporation of America ("Seller") are expressly conditioned upon these terms and conditions (the "Terms"). These Terms may in some instances differ with those affixed to Buyer's purchase order or other documents. If so, any additional conditions, requirements or terms conflicting with these Terms will not apply and are expressly rejected unless specifically set forth in a separate written agreement between the parties. Acceptance of Buyer's order is expressly conditioned upon Buyer's acceptance of or assent to these Terms, which shall be established by a written acknowledgment, by implication, or by acceptance or payment for products ordered hereunder (the "Goods"). Seller's forbearance or failure to enforce any of the Terms stated herein or failure to object to provisions contained in any communication from Buyer shall not be deemed a waiver of these Terms. Any changes in these Terms must specifically be agreed to in writing and signed by an officer of Seller before becoming binding.

SALES. All prices are F.O.B. Seller's plant unless otherwise specifically set forth on the invoice transmitted herewith. Prices stated are subject to change without notice. Stenographic and clerical errors and omissions in the invoice are subject to correction. All invoices become net due and payable thirty days from date of invoice unless stated otherwise. Buyer agrees to pay for the products according to Seller's payment terms. Buyer agrees to pay a delinquency charge of 1 and 1/2% per month (or if such rate shall exceed the maximum rate allowed by applicable law, then a delinquency charge calculated at such maximum rate) on the outstanding balance not paid when due, from the date such balances were due until payment with respect thereof is made in full. In the event Buyer fails to make any payment to Seller when due, Buyer's entire account(s) with Seller shall become immediately due and payable without notice or demand. In the event that Seller incurs attorney fees in its efforts to collect monies owed by Buyer, Buyer agrees to pay all expenses of collection, including but not limited to, all attorney fees, incurred in the collection of this

account. Seller may establish a credit limit and future credit sales may be refused when the account is delinquent. If, in Seller's opinion, the financial condition of the Buyer at any time does not justify continuance of production or shipment on the terms of payment specified, Seller reserves the right to decline to make shipment or may otherwise require full or partial payment in advance. All orders and shipments shall at all times be subject to the approval of the Seller's Sales Department.

SHIPPING/DELIVERY. Seller shall select the carrier for any and all deliveries, unless the parties mutually agree otherwise. All transportation charges are for the account of the Buyer. All shipments will be billed at the Seller's prices in effect at the time of delivery and shall not exceed the maximum prices lawfully established under any applicable law or governmental regulation in effect at time of shipment. Title to the Goods and risk of loss pass to Buyer upon delivery of the Goods by Seller to the carrier or delivery service. Buyer assumes all risk of loss in shipping and all liability for loss or damage, whether direct, indirect, consequential or otherwise, due to delays once the Goods have been delivered to the carrier. Buyer agrees to purchase any and all insurance it deems necessary to indemnify it against any loss in shipping. Seller shall not be responsible for insuring shipments unless specifically requested by Buyer and any insurance so requested shall be at Buyer's expense and valuation. Seller is not liable for delays due to force majeure, including, but not limited to, weather conditions, acts of God, acts of civil or military authorities, fires, strikes, job actions, floods, earthquakes, epidemics, quarantine restriction, war, terrorism, riot, supplier or vendor delays, or any other causes beyond the reasonable control of Seller. Delivery is also subject to federal and state laws and regulations. Delivery dates are approximate and are based upon current availability of materials, present production schedules, and prompt receipt of all necessary information. Seller does not guarantee to ship within the time provided on the invoice, but uses its best efforts

to do so and shall not be liable for any damage caused by delay in delivery.

ACCEPTANCE. Upon Buyer's receipt of shipment, Buyer shall immediately inspect the Goods. Unless Buyer provides Seller with written notice of any claim of shortages or defects in the Goods within forty-eight (48) hours after receipt of shipment, such Goods shall be deemed finally inspected, checked and accepted by Buyer. Upon acceptance of the Goods, Buyer waives any right to revoke such acceptance for any reason, whether known or unknown to Buyer at the time of acceptance. Any defect or nonconformance in the Goods after such acceptance shall be corrected under, and subject to, the conditions set forth in the Assmann Limited Warranty. Goods may not be returned without Seller's prior written return authorization. Once a return authorization number is issued by Seller, Buyer may return the Goods transportation and insurance prepaid in accordance with instructions issued by Seller. Failure to follow Seller's return procedures may result in lost Goods, delay, additional service, restocking charges, warranty denial, or refusal of a shipment. The return authorization number must appear on the shipping label along with all paperwork associated with the return. Seller has the right to reject Goods returned without the correct return authorization number clearly marked on the outside of the shipping container. Granting a return authorization number does not necessarily mean that a credit will be approved or that the evaluation or repair will take place without a fee.

SECURITY INTEREST. Buyer hereby grants Seller a purchase money security interest in the Goods until such time as Seller is fully paid. Buyer will assist Seller in taking the necessary action to perfect and protect Seller's security interest. No Goods furnished by the Seller shall become a fixture by reason of being attached to real estate.

WARRANTY. Seller provides the Assmann Limited Warranty ("Limited Warranty") on the Goods and this Limited Warranty, which Seller incorporates herein by reference, constitutes the exclusive remedies available to Buyer from Seller. The Limited Warranty is exclusive and in lieu of all other warranties, whether written, oral, implied or statutory. **THERE ARE NO WARRANTIES, EXPRESS OR IMPLIED, AS TO MERCHANTABILITY OR FITNESS FOR A**

PARTICULAR PURPOSE OR OTHERWISE, WHICH EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF. All other conditions or warranties express or implied, statutory or otherwise (including without limitation as to quality, performance, merchantability or fitness or suitability for purpose) are excluded to the fullest extent permitted by law. Upon expiration of the applicable Limited Warranty period, any liability of Seller in connection with such exclusive remedies shall terminate, and Buyer shall have 30 days after the warranty period to give written notice of any defects, failures, malfunctions, or other performance or non-performance issue that appeared during the warranty period. No statement or recommendation made or assistance given by the Seller or its representatives to the Buyer or its representatives, in connection with the sale or use of the Goods shall constitute a waiver by the Seller of any of the Terms or any provision of the Limited Warranty or otherwise affect the Seller's liability, as herein defined.

LIMITATION OF LIABILITY. Seller's liability (under any theory of law or equity, including, but not limited to, breach of contract or warranty, negligence, tort and/or strict liability) for any loss or damage arising out of, connected with, or resulting from the transaction, or from Seller's performance or breach thereof, or from the design, manufacture, sale, resale, installation, repair, operation or use of the Goods furnished herein, SHALL BE LIMITED TO REPAIRING OR REPLACING (AT SELLER'S OPTION) GOODS FOUND BY SELLER TO BE NON-CONFORMING, OR AT SELLER'S OPTION, TO REFUNDING THE PURCHASE PRICE OF THE NON-CONFORMING GOODS PURSUANT TO THE TERMS OF SELLER'S LIMITED WARRANTY. Seller shall not be liable for Buyer's or Buyer's customer's mishandling or misuse of the Goods. At Seller's request, Buyer will send, at Buyer's sole expense, any allegedly defective Goods to Seller's plant.

IN NO EVENT, SHALL SELLER BE LIABLE FOR ANY SPECIAL, CONSEQUENTIAL, INCIDENTAL OR PUNITIVE DAMAGES, INCLUDING BUT NOT LIMITED TO, LOSS OF PROFIT OR REVENUES, LOSS OF USE OF THE PRODUCTS OR ANY ASSOCIATED EQUIPMENT, DAMAGE TO ASSOCIATED EQUIPMENT OR PROPERTY, COST OF CAPITAL, COST OF SUBSTITUTE

PRODUCTS, FACILITIES OR SERVICES, DOWN TIME COSTS, OR CLAIMS OF BUYER'S CUSTOMER FOR SUCH DAMAGE, EVEN IF THE LOSS OR DAMAGE IS CAUSED BY ITS OWN NEGLIGENCE OR FAULT.

SELLER'S TOTAL AND AGGREGATE LIABILITY FOR ANY CLAIM OF ANY KIND ARISING OUT OF OR RELATED TO THESE TERMS SHALL BE LIMITED TO THE PURCHASE PRICE PAID TO SELLER UNDER BUYER'S ORDER AND BUYER AGREES TO INDEMNIFY SELLER FOR ANY EXCESS AMOUNTS. TO THE EXTENT THAT THIS LIMITATION OF LIABILITY CONFLICTS WITH ANY OTHER PROVISION(S) HEREOF, SUCH PROVISION(S) WILL BE REGARDED AS AMENDED TO WHATEVER EXTENT REQUIRED TO MAKE SUCH PROVISION(S) CONSISTENT WITH THIS PROVISION.

TAXES. Any sales, excise, personal property or similar taxes, export charges, fees or other levies, taxes or surcharges now or hereafter imposed in connection with the production, sale, delivery, use or proceeds of the Goods (except for taxes on Seller's net income) shall be payable by Buyer, and if such taxes or fees are paid or are required to be paid by Seller, the amount thereof shall be added to and become part of the price payable by Buyer hereunder, unless Buyer provides Seller with a valid tax exemption certificate.

SEVERABILITY. If any provision of this agreement is unenforceable or invalid, this Agreement shall be interpreted and enforced to the greatest extent possible as if the unenforceable provision or portion had never been a part hereof.

ASSIGNMENT. These Terms shall be binding upon and shall inure to the benefit of the successors and assigns of Buyer and Seller provided, however, that Buyer may not assign or transfer this contract, in whole or in part, except upon the prior written consent of Seller.

GOVERNING LAW. These Terms and the purchase of the Goods shall be construed in accordance with and governed by the laws of the State of Indiana with regard to its conflict of law provisions.

ENTIRE AGREEMENT. The Terms set forth herein, along with the invoice and Limited Warranty

incorporated which are herein by reference, constitute the entire agreement between the parties with respect to the subject matter hereof and supersede any prior representations or agreements, oral or written, and all other communications between the parties relating to the subject matter hereof. There are no understandings or agreements between Buyer and Seller relative hereto which are not fully expressed herein, and no change made herein shall be valid unless it is made in writing and signed by both parties.

DISPUTES. Buyer and Seller shall endeavor in good faith to negotiate an amicable resolution to any dispute or claim arising from or relating to the order, sale, manufacture and/or delivery of the Goods. In the event such negotiations are not successful, Buyer and Seller agree that any and all remaining disputes shall be submitted to binding arbitration for resolution, pursuant to the Federal Arbitration Act (9 U.S.C. § 1, *et seq.*) and in accordance with the then-current Expedited Commercial Arbitration Rules under the American Arbitration Association ("AAA"), except to the extent those rules conflict with the Terms. If such a conflict arises, the Terms shall prevail. Each party shall bear equally the costs of the arbitration.

The venue of any arbitration will be in Fort Wayne, Indiana unless otherwise agreed to by the parties in writing. The arbitration will be conducted by a single arbitrator, selected pursuant to the rules of the AAA, though the arbitrator does not necessarily need to be retained or appointed through AAA. Any arbitration award must state the arbitrator's material findings of fact and conclusions of law. A party may seek preliminary injunctive or other equitable relief from any court of competent jurisdiction to preserve the status quo pending appointment of an arbitrator. A prevailing party in litigation to require arbitration or to obtain preliminary relief pending appointment of an arbitrator or in litigation to confirm or enforce an arbitration award will be entitled to recover its reasonable attorney's fees and costs. Any suit to require arbitration under this agreement, or to enforce judgment upon an arbitration award, shall be brought in the state courts of the State of Indiana.



Designation: D1998 – 15

Standard Specifications for

Polyethylene Upright Storage Tanks



Standard Specification for Polyethylene Upright Storage Tanks¹

This standard is issued under the fixed designation D1998; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope*

1.1 This specification covers flat-bottom, upright, cylindrical tanks molded in one-piece seamless construction by rotational molding. The tanks are molded from polyethylene for above ground, vertical installation and are capable of containing aggressive chemicals at atmospheric pressure. Included are requirements for materials, properties, design, construction, dimensions, tolerances, workmanship and appearance. Tank capacities are from 1900 L (500 gal) up.

1.2 This specification covers the design of stationery vessels for use at atmospheric pressure intended for use with liquids heated below their flash points and continuous service temperatures below 66°C (150°F) for Type I tanks and below 60°C (140°F) for Type II tanks.

1.2.1 NFPA Standards 30 and NFPA 31 shall be consulted for installations that are subject to the requirements of these standards.

1.3 For service requirements beyond the scope of this specification (1.2), such as externally imposed mechanical forces, internal pressure or vacuum, higher temperature service, etc., other relevant sources of standards, for example, local and state building codes, NFPA, ASME, ARM, etc., shall be consulted.

1.4 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

NOTE 1—ISO 13341:2005+A1:2011 and ISO 13575:2012 are similar, but not equivalent to this standard.

1.5 The following precautionary caveat pertains only to the test methods portion, Section 11, of this specification: *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

¹ This specification is under the jurisdiction of ASTM Committee D20 on Plastics and is the direct responsibility of Subcommittee D20.19 on Film, Sheeting, and Molded Products (Section D20.15.01).

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2. Referenced Documents

2.1 ASTM Standards:²

D618 Practice for Conditioning Plastics for Testing

D883 Terminology Relating to Plastics

D1693 Test Method for Environmental Stress-Cracking of Ethylene Plastics

D2837 Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products

D3892 Practice for Packaging/Packing of Plastics

D4703 Practice for Compression Molding Thermoplastic Materials into Test Specimens, Plaques, or Sheets

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

F412 Terminology Relating to Plastic Piping Systems

2.2 OSHA Standard:

29 CFR 1910.106 Occupational Safety and Health Administration, Flammable and Combustible Liquids³

2.3 ANSI Standard:

B-16.5 Pipe Flanges and Flanged Fittings⁴

2.4 NFPA Standards:

30 Flammable and Combustible Liquid Code⁵

31 Installation of Oil Burning Equipment⁵

2.5 ISO Standards:⁶

ISO 13341:2005+A1:2011 Static Thermoplastic Tanks for the Above Ground Storage of Chemicals – Blow Moulded or Rotationally Moulded Polyethylene Tanks – Requirements and Test Methods

ISO 13575:2012 Static Thermoplastic Tanks for Above Ground Storage of Domestic Heating Oils, Kerosene and Diesel Fuels – Blow Moulded and Rotationally Moulded Polyethylene Tanks and Rotationally Moulded Tanks

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ Available from Occupational Safety and Health Administration (OSHA), 200 Constitution Ave., NW, Washington, DC 20210.

⁴ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.

⁵ Available from National Fire Protection Association (NFPA), 1 Batterymarch Park, Quincy, MA 02269-9101.

⁶ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

*A Summary of Changes section appears at the end of this standard

Made of Anionically Polymerized Polyamide 6 – Requirements and Test Methods

3. Terminology

3.1 *Definitions*—Definitions are in accordance with Terminologies **D883** and **F412** and the Association of Rotational Molders (ARM) Glossary of Terms,⁷ unless otherwise indicated.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *bottom knuckle radius, n*—the outside corner radius.

3.2.2 *impact failure, n*—any crack in the test specimen resulting from the impact and visible in normal room lighting to a person with normal eyesight.

3.2.3 *rotational molding, n*—a three-stage commercial process consisting of loading the mold with powdered resin, fusing the resin by heating while rotating the mold about more than one axis, and cooling and removing the molded article.

3.2.4 *service factor, n*—a number less than 1.0 (that takes into consideration all the variables and degrees of safety involved in a polyethylene storage tank installation) that is multiplied by the hydrostatic design basis to give the design hoop stress.

4. Classification

4.1 Tanks meeting this specification are classified according to type as follows, and it is the responsibility of the purchaser to specify Type I or Type II:

4.1.1 Type I—Tanks molded from cross-linkable polyethylene.

4.1.2 Type II—Tanks molded from non-cross-linkable polyethylene.

5. Materials

5.1 This specification is based upon the use of 100 % virgin polyethylene intended for the rotational molding process. Any use of regrind, recycled or reprocessed materials, or combinations of such materials, shall not rely upon the performance data of their original constituents, but must meet the requirements of this specification in its own right.

5.1.1 The polyethylene shall have a stress-cracking resistance of 500 h minimum F50 in accordance with Test Method **D1693**, Condition A, full-strength stress-cracking agent. The test specimens shall be compression molded or rotational molded. If compression molded, Procedure C of Annex A1 of Practice **D4703** shall be followed for both types of polyethylene with a minimum platen temperature of 177°C (350°F) for Type II materials. The temperature for Type I (cross-linkable) polyethylene shall be 197°C (390°F) and the platen shall be kept closed under full pressure for five minutes at the specified temperature in order to bring about the crosslinking reaction. If the test specimens are rotational molded, the conditions for rotational molding shall be similar to the conditions used for molding a tank from this polyethylene.

NOTE 2—The stress-cracking test is not used as an indicator of general

⁷ Available from Association of Rotational Molders, 800 Roosevelt Road, C-312, Glen Ellyn, IL 60137, tel: 630-942-6589.

chemical resistance of a polyethylene. Refer to the polyethylene supplier's or molder's chemical-resistance chart for information on the resistance of the polyethylene to specific chemicals or products, or test specific products or chemicals prior to use.

5.2 All tanks used for outdoor installation shall contain an ultraviolet stabilizer at a level adequate to give protection for the intended service life of the tanks. This stabilizer shall be compounded into the polyethylene.

5.3 Any pigments added must be compatible with the polyethylene and shall not exceed 0.5 % dry blended, and 2 % compounded in, of the total weight.

NOTE 3—The use of dry-blended pigments may have an effect on physical properties, that is, impact strength.

5.4 Each resin used in designing tanks covered by this specification shall have hydrostatic-hoop-stress data available.

6. Design Requirements for Both Type I and Type II Tanks

6.1 *Cylinder Shell (Unsupported Portion of Tanks)*—The minimum required wall thickness of the cylindrical shell at any fluid level (F) shall be determined by the following equations, but shall not be less than 4.7 mm (0.187 in.) thick. The tolerance indicated in **9.1.2** applies to these dimensions.

$$HL = HM - F \quad (1)$$

where:

HL = head at level F, m (ft),

HM = maximum fluid head, m (ft), and

F = any fluid level, m (ft).

For illustration, see **Fig. 1**.

$$T = P \times OD/2 \ SD \quad (2)$$

where:

T = wall thickness, mm (in.),

P = pressure, MPa (0.0098 MPa/m-H₂O × SG × HL (m)), or psi (0.433 psi/ft-H₂O × SG × HL (ft)),

SG = specific gravity of fluid,

HL = head at level F, m (ft),

OD = outside diameter of tank, mm (in.), and

SD = hydrostatic design stress, MPa (psi).

6.1.1 The hydrostatic design stress that is used to determine the minimum wall thickness at any fluid level must be based on hoop stress data for the resin. The hoop stress data, obtained in accordance with the procedures of Test Method **D2837**, provide a hydrostatic-design-basis for the resin. The hydrostatic-design-basis must be reduced by a service factor to determine the actual hydrostatic design stress. The maximum service factor shall be 0.5 for wall thicknesses less than 9.5 mm (0.375 in.). For thicknesses equal to or greater than 9.5 mm (0.375 in.), the maximum service factor shall be 0.475. For example, if the hydrostatic-design-basis for the resin is 8.7 MPa (1260 psi), the hydrostatic design stress for a tank with wall thickness greater than 9.5 mm (0.375 in.) is 0.475 × 8.7 = 4.1 MPa (or 0.475 × 1260 = 600 psi).

6.1.2 Tank hoop stresses shall be derated for service above 23°C (73.4°F).

6.2 *Cylinder Shell (Externally Supported Tanks)*—The minimum required wall thickness for the cylinder straight shell

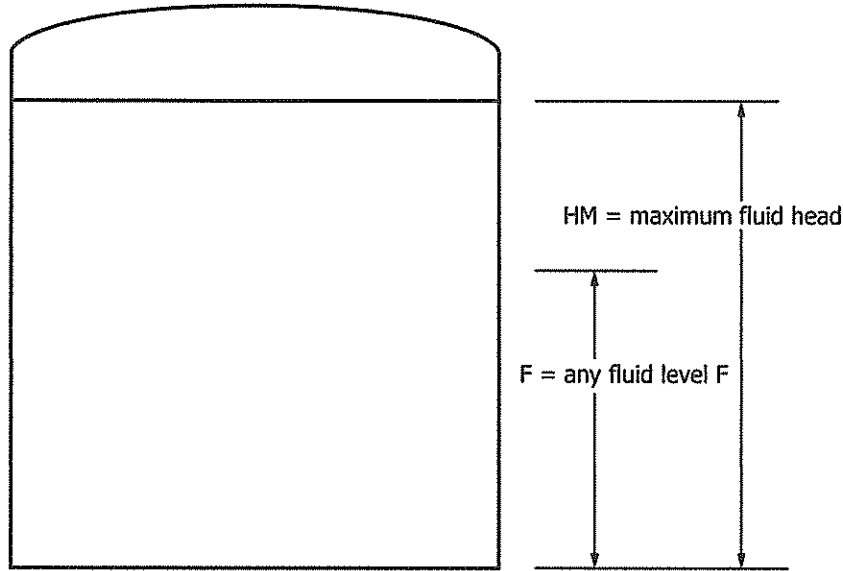


FIG. 1 Illustration of Cylinder Shell

must be sufficient to support its own weight in an upright position without any external support, but shall not be less than 4.7 mm (0.187 in.) thick. The tolerance indicated in 9.1.2 applies to these dimensions.

6.3 *Top Head*—Must be integrally molded with the cylinder shell. The minimum thickness of the top head shall be equal to the top of the straight wall.

6.4 *Bottom Head*—Must be integrally molded with the cylinder shell. The minimum thickness for a full-supported flat-bottom head shall be 4.7 mm (0.187 in.). The radius of the bottom knuckle of a flat-bottom tank shall not be less than 25.4 mm (1 in.) for tanks with a diameter less than 1.8 m (6 ft) and 38.1 mm (1.5 in.) for a diameter greater than 1.8 m (6 ft). The minimum thickness of the radius shall not be less than the maximum thickness of the cylinder wall.

6.5 *Bottom Knuckle Radius*—The minimum thickness of the outer radius shall not be less than the maximum thickness of the cylinder wall.

NOTE 4—Since it is difficult to control the absolute radius dimension and, in the absence of any FEA or scientific analysis, it is recommended that the outside radius of the bottom knuckle of a flat-bottom tank not be less than 25.4 mm (1 in.) for tanks with a diameter less than 1.8 m (6 ft) and 38.1 mm (1.5 in.) for a diameter greater than 1.8 (6 ft).

6.6 *Open-Top Tanks*—The top edge of open tanks shall be reinforced by design to maintain its shape after installation.

7. Fittings

7.1 Fabricated nozzles, gaskets, and other fitting accessories must be chemically compatible with the materials to be handled in the tanks.

7.2 Openings that are cut in tanks to install fittings must not have sharp corners. Holes shall have minimum clearance to insure best performance of fittings.

7.3 The size, location, and specification, and so forth, for manways and fittings shall be agreed upon between the purchaser and the manufacturer.

7.4 The vents must comply with OSHA 1910.106 (F) (iii) (2) (IV) (9) normal venting for atmospheric tanks, or other accepted standard, or shall be at least as large as the filling or withdrawal connection, whichever is larger but in no case less than 25.4 mm (1 in.) nominal inside diameter.

7.5 Fittings installed in tanks shall be of appropriate strength to meet manufacturer and purchaser specifications.

7.6 Bolts securing mechanical fittings must be manufactured of materials compatible with tank contents.

7.7 Provisions shall be made to attach hold-down devices to the tanks for outdoor service.

7.8 For all flanged connectors, the flange drilling and bolting shall be in accordance with ANSI/ASME B-16.5 for 150 psi (1 MPa) pressure class straddling the principal centerline of the vessel.

8. Performance Requirements

8.1 The following performance requirements shall be met by Type I and Type II tanks:

8.1.1 *Low-Temperature Impact*—Low-temperature impact shall be determined using the test method described in 11.3. The requirements for Type I and Type II tanks are as follows:

Wall thickness, mm (in.)	Impact energy, min. J (ft-lb)
4.7 mm (0.187 in.) to and including 6.4 mm (0.25 in.)	122.0 (90)
6.6 mm (0.26 in.) to and including 12.9 mm (0.50 in.)	135.5 (100)
12.9 mm (0.51 in.) to and including 19.3 mm (0.75 in.)	203.2 (150)
19.3 mm (0.76 in.) to and including 25.4 mm (1.00 in.)	271.0 (200)
Greater than 25.4 mm (1.00 in.)	271.0 (200)

8.1.2 *Percent Gel, for Type I Tanks Only*—The percent gel level shall be determined using the test method described in 11.4. The percent gel level for Type I tanks on the inside 3.2 mm (0.125 in.) of the wall shall be a minimum of 60 %.

9. Dimensions and Tolerances

9.1 *General*—All dimensions will be taken with the tank in the vertical position, unfilled. Tank dimensions will represent the exterior measurements.

9.1.1 *Outside Diameter*—The tolerance for the outside diameter, including out of roundness, shall be $\pm 3\%$.

9.1.2 *Shell Wall and Head Thickness*—The tolerance for average thickness at each elevation shall be -10% of the design thickness on the low side and shall be unlimited on the high side. The tolerance for individual audit readings shall be limited to -20% of the design thickness. The total amount of surface area on the low side of the tolerance shall not exceed 10% of the total surface area.

