

Entity: Lorain County II Landfill
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Doc Subtype: Application + Support
Program: MSW Landfills
County: Lorain
Secondary ID: MSWL 018801

Leachate Storage Facility Expansion
Construction Certification Report
for the Lorain County II Landfill

Prepared for



Lorain County, Oberlin, Ohio
March 2013

142575

RECEIVED

MAR 12 2013

OHIO EPA NEDO



4700 Lakehurst Court, Suite 100
Columbus, Ohio 43016

4949



John R. Kasich, Governor
Mary Taylor, Lt. Governor
Scott J. Nally, Director

March 28, 2013

**RE: LORAIN COUNTY II LANDFILL
LORAIN COUNTY
LEACHATE STORAGE TANK
CERTIFICATION CONCURRENCE**

Mr. Chris Jaquet
Environmental Manager
Republic Services, Inc.
43502 Oberlin-Elyria Road
Oberlin, OH 44074

Dear Mr. Jaquet:

On March 12, 2013, Ohio EPA received the following submittal for the Lorain County II Landfill: "Leachate Storage Facility Expansion, Construction Certification Report." The landfill is located at 43502 Oberlin-Elyria Road, New Russia Township, Lorain County, Ohio. The purpose of the report is to detail the construction activities associated with the installation of the second of two leachate tanks. Each tank has a volume of 398,000 gallons.

After finalization of Director's Findings and Orders on August 22, 2008, the relocation of the leachate collection tank facility was approved on August 27, 2008, through a PTI alteration request. The district office also concurred with the certification report for the first tank on August 27, 2008. The second tank was installed between October 16, 2012 and February 18, 2013.

Based on a review of all information, Ohio EPA concurs with the report. If you have any questions, I can be reached at (330) 963-1186, or by electronic mail at jerry.parker@epa.ohio.gov.

Sincerely,

A handwritten signature in black ink, appearing to read "J. Parker", with a long horizontal flourish extending to the right.

Jerry L. Parker
Division of Materials and Waste Management

JLP/cl

cc: Clarissa Gereby, DMWM-NEDO
John Sabo, Lorain County Board of Health
File: [Land/Lorain II Landfill/Aut/47]
DMWM # 4949

Erik Bewley, DAPC-NEDO
Rick Isaac, Brown and Caldwell

4700 Lakehurst Court, Suite 100
Dublin, Ohio 43016
Tel: 614-410-6144
Fax: 614-410-3088
www.browncaldwell.com



March 11, 2013

Mr. Jerry Parker, P.E., R.S.
Environmental Engineer
Ohio Environmental Protection Agency
Division of Materials and Waste Management
Northeast District Office
2110 East Aurora Road
Twinsburg, Ohio 44087

142575

**Subject: Leachate Storage Facility Expansion Construction Certification Report
Lorain County II Landfill
Lorain County, Oberlin, Ohio**

Dear Mr. Parker:

Brown and Caldwell, on behalf of Republic Services, Inc. (Republic), respectfully submits the Leachate Storage Facility Expansion Construction Certification Report (Certification Report) for the Lorain County II Landfill located in Lorain County, Oberlin, Ohio. One copy of the Certification Report is enclosed for your review and comment.

Please contact me at 614-923-5006, if you have any questions concerning the Certification Report.

Very truly yours,

Brown and Caldwell

A handwritten signature in blue ink, appearing to read "R. Isaac".

Richard A. Isaac, P.E.
Supervising Engineer

Enclosure

cc: Chris Jaquet, Republic Services, Inc., Fairview Heights, OH, w/enc.
Richard Kostelnick, Republic Services, Inc., Oberlin, OH, w/enc.
John Sabo, Lorain County Health Department, Elyria, OH, w/enc.
Erik Bewley, Ohio EPA, NEDO, DAPC, Twinsburg, OH, w/enc.
Project File

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MAR 12 2013

OHIO EPA NEDO

Notarized Statement

"I, Chris Jaquet, certify that this Leachate Storage Facility Expansion Construction Certification Report for the Republic Services, Inc. Lorain County II Landfill in Lorain County, Oberlin, Ohio and all attachments were prepared in accordance with the provisions and requirements of Ohio Administrative Code (OAC) Rule 3745-27-08(H) effective August 2003. Based on my inquiry of the person or persons who were directly responsible for gathering the information, or the immediate supervisor of such person(s), the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."



Signature

3/8/13

Date

Chris Jaquet

Name

Area Environmental Manager

Title

On this, the 8 day of March 2013, before me, a notary public, the above signed person, known to me to be the person whose name is subscribed to the within instrument and acknowledged that he executed the same for purposes therein contained.

In witness whereof, I hereunto set my hand and official seal.


Notary Public

LYNN C WILLIAMS
NOTARY PUBLIC - OHIO
MY COMMISSION EXPIRES 08-23-16

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Engineer's Certification

"I, Richard A. Isaac, being a Registered Professional Engineer in the State of Ohio, PE No. E-57074, certify under penalty of law that this Leachate Storage Facility Expansion Construction Certification Report for the Republic Services, Inc. Lorain County II Landfill in Lorain County, Oberlin, Ohio and all attachments were prepared by me or under my direction or supervision in accordance with the provisions and requirements of Ohio Administrative Code (OAC) Rule 3745-27-08(H) effective August 2003 and in accordance with good engineering practices. I have personally visited and examined the facility and am familiar with the information submitted in this document and based on my inquiry of the person or persons directly responsible for preparing this Leachate Storage Facility Expansion Construction Certification Report, the information submitted in the Leachate Storage Facility Expansion Construction Certification Report is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant civil and/or criminal penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Richard A. Isaac

Signature

3/11/13

Date

Richard A. Isaac, P.E.

Name



On this, the *11th* day of *March* 2013, before me, a notary public, the above signed person, known to me to be the person whose name is subscribed to the within instrument and acknowledged that he executed the same for purposes therein contained.

In witness whereof, I hereunto set my hand and official seal.

Kathleen Alleman

Notary Public



KATHLEEN ALLEMAN
Notary Public
In and for the State of Ohio
My Commission Expires
August 11, 2014

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8/4/8

2010

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Section 1

Introduction

The purpose of this Leachate Storage Facility Expansion Construction Certification Report (Certification Report) is to detail the materials, construction/installation methods, and observations and tests performed for the Leachate Storage Facility Expansion Construction Project (LSF) at the Lorain County II Landfill (herein after referred to as the "Landfill"), Lorain County, Oberlin, Ohio. This Certification Report was prepared in general conformance with Ohio Administrative Code (OAC) 3745-27-08(H). The Owner's Notarized Statement and the Engineer's Certification attesting to the accuracy and compliance of this Certification Report are included as Pages ii and iii, respectively.

The Certification Report includes the following sections:

1. Introduction
2. Leachate Storage Tank
3. Pipelines
4. Electrical

A discussion of the LSF materials, construction/installation methods, and observations/tests performed is provided in the appropriate sections. Daily field logs, photographs, project record drawings, pipe pressure test results, and additional relevant information is provided in the appendices.

The field work was performed from October 16, 2012 to February 18, 2013 by Republic's subcontractor, Miller Bros Construction, Inc. (MBC) of Archbold, Ohio. MBC, under the supervision of Brock Quaintance (Superintendent) performed the construction/installation of the pipeline components and aeration system associated with the leachate storage tank. The tank was designed and manufactured by CST Industries, Inc. (CST) of DeKalb, Illinois. The aeration system was designed and manufactured by Aertec Aeration Technologies, Inc. (Aertec) of North Andover, Massachusetts. MBC's subcontractor, Gateway Tank, Inc. (Gateway) of Avon, Ohio, provided assembly services for the tank. Heat trace, pipe insulation, and electrical controls were installed by MBC's subcontractor, Butchko Electric, Inc. of Amherst, Ohio. Construction quality assurance (CQA) oversight was performed by Brown and Caldwell with Nate Givens and Janet Todia providing observations and documentation. Richard A. Isaac, P.E. of Brown and Caldwell served as the certifying engineer and also served as the Project Manager. Daily field logs and construction/installation photographs during periodic site visits/construction meetings are included in Appendices A and B, respectively. Qualifications for Mr. Givens, Ms. Todia, and Mr. Isaac are included in Appendix C.

For the purposes of this Certification Report, construction quality assurance (CQA) is used to refer to activities performed by Brown and Caldwell, where quality control (QC) refers to observation and testing activities performed by the leachate storage tank component's installer (MBC) and manufacturers (Gateway and Aertec).

1.1 Field Alterations/Deviations

During the course of the construction/installation activities, minor alterations/deviations from the construction drawings were implemented in the field. These minor alterations/deviations are listed below, and are also reflected in the Project Record Drawings included in Appendix D:

- The new 10-inch diameter off gas pipe was connected to the existing odor control system.

- The new 6-inch diameter steel airline was connected to the existing 4-inch diameter HDPE airline with a 6-inch by 4-inch tee and a 4-inch diameter steel pipe in order to supply air to the aeration system in the new leachate storage tank.

Section 2

Leachate Storage Tank

The new 404,184-gallon, epoxy-coated, steel leachate storage tank is a Model 3652 SFTT TecStore™ tank designed and manufactured by CST (see Appendix E). The tank is a factory-applied epoxy-coated steel bolt-together constructed tank with an aluminum spherical dome roof. The plan view and details of the new leachate storage tank are provided on the Project Record Drawings (see Appendix D). The tank was assembled on the existing concrete foundation located within the Leachate Storage Facility secondary containment, constructed in 2009.

The new leachate storage tank floor is constructed of factory-applied epoxy-coated steel bolt-together panels set on ½-inch thick Dow® Styrofoam™ sheathing insulation. The 36-foot diameter by 52-foot tall tank sidewall structure is constructed of eleven courses of semi-circular factory-applied epoxy-coated steel bolt-together panels, plus a bottom starter ring of semi-circular factory-applied epoxy-coated steel bolt-together panels. The sidewall starter ring is held in place with embedded steel anchor bolts and steel anchor chairs. The upper portion of the tank sidewall is reinforced with a steel web truss wind stiffener bolted to the bottom of the third course of sidewall panels from the top.

The dome roof is a free span, aluminum geodesic dome, constructed with non-corrugated triangular aluminum panels interlocked by a truss system with wide flange extrusions, and bolted onto the tank sidewall with an attached extended eave angle (see Appendix E). A 24-inch diameter aluminum roof vent is mounted near the center of the dome roof. A 30-inch square aluminum roof manway was installed near the edge of the roof next to the top ladder step-off platform.

One sidewall manway is mounted on the lowest course of full-size panels on the north side of the tank. A tank ladder constructed of aluminum rails and rungs with a hot-dip galvanized cage and a hot-dip galvanized step-off platform is mounted on the south side of the new tank. A liquid level indicator was also installed on the outside of the tank sidewall on the south side of the tank.

The new leachate storage tank is equipped with an aeration system discussed in Section 4.

2.1 Materials

The materials used for the construction/installation of the new leachate storage tank included the following:

- 404,184-gallon, epoxy-coated, steel tank – Model 3652 SFTT TecStore™ tank with appurtenances.
- Pressure relief valve.
- Pressure transducer.
- Liquid level indicator.
- Tank ladder with cage and step off platform.

2.2 Construction/Installation Methods

The general construction/installation methods were as follows:

- The tank and dome were erected by Gateway following the manufacturer's (CST) specifications and recommendations including manways, vents, ladders, platforms, and appurtenances.

- Gateway assembled the starter ring and dome on a system of temporary jacks and struts.
- The dome was hoisted on the jacks and the first course of wall panels was assembled. The process was repeated until all eleven courses of wall panels were assembled. One panel in the lowermost course of full-size wall panels was omitted until installation of the aeration system piping was completed and was later installed by Gateway to complete the tank assembly.
- Gateway disassembled the jacks and struts and removed them from the tank.
- Gateway installed the pressure relief valve on the dome roof.
- Gateway installed the pressure transducer with low level interlock to control the transfer pump and high level switch interlock to stop the leachate fill pumps.
- Gateway installed the external liquid level indicator to the outside of the tank.
- Gateway installed the tank ladder with safety cage and the step off platform to the outside of the tank and the dome roof.
- Gateway installed the pipe nozzles for the pipeline connections discussed in Section 3.

2.3 Observations/Tests

The following observations and tests were performed during the construction/installation of the new leachate storage tank:

- The tank design submittal including the professional engineer's certification was reviewed and is provided in Appendix E.
- The new leachate storage tank, dome, and appurtenances were visually inspected for conformance with the specifications, as well as to verify there were no signs of damage. The new leachate storage tank materials were determined to be in conformance with the specifications and no visual damage to the tank components was observed.
- Visual observation and documentation of the new leachate storage tank installation was performed (see Appendix A and Appendix B for the daily field logs and photographs). No issues were observed for the leachate storage tank installation.
- Hydrostatic testing of the new leachate storage tank was performed over a 24-hour time period (January 17, 2013 at 1420 to January 18, 2013 at 1425) by filling the tank with water and visually observing the tank, manway opening, pipe connections, valves, etc. for leaks. One small leak was detected due to a missing nut on one of the bolts. Gateway installed a nut on this bolt and the leak stopped. The leak test was started following verification that the leak was fixed. No leaks were observed throughout the 24-hour test period. A project certification letter from Gateway certifying the leak test warranty and floor bracket installation is provided in Appendix F.

Section 3

Pipelines

MBC installed the pipeline components required to incorporate the new leachate storage tank into the existing Leachate Storage Tank Facility. The following pipe was used to connect the new leachate storage tank to the existing Landfill Leachate Storage Facility:

- Approximately 142 linear feet of 4-inch diameter SDR 11 solid-wall HDPE pipe.
- Approximately 80 linear feet of 2-inch diameter SDR 11 solid-wall HDPE pipe - secondary containment sump discharge pipeline.
- Approximately 160 linear feet of 10-inch diameter SDR 17 solid-wall HDPE pipe - odor control system pipeline.
- Approximately 80 linear feet of 6-inch diameter steel pipe and 70 linear feet of 4-inch diameter steel pipe - aeration system air compressor pipeline.

A tee and blind flanges were installed at the ends of the odor control and aeration system air compressor pipelines to accommodate future connections for new odor control and air compressor systems. The location of these pipelines is depicted on the Project Record Drawing (see Appendix D).

3.1 Materials

The components used to incorporate the new leachate storage tank into the existing Landfill Leachate Storage Facility include the following:

- 2-inch diameter solid SDR 11 HDPE force main pipe.
- 4-inch diameter solid SDR 11 HDPE force main pipe.
- 10-inch diameter solid SDR 17 HDPE off gas pipe
- 4-inch diameter steel airline.
- 6-inch diameter steel airline
- Various sizes of HDPE tie-in couplings, reducers, tees, and other fittings and appurtenances.
- Recirculation system pump.
- Pipe supports.
- Metal platform extension.

3.2 Construction/Installation Methods

The general construction/installation methods used to connect the new leachate storage tank to the existing Landfill Leachate Storage Facility were as follows:

- HDPE and steel pipe of various diameters was delivered to the site and stored in a clean area.
- The 2-inch, 4-inch, and 10-inch HDPE pipe was butt-fusion welded on-site by MBC prior to being connected to the new leachate storage tank and the existing Landfill Leachate Storage Facility.
- MBC installed steel pipe support columns along pipe alignments. The pipe supports were secured to the floor and side slopes of the secondary containment with concrete studs.
- The steel pipe was pre-fabricated with flange connections and all necessary elbows and tees by the steel pipe supplier.

- MBC connected the steel and HDPE pipelines, check valves, and isolation valves to the new leachate storage tank and to the existing Landfill Leachate Storage Facility with flange connections.
- The recirculation pump was installed in the recirculation system piping.
- Installed pipelines, fittings, and components were field surveyed after installation.

Locations of the pipelines, components, and appurtenances are provided on the Project Record Drawing in Appendix D.

The existing metal stairs were removed from the pump platform, the platform was extended, and the metal stair were reattached.

3.3 Observations/Tests

The following observations and tests were performed during the connection of the new leachate storage tank to the existing Landfill Leachate Storage Facility:

- The HDPE pipe and valves submittal was reviewed are included in Appendix E.
- Pipe was visually observed for conformance with the construction drawings, as well as to verify there were no signs of damage. The pipe was determined to be in conformance with the construction drawings and no visual damage to the pipe was observed.
- Butt-fusion welds were visually observed. Brown and Caldwell CQA monitors observed hot plate temperature, holding times, and welding techniques. The welds were determined to be in conformance with the specifications.
- Pipelines were air pressure tested prior to being connected to the existing Landfill Leachate Storage Facility. Air pressure testing consisted of applying a minimum of 25 pounds per square inch (psi) for the 10-inch diameter SDR 17 HDPE pipe, and a minimum of 50 psi for the 4-inch diameter and 2-inch diameter SDR 11 HDPE pipe. All tests were conducted over a minimum four-hour period. Prior to beginning the test, during the test, and following completion of the test, the gauges were visually assessed for damage and proper units of measurement. The results of the pressure tests determined that the pipelines did not have any leaks. Pipe pressure test results are provided in Appendix G.

Section 4

Aeration System

The aeration system consists of a 6-inch diameter stainless steel drop pipe, two 4-inch diameter solid SDR 11 HDPE header pipes, and four 4-inch diameter perforated SDR 11 HDPE lateral pipes. The stainless steel drop pipe is secured to the tank via a flange connection at the top and four (4) angle brackets bolted to the tank wall. The drop pipe rests on a pipe support welded to the stainless steel elbow at the bottom with an HDPE bearing pad separating the support from the tank floor. The solid HDPE header pipes are connected to the drop pipe via 4-inch diameter flange connections with stainless steel backup rings. The header and lateral pipes are secured to the floor of the tank with yokes and retaining rods supplied by Aertec. Retaining anchor plates, field fabricated by MBC, connect the aeration system laterals to the floor of the tank.

4.1 Materials

The aeration system components include the following materials:

- Aertec® Aergrid™ aeration system with stainless steel drop pipe, header pipes, lateral pipes, and appurtenances.
- Various sizes of stainless steel and HDPE tees, fittings, and appurtenances.
- Various sizes of stainless steel plates, HDPE flat stock, fittings, and stainless steel fasteners.

4.2 Construction/Installation Methods

The aeration system was installed by MBC as follows:

- MBC assembled the aeration system piping provided by Aertec inside the tank.
- MBC anchored the aeration grid to the floor of the tank as follows:
 - Field-drilled stainless steel plates.
 - Cut various sizes of HDPE flat stock to form bearing pads under the plates.
 - The plates were secured to the tank floor using the tank floor bolts and additional stainless steel bolts, nuts, and washers.
 - The aeration grid pipe supports (yokes, threaded rods, and bent plates) provided by Aertec were fastened to the stainless steel plates with stainless steel bolts, nuts, and washers.

4.3 Observations/Tests

The following observations and tests were performed during the installation of the aeration system:

- The aeration system submittals were reviewed and are provided in Appendix E.
- The aeration system and appurtenances were visually observed for conformance with the specifications, as well as to verify there were no signs of damage. These materials were determined to be in conformance with the specifications and no visual damage to the materials was observed.
- The aeration system was observed for proper alignment inside the tank.
- The aeration system anchors were observed for proper installation to the tank floor and connection of the support yokes to the anchors.

4.4 Air Monitoring

Air monitoring was performed during performance of a confined space entry into the assembled tank to observe the aeration system anchors. A multi-gas VRAE monitoring device, manufactured by RAE Systems, was used to conduct the air monitoring. The atmospheric concentrations within the breathing zone were monitored for methane (lower explosive limit [LEL]), oxygen, carbon monoxide, and hydrogen sulfide. The air monitoring results, which were recorded by the Brown and Caldwell CQA monitor and the confined space entry permit are provided in Appendix H.

Section 5

Electrical

Electrical work associated with the installation of the new leachate storage tank included pipeline heat trace power. The electrical work was performed by Butchko.

The existing control panel was used to connect pipeline heat trace system. The heat trace was installed on the pipelines, valves, and pumps by wrapping each component as recommended by the manufacturer. The heat trace monitoring lights were installed and the heat trace was tested as provided in Section 5.3. The insulation was placed over the pipelines, valves, and pumps and covered with the PVC jacketing (see Section 5.2 for a discussion of the installation methods).

5.1 Materials

The materials used in the installation of the electrical equipment included the following:

- Delta-Therm Corporation PF High Temp Series Constant Wattage Cables.
- Delta-Therm Corporation PF Series Power and End Terminal Kit.
- Delta-Therm Corporation PC1 and PC 2 Polycarbonate Junction Boxes.
- Delta-Therm Corporation OL-PC Monitor Lights.
- Various ties, clips, and other appurtenances.
- TRYMER™ 2000 XP Polyisocyanurate Insulation.
- Pittsburgh Corning Foamglas® One™ Insulation Systems.
- ITW Insulation Systems aluminum roll jacketing (cladding).
- One-inch and ¾-inch diameter galvanized conduit, tees, 90° elbows, and other appurtenances – electrical conduit.

Product information and data is provided in Appendix E.

5.2 Construction/Installation Methods

The general installation sequence used to install the electrical equipment was as follows:

- The electrical conduit was installed to the existing control panel. Connection to the power source did not occur until the heat trace was installed.
- The heat trace cable, monitoring lights, and power connection were installed along the pipelines, valves, and pumps.
- The thermostat was installed; factory set to activate the heat trace at 40° F.
- One-inch and ¾-inch diameter galvanized electrical conduit was installed and supported along the pipeline supports for the heat trace, monitoring lights, and thermostat.
- Insulation with aluminum covering was placed over the pipelines, valves, and pumps.

5.3 Observations/Tests

The following observations and tests were performed during the electrical installation activities:

- The heat trace and insulation equipment and material submittals were reviewed and are provided in Appendix E.
- Electrical equipment was visually inspected for conformance with the specifications, as well as to verify there were no signs of damage. The electrical equipment was determined to be in conformance with the specifications and no visual damage to the electrical equipment was observed.
- Pipeline insulation and plastic covering were visually inspected for conformance with the specifications, as well as to verify there were no signs of damage. The pipeline insulation and aluminum covering were determined to be in conformance with the specifications and no visual damage to the pipeline insulation and plastic covering was observed.
- Heat trace and thermostat were tested and determined to provide heat to the pipelines based on the pre-set temperature level of 40° F.
- Monitoring lights were tested and determined to be operational when the heat trace was energized.

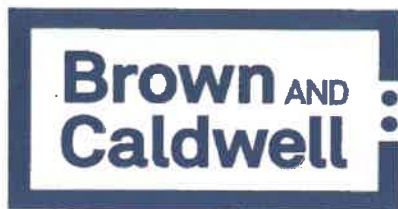
Appendix A: Daily Field Logs

Brown and Caldwell

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Brown and Caldwell

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Daily Field Report

Date: 10-17-12 WEDNESDAY

BC Personnel: N. GIVENS, R. ISAAC

Site: Lorain County II Landfill, Oberlin, OH

Time In: 0900

Project: Leachate Storage Facility Expansion

Time Out: 1100

Project Number: 142575

Weather: CLOUDY, HI 72°F

Items Worked On:

- | | |
|---|--|
| ☒ Tank Installation | ☐ Pipe Pressure Testing |
| ☐ Pipe Fabrication/Installation | ☐ Tank Hydrostatic Testing |
| ☐ Aeration System Installation | ☒ Other - <u>PRECONSTRUCTION MEETING</u> |
| ☐ Heat Trace/Insulation Installation | |
| ☐ Electrical Controls Installation | |

Contractor/Subcontractors/Visitors/Materials Delivered/Alterations:

Contractor - MILLER BROS. (MBC)

Subcontractors - GATEWAY TANK (GATEWAY)

Visitors - N/A

Materials Delivered - N/A

Phone Calls - N/A

Alterations - N/A

Summary of Work:

Page 1 of 1

- ONSITE @ 0900
- PRECONSTRUCTION MEETING
- GATEWAY BEGAN ~~CONSTR~~ ASSEMBLY OF TANK FLOOR
- SPOKE TO BOB QUAINANCE (MBC) ABOUT CONSTRUCTION SCHEDULE
- OFFSITE @ 1100

Attachments:

- ☐ Contractor Report
☐ Field Notes
☐ Other:


Signature of CQA Monitor

10-17-12
Date



Daily Field Report

Date: 10-23-12 TUESDAY

BC Personnel: N. GUEWS

Site: Lorain County II Landfill, Oberlin, OH

Time In: 0730

Project: Leachate Storage Facility Expansion

Time Out: 0945

Project Number: 142575

Weather: Cloudy HI 68°F

Items Worked On:

- | | |
|---|---|
| ☒ Tank Installation | ☐ Pipe Pressure Testing |
| ☐ Pipe Fabrication/Installation | ☐ Tank Hydrostatic Testing |
| ☐ Aeration System Installation | ☐ Other - |
| ☐ Heat Trace/Insulation Installation | |
| ☐ Electrical Controls Installation | |

Contractor/Subcontractors/Visitors/Materials Delivered/Alterations:

Contractor - MBL

Subcontractors - GATEWAY

Visitors - N/A

Materials Delivered - N/A

Phone Calls - R. ISOM (BL)

Alterations N/A

Summary of Work:

Page 1 of 1

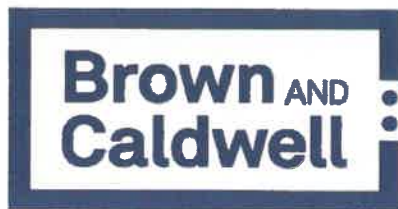
- ONSITE @ 0730
- WEEKLY PROGRESS MEETING
- SPOKE TO BROCK GUINANCE ABOUT CONSTRUCTION SCHEDULE
- GATEWAY ASSEMBLED TANK DOME AND UPPERMOST COURSE OF SHELL PANELS
- OFFSITE @ 0945

Attachments:

- ☐ Contractor Report
- ☐ Field Notes
- ☐ Other:

[Signature]
Signature of CQA Monitor

10-23-12
Date



Daily Field Report

Date: 11-7-12 WEDNESDAY

BC Personnel: N. GWENS

Site: Lorain County II Landfill, Oberlin, OH

Time In: 0915

Project: Leachate Storage Facility Expansion

Time Out: 1325

Project Number: 142575

Weather: SUNNY, HI 46°F

Items Worked On:

- | | |
|---|---|
| ☒ Tank Installation | ☐ Pipe Pressure Testing |
| ☐ Pipe Fabrication/Installation | ☐ Tank Hydrostatic Testing |
| ☐ Aeration System Installation | ☐ Other - |
| ☐ Heat Trace/Insulation Installation | |
| ☐ Electrical Controls Installation | |

Contractor/Subcontractors/Visitors/Materials Delivered/Alterations:

Contractor - MBC

Subcontractors - GATEWAY

Visitors - N/A

Materials Delivered - N/A

Phone Calls - R. KANAL (BC)

Alterations - N/A

Summary of Work:

Page 1 of 1

- ONSITE @ 0915
- SPOKE TO BROCK QUAINANCE ABOUT CONSTRUCTION SCHEDULE AND PROGRESS
- WEEKLY PROGRESS MEETING
- GATEWAY CONTINUED ASSEMBLY OF TANK SHELL. NOZZLES FOR PIPE CONNECTIONS INSTALLED IN LARGEST COURSE OF SHELL PANELS. LADDER W/ SAFETY CAGE, OVERFLOW PIPE, AND LEVEL INDICATOR ARE BEING INSTALLED IN SEGMENTS, FROM THE TOP DOWN, AS TANK IS CREATED.
- OFFSITE @ 1325

Attachments:

- ☐ Contractor Report
- ☐ Field Notes
- ☐ Other:


Signature of CQA Monitor

11-7-12
Date



Daily Field Report

Date: 11-13-12 TUESDAY

BC Personnel: N. GWENS

Site: Lorain County # Landfill, Oberlin, OH

Time In: 1425

Project: Leachate Storage Facility Expansion

Time Out: 1500

Project Number: 142575

Weather: CLOUDY HI 36°F

Items Worked On:

- | | |
|---|---|
| ☐ Tank Installation | ☐ Pipe Pressure Testing |
| ☒ Pipe Fabrication/Installation | ☐ Tank Hydrostatic Testing |
| ☐ Aeration System Installation | ☐ Other - |
| ☐ Heat Trace/Insulation Installation | |
| ☐ Electrical Controls Installation | |

Contractor/Subcontractors/Visitors/Materials Delivered/Alterations:

Contractor - MBL

Subcontractors - N/A

Visitors - N/A

Materials Delivered - N/A

Phone Calls - R. ISAAC (BC)

Alterations - N/A

Summary of Work:

Page 1 of 1

- ONSITE @ 1425
- MET W/ AMANDA JETT (REPUBLIC) TO DISCUSS PROGRESS
- MET W/ BROCK QUAINANCE TO DISCUSS CONSTRUCTION SCHEDULE AND PROGRESS
- MBL IS FABRICATING HDPE PIPE ASSEMBLIES FOR PRESSURE TESTING AND INSTALLATION
- OFFSITE @ 1500

Attachments:

- ☐ Contractor Report
- ☐ Field Notes
- ☐ Other:


Signature of CQA Monitor

11-13-12
Date



Daily Field Report

Date: 11-15-12

BC Personnel: N GWENS

Site: Lorain County II Landfill, Oberlin, OH

Time In: 0900

Project: Leachate Storage Facility Expansion

Time Out: 1330

Project Number: 142575

Weather: SUNNY, HI 45F

Items Worked On:

- | | |
|---|---|
| ☐ Tank Installation | ☒ Pipe Pressure Testing |
| ☐ Pipe Fabrication/Installation | ☐ Tank Hydrostatic Testing |
| ☐ Aeration System Installation | ☐ Other - |
| ☐ Heat Trace/Insulation Installation | |
| ☐ Electrical Controls Installation | |

Contractor/Subcontractors/Visitors/Materials Delivered/Alterations:

Contractor - <u>MBC</u>	Subcontractors - <u>N/A</u>
Visitors - <u>N/A</u>	Materials Delivered - <u>N/A</u>
Phone Calls - <u>R. ISAK</u>	Alterations - <u>N/A</u>

Summary of Work:

Page 1 of 1

- ONSITE @ 0900
- MBC PRESSURIZED HDPE PIPE ASSEMBLIES FOR AIR PRESSURE TESTING.
BELAN AIR PRESSURE TESTS
- AIR PRESSURE TESTS COMPLETED. ALL PRESSURE TESTS PASSED WITH NO PRESSURE DROP.
- OFFSITE @ 1330

Attachments:

- ☐ Contractor Report
- ☐ Field Notes
- ☐ Other:


Signature of CQA Monitor

11-15-12
Date



Daily Field Report

Date: 11-30-12 FRIDAY

BC Personnel: N. GWENS

Site: Lorain County II Landfill, Oberlin, OH

Time In: 0810

Project: Leachate Storage Facility Expansion

Time Out: 1135

Project Number: 142575

Weather: CLOUDY, HI 50°F

Items Worked On:

- | | |
|--|---|
| ☒ Tank Installation | ☐ Pipe Pressure Testing |
| ☐ Pipe Fabrication/Installation | ☐ Tank Hydrostatic Testing |
| ☒ Aeration System Installation | ☐ Other - |
| ☐ Heat Trace/Insulation Installation | |
| ☐ Electrical Controls Installation | |

Contractor/Subcontractors/Visitors/Materials Delivered/Alterations:

Contractor - MBL

Subcontractors - GATEWAY

Visitors - N/A

Materials Delivered - N/A

Phone Calls - R. ISAAC

Alterations - N/A

Summary of Work:

Page 1 of 1

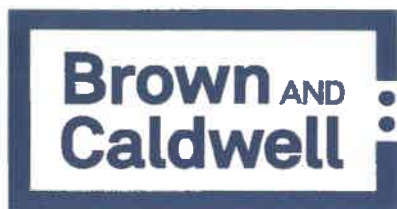
- ONSITE @ 0810
- MET W/ BROCK QUAINANCE TO DISCUSS CONSTRUCTION SCHEDULE AND PROGRESS.
- GATEWAY INSPECTED 4" NOZZLE FOR RECIRCULATION PUMP SUCTION LINE AND FINAL SHELL PANEL AERATION SYSTEM COMPONENTS (SS. DROP PIPE, MANIFOLD, BUT HDPE LATERALS) INSTALLED BY MILLER BROS. IN TANK.
- WEEKLY PROGRESS MEETING
- OFFSITE @ 1135

Attachments:

- ☐ Contractor Report
☐ Field Notes
☐ Other:


Signature of CQA Monitor

11-30-12
Date



Daily Field Report

Date: 12-10-12

BC Personnel: N. GWENS

Site: Lorain County II Landfill, Oberlin, OH

Time In: 1340

Project: Leachate Storage Facility Expansion

Time Out: 1430

Project Number: 142575

Weather: CLOUDY, HI 55°F

Items Worked On:

- | | |
|---|---|
| ☐ Tank Installation | ☐ Pipe Pressure Testing |
| ☐ Pipe Fabrication/Installation | ☐ Tank Hydrostatic Testing |
| ☐ Aeration System Installation | ☐ Other - |
| ☐ Heat Trace/Insulation Installation | |
| ☐ Electrical Controls Installation | |

Contractor/Subcontractors/Visitors/Materials Delivered/Alterations:

Contractor - MBC Subcontractors - N/A

Visitors - AMANDA JETT Materials Delivered - N/A

Phone Calls - R. ISAAC Alterations - N/A

Summary of Work:

Page 1 of 1

- ONSITE @ 1340
- MET W/ AMANDA JETT AT TANK TO DISCUSS CONFIGURATION OF AERATION SYSTEM ANCHOR BOLTS AND BRACKETS.
- NO WORK ON TANK TODAY
- OFFSITE @ 1430

Attachments:

- ☐ Contractor Report
☐ Field Notes
☐ Other:


Signature of CQA Monitor

12-10-12
Date



Daily Field Report

Date: 12-18-12

BC Personnel: N. GIVENS

Site: Lorain County II Landfill, Oberlin, OH

Time In: 1300

Project: Leachate Storage Facility Expansion

Time Out: 1410

Project Number: 142575

Weather: CLOUDY, HI 39°F

Items Worked On:

- | | |
|--|---|
| ☐ Tank Installation | ☐ Pipe Pressure Testing |
| ☐ Pipe Fabrication/Installation | ☐ Tank Hydrostatic Testing |
| ☐ Aeration System Installation | ☐ Other - |
| ☒ Heat Trace/Insulation Installation | |
| ☐ Electrical Controls Installation | |

Contractor/Subcontractors/Visitors/Materials Delivered/Alterations:

Contractor - MBL

Subcontractors - BUTCHKO ELECTRIC (BUTCHKO)

Visitors - N/A

Materials Delivered - N/A

Phone Calls - R. ISAAC

Alterations - N/A

Summary of Work:

Page 1 of 1

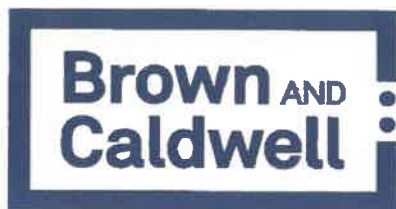
- ONSITE @ 1300
- MET W/ AMANDA JETT AND CHAIR JAQUET (REPUBLIC) TO DISCUSS PROGRESS.
- BUTCHKO BEGAN INSTALLATION OF HEAT TRACE AND PIPE INSULATION ON LEACHATE PIPING
- OFFSITE @ 1410

Attachments:

- ☐ Contractor Report
- ☐ Field Notes
- ☐ Other:


Signature of CQA Monitor

12-18-12
Date



Daily Field Report

Date: 1-10-13

BC Personnel: N. GIVENS

Site: Lorain County II Landfill, Oberlin, OH

Time In: 1330

Project: Leachate Storage Facility Expansion

Time Out: 1500

Project Number: 142575

Weather: SUNNY, H₂ 41°F

Items Worked On:

- | | |
|--|---|
| ☐ Tank Installation | ☐ Pipe Pressure Testing |
| ☐ Pipe Fabrication/Installation | ☐ Tank Hydrostatic Testing |
| ☒ Aeration System Installation | ☒ Other - <u>TRANSFER PUMP INSTALLATION</u> |
| ☒ Heat Trace/Insulation Installation | |
| ☐ Electrical Controls Installation | |

Contractor/Subcontractors/Visitors/Materials Delivered/Alterations:

Contractor - MBC

Subcontractors - BUTCHKO

Visitors - N/A

Materials Delivered - N/A

Phone Calls - N/A

Alterations - N/A

Summary of Work:

Page 1 of 1

- ONSITE @ 1330
- Spoke to AMANDA JETT ABOUT PROJECT STATUS
- BUTCHKO ELECTRIC CONTINUED INSTALLATION OF HEAT TRACE AND PIPE INSULATION
- GATEWAY INSTALLED STAINLESS STEEL THREADED COUPLERS ON EXISTING TANK FLOOR BOLTS AT LOCATIONS OF AERGRID PIPE YOKES FOR INSTALLATION OF STAINLESS STEEL BRACKETS. BRACKET INSTALLATION TO OCCUR TOMORROW (1-11-13).
- MBC INSTALLED NEW TRANSFER PUMP ON PLATFORM EXTENSION BETWEEN LEACHATE STORAGE TANKS.
- OFFSITE @ 1500

Attachments:

- ☐ Contractor Report
☐ Field Notes
☐ Other:

N. Givens
Signature of CQA Monitor

1-10-13

Date



Daily Field Report

Date: 1-11-13

BC Personnel: N GIVENS, S BLANCHARD

Site: Lorain County II Landfill, Oberlin, OH

Time In: 1100

Project: Leachate Storage Facility Expansion

Time Out: 1620

Project Number: 142575

Weather: CLOUDY, HI 57°F

Items Worked On:

- | | |
|--|---|
| ☐ Tank Installation | ☐ Pipe Pressure Testing |
| ☐ Pipe Fabrication/Installation | ☐ Tank Hydrostatic Testing |
| ☒ Aeration System Installation | ☐ Other - |
| ☐ Heat Trace/Insulation Installation | |
| ☐ Electrical Controls Installation | |

Contractor/Subcontractors/Visitors/Materials Delivered/Alterations:

Contractor - MBL

Subcontractors - N/A

Visitors - N/A

Materials Delivered - N/A

Phone Calls - R. KRAK

Alterations - N/A

Summary of Work:

Page 1 of 1

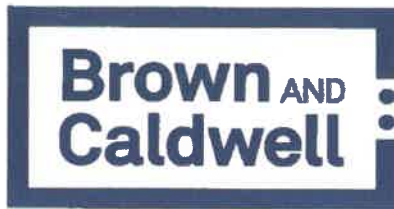
- ONSITE @ 1100
- MBL FABRICATED STAINLESS STEEL PLATES AND HDPE BEARING PADS FOR AERGRID PIPE YOKE ATTACHMENT TO TANK FLOOR. AERGRID YOKES AND BRACKETS (SUPPLIED BY AERTEL) WERE BOLTED TO THE FABRICATED PLATES, WHICH WERE FASTENED TO PREVIOUSLY INSTALLED STAINLESS STEEL FASTENERS WITH STAINLESS STEEL HARDWARE.
- SCOT BLANCHARD (BC) ONSITE.
- TANK ENTRY TO PHOTOGRAPH ASSEMBLY / INSTALLATION OF AERGRID PIPE YOKES/BRACKETS / MOUNTING PLATES COMPLETED
- OFFSITE @ 1620 BLANCHARD AND GIVENS OFFSITE @ 1620.

Attachments:

- ☐ Contractor Report
☐ Field Notes
☐ Other:


Signature of CQA Monitor

1-11-13
Date



Daily Field Report

Date: 1-15-13

BC Personnel: N. GWENS

Site: Lorain County II Landfill, Oberlin, OH

Time In: 1145

Project: Leachate Storage Facility Expansion

Time Out: 1320

Project Number: 142575

Weather: SUNNY, HI 30°F

Items Worked On:

- | | |
|---|--|
| ☐ Tank Installation | ☐ Pipe Pressure Testing |
| ☐ Pipe Fabrication/Installation | ☒ Tank Hydrostatic Testing |
| ☐ Aeration System Installation | ☐ Other - |
| ☐ Heat Trace/Insulation Installation | |
| ☐ Electrical Controls Installation | |

Contractor/Subcontractors/Visitors/Materials Delivered/Alterations:

Contractor - MBL

Subcontractors - BUTCHKO

Visitors - N/A

Materials Delivered - N/A

Phone Calls - R. ISAAC

Alterations - N/A

Summary of Work:

Page 1 of 1

- ONSITE @ 1145
- MBL BEGAN FILLING TANK WITH WATER FOR HYDROSTATIC TEST
- BUTCHKO REMAIN CONTINUED INSTALLATION OF HEAT TRACE AND PIPE INSULATION.
- TANK FILLED TO APPROX. 31'. PUMPING TO CONTINUE UNTIL 1700 OR UNTIL TANK IS FULL. FILLING WILL RESUME TOMORROW MORNING IF NECESSARY. HYDROSTATIC TEST WILL BEGIN WHEN TANK IS FULL AND BC PERSONNEL ARRIVE ONSITE TO DOCUMENT TEST.
- OFFSITE @ 1320

Attachments:

- ☐ Contractor Report
- ☐ Field Notes
- ☐ Other:

[Signature]
Signature of CQA Monitor

1-15-13
Date



Daily Field Report

Date: 1-16-13

BC Personnel: N. GWENS

Site: Lorain County II Landfill, Oberlin, OH

Time In: 1335

Project: Leachate Storage Facility Expansion

Time Out: 1420

Project Number: 142575

Weather: SUNNY, HI 35°F

Items Worked On:

- | | |
|--|--|
| ☐ Tank Installation | ☐ Pipe Pressure Testing |
| ☐ Pipe Fabrication/Installation | ☒ Tank Hydrostatic Testing |
| ☐ Aeration System Installation | ☐ Other - |
| ☒ Heat Trace/Insulation Installation | |
| ☐ Electrical Controls Installation | |

Contractor/Subcontractors/Visitors/Materials Delivered/Alterations:

Contractor - MBL

Subcontractors - BUTCH KO

Visitors - N/A

Materials Delivered - N/A

Phone Calls - R. ISAAC

Alterations - N/A

Summary of Work:

Page 1 of 1

- ONSITE @ 1335
- TANK FILLED WITH WATER FOR HYDROSTATIC TEST. ONE LEAK OBSERVED IN NORTHEAST QUADRANT OF TANK, ORIGINATING AT ONE BOLT IN WEB TROSS CONNECTION TO TANK.
- SPOKE TO BROCK QUAINANCE ABOUT LEAK, GATEWAY WILL BE ONSITE TOMORROW (1-17-13) TO CORRECT LEAK. 24-HOUR HYDROSTATIC TEST WILL BEGIN UPON STOPPAGE OF LEAK.
- OFFSITE @ 1420

Attachments:

- ☐ Contractor Report
- ☐ Field Notes
- ☐ Other:


Signature of CQA Monitor

1-16-13
Date



Daily Field Report

Date: 1-17-13

BC Personnel: N GWENS

Site: Lorain County II Landfill, Oberlin, OH

Time In: 1020

Project: Leachate Storage Facility Expansion

Time Out: 1540

Project Number: 142575

Weather: CLOUDY, HI 36°F

Items Worked On:

- | | |
|---|--|
| ☐ Tank Installation | ☐ Pipe Pressure Testing |
| ☐ Pipe Fabrication/Installation | ☒ Tank Hydrostatic Testing |
| ☐ Aeration System Installation | ☒ Other - <u>PROJECT REQUIRES SURVEY</u> |
| ☐ Heat Trace/Insulation Installation | |
| ☐ Electrical Controls Installation | |

Contractor/Subcontractors/Visitors/Materials Delivered/Alterations:

Contractor - MBL

Subcontractors - GATEWAY

Visitors - N/A

Materials Delivered - N/A

Phone Calls - E. ISAAC

Alterations - N/A

Summary of Work:

Page 1 of 1

- ONSITE @ 1020
- WELLSET SURVEYING ONSITE TO SURVEY COMPLETED WORK
- GATEWAY CORRECTED SOURCE OF LEAK. ~~WAS~~ LOOSE NUT ON WEB TIE'S CONNECTION TO TANK WAS TIGHTENED AND LEAK STOPPED.
- BEGAN HYDROSTATIC TEST OF LEACHATE TANK @ 1420. TEST WILL CONCLUDE AFTER 24-HOURS WITH NO LEAKS. JAWET TOPIA (BC) WILL OBSERVE TANK FOR ANY SIGNS OF LEAKAGE TOMORROW (1-18-13) AT OR AFTER 1420.
- OFFSITE @ 1540

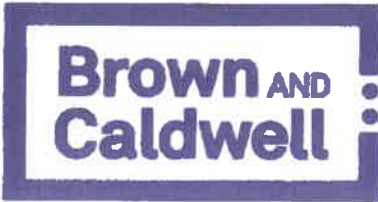
Attachments:

- ☐ Contractor Report
☐ Field Notes
☐ Other:


Signature of CQA Monitor

1-17-13

Date



Daily Field Report

Date: 1-18-13

BC Personnel: J. TODIA

Site: Lorain County II Landfill, Oberlin, OH

Time In: 1415

Project: Leachate Storage Facility Expansion

Time Out: 1430

Project Number: 148575

Weather: CLOUDY H: 37°F

Items Worked On:

- | | |
|---|--|
| ☐ Tank Installation | ☐ Pipe Pressure Testing |
| ☐ Pipe Fabrication/Installation | ☒ Tank Hydrostatic Testing |
| ☐ Aeration System Installation | ☐ Other - |
| ☐ Heat Trace/Insulation Installation | |
| ☐ Electrical Controls Installation | |

Contractor/Subcontractors/Visitors/Materials Delivered/Alterations:

Contractor - MBE

Subcontractors - N/A

Visitors - N/A

Materials Delivered - N/A

Phone Calls - N. GWENS (BC)

Alterations - N/A

Summary of Work:

Page 1 of 1

- ONSITE @ 1415
- I CHECKED THE TANK FOR SIGNS OF LEAKAGE. NO LEAKS WERE OBSERVED.
- HYDROSTATIC TEST CONCLUDED @ 1425. HYDROSTATIC TEST PASSED.
- OFFSITE @ 1430

Attachments:

- ☐ Contractor Report
☐ Field Notes
☐ Other:


Signature of CQA Monitor

1/18/13
Date

Appendix B: Construction Photographs and Description Log

(CD Enclosed)

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Leachate Storage Facility Expansion
Lorain County II Landfill
Construction Certification Report
Photograph Log

Photo ID	Description
1.jpg	Styrofoam insulation beneath the tank floor
2.jpg	Tank floor panel bolts
3.jpg	Tank floor installation
4.jpg	Bottom starter ring, upper ring, and dome roof
5.jpg	Jack used to raise roof dome and installed tank panel rings
6.jpg	Roof dome connection to upper ring
7.jpg	Tank walking platform
8.jpg	Tank ladder with safety cage
9.jpg	Tank bottom ring
10.jpg	Placing bottom ring panel
11.jpg	Bolting bottom ring panel
12.jpg	Sealed tank panel bolts and nuts
13.jpg	New leachate storage tank
14.jpg	Roof dome from inside the tank
15.jpg	Steel chair anchors
16.jpg	Outside pipe connection bracket
17.jpg	Liquid level indicator and ladder with safety cage
18.jpg	Liquid level indicator
19.jpg	Installed walking platform
20.jpg	Internal liquid level switch
21.jpg	Pipe pressure gauge test
22.jpg	Stainless steel aeration system pipeline
23.jpg	Aeration system stainless steel manifold with HDPE pipe connections
24.jpg	Aeration system laterals
25.jpg	Aeration system laterals
26.jpg	Aeration system exterior compressed air pipeline
27.jpg	Aeration system bent plate and tee anchor screw
28.jpg	Aeration system lateral pipe yoke
29.jpg	Odor control pipeline tee connection
30.jpg	10-inch diameter odor control and 4-inch diameter compressed air pipelines
31.jpg	Odor control and compressed air pipeline tank connections
32.jpg	Pipe stand
33.jpg	Pipe stand
34.jpg	Heat trace cable around valves
35.jpg	Extended pump platform, new recirculation pump, and relocated stairs
36.jpg	Drilling stainless steel anchor system plates
37.jpg	Aeration system lateral pipeline anchor
38.jpg	Installed pipe insulation
39.jpg	Heat trace installed around new recirculation pump
40.jpg	Aluminum jacketing installed around insulation and heat trace system junction boxes
41.jpg	Heat trace system monitoring lights
42.jpg	Heat trace cable, insulation, and aluminum jacketing on a vertical pipeline

Leachate Storage Facility Expansion
Lorain County II Landfill
Construction Certification Report
Photograph Log

Photo ID	Description
43.jpg	Completed pipeline insulation and aluminum jacketing installation
44.jpg	Heat system testing - monitoring lights
45.jpg	Installed pressure relief valve

Appendix C: Resumes for CQA Certifying Engineer and Monitors

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Richard A. Isaac, P.E.

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Experience Summary

Mr. Isaac has 32 years of extensive experience managing, performing, and certifying engineering design, permitting, and construction quality assurance (CQA) programs for new land disposal and other solid and hazardous waste management facilities. Rick's CQA experience includes landfills in Ohio, Virginia, West Virginia, Pennsylvania, and Maryland for new cell construction, final cover system construction and final landfill closure, and landfill gas collection and control system (GCCS) installations. Rick has prepared and certified construction quality assurance plans (CQAPs) for landfills used as the basis for performing field oversight and CQA services. Rick has managed and certified the CQA activities on recent projects for Republic in Ohio at the Lorain County II Landfill, County Environmental of Wyandot Landfill, County Land Development (CLD) Landfill, and Lewis Landfill (Closed). Rick has successfully completed and received approval of Construction Certification Reports from the Ohio Environmental Protection Agency (Ohio EPA) for various types of construction at each of these landfills.

In addition, Rick brings to his work extensive experience in managing feasibility studies (FS) and remedial design/remedial action (RD/RA) for Superfund sites under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and state-led remedial sites, as well as managing corrective measures studies (CMS) and implementation of remediation systems for operating facilities under Resource Conservation and Recovery Act (RCRA). Rick also possesses extensive experience with bid procurement services including preparation of contract documents, technical specifications, and construction drawings for a wide variety of projects including solid and hazardous waste facilities, remediation, and the cleaning and demolition of buildings, both municipal and industrial. Rick participates in and/or conducts pre-bid and pre-construction meetings, bid review, evaluation, recommendation, and contract award.

Assignment

Project Manager/Engineer

Education

B.S. Civil Engineering, West Virginia University, Morgantown, 1978

Registration

Professional Engineer in Ohio, Pennsylvania, Michigan, Mississippi, and Louisiana; West Virginia (retired status); Virginia (retired status); Colorado (retired status); Wyoming (retired status); and Montana (retired status)

Experience

32 years

Joined Firm

2007

Training

OSHA 29 CFR 1910.120, Health and Safety Training

Relevant Expertise

- Solid and Hazardous Waste Management
- CERCLA, RCRA, and Remediation
- Site Assessments and Investigations
- Regulatory Compliance
- Storm Water/Surface Water Management
- Abandoned Mine Lands and Mining

Brown AND Caldwell

Solid and Hazardous Waste Management

County Land Development Landfill Closure CQA Services, Republic Services, Inc., Salem, Ohio

Managed the CQA for the implementation of final closure activities at a sanitary/construction demolition debris (C&DD) landfill in Salem, Ohio. Provided direction to the field inspectors who were onsite full-time throughout the duration of the final closure implementation including final cover construction, landfill gas management system expansion, and storm water controls. Managed and assisted in the preparation, performed quality assurance (QA) review, and served as the "Engineer of Record" for the Final Closure Certification Report submitted to the Ohio EPA to document the implementation of the final landfill closure construction.

County Environmental of Wyandot Landfill Gas Design and CQA Services, Republic Services, Inc., Carey, Ohio

Managed the CQA for the expansion of the landfill gas management system at a landfill in Carey, Ohio. Provided direction to the field inspectors who were onsite full-time throughout the duration of the expansion implementation activities. The expansion activities included installation of an enclosed flare station, condensate sumps, 24-inch diameter high-density polyethylene (HDPE) header pipeline, laterals to new and re-drilled gas extraction wells, condensate and airlines, and road crossings. Managed the

preparation and provided QA review of the construction drawings for the landfill gas management system expansion. Assisted in the preparation, performed QA review, and served as the “Engineer of Record” for the Certification Report submitted to the Ohio EPA to document the landfill gas system expansion installation.

Lorain County II Landfill Gas Design and CQA Services, Republic Services, Inc., Oberlin, Ohio

Managed the CQA for the expansion of the landfill gas management system at a landfill in Oberlin, Ohio. Provided direction to the field inspectors who were onsite full-time throughout the duration of the expansion implementation activities. The expansion activities included installation of an enclosed flare station, condensate sumps, 24-inch and 18-inch diameter HDPE header pipelines, laterals to new and re-drilled gas extraction wells, condensate and airlines, and road crossings. Managed the preparation and provided QA review of the construction drawings for the landfill gas management system expansion. Assisted in the preparation, performed QA review, and served as the “Engineer of Record” for the Certification Report submitted to the Ohio EPA to document the landfill gas system expansion installation.

Lorain County I Landfill Gas CQA Services, Allied Waste Industries, Inc., Oberlin, Ohio

Managed the CQA for the expansion of the landfill gas management system at a closed landfill in Oberlin, Ohio. Provided direction to the field inspectors who were onsite full-time throughout the duration of the expansion implementation activities. The expansion activities included installation of 8-inch diameter HDPE header pipelines, laterals to new and re-drilled gas extraction wells, installation of Landtec combination wellheads, leachate system force main, condensate and airlines, and road crossings. Assisted in the preparation, performed QA review, and served as the “Engineer of Record” for the Certification Report submitted to the Ohio EPA to document the landfill gas system expansion installation.

Cherokee Run Landfill Gas Design Services, Republic Services, Inc., Bellefontaine, Ohio

Managed the design of the expansion of the landfill gas management system at a landfill in Bellefontaine, Ohio. Provided direction to the design engineers who prepared the construction drawings and details for use by the installer to construct the landfill gas management system expansion. The expansion activities included installation of a condensate sump, 18-inch diameter HDPE header pipeline, laterals to new and re-drilled gas extraction wells, and condensate and airlines. Provided QA review of the construction drawings for the landfill gas management system expansion.

Noble Road Landfill Vertical Expansion Perimeter Berm Design, Republic Services, Inc., Shiloh, Ohio

Managed the design of a perimeter berm used to expand the available air space at a landfill in Shiloh, Ohio. Provided direction and assisted staff engineers in the preparation of “construction-ready” design drawings for

use by contractors in preparation of bids. The drawings included grading plans, construction sequence plans, leachate management system plans, storm water management plans, and details. Prepared the contract documents and technical specifications for use by contractors in preparing bids. Participated in the bid procurement, bid review, and contractor selection for construction of the perimeter berm. Performed QA review, and served as the "Engineer of Record" for the berm design.

Hazardous Waste Landfill Remediation, Laufen International, Inc., East Sparta, Ohio

As part of a RCRA Corrective Action through a Consent Decree with the U.S. EPA Region 5, prepared an Interim Measures Work Plan for the remediation of a hazardous waste landfill at a facility in eastern Ohio. The Interim Measures included landfill cap enhancements, leachate management system modifications, construction of a flood protection levee, modification of the perimeter surface drainage system, and modification of the settlement monitoring program. Managed and prepared the contract documents, technical specifications, and drawings to procure a geosynthetics installer for the synthetic components of the new final cover system. Managed the implementation and CQA for the construction of the Interim Measures including construction of a new final cover system to encapsulate the existing landfill and the geotechnical program and construction of the flood protection levee. Prepared the construction certification report for submittal to the U.S. EPA following completion of the remediation activities.

Design, Permitting, and Construction of a Solid Waste Transfer Station, Rumpke Waste, Inc., Ironton, Ohio

Managed the design, permitting, and construction of a solid waste transfer station for a major solid waste company in southeast Ohio. The facility permit was through the Ohio EPA Southeast District Office in accordance with the Ohio Administrative Code rules and regulations pertaining to transfer stations. Coordinated and managed the transfer facility design by assembling a team of design professionals including site work, geotechnical and structural, environmental management systems, architectural, and mechanical, electrical, and plumbing including both wet and dry fire suppression systems. Prepared and obtained the required building permits through the Ohio Department of Commerce, Bureau of Building Code Compliance office. Managed the preparation of the contract documents, technical specifications, and construction drawings including QA/QC of the final bid documents and was responsible for the bid procurement including pre-bid meeting, bid evaluation, recommendation, and contract award. Performed limited CQA during the facility construction including project progress meetings, contractor requests for information, pay application review and approval, and change order requests.

Design and Permitting for a Type I Restricted Waste Landfill, Mittal Steel USA, Burns Harbor, Indiana

Managed the design and permit preparation for a Type I Restricted Waste Landfill for disposal of secondary wastewater treatment plant sludge at a

major steel manufacturing facility in Indiana. Performed the leachate management system evaluation including landfill floor configuration, HELP Model to determine leachate volumes, and design calculations for pipe sizes, perforation openings, sumps, and pumps. Assisted with the preparation of the Special Exception to the Zoning Application required for the facility.

**C&DD Landfill Closure Certification, Stambaugh Properties
Ravenna, Ohio**

Managed the closure and closure certification of a C&DD landfill in Ravenna, Ohio. Performed field oversight services including soil sample collection for geotechnical analysis. Prepared the Closure Certification Report and served as the Engineer-of-Record. Submitted the Closure Certification Report to the Portage County Health Department.

**Hazardous Waste Facility Post – Closure Plan, ESAB Welding &
Cutting Ashtabula, Ohio**

Prepared and submitted to the Ohio EPA a hazardous waste facility post-closure plan for former lime ponds and associated impoundments at a welding wire manufacturer in Northeast Ohio. Post-closure plan included discussions on site security, inspection plan, monitoring plan, maintenance plan, and financial assurance.

**Design and Permitting of a Solid Waste Transfer Station, Waste
Management, Inc., Wooster, Ohio**

Managed the design and permitting of a solid waste transfer station for a major solid waste company in central Ohio. The design included grading and storm water control plans, vehicle sequencing and staging plans, and detailed design of the transfer building structure and operating pad.

**Design and Permitting for the Vertical Expansion of a Sanitary
Landfill, Mid-American Waste Systems, Gary, Indiana**

Managed the design and permitting for the vertical expansion of an existing sanitary landfill. Project included the design of leachate management, gas management, grading, closure and post-closure, and erosion and sediment control plans. Coordinated site remediation activities, including a toe drain collection and conveyance system and a groundwater cut-off slurry wall.

**Design and Permitting for the Upgrade and Compliance of a Large
Sanitary Landfill, City of Virginia Beach, Virginia**

Managed the design and permitting for upgrade and compliance of a large existing sanitary landfill located in the Tidewater region of Virginia with new Subtitle D regulations. The design included plans for grading, leachate collection system and groundwater underdrain, closure and post-closure, and storm water management. Wetlands associated with expansion were permitted through the US Army Corps of Engineers Nationwide 26 Permit process.

Design and Closure of an On-Site Waste Disposal Site at an Aluminum-Processing Facility, Alcoa Cleveland Works, Cleveland, Ohio

Managed the design and closure of an on-site waste disposal site at an aluminum processing facility. Closure plan included grading, storm water management, gas management, post-closure care, and land-use plans.

Design and Permitting for Closure of Three Disposal Units at a Coke Facility, Wheeling-Pittsburgh Steel, Follansbee, West Virginia

Managed the design and permitting for the closure of three disposal units located at a coke facility along the Ohio River. Closure plans included grading, storm water management, gas management, and post-closure care and land use plans. Designed the closure plans and prepared permit applications as “fast track” projects in order to meet imposed regulatory deadlines.

Closure of a Hazardous Ash Disposal Impoundment at a Paint Pigment Facility, Cytec Industries, Inc., Washington, West Virginia

Managed the closure of a hazardous ash disposal impoundment at a paint pigment facility located along the Ohio River in West Virginia. The closure included final grading plan; final cover system configuration, including geogrids to allow construction equipment access to the ash material during the construction phase; and surface water management.

Design and Preparation of Permit Application Drawings for the Vertical Expansion of a Landfill, City of Barnstable, Massachusetts

Managed the design and preparation of permit application drawings for the vertical expansion of an existing landfill in Massachusetts. The project included the design of grading plans, disposal cell phase and sequence plans, storm water management, leachate collection and treatment systems, landfill gas management system, liner and fill cap system configurations, and closure and post-closure care plans. The existing site is located on Cape Cod within a Zone II Aquifer system, which required specialized engineering designs to ensure zone environmental protection of the groundwater systems at the site.

Preparation of a Waste Alternatives Study for a Large Paper Mill Facility, WESTVACO, Luke, Maryland

Managed the preparation of a Waste Alternatives Study for a large paper mill facility located in western Maryland. The study compared the development, design, permit preparation, and construction of two potential landfill sites: one located in West Virginia and the second located in Maryland. The study evaluated operations, design, permitting, material hauling to each site, and construction of each potential site for a study period of 20 years, with present worth analysis performed to determine capital required to finance the project. Each potential site was also compared to contract waste collection, transportation, and disposal by an independent waste contractor.

Design and Permitting for a Construction and Demolition Debris Landfill, Warren Recycling, Inc., Warren, Ohio

Managed the design and permitting for a C&DD landfill located in Warren, Ohio. The project included License Application forms, grading plans, leachate management plans, storm water management plans, and fill sequence plans. Applied for and received a variance from groundwater monitoring from the City Health Department.

Design and Permitting for a Construction and Demolition Debris Landfill, Iron Valley, Chesapeake, Lawrence County, Ohio

Managed the design and permitting for a C&DD landfill located in Lawrence County, Ohio. The project included License Application forms, grading plans, leachate management plans, storm water management plans, and fill sequence plans.

Design and Permitting of the Closure for a Residual Carbon Waste Disposal Facility, The Stackpole Corporation, St. Marys, Pennsylvania

Managed the design and permitting of the closure for a residual carbon waste disposal facility in Pennsylvania. Design included a combination RCRA-style final cover system and standard State of Pennsylvania cover system.

CERCLA, RCRA, and Remediation

Bid Documents, Technical Specifications and Construction Drawings for a Hydraulic Barrier Wall and Groundwater Extraction and Treatment System for a Site in Holland, Michigan

Prepared the bid documents, technical specifications, and construction drawings for the installation of a hydraulic barrier wall and groundwater extraction and treatment system at a former manufacturing site. The hydraulic barrier wall consists of a soil-bentonite (SB) slurry wall and blast furnace slag- cement-bentonite (BFSCB) slurry wall. Groundwater extraction and treatment system consists of five extraction wells, water filtration treatment, and deep well injection under high pressure. Bid documents and technical specification were prepared to following the CSI 2004 format. Participated in pre-bid meetings, bid evaluation, and contractor recommendation and contract award. Served as the Engineer-of Record for the design and assisted with the field CQA program including contractor oversight, project progress meetings, and contractor requests for information.

Preparation of RD/RA for Former Tar and Chemical Facility, Reilly Industries, Inc., Dover, Ohio

Managed the preparation of the RD/RA for a former tar and chemical facility located in Dover, Ohio. The remedial design included excavation of on-site soils and sediments contaminated with polycyclic aromatic hydrocarbons (PAHs), and benzene, toluene, ethylbenzene, and xylene (BTEX) for either off-site treatment by thermal destruction and disposal or placement within an on-site building foundation closed by the construction of an Ohio EPA- compliant solid waste final cover system; construction of

a groundwater recovery trench with recovered groundwater discharged to the local publically owned treatment works (POTW); and placement of soil cover.

Hydrogeologic Site Investigation and Preparation of a Focused FS for a Lagoon at a Major Coke-Producing Facility, US Steel, Clairton, Pennsylvania

Managed the performance of a hydrogeologic site investigation and preparation of a "focused" FS for a lagoon contaminated with polynuclear aromatic hydrocarbons, volatile organic compounds (VOCs), and semi-volatile organic compounds (SVOCs) at a major coke-producing facility. Performed the FS to adhere to the requirements of the Pennsylvania Department of Environmental Protection (PADEP). Alternatives evaluated included augmenting the existing groundwater pump and treat with lagoon sediment solidification/stabilization and construction of a PADEP-compliant final cover system.

Site Investigation, Permitting, Remedial Design, and Remediation Implementation at a Creosote Wood Treating Facility, Southern Wood Piedmont, Benson, North Carolina

Managed the site investigation, permitting, remedial design, and remediation implementation at a creosote wood treating facility in North Carolina. Surface impoundments used for disposal of creosote and surface water were remediated by stabilization/solidification of the resulting sludge and covering with a solid-waste-style final cover system.

Preparation of a Feasibility Study for a Large Primary Aluminum Facility, Ormet, Hannibal, Ohio

Managed the preparation of a FS for a large primary aluminum facility located along the Ohio River in the State of Ohio. Five impoundments, a former potash disposal area, a former spent carbon disposal area, a former construction material and demolition debris area, and the backwash area required remediation for fluoride, cyanide, and VOCs. The final proposed remedy included construction of RCRA-style final cover systems; soil washing/soil flushing aided by a Ranney well, which influenced the flow of groundwater; and river sediment dredging.

Preparation of a "Focused" Corrective Measures Study for a Hazardous Measures Recycling Facility, Safety-Kleen, Hebron, Ohio

Managed the preparation of a "focused" CMS for a hazardous materials recycling facility in the State of Ohio. Implemented interim corrective measures including groundwater recovery wells and low-profile air stripper with a groundwater cut-off wall. The CMS evaluated alternatives for remediating VOCs that had entered the soils and groundwater as a result of a fire at the facility.

Design of an Ultraviolet Peroxidation Groundwater Treatment System, Honeywell, Annapolis, Maryland

Managed the design of an ultraviolet (UV) peroxidation groundwater treatment system. The design included the UV system and associated

groundwater recovery system for the remediation of VOCs, and SVOCs. Prepared contract documents, technical specifications, and construction drawings for use in the contractor bid procurement process.

Paint Sludge and Sediment Remediation in Lake Michigan, Flanders Industries, Inc., Menominee, Michigan

Managed the design and preparation of contract documents, technical specifications, and construction drawings for paint sludge and sediment remediation in Lake Michigan. Project included the design and construction of an impermeable dike built in Lake Michigan to isolate the contaminated sediments, sediment removal plans, sediment staging and sequencing plans, sediment testing plans, and site restoration plans.

