March 28, 2013

Ms. Charlene Fitch, P.E.
Solid Waste Management Program
P.O. Box 176
Jefferson City, Missouri 65102-0176

Subject: Bridgeton Landfill (County Permit # 418, and MoDNR Permit #0118912)
Leachate Tank and Transport Disposal
CEC Project 130-484

Dear Ms. Fitch:

In response to your March 20th, 2013 letter, we have attached to this cover letter the revised documents and submittal for the proposed tank being installed at Bridgeton Landfill. The design is consistent with the last submittal; however, additional detail and documentation of the proposed tank, components, and load out area have been included as requested by St Louis County Department of Health (See Attachment C). As you have requested, two original copies are included. Furthermore, we understand your request that a CQA report shall be submitted within 60 days of the project completion. Lastly, the detailed site plans show the drainage of the site surrounding the proposed tank and the improvements that address the concerns of improvements located over existing areas of trash in old landfills. It should be noted that no areas of cut are proposed in these areas. (See attachment D)

We appreciate your help on this project. Please feel free to contact Republic directly or Kevin Kamp at 314-397-0414 to address any questions or further concerns you may have.

Sincerely,
CIVIL & ENVIRONMENTAL CONSULTANTS, INC.

Kevin T. Kamp, P.E.
Missouri PE#2006019670
Senior Project Manager

STATE OF MISSOURI
KEVIN T. KAMP
NUMBER
PE-2006019670
3/28/13
PROFESSIONAL ENGINEER

Attachments: Cover Letter addressed to Ms. Charlene Fitch, P.E. dated 3-28-13
Response Letter addressed to Ms. Charlene Fitch, P.E. dated 3-5-13
Revised Project Narrative addressed to Ms. Charlene Fitch, P.E. dated 3-5-13
Exhibit 1
Exhibit 2
Attachment A
Attachment B
Attachment C
Attachment D

cc: Ms. Charlene S. Fitch, P.E. – MoDNR
Mr. Craig Almanza – Republic

March 28, 2013

Laura Yates
Field Services Supervisor
Solid Waste Management Program
St. Louis County Department of Health
4562 Lemay Road
St. Louis, MO 63129

Subject: Bridgeton Landfill (County Permit # 418, and MoDNR Permit #0118912)
Leachate Tank and Transport Disposal
CEC Project 130-484

Dear Ms. Yates:

In response to your March 14th, 2013 letter, we have attached to this cover letter the revised documents and submittal for the proposed tank being installed at the Bridgeton Landfill. The design is consistent with the last submittal; however, additional detail and documentation of the proposed tank, components, and load out area have been included as requested (See Attachment C and D).

Sincerely,

CIVIL & ENVIRONMENTAL CONSULTANTS, INC.

Kevin T. Kamp, P.E.
Missouri PE#2006019670
Senior Project Manager

STATE OF MISSOURI
KEVIN T. KAMP
NUMBER
PE-2006019670
3/28/13
PROFESSIONAL ENGINEER

Attachments: Cover Letter addressed to Ms. Charlene Fitch, P.E. dated 3-28-13
Response Letter addressed to Ms. Charlene Fitch, P.E. dated 3-5-13
Revised Project Narrative addressed to Ms. Charlene Fitch, P.E. dated 3-5-13
Exhibit 1
Exhibit 2
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Attachment D

cc: Ms. Charlene S. Fitch, P.E. – MoDNR
Mr. Craig Almanza – Republic

March 5, 2013

Ms. Charlene Fitch, P.E.
Solid Waste Management Program
P.O. Box 176
Jefferson City, Missouri 65102-0176

Subject: Bridgeton Landfill (County Permit # 418, and MoDNR Permit #0118912)
Leachate Tank and Transport Disposal
CEC Project 130-484

Dear Ms. Fitch:

Below please find the responses (noted in italics) to comments received to date from MDNR-SWMP as well as the St. Louis county Department of Health. Additionally the drawings and figures depicting the details and location proposed for this project have been updated to incorporate the comments and are attached.

Missouri Department of Natural Resources Comments:

1. *The SWMP will need a new cover letter emailed to SWMP addressed to:*
   Ms. Charlene Fitch, P.E.
   Solid Waste Management Program
   P.O. Box 176
   Jefferson City, Missouri 65102-0176
   After we get all questions and additions worked out, the SWMP will need the letter and submittal sent hard copy via U. S. Mail.

   A new cover letter is herein and addressed, as requested. We anticipate sending you hard copies of the final documentation for this project approval request, once our plans address the needs and clarification requested by you and the others involved.

2. *Section 2, Proposed design, last paragraph, "a tee and series of valves and piping will also be installed to facilitate efficient leachate collection procedures by allowing better control of flow of the collected leachate to either of the tanks", needs to be shown on the drawings. Unless you are just going to use for loadout now and will submit that modification in the future before installing this equipment. If this is the case, at least show the discharge point from the tank and the valves.*

At this point, it is proposed that the current flow (or a portion thereof) will be directed to the new tank location. This new tank will facilitate the loading for transport disposal of the liquid waste. In the future, there may be other means of discharge available, and we will address revisions to the plans at that time. The loadout location has been shown on the plans. This revision is noted in the plans and the revised project description.

3. *Will a separate pump be required to pump leachate between the two tanks and also to the sewer?*

   A separate pump will be installed to facilitate transferring/diverting the flow of leachate to the new tank location. The location of this pump has been shown on the revised plans.

4. *Also in the same section the second line for direct discharge to municipal sewer either needs to be shown on the drawings or the valve and the connection to the tank for future use.*

   As described in response #2, this will be clarified and shown in future expansion/modifications of the proposed tank. This application and request is to facilitate loadout and transport disposal of the liquid waste only.

5. *Drawing 2, detail 4/2, concrete saw cut 3 in. deep in 6 in. of concrete, is this correct?*

   The depth of the saw cut in the slab control joint should be 1/3 of the slab thickness. Detail 4/2 has been revised to show a 2-in. saw cut.

6. *Drawing 2, detail 10/2, shows a 15-in. by 20-in. aeration pad.*

   The size of the aeration pad has been corrected and is shown in feet. The location of the aeration pad has also been moved to better coincide with the available electrical service near the proposed containment location. The new proposed location is shown on sheets 2, 5, and 6.

7. *Drawing 4, detail 7/4, no height given for over-head loadout.*

   Detail 7/4 has been revised to show a height for the over-head loadout, which is approximately 6 ft. above the top of a typical truck.

8. *Will the collection sump in the loadout pad with the 3-in. gravity drain line to the sump pump handle all spills or discharge line releases?*

   The loadout pad is designed to hold approximately 9,800 gallons, which is more than a typical large tanker load of around 7,500 gallons. If an entire truck load spilled in the loadout area, there would be adequate storage as it drained to the sump, and then was pumped to the tank.

9. *Drawing 5 needs to show all discharge lines, not just the loadout lines, even if just for future use.*

   A nozzle and valve will be installed for a future discharge line to the existing tank and/or off-site discharge. Additional information will be submitted to MDNR-SWMP prior to installing the discharge line. The nozzle and valve are depicted in detail 7/5, and have been added to the plan views on sheets 5 and 6.

10. *Pump capacity not listed for loadout discharge pumps or sump pumps?*

    The proposed loadout pumps are designed to pump at 500 gpm at 25 ft. total dynamic head (TDH). The pumps in the loadout sump and the containment sump are designed to pump at 55 gpm at 30 ft. TDH.

11. *It is not clear if the recirculation system and the aeration system use the same piping in the tank or if they are two separate pipes.*

    Detail 5/6 shows that the 6-in. air pipe is mounted above the liquid circulation pipe. The circulation pipe is 14 in., reducing to 12 in. near the center of the tank. Both air and liquid are combined in the jet aeration nozzles.

12. *The three inlet lines connecting to the tank do not show the connection to the existing leachate piping system.*

    The overall site plan has shown the approximate location of the line from the termination at the existing tank to the new location.

13. *Does the capacity of the air filtration system match the capacity of the aeration blower? How long will filter last?*

The air filtration system is designed to have a capacity of 1000 cfm. Two aeration blowers are planned, each with 360-scfm capacity. The filter media has a typical life of 2 years, and is warranted for 6 months. Bridgeton Landfill will keep on hand a spare supply of 30-cubic ft. of filter media (approximately 33% of the filter capacity). The manufacturer will keep a supply of 60-cubic ft. of filter media on hand, designated for use at Bridgeton Landfill.

14. *What constituents are the aeration system and the recirculation system supposed to remove?*

Leachate aeration systems are used to reduce typical constituents found in leachate that some municipal treatment plants are sensitive to, such as ammonia, volatile organics, and BOD/COD.

15. *Most Drawings are labeled N.T.S., where important, please scale.*

Critical dimensions have been revised and shown, as needed. At the completion of the project, an as-built set of drawings will be supplied to the agency.

St. Louis County Department of Health Comments:

1. *Please explain what function(s) the storage tank is designed for: simple storage, equalization of flow, benzene removal, control benzene emissions, BOD removal?*

The leachate storage tank and aeration systems are used to reduce typical constituents found in leachate that some municipal treatment plants are sensitive to, such as ammonia, volatile organics, and BOD/COD

2. *Will this system use a carbon adsorption process to remove benzene? If so, how is it operated and what is the capacity?*

The air filtration system is designed to have a capacity of 1000 scfm. Two aeration blowers are planned, each with 360 scfm capacity. The blowers will introduce air into the aeration system. Once the air has moved through the leachate, it will exit the tank through the outlet on top of the tank, pass through the demister, and through the PureAir filter. The PureAir system will use 2 types of adsorbent media. Leachate SXL media consists of bituminous activated carbon, and CPSB Broad Spectrum media is a blend of permanganate based media and bituminous activated carbon. The manufacturer's literature (Attachment C) contains specifications for these media.

3. *How will air emission standards and/or permitting requirements be met?*

   Air permitting associated with the proposed modifications to the site are currently being evaluated in relation to applicable regulations and current site permits. Any applicable permits will be obtained as required by Missouri Department of Natural Resources and St. Louis County Department of Health. Site-wide emissions will be calculated for purposes of making any updates to site air permitting.

4. *How will the tank be connected to the existing LCS?*

   The exhibits have been revised to show the connection to the existing LCS.

5. *How will the tank be connected directly to MSD ?*

   The current connection to MSD facilities is from the existing tank and currently this line is not being utilized. In the event the direct discharge option is available a request will be submitted to MDNR-SWMP and the St. Louis County Department of Health to resume this method of disposal.

6. *The detail drawings of the tank need to show the proposed discharge lines to the existing leachate system and the future discharge line to MSD.*

   At this time, the proposed tank is designed for load out for transport disposal only. A direct connection to MSD and/or the existing leachate storage tank may be installed in the future. Additional information will be submitted to MDNR-SWMP and the St. Louis County Department of Health prior to installing any additional discharge line for direct disposal.

7. *How much leachate (treated and untreated) is being stored on-site now ? How much leachate do you estimate will be stored onsite with the expanded leachate collection system ?*

   Currently the temporary leachate storage is for the purpose of collecting and cataloguing liquid while we secure trucking and disposal treatment capacity options. The temporary storage in place at this time is needed while long term transport and disposal sites acclimate their treatment plants and establish capacity acceptance limits. The current expanded collection system represented by this application allows for approximately 2 to 3 days of storage while larger tank storage and on-site treatment process needs are developed, designed, permitted and constructed.

If there are additional questions or comments, please do not hesitate to contact us.

Sincerely,
CIVIL & ENVIRONMENTAL CONSULTANTS, INC.

Kevin T. Kamp, P.E.
Missouri PE#2006019670
Senior Project Manager

STATE OF MISSOURI
KEVIN T. KAMP
NUMBER PE-2006019670
PROFESSIONAL ENGINEER
3/28/13

cc: Ms. Laura Yates, St. Louis County Department of Health

February 22, 2013
REVISED March 5, 2013

Ms. Charlene Fitch, P.E.
Solid Waste Management Program
P.O. Box 176
Jefferson City, Missouri 65102-0176

Subject: Bridgeton Landfill (County Permit # 418, and MoDNR Permit #0118912)
Leachate Tank and Transport Disposal
CEC Project 130-484

Dear Ms. Fitch:

Below please find the narrative description of this project and the attached drawing depicting the details and location proposed for this project inclusive of the revisions/clarifications requested by J. P. Boessen of Missouri Department of Natural Resources.

1.0 Introduction

The available storage volume for the current leachate collection system at the Bridgeton landfill consists of a 96,000 gallon tank located on the southern edge of the landfill near the termination of Boenker Street. In an effort to improve the leachate management situation at the site, additional storage capacity is needed to facilitate the collection and disposal of wastewater to treatment facilities. To accomplish this task, a new tank is being proposed within the central part of the landfill situated such that public visibility, efficiency, and traffic flow are considered. (See Exhibit 1)

2.0 Proposed Design

The proposed location has the following benefits: (See Exhibit 2)

- It is surrounded by the Bridgeton Landfill on the east and the Westlake Landfill on the south, west, and north and limits the visibility from the public right of way.
- It provides for good traffic flow for loading of tanker trucks and uses roadways already serving the transfer station, and
- The proposed location also has the open space capable of providing additional area for some if not all of the future expansion considerations.

The design plan proposes the addition of a +/- 316,000 gallon tank for the leachate collection system. (See Attachment A) This new 48 foot diameter tank will be located within a concrete secondary containment structure. Adjacent to the containment area, a concrete pad is proposed that will act as the load-out area for the alternate disposal option. This pad will be sloped to a sump to contain any potential spill. (See Attachment B)

The current landfill collection system terminates at the existing tank. Once the new tank is installed, it is initially proposed to pump the liquid from the existing tank location to the new tank. This will facilitate efficient loading of liquid waste for transport disposal. In the future, a line can be constructed for direct discharge. If and when this time comes, an application for modification of this system will be forwarded for your approval.

3.0 Closing

The above project narrative and attached figures and plans were prepared at the request and on behalf of Bridgeton Landfill, LLC. If there are any questions please do not hesitate to contact us.

Sincerely,
CIVIL & ENVIRONMENTAL CONSULTANTS, INC.

Kevin T. Kamp, P.E.
Missouri PE#2006019670
Senior Project Manager

STATE OF MISSOURI
KEVIN T. KAMP
NUMBER PE-2006019670
PROFESSIONAL ENGINEER
3/5/13

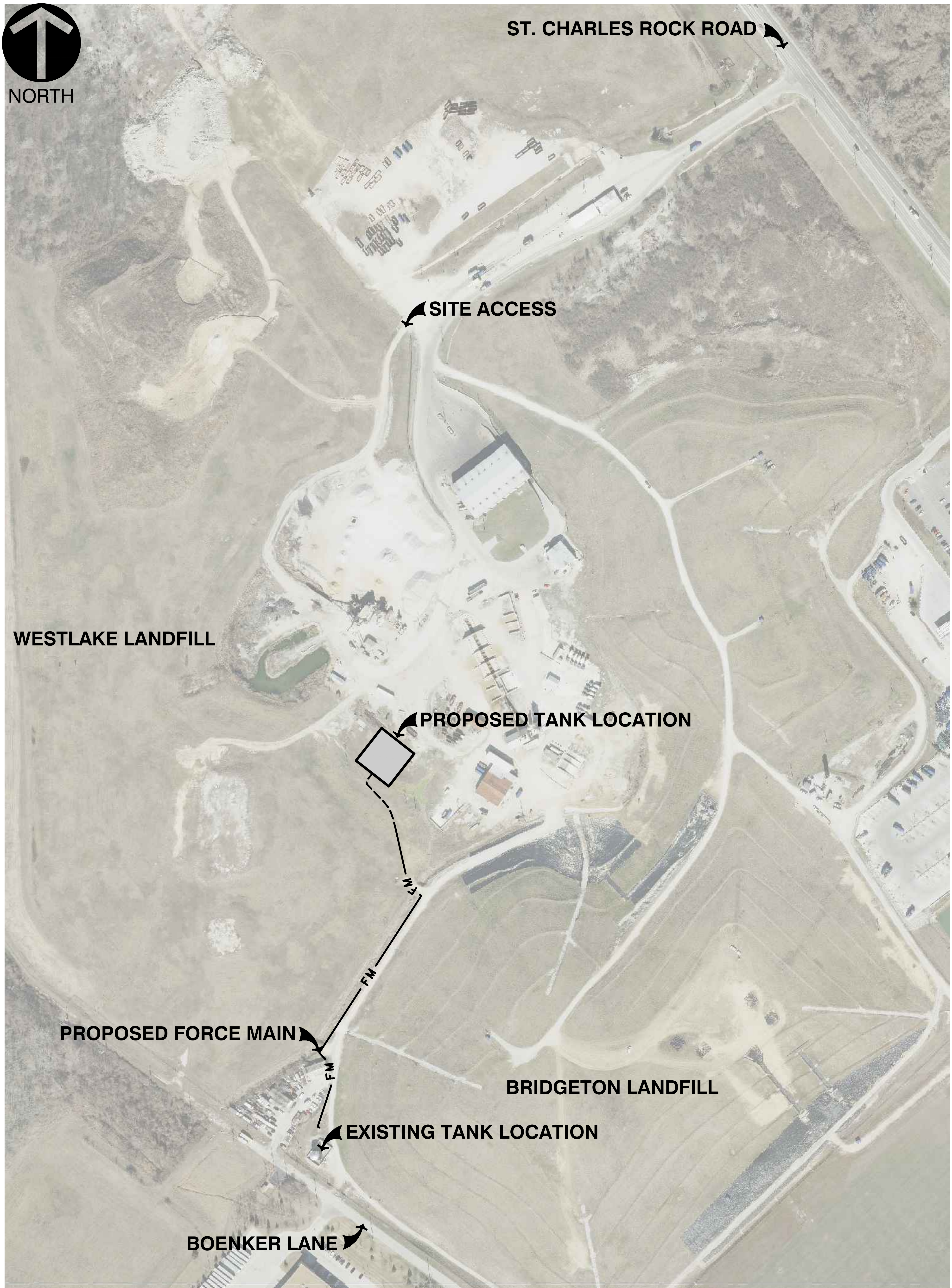
Randal F. Bodnar
VKK

Randal F. Bodnar, P.E.
Arizona PE#48595
Vice President

Attachments: Exhibit 1
Exhibit 2
Attachment A
Attachment B
Attachment C
Attachment D

cc: Ms. Laura Yates, St. Louis County Department of Health

P:\2013\130-484\-CADD\Dwg\130484-Exhibit_1 and 2.dwg{1} LS:(3/5/2013 - ccolthorp) - LP: 3/5/2013 9:21 AM



SCALE IN FEET

0 250 500

REFERENCE

1. TOPOGRAPHIC INFORMATION BASED UPON 312011540-PLAN SURVEY PROVIDED BY WEAVER BOOS ON 02/19/2013.
2. AERIAL IMAGERY PROVIDED BY EAST WEST GATEWAY COORDINATING COUNCIL OF MISSOURI AND ILLINOIS, COLLECTED IN LATE FEBRUARY AND EARLY MARCH OF 2012.

CEC

Civil & Environmental Consultants, Inc.

4848 Park 370 Blvd., Suite F - Hazelwood, MO 63042

314-656-4566 · 866-250-3679

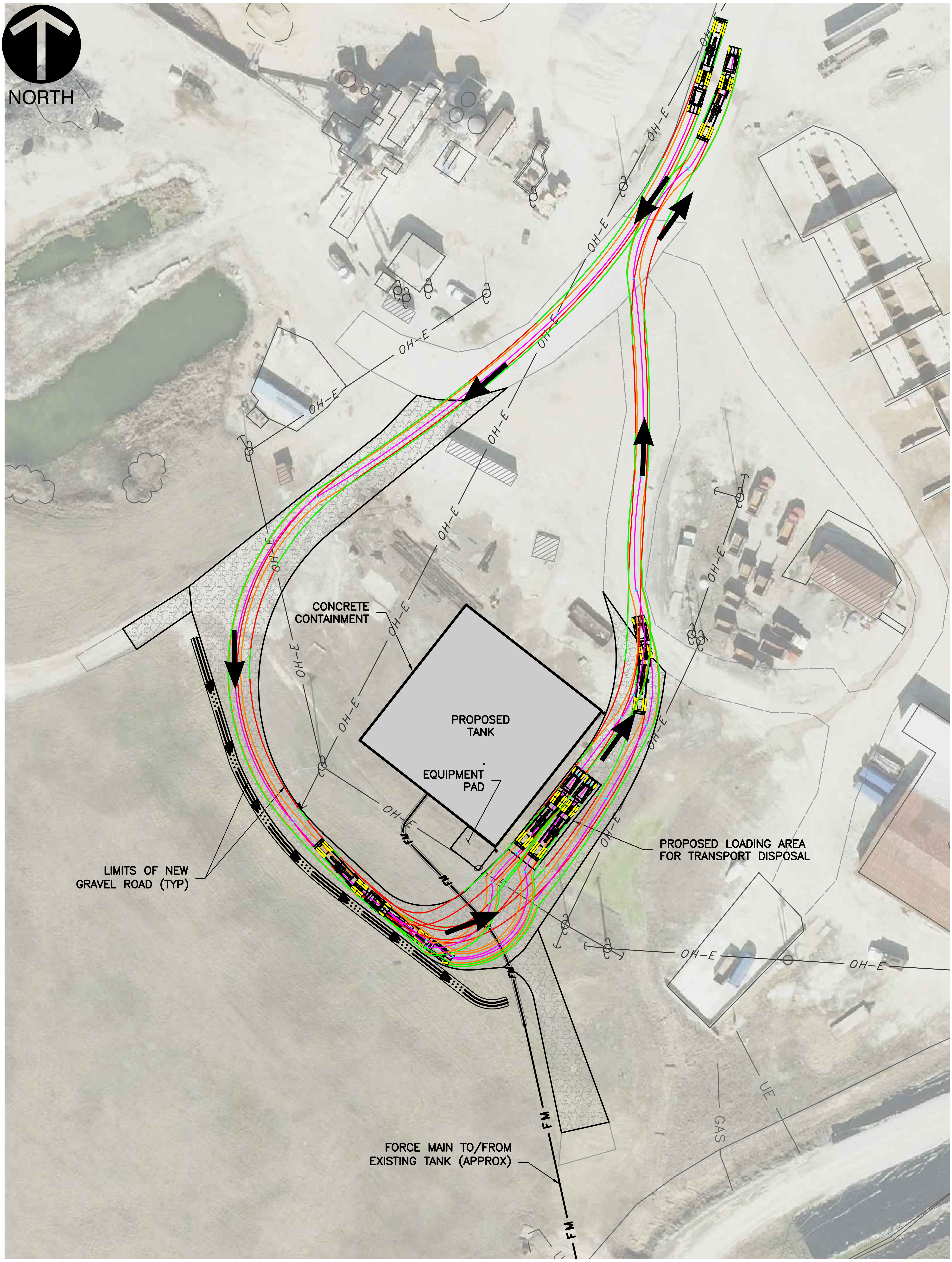
www.cecinc.com

BRIDGETON LANDFILL LLC
BRIDGETON, MISSOURI

PROPOSED SITE LOCATION

DRAWN BY:	CAC	CHECKED BY:	KTK	APPROVED BY:	KTK*	EXHIBIT:	
DATE:	FEB 2013	DWG SCALE:	1"=250'	PROJECT NO:	130-484		1

P:\2013\130-484\-CADD\Dwg\130484-Exhibit_1 and 2.dwg{2} LS:(3/4/2013 - ccolthorp) - LP: 3/5/2013 9:15 AM



REFERENCE

1. TOPOGRAPHIC INFORMATION BASED UPON 312011540-PLAN SURVEY PROVIDED BY WEAVER BOOS ON 02/19/2013.
2. AERIAL IMAGERY PROVIDED BY EAST WEST GATEWAY COORDINATING COUNCIL OF MISSOURI AND ILLINOIS, COLLECTED IN LATE FEBRUARY AND EARLY MARCH OF 2012.

SCALE IN FEET
0 60 120

STATE OF MISSOURI
KEVIN T. KAMP
NUMBER PE-2006019670
PROFESSIONAL ENGINEER
3/5/13

CEC
Civil & Environmental Consultants, Inc.
4848 Park 370 Blvd., Suite F - Hazelwood, MO 63042
314-656-4566 · 866-250-3679
www.cecinc.com

BRIDGETON LANDFILL LLC
BRIDGETON, MISSOURI

PROPOSED SITE LOCATION

DRAWN BY: CAC	CHECKED BY: KTK	APPROVED BY: KTK*	EXHIBIT:
DATE: FEB 2013	DWG SCALE: 1"=60'	PROJECT NO: 130-484	2

ATTACHMENT A

CST STORAGE
345 Harvestore Drive
Dekalb, IL 60115-9607 U.S.A.
815-756-1551 Phone, 815-756-7821 Fax

QMS REGISTERED 0534
ISO9001 CERTIFIED

Project Name: ***Bridgeton TP***
Project Location: ***Bridgeton, Missouri***

Dealer: ***Cady Aquastore***
920G Prairie Drive
Sycamore, Illinois, 60178
Phone: (815) 899-5678 Fax: (815) 899-5681

Project Number: ***8130476***

Submittal Release.No.: ***1***

Aquastore Glass Fused to Steel Bolted Storage Tank

48' diameter (nom.) x 25' high (nom.) Model 4825
Steel Floor Foundation

Shell interior coating:

Vitrium fused glass with Edgecoat process

Shell exterior coating:

Fused glass

Shell Exterior Color: ***Cobalt Blue***

Roof Exterior Color: ***N/A***

Date: February 21, 2013

MADE IN AMERICA WITH AMERICAN STEEL

EQuote # 8130476 rev. 10

Construction Method: Jack

This document consists of 24 pages.

Submitted by:	Date: 2/22/2013	Date: Expires:
Date:	STATE OF MISSOURI JOHN J. SWEENEY E-26360 REGISTERED PROFESSIONAL ENGINEER	

Tank Project Drawing Index

Document Number	Document Title
8130476-001	Tank Drawing
8130476-010	Tank Calculations & Design Formulas
8130476-011	Tank General Notes
8130476-012	Tank Fastener Schedule
8130476-013	Tank Schematic
8130476-014	Tank Parts List

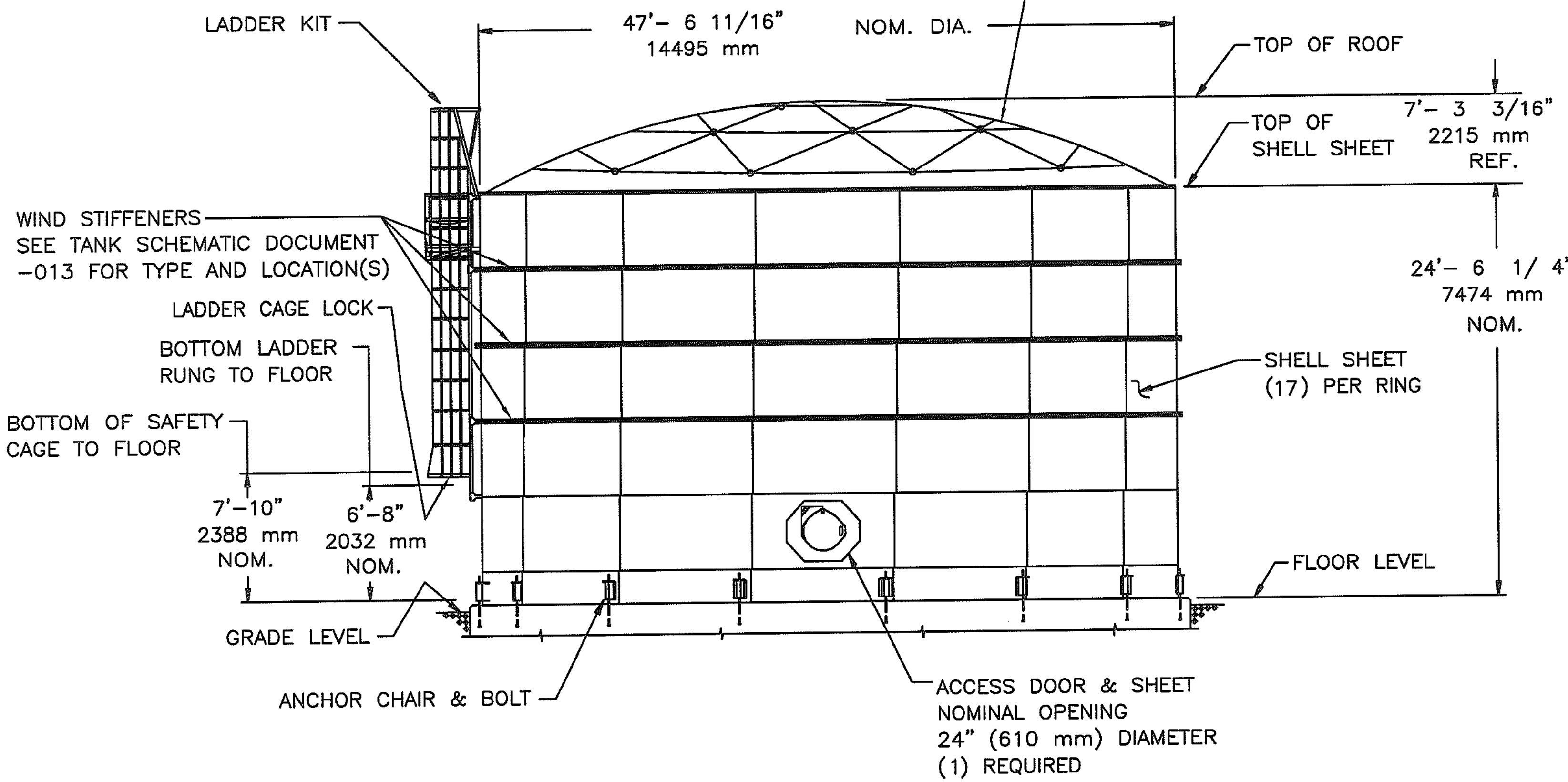
Foundation Project Index

8130476-002	SF Foundation Drawing
8130476-003	Anchor Bolt Placement
8130476-020	Foundation Calculations
8130476-021	Foundation General Notes
8130476-022	Foundation Materials Schedule
8130476-023	Foundation Parts List
8130476-024	Foundation Fastener Schedule
8130476-025	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.

TANK DESIGN FREEBOARD	12 in 305 mm
MAX. ROOF LOAD PER ATTACHMENT POINT (FIXED TYPE CONNECTION)	3500 lb 1587 kg
SEISMIC SLOSHING WAVE HEIGHT	17 in 432.3 mm

REL	DESCRIPTION
1	REL PER MIP 8130476 02/22/13



ELEVATION

PANEL INTERIOR COATING:
VITRIUM FUSED GLASS WITH EDGECOAT PROCESS
PANEL EXTERIOR COATING:
FUSED GLASS
SHELL COLOR: COBALT BLUE

CST STORAGE

DEKALB, ILLINOIS 60115

CONFIDENTIAL

FILE: 8130476A

DRAWN BY RRL
DATE 02/22/13

4825 SFTT
SZ AWWA D103-09
BRIDGETON TP
BRIDGETON, MISSOURI

DRWG NO. 8130476-001

REL.: 1

DATE: February 21, 2013

BY: MP

SUMMARY OF TANK DESIGN INPUT DATA

STRUCTURE MODEL	48 25	
FOUNDATION TYPE	Steel Floor	
SPECIFIC GRAVITY	1.000	
H/V PRESSURE RATIO	1.000	
FREEBOARD	12.000 in	304.800 mm
ROOF TYPE	CST Covers Aluminum Dome	
ROOF WEIGHT	2.200 psf	10.740 kg/m2
SC ROOF HEIGHT	0.000 in	0.000 mm
DC ROOF PROJ AREA	234.200 sq ft	21.758 sq m
DC ROOF CENTROID	34.200 in	868.680 mm
TOTAL ROOF HEIGHT	87.204 in	2214.982 mm
ROOF SNOW LOAD	25.000 psf	1.198 kPa
WIND DESIGN	ASCE 7-05*(10.00 psf)*	
EXPOSURE FACTOR	B	
IMPORTANCE FACTOR	1.000	
WIND SPEED	100.000 mph	45.000 m/s
WIND STIFFENER ANALYSIS	ASCE 7-05*(10.00 psf)*	
SEISMIC DESIGN	AWWA D103-09/IBC 2006	
Ss	0.495	
S1	0.151	
TL	12.0	
SEISMIC IMPORTANCE FACTOR	1.000	
SDs	0.396	
SD1	0.166	
SITE CLASS	C	
FLAT BOTTOM GROUND SUPPORTED ANCHORED TANK.		
DESIGN BASE SHEAR	V =0.052 W	
ANALYSIS PROCEDURE	AWWA D103-09	
ALLOWABLES USED	AISC	
FLOOR O.D	47.750 ft	14554.200 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	0.094 in	2.388 mm
DIST T/FTG TO B/FLR	0.000 in	0.000 mm
TOTAL FNDN THICKNESS	0.094 in	2.388 mm
SHEET DENSITY	590.000 pcf	9451 kg/m3
STEEL ELASTIC MODULUS	30000000 psi	206843 MPa
STEEL FLOOR DENSITY	590 pcf	9451 kg/m3
NET SHEET WIDTH	105.462 in	2679.000 mm
NET STANDARD SHEET HT.	54.990 in	1397.000 mm
STARTER PANEL HEIGHT	18.308 in	465.000 mm
INVENTORY USED	wssf(1311)	

48 25 AQUASTORE STRUCTURE DESIGN SUMMARY (17 FULL LENGTH SHEETS PER RING/COURSE)

COURSE NUMBER	THICK In.	THICK mm	GEOM CODE	MAT CODE	LIMITING FACTOR(S)
1	0.094	2.4	1101	110	
2	0.099	2.5	1201	2	[16]
3	0.099	2.5	1201	2	
4	0.132	3.4	1201	2	[15]
5	0.164	4.2	1201	2	
FND	0.197	5.0	6321	2	

WIND STIFFENERS REQUIRED:

STIFFENER AT BOTTOM OF COURSE 1	=	0.586cu in	3" Web Truss
STIFFENER AT BOTTOM OF COURSE 2	=	0.576cu in	3" Web Truss
STIFFENER AT BOTTOM OF COURSE 3	=	0.576cu in	3" Web Truss

ANCHORS REQUIRED: (1)0.75in. ANCHORS REQUIRED PER SHEET.

STRUCTURE DIAMETER	=	47.56 ft	14495.35 mm
HEIGHT OF STRUCTURE TO EAVE	=	24.52 ft	7474.15 mm
SLOSHING WAVE HEIGHT	=	1.42 ft	432.30 mm
MINIMUM FREEBOARD	=	0.00 ft	0.00 mm
VOLUME OF STRUCTURE TO EAVE	=	43558 cu ft	1233 m3
VOLUME OF CONTENTS	=	41781 cu ft	1183 m3
VOLUME OF CONTENTS	=	312546 gal	1183116 L
VOLUME OF STEEL FLOOR FND.	=	14 cu ft	0 m3
WEIGHT OF EMPTY CYLINDER ABOVE FLOOR	=	22001 lb	9979 kg
WEIGHT OF ROOF	=	3908 lb	1773 kg
SNOW (LIVE) LOAD	=	44408 lb	20143 kg
WEIGHT OF CONTENTS	=	2607156 lb	1182585 kg
STEEL FLOOR WEIGHT	=	8276 lb	3754 kg
TOTAL WEIGHT ON FOOTING	=	2685749 lb	1218234 kg
WIND SHEAR AT TOP OF FOOTING	=	14004 lb	62291 N
WIND MOMENT AT TOP OF FOOTING	=	207195 ft-lb	281 kN-m
SEISMIC SHEAR AT TOP OF FOOTING	=	138693 lb	616936 N
SEISMIC MOMENT AT TOP OF FOOTING	=	1287052 ft-lb	1745 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	3.7	1.6	6569	18000	20397	40500	4882	30000
2	8.2	3.6	14034	28721	21789	67500	5493	30000
3	12.8	5.6	21832	28721	33894	67500	8545	30000
4	17.4	7.5	22222	28721	34499	67500	11596	30000
5	22.0	9.5	22592	28721	35075	67500	14648	30000
FND	23.5	10.2	18095	28191	26188	67500	13138	30000

AXIAL STRESS ANALYSIS

---- STRESS-PSI ----

Course Number	Axial Compressive	Allowable Compressive	Hole Bearing	Allowable Bearing	Bolt Shear	Allowable Shear
1	305	652	3068	40500	734	30000
2	309	686	3102	67500	782	30000
3	328	686	3290	67500	829	30000
4	264	911	2656	67500	893	30000
5	232	1127	2327	67500	972	30000
FND	199	1349	1000	67500	502	30000

WIND STRESS ANALYSIS

---- STRESS-PSI ----

Course Number	Axial Comp	Wind Bending	Total Comp	Allowable Comp	Hole Bearing	Allowable Bearing	Bolt Shear	Allowable Shear
1	42	11	53	869	536	54000	128	40000
2	59	23	82	915	820	90000	207	40000
3	77	40	117	915	1180	90000	297	40000
4	77	46	123	1215	1237	90000	416	40000
5	81	53	134	1503	1345	90000	562	40000
FND	73	49	123	1799	616	90000	309	40000

SEISMIC STRESS ANALYSIS

---- STRESS-PSI ----

Course Number	Axial Comp	Seismic Bending	Total Comp	Allowable Comp	Hole Bearing	Allowable Bearing	Bolt Shear	Allowable Shear
1	42	58	100	869	1007	54000	241	40000
2	59	132	190	915	1911	90000	482	40000
3	77	254	332	915	3330	90000	839	40000
4	77	324	401	1215	4027	90000	1354	40000
5	81	403	483	1503	4855	90000	2028	40000
FND	73	381	455	1799	2284	90000	1146	40000

SEISMIC STRESS ANALYSIS CONTINUED

Course Number	---- STRESS-PSI ---- Hydro-Dynamic Hoop	Total Hoop	Allowable Tensile
1	786	7356	24000
2	1452	15487	38295
3	2014	23846	38295
4	1827	24048	38295
5	1643	24236	38295
FND	1402	19497	37588

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 8130476-010 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 50,type 1;with 1/2"-13 UNC-2A thread, and conform to AWWA D103,Section 4.2.1 & 4.2.2, 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 2 inches (51mm) in diameter shall be reinforced in accordance with AWWA D103, Section 5.10. 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 2 inches (51 mm). These openings of 2 inches (51 mm) and less shall be reinforced in accordance with AWWA D103, Section 5.10.

LADDER SPECIFICATIONS

The ladder system is manufactured in compliance with AWWA Standard D103 Section 7.4 and meets minimum OSHA requirements. In addition, the tank ladder side rails are fabricated from 6061-T6 aluminum while the ladder rungs are fabricated from 6061-T4 aluminum.

CATHODIC PROTECTION SPECIFICATIONS

This tank is equipped with a cathodic protection system conforming to NACE SP0196-2011. This system is designed to protect the items described below.

Entire submerged portion of tank sidewall and floor area including appurtenances supplied by the tank manufacturer. Submerged uncoated metal objects not supplied by the tank manufacturer totaling: 0 sq. ft.

Submerged coated metal objects not supplied by the tank manufacturer totaling: 0 sq. ft.

This system is suitable for use in liquid having a resistivity of 1000 - 1100 ohm-centimeters.

Field verification of liquid resistivity is required after the tank is placed into service.

The performance of the cathodic protection system may be adversely affected if the system is operated outside the resistivity range above.

The presence of submerged uncoated metallic items, for which cathodic protection has not been provided by the tank supplier, may also adversely affect the performance of the cathodic protection system.

Electrical isolation and/or the determination of the cathodic protection requirements for such submerged items shall be the responsibility of the owner or the owner's designated agent.

Tank warranty issues may also be affected.

For further information, refer to the instructions provided with the cathodic protection system.

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

	Thru the sheet fasteners							Truss Fasteners			
BOLT LENGTHS:	1" 25.40	1 1/4" 31.75	1 1/2" 38.10	1 3/4" 44.45	2" 50.80	2 1/4" 57.15	2 1/2" 63.50	1 1/4" 31.75 C.S.	2 1/4" 57.17 C.S.	3" 76.20 C.S.	3 1/2" 88.90 C.S.
SEAM Wide H 1	0	250	39	204	0	0	0	0	0	0	0
SEAM V 1	408	0	0	0	0	0	0	0	0	0	0
SEAM Wide H 2	217	157	0	0	0	0	0	238	0	0	0
SEAM V 2	867	0	0	0	0	0	0	0	0	0	0
SEAM Wide H 3	221	153	0	0	0	0	0	238	0	0	0
SEAM V 3	867	0	0	0	0	0	0	0	0	0	0
SEAM Wide H 4	219	155	0	0	0	0	0	238	0	0	0
SEAM V 4	867	0	0	0	0	0	0	0	0	0	0
SEAM Wide H 5	0	374	0	0	0	0	0	0	0	0	0
SEAM V 5	0	867	0	0	0	0	0	0	0	0	0
SEAM Fnd. H 6	0	340	34	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:	3666	2296	163	234	0	0	0	714	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	0.094" (2.4mm)	BRKT	4	1V	260576K0100
-----(TYPE 3" Web Truss #261847)					
RING # : 2	0.099" (2.5mm)	BRKT	4	2V	256050-0100
-----(TYPE 3" Web Truss #261847)					
RING # : 3	0.099" (2.5mm)	NONE	0	2V	256050-0100
-----(TYPE 3" Web Truss #261847)					
RING # : 4	0.132" (3.4mm)	BRKT	2	2V	256050-1200
RING # : 5	0.164" (4.2mm)	BRKT	2	2V	256050-0500
FND. :	0.197" (5.0mm)	NONE	0	3V	See fnd. parts list

-	1	8130476-001	TANK ASSEMBLY
1	1	8130476-002	FOUNDATION ASSEMBLY
2			
3			
4			
5			
6			
7			
8			
9			
10			
11	1	264391-000	MANWAY PLATFORM ASSEMBLY
12			
13			
14	400	258960-000	SILICONE SEALANT (BLACK)
15			
16			
17	1	258447-002	LADDER W/CAGE KIT
18	1	264769-000	LADDER DOOR ASSEMBLY
19			
20			
21	1	277650-000	GASKET, 24"
22	2	266214-1300	REINFORCING PLATE, .197"
23			
24			
25			
26			
27	17	261256-048	STIFFENER ANGLE
28	17	260577-003	SPLICE ANGLE
29	17	084373-000	TAPERED SPACER
30			
31	357	261847-000	WEB TRUSS, 3"
32			
33			
34			
35			
36			
37			
38			
39			
40			
41			
42			
43			
44	3666	262000-001	STRUCTURE BOLT, 1"
45	2296	262000-002	STRUCTURE BOLT, 1 1/4"
46	163	262000-003	STRUCTURE BOLT, 1 1/2"
47	234	262000-004	STRUCTURE BOLT, 1 3/4"
48			
49			
50			
51	714	262415-001	HHCS 1/2 X 1 1/4" SPCL. FNSH.
52			
53			
54			
55	714	261974-000	WASHER, SPECIAL
56	6716	252275-000	WASHER, 1/2"
57	6359	262416-001	HEX. NUT, 1/2" HDZ
58	714	263525-001	HEX. NUT, 1/2" MDZ

Item	Quantity	Part No.	Description
59			
60	5	264913-000	BUSS BAR
61	1	276534-000	AQUASTORE CP LIT. PACK
62			
63	2	266680-300	CATHODIC PROT. SYSTEM - ZINC
64			
65	3	255495-000	INSTRUCTION DECAL
66	3	262778-000	DANGER DECAL
67			
68	1	266182-000	NAMEPLATE
69	1	271220-000	OPERATORS MANUAL
70	3	262166-000	IMPORTANT DECAL
71	3	260581-000	TANK MOD. WARNING DECAL
72			
73	6	268364-000	LADDER BRACKET ASSY. (LONG)
74			
75			
76			
77			
78			
79			
80			
81	1	266216-0502	24" ROUND ACCESS DOOR SHEET
82	17	260576K0100	TOP RING SHEET
83	1	259813-050	24" ACCESS DOOR, NORMAL DUTY, STANDARD (GALV)
84			
85			
86			
87	34	256050-0100	SHELL SHEET 0.099" HSLA
88			
89	17	256050-1200	SHELL SHEET 0.132" HSLA
90	16	256050-0500	SHELL SHEET 0.164" HSLA
91			
92			
93			
94			
95			
96			
97			
98			
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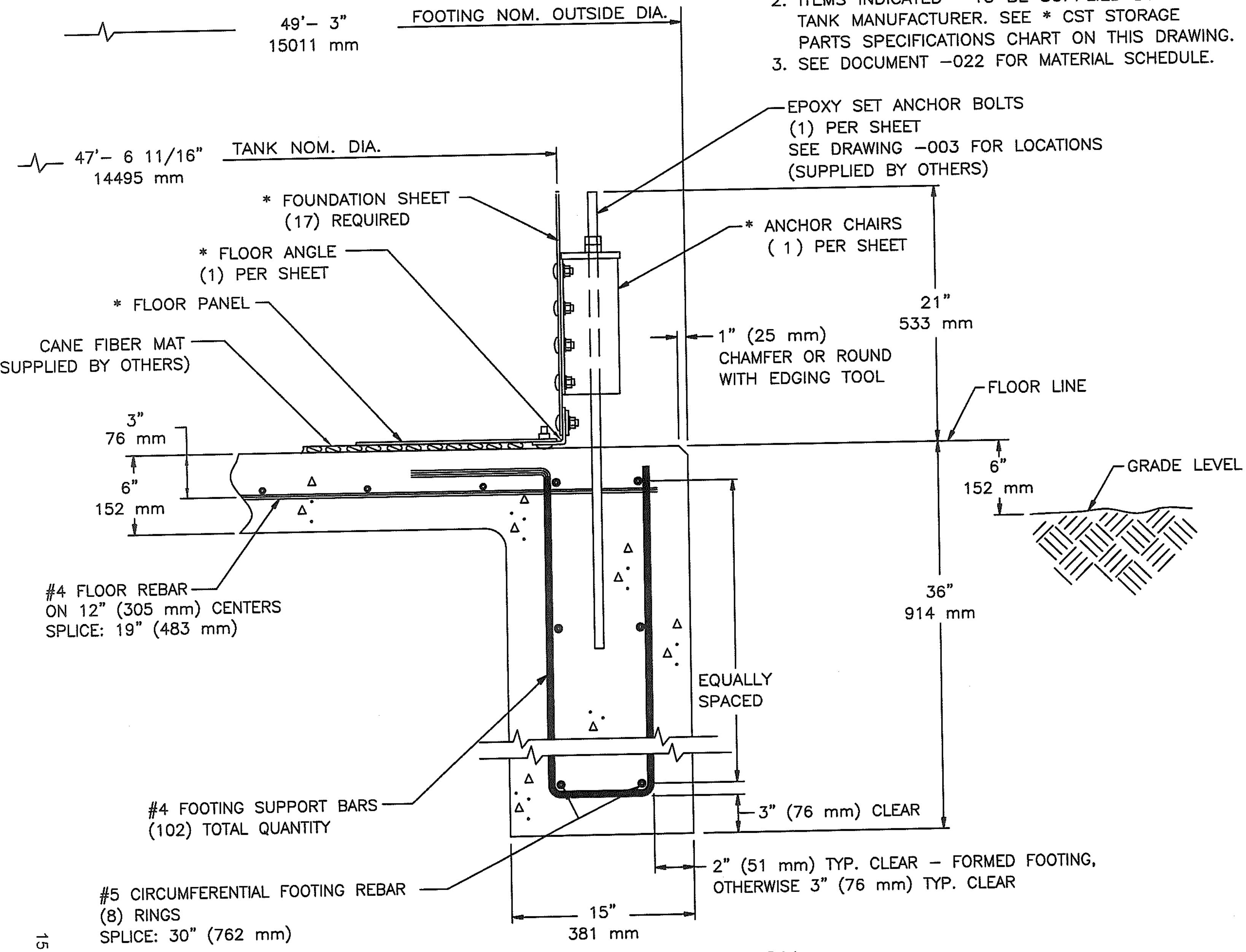
118			

NOTES:
1. THIS DRAWING IS NOT TO SCALE.
2. ITEMS INDICATED * TO BE SUPPLIED BY THE TANK MANUFACTURER. SEE * CST STORAGE PARTS SPECIFICATIONS CHART ON THIS DRAWING.
3. SEE DOCUMENT −022 FOR MATERIAL SCHEDULE.



SECTION THROUGH FOUNDATION

REL	DESCRIPTION
1	REL PER MIP 8130476 02/22/13

* CST STORAGE PARTS SPECIFICATIONS		
FLOOR ANGLES	IN.	3 X 3 X 1/4
	mm	76 X 76 X 6
ANCHOR CHAIRS	IN.	1/4 FORMED PLATE
	mm	6 FORMED PLATE

CST STORAGE

DEKALB, ILLINOIS 60115

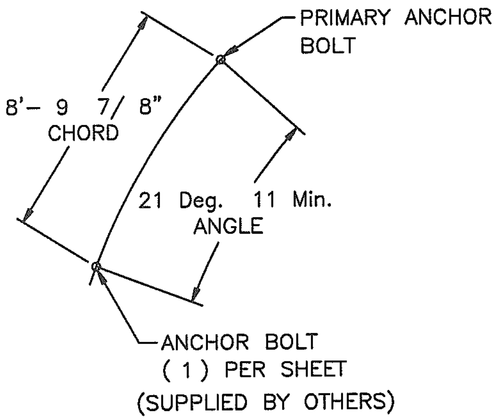
CONFIDENTIAL

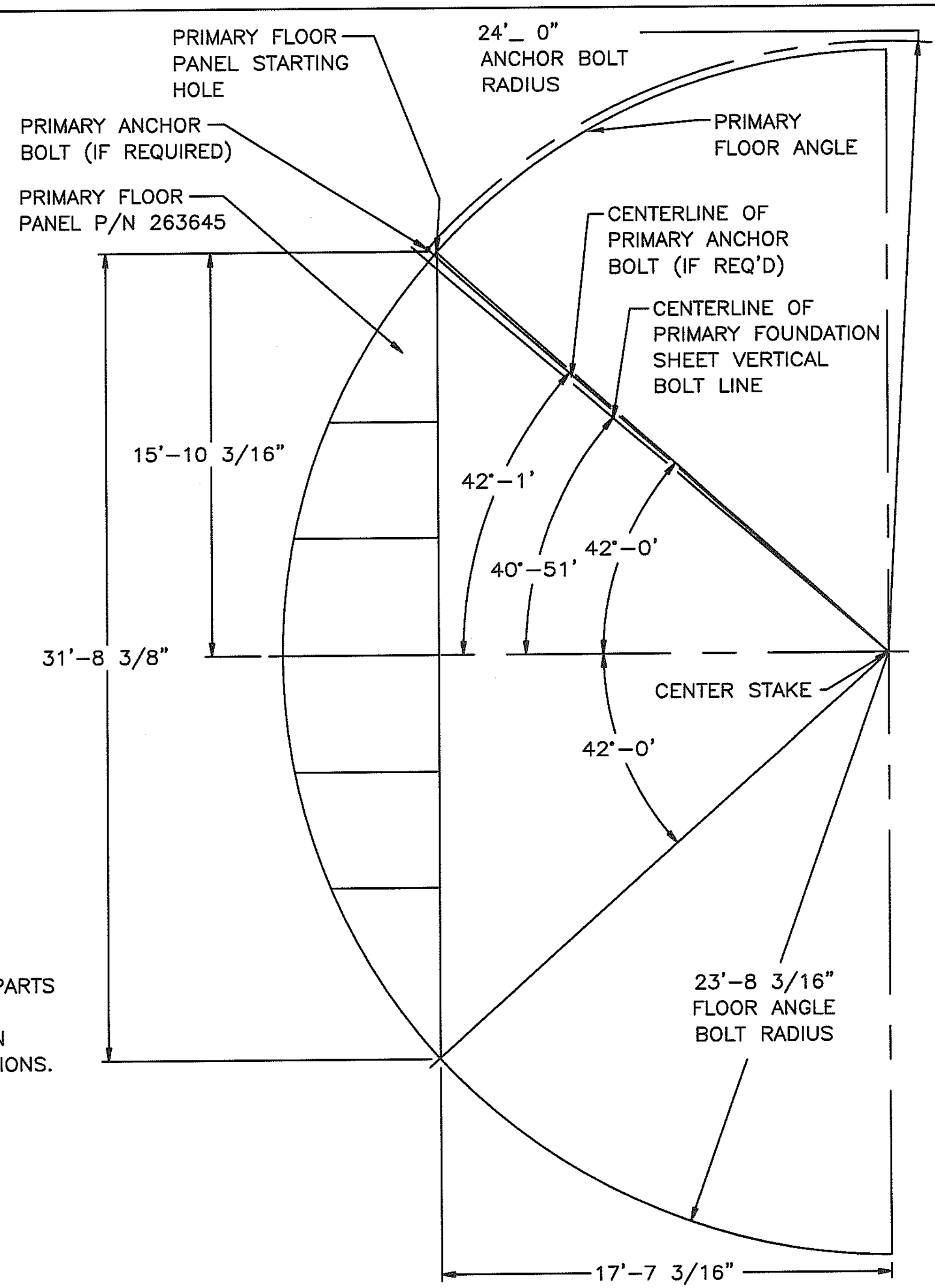
FILE: 8130476B

DRAWN BY RRL
DATE 02/22/13

48' STEEL FLOOR FND.
SZ AWWA D103-09
BRIDGETON TP
BRIDGETON, MISSOURI

DRWG NO. 8130476-002





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

REL	DESCRIPTION
1	REL PER MIP 8130476 02/22/13

CST STORAGE

DEKALB, ILLINOIS 60115

CONFIDENTIAL

FILE: 8130476C

DRAWN BY RRL
DATE 02/22/13

48' STEEL FLOOR FND.
SZ AWWA D103-09
BRIDGETON TP
BRIDGETON, MISSOURI

DRWG NO. 8130476-003

TANK DESIGNATION:	**8130476 Rel 1**	Engineer: JJS	2/22/2013
INPUT:			

Tank Diameter (ft):	47.56	Design per:	ACI 318-05
Contents Height (ft):	23.52	Tank Type:	Anchored
Slab Thickness (in):	6		
Slab O.D. (ft):	49.25		
Foundation Depth (in):	6		
Footer Depth (in):	30		
Footer Width (in):	15	Self or Center Supported Roof :	Self
Allowable soil pressure (psf)	2,000	Specific Gravity of Contents:	1.00
Wind Shear (lbs):	14004	Subgrade Modulus - ks (pci):	56
Wind Moment (ft-lb):	207,195	Coeff. Active pressure - K_a:	0.3
Seismic Shear (lbs):	138693	Concrete strength - f'_c (psi):	4,000
Seismic Moment (ft-lb):	1,287,052	Yield strength of steel - f_y (ksi):	60
Sloshing Wave Height (ft):	1.42		
Weight of Tank (lbs):	22,001		
Weight of Roof (lbs):	3,908		
Snow Load (psf):	25		

TANK DESIGNATION:	**8130476 Rel 1**		Engineer: JJS	2/22/2013
RESULTS:				

Soil Pressure:				
dead plus live load:	1570 psf	<=	2000 psf	(Allowable)
dead plus live plus wind load:	1600 psf	<=	2667 psf	(4/3 * Allowable)
dead plus live plus seismic load:	1764 psf	<=	2667 psf	(4/3 * Allowable)
dead minus wind load:	174 psf		No Uplift	
dead plus live minus seismic load:	1317 psf		No Uplift	
Shear stress at inside of footer =	66 psi	<=	95 psi	Shear Strength
F.S .Overturning - Seismic w/ 45° line:	4.14	>=	1	Required
F.S. Overturning - Seismic (AWWA):	2.67	>=	1	Required
F.S. Overturning - Wind:	26.55	>=	1.5	Required

A_s - foundation (both ways) layer at mid-height:	0.13	sq.in./ft	[# 4 @ 12" o.c.]
A_s - curb area:	0.55	sq.in.	[2 - # 5]
A_s - footer bottom layer:	0.55	sq.in.	[2 - # 5]
A_s - hoop steel:	0.83	sq.in.	[4 - # 5]
A_s - vertical tie bars (2 legs):	0.27	sq.in./ft	[# 4 @ 17.5" o.c.]

Minimum guidelines and specifications are given below. The owner or the owner's designated agent may amend or modify these guidelines and specifications, but in no case shall the requirements be less than those given below

FOUNDATION DESIGN

See Tank Foundation Design Input Data Sheet for foundation design data.

SITEWORK

1. Clear the site of all vegetation, organic materials, rubbish, debris, and other foreign or objectionable materials above the ground surface. Remove all stumps, large roots, buried logs, and other objectionable materials below the ground surface.

2. Soil beneath the entire tank shall have a minimum bearing capacity of 2000 PSF (95761 Pa) and shall be suitable in all respects to properly support the tank as determined by a qualified professional retained by the owner or the owner's designated agent.

3. Compact the subsoil to site specifications.

4. Orientation of connecting piping shall be established in the field.

5. Place all underground piping. Backfill and compact to site specifications. Inlet/outlet piping may penetrate ring walls provided the hole size is less than or equal to one half the wall height; all details of reinforcement cushioning needs, thrust blocks, and encasement shall be provided by others. Otherwise, all piping must pass beneath the footing unless the footing/foundation system has been designed and fully detailed by others to accommodate both a pipe passing through it and the proper transfer of tank loads to the supporting soil.

6. If conditions exist which require footing and/or floor design details differing from those shown on the drawings herein, such new design and details shall be provided by the owner or the owner's designated agent. CST Storage can not show details on its drawings other than those derived as a result of the design efforts of its own Engineering Department.

CONCRETE WORK

Concrete work shall conform to the requirements of ACI 301-05, published by the American Concrete Institute, Farmington Hills, Michigan, except as modified by the supplemental requirements noted below.

1. Concrete shall attain an ultimate 28 day compressive strength of 4000 PSI (27579 KPa).

2. Reinforcing bars shall conform to ASTM A615, grade 60. Welding of bars is not permitted. Field bending of partially embedded reinforcing bars shall conform to Section 3.3.2.8.

3. Cement shall conform to ASTM C150, Type I or Type II with air entraining admixture per ASTM C260 added at the mixer to achieve 4-6% by volume of entrained air at the point of concrete placement.

4. Maximum aggregate size shall be 1 1/2" (38 mm). Fine and coarse aggregate shall conform to ASTM C33, and the restrictions on reactive materials specified in ASTM C33, paragraphs 7.3 and 11.2, shall apply.

5. Ready mixed concrete shall conform to ASTM C94, Option A. The supplier shall be responsible for determining the proportions used in the concrete mix.

6. Earth cuts may be used as formwork for footings only, provided the footing depth does not exceed 48" (1219 mm).

7. Finished surfaces
   A. Rough form finish is acceptable for vertical surfaces.
   B. Floated finish is required for the floor surface.

8. The following sections of ACI 301-05 do not apply:
   6 - Architectural Concrete
   7 - Lightweight Concrete
   8 - Mass Concrete
   9 - Prestressed Concrete
   10 - Shrinkage-compensating Concrete

These materials are to be furnished by the builder. Quantities are estimated.

CONCRETE AND GRAVEL REQUIREMENTS:

CONCRETE IN FLOOR:-		
Per 6" depth (152.4 mm)	35.3 cu. yds	27 m3
CONCRETE IN FOOTING:-		
Per 1" depth (25.4 mm)	0.6 cu. yds	0.4 m3

-	1	8130476-002	S.F. FOUNDATION ASSY.
1	17	261713-1300	0.197" FND. SHT. HSLA
2	1	263632K0100	48.0 FT. DIA. FLOOR ASSEMBLY
3			
4			
5			
6			
7			
8	17	261067-002	TAPERED SPACER
9			
10			
11	17	261424-000	ANCHOR BOLT CHAIR
12			
13	17	261725-006	WASHER, PLATE, 3/4"
14			
15			
16			
17			
18	320	258960-000	SILICONE SEALANT
19	1	261287-000	SEALER PRIMER
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			
32			
33			
34			
35			
36			
37	841	262000-002	STRUCTURE BOLT 1 1/4"
38	204	262000-003	STRUCTURE BOLT 1 1/2"
39			
40			
41	1045	262416-001	HEX NUT, 1/2" HDZ
42	1060	252275-000	WASHER, 1/2"
43			
44			
45			
46			
47			
48			
49			

BOLT LENGTHS:	1" 25.40	1 1/4" 31.75	1 1/2" 38.10	1 3/4" 44.45	2" 50.80	ANCHOR RODS
ANCH. CHAIR	0	68	68	0	0	
VERTICAL	0	221	0	0	0	
HORIZONTAL	0	552	136	0	0	

MANUFACTURER'S LIMITED WARRANTY

One-Year Industrial Warranty

CST Storage warrants that an Aquastore® 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

The 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.

b. The CST Storage Limited Warranty does not cover damage 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 Aquastore brand liquid storage tank to perform as warranted in the 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 (which, 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.

Disclaimers

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

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 document signed by an authorized CST Storage employee.

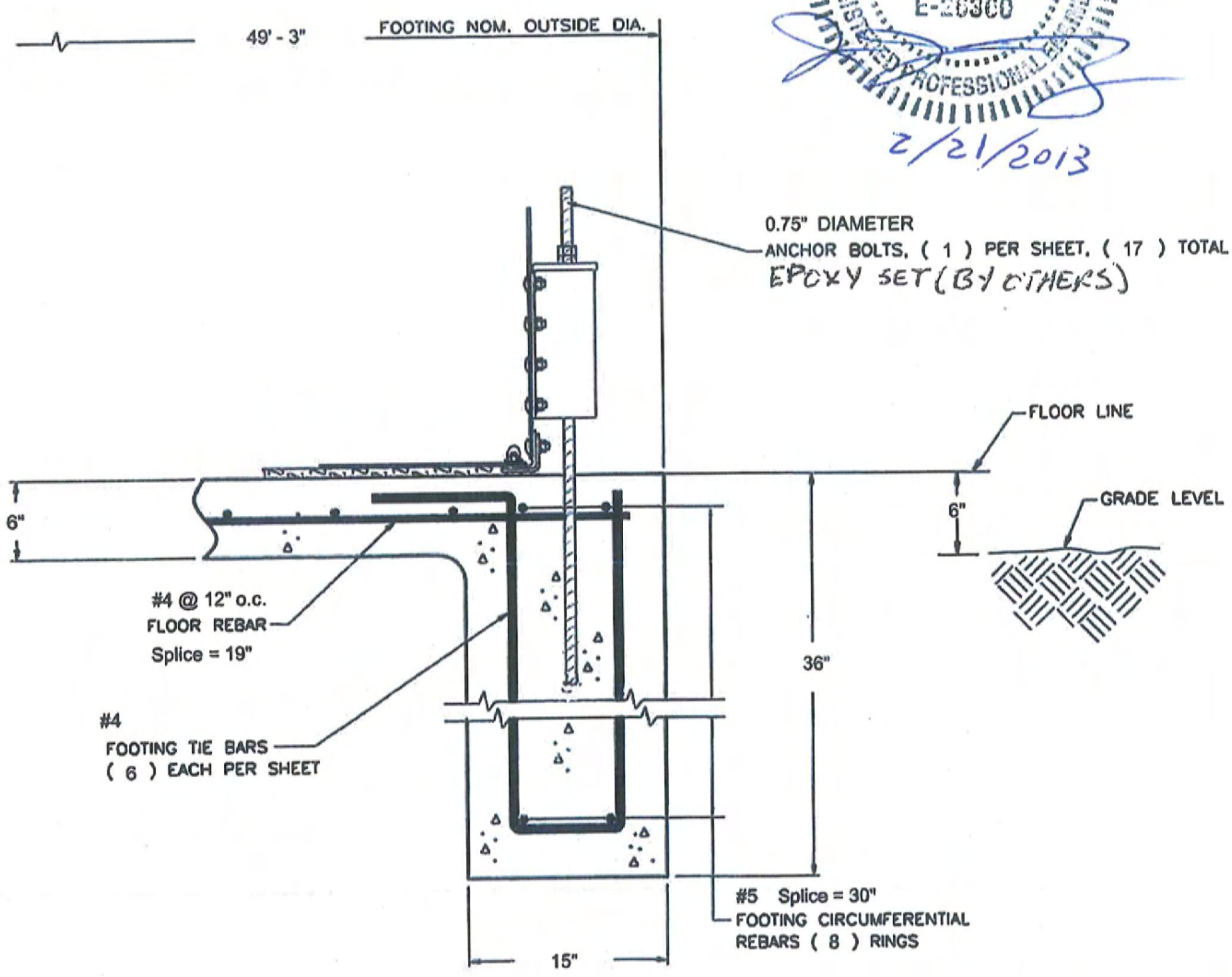
345 Harvestore Drive
DeKalb, Illinois 60115-9607 U.S.A.
815-756-1551 Phone, 815-756-7821 Fax

CST P/N 267232-000 Rel. 3 ECN 1105

CST STORAGE
345 HARVESTORE DRIVE DEKALB, IL 60115
PHONE 815-756-1551 FAX 815-756-7821

Preliminary	☐	Project Name	Bridgeton TP
Final	☑	Project Loc.	Bridgeton, Missouri
Dia. (ft)	48	Project Number	8130476
Ht. (ft)	25	By MP	Release No. 1 Revision No. 10
Fnd. Type	Steel Floor	Date 02/21/13	Page 1 of 3
Prod. Type	TT		

STATE OF MISSOURI
JOHN J. SWEENEY
E-26300
REGISTERED PROFESSIONAL ENGINEER
2/21/2013



TANK DESIGN AISC

Site Class = C
Ss = 0.495
S1 = 0.151
Ie = 1.0
TL = 12

f'c = 4,000 psi

WIND DESIGN ASCE 7-05
WIND SPEED (MPH) 100

QTY. SHEETS PER RING: 17

SOIL BEARING 2,000 psf

IMPORTANCE FACTOR 1.0

SEISMIC DESIGN CODE/ZONE AWWA D-103 09 / n/a

EXPOSURE FACTOR B

E:\AQUA\FND36

2/3

TANK DESIGNATION: **8130476 Rel 1** Engineer: MP 2/21/2013

INPUT:

Tank Diameter (ft):	47.56
Contents Height (ft):	23.52
Slab Thickness (in):	6
Slab O.D. (ft):	49.25
Foundation Depth (in):	6
Footer Depth (in):	30
Footer Width (in):	15
Allowable soil pressure (psf)	2,000
Wind Shear (lbs):	14004
Wind Moment (ft-lb):	207,195
Seismic Shear (lbs):	138693
Seismic Moment (ft-lb):	1,287,051
Sloshing Wave Height (ft):	1.42
Weight of Tank (lbs):	22,001
Weight of Roof (lbs):	3,908
Snow Load (psf):	25

Design per:		ACI 318-05
Tank Type:		Anchored
Self or Center Supported Roof :		Self
Specific Gravity of Contents:		1.00
Subgrade Modulus - ks (pci):		56
Coeff. Active pressure - K_a:		0.3
Concrete strength - f'_c	(psi):	4,000
Yield strength of steel - f_y	(ksi):	60

CST STORAGE

TANK DESIGNATION:	**8130476 Rel 1**		Engineer: MP	2/21/2013
RESULTS:				

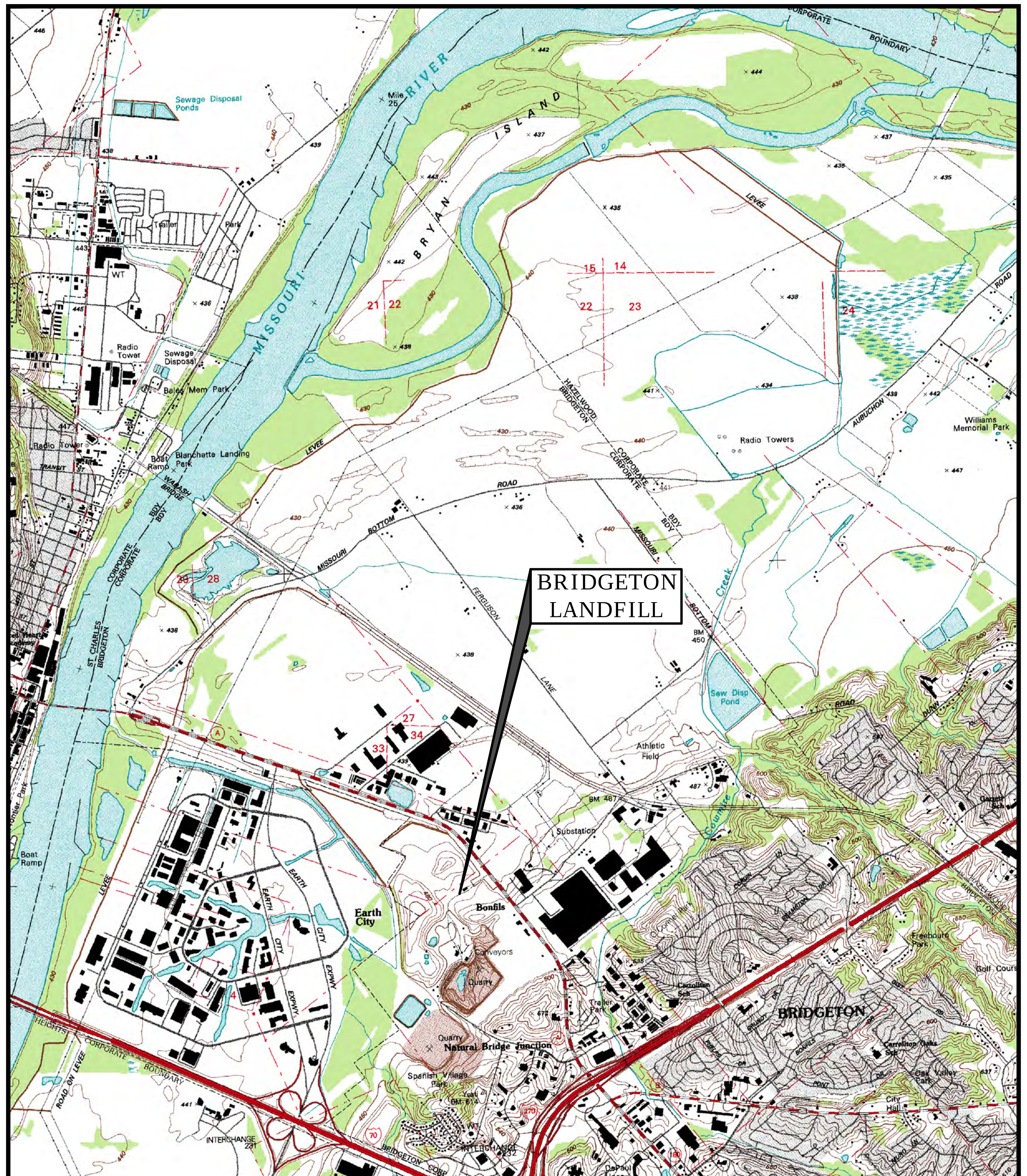
Soil Pressure:				
dead plus live load:	1570 psf	<=	2000 psf	(Allowable)
dead plus live plus wind load:	1600 psf	<=	2667 psf	(4/3 * Allowable)
dead plus live plus seismic load:	1764 psf	<=	2667 psf	(4/3 * Allowable)
dead minus wind load:	174 psf		No Uplift	
dead plus live minus seismic load:	1317 psf		No Uplift	
Shear stress at inside of footer =	66 psi	<=	95 psi	Shear Strength
F.S .Overturning - Seismic w/ 45° line:	4.14	>=	1	Required
F.S. Overturning - Seismic (AWWA):	2.67	>=	1	Required
F.S. Overturning - Wind:	26.55	>=	1.5	Required

A_s - foundation (both ways)			
layer at mid-height:	0.13	sq.in./ft	[# 4 @ 12" o.c.]
A_s - curb area:	0.55	sq.in.	[2 - # 5]
A_s - footer bottom layer:	0.55	sq.in.	[2 - # 5]
A_s - hoop steel:	0.83	sq.in.	[4 - # 5]
A_s - vertical tie bars (2 legs):	0.27	sq.in./ft	[# 4 @ 17.5" o.c.]

ATTACHMENT B

ENGINEERING DESIGN DRAWINGS FOR
BRIDGETON LANDFILL
BRIDGETON, MISSOURI
LEACHATE STORAGE TANK & LOADOUT CONSTRUCTION PLANS

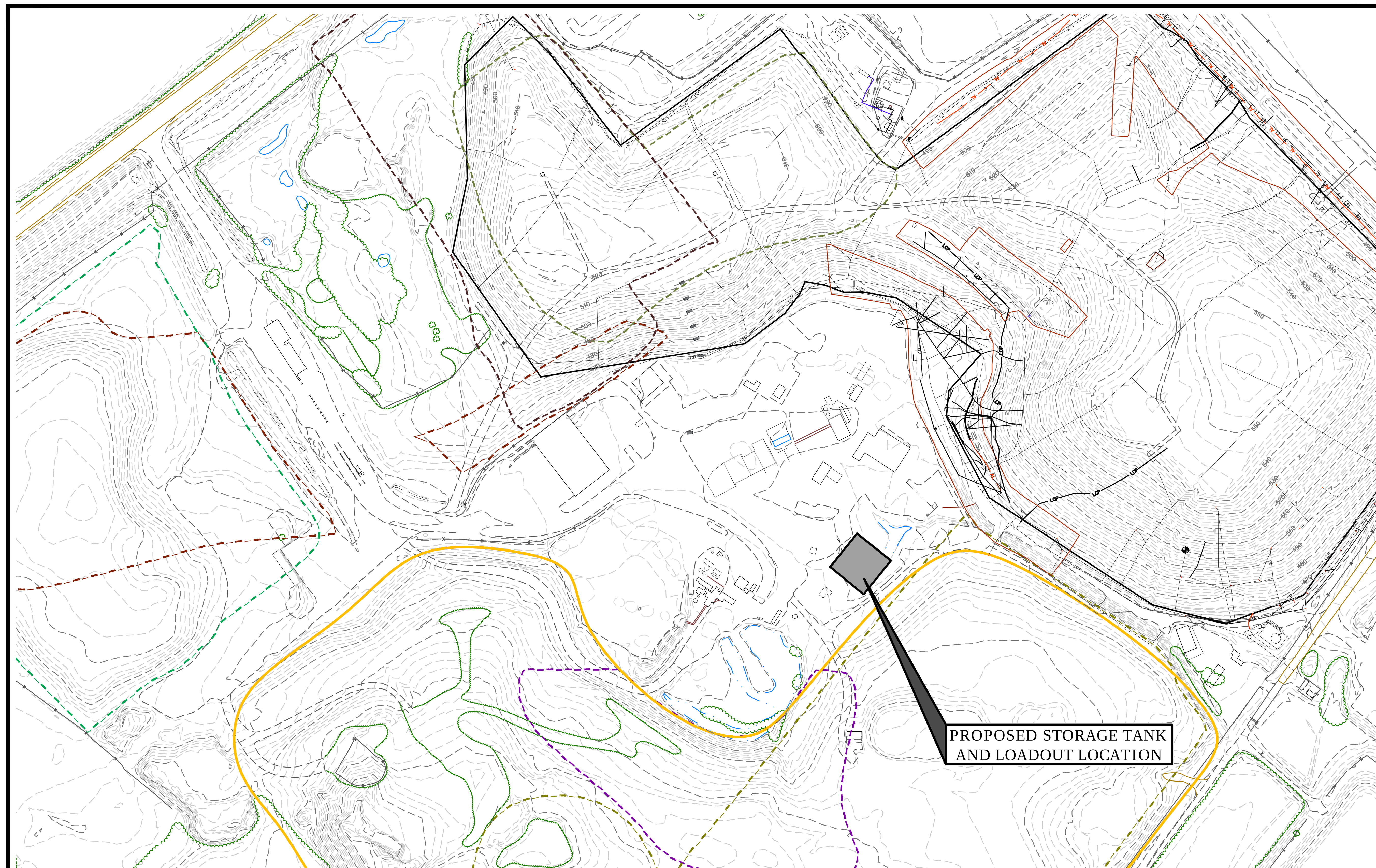
DRAWING	TITLE	FILE
1	COVER SHEET AND SITE LOCATION	BL000002.DWG
2	CONCRETE CONTAINMENT DETAILS	BL000004.DWG
3	CONCRETE CONTAINMENT DETAILS AND NOTES	BL000005.DWG
4	LEACHATE LOAD OUT PAD DETAILS	BL000006.DWG
5	PLUMBING DETAILS	BL000007.DWG
6	AERATION SYSTEM DETAILS	BL000008.DWG



U.S.G.S. SITE LOCATION MAP

APPROXIMATE SCALE: 1" = 2000'

0 1000' 2000' 4000'



SITE PLAN

SCALE: 1" = 200'

0 100' 200' 400'

PREPARED FOR

BRIDGETON LANDFILL, LLC

COVER SHEET AND SITE LOCATION

BRIDGETON LANDFILL

BRIDGETON, ST. LOUIS COUNTY, MISSOURI

No.	DATE	REVISION DESCRIPTION

W E A V E R B O O S C O N S U L T A N T S

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SPRINGFIELD, IL EVANSVILLE, IN

www.weaverboos.com

STATE OF MISSOURI
JOHN BOSSERT
NUMBER
E-2000158235
REGISTERED PROFESSIONAL ENGINEER

DRAWN BY:	JDA
DESIGNED BY:	MEM
REVIEWED BY:	JB
DATE:	02/21/2013
FILE:	0120-131-25
CAD:	BL000002.DWG

SHEET 1 OF 6

J:\users\0120 - Allied\0120-131 Bridgeton\2013 AST Tank\DWG\BL000004 13-03-04.dwg, 3/4/2013 5:06:53 PM

PREPARED FOR
BRIDGETON LANDFILL, LLC

CONCRETE CONTAINMENT DETAILS

BRIDGETON LANDFILL
BRIDGETON, ST. LOUIS COUNTY, MO

No.	DATE	REVISION DESCRIPTION
1	3/4/13	RESPONSE TO MDNR COMMENTS
2	3/4/13	DEEPER FOOTING EAST CORNER

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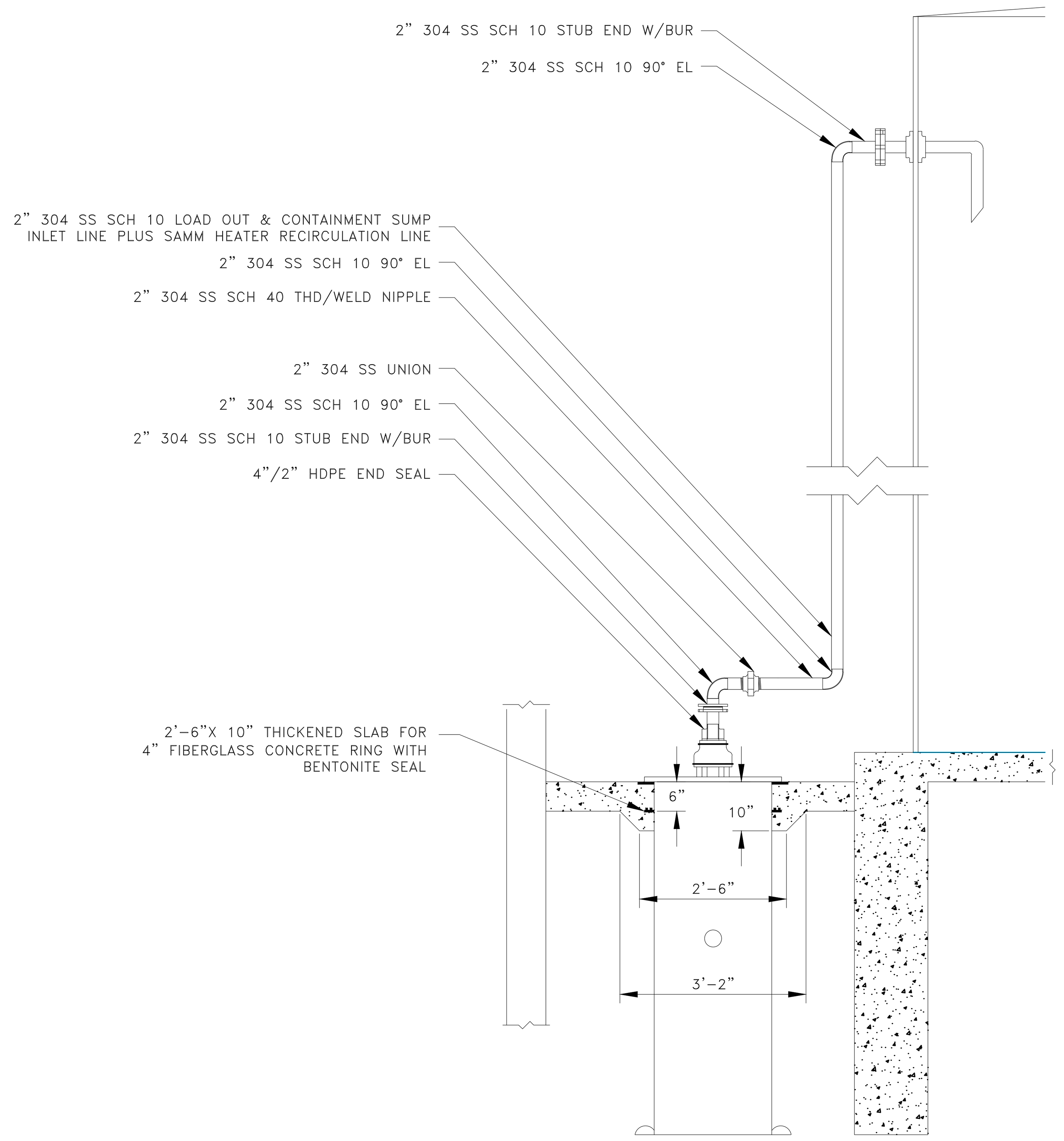
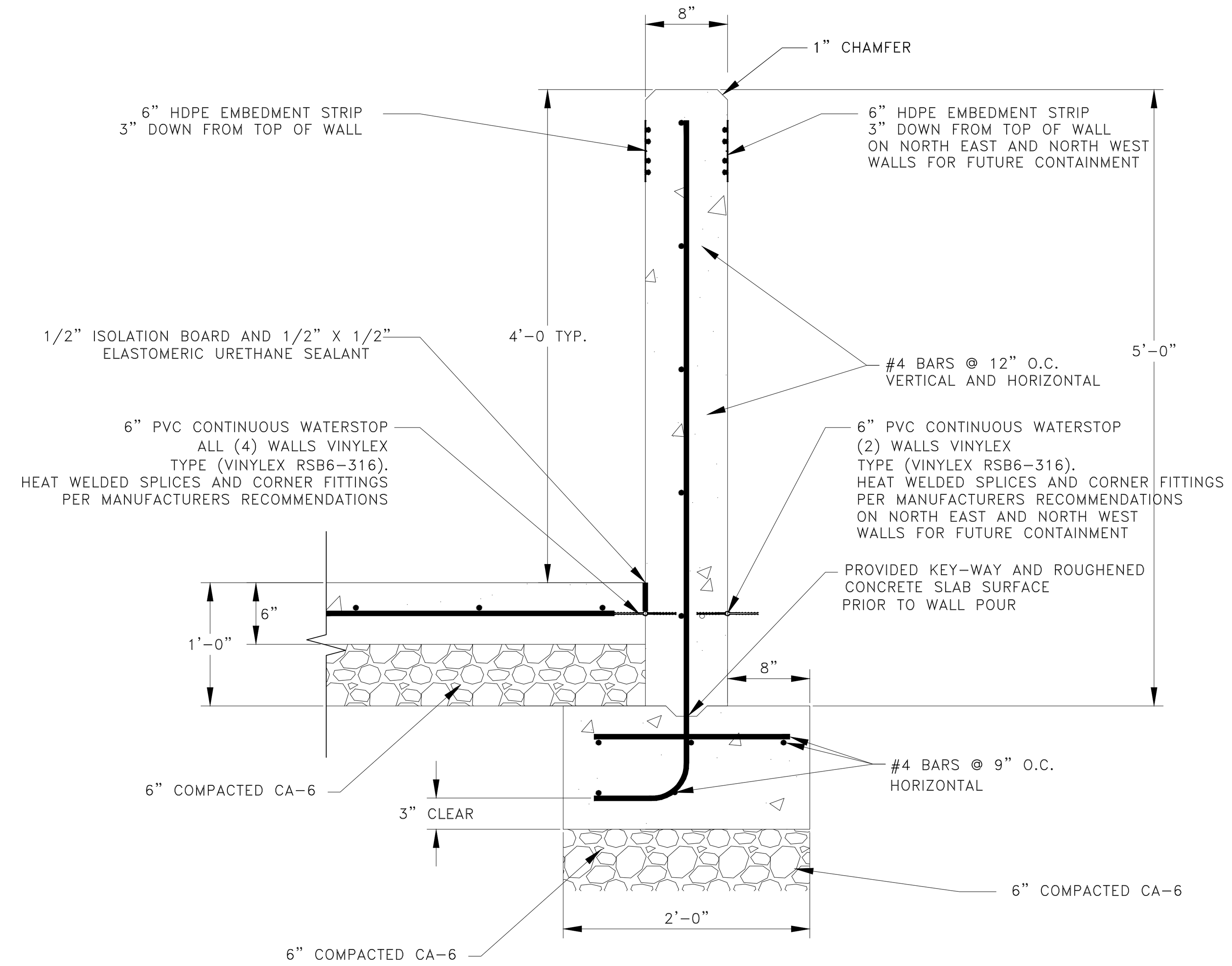
DESIGNED BY: MEM
REVIEWED BY: JB
DATE: 02/17/2013
FILE: 0120-131-25-13-01
BL000004 13-03-04.DWG
SHEET 2 OF 6



1 / 3 CONTAINMENT SUMP DETAIL
SCALE: N.T.S.