9.1.3 *Placement of Fittings*—The tolerance for fitting placements shall be 12.7 mm (0.5 in.) in elevation and 2° radial at ambient temperature.

10. Workmanship

10.1 Type I finished tank walls shall be free, as commercially practicable, of visual defects such as foreign inclusions, air bubbles, pinholes, pimples, crazing, cracking and delaminations that will impair the serviceability of the vessel. Fine bubbles are acceptable with Type II tanks to the degree to which they do not interfere with proper fusion of the resin melt.

10.2 The acceptable finish shall be predetermined by agreement between the molder and the buyer.

11. Test Methods

11.1 *Test Specimens*—Test specimens shall be taken from an area that is representative of the bottom side wall. If no representative sample cut-out area in the tank is available, test specimens shall be molded in a test mold. In either case, prior testing shall verify that the tank wall and the test specimen have equal impact resistance.

11.1.1 The test mold shall be constructed of the same type material and have the same wall thickness as the tank mold. The thickness of the specimen from a test mold shall be the same as the thickness of the bottom sidewall within the tolerances as defined in 9.1.2. The test mold shall be molded with each tank.

11.2 *Conditioning*—If requested, test specimens shall be conditioned at $23 \pm 2^\circ\text{C}$ ($73.4 \pm 3.6^\circ\text{F}$) and $50 \pm 10\%$ relative humidity for not less than 40 h prior to testing in accordance with Procedure A of Practice D618.

11.3 Low-Temperature Impact Test:

11.3.1 *Scope*—This test method is for the determination of the impact property of rotational-molded polyethylene tanks at low temperature. The test method is used on tanks molded from both crosslinked and non-crosslinked polyethylenes.

11.3.2 *Summary of Test Method*—Test specimens are cut from available areas on the tank and conditioned at -29°C (-20°F) for a specified time. A suitable type of test apparatus

is shown in Fig. 2 and Fig. 3. The specimens are placed, inside-surface down, in the sample holder and immediately impacted from a prescribed height with a dart of specified weight and tip radius. The specimen is observed for failure on both surfaces. The test prescribes a minimum impact value that the specimen must pass.

11.3.3 Significance and Use:

11.3.3.1 The dart impact test at -29°C (-20°F) produces a value that is used as an indication of the quality of the tank. If the molding conditions were inadequate and a homogenous melt was not obtained, the impact will likely be low. Higher impact values are obtained with ideal molding conditions indicating that a quality part with good impact resistance has been molded.

11.3.3.2 The impact test gives a true indication of how well the tank was molded.

11.3.4 Procedure:

11.3.4.1 Cut specimens to loosely fit the 127 mm by 127 mm (5 in. by 5 in.) sample holder (See Fig. 3). Specimens shall be approximately 127 mm by 127 mm (5 in. by 5 in.), or the maximum size available. In those tanks where specimens of the above size are not available, the supplier must show correlation data between the smaller size and the recommended size.

11.3.4.2 Cool bath to -29°C (-20°F) by immersing small quantities of dry ice in isopropyl alcohol used as the bath medium or chill the specimens in a freezer if available. (**Warning**—Care shall be exercised as the dry ice will agitate the solution violently.)

Note 5—An alternative temperature for impact is -40°C (-40°F) or, in some cases, the service temperature. In applications that have a service

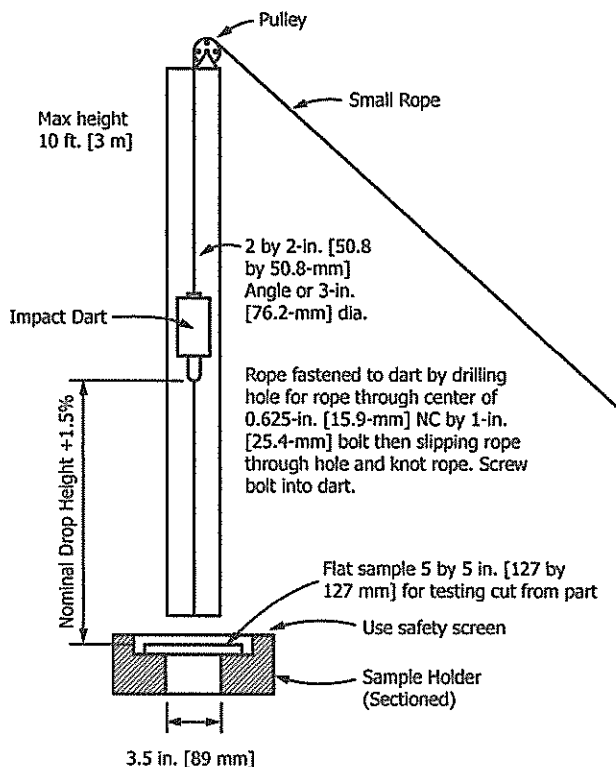


FIG. 2 Dart Drop Impact Test Apparatus

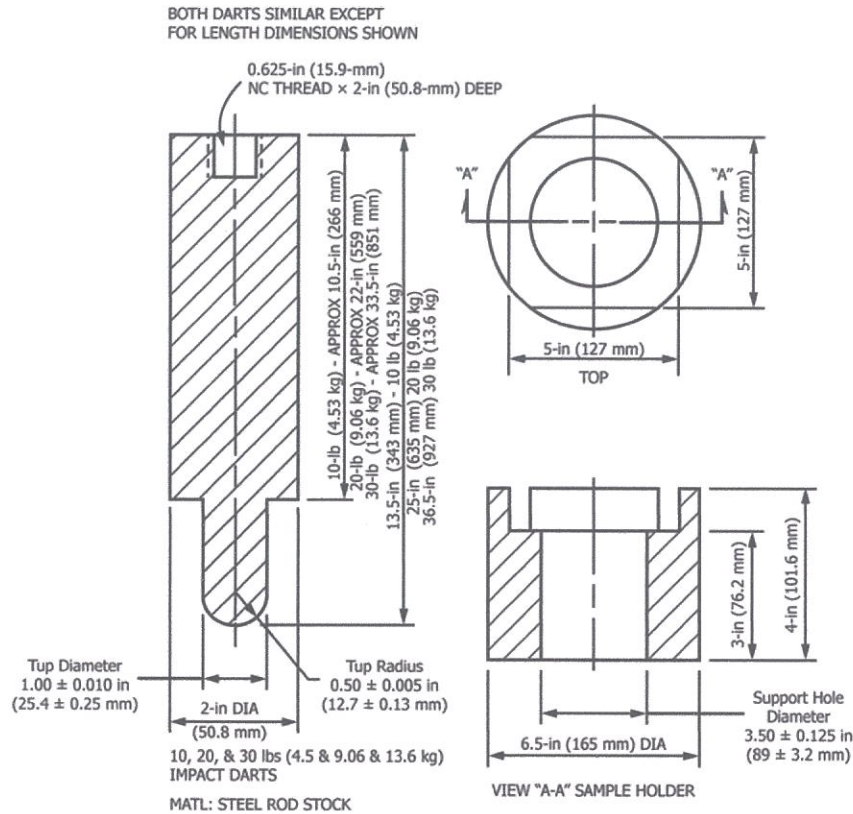


FIG. 3 Dart Drop Impact Test Apparatus

temperature between -29°C (-20°F) and -40°C (-40°F), either the service temperature or -40°C (-40°F) shall be used. For applications that have a service temperature below -40°C (-40°F), the impact temperature shall be at or below the service temperature.

11.3.4.3 Immerse the specimens in the bath for a minimum of 30 min while maintaining the bath temperature. More immersion time is required for specimens greater than 6.4 mm (0.25 in.) thick or for specimens chilled in air instead of alcohol. A minimum of two hours is required for air chilled specimens.

11.3.4.4 Remove specimens from the freezer or bath one at a time. Within five seconds, release the dart and impact each specimen on the outer surface. Use the impact energy specified in 8.1.1 as calculated by multiplying the nominal dart weight (known to $\pm 1\%$) by the drop height (Fig. 2). The specimen shall not fail at the specified impact energy (see 3.2.2 for the definition of failure). Whenever possible, choose a dart weight that permits the drop height to be between 0.8 and 2.3 m (2.5 and 7.5 ft) in order to minimize the effect of velocity on the result of the test.

NOTE 6—Ductile failures indicate proper molding for Type I and Type II tanks, while cracking or shattering indicates improperly molded specimens. The test apparatus is shown in Fig. 2 and Fig. 3.

11.3.5 Report the Following Information:

- 11.3.5.1 Identification of the tank,
 - 11.3.5.2 Date of test,
 - 11.3.5.3 Impact energy used for the test in J (ft-lb), and
 - 11.3.5.4 Pass or fail.
- 11.3.6 Precision and Bias:

11.3.6.1 Table 1 is based on a round robin conducted in 1991 in accordance with Practice E691, involving two materials tested by seven laboratories and two materials tested by four laboratories. For each material, all of the samples were molded at one source. Each laboratory tested 20 specimens of a material on two different days under the same conditions.

11.3.6.2 Table 2 is based on a round robin conducted in 1988 in accordance with Practice E691, involving two materials tested by seven laboratories. For each material, all the samples were prepared at one source, but the individual specimens were prepared at the laboratories that tested them. Each test result was the average of 20 individual determinations. Each laboratory obtained two test results for each material. (Warning—The following explanations of r and R are only intended to present a meaningful way of considering the approximate precision of this test method. The data in Table 1 and Table 2 shall not be rigorously applied to acceptance or

TABLE 1 Precision Summary—Impact Strength at -29°C (-20°F)

Material	Average	S_r^A	S_R^B	V_r^C	V_R^C	r^D	R^D
6	44.4	9.1	11.7	20.5	26.4	25.6	32.8
3	119.8	7.3	11.4	6.1	9.5	20.4	31.9
4	119.8	3.1	15.4	2.6	12.9	8.6	63.1
5	121.6	6.6	26.3	3.8	20.0	12.8	67.9

^A S_r is the within laboratory repeatability.

^B S_R is the between laboratory reproducibility.

^C V_r and V_R are the coefficients of variation (standard deviation expressed as a percent of the average).

^D r and R are the 95% limits for a single sample for repeatability and reproducibility respectively.

TABLE 2 Precision Summary—Impact Strength at -40°C (-40°F)

Material	Average	S_r^A	S_R^B	V_r^C	V_R^C	r^D	R^D
2	155.5714	5.1686	16.3623	3.3	10.5	14.472045	8.146
1	167.6429	6.2393	13.6268	3.7	8.1	17.470038	15.51
Average:				3.5	9.3		

^A S_r is the within laboratory repeatability.

^B S_R is the between laboratory reproducibility.

^C V_r and V_R are the coefficients of variation (standard deviation expressed as a percent of the average).

^D r and R are the 95 % limits for a single sample for repeatability and reproducibility respectively.

rejection of material, as those data are specific to the round robin and are not necessarily representative of other lots, conditions, materials, or laboratories. Users of this test method shall apply the principles outlined in Practice E691 to generate data specific to their laboratory and materials, or between specific laboratories. The principles shown below would then be valid for such data.)

11.3.6.3 *Concept of r and R* —If S_r and S_R have been calculated from a large-enough body of data, and for test results that were averages from testing 20 specimens:

(1) *Repeatability, r* —In comparing two test results for the same material, obtained by the same operator using the same equipment on the same day, the two test results shall be judged not equivalent if they differ by more than the r value for that material.

(2) *Reproducibility, R* —In comparing two test results for the same material, obtained by different operators using different equipment on different days, the two test results shall be judged not equivalent if they differ by more than the R value for the material.

(3) Any judgment in accordance with (1) or (2) would have an approximate 95 % (0.95) probability of being correct.

11.3.6.4 There are no recognized standards by which to estimate the bias of this test method.

11.4 *O-Xylene-Insoluble Fraction (Gel Test):*

11.4.1 *Scope*—This test method is for determination of the ortho-xylene insoluble fraction (gel) of crosslinked polyethylene. (Type I tanks)

11.4.2 *Summary of Test Method*—A weighed specimen of the crosslinked polyethylene sample is placed in a screen container and the total weight is taken. The container is submerged in boiling o-xylene overnight, which dissolves the uncross-linked portion of the sample. The container with the specimen is dried in an oven and weighed. The percentage gel content is calculated from the weight loss and the original specimen weight.

11.4.3 *Significance of Test*—The o-xylene insoluble portion (gel) of crosslinked polyethylene is an indication of the amount of crosslinking in the polyethylene. The gel is not a direct measure of the extent of the crosslinking network, but indirectly serves to provide a good measure of the crosslinking. It is, therefore, valuable as a test for the quality of the crosslinked polyethylene part.

11.4.4 *Apparatus:*⁸

⁸ Suitable apparatus is available from many laboratory supply firms.

11.4.4.1 *Extraction Apparatus:*

- (1) Resin Kettle 2-L
- (2) Heating Mantle 2-L
- (3) Clamp, Resin Kettle
- (4) Condenser, with ground taper joint to fit hole in resin kettle lid
- (5) Variable Transformer
- (6) Stand with clamp to support the kettle and condenser
- (7) Metal pan, for setting the apparatus in to retain the o-xylene in the event the kettle breaks

11.4.4.2 *Analytical Balance*, that weighs to four decimal places.

11.4.4.3 *Stainless Steel Screen*, 100-mesh.

11.4.4.4 *Muffle Furnace*.

11.4.4.5 *Forced-Draft Oven*.

11.4.4.6 *Reagents:*

- (1) O-xylene, technical grade
- (2) Cyanox 2246, antioxidant⁹ or equivalent (2,2'-Methylenebis(4-methyl-6-tert-butylphenol))

11.4.5 *Hazards:*

11.4.5.1 Care shall be exercised in handling o-xylene. The Material Safety Data Sheet shall be consulted prior to its use. O-xylene is listed in Subpart Z—Toxic and Hazardous Substances of 29 CFR Ch. VII (7-1-88 Edition). Other applicable EPA and government standards shall also be consulted.

11.4.6 *Test Specimens:*

11.4.6.1 The test specimen shall be from the 3.2 mm (0.125 in.) thickness of the interior wall of Type I tanks. It shall be cleanly cut so there are no frayed edges or corners.

11.4.6.2 The specimen shall be taken from a manway, drain opening or similar area that is normally removed from the tank before use.

11.4.7 *Procedure:*

11.4.7.1 Weigh a 0.3 g specimen cut from the molded part to ± 0.0002 g. Record the specimen weight as W_1 .

11.4.7.2 Cut a 35 by 76 mm (1.5 by 3 in.) piece of 100-mesh stainless steel screen for each specimen. Clean the screen with o-xylene, rinse with acetone, and dry in a stream of air.

11.4.7.3 Fold the screen to form a 38 by 38 mm (1.5 by 1.5 in.) square. Make a fold about 6.4 mm ($\frac{1}{4}$ in.) along each of the two open edges to form a pouch, and staple the folds.

11.4.7.4 Place the specimen into the screen pouch, fold the remaining edge, staple the fold and identify each screen with a metal tag. Do not squeeze the pouch sides together. Leave space for the specimen to swell. Weigh the sample plus screen to ± 0.0002 g and record this weight as W_2 .

Note 7—An alternative specimen holder is a reusable cage made from 100-mesh stainless steel screen as shown in Fig. 4 and Fig. 5. A size of 15.2 mm by 35.6 mm (0.6 in. by 1.4 in.) has been found satisfactory for the cage. The cages must be cleaned after each test by burning off remaining polyethylene at 427°C (800°F) for approximately 30 min in a muffle furnace.

⁹ The sole source of supply of this reagent known to the committee at this time is Cytec Industries, Inc., Five Garret Mountain Plaza, West Paterson, NJ 07424. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,¹ which you may attend.

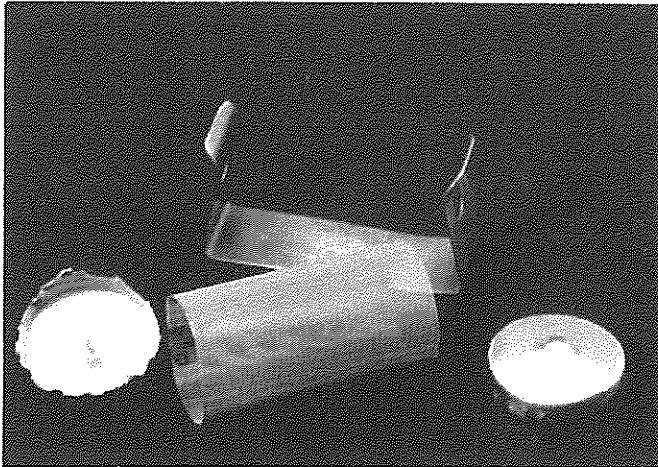


FIG. 4 Gel Cage

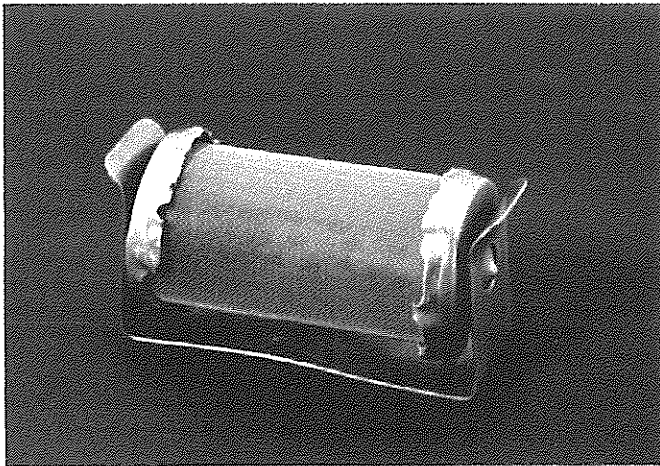


FIG. 5 Gel Cage

11.4.7.5 Place 1500 mL of o-xylene and 10 g of Cyanox 2246 or equivalent antioxidant in the resin kettle and heat to reflux.

NOTE 8—The antioxidant is added to prevent further crosslinking of the polymer during the extraction.

11.4.7.6 Suspend the sample screen in the refluxing solvent for 16 h. An overnight run is convenient.

NOTE 9—Do not test more than eight specimens per run to avoid saturating the solvent with dissolved polyethylene.

11.4.7.7 Remove the sample screen while hot and dry to constant weight (W_3) in a forced-draft oven at 170°C (338°F) for about two h.

11.4.8 Calculation:

$$\text{Gel Weight, \%} = \frac{[W_1 - (W_2 - W_3)] \times 100}{W_1} \quad (3)$$

where:

- W_1 = weight of sample, g,
- W_2 = weight of sample plus screen, g, and
- W_3 = weight of sample plus screen after extraction, g.

11.4.9 Report the Following Information:

- 11.4.9.1 Identification of the tank,
- 11.4.9.2 Date of the test, and
- 11.4.9.3 Percentage of gel determined in 11.4.8.

11.4.10 Precision and Bias:

11.4.10.1 Table 3 is based on a round robin conducted in 1989 in accordance with Practice E691, involving eight materials tested by seven laboratories. For each material, all the samples were prepared at one source, but the individual specimens were prepared at the laboratories that tested them. Each test result was the average of two individual determinations. Each laboratory obtained three test results for each material. (Warning—The following explanations of r and R are only intended to present a meaningful way of considering the approximate precision of this test method. The data in Table 3 shall not be rigorously applied to acceptance or rejection of material, as those data are specific to the round robin and are not necessarily representative of other lots, conditions, materials, or laboratories. Users of this test method shall apply the principles outlined in Practice E691 to generate data specific to their laboratory and materials, or between specific laboratories. The principles shown below would then be valid for such data.)

11.4.10.2 Concept of r and R —If S_r and S_R have been calculated from a large enough body of data, and for test results that were averages from testing two specimens:

(1) Repeatability, r —In comparing two test results for the same material, obtained by the same operator using the same equipment on the same day, the two test results shall be judged not equivalent if they differ by more than the r value for that material.

TABLE 3 Precision Summary—O-Xylene Insoluble Fraction (Gel)

Material ^A	Average	S_r ^B	S_R ^C	V_r ^D	V_R ^D	r^E	R^E
6	79.9605	2.4733	4.1864	3.1	5.2	6.9251	11.7219
5	81.9357	2.1598	3.4861	2.6	4.3	6.0475	9.7612
4	82.1852	1.2954	3.0863	1.6	3.8	3.6271	8.6415
1	84.1072	1.6594	2.9802	2.0	3.5	4.6462	8.3447
7	84.6600	2.0078	2.9978	2.4	3.5	5.6219	8.3938
8	85.4129	1.7201	3.2507	2.0	3.8	4.8164	9.1019
3	91.4138	2.9248	5.1655	3.2	5.7	8.1894	14.4633
2	92.5576	0.9363	1.8244	1.0	2.0	2.6217	5.1083
Average:				2.2	4.0		

^A The thicknesses of the molded samples from which the specimens were taken were as follows:

	in.	mm
6	>3/4	>19
5	>1/2	>13
4	>1/4	>6
1	1/4	6
7	>3/4	>19
8	1/4	6
3	1/2	13
2	1/4	6

The materials were the same for samples (2 and 3), (4, 5 and 6) and (7 and 8). Sample 1 was different from the others.

^B S_r is the within-laboratory repeatability and

^C S_R is the between-laboratory reproducibility

^D V_r and V_R are the coefficients of variation (standard deviation expressed as a percent of the average)

(2) *Reproducibility, R*—In comparing two test results for the same material, obtained by different operators using different equipment on different days, the two test results shall be judged not equivalent if they differ by more than the *R* value for the material.

(3) Any judgment in accordance with (1) or (2) would have an approximate 95 % (0.95) probability of being correct.

11.4.10.3 There are no recognized standards by which to estimate the bias of this test method.

11.5 *Visual Inspection*—The tank shall be visually inspected to determine such qualities as are discussed in the Workmanship Section.

11.6 *Water Test*—Each tank shall be hydrostatically tested by the supplier by filling the tank completely with water. The tank shall also be pre-tested at the time of installation by the user by filling the tank completely with water. Such a test also allows final inspection for proper installation of all fittings.

12. Marking

12.1 The tank shall be marked to identify the producer, date (month and year) of manufacturer, capacity, maximum specific gravity of tank design, serial number and Type I or Type II. The marking shall be permanent.

12.2 The proper caution or warning signs as prescribed by OSHA standard 29 CFR 1910.106 shall be affixed to the tank.

12.3 Tank capacity shall be based on the fluid level used to determine the minimum wall thickness as defined in 6.1.

13. Packing, Packaging and Marking

13.1 All packing, packaging, and marking provisions of Practice D3892 shall apply to this specification.

14. Shipping

14.1 Since there are variations in methods of shipping and handling, the manufacturer's instructions shall be followed in all cases.

14.2 A suitable means shall be provided, if required, at the open end of open-top tanks to keep the loaded tank rigid.

14.3 All fittings and flange faces shall be protected from damage by covering with suitable plywood, hardboard or plastic securely fastened. Tanks shall be positively vented at all times.

14.4 Pipe and tubing, fittings and miscellaneous small parts shall be packaged. Loose items that scratch the interior surface shall not be placed inside the tank during shipment. Additional protection, such as battens, end wrapping, cross bracing, or other interior fastenings shall be used as required to assure such individual equipment pieces are not damaged in transit.

14.5 Upon arrival at the destination, the purchaser shall be responsible for inspection for damage in transit. If damage has occurred, a claim should be filed with the carrier by the purchaser. The supplier shall be notified if the damage is not first repaired by the fabricator prior to the tank being put into service. The purchaser accepts all future responsibility for the effects of the tank failure resulting from damage.

15. Keywords

15.1 polyethylene; tanks; upright

SUMMARY OF CHANGES

Committee D20 has identified the location of selected changes to this standard since the last issue, D1998 - 13, that may impact the use of this standard. (September 15, 2015)

- (1) Revised Section 1.2 to clarify scope.
- (2) Revised Section 1.3 to clarify service conditions outside the scope of this specification
- (3) Added 3.2.2, Definition of knuckle radius
- (4) Expanded 6.1 to clarify calculation of minimum wall thickness

- (5) Corrected drawing describing Equation (1).
- (6) Added 6.5 and discussion as a separate recommendation for bottom knuckle radius.