Design and Construction of a Recovery and Treatment System at a Carbon Graphitizing Facility, The Stackpole Corporation, St. Marys, Pennsylvania

Provided QA/QC and senior oversight for the design and construction of a recovery and treatment system at a carbon graphitizing facility in Pennsylvania. The system included 14 groundwater recovery wells and soil vapor extraction for chlorinated organics.

General Engineering

Implementation of Design/Build Services for Building Demolition, TRW, Inc., Cleveland, Ohio

Lead engineer responsible for providing direction and oversight to the onsite CQA inspector throughout the performance of the building demolition for a former automobile parts manufacturing facility. Site activities included asbestos abatement, multi-story building complex demolition consisting of steel and wood frame, concrete, block and brick buildings including removal, cleaning, and off-site disposal of tanks and pipelines containing residual materials, removal, cleaning, and off-site disposal of PCB-containing transformers, and segregation and recycling of steel, concrete, and brick materials. Provided interpretation of project specifications and conducted bi-monthly project progress meetings.

Design, Technical Specifications and Construction Drawings for Filter Press installation, Whirlpool Corporation, Marion, Ohio

Project manager for the design and preparation of technical specifications and construction drawings for the installation of a filter press in an existing water treatment building. Prepared the civil component of the specifications and drawings and managed the preparation of the structural, mechanical, electric, and plumbing (MEP) components of the project. Installed the filter press in the existing filter press building by retrofitting the inside of the building and the existing structural components and MEP. Installation of the filter press allowed the client to realize a two-fold increase in filtering the effluent from the onsite wastewater treatment plant (WWTP).

Technical Specifications and Construction Drawings for Building Demolition, City of Dayton, Office of Economic Development, Dayton, Ohio

Prepared the contract documents, bidding documents, technical specifications, and construction drawings for the demolition of a 845,000 square foot, multi-story building complex consisting of steel frame, concrete, block and brick buildings including removal and off-site disposal of tanks and pipelines containing residual materials. Contract and bidding documents were prepared to adhere to client's (municipal) preferred formats. Participated in pre-bid and pre-demolition meetings, bid evaluation, and contractor recommendation and contract award. Managed the CQA program including contractor oversight, project progress meetings, and contractor requests for information.

Technical Specifications and Construction Drawings for Building Demolition, Columbus Recreation and Parks, Columbus, Ohio

Prepared the contract documents, bidding documents, technical specifications, and construction drawings for the demolition of a 25,500 square foot, three-story, steel frame, concrete, block and brick building including removal and off-site disposal of an underground storage tank (UST). Contract and bidding documents were prepared to adhere to client's (municipal) preferred formats. Participated in pre-bid and pre-demolition meetings, bid evaluation, and contractor recommendation and contract award. Project included field survey and verification of existing utilities associated with the building and preparation of a site grading plan following removal of the building debris from the site.

Cleaning, Asbestos Abatement, and Demolition of Aboveground Storage Tanks, Buildings, Process Equipment, and Pipelines at a Large Coal Tar Refining Facility, Reilly Industries, Inc., Cleveland, Ohio

Managed the cleaning, asbestos abatement, and demolition of aboveground storage tanks (500 to 1,000,000 gallons) and pipelines and demolition of facility buildings and process equipment at a large coal tar refining facility under the Ohio EPA Cessation of Regulated Operations (CRO) Program. Products produced at the site included coal tar and coal tar distillates, creosote, naphthalene, and oils. Directly prepared technical specifications and construction drawings for use in bid procurement, conducted pre-bid and pre-demolition meetings, bid review and evaluation and assisted client with contract award. Managed the field oversight services throughout performance of the field activities.

Site Assessments and Investigations**Preparation of Phase I Environmental Site Assessment, City of Steubenville, City Engineer, Steubenville, Ohio**

Project Manager. Performed the Phase I Environmental Site Assessment (ESA) in accordance with ASTM E1527-00 Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process. The Phase I ESA included environmental database searches,

interviews with past property owners, limited title searches, site reconnaissance, agency information reviews, and report preparation.

Preliminary Phase II Site Screening, Whittier Peninsula Properties, Columbus Recreation and Parks, Columbus, Ohio

Project Manager. The purpose of the site screening was to review historical information and data related to environmental issues and concerns associated with the Peninsula properties, develop a site ranking system, and develop preliminary recommendations and costs for performing Phase II site investigation activities to identify potential impacts to the soils and groundwater at the Whittier Peninsula.

Phase II Environmental Site Investigation, Whittier Peninsula Properties, Columbus Recreation and Parks, Columbus, Ohio

Project Manager. The Phase II ESI included field work, laboratory analysis, and reporting writing in accordance with the Ohio EPA Voluntary Action Program (VAP) rules and regulations. Field work included collection of soil samples using the Geoprobe® Direct-Push Technology and installation and sampling of groundwater monitoring wells. Prepared the report narrative text, tables, and drawings.

Preparation of Phase I Environmental Site Assessment, City of Columbus, Street Design Department, Columbus, Ohio

Managed and provided QA/QC for a Phase I ESA of Short Street in Columbus, Ohio. Performed the Phase I ESA for the City of Columbus Street Design Department as part of the street-widening program. Used ASTM E1527-00 Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process in the performance and preparation of the Phase I ESA report.

Preparation of Phase II Environmental Site Investigation, City of Columbus, Street Design Department, Columbus, Ohio

Managed and provided QA/QC for a site investigation performed at Reynolds Avenue in the City of Columbus, Ohio. Performed work for the City of Columbus Street Design Department as part of the street-widening program. The site investigation included the performance of Geoprobe holes to collect soil samples for laboratory analysis prior to initiation of construction activities. Prepared a Phase II Environmental Site Investigation Report presenting the results of the investigation and conclusions that no subsurface contamination was present within the construction limits.

Preparation of Phase II Environmental Site Investigation, City of Columbus, Street Design Department, Columbus, Ohio

Managed and provided QA/QC for a site investigation at an intersection along Hudson Street in the City of Columbus, Ohio. The intersection was being modified to include turning lanes and Geoprobe holes were performed to collect subsurface soil samples. Performed work for the City of Columbus Street Design Department as part of the street-widening program.

Phase II Environmental Site Investigation and Remediation, City of Columbus, Street Design Department, Columbus, Ohio

Managed and performed QA/QC for a site investigation and remediation of a former dry-ice manufacturing facility along McKinley Avenue in Columbus, Ohio. The City of Columbus Street Design Department was widening McKinley Avenue. Used Geoprobe technology to collect subsurface soil samples for purposes of determining the presence of contamination within the construction limits. A former dry ice manufacturing facility, located along the revised road centerline, required remediation of an existing concrete vault prior to demolition to allow construction to proceed. Cleaned the vault by power washing and vacuuming with off-site disposal of the resulting sludge and rinsate waters.

Compliance

Spill Prevention, Control, and Countermeasure Plan, The Ohio State University, Columbus, Ohio

Performed the “five-year” review and evaluation of existing Spill Prevention, Control, and Countermeasure (SPCC) Plans for re-certification in accordance with the requirements of 40 CFR 112 as amended in December 2006 for The Ohio State University (OSU) in Columbus, Ohio. Reviewed, revised, and re-certified the Master SPCC Plan for the OSU main campus. Reviewed facility specific SPCC Plans, performed facility inspections, and revised the SPCC Plans using the “poster-format” with cross-references and supporting documents for four facilities within the OSU main campus: Center for Automotive Research, McCracken Power Plant, Transportation and Parking Services, and the Scarlet and Gray Golf Course. Also reviewed the SPCC Plan for the Wooster Campus of OSU in Wooster, Ohio, performed a site inspection, and prepared and certified the “poster-format” with cross-references and supporting documents.

Integrated Contingency Plan (ICP), The Ohio State University, Don Scott Field, Columbus, Ohio

Prepared an ICP for The Ohio State University Airport, Don Scott Field. Combined the existing Storm Water Pollution Prevention Plan (SWP3) and the existing SPCC Plan into one document that also included a new emergency response plan for the airport. The ICP addressed the onsite Avgas and Jet A aviation fuel storage facility, mobile aircraft refuelers, and two maintenance facilities resident on the airport property. Prepared the ICP in accordance with the National Interagency Incident Management System (NIIMS) Incident Command System (ICS) that is a nationally recognized system that provides a commonly understood framework that allows for effective interaction among response personnel, thus facilitating its ease of use during an emergency situation.

Spill Prevention, Control, and Countermeasure Plan, Denison Hydraulics, Marysville, Ohio

Prepared SPCC Plan to bring the Denison Hydraulics facility in compliance with the requirements of 40 CFR 112 for a specialty hydraulic equipment manufacturing facility in Marysville, Ohio. Prepared the SPCC Plan text,

drawings, and appendices based on review of historic records, conversations with facility personnel, and site inspections. Served as the “Engineer-of-Record” for certification of the SPCC Plan.

Spill Prevention, Control, and Countermeasure Plan, Koneta Rubber, Wapakoneta, Ohio

Prepared SPCC Plans to bring two facilities in compliance with the requirements of 40 CFR 112 for a specialty rubber manufacturing facility in Wapakoneta, Ohio. Prepared the SPCC Plan text, drawings, and appendices based on review of historic records, conversations with facility personnel, and site inspections. Served as the “Engineer-of-Record” for certification of the SPCC Plans.

Notice of Intent and Storm Water Pollution Prevention Plan, United Precast, Mount Vernon, Ohio

Prepared and submitted the Notice of Intent (NOI) for a concrete manufacturing facility in central Ohio to provide coverage of the facility under the General Permit Authorization to discharge Storm Water Associated with Industrial Activity (General Permit No. OHR000003) Under the National Pollutant Discharge Elimination System (NPDES) as administered by the Ohio EPA. As a condition of the General Permit, prepared the SWP3 for the facility including a site walk over, material inventory, preliminary development of “Best Management Practices (BMPs)”, certification of non-storm water discharges, and recommendations for implementing BMPs to minimize contact with storm water.

Spill Prevention, Control, and Countermeasure Plan, Campbell Soup Company, Napoleon, Ohio

Reviewed and revised existing SPCC Plan for re-certification in accordance with the requirements of 40 CFR 112 for a food manufacturing facility in Napoleon, Ohio. Prepared revisions to the SPCC Plan based on the site inspection and updated the existing plan to adhere to the revised SPCC Plan Rules and Regulations effective as of August 16, 2002.

Spill Prevention, Control, and Countermeasure Plan, Lumi-Lite Candle Factory, Norwich, Ohio

Reviewed and revised existing SPCC Plan for re-certification in accordance with the requirements of 40 CFR 112 for a candle manufacturing facility in Norwich, Ohio. Prepared revisions to the SPCC Plan based on the site inspection and updated the existing plan to adhere to the revised SPCC Plan Rules and Regulations effective as of August 16, 2002.

Spill Prevention, Control, and Countermeasure Plan, Confidential Client, Bucyrus, Ohio

Reviewed and revised existing SPCC Plan for re-certification in accordance with the requirements of 40 CFR 112 for a rubber and plastic hose manufacturing facility in Bucyrus, Ohio. Prepared revisions to the SPCC Plan based on the site inspection and updated the existing plan to adhere to the revised SPCC Plan Rules and Regulations effective as of August 16, 2002.

Conditional No Exposure Exclusion for Industrial Activity, Delphi Automotive Systems, Warren, Ohio

Performed site inspections and developed inspection forms for five automotive parts manufacturing facilities to determine compliance with the NPDES, Storm Water Phase II Final Rule – Conditional No Exposure Exclusion for Industrial Activity as administered by the Ohio EPA. Used the initial facility inspections to develop forms that the client could use to perform subsequent annual compliance inspections. Provided a summary of issues to be addressed prior to submitting Conditional No Exposure Exclusion requests to the Ohio EPA.

Spill Prevention, Control, and Countermeasures Plan Re-Certification, Delphi Automotive Systems, Warren, Ohio

Perform review, prepared revisions, and re-certified SPCC Plans in accordance with the requirements of 40 CFR 112 for a major automotive parts manufacturer in Northeast Ohio. Performed site inspections for two facilities, updated the SPCC Plans, and signed as the “Engineer of Record”.

Storm Water Pollution Prevention Plans, Delphi Automotive Systems, Warren, Ohio

Performed site inspections, review of existing plans, and prepared required revisions of SWP3s for a major automotive parts manufacturer in Northeast Ohio. Reviewed and revised the SWP3s in accordance with the facilities General Permit Authorization to Discharge Storm Water Associated with Industrial Activity under the NPDES.

Aboveground Tank Compatibility Certification, Yenkin-Majestic Paint Corporation, Columbus, Ohio

Certified the compatibility of an aboveground storage tank (AST) for use in storing waste solvents in accordance with Ohio Administrative Code (OAC) Rules and Regulations, Chapter 3745-66-92. Certification included inspection of the AST including overflow and automatic shut-off controls, preparation of the certification report and submittal to the Ohio EPA.

Storm Water/Surface Water Management**Design and Implementation of a “Class A” Trout Stream, Cerro Metal Products, Company, Bellefonte, Pennsylvania**

Managed the design and implementation of a “Class A” trout stream in central Pennsylvania. Lead, copper, zinc, and PCBs contaminated the stream banks and sediment. Modeled 20+ square mile drainage area utilizing SEDCAD 4 software for the design of riprap/gabion baskets to stabilize the stream banks, following excavation and off-site removal of the contaminated soils and sediments. Prepared contract documents, technical specifications, and construction drawings. Completed the project on a “fast track” schedule due to strict regulatory deadlines.

Evaluation of Sedimentation Basin at a Sanitary Landfill, Private Landfill in Minnesota

Prepared the evaluation of an existing sedimentation basin at a sanitary landfill utilizing SEDCAD+ computer software. Modeled the watershed

for the basin and added 1000 GPM of inflow from a groundwater recovery/treatment system. Treated the basin as an infiltration structure, which saved the client \$200,000 by not having to construct a second basin to handle water from the groundwater recovery/treatment system.

Abandoned Mine Lands and Mining

Acid Mine Drainage, Investigation and Remedial Design, Meigs County, Ohio, Ohio Department of Natural Resources, Columbus, Ohio

Managed the investigation and remedial design for acid mine drainage (AMD) from old underground mine openings in Meigs County, Ohio. Basements of houses located within 30- to 50-feet of the toe of the slope were flooding during rainfall events due to saturation of the soils caused by AMD from the mine openings. Resealed the openings and employed an underdrain system to drain the back yards of the houses and former mine openings. Designed the underdrain system and constructed taking into account the proximity of the toe of the slope and the need to protect the integrity of the slope by preventing slope failure. Technical specifications and drawings were prepared in accordance with the Ohio Department of Natural Resources (ODNR) protocols.

Reclamation and Surface Erosion Remediation, Gallia County, Ohio, Ohio Department of Natural Resources, Columbus, Ohio

Managed the reclamation and surface erosion remediation at an abandoned mine land site in Gallia County, Ohio. The reclamation design involved the regrading of the site, including highwall and slope reduction to minimize future potential surface erosion problems. Developed technical specifications, prepared in accordance with the ODNR protocols, grading plans, and surface water control plans, in a format suitable for contractors to perform the reclamation work.

Mine Reclamation and Surface Erosion Remediation, Gallia County, Ohio, Ohio Department of Natural Resources, Columbus, Ohio

Managed the reclamation and surface erosion remediation at an abandoned mine land site in Gallia County, Ohio. The reclamation design involved the regrading of the site, including highwall and slope reduction to minimize future potential surface erosion problems. The grading plans were required to incorporate access to an active natural gas well located on the site. Developed topsoil borrow area plans (from adjacent undisturbed properties), including sampling plans, volume estimates, grading plans, and surface water control plans. Developed technical specifications, prepared in accordance with the ODNR protocols, grading plans, and surface water control plans, in a format suitable for contractors to perform the reclamation work.

Reclamation Design for Control of Acid Mine Drainage, Peabody Coal Company, St. Louis, Missouri

Prepared the reclamation design for control of AMD from an old abandoned auger mining pit in Missouri. AMD from the auger pit was

flowing into the Clairton River and causing discoloration problems. The reclamation design included the construction of a sedimentation basin at the mouth of the valley leading from the old auger pit and prior to entering the river. Sedimentation basin outfall was a corrugated pipe down the slope to the river to minimize potential surface erosion attributed to the outfall.

Mine Plans and Reclamation Plans for Two Large Coal Mines, Powder River Coal Company, Bill, Wyoming

Prepared mine plans and reclamation plans for two large coal mines in Wyoming (6,000,000 tons/year and 8,000,000 tons/year). Plans included sequencing of strip pits, overburden handling, backfill, and grading plans. Storm water management included design of sedimentation basins, diversion ditches, containment berms, and ditches.

Permit Revisions to an Existing Mine Plan, Powder River Coal Company, Bill, Wyoming

Managed the preparation of permit revisions to an existing mine plan to include the construction of a concentric loop track, silo, slot storage, and conveyor system for increased coal handling, storage, and loading capacity. Following approval of the permit revision, managed the preparation of technical specifications and construction drawings for the required facility upgrades, the bidding and contractor procurement activities, and construction oversight activities throughout the construction of the project.

Underdrain System to Control Groundwater Flow at a Mine in the Rocky Mountains, Peabody Coal Company, Denver, Colorado

Designed an underdrain system to control groundwater flow beneath backfilled overburden at a mine in the Rocky Mountains. The underdrain allowed mining of the coal seam from the bottom of the mountain to the top, instead of contour mining, which increased the amount of recoverable coal. Used the slope stability program REAME developed by the University of Kentucky to aid in the design and backfill placement of underdrain materials and overburden to create a stable backfill as part of the reclamation.

Major Channel Relocation/Remediation, Powder River Coal Company, Bill, Wyoming

Participated in the design, material handling, stockpiling, and backfilling of a major channel relocation/remediation. During the early stages of opening a new mine, relocated a major creek to allow for maximum recovery of the coal seam. As the creek was being stripped, selectively handled and stockpiled the material comprising the creek, i.e., sands, gravels, etc., for reconstruction during the reclamation process for this area. Following coal removal, reconstructed the stream in its former location, with each lithologic unit replaced to recreate the stream before mining events took place.

Publications

"Construction and Demolition Debris Rules in Ohio," Concrete Connection, Ohio Ready Mixed Concrete Association (ORMCA), November 1998

"Simplifying Environmental Planning Requirements," FOUNDRY Management & Technology, pp. 20-23, April 1999.

Nate Givens, E.I.

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Experience Summary

Mr. Givens recently obtained his civil engineering degree after more than 14 years of experience in the construction industry. His experience includes construction of surface and subsurface drainage systems, wetlands, stormwater detention basins, underground utilities and roadways. Since joining Brown and Caldwell, Mr. Givens has been involved with landfill gas collection and control system (GCCS) design and construction quality assurance (CQA), remediation, and groundwater monitoring projects. He brings exceptional attention to detail, proven understanding and is driven to provide quality services.

Assignment

Field CQA Monitor

Education

B.S., Civil Engineering, Ohio University, 2009

Registration

Engineer Intern, Ohio

Experience

16 years

Joined Firm

2010

Training

- HAZWOPER Eight-hour Refresher
- Bloodborne Pathogens Exposure Control
- First Aid
- Hazard Communications
- 40-Hour Hazardous Waste Operations Safety Training

Relevant Expertise

- Construction Quality Assurance
- Field Testing
- Soil and Groundwater Sampling
- Landfill Gas Design

ArvinMeritor Groundwater Sampling, ArvinMeritor, Inc., Grenada, Mississippi

Engineer. Performed the semi-annual groundwater monitoring at the site. Samples were obtained following Mississippi Department of Environmental Quality (DEQ) and USEPA sampling protocols.

Bobmeyer Landfill Publicly Owned Treatment Works (POTW) Connection, Republic Services, Inc., Fairfield, Ohio

Engineer. Worked with the City of Fairfield and the City of Hamilton to meet both the client's needs and each municipality's needs. Observed and documented construction of a new leachate force main connection to the City of Hamilton, Ohio POTW. Worked with contractors to adapt design to unforeseen circumstances during construction.

Cherokee Run Landfill Gas Collection and Control System (GCCS) Construction Quality Assurance Monitor, Republic Services, Inc., Bellefontaine, Ohio

Engineer. Observed installation of landfill gas extraction wells, GCCS piping, and leachate forcemain at a municipal waste landfill over multiple phases. Provided written and photographic documentation of installation methods, as well as equipment and materials onsite. Prepared daily work summary reports for client.

Fremont Raw Water Reservoir, City of Fremont, Ohio

Engineer. Performed compaction testing of structural fill and observed and documented installation of 94 acres of geocomposite clay liner (GCL), 40-mil linear low-density polyethylene (LLDPE) geomembrane, and geotextile.

Grenada Sludge Lagoon Closure Construction Quality Assurance Monitor, ArvinMeritor, Inc., Grenada, Mississippi

Engineer. Observed and documented the installation of the vegetative soil cover component of the final cover system for the closure of a former sludge lagoon. Provided direction to the contractor for expansion of the onsite soil borrow area.

Imperial Landfill Gas Collection and Control System Construction Quality Assurance Monitor, Republic Services, Inc., Imperial, Pennsylvania

Engineer. Observed installation of landfill gas extraction wells, GCCS piping, and leachate forcemain at a municipal waste landfill over multiple phases. Provided written and photographic documentation of installation methods, as well as equipment and materials onsite. Prepared daily work summary reports for client.

Imperial Landfill New Cell Construction, Republic Services, Inc., Imperial, Pennsylvania

Engineer. Observed installation of a 3.8-acre, dual-lined solid waste disposal cell. Provided written and photographic documentation of installation methods, as well as equipment and materials onsite. Prepared daily work summary reports for client.

Imperial Landfill Temporary Cell Closure, Republic Services, Inc., Imperial, Pennsylvania

Engineer. Observed installation of 40 acres of geotextile and 40-mile high-density polyethylene (HDPE) geomembrane, surface water channels, surface water culverts and sedimentation basins. Provided written and photographic documentation of installation methods, as well as equipment and materials onsite. Prepared daily work summary reports for client.

Lorain II Landfill Gas Collection and Control System Construction Quality Assurance Monitor, Republic Services, Inc., Oberlin, Ohio

Engineer. Observed installation of landfill gas extraction wells, GCCS piping, and leachate forcemain at a municipal waste landfill over multiple phases. Provided written and photographic documentation of installation methods, as well as equipment and materials onsite. Prepared daily work summary reports for client.

Preble County Landfill Groundwater Sampling, Preble County, Eaton, Ohio

Engineer. Performed the semi-annual groundwater monitoring at the site. Samples are obtained following Ohio EPA and USEPA sampling protocols.

Site Closure Activities—Historical Document Review, Confidential Client, Ohio

Engineer. Reviewed more than 20 years of historical documents related to closure activities for the site. Attributed the client provided documents by document type, date, author and subject making them easily retrievable for future use. Entered historical analytical data into spreadsheets for trending purposes.

Janet Todia

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Experience Summary

Janet Todia recently joined Brown and Caldwell. Ms. Todia brings 12 years of experience in landfill operation and maintenance.

Assignment

Field CQA Monitor

Education

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Registration

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Experience

12 years

Joined Firm

2010

Relevant Expertise

- Solid Waste Management
- Landfill Gas Systems
- Air Compliance

Landfill Operation and Maintenance Experience

Cuyahoga Regional Sanitary Landfill, Solon, Ohio

Project Manager for landfill gas services to supply a 3.8 megawatt power plant on site and a 72 mmbtu boiler system to Nestle USA. Managed coordination of field operations with pipeline and compression skid construction activities for the start up of the Nestle Gas to Energy Project.

Epperson Waste Disposal, Republic Services, Williamstown, Kentucky

Supervisor for well field technicians. Aided in the installation of pneumatic pumps for well dewatering purposes. Responsible for environmental compliance reporting.

Hazel Road Landfill, Akron, Ohio

Project Manager for landfill gas field services. Assisted field technicians in trouble shooting potential landfill gas migration issues and pneumatic pump installation.

Hoffman Road Landfill, City of Toledo, Toledo, Ohio

Project Manager for landfill gas field services. Managed environmental compliance and reporting, assisted site technicians in small-scale construction repairs, installation of pneumatic pumps, potential site migration issues, and routine well field tuning. Responsible for routine and non-routine construction budgets.

Lake County RDF, Waste Management, Chesterland, Ohio

Project Manager for landfill gas field services. Managed small-scale construction repairs, submitted proposals for small-scale construction projects, and coordinated well field compliance with Environmental Specialists, Inc.

Oakland Heights Development, Allied Waste Industries, Inc., Auburn Hills, Michigan

Project Manager for landfill gas project that provides methane to the GM Lake Orion boiler system. Managed budget and non-routine activities. Worked with Air Quality Specialists, Inc. to maintain environmental compliance.

Pine Tree Acres Landfill, Inc., Waste Management, Lenox Township, Michigan

Project Manager for well field technicians and aided in routine well field tuning to increase flow to the gas energy plant on site. Worked with Air Quality Specialists, Inc. to maintain environmental compliance.

Statewide Landfill, Waste Management, Canton, Ohio

Project Manager for well field technicians and aided in routine well field tuning, installation of pneumatic pumps, small scale construction repairs, and troubleshooting potential landfill gas migration issues.

Valley View Landfill, Republic Services, Sulpher, Kentucky

Supervisor for well field technicians. Managed routine and non-routine budgets. Responsible for environmental compliance reporting.

Landfill Air Compliance Reporting Experience

Deercroft Recycling and Disposal Facility, Waste Management, Michigan City, Indiana

Prepared semiannual Title V reports, semiannual new source performance standards (NSPS) reports, and semiannual startup, shutdown, and malfunction (SSM) reports. Submitted variance requests/alternative timeline requests, Title V annual compliance certification, and well decommissioning requests and Deviation Occurrence Reports.

Douglas County Recycling and Disposal Facility, Waste Management, Bennington, Nebraska

Prepared semiannual Title V reports, semiannual NSPS reports, semiannual SSM reports, and Title V annual compliance certifications.

ELDA Recycling and Disposal Facility, Waste Management, Cincinnati, Ohio

Prepared quarterly/semiannual Title V reports, semiannual EG reports, and semiannual SSM reports. Submitted variance requests/alternative timeline requests and well decommissioning requests.

Epperson Waste Disposal, Republic Services, Williamstown, Kentucky

Prepared semiannual NSPS reports and semiannual SSM reports. Submitted alternative variance requests/alternative timeline requests and well decommissioning requests.

Greene Valley Recycling and Disposal Facility, Waste Management, Naperville, Illinois

Prepared semiannual EG reports, semiannual SSM reports, semiannual Clean Air Act Permit Program (CAAPP) reports, and annual CAAPP compliance certifications. Submitted CAAPP Form 405s on an as need basis.

Hardy Road Sanitary Landfill, Waste Management, Akron, Ohio

Prepared semiannual NSPS reports, semiannual SSM reports, quarterly/semiannual Title V reports, annual Title V compliance certifications, and annual solid waste report. Maintained operating records.

Hoffman Road Landfill, City of Toledo, Toledo, Ohio

Prepared semiannual NSPS reports, semiannual SSM reports, and quarterly/semiannual Title V reports.

Lake County RDF, Waste Management, Chesterland, Ohio

Prepared semiannual EG reports, semiannual SSM reports, quarterly/semiannual Title V reports, annual Title V compliance certifications, and annual solid waste report.

Lake Landfill, Waste Management, Northbrook, Illinois

Prepared semiannual EG reports, semiannual SSM reports, semiannual CAAPP reports, and annual CAAPP compliance certifications. Submitted CAAPP Form 405s on an as need basis.

Metro Park East Landfill, Waste Management, Mitchellville, Iowa

Prepared semiannual NSPS reports, semiannual SSM reports, semiannual Title V reports, and annual Title V compliance certifications.

Valley View Landfill, Republic Services, Sulphur, Kentucky

Prepared semiannual NSPS reports, semiannual SSM reports, semiannual Title V reports, and annual compliance certifications. Submitted variance requests/alternative timeline requests, and well decommissioning requests.

Wheeler Recycling and Disposal Facility, Waste Management, Wheeler, Indiana

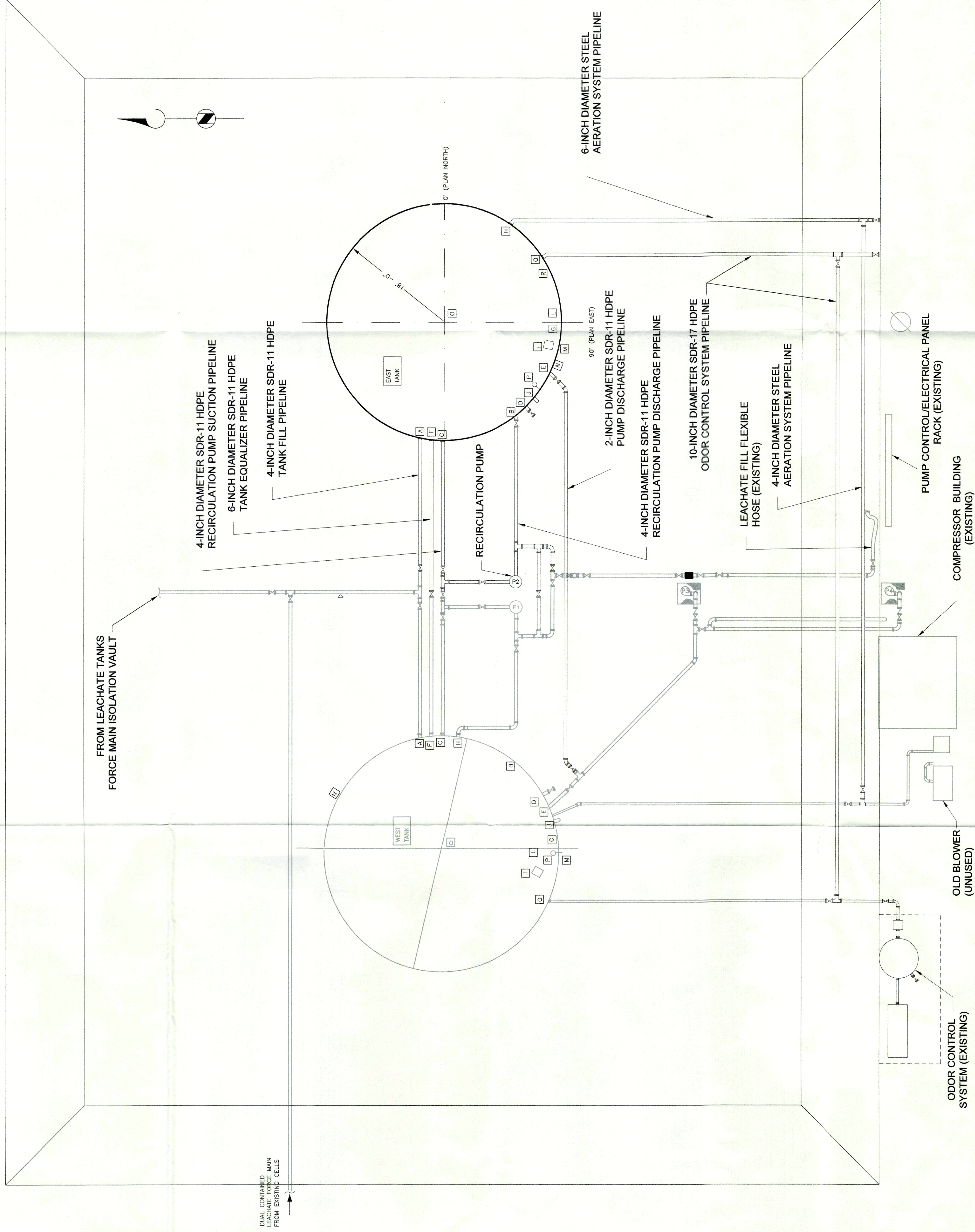
Prepared semiannual EG reports, semiannual SSM reports, quarterly/semiannual Part 70 compliance certifications, and annual Part 70 compliance certifications. Submitted variance requests/alternative timeline requests, well decommissioning requests, and Deviation Occurrence Reports.

Woodland Recycling and Disposal Facility, Waste Management, South Elgin, Illinois

Prepared semiannual EG reports, semiannual SSM reports, semiannual Title V reports, and annual compliance certifications. Submitted variance requests/alternative timeline requests, and well decommissioning requests.

Appendix D: Project Record Drawings

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CON#	DIMENSION FROM TANK TO		SIZE	REF. DEGREE		PURPOSE
	BOTTOM	TOP		EAST TANK	WEST TANK	
A		8"	4"	193		TANK FILL LINE
B		6"	4"	128		RECIRCULATION PUMP DISCHARGE
C	6'		4"	180		RECIRCULATION PUMP SUCTION
D	6"		6"	117		DRAIN LINE
E		6"	2"	112		SUMP DISCHARGE
F		6'	6"	185		TANK EQUALIZER
G		ROOF	4"	NEAR PLATFORM		LEVEL CONTROL CONNECTION
H		6"	4" DBL	80		BLOWER CONNECTION
I		ROOF	STD	NEAR PLATFORM		MANWAY
J		6"	150 GPM	105		OVERFLOW
L			4"	NEAR PLATFORM		LEVEL CONTROL CONNECTION
M			STD	85		LADDER
N	2'-6"		STD	315		MANWAY
O		ROOF	300 GPM	STD		VENT
P				NEAR PLATFORM		LEVEL GUAGE
Q		6"	10"	75		OFFGAS CONNECTION
R		ROOF	4"	NEAR PLATFORM		PRESSURE TRANSDUCER CONNECTOR

DIMENSIONS BASED ON A FREEBOARD OF 12".

NOTES:

1. NEW EAST LEACHATE STORAGE TANK INSTALLED ON THE EXISTING FOUNDATION PAD AS SHOWN IN DRAWING.
2. LEACHATE STORAGE TANK BOLTED STEEL FABRICATED TANK WITH COATINGS (INTERNAL AND EXTERNAL). NEW (EAST) TANK DIMENSIONS IDENTICAL TO EXISTING TANK.
3. NEW (EAST) TANK EQUIPPED WITH EXTERNAL LEVEL INDICATOR AND PRESSURE TRANSDUCER WITH LOW LEVEL INTERLOCK TO CONTROL. TRANSFER PUMP AND HIGH LEVEL SWITCH INTERLOCK TO STOP LEACHATE COLLECTION PUMPS.
4. MANWAY PROVIDED ON NEW (EAST) TANK PER MANUFACTURE'S STANDARD DETAIL.
5. GROUNDING OF TANK AND CONNECTION TO EXISTING GROUNDING GRID WITH CONNECTED BARE COPPER LIGHTENING DOWN CONDUCTORS TO GROUND WITH 10' 5/8" COOPER GROUNDING RODS AT EACH SIDE OF TANK.
6. LEACHATE PIPING WITHIN CONTAINMENT AREA IS SINGLE-WALLED HDPE. VALVES 4" AND SMALLER ARE BALL VALVES AND 6" VALVES ARE GATE VALVES. ALL PIPING AND VALVES WITHIN CONTAINMENT AREA INSTALLED ABOVE THE MAXIMUM OVERFLOW ELEVATION. PIPE SUPPORTS ARE THE SAME AS EXISTING SYSTEM.
7. ABOVE GROUND PIPING ELECTRICALLY HEAT TRACED AND INSULATED FOR FREEZE PROTECTION.
8. NEW (EAST) TANK AERATED WITH AN ORIFICE DIFFUSER SYSTEM SIZED TO HANDLE AIRFLOW 500 SCFM AT 50 PSI. DIFFUSER LATERAL SYSTEM ANCHORED TO TANK FLOOR.
9. AIR SUPPLIED BY EXISTING COMPRESSOR SYSTEM PROVIDING 500 SCFM AT 100 PSI.
10. NEW OFF-GAS FILTRATION SYSTEM CONNECTED TO EXISTING SYSTEM SIZED TO TREAT 500 SCFM.
11. SINGLE-WALL HDPE PIPE AND FITTINGS BUTT-FUSED WELDED AND PRESSURE TESTED. PIPE STANDS USED TO SUPPORT PIPING.

[illegible]

PROJECT RECORD DRAWING PLAN VIEW	FILENAME
	BC PROJECT NUMBER 142575
	CLIENT PROJECT NUMBER
	DRAWING NUMBER
	RD-01
	SHEET NUMBER 1 OF 1



Appendix E: Contractor Submittals

CST Storage TecStore Epoxy Bolted Storage Tank; Model 3652

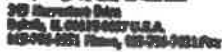
VAREC Vapor Control Inc. 2010B Pressure and Vacuum Relief Valve

HDPE Pipe and Valves

AERTEC® Aeration Technologies Inc. AERGRID™/AERSPARGE™ Aeration System

Heat Trace and Insulation

CST Storage TecStore Epoxy Bolted Storage Tank; Model 3652



HOW TO Cite

MADE IN
AMERICA
AMERICAN
STEEL

Submitted by:	Date: 8/8/2012	Date:	Expires:
Date:			

Tank Project Drawing Index

Document Number	Document Title
8123113-001	Tank Drawing
8123113-010	Tank Calculations & Design Formulas
8123113-011	Tank General Notes
8123113-012	Tank Fastener Schedule
8123113-013	Tank Schematic
8123113-014	Tank Parts List

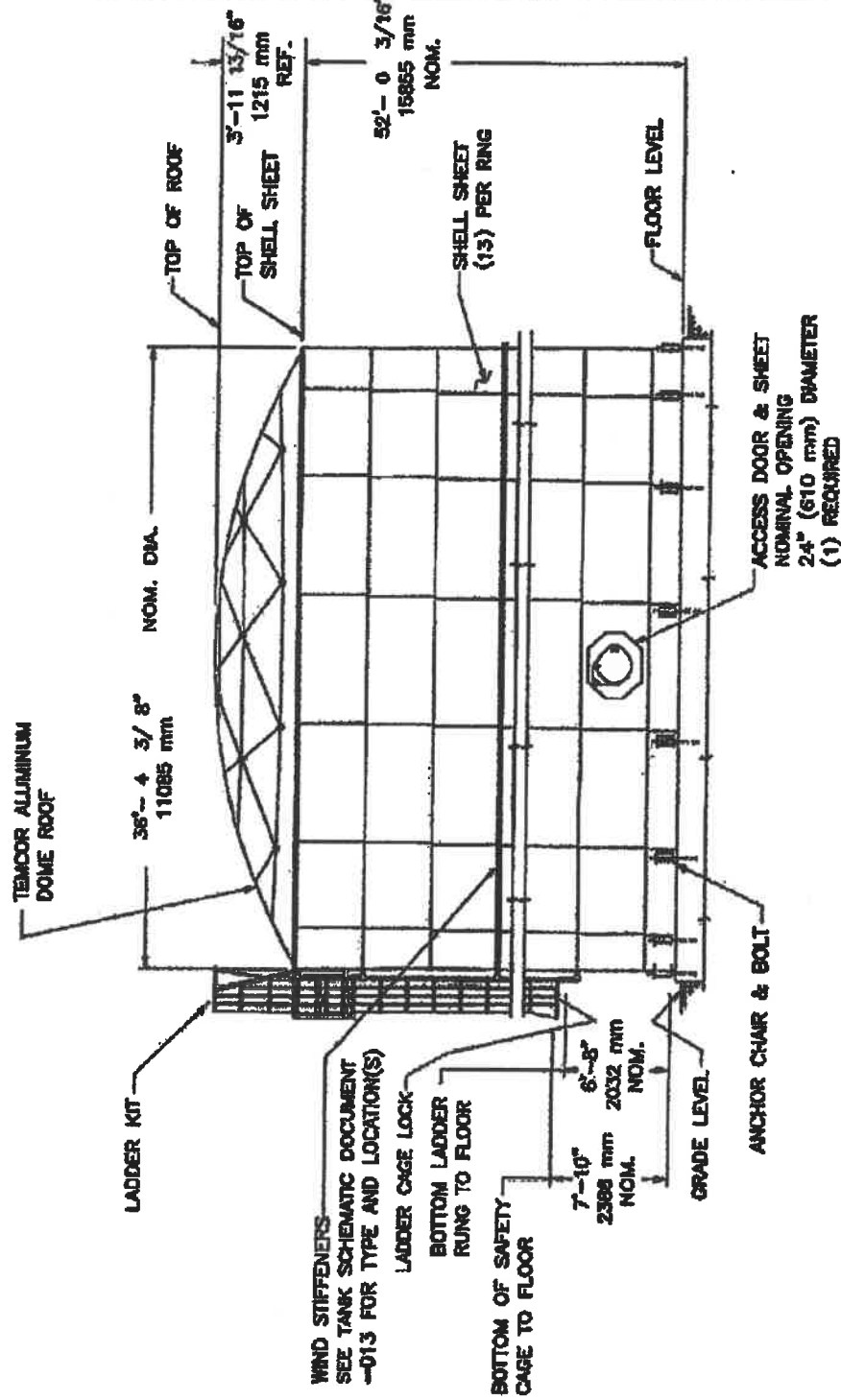
Foundation Project Index

8123113-002	SF Foundation Drawing
8123113-003	Anchor Bolt Placement
8123113-023	Foundation Parts List
8123113-024	Foundation Fastener Schedule
8123113-025	Manufacturers Warranty

NOTES:

1. THIS DRAWING IS NOT TO SCALE.
2. REFER TO TANK SCHEMATIC DOCUMENT -013 FOR NUMBER OF RINGS IN TANK AND RESPECTIVE SHEET THICKNESSES.
3. THIS TANK AND FLOOR ARE NOT DESIGNED FOR ANY EXTERNAL HYDROSTATIC LOADING.

MAX. ROOF LOAD PER ATTACHMENT POINT 3300 lb
(FIXED TYPE CONNECTION)
1497 kg
SEISMIC SLOSHING WAVE HEIGHT = 2.64'



ELEVATION

REL	DESCRIPTION
1	REL PER MP 8123113 08/07/12
ESPC PANEL INTERIOR COATING KUDO-401 (5 MILS) ESPC PANEL EXTERIOR COATING KUDO-401 URETHANE TOP COAT SHELL COLOR: LIGHT BLUE	
CST STORAGE DODGE, ILLINOIS 60115 CONFIDENTIAL THIS PROJECT IS THE PROPERTY OF CST STORAGE COMPANY OF ILLINOIS. ALL RIGHTS RESERVED.	
FILED	8123113A
DRAWN BY	RR
DATE	08/07/12
3652 SFTT SZ 1 LORAIN LANDFILL AMHERST, OHIO	
DWG NO.	8123113-001

DOCUMENT NUMBER: 8123113-010

TITLE: TANK CALCULATIONS

PAGE: 1

REL.: 1

DATE: August 03, 2012

BY: BP

SUMMARY OF TANK DESIGN INPUT DATA

STRUCTURE MODEL	36 52	
FOUNDATION TYPE	Steel Floor	
SPECIFIC GRAVITY	1.000	
HV PRESSURE RATIO	1.000	
FREEBOARD	0.000 in	0.000 mm
ROOF TYPE	Temcor Aluminium Dome	
ROOF WEIGHT	2.100 psf	10.252 kg/m2
SC ROOF HEIGHT	0.000 in	0.000 mm
DC ROOF PROJ AREA	89.800 sq ft	8.263 sq m
DC ROOF CENTROID	16.600 in	469.900 mm
TOTAL ROOF HEIGHT	47.832 in	1214.933 mm
ROOF SNOW LOAD	30.000 psf	1.437 kPa
WIND DESIGN	ASCE 7-05*(10.00 psf)*	
EXPOSURE FACTOR	B	
IMPORTANCE FACTOR	1.000	
WIND SPEED	80.000 mph	40.600 m/s
WIND STIFFENER ANALYSIS	ASCE 7-05*(10.00 psf)*	
SEISMIC DESIGN	AWWA D103 87 (EFFECTIVE MASS)	
SEISMIC ZONE	1	
USE FACTOR, I	1.000	
SITE AMPLIFICATION FACTOR	1.000	
ALLOWABLES USED	AISC	
FLOOR O.D	38,500 ft	11126.200 mm

SUMMARY OF INTERNALLY ASSIGNED PARAMETERS

BOLT DIAMETER	0.500 in	12.700 mm
HOLE DIAMETER	0.562 in	14.288 mm
TOP COURSE EDGE DIST	1.000 in	25.400 mm
STEEL FLOOR IN FNDN	0.132 in	3.353 mm
DIST T/FTG TO B/FLR	0.000 in	0.000 mm
TOTAL FNDN THICKNESS	0.132 in	3.353 mm
SHEET DENSITY	590.000 pcf	9461 kg/m3
STEEL ELASTIC MODULUS	30000000 psi	208843 MPa
STEEL FLOOR DENSITY	590 pcf	9461 kg/m3
NET SHEET WIDTH	105.482 in	2679.000 mm
NET STANDARD SHEET HT.	54.980 in	1397.000 mm
STARTER PANEL HEIGHT	18.308 in	465.000 mm
INVENTORY USED	wossiblk(2312)	

36 52 AQUASTORE STRUCTURE DESIGN SUMMARY (13 FULL LENGTH SHEETS PER RING/COURSE)

COURSE NUMBER	THICK In.	THICK mm	GEOM CODE	MAT CODE	LIMITING FACTOR(S)
1	0.106	2.7	1101	40	()
2	0.106	2.7	1201	40	()
3	0.106	2.7	1201	40	()
4	0.106	2.7	1201	40	()
5	0.099	2.5	8201	9	()
6	0.132	3.4	2201	3	(15)
7	0.132	3.4	2201	3	()
8	0.164	4.2	2201	3	(15)
9	0.164	4.2	2201	3	()
10	0.197	5.0	2201	3	(15)
11	0.197	5.0	2201	3	()
FND	0.197	5.0	4321	3	()

WIND STIFFENERS REQUIRED:

STIFFENER AT BOTTOM OF COURSE 3

= 1,018cu ft

3" Web Truss

ANCHORS REQUIRED:

(1)1.5in. ANCHORS REQUIRED PER SHEET.

STRUCTURE DIAMETER	= 38.37 ft	11684.08 mm
HEIGHT OF STRUCTURE TO EAVE	= 52.02 ft	15854.83 mm
BLOSHING WAVE HEIGHT	= 0.22 ft	68.52 mm
VOLUME OF STRUCTURE TO EAVE	= 54092 cu ft	1530 m3
VOLUME OF CONTENTS	= 54092 cu ft	1530 m3
VOLUME OF CONTENTS	= 404104 gal	1539005 L
VOLUME OF STEEL FLOOR FND.	= 12 cu ft	0 m3
WEIGHT OF EMPTY CYLINDER ABOVE FLOOR	= 40888 lb	18324 kg
WEIGHT OF ROOF	= 2181 lb	988 kg
SNOW(LIVE) LOAD	= 31182 lb	14186 kg
WEIGHT OF CONTENTS	= 3371668 lb	1529317 kg
STEEL FLOOR WEIGHT	= 6781 lb	3080 kg
TOTAL WEIGHT ON FOOTING	= 3461308 lb	1565821 kg
WIND SHEAR AT TOP OF FOOTING	= 18913 lb	85977 N
WIND MOMENT AT TOP OF FOOTING	= 545558 ft-lb	740 kN-m
SEISMIC SHEAR AT TOP OF FOOTING	= 138331 lb	608431 N
SEISMIC MOMENT AT TOP OF FOOTING	= 3228813 ft-lb	4378 kN-m

HOOP STRESS ANALYSIS

--- STRESS-PSI ---

Course Number	Depth (ft)	Press (PSI)	Net Tensile	Allowable Tensile	Hole Bearing	Allowable Bearing	Bolt Shear	Allowable Shear
1	4.7	2.0	5760	22254	17868	54000	4757	30000
2	8.2	4.0	11368	24000	17690	54000	4713	30000
3	13.6	6.0	17044	24000	26462	54000	7047	30000
4	18.4	8.0	22689	24000	35214	54000	9362	30000
5	23.0	10.0	28921	33923	46462	81000	11711	30000
6	27.6	12.0	26913	33923	41782	81000	14044	30000
7	32.2	13.9	31384	33923	48724	81000	16378	30000
8	36.7	15.9	28860	33923	44805	81000	18712	30000
9	41.3	17.9	32459	33923	50363	81000	21046	30000
10	45.9	19.9	30018	33923	46803	81000	23379	30000
11	50.5	21.9	33015	33923	51256	81000	25713	30000
FND	52.0	22.6	30601	33297	44297	81000	22217	30000

AXIAL STRESS ANALYSIS

--- STRESS-PSI ---

Course Number	Axial Compressive	Allowable Compressive	Hole Bearing	Allowable Bearing	Bolt Shear	Allowable Shear
1	276	943	2787	54000	667	30000
2	282	943	2835	54000	715	30000
3	301	943	3024	54000	762	30000
4	320	943	3212	54000	810	30000
5	339	894	1700	81000	429	30000
6	273	1185	1370	81000	460	30000
7	291	1185	1484	81000	492	30000
8	253	1468	1273	81000	531	30000
9	272	1468	1367	81000	571	30000
10	246	1751	1232	81000	618	30000
11	264	1751	1326	81000	665	30000
FND	270	1751	1358	81000	681	30000

WIND STRESS ANALYSIS

--- STRESS-P81 ---

Course Number	Axial Comp	Wind Bending	Total Comp	Allowable Comp	Hole Bearing	Allowable Bearing	Bolt Shear	Allowable Shear
1	36	9	44	1258	446	72000	107	40000
2	53	21	74	1258	743	72000	187	40000
3	71	41	112	1258	1125	72000	284	40000
4	90	68	158	1258	1570	72000	398	40000
5	109	96	207	1192	1038	108000	262	40000
6	101	102	202	1581	1015	108000	341	40000
7	119	135	254	1581	1275	108000	429	40000
8	115	139	253	1954	1273	108000	532	40000
9	134	173	306	1954	1538	108000	642	40000
10	130	175	305	2335	1533	108000	788	40000
11	149	210	359	2335	1801	108000	903	40000
FND	155	222	377	2335	1893	108000	950	40000

SEISMIC STRESS ANALYSIS

--- STRESS-P81 ---

Course Number	Axial Comp	Seismic Bending	Total Comp	Allowable Comp	Hole Bearing	Allowable Bearing	Bolt Shear	Allowable Shear
1	36	7	43	1258	432	72000	103	40000
2	53	42	94	1258	947	72000	239	40000
3	71	112	183	1258	1842	72000	484	40000
4	90	224	314	1258	3151	72000	794	40000
5	109	379	487	1192	2446	108000	617	40000
6	101	432	533	1581	2677	108000	900	40000
7	119	535	754	1581	3789	108000	1273	40000
8	115	706	821	1954	4123	108000	1722	40000
9	134	832	1066	1954	5359	108000	2236	40000
10	130	980	1120	2335	5624	108000	2821	40000
11	149	1229	1377	2335	6917	108000	3470	40000
FND	155	1314	1469	2335	7378	108000	3700	40000

SEISMIC STRESS ANALYSIS CONTINUED

Course Number	--- STRESS-PSI ---		
	Hydro-Dynamic Hoop	Total Hoop	Allowable Tensile
1	328	8088	29871
2	500	11898	32000
3	632	17676	32000
4	723	23412	32000
5	776	30697	45230
6	883	27606	45230
7	690	31874	45230
8	473	29333	45230
9	472	32832	45230
10	393	30411	45230
11	393	33407	45230
FND	393	30893	44398

TANK DESIGN SPECIFICATIONS

This tank is designed in accordance with **ANSI/AISC 360-05**, Specification for Structural Steel Buildings - Allowable Stress Design. See page 1 of Document 8123113-010 for Summary of Tank Design Input Data.

COATINGS SPECIFICATIONS

Coatings used on components of this tank are in compliance with the appropriate sections of AWWA Standard D103.

STRUCTURE BOLT SPECIFICATIONS

Structure bolts are carbon steel, zinc mechanically deposited per the latest revision of ASTM B695, class 80, type 1, with 1/2"-13 UNC-2A thread, and conform to AWWA D103, Section 2.2.1, as noted below.

A. 1 inch long and 1-1/4 inch long bolts conform to the mechanical properties of SAEJ429, Grade 5 - equivalent to the mechanical properties of ASTM A325.

B. 1-1/2 inch long and longer bolts conform to the mechanical properties of SAEJ429, Grade 8 - equivalent to the mechanical properties of ASTM A490.

Unless noted, all tank structure connections are bearing type connections, snug-tight condition, per ANSI/AISC 360-05. Tank manufacturer does not require special inspection per IBC, Section 1704.

APPURTENANCE AND PIPING ORIENTATION

Orientation of all appurtenances and piping connections shall be established in the field.

THROUGH-THE-SHEET PENETRATIONS

All openings through the tank side wall greater than 4 inches (102mm) in diameter shall be reinforced in accordance with AWWA D103, Section 3.11. All openings through sheets having less than 24 inches (610 mm) between horizontal bolt lines, or having less than 24 inches (610 mm) of available sheet space from the floor surface up to the first horizontal bolt line shall not exceed a diameter of 4 inches (102 mm). These openings of 4 inches (102 mm) and less shall be reinforced in accordance with AWWA D103, Section 3.11.

LADDER SPECIFICATIONS

The ladder system is manufactured in compliance with AWWA Standard D103 Section 5.4 and meets minimum OSHA requirements. In addition, the tank ladder side rails are fabricated from 6061-T8 aluminum while the ladder rungs are fabricated from 6061-T4 aluminum.

LANDFILL LEACHATE WASTE WATER

No leachate analysis has been provided for the proposed contents of this tank. The tank coatings and sealants have been specified based upon the information contained in this submittal package and the following assumed properties of the contents: the contents shall have a pH within the range of 6 and 8, at ambient temperature, and a total volatiles concentration not to exceed 500 parts per million (ppm). Volatiles may include, but are not limited to, benzene, acetone, xylene, methylene chloride, and similar organic compounds. If the contents exceed the values noted above, the tank coatings and/or sealants may become compromised and the warranty voided.

Structure bolt quantities at (H)orizontal and (V)ertical seams

BOLT LENGTHS:	Thru the sheet fasteners							Truss Fasteners			
	1"	1 1/4"	1 1/2"	1 3/4"	2"	2 1/4"	2 1/2"	1 1/4"	2 1/4"	3"	3 1/2"
	25.40	31.75	38.10	44.45	50.80	57.15	63.50	31.75	57.17	76.20	88.90
								C.S.	C.S.	C.S.	C.S.
SEAM Wide H 1	0	190	31	166	0	0	0	0	0	0	0
SEAM V 1	312	0	0	0	0	0	0	0	0	0	0
SEAM Wide H 2	256	30	0	0	0	0	0	0	0	0	0
SEAM V 2	663	0	0	0	0	0	0	0	0	0	0
SEAM Wide H 3	260	26	0	0	0	0	0	0	0	0	0
SEAM V 3	663	0	0	0	0	0	0	0	0	0	0
SEAM Wide H 4	167	119	0	0	0	0	0	182	0	0	0
SEAM V 4	663	0	0	0	0	0	0	0	0	0	0
SEAM Trans H 5	260	26	0	0	0	0	0	0	0	0	0
SEAM V 5	663	0	0	0	0	0	0	0	0	0	0
SEAM Close H 6	516	30	0	0	0	0	0	0	0	0	0
SEAM V 6	663	0	0	0	0	0	0	0	0	0	0
SEAM Close H 7	516	26	0	0	0	0	0	0	0	0	0
SEAM V 7	663	0	0	0	0	0	0	0	0	0	0
SEAM Close H 8	0	546	0	0	0	0	0	0	0	0	0
SEAM V 8	0	663	0	0	0	0	0	0	0	0	0
SEAM Close H 9	0	546	0	0	0	0	0	0	0	0	0
SEAM V 9	0	663	0	0	0	0	0	0	0	0	0
SEAM Close H 10	0	516	26	0	0	0	0	0	0	0	0
SEAM V 10	0	663	0	0	0	0	0	0	0	0	0
SEAM Close H 11	0	516	26	0	0	0	0	0	0	0	0
SEAM V 11	0	663	0	0	0	0	0	0	0	0	0
SEAM Fnd. H 12	0	507	39	0	0	0	0	0	0	0	0
ACCESS DOOR	0	0	0	30	0	0	0	0	0	0	0
REINF. PLT.	0	0	90	0	0	0	0	0	0	0	0
Total:	6267	5736	216	186	0	0	0	182	0	0	0

Note: All brackets located at top of specified ring.

Ring are identified from top of tank to foundation

Ring #	Sheet Thick.	Bracket Type	Bracket Quantity	Vertical Bolt Line	Shell Sheet Part No.
Use tapered spacer at top horizontal seam					
RING # : 1	0.108" (2.7mm)	BRKT	4	1V	280578N8000
RING # : 2	0.108" (2.7mm)	BRKT	4	2V	288050N5000
RING # : 3	0.108" (2.7mm)	NONE	0	2V	288050N8000
---(TYPE 3" Web Truss #281847)					
RING # : 4	0.108" (2.7mm)	BRKT	2	2V	288050N5000
RING # : 5	0.098" (2.5mm)	NONE	0	2V	281181-0100
RING # : 6	0.132" (3.4mm)	BRKT	4	2V	263106-1200
RING # : 7	0.132" (3.4mm)	BRKT	2	2V	263106-1200
RING # : 8	0.164" (4.2mm)	BRKT	2	2V	263106-0500
RING # : 9	0.164" (4.2mm)	NONE	0	2V	283106-0800
RING # : 10	0.197" (5.0mm)	BRKT	2	2V	263106-1300
RING # : 11	0.197" (5.0mm)	BRKT	2	2V	263106-1300
FND. :	0.197" (5.0mm)	NONE	0	3V	See fnd. parts list

DOCUMENT NUMBER: 8123113-014

REL:1 TITLE: TANK PARTS LIST

PAGE: 1

Item	Quantity	Part No.	Description
-	1	8123113-001	TANK ASSEMBLY
1	1	8123113-002	FOUNDATION ASSEMBLY
2			
3			
4			
5			
6			
7			
8			
9			
10			
11	1	284391-000	MANWAY PLATFORM ASSEMBLY
12			
13			
14	11	285777-203	SEALER 98, CARTONS (BLACK)
15			
16			
17	1	288448-004	LADDER W/CAGE, W/PLATFORM
18	1	284769-000	LADDER DOOR ASSEMBLY
19			
20			
21	1	277650-000	GASKET, 24"
22	2	288214-1300	REINFORCING PLATE, .187"
23			
24			
25			
26			
27	13	281258-038	STIFFENER ANGLE
28	13	280577-083	SPLICE ANGLE
29	13	084373-000	TAPERED SPACER
30			
31	91	281847-000	WEB TRUSS, 3'
32			
33			
34			
35			
36			
37			
38			
39			
40			
41			
42			
43			
44	6287	282000-001	STRUCTURE BOLT, 1"
45	5738	282000-002	STRUCTURE BOLT, 1 1/4"
46	218	282000-003	STRUCTURE BOLT, 1 1/2"
47	188	282000-004	STRUCTURE BOLT, 1 3/4"
48			
49			
50			
51	182	282415-001	HHCS 1/2 X 1 1/4" SPCL. FN6H.
52			
53			
54			
55	182	281874-000	WASHER, SPECIAL
56	12408	282278-000	WASHER, 1/2"
57	12405	282418-001	HEX. NUT, 1/2" HDZ
58	182	283528-001	HEX. NUT, 1/2" MDZ

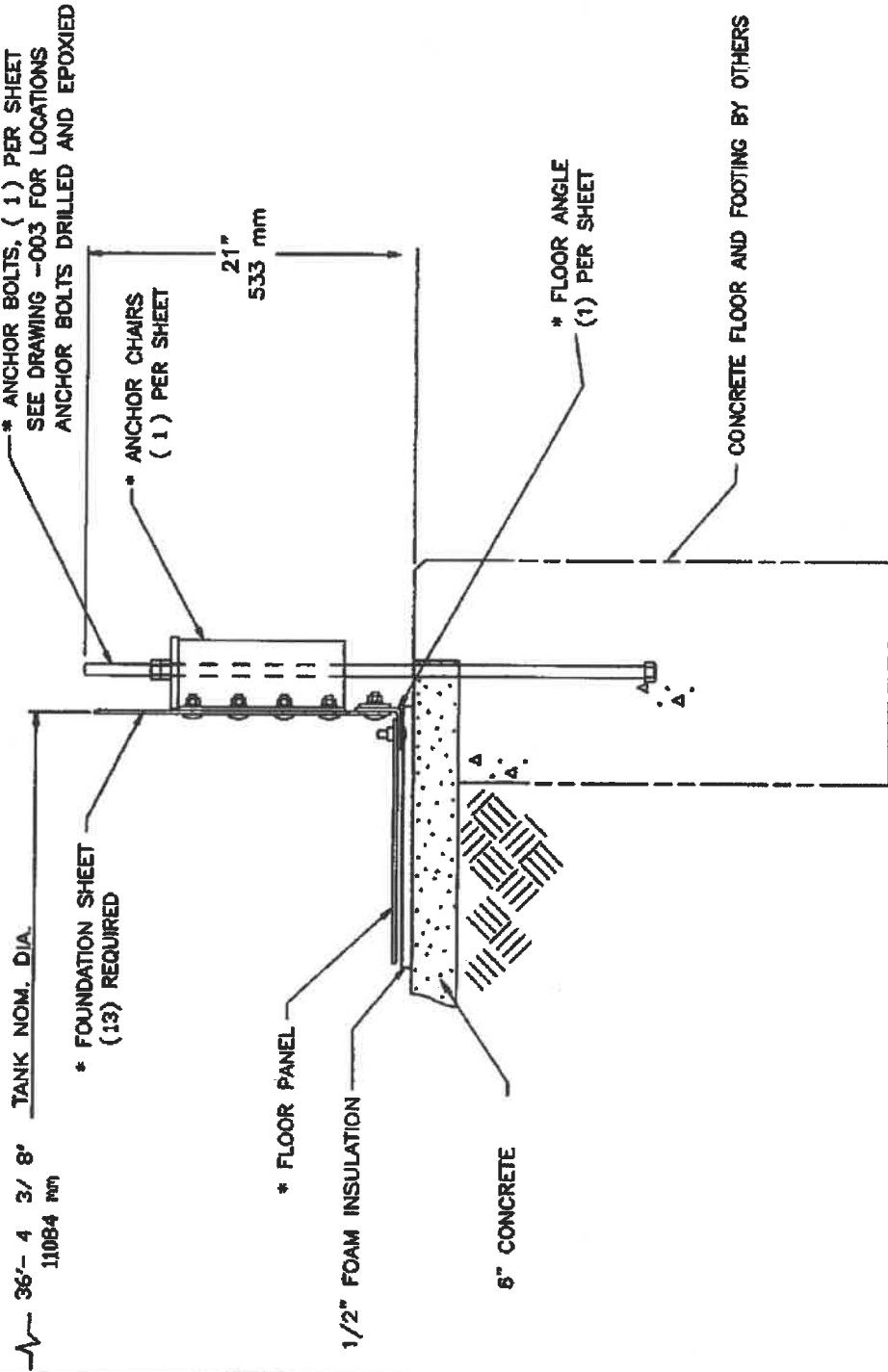


Item	Quantity	Part No.	Description
59			
60			
61			
62			
63			
64			
65	3	286486-080	INSTRUCTION DECAL
66	3	282778-000	DANGER DECAL
67			
68	1	288182-000	NAMEPLATE
69	1	286284-000	OPERATORS MANUAL
70	3	282188-000	IMPORTANT DECAL
71	3	280881-000	TANK MOD. WARNING DECAL
72	1	288255-000	INSPECTION & MAINT. REVIEW
73	11	288384-000	LADDER BRACKET ASSY. (LONG)
74			
75			
76			
77			
78			
79	13	261191-0100	TRANS. SHT. 0.089" HSLA
80			
81	1	266216-1306	24" ROUND ACCESS DOOR SHEET
82	13	260578N5000	TOP RING SHEET
83	1	277487-036	24" ACCESS DOOR, NORMAL DUTY, EPOXY/GALV
84			
85			
86			
87	39	266060N5000	SHELL SHEET 0.106" HRS
88			
89	26	263106-1200	SHELL SHEET 0.132" HSLA60
90	26	263106-0900	SHELL SHEET 0.164" HSLA60
91	26	263106-1300	SHELL SHEET 0.197" HSLA60
92			
93			
94			
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118			

CST
STORAGE

NOTES:

1. THIS DRAWING IS NOT TO SCALE.
2. ITEMS INDICATED * TO BE SUPPLIED BY THE TANK MANUFACTURER. SEE * ESPC PARTS SPECIFICATIONS CHART ON THIS DRAWING.



REL. DESCRIPTION

REL PER MIP 8123113
08/07/12

* EPC PARTS SPECIFICATIONS

FLOOR ANGLES	IN. 3 X 3 X 1/4
ANCHOR CHAIRS	78 X 76 X 6
ANCHOR BOLTS	IN. 1/4 FORMED PLATE
	IN. 1/2 DIA X 36 LG.
	38 DIA X 915 LG.

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STORAGE
DETAILED LUNDS 20115
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FILE: 8123113B

DRAWN BY RR

DATE 08/07/12

36' STEEL FLOOR FND.