2 / 3 SECTION 2-2 CONTAINMENT WALL DETAIL
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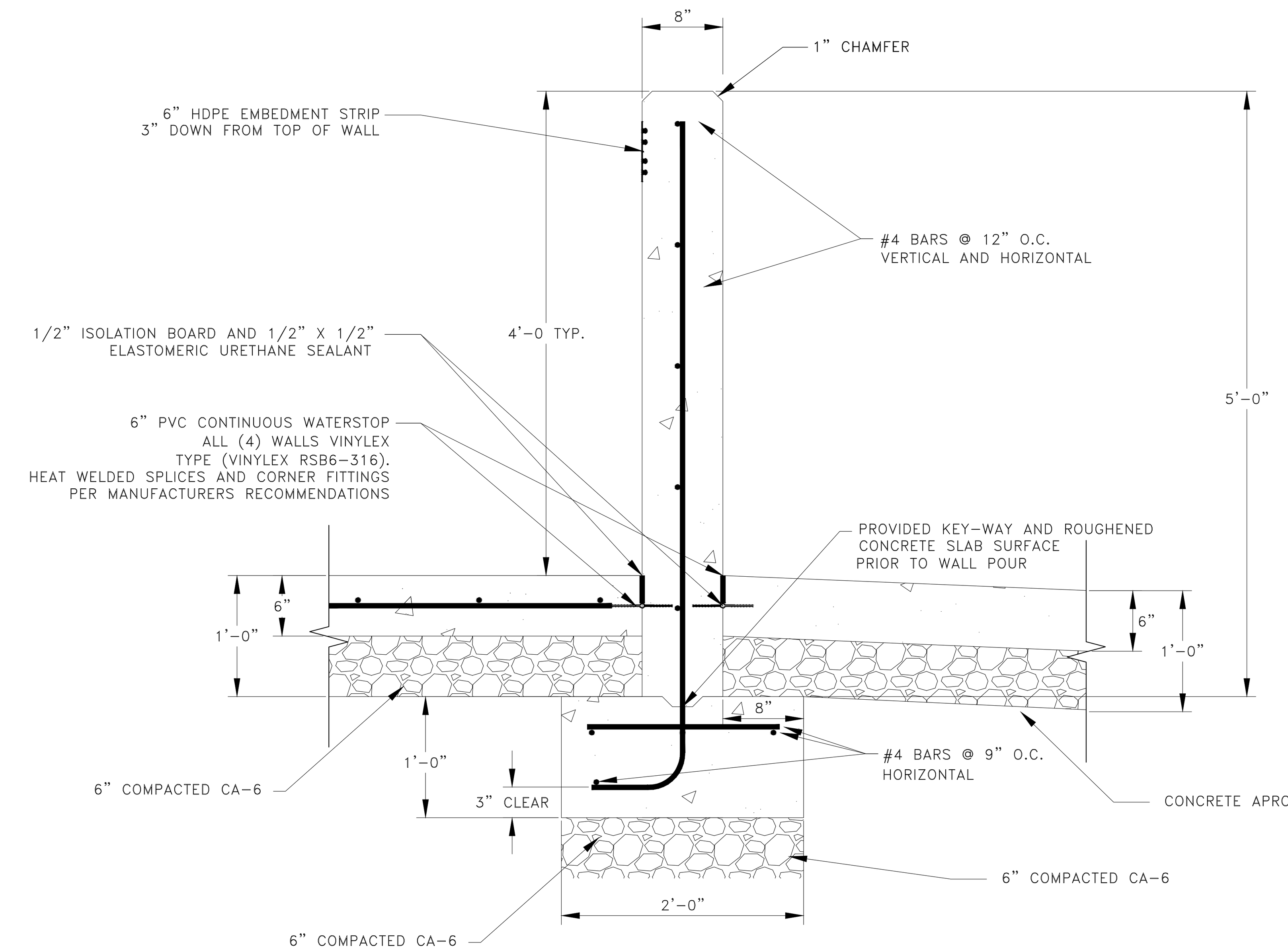
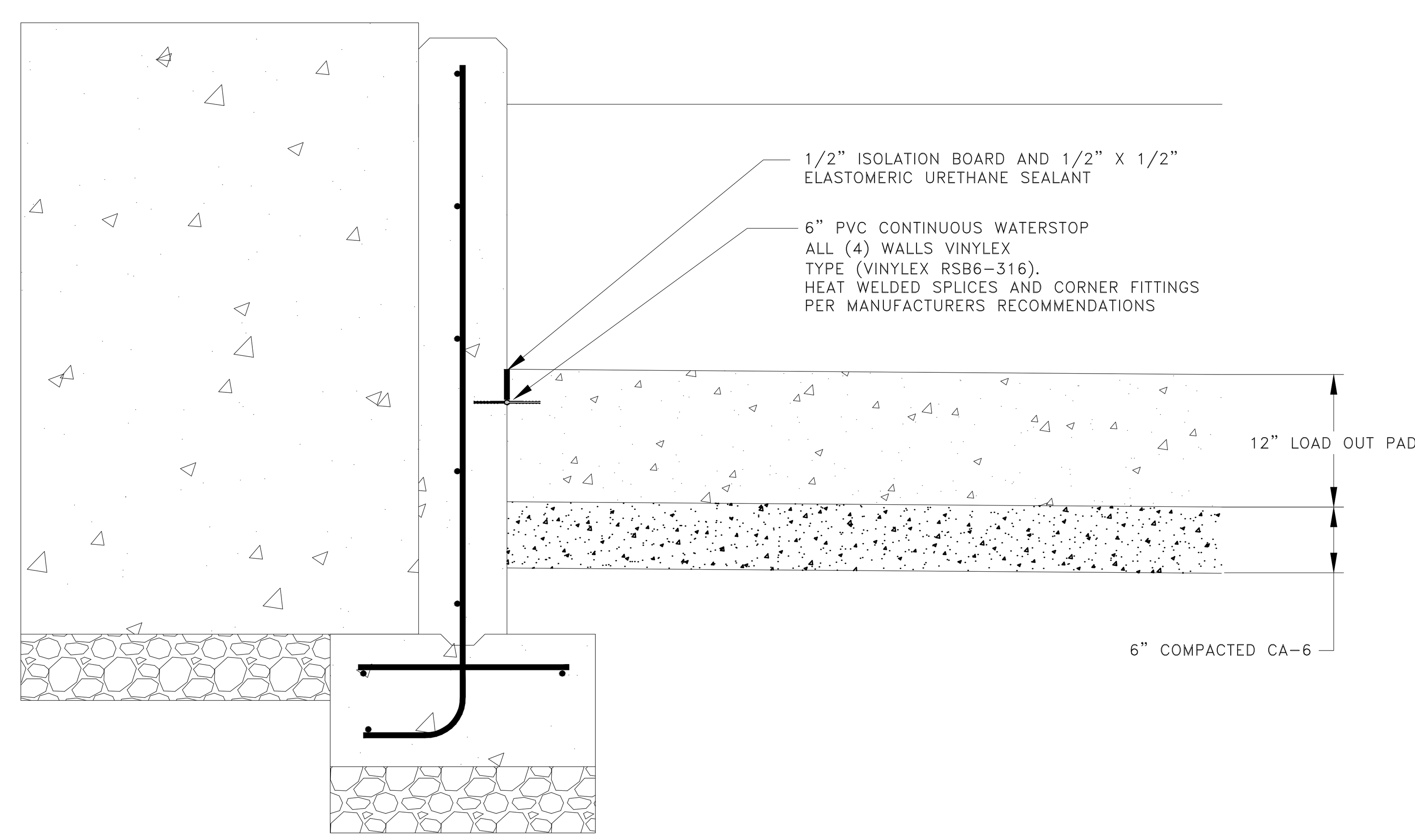
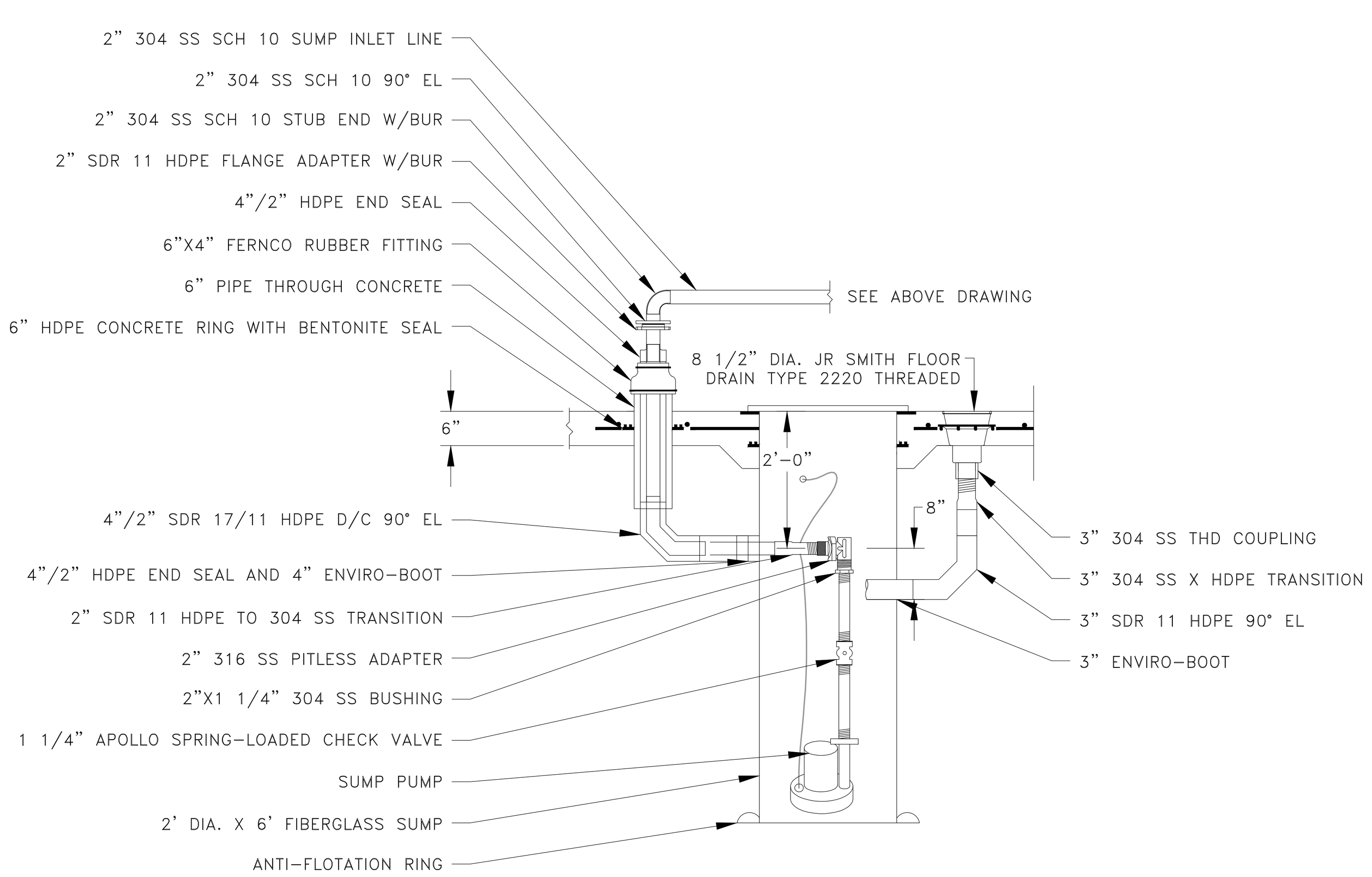


3 / 3 SECTION 3-3 CONTAINMENT WALL DETAIL
SCALE: N.T.S.



5 / 3 SECTION 6-6 LOAD OUT WALL DETAIL
SCALE: N.T.S.



4 / 3 CONTAINMENT SUMP DETAIL
SCALE: N.T.S.

CONCRETE NOTES:

1. CONCRETE MATERIALS SHALL CONFORM TO THE APPROPRIATE STATE REQUIREMENTS FOR EXPOSED STRUCTURAL CONCRETE.
2. MAXIMUM AGGREGATE SIZE SHALL NOT EXCEED 1 INCH. ALL COARSE AND FINE AGGREGATES SHALL CONFORM TO ASTM C33. PLACE AND COMPACT CA-6 AGGREGATE AS SHOWN ON THE DRAWINGS. MoDOT TYPE 5 AGGREGATE CAN BE USED IN PLACE OF IDOT CA-6.
3. REBAR REINFORCEMENT SHALL BE DEFORMED AND CONFORM TO THE REQUIREMENTS OF ASTM A615 GRADE 60 INCLUDING SUPPLEMENTARY REQUIREMENTS S1, UNLESS OTHERWISE NOTED. WELDED WIRE FABRIC SHALL CONFORM TO THE REQUIREMENTS OF ASTM 185.
4. WELDING OR HEATING OF REINFORCING STEEL IS PROHIBITED. FIELD COLD BENDING OF REINFORCING BARS SHALL CONFORM TO ACI 315. BEND RADIUS SHALL NOT BE LESS THAN SPECIFIED IN ACI 315.
5. CONCRETE COVER (CLEAR DISTANCE FROM FORMS TO BARS) SHALL BE AS FOLLOWS UNLESS OTHERWISE NOTED ON THE DRAWINGS: WALL REINFORCING AND BOTTOM BARS OF SLABS – 2" (±1/2") TOP BARS OF SLABS – 1-1/2" (±1/4").
6. VERTICAL AND HORIZONTAL BARS TIED TOGETHER SHALL BE ARRANGED AS SHOWN ON CONSTRUCTION DRAWINGS WITH PARTICULAR ATTENTION AS TO WHICH LAYER IS CLOSEST TO FORMS AND WHICH LAYER IS TIED INSIDE THE OUTER LAYER. BAR SPACING SHALL AVERAGE THE SPACING SHOWN ON THE DRAWINGS OVER ANY 5 FOOT DISTANCE AND INDIVIDUAL BAR SPACING SHALL NOT VARY MORE THAN 1 INCH FROM THE SPACING SHOWN.
7. REINFORCING STEEL AND EMBEDDED STEEL ITEMS SHALL BE SECURELY TIED AND SUPPORTED TO PREVENT DISLODGING OR MOVEMENT DURING CONCRETE PLACEMENT.
8. VIBRATE CONCRETE IMMEDIATELY AFTER PLACING TO PREVENT HONEYCOMBING. AVOID OVER-VIBRATING TO PREVENT AGGREGATE SEGREGATION AND EXCESSIVE BLEED WATER.
9. BEFORE PLACING GRANULAR UNDERLAYMENT, REMOVE ALL TOPSOIL/ORGANIC, LOOSE AND/OR SOFT SOIL AND REPLACE WITH COMPACTED STRUCTURAL FILL TO SATISFACTION OF QC/QA.
10. FILL ALL SURFACE VOIDS AND IMPERFECTIONS IMMEDIATELY AFTER STRIPPING FORMS WITH A GROUT MIX OF 2 PARTS SAND TO 1 PART TYPE 1 PORTLAND CEMENT.
11. FORMS SHALL BE CLEAN, TIGHT, AND ADEQUATELY CONSTRUCTED AND BRACED TO PREVENT MOVEMENT AND EXCESSIVE BULGING. FORM TOLERANCES ARE AS SPECIFIED IN ACI 318-89.
12. LOOSE MATERIAL SHALL BE REMOVED FROM BOTTOM OF EXCAVATION PRIOR TO CONCRETE PLACEMENT.
13. CONCRETE SHALL BE PLACED IN A MANNER THAT WILL PREVENT SEGREGATION OF CONCRETE MATERIALS, INFILTRATION OF WATER OR SOIL AND OTHER OCCURRENCES WHICH MAY DECREASE THE STRENGTH OR DURABILITY OF THE CONCRETE. UNDER NO CIRCUMSTANCES SHALL CONCRETE BE PLACED THROUGH OR UNDER WATER.
14. FORMS SHALL BE KEPT CLEAN AND FREE OF DEBRIS. FORMS SHALL BE CHECKED PRIOR TO CONCRETE PLACEMENT FOR FOREIGN OBJECTS. ALL SUCH OBJECTS SHALL BE REMOVED, REGARDLESS OF SIZE.
15. COMPACT ALL BACKFILL BELOW TRAFFIC AREAS.
16. ELEVATIONS SHALL BE FIELD DETERMINED BASED UPON SURROUNDING GRADE AT THE TIME OF INSTALLATION. THE ELEVATIONS SHOWN ARE RELATIVE TO EACH OTHER, ONLY.
17. NOTIFY QC/QA PRIOR TO CONCRETE PLACEMENT. OWNER AND/OR QC/QA SHALL BE ALLOWED TO INSPECT THE WORK, INCLUDING REINFORCING STEEL AND CONCRETE PLACEMENT. INSPECTION MAY INCLUDE OBTAINING CONCRETE CYLINDERS, MEASURING SLUMP AND CHECKING COMPACTED FILL DENSITY.
18. THE USE OF ANY ADMIXTURES, POZZOLANS OR FLYASH IN THE CONCRETE MIX SHALL BE REPORTED TO THE QC/QA AND APPROVED PRIOR TO CONCRETE ORDERING. REPORT TYPE OF ADMIXTURE, AMOUNT TO BE USED PER CUBIC YARD, AND ADMIXTURE MANUFACTURER. NO CALCIUM CHLORIDE WILL BE ALLOWED.
19. FINISHED GRADE SURROUNDING STRUCTURES SHALL BE SLOPED TO PROVIDE ADEQUATE DRAINAGE AWAY FROM STRUCTURES.
20. CURE ALL CONCRETE WITH WATER AND HAY COVERED BY VISQUINE WHEN NEEDED. PROTECT CONCRETE FROM FREEZING IN ACCORDANCE WITH ACI CODE FOR WINTER PLACEMENT OF CONCRETE. (E.G. USE INSULATION BLANKETS)

ELEVATION KEY

TW= TOP OF WALL ELEV.
TCP= TOP OF CONCRETE PAD ELEV.
BF= BOTTOM OF FOOTING ELEV.
TF= TOP OF FOOTING ELEV.
TTP= TOP OF TANK PAD
N.= NORTHING
E.= EASTING

PREPARED FOR
BRIDGETON LANDFILL, LLC

CONCRETE CONTAINMENT DETAILS AND NOTES

BRIDGETON LANDFILL
BRIDGETON, ST. LOUIS COUNTY, MISSOURI

No.	DATE	REVISION DESCRIPTION
1		
2		

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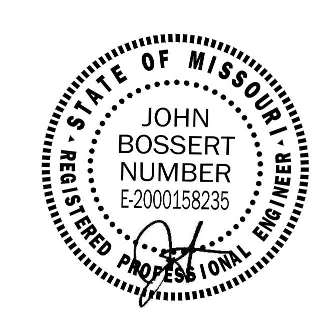

DRAWN BY:	AWS
DESIGNED BY:	MEM
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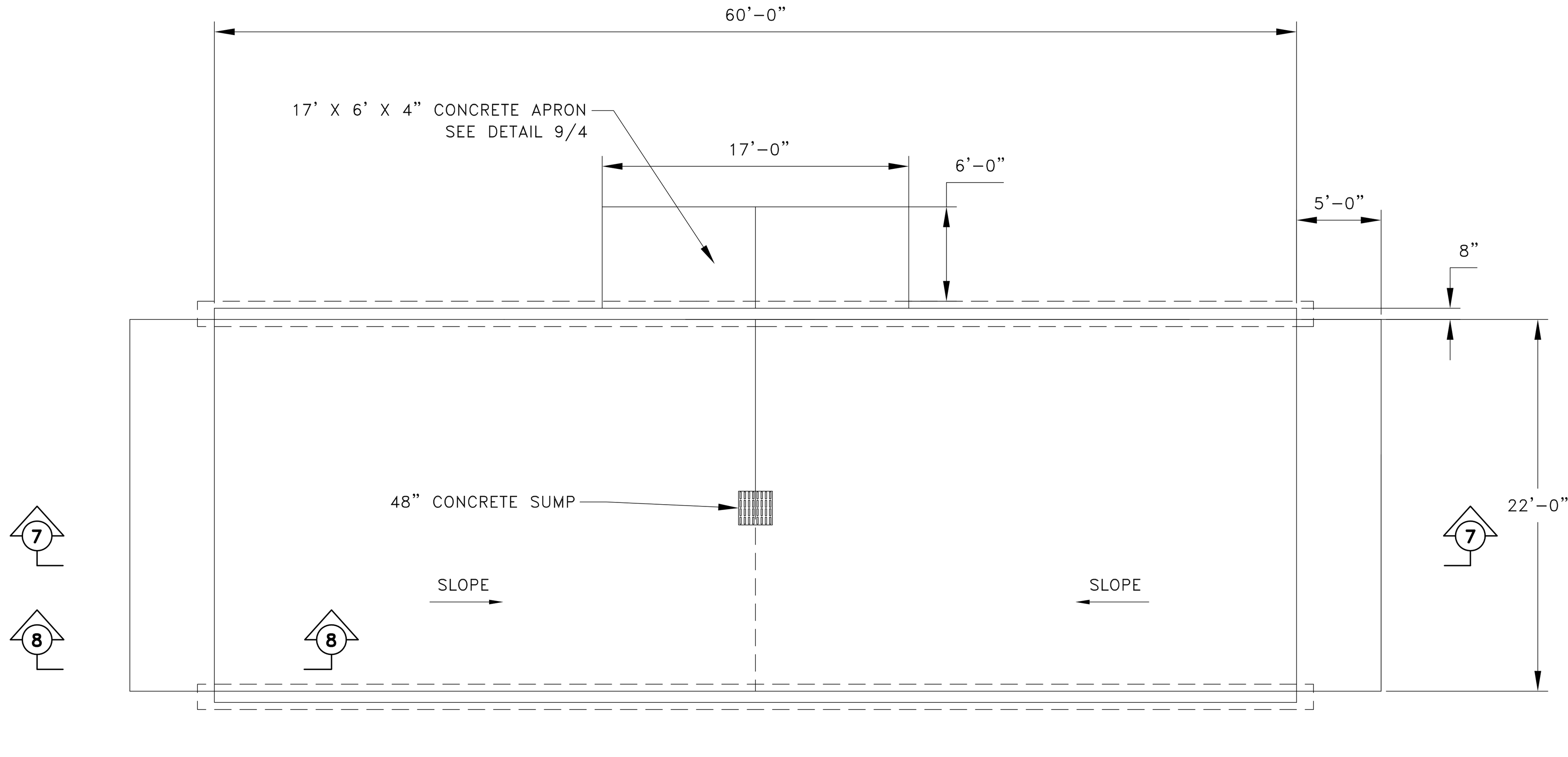
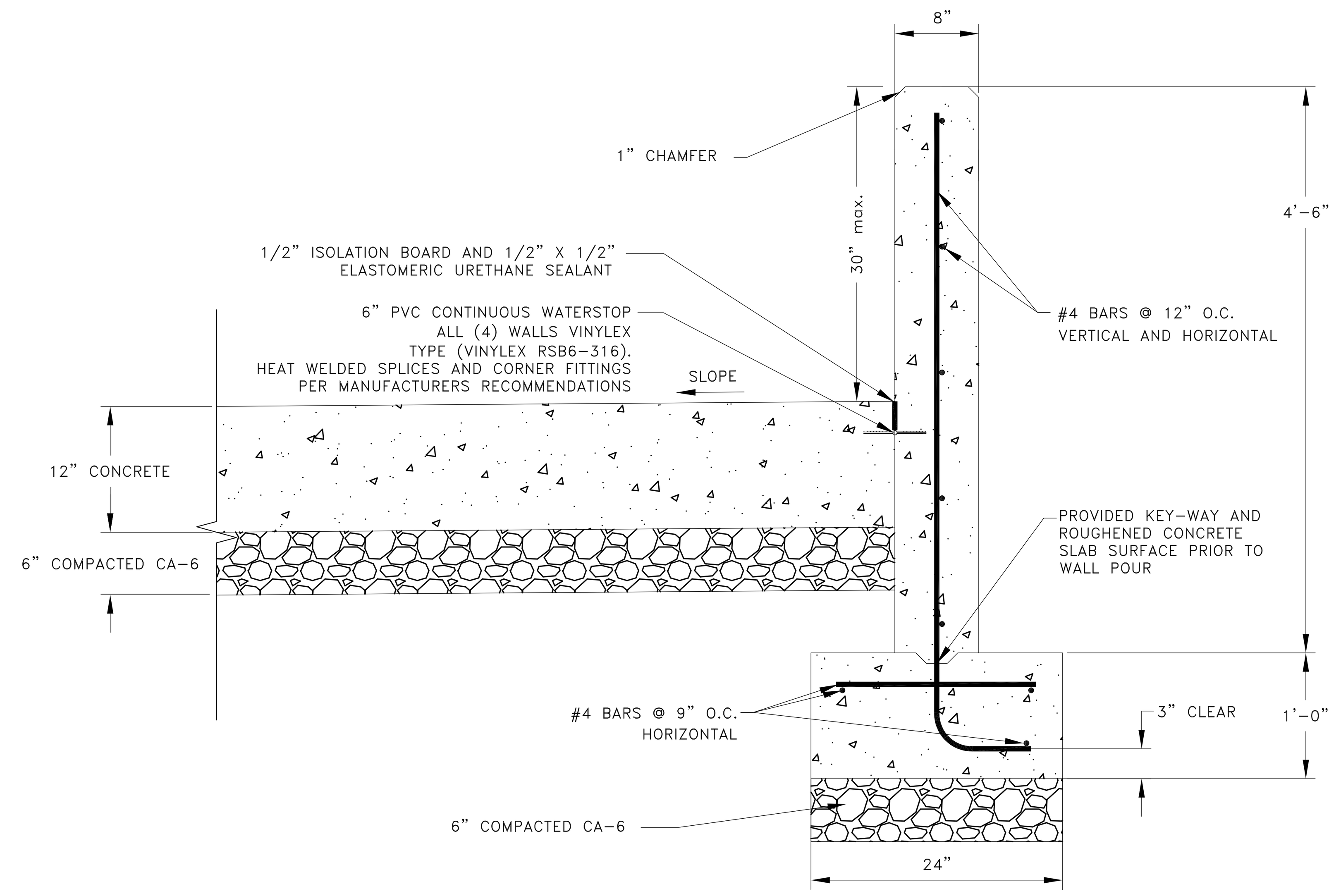
DATE:	02/17/2013
FILE:	0120-131-25-13-01
CAD:	BL000005.DWG

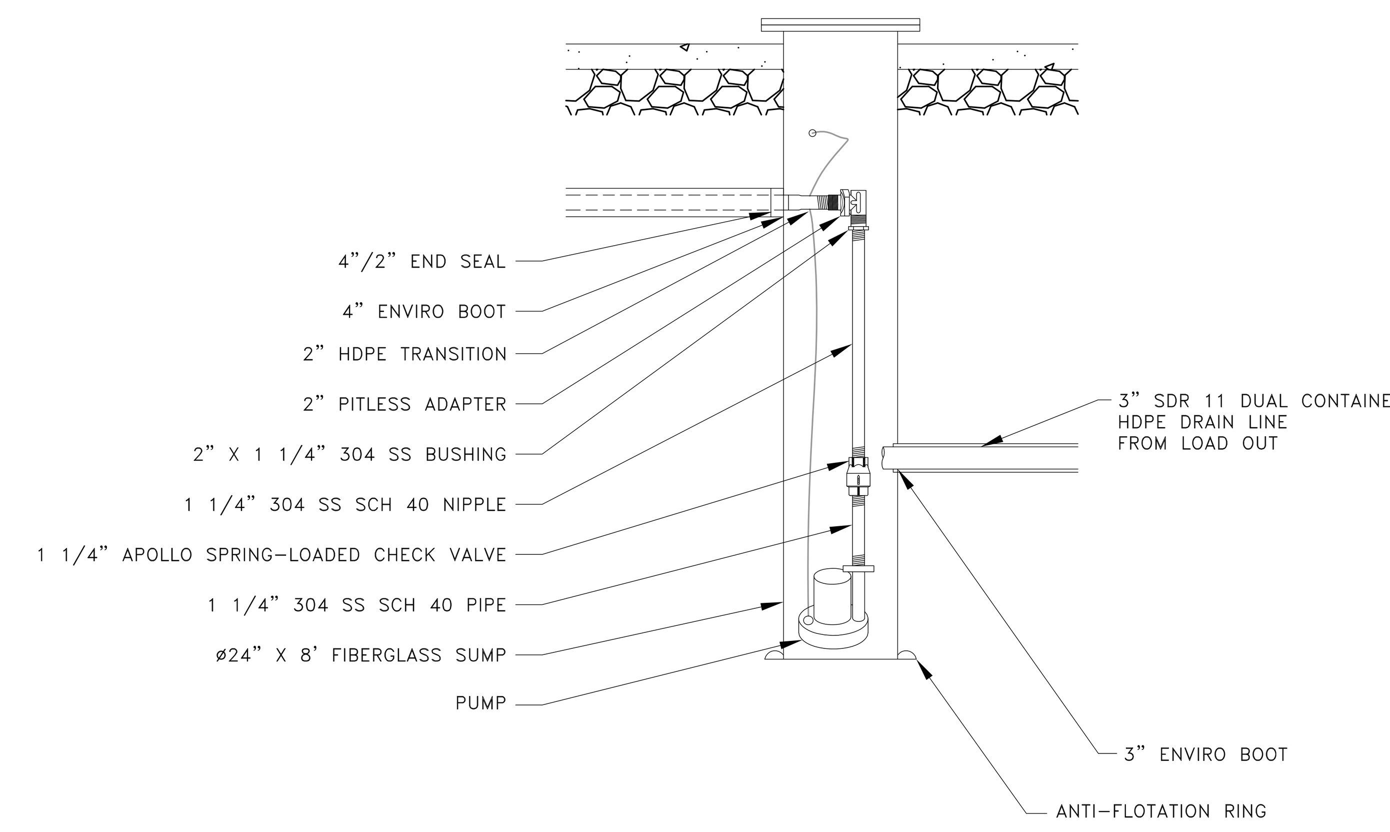
SHEET 3 OF 6



1/4 LOAD OUT PAD PLAN VIEW
SCALE: N.T.S.



8/4 SECTION 5–5 LOAD OUT WALL DETAIL
SCALE: 1" = 1'



4/4 SUMP DETAIL
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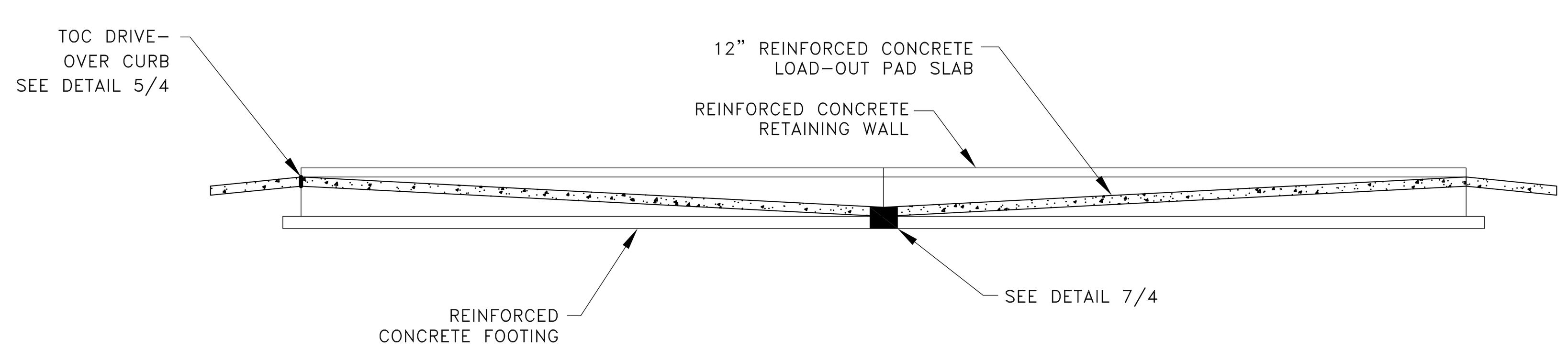
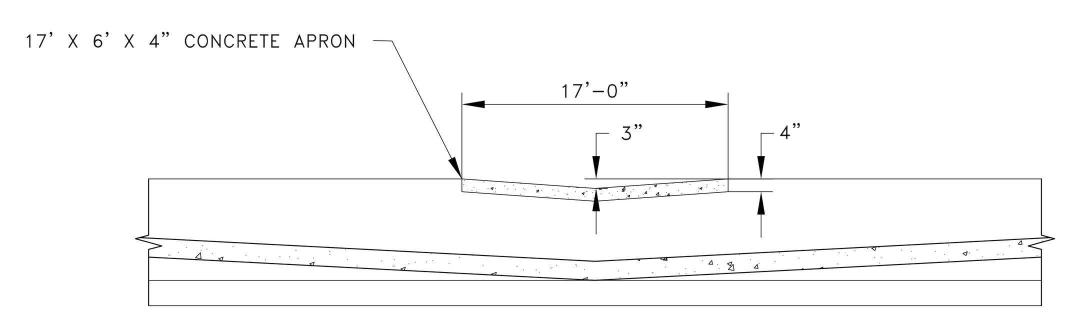
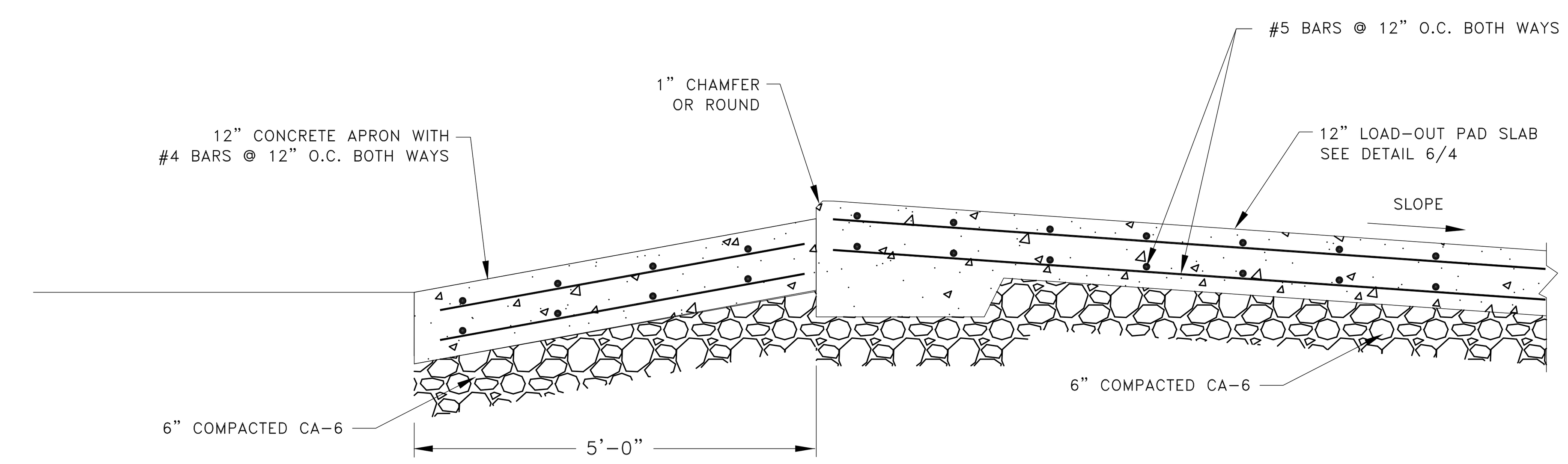


2/4 SECTION 7–7 LOAD OUT PAD PROFILE VIEW
SCALE: N.T.S.



9/4 LOAD OUT PAD APRON
SCALE: N.T.S.



5/4 SECTION 8–8 LOAD-OUT PAD CURB DETAIL
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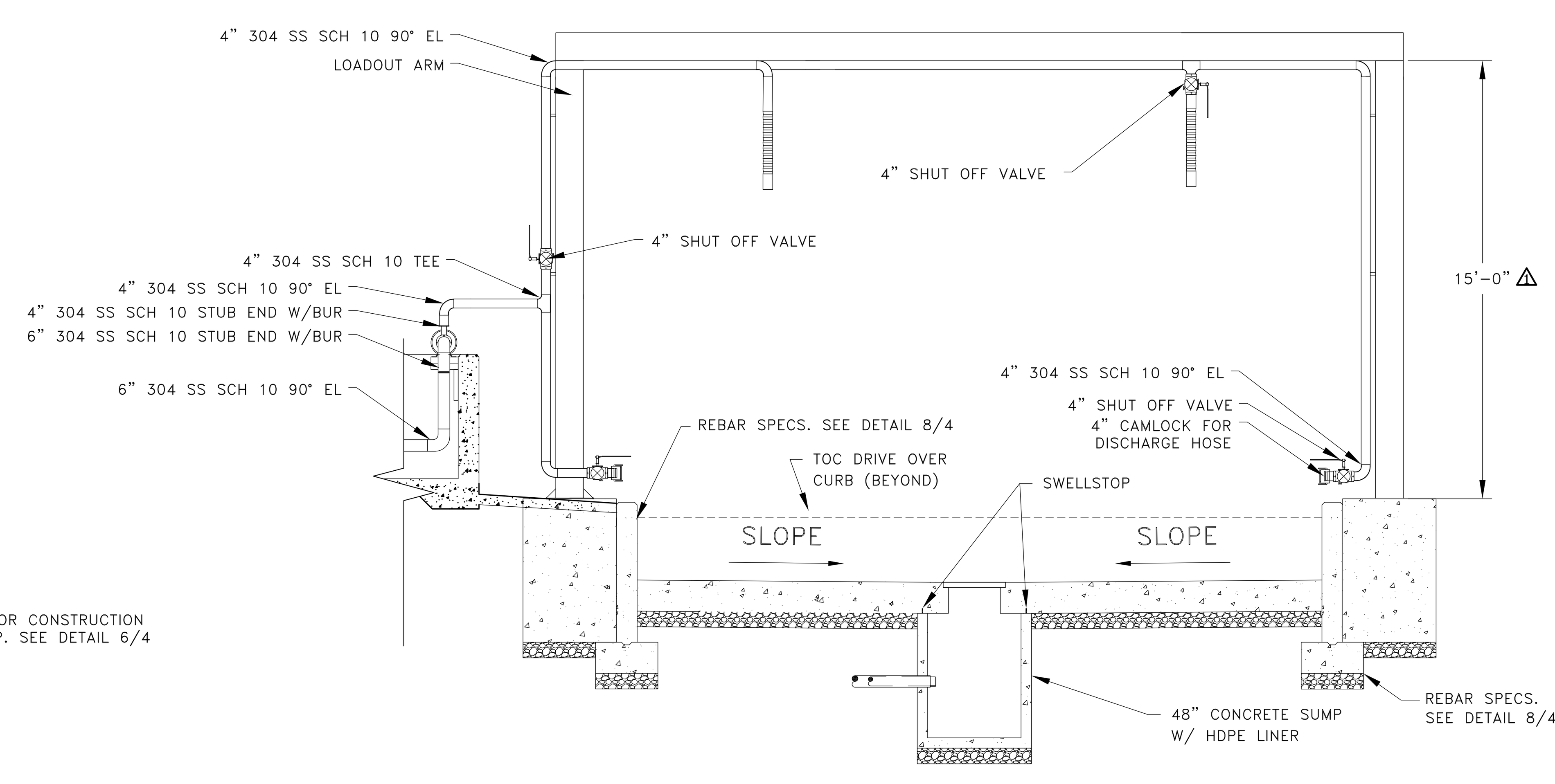

7/4 LOAD OUT PAD FRONT VIEW
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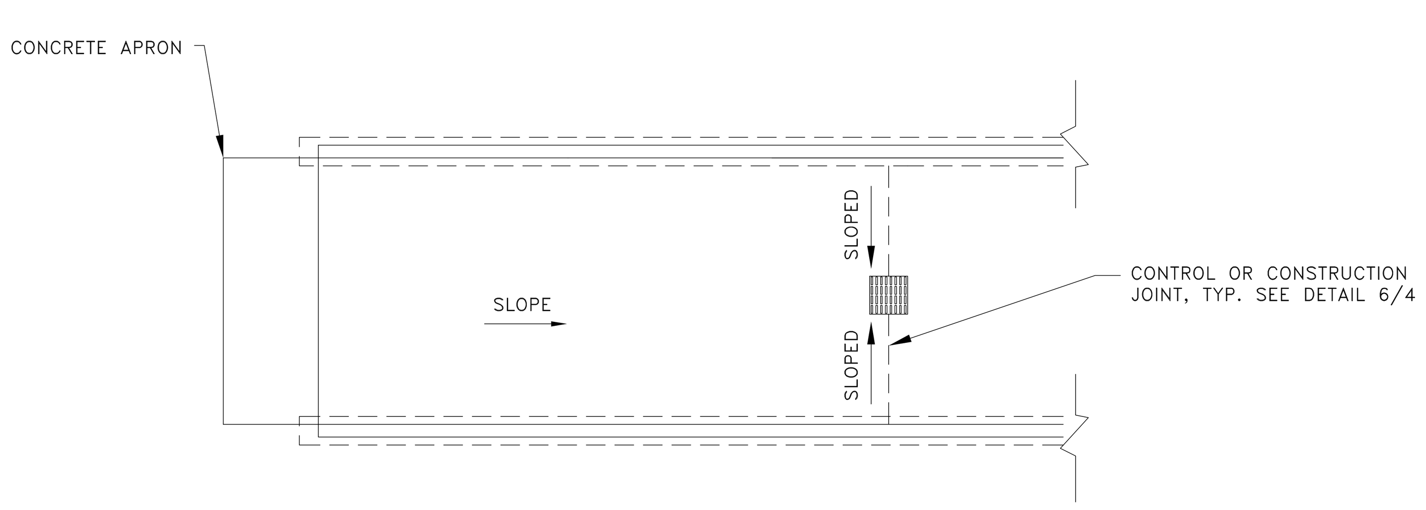
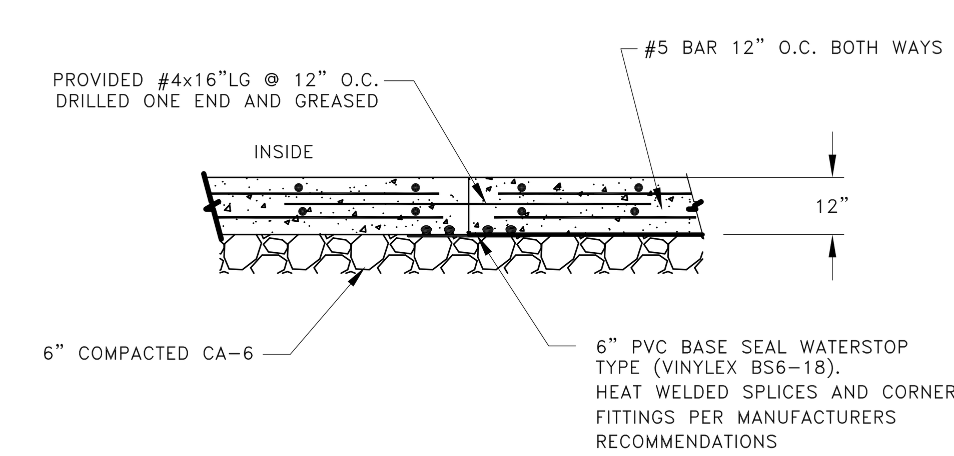


3/4 LOAD OUT PAD PLAN VIEW
SCALE: N.T.S.



6/4 TYPICAL LOAD OUT SLAB CONSTRUCTION JOINT
SCALE: N.T.S.

NOTE:

1. MoDOT TYPE 5 AGGREGATE CAN BE USED IN PLACE OF IDOT CA-6.

ELEVATION KEY

TW= TOP OF WALL ELEV.
TCP= TOP OF CONCRETE PAD ELEV.
BF= BOTTOM OF FOOTING ELEV.
TF= TOP OF FOOTING ELEV.
TTP= TOP OF TANK PAD
N.= NORTHING
E.= EASTING

PREPARED FOR
BRIDGETON LANDFILL, LLC

LEACHATE LOAD OUT PAD DETAILS AND NOTES
BRIDGETON LANDFILL
BRIDGETON, ST LOUIS COUNTY, MISSOURI

No.	DATE	REVISION DESCRIPTION
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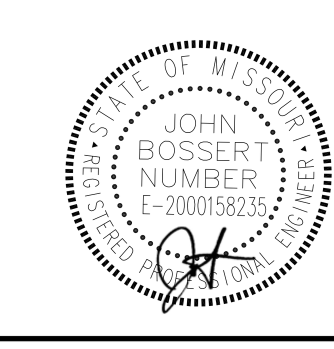

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FILE:	0120-131-25-30-01
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SHEET 4	OF 6

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PLUMBING DETAILS
BRIDGETON LANDFILL
BRIDGETON, ST. LOUIS COUNTY, MISSOURI

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STATE OF MISSOURI JOHN BOSSERT NUMBER E-2000158235 REGISTERED PROFESSIONAL ENGINEER

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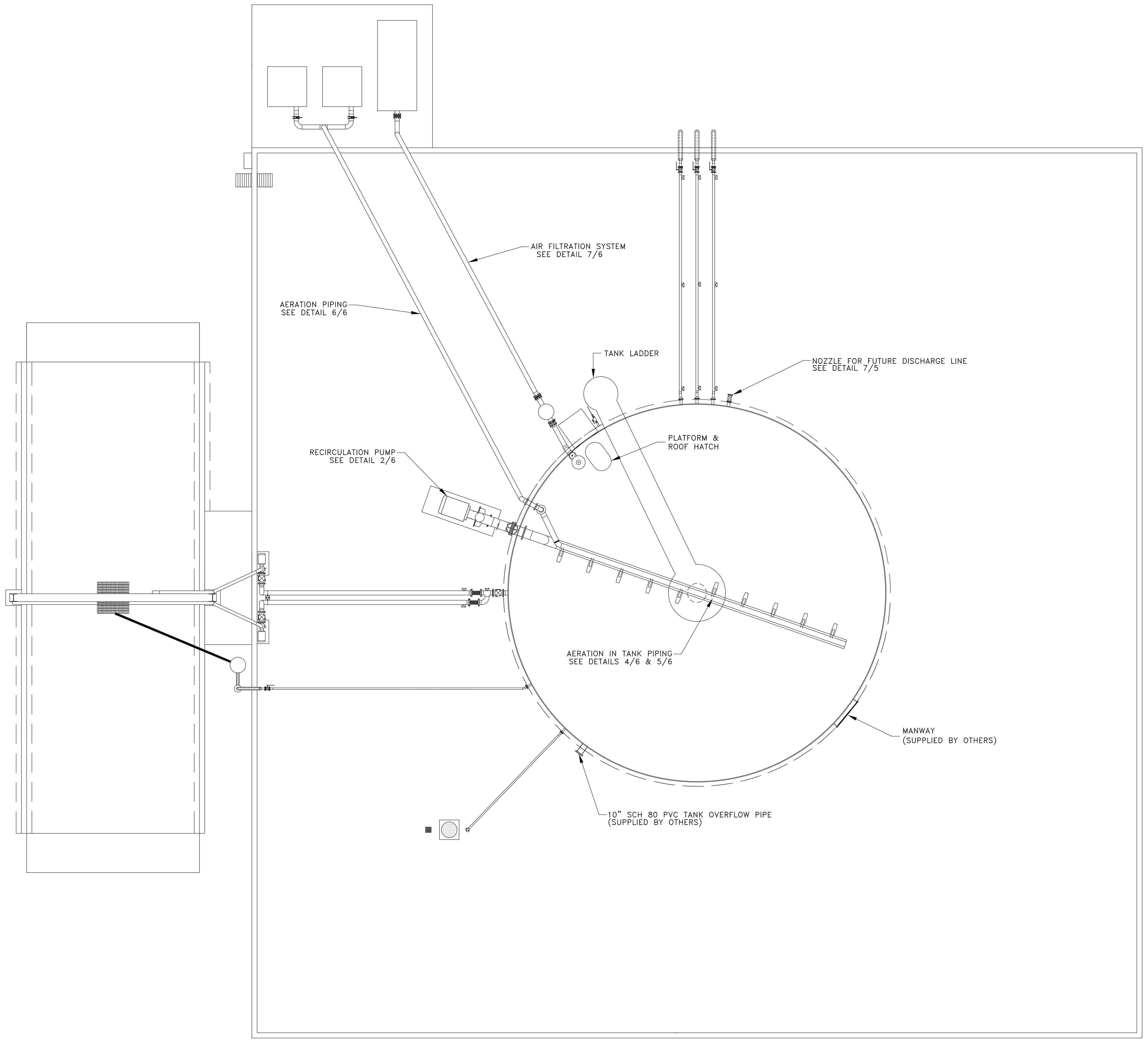
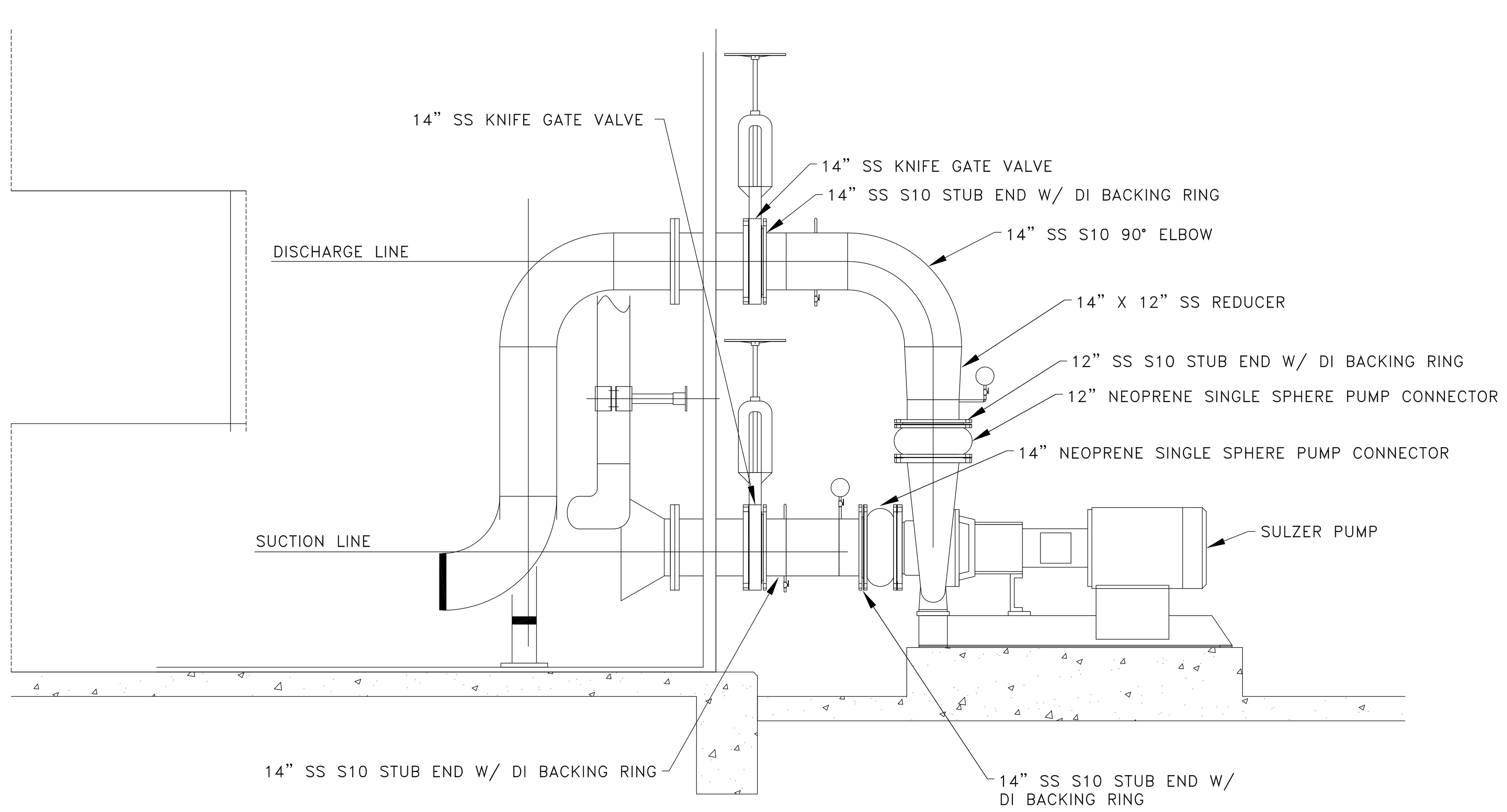
DATE:	02/17/2013
FILE:	0120-122-25
	BL000007 13-03-04.DWG

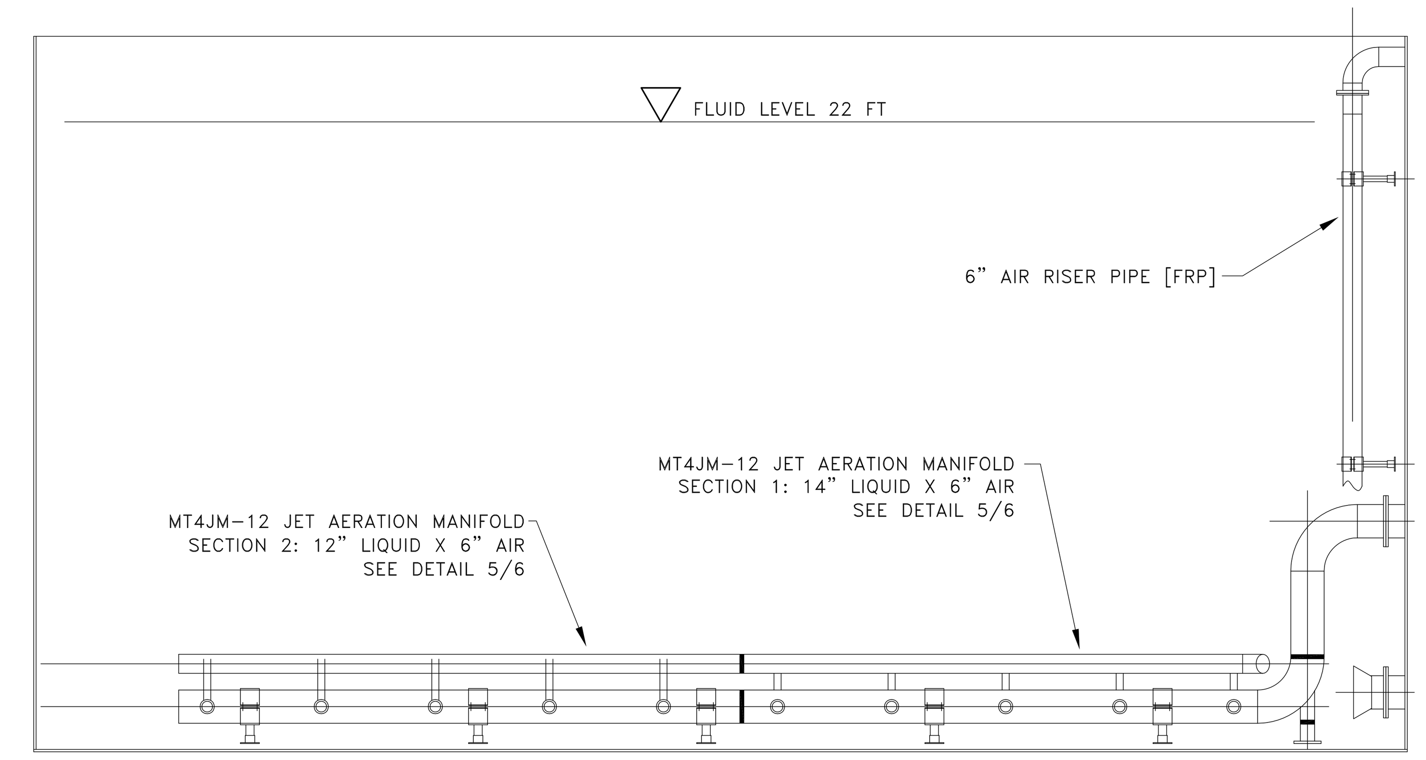
SHEET 5 OF 6



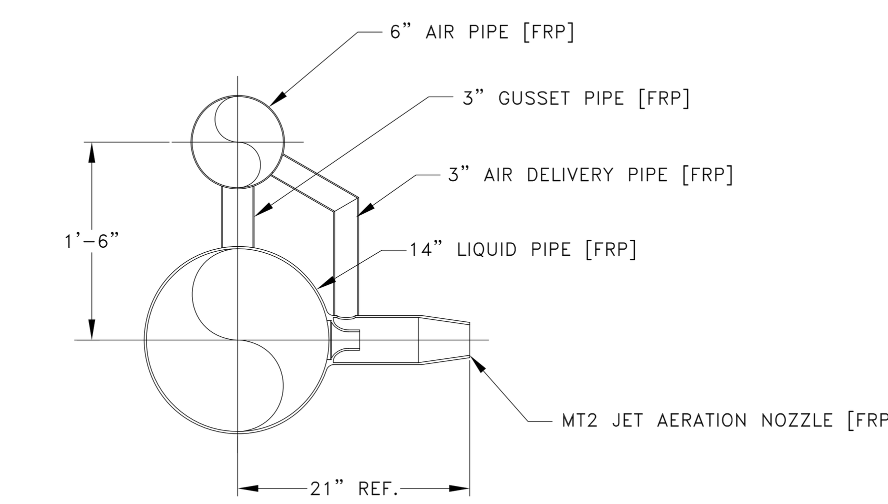
1/6 AERATION PIPING PLAN VIEW
SCALE: N.T.S.



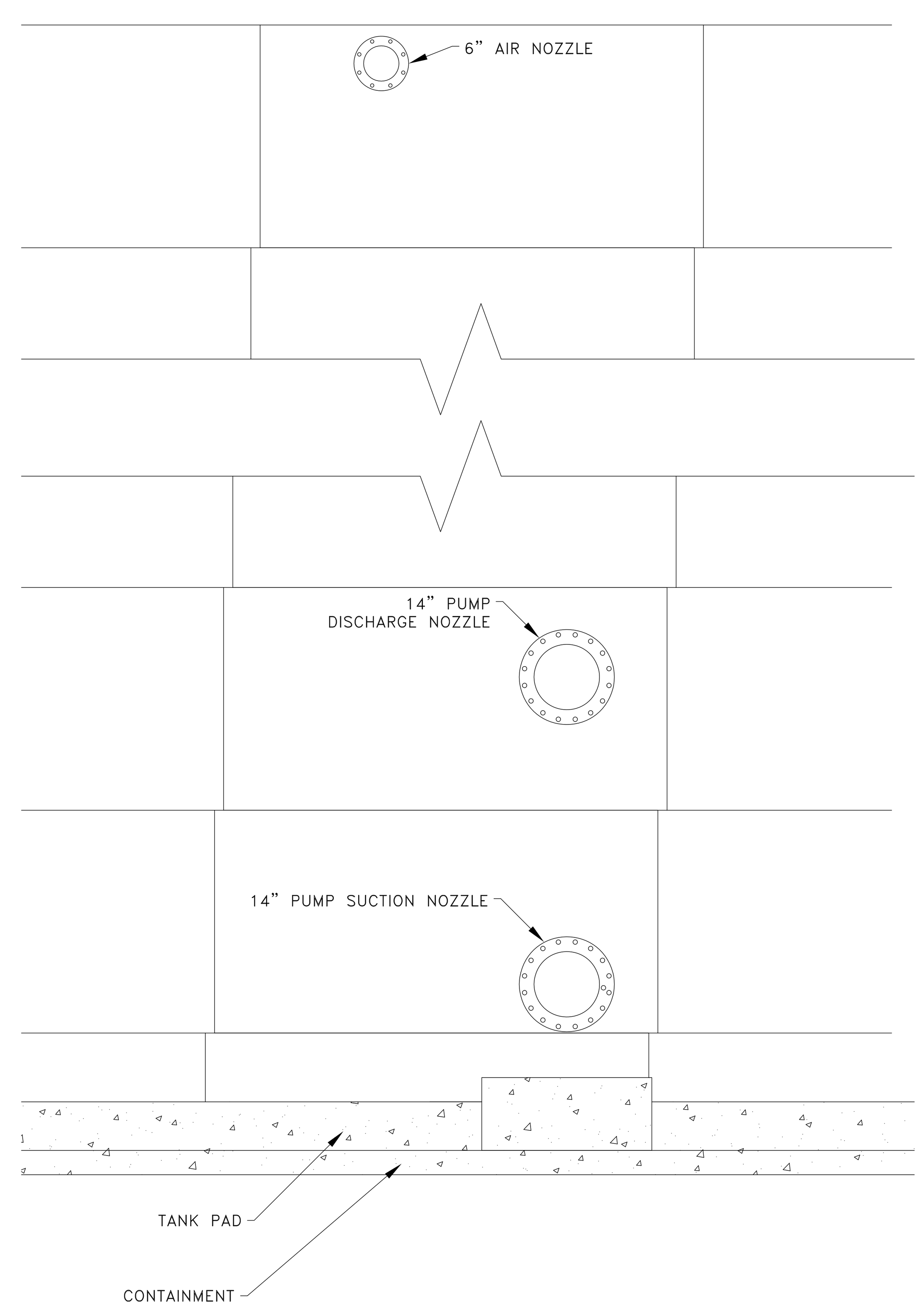
2/6 RECIRCULATION PUMP PIPING
SCALE: N.T.S.



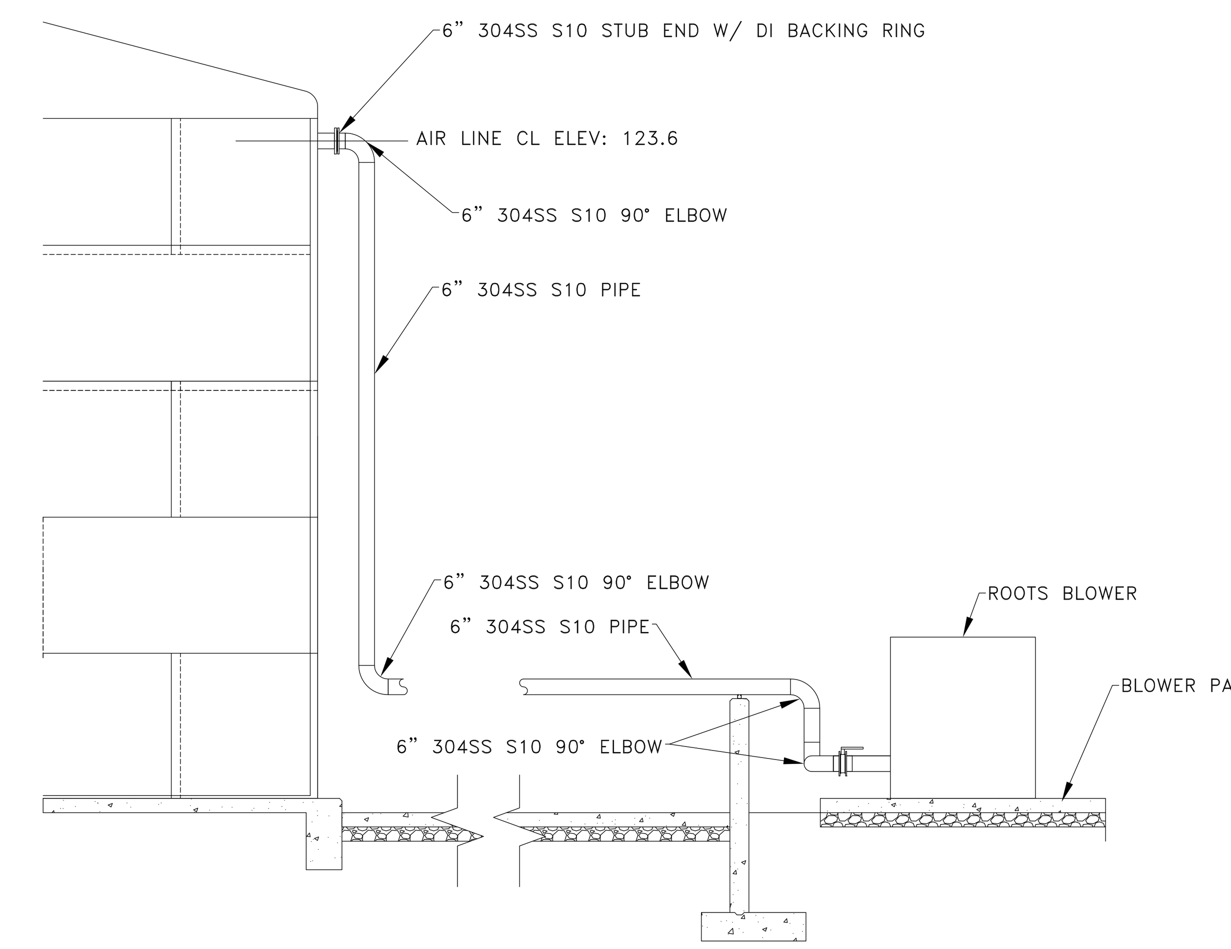
4/6 AERATION IN TANK PIPING
SCALE: N.T.S.



5/6 AERATION IN TANK PIPING
SCALE: N.T.S.



3/6 AERATION NOZZLE DETAIL
SCALE: N.T.S.



6/6 AERATION BLOWER PIPING
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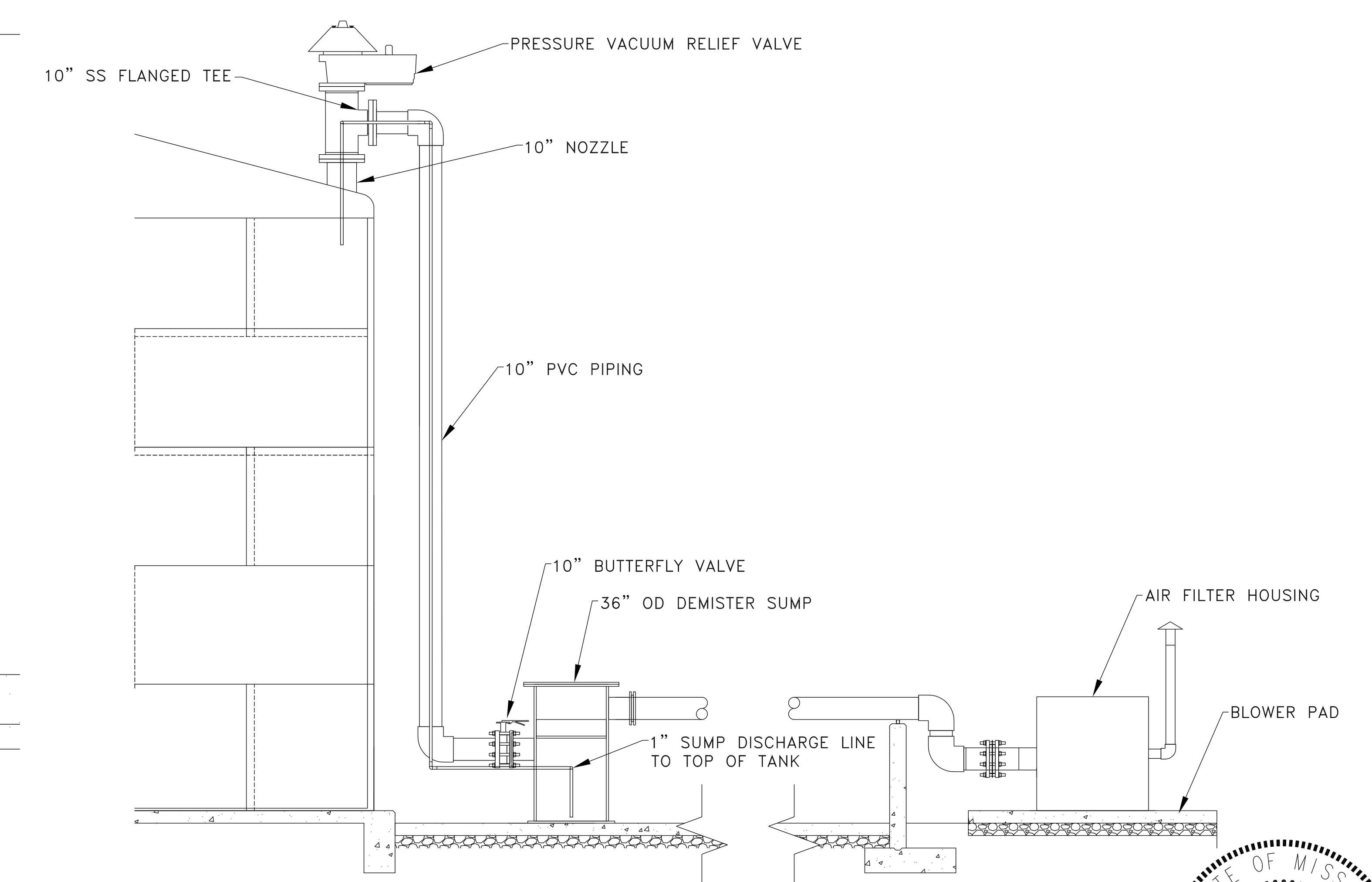

7/6 AIR FILTRATION SYSTEM
SCALE: N.T.S.

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BRIDGETON LANDFILL, LLC

AERATION SYSTEM DETAILS
BRIDGETON LANDFILL
BRIDGETON, ST. LOUIS COUNTY, MISSOURI

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	BL000008 13-03-04.DWG

SHEET 6 OF 6

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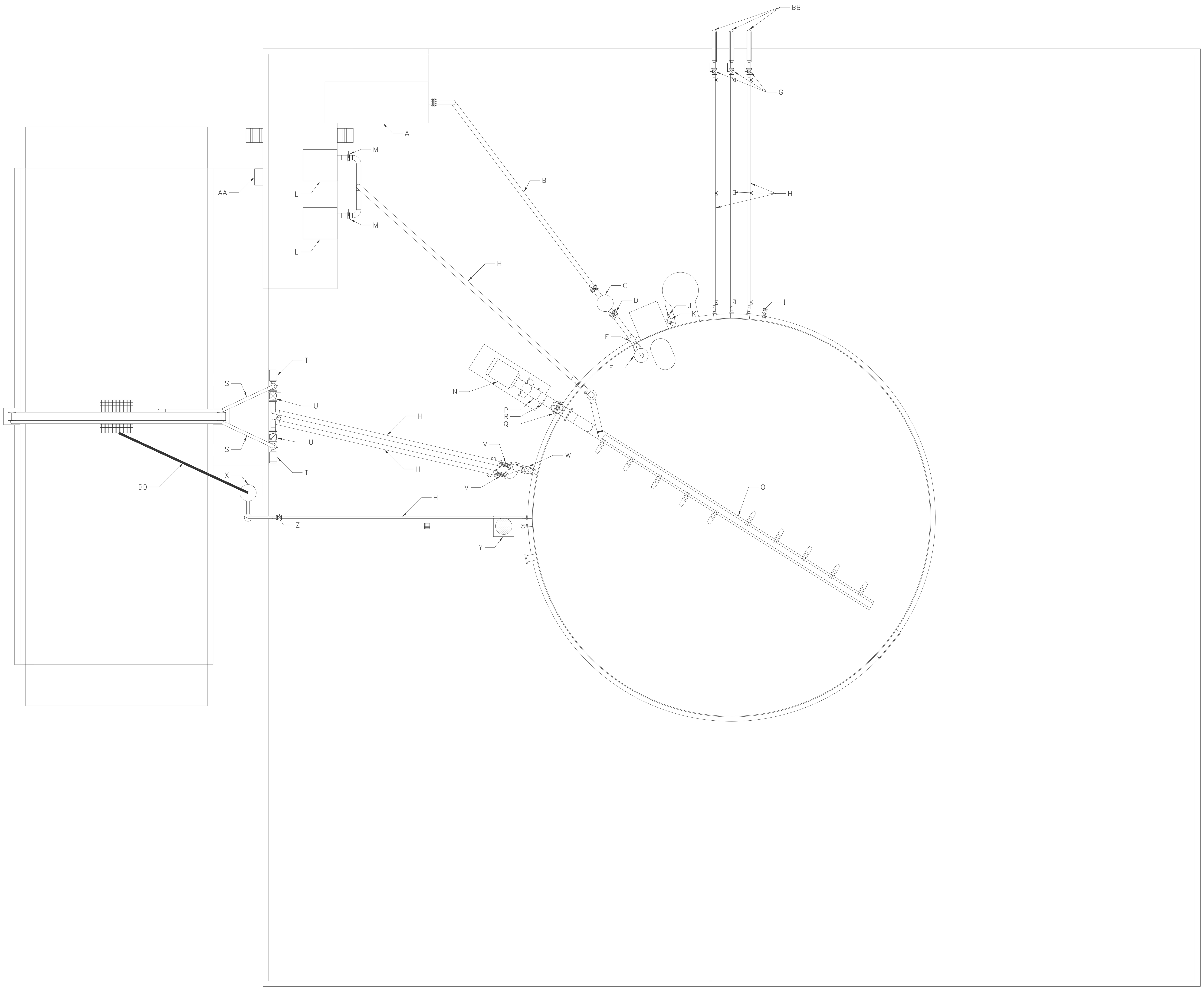
ATTACHMENT C



Tag	Description
A	Pure Air PBS
B	PVC Duct Piping
C	Knock-Out Sump
D	10" Del Tech Butterfly Valve
E	Dwyer 2302 Magnehelic Gauge
F	Enardo 550 PVRV
G	3" Actuated SS Ball Valve
H	304SS A312 Piping & A403 Fittings
I	4" SS Ball Valve
J	Dwyer 681-42 Sanitary Pressure Transmitter
K	2" SS Thrd Ball Valve
L	Kaeser Blowers
M	4" Del Tech Butterfly Valve
N	Sulzer APT43-12 Pump
O	FRP Fiberglass Piping
P	12" Neoprene Single Spheere Expansion Joint
Q	14" Davis SS Knife Gate Valve
R	Trerice 700LFSS Pressure Gauge
S	4" SS Check Valve
T	Summit ANSI 2196 Pump
U	6" SS Actuated Ball Valve
V	6" SS Braided Pump Connector
W	6" SS Ball Valve
X	24" x 96" Fiberglass Dual Contained Sump
Y	24" x 72" Fiberglass Dual Contained Sump
Z	2" SS Ball Valve
AA	Tank Farm Control Panel
BB	HDPE Piping

PREPARED FOR
BRIDGETON LANDFILL, LLC

PLUMBING DETAILS

BRIDGETON LANDFILL
BRIDGETON, ST. LOUIS COUNTY, MISSOURI

No.	DATE	REVISION DESCRIPTION

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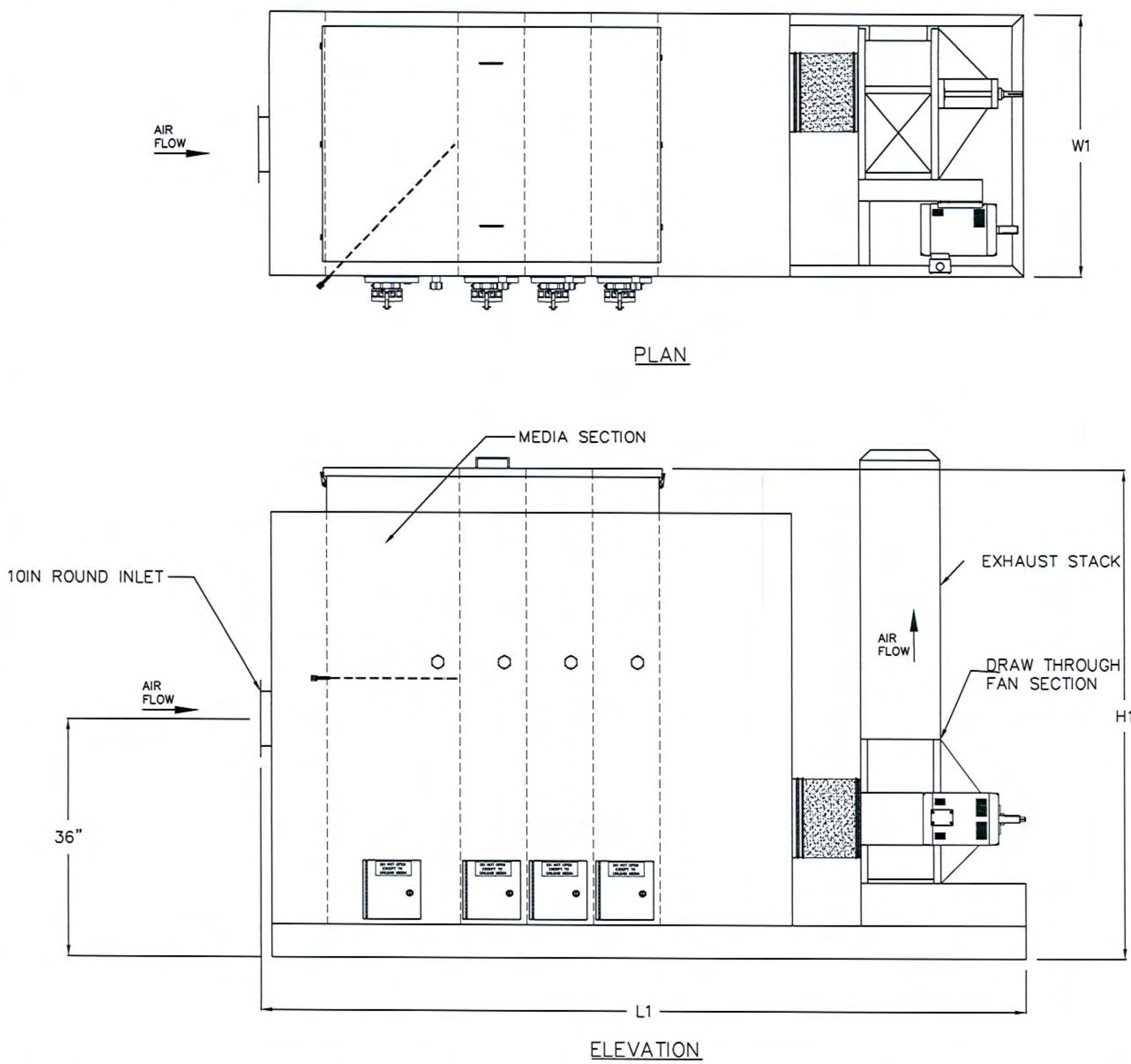
REVIEWED BY:	JB
DATE:	03/28/2013
FILE:	0120-122-25
CAD:	BL000007 AB.2013-3-28.DWG

SHEET 1 OF 1

TAG: A



DIMENSIONS			
PBS MODEL	W1	L1	H1
605	60"	150"	32"

CONSTRUCTION

- FIBERGLASS REINFORCED PLASTIC (FRP)
- DRAW THRU DESIGN
- MIST AND GREASE HOUSING WITH SS316 POLY MESH PAD
- DOORS SEALED WITH CLOSED CELL NEOPRENE GASKETING
- 1/4 TURN COMPRESSION DOOR LATCHES
- LIFTING LUGS AND ANCHOR LUGS AS REQUIRED

UNIT OPTIONS

- MAGNEHELIC PRESSURE GAGES
- VACUUM UNLOADER
- MEDIA BED MONITOR
- MEDIA SAMPLE PORTS
- INLET WITH TRANSITION TO MATCH CUSTOMER DUCTWORK

MISCELLANEOUS

- ALTERNATE CONFIGURATIONS AND OPTIONS AVAILABLE
- DIMENSIONS ARE APPROXIMATE (INCHES)

PureAir Filtration
6050 Peachtree Pkwy
Suite 240-187
Atlanta, GA 30092
(678) 935-1431

CLIENT:
PROJECT:
MODEL: PBS-605-FRP-DT-MG-MB-FF
DRAWING: M-1

SCALE:	N.T.S.	DRAWN BY:	JPB	REVISION:	1	DATE:	FEB 14, 2013

TAG: A

PureAir Filtration

Leachate SXL
Adsorbent Media

Description:

Leachate SXL was developed to provide our customers with the highest extended life. Leachate SXL has a capacity for capturing heavy VOC's such as Benzene and Toluene along with Hydrogen Sulfide (H_2S). PureAir's unique media is specially formulated with 2 additional proprietary neutralizing ingredients in order to excel in the harsh leachate environments. Leachate SXL performs exceptionally well not only in PureAir scrubbers, but also as replacement media in scrubbers manufactured by other companies.

Specifications:

Sulphasorb SXL —

General Description: Porous, cylindrical pellets of high grade bituminous activated carbon Plus 2 proprietary neutralizing ingredients.

Properties:

• **H_2S Removal Capacity** (by volume):	**0.30 g/cc min**
• Removal Capacity (by weight):	H_2S: 50% min
• CTC value:	70% min
• Surface Area:	1050 m^2/g min
• Typical Apparent Density:	.44 g/cc (28 lbs/ft^3)
• Moisture Content:	15% max
• Hardness:	95 min
• Ignition Temperature:	>400 C
• Iodine No.:	1050 mg/g min
• Butane Activity, (weight%):	26% min
• Mean Particle Diameter:	4 mm (typical)

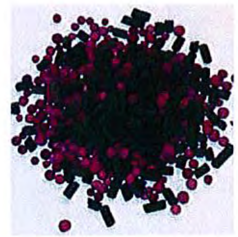
Life Testing: Leachate SXL works with PureAir's exclusive Media Bed Monitor.

Pure Air Filtration, LLC
6050 Peachtree Pkwy Suite 240-187
Atlanta, GA 30092 USA
+1 (678) 935-1431 toll free 1-866-543-7479
Fax +1 (678) 935-0648

Visit us at: www.PureAirFiltration.com or
write us at: info@PureAirFiltration.com

TAG: A

PureAir Filtration



CPSB Broad Spectrum Leachate Blend Adsorbent Media

Description:

CPSB Leachate Blend media is a 50 percent/ 50 percent blend of PureAir 12 permanganate based media and PureAir AC virgin bituminous activated carbon designed for the broadest range removal of corrosive, odorous, or toxic gases.

Specifications:

PureAir 12 Component

General Description: Spherical or cylindrical porous pellets formed from a combination of powdered activated alumina and other binders, suitably impregnated with potassium permanganate to provide optimum adsorption, absorption, and oxidation of a wide variety of gaseous contaminants.

Removal Capacity:

- Hydrogen Sulfide: 0.20 g/cc min (24% by weight)
- Sulfur Dioxide: 0.11 g/cc min (12% by weight)
- Nitric Oxide: 0.06 g/cc min (7.5% by weight)
- Nitrogen Dioxide: 0.024 g/cc min (3.0% by weight)
- Formaldehyde: 0.04 g/cc min (5.0% by weight)

Manufacturing Quality Assurance Standards:

- Leach Test (indication of porosity)- 180 minute or less
- Permanganate Content: 12 % minimum
- Moisture Content: 20 % maximum
- Crush Strength: 40 to 60 %
- Abrasion Loss: 3.0 % maximum
- Nominal Pellet Diameter: 1/8" (approximately 4 mm), 85% after screening
- Nominal Density: 50 lbs/ft^3 (0.80 g/cc)

PureAir AC Component

General Description: Porous, cylindrical pellets of high grade bituminous activated carbon. Along with 2 additional proprietary neutralizing ingredients.

Properties:

- Ash content: 2-3%
- CTC Percentage: 60 to 70 percent
- Surface area: 1200 square meters per gram minimum
- Density: 32 pounds per cubic foot nominal
- Mesh Size: 4 by 6, 90% after screening
- Hardness: 95
- 2 proprietary neutralizing ingredients

Media Remaining Life Testing: Pure Air Filtration provides free quarterly media testing for the life of the media installation. This testing provides critical data including remaining carbon life, remaining permanganate content, total life prediction, moisture content, and projected replacement date. Data is provided for each of the separated components of a blend. All analyses are performed at our certified laboratory

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write us at: info@PureAirFiltration.com

PureAir Filtration

Leachate SXL Adsorbent Media

Description:
Leachate SXL was developed to provide our customers with the highest extended life. Leachate SXL has a capacity for capturing heavy VOC's such as Benzene and Toluene along with Hydrogen Sulfide (H_2S).
Leachate SXL performs exceptionally well not only in PureAir scrubbers, but also as replacement media in scrubbers manufactured by other companies.

Specifications: Sulphasorb XL is available in two formulations

Sulphasorb XLx—
General Description: Porous, cylindrical pellets of high grade bituminous activated carbon.
Properties:

H_2S Removal Capacity (by volume):	**0.30 g/cc min**
Removal Capacity (by weight):	H_2S: 50% min
CTC value:	70% min
Surface Area:	1050 m^2/g min
Typical Apparent Density:	.44 g/cc (28 lbs/ft^3)
Moisture Content:	15% max
Hardness:	95 min
Ignition Temperature:	>400 C
Iodine No.:	1050 mg/g min
Butane Activity, (weight%):	26% min
Mean Particle Diameter:	4 mm (typical)

Life Testing: Leachate SXL works with PureAir's exclusive Media Bed Monitor.

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PureAir Filtration

CPSB Broad Spectrum Leachate Blend Adsorbent Media

Description:

CPSB Leachate Blend media is a 50 percent/ 50 percent blend of PureAir 12 permanganate based media and PureAir AC virgin bituminous activated carbon designed for the broadest range removal of corrosive, odorous, or toxic gases.

Specifications:

PureAir 12 Component

General Description: Spherical or cylindrical porous pellets formed from a combination of powdered activated alumina and other binders, suitably impregnated with potassium permanganate to provide optimum adsorption, absorption, and oxidation of a wide variety of gaseous contaminants.

Removal Capacity:

- Hydrogen Sulfide: 0.20 g/cc min (24% by weight)
- Sulfur Dioxide: 0.11 g/cc min (12% by weight)
- Nitric Oxide: 0.06 g/cc min (7.5% by weight)
- Nitrogen Dioxide: 0.024 g/cc min (3.0% by weight)
- Formaldehyde: 0.04 g/cc min (5.0% by weight)

Manufacturing Quality Assurance Standards:

- Leach Test (indication of porosity)- 180 minute or less
- Permanganate Content: 12 % minimum
- Moisture Content: 20 % maximum
- Crush Strength: 40 to 60 %
- Abrasion Loss: 3.0 % maximum
- Nominal Pellet Diameter: 1/8" (approximately 4 mm), 85% after screening
- Nominal Density: 50 lbs/ft^3 (0.80 g/cc)

PureAir AC Component

General Description: Porous, cylindrical pellets of high grade bituminous activated carbon.