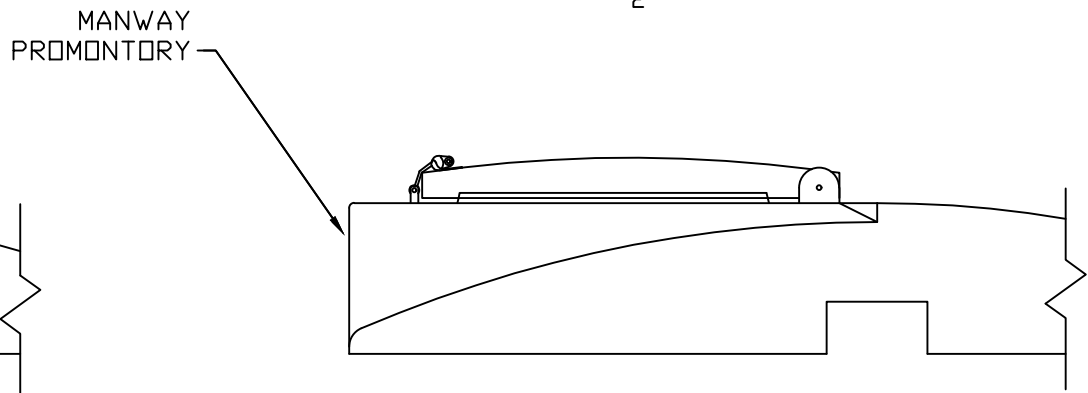
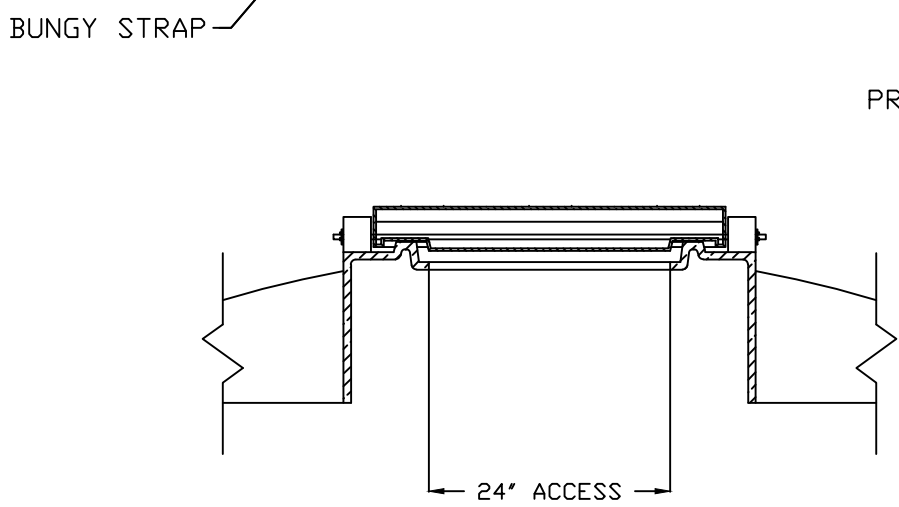
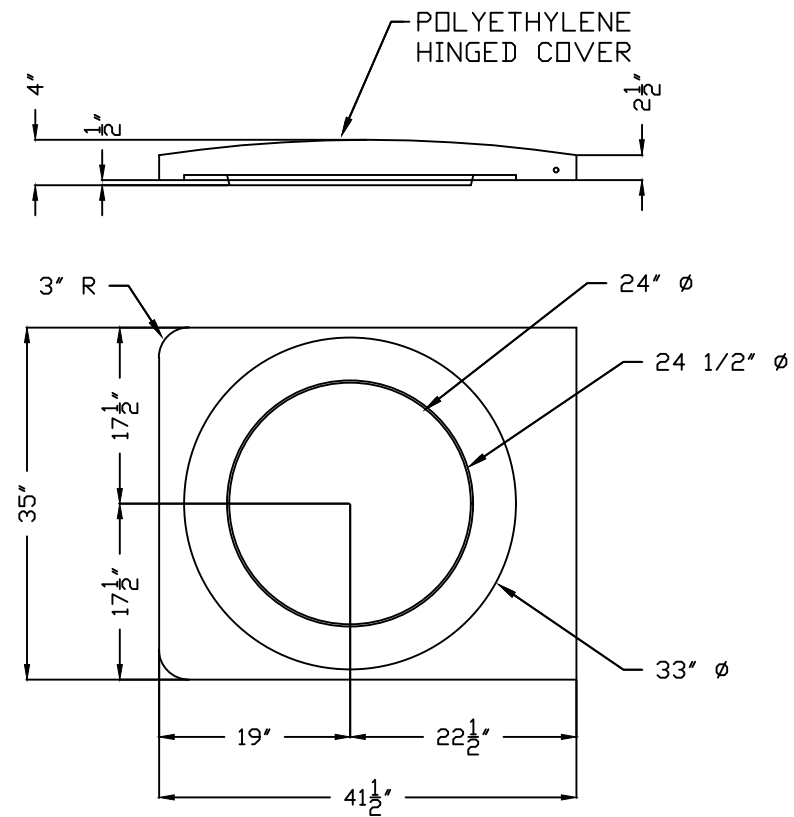
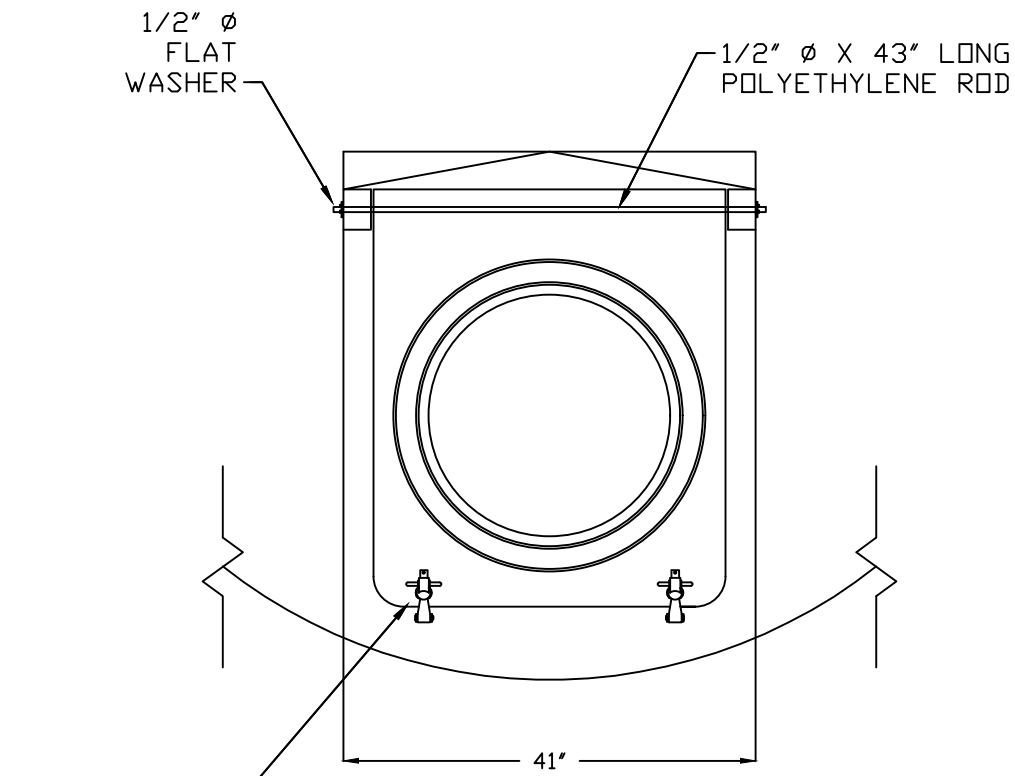
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APPENDIX A

24" Hinged Manway Cover	Figure MK24
Flange Fitting	Figure FF001
Flange Adapter	Figure FA001
Flange Fitting w/ Drop Tube and Support Bracket	Figure FF-DT
Self-Align Dome Fitting	Figure SADF
Self-Align Dome Fitting w/ Anti-Foam Elbow	Figure SADF-AFE
Fill Line Assembly w/ Self Align Fitting and Anti-Foam Elbow	Figure SA-FL-AFE
U-Vent Assembly	Figure BH-U-VENT
Titanium Single Wall Double Male	Figure SWDM
Double Male Fitting w/ Siphon Drain	Figure SWDM-SD
Double Male Fitting w/ Siphon Drain and Flange Adapter	Figure SWDM-FA-SD
Nameplate	Figure NAMEPLATE
Heat Tracing Controller	Page 1-5
Heat Tracing Pads	Page 1-2
Foam Spray Insulation	Page 1-2
Grey Mastic Coating	Page 1-4

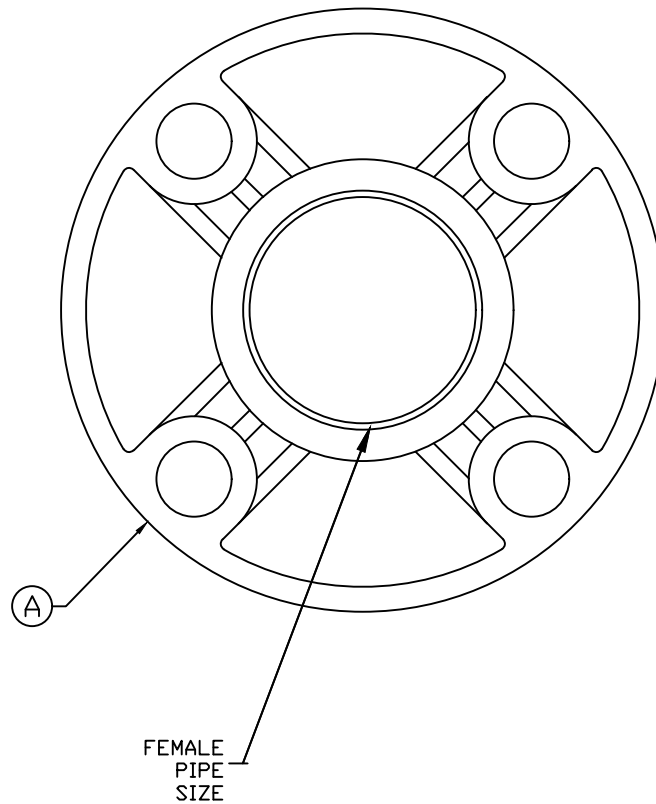
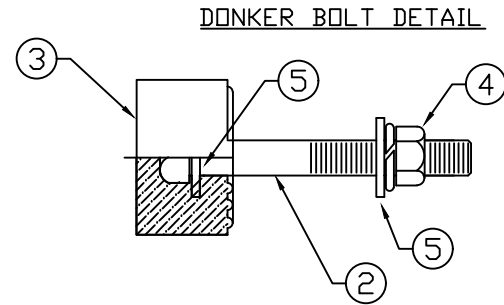
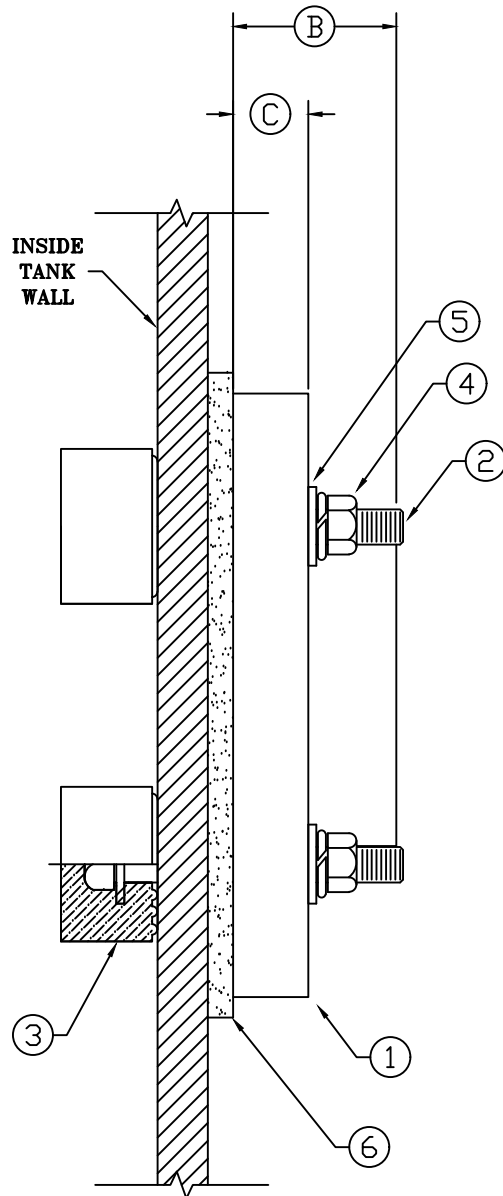


A	UPDATED TITLE BLOCK	6/29/09 MG
REV	REVISION DESCRIPTION	REV DATE
		300 N TAYLOR ROAD GARRETT, IN 46738 PHONE: (260) 357-3181 FAX: (260) 357-3738
TITLE 24" TOP MANWAY WITH HINGED COVER		DRAWN BY: D. CRAGER DRAWN DATE: 1/02/95
DWG NUMBER: MK24		REV A

NOTES:

1. A.N.S.I.-B 150LBS. FLANGE
2. 1/2"-13UNC-2B X 3" HEX HD BOLT
3. 2" ϕ ENCAPSULATED BOLT HEAD
4. 1/2"-13UNC-2B HEX NUT
5. 1/2" WASHERS
6. GASKET

FPT PIPE SIZE	DIM. A	DIM. B	DIM. C	# OF BOLTS	DIM. OF BOLT HOLE
2"	6"	1 1/8"	7/8"	4	4 3/4" ϕ



MATERIALS:

FLANGE FITTINGS

PVC

GASKET MATERIAL:

E.P.D.M.

MOLDED ENCAPCILATED HEAD MATERIAL

E.P.D.M

BOLTS, NUTS AND WASHERS

TITANIUM

B	ADDED 8" FLANGE	5/19/2016 MC
A	UPDATED TITLE BLOCK	4/17/09 MG
REV	REVISION DESCRIPTION	REV DATE

	300 N TAYLOR ROAD GARRETT, IN 46738 PHONE: (260) 357-3181 FAX: (260) 357-3738	DRAWN BY:
	DRAWN DATE: 4/02/93	
TITLE FLANGE FITTING WITH FREE BOLTS		DWG NUMBER: FF001
		REV B

FLANGE ADAPTER:

PVC

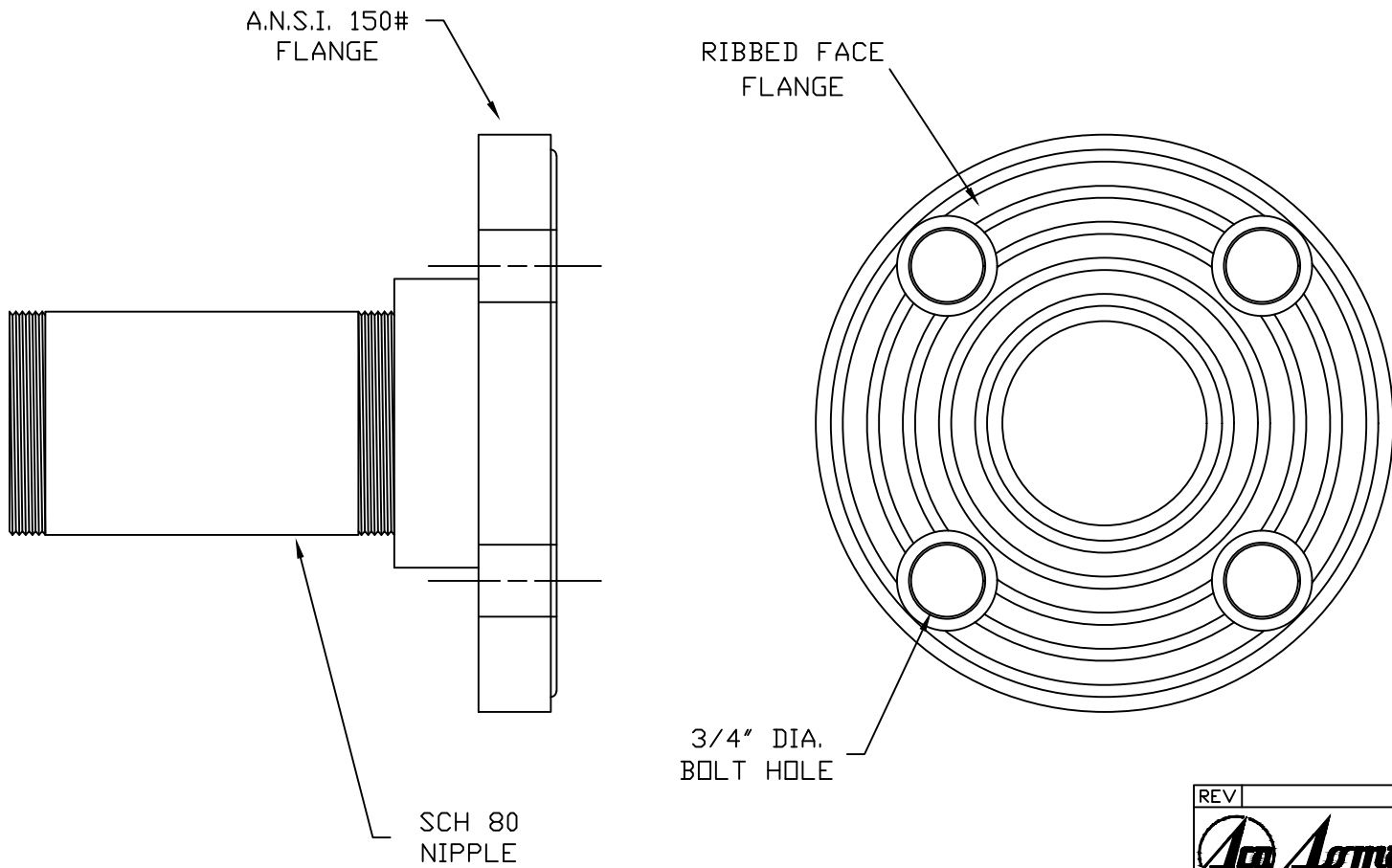
Nominal Pipe Size	Diameter of Flange	No. of Bolts	Diameter of Bolts	Diameter of Bolt Holes	Bolt Circle
2"	6"	4	5/8"	3/4"	4 3/4"


SIZES AVAILABLE

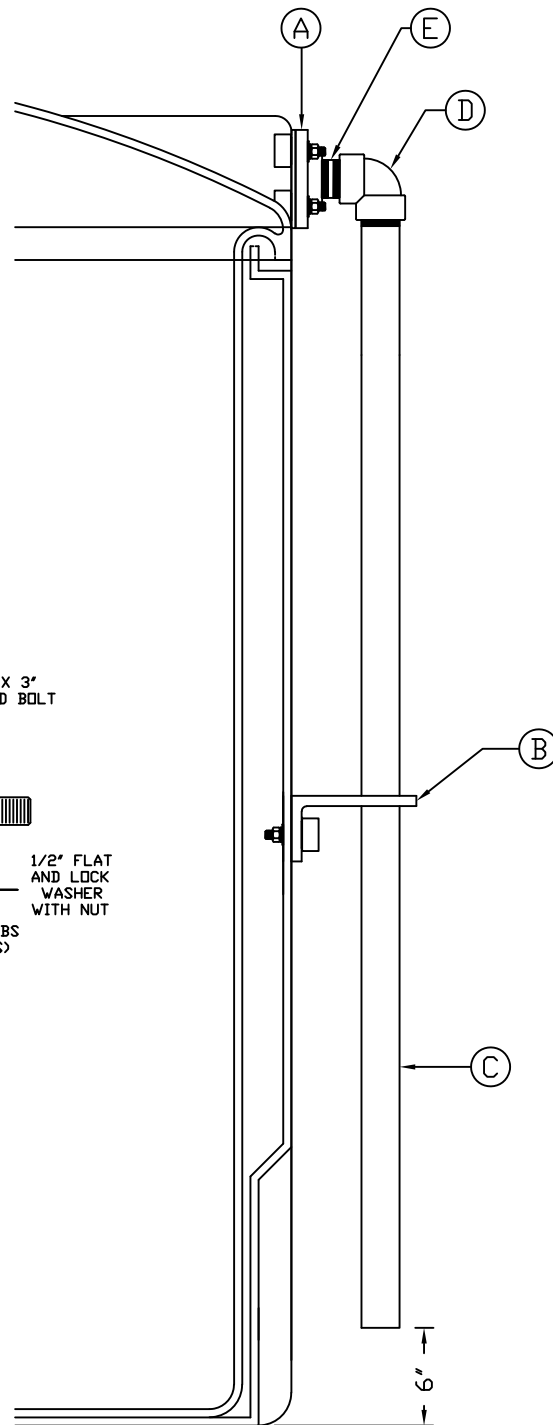
2"

NOTES:

1/2" THROUGH 4" ARE THREADED FLANGES
 6" THROUGH 8" ARE SOCKET FLANGES



REV	REVISION DESCRIPTION	REV DATE
		
300 N TAYLOR ROAD GARRETT, IN 46738 PHONE: (260) 357-3181 FAX: (260) 357-3738		DRAWN BY: SROWLISON DRAWN DATE: 5/28/14
TITLE FLANGE ADAPTER		DWG NUMBER: FA001
		REV Ø



ACCESSORIES			
MK	QTY	SIZE	DESCRIPTION
A	1	-	PVC/ SCH. 80 FLANGE FITTING W/ SS-EPDM BOLTS & EPDM (STANDARD)
B	1	-	POLYETHYLENE PIPE SUPPORT BRACKET. (STANDARD) WITH S/S BOLTS, EPDM ENCAPSULATED HEADS & EPDM GASKET
C	1	-	PVC/ SCH. 80 PIPE (STANDARD)
D	1	-	PVC/ SCH. 80 90° ELBOW (STANDARD)
E	1	-	PVC/ SCH. 80 CLOSE NIPPLE (STANDARD)

MATERIALS:

FLANGE FITTING:

PVC

PIPING:

PVC

DONKER BOLTS:


TT-EPDM

GASKET:

E.P.D.M.

SIZES AVAILABLE:

2"

REV	REVISION DESCRIPTION	REV DATE
	 <p>300 N TAYLOR ROAD GARRETT, IN 46738 PHONE: (260) 357-3181 FAX: (260) 357-3738</p> <p>CORPORATION OF AMERICA</p>	<p>SALES ORDER</p> <p>DRAWN BY: M.COMBS</p> <p>DRAWN DATE: 9/20/2016</p>
	<p>TITLE EXTERIOR OVERFLOW ASSEMBLY WITH FLANGE FITTING</p>	<p>DWG NUMBER: FF-OF</p> <p>REV -</p>

MATERIALS:

SELF ALIGNING DOME FITTING:

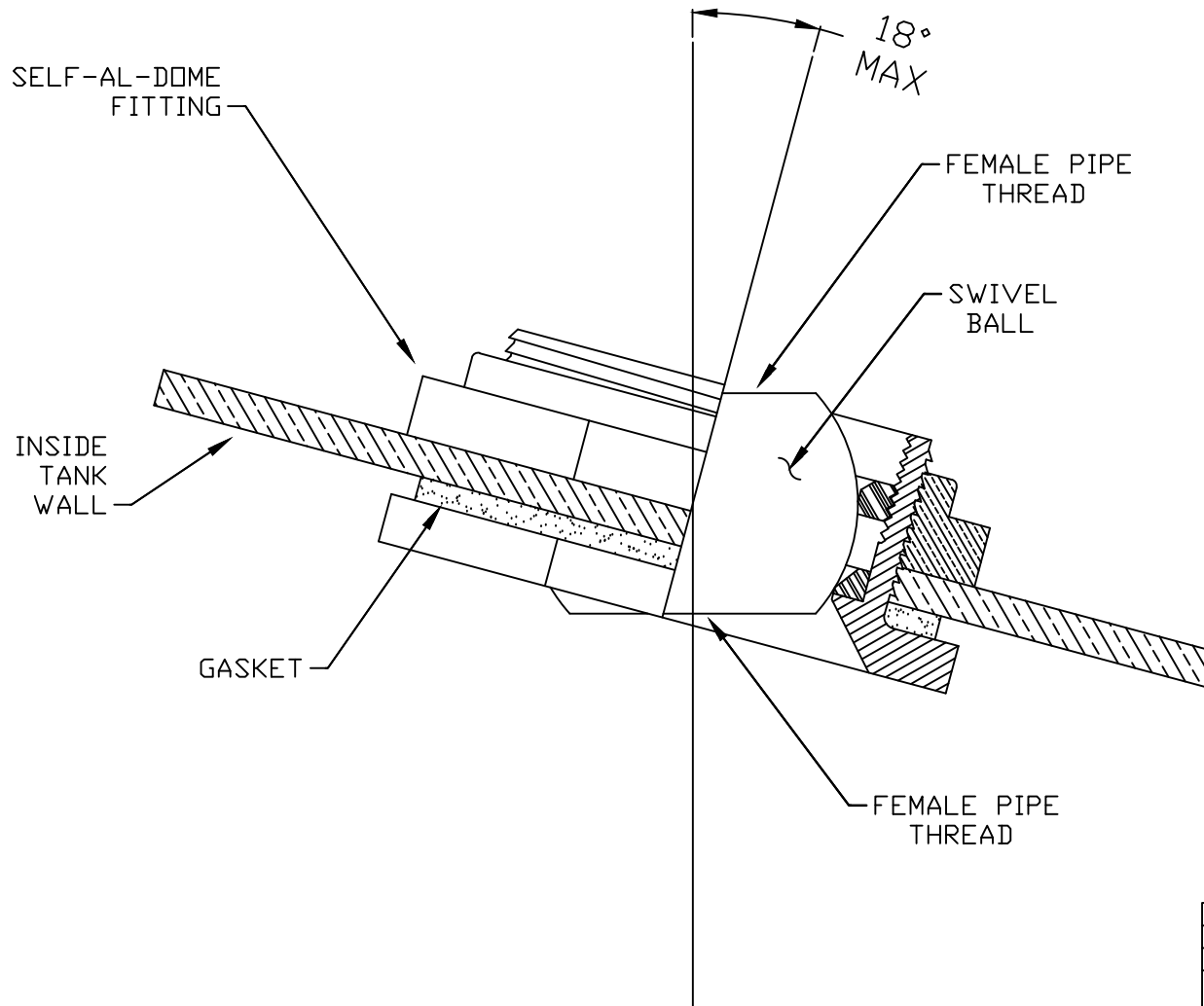
PVC


GASKET MATERIAL:

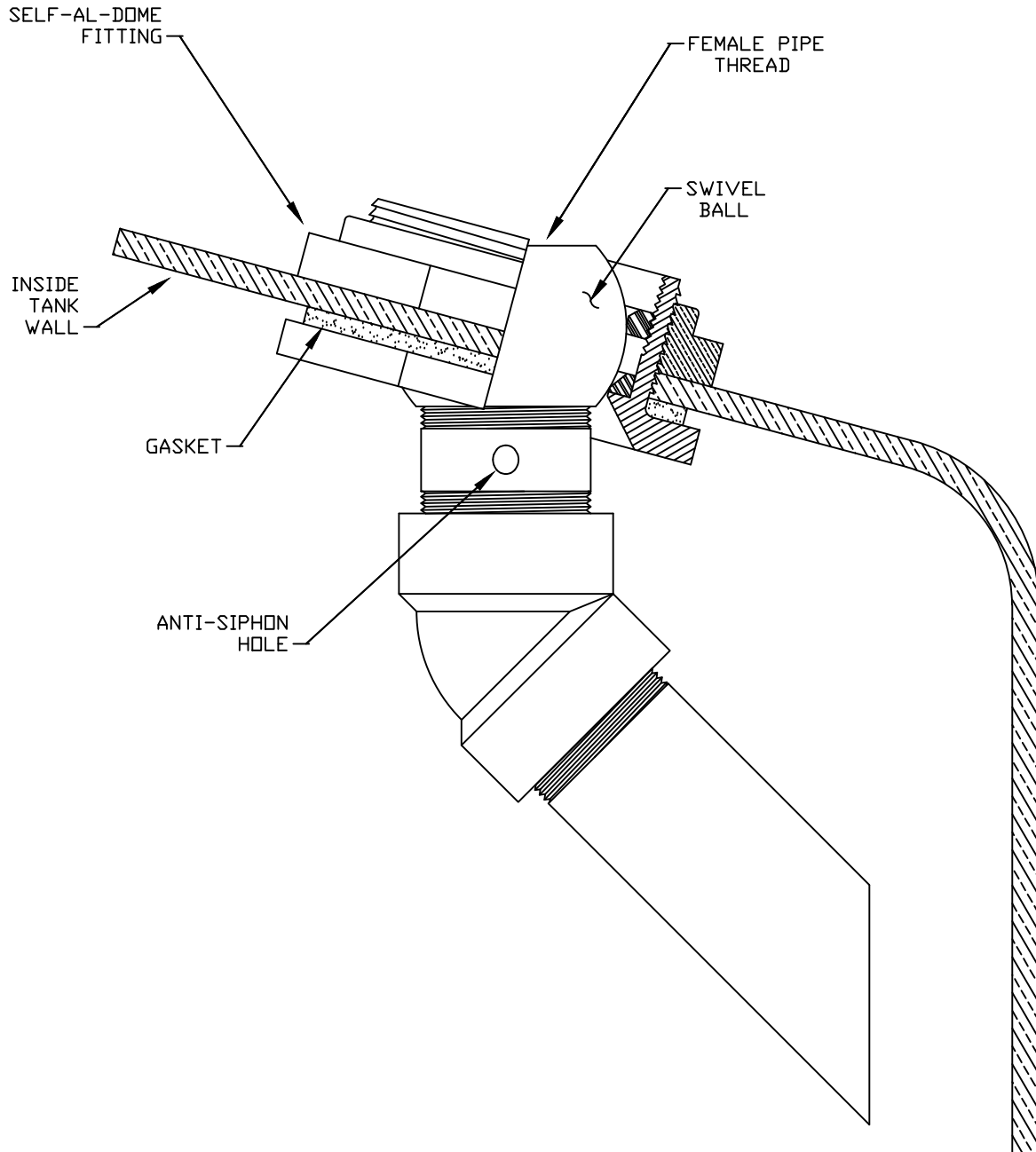
E.P.D.M.

SIZES AVAILABLE

2"



B	ADDED CPVC TO MATERIALS AVAILABLE LIST	4/3/17 JE
A	UPDATED TITLE BLOCK	4/21/09 MG
REV	REVISION DESCRIPTION	REV DATE
		
300 N TAYLOR ROAD GARRETT, IN 46738 PHONE: (260) 357-3181 FAX: (260) 357-3738		DRAWN BY: D. CRAGER
TITLE SELF ALIGNING DOME FITTING		DRAWN DATE: 6/10/93
		DWG NUMBER: SADF
		REV A



MATERIALS:

SELF ALIGNING DOME FITTING:

PVC

GASKET MATERIAL:


E.P.D.M.

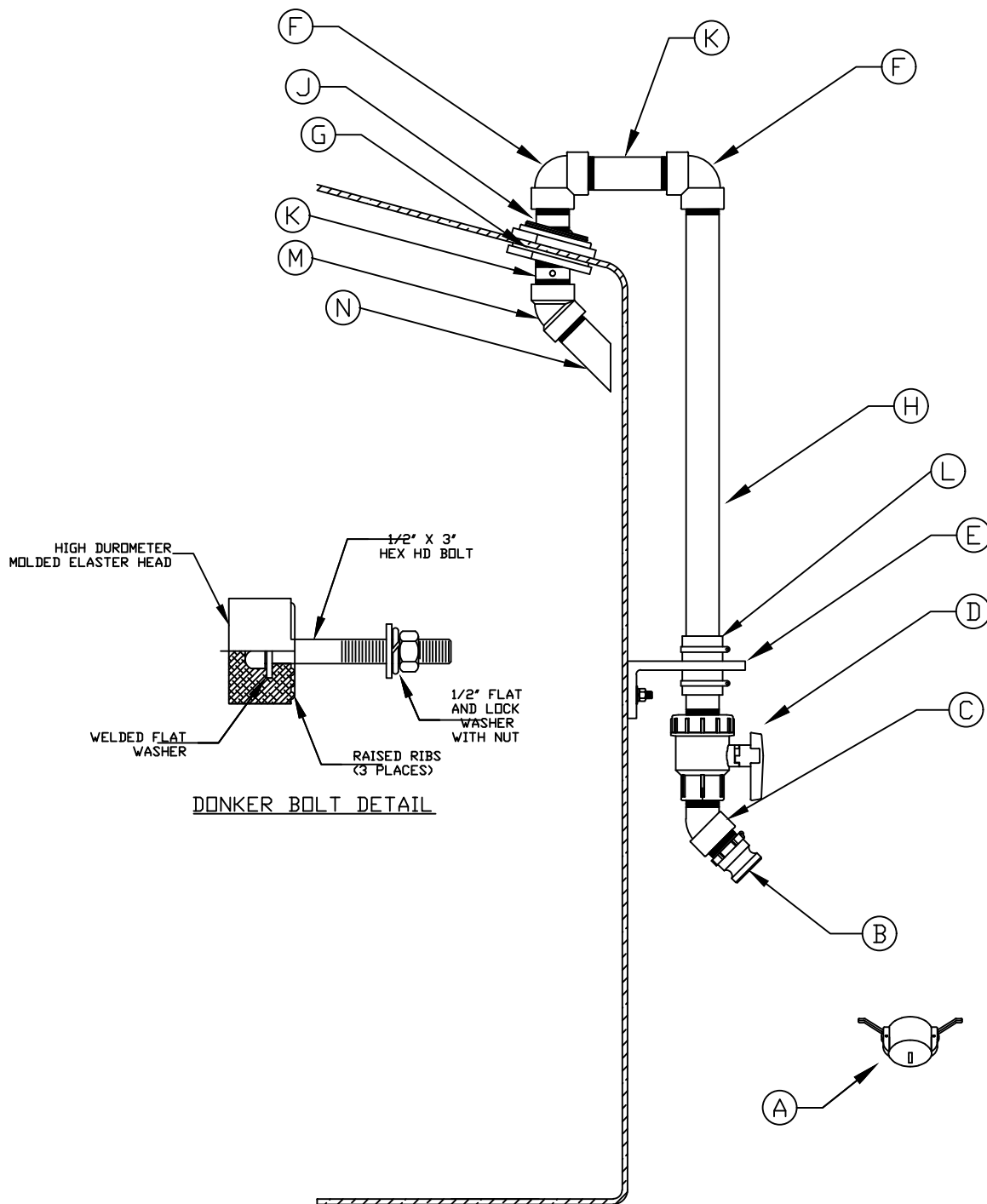
ANTI-FOAM ELBOW:

PVC

SIZES AVAILABLE

2"

B	ADDED CPVC AS A MATERIAL OPTION	6/5/17 SR
A	UPDATED TITLE BLOCK	4/21/09 MG
REV	REVISION DESCRIPTION	REV DATE
		300 N TAYLOR ROAD GARRETT, IN 46738 PHONE: (260) 357-3181 FAX: (260) 357-3738
TITLE SELF ALIGNING DOME FITTING WITH ANTI-FOAM ELBOW		DRAWN BY: D. CRAGER DRAWN DATE: 6/10/93
DWG NUMBER: SADP-AFE		REV B



ACCESSORIES			
MK	QTY	SIZE	DESCRIPTION
A	1	-	POLY-PRD CAP FOR MALE ADAPTER
B	1	-	POLY-PRD MALE THREAD X MALE ADAPTER
C	1	-	POLY-PRD 45° STREET ELBOW
D	1	-	BALL VALVE W/ ELASTOMER SEALS (STANDARD)
E	2	-	POLYETHYLENE PIPE SUPPORT BRACKET (STANDARD) WITH METALIC BOLTS, ELASTOMER ENCAPSULATED HEADS & GASKET
F	2	-	SCH. 80 THREADED 90° ELBOW (STANDARD)
G	1	-	SCH. 80 SELF ALIGNING DOME FITTING
H	2	-	SCH. 80 PIPE (STANDARD)
J	1	-	SCH. 80 CLOSE NIPPLE (STANDARD)
K	1	-	SCH. 80 NIPPLE (STANDARD)
L	1	-	FERNCO PIPE CLAMP
M	1	-	SCH. 80 THREADED 45° ELBOW (STANDARD)
N	1	-	SCH. 80 THREADED 45° ELBOW (STANDARD)

MATERIALS:

SELF ALIGNING DOME FITTING:

PVC

BALL VALVES:

PVC

VALVE SEALS:

E.D.P.M

PIPING, NIPPLES, & ELBOWS

PVC

DONKER BOLTS:

TT-E.P.D.M

GASKET MATERIAL:

E.P.D.M.

ANTIFOAM ELBOW:

PVC

SIZES AVAILABLE

2"

A	UPDATED TITLE BLOCK	4/23/09 MG
REV	REVISION DESCRIPTION	REV DATE
 CORPORATION OF AMERICA	300 N TAYLOR ROAD GARRETT, IN 46738 PHONE: (260) 357-3181 FAX: (260) 357-3738	SALES ORDER
	TITLE: FILL LINE ASSEMBLY WITH SELF ALIGNING DOME FITTING	DRAWN BY: D. CRAGER DRAWN DATE: 6/12/96
	DWG NUMBER:	SA-FL-AFE
		A

NOTES:

1. ALL "U" VENT ASDSEMBLIES STANDARD WITH FITTINGS
2. OPTIONAL STAINLESS STEEL OR POLYETHYLENE PEST SCREEN AVAILABLE

MATERIALS:

BULKHEAD FITTING:

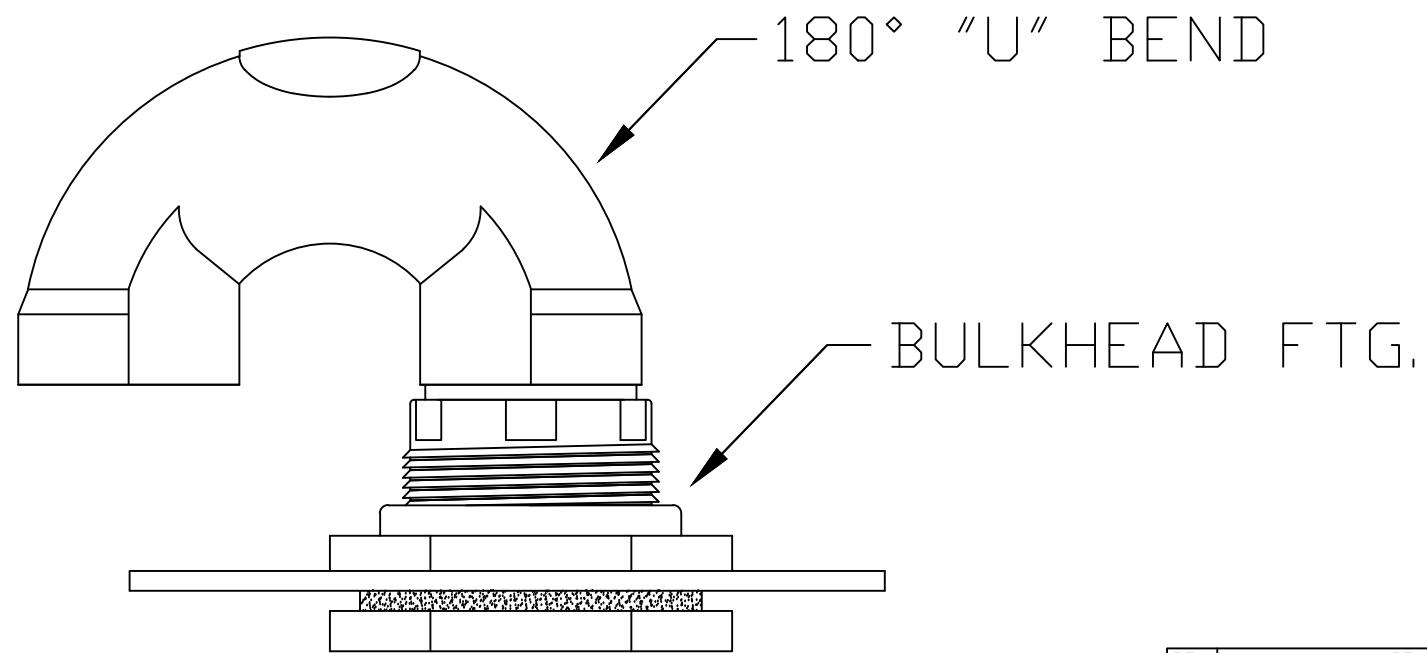
PVC


GASKET MATERIAL:

VITON

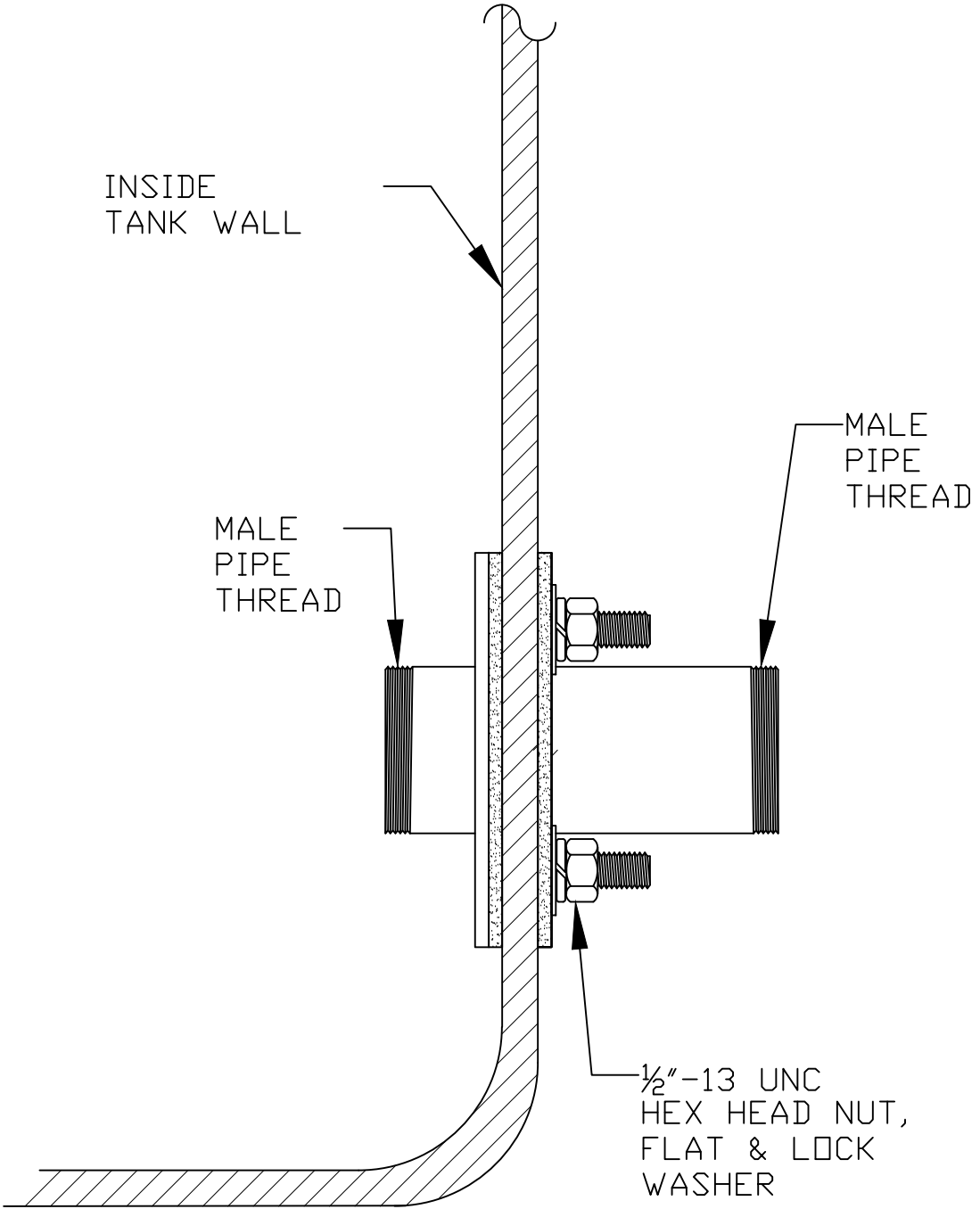
SIZES AVAILABLE

4"



REV	REVISION DESCRIPTION	REV DATE
		
300 N TAYLOR ROAD GARRETT, IN 46738 PHONE: (260) 357-3181 FAX: (260) 357-3738		DRAWN BY: _____ DRAWN DATE: _____
TITLE "U" VENT ASSEMBLY WITH BULKHEAD FITTING		DWG NUMBER: BH-U-VENT REV A

MALE PIPE SIZE	PLATE SIZE DIMENSION A	NUMBER OF BOLTS	BOLT PAT. DIMENSION B
2"	4 1/2"	4	3 3/8"

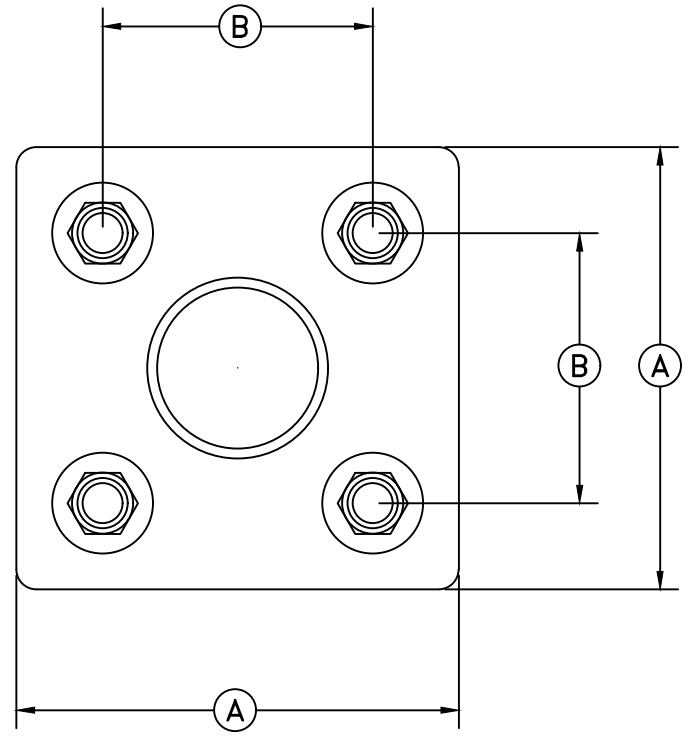



MATERIALS:

TITANIUM

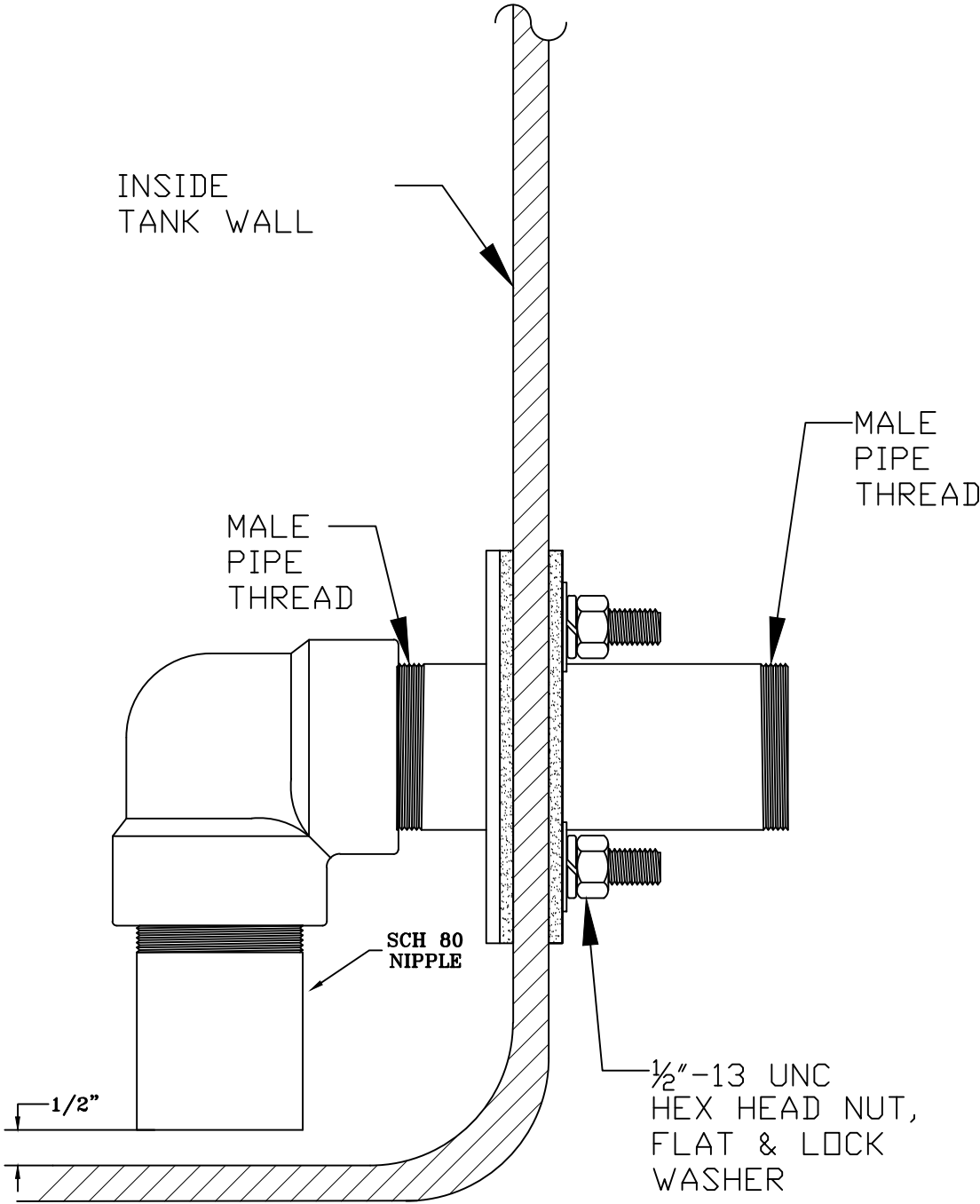
GASKET MATERIAL:

E.P.D.M.



REV	REVISION DESCRIPTION	REV DATE
	 300 N TAYLOR ROAD GARRETT, IN 46738 PHONE: (260) 357-3181 FAX: (260) 357-3738	DRAWN BY: DRAWN DATE: 4/05/93
TITLE SINGLE WALL DOUBLE MALE FITTING		DWG NUMBER: S W D M
		REV A

MALE PIPE SIZE	PLATE SIZE DIMENSION A	NUMBER OF BOLTS	BOLT PAT. DIMENSION B
2"	4 1/2"	4	3 3/8"



MATERIALS:

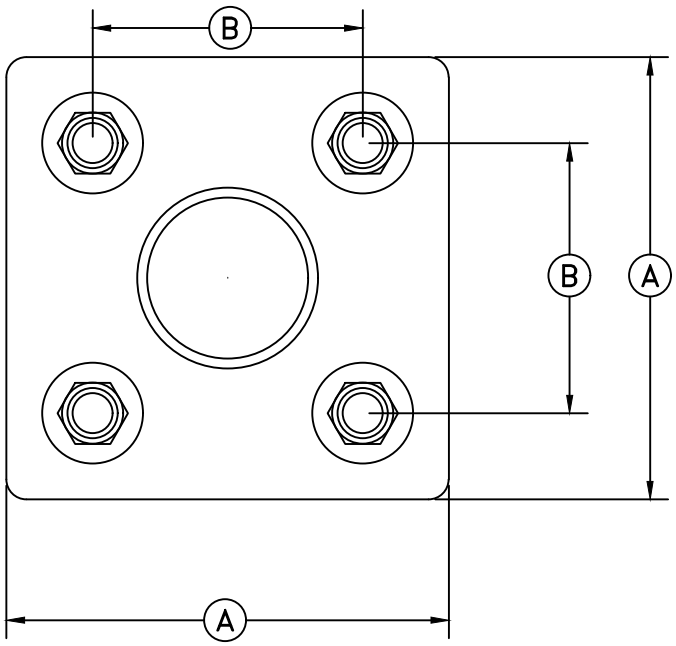
STAINLESS STEEL


GASKET MATERIAL:

E.P.D.M.