SZ 1

LDRAIN LANDFILL

AMHERST, OHIO

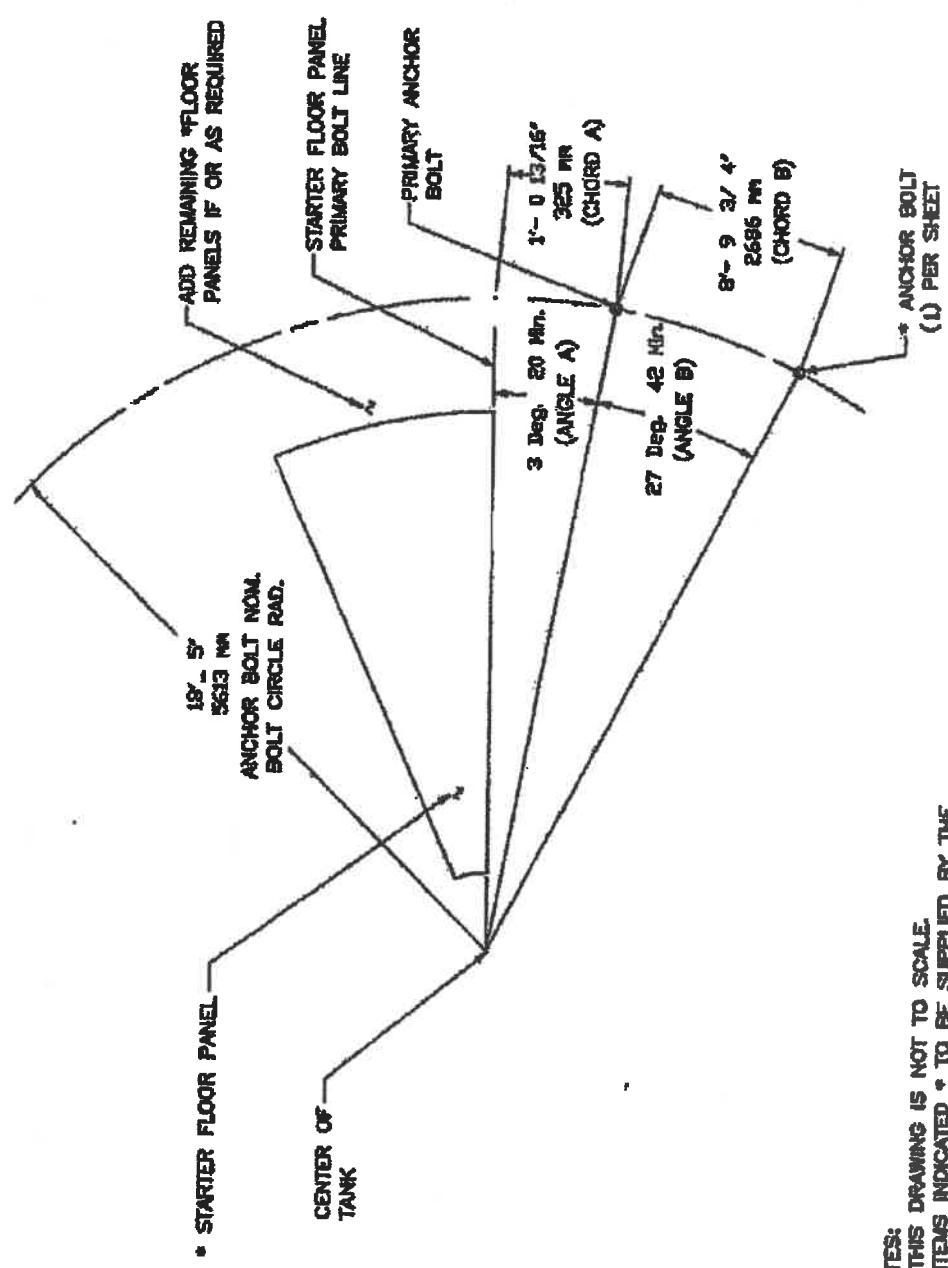
SECTION THROUGH FOUNDATION

DWG NO.

8123113-002

REL	DESIGNATION
REL PER WIP 8123113	
08/07/82	

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FILE: 8123113C	
DRAWN BY: JR	
DATE: 08/07/82	
36' STEEL FLOOR FND.	
SZ 1	
LORAIN LANDFILL	
AMHERST, OHIO	
DWG NO.	8123113-003



ANCHOR BOLT LOCATION
WITH RESPECT TO THE
PRIMARY FLOOR PANEL

- NOTES:
1. THIS DRAWING IS NOT TO SCALE.
 2. ITEMS INDICATED * TO BE SUPPLIED BY THE TANK MANUFACTURER. SEE * ESPC PARTS SPECIFICATIONS CHART ON DRAWING -002.
 3. PLACEMENT OF ANCHOR BOLTS TO BE WITHIN 1/2" (13 mm) OF INDICATED CHORD DIMENSIONS.

DOCUMENT NUMBER: 8123113-023

REL:1 TITLE: FND. PARTS LIST

PAGE: 1

Item	Quantity	Part No.	Description
-	1	8123113-002	S.F. FOUNDATION ASSY.
1	13	281703-1300	9.187" FND. SHT. HSLA
2	1	263752K1200	36.0 FT. DIA. FLOOR ASSEMBLY
3			
4			
5			
6			
7			
8	13	281067-002	TAPERED SPACER
9			
10	13	286621-012	ANCHOR BOLT ASSY., 1 1/2"
11	13	281424-000	ANCHOR BOLT CHAIR
12			
13	13	281725-012	WASHER, PLATE, 1 1/2"
14			
15			
16			
17			
18	4	268777-203	SEALER 98, CARTONS(BLACK)
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			
32			
33	45	263156-001	ENCAPSULATED NUT, PLASTIC
34			
35			
36			
37	886	282000-002	STRUCTURE BOLT 1 1/4"
38	166	282000-003	STRUCTURE BOLT 1 1/2"
39			
40			
41	842	263416-001	HEX NUT, 1/2" HDZ
42	857	262275-000	WASHER, 1/2"
43			
44			
45			
46			
47			
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49			

CST
STORAGE

Item	Quantity	Part No.	Description
60			
61			
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CST STORAGE

CST
STORAGE

BOLT LENGTHS:	1"	1 1/4"	1 1/2"	1 3/4"	2"	ANCHOR RODS
	25.40	31.75	38.10	44.45	50.80	
ANCH. CHAIR	0	52	52	0	0	
VERTICAL	0	189	0	0	0	
HORIZONTAL	0	420	104	0	0	

MANUFACTURER'S LIMITED WARRANTY

One-Year Limited Warranty

CST Storage warrants that a TecStore™ brand liquid storage tank will be free from defects in workmanship and materials, under normal and proper use, maintenance and operation, during the period expiring on the earlier of (i) one year after liquid is first introduced into the tank or (ii) 14 months after shipment from the factory.

Limitations and Conditions

This CST Storage Limited Warranty is subject to the following limitations and conditions:

a. The CST Storage Limited Warranty shall

remain in effect only as long as the tank is used for the storage of the liquid specified in the order. The CST Storage Limited Warranty shall become void and terminate should the tank be used for storage of any other liquid or material unless specified in writing prior to CST Storage's acceptance of the order for the tank.

b. The CST Storage Limited Warranty does not cover damages caused by shipping, handling or tank erection, or damage caused by operating or maintenance activities. CST Storage makes no warranty about and shall not be responsible for any defects in erection or installation of a tank.

c. The CST Storage Limited Warranty shall become void and terminate if any alterations are made to the tank without the prior written approval of CST Storage.

d. The CST Storage Limited Warranty shall become void and terminate if the tank is not used, operated and maintained in accordance with the requirements stated in the CST Storage Operating Manual(s) supplied with the tank, or if the tank is damaged or subject to any abuse, misuse or vandalism.

Limitation of Remedies

In the event of any failure of any TecStore brand liquid storage tank to perform as warranted in this Limited Warranty, the sole and exclusive obligation of CST Storage shall be, at its sole option, either to repair the tank or repair or replace (FOB factory) any part of the tank which is defective.

IN NO EVENT SHALL CST STORAGE BE LIABLE (WHETHER FOR BREACH OF WARRANTY OR CONTRACT, FOR STRICT LIABILITY OR NEGLIGENCE, OR OTHERWISE) FOR ANY SPECIAL, INCIDENTAL, PUNITIVE OR CONSEQUENTIAL DAMAGES, INCLUDING, BUT NOT LIMITED TO, DAMAGES FOR LOSS OF CONTENTS OR LOSS OF PROFITS, OR FOR THE CONDITION OR QUALITY OF LIQUID STORED IN THE TANK, OR FOR ANY INABILITY OF OWNER TO PROVIDE PRODUCT OR SERVICE TO ANY CUSTOMER OF OWNER.

Any action against CST Storage for breach of warranty or contract, or for strict liability, negligence or otherwise relating to a tank, must be commenced within one year after such cause of action accrues.

Any Warranty claim shall be made to CST Storage in writing. Once a claim has been made, CST Storage shall have the right to perform on-site inspections of the tank. If CST Storage chooses to do repair-work (either, for purposes of this paragraph, shall include repairing or replacing defective parts) on the tank, CST Storage shall be granted permission to perform such work with its own service personnel or personnel of others, and under nonunion conditions unless CST Storage otherwise agrees. Any repairs made to a tank before CST Storage is notified of a claim shall be at the Owner's expense. Preparation for inspection or repair of a tank (such as removing the contents and obstructive equipment in the tank) shall be the sole responsibility and expense of Owner. Preparation of the tank for use after repair shall be the sole responsibility and expense of the Owner.

Preparation for inspection or repair of a tank (such as removing the contents and obstructive equipment in the tank) shall be the sole responsibility and expense of Owner. Preparation of the tank for use after repair shall be the sole responsibility and expense of the Owner.



Disclaimers

EXCEPT FOR THE LIMITED WARRANTY SET FORTH ABOVE, THERE ARE NO UNDERSTANDINGS, AGREEMENTS, REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, RESPECTING THE TECSTORE BRAND LIQUID STORAGE TANK. CST STORAGE EXPRESSLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

The CST Storage Authorized Dealers are independent contractors and are not agents or employees of CST Storage. No statement by any CST Storage Authorized Dealer or any CST Storage employee shall constitute an understanding, agreement, representation or warranty by CST Storage. CST Storage makes no warranty with respect to goods manufactured by others, even if sold by a CST Storage Authorized Dealer.

This Limited Warranty and related limitations and disclaimers cannot be modified or amended by a CST Storage Authorized Dealer, and can be modified or amended only by written documents signed by an authorized CST Storage employee.

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CST PWS00200-000 Rev. 0 02/01 TMS

CST STORAGE

345 Horvath Drive
Dekalb, Illinois 60115-6607 U.S.A.
815-786-1551 Phone, 815-758-7821 Fax

JACK LOAD ANALYSIS

EMP No.: 8123113

Model: 36 52

Course Being Lifted	08 Jack System Wind Velocity	08 Jack System Wind Velocity	Model 18 Jack System Wind Velocity
1	30	30	30
2	30	30	30
3	30	30	30
4	30	30	30
5	30	30	30
6	30	30	30
7	30	30	30
8	30	30	30
9	30	30	30
10	30	30	30

The values listed above indicate the maximum wind velocities (MPH) at which the designated structure course may be lifted.

CONDITIONS:

- > Tank is ground supported.
- > Wind speed is determined at 33 feet above the tank floor.
- > A jack is positioned at each vertical seam.

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JACK LOAD ANALYSIS

NIP No.: 8123113

Model: 35 52

Course Being Lifted	06 Jack System Wind Velocity	06 Jack System Wind Velocity	Model 16 Jack System Wind Velocity
1	30	30	30
2	30	30	30
3	30	30	30
4	30	30	30
5	30	30	30
6	30	30	30
7	30	30	30
8	30	30	30
9	30	30	30
10	30	30	30

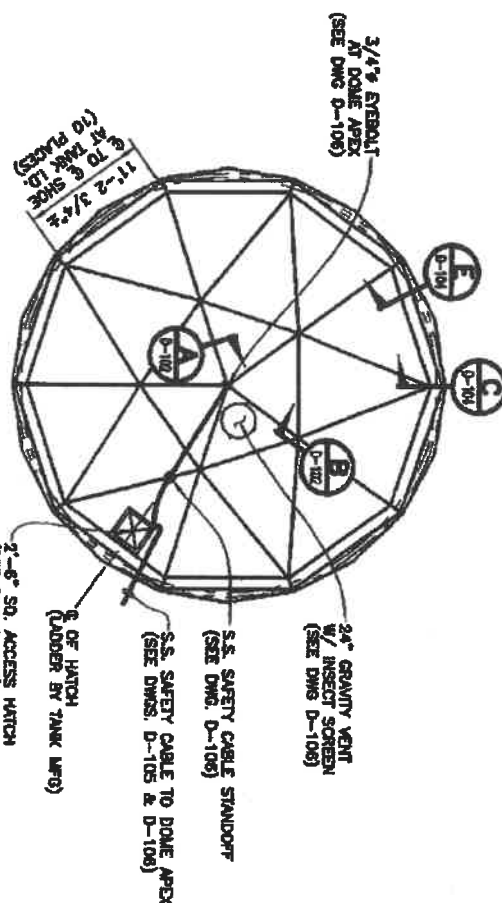
The values listed above indicate the maximum wind velocities (MPH) at which the designated structure course may be lifted.

CONDITIONS:

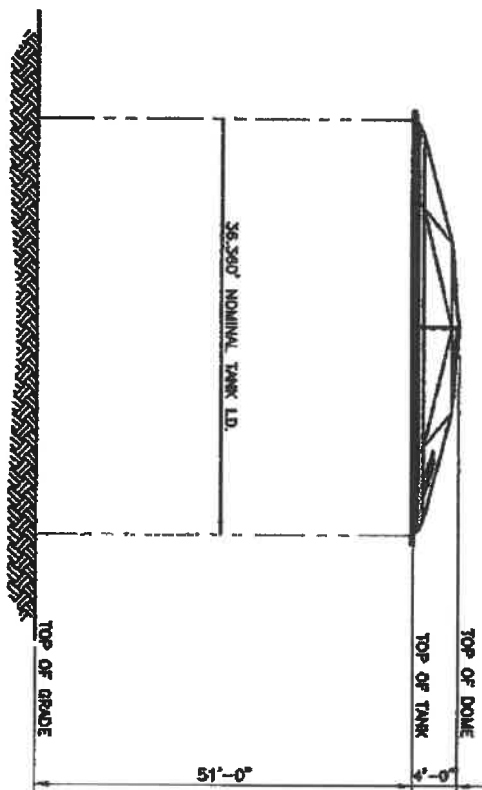
- > Tank is ground supported.
- > Wind speed is determined at 33 feet above the tank floor.
- > A jack is positioned at alternate vertical seams.
- > A strut is positioned at each vertical seam.

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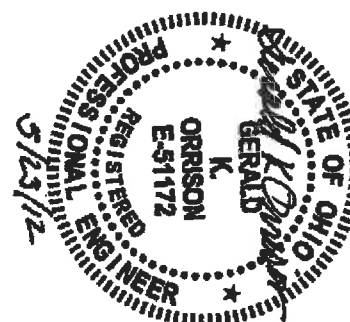
CST
STORAGE



ELEVATION



DESIGN LOADS
(AWMA D-103 08 & ASCE7-05)
SNOW LOAD: 25 PSF
WIND SPEED: 100 MPH



MAY 23 2012

FOR APPROVAL

DWG. TITLE

DOME PLAN AND ELEVATION

PROJECT DESCRIPTION

(1) DOME FOR 36'± I.D. AQUASTORE TANK
OBERLIN, OH

JOB NO.

212119

DRAWING NO.

D-101

REVISION

0

CUST. CONTR. NO.

120436

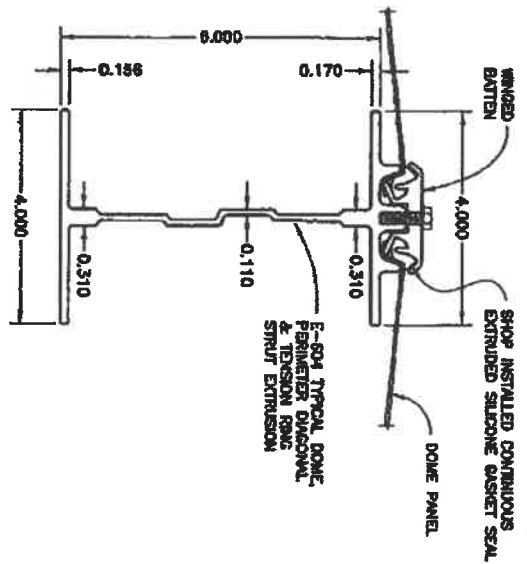
CST THERMOP
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GARDENA, CA CONTROL TX

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APPLICATION, AND MAY NOT BE
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PERMISSION FROM CST COVERS

0	05/23/12	MAA	GKO	FOR APPROVAL
REV.	DATE:	DRN BY	CHKD BY	DESCRIPTION

CUSTOMER

GATEWAY TANK, INC.



TYPICAL DOME STRUT A

NOTES:

1. ALL MATERIAL EXCEPT AS OTHERWISE NOTED IS MILL FINISH ALUMINUM AS FOLLOWS:
STRUTS, GUSSETS AND PLATES: 6061-T6
PANELS, FLASHING, AND GUSSET COVERS: 3003-H16
BATTENS: 6061-T6 OR 6063-T6

2. MATERIAL SIZE:

STRUT	AS NOTED
TYPICAL TOP GUSSET	3/8" x 1 1/4" DIA.
TYPICAL BOTTOM GUSSET	3/8" x 1 1/4" DIA.
SHOE TOP GUSSET	3/8" x 1 1/4" DIA.
SHOE BOTTOM GUSSET	3/8" x 1 1/4" DIA.
PANEL AND FLASHING	0.05" THICK

3. FASTENERS:

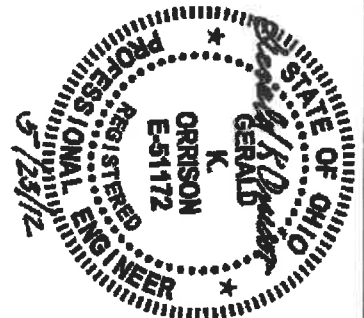
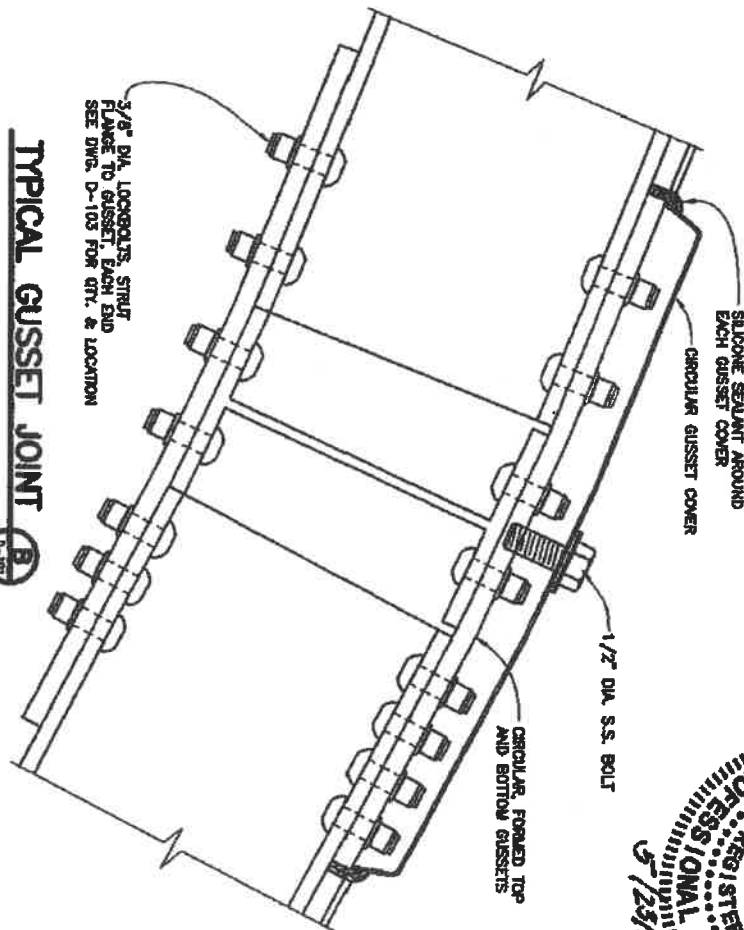
LOCKBOLTS - ALUMINUM (7075-T73) OR S.S. (300 SERIES)
AS NOTED (AL LOCKBOLTS CLEAR ANODIZED 20A)
LOCKBOLT COLLARS - ALUMINUM (6061 HEAT TREATED)
GUSSET COVER BOLTS - S.S. (300 SERIES)
BATTEN SCREWS - #14 DIA. S.S. (302)

4. SEALANT

1. PEDORA SILICONE SEALANT MEETING FEDERAL SPEC
TI-S-001543A AND TI-S-00230C.
2. ALL DIMENSIONS SHOWN ARE NOMINAL AND IN INCHES,
UNLESS NOTED OTHERWISE.

3/8" DIA. LOCKBOLTS, STRUT
FLANGE TO GUSSET, EACH END
SEE DWG. D-103 FOR DET. & LOCATION

TYPICAL GUSSET JOINT B



MAY 23 2012

FOR APPROVAL

DWG. TITLE
TYPICAL STRUT & GUSSET JOINT DETAIL

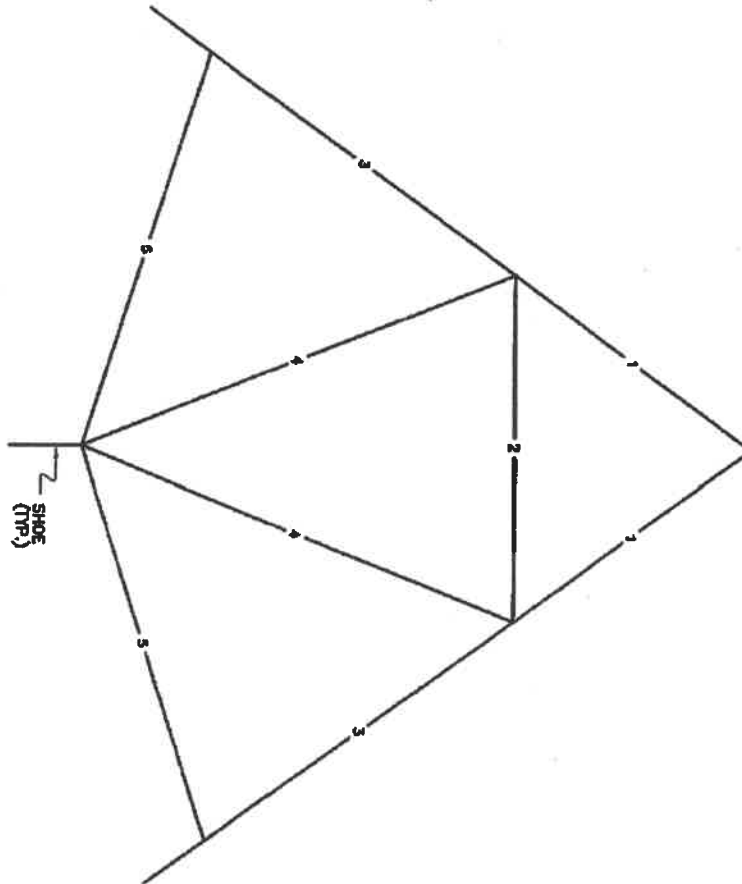
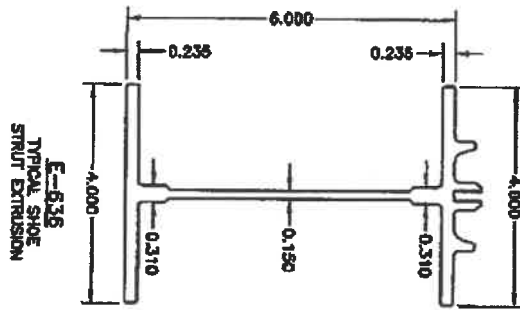
PROJECT DESCRIPTION
(1) DOME FOR 36'± I.D. AQUASTORE TANK
OBERLIN, OH

JOB NO.	DRAWING NO.	REVISION	CUST. CONTR. NO.
212119	D-102	0	120436

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CARPENTERS, CA
CONROE, TX
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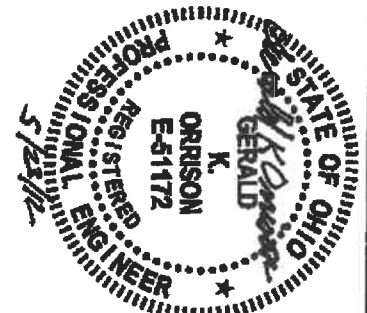
REV.	DATE	BY	CHKD BY	DESCRIPTION
0	05/23/12	MAA	GKO	FOR APPROVAL

CUSTOMER
GATEWAY TANK, INC.



DOMESTIC SECTOR PLAN
M.T.A.

STRUT		LOCKBOLT COUNT	
NO.	TYPE	TOP	BOTTOM
1	E-604	4 AL	4 AL
2	E-604	6 AL	6 AL
3	E-604	8 AL	6 AL
4	E-604	6 AL	8 AL
5	E-604	6 AL	4 AL
Shoe	E-636	4 SS	4 SS



MAY 23 2012

FOR APPROVAL

DWG. TITLE
DOMESTIC SECTOR PLAN & STRUT DETAILS

PROJECT DESCRIPTION
**(1) DOME FOR 36'± I.D. AQUASTORE TANK
OBERLIN, OH**

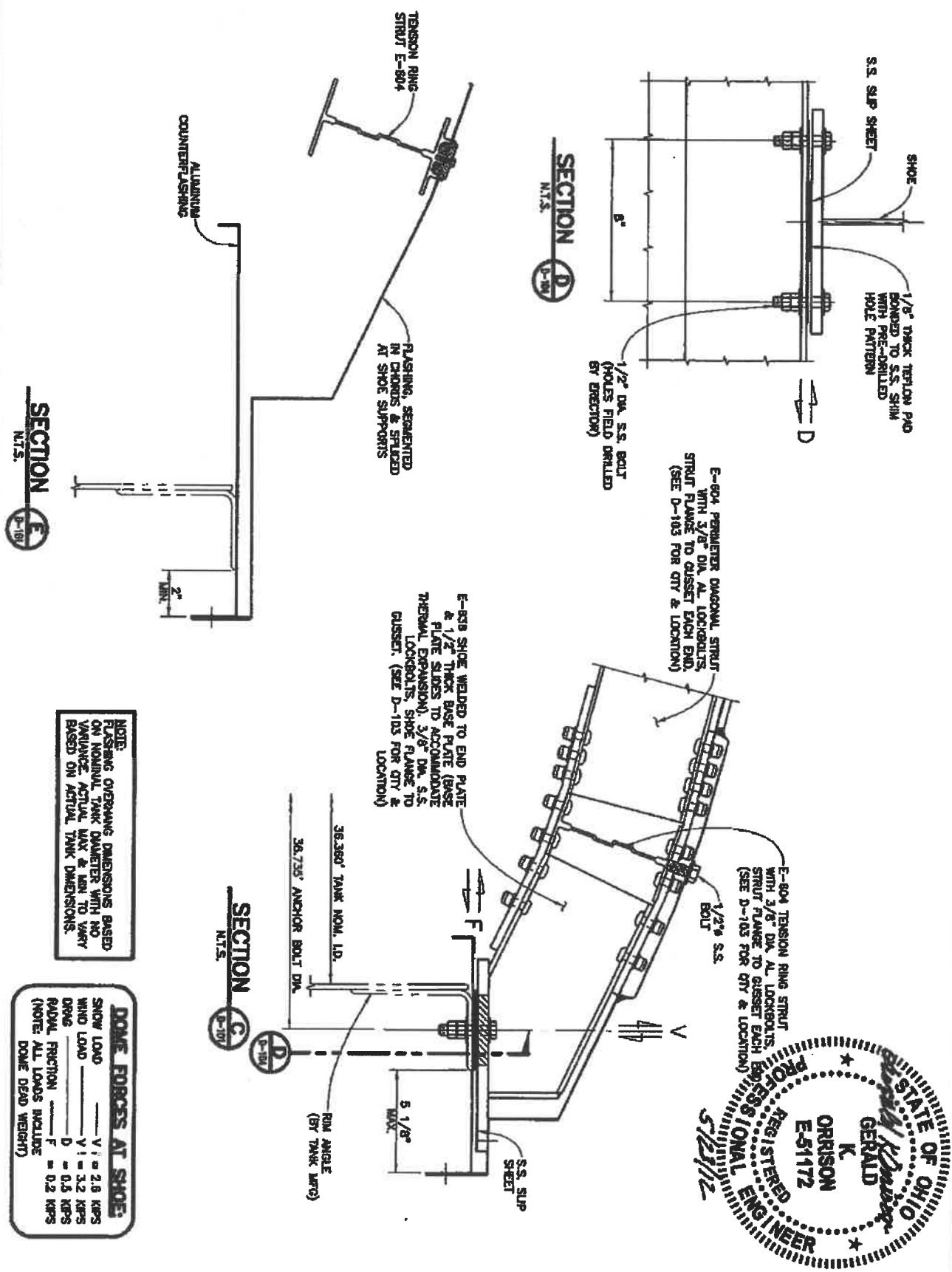
JOB NO. 212119	DRAWING NO. D-103	REVISION 0	CUST. CONTR. NO. 120436
--------------------------	-----------------------------	----------------------	-----------------------------------

CST TENCOR
COVERS CONSERVATION
GARDENA, CA CONROF, TX
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PERMISSION FROM CST TENCOR

0	05/23/12	MAA	GKO	FOR APPROVAL
REV.	DATE	DRAWN BY	CHECK BY	DESCRIPTION

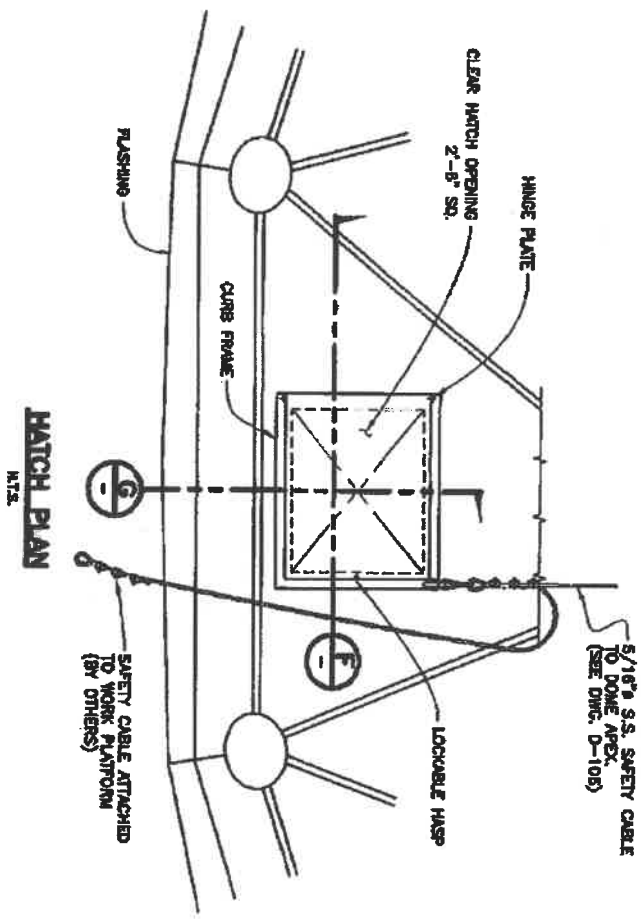
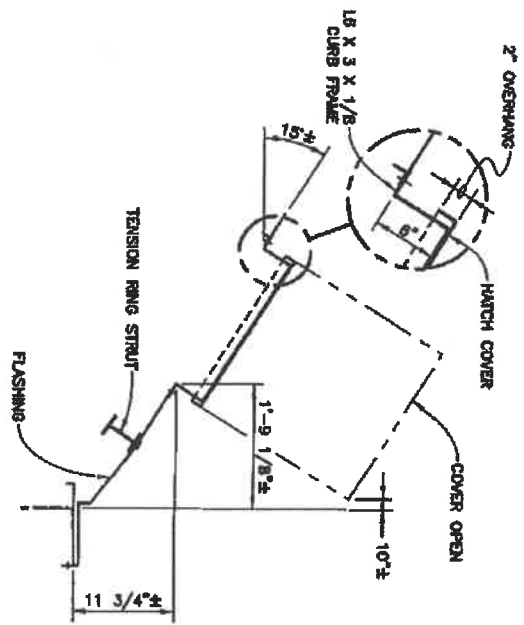
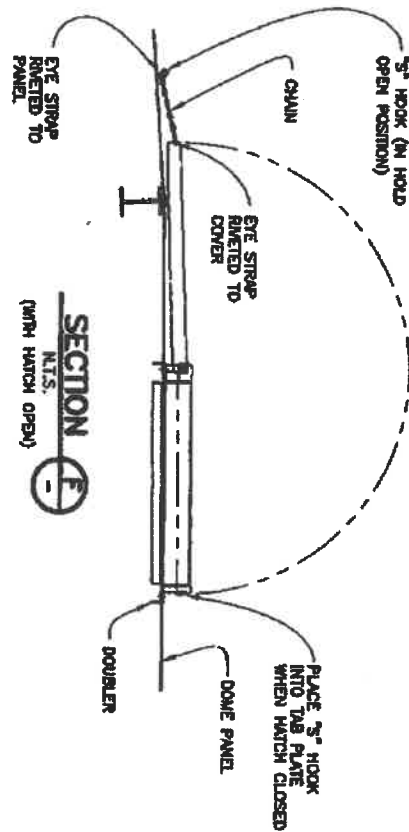
CUSTOMER

GATEWAY TANK, INC.



MAY 23 2012 FOR APPROVAL

DWG. TITLE SHOE, TENSION RING & FLASHING				CST TENCOR COVERS CONCRETE GARDENA, CA COMBIE, TX ALL DESIGNS, DETAILS, PROCESES OR DEVELOPMENTS ORIGINATED OR DISCLOSED BY CST COVERS ARE PROPRIETARY, PATENTED OR THE SUBJECT MATTER FOR WHICH APPLICATION, AND MAY NOT BE REPRODUCED WITHOUT WRITTEN PERMISSION FROM CST COVERS				
PROJECT DESCRIPTION (1) DOME FOR 36'± I.D. AQUASTORE TANK OBERLIN, OH								
JOB NO. 212119	DRAWING NO. D-104	REVISION 0	CUST. CONTR. NO. 120436	0	05/23/12	MMA	GKO	FOR APPROVAL
				REV.	DATE:	DRAWN BY	CHKD BY	DESCRIPTION
				CUSTOMER GATEWAY TANK, INC.				



NOTE:
HATCH FRAME AND COVER ARE
ALL ALUMINUM CONSTRUCTION.

MAY 23 2012

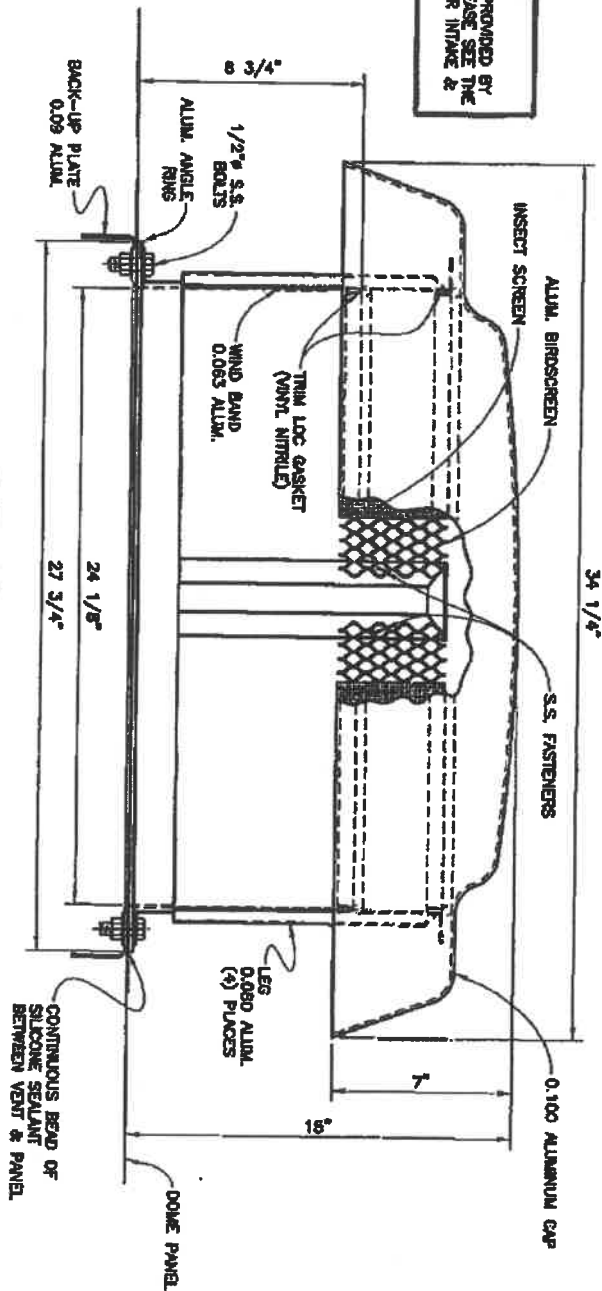
FOR APPROVAL

DWC. TITLE ACCESS HATCH DETAIL			
PROJECT DESCRIPTION (1) DOME FOR 36'± I.D. AQUASTORE TANK OBERLIN, OH			
JOB NO. 212119	DRAWING NO. D-105	REVISION 0	CUST. CONTR. NO. 120436

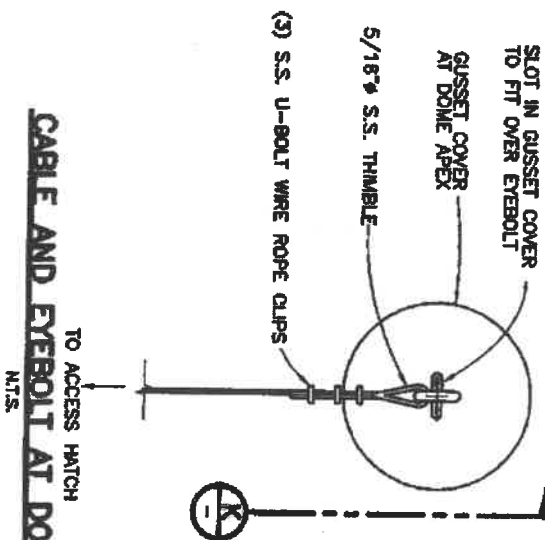
CST TENCOR
COVERS CORPORATION
CAROLINA, CA CONROE, TX
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APPLICATION, AND MAY NOT BE
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0	05/23/12	MAA	GKO	FOR APPROVAL
REV.	DATE:	DRAWN BY	CHECK BY	DESCRIPTION
CUSTOMER GATEWAY TANK, INC.				

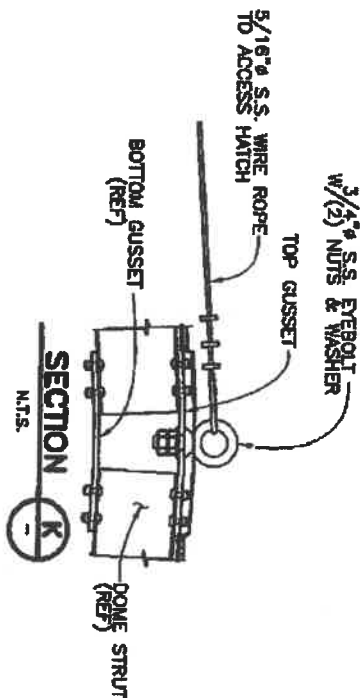
NOTE:
VENT PERFORMANCE DATA IS PROVIDED BY THE VENT MANUFACTURER. PLEASE SEE THE KOWEPCO VENT CUT SHEET FOR INTAKE & RELIEF CAPACITIES.



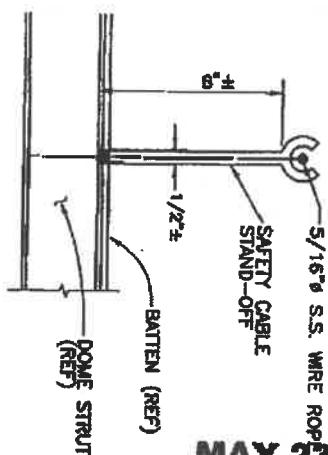
24" VENTILATOR (KOWEPCO CORP. VENT)



CABLE AND EYEBOLT AT DOME APEX N.T.S.



SAFETY CABLE STANDOFF N.T.S.



NOTE:
EYEBOLT FOR DOME ACCESS
MAINTENANCE ONLY BY QUALIFIED
PERSONNEL. EYEBOLT RATED FOR
CATASTROPHIC FAILURE - MUST
BE INSPECTED OR REPLACED AFTER
FALL OR OTHER SHOCK LOADING.
REMOVE ANY TEMPORARY SAFETY
LINE IMMEDIATELY AFTER USE.

MAY 23 2012

FOR APPROVAL

OWN, TITLE
24" VENT, SAFETY LINE & APEX EYEBOLT

PROJECT DESCRIPTION
(1) DOME FOR 36'± I.D. AQUASTORE TANK
OBERLIN, OH

JOB NO.	DRAWING NO.	REVISION	CUST CONTR. NO.
212119	D-106	0	120436

CST TENSION COVERS
CARROLL, CA CONROCK, TX
ALL DESIGNS, PATENTS, OR DEVELOPMENTS ORIGINATED OR DISCLOSED BY CST COVERS ARE PROPRIETARY, PATENTED OR THE SUBJECT MATTER FOR PATENT APPLICATION AND MAY NOT BE REPRODUCED WITHOUT WRITTEN PERMISSION FROM CST COVERS.

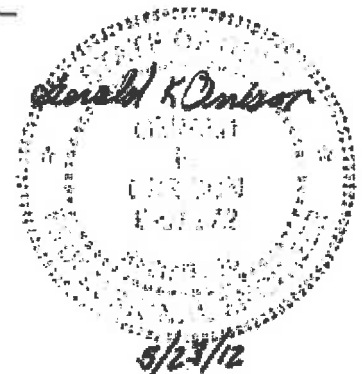
REV.	DATE	MAA	GKO	FOR APPROVAL
0	05/23/12	MAA	GKO	FOR APPROVAL
CUSTOMER				DESCRIPTION
GATEWAY TANK, INC.				

**STRUCTURAL ANALYSIS AND
DESIGN SUMMARY
CST COVERS ALUMINUM DOME FOR
(1) 36' (36.36') DIAMETER
AQUASTORE WASTE WATER STORAGE TANK
OBERLIN, OH
(CST COVERS JOB No. 212119)
FOR APPROVAL**

MAY 23 2012

ENGR MAA CHCKD GKO DATE MAY 23, 2012

PAGES 1 THROUGH 37



NOTATION

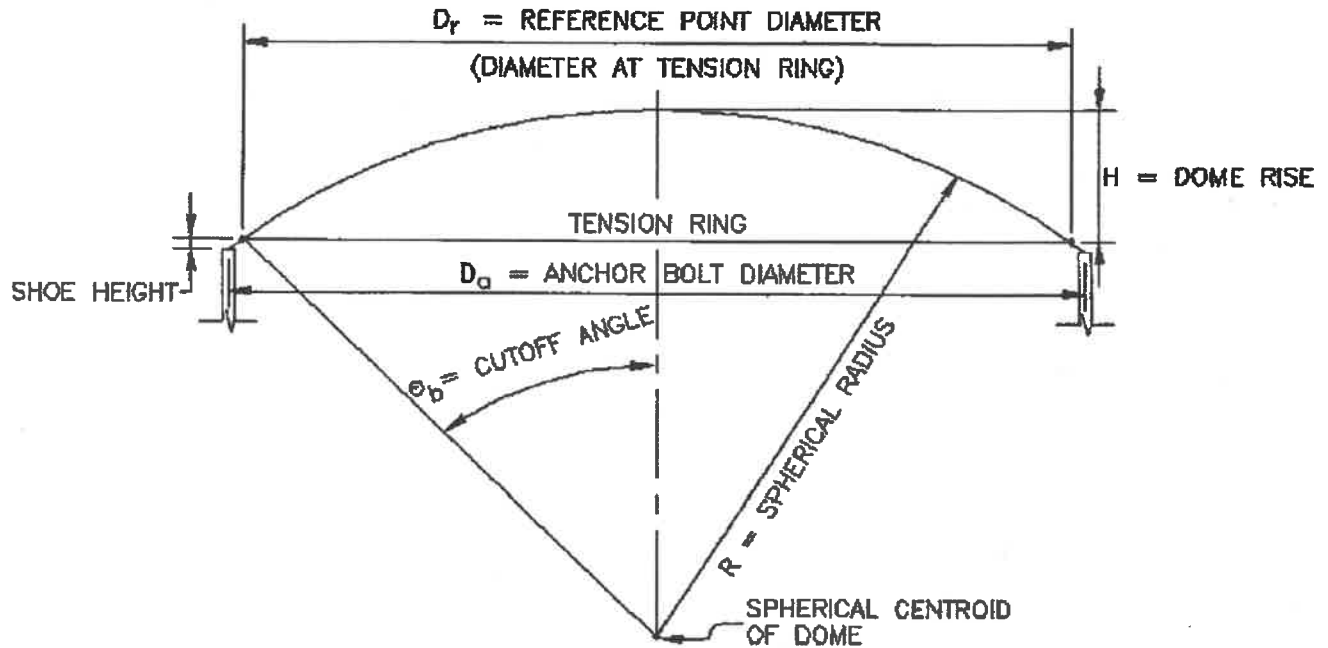
f	=	Maximum member stress.
F	=	Member allowable stress.
F-X, F-Y, F-Z	=	Reaction forces acting in the indicated direction, in the global or local coordinate system.
C-s	=	Roof slope factor.
P-s	=	Sloped roof snow load.
P-f	=	Flat roof snow load.
K-z	=	Velocity pressure exposure coefficient.
Q-z	=	Velocity pressure.
G-h	=	Gust response factor.
Y-BAR	=	Distance from the bottom flange to the neutral axis
Rv	=	Maximum vertical (downward) reaction at the shoe.
Rd	=	Maximum lateral reaction at the shoe.
Rl	=	Maximum vertical (upward) reaction at the shoe.

ANALYSIS PROCEDURE

This structure was analyzed on CST Covers' proprietary dome analysis program using the stiffness method of analysis. The dome struts are modeled using three dimensional beam elements which consider torsion, bending about two axes, axial and shear deformation. Panel loads are transformed into triangular beam loads equal to the load times one third the adjacent panel area normal to the load. These beam loads are then transformed into components parallel and perpendicular to the plane of the beam web. Member dead load is applied as a uniform beam load along the length of the member using the strut area times the density of the specified material times a factor which accounts for the batten. Panel dead load is treated as another panel load. In addition to the beam loads, loads may be applied to the nodes if required. The program will handle multiple load combinations with each combination composed of multiple load types.

The maximum member stresses have been calculated from individual member equilibrium equations using the member end forces obtained from the stiffness analysis procedure and the applied beam loads. Each beam is divided into 20 increments and forces and corresponding stress are calculated for each increment. Member allowable stresses are also calculated at each increment and compared to the computed stresses. Allowable stresses are computed in accordance with the formulas specified by the "Specifications for Aluminum Structures - Allowable Stress Design" (Sixth Edition, October 1994) as published by the Aluminum Association, Inc., Washington, D.C..

All the dome frame struts, tension ring and gussets are aluminum alloy 6061-T6 unless otherwise noted. All fasteners are either aluminum or stainless steel as specified.

JOB NO.: 212119**DESIGN PARAMETER**

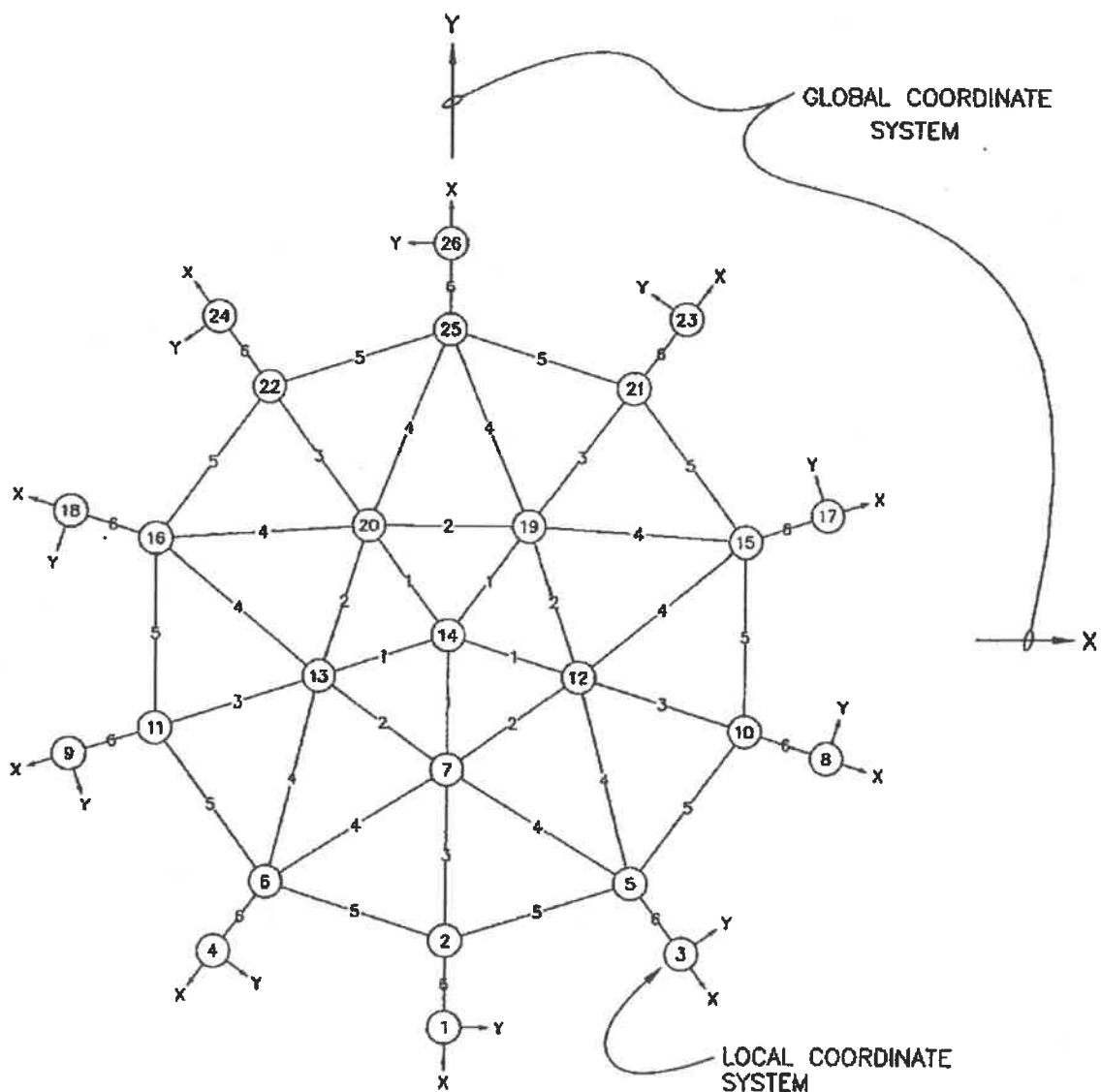
REF. POINT DIAMETER	:	35.39 feet	(D_r)
ANCHOR BOLT DIAMETER	:	36.74 feet	(D_a)
DOME RISE	:	3.12 feet	(H)
CUTOFF ANGLE	:	20.00 degrees	(θ_b)
SPHERICAL RADIUS	:	51.73 feet	(R)
NUMBER OF DOME SHOES	:	10	

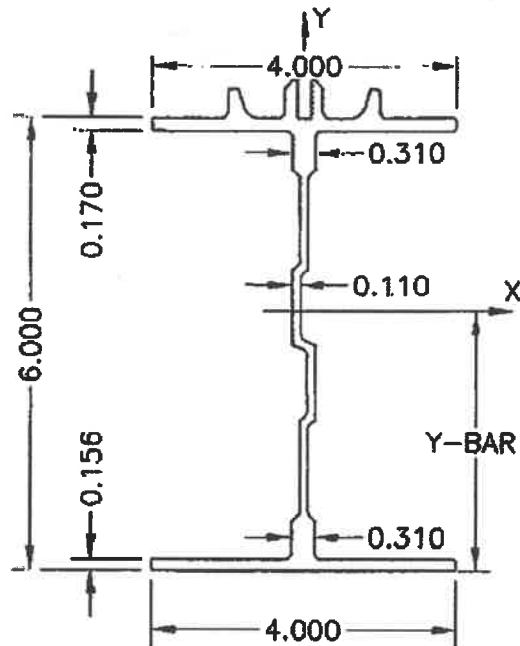
DESIGN LOADS

DESIGN CODE	:	AWWA D103-09 & ASCE7-05
DEAD LOAD	:	2.072 PSF
SNOW LOAD	:	25.0 PSF
WIND VELOCITY	:	100.0 MPH

In addition to the applied loads listed above, seismic effects have also been considered in the structural analysis. The degree to which seismic effects have an impact upon a structure's design depends most significantly on the structure's density. Due to the low mass to volume ratio of the aluminum dome, seismic effects do not control the dome design, nor the base shear reactions. Rather, applied wind loading on the large surface area on the dome results in the largest horizontal shear reactions. Therefore, wind load cases are presented in these Design Calculations. Other applied load cases and load combinations have been considered in the design; however, only the controlling load combinations are included in the following Design Calculations.

10-C5-088M GEOMETRY



**EXTRUSION SECTION PROPERTIES**

E-604 : DOME STRUT #1
PERIM DIAG #3
TENS STRUT #5

DOME STRUT #2
PERIM DIAG #4

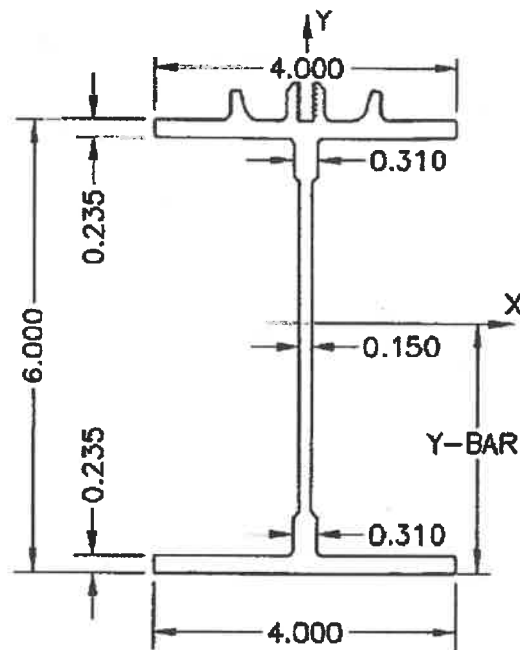
1. GEOMETRIC PROPERTIES

CROSS SECTIONAL AREA = 2.490 in²
Y-BAR = 3.456 in
DEPTH = 6.000 in
TOP FLANGE DIMENSIONS = 0.170 X 4.000 (in)
BOT FLANGE DIMENSIONS = 0.156 X 4.000 (in)
WEB DIMENSIONS = 5.674 X 0.110 (in)

2. ELASTIC PROPERTIES

TORSIONAL MOMENT OF INERTIA = 0.014 in⁴
Y AXIS MOMENT OF INERTIA = 1.871 in⁴
X AXIS MOMENT OF INERTIA = 16.896 in⁴

JOB NO.: 212119



EXTRUSION SECTION PROPERTIES

E-636 : SHOE STRUT #6

1. GEOMETRIC PROPERTIES

CROSS SECTIONAL AREA	=	3.193 in ²
Y-BAR	=	3.308 in
DEPTH	=	6.000 in
TOP FLANGE DIMENSIONS	=	0.235 X 4.000 (in)
BOT FLANGE DIMENSIONS	=	0.235 X 4.000 (in)
WEB DIMENSIONS	=	5.530 X 0.150 (in)

2. ELASTIC PROPERTIES

TORSIONAL MOMENT OF INERTIA	=	0.041 in ⁴
Y AXIS MOMENT OF INERTIA	=	2.637 in ⁴
X AXIS MOMENT OF INERTIA	=	21.686 in ⁴

FASTENER INFORMATION

	FASTENER TYPE	NOMINAL SIZE	BODY DIAMETER	TENSION (kips)	SHEAR (kips)
STANDARD BOLTS AND NUTS	300 series CW stainless steel (100 ksi minimum F_u)	3/8 - 16	0.375	3.31	2.83
	($F_t = 42.7$ ksi)	1/2 - 13	0.50	6.06	5.03
	($F_v = 25.6$ ksi)	5/8 - 11	0.625	9.65	7.85
	(85 ksi minimum F_u)	3/4 - 10	0.75	12.12	9.63
	($F_t = 36.3$ ksi)	7/8 - 9	0.875	16.77	13.11
	($F_v = 21.8$ ksi)	1 - 8	1.000	22.00	17.12
LOCK BOLTS	305 stainless steel (C6LBHS-U12/3LC-F12)	3/8	0.382	3.00	4.00
	316 stainless steel (C6LB316-U12/3LC-F12)	3/8	0.382	2.10	3.00
	7075-T73 aluminum (C6LB-E12/3LC-F12)	3/8	0.382	1.80	2.00
SPECIAL FASTENER	DRIVE RIVETS Aluminum body - 5056 Pin - 2117	3/8	0.370	0.60	1.00
	MAGNA-TITE Aluminum body - 5056 Pin - 2024	3/16	0.199	0.45	0.63
WEDGE ANCHORS		DIA $\times$ L	EMBEDMENT	PULL OUT	SHEAR
	300 series stainless steel	1/4 $\times$ 2.25	1.5	0.47	0.47
	Note:	3/8 $\times$ 3.75	3	1.33	0.92
	Allowable loads assume no	1/2 $\times$ 5.5	4	2.04	1.67
	reductions required due to	5/8 $\times$ 8.5	6	3.22	2.69
	edge distance or anchor	3/4 $\times$ 10	8	4.92	3.97
	Spacing	1 $\times$ 12	9	7.55	7.42

NOTES:

1. Shear strengths are based on the threads outside of the shear plane
2. Lockbolt values are based on the manufacturers guaranteed minimum values.
3. Wedge anchors are based on the manufacturers test data for 3000 psi concrete.
4. Safety factors are:
 - = 2.34 for bolt tension
 - = 2.34 for bolt shear
 - = 4.00 for wedge anchor pullout
 - = 4.00 for wedge anchor shear

BY: MAA DATE: 16-MAY-12 PROJECT: OBERLIN OH

CSTCovers
ISO 9001 Certified

JOB NO.: 212119

<2804>

BASIC LOAD CASE NO. 1
DEAD LOAD

	X DIRECTION	Y DIRECTION	Z DIRECTION
FRACTION OF GRAVITY	0.000	0.000	-1.310
PANEL DEAD LOAD	0.000	0.000	-0.730 (psf)
FULL DOME LIVE LOAD	0.000	0.000	0.000 (psf)
HALF DOME LIVE LOAD	0.000	0.000	0.000 (psf)
GROUND SNOW LOAD - TOTAL DOME		=	0.000 (psf)
GROUND SNOW LOAD - DRIFT		=	0.000 (psf)
WIND LOAD - DYNAMIC PRESSURE		=	0.000 (psf)
INTERNAL PRESSURE LOAD		=	0.000 (psf)
TEMPERATURE CHANGE - TOP FLANGE		=	0.000 (Deg. F.)
TEMPERATURE CHANGE - BTM FLANGE		=	0.000 (Deg. F.)
ALLOWABLE STRESS FACTOR	1.000		

BY: MAA DATE: 16-MAY-12 PROJECT: OSHERLIN, OH

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JOB NO.: 212119

BASIC LOAD CASE NO. 2

DEAD + 25 PSF SNOW

PER AWWA D103-09

	X	Y	Z
	DIRECTION	DIRECTION	DIRECTION
FRACTION OF GRAVITY	0.000	0.000	-1.310
PANEL DEAD LOAD	0.000	0.000	-0.730 (psf)
FULL DOME LIVE LOAD	0.000	0.000	0.000 (psf)
HALF DOME LIVE LOAD	0.000	0.000	0.000 (psf)
GROUND SNOW LOAD - TOTAL DOME		=	25.000 (psf)
GROUND SNOW LOAD - DRIFT		=	0.000 (psf)
WIND LOAD - DYNAMIC PRESSURE		=	0.000 (psf)
INTERNAL PRESSURE LOAD		=	0.000 (psf)
TEMPERATURE CHANGE - TOP FLANGE		=	0.000 (Deg. F.)
TEMPERATURE CHANGE - BTM FLANGE		=	0.000 (Deg. F.)

ALLOWABLE STRESS FACTOR 1.000

(AWWA D103-09 SNOW LOAD)

BY: MAA DATE: 16-MAY-12 PROJECT: OBERLIN OH

CSTCovers
ISO 9001 Certified

JOB NO.: 212119

<2804>

BASIC LOAD CASE NO. 3

DEAD + SNOW

25 PSF PER ASCE7-05

	X	Y	Z
	DIRECTION	DIRECTION	DIRECTION
FRACTION OF GRAVITY	0.000	0.000	-1.310
PANEL DEAD LOAD	0.000	0.000	-0.730 (psf)
FULL DOME LIVE LOAD	0.000	0.000	0.000 (psf)
HALF DOME LIVE LOAD	0.000	0.000	0.000 (psf)
GROUND SNOW LOAD - TOTAL DOME		=	25.000 (psf)
GROUND SNOW LOAD - DRIFT		=	0.000 (psf)
WIND LOAD - DYNAMIC PRESSURE		=	0.000 (psf)
INTERNAL PRESSURE LOAD		=	0.000 (psf)
TEMPERATURE CHANGE - TOP FLANGE		=	0.000 (Deg. F.)
TEMPERATURE CHANGE - BTM FLANGE		=	0.000 (Deg. F.)

ALLOWABLE STRESS FACTOR 1.000

SNOW LOAD FACTORS: (ASCE7-05)

IMPORTANCE FACTOR: 1.100

EXPOSURE FACTOR: 1.000

THERMAL FACTOR: 1.200

P-f : 23.100 (psf)

Ps @ 15.0 degrees: 23.100 (psf)

Ps @ eave : 21.000 (psf)

(COLD ROOF, NON-OBSTRUCTED SLIPPERY SURFACE)

Cs_15.0: 1.000

Cs_eave: 0.909

BY: MAA DATE: 16-MAY-12 PROJECT: OBBERLIN, OH

CSTCovers
ISO 9001 Certified

JOB NO.: 212119

<2804>

BASIC LOAD CASE NO. 4

DEAD + SNOW DRIFT
25 PSF PER ASCE7-05

	X	Y	Z
	DIRECTION	DIRECTION	DIRECTION
FRACTION OF GRAVITY	0.000	0.000	-1.310
PANEL DEAD LOAD	0.000	0.000	-0.730 (psf)
FULL DOME LIVE LOAD	0.000	0.000	0.000 (psf)
HALF DOME LIVE LOAD	0.000	0.000	0.000 (psf)
GROUND SNOW LOAD - TOTAL DOME			= 0.000 (psf)
GROUND SNOW LOAD - DRIFT CENTERED @ 90.0 DEG			= 25.000 (psf)
WIND LOAD - DYNAMIC PRESSURE			= 0.000 (psf)
INTERNAL PRESSURE LOAD			= 0.000 (psf)
TEMPERATURE CHANGE - TOP FLANGE			= 0.000 (Deg. F.)
TEMPERATURE CHANGE - BTM FLANGE			= 0.000 (Deg. F.)

ALLOWABLE STRESS FACTOR 1.000

DRIFT LOAD FACTORS: (ASCE7-05)

IMPORTANCE FACTOR:	1.100	
EXPOSURE FACTOR:	1.000	
THERMAL FACTOR:	1.200	
P-f :	23.100 (psf)	
Ps @ 0.0 degrees:	11.550 (psf)	Cs_0.0 : 1.000
Ps @ eave :	33.600 (psf)	Cs_eave: 0.909
MAX. DRIFT LOAD:	33.600 psf at 20.000 degrees	
(COLD ROOF, NON-OBSTRUCTED SLIPPERY SURFACE)		

BY: MAA DATE: 16-MAY-12 PROJECT: OBERLIN, OH

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ISO 9001 Certified

<2804>

JOB NO.: 212119

BASIC LOAD CASE NO. 5

DEAD + 18.694 PSF WIND PRESSURE
PER AWWA D103-09

	X DIRECTION	Y DIRECTION	Z DIRECTION
FRACTION OF GRAVITY	0.000	0.000	-1.310
PANEL DEAD LOAD	0.000	0.000	-0.730 (psf)
FULL DOME LIVE LOAD	0.000	0.000	0.000 (psf)
HALF DOME LIVE LOAD @ 90.0 DEG	0.000	-18.694	0.000 (psf)
GROUND SNOW LOAD - TOTAL DOME		=	0.000 (psf)
GROUND SNOW LOAD - DRIFT		=	0.000 (psf)
WIND LOAD - DYNAMIC PRESSURE		=	0.000 (psf)
INTERNAL PRESSURE LOAD		=	0.000 (psf)
TEMPERATURE CHANGE - TOP FLANGE		=	0.000 (Deg. F.)
TEMPERATURE CHANGE - BTM FLANGE		=	0.000 (Deg. F.)

ALLOWABLE STRESS FACTOR 1.000

BY: MAA DATE: 16-MAY-12 PROJECT: OBERLIN, OH

CSTCovers
ISO 9001 Certified

JOB NO.: 212119

<2804>

BASIC LOAD CASE NO. 6
DEAD + WIND VELOCITY
100 MPH PER ASCE 7-05, CASE A

	X DIRECTION	Y DIRECTION	Z DIRECTION	
FRACTION OF GRAVITY	0.000	0.000	-1.310	
PANEL DEAD LOAD	0.000	0.000	-0.730	(psf)
FULL DOME LIVE LOAD	0.000	0.000	0.000	(psf)
HALF DOME LIVE LOAD	0.000	0.000	0.000	(psf)
GROUND SNOW LOAD - TOTAL DOME			=	0.000 (psf)
GROUND SNOW LOAD - DRIFT			=	0.000 (psf)
WIND LOAD - DYNAMIC PRESSURE FROM 270.0 DEG			=	26.439 (psf)
INTERNAL PRESSURE LOAD			=	0.000 (psf)
TEMPERATURE CHANGE - TOP FLANGE			=	0.000 (Deg. F.)
TEMPERATURE CHANGE - BTM FLANGE			=	0.000 (Deg. F.)