Properties:

- Ash content: 2-3%
- CTC Percentage: 60 to 70 percent
- Surface area: 1200 square meters per gram minimum
- Density: 32 pounds per cubic foot nominal
- Mesh Size: 4 by 6, 90% after screening
- Hardness: 95

Media Remaining Life Testing: Pure Air Filtration provides free quarterly media testing for the life of the media installation. This testing provides critical data including remaining carbon life, remaining permanganate content, total life prediction, moisture content, and projected replacement date. Data is provided for each of the separated components of a blend. All analyses are performed at our certified laboratory.

UL Rating: CPS Blend meets the requirements for a UL Class 1 fire rating.

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6050 Peachtree Pkwy Suite 240-187
Atlanta, GA 30092 USA
+1 (678) 935-1431 toll free 1-866-543-7479
Fax +1 (678) 935-0648

Visit us at: www.PureAirFiltration.com or
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TAG: B

SPEARS® MANUFACTURING COMPANY
CORPORATE OFFICE
15853 OLDEN STREET • SYLMAR, CALIFORNIA 91342
MAILING ADDRESS: P.O. BOX 9203 • SYLMAR, CALIFORNIA 91392
TELEPHONE (818) 364-1611 • FAX (818) 364-6945
www.spearsmfg.com

CERTIFICATE OF COMPLIANCE

PVC AND CPVC FABRICATED DUCT FITTINGS

Spears® Manufacturing Company certifies that its Polyvinyl Chloride (PVC) fabricated round duct fittings are manufactured and produced from seamless PVC pipe stock (sizes 6" to 24") with a cell classification 12454 conforming to ASTM standard D1784. Our Chlorinated Polyvinyl Chloride (CPVC) Fabricated Round Duct Fittings are manufactured and produced from seamless CPVC pipe stock (sizes 6" to 24") with a cell classification 23447 conforming to ASTM standard D1784. CPVC Fabricated Duct Fittings are produced from pipe evaluated for surface burning characteristics by ULC to CAN/ULC standard S102.2 and are certified to having a flame spread rating of less than or equal to 25 and a smoke development rating of less than or equal to 50.

Spears® Fabricated Duct Fittings are made in the U.S.A. Custom produced sizes above 24", Conical Reducers and certain specialty fittings shall be constructed from cold rolled PVC extruded sheet-stock with a cell classification 12454 conforming to ASTM standard D1784 and CPVC extruded sheet-stock with a cell classification 23447 conforming to ASTM standard D1784 with thermal fused seams.

Spears® Fabricated Duct Fittings are manufactured in accordance with the applicable guidelines and requirements of the Sheet Metal and Air Conditioning Contractors' National Association (SMACNA). Note: Spears® offers both SMACNA compliant and general purpose duct fittings for certain configurations including 90° Elbows, 45° Elbows and multi-step Reducer Couplings. *Where not specified, general-purpose fittings will be provided.*

Spears® Fabricated Duct Fittings have been successfully tested in a vacuum of twenty-six inches of mercury (Hg) at 73°F. This test was conducted for one hour with a leak factor of not more than one inch of mercury. This data is based on fittings that were randomly selected from production and tested in a laboratory environment. Special appurtenances such as Butterfly Dampers, Blast Gates and Flanges are not included.

A Lunt

Alan Lunt
Director, Technical Services
alunt@spearsmfg.net

January 2012

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SPEARS®

PVC & CPVC FABRICATED DUCT FITTINGS

FD-2-0508

Industrial Grade for General Purpose & Corrosive Vapor Fumes

Spears® Industrial Grade Fabricated PVC & CPVC Duct provides a light weight and low maintenance alternative to conventional metal ducting with superior chemical & corrosion resistance. Produced in a wide variety of sizes and configurations from 6" through 24" with custom fabrication available to virtually any size and shape.

Thermoplastic Duct Construction

Spears® Fabricated Duct fittings are manufactured in accordance with applicable guidelines and requirements to assure sound, reliable construction, performance and compatibility that meet customer design specifications. Included with our high quality standard duct line, Spears® offers duct product designed to the Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) requirements.

Chemical & Corrosion Resistant PVC & CPVC Construction

Unlike metal, PVC & CPVC Duct never rusts, scales or pits remaining virtually maintenance free for years.

Fabricated From Premium Quality Seamless Extruded Round Duct

Spears® Fabricated Duct Fittings are produced from premium quality PVC & CPVC materials conforming to ASTM D1784.

Custom Fabricated Duct Fittings, Accessories & Complete Exhaust Systems

Spears® offers custom fabrication for a wide variety of specialty needs including:

- Square Duct
- Rectangular Duct
- Fume Hoods
- Fume Exhaust Systems

General Specifications for Round PVC & CPVC Duct Fittings

Materials

All fabricated duct fittings, sizes 6" to 24", shall be constructed from ASTM D 1784 PVC or CPVC seamless extruded duct. Custom produced sizes above 24" shall be constructed from cold rolled PVC Type I & Type II, Grade I extruded sheet with thermal fused seam.

Elbow Configurations

Elbows angles are manufactured through the use of thermoforming and hot gas welding. Standard 45° elbows are offered 1-piece formed, with 2-piece or 3-piece welded. The 45° 3-piece meet SMACNA requirements. Standard 90° elbows are offered in 2-piece formed, with 3-piece or 5-piece welded. The 90° 5-piece meet SMACNA requirements. Additional elbow configurations meeting SMACNA requirements are available upon request.

Maximum Service Temperatures

PVC = 140°F; CPVC = 200°F

Joining Methods

Solvent cement, hot-gas welding, or flanged connections.

Dimensions

Round Duct socket dimensions shall meet the requirements of the Sheet Metal and Air Conditioning Contractors' National Association Thermoplastic Duct Construction Manual. Fittings shall be constructed from seamless duct meeting the following dimensional specifications. All dimensions are in inches:

Size	Average O.D.	Average O.D. Tol	Out of Round[1]	Min. Wall	Max. Wall
6"	6.625	±.020	±.050	.172	.202
7" *	7.375	±.020	±.050	.172	.202
8"	8.625	±.020	±.075	.172	.202
9" *	9.375	±.025	±.075	.172	.202
10"	10.750	±.025	±.075	.172	.202
11" *	11.375	±.025	±.075	.172	.202
12"	12.750	±.025	±.075	.172	.202
14"	14.000	±.030	±.075	.172	.202
16"	16.000	±.030	±.075	.172	.202
18"	18.000	±.040	±.080	.172	.202
20"	20.000	±.070	±.140	.199	.239
24"	24.000	±.090	±.180	.230	.270

1: Out-of-Round as produced at factory.
*: PVC Only

Systems should be installed and supported in accordance with the duct pipe manufacturer's installation guidelines. Contact Spears® Technical Services for additional information.

PROGRESSIVE PRODUCTS FROM SPEARS® INNOVATION & TECHNOLOGY

SPEARS® MANUFACTURING COMPANY • CORPORATE OFFICE
15853 Olden St., Sylmar, CA 91342 • PO Box 9203, Sylmar, CA 91392
(818) 364-1611 • www.spearsmfg.com

 FD-2-0508

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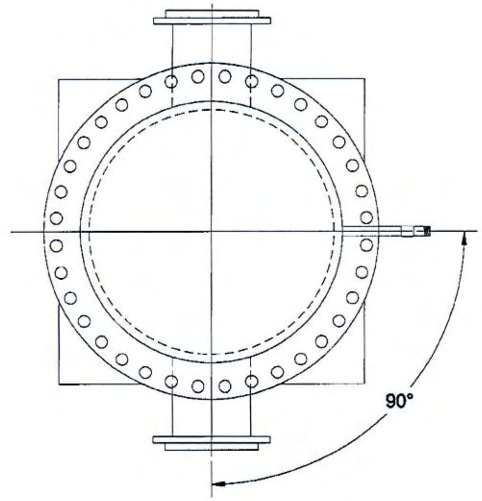
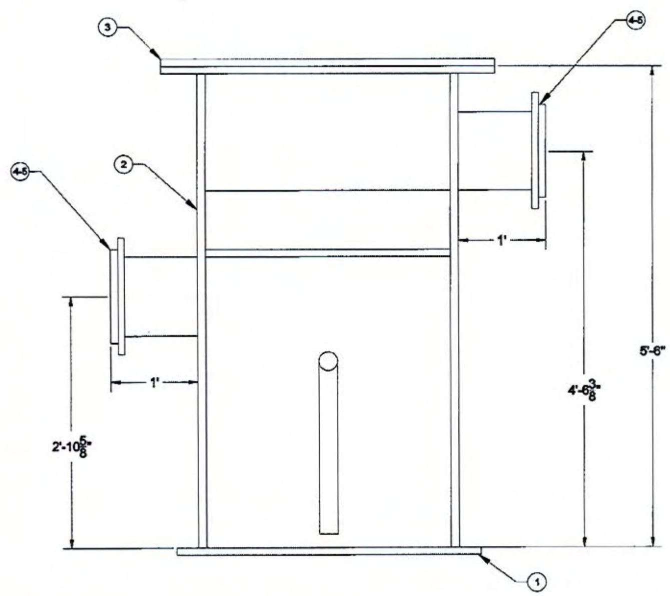
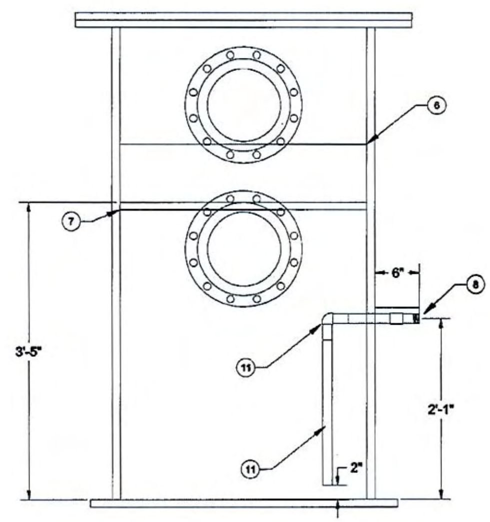
PARTS LIST		
ITEM	QTY	DESCRIPTION
1	1	1" X 3'6" HDPE SHEET STOCK BASE PLATE
2	5.5 FT	36' SDR 32.5 HDPE PIPE
3	1	36" FLANGE SET W/ NEOPRENE GASKET AND BOLTPACK
4	2	10" SDR 17 FLANGE ADAPTER
5	2	10" DI BACKING RING
6	1	DEMISTER PAD 8" OVERALL THICKNESS
7	1	HDPE SUPPORT RING FROM 1" SHEET 2" WIDE
8	1	1" HDPE SDR 11 SS MALE TRANSITION
9	1	1" HDPE SDR11 90 ELBOW
10	1	1" HDPE SDR 11 PIPE







PURE_AIR
KNOCK-OUT

Landmarc Environmental Systems, LLC

DRAWN BY: AWS	DATE: 2/21/2013	FILE: KNOCK-OUT
REVIEWED BY: MEM	CAD: KNOCK-OUT	SHEET # 1

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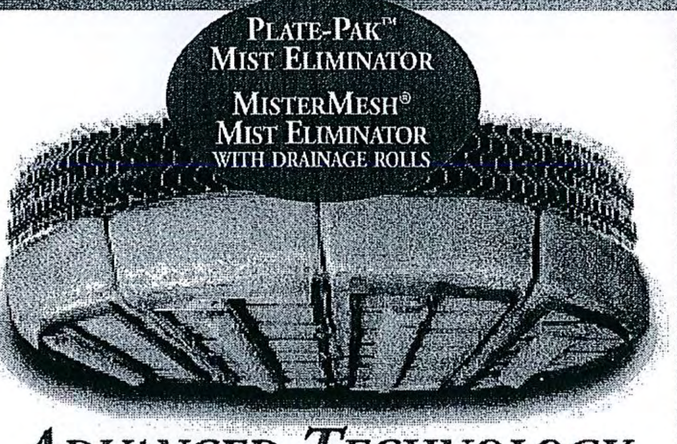
HIGH CAPACITY MIST ELIMINATORS OUT PERFORM CONVENTIONAL TECHNOLOGY!



ADVANCED TECHNOLOGY FOR DEBOTTLENECKING!

Our proprietary MisterMesh® Mist Eliminator out performs conventional pads. The drainage rolls accelerate liquid removal thus increasing capacity and reducing pressure drop. Used in conjunction with our Plate-Pak™, the MisterMesh® can increase capacity by over **200%** while separating droplets down to 3 microns.

ACS

SEPARATIONS & MASS-TRANSFER PRODUCTS

ACS Industries, LP • Houston, Texas • USA

24-hour emergency service   Free technical support   50 years experience

800-231-0077

14211 Industry Road • Houston, TX 77053 • **TEL:** 713-434-0934 • **FAX:** 713-433-6201
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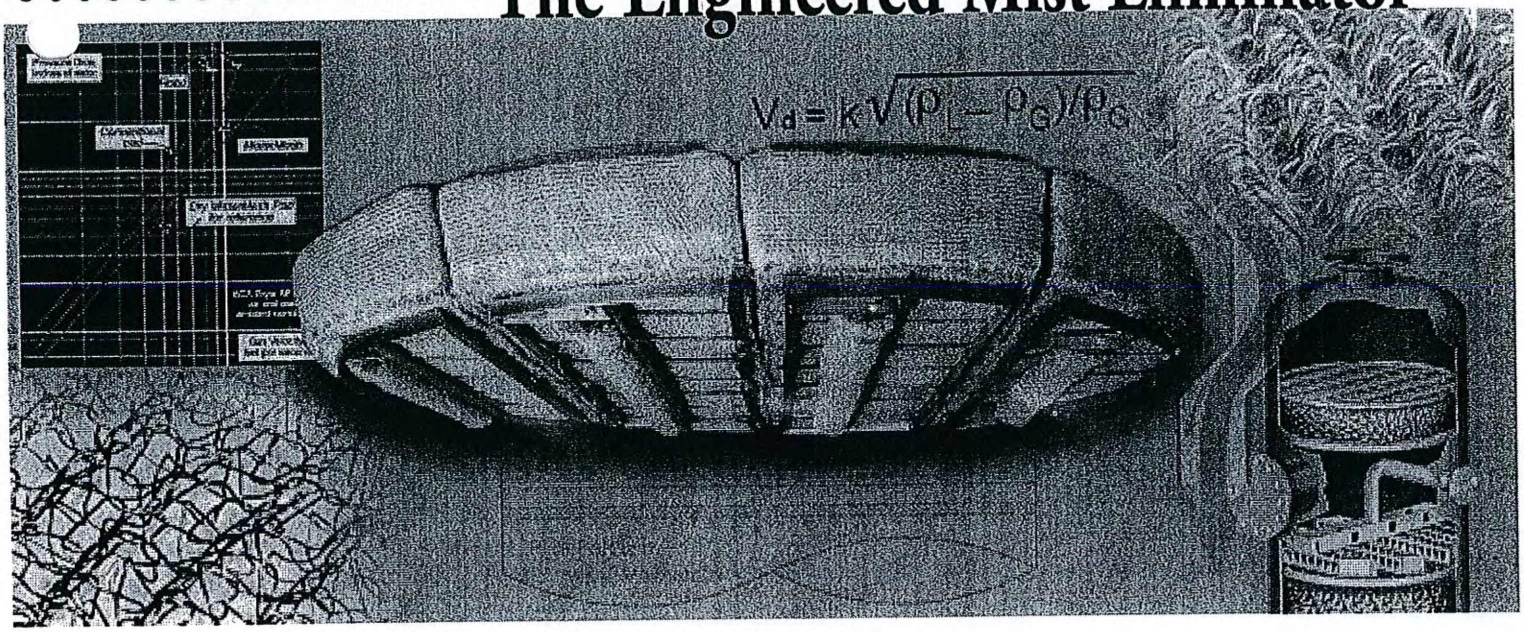
The Engineered Mist Eliminator



REDUCE COSTS

INCREASE CAPACITY

IMPROVE PERFORMANCE

DEBOTTLENECK EQUIPMENT

SIMPLIFY INSTALLATION

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Table of Contents

The Engineered Mist Eliminator

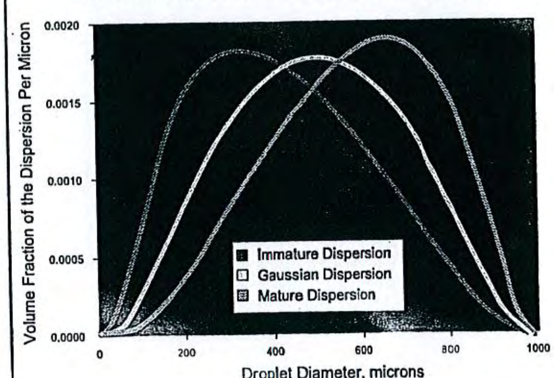
Mist elimination, or the removal of entrained liquid droplets from a vapor stream, is one of the most commonly encountered processes regardless of unit operation. Unfortunately, mist eliminators are often considered commodity items and are specified without attention to available technologies and design approaches. The engineered mist eliminator may reduce liquid carryover by a factor of one hundred or more relative to a standard unit, drop head losses by 50% or more, or increase capacity by factors of three or four. This manual summarizes cost effective approaches to reducing solvent losses or emissions, extending equipment life and maintenance cycles using proven and cost effective technologies and techniques.

Droplet Formation and Size Distributions

Entrained liquid does not consist of same-sized droplets, but as a broad range of droplet sizes that may be characterized with a Normal or Bell Distribution centered about some mean or average. The average droplet size depends very much on the mechanism by which they are generated. Sizing equations are expressed in terms of the probability of removing a droplet of a given diameter, and mist eliminator performance is the integration or cumulative sum of individual removal efficiencies. It is therefore critical to know the approximate droplet size distribution in order to properly design a mist elimination system. Figure 1 show some typical size distribution curves from different sources.

FIGURE 1

VOLUME FRACTION FREQUENCY DISTRIBUTIONS FOR DISPERSIONS OF VARIOUS MATURITIES



In practice, designers or engineers do not quantify or measure droplet size distributions, rather they are assumed based on empirical data or experience. Fortunately, an experienced engineer can assume an approximate distribution based on the means or mechanism by which the droplets are generated. Typical examples from common mist sources are given to illustrate these concepts.

Fine droplet distributions, often called *fogs* (<3 µm diameter particles with an average typically in the submicron range), occur in high speed metal stamping in which cycles of extreme frictional heating and shock condensation of lubricating oils form droplets in the submicron range, so-called "blue smoke". This smoke is removed to comply with health and environmental regulations.

Fog is also produced when gas phase reactions form a liquid product as in the case of vapor phase SO_3 and water yielding H_2SO_4. Downstream

TAC : C

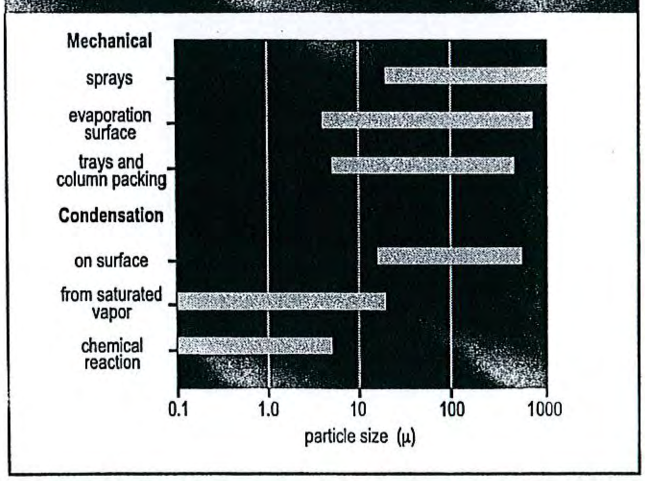
equipment corrodes rapidly without the removal of this liquid. Similar concerns are found in ammonia prill towers, many chlorine applications, as well as phosphoric and nitric acid plants.

A *mist* consists of droplets in the range of 3µm and greater, though distributions with average diameters 20 µm and greater are termed *Sprays*. Mist coming off the top of packing or trays, or generated by surface evaporation, are typically in the broad range of 5-800 µm. In towers used in glycol dehydration and amine sweetening in which mists are a major source of costly solvent losses, removal of droplets down to 5 µm is recommended.

Hydraulic spray nozzles generate particles of diameters greater than 50 µm and pneumatic nozzles greater than 10 µm, with upper limits reaching 1000 µm.

The first step in engineering a mist eliminator is to determine the mechanism by which the droplets are generated and assume an average droplet size. Figure 2 summarizes typical particle size distributions caused by various mechanisms:

FIGURE 2

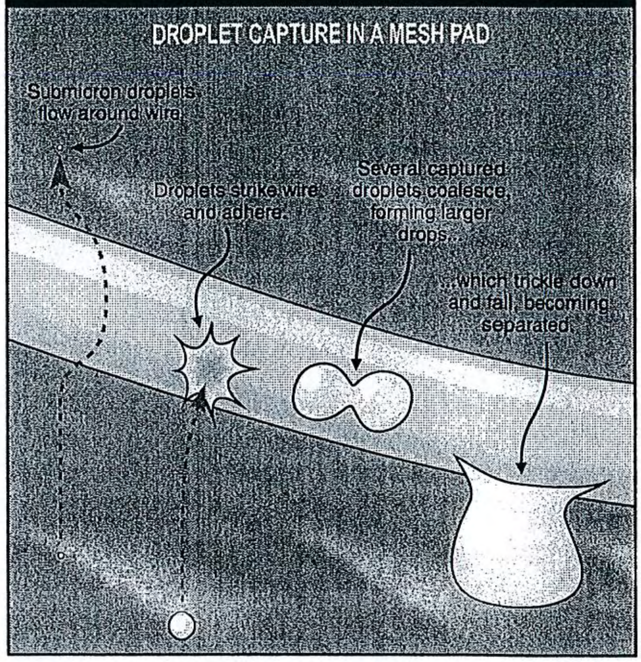


This manual contains basic design concepts used by engineers to remove droplets greater than 3 µm in diameter, so called mists and sprays.

Mechanisms of Droplet Removal

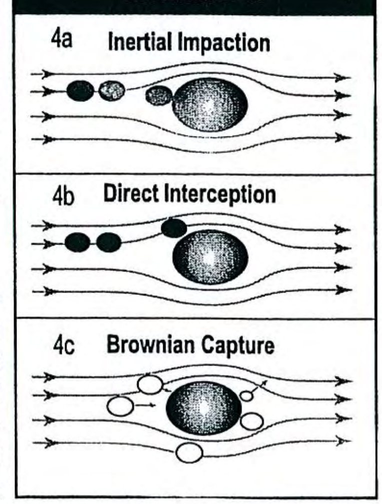
Droplets are removed from a vapor stream through a series of three stages: collision & adherence to a target, coalescence into larger droplets, and drainage from the impingement element. Knowing the size distributions as explained above is important because empirical evidence shows that the target size - important in the first step of removal - must be in the order of magnitude as the particles to be removed. These steps are shown schematically in Figure 3 for mist elimination using a wire mesh mist elimination.

FIGURE 3



For fogs in which the bulk of the droplets are characterized with submicron diameters, the energy to bring about the collision with the target is derived from Brownian Diffusion, the random motion of fine liquid particles as they are pushed about by molecular action as shown in Figure 4c. Fog elimination with so-called fiberbed technology is beyond the scope of this manual.

FIGURE 4



For particles in the mist region between 3-20 µm, knitted wire mesh is most common type of mist eliminator used and Interception is the

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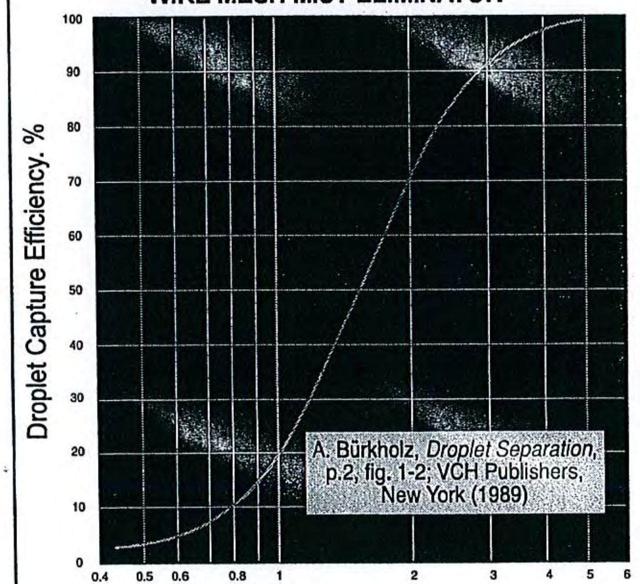
primary mechanism. Consider a droplet approaching a mesh filament of much larger diameter as shown in Figure 4b. The more dense the droplet relative to the gas, the larger the droplet relative to the filament, and the higher the gas velocity, the more likely it is that the droplet will strike the filament. If the velocity is too low, or the droplet too small or too light compared to the gas, the droplet will simply flow around the filament with the gas. If the velocity is too high, liquid clinging to the filaments will be re-entrained, mostly as larger droplets, and carried away by the gas. Re-entrainment is also promoted by low relative liquid density (making it easier for the gas to pick up a droplet) and low liquid surface tension (as less energy is required to break up a film or droplet). The engineered wire mesh mist eliminator may remove 99.9% of particles 2 µm and greater diameter. Figure 5 shows a typical removal efficiency vs droplet size distribution for a wire mesh mist eliminator.

FIGURE 5

SEPARATION EFFICIENCY FOR VARIOUS DROPLET SIZES IN A TYPICAL WIRE MESH MIST ELIMINATOR



Droplets ~20 µm and greater are primarily collected by means of Inertial Impaction whereby the target is directly in the path of the streamline, as shown in Figure 4a. Figure 6 depicts a profile of the ACS PlatePak™ vane. The entrained droplets, due to their momentum, tend to move in straight lines. By studying this figure, it is easy to understand why in the design equations to follow the removal efficiency is directly proportional to the difference in densities of the liquid droplet and carrying gas. With each change in direction of the gas, some droplets collide with the surface and adhere, eventually coalescing into larger droplets which then drain by gravity. Properly designed vane mist eliminators can remove 99% of particles as low as 10 µm in diameter, especially at lower pressures.

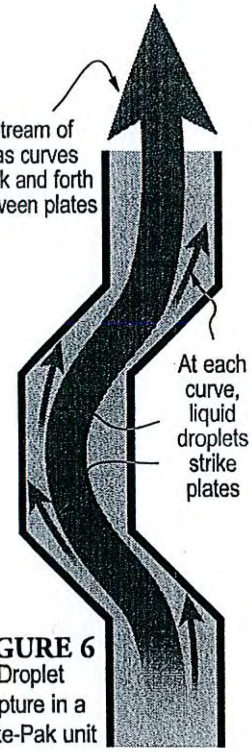


FIGURE 6 Droplet capture in a Plate-Pak unit

Figure 7 illustrates typical wire mesh and PlatePak™ vane mist eliminators, and Figure 8 shows some typical performance curves for both mesh and vane mist eliminators.

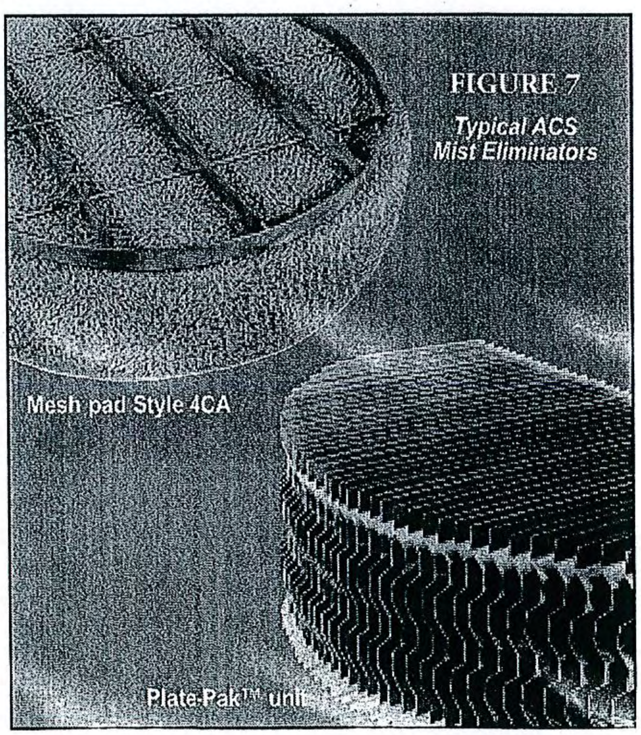
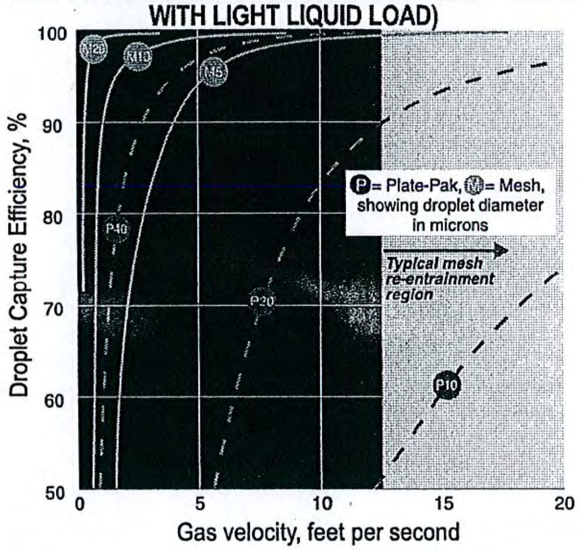


FIGURE 7 *Typical ACS Mist Eliminators*

FIGURE 8

THEORETICAL EFFICIENCY VS. VELOCITY FOR VARIOUS DROPLET SIZES (WATER IN AIR AT AMBIENT CONDITIONS FOR TYPICAL MESH PADS AND PLATE-PAK™ UNITS WITH LIGHT LIQUID LOAD)



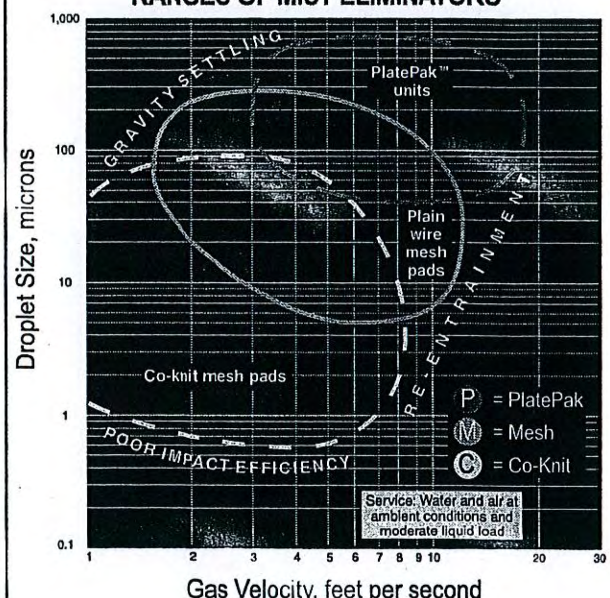
It is worthwhile to discuss Fig. 8 and mist eliminator performance. The dotted curves correspond to different styles of vanes and the solid to wire mesh styles. Note first of all that vanes can be engineered to operate at higher gas velocities and flow rates relative to mesh, but that mesh mist eliminators can approach 100% removal efficiency at smaller droplet sizes. This agrees with the discussions above on Interception and Inertial Impaction removal mechanisms. Note the drastic efficiency drop off at low velocities, in which droplets drift around the filaments or vane blades without striking them. This phenomenon defines the lower operating range of a mist eliminator. The other extreme is when the velocity is too high. In this case, the droplets are captured but the velocity of the gas provides sufficient energy to tear-off and re-entrain droplets. It is in the context of re-entrainment that the design equations which follow show that the removal efficiency is directly proportional to the surface tension of the liquid. As the surface tension increases, so it requires greater kinetic energy (i.e. gas velocity) to break the bond between droplet and target, and the droplets collect and coalesce until drainage by gravity. Re-entrainment defines the upper capacity limit of a mist eliminator.

Operating range is also affected by the liquid loading (proportion of liquid) of the gas. If too great, the mist eliminator becomes choked with liquid, a condition called flooding. Flooding is often noticed by high pressure drops or massive carryover of liquids. Typical wire mesh mist eliminators accommodate liquid loads up to about one US gallon per square foot and vanes twice as much.

The key operating ranges and suitability of mesh and vane mist eliminators is summarized in Figure 9. It emphasizes that vanes are more effective at higher velocities and greater droplet sizes while mesh is more suitable for removing smaller particles at lower velocities. Gravity settling alone is sufficient for very large particles, and co-knit mesh pads, discussed below, for particles in the range of sizes from 2-8 μm. Finally, fiberbed technology is used for submicron fogs.

FIGURE 9

APPROXIMATE OPERATING RANGES OF MIST ELIMINATORS



Types of Mist Eliminator Mesh Styles & Materials

Most designers believe that all wire mesh mist eliminators behave basically the same in terms of capacity and removal efficiency. It is true that for meshes of same filament diameter, the denser mesh offers superior removal efficiency. For meshes with differing filament diameters, a lighter (less dense) mesh may offer considerably better removal efficiency. The key is that the working part of the mesh is the target density, not

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the mass density. For example, the most common 9-lb density mesh, ACS style 4CA, exhibits ~85 sq-ft/cu-ft of surface area. Compare this to the co-knit of a metal with fiberglass (ACS style 6BE) which also exhibits 9-lb mass density but exhibits a specific surface area approaching 3,700 sq-ft/cu-ft, some 40X greater targets per unit volume.

Table 1 shows a few of the more common mesh styles available, together with mesh density and void fraction, and most importantly, the diameter and specific surface area (i.e. the target density) of filaments used.

TABLE 1 • *Wire and Plastic Mesh Styles*

Mesh Style	Density lbs/ft³	Diameter D, inches	Surface, S, ft²/ft³	Percent Voids, ε
Metal mesh				
7CA	5.0	0.011	45	99.0
5CA	7.0	0.011	65	98.6
4CA	9.0	0.011	85	98.2
4BA	12.0	0.011	115	97.6
3BF	7.2	0.006	120	98.6
3BA	12.0	0.006	200	97.6
Plastic mesh				
8P	4.0	0.011	130	92.0
8K	4.0	0.011	160	96.3
8T	4.0	0.011	130	97.0

Mesh Style	Density lbs/ft³	Diameter D, inches	Surface, S, ft²/ft³	Percent Voids, ε
Metal mesh				
8D	9	0.0008	485	99.0
8TMW11	12	0.0008	485	99.0
6BE	9	0.00036	3725	99.0
Plastic mesh				
8PP	3	0.001	530	99.0
8TT	5	0.0008	530	99.0

It is the amount of targets per unit volume which influences removal efficiency, not the density of mesh (the greater the number of targets the greater the probability of a successful collision).

In a co-knit such as a metal alloy and fiberglass, the alloy provides a skeleton for structural support and prevents the high specific surface media from collapsing on itself.

As far back as the 1950's researchers (C. LeRoy Carpenter et al) determined that specific surface area and target or filament diameter play a great role in removal efficiency. Target or filament diameter must be on the order of magnitude as the smallest droplets to be removed. Due to limitations in metal wire ductility and corrosion considerations, co-knits provide finer targets and hence remove finer droplets. Figures 8 and 9 are enlarged images of crimped wire mesh and a co-knit with fiberglass respectively.

FIGURE 8

CRIMPED WIRE MESH

FIGURE 9

CO-KNIT MESH WITH FIBERGLASS YARN

In summary, it is important to report mesh styles in terms of the specific surface area - a measure of the target density, and filament diameter -a measure of the smallest droplet size that can be removed with high efficiency. The mass density is only relevant insofar that a metal mesh of density 12-lb exhibits a greater specific surface area than one of density 7-lb provided the wire diameter remains constant.

Selecting the material of mesh style(s) is also important. Corrosion rates as low as 0.005"/year is not serious in vessel walls but will quickly destroy 0.006" or 0.011" wire mesh. Table 2 gives preliminary guidelines, but ACS draws wire and knits mesh with any ductile metal for special applications.

When applying non-metal materials operating temperature limits must be considered.

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TABLE 2

Mesh Corrosion & Temp. Considerations

Material	Spec. Grav.	Max. Op. Temp., °F	Typical Surface
304 SS	1.00	—	Petroleum, aqueous
304L	1.00	—	Petroleum, aqueous
316L	1.00	—	Sulfuric acid
410 SS	1.00	—	Mild chemicals
Monel®	1.12	—	Corrosive chemicals
Nickel	1.13	—	Caustic evaporators
Alloy 20	1.00	—	Sulfuric acid
Glass	2.52	—	Mild aqueous chemicals
Hasteloy®	1.14	—	Hydrochloric & other acids
Dacron®	1.38	350	Co-knit applications
Kynar®	1.75	300	Acid, alkali
Polypropylene	0.90	160	Water, acid, alkali
Teflon®	2.15	400	Hot sulfuric acid up tp 300ßF
Tefzel®	1.70	380	Acid, alkali

Design Equations

To determine mist eliminator cross-sectional area (and hence vessel size) and predict performance in terms of removal efficiency, the optimum design gas velocity is determined first. The Souders-Brown equation is used to determine this velocity based on the physical properties of the liquid droplets and carrying vapor:

$$V_d = k(\rho L - \rho G/\rho G)^{1/2} \qquad (1)$$

where V_d = design gas velocity (ft/sec)
k = Capacity Factor (ft/sec)
ρL = Liquid Density
ρG = Vapor Density

The capacity factor is determined through experience and for each application, and is influenced by type and style of mesh or vane targets used, the geometry of the targets (vertical or horizontal relative to the vapor flow), as well as by properties such as operating pressure, fluid viscosities, and liquid surface tension.

The design velocity V_d for a given application is the value that produces the best performance in terms of capturing droplets and avoiding re-entrainment. Referring to Figure 8, this ideal velocity* for a given class of mist eliminators would be somewhere toward the upper end of the range: about 10 fps for plain wire mesh pads, about 8.5 fps for co-knits, and 14 fps for PlatePak™ elements. As discussed, effectiveness drops off at lower velocities as the droplets have sufficiently low momentum to negotiate paths through the targets, and at higher velocities because the vapor carried sufficient kinetic energy to re-entrain droplets. For typical designs, acceptable velocities range between 25% to 125% of the ideal value.

The Capacity Factor may be thought of as an indication of ability of a mist eliminator to drain liquids and avoid re-entrainment under various conditions. See Table 3 for some typical baseline values.

TABLE 3

Standard Souders-Brown Coefficients (k factors) for mesh and Plate-Pak™ Units

Pad Arrangement	k, ft/sec
1. Horizontal Style 4CA pad	0.35
2. Style 4CA MisterMesh® Pad	0.42
3. Horizontal Plate-Pak™ Unit *With or without MisterMesh below*	0.50
4. Vertical Plate-Pak™ Unit *With or without Mesh ahead*	0.65

NOTE: Water and air, room temperature, pressure below 100 psia

Note that Souders-Brown equation provides correction for only gas and liquid densities. Should any conditions exist which affects drainage or re-entrainment, the Capacity Factor must be pro-rated as appropriate.

After selecting the appropriate Capacity Factor and calculating the ideal vapor velocity, the cross-sectional area of mist eliminator is readily determined by dividing the volumetric flow rate by the velocity.

Having established this design velocity for the application, you can now predict the efficiency of a mesh pad for droplets of a particular size. This procedure is laborious and therefore well suited for a computer. The ACS MistXpert® software uses the method described below.

First, calculate the inertial parameter K as follows, using consistent units of measurement:

* For Air Water at ambient temperature and atmospheric pressure

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$K = K = [(\rho L - \rho G)Vd^2] / 9\mu D$ (2)

Where K = dimensionless inertial parameter
V =gas velocity in fps
d =Liquid droplet diameter in ft
μ =Gas viscosity in lb/ft s
D =Wire or filament diameter in ft

Use this calculated K value with Figure 10 to find the corresponding value of the impaction efficiency fraction E. From Table 1, find S, the specific surface area for the mesh style of interest.
And determine SO, of the mist eliminator perpendicular to vapor flow and with a correction factor of 0.67 to remove that portion of the knitted wire not perpendicular to the gas flow:

SO = Specific Surface Area x $1/\pi$ x Thickness (ft) x 0.67
Using these values and T, the thickness of the pad, calculate the capture efficiency:

Efficiency % = 100-(100/e0.213^{ESO})

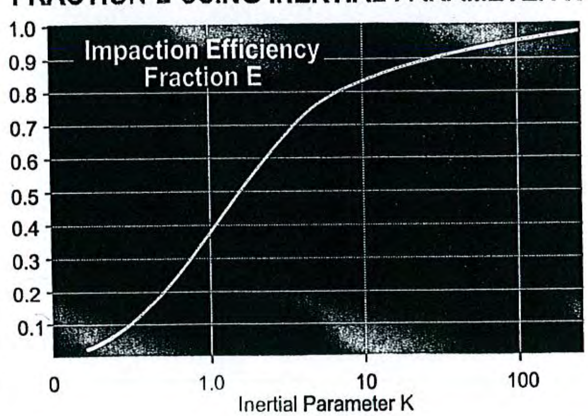
Where S0 = Corrected Pad Specific Surface Area

E = Impaction efficiency fraction

This efficiency is the percent of all incoming droplets of the given diameter which will be captured rather than passing through the mist eliminator. The percentage will be higher for larger droplets and lower for smaller.

FIGURE 10

DETERMINING IMPACTION EFFICIENCY FRACTION E USING INERTIAL PARAMETER K



Predicting Pressure Drop

Although the operating pressure differential across a properly sized mesh pad or vane is never more than a few inches of water, pressure drop is an important design consideration in certain applications, particularly vacuum systems or larger columns requiring the movement of great quantities of gas. It has been shown that each inch of head loss requires some 0.16 hp/scfm. A simple correlation has been developed to describe the pressure drop through a dry mist eliminator (no mist):

$\Delta P_{dry} = 0.4Vd^2 \rho_G ST/g_c \, \varepsilon \, \rho w$ (3)

Where gc =gravitational constant
ε =Mesh Void Fraction
ρ_w =Ambient water density

The overall pressure drop is the sum of the head loss incurred as the gas travels through the mesh, as well as that due to the resistance to captured liquids. Liquid accumulates as a pool in the bottom of the mist eliminator. If the liquid loading and velocity are such that a 2" deep pool accumulates in the bottom of the mesh pad, this amount must be added to that calculated using Equation 3. Figure 11 summarizes pressure drop and velocity test data collected on the ACS pilot plant for light and medium liquid loading.

With due consideration given to the mist eliminator itself, the flow of fluid to and from it requires the same attention.

Inlet Diffusers

At high flow rates, primary removal of bulk liquids upstream of the mist eliminator is very important to prevent flooding. This is typically done in a cost effective manner by using a simple inlet diverter as shown in Fig. 12.

With this design, liquids impinge upon the diverters, the flow is forced to flow laterally to allow bulk liquids to escape by gravity and eliminate the countercurrent momentum of the gas.

The *Force of Inertia*, expressed as ρv^2, is typically used to quantify the flow entering a vessel to determine whether a simple baffle will suffice ACS recommends inlet diverters to a Force of Inertia up to 2,500 lb/ft s^2. Above this, more sophisticated distributors are recommended.

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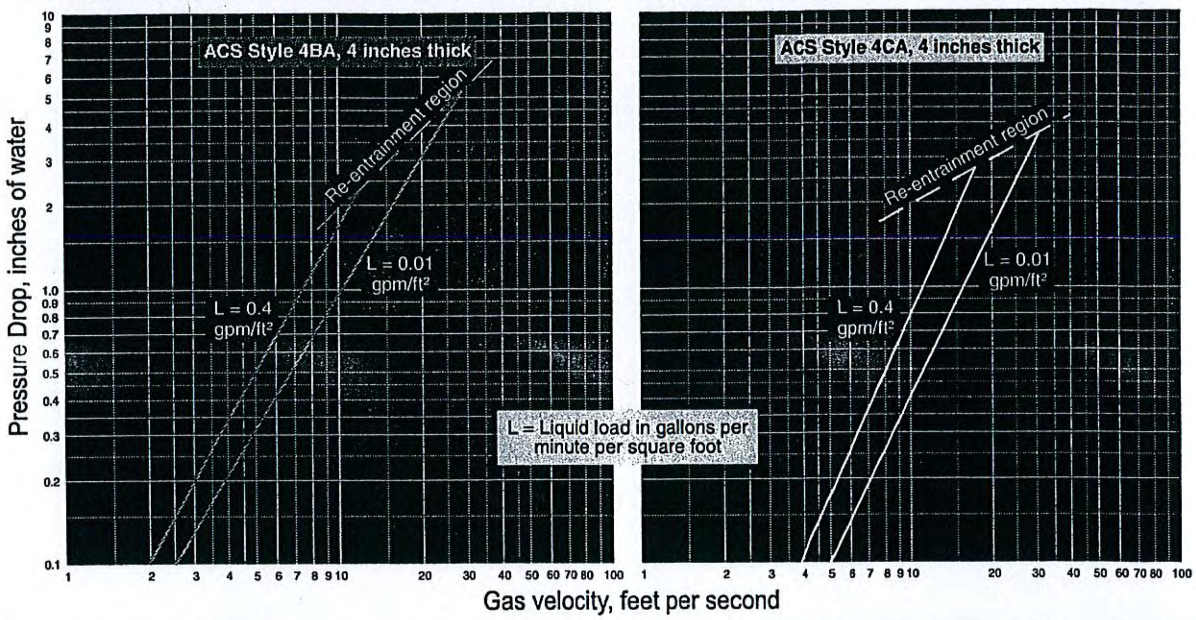
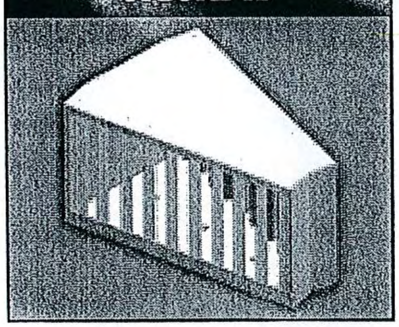
FIGURE 11

ACTUAL PRESSURE DROP VERSUS VELOCITY FOR TYPICAL ACS MESH PADS AT LIGHT AND MEDIUM LOADS



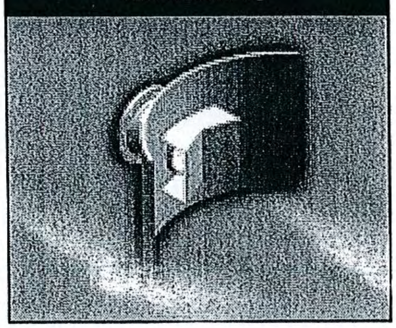
Decades ago, Dutch Shell Chemical Company introduced Schoepentoeter® style bladed designs (Fig. 12).

FIGURE 12



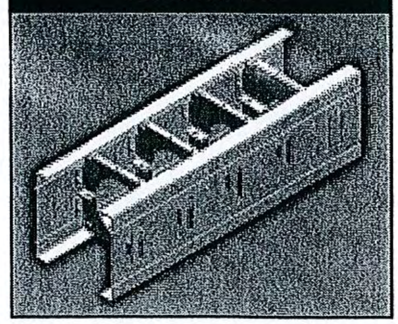
As the fluid flows axially towards the shell opposite of the inlet nozzle, liquids are captured by specially placed blades. This design is superior because it allows the escape of liquids over a much greater region of the vessel. A simple inlet diverter (Fig. 13) would simply shear bulk liquids into smaller droplets at great flow rates:

FIGURE 13



ACS AccuFlow™ Inlet Diffuser (Fig. 14) is an adaption of the bladed designs in which the body of the diffuser maintains its shape, the restriction of flow which allows the escape of liquids over the diameter of the vessel is accomplished using internal blades of concentric and decreasing cross-sectional areas.

FIGURE 14



Vessel Configuration

Several factors must be considered when deciding on the configuration of vessel internals. The first step is to determine the cross-sectional area needed. Then a tentative geometry and shape appropriate for both the vessel and plant location is selected. Figure 15 shows the most typical, but by no means complete, configurations. Mist eliminators can be of virtually any size or shape to accommodate all factors.

The performance of the mist eliminator depends strongly on an even velocity distribution over the cross-sectional area. As a general rule, a distance of either half the vessel diameter is sufficient spacing both upstream and downstream of the element. Representations for specific cases are illustrated in Figure 16.

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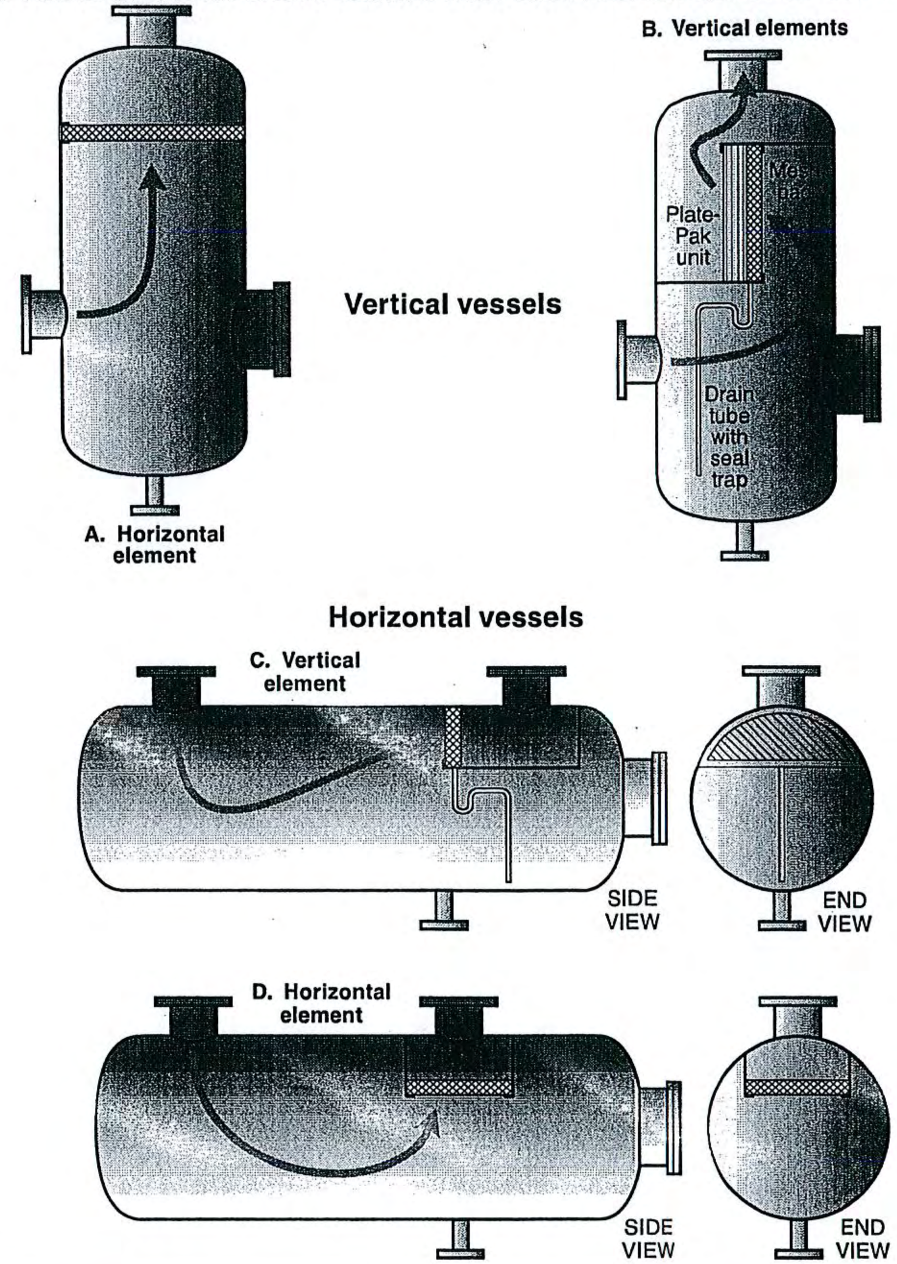
FIGURE 15

SIMPLIFIED VIEWS OF TYPICAL MIST ELIMINATOR CONFIGURATIONS IN SEPARATOR VESSELS



Small velocity differences are acceptable, but should be minimized at the design stage. Otherwise, some regions of the mist eliminator may be subjected to heavy loading leading to re-entrainment while other regions are unused.

Most often, the mist eliminator is located just upstream of the outlet nozzle with insufficient disengagement space. Vapor tends to channel through the pad in the region closest to the outlet nozzle and peripheral regions of the pad remain unused. To rectify this, ACS engineers apply an *Integral Flow Distributor* which is welded to region(s) of the downstream face of the pad. This technique allows the engineer to selectively increase the pressure drop through regions of the pad likely to suffer from channeling, and is cost effective.

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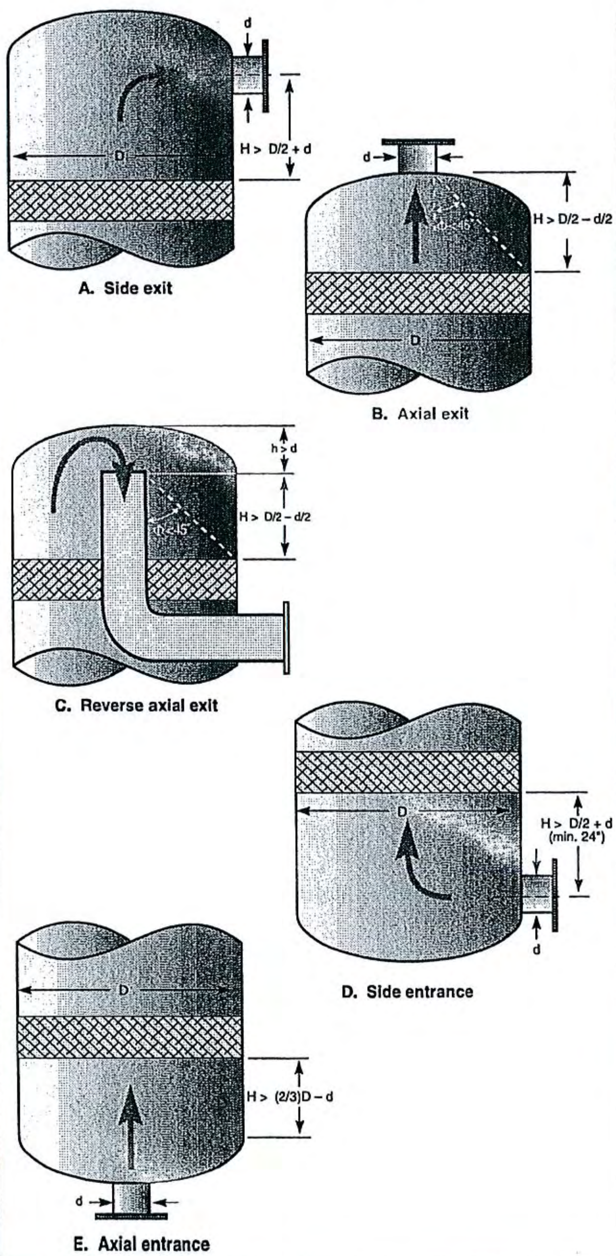
Advanced Mist Eliminator Designs

There are several modifications to mesh pads and vanes to dramatically enhance performance.

FIGURE 16

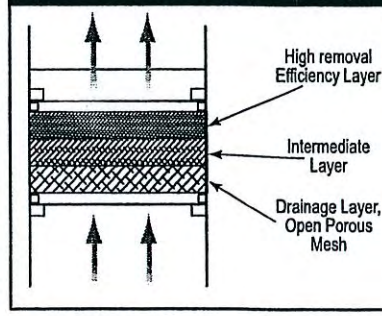
Guidelines for maintaining even flow distribution across mesh pads or vane units with axial flow in cylindrical vessels. Height of vessel head is assumed to be 1/4 of vessel diameter. Flow distribution devices can minimize required disengement space above mesh pads. Contact ACS for assistance.



Drainage & Collection Layering

Recall the discussion on pressure drop through a mist eliminator in which liquid tends to pool in the lower layers of mesh. The simplest technique to promote drainage is to use a few inches of open, porous mesh such as ACS style 7CA (5-lb density with specific surface area as low as 45 sq-ft/cu-ft) in the upstream position. As drainage occurs through the bottom regions of the mesh, opening the knit enhances liquid drainage.

FIGURE 17



An extension of this approach is to use higher specific surface area mesh in downstream positions to enhance separation efficiency, with intermediate mesh between the collection and drainage zones. Figure 17 illustrates a Multilayer mist eliminator.

MisterMesh® Drainage Coils

A second technique used by ACS to enhance liquid drainage, and often in conjunction with multi-layering, is to append drainage coils to the upstream face of a horizontal mist eliminator as shown in Figure 18.
The coils are also made of mesh and "fill" with liquid.

FIGURE 18

Once filled, liquid from the pad above is drawn through surface tension to the coils, thereby establishing distinct regions for liquid drainage and liquid collection in the upstream layers. Figure 18 compares the pressure drop and flooding point of both conventional and MisterMesh® Mist Eliminators.

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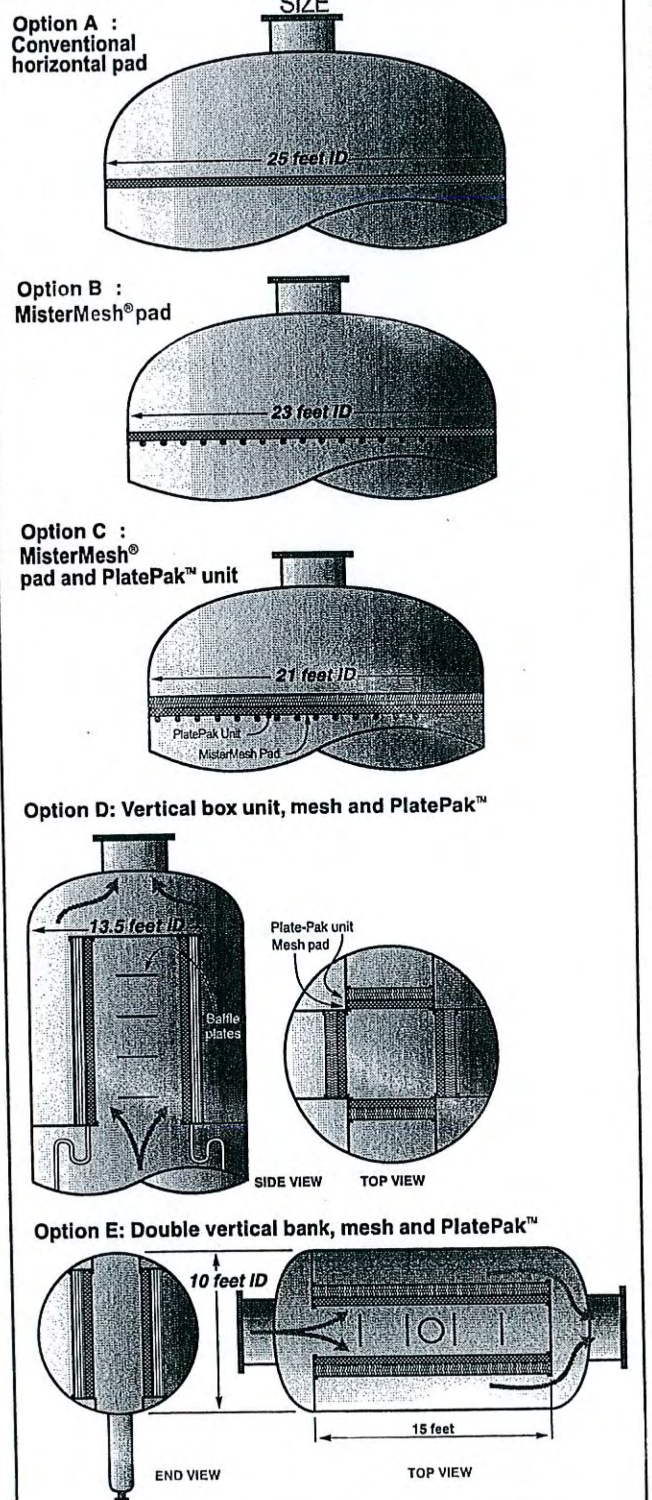
FIGURE 22

APPLYING COMBINATIONS OF ACS MESH PADS AND PLATEPAK™ VANE UNITS TO MINIMIZE VESSEL SIZE



CASE STUDY #1

Problem: In an HCl scrubber, an air stream of 60 acfs is coming off a bed of random packing and contains droplets of a week acid. The unit operates at 122 psia at 82°F. Determine the size of mist eliminator required to remove this mist and the removal efficiency possible.

Solution: Since the acid is dilute we assume the density and viscosity of water at the operating pressure and temperature:

$$\rho_L = 62.4 \text{ lb/ft}^3$$
$$\rho_G = 0.60 \text{ lb/ft}^3$$
$$P = 122 \text{ lb/ft}^2$$
$$T = 82^\circ\text{F}$$
$$F = 60 \text{ ft}^3/\text{s}$$

The first step is to select the mist eliminator type and mesh style. As shown in Figure 2, mist coming off the top of packing is typically comprised of droplets ranging in size from as small as 5 µm, so we select a mesh style mist eliminator to achieve this level of performance. From experience, the capacity factor for poly mesh at moderate liquid loading and lower pressures is ~.27 fps. Using the Souders-Brown equation the ideal velocity is calculated:

$$V_{ideal} = k\,[(\rho L - \rho G)/\rho G]^{1/2}$$
$$V_{ideal} = 0.27[(62.4-.060)/0.60]^{1/2}$$
$$V_{ideal} = 3.55 \text{ fps}$$

The cross-sectional area of mist eliminator is determined by dividing the volumetric flow rate by the ideal velocity:

$$\text{Area}_{\text{Mist Eliminator}} = \text{Volumetric Flow Rate}/\text{Superficial Vapor Velocity}$$

$$\text{Area}_{\text{Mist Eliminator}} = [60 \text{ ft3/s}]/3.55 \text{ fps}$$

$$\text{Area}_{\text{Mist Eliminator}} = 16.9 \text{ ft2}$$

The corresponding diameter is 55.67", rounded up to a standard 60" scrubber vessel. Note that performing the same calculations using a vane (and a Capacity Factor of 0.50) yields an ideal vessel diameter of 46.57", rounded up to a standard 48" ID vessel. To calculate the removal efficiency at 5 µm, several parameters must be identified to use equation 2 to determine the inertial parameter K:

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$K = [(\rho L - \rho G)Vd^2]/9\mu D$

$K = 0.54$

From Figure 10, the corresponding Impaction Efficiency Fraction E is ~0.15. In the Removal Efficiency Equation there is a term for the corrected specific surface area SO:

SO= Specific Surface Area x 1/π x Thickness (ft) x 0.67

For ACS style 8P, the specific surface area is (185 + 36) = 221 ft^2/ft^3, we will try both 4" and 6" thick mist eliminator thicknesses (1/3 and 1/2ft):

$$SO = 221 \times 1/3.14 \times 1/3 \times 0.67$$

$$SO_{4\text{"thick}} = 15.7 \text{ and } SO_{6\text{"thick}} = 23.6$$

And Removal Efficiency E at 5 μm is:

$$\text{Efficiency} = 100 - 100/e^{ESO}$$
$$\text{Efficiency} = 100 - 100/e(0.15)(15.7)$$
$$\text{Efficiency} = 90.5\%$$

For the 6" thick element, the removal efficiency is 97.1%. By using a composite pad containing a 2" layer of regular monofilament polypropylene, style 8P, upstream of a 2" thick layer of 8PP, mono- and multi-filament co-knit, the removal efficiency is 99.9% .

CASE STUDY #2

Traditionally, trays are used to bring about contact between glycol and natural gas in dehydration contactors. In recent years, the industry moved towards smaller diameter columns by exploiting the higher capacities achieved with structured packing. However, the lower capital investment associated with a smaller diameter packed tower is often offset by dramatically increased glycol losses.

Consider a mid-western sour gas plant operating a 96" glycol contactor and processing 1,310,000 lb/hr of gas at 116°F and 1214 psia. The gas and liquid specific densities were 4.4 and 68 lb/cu-ft respectively. The plant was experiencing 0.13 US gal of carryover per mmscf, amounting to some 65 gal/day of lost triethylene glycol, several hundred dollars worth per day. A 10" thick wire mesh mist eliminator of 12-lb mass density was installed above the packing.

From experience, ACS engineers knew that the droplet size distribution for glycol coming off the top of a packed dehydrator extends down to diameters of 5 μm and greater. Also, if the diameter of the packed column was sized in accordance with the hydraulic requirements of the packing, the wire mesh mist eliminator would be undersized.

The capacity factor for 12-lb density mesh in this service is ~0.23 – 0.27, having been de-rated for the high liquid viscosity of 18 cP (which retards liquid drainage) and relatively high operating pressure. Using the gas density, volumetric flow rate and cross-sectional area of the mist eliminator, the actual superficial velocity is readily calculated. Next, using known densities of the gas and glycol, the actual or operating Capacity Factor k is determined:

$$V_{actual} = k_{actual} [(\rho L - \rho G) / \rho G]^{1/2}$$

Re-arranging for

$$k_{actual} = V_{actual} / [(\rho L - \rho G) / \rho G]^{1/2}$$

$$= 0.44 \text{ fps}$$

A Capacity Factor of 0.44 fps is almost twice as high as the optimum, and is in the range of that of an ACS PlatePak™ Vane mist eliminator. However, the vane will not remove particles down to 5 μm, so a mesh-vane assembly was proposed. The assembly has a multilayered mesh section with open, porous mesh (ACS style 7CA) upstream of high specific surface area mesh (8D(T) co-knit of stainless and Dacron®). MisterMesh® drainage coils were appended to the bottom face of the mist eliminator. Downstream of the mesh was placed a PlatePak™ Vane. The total thickness was 12" and was accommodated using the same supports as the mist eliminator it replaced.

Carryover from a glycol contactor occurs through two mechanisms, evaporative losses and mechanical (carryover) losse). In this example, simulations showed evaporative glycol losses of 0.0054 gal/mmscfd. The total losses after the revamp were less than 0.008 gal/mmscfd, and carryover losses had been reduced from 0.13 gal/mmscfd, a 94% reduction!

TAG: D

DelTech

DelVal® SERIES 50/52

Resilient Seated Butterfly Valves

Wafer & Lug

Sizes 2"-24" / DN 50 - DN 600

Leading the Industry with Innovation by Design

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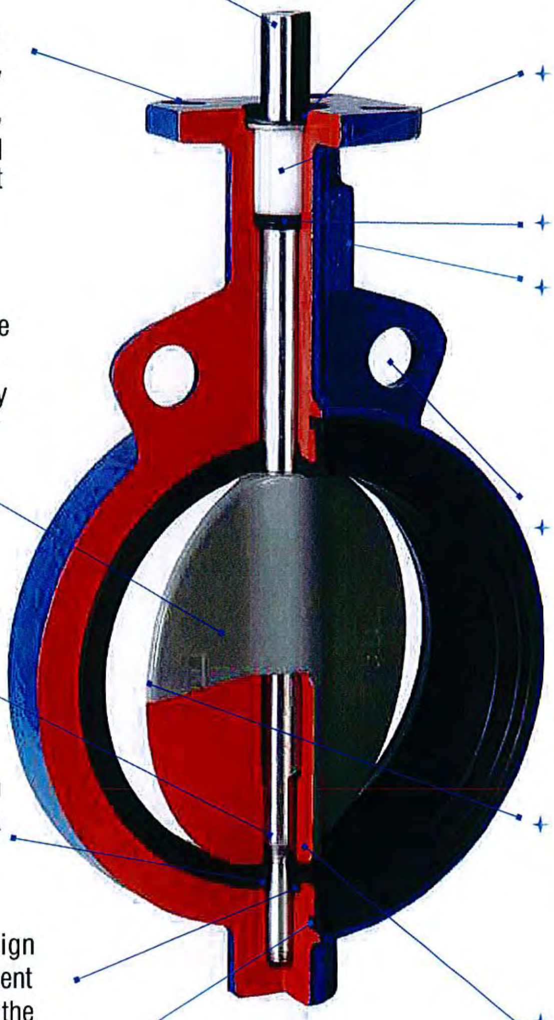
DelTech Controls is pleased to offer top-of-the-line products in pipeline flow control. The DelVal Series 50 (wafer body) and Series 52 (lug body) Butterfly Valves have been developed with extensive application, design and manufacturing expertise. These products are produced by employing modern manufacturing practices under a robust quality assurance system. These practices ensure consistent product quality and dependable performance. The DelVal Series 50/52 Butterfly Valves have been designed to include state-of-the-art features that are described in this bulletin.

Features

- Stem connection available in standard DelVal sizes or optional sizes to match standard secondary top plate drilling.
- Top plate double drilled to fit ISO 5211 dimensions and standard secondary bolt circle dimensions. All handles, gear operators and pneumatic DelTorq actuators are designed to mount directly to DelVal Valves.
- Nylon PA 12 coated disc option ensures excellent corrosion resistance to several chemical media. The hard, non-porous sintered polymer has very low hygroscopicity and is suitable for use in drinking water and non-alcoholic foodstuffs.
- One piece stem with close tolerance double D drive eliminates the need for disc screws or taper pins.
- Double O-rings are molded in both upper and lower journals providing a superior secondary seal.
- Unique "Center-Lock" seat design virtually eliminates any seat movement during the seating and un-seating of the disc.
- Heavy duty square-grooved seat design with molded O-ring seals to serve as flange gaskets. EPDM and Buna-N seats are peroxide cured to yield the best elastic properties of the elastomer.

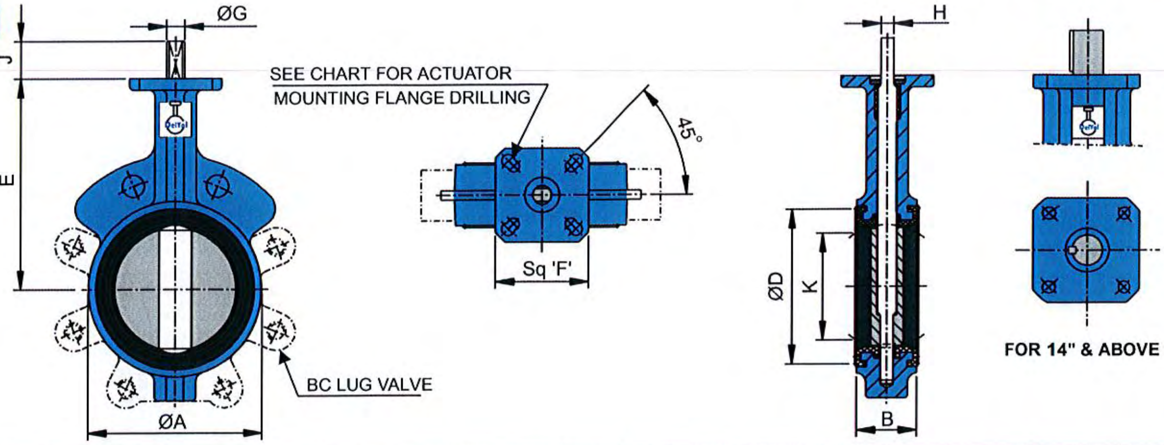


- Unique stem retention system to provide blow-out proof stem and easy assembly and disassembly of valve.
- Heavy duty acetal bushing absorbs the forces acting on the stem/disc assembly due to line pressure.
- Bi-directional 'U' cup stem seal.
- Heavy duty one-piece body with extended neck for 2" piping insulation. Standard coating is two coats of hard, Zinc-rich epoxy for excellent corrosion resistance.
- Two flange locating holes for sizes up to 12" and four flange locating holes from size 14" to 24" for easy alignment of valve during installation. They meet ANSI #125 /150 or other world drilling standards.
- High strength disc with hand polished disc edge and hubs.
- Precision machined radius on the upper and lower disc hubs is pressed against upper and lower seat sealing faces for achieving primary sealing between disc and seat.

- "Center-Lock" seat design

TAG: D

Engineering



DIMENSIONS (Inches)

Valve Size		ØA	*B	ØD	E	Sq'F'	Top Plate Drilling			ØG	H	J	Key Size	K	Lug Bolting Data			Weight in Lbs.	
Inches	DN						BC	No. of Holes	Hole Dia						BC	No.of Holes	Threads UNC-2B	Wafer (Series 50)	Lug (Series 52)
2	50	3.46	1.69	2.99	5.51	3.15	2.76/3.25	4	0.39/0.438	0.55	0.39	1.25	---	1.35	4.75	4	5/8-11	5.50	7.70
2 ½	65	4.02	1.81	3.54	5.98	3.15	2.76/3.25	4	0.39/0.438	0.55	0.39	1.25	---	2.08	5.50	4	5/8-11	6.38	8.36
3	80	4.72	1.81	4.17	6.30	3.15	2.76/3.25	4	0.39/0.438	0.55	0.39	1.25	---	2.72	6.00	4	5/8-11	7.70	9.24
4	100	5.91	2.06	5.20	7.09	3.15	2.76/3.25	4	0.39/0.438	0.63	0.43	1.25	---	3.59	7.50	8	5/8-11	12.32	17.60
5	125	6.89	2.19	6.30	7.56	3.15	2.76/3.25	4	0.39/0.438	0.75	0.51	1.25	---	4.62	8.50	8	3/4-10	14.08	21.56
6	150	7.87	2.19	7.36	8.07	3.15	2.76/3.25	4	0.39/0.438	0.75	0.51	1.25	---	5.50	9.50	8	3/4-10	15.84	24.86
8	200	10.04	2.38	9.45	9.49	4.72	4.92/5.00	4	0.55/0.563	0.87	0.63	1.25	---	7.39	11.75	8	3/4-10	31.68	40.48
10	250	12.21	2.69	11.50	10.75	4.72	4.92/5.00	4	0.55/0.563	1.18	0.87	2.00	---	9.31	14.25	12	7/8- 9	47.30	62.70
12	300	14.17	3.06	13.58	12.24	4.72	4.92/5.00	4	0.55/0.563	1.18	0.87	2.00	---	11.12	17.00	12	7/8- 9	67.10	91.30
14	350	16.34	3.06	15.28	13.62	4.72	4.92/5.00	4	0.55/0.563	1.38	---	2.00	0.39x0.39	12.96	18.75	12	1- 8	103.40	124.30
16	400	18.58	4.00	17.40	14.76	4.72	4.92	4	0.55	1.38	---	2.00	0.39x0.39	14.81	21.25	16	1- 8	147.40	201.30
18	450	20.67	4.50	19.49	15.98	6.70	6.50	4	0.83	1.97	---	2.50	0.39x0.47	16.59	22.75	16	11/8 -7	206.80	242.00
20	500	22.83	5.00	21.57	17.24	6.70	6.50	4	0.83	1.97	---	2.50	0.39x0.47	18.65	25.00	20	11/8 -7	271.00	325.60
24	600	27.24	6.06	25.75	19.49	6.70	6.50	4	0.83	2.50	---	4.00	0.62x0.62	22.53	29.50	20	11/4 -7	430.00	513.80

DIMENSIONS (mm)

Valve Size		ØA	*B	ØD	E	Sq'F'	Top Plate Drilling			ØG	H	J	Key Size	K	Lug Bolting Data			Weight in Kg.	
Inches	DN						BC	No. of Holes	Hole Dia						BC	No.of Holes	Threads UNC-2B	Wafer (Series 50)	Lug (Series 52)
2	50	88	43	76	140	80	70/82.5	4	10/11	14	10	32	---	34.3	120.7	4	5/8-11	2.5	3.5
2 ½	65	102	46	90	152	80	70/82.5	4	10/11	14	10	32	---	52.8	139.7	4	5/8-11	2.9	3.8
3	80	120	46	106	160	80	70/82.5	4	10/11	14	10	32	---	69.1	152.4	4	5/8-11	3.5	4.2
4	100	150	52	132	180	80	70/82.5	4	10/11	16	11	32	---	91.2	190.5	8	5/8-11	5.6	8.0
5	125	175	56	160	192	80	70/82.5	4	10/11	19	13	32	---	117.3	215.9	8	3/4-10	6.4	9.8
6	150	200	56	187	205	80	70/82.5	4	10/11	19	13	32	---	139.7	241.3	8	3/4-10	7.2	11.3
8	200	255	60	240	241	120	125/127	4	14/14.3	22	16	32	---	187.6	298.5	8	3/4-10	14.4	18.4
10	250	310	68	292	273	120	125/127	4	14/14.3	30	22	51	---	236.4	362.0	12	7/8-10	21.5	28.5
12	300	360	78	345	311	120	125/127	4	14/14.3	30	22	51	---	282.4	431.8	12	7/8-10	30.5	41.5
14	350	415	78	388	346	120	125/127	4	14/14.3	35	---	51	10x10	329.2	476.2	12	1-8	47	56.5
16	400	472	102	442	375	120	125	4	14	35	---	51	10x10	376.2	539.7	16	1-8	67	91.5
18	450	525	114	495	406	170	165	4	21	50	---	64	10x12	421.5	577.8	16	1 1/8-7	94	110
20	500	580	127	548	438	170	165	4	21	50	---	64	10x12	473.8	635.0	20	1 1/8-7	123	148
24	600	692	154	654	495	170	165	4	21	63.5	---	102	15.88x15.88	572.3	749.3	20	1 1/4-7	195	233

* Face to Face dimension "B", generally conforming to API 609/BS EN 558-1 / ISO 5752

TORQUE (Lb.-Inches)

Valve Size		2"	2.5"	3"	4"	5"	6"	8"	10"	12"	14"	16"	18"	20"	24"
Full Rated Pressure Valve Δ P, PSI	50	89	133	177	283	381	566	1098	1761	2629	3806	4912	6036	7930	12001
	100	97	159	204	301	416	637	1221	1983	2974	4381	5904	7576	9931	15603
	150	102	164	212	319	451	681	1354	2195	3319	4957	6904	9117	11922	19470
	175	106	168	221	328	469	726	1416	2301	3496	---	---	---	---	---
Reduced Disc Dia. Δ P, PSI	50	89	133	177	186	283	372	752	1151	1761	2540	3284	4054	5284	7611

TORQUE (Nm)

Full Rated Pressure Valve Δ P, Bar	3.5	10	15	20	32	43	64	124	199	297	430	555	682	896	1356
	7	11	18	23	34	47	72	138	224	336	495	667	856	1122	1763
	10	11.5	18.5	24	36	51	77	153	248	375	560	780	1030	1347	2200
	12	12	19	25	37	53	82	160	260	395	---	---	---	---	---
Reduced Disc Dia. Δ P, Bar	3.5	10	15	20	21	32	42	85	130	199	287	371	458	597	860

TAG: D

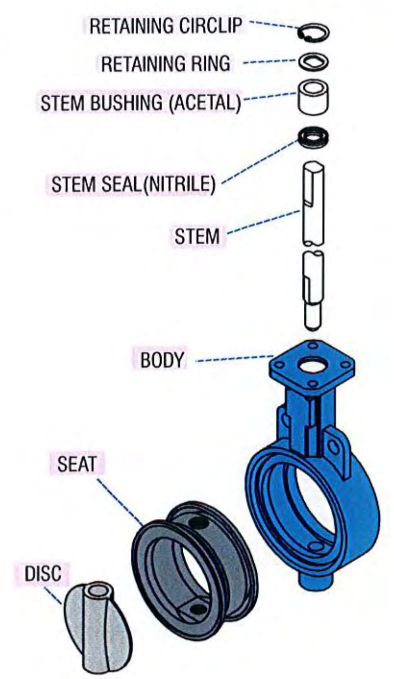
Material of Construction

Body
- Cast Iron ASTM A126 Class B
- Ductile Iron ASTM A536 Grade 65-45-12
- Carbon steel ASTM A 216 WCB

Disc
- Nylon 12 Coated Ductile Iron ASTM A536 Grade 65-45-12
- DI ASTM A 536 Grade 65-45-12 + Aroxy coated
- 316 Stainless Steel ASTM A351 Grade CF8M
- Aluminum Bronze ASTM B148-C95400

Stem
- 410 Stainless Steel ASTM A479 Type 410
- 316 Stainless Steel ASTM A276 Type 316
- Carbon steel BS 970

Seat
- EPDM - Food Grade
- Buna-N - Food Grade
- White Buna-N - Food Grade
- Viton®/ FKM - Food Grade
- Silicone



Seat Temperature Range

Seat Type	Temperature Range	
	Min.	Max.
EPDM	-13° F (-25°C)	248° F (120°C)
BUNA-N	-13° F (-25°C)	212° F (100°C)
White BUNA-N	-13° F (-25°C)	212° F (100°C)
Viton®/ FKM	-23°F (-5°C)	392° F (200°C)
Silicone	-58° F (-50°C)	356° F (180°C)

Viton® is registered trademark of E.I. DuPont

Pressure Rating

For bi-directional bubble tight shut off with disc in the closed position

Inches	DN	PSIG
2"-12"	50-300	175
14"-24"	350-600	150

Dead-End Service : Without a downstream flange installed, the dead-end pressure ratings are equal to the values stated above.

Operators

Valves up to size 12" can be supplied with lever handles for manual operation. Optional accessories for hand-lever operation can be provided for various flow control requirements. Pad locking can also be provided for preventing unauthorized operation.

Valves up to size 24" can be direct mounted with gear operators for manual operation. Gear operators can also be attached with chain-wheel operators for opening or closing valves located on pipelines at high elevations.

All valves can be direct mounted with pneumatic actuators or electric actuators and accessories for complete automation options such as fail open/close & positioner controlled. Valves can be mounted with manual overrides.

TPDELVAL 04/06

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DelVal Mi4 - 04/06

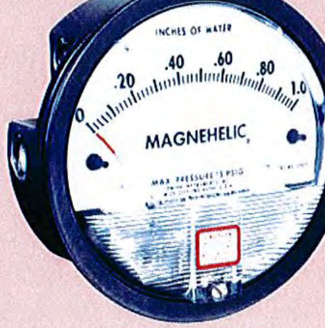
Website : www.deltechcontrols.com

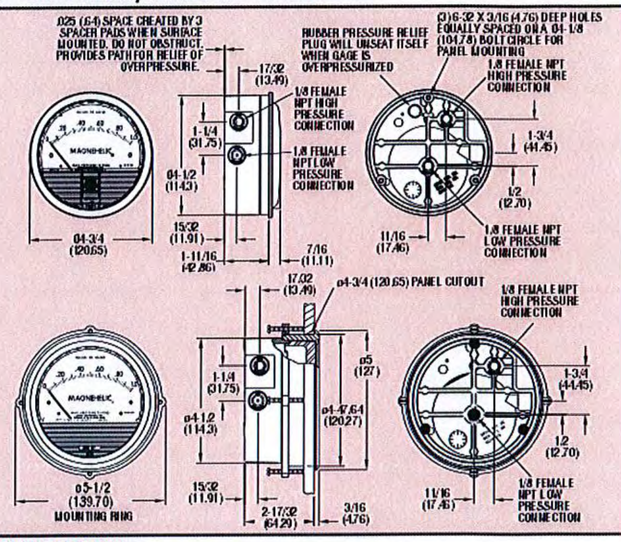
TAG: E

Series 2000

Magnehelic® Differential Pressure Gages

Indicate Positive, Negative or Differential, Accurate within 2%



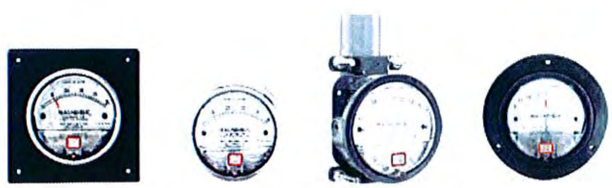


Select the Dwyer® Magnehelic® gage for high accuracy – guaranteed within 2% of full-scale – and for the wide choice of 81 models available to suit your needs precisely. Using Dwyer's simple, frictionless Magnehelic® gage movement, it quickly indicates low air or non-corrosive gas pressures – either positive, negative (vacuum) or differential. The design resists shock, vibration and over-pressures. No manometer fluid to evaporate, freeze or cause toxic or leveling problems. It's inexpensive, too.

The Magnehelic® gage is the industry standard to measure fan and blower pressures, filter resistance, air velocity, furnace draft, pressure drop across orifice plates, liquid levels with bubbler systems and pressures in fluid amplifier or fluidic systems. It also checks gas-air ratio controls and automatic valves, and monitors blood and respiratory pressures in medical care equipment.

Mounting

A single case size is used for most models of Magnehelic® gages. They can be flush or surface mounted with standard hardware supplied. Although calibrated for vertical position, many ranges above 1" may be used at any angle by simply re-zeroing. However, for maximum accuracy, they must be calibrated in the same position in which they are used. These characteristics make Magnehelic® gages ideal for both stationary and portable applications. A 4-9/16" hole is required for flush panel mounting. Complete mounting and connection fittings, plus instructions, are furnished with each instrument. See pages 6 and 7 for more information on mounting accessories.