SIPHON DRAIN:

PVC



REV	REVISION DESCRIPTION	REV DATE
	 300 N TAYLOR ROAD GARRETT, IN 46738 PHONE: (260) 357-3181 FAX: (260) 357-3738	DRAWN BY: DRAWN DATE: 4/05/93
TITLE SINGLE WALL DOUBLE MALE FITTING W/ SIPHON DRAIN		DWG NUMBER: SWDM-SD
		REV A

MALE PIPE SIZE	PLATE SIZE DIMENSION A	NUMBER OF BOLTS	BOLT PAT. DIMENSION B
2"	4 1/2"	4	3 3/8"

MATERIALS:

STAINLESS STEEL
TITANIUM

GASKET MATERIAL:

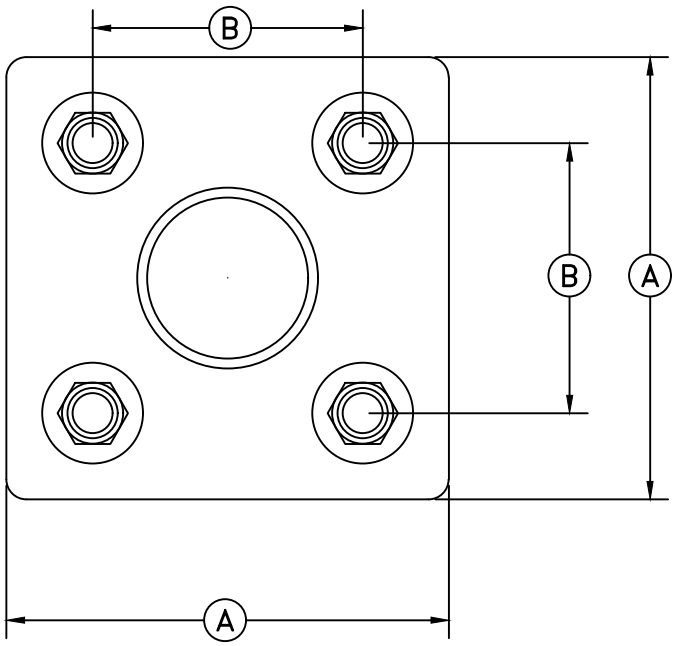
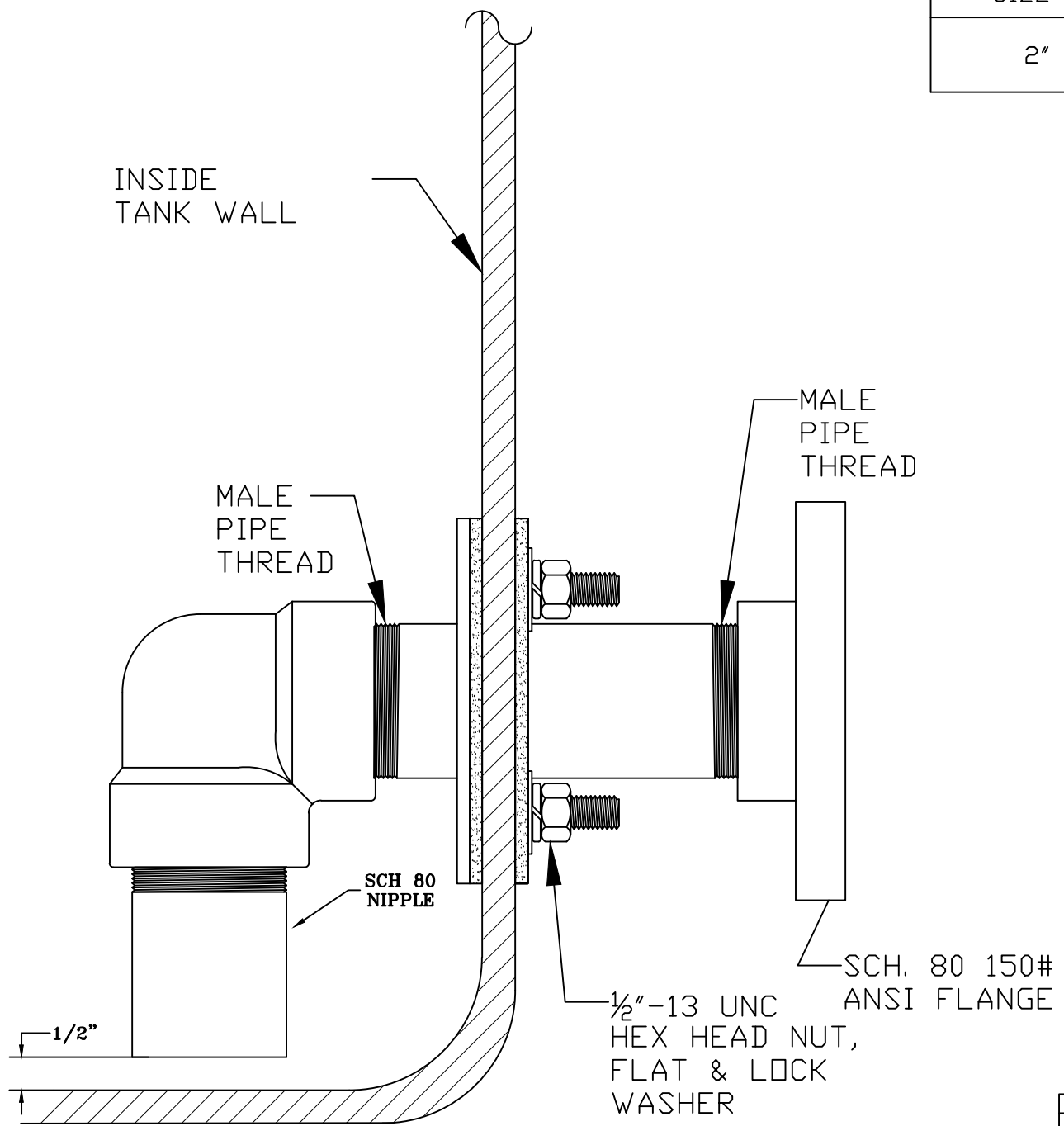
E.P.D.M.


FLANGE ADAPTER:

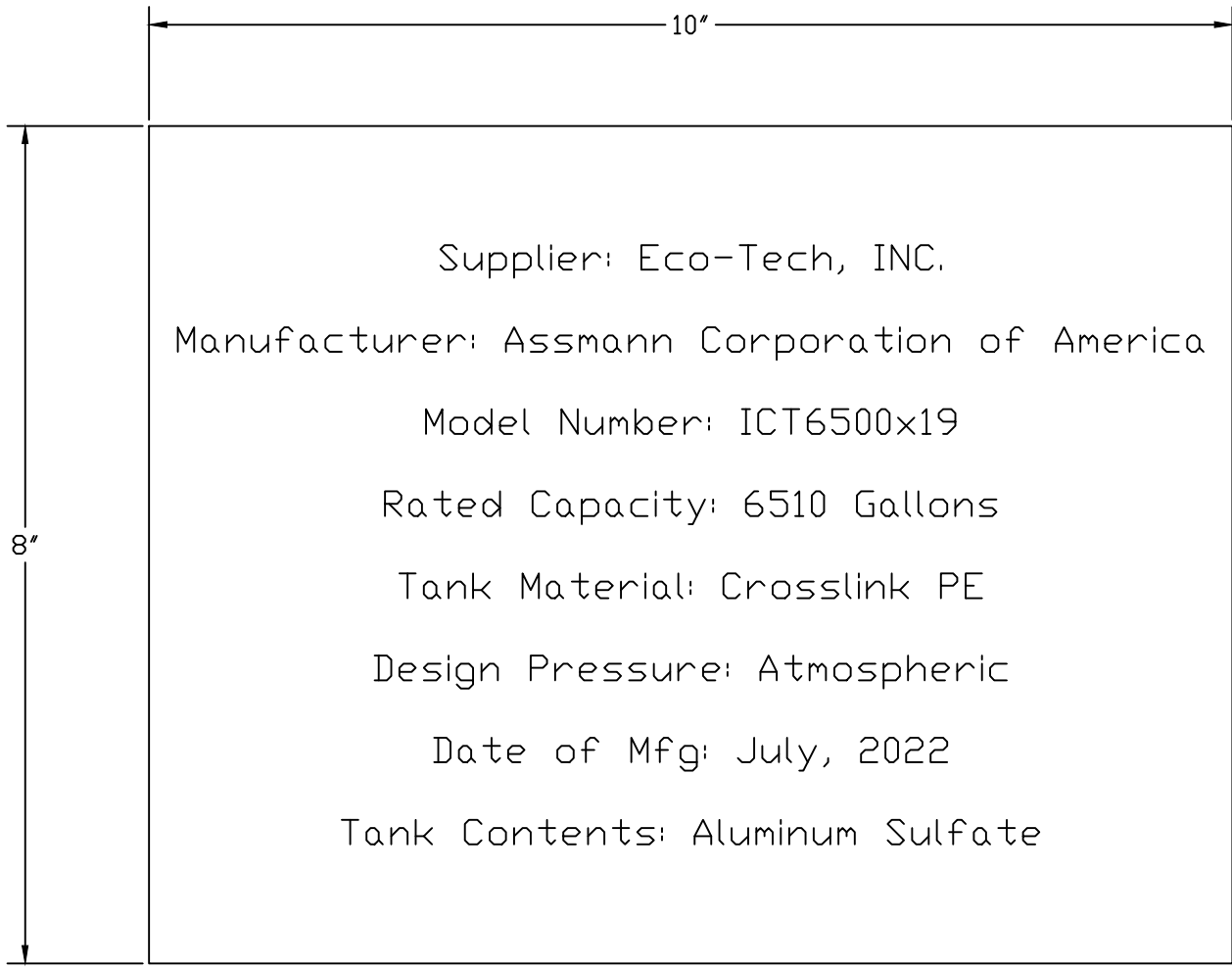
PVC

SIPHON DRAIN:

PVC




REV	REVISION DESCRIPTION	REV DATE
	 300 N TAYLOR ROAD GARRETT, IN 46738 PHONE: (260) 357-3181 FAX: (260) 357-3738	DRAWN BY: DRAWN DATE: 4/05/93
TITLE SINGLE WALL DOUBLE MALE FITTING W/ FLANGE ADAPTER AND SIPHON DRAIN		DWG NUMBER: SWDM-FA-SD
		REV A



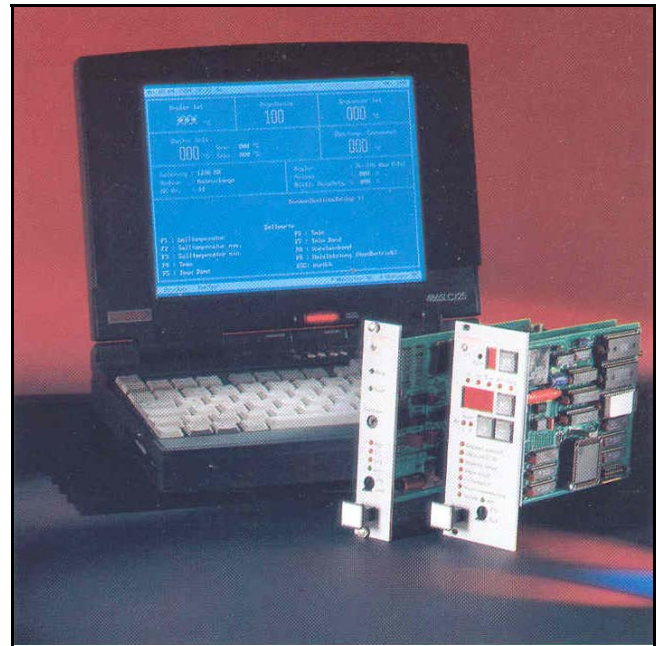
NAMEPLATE MATERIAL:
 __ STAINLESS STEEL
 __ WHITE PHENOLIC PLASTIC

NOTE:
 NAMEPLATE CAN BE ENGRAVED WITH INFORMATION
 PER CUSTOMER SPECIFICATIONS. EXAMPLE SHOWN IS
 TYPICAL INFORMATION. SPECIFY INFORMATION WHEN
 ORDERING

REV	REVISION DESCRIPTION	REV DATE
	 300 N TAYLOR ROAD GARRETT, IN 46738 PHONE: (260) 357-3181 FAX: (260) 357-3738	SALES ORDER
	TITLE ENGRAVED NAMEPLATE	DRAWN BY: SROWLISON
	S/S OR WHITE PHENOLIC PLASTIC	DRAWN DATE: 11/21/12
		DWG NUMBER: NAMEPLATE
		REV \emptyset

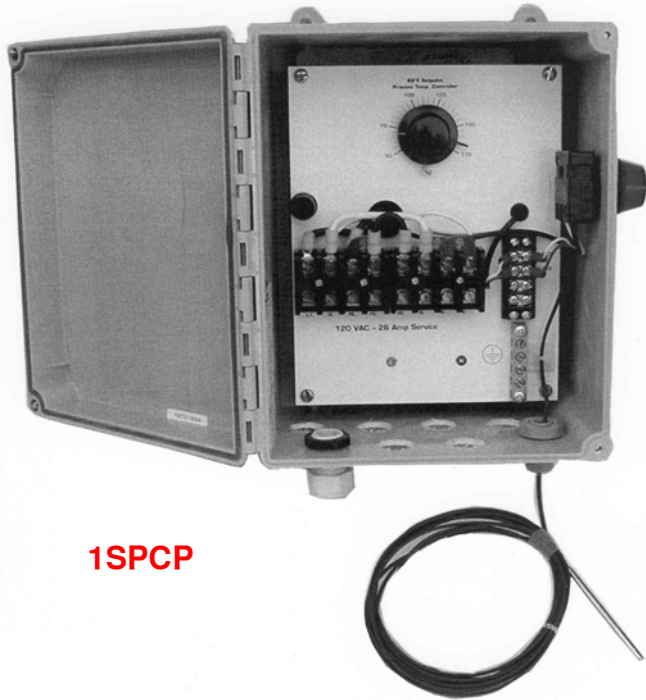


THERMOSTATS, CONTROLLERS AND CONTROL SYSTEMS



**FOR PIPE TRACING,
TANK HEATING,
HOPPER HEATING
AND OTHER
GENERAL HEAT TRACING
APPLICATIONS**

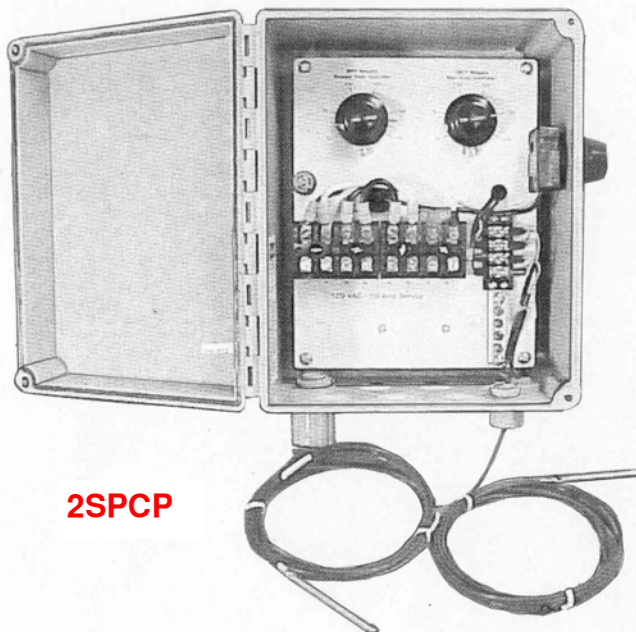




1SPCP

1SPCP Electronic process sensing controller

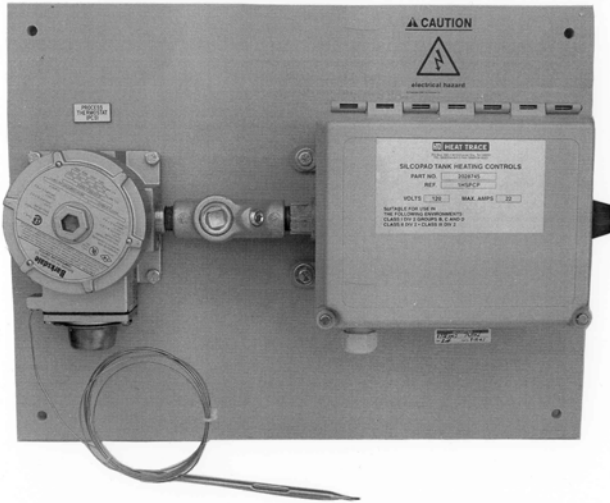
- USAGE:** Tank heating (Metal Tanks)
- RANGE:** 50 to 175°F (10 to 80°C)
- ENCLOSURE:** Fiberglass
- CLASSIFICATION:** NEMA 4X
- SENSOR MATERIAL:** Stainless steel "J" thermocouple with 10' with SS braid and FEP jacket
- SWITCH:** Solid State Relay
- WIRING:** Terminal block
- ELECTRICAL RATING:** 26A, 120VAC or 26A, 240VAC
- APPROVALS:** Major components used throughout this assembly are UL listed products.



2SPCP

2SPCP Dual electronic process sensing controller

- USAGE:** Tank heating (FRP & Plastic Tanks)
- RANGE:** (process) 50 to 175°F (10 to 80°C)
(high-limit) 50 to 175°F (10 to 80°C)
- ENCLOSURE:** Fiberglass
- CLASSIFICATION:** NEMA 4X
- SENSOR MATERIAL:** Two Stainless steel "J" thermocouples with 10' with SS braid and FEP jacket
- SWITCH:** Solid State Relay
- WIRING:** Terminal block
- ELECTRICAL RATING:** 26A, 120VAC or 26A, 240VAC
- APPROVALS:** Major components used throughout this assembly are UL listed products.



1HSPCP Process sensing controller

USAGE: Tank heating (Metal Tanks)
RANGE: 25 to 325°F (-5 to 163°C)
 Factory preset at 60°F (16°C)

HEATER JUNCTION BOX: Fiberglass

JUNCTION BOX CLASSIFICATION: NEMA 4X

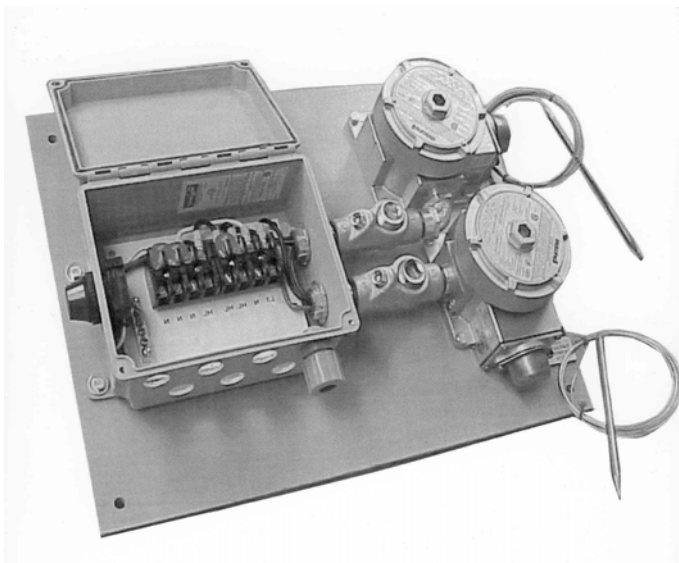
SENSOR MATERIAL: Stainless steel, 10' capillary

SWITCH: One SPDT snap action

WIRING: Terminal block

ELECTRICAL RATING: 22A / 480 VAC

APPROVALS: Interconnecting conduit and wiring meets NEC requirements and thermostat is UL, CSA, and FM approved for hazardous area usage.



2HSPCP Dual electronic process sensing controller

USAGE: Tank heating (FRP & Plastic Tanks)
RANGE: (process) 25 to 325°F (-5 to 163°C)
 Factory preset at 60°F (16°C)
 (high-limit) 25 to 325°F (-5 to 163°C)
 Factory preset at 150°F (66°C)

HEATER JUNCTION BOX: Fiberglass

JUNCTION BOX CLASSIFICATION: NEMA 4X

SENSOR MATERIALS: Stainless steel, 10' capillaries

SWITCHES: One SPDT snap action (ea t'stat)

WIRING: Terminal block

ELECTRICAL RATINGS: 22A / 480 VAC (each t'stat)

APPROVALS: Interconnecting conduit and wiring meets NEC requirements and thermostats are UL, CSA and FM approved for hazardous area usage.

SP

For freeze protection and process heating applications on Plastic Tanks



SilcoPad® Super low watt density heater pad

- ◆ *Specifically designed for safe operation on polyethylene, polypropylene and other types of heat-sensitive tanks*
- ◆ *Two sizes fit both horizontal and vertical tanks*
- ◆ *Will not overheat or burn out*
- ◆ *Super low watt density heat source will not harm the tank or tank contents*
- ◆ *Installation is quick, simple and effective*
- ◆ *FM approved for use in non-hazardous, hazardous and corrosive environments*

SilcoPad heaters are specifically designed to provide the unique product and system features essential for the safe and reliable application of heat to the surface of plastic tanks and other types of heat-sensitive, non-metallic tanks. SilcoPad heaters are most commonly used on polyethylene and polypropylene tanks for freeze protection and temperature maintenance applications up to 120° F. (When used on metal tanks, SilcoPad systems can be designed for temperature maintenance applications up to 200° F)

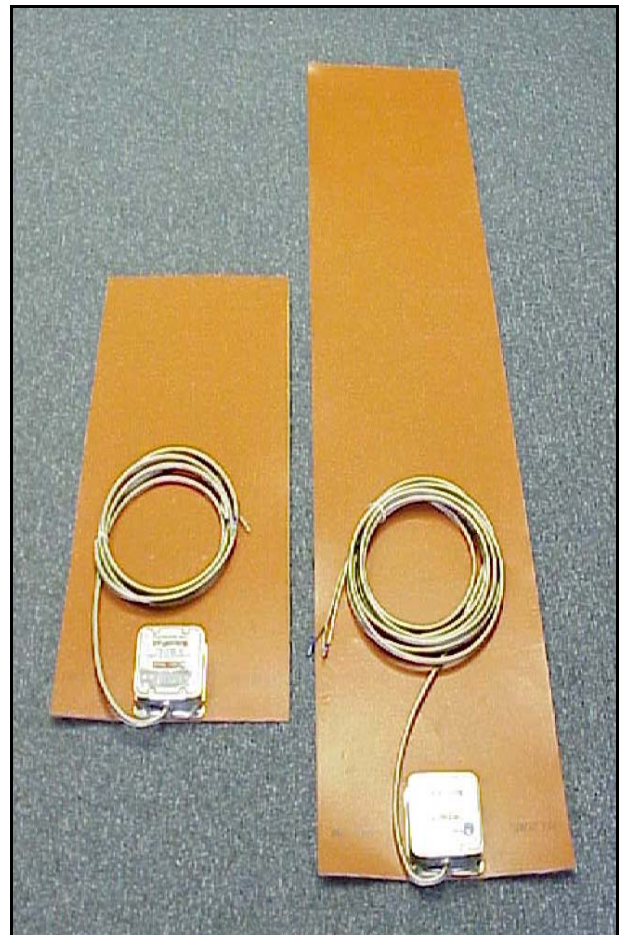
The SilcoPad design uses a *super low watt density*, parallel circuit heating element that is pressure laminated into a multi-layer silicone rubber dielectric construction to form a flexible, lightweight waterproof heater pad. Each SilcoPad heater is supplied with a rugged, encapsulated, factory made termination complete with a standard length of over-braided cold lead.

SilcoPad tank heaters are extremely safe, reliable and cannot overheat or burnout.

The gentle heat output of 0.5 w/sq.inch will not harm a plastic tank or contents. Additional security is also incorporated into every SilcoPad heater by the inclusion of a preset, automatic safety switch that is built directly into the pad. This factory installed device completely eliminates all potential for overheating, even if the heating system should remain energized while the tank is empty.

The SilcoPad heater construction also includes an aluminum ground shield for full compliance with the latest requirements of the National Electrical Code.

Factory applied adhesive backing is used to bond the heater pad directly to the tank surface, allowing one person to complete a simple and effective installation in a matter of just a few minutes.



For further information, please contact us at our New Jersey headquarters.