ALLOWABLE STRESS FACTOR 1.000

WIND LOAD FACTORS: (ASCE7-05, CASE A)
(INPUT)

VELOCITY	:	100.000	(mph)
IMPORTANCE FACTOR	:	1.150	
EXPOSURE CATEGORY C			
CURB HEIGHT	:	51.000	(feet)
TANK HEIGHT	:	51.000	(feet)
TOPOGRAPHIC FACTOR Kzt	:	1.000	
DIRECTIONALITY FACTOR Kd	:	0.950	

(CALCULATED)

DOME RISE-TO-SPAN RATIO	:	0.088	
APEX ROOF HEIGHT	:	54.120	(feet)
TANK HEIGHT / DIAMETER RATIO	:	1.441	
POWER LAW CONSTANT ALPHA	:	9.500	
GRADIENT HEIGHT Z-g	:	900.000	(feet)
K-z	:	1.112	
Q-z	:	31.105	(psf)
GUST RESPONSE FACTOR G-h	:	0.850	(Maximum)
GUST RESPONSE FACTOR G-h	:	0.879	(Eq. 6-2)
TURBULENCE INTENSITY I-z	:	0.201	(Eq. 6-3)
BACKGROUND RESPONSE Q	:	0.908	(Eq. 6-4)
BUILDING LENGTH B	:	35.385	(feet)
LENGTH SCALE OF TURBULENCE L-z	:	498.389	(feet) (Eq. 6-5)
INTEGRAL LENGTH SCALE FACTOR l	:	500.000	(feet)
INTEGRAL LENGTH SCALE POWER EXP.	:	1/5.0	
EQUIVALENT STRUCTURE HT. Z_bar	:	32.472	(feet)
MINIMUM HEIGHT Z_min	:	15.000	(feet)
CONSTANT A (Figure 6-7)	:	-1.62898	
CONSTANT B (Figure 6-7)	:	-0.72898	
CONSTANT C (Figure 6-7)	:	-0.50000	
THETA-25	:	6.608	Degrees

JOB NO.: 212119**BASIC LOAD CASE NO. 7**

DEAD + WIND VELOCITY

100 MPH PER ASCE 7-05, CASE B

	X	Y	Z
	DIRECTION	DIRECTION	DIRECTION
FRACTION OF GRAVITY	0.000	0.000	-1.310
PANEL DEAD LOAD	0.000	0.000	-0.730 (psf)
FULL DOME LIVE LOAD	0.000	0.000	0.000 (psf)
HALF DOME LIVE LOAD	0.000	0.000	0.000 (psf)
GROUND SNOW LOAD - TOTAL DOME			= 0.000 (psf)
GROUND SNOW LOAD - DRIFT			= 0.000 (psf)
WIND LOAD - DYNAMIC PRESSURE FROM 270.0 DEG			= 26.439 (psf)
INTERNAL PRESSURE LOAD			= 0.000 (psf)
TEMPERATURE CHANGE - TOP FLANGE			= 0.000 (Deg. F.)
TEMPERATURE CHANGE - BTM FLANGE			= 0.000 (Deg. F.)

ALLOWABLE STRESS FACTOR 1.000

WIND LOAD FACTORS: (ASCE7-05, CASE B)
(INPUT)

VELOCITY	:	100.000	(mph)
IMPORTANCE FACTOR	:	1.150	
EXPOSURE CATEGORY C			
CURB HEIGHT	:	51.000	(feet)
TANK HEIGHT	:	51.000	(feet)
TOPOGRAPHIC FACTOR Kzt	:	1.000	
DIRECTIONALITY FACTOR Kd	:	0.950	
(CALCULATED)			
DOME RISE-TO-SPAN RATIO	:	0.088	
APEX ROOF HEIGHT	:	54.120	(feet)
TANK HEIGHT / DIAMETER RATIO	:	1.441	
POWER LAW CONSTANT ALPHA	:	9.500	
GRADIENT HEIGHT Z-g	:	900.000	(feet)
K-z	:	1.112	
Q-z	:	31.105	(psf)
GUST RESPONSE FACTOR G-h	:	0.850	(Maximum)
GUST RESPONSE FACTOR G-h	:	0.879	(Eq. 6-2)
TURBULENCE INTENSITY I-z	:	0.201	(Eq. 6-3)
BACKGROUND RESPONSE Q	:	0.908	(Eq. 6-4)
BUILDING LENGTH B	:	35.385	(feet)
LENGTH SCALE OF TURBULENCE L-z	:	498.389	(feet) (Eq. 6-5)
INTEGRAL LENGTH SCALE FACTOR l	:	500.000	(feet)
INTEGRAL LENGTH SCALE POWER EXP.	:	1/5.0	
EQUIVALENT STRUCTURE HT. Z_bar	:	32.472	(feet)
MINIMUM HEIGHT Z_min	:	15.000	(feet)
CONSTANT A (Figure 6-7)	:	-1.62898	
CONSTANT B (Figure 6-7)	:	-0.72898	
CONSTANT C (Figure 6-7)	:	-0.50000	
THETA-25	:	6.608	Degrees

BY: MAA DATE: 16-MAY-12 PROJECT: OSBERLIN, OH

CSTCovers
ISO 9001 Certified

JOB NO.: 212119

<2804>

R E A C T I O N S U M M A R Y

BASIC LOAD CASE No 1

DEAD LOAD

MAXIMUM AND MINIMUM REACTIONS:

<u>RADIAL</u> <u>(kips)</u>	<u>TANGENTIAL</u> <u>(kips)</u>	<u>VERTICAL</u> <u>(kips)</u>	<u>DIRECTION</u>
0.0	0.0	0.2	x-max
0.0	0.0	0.2	x-min
0.0	0.0	0.2	y-max
0.0	0.0	0.2	y-min
0.0	0.0	0.2	z-max
0.0	0.0	0.2	z-min

TOTAL MODEL REACTIONS:

<u>GLOBAL-X</u> <u>(kips)</u>	<u>GLOBAL-Y</u> <u>(kips)</u>	<u>GLOBAL-Z</u> <u>(kips)</u>
0.0	0.0	2.2

BY: MAA DATE: 16-MAY-12 PROJECT: OBERLIN, OH

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ISO 9001 Certified

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JOB NO.: 212119

R E A C T I O N S U M M A R Y

BASIC LOAD CASE No 2

DEAD + 25 PSF SNOW

PER AWWA D103-09

MAXIMUM AND MINIMUM REACTIONS:

<u>RADIAL</u> <u>(kips)</u>	<u>TANGENTIAL</u> <u>(kips)</u>	<u>VERTICAL</u> <u>(kips)</u>	<u>DIRECTION</u>
0.0	0.0	2.5	x-max
0.0	0.0	2.6	x-min
0.0	0.0	2.6	y-max
0.0	0.0	2.6	y-min
0.0	0.0	2.6	z-max
0.0	0.0	2.5	z-min

TOTAL MODEL REACTIONS:

<u>GLOBAL-X</u> <u>(kips)</u>	<u>GLOBAL-Y</u> <u>(kips)</u>	<u>GLOBAL-Z</u> <u>(kips)</u>
0.0	0.0	25.2

BY: MRA DATE: 16-MAY-12 PROJECT: OBERLIN OH

CSTCovers
ISO 9001 Certified

JOB NO.: 212119

<2804>

R E A C T I O N S U M M A R Y

BASIC LOAD CASE No 3

DEAD + SNOW

25 PSF PER ASCE7-05

MAXIMUM AND MINIMUM REACTIONS:

<u>RADIAL</u> <u>(kips)</u>	<u>TANGENTIAL</u> <u>(kips)</u>	<u>VERTICAL</u> <u>(kips)</u>	<u>DIRECTION</u>
0.0	0.0	2.3	x-max
0.0	0.0	2.4	x-min
0.0	0.0	2.4	y-max
0.0	0.0	2.4	y-min
0.0	0.0	2.4	z-max
0.0	0.0	2.3	z-min

TOTAL MODEL REACTIONS:

<u>GLOBAL-X</u> <u>(kips)</u>	<u>GLOBAL-Y</u> <u>(kips)</u>	<u>GLOBAL-Z</u> <u>(kips)</u>
0.0	0.0	23.3

BY: MAA DATE: 16-MAY-12 PROJECT: OBBERLIN, OH

CSTCovers
ISO 9001 Certified

JOB NO.: 212119

<2804>

R E A C T I O N S U M M A R Y

BASIC LOAD CASE No 4

DEAD + SNOW DRIFT

25 PSF PER ASCE7-05

MAXIMUM AND MINIMUM REACTIONS:

<u>RADIAL</u> <u>(kips)</u>	<u>TANGENTIAL</u> <u>(kips)</u>	<u>VERTICAL</u> <u>(kips)</u>	<u>DIRECTION</u>
0.0	0.0	0.3	x-max
0.0	0.0	2.0	x-min
0.0	0.5	1.0	y-max
0.0	-0.5	1.0	y-min
0.0	0.0	2.0	z-max
0.0	0.0	0.3	z-min

TOTAL MODEL REACTIONS:

<u>GLOBAL-X</u> <u>(kips)</u>	<u>GLOBAL-Y</u> <u>(kips)</u>	<u>GLOBAL-Z</u> <u>(kips)</u>
0.0	0.0	9.1

BY: MAA DATE: 16-MAY-12 PROJECT: OBERLIN, OH

CSTCovers
ISO 9001 Certified

JOB NO.: 212119

<2804>

R E A C T I O N S U M M A R Y

BASIC LOAD CASE No 5
DEAD + 18.694 PSF WIND PRESSURE
PER AWWA D103-09

MAXIMUM AND MINIMUM REACTIONS:

<u>RADIAL</u> <u>(kips)</u>	<u>TANGENTIAL</u> <u>(kips)</u>	<u>VERTICAL</u> <u>(kips)</u>	<u>DIRECTION</u>
0.0	0.0	0.2	x-max
0.0	0.0	0.2	x-min
0.0	0.3	0.2	y-max
0.0	-0.3	0.2	y-min
0.0	0.1	0.3	z-max
0.0	-0.1	0.2	z-min

TOTAL MODEL REACTIONS:

<u>GLOBAL-X</u> <u>(kips)</u>	<u>GLOBAL-Y</u> <u>(kips)</u>	<u>GLOBAL-Z</u> <u>(kips)</u>
0.0	1.2	2.2

BY: MAA DATE: 16-MAY-12 PROJECT: OBERLIN, OH
 JOB NO.: 212119 <2804>

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REACTION SUMMARY

BASIC LOAD CASE No 6
 DEAD + WIND VELOCITY
 100 MPH PER ASCE 7-05, CASE A

MAXIMUM AND MINIMUM REACTIONS:

<u>RADIAL</u> <u>(kips)</u>	<u>TANGENTIAL</u> <u>(kips)</u>	<u>VERTICAL</u> <u>(kips)</u>	<u>DIRECTION</u>
0.0	0.0	-2.8	x-max
0.0	0.0	-1.4	x-min
0.0	0.4	-2.2	y-max
0.0	-0.4	-2.2	y-min
0.0	0.1	-1.4	z-max
0.0	-0.2	-3.0	z-min

TOTAL MODEL REACTIONS:

<u>GLOBAL-X</u> <u>(kips)</u>	<u>GLOBAL-Y</u> <u>(kips)</u>	<u>GLOBAL-Z</u> <u>(kips)</u>
0.0	1.6	-21.0

BY: MAA DATE: 16-MAY-12 PROJECT: OBERLIN, OH

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JOB NO.: 212119

<2804>

R E A C T I O N S U M M A R Y

BASIC LOAD CASE No 7
DEAD + WIND VELOCITY
100 MPH PER ASCE 7-05, CASE B

MAXIMUM AND MINIMUM REACTIONS:

<u>RADIAL</u> <u>(kips)</u>	<u>TANGENTIAL</u> <u>(kips)</u>	<u>VERTICAL</u> <u>(kips)</u>	<u>DIRECTION</u>
0.0	0.0	-3.0	x-max
0.0	0.0	-1.5	x-min
0.0	0.4	-2.5	y-max
0.0	-0.4	-2.5	y-min
0.0	0.1	-1.5	z-max
0.0	-0.2	-3.2	z-min

TOTAL MODEL REACTIONS:

<u>GLOBAL-X</u> <u>(kips)</u>	<u>GLOBAL-Y</u> <u>(kips)</u>	<u>GLOBAL-Z</u> <u>(kips)</u>
0.0	1.9	-22.6

JOB NO.: 212119

S T R E S S S U M M A R YBASIC LOAD CASE No: 1
DEAD LOAD

CONTROLLING MEMBER STRESSES (ksi) AND FORCES (kips, in-kips)							
EXTRUSION	TYPE	AXIAL	BENDING				COMBINED STRESS RATIO
			(+) MOMENT		(-) MOMENT		
			COMP	TENS	COMP	TENS	
E-604	(Struts	1 through	1)				
	FORCE	0.58	1.03	1.03	-0.04	-0.04	0.03
	STRSS	0.23	0.21	-0.15	0.01	-0.01	
	ALLOW	17.03	16.41	19.49	21.21	19.49	
	f/F	0.01	0.01	0.01	0.00	0.00	
E-604	(Struts	2 through	2)				
	FORCE	0.78	1.28	1.28	-0.29	-0.29	0.04
	STRSS	0.31	0.26	-0.19	0.04	-0.06	
	ALLOW	16.49	16.41	19.49	21.21	19.49	
	f/F	0.02	0.02	0.01	0.00	0.00	
E-604	(Struts	3 through	3)				
	FORCE	1.00	0.47	0.47	-3.33	-3.33	0.05
	STRSS	0.40	0.10	-0.07	0.50	-0.68	
	ALLOW	14.27	16.41	19.49	21.21	19.49	
	f/F	0.03	0.01	0.00	0.02	0.03	
E-604	(Struts	4 through	4)				
	FORCE	0.54	1.33	1.33	-2.68	-2.68	0.03
	STRSS	0.22	0.27	-0.20	0.40	-0.55	
	ALLOW	12.94	16.41	19.49	21.21	19.49	
	f/F	0.02	0.02	0.01	0.02	0.03	
E-604	(Struts	5 through	5)				
	FORCE	-0.74	0.00	0.00	-1.66	-1.66	0.04
	STRSS	-0.30	0.00	0.00	0.25	-0.34	
	ALLOW	19.49	0.00	0.00	21.21	19.49	
	f/F	0.02	0.00	0.00	0.01	0.02	
E-636	(Struts	6 through	6)				
	FORCE	0.13	0.00	0.00	-1.31	-1.31	0.01
	STRSS	0.04	0.00	0.00	0.16	-0.20	
	ALLOW	17.04	0.00	0.00	21.21	19.49	
	f/F	0.00	0.00	0.00	0.01	0.01	

BY: MAA DATE: 16-MAY-12 PROJECT: OBERLIN, OH

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JOB NO.: 212119

<2804>

S T R E S S S U M M A R Y

BASIC LOAD CASE No: 2
DEAD + 25 PSF SNOW
PER AWWA D103-09

CONTROLLING MEMBER STRESSES(ksi) AND FORCES(kips, in-kips)							
EXTRUSION	TYPE	AXIAL	BENDING				COMBINED STRESS RATIO
			(+) MOMENT		(-) MOMENT		
			COMP	TENS	COMP	TENS	
E-604	(Struts	1 through	1)				
	FORCE	6.65	12.98	12.98	-0.83	-0.83	0.32
	STRSS	2.67	2.65	-1.95	0.12	-0.17	
	ALLOW	17.03	16.41	19.49	21.21	19.49	
	f/F	0.16	0.16	0.10	0.01	0.01	
E-604	(Struts	2 through	2)				
	FORCE	9.24	16.10	16.10	-4.31	-4.31	0.44
	STRSS	3.71	3.29	-2.42	0.65	-0.88	
	ALLOW	16.49	16.41	19.49	21.21	19.49	
	f/F	0.23	0.20	0.12	0.03	0.05	
E-604	(Struts	3 through	3)				
	FORCE	11.65	5.90	5.90	-40.88	-40.88	0.63
	STRSS	4.68	1.21	-0.89	6.16	-8.36	
	ALLOW	14.27	16.41	19.49	21.21	19.49	
	f/F	0.33	0.07	0.05	0.29	0.43	
E-604	(Struts	4 through	4)				
	FORCE	6.32	16.47	16.47	-33.24	-33.24	0.44
	STRSS	2.54	3.37	-2.48	5.01	-6.80	
	ALLOW	12.94	16.41	19.49	21.21	19.49	
	f/F	0.20	0.21	0.13	0.24	0.35	
E-604	(Struts	5 through	5)				
	FORCE	-9.52	0.00	0.00	-19.27	-19.27	0.45
	STRSS	-3.82	0.00	0.00	2.90	-3.94	
	ALLOW	19.49	0.00	0.00	21.21	19.49	
	f/F	0.20	0.00	0.00	0.14	0.20	
E-636	(Struts	6 through	6)				
	FORCE	1.54	0.00	0.00	-14.96	-14.96	0.12
	STRSS	0.48	0.00	0.00	1.86	-2.28	
	ALLOW	17.04	0.00	0.00	21.21	19.49	
	f/F	0.03	0.00	0.00	0.09	0.12	

JOB NO.: 212118**S T R E S S S U M M A R Y**

BASIC LOAD CASE No: 3

DEAD + SNOW

25 PSF PER ASCE7-05

CONTROLLING MEMBER STRESSES(ksi) AND FORCES(kips, in-kips)							
EXTRUSION	TYPE	AXIAL	BENDING				COMBINED STRESS RATIO
			(+) MOMENT		(-) MOMENT		
			COMP	TENS	COMP	TENS	
E-604	(Struts	1 through	1)				
	FORCE	6.24	12.12	12.12	-0.80	-0.80	0.30
	STRSS	2.51	2.48	-1.82	0.12	-0.16	
	ALLOW	17.03	16.41	19.49	21.21	19.49	
	f/F	0.15	0.15	0.09	0.01	0.01	
E-604	(Struts	2 through	2)				
	FORCE	8.64	15.07	15.07	-4.07	-4.07	0.42
	STRSS	3.47	3.08	-2.27	0.61	-0.83	
	ALLOW	16.49	16.41	19.49	21.21	19.49	
	f/F	0.21	0.19	0.12	0.03	0.04	
E-604	(Struts	3 through	3)				
	FORCE	10.88	5.54	5.54	-38.05	-38.05	0.59
	STRSS	4.37	1.13	-0.83	5.73	-7.78	
	ALLOW	14.27	16.41	19.49	21.21	19.49	
	f/F	0.31	0.07	0.04	0.27	0.40	
E-604	(Struts	4 through	4)				
	FORCE	5.91	15.42	15.42	-30.97	-30.97	0.41
	STRSS	2.37	3.15	-2.32	4.66	-6.34	
	ALLOW	12.94	16.41	19.49	21.21	19.49	
	f/F	0.18	0.19	0.12	0.22	0.33	
E-604	(Struts	5 through	5)				
	FORCE	-8.80	0.00	0.00	-17.95	-17.95	0.42
	STRSS	-3.54	0.00	0.00	2.70	-3.67	
	ALLOW	19.49	0.00	0.00	21.21	19.49	
	f/F	0.18	0.00	0.00	0.13	0.19	
E-636	(Struts	6 through	6)				
	FORCE	1.43	0.00	0.00	-13.86	-13.86	0.11
	STRSS	0.45	0.00	0.00	1.72	-2.11	
	ALLOW	17.04	0.00	0.00	21.21	19.49	
	f/F	0.03	0.00	0.00	0.08	0.11	

BY: MAA DATE: 16-MAY-12 PROJECT: OBERLIN, OH

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ISO 9001 Certified

JOB NO.: 212119

<2804>

S T R E S S S U M M A R Y

BASIC LOAD CASE No: 4

DEAD + SNOW DRIFT

25 PSF PER ASCE7-05

CONTROLLING MEMBER STRESSES (ksi) AND FORCES (kips, in-kips)							
EXTRUSION	TYPE	AXIAL	BENDING				COMBINED STRESS RATIO
			(+) MOMENT		(-) MOMENT		
			COMP	TENS	COMP	TENS	
E-604	(Struts	1 through	1)				
	FORCE	2.34	6.76	6.76	0.00	0.00	0.20
	STRSS	0.94	1.38	-1.02	0.00	0.00	
	ALLOW	17.03	16.41	19.49	0.00	0.00	
	f/F	0.06	0.08	0.05	0.00	0.00	
E-604	(Struts	2 through	2)				
	FORCE	9.67	7.22	7.22	-11.17	-11.17	0.37
	STRSS	3.88	1.48	-1.09	1.68	-2.29	
	ALLOW	16.49	16.41	19.49	21.21	19.49	
	f/F	0.24	0.09	0.06	0.08	0.12	
E-604	(Struts	3 through	3)				
	FORCE	7.84	5.72	5.72	-37.74	-37.74	0.50
	STRSS	3.15	1.17	-0.86	5.68	-7.72	
	ALLOW	14.27	16.41	19.49	21.21	19.49	
	f/F	0.22	0.07	0.04	0.27	0.40	
E-604	(Struts	4 through	4)				
	FORCE	6.10	8.88	8.88	-11.80	-11.80	0.44
	STRSS	2.45	1.82	-1.34	1.78	-2.41	
	ALLOW	12.94	16.41	19.49	21.21	19.49	
	f/F	0.19	0.11	0.07	0.08	0.12	
E-604	(Struts	5 through	5)				
	FORCE	-3.30	0.00	0.00	-19.27	-19.27	0.33
	STRSS	-1.32	0.00	0.00	2.90	-3.94	
	ALLOW	19.49	0.00	0.00	21.21	19.49	
	f/F	0.07	0.00	0.00	0.14	0.20	
E-636	(Struts	6 through	6)				
	FORCE	0.58	0.00	0.00	-5.64	-5.64	0.14
	STRSS	0.18	0.00	0.00	0.70	-0.86	
	ALLOW	17.04	0.00	0.00	21.21	19.49	
	f/F	0.01	0.00	0.00	0.03	0.04	

BY: MAA DATE: 16-MAY-12 PROJECT: OBERLIN, OH

CSTCovers
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<2804>

JOB NO.: 212119

S T R E S S S U M M A R Y

BASIC LOAD CASE No: 5
DEAD + 18.694 PSF WIND PRESSURE
PER AWWA D103-09

CONTROLLING MEMBER STRESSES(ksi) AND FORCES(kips, in-kips)							
EXTRUSION	TYPE	AXIAL	BENDING				COMBINED STRESS RATIO
			(+) MOMENT		(-) MOMENT		
			COMP	TENS	COMP	TENS	
E-604	(Struts	1 through	1)				
	FORCE	0.75	1.40	1.40	0.00	0.00	0.04
	STRSS	0.30	0.29	-0.21	0.00	0.00	
	ALLOW	17.03	16.41	19.49	0.00	0.00	
	f/F	0.02	0.02	0.01	0.00	0.00	
E-604	(Struts	2 through	2)				
	FORCE	1.03	2.31	2.31	0.00	0.00	0.06
	STRSS	0.42	0.47	-0.35	0.00	0.00	
	ALLOW	16.49	16.41	19.49	0.00	0.00	
	f/F	0.03	0.03	0.02	0.00	0.00	
E-604	(Struts	3 through	3)				
	FORCE	1.26	0.72	0.72	-4.55	-4.55	0.06
	STRSS	0.50	0.15	-0.11	0.69	-0.93	
	ALLOW	14.27	16.41	19.49	21.21	19.49	
	f/F	0.04	0.01	0.01	0.03	0.05	
E-604	(Struts	4 through	4)				
	FORCE	0.82	1.88	1.88	-4.17	-4.17	0.05
	STRSS	0.33	0.38	-0.28	0.63	-0.85	
	ALLOW	12.94	16.41	19.49	21.21	19.49	
	f/F	0.03	0.02	0.01	0.03	0.04	
E-604	(Struts	5 through	5)				
	FORCE	-0.29	0.27	0.27	-2.47	-2.47	0.04
	STRSS	-0.12	0.06	-0.04	0.37	-0.51	
	ALLOW	19.49	16.41	19.49	21.21	19.49	
	f/F	0.01	0.00	0.00	0.02	0.03	
E-636	(Struts	6 through	6)				
	FORCE	0.12	0.00	0.00	-1.19	-1.19	0.06
	STRSS	0.04	0.00	0.00	0.15	-0.18	
	ALLOW	17.04	0.00	0.00	21.21	19.49	
	f/F	0.00	0.00	0.00	0.01	0.01	

JOB NO.: 212119

<2804>

S T R E S S S U M M A R Y

BASIC LOAD CASE No: 6
DEAD + WIND VELOCITY
100 MPH PER ASCE 7-05, CASE A

CONTROLLING MEMBER STRESSES (ksi) AND FORCES (kips, in-kips)							
EXTRUSION	TYPE	AXIAL	BENDING				COMBINED STRESS RATIO
			(+) MOMENT		(-) MOMENT		
			COMP	TENS	COMP	TENS	
E-604	(Struts 1 through 1)						
	FORCE	-0.77	2.75	2.75	-1.86	-1.86	0.06
	STRSS	-0.31	0.56	-0.41	0.28	-0.38	
	ALLOW	19.49	16.41	19.49	21.21	19.49	
	f/F	0.02	0.03	0.02	0.01	0.02	
E-604	(Struts 2 through 2)						
	FORCE	-2.91	3.55	3.55	-0.59	-0.59	0.11
	STRSS	-1.17	0.73	-0.54	0.09	-0.12	
	ALLOW	19.49	16.41	19.49	21.21	19.49	
	f/F	0.06	0.04	0.03	0.00	0.01	
E-604	(Struts 3 through 3)						
	FORCE	-0.21	19.21	19.21	0.00	0.00	0.24
	STRSS	-0.09	3.93	-2.89	0.00	0.00	
	ALLOW	19.49	16.41	19.49	0.00	0.00	
	f/F	0.00	0.24	0.15	0.00	0.00	
E-604	(Struts 4 through 4)						
	FORCE	1.89	18.98	18.98	-2.69	-2.69	0.29
	STRSS	0.76	3.88	-2.86	0.40	-0.55	
	ALLOW	12.94	16.41	19.49	21.21	19.49	
	f/F	0.06	0.24	0.15	0.02	0.03	
E-604	(Struts 5 through 5)						
	FORCE	12.01	9.81	9.81	0.00	0.00	0.57
	STRSS	4.82	2.01	-1.48	0.00	0.00	
	ALLOW	15.76	16.41	19.49	0.00	0.00	
	f/F	0.31	0.12	0.08	0.00	0.00	
E-636	(Struts 6 through 6)						
	FORCE	-1.77	17.20	17.20	0.00	0.00	0.18
	STRSS	-0.55	2.62	-2.13	0.00	0.00	
	ALLOW	19.49	21.04	19.49	0.00	0.00	
	f/F	0.03	0.12	0.11	0.00	0.00	

JOB NO.: 212119

<2804>

S T R E S S S U M M A R Y

BASIC LOAD CASE No: 7
DEAD + WIND VELOCITY
100 MPH PER ASCE 7-05, CASE B

CONTROLLING MEMBER STRESSES(ksi) AND FORCES(kips, in-kips)							
EXTRUSION	TYPE	AXIAL	BENDING				COMBINED STRESS RATIO
			(+) MOMENT		(-) MOMENT		
			COMP	TENS	COMP	TENS	
E-604	(Struts	1 through	1)				
	FORCE	-1.00	2.63	2.63	-2.20	-2.20	0.07
	STRSS	-0.40	0.54	-0.40	0.33	-0.45	
	ALLOW	19.49	16.41	19.49	21.21	19.49	
	f/F	0.02	0.03	0.02	0.02	0.02	
E-604	(Struts	2 through	2)				
	FORCE	-3.34	4.36	4.36	-0.75	-0.75	0.12
	STRSS	-1.34	0.89	-0.66	0.11	-0.15	
	ALLOW	19.49	16.41	19.49	21.21	19.49	
	f/F	0.07	0.05	0.03	0.01	0.01	
E-604	(Struts	3 through	3)				
	FORCE	-0.62	20.82	20.82	0.00	0.00	0.26
	STRSS	-0.25	4.26	-3.13	0.00	0.00	
	ALLOW	19.49	16.41	19.49	0.00	0.00	
	f/F	0.01	0.26	0.16	0.00	0.00	
E-604	(Struts	4 through	4)				
	FORCE	2.06	21.70	21.70	-3.15	-3.15	0.33
	STRSS	0.83	4.44	-3.27	0.48	-0.65	
	ALLOW	12.94	16.41	19.49	21.21	19.49	
	f/F	0.06	0.27	0.17	0.02	0.03	
E-604	(Struts	5 through	5)				
	FORCE	12.95	10.60	10.60	0.00	0.00	0.60
	STRSS	5.20	2.17	-1.60	0.00	0.00	
	ALLOW	15.76	16.41	19.49	0.00	0.00	
	f/F	0.33	0.13	0.08	0.00	0.00	
E-636	(Struts	6 through	6)				
	FORCE	-1.93	18.80	18.80	0.00	0.00	0.20
	STRSS	-0.61	2.87	-2.33	0.00	0.00	
	ALLOW	19.49	21.04	19.49	0.00	0.00	
	f/F	0.03	0.14	0.12	0.00	0.00	

C O N S O L I D A T E D S T R E S S S U M M A R Y

CONTROLLING MEMBER STRESSES (ksi) AND FORCES (kips, in-kips)							
EXTRUSION	TYPE	AXIAL	BENDING				COMBINED STRESS RATIO
			(+) MOMENT		(-) MOMENT		
			COMP	TENS	COMP	TENS	
E-604	(Struts	1 through	1)				
	FORCE	6.65	12.98	12.98	-0.83	-0.83	0.32
	STRSS	2.67	2.65	-1.95	0.12	-0.17	
	ALLOW	17.03	16.41	19.49	21.21	19.49	
	f/F	0.16	0.16	0.10	0.01	0.01	
E-604	(Struts	2 through	2)				
	FORCE	9.24	16.10	16.10	-4.31	-4.31	0.44
	STRSS	3.71	3.29	-2.42	0.65	-0.88	
	ALLOW	16.49	16.41	19.49	21.21	19.49	
	f/F	0.23	0.20	0.12	0.03	0.05	
E-604	(Struts	3 through	3)				
	FORCE	11.65	5.90	5.90	-40.88	-40.88	0.63
	STRSS	4.68	1.21	-0.89	6.16	-8.36	
	ALLOW	14.27	16.41	19.49	21.21	19.49	
	f/F	0.33	0.07	0.05	0.29	0.43	
E-604	(Struts	4 through	4)				
	FORCE	6.10	8.88	8.88	-11.80	-11.80	0.44
	STRSS	2.45	1.82	-1.34	1.78	-2.41	
	ALLOW	12.94	16.41	19.49	21.21	19.49	
	f/F	0.19	0.11	0.07	0.08	0.12	
E-604	(Struts	5 through	5)				
	FORCE	12.95	10.60	10.60	0.00	0.00	0.60
	STRSS	5.20	2.17	-1.60	0.00	0.00	
	ALLOW	15.76	16.41	19.49	0.00	0.00	
	f/F	0.33	0.13	0.08	0.00	0.00	
E-636	(Struts	6 through	6)				
	FORCE	-1.93	18.80	18.80	0.00	0.00	0.20
	STRSS	-0.61	2.87	-2.33	0.00	0.00	
	ALLOW	19.49	21.04	19.49	0.00	0.00	
	f/F	0.03	0.14	0.12	0.00	0.00	

BY: MAA DATE: 16-MAY-12 PROJECT: OBERLIN OH

CSTCovers
ISO 9001 Certified

<2804>

JOB NO.: 212119

C O N N E C T I O N F O R C E S U M M A R Y

BASIC LOAD CASE No. 1
DEAD LOAD

MAXIMUM CONNECTION FORCES (kips) AND MOMENTS (in-k)					
EXTRUSION	TYPE	TOP FLANGE		BOTTOM FLANGE	
		COMP	TENS	COMP	TENS
E-604	(Struts 1 through 1)				
	AXIAL FORCE	0.58	--	0.57	--
	END MOMENT	0.75	--	1.03	--
	CNCTN FORCE	0.21	--	0.41	--
E-604	(Struts 2 through 2)				
	AXIAL FORCE	0.78	--	0.78	--
	END MOMENT	1.28	--	1.28	--
	CNCTN FORCE	0.24	--	0.55	--
E-604	(Struts 3 through 3)				
	AXIAL FORCE	1.00	--	0.98	--
	END MOMENT	-2.09	--	0.47	--
	CNCTN FORCE	0.92	--	0.50	--
E-604	(Struts 4 through 4)				
	AXIAL FORCE	0.54	--	0.53	--
	END MOMENT	-1.32	--	1.33	--
	CNCTN FORCE	0.53	--	0.44	--
E-604	(Struts 5 through 5)				
	AXIAL FORCE	--	-0.74	--	-0.74
	END MOMENT	--	-0.01	--	-0.23
	CNCTN FORCE	--	-0.42	--	-0.35
E-636	(Struts 6 through 6)				
	AXIAL FORCE	0.13	--	--	0.13
	END MOMENT	-1.31	--	--	-1.31
	CNCTN FORCE	0.29	--	--	-0.16

BY: MAA DATE: 16-MAY-12 PROJECT: OBERLIN, OH

CSTCovers
ISO 9001 Certified

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JOB NO.: 212119

C O N N E C T I O N F O R C E S U M M A R Y

BASIC LOAD CASE No. 2
DEAD + 25 PSF SNOW
PER AWWA D103-09

MAXIMUM CONNECTION FORCES (kips) AND MOMENTS (in-k)					
EXTRUSION	TYPE	TOP FLANGE		BOTTOM FLANGE	
		COMP	TENS	COMP	TENS
E-604	(Struts 1 through 1)				
	AXIAL FORCE	6.65	--	6.61	--
	END MOMENT	8.83	--	12.98	--
	CNCTN FORCE	2.36	--	4.97	--
E-604	(Struts 2 through 2)				
	AXIAL FORCE	9.24	--	9.24	--
	END MOMENT	16.10	--	16.10	--
	CNCTN FORCE	2.64	--	6.60	--
E-604	(Struts 3 through 3)				
	AXIAL FORCE	11.65	--	11.42	--
	END MOMENT	-23.17	--	5.90	--
	CNCTN FORCE	10.57	--	5.83	--
E-604	(Struts 4 through 4)				
	AXIAL FORCE	6.32	--	6.13	--
	END MOMENT	-14.41	--	16.47	--
	CNCTN FORCE	6.04	--	5.34	--
E-604	(Struts 5 through 5)				
	AXIAL FORCE	--	-9.52	--	-9.52
	END MOMENT	--	-1.70	--	-4.25
	CNCTN FORCE	--	-5.20	--	-4.74
E-636	(Struts 6 through 6)				
	AXIAL FORCE	1.54	--	--	1.54
	END MOMENT	-14.96	--	--	-14.96
	CNCTN FORCE	3.34	--	--	-1.80

JOB NO.: 212119C O N N E C T I O N F O R C E S U M M A R Y

BASIC LOAD CASE No. 3

DEAD + SNOW

25 PSF PER ASCE7-05

MAXIMUM CONNECTION FORCES (kips) AND MOMENTS (in-k)					
EXTRUSION	TYPE	TOP FLANGE		BOTTOM FLANGE	
		COMP	TENS	COMP	TENS
E-604	(Struts 1 through 1)				
	AXIAL FORCE	6.24	--	6.20	--
	END MOMENT	8.28	--	12.12	--
	CNCTN FORCE	2.21	--	4.65	--
E-604	(Struts 2 through 2)				
	AXIAL FORCE	8.64	--	8.64	--
	END MOMENT	15.07	--	15.07	--
	CNCTN FORCE	2.47	--	6.18	--
E-604	(Struts 3 through 3)				
	AXIAL FORCE	10.88	--	10.67	--
	END MOMENT	-21.52	--	5.54	--
	CNCTN FORCE	9.86	--	5.45	--
E-604	(Struts 4 through 4)				
	AXIAL FORCE	5.91	--	5.74	--
	END MOMENT	-13.37	--	15.42	--
	CNCTN FORCE	5.63	--	5.00	--
E-604	(Struts 5 through 5)				
	AXIAL FORCE	--	-8.80	--	-8.80
	END MOMENT	--	-1.56	--	-3.91
	CNCTN FORCE	--	-4.81	--	-4.39
E-636	(Struts 6 through 6)				
	AXIAL FORCE	1.42	--	--	1.42
	END MOMENT	-13.86	--	--	-13.86
	CNCTN FORCE	3.10	--	--	-1.67

JOB NO.: 212119

<2804>

C O N N E C T I O N F O R C E S U M M A R Y

BASIC LOAD CASE No. 4
DEAD + SNOW DRIFT
25 PSF PER ASCE7-05

MAXIMUM CONNECTION FORCES (kips) AND MOMENTS (in-k)					
EXTRUSION	TYPE	TOP		BOTTOM	
		FLANGE		FLANGE	
		COMP	TENS	COMP	TENS
E-604	(Struts 1 through 1)				
	AXIAL FORCE	2.31	2.31	2.31	--
	END MOMENT	1.20	10.09	10.09	--
	CNCTN FORCE	1.13	-0.35	2.66	--
E-604	(Struts 2 through 2)				
	AXIAL FORCE	9.67	-0.49	9.67	--
	END MOMENT	7.22	2.58	7.22	--
	CNCTN FORCE	4.36	-0.71	5.30	--
E-604	(Struts 3 through 3)				
	AXIAL FORCE	7.84	--	7.61	--
	END MOMENT	-17.61	--	5.72	--
	CNCTN FORCE	7.45	--	4.18	--
E-604	(Struts 4 through 4)				
	AXIAL FORCE	4.41	-1.92	6.01	-1.90
	END MOMENT	-12.30	3.00	8.88	-11.76
	CNCTN FORCE	4.59	-1.60	4.03	-2.77
E-604	(Struts 5 through 5)				
	AXIAL FORCE	--	-2.92	--	-3.70
	END MOMENT	--	3.86	--	-1.09
	CNCTN FORCE	--	-2.33	--	-1.75
E-636	(Struts 6 through 6)				
	AXIAL FORCE	1.18	--	--	1.18
	END MOMENT	-11.50	--	--	-11.50
	CNCTN FORCE	2.57	--	--	-1.39

BY: MAA DATE: 16-MAY-12 PROJECT: OBBRLTN, OH

CSTCovers
ISO 9001 Certified

JOB NO.: 212119

<2804>

C O N N E C T I O N F O R C E S U M M A R Y

BASIC LOAD CASE No. 5
DEAD + 18.694 PSF WIND PRESSURE
PER AWWA D103-09

MAXIMUM CONNECTION FORCES (kips) AND MOMENTS (in-k)					
EXTRUSION	TYPE	TOP FLANGE		BOTTOM FLANGE	
		COMP	TENS	COMP	TENS
E-604	(Struts 1 through 1)				
	AXIAL FORCE	0.75	--	0.75	--
	END MOMENT	0.72	--	1.40	--
	CNCTN FORCE	0.31	--	0.55	--
E-604	(Struts 2 through 2)				
	AXIAL FORCE	1.03	--	1.01	--
	END MOMENT	1.31	--	2.31	--
	CNCTN FORCE	0.38	--	0.81	--
E-604	(Struts 3 through 3)				
	AXIAL FORCE	1.11	--	1.26	--
	END MOMENT	-2.40	--	0.72	--
	CNCTN FORCE	1.04	--	0.65	--
E-604	(Struts 4 through 4)				
	AXIAL FORCE	0.68	0.33	0.82	0.34
	END MOMENT	-1.45	1.48	1.88	-1.47
	CNCTN FORCE	0.64	-0.05	0.66	-0.10
E-604	(Struts 5 through 5)				
	AXIAL FORCE	--	-0.86	--	-0.86
	END MOMENT	--	0.30	--	-0.61
	CNCTN FORCE	--	-0.54	--	-0.46
E-636	(Struts 6 through 6)				
	AXIAL FORCE	0.15	--	--	0.15
	END MOMENT	-1.44	--	--	-1.44
	CNCTN FORCE	0.32	--	--	-0.17

C O N N E C T I O N F O R C E S U M M A R Y

BASIC LOAD CASE No. 6
DEAD + WIND VELOCITY
100 MPH PER ASCE 7-05, CASE A

MAXIMUM CONNECTION FORCES (kips) AND MOMENTS (in-k)					
EXTRUSION	TYPE	TOP FLANGE		BOTTOM FLANGE	
		COMP	TENS	COMP	TENS
E-604	(Struts 1 through 1)				
	AXIAL FORCE	-0.72	-0.71	-0.71	-0.72
	END MOMENT	-3.77	4.75	4.75	-3.77
	CNCTN FORCE	0.22	-1.20	0.49	-0.93
E-604	(Struts 2 through 2)				
	AXIAL FORCE	1.44	-2.91	1.44	-2.91
	END MOMENT	0.91	0.14	0.91	-0.59
	CNCTN FORCE	0.68	-1.70	0.76	-1.33
E-604	(Struts 3 through 3)				
	AXIAL FORCE	--	-0.20	-0.20	-1.42
	END MOMENT	--	18.25	18.25	1.81
	CNCTN FORCE	--	-3.16	2.96	-0.30
E-604	(Struts 4 through 4)				
	AXIAL FORCE	1.87	-1.84	1.89	-3.34
	END MOMENT	-2.69	9.95	12.54	-1.83
	CNCTN FORCE	1.53	-2.72	2.89	-1.72
E-604	(Struts 5 through 5)				
	AXIAL FORCE	12.01	--	12.01	--
	END MOMENT	6.13	--	7.37	--
	CNCTN FORCE	5.89	--	6.32	--
E-636	(Struts 6 through 6)				
	AXIAL FORCE	--	-1.77	-1.77	--
	END MOMENT	--	17.20	17.20	--
	CNCTN FORCE	--	-3.84	2.07	--

JOB NO.: 212119

C O N N E C T I O N F O R C E S U M M A R Y

BASIC LOAD CASE No. 7
DEAD + WIND VELOCITY
100 MPH PER ASCE 7-05, CASE B

MAXIMUM CONNECTION FORCES (kips) AND MOMENTS (in-k)					
EXTRUSION	TYPE	TOP FLANGE		BOTTOM FLANGE	
		COMP	TENS	COMP	TENS
E-604	(Struts 1 through 1)				
	AXIAL FORCE	-0.62	-0.61	-0.61	-1.77
	END MOMENT	-4.23	5.52	5.52	-1.82
	CNCTN FORCE	0.35	-1.27	0.66	-1.05
E-604	(Struts 2 through 2)				
	AXIAL FORCE	1.70	-3.34	1.70	-3.34
	END MOMENT	0.87	-0.29	0.87	-0.75
	CNCTN FORCE	0.83	-1.88	0.86	-1.54
E-604	(Struts 3 through 3)				
	AXIAL FORCE	--	-0.60	-0.60	-1.69
	END MOMENT	--	19.60	19.60	1.49
	CNCTN FORCE	--	-3.61	3.01	-0.47
E-604	(Struts 4 through 4)				
	AXIAL FORCE	2.05	-2.17	2.06	-3.97
	END MOMENT	-3.15	11.34	13.45	-1.97
	CNCTN FORCE	1.71	-3.14	3.12	-2.01
E-604	(Struts 5 through 5)				
	AXIAL FORCE	12.95	--	12.95	--
	END MOMENT	6.66	--	7.88	--
	CNCTN FORCE	6.35	--	6.80	--
E-636	(Struts 6 through 6)				
	AXIAL FORCE	--	-1.93	-1.93	--
	END MOMENT	--	18.80	18.80	--
	CNCTN FORCE	--	-4.20	2.27	--

VAREC Vapor Control Inc. 2010B Pressure and Vacuum Relief Value

GATEWAY TANKS, INC.

Contractor Approval

For Dimensions & Quantity

Date 9/13/12

Approved JDN

Approved [Signature]

Released to [Signature]

Approved: Resubmit

Varec 2010B/2020B

Pressure and Vacuum Relief Valves

The Varec 2010B/2020B protects tanks from damage or deformation, and minimizes emissions to the environment, as well as loss of product due to evaporation.

Introduction

The Varec 2010B and 2020B Pressure and Vacuum Relief Valves are designed for use on atmospheric and low pressure storage tanks. The 2010B vents to atmosphere. The 2020B allows vapors to be piped away for recovery or destruction.

The primary function of both models is to protect the tank from physical damage or permanent deformation caused by increases in internal pressure or vacuum encountered in normal operations. On smaller tanks, the valve may also provide sufficient flow capacity for emergency venting. The "air-cushion" seating design keeps the valve tightly sealed until the pressure inside the tank approaches the valve setting. Valve selection should be in accordance with American Petroleum Institute Standard 2000 or other applicable standard.

Flow curves are provided to help you select the proper valve size for your venting requirements. Additionally, Varec's applications engineering staff and factory trained representatives are always available to assist you.

By controlling tank venting, the 2010B and 2020B not only minimize emissions to the environment, but also minimize the loss of product to evaporation. When combined with a well-designed vapor recovery system, the loss can be cut to essentially zero.

An "All-Weather" option is offered for freezing climates. The design features a special non-frosting and icing-resistant coating on the pallet perimeter, stem, guide posts and tip-of-seat ring. The coating, along with the flexible Teflon® seat insert, provides additional protection against pallets freezing closed.

For high temperature and chemical applications, Varec recommends one of the extended service options, which offers the selection of O-ring, gasket, and screen material.

Features

- The pressure and vacuum ports are oversized to provide maximum flow capacity.
- The hood and cover can be easily removed for inspection and maintenance.
- The seat rings are both interchangeable and field replaceable.
- Protective screens are provided at pressure and vacuum ports to help prevent entrance of foreign matter.
- The outlet adapter on the 2020B Series is one pipe size larger than the valve inlet flange to optimize flow capacity.

The 2010B and 2020B are part of Varec's modular products which use interchangeable components for assembling a variety of functional configurations. The modular design provides flexibility of field installation and allows the valve to be reconfigured, repaired and even upgraded on-site by simply replacing or adding components.

Available Materials

Aluminum

Carbon Steel

Stainless Steel

Ductile Iron

Special Materials on Application

Technical Data

2" to 12" [50 - 300 mm] sizes available. 10"

- Vent to atmosphere or pipe away model.
- Oversized pressure and vacuum ports.
- Optional "All-Weather" coating of valve seats and guides.
- Extended service available for chemical applications.
- Replaceable and interchangeable pressure and vacuum seat rings.
- Leakage rate of 1 SCFH [0.03 Nm³/hr] or less at 90% of setpoint.
- Pressure settings up to 2 psig [0.14 barg].

tyco Flow Control

Varec is either a trademark or registered trademark of Tyco International Services AG or its affiliates in the United States and/or other countries. All other brand names, product names, or trademarks belong to their respective holders.

Specifications

The 2010B and 2020B Series Pressure and Vacuum Relief Valves are available in a variety of configurations to meet your specific needs.

Sizes

2010B/2011B: 2" [50 mm]
3" [80 mm]
4" [100 mm]
6" [150 mm]
8" [200 mm]
10" [250 mm]
12" [300 mm]

2020B/2021B: 2" x 3"
3" x 4"
4" x 6"
6" x 8"
8" x 10"
10" x 12"
12" x 14"

Standard Flange Drilling

Aluminum

Drilled to ANSI/ASA Class 125 dimensions (Flat Face)

Drilled to DIN 2633 [16 Bar] dimensions (Flat Face)

CS, DI and SS Body

Drilled to ANSI Class 150 dimensions (Raised or Flat Face)

Drilled to Imperial DIN 2633 [16 Bar] dimensions (Raised or Flat Face)

Drilled to API or JIS (Raised or Flat Face) - consult your sales representative

Mounting Studs

Fractional (Imperial)

~~Metric~~

Testing

Each valve is tested for proper setting and for a leakage rate of less than 1 SCFH (0.03 Nm³/hr) of air at 90 percent of the set point. Each valve is tested for leak tightness at 75 percent of set point as required in API Standard 2000.

Parts and Materials Table (see page 3)

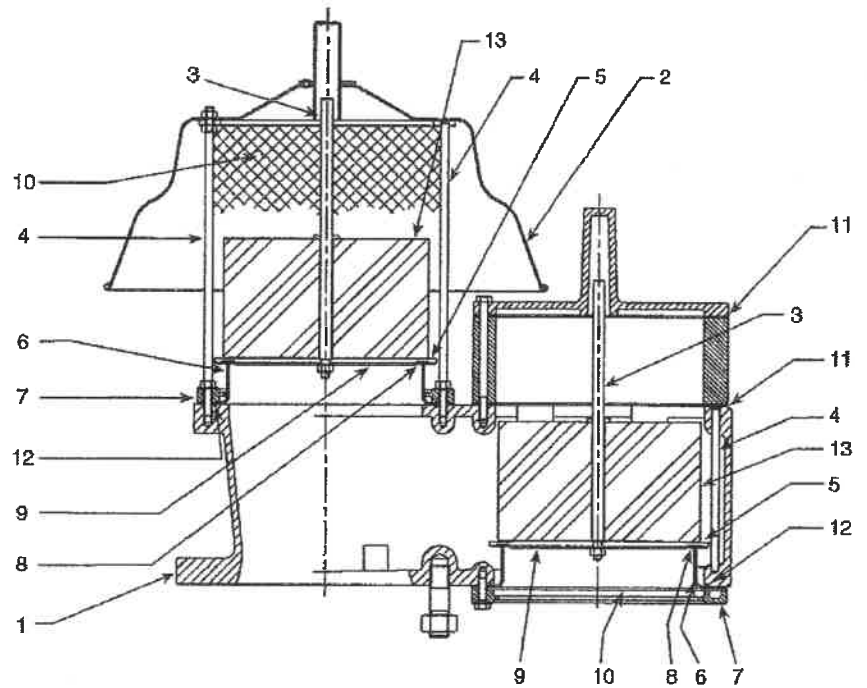
Item	Material Code				
	1	2	3	4	5
1 Body	Aluminum	Aluminum	Carbon Steel	316 SS	Ductile Iron
2 Weatherhood	Aluminum	Aluminum	Carbon Steel	316 SS	Carbon Steel
3 Guide Stem	Aluminum	316 SS	316 SS	316 SS	316 SS
4 Guide Posts	316 SS	316 SS	316 SS	316 SS	316 SS
5 Pallet	Aluminum	316 SS	316 SS	316 SS	316 SS
6 Seat Ring	Aluminum	316 SS	316 SS	316 SS	316 SS
7 Seat Ring Retainer ¹	Polypropylene	Polypropylene	Polypropylene	Polypropylene	Polypropylene
8 Insert ¹	Teflon®	Teflon®	Teflon®	Teflon®	Teflon®
9 Insert Retainer	Aluminum	316 SS	316 SS	316 SS	316 SS
10 Screen ¹	HDPE	HDPE	HDPE	HDPE	HDPE
11 Gaskets ¹	Fiber	Fiber	Fiber	Fiber	Fiber
12 O-ring ¹	BUNA-N	BUNA-N	BUNA-N	BUNA-N	BUNA-N
13 Weights	Lead	Lead	Lead	Lead	Lead

Notes

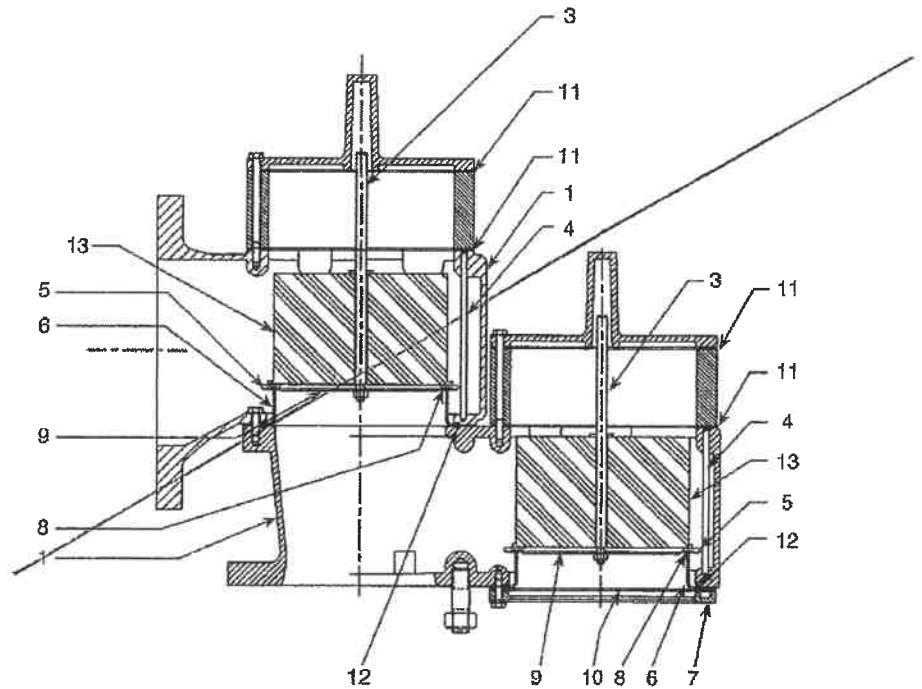
- Materials are as standard. See model option code for other materials and their associated temperature ranges.
- Teflon® coated aluminum may be supplied with material codes 2 - 5 to achieve lower settings.
- All nuts and cap screws are 316 SS.

Parts and Materials

2010B (see page 2)



2020B (see page 2)



Specifications

Setting Information

Size	Minimum Pressure Set, oz/in ²		Minimum Vacuum Set, oz/in ²		Low Set Range		High Set Range	
	Aluminum	316 SS	Aluminum	316 SS	Pressure	Vacuum	Pressure	Vacuum
2"	0.29	0.70	0.26	0.62	Min to 16 oz/in ²	Min to 10 oz/in ²	16.01 oz/in ² to 2 psig	10.01 oz/in ² to 2 psig
3"	0.23	0.55	0.21	0.49	Min to 16 oz/in ²	Min to 10 oz/in ²	16.01 oz/in ² to 2 psig	10.01 oz/in ² to 2 psig
4"	0.29	0.60	0.27	0.56	Min to 16 oz/in ²	Min to 16 oz/in ²	16.01 oz/in ² to 2 psig	16.01 oz/in ² to 2 psig
6"	0.26	0.61	0.26	0.61	Min to 16 oz/in ²	Min to 16 oz/in ²	16.01 oz/in ² to 2 psig	16.01 oz/in ² to 2 psig
8"	0.25	0.55	0.25	0.55	Min to 16 oz/in ²	Min to 16 oz/in ²	16.01 oz/in ² to 2 psig	16.01 oz/in ² to 2 psig
10"	0.25	0.63	0.25	0.63	Min to 16 oz/in ²	Min to 16 oz/in ²	16.01 oz/in ² to 2 psig	16.01 oz/in ² to 2 psig
12"	0.23	0.59	0.23	0.59	Min to 16 oz/in ²	Min to 16 oz/in ²	16.01 oz/in ² to 2 psig	16.01 oz/in ² to 2 psig

2"	0.29	0.70	0.26	0.62	Min to 16 oz/in ²	Min to 10 oz/in ²	16.01 oz/in ² to 2 psig	10.01 oz/in ² to 2 psig
3"	0.23	0.55	0.21	0.49	Min to 16 oz/in ²	Min to 10 oz/in ²	16.01 oz/in ² to 2 psig	10.01 oz/in ² to 2 psig
4"	0.29	0.60	0.27	0.56	Min to 16 oz/in ²	Min to 16 oz/in ²	16.01 oz/in ² to 2 psig	16.01 oz/in ² to 2 psig
6"	0.26	0.61	0.26	0.61	Min to 16 oz/in ²	Min to 16 oz/in ²	16.01 oz/in ² to 2 psig	16.01 oz/in ² to 2 psig
8"	0.25	0.55	0.25	0.55	Min to 16 oz/in ²	Min to 16 oz/in ²	16.01 oz/in ² to 2 psig	16.01 oz/in ² to 2 psig
10"	0.49	1.33	0.49	1.33	Min to 16 oz/in ²	Min to 16 oz/in ²	16.01 oz/in ² to 2 psig	16.01 oz/in ² to 2 psig
12"	0.47	1.28	0.47	1.28	Min to 16 oz/in ²	Min to 16 oz/in ²	16.01 oz/in ² to 2 psig	16.01 oz/in ² to 2 psig

2"	0.26	0.62	0.26	0.62	Min to 10 oz/in ²	Min to 10 oz/in ²	10.01 oz/in ² to 2 psig	10.01 oz/in ² to 2 psig
3"	0.21	0.49	0.21	0.49	Min to 10 oz/in ²	Min to 10 oz/in ²	10.01 oz/in ² to 2 psig	10.01 oz/in ² to 2 psig
4"	0.27	0.56	0.27	0.56	Min to 16 oz/in ²	Min to 16 oz/in ²	16.01 oz/in ² to 2 psig	16.01 oz/in ² to 2 psig
6"	0.26	0.61	0.26	0.61	Min to 16 oz/in ²	Min to 16 oz/in ²	16.01 oz/in ² to 2 psig	16.01 oz/in ² to 2 psig
8"	0.25	0.55	0.25	0.55	Min to 16 oz/in ²	Min to 16 oz/in ²	16.01 oz/in ² to 2 psig	16.01 oz/in ² to 2 psig
10"	0.25	0.63	0.25	0.63	Min to 16 oz/in ²	Min to 16 oz/in ²	16.01 oz/in ² to 2 psig	16.01 oz/in ² to 2 psig
12"	0.23	0.59	0.23	0.59	Min to 16 oz/in ²	Min to 16 oz/in ²	16.01 oz/in ² to 2 psig	16.01 oz/in ² to 2 psig

2"	0.26	0.62	0.26	0.62	Min to 10 oz/in ²	Min to 10 oz/in ²	10.01 oz/in ² to 2 psig	10.01 oz/in ² to 2 psig
3"	0.21	0.49	0.21	0.49	Min to 10 oz/in ²	Min to 10 oz/in ²	10.01 oz/in ² to 2 psig	10.01 oz/in ² to 2 psig
4"	0.27	0.56	0.27	0.56	Min to 16 oz/in ²	Min to 16 oz/in ²	16.01 oz/in ² to 2 psig	16.01 oz/in ² to 2 psig
6"	0.26	0.61	0.26	0.61	Min to 16 oz/in ²	Min to 16 oz/in ²	16.01 oz/in ² to 2 psig	16.01 oz/in ² to 2 psig
8"	0.25	0.55	0.25	0.55	Min to 16 oz/in ²	Min to 16 oz/in ²	16.01 oz/in ² to 2 psig	16.01 oz/in ² to 2 psig
10"	0.49	1.33	0.49	1.33	Min to 16 oz/in ²	Min to 16 oz/in ²	16.01 oz/in ² to 2 psig	16.01 oz/in ² to 2 psig
12"	0.47	1.28	0.47	1.28	Min to 16 oz/in ²	Min to 16 oz/in ²	16.01 oz/in ² to 2 psig	16.01 oz/in ² to 2 psig

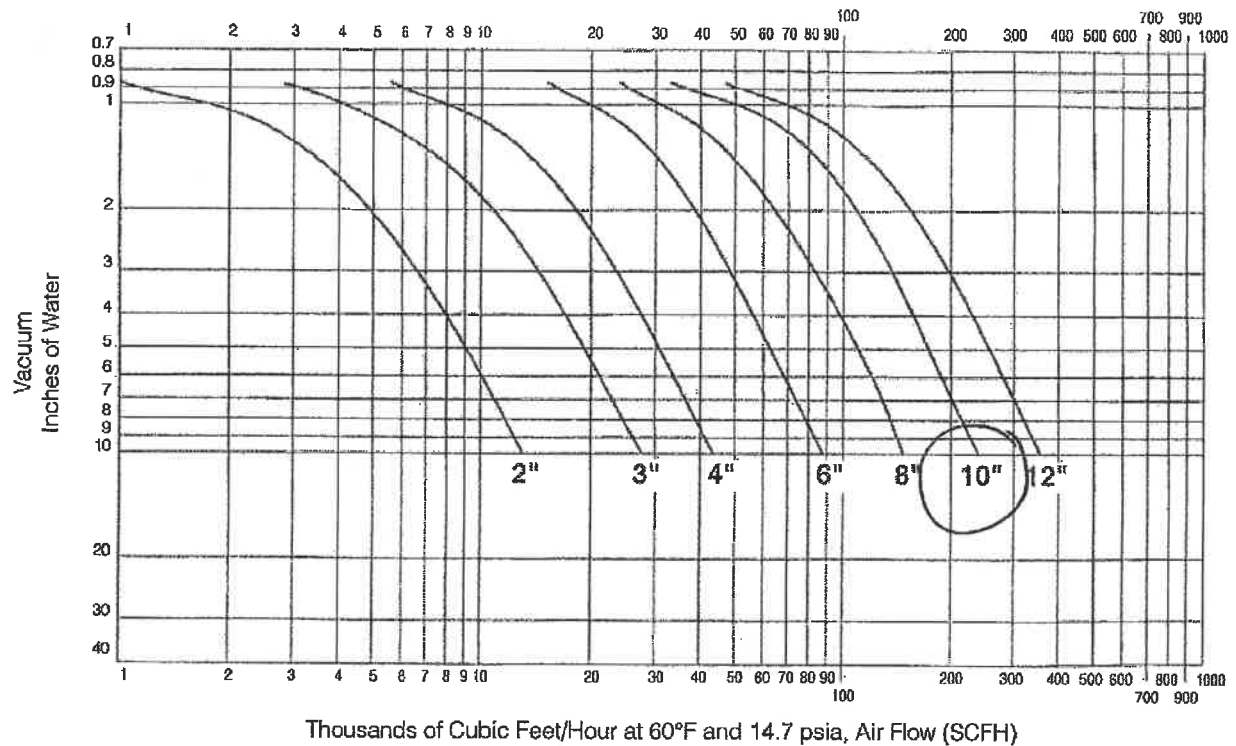
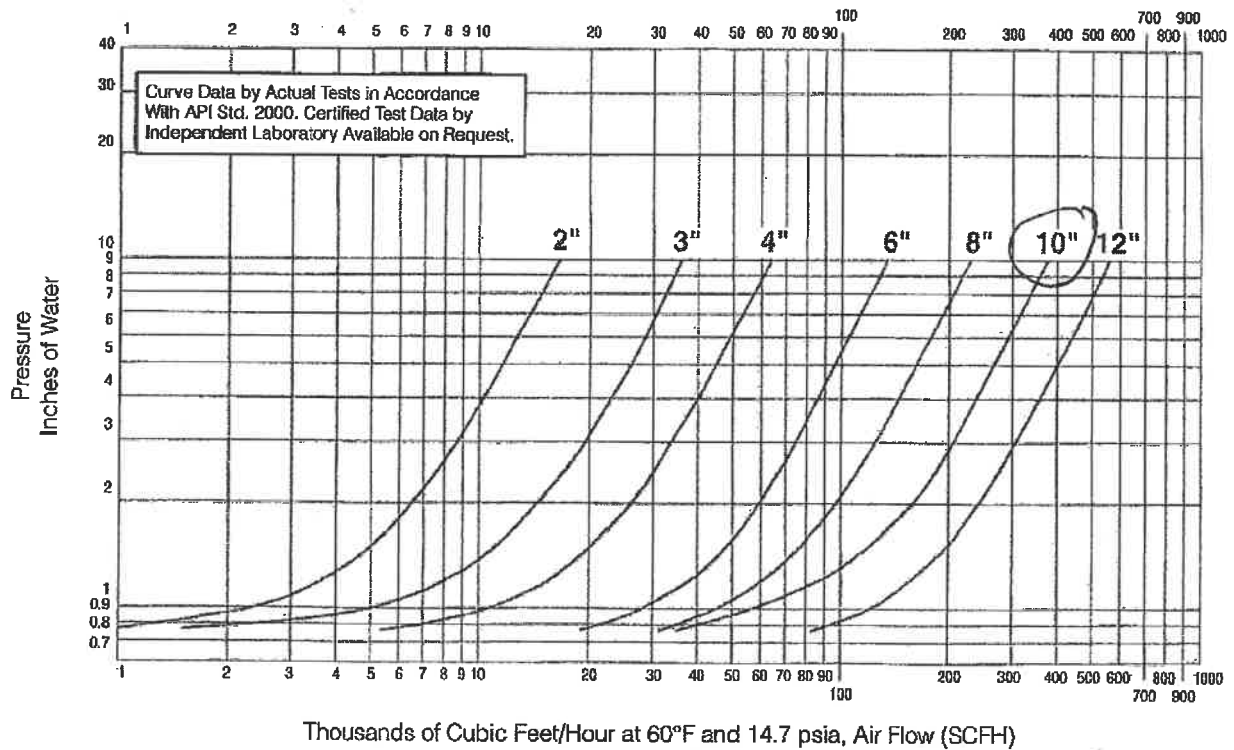
Lower settings may be available. Please consult your sales representative.

All valves are factory tested for leakage and correct setting prior to shipment. Certification of valve setting is available upon request.