Flush, Surface or Pipe Mounted

Enclosure Mounted

SPECIFICATIONS

Service: Air and non-combustible, compatible gases (natural gas option available).
Note: May be used with hydrogen. Order a Buna-N diaphragm. Pressures must be less than 35 psi.
Wetted Materials: Consult factory.
Housing: Die cast aluminum case and bezel, with acrylic cover. Exterior finish is coated gray to withstand 168 hour salt spray corrosion test.
Accuracy: ±2% of FS (±3% on - 0, -100 Pa, -125 Pa, 10MM and ±4% on - 00, -60 Pa, -6MM ranges), throughout range at 70°F (21.1°C).
Pressure Limits: -20 in Hg to 15 psig† (-0.677 to 1.034 bar); MP option: 35 psig (2.41 bar); HP option: 80 psig (5.52 bar).
Overpressure: Relief plug opens at approximately 25 psig (1.72 bar), standard gages only. See Overpressure Protection Note on next page.
Temperature Limits: 20 to 140°F* (-6.67 to 60°C). -20°F (-28°C) with low temperature option.
Size: 4" (101.6 mm) diameter dial face.
Mounting Orientation: Diaphragm in vertical position. Consult factory for other position orientations.
Process Connections: 1/8" female NPT duplicate high and low pressure taps - one pair side and one pair back.
Weight: 1 lb 2 oz (510 g), MP & HP 2 lb 2 oz (963 g).
Standard Accessories: Two 1/8" NPT plugs for duplicate pressure taps, two 1/8" pipe thread to rubber tubing adapter, and three flush mounting adapters with screws. (Mounting and snap ring retainer substituted for three adapters in MP & HP gage accessories.)
Agency Approval: RoHS. **Note:** -SP models not RoHS approved.
†For applications with high cycle rate within gage total pressure rating, next higher rating is recommended. See Medium and High pressure options at lower left.

ACCESSORIES

Model A-432 Portable Kit
Combine carrying case with any Magnehelic® gage of standard range, except high pressure connection. Includes 9 ft (2.7 m) of 3/16" ID rubber tubing, standhang bracket and terminal tube with holder.

Model A-605 Air Filter Gage Accessory Kit
Adapts any standard Magnehelic® gage for use as an air filter gage. Includes aluminum surface mounting bracket with screws, two 5 ft (1.5 m) lengths of 1/4" aluminum tubing two static pressure tips and two molded plastic vent valves, integral compression fittings on both tips and valves.

A-605B Air Filter Gage Accessory Kit, Air filter kit with two plastic open/close valves, two 4" steel static tips, plastic tubing and mounting flange

A-605C Air Filter Gage Accessory Kit, Air filter kit with two plastic open/close valves, two plastic static tips, plastic tubing and mounting flange

TAG: E

PRESSURE

Differential Pressure Gages

Dwyer®

Series 2000

Magnehelic® Gage Models & Ranges

Bezel provides flange for flush mounting in panel.

Clear plastic face is highly resistant to breakage. Provides undistorted viewing of pointer and scale.

Precision litho-printed scale is accurate and easy to read.

Red tipped pointer of heat treated aluminum tubing is easy to see. It is rigidly mounted on the helix shaft.

Pointer stops of molded rubber prevent pointer over-travel without damage.

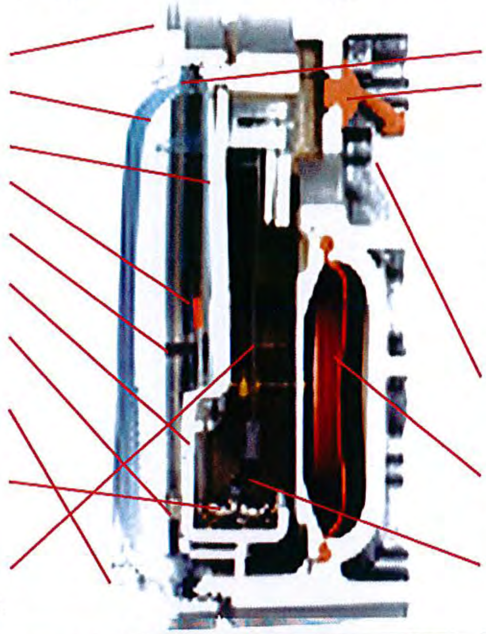
"Wishbone" assembly provides mounting for helix, helix bearings and pointer shaft.

Jeweled bearings are shock-resistant mounted; provide virtually friction-free motion for helix. Motion damped with high viscosity silicone fluid.

Zero adjustment screw is conveniently located in the plastic cover, and is accessible without removing cover. O-ring seal provides pressure tightness.

Helix is precision made from an alloy of high magnetic permeability. Mounted in jeweled bearings, it turns freely, following the magnetic field to move the pointer across the scale.

Calibrated range spring is flat spring steel. Small amplitude of motion assures consistency and long life. It reacts to pressure on diaphragm. Live length adjustable for calibration.



O-ring seal for cover assures pressure integrity of case.

OVERPRESSURE PROTECTION
Blowout plug is comprised of a rubber plug on the rear which functions as a relief valve by unseating and venting the gage interior when over pressure reaches approximately 25 psig (1.7 bar). To provide a free path for pressure relief, there are four spacer pads which maintain 0.023" clearance when gage is surface mounted. Do not obstruct the gap created by these pads. The blowout plug is not used on models above 180" of water pressure, medium or high pressure models, or on gages which require an elastomer other than silicone for the diaphragm. The blowout plug should not be used as a system overpressure control. High supply pressures may still cause the gage to fail due to over pressurization, resulting in property damage or serious injury. Good engineering practices should be utilized to prevent your system from exceeding the ratings or any component.

Die cast aluminum case is precision made and iridite-dipped to withstand 168 hour salt spray corrosion test. Exterior finished in baked dark gray hammerloid. One case size is used for all standard pressure options, and for both surface and flush mounting.

Silicone rubber diaphragm with integrally molded O-ring is supported by front and rear plates. It is locked and sealed in position with a sealing plate and retaining ring. Diaphragm motion is restricted to prevent damage due to overpressures.

Samarium Cobalt magnet mounted at one end of range spring rotates helix without mechanical linkages.

Model	Range Inches of Water
2000-00N†••	.05-0-.2
2000-00†••	0-.25
2000-0†•	0-.50
2001	0-1.0
2002	0-2.0
2003	0-3.0
2004	0-4.0
2005	0-5.0
2006	0-6.0
2008	0-8.0
2010	0-10
2012	0-12
2015	0-15
2020	0-20
2025	0-25
2030	0-30
2040	0-40
2050	0-50
2060	0-60
2080	0-80
2100	0-100
2120	0-120
2150	0-150
2160	0-160
2180*	0-180
2250*	0-250
Zero Center Ranges	
2300-00†••	0.125-0-0.125
2300-0†•	.25-0-.25
2301	.5-0-.5
→ 2302	1-0-1
2304	2-0-2
2310	5-0-5
2320	10-0-10
2330	15-0-15

Model	Range PSI
2201	0-1
2202	0-2
2203	0-3
2204	0-4
2205	0-5
2210*	0-10
2215*	0-15
2220*	0-20
2230**	0-30

Model	Range, CM of Water
2000-15CM	0-15
2000-20CM	0-20
2000-25CM	0-25
2000-50CM	0-50
2000-80CM	0-80
2000-100CM	0-100
2000-150CM	0-150
2000-200CM	0-200
2000-250CM	0-250
2000-300CM	0-300
Zero Center Ranges	
2300-4CM	2-0-2
2300-10CM	5-0-5
2300-30CM	15-0-15

† These ranges calibrated for vertical scale position.
• Accuracy +/-3%
• • Accuracy +/-4%
*MP option standard
**HP option standard

Model	Range MM of Water
2000-6MM†••	0-6
2000-10MM†•	0-10
2000-15MM	0-15
2000-25MM	0-25
2000-30MM	0-30
2000-50MM	0-50
2000-80MM	0-80
2000-100MM	0-100
2000-125MM	0-125
2000-150MM	0-150
2000-200MM	0-200
2000-250MM	0-250
2000-300MM	0-300
Zero Center Ranges	
2300-6MM†••	3-0-3
2300-10MM†•	5-0-5
2300-20MM†•	10-0-10

Model	Range, Pa
2000-60NPA†••	10-0-50
2000-60PA†••	0-60
2000-100PA†•	0-100
2000-125PA†•	0-125
2000-250PA	0-250
2000-300PA	0-300
2000-500PA	0-500
2000-750PA	0-750
2000-1000PA	0-1000
Zero Center Ranges	
Model	**Range, Pa**
2300-60PA†••	30-0-30
2300-100PA†•	50-0-50
2300-120PA	60-0-60
2300-200PA	100-0-100
2300-250PA	125-0-125
2300-300PA	150-0-150
2300-500PA	250-0-250
2300-1000PA	500-0-500

Model	Range, kPa
2000-0.5KPA	0-0.5
2000-1KPA	0-1
2000-1.5KPA	0-1.5
2000-2KPA	0-2
2000-2.5KPA	0-2.5
2000-3KPA	0-3
2000-4KPA	0-4
2000-5KPA	0-5
2000-8KPA	0-8
2000-10KPA	0-10
2000-15KPA	0-15
2000-20KPA	0-20
2000-25KPA	0-25
2000-30KPA	0-30
Zero Center Ranges	
2300-1KPA	.5-0-.5
2300-2KPA	1-0-1
2300-2.5KPA	1.25-0-1.25
2300-3KPA	1.5-0-1.5

Dual Scale Air Velocity Units
For use with pitot tube

Model	Range in W.C./ Velocity F.P.M.
2000-00AV†••	0-.25/300-2000
2000-0AV†•	0-.50/500-2800
2001AV	0-1.0/500-4000
2002AV	0-2.0/1000-5600
2005AV	0-5.0/2000-8800
2010AV	0-10/2000-12500

Dual Scale English/Metric Models

Model	Range, in w.c.	Range, Pa or kPa
2000-00D†••	0-.25	0-62 Pa
2000-0D†•	0-0.5	0-125 Pa
2001D	0-1.0	0-250 Pa
2002D	0-2.0	0-500 Pa
2003D	0-3.0	0-750 Pa
2004D	0-4.0	0-1.0 kPa
2005D	0-5.0	0-1.25 kPa
2006D	0-6.0	0-1.5 kPa
2008D	0-8.0	0-2.0 kPa
2010D	0-10	0-2.5 kPa
2015D	0-15	0-3.7 kPa
2020D	0-20	0-5 kPa
2025D	0-25	0-6.2 kPa
2050D	0-50	0-12.4 kPa
2060D	0-60	0-15 kPa

VELOCITY AND VOLUMETRIC FLOW UNITS
Scales are available on the Magnehelic® that read in velocity units (FPM, m/s) or volumetric flow units (SCFM, m^3/s, m^3/h). Stocked velocity units with dual range scales in inches w.c. and feet per minute are shown above. For other ranges contact the factory.
When ordering volumetric flow scales please specify the maximum flow rate and its corresponding pressure. Example: 0.5 in w.c. = 16,000 CFM.

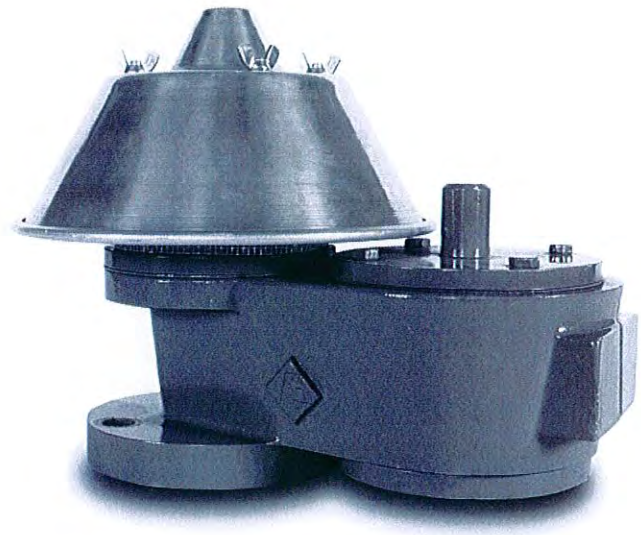
ACCESSORIES
A-321, Safety Relief Valve
A-448, 3-piece magnet kit for mounting Magnehelic® gage directly to magnetic surface
A-135, Rubber gasket for panel mounting

A-310A 3-Way Vent Valves
In applications where pressure is continuous and the Magnehelic® gage is connected by metal or plastic tubing which cannot be easily removed, we suggest using Dwyer A-310A vent valves to connect gage. Pressure can then be removed to check or re-zero the gage.

Pressure Vacuum Relief Valve, Model 550

Enardo 550 Pressure Vacuum Relief Valves are advanced designs for vent-to-atmosphere applications. This relief valve provides protection against positive or vacuum over pressure and prevents air intake, evaporative losses of product and helps contain odorous and potentially explosive vapors.

The pressure vacuum relief valve maintains a tight seal until system pressure or vacuum exceeds the set pressure of the valve. When over pressure occurs, the weighted pallet lifts, breaking the seal between the seat and pallet, allowing vapors to pass through the valve orifice and relieving the pressure or vacuum buildup. The valve reseals upon relief and remains sealed.



Features and Benefits

- Externally coated with Ameron Amershield Aliphatic polyurethane coating at no additional cost. Provides excellent chemical, impact and abrasion resistance.
- 316 Stainless Steel pallet as a standard for additional corrosion resistance as opposed to other manufacturers that offer aluminum pallets. FEP Teflon pallet seals for long service life to meet any type application.
- High flow capacity maximizes cost effectiveness.
- Fully field replaceable pallet and seat assemblies without need for special tools or complex procedures which eliminates the need to send out for rebuilding or total valve replacement (Can be maintained by in house maintenance personnel).
- EN 13463-1: 2001, EN 13463-5: 2003 Certified.

Valve Setting Range

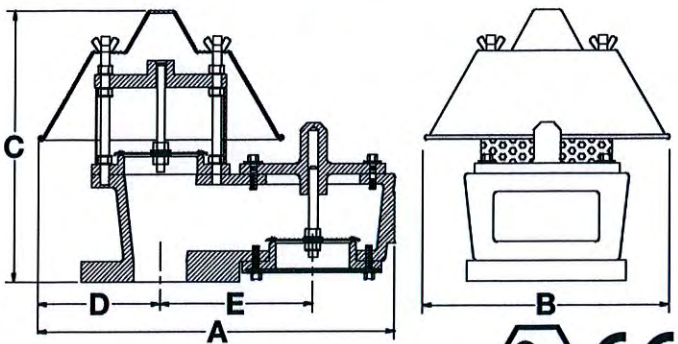
Model Numbers	Sizes Available	Pressure	Vacuum
Model 550	2" (50 mm) and 3" (80 mm)	0.5 to 16.0 oz/sq. in. (0.5 oz Increments) 1.0 to 26.0 inH_2O (0.5 in. Increments) 2.0 to 69.0 mbar (2.2 mbar increments)	0.5 to 8.0 oz/sq. in. (0.5 oz Increments) 1.0 to 13.0 inH_2O (0.5 in. Increments) 2.0 to 34.0 mbar (2.2 mbar increments)
	4" (100 mm) through 12" (300 mm)	0.5 to 16.0 oz/sq. in. (0.5 oz Increments) 1.0 to 26.0 inH_2O (0.5 in. Increments) 2.0 to 69.0 mbar (2.2 mbar increments)	0.5 to 10.5 oz/sq. in. (0.5 oz Increments) 1.0 to 15.5 inH_2O (0.5 in. Increments) 2.0 to 44.0 mbar (2.2 mbar increments)

Materials of Construction

Housing	Seat / Pallet	Pallet Seal	Hardware	Weights	Gaskets
Cast Aluminum Carbon Steel Stainless Steel	Aluminum/316SS Carbon Steel/316SS Stainless Steel/316SS	FEP Teflon	Zinc Plated C.S. 300 Series Stainless	Carbon Steel Stainless Steel Lead	Compressed Fiber

TAG: F

Pressure Vacuum Relief Valve, Model 550



Model 550 Maximum Pressure/Vacuum Settings

Size (In.)	Pressure		Vacuum	
	inH$_2$0	oz/sq. in.	inH$_2$0	oz/sq. in.
2	11.0	8.0	9.0	6.5
3	13.5	9.5	11.0	8.0
4	13.5	9.0	15.5	10.5
6	13.0	10.0	15.0	11.5
8	15.0	11.5	23.5	19.5
10	17.5	14.0	21.0	16.0
12	17.5	14.0	23.5	18.5

Model 550 Dimensions and Weights

Model	Inlet Conn. In. (mm)	A Overall Length In. (mm)	B Overall Width In. (mm)	C Overall Height In. (mm)	D CL Inlet In. (mm)	E CL I/O In. (mm)	Weight Aluminum Unit Lb. (kg)	Weight C.S or S.S. Unit Lb. (kg)
550	2 (50)	13-1/2 (343)	9-1/2 (241)	10-1/8 (257)	4-3/4 (121)	5-3/4 (146)	12 (5)	32 (15)
550	3 (80)	16-7/16 (418)	10-15/16 (278)	11-1/4 (286)	5-3/4 (146)	7 (178)	19 (9)	47 (21)
550	4 (100)	19 (483)	12-1/4 (311)	12-13/16 (325)	6-1/8 (156)	8-3/4 (222)	26 (12)	63 (29)
550	6 (150)	25-1/16 (637)	16-1/2 (419)	15-7/8 (403)	8-3/8 (213)	10-3/4 (273)	45 (20)	117 (53)
550	8 (200)	32-3/16 (818)	20-1/2 (521)	19-7/16 (494)	10 (254)	14 (356)	83 (38)	201 (91)
550	10 (250)	35-1/2 (902)	22-1/2 (572)	20 (508)	11-1/8 (283)	15-1/2 (394)	107 (49)	257 (117)
550	12 (300)	40-3/8 (1026)	25-1/8 (638)	20-5/8 (524)	12-1/2 (318)	17-3/4 (451)	140 (64)	340 (154)

Unit weights indicate Net Weight of valve in pounds at standard set pressure (0.5 oz/sq.in. pressure - 0.5 oz/sq.in. vacuum), does not include shipping crate or box. Add 20% for gross shipping weight (Domestic Only).

Key to Enardo Pressure/Vacuum Relief Valve Model Number

550 — [10] — [1] [2] [1] [n][1.5] / [1.0] — [B][ ][ ]

Inlet Connection Size
(2" thru 12")

Housing Material
1. Aluminum
4. Stainless Steel
5. Carbon Steel

Pallet Material
2. 316 Stainless Steel

Pallet Seal Material
1. FEP Teflon
2. Buna-N
3. Viton

Pressure Settings
z - oz/sq.in.
n - inH$_2$0

0.5 oz/sq.in. to 8.0 oz/sq.in. (0.5 oz/sq.in. increments)

1.0 inH$_2$0 to 13.0 inH$_2$0 (0.5 inH$_2$0 increments)

Vacuum Settings
z - oz/sq.in.
n - inH$_2$0

0.5 oz/sq.in. to 8.0 oz/sq.in. (0.5 oz/sq.in. increments)

1.0 inH$_2$0 to 13.0 inH$_2$0 (0.5 inH$_2$0 increments)

Options
0. No Options
A. Special Coating
B. S.S. Weights
E. Optional Gasket Material
G. Steam Jacket or Trace
J. Seat Material

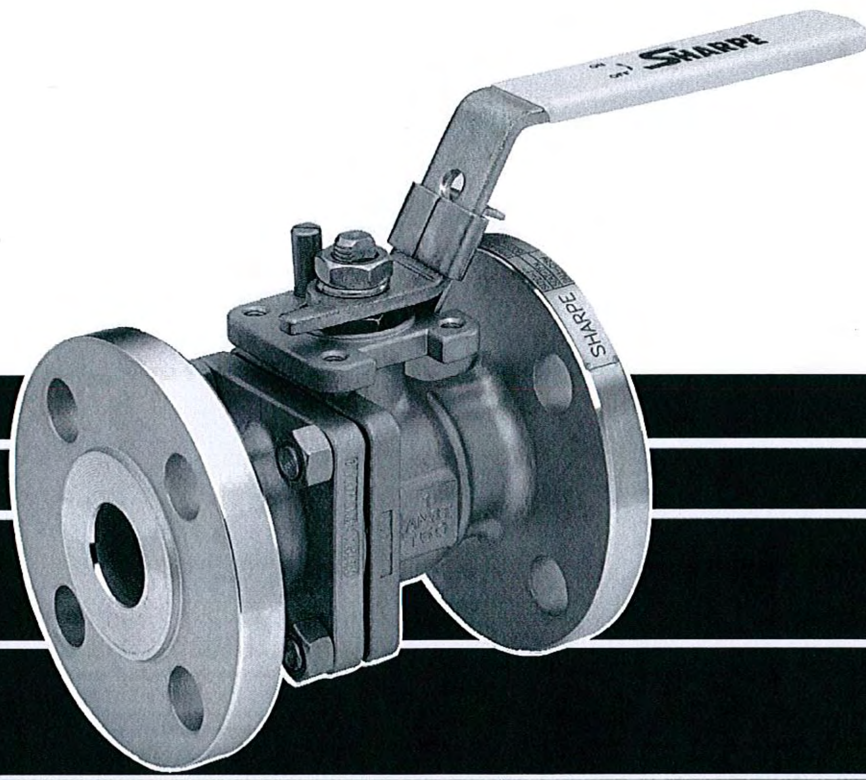
Example:

550 — [2] — [5] [2] [2] [n][12] / [6] — [ ][ ][ ]

Indicates a Pipe-Away pressure vacuum relief valve with 2" inlet, ANSI 150 lb. raised face flange pattern connections, carbon steel housing and seat, stainless steel pallet and FEP Teflon pallet seal. Pressure setting is 12 inH$_2$O and vacuum setting is 6 inH$_2$O.

TAG: G

SHARPE® VALVES



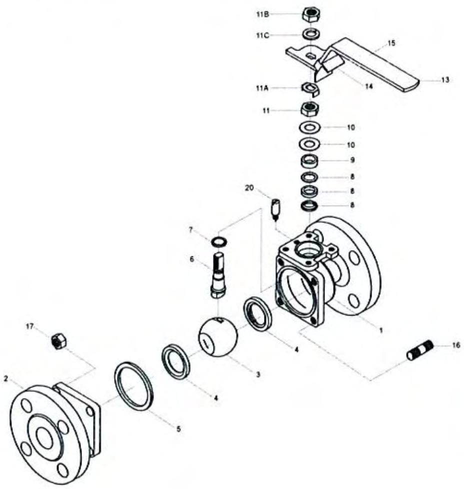
FLANGED FULL PORT
BALL VALVE
SERIES 50 / CLASS 150

TAG: G

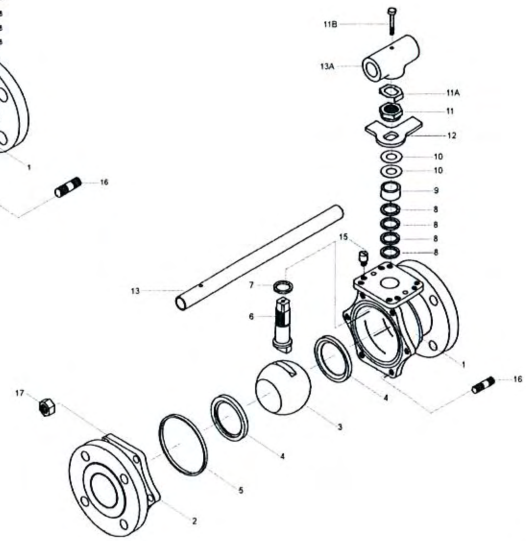
SERIES 50
VALVE PARTS AND IDENTIFICATION

CLASS 150
BLOW OUT PROOF STEM
LOCKING DEVICE

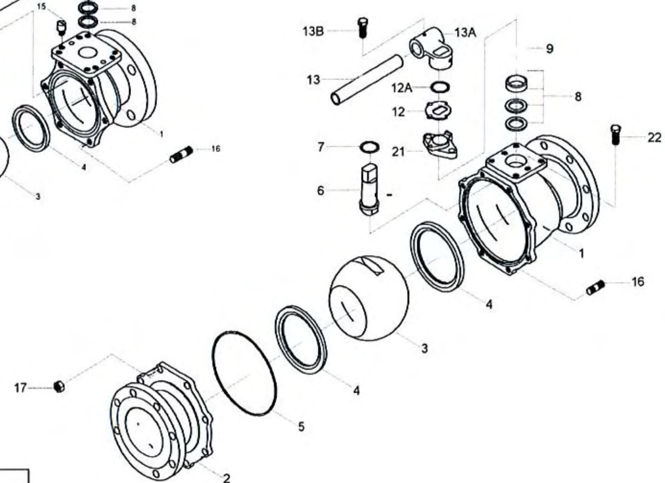
APPLICABLE STANDARDS	
Wall Thickness	ASME B 16.34
Face to Face Dimensions	ASME B 16.10
Flange Dimensions	ASME B 16.5
Pressure Tests	ASME B 16.34 API 598 (Optional)
Basic Design	ASME B16.34



1/2" - 2"



2-1/2" - 4"



6" - 8"

PART NO.	PART	QTY.	MATERIAL
1	Body	1	316 Stainless Steel ASTM A351 CF8M Alloy 20 ASTM A351 CN7M Carbon Steel ASTM A216 WCB Hastelloy C ASTM A494 GR CW-12MW Monel ASTM A494 GR M35-1
2	End Connector	1	316 Stainless Steel ASTM A351 CF8M Alloy 20 ASTM A351 CN7M Carbon Steel ASTM A216 WCB Hastelloy C ASTM A494 GR CW-12MW Monel ASTM A494 GR M35-1
3	Ball	1	316 Stainless Steel Alloy 20 Hastelloy C
4	Seat	2	TFM(Super TFE) TFE Reinforced TFE NOVA PEEK
5	Body Seal	1	TFE
6	Stem	1	316 Stainless Steel Alloy 20 Hastelloy C 17-4PH (Option)
7	Thrust Bearing	2	Reinforced TFE
8	Stem Packing	3/4	Reinforced TFE
9	Gland Packing	1	304 Stainless Steel
10	Belleville Washer (1/2"-4")	2/4	304 Stainless Steel
11	Packing Nut (1/2"-4")	1	304 Stainless Steel
11A	Lock Tab	1	Stainless Steel
11B	Handle Nut	1	304 Stainless Steel
11C	Lock Washer	1	304 Stainless Steel (1/2"-2")

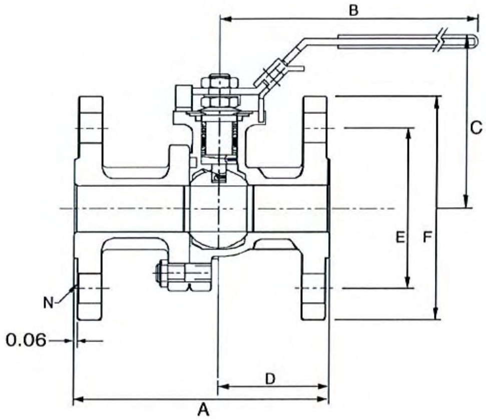
*See Dimensions

PART NO.	PART	QTY.	MATERIAL
12	Stopper	1	304 Stainless Steel
12A	Snap Ring	1	Stainless Steel (6"-8")
13	Handle	1	304 Stainless Steel (1/2"-2") Galvanized Steel (2-1/2"-4") Ductile Iron (6"-8")
13A	Wrench Block	1	Stainless Steel
13B	Hex Head Bolt	1	304 Stainless Steel
14	Locking Device (1/2"-2")	1	304 Stainless Steel
15	Sleeve	1	Vinyl
16	Body Stud	SEE* N	A193 B8 (SST) A193 B7 (CS)
17	Nut	SEE* N	A194 8 (SST) A194 2H (CS)
20	Stop Pin (1/2"-2") (2-1/2"-4")	1 2	304 Stainless Steel 304 Stainless Steel
21	Gland Flange (6"-8")	1	304 Stainless Steel
22	Gland Bolts (6"-8")	2	304 Stainless Steel

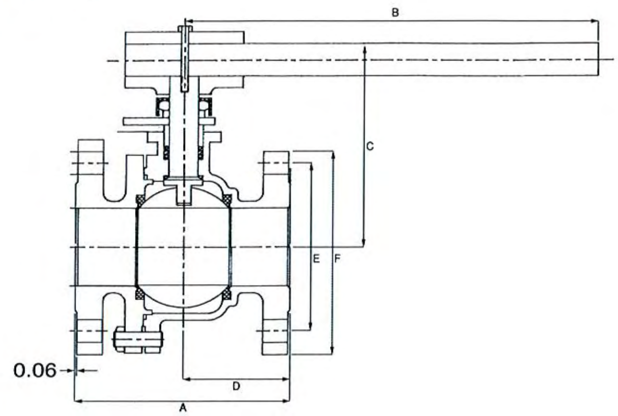
TAG: G

SERIES 50
DIMENSIONS

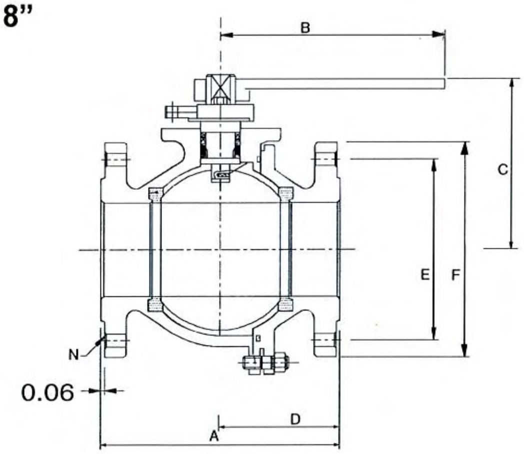
1/2" - 2"



2-1/2" - 4"



6" - 8"



CV DATA

1/2"	26
3/4"	50
1"	94
1-1/2"	260
2"	480
2-1/2"	750
3"	1300
4"	2300
6"	5400
8"	10000

PORT

1/2"	0.59
3/4"	0.78
1"	1.00
1-1/2"	1.50
2"	2.00
2-1/2"	2.55
3"	3.00
4"	4.00
6"	6.00
8"	7.88

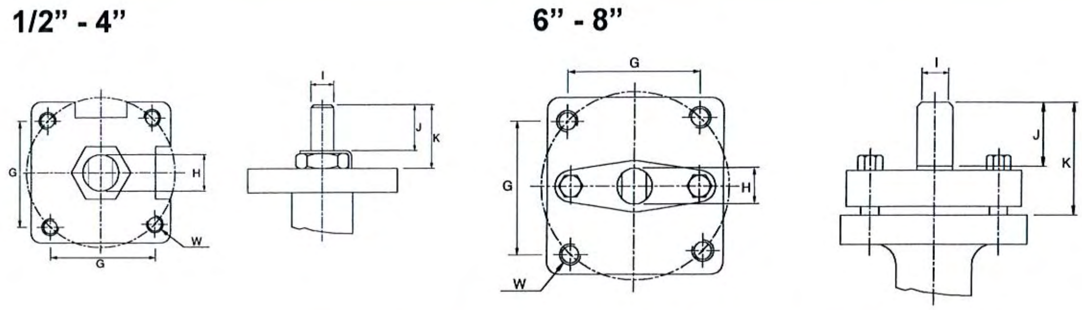
WEIGHT (lbs.)

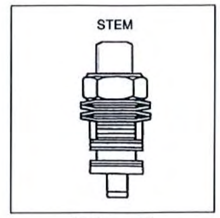
1/2"	4
3/4"	6
1"	8
1-1/2"	15
2"	20
2-1/2"	36
3"	45
4"	75
6"	135
8"	290

SIZE	A	B	C	D	E	F	N	G	H	I	J	K	W
1/2"	4.25	4.75	3.60	1.80	2.38	3.50	4	1.39	3/8-24 UNF	.22	.28	.63	M5
3/4"	4.62	4.75	3.75	2.00	2.75	3.85	4	1.39	3/8-24 UNF	.22	.28	.63	M5
1"	5.00	6.22	3.75	2.12	3.13	4.25	4	1.39	7/16-20 UNF	.30	.30	.90	M6
1-1/2"	6.50	9.00	4.50	2.76	3.56	5.00	4	1.94	9/16-18 UNF	.35	.42	1.18	M8
2"	7.00	9.00	4.80	3.08	4.75	6.00	4	1.94	9/16-18 UNF	.35	.42	1.18	M8
2-1/2"	7.50	13.75	6.70	3.09	5.50	7.00	4	2.84	M20	.55	.55	1.83	M10
3"	8.00	13.75	7.00	3.74	6.00	7.48	4	2.84	1-14 UNS	.745	.66	1.83	M10
4"	9.00	13.75	7.70	4.46	7.50	9.01	8	2.84	1-14 UNS	.745	.66	1.83	M10
6"	15.50	38.97	11.22	7.61	9.50	10.98	8	3.89	1.02	1.64	1.46	3.00	M12
8"	18.00	38.97	11.57	8.34	11.75	13.50	8	4.59	1.02	1.64	1.46	3.00	M12

The dimensions above are for information only, not for construction. For complete actuator mounting dimensions refer to Engineering Bulletin EB-2003.

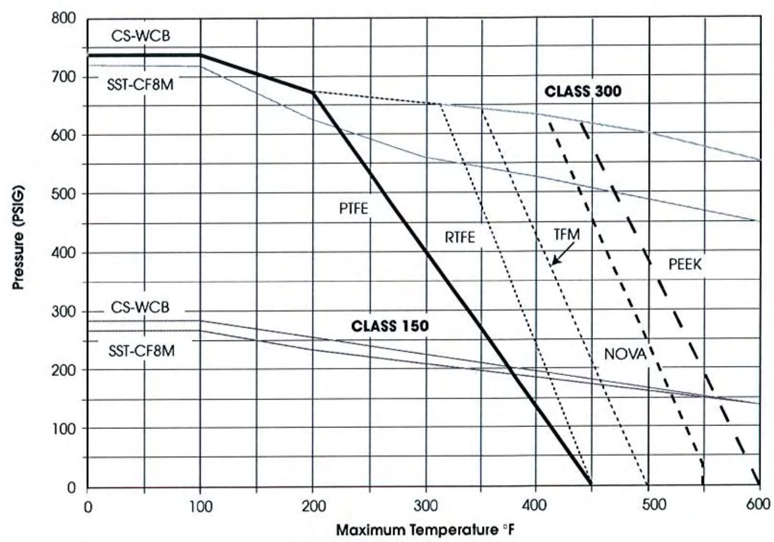
TAG: G





1/2" - 4"
STEM ARRANGEMENT
FOR ACTUATORS

SEAT PRESSURE/TEMPERATURE RATING SERIES 50



HOW TO ORDER

VALVE SIZE	VALVE SERIES	CLASS	ALLOY	SEATS	OPTIONS
1/2"	50	150# = 11	2 = Alloy 20	T = TFE	X = Oxygen Service
3/4"			4 = Carbon Steel	R = RTFE	OH = Oval Handle
1"			6 = Stainless Steel	N = NOVA	F = Fugitive Emissions Certified ANSI 593.00.01
1-1/2"			5 = Hastelloy C	P = Peek	
2"			3 = Monel	M = TFM™	E = Extended Stem
2-1/2"					L = Lockable Extended Stem
3"					D = Leak detection Stem
4"					GO = Gear Operator
6"					7 = 17- 4PH Stem
8"					A = Nace

3/4" 50 11 6 T X

SHARPE® VALVES

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Rev. 1/09

TAG: G

VALVCON BACK-UP POWERED ELECTRIC ACTUATOR ADC SERIES

Metso is a leading designer and provider of Valvcon compact, reliable, electronically controlled electric actuators for valves and dampers. We offer a complete line of electric actuators for accurate positioning of dampers and valves in the aerospace, automotive, consumer services, discrete manufacturing, energy, environmental, oil/pipeline, petrochemical, power/utilities, process, recreation, transportation, and water/wastewater industries.

We have developed and introduced the industry's most innovative Metso Valvcon electric actuator products, including simple "set and go" calibration, intelligent processor-based digital electronics, "Plug-in" accessory boards, Back-Up Power actuators, as well as electric actuators designed for remote control, solar-powered applications and two-wire network applications.

The quarter-turn electric actuator will comply with Part 15, Class A of the FCC regulations for emissions and conducted radiation for industrial devices. It will also be designed to meet NEMA standards for use in weathertight or weathertight and hazardous locations. The actuator will be a single, complete unit composed of a compact cast aluminum housing, motor, gearing, limit switches controlled by metal cams for end of travel control, mechanical position indicator, and an optional internal back-up power source to drive to a pre-set position in the event of an external power loss. Actuator mounting flanges shall comply with ISO 5211 standards incorporating a female drive for direct output coupling. The actuator shall be capable of operating in ambient environments of -40° F to 130° F; optional internal heaters are required at temperatures below 32° F.

FEATURES AND BENEFITS

Isolation and Electrical

Internal electronic control boards shall have clearly marked and different size connection terminals for Power and Control Signals to prevent incorrect wiring and shall provide CW and CCW push buttons for local manual control. The actuator control electronics shall be electrically isolated to allow multiple actuators to be wired in parallel. Electronic control boards shall be protected on the outward side with insulating overlays providing operating instructions and additional safety. Additionally, electronic control boards shall include a simple user-interface, including slide switches and selection knob for mode selection, calibration and set up. The electronic control boards will also supply a mA or voltage position feedback signal and include a holding brake feature to prevent back-driving. All internal connections, (motor leads, limit switch leads, option connectors, etc.) shall be coded, using different style connectors for each function, to prevent incorrect wiring. All connections will plug-in to simplify field repairs and upgrades. In AC applications a highly reliable switching power supply will provide power conversion to drive the internal DC motor; DC applications will utilize an equally reliable DC to DC regulator. Other than periodic battery replacement; no maintenance will be required.

Motor

The internal electric motor will be of a brushless DC type, capable of running continuously at full torque at ambient temperature at or below 104° F.

metso
Expect results

Lubrication

All rotating power train components will be coated with a multi-purpose grease. Lubricants will be suitable for ambient conditions of -40° F to 130° F. For operation in temperatures between 32° F and -40° F an optional heater and thermostat assembly must be included.

Gearing

The powertrain will be comprised of hardened steel, machine cut spur gears. Non-metallic, aluminum, cast or stamped gearing will not be permitted.

Limit Switches

Actuators will have two standard end-of-travel switches, single pole double throw, rated at 15 amps at 250 VAC. Under normal operation the end of travel limit switches will not be activated; activating the limit switches will interrupt actuator travel. Up to two additional limit switches, adjustable to operate at any position as required by the process application, may be added to the actuator for end of travel indication.

On/Off Control (Open/Close Operation) with Optional Battery Back-Up

Open/Close actuators require separate Power and Control signals. The Power signal must be constantly maintained; immediately upon loss of the Power signal, the internal back-up power source will drive the actuator to the Power Loss Position. The Control signal consists of one to three maintained AC or DC contacts and the actuator can be set to operate in Two-wire, Three-wire or Three-position modes. In Two-wire mode a signal is maintained to drive the actuator to the CCW position and removed to drive to the CW position. In Three-wire mode separate Control signals are applied to drive the actuator to the CW and CCW positions and may be removed at any point in mid-stroke to position the valve or damper. In Three-position mode separate Control signals are applied to drive the actuator to the CW, "MID" or CCW positions and may be removed at any point in mid-stroke to position the valve or damper. The Power Loss Position may be either the full CW, the full CCW or "MID" position and is determined by the fail position selection switch.

Proportional Control (Modulating Operation) with Optional Battery Back-Up

Modulating control actuators will accept a variable, proportional 4-20 mA or 0-10VDC valve position signal and respond by positioning the valve linearly with an accuracy of 1%. Normally, the actuator will drive clockwise in response to a decreasing control signal; however, the actuator will be capable of "reverse acting" operation (driving counter-clockwise in response to a decreasing control signal) without internal wiring changes. The actuator will also provide the ability to adjust the sensitivity to control signal changes. Slide switches will enable the user to set the actuator response to a loss of control signal, select the "fail" position upon loss of Power and select either the single cycle or multi-cycle loss of power mode. Locked rotor, stall protection will detect whenever the actuator is unable to achieve the position commanded by the control signal, and will terminate power to the motor in order to prevent damage due to repeated stall conditions.

The Back-Up Powered Electric Actuators from Metso

Metso offers several product lines that are designed to drive a valve or damper to a pre-determined position in the event of a power loss. Under normal power conditions, they provide accurate positioning in response to the powered control signals.

Optional Internal Battery Back-Up

Metso Valvcon ADC Series can be equipped with an optional internal battery pack. The actuator is driven by an external power source under normal conditions. When power is lost, the internal battery pack can be set up to either drive immediately to the pre-set position, or continue to respond to a maintained control signal. The ADC Series is an excellent choice for continuous duty modulating applications, or any application where an inexpensive alternative to mechanical spring back-up is desired.

Break-away Torque

Designed for efficiency and reliability, all Metso Valvcon actuators deliver the power you need when and where it is needed. With efficient gear trains and motors these actuators are rated at breakaway torque. Immediately upon power up, the actuator supplies the rated torque — when it is needed to break the valve away from its seat. Other manufacturer's actuators may be rated at running torque, but actually deliver significantly less breakaway torque.

FEATURES AT A GLANCE!

ADC Series

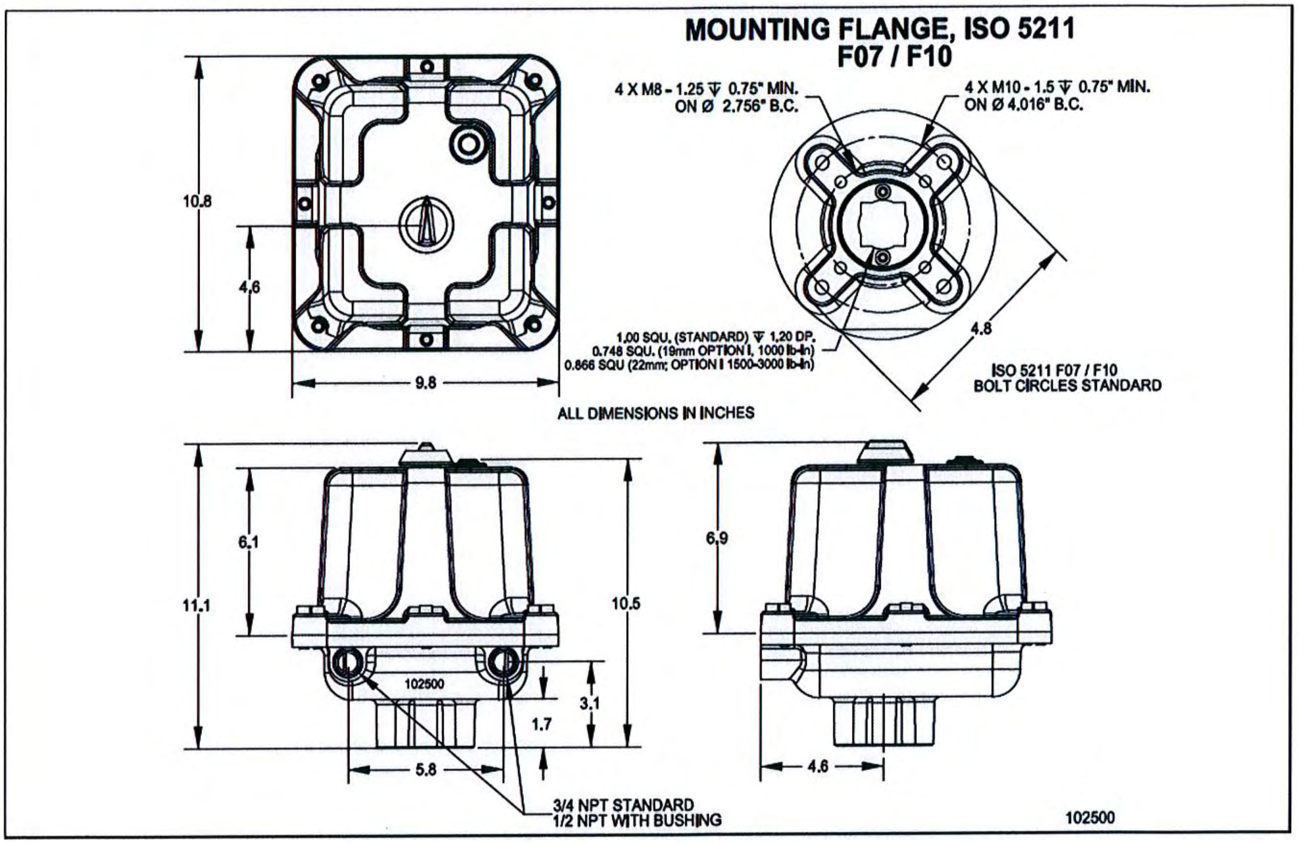
- ☐ Optional internal battery packs allow for continued modulation during power outages, provided the control signal remains.
- ☐ Field-settable for "fail clockwise" or "fail counter-clockwise."

Valvcon Back-up Powered Actuators:

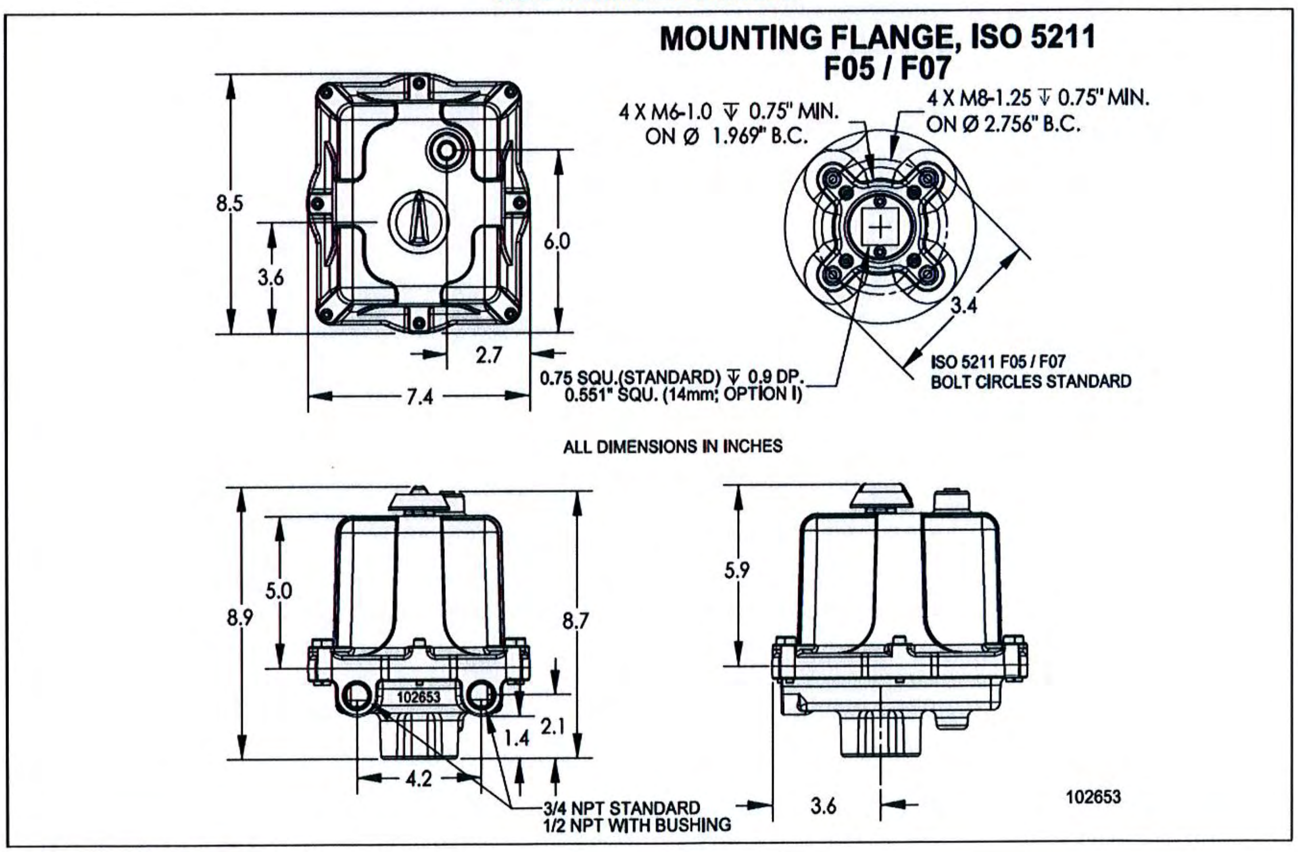
- ☐ Patented technology provides back-up capabilities within the standard size actuator enclosures!
- ☐ Dual conduit openings make wiring easier, and keep power and control wiring separate.
- ☐ Two year warranty.

Tag: G

LADC-SERIES ENCLOSURE



ADC-SERIES ENCLOSURE



ALL DIMENSIONS IN INCHES

ADC SPECIFICATIONS

Battery Back-up Power

Metso Valvcon ADC Series electric actuators, equipped with internal battery power, allow you to shut down your system in the event of an external power loss. Engineered to supply dependable valve actuation, they can provide up to 10 complete cycles under their own internal power.

The electronic back-up powered feature incorporates a rechargeable battery pack on a plug-in, modular PC board under the actuator cover. Upon power loss or a signal from an external sensor, the battery pack is automatically activated as the main power supply. The battery is compact and fits easily into the standard enclosures for an easy, space-saving upgrade. No hard-wiring or other complex operations are required.

Metso Valvcon battery back-up actuators are available in on/off (two position) or continuous duty modulating models.

- Internal batteries allow for continued cycling during power outages, enabling an orderly shut-down of critical processes.
- A built-in trickle charger, with over-charge protection, ensures the batteries always have enough power when called upon
- Batteries can be easily replaced in the field.

MODULATING DATA

Torque (in-lbs)	Duty Cycle	12VDC		24VDC		24VAC		115VAC		230VAC	
		Cycle Time (sec/90°)	Current Draw (Amps)	Cycle Time (sec/90°)	Current Draw (Amps)	Cycle Time (sec/90°)	Current Draw (Amps)	Cycle Time (sec/90°)	Current Draw (Amps)	Cycle Time (sec/90°)	Current Draw (Amps)
150	100%	11	2.2	13	1.2	8	1.8	9	0.4	9	0.4
300	100%	17	2.5	13	1.4	12	2.1	13	0.5	13	0.4
600	100%	17	2.8	13	1.7	13	2.5	14	0.6	14	0.5
1000	100%	21	4	14	2.4	15	3.5	15	0.9	15	0.6
1500	100%	40	4	24	2.4	27	3.5	29	0.9	29	0.6
2000	100%	40	4.3	33	2.4	28	3.5	29	0.9	29	0.6
2500	100%	55	3.3	40	2	38	3.1	39	0.8	39	0.6
3000	100%	60	3.7	42	2.2	40	3.5	42	0.8	43	0.6

ON/OFF DATA

Torque (in lbs.)	Speed (per 90° rotation, in seconds)		Duty Cycle**	Normal Operating Current Draw (in Amps)				
		24VDC only		12VDC	24VDC	24VAC	115VAC	230VAC
150	5	3	Continuous**	1.9	2.4	1.5	.2	.1
300	10	5	Continuous**	1.9	2.4	1.5	.2	.1
600	15	8	Continuous**	1.9	2.4	1.5	.2	.1
1000	15	15	Continuous**	3.5	3.5	2.0	.4	.2
1500	20	20	Continuous**	3.5	3.5	2.0	.4	.2
2000	25	25	Continuous**	4.8	4.8	2.0	.4	.2
2500	30	30	Continuous**	4.8	4.8	2.0	.4	.2
3000	35	35	Continuous**	4.8	4.8	2.0	.4	.2

**Continuous for 1 hour after which duty cycle is reduced to 80%.

TAG: G

BACK-UP POWERED ELECTRIC ACTUATORS OPTIONS

Tropical Heater/Thermostat

(Order Code H)

Recommended in all high humidity applications where condensation may accumulate inside the actuator. For 115VAC applications the heater consumes 15 watts, for 230VAC applications the heater consumes 40 watts.

ISO 5211 Output

(Order I)

ISO 5211 Standard mounting configuration and output coupling.

150-600 in-lb models with "I" options are supplied with a 14mm female square. (note: without option "I" the female square is 3/4 inch).

1000 in-lb models with "I" options are supplied with a 19mm female square and 1500-3000 in-lb models are supplied with a 22 mm female square. (note: without option "I" the female square is 1inch).

Additional Limit Switches

(Order Code S2)

Up to two additional limit switches may be added for position indication or as dry contacts to operate other devices. Single pole, double throw switches rated for 1/2 HP, 15 amps @ 250VAC, CSA certified.

Heater/Thermostat

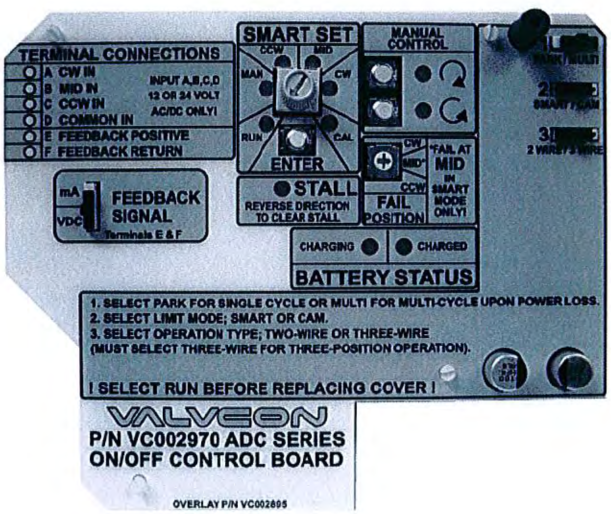
(Order Code T)

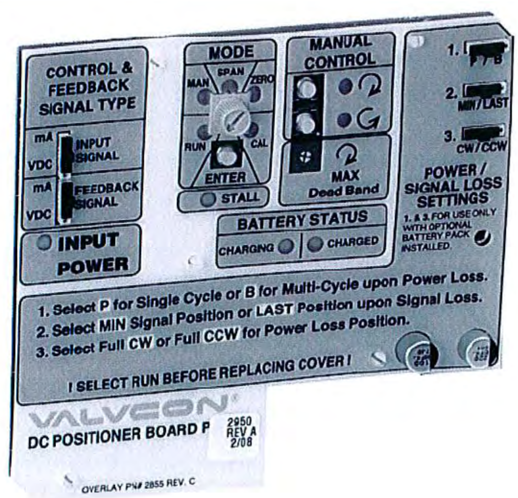
Required in all applications where the temperature may drop below 32°F. For 115VAC applications the heater consumes 15 watts, for 230VAC applications the heater consumes 40 watts.

Hazardous Location Enclosures

(ADCWX and LADCWX)

The standard enclosures (W) are rated for NEMA 4/4X (weather tight and corrosion resistant). The Hazardous Location enclosures (WX) are rated for NEMA 4/4X/7 & 9, Class I, Div 1, Groups C&D; Class II, Div. 1, Groups E, F, & G; Class III.

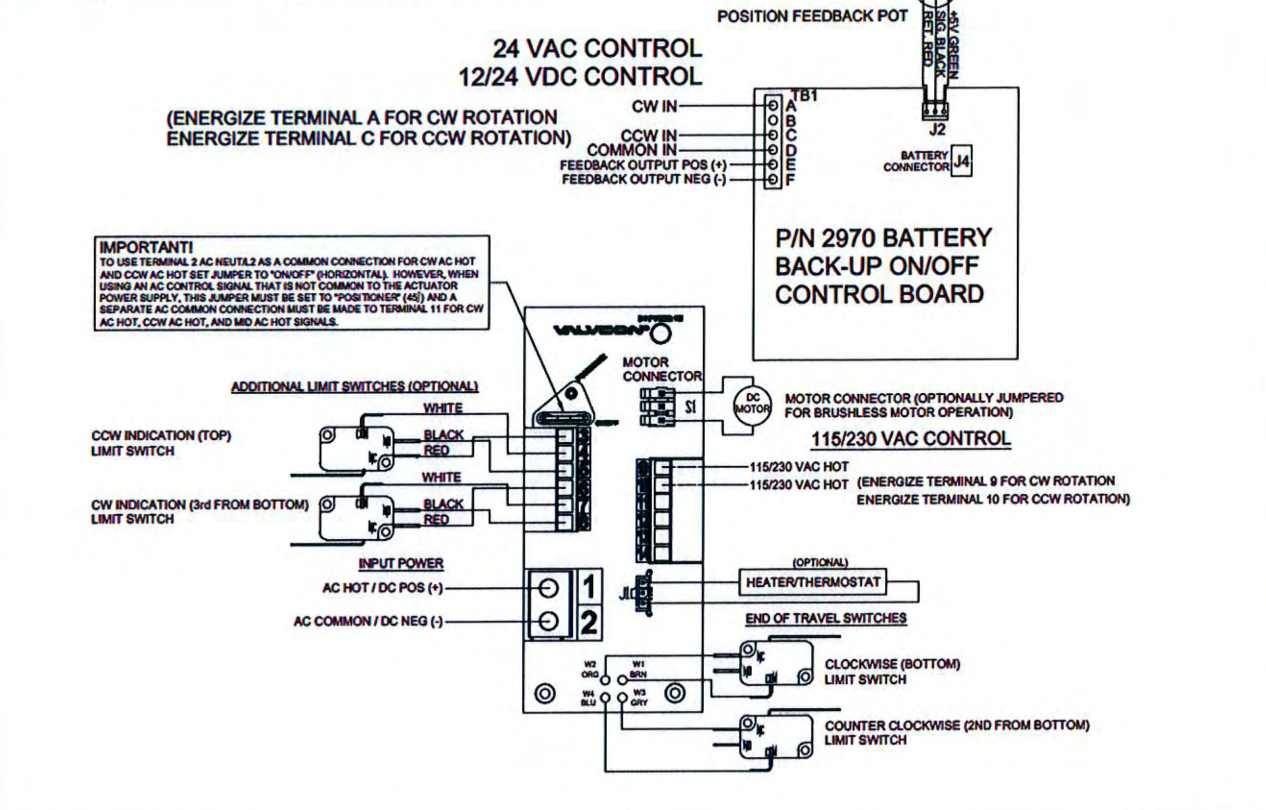




TAG: G

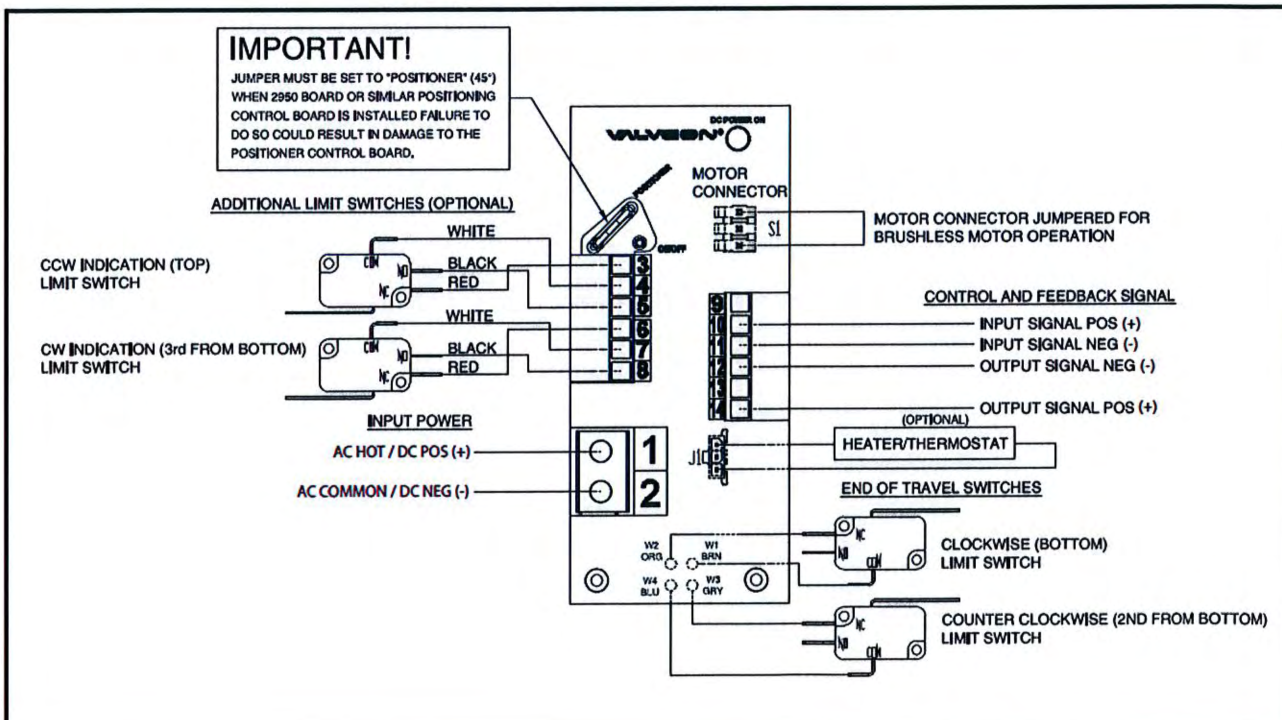
ADC/LADC ON/OFF APPLICATIONS

Wiring Diagram – "Three Wire" Control



Note: "Three Wire" control shown for other configurations see IMO.

ADC/LADC MODULATING APPLICATIONS



TAG: G

HOW TO ORDER – ADC SERIES ACTUATORS

Example: Sample model code: ADCW150CL2IS2N24AC

1	2	3	4	5	6
ADC	W	150	CL2	I S2	N24AC

1	Series
ADC	ADC

2	Enclosure
W	Weathertight (NEMA 4/4X)
WX	Weathertight & Explosion proof (NEMA 4/4X/7 & 9)

3	Torque (in lbs)
150	150
300	300
600	600

4	Options [1] (Must Select One)
C	Modulating
CL2	Modulating Battery Back-Up
L2	On/Off Battery Back-Up
L4	ON/Off Battery Back-Up - 3 Position
R2	ON/Off Isolated Control
R3	ON/Off Board - 3 Position

5	Other Options
—	No entry if standard
H[2]	Tropical Heater/Thermostat
I[3a]	ISO 5211 Output
S2	Two Auxiliary Limit Switches
T[4]	Heater/Thermostat
Z[5]	Handwheel

6	Operating Voltage
N115AC	115VAC
N230AC	230VAC
N24AC	24VAC
N12DC	12VDC
N24DC	24VDC

HOW TO ORDER – LADC SERIES ACTUATORS

Example: Sample model code: LADCW1500CL3IS2N24AC

1	2	3	4	5	6
LADC	W	1500	CL3	I S2	N24AC

1	Series
LADC	LADC

2	Enclosure
W	Weathertight (NEMA 4/4X)
WX	Weathertight & Explosion proof (NEMA 4/4X/7 & 9)

3	Torque (in lbs)
1000	1000
1500	1500
2000	2000
2500	2500
3000	3000

4	Options [1] (Must Select One)
C	Modulating
CL3	Modulating Battery Back-Up
L3	On/Off Battery Back-Up
L5	ON/Off Battery Back-Up - 3 Position
R2	ON/Off Isolated Control
R3	ON/Off Board - 3 Position

5	Other Options
—	No entry if standard
H[2]	Tropical Heater/Thermostat
I[3b]	ISO 5211 Output
S2	Two Auxiliary Limit Switches
T[4]	Heater/Thermostat
Z[5]	Handwheel

6	Operating Voltage
N115AC	115VAC
N230AC	230VAC
N24AC	24VAC
N12DC	12VDC
N24DC	24VDC

Notes:

1. Must select only one board option; all of these board options include 4-20mA or 0-10VDC position feedback, (2-10VDC on On/Off option boards) and a holding brake feature.
2. This heater option activates at or below 90°F and deactivates at 110°F; it is recommended in high-humidity applications.

3a. 150 - 600 lb-in models with I option are supplied with a 14mm female square (note that without option I the female square is 3/4").

3b. 1000 lb-in models with I option are supplied with a 19mm female square and 1500 - 3000 lb-in models are supplied with a 22mm female square (note that without option I the female square is 1").

4. This heater option activates at or below 40°F and deactivates at 60°F; it is recommended in applications where the temperature may drop below 32°F.
5. Handwheel option not recommended with Back-Up Powered options.

TAG: G

Committed to Customer Service

Metso worldwide web site:
www.metso.com/automation/valvcon, provides 24 hour a day access to all technical support material—from sales brochures to instruction manuals to installation and troubleshooting tips. For local support, Our network of trained stocking distributors/representatives are industry leading experts in valve automation. Contact the Metso, Valvcon product web site to locate the nearest stocking distributor/representative.

Timely Technical Support

Metso Express Services is on call to answer your engineering or application questions, and to quickly repair or upgrade your actuators. These highly trained support engineers offer a broad range of expertise, with the combined experience to assist specifying engineers and contractors with information on feasibility and special applications. Find Metso Express at **www.metso.com/automation/valvcon.**

A Tradition of Quality

Metso is dedicated to producing superior-quality products that are second to none. Our development laboratory and manufacturing facilities exemplify our total commitment to producing quality products.

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Tel. int. +358 20 483 150. Fax int. +358 20 483 151
North America, 44 Bowditch Drive, P.O.Box 8044, Shrewsbury, Massachusetts, 01545-8044 USA.
Tel. int. +1 508 595 5083. Fax int. +1 508 595 5183
www.metso.com/automation/valvcon

metso

ALLOYS

304/304L

(UNS S30400/S30403)

Availability:

Seamless Pipe: 1/4" - 24"
Weld Pipe: 1/2" - 36"
Butt-Weld Fit: 1/2" - 36"
Butt-Weld Fit SMLS: 1/2" - 36"
Pressure Fittings: 1/4" - 4"
150# Fittings/Nipples: 1/4" - 6"
Valves: 1/2" - 24"
Tubing: 1/4", 3/8", 1/2", 3/4", 1"
Flanges: 1/2" - 36"
Bar: 1/8" - 12"

Specifications:

ASTM A312, A376, A358, A269 A249, A403, A182, A351
ASME SA312, SA376, SA358 SA269, SA249, SA403 SA182, SA351

Description:

304 stainless is a low-carbon (0.08% max) version of basic 18-8, also known as 302. Type 302 has 18% chromium and 8% nickel. Type 304 has a slightly lower strength than 302 due to its lower carbon content. Type 304 is used in welding applications, because the low carbon permits some exposure in the carbide precipitation range of 800° F - 1500° F without the need for post-annealing operations. However, the severity of the corrosive environments may necessitate annealing after welding or the use of 304L. Type 304L has a carbon content of 0.03% or less.

Typical Applications:

- Sanitary systems
- Dairy and food processing
- Heat exchangers, evaporators
- Feedwater heaters

Tensile Requirements:

Tensile Strength (KSI) = 70

Yield Strength (KSI) = 25

KSI can be converted to MPA (Megapascals) by multiplying by 6.895.

Chemical Composition %

C	Cr	Mn	Ni	P	S	Si
MAX		MAX		MAX	MAX	MAX
0.035	18.0 - 20.0	2.0	8.0 - 13.0	0.045	0.030	1.00

310S/310H

(UNS S31008)

Availability:

Seamless Pipe: 1/2" - 8"
Weld Pipe: 8" - 12"
Butt-Weld Fittings: 1/2" - 8"
Bar: 1" - 8"

Specifications:

ASTM A312, A403, A182
ASME SA312, SA403, SA182

Description:

Alloy 310S has excellent resistance to oxidation under constant temperatures up to 2000° F. Cyclic conditions reduce its oxidation resistance, and a maximum operating temperature of 1900° F is generally recommended if cycling is involved. Having a lower coefficient of expansion than most 300 stainless steels, 310S may be used in operations involving moderately sever thermal cycling, such as rapid air cooling. Its not usually recommended for liquid quenching. 310S is widely used in moderately carburizing atmospheres such as petro-chemical plants.

Typical Applications:

- Heat exchanger and heat recuperator tubing
- Molten salt applications
- Sulfur-bearing gas atmospheres

Tensile Requirements:

Tensile Strength (KSI) = 75

Yield Strength (KSI) = 30

KSI can be converted to MPA (Megapascals) by multiplying by 6.895.

Chemical Composition %

C	Cr	Mn	Mo	Ni	P	S	Si
MAX		MAX	MAX		MAX	MAX	MAX
0.08	24.0 - 26.0	2.0	0.75	19.0 - 22.0	0.045	0.03	1.00

316/316L

(UNS S31600/S31603)

Availability:

Seamless Pipe: 1/4" - 24"
Weld Pipe: 1/2" - 36"
Butt-Weld Fit: 1/2" - 36"
Butt-Weld Fit SMLS: 1/2" - 36"
Flanges: 1/2" - 24"
Pressure Fittings: 1/4" - 4"
150# Fittings/Nipples: 1/4" - 6"
Valves: 1/2" - 24"
Tubing: 1/4", 3/8", 1/2", 3/4", 1"
Bar: 1/8" - 8"

Specifications:

ASTM A312, A376, A358, A269 A249, A403, A182, A351 A479, A276
ASME SA312, SA376, SA358 SA269, SA249, SA182 SA276, SA403, SA479, SA351

Description:

Type 316 is a molybdenum steel possessing improved resistance to pitting by solutions containing chlorides and other halides. In addition, it provides excellent tensile, creep and stress-rupture strengths at elevated temperatures. Type 316 is available in low carbon (316L) and high carbon (316H) alloys.

Typical Applications:

- Nuclear, chemical processing, rubber, plastics, pulp/paper, pharmaceutical and textile industries
- Heat exchangers, condensers and evaporators

Tensile Requirements:

Tensile Strength (KSI) = 70

Yield Strength (KSI) = 25

KSI can be converted to MPA (Megapascals) by multiplying by 6.895.

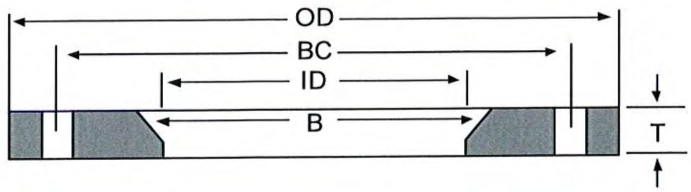
Chemical Composition %

C	Cr	Mn	Mo	Ni	P	S	Si
MAX		MAX			MAX	MAX	MAX
0.035	16.0 - 18.0	2.00	2.0 - 3.0	10.0 - 14.0	0.045	0.030	1.00

TAG: H

ASTM A-536 Ductile Iron Back-up Flanges

Light Weight Pattern
150# Drilling
Angle Face Rings (AFR) Stub-Ends (IPS)
Primer - Painted and Hot-Dip Galvanized



Nominal size	Inside Diameter (ID)		Outside Diameter (OD)	Thickness (T)	Bolt Circle (BC)	Hole Diameter	No. of Bolt Holes	45 Degree Bevel (B)	Weight Each (lbs)
	AFR	IPS			Drilling Pattern #150				
1/2		0.90	3.50	0.50	2.38	0.625	4	0.250	1.0
3/4		1.11	3.88	0.50	2.75	0.625	4	0.250	1.4
1	1.75	1.38	4.25	0.50	3.13	0.625	4	0.250	1.7
1 1/4	2.00	1.72	4.63	0.50	3.50	0.625	4	0.250	1.8
1 1/2	2.25	1.97	5.00	0.50	3.88	0.625	4	0.250	2.0
2	2.80	2.46	6.00	0.50	4.75	0.750	4	0.250	3.0
2 1/2	3.31	2.97	7.00	0.50	5.50	0.750	4	0.250	3.9
3	3.94	3.60	7.50	0.50	6.00	0.750	4	0.250	4.0
4	4.94	4.60	9.00	0.56	7.50	0.750	8	0.250	6.5
5	6.10	5.69	10.00	0.63	8.63	0.875	8	0.250	7.0
6	7.20	6.75	11.00	0.63	9.50	0.875	8	0.250	8.0
8	9.25	8.75	13.50	0.63	11.75	0.875	8	0.312	11.5
10	11.44	10.95	16.00	0.63	14.25	1.000	12	0.312	15.0
12	13.44	12.95	19.00	0.75	17.00	1.000	12	0.312	26.0
14	14.81	14.20	21.00	0.75	18.75	1.125	12	0.312	34.0
16	16.91	16.20	23.50	0.75	21.25	1.125	16	0.375	37.0
18	18.91	18.20	25.00	0.88	22.75	1.250	16	0.375	42.0
20	20.91	20.25	27.50	0.88	25.00	1.250	20	0.375	51.0
24	24.91	24.25	32.00	1.00	29.50	1.375	20	0.375	76.0
30	30.91	30.25	38.75	1.00	36.00	1.375	28	0.500	104.0
36	36.91	36.25	46.00	1.13	42.75	1.625	32	0.500	150.0
42	42.91	42.28	53.00	1.25	49.50	1.625	36	0.500	208.0
48	48.91	48.28	59.50	1.25	56.00	1.625	44	0.500	246.0

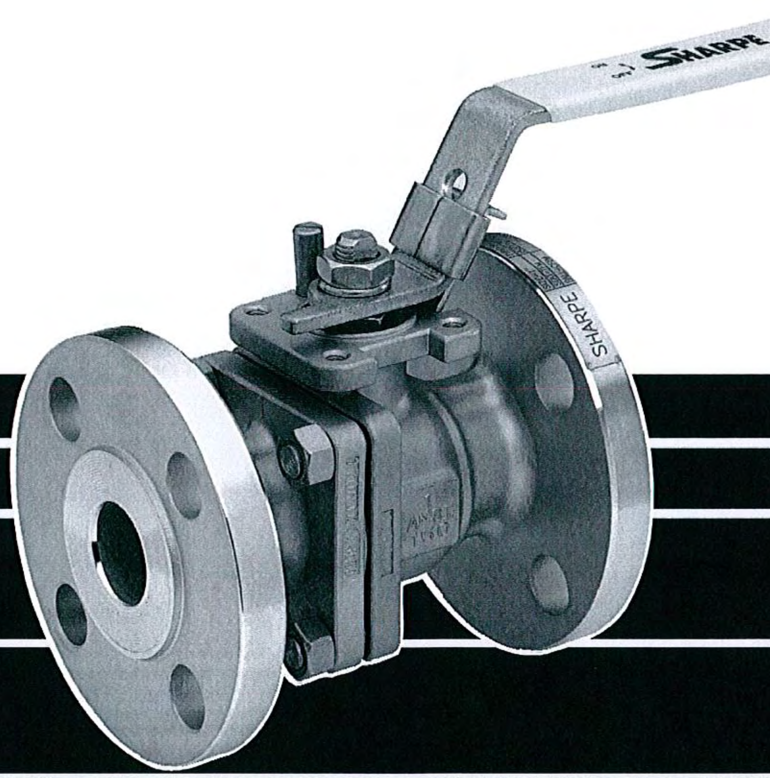
Physical Properties (minimum)
Tensile Strength: 65,000 psi
Yield Strength: 45,000 psi
Elongation: 10%

Corporate Headquaters
CAB Incorporated
5411 Cole Road, Buford, GA USA 30518
800-241-7311 678-745-2100 Fax 678-745-2082
www.cabinc.com email: sales@cabinc.com

Texas Manufacturing Facility
CAB Incorporated
2306 Rayburn Drive, Nacogdoches, TX USA 75961
800-435-2643 936-569-9430 Fax 936-569-0795

TAG: I

SHARPE® VALVES



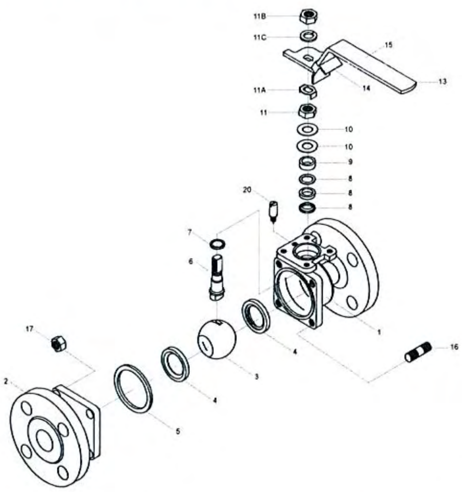
FLANGED FULL PORT
BALL VALVE
SERIES 50 / CLASS 150

TAG: I

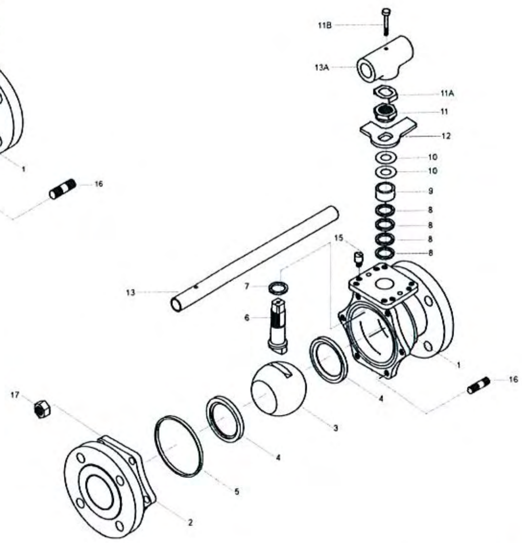
SERIES 50
VALVE PARTS AND IDENTIFICATION

CLASS 150
BLOW OUT PROOF STEM
LOCKING DEVICE

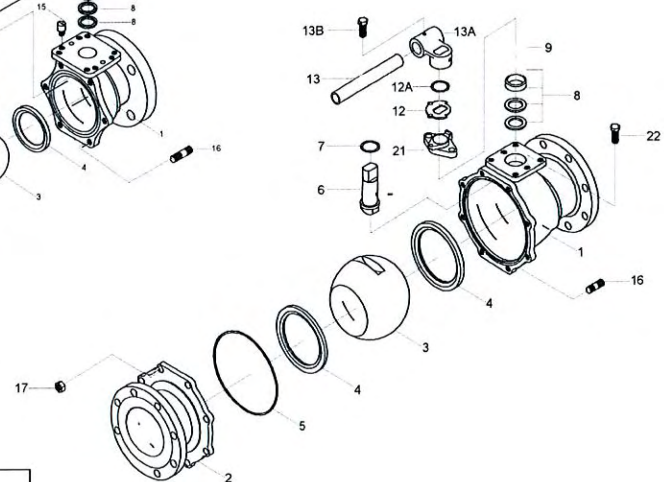
APPLICABLE STANDARDS	
Wall Thickness	ASME B 16.34
Face to Face Dimensions	ASME B 16.10
Flange Dimensions	ASME B 16.5
Pressure Tests	ASME B 16.34 API 598 (Optional)
Basic Design	ASME B16.34



1/2" - 2"



2-1/2" - 4"



6" - 8"

PART NO.	PART	QTY.	MATERIAL
1	Body	1	316 Stainless Steel ASTM A351 CF8M Alloy 20 ASTM A351 CN7M Carbon Steel ASTM A216 WCB Hastelloy C ASTM A494 GR CW-12MW Monel ASTM A494 GR M35-1
2	End Connector	1	316 Stainless Steel ASTM A351 CF8M Alloy 20 ASTM A351 CN7M Carbon Steel ASTM A216 WCB Hastelloy C ASTM A494 GR CW-12MW Monel ASTM A494 GR M35-1
3	Ball	1	316 Stainless Steel Alloy 20 Hastelloy C
4	Seat	2	TFM(Super TFE) TFE Reinforced TFE NOVA PEEK
5	Body Seal	1	TFE
6	Stem	1	316 Stainless Steel Alloy 20 Hastelloy C 17-4PH (Option)
7	Thrust Bearing	2	Reinforced TFE
8	Stem Packing	3/4	Reinforced TFE
9	Gland Packing	1	304 Stainless Steel
10	Belleville Washer (1/2"-4")	2/4	304 Stainless Steel
11	Packing Nut (1/2"-4")	1	304 Stainless Steel
11A	Lock Tab	1	Stainless Steel
11B	Handle Nut	1	304 Stainless Steel
11C	Lock Washer	1	304 Stainless Steel (1/2"-2")

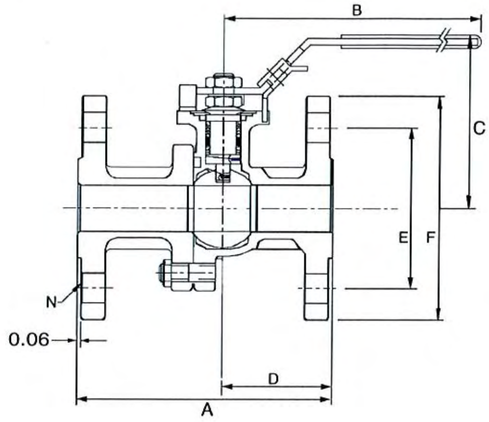
*See Dimensions

PART NO.	PART	QTY.	MATERIAL
12	Stopper	1	304 Stainless Steel
12A	Snap Ring	1	Stainless Steel (6"-8")
13	Handle	1	304 Stainless Steel (1/2"-2") Galvanized Steel (2-1/2"-4") Ductile Iron (6"-8")
13A	Wrench Block	1	Stainless Steel
13B	Hex Head Bolt	1	304 Stainless Steel
14	Locking Device (1/2"-2")	1	304 Stainless Steel
15	Sleeve	1	Vinyl
16	Body Stud	SEE* N	A193 B8 (SST) A193 B7 (CS)
17	Nut	SEE* N	A194 8 (SST) A194 2H (CS)
20	Stop Pin (1/2"-2") (2-1/2"-4")	1 2	304 Stainless Steel 304 Stainless Steel
21	Gland Flange (6"-8")	1	304 Stainless Steel
22	Gland Bolts (6"-8")	2	304 Stainless Steel

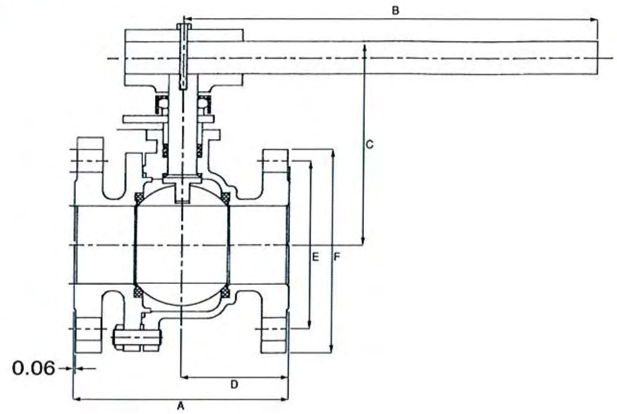
TAG: I

SERIES 50
DIMENSIONS

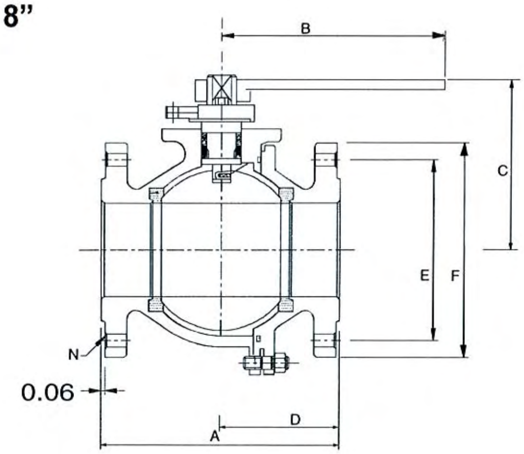
1/2" - 2"



2-1/2" - 4"



6" - 8"



CV DATA

1/2"	26
3/4"	50
1"	94
1-1/2"	260
2"	480
2-1/2"	750
3"	1300
4"	2300
6"	5400
8"	10000

PORT

1/2"	0.59
3/4"	0.78
1"	1.00
1-1/2"	1.50
2"	2.00
2-1/2"	2.55
3"	3.00
4"	4.00
6"	6.00
8"	7.88

WEIGHT (lbs.)

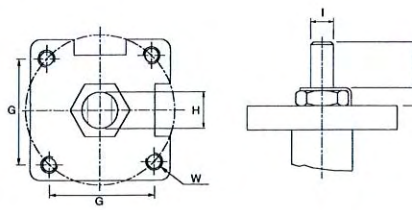
1/2"	4
3/4"	6
1"	8
1-1/2"	15
2"	20
2-1/2"	36
3"	45
4"	75
6"	135
8"	290

SIZE	A	B	C	D	E	F	N	G	H	I	J	K	W
1/2"	4.25	4.75	3.60	1.80	2.38	3.50	4	1.39	3/8-24 UNF	.22	.28	.63	M5
3/4"	4.62	4.75	3.75	2.00	2.75	3.85	4	1.39	3/8-24 UNF	.22	.28	.63	M5
1"	5.00	6.22	3.75	2.12	3.13	4.25	4	1.39	7/16-20 UNF	.30	.30	.90	M6
1-1/2"	6.50	9.00	4.50	2.76	3.56	5.00	4	1.94	9/16-18 UNF	.35	.42	1.18	M8
2"	7.00	9.00	4.80	3.08	4.75	6.00	4	1.94	9/16-18 UNF	.35	.42	1.18	M8
2-1/2"	7.50	13.75	6.70	3.09	5.50	7.00	4	2.84	M20	.55	.55	1.83	M10
3"	8.00	13.75	7.00	3.74	6.00	7.48	4	2.84	1-14 UNS	.745	.66	1.83	M10
4"	9.00	13.75	7.70	4.46	7.50	9.01	8	2.84	1-14 UNS	.745	.66	1.83	M10
6"	15.50	38.97	11.22	7.61	9.50	10.98	8	3.89	1.02	1.64	1.46	3.00	M12
8"	18.00	38.97	11.57	8.34	11.75	13.50	8	4.59	1.02	1.64	1.46	3.00	M12

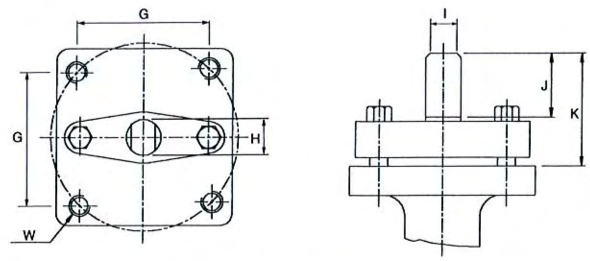
The dimensions above are for information only, not for construction. For complete actuator mounting dimensions refer to Engineering Bulletin EB-2003.