Tel (908) 534 8313
E mail address

Fax (908) 534 8023
sales@htdheattrace.com

PRODUCT SPECIFICATIONS

PHYSICAL, ELECTRICAL & THERMAL

PRODUCT FAMILY	SilcoPad
PRODUCT REFERENCES	SP 210 SP 420 & SP 420-16
SIZES	SP 210 14 x 30 inches SP 420 14 x 60 inches
PAD THICKNESS	0.1 inches
WEIGHTS	SP 210 3 LBS SP 420 5½ LBS
POWER RATINGS	SP 210 210 watts SP 420 420 watts
POWER DENSITY	0.5 watts/sq.inch
OPERATING VOLTAGE	120 VAC
NOMINAL CURRENT	SP 210 1.75 A SP 420 3.50 A
LEAKAGE VALUES ON 120 VAC	SP 210 0.2 mA SP 420 0.4 mA
TYPICAL MAXIMUM APPLICATION TEMPERATURES	Polyethylene 120° F Polypropylene 120° F PVC 140° F CPVC 150° F FRP 150° F
<p>The above maximum application temperatures are only typical for the materials listed. Service temperature ratings for each tank material depend upon operating pressure and may be lower. Maximum permissible operating temperatures for each specific type of tank must be determined by the Tank Manufacturer and/or end user.</p>	
MAXIMUM EXPOSURE TEMPERATURES	With integral switch 185° F Without integral switch 250° F
MINIMUM INSTALLATION TEMPERATURE	40° F
MINIMUM BENDING RADIUS	6 inches
MINIMUM TANK SIZE	12 inches diameter


ACCESSORIES

SEALING TAPE	Use type IAAT 3 adhesive backed aluminum tape to seal the four edges of each SilcoPad to the tank surface. This simple procedure prevents any thermal insulation from migrating between the tank surface and the heater pad.
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CONSTRUCTIONAL

HEATING ELEMENT	Nichrome resistance wires
HEATING ELEMENT DESIGN	Parallel circuit
DIELECTRIC MATERIALS	3 plys of 0.026 inch thick silicone / glass bond
DIELECTRIC STRENGTH	1.48KV for one minute
INTEGRAL GROUND PLANE	0.005 inch thick aluminum foil
GROUND PLANE RESISTANCE	3.26 mΩ/ft
TERMINATION BOX	4 x 4 inch steel enclosure
COLD LEAD CABLE	3 conductor # 16 AWG tinned copper with silicone rubber insulation and nickel-plated copper overbraid
STANDARD COLD LEAD LENGTHS	SP 210 10 ft SP 420 10 ft SP 420-16 16 ft
Custom cold lead lengths can be supplied as special order	
INSTALLATION METHOD	Factory applied adhesive backing with peel off protective paper

APPROVALS

FACTORY MUTUAL	Unclassified areas Class I Div 2 B, C, D Class II Div 2 E, F, G Class III
	
T-RATING	T4A

CONTROLS

PLASTIC TANKS	<p>The recommended controller for unclassified, non-hazardous area installations is type 2SPCP with dual electronic thermostats for process control and high temperature cut out.</p> <p>Use type 2HSPCP controller to provide the same features on all hazardous area installations.</p>
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SPX

**For freeze protection
and process heating
applications
on Plastic Tanks**

SPX

PLASTIC TANK HEATING PAD

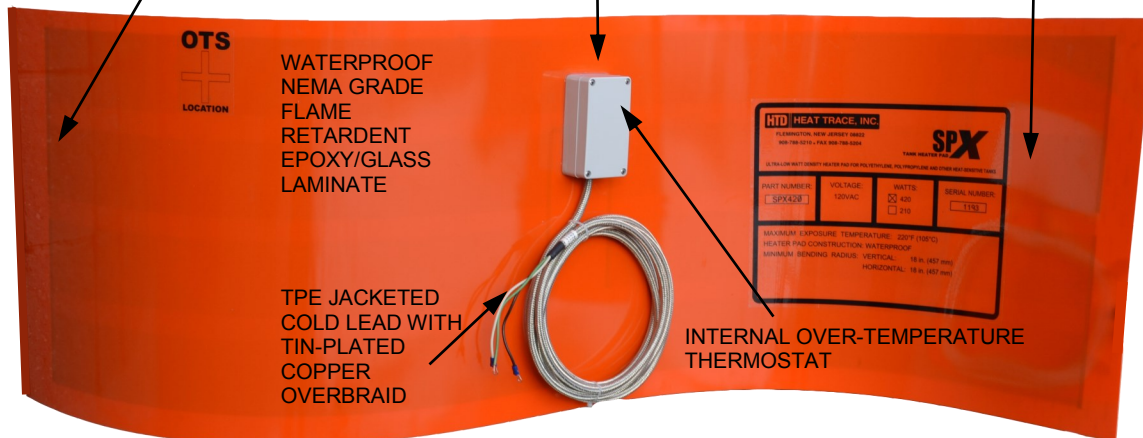
- ◆ Specifically designed for safe, reliable operation on heat sensitive plastic storage tanks
- ◆ Proven epoxy-glass laminate platform performance, with thousands of major installations worldwide
- ◆ Ultra low watt density, high efficiency, flexible heating pads with adhesive backing.
- ◆ FM Approved for use in unclassified, hazardous and corrosive environments for the United States and Canada
- ◆ Quick, simple, low cost, one person installation
- ◆ Two pad sizes and power outputs for conventional, small and custom-shaped tanks.



PROPRIETARY MULTI - PATH,
PARALLEL CIRCUIT HEATING
ELEMENT WITH CONTINUOUSLY
SPOT WELDED CONNECTIONS

WATERPROOF
EPOXY
ENCAPSULATED
POLYCARBONATE
TERMINATION
ENCLOSURE

INTERNAL ALUMINUM
GROUNDING SHIELD TO
COMPLY WITH NEC ARTICLE
427 23(b) REQUIREMENTS



The HTD Heat Trace SPX heater pad is the latest step in the improvement of the SilcoPad range of heaters for plastic tanks.

The SPX epoxy/glass composite construction was first developed and used in the Eagle Panel range of products for heating FRP tanks. This rugged construction has been re-engineered for performance on heat-sensitive tanks, resulting in a new, ultra-low watt density, highly flexible, waterproof heating pad that includes adhesive backing for quick and simple installation.

The SPX tank heater pad has been specifically designed for temperature maintenance and freeze protection on heat-sensitive polyethylene and polypropylene tanks. These tanks require ultra-low watt density, evenly applied heat.

The SPX heater pad provides this with the added safety feature of an internal over-temperature thermostat. This extra feature ensures that the pad cannot operate above the maximum permissible temperature of the tank.

Being completely waterproof, the new SPX heater pad will continue to operate as designed even if rain, flooding or tank overflow infiltrates between the tank and the thermal insulation.

The new HTD Heat trace SPX 210 and SPX 420: engineered for efficiency, long life and safety.

8 Bartles Corner Road, Unit # 104
Flemington, NJ 08822-5758 USA

Tel (908) 788-5210
Fax (908) 788-5204

e-mail: sales@htdheattrace.com
WWW.HTDHEATTRACE.COM





SPECIFICATIONS

PLASTIC TANK HEATING PAD

PRODUCT FEATURES

ULTRA-LOW WATT DENSITY SPX Tank Heater pads have a power rating of 0.39 w/sq.in(603 w/m²) for ultra-safe operation and reliability on heat-sensitive applications

LAMINATED CONSTRUCTION WITH PEEL AND STICK APPLICATION With its laminated, epoxy composite construction, the SPX heater pad is superbly qualified to meet the rigorous requirements for use in all industrial and climatic environments. It is extremely rugged, completely waterproof, dust-tight and corrosion-resistant.

MULTI-PATH PARALLEL CIRCUIT HEATING ELEMENT SPX heater pads are built with unique multi-path, parallel circuit heating elements that are significantly safer and more reliable than the series type heating elements used in competitors products.

DESIGN RATINGS

MAX MAINTAIN TEMP 150°F (66°C)

MAX EXPOSURE TEMP 220°F (104° C)

MIN INSTALLATION TEMP 40° F (4.4°C)

MINIMUM BENDING 15" (381 mm) Do not install SPX pads on any tank that is less than 30" (762 mm) diameter
VOLTAGE RATINGS 120 VAC

*Consult HTD for 240 VAC applications

CONSTRUCTION

HEATING ELEMENTS Multi-path, parallel circuitry

CIRCUIT CONNECTIONS Stainless steel bridge pieces continuously spot welded with triple welding passes

DIELECTRIC CONSTRUCTION Multi-layer glasscloth composite

LAMINATE PROPERTIES Density - 0.069 lbs/cu.in
Rockwell Hardness - 115
Flexural Strength - 50,000 psi
Dielectric Strength - 550 vpm
Flammability Rating - UL-94.V.O

GROUND SHIELD 5 mil thick aluminum mesh

TERMINATION METHOD Epoxy encapsulated polycarbonate termination box

COLD LEAD CABLE 3-16 AWG conductors with TPE outer jacket and Tin-Plated Copper over-braid

COLD LEAD LENGTHS Standard lengths:
SPX 210
SPX 420 10 FT (3 m)
SPX 210-16
SPX 420-16, 16 FT (4.87 m)
Custom cold lead lengths available to suit your application.
2 Ft. min., 50 Ft. max.

PRODUCT REFERENCES, RATINGS AND SIZES

SPX 420 420 Watts (0.39 w/sq.in)
60" long by 18" wide (457 x 762 mm)

SPX 210 210 Watts (0.39 w/sq.in)
30" long by 18" wide (457 x 1524 mm)

APPLICATIONS AND USAGE

TANK MATERIAL	APPLICATION RANGES	SPX 420	SPX 210
Polyethylene, Polypropylene	Up to 120° F (49°C)	YES	YES
FRP	Up to 150° F (66°C)	YES	YES
Steel, Stainless Steel	Up to 150° F (66°C)	YES	YES

T-RATING: T4A

APPROVALS

Factory Mutual approved to IEEE standard 515 and CSA standard C22.2 no.130-03 for use in the following areas:
Unclassified
Class I Div.2 Groups B,C,D
Class II Div.2 Group F,G
Class III Div.2



8 Bartles Corner Road, Unit # 104 Tel (908) 788-5210
Flemington, NJ 08822-5758 USA Fax (908) 788-5204

e-mail: sales@htdheattrace.com
WWW.HTDHEATTRACE.COM

SPRAYTITE® 158 Series

BUILDING ENVELOPE INSULATION SYSTEM

ICC ESR-2642

PRODUCT DESCRIPTION:

SPRAYTITE 158 is a closed-cell polyurethane system utilizing an EPA approved, zero ozone-depleting, blowing agent. It is designed for use in commercial and residential construction applications. **SPRAYTITE 158** is compatible with most common construction materials, but can only be processed with BASF SPRAY 8000A/FE 800A Isocyanate. The benefits of **SPRAYTITE 158** include:

- Superior insulation performance
- Control moisture infiltration
- Controls air infiltration
- Ease of application
- Non-fibrous
- Structural properties

APPROVALS AND CREDENTIALS:

ASTM E-84**/***

Class I
SPF Thickness – 4.0 inches
Flame Spread Index ≤ 25
Smoke Development Index ≤ 450

NFPA 286

8 inch wall
12 inch ceiling
with 15 min. thermal barrier
Test Report Number: 3116019-001

ICC ESR-2642

*This numerical flame spread rating does not reflect hazards presented by this or any other material under actual fire conditions. Polyurethane foam systems should not be left exposed and must be protected by a minimum 15-minute thermal barrier or other code-compliant material as allowed by applicable building code(s) and Code Officials. Building Codes provide guidelines representing minimum requirements. Further information is available at www.iccsafe.org. Consult all Authorities having jurisdiction over an area for additional or specific requirements prior to beginning a project.

**ASTM E-84 is a test designed for sample thickness up to 4 inches. NFPA 286 is a building code recognized alternative test that is conducted for greater thickness applications of spray foam. These two test reports can then be used by design professionals for their product selection process for projects.

TYPICAL PROPERTIES**:

<u>PROPERTY</u>	<u>VALUE</u>	<u>TEST METHOD</u>
Liquid Resin – As Supplied		
Specific Gravity @ 70°F	1.175	ASTM D 1638
Viscosity @ 70°F (cps)	1050	Brookfield
As Cured		
Iso:Resin Mix Ratio (vol:vol)	1:1	
Density (pcf @ 2" lift)	2.15	ASTM D 1622
Compressive Strength (psi)	22	ASTM D 1621
Tensile Strength (psi)	28	ASTM D 1623 Type C
Closed Cell Content (%)	>90	ASTM D 6226
Aged k-factor (Btu in/ft ² hr °F)	0.152 (R=6.6/in)*** @ 1"	ASTM C 518
In conformance with ICC AC377	0.147 (R=6.8/in)*** @ 4"	ASTM C 518
Permeability (perm inch)	2.38	ASTM E 96
Permeance (perms)	2.38 @ 1" SPF 1.19 @ 2" SPF 0.79 @ 3" SPF 0.60 @ 4" SPF	
Air Permeance	0.00025 L/s/m ² @ 75Pa	ASTM E 2178-01
Air Leakage	0.00025 L/s/m ² @ 75Pa	ASTM E 283-99
Dimensional Stability (%Volume Change)		
Dry Age 28 Days (158°F)	5.75%	ASTM D 2126
Freeze Age 14 Days (-20°F)	0.30%	ASTM D 2126

** - These physical property values are typical for this material as applied at our development facility under controlled conditions. SPF performance and actual physical properties will vary with differences in application (i.e. ambient conditions, process equipment and settings, material throughput, etc). As a result, these published properties should be used as guidelines solely for the purpose of evaluation. Physical property specifications should be determined from actual production material.

The above data was collected from samples prepared using the following equipment configuration:

- Gusmer® H-20/35 proportioner set at 1:1 volume ratio with 50 ft of heated delivery hose
- Gusmer® GX-7 spray-gun configured with a #1 mix module and #70 PCD and/or GAP spray-gun configured with a #1 mix chamber
- Process temperature settings: Isocyanate 130°F; Resin 130°F; Hose 130°F
- Process pressure: 1000 psig minimum while spraying

SPRAYTITE 158 has shown acceptable on-site performance with temperature settings in the range of 110°F - 130°F for Isocyanate, Resin and Hose. Every job site and set of ambient /substrate conditions are different; therefore, one set of process settings may not work for every situation. It is the responsibility of the applicator to evaluate the on-site conditions and then determine the appropriate SPF reactivity and process settings.

***The data chart shows the R-value of this insulation. "R" means resistance to heat flow. The higher the R-value, the greater the insulating power. Compare insulation R-values before you buy. There are other factors to consider. The amount of insulation will depend upon the climate, the type and size of your house, and the fuel use patterns and family size. If you buy too much insulation it will cost you more than what you will save on fuel. To achieve proper R-values, it is essential that this insulation be installed properly.



The Chemical Company

BASF Polyurethane
Foam Enterprises LLC

GENERAL INFORMATION:

SPRAYTITE 158 is a spray polyurethane foam (SPF) system intended for installation by qualified contractors trained in the processing and application of SPF systems, as well as the plural-component polyurethane dispensing equipment required to do so. Contractors and applicators must comply with all applicable and appropriate storage, handling, processing and safety guidelines. BASF Polyurethane Foam Enterprises LLC technical service personnel should be consulted in all cases where application conditions are questionable.

CAUTIONS AND RECOMMENDATIONS:

SPRAYTITE 158 is designed for an application rate of ½ inch minimum to 2 inches maximum per pass. Once installed material has cooled it is possible to add additional applications in order to increase the overall installed thickness of SPF. This application procedure is in compliance with the Spray Polyurethane Foam Alliance (SPFA).

SPRAYTITE 158 is **NOT** designed for use as an **EXTERIOR** roofing system. BASF Polyurethane Foam Enterprises LLC offers a separate line of products for exterior roofing applications. For more information please contact your sales representative.

Cold-storage structures such as coolers and freezers demand special design considerations with regard to thermal insulation and moisture-vapor drive. **SPRAYTITE 158** should **NOT** be installed in these types of constructions unless the structure was designed by a design professional for specific use as cold storage.

SPRAYTITE 158 is designed for installation in most standard construction configurations using common materials such as wood and wood products, metal and concrete. **SPRAYTITE 158** has performed successfully when sprayed onto wood substrates down to 40°F. For other substrates, please consult your BASF Polyurethane Foam Enterprises LLC sales or technical service representative for specific recommendations.

Foam plastic materials installed in walls or ceilings may present a fire hazard unless protected by an approved, fire-resistant thermal barrier with a finish rating of not less than 15 minutes as required by building codes. Rim joists/header areas, in accordance with the IRC and IBC may not require additional protection. Foam plastic must also be protected against ignition by code-approved materials in attics and crawl spaces. See relevant Building Codes and www.iccsafe.org for more information.

The **SPRAYTITE 158** foam systems are **NOT** recommended for medical uses; such as, splints or casts for broken bones nor other medical or pharmaceutical uses.

In addition to reading and understanding the MSDS, all contractors and applicators must use appropriate respiratory, skin and eye Personal Protective Equipment (PPE) when handling and processing polyurethane chemical systems. Personnel should review the following document published by Spray Polyurethane Foam Alliance (SPFA):

AX-171 Course 101-R Chapter 1: Health, Safety and Environmental Aspects of Spray Polyurethane Foam and Coverings

and the following document available from the Center for the Polyurethanes Industries (CPI):

Model Respiratory Protection Program for Compliance with the Occupational Safety and Health Administration's Respiratory Protection Program Standard 29 C.F.R. §1910.134

As with all SPF systems improper application techniques should be avoided. Examples of improper application techniques include, but are not limited to excessive thickness of SPF, off-ratio material and spraying into or under rising SPF. Potential results of improperly installed SPF include: dangerously high reaction temperatures that may result in fire and offensive odors that may or may not dissipate. Improperly installed SPF must be removed and replaced with properly installed materials.

LARGE MASSES of SPF should be removed to an outside safe area, cut into smaller pieces and allowed to cool before discarding into any trash receptacle.

SPF insulation is combustible. High-intensity heat sources such as welding or cutting torches must not be used in contact with or in close proximity to **SPRAYTITE 158** or any polyurethane foam.

SHELF LIFE AND STORAGE CONDITIONS:

SPRAYTITE 158 Series has a shelf life of approximately three months from the date of manufacture when stored in original, unopened containers at 50-80°F. As with all industrial chemicals this material should be stored in a covered, secure location and never in direct sunlight. Storage temperatures above the recommended range will shorten shelf life. Storage temperatures above the recommended range may also result in elevated headspace pressure within packages.

LIMITED WARRANTY INFORMATION – PLEASE READ CAREFULLY:

The information herein is to assist customers in determining whether our products are suitable for their applications. Our products are only intended for sale to industrial and commercial customers. Customer assumes full responsibility for quality control, testing and determination of suitability of products for its intended application or use. We warrant that our products will meet our written liquid component specifications. We make no other warranty of any kind, either express or implied, by fact or law, including any warranty of merchantability or fitness for a particular purpose. Our total liability and customers' exclusive remedy for all proven claims is replacement of nonconforming product and in no event shall we be liable for any other damages.



R3.09 COMMERCIAL GRADE GRAY ELASTOMERIC GRAY ROOF COATING

41-520

PRODUCT INFORMATION

RECOMMENDED SYSTEMS	SURFACE PREPARATION								
<p>Metal.....2½ gallons per 100 sq. ft. Elastomeric 1st coat @ 1 gallon per 100 sq. ft. Elastomeric 2nd coat @ 1½ gallons per 100 sq. ft.</p> <p>Single Ply.....3 gallons per 100 sq. ft. SPE Gray Base Coat @ 1½ gallons per 100 sq. ft. Elastomeric Finish Coat @ 1½ gallons per 100 sq. ft.</p> <p>Smooth BUR/ Modified Bitumen.....3 gallons per 100 sq. ft. Elastomeric MB Base Coat @ 1½ gallons per 100 sq. ft. Elastomeric Finish Coat @ 1½ gallons per 100 sq. ft.</p> <p>Polyurethane Foam.....3 - 4 gallons per 100 sq. ft. Elastomeric 1st coat @ 1½ - 2 gallons per 100 sq. ft. Elastomeric 2nd coat @ 1½ - 2 gallons per 100 sq. ft.</p> <p>Concrete.....4 gallons per 100 sq. ft. Elastomeric 1st coat @ 2 gallons per 100 sq. ft. Elastomeric 2nd coat @ 2 gallons per 100 sq. ft.</p>	<p>Surface must be power washed to remove dirt, loose paint and rust, excessive chalk, and other foreign matter which could prevent proper adhesion. Surface must be completely dry prior to coating.</p> <p>IMPORTANT: Where ponding water conditions persist beyond 48 hours, roof drains or other corrective measures must be installed to eliminate water build-up prior to coating the roof.</p>								
APPLICATION CONDITIONS									
<p>Do not apply below 50° F (10° C) or when rain is forecast. Applications during periods of low temperature or high humidity will extend dry time. Allow 4 - 6 hours for coating to dry prior to being subjected to rain, heavy dew or temperatures below 50° F. KEEP FROM FREEZING.</p> <p>Refer to product Application Bulletin for detailed application information.</p>									
PACKAGING									
<p>275 gallon totes (1040.9 liters) 55 gallon drums (208.2 liters) 5 gallon pails (18.9 liters)</p>									
SAFETY PRECAUTIONS									
<p>Refer to the MSDS sheet before use.</p> <p>Published technical data and instructions are subject to change without notice. Contact your Uniflex® representative for additional technical data and instructions.</p>									
WARRANTY									
<p>This product is manufactured of good materials and by competent workmen. Seller and manufacturer's only obligations shall be to replace such quantity of product proved to be defective. Neither seller nor manufacturer shall be liable for any injury, loss or damage, direct or consequential, arising from the use or the inability to use the product for his/her intended use; and user assumes all risk and liability.</p> <p>Uniflex® is a U.S. registered trademark. The information on this data sheet is effective as of August 2007 and supersedes all previous information.</p>									
KST041520									
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%;">SMIS #</th> <th style="width: 50%;">SIZE</th> </tr> </thead> <tbody> <tr> <td>155-6653</td> <td>275 gal. tote</td> </tr> <tr> <td>992-1297</td> <td>55 gal. drum</td> </tr> <tr> <td>992-1289</td> <td>5 gal. pail</td> </tr> </tbody> </table>		SMIS #	SIZE	155-6653	275 gal. tote	992-1297	55 gal. drum	992-1289	5 gal. pail
SMIS #	SIZE								
155-6653	275 gal. tote								
992-1297	55 gal. drum								
992-1289	5 gal. pail								
DISCLAIMER									
<p>The information and recommendations set forth in this Product Data Sheet are based upon tests conducted by or on behalf of KST Coatings – A Business Unit of The Sherwin-Williams Company. Such information and recommendations set forth herein are subject to change and pertain to the product offered at the time of publication. Consult your Uniflex® representative to obtain the most recent Product Data Information and Application Bulletin.</p>									

APPLICATION BULLETIN

SURFACE PREPARATION	APPLICATION CONDITIONS			
<p>Surface must be power washed (minimum 2,000 psi) to remove dirt, loose paint and rust, excessive chalk, and other foreign matter which could prevent proper adhesion. Surface must be completely dry prior to coating.</p> <p>Previously Coated Surfaces: Any surface preparation short of total removal of the old coating may compromise the service length of the system. Check for compatibility by applying a test patch of the recommended coating system, covering at least 2 - 3 sq. ft. Allow one week to dry before testing adhesion per ASTM 3359. If the coating is incompatible, complete removal is required.</p> <p>IMPORTANT: Where ponding water conditions persist beyond 48 hours, roof drains or other corrective measures must be installed to eliminate water build-up prior to coating the roof.</p> <p>For the following substrates refer to system specifications for detailed application procedures.</p> <p>Metal Roofs: Refer to system specifications. Remove all loose rust and prime areas where existing rust was cleaned using Uniflex[®] Rust Inhibitive Metal Primer (refer to data sheet #34-520). Replace loose and/or missing fasteners. Repair defective seams, small holes, flashings, around roof curbs and skylights with Uniflex[®] Seam Tape (refer to Seam Tape data sheet).</p> <p>NOTE: New metal roofs contain residual oils from the manufacturing process of the panels. Allow the roof to weather six months before coating, remove all oil and grease by steam cleaning per SSPC-SP1.</p> <p>Single Ply: Hypalon – refer to system specifications and SPE Gray Acrylic Base Coat (data sheet #41-321) for detailed application procedures. EPDM – refer to system application, BOND-IT Wash Primer (data sheet #38-620) and SPE Gray Acrylic Base Coat for detailed application procedures. Repair defective seams, small holes, flashings, around roof curbs and skylights with Uniflex[®] Seam Tape (refer to Seam Tape data sheet).</p> <p>Built-up and Modified Bitumen Roofs: Refer to system specifications. Repair any blisters, open seams, splits, and flashings with Polyester Fabric (refer to data sheet #20-385) and Acrylic Patching Cement (refer to data sheet #41-220). Apply Elastomeric MB Base Coat (refer to data sheet #41-510).</p> <p>Polyurethane Foam: Refer to system specifications. Repair all cracks and holes with Polyester Fabric (refer to data sheet #20-385) and Acrylic Patching Cement (refer to data sheet #41-220). Deteriorated foam must be removed and area refoamed. New surfaces require no cleaning and should be coated within the time frame recommended by the foam manufacturer.</p> <p>NOTE: Previously coated foam must be checked as to type of coating. Uniflex[®] Elastomeric Coating will not adhere to silicone based coatings.</p> <p>Concrete: Refer to system specifications. Power-wash the entire surface. Prime using Sherwin-Williams Loxon Acrylic Primer (product #A24W300). Using a three-course method, repair cracks and any weakened section of concrete using Polyester Fabric (refer to data sheet #20-385) and Acrylic Patching Cement (refer to data sheet #41-220).</p>	<p>Do not apply below 50° F (10° C) or when rain is forecast. Applications during periods of low temperature or high humidity will extend dry time. Allow 4 - 6 hours for coating to dry prior to being subjected to rain, heavy dew or temperatures below 50° F. KEEP FROM FREEZING.</p> <tr> <th colspan="2" style="text-align: center;">APPLICATION EQUIPMENT</th> </tr> <td> <p>Inspect preliminary work relating to substrate for problem areas to ensure all preparatory work has been properly completed.</p> <p>Apply with a soft brush (avoid excessive brushing), roller or airless spray. This product has excellent suspension and requires minimal stirring. DO NOT THIN.</p> <p>Airless Spray</p> <ul style="list-style-type: none"> • Pressure: 2,800 psi • Spray tip: Reversible, self-cleaning tip without diffuser pin. Size .033" with a fan angle of 60° (ex. 633). • Hose Size: At 300' total hose length, use 250' of ¾" → ½" 10' swivel whip end ⅝" hose. • General: The longer the hose, the smaller the tip orifice size. <p>Brush/Roll</p> <ul style="list-style-type: none"> • Soft brushes or a ¾" nap roller may be used. May require multiple coats to achieve proper coverage. </td>	APPLICATION EQUIPMENT		<p>Inspect preliminary work relating to substrate for problem areas to ensure all preparatory work has been properly completed.</p> <p>Apply with a soft brush (avoid excessive brushing), roller or airless spray. This product has excellent suspension and requires minimal stirring. DO NOT THIN.</p> <p>Airless Spray</p> <ul style="list-style-type: none"> • Pressure: 2,800 psi • Spray tip: Reversible, self-cleaning tip without diffuser pin. Size .033" with a fan angle of 60° (ex. 633). • Hose Size: At 300' total hose length, use 250' of ¾" → ½" 10' swivel whip end ⅝" hose. • General: The longer the hose, the smaller the tip orifice size. <p>Brush/Roll</p> <ul style="list-style-type: none"> • Soft brushes or a ¾" nap roller may be used. May require multiple coats to achieve proper coverage.
APPLICATION EQUIPMENT				