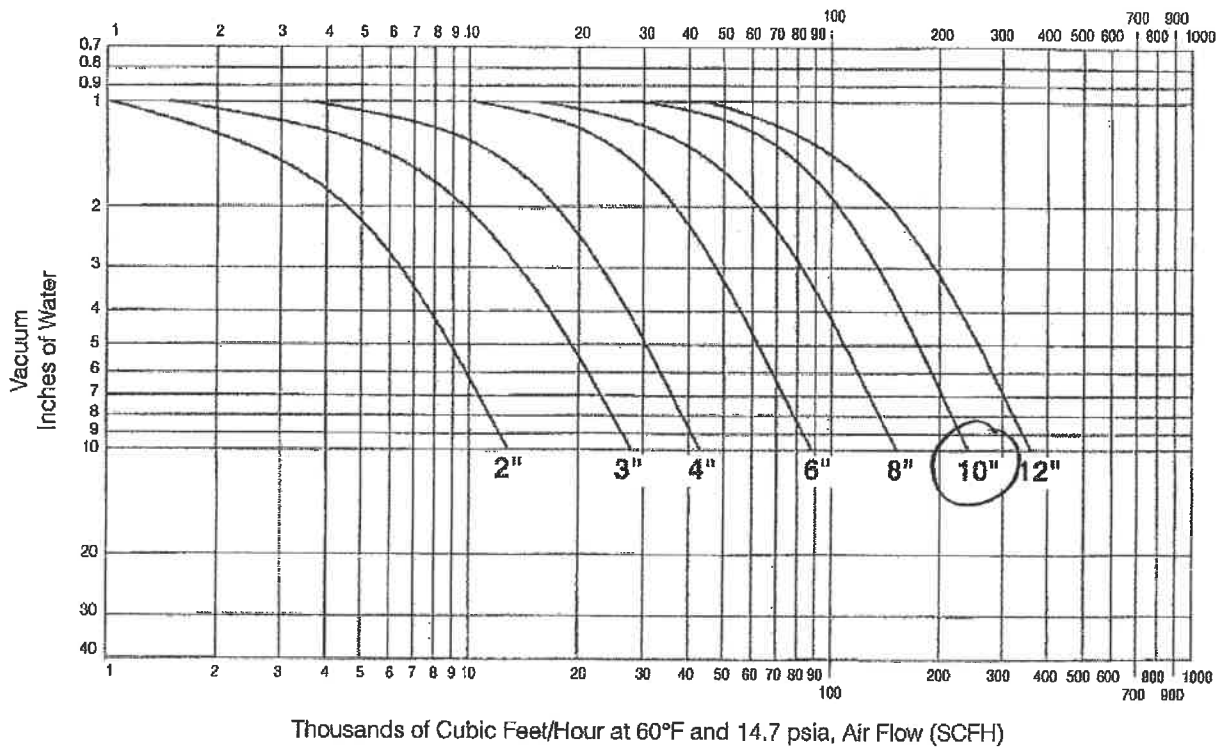
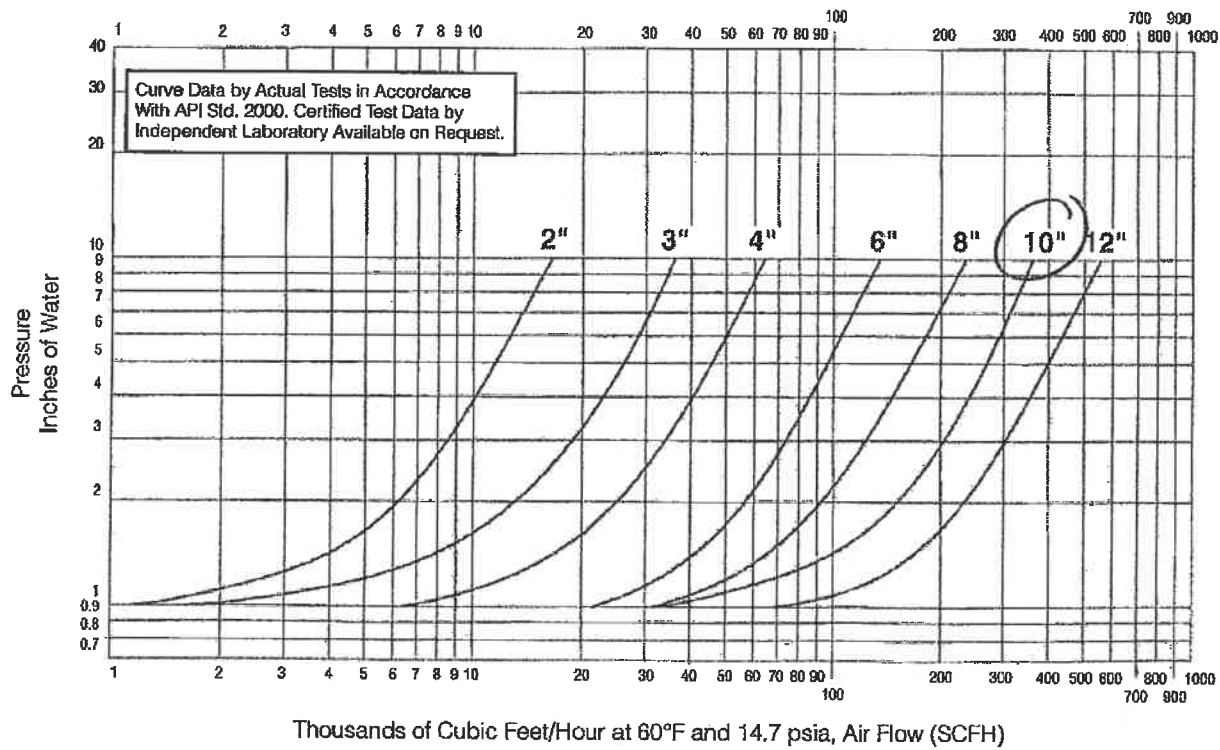
The mixed pressure/vacuum set ranges, 0204 and 0402 (Low Pressure/High Vacuum and High Pressure/Low Vacuum) use heavier pallets, and therefore have higher low set range minimums. For these cases, add the applicable value from the following table to the low set range minimum. This increase does not apply for 10" and 12" 2011B/2021B.)

Size	Aluminum	316 SS
2"	0.30	0.72
3"	0.27	0.70
4"	0.21	0.62
6"	0.20	0.55
8"	0.21	0.44
10"	0.25	0.61
12"	0.26	0.67

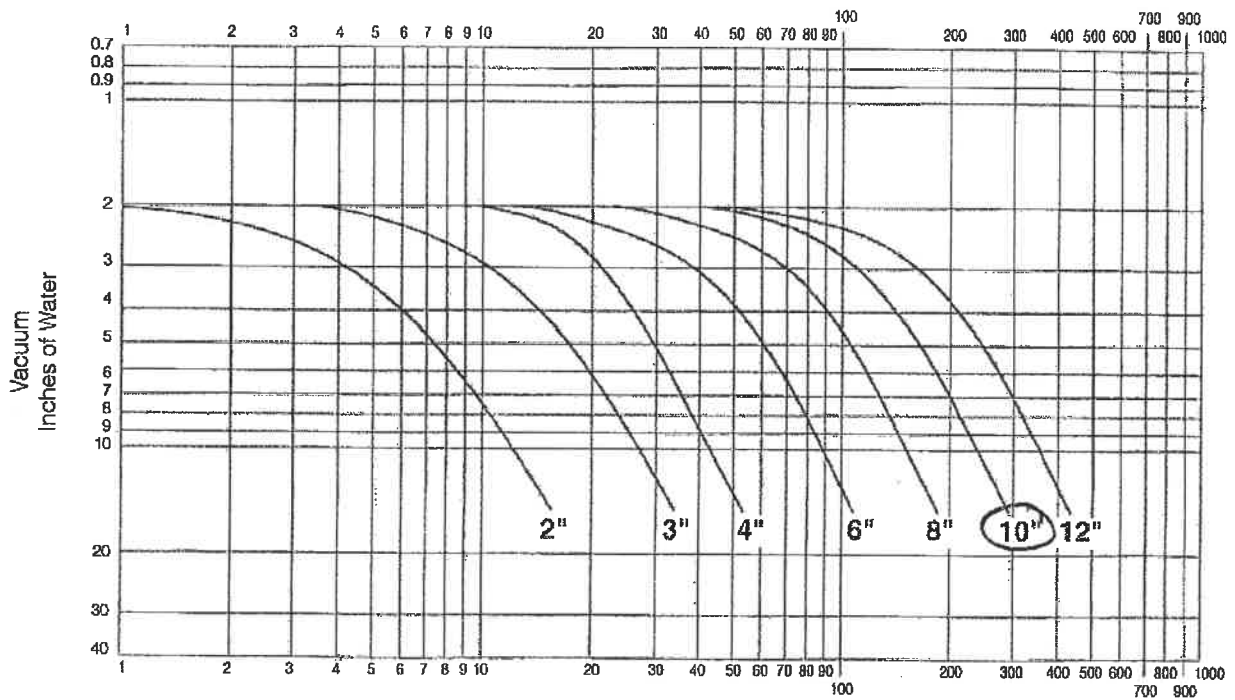
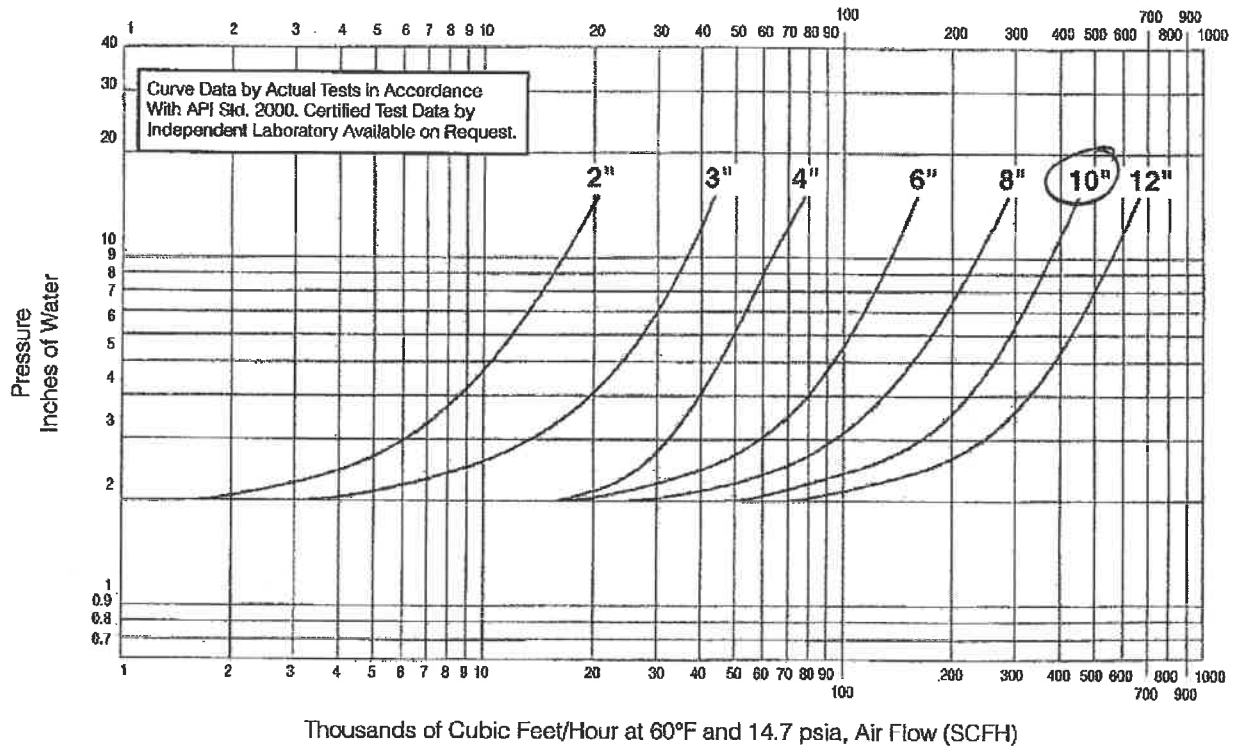
Flow Curves for 2010B Series, Set at 0.865 Inch of Water



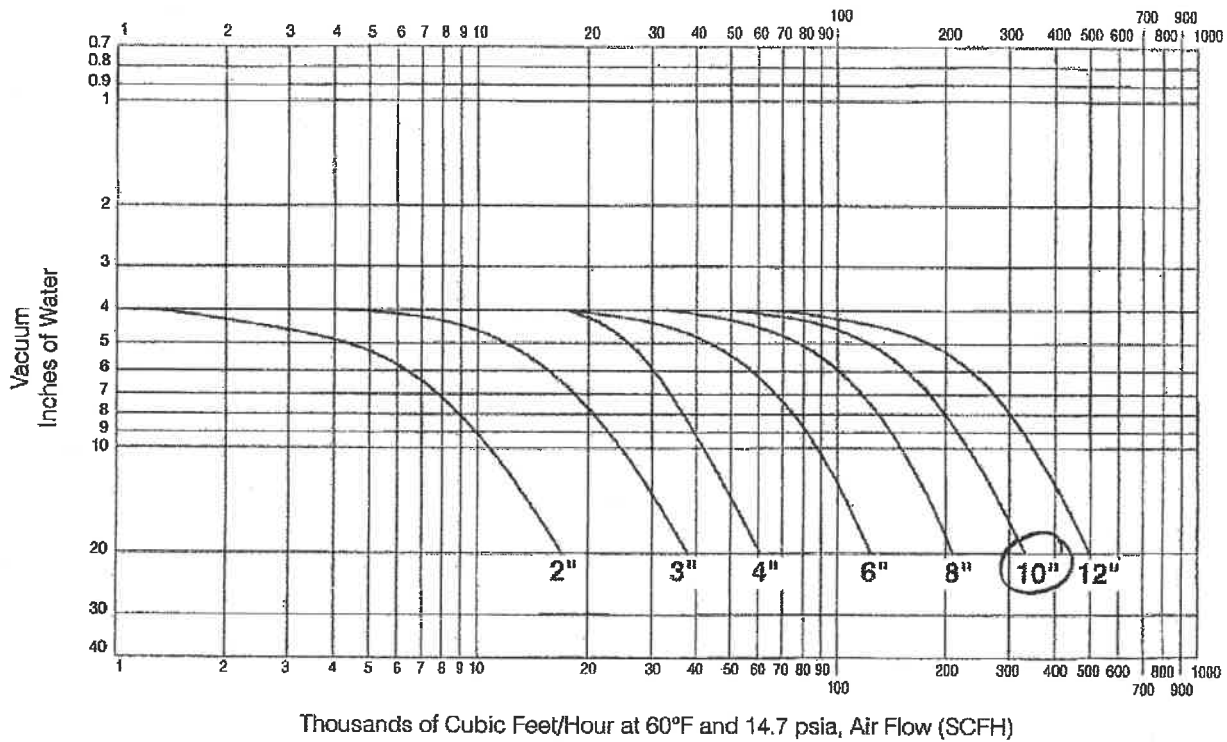
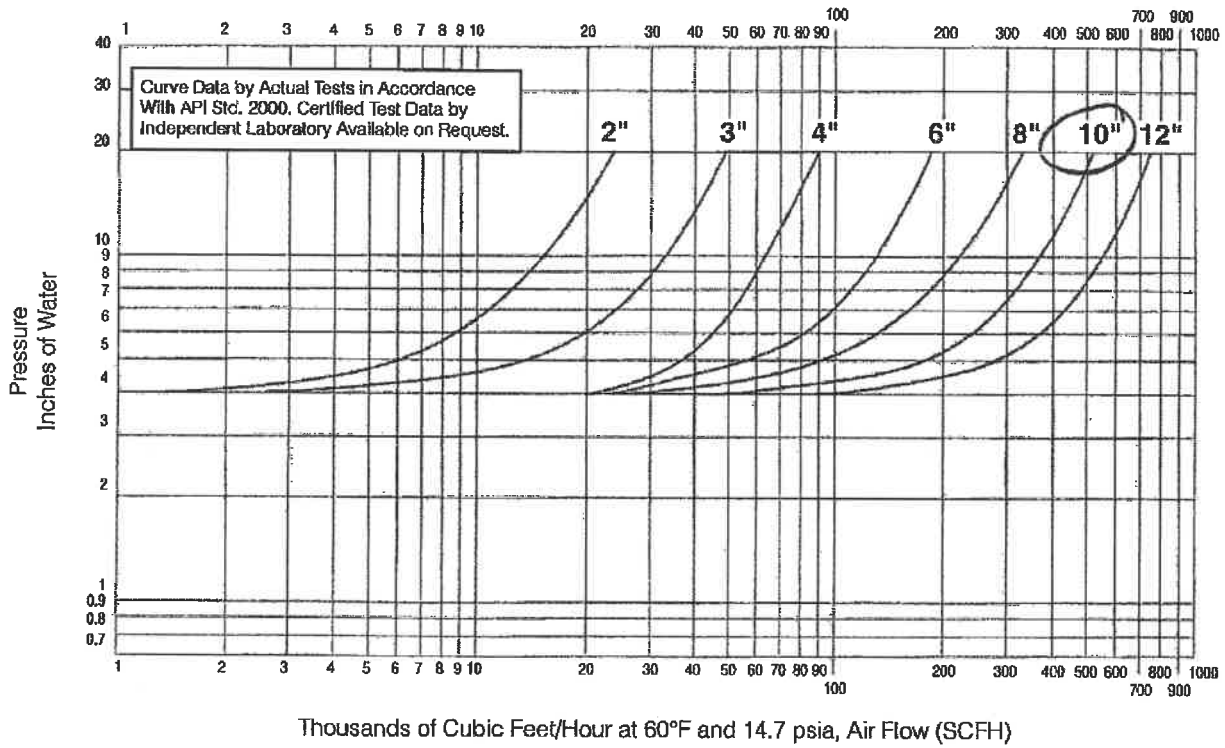
Flow Curves for 2010B Series, Set at 1 inch of Water



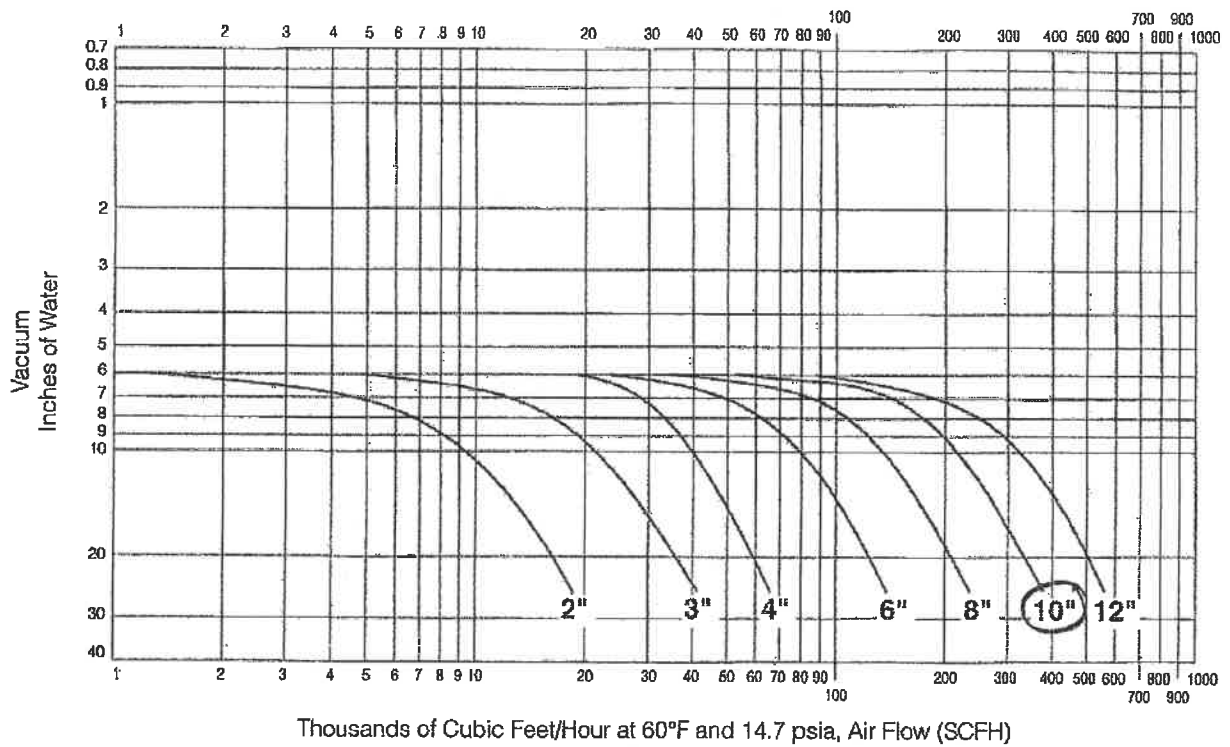
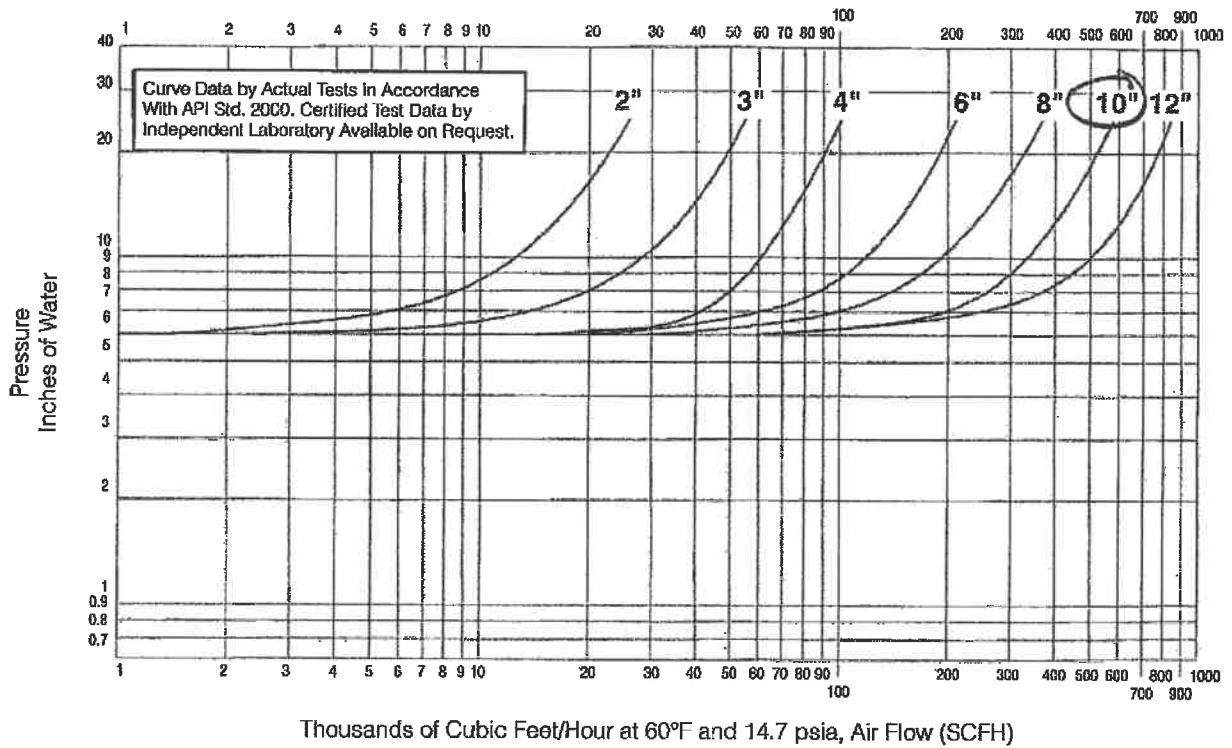
Flow Curves for 2010B Series, Set at 2 inches of Water



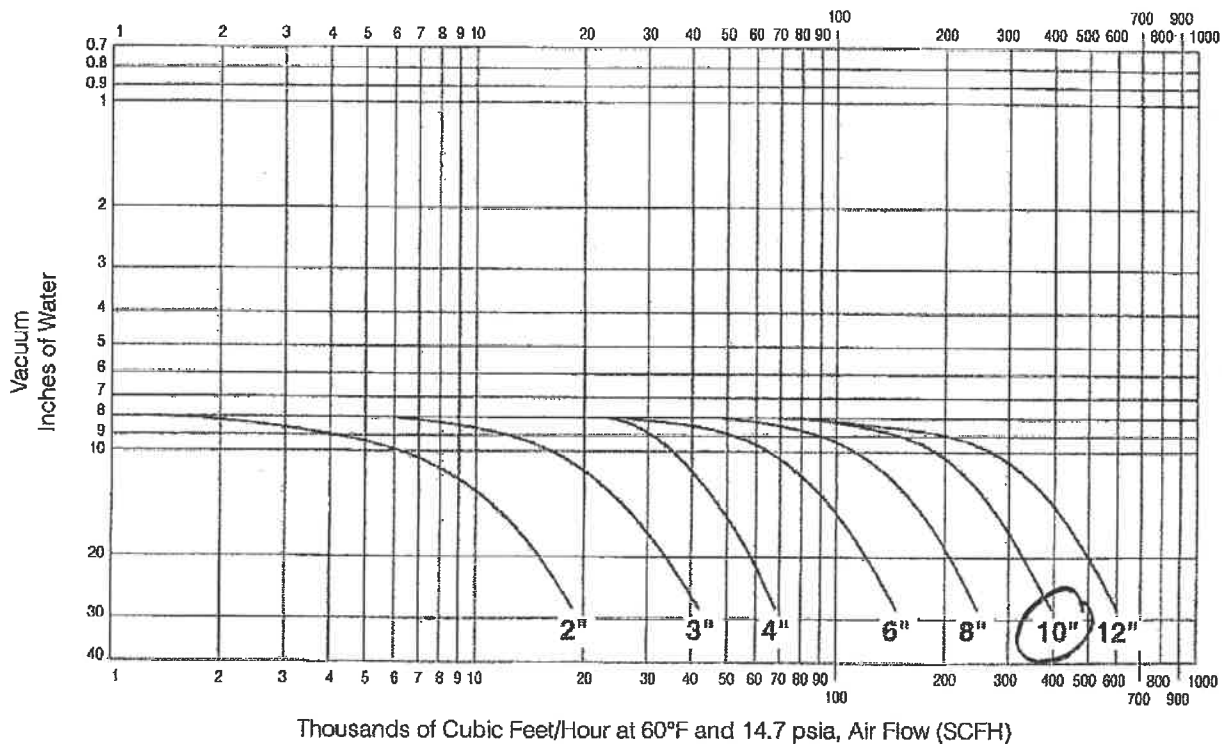
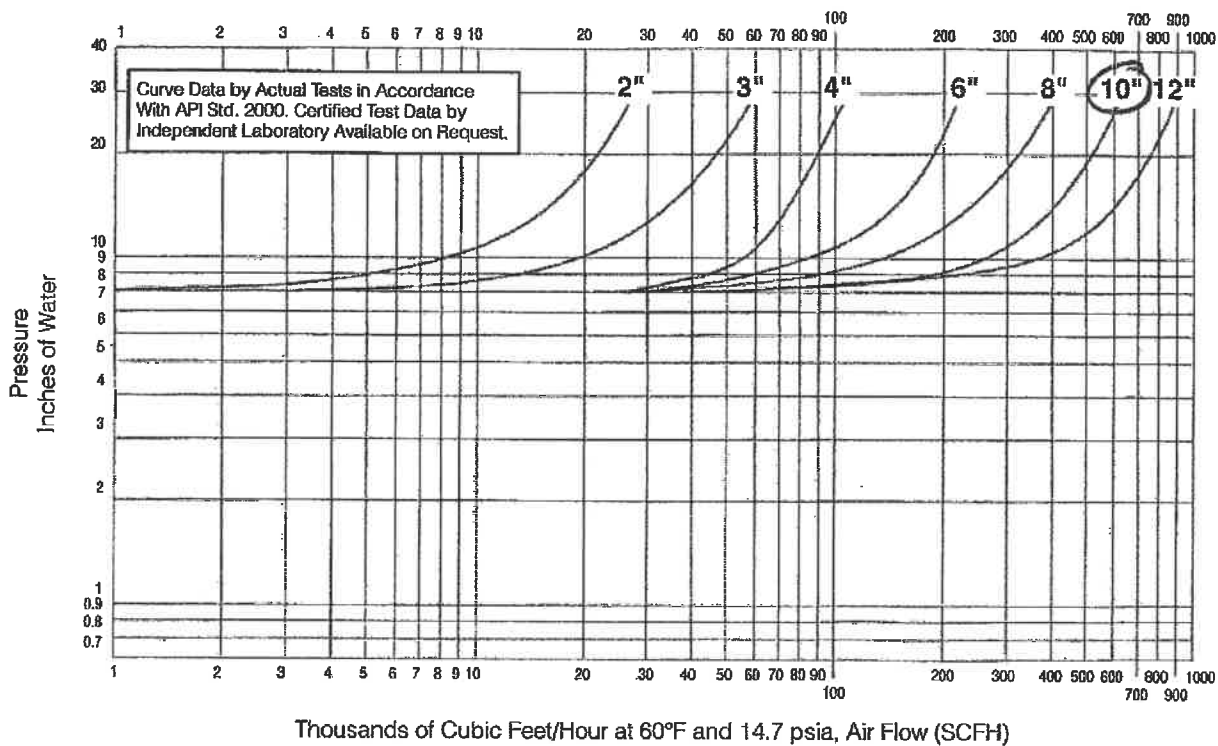
Flow Curves for 2010B Series, Set at 4 inches of Water



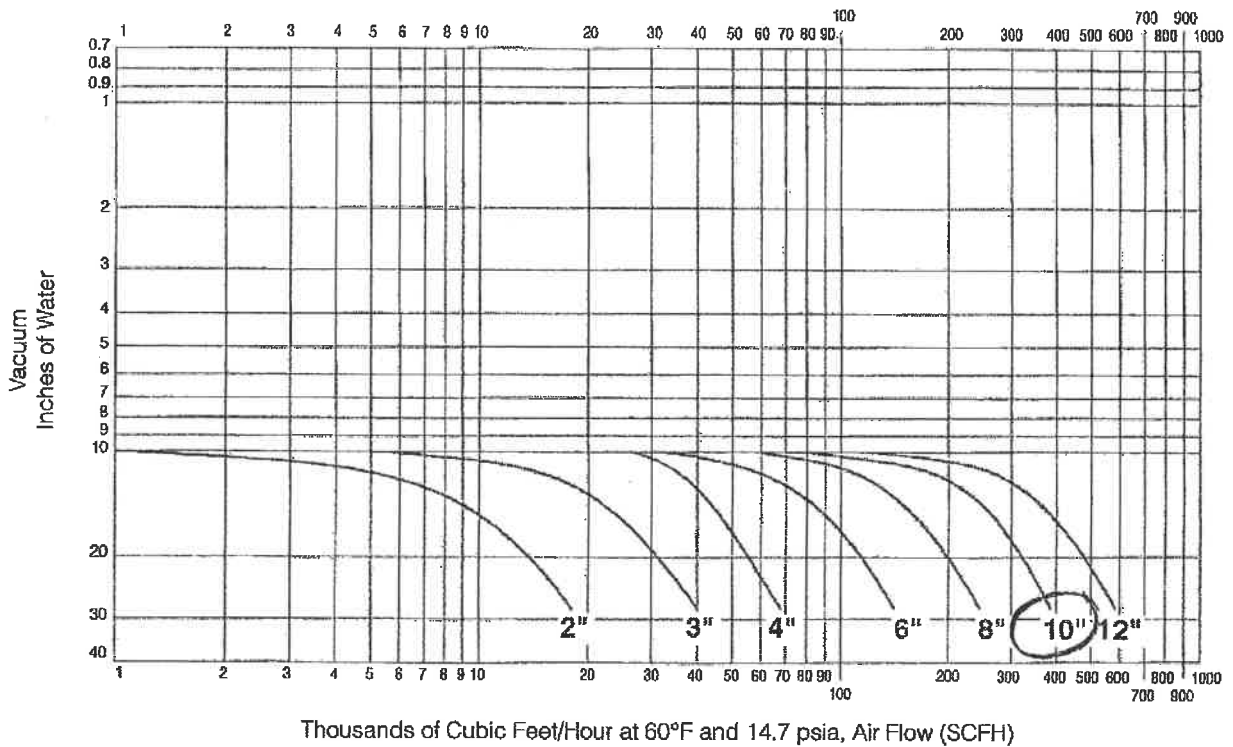
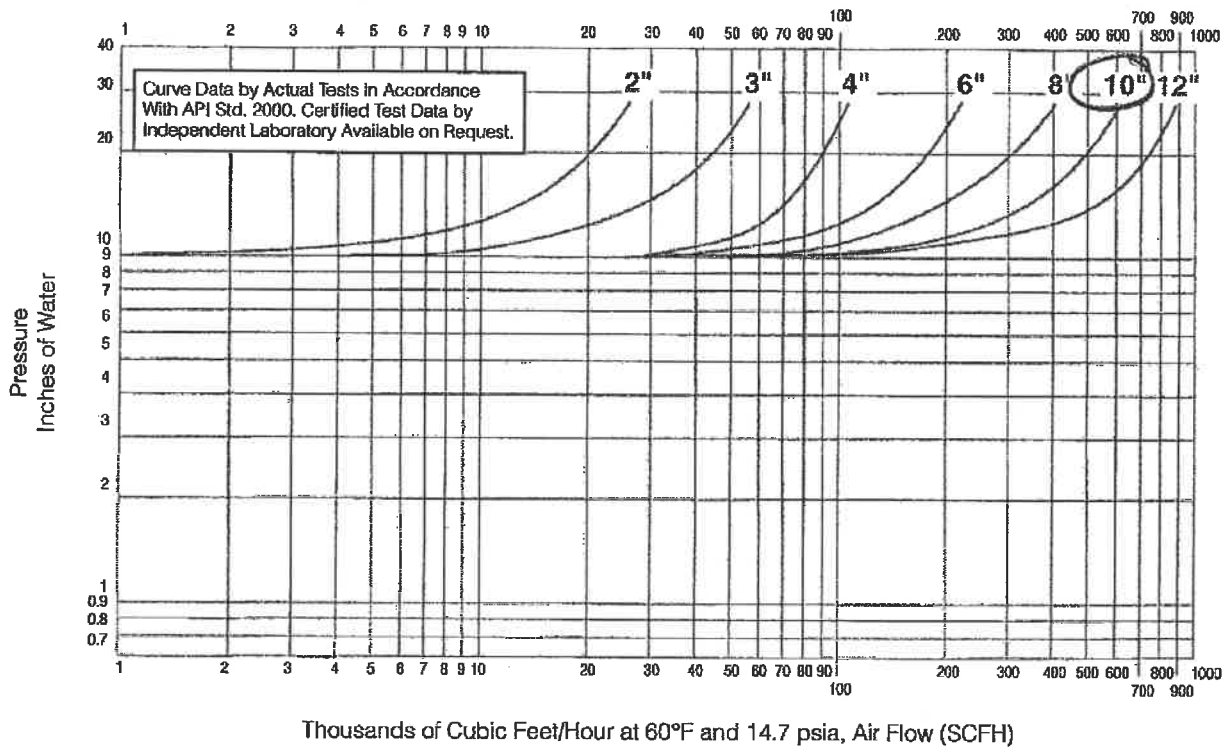
Flow Curves for 2010B Series, Set at 6 inches of Water



Flow Curves for 2010B Series, Set at 8 inches of Water

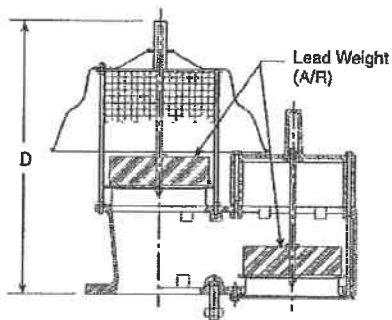
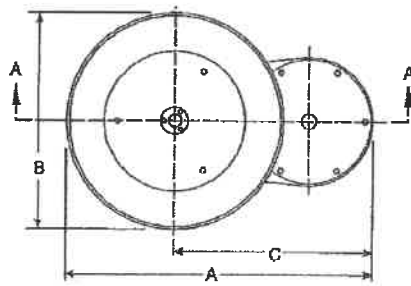


Flow Curves for 2010B Series, Set at 10 Inches of Water



Varec 2010B/2020B
Pressure and Vacuum Relief Valves

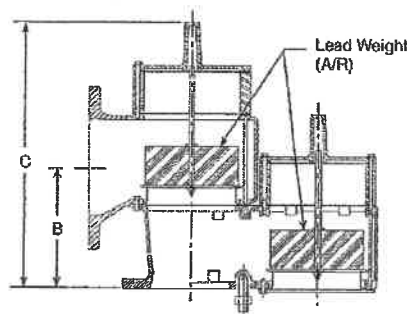
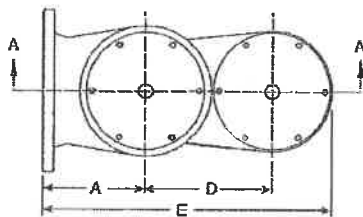
Dimensions, in. [mm]



Section A-A

Size Code	2	3	4	6	8	0	1
Nominal Pipe Size	2 [50]	3 [80]	4 [100]	6 [150]	8 [200]	10 [250]	12 [300]
A	14 ¹ / ₁₆ [359]	17 ⁹ / ₁₆ [446]	19 ¹ / ₁₆ [486]	24 [610]	29 ⁷ / ₁₆ [759]	38 ⁷ / ₁₆ [976]	46 ⁵ / ₁₆ [1184]
B	8 ¹ / ₂ [216]	10 ³ / ₄ [273]	13 ³ / ₈ [340]	17 [432]	20 ⁵ / ₈ [524]	27 [686]	34 [864]
C	9 ⁷ / ₈ [251]	12 ¹ / ₄ [311]	12 ⁷ / ₁₆ [316]	15 ¹ / ₂ [394]	19 ⁹ / ₁₆ [497]	24 ¹⁵ / ₁₆ [633]	29 ³ / ₈ [746]
D	10 ⁷ / ₁₆ [265]	12 ⁵ / ₁₆ [313]	14 ¹ / ₂ [368]	18 ³ / ₁₆ [462]	21 ⁵ / ₈ [549]	27 ¹ / ₄ [697]	31 ⁷ / ₈ [810]
Low Set	[265]	[313]	[368]	[462]	[549]	[697]	[810]
D	13 ⁹ / ₁₆ [338]	15 ¹ / ₄ [387]	16 ⁵ / ₈ [422]	21 ¹ / ₂ [546]	24 ³ / ₄ [629]	29 ⁷ / ₁₆ [748]	31 ⁷ / ₈ [810]
High Set	[338]	[387]	[422]	[546]	[629]	[748]	[810]

Figure shown is for high set option.



Section A-A

Size Code	2	3	4	6	8	0	1
Nominal Pipe Size	2 x 3 [50 x 80]	3 x 4 [80 x 100]	4 x 6 [100 x 150]	6 x 8 [150 x 200]	8 x 10 [200 x 250]	10 x 12 [250 x 300]	12 x 14 [300 x 350]
A	4 ¹⁵ / ₁₆ [125]	6 ³ / ₈ [168]	8 [203]	8 ⁹ / ₁₆ [217]	11 ¹³ / ₁₆ [284]	13 ⁵ / ₈ [346]	15 ³ / ₈ [391]
B	5 ¹ / ₄ [133]	5 ⁷ / ₈ [149]	6 ¹³ / ₁₆ [173]	10 [254]	12 ¹ / ₂ [308]	16 ¹ / ₈ [410]	18 ³ / ₄ [476]
C	9 ¹ / ₁₆ [230]	10 ³ / ₄ [273]	12 ³ / ₄ [324]	18 ³ / ₄ [476]	22 ¹ / ₈ [562]	27 ⁹ / ₁₆ [700]	32 [813]
Low Set	[230]	[273]	[324]	[476]	[562]	[700]	[813]
C	13 ¹ / ₂ [343]	15 ¹ / ₂ [394]	16 ³ / ₁₆ [427]	22 [559]	24 ¹ / ₂ [622]	29 ¹ / ₄ [743]	32 [813]
High Set	[343]	[394]	[427]	[559]	[622]	[743]	[813]
D	6 ³ / ₄ [171]	8 ⁷ / ₈ [213]	8 ⁷ / ₁₆ [214]	10 ¹ / ₂ [267]	13 ¹ / ₈ [333]	16 ⁷ / ₈ [429]	19 ³ / ₄ [502]
D	[171]	[213]	[214]	[267]	[333]	[429]	[502]
E	14 ³ / ₄ [375]	18 ⁹ / ₁₆ [471]	20 ⁷ / ₁₆ [519]	24 ¹ / ₄ [616]	30 ³ / ₈ [781]	38 ⁹ / ₁₆ [979]	44 ¹ / ₁₆ [1135]
E	[375]	[471]	[519]	[616]	[781]	[979]	[1135]

Figure shown is for high set option.

Dimensions are for preliminary general information and should not be used for construction purposes. Certified dimensional drawings are available upon request.

Code	Description
20	Air Cushion Pressure/Vacuum Relief Valve

Code	Model
1	Vent-to-Atmosphere
2	Pipe-Away
Code	Configuration
0B	Standard
1B	All Weather Type (-25°F to 200°F)

Code	Size
2	2" (2" x 3")
3	3" (3" x 4")
4	4" (4" x 6")
6	6" (6" x 8")
8	8" (8" x 10")
0	10" (10" x 12")
1	12" (12" x 14")

Code	Body/Trim Material
1	Aluminum/Aluminum (-20°F to 250°F)
2	Aluminum/316 Stainless Steel (-20°F to 250°F)
3	Carbon Steel/316 Stainless Steel (-20°F to 350°F)
4	316 Stainless Steel/316 Stainless Steel (-65°F to 350°F)
6	Ductile Iron/316 Stainless Steel (2 to 8 Inch only) (-20°F to 325°F)

Code	Insert Material
T	Teflon® (-65°F to 400°F)
B	BUJNA-N (-40°F to 250°F)
V	Viton® (-15°F to 400°F)

Code	Flange Connection
FF	125# ANSI/ASA Flat Face Flange Drilling with Fractional Studs
MF	125# ANSI/ASA Flat Face Flange Drilling with Metric Studs
FR	150# ANSI/ASA Raised Face Flange Drilling with Fractional Studs (not available on Aluminum)
MR	150# ANSI/ASA Raised Face Flange Drilling with Metric Studs (not available on Aluminum)
DF	DIN Flat Face Flange Drilling
DR	DIN Raised Face Flange Drilling (not available on Aluminum)

Code	Gasket/O-ring and Retainer/Screen Material
OP	Standard Fiber/BUNA-N and Plastic (-40°F to 250°F)
OS	Standard Fiber/BUNA-N and Stainless Steel (-40°F to 250°F)
TP	Teflon® and Plastic (-65°F to 250°F)
TS	Teflon® and Stainless Steel (-65°F to 350°F)
BP	BUNA-N and Plastic (-40°F to 250°F)
BS	BUNA-N and Stainless Steel (-40°F to 250°F)
VP	Viton® and Plastic (-15°F to 250°F)
VS	Viton® and Stainless Steel (-15°F to 350°F)

Code Pressure Setting Range (see table, page 4)

02	Low Setting
04	High Setting

Code **Vacuum Setting Range** (see table, page 4)

02 Low Setting

04 High Setting

20 1 0B ~~1~~ ~~2~~ T ~~FF~~ 0P ~~02~~ ~~02~~ (Example)

Example: 12" size Aluminum body/316SS trim, Teflon® insert, 125 FF Flanges, Standard Fiber/BUNA-N gaskets, low set pressure and vacuum, temperature range: -20°F to 250°F.

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Flow Control

VAREC ISO 9001 Certified Firm

VAREC®

Vapor Control Inc.

2010B/2020B/3500B Series Pressure and Vacuum Relief Valve

INSTRUCTION, OPERATION AND MAINTENANCE MANUAL

DATE: 9/13/12

By: [Signature]

For Information & Approval

Date: 9/13/12

By: [Signature]

As Approved or Noted

As Approved or Noted or Rejected or Rejected

to [Signature]

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Disclaimer of Warranties

The contract between VAREC Vapor Control Inc. and our customer states VAREC's entire obligation. The contents of this instruction manual shall not become part of or modify any prior or existing agreement, commitment or relationship between VAREC Vapor Control Inc. and our customer. There are no express or implied warranties set out in this instruction manual. The only warranties that apply are those in the existing contract between VAREC Vapor Control Inc. and our customer.

The VAREC Vapor Control Inc. 2010B/2020B/3500B Series Pressure and/or Vacuum Relief Valves have not been tested by VAREC Vapor Control Inc. under all possible operational conditions, and VAREC Vapor Control Inc. does not have all the data relative to your application. The information in this instruction manual is not all inclusive and does not and cannot take into account all unique situations. Consequently, you should review this product literature in view of your application. If you have any further questions, please contact VAREC Vapor Control Inc. for assistance.

Limitations of Seller's Liability

If it is determined that this instruction manual created some new warranties, VAREC Vapor Control Inc. liability shall be limited to repair or replacement under the standard warranty clause. In no case shall VAREC Vapor Control Inc. liability exceed that stated as Limitations of Remedy in the contract between VAREC Vapor Control Inc. and our customer

Safety Precautions

READ AND UNDERSTAND THIS INSTRUCTION MANUAL BEFORE INSTALLING, OPERATING OR PERFORMING MAINTENANCE ON VAREC VAPOR CONTROL INC. 2010B/2020B/3500B SERIES PRESSURE AND/OR VACUUM RELIEF VALVE. FOLLOW ALL PRECAUTIONS AND WARNINGS NOTED HEREIN WHEN INSTALLING, OPERATING OR PERFORMING MAINTENANCE ON THIS EQUIPMENT.

WARNING

Relief valve must be isolated from tank pressure before servicing. All gas must be blocked and pressure safely vented.

Safety Precaution Definitions

CAUTION

Damage to equipment may result if this precaution is disregarded.

WARNING

Direct injury to personnel or damage to equipment which can cause injury to personnel may result if this precaution is not followed.

General Information

The 2010B/2020B/3500B Series Pressure and/or Vacuum Relief Valves are designed to protect low pressure storage tanks, sludge digesters and gas holders from excessive pressure and/or vacuum. The valve is installed on the storage tank roof or digester cover. It may be used in combination with a VAREC Vapor Control Inc. Flame Arrester.

The 2010B Series Valve relieves pressure directly to the atmosphere. A weatherhood and mesh screen protect the pressure pallet and guideposts. Vacuum pressure is relieved by inbreathing ambient air.

The 2020B Series valve relieves pressure through an enclosed outlet adapter. Product vapors may be piped away rather than relieving directly to the atmosphere. Vacuum pressure is relieved by inbreathing ambient air.

The 3500B Series Valve is a vacuum relief valve that relieves negative pressure by inbreathing ambient air.

Construction

Standard materials of construction include cast body and cover(s). Pallets are dead weight loaded with lead or coated steel weights and include a flexible membrane sealing insert. The pallet is loosely guided through a center stem and pallet guide posts.

The "All-Weather" Models 2011B, 2021B and 3501B Series include a special coating on portions of the pallets, seat rings and guides to eliminate ice accumulation.

Operation

When the internal tank pressure approaches the valve setting, the pressure pallet begins to lift. As the pressure exceeds the valve setting, the pressure pallet lifts off the seat ring. Excess product vapor is allowed to vent to the atmosphere or through the pipe away system adapter, relieving the over pressure condition. The pallet automatically re-seats as the tank pressure drops below the valve setting.

If a vacuum within the tank approaches the valve setting, the vacuum pallet begins to lift. As the vacuum exceeds the valve setting, the vacuum pallet lifts off the seat ring. Atmospheric air is allowed to flow into the tank, relieving the excess vacuum condition. The pallet automatically re-seats as the vacuum drops below the valve setting.

Installation

2010B/2020B/3500B Series Pressure and Vacuum Relief Valves must be mated with the appropriate flange(s). The nozzle must be plumb and the inlet flange face level to ensure proper operation of the relief valve.

1. Remove the valve from the shipping container. Check to see if extra loading weights were bagged and packed separately.

2. Remove the weatherhood and/or cover(s) and all packing material above the pallets and within the valve.

CAUTION

Whenever the weatherhood and/or cover(s) is removed and reinstalled, the end of the pallet stem must engage the stem guide in the weatherhood and/or the stem guide chamber in the cover(s) for proper seating and valve operation.

NOTE

Spun sheet metal pallets have a compensating weight on top of the pallet. Do not remove this weight. Refer to Table 1 for incremental weight information.

3. To load vacuum pallet weights, perform the following:
 - a) With vacuum cover and gasket removed, remove vacuum pallet assembly from body.
 - b) Remove grip ring from pallet stem.
 - c) NON-VARIABLE SETTING: Locate weight marked "VACUUM" and place on top of compensating weight and/or pallet. Secure with grip ring. NOTE: If setting is less than 2" WC, weight will be pre-loaded on the pallet.
 - d) VARIABLE SETTING: Each lead weight is calibrated from 1" WC increment. (Increments of 1/4" WC and 1/2" WC may be supplied on special order). Those weights necessary for the initial specified setting will be tagged separately from any extra weight provided. Remove the packaging on the weights tagged from the initial specified setting and place the weights on top of the compensating weight. Secure with grip ring. Store remaining weights for future use (in case the setting needs to be increased).
 - e) Weigh entire pallet assembly (including installed weights). Using Table 1, confirm that the assembly is the proper weight to achieve the required setting. Allowable weight tolerance is +5%,-5%.
 - f) Remove any remaining packing material from valve body. Wipe vacuum seat ring, guide posts and pallet assembly with a soft cloth to remove any material which could affect valve operation.
 - g) Place pallet assembly on valve body seat. Ensure that pallet moves freely within guide posts and rests flat on the seat ring.
 - h) Replace the cover gasket and cover. Tighten cover screws uniformly.

CAUTION

The end of the pallet stem must engage the stem guide chamber in the cover for proper seating and valve operation.

NOTE

Spun sheet metal pallets have a compensating weight on top of the pallet. Do not remove this weight. Refer to Table 1 for incremental weight information.

1. To load pressure pallet weights, perform the following:

- a) With weatherhood from Model 2010B, or pipe away adapter cover and gasket from Model 2020B removed, remove pressure pallet assembly from body.
- b) Remove grip ring from pallet stem.
- c) NON-VARIABLE SETTING: Locate weight marked "PRESSURE" and place on top of compensating weight and/or pallet. Secure with grip ring. If setting is less than 2" WC, weight will be pre-loaded on the pallet.
- d) VARIABLE SETTING: Each lead weight is calibrated from 1" WC increment. (Increments of 1/4" WC and 1/2" WC may be supplied on special order). Those weights necessary for the initial specified setting will be tagged separately from any extra weight provided. Remove the packaging on the weights tagged from the initial specified setting and place the weights on top of the compensating weight. Secure with grip ring. Store remaining weights for future use (in case the setting needs to be increased).
- e) Weigh entire pallet assembly (including installed weights). Using Table 1, confirm that the assembly is the proper weight to achieve the required setting. Allowable weight tolerance is +5%,-5%.
- f) Remove any remaining packing material from valve body. Wipe pressure seat ring, guide posts and pallet assembly with a soft cloth to remove any material which could affect valve operation.
- g) Place pallet assembly on seat. Ensure that pallet moves freely within guide posts and rests flat on the seat ring.
- h) Replace the weatherhood on Model 2010B or the pressure cover and gasket on Model 2020B. Tighten all nuts and screws uniformly.

CAUTION

The end of the pallet stem must engage the stem guide in the weatherhood or the stem guide chamber in the cover for proper seating and valve operation.

5. Place the valve in a level position. Reach up through the inlet flange and carefully push up on the pressure pallet, then lower it onto the seat. Pallet should move up and down freely and rest flat on the seat ring.
6. Check the vacuum pallet by using a non-sparking tool which will pass through the center of the mesh screen. Push up on the vacuum pallet, then lower it onto the seat. Pallet should move freely and rest flat on the seat ring.
7. Mount the valve on the flanged nozzle or flame arrester using the appropriate full faced gasket.

CAUTION

DO NOT MATE A FLAT FACE FLANGE TO A RAISED FACE FLANGE.

If it necessary to mate an ANSI Class 125 F.F. flange with an ANSI Class 150 R.F. flange, use the proper spacer to convert the raised face to a flat face.

8. Verify that the valve is level to permit proper operation of the pallets. Install mounting hardware, and tighten uniformly.
9. When using Model 2020B Series, install connecting piping (if required) to outlet flange. Use a full faced gasket and tighten all mounting hardware uniformly.

NOTE

It is recommended that steel and iron valves be given a coat of paint immediately after installation is completed. Apply paint to external surfaces only.

Maintenance

The valve should be inspected and cleaned at periodic intervals. The first inspection should be made approximately 30 days after commissioning. Subsequent inspections should be made every 30 days. The user may adjust the schedule for his own convenience and safety, depending upon the product being stored.

WARNING

- Relief valve must be isolated from tank pressure before servicing. All gas must be blocked and pressure safely vented. If no isolation valve is present, carefully open vacuum cover or lift pressure pallet, allowing pressure to vent slowly.
- Wear appropriate gloves and/or breathing apparatus if hazardous vapors are present.

1. To inspect valve proceed as follows:

- a) Remove the weatherhood and/or cover(s).
- b) Remove pallets one at a time. Identify the pallets to ensure they are returned to the correct valve seat.
- c) Inspect pallet inserts for ripples, tears, or nicks, as well as seating surfaces for debris, abrasion or pitting. Pallet edges and guide posts should be free of burrs, corrosion or other obvious damage. Clean all components, replacing any showing excess wear or damage. On the "All-Weather" versions, inspect the Teflon coating for any damage that would affect operation.
- d) Reassemble in reverse order.

CAUTION

The end of the pallet stem must engage the stem guide in the weatherhood and/or the stem guide chamber in the cover(s) for proper seating and valve operation.

CAUTION

During periods of freezing weather, extra maintenance is required for Models 2010B/2020B/3500B. Either remove the pallets or apply generous portions of silicone grease to the pallets, seat rings and guide posts. When using silicone grease, inspect valves at least weekly. This procedure is not required for "All-Weather" Models 2011B, 2021B or 3501B.

2. To replace pallet insert proceed as follows:.

- a) Remove weatherhood and/or cover(s) and then pallet assembly.
- b) Remove nut from base of pallet stem. Remove retainer plate and insert. Clean all surfaces and threads. Install new insert, handling carefully to avoid damaging insert or pallet.
- c) Reassemble pallet and place on seat of valve body. Ensure pallet assembly moves freely within guide posts and rests flat on seat ring.
- d) Reinstall weatherhood and/or cover(s).

CAUTION

The end of the pallet stem must engage the stem guide in the weatherhood and/or the stem guide chamber in the cover(s) for proper seating and valve operation.

3. To replace pressure seat ring perform the following:

- a) For Model 2010B, remove weatherhood, screen, spacer ring, pallet assembly and guide posts. For Model 2020B, remove pressure cover, spacer (high setting), gaskets, pallet assembly, outlet adapter, and guide posts.
- b) Remove seat ring and O-Ring from valve body. Clean body, outlet adapter mating surfaces and O-Ring Groove.
- c) Install new O-Ring into groove; insure that the O-Ring stays properly in groove while installing seat ring.
- d) Install new seat ring carefully to avoid distortion. Reassemble guide posts (2010B) or outlet adapter (2020B) to secure seat. Ensure that seat is flush and level with valve body.
- e) Reassemble guide posts (2020B).
- f) Place pallet assembly on valve body seat. Ensure pallet assembly moves freely within guide posts and rest flat on seat ring.
- g) Reassemble remaining parts in reverse order.

CAUTION

The end of the pallet stem must engage the stem guide in the weatherhood or the stem guide chamber in the cover for proper seating and valve operation.

4. To replace vacuum seat ring perform the following:

- a) Remove vacuum cover, spacer (high setting), gaskets, pallet assembly, screen retainer, screen and guide posts.
- b) Remove seat ring and O-Ring from valve body. Clean body mating surface and O-Ring groove.
- c) Install new O-Ring into groove; insure that the O-Ring stays properly in groove while installing seat ring.

- d) Install new seat ring carefully to avoid distortion. Reassemble screen and retaining ring to secure seat ring. Ensure that seat is flush and level with valve body.
- e) Reassemble guide posts.
- f) Place pallet assembly on valve body seat. Ensure pallet assembly moves freely within guide posts and rests flat on seat ring.
- g) Reassemble spacer, cover and gaskets.

CAUTION

The end of the pallet stem must engage the stem guide chamber in the cover for proper seating and valve operation.

5. Seat ring repair:

- a) Seat may be ground or ground and lapped (in place) to improve seal. Use a lapping plate and medium valve grinding compound, applying light pressure.
- b) Finish lapping with a fine compound. Avoid scoring or removing excessive amounts of material.
- c) Clean all compound from valve parts.
- d) Hand buff seat with a medium grade 'Scotch-Brite' (#7447) pad and light oil.

CAUTION

Whenever the weatherhood and/or cover(s) is removed and reinstalled, the end of the pallet stem must engage the stem guide in the weatherhood and/or the stem guide chamber in the cover(s) for proper seating and valve operation.

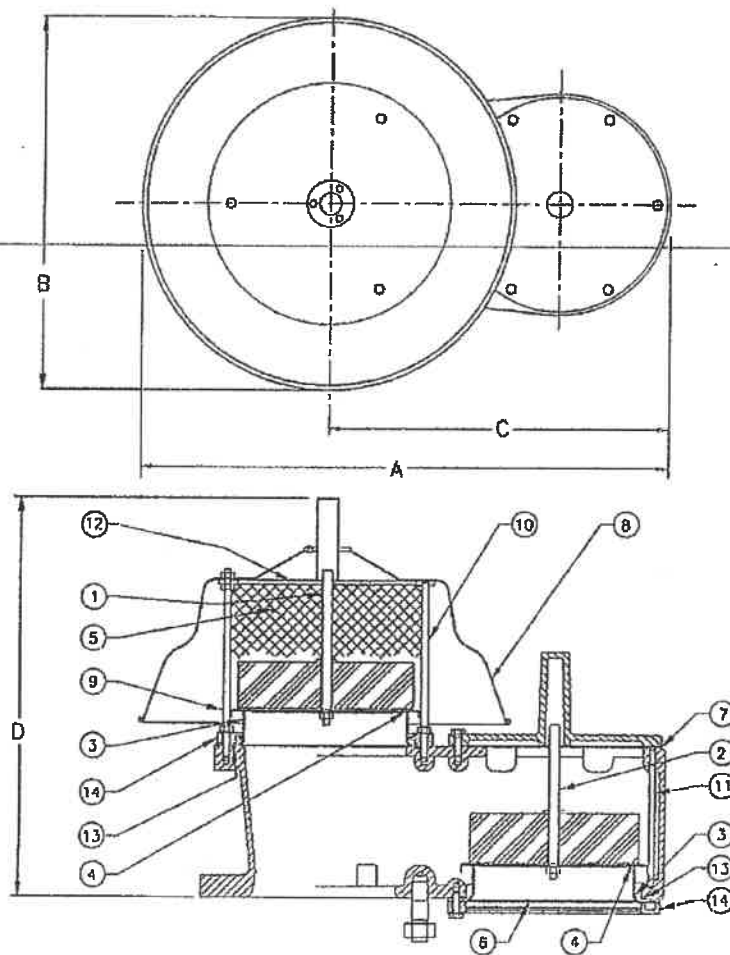
Calibration

To verify setting, calculate the total necessary weight using the table below. Check this value against the actual weight of the pallet assembly (including loading weights). Adjust loading weights as required.

PALLET LOADING (INCLUDES WEIGHT OF PALLET)		
VALVE SIZE	OUNCES OF WEIGHT REQUIRED PER OUNCE OF SETTING	OUNCES OF WEIGHT REQUIRED PER INCH OF WC SETTING
2"	8.3	4.8
3"	16.8	9.7
4"	22.1	12.8
6"	43.4	25.1
8"	72.7	42.0
10"	120.1	69.4
12"	179.9	104.0

Weight tolerance: + 5%/- 5%

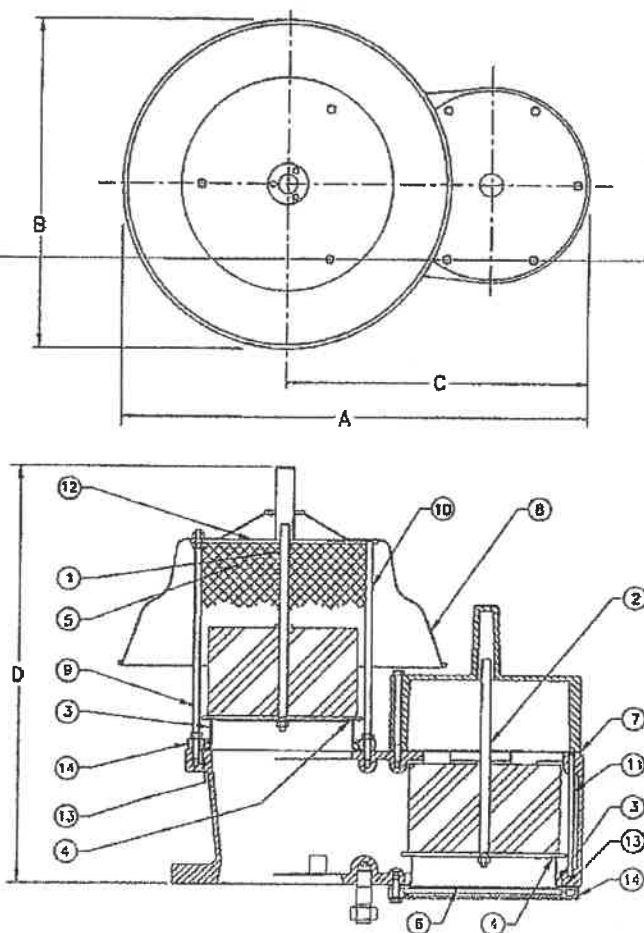
Setting tolerance: + 0%/- 10%



SIZES AND DIMENSIONS					
SIZE		A	B	C	D
2"	IN.	14-1/8	8-1/2	9-7/8	10-7/16
	MM	359	216	251	265
3"	IN.	17-9/16	10-3/4	12-1/4	12-5/16
	MM	446	273	311	313
4"	IN	19-1/8	13-3/8	12-7/16	14-1/2
	MM	486	339	316	368
6"	IN.	24	17	15-1/2	18-3/16
	MM	610	432	394	462
8"	IN.	29-7/8	20-5/8	19-9/16	21-5/8
	MM	759	524	497	549
10"	IN.	38-7/16	27	24-15/16	27-7/16
	MM	976	686	633	697
12"	IN.	46-5/8	34	29-3/8	31-7/8
	MM	1184	864	746	810

Drilling Per ANSI Class 125 F.F.

Figure 1 – 2010B Low Setting



SIZES AND DIMENSIONS					
SIZE		A	B	C	D
2"	IN.	14-1/8	8-1/2	9-7/8	13-1/4
	MM	359	216	251	337
3"	IN.	17-9/16	10-3/4	12-1/4	15-1/4
	MM	446	273	311	387
4"	IN.	19-1/8	13-3/8	12-7/16	16-5/8
	MM	486	339	316	423
6"	IN.	24	17	15-1/2	21-1/2
	MM	610	432	394	546
8"	IN.	29-7/8	20-5/8	19-9/16	24-3/4
	MM	759	524	497	629
10"	IN.	38-7/16	27	24-15/16	29-7/16
	MM	978	686	633	748
12"	IN.	46-5/8	34	29-3/8	31-7/8
	MM	1184	864	746	810

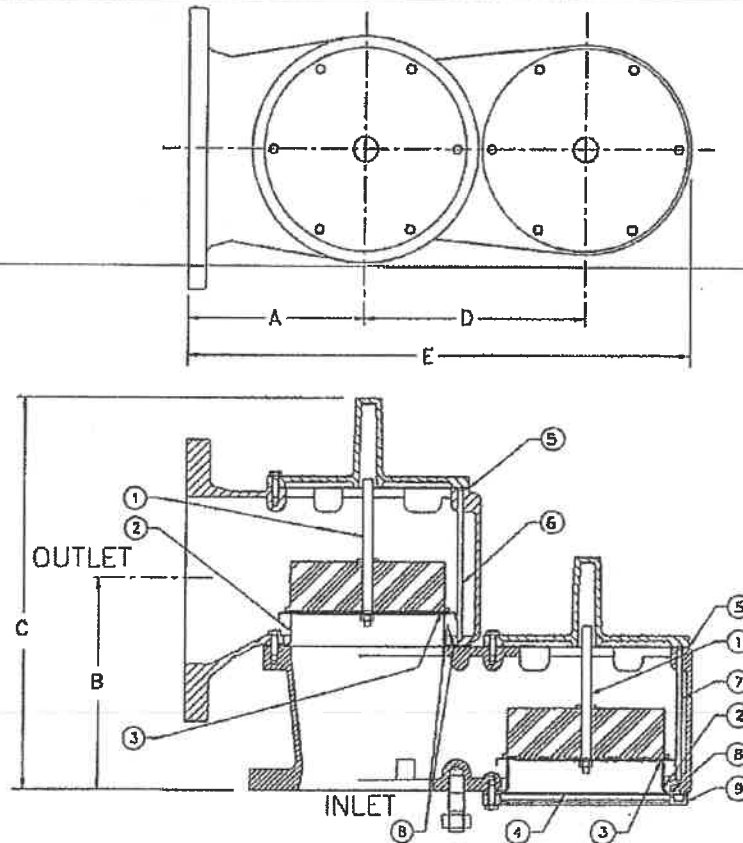
Drilling per ANSI Class 125 F.F.

Figure 2 – 2010B High Setting

2010B Replacement Parts

When ordering replacement parts, specify relief valve by model number, pipe size and serial number.
Identify replacement parts by part number, description and material where possible.