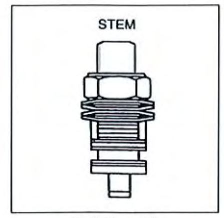
TAG: I

1/2" - 4"



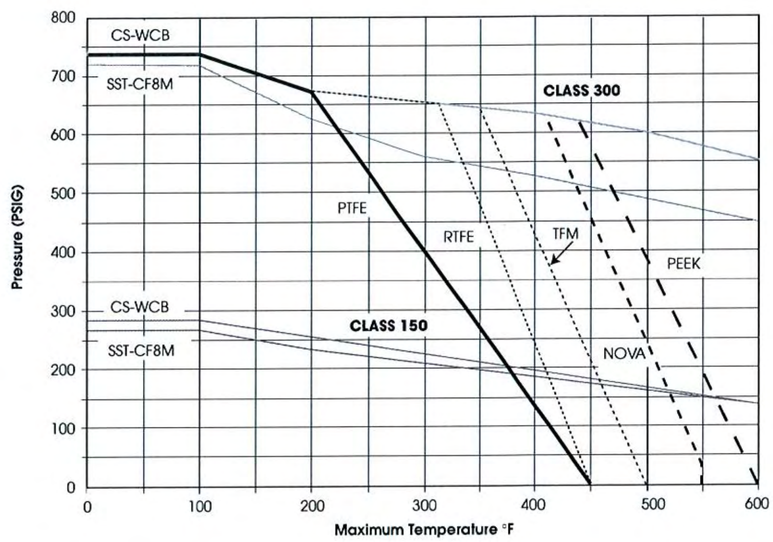
6" - 8"





1/2" - 4"
STEM ARRANGEMENT
FOR ACTUATORS

SEAT PRESSURE/TEMPERATURE RATING SERIES 50



HOW TO ORDER

VALVE SIZE	VALVE SERIES	CLASS	ALLOY	SEATS	OPTIONS
1/2"	50	150# = 11	2 = Alloy 20	T = TFE	X = Oxygen Service
3/4"			4 = Carbon Steel	R = RTFE	OH = Oval Handle
1"			6 = Stainless Steel	N = NOVA	F = Fugitive Emissions Certified ANSI 593.00.01
1-1/2"			5 = Hastelloy C	P = Peek	E = Extended Stem
2"			3 = Monel	M = TFM™	L = Lockable Extended Stem
2-1/2"					D = Leak detection Stem
3"					GO = Gear Operator
4"					7 = 17- 4PH Stem
6"					A = Nace
8"					

3/4" 50 11 6 T X

SHARPE® VALVES

A Division of Smith-Cooper International, LLC

Toll-Free 1-877-7SHARPE
(877) 774-2773
Fax: (708) 562-9250
E-Mail: info@sharpevalves.com
www.sharpevalves.com
1260 Garnet Drive
Northlake, Illinois 60164 U.S.A.

Due to continuous development of our product range we reserve the right to change the dimensions and information contained in the leaflet as required. Rev. 1/09

PRESSURE

Single Pressure Transmitters

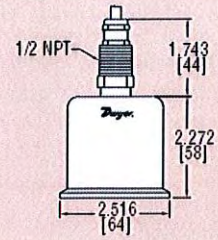
Dwyer® Series 681

Sanitary Pressure Transmitter

No Liquid Fill Diaphragm, Sanitary Clamp Fitting

TAG: J

CE



The Series 681 Sanitary Pressure Transmitter is designed to meet sanitary standards for applications in food, dairy, beverage and pharmaceutical processing, liquid level control, and sanitary pipelines. The unit is fully sealed to withstand high pressure washdown in Clean-in-Place (CIP) and Sterilize-in-Place (SIP) installations. The Series 681 is designed with a unique, no liquid fill diaphragm and a sanitary clamp pressure fitting for easy installation with negligible clamping effect. A conduit fitting, shielded cable with vent tube and sealed screws for zero and span adjustment combine to make the Series 681 completely watertight.

Model	Range	Overpressure	Sanitary Clamp Connection
681-02	0 to 1 psi	50 psi	2″
681-12	0 to 2 psi	100 psi	2″
→ 681-42	0 to 15 psi	150 psi	2″
681-52	0 to 30 psi	150 psi	2″
681-62	0 to 60 psi	180 psi	2″

SPECIFICATIONS
Service: Compatible liquids and gases.
Wetted Parts: 316L SS.
Accuracy: ±.20% FS (includes non-linearity, hysteresis and non-repeatability).
Temperature Limits: -40 to 260°F (-40 to 125°C) 10 to 90% RH, non-condensing.
Pressure Limits: See table.
Compensated Temperature Range: 20 to 180°F (-7 to 80°C).
Thermal Effect: Zero and span shift: ±2.0% FS/100°F.
Power Requirements: 9 to 30 VDC.
Output Signal: 4 to 20 mA, 2-wire.
Zero and Span Adjustment: ±0.5 mA, non-interactive.
Response Time: ≤ 10 ms.
Loop Resistance: 800 Ω.
Electrical Connections: 1/2″ conduit fitting and strain relief with 15 ft (4.5 m) cable.
Process Connection: 2″ or 1-1/2″ sanitary clamp fitting male NPT.
Clamping Effect: Zero and span shift: ±0.15% FS for ranges up to 30 psi; ±0.25% FS for ranges >30 psi.
Weight: 8 oz (227 g).
Agency Approvals: CE.

Series 50M76

2-Piece Ball Valve

TAG: K

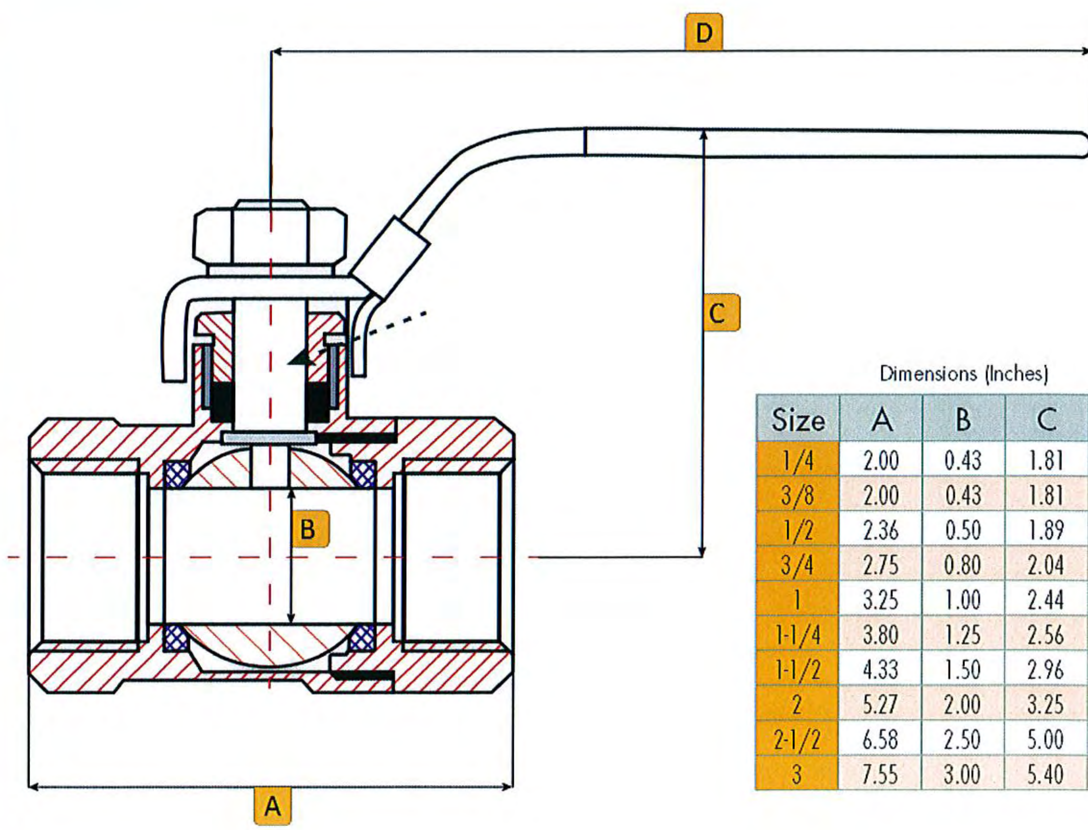
SHARPE®

Valves, Automation & Controls

Features

- Full port
- 1000 WOG
- Locking device
- Blow-out proof stem
- Oval handle available

Dimensions



Dimensions (Inches)

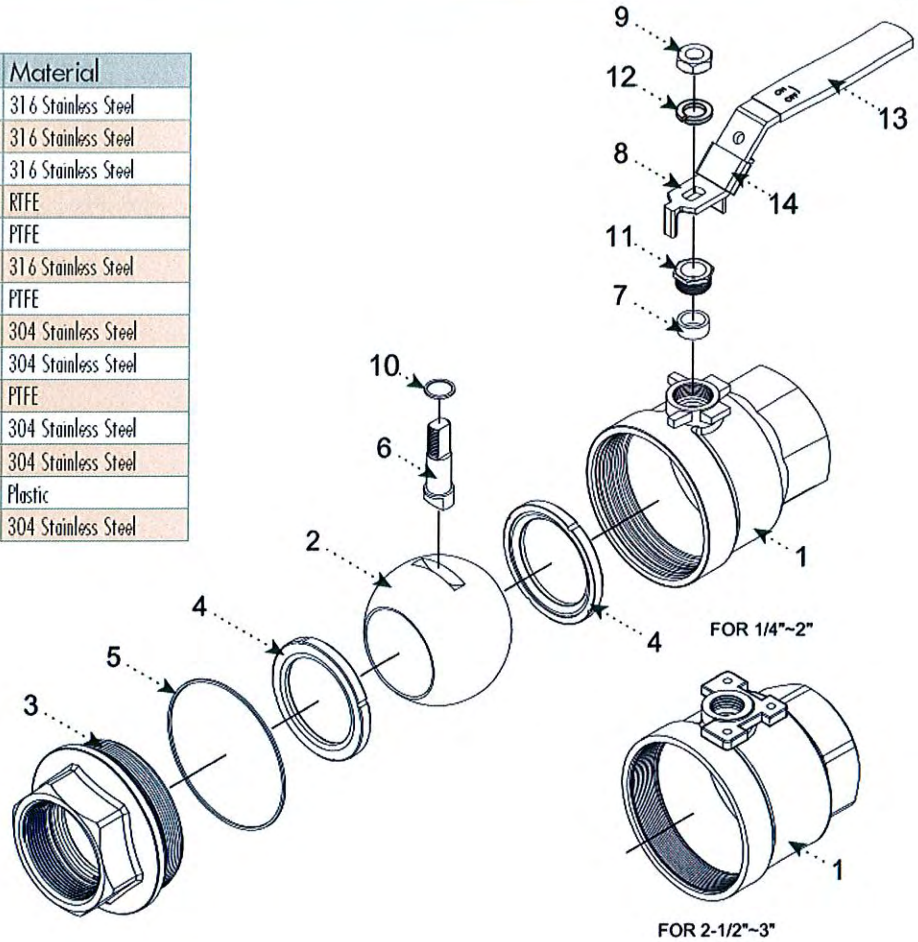
Size	A	B	C	D
1/4	2.00	0.43	1.81	4.00
3/8	2.00	0.43	1.81	4.00
1/2	2.36	0.50	1.89	4.00
3/4	2.75	0.80	2.04	5.00
1	3.25	1.00	2.44	5.75
1-1/4	3.80	1.25	2.56	5.75
1-1/2	4.33	1.50	2.96	7.50
2	5.27	2.00	3.25	7.50
2-1/2	6.58	2.50	5.00	9.73
3	7.55	3.00	5.40	9.73

SHARPE - SERIES 50M76 | 2-Piece Ball Valve | Toll Free (877) 774-2273 | Local (708) 562-9221 | Fax (708) 562-0890 | www.sharpevalves.com

TAG: K

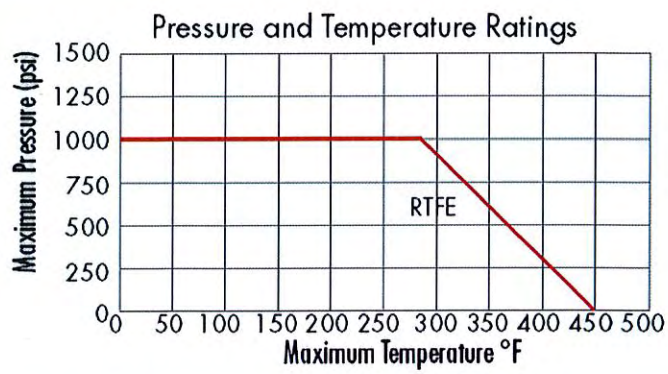
Parts & Materials

No.	Part Name	Qty	Material
1	Body	1	316 Stainless Steel
2	Ball	1	316 Stainless Steel
3	Cap	1	316 Stainless Steel
4	Seat	2	RTFE
5	Gasket	1	PTFE
6	Stem	1	316 Stainless Steel
7	Stem Packing	1 Set	PTFE
8	Handle	1	304 Stainless Steel
9	Nut	1	304 Stainless Steel
10	Thrust Washer	1	PTFE
11	Galand Nut	1	304 Stainless Steel
12	Spring Washer	1	304 Stainless Steel
13	Handle Cover	1	Plastic
14	Locking Pad	1	304 Stainless Steel



Technical Information

Size	Cv	Weight
1/4	6	0.6
3/8	6	0.5
1/2	24	0.7
3/4	35	1.1
1	47	1.7
1-1/4	81	2.6
1-1/2	105	4.1
2	241	6.8
2-1/2	319	14.7
3	580	22.4



Ordering

Fig: 1/2 - 50M76
Description: 1/2" - Series 50M76

Size		Series	Options	
1/4 3/8 1/2 3/4 1	1-1/4 1-1/2 2 2-1/2 3	50M76	OH	Oval Handle

Due to continuous development of our product range, we reserve the right to change the dimensions and information for this product as required.

SHARPE - SERIES 50M76 | 2-Piece Ball Valve | www.sharpevalves.com
Toll Free (877) 774-2773 | Local (708) 562-9221 | Fax (708) 562-0890

TAG: 6

OMEGA/OMEGA PLUS ROTARY BLOWERS - PACKAGE RECOMMENDATIONS -

Customer: Mass Transfer

Prepared By: Kaeser-Geary

INPUT DATA:

Operating mode: Gauge pressure

Kind of package: Com-paK Plus

Inlet temperature : 95 °F

Inlet pressure : 14.7 psi

Flow medium: Dry Air

Specific heat constant κ: 1.40

Specific weight at standard conditions : 0.076 lb/ ft³

Pressure difference : 10.0 psig

Discharge pressure : 24.7 psi

Technical data:

NOTE: ACCESSORIES SHOWN ARE INTENDED FOR AIR USE ONLY.

Package: DB 236C

Blower: OMEGA 43P

Motor power: 30.0 hp

Operating voltage: 460V/60Hz

Blower speed: 2905 rpm

Connection ANSI: 4"

% of maximum speed: 65

Volumetric efficiency: 0.83

Performance data:

	max. load	**design point**
Blower: OMEGA 43P		
Pressure difference Δp:	11.5 psig	10.0 psig
Inlet flow Q1*:	448 icfm	455 icfm
Inlet air flow Q1 (standard) : Standard conditions 14.7 psia, 68°F and 0 % RH		433 scfm
Discharge temperature*:	246 °F	225 °F
Motor shaft power :	31.5 bhp	27.9 bhp
Blower shaft power*:		25.7 bhp
	without sound enclosure	with sound enclosure
Sound pressure level** :	86 dB(A)	71 dB(A)
Sound power level** :	101 dB(A)	87 dB(A)
Dimension [inches] (L x W x H)	35x 42 x 44	44x 46 x 51
Estimated Weight	ca. 758 lbs	ca. 1199 lbs

*** Performance data to DIN ISO 1217, part 1, annex C**

****Measured to DIN EN ISO 2151, figures ± 3 dB(A), with sound isolated pipework**

Motor shaft power includes belt losses in addition to dirty filter losses of 0.6 psig (40 mbar).

TAC: L

KAESER
OMEGA BLOWERS

OMEGA/OMEGA PLUS ROTARY BLOWERS 02/14/13
- PACKAGE RECOMMENDATIONS -

Customer: Mass Transfer

Prepared By: Kaeser-Geary

Kind of package: Com-paK Plus

Operating mode: Gauge pressure

Inlet temperature : 95 °F

Inlet pressure : 14.7 psi

Input inlet flow: 420 icfm

Valve set pressure: 13.3 psig

Package: **DB 236C**

Blower: OMEGA 43P

Motor power: 30.0 hp

Operating voltage: 460V/60Hz

Blower speed: 2905 rpm

Connection ANSI: 4"

% of maximum speed: 65

Nameplate data:
related to 14.7 psia and 68°F

Pressure difference Δp: 11.2 psig

Discharge pressure p2 *: 25.9 psia

*Discharge pressure related to max. pressure difference

Inlet flow Q1: 452 icfm

Related to inlet conditions

NOTE: ACCESSORIES SHOWN ARE INTENDED FOR AIR USE ONLY.

Accessories:

	yes	no
Unloaded start up valve: AFE15	☐	☒
Check plate: 4"	☒	☐
Instruments/ sensor:		
Temperature gauge with switch point:	☒	☐
Pressure gauge:	☒	☐
Filter differential pressure switch:	☐	☒
oil level sensor:	☐	☒
speed monitor:	☐	☒

	yes	no
Sound enclosure:	☒	☐
Inlet silencer-suction from ambient:	☒	☐
Inlet silencer-suction from pipe:	☐	☒
Optional for package with sound enclosure		
Sound enclosure for outdor installation:	☐	☒

Standard equipment with s. encl.: 1x 2" Blowoff valve, pressure gauge, filter with maintenance indicator

Standard equipment without s. encl.: 1x 2" Blowoff valve, filter with maintenance indicator

Comments for project:

TAG: L

TECHNICAL PROPOSAL	OMEGA PLUS	More air flow With less energy	KAESER OMEGA BLOWERS

Project Reference: Mass Transfer
Location: MA
Customer: Mass Transfer

Prepared By: Kaeser-Geary
Date: 02/14/13

KAESER

Com-paK Plus DB 236C / 43P

Rotary Blower Package

Gauge pressure application

For an oil-free conveying medium

with CE Declaration of incorporation within the meaning of Machinery Directive 2006/ 42 EG, annex II B

Gas handled	Dry Air	
Effective inlet air flow Q_1 at design point	455	icfm
Inlet flow at standard conditions: Standard conditions 14.7 psia, 68 °F and 0% RH	433	scfm
Blower speed at design conditions:	2905	rpm
Design conditions:		
Inlet pressure (absolute)	14.7	psia
Inlet temperature	95	°F
Pressure difference	10.0	psig
Discharge pressure (absolute)	24.7	psia
Discharge temperature	225	°F
Blower shaft power	25.7	bhp
Motor rated power	30.0	hp
Motor enclosure	TEFC	
Motor voltage / frequency	460V/60Hz	
Type of cooling	Air cooled	
Connection size	4"	
Volumetric efficiency	0.83	

	without enclosure	with enclosure
Estimated noise level to DIN EN ISO 2151 figures ± 3 dB(A), with sound insulated piping	86 dB(A)	71 dB(A)
Dimension (L x W x H) inches	35 x 42 x 44	44 x 46 x 51
Estimated Weight	ca. 758 lbs	ca. 1199 lbs

V 7.2 AD VERSION 14/01/11 T1

Kaeser Compressors, Inc.
P.O. Box 946
Fredericksburg, VA 22408
Tel.: (540) 898-5500 Fax.: -5520

TAG! L

Kaeser Com-paK Installation Data Sheet

KAESER OMEGA BLOWERS

DB166C/DB236C

Package	Blower	Horsepower
DB166C	Omega 42P	7.5,10,15,20,25,30,40,50
DB236C	Omega 43P	15,20,25,30,40,50,60

Electrical Data Drive Motor											
						wye-delta starting (2-wire per phase)			direct online (1-wire per phase)		
Hp	Voltage	FLA +/- 10%	Nominal Eff	Insulation Class	Enclosure Type	Jumper Connection	Disconnect Fuse	Wire Size (75°C or higher)	Jumper Connection	Disconnect Fuse	Wire Size (75°C or higher)
7.5	208	18.4	89.5	F	TEFC	YY -> ΔΔ	25 AMP	14 AWG	ΔΔ	30 AMP	10 AWG
	230	17.6				YY -> ΔΔ	25 AMP	14 AWG	ΔΔ	30 AMP	10 AWG
	460	8.8				Y -> Δ	10 AMP	14 AWG	Δ	15 AMP	14 AWG
10	208	25.2	90.2	F	TEFC	YY -> ΔΔ	35 AMP	14 AWG	ΔΔ	40 AMP	8 AWG
	230	22.8				YY -> ΔΔ	30 AMP	14 AWG	ΔΔ	35 AMP	8 AWG
	460	11.4				Y -> Δ	20 AMP	14 AWG	Δ	20 AMP	12 AWG
15	208	36.4	91.2	F	TEFC	YY -> ΔΔ	50 AMP	10 AWG	ΔΔ	60 AMP	4 AWG
	230	34				YY -> ΔΔ	50 AMP	10 AWG	ΔΔ	50 AMP	6 AWG
	460	20				Y -> Δ	30 AMP	14 AWG	Δ	35 AMP	8 AWG
20	208	50	93	F	TEFC	YY -> ΔΔ	70 AMP	8 AWG	ΔΔ	80 AMP	3 AWG
	230	47				YY -> ΔΔ	70 AMP	8 AWG	ΔΔ	80 AMP	3 AWG
	460	23.4				Y -> Δ	35 AMP	14 AWG	Δ	40 AMP	8 AWG
25	208	62	91.7	F	TEFC	YY -> ΔΔ	100 AMP	4 AWG	ΔΔ	125 AMP	2 AWG
	230	57				YY -> ΔΔ	90 AMP	6 AWG	ΔΔ	110 AMP	2 AWG
	460	28.5				Y -> Δ	45 AMP	8 AWG	Δ	50 AMP	6 AWG
30	208	73	91.7	F	TEFC	YY -> ΔΔ	100 AMP	4 AWG	ΔΔ	125 AMP	1/0 AWG
	230	66				YY -> ΔΔ	90 AMP	6 AWG	ΔΔ	110 AMP	1 AWG
	460	33				Y -> Δ	45 AMP	8 AWG	Δ	50 AMP	6 AWG
40	208	100	92.4	F	TEFC	YY -> ΔΔ	150 AMP	4 AWG	ΔΔ	175 AMP	1/0 AWG
	230	93				YY -> ΔΔ	125 AMP	4 AWG	ΔΔ	150 AMP	1/0 AWG
	460	46.5				Y -> Δ	60 AMP	8 AWG	Δ	80 AMP	3 AWG
50	460	56	93.6	F	TEFC	Y -> Δ	80 AMP	6 AWG	Δ	100 AMP	2 AWG
60	460	72	93.6	F	TEFC	Y -> Δ	100 AMP	6 AWG	Δ	125 AMP	1 AWG

Notes: 1. Disconect fuses should be of dual element time delay design.
2. Breaker should be suitable for a heavy duty starting load and of inverse time delay design that complies to regulations outlined in NEC 430.52
3. Fuse and wire sizes determined in accordance to NEC 240.6, 430.52 and tables 250.122, 430.248, 430.250, 430.252.

Enclosure Fan Data								
Power	Voltage	Phase	Current Draw	Jumper Connection	Quantity	Enclosure Type	Fan Type	Flow
180W	115	1	3.80	Capacitor	1	TEFC	Axial	1188 CFM
120W	230	1	1.10	Capacitor	1	TEFC	Axial	1294 CFM
120W	208	3	0.92	Δ	1	TEFC	Axial	1294 CFM
120W	230	3	0.68	Δ	1	TEFC	Axial	1188 CFM
120W	460	3	0.37	Y	1	TEFC	Axial	1188 CFM
140W	575	3	0.32	Y	1	TEFC	Axial	1233 CFM

Notes: 1.) Nominal power in Watts.
2.) Current in A (+/- 10%).
3.) Default fan selection is 230/460V. If other voltage is required, it must be noted at time of order.
4.) Fan requires separate power supply.
5.) Fan should run at the same time as main motor. If fan is able to run for 15 minutes after machine is turned off, it will improve thermal conditions inside enclosure.

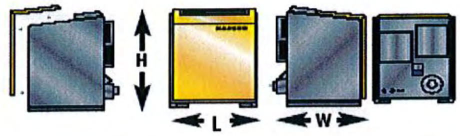
TAG: L

KAESER OMEGA BLOWERS

Kaeser Com-paK Installation Data Sheet

DB166C/DB236C

Oil System Data	
Drive End Capacity	0.25 quarts
Gear End Capacity	0.30 quarts
Oil Type (Synthetic)	SB 220



Package Connections

Hp	Cable Entry		Length (in.) L	Width (in.) W	Height* (in.) H	Floor (sq ft)	Weight (lb)		Connection Size (in.)	Type
	Drive Motor	Fan Motor					DB166C	DB236C		
7.5	3 x 1" NPT	2 × M16					981	1036	4	Tube
10	3 x 1" NPT	2 × M16					992	1058	4	Tube
15	3 x 1" NPT	2 × M16					1025	1091	4	Tube
20	3 x 1-1/4" NPT	2 × M16					1047	1102	4	Tube
25	3 x 1" NPT	2 × M16	43 3/4	45 1/8	51	13 5/7	1124	1191	4	Tube
30	3 x 1" NPT	2 × M16					1135	1202	4	Tube
40	2 x 2" NPT & 1 x 1/2" NPT	2 × M16					1334	1389	4	Tube
50	2 x 2" NPT & 1 x 1/2" NPT	2 × M16					1378	1433	4	Tube
60	2 x 2" NPT & 1 x 1/2" NPT	2 × M16					1444	1499	4	Tube

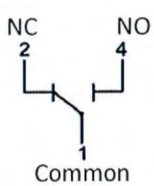
*without optional weather hood

Safety Devices

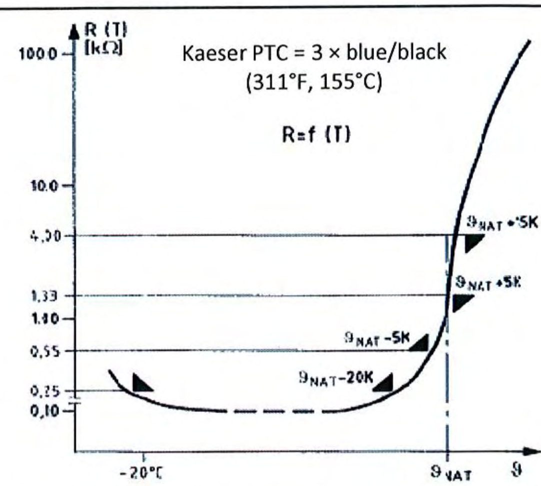
Discharge Temperature Gauge with Switch	Motor Winding PTC's

Range: 120 - 400°F (50 - 200°C)

Switching point: adjustable
Switching: 1 = common, 2 = NC, 4 = NO
Contacts: 5A / 24VDC non-inductive



Blower discharge temperature switch should be wired into control system to shut down blower operation when switch point is achieved.

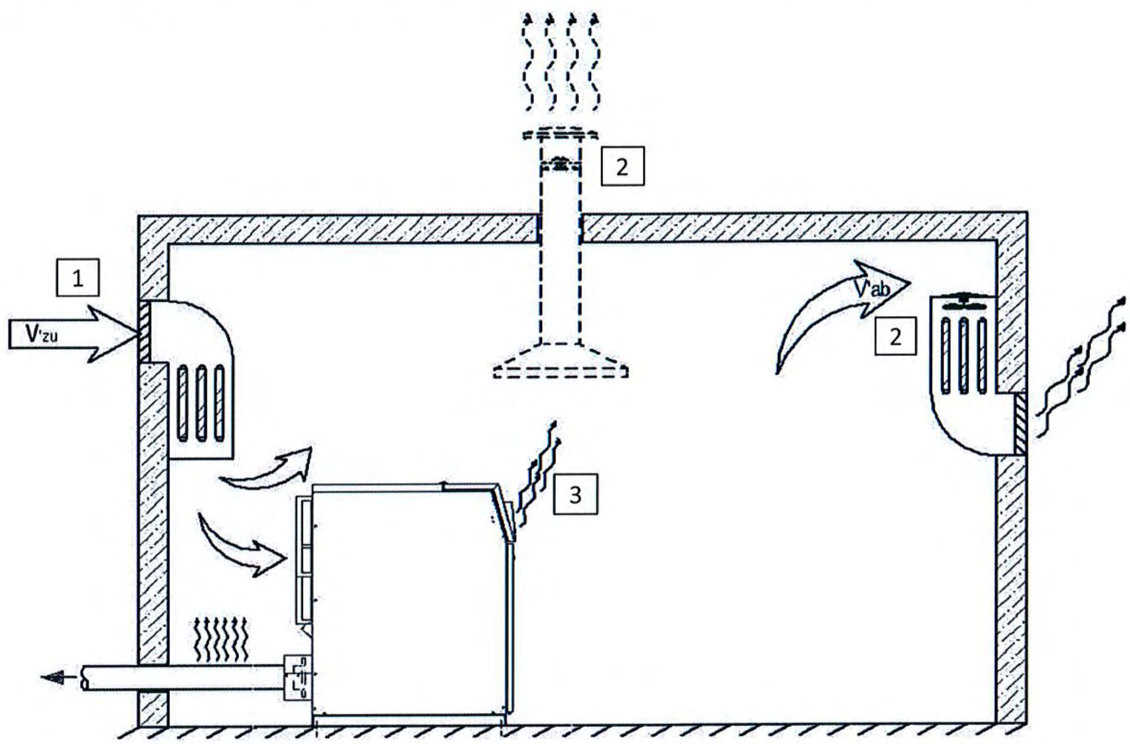


Motor winding PTC's require use of a control module. Kaeser part number 7.2710.2 can be purchased and integrated into control scheme for this purpose.

DB166C/DB236C

Ventilation of Blower Room		
Air Inlet Opening	1	4.0 sq. ft
Cooling Fan Capacity (forced ventilation)	2	1,700 CFM
Max Heat Rejection	3	21,200 BTU / HR

Ventilation values based on 640 CFM @ 15.PSIG ΔP, 60Hp and ambient inlet. Max. room temp. = 104°F and cooling air temp = 95°F. Discharge piping length = 5 ft.



It is recommended to extract the exhaust air from the upper third of the room as this is where the heat collects. The room ventilation openings should be arranged that the current of cooling air flowing through the room passes over the blower inlet and exhaust ports and, if possible, should leave no stagnant air in the room. (A thermal short circuit must be avoided, i.e. discharged cooling air must not find its way to the cooling air inlet.)
The blower must not be positioned so near to a wall that the inflow of cooling air is obstructed.

Pipework should be insulated against heat emission.

If the blower station is located in the middle of a large hall its exhaust air can be extracted by means of a duct positioned above the exhaust port (illustrated in broken lines).

TAG: M

DelVal® SERIES 50/52

DelTech

Resilient Seated Butterfly Valves

Wafer & Lug
Sizes 2"-24" / DN 50 - DN 600

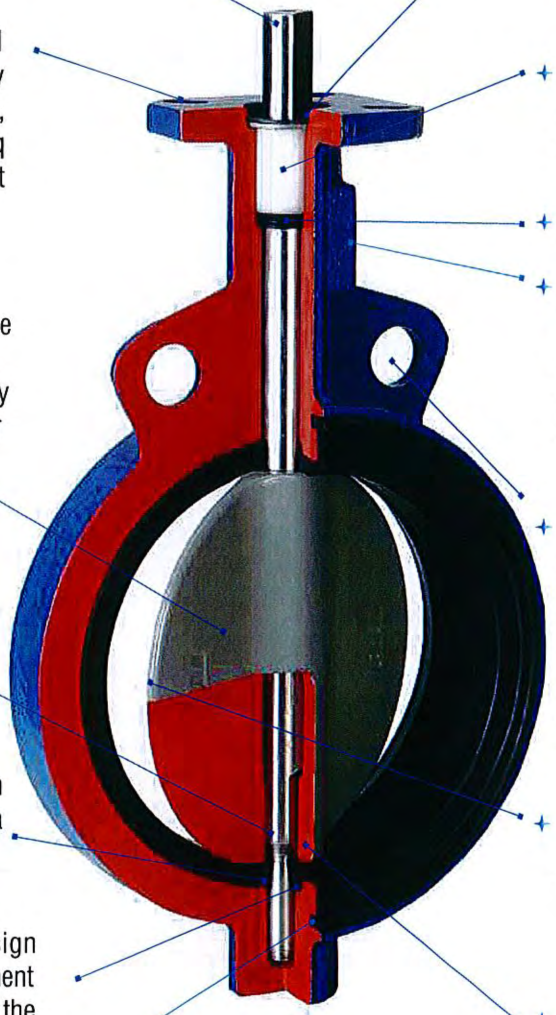
Leading the Industry with Innovation by Design

TAG: M

DelTech Controls is pleased to offer top-of-the-line products in pipeline flow control. The DelVal Series 50 (wafer body) and Series 52 (lug body) Butterfly Valves have been developed with extensive application, design and manufacturing expertise. These products are produced by employing modern manufacturing practices under a robust quality assurance system. These practices ensure consistent product quality and dependable performance. The DelVal Series 50/52 Butterfly Valves have been designed to include state-of-the-art features that are described in this bulletin.

Features

- Stem connection available in standard DelVal sizes or optional sizes to match standard secondary top plate drilling.
- Top plate double drilled to fit ISO 5211 dimensions and standard secondary bolt circle dimensions. All handles, gear operators and pneumatic DelTorq actuators are designed to mount directly to DelVal Valves.
- Nylon PA 12 coated disc option ensures excellent corrosion resistance to several chemical media. The hard, non-porous sintered polymer has very low hygroscopicity and is suitable for use in drinking water and non-alcoholic foodstuffs.
- One piece stem with close tolerance double D drive eliminates the need for disc screws or taper pins.
- Double O-rings are molded in both upper and lower journals providing a superior secondary seal.
- Unique "Center-Lock" seat design virtually eliminates any seat movement during the seating and un-seating of the disc.
- Heavy duty square-grooved seat design with molded O-ring seals to serve as flange gaskets. EPDM and Buna-N seats are peroxide cured to yield the best elastic properties of the elastomer.

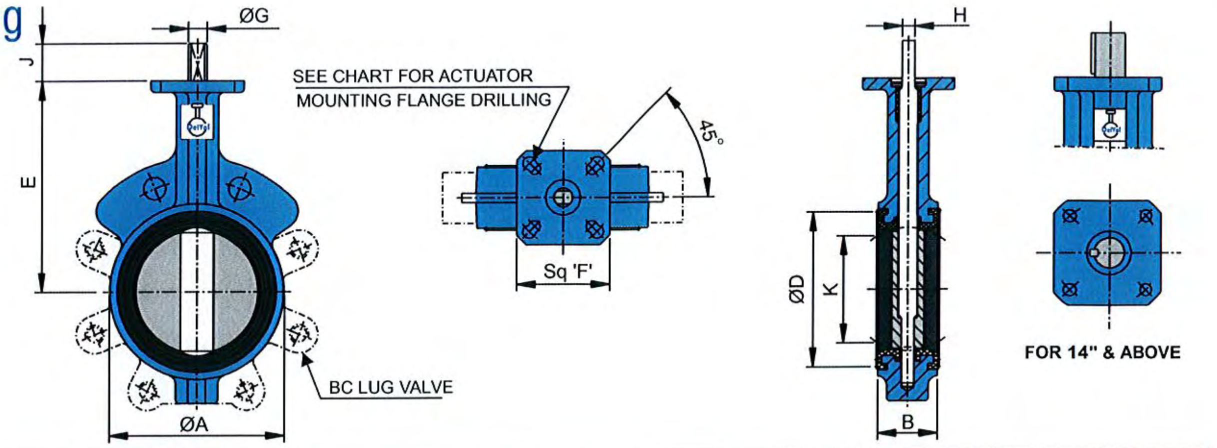


- Unique stem retention system to provide blow-out proof stem and easy assembly and disassembly of valve.
- Heavy duty acetal bushing absorbs the forces acting on the stem/disc assembly due to line pressure.
- Bi-directional 'U' cup stem seal.
- Heavy duty one-piece body with extended neck for 2" piping insulation. Standard coating is two coats of hard, Zinc-rich epoxy for excellent corrosion resistance.
- Two flange locating holes for sizes up to 12" and four flange locating holes from size 14" to 24" for easy alignment of valve during installation. They meet ANSI #125 /150 or other world drilling standards.
- High strength disc with hand polished disc edge and hubs.
- Precision machined radius on the upper and lower disc hubs is pressed against upper and lower seat sealing faces for achieving primary sealing between disc and seat.

- "Center-Lock" seat design

TAG: M

Engineering



DIMENSIONS (Inches)

Valve Size		ØA	*B	ØD	E	Sq'F'	Top Plate Drilling			ØG	H	J	Key Size	K	Lug Bolting Data			Weight in Lbs.	
Inches	DN						BC	No. of Holes	Hole Dia						BC	No.of Holes	Threads UNC-2B	Wafer (Series 50)	Lug (Series 52)
2	50	3.46	1.69	2.99	5.51	3.15	2.76/3.25	4	0.39/0.438	0.55	0.39	1.25	---	1.35	4.75	4	5/8-11	5.50	7.70
2 ½	65	4.02	1.81	3.54	5.98	3.15	2.76/3.25	4	0.39/0.438	0.55	0.39	1.25	---	2.08	5.50	4	5/8-11	6.38	8.36
3	80	4.72	1.81	4.17	6.30	3.15	2.76/3.25	4	0.39/0.438	0.55	0.39	1.25	---	2.72	6.00	4	5/8-11	7.70	9.24
4	100	5.91	2.06	5.20	7.09	3.15	2.76/3.25	4	0.39/0.438	0.63	0.43	1.25	---	3.59	7.50	8	5/8-11	12.32	17.60
5	125	6.89	2.19	6.30	7.56	3.15	2.76/3.25	4	0.39/0.438	0.75	0.51	1.25	---	4.62	8.50	8	3/4-10	14.08	21.56
6	150	7.87	2.19	7.36	8.07	3.15	2.76/3.25	4	0.39/0.438	0.75	0.51	1.25	---	5.50	9.50	8	3/4-10	15.84	24.86
8	200	10.04	2.38	9.45	9.49	4.72	4.92/5.00	4	0.55/0.563	0.87	0.63	1.25	---	7.39	11.75	8	3/4-10	31.68	40.48
10	250	12.21	2.69	11.50	10.75	4.72	4.92/5.00	4	0.55/0.563	1.18	0.87	2.00	---	9.31	14.25	12	7/8- 9	47.30	62.70
12	300	14.17	3.06	13.58	12.24	4.72	4.92/5.00	4	0.55/0.563	1.18	0.87	2.00	---	11.12	17.00	12	7/8- 9	67.10	91.30
14	350	16.34	3.06	15.28	13.62	4.72	4.92/5.00	4	0.55/0.563	1.38	---	2.00	0.39x0.39	12.96	18.75	12	1- 8	103.40	124.30
16	400	18.58	4.00	17.40	14.76	4.72	4.92	4	0.55	1.38	---	2.00	0.39x0.39	14.81	21.25	16	1- 8	147.40	201.30
18	450	20.67	4.50	19.49	15.98	6.70	6.50	4	0.83	1.97	---	2.50	0.39x0.47	16.59	22.75	16	11/8 -7	206.80	242.00
20	500	22.83	5.00	21.57	17.24	6.70	6.50	4	0.83	1.97	---	2.50	0.39x0.47	18.65	25.00	20	11/8 -7	271.00	325.60
24	600	27.24	6.06	25.75	19.49	6.70	6.50	4	0.83	2.50	---	4.00	0.62x0.62	22.53	29.50	20	11/4 -7	430.00	513.80

DIMENSIONS (mm)

Valve Size		ØA	*B	ØD	E	Sq'F'	Top Plate Drilling			ØG	H	J	Key Size	K	Lug Bolting Data			Weight in Kg.	
Inches	DN						BC	No. of Holes	Hole Dia						BC	No.of Holes	Threads UNC-2B	Wafer (Series 50)	Lug (Series 52)
2	50	88	43	76	140	80	70/82.5	4	10/11	14	10	32	---	34.3	120.7	4	5/8-11	2.5	3.5
2 ½	65	102	46	90	152	80	70/82.5	4	10/11	14	10	32	---	52.8	139.7	4	5/8-11	2.9	3.8
3	80	120	46	106	160	80	70/82.5	4	10/11	14	10	32	---	69.1	152.4	4	5/8-11	3.5	4.2
4	100	150	52	132	180	80	70/82.5	4	10/11	16	11	32	---	91.2	190.5	8	5/8-11	5.6	8.0
5	125	175	56	160	192	80	70/82.5	4	10/11	19	13	32	---	117.3	215.9	8	3/4-10	6.4	9.8
6	150	200	56	187	205	80	70/82.5	4	10/11	19	13	32	---	139.7	241.3	8	3/4-10	7.2	11.3
8	200	255	60	240	241	120	125/127	4	14/14.3	22	16	32	---	187.6	298.5	8	3/4-10	14.4	18.4
10	250	310	68	292	273	120	125/127	4	14/14.3	30	22	51	---	236.4	362.0	12	7/8-10	21.5	28.5
12	300	360	78	345	311	120	125/127	4	14/14.3	30	22	51	---	282.4	431.8	12	7/8-10	30.5	41.5
14	350	415	78	388	346	120	125/127	4	14/14.3	35	---	51	10x10	329.2	476.2	12	1-8	47	56.5
16	400	472	102	442	375	120	125	4	14	35	---	51	10x10	376.2	539.7	16	1-8	67	91.5
18	450	525	114	495	406	170	165	4	21	50	---	64	10x12	421.5	577.8	16	1 1/8-7	94	110
20	500	580	127	548	438	170	165	4	21	50	---	64	10x12	473.8	635.0	20	1 1/8-7	123	148
24	600	692	154	654	495	170	165	4	21	63.5	---	102	15.88x15.88	572.3	749.3	20	1 1/4-7	195	233

* Face to Face dimension "B", generally conforming to API 609/BS EN 558-1 / ISO 5752

TORQUE (Lb.-Inches) / TORQUE (Nm)

Valve Size		2"	2.5"	3"	4"	5"	6"	8"	10"	12"	14"	16"	18"	20"	24"
Full Rated Pressure Valve ΔP, PSI	50	89	133	177	283	381	566	1098	1761	2629	3806	4912	6036	7930	12001
	100	97	159	204	301	416	637	1221	1983	2974	4381	5904	7576	9931	15603
	150	102	164	212	319	451	681	1354	2195	3319	4957	6904	9117	11922	19470
	175	106	168	221	328	469	726	1416	2301	3496	---	---	---	---	---
Reduced Disc Dia. ΔP, PSI	50	89	133	177	186	283	372	752	1151	1761	2540	3284	4054	5284	7611
Full Rated Pressure Valve ΔP, Bar	3.5	10	15	20	32	43	64	124	199	297	430	555	682	896	1356
	7	11	18	23	34	47	72	138	224	336	495	667	856	1122	1763
	10	11.5	18.5	24	36	51	77	153	248	375	560	780	1030	1347	2200
	12	12	19	25	37	53	82	160	260	395	---	---	---	---	---
Reduced Disc Dia. ΔP, Bar	3.5	10	15	20	21	32	42	85	130	199	287	371	458	597	860

TAG: M

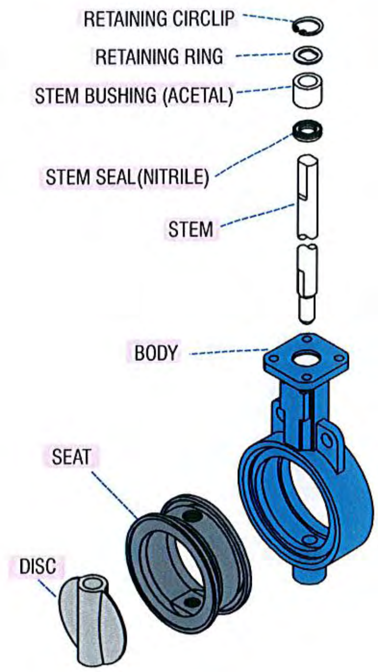
Material of Construction

Body
→ Cast Iron ASTM A126 Class B
Ductile Iron ASTM A536 Grade 65-45-12
Carbon steel ASTM A 216 WCB

Disc
→ Nylon 12 Coated Ductile Iron ASTM A536 Grade 65-45-12
DI ASTM A 536 Grade 65-45-12 + Aroxy coated
316 Stainless Steel ASTM A351 Grade CF8M
Aluminum Bronze ASTM B148-C95400

Stem
→ 410 Stainless Steel ASTM A479 Type 410
316 Stainless Steel ASTM A276 Type 316
Carbon steel BS 970

Seat
→ EPDM - Food Grade
Buna-N - Food Grade
White Buna-N - Food Grade
Viton® / FKM - Food Grade
Silicone



Seat Temperature Range

Seat Type	Temperature Range	
	Min.	Max.
→ EPDM	-13°F (-25°C)	248° F (120°C)
BUNA-N	-13° F (-25°C)	212° F (100°C)
White BUNA-N	-13° F (-25°C)	212° F (100°C)
Viton®/ FKM	-23°F (-5°C)	392° F (200°C)
Silicone	-58° F (-50°C)	356° F (180°C)

Viton® is registered trademark of E.I. DuPont

Pressure Rating

For bi-directional bubble tight shut off with disc in the closed position

Inches	DN	PSIG
2"-12"	50-300	175
14"-24"	350-600	150

Dead-End Service : Without a downstream flange installed, the dead-end pressure ratings are equal to the values stated above.

Operators

Valves up to size 12" can be supplied with lever handles for manual operation. Optional accessories for hand-lever operation can be provided for various flow control requirements. Pad locking can also be provided for preventing unauthorized operation.

Valves up to size 24" can be direct mounted with gear operators for manual operation. Gear operators can also be attached with chain-wheel operators for opening or closing valves located on pipelines at high elevations.

All valves can be direct mounted with pneumatic actuators or electric actuators and accessories for complete automation options such as fail open/close & positioner controlled. Valves can be mounted with manual overrides.

TPDELVAL 04/06

Distributor

DelTech

DelTech Controls LLC
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Geismar, LA 70734
USA

Phone: (225) 744-4326

Fax: (225) 744-4328

Email : sales@deltechcontrols.com

DelVal FlowControls Pvt. Ltd.
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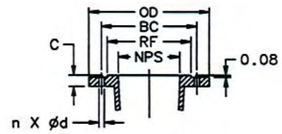
Elpro Compound, Chinchwadgaon,
Pune 411 033, INDIA

Phone : +91-20-2746 0591, 27460593
Fax: +91-20-27460589
Email : salesindia@deltechcontrols.com

DelVal Mi4 - 04/06

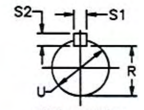
Website : www.deltechcontrols.com

TAG: N



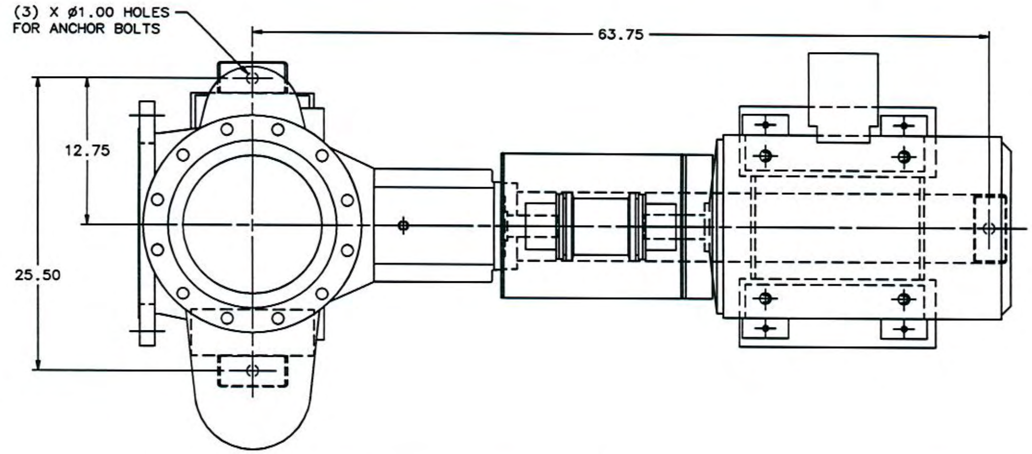
DRILLING OF PUMP FLANGES
ASME B16.5 - CLASS 150

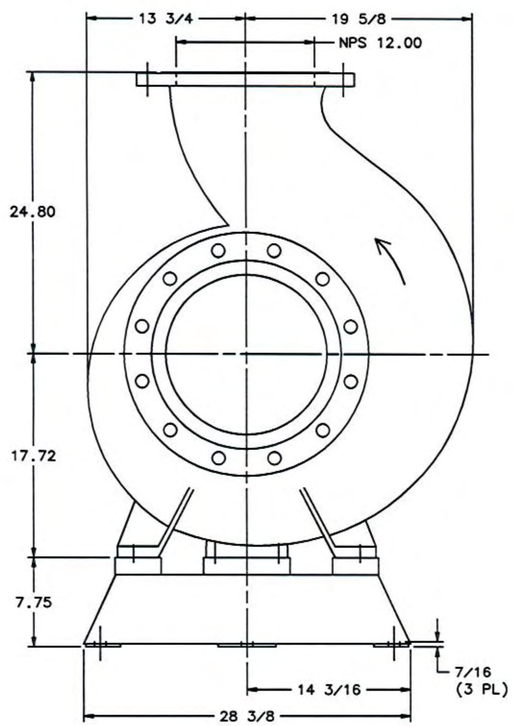
	NPS	OD	RF	C	BC	d	n
DISCHARGE	12.00	18.90	14.57	1.25	17.00	1.00	12
SUCTION	14.00	21.26	16.50	1.38	18.75	1.12	12

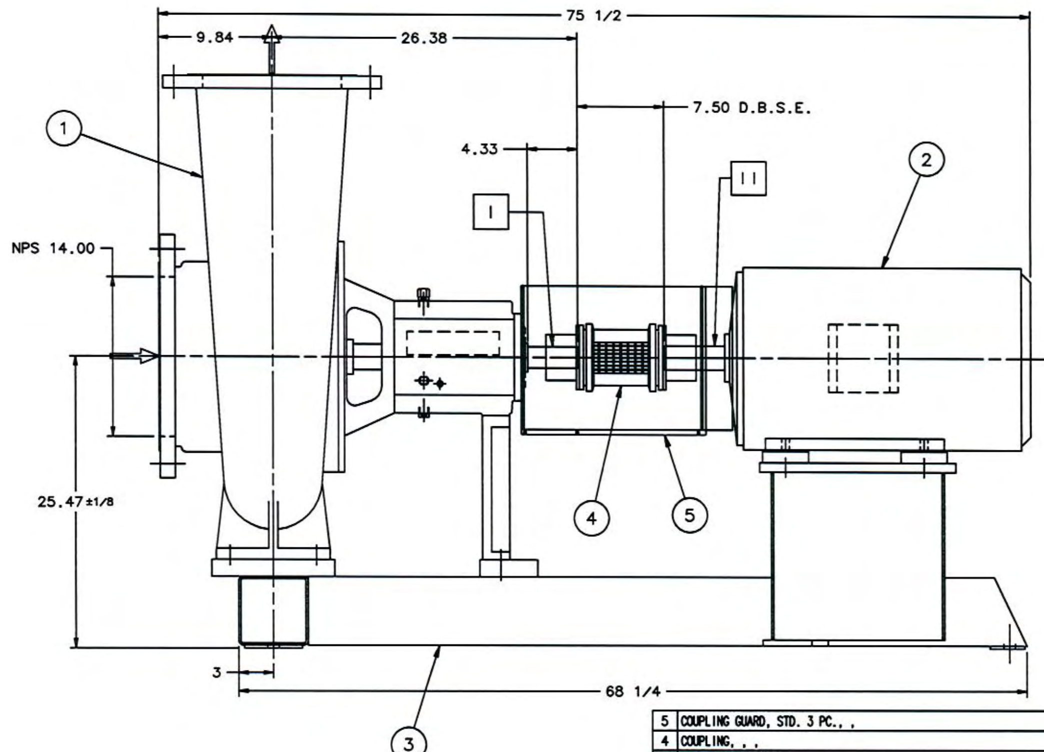


SHAFT ENDS

SE	U	S1	S2	R
I	1.875	0.50	0.50	1.591
II	2.125	0.50	0.50	1.845







NOTES
1. ALL DIMENSIONS IN INCHES.
2. SOME HIDDEN LINES OMITTED FOR CLARITY.
3. MOMENT OF INERTIA (W/O COUPLING) = 21.357 LBFT^2

APPROXIMATE WEIGHTS (LBS)	
PUMP	1050
MOTOR	650
BASE ASSEMBLY	350
COUPLING/GUARD	50
TOTAL WEIGHT	2100

5	COUPLING GUARD, STD. 3 PC., ,	1
4	COUPLING, , ,	1
3	BASEPLATE, SLT 5, ,	1
2	MOTOR, NEMA 326T, ,	1
1	PUMP, APT 43-12, ,	1

MITTAPIIRROS 001
DIMENSIONAL DRAWING 001
APT 43-12. SLT 5 T-BASE. NEMA 326T
parsodu 130227
IDEAS-E

SULZER Sulzer Pumps U.S. Inc.

983759

TAG: N

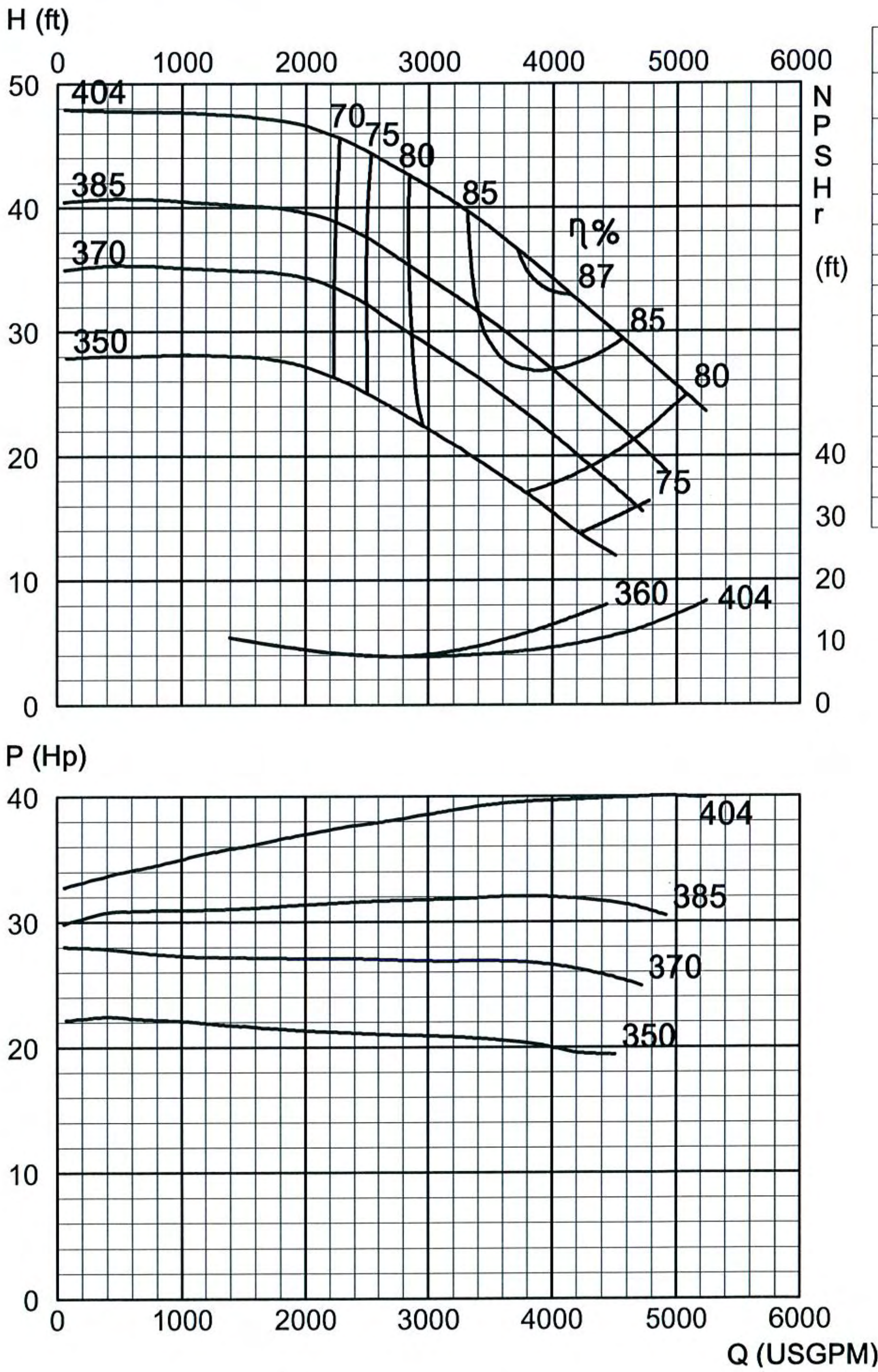
SULZER

AHLSTAR APT43-12 (14x12-15)

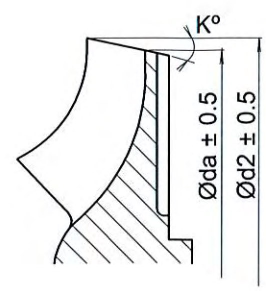
Characteristic Curve K15978

Impeller type: Special open1 / 286089 B2.83 Z4, Impeller holes: No holes / Balance holes
Special open1 / 286562 B2.83 Z4, Impeller holes: Gas holes, Please add the power demand of the degassing system

Pump rotational speed: 880 rpm



IMPELLER DIA			
Ød2		K°	Øda (mm)
(mm)	(in)		
404	15.91	13	371.7
400	15.75	13	367.2
395	15.55	14	359.2
390	15.35	14	354.0
385	15.16	15	346.2
380	14.96	16	338.1
375	14.76	17	330.0
370	14.57	18	321.8
365	14.37	19	313.6
360	14.17	20	304.9
355	13.98	22	293.6
350	13.78	24	282.1

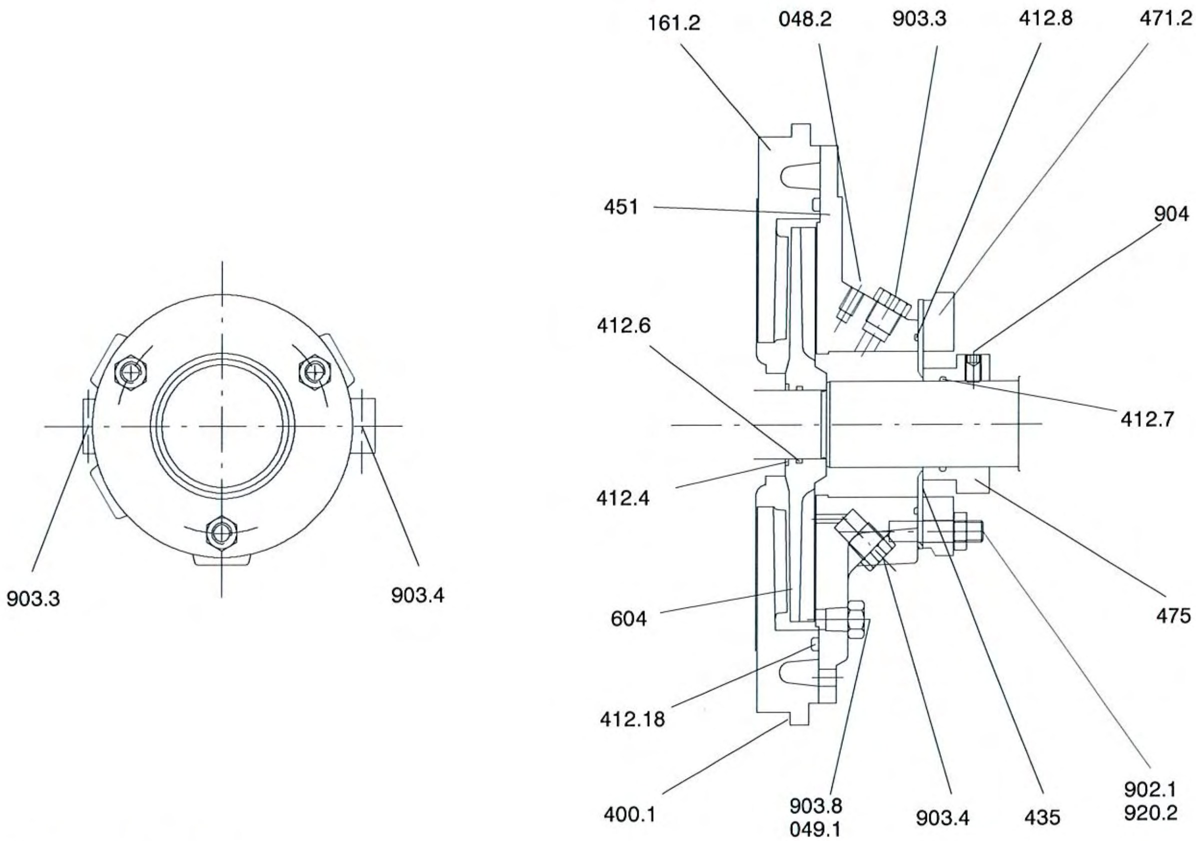


TAG: N

012 Shaft seal

APP/APT, NPP/NPT, WPP/WPT

Fitting DS01
Single stage, large expeller for sizes 33, 43, 44, 54, 55, 61, 62
Single stage, small expeller for sizes 22, 23, 31, 32, 51, 53, 55



CAD drawing 910505

TAG: O

MTS - MASS TRANSFER SYSTEMS
JET AERATION SYSTEM DESIGN FOR
BRIDEGTON
MTS #M213116 Revision 0

DESIGN PARAMETERS

Process	LEACHATE	
Number of Tanks/Basins	1	
	ENGLISH	METRIC
Total SOR	140 lb O_2/hr	64 kg O_2/h
Circular Tank		
Diameter	48 ft	14.6 m
Liquid Depth	22 ft	6.7 m
Volume Per Tank/Basin	297,801 gal	1,127 m^3
Total Aeration Volume	297,801 gal	1,127 m^3

Note: Some of the above parameters were supplied to or assumed by MTS and should be reviewed.

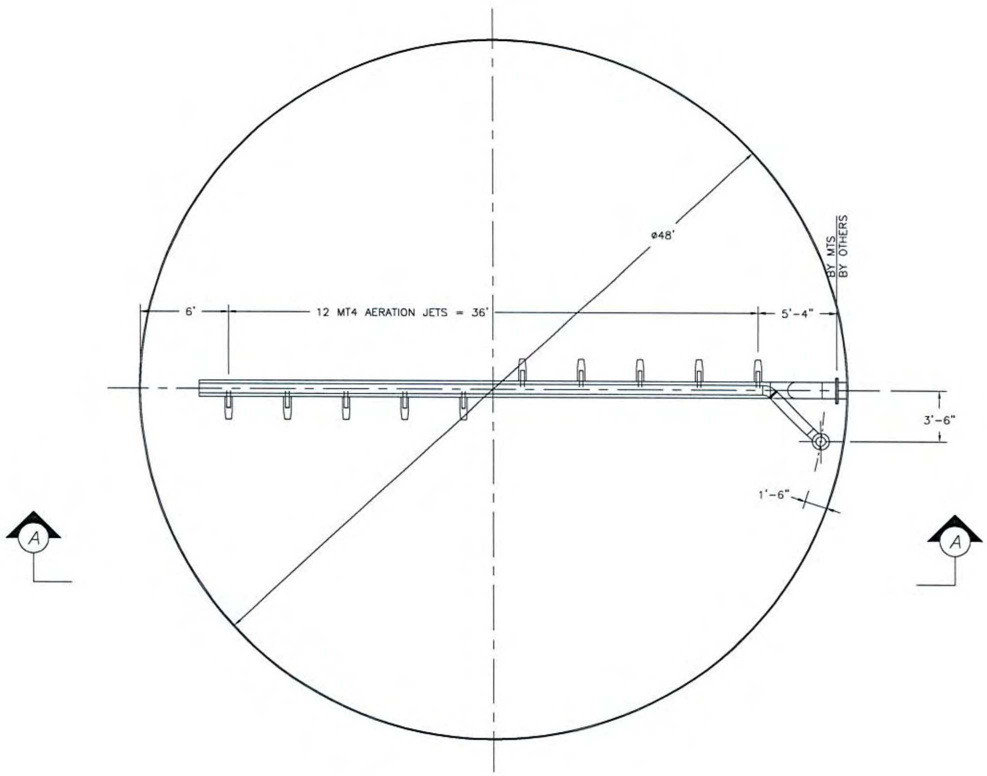
DESIGN SUMMARY

MTS Jet Aerators Required	1 @ MT4JM-10	1 @ MT4JM-10
Air Flow Rate per Aerator	360 SCFM	612 std m^3/hr[1]
Total Air Flow Rate	360 SCFM	612 std m^3/hr
Air Pressure Required at Manifold[2]	8.9 psig	0.61 bar gauge
Standard Oxygen Absorption Efficiency	37.6 %	37.6 %
Liquid Flow Rate per Aerator	3,660 gpm	231 L/s
Total Liquid Flow Rate	3,660 gpm	231 L/s
Liquid Pressure Required at Manifold[3]	16 ft TDH	4.9 m TDH
Total Blower Power[4]	19.1 bhp	14.2 bkW
Total Pump Power[5]	20.8 bhp	15.5 bkW
Total Power	40 bhp	29.7 bkW
Standard Aeration Efficiency	3.51 lb O_2/bhp-hr	2.13 kg O_2/bkW-h
Power Density	134 bhp/MG	26 bkW/1000 m^3

[1] A standard m3 of air defined at 20°C, 1 atm, and 36% RH.
[2] Does not includes losses in the out-of-basin piping (typically 1 psi/0.07 bar).
[3] Does not include losses in out-of-basin piping (typically 2 ft /0.6 m).
[4] Assumes blower adiabatic efficiency of 70%.
[5] Assumes pump hydraulic efficiency of 80%.

TAG: O

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED



PLAN VIEW – LEACHATE TANK

1/8" = 1'-0"

GENERAL NOTES

1. THE LOCATIONS SHOWN FOR EACH PIECE OF EQUIPMENT MUST BE CONFIRMED BY THE CUSTOMER OR PROJECT ENGINEER TO INSURE THAT NO INTERFERENCE IS ENCOUNTERED WITH OTHER PIPING SYSTEMS AND/OR EQUIPMENT. THE MATERIALS OF CONSTRUCTION FOR THE TANK BOTTOM AND SIDE WALL MUST ALSO BE SPECIFIED TO INSURE PROPER PIPE SUPPORT DESIGN. ANY CHANGES IN ELEVATION THAT MAY EXIST IN THE TANK BOTTOM FOR DRAINAGE, ETC. MUST BE DETAILED ON MTS PROJECT DRAWINGS DURING DRAWING REVIEW PROCESS AND REFERRED TO AS DRAWING REVIEW COMMENTS.

2. AN ALARM SIGNAL AND/OR PUMP SHUT-OFF SYSTEM SHOULD BE INCORPORATED INTO PUMP CONTROL PANEL TO PREVENT PUMP OPERATION AT IMPROPER WATER LEVEL. REFER TO PUMP MANUFACTURER'S OPERATING INSTRUCTIONS TO DETERMINE MINIMUM OPERATING WATER LEVEL.

3. CUSTOMER MUST ADVISE LOCATION OF THE TANK INFLUENT AND EFFLUENT TO INSURE JET AERATION MANIFOLD LOCATIONS SHOWN WILL NOT SHORT-CIRCUIT THE JET AERATION PROCESS. UNLESS OTHERWISE REQUESTED, ALL OF THE SYSTEM'S EQUIPMENT WILL BE MANUFACTURED AS DETAILED ON THESE DRAWINGS. THE OPERATING LIQUID SURFACE DEPTH SHOULD ALSO BE CONFIRMED DURING DRAWING APPROVAL CYCLE.

4. THE JET AERATION MANIFOLD AND IN-BASIN PIPING WILL BE FABRICATED FROM FIBERGLASS REINFORCED PLASTIC (FRP) USING AN ISOPHTHALIC RESIN. ALL FABRICATION WILL BE PERFORMED IN ACCORDANCE WITH THE NATIONAL BUREAU OF STANDARDS SPECIFICATION PS 15-69 AND ANSI/ASTM SPECIFICATION D-2996-088. THE JET AERATION NOZZLES WILL HAVE AN INTERNAL NEXUS LINER FOR ADDED ABRASION PROTECTION.

5. THE CONTINUATION OF THE AIR SUPPLY PIPING SYSTEM IS TO BE SUPPLIED BY OTHERS. A BUTTERFLY VALVE SHOULD BE PROVIDED FOR EACH AIR SUPPLY RISER PIPE TO ALLOW BALANCING OF THE AIR FLOW. A SIPHON BREAK SHOULD ALSO BE PROVIDED TO PREVENT THE BACK FLOW OF LIQUID THROUGH THE AIR SUPPLY PIPING SYSTEM. ALL FLANGE CONNECTIONS ARE TO STRADDLE VERTICAL CENTERLINES OF BASIN. HARDWARE AND GASKETS REQUIRED TO ASSEMBLE FLANGE CONNECTIONS AT THE MTS/CUSTOMER EQUIPMENT INTERFACE ARE SPECIFICALLY EXCLUDED FROM MTS SCOPE OF SUPPLY.

6. PUMP SUCTION AND DISCHARGE PIPING SHOULD INCORPORATE VALVES AND EXPANSION JOINTS WITH FULL PORT DESIGN (NON-RESTRICTIVE FLOW). GAUGES WITH SHUT-OFF AND BLEED VALVES SHOULD ALSO BE PROVIDED. ALL FLANGE CONNECTIONS ARE TO BE 150# ANSI STYLE CONFIGURATION STRADDLING CENTERLINES. HARDWARE AND GASKETS REQUIRED TO ASSEMBLE FLANGE CONNECTIONS AT EQUIPMENT INTERFACE ARE TO BE SUPPLIED BY OTHERS. PUMP SUCTION AND DISCHARGE PIPING SHOULD BE DESIGNED IN ACCORDANCE WITH HYDRAULIC INSTITUTE STANDARDS. ALL PIPING MUST BE FULLY SUPPORTED TO PREVENT PIPE STRAIN AT RECIRCULATION PUMP. THE VERTICAL LOCATION OF THE PUMP SUCTION AND DISCHARGE PIPING IS TO BE CONFIRMED PRIOR TO RELEASE TO MANUFACTURE.

7. MTS IS PROVIDING ONE (1) SULZER APT 43-12 RECIRCULATION PUMP WITH 25-HP MOTOR. PUMP IS SIZED TO DELIVER 3660 GPM AT 18 FEET (TDH). REFER TO PUMP INFORMATION LOCATED IN MTS SUBMITTAL DATA AND/OR I.O.M. MANUAL FOR DIMENSIONAL DETAILS AND MATERIAL SPECIFICATIONS. ALL INTERCONNECTING PIPING REQUIRED TO INSTALL THE RECIRCULATION PUMPS IS TO BE SUPPLIED BY OTHERS, UNLESS OTHERWISE NOTED. THE HEAD LOSS ASSOCIATED WITH THE RECIRCULATION PUMP SUCTION AND DISCHARGE PIPING MUST NOT EXCEED 2 FEET.

8. MTS IS PROVIDING TWO (2) KAESER DB236C OMEGA PLUS BLOWER PACKAGES, WITH 30-HP MOTORS. REFER TO BLOWER INFORMATION LOCATED IN MTS SUBMITTAL DATA AND/OR I.O.M. MANUAL FOR DIMENSIONAL DETAILS AND MATERIAL SPECIFICATIONS. ALL INTERCONNECTING PIPING REQUIRED TO INSTALL ROTARY BLOWERS IS TO BE SUPPLIED BY OTHERS. EACH BLOWER IS SIZED TO DELIVER 433 SCFM AT 10.0 PSIG DISCHARGE PRESSURE. THE LINE LOSS ASSOCIATED WITH THE AIR SUPPLY PIPING BETWEEN THE BLOWER DISCHARGE AND BASIN EDGE MUST NOT EXCEED 1.0 PSIG.

9. FW DENOTES A FIELD WRAP JOINT LOCATION. ALL FIELD WRAP JOINTS ARE TO BE INSTALLED BY OTHERS USING FILED WRAP KITS/INSTRUCTIONS SUPPLIED BY MTS. INSTALLATION CONTRACTOR SHOULD CONTACT MTS PRIOR TO THE INSTALLATION OF FIELD WRAPS JOINTS TO INSURE FINISHED JOINTS WILL COMPLY WITH MTS SPECIFICATIONS. MTS WILL REJECT ALL FIELD WRAP JOINTS THAT DO NOT MEET SPECIFICATION DURING FIELD INSPECTION. REPAIR AND/OR REPLACEMENT WILL BE THE INSTALLER'S RESPONSIBILITY.

MTS
23 WALPOLE PARK SOUTH
WALPOLE, MA 02081-2558
PHONE: (508) 660-9150 FAX (508) 660-9151
www.mtsjets.com

SCALE	AS NOTED	DRAWN	DRT
DATE	14 FEB 2013	REV	0

MT4JM-10 JET AERATION SYSTEM
LEACHATE TANK

BRIDGETON	MISSOURI	DWG. NO.	1 OF 3
BRIDGETON LANDFILL		M213116 AMB	

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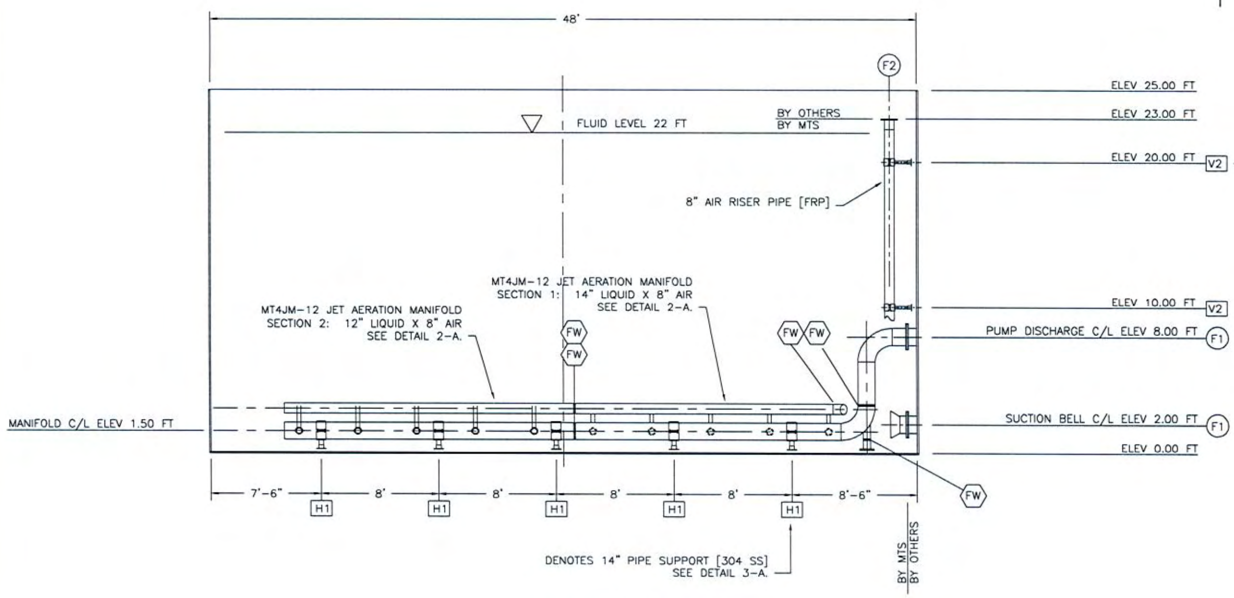
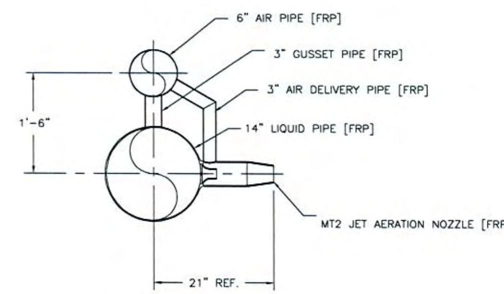
TAG: 0

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED



SECTION A/A
1/8" = 1'-0"



DETAIL 2/A
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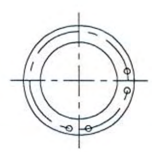

BOLT HOLES ARE TO STRADDLE VERTICAL AND HORIZONTAL CENTER LINES

DETAIL 2/B
NTS

150# ANSI STYLE FLANGE DIMENSION TABLE

FLANGE I.D.	FLANGE SIZE	FLANGE O.D.	FLANGE THICKNESS	NUMBER OF HOLES	HOLES SIZE	BOLT CIRCLE	REMARKS:
F1	14"	21 1/2"	1 1/16"	12	1 1/8"	18 3/4"	14" SUCTION BELL & LIQUID SUPPLY PIPE FLANGES
F2	6"	11 1/2"	5/8"	8	7/8"	9 1/2"	6" AIR PIPE FLANGE

MTS

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DATE 14 FEB 2013		REV	0

MT4JM-10 JET AERATION SYSTEM
LEACHATE TANK

BRIDGETON MISSOURI
BRIDGETON LANDFILL

DWG. NO. 2 OF 3
M213116 AMB

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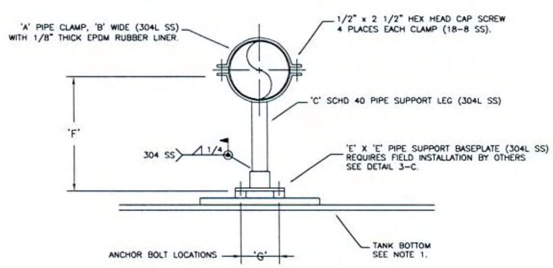
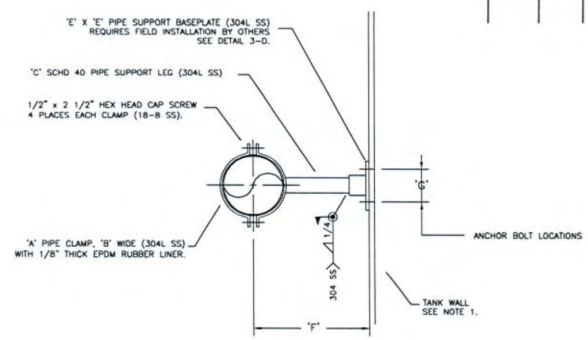
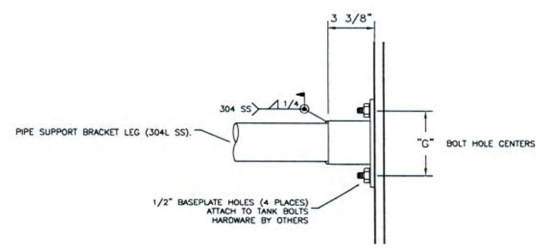


DETAIL 3/A
NTS

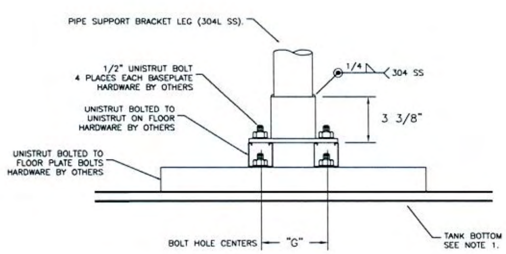


DETAIL 3/B
NTS

PIPE SUPPORT DIMENSION TABLE									
IDENT. NO.	DIM "A"	DIM "B"	DIM "C"	DIM "D"	DIM "E"	DIM "F"	DIM "G"	QTY	LOCATION
H1	14"	8"	3"	1/2"	8"	15"	6"	5	14" MANIFOLD PIPE SUPPORT
V2	6"	6"	2"	1/2"	8"	18"	6"	2	6" AIR PIPE SUPPORT



DETAIL 3/D
NTS



DETAIL 3/C
NTS

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ZONE	REV	DESCRIPTION	DATE	APPROVED

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SCALE	AS NOTED		DRAWN	DRT
DATE	14 FEB 2013		REV	0

MT4JM-10 JET AERATION SYSTEM
LEACHATE TANK

BRIDGETON MISSOURI
BRIDGETON LANDFILL

DWG. NO. 3 OF 3
M213116 AMB

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TAG: 0

FIBERGLASS MATERIAL SPECIFICATION M213116-FRP-SPEC-ISO

Revision:0 *Date: 2/18/2013*

PIPE:

All piping shall be fabricated of structurally sound, filament-wound fiberglass reinforced plastic (FRP) fabricated in accordance with ASTM Spec D-2996-01. The resin is to be a thermosetting Isophthalic polyester resin (Ashland Chemical 7241T15 or equal) with ultra-violet protection. The resin shall remain natural in color (No Pigment Allowed).

Pipe shall have a minimum wall thickness of 0.15" for 4", 6", 10" pipe and 0.21" for 14" pipe.

JET NOZZLES:

The jet nozzles are to be fabricated from hand-lay-up fiberglass reinforced plastic using a Isophthalic polyester resin (Ashland Chemical 7241T15 or equal) with ultra-violet protection. The resin shall be natural in color (No Pigment Allowed) with **silicon carbide**. A 10 to 20 mil "C" veil liner, shall be applied to the inside of all primary and secondary jet nozzles. A nexus liner will also be applied to the inside of all primary and secondary jet nozzle for added abrasion protection. All hand-lay-up will be performed in accordance with the National Bureau of Standards specification PS 15-69.

FLANGES AND FITTINGS:

All flanges and fittings will be fabricated from hand-lay-up fiberglass reinforced plastic using a Isophthalic polyester resin with ultra-violet protection. The resin shall be natural in color (No Pigment Allowed). A 10 to 20 mil "C" veil liner shall be applied to the inside and outside of all flanges and fittings. A nexus liner will be applied above the inside 10 to 20 mil "C" veil liner on all flanges and fittings for added abrasion protection. All hand-lay-up will be performed in accordance with the National Bureau of Standards specification PS 15-69. All flange connections are to be flat face ANSI 150# style configuration straddling centerlines, unless noted otherwise.

CONSTRUCTION AND MANUFACTURING:

All sharp edges, cuts and burrs are to be sanded and resin coated to seal exposed edges. All flange connections are to straddle the vertical and horizontal centerlines of the equipment in the installed position. Whenever possible, flange and fitting to pipe joints are to be hand-layup and resin coated internally so there are no internal seams. All external areas of the fiberglass equipment are to be resin coated after completion of all assembly and hand-lay-up procedures.

TAG: O

FIBERGLASS MATERIAL SPECIFICATION M213116-FRP-SPEC-ISO

PHYSICAL PROPERTIES OF PIPE:

Hand-Lay-Up		Filament Winding	
Density (lb./cu. In.)	0.050 to 0.061	Density (lb./cu. In.)	0.064 to 0.070
Specific Gravity	1.3 to 1.7	Specific Gravity	1.7 - 2.0
Tensile Strength ASTM D.638	9,000 - 15,000	Tensile Modulus in Fiber Direction	4.5×10^6 psi
Flexural Strength ASTM D.790	16,000 – 22,000 psi	Tensile Strength in Fiber Direction	59,000 psi
Flexural Modulus ASTM D.790	$0.8 \times 10^6 - 1.0 \times 10^6$	Typical Winding Angle	54° 45°
Compressive Strength Edge ASTM D.695	18,000 – 24,000 psi	Compressive Strength	31,500 psi
Impact Strength IZOD ASTM D.256	30 – 40 ft. – lbs.	Impact	40 – 50 ft./lb.
Machinability	Good	Machinability	Good
Barcol Hardness	25 – 40	Barcol Hardness	25 – 40
Rockwell "M" Scale ASTM D.785	90 - 105		

Electrical Properties		Thermal Properties	
Dielectric Strength at 20° C (volts/mil) (step–by–step method)	450 - 500	Thermal Conductivity (BTU/sq. ft./hr./°F/in.) at 212° F	1.2 – 2.0
Electricity Resistivity	Infinite	Linear Co-efficient of Thermal Expansion (in./in/ deg. F) at 32 - 212° F	Hand Layup $15 - 20 \times 10^{-6}$ Filament Wound $6 - 10 \times 10^{-6}$
Dielectric Constant	3 - 4	Heat Distortion Temperature at 264 psi ASTM D.648	120° - 180° C

TAG: P

Engineered Flexible Products, Inc.
5331 Quam Ave. N.E., St. Michael, MN 55376
Toll Free: 1-877-769-8262 Voice: 763-201-2151 Fax: 763-201-2134

Rubber Expansion Joints
→ Single Sphere 301
Double Sphere 302
Spool Type 200
Double Sphere Union 303
Concentric Reducer 201RC
PTFE Expansion Joints
440 Series
Metal Expansion Joints
Metal Expansion Joints
Low Corrugation
High Corrugation
Externally Pressurized

Single Sphere 301 Series

The Single Sphere joint/flexible connector provides up to 225 PSI and temperatures up to 230° F*! It protects your pumps and piping system from changes in temperature and pressure, while reducing vibration.

An extremely economical and resilient expansion joint/connector, the Single Sphere also helps control pulsation shocks and noise transmission. Its spherical shape reduces the force exerted on pipe lines and equipment.

It has a self-cleaning arch and solid plate flanges that are tapped or drilled to mate with 150# or 300# companion flanges. Flanges can be rotated for easy installation and grip the sealing area for an extremely tight connection.

Constructed of neoprene and nylon, it has bias-ply tire cord for strength, and is molded into a dense, uniform body. Other materials are also available. Refer to the charts below.

EPDM body with 150# drilled flanges provides up to 225 PSI and temperatures up to 230° F*.

→ Neoprene body with 150# drilled flanges provides up to 225 PSI and temperatures up to 230° F*.

Butyl body with 150# drilled flanges provides up to 225 PSI and temperatures up to 230° F*.