APPLICATION BULLETIN

APPLICATION PROCEDURES	CLEAN-UP INSTRUCTIONS
<p>Surface Preparation must be completed as indicated.</p> <p>Mixing Instructions: Minimal stirring required.</p> <p>Application Rate: Apply each coat at a rate of 1 - 2 gallons per 100 sq. ft. (16-32 wet mils). See system specifications for more details.</p> <p>Dry Time: Exposure to rain or heavy dew: 4 - 6 hours Between coats and before foot traffic: 24 hours minimum drying time is temperature, humidity and film thickness dependent.</p> <p>Clean Up: Warm, soapy water.</p>	<p>Inspect completed application and correct any defects. Manufacturer's representatives may inspect the completed roofing system and notify the contractor of any defects in the application. Clean up all debris, excess materials, and equipment and remove from site. Restrict traffic to only essential personnel. Provide appropriate protection against traffic and construction activities on completed roofs.</p>
	PERFORMANCE TIPS
	<ul style="list-style-type: none"> • Inspect base coat prior to applying finish coat to ensure proper adhesion and that surface is clean. • Use wet mil gauge to ensure proper coating requirement. • When being used as a topcoat, "Box" product together to ensure color uniformity • Allow 24 hours between coats or before foot traffic. • It is recommended that the coating installation be checked on regular maintenance schedule. Small area touch-up can be made at any time following recommended application procedures. • Technical advice on use of material for specific application and end-use requirements is available from the manufacturer. Material Safety Data Sheet (MSDS) should be consulted for further information. This product is for industrial and professional use only. • Any discharge of fumes or possible contaminants must be noted. Contact Uniflex[®] to determine if fumes or matter being exhausted will interfere with adhesion. • Note: Slope of roof area must not be less than ¼" per foot.
	SAFETY PRECAUTION
	<p>Refer to the MSDS sheet before use.</p> <p>Published technical data and instructions are subject to change without notice. Contact your Uniflex[®] representative for additional technical data and instructions.</p>
	WARRANTY
	<p>This product is manufactured of good materials and by competent workmen. Seller and manufacturer's only obligations shall be to replace such quantity of product proved to be defective. Neither seller nor manufacturer shall be liable for any injury, loss or damage, direct or consequential, arising from the use or the inability to use the product for his/her intended use; and user assumes all risk and liability.</p>
DISCLAIMER	
<p>The information and recommendations set forth in this Product Data Sheet are based upon tests conducted by or on behalf of KST Coatings – A Business Unit of The Sherwin-Williams Company. Such information and recommendations set forth herein are subject to change and pertain to the product offered at the time of publication. Consult your Uniflex[®] representative to obtain the most recent Product Data Information and Application Bulletin.</p>	<p>Uniflex[®] is a U.S. registered trademark. The information on this data sheet is effective as of August 2007 and supersedes all previous information.</p>

APPENDIX B

Polyethylene Restraint System

Figure WRPE-ASM

Polyethylene Lifting Lug

Figure WRPE-LUG

Polyethylene Clip

Figure WRPE-CLIP

Side Mounted Lifting Lugs

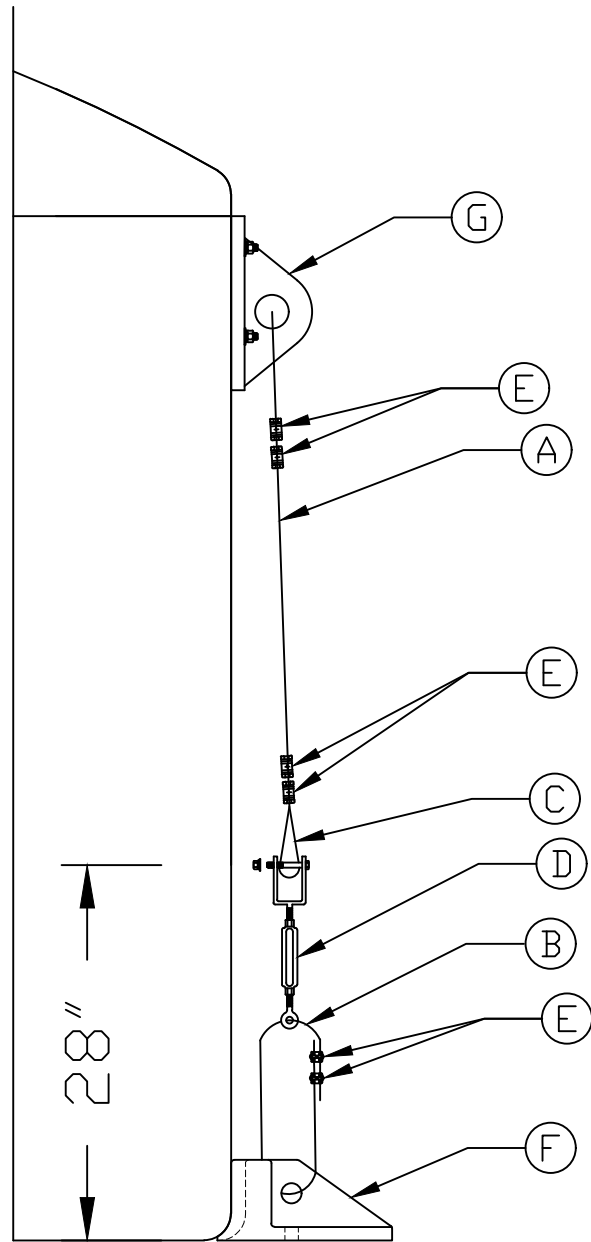
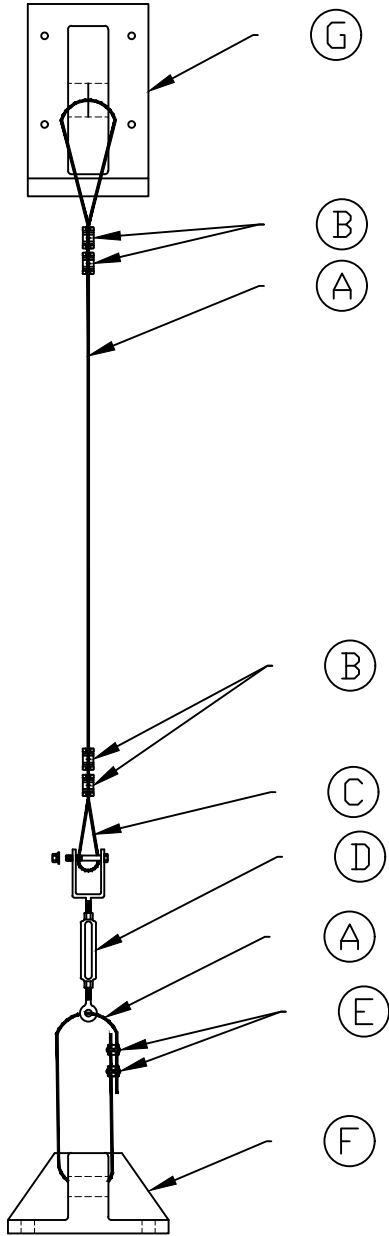
Figure LL002

ATC Hazards by Location Data Sheets

Pages 1-5

Preliminary Calculations


Pages 1-10



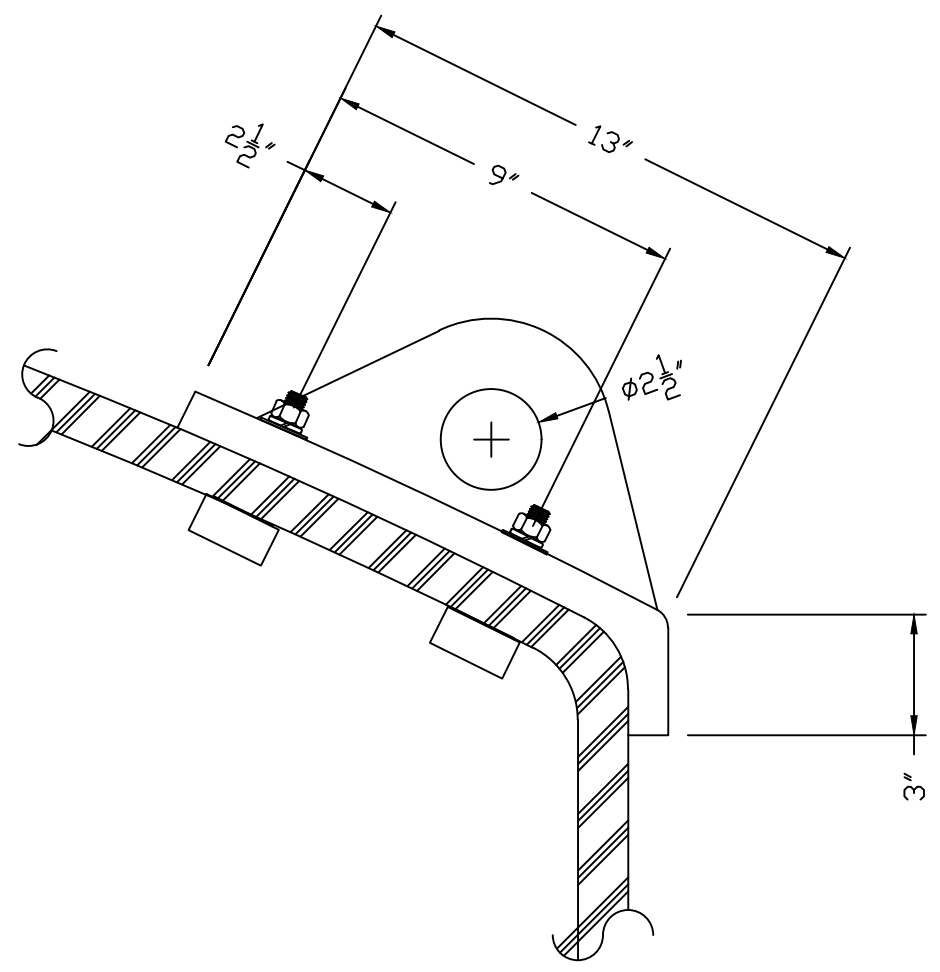
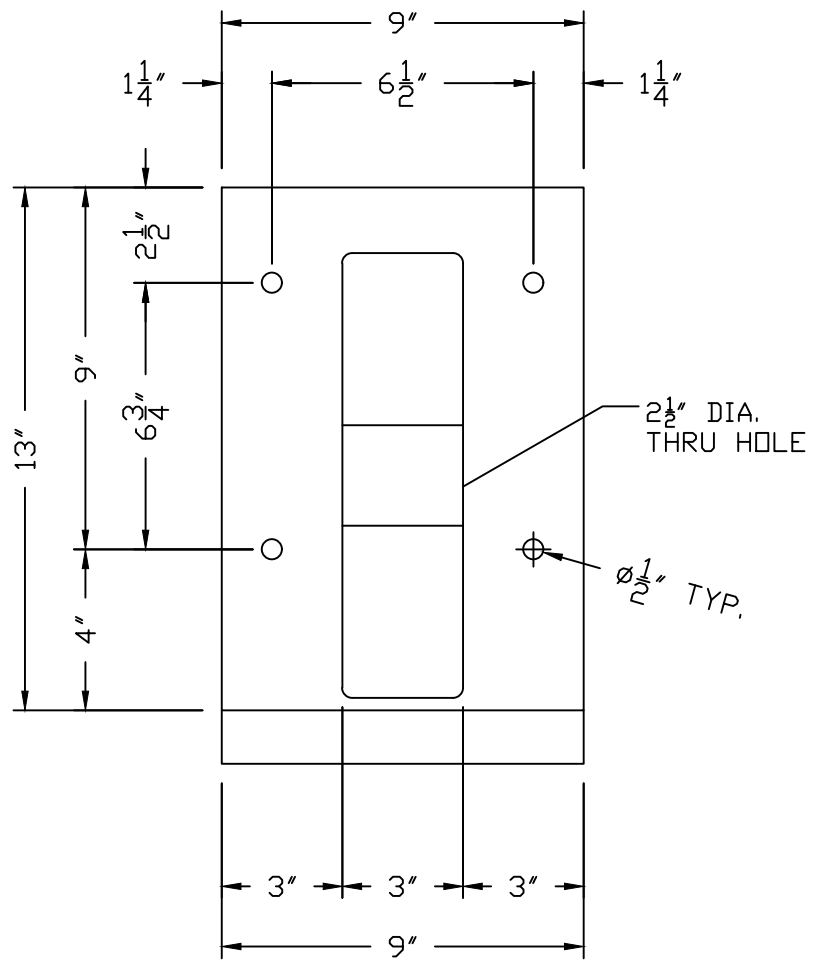
ANCHOR BOLTS NOT SUPPLIED BY ASSMANN

ACCESSORIES			
MK	QTY	SIZE	DESCRIPTION
A	4	3/16	$\frac{3}{16}$ " DIAMETER AIRCRAFT GRADE CABLE GALVANIZED OR STAINLESS (TOP CABLE AS REQUIRED) (BOTTOM CABLE CUT TO 4') 4 REQUIRED
B	16	3/16	$\frac{3}{16}$ " CABLE SIZE SWAGE FITTINGS ALUMINUM OR STAINLESS (4 PER CABLE ASSEMBLY) SWAGE FITTINGS CRIMPED TWICE 2PCS PER CONNECTION
C	4	3/16	$\frac{3}{16}$ " SIZE STANDARD DUTY GALVANIZED OR STAINLESS THIMBLES (1 PER CABLE ASSEMBLY) THIMBLE IS INSTALLED ON BOTTOM OF UPPER CABLE (28" ELEVATION TO CENTER OF THIMBLE)
D	4	3/16	$\frac{1}{2}$ " X 4" DROP FORGED GALVANIZED OR STAINLESS EYE / JAW TURNBUCKLE (1 PER CABLE ASSEMBLY)
E	8	3/16	$\frac{3}{16}$ " SIZE STANDARD DUTY GALVANIZED OR STAINLESS CABLE CLAMPS (2 PER CABLE ASSEMBLY)
F	4	-	ROTATIONALLY MOLDED POLYETHYLENE RESTRAINT CLIPS (4 PCS)
G	4	-	ROTATIONALLY MOLDED POLYETHYLENE LIFTING LUG / CABLE GUIDES (4 INSTALLED ON TANK)


USE TANK OVERALL HEIGHT PLUS 30" TO CALCULATE TOTAL CABLE LENGTH

A	REVISED RESTRAINT CONFIGURATION	11/6/2014	MC
REV	REVISION DESCRIPTION	REV DATE	
		SALES ORDER 300 N TAYLOR ROAD GARRETT, IN 46738 PHONE: (260) 357-3181 FAX: (260) 357-3738	
TITLE POLYETHYLENE WINDLOAD RESTRAINT SYSTEM ASSEMBLY DRAWING (SIDE MOUNT)		DRAWN BY: SROWLISON DRAWN DATE: 4/21/11	
ASSMANN CORPORATION OF AMERICA		DWG NUMBER: WRPE-ASM-SIDE	
		REV A	

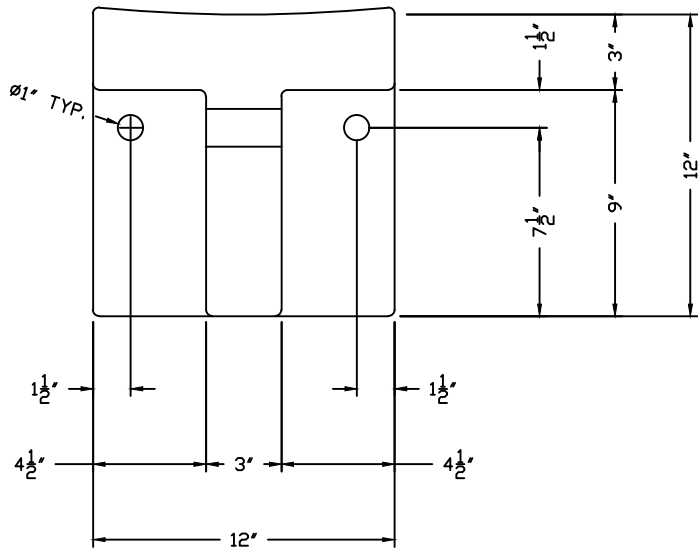
ACCESSORIES			DESCRIPTION
MK	QTY	SIZE	



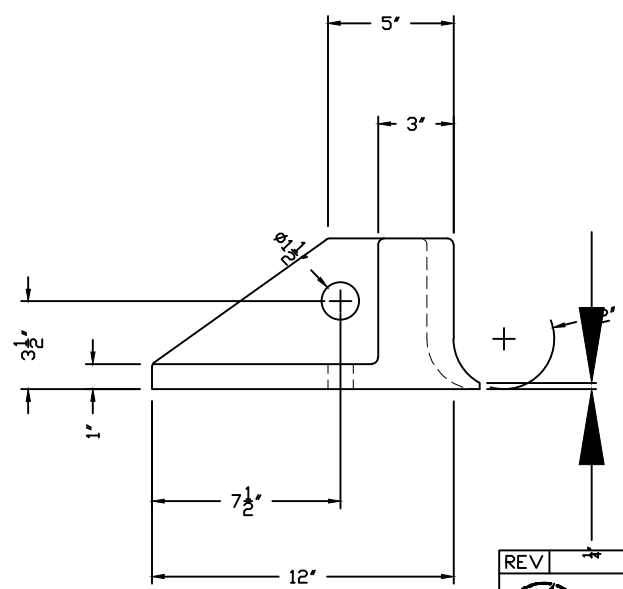
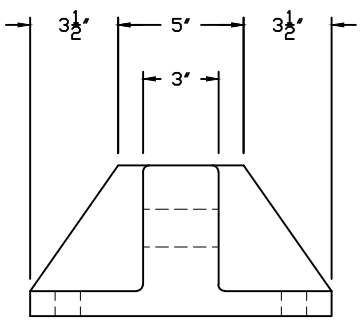
NOTES:
 1) RESTRAINT LUGS ARE BLACK POLYETHYLENE.
 2) RESTRAINT LUGS ARE MOLDED WITH S/S THROUGH HOLE INSERT PIPE

REV	REVISION DESCRIPTION	REV DATE
	 300 N TAYLOR ROAD GARRETT, IN 46738 PHONE: (260) 357-3181 FAX: (260) 357-3738	SALES ORDER
	TITLE POLYETHYLENE MOLDED TIE DOWN LIFTING LUG DETAIL DRAWING	DRAWN BY: D. MYERS
	ASSMANN CORPORATION OF AMERICA	DRAWN DATE: 09/28/10
		DWG NUMBER: WRPE-LUG
		REV -

ACCESSORIES			
MK	QTY	SIZE	DESCRIPTION

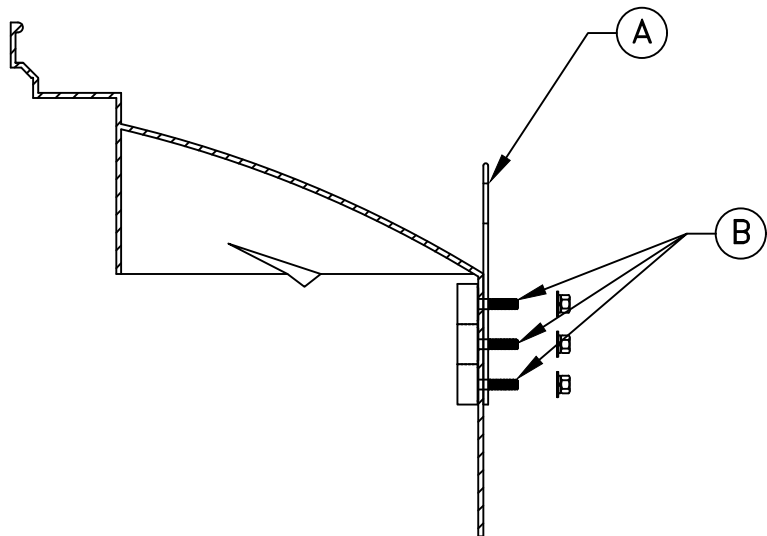


- NOTES:
- 1) RESTRAINT CLIPS ARE BLACK POLYETHYLENE.
 - 2) RESTRAINT CLIPS ARE MOLDED WITH S/S THROUGH HOLE INSERT PIPE
 - 3) ANCHOR BOLTS ARE NOT SUPPLIED BY ASSMANN

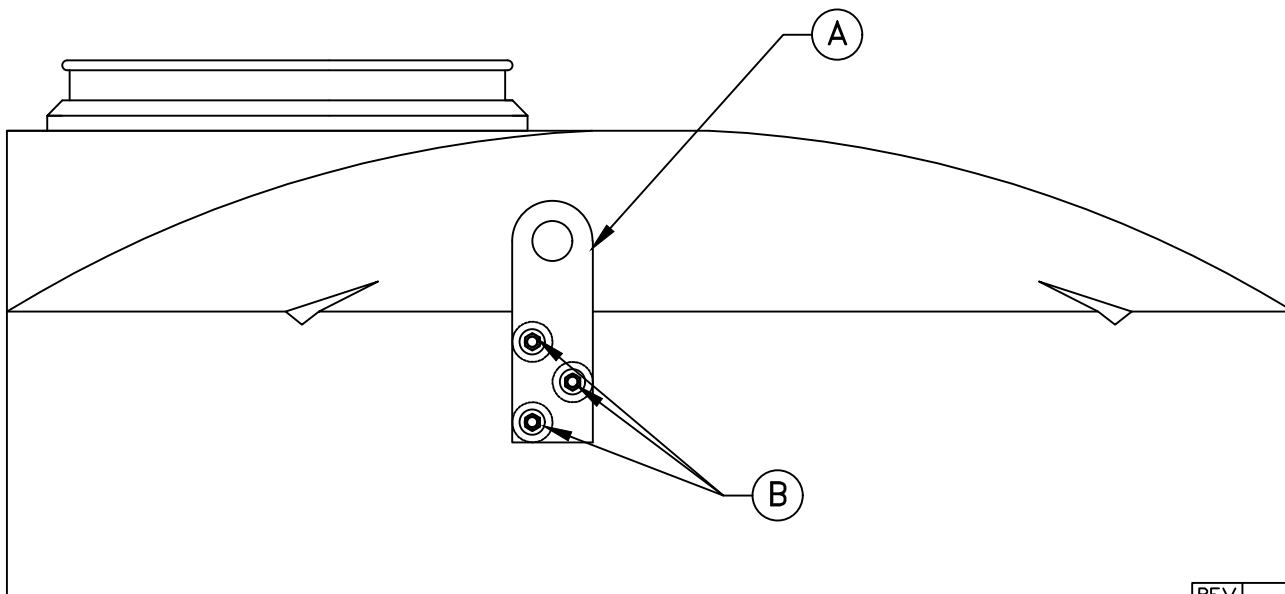


REV	REVISION DESCRIPTION	REV DATE
1		


	300 N TAYLOR ROAD GARRETT, IN 46738 PHONE: (260) 357-3181 FAX: (260) 357-3738	SALES ORDER
	DRAWN BY: SROWLISON	DRAWN DATE: 09/07/11
TITLE POLYETHYLENE WINDLOAD RESTRAINT PAD / CLIP DETAIL DRAWING		DWG NUMBER: WRPE-CLIP
		REV -



ACCESSORIES			
MK	QTY	SIZE	DESCRIPTION
A	4	-	SIDE MOUNT LIFTING LUG CONSTRUCTED OF EITHER MILD STEEL EPOXY COATED OR 316 STAINLESS STEEL
B	12	-	ENCAPSULATED BOLTS, EITHER 316 STAINLESS STEEL, TITANIUM OR HASTELLOY. RUBBER ENCAPSULATION EITHER EPDM OR VITON

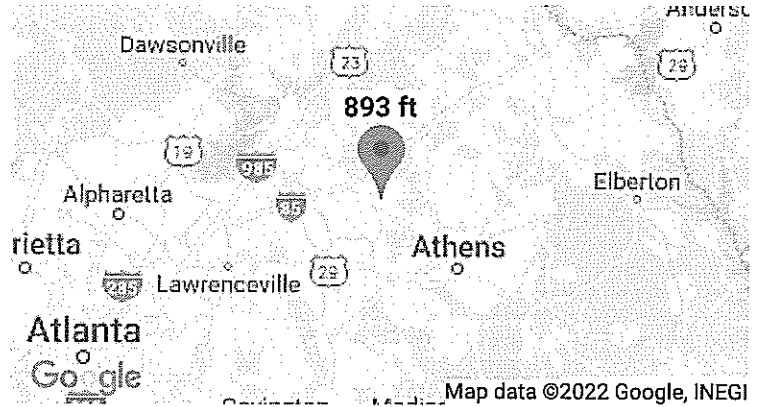


NOTES:
 1 LIFTING LUGS SET INCLUDES 4PCS EVENLY SPACED
 90° TYPICAL.