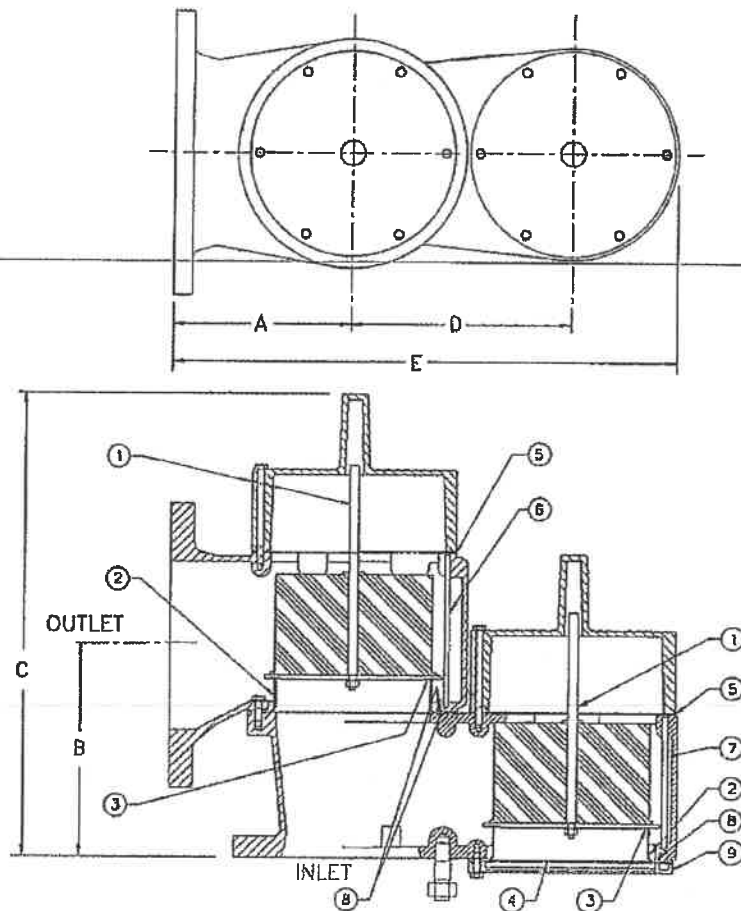
ITEM NO.	DESCRIPTION	USAGE	MATERIAL	NOMINAL PIPE SIZE						
				2"	3"	4"	6"	8"	10"	12"
*1	PRESSURE PALLET ASSEMBLY	LOW SET	ALUM.	06-11485-301	06-11485-401	06-11485-501	06-11485-601	06-11485-701	06-11485-801	06-11485-901
		HIGH SET	ALUM.	06-11486-101	06-11486-201	06-11486-301	06-11486-401	06-11486-501	06-11486-601	06-11486-701
		LOW SET	316 SST	06-11485-306	06-11485-406	06-11485-506	06-11485-606	06-11485-706	06-11485-806	06-11485-906
		HIGH SET	316 SST	06-11486-106	06-11486-206	06-11486-306	06-11486-406	06-11486-506	06-11486-606	06-11486-706
*2	VACUUM PALLET ASSEMBLY	LOW SET	ALUM.	06-11485-101	06-11485-201	06-11485-001	06-11485-601	06-11485-701	06-11485-801	06-11485-901
		HIGH SET	ALUM.	06-11486-101	06-11486-201	06-11486-301	06-11486-401	06-11486-501	06-11486-601	06-11486-701
		LOW SET	316 SST	06-11485-106	06-11485-206	06-11485-006	06-11485-606	06-11485-706	06-11485-806	06-11485-906
		HIGH SET	316 SST	06-11486-106	06-11486-206	06-11486-306	06-11486-406	06-11486-506	06-11486-606	06-11486-706
*3	SEAT RING	ALL	ALUM.	02-10438-001	02-10251-001	02-05464-001	02-05478-001	02-05482-001	02-05487-001	02-05499-001
		ALL	316 SST	02-10438-006	02-10251-006	02-05464-006	02-05478-006	02-05482-006	02-05487-006	02-05499-006
4	PALLET INSERT	ALL	TEFLON	02-10361-093	02-09704-093	B12741-093	B12742-093	B12743-093	B12744-093	B13288-093
5	PRESSURE SCREEN	LOW SET	HDPE	02-10439-051	02-10323-051	B16209-351	B14390-151	B14390-251	B14390-351	B14390-451
		HIGH SET	HDPE	02-10439-151	02-10323-151	B16209-451	B14390-551	B14390-651	B14390-751	B14390-851
6	VACUUM SCREEN	ALL	HDPE	02-11547-051	02-11547-151	02-11547-251	02-11547-351	02-11547-451	02-11547-551	02-11547-651
7	COVER & SPACER GASKET	LOW SET	FIBER	02-11380-071	02-11381-071	02-11382-071	02-11383-071	02-11384-071	02-11385-071	02-11386-071
		HIGH SET	BUNA-N	02-11380-075	02-11381-075	02-11382-075	02-11383-075	02-11384-075	02-11385-075	02-11386-075
8	HOOD	LOW PRESS SET WITH LOW VAC SET	ALUM.	06-11136-01	06-11136-02	06-11136-08	06-11137-01	06-11137-02	06-11137-03	06-11137-04
			STEEL	02-10455-003	02-10310-003	02-10066-103	D6064-203	C6433-203	C6436-203	C6500-203
			304 SST	02-10455-005	02-10310-005	02-10066-105	E2331-205	C7119-205	E2322-205	E2317-205
		HIGH PRESS SET WITH LOW VAC SET	ALUM.	06-11136-01	06-11136-02	06-11136-03	06-11137-01	06-11137-02	06-11137-03	06-11137-04
			STEEL	02-10455-003	02-10310-003	02-10066-103	D6064-203	C6433-203	C6436-203	C6500-203
			304 SST	02-10455-005	02-10310-005	02-10066-105	E2331-205	C7119-205	E2322-205	E2317-205
		LOW PRESS SET WITH HIGH VAC SET	ALUM.	06-11545-01	06-11545-02	06-11545-03	06-11137-05	06-11137-06	06-11137-07	06-11137-04
			STEEL	02-11197-003	02-11199-003	02-11045-203	02-11004-003	02-11006-003	02-11007-003	C6500-203
			304 SST	02-11197-005	02-11199-005	02-11045-205	02-11004-005	02-11006-005	02-11007-005	E2317-205
		HIGH PRESS SET WITH HIGH VAC SET	ALUM.	06-11545-01	06-11545-02	06-11545-04	06-11137-01	06-11137-02	06-11137-03	06-11137-04
			STEEL	02-11197-103	02-11199-103	02-11045-303	D6064-203	C6433-203	C6436-203	C6500-203
			304 SST	02-11197-105	02-11199-105	02-11045-305	E24331-205	C7119-205	E2322-205	E2317-205
*9	PRESS GUIDE POST (HOOD ATTACH)	LOW SET	316 SST	02-11411-106	02-11411-206	02-11412-106	02-11413-106	02-11413-206	02-11415-106	02-11415-206
		HIGH SET	316 SST	02-11411-306	02-11411-406	02-11412-206	02-11413-306	02-11413-406	02-11415-306	02-11415-406
*10	PRESSURE GUIDE POST	LOW SET	316 SST	---	---	---	02-11414-106	02-11414-206	02-11416-106	02-11416-206
		HIGH SET	316 SST	---	---	---	02-11414-306	02-11414-406	02-11416-306	02-11416-406
*11	VACUUM GUIDE POST	ALL	316 SST	02-11015-106	02-11015-206	02-11432-106	B14384-106	B14384-206	B14384-506	02-11433-106
12	SPACER RING	ALL	ALUM.	---	---	---	B14389-011	B14439-011	B14449-011	B16113-011
		ALL	STEEL	---	---	---	B14389-003	B14439-003	B14449-003	B16113-003
		ALL	316 SST	---	---	---	B14389-006	B14439-006	B14449-006	B16113-006
13	O-RING	ALL	BUNA-N	P014-03-285	P014-03-273	P014-03-286	P014-03-287	P014-03-288	P014-03-289	P014-03-290
14	RETAINING RING	ALL	POLYPROPYLENE	02-11396	02-11397	02-11398	02-11399	02-11400	02-11401	02-11402
* FOR ALL WEATHER PARTS, ADD -1 TO END OF LISTED PART NUMBERS.										



SIZES AND DIMENSIONS							
SIZE			A	B	C	D	E
INLET	OUTLET						
2"	3"	IN	4-15/16	5-1/4	9-1/16	6-3/4	14-3/4
		MM	125	133	230	171	375
3"	4"	IN	6-3/8	5-7/8	10-3/4	8-3/8	18-9/16
		MM	162	149	273	213	472
4"	6"	IN	8	6-13/16	12-3/4	8-7/16	20-7/16
		MM	203	173	324	214	519
6"	8"	IN	8-9/16	10	18-3/4	10-1/2	24-1/4
		MM	217	255	476	267	616
8"	10"	IN	11-3/16	12-1/8	22-1/8	13-1/8	30-3/4
		MM	284	308	562	333	781
10"	12"	IN	13-5/8	16-1/8	27-9/16	16-7/8	38-9/16
		MM	346	409	700	429	980
12"	14"	IN	15-3/8	18-3/4	32	19-3/4	44-11/16
		MM	391	476	813	502	1135

Drilling Per ANSI Class 125 F.F.

Figure 3 – 2020B Low Setting



SIZES AND DIMENSIONS						
SIZE		A	B	C	D	E
INLET	OUTLET					
2"	3"	IN 4-15/16	5-1/4	13-1/2	6-3/4	14-3/4
		MM 125	133	343	171	375
3"	4"	IN 6-3/8	5-7/8	15-1/2	8-3/8	18-9/16
		MM 162	149	394	213	472
4"	6"	IN 8	6-13/16	16-13/16	8-7/16	20-7/16
		MM 203	173	427	214	519
6"	8"	IN 8-9/16	10	22	10-1/2	24-1/4
		MM 217	255	559	267	616
8"	10"	IN 11-3/16	12-1/8	24-1/2	13-1/8	30-3/4
		MM 284	308	622	333	781
10"	12"	IN 13-5/8	16-1/8	29-1/4	16-7/8	38-9/16
		MM 346	409	743	429	980
12"	14"	IN 15-3/8	18-3/4	32	19-3/4	44-11/16
		MM 391	476	813	502	1135

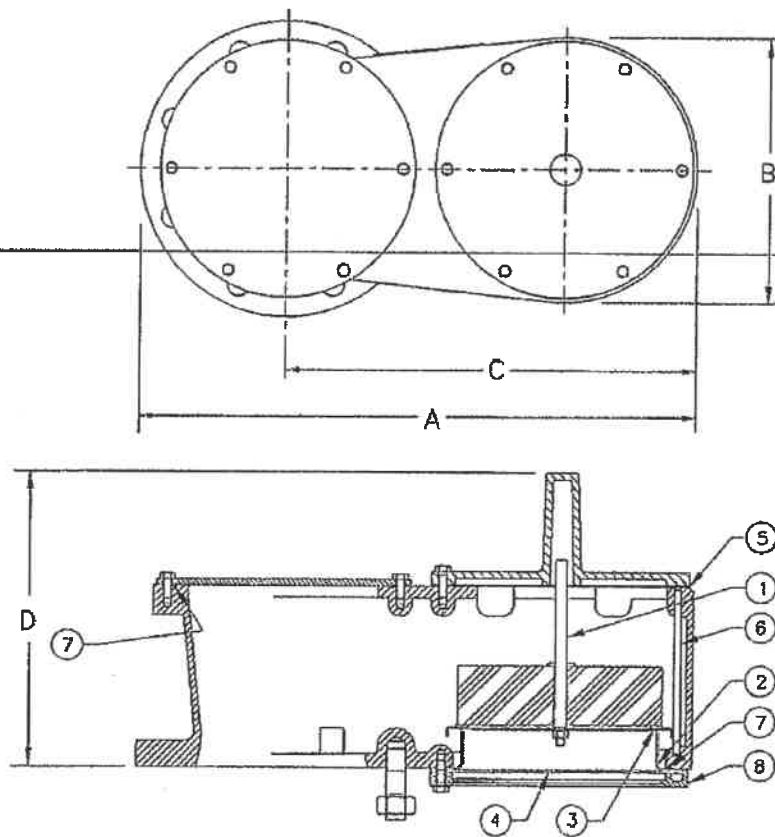
Drilling Per ANSI Class 125 F.F.

Figure 4 – 2020B High Setting

2020B Replacement Parts

When ordering replacement parts, specify relief valve by model number, pipe size and serial number. Identify replacement parts by part number, description and material where possible.

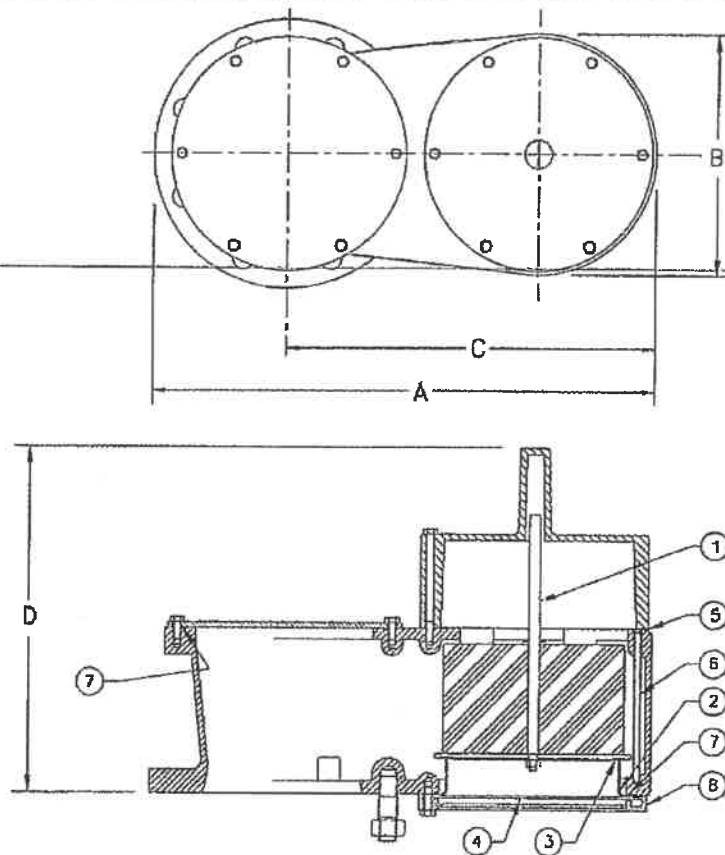
ITEM NO.	DESCRIPTION	USAGE	MATERIAL	NOMINAL PIPE SIZE (INLET X OUTLET)						
				2" X 3"	3" X 4"	4" X 6"	6" X 8"	8" X 10"	10" X 12"	12" X 14"
*1	PALLET ASSEMBLY	LOW SET.	ALUM.	06-11485-101	06-11485-201	06-11485-001	06-11485-601	06-11485-701	06-11485-801	06-11485-901
		HIGH SET.	ALUM.	06-11486-101	06-11486-201	06-11486-301	06-11486-401	06-11486-501	06-11486-601	06-11486-701
		LOW SET.	316 SST.	06-11485-106	06-11485-206	06-11485-006	06-11485-606	06-11485-706	06-11485-806	06-11485-906
		HIGH SET.	316 SST.	06-11486-106	06-11486-206	06-11486-306	06-11486-406	06-11486-506	06-11486-606	06-11486-706
*2	SEAT RING	ALL	ALUM.	02-10438-001	02-10251-001	02-05464-001	02-05478-001	02-05482-001	02-05487-001	02-05499-001
		ALL	316 SST.	02-10438-006	02-10251-006	02-05464-006	02-05478-006	02-05482-006	02-05487-006	02-05499-006
3	PALLET INSERT	ALL	TEFLON	02-10361-093	02-09704-093	B12741-093	B12742-093	B12743-093	B12744-093	B13288-093
4	SCREEN	ALL	HDPE	02-11547-051	02-11547-151	02-11547-251	02-11547-351	02-11547-451	02-11547-551	02-11547-651
5	COVER & SPACER GASKET	LOW SET.	FIBER	02-11380-071	02-11381-071	02-11382-071	02-11383-071	02-11384-071	02-11385-071	02-11386-071
		HIGH SET.	BUNA-N	02-11380-075	02-11381-075	02-11382-075	02-11383-075	02-11384-075	02-11385-075	02-11386-075
*6	PRESS. GUIDE POST	ALL	316 SST.	02-11015-106	02-11015-206	02-11432-106	B16553-406	B16553-206	B16553-506	02-11433-106
*7	VACUUM GUIDE POST	ALL	316 SST.	02-11015-106	02-11015-206	02-11432-106	B14384-106	B14384-206	B14384-506	02-11433-106
8	O-RING	ALL	BUNA-N	F014-03-285	F014-03-273	F014-03-286	F014-03-287	F014-03-288	F014-03-289	F014-03-290
9	RETAINING RING	ALL	POLYPROPYLENE	02-11396	02-11397	02-11398	02-11399	02-11400	02-11401	02-11402
* FOR 'ALL WEATHER' PARTS, ADD -1 TO END OF LISTED PART NUMBERS.										



SIZES AND DIMENSIONS					
SIZE		A	B	C	D
2"	IN.	13-1/8	6-3/16	9-7/8	5-9/16
	MM	333	157	251	141
3"	IN.	16-1/8	7-5/8	12-3/16	6-9/16
	MM	410	194	310	167
4"	IN.	16-15/16	8	12-7/16	7-11/16
	MM	430	203	316	195
6"	IN.	21-3/16	10-1/16	15-9/16	11-3/16
	MM	538	256	395	284
8"	IN.	26-5/16	12-7/8	19-9/16	13-3/16
	MM	668	327	497	335
10"	IN.	32-15/16	16-1/8	24-15/16	16-1/16
	MM	837	410	633	408
12"	IN.	38-7/8	19-1/4	29-3/8	18-3/4
	MM	987	489	746	476

Drilling Per ANSI Class 125 F.F.

Figure 5 – 3500B Low Setting



SIZES AND DIMENSIONS					
SIZE		A	B	C	D
2"	IN.	13-1/8	6-3/16	9-7/8	10-1/16
	MM	333	157	251	256
3"	IN.	16-1/8	7-5/8	12-3/16	11-5/16
	MM	410	194	310	287
4"	IN.	16-15/16	8	12-7/16	11-7/8
	MM	430	203	316	301
6"	IN.	21-3/16	10-1/16	15-9/16	14-7/16
	MM	538	256	395	367
8"	IN.	26-5/16	12-7/8	19-9/16	15-5/8
	MM	668	327	497	397
10"	IN.	32-15/16	16-1/8	24-15/16	17-3/4
	MM	837	410	633	451
12"	IN.	38-7/8	19-1/4	29-3/8	18-3/4
	MM	987	489	746	476

Drilling Per ANSI Class 125 F.F.

Figure 6 – 3500B High Setting

3500B Replacement Parts

When ordering replacement parts, specify relief valve by model number, pipe size and serial number. Identify replacement parts by part number, description and material where possible.

ITEM NO.	DESCRIPTION	USAGE	MATERIAL	NOMINAL PIPE SIZE						
				2"	3"	4"	6"	8"	10"	12"
*1	PALLET ASSEMBLY	LOW SET.	ALUM.	06-11485-101	06-11485-201	06-11485-001	06-11485-601	06-11485-701	06-11485-801	06-11485-901
		HIGH SET.	ALUM.	06-11486-101	06-11486-201	06-11486-301	06-11486-401	06-11486-501	06-11486-601	06-11486-701
		LOW SET.	316 SST.	06-11485-106	06-11485-206	06-11485-006	06-11485-606	06-11485-706	06-11485-806	06-11485-906
		HIGH SET.	316 SST.	06-11486-106	06-11486-206	06-11486-306	06-11486-406	06-11486-506	06-11486-606	06-11486-706
*2	SEAT RING	ALL	ALUM.	02-10438-001	02-10251-001	02-05464-001	02-05478-001	02-05482-001	02-05487-001	02-05499-001
		ALL	316 SST.	02-10438-006	02-10251-006	02-05464-006	02-05478-006	02-05482-006	02-05487-006	02-05499-006
3	PALLET INSERT	ALL	TEFLON	02-10361-093	02-09704-093	B12741-093	B12742-093	B12743-093	B12744-093	B13288-093
4	SCREEN	ALL	HDPE	02-11547-051	02-11547-151	02-11547-251	02-11547-351	02-11547-451	02-11547-551	02-11547-651
5	COVER & SPACER GASKET	ALL	BUNA-N	02-11380-075	02-11381-075	02-11382-075	02-11383-075	02-11384-075	02-11385-075	02-11386-075
*6	GUIDE POST	ALL	316 SST.	02-11015-106	02-11015-206	02-11432-106	B14384-106	B14384-206	B14384-506	02-11433-106
7	ORING	ALL	BUNA-N	F014-03-285	F014-03-273	F014-03-286	F014-03-287	F014-03-288	F014-03-289	F014-03-290
8	RETAINING RING	ALL	POLYPROPYLENE	02-11396	02-11397	02-11398	02-11399	02-11400	02-11401	02-11402
* FOR 'ALL WEATHER' PARTS, ADD -1 TO END OF LISTED PART NUMBERS.										

VAREC

REVISIONS

REV.	DESCRIPTION	APPROVAL/DATE
C	ECN #01-1226	S.WILLIS 8-17-01 G.SETZER 8-20-01 D.WYANT 8-20-01
D	ECN #07-1454 Revised table on pg.12.	S.WILLIS 2-12-08 <i>J. Wyant 2-29-08</i> <i>DK Sharma 2-29-08</i>

THIS PAGE IS FOR APPROVALS AND REVISION RECORDS OF THE DOCUMENT
IN THIS FOLDER. COPIES OF THIS PAGE ARE NOT TO BE DISTRIBUTED
WITH THE ASSOCIATED DOCUMENT.

EXCLUDING THIS PAGE, THIS DOCUMENT CONTAINS 18

DWN			INSTALLATION, OPERATION & MAINTENANCE MANUAL FOR 2010B/2020B/3500B SERIES PRESSURE OR VACUUM RELIEF VALVES		
CHK					
APPR					
APPR					
APPR					
APPR			SIZE		REV.
APPR			A	33-11516	D

HDPE Pipe and Valves



Lee Supply Co., Inc
Charleroi, PA
1-800-353-3747

PerformancePipe.com

DRISCOPLEX® 4000 (DIPS) / 4100 (IPS) HDPE PIPE DATA SHEET

DriscoPlex® 4000/4100 Pipe meets or exceeds:

ASTM F714 (4" and larger) AWWA C906 NSF/ANSI 61
ASTM D3035 (up to 3") AWWA C901 NSF/ANSI 61
ASTM D3350, cell classification PE445574C
PPI TR-4 designation PE4710
NSF/ANSI 14 – Available upon request

DriscoPlex® 4000/4100 Pipe for:

Potable Water, Raw Water, Sanitary Sewer,
Reclaimed Water, Storm Drain, Treated Sewage, etc.
Iron Pipe Size OD (IPS) ¾" to 54",
Ductile Iron Pipe Size OD (DIPS) 4" to 42"
40' and 50' Joints / Solid Black / Color Striping Available
500' coils available in sizes through 6"

NOMINAL PIPE PROPERTIES ⁽¹⁾		UNIT	TEST METHOD	VALUE PE4710
Density		gms / cm ³	ASTM D1505	0.960 (black)
Melt Index (MI)	Condition 190°C / 2.16kg	gms / 10 minutes	ASTM D1238	0.08
Hydrostatic Design Basis	73° F (23° C)	psi	ASTM D2837	1600
Hydrostatic Design Basis	140° F (60° C)	psi	ASTM D2837	1000
Color: UV Stabilizer [C]		—	ASTM D3350	Min 2% Carbon Black
NOMINAL MATERIAL PROPERTIES ⁽¹⁾⁽²⁾		UNIT	TEST METHOD	VALUE PE4710
Flexural Modulus		psi	ASTM D790	>120,000
2% Secant – 16:1 span: depth. 0.5 in / min.				
Tensile Strength at Yield		psi	ASTM D638 Type IV	>3500
Elongation at Break		%	ASTM D638	>800
2 in / min., Type IV Bar				
Elastic Modulus		psi	ASTM D638	>175,000
Hardness		Shore D	ASTM D2240	62
PENT		hrs	ASTM F1473	>500
Vicat Softening Temperature		°F	ASTM D1525	256
Brittleness Temperature		°F	ASTM D746	< -103
Thermal Expansion		in / in / °F	ASTM D696	1.0 x 10 ⁻⁴

1. This is not a product specification and does not guarantee or establish specific minimum or maximum values or manufacturing tolerance for material or piping products to be supplied.
2. Values obtained from tests of specimens taken from piping product may vary from these typical values.

When Performance Matters Rely on
Performance Pipe

Bulletin: PP101 / January 2011

© 2009 Chevron Phillips Chemical Company LP

Performance Pipe, a division of Chevron Phillips Chemical Company LP | 5085 W. Park Blvd | Suite 500 | Plano, TX 75093 | Phone: 800-527-0662 | Fax: 972-599-7348

This data sheet provides typical properties for Performance Pipe piping products. Before using this product, the user is advised and cautioned to make their own determination and assessment of the safety and suitability of the product for the specific use in question and is further advised against relying on the information contained herein as it may relate to any specific use or application. It is the ultimate responsibility of the user to ensure that the product is suited and the information is application to the user's specific application. Chevron Phillips Chemical Company LP does not make, and expressly disclaims, all warranties, including warranties of merchantability or fitness for a particular purpose, regardless of whether oral or written, express or implied, allegedly arising from any usage of any trade or from any course of dealing in connection with the use of information contained herein or the product itself. The user expressly assumes all risk and liability, whether based in contract, tort or otherwise, in connection with the use of the information contained herein or the product itself. Further, information contained herein is given without reference to any intellectual property issues, as well as federal, state or local laws which may be encountered in the use thereof. Such questions should be investigated by the user. The data sheet may change periodically. Visit www.PerformancePipe.com for the most current data sheet.

Lee Supply Co., Inc
Charlertoi, PA
1-800-353-3747



Revised 08-02-2012
PE4710 (PE3408)

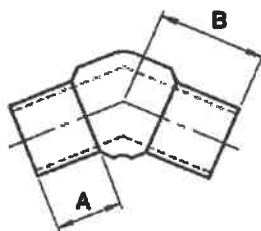
IPS Size and Dimension Data

DriscoPlex® Municipal & Industrial & Energy Series/IPS Pipe Data

Pressure Ratings are calculated using 0.63 design factor for HDS at 73°F as listed in PPI TR-4 for PE 4710 materials. Temperature, Chemical, and Environmental use considerations may require use of additional design factors.

Pressure Rating		125 psi DR 17.0			100 psi DR 21.0			80 psi DR 26.0			63 psi DR 32.5		
IPS Pipe Size	Nominal OD (in)	Minimum Wall (in)	Average ID (in)	Weight (lbs/ft)	Minimum Wall (in)	Average ID (in)	Weight (lbs/ft)	Minimum Wall (in)	Average ID (in)	Weight (lbs/ft)	Minimum Wall (in)	Average ID (in)	Weight (lbs/ft)
1 1/4"	1.660												
1 1/2"	1.900												
2"	2.375	0.140	2.078	0.43									
3"	3.500	0.206	3.063	0.94									
4"	4.500	0.265	3.938	1.55	0.214	4.046	1.27						
6"	6.625	0.390	5.798	3.36	0.315	5.957	2.75	0.255	6.084	2.24	0.204	6.193	1.81
8"	8.625	0.507	7.550	5.69	0.411	7.754	4.66	0.332	7.921	3.80	0.265	8.063	3.07
10"	10.750	0.632	9.410	8.83	0.512	9.665	7.24	0.413	9.874	5.91	0.331	10.048	4.77
12"	12.750	0.750	11.160	12.43	0.607	11.463	10.19	0.490	11.711	8.31	0.382	11.919	6.71
14"	14.000	0.824	12.253	14.98	0.667	12.586	12.28	0.538	12.859	10.02	0.431	13.086	8.09
16"	16.000	0.941	14.005	19.57	0.762	14.385	16.04	0.615	14.696	13.09	0.492	14.957	10.56
18"	18.000	1.059	15.755	24.77	0.857	16.183	20.30	0.692	16.533	16.57	0.554	16.896	13.37
20"	20.000	1.176	17.507	30.58	0.962	17.982	25.07	0.769	18.370	20.45	0.615	18.696	16.50
22"	22.000	1.294	19.257	37.00	1.048	19.778	30.33	0.846	20.206	24.75	0.677	20.565	19.97
24"	24.000	1.412	21.007	44.03	1.143	21.577	36.10	0.923	22.043	29.45	0.738	22.435	23.76
26"	26.000	1.529	22.759	51.67	1.238	23.375	42.36	1.000	23.880	34.57	0.800	24.304	27.89
28"	28.000	1.647	24.508	59.93	1.333	25.174	49.13	1.077	25.717	40.09	0.862	26.173	32.34
30"	30.000	1.765	26.258	68.80	1.429	26.971	56.40	1.154	27.554	46.02	0.923	28.043	37.13
32"	32.000	1.882	28.010	78.28	1.524	28.769	64.17	1.231	29.390	52.36	0.985	29.912	42.24
34"	34.000	2.000	29.760	88.37	1.619	30.568	72.44	1.308	31.227	59.11	1.046	31.782	47.69
36"	36.000	2.118	31.510	99.07	1.714	32.366	81.21	1.385	33.064	66.27	1.108	33.651	53.46
42"	42.000	2.471	36.761	134.84	2.000	37.760	110.54	1.615	38.576	90.20	1.292	39.261	72.77
48"	48.000	2.824	42.013	176.12	2.266	43.154	144.38	1.846	44.086	117.81	1.477	44.869	95.05
54"	54.000	3.176	47.266	222.9	2.571	48.549	182.73	2.077	49.597	149.10	1.662	50.477	120.29

Pipe weights are calculated in accordance with PPI TR-7. Average inside diameter is calculated using nominal OD and Minimum wall plus 6% for use in estimating fluid flows. Actual ID will vary. When designing components to fit the pipe ID, refer to pipe dimension and tolerances in the applicable pipe manufacturing specification.



Butt 45° Elbows

PRODUCED TO ASTM D2513 & D3261
AND AWWA C901-02 & 906-99

Butt 45 Degree Ells	DR/Wall	Dimensions A x B (in)	Package Quantity	Package Weight (lbs.)	Box Quan- tity	CSA ¹	IAPMO ¹	FM		Reference Number
								150	200	
2" IPS	DR 7	2.45 x 3.20	20	20.0	20					*M020*L45D*
	DR 9			18.6						
	DR 11			15.2						
	DR 17			13.0						
3" IPS	DR 7	3.10 x 5.38	4	11.4	4					*M030*L45D*
	DR 9			10.8					x	
	DR 11 / 11.5			9.0		x ²		x		
	DR 13.5									
	DR 17									
4" IPS	DR 7	3.00 x 5.38	4	15.1	4					*M040*L45D*
	DR 9	3.00 x 4.93		9.4					x	
	DR 11 / 11.5					x ²		x		
	DR 13.5					x				
	DR 17									
6" IPS	DR 7	4.25 x 7.12	2	20.4	2					*M060*L45D*
	DR 9	4.00 x 6.38		13.3					x	
	DR 11 / 11.5					x ²	x	x		
	DR 13.5					x				
	DR 17									
8" IPS	DR 7	6.00 x 10.00	1	22.7	1					*M080*L45D*
	DR 9			17.0					x	
	DR 11					x		x		
	DR 13.5					x				
	DR 17					16.3				

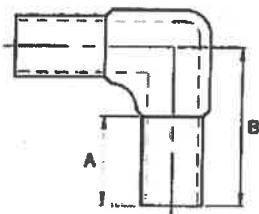
¹ - CSA and IAPMO available as DriscoPlex® 6500 MDPE materials ONLY.

² - CSA only DR11 is approved (not 11.5)

x - Indicates certification/approval for application at additional charge.

- Drawing No. CU70B257

Lee Supply Co., Inc
Charleroi, PA
1-800-353-3747



Butt 90° Elbow

PRODUCED TO ASTM D2513 & D3261
and AWWA C901-02 & C906-99

Butt 90 Degree Elbs	DR/Wall	Dimensions A x B (In)	Package Quantity	Package Weight (lbs.)	Box Quantity	CSA ¹	IAPMO ¹	FM		Reference Number
								150	200	
1/2" CTS	0.090 wall	1.69 x 1.79	10	0.4	100					*M.50*L90D*
3/4" CTS	0.090 wall	1.72 x 2.94	10	0.8	50					*M.75*L90D*
1" CTS	0.102 wall 0.125 wall	1.69 x 2.94	10	0.9	50					*M010*L90D*
3/4" IPS	DR 11	1.72 x 2.94	10	0.9	50	x				*M.75*L90D*
1" IPS	DR 9 DR 11	1.72 x 3.06	10	1.3	50	x	x			*M010*L90D*
1 1/4" IPS	DR 9 DR 10 DR 11	2.50 x 3.88 3.13 x 4.50	10	3.2	20	x x				*M1.25*L90D*
1 1/2" IPS	DR 9 DR 11	3.00 x 4.50	10	5.0	10	x				*M1.50*L90D*
2" IPS	DR 7 DR 9 DR 11 DR 17	2.88 x 5.06	10	10.8 9.3 7.6 7.6	10	x x x x	x x x x	x x x x		*M020*L90D*
3" IPS	DR 7 DR 9 DR 11 / 11.5 DR 13.5 DR 17	3.00 x 6.00 3.00 x 5.63	4	11.7 7.3	4	x ² x	x x x x	x x x x		*M030*L90D*
4" IPS	DR 7 DR 9 DR 11 / 11.5 DR 13.5 DR 17	3.00 x 6.00 3.00 x 6.75	4	16.2 16.3	4	x ² x	x x x x	x x x x		*M040*L90D*
6" IPS	DR 7 DR 9 DR 11 / 11.5 DR 13.5 DR 17	4.25 x 8.63 4.00 x 8.25	2	27.2 26.8 17.3 16.6	2	x ² x	x x x x	x x x x		*M060*L90D*
8" IPS	DR 7 DR 9 DR 11 DR 13.5 DR 17	6.00 x 11.81	1	26.5 20.2		x x	x x	x x		*M080*L90D*

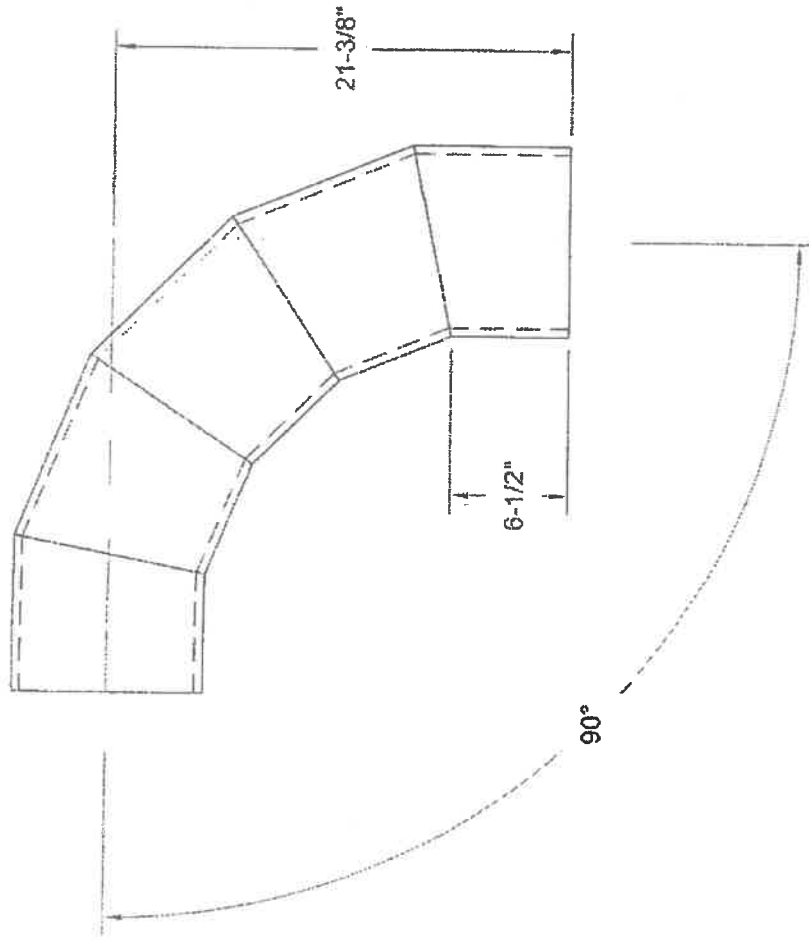
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² - CSA only DR11 is approved (not 11.5)

x - Indicates certification/approval for appropriate application at additional charge.

- Drawing No. CU70B247 for 1/2" CTS thru 1" IPS & CU70B255 for 1-1/4" IPS thru 8" IPS

Lee Supply Co., Inc
Charleroi, PA
1-800-353-3747



10" HDPE DR17 90°

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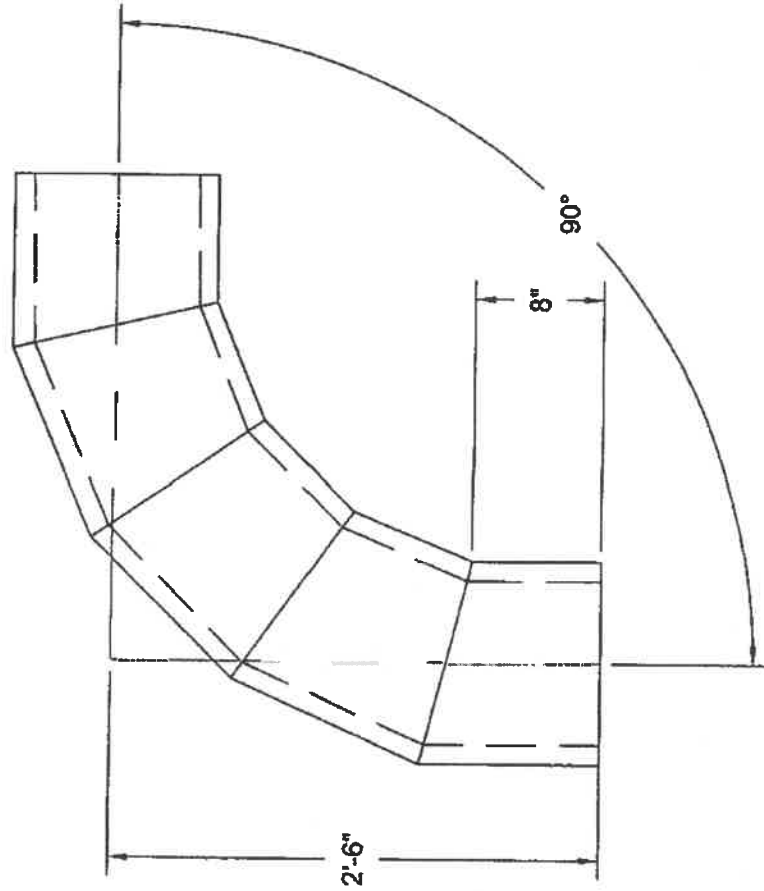
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LEE
SUPPLY CO. INC.

1-800-353-3747

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DRAWN BY:	APRIL 2, 2012
DATE:	
APPROVED BY:	
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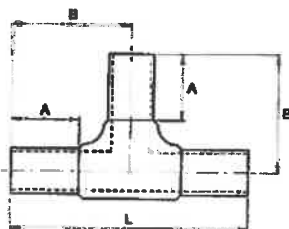
12" HDPE DR 1790°

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CUSTOMER:
DRAWN BY: MATTHEW
DATE: JUNE 25, 2012
APPROVED BY:
REVISIONS:



BUTT TEE

PRODUCED TO ASTM D2513 & D3261
and AWWA C901-02 & C906-99

Molded Butt Tee	DR/Wall	Dimensions A x B x L (in)	Package Quantity	Package Weight (lbs.)	Box Quantity	CSA ¹	IAPMO ¹	FM 150	FM 200	Reference Number
1/2" CTS	0.090 wall	1.69 x 2.83 x 5.65	10	0.6	100	x				*M.50*TSTR*
3/4" CTS	0.090 wall	1.72 x 2.94 x 5.88	10	1.1	50					*M.75*TSTR*
1" CTS	0.102 wall	1.72 x 2.94 x 5.88	10	1.3	50					*M010*TSTR*
	0.125 wall				50					
1/2" IPS	DR 9.3	1.72 x 2.94 x 5.88	10	.8	50					*M.50*TSTR*
3/4" IPS	DR 11	1.72 x 2.94 x 5.88	10	1.2	50	x				*M.75*TSTR*
1" IPS	DR 9	1.72 x 3.06 x 6.12	10	1.8	50					*M010*TSTR*
	DR 11				50	x				
1 1/4" IPS	DR 9	2.50 x 3.90 x 7.80	10	4.4	10					*M1.25*TSTR*
	DR 10	2.75 x 4.53 x 9.25	10	5.2	10	x				
	DR 11				10	x				
1 1/2" IPS	DR 11	3.02 x 4.62 x 9.24	10	6.6	10	x	x			*M1.50*TSTR*
	DR 9				10					
2" IPS	DR 7	2.88 x 5.125 x 10.25	10	14.0	10					*M020*TSTR*
	DR 9		10	11.8	10				x	
	DR 11		10	10.0	10	x	x	x		
	DR 17		10	10.0	10					
3" IPS	DR 7	3.00 x 6.06 x 12.13	4	15.3	4					*M030*TSTR*
	DR 9		4	14.9	4				x	
	DR 11 /	3.00 x 5.72 x 11.44	4	10.4	4	x ²	x	x		
	DR 13.5				4	x				
	DR 17				4					
4" IPS	DR 7	3.00 x 6.22 x 12.44	4	23.0	4					*M040*TSTR*
	DR 9		4	22.0	4				x	
	DR 11 /	3.00 x 6.75 x 13.50	4	21.0	4	x ²	x	x		
	DR 13.5		4	20.0	4	x				
	DR 17		4	19.9	4					
6" IPS	DR 7	4.25 x 8.63 x 17.25	1	16.7	1					*M060*TSTR*
	DR 9				1				x	
	DR 11 /	4.06 x 8.31 x 16.82	1	11.6	1	x ²	x	x		
	DR 13.5				1	x				
	DR 17				1					
8" IPS	DR 7	6.00 x 12.09 x 24.18	1	37.6	1					*M080*TSTR*
	DR 9		1	36.6	1				x	
	DR 11		1	27.5	1	x		x		
	DR 13.5		1	26.3	1	x				
	DR 17				1					

¹ - CSA and IAPMO available as DriscoPlex® 6500 MDPE materials ONLY.

² - CSA only DR11 is approved (not 11.5)

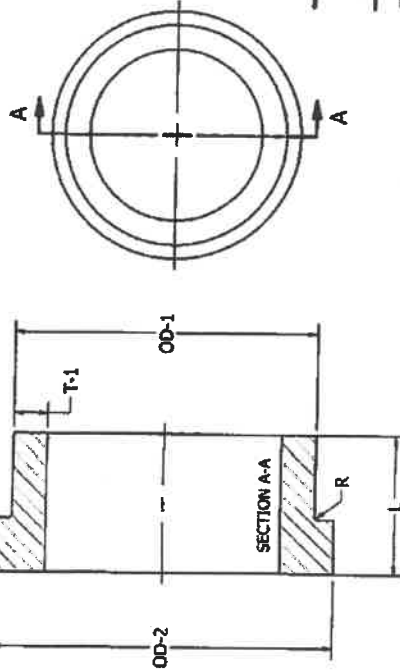
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- Drawing No. CU70B246 for 1/2" CTS thru 1" IPS & CU70B256 for 1-1/4" IPS thru 8" IPS

Lee Supply Co., Inc
Charleroi, PA
1-800-353-3747

Material: PE 4710

Wall Thickness and Hub Height (2" - 16")												
Size	SDR's											
	7	9	11	13.5	15.5	17	19	21	26	32.5	37.5	41
	T-1	T-2	T-1	T-2	T-1	T-2	T-1	T-2	T-1	T-2	T-1	T-2
2	0.339	0.450	0.264	0.400	0.217	0.402	0.138	0.402				
3	0.500	0.600	0.389	0.598	0.319	0.598	0.205	0.598				
4	0.642	1.000	0.500	0.800	0.409	0.800	0.264	0.800				
6	0.945	1.200	0.736	0.920	0.602	0.799	0.390	0.799				
8	1.232	1.598	0.958	1.200	0.783	0.799	0.508	0.799				
10	1.535	1.900	1.194	1.490	0.976	1.299	0.634	0.902				
12	1.823	2.299	1.417	1.770	1.157	1.500	0.752	1.000				
14	2.000	2.598	1.556	1.950	1.272	1.701	0.823	1.098				
16	2.287	3.000	1.778	2.220	1.453	1.902	0.941	1.201				



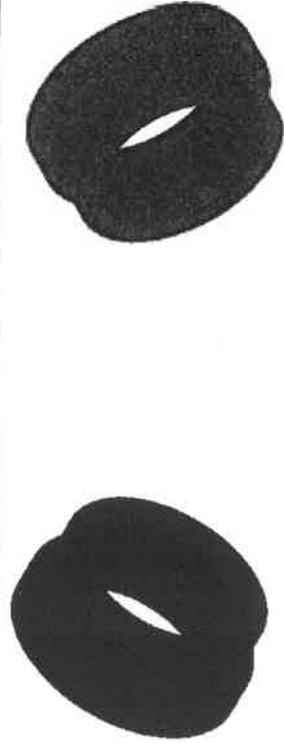
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Charlertoi, PA
1-800-353-3747

Range Adapter Dimensions					
Size	Type	OD-1	OD-2	L	R
2	IPS	2.375	4.000	5.984	0.354
3	IPS	3.500	5.000	5.984	0.354
4	IPS	4.500	6.598	5.984	0.433
6	IPS	6.625	8.500	7.992	0.433
8	IPS	8.625	10.598	9.016	0.433
10	IPS	10.750	12.799	11.000	0.433
12	IPS	12.750	15.252	11.000	0.433
14	IPS	14.000	17.500	11.000	0.433
16	IPS	16.000	20.000	12.000	0.433
18	IPS	18.000	21.098	12.000	0.500
20	IPS	20.000	23.500	12.000	0.500
22	IPS	22.000	25.600	12.000	0.500
24	IPS	24.000	27.900	14.000	0.500
26	IPS	26.000	29.750	14.000	0.500
28	IPS	28.000	32.000	14.000	0.500
30	IPS	30.000	34.000	14.000	0.500
32	IPS	32.000	36.125	14.000	0.500
34	IPS	34.000	38.125	14.000	0.500
36	IPS	36.000	40.500	14.000*	0.500
42	IPS	42.000	47.125	21.000	0.500
48	IPS	48.000	53.500	21.000	0.500
54	IPS	54.000	59.625	21.000	0.500
63	IPS	63.000	66.790	21.000	0.500

*Length is 16.500" for 36" SDR8 only.

Wall Thickness and Hub Height (18" - 63")

SDR's												
Size	7	9	11	13.5	15.5	17	19	21	26	32.5	37.5	41
	T-1	T-2	T-1	T-2	T-1	T-2	T-1	T-2	T-1	T-2	T-1	T-2
18	2.571	3.858	2.000	2.500	1.638	2.100	1.333	2.100	1.161	2.100	1.059	1.400
20	2.857	3.690	2.222	3.490	1.819	2.300	1.481	2.300	1.290	2.300	1.177	1.500
22	3.143	3.920	2.444	3.920	2.000	2.500	1.630	2.500	1.419	2.500	1.295	1.600
24	3.429	4.360	2.667	4.360	2.181	2.900	1.778	2.900	1.548	2.900	1.413	1.800
26	3.714	4.643	2.889	4.643	2.364	2.955	1.976	2.955	1.677	2.955	1.529	1.955
28			3.111	5.000	2.545	3.182	2.074	3.182	1.806	3.182	1.647	2.074
30			3.333	5.357	2.727	3.409	2.222	3.409	1.935	3.409	1.765	2.222
32			3.556	5.714	2.909	3.636	2.370	3.636	2.065	3.636	1.882	2.370
34			3.778	6.071	3.091	3.864	2.519	3.864	2.194	3.864	2.000	2.519
36			4.000	6.429	3.273	4.091	2.667	4.091	2.323	4.091	2.118	2.667
42					3.818	4.773	3.111	4.773	2.710	4.773	2.471	3.111
48					4.364	5.455	3.556	5.455	3.097	5.455	2.824	3.556
54									3.571	3.553	2.077	3.553
63									3.000	4.145	2.423	4.145



Notes:
1" - 24" meet requirements of ASTM D2513, Certified to NSF / ANSI 61*
2" - 48" meet requirements of ASTM D2513
4" - 63" meet requirements of AWWA C900
NSF / ANSI certification obtained on IPSR plant

DRAWN: Malt Graft 5/19/2011
ENG: Ellis Clark 9/1/2011
QA: Agil Nasir 5/19/2011
WFO: Duncan Schlicht 9/1/2011

PPIMPROVED
PIPING PRODUCTS, INC.

IPS Flange Adapter Submittal

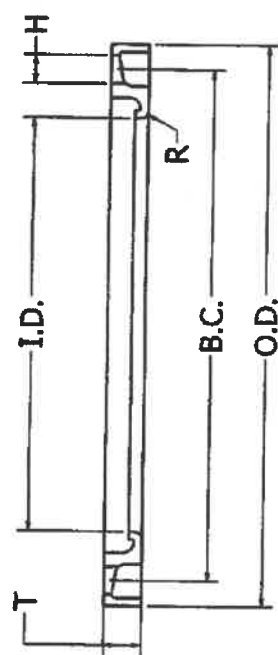
Ongoing engineering design efforts may affect the technical information listed in our publications.

SIZE PART NO: C IPS Flange Adapter Submittal
SCALE: 1" = 1'-0"
REV 3 SHEET 1 OF 1

REV	REVISION HISTORY	DATE
1	VALID	07/29/11
2	ADD 42" SDR11	09/07/11
3	ADD 20", 22", 24" SDR7	10/14/11

Page 1 of 2

Lee Supply Co., Inc
Charleroi, PA
1-800-353-3747



Notes
Finish: Red oxide primed, Hot dip galvanized or Epoxy coated Plate with all 150 lb flanges, ANSI B16.5, B16.47, B16.1, API 6A 2007

2 IMPROVED
PIPING PRODUCTS INC.

UP-SDR Convuluted Flange / Backup Ring

UNLESS OTHERWISE NOTED, ALL DIMENSIONS IN INCHES	SIZE PART NO	SALES NO
	C	BUP-SDR submittal
	SCALE	

Ongoing engineering design efforts may affect the technical information listed in our publications.

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BADEN STEELBAR & BOLT CORP.

852 Big Sewickley Creek Road, Sewickley, PA 15143

(724) 266-3003

FAX (724) 266-1619

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STUDS - LOW CARBON COMMERCIAL GRADE STEEL

WITH BARE ENDS

HEX BOLTS - GRADE 2

HEX NUTS - GRADE 2

FLAT WASHERS - GRADE 2

LOCK WASHERS - GRADE 2

LEE SUPPLY CO., INC.
P. O. BOX #35
CHARLEROI, PA 15022

Mark Holzbach

PRODUCT INFO

BILTRITE

Neoprene Blended Sheet

Style 10 Smooth Finish

Style	Thickness Inches	Width Inches	Durometer Hardness Shore A ±5	Tensile	Elongation	Temperature	Wt. Per Lin. Foot 36"	Finish	Specifications
10	1/16 thru 1	36 & 48	40	800	350	-20°F to +170°F	1/8-2.5	Smooth	ASTM D-2000 SAE J200, 1BC 408Z1* MIL R-3065, SC 408Z1*
10	1/16 thru 2	36 & 48	50	800	300	-20°F to +170°F	1/8-2.6	Smooth	ASTM D-2000 SAE J200, 1BC 508 MIL R-3065, SC 508
10	1/32 thru 2	36 & 48	60	900	300	-20°F to +170°F	1/8-2.7	Smooth	ASTM D-2000 SAE J200, 1BC 609 MIL R-3065, SC 609
	1/16, 1/8, 1/4	72							
10	1/16 thru 2	36 & 48	70	1000	200	-20°F to +170°F	1/8-2.7	Smooth	ASTM D-2000 SAE J200, 1BC 710 MIL R-3065, SC 710
10	1/16 thru 2	36 & 48	80	1000	100	-20°F to +170°F	1/8-2.9	Smooth	ASTM D-2000 SAE J-200, 1BC 810 MIL R-3065, SC 810

* Z1 Elongation 350%

LEE SUPPLY CO., INC.
P. O. BOX #35
CHARLEROI, PA 15022

IPEX /FRIATEC Couplings

Revised: 07/29/05

T.P. McCarthy

Types, Sizes, & Ratings:

1. ½"CTS – 20" IPS couplings: 145 psig Gas and 232 psig Water (SDR-11)
2. 22" IPS coupling: 130 psig Water (SDR-17)
3. 24" IPS coupling: 150 psig Water (SDR-13.5)
4. 28" IPS coupling: 130 psig Water (SDR-17)
5. 4" DIP coupling: 150 psig Water (SDR-13.5)
6. 6" – 16" DIP couplings: 145 psig Gas & 232 psig Water (SRD-11)
7. 18" & 20" DIP couplings: 150 psig Water (SDR-13.5)
8. LOW PRESSURE "Thin-wall" Coupling: 8,10,12,15,and 16". (SDR-11-32)
Designed for Low Pressure Water and Gravity Sewer applications up to 80 psig Water.
The LOW PRESSURE coupling line is not rated for use on gas systems.)

Advantages of IPEX / FRIATEC Couplings

1. Fully Compatible with ALL HDPE and MDPE piping, SDR 9 through 17.6 (Melt Index's 003 – 050)
2. Exposed heating element provides simultaneous transfer of heat energy to the pipe and fitting for maximum fusion efficiency. The fitting body remains cool and strong and fusion and cooling times are reduced.
3. Wide fusion zones and Engineered cold zones on each fitting to contain and optimize melt flow and fusion pressures.
4. Heavy coupling walls with long pipe insertion depths for exceptional strength and alignment. (Coupling walls up to 30% thicker than SDR 11.)
5. No Alignment Clamps Required During Installation.
6. REFUSIBLE: ALL IPEX / FRIATEC fittings may be REFUSED up to three times.
7. Bar Code Technology for easy error free installation of any bar coded fittings.

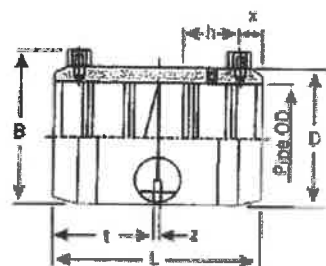
IPEX / FRIATEC "TEAM" GOALS

- Provide the Highest quality fittings at competitive prices.
- Provide continuous customer support, in the form of regular customer visits, training and qualification of customer personnel in the proper installation and operation of IPEX / FRIATEC equipment and fittings.
- Provide prompt and accurate filling and shipment of customer orders.
- Customer Technical Support VIA telephone from IPEX Engineering & Technical Staff.

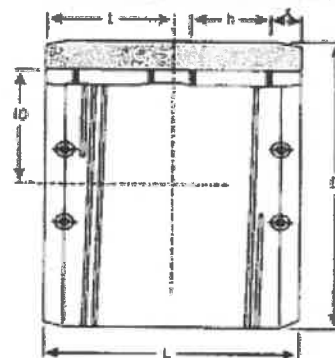
Lee Supply Co., Inc
Charleroi, PA
1-800-353-3747

1/2" CTS through 28" IPS cont'd

1/2" - 6"



8" - 28"

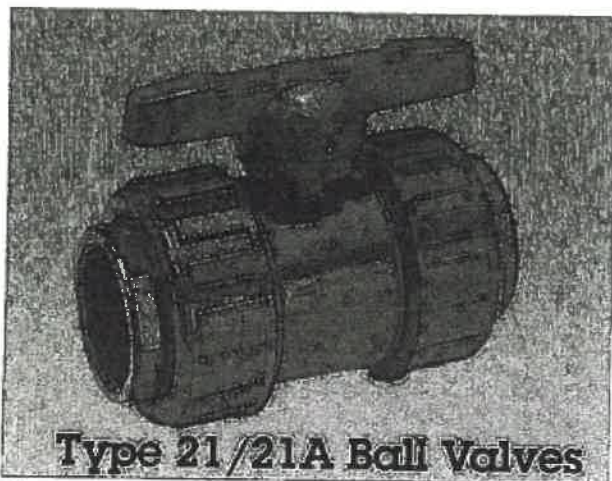


Nominal Pipe OD CTS SDR	Product Code	ID min	ID max	D	B	L	t	z	h	x	Fusion Time/Sec @ 73°F	Cooling Time/Min * / ** / ***	
1/2"	11	128031	0.622	0.634	1.102	1.732	2.283	1.142	0.079	0.591	0.23	27	05/08/10
1"	11	128027	1.122	1.134	1.654	2.244	3.071	1.535	0.079	0.787	0.31	28	05/08/10

Nominal Pipe OD IPS SDR	Product Code	ID min	ID max	D	B	L	t	z	h	x	Fusion Time/Sec @ 73°F	Cooling Time/Min */**/***	
3/4"	11	128026	1.047	1.059	1.575	2.165	2.598	1.260	0.079	0.728	0.27	28	05/08/10
1"	11	128024	1.311	1.323	1.850	2.460	3.071	1.496	0.079	0.787	0.31	28	05/08/10
1-1/4"	11	128025	1.654	1.679	2.244	2.835	3.346	1.534	0.079	0.945	0.39	34	10/15/25
1-1/2"	11	128033	1.902	1.917	2.480	3.130	3.858	1.870	0.079	1.060	0.46	34	10/15/25
2"	11	128028	2.374	2.390	3.142	3.657	4.449	2.205	0.079	1.205	0.51	54	10/15/25
3"	11	128029	3.496	3.516	4.606	4.980	5.472	2.717	0.079	1.417	0.59	100	10/30/40
4"	11	128030	4.492	4.516	5.827	6.173	6.260	3.110	0.079	1.689	0.67	151	10/30/40
6"	11	128032	6.610	6.634	8.543	8.740	7.992	3.976	0.079	2.295	0.79	440	20/60/75
8" non-flare	11	128060	8.626	8.665	11.029	-	9.448	4.724	-	2.953	1.063	540	20/60/75
8" flare	11	128023	8.626	8.665	11.022	-	9.448	4.724	-	2.953	1.063	554 ea side	20/60/75
10"	11	128061	10.748	10.787	13.975	-	11.811	5.275	-	3.149	1.063	500 ea side	30/75/100
12"	11	128062	12.748	12.787	15.746	-	11.219	5.610	-	2.679	1.142	550 ea side	30/75/100
14"	11	128064	13.976	14.016	17.716	-	11.811	5.905	-	3.500	1.260	560 ea side	30/75/100
16"	11	128063	15.969	16.008	19.685	-	12.598	6.299	-	3.748	1.260	870/730 ea side	45/95/120
18"	11	128065	17.969	18.008	22.047	-	13.386	6.693	-	3.346	1.260	870/870 ea side	45/95/120
20"	11	128176	19.961	20.016	24.803	-	14.173	7.086	-	3.622	1.260	870/720 ea side	45/95/120
22"	17	128066	21.961	22.016	24.803	-	14.566	7.283	-	3.291	1.260	370/720 ea side	45/95/120
24"	13.5	128067	24.000	24.039	27.952	-	15.748	7.874	-	4.095	1.420	370/350 ea side	45/95/120
28"	17	128068	27.992	28.031	31.496	-	15.748	7.874	-	5.062	1.614	350/350 ea side	60/80/120

FRIATEC Safety Fittings can be fused to all PE pipes SDR range 9.33 through 17.6.

- * Pipe can be moved after indicated cooling time (handling)
- ** Pipe can be pressurized after indicated cooling time (pressure <90 psi)
- *** Pipe can be pressurized after indicated cooling time (pressure >90 psi)
- † FM 200 psi, Short Designation: MBI...OD
- ‡ NSF approved



Type 21/21A Ball Valves

Standard Features (Sizes 1/2" - 6")

- Pressure rated up to 230 psi (PVC, CPVC, PVDF)
- Double O-ring seals on stem for added protection
- Full bore, sizes 1/2" - 2"
- Full vacuum rated, all sizes
- Blocks in two directions, upstream and downstream, leaving full pressure on the opposite end of the valve
- Integrally molded ISO mounting pad for both manual and actuated operations
- Integrally molded base pad to mount valves securely or panel mounting
- PTFE seats with elastomeric backing cushions ensure bubble-tight shut-off and a low fixed torque, while at the same time compensating for wear
- True Union design for easier installation or repairs without expanding the pipe system
- Built-in spanner wrench on the handle for valve disassembly and assembly
- Two sets of end connectors (socket and threaded) included with all PVC and CPVC valves in sizes 1/2" - 2"
- CPVC threaded end connectors on sizes 1/2" - 1" come with stainless steel reinforcing rings
- New PTFE Seat design - Facilitates easier field maintenance if required
- Tapered O-ring groove - Helps to Keep the end connector O-rings on the valve body during installation
- Body Flats - Flats have been added to either side of the valve body where a wrench can be applied to prevent the valve body from turning when the Union Nuts are tightened

Options

- Pneumatic and electric actuators & accessories
- Stem extensions
- 2" square operating nut or "T" nut
- Locking and/or spring return handles
- Limit switches
- Vented ball

Specifications

Sizes: 1/2" - 6"
Models: PVC & CPVC: Socket, Threaded and Flanged (ANSI)
 PP & PVDF: IPS and Metric (DIN)
 Socket, Threaded, Butt and Flanged (ANSI)
Bodies: PVC, CPVC, PP and PVDF
Seats: PTFE backed with EPDM or FKM
Seals: EPDM or FKM or AFLAS[®]

Sizes 1/2" - 4" PVC/EPDM/FKM Models
 NSF-61 Certified

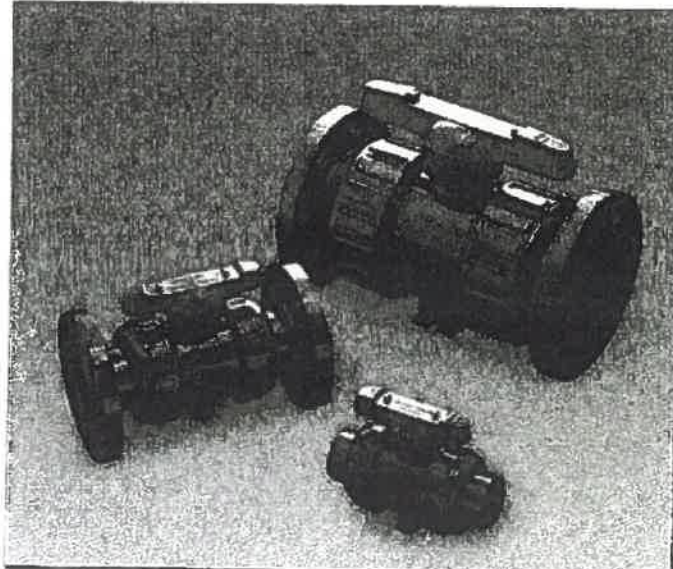
† Trademark of Asahi Glass Co., Ltd.

Parts List (Sizes 1/2" - 2")

PARTS			
NO.	DESCRIPTION	PCS.	MATERIAL
1	Body	1	PVC, CPVC, PP, PVDF
2	Ball	1	PVC, CPVC, PP, PVDF
3	Carrier	1	PVC, CPVC, PP, PVDF
4	End Connector	2	PVC, CPVC, PP, PVDF
5	Union Nut	2	PVC, CPVC, PP, PVDF
6	Stem	1	PVC, CPVC, PP, PVDF
7	Seat	2	PTFE
8	O-Ring (A)	2	EPDM, FKM, Others
9	O-Ring (B)	1	EPDM, FKM, Others
10	O-Ring (C)	2	EPDM, FKM, Others
11	O-Ring (D)	1	EPDM, FKM, Others
12	O-Ring (E)	1	EPDM, FKM, Others
13	Stop Ring*	2	PVDF
14	Handle	1	ABS
4a	Ring**	2	304 Stainless Steel

* Used for flanged and

** Used for CPVC body, threaded end, 1/2" - 1"



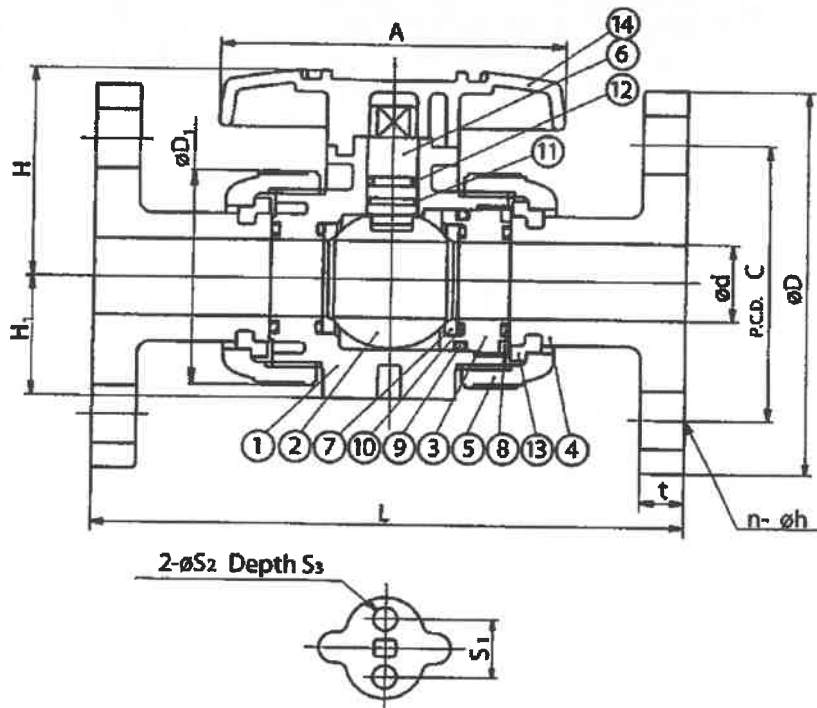
ASAHI/AMERICA

Rev. F 8-11

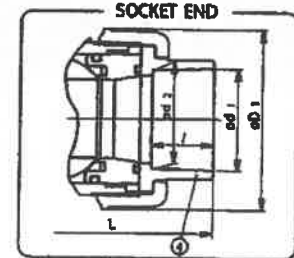
Type 21/21A

Ball Valves

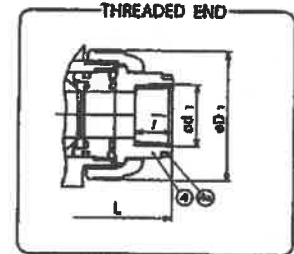
FLANGED END



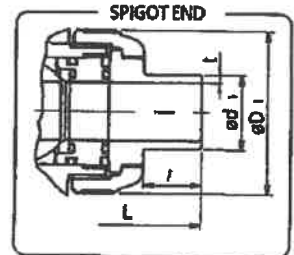
SOCKET END



THREADED END



SPIGOT END



Dimensions (Sizes 1/2" - 2")

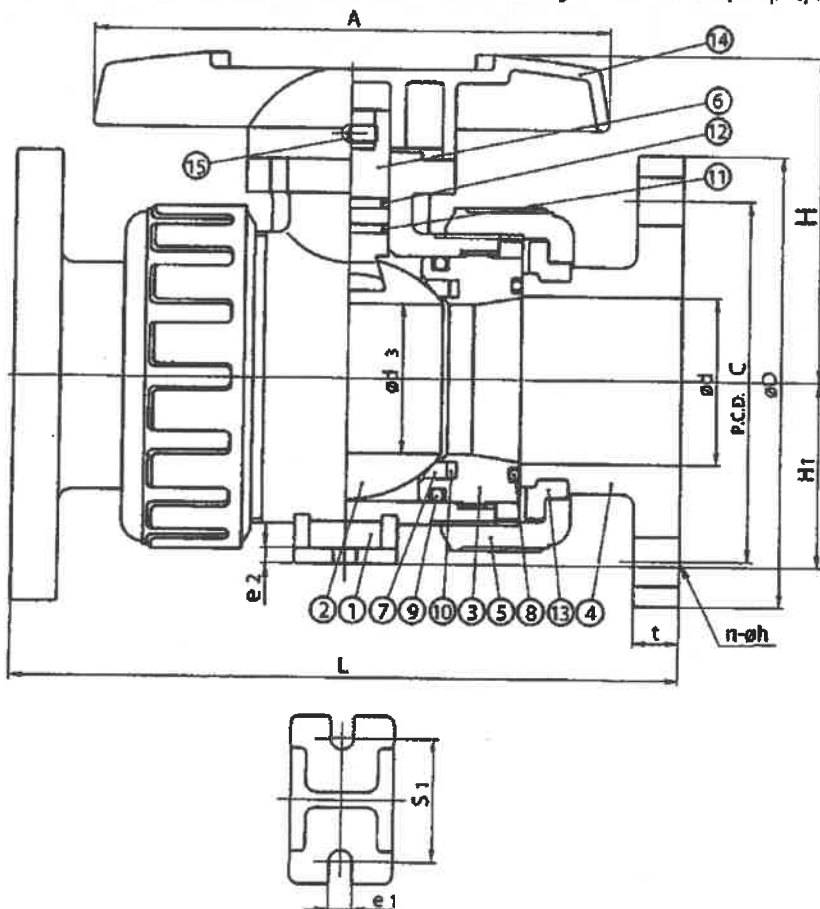
NOMINAL SIZE		d	FLANGED						SOCKET											
			ANSI CLASS 150				L	t	PVC, CPVC				PP, PVDF (DIN)				PP, PVDF (IPS)			
			D	C	n	h			d1	d2	l	L	d1	d2	/	L	d1	l	L	
INCHES	mm																			
1/2	15	0.59	3.50	2.38	4	0.62	5.63	0.47	0.848	0.836	0.875	4.45	0.768	0.760	0.57	3.90	0.83	0.87	4.45	
3/4	20	0.79	3.88	2.75	4	0.62	6.77	0.55	1.058	1.046	1.000	5.08	0.965	0.957	0.63	4.49	1.03	1.00	5.08	
1	25	0.98	4.25	3.12	4	0.62	7.36	0.55	1.325	1.310	1.125	5.75	1.240	1.232	0.71	4.84	1.30	1.13	5.75	
1 1/4	32	1.26	4.62	3.50	4	0.62	7.48	0.63	1.670	1.655	1.250	6.46	1.553	1.543	0.81	5.47	1.65	1.25	6.46	
1 1/2	40	1.57	5.00	3.88	4	0.62	8.35	0.63	1.912	1.894	1.375	7.24	1.947	1.937	0.93	5.83	1.89	1.37	7.24	
2	50	2.01	6.00	4.75	4	0.75	9.21	0.63	2.387	2.369	1.500	8.23	2.461	2.445	1.08	6.93	2.36	1.50	8.23	

NOMINAL SIZE		THREADED							SPIGOT (BUTT END)									
									PP, PVDF									
									DIN 3442									
INCHES	mm	d1	l	L	D1	H	H1	A	d1	l	t	t	L	S1	S2	S3		
1/2	15	1/2-14 NPT	0.59	4.02	1.89	2.03	1.14	3.62	0.787	0.728	0.098	0.075	4.882	0.75	0.29	0.43		
3/4	20	3/4-14 NPT	0.67	4.72	2.36	2.34	1.38	3.94	0.984	0.866	0.106	0.075	5.670	0.75	0.29	0.43		
1	25	1-11 1/2 NPT	0.79	5.16	2.76	2.68	1.54	4.33	1.260	0.886	0.118	0.094	6.063	0.75	0.29	0.43		
1 1/4	32	1 1/4-11 1/2 NPT	0.87	5.91	3.23	3.17	1.85	4.76	1.575	1.024	0.146	0.094	6.850	1.18	0.35	0.59		
1 1/2	40	1 1/2-11 1/2 NPT	0.98	6.42	3.94	3.50	2.17	5.16	1.969	1.260	0.181	0.118	7.638	1.18	0.35	0.59		
2	50	2-11 1/2 NPT	1.10	7.76	4.96	4.04	2.60	6.26	2.480	1.417	0.228	0.118	8.819	1.18	0.35	0.59		

Type 21/21A

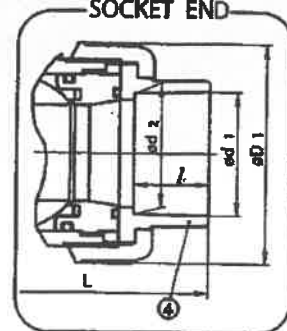
Ball Valves

FLANGED END

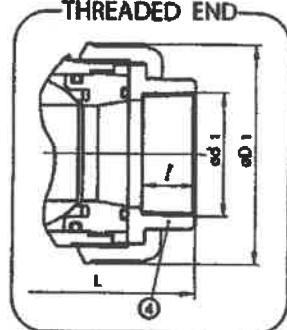


NOTE: Quantity on Nos. 3 and 9 (see p. 6) is 2.