Nitrile body with 150# drilled flanges provides up to 225 PSI and temperatures up to 230° F*.

*Maximum Operating Temperature	
Temperature (°F)	Maximum Pressure PSI
	12" & Smaller
170°	225
180°	200
190°	175
200°	150
210°	125
220°	100
230°	75

TAG: P

*Contact factory for other elastomers. Not for steam applications.

EPDM body with 150# drilled flanges provides up to 225 PSI and temperatures up to 230° F*

MODEL #	JOINT SIZE I.D. (in.)	FACE-TO-FACE (in.)	MOVEMENT CAPABILITY			ANGULAR (degrees)	GROSS WT. (lbs.)
			COMPRESSION (in.)	ELONGATION (in.)	LATERAL (in.)		
301EE0200	2	6	1/2	3/8	1/2	20	8
301EE0250	2 1/2	6	1/2	3/8	1/2	17	13
301EE0300	3	6	1/2	3/8	1/2	14	14
301EE0400	4	6	5/8	3/8	1/2	14	18
301EE0500	5	6	5/8	3/8	1/2	11	23
301EE0600	6	6	5/8	3/8	1/2	9	28
301EE0800	8	6	5/8	3/8	1/2	7	40
301EE1000	10	8	3/4	1/2	3/4	7	57
301EE1200	12	8	3/4	1/2	3/4	6	83

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Neoprene body with 150# drilled flanges provides up to 225 PSI and temperatures up to 230° F*

MODEL #	JOINT SIZE I.D. (in.)	FACE-TO-FACE (in.)	MOVEMENT CAPABILITY			ANGULAR (degrees)	GROSS WT. (lbs.)
			COMPRESSION (in.)	ELONGATION (in.)	LATERAL (in.)		
301NN0200	2	6	1/2	3/8	1/2	20	8
301NN0250	2 1/2	6	1/2	3/8	1/2	17	13
301NN0300	3	6	1/2	3/8	1/2	14	14
301NN0400	4	6	5/8	3/8	1/2	14	18
301NN0500	5	6	5/8	3/8	1/2	11	23
301NN0600	6	6	5/8	3/8	1/2	9	28
301NN0800	8	6	5/8	3/8	1/2	7	40
301NN1000	10	8	3/4	1/2	3/4	7	57
→ 301NN1200	12	8	3/4	1/2	3/4	6	83

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TAG: P

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Butyl body with 150# drilled flanges provides up to 225 PSI and temperatures up to 230° F*

MODEL #	JOINT SIZE I.D. (in.)	FACE-TO-FACE (in.)	MOVEMENT CAPABILITY			ANGULAR (degrees)	GROSS WT. (lbs.)
			COMPRESSION (in.)	ELONGATION (in.)	LATERAL (in.)		
301BB0200	2	6	1/2	3/8	1/2	20	8
301BB0250	2 1/2	6	1/2	3/8	1/2	17	13
301BB0300	3	6	1/2	3/8	1/2	14	14
301BB0400	4	6	5/8	3/8	1/2	14	18
301BB0500	5	6	5/8	3/8	1/2	11	23
301BB0600	6	6	5/8	3/8	1/2	9	28
301BB0800	8	6	5/8	3/8	1/2	7	40
301BB1000	10	8	3/4	1/2	3/4	7	57
301BB1200	12	8	3/4	1/2	3/4	6	83

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Nitrile body with 150# drilled flanges provides up to 225 PSI at temperatures up to 230° F*

MODEL #	JOINT SIZE I.D. (in.)	FACE-TO-FACE (in.)	MOVEMENT CAPABILITY			ANGULAR (degrees)	GROSS WT. (lbs.)
			COMPRESSION (in.)	ELONGATION (in.)	LATERAL (in.)		
301NP0200	2	6	1/2	3/8	1/2	20	8
301NP0250	2 1/2	6	1/2	3/8	1/2	17	13
301NP0300	3	6	1/2	3/8	1/2	14	14
301NP0400	4	6	5/8	3/8	1/2	14	18
301NP0500	5	6	5/8	3/8	1/2	11	23
301NP0600	6	6	5/8	3/8	1/2	9	28
301NP0800	8	6	5/8	3/8	1/2	7	40
301NP1000	10	8	3/4	1/2	3/4	7	57
301NP1200	12	8	3/4	1/2	3/4	6	83

TAG: P

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TAG: R

INDUSTRIAL GAUGES

700 Series

Field Liquid Fillable • Stainless Steel Case

700SS shown

- 2½", 4", 6" Dial Sizes
- ±1.0% Accuracy
- Stainless Steel Case
- Field Liquid Fillable

The Trerice 700 Series Industrial Gauge is designed for the varying needs of the world's industrial applications. This gauge has a stainless steel case and ring. Its sturdy interior design and field liquid-fill capability (no kit required) provide the durability and accuracy required for industrial process environments. Available wetted parts are bronze tube with brass socket, stainless steel tube and socket, or Monel tube and socket.

- Optional features and case style variations available: Please consult the Options & Accessories Section for details.
- For correct use and application of all pressure gauges, please refer to: Pressure Gauge Standard ASME B40.100.

700LFSS4002LA090

HOW TO ORDER

Sample Order Number: 700LFSS 25 02 B A 140

Model	Dial Size	Connection Size	Connection Location	Units of Measure	Range Code
700B 700LFB 700SS 700LFSS 700M 700LFM	25 2½"* 40 4" 60 6"	02 ¼ NPT 04 ½ NPT	L Lower B Back	A psi D psi/kPa	See Standard Ranges

* Not available with Monel wetted parts or with ½ NPT connection.

Specifications

Models		Wetted Parts
700B **700LFB**	(dry) (liquid-filled)	Bronze tube, brass socket
700SS **700LFSS**	(dry) (liquid-filled)	316 stainless steel tube and socket
700M **700LFM**	(dry) (liquid-filled)	Monel tube and socket (meets NACE MR 01.75)

Dial Sizes	2½", 4", 6"
Fill	Glycerine. Other fills available. See Options & Accessories.
Movement	Stainless steel
Connection	2½" Dial Size: Lower male or center back male, ¼ NPT 4", 6" Dial Size: Lower male or lower back male, ¼ or ½ NPT
Case	304 stainless steel, satin finished, stem-mounted flangeless
Ring	Bayonet type, 304 stainless steel
Window	Laminated safety glass
Pointer	2½" Dial Size: Adjustable, black finished 4", 6", Dial Size: Micro adjustable, black finished
Dial Face	Aluminum, white background with black graduations and markings
Accuracy	±1.0% Full Scale, ASME B40.100 Grade 1A

Maximum Temperature
700SS, 700M:
250°F (121°C)
700B, 700LFB, 700LFSS, 700LFM:
150°F (65°C)

Approximate Shipping Weight
700B, 700SS 2½" Dial Size:
0.4 lbs [0.18 kg]
700LFB, 700LFSS, 700LFM
2½" Dial Size:
0.5 lbs [0.23 kg]
700B, 700SS, 700M 4" Dial Size:
1.3 lbs [0.59 kg]
700LFB, 700LFSS, 700LFM
4" Dial Size:
2.1 lbs [0.95 kg]
700B, 700SS, 700M 6" Dial Size:
2.0 lbs [0.91 kg]
700LFB, 700LFSS, 700LFM
6" Dial Size:
3.8 lbs [1.72 kg]

12950 W. Eight Mile Road • Oak Park, MI 48237-3288 • TEL:248/399-8000 • FAX: 248/399-7246 • www.TRERICE.com

TAG: R

700 Series

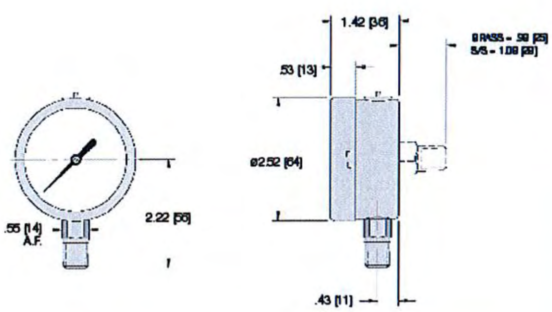
Field Liquid Fillable • Stainless Steel Case

INDUSTRIAL GAUGES

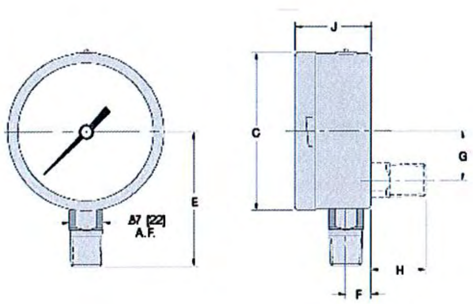
All dimensions are nominal. Dimensions in [ ] are in millimeters.

Dial Size	Material	C	E	F	G	H	J
4"	Brass	3.98 [101]	3.39 [86]	0.94 [24]	1.04 [27]	1.44 [37]	2.24 [57]
	SS	3.98 [101]	3.39 [86]	0.94 [24]	1.36 [35]	1.38 [35]	2.24 [57]
6"	Brass	6.34 [161]	4.57 [116]	0.69 [18]	1.04 [27]	1.44 [37]	1.97 [50]
	SS	6.34 [161]	4.57 [116]	0.69 [18]	1.36 [35]	1.38 [35]	1.97 [50]

$2\frac{1}{2}$"



4" & 6"



Standard Ranges

psi Ranges (A)			
All Sizes			
Range Code	**Specific Range (psi)**	**Figure Intervals**	**Minor Divisions**
010	30" Hg to 0	5	0.5
020	30" Hg to 15 psi	10/5	0.5/0.5
030	30" Hg to 30 psi	10/5	1/1
040	30" Hg to 60 psi	10/10	2/1
050	30" Hg to 100 psi	30/20	2/2
060	30" Hg to 150 psi	30/20	5/2
070	30" Hg to 300 psi	30/50	5/5
080	0 to 15 psi	3	0.2
090	0 to 30 psi	5	0.5
100	0 to 60 psi	10	1
110	0 to 100 psi	10	1
120	0 to 160 psi	20	2
130	0 to 200 psi	20	2
140	0 to 300 psi	50	5
150	0 to 400 psi	50	5
160	0 to 600 psi	100	10
Ranges over 600 psi are not available in 700B or 700LFB in 4" or 6" Dial Sizes.			
180	0 to 1000 psi	100	20
190	0 to 1500 psi	300	20
200	0 to 2000 psi	200	20
210	0 to 3000 psi	500	50
220	0 to 5000 psi	1000	100
230	0 to 10,000 psi	2000	200
Ranges over 10,000 psi are ONLY available in 700SS or 700LFSS in 4" or 6" Dial Sizes.			
240	0 to 15,000 psi	2000	200

For dual scale ranges, specify the appropriate ***Units of Measure: D*** *(psi/kPa) followed by the corresponding* ***A*** *(psi)* ***Range Code****. Other pressure ranges are also available including: Altitude, Ammonia, Refrigerant and Receiver. Consult Special Application Ranges section or factory for availability.*

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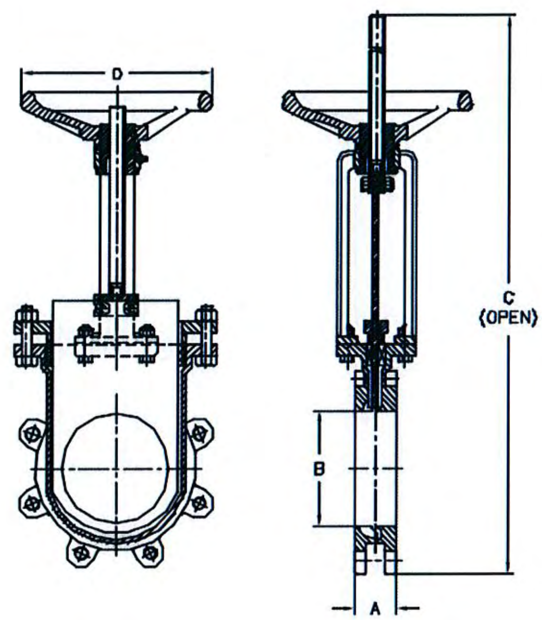
TAG: Q

Stainless Steel Knife Gate

TOPWORKS DETAIL
16" TO 48"

Model 60C - CF8 (304SS)
Model 60F - CF8M (316SS)
Model 60G - CG8M (317SS)



PART NAME	MATERIALS A 351-CF8	MATERIALS A 351-CF8M	MATERIALS A 351-CG8M
BODY	A 351-CF8	A 351-CF8M	A 351-CG8M
GATE	SS 304	SS 316	SS 317
YOKE	A 351-CF8	A 351-CF8	A 351-CF8
STEM	SS 304	SS 304	SS 304
GLAND	A 351-CF8	A 351-CF8M	A 351-CG8M
GLAND PACKING	PTFE	PTFE	PTFE
STEM NUT	AL BRONZE	AL BRONZE	AL BRONZE
HAND WHEEL	A 216-WCB	A 216-WCB	A 216-WCB

SIZE	INCH	2	2½	3	4	5	6	8	10	12	14	16	18	20	24	30	36
	MM	50	65	80	100	127	150	200	250	300	350	400	450	500	600	762	915
A	INCH	1.88	2.0	2.0	2.0	2.25	2.25	2.75	2.75	3.0	3.0	3.5	3.5	4.5	4.5	5.4	6.3
	MM	47.8	50.8	50.8	50.8	57.2	57.2	69.9	69.9	76.2	76.2	88.9	88.9	114.3	114.3	137.1	160.0
B	INCH	2.0	2.5	3.0	4.0	5.0	6.0	8.0	10.0	12.0	13.25	15.25	17.25	19.25	23.25	29.25	35.25
	MM	50.8	63.5	76.2	101.6	127.0	152.4	203.2	254.0	304.8	336.5	387.3	438.1	488.9	590.5	742.9	895.3
C	INCH	15.5	19.3	19.3	23.0	26.2	29.25	36.25	44.0	51.0	57.0	66.0	73.0	79.5	93.0	131.9	151.9
	MM	393.7	490.2	490.2	584.2	665.4	743.0	920.8	1117.6	1295.4	1447.8	1676.0	1854.0	2019.3	2362.2	3350.4	3858.2
D	INCH	8.0	8.0	8.0	10.0	10.0	12.0	14.0	16.0	16.7	18.9	18.9	20.9	20.9	24.8	36.7	36.7
	MM	203.0	203.0	203.0	254.0	254.0	304.8	355.6	406.4	424.1	480.0	480.0	530.8	530.8	630.0	932.1	932.1
WGT	LBS	22		31	38	47	59	84	124	170	201	294	372	503	671	1810	2252
	KGS	10		14	18	22	27	38	56	77	91	133	168	228	305	820	1020

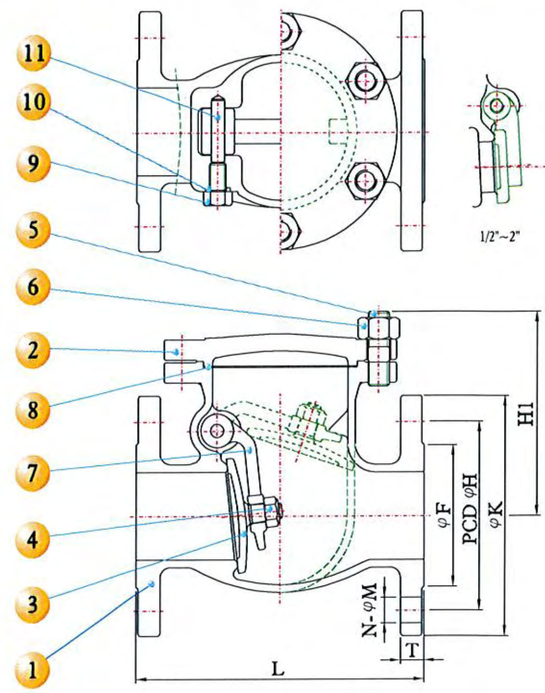
Davis Valve

TAG: S

TC-CKF-ANSI 150LB FLANGE END SWING CHECK VALVE

DESIGN FEATURES:

- Swing Type
- Body: ASTM A 351 Gr.CF8M
- Disc: ASTM A 351 Gr.CF8M
- End Type: Flange End
- Face to Face: ANSI B16.10
- Flange Dimensions: ANSI B16.5 150
- Wall Thickness:ANSI B16.34
- TEST STANDARD:API 598
- Pressure/ Temperature ratings in accordance with ASME/ASTM B16.34



MATERIALS LIST

NO.	PART NAME	MATERIAL	Q'TY
1	BODY	ASTM A351 Gr.CF8M	1
2	COVER	ASTM A351 Gr.CF8M	1
3	DISC	ASTM A351 Gr.CF8M	1
4	DISC NUT	ASTM A194 Gr.8	1
5	COVER BOLT	ASTM A193 Gr.B8	4 - 12
6	COVER NUT	ASTM A194 Gr.8	4 - 12
7	ARM	ASTM A351 Gr.CF8M	1
8	GASKET	PTFE	1
9	PLUG	SS316	1
10	PLUG GASKET	SS304	1
11	HINGE PIN	SS316	1

DIMENSIONS

SIZE		L		H1		K		H		F		T		M		N	Cv	Weight	
inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm		Factor	Kg	Lb
1/2"	15	4.25	108	2.87	73	3.50	89	2.38	60.5	1.38	35	0.44	11.2	0.62	15.7	4	9.5	2.30	5.07
3/4"	20	4.63	117	2.95	75	3.86	98	2.76	70.0	1.69	43	0.44	11.2	0.62	15.7	4	16	2.80	6.17
1"	25	5.00	127	3.15	80	4.25	108	3.13	79.5	2.01	51	0.44	11.2	0.62	15.7	4	27	4.30	9.47
1 1/2"	40	6.50	165	4.37	111	5.00	127	3.88	98.5	2.87	73	0.56	14.3	0.62	15.7	4	51	6.50	14.32
2"	50	8.00	203	4.84	123	5.98	152	4.74	120.5	3.62	92	0.63	15.9	0.75	19.0	4	70	9.30	20.48
2 1/2"	65	8.50	216	5.28	134	7.01	178	5.49	139.5	4.13	105	0.69	17.5	0.75	19.0	4	120	15.00	33.04
3"	80	9.50	241	5.83	148	7.48	190	6.00	152.5	5.00	127	0.75	19.1	0.75	19.0	4	170	18.00	39.65
4"	100	11.50	292	6.22	158	9.02	229	7.50	190.5	6.18	157	0.94	23.9	0.75	19.0	8	250	26.80	59.03
5"	125	13.00	330	7.56	192	10.00	254	8.50	216.0	7.32	186	0.94	23.9	0.88	22.3	8	470	35.00	77.09
6"	150	14.00	356	8.78	223	10.98	279	9.51	241.5	8.50	216	1.00	25.4	0.88	22.3	8	1100	49.30	108.59
8"	200	19.50	495	11.14	283	13.50	343	11.75	298.5	10.63	270	1.13	28.6	0.88	22.3	8	2000	78.00	171.81
10"	250	24.50	622	12.52	318	15.98	406	14.25	362.0	12.76	324	1.19	30.2	1.00	25.4	12	3300	138.00	303.96
12"	300	27.50	698	14.06	357	19.02	483	17.01	432.0	15.00	381	1.25	31.8	1.00	25.4	12	4900	205.00	451.54

TAG: T

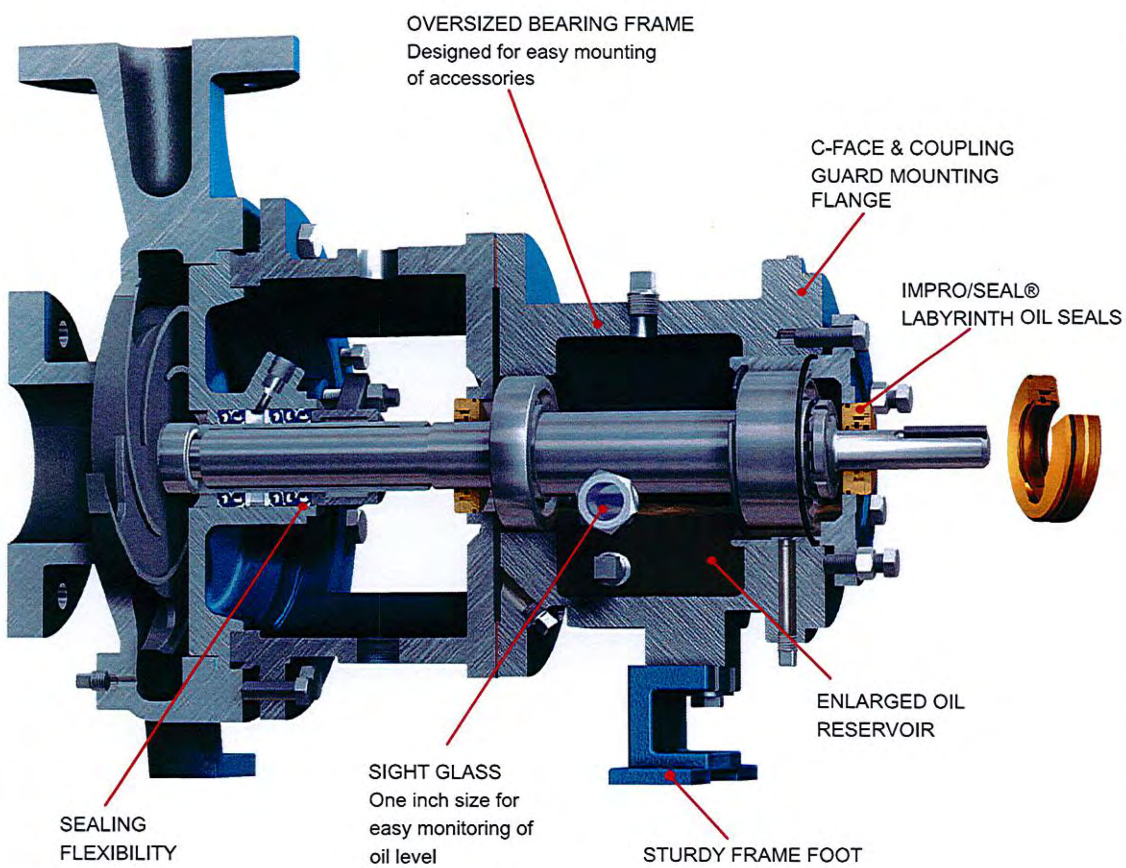
SUMMIT™

ANSI Dimension Model 2196

SUMMIT™
PUMP

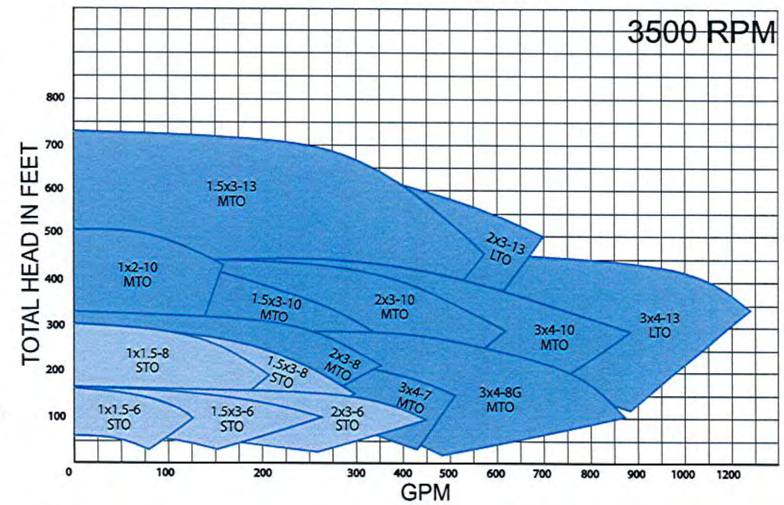
TAG: T

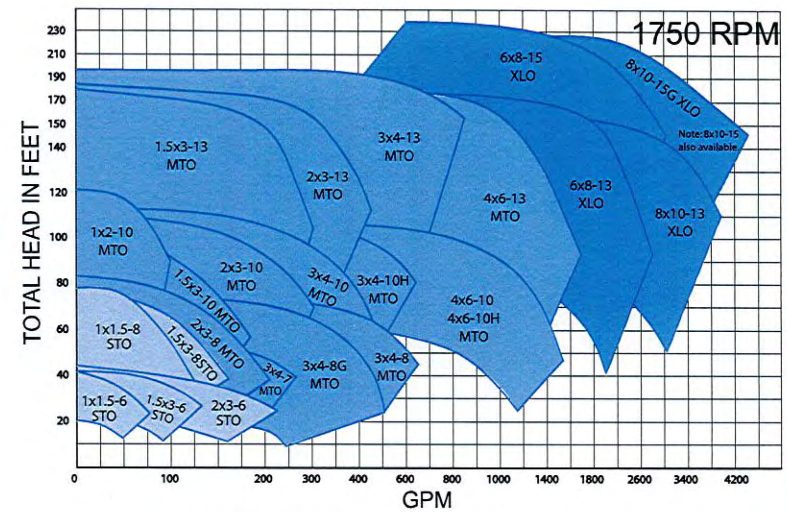
ANSI Dimension Model 2196



OPTIONAL: FINNED-TUBE OIL COOLER Can be installed in field

Performance / Sizing Charts

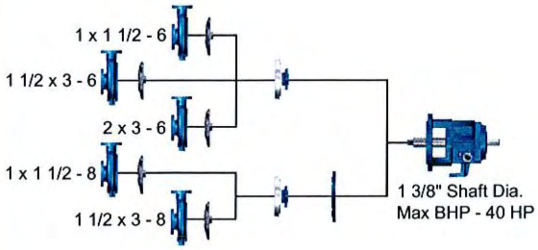


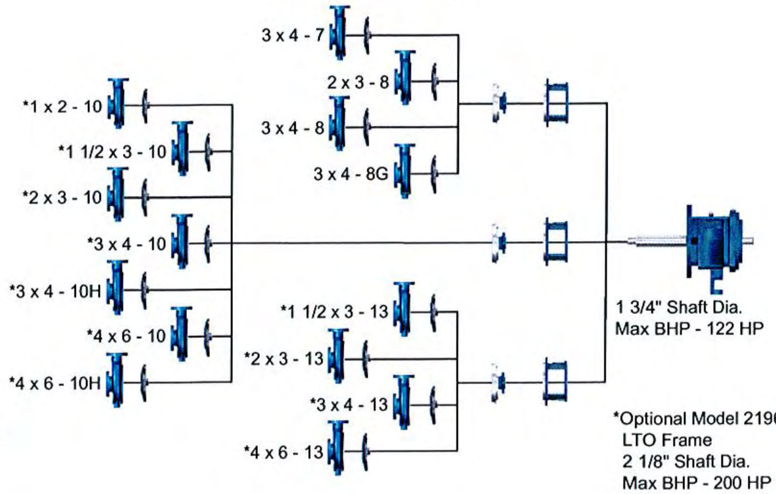


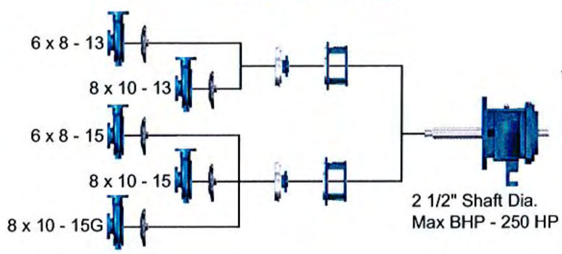
Note: Performance & Sizing curves are provided for reference only.
For specific information, contact your distributor or the manufacturer.

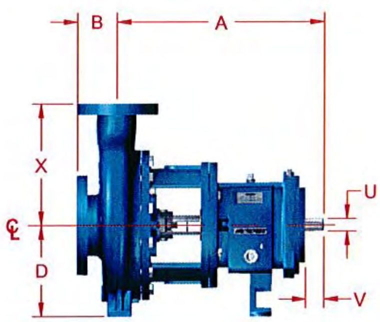
TAG: T

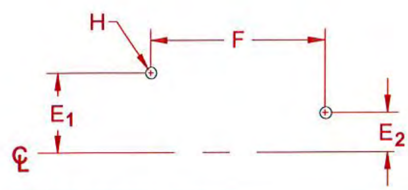
Model 2196 Interchangeability and Dimensional Data











Pump Frame	ANSI	Size			Pump Dimensions											
										Foot Pattern				Shaft		
		DIS	SUC	IMP	X	D	B	A	SP	E1	E2	F	H	U	KEYWAY	V
STO	AA	1	1.5	6	6 1/2	5 1/4	4	13 1/2	3 3/4	3	0	7 1/4	5/8	.875	3/16 X 3/32	2
	AB	1.5	3	6												
		2	3	6												
	AA	1	1.5	8												
	AB	1.5	3	8												
	A60	2	3	8	9 1/2	8 1/4	4	19 1/2	3 3/4	4 7/8	3 5/8	12 1/2	5/8	MTO 1.125	MTO 1/4X1/8	2 5/8
	A70	3	4	8	11											
MTO	A70	3	4	8G	11											
	A05	1	2	10	8 1/2											
	A50	1.5	3	10	8 1/2											
	A60	2	3	10	9 1/2											
or	A70	3	4	10	11											
	A40	3	4	10H	12 1/2	10										
	A80	4	6	10	13 1/2											
	A80	4	6	10H	13 1/2											
LTO	A20	1.5	3	13	10 1/2									LTO 1.875	LTO 1/2X1/4	
	A30	2	3	13	11 1/2											
	A40	3	4	13	12 1/2											
	A80	4	6	13	13 1/2											
XLO	A90	6	8	13	16	14 1/2	6	27 7/8	5 1/4	8	4 1/2	18 3/4	7/8	2.375	5/8 X 5/16	4
	A100	8	10	13	18											
	A110	6	8	15	18											
	A120	8	10	15	19											
	A120	8	10	15G	19											

TAG: T

CERTIFICATION DATA SHEET

Model#:	213TTFW14045 AA	**WINDING#:**	K2134189 NONE 1
CONN. DIAGRAM:	A-EE7308	**ASSEMBLY:**	F1/F2 CAPABLE
OUTLINE:	A-SS86634-965		

TYPICAL MOTOR PERFORMANCE DATA

HP	KW	SYNC. RPM	F.L. RPM	FRAME	ENCLOSURE	KVA CODE	DESIGN
7 1/2&5	5.6&3.7	1800	1760&1470	213TC	TEFC	H	B

PH	Hz	VOLTS	FL AMPS	START TYPE	DUTY	INSL	S.F	AMB	ELEVATION
3	60/50	230/460#190/ 380	20/10&17/8.5	ACROSS THE LINE	CONTINUOU S	F4	1.15/1.15	40	3300

FULL LOAD EFF: 89.5&89.5	3/4 LOAD EFF: 89.5	1/2 LOAD EFF: 88.5	GTD. EFF	ELEC. TYPE	NO LOAD AMPS
FULL LOAD PF: 78&75	3/4 LOAD PF: 73	1/2 LOAD PF: 61	87.5	SQ CAGE IND RUN	9.6 / 4.8

F.L. TORQUE	LOCKED ROTOR AMPS	L.R. TORQUE	B.D. TORQUE	F.L. RISE
22.5 LB-FT	124 / 62	48.5 LB-FT 216	69.5 LB-FT 309	57

SOUND PRESSURE @ 3 FT.	SOUND POWER	ROTOR WK^2	MAX. WK^2	SAFE STALL TIME	STARTS /HOUR	APPROX. MOTOR WGT
72 dBA	82 dBA	0.7 LB-FT^2	82 LB-FT^2	20 SEC.	2	115 LBS.

*** SUPPLEMENTAL INFORMATION ***

DE BRACKET TYPE	ODE BRACKET TYPE	MOUNT TYPE	ORIENTATION	SEVERE DUTY	HAZARDOUS LOCATION	DRIP COVER	SCREENS	PAINT
C-FACE	STANDARD	ROUND	HORIZONTAL	FALSE	NONE	FALSE	NONE	STANDARD

BEARINGS		GREASE	SHAFT TYPE	SPECIAL DE	SPECIAL ODE	SHAFT MATERIAL	FRAME MATERIAL
DE	OPE						
BALL	BALL	STANDARD	T	NONE	NONE	STANDARD	ROLLED STEEL
6309	6206						

THERMO-PROTECTORS				THERMISTORS	CONTROL	SPACE /n HEATERS
THERMOSTATS	PROTECTORS	WDG RTDs	BRG RTDs			
NONE	NOT	NONE	NONE	NONE	FALSE	NONE VOLTS

*
N
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E
S
*

INVERTER TORQUE: NONE
INV. HP SPEED RANGE: NONE

ENCODER: NONE
NONE NONE
NONE NONE PPR

BRAKE: NONE NONE
NONE P/N NONE
NONE NONE
- FT-LB NONE V NONE Hz

DATE: 03/27/2013 06:04:02 PM
FORM 3531 REV.3 02/07/99
** Subject to change without notice.

SS86634

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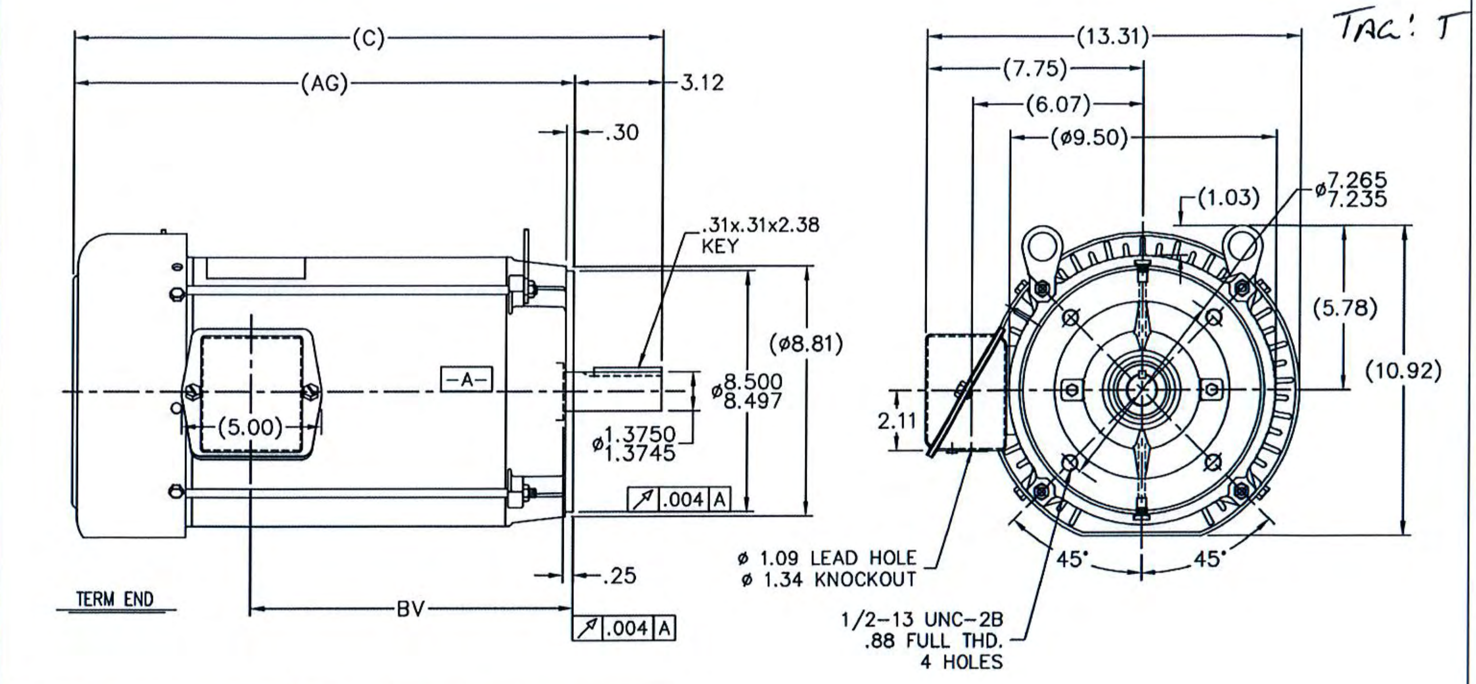

DASH	FR.	C	AG	BV	MOUNTING
965	213T	19.46	16.34	9.96	
1115	213/15T	20.96	17.84	11.46	
1240	213/15T	22.21	19.09	12.71	

NOTES:
1. NAMEPLATE TO BE READ FROM C'BOX SIDE OF MOTOR.
2. BOX CAN BE MOUNTED IN 90° STEPS.

NO.	REVISION		BY & DATE	CHK
5	REDRAWN IN AUTOCAD		TAT 06-29-2004	ML
4	UPDATED C' BOX GEOMETRY	CN 28425	DRS 01-31-2000	
3	REMOVED GROUND SCREW FROM FRAME	CN 24453	DRS 10-01-1997	
2	REMOVED NOTE: BOX CAN BE MOUNTED ON OPPOSITE SIDE OF MOTOR	CN 23925-459	MJD 09-02-1997	

TOLERANCES UNLESS SPECIFIED	
DEC.	INCHES
.X	±.1
.XX	±.03
.XXX	±.005
.XXXX	±.0005
ANG	±7'30"

MARATHON ELECTRIC

TITLE OUTLINE
210T FR. -BB -TS -TEFC -R/S -C' FACE

MAT'L.

FINISH

DRAWN DRS 10-02-1996
CHK ML 10-03-1996
APPD DN 10-04-1996
SCALE 1=5
REF
FMF
PREV

RFP
DIST LB

CAD FILE ss86634

SIZE A | DRAWING NO. SS86634 | PAGE OF | REV. 5

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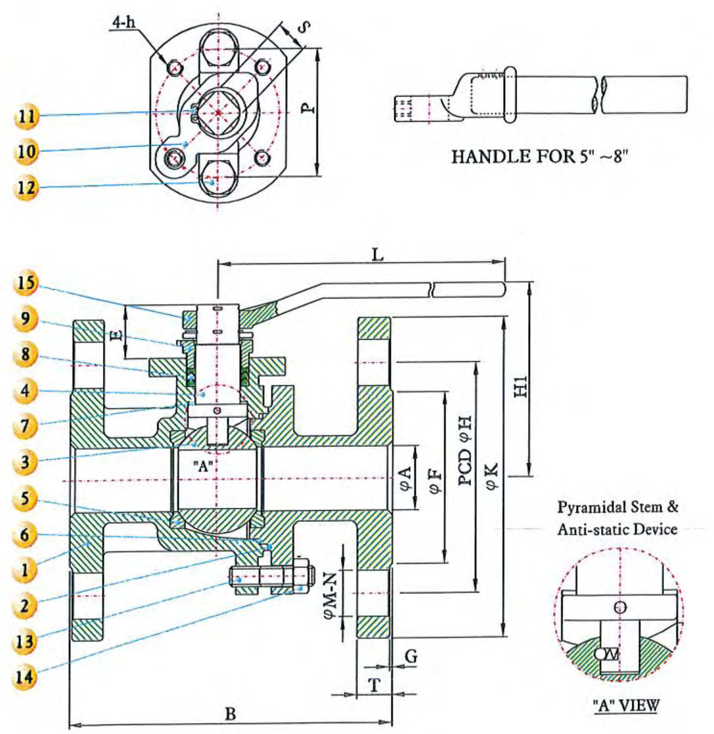
TAG: U

TC-0802A 2PC 150# FULL PORT BALL VALVE, FLANGED

DESIGN FEATURES:

- Steam rating:150 psi WSP
- ISO 5211 Actuator Mounting Pad
- Blow-out-proof stem design
- Anti - Static Device
- Body: ASTM A351 Gr.CF8M
- Ball: SS316
- Stem: SS316
- ME-PTFE SEAL KITS: REPLACES PTFE, RPTFE AND FPA
  LOW DEFORMATION UNDER LOAD
  LOW PERMEATION
- Temperature Rating: -45.5°C (-50°F) to 246°C (475°F)
- Face to Face: ANSI B16.10
- Flange Dimensions: ANSI B16.5 150#
- TEST STANDARD: API 598
- Vacuum Service to 29" Hg

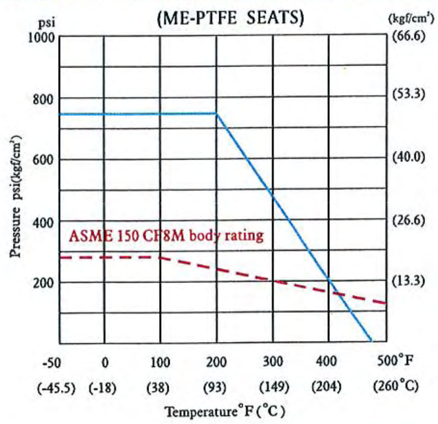


MATERIALS LIST

NO.	PART NAME	MATERIAL	QTY
1	BODY	ASTM A351 Gr.CF8M	1
2	CAP	ASTM A351 Gr.CF8M	1
3	BALL	ASTM A351 Gr.CF8M	1
4	STEM	ASTM A276 Gr.316	1
5	SEAT	ME-PTFE	2
6	GASKET	ME-PTFE	1
7	THRUST WASHER	ME-PTFE	1
8	PACKING	ME-PTFE	1
9	GLAND	ASTM A351 Gr.CF8	1
10	STOPPER	SS304	1
11	SNAP RING	SS304	2
12	GLAND BOLT	ASTM A193 Gr.B8	2
13	STUD BOLT	ASTM A193 Gr.B8	4~12
14	SET NUT	ASTM A194 Gr.8M	4~12
15	HANDLE	ASTM A536 Gr.B 65-45-12	1

ME-PTFE IS Molecularly Enhanced PTFE

PRESSURE TEMPERATURE RATINGS



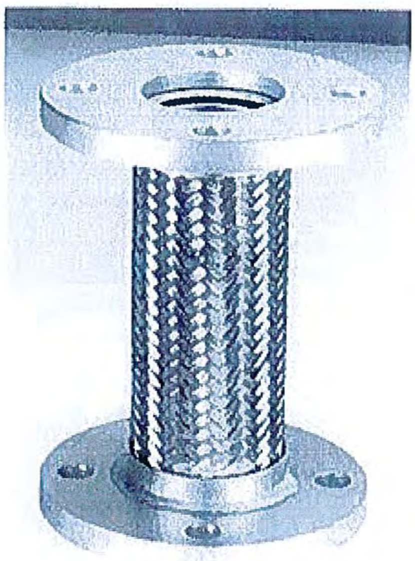
DIMENSIONS

SIZE		A		B		E		F		G		H		K	
inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
1/2"	15	0.59	15.0	4.25	107.9	0.98	25.0	1.38	35.0	0.06	1.6	2.38	60.4	3.50	88.9
3/4"	20	0.79	20.0	4.62	117.3	1.02	26.0	1.69	42.9	0.06	1.6	2.75	69.8	3.88	98.5
1"	25	0.98	25.0	5.00	127.0	1.24	31.5	2.00	50.8	0.06	1.6	3.12	79.2	4.25	107.9
1 1/4"	32	1.26	32.0	5.50	139.7	1.24	31.5	2.50	63.5	0.06	1.6	3.50	88.9	4.62	117.3
1 1/2"	40	1.50	38.0	6.50	165.1	1.65	42.0	2.88	73.1	0.06	1.6	3.88	98.5	5.00	127.0
2"	50	1.97	50.0	7.00	177.8	1.65	42.0	3.62	91.9	0.06	1.6	4.75	120.6	6.00	152.4
2 1/2"	65	2.56	65.0	7.50	190.5	1.65	42.0	4.12	104.6	0.06	1.6	5.50	139.7	7.00	177.8
3"	80	3.15	80.0	8.00	203.2	2.20	56.0	5.00	127.0	0.06	1.6	6.00	152.4	7.50	190.5
4"	100	3.94	100.0	9.00	228.6	2.20	56.0	6.19	157.2	0.06	1.6	7.50	190.5	9.00	228.6
6"	150	5.91	150.0	15.50	393.7	2.64	67.0	8.50	215.9	0.06	1.6	9.50	241.3	11.00	279.4
8"	200	7.87	200.0	18.00	457.2	2.62	66.5	10.62	269.7	0.06	1.6	11.75	298.4	13.50	342.9

SIZE		T		M		N	P		S		L		H1		h	Cv	Weight	
inch	mm	inch	mm	inch	mm		inch	mm	inch	mm	inch	mm	inch	mm		Factor	Kg	Lb
1/2"	15	0.44	11.2	0.62	15.7	4	1.65	42	0.43	11	5.18	131.5	2.91	73.8	M5*P0.8	26	2.00	4.41
3/4"	20	0.44	11.2	0.62	15.7	4	1.65	42	0.43	11	5.18	131.5	2.94	74.8	M5*P0.8	55	2.50	5.51
1"	25	0.44	11.2	0.62	15.7	4	1.97	50	0.55	14	6.42	163.0	3.44	87.4	M6*P1.0	110	3.00	6.61
1 1/4"	32	0.50	12.7	0.62	15.7	4	1.97	50	0.55	14	6.42	163.0	3.63	92.2	M6*P1.0	180	4.50	9.91
1 1/2"	40	0.56	14.2	0.62	15.7	4	2.76	70	0.67	17	9.13	232.0	4.76	121.0	M8*P1.25	270	6.00	13.22
2"	50	0.62	15.7	0.75	19.0	4	2.76	70	0.67	17	9.13	232.0	5.08	129.0	M8*P1.25	500	8.50	18.72
2 1/2"	65	0.69	17.5	0.75	19.0	4	2.76	70	0.67	17	9.13	232.0	5.55	141.0	M8*P1.25	800	13.00	28.63
3"	80	0.75	19.0	0.75	19.0	4	4.02	102	0.87	22	12.87	327.0	6.52	165.7	M10*P1.5	1150	18.00	39.65
4"	100	0.94	23.8	0.75	19.0	8	4.02	102	0.87	22	12.87	327.0	7.11	180.7	M10*P1.5	2120	28.00	61.67
6"	150	1.00	25.4	0.88	22.3	8	4.92	125	1.06	27	42.20	1072.0	9.95	252.8	M12*P1.75	5100	75.00	165.20
8"	200	1.12	28.4	0.88	22.3	8	5.51	140	1.30	33	42.52	1080.0	11.73	297.9	M16*P2.0	9400	110.00	242.29

TAG! √

Engineered Flexible Products, Inc.
5331 Quam Ave. N.E., St. Michael, MN 55376
Toll Free: 1-877-769-8262 Voice: 763-201-2151 Fax: 763-201-2134



PCS-FLG Flanged

Fast and economical. EFP has an extensive inventory of flanged metal hose in the most popular sizes and materials. Ready to ship.

For those unique engineering applications, EFP also makes custom hose assemblies in materials and fittings specifically tailored to meet your unique needs.

Need engineering and design assistance? Contact EFP's customer service department and we will help you design and engineer the assembly that will economically meet your specifications.

Use the charts below to guide your design. It is just a sample of what we can do. If you don't see what you need, contact us with your specifications.

PCS - FLG Flanged
PCS - MMT Threaded End

Standard Sizes Ready for Immediate Shipment

Pipe size	Length	Pressure @ 70° F
2	9	455
2.5	9	345
3	9	300
4	9	300
5	11	220
→ 6	11	200
8	12	190
10	13	150

TAG: ✓

12	14	125
14	14	105

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Correction Factors For Elevated Temperatures
Apply to pressure rating for elevated temperature

Temp F	Material			
	Stainless	Steel	Monel	Bronze
70	1.00	1.00	1.00	1.00
150	.97	.99	.93	.92
200	.94	.97	.90	.89
250	.92	.96	.87	.86
300	.88	.93	.83	.83
350	.86	.91	.82	.81
400	.83	.87	.79	.78
450	.81	.86	.77	.75
500	.78	.81	.73	
600	.74	.74	.72	
700	.70	.66	.71	
800	.66	.52	.70	
900	.62	.50		
1000	.60			
1100	.58			
1200	.55			
1300	.50			
1400	.44			
1500	.40			

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EFP

ENGINEERED FLEXIBLE PRODUCTS, INC.

5331 Quam Ave., N.E.
St. Michael, MN 55376

Metal Hose – Standard

T-321 & T-316 Stainless Steel Annular Corrugated Hose

Nom. I.D. (in.)	Braid Layers	Nom O.D. (in.)	Maximum Pressure @ 70°F (PSIG)[a]			Centerline Bend Radius (in.)		Weight per Foot (lb.)
			Working	Test	Nominal Burst	Dynamic	Static Bend	
1/4	0	.48	180	270	--			.09
	1	.57	2116	3844	10250	5.00	1.00	.17
	2	.64	3125	4687	12500			.26
3/8	0	.63	100	150	--			.13
	1	.74	1501	2251	6004	5.50	1.25	.25
	2	.81	2401	3602	9604			.36
1/2	0	.82	80	120	--			.23
	1	.89	1075	1613	4301	6.00	1.50	.34
	2	.96	1720	2580	6880			.46
3/4	0	1.12	70	105	--			.39
	1	1.28	792	1188	3168	8.00	2.25	.59
	2	1.35	1267	1901	5069			.79
1	0	1.51	40	60	--			.53
	1	1.58	571	857	2285	9.00	2.75	.75
	2	1.65	914	1370	3654			.98
1 1/4	0	1.85	25	38	--			.76
	1	1.93	531	797	2125	10.50	3.50	1.07
	2	2.20	850	1274	3398			1.37
1 1/2	0	2.19	20	30	--			.84
	1	2.28	472	708	1887	12.00	4.00	1.23
	2	2.37	755	1133	3021			1.63
2	0	2.60	15	23	--			.90
	1	2.72	516	774	2064	15.00	5.00	1.52
	2	2.84	826	1239	3302			2.14
2 1/2	0	3.23	12	18	--			1.16
	1	3.33	387	581	1548	20.00	8.00	1.86
	2	3.43	619	929	2477			2.56
3	0	3.78	10	15	--			1.21
	1	3.88	316	474	1264	22.00	9.00	2.00
	2	3.98	506	758	2022			2.80
4	0	4.85	8	12	--			1.69
	1	4.98	232	348	927	27.00	13.00	2.68
	2	5.10	371	557	1485			3.86
5	0	5.90	6	9	--			2.50
	1	6.03	191	286	764	31.00	18.00	3.75
	2	6.15	306	458	1222			5.00
6	0	6.87	5	8	--			3.47
	1	7.10	165	247	660	36.00	19.00	4.75
	2	7.33	264	396	1056			6.04
8	0	9.09	6	9	--			5.56
	1	9.19	234	350	934	40.00	20.00	9.44
	2	9.28	374	561	1495			13.36

TAG: ✓

ENGINEERED FLEXIBLE PRODUCTS, INC.

5331 Quam Ave., N.E.
St. Michael, MN 55376

10	0	11.18	5	8	--			6.80
	1	11.32	230	344	918	50.00	25.00	12.90
	2	11.45	367	551	1469			19.00
12	0	13.23	3	5	--			9.02
	1	13.37	161	241	643	60.00	30.00	14.83
	2	13.50	257	386	1029			20.64
14	0	14.70	3	5	--			14.10
	1	14.84	119	178	476	70.00	35.00	21.70
	2	14.98	190	285	760			29.30

TAG: V

ENGINEERED FLEXIBLE PRODUCTS, INC.

5331 Quam Ave., N.E.
St. Michael, MN 55376

Metal Hose - PCS-FLG Flanged Hose

Correction Factors For Elevated Temperatures
Apply to pressure rating for elevated temperature

Temp F	Material			
	Stainless	Steel	Monel	Bronze
70	1.00	1.00	1.00	1.00
150	.97	.99	.93	.92
200	.94	.97	.90	.89
250	.92	.96	.87	.86
300	.88	.93	.83	.83
350	.86	.91	.82	.81
400	.83	.87	.79	.78
450	.81	.86	.77	.75
500	.78	.81	.73	
600	.74	.74	.72	
700	.70	.66	.71	
800	.66	.52	.70	
900	.62	.50		
1000	.60			
1100	.58			
1200	.55			
1300	.50			
1400	.44			
1500	.40			

TAG: W

TC-0802A 2PC 150# FULL PORT BALL VALVE, FLANGED

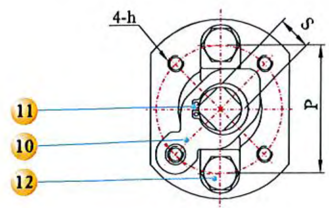
DESIGN FEATURES:

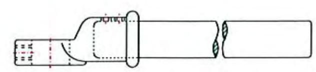
- Steam rating:150 psi WSP
- ISO 5211 Actuator Mounting Pad
- Blow-out-proof stem design
- Anti - Static Device
- Body: ASTM A351 Gr.CF8M
- Ball: SS316
- Stem: SS316
- ME-PTFE SEAL KITS : REPLACES PTFE ,RPTFE AND FPA
  LOW DEFORMATION UNDER LOAD
  LOW PERMEATION
- Temperature Rating :-45.5°C (-50°F) to 246°C (475°F)
- Face to Face: ANSI B16.10
- Flange Dimensions: ANSI B16.5 150#
- TEST STANDARD:API 598
- Vacuum Service to 29" Hg

MATERIALS LIST

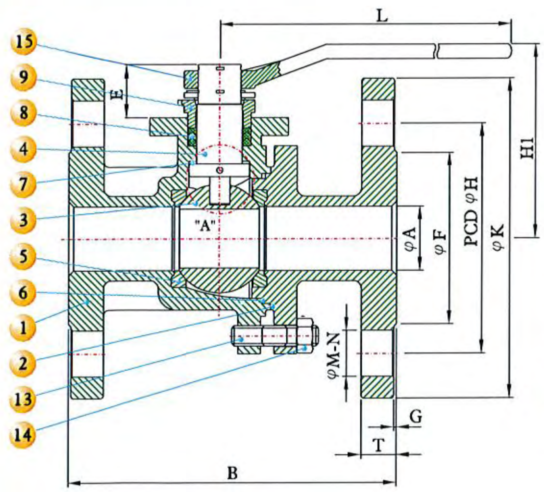
NO.	PART NAME	MATERIAL	QTY
1	BODY	ASTM A351 Gr.CF8M	1
2	CAP	ASTM A351 Gr.CF8M	1
3	BALL	ASTM A351 Gr.CF8M	1
4	STEM	ASTM A276 Gr.316	1
5	SEAT	ME-PTFE	2
6	GASKET	ME-PTFE	1
7	THRUST WASHER	ME-PTFE	1
8	PACKING	ME-PTFE	1
9	GLAND	ASTM A351 Gr.CF8	1
10	STOPPER	SS304	1
11	SNAP RING	SS304	2
12	GLAND BOLT	ASTM A193 Gr.B8	2
13	STUD BOLT	ASTM A193 Gr.B8	4~12
14	SET NUT	ASTM A194 Gr.8M	4~12
15	HANDLE	ASTM A536 Gr.B 65-45-12	1

ME-PTFE IS Molecularly Enhanced PTFE

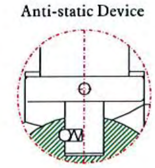




HANDLE FOR 5" ~8"

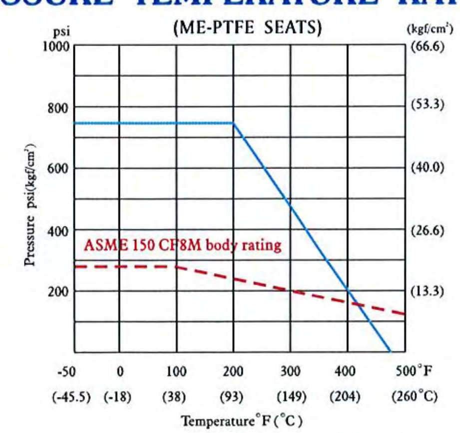


Pyramidal Stem & Anti-static Device



"A" VIEW

PRESSURE TEMPERATURE RATINGS



DIMENSIONS

SIZE		A		B		E		F		G		H		K	
inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
1/2"	15	0.59	15.0	4.25	107.9	0.98	25.0	1.38	35.0	0.06	1.6	2.38	60.4	3.50	88.9
3/4"	20	0.79	20.0	4.62	117.3	1.02	26.0	1.69	42.9	0.06	1.6	2.75	69.8	3.88	98.5
1"	25	0.98	25.0	5.00	127.0	1.24	31.5	2.00	50.8	0.06	1.6	3.12	79.2	4.25	107.9
1 1/4"	32	1.26	32.0	5.50	139.7	1.24	31.5	2.50	63.5	0.06	1.6	3.50	88.9	4.62	117.3
1 1/2"	40	1.50	38.0	6.50	165.1	1.65	42.0	2.88	73.1	0.06	1.6	3.88	98.5	5.00	127.0
2"	50	1.97	50.0	7.00	177.8	1.65	42.0	3.62	91.9	0.06	1.6	4.75	120.6	6.00	152.4
2 1/2"	65	2.56	65.0	7.50	190.5	1.65	42.0	4.12	104.6	0.06	1.6	5.50	139.7	7.00	177.8
3"	80	3.15	80.0	8.00	203.2	2.20	56.0	5.00	127.0	0.06	1.6	6.00	152.4	7.50	190.5
4"	100	3.94	100.0	9.00	228.6	2.20	56.0	6.19	157.2	0.06	1.6	7.50	190.5	9.00	228.6
→ 6"	150	5.91	150.0	15.50	393.7	2.64	67.0	8.50	215.9	0.06	1.6	9.50	241.3	11.00	279.4
8"	200	7.87	200.0	18.00	457.2	2.62	66.5	10.62	269.7	0.06	1.6	11.75	298.4	13.50	342.9

SIZE		T		M		N	P		S		L		H1		h	Cv	Weight	
inch	mm	inch	mm	inch	mm		inch	mm	inch	mm	inch	mm	inch	mm		Factor	Kg	Lb
1/2"	15	0.44	11.2	0.62	15.7	4	1.65	42	0.43	11	5.18	131.5	2.91	73.8	M5*P0.8	26	2.00	4.41
3/4"	20	0.44	11.2	0.62	15.7	4	1.65	42	0.43	11	5.18	131.5	2.94	74.8	M5*P0.8	55	2.50	5.51
1"	25	0.44	11.2	0.62	15.7	4	1.97	50	0.55	14	6.42	163.0	3.44	87.4	M6*P1.0	110	3.00	6.61
1 1/4"	32	0.50	12.7	0.62	15.7	4	1.97	50	0.55	14	6.42	163.0	3.63	92.2	M6*P1.0	180	4.50	9.91
1 1/2"	40	0.56	14.2	0.62	15.7	4	2.76	70	0.67	17	9.13	232.0	4.76	121.0	M8*P1.25	270	6.00	13.22
2"	50	0.62	15.7	0.75	19.0	4	2.76	70	0.67	17	9.13	232.0	5.08	129.0	M8*P1.25	500	8.50	18.72
2 1/2"	65	0.69	17.5	0.75	19.0	4	2.76	70	0.67	17	9.13	232.0	5.55	141.0	M8*P1.25	800	13.00	28.63
3"	80	0.75	19.0	0.75	19.0	4	4.02	102	0.87	22	12.87	327.0	6.52	165.7	M10*P1.5	1150	18.00	39.65
4"	100	0.94	23.8	0.75	19.0	8	4.02	102	0.87	22	12.87	327.0	7.11	180.7	M10*P1.5	2120	28.00	61.67
→ 6"	150	1.00	25.4	0.88	22.3	8	4.92	125	1.06	27	42.20	1072.0	9.95	252.8	M12*P1.75	5100	75.00	165.20
8"	200	1.12	28.4	0.88	22.3	8	5.51	140	1.30	33	42.52	1080.0	11.73	297.9	M16*P2.0	9400	110.00	242.29

TAG: W

metso

VALVCON
BACK-UP POWERED ELECTRIC ACTUATOR ADC SERIES

Metso is a leading designer and provider of Valvcon compact, reliable, electronically controlled electric actuators for valves and dampers. We offer a complete line of electric actuators for accurate positioning of dampers and valves in the aerospace, automotive, consumer services, discrete manufacturing, energy, environmental, oil/pipeline, petrochemical, power/utilities, process, recreation, transportation, and water/wastewater industries.

We have developed and introduced the industry's most innovative Metso Valvcon electric actuator products, including simple "set and go" calibration, intelligent processor-based digital electronics, "Plug-in" accessory boards, Back-Up Power actuators, as well as electric actuators designed for remote control, solar-powered applications and two-wire network applications.

The quarter-turn electric actuator will comply with Part 15, Class A of the FCC regulations for emissions and conducted radiation for industrial devices. It will also be designed to meet NEMA standards for use in weathertight or weathertight and hazardous locations. The actuator will be a single, complete unit composed of a compact cast aluminum housing, motor, gearing, limit switches controlled by metal cams for end of travel control, mechanical position indicator, and an optional internal back-up power source to drive to a pre-set position in the event of an external power loss. Actuator mounting flanges shall comply with ISO 5211 standards incorporating a female drive for direct output coupling. The actuator shall be capable of operating in ambient environments of -40° F to 130° F; optional internal heaters are required at temperatures below 32° F.

FEATURES AND BENEFITS

Isolation and Electrical

Internal electronic control boards shall have clearly marked and different size connection terminals for Power and Control Signals to prevent incorrect wiring and shall provide CW and CCW push buttons for local manual control. The actuator control electronics shall be electrically isolated to allow multiple actuators to be wired in parallel. Electronic control boards shall be protected on the outward side with insulating overlays providing operating instructions and additional safety. Additionally, electronic control boards shall include a simple user-interface, including slide switches and selection knob for mode selection, calibration and set up. The electronic control boards will also supply a mA or voltage position feedback signal and include a holding brake feature to prevent back-driving. All internal connections, (motor leads, limit switch leads, option connectors, etc.) shall be coded, using different style connectors for each function, to prevent incorrect wiring. All connections will plug-in to simplify field repairs and upgrades. In AC applications a highly reliable switching power supply will provide power conversion to drive the internal DC motor; DC applications will utilize an equally reliable DC to DC regulator. Other than periodic battery replacement; no maintenance will be required.

Motor

The internal electric motor will be of a brushless DC type, capable of running continuously at full torque at ambient temperature at or below 104° F.

metso
Expect results

V201-1 • 5/2009

Lubrication

All rotating power train components will be coated with a multi-purpose grease. Lubricants will be suitable for ambient conditions of -40° F to 130° F. For operation in temperatures between 32° F and -40° F an optional heater and thermostat assembly must be included.

Gearing

The powertrain will be comprised of hardened steel, machine cut spur gears. Non-metallic, aluminum, cast or stamped gearing will not be permitted.

Limit Switches

Actuators will have two standard end-of-travel switches, single pole double throw, rated at 15 amps at 250 VAC. Under normal operation the end of travel limit switches will not be activated; activating the limit switches will interrupt actuator travel. Up to two additional limit switches, adjustable to operate at any position as required by the process application, may be added to the actuator for end of travel indication.

On/Off Control (Open/Close Operation) with Optional Battery Back-Up

Open/Close actuators require separate Power and Control signals. The Power signal must be constantly maintained; immediately upon loss of the Power signal, the internal back-up power source will drive the actuator to the Power Loss Position. The Control signal consists of one to three maintained AC or DC contacts and the actuator can be set to operate in Two-wire, Three-wire or Three-position modes. In Two-wire mode a signal is maintained to drive the actuator to the CCW position and removed to drive to the CW position. In Three-wire mode separate Control signals are applied to drive the actuator to the CW and CCW positions and may be removed at any point in mid-stroke to position the valve or damper. In Three-position mode separate Control signals are applied to drive the actuator to the CW, "MID" or CCW positions and may be removed at any point in mid-stroke to position the valve or damper. The Power Loss Position may be either the full CW, the full CCW or "MID" position and is determined by the fail position selection switch.

Proportional Control (Modulating Operation) with Optional Battery Back-Up

Modulating control actuators will accept a variable, proportional 4-20 mA or 0-10VDC valve position signal and respond by positioning the valve linearly with an accuracy of 1%. Normally, the actuator will drive clockwise in response to a decreasing control signal; however, the actuator will be capable of "reverse acting" operation (driving counter-clockwise in response to a decreasing control signal) without internal wiring changes. The actuator will also provide the ability to adjust the sensitivity to control signal changes. Slide switches will enable the user to set the actuator response to a loss of control signal, select the "fail" position upon loss of Power and select either the single cycle or multi-cycle loss of power mode. Locked rotor, stall protection will detect whenever the actuator is unable to achieve the position commanded by the control signal, and will terminate power to the motor in order to prevent damage due to repeated stall conditions.

The Back-Up Powered Electric Actuators from Metso

Metso offers several product lines that are designed to drive a valve or damper to a pre-determined position in the event of a power loss. Under normal power conditions, they provide accurate positioning in response to the powered control signals.

Optional Internal Battery Back-Up

Metso Valvcon ADC Series can be equipped with an optional internal battery pack. The actuator is driven by an external power source under normal conditions. When power is lost, the internal battery pack can be set up to either drive immediately to the pre-set position, or continue to respond to a maintained control signal. The ADC Series is an excellent choice for continuous duty modulating applications, or any application where an inexpensive alternative to mechanical spring back-up is desired.

Break-away Torque

Designed for efficiency and reliability, all Metso Valvcon actuators deliver the power you need when and where it is needed. With efficient gear trains and motors these actuators are rated at breakaway torque. Immediately upon power up, the actuator supplies the rated torque — when it is needed to break the valve away from its seat. Other manufacturer's actuators may be rated at running torque, but actually deliver significantly less breakaway torque.

FEATURES AT A GLANCE!

ADC Series

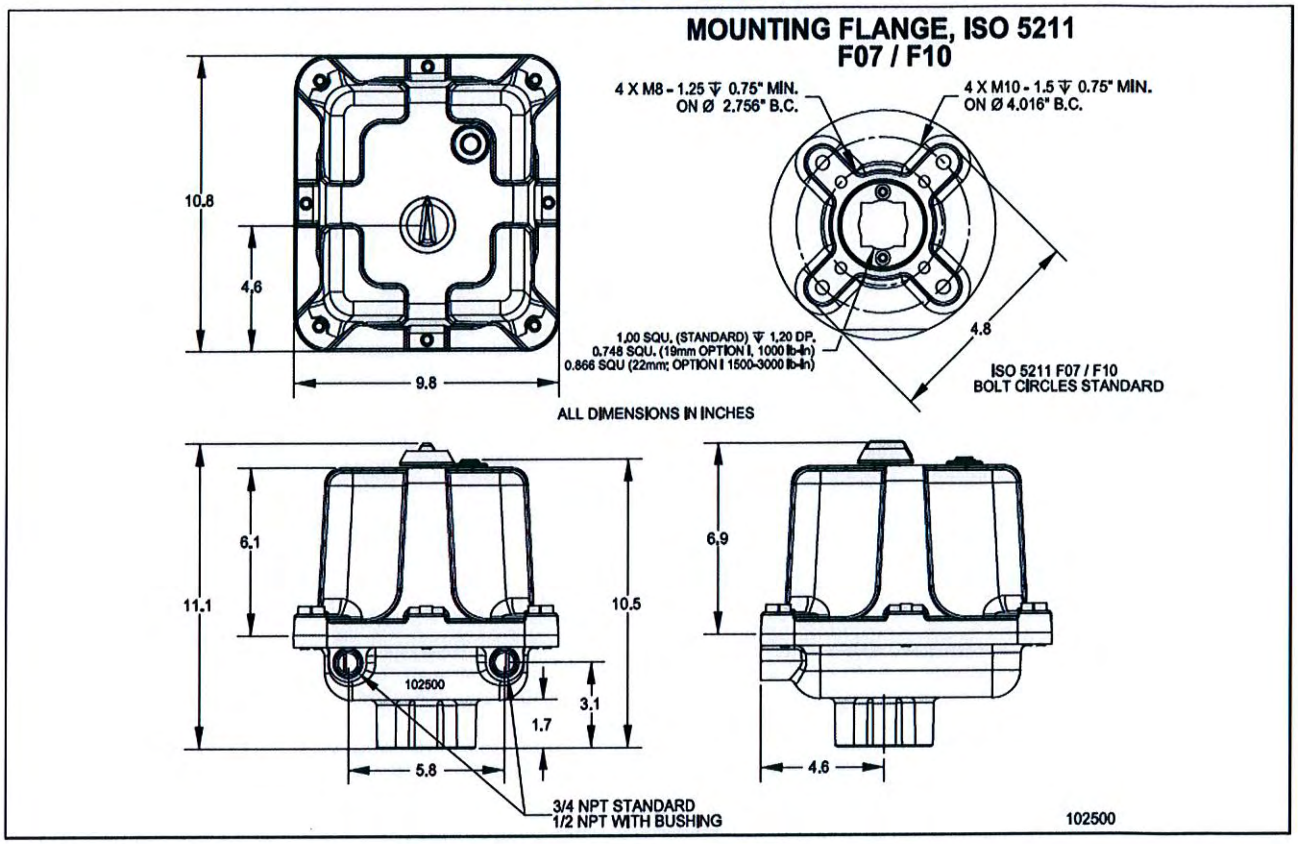
- Optional internal battery packs allow for continued modulation during power outages, provided the control signal remains.
- Field-settable for "fail clockwise" or "fail counter-clockwise."

Valvcon Back-up Powered Actuators:

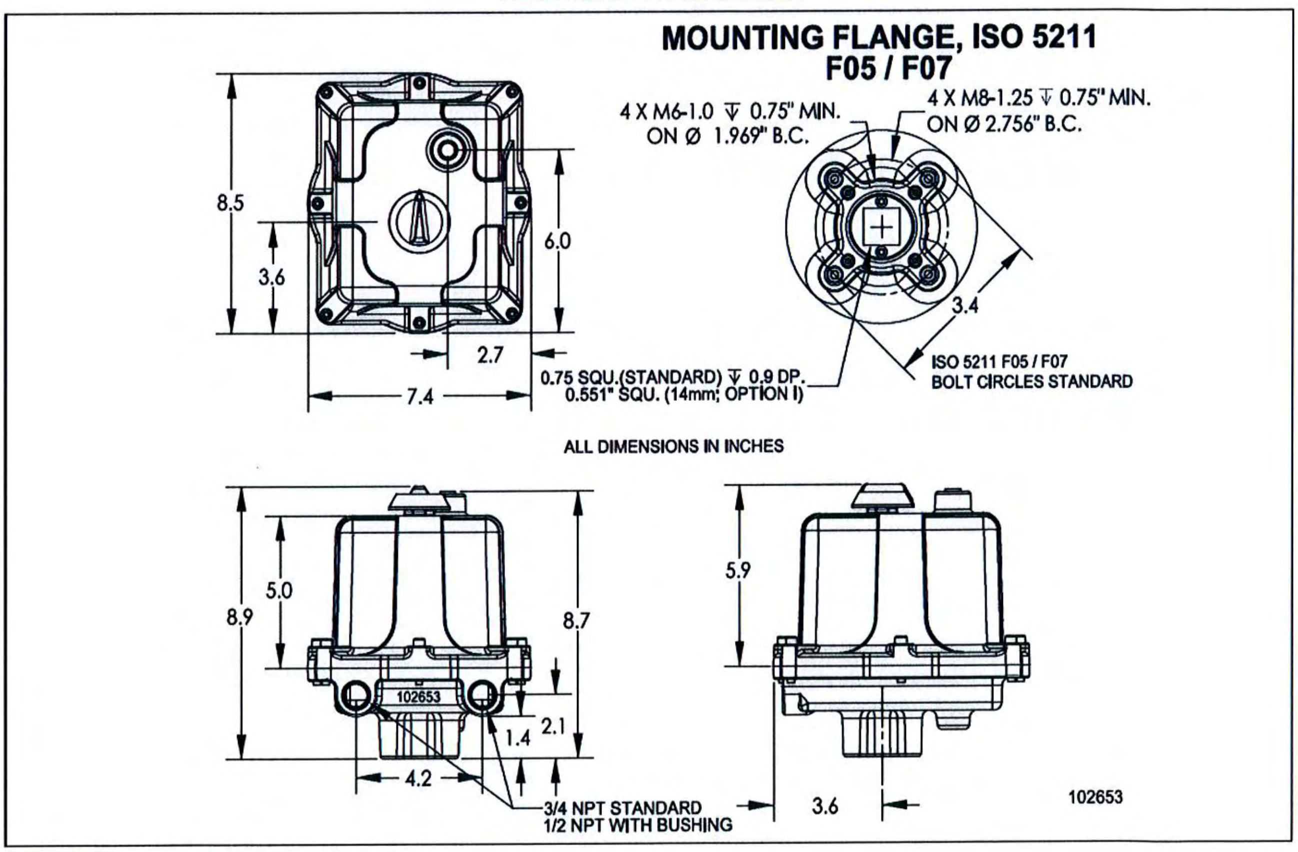
- Patented technology provides back-up capabilities within the standard size actuator enclosures!
- Dual conduit openings make wiring easier, and keep power and control wiring separate.
- Two year warranty.

TAG: W

LADC-SERIES ENCLOSURE



ADC-SERIES ENCLOSURE



ALL DIMENSIONS IN INCHES

TAC: W

ADC SPECIFICATIONS

Battery Back-up Power

Metso Valvcon ADC Series electric actuators, equipped with internal battery power, allow you to shut down your system in the event of an external power loss. Engineered to supply dependable valve actuation, they can provide up to 10 complete cycles under their own internal power.

The electronic back-up powered feature incorporates a rechargeable battery pack on a plug-in, modular PC board under the actuator cover. Upon power loss or a signal from an external sensor, the battery pack is automatically activated as the main power supply. The battery is compact and fits easily into the standard enclosures for an easy, space-saving upgrade. No hard-wiring or other complex operations are required.

Metso Valvcon battery back-up actuators are available in on/off (two position) or continuous duty modulating models.

- Internal batteries allow for continued cycling during power outages, enabling an orderly shut-down of critical processes.
- A built-in trickle charger, with over-charge protection, ensures the batteries always have enough power when called upon
- Batteries can be easily replaced in the field.

MODULATING DATA

Torque (in-lbs)	Duty Cycle	12VDC		24VDC		24VAC		115VAC		230VAC	
		Cycle Time (sec/90°)	Current Draw (Amps)	Cycle Time (sec/90°)	Current Draw (Amps)	Cycle Time (sec/90°)	Current Draw (Amps)	Cycle Time (sec/90°)	Current Draw (Amps)	Cycle Time (sec/90°)	Current Draw (Amps)
150	100%	11	2.2	13	1.2	8	1.8	9	0.4	9	0.4
300	100%	17	2.5	13	1.4	12	2.1	13	0.5	13	0.4
600	100%	17	2.8	13	1.7	13	2.5	14	0.6	14	0.5
1000	100%	21	4	14	2.4	15	3.5	15	0.9	15	0.6
1500	100%	40	4	24	2.4	27	3.5	29	0.9	29	0.6
2000	100%	40	4.3	33	2.4	28	3.5	29	0.9	29	0.6
2500	100%	55	3.3	40	2	38	3.1	39	0.8	39	0.6
3000	100%	60	3.7	42	2.2	40	3.5	42	0.8	43	0.6

ON/OFF DATA

Torque (in lbs.)	Speed (per 90° rotation, in seconds)		Duty Cycle**	Normal Operating Current Draw (in Amps)				
		24VDC only		12VDC	24VDC	24VAC	115VAC	230VAC
150	5	3	Continuous**	1.9	2.4	1.5	.2	.1
300	10	5	Continuous**	1.9	2.4	1.5	.2	.1
600	15	8	Continuous**	1.9	2.4	1.5	.2	.1
1000	15	15	Continuous**	3.5	3.5	2.0	.4	.2
1500	20	20	Continuous**	3.5	3.5	2.0	.4	.2
2000	25	25	Continuous**	4.8	4.8	2.0	.4	.2
2500	30	30	Continuous**	4.8	4.8	2.0	.4	.2
3000	35	35	Continuous**	4.8	4.8	2.0	.4	.2

**Continuous for 1 hour after which duty cycle is reduced to 80%.

TAG: W

BACK-UP POWERED ELECTRIC ACTUATORS OPTIONS

Tropical Heater/Thermostat

(Order Code H)

Recommended in all high humidity applications where condensation may accumulate inside the actuator. For 115VAC applications the heater consumes 15 watts, for 230VAC applications the heater consumes 40 watts.

ISO 5211 Output

(Order I)

ISO 5211 Standard mounting configuration and output coupling.

150-600 in-lb models with "I" options are supplied with a 14mm female square. (note: without option "I" the female square is 3/4 inch).

1000 in-lb models with "I" options are supplied with a 19mm female square and 1500-3000 in-lb models are supplied with a 22 mm female square. (note: without option "I" the female square is 1inch).

Additional Limit Switches

(Order Code S2)

Up to two additional limit switches may be added for position indication or as dry contacts to operate other devices. Single pole, double throw switches rated for 1/2 HP, 15 amps @ 250VAC, CSA certified.

Heater/Thermostat

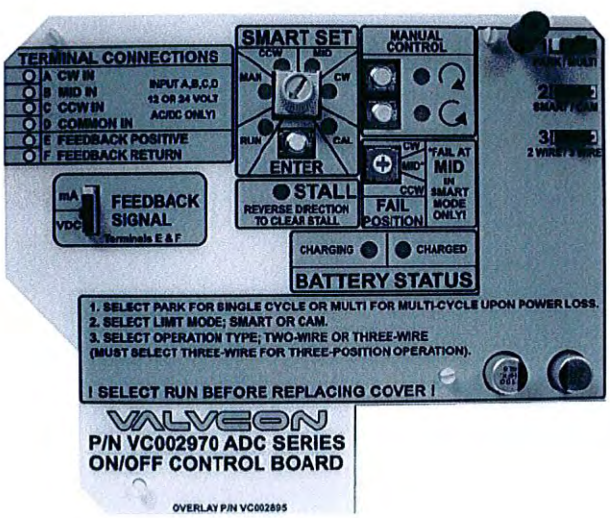
(Order Code T)

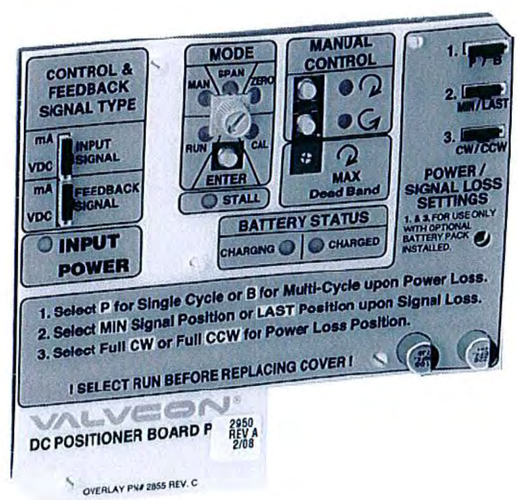
Required in all applications where the temperature may drop below 32°F. For 115VAC applications the heater consumes 15 watts, for 230VAC applications the heater consumes 40 watts.

Hazardous Location Enclosures

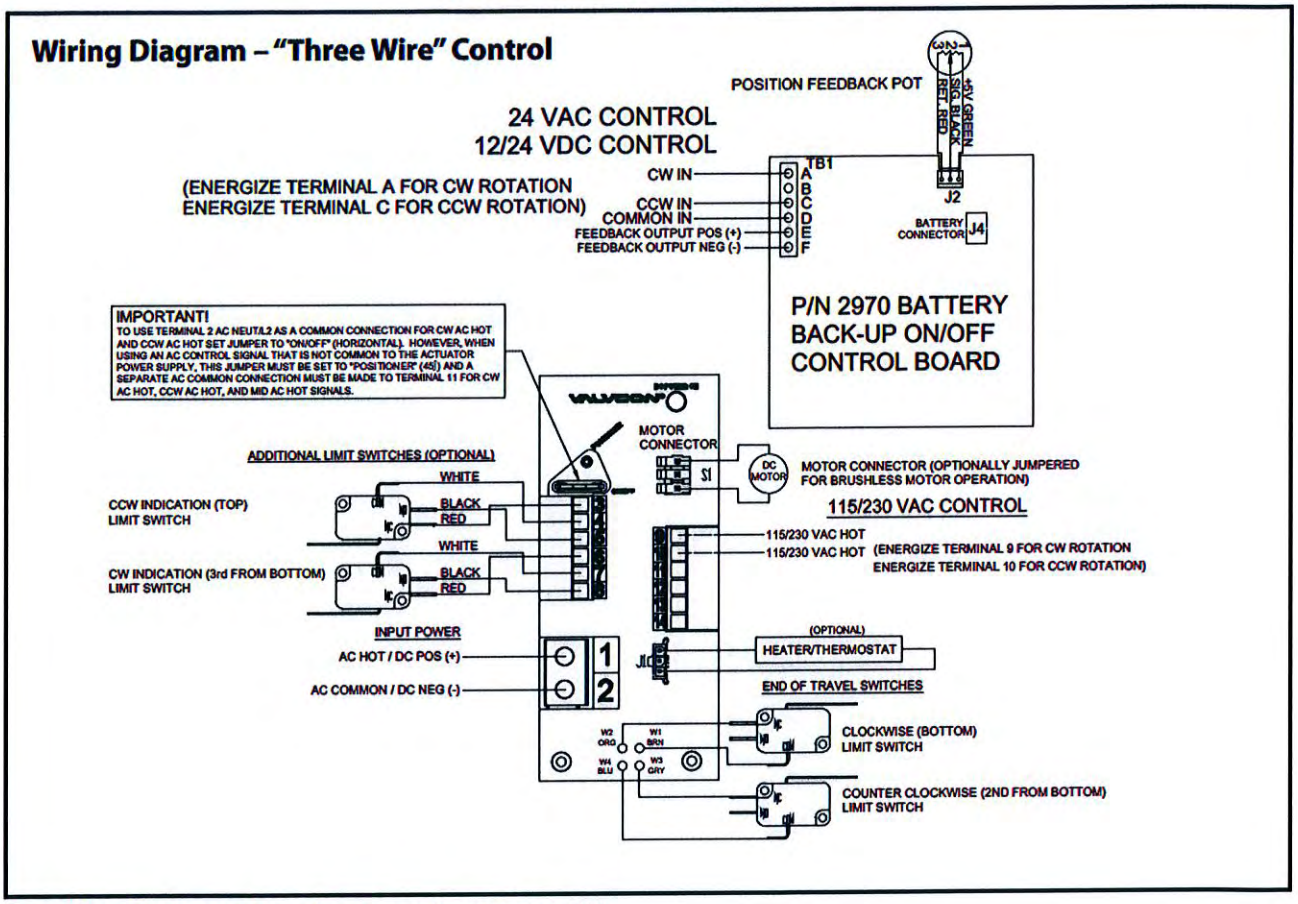
(ADCWX and LADCWX)

The standard enclosures (W) are rated for NEMA 4/4X (weather tight and corrosion resistant). The Hazardous Location enclosures (WX) are rated for NEMA 4/4X/7 & 9, Class I, Div 1, Groups C&D; Class II, Div. 1, Groups E, F, & G; Class III.



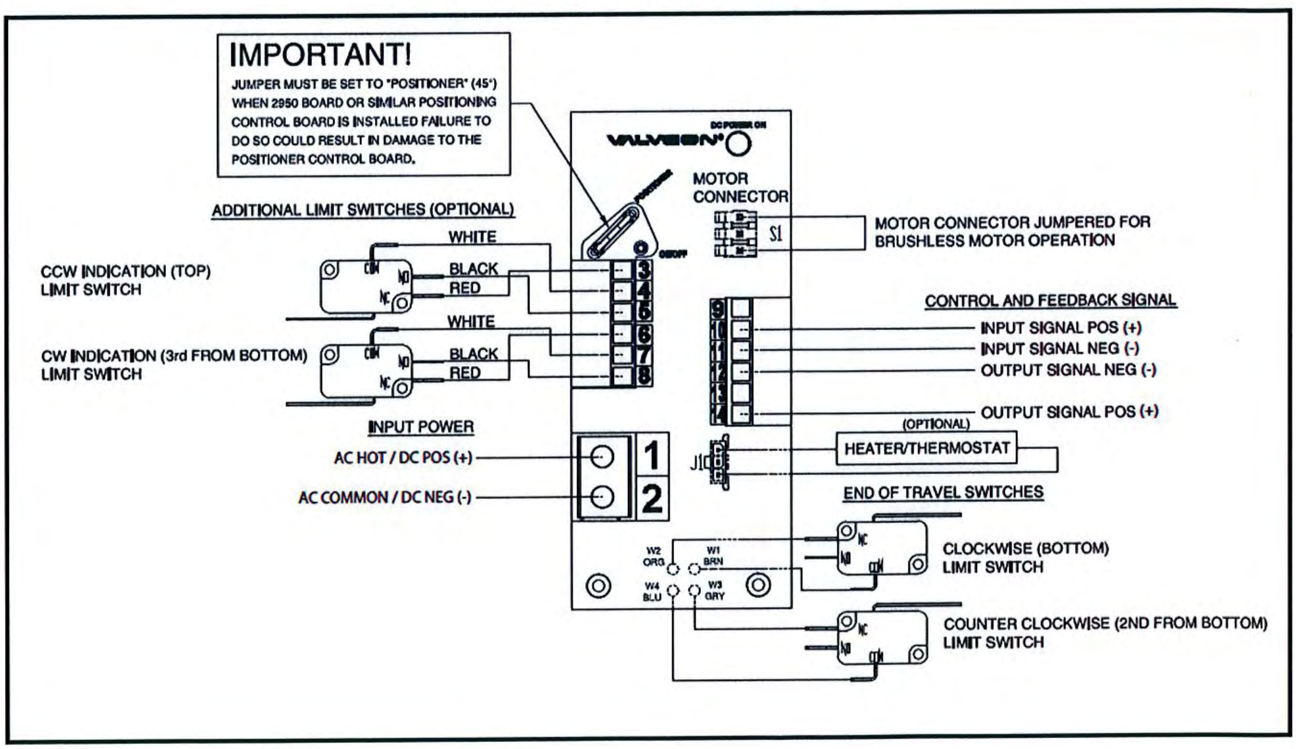


ADC/LADC ON/OFF APPLICATIONS



Note: "Three Wire" control shown for other configurations see IMO.