REV	REVISION DESCRIPTION	REV DATE
	 300 N TAYLOR ROAD GARRETT, IN 46738 PHONE: (260) 357-3181 FAX: (260) 357-3738	SALES ORDER DRAWN BY: SROWLISON DRAWN DATE: 5/10/2000
	TITLE SIDE MOUNT LIFTING LUG ASSEMBLY	DWG NUMBER: LL002 REV ∅

Search Information

Address: 30549
Coordinates: 34.0963975, -83.57096399999999
Elevation: 893 ft
Timestamp: 2022-06-02T16:22:48.401Z
Hazard Type: Wind



ASCE 7-16

MRI 10-Year 72 mph
 MRI 25-Year 78 mph
 MRI 50-Year 84 mph
 MRI 100-Year 90 mph
 Risk Category I 99 mph
 Risk Category II 106 mph
 Risk Category III 113 mph
 Risk Category IV 118 mph

ASCE 7-10

MRI 10-Year 76 mph
 MRI 25-Year 84 mph
 MRI 50-Year 90 mph
 MRI 100-Year 96 mph
 Risk Category I 105 mph
 Risk Category II 115 mph
 Risk Category III-IV 120 mph

ASCE 7-05

ASCE 7-05 Wind Speed 90 mph

The results indicated here DO NOT reflect any state or local amendments to the values or any delineation lines made during the building code adoption process. Users should confirm any output obtained from this tool with the local Authority Having Jurisdiction before proceeding with design.

Disclaimer

Hazard loads are interpolated from data provided in ASCE 7 and rounded up to the nearest whole integer. Per ASCE 7, islands and coastal areas outside the last contour should use the last wind speed contour of the coastal area – in some cases, this website will extrapolate past the last wind speed contour and therefore, provide a wind speed that is slightly higher. NOTE: For queries near wind-borne debris region boundaries, the resulting determination is sensitive to rounding which may affect whether or not it is considered to be within a wind-borne debris region.

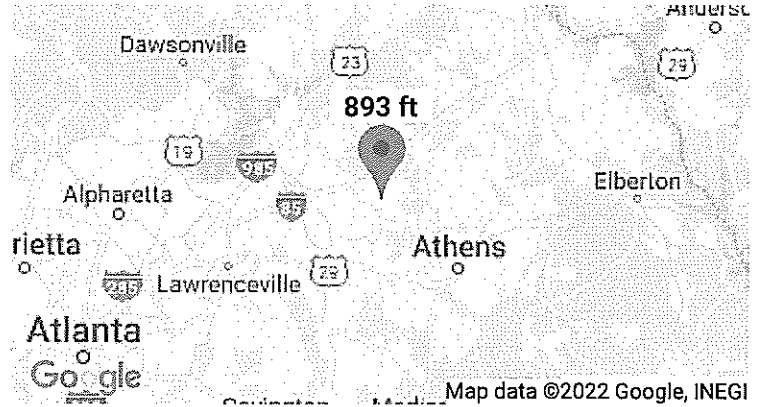
Mountainous terrain, gorges, ocean promontories, and special wind regions shall be examined for unusual wind conditions.

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and users does not imply approval by the governing banking code bodies responsible for banking code approval and interpretation for the building site described by latitude/longitude location in the report.

Search Information

Address: 30549
Coordinates: 34.0963975, -83.57096399999999
Elevation: 893 ft
Timestamp: 2022-06-02T16:23:02.650Z
Hazard Type: Snow



ASCE 7-16

Ground Snow Load 5 lb/sqft

ASCE 7-10

Ground Snow Load 5 lb/sqft

ASCE 7-05

Ground Snow Load 5 lb/sqft

The results indicated here DO NOT reflect any state or local amendments to the values or any delineation lines made during the building code adoption process. Users should confirm any output obtained from this tool with the local Authority Having Jurisdiction before proceeding with design.

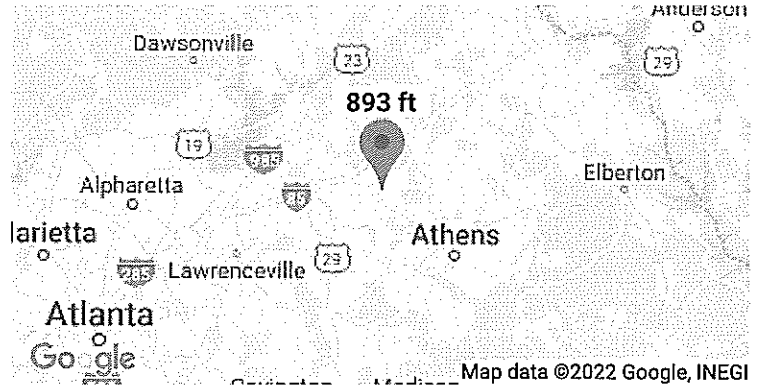
Disclaimer

Hazard loads are interpolated from data provided in ASCE 7 and rounded up to the nearest whole integer.

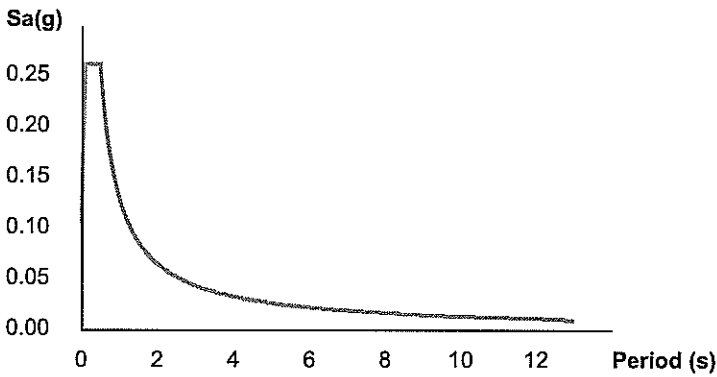
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Search Information

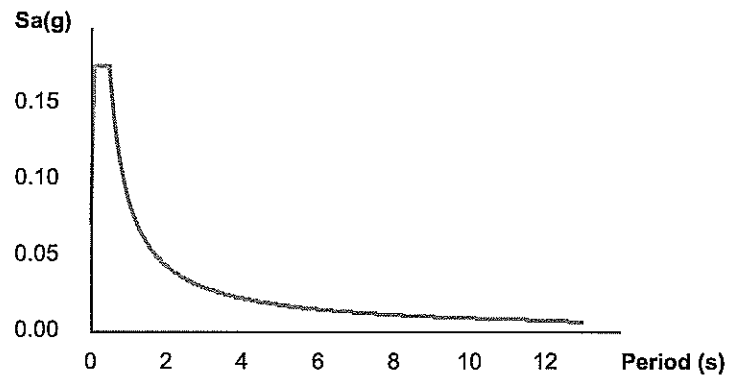
Address: 30549
Coordinates: 34.0963975, -83.57096399999999
Elevation: 893 ft
Timestamp: 2022-06-02T16:23:19.735Z
Hazard Type: Seismic
Reference Document: ASCE7-16
Risk Category: III
Site Class: C



MCE_R Horizontal Response Spectrum



Design Horizontal Response Spectrum



Basic Parameters

Name	Value	Description
S_S	0.201	MCE _R ground motion (period=0.2s)
S_1	0.086	MCE _R ground motion (period=1.0s)
S_{MS}	0.261	Site-modified spectral acceleration value
S_{M1}	0.13	Site-modified spectral acceleration value
S_{DS}	0.174	Numeric seismic design value at 0.2s SA
S_{D1}	0.086	Numeric seismic design value at 1.0s SA

Additional Information

Name	Value	Description
SDC	B	Seismic design category
F_a	1.3	Site amplification factor at 0.2s
F_v	1.5	Site amplification factor at 1.0s

CR _S	0.939	Coefficient of risk (0.2s)
CR ₁	0.908	Coefficient of risk (1.0s)
PGA	0.102	MCE _G peak ground acceleration
F _{PGA}	1.298	Site amplification factor at PGA
PGA _M	0.132	Site modified peak ground acceleration
T _L	12	Long-period transition period (s)
SsRT	0.201	Probabilistic risk-targeted ground motion (0.2s)
SsUH	0.214	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
SsD	1.5	Factored deterministic acceleration value (0.2s)
S1RT	0.086	Probabilistic risk-targeted ground motion (1.0s)
S1UH	0.095	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
S1D	0.6	Factored deterministic acceleration value (1.0s)
PGA _d	0.5	Factored deterministic acceleration value (PGA)

The results indicated here DO NOT reflect any state or local amendments to the values or any delineation lines made during the building code adoption process. Users should confirm any output obtained from this tool with the local Authority Having Jurisdiction before proceeding with design.

Disclaimer

Hazard loads are provided by the U.S. Geological Survey [Seismic Design Web Services](#).

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Structural Analysis

Location

Jefferson GA 30549

Tank-Model

ICT 6500

6/2/2022

Bowers Engineering Services
127 S. Main St.
Auburn, IN

(260) 333-0900
jbowers@bowerseng.com

Project: 95704

Rev: -

Structural Analysis

95704

Tank Design Information

Tank	ICT 6500	<i>SG</i>	<i>Min Required Thickness</i>
	Primary I Crosslink	1.90	1.00
	Secondary I Crosslink	N/A	N/A
	Fluid	1.34	
	Lugs	3	
	Anchors	7/8	inch Diameter 4 inch Embed
		Hilti HIT-RE 500 with	
		ASTM A 193 B7 threaded rod	6 total

Loading

<i>Pg</i>	5.00 psf	<i>Live Load</i>	20 psf
<i>Pf</i>	4.16 psf	<i>Dead Load</i>	2500 lb
<i>Sds</i>	0.174	<i>Wind</i>	120 MPH
<i>Sd1</i>	0.086		
<i>V</i>	5.56 k		

Code Specifications

IBC	IBC 2018
ASCE	ASCE7-16

Material Specifications

Cross-Linkable High Density Polyethylene	Tensile Yield Strength	2800 psi
Linear Low Density Polyethylene	Tensile Yield Strength	2600 psi

Lugs	Linear Low Density Polyethylene
Anchor Bolts	Hilti HIT-RE 500 V3
Cables	3/16" diameter with a breaking strength of 3210 lb.

Design Notes

- * Design pressures are based on environmental loads and fluid pressures only!
- * Assumed 2000 psi concrete
- * Tanks assumed to be in continuous contact with the foundation.
- * Design Calculations based on new condition.
- * Anchor bolt recommendations based on minimum requirements
- * Final anchor bolt design by GC/Engineer Of Record based on site conditions.

Tank Design Data entry		General Info	
Cust. Name:	ECO-TECH	Subject:	ICT 6500
Job Number:	95704	Originator:	JLL
Date:	6/2/2022	Checker:	
City, State:	Jefferson GA 30549	Rev:	-

General Information

Tank Type

Poly. Type	I Crosslink	Tank SG
Single Wall	ICT 6500	1.9
Double Wall		
Secondary Outer		
Primary Inner		

Tank Info O/A

Fluid Height	14.42 ft
Tank Height	16.08 ft
Dome Height	15.00 in
Design Stress	600 psi

Design Loads

Risk Category	III
Terrain Category C _e	C

$I_s = 1.1$

$I_e = 1.25$

Live Load =	20 psf
Snow Load =	5 psf
Total Dead Load =	2500 lb
Rain Load =	5 psf
Wind Velocity =	120 mph
$S_{Ds} =$	0.174
$S_{D1} =$	0.086
$T_L =$	12 sec
Fluid SG _{max} =	1.34

Primary Inner

Diameter	8.75 ft
Tank Area	60.13 ft ²
Weight of Fluid	72519.50 lb
Min thickness	1.00 in

Secondary Outer

Diameter	8.75 ft
Tank Area	60.13 ft ²
Weight of Fluid	72519.50 lb
Min thickness	1.00 in

Building Code
IBC 2018

Design Pressures

	Height	Pressure
1	14.42	1.16 ksf
2	12.98	1.04 ksf
3	11.53	0.92 ksf
4	10.09	0.80 ksf
5	8.65	0.68 ksf
6	7.21	0.56 ksf
7	5.77	0.44 ksf
8	4.33	0.32 ksf
9	2.88	0.20 ksf
10	1.44	0.08 ksf

Assmann Corporation 300 N. Taylor Rd. Garrett, IN		Date: 6/2/2022	Tank Design <u>Load Cases</u>
Cust. Name:	ECO-TECH	Subject:	ICT 6500
Job Number:	95704	Originator:	JLL
		Checker:	

Dead Load = 41.58 psf
 Live Load = 20.00 psf
 Snow Load = 9.24 psf
 Rain Load = 5.00 psf
 Wind Load H = 16.00 psf
 Wind Load V = -23.43 psf
 Seismic = 39.49 psf

Vertical Load Cases

Tank Filled

Tank Empty

1 D	41.58 psf	41.58 psf
2 D + L	61.58 psf	61.58 psf
3 D + (Lr or S or R)	61.58 psf	61.58 psf
4 D + 0.75L + 0.75(Lr or S or R)	61.58 psf	61.58 psf
5 D + (0.6W or 0.7E)	69.22 psf	69.22 psf
6a D + 0.75L + 0.75(0.6W) + 0.75(Lr or S or R)	46.03 psf	46.03 psf
6b D + 0.75L + 0.75(0.7E) + 0.75S	69.24 psf	69.24 psf
7 0.6D + 0.6W	10.89 psf	10.89 psf
8 0.6D + 0.7E	52.59 psf	52.59 psf

Max W_v = 69.24 psf Positive
 0.00 psf Negative

Horizontal Load Cases

1 D	0.00 psf	0.00 psf
2 D + L	0.00 psf	0.00 psf
3 D + (Lr or S or R)	0.00 psf	0.00 psf
4 D + 0.75L + 0.75(Lr or S or R)	0.00 psf	0.00 psf
5 D + (0.6W or 0.7E)	27.64 psf	9.60 psf
6a D + 0.75L + 0.75(0.6W) + 0.75(Lr or S or R)	7.20 psf	7.20 psf
6b D + 0.75L + 0.75(0.7E) + 0.75S	20.73 psf	0.62 psf
7 0.6D + 0.6W	9.60 psf	9.60 psf
8 0.6D + 0.7E	27.64 psf	0.83 psf

Max $W_{H\text{Filled}}$ = 27.64 psf
 Max $W_{H\text{Empty}}$ = 10.00 psf

Assmann Corporation 300 N. Taylor Rd. Garrett, IN		Date: 6/2/2022	Tank Design <u>Loading</u>
Cust. Name:	ECO-TECH	Subject:	ICT 6500
Job Number:	95704	Originator:	JLL Checker:

Tank

ICT 6500

Tank Type	I Crosslink	Design Stress	600	psi
Diameter =	8.75	ft		
Height =	16.08	ft		
Fluid Height =	14.42	ft		
Specific Gravity =	1.34			
Fluid Pressure =	8.07	psi		
Tank Weight =	2500.00	lb		
Fluid Weight =	72519.50	lb		

Design

Load Case 1) Filled

OM =	49.12	k-ft	OK	
RM =	196.93	k-ft	196.93	k-ft > 49.1 k-ft
Uplift =	0.00	k	OK	
Total Weight =	75.02	k	75.02	k > 0.00 k
Sliding =	6.11	k	OK	
Friction =	26.26	k	26.26	k > 6.11 k

Load Case 2) Empty

OM =	17.77	k-ft	Needs Tie Downs	
RM =	6.56	k-ft	6.56	k-ft < 17.77 k-ft
Uplift =	0.00	k	OK	
Total Weight =	2.50	k	2.50	k > 0.00 k
Sliding =	2.21	k	Needs Tie Downs	
Friction =	0.88	k	0.88	k < 2.21 k

OM	11.21	k-ft
Uplift	No Tie Downs Needed	k
Sliding	1.34	k

Maximum Moment to be resisted

11.21 k-ft

Maximum horizontal Load to be resisted

1.34 k

Assmann Corporation 300 N. Taylor Rd. Garrett, IN		Primary	Date: 6/2/2022	Tank Design <u>IBC 2018</u>
Cust. Name:	ECO-TECH	Subject:	ICT 6500	
Job Number:	95704	Originator:	JLL	Checker:

Tank

ICT 6500

Tank Type	I Crosslink	Design Stress	600 psi
Diameter =	8.75 ft	External Pressure	
Height =	16.08 ft	Load Case	
Fluid Height =	14.42 ft	Vertical + =	69.24 psf
Specific Gravity =	1.34	Vertical - =	0.00 psf
Fluid Pressure =	8.07 psi	Horizontal =	27.64 psf
Tank Weight =	2500.00 lb		
Fluid Weight =	72519.50 lb		

Internal Pressure (max@6" from Bottom)
8.07 psi

Barlow Formula

$P=2st/D$

$T= P \times OD / 2 * SD$ 1.00 in Min wall thickness at 100° F

Cable Lug/Lateral Stop

Res. Moment $M_v =$ 11.21 k-ft
Horizontal Load $P_H =$ 1.34 k

Cable Lug/ Lateral Stop Vertical Load

$P_v =$ 1.28 k **Number required** 3 SF = 3

Lateral Stop Horizontal Load

$P_H =$ 1.34 k **Number required** 3 SF = 3

Cable Lug/Lateral Stop

Use 3 Cable Lugs/Lateral Stops

Anchor Bolts

	2 AB per lug	Hilti Allowable
$P_v =$	640.39 lb	3005 lb
$P_H =$	333.78 lb	7795 lb

**Use 7/8 in Diameter Hilti HIT-RE 500 V3 with $f_c = 2000$ psi
ASTM A 193 B7 threaded rod and**

4 in Embed

Minimum Anchor Size. Anchors designed by others.

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Assmann Corporation 300 N. Taylor Rd. Garrett, IN		Secondary		Date: 6/2/2022	Tank Design <u>IBC 2018</u>
Cust. Name:	ECO-TECH	Subject:	ICT 6500		
Job Number:	95704	Originator:	JLL	Checker:	

Tank

ICT 6500

Tank Type I Crosslink
Diameter = 8.75 ft
Height = 16.08 ft
Fluid Height = 14.42 ft
Specific Gravity = 1.34
Fluid Pressure = 8.07 psi
Tank Weight = 2500.00 lb
Fluid Weight = 72519.50 lb

Design Stress 600 psi
External Pressure
Load Case
Vertical + = 69.24 psf
Vertical - = 0.00 psf
Horizontal = 27.64 psf

Internal Pressure (max@6" from Bottom)
8.07 psi

Barlow Formula

$P=2st/D$

$T= P \times OD / 2 * SD$ 1.00 in Min wall thickness at 100° F

Assmann Corporation 300 N. Taylor Rd. Garrett, IN		Date: 6/2/2022	Tank Design <u>Wind Loads</u>
Cust. Name:	ECO-TECH	Subject:	ICT 6500
Job Number:	95704	Originator:	JLL
		Checker:	

Tank

ICT 6500

Diameter = 8.75 ft

Height = 16.08 ft

Code Reference

$$q_z = .00256 * K_z * K_{zt} * K_d * K_e * V^2$$

30.15 lb/ft² 29.3.2

Z = 16.08 ft
 Exposure = C
 V = 120 mph 26.5
 K_z = 0.86 29.3.1
 K_{zt} = 1 26.8.2
 K_d = 0.95 26.6
 K_e = 1

$$F = q_z * G * C_f * A_f$$

3397.91 lb 29.5

D = 8.75 ft
 h/D = 1.84
 Surface Type = Moderatly Smooth
 D√q_z = 48.04
 G = 0.85 26.9.1
 C_f = 0.6 Fig 29.5-1
 A_f = 221.01 ft²

Wind Load _u = 16.00 psf

Uplift

$$p = q * G_f * C_p$$

NO internal pressure assumed 27.4-2

f = 15.00 in
 D = 8.75 ft
 h_D = 16.08 ft
 f/D = 0.14
 h_D/D = 1.84

C_p = -0.91 Negative Table 27.4-3

Wind Load _v = -23.43 psf

Assmann Corporation 300 N. Taylor Rd. Garrett, IN		Date: 6/2/2022	Tank Design <u>Snow Loads</u>
Cust. Name:	ECO-TECH	Subject:	ICT 6500
Job Number:	95704	Originator:	JLL
		Checker:	

Tank Code Reference
ICT 6500
Diameter = 8.75 ft
Height = 16.08 ft

Flat Roof Snow Load 7.3

$pf = 0.7 * C_e * C_t * I_s * P_g$ 7.3-1
4.16 psf

- Exposure = C
- $C_e = 0.9$ 7.3-1
- $C_t = 1.2$ 7.3.2
- $I_s = 1.1$ 7.3.3
- $P_g = 5$ psf 7.2
- $C_s = 1$ 7.4.3

Unbalanced Snow Load 7.6.2

- Total Dome Height = 15.00 in
- w = 4.38 ft
- $\theta = 15.95$ degrees
- Unbalanced Snow Load = 9.24 psf 7.6.2

Rain on Snow Surcharge 7.10
 $P_g \leq 20$ psf

$P_g = 0$ psf

Snow Load = 9.24 psf

Assmann Corporation 300 N. Taylor Rd. Garrett, IN		Date: 6/2/2022	Tank Design <u>Seismic Loads</u>
Cust. Name:	ECO-TECH	Subject:	ICT 6500
Job Number:	95704	Originator:	JLL
		Checker:	

Tank		Code Reference
ICT 6500		
Diameter =	8.75 ft	OCC Cat = III
Height =	16.08 ft	R = 3.25
Fluid Height =	14.42 ft	Ie = 1.25
		H/R = 3.29524
$T_i =$	0.38 s	$S_{DS} = 0.17$ B
$T_c =$	1.71 s	$S_{D1} = 0.09$ B
$T_s =$	0.49 s	$C_i = 7$
$T_L =$	12.00 s	$C_c = 1.75$
		$\rho = 1$
V Impulsive		15.7.6.1
$T_i \leq T_s$ $S_{ai} = S_{DS}$	0.17	EQ 15.7-7
$T_s < T_i \leq T_L$ $S_{ai} = S_{D1}/T_i$	0.23	EQ 15.7-8
$T_i > T_L$ $S_{ai} = S_{D1}T_L/T_i^2$	7.29	EQ 15.7-9
$W_{ifilled} =$	75019.50 lb	
$W_{iempty} =$	2500.00 lb	
$V_{ifilled} = S_{ai}W_i/(R/I)$	5020.54 lb	EQ 15.7-5
$V_{iempty} = S_{ai}W_i/(R/I)$	167.31 lb	EQ 15.7-5
V Convective		15.7.6.1
$T_c \leq T_L$ $S_{ac} = 1.5S_{D1}/T_c \leq 1.5S_{DS}$	0.15	EQ 15.7-10
$T_c > T_L$ $S_{ac} = 1.5S_{D1}T_L/T_c^2$	0.53	EQ 15.7-11
$W_{cfilled} =$	4205.20 lb	
$W_{cempty} =$	0.00 lb	
$V_c = S_{ac}I_e/1.5*W_c$	535.69 lb	EQ 15.7-6
$V_c = S_{ac}I_e/1.5*W_c$	0.00 lb	
Base Shear		15.7.6.1
$V = (V_i + V_c)\rho$	5556.23 lb	EQ 15.7-4
$V = V_i + V_c$	167.31 lb	
Sloshing		
a) Wave Height		15.7.6.1.2
$\delta_s = .42D_iI_eS_{ac}$	0.84 ft	EQ 15.7-13
b)		
Min Freeboard	N/A	ft