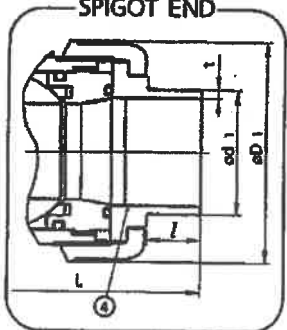
SOCKET END



THREADED END



SPIGOT END



Dimensions (Sizes 2-1/2" - 4") FOR 6" SIZE CONSULT FACTORY

NOMINAL SIZE		d	FLANGED						SOCKET												
			ANSI CLASS 150						PVC, CPVC				PP, PVDF (DIN)				PP, PVDF (IPS)				
			D	C	n	h	L	t	ASTM SCH 80			L	DIN 16962			L	d1	/	L		
d1	d2	l							d1	d2	/										
INCHES	mm	21/2	65	2.56	7	5.5	4	0.75	10.2	0.71	2.889	2.868	1.75	9.45	2.923	2.911	1.22	8.15	2.88	1.752	9.45
3	80	3.07	7.5	6	4	0.75	11.97	0.71	3.516	3.492	1.875	11.1	3.512	3.498	1.4	9.88	3.48	1.874	11.1		
4	100	3.94	9	7.5	8	0.75	14.65	0.71	4.518	4.491	2	13.9	4.293	4.278	1.63	12.2	4.48	2.252	14.37		

NOMINAL SIZE	INCHES	mm	THREADED						SPIGOT (BUTT END)									
									PP, PVDF									
									DIN 3442									
			d1	d2	d3	d4	d5	d6	d7	d8	d9	d10	d11	d12	d13	d14	d15	d16
2 1/2	65		2 1/2 - 8NPT	1.26	8.46	2.28	5.24	4.98	2.83	7.87	2.953	1.496	0.272	0.142	9.72	0.35	0.24	1.89
3	80		3 - 8NPT	1.38	10.39	2.70	5.98	5.51	3.35	9.45	3.543	1.496	0.323	0.169	11.61	0.43	0.28	2.17
4	100		4 - 8NPT	1.77	14.17	3.54	8.27	7.01	4.33	11.81	4.331	1.752	0.394	0.209	12.72	0.43	0.31	2.56

ASAHI/AMERICA

Rev. F 8-11

Type 21/21A

Ball Valves

Pressure vs. Temperature (PSI, WATER, NON-SHOCK)

NOMINAL SIZE		PVC				CPVC						PP				PVDF				
		30° F 70° F	71° F 105° F	106° F 120° F	121° F 140° F	30° F 70° F	71° F 105° F	106° F 120° F	121° F 140° F	141° F 175° F	176° F 195° F	5° F 85° F	86° F 120° F	121° F 140° F	141° F 175° F	5° F 70° F	71° F 105° F	106° F 140° F	141° F 175° F	176° F 210° F
1/2-2	15-50	230	170	150	30	230	170	150	120	75	55	150	110	90	55	230	185	150	115	85
2 1/2	65	230	170	150	NA	230	170	150	120	75	55	150	95	70	40	230	185	150	115	85
3	80	230	170	150	NA	230	170	150	85	55	40	150	95	70	40	230	185	150	100	70
4-6	100-150	150	150	150	NA	150	150	150	85	55	40	150	95	70	40	150	150	150	100	70

Sample Specification

All TYPE 21/21A Ball Valves, sizes 1/2" to 4", shall be of true union design with two-way blocking capability. All O-rings shall be EPDM or FKM with PTFE seats. PTFE seats shall have elastomeric backing cushion of the same material as the valve seals. Stem shall have double O-rings and be of blowout-proof design. The valve handle shall double as carrier removal and/or tightening tool. ISO mounting pad shall be integrally molded to valve body for actuation. PVC conforming to ASTM D1784 Cell Classification 12454-A, CPVC conforming to ASTM D1784 Cell Classification 23567-A, PP Conforming to ASTM D4101 Cell Classification PPO210B67272 and PVDF conforming to ASTM D3222 Cell Classification Type II. The ball valves, except PP, shall have a pressure rating of 230 psi for sizes 1/2" to 3" and 150 psi for 4" (150 psi for PP, all sizes) at 70° F. Type 21 Ball Valves must carry a two-year guarantee, as manufactured by Asahi/America, Inc.

Cv Values

NOMINAL SIZE		Cv
INCHES	mm	
1/2	15	14
3/4	20	29
1	25	47
1 1/4	32	72
1 1/2	40	155
2	50	190
2 1/2	65	365
3	80	410
4	100	680

Weight (POUNDS)

NOMINAL SIZE		SOCKET THREADED		FLANGED
INCHES	mm			
1/2	15	0.44		1.10
3/4	20	0.66		1.54
1	25	1.10		2.70
1 1/4	32	1.54		3.30
1 1/2	40	2.64		4.40
2	50	4.40		8.15
2 1/2	65	6.17		8.80
3	80	9.70		13.00
4	100	24.00		26.67

Caution

- Never remove valve from pipeline under pressure.
- Always wear protective gloves and goggles.
- Watch out for trapped fluid in valve. It is safe to close valve before removing it from the pipeline.

Caution

- Do not use ball valves where media has suspended particles. Use the following valves:
Butterfly Valves - PVDF disc is most abrasion resistant and make sure of chemical compatibility.
Diaphragm Valves - Elastomeric diaphragm is designed for handling suspended particles.
- Volatile fluids such as sodium hypochlorite (NaClO) and hydrogen peroxide (H₂O₂) could be trapped and gasified within the valve. We can provide you with a Type 21 ball valve with a *vented ball* to relieve pressure build-up inside the valve.

Troubleshooting

What if the fluid still flows when valve is closed?

1. Carrier is not properly tightened. Tighten it.
2. PTFE seat is damaged or worn. Replace seat.
3. Foreign material is caught between ball and PTFE seat. Remove material and clean.
4. Ball is damaged or worn. Change ball.

What if fluid leaks outside of valve?

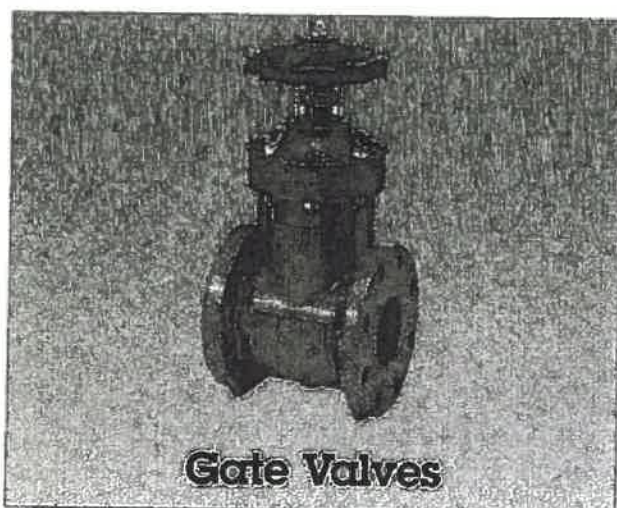
1. Union nut not properly tightened. Retighten.
2. Carrier is not properly tightened. Thread it in firmly.
3. Carrier or face O-ring is damaged, worn, or missing. Replace O-ring.

What if handle does not rotate smoothly?

1. Foreign material has formed on the ball or seat. Clean both.
2. Internal part(s) chemically attacked or swollen. Refer to Asahi/America Chemical Resistance Chart for compatibility. Replace part(s) as required.
3. Carrier over-tightened. Retighten properly.

What if handle rotates too freely?

1. Stem is damaged. Replace stem.
2. Handle is not engaged with stem. Disassemble and reengage. Inspect.
3. Engaging part of stem and/or ball is damaged. Change stem and/or ball.



Gate Valves

Standard Features (Sizes 1-1/2" - 14")

- Straight-through flow with minimal pressure drop
- Unique sliding cylindrical plug design provides larger seating area than conventional gate valves
- Made of durable, corrosion resistant plastic
- No metal to media contact anywhere in valve
- Clean-out (drain) plug in bottom area of valve body
- Rated for full vacuum service
- Light weight for easier and economical installation
- Positive bubble-tight shut-off
- Visual position indicator

Options

- 2" square operating nut
- Stem extensions
- Locking handles
- Electric actuation, up to 3"
- FKM seals

Lee Supply Co., Inc
Charleroi, PA
1-800-353-3747

Caution

- Never remove valve from pipeline under pressure.
- Always wear protective gloves and goggles.

Specifications

Sizes: 1-1/2" - 14"
 Body: High Impact PVC
 Models: Flanged (ANSI)

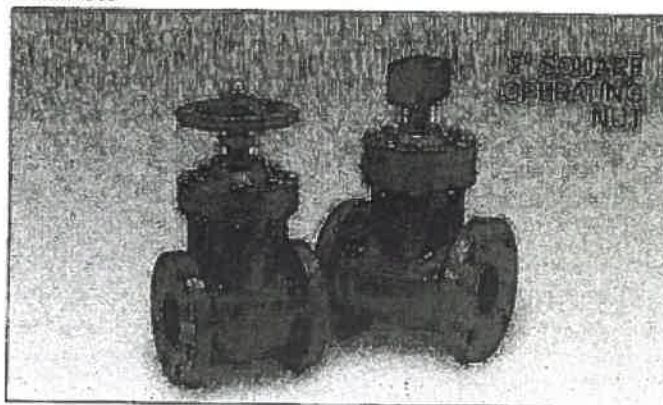
Types/Sizes: "P" Type: PP, 1-1/2" - 14"
 Seals: EPDM, FKM(Optional)

Sizes 1 1/2" - 14" PVC/PP/EPDM/FKM
 NSF-61 Certified

Type P Parts (Sizes 1-1/2" - 6")

PARTS			
NO.	DESCRIPTION	PCS.	MATERIAL
1	Body	1	HI-PVC
2	Gate (Plug)	1	PP
3	Stem	1	HI-PVC
4	Bonnet (A)	1	HI-PVC
5	Bonnet (B)*	1	HI-PVC
6	Thrust Bearing	1 Set	PP
7	Bolt, Nut, Washer	-	Stainless Steel 304
8	Hand Wheel	1	PP
9	Indicating Cover	1	PC
10	Indicating Ring	1	PVC
11	Guide Pin	1	Stainless Steel 304
12	Guide Pin Holder	1	PVC
13	Gasket	1	EPDM
14	O-Ring (A)	1	EPDM
15	Washer	1	PVC
16	Nut	1	Stainless Steel 304
17	O-Ring (B)	1	EPDM, FKM
18	O-Ring (C)	2	EPDM, FKM
23	Sheet Gasket	1	EPDM, FKM
24	Plug	1	PVC

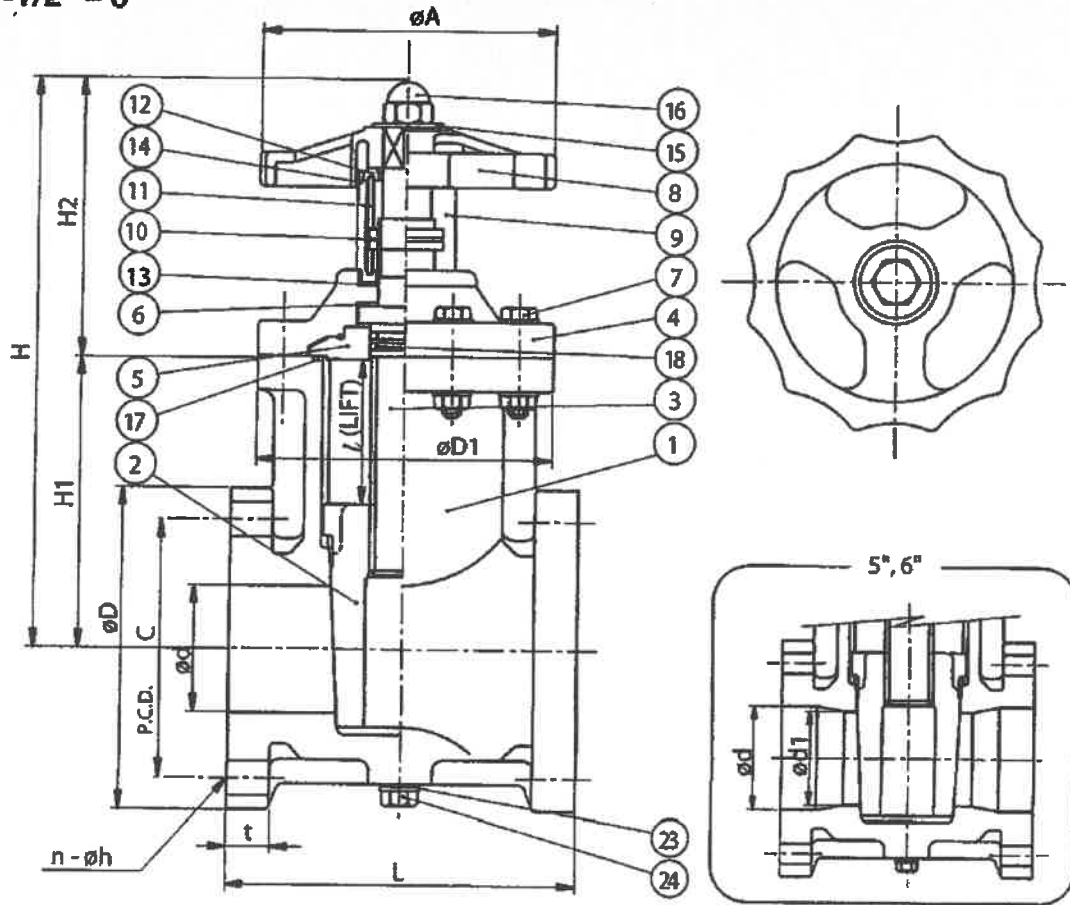
* Stem holder



Type P

Gate Valves

Sizes 1-1/2" - 6"



Troubleshooting

What if fluid still flows when fully closed?

1. Body or plug is worn or damaged. Replace.
2. Seat is worn or damaged. Replace.
3. Foreign material caught at the bottom of body. Needs cleaning.

What if handle does not engage with stem?

1. Stem damaged or broken. Change stem.

2. Engaging part of stem and/or plug damaged or broken. Need to replace stem and/or plug.

What if there are leaks between bonnet and body?

1. Bolts are not tightened properly. Tighten diagonally and evenly.
2. O-ring between body and bonnet damaged or worn. Change O-ring.

Dimensions (Sizes 1-1/2" - 6")

NOMINAL SIZE		ANSI CLASS 150														
INCHES	mm	d	d1	D	C	n	h	L	t	D1	A	L	H1	H2	H	
1 1/2	40	1.57	-	5.00	3.88	4	0.62	6.50	0.87	4.72	4.72	1.93	4.21	5.20	9.41	
2	50	1.97	-	6.00	4.75	4	0.75	7.01	0.91	5.12	5.12	2.36	5.28	5.35	10.63	
2 1/2	65	2.56	-	7.00	5.50	4	0.75	7.48	0.94	6.10	6.10	2.95	5.98	5.91	11.89	
3	80	2.95	-	7.50	6.00	4	0.75	7.99	0.98	6.69	6.69	3.35	6.69	6.10	12.79	
4	100	3.94	-	9.00	7.50	8	0.75	9.02	1.06	7.68	7.68	4.33	8.15	6.42	14.57	
5	125	4.92	4.33	10.00	8.50	8	0.88	10.24	1.06	9.25	9.25	4.61	8.94	7.09	16.03	
6	150	5.91	5.12	11.00	9.50	8	0.88	10.51	1.06	10.63	10.63	5.43	10.35	7.17	17.52	

Lee Supply Co., Inc
Charleroi, PA
1-800-353-3747

Pressure vs. Temp.
(PSI, WATER, NON-SHOCK)

NOMINAL SIZE		30° F 120° F
INCHES	mm	
1 1/2 - 8	40-200	150
10	250	110
12-14	300-350	75

ASAHI/AMERICA

Rev. F 8-11

Gate Valves

Type P

Type P Parts (Sizes 8" - 14")

PARTS			
NO.	DESCRIPTION	PCS.	MATERIAL
1	Body	1	HI-PVC
2	Gate (Plug)	1	PP
3	Stem	1	HI-PVC
4	Bonnet (A)	1	HI-PVC
4a	Bush (A)	1	PP
4b	Knock Pin (A)	1	PP
5	Bonnet (B)*	1	HI-PVC
5a	Bush (B)	1	PP
5b	Knock Pin (B)	1	PP
6	Thrust Bearing	1 Set	High Carbon Chromium
7	Bolt, Nut, Washer	-	Stainless Steel 304
8	Hand Wheel	1	PP
9	Indicating Cover	1	PC
10	Indicating Ring	1	PVC
11	Guide Pin	1	Stainless Steel 304
12	Guide Pin Holder	1	PVC
13	Gasket	1	EPDM
14	O-Ring (A)	1	EPDM
15	Washer	1	PVC
16	Nut	1	Stainless Steel 304
17	Screw	1	Stainless Steel 304
18	O-Ring (B)	1	EPDM FKM
19	O-Ring (C)	3	EPDM FKM
20	O-Ring (D)	1	EPDM FKM
21	O-Ring (E)	1	EPDM FKM
22	O-Ring (F)	1	EPDM FKM
23	Sheet Gasket	1	EPDM FKM
24	Plug	1	PVC
1a	Body Metal Inserts**	-	Copper Alloy

* Stem holder

** 8" and 12" sizes: 4 inserts; 14" size: 8 inserts

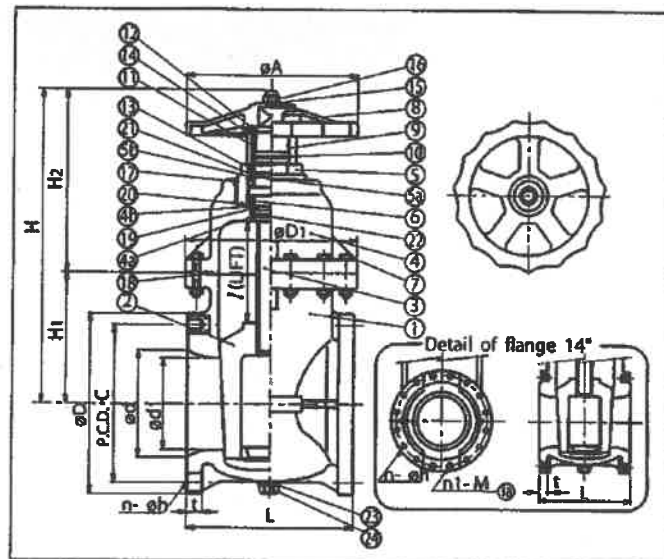
Sample Specification

All Gate Valves shall be constructed of High Impact PVC and have no metal-to-media contact. The gate shall be a tapered cylindrical plug design PVC shall conform to ASTM D1784 Cell Classification 12454-A, & PP to ASTM D4101 Cell Classification PP0210B67272. Valves shall have a pressure rating of 150 psi at 70 degrees F sizes 1-1/2" through 8", 110 psi at 70 degrees F size 10", and

Dimensions (Sizes: 8" - 14")

NOMINAL SIZE		ANSI CLASS 150										1-800-353-3747				
INCHES	mm	d	d1	D	C	n	h	n1 - M	L	t	D1	A	l	H1	H2	H
8	200	7.72	6.61	13.50	11.75	6	0.88	2 - 3/4 UNC	11.50	1.10	12.20	12.20	7.09	9.45	13.27	22.72
10	250	9.72	8.27	16.00	14.25	12	0.98	-	14.96	1.18	14.17	14.17	8.90	10.63	16.54	27.17
12	300	11.73	10.04	19.00	17.00	10	0.98	2 - 7/8 UNC	15.75	1.22	16.14	16.14	10.75	12.60	18.90	31.50
14	350	13.70	11.69	21.00	18.75	8	1.14	4 - 1 UNC	16.93	1.26	17.32	17.91	12.56	12.20	23.62	35.83

Sizes: 8" - 14"



Cv Values

NOMINAL SIZE		Cv
INCHES	mm	
1 1/2	40	130
2	50	180
2 1/2	65	415
3	80	470
4	100	690
5	125	1000
6	150	1400
8	200	2900
10	250	3700
12	300	5200
14	350	7000

Weight (POUNDS)

NOMINAL SIZE		FLANGED
INCHES	mm	
1 1/2	40	7.50
2	50	10.20
2 1/2	65	13.00
3	80	16.60
4	100	22.00
5	125	29.00
6	150	42.00
8	200	68.50
10	250	95.00
12	300	150.00
14	350	188.00

75 psi at 70 degrees F sizes 12" and 14". The valve shall have a non-rising stem, come standard with sealed position indicator, clean-out plug and EPDM or FKM seals as manufactured by Asahi/America Inc.

Lee Supply Co., Inc
Charleroi, PA

AERTEC® Aeration Technologies Inc. AERGRID™/AERSPARGE™ Aeration System

**AERGRID™/AERSPARGE™
AERATION SYSTEM**

**INSTALLATION, OPERATION AND
MAINTENANCE MANUAL
FOR
LORAIN COUNTY LANDFILL,
OBERLIN, OH**

August 26, 2012

FACTORY AUTHORIZED SERVICE:
Susan Goodhue, Project Manager
Aertec
3 Commercial Lane, Unit F
Londonderry, NH 03053

TEL: (603) 434-3539
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1.0 GENERAL

The AERGRID™/AERSPARGE™ Aeration System has been designed to be installed into one Leachate tank at Lorain County landfill, Oberlin, Oh. The system consists of four laterals two headers and one drop pipe with supports. All of the components will be installed at the elevation shown on the drawings.

Complete drawings are included to show the layout of the system and details of the components.

2.0 DESCRIPTION OF MATERIALS AND SERVICES

The AERGRID™/AERSPARGE™ Full Floor Coverage High Efficiency Coarse Bubble Aeration System is a custom designed full floor coarse bubble sparger aeration system consisting of a header system and HDPE air distribution piping with supports and hardware. The in-basin AERGRID™ air laterals consist of HDPE pipe with supports and an anchorage system consisting of a weld plate and yoke pipe supports. Orifices, equally spaced will distribute the air.

2.1 AIR DISTRIBUTION PIPING, AERGRID™ AIR LATERALS AND HEADER PIPES

2.1.1 The submerged air distribution pipe is 4-in. diameter, ultra violet stabilized, high density polyethylene (HDPE) pipe with a minimum thickness rating conforming to DR-11 (ASTM 2239-67).

2.1.2 The resin is high density polyethylene ASTM D3350, cell classification PE445574C with the following properties:

density	0.960 g/cm ³
melt index*	0.08 g/10 min.
tensile strength	3,550 psi
elongation	>800 percent
modulus of elasticity	175,000 psi
flexural modulus	120,000 psi

*Melt index is the value reflecting flow rate of material during molding or extruding.

2.1.3 The AERGRID™ laterals are fused to the elbow at the bottom of the drop pipe.

2.1.4 The air distribution pipe is installed through the HDPE yoke. Air distribution pipe orifices are located such that the air exiting the orifices is in a downward vertical position during operating.

2.1.5 All flanges are 304ss and the hardware is 316ss. No gaskets are required where polyethylene pipe is involved.

2.2 AERGRID™ SUPPORTS

2.2.1 The AERGRID™ support consists of HDPE yoke pipe support, 316ss "Tee" rod, two 316ss threaded plates, one 5/8-in 316ss nut, one 304ss bent plate, one combination weld plate, one HDPE wear plate, four 3/8-in 316ss nuts, two 3/8-in 316ss flat washers.

2.2.2 The resin for manufacturing the yoke is high density polyethylene with the following properties:

density	0.95 g/cm ³
melt index	10 HLMI (Condition F)
tensile strength	3,800 psi

elongation
flexural modulus

>600 percent
175,000 psi

- 2.2.3 Gear clamps, metal pipe clamps, plastic ties, or other types of rigid clamps are not allowed as AERGRID™ supports.
- 2.2.4 AERGRID™ pipe supports permit thermal expansion and contraction of the air distribution pipe during operation.
- 2.2.5 Smooth surfaces exist wherever polyethylene piping comes into contact with the anchor assembly in order to ensure a non-abrasive contact.
- 2.2.7 All yoke pipe support assemblies are checked or tested for:
 - a. Dimensional conformation to Drawings.
 - b. Proof tested to withstand a minimum 2,000 pound tensile force to verify integrity of the assembly.
 - c. Destructive testing is performed on one assembly in fifty (50) to verify its ultimate strength.

2.3 STAINLESS STEEL DROP PIPE

- 2.3.1 The drop pipe is 6-in 304 stainless steel shipped in two sections and includes the hardware and gasket to bolt the two sections together. The hardware for bolting the HDPE drop pipe is included and is 316ss also.

2.4 HEADER AND DROP PIPE SUPPORTS

- 2.4.1 The AERGRID™ header and drop pipe supports consist of a stand with two straps, hardware and anchor bolts as shown on the drawings. The hardware is 316ss and all other metal is 304ss.

3.0 INSTALLATION PROCEDURE

- 3.1 AERGRID Layout** - Determine the centerline of all of the drop pipes and laterals. Locate the centerline of the supports along the laterals. Drill the anchor bolt holes and install the bolts.
- 3.2 AERGRID™ Yoke Supports and Laterals** - The AERGRID supports and laterals must be assembled and installed at the same time. The installing contractor must determine the most efficient method of combined assembly. Our preferred method is to weld the laterals to the header pipe as a first step using Performance Pipe Bulletin 108 for reference. Make sure all orifices are positioned on the bottom of the pipe +/- 5 degrees of the centerline.

Next pre-assemble the yokes and hardware then slide the yokes over the 4-in HDPE AERGRID Laterals. After the yokes are on the pipe adjust the elevation by raising or lowering the bottom threaded plate and turning the "Tee" rod until the threaded plate is touching the bottom of the yoke. Keep the "Tee" rod properly aligned and tighten the thread plate against the bottom of the yoke using the turn of the nut method. Tighten the 5/8-in nut against the threaded plate.

At this point the support should hold the pipe at the proper elevation. Place the bent plate of the support over the anchor bolts. Coat all of the threaded parts with anti seize compound and place one washer and one nut on each stud. Torque to 20-lbs.ft.. Place the second nut on the stud and lock against the first nut.

Photo 1. Assembled Yoke. shows the correct installation of hardware. All yokes should face the same direction.

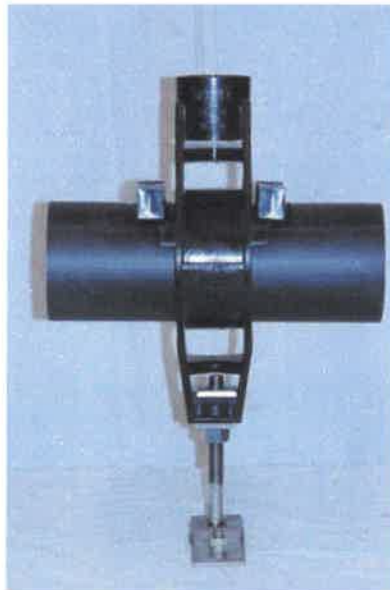


Photo 1.0 Assembled Yoke

- 3.3 Drop Pipe and Supports** – Install the drop pipe supports at a location closest to the dimensions shown on the drawings by bolting to the tank wall. After the wall supports are installed, position the drop pipe and bolt to the floor with 3/4-in 316ss anchor bolts included. Make certain the drop pipe is vertical and at the proper rotation.
- 3.4 Header Pipe and Supports** – Install the header pipe supports at the location shown on the drawings by bolting to the tank floor. After the supports are installed, position the header pipes on the lower straps and bolt the sections to the drop pipe with 5/8-in bolts included. Level the headers to the proper elevation and install the top strap. Lock the bottom double nuts together and tighten the top strap first nut snug plus one half turn. Lock the top double nuts together at 45-ft.lbs. Make sure the anchor bolts are torqued to 20-ft.lbs.
- 3.5 AERGRID™ System Inspection** - Upon completion of installation pick up all debris. Inspect every nut, bolt and washer for correct torque and make certain all items are installed. Inspect all welds and repair any that are defective in appearance. Use the Performance Pipe Bulletin 108 for weld procedures and inspections.

4.0 BILL OF MATERIALS

4.1	AERGRID Supports	
	4-in HDPE yoke	16
	Bent Plate, 304ss	16
	6-in Tee Rod, 316ss	16
	5/8-in Nut, 316ss	16
	¼ x 1-1/2-in Threaded Plates, 316ss	32
	3/8-in Expansion Anchor Bolts, 316ss	32
	3/8-in Nuts, 316ss	64
	3/8-in Flat Washers, 316ss	32
4.2	AERGRID Laterals	
	4-in HDPE DR 11.0 Pipes, Factory Fabricated (A-D)	4
4.3	Drop Pipe Supports	
	6-in Pipe Stand, 340ss	3
	6-in Pipe Straps, 304ss	6
	5/8-in Nuts, 316ss	24
4.4	Drop Pipes	
	6-in 304ss Schedule 10 Pipe, 25'-15/16" Long	1
	6-in 304ss Schedule 10 Pipe with Elbow, Tee, Reducers, and Flanges, 25'- 15/16" Long	1
	Hardware Kit for 6-in Flange:	
	3/4 x 2-1/2-in Hex Head Cap Screw, 316ss	8
	3/4-in 316ss Nuts	8
	Hardware Kit for HDPE Connection:	
	5/8 x 2-1/2 Hex Head Cap Screw, 316ss	16
	5/8-in Nuts, 316ss	16
4.5	Header Pipe Supports	
	4-in Pipe Stand, 340ss	6
	4-in Pipe Straps, 304ss	12
	1/2-in Nuts, 316ss	48
	3/8-in Expansion Anchor Bolts, 316ss	12
	3/8-in Nuts, 316ss	24
	3/8-in Flat Washers, 316ss	12
4.6	Header Pipe	
	4-in HDPE DR 11.0 Pipes, Factory Fabricated with fittings and 304ss flanges	2

5.0 OPERATION AND MAINTENANCE

On a periodic basis, minimum monthly, check the surface pattern of the basin for uniform distribution of bubbles. If the pattern is not uniform contact AERTEC for instructions.

There is no routine maintenance because there are no moving parts.

6.0 WARRANTY

Aeration Technologies warrants all components of the system supplied by AERTEC to be free of defects in materials and workmanship for a period of 24 months from the date of shipment..

7.0 ENGINEERING CALCULATIONS

7.1 PRESSURE LOSS COMPUTATIONS

7.1.1 Static Pressure

Static Pressure = (orifice submergence) x (0.433) = 21.19 psig

7.1.2 Orifice Pressure Loss:

$$qm = \frac{(678)(Y)(C)(D)^2 \sqrt{(P)(P_a)}}{\sqrt{T} \sqrt{SG}}$$

where: qm = airflow per orifice
Y = expansion factor (.98)
C = orifice coefficient (.58)
D = orifice diameter (in.)
P = orifice pressure loss (psi)
T = absolute temperature
SG = specific gravity (1.0)
P_a = absolute pressure

7.1.3 Air Lateral Pipe Pressure Loss

$$P_{dp} = \frac{V^2}{gRT} \left[\frac{CFL}{2D} - K_d \right] (P_a)$$

where: V = air velocity (FPS)
g = gravity
R = gas constant (53.3)
T = absolute temperature
C = manifold coefficient (0.333)
F = friction factor (0.018)
L = pipe length (ft.)
D = diameter (ft.)
K_d = 0.6
P_a = absolute pressure

7.1.4 Air Header Pressure Loss

$$P_{dp} = \frac{V^2}{gRT} \left[\frac{CFL}{2D} - K_d \right] (P_a)$$

where: V = air velocity (FPS)
g = gravity
R = gas constant (53.3)
T = absolute temperature
C = manifold coefficient (0.333)
F = friction factor (0.018)
L = pipe length (ft.)
D = diameter (ft.)
K_d = 0.6
P_a = absolute pressure

7.1.5 Drop Pipe Pressure Loss

$$P_s = \frac{V^2}{gR} \left[\frac{F}{2D} \right] (P_a)$$

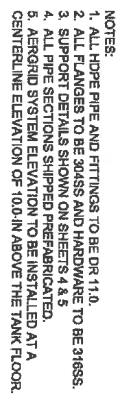
where: V = air velocity (FPS)
g = gravity
R = gas constant (53.3)
T = absolute temperature

F = friction factor (0.018)
L = pipe length (ft.)
D = diameter (ft.)
P_a = absolute pressure

Assumptions	Minimum	Peak
Airflow, SCFM	300	1500
T, °F	680	680
D (in.)	15/32	15/32
Qm, SCFM, per Orifice	7.89	39.47
T, °F	680	680
P _a	38.39	43.39
No. Orifices	38	38
Liquid Depth (SWD)	52.0	52.0
Orifice Submergence	51.2	51.2
Static Water Pressure	22.19	22.19
Calculated Orifice Pressure Loss	0.21	4.73
Calculated Lateral Pressure Loss	0.01	0.05
Calculated Header Pressure Loss	0.01	0.05
Calculated Drop Pipe Pressure Loss	0.01	0.27

8.0 DRAWINGS

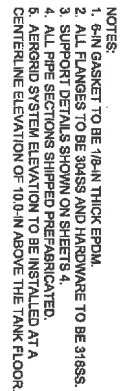
8.1 Drawings - Sheets 1 of 5 through 5 of 5



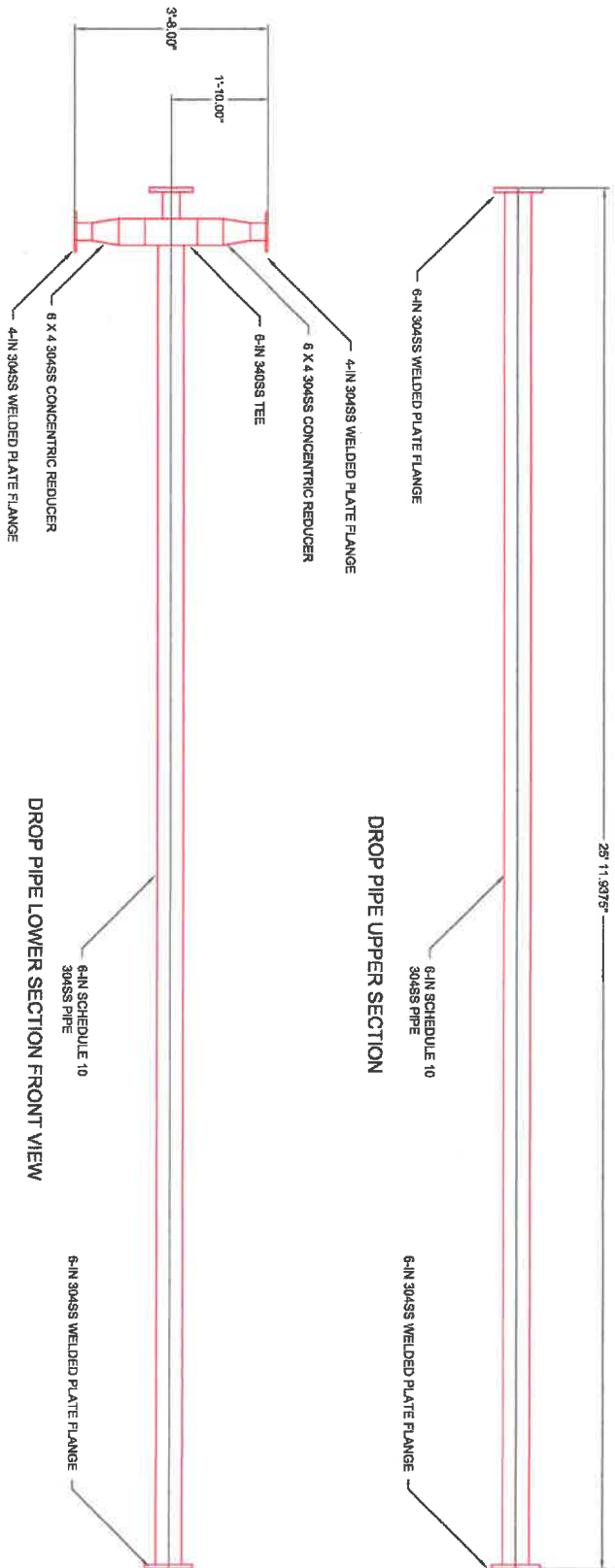
TOTAL AIRFLOW = 300 - 1,500 SCFM
DESIGN AIRFLOW = 300 SCFM
TOTAL NUMBER OF ORIFICES = 36
ORIFICE DIAMETER = 27/64-IN
OPERATING LIQUID DEPTH = 52-FT

AERGRID AERATION SYSTEM FOR LORAIN COUNTY LANDFILL, OBERLIN, OH	
DATE: 24 AUGUST 2012	
SCALE: NONE	
DRAWN: RGS	
REVISION:	
FILE NUMBER: Dwp2163	13
PLAN VIEW OF AERATION TANK	

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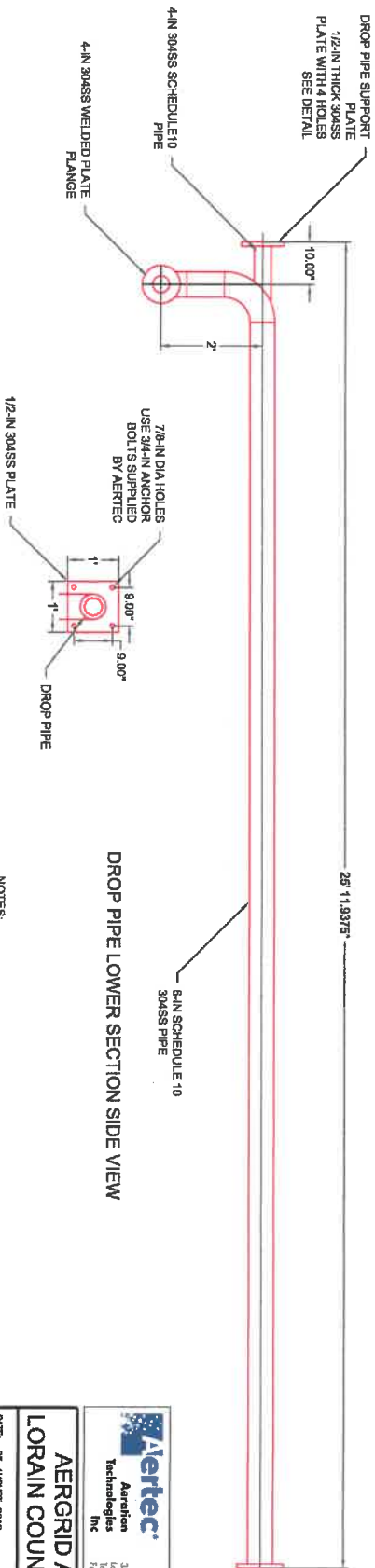


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DROP PIPE UPPER SECTION

DROP PIPE LOWER SECTION FRONT VIEW



DROP PIPE LOWER SECTION SIDE VIEW

DROP PIPE SUPPORT PLATE

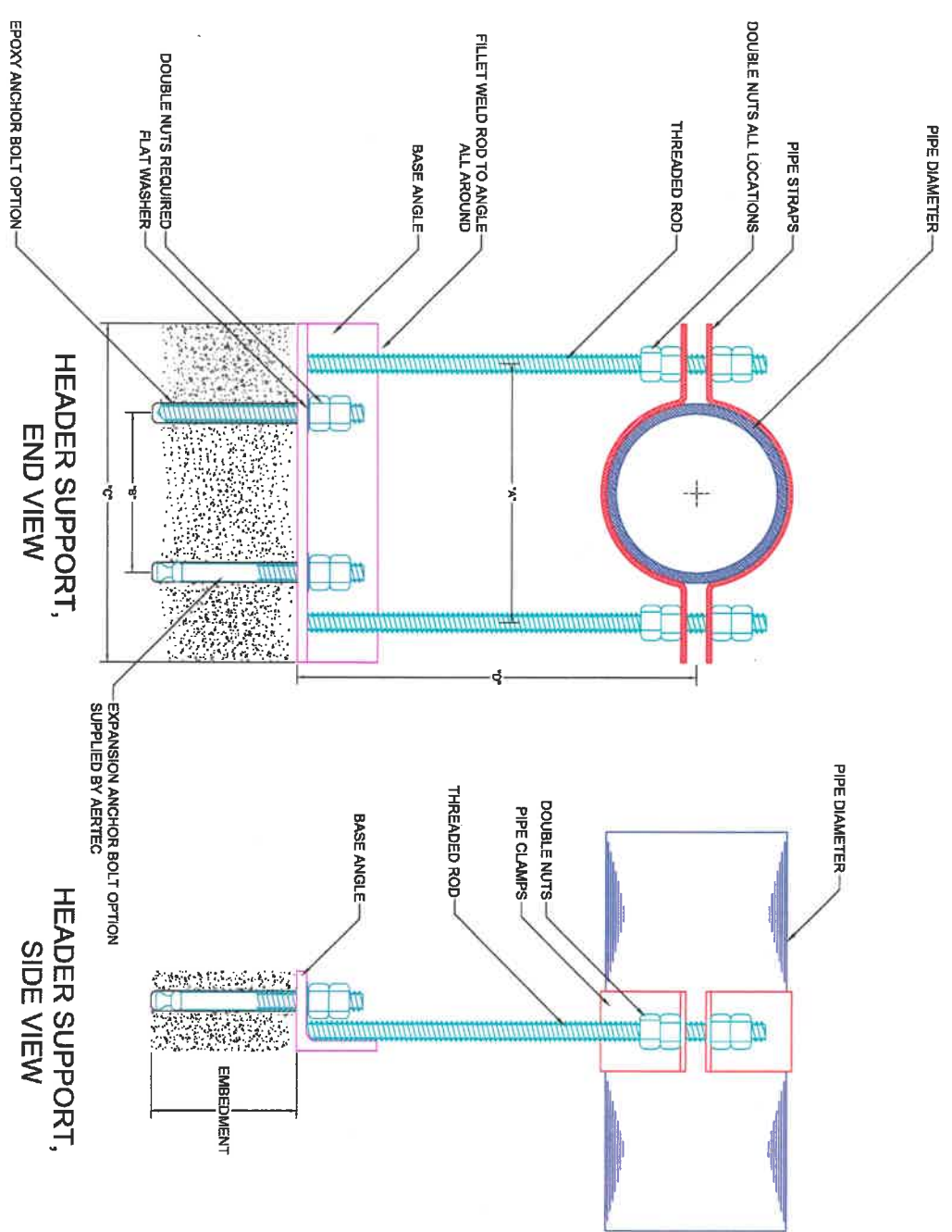
- NOTES:
1. ALL FLANGES TO BE 304SS AND HARDWARE TO BE 316SS.
 2. ALL PIPE SECTIONS SHIPPED PREFABRICATED.
 3. ONE 6-IN EPDM GASKET INCLUDED WITH 316SS HARDWARE.
 4. ALL FLANGES WELDED USING TWO HOLE ALIGNMENT METHOD.

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AERGRID AERATION SYSTEM FOR LORAIN COUNTY LANDFILL, OBERLIN, OH	
DATE: 28 AUGUST 2012	DROP PIPE
SCALE: NONE	FABRICATION
DRAWN: MCS	DETAILS
REVISION:	FILE NUMBER: D-12185
	15



- NOTES:
1. LEVEL ALL SUPPORTS SUCH THAT SYSTEM IS LEVEL TO $\pm 1/4$ -IN.
 2. TORQUE 3/8-IN ANCHOR BOLTS TO 20-FT LBS
 3. COAT ALL THREADED PARTS WITH NEVER SEIZE.
 4. TIGHTEN SUPPORT NUTS USING TURN OF THE NUT METHOD.
 5. ANCHOR BOLTS SUPPLIED BY AERTEC.

PIPE SUPPORT DETAILS			
LOCATION	6-IN DROP PIPE	4-IN HEADER	
PIPE DIAMETER	6.625-IN	4.5-IN	
THREADED ROD DIAMETER	5/8-IN	1/2-IN	
ANCHOR BOLT DIAMETER	5/8-IN	3/8-IN	
BASE ANGLE DIMENSION	1/4 X 2-IN	1/4 X 2-IN	
PIPE CLAMP DIMENSION	3/16 X 2-IN	1/8 X 2-IN	
MATERIAL FOR HARDWARE	316SS	316SS	
MATERIAL FOR CLAMPS	304SS	304SS	
THREADED ROD MATERIAL	316SS	316SS	
BASE ANGLE MATERIAL	304SS	304SS	
ANCHOR BOLT OPTION	BY OTHERS	EXPANSION	
ANCHOR BOLT EMBEDMENT	N/A	2-IN	
THREADED ROD LENGTH	18-IN	16-IN	
DIMENSION "A"	11-IN	7-IN	
DIMENSION "B"	7-IN	4.5-IN	
DIMENSION "C"	14-IN	8-IN	
DIMENSION "D"	12-IN	12-IN	
NUMBER OF SUPPORTS	3	6	

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3 Corporate Lane, Unit F
Bridgewater, NJ 08807
Tel: 609 424 5625
Fax: 609 424 5625

SHEET 4 OF 5

AERGRID AERATION SYSTEM FOR LORAIN COUNTY LANDFILL, OBERLIN, OH

DATE: 28 AUGUST 2012

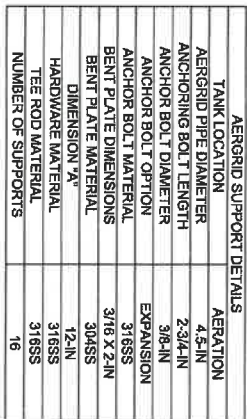
SCALE: NONE

DRAWN: RCS

DESIGNER: A

HEADER SUPPORT DETAILS

FILE NUMBER: DW2186



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AERTEC LITERATURE

AERTEC™

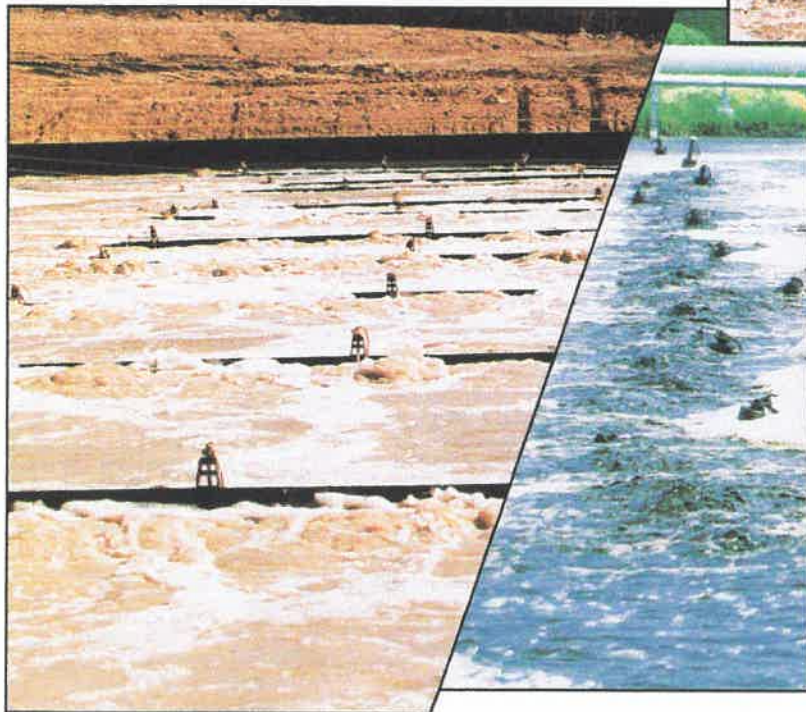
AERATION TECHNOLOGIES, INC.



AERGRID™
Floor Grid Systems



AERMAX®
Fine Pore Diffusers



WETEC-FAS™ and **WETEC-TAS™**
Wet Installable Systems



AERTUBE™
Static Tube Aerators

SOLUTIONS

for your aeration needs

AERATION TECHNOLOGY – Leading Edge Capabilities



Full Depth Column Alpha Testing

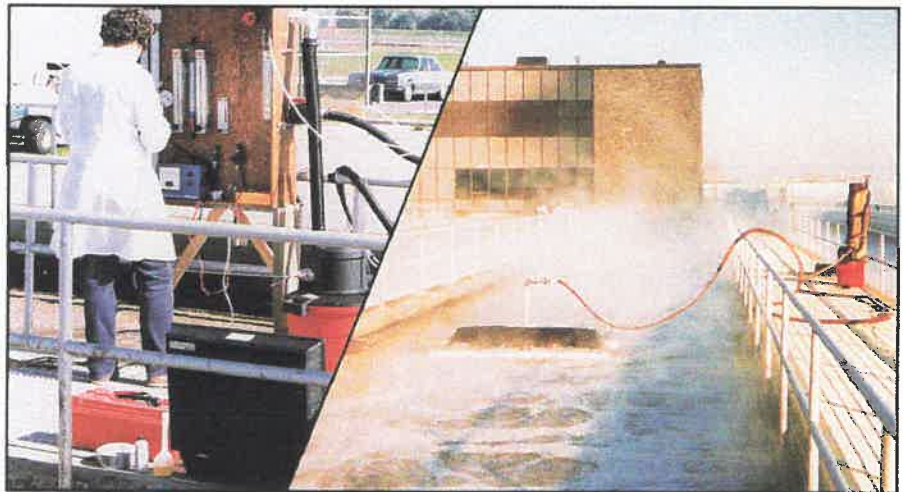
AERTEC™ offers state-of-the-art technology for full scale alpha testing of diffusers, and **in situ** off-gas testing of operating systems.

Aeration system performance and evaluation services are available.

At **AERTEC™** aeration is all we do – our name says it all – engineered solutions involving development, evaluation, design, manufacturing, installation and service.

We are dedicated to furnishing the latest and best available oxygen transfer and mixing technology. From conception through installation and start-up, we provide it all.

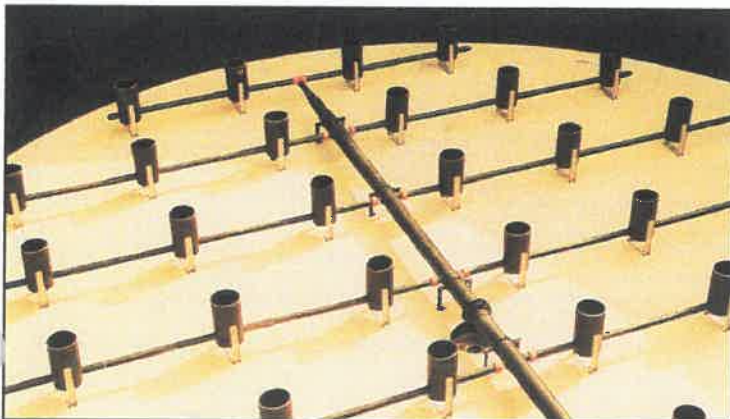
Our goal is to develop engineered **solutions** for your aeration needs – not just to offer equipment.



Field Off-Gas Testing

AERTUBE™ – Static Tube Aerators

Simple yet functionally and mechanically superior to other static tube aerator designs. Used in activated sludge, digester, equalization and other aeration and mixing applications.



AERTUBE™ DT Aerator Installation



AERTUBE™
Model R-1210

AERMAX® – Fine Pore Diffusers



AERMAX® Wind Band Aeration System

Features:

- ▷ highest oxygen transfer efficiency
- ▷ stainless steel threaded end connection
- ▷ stainless steel structural support frame
- ▷ thick EPDM membrane
- ▷ stainless steel fasteners
- ▷ positive closure umbrella check valve

Advanced design for flexible membrane tube diffusers.

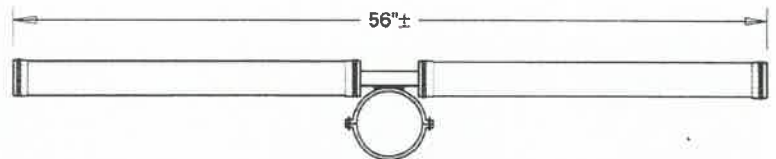
AERMAX® Diffusers are miles ahead of the competition in aeration efficiency and mechanical strength.

Use **AERMAX®** Diffusers for new, retro-fit, and **membrane replacement** applications.

Four perforation designs and **several dimensional sizes** are available for custom fit to your needs.



AERMAX®, Model S-225



AERMAX®, Model S-225 Duplex with SS Bracket

AERGRID™ – High Efficiency Floor Grid Systems

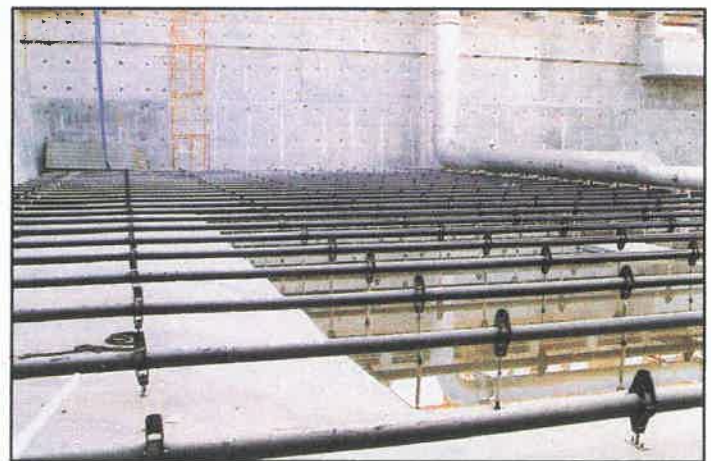
Leading edge technology for applications from mixed limited to high rate, including high solids suspension applications.

The **AERGRID™** layout allows the designer the flexibility to put aeration where it is needed.

Full floor coverage or tapered. **AERGRID™** improves in efficiency as airflow increases!



AERGRID™ Air Distribution Test



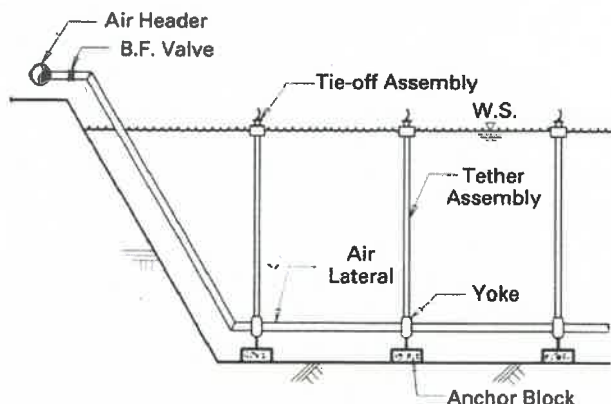
AERGRID™ High Rate CMAS System

Features:

- ▷ unparalleled performance and durability
- ▷ economical capital and operating cost
- ▷ no maintenance operation
- ▷ non-clogging, self-draining design
- ▷ widest available operating range
- ▷ best mixing per unit of power input
- ▷ corrosion free construction of HDPE and stainless steel

UNIQUE WET INSTALLATION OPTIONS – No Dewatering

Install our systems **without** draining your tank, basin or lagoon. Our **drop-in** designs let you retrofit, augment, or initiate aeration whenever and wherever you cannot dewater.



WETEC-TAS™ Equipment Schematic

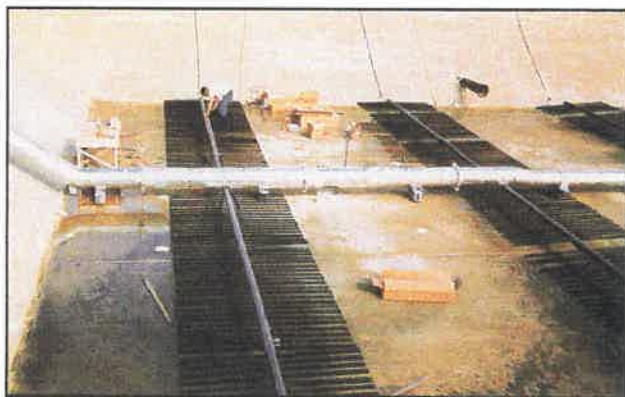


WETEC-TAS™ /AERGRID™ Retrofit Installation

WETEC-TAS™ – Wet Installable Tether Aeration Systems **drop-in** anywhere for maximum capacity and flexibility, **plus** they can be installed, retrieved, and adjusted from the liquid surface without interruption of service.

WETEC-FAS™ – Wet Installable Floating Aeration Systems **drop-in** with flexibility for easy lateral and vertical adjustment at any time. Ideal for supplemental aeration capacity needs and lagoon systems.

TURNKEY FACTORY INSTALLED SYSTEMS – 2X Warranty



AERMAX® System Dry Installation

Wet or Dry – no matter what the facility type and the equipment selected – **AERTEC™** has the capability and experience to provide single source turnkey installed systems, **plus** a blanket warranty twice that of an equipment only warranty!

Based on our extensive technology, experience, and wide range of products and services, we may have already solved **your** current aeration need.

AERTEC™

AERATION TECHNOLOGIES, INC.
P.O. Box 488, N. Andover, MA 01845
(978) 475-6385 FAX (978) 475-6387
www.aertec.com email: aertec@aer.net

For
more
information
call:

PERFORMANCE PIPE LITERATURE

PE 3408 ENHANCED PIPE
Butt Fusion Procedures



Plexco®



Extra High Molecular Weight High Density Polyethylene PE 3408 Pipe

Over 50 Years of Quality Service

This manual is a training guide for the butt (heat) fusion technique for joining PLEXCO PE 3408 Extra High Molecular Weight (EHMW) High Density Polyethylene Pipe. Butt fusion is the preferred method for joining high density polyethylene pipe. It has been an accepted procedure in the gas and municipal service industries for over 30 years.

The PLEXCO P34CH resin used in making PLEXCO PE 3408 Pipe has been specially engineered to provide a quality piping material that can be easily fused to form tough, strong joints. The average molecular weight is in the extra high molecular weight range (250,000 - 1,500,000) and is comparable to that of any other polyethylene piping material on the market. The broad molecular weight distribution of this resin makes it possible to easily produce quality butt fusion joints with greater control than is possible with pipe made from resins having the same molecular weight but a narrow weight distribution. This means that in PLEXCO EHMW High Density Polyethylene PE 3408 Piping, you have the pressure rating and abrasion resistance of a high density, extra high molecular weight material plus easy assembly by butt fusion joining.

Described here are the recommended procedures for using heat fusion to form strong and durable joints with PLEXCO PE 3408 Pipe. Experience has shown that a joint made by a properly trained person, using a proven fusion procedure, which passes a visual inspection based on proper bead formation, will have strength characteristics comparable to the pipe itself. Heat fused pipe sections become, in effect, a single piece of pipe.

NOTE: Butt fusion procedures recommended by Plexco have been qualified in accordance with Title 49, Code of Federal Regulations, Part 192.283. Under the Title 49 regulations, gas pipeline operators are required to have qualified joining procedures, and per Part 192.285, to ensure that persons making joints in their gas piping system are qualified to make joints using the gas pipeline operator's qualified joining procedure.

This bulletin is intended to be used as a guide for butt fusion techniques. It is not intended to be used as installation instructions, and should not be substituted in place of the advice of a professional design engineer.



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Key Features of Butt Fusion Procedures

PLEXCO PE 3408 EHMW High Density Polyethylene Pipe is joined by a simple heat fusion process. The basic steps in this process are:

1. Be sure that the surfaces of the fusion tools, pipe and fittings are free of contaminants.
2. Heat the surfaces to be joined – both the pipe and fittings – simultaneously at a prescribed temperature for a specified time.
3. Remove the heater – bring melted surfaces together.
4. Hold until solidified.

A correctly made fusion produces a joint that is as strong as the pipe itself and has a record of proven performance.

Before you begin fusing, here are some points to remember:

1. All heater surfaces have a thin layer of non-stick coating that is easily scratched or scraped off. This coating prevents melted polyethylene from adhering firmly to the heater surfaces, but occasionally it also must be cleaned.

Metal tools should NEVER be used to clean the heater surfaces because they scratch and remove the coating.

Wooden implements and clean, dry, lint-free rags are recommended for cleaning. All-cotton rags are recommended because rags containing a substantial amount of synthetic fibers may melt and char against the heater surface.

If the non-stick coating becomes worn or scratched, the heating unit should be recoated.

Melted polyethylene adheres firmly to the heating iron and is more difficult to remove at places where the coating has been scraped off. In addition, since the coating acts as an insulator, heat transfer in these uncoated areas is greater, and local overheating can occur.

2. Just before using, wipe heaters to remove dirt and foreign material. As soon as possible after use, clean heaters with wooden implements and clean rags to remove melted or charred plastic.

3. At the end of every heating cycle, quickly observe the parts to be joined to insure sufficient and uniform melting patterns.

Join parts within 3 seconds.

If a non-uniform pattern is obtained, allow the pipe to cool, cut off the pipe ends, and repeat the procedure.

4. Check heater surface temperature at least once a day with a device such as surface pyrometer or crayon indicators for $440 \pm 10^\circ\text{F}$ or $500 \pm 10^\circ\text{F}$ fusion surface temperature. The heater thermometer will probably read a higher temperature than the fusion surfaces. Check the thermometer frequently for consistent readings.

5. NEVER lay a hot heating unit on the soil or grass when the heat cycle is completed.

Return it to the holder, if possible, or at least lay it on a board.

Soil can contaminate the joint and damage the coating; grass may burn and char the heater surface.

Temperature for Butt Fusion

PLEXCO Technical Services personnel have conducted extensive testing to qualify the butt fusion procedure under laboratory conditions at a number of different temperatures over the range of 350° to 525°F . This work has shown that there are a number of "time-temperature-pressure" conditions that can be used to make acceptable joints.

The laboratory proven procedures have been modified based on field experience to provide two heater iron surface temperatures that are recommended for butt fusion of PLEXCO Polyethylene Pipe and Fittings: 440°F and 500°F . The choice of temperature should be based on the operating procedures and operating conditions of the individual installer.

The principal difference in the procedures used for 440°F and 500°F is the heating time necessary before making a joint. The lower temperature requires a slightly longer heating time. This extra time does allow some advantages in control and reproducibility of bead size.