ADC/LADC MODULATING APPLICATIONS



TAG: W

HOW TO ORDER – ADC SERIES ACTUATORS

Example: Sample model code: ADCW150CL2IS2N24AC

1	2	3	4	5	6
ADC	W	150	CL2	I S2	N24AC

1	Series
ADC	ADC

2	Enclosure
W	Weathertight (NEMA 4/4X)
WX	Weathertight & Explosion proof (NEMA 4/4X/7 & 9)

3	Torque (in lbs)
150	150
300	300
600	600

4	Options [1] (Must Select One)
C	Modulating
CL2	Modulating Battery Back-Up
L2	On/Off Battery Back-Up
L4	ON/Off Battery Back-Up - 3 Position
R2	ON/Off Isolated Control
R3	ON/Off Board - 3 Position

5	Other Options
—	No entry if standard
H[2]	Tropical Heater/Thermostat
I[3a]	ISO 5211 Output
S2	Two Auxiliary Limit Switches
T[4]	Heater/Thermostat
Z[5]	Handwheel

6	Operating Voltage
N115AC	115VAC
N230AC	230VAC
N24AC	24VAC
N12DC	12VDC
N24DC	24VDC

HOW TO ORDER – LADC SERIES ACTUATORS

Example: Sample model code: LADCW1500CL3IS2N24AC

1	2	3	4	5	6
LADC	W	1500	CL3	I S2	N24AC

1	Series
LADC	LADC

2	Enclosure
W	Weathertight (NEMA 4/4X)
WX	Weathertight & Explosion proof (NEMA 4/4X/7 & 9)

3	Torque (in lbs)
1000	1000
1500	1500
2000	2000
2500	2500
3000	3000

4	Options [1] (Must Select One)
C	Modulating
CL3	Modulating Battery Back-Up
L3	On/Off Battery Back-Up
L5	ON/Off Battery Back-Up - 3 Position
R2	ON/Off Isolated Control
R3	ON/Off Board - 3 Position

5	Other Options
—	No entry if standard
H[2]	Tropical Heater/Thermostat
I[3b]	ISO 5211 Output
S2	Two Auxiliary Limit Switches
T[4]	Heater/Thermostat
Z[5]	Handwheel

6	Operating Voltage
N115AC	115VAC
N230AC	230VAC
N24AC	24VAC
N12DC	12VDC
N24DC	24VDC

Notes:

1. Must select only one board option; all of these board options include 4-20mA or 0-10VDC position feedback, (2-10VDC on On/Off option boards) and a holding brake feature.
2. This heater option activates at or below 90°F and deactivates at 110°F; it is recommended in high-humidity applications.

3a. 150 - 600 lb-in models with I option are supplied with a 14mm female square (note that without option I the female square is 3/4").

3b. 1000 lb-in models with I option are supplied with a 19mm female square and 1500 - 3000 lb-in models are supplied with a 22mm female square (note that without option I the female square is 1").

4. This heater option activates at or below 40°F and deactivates at 60°F; it is recommended in applications where the temperature may drop below 32°F.
5. Handwheel option not recommended with Back-Up Powered options.

TAG: W

Committed to Customer Service

Metso worldwide web site:
www.metso.com/automation/valvcon, provides 24 hour a day access to all technical support material—from sales brochures to instruction manuals to installation and troubleshooting tips. For local support, Our network of trained stocking distributors/representatives are industry leading experts in valve automation. Contact the Metso, Valvcon product web site to locate the nearest stocking distributor/representative.

Timely Technical Support

Metso Express Services is on call to answer your engineering or application questions, and to quickly repair or upgrade your actuators. These highly trained support engineers offer a broad range of expertise, with the combined experience to assist specifying engineers and contractors with information on feasibility and special applications. Find Metso Express at **www.metso.com/automation/valvcon**.

A Tradition of Quality

Metso is dedicated to producing superior-quality products that are second to none. Our development laboratory and manufacturing facilities exemplify our total commitment to producing quality products.

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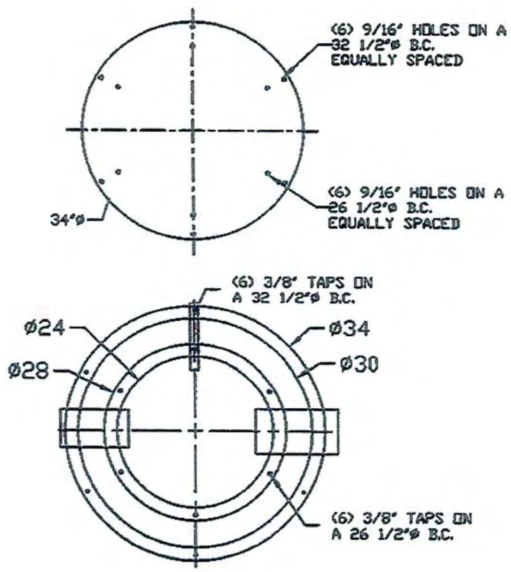
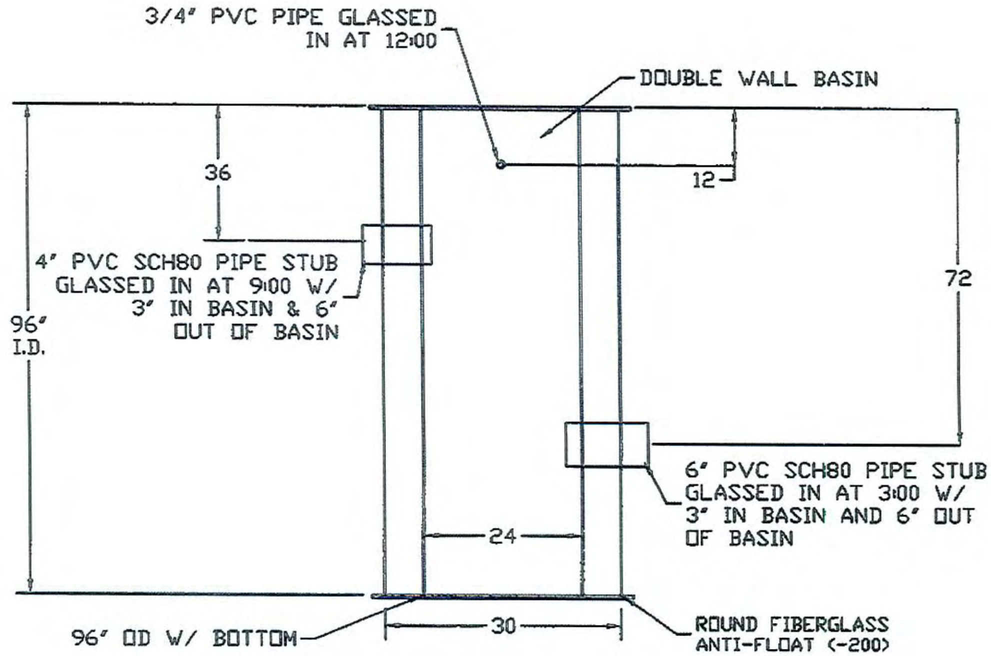
Tel. int. +1 508 595 5083. Fax int. +1 508 595 5183
www.metso.com/automation/valvcon

metso

TAG: X

NOTE: MEASUREMENTS OF BASINS ARE ALL I.D., IF NOT OTHERWISE SPECIFIED





TO CUSTOMER:

EXAMINE THIS DRAWING CAREFULLY. VERIFY ALL DIMENSIONS, LOCATIONS, AND ELEVATIONS FOR ACCURACY. SIGN AND DATE AT LINE. ANY MODIFICATIONS OR CHANGES TO THIS DRAWING OR FINISHED PRODUCT, AFTER IT HAS BEEN SIGNED, MAY RESULT IN ADDITIONAL CHARGES AND SHIPPING DELAYS. NO JOB WILL BE STARTED UNTIL CONFIRMATION THROUGH SIGNATURE.

Ada Sheck 3/4/13

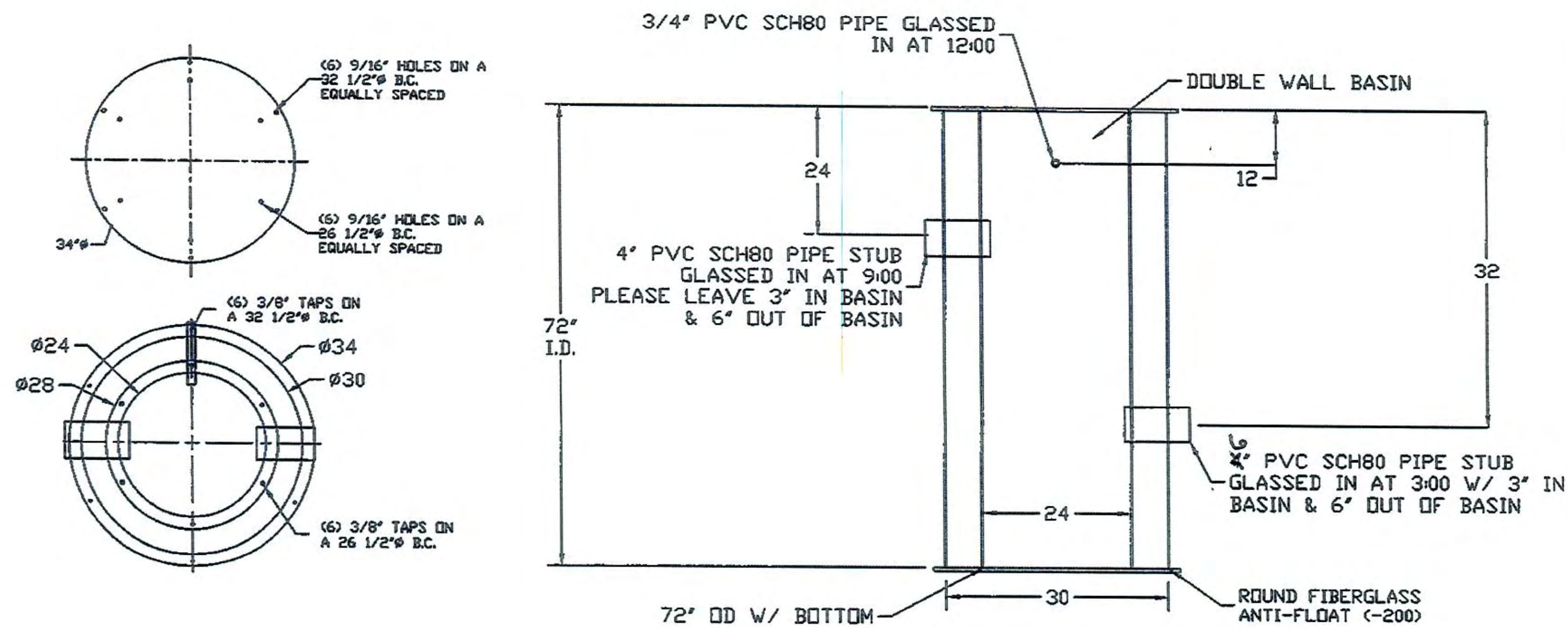
(REQUESTED SIGNATURE & DATE PER ABOVE)

CONFIRMATION THROUGH SIGNATURE RELEASES ORDER FOR PRODUCTION

DRAWN FOR: HART TRAVERS	PO# ---	DISCONNECTS: ---	SHEET 1 OF 1 · Revision 2
	QUOTE # 42751	PUMPS: ---	"THE BEST AROUND UNDERGROUND"
JOB REFERENCE / Notes: ---	BASIN DESCRIPTION: 30 X 96-200 DOUBLE WALL	DRAWN BY: B.SNYDER DATE: 3/4/13	
	COVER DESCRIPTION: SOLID FIBERGLASS COVER	CHECKED BY: DATE CHECKED:	PH: (574)-936-6022 FX: (574)-936-5811 WWW.AKINDUSTRIES.COM

TAG: Y

NOTE: MEASUREMENTS OF BASINS ARE ALL I.D., IF NOT OTHERWISE SPECIFIED



TO CUSTOMER:

EXAMINE THIS DRAWING CAREFULLY. VERIFY ALL DIMENSIONS, LOCATIONS, AND ELEVATIONS FOR ACCURACY. SIGN AND DATE AT LINE. ANY MODIFICATIONS OR CHANGES TO THIS DRAWING OR FINISHED PRODUCT, AFTER IT HAS BEEN SIGNED, MAY RESULT IN ADDITIONAL CHARGES AND SHIPPING DELAYS. NO JOB WILL BE STARTED UNTIL CONFIRMATION THROUGH SIGNATURE.

Aclan Sheccl 3/4/13

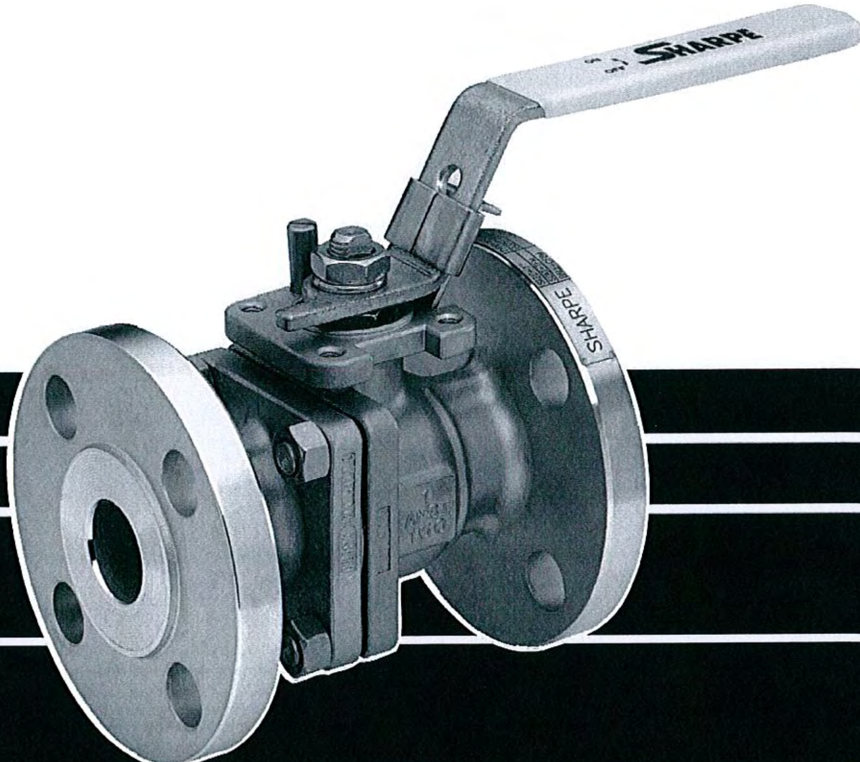
(REQUESTED SIGNATURE & DATE PER ABOVE)

CONFIRMATION THROUGH SIGNATURE RELEASES ORDER FOR PRODUCTION

DRAWN FOR: HART TRAVERS	PO# ---	DISCONNECTS: ---	SHEET 1 OF 1 — Revision 2
	QUOTE # 42754	PUMPS: ---	"THE BEST AROUND UNDERGROUND"
JOB REFERENCE / Notes: ---	BASIN DESCRIPTION: 30 X 72-200 DOUBLE WALL	DRAWN BY: B.SNYDER DATE: 3/4/13	
	COVER DESCRIPTION: SOLID FIBERGLASS COVER	CHECKED BY: DATE CHECKED:	PH: (574)-936-6022 FX: (574)-936-5811 WWW.AKINDUSTRIES.COM

TAG: Z

SHARPE® VALVES



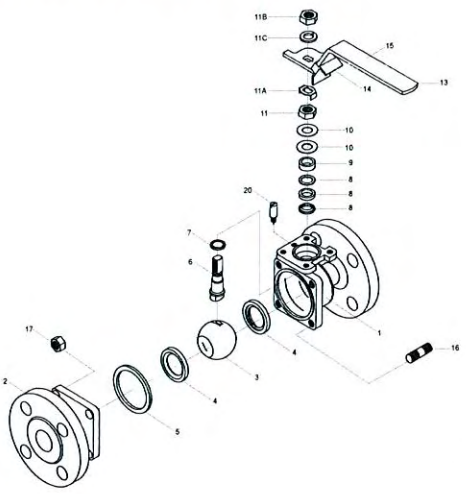
FLANGED FULL PORT BALL VALVE SERIES 50 / CLASS 150

TAG: Z

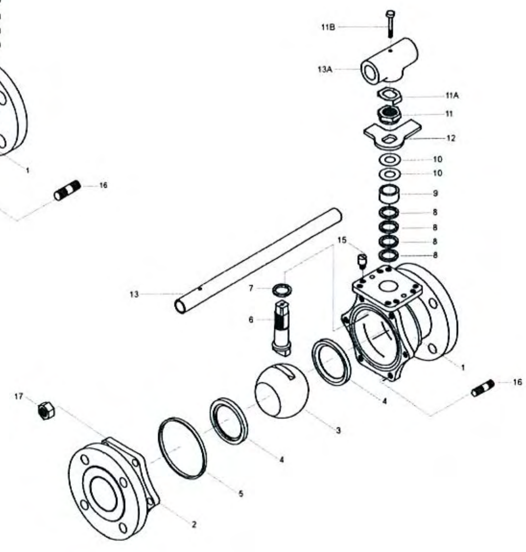
SERIES 50
VALVE PARTS AND IDENTIFICATION

CLASS 150
BLOW OUT PROOF STEM
LOCKING DEVICE

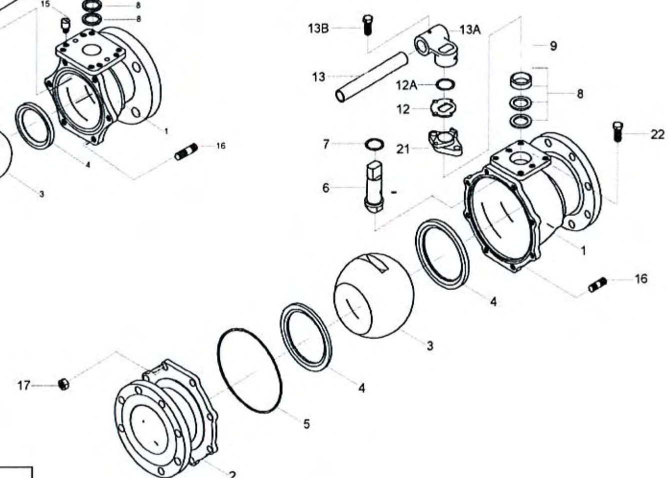
APPLICABLE STANDARDS	
Wall Thickness	ASME B 16.34
Face to Face Dimensions	ASME B 16.10
Flange Dimensions	ASME B 16.5
Pressure Tests	ASME B 16.34 API 598 (Optional)
Basic Design	ASME B16.34



1/2" - 2"



2-1/2" - 4"



6" - 8"

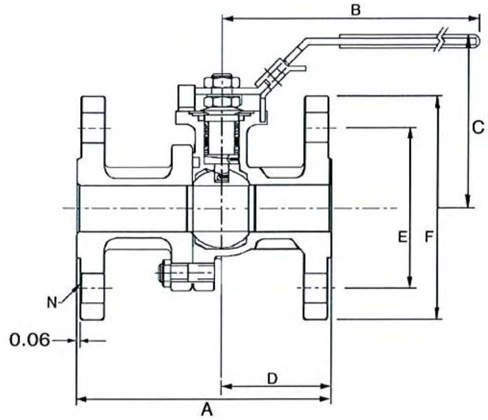
PART NO.	PART	QTY.	MATERIAL
1	Body	1	316 Stainless Steel ASTM A351 CF8M Alloy 20 ASTM A351 CN7M Carbon Steel ASTM A216 WCB Hastelloy C ASTM A494 GR CW-12MW Monel ASTM A494 GR M35-1
2	End Connector	1	316 Stainless Steel ASTM A351 CF8M Alloy 20 ASTM A351 CN7M Carbon Steel ASTM A216 WCB Hastelloy C ASTM A494 GR CW-12MW Monel ASTM A494 GR M35-1
3	Ball	1	316 Stainless Steel Alloy 20 Hastelloy C
4	Seat	2	TFM(Super TFE) TFE Reinforced TFE NOVA PEEK
5	Body Seal	1	TFE
6	Stem	1	316 Stainless Steel Alloy 20 Hastelloy C 17-4PH (Option)
7	Thrust Bearing	2	Reinforced TFE
8	Stem Packing	3/4	Reinforced TFE
9	Gland Packing	1	304 Stainless Steel
10	Belleville Washer (1/2"-4")	2/4	304 Stainless Steel
11	Packing Nut (1/2"-4")	1	304 Stainless Steel
11A	Lock Tab	1	Stainless Steel
11B	Handle Nut	1	304 Stainless Steel
11C	Lock Washer	1	304 Stainless Steel (1/2"-2")
12	Stopper	1	304 Stainless Steel
12A	Snap Ring	1	Stainless Steel (6"-8")
13	Handle	1	304 Stainless Steel (1/2"-2") Galvanized Steel (2-1/2"-4") Ductile Iron (6"-8")
13A	Wrench Block	1	Stainless Steel
13B	Hex Head Bolt	1	304 Stainless Steel
14	Locking Device (1/2"-2")	1	304 Stainless Steel
15	Sleeve	1	Vinyl
16	Body Stud	SEE* N	A193 B8 (SST) A193 B7 (CS)
17	Nut	SEE* N	A194 8 (SST) A194 2H (CS)
20	Stop Pin (1/2"-2") (2-1/2"-4")	1 2	304 Stainless Steel 304 Stainless Steel
21	Gland Flange (6"-8")	1	304 Stainless Steel
22	Gland Bolts (6"-8")	2	304 Stainless Steel

*See Dimensions

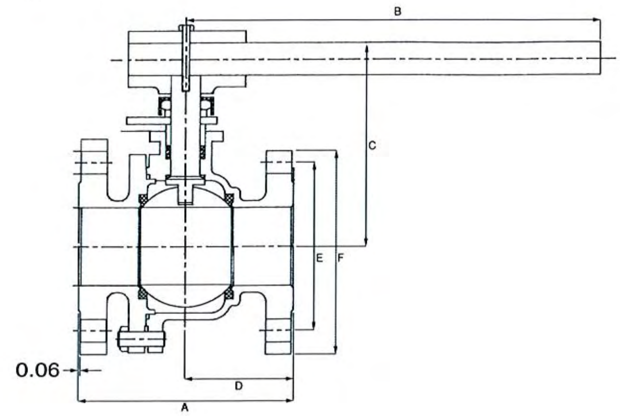
TAG: Z

SERIES 50 DIMENSIONS

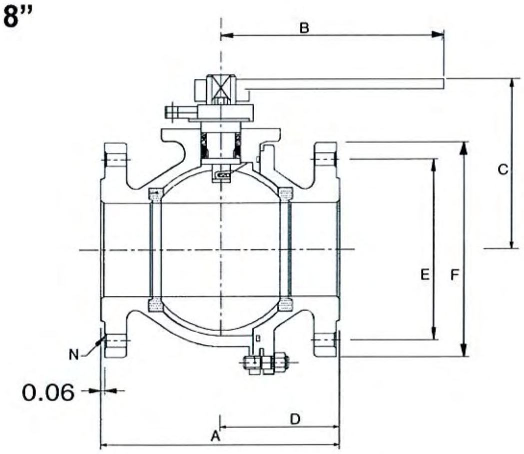
1/2" - 2"



2-1/2" - 4"



6" - 8"



CV DATA

1/2"	26
3/4"	50
1"	94
1-1/2"	260
2"	480
2-1/2"	750
3"	1300
4"	2300
6"	5400
8"	10000

PORT

1/2"	0.59
3/4"	0.78
1"	1.00
1-1/2"	1.50
2"	2.00
2-1/2"	2.55
3"	3.00
4"	4.00
6"	6.00
8"	7.88

WEIGHT (lbs.)

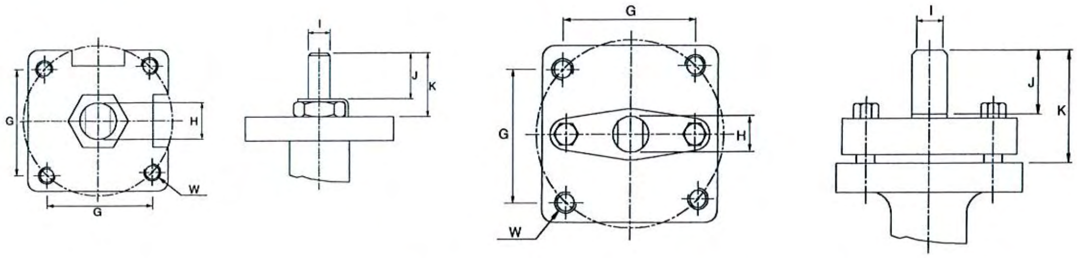
1/2"	4
3/4"	6
1"	8
1-1/2"	15
2"	20
2-1/2"	36
3"	45
4"	75
6"	135
8"	290

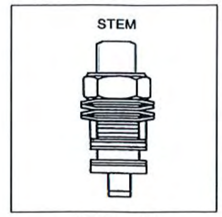
SIZE	A	B	C	D	E	F	N	G	H	I	J	K	W
1/2"	4.25	4.75	3.60	1.80	2.38	3.50	4	1.39	3/8-24 UNF	.22	.28	.63	M5
3/4"	4.62	4.75	3.75	2.00	2.75	3.85	4	1.39	3/8-24 UNF	.22	.28	.63	M5
1"	5.00	6.22	3.75	2.12	3.13	4.25	4	1.39	7/16-20 UNF	.30	.30	.90	M6
1-1/2"	6.50	9.00	4.50	2.76	3.56	5.00	4	1.94	9/16-18 UNF	.35	.42	1.18	M8
2"	7.00	9.00	4.80	3.08	4.75	6.00	4	1.94	9/16-18 UNF	.35	.42	1.18	M8
2-1/2"	7.50	13.75	6.70	3.09	5.50	7.00	4	2.84	M20	.55	.55	1.83	M10
3"	8.00	13.75	7.00	3.74	6.00	7.48	4	2.84	1-14 UNS	.745	.66	1.83	M10
4"	9.00	13.75	7.70	4.46	7.50	9.01	8	2.84	1-14 UNS	.745	.66	1.83	M10
6"	15.50	38.97	11.22	7.61	9.50	10.98	8	3.89	1.02	1.64	1.46	3.00	M12
8"	18.00	38.97	11.57	8.34	11.75	13.50	8	4.59	1.02	1.64	1.46	3.00	M12

The dimensions above are for information only, not for construction. For complete actuator mounting dimensions refer to Engineering Bulletin EB-2003.

TAG : Z

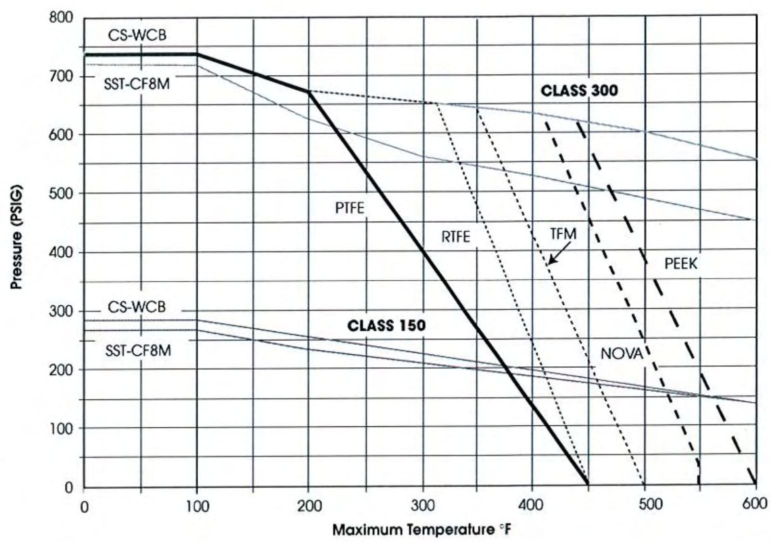
1/2" - 4" **6" - 8"**





1/2" - 4"
STEM ARRANGEMENT
FOR ACTUATORS

SEAT PRESSURE/TEMPERATURE RATING SERIES 50



HOW TO ORDER

VALVE SIZE	VALVE SERIES	CLASS	ALLOY	SEATS	OPTIONS
1/2"	50	150# = 11	2 = Alloy 20	T = TFE	X = Oxygen Service
3/4"			4 = Carbon Steel	R = RTFE	OH = Oval Handle
1"			6 = Stainless Steel	N = NOVA	F = Fugitive Emissions Certified ANSI 593.00.01
1-1/2"			5 = Hastelloy C	P = Peek	E = Extended Stem
2"			3 = Monel	M = TFM™	L = Lockable Extended Stem
2-1/2"					D = Leak detection Stem
3"					GO = Gear Operator
4"					7 = 17- 4PH Stem
6"					A = Nace
8"					

3/4" 50 11 6 T X

SHARPE® VALVES

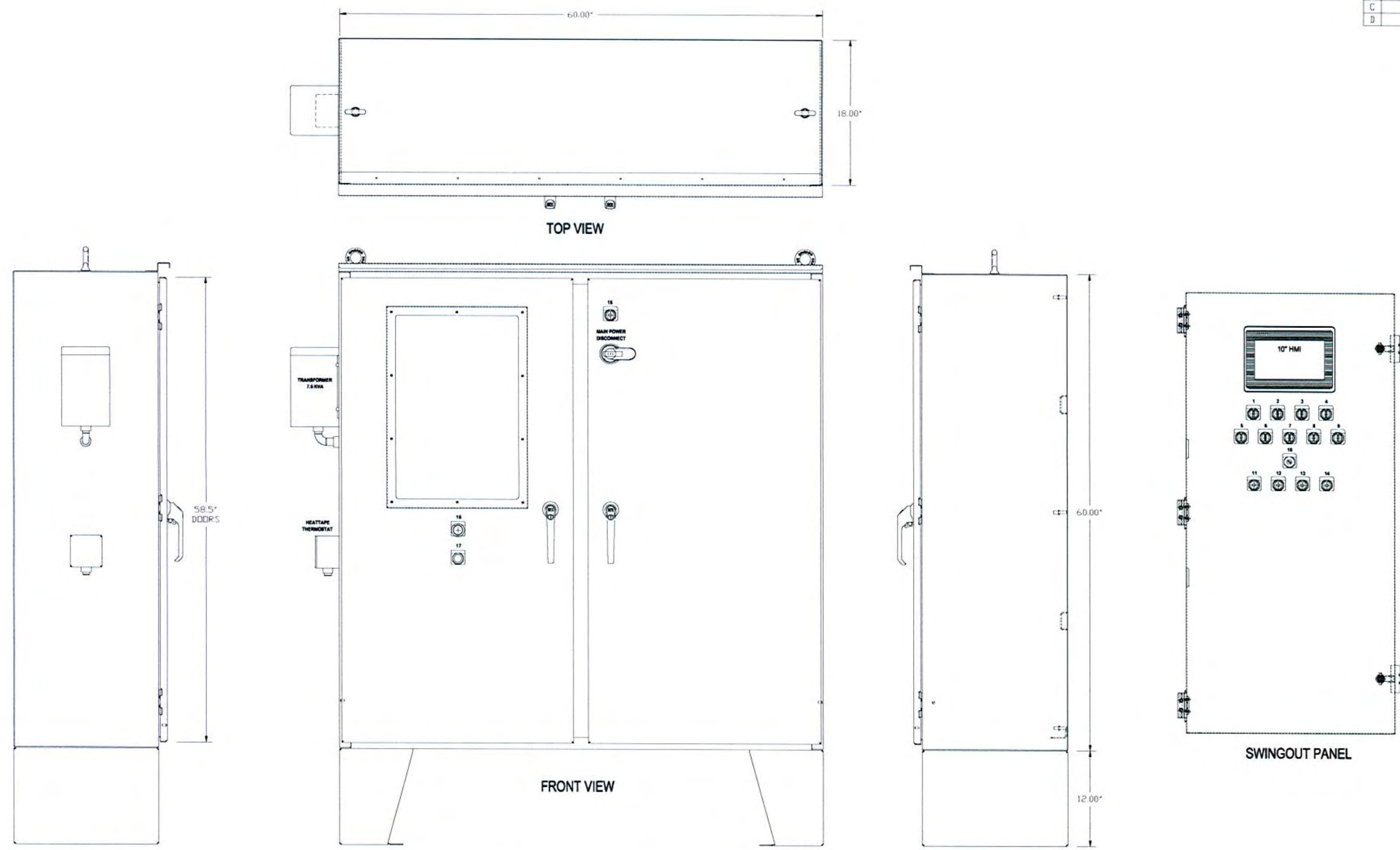
A Division of Smith-Cooper International, LLC

Toll-Free 1-877-7SHARPE
(877) 774-2773
Fax: (708) 562-9250
E-Mail: info@sharpevalves.com
www.sharpevalves.com
1260 Garnet Drive
Northlake, Illinois 60164 U.S.A.

Rev. 1/09

TAG: AA

A	ORIGINAL ISSUE	MH	1/18/13
B			
C			
D			



DEVICE LEGEND:

1	TLO PUMP #1 HAND-OFF-AUTO
2	TLO PUMP #2 HAND-OFF-AUTO
3	TLO SUMP PUMP HAND-OFF-AUTO
4	CONTAINMENT SUMP PUMP HAND-OFF-AUTO
5	MIXER PUMP HAND-OFF-AUTO
6	KO POT PUMP HAND-OFF-AUTO
7	PURE AIR PUMP HAND-OFF-AUTO
8	BLOWER #1 HAND-OFF-AUTO
9	BLOWER #2 HAND-OFF-AUTO
10	PLC LOCKED / UNLOCKED KEY SWITCH
11	HEAT TAPE #1 LIGHT (WHITE - PTT)
12	HEAT TAPE #2 LIGHT (WHITE - PTT)
13	HEAT TAPE #3 LIGHT (WHITE - PTT)
14	HEAT TAPE #4 LIGHT (WHITE - PTT)
15	CONTROL POWER ON LIGHT
16	E-STOP
17	WAKE PUSH BUTTON

ELECTRICAL ENCLOSURE 60" X 60" X 18"
TYPE 4

NOTE:
COMPLETED PUMP CONTROL PANEL ASSEMBLY WILL BE UL LISTED AND LABELED UNDER STANDARD 698A

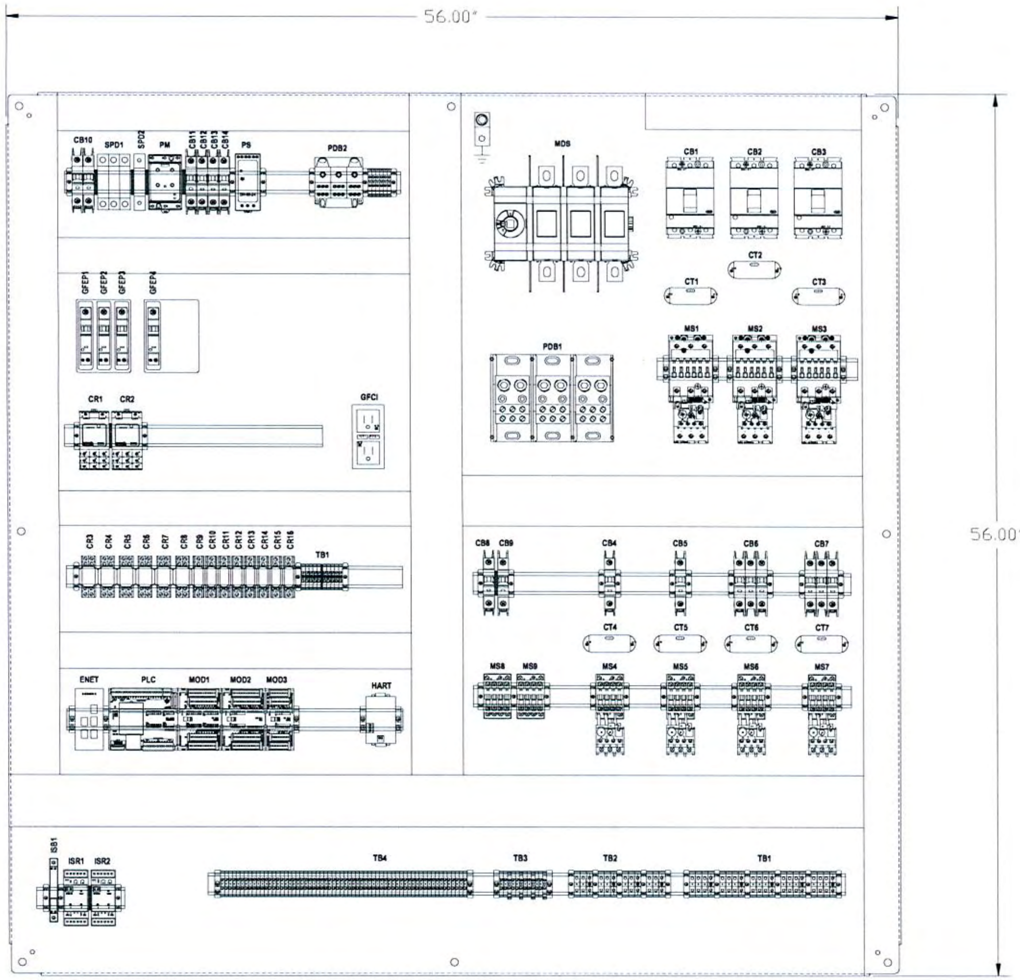
NOTE:
1. THIS PANEL MUST BE INSTALLED OBSERVING ALL APPLICABLE STATE AND LOCAL CODES, AND AS PER LATEST REVISION OF NEC. THIS SHALL INCLUDE, BUT NOT BE LIMITED TO, ANY REQUIRED SERVICE ENTRANCE EQUIPMENT NOT INCLUDED IN THIS CONTROL PANEL.
2. ENCLOSURE MUST BE CONNECTED TO A GOOD EARTH GROUND.

SLIGO SYSTEMS
Landfill Pumps & Controls
Lake Helen, Florida
386-218-4981
www.sligosystems.com

DWG. TITLE	BRIDGETON TANK CONTROL 460VAC - 3 PHASE		
DATE 02/18/2013	CSD MHH	DWG.NO. E-5024	REV A
DRAWN BY MHH	APP'D. MHH	SHT. 2 OF X	

TAG: AA

A	ORIGINAL ISSUE	MH	1/19/13
B			
C			
D			



BACK PANEL

NOTES:

CB1	460VAC - 3POLE - 40AMP (ABB)	MIXER MOTOR
CB2	460VAC - 3POLE - 60AMP (ABB)	BLOWER #1
CB3	460VAC - 3POLE - 60AMP (ABB)	BLOWER #2
CB4	120VAC - 1POLE - 15AMP (EATON)	KO POT PUMP
CB5	120VAC - 1POLE - 15AMP (EATON)	PURE AIR BLOWER
CB6	460VAC - 3POLE - 15AMP (EATON)	TRUCK LOAD OUT PUMP #1
CB7	460VAC - 3POLE - 15AMP (EATON)	TRUCK LOAD OUT PUMP #2
CB8	120VAC - 1POLE - 15AMP (EATON)	TRUCK LOAD OUT SUMP PUMP
CB9	120VAC - 1POLE - 15AMP (EATON)	CONTAINMENT SUMP PUMP
CB10	480VAC - 2POLE - 5AMP (EATON)	480-120VAC TRANSFORMER
CB11	120VAC - 1POLE - 5AMP (EATON)	120VAC CONTROL POWER
CB12	120VAC - 1POLE - 15AMP (EATON)	GFCI OUTLET
CB13	120VAC - 1POLE - 2AMP (EATON)	DC POWER SUPPLY
CB14	120VAC - 1POLE - 2AMP (EATON)	120VAC FIELD POWER
GFEP1	120VAC - 15AMP (GE)	HEATTAPE #1
GFEP2	120VAC - 15AMP (GE)	HEATTAPE #2
GFEP3	120VAC - 15AMP (GE)	HEATTAPE #3
GFEP4	120VAC - 15AMP (GE)	HEATTAPE #4

NOTE:
COMPLETED PUMP CONTROL PANEL ASSEMBLY WILL BE UL LISTED AND LABELED UNDER STANDARD 698A

NOTE:
1. THIS PANEL MUST BE INSTALLED OBSERVING ALL APPLICABLE STATE AND LOCAL CODES, AND AS PER LATEST REVISION OF NEC. THIS SHALL INCLUDE, BUT NOT BE LIMITED TO, ANY REQUIRED SERVICE ENTRANCE EQUIPMENT NOT INCLUDED IN THIS CONTROL PANEL.
2. ENCLOSURE MUST BE CONNECTED TO A GOOD EARTH GROUND.

SLIGO SYSTEMS
Landfill Pumps & Controls
Lake Helen, Florida
386-218-4981
www.sligosystems.com

DWG. TITLE	BRIDGETON TANK CONTROL 230VAC - 3 PHASE		
DATE 02/19/2013	CSD MHH	DWG.NO. E-5024	REV A
DRAWN BY MHH	APP'D. MHH	SHT. 3 OF X	

TAG: BB

ISCO INDUSTRIES
800-345-ISCO
www.isco-pipe.com

HIGH DENSITY POLYETHYLENE PIPE
Typical Physical Properties***

Property	**Specification**	**Unit**	**Nominal Value**
Material Designation	PPI / ASTM		PE 3408
Material Classification	ASTM D-1248		III C 5 P34
Cell Classification	**ASTM D3350-99**		**345464C**
-Density (3)	ASTM D-1505	gm/cm3	0.955
-Melt Index (4)	ASTM D-1238 (216 kg/190¡C)	gm/10 min.	0.11*
-Flex Modulus (5)	ASTM D-790	psi	135,000
-Tensile Strength (4)	ASTM D-638	psi	3,200
PENT (6)	ASTM F-1473	Hours	>100
-HDB @73¡ F (4)	ASTM D-2837	psi	1,600
-HDB @ 140 Deg F	ASTM D-2837	psi	800
-U-V Stabilizer (C)	ASTM D-1603	% C	2.5
Hardness	ASTM D-2240	Shore "D"	65
Compressive Strength (yield)	ASTM D-695	psi	1,600
Tensile Strength @ Yield (Type IV Spec.)	ASTM D-638 (2"/min.)	psi	3,200
Elongation @ Yield	ASTM D-638	%, minimum	8
Tensile Strength @ Break (Type IV Spec.)	ASTM D-638	psi	5,000
Elongation @ Break	ASTM D-638	%, minimum	750
Modulus of Elasticity	ASTM D-638	psi	130,000
PENT (6)	ASTM F-1473	Hours	>100
(Cond. A, B, C: Mold. Slab)	ASTM D-1693	Fo, Hours	>5,000
(Compressed Ring - pipe)	ASTM F-1248	Fo, Hours	>3,500
Slow Crack Growth	Battelle Method	Days to Failure	>64
Impact Strength (IZOD) (.125Ó Thick)	ASTM D-256 (Method A)	In-lb / in notch	42
Linear Thermal Expansion Coef.	ASTM D-696	in / in/¡F	1.2x10-4
Thermal Conductivity	ASTM D-177	BTU-in/ft2/ hrs/ degreesF	2.7
Brittleness Temp.	ASTM D-746	degrees F	< -180
Vicat Soft. Temp.	ASTM D-1525	degrees F	257
Heat Fusion Cond.	ASTM D-1525	@ psi degrees F	75 @ 400

*** This list of typical physical properties is intended for basic characterization of the material and does not represent specific determinations of specifications. The physical properties values reported herein were determined on compression molded specimens prepared in accordance with Procedure C of ASTM D 1928 and may differ from specimens taken from pipe.
** Tests were discontinued because no failures and no indication of stress crackinitiation.
* Average Melt Index value with a standard deviation of 0.01

QW-482 SUGGESTED FORMAT FOR WELDING PROCEDURE SPECIFICATION (WPS)

(See QW-201.1, Section IX, ASME Boiler and Pressure Vessel Code)

Company Name: Bruce's Welding By: Bruce Barnes

Welding Procedure Specification No. BW-WPS-001 Date: 8-23-07 Supporting PQR No.(s) BW-PQR-001

Revision No. N/A Date N/A

Welding Process(es) GTAW/SMAW Type (s) Manual

JOINTS (QW-402)

Joint Design: See permitted figures (right) or per constr. dwg

Backing (Yes) No (No) Yes

Backing Material (Type) None Permitted

☒ Metal ☐ Nonfusing Metal

☐ Nonmetalic ☐ Other

Details

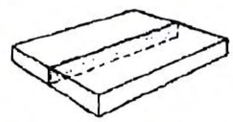


FIG A (BUTT JOINT)

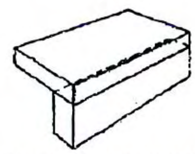


FIG B (CORNER JOINT)

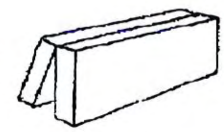


FIG C (EDGE JOINT)

Sketches. Production Drawings, Weld Symbols or Written Description should show the general arrangement of the parts to be welded. Where applicable, the root spacing and the details of weld groove may be specified.

(At the option of the Mfgr., sketches may be attached to illustrate joint design, weld layers and bead sequence, e.g., for notch toughness procedures, for multiple process procedures etc.)

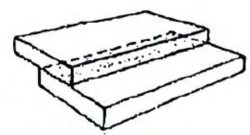


FIG D (LAP JOINT)

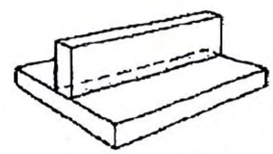


FIG E (TEE JOINT)

☐ Other (Describe)

☒ Figure A ☐ Figure B ☐ Figure C ☐ Figure D ☐ Figure E

***BASE METALS (QW-403)**

P-No. 1 Group No. All to P-No. 1 Group No. All

OR

Specification type and grade: N/A

to Specification type and grade: N/A

OR

Chem. Analysis and Mech. Prop.: N/A

to Chem. Analysis and Mech. Prop.: N/A

Thickness Range:

Base Metal: Groove .218" to .436" Fillet Unlimited

Other N/A

***FILLER METALS (QW-404)**

Spec. No. (SFA)	A5.2	A5.1		
AWS No. (Class)	ER70S-2	E7018		
F-No.	6	4		
A-No.	1	1		
Size of Filler Metal	3/32" to 1/8"	3/32"		
Weld Metal Thickness Range:				
Groove	.436" max.	.436" max		
Fillet	Unlimited	Unlimited		
Electrode-Flux (Class)	N/A	N/A		
Flux Trade Name	N/A	N/A		
Consumable Insert	N/A	N/A		
Other				

*Each base metal-filler metal combination should be recorded individually.

QW-482 (Back)

WPS No. BW-WPS-001 Rev N/A

POSITIONS (QW-405)
Position(s) of Groove 6G
Welding Progression: Up X Down
Position(s) of Fillet N/A

POST WELD HEAT TREATMENT (QW-407)
Temperature Range N/A
Time Range N/A

PREHEAT (QW-406)
Preheat Temp. Min. 50 °F
Interpass Temp. Max. 400 max. °F
Preheat Maintenance N/A
(Continuous or special heating where applicable should be recorded)

GAS (QW-408) Percent Composition

	Gas(es)	(Mixture)	Flow Rate
Shielding	Argon	100% 12-15	CFH
Trailing	N/A	N/A	CFH
Backing	N/A	N/A	CFH

ELECTRICAL CHARACTERISTICS (QW-409)
Current AC or DC DC Polarity SEN/REP
Amps (Range) 100 - 125 Volts (Range) Not monitored

(Amps and volt range should be recorded for each electrode size, position, and thickness, etc. This information may be listed in a tab-ular form similar to that shown below.)

Tungsten Electrode Size and Type 2% Thoriated 3/32" dia.
(Pure Tungsten, 2% Thoriated, etc.)

Mode of Metal Transfer for GMAW N/A
(Spray arc, short circuiting arc, etc.)

Electrode Wire feed speed range N/A

TECHNIQUE (QW-410)
String or Weave Bead String or Weave
Orifice or Gas Cup Size #6 to #10
Initial and Interpass Cleaning (Brushing, Grinding, etc.) Brushing, grinding, chipping
Grinding not permitted on root pass
Method of Back Gouging None
Oscillation None
Contact Tube to Work Distance N/A
Multiple or Single Pass (per side) Multiple
Multiple or Single Electrodes Multiple
Travel Speed (Range) N/A
Peening None
Other No Single Pass To Exceed 1/2" In Thickness Pulsed Power Supply not permitted

Weld Layer(s)	Process	Filler Metal Class	Filler Metal Dia.	Current Type Polar.	Current Amp. Range	Volt Range	Travel Speed Range	Other (e.g., Remarks, Com-ments, Hot Wire Addition, Technique, Torch Angle, Etc.)
1 - 3	GTAW	ER70S-2	3/32" to 1/8"	SEN	100 - 125	N/A	N/A	
4	SMAW	E7018	3/32"	REP	105 - 110	N/A	N/A	

QW-483 SUGGESTED FORMAT FOR PROCEDURE QUALIFICATION RECORDS (PQR)
(See QW-200.2, Section IX, ASME Boiler and Pressure Vessel Code)
Record Actual Conditions Used to Weld Test Coupon

Company Name: Bruce's Welding
Procedure Qualification Record No. BW-PQR-001 Date 8-23-07
WPS No. BW-WPS-001
Welding Process (es) GTAW/SMAW
Types (Manual, Automatic, Semi-auto)
Joints (QW-402)

See attached drawing

Groove Design of Test Coupon

(For combination qualifications, the deposited weld metal thickness shall be recorded for each filler metal or process used.)

BASE METALS (QW-403)
Material Spec: SA53
Type or Grade: B
P no. 1 To P No. 1
Thickness of Test Coupon: .218"
Diameter of Test Coupon: 2.375"
Other: N/A

FILLER METALS (QW-404)
SFA Specification: A5.2/A5.1
AWS Classification: ER70S-2/E7018
Filler Metal F No.: 6/4
Weld Metal Analysis A No.: 1/1
Size of Filler Metal: 3/32" - 1/8"/3/32"
Other: N/A

Weld Metal Thickness: N/A

POSITION (QW-405)
Position of Groove: 6G
Weld Progression (Uphill, Downhill): Uphill
Other: N/A

PREHEAT (QW-406)
Preheat Temp.: 50°F
Interpass Temp.: 400°F
Other: N/A

POST WELD HEAT TREATMENT (QW-407)
Temperature: N/A
Time: N/A
Other: N/A

GAS (QW-408)

	Gas (es)	Percent Composition (Mixture)	Flow Rate
Shielding	Argon	100%	12 - 15
Trailing	N/A		
Backing	N/A		

ELECTRICAL CHARACTERISTICS (QW-409)
Current: DC
Polarity: SEN/REP
Amps: 100 - 125 Volts: N/A
Tungsten Electrode Size: 3/32"
Other: N/A

TECHNIQUE (QW-410)
Travel Speed: N/A
String or Weave Bead: Stringers
Oscillation: Only on cap
Multipass or Singles Pass (per side): Multiple
Single or Multiple Electrodes: Multiple
Other: N/A

QW-483 (Back)

PQR No. BW-PQR-001

Tensile Test (QW-150)

Specimen No.	Width	Thickness	Area	Ultimate Total Load lb	Ultimate Unit Stress psi	Type of Failure & Location
6G-1	.746	.204	.152	11,351	74,677	Parent Metal
6G-2	.746	.207	.154	11,329	74,532	Parent Metal

Guided Bend Tests (QW-160)

Type and Figure No.	Result
6G - 2 o'clock root	Complies to code requirements
6G - 4 o'clock face	Complies to code requirements
6G - 8 o'clock root	Complies to code requirements
6G - 10 o'clock face	Complies to code requirements

Toughness Tests (QW-170)

Specimen No.	Notch Location	Specimen Size	Test Temp.	Impact Values			Drop Weight Break (Y/N)
				Ft. lbs	% Shear	Mils	
N/A							

Comments N/A

Fillet Weld Test (QW-180)

Result- Satisfactory: Yes N/A No N/A Penetration into Parent Metal: Yes N/A No N/A

Macro - Results N/A

Other Tests

Type of Test N/A

Deposit Analysis N/A

Other N/A

Welders Name Bruce Barnes Clock No. 0024 Stamp No. 0024

Tests Conducted by X Wm. L. Shreve, M.S. Laboratory Test No. Shreve Weld-Tech

We certify that statements made in this record are correct and that the test welds were prepared, welded, and tested in accordance with the Requirements of Section IX of the ASME Code

Manufacturer ____________

Date ____________ By ____________

QW-484 WELDER/WELDING OPERATOR
PERFORMANCE QUALIFICATIONS (WPQ)
See QW-301, Section IX, ASME Boiler and Pressure Vessel Code

Welder's name Bruce Barnes Clock number 24 Stamp No. 24

Welding process(es) used GTAW/SMAW Type Manual

Identification of WPS followed by welder during welding of test coupon BW-WPS-001

Base material(s) welded SA53B Thickness .218"

Manual or Semiautomatic Variables for Each Process (QW-350)	Actual Values	Range Qualified
Backing (metal, weld metal, welded from both sides, flux, etc.) (QW-402)	Without	With or without
ASME P-No. 1 to ASME P-No. (QW-403)	1 to 1	1 to 1
( ) Plate (X) Pipe (enter diameter, if pipe)	2.375"	2.375" and up
Filler metal specifications (SFA): ______ Classification (QW-404)	GTAW-A5.2/SMAW-A5.1	----
Filler metal F-No.	GTAW-1/SMAW-4	GTAW - 1/SMAW-3-4
Consumable insert for GTAW or PAW	None	None
Weld deposit thickness for each welding process	GTAW .375"/SMAW .500"	N/A
Welding position (1G, 5G, etc.) (QW-405)	6G	All
Progression (uphill/downhill)	Vertical Up	Vertical Up
Backing gas for GTAW, PAW, or GMAW; fuel gas for OFW (QW-408)	N/A	N/A
GMAW transfer mode (QW-409)	N/A	N/A
GTAW welding current type/polarity	SEN	SEN

Machine Welding Variables for the Process Used (QW-360)	Actual Values	Range Qualified
Direct/remote visual control	N/A	N/A
Automatic voltage control (GTAW)	N/A	N/A
Automatic joint tracking	N/A	N/A
Welding position (1G, 5G, etc.)	N/A	N/A
Consumable insert	N/A	N/A
Backing (metal, weld metal, welded from both sides, flux, etc.)	N/A	N/A

Guided Bend Test Results

Guided Bend Tests Type	(X) QW-462.2 (Side) Results	( ) QW-462.3(a) (Trans. R & F) Type	( ) QW-462.3(b) (Long. R & F) Results
2 o'clock root			Complies to code - Pass
8 o'clock root			Complies to code - Pass
4 o'clock face			Complies to code - Pass
10 o'clock face			Complies to code - Pass

Visual examination results (QW-302.4) Complies

Radiographic test results (QW-304 and QW-305) N/A

(For alternative qualification of groove welds by radiography)

Fillet Weld__Fracture test N/A Length and percent of defects N/A in.

Macro test fusion N/A Fillet leg size N/A in. X N/A in. Concavity/convexity N/A in.

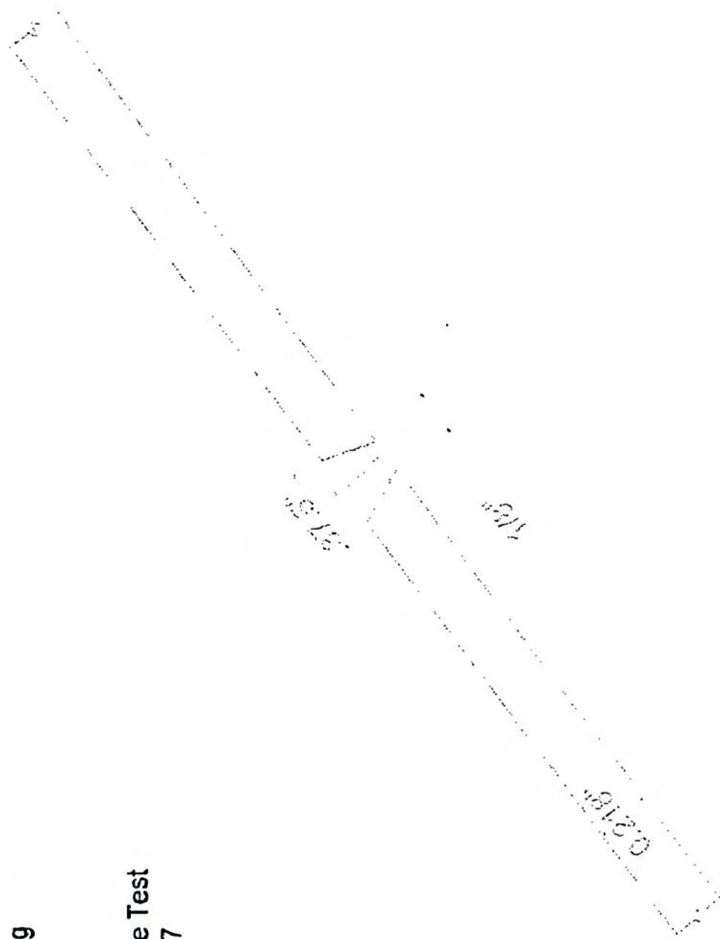
Welding and mechanical tests conducted by Wm. L. Shreve, M.S. CWI 96090341

AWS CWI WILLIAM E. SHREVE

We certify that the statements in this record are correct and that the test coupons were prepared, welded, and tested in accordance with the requirements of Section IX of the ASME Code.

Organization ______

Date ______ By ______



Bruce's Welding
BW-WPS-001
BW-PQR-001
6G Carbon Steel Pipe Test
August 23, 2007

BRUCE'S WELDING INC.
STRUCTURAL STEEL WELDING
INDIVIDUAL QUALIFICATION WELD TEST

Weld Test Conductor CWI Name:	Weld Test Conductor CWI Address:
Wm. L. Shreve	736 East Melvin Ave., Oshkosh, WI 54901

PERSONAL INFORMATION

Welder's Name: (First, Middle and Last)	Social Security Number:	Welder Symbol:	
Bruce Barnes	345-52-0024		
Address: (Street or P.O. Box)	**City:**	**State:**	**Zip + 4 Code:**
20826 Enslow Road	Wagner	IL	62572

TEST INFORMATION

Performance Qualification:	Yes X No		Procedure Qualification:	Yes	No X
Employer Name: Bruce's Welding Inc.	Address: 302 South 3rd		City: Girard	State: IL	Zip + 4 Code: 62640
Weld Procedure Specification Number: BW-GMAW-CS-2G	Code Standard and Year Edition: AWS D1.1 - 2004		Welding Process: GMAW	Base Material Specification: A36 to A36	
Electrode Specification SFA Number: AWS 5.18	AWS Classification: ER70S-3 (.035" dia.)		AWS Group Number: 6	Current Type and Polarity: DC-REVERSE	
Thickness of Test Piece: 0.375"	Tensile Strength: 50,000	Is Backing Strip Used? Yes X No		Amperage: 150 - 190	Voltage: 20 - 23
Fillet Weld Number of Passes: N/A	Groove Weld Number of Passes: 6		Weld Progression: 2G	Flux: N/A	
Shielding Gas Mixture: Shurgon 95%AR / 5%CO_2	Flowrate: 30 - 40 cfh		Interpass Temperature: Not monitored	Qualification by Radiograph? Yes	No X

Indicate Joint Position and Type	Indicate Specimen Identification	In the blanks, briefly describe any defects revealed	Pass or Fail
2G	Face	Clear	Pass
2G	Root	Clear	Pass

Tensile Specimen	Width (In.)	Area (In.)	Ultimate Total Load (lbs.)	Ultimate Total Stress (PSI)	Character & Location of Failure
Sample 1	N/A				
Sample 2	N/A				

Code Standard and Year:	Section:	Part:	Paragraph Number:	Option:
AWS D1.1 - 2004	5	B	5.2	N/A

Test Conducted and Evaluated By: (Signature of CWI)	Test Date:	Expiration Date:
Wm. L. Shreve, M.S.	6/20/2003	Period of effectiveness

AWS QC 1 WILLIAM L. SHREVE 96090341 CWI

This Certifies that: (Welder's Name) Bruce Barnes		Specification No.: BW-GMAW-CS-2G	Process: GMAW / Base Material: A36
Social Security Number: 345-52-0024	Welder Symbol:	Employer: Bruce's Welding Inc.	Address, City, Zip: 302 South 3rd Girard, IL 62640
Welder's Signature:			
Has passed the required welder qualification test. Extent of limitations listed below and at right.		Filler Material: ER70S-3 (.035") / SFA: 5.18	Group: 6 / Thickness Range: .125" - .750"
Weld Position Qualified: 1F, 2F, 1G, 2G		Groove Limited: 1G, 2G	
		Fillet Limited: 1F, 2F	
Expiration Date: Period of effectiveness		Pipe Tubing:	Thru 4": N/A / Over 4": N/A
Test Conducted by CWI: Wm. L. Shreve, M.S.	CWI Credential No.: 96090341	Positions Qualified: 1F, 2F, 1G, 2G	

96090341 CWI

BRUCE'S WELDING INC.
STRUCTURAL STEEL WELDING
INDIVIDUAL QUALIFICATION WELD TEST

Weld Test Conductor CWI Name:	Weld Test Conductor CWI Address:
Wm. L. Shreve	736 East Melvin Ave., Oshkosh, WI 54901

PERSONAL INFORMATION

Welder's Name: (First, Middle and Last)	Social Security Number:	Welder Symbol:	
Bruce Barnes	345-52-0024		
Address: (Street or P.O. Box)	**City:**	**State:**	**Zip + 4 Code:**
20826 Enslow Road	Wagner	IL	62572

TEST INFORMATION

Performance Qualification:	Yes X No	**Procedure Qualification:**	Yes No X	
Employer Name: Bruce's Welding Inc.	**Address:** 302 South 3rd	**City:** Girard	**State:** IL	**Zip + 4 Code:** 62640
Weld Procedure Specification Number: BW-SMAW-CS-3G4G	**Code Standard and Year Edition** AWS D 1.1 - 1988	**Welding Process:** SMAW	**Base Material Specification:** A36 to A36	
Electrode Specification SFA Number: 5.10	**AWS Classification:** E7018	**AWS Group Number:** F4	**Current Type and Polarity:** Direct Reverse	
Thickness of Test Piece: 0.375"	**Tensile Strength:** 60,000	**Is Backing Strip Used?** Yes X No	**Amperage:** 80 - 125	**Voltage:** 17 - 22
Fillet Weld Number of Passes: N/A	**Groove Weld Number of Passes** 6 - 12	**Weld Progression:** 3G Vertical Up, 4G Overhead	**Flux:** N/A	
Shielding Gas Mixture: N/A	**Flowrate:** N/A	**Interpass Temperature:** Not monitored	**Qualification by Radiograph?** Yes No X	

Indicate Joint Position and Type	Indicate Specimen Identification	In the blanks, briefly describe any defects revealed	Pass or Fail
3G	Face	No defects.	Pass
3G	Root	No defects.	Pass
4G	Face	No defects.	Pass
4G	Root	No defects.	Pass

Tensile Specimen	Width (In.)	Area (In.)	Ultimate Total Load (lbs.)	Ultimate Total Stress (PSI)	Character & Location of Failure
Sample 1	N/A				
Sample 2	N/A				

Code Standard and Year:	Section:	Part:	Paragraph Number:	Option:
AWS D 1.1 - 1988	5	C	5.28	N/A

Test Conducted and Evaluated By: (Signature of CWI)	Test Date:	Expiration Date:
Wm. L. Shreve, M.S.	6/20/2003	Period of effectiveness.

AWS QC 1 WILLIAM L. SHREVE 96090341 CWI

This Certifies that: (Welder's Name) Bruce Barnes	**Specification No.:** BW-SMAW-CS-3G4G	**Process:** SMAW	**Base Material:** A36 - A36
Social Security Number: 345-52-0024 / **Welder Symbol:**	**Employer:** Bruce's Welding Inc.	**Address, City, Zip:** 302 South 3rd Girard, IL 62640	
Welder's Signature:			
Has passed the required welder qualification test. Extent of limitations listed below and at right.	**Filler Material:** E 7018 / **SFA:** 5.10	**Group:** F4	**Thickness Range:** .125" - .750"
Weld Position Qualified: 1G, 2G, 3G, 4G, 1F, 2F, 3F, 4F	**Groove Limited:** 1G, 2G, 3G, 4G		
	Fillet Limited: 1F, 2F, 3F, 4F		
Expiration Date: Period of effectiveness	**Pipe Tubing:**	**Thru 4"** N/A	**Over 4"** N/A
Test Conducted by CWI: Wm. L. Shreve, M.S. / **CWI Credential No.:** 96090341	**Positions Qualified:** 1G, 2G, 3G, 4G, 1F, 2F, 3F, 4F		

AWS QC 1 WILLIAM L. SHREVE 96090341 CWI

BRUCE'S WELDING INC.
STAINLESS STEEL WELDING
INDIVIDUAL QUALIFICATION WELD TEST

Weld Test Conductor CWI Name:	Weld Test Conductor CWI Address:
Wm. L. Shreve	736 East Melvin Ave., Oshkosh, WI 54901

PERSONAL INFORMATION

Welder's Name: (First, Middle and Last)	Social Security Number:	Welder Symbol:	
Bruce Barnes	345-52-0024		
Address: (Street or P.O. Box)	**City:**	**State:**	**Zip + 4 Code:**
20826 Enslow Road	Wagner	IL	62572

TEST INFORMATION

Performance Qualification:	Yes X No	Procedure Qualification:	Yes	No X
Employer Name: Bruce's Welding Inc.	Address: 302 South 3rd	City: Girard	State: IL	Zip + 4 Code: 62640
Weld Procedure Specification Number: BW-GTAW-SS-3G	Code Standard and Year Edition: AWS D1.6 - 1999	Welding Process: GTAW	Base Material Specification: ASTM A204/06, Type 304	
Electrode Specification SFA Number: AWS/ANSI A5.9	AWS Classification: ER308Lsi (1/16"-1/8") 2% Thoriated Tungsten (3/32")	AWS Group Number: 6	Current Type and Polarity: DCEN - Straight Polarity	
Thickness of Test Piece: .375"	Tensile Strength: 80 ksi	Is Backing Strip Used? Yes X No	Amperage: 125 - 147	Voltage: 17.5 - 22.5
Fillet Weld Number of Passes: N/A	Groove Weld Number of Passes: 7 - 9	Weld Progression: 3G Vertical Up	Flux: N/A	
Shielding Gas Mixture: 100% Argon	Flowrate: 12 - 15 cfh	Interpass Temperature: Not monitored	Qualification by Radiograph? Yes	No X

Indicate Joint Position and Type	Indicate Specimen Identification	In the blanks, briefly describe any defects revealed	Pass or Fail
3G	Face	Complies with code requirements.	Pass
3G	Root	Complies with code requirements.	Pass

Tensile Specimen	Width (In.)	Area (In.)	Ultimate Total Load (lbs.)	Ultimate Total Stress (PSI)	Character & Location of Failure
Sample 1	N/A				
Sample 2	N/A				

Code Standard and Year:	Section:	Part:	Paragraph Number:	Option:
AWS D1.6 - 1999	4	B	4.7.1	N/A

Test Conducted and Evaluated by: (Signature of CWI)	Test Date:	Expiration Date:
Wm. L. Shreve, M.S. [signature]	6/20/2003	Period of effectiveness.

AWS QC 1 WILLIAM L SHREVE 96090341 CWI

This Certifies that: (Welder's Name) Bruce Barnes	Specification No.: BW-GTAW-SS-3G	Process: GTAW	Base Material: Type 304
Social Security Number: 345-52-0024 / Welder Symbol:	Employer: Bruce's Welding Inc.	Address, City, Zip: 302 South 3rd Girard, IL 62640	
Welder's Signature:			
Has passed the required welder qualification test. Extent of limitations listed below and at right.	Filler Material: ER308Lsi(1/16"-1/8")2% ThoriatedTungsten(3/32") / SFA: A5.9	Group: 6	Thickness Range: .125" - .750"
Weld Position Qualified: 1G, 2G, 3G, 1F, 2F, 3F	Groove Limited: 1G, 2G, 3G		
	Fillet Limited: 1F, 2F, 3F		
Expiration Date: Period of effectiveness	Pipe Tubing:	Thru 4": N/A	Over 4": N/A
Test Conducted by CWI: Wm. L. Shreve, M.S. / Credential No.: 96090341	Positions Qualified: 1G, 2G, 3G, 1F, 2F, 3F		

WILLIAM L SHREVE 96090341 CWI

SLIGO SYSTEMS	SERIES 1 PUMPS	SPECIFICATIONS

FEATURES

1. Semi-Vortex (PU) or Enclosed (PN, PSF) FRP (Fiberglass Reinforced Plastic), impeller provides for high head pumping of effluent or water.
2. Double inside mechanical seals with silicon carbide faces, running in an oil filled chamber and further protected by a lip seal, provides for the most durable seal design available.
3. Highly efficient, continuous duty, air filled, copper wound motor with class E, insulation minimizes the cost of operation.
4. Double shielded, permanently lubricated, high temperature C3 ball bearings rated for a B-10 life of 60,000 hours, extend operational life.
5. Utilization of application appropriate FRP & stainless steel components increases corrosion resistance in a wide variety of applications.

APPLICATIONS

1. Residential, commercial, effluent, wastewater and site drainage.
2. Chemical spill containment.
3. Leachate Applications
4. Raw water supply from rivers or lakes.

OIL LIFTER (PAT PEND.) EQUIPPED (2 HP >)

C ETL LISTED US

ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION REG No 24 ISO 9001

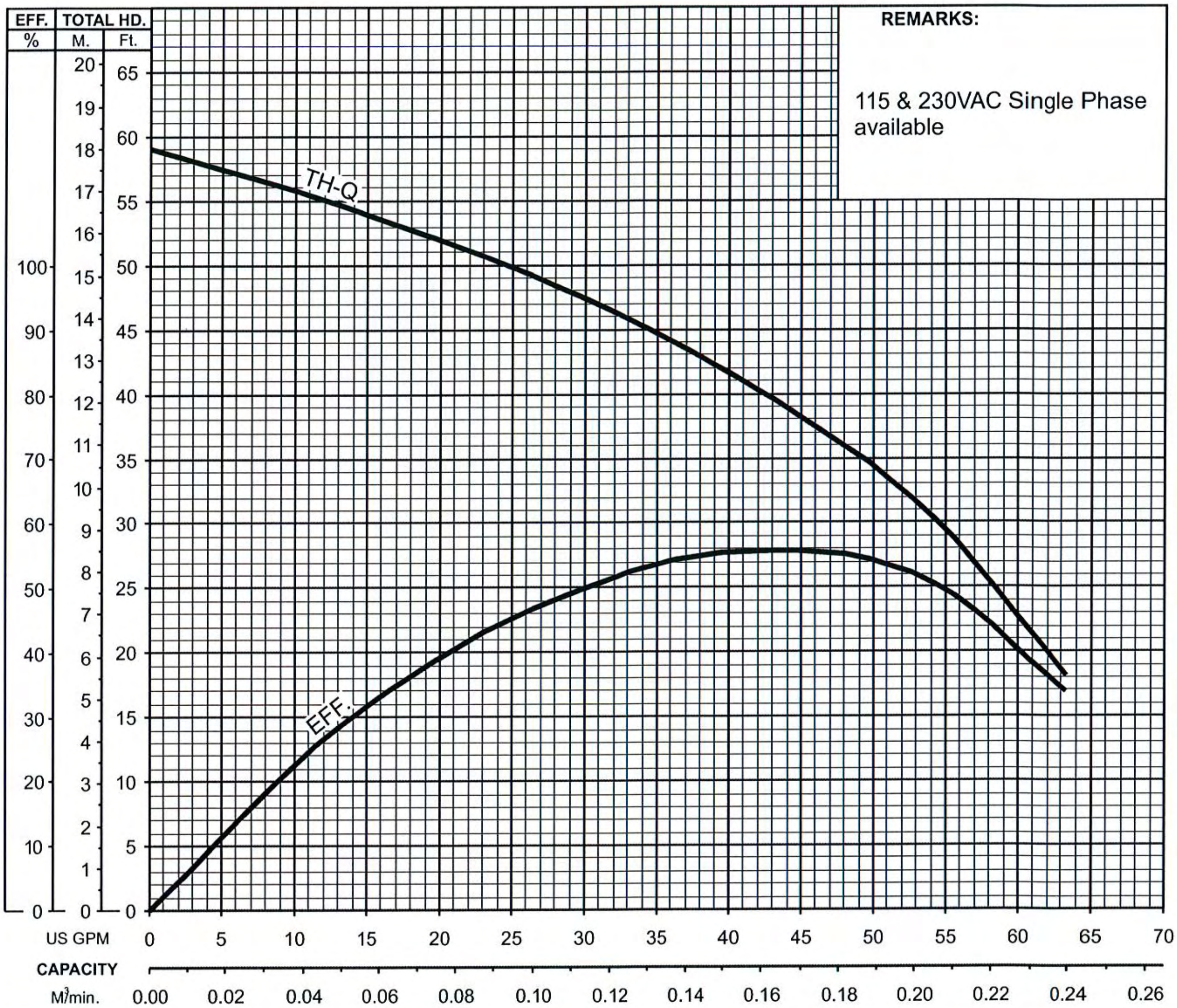
SPECIFICATIONS	STANDARD	
Discharge Size	2" N.P.T. (50 mm)	
Horsepower Range	1/3 ~ 2Hp. (.2 ~ 1.52 kW)	
Performance Range Capacity	7 ~ 184 G.P.M. (.026 ~ .7 m^3/min)	
Head	6.5. ~ 65 Ft. (2 ~ 20 m)	
Maximum water temperature	140°F. (60 °C.)	
Materials of Construction		
Casing (upper)/(lower)	FRP (ABS + G20) / ABS	
Impeller	FRP (ABS + G20)	
Shaft	403 Stainless Steel	
Motor Frame	304 Stainless Steel	
Fasteners	304 Stainless Steel	
Mechanical Seal	Silicon Carbide	
Elastomers	NBR (Nitril Buna Rubber)	
Impeller Type	Enclosed, Multi-vane	
Solids Handling Capability	.32~.88" (8~11 mm)	
Bearings	Pre-lubricated, Double Shielded	
Motor Nomenclature		
Type, Speed, Hz.	Air Filled, 3600 Rpm, 60 Hz.	
Voltage, Phase	115 or 230 V.,1 Ph., 230 or 460 V. 3 Ph .2 hp. 230 or 460 V. 3 Ph only.	
Insulation	Class E	
Accessories	Submersible Power Cable 32' (10 m)	Length as Required
Operational Mode		Model A (Automatic),Model AW (Automatic Alternating) TOK (FRP) Slide rail system

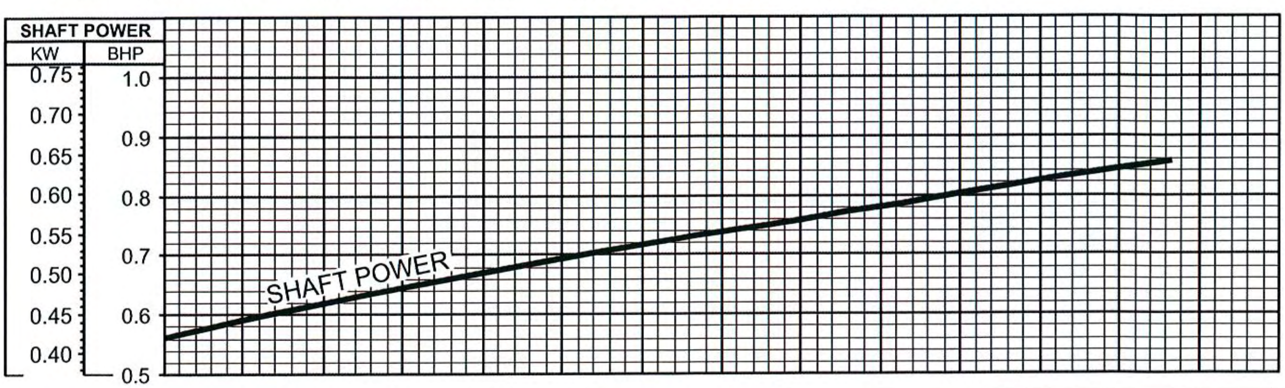
SLIGO SYSTEMS	SERIES 1 PUMPS PERFORMANCE CURVE	1-1-2PSF

MODEL		BORE	HP	KW	RPM	SOLIDS DIA	LIQUID	SG.	VISCOSITY	TEMP.
1-1-2PSF		2"/50mm	1	0.75	3415	0.433"/ 11mm	Water	1.0	1.81 CST	60F
PUMP TYPE		PHASE	VOLTAGE		AMPERAGE	HZ	STARTING METHOD		INS. CLASS	
Leachate Pump		3	208 / 230 / 460		3.5 / 3.4 / 1.7	60	Direct On Line		E	
CURVE No.	DATE	PHASE	VOLTAGE		AMPERAGE	HZ	STARTING METHOD		INS. CLASS	
-	-	-	-		-	-	-		-	

REMARKS:

115 & 230VAC Single Phase available





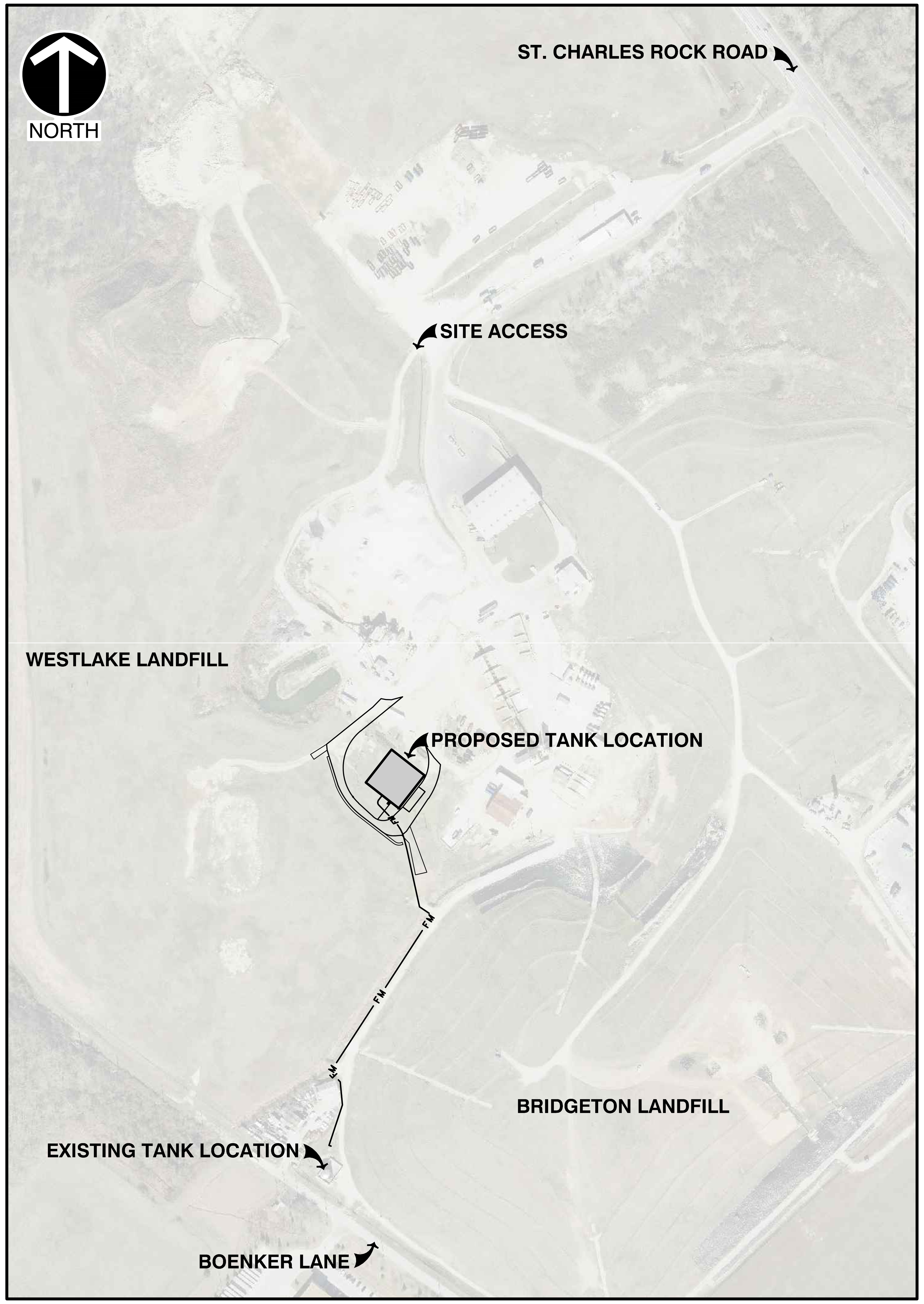
ATTACHMENT D

ENGINEERING DESIGN DRAWINGS FOR

BRIDGETON LANDFILL

BRIDGETON, MISSOURI

LEACHATE STORAGE TANK & LOADOUT SITE AREA CONSTRUCTION PLANS



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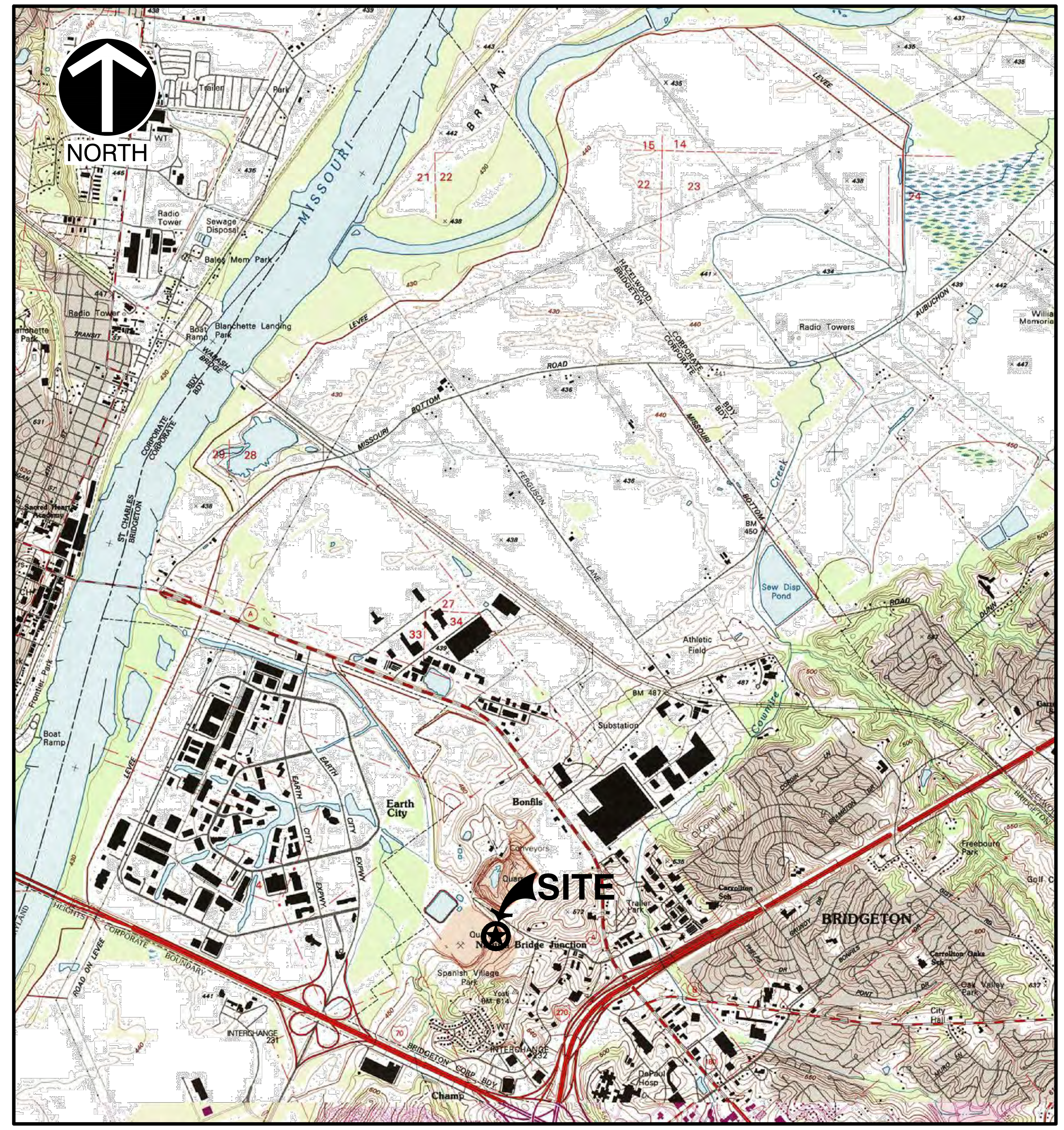

SCALE IN FEET
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ENGINEERING QUANTITIES FOR SITE IMPROVEMENTS

PROJECT NAME:	BRIDGETON LANDFILL	JOB #: 130-484	
CLIENT:	BRIDGETON LANDFILL, LLC	DATE: 03/07/13	
NO.	**ITEM**	**QTY.**	**UNIT**
	GRADING		
	Grading	252	Cu.Yd.
	Gravel road to be removed (Per Owner's discretion)	109	Cu.Yd.
	Import Fill Material	4,743	Cu.Yd.
	DRIVEWAYS*		
	18" Crushed Rock	3,158	Sq.Yd.
	6" Aggregate Type 5, compacted	3,158	Sq.Yd.
	*containment and loadout area not included		
	STORM SEWERS		
	12" Ductile Iron	215	Lin.Ft.
	15" Ductile Iron	605	Lin.Ft.
	Granular Fill	85	Cu.Yd.
	Rip-Rap	60	Cu.Yd.
	SWPPP - Erosion & Sediment Controls (BMPs)		
	Silt Fence	350	Lin.Ft.
	Restoration - Seeding	6,450	Sq.Yd.