Butt Fusion Procedure

Butt fusion of PLEXCO PE 3408 EHMW High Density Polyethylene Pipe and Fittings is easily performed utilizing the equipment available today. For pipe sizes 4" IPS and larger, hydraulic fusion machines are normally used, and the following procedures are presented for such machines. Pipe sizes of 4" IPS and smaller are fused using manually operated equipment. The procedures and principles for manual fusion equipment are essentially the same as those which follow.

Fusing PLEXCO PE 3408 Pipe to Other Manufacturers' Pipe

Industry studies indicate that polyethylene of different trade names and/or different polyethylenes, such as 2306, 2406, 3406, and 3408 materials, can be successfully joined by heat fusion.

Melt times prescribed at 500°F by each manufacturer for his product should be used. Apply the heating tool first to the material requiring the longest melt time. Then apply the product requiring the lesser melt time to the heater so the melt cycle for both products will be completed at the same time. All other fusion conditions and procedures remain the same as when joining PLEXCO products.

The Plastics Pipe Institute has issued a document, PPI Technical Note TN-13, on "General Guidelines for the Heat Fusion of Unlike Polyethylene Pipes and Fittings." PLEXCO recommends that these guidelines be utilized when joining different polyethylenes. However, the mixing of different polyethylenes should not be done indiscriminately—optimum conditions will be achieved when joining pipe and fittings from the same manufacturer's system.

Upon request, PLEXCO will provide additional information and technical assistance in proper fusion procedures for joining the PLEXCO system with polyethylene systems of other manufacturers and material designations.

Preparation Procedure for Hydraulic Fusion Machines*

Butt fusion machines are available from several manufacturers. Various machines will have slightly different procedures for use, care, set-up, and operation. Consult the equipment manufacturer's manuals for correct instructions on the use, care, set-up, and operation of the butt fusion machine.

Hydraulic fusion machines typically have controls for setting pressures used for facing, heating, and fusing. It may be necessary to add pressure to overcome machine internal drag pressure or external forces acting on the pipe.

- Facing should be conducted at a pressure that produces properly faced pipe ends.
- Heating pressure should be set so that the pipe ends maintain contact against the heater, but are not forced against the heater (zero contact pressure).
- Fusing pressure may be determined using the interface pressures presented below.

Fusion Interface Pressure Guidelines

Heater Surface Temperature	Interface Pressure
440°F ± 10°F	60 ± 15 psi
500°F ± 10°F	80 ± 15 psi

Install appropriate inserts in the pipe clamps as necessary. IPS sizes are for IPS (steel) pipe diameters; DIPS sizes are for ductile iron pipe sizes.

Heater surfaces must be clean and free of contaminants such as dirt, oil, grease, and melted or charred plastic. To clean the heater, use only wooden implements and clean, dry, lint-free non-synthetic cloths. Take care not to damage coated surfaces.

With a surface pyrometer, check the heater for uniform surface temperature. Adjust the heater as necessary for 400°F ± 10°F or 500° ± 10°F surface temperature. (Heater thermometers indicate internal, not surface temperature.)



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Butt Fusion Procedure

With a clean dry cloth wipe both inside and outside surfaces of the two ends to be joined to remove dirt and foreign material. It is important that the ends protruding past the jaws be absolutely clean and free of contaminants.

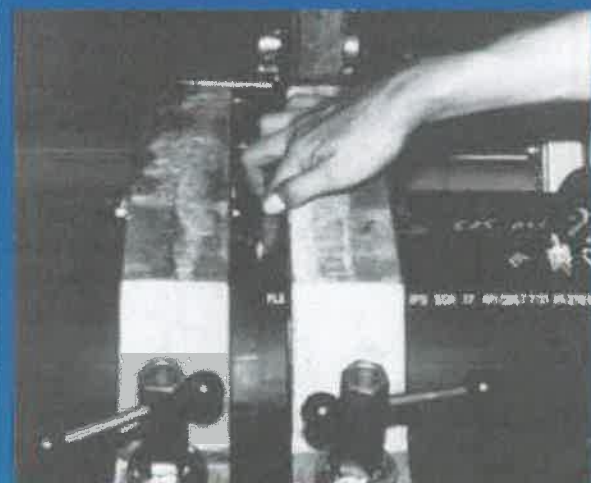
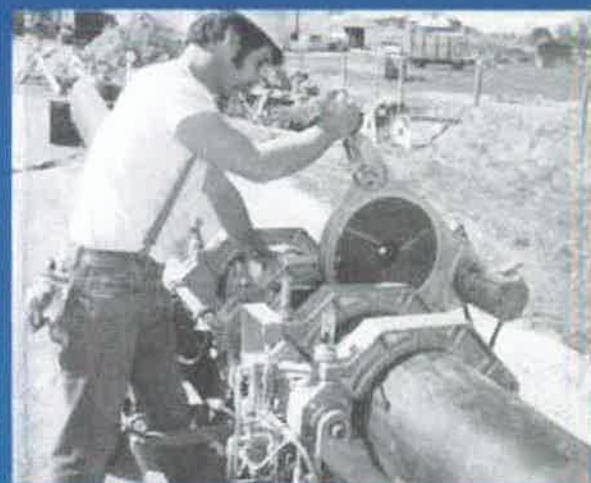
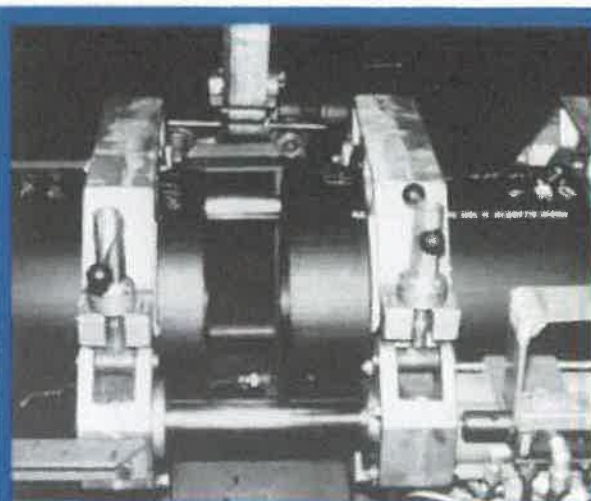
1. Install pipe in machine. Ends should extend approximately an inch past alignment clamps for facing. Check alignment and adjust as necessary.

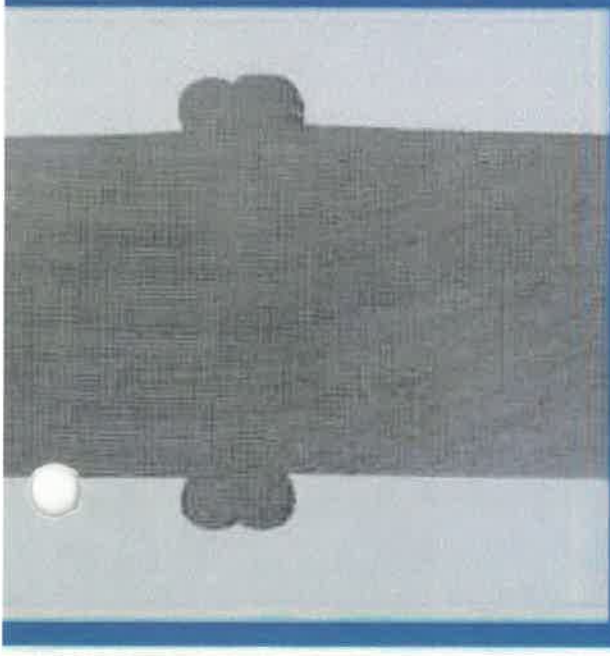
2. Place the facer between the pipe ends. Face the pipe ends until continuous ribbons are produced on both side of the facer. Turn off the facer, move the pipe ends apart, and remove the facer. Clean out ribbons and shavings from around and inside the pipes. Do not touch the newly faced surfaces with the hands, as perspiration and body oils could contaminate the surfaces.

IMPORTANT: *The pipe ends are properly faced when continuous ribbons are produced on both sides of the facer unit. If the facing stops are reached before continuous ribbons are produced, re-install the pipe ends in the machine (Step 1), and continue facing until continuous ribbons are produced on both pipe ends. Facing down to the stops is preferred.*

3. Bring the two pipe sections together and, with the fingers, feel for any high-low difference at the junction of the two ends. If necessary, tighten the appropriate inside clamp until the two sections are aligned as closely as possible. Tighten the high side, never loosen the low side.

IMPORTANT: *After facing the pipe ends, if any adjustment at all is made on one or both inside clamps, then the facing unit should be re-installed and the pipe ends given several turns with the cutter until the motor speeds up, before continuing with heating and fusing.*





position where it will come between pipe ends. Use caution in this operation to avoid coming in contact with pipe. Bring the movable pipe section against the heater until both pipe ends are in firm contact with the heater.

IMPORTANT: *As soon as the pipe ends are firmly against heater, immediately move control valves to a neutral position to remove pressure of pipe against heater.*

If pressure of the pipe against the heater is maintained during the heating period, melt will be squeezed away from pipe ends, causing a concave effect in the heated pipe ends. This could result in a weakened joint after fusing.

5. Heat the pipe ends until properly sized melt beads are formed on both pipe ends. As the pipe ends are melted against the heater during the heating period, the molten plastic will swell and form melt beads around the pipe ends. The melt beads should be the same size on both pipe ends, and uniformly sized all the way around.

Approximate Melt Swell Bead Size

Pipe Size	Melt Bead Size
Less than 3"	1/16"
3" - 6"	1/8"
8" - 10"	3/16"
12" - 24"	1/4"
26" - 36"	7/16"
38" - 54"	9/16"

Depending upon wall thickness, melt swell bead size may vary.

6. After melting has been completed as above, separate the pipe ends just enough to remove the heater. Quickly observe the parts to be joined to ensure sufficient and uniform melting patterns. Then quickly bring the pipe ends together with the pressure recommended by PLEXCO. Join parts within 3 seconds. If melted plastic sticks to the heater, don't join the two ends – discontinue making the joint, let cool, and start over again from Step No. 1.

IMPORTANT: *Do not use pressures above the range indicated. Excessive pressures will squeeze too much melt out of the fusion area and result in a weakened joint.*

The force applied will cause each bead to roll back onto the pipe as shown. Insufficient rollback is one indication of a faulty joint.

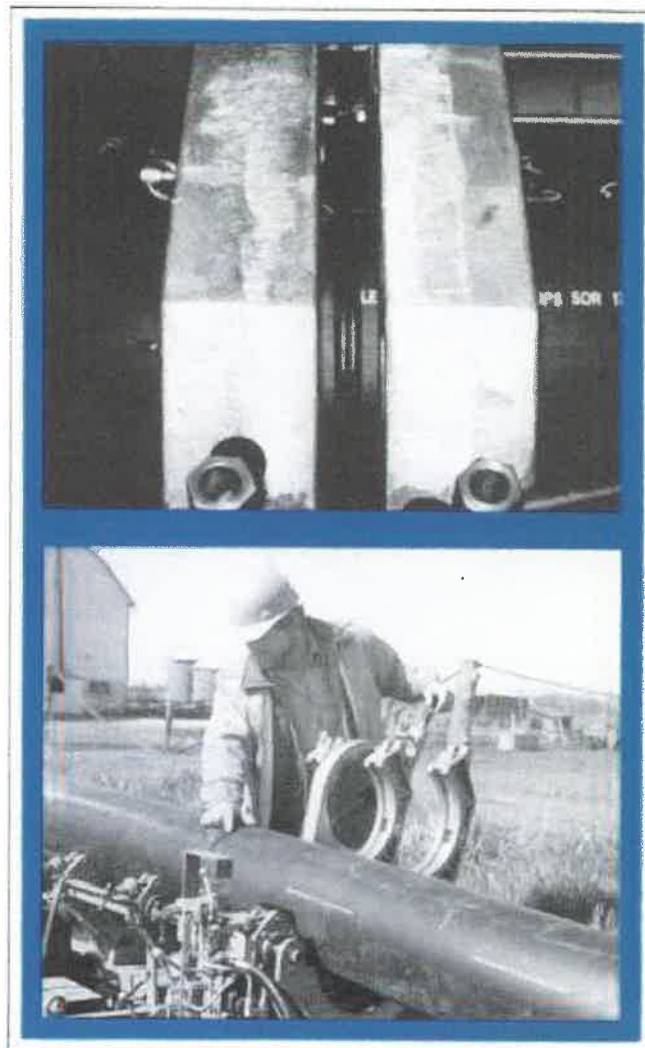


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7. While maintaining the pressure used in making joints, allow the joint to cool for 30 to 90 seconds per inch of pipe diameter before removing from machine. Heavier walled pipes (lower SDR) will require more cooling time. If upon examination the joint appears faulty, cut open and start again with Step No. 1.

8. Remove fused pipe sections from fusion machine.

Allow joint to cool at least 20 minutes after removal before subjecting it to testing, bending or backfilling stresses. Reposition fusion machine so that end of the newly fused section lies in the stationary clamps while a new pipe section is placed in the movable clamps. Repeat fusion procedure beginning with Step No. 1.

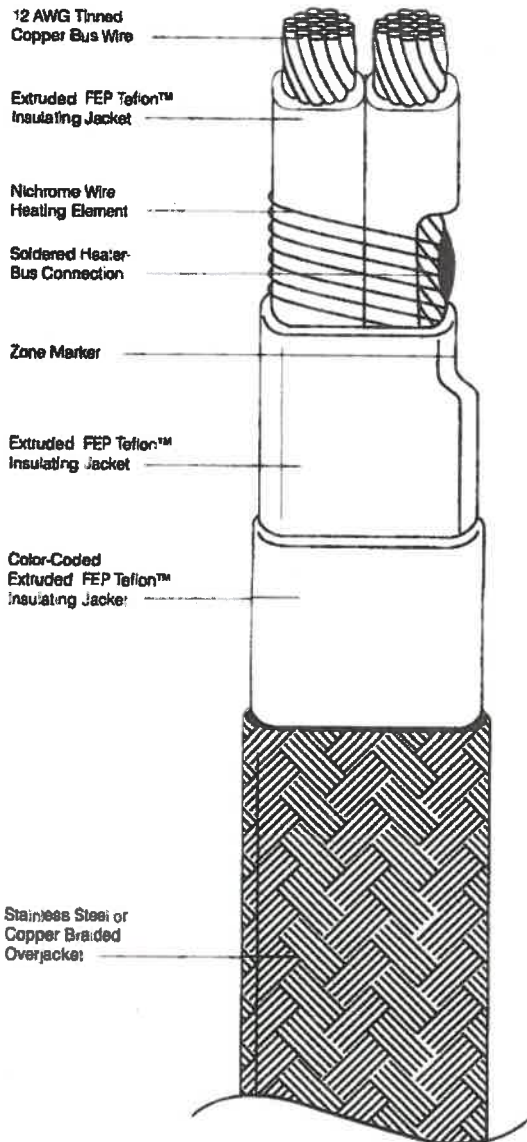


Heat Trace and Insulation



PF HIGH TEMP SERIES

Constant Wattage Cable



™ Dupont Co.



WARNING

WARNING: This cable is designed for commercial construction and process heating applications and must be installed by a qualified electrician. Improper installation can result in property damage, serious injury, and/or death due to electric shock.

DESCRIPTION

Delta-Therm's Power Trace brand, zone-type constant watt heating cable produces a constant heat output. Designed for freeze protection and process heating applications, our PF Series cable has a maximum maintenance temperature of 200°F (93°C) and a maximum exposure temperature of 400°F (204°C). Refer to back page for additional specifications.

PF Series constant watt cable consists of two parallel 12 AWG stranded, tinned-copper bus wires individually encased in extruded FEP Teflon™ jackets. A nichrome wire heating element is wrapped around the jacket and soldered to alternating bus wires at 24-inch to 48-inch intervals (depending on the cable model). The jacket and the nichrome wire are encased in an extruded FEP insulating jacket, which is covered by a color-coded FEP overjacket. A stainless steel or copper braided overjacket provides additional mechanical strength and meets NEC requirements as stated in Articles 427-22 and 427-23. See back page for further details.

FEP jackets provide the flexibility needed for pipe, valve, pump, and flange tracing. FEP jackets also offer outstanding resistance to corrosive chemicals such as gasoline and oils. Color-coded and marked for easy identification, the cables can be cut to length in the field for quick installation. When used in freeze protection and process heating applications, PF cables can be safely overlapped. See back page to operate PF cables at alternate voltages.

APPLICATIONS

PF Series cable can be used in freeze protection and process heating applications.

APPROVALS

Ordinary Locations: FM Approved For Pipe Tracing

Hazardous Locations: FM Approved for—Class I, Division 2, Groups B, C, And D

* Voltage range depends upon cable model. See Watts Per Foot (m) tables on back page.



PF SERIES TECHNICAL INFORMATION

PF Series Cable Description

Part #	Color	Voltage	Watts/Ft. (m)	Amps/Ft. (m)	Zone Length* In. (cm)	Max. Circuit Length** Ft. (m)
PF-3	Orange	208	2.7 (9)	.013 (.04)	48" (122)	710' (216)
PF-6	Red	120	6.0 (20)	.050 (.16)	24" (61)	280' (85)
PF-7	Green	120	8.0 (26)	.067 (.22)	24" (61)	240' (73)
PF-8	Blue	120	1.8 (6)	.015 (.05)	24" (61)	480' (148)
PF-10	Yellow	208	8.9 (29)	.043 (.14)	24" (61)	390' (118)
PF-12	Brown	480	12.0 (38)	.025 (.08)	48" (122)	780' (238)

*One complete heating zone is the distance between two successive bus connections.

**Maximum circuit length is defined as the length of cable at which the heat output, due to voltage drop, decreases to 90 percent of the heat output at the power connection point.

Watts/Ft. (m) At Alternate Voltages

Part #	120V	208V	240V	277V	480V
PF-3	-	3 (9)	4 (12)	5 (16)	-
PF-6	6 (20)	-	-	-	-
PF-7	8 (26)	-	-	-	-
PF-8	2 (6)	5 (16)	7 (23)	9 (31)	-
PF-10	3 (10)	9 (29)	12 (38)	-	-
PF-12	-	-	3 (10)	4 (13)	12 (38)

Electrical Specifications

Max. Maintenance Temp. °F (°C)	200° (93°)
Max. Exposure Temp. °F (°C)	400° (204°)
Cable Insulation	FEP Teflon™
Cable Overjacket	FEP Teflon™
Bus Wires	12 AWG

™ Dupont Co.

Thermostatic Controls and Panels

Please refer to the heat trace controls chart in the introduction section of the catalog.

Accessories for PF Series Cable

PCK-PT/PF	Power Connection And End Termination Kit
SPK-PT/PF	In-line Splice Connection Kit
PT-T3SL	Tee Splice Connection Kit
T-ALXXX	Aluminum Heat Distribution Tape
T-FXX	Fiberglass Banding Tape
CL-X	Caution Labels
DT Box	Electrical Junction Box

ZONE MARKER:

Zone Markers for PF series cable may be raised bumps, or depressions on the edge of the cable. (Braid may have to be pulled away to locate.)

Use Of Ground Fault Protective Devices And Metallic Overshield

NEC CODE 2005, ARTICLE 427-22:

Equipment Protection. Ground-fault protection of equipment shall be provided for electric heat tracing and heating panels. This requirement shall not apply in industrial establishments where there is alarm indication of ground faults and

- (1) Conditions of maintenance and supervision ensure that only qualified persons service the installed systems.
- (2) Continued circuit operation is necessary for safe operation of equipment or processes.

NEC CODE 2005, ARTICLE 427-23:

Grounded Conductive Covering. Electric heating equipment shall be listed and have a grounded conductive covering in accordance with 427.23 (A) or (B). The conductive covering shall provide an effective ground path for equipment protection.

(a) Heating Wires or Cables. Heating wires or cables shall have a grounded conductive covering that surrounds the heating element and bus wires, if any, and their electrical insulation. The conductive covering shall provide an effective ground path for equipment protection.

TO ORDER:

Series (PF) - -

Part No.

Stainless Steel Or Copper Braided Overjacket Suffix (SB Or CB)

The material contained in this document is presented in good faith and believed to be reliable and accurate. However, because testing conditions may vary and material quality or information that may be provided in whole or in part by others may be beyond our control, no warranty, expressed or implied, is given. Delta-Therm can assume no liability for results obtained or damages incurred through the application of the data and tests presented.



PCK-PT/PF

PT and PF Series Power And End Termination Kit For Ordinary And Hazardous Locations Class I, Division II, Groups B, C, And D

DESCRIPTION

PCK-PT/PF allows you to make electrical connections to the PT and PF series PowerTrace constant wattage heater cable. The kit contains materials for one power termination and one end termination.

HEATER ZONE MARKERS

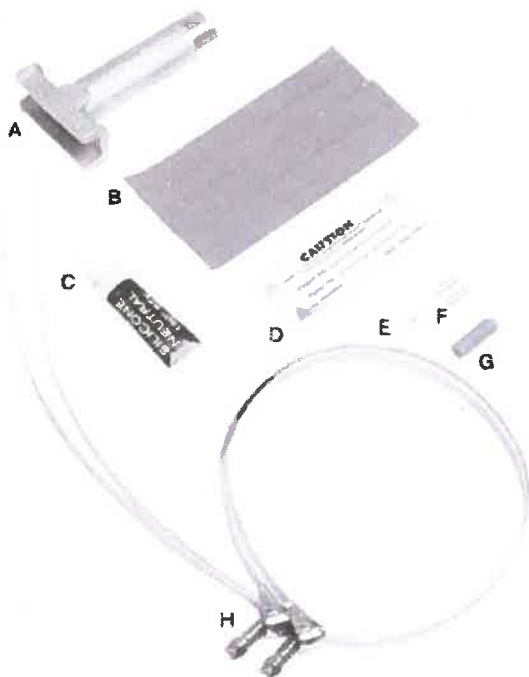
The heater zone markers for the PT cable are raised bumps on the cable edge. The markers on the PF cable may be raised bumps or slight depressions on the cable edge.

ITEMS REQUIRED BUT NOT SUPPLIED

- Weather-Tight Junction Box, With .75" (2cm) NPT Hubs.
- Conduit

TOOLS REQUIRED

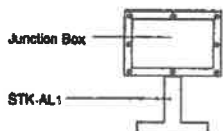
- Crimping Tool
- Wire Stripper/Cutter
- Utility Knife
- Screw Drivers
- Needle Nose Pliers
- Adjustable Wrench
- Measuring Tape



- | | |
|-----------------------|--|
| A. Aluminum Stand Off | E. Ring Connector |
| B. Silicone Tape (4) | F. Large Non-Insulated Butt Splice (2) |
| C. Silicone Sealant | G. Silicone End Cap .5" x 1.5" (1 x 4cm) |
| D. Caution Label | H. Pipe Strap (2) |

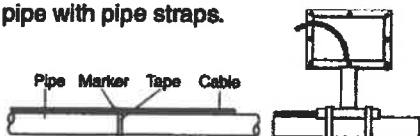
CONNECTING TO POWER

1. Install junction box over STK-AL1.



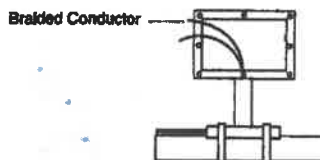
Detail 1.

2. Locate heater zone markers. Cut cable 12" (30cm) from the end of the marker. Pull the cable through the STK-AL1 into the junction box. (The last marker should remain fastened to the pipe.) Fasten the STK-AL1 to the pipe with pipe straps.



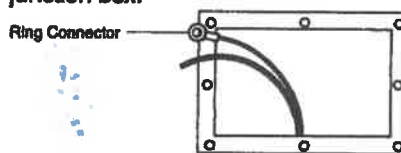
Detail 2.

3. Comb the braid back 4" (10cm) and twist into a conductor.



Detail 3.

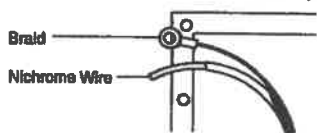
4. Crimp the ring connector to the braid and ground to the junction box.



Detail 4.

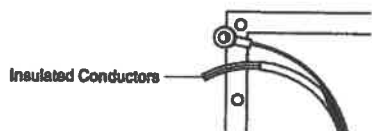


5. Remove 2" (5cm) of the outer jacket from the cable.



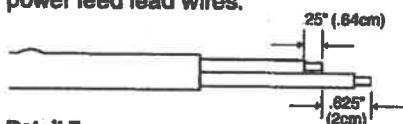
Detail 5.

6. Remove the nichrome wire from the insulated conductors. Tuck any remaining nichrome wire under the outer jacket.
7. Install conduit and power feed to junction box.



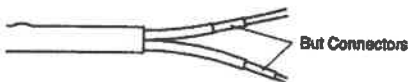
Detail 6.

8. Cut back one of the heater cable conductors .625" (2cm) so the splices will be staggered. Strip the leads back .25" (.64cm) on the heater cable conductors and the power feed lead wires.



Detail 7.

9. Butt splice the heater cable conductors to the power feed wires, using the non-insulated butt splices.



Detail 8.

10. Insulate the butt splices using the 6" (15cm) self fusing silicone tape pieces. (Note that the tape should be stretched tightly over the splices.)



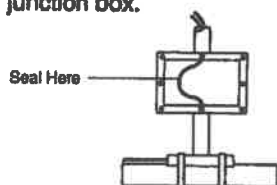
Detail 9.

11. Insulate the entire spliced area from the outer jacket side, to one inch past the spliced area. Use the 6" (15cm) piece of self fusing tape.



Detail 10.

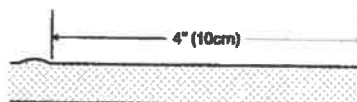
12. Seal the entry from the connection nipple with silicone sealant (RTV). Insert the splice into the junction box and cover. Fasten the caution label (CL-S) to the junction box.



Detail 11.

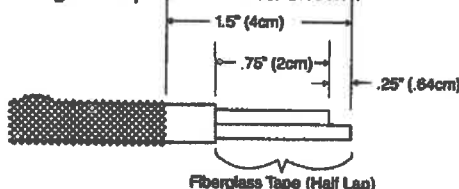
END TERMINATION (PT50)

13. Locate heater zone markers. Cut cable 4" (10cm) from the end of the last marker.



Detail 12.

14. Trim braid 1.5" (4cm) from the end of the cable. Remove .75" (2cm) of the outer insulation from the end of the cable. Remove the nichrome wire from the insulated bus wires. Stagger the bus wires by cutting one lead .25" (.64cm) shorter than the other (do not strip ends). Apply fiber glass tape to the area shown.



Detail 13.

15. Insert the cable end into the end cap completely. Seal the end cap by completely taping over the end cap with 6" (15cm) self fusing silicone tape. Start at the braid and half-lap (under tension) over the cap and double back over the cap finishing over the braid.



Detail 14.

BRAID

Remove the braid in areas to be terminated by combing the braid with care, or trimming to the dimensions indicated above.

Power termination side:

Twist the braid together to form a conductor. Crimp the ring connector to the braid, and fasten to the junction box.

End termination side:

Before trimming, wrap braid with electrical tape to hold in place. Trim to the dimension shown above.

TECHNICAL SUPPORT

Please Call Delta-Therm Corporation at 800-526-7887 with any installation or operating questions.



WARNING

WARNING: The PCK-PT/PF must be installed by a qualified electrician. All assembly, installation, and test instructions must be followed. Improper installation can result in property damage, serious injury, or death due to electric shock. Please call Delta-Therm Corporation at 1-800-526-7887 with any installation or operating questions.

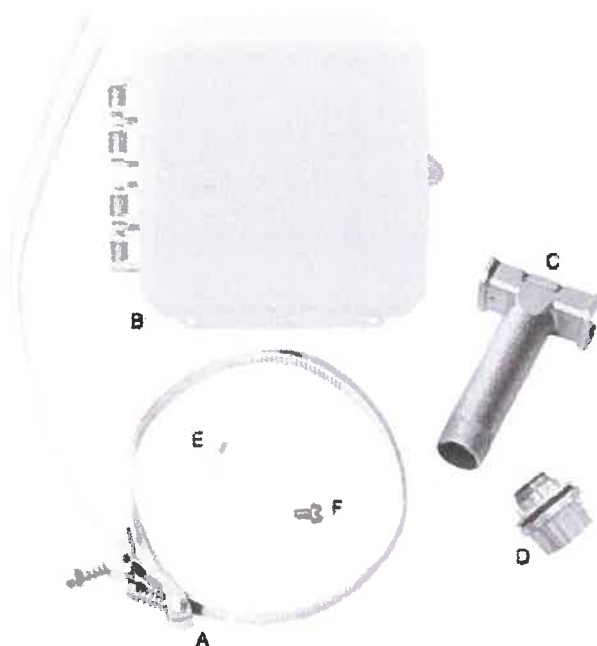
PC1 AND PC2

Polycarbonate Junction Box



Detail 1. PC1 with components.

- A. Polycarbonate Junction Box (6" x 6" x 3")
- B. Hub



Detail 2. PC2 with components.

- A. Pipe Straps (2)
- B. Polycarbonate Junction Box (6" x 6" x 3")
- C. 3/4" Standoff Pipe
- D. Hub
- E. Ring Connector
- F. Ground Screw

DESCRIPTION

The Delta-Therm PC1 and PC2 polycarbonate junction box, is supplied with all necessary components to install the unit onto a pipe quickly and easily.

The Delta-Therm PC1 is to be used with the following kits: PCK-IN, PCK-RG, PCK-C6, PCK-RGP and PCK-PT/PF.

The PC2 is to be used with the these Delta-Therm kits: SPK-IN, ETK-IN, SPK-PF/PT and ETK-PF/PT.

PC1 AND PC2 FEATURES

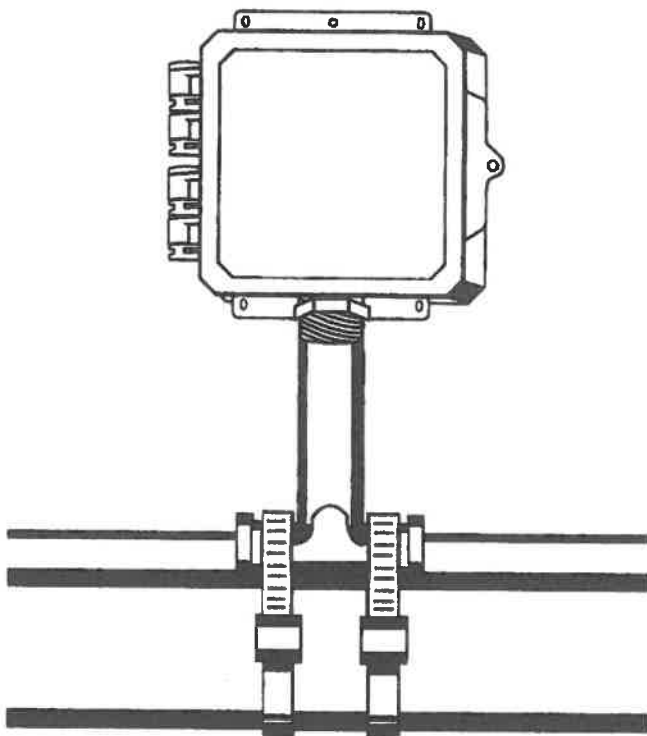
- NEMA 4X Enclosure
- Polycarbonate Is Durable And Contains No Metal Components
- Lockable Enclosure
- 6"x 6"x3" Enclosure Provides Room To Make Connections
- Hinged Cover Is Easy To Open And Close
- Vibration Resistant
- Suitable For Wet Locations
- 120, 208, 240, Or 277 VAC Operation

PC1 COMPONENTS

- Polycarbonate Junction Box (6" x 6" x 3")
- 3/4" Hub

PC2 COMPONENTS

- Polycarbonate Junction Box (6" x 6" x 3")
- Pipe Straps (2)
- 3/4" Standoff Pipe
- 3/4" Hub
- Ring Connector
- Ground Screw



Detail 3. Polycarbonate junction box installed on pipe. (PC1 - Box and hub only. PC2 - includes standoff, pipe straps, hub, ring connector and ground screw).

TECHNICAL SUPPORT

A full set of installation instructions is included with order.
Please call 1-800-526-7887 with any questions.

OL-PC

Monitor Light (Ordinary Locations)

DESCRIPTION

The Delta-Therm OL-PC monitor light provides a means for end of line continuity monitoring of field terminated self-regulating and constant wattage cables.

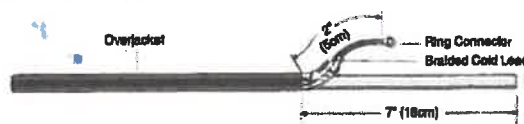
The OL-PC is supplied complete with stand-off and all necessary components to install the unit onto a pipe quickly and easily.

OL-PC FEATURES

- NEMA 4X Enclosure
- Polycarbonate Is Durable And Contains No Metal Components
- Lockable Enclosure
- 6"x 6"x3" Enclosure Provides Room To Make Connections
- Hinged Cover Is Easy To Open And Close
- 100,000 Hours Of Operating Life
- Vibration Resistant
- Eliminates Lamp Failure Due To Fragile Lamp Filaments
- Large Viewing Angle
- Suitable For Wet Locations
- 120, 208, 240, Or 277 VAC Operation
- One Monitor Light Stocking Item For 4 Voltages
- Light Intensity Comparable To Incandescent Lamps, And Far Superior To Neon Lamps

PREPARING CABLE FOR INSTALLATION

- 1. SELF-REGULATING CABLE end:** Remove 7" (18cm) of overjacket. Remove 5" (13cm) of braid. Unbraid and twist remaining 2" (5cm) of braid and crimp on ring connector. Refer to Detail 1.

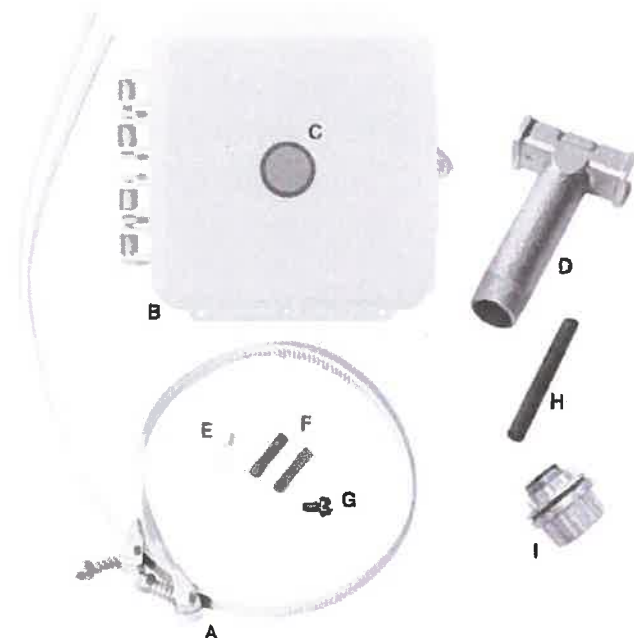


Detail 1. Self-regulating cable preparation.

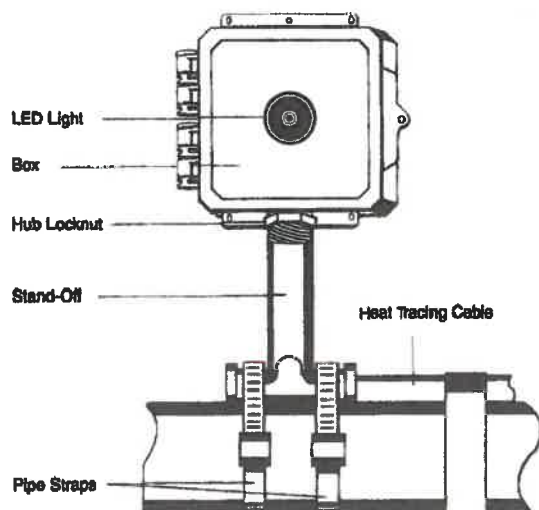
- 2. CONSTANT WATT CABLE end:** Remove 5" (13cm) of braid, and unbraid and twist 2" (5cm) of braid and crimp on ring connector. Refer to Detail 2.



Detail 2. Constant watt cable preparation.

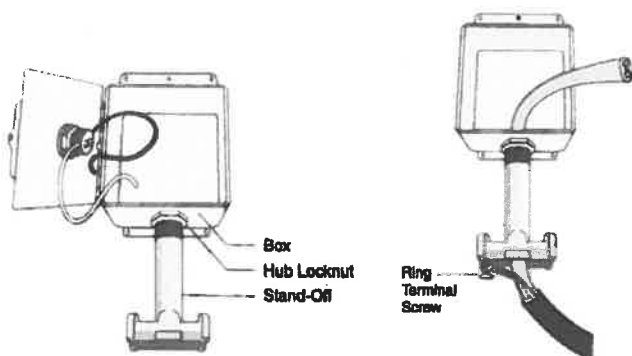


- A. Pipe Straps (2)
- B. Polycarbonate Junction Box (6" x 6" x 3")
- C. LED Light
- D. 3/4" Standoff Pipe
- E. Ring Connector
- F. Butt Connectors (2)
- G. Ground Screw
- H. 3" of .5" (8 x 1cm) Diameter Heat Shrink Sleeve
- I. Hub



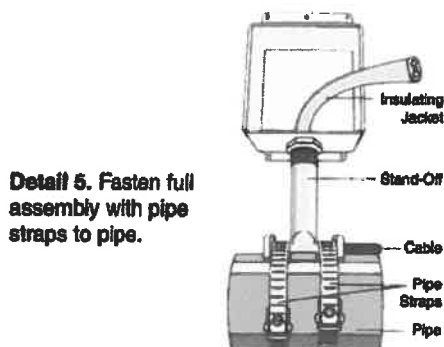
INSTALLING THE OL-PC MONITOR LIGHT

1. Screw hub onto stand off. Remove hub locknut. Place box on hub and secure with locknut. Open OL-PC panel door. Refer to Detail 3.
2. Push cable through standoff and into the box. Continue until ring terminal reaches threaded screw hole on underside of stand-off, secure with screw provided. Refer to Detail 4.
3. Set the assembly on pipe and fasten with pipe straps. Refer to Detail 5.
4. Slide the large 3" (8cm) heat shrink sleeve over the bus wires and insulated jacket. Refer to Detail 6 or 7. **Do not heat shrink at this detail.**
5. For **SELF-REGULATING CABLE**. Remove 2" (5cm) of insulating jacket. Split approximately 2" (5cm) of the center matrix on self-regulating cable. Refer to Detail 6. Strip bus wires and OL-PC's black and white wires at least .25" (.64cm). Refer to Detail 6. Strip .25" (.64cm) of the conductive core to expose the leads to the heater.
For **CONSTANT WATT CABLE**. Remove 2" (5cm) of insulating jacket to expose insulated bus wire, and remove thin spiralled nichrome wire. Tuck nichrome wire end under jacket. Split approximately 2" (5cm) of insulated bus wire. Strip at least .25" (.64cm) off each wire. Refer to Detail 7.
6. Crimp one bus wire to the black monitor light wire and the other bus wire to the white monitor light wire using the insulated crimp connectors. Refer to Detail 8.
7. Position heat shrink sleeve over connectors, lead wires, insulating jacket and apply heat to shrink and seal. Refer to Detail 9.
8. Push wire into box and close the OL-PC panel door. Refer to Detail 10.

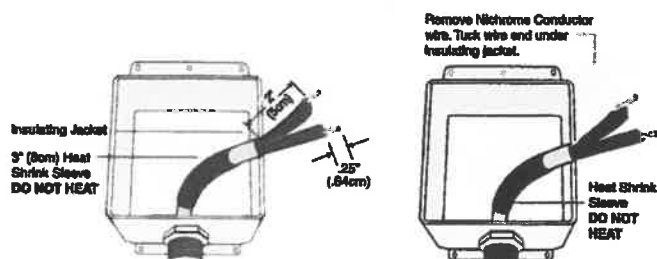


Detail 3. Screw box onto stand off. Remove OL-PC front.

Detail 4. Insert cable and ring terminal.



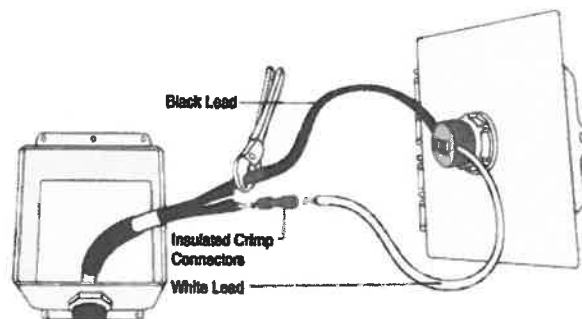
Detail 5. Fasten full assembly with pipe straps to pipe.



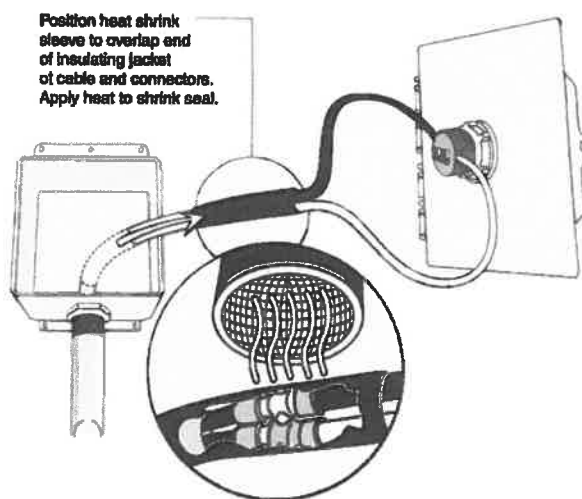
Detail 6. Self-regulating cable.

Detail 7. Constant watt cable.

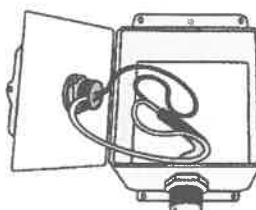
NOTE: Do not remove or replace white and/or black lead wires from LED light assembly.



Detail 8. Attach cable to LED light.



Detail 9. Position heat shrink sleeve and heat.



Detail 10. Finished assembly.

NOTE: To brighten LED light (for 120 VAC applications only), remove the white wire from light. Cut off the black Heat Shrink area from white wire. Strip .25" of insulation from newly cut end of white wire. Reattach white wire to light.

TECHNICAL SUPPORT

A full set of installation instructions is included with order. Please call 1-800-526-7887 with any questions.

TRYMER™ 2000 XP Polyisocyanurate Insulation

TRYMER™
PIR insulation

TRYMER™ 2000 XP insulation is polyurethane modified polyisocyanurate cellular plastic. The rigid insulation is supplied in the form of bunstock for fabrication into sheets, pipe shells, tank and vessel coverings, and other shapes for a variety of thermal insulation applications.

TRYMER™ 2000 XP insulation features improved dimensional stability over a wider range of temperatures than standard polyurethane insulation.

TRYMER™ insulation is not a known nutrient source for mold and mildew.

Applications

TRYMER™ 2000 XP insulation is suitable for applications that require a Flame Spread Index of 25 or less and a Smoke Developed Index of 450 or less when tested as per ASTM E84. These are typical requirements for pipe insulation located in non-plenum locations so Trymer 2000 XP Insulation is particularly ideal for use as pipe insulation in the non-plenum areas of commercial buildings. For pipe insulation located inside plenums of commercial buildings, ITW recommends the use of our Trymer Green Phenolic Insulation. Trymer™ 2000 XP can be used within the service temperature range of -297°F to 300°F (-183°C to 149°C). Typical applications for TRYMER™ 2000 XP insulation include:

- industrial pipe insulation, including elbows and fittings
- commercial chilled water insulation
- tank and vessel insulation
- core material for architectural and structural panels
- insulation for shipping containers, trucks or railcars
- core material for factory built panelized constructions
- flat or tapered board stock for roof insulation

ITW can provide general guidelines and recommendations for TRYMER™ 2000 XP insulation. For additional information, visit www.itwinsulation.com, call 1-800-231-1024 or contact your regional ITW representative.

SIZE

Height	24" (61 cm)
Width	48" (122 cm)
Length	36" (91 cm)
	96" (244 cm)
	108" (274 cm)

Custom lengths are also available. Contact your regional ITW representative for details.

PHYSICAL PROPERTIES

TRYMER™ 2000 XP insulation exhibits the properties and characteristics indicated in Table 1 when tested as represented. Consultation with local code officials and design engineers/specifiers is recommended before application.

As with all cellular polymers, TRYMER™ 2000 XP insulation will degrade upon prolonged exposure to sunlight. A covering to block ultraviolet radiation must be used to help prevent degradation. Other coverings to protect the insulation from the elements may be required.

ENVIRONMENTAL DATA

TRYMER™ 2000 XP insulation is specifically formulated to provide excellent thermal insulation properties without the use of chlorofluorocarbon (CFC) or hydrochlorofluorocarbon (HCFC) blowing agents. In compliance with the Montreal Protocol and the Clean Air Act, TRYMER™ 2000 XP insulation is manufactured with hydrocarbon blowing agents, which have no ozone depletion potential.

SAFETY

CONSIDERATIONS

TRYMER™ 2000 XP insulation requires care in handling. All persons working with this material must know and follow the proper handling procedures. The current Material Safety Data Sheet (MSDS) and General Handling Recommendations for TRYMER™ contain information on the safe handling, storage and use of this material. For copies of these documents, visit the literature library at www.itwinsulation.com, call 1-800-231-1024 or contact your regional ITW representative.

Installation

TRYMER™ 2000 XP insulation is specifically formulated for easy fabrication into many shapes, such as pipe coverings, valve and fitting covers, and others to meet specific design needs. Because of the critical technical design aspects in many applications, ITW recommends contacting qualified designers to specify the total system. For more specific instructions, contact a regional ITW representative or access the literature library at www.itwinsulation.com.

Availability

TRYMER™ 2000 XP insulation is distributed through ITW's extensive Authorized Fabricator Network. For more information, call 1-800-231-1024.

TRYMER 2000 XP Polyisocyanurate Insulation



Pittsburgh Corning

Protecting Companies and Their People Worldwide

FOAMGLAS® insulation is a lightweight, rigid material composed of millions of completely sealed glass cells. Each cell is an insulating entity. FOAMGLAS® insulation's all-glass, closed-cell structure provides the following benefits:

- Constant Insulating Efficiency
- Zero Water Vapor Permeability
- Moisture Resistance
- Fire Protection
- Corrosion Resistance
- Long-Term Dimensional Stability
- Vermin Resistance
- CFC and HCFC Free

These benefits result in AQUACLAS® Insulation Systems that are long-lasting, require little maintenance and are ideal for:

- Low temperature pipe, equipment, tanks and vessels
- Medium and high temperature pipes and equipment
- Hot oil and hot asphalt storage tanks
- Heat transfer fluid systems
- Hydrocarbon processing systems
- Chemical processing systems
- Above ground and underground steam and chilled water piping
- Commercial piping and ductwork

FOAMGLAS® insulation is manufactured by Pittsburgh Corning in a basic block form. Blocks are fabricated into a wide range of shapes, thicknesses and sizes to satisfy industrial insulation requirements.

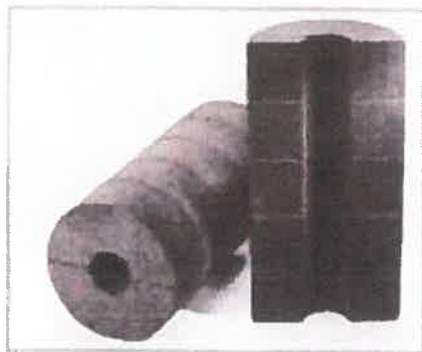
PHYSICAL AND THERMAL PROPERTIES OF FOAMGLAS® ONE™ INSULATION

PHYSICAL PROPERTIES	ASTM			EN ISO
	D5	D568M	Method	Method
Appearance of Residue (Water to 5% Solution)	0.0%	0.0%	0.0%	0% (0.0%) (0.0 - 0.0%)
	This reaction obtained is that affecting a surface with after immersion			
Water vapor Permeability	0.00 g/cm ²	0.00 g/cm ²	194 Water Vapor Permeability B	EN 12086 EN 12086 (2004)
Acid Resistance	Immersion in common acids and their fumes causes no damage and			
Capillary	None			
Compressibility & Reaction to Fire	Non-compressible - will not burn Reaction to Fire 2 Class 2 (non-combustible)		1.129 EN 4554	EN 13501-1 (2002) (EN 13501-1)
Composites	None (no other physical properties)			
Compressive strength, Mod	500 MPa Strength for the material Increase with the strength	50 MPa 50 MPa 50 MPa	1.129 1.129 1.129	EN 4554 EN 4554 EN 4554
Density	1.25 g/cm ³	1.25 g/cm ³	1.129	EN 4554
Dimensional Stability	No shrinkage or expansion in water			
Pressure Strength, Mod	500 MPa	50 MPa	1.129 1.129	EN 12086 EN 12086 (2004)
Flammability	No reaction to weight of 0.0% (0.0% (0.0%))			
Free Coefficients of Thermal Expansion	0.000 000 000	0.000 000 000	1.129	EN 12086
Thermal Expansion Coefficient	0.000 000 000	0.000 000 000	1.129	EN 12086
Modulus of Elasticity, Modulus	100 MPa	1.0 x 10 ¹⁰ MPa	1.129	EN 4554
Thermal Conductivity	0.000 000 000	0.000 000 000	1.129	EN 12086
Water Absorption	0.000 000 000	0.000 000 000	1.129	EN 12086
Thermal Coefficients	0.000 000 000	0.000 000 000	1.129	EN 12086

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FOAMGLAS® ONE™ INSULATION SYSTEMS FOR INDUSTRIAL APPLICATIONS

Pittsburgh Corning has developed insulation systems for a wide range of piping and equipment applications—above ground or underground, indoors or outdoors—at operating temperatures from -450°F to +900°F (-268°C to +482°C).



With the patented Stratafast® System, blocks of FOAMGLAS® insulation are laminated into tiles using a special high temperature adhesive. These tiles are fabricated into the desired shapes and sizes for pipe, tank, vessels, flanges and valves—effectively any industrial insulation application.

Totally Impermeable

Long Term Performance

Because it consists of dried glass cells, FOAMGLAS® insulation resists moisture in both liquid and vapor forms. When tested in accordance with ASTM E96, it has a permeability rating of 0.00 perm-in.

Noncombustible

FOAMGLAS® insulation is 100% glass and contains no binders or fillers—it cannot burn. FOAMGLAS® insulation will not absorb flammable liquids or vapors. If a fire does occur, FOAMGLAS® insulation can help to contain or suppress it.

Corrosion-Resistant

100% glass FOAMGLAS® insulation is unaffected by common chemicals and by most corrosive plant atmospheres. It does not promote metal corrosion and its moisture resistance will help keep water from reaching equipment and piping.

Dimensionally Stable

FOAMGLAS® insulation is unaffected by temperature differentials and humidity. It will not swell, warp, shrink or otherwise distort. The insulation system's integrity remains intact.

High Compressive Strength

FOAMGLAS® insulation can withstand loads which crush most other insulating materials. In a properly designed piping system, FOAMGLAS® insulation eliminates the need for special treatment of pipe cracks. It also provides a firm base for roof membranes, jacking or vapor retarders, prolonging their life.

Technical Service

Pittsburgh Corning's Technical Service Staff provides product, application and material testing—standardized and custom—specifications—on-site customer assistance and installation guidance.

For complete data on FOAMGLAS® Insulation Systems, please visit our Web site at www.foamglas.com, or contact Pittsburgh Corning at any of the following locations:

Pittsburgh Corning (USA)
(Corporate Headquarters)
800 Presque Isle Drive
Pittsburgh, PA 15230
Tel: 1-724-327-6100
Fax: 1-724-387-3507

Pittsburgh Corning Corporation: Asia
(Asia Headquarters)
Pittsburgh Corning Corporation
3-7-4-304 Hikarigaoka
Nerunji-ku, Tokyo, Japan 179-0017
Tel & Fax: 011-81-3-5997-0249

Pittsburgh Corning Europe NV
Europe / Middle East Africa
Headquarters)
Aldershot, UK
9-2980 Topenderlo
Belgium
Tel: +32-13-66 17 21
Fax: +32-13-66 78 54

STANDARDS, CERTIFICATIONS* AND APPROVALS

FOAMGLAS® insulation can be certified to conform to the requirements of:

- ASTM C 552 "Specification for Cellular Glass Thermal Insulation"
- ASTM C 1639 "Standard Specification for Fabrication of Cellular Glass Piping and Tubing Insulation"
- Military Specification MIL-I-24244C, "Insulation Materials, Thermal, with Special Corrosion and Chloride Requirement"
- Nuclear Regulatory Guide 1.36, ASTM C 795, C 692, C 871
- Flame Spread 5, Smoke Developed 0 (UL 723, ASTM E 84), UL R2844, also classified by UL of Canada
- ISO 9001:2006
- UL 1709
- For a listing of UL Through Penetration Fire Stop Approved Systems please search the UL Database at <http://www.ul.com/>. Once on this page click on CERTIFICATIONS on the left hand side. Under General Search click on UL FILE NUMBER and type in R15707 and then SEARCH.
- Board of Steamship Inspection (Canada) Certificate of Approval No. 100/F1-98
- General Services Administration, PBS (PCD) 15250, Public Building Service Guide, Specification, "Thermal Insulation (Mechanical)"
- New York City Dept. of Bldgs., NEA #138-81 M FOAMGLAS® insulation for piping, equipment, walls and ceilings
- New York State Uniform Fire Prevention and Building Code Dept. of State (DOS) 07200-890201-2013
- City of Los Angeles General Approval RR22534

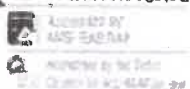
FOAMGLAS® insulation is identified by Federal Supply Code for Manufacturers (FSCM 08859)

*Written request for certificate of compliance must accompany order.



ISO 9001:2000
REMA CERTIFICATE

BCCA ISO 9001:2000



The above information is for informational purposes only and does not constitute an offer of insurance. Insurance coverage is provided by member companies of the National Association of Insurance Commissioners (NAIC) and is subject to underwriting. The above information is not intended to be used as a basis for any insurance policy. The above information is not intended to be used as a basis for any insurance policy. The above information is not intended to be used as a basis for any insurance policy.



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ITW Insulation Systems

PABCO - CHILDERS METALS

ALUMINUM ROLL JACKETING (cladding)

DESCRIPTION

ITW Pabco Childers Aluminum Roll Jacketing is the premier protective outer surface for mechanical insulation systems including pipe, vessels, and equipment. It protects the insulation and underlying pipe/vessel from physical damage, UV exposure, corrosive atmospheres, and water.

ITW Aluminum Roll Jacketing (also called cladding) is available in smooth, stucco embossed, and 1/8 corrugated (cross-ribbed) finishes. For larger surfaces, box-rib and deep corrugated sheets are also available.

ITW Aluminum Roll Jacketing has a bare outer surface and comes standard with a 3 mil thick polysurlyn moisture barrier heat-laminated to the interior surface to help prevent corrosion of the jacketing and the underlying metal pipe, vessel, or equipment.

COMPOSITION

Commercially pure aluminum is relatively soft and less suited for use in this application. Its strength can be greatly improved by alloying with small percentages of one or more other elements such as manganese, silicon, copper, zinc, and magnesium. Additional strength can be achieved by cold working. ITW Insulation Systems carefully screens all potential aluminum coil suppliers to assure our products have the highest quality, are corrosion resistant, and comply with all relevant standards.

ITW Aluminum Roll Jacketing is typically manufactured using alloys 3105 or 3003 which have very similar composition and performance and are considered interchangeable for use as insulation jacketing. ITW reserves the right to ship whichever alloy is in stock at the time of order placement. One of these two specific alloys or an alternative alloy can be specified by purchaser at time of order placement but this may affect minimum quantity, lead-time, and price.

Composition Differences in Aluminum Alloys (%)

Alloy	Cu	Mn	Mg	Zn
3105	0.1	0.5-0.8	0.2-0.8	0.4
3003	0.05-0.2	1-1.5	—	0.1

COMPLIANCE TO STANDARDS

Both bare and polysurlyn lined Aluminum Roll Jacketing from ITW Insulation Systems comply with the requirements of the ASTM Aluminum Jacketing Material

Standard, Q1729, Type I, which includes the strength and chemical composition requirements for compliance to ASTM B209 (Aluminum Alloy Standard).

RECOMMENDED USES

ITW Aluminum Roll Jacketing is recommended for use in all of the following insulation system applications:

- Standard outdoor use on all pipe and vessel insulation systems up to 8 ft outer diameter
- Indoor insulation system applications up to 8 ft outer diameter where increased damage resistance is desired

LIMITATIONS ON USE

ITW Aluminum Roll Jacketing is not appropriate for the following applications:

- For equipment and vessel insulation applications where the outer diameter is larger than 8 ft, ITW deep corrugated aluminum sheets should be used
- For rooftop refrigeration applications, painted Aluminum Jacketing should be considered
- For applications where maximum fire resistance is required, stainless steel jacketing should be used
- For applications where additional resistance to corrosion from the external environment is required, ITW painted aluminum jacketing may be used. Where maximum corrosion resistance is required, ITW stainless steel jacketing (T304 or T316) should be used.

POLYSURLYN MOISTURE BARRIER

Polysurlyn Moisture Barrier (PSMB) is an engineered three layer coextruded film of polyethylene and Surlyn® polymers with a total film thickness of 3 mils (76 µm) that is heat laminated in the factory to the interior surface of Aluminum Roll Jacketing. ITW recommends the use of PSMB on all Aluminum Roll Jacketing to help prevent pitting, crevice, and galvanic corrosion of the interior surface of the metal jacketing and the underlying insulated pipe, tank, or equipment.

Due to its superior performance characteristics, PSMB replaces the old moisture barrier technology of 1 to 3 mil thick polykraft.

ITW Insulation Systems

PABCO - CHILDERS METALS

ALUMINUM ROLL JACKETING (cladding)

PERFORMANCE REQUIREMENTS

ITW Aluminum Roll Jacketing with a 3 mil polysulfone moisture barrier has been tested at a third party lab for flammability and emittance using the standard industry test methods. The results were:

Property	Value
ASTM E84 Flame Spread Index*	0
ASTM E84 Smoke Developed Index*	5
Outer Surface Emittance	0.1

*Tested with exterior metal surface exposed to the flame

SURFACE FINISHES

Each of the three surface finishes available for ITW Aluminum Roll Jacketing (smooth, stucco embossed, and 3/16" corrugated) has applications where it is recommended. All of these can be supplied with a painted exterior. For more information on this, consult the ITW data sheet on painted Aluminum Roll Jacketing.

Smooth (Plain Mill) Finish

This is a very popular finish and is the "default" for the many end-users/specifiers who prefer the clean look of this finish. This finish sheds rain water the best. However, this smooth surface readily shows damage such as from hail or other physical abuse. It also shows the dirt more than the other finishes due to its smoothness. Lastly, it is highly reflective of sunlight and when located near roadways, some specifiers see this reflection as a possible concern.

Stucco Embossed Finish

This is another popular finish used for ITW Aluminum Roll Jacketing. The stucco-like surface texture hides small imperfections and scratches caused by physical damage during or after installation. This finish also reduces reflectivity while still looking very professional. Lastly, the use of stucco embossed finish provides a small increase to the rigidity and strength of the ITW Aluminum Roll Jacketing.

3/16" Corrugated (Cross-Crimped) Finish

This finish consists of parallel grooves or crimps about 3/16" apart running in the length direction of the pipe. This finish also hides small damage and scratches to the jacketing and reduces sunlight reflection. In addition, the nature of this finish gives the aluminum jacket more ability to expand and contract to adapt to insulation movement caused by pipe or ambient temperature changes. Lastly, the rigidity and strength of 3/16" corrugated finish is substantially increased making it ideal for use as jacketing on large diameter pipe and vessels up to 8 ft diameter. This finish is available in a maximum thickness of 0.024 inches.

RECOMMENDED THICKNESS

ITW recommends that the thickness of Aluminum Roll Jacketing used vary based on the outer diameter of the insulation system per the requirements of ASTM C 1729. This recommended thickness is shown in the table below.

Outer Insulation Diameter (in)	Minimum Aluminum Jacket Thickness, inches (mm)	
	Rigid Insulation	Non-Rigid Insulation
≤ 8	0.016 (0.4)	0.016 (0.4)
Over 8 thru 11	0.016 (0.4)	0.020 (0.5)
Over 11 thru 24	0.016 (0.4)	0.024 (0.6)
Over 24 thru 36	0.020 (0.5)	0.032 (0.8)
>36	0.024 (0.6)	0.040 (1.0)

Appendix F: Tank Manufacturer's Certification Letter

PROJECT NAME: Lorain County Landfill
AQUASTORE TANK NO. 8123113 - 3652
DATE: 2/6/13
ENGINEER: Brown & Caldwell

PROJECT CERTIFICATION

Based on the requirement in the project specifications for the Lorain County Landfill in Oberlin, OH, we (Gateway Tank), hereby certify that the 3652 Tecstore that has been provided for the Landfill, and is manufactured by CST Storage of Dekalb, IL., has been installed according to the plans and specification provided us by the engineer.

Items inspected are:

- All Epoxy coated steel panels are provided as per manufacturer's specifications
- All panels have been inspected and holiday tested as per manufacturer's requirements
- The Tank installation and leak testing
- Dome structural integrity

The 36' diameter tank has been installed in accordance with the Manufacturers assembly requirements by the certified and authorized crew of the tank distributor, Gateway Tank, Inc of Avon, OH.

Leak Testing Warranty:

Gateway Tank hereby warrants that the tank provided has been leak tested and shall be free from any water leaking. Should any leak be found, Gateway Tank, will be notified, and shall dispatch a crew to repair leak, as per Manufacturer's specifications.

Floor Bracket Installation:

Gateway Tank approved a floor bracket design for the aeration in the tank and has inspected the installation. After installation of floor brackets, the sealer at the floor joints was inspected and was not disturbed by work done from brackets. This installation of the floor brackets does not void any warranty on the floor.

Dave Witzigreuter, President

Date



2-8-13

Appendix G: Pipeline Pressure Test Results

Appendix H: Air Monitoring Results

Confined Space Entry Permit

A new permit shall be completed daily for each shift

(Page 1 of 2)

GENERAL INFORMATION

Location/Space to be Entered <i>Level II 2. Leachite Storage Tank</i>		Date of Entry <i>1/11/13</i>
Project No.	Purpose of Entry <i>CQA of new acoustics sys. install</i>	
Authorized Entrants <i>Note Gines</i>		
Authorized Attendants <i>Staff B.L. 12</i>		

PHYSICAL HAZARD INFORMATION

Physical Hazards Present <i>low light hot atmosphere leakage piping</i>	Physical Hazard Controls <i>heat shield by hot monitoring and blower closed valve w/ remote valve handle</i>
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Miller Bros. Personnel in space w/o impact to BC Monitoring

ATMOSPHERIC HAZARDS AND PRE-ENTRY/ENTRY AIR MONITORING DATA

Acceptable atmospheric conditions: O₂ > 20.0 percent and < 22.0 percent; LEL < 5 percent; H₂S < 5 ppm; CO < 12 ppm; VOCs 50 percent of the TLV or PEL (whichever is lower). Complete the information below as applicable.

Name/signature of person(s) performing air monitoring						
Date/Time	Initials	O ₂	LEL	H ₂ S	CO	Other (specify)
<i>1/11/13 1530</i>	<i>SM</i>	<i>20.3</i>	<i>0</i>	<i>0</i>	<i>0</i>	
<i>1/11/13 1537</i>	<i>SM</i>	<i>20.2</i>	<i>0</i>	<i>0</i>	<i>0</i>	
<i>1/11/13 1539</i>	<i>SL</i>	<i>20.2</i>	<i>0</i>	<i>0</i>	<i>0</i>	
<i>1/11/13 1539</i>	<i>SM</i>	<i>20.2</i>	<i>0</i>	<i>0</i>	<i>0</i>	
<i>1543</i>	<i>SM</i>	<i>20.2</i>	<i>0</i>	<i>0</i>	<i>0</i>	
<i>1545</i>	<i>SM</i>	<i>20.2</i>	<i>0</i>	<i>0</i>	<i>0</i>	

Any Entry

Original to work station; then to Health and Safety Director.
Copy to project file.

RECEIVED

MAR 12 2013

Brown AND Caldwell

OHIO EPA NEDO

Confined Space Entry Permit (Cont.)

A new permit shall be completed daily for each shift

(Page 2 of 2)

VENTILATION

Based on air monitoring results above, is forced air ventilation required? ☐ Yes ☒ No
If yes, ventilation should be run for at least 15 minutes before the air is re-monitored. If no, continuous air monitoring should be performed.

EMERGENCY INFORMATION AND RESCUE PROVISIONS

Method of communication between entrants and attendant (i.e. verbal, radio, etc.)

Verbal

Method of responding to emergencies/rescue

☒ Non-Entry Rescue (i.e. tri-pod/winch system) *Retrieval line*

☐ Entry Rescue (Outside Provider – specify)

Emergency Contact Information (Name and Phone No.)

911

PERSONAL PROTECTIVE EQUIPMENT REQUIRED FOR ENTRY (Check all that apply)

☒ Hard Hat	☒ Safety Glasses	☐ Safety Goggles	☐ Face shield
☒ Safety Boots	☒ Work Gloves	☐ Chemical Gloves	☐ Tyvek Coveralls
☐ Poly-Tyvek Coveralls	☐ Saranex Coveralls	☒ Full Body Harness/Lanyard <i>Life line</i>	☐ Tri-Pod/Emergency Winch
☐ Hearing Protection	☒ Flashlight	☒ Supplemental Lighting	☐
☐ Intrinsically safe/explosion-proof equipment (specify): <i>N/A</i>			
☐ Respiratory Protection: <i>N/A</i>			
☐ Air Purifying (1/2 or full face); Cartridges: _____			
☐ SCBA ☐ Supplied Air			
☐ Other (specify): _____			

AUTHORIZATION AND VERIFICATION

Entry Supervisor Signature <i>Scott Blum</i>	Date/Time: <i>1/11/13 1340</i>
Attendant Signature <i>John Gair</i>	Date/Time: <i>1/11/13 1341</i>

PERMIT CANCELLATION

Cancelled By: <i>Scott Blum</i>	Date/Time: <i>1/11/13 15:46</i>	Reason: <i>Entry complete</i>
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Original to work station; then to Health and Safety Director.
Copy to project file.

Revised: March 2010