LIST OF DRAWINGS

SHEET #	SHEET TITLE(S)	NAME
01	COVER SHEET	C000
02	PROPOSED SITE LAYOUT WITH OVERHEAD WIRE HEIGHTS SITE GRADING, SWPPP, SWALE SECTIONS	C300
03	PROPOSED DRIVE ALIGNMENTS STORM WATER PLAN & PROFILES	C301
04	PROPOSED DRIVE PROFILES	C302
05	GRADING & SECTIONS AT CONTAINMENT WALL FOOTING	C800
06	CONSTRUCTION & SWPPP DETAILS	C800

KEVIN KAMP, ENGINEER
PE - 2006019670
*HAND SIGNATURE ON INDIVIDUAL SHEETS

REVISION RECORD

NO	DATE	DESCRIPTION
1	----	----
2	----	----
3	----	----
4	----	----
5	----	----
6	----	----
7	----	----
8	----	----

Civil & Environmental Consultants, Inc.
4848 Park 370 Blvd., Suite F - Hazelwood, MO 63042
314-656-4566 · 866-250-3679
www.cecinc.com

BRIDGETON LANFILL, LLC
12976 ST. CHARLES ROCK ROAD
BRIDGETON, MO 63044
PHONE: (314) 744-8195
FAX: (314) 656-2107

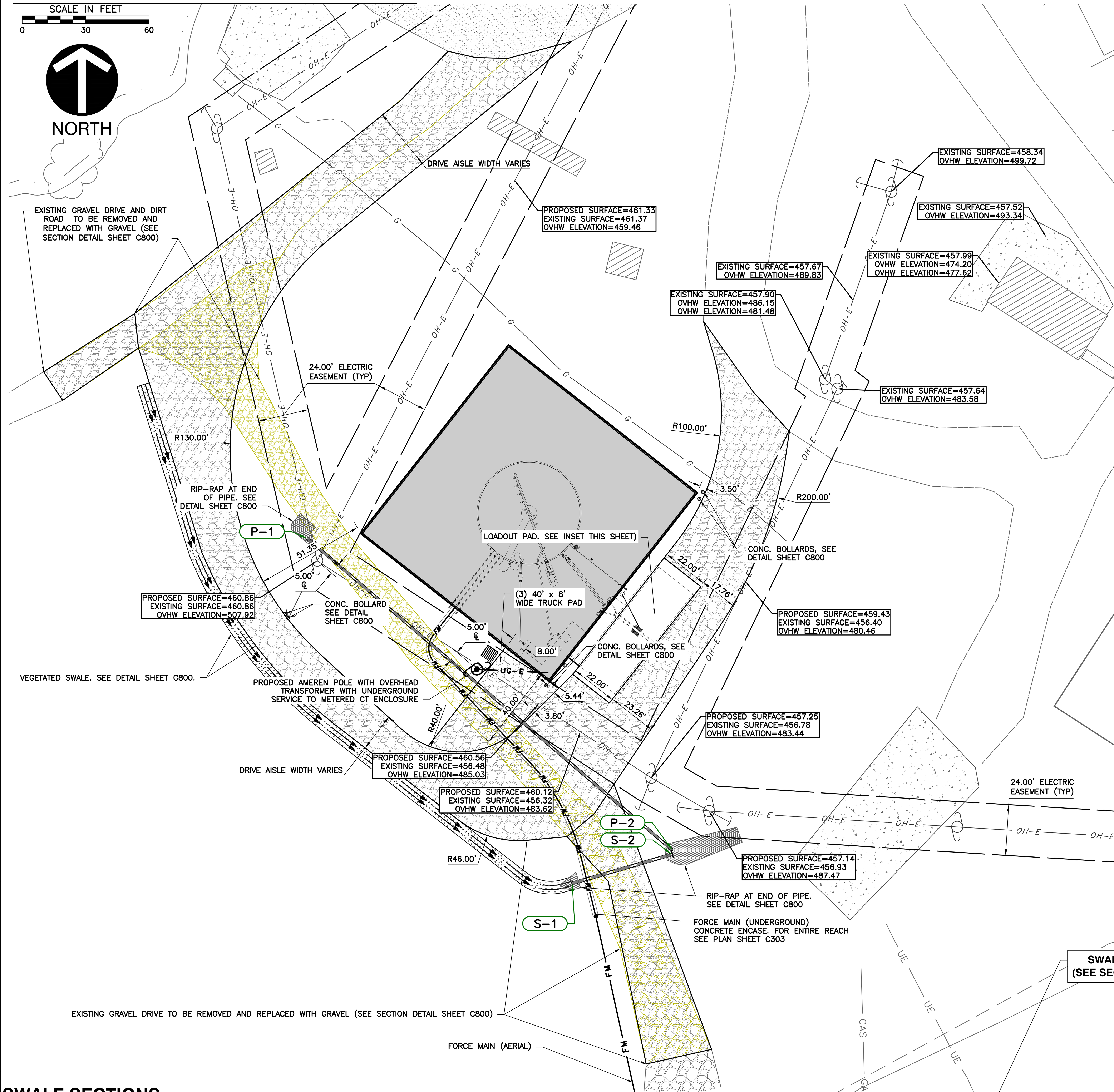
BRIDGETON LANDFILL
13570 ST. CHARLES ROCK ROAD

COVER SHEET

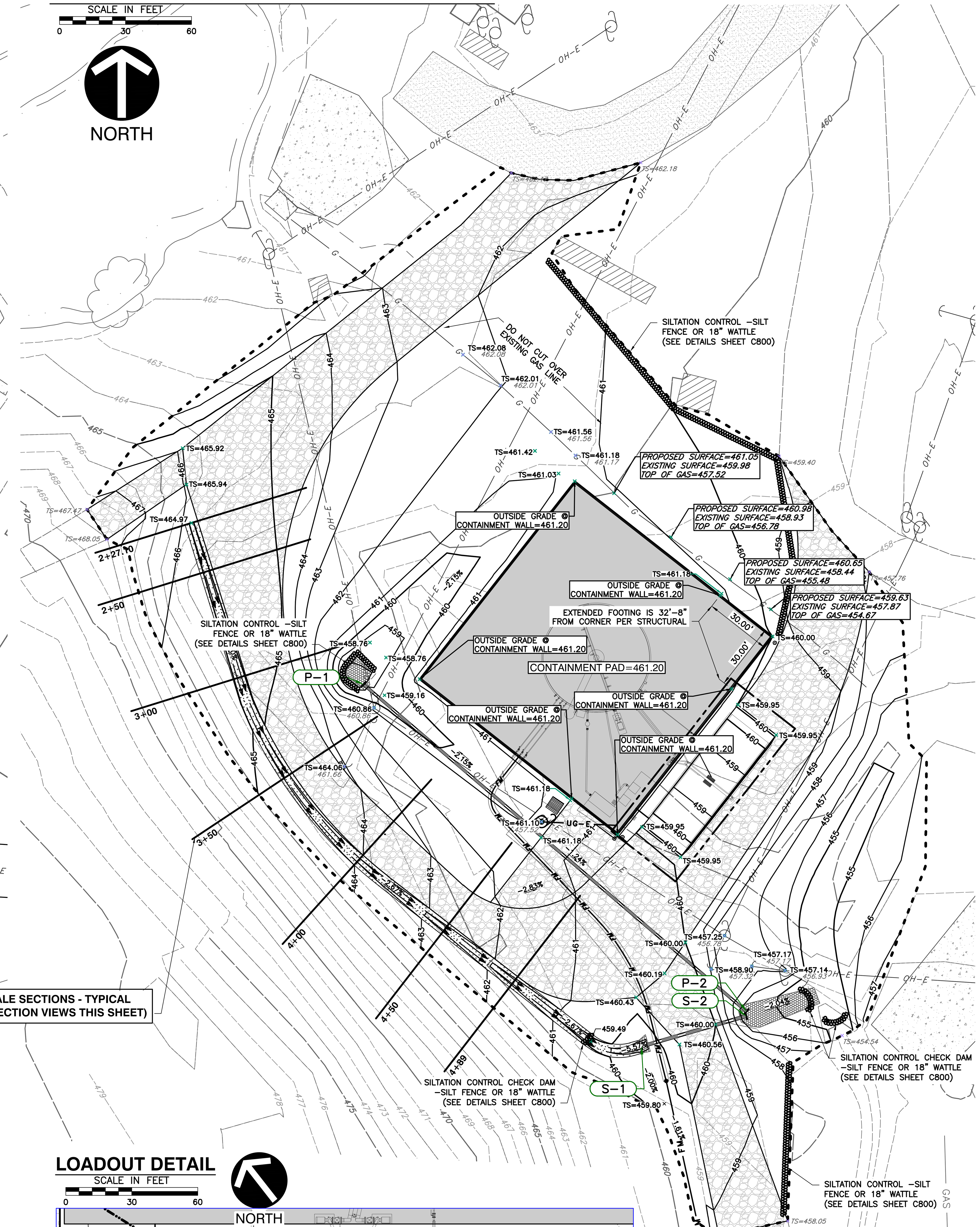
DATE:	FEB 2013	DRAWN BY:	CAC
DWG SCALE:	1" = 30'	CHECKED BY:	DRAFT
PROJECT NO:	130-484		
APPROVED BY:	KTK (SIGNED & SEALED)*		

DRAWING NO.: C000
SHEET 1 OF 6

SITE LAYOUT WITH OVERHEAD WIRE HEIGHTS

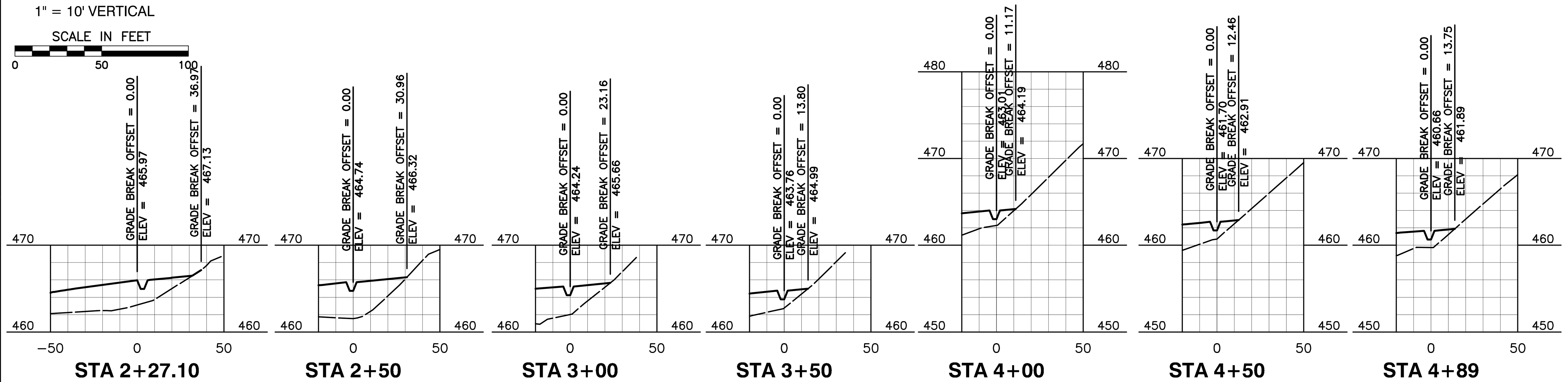


SITE GRADING & SWPPP WITH SWALE SECTIONS

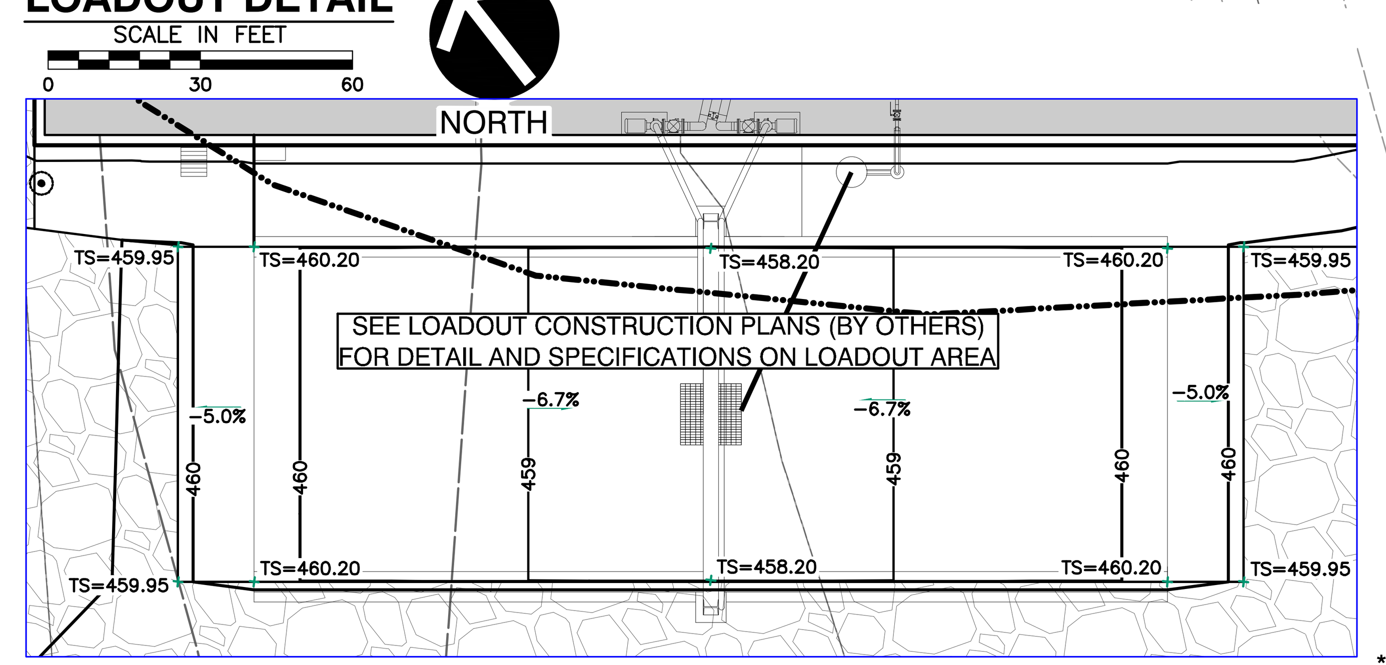


SWALE SECTIONS

1" = 50' HORIZONTAL
1" = 10' VERTICAL



LOADOUT DETAIL



KEVIN KAMP, ENGINEER
PE - 2006019670
*HAND SIGNATURE ON INDIVIDUAL SHEETS

REVISION RECORD

NO	DATE	DESCRIPTION
1		
2		
3		
4		
5		
6		
7		
8		

CEC
Civil & Environmental Consultants, Inc.
4848 Park 370 Blvd., Suite F - Hazelwood, MO 63042
314-656-4566 · 866-250-3679
www.cecinc.com

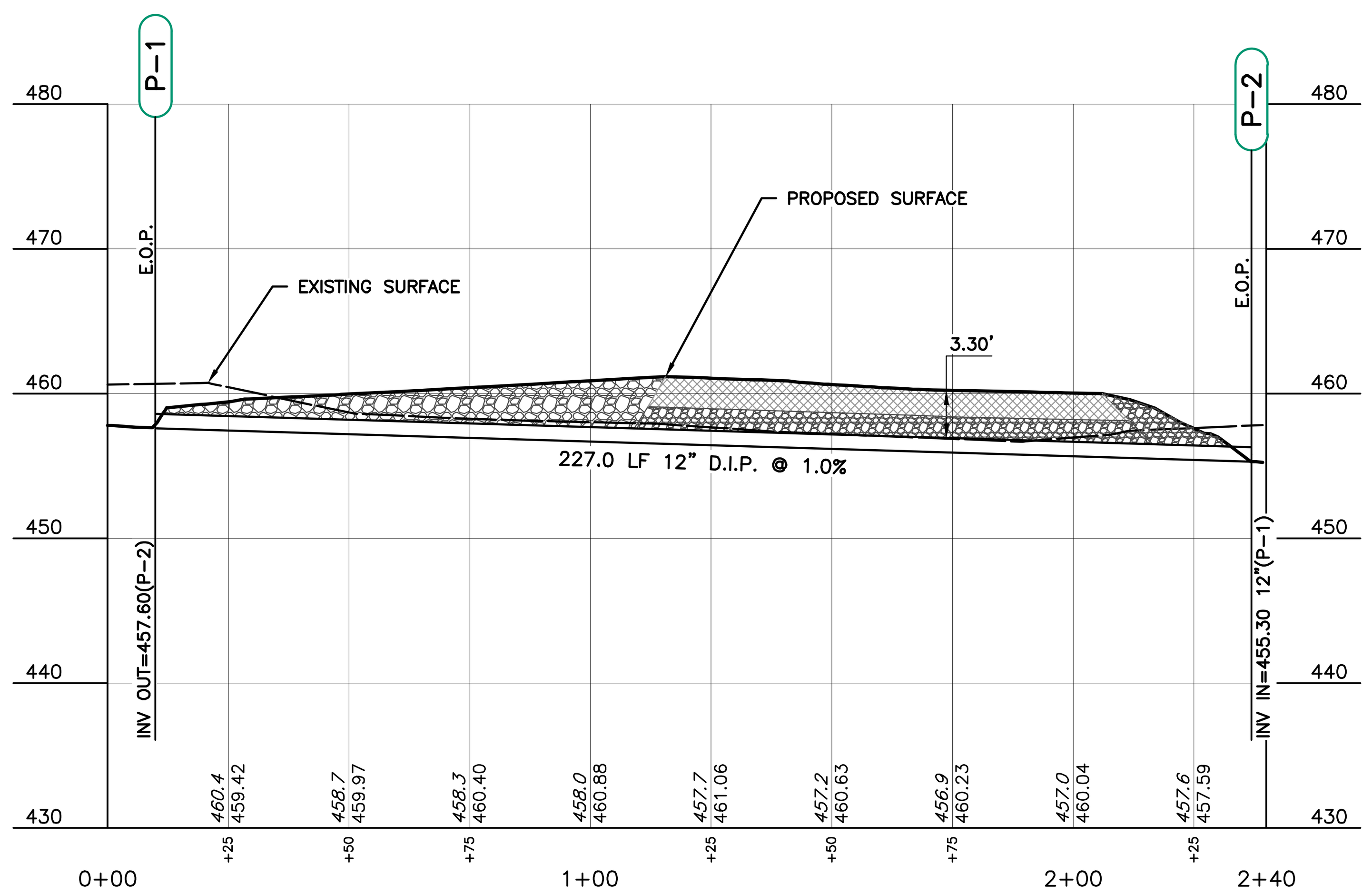
BRIDGETON LANFILL, LLC
12976 ST. CHARLES ROCK ROAD
BRIDGETON, MO 63044
PHONE: (314) 744-8195
FAX: (314) 656-2107

BRIDGETON LANDFILL
13570 ST. CHARLES ROCK ROAD
SITE LAYOUT W/ OVERHEAD WIRE HGTS
SITE GRADING, SWPPP, SWALE SECTIONS

DATE:	FEB 2013	DRAWN BY:	CAC
DWG SCALE:	1" = 30'	CHECKED BY:	DRAFT
PROJECT NO:	130-484	APPROVED BY:	KTK (SIGNED & SEALED)*

DRAWING NO.:
C300

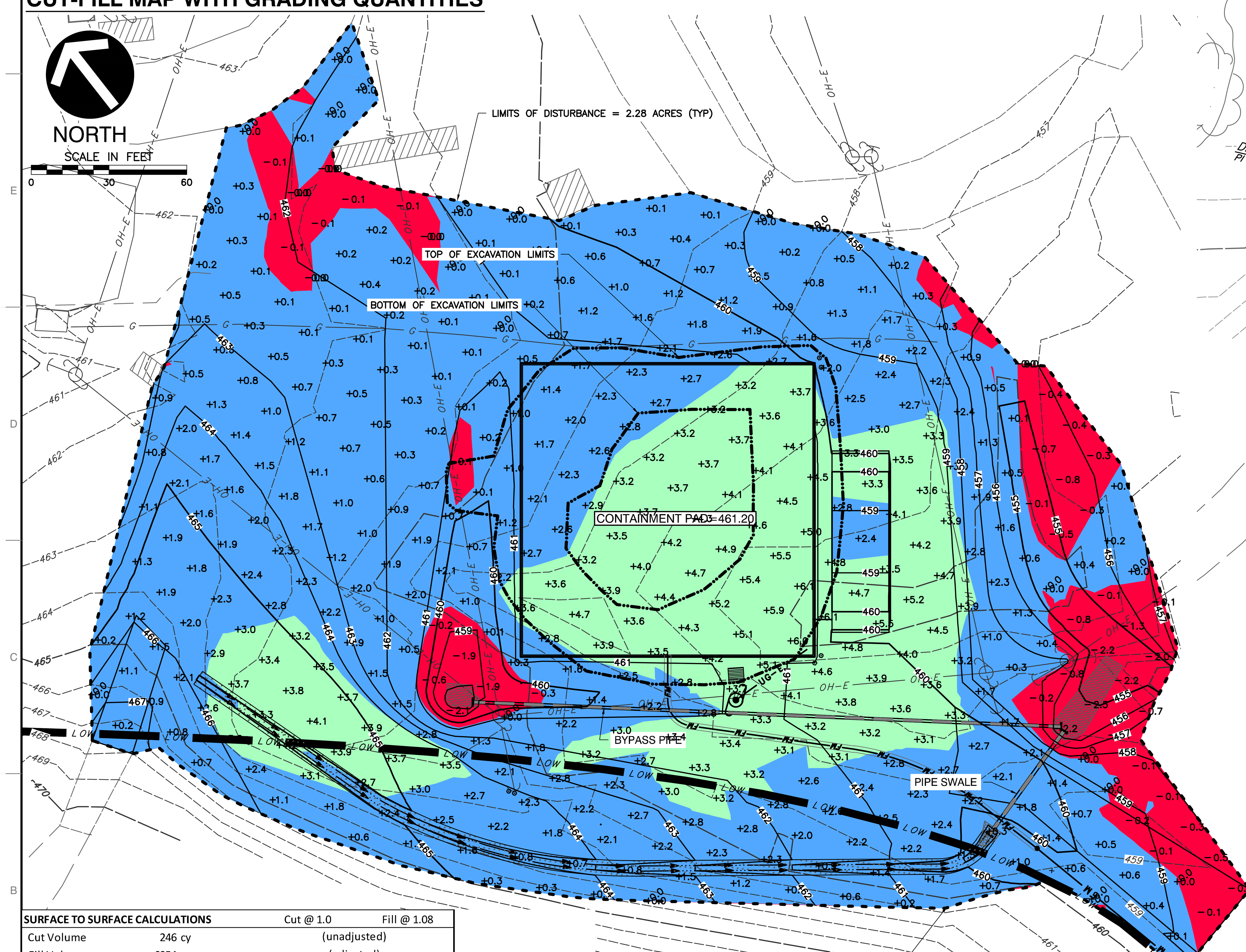
SHEET 2 OF 6



BYPASS PIPE PROFILE

SCALE H:1"=30'; V:1"=10'

CUT-FILL MAP WITH GRADING QUANTITIES



SURFACE TO SURFACE CALCULATIONS		Cut @ 1.0	Fill @ 1.08
Cut Volume	246 cy	(unadjusted)	
Fill Volume	6954 cy	(adjusted)	
Net Volume	-6708 cy*	(adjusted)	

*NOTE: THIS VALUE DOES NOT ACCOUNT FOR SUBSURFACE DEMO OR PROPOSED SUBGRADE

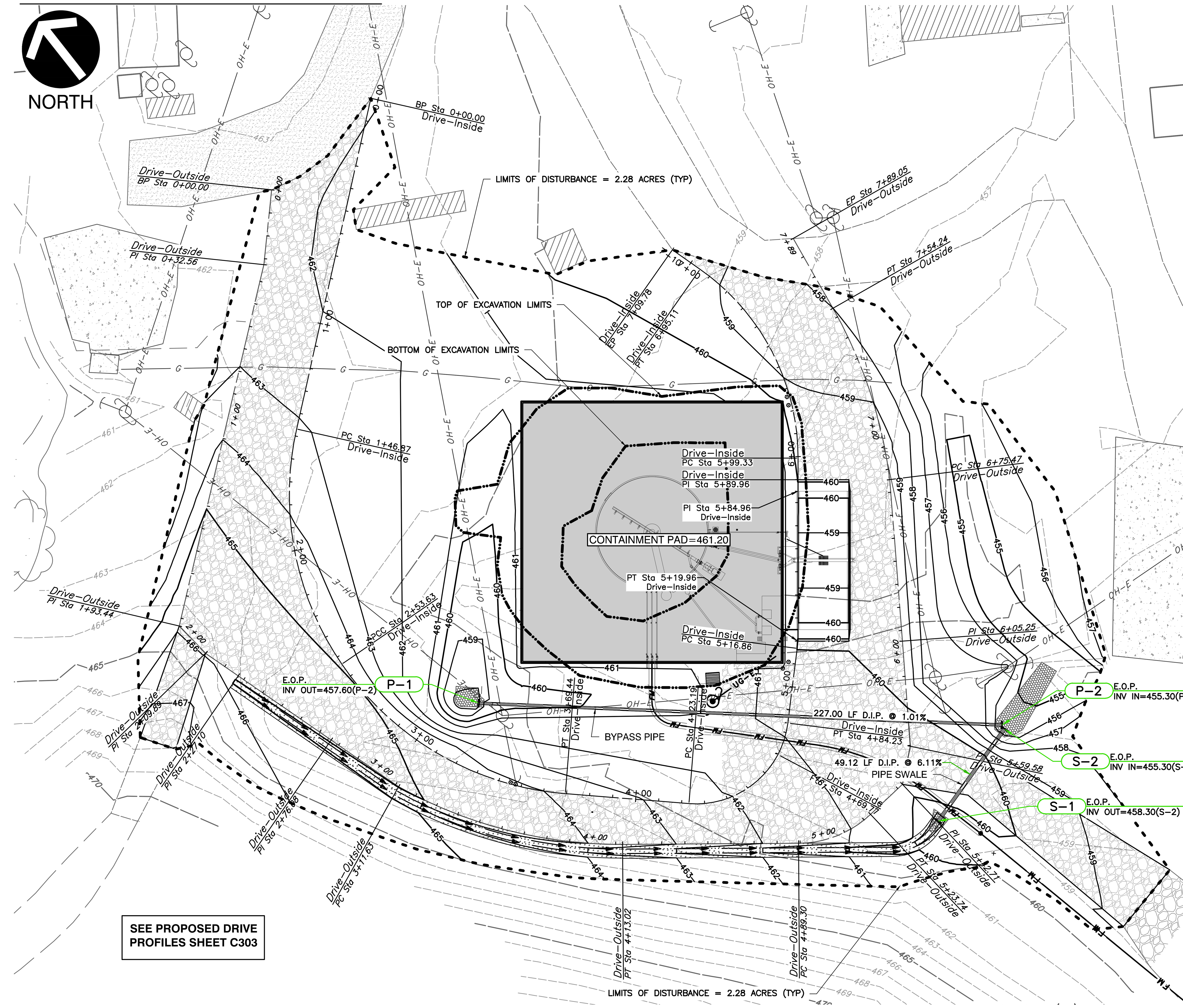
ITEM		EXPORT	IMPORT
SUBSURFACE DEMOLITION		109	
PROPOSED SUBGRADE TO SURFACE			2255
SITE GRADING	FILL		-8854
	TOTALS	109	-6599

6708 + 109 - 2255 = 4562

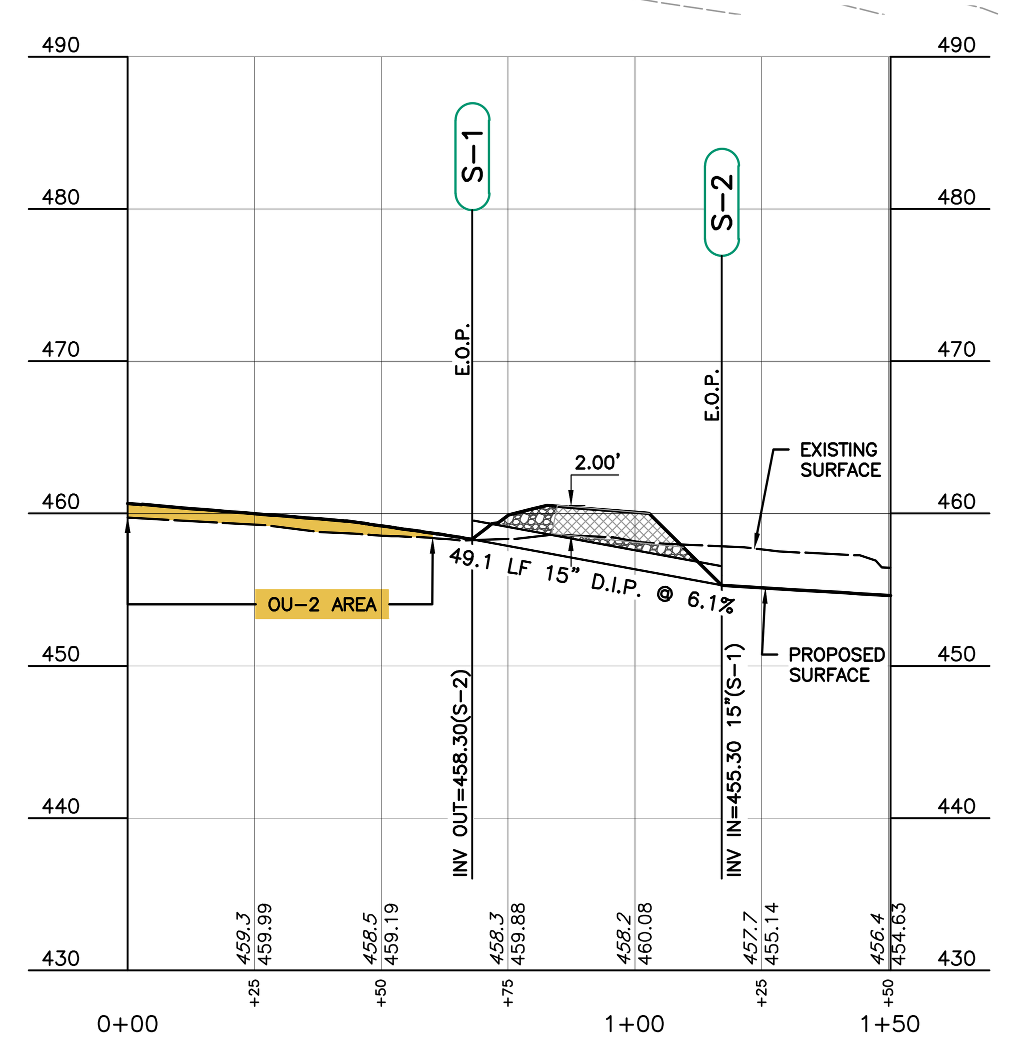
**THE ABOVE GRADING QUANTITY IS APPROXIMATE ONLY AND DOES NOT INCLUDE SPOILS FROM SEWER AND UTILITY EXCAVATION. ASSUMED SUBGRADE ON EXISTING BUILDING AND PAVEMENT THICKNESSES. ABOVE GRADE DEMOLITION EXCLUDED. NOT FOR BIDDING PURPOSES. CONTRACTOR SHALL VERIFY QUANTITIES PRIOR TO CONSTRUCTION.

ELEVATIONS TABLE			
NUMBER	MINIMUM ELEVATION	MAXIMUM ELEVATION	COLOR
1	-3.200	0.000	
2	0.000	3.000	
3	3.000	7.000	

SITE GRADING - PROPOSED DRIVE ALIGNMENTS
SITE STORMWATER PLAN & PROFILES



SEE PROPOSED DRIVE PROFILES SHEET C303



PIPE SWALE PROFILE

SCALE H:1"=30'; V:1"=10'

SCALE IN FEET 0 30 60

KEVIN KAMP, ENGINEER
PE - 2006019670
*HAND SIGNATURE ON INDIVIDUAL SHEETS

REVISION RECORD

NO	DATE	DESCRIPTION
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4848 Park 370 Blvd., Suite F - Hazelwood, MO 63042
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www.cecinc.com

BRIDGETON LANFILL, LLC
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FAX: (314) 656-2107

BRIDGETON LANDFILL
13570 ST. CHARLES ROCK ROAD
PROPOSED DRIVE ALIGNMENTS
STORM WATER PLAN & PROFILES

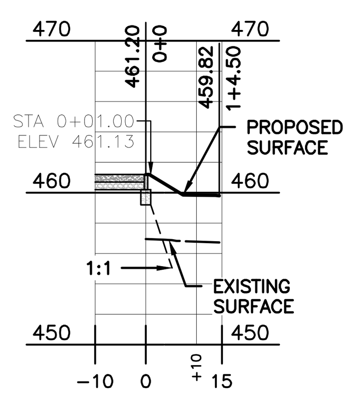
DATE:	FEB 2013	DRAWN BY:	CAC
DWG SCALE:	1" = 30'	CHECKED BY:	DRAFT
PROJECT NO:	130-484		
APPROVED BY:	KTK (SIGNED & SEALED)*		

DRAWING NO.: C301

SHEET 3 OF 6

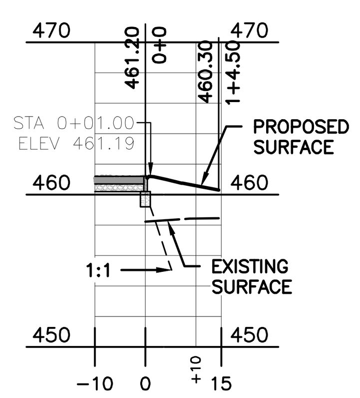
SECTIONS AT CONTAINMENT WALL FOOTING

SCALE H:1"=30' : V:1"=10'



EAST-ELEV CHANGE SECTION

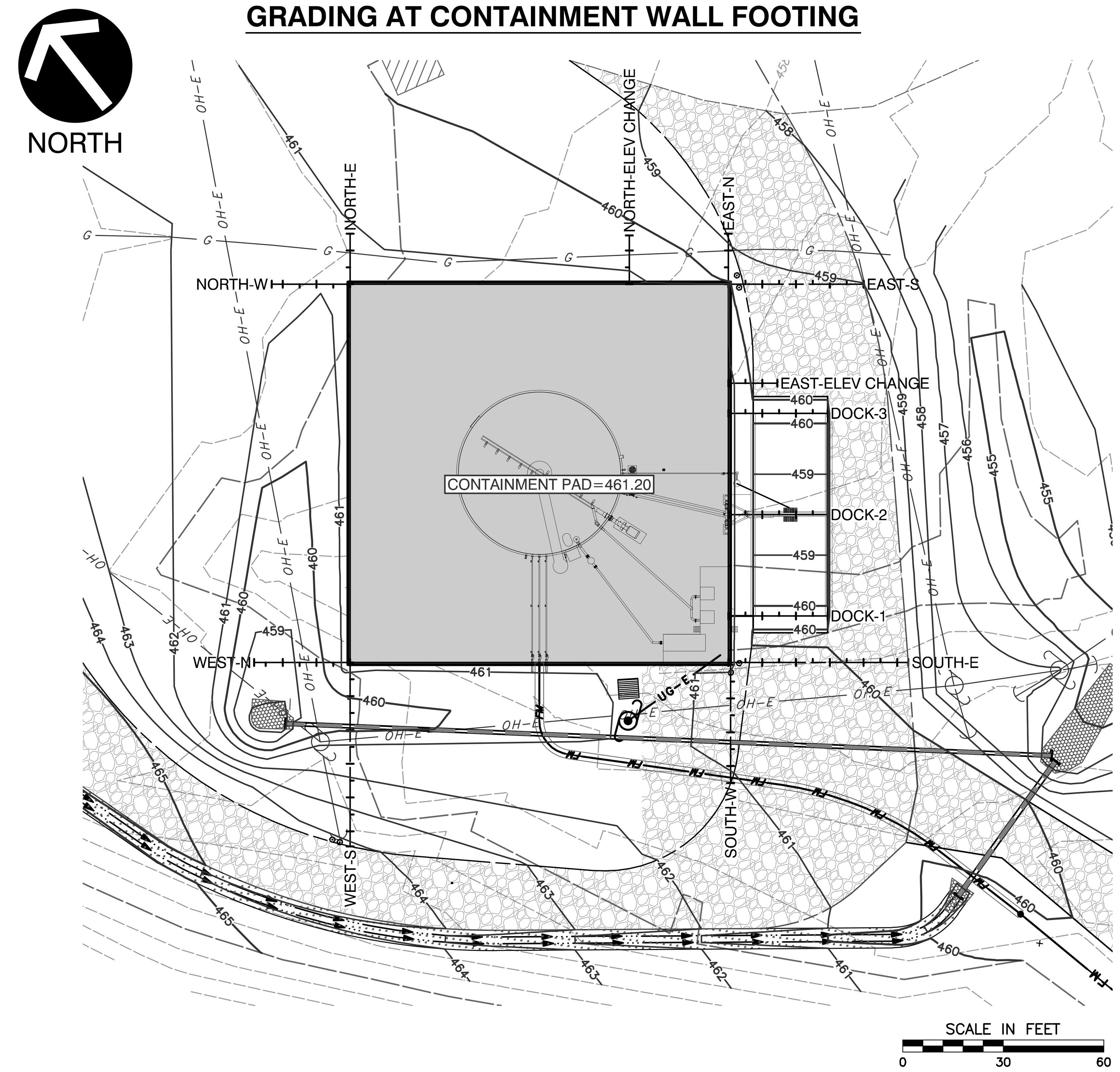
EXTENDED FOUNDATION BEGINS 32'-8" FROM CORNER (PER STRUCTURAL)

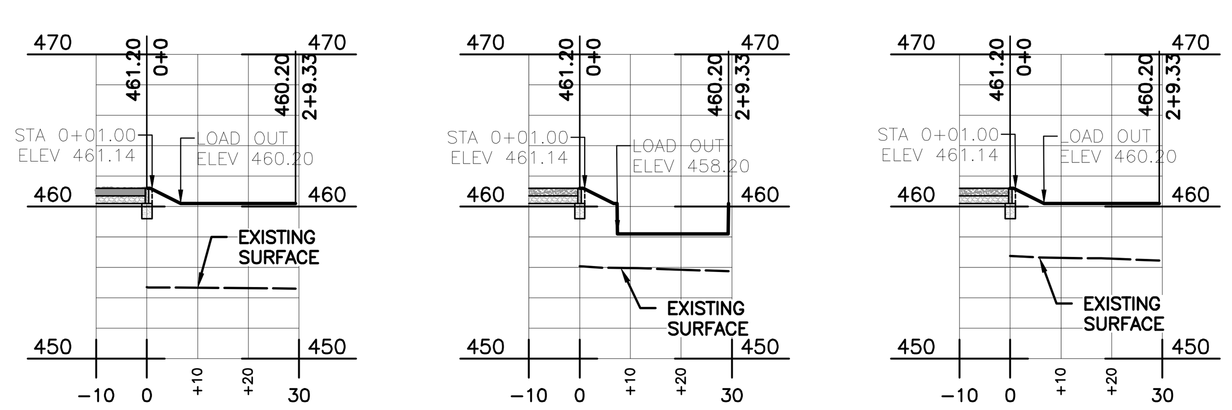


NORTH-ELEV CHANGE SECTION

EXTENDED FOUNDATION BEGINS 32'-8" FROM CORNER (PER STRUCTURAL)

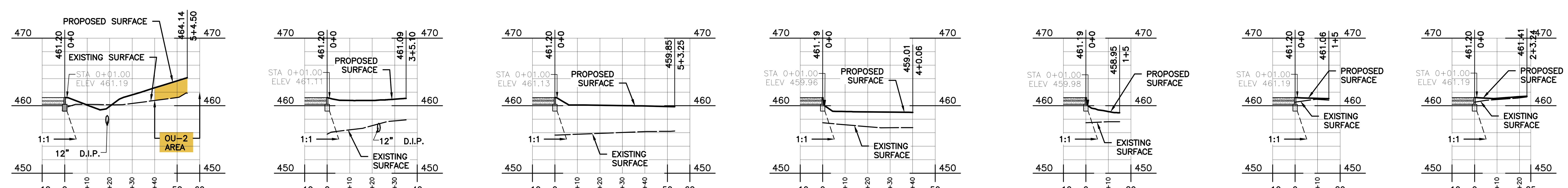
GRADING AT CONTAINMENT WALL FOOTING





DOCK-1 SECTION **DOCK-2 SECTION** **DOCK-3 SECTION**

PROPOSED LOAD OUT SURFACE DOES NOT DEPICT WALL NOR LOAD OUT BASE/PIER FOR OVERHEAD LOAD OUT ARMS



WEST-S SECTION **SOUTH-W SECTION** **SOUTH-E SECTION** **EAST-S SECTION** **EAST-N SECTION** **NORTH-E SECTION** **NORTH-W SECTION**

EAST-S SECTION: EXTENDED FOUNDATION REQUIRED

EAST-N SECTION: EXTENDED FOUNDATION REQUIRED

KEVIN KAMP, ENGINEER
PE - 2006019670
*HAND SIGNATURE ON INDIVIDUAL SHEETS

REVISION RECORD

NO	DATE	DESCRIPTION
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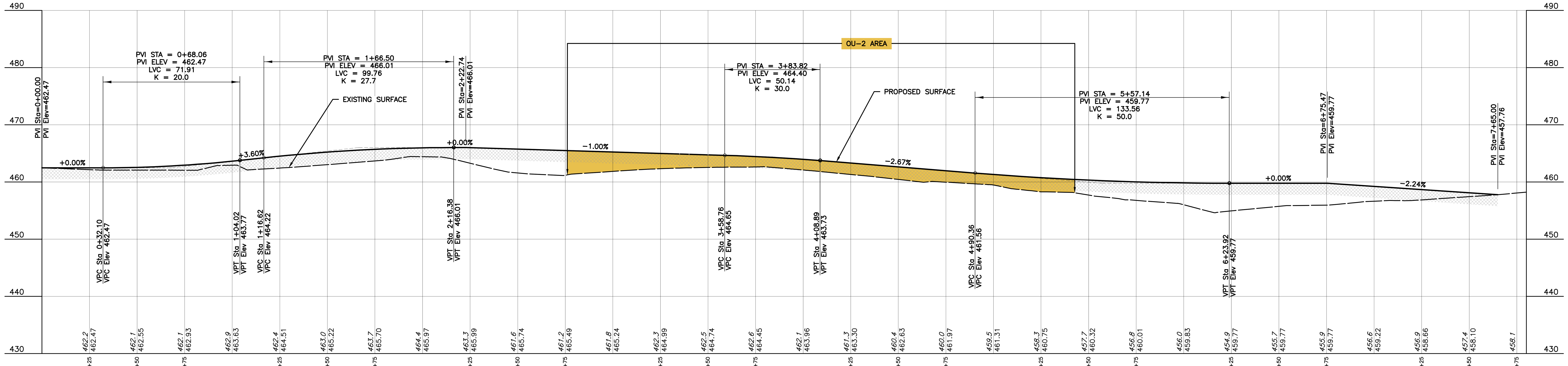
BRIDGETON LANDFILL
13570 ST. CHARLES ROCK ROAD
SECTIONS
GRADING AT CONTAINMENT WALL

DATE:	FEB 2013	DRAWN BY:	CAC
DWG SCALE:	1" = 30'	CHECKED BY:	DRAFT
PROJECT NO:	130-484		
APPROVED BY:	KTK (SIGNED & SEALED)*		

DRAWING NO.: C302

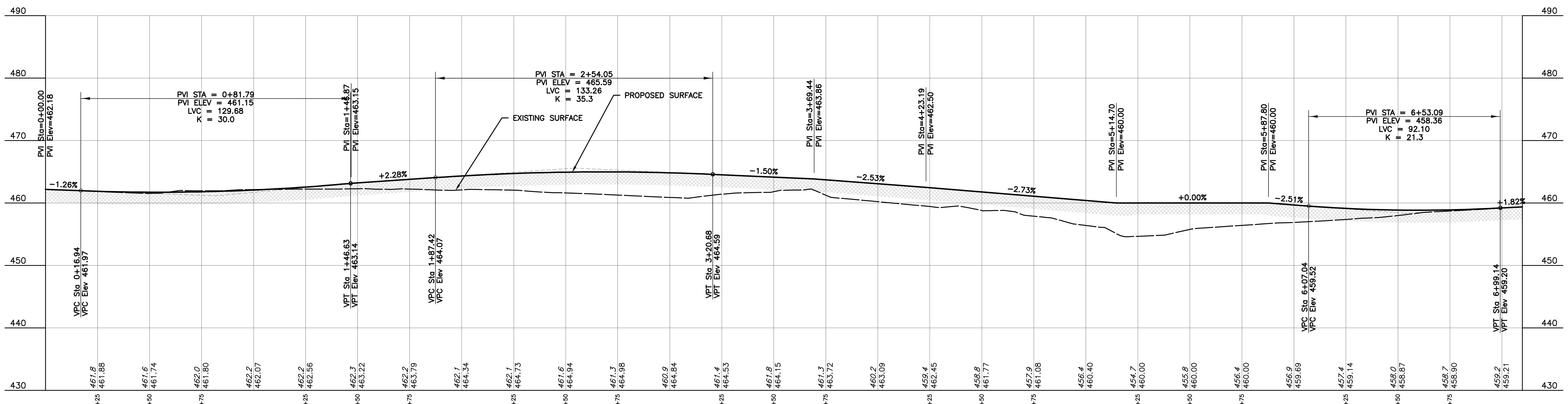
SHEET 4 OF 6



DRIVE-OUTSIDE PROFILE

SCALE H:1"=30'; V:1"=10'

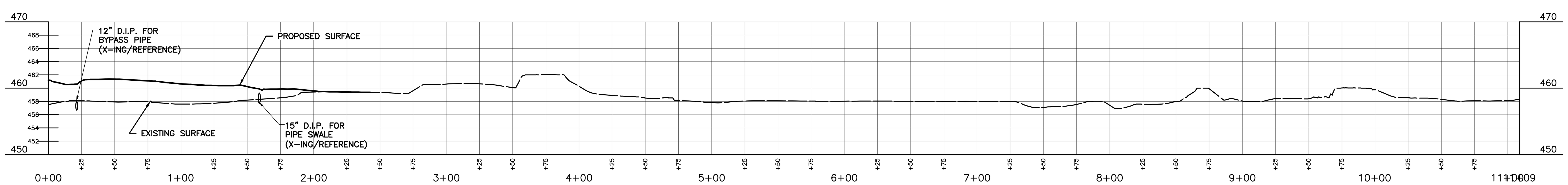
SCALE IN FEET



DRIVE-INSIDE PROFILE

SCALE H:1"=30'; V:1"=10'

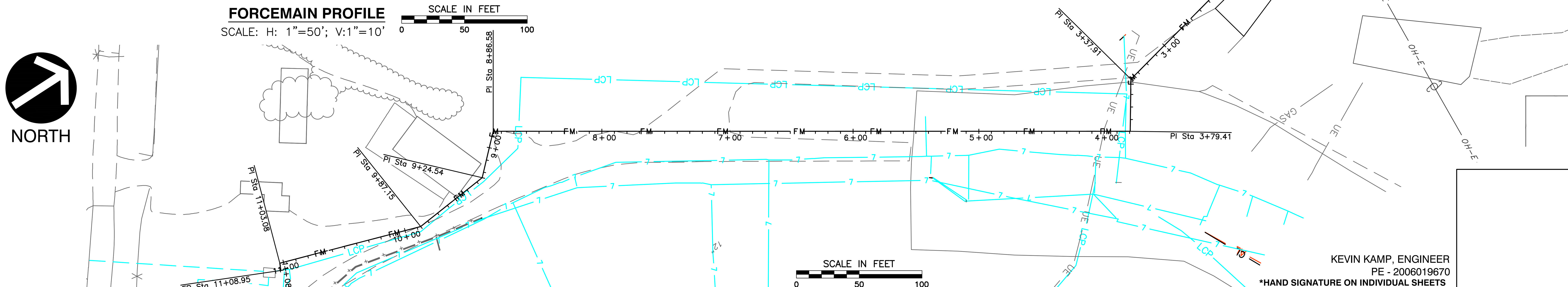
SCALE IN FEET



FORCEMAIN PROFILE

SCALE: H: 1"=50'; V:1"=10'

SCALE IN FEET



SCALE IN FEET

KEVIN KAMP, ENGINEER
PE - 2006019670
*HAND SIGNATURE ON INDIVIDUAL SHEETS

REVISION RECORD

NO	DATE	DESCRIPTION
1		
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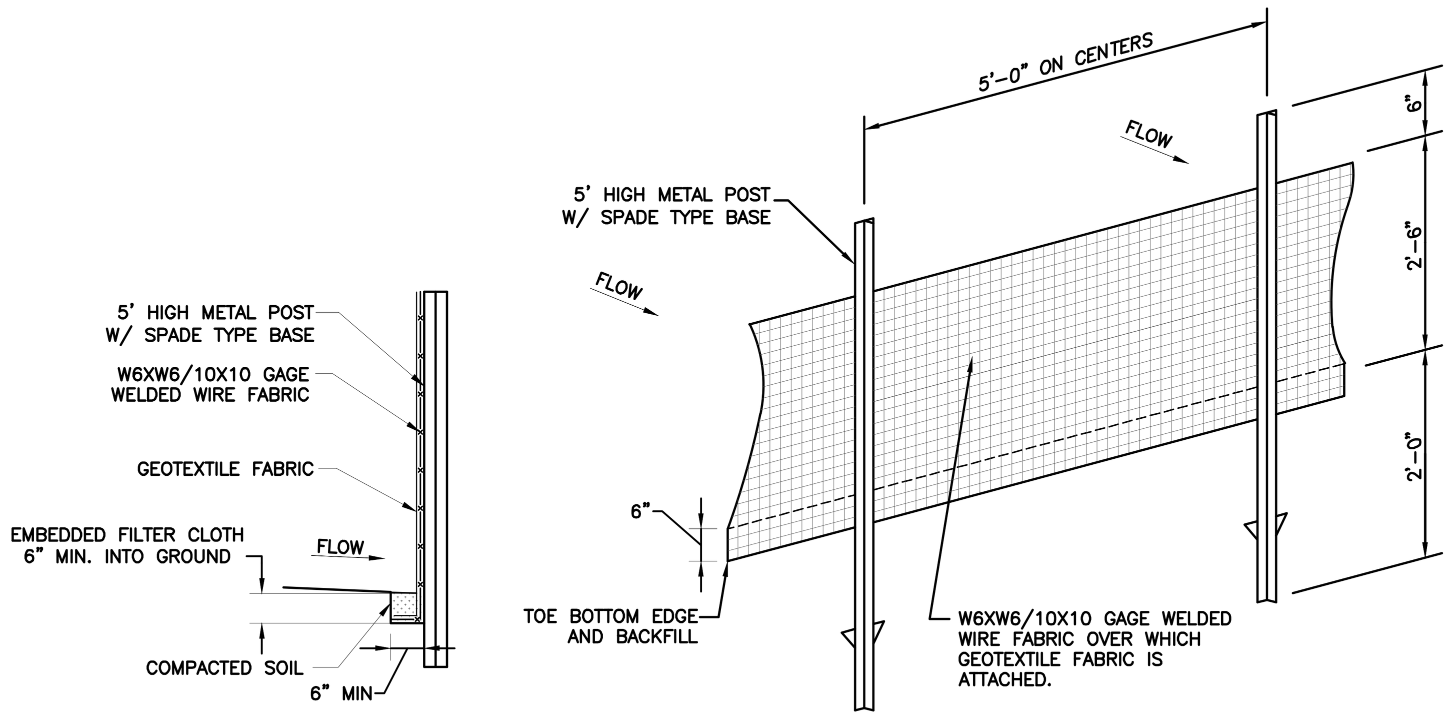
BRIDGETON LANDFILL
13570 ST. CHARLES ROCK ROAD

PROPOSED DRIVE PROFILES

DATE: FEB 2013 | DRAWN BY: CAC
DWG SCALE: 1" = 30' | CHECKED BY: DRAFT
PROJECT NO: 130-484
APPROVED BY: KTK (SIGNED & SEALED)*

DRAWING NO.: C303

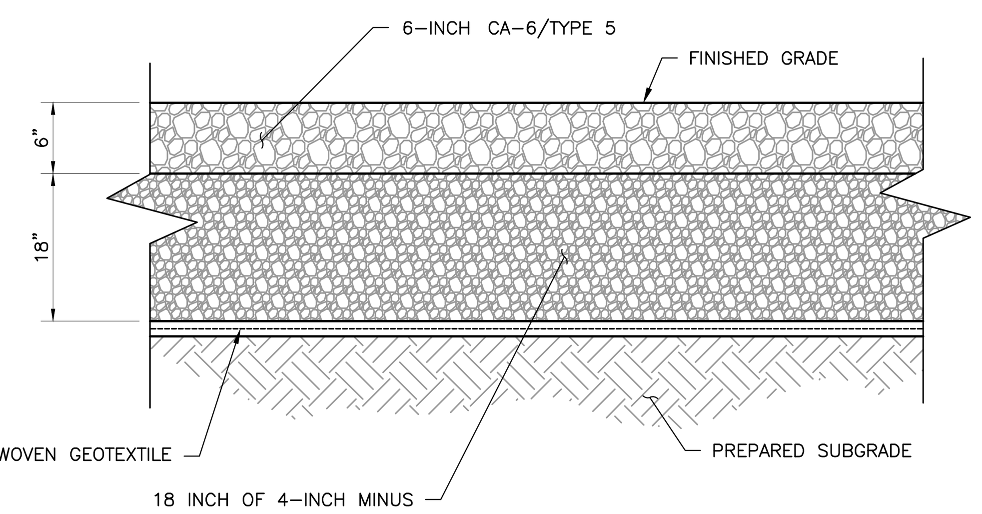
SHEET 5 OF 6



CONSTRUCTION SPECIFICATIONS

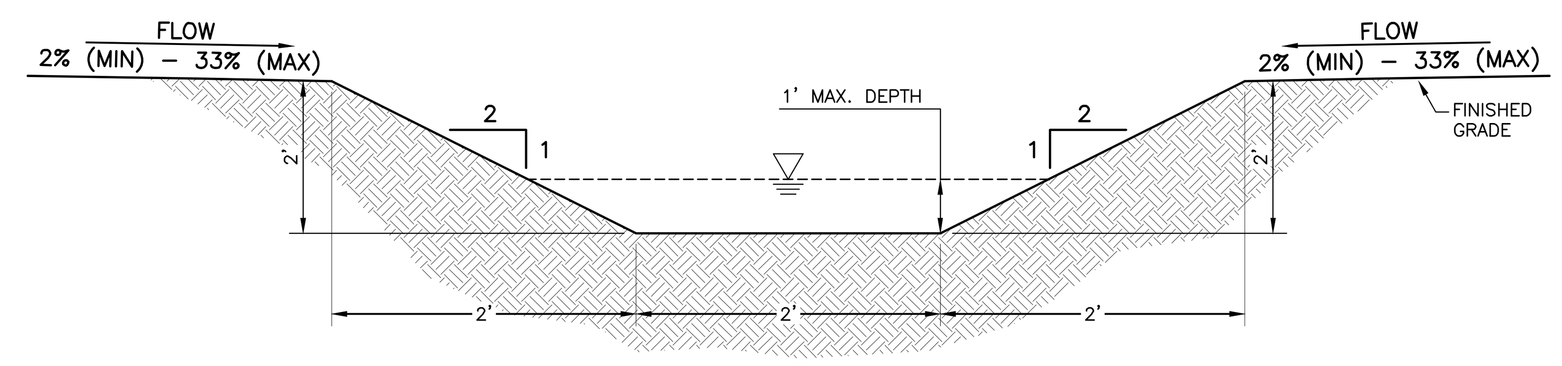
1. WIRE FENCING SHALL BE FASTENED SECURELY TO THE FENCE POSTS WITH WIRE TIES OR STAPLES.
2. FILTER CLOTH SHALL BE FASTENED SECURELY TO THE WIRE FENCING IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATION.
3. FILTER BARRIERS SHALL BE INSPECTED IMMEDIATELY AFTER EACH RAINFALL AND AT LEAST DAILY DURING PROLONGED RAINFALL. ANY REQUIRED REPAIRS SHALL BE MADE IMMEDIATELY.
4. SHOULD THE FABRIC DECOMPOSE OR BECOME INEFFECTIVE PRIOR TO THE END OF THE EXPECTED USABLE LIFE AND THE BARRIER STILL BE NECESSARY, THE FABRIC SHALL BE REPLACED PROMPTLY.
5. SEDIMENT DEPOSITS SHOULD BE REMOVED AFTER EACH STORM EVENT. THEY MUST BE REMOVED WHEN DEPOSITS REACH APPROXIMATELY HALF THE HEIGHT OF THE BARRIER.
6. ANY SEDIMENT DEPOSITS REMAINING IN PLACE AFTER THE SILT FENCE OR FILTER BARRIER IS NO LONGER REQUIRED SHALL BE DRESSED TO CONFORM WITH THE EXISTING GRADE, PREPARED AND SEEDED.

SILT FENCE
N.T.S.



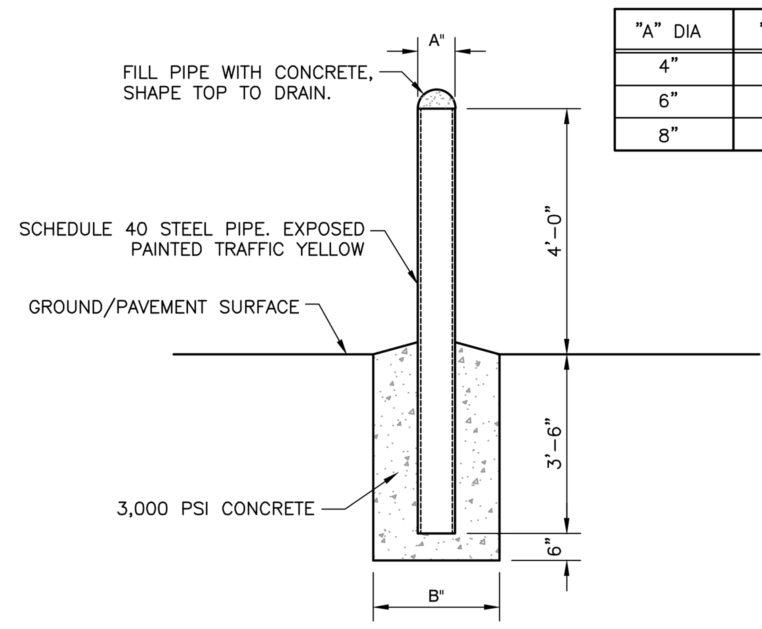
NOTES:
1. REFER TO GEOTECHNICAL REPORT FOR FURTHER SPECIFICATIONS AND/OR RECOMMENDATIONS.

GRAVEL ROAD (TYP)
NOT TO SCALE



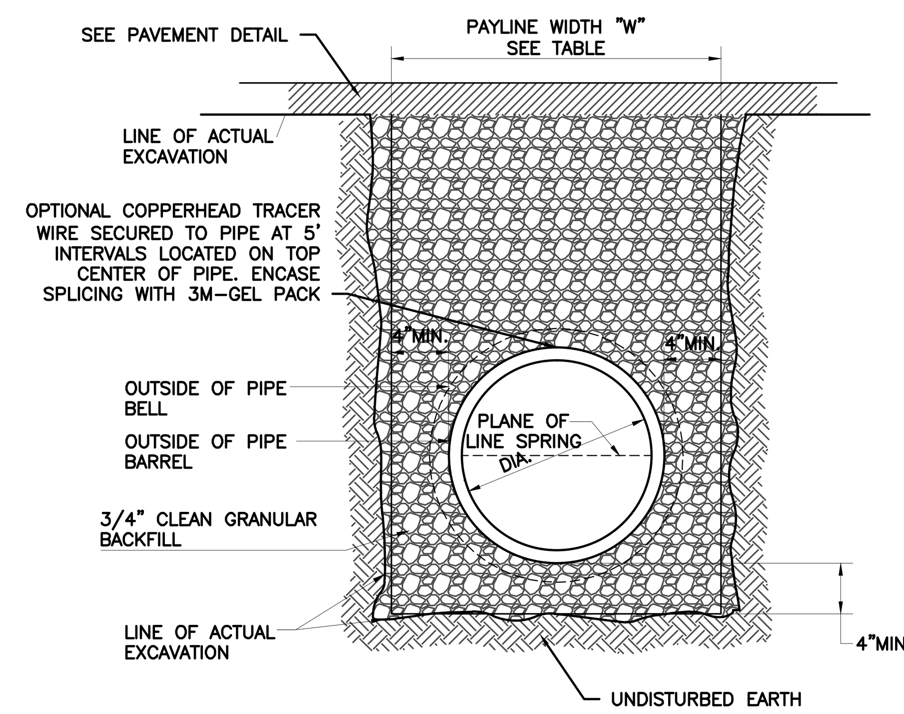
NOTES:
1. LONGITUDINAL SLOPE 1%-5%. FOR GREATER SLOPES UP TO 15%, FLOW VELOCITY MUST BE LESS THAN 5 FPS
2. VEGETATION TO BE MAINTAINED TO 3-6" HEIGHT

VEGETATED SWALE
NOT TO SCALE

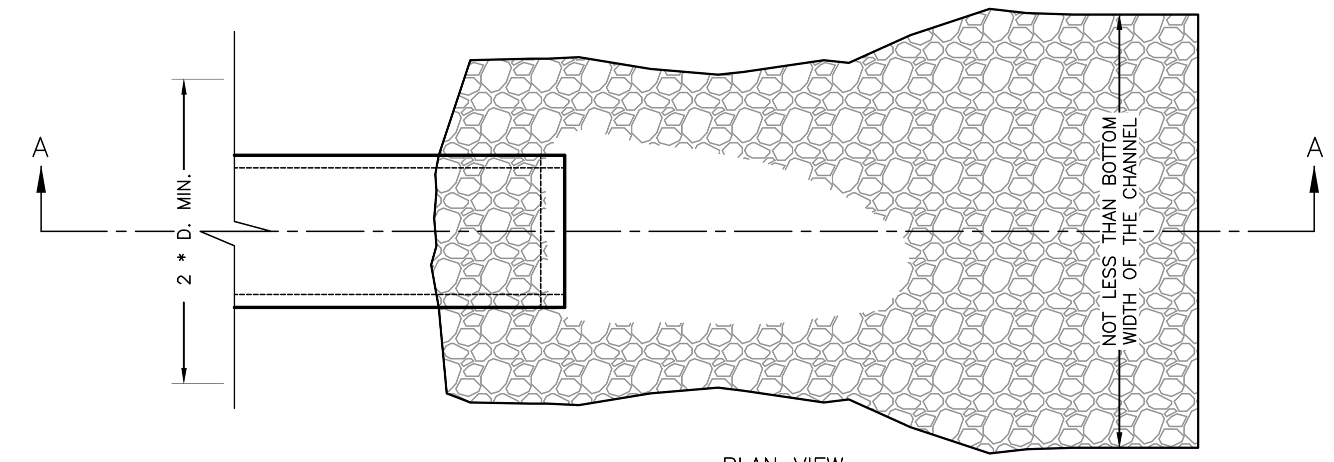


"A" DIA	"B" DIA
4"	16"
6"	18"
8"	20"

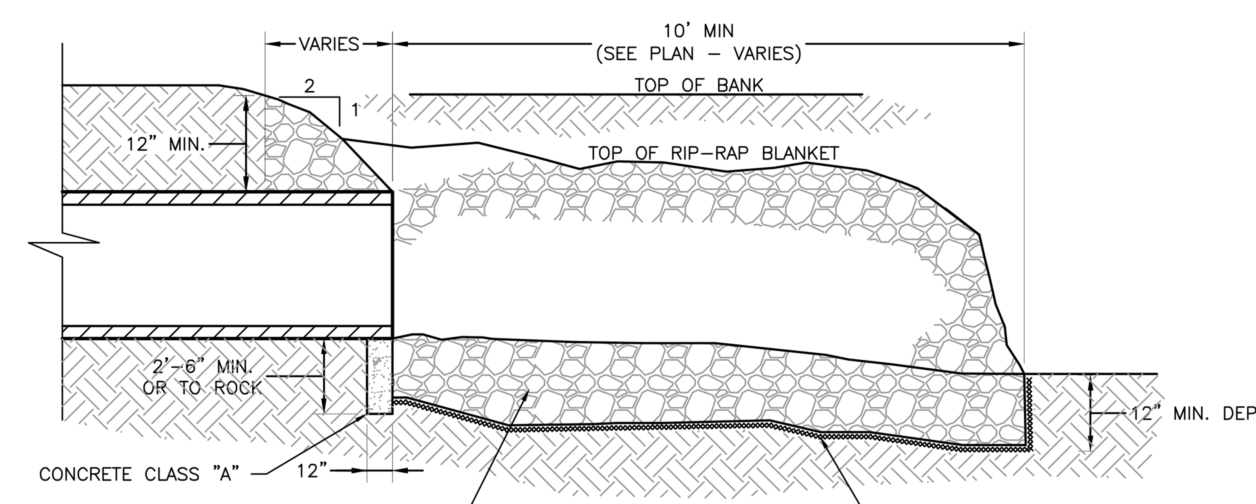
PIPE BOLLARD
NOT TO SCALE



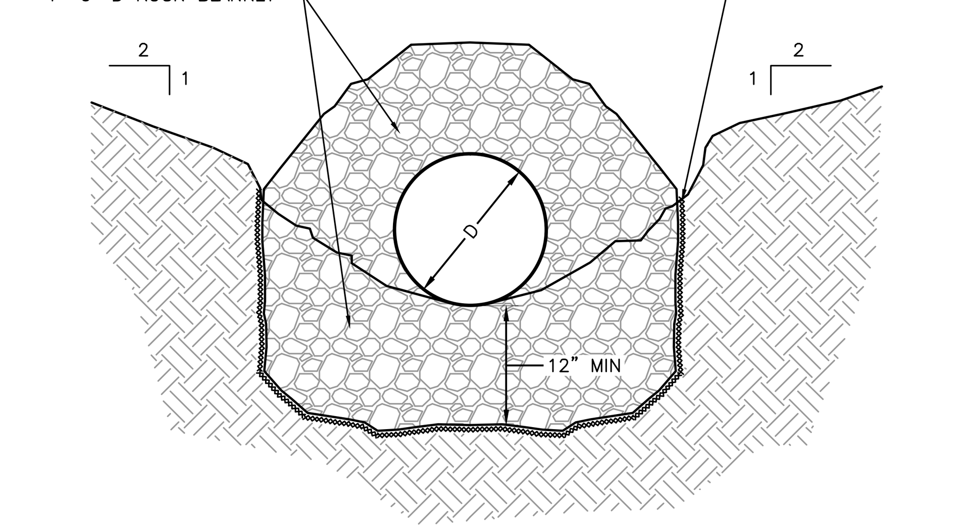
DUCTILE IRON PIPE BEDDING
N.T.S.



PLAN VIEW



SECTION A-A



END VIEW

NOTES:
1. "D" = DIAMETER
2. GRADE OF ROCK BLANKET TO BE ADJUSTED ACCORDINGLY, TO BE USED AT INTAKE AND DISCHARGE END OF PIPE.

RIP-RAP AT PIPE END
NOT TO SCALE

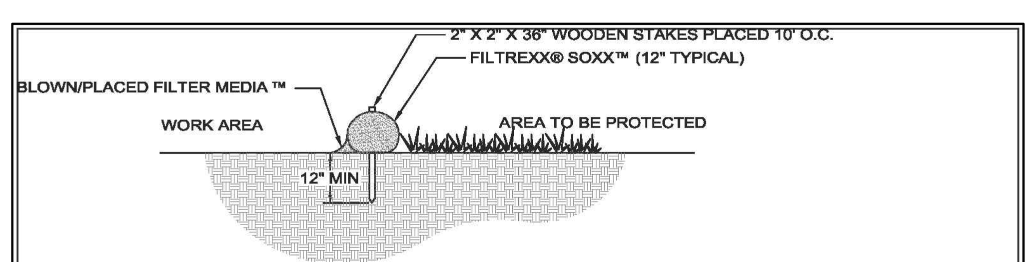
WATTLE BAGS

OR SIMILAR

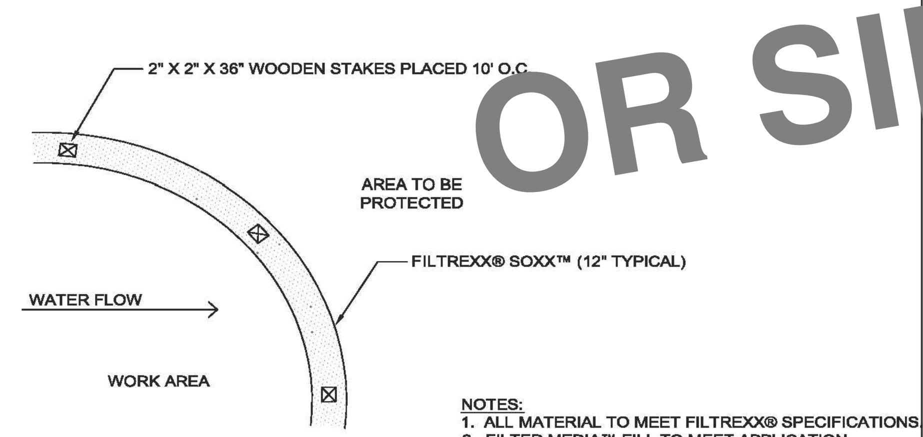
Slope Percent	Maximum Slope Length Above Sediment Control in Feet (meters)*				
	8 in (200 mm) Sediment control	12 in (300 mm) Sediment control	18 in (450 mm) Sediment control	24 in (600mm) Sediment control	32 in (800mm) Sediment control
	6.5 in (160 mm)**	9.5 in (240 mm)**	14.5 in (360 mm)**	19 in (480 mm)**	26 in (650 mm)**
2 (or less)	600 (180)	750 (225)	1000 (300)	1300 (400)	1650 (500)
5	400 (120)	500 (150)	550 (165)	650 (200)	750 (225)
10	200 (60)	250 (75)	300 (90)	400 (120)	500 (150)
15	140 (40)	170 (50)	200 (60)	325 (100)	450 (140)
20	100 (30)	125 (38)	140 (42)	260 (80)	400 (120)
25	80 (24)	100 (30)	110 (33)	200 (60)	275 (85)
30	60 (18)	75 (23)	90 (27)	130 (40)	200 (60)
35	60 (18)	75 (23)	80 (24)	115 (35)	150 (45)
40	60 (18)	75 (23)	80 (24)	100 (30)	125 (38)
45	40 (12)	50 (15)	60 (18)	80 (24)	100 (30)
50	40 (12)	50 (15)	55 (17)	85 (20)	75 (23)

* Based on a failure point of 36 in (0.9 m) super silt fence (wire reinforced) at 1000 ft (303 m) of slope, watershed width equivalent to receiving length of sediment control device, 1 in/ 24 hr (25 mm/24 hr) rain event.

** Effective height of Sediment control after installat[illegible]stant head from runoff as determined by Ohio State University.



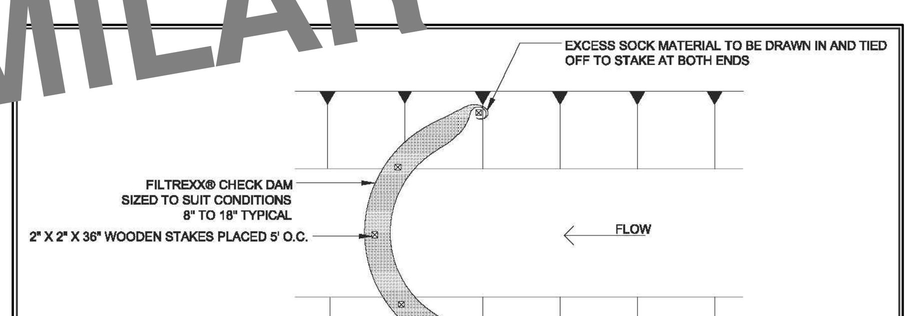
SECTION NTS



PLAN NTS

NOTES:
1. ALL MATERIAL TO MEET FILTREXX® SPECIFICATIONS.
2. FILTER MEDIA™ FILL TO MEET APPLICATION REQUIREMENTS.
3. COMPOST MATERIAL TO BE DISPERSED ON SITE, AS DETERMINED BY ENGINEER.

FILTREXX® SEDIMENT CONTROL
NTS



NOTES:
1. ALL MATERIAL TO MEET FILTREXX® SPECIFICATIONS.
2. CHECK DAM SHOULD BE USED IN AREAS THAT DRAIN 10 ACRES OR LESS.
3. SEDIMENT SHOULD BE REMOVED FROM BEHIND CHECK DAM ONCE THE ACCUMULATED HEIGHT HAS REACHED ½ THE HEIGHT OF THE CHECK DAM.
4. CHECK DAM CAN BE DIRECT SEEDED AT THE TIME OF INSTALLATION.
5. CONTRACTOR IS REQUIRED TO BE A FILTREXX CERTIFIED™ INSTALLER.

FILTREXX® CHECK DAM
NTS

ROUND PIPE				HORIZONTAL ELLIPTICAL PIPE			
Inside Diameter of Pipe (Inches)	"W" Payline Width of Trench (Inches)	"W" Payline Width of Trench (Feet)	Pay-volumes cu.ft. per ft. Concrete Encasement	Inside Diameter of Pipe (Inches)	"W" Payline Width of Trench (Inches)	"W" Payline Width of Trench (Feet)	Pay-volumes cu.ft. per ft. Concrete Encasement
4	28	2.33	3.20				
6	28	2.33	3.46				
8	28	2.33	3.70				
10	28	2.33	3.86				
12	28	2.33	3.98				
15	32	2.67	4.89				
18	35	2.92	5.63	14 X 23	41	3.42	5.94
21	39	3.25	6.61				
24	42	3.50	7.39	19 X 30	49	4.08	7.68
27	45	3.75	8.18	22 X 34	53	4.42	8.61
30	49	4.08	9.30	24 X 38	58	4.83	9.70
33	53	4.42	10.53	27 X 42	62	5.17	10.71
36	56	4.67	11.43	29 X 45	66	5.50	11.72
39	DISCONTINUED			32 X 49	71	5.92	13.14
42	63	5.25	13.38	34 X 53	75	6.25	14.05
48	70	5.83	15.67	38 X 60	83	6.92	16.18
54	77	6.42	18.15	43 X 68	92	7.67	18.81
60	84	7.00	20.73	48 X 76	101	8.42	21.59
66	91	7.58	23.45	53 X 83	109	9.08	24.35
72	98	8.17	26.37	58 X 91	118	9.83	27.45
78	105	8.75	29.39	63 X 98	126	10.50	30.50
84	112	9.33	32.57	68 X 106	135	11.25	33.91
90	119	9.92	35.90	72 X 113	143	11.92	36.99
96	126	10.50	39.37	77 X 121	152	12.67	40.69
102	133	11.08	42.99	82 X 128	160	13.33	44.45
108	140	11.67	46.75	87 X 136	168	14.00	47.79
114	147	12.25	50.66	92 X 143	176	14.67	51.70
120	154	12.83	54.72	97 X 151	185	15.42	56.01
126	161	13.42	58.92				
132	168	14.00	63.27	106 X 166	202	16.83	64.48
144	182	15.17	72.40	116 X 180	218	18.17	73.59

PAYLINE WIDTHS-TRENCH PAY QUANTITIES

KEVIN KAMP, ENGINEER
PE - 2006019670
*HAND SIGNATURE ON INDIVIDUAL SHEETS

REVISION RECORD		
NO	DATE	DESCRIPTION
1		
2		
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BRIDGETON LANDFILL
13570 ST. CHARLES ROCK ROAD

CONSTRUCTION DETAILS

DATE:	FEB 2013	DRAWN BY:	CAC
DWG SCALE:	1" = 30'	CHECKED BY:	DRAFT
PROJECT NO:			130-484
APPROVED BY:			KTK (SIGNED & SEALED)*

DRAWING NO.: C800

SHEET 6 OF 6

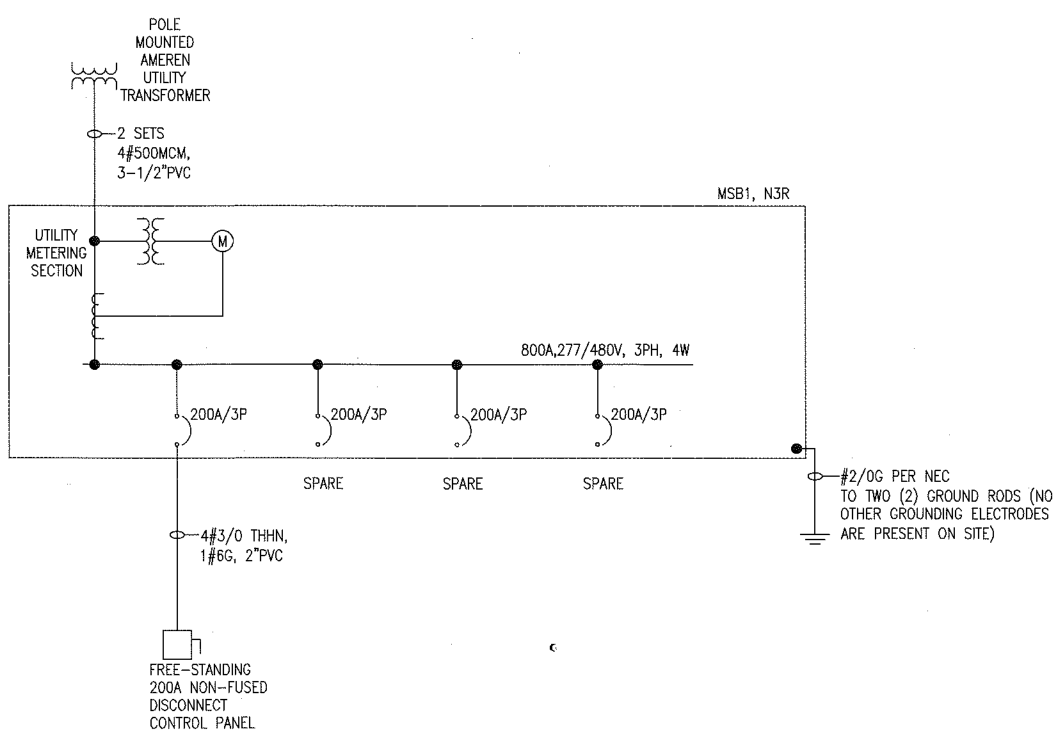
Electrical Drawing List			
Drawing	Title	Revision	Date
E-1.00	COVER SHEET, SYMBOLS, ONE LINE DIAGRAM	0	3/25/2013
–	–	–	–
–	–	–	–
–	–	–	–
–	–	–	–

1 / 1.00 DRAWING LIST
NO SCALE

ELECTRICAL SYMBOLS

LIGHTING FIXTURES	DEVICES	SYSTEMS	POWER DISTRIBUTION
TYPE DESIGNATION	RECEPTACLE SINGLE	SYSTEM CONTROL CABINET (TOP OF CAB @ 6'-0")	FLUSH MOUNTED PANEL (TOP OF PNL @ 6'-0")
SWITCH REFERENCE	DUPLEX RECEPTACLE	FIRE ALARM PULL STATION	SURFACE MOUNTED PANEL (TOP OF PNL @ 6'-0")
CIRCUIT NUMBER	SPLIT WIRED DUPLEX RECEPTACLE	FIRE ALARM HEAT DETECTOR	TRANSFORMER
EXIT LIGHT WITH DIRECTIONAL ARROW(S) DARKENED AREA INDICATES NUMBER AND ORIENTATION OF FACES	DOUBLE DUPLEX RECEPTACLE	FIRE ALARM SMOKE DETECTOR	GENERATOR
INDICATES WALL MOUNTED (TYPICAL)	RECEPTACLE GROUND FAULT PROTECTED	DUCT SMOKE DETECTOR	**MOTOR AND EQUIPMENT**
SURFACE FIXTURE (1X4, 2X4)	RECEPTACLE ISOLATED GROUND	FIRE ALARM HORN	MOTOR CONNECTION (NO. REFERS TO M&E SCH)
RECESSED FIXTURE	RECEPTACLE WEATHER PROOF	FIRE ALARM AUDIBLE/VISUAL DEVICE	EQUIPMENT CONNECTION (NO. REFERS TO M&E SCH)
RECESSED NIGHT LIGHT FIXTURE NL	TELE-POWER POLE	FIRE ALARM STROBE	DISCONNECT SWITCH
PENDANT MOUNTED FIXTURE	FLOOR BOX	SPRINKLER FLOW SWITCH	MOTOR STARTER
WALL MOUNTED FIXTURE	SWITCH SINGLE POLE b – SWITCH LABEL IF APPLICABLE	SPRINKLER TAMPER SWITCH	COMBINATION STARTER/DISCONNECT SWITCH
STRIP FIXTURE	SWITCH TWO POLE b – SWITCH LABEL IF APPLICABLE	FIREMAN'S PHONE JACK	MOTOR STARTER SWITCH
TRACK LIGHTING (TRIANGLES INDICATE THE NUMBER OF LIGHTS)	SWITCH 3-WAY b – SWITCH LABEL IF APPLICABLE	MAGNETIC DOOR HOLDER	THERMOSTAT
EMERGENCY LIGHT FIXTURE	SWITCH 4-WAY b – SWITCH LABEL IF APPLICABLE	CLOCK	EXHAUST FAN
SINGLE HEAD POLE FIXTURE	DIMMER SWITCH	COMPUTER OUTLET	
DOUBLE HEAD POLE FIXTURE @ 180°	KEY OPERATED SWITCH	MICROPHONE JACK	
WALLPACK	PILOT LIGHT SWITCH	SPEAKER	
CEILING FAN	PUSHBUTTON SWITCH	TELEVISION OUTLET	
BOLLARD	JUNCTION BOX	TELEPHONE OUTLET WITH (1) PHONE CABLE	
SPOT LIGHT		DATA OUTLET WITH (1) DATA CABLE	
COMBO EXIT/EMERGENCY FIXTURE		VOICE/DATA OUTLET WITH (1) PHONE CABLE AND (1) DATA CABLE	
COMBO EXIT/EMERGENCY FIXTURE		EMERGENCY STATION	
		INTERCOM OUTLET	
		CAMERA	

2 / 1.00 SYMBOLS
NO SCALE



4 / 1.00 ONE LINE DIAGRAM
NO SCALE

PROJECT NAME: THE VILLAGE AT MACKENZIE PLACE, 31 UNIT BLDG

12/1/05 Attachment "B" of St. Louis County Rules & Regulations
Seismic Code Block on 1st Sheet of Electrical Plans
Electrical System Components / Earthquake Load Resistance

Seismic Use Group (1) Seismic Design Category (B)

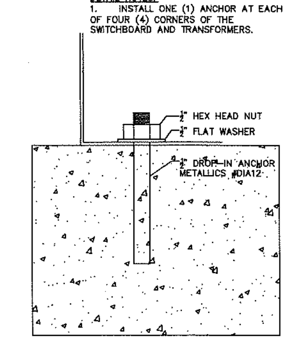
Listing of Equipment and System Components	Anchorage to Floors, Roofs, Etc.		Sway Bracing		Location of Professionally Sealed Anchorage and Sway Bracing Details			Comments
					On Const. Documents	Subsequent Submittal		
	Not Provided	Provided	Not Provided	Provided	Drawing No./ Spec Section	Shop Drawings	Separate Permit & Plans	
Fire Protection, Detection and Alarm Equipment, and System Components *See Attachment "C" Table 200 (List items such as fire alarm panels, electric conductors powering fire protection equipment, etc.)	X		X					Not Applicable
Emergency or Standby Equipment and System Components *See Attachment "C" Table 200 (List items such as emergency generators, panel boards, single hanger and trapeze supported system components, bus ducts, primary cable systems, motors control centers and devices, switch gears, transformers, unit substations, cable tray, conduit, lighting, fixtures, etc.)	X		X					Not Applicable
Other Equipment & System Components *See Attachment "C" Table 200 Needed for Continued Operation of Seismic Use Group III Facilities or Whose Failure Could Impair Their Continued Operation (List Items)	X		X					Not Applicable
Other General Equipment & System Components (List items such as panel boards, single hanger and trapeze supported system components, communication systems, electrical bus ducts, primary cable systems, electrical motor control centers, motor control devices, switchgear, transformers, unit substations, cable tray, conduit, lighting fixtures, etc.)		X		X				See General Notes #1, #3, #4 on this drawing.

GENERAL NOTES – ELECTRICAL:

1. ALL CONDUIT IS ROUTED IN TRENCH BELOW GRADE.
2. NOT USED
3. ELECTRICAL INSTALLATION SHALL FOLLOW THE 2008 EDITION OF THE NEC.
4. MOUNT SWITCHBOARDS, PANELBOARDS, AND DRY TYPE TRANSFORMERS TO STRUCTURE PER MANUFACTURER'S INSTRUCTIONS.

3 / 1.00 SEISMIC CODE BLOCK
NO SCALE

DETAIL NOTES:
1. INSTALL ONE (1) ANCHOR AT EACH OF FOUR (4) CORNERS OF THE SWITCHBOARD AND TRANSFORMERS.



STATE OF MISSOURI
BRIAN KOHNEN
NUMBER E-22461
REGISTERED PROFESSIONAL ENGINEER

CONSTRUCTION
03/25/2013

REPUBLIC SERVICES, INC.
LEACHATE SERVICE

KAY-BEE ELECTRIC
250 RUE ST. FRANCOIS
FLORISSANT, MO 63031
(314) 837-3308
(314) 837-3924 FAX

DRAWN BY: JGB
CHECKED BY: BJK
DATE: 03/25/13
SCALE: NONE
FILE NAME:
REVISIONS: 03/25/13 PERMIT

E-1